TENSA
GRUPPO DE ECCHER

VOLUME	PRODUCT CATALOGUE
04	EXPANSION JOINTS

YOUR CHALLENGES,
OUR SOLUTIONS


Investment & Contracting Company
DEAL

01

COMPANY PROFILE

Our mission is to constantly improve the methods
and the quality of construction processes
through research, innovation and cooperation
with designers, engineers and contractors worldwide.

TENSA

Tensacciai, now renamed TENSA, was founded in 1951 with headquarters in Milan, Italy. It is now active in over 50 countries with a direct presence in 14 countries. TENSA is a leader in stay cables, post-tensioning, anti-seismic devices, structural bearings and expansion joints. TENSA has extensive references and numerous certifications for its products worldwide.

HISTORY

1951: Beginning of activity 1964: In the sixties Tensacciai undergoes a phase of remarkable growth in Italy. Post-tensioning is just at the beginning of its history and its application is still experimental. 1970: A programme of technological renewal begins with the adoption of the steel strand. 1980: Tensacciai develops new tensioning systems and equipment in the field of ground anchors, combining innovation with versatility and ease of use. 1990: New subsidiaries established in Brazil, India and Australia and in Europe sister companies in Portugal, Greece and the Netherlands. 2000: The internationalization process of Tensacciai continues unabated. 2010: The company becomes directly involved in projects in all five continents. 2011: Tensacciai is acquired by Deal - world leading solutions provider in the field of bridge construction - and becomes part of De Eccher Group. Tensacciai is now member of an organisation capable of designing, manufacturing and installing systems everywhere in the world, thanks to specialised technicians, engineers in the technical department and quality control. All production and delivery processes are attested by the ISO9001 certification. 2012: Tensacciai merges with Tesit, another successful concrete specialist contractor with international experience in post-tensioning, steel bars, structural bearings and expansion joints becoming a prominent player in the field of specialised subcontracting. Tensacciai enters into a Worldwide Exclusive License Agreement with Rome-based TIS (Tecniche Idraulico-Stradali S.r.l.) - a leading company with experience in designing and producing structural bearings, expansion joints and anti-seismic devices since 1973. 2014: TIS is acquired by Tensacciai. 2015: TENSA is formed from the merging and development of the three important companies mentioned above: Tensacciai, Tesit, TIS.

MISSION

Our mission is to constantly improve the methods and the quality of construction processes through research, innovation and cooperation with designers, engineers and contractors worldwide. A strong commitment to quality is the only way to ensure safe and long-lasting structures. We support the design from the initial stage, challenging standards to develop custom solutions. We value timely execution and service as keys to building long-term relationships. Our core knowledge lies within stay-cables and post-tensioning systems, anti-seismic devices, structural bearings and expansion joints as well as all the related accessories, equipment and services. TENSA strives to push its vast experience towards new methods and variations of applications, developing ingenious solutions for building new structures, whether they are buildings or infrastructures, as well as the rehabilitation of existing ones.

PRODUCT CATALOGUES

02

EXPANSION JOINTS SELECTION CRITERIA

INTRODUCTION

Expansion joints are rectilinear devices, designed to restore structural continuity and at the same time allow movement between two interlinked elements. The movements may be of a 'pseudo-static/slow' nature when induced by temperature variations, creep or shrinkage or of a 'dynamic' nature if the movements are due to impulsive external forces (earthquake, wind and braking).
TENSA offers different types of expansion joints to meet the most varied project requirements and guarantee high quality, functionality and durability.
For some families of joints, the performance is diversified between static conditions and extreme dynamic load conditions such as those of a seismic nature. In this way these types can adapt to particular uses, guaranteeing minimum dimensions and highly specialized performance.

SELECTION

The choice of joints, with the same design life, depends on the field of use (road, railway, pedestrian), the extent of movements required (seismic or not), the available space, the type of structure, the type of installation required and the maintenance to be forecast over time.
TENSA offers the following expansion joints:

Mat Joints – series UBJ (UniBlock Joints)

- In reinforced rubber
- Service displacements of 0-360 mm (±180)
- ULS displacements 0-900 mm (±450)
- Structural gaps 45-470 mm

Mat Joints – series MBJx (MultiBlock Joints)

- In rubber with steel bridge plate
- Displacements of 400-2000 mm (±200/±1000)
- Structural gaps 220-1020 mm

Cantilever Joints – series SFJ (Steel Finger Joints)

- Service displacements and ULS of 100-800 mm (±50/±400)
- Structural gaps 70-420 mm for joints with the movements mentioned above or greater in the case of special projects
- Allows only longitudinal movements

Modular Joints – series SMJ (Steel Modular Joint)

- Service displacements and ULS of 160-560 mm (±80/±280)
- Structural gaps 160-760 mm for joints with the movements mentioned above or greater in the case of special projects
- Allows longitudinal movements and moderate transversal movements

Railways Joints – series RRJ (Rubber Railway Joint)

- Designed in compliance with the stringent specifications of the RFI (Italian Railway Network) with a 100 to 200 mm displacements capacity.

Nosing Joints – series SSJ

- Service displacements and ULS up to 90 mm (±45)
- Allows both longitudinal and transversal movements

Nosing Joint - series UBJ-R

- In reinforced rubber
- Displacement capacity up to 75mm

The following table shows the main characteristics of the various types of joints according to which a suitable selection can be made based on the project requirements and the surrounding situation.

Joint	Type	SLS long. Mov	SLS trans. Mov.	Seismic longitudinal movement	Seismic transversal movement	Installation	Sostituibility	Durability
UBJ-R	Nosing Joint Roadway /Pedestrian	****	***	****	***	*****	****	*****
SSJ	Nosing Joint Roadway /Pedestrian	**	**	**	**	***	*	***
UBJ	Mat Joint Roadway /Pedestrian	****	***	****	***	*****	****	*****
MBJ	Mat Joint Roadway /Pedestrian	*****	*	*****	*	***	*****	****
SFJ	Cantilever Joint Roadway /Pedestrian	***	*	***	*	***	**	***
SMJ	Modular Joints Roadway /Pedestrian	*****	**	*****	**	***	*****	****
RRJ	Railways	***	*	***	*	****	**	****

The stated nominal performances refer to the use of the joints in their standard configuration, i.e. installed with a structural gap equal to that reported in this Catalogue. The joints can also be installed with different gaps to the nominal ones where there are special design requirements and/or variations in the installation conditions have occurred (different installation temperatures, partially or totally dissipated flow and shrinkage phenomena). In these cases the performance in terms of movement range in SLS and ULS conditions may vary.
The TENSA technical office is available to provide the services related to the specific project hypothesis, supporting the customer in every phase of choice and installation.
In special cases, as in the design of particularly complex or valuable structures, TENSA supports its partners by providing a highly specialized team and, starting from the standard solutions, defines and proposes new types of 'ad hoc' joints.

STANDARDS

The calculation criteria adopted is that of Ultimate Limit State according to current Standards, namely:

- EAD-120112-00-0107- Supported expansion joints for road bridges
- EAD-120109-00-0107 - Nosing expansion joint for road bridges
- EAD-120113-00-0107 - Modular expansion joints for road bridges
- EAD-120110-00-0107 - Mat expansion joint for road bridges
- EAD-120111-00-0107 - Cantilever expansion joints for road bridges
- EN 1991-2:2005 – Actions on structures. Part 2: Traffic loads on bridges.
- EN 1993-1-3:2007 – Design of steel structures. Part 1-3: General rules -Supplementary rules for cold-formed members and sheeting.
- EN 1993-1-9:2005 – Design of steel structures – Part 1-9: Fatigue
- EN 1998-2:2006 – Design of structures for earthquake resistance – Part 2: Bridges
- EN 1337-3:2005 – Elastomeric bearings.
- D.M. 17.01.18: Norme tecniche per le costruzioni and relevant Circolare 7 del 21.01.19

To date, the Expansion Joints are designed and manufactured in compliance with the requirements set out in the relavant EADs. TENSA has started with the TAB the procedure for obtaining the ETA certification and is carrying out a campaign of tests in accordance with the EAD mentioned above.

Wadi Hanifa viaduct, (KSA)

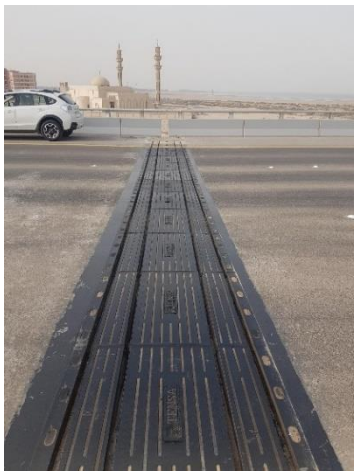
03

UBJ EXPANSION JOINTS

MAT EXPANSION JOINTS
Series for small to medium movement range

DESCRIPTION

The reinforced rubber joints allow longitudinal movements, and, where necessary, also transversal, and vertical movements, by elastic deformation of the internal rubber parts, in relation to the particular geometry.
The rubber joints have steel sheets inside that guarantee the proper rigidity of the overlapping system to allow traffic to travel over them safely and with adequate comfort. These plates do not require any kind of corrosion protection as they are vulcanized within the rubber, which by its very nature has excellent resistance properties to wear, ageing due to exposure to U.V. and contact with oils, greases, and petroleum. UBJ reinforced rubber panels come in standard lengths of 1015 or 2015 mm, depending on the type. The panels are equipped with male-female joints that ensure structural continuity and impermeability between the panel joining line.
In particular, the more and more frequent use of seismic isolation in the design of structure has caused an increase of the demand for joints that cover always larger displacements and gaps, in order to avoid the hammering phenomenon occurring during the seismic phase.
Therefore, the UBJ series has been designed to diversify joint performance in terms of service and seismic conditions.

Kuwait – RA213 Project

The following are the main advantages with the use of the UBJ series joint:

- Coverage of the structural gap in any service condition of the structure;
- No interference with other structural elements thanks to the reduced joint thickness;
- Design simplicity and system reliability;
- Waterproofing guaranteed by the system consisting of the joint cover, flashing and integrated drainage system in the transition strips between asphalt and joint;
- Simplicity and speed of installation;
- Low noise levels when traffic passes;
- Lower costs than other steel joint systems;
- Possibility of using the system in new and existing facilities;
- Possibility of carrying out work to part of the carriageway without interrupting the traffic flow in the event of replacing one or more joint elements;
- Safety for vehicular flow thanks to the adequate adherence that develops between the rotating elements of the traffic and the joint;
- Limited maintenance during the expected life of the system.

MATERIALS

For the materials used for the production of UBJ joints, reference should be made to the following:

Element	Material
Rubber cover	Rubber 60sh – EAD-120110-00-0107 Rubber 60sh – AASTHO M251
Internal reinforcement plates	S355JR/J0/J2 – EN 10025
Round/oval washers	S235JR/J0/J2 – EN 10025
Threaded anchor rods	Class 8.8 – EN 20898
	Stainless steel – AISI316
Nuts	Class 8 – EN 20898
	Stainless steel – AISI316
Flashings	EPDM

The following are the rubber properties:

- Hardness → 60±5 Shore A (ISO 48)
- Breaking force → ≥ 15,5 MPa (ISO 37 type 2)
- Breaking elongation → ≥ 350% (ISO 37 type 2)
- Ozone resistance (50 pphm 96h 40 °C) → no cracks (ISO 1431-1)
- Britleness temperature → ‹ -25°C (ISO 812)

The expansion joints can be made of different compound. Anyway, the compounds are studied to guarantee the best possible resistance to abrasion.
Furthermore, rubbers with high resistance to low temperatures are available; TENSA's technical office is available for any clarification and for the study of other solutions based on specific design requirements.

MARKING

The joints of the UBJ series are identified by the acronym for Uni Block Joint followed by two numerical figures. The first figure corresponds to the displacement capacity in the SLS/ULS static condition, whereas the second relating to the displacement capacity in a SEISMIC condition is followed by an "S". If the movement capacity is transversal, then a "T" is added to the UBJ code.

UBJ	240	/	300S
Uni Block Joint	Static movement range SLS/ULS	/	Seismic range ULS

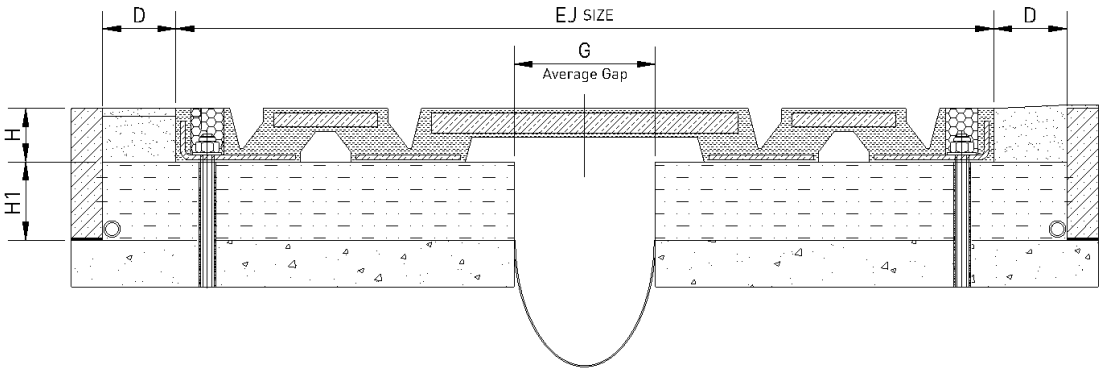
CATALOGUE WITH MOVEMENT RANGE

The standard UBJ range covers a total nominal service movements of up to 360 mm (from ± 20 mm to ± 180 mm for installations with a nominal gap at an average temperature without pre-setting) and an increased displacement capacity in the seismic condition of up to ± 450mm, maintaining the residual load-bearing capacity after the event as well as covering of the gap during the seismic deviation.

The entire UBJ series is designed according to EAD-120110-00-0107, with fatigue life between 25 and 50 years.
It should be noted that the displacement capacity mentioned is considered to be the maximum displacement deriving from the vector composition of the longitudinal and transversal movements.
The gap may be less or wider than that indicated in the Table, compatibly with a decreased movement capacity to be checked with the TENSA technical office.

PRESTAZIONI - Performances									
TIPO Type	MOVIMENTO LONGITUDINALE Longitudinal Displacement (mm)			MOVIMENTO TRASVERSALE Transversal Displacement (mm)			GAP STRUTTURALE Structural gap (mm)	PRESET (T=T0) Preset (T=T0)	ESCURSIONE GIUNTO Joint movement (mm)
	SLS	STR/SLU	SEISMIC	SLS	STR/SLU	SEISMIC			
UBJ 60/80S	±25	±30	±40	±25	±25	±35	60	0	20-100
UBJ 100/130S	±40	±50	±65	±35	±45	±55	85	0	20-150
UBJ 140/180S	±60	±70	±90	±50	±60	±75	110	0	20-200
UBJ 180/230S	±75	±90	±115	±65	±75	±100	135	0	20-250
UBJ 240/300S	±100	±120	±150	±85	±100	±125	170	0	20-320
UBJ 300/400S	±125	±150	±200	±105	±125	±170	220	0	20-420
UBJ 360/500S	±150	±180	±250	±125	±150	±210	270	0	20-520
UBJ 360/700S	±150	±180	±350	±125	±150	±300	370	0	20-720
UBJ 360/900S	±150	±180	±450	±125	±150	±375	470	0	20-920

Note:
1) Design criteria as per EAD-120110-00-0107
2) Design Life 50 years with Nobs=500.000 or Design Life 10 years with Nobs=2.000.000
3) Structural gap for installation temperature of 20 ° C
4) The transverse displacements are not simultaneous with the maximum longitudinal displacements



Where necessary, each type of joint in the UBJ series can be fitted with a transversal movement capacity expansion system, which allows a further increase of ± 75mm in a transversal direction, both for operating and seismic conditions, to be considered simultaneous with the maximum longitudinal movement of the joint.
In this case the series becomes UBJ-T.


A59
VILLA

04

MBJx EXPANSION JOINTS

MAT EXPANSION JOINTS
Series for large movement range

DESCRIPTION

The MBJX series is an expansion joint that allows overall displacements of up to 2000 mm (±1000 mm).
The MBJX joint consists of three elements: a bridge plate, a rubber tile and an anti-lifting device. For movements greater than 1000 mm, the bridge plate is centred at the gap with respect to two rubber tiles on the sides. When only one rubber tile is present, the anchorage of the bridge plate to the concrete is realized by an elastic hinge.
The joint movement is obtained by deformation of modular rubber elements arranged in series, whose total number varies according to the displacement capacity.
The rubber tile, directly sliding on the structural extrados, is able to absorb displacements while ensuring continuity of the carriageway.
The anti-lifting devices made of stainless steel guarantee the vertical stability of the joint with respect to the support surface, as well as a high level of travel comfort.
The surface of the bridge plate subjected to transiting is machined in such a way as to improve grip with the tyre and ensure a rapid outflow of rainwater.
The joint is completed by a sub-floor drainage system made of an aluminium profile, placed upstream the joint, together with a rubber flashing, placed at the structural gap to drain off the rainwater.
The setting plane of the joint is finished off with high resistance and waterproofing resins.
The transition strip is realized with mortar that can be fiber-reinforced or with elastic epoxy-polyurethane based sealant.

MATERIALS

For the materials used for the production of MBJX joints, reference should be made to the following table:

Element	Material
Rubber tile	Rubber 60sh – EAD-120112-00-0107 Rubber 60sh – AASTHO M251
Internal reinforcement plates	S355JR/J0/J2 – EN 10025
Round/oval washers	S235JR/J0/J2 – EN 10025
Threaded anchor rods	Class 8.8 – EN 20898
	Stainless steel – AISI316
Nuts	Class 8 – EN 20898
	Stainless steel – AISI316
Flashings	EPDM

The following are the rubber properties:

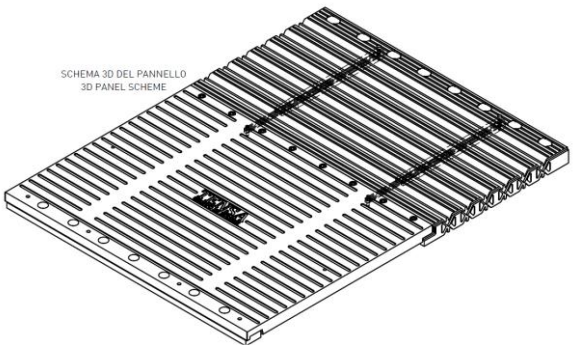
- Hardness → 60±5 Shore A (ISO 48)
- Breaking force → ≥ 15,5 MPa (ISO 37 type 2)
- Breaking elongation → ≥ 350% (ISO 37 type 2)
- Ozone resistance (50 pphm 96h 40 °C) → no cracks (ISO 1431-1)
- Britleness temperature → ‹ -25°C (ISO 812)

The expansion joints can be made of different compound. Anyway, the compounds are studied to guarantee the best possible resistance to abrasion.
Furthermore, rubbers with high resistance to low temperatures are available; TENSA's technical office is available for any clarification and for the study of other solutions based on specific design requirements.

MARKING

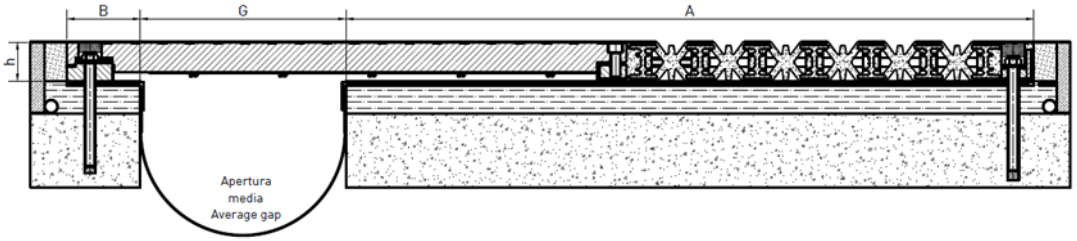
The MBJX series joints are identified by the acronym for Multi Block Joint followed by one numerical value. This value corresponds to the movement capacity.
If it has a transversal movement capacity, a "T" is added to MBJX.

MBJX-T **500**
Multi Block Joint-T **Movement range**



CATALOGUE WITH MOVEMENT RANGE

The standard MBJX range covers a total nominal service movement of up to 1800mm (±900mm) maintaining residual load capacity after the seismic event as well as gap cover.
It should be noted that the displacement capacity mentioned is considered to be the maximum displacement deriving from the vector composition of the longitudinal and transversal movements.
The gap may be less or wider than that indicated in the Table, compatibly with a decreased movement capacity to be checked with the TENSA technical office.



Class MBJX/MBJX-T with single deformable element

PRESTAZIONI - Performances												
TIPO Type	MOVIMENTO LONGITUDINALE			MOVIMENTO TRASVERSALE			h	A	B	GAP STRUTTURALE Structural gap (mm)	PRESET (T=T0) Preset (T=T0)	ESCURSIONE GIUNTO Joint movement (mm)
	SLS (mm)	STR/SLU (mm)	SEISMIC (mm)	SLS (mm)	STR/SLU (mm)	SEISMIC (mm)	(mm)	(mm)	(mm)			
MBJX-360 PP-360	±150	±180	±180	±65	±80	±105	85	930	160	200	0	360
MBJX-450 PP-450	±190	±225	±225	±80	±100	±135	85	1100	160	245	0	450
MBJX-540 PP-540	±225	±270	±270	±100	±120	±160	85	1270	160	290	0	540
MBJX-630 PP-630	±265	±315	±315	±115	±140	±185	85	1440	160	335	0	630
MBJX-720 PP-720	±300	±360	±360	±135	±160	±215	85	1610	160	380	0	720
MBJX-810 PP-810	±340	±405	±405	±150	±180	±240	85	1780	160	425	0	810
MBJX-900 PP-900	±375	±450	±450	±165	±200	±270	85	1950	160	470	0	900

Note:
1) Design criteria as per EAD-120112-00-0107
2) Design Life 50 years with Nobs=500.000 or Design Life 10 years with Nobs=2.000.000
3) Structural gap for installation temperature of 20 ° C
4) The transverse displacements are not simultaneous with the maximum longitudinal displacements

At installation, the gap can be less or wider than that indicated, compatibly with a different movement capacity to be checked with the technical office of TENSA.
The MBJX series allows an extremely flexible joint configuration as the bridge plate can be combined also with rubber tiles having different displacement capacities compared to the nominal one. In this way it is possible to make the joint more efficient under conditions in which, for example, the service condition movements are is lower than the seismic ones.

The joint can also be easily pre-set directly at the time of installation if the opening and closing design displacement are relatively different, or if the gap is different from the initial design value due to unexpected thermal or shrinkage effects, further specializing its operation.


TENSA

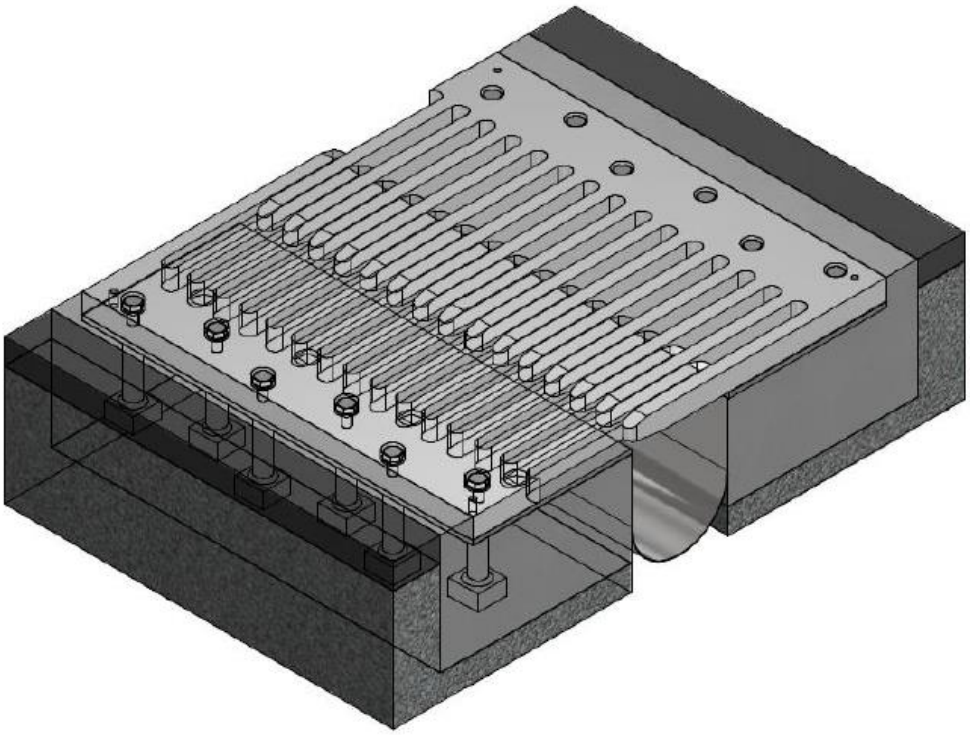
05

SFJ EXPANSION JOINTS

CANTILEVER EXPANSION JOINTS

DESCRIPTION

The joints of the SFJ series are mainly made up of two metal elements with a finger configuration so that they are complementary to each other. Thanks to their interconnection they ensure a structural continuity of the carriageway when there is an expansion/contraction of the connected structural elements (deck - deck, abutment - deck). The steel elements are secured to the deck by means of specific anchor bars. The top surface of the joints is produced with an anti-skid process that increases the friction between the wheels of the vehicles and the joint. The SFJ devices cover mainly longitudinal displacements from 100 mm up to 800 mm. A flashing system is adopted, as with the other types of joints, to allow a correct flow of rainwater.



MATERIALS

For the materials used for the production of SFJ joints, reference should be made to the following:

Element	Material
Bridge plate	S355JR/J0/JS or S355J0W - EN 10025
Round/oval washers	S235JR - EN 10025
Threaded anchor rods	Class 8.8 - EN 20898
	Stainless steel - AISI316
Nuts	Class 8 - EN 20898
	Stainless steel - AISI316
Flashings	EPDM

MARKING

The joints of the SFJ series are identified by the acronym for Steel Finger Joint followed by a numerical value that corresponds to the maximum movement capacity, which in this case turns out to be identical both in the SLS/ULS Static condition and in the SEISMIC condition.

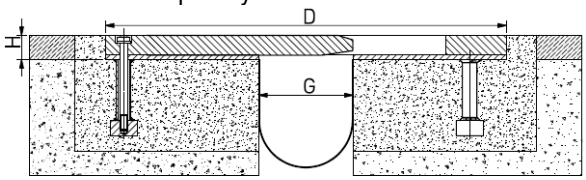
SFJ	**500**
Steel Finger Joint	**Maximum movement range**

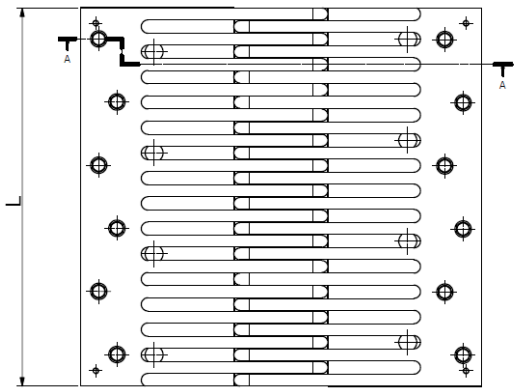
CATALOGUE WITH MOVEMENT RANGE

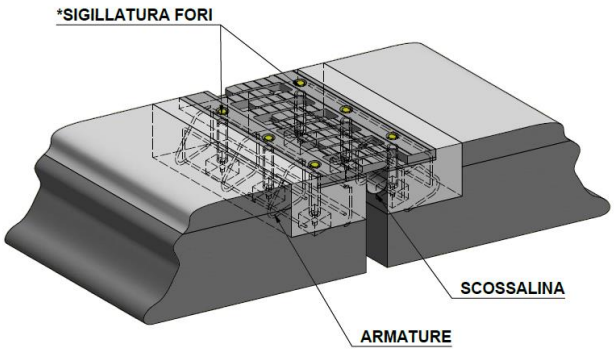
The standard SFJ range covers nominal movements from 100mm (± 50mm) up to 800mm (± 400mm), maintaining a residual load capacity after the event as well as covering the gap during the seismic deviation.

The transversal displacement of the joint is almost nil since the configuration does not allow displacements in an orthogonal direction to that of travel.

The gap may be less or wider than that indicated in the table, compatibly with a decreased movement capacity to be checked with the TENSA technical office.







Joint Name	Gap	Movement	H	L	D
	Size	Total movement	Height	Plate width	lenght with nominal gap
	(mm)	(mm)	(mm)	(mm)	(mm)
SFJ-100	70	100	45	1242,5	380
SFJ-200	120	200	50	1242,5	530
SFJ-300	170	300	50	1242,5	780
SFJ-400	220	400	65	1242,5	1030
SFJ-500	270	500	75	1242,5	1180
SFJ-600	320	600	80	1242,5	1330
SFJ-700	370	700	90	1242,5	1480
SFJ-800	420	800	1000	1242,5	1630

Doha Metro, Red Line North, Doha (Qatar)

06

SMJ EXPANSION JOINTS

MODULAR EXPANSION JOINTS

DESCRIPTION

The joints of the SMJ series are mainly made up of steel modular elements connected by rubber strips. Thanks to their interconnection they ensure a structural continuity of the carriageway when there is an expansion/contraction of the connected structural elements (deck - deck, abutment - deck). The SMJ devices covers total static nominal movements up to 560 mm (from ±80 mm to ±280 mm for installation with nominal gap at medium temperature with no pre-regulation) having a residual loading capacity after seismic events and ensuring covering of gap during seismic movement.

MATERIALS

For the materials used for the production of SMJ joints, reference should be made to the following:

Element	Material can comply with
Rubber Strip	EPDM
Support box	S235-Q235B / EN10025-GB700
Support Bar	S355-Q345B / EN10025-GB700
Center Beam	S355-Q345B / EN10025-GB700
Edge Beam	S355-Q345B / EN10025-GB700
Flashing	EPDM - Hypalon

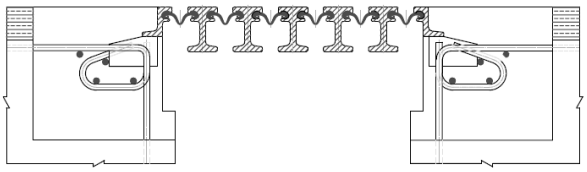
MARKING

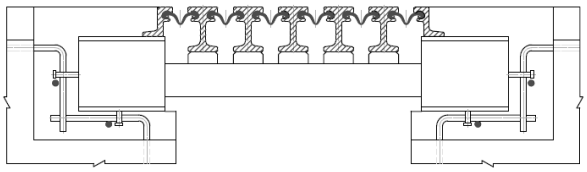
The joints of the SMJ series are identified by the acronym for SMJ followed by a numerical value that corresponds to the maximum movement capacity, which in this case turns out to be identical both in the SLS/ULS Static condition and in the SEISMIC condition.

SMJ **160**
Steel Modular Joint **Maximum movement range**

CATALOGUE WITH MOVEMENT RANGE

SMJ standard joint system covers total static nominal movements up to 560 mm (from ±80 mm to ±280 mm for installation with nominal gap at medium temperature with no pre-regulation) having a residual loading capacity after seismic events and ensuring covering of gap during seismic movement.
The reported movement refers to non-concurrent displacements. The movements have to be considered as the maximum displacement resultant from the vector composition of the longitudinal and transverse movements. The gap can be different from what indicated in the table: smaller and, in some cases, even larger, compatibly with a reduced displacement capacity to be verified with TENSA's technical office.





PRESTAZIONI - Performances								
TIPO Type	**MOVIMENTO LONGITUDINALE** Longitudinal Displacement (mm)			**MOVIMENTO TRASVERSALE** Transversal Displacement (mm)			**GAP STRUTTURALE A LIVELLO STRADALE** Structural gap at road level (mm)	**ESCURSIONE GIUNTO** Joint movement (mm)
	SLS	STR/SLU	SEISMIC	SLS	STR/SLU	SEISMIC		
SMJ 160	±80	±80	±80	±20	±20	±20	160	80-240
SMJ 240	±120	±120	±120	±30	±30	±30	280	160-400
SMJ 320	±160	±160	±160	±40	±40	±40	400	240-560
SMJ 400	±200	±200	±200	±50	±50	±50	520	320-720
SMJ 480	±240	±240	±240	±60	±60	±60	640	400-880
SMJ 560	±280	±280	±280	±70	±70	±70	760	480-1040
1) Structural gap for installation temperature of 15°C								

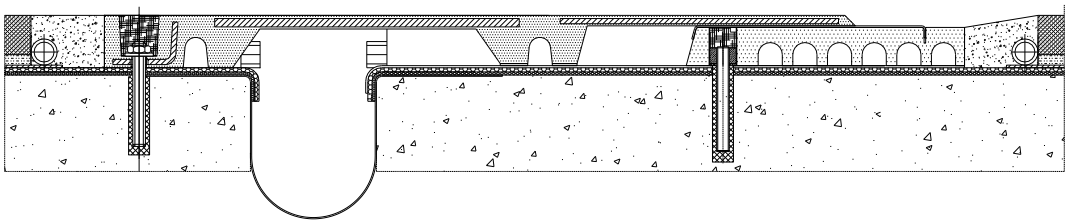
07

RRJ EXPANSION JOINTS

RAILWAY EXPANSION JOINTS

DESCRIPTION

The RRJ series expansion joints are designed specifically for the high speed railway bridges.
They have been approved by the RFI (Italian Railway Network) as they meet the specifications contained in RFI Technical Instruction.
The joint is designed to offer maximum structural and functional simplicity, ease of installation and consequent cost savings.
These joints are suitable for installation with ballast.



This type of joint consists of two parts installed separately. The relative movement is obtained by sliding between an elastomer and a stainless steel surface and not by deformation of the rubber elements of the joint.
The bridge plate is completely covered by 'dielectric' rubber with steel reinforcement vulcanized inside the rubber to limit the vertical deformation. These plates do not require any kind of corrosion protection as they are vulcanized within the rubber, which by its very nature has excellent resistance properties to wear, ageing due to exposure to U.V. and contact with oils, greases and petroleum.
The elastomeric components work as hinges during the rotations (in operation and in the lifting phases which determine vertical misalignment) and house the anchors to be grouted to the concrete structure.
Since the joint is made up of two separate elements that are installed independently, any need to preset the joint, due to shrinkage and fluage or to different installation temperatures to the nominal one, can be solved directly, without having to impose deformation on the joint itself, as is the case for other types of joints, simply by varying the relative position between the two elements.

Obviously this needs to be checked with the TENSA technical office beforehand.
In order to avoid percolation through the joint, special micro-slit pipes are positioned to collect the water coming from the deck waterproofing. These pipes are able to create a preferential channel for the water, which will inevitably be conveyed to the edges of the deck and then drained outside the deck. To avoid clogging due to dirt, the drainage systems are covered in non-woven fabric. As a further safety, rubber flashing is placed between the two slabs to ensure continuity of the deck waterproofing system.

MATERIALS

For the materials used for the production of RRJ joints, reference should be made to the following:

Element	Material
Rubber tile	Dielectric rubber 60sh – ISO 48
Internal reinforcing plates	S355J2 - EN 10025
Running surfaces	Austenitic steel X5 CrNiMo 17/12 (AISI 316) or X2 CrNiMo 17/12 (AISI 316 L)
PTFE	Virgin PTFE– EN1337-2
Circular/oval washers	S235JR - EN 10025
Threaded anchor rods	Class 8.8 - EN 20898
	Stainless steel - AISI316
Nuts	Class 8 - EN 20898
	Stainless steel - AISI316
Flashing	EPDM

MARKING

The joints of the RRJ series are identified by the acronym for Rubber Railways Joint followed by a numerical value that corresponds to the maximum movement capacity, which in this case turns out to be identical both in the SLS/ULS Static condition and in the SEISMIC condition.

RRJ	200
Rubber Railways Joint	Maximum movement range

CATALOGUE WITH MOVEMENT RANGE

The RRJ range covers nominal movements from 100mm (± 50mm) up to 200mm (± 100mm), maintaining a residual load-bearing capacity after the event and covering the gap during the seismic deviation. The RRJ joint allows a rotation of the connected decks of up to 2 degrees.
The gap may be less or wider than that indicated in the table, compatibly with a decreased movement capability to be checked with the TENSA technical office.

TYPE	Longitudinal displacement			Vertical displacement	Rotation
	SLS	SLS	Seismic		
	mm	mm	mm	mm	rad
RRJ-100	±50	±50	±50	±50	±0.035
RRJ-160	±80	±80	±80	±50	±0.035
RRJ-200	±100	±100	±100	±50	±0.035
RRJ-300	±150	±150	±150	±50	±0.035

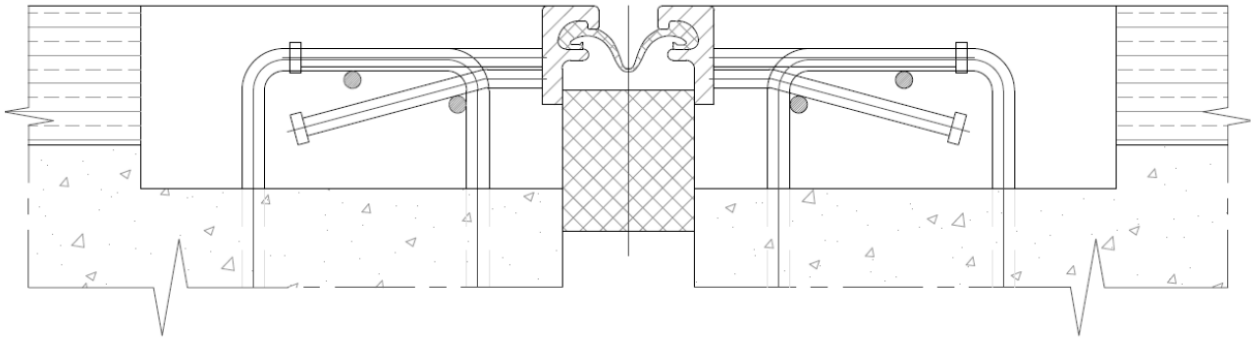
08

SSJ EXPANSION JOINTS

NOSING EXPANSION JOINTS

DESCRIPTION

The SSJ series expansion joints are the simplest solution that TENSA can offer to cover a structural gap. The joint consists of two edge rail and a rubber bellow.
Movement capability is guaranteed by deformation of the elastomer. The SSJ joints system provides water-proofing for the deck.



MATERIALS

For the materials used to produce SSJ joints, reference should be made to the following:

Element	Material
Rubber bellow	Rubber 60sh – EAD 120109-00-0107 Rubber 60sh – AASHTO M251
F shaped steel elements (Edge Rail)	S355J2 – EN10025 or equivalent or superior
Anchoring bars	S275JR – EN10025 or equivalent or superior

MARKING

Joints of the SSJ series are identified by the letter TSSJ followed by a numerical value. This value corresponds to the movement capacity of the joint

SSJ	90
	Maximum movement range

CATALOGUE WITH MOVEMENT RANGE

The SSJ range covers nominal movements up to 90mm (± 45mm).

09

UBJ-R EXPANSION JOINTS

NOSING EXPANSION JOINTS.

DESCRIPTION

The UBJ R solution, a simplified version of the standard UBJ one, proposed by TENSA only for small movements, has a simple or double rubber bellow element that allows the passage of the gap in a practical and economical way.

MATERIALS

For the materials used for the production of UBJ joints, reference should be made to the following:

Element	Material
Rubber cover	Rubber 60sh – EAD-120109-00-0107 Rubber 60sh – AASTHO M251
Internal reinforcement plates	S355JR/J0/J2 – EN 10025
Round/oval washers	S235JR/J0/J2 – EN 10025
Threaded anchor rods	Class 8.8 – EN 20898
	Stainless steel – AISI316
Nuts	Class 8 – EN 20898
	Stainless steel – AISI316
Flashings	EPDM

The following are the rubber properties:

- Hardness → 60±5 Shore A (ISO 48)
- Breaking force → ≥ 15,5 MPa (ISO 37 type 2)
- Breaking elongation → ≥ 350% (ISO 37 type 2)
- Ozone resistance (50 pphm 96h 40 °C) → no cracks (ISO 1431-1)
- Britleness temperature → ‹ -25°C (ISO 812)

The expansion joints can be made of different compound. Anyway, the compounds are studied to guarantee the best possible resistance to abrasion.
Furthermore, rubbers with high resistance to low temperatures are available; TENSA's technical office is available for any clarification and for the study of other solutions based on specific design requirements.

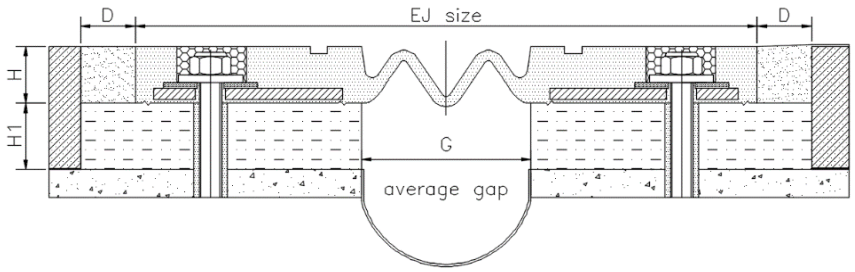
MARKING

The joints of the UBJ-R series are identified by the acronym for Uni Block Joint followed by one numerical figure; this corresponds to the displacement capacity in the ULS static condition.

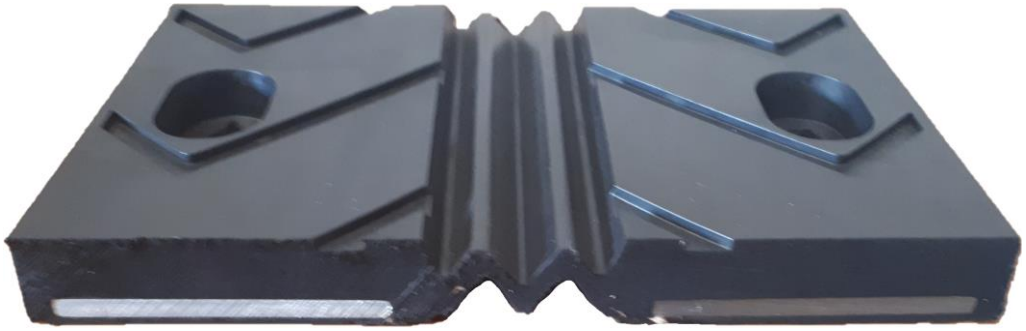
UBJ-R	**50**
Uni Block Joint	**Static movement range SLS/ULS**

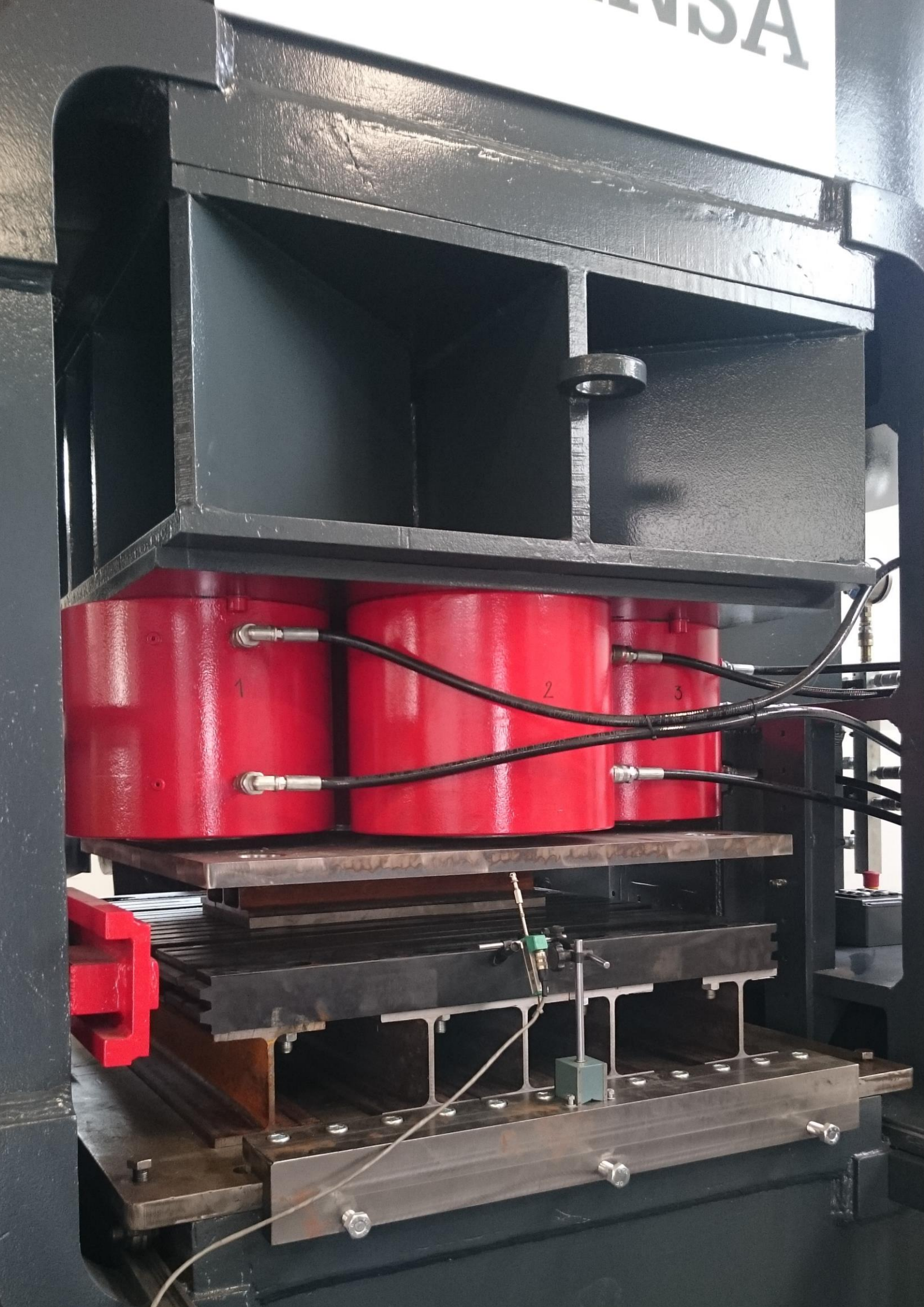
CATALOGUE WITH MOVEMENT RANGE

The UBJ-R series covers a total nominal static movement of up to 75 mm (from ± 25 mm to ± 37,5 mm for installations with a nominal gap at an average temperature).
It should be noted that the displacement capacity mentioned is considered to be the maximum displacement deriving from the vector composition of the longitudinal and transversal movements. The gap may be less or wider than that indicated in the Table, compatibly with a decreased movement capacity to be checked with the TENSA technical office.



PRESTAZIONI - Performances									
TIPO Type	**MOVIMENTO LONGITUDINALE** Longitudinal Displacement (mm)			**MOVIMENTO TRASVERSALE** Transversal Displacement (mm)			**GAP STRUTTURALE** Structural gap (mm)	**PRESET (T=T0)** Preset (T=T0)	**ESCURSIONE GIUNTO** Joint movement (mm)
	SLS	**STR/SLU**	**SEISMIC**	**SLS**	**STR/SLU**	**SEISMIC**			
UBJ R50	±20	±25	±25	±10	±12	±12	45	0	20-70
UBJ R75	±30	±37,5	±37,5	±15	±18	±18	57,5	0	20-95
Note:	1) Structural gap for installation temperature of 20 ° C								
	2) The transverse displacements are not simultaneous with the maximum longitudinal displacements								




1
2
3

10

QUALITY AND TESTING

GENERAL

Through the years joints have undergone a constant process of improvement, in design and materials together with a dedicated validation testing process.

All expansion joints made by TENSA are produced according to the UNI EN ISO 9001:2008 quality system.

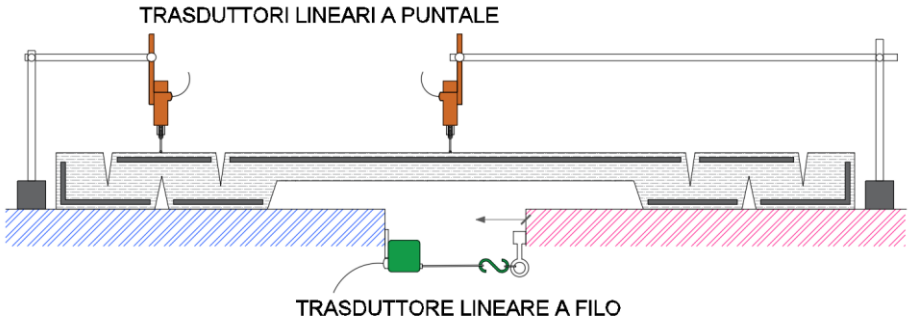
The entire production process is controlled by operating instructions, quality control plans (PCQ) and quality registration documents; more specifically: controls on raw materials, production parameters and finishing operations ensure that all products delivered meet the performance and durability requirements.
Each supply is completed with a declaration of conformity to the system or, in the case of special specifications, to customer requests or technical approvals in force in the various countries.
The compounds used are subjected to periodic and continuous checks to ensure compliance with the stated characteristics.
The samples of the various types of joint are tested at TensaLAB on a dedicated test bench, equipped with two platforms: one that applies differential vertical displacements, while the other guided longitudinally, so as to simulate the joint deviations.

Expansion joint test bench

Strict capacity tests (cyclical tests of opening and closing in a longitudinal direction, transversal-deformation, with or without height difference between the two decks and vertical load) are carried out both for research and development as well as for production control or functional testing of prototypes. The purpose of this is to check the functionality of the joints in the different configurations and deformation conditions, to check characteristics that have been stated in the project and to study new design and manufacturing solutions.
For experimentation purposes, tests have also carried out, bringing the opening and closing values well beyond the design limits, with a full functionality of the joint once it has been restored to its initial position.

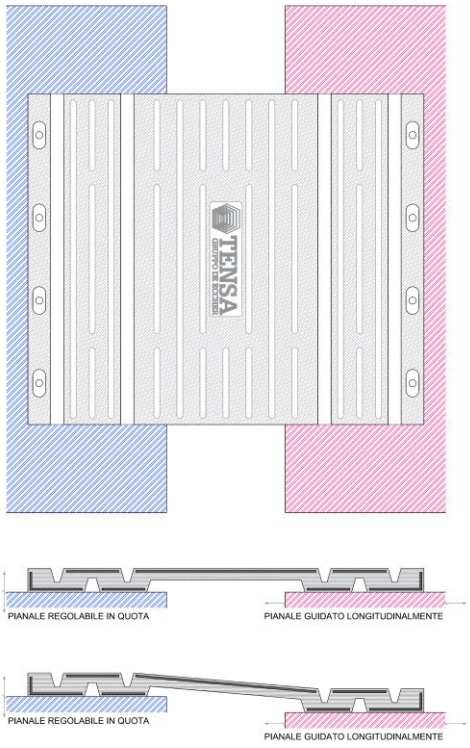
TESTS

The instruments at TensaLAB make it possible to detect and record the movements and deformations of the joints subjected to cyclic tests, in addition to the longitudinal forces that develop during opening and closing by the deformation of the rubber and to monitor the raising and lowering of the various joint sections during the transverse and longitudinal movements.
The following diagram shows the typical positioning of the measuring instruments during a functional test.

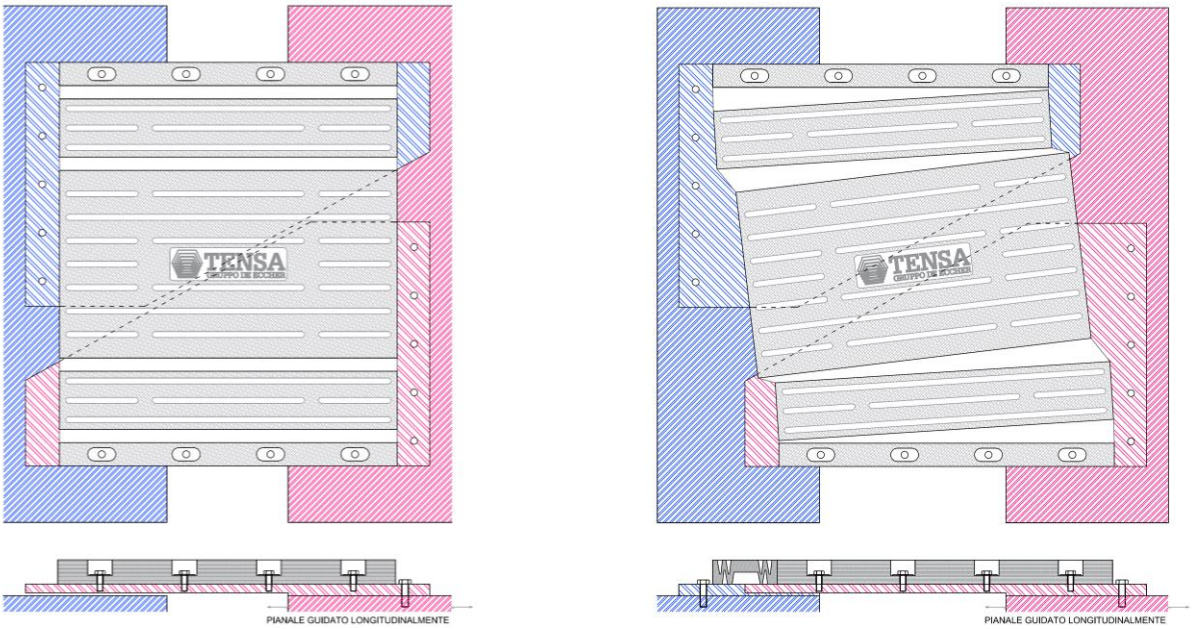


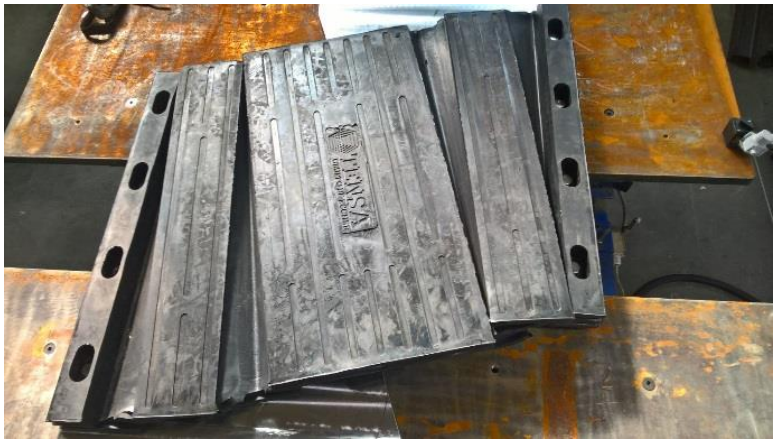
LONGITUDINAL TEST

Trasduttori lineari a puntale = Vertical linear transducer
Trasduttori lineare a filo = Flush linear transducer



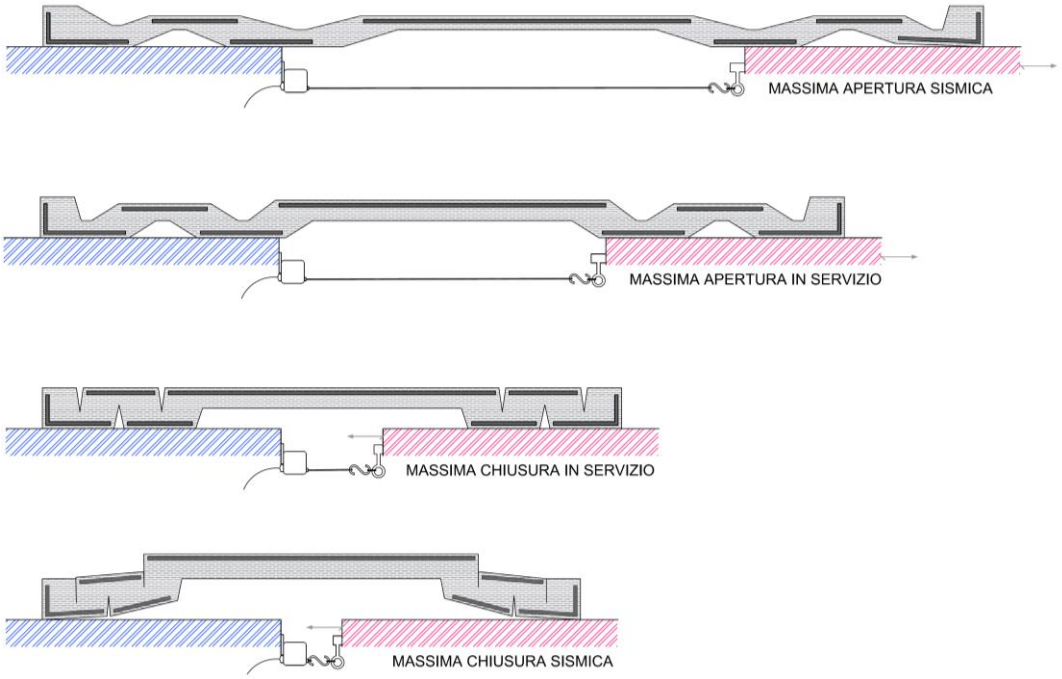
TRANSVERSAL TEST



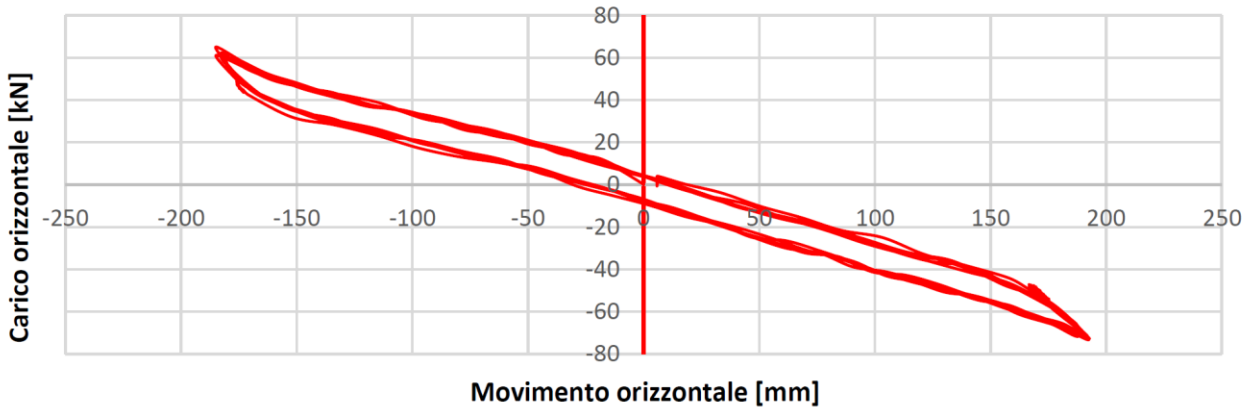


LIMIT CONFIGURATIONS

Tests have also been carried out according to the new and strict prescriptions introduced by EAD-120109-00-0107, verifying the joint displacement capacity in operating service conditions, as well as in seismic conditions in a distinct manner.
Fatigue load conditions have also been investigated by performing repeated cyclic tests both for applied displacements and for simulated vehicular loads.



Deformation diagram of UBJ joints subjected to SLS and seismic movements.



Typical UBJ/MBJ expansion joint force-displacement curve

VERTICAL LOAD TEST

To simulate the vehicular load on the joints, another test structure in TensaLAB is also used. The facility consists of a machine that applies vertical loads of up to 30MN on a conventional fingerprint, according to EAD-120109-00-0107 to verify the joint capacity and maximum deformation.

The joints are constantly tested and checked in terms of resistance to vehicular loads (conventional fingerprints), while also evaluating the deformability thereof, which is useful and fundamental to verify the maximum flatness of the sliding surfaces that the joint is able to guarantee. At the same time, this also provides an excellent tool for checking the noise or the "whip" effects induced by dynamic vertical loads.


TENSA

TENSA

Job title		Job No.
Design by	Date	Sheet No.
Item		

TENSA AROUND THE WORLD

TENSA HEADQUARTERS

TENSA – HEAD OFFICE
Via Pordenone, 8
20132 Milano - ITALY
T +39 02 4300161
F +39 02 48010726
mail@tensainternational.com

TENSA – ROME OFFICE
Via Cremona, 15b
00161 Roma - ITALY
T +39 06 8084621
F +39 06 8085427
mail@tensainternational.com

TENSA – WORKSHOP
Via Buttrio, 36
33050 Pozzuolo del Friuli (UD) - ITALY
T +39 0432 6071
mail@tensainternational.com

BRANCHES

TENSA AMERICA LLC
1111 Kane Concourse, S.te 200
Bay Harbor Island – 33154 FL
T +1 305 8669917
mail@tensaamerica.com
www.tensaamerica.com

TENSA INDIA
Private LTD, India
K-71,Lokmanya Pan Bazar,
Chunabhatti,
Mumbai 400021
M + 91 98 70793974
www.tensaindia.com

TENSA RUSSIA
5th Yamskogo Polya Street, 5
Bldg 1, 16th Floor
125040 Moscow
T +7 495 2300024
mail@tensarussia.com
www.tensarussia.com

TENSA PORTUGAL
Constr. Civil e Obras Publicas
Rua Eng. Frederico Ulrich, 3210-3
Sala 314
4470-605 Moreira da Maia
T +351 229416633
F +351 229415151
mail@tensainternational.com
www.tensainternational.com

TENSA AUSTRALIA
Level 1, 488 Botany Road
Alexandria, NSW 2015
T +61 2 8332 6151
F +61 2 8332 6101
mail@tensainternational.com
www.tensainternational.com

TENSA MIDDLE EAST
RAKIA Business Center 5
Building A4, floor 12, office 1209
T +971 72432888

mail@tensainternational.com
www.tensainternational.com

TENSA
Via Pordenone, 8
20132 Milano, Italy
T +39 02 4300161
F +39 02 48010726
mail@tensainternational.com
www.tensainternational.com

V.05-01-01-EN