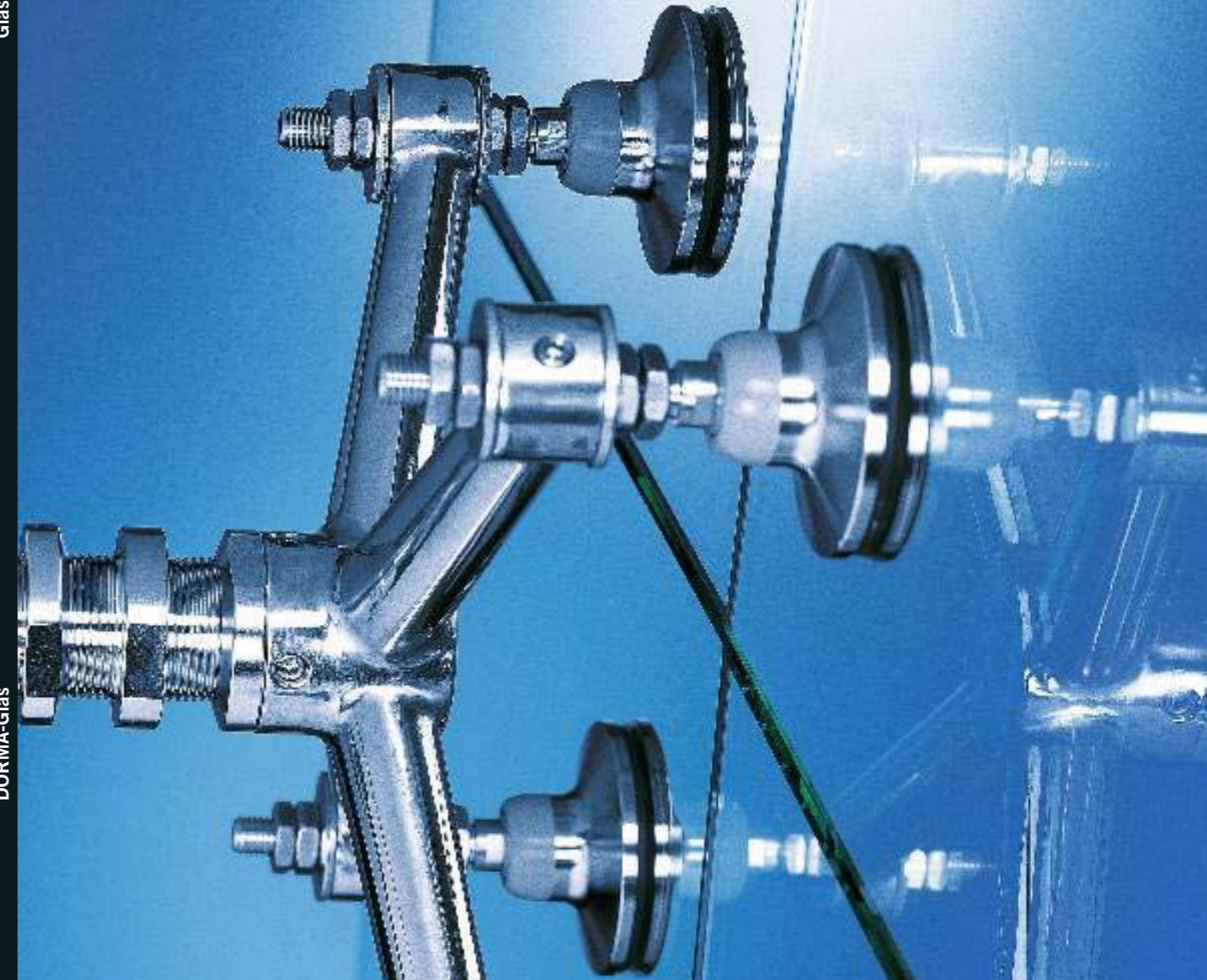


Glass Construction – RODAN, MANET CONSTRUCT, LOOP

RODAN MANET LOOP

Glass
Construction



DORMA-Glas

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DORMA RODAN

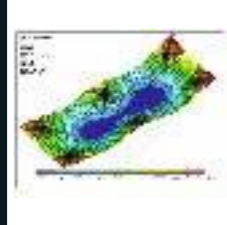
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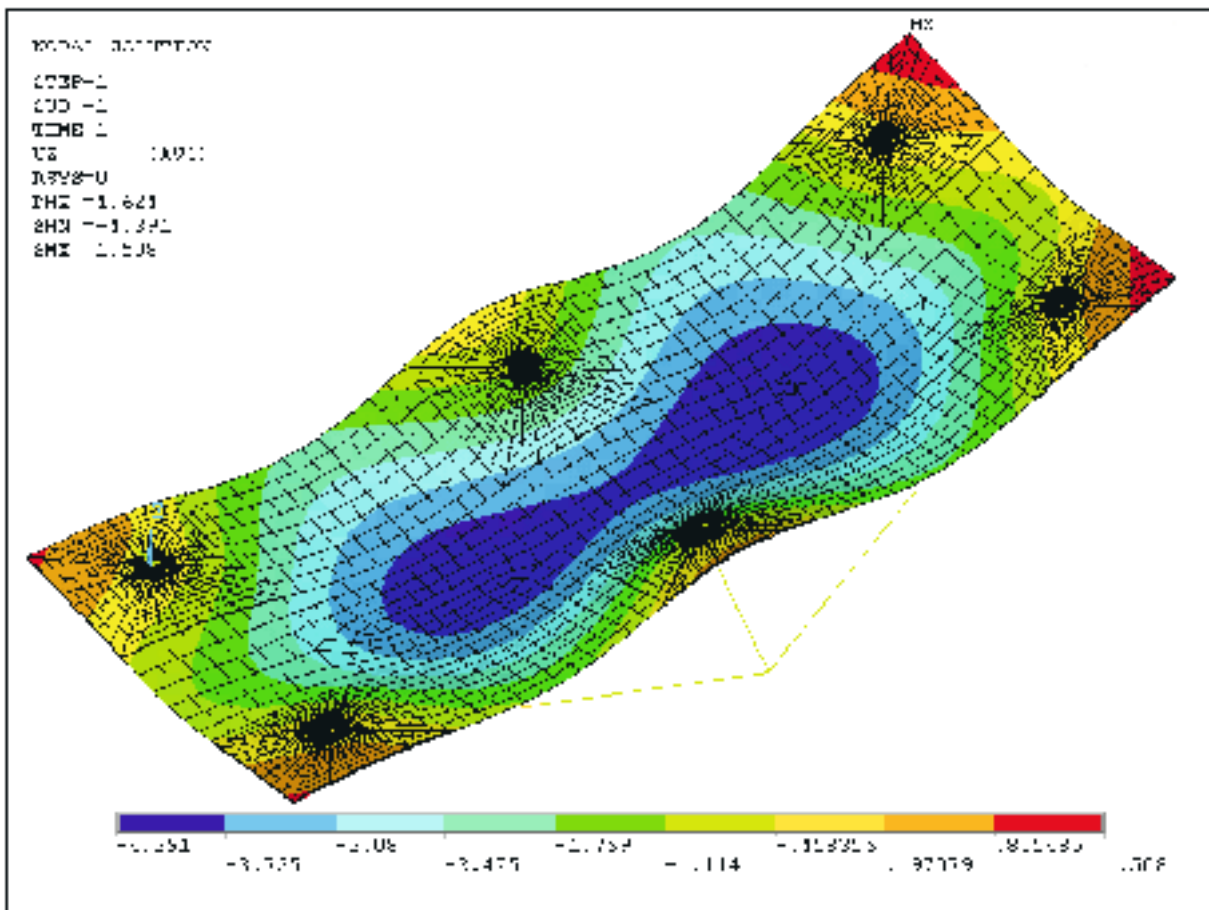
DORMA for safety's sake

DORMA offers sophisticated solutions right from the start. The specialists of our Glass Fittings and Accessories division are committed to innovation and development work involving glass and its unique range of application possibilities. Consistently setting high standards with respect to design, functionality and longevity, DORMA has grown into a leading proponent of the art of structural glass engineering. Glass panels mounted on single-point fixings can be used for a wide range of applications: as canopies and overhead glazings, as façades, balustrades, banister systems and fall hazard protection guards as well as

many other structures and constructions. The planning and execution of these designs often represents a major challenge for metal fabricators, with demanding system details challenging their skills and capabilities. Simply paying for the glass and mountings is not enough. Installers and fabricators also need to be able to rely on the support of the system supplier, often only the source of the necessary expertise. Approvals for glass constructions mounted on single-point fixings often have to be obtained on a case-by-case basis, and the costs involved are difficult to predict.

DORMA glass construction hardware not only meets the desire for maximum transparency but also ensures the necessary safety and reliability for the planning and implementation of sophisticated glass constructions. Our proven and patented RODAN, MANET CONSTRUCT and LOOP systems all come with the necessary basic structural analyses, type test certificates and reports, certificates of suitability, and certificates of general building approval (including European Technical Approvals/ETAs). Where application correlation can be evidenced, these simplify the downstream approval processes which may be neces-

sary. We also supply detailed technical documents to support each individual project, prepared in close consultation and through design collaborations with users of DORMA products. DORMA is a reliable system supplier and our in-house application engineers can be relied upon to provide effective technical support whenever questions, issues and problems arise. They will also assist users in obtaining necessary permits and approvals for each individual application – with DORMA products and the excellent design credentials that come with them, this is rarely a problem.



Glass as a building material

There is hardly another material that enjoys as much popularity with architects and construction engineers as glass. Within just a few decades, glass has developed from a simple window glazing element into a construction material which, through its enormous potential, has significantly influenced the further development of the building art. This fact is amply demonstrated by numerous spectacular structures in steel and glass which have either been constructed in the last few years or are currently at the planning and execution stages.

The reasons for this rapid evolution essentially lie in the technological developments that glass has undergone, leading to improved mechanical strength values and enhanced physical properties for building applications. Aside from glass being used in its primary guise as a containment and dividing material with the allure of high transparency, it is also now being increasingly applied as a load-bearing element. Consequently, glass has a high standing among the materials used in architecture.



Vanity Opera St. Petersburg

Glass as a load-bearing element

Transparent constructions in glass can be found today in virtually every area of architecture. Until recently, the material was primarily used as an ancillary adornment for applications such as façades, interior partitions or roof cladding, based solely on its ability to fill space. Glazing systems can be fixed to the substructure either by linear or point mounting arrangements. It is also possible to combine both processes.

The application of a point bearing system is currently not covered by general building regulations and, in Germany as in most countries, it is therefore subject to approval on a case-by-case

basis by the highest building supervisory authority of the administrative jurisdiction in which the application is made.

Now, a new concept has been introduced into the world of construction, namely that of “load-bearing glass”, which refers in effect to load-bearing structures of glass such as beams, supports, struts, bracing elements etc.

“Load-bearing transparency” means that glass as a construction material with all of its inherent advantages is structurally integrated not only within the primary support system of the glass application itself but also in

that of the building. Naturally, these constructions in glass need to meet the same safety standards as structures using conventional, proven building materials such as steel, timber or concrete. More than this, however, load-bearing glass constructions need to be able to withstand not only the standard stress load types such as wind, snow or impact but also the invidious scourge of vandalism.



Casino Stuttgart

Ebersbach
bus terminus



Overview of DORMA's range of glass construction hardware

Vertical glazing systems

Safety-relevant vertical glazing systems are said to exist in applications in which the assembly is inclined to the vertical by up to 10 degrees and the top edge is located more than 4 m above a pedestrian or wheeled traffic zone.

Consequently, shop windows and glass dividing walls are not generally subject to the same approval conditions as defined vertical glazing systems. This is because the danger of injury with such glazing systems is significantly lower in the event of failure than in the case of large-height glazing systems or overhead glazing systems.

DORMA systems suitable for vertical glazing

RODAN KH/KU/SKU/F
MANET CONSTRUCT
EA/ESA
LOOP

Overhead glazing systems

Overhead glazing systems are all those glass constructions which are inclined by more than 10 degrees to the vertical, including those with a smaller angle of inclination if they are required to absorb bending stresses and are secured by single-point fixings. With overhead glazing systems, residual load-bearing capacity analyses have to be carried out in addition to the usual static analyses.

In experiments, it has been discovered that glass panels secured with single-point fixings essentially exhibit a better level of residual load-bearing capacity than glazing

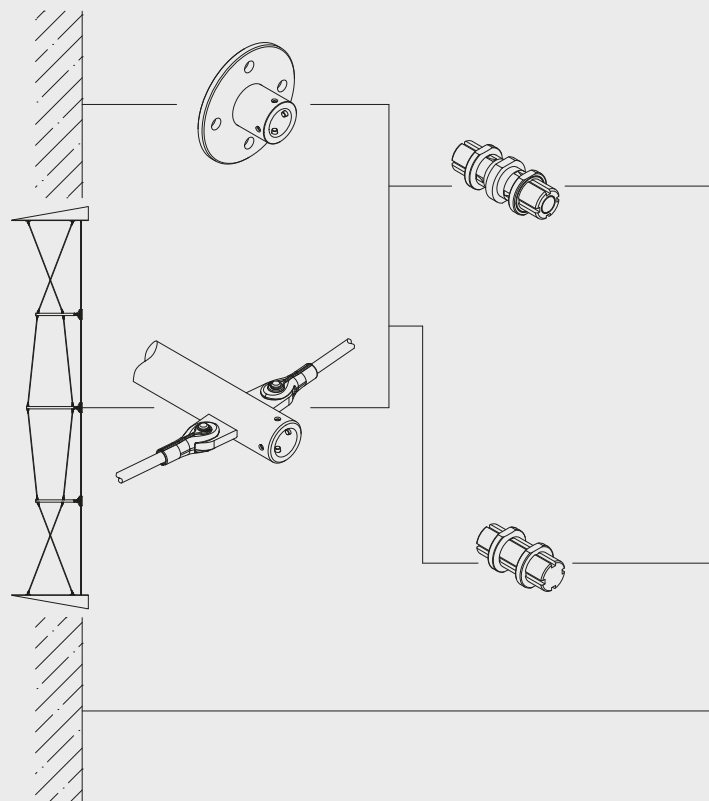
systems with linear bearing supports. The resistance of the single-point fixings to detachment is a decisive factor for residual load-bearing capacity. This resistance increases when disk-shaped mountings are used. Glass roof constructions with downwardly directed countersinking should be avoided.

DORMA systems suitable for overhead glazing

RODAN KH/KU/F
MANET CONSTRUCT EA



System structure



Fall protection safety glazing

Glass panels in stairwells, on parapets and in balustrades are often required to perform protective and safety functions.

This is the case if such glass applications between traffic zones protect a height differential of more than 1m. Because there is the danger of people impacting the glazing and falling through, the load-bearing capacity of the glass elements must be appropriately verified for impulsive and impact loading.

In order to obtain approval, mechanical tests have to be carried out in individual cases in order to investigate the system behaviour on im-

part and fracture.

The general rule reads: The greater the rigidity of the impact surface, the higher the likelihood of fracture.

Consequently, where glass panels are used for fall hazard protection, a resilient bearing system has to be generally applied such as that available with the MANET CONSTRUCT EV system.

DORMA systems suitable for fall hazard protection

**RODAN KH/KU/F
MANET CONSTRUCT EA/
Series EV**

Traffic-accessible/step-on glazing systems

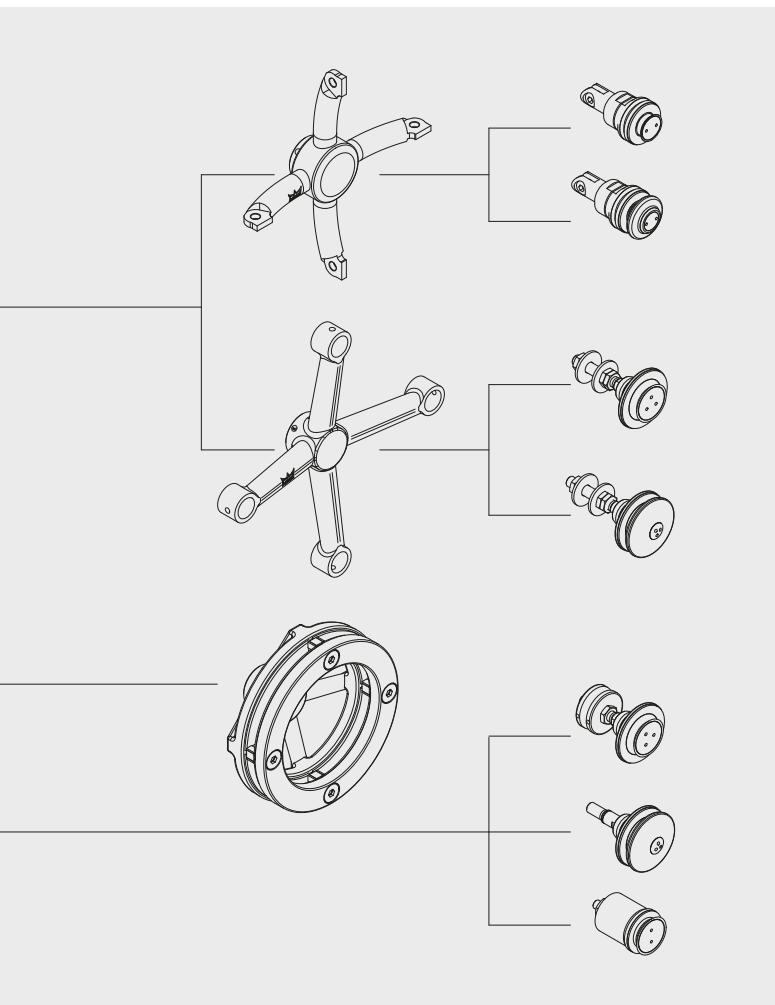
With glass elements, there is a distinction between step-on load-bearing capacity and the higher requirement of traffic accessibility. The need for step-on load-bearing capacity applies to glazing systems which are only intended to be accessible for erection, maintenance or cleaning work. If a continual or recurring live load has to be supported – such as in the case of public usage – we speak of traffic accessibility.

Traffic-accessible glass components must offer sufficient protection against falling objects (impact loading).

This means that the glass component, on impact, must not completely fracture and must certainly not be penetrated by the falling object. And such glazing systems must, of course, also be able to reliably bear their own weight and that of live loads or other bodies acting upon them without falling onto the traffic area below.

DORMA systems suitable for step-on/traffic-accessible glazing systems

**RODAN KH/KU/SKU/F
MANET CONSTRUCT EA/
Series EV**





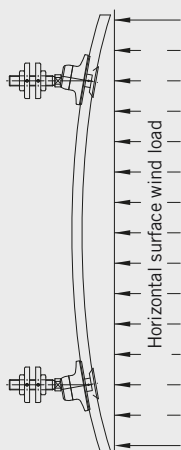
Types of point bearing support

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Because the point of articulation is within the plane of the glass panel, the deadweight of the glass G does not give rise to any additional stresses at the fitting.

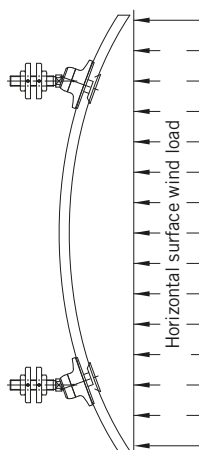
Consequently, the glass does not need to absorb any differential torque occurring at the point fixing.

When using an articulated fitting, the glass thickness can be reduced to a minimum.



2. Point of articulation outside the glass plane (free articulation)

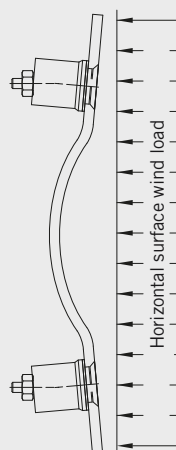
The glass has to absorb the differential torque arising from the eccentricity ($M = G \times e$) at the point fixing. This gives rise to high stresses in the area of the glass around the fitting, which has an effect on the glass thickness needed.



3. Flexibly articulated fittings

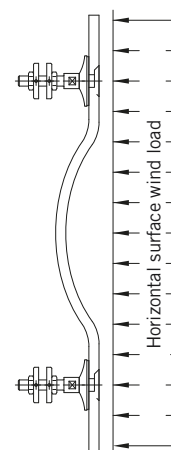
Through the use of a flexible fitting that is not freely rotating within the point-fixed construction, it is possible to fill the gap between an ideally articulated and a rigidly clamped glass fitting system. This gives rise to a reduced degree of glass deformation across the span combined with a reduction in glass stresses in the area of the fitting bore, enabling the achievement of more economic glass dimensioning.

As a positive side effect, the flexibility directly vertical to the glass panel plane in the event of impact loads (e.g. in fall protection glazing systems) means that high, brief and sudden loads can be cushioned by fitting deformation.



4. Rigid, non-articulated fitting

The ability of the glass to rotate is hindered. This gives rise to very high stress peaks around the rigid point fittings in terms of load per unit area. A cogent static analysis of the glazing panels would result in the requirement to either drastically reduce the spans between the fittings or to use very thick panels.



Interaction of fittings and glass and how this affects dimensioning requirements:

1. Articulated fittings

– point of rotation in the glass

2. Articulated fittings

– point of rotation outside the glass plane

3. Flexible fittings

4. Rigid mountings

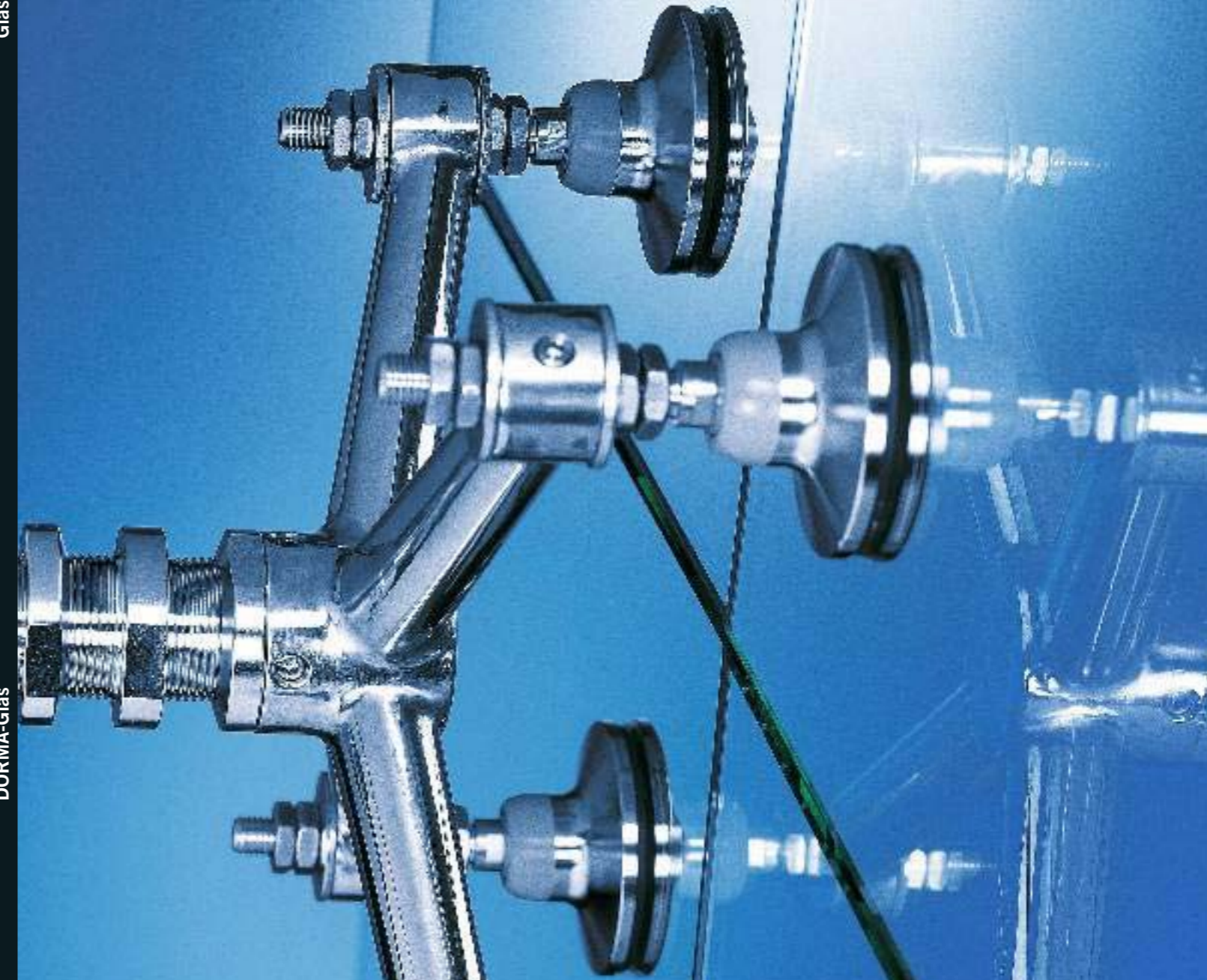
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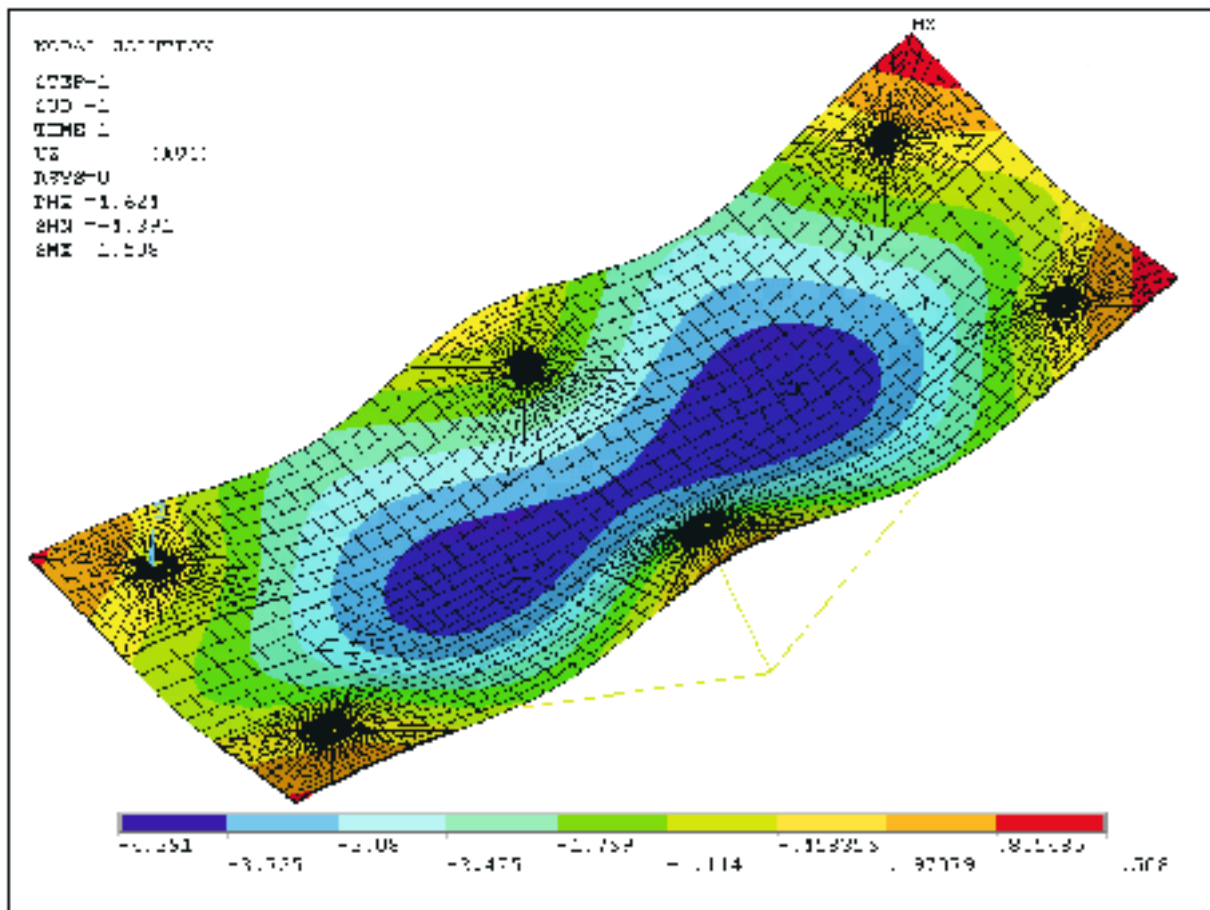
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Casino Stuttgart

Ebersbach
bus terminus



Overview of DORMA's range of glass construction hardware

Vertical glazing systems

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DORMA systems suitable for vertical glazing

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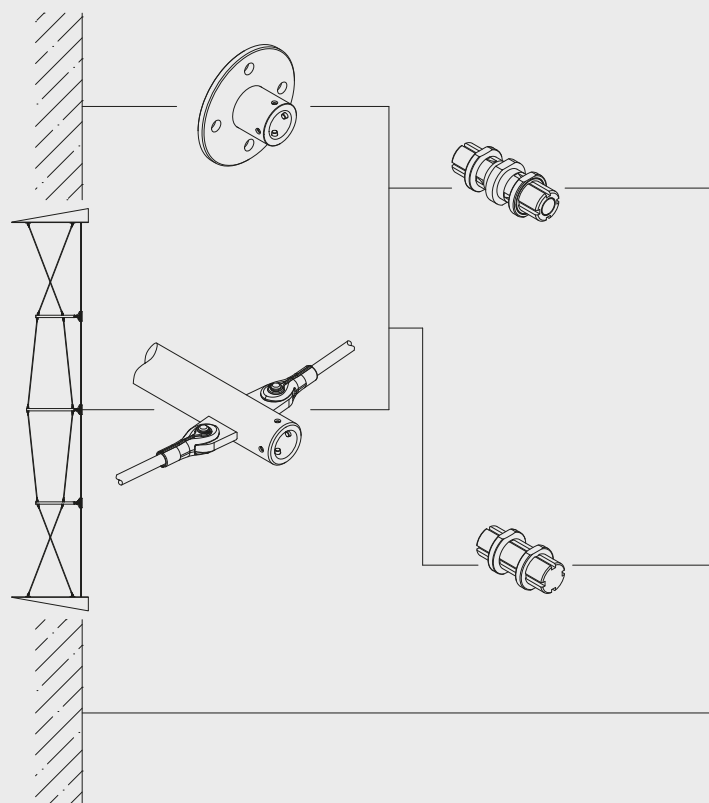
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DORMA systems suitable for overhead glazing

RODAN KH/KU/F
MANET CONSTRUCT EA



System structure



Fall protection safety glazing

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DORMA systems suitable for fall hazard protection

**RODAN KH/KU/F
MANET CONSTRUCT EA/
Series EV**

Traffic-accessible/step-on glazing systems

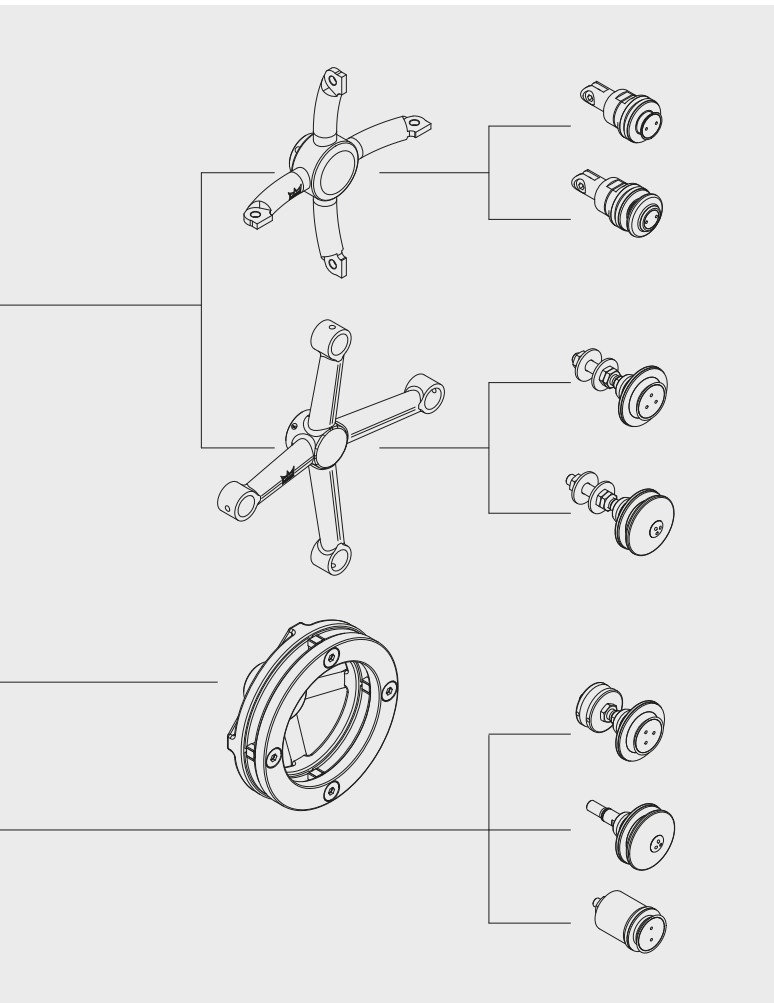
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**RODAN KH/KU/SKU/F
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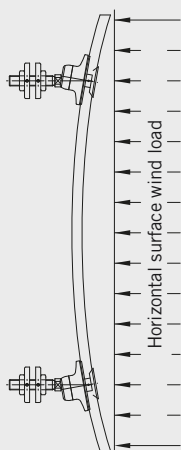
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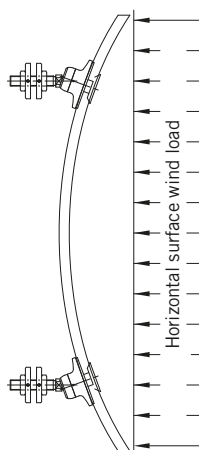
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When using an articulated fitting, the glass thickness can be reduced to a minimum.



2. Point of articulation outside the glass plane (free articulation)

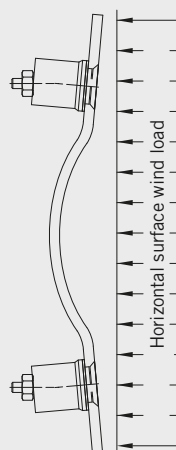
The glass has to absorb the differential torque arising from the eccentricity ($M = G \times e$) at the point fixing. This gives rise to high stresses in the area of the glass around the fitting, which has an effect on the glass thickness needed.



3. Flexibly articulated fittings

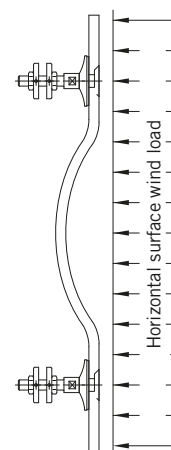
Through the use of a flexible fitting that is not freely rotating within the point-fixed construction, it is possible to fill the gap between an ideally articulated and a rigidly clamped glass fitting system. This gives rise to a reduced degree of glass deformation across the span combined with a reduction in glass stresses in the area of the fitting bore, enabling the achievement of more economic glass dimensioning.

As a positive side effect, the flexibility directly vertical to the glass panel plane in the event of impact loads (e.g. in fall protection glazing systems) means that high, brief and sudden loads can be cushioned by fitting deformation.



4. Rigid, non-articulated fitting

The ability of the glass to rotate is hindered. This gives rise to very high stress peaks around the rigid point fittings in terms of load per unit area. A cogent static analysis of the glazing panels would result in the requirement to either drastically reduce the spans between the fittings or to use very thick panels.



Interaction of fittings and glass and how this affects dimensioning requirements:

1. Articulated fittings

– point of rotation in the glass

2. Articulated fittings

– point of rotation outside the glass plane

3. Flexible fittings

4. Rigid mountings

DORMA RODAN

Nowadays, single-point fixings and tie arrangements are frequently used in order to minimise the bulk of the support structures required for major glazing systems. As a result of the transparency of the glass, the support and bearing hardware is readily visible and thus constitutes an important aesthetic aspect. For glass architecture to be attractive, therefore, these elements have to be properly designed. The time-proven RODAN system with its single-point fixings and tie systems provides architects and specifiers with the necessary decorative appeal in such components. Precision and excellence in detail, based on the purity of the ma-

terials used, such as castings from the best addresses and stainless steel, ensure safety and longevity, while immaculate styling and efficiency of function serve as guarantors for a perfect combination of discrete elegance and expressive appeal in glass architecture.

The design

Aside from offering sophisticated engineering and near technical perfection, the RODAN system has also been awarded with a number of design prizes.



The RODAN single-point fixing was the recipient of the 2001 Design Award conferred by Industrie Forum Design Hannover.



Design Center Stuttgart Design Shortlist 1992

Certificates

Designs in glass begin with the material, but do not end there. Glass architecture requires advanced engineering and a plenty of design input based on close and careful cooperation between architects, engineers, structural physicists and the hardware manufacturer – for example DORMA as the provider of the tried, tested and certified RODAN system.

ETA-05/0074

European Technical Approval for the RODAN point fixing system

ETA-06/0021

European Technical Approval for the stainless steel tie rod

ETA-05/0207

European Technical Approval for the steel tie rod

Z-14.4-458

Certificate of General Building Approval of the DORMA spiders, type RODAN and type MANET CONSTRUCT



Mark of compliance awarded to the DORMA spiders, type RODAN and type MANET CONSTRUCT

System components

Spider



Single-point fixing



Tie system



Trussed glass panels



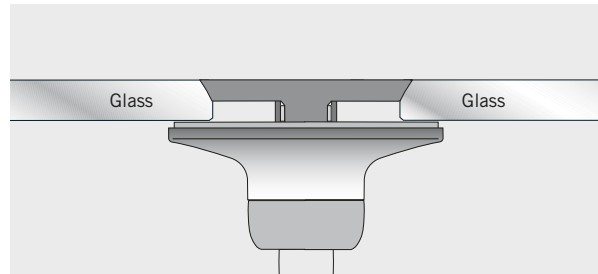
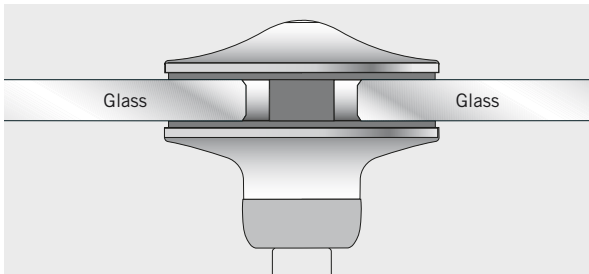
RODAN single-point fixings

Glass panels place particular requirements on the stress relief provided by the support and fixing system. Each RODAN single point fixing is therefore tailored to its specific task, not only in relation to its ease of installation but also its ability to compensate for building tolerances. RODAN single point fixings are generally available in the sizes 50, 60 and 70, these

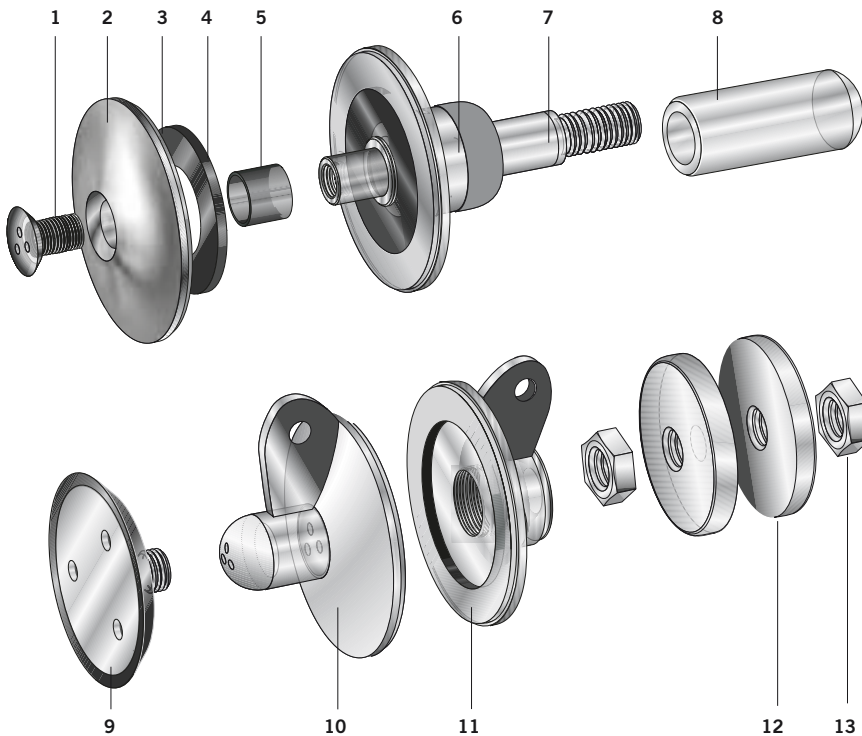
figures referring to the diameter of counter-bearing disk in mm (see also pages 14-21). With their articulating ball joint, these fittings move in all directions, allowing the free deformation of the glass panel in the area of the fixing bore and ensuring the reliable dissipation of peak stresses and effective stress relief at the fixing points specifically.

The engineering, the glass, the design and the installation method together determine the functional reliability of the complete system. Hence RODAN single point fixings have been designed with a full complement of optional features – from clamping disk variants to articulated countersunk disk fittings for all the visual advantages of a flush-fixed

system, and from integrally welded sleeves to conventional bolting systems with nuts and washers for connection to the substructure. It is essential to calculate in advance and to coordinate the glass and substructure tolerances and also the temperature fluctuations likely to occur. Only in this way can the achievement of optimised project solutions be ensured.





















System components (examples of single point fixings)



Individual components

- 1 Countersunk screw
- 2 Clamping disk
- 3 Contact ring
- 4 Rubber washer
- 5 Spacer sleeve
- 6 Counter-bearing disk assembly
- 7 Threaded ball pin
- 8 Welding sleeve
- 9 Countersunk screw-fixed disk with clamping ring
- 10 Clamping disk with welded eyelet
- 11 Counter-bearing disk with welded eyelet
- 12 Washer
- 13 Lock nut

Overview of point fixings with properties and connection possibilities.

Point fixing	Series	Rigid	With ball joint	Clamp fitting	Countersunk fitting	Disk size Ø mm	Connection to substructure					Detailed information on page
							Internally threaded bore	Welding sleeve/Welding pin	With washers for eyelet plate connection	For spider connection	With welded eyelets for tie rods	
	F	•		•		50 70		•				14
	FL	•		•		70					•	14
	FLL	•		•		70					•	14
	FU	•		•		50 70			•			15
	SFU	•			•	50			•			15
	K		•	•		50 60 70	•					16
	KH		•	•		50 60 70		•				16
	KU		•	•		50 60 70			•			17
	SKU		•		•	50 70			•			17
	KU-S		•	•		50 70				•		18
	SKU-S		•		•	50 70				•		18
	KLU/H		•	•		70		•			•	19
	KLU/U		•	•		70			•		•	19
	KLO/H		•	•		70		•			•	20
	KLO/U		•	•		70			•		•	20
	KLL/H		•	•		70		•			•	21
	KLL/U		•	•		70			•		•	21
	Strut F 70	•		•		70					•	48

Series F

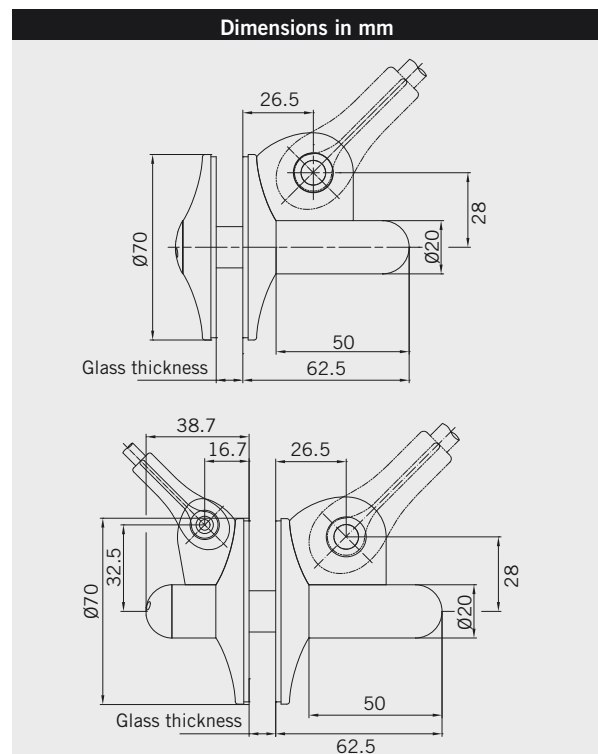
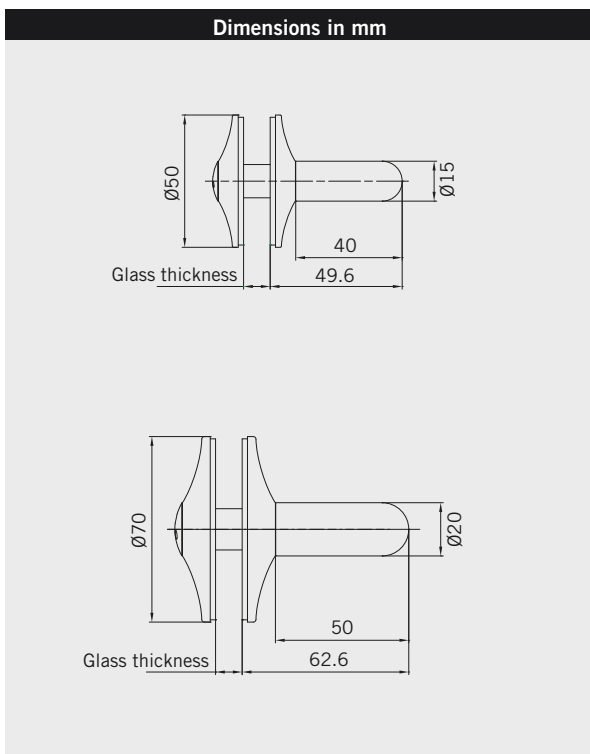


For small-sized glass panels or in combination with ball-joint fittings, clamp fittings without a ball joint (rigid) are used. Available disk sizes: 50 and 70 mm.

Series FL+FLL



The rigid glass clamp fittings of the series FL and FLL (disk size 70 mm) with one or two welded eyelets are designed for tie rod connection, for example in trussed assemblies used for canopy constructions.



Order data for complete Series F fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
F 50	10	8.23.170.703.99
	12	8.23.171.703.99
	13.5	8.23.174.703.99
	17.5	8.23.172.703.99
	21.5	8.23.173.702.99
F 70	10/12	8.23.370.702.99
	13.5	8.23.373.703.99
	17.5	8.23.371.703.99
	21.5	8.23.372.703.99

Order data for complete Series FL/FLL fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
FL 70	10/12	8.23.380.703.99
	13.5	8.23.383.703.99
	17.5	8.23.381.703.99
	21.5	8.23.382.702.99
	10/12	8.23.385.703.99
FLL 70	13.5	8.23.386.703.99
	17.5	8.23.387.703.99
	21.5	8.23.388.703.99

Series FU

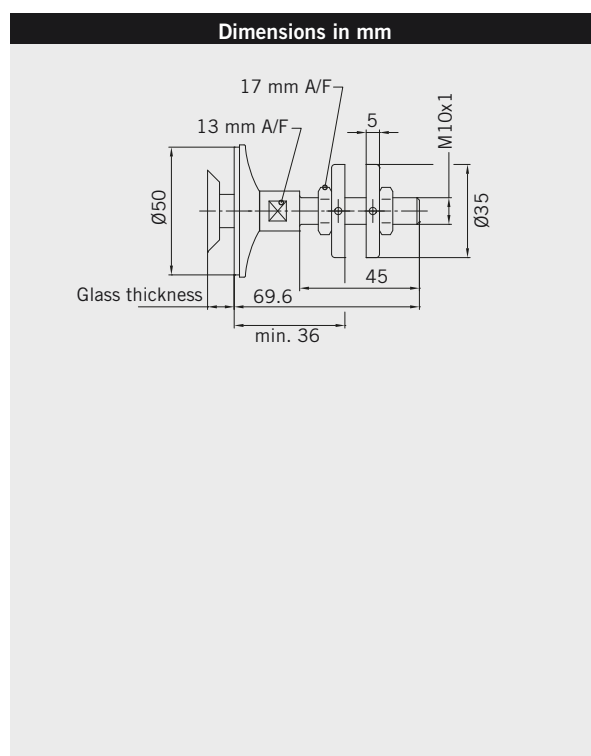
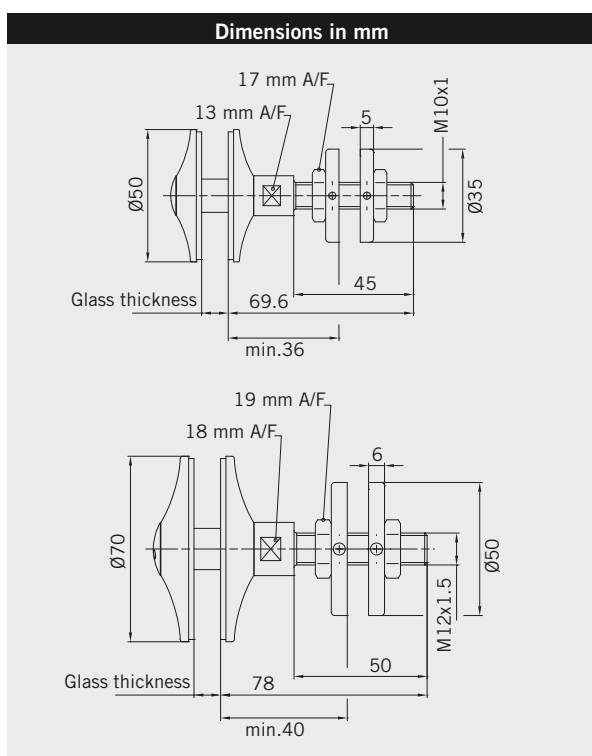


The FU range of rigid clamp fittings with washers are used for small-sized glass panels and are available with disk sizes of 50 and 70 mm.

Series SFU



Rigid countersunk fittings with washers carry the designation SFU. These fittings are available with a counter-bearing disk diameter of 50 mm.



Order data for complete Series FU fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
FU 50	10	8.23.190.703.99
	12	8.23.191.703.99
	13.5	8.23.194.703.99
	17.5	8.23.192.702.99
	21.5	8.23.193.702.99
FU 70	10/12	8.23.390.702.99
	13.5	8.23.393.702.99
	17.5	8.23.391.703.99
	21.5	8.23.392.703.99

Order data for complete Series SFU fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
SFU 50	10	8.23.135.703.99
	12	8.23.136.703.99
	13.5	8.23.137.703.99
	17.5	8.23.138.703.99
	21.5	8.23.139.703.99

Series K

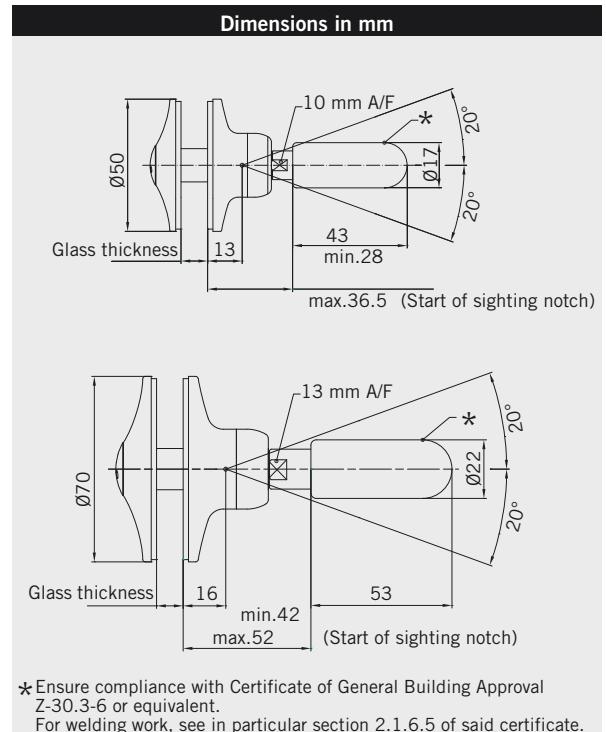
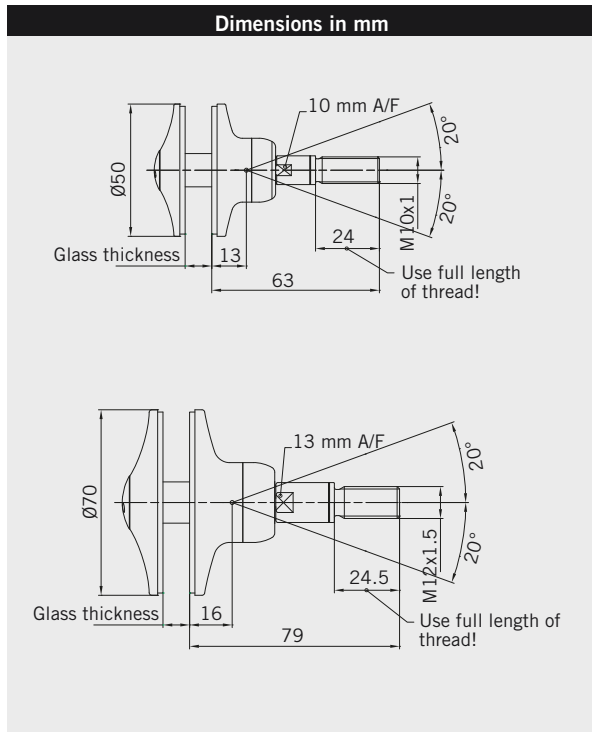


Series K clamp fittings are equipped with an articulating ball joint and available in the disk sizes 50, 60 and 70 mm. Type K mountings have a precision M10x1 / M12x1.5 thread for fixing them to the substructure.

Series KH



Clamp fittings of the KH series have an articulating ball joint and welding sleeve and are available in the sizes 50, 60 and 70. The sleeve (mill finish) is separately supplied in advance for welding to the substructure, and is then surface treated together with the substructure. As the glazing panels are fitted, the clamp fittings are screwed into the pre-installed sleeves.



Order data for complete Series K fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
K 50	10	8.23.100.703.99
	12	8.23.101.703.99
	13.5	8.23.104.703.99
	17.5	8.23.102.703.99
	21.5	8.23.103.703.99
K 60	10	8.23.200.703.99
	12	8.23.201.703.99
	13.5	8.23.204.703.99
	17.5	8.23.202.703.99
	21.5	8.23.203.703.99
K 70	10/12	8.23.300.703.99
	13.5	8.23.303.703.99
	17.5	8.23.301.703.99
	21.5	8.23.302.703.99
	25.5	8.23.304.703.99

Order data for complete Series KH fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
KH 50	10	8.23.110.703.99
	12	8.23.111.703.99
	13.5	8.23.114.703.99
	17.5	8.23.112.703.99
	21.5	8.23.113.703.99
KH 60	10	8.23.210.703.99
	12	8.23.211.703.99
	13.5	8.23.214.703.99
	17.5	8.23.212.703.99
	21.5	8.23.213.703.99
KH 70	10/12	8.23.310.703.99
	13.5	8.23.313.703.99
	17.5	8.23.311.703.99
	21.5	8.23.312.703.99
	25.5	8.23.314.703.99

Series KU

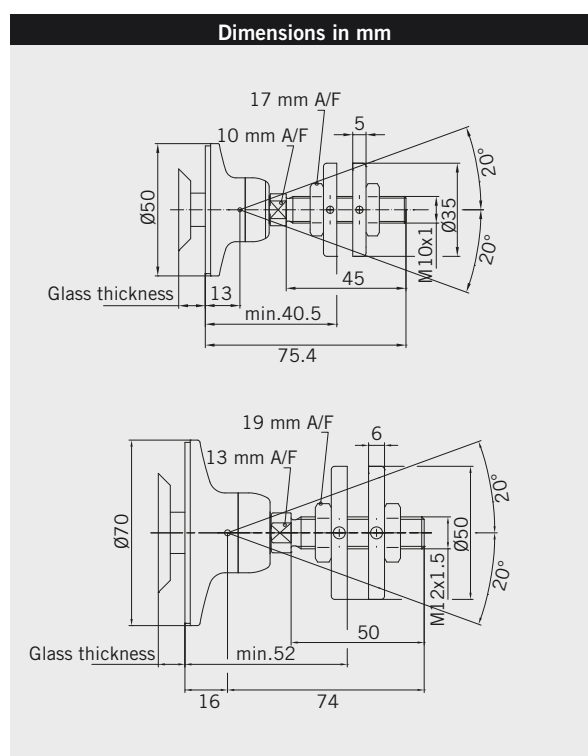
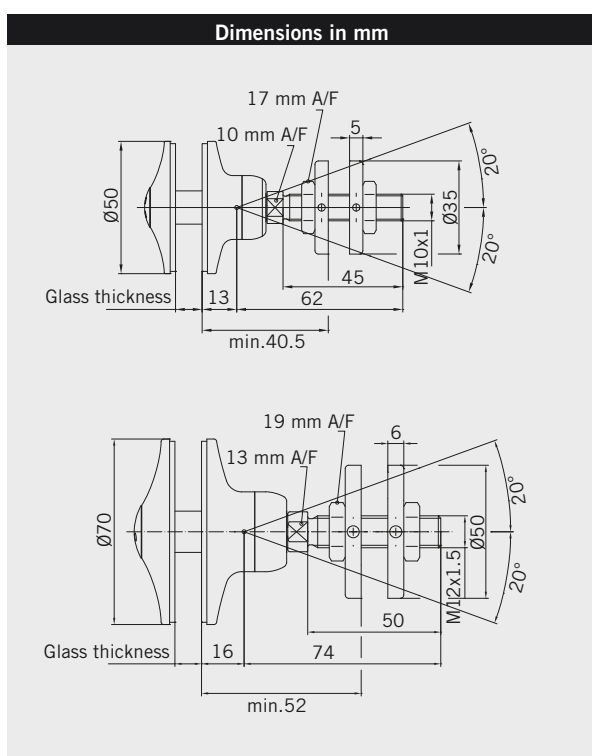


In contrast to clamp fittings with a ball joint and sleeve, the series KU is secured by washers and lock nuts to the sub-structure. These mountings also come in the disk sizes 50, 60 and 70 mm.

Series SKU



SKU countersunk fittings with washers, type SKU, are primarily used for vertical glazing systems and are available in counter-bearing disk diameters of 50 and 70 mm.



Order data for complete Series KU fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
KU 50	10	8.23.120.703.99
	12	8.23.121.703.99
	13.5	8.23.124.703.99
	17.5	8.23.122.703.99
	21.5	8.23.123.703.99
KU 60	10	8.23.220.703.99
	12	8.23.221.703.99
	13.5	8.23.224.703.99
	17.5	8.23.222.703.99
	21.5	8.23.223.703.99
KU 70	10/12	8.23.320.703.99
	13.5	8.23.323.703.99
	17.5	8.23.321.703.99
	21.5	8.23.322.703.99
	25.5	8.23.324.703.99

Order data for complete Series SKU fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
SKU 50	10	8.23.140.703.99
	12	8.23.141.703.99
	13.5	8.23.144.703.99
	17.5	8.23.142.703.99
	21.5	8.23.143.703.99
SKU 70	10	8.23.330.703.99
	12	8.23.331.703.99
	13.5	8.23.334.703.99
	17.5	8.23.332.703.99
	21.5	8.23.333.703.99

Series KU-S

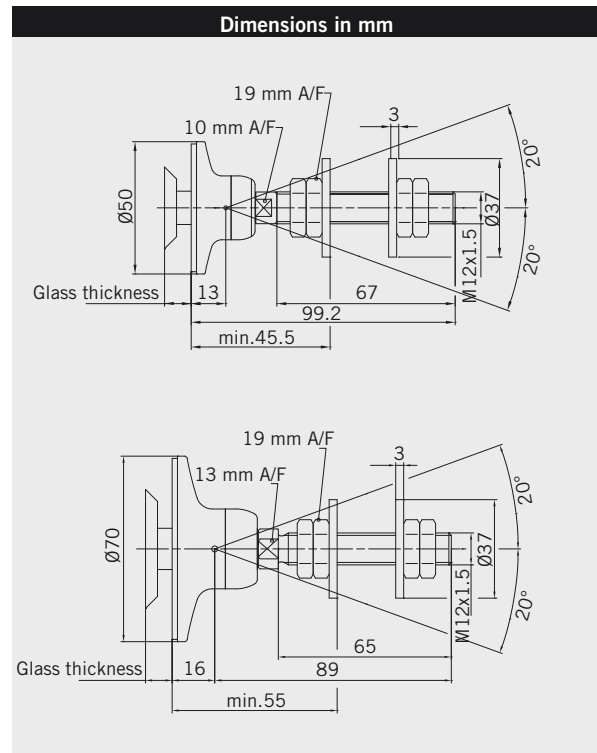
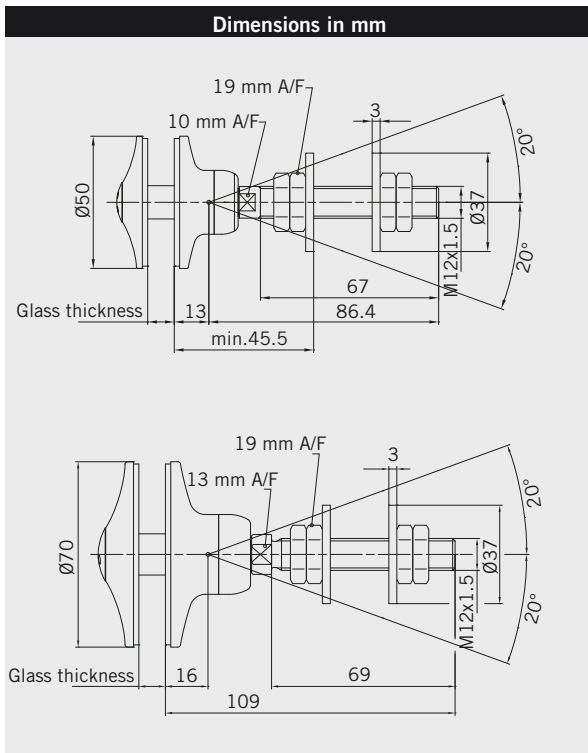


Clamp fittings of the series KU-S are specifically designed for RODAN spiders and are available in the disk sizes 50 and 70 mm.

Series SKU-S



Countersunk fittings of the SKU-S range are specifically designed for RODAN spiders and are available in counter-bearing disk sizes 50 and 70 mm.



Order data for complete Series KU-S fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
KU 50S	10	8.23.450.703.99
	12	8.23.451.703.99
	13.5	8.23.454.703.99
	17.5	8.23.452.703.99
	21.5	8.23.453.703.99
KU 70S	10/12	8.23.225.703.99
	13.5	8.23.229.703.99
	17.5	8.23.226.703.99
	21.5	8.23.227.703.99
	25.5	8.23.228.703.99

Order data for complete Series SKU-S fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
SKU 50S	10	8.23.460.703.99
	12	8.23.461.703.99
	13.5	8.23.464.703.99
	17.5	8.23.462.703.99
	21.5	8.23.463.703.99
SKU 70S	10	8.23.335.703.99
	12	8.23.336.703.99
	13.5	8.23.339.703.99
	17.5	8.23.337.703.99
	21.5	8.23.338.703.99

Series KLU/H

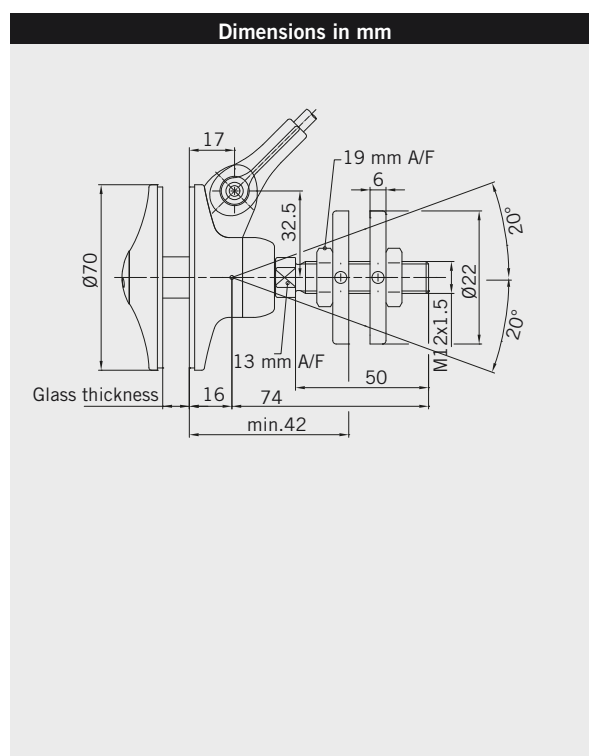
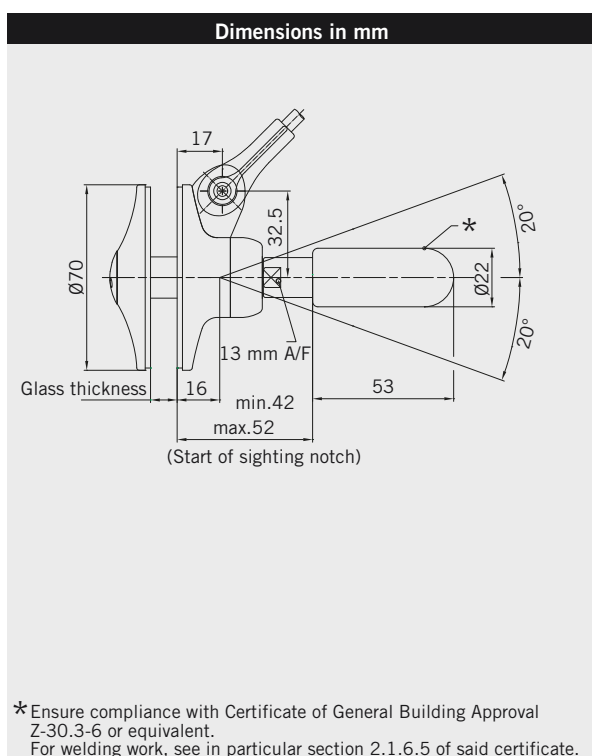


Clamp fittings with articulating ball joint and welding sleeve and also a welded eyelet on the rear counter-bearing disk carry the designation KLU/H. The laser-welded eyelet fits a tie rod of the size RDA6. Clamp fittings of this type are used, for example, for bottom-trussed glass panels.

Series KLU/U



Instead of a welding sleeve, the type KLU/U features washers and lock nuts for attachment to the substructure.



Order data for complete Series KLU/H fittings		
Typ	Glass thickness mm	Article No. Stainless steel 1.4404
KLU/H 70	10/12	8.23.340.703.99
	13.5	8.23.343.703.99
	17.5	8.23.341.703.99
	21.5	8.23.342.703.99

Order data for complete Series KLU/U fittings		
Typ	Glass thickness mm	Article No. Stainless steel 1.4404
KLU/U 70	10/12	8.23.345.703.99
	13.5	8.23.348.703.99
	17.5	8.23.346.703.99
	21.5	8.23.347.703.99

Series KLO/H

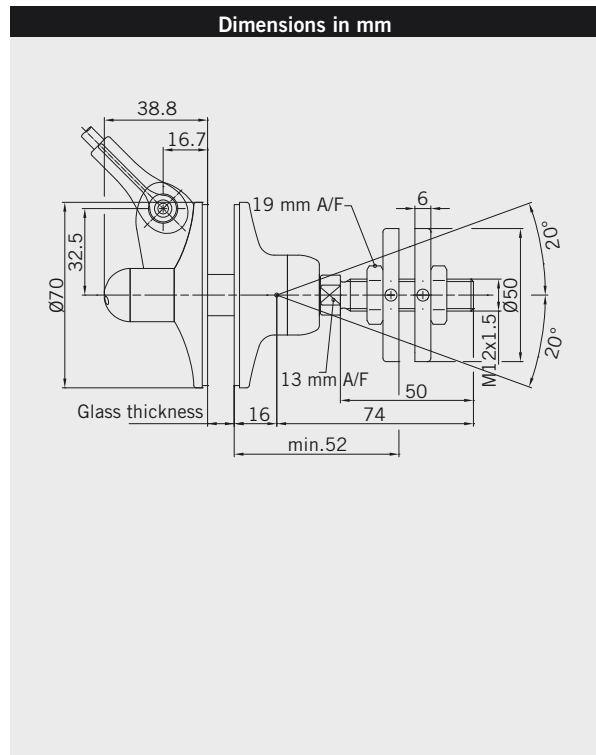
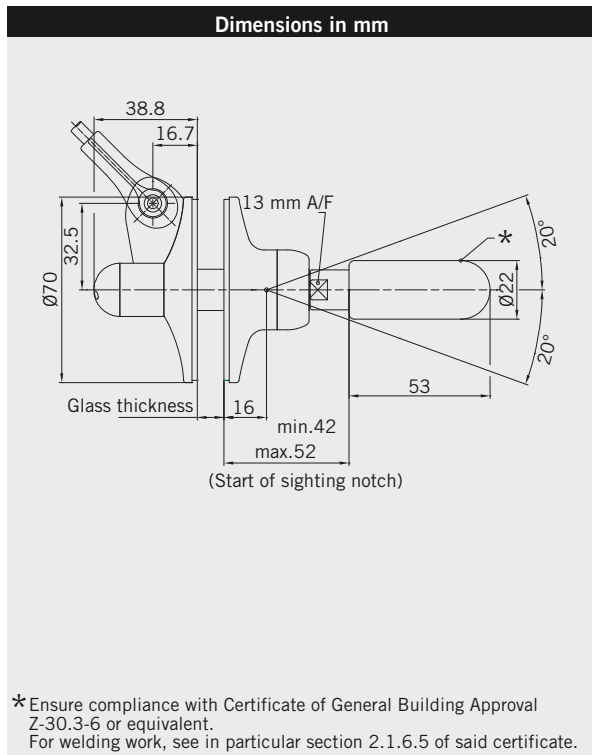


Clamp fittings with articulating ball joint and welding sleeve plus eyelet on the front clamping disk carry the designation KLO/H. These are used in applications where the RODAN tie system serves to dissipate forces acting on the front face of the glass.

Series KLO/U



Clamp fittings with eyelets for tie rods at the front or upper glass surface are also available with washers and lock nuts under the designation KLO/U.



Order data for complete Series KLO/H fittings

Type	Glass thickness mm	Article No. Stainless steel 1.4404
KLO/H 70	10/12	8.23.360.703.99
	13.5	8.23.363.703.99
	17.5	8.23.361.703.99
	21.5	8.23.362.703.99

Order data for complete Series KLO/U fittings

Type	Glass thickness mm	Article No. Stainless steel 1.4404
KLO/U 70	10/12	8.23.365.703.99
	13.5	8.23.368.703.99
	17.5	8.23.366.703.99
	21.5	8.23.367.703.99

Series KLL/H

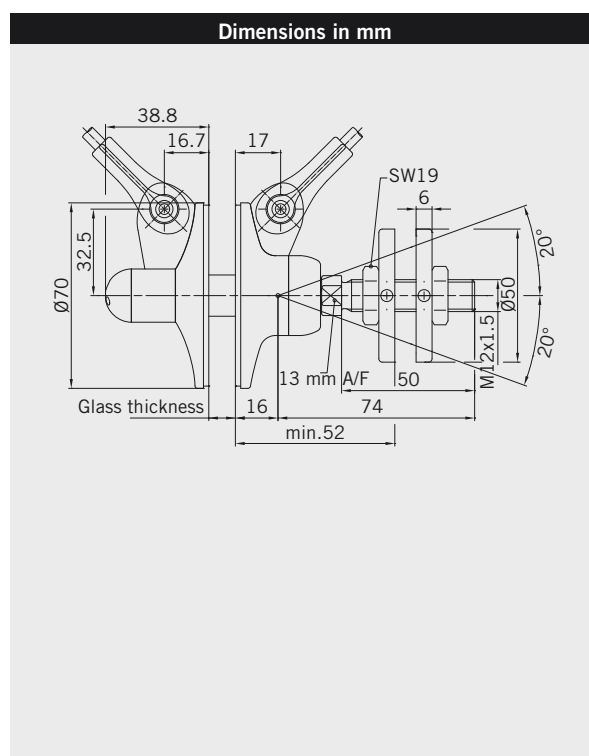
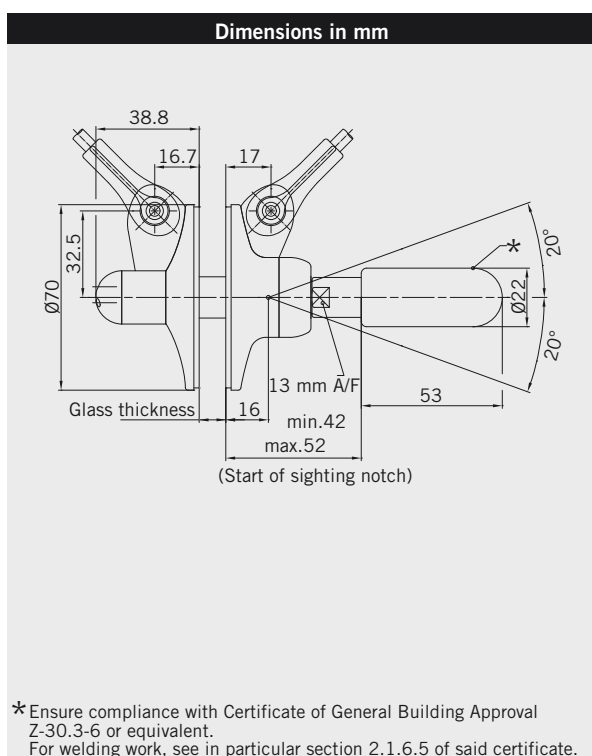


Clamp fittings with articulating ball joint, welding sleeve and welded eyelets on both the clamping disk and the counter-bearing disk assembly carry the designation KLL/H. This fitting type is used for glazing systems in which the application requires top and bottom trussing.

Series KLL/U



Similar clamp fittings for connection to the substructure by means of washers and lock nuts are available under the designation KLL/U.



Order data for complete Series KLL/H fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
KLL/H 70	10/12	8.23.350.703.99
	13.5	8.23.353.703.99
	17.5	8.23.351.703.99
	21.5	8.23.352.703.99

Order data for complete Series KLL/U fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
KLL/U 70	10/12	8.23.355.703.99
	13.5	8.23.358.703.99
	17.5	8.23.356.703.99
	21.5	8.23.357.703.99

Drilling the glass

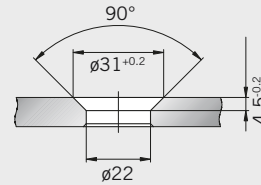
Arrangement of RODAN single-point fixings for glass panels

The arrangement of the RODAN single-point fixings is of decisive importance for minimising stresses in the glass for a given loading pattern.

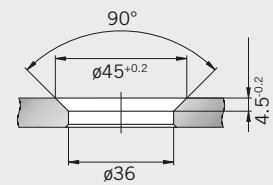
The edge clearances depend on a number of factors in practice (e.g. position of the substructure). Corresponding values for achieving optimum support of the glass panels have to be indicated in each individual case.

Countersunk bore for countersunk fitting

Fitting type S50



Fitting type S70



Compensation of tolerances

Clamp fitting

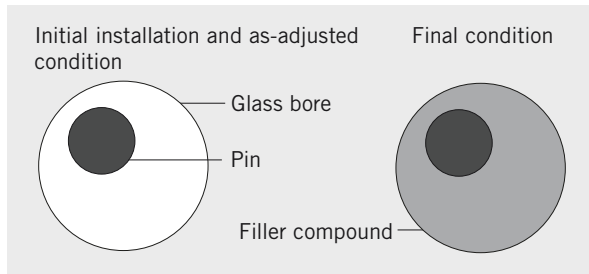


Glass bore

Tight fit created through the use of a glass-compatible hard-curing filler compound.

Caution!

Ensure that all the bores are filled for a tight fit as otherwise the glass panel may slip under load!



Consumption volumes of filler compound in drilled glass bores

The table shows the values calculated for a glass thickness of 10 mm. With, for example, a glass thickness of 21.5 mm, the values should be multiplied by a factor of 2.15 (example KH 50 = 3.68 x 2.15 = 7.91 cm³).

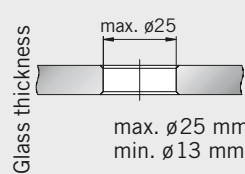
Fitting	∅	50	60	70
Glass bore max.	∅	25	30	35
Sleeve OD	∅	12.5	12.5	15.5
Area of filler compound	mm ²	368	584	962
Volume of filler compound	cm ³	3.68	5.84	9.62
Width of contact ring	mm	10	10	10
Bearing contact area	mm ²	1193	1508	1822
Tolerance compensation x/y direction	mm	± 6	± 8.5	± 9.5

Manufacturer's data relating to filler compound usage must be taken into account for static analysis purposes.

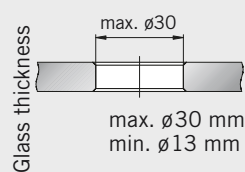
Through-bores for clamp fittings

Selection of the minimum diameter: fitting fits tightly in glass bore. Selection of maximum diameter: maximum compensation of tolerances in the glass bore – filler compound necessary.

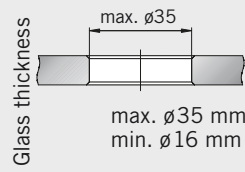
Fitting type 50



Fitting type 60



Fitting type 70

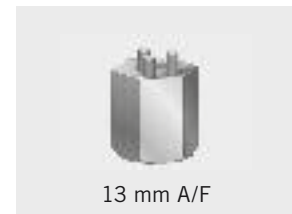


Installation tools

Additionally required standard tools:

- Open-jaw wrench
- M8 hexagonal wrench
- Torque wrench with socket

For RODAN clamp fittings:



K 50 / K 60



K 70



K 50 S / K 70 S

Installing the RODAN clamp fittings

Series KH



Substructure

The welding sleeve (1) should be welded with the structurally required weld thickness to the substructure such that it is free from distortion. When welding the stainless steel sleeve to a structural steel, the weld must be provided with an appropriate coating in order to avoid electrochemical (=galvanic) corrosion. Before coating, the thread of the welding sleeve needs to be protected by winding in the plug screw (8).

When carrying out welds of this type, ensure compliance with relevant regulations such as Certificate of General Building Approval Z-30.3-6 (in Germany) for stainless steels.

Fittings

The single-point fixings are wound into the welding sleeve (1) by applying a wrench to the ball pin flats.

Glass

Once all the fittings have been installed and pre-adjusted, undo the countersunk screw (6) and remove the clamping disk (5). The glass panel (3) can now be positioned and aligned. Tolerances in the glass panel plane are absorbed by the larger diameter bores of the glass panel (only possible with properly supported glass panels). In addition, the glass panel can be adjusted in the depth direction using an open-jaw wrench applied to the ball pin flats. The remaining cavity (4) of the glass panel is filled using a special compound (hard-curing) in accordance with the specifications of the planning engineers. Once the cavities have been filled, the clamping disk (5) is fitted using the countersunk screw (6) wound into to the counter-bearing disk assembly using the special driver (7).

Series KU



Substructure

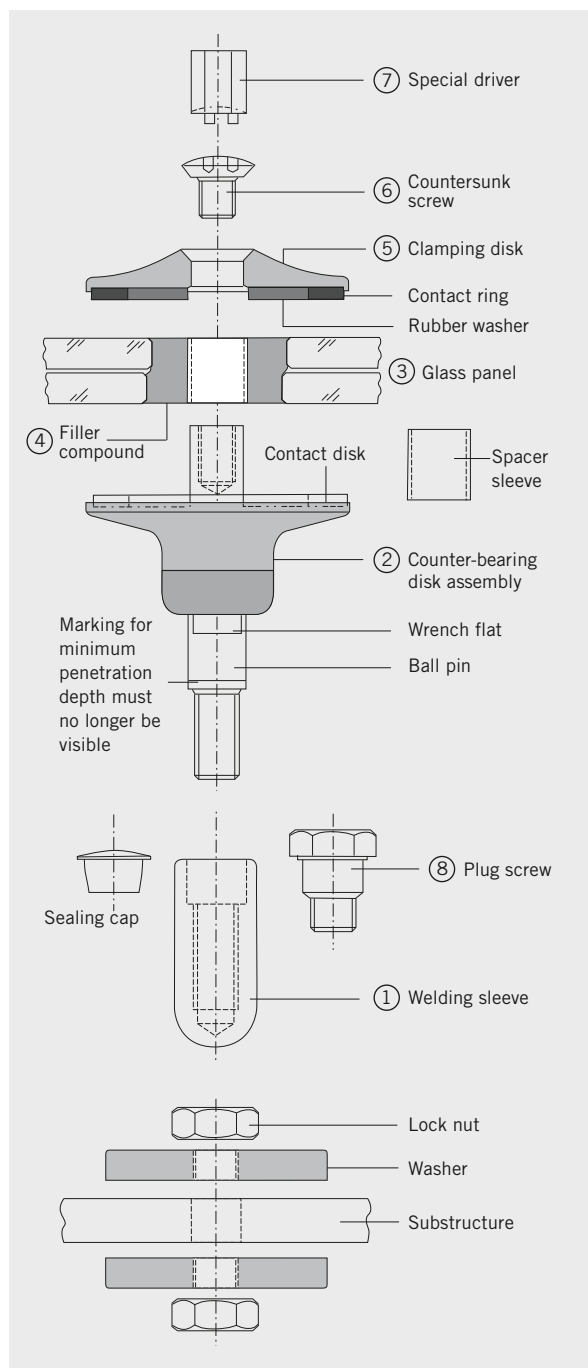
Drill bores in accordance with structural and tolerance requirements.

Fittings

Insert the KU fittings and adjust to required depth using the nuts and washers.

Glass

Proceed as described above for the series KH fittings.



Static values and approvals

The RODAN series KH glass clamp fittings were the first fittings for glass construction applications to receive European Technical Approval (ETA-05/0074). An assumed lifetime for the mountings of 25 years forms the basis of the documented regulations. This longevity is the result of positive experience gained in many years of practical applications and numerous scientific investigations involving RODAN products. The ETA approval

is supplemented by a certificate of suitability relating to the RODAN mounting types KU and SKU, issued and monitored by the Research Centre for Steel, Timber and Masonry of the University of Karlsruhe. This certificate of suitability contains audited information relating to application, load-bearing capacity and the durability of the fittings.



European Technical Approval
ETA-05/0074



Certificate of suitability

Load-bearing capacities of the glass clamp fittings

Glass clamp fitting type KH

The table below contains the characteristic loadability values of the glass clamp fittings exposed to normal and transverse forces. The dimensioning values are derived

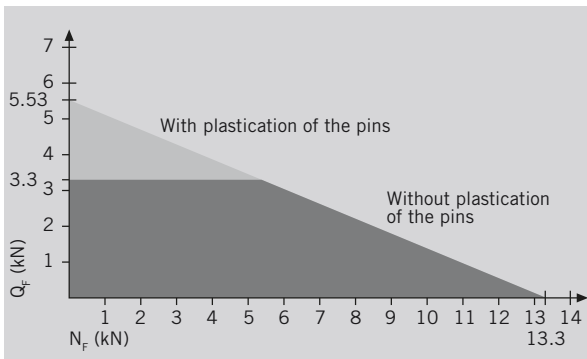
from these data by dividing by a partial safety factor of $\gamma_m = 1.1$. When using a screwed connection between the pin and the substructure, the analysis is performed by mathematical means. If the

fittings are simultaneously stressed by both normal and transverse forces, dimensioning can be determined on the basis of the interaction diagrams provided at the bottom of the page.

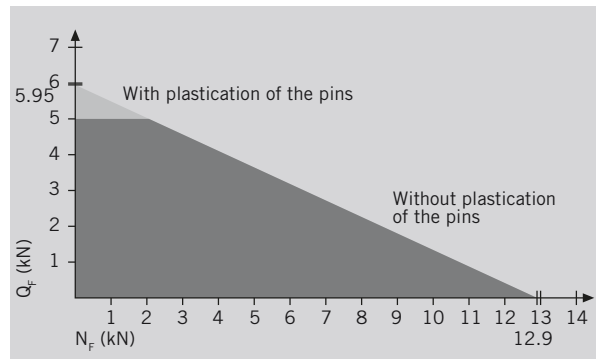
Determination of the design loads is based on the partial safety concept specified in DIN 18 800.

Glass clamp fitting type	Normal force N_f	Transverse force Q_f
KH 50 (Pin \varnothing 10 mm)	13.33 kN	5.53 kN
KH 60 (Pin \varnothing 10 mm)	13.33 kN	5.53 kN
KH 70 (Pin \varnothing 12 mm)	12.90 kN	5.95 kN

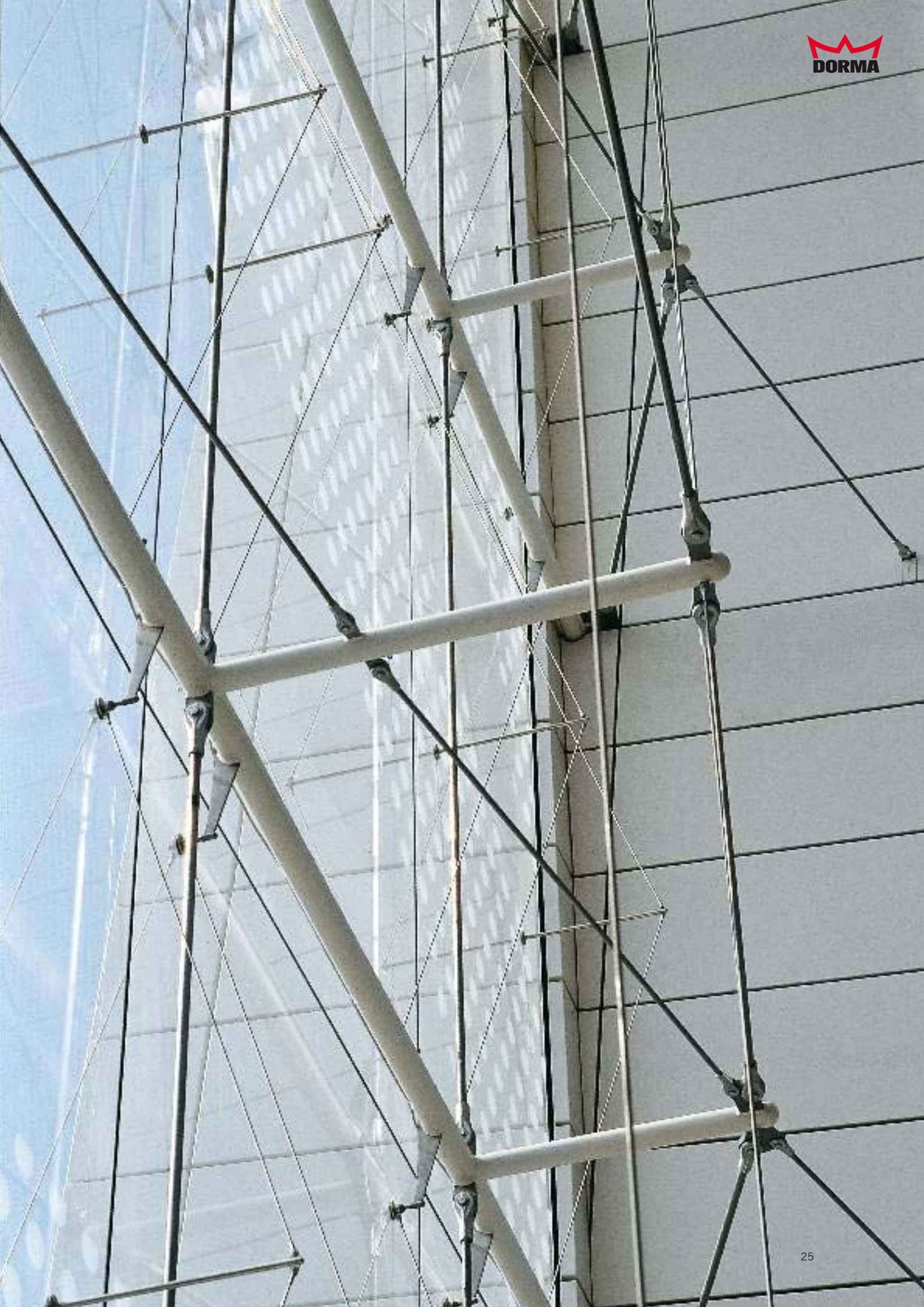
Table: Characteristic loadability values



Interaction diagram: KH 50, KH 60



Interaction diagram: KH 70



RODAN spider

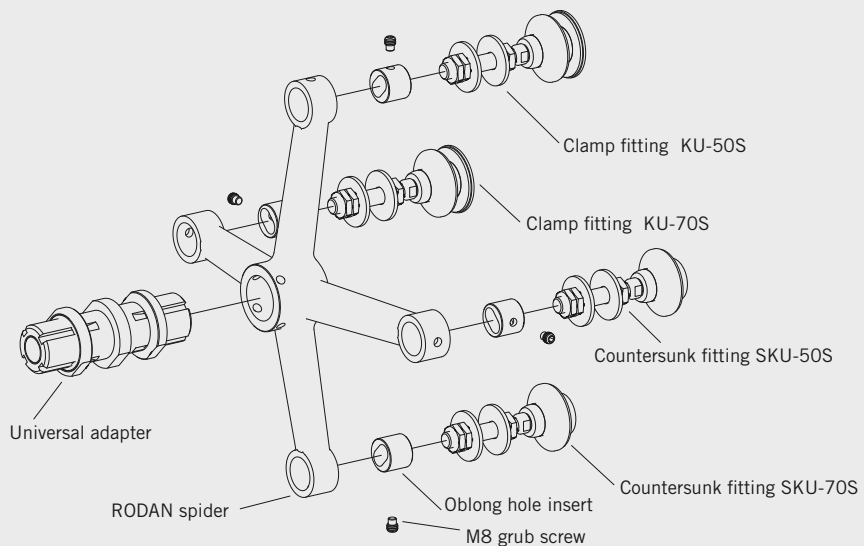
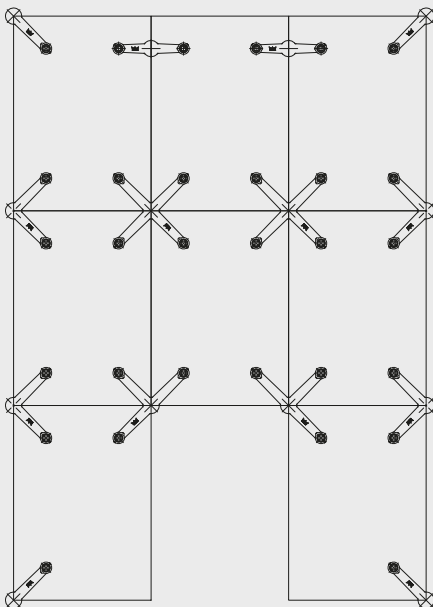
The RODAN spider offers the ideal combination of functional efficiency and aesthetic elegance. Covered by a general approval certificate under German building regulations, the spider system serves to connect between 1 and 4 single-point fixings or glass support bearings to a central point at the substructure. The spider is suitable for appropriately adapted RODAN fittings of the type KU-S and SKU-S in the sizes 50 and 70 mm.

The RODAN spider can be used as a one-arm, two-arm (90 degrees and 180 degrees), three-arm or four-

arm connector, covering the full range of individual design requirements associated likely to arise in a specific construction project. The oblong hole inserts in the spider arms enable the glass clamp mountings to be installed as fixed, single-axis horizontal bearings or as dual-axis floating bearings. The spider is secured by means of a standardised so-called universal adapter to the substructure. Under conditions of symmetrical loading, anti-rotation locks integrated within the spider hub and in the substructure connector prevent the possibility of twist.



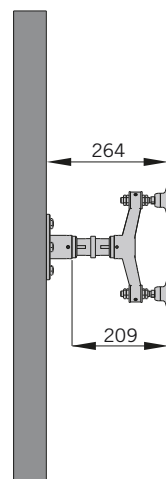
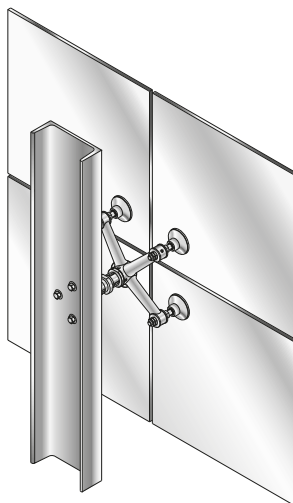
Possible spider applications for a façade



RODAN spider connection possibilities

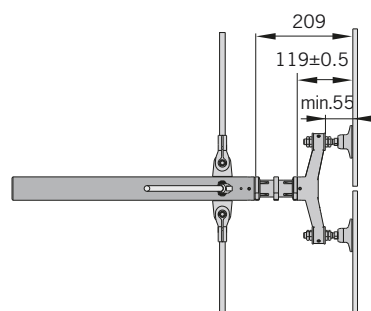
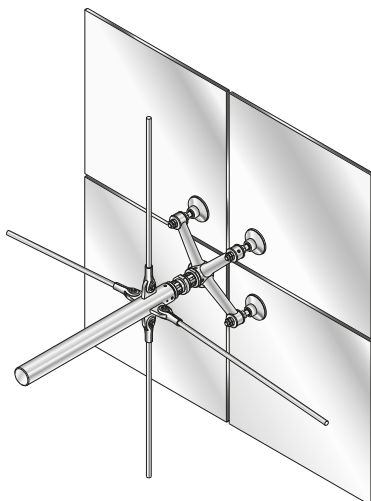
1. Connection via bracket

Spider construction with universal adapter connected to a screw-fixed standard bracket for mounting onto the substructure profile.



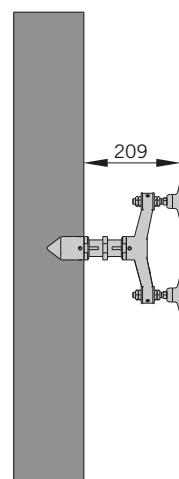
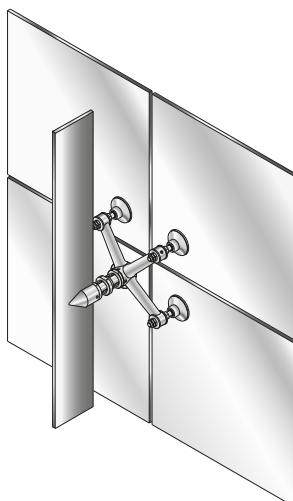
2. Connection via strut

Spider construction featuring universal adapter screwed into a strut attached to the rear-trussed primary construction.




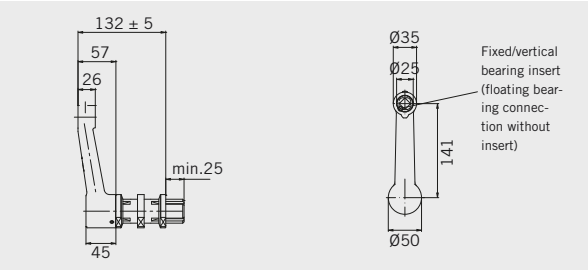

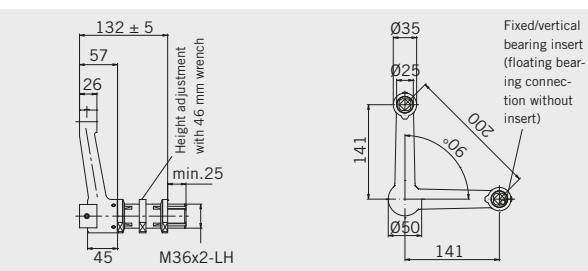

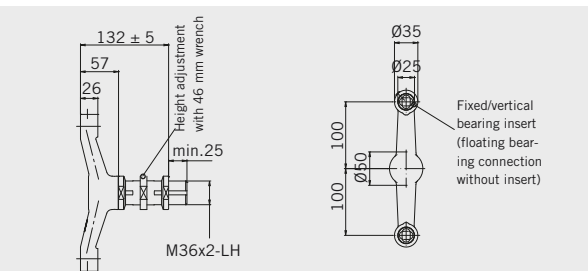

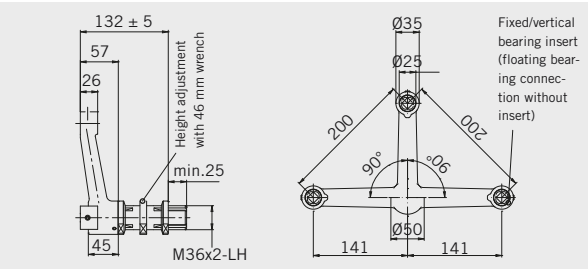

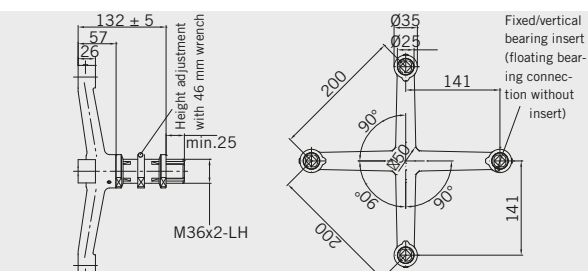
3. Connection directly to substructure profile

Spider construction with universal adapter, screwed into a socket connector welded onto the substructure profile.



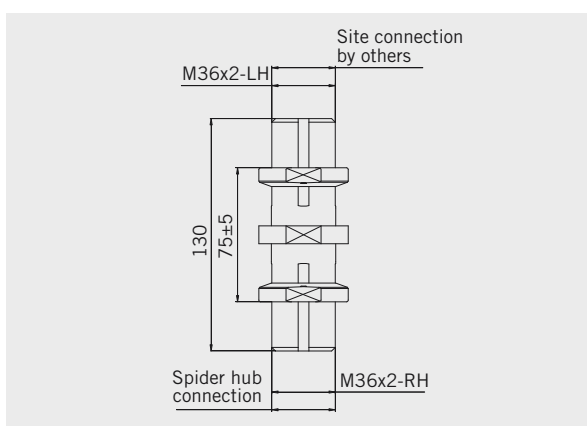
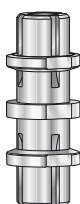
Spider types

RODAN spiders have between one and four arms and are of modular design. The hub diameter is 50 mm, while the overall height of the spider is 57 mm. Connection to the substructure is made using the type-tested M 36 x 2 universal adapter.

		Order data
		<p>Stainless steel 1.4468, polished</p> <p>Spider, one-arm with inserts Art. No. 8.23.500.701.99</p>
		<p>Spider, two-arm, 90° with inserts Art. No. 8.23.501.701.99</p>
		<p>Spider, two-arm, 180° with inserts Art. No. 8.23.502.701.99</p>
		<p>Spider, three-arm with inserts Art. No. 8.23.503.701.99</p>
		<p>Spider, four-arm with inserts Art. No. 8.23.504.701.99</p>

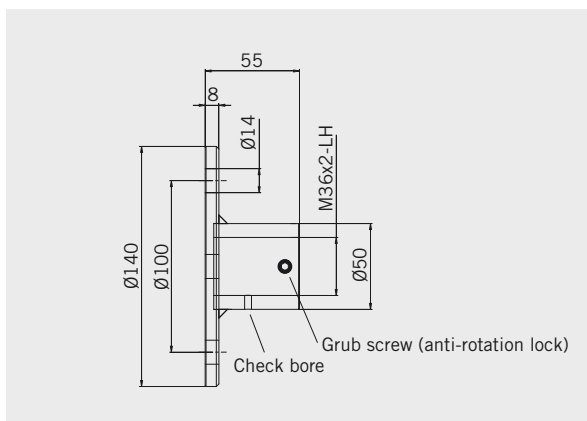
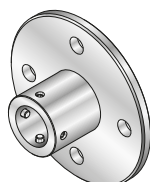
Spider accessories

The spider accessories available include not only the special components for connection to the substructure but also single-point fixings with a ball-pin articulating joint. These come in the form of clamp fitting type KU-S or countersunk fitting type SKU-S. For further information regarding the size of these single-point fixings and the glass thicknesses for which they are suitable, together with the relevant article numbers, please turn to page 18.

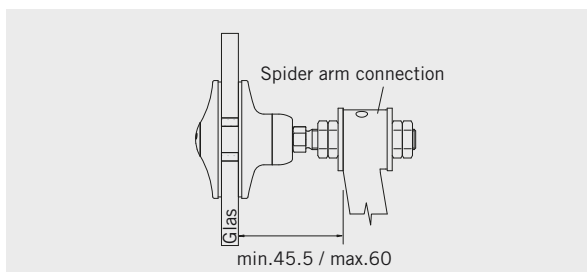


Order data

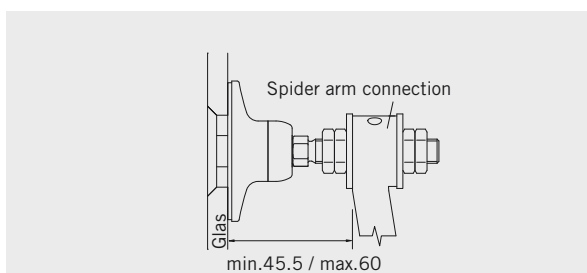
Stainless steel 1.4404
Universal adapter
 Art. No. 8.23.565.703.99



Connection bracket
Stainless steel 1.4404
 for mounting onto the substructure
 Art. No. 8.23.570.703.99



RODAN clamp fitting
Stainless steel 1.4404
 KU 50/70 S
 (see page 18)



RODAN countersunk fitting
Stainless steel 1.4404
 SKU 50/70 S
 (see page 18)

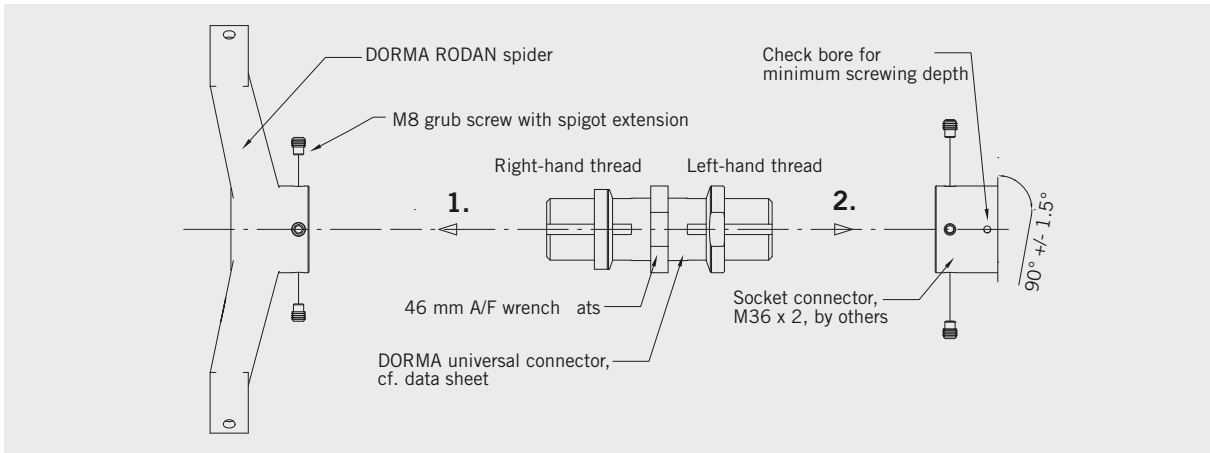
RODAN spider assembly and installation

Important note!

RODAN single-point fixings and RODAN spider assemblies may only be used in accordance with the regulations of the associated certificate of suitability, certificate of general

building approval and type test report or equivalent national regulations. The original assembly and installation instructions in each case are binding.

1. Fitting the RODAN universal adapter and spider to the substructure



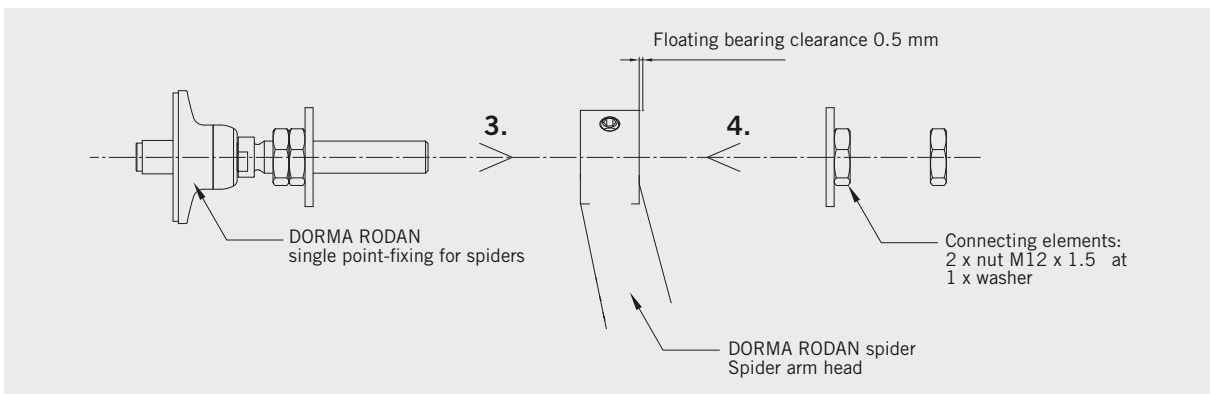
Once the fine adjustment of the substructure has been completed, the spider can be installed. Note: Ensure compliance with the RODAN universal adapter data sheet! Wind the RODAN universal

adapter into the threaded hub socket of the spider to a depth of 27.5 ± 2.5 mm (1.). Screw the spider and universal adapter into the female thread of the socket connector attached to the

substructure using a wrench at the 46 mm A/F flats (2.) until the thread becomes visible in the check bore. Axial adjustment range ± 5 mm (thread must remain visible in the check bore!). Wind in

the grub screws with spigot extension in order to secure the assembly against rotation/twist. Tighten the lock nuts of the universal adapter (for details of universal adapter, see page 34).

2. Fitting RODAN single-point fixings to the RODAN spider



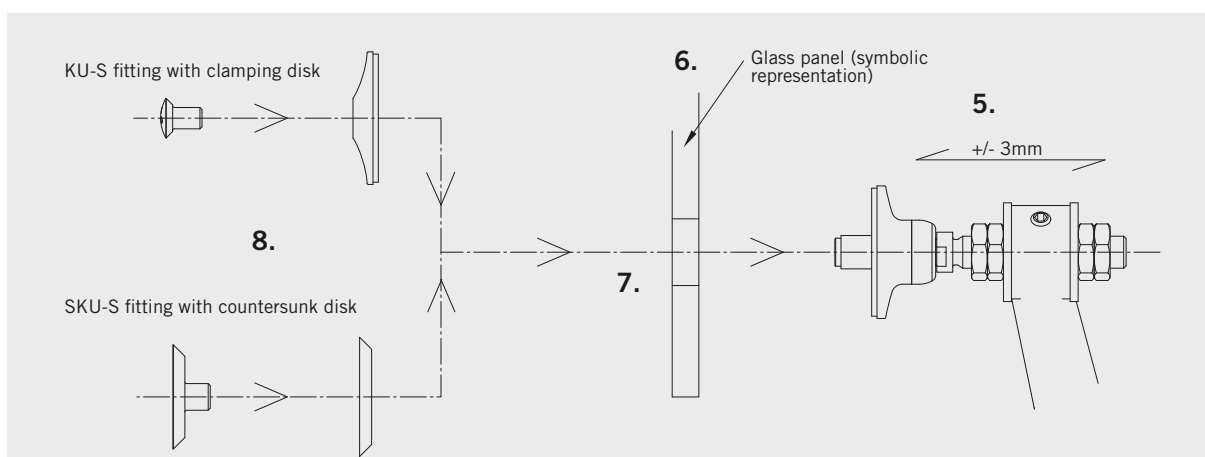
Insert the bearing pin in the socket of the DORMA RODAN spider in accordance with the general support principle (1.) and fix using grub screw with

spigot extension (2.). Insert the DORMA RODAN single-point fixing on the façade side through the spider arm head (3.) and fix with M12 x 1.5 nuts (4.).

Note: Floating bearing and vertical bearing (horizontal floating bearing) must be in accordance with the structural design/static analysis – adjust using a gauge

(0.5 mm) placed between the washer and the spider arm head. Secure with nuts to eliminate backlash.

3. Fitting the glass to the RODAN single-point fixings



Perform fine adjustment in the axial direction within ± 3 mm (5.). Raise the glass panels to the installation position (6.) and align.

Fill the remaining bore cavity using a suitable hard-curing compound in accordance with engineering specifications (7.).

Install the disks using appropriate RODAN tools.

Note: Only load fittings after the curing time for the filler compound has expired (cf. manufacturer's data sheet).

Tools

Additionally required standard tools:

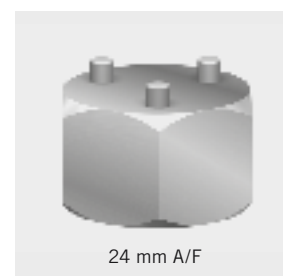
- Open-jaw wrench
- M8 hexagonal socket wrench
- Torque wrench with socket



For RODAN single-point fixings: KU 50 S



KU 70 S



SKU 50/70 S

Approvals and certificates

The RODAN spider assembly with universal adapter is generally approved according to German regulations for construction applications. Its suitability can also be verified by static analysis on the basis of the type test carried out, using a standardised dimensioning process for each individual application.

All certificates, approvals and type test reports are available from DORMA-Glas.

4-26/03

Darmstadt Regional Administrative Authority,
Test Report No. 4 – 26/03

5-26/03

Darmstadt Regional Administrative Authority,
Test Report No. 5 – 26/03

Z-14.4-458

German Institute for Building Technology, Certificate of General Building Approval



Mark of conformity awarded to RODAN products

Static values and load-bearing capacities

Static analyses for individual applications are performed on the basis of the type test. The dimensioning diagram used in the respective type tests can also be applied for pre-dimensioning in the initial planning stage. All the external stress loads acting

on the spider assembly must be determined in advance in order to enable the pre-dimensioning of the components involved. Using these values, the diagrams shown on the following pages can then be used on the basis of the brief descriptions and

examples provided. The certificate of suitability for the single-point fixings to be connected to the spider and also the type test for the universal adapter will, in all cases, also have to be taken into account.

In Germany, the respective original type test document in conjunction with the certificate of general building approval is exclusively binding for preparation of the verifiable static analysis.

Standard type pre-dimensioning

1. The present type dimensioning sheet RODAN spider 45° applies to the following spider types: one-arm, two-arm 90°, three-arm and four-arm. The type dimensioning sheet RODAN spider 180° is applicable to the spider type two-arm 180°.

2. Within the context of a predominantly glass construction, the investment-cast spider of stainless steel is used as a one-arm, two-arm, three-arm or four-arm load-bearing element in conjunction with single-point fixings on the glass side and a suitable connection flange on the structural side.

3. The spider provides the bearing support for the single-point fixings and transmits the load stresses transferred to it to a sufficiently load-bearing substructure.

4. The substructure may, for example, take the form of a lattice work of DORMA RODAN tie rods. Connection to a concrete or steel construction is, for example, possible using the universal adapter.

5. The spider may only be used in conjunction with single-point fixings of the type RODAN and the DORMA universal adapter.

6. The design values for stress loads N_d (Z direction), Q_{x_d} (X direction), Q_{y_d} (Y direction) must be determined as support reactions on the basis of the superordinated static system.

7. The spider assembly is deemed to have sufficient load-bearing capacity if, for the determined design values for stresses Q_{x_d} , Q_{y_d} and N_d , the specified interaction condition is fulfilled. Q_{x_d} , Q_{y_d} and N_d within this context are interrelated load stresses acting on a spider arm. The spider assembly is also deemed to have sufficient load-bearing capacity if the determined design values for load stresses Q_{x_d} , Q_{y_d} and N_d give rise to points of intersection that are all below the plotted linearities (straight-line plots).

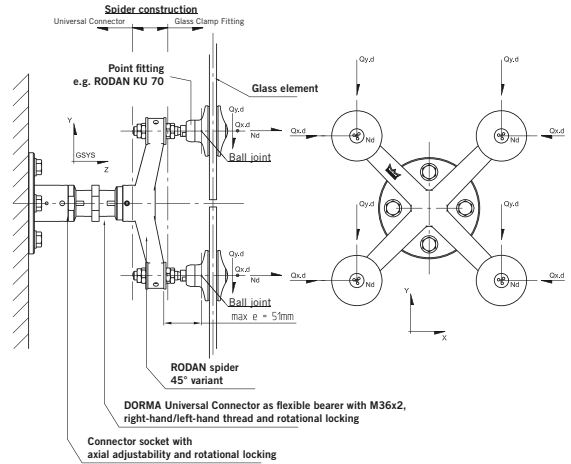


RODAN spider 45°

Annex 2

Field of application and verification procedure

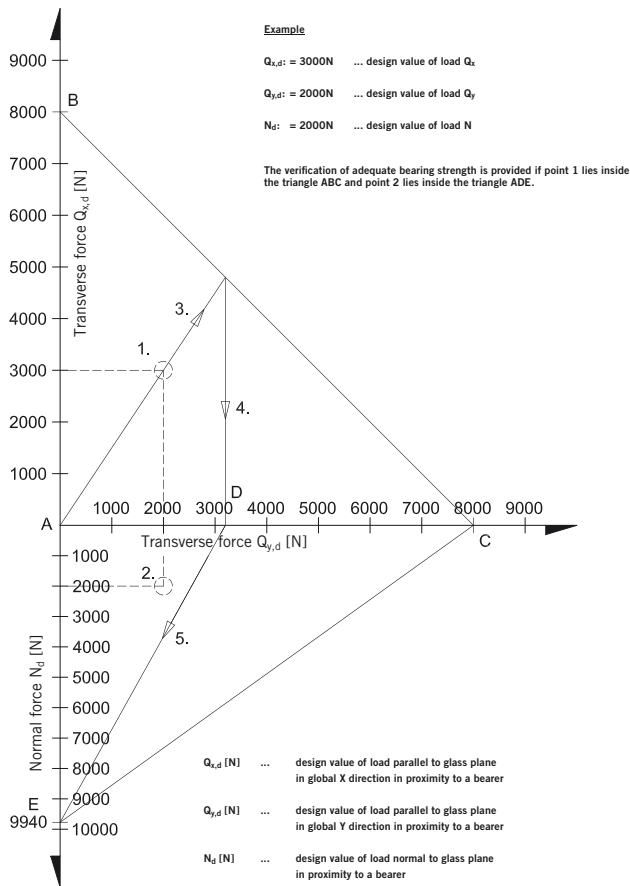
RODAN spider 45°



Annex 2

RODAN spider 45°

Application example of interaction diagram

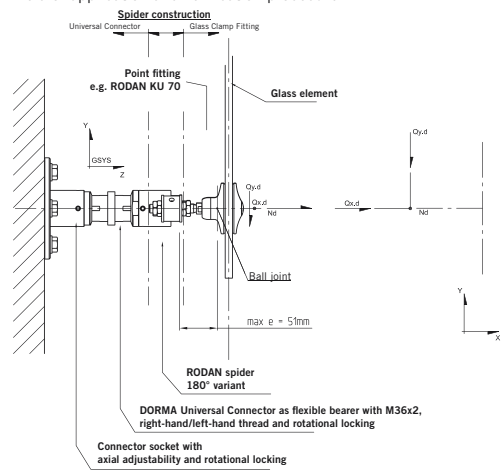


$$\text{Interaction from } N_d, Q_{x,d} \text{ and } Q_{y,d}: \frac{|Q_{x,d}| + |Q_{y,d}|}{8000\text{N}} + \frac{|N_d|}{9940\text{N}} \leq 1$$

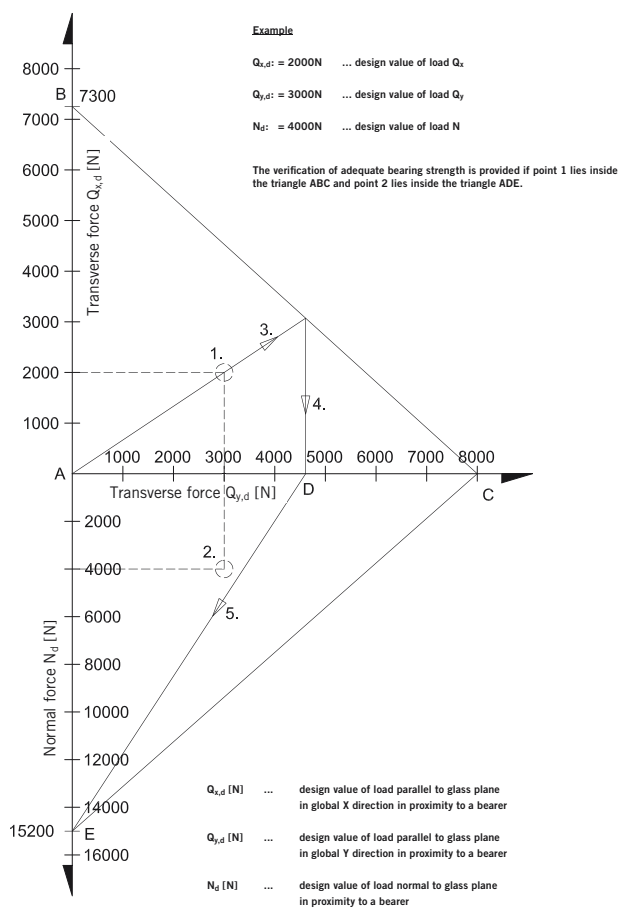
13.08.03

RODAN spider 180°

Annex 2 Field of application and verification procedure RODAN spider 180°



Annex 2 Application example of interaction diagram RODAN spider 180°



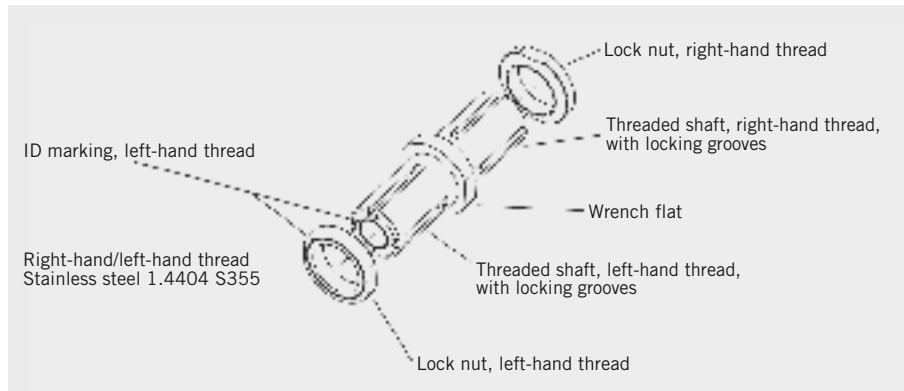
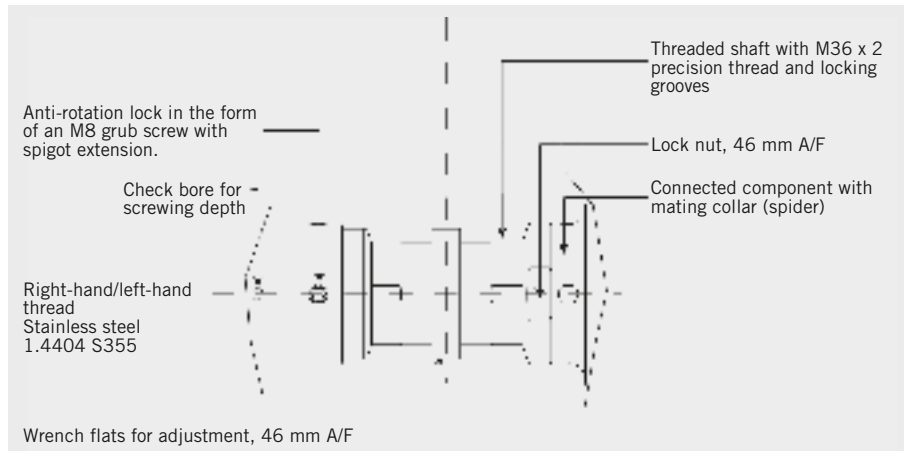
$$\text{Interaction from } N_d, Q_{x,d} \text{ and } Q_{y,d}: \frac{|Q_{x,d}|}{7300N} + \frac{|Q_{y,d}|}{8000N} + \frac{|N_d|}{15200N} \leq 1$$

13.08.03

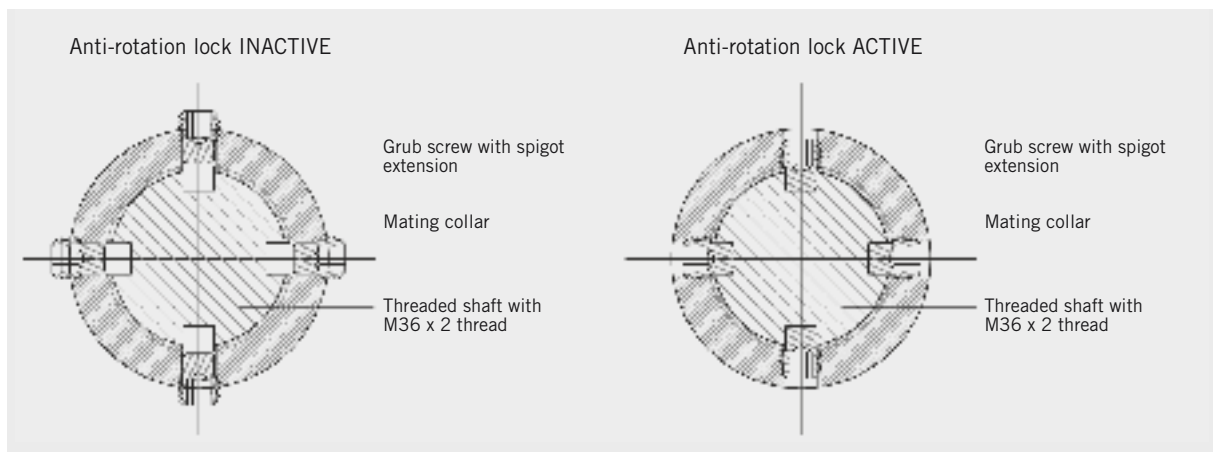
Universal adapter

The universal adapter connects the spider's hub to the substructure, enabling additional tolerance equalisation of $\pm 5\text{mm}$ during installation.

Because the universal adapter has a right-hand and a left-hand thread at either end, adjustment of the distance between the glass and the substructure can be performed simply and reliably by rotation at the centre wrench flats, even once the system has been fully installed. Lock nuts secure the as-adjusted condition of the installed universal adapter. Thanks to the integral anti-rotation locking devices, adapter twist in the event of asymmetrical loading (such as may occur during the installation work) is also reliably prevented.



Functional principle of the anti-rotation lock



The DORMA universal adapter may only be used in accordance with the specifications and regulations stipulated in the associated type test report.

In order to avoid lesions (cut injuries), safety gloves must be worn at all times when handling the threaded shafts of the universal adapter.

The threads must be protected against contamination and damage.

Installation should be performed in accordance with the instructions provided with the associated DORMA products.

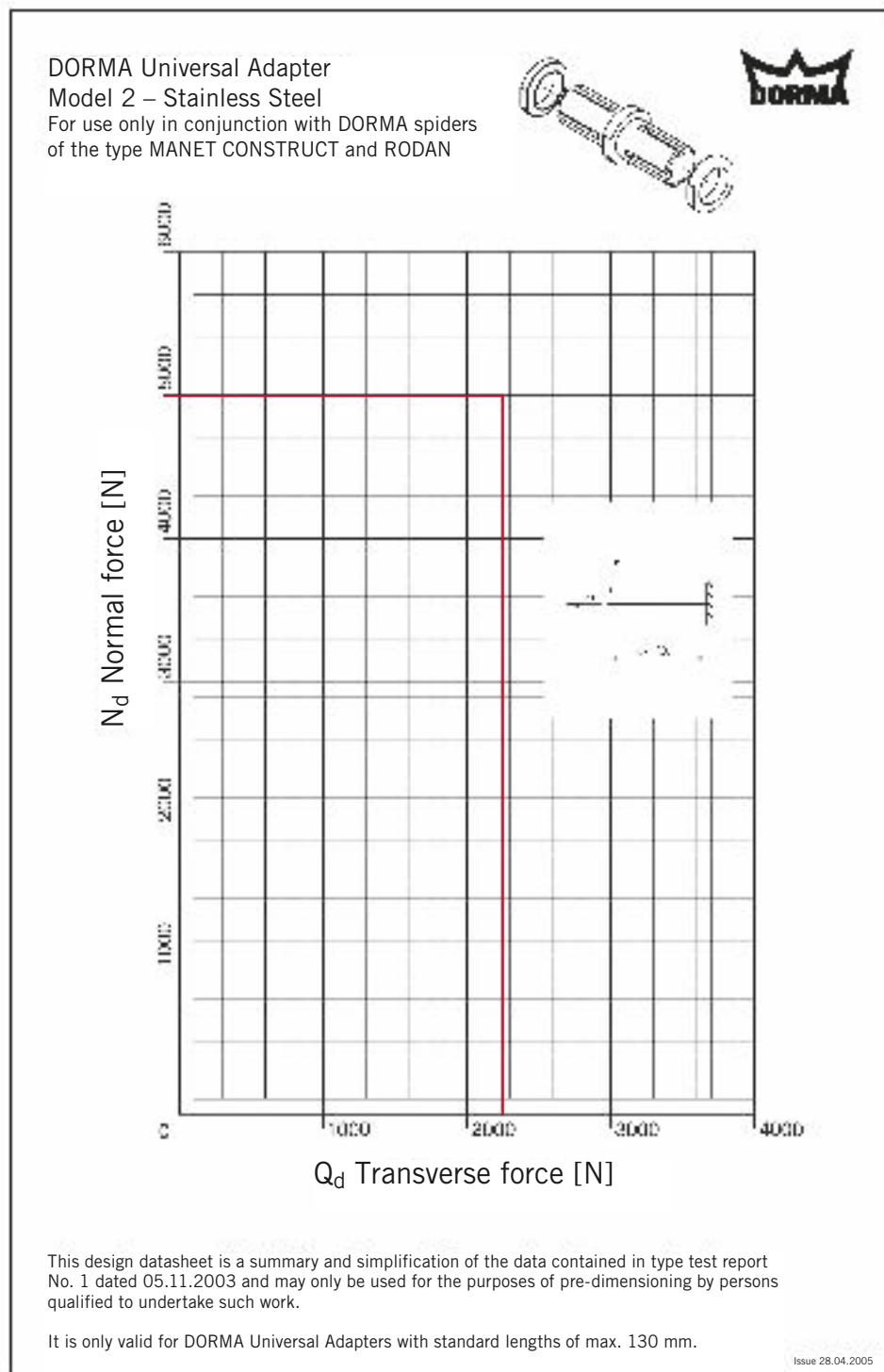
Load-bearing capacities

Load-bearing capacities in accordance with "Type test report No. 1 of the Hesse State Testing Authority for Structural Engineering of

the Darmstadt Regional Authority dated 05.11.03" which is available as a binding structural engineering document for verifiable

static analysis from DORMA-Glas. Loads acting in combination are to be analysed in accordance with DIN 18800 using

appropriate loading vector combinations and the safety factors applicable in each case.

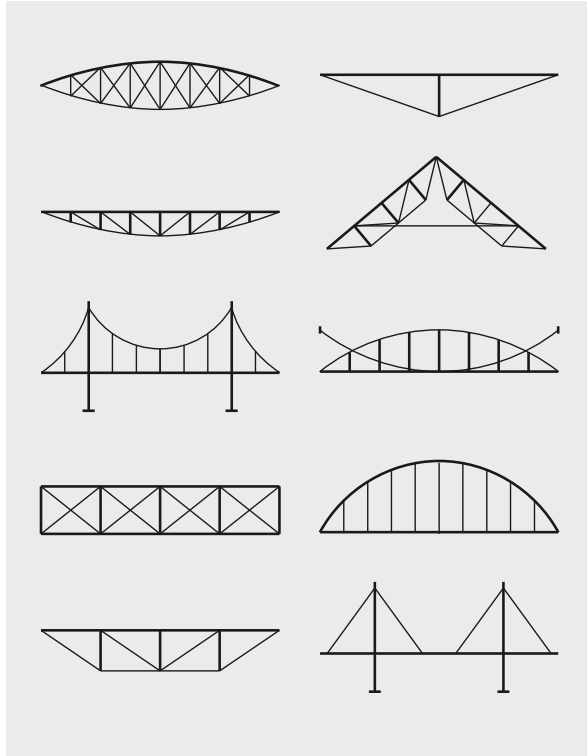


Tie system

The RODAN tie system is often used for lightweight constructions and in the creation of aesthetically attractive 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 series 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, the components 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

System elements Structural steel tie system

The use of fine-grain structural steel for rod diameters of 16 mm and larger, and of cast steel for the fork end pieces, greatly enhances the efficiency of the S460 tie systems. Due to the high strength achieved, the ties can be kept particularly slender, thus saving on material and also ultimately on cost.

The requirements of the relevant structural steel standards with respect to impact toughness are readily fulfilled (impact energy > 27 J at -20°C).

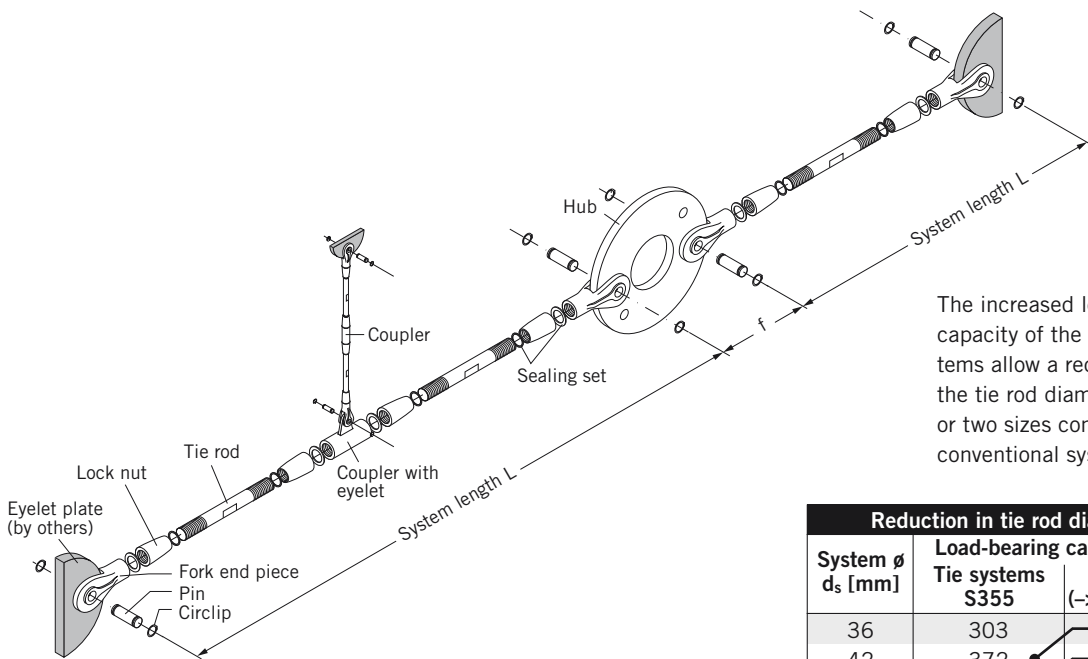
Fork end pieces, lock nuts

A structural steel tie system comprises two fork end pieces, one with a left-hand and one with a right-hand thread, which provide the connection between the tie rod and the eyelet connection plates attached to the structure or the hub assembly. The fork end pieces are sealed at their socket end by a plastic plug which is colour-coded to enable easy identification (yellow = right-hand thread, blue = left-hand thread). The fork end pieces are supplied complete with pins, circlips

and lock nuts. Lock nuts of M16 and larger are provided from the factory with an internal rubber ring seal. Also included in the connection set is a flat seal which has to be inserted between the lock nut and the fork end piece/coupler during site installation. The tie rods have markings in order to check their screwing depth; if these are covered once the lock nut has been tightened, sufficient screwing depth is ensured.

Couplers

Couplers are used to interconnect tie rods in order to achieve larger spans. They also create a greater degree of length adjustability. Each coupler is supplied with two lock nuts. Couplers of M12 and larger are also available with a welded eyelet enabling the suspension of the tie assembly in order to prevent sag, e.g. where large spans are involved.



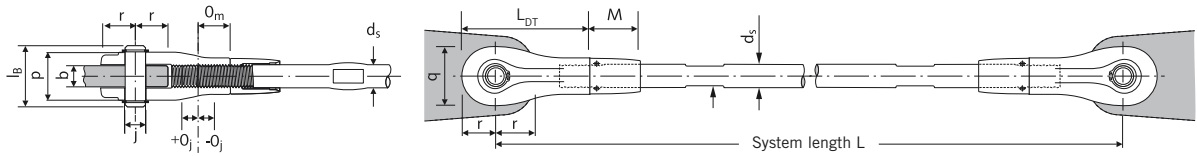
The increased load-bearing capacity of the S460 systems allow a reduction in the tie rod diameters by one or two sizes compared to conventional systems!

Reduction in tie rod diameter		
System \varnothing d_s [mm]	Load-bearing capacity [kN]	
	Tie systems S355	S460 (-> Table p. 45)
36	303	367.5
42	372	504.4
48	486	662.9
52	570	791.0
56	662	913.5
60	759	1063.0

System component materials and designs						
	Tie rod		Fork end piece		Couplers, lock nuts	Hub
System \varnothing d_s [mm]	10-12	16-60	10-12	16-60	10-60	10-60
Material	S355J2	S460N	S355J2	G20 Mn5+QT	S355J2	S355J2
Finish	wb	Mill bright	Geomet*		Geomet*	Hot-dip galvanised
	fv	Hot-dip galvanised	Geomet*		Geomet*	Hot-dip galvanised

* A double coating applied by cold immersion or spraying. In contrast to dacromet coating, geomet coating is free of chromium oxide and heavy metals.

Tie rod, fork end piece



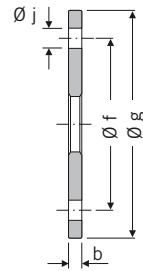
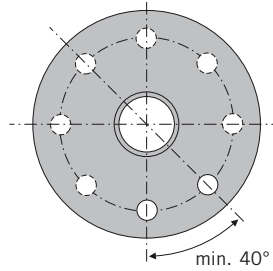
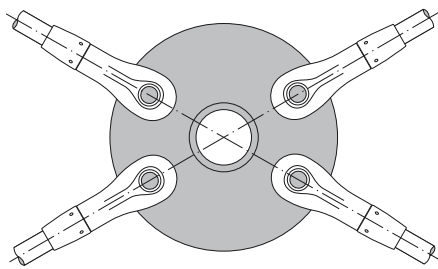
System dimensions [mm]; materials: see table on page 39

System \varnothing	d_s	10	12	16	20	24	27	30	36	42	48	52	56	60
Fork end piece length	L_{DT}	60	73	89	110	133	147	160	192	225	265	285	305	335
Pin length	l_B	28	32	42	50	58	63	70	82	95	109	117	128	137
Fork end piece width	p	20	24	33	40	46	51	57	68	79	90	98	107	116
Fork end piece height	q	26	31	41	51	61	69	75	90	105	119	125	137	146
Screwing depth	o_m	15.0	18.5	22.5	27.0	34.0	37.5	42.5	51.0	55.0	62.5	70.5	77.5	85.0
Scr. depth adjustm.	o_j	5.0	6.5	7.5	8.0	11.0	12.5	12.5	14.0	15.0	17.5	20.0	22.5	25.0
Length of lock nut	M	24.5	37.0	41.0	50.0	58.0	63.0	64.0	72.0	83.0	91.0	98.0	105	112

Hubs

Example: Hub with 4 tie rods

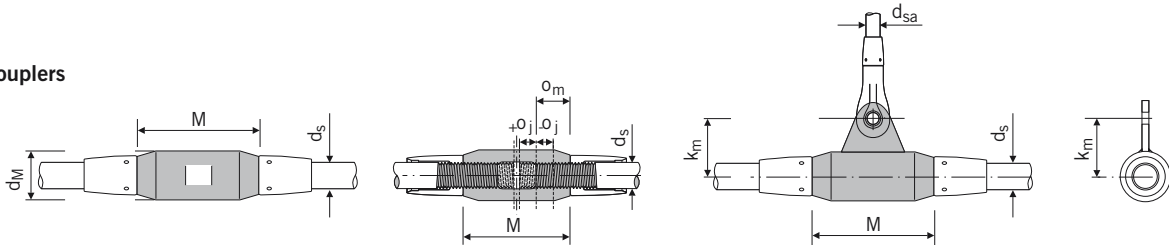
Maximum 8 tie rod connections per hub



System dimensions [mm]; material: steel, strength class S355J2

System \varnothing	d_s	10	12	16	20	24	27	30	36	42	48	52	56	60
Pitch circle \varnothing	f	90	110	140	180	210	240	260	310	360	420	450	490	520
Hub OD	g	120	146	186	238	280	318	346	412	480	558	600	652	692

Couplers

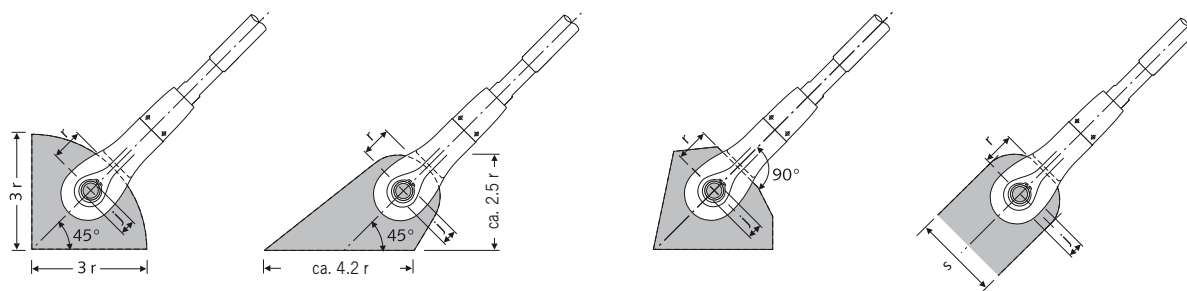


System dimensions [mm]; material: steel, strength class S355J2

System \varnothing	d_s	10	12	16	20	24	27	30	36	42	48	52	56	60
Coupler length	M	40	50	62	78	94	104	120	140	158	180	195	210	245
Coupler \varnothing	d_M	20	22	28	35	42	47	53	64	75	87	93	98	104
Screwing depth	o_m	15.0	18.5	22.5	27.0	34.0	37.5	42.5	51.0	55.0	62.5	70.5	77.5	85.0
Scr. depth adjustm.	o_j	5.0	6.5	7.5	8.0	11.0	12.5	12.5	14.0	15.0	17.5	20.0	22.5	25.0
Mating \varnothing	d_{sa}	-	6	6	8	8	10	10	10	10	12	12	12	12
Susp. bore centre height	k_m	-	27.5	33.0	37.0	44.0	50.5	57.5	72.0	86.5	98.5	111.5	124.5	137.0

Eyelet connection plates

The eyelet connection plates have to be designed well adapted for the installation situation. The dimensions specified in the table below and in the drawings are mandatory.



System dimensions [mm]; minimum material grades for Ø 10-12: steel strength class S235JR, for Ø 16-60: steel strength class S355J2														
System Ø	d _s	10	12	16	20	24	27	30	36	42	48	52	56	60
Plate thickness	b	8	10	15	18	20	22	25	30	35	40	45	50	55
Bore Ø	j	9.5	11.5	15.5	19.5	23.5	26.5	29.5	33.5	41	47	49	53	57
Bore position	r	15	18	24	29	35	39	43	51	60	70	76	83	88
Minimum width	s	28	33	40	51	64	73	80	94	113	129	142	151	161

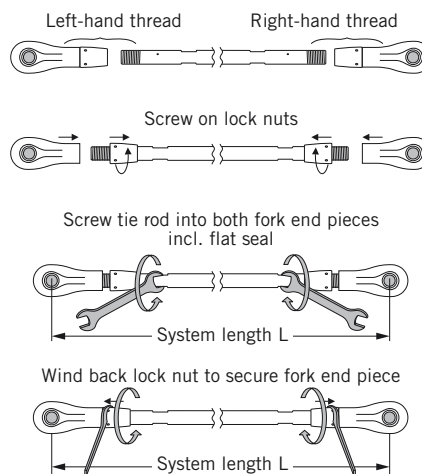
Installation

The load-bearing capacities indicated can only be applied if all the components used are exclusively from the DORMA structural steel tie system. Before installation, all components must be visually inspected for transport damage.

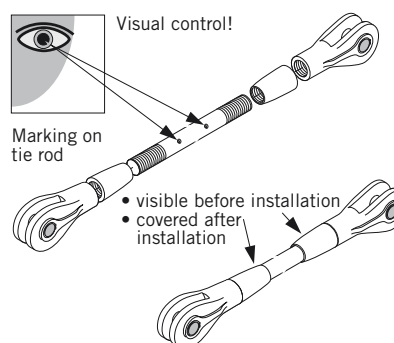
When using eyelet connection plates, the material specified must be used and the geometric data must comply with the specified minimum values. Compliance is also required with the specified installation tolerances. If, following delivery of the components, they are subjected to machining work by the user or installer, the type test becomes null and void.

1. Screw the lock nuts over their full travel on the tie rod and then screw the fork end piece onto the tie rod until the required system length is reached. Then wind back the lock nut until the fork end piece is secured.
2. The marking on the tie rod must no longer be visible. The minimum screwing depth is reached once the marking at both ends of the tie rod is covered by the lock nut.
3. The pins at the fork end pieces should be fitted at both ends with circlips applied using circlip pliers.

Installation



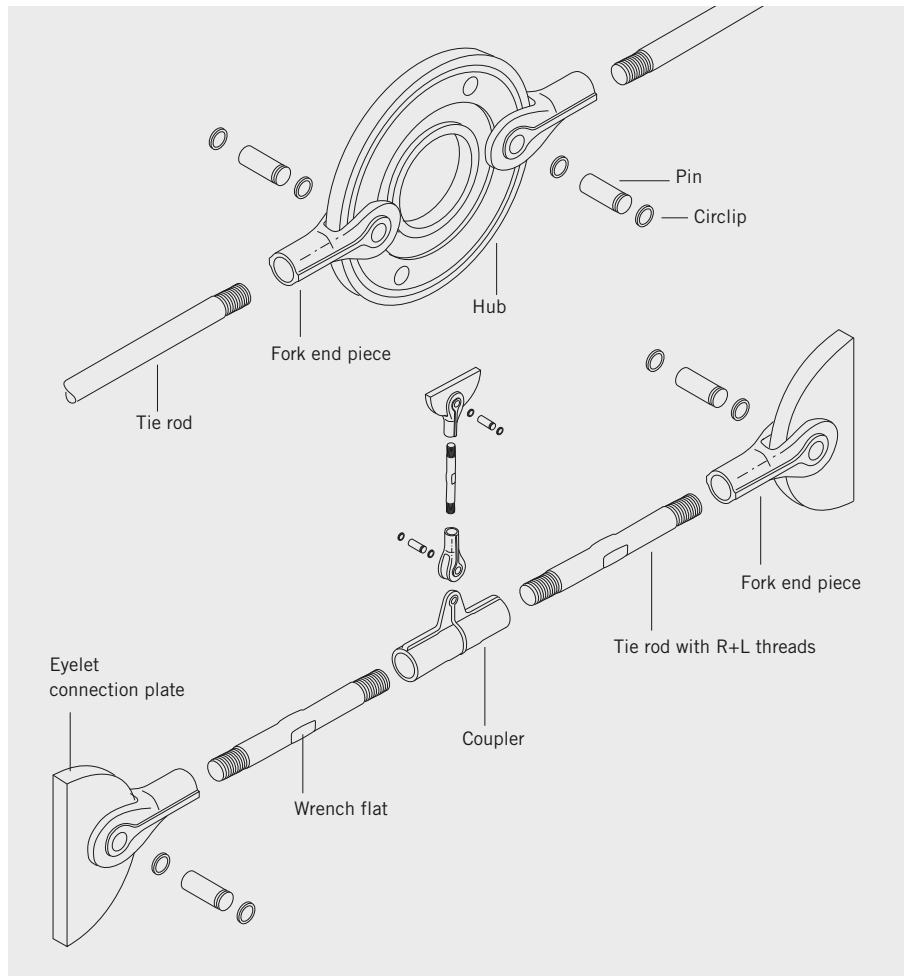
Control of minimum screwing depth



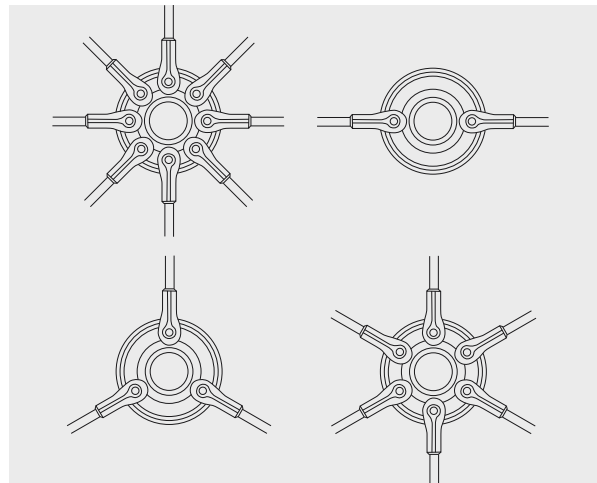
System elements Stainless steel tie system

The RODAN stainless steel tie system consists of just a few components that can be combined to create simple assemblies. The system is comprised of a tie rod and two fork end pieces with left-hand and right-hand threads respectively, plus two pins and four circlips. The system is ideally complemented in both function and design by the coupler and hub.

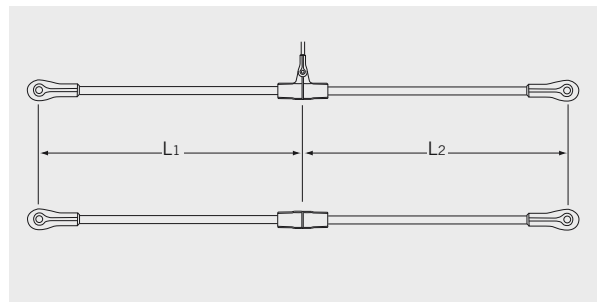
The materials of the stainless steel tie system correspond to the corrosion resistance class 3 as defined in Z-30.3-6.



The turned hub can be used for wind bracing or pyramid-shaped roofs with horizontal bracing. Up to eight tie rods can be connected to a hub if necessary.

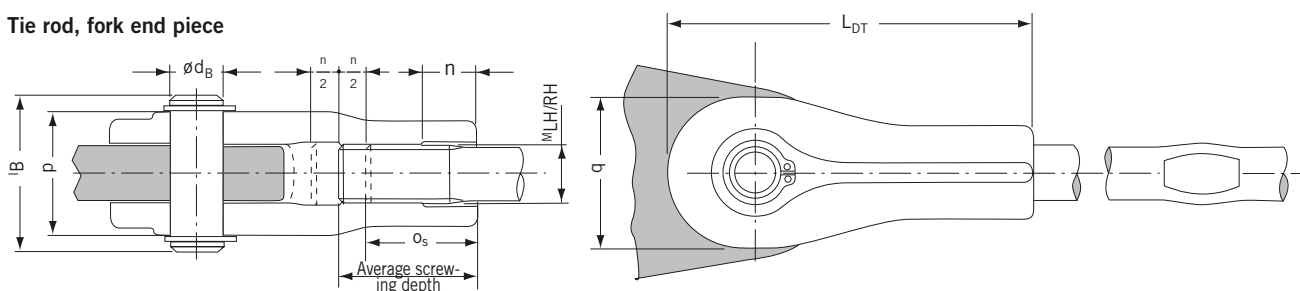


The turned couplers serve to interconnect the tie rods. A further tie rod can be laterally connected to the coupler by means of an eyelet.



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

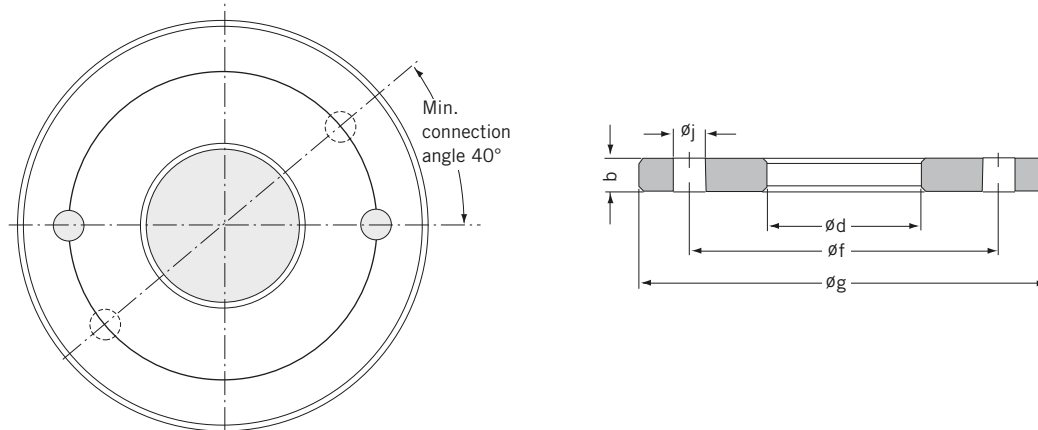
Tie rod, fork end piece



Dimensions [mm]

System \varnothing	d_S	6	8	10	12	16	20	24	30	36
Fork end piece length	L_{DT}	44	52	64	78	100	122	150	185	220
Pin length	l_B	18	22	27	32	42	50	58	70	82
Fork end piece width	q	12	16	19.6	23.6	33	40	46.2	57.1	68
Fork end piece height	p	16.7	21.3	25.5	30	40	49	58	71.5	84.5
Min. screwing depth	o_S	15	17	20	25	30	35	45	55	63
Thread	$M_{LH/RH}$	M6	M8	M10	M12	M16	M20	M24	M30	M36
Pin \varnothing	d_B	6	7	9	11	14	18	21	26	30

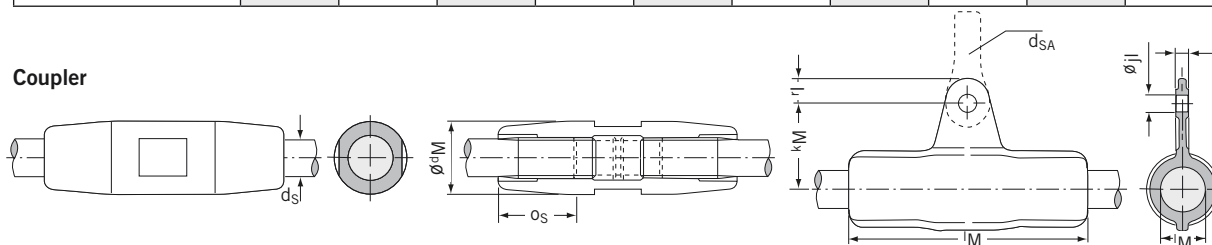
Hub



Dimensions [mm]

System \varnothing	d_S	6	8	10	12	16	20	24	30	36
Hub thickness	b	5	7	8	10	15	18	20	25	30
Pitch circle \varnothing	f	55	75	90	110	140	180	238	260	310
Hub OD	g	75	99	120	146	186	238	280	346	412

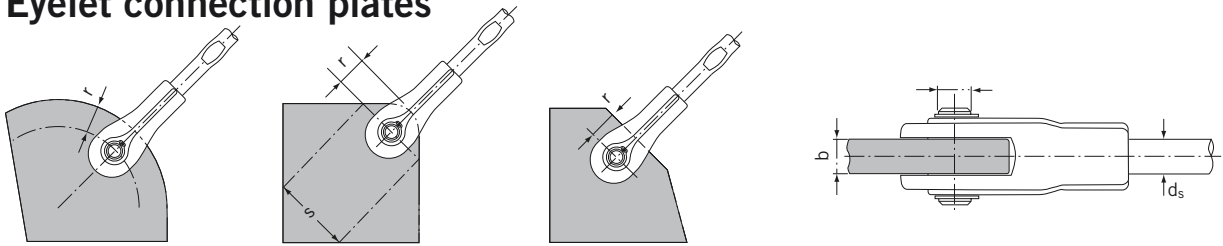
Coupler



Dimensions [mm]

System \varnothing	d_S	6	8	10	12	16	20	24	30	36
Coupler length	l_M	46	52	60	75	92	110	138	170	196
Coupler \varnothing	d_M	11	14	17	20	26	32	38	48	56
Min. screwing depth	o_S	15	17	20	25	30	35	45	55	63
Mating \varnothing	d_{SA}	6	6	6	6	6	8	8	10	10
Susp. bore centre height	k_M	19	21	23	27.532	33	37	44	57.5	72

Eyelet connection plates



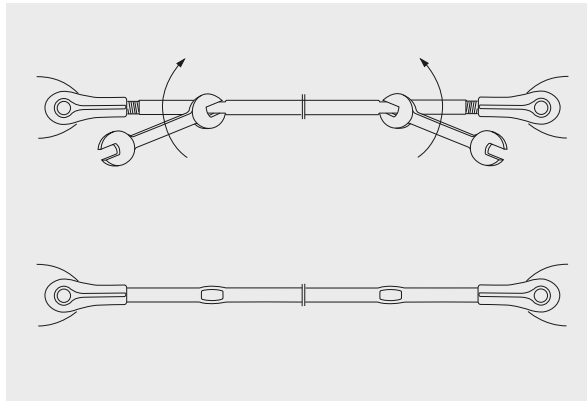
System dimensions [mm]										
System \varnothing	d_s	6	8	10	12	16	20	24	30	36
Plate thickness	$b_{-0}^{+0.5}$	5	7	8	10	15	18	20	25	30
Bore \varnothing	j	6.5	7.5	9.5	11.5	14.5	18.5	21.5	26.5	30.5
Bore position	r	9	12	15	18	24	29	35	43	51
Minimum width	s	18	21	28	33	42	54	66	82	97

Installation

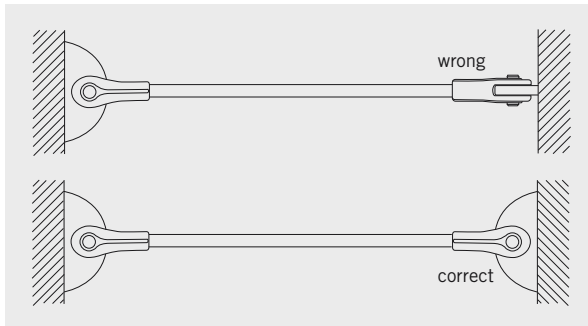
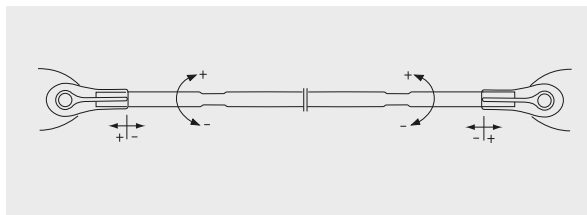
When installing the RODAN ties, ensure compliance with the following safety requirements:

If using eyelet connection plates that were not supplied by DORMA, ensure that the material and grade are as indicated in the type test report. Compliance is also required with the minimum geometric data specified in the type test report. Adherence to the installation tolerances indicated in the type test report is likewise mandatory. If the RODAN system components are modified by the user, the type test report loses its validity.

When installing the pins, the supplied circlips should only be mounted onto the pins using circlip pliers of the appropriate size.



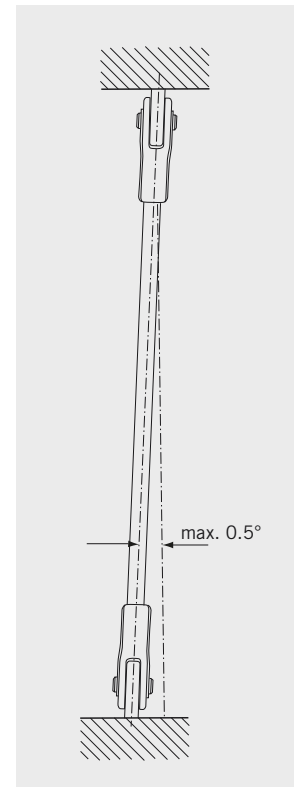
The tie rods should only be tightened using the integral flats provided on the tie rod and an appropriate open-jaw wrench as per the technical description. The tie rods must be screwed down to the minimum fitting depth in the fork end pieces. This is achieved once the thread at both ends is no longer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



When designing and installing the system, 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.

When installing the tie systems, the system components must be kept free of deformation such as that caused, for example, by imprecise positioning of opposing eyelet connection plates. Ensure accurate alignment with the notional system axes so that any deflection is minimal.



Static values and certificates

The RODAN tie systems are covered by a European technical approval including a structural type test report on the basis of which corresponding load-bearing capacities can be calculated for safe and time-efficient dimensioning and for providing the requisite statistical analysis of stability.

The ETA, and the type test report serving as a binding structural design document for the static analysis, are both available from DORMA-Glas.

ETA-06/0021

European Technical Approval for the RODAN tie system in stainless steel

ETA-05/0207

European Technical Approval for the RODAN tie system in structural steel

Load-bearing capacities / Pre-dimensioning

Tie System Stahl RDA-S															
System \varnothing	d_s [mm]		10	12	16	20	24	27	30	36	42	48	52	56	60
Load capacity	Z_d^* [kN]	S355	21.3	30.9	-	-	-	-	-	-	-	-	-	-	-
		S460N	-	-	70.5	110.2	158.6	206.7	252.3	367.5	504.4	662.9	791.0	913.5	1063.0

Material: Structural steel, strength class S355 ($\varnothing d_s$ 10-12 mm) or S460N ($\varnothing d_s$ 16-60 mm)

* Z_d : Design load according to DIN 18800 (Nov. 1990) if, with a combination of load vectors, calculations are performed using the partial safety factors γ_F . Partial safety factor $\gamma_M = 1.1$ is incorporated.

See also type test report S460 (for system \varnothing 16 - 60 mm) and RDA-S (for system \varnothing 10 - 12 mm).

RODAN tie system in stainless steel, RDA-E

In accordance with section 2.1.3 of European Technical Approval ETA-06/0021 of 18.04.2006, the design values relating to the limiting tensile forces as a function of system size are as follows:

System \varnothing	d_s [mm]		6	8	10	12	16	20	24	30	36
Load capacity	$N_{R,d}$ [kN]	S355	7.8	12.6	19.8	28.6	52.5	82.8	118.8	189.0	273.8
		S460	10.0	16.6	26.0	37.6	69.1	108.8	156.1	248.4	349.0

These values result from a static analysis of the RDA-E system based on the data taken from ETA-06/0021. This is not a type test static analysis and must therefore be proved on a building-specific or project-

related basis by the planning engineer and/or the relevant building control authority. This static analysis is, however, available from DORMA-Glas on request.

Combinations of glass clamp fittings and tie rods

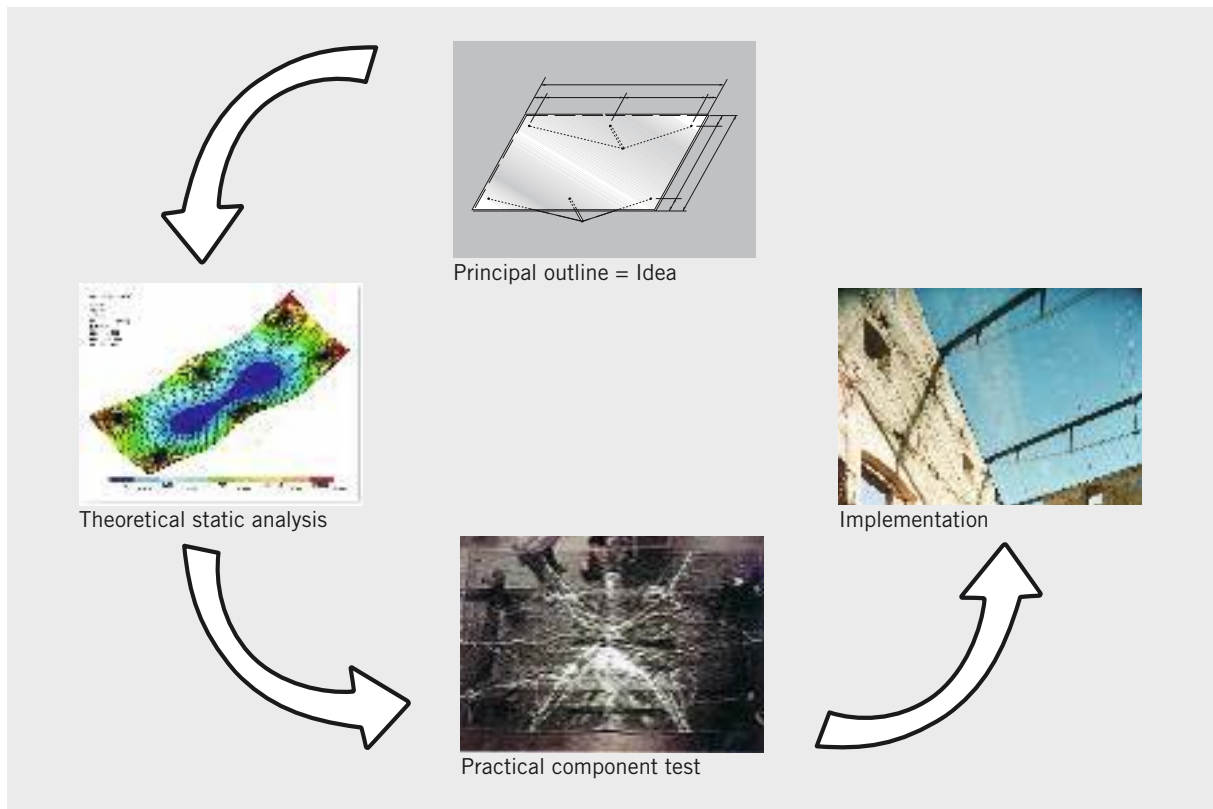
Point-supported, braced glass panels

Transparent glass constructions can be found these days in virtually every area of modern and contemporary architecture. Particularly in the case of large-area, vertical glazing systems such as in façades, the objective is to achieve a maximum of transparency combined with a minimum of cost. This requires suitable and efficient glass construction systems.

In the special applications involving horizontal and inclined overhead glazing systems (e.g. canopy roofs), the system of bottom-trussing the glass panels increases their residual load-bearing capacity. It also improves the residual stability of the (laminated safety) glass panel in the event of glass fracture as this will remain supported by the system-integrated, stable tie rod bottom-trussing arrangement.

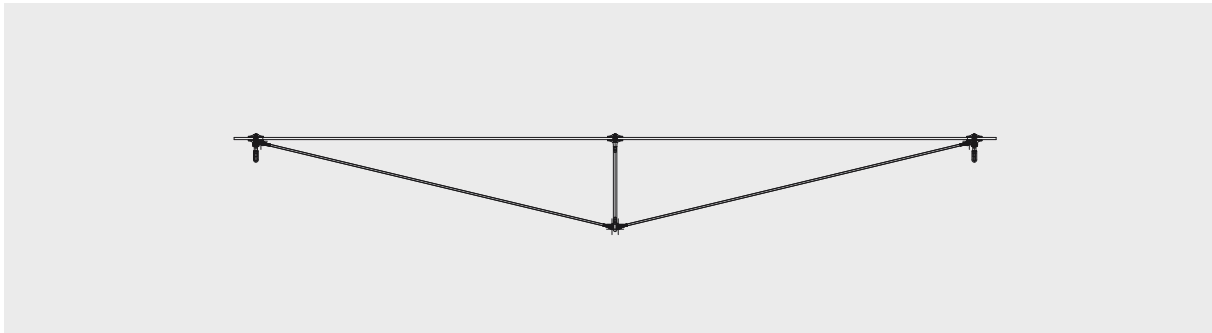
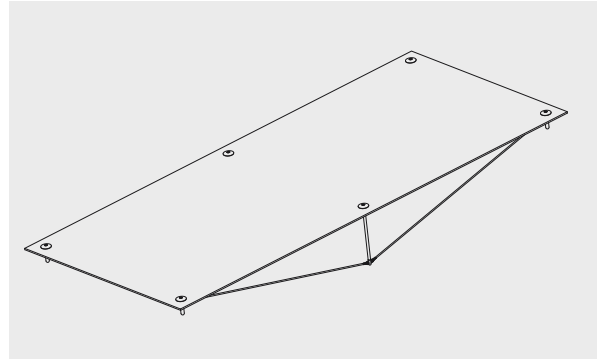


The safe route from idea to economic application



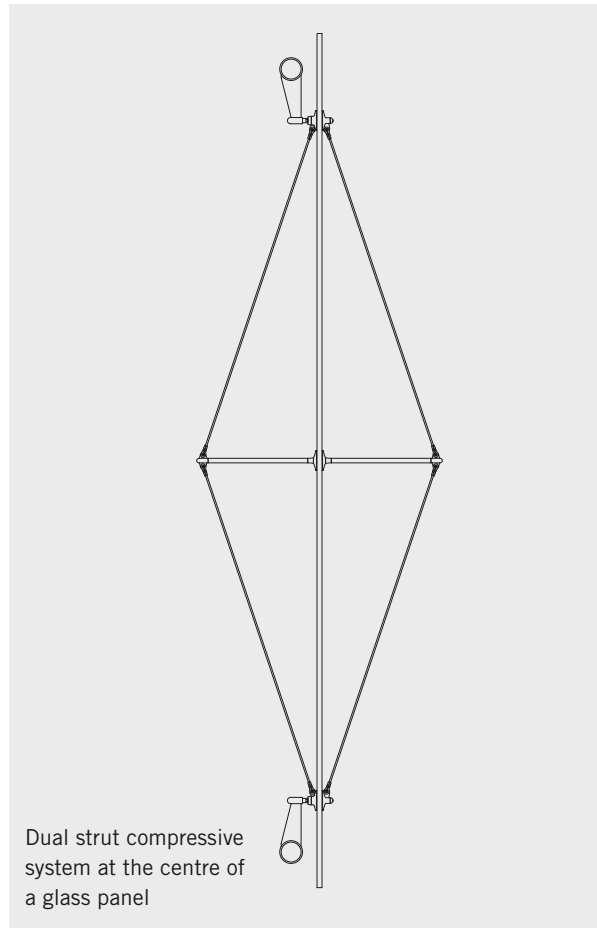
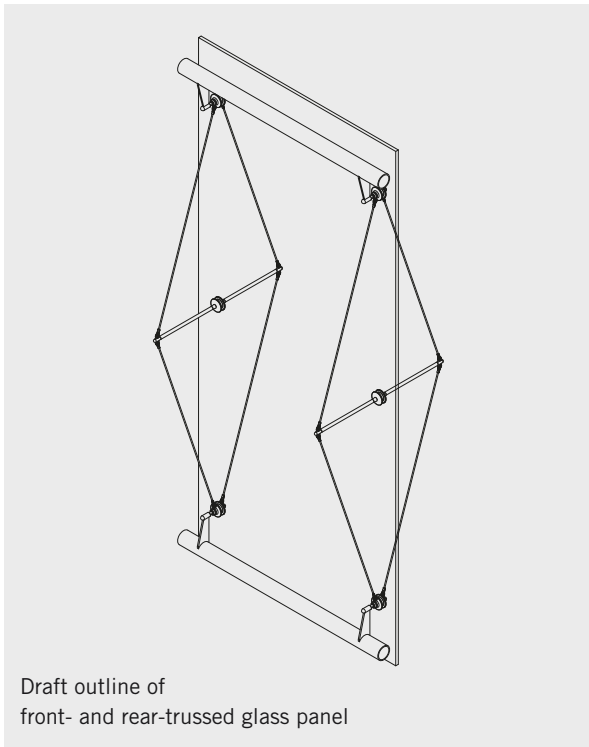
Horizontal, bottom-trussed glass panel

Suitable glass clamp fittings:
 KLU/H + KLO/H or
 KLU/U + KLO/U
 (see pages 19-20 for full range of point fixings)



Vertical, braced glass panels

Suitable glass clamp fittings:
 KLL/H + KLL/U
 (see page 21 for full range of point fixings)



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.

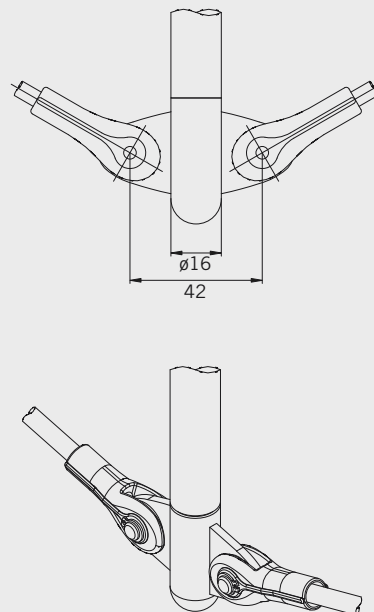
The glass panels are laid in the direction of the roof slope and arranged with tile-like overlap joints in the axis of the steel girders. As the plan of the roof area is trapezoidal, the glass panels were divided between the lines of a radial grid. This means that there are no identical glass panels anywhere in the roof system. In order to avoid er-

rors 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/m² to allow for snow plus dead-weight. 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 fittings, the glass panels are provided with a statically defined bearing system and can be installed as stress-free elements. The glass clamp fittings 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 fitting.



Detail of the bracing system/compressive struts used to bottom-truss the glass panels with RODAN tie rod RDA 6.



Glass façades in the City Centre of Kirchberg in Luxembourg

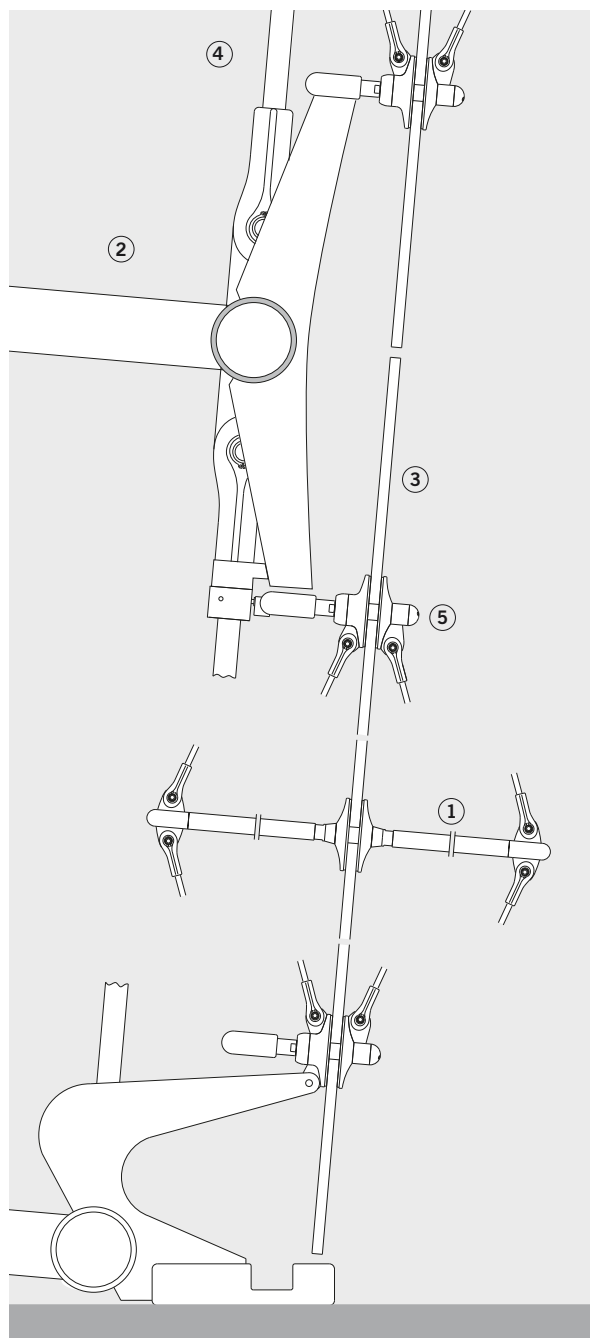
The 250 m long and 16.8 m wide shopping mall in Luxembourg's banking district on the Kirchberg plateau lies between two five-storey blocks under a glass canopy roof. The side buildings are composite structures in steel and concrete with a wide-spanning panel grid of 8.40 x 16.80 m. The design is thus 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.



The glass and steel façade of the Kirchberg shopping mall in Luxembourg

Coordination and site management:
Stefan Jeromin
Design and consultancy services:
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 the 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 the wind loads are transmitted to the substructure by four RODAN glass clamp mountings.

The bracing struts are A4 stainless steel tubes with a diameter of 14/2 mm, featuring laser-welded eyelets for fixing the tie rods, also of A4 stainless steel, 5 mm in diameter and featuring precision-rolled threads.

- 1 Bracing strut
- 2 Primary strut
- 3 Vent
- 4 Main hanger with size 22 RODAN tie rod
- 5 RODAN glass clamp fitting with tie rod for glass panel trussing



Corvinus University, Budapest, Hungary



Juval Castle, Southern Tyrol, Italy



School of Wood Carving, Garmisch, Germany



School of Wood Carving, Garmisch, Germany

Braced glass canopy roofs

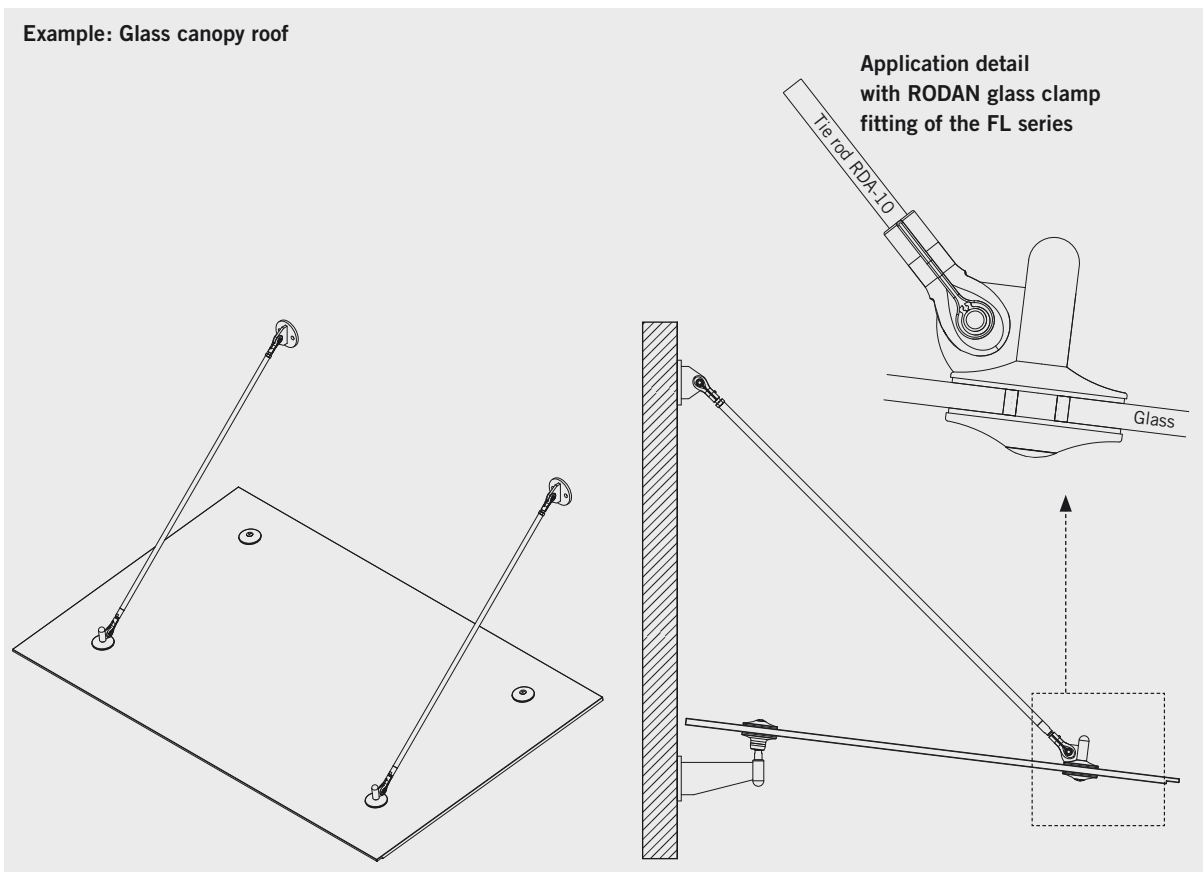
Horizontal and also inclined glass panel constructions, frequently used as canopy roofs above building entrances or shop windows, can be supported by a system-integrated bracing system without the need for additional steel members, thus removing much of the unsightly hardware conventionally required in such systems. Here, the glass panel is fixed to the building by means of a steel or stainless steel bracket and point fixings in the form of glass clamp fittings. The end supports take the form of point-fixed bracing arrangements with tie rods or struts. These connect the clamp fittings secured to the glass at a bracing angle of 30-45° to the building masonry or primary structure.

In order to maximise the span widths and improve the residual load-bearing properties of such arrangements, the glass construction may also be provided with a bottom-trussing arrangement.

RODAN point fixings with and without eyelet and RODAN tie rods are ideal as supplementary elements for the basic building-side construction (brackets for wall connection).



Example: Glass canopy roof



MANET CONSTRUCT

External and internal walls, façades and roofs of glass require construction systems that satisfy the highest demands in terms of functionality and design.

Providing sophisticated technology and ensuring a harmonious design, the MANET CONSTRUCT range of hardware meets the specific requirements of all-glass systems, setting truly new standards in the process.

The broad product portfolio – flush-mounted single-point fixings, clamp fittings and the other construction hardware components – ensures optimum planning reliability with respect to both the structural engineering requirements and visual appearance of the ensuing glass construction.

All components of the MANET CONSTRUCT system – from the point fixings to

the spider – are designed to ensure extensively constraint-free installation and effective load transmission to the substructure.

In formal terms, the MANET CONSTRUCT system is assigned to the MANET product group, providing structural and safety-relevant solutions that extend and complement that portfolio.

Z-14.4-458

Certificate of General Building Approval for MANET CONSTRUCT Spiders

Report No. 031215
MANET CONSTRUCT
Point fixings EA50/ESA50
Dated 15.12.2003



Mark of conformity awarded to MANET CONSTRUCT products



design award
winner
2002



reddot



Spider



Connection system



EV single-point fixings



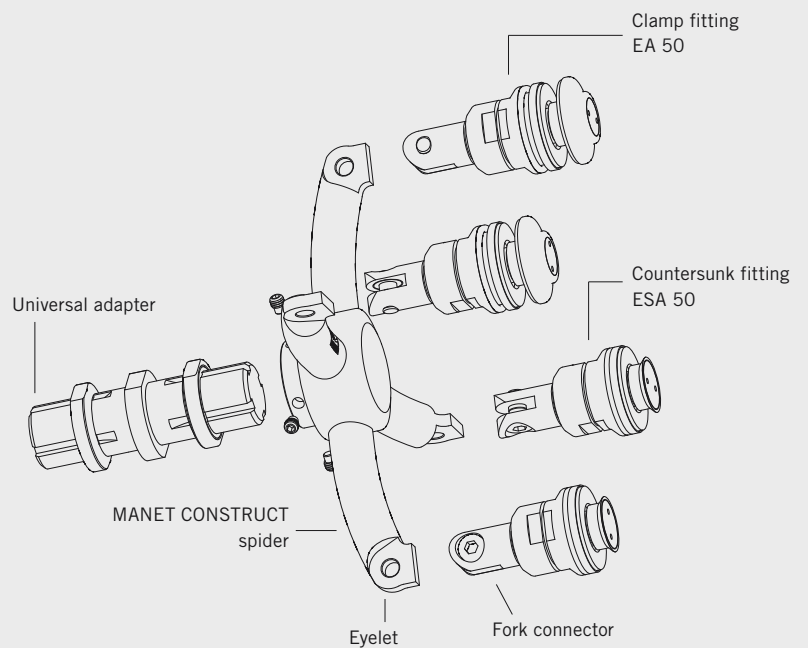
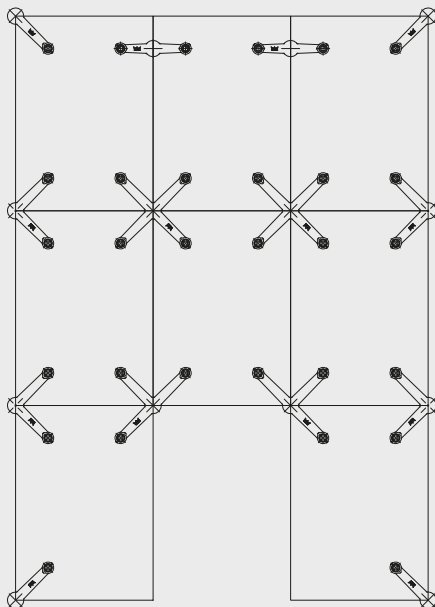
The MANET CONSTRUCT spider

Offering fascinating design features for any façade, whether straight, segmented or rounded with curved glazing, the MANET CONSTRUCT spider adds aesthetic allure to connection efficiency. The arms of the spider absorb the load at all points of contact. Carrying a German certificate of general building approval, the spider system serves as the connection element to a central point on the substructure. The spider is designed for fitting the associated MANET CONSTRUCT single-point fixings EA (clamp fitting) and ESA (countersunk fitting) and ESA

(countersunk fitting). The MANET CONSTRUCT spider can be used as a one-arm, two-arm (90° and 180°), three-arm or four-arm element, covering all the requirements of each individual construction project. The spider is secured to the substructure by means of a standardised universal adapter. In the event of asymmetrical loading, anti-rotation locks incorporated within the spider hub and the substructure connector prevent the possibility of system twist.



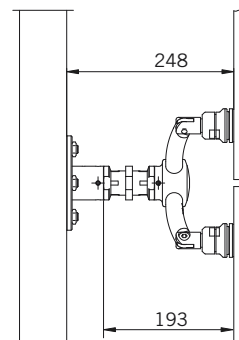
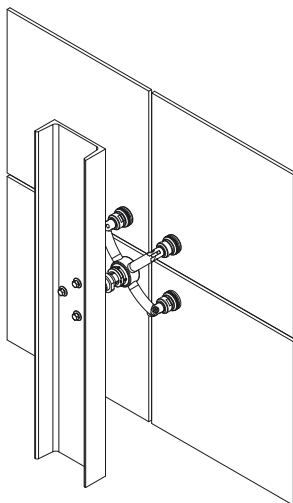
Possible spider applications for a façade



MANET CONSTRUCT spider connection possibilities

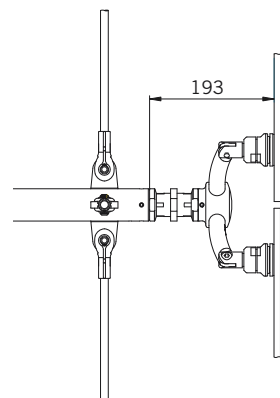
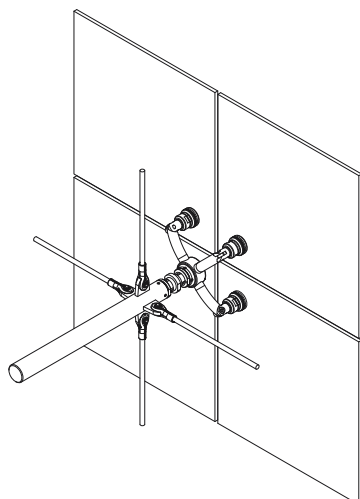
1. Connection via bracket

Spider construction with universal adapter connected to a screw-fixed standard bracket for mounting onto the substructure profile.



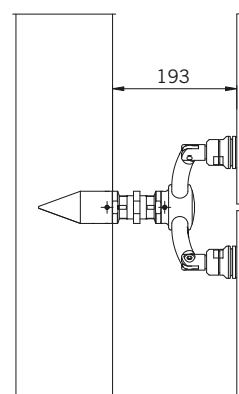
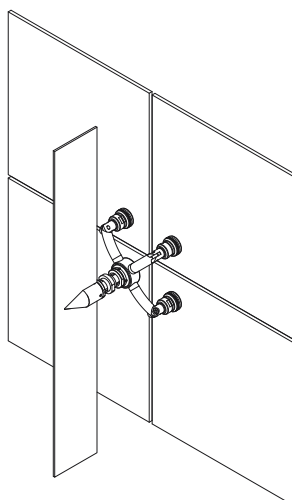
2. Connection via strut

Spider construction featuring universal adapter screwed into a strut attached to the rear-trussed primary construction.



3. Connection directly to substructure profile

Spider construction with universal adapter, screwed into a socket connector welded onto the substructure profile.



MANET CONSTRUCT single-point fixings for spiders

The standard single-point fixings designed for the MANET CONSTRUCT spider are the EA/ESA 50 fittings. Clamp fittings for overhead glazing systems and countersunk fittings – preferred for vertical glazing systems – are included in the standard range and available for relevant glass thicknesses of 10/12/17.5 and 21.5 mm. Stresses in the glass arising from deformation/expansion are reduced by an interfacial elastomer pad located in the front part of the mounting.

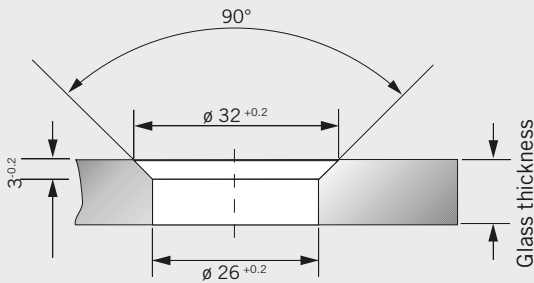


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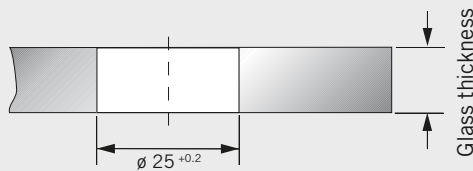
Gutachten zu Verwendbarkeitsnachweisen Universität (TH) Karlsruhe

Drilling the glass

Countersunk bore for countersunk fittings

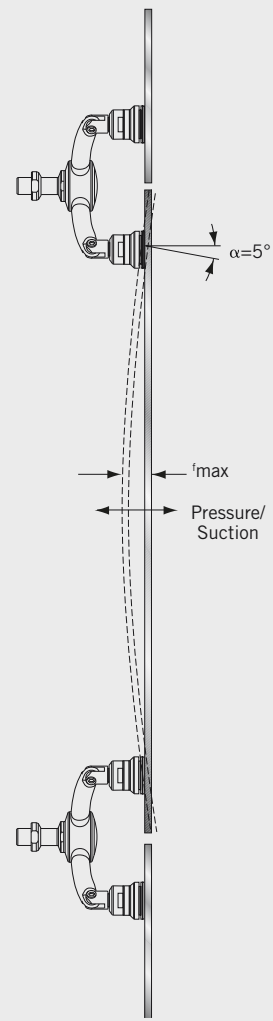


Through-bore for clamp fittings



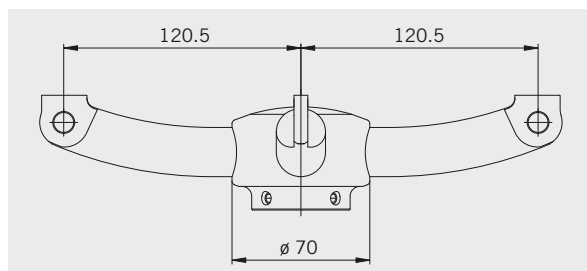
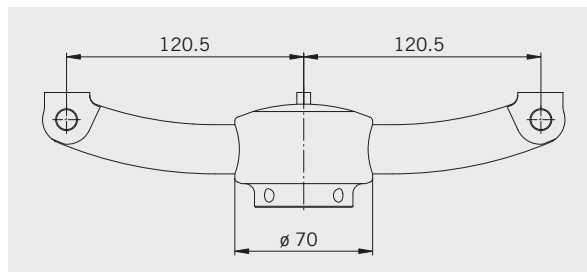
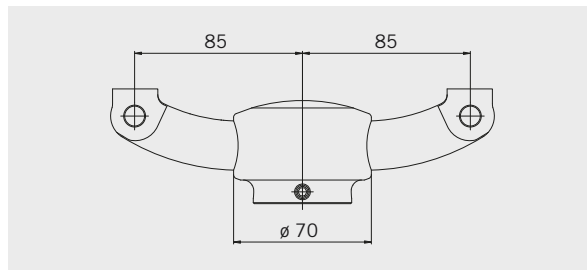
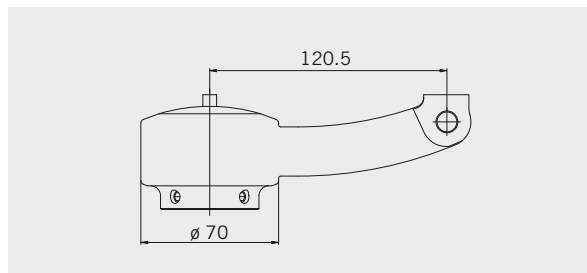
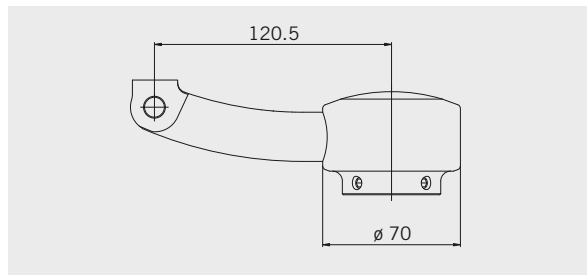
The requisite glass thickness is determined by static analysis. Pre-dimensioning service available on request.

Stress loading theory



Spider designs and accessories

The spiders are of modular design with one to four arms. They are secured to the substructure by means of the type-tested M 36 x 2 universal adapter. The hub diameter is 70 mm and the spider has an overall height of 117 mm including the sockets for the single-point fixings (rear face of glass).



Order data

Stainless steel 1.4468

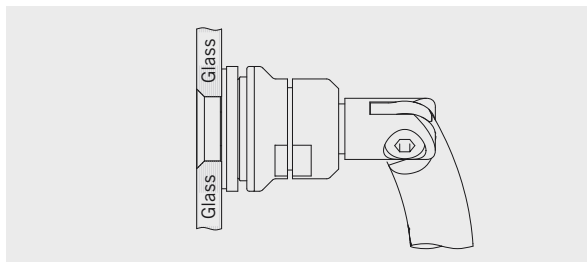
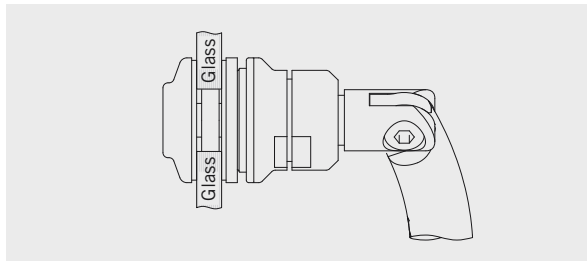
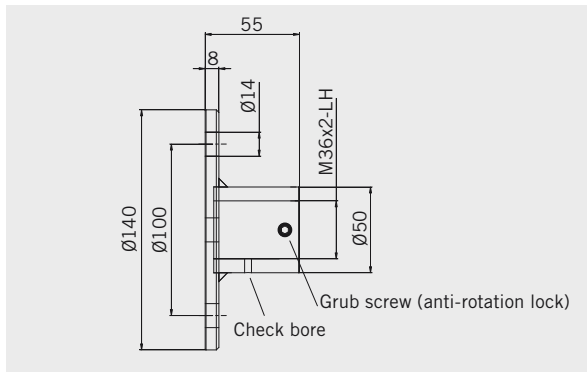
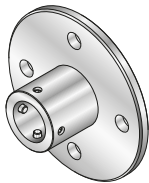
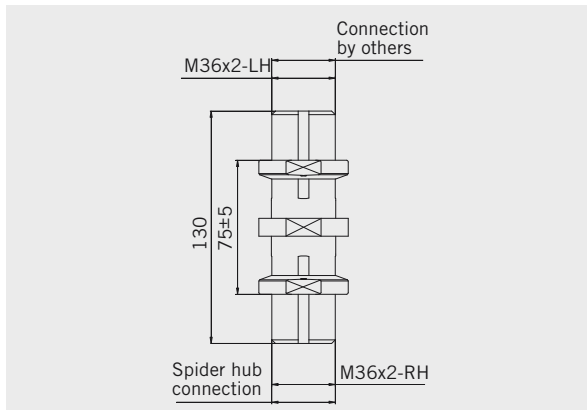
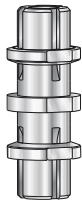
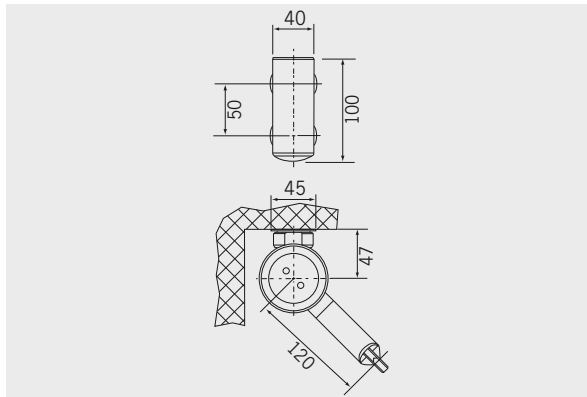
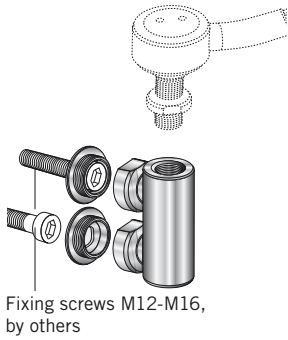
Spider, one-arm
Art.-No. 8.22.180.701.99

Spider, two-arm, 90°
Art.-No. 8.22.181.701.99

Spider, two-arm, 180°
Art.-No. 8.22.182.701.99

Spider, three-arm
Art.-No. 8.22.183.701.99

Spider, four-arm
Art.-No. 8.22.184.701.99



Order data

Wall fixing
for spiders
Art.-No. 8.22.195.703.99

Universal adapter
Stainless steel 1.4404
Art.-No. 8.23.565.703.99

Connection bracket
Stainless steel 1.4404
for mounting onto the substructure
Art.-No. 8.23.570.703.99

MANET CONSTRUCT
Clamp fitting
Stainless steel 1.4404
EA 50 with 3D joint and fork connector
(see page 59)

MANET CONSTRUCT
Countersunk fitting
Stainless steel 1.4404
ESA 50 with 3D joint and fork connector
(see page 59)

Series EA 50

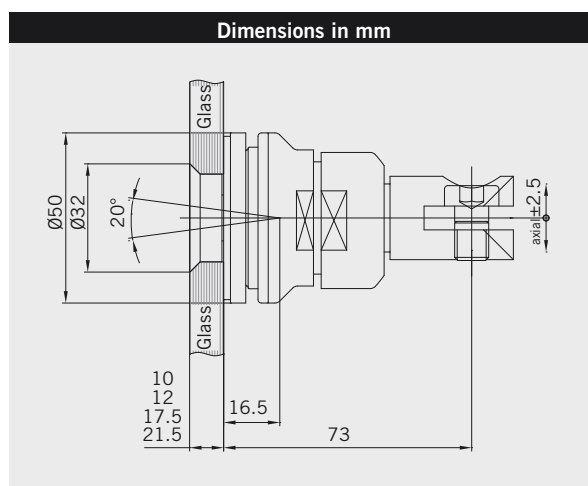
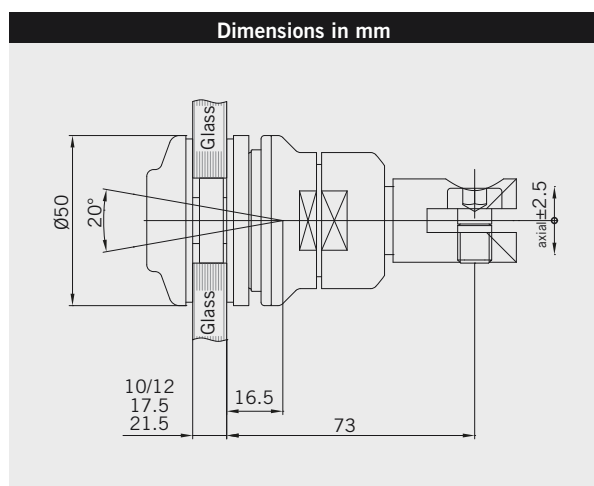


Clamp fitting of the series EA 50 for MANET CONSTRUCT spiders. Available in a disk size of 50 mm.

Series ESA 50



Countersunk fitting of the series ESA 50 for MANET CONSTRUCT spiders. Available in a counter-bearing disk size of 50 mm.



Order data for complete series EA 50 fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
EA 50	10/12	8.22.145.703.99
	17.5	8.22.146.703.99
	21.5	8.22.147.703.99

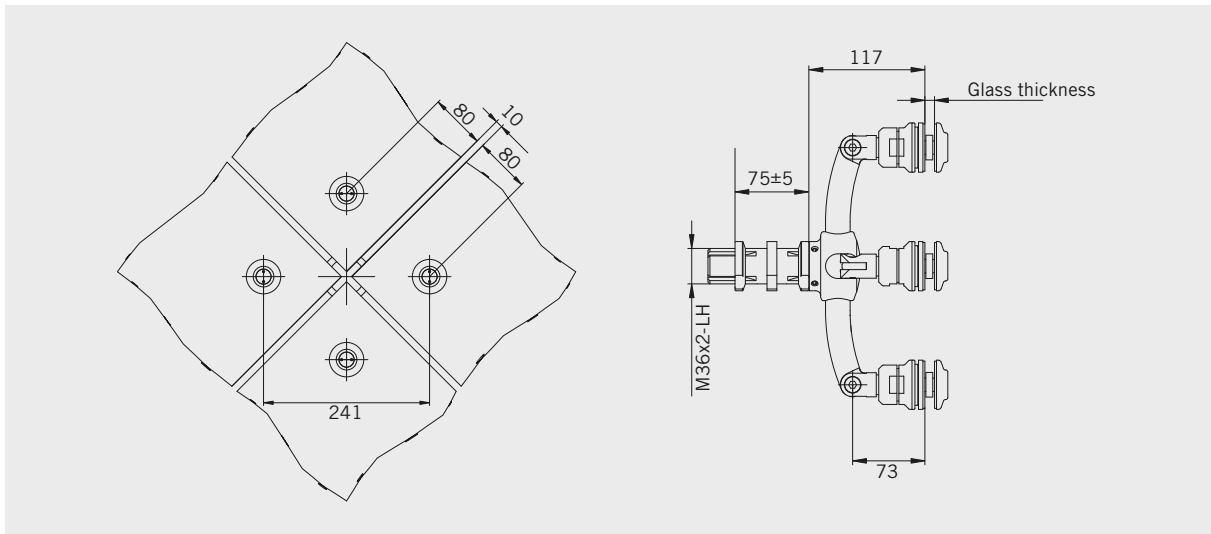
Order data for complete series ESA 50 fittings		
Type	Glass thickness mm	Article No. Stainless steel 1.4404
ESA 50	10	8.22.105.703.99
	12	8.22.106.703.99
	17.5	8.22.107.703.99
	21.5	8.22.108.703.99

Load-bearing capacities of single-point fixings for spiders

Fitting type	Normal force N_F	Transverse force Q_F
EA 50	20.72 kN	7.24 kN
ESA 50	18.40 kN	6.64 kN

Characteristic loadability values of the mountings exposed to normal and transverse forces. The dimensioning values are derived from these data by dividing with a safety coefficient $\gamma_m = 1.1$.

Geometric data for glass drilling operations



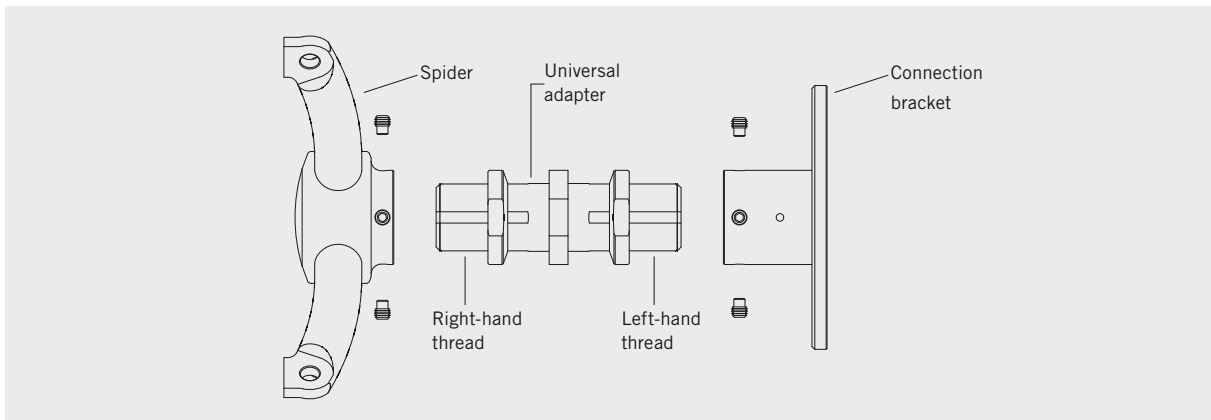
MANET CONSTRUCT spider installation

Important advisory!

MANET CONSTRUCT single-point fixings and MANET CONSTRUCT spider assemblies may only be used in accordance with the regulations of the associated certificate of suitability,

certificate of general building approval and type test report or equivalent national regulations. The original assembly and installation instructions in each case are binding.

1. Fitting the MANET CONSTRUCT universal adapter and spider to the substructure



Once the fine adjustment of the substructure has been completed, the spider can be installed. Note: Ensure compliance with the MANET CONSTRUCT universal adapter datasheet! Wind the

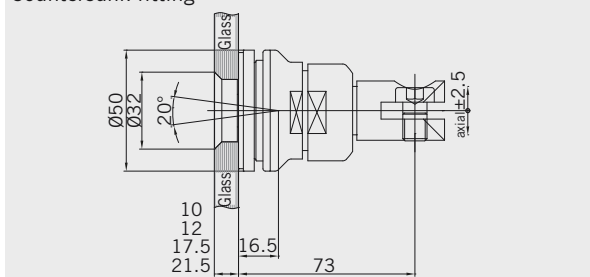
MANET CONSTRUCT universal adapter into the threaded hub socket of the spider two to three turns. Screw the spider and universal adapter into the female thread of the connec-

tion bracket mounted on the substructure using a wrench applied to the flats, until the thread becomes visible in the check bore. Axial adjustment range ± 5 mm (thread must remain visible in the

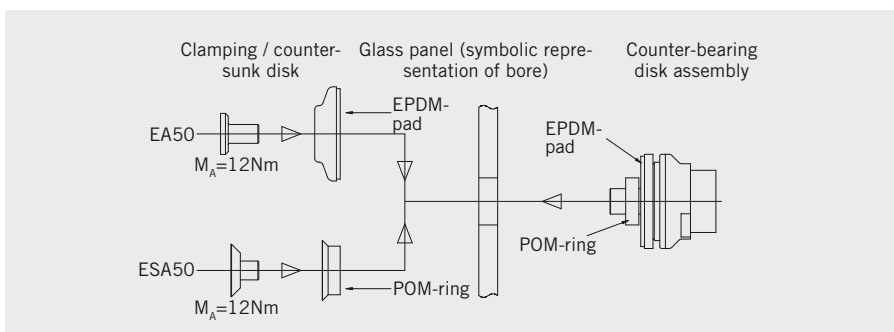
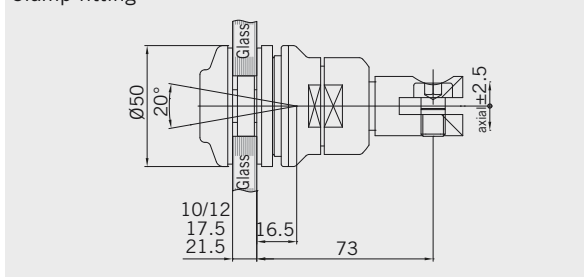
check bore!). Wind in the grub screws with spigot extension in order to secure the assembly against rotation/twist. Tighten the lock nuts of the universal adapter.

2. Fixing MANET CONSTRUCT fittings to the glass

Countersunk fitting

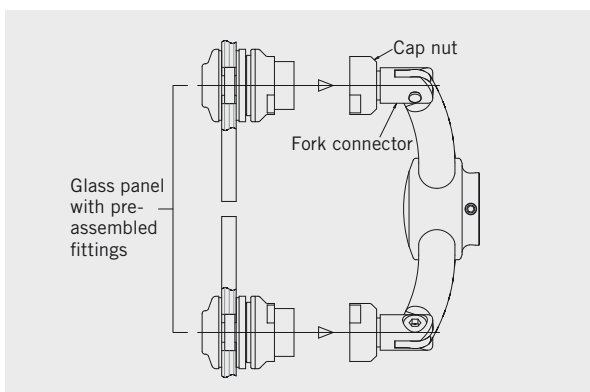


Clamp fitting



Fit the clamping / counter-sunk disk of the fitting through the hole in the glass panel and screw into the counter-bearing disk assembly using the MANET wrench (tightening torque 15 Nm).

3. Installation of the glass panels with fittings onto the MANET CONSTRUCT spider



1. Fix the fork connector with the cap nut to the spider arm using a hexagonal socket head cap screw (M10 x 16-70). Do not tighten!
2. Raise the pre-assembled glass panel to the point of

installation.
3. Connect the mounting with the fork connector using the cap nut.
4. Adjust for tolerances using the DORMA universal adapter (± 5 mm).

5. Tighten the cap nut (50 Nm) using the MANET open-jaw wrench.
6. Tighten the hexagonal socket head cap screw M10 x 16-70 to 15 Nm. Caution! Make sure that the threads of the cap nut are

not crossed! Caution! Tighten the cap nut first before removing the glass panel lifting/support appliance (tightening to be performed in unloaded condition).

Installation tools

Additionally required standard tools:

- Open-jaw wrench, 46 mm A/F
- Hexagonal socket wrench M 8
- Torque wrench with socket, 19 mm A/F

For MANET CONSTRUCT single-point fixings:



EA 50 / ESA 50

Approvals and certificates

The MANET CONSTRUCT spider assembly with universal adapter is generally approved according to German regulations for construction applications. Its suitability can also be verified by static analysis on the basis of the type test carried out, using a standardised dimensioning process for each individual application.

All certificates, approvals and type test reports are available from DORMA-Glas.

2-26/03

Darmstadt Regional Administrative Authority,
Test Report No. 2 – 26/03

3-26/03

Darmstadt Regional Administrative Authority,
Test Report No. 3 – 26/03

Z-14.4-458

German Institute for Building Technology, Certificate of General Building Approval



Mark of conformity awarded to MANET CONSTRUCT products

Static values and load-bearing capacities

Static analyses for individual applications are performed on the basis of the type test. The dimensioning diagram used in the respective type tests can also be applied for pre-dimensioning in the initial planning stage. All the external stress loads acting

on the spider assembly must be determined in advance in order to enable the pre-dimensioning of the components involved. Using these values, the diagrams shown on the following pages can then be used on the basis of the brief descriptions and

examples provided. The certificate of suitability for the single-point fittings to be connected to the spider and also the type test for the universal adapter will, in all cases, also have to be taken into account.

In Germany, the respective

original type test document in conjunction with the certificate of general building approval is exclusively binding for preparation of the verifiable static analysis.

Standard type pre-dimensioning

1. The present type dimensioning sheet MANET CONSTRUCT spider 45° applies to the following spider types: one-arm, two-arm 90°, three-arm and four-arm. The type dimensioning sheet MANET CONSTRUCT spider 180° is applicable to the spider type two-arm 180°.

2. Within the context of a predominantly glass construction, the investment-cast spider of stainless steel is used as a one-arm, two-arm, three-arm or four-arm load-bearing element in conjunction with single-point fixings on the glass side and a suitable connection flange on the structural side.

3. The spider provides the bearing support for the single-point fixings and transmits the load stresses transferred to it to a sufficiently load-bearing substructure.

4. The substructure may, for example, take the form of a lattice work of DORMA RODAN tie rods. Connection to a concrete or steel construction is, for example, possible using the universal adapter.

5. The spider may only be used in conjunction with single-point fixings of the type MANET CONSTRUCT and the DORMA universal adapter.

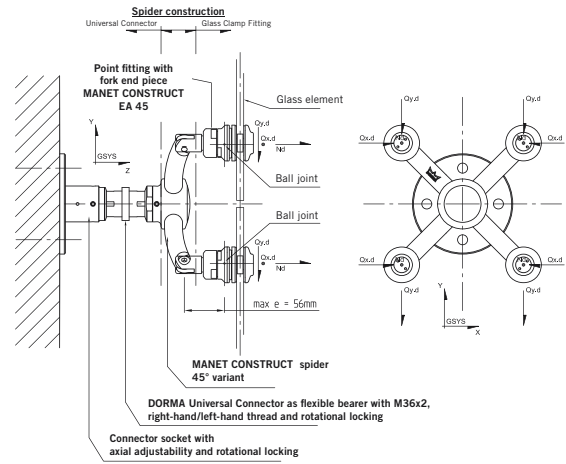
6. The design values for stress loads N_d (Z direction), $Q_{x,d}$ (X direction) and $Q_{y,d}$ (Y direction) must be determined as support reactions on the basis of the superordinated static system.

7. The spider assembly is deemed to have sufficient load-bearing capacity if, for the determined design values for stresses $Q_{x,d}$, $Q_{y,d}$ and N_d , the specified interaction condition is fulfilled. $Q_{x,d}$, $Q_{y,d}$ and N_d within this context are interrelated load stresses acting on a spider arm. The spider assembly is also deemed to have sufficient load-bearing capacity if the determined design values for load stresses $Q_{x,d}$, $Q_{y,d}$ and N_d give rise to points of intersection that are all below the plotted linearities (straight-line plots).

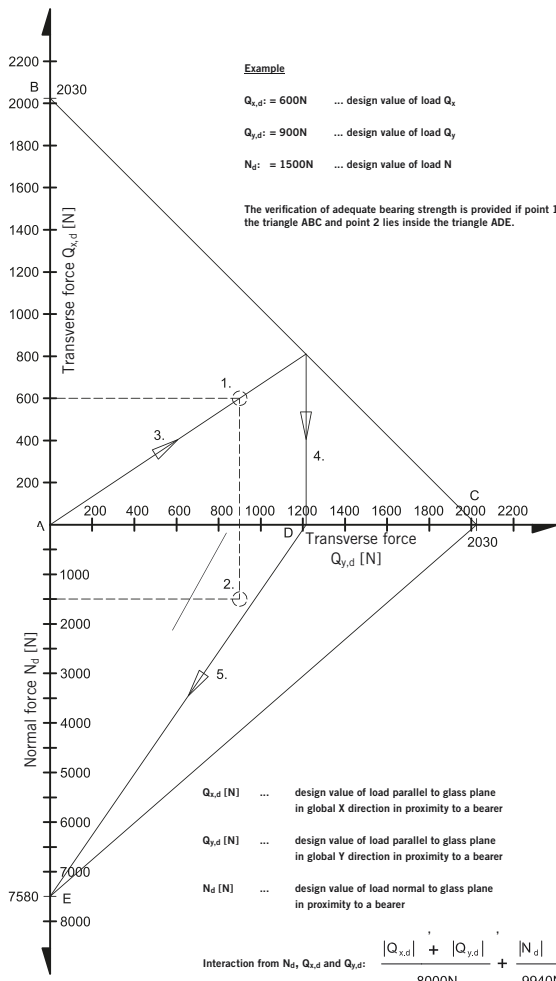


MANET CONSTRUCT spider 45°

Annex 2 MANET CONSTRUCT spider 45° Field of application and verification procedure



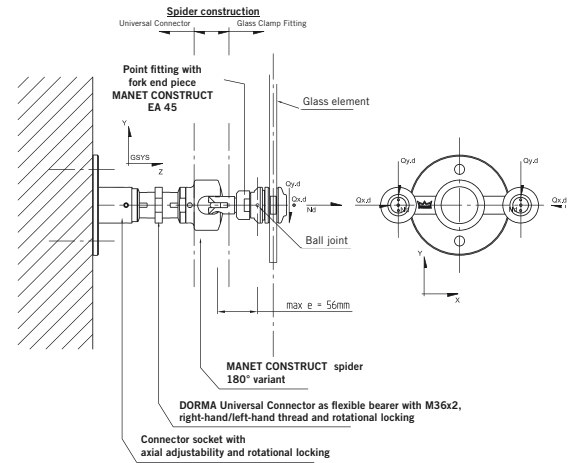
Annex 2 MANET CONSTRUCT spider 45° Application example of interaction diagram



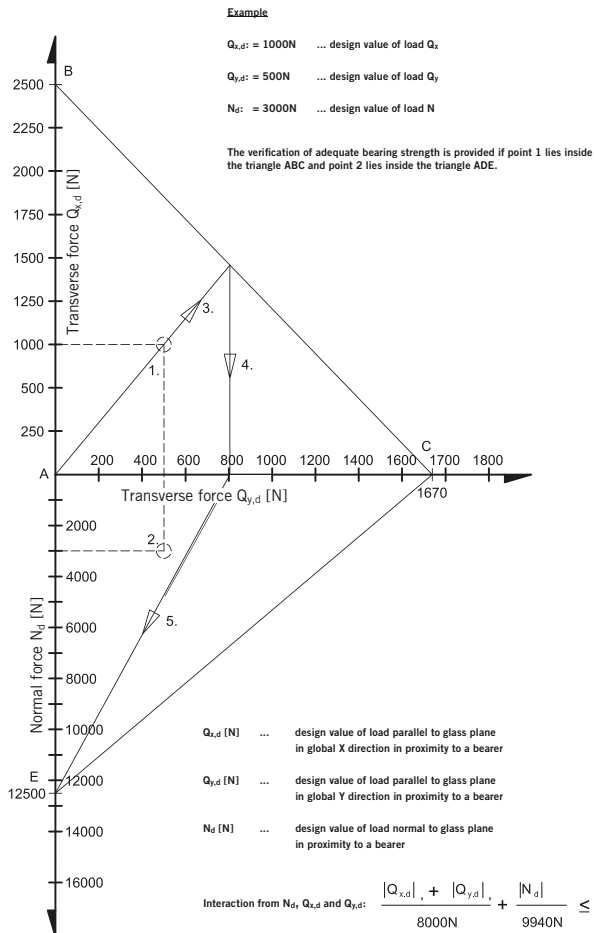
12.08.03

MANET CONSTRUCT spider 180°

Annex 2 MANET CONSTRUCT Spider 180° Field of application and verification procedure



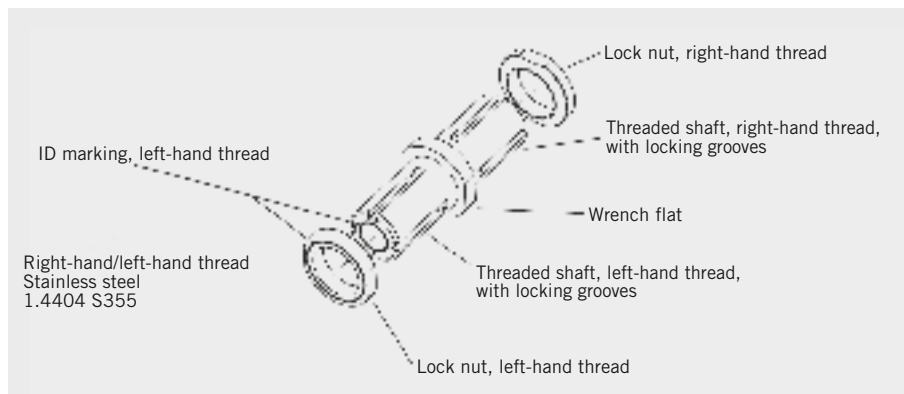
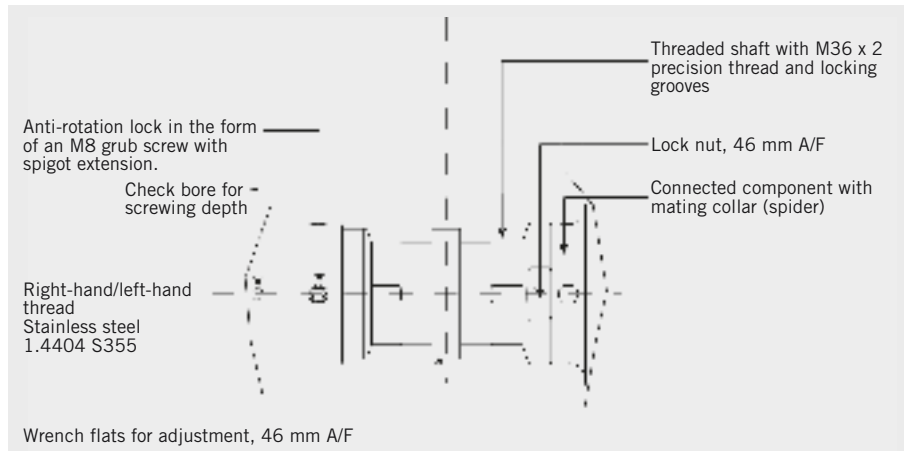
Annex 2 MANET CONSTRUCT spider 180° Application example of interaction diagram



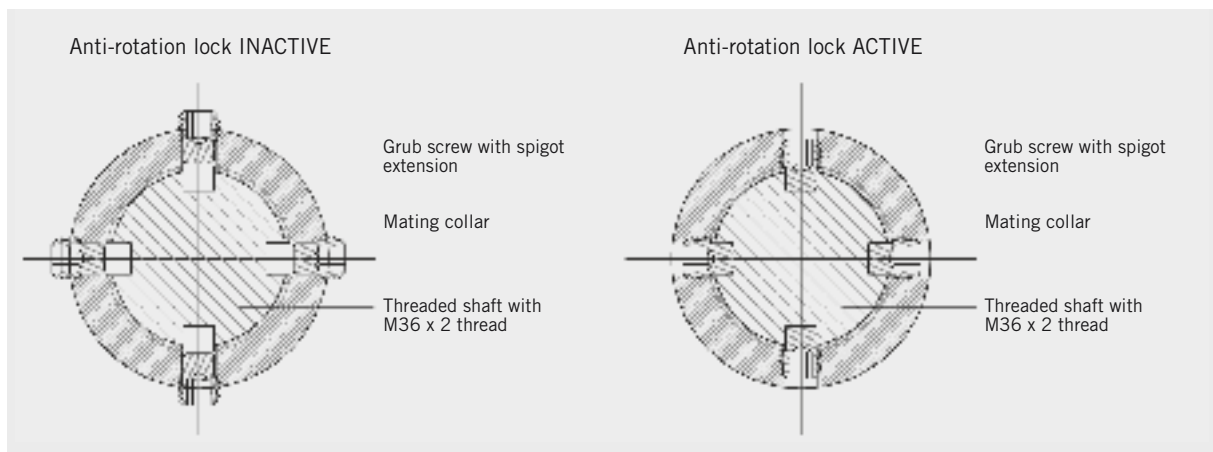
Universal adapter

The universal adapter connects the spider's hub to the substructure, enabling additional tolerance equalisation of $\pm 5\text{mm}$ during installation.

Because the universal adapter has a right-hand and a left-hand thread at either end, adjustment of the distance between the glass and the substructure can be performed simply and reliably by rotation at the centre wrench flats, even once the system has been fully installed. Lock nuts secure the as-adjusted condition of the installed universal adapter. Thanks to the integral anti-rotation locking devices, adapter twist in the event of asymmetrical loading (such as may occur during the installation work) is also reliably prevented.



Functional principle of the anti-rotation lock



The DORMA universal adapter may only be used in accordance with the specifications and regulations stipulated in the associated type test report.

In order to avoid lesions (cut injuries), safety gloves must be worn at all times when handling the threaded shafts of the universal adapter.

The threads must be protected against contamination and damage.

Installation should be performed in accordance with the instructions provided with the associated DORMA products.

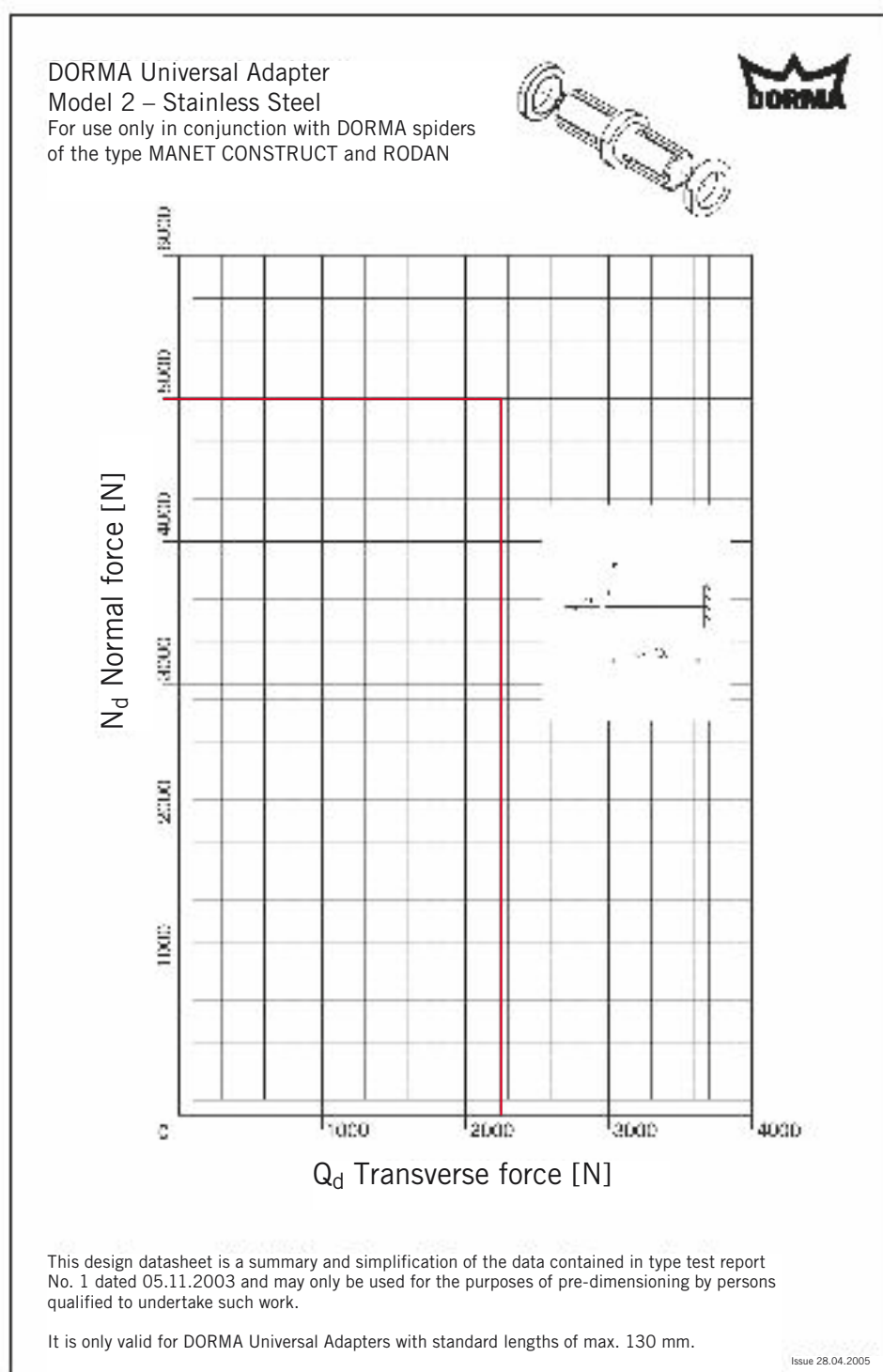
Load-bearing capacities

Load-bearing capacities in accordance with "Type test report No. 1 of the Hesse State Testing Authority for Structural Engineering of

the Darmstadt Regional Authority dated 05.11.03" which is available as a binding structural engineering document for verifiable

static analysis from DORMA-Glas. Loads acting in combination are to be analysed in accordance with DIN 18800 using

appropriate loading vector combinations and the safety factors applicable in each case.



MANET CONSTRUCT connection system

The MANET CONSTRUCT connection system enables glass to be mounted to glass or to building structures/sub-structures. Depending on the components involved, they not only perform the interconnection task but also a range of load-bearing functions.

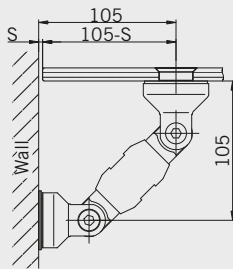
Particularly impressive is the flexibility of the system: as alternatives to rigid arms, also available are arms equipped with right-hand and left-hand threads and with adjustable centre sections for installation between the single-point fixings and/or wall connections, enabling tolerances to be effectively evened out.



Corner connections

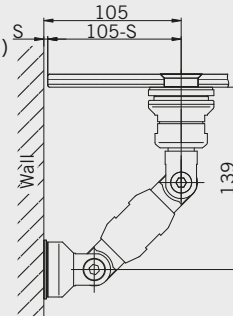
Glass/wall connection

with countersunk fitting and wall fixing (rigid)



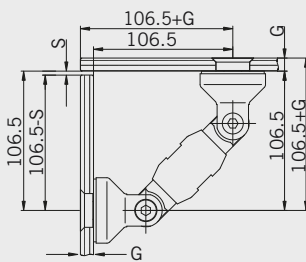
Glass/wall connection

with ESA 50 countersunk fitting and wall fixing (rigid)



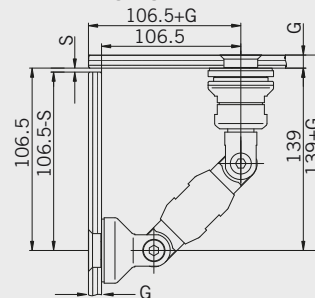
Glass/glass connection

with countersunk fittings (rigid)



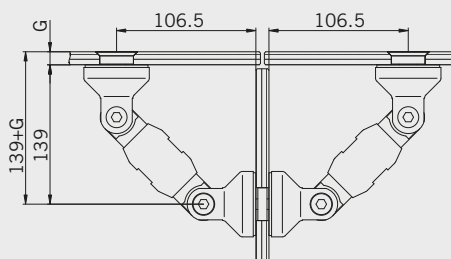
Glass/glass connection

with countersunk fitting (rigid) and ESA 50 countersunk fitting



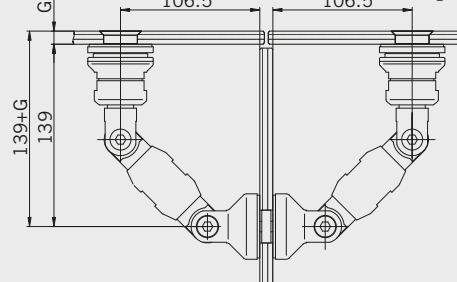
Glass/stiffener plate connection

with countersunk fittings and dual connection clamp fittings (rigid)

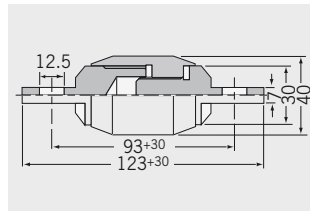
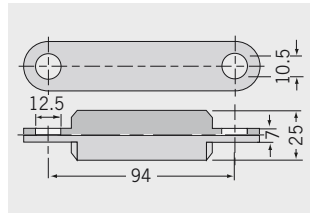
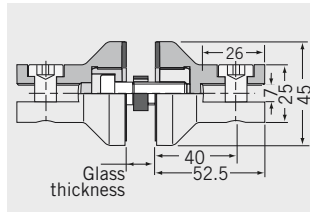
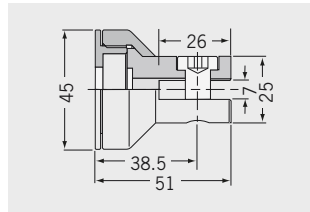
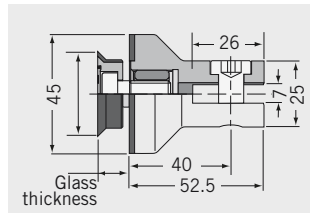
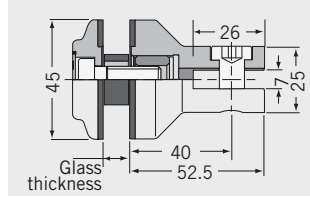


Glass/stiffener plate connection

with ESA 50 countersunk fittings and dual connection clamp fittings (rigid)



Connection components



Order data Stainless steel 1.4404, electro-polished

Clamp fitting, rigid

10/12 mm: Art.-No. 8.22.420.703.99
 17.5 mm: Art.-No. 8.22.421.703.99
 21.5 mm: Art.-No. 8.22.422.703.99

Countersunk fitting, rigid

10 mm: Art.-No. 8.22.405.703.99
 12 mm: Art.-No. 8.22.408.703.99
 17.5 mm: Art.-No. 8.22.409.703.99
 21.5 mm: Art.-No. 8.22.411.703.99

Wall fixing, rigid

Art.-No. 8.22.400.703.99

Dual connection clamp fitting, rigid

10/12/13.5 mm: Art.-No. 8.22.440.703.99
 17.5 mm: Art.-No. 8.22.441.703.99
 21.5 mm: Art.-No. 8.22.442.703.99

Connecting rod, rigid

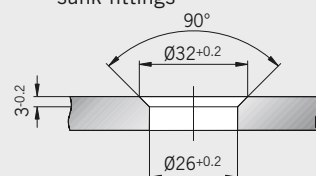
Art.-No. 8.22.350.703.99

Connecting rod, adjustable

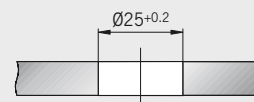
Art.-No. 8.22.410.703.99

Drilling the glass

Countersunk bore for countersunk fittings



Through-bore for clamp fittings/
 dual connection clamp fittings



MANET CONSTRUCT single-point fixings, Series EV

The MANET Series EV single-point fixings are specifically designed to satisfy exacting public safety requirements. In order to achieve maximum freedom from constraint when fixing the glass panels and minimised stress when installed (i.e. when exposed to external loads), the component design features two independent bearing systems. The integrated elastomer pads not only act as an axial buffer for the absorption of impact or shock loading, but also allow a degree of sprung angular movement. This means that a glass panel can freely deform at the mounting zone when exposed to an external load.

The fixing system additionally comprises three different types of bearing location. These are designated as the fixed [F], vertical [V] and floating [L] bearing. The

fixed bearing [F] offers a horizontal tolerance compensation of ± 3 mm for installation purposes. There is no adjustability in the vertical direction. When it is installed, this bearing type is completely rigid - i.e. fixed. It is equivalent to a tight fitting hole in the substructure.

The vertical bearing [V] also offers a horizontal tolerance compensation of ± 3 mm for installation purposes. And again there is no adjustability in the vertical direction. When it is installed, the assembly remains adjustable within the ± 3 mm zone in the horizontal. This design is equivalent to a tolerance hole in the substructure. In order to ensure long-term adaptability, there is also an axial clearance between the bearing components of ± 0.3 mm. The floating bearing [L] offers a

horizontal and a vertical tolerance adjustment of ± 2 mm for installation purposes. This design is equivalent to a tolerance hole in the substructure. Again, in order to ensure long-term adaptability, there is an axial clearance between the bearing components of ± 0.3 mm.

The deadweight load of the glass is transmitted to the fixed and vertical bearings. The horizontal load (wind/impact) is absorbed in the axial direction by all the fixings.

Free, unconstrained expansion of the glass panel is ensured under thermal loading by the arrangement of the bearing types within a statically analysed system.

Force transmission to the single-point fixing is effected both via the positive lock

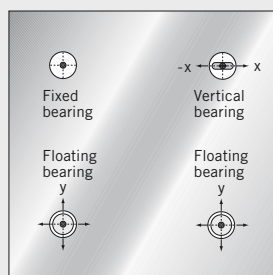


Detail lift shaft

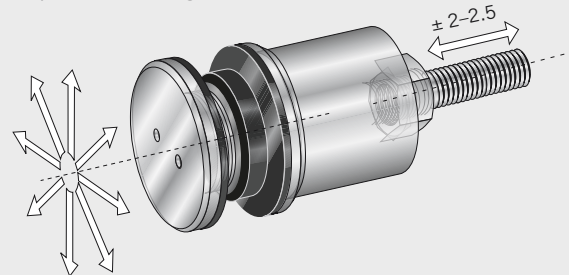
provided by the glass fixing screw and via the location of the cylindrical glass bore on the cantilever portion of the fixing. Contact between the stainless steel and glass is prevented by a system of plastic sleeves and rings.

General glass panel bearing arrangement

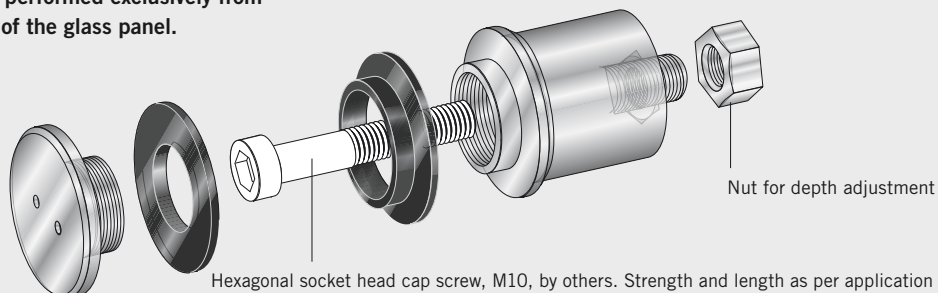
Depending on the loading pattern involved, the arrangement of the single-point fixings may be of critical importance for minimising stress in the glass.



Integrated, flexible articulated construction and compensatory elements for stress relief and absorption of building tolerances



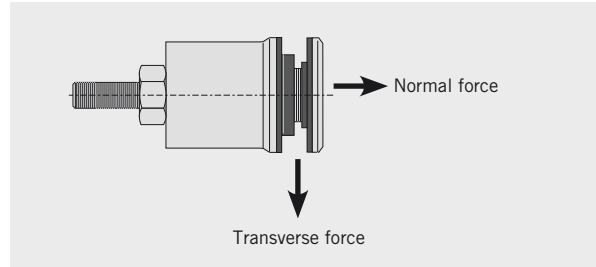
Fitting can be performed exclusively from the front face of the glass panel.



Hexagonal socket head cap screw, M10, by others. Strength and length as per application requirements.

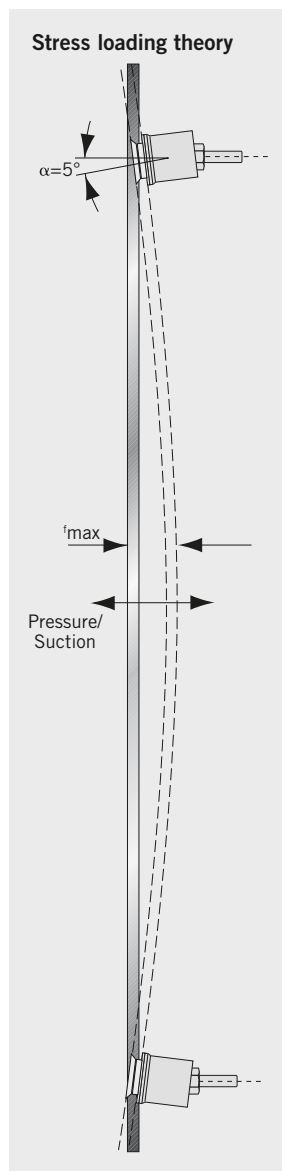
Load-bearing capacities of Series EV single-point fixings

- Normal force is applied perpendicular to the glass panel (e.g. wind load in the case of vertical glazing systems)
- Transverse force acts parallel to the panel plane (e.g. deadweight of vertical glazing systems)



Single point fixing type	Normal force N_F	Transverse force Q_F
EV 45/50 countersunk fitting	3.64 kN	0.45 kN
EV 50/50 clamp fitting	3.64 kN	0.45 kN

Characteristic values for stress load capacity under normal and transverse forces.
The design values are derived from these values by dividing with the safety factor $\gamma_m = 1.1$.

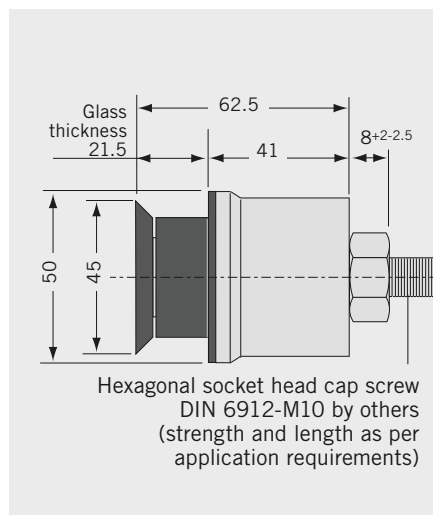
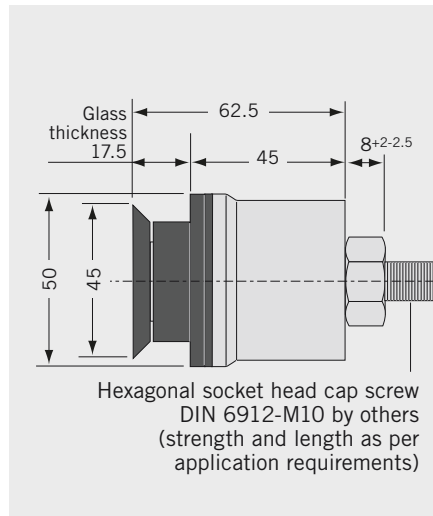
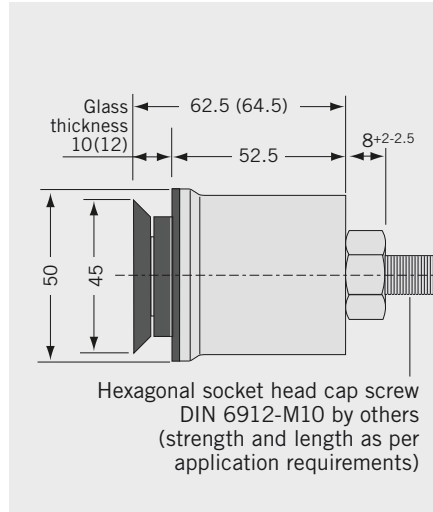


Glazed lift shaft at Düsseldorf airport

Single-point fixings, Series EV 45/50

Series EV 45/50 single-point fixings are countersunk fittings allowing for flush glass fixing to give an impression of understated elegance. Thanks to optimum deadweight transmission to the substructure, mountings of this type

are the preferred solution for vertical glazing systems. The countersunk fitting requires a high level of accuracy and minimal tolerances in mounting/substructure fixing point alignment.



Order data

Material: Stainless steel
1.4404, electro-polished

Glass thickness 10/12 mm

Countersunk fitting,
vertical bearing
Art.-No. 8.22.800.703.99

Countersunk fitting,
fixed bearing
Art.-No. 8.22.810.703.99

Countersunk fitting,
floating bearing
Art.-No. 8.22.820.703.99

Glass thickness 17.5 mm

Countersunk fitting,
vertical bearing
Art.-No. 8.22.802.703.99

Countersunk fitting,
fixed bearing
Art.-No. 8.22.812.703.99

Countersunk fitting,
floating bearing
Art.-No. 8.22.822.703.99

Glass thickness 21.5 mm

Countersunk fitting,
vertical bearing
Art.-No. 8.22.803.703.99

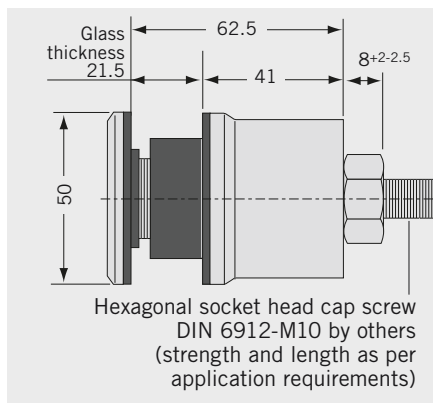
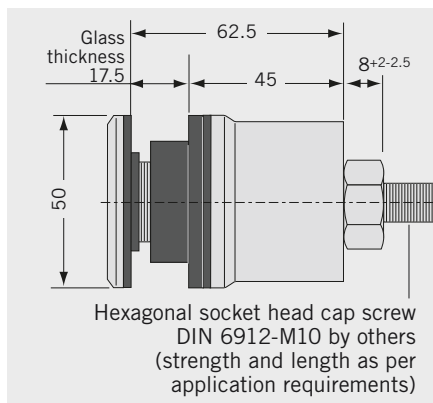
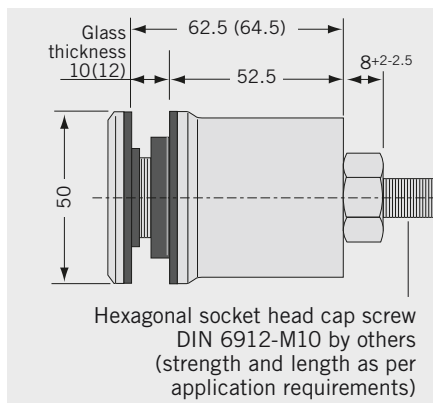
Countersunk fitting,
fixed bearing
Art.-No. 8.22.813.703.99

Countersunk fitting,
floating bearing
Art.-No. 8.22.823.703.99

Single-point fixings, Series EV 50/50

Series EV 50/50 single-point fixings are clamp fittings that press onto the glass surface rather than lying flush in a countersunk bore. The relatively large clamp contact area on

the glass provides for higher bearing capacities, particularly in the case of damaged laminated safety glass, and thus enhanced safety in sloping and overhead glazing systems.



Order data

Material: Stainless steel
1.4404, electro-polished

Glass thickness 10/12 mm

Clamp fitting,
vertical bearing
Art.-No. 8.22.850.703.99

Clamp fitting,
fixed bearing
Art.-No. 8.22.860.703.99

Clamp fitting,
floating bearing
Art.-No. 8.22.870.703.99

Glass thickness 17.5 mm

Clamp fitting,
vertical bearing
Art.-No. 8.22.852.703.99

Clamp fitting,
fixed bearing
Art.-No. 8.22.862.703.99

Clamp fitting,
floating bearing
Art.-No. 8.22.872.703.99

Glass thickness 21.5 mm

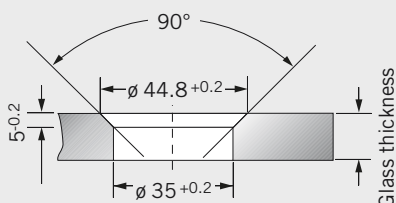
Clamp fitting,
vertical bearing
Art.-No. 8.22.853.703.99

Clamp fitting,
fixed bearing
Art.-No. 8.22.863.703.99

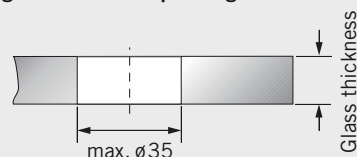
Clamp fitting,
floating bearing
Art.-No. 8.22.873.703.99

Drilling the glass

Countersunk bore for
countersunk fittings



Through-bore for clamp fittings

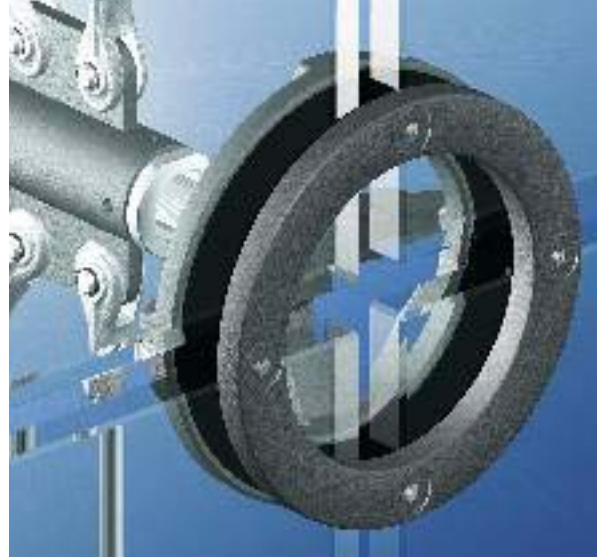


The requisite glass thickness is determined by static analysis. Pre-dimensioning service available on request.

Unique and unmistakable

Architects, builders and clients have been voicing demands for more competitively priced, attractive glass connection elements – and now LOOP has arrived to provide an innovative response. The individualistic solution for vertical glazing systems offers impressively solid technology plus easy handling. LOOP grips and connects the glass panels in both internal and external applications. And the system is already leaving its circular mark in modern glass construction projects.

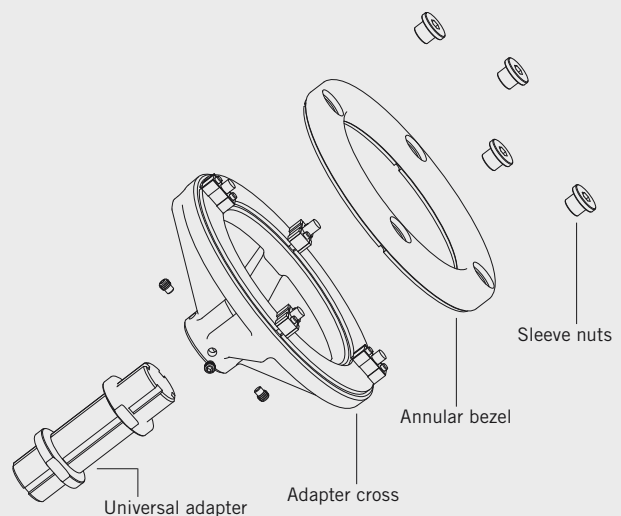
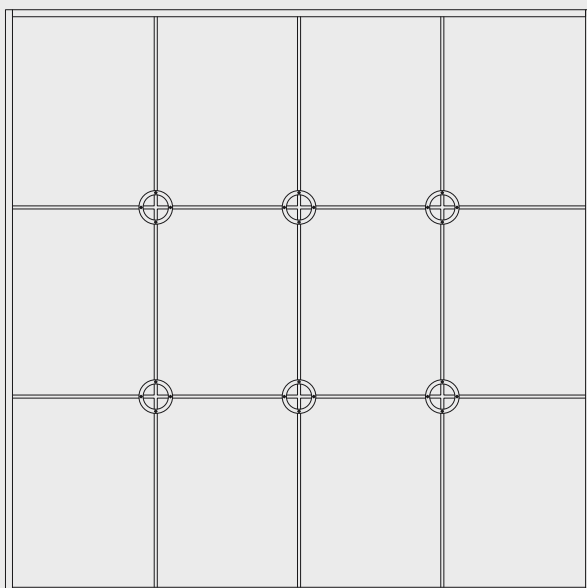
Without corners and edges, LOOP provides an ideal counterbalance to straight-lined glass panel arrangements. A sophisticated, integrated system that offers simple installation and adjustment, it eliminates the need for any drilling in the glass. And because strict adherence to DIN specifications was a primary objective during the product development phase, overcoming approval barriers in building projects should be an easy matter. Overall a convincing and thoroughly rounded solution.



Special characteristics

- Design: Glass retaining ring
- Glass type: Toughened safety glass, laminated safety glass, double glazing – *no drilling required*
- Cost efficiency: Particularly economical thanks to design simplicity, ease of installation and materials used.

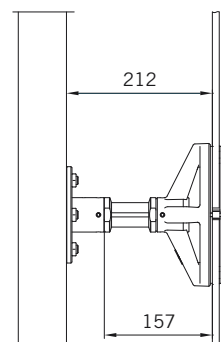
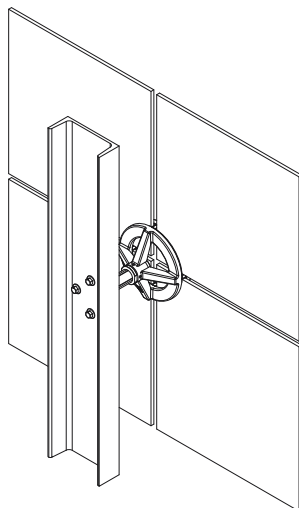
Possible LOOP applications in a façade



LOOP connection possibilities

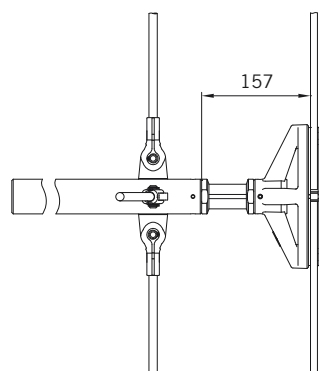
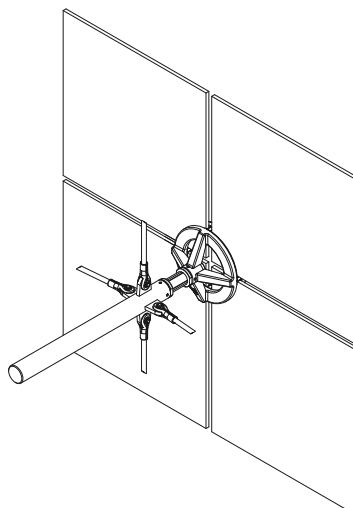
1. Connection via bracket

LOOP with universal adapter connected to a screw-fixed standard bracket for mounting onto the substructure profile.



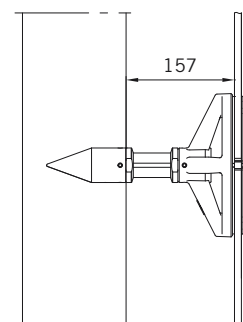
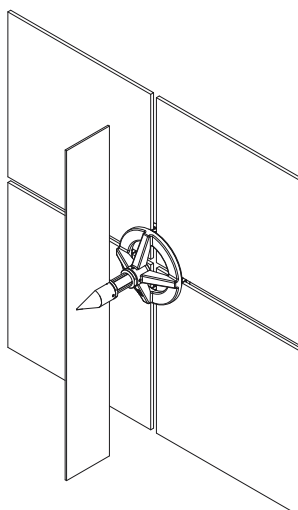
2. Connection via strut

LOOP construction featuring universal adapter screwed into a strut attached to the rear-trussed primary construction.



3. Connection directly to substructure profile

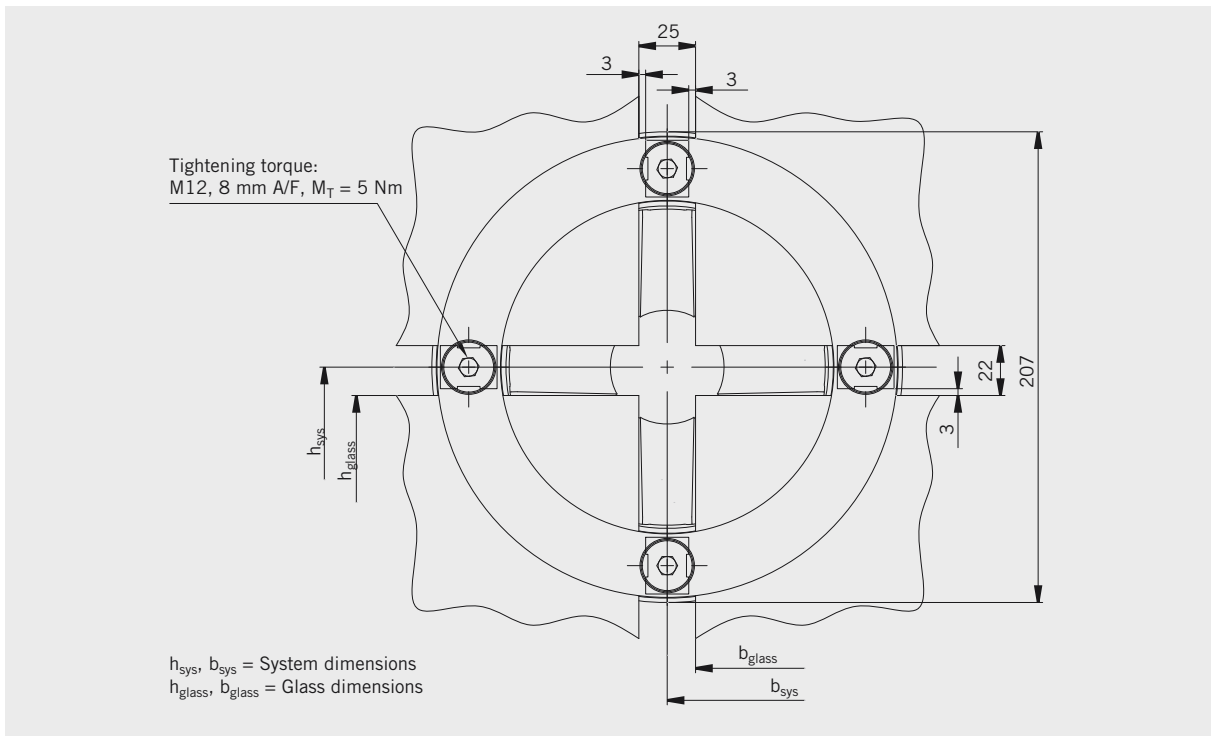
LOOP construction with universal adapter, screwed into a socket connector welded onto the substructure profile.



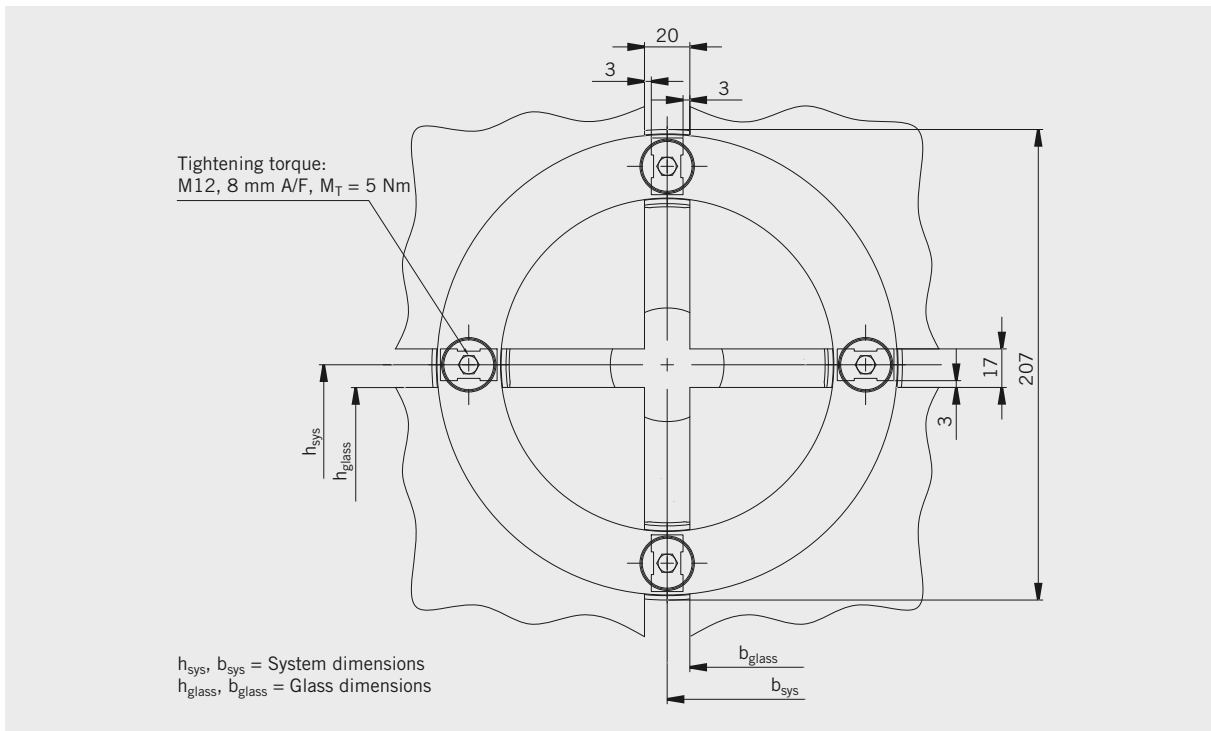
System models

The LOOP glass retaining ring is available in two models. The light-duty variant offers a glass clearance of ≥ 17 mm and the heavy-duty version offers a glass clearance of ≥ 22 mm.

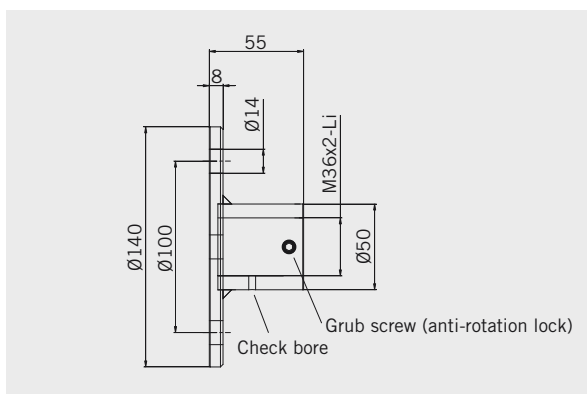
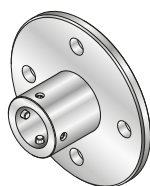
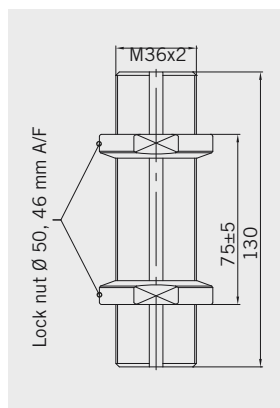
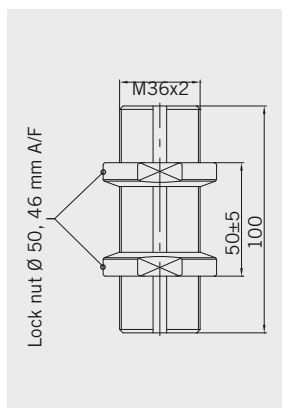
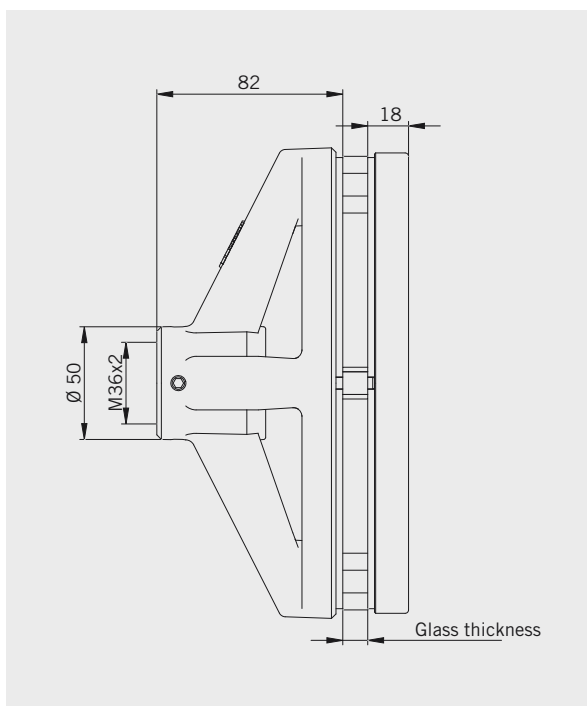
Heavy-duty model



Light-duty model



System components



Order data

LOOP glass retaining ring

Electrogalvanised steel,
powder-coated finish

Heavy-duty model

Glass mm	Art.-No.
10	8.23.557.399.99
12	8.23.558.399.99
13.5	8.23.560.399.99
15	8.23.559.399.99
17.5	8.23.561.399.99
21.5	8.23.562.399.99
25.5	8.23.563.399.99
≥ 25.5	On application

Light-duty model

Glass mm	Art.-No.
10	8.23.550.399.99
12	8.23.551.399.99
13.5	8.23.553.399.99
15	8.23.552.399.99
17.5	8.23.554.399.99
21.5	8.23.555.399.99
25.5	8.23.556.399.99
≥ 25.5	On application

Universal adapter for LOOP

Electrogalvanised steel
Art.-No. 8.23.566.399.99
(100 mm length)
Art.-No. 8.23.565.399.99
(130 mm length)

Connection bracket

for mounting onto the
substructure
Electrogalvanised steel
Art.-No. 8.23.571.010.99

LOOP installation

General information

The DORMA LOOP glass retaining ring may only be used for vertical glazing systems, whether in internal or external applications, with a verified static analysis based on applicable technical building regulations.

Before starting the installation work proper, check the visible surface of the DORMA LOOP components for significant damage as otherwise long-term corrosion protection cannot be assured. In order to avoid lesions

(cut injuries), safety gloves must be worn at all times when handling the threaded shafts of the universal adapter.

All metallic surfaces that may come into contact with the glass panel must be provided with a plastics pad.

The DORMA LOOP may only be used in accordance with the regulations contained in the associated certificate of suitability or type test report.

Component assemblies

The DORMA LOOP system is divided into two subassembly components (Components 1 and 2) which are fixed by the DORMA universal adapter to the socket connector attached to the structure/substructure.

Before fixing and assembly of the DORMA LOOP, the spatial (3D) axes of all fixing positions must be measured and aligned in accordance with the installation drawing. All distances must lie within a tolerance range of ± 3 mm. All significant system axes must be perpendicular to one another within a range of $\pm 1.5^\circ$.

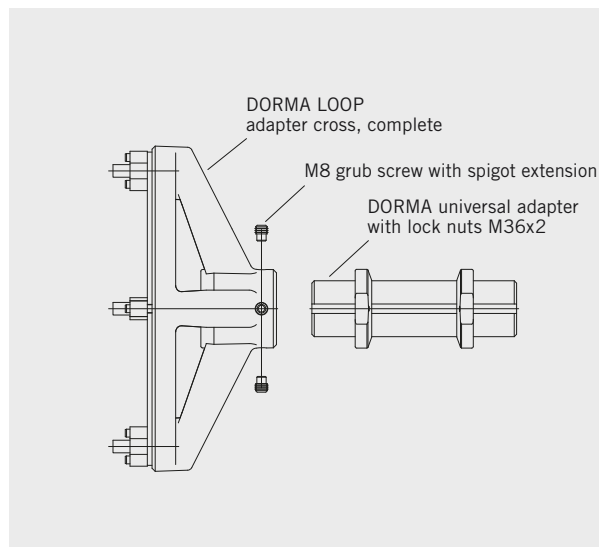
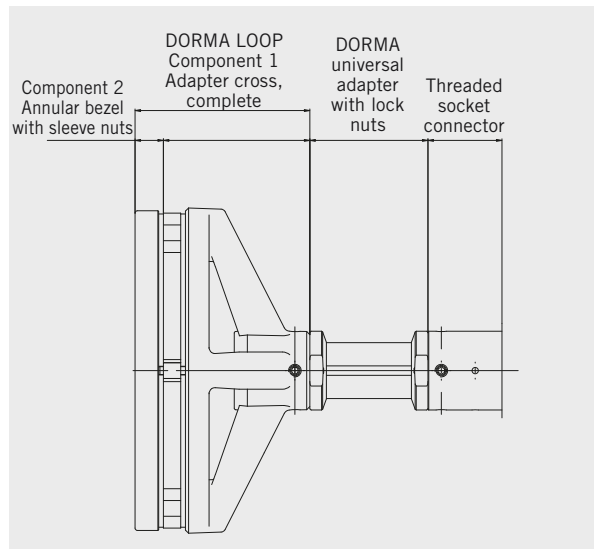
All axis measurements must be checked using appropriate tools.

Assembly tooling required:

Allen keys, 4 and 8 mm
Open-jaw wrench, 46 mm A/F

Assembly sequence

1. Screw component 1 of the DORMA LOOP to the DORMA universal adapter. Screw in the universal adapter until it reaches the end of the thread in the adapter cross. Then unscrew the universal adapter until the grub screws with spigot extension can be screwed into the locking grooves in the universal adapter. Screw in the grub screws with spigot extension. If required, lubricate the thread of the universal adapter to simplify fixing. Do not dirty the thread.



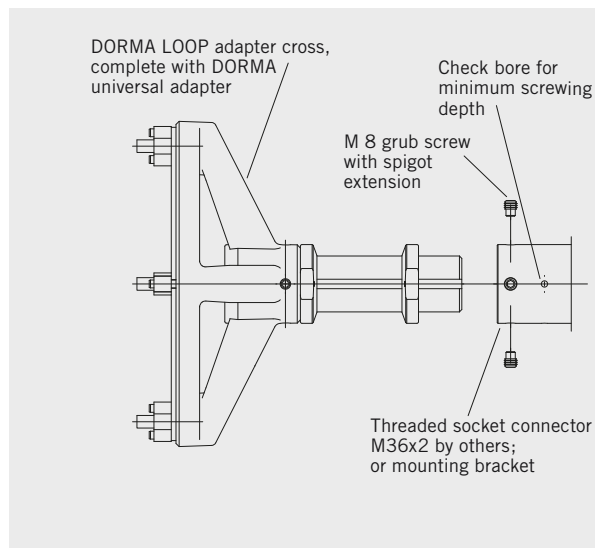
2. Screw the DORMA LOOP with the universal adapter into the threaded socket connector on the substructure side until the thread of the universal adapter can be seen in the check bore.

Ensure alignment with the system axes by further winding of the threaded connections if required.

After fine adjustment (check the position of the locking grooves), screw in the grub screws with spigot extension on the substructure side.

Tighten the lock nuts.

Check that the axes are perpendicular to each other and align if required.



3. Place the glass panels on the support spigots in their installation position.

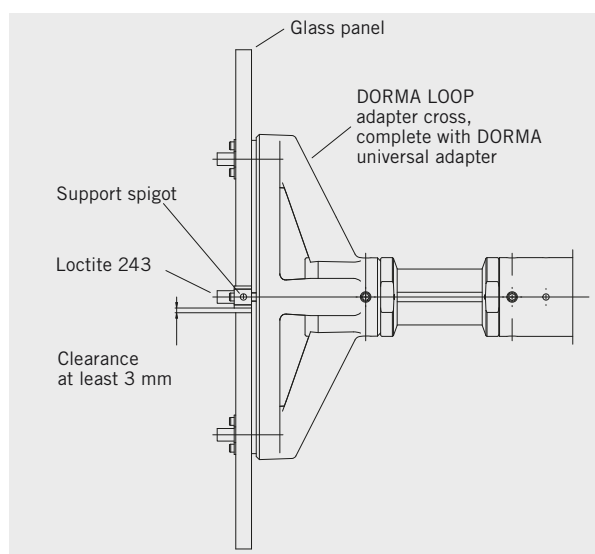
Align the edges of the glass panels vertically and adjust if required by inserting POM blocks.

Fix the glass panels temporarily using suitable straps.

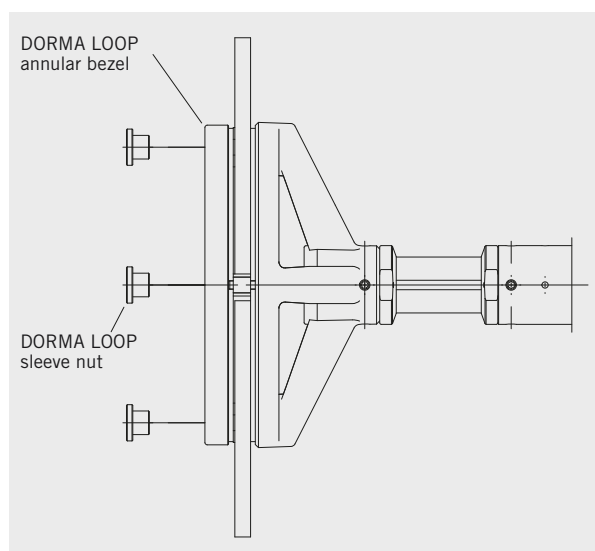
Check that all bottom and vertical clearances are 3 mm (or as per the structural analysis).

Apply Loctite 243 to the threads of the support spigots (ensuring compliance with the instructions and safety datasheet of the manufacturer).

Note! The thread must be clean, i.e. free of dirt, grease, oil and other contaminants, and must also be dry.



4. To complete fixing of the glass panels, fit the annular bezel and tighten the sleeve nuts (tightening torque 8 Nm).



Approvals and certificates

The DORMA LOOP glass retaining ring assembly with universal adapter is generally approved according to German regulations for construction applications. Its suitability can also be verified by static analysis on the basis of the type test carried out, using a standardised dimensioning process for each

individual application. All certificates, approvals and type test reports are available from DORMA-Glas.

1-26/03

Darmstadt Regional Administrative Authority,
Test Report No. 1 – 26/03

Z-14.4-462

German Institute for Building Technology, Certificate of General Building Approval



Mark of conformity awarded to LOOP

Static values and load-bearing capacities

Static analyses for individual applications are performed on the basis of the type test. The dimensioning diagram used in the respective type tests can also be applied for pre-dimensioning in the initial planning stage. All the external stress loads acting on the LOOP assembly must be determined in advance in order to enable the pre-dimensioning of the components involved. Using these values, the diagrams shown on the following pages can then be used on the basis of the brief descriptions and examples provided. The type test for the universal adapter will, in all cases, also have to be taken into account.

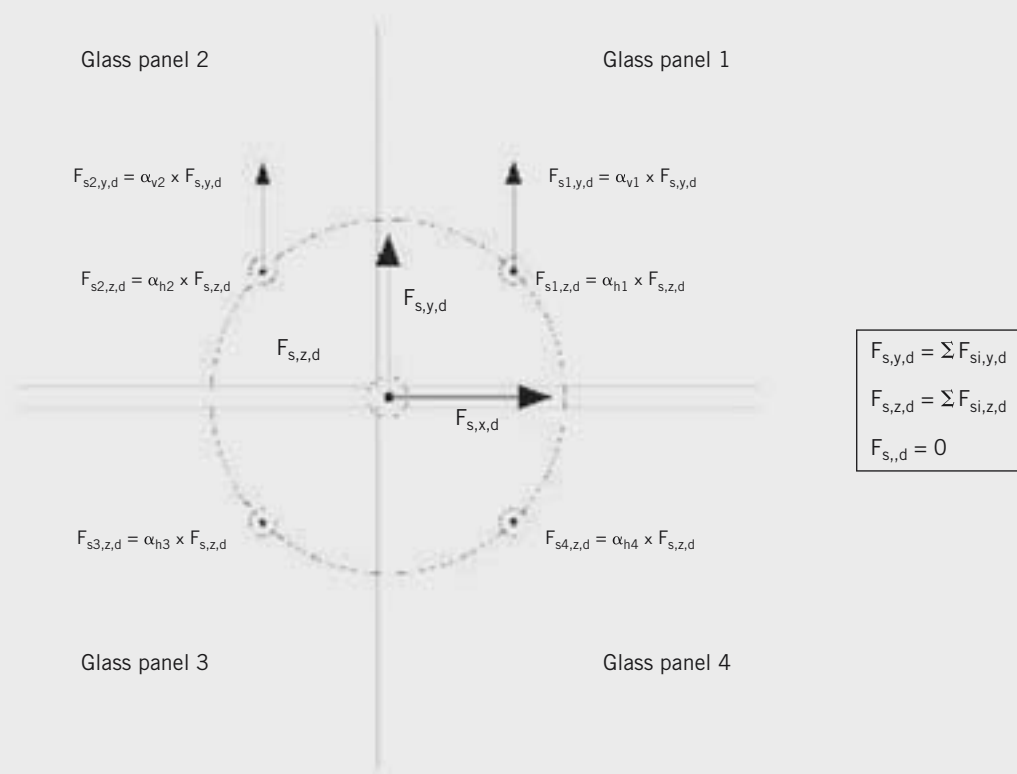
In Germany, the respective original type test document in conjunction with the certificate of general building approval is exclusively binding for preparation of the verifiable static analysis.



DORMA LOOP dimensioning diagrams

Variables

$F_{s,z,d}$	Horizontal load perpendicular to the glass panel plane (wind suction = positive)
$\alpha_{h,1}, \alpha_{h,2}, \alpha_{h,3}, \alpha_{h,4}$	Horizontal load components of the glass panels $\alpha_{h,i} = F_{i,s,z,d} / \Sigma F_{i,s,z,d}$
$F_{s,y,d}$	Vertical loads in the glass panel plane ("from top to bottom" = positive)
$\alpha_{v,1}, \alpha_{v,2}$	Vertical load components of the glass panels $\alpha_{v,i} = F_{i,s,y,d} / \Sigma F_{i,s,y,d}$
LV, SV	Light-duty (LV) / heavy-duty (SV) versions
$t_1, t_2, t_3, t_4, t_5, t_6, t_7$	Thicknesses: 10 / 12 / 15 / 13.5 / 17.5 / 21.5 / 25.5 mm



1. Determine resultant horizontal load $F_{s,z,d}$ as per diagram using accepted technical rules (ensure compliance with direction of action)

2. Determine resultant vertical load $F_{s,y,d}$ as per diagram using accepted technical rules (ensure compliance with direction of action)

3. Select load component factors as per stress loading example

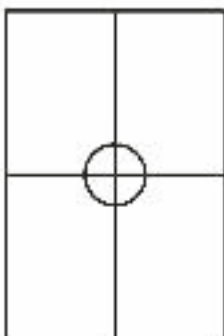
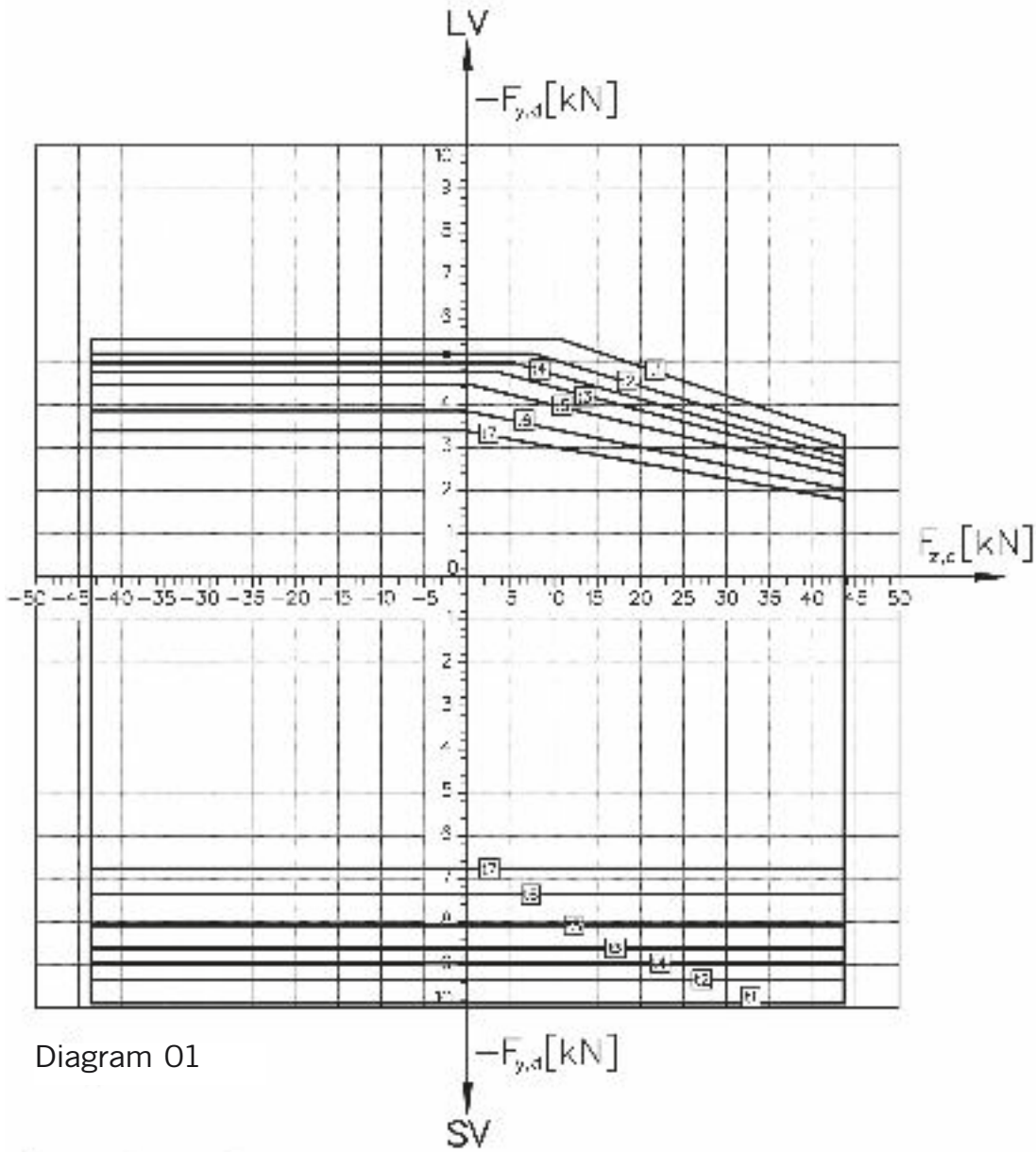
4. Calculate component loads $F_{si,y/z,d}$ ($i=1$ to x) as per diagram and form sum values ($F_{s,y/z,d}$) in respect of corresponding glass panels

5. Select dimensioning diagram

6. Read off permissible values (points of intersection along the glass thickness line = permissible $F_{s,y/z,d}$)

7. Verification that $F_{s,y/z,d} /$ permissible $F_{s,y/z,d} \leq 1$ (Application example can be provided on request.)

The algorithm shown is for pre-dimensioning only and does not release those responsible from having a proper static analysis of the complete system prepared by a qualified expert in the field.



$$\alpha_{x,1} = \alpha_{x,2} = \alpha_{x,3} = \alpha_{x,4} = 1/4$$

$$\alpha_{y,1} = \alpha_{y,2} = 1/2$$

Dimensioning diagrams for further glass panel formats/arrangements on application or as per type static analysis.



Diagram 02



Diagram 03



Diagram 04

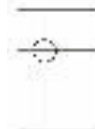


Diagram 05

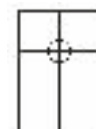


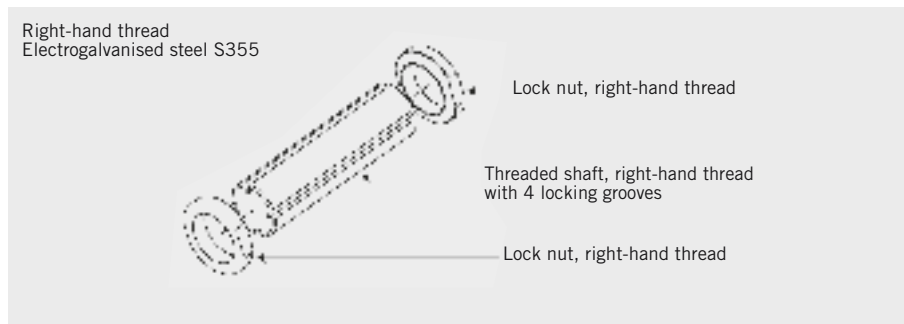
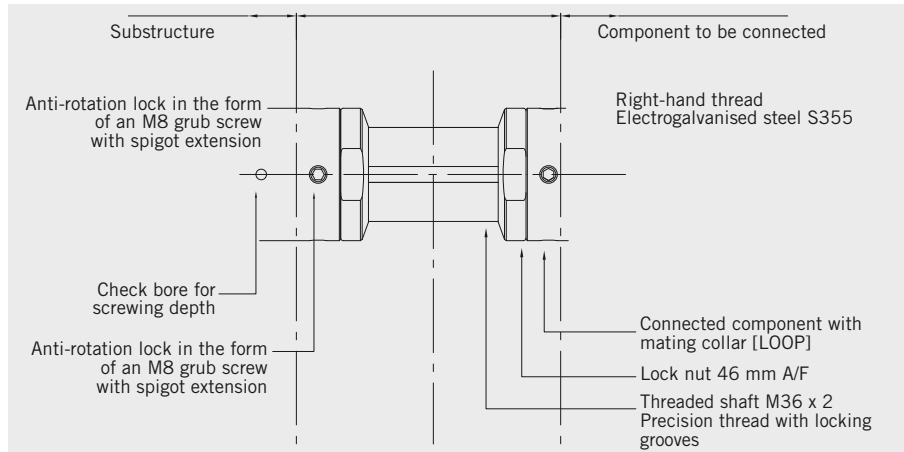
Diagram 06



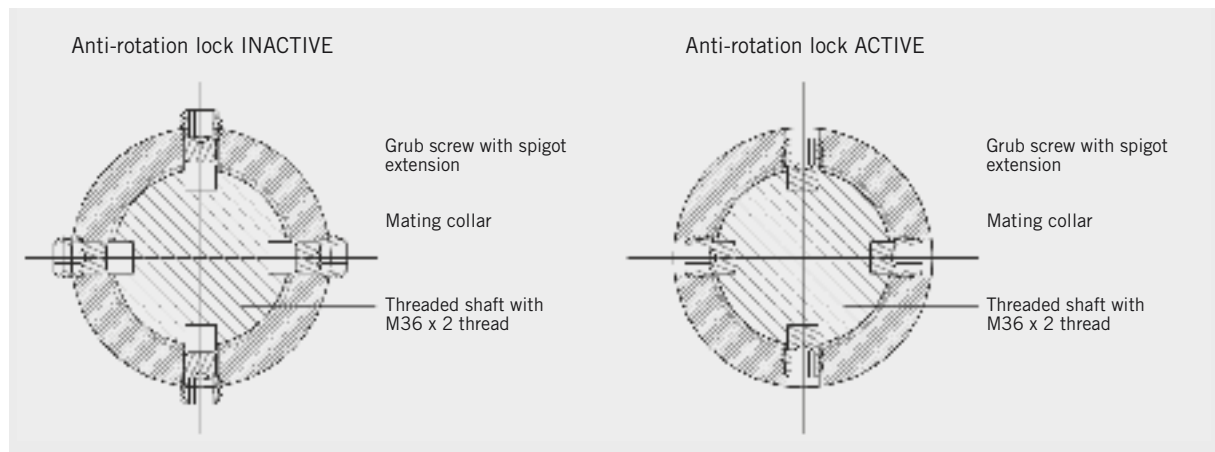
Universal adapter

The universal adapter connects the LOOP elements to the substructure, enabling additional tolerance equalisation of $\pm 5\text{mm}$ during installation.

Lock nuts secure the as-adjusted condition of the installed universal adapter. Thanks to the integral anti-rotation locking devices, assembly twist in the event of asymmetrical loading (such as may occur during the installation work) is also reliably prevented.



Functional principle of the anti-rotation lock



The DORMA universal adapter may only be used in accordance with the specifications and regulations stipulated in the associated type test report.

In order to avoid lesions (cut injuries), safety gloves must be worn at all times when handling the threaded shafts of the universal adapter.

The threads must be protected against contamination and damage.

Installation should be performed in accordance with the instructions provided with the associated DORMA products.

Load-bearing capacities of the LOOP universal adapter

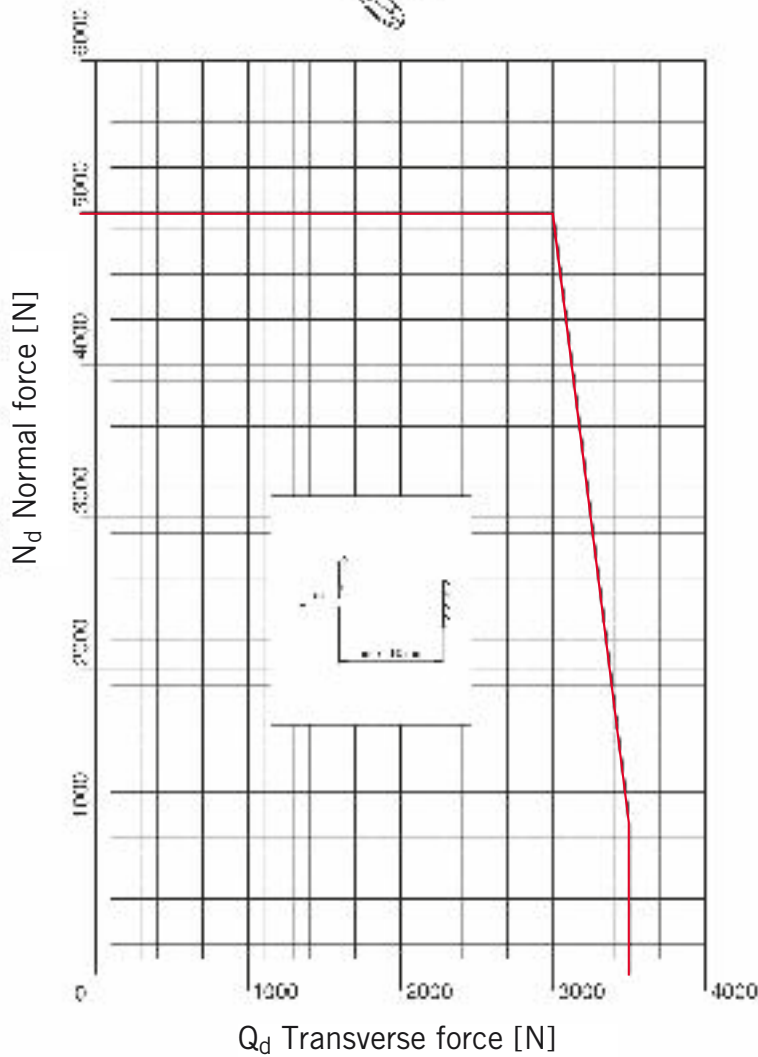
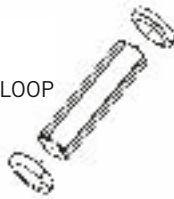
Load-bearing capacities in accordance with "Type test report No. 1 of the Hesse State Testing Authority for Structural Engineering of

the Darmstadt Regional Authority dated 05.11.03" which is available as a binding structural engineering document for verifiable

static analysis from DORMA-Glas. Loads acting in combination are to be analysed in accordance with DIN 18800 using

appropriate loading vector combinations and the safety factors applicable in each case.

DORMA Universal Adapter
Model 1 – Steel
For use only in conjunction with DORMA LOOP



This design datasheet is a summary and simplification of the data contained in type test report No. 1 dated 05.11.2003 and may only be used for the purposes of pre-dimensioning by persons qualified to undertake such work.

It is only valid for DORMA Universal Adapters with standard lengths of max. 130 mm.

Issue 28.04.2005



Mall of Arabia; Jeddah, Kingdom of Saudi Arabia
Architect: ECHO Design; Riyadh / Kingdom of Saudi Arabia
Facade Area: 5000 m²
Facade construction with LOOP glass retaining ring and RODAN tie system