

SPECIAL SPHERICAL BEARINGS FOR UPLIFT

TETRON® DC-SB

DOUBLE-CAP SPHERICAL BEARINGS

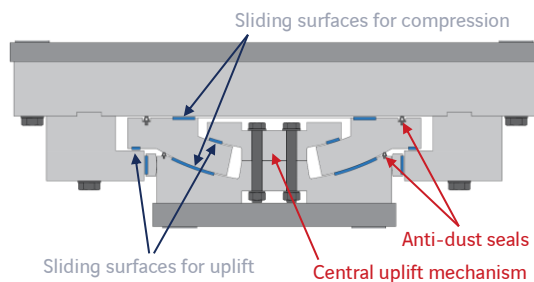
Data sheet n°: FT En C V 8 3 V01 – 01/22

- Accommodate uplift loads in service limit state
- No gaps, even during uplift event
- Rotation and displacement during uplift, with minimum resistance to movement
- Suitable for reversible compression-tension forces
- Excellent durability
- Fatigue-resistant design

Introduction

TETRON® double-cap spherical bearings are cutting-edge technology. They provide structural restraints fully operational under both compression and uplift (tension) forces. Contrary to common bearings with lateral clamps, they also allow for concurrent sliding movements and bi-directional rotations, even while subjected to uplift forces. They are not prone to common failure of sliding interface during uplift events as can be the case with classic lateral clamps solutions.

Description



Main components shown in a cross section



TETRON® DC-SB GG guided uplift bearing during assembly

Materials

In order to provide the best mechanical performance and durability, the following materials are used:

- Structural steel components: minimum grade S355J2 as per EN 10025.
- Special sliding material for all sliding surfaces: improved polytetrafluoroethylene material ISOGLIDE as per ETA 17/0808, certified for temperatures range from -50°C to +90°C.
- Sliding surfaces: austenitic steel 1.4401/1.4404+2B as per EN 10088 or hard chromium plating as per EN 1337-2.
- Structural bolting: minimum class 10.9 as per ISO 898.

Field of applications

The TETRON® DC-SB double-cap spherical bearings have been developed by Freyssinet to address increasing need to provide bearings suitable to carry frequent uplift forces with un-compromised durability.

Fields of application include, but are not limited to:

- Road and rail bridges (e.g., abutments of curved bridges)
- Light and cantilever roof structures (e.g., stadiums, sports halls)
- Buildings
- Industrial structures, ports, and harbour
- Offshore platforms and link bridges

Typically, TETRON® DC-SB are installed where uplift forces occur in service, while standard spherical or pot bearings are suitable for other locations.

Design

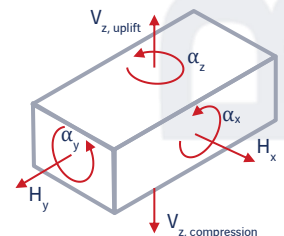
Double-cap spherical bearings are custom designed to suit specific project needs, according to main bearing-design standards: European Standards EN 1337, American AASHTO & AREMA, Australian Standards AS 5100 and many others. Design of sliding surfaces always complies with European Technical Approval ETA 17/0808.

Bearing schedule shall identify applicable loads / displacements and rotations in Service and Ultimate/Strength combinations.

Like other bearings, TETRON® DC-SB come in the following basic types:

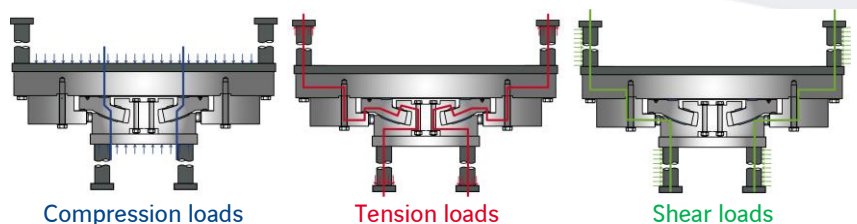
- FX: Fixed
- GG: Guided sliding
- GL: Free sliding

Behaviour of each type is summarized in the table below:



Type	Reactions			Displacements			Rotations		
	H_x	H_y	V_z	Δ_x	Δ_y	Δ_z	α_x	α_y	α_z
FX	✓	✓		-	-				✓
GG		✓	✓ uplift & compression	✓	-	-	✓	✓	✓ ¹
	✓			-	✓				
GL				✓	✓				✓

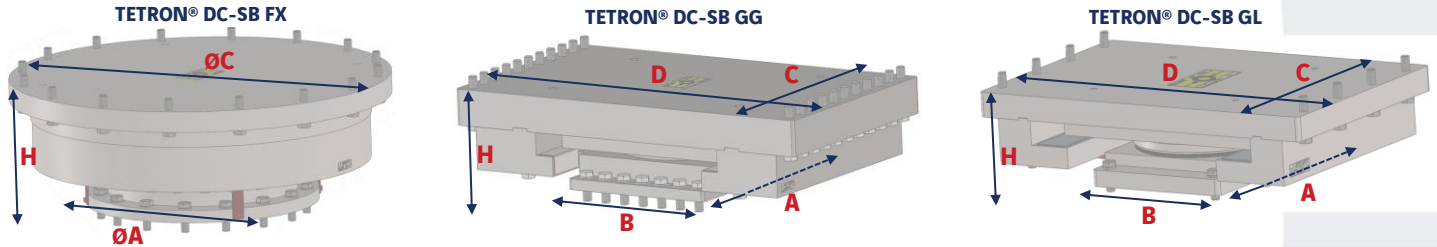
¹ Rotational element can be added if required



Load path through TETRON® DC-SB uplift bearings (vertical compression in blue, vertical uplift in red, horizontal force in green)

TETRON® DC-SB DOUBLE-CAP SPHERICAL BEARINGS

Indicative dimensions



Type	$V_{max, ULS}$ [kN]	$V_{min, ULS} / V_{min, SLS}$ [kN]	H_{ULS} [kN]	Δ_x [mm]	Δ_y [mm]	$\alpha_x = \alpha_y$ [rad]	A [mm]	B [mm]	C [mm]	D [mm]	H [mm]
TETRON® DC-SB FX(-t) 1500(-250)-450	1500	-250 / -170	450	-	-	0.010	Ø 390	-	Ø 660	-	390
TETRON® DC-SB FX(-t) 3000(-500)-900	3000	-500 / -340	900	-	-	0.010	Ø 460	-	Ø 775	-	460
TETRON® DC-SB FX(-t) 6000(-1000)-1800	6000	-1000 / -670	1800	-	-	0.010	Ø 590	-	Ø 980	-	590
TETRON® DC-SB GG(-t) 1500(-250)-450.200	1500	-250 / -170	450	± 100	-	0.010	375	290	530	735	375
TETRON® DC-SB GG(-t) 3000(-500)-900.200	3000	-500 / -340	900	± 100	-	0.010	490	340	585	875	490
TETRON® DC-SB GG(-t) 6000(-1000)-1800.200	6000	-1000 / -670	1800	± 100	-	0.010	620	455	795	1145	620
TETRON® DC-SB GL(-t) 1500(-250).200.20	1500	-250 / -170	-	± 100	± 10	0.010	340	270	530	625	340
TETRON® DC-SB GL(-t) 3000(-500).200.20	3000	-500 / -340	-	± 100	± 10	0.010	425	340	585	740	425
TETRON® DC-SB GL(-t) 6000(-1000).200.20	6000	-1000 / -670	-	± 100	± 10	0.010	550	445	690	875	550

All dimensions are indicative, all bearings are custom designed according to project specifications, loads / displacements / rotations and required anchorage system.

Durability

Standard TETRON® bearings are provided with proven corrosion protection systems as per ISO 12944 applied in-house in Freyssinet factories. Bearings can also be manufactured in special materials for enhanced durability. Sliding materials are protected by special wiper seal system, so keeping lubricant inside and dust outside as long as possible, to ensure constant sliding capacity with minimum friction all along the lifetime.

Thanks to introduction of Freyssinet sliding material ISOGLIDE a certified accumulated sliding path of 50,000 m can be achieved, extending conventional service life of TETRON® DC-SB bearings is a minimum of 50 years.

Testing

Full-scale testing of finished bearings can be carried out to demonstrate the bearings behaviour. Test protocols can include testing in compression and in uplift, with or without rotation. Friction tests can also be performed.



TETRON® DC-SB bearing test for concurrent uplift and rotation at ISOLAB testing facility

Installation and whole-life support

Structural bearings should always be installed by qualified personnel that understand the function of components and long-term operation goals. Uplift bearings require specific design of their connection into the structure, including pull-off anchors analysis and plinth rebars detailing. Through large network of local Business Units, Freyssinet offers turn-key installation, technical assistance and bearing inspection services all over the world.



TETRON® DC SB GL bearings with inverted sliding surface and provided with seismic stoppers, before installation of dust cover system (left picture),

TETRON® DC SB GL bearings installed and grouted on site (right picture)

References

Project	Type of structure	Country
Levante stadium	Stadium cable roof	Spain
CTW 130	Railway bridge	Saudi Arabia
Skycity	Building	Hong Kong
GTC Roof	Sports hall – steel truss roof	Hong Kong
Charles de Gaulle Express	Railway bridge	France
Semapa	Building	France
Barceni Overpass	Road Bridge	Romania
Hong Kong Airport	Building	Hong Kong
Arctic LNG 2	Oil & Gas	Russia
Ligne 18.2	Railway bridge	France