





SRAC CERTSERV

NOTIFIED BODY No. 1835

Certificate of constancy of performance,
1835 - CPR



SRAC

NO



SRAC CERTSERV

NOTIFIED BODY No. 1835

Certificate of constancy of performance,
1835 - CPR - 00-0011

In compliance with Regulation (EU) No. 305/2011 of the European Parliament and of the Council of 9 March 2011 (the Construction products Regulation or CPR), this certificate applies to the construction products



SRAC CERTSERV

NOTIFIED BODY No. 1835

Certificate of constancy of performance,
1835 - CPR - 00-0013

In compliance with Regulation (EU) No. 305/2011 of the European Parliament and of the Council of 9 March 2011 (the Construction products Regulation or CPR), this certificate applies to the construction products

ANTISEISMIC DEVICES. SEISMIC ISOLATORS. CURVED AND FLAT SURFACE SLIDERS ISOLATORS

used in buildings and civil engineering works where requirements on individual products are critical and whose characteristics are detailed in the Annexes 1 and 2

placed on the market under the name or trade mark of

FIP INDUSTRIALE S.p.A.
Via Scapacchiò 41, 35030, Selvazzano Dentro, Padova, Italy

and produced in the manufacturing plant

FIP INDUSTRIALE S.p.A.
Via Scapacchiò 41, 35030, Selvazzano Dentro, Padova, Italy.

This certificate attests that all provisions concerning the assessment and verification of constancy of performance (AVCP) described in Annex ZA of the standard

EN 15129:2009 §§ 8.3 and 8.4

under system 1 for the performance set out in this certificate are applied and that the factory production control conducted by the manufacturer is assessed to ensure the

constancy of performance of the construction product.

This certificate was first issued on 19.01.2011 and will remain valid as long as neither the harmonised standard, the construction product, the AVCP methods nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified product certification body.

15.01.2016

Administrator General Director,
Gabriel IONESCU



6 Theodor Burada Street, Sector 1, Bucharest, 010215, ROMANIA

This certificate attests that all provisions concerning the assessment and verification of constancy of performance (AVCP) described in Annex ZA of the standard

under system 1 for the performance set out in this certificate are applied and that the factory production control conducted by the manufacturer is assessed to ensure the

This certificate was first issued on 19.01.2011 and will remain valid as long as neither the harmonised standard, the construction product, the AVCP methods nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified product certification body.

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INTRODUCTION

CERTIFICATIONS

In 1992, **FIP Industriale** secured CISQ-ICIM certification for its Quality Assurance System in conformance with EN 29001 European Standard (ISO 9001).

FIP Industriale is proud to be the first Italian manufacturer of structural bearings, anti-seismic devices and expansion joints boasting a Quality Assurance System certified at the highest level from design to customer service assistance.

Certification has been achieved via rigorous evaluation by an internationally recognized Third Party Organisation, thus internationally validating the quality assurance system.

In the framework of the enforcement of the European Construction Products Directive, **FIP Industriale** has gained the CE marking of different types of anti-seismic devices, including elastomeric isolators, in accordance with the harmonised European Standard EN 15129:2009 *Anti-seismic devices*.



OHS 618800



BIM READY

The use of shared digital representations to facilitate the design, construction and operation of a structure is the starting point for a reliable and interactive decision making process which allows municipalities, private clients, contractors and designers to rule all their choices.

FIP Industriale is able to provide BIM models – according to IFC standard – to its Clients in such a way to support the communication, cooperation, simulation and improvement of a project through the whole design life of the built or building structure.

DESCRIPTION

The series **SI** elastomeric isolators are reinforced rubber bearings made up of alternating layers of steel laminates and hot vulcanized rubber. Usually, they are circular in shape but can be fabricated in square or rectangular section as well.

These devices are characterised by low horizontal stiffness, high vertical stiffness and a suitable damping capacity. These characteristics permit, respectively, to increase the fundamental period of vibration of the structure, to resist to vertical loads without appreciable settling, and to limit horizontal displacements in seismically isolated structures.

The fundamental design parameters used to determine vertical and horizontal stiffness are the isolator's geometrical characteristics (i.e.: overall dimensions, single layer thickness, etc.) and the mechanical characteristics of its elastomer. The damping capacity of the isolators is determined by the type of elastomeric compound, which usually is a high damping one.





• UDINE, ITALY - "Gervasutta" Hospital



• L' AQUILA, ITALY - ANAS New Head Office



CHARACTERISTICS

ELASTOMER

The rubber compounds used in the production of series **SI** elastomeric isolators are characterised by an effective dynamic shear modulus G_{din} between 0.4 MPa and 1.4 MPa and by the equivalent viscous damping coefficient equal to 10% or 15% - subject to the Design Engineer's discretion.

The table here below shows some of the physical and mechanical characteristics of the three standard rubber compounds used, measured using Italian Standard UNI a/o Italian seismic Regulations NTC-DM 14/01/2008 test methods.

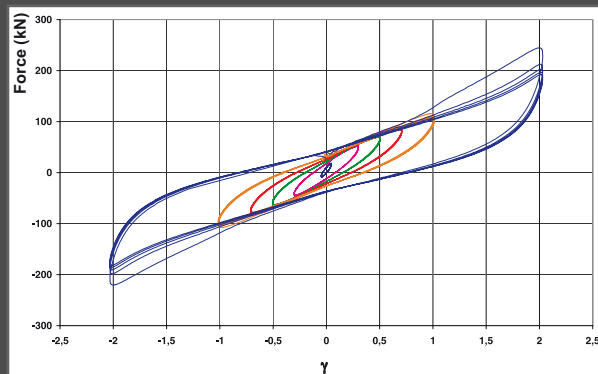
CHARACTERISTIC	COMPOUND		
	SOFT (S)	NORMAL (N)	HARD (H)
Hardness (Shore A)	40	60	75
Dynamic shear modulus G_{din} at $\gamma = 1$ (MPa)	0.4	0.8	1.4
Equivalent viscous damping coefficient ξ at $\gamma = 1$ (%)	10 / 15	10 / 15	10 / 15

High damping rubber compounds are characterised by a significant variation of the shear modulus G_{din} when the shear strain γ is lower than 0.5. This permits to avoid excessive displacements under dynamic low intensity excitations such as wind loads.

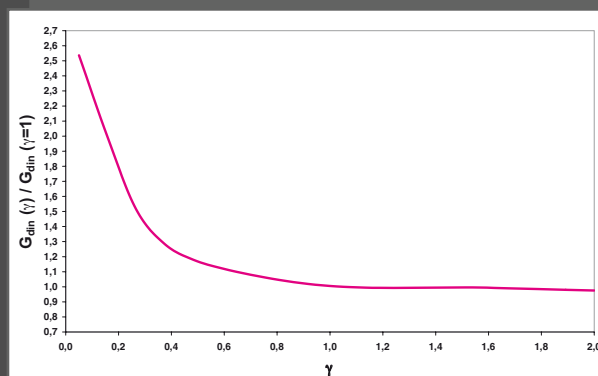
The G_{din} value remains practically constant for γ values between 1 and 2, corresponding to seismic design displacements. The equivalent viscous damping coefficient ξ also varies as a function of the shear strain γ .

The enclosed graphics show the typical course of the effective dynamic shear modulus G_{din} and the equivalent viscous damping coefficient ξ , normalized with respect to their respective values for $\gamma = 1$, as a function of the elastomer's shear strain γ .

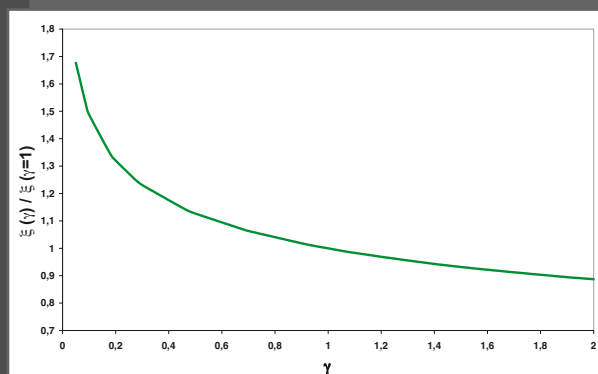
The compounds contain suitable anti-aging additives that guarantee limited variation of the physical and mechanical characteristics in time, as assessed through artificial aging tests (e.g.: 21 days at 70°C in accordance with NTC-DM 14/01/2008).



Typical hysteretic curve of an elastomeric isolator achieved during dynamic tests with increasing shear strain amplitude.



Mean variation in effective dynamic shear modulus G_{din} as a function of the shear strain γ .



Mean variation of the equivalent viscous damping coefficient ξ as a function of the shear strain γ .



PORTUGAL - Loureiro Viaduct

DESIGN AND PRODUCTION CRITERIA

STANDARDS

The series **SI** isolators can be designed ad hoc to satisfy all international standards (i.e.: EN 15129, AASHTO, etc.).

Notwithstanding, the standard isolators in this catalogue are designed in compliance with Italian seismic regulations (NTC-DM 14/01/2008), which are based on Eurocode 8 as well as with the European standard EN 1337-3:2005 (Structural Bearings. Part 3: Elastomeric Bearings) regarding the normal non-seismic service conditions.

DESIGN FEATURES

The standard elastomeric isolators whose geometric and mechanical characteristics are listed in the enclosed tables, are designed for seven different values of maximum displacement, from 100 to 400 mm.

Such entity of displacement is understood to be the maximum design displacement at ULS, factored by the increased reliability factor as per Eurocode 8.

The vertical load V indicated in the tables is the maximum admissible value upon the isolator in the presence of an earthquake provoking the aforesaid displacement.

Null rotation is assumed with reference to the use of these isolators in buildings. The displacement under normal service conditions (i.e.: induced by thermal expansion) is assumed to be 10 mm.

FIP Industriale's Technical Department is at the design Engineer's disposal to check standard isolators against displacements and rotations differing from those assumed, and to design ad hoc isolators diverging from standard features.

ANCHORING SYSTEMS

The elastomeric isolators are endowed with mechanical anchoring systems providing horizontal load transfer in accordance with Italian and international standards.

QUALITY CONTROL

FIP Industriale's internal quality control system ensures the conformity of the product to the various requirements thus guaranteeing the quality both of materials and manufacturing processes.

QUALIFICATION AND ACCEPTANCE TESTS

FIP Industriale's Test Laboratory is equipped to carry out qualification and acceptance tests on elastomeric isolators. Series **SI** isolators have also been tested at independent laboratories as well as *in situ* through snap-back tests of an entire seismically isolated building.



INSTALLATION

The typical installation procedure of an isolator anchored on its upper and lower side to reinforced *cast-in-situ* concrete structures, comprises the following phases:

- casting of the substructure up to a level lower than the isolator itself by a few centimeters, leaving holes for the anchor dowels with a diameter at least twice that of the same;
- positioning the isolator at the design level and leveling its base horizontally;
- construction of a formwork slightly larger than the isolator and approximately 1 cm higher than its lower edge;
- grouting (epoxy mortar or shrink free cementitious mortar) to a suggested thickness between 2 and 5 cm;
- screwing of the upper dowels to the isolator (if not already affixed);
- setting the upper formwork adapting it tightly against the isolator upper plate;
- positioning the superstructure reinforcement followed by concrete casting.



MARKS

The elastomeric isolators are classified by the mark **SI** (**S**eismic **I**solator) followed by a letter (S, N, H to indicate respectively the type of soft, normal and hard compound) and two numbers. The first number represents the diameter in millimeters and the second stands for the total thickness of the rubber layers in millimeters.

Example:

SI-S 800/130

Elastomeric Isolator, diameter 800 mm, made of soft elastomeric compound with rubber layers having a total thickness of 130 mm.





• FOLIGNO, ITALY - Civic Protection Centre



DISPLACEMENT ± 100 mm

SI-S	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-S 300/52	490	1860	0.54	584	300	52	116	166	350	84
SI-S 350/50	700	3010	0.77	779	350	50	108	158	400	109
SI-S 400/50	1150	4680	1.01	1246	400	50	108	158	450	140
SI-S 450/54	1540	5770	1.18	1369	450	54	118	168	500	183
SI-S 500/54	2230	8050	1.45	1962	500	54	118	168	550	224
SI-S 550/56	2720	9310	1.70	2153	550	56	117	167	600	265
SI-S 600/56	3200	10310	2.02	2438	600	56	114	164	650	307
SI-S 650/54	3650	10830	2.46	2848	650	54	109	159	700	351
SI-S 700/60	4460	11370	2.57	2871	700	60	125	185	750	481
SI-S 800/60	6930	14990	3.35	4519	800	60	125	185	850	624
SI-S 900/60	8480	21220	4.24	5317	900	60	126	186	950	790
SI-S 1000/70	10940	22590	4.49	5316	1000	70	146	226	1050	1214
SI-S 1100/70	14840	27460	5.43	7324	1100	70	146	226	1150	1463
SI-S 1200/80	17990	28700	5.66	7224	1200	80	156	236	1250	1750

SI-N	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-N 300/52	920	2610	1.09	879	300	52	116	166	350	84
SI-N 350/50	1400	3510	1.54	1195	350	50	108	158	400	109
SI-N 400/50	2300	4680	2.01	1824	400	50	108	158	450	140
SI-N 450/54	3080	7510	2.36	2044	450	54	118	168	500	183
SI-N 500/54	4470	9380	2.91	2822	500	54	118	168	550	224
SI-N 550/56	5440	9820	3.39	3156	550	56	117	167	600	265
SI-N 600/56	6410	10310	4.04	3627	600	56	114	164	650	307
SI-N 650/54	7310	10830	4.92	4286	650	54	109	159	700	351
SI-N 700/60	8920	11370	5.13	4362	700	60	125	185	750	481
SI-N 800/60	12690	14990	6.70	6557	800	60	125	185	850	624
SI-N 900/60	16960	21220	8.48	7879	900	60	126	186	950	790
SI-N 1000/70	19830	22590	8.98	8000	1000	70	146	226	1050	1214
SI-N 1100/70	24420	27460	10.86	10668	1100	70	146	226	1150	1463
SI-N 1200/80	25800	28700	11.31	10684	1200	80	156	236	1250	1750

SI-H	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-H 300/52	920	2610	1.90	1122	300	52	116	166	350	84
SI-H 350/50	2240	3510	2.69	1550	350	50	108	158	400	109
SI-H 400/50	3200	4680	3.52	2276	400	50	108	158	450	140
SI-H 450/54	5400	7510	4.12	2592	450	54	118	168	500	183
SI-H 500/54	7040	9380	5.09	3475	500	54	118	168	550	224
SI-H 550/56	7610	9820	5.94	3944	550	56	117	167	600	265
SI-H 600/56	8190	10310	7.07	4585	600	56	114	164	650	307
SI-H 650/54	8770	10830	8.60	5470	650	54	109	159	700	351
SI-H 700/60	9370	11370	8.98	5612	700	60	125	185	750	481
SI-H 800/60	12690	14990	11.73	8129	800	60	125	185	850	624
SI-H 900/60	18340	21220	14.84	9930	900	60	126	186	950	790
SI-H 1000/70	19830	22590	15.71	10210	1000	70	146	226	1050	1214
SI-H 1100/70	24420	27460	19.01	13263	1100	70	146	226	1150	1463
SI-H 1200/80	25800	28700	19.79	13443	1200	80	156	236	1250	1750

Legend:

V	Maximum vertical load at load combinations including the seismic action
F _{zd}	Maximum vertical load at non-seismic load combinations, at ULS, concurrent with 0 rotation and 10 mm horizontal displacement
K _e	Effective horizontal stiffness
K _v	Vertical stiffness
D _g	Elastomer diameter
t _e	Total elastomer thickness
h	Height excluding outer steel plates
H	Total height including outer steel plates
Z	Side length of outer steel plates
W	Isolator weight excluding anchoring elements

DISPLACEMENT ± 150 mm

SI-S	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-S 300/76	270	1270	0.37	400	300	76	152	202	350	92
SI-S 350/75	490	2000	0.51	519	350	75	143	193	400	118
SI-S 400/75	880	3540	0.67	830	400	75	143	193	450	153
SI-S 450/78	1200	4660	0.82	948	450	78	154	204	500	202
SI-S 500/78	1800	7260	1.01	1358	500	78	154	204	550	247
SI-S 550/77	2190	9380	1.23	1566	550	77	147	197	600	287
SI-S 600/80	2690	10310	1.41	1707	600	80	147	197	650	335
SI-S 650/81	3200	10830	1.64	1898	650	81	145	195	700	384
SI-S 700/80	3710	11370	1.92	2153	700	80	151	211	750	508
SI-S 800/80	5870	14990	2.51	3389	800	80	151	211	850	659
SI-S 900/84	7490	21220	3.03	3798	900	84	158	218	950	848
SI-S 1000/84	9110	22590	3.74	4430	1000	84	164	244	1050	1252
SI-S 1100/84	12470	27460	4.53	6103	1100	84	164	244	1150	1509
SI-S 1200/96	15490	28700	4.71	6020	1200	96	176	256	1250	1807

SI-N	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-N 300/76	550	1780	0.74	602	300	76	152	202	350	92
SI-N 350/75	990	2800	1.03	796	350	75	143	193	400	118
SI-N 400/75	1760	4680	1.34	1216	400	75	143	193	450	153
SI-N 450/78	2410	6530	1.63	1415	450	78	154	204	500	202
SI-N 500/78	3610	9380	2.01	1954	500	78	154	204	550	247
SI-N 550/77	4380	9820	2.47	2296	550	77	147	197	600	287
SI-N 600/80	5380	10310	2.83	2539	600	80	147	197	650	335
SI-N 650/81	6400	10830	3.28	2857	650	81	145	195	700	384
SI-N 700/80	7420	11370	3.85	3272	700	80	151	211	750	508
SI-N 800/80	11470	14990	5.03	4918	800	80	151	211	850	659
SI-N 900/84	14980	21220	6.06	5628	900	84	158	218	950	848
SI-N 1000/84	18230	22590	7.48	6667	1000	84	164	244	1050	1252
SI-N 1100/84	22800	27460	9.05	8890	1100	84	164	244	1150	1509
SI-N 1200/96	24240	28700	9.43	8903	1200	96	176	256	1250	1807

SI-H	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-H 300/76	970	3060	1.30	768	300	76	152	202	350	92
SI-H 350/75	1590	3510	1.80	1033	350	75	143	193	400	118
SI-H 400/75	2450	4680	2.35	1518	400	75	143	193	450	153
SI-H 450/78	4220	7510	2.86	1794	450	78	154	204	500	202
SI-H 500/78	5820	9380	3.52	2406	500	78	154	204	550	247
SI-H 550/77	6440	9820	4.32	2868	550	77	147	197	600	287
SI-H 600/80	7060	10310	4.95	3209	600	80	147	197	650	335
SI-H 650/81	7690	10830	5.74	3646	650	81	145	195	700	384
SI-H 700/80	8310	11370	6.74	4209	700	80	151	211	750	508
SI-H 800/80	11470	14990	8.80	6096	800	80	151	211	850	659
SI-H 900/84	16810	21220	10.60	7093	900	84	158	218	950	848
SI-H 1000/84	18360	22590	13.09	8508	1000	84	164	244	1050	1252
SI-H 1100/84	22800	27460	15.84	11052	1100	84	164	244	1150	1509
SI-H 1200/96	24240	28700	16.49	11203	1200	96	176	256	1250	1807

Legend:

V	Maximum vertical load at load combinations including the seismic action
F _{zd}	Maximum vertical load at non-seismic load combinations, at ULS, concurrent with 0 rotation and 10 mm horizontal displacement
K _e	Effective horizontal stiffness
K _v	Vertical stiffness
D _g	Elastomer diameter
t _e	Total elastomer thickness
h	Height excluding outer steel plates
H	Total height including outer steel plates
Z	Side length of outer steel plates
W	Isolator weight excluding anchoring elements

DISPLACEMENT ± 200 mm

SI-S	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-S 300/100	105	960	0.28	304	300	100	188	238	350	100
SI-S 350/100	250	1500	0.39	389	350	100	178	228	400	128
SI-S 400/100	590	2650	0.50	623	400	100	178	228	450	166
SI-S 450/102	900	3570	0.62	725	450	102	190	240	500	220
SI-S 500/102	1420	3970	0.77	1038	500	102	190	240	550	270
SI-S 550/105	1830	6890	0.91	1148	550	105	187	237	600	316
SI-S 600/104	2230	8750	1.09	1313	600	104	180	230	650	362
SI-S 650/108	2760	10430	1.23	1424	650	108	181	231	700	418
SI-S 700/100	3110	11370	1.54	1722	700	100	177	237	750	535
SI-S 800/100	5040	14990	2.01	2711	800	100	177	237	850	694
SI-S 900/108	6670	21220	2.36	2954	900	108	190	250	950	905
SI-S 1000/112	8390	22590	2.81	3322	1000	112	200	280	1050	1327
SI-S 1100/112	11590	27460	3.39	4577	1100	112	200	280	1150	1600
SI-S 1200/112	13570	28700	4.04	5160	1200	112	196	276	1250	1865

SI-N	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-N 300/100	210	1350	0.57	457	300	100	188	238	350	100
SI-N 350/100	510	2100	0.77	597	350	100	178	228	400	128
SI-N 400/100	1180	3720	1.01	912	400	100	178	228	450	166
SI-N 450/102	1810	4990	1.25	1082	450	102	190	240	500	220
SI-N 500/102	2840	7780	1.54	1494	500	102	190	240	550	270
SI-N 550/105	3660	9650	1.81	1683	550	105	187	237	600	316
SI-N 600/104	4470	10310	2.18	1953	600	104	180	230	650	362
SI-N 650/108	5520	10830	2.46	2143	650	108	181	231	700	418
SI-N 700/100	6230	11370	3.08	2617	700	100	177	237	750	535
SI-N 800/100	10090	14990	4.02	3934	800	100	177	237	850	694
SI-N 900/108	13350	21220	4.71	4377	900	108	190	250	950	905
SI-N 1000/112	16780	22590	5.61	5000	1000	112	200	280	1050	1327
SI-N 1100/112	21190	27460	6.79	6667	1100	112	200	280	1150	1600
SI-N 1200/112	22700	28700	8.08	7631	1200	112	196	276	1250	1865

SI-H	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-H 300/100	370	2320	0.99	583	300	100	188	238	350	100
SI-H 350/100	900	3510	1.35	775	350	100	178	228	400	128
SI-H 400/100	1720	4680	1.76	1138	400	100	178	228	450	166
SI-H 450/102	3170	7510	2.18	1372	450	102	190	240	500	220
SI-H 500/102	4640	9380	2.70	1840	500	102	190	240	550	270
SI-H 550/105	5310	9820	3.17	2103	550	105	187	237	600	316
SI-H 600/104	5970	10310	3.81	2469	600	104	180	230	650	362
SI-H 650/108	6620	10830	4.30	2735	650	108	181	231	700	418
SI-H 700/100	7270	11370	5.39	3367	700	100	177	237	750	535
SI-H 800/100	10260	14990	7.04	4877	800	100	177	237	850	694
SI-H 900/108	15290	21220	8.25	5517	900	108	190	250	950	905
SI-H 1000/112	16910	22590	9.82	6381	1000	112	200	280	1050	1327
SI-H 1100/112	21190	27460	11.88	8289	1100	112	200	280	1150	1600
SI-H 1200/112	22700	28700	14.14	9602	1200	112	196	276	1250	1865

Legend:

V	Maximum vertical load at load combinations including the seismic action
F _{zd}	Maximum vertical load at non-seismic load combinations, at ULS, concurrent with 0 rotation and 10 mm horizontal displacement
K _e	Effective horizontal stiffness
K _v	Vertical stiffness
D _g	Elastomer diameter
t _e	Total elastomer thickness
h	Height excluding outer steel plates
H	Total height including outer steel plates
Z	Side length of outer steel plates
W	Isolator weight excluding anchoring elements

DISPLACEMENT ± 250 mm

SI-S	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-S 300/128	15	750	0.22	237	300	128	230	280	350	110
SI-S 350/125	100	1200	0.31	311	350	125	213	263	400	138
SI-S 400/125	290	2120	0.40	498	400	125	213	263	450	179
SI-S 450/126	530	2890	0.51	587	450	126	226	276	500	239
SI-S 500/126	1010	4500	0.62	841	500	126	226	276	550	294
SI-S 550/126	1410	5740	0.75	957	550	126	217	267	600	338
SI-S 600/128	1820	7100	0.88	1067	600	128	213	263	650	389
SI-S 650/126	2230	8940	1.05	1220	650	126	205	255	700	440
SI-S 700/130	2740	10600	1.18	1325	700	130	216	276	750	575
SI-S 800/130	4570	14990	1.55	2086	800	130	216	276	850	747
SI-S 900/132	5940	21220	1.93	2417	900	132	222	282	950	963
SI-S 1000/140	7670	22590	2.24	2658	1000	140	236	316	1050	1402
SI-S 1100/140	10720	27460	2.72	3662	1100	140	236	316	1150	1691
SI-S 1200/144	12850	28700	3.14	4013	1200	144	236	316	1250	1979

SI-N	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-N 300/128	35	1060	0.44	357	300	128	230	280	350	110
SI-N 350/125	200	1680	0.62	478	350	125	213	263	400	138
SI-N 400/125	590	2970	0.80	729	400	125	213	263	450	179
SI-N 450/126	1070	4040	1.01	876	450	126	226	276	500	239
SI-N 500/126	2030	6300	1.25	1209	500	126	226	276	550	294
SI-N 550/126	2830	8040	1.51	1403	550	126	217	267	600	338
SI-N 600/128	3640	9950	1.77	1587	600	128	213	263	650	389
SI-N 650/126	4460	10830	2.11	1837	650	126	205	255	700	440
SI-N 700/130	5490	11370	2.37	2013	700	130	216	276	750	575
SI-N 800/130	9080	14990	3.09	3026	800	130	216	276	850	747
SI-N 900/132	11880	21220	3.86	3582	900	132	222	282	950	963
SI-N 1000/140	15350	22590	4.49	4000	1000	140	236	316	1050	1402
SI-N 1100/140	19590	27460	5.43	5334	1100	140	236	316	1150	1691
SI-N 1200/144	21170	28700	6.28	5935	1200	144	236	316	1250	1979

SI-H	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-H 300/128	65	1810	0.77	456	300	128	230	280	350	110
SI-H 350/125	350	2890	1.08	620	350	125	213	263	400	138
SI-H 400/125	1040	4680	1.41	911	400	125	213	263	450	179
SI-H 450/126	1880	6930	1.77	1111	450	126	226	276	500	239
SI-H 500/126	3520	9380	2.18	1489	500	126	226	276	550	294
SI-H 550/126	4220	9820	2.64	1753	550	126	217	267	600	338
SI-H 600/128	4910	10310	3.09	2006	600	128	213	263	650	389
SI-H 650/126	5580	10830	3.69	2344	650	126	205	255	700	440
SI-H 700/130	6250	11370	4.14	2590	700	130	216	276	750	575
SI-H 800/130	9080	14990	5.41	3752	800	130	216	276	850	747
SI-H 900/132	13790	21220	6.75	4514	900	132	222	282	950	963
SI-H 1000/140	15470	22590	7.85	5105	1000	140	236	316	1050	1402
SI-H 1100/140	19590	27460	9.50	6631	1100	140	236	316	1150	1691
SI-H 1200/144	21170	28700	11.00	7468	1200	144	236	316	1250	1979

Legend:

V	Maximum vertical load at load combinations including the seismic action
F _{zd}	Maximum vertical load at non-seismic load combinations, at ULS, concurrent with 0 rotation and 10 mm horizontal displacement
K _e	Effective horizontal stiffness
K _v	Vertical stiffness
D _g	Elastomer diameter
t _e	Total elastomer thickness
h	Height excluding outer steel plates
H	Total height including outer steel plates
Z	Side length of outer steel plates
W	Isolator weight excluding anchoring elements

DISPLACEMENT ± 300 mm

SI-S	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-S 350/150	20	1000	0.26	260	350	150	248	298	400	148
SI-S 400/150	120	1470	0.34	415	400	150	248	298	450	192
SI-S 450/150	280	2420	0.42	493	450	150	262	312	500	258
SI-S 500/150	600	3770	0.52	706	500	150	262	312	550	317
SI-S 550/154	910	4690	0.62	783	550	154	257	307	600	368
SI-S 600/152	1350	5980	0.74	898	600	152	246	296	650	417
SI-S 650/153	1840	7360	0.87	1005	650	153	241	291	700	473
SI-S 700/160	2350	8610	0.96	1077	700	160	255	315	750	615
SI-S 800/160	4050	14940	1.26	1695	800	160	255	315	850	800
SI-S 900/168	5490	19240	1.52	1899	900	168	270	330	950	1049
SI-S 1000/168	6970	22590	1.87	2215	1000	168	272	352	1050	1477
SI-S 1100/168	9850	27460	2.26	3052	1100	168	272	352	1150	1782
SI-S 1200/176	12040	28700	2.57	3283	1200	176	276	356	1250	2093

SI-N	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-N 350/150	40	1400	0.51	398	350	150	248	298	400	148
SI-N 400/150	240	2060	0.67	608	400	150	248	298	450	192
SI-N 450/150	560	3390	0.85	736	450	150	262	312	500	258
SI-N 500/150	1200	5290	1.05	1016	500	150	262	312	550	317
SI-N 550/154	1830	6580	1.23	1148	550	154	257	307	600	368
SI-N 600/152	2710	8380	1.49	1336	600	152	246	296	650	417
SI-N 650/153	3690	10310	1.74	1513	650	153	241	291	700	473
SI-N 700/160	4700	11370	1.92	1636	700	160	255	315	750	615
SI-N 800/160	7920	14940	2.51	2459	800	160	255	315	850	800
SI-N 900/168	10980	21220	3.03	2814	900	168	270	330	950	1049
SI-N 1000/168	13940	22590	3.74	3333	1000	168	272	352	1050	1477
SI-N 1100/168	18020	27460	4.53	4445	1100	168	272	352	1150	1782
SI-N 1200/176	19650	28700	5.14	4856	1200	176	276	356	1250	2093

SI-H	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-H 350/150	70	2400	0.90	517	350	150	248	298	400	148
SI-H 400/150	420	4250	1.17	759	400	150	248	298	450	192
SI-H 450/150	990	5820	1.48	933	450	150	262	312	500	258
SI-H 500/150	2100	9070	1.83	1251	500	150	262	312	550	317
SI-H 550/154	3190	9820	2.16	1434	550	154	257	307	600	368
SI-H 600/152	3890	10310	2.60	1689	600	152	246	296	650	417
SI-H 650/153	4580	10830	3.04	1930	650	153	241	291	700	473
SI-H 700/160	5260	11370	3.37	2104	700	160	255	315	750	615
SI-H 800/160	7920	14940	4.40	3048	800	160	255	315	850	800
SI-H 900/168	12310	21220	5.30	3546	900	168	270	330	950	1049
SI-H 1000/168	14050	22590	6.55	4254	1000	168	272	352	1050	1477
SI-H 1100/168	18020	27460	7.92	5526	1100	168	272	352	1150	1782
SI-H 1200/176	19650	28700	9.00	6111	1200	176	276	356	1250	2093

Legend:

V	Maximum vertical load at load combinations including the seismic action
F _{zd}	Maximum vertical load at non-seismic load combinations, at ULS, concurrent with 0 rotation and 10 mm horizontal displacement
K _e	Effective horizontal stiffness
K _v	Vertical stiffness
D _g	Elastomer diameter
t _e	Total elastomer thickness
h	Height excluding outer steel plates
H	Total height including outer steel plates
Z	Side length of outer steel plates
W	Isolator weight excluding anchoring elements

DISPLACEMENT ± 350 mm

SI-S	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-S 400/175	24	1510	0.29	356	400	175	283	333	450	205
SI-S 450/180	115	2020	0.35	411	450	180	307	357	500	281
SI-S 500/180	310	3150	0.44	588	500	180	307	357	550	346
SI-S 550/175	560	4130	0.54	689	550	175	287	337	600	390
SI-S 600/176	880	5160	0.64	776	600	176	279	329	650	444
SI-S 650/180	1260	6260	0.74	854	650	180	277	327	700	507
SI-S 700/180	1740	7660	0.86	957	700	180	281	341	750	642
SI-S 800/180	3400	13280	1.12	1506	800	180	281	341	850	835
SI-S 900/180	4600	17960	1.41	1772	900	180	286	346	950	1078
SI-S 1000/182	6010	22590	1.73	2044	1000	182	290	370	1050	1515
SI-S 1100/182	8620	27460	2.09	2817	1100	182	290	370	1150	1828
SI-S 1200/192	9530	28700	2.36	3010	1200	192	296	376	1250	2150

SI-N	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-N 400/175	45	2120	0.57	521	400	175	283	333	450	205
SI-N 450/180	230	2830	0.71	613	450	180	307	357	500	281
SI-N 500/180	620	4410	0.87	847	500	180	307	357	550	346
SI-N 550/175	1130	5790	1.09	1010	550	175	287	337	600	390
SI-N 600/176	1770	7230	1.29	1154	600	176	279	329	650	444
SI-N 650/180	2520	8760	1.48	1286	650	180	277	327	700	507
SI-N 700/180	3490	10720	1.71	1454	700	180	281	341	750	642
SI-N 800/180	6790	14990	2.23	2186	800	180	281	341	850	835
SI-N 900/180	8310	21220	2.83	2626	900	180	286	346	950	1078
SI-N 1000/182	12025	22590	3.45	3077	1000	182	290	370	1050	1515
SI-N 1100/182	16460	27460	4.18	4103	1100	182	290	370	1150	1828
SI-N 1200/192	18150	28700	4.71	4452	1200	192	296	376	1250	2150

SI-H	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-H 400/175	85	3640	1.01	650	400	175	283	333	450	205
SI-H 450/180	400	4850	1.24	778	450	180	307	357	500	281
SI-H 500/180	1090	7560	1.53	1043	500	180	307	357	550	346
SI-H 550/175	1990	9820	1.90	1262	550	175	287	337	600	390
SI-H 600/176	2940	10310	2.25	1459	600	176	279	329	650	444
SI-H 650/180	3630	10830	2.58	1641	650	180	277	327	700	507
SI-H 700/180	4310	11370	2.99	1871	700	180	281	341	750	642
SI-H 800/180	6790	14990	3.91	2710	800	180	281	341	850	835
SI-H 900/180	10870	21220	4.95	3310	900	180	286	346	950	1078
SI-H 1000/182	12650	22590	6.04	3927	1000	182	290	370	1050	1515
SI-H 1100/182	16460	27460	7.31	5101	1100	182	290	370	1150	1828
SI-H 1200/192	18150	28700	8.25	5601	1200	192	296	376	1250	2150

Legend:

V	Maximum vertical load at load combinations including the seismic action
F _{zd}	Maximum vertical load at non-seismic load combinations, at ULS, concurrent with 0 rotation and 10 mm horizontal displacement
K _e	Effective horizontal stiffness
K _v	Vertical stiffness
D _g	Elastomer diameter
t _e	Total elastomer thickness
h	Height excluding outer steel plates
H	Total height including outer steel plates
Z	Side length of outer steel plates
W	Isolator weight excluding anchoring elements

DISPLACEMENT ± 400 mm

SI-S	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-S 450/204	20	1780	0.31	362	450	204	343	393	500	300
SI-S 500/204	135	2780	0.39	519	500	204	343	393	550	369
SI-S 550/203	300	3560	0.47	594	550	203	327	377	600	419
SI-S 600/200	540	4540	0.57	683	600	200	312	362	650	471
SI-S 650/207	820	5440	0.64	743	650	207	313	363	700	540
SI-S 700/200	1240	6890	0.77	861	700	200	307	367	750	669
SI-S 800/200	2730	11950	1.01	1356	800	200	307	367	850	871
SI-S 900/204	3990	15850	1.25	1564	900	204	318	378	950	1136
SI-S 1000/210	5385	20320	1.50	1772	1000	210	326	406	1050	1590
SI-S 1100/210	7860	27460	1.81	2441	1100	210	326	406	1150	1919
SI-S 1200/208	9540	28700	2.18	2778	1200	208	316	396	1250	2207

SI-N	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-N 450/204	45	2490	0.62	541	450	204	343	393	500	300
SI-N 500/204	270	3890	0.77	747	500	204	343	393	550	369
SI-N 550/203	610	5790	0.94	871	550	203	327	377	600	419
SI-N 600/200	1090	6360	1.13	1016	600	200	312	362	650	471
SI-N 650/207	1650	7620	1.28	1118	650	207	313	363	700	540
SI-N 700/200	2490	9650	1.54	1309	700	200	307	367	750	669
SI-N 800/200	5470	14990	2.01	1967	800	200	307	367	850	871
SI-N 900/204	7980	21220	2.50	2317	900	204	318	378	950	1136
SI-N 1000/210	10780	22590	2.99	2667	1000	210	326	406	1050	1590
SI-N 1100/210	14930	27460	3.62	3556	1100	210	326	406	1150	1919
SI-N 1200/208	16670	28700	4.35	4109	1200	208	316	396	1250	2207

SI-H	V kN	F _{zd} kN	K _e kN/mm	K _v kN/mm	D _g mm	t _e mm	h mm	H mm	Z mm	W kg
SI-H 450/204	80	4280	1.09	686	450	204	343	393	500	300
SI-H 500/204	470	6670	1.35	920	500	204	343	393	550	369
SI-H 550/203	1070	8550	1.64	1088	550	203	327	377	600	419
SI-H 600/200	1920	10310	1.98	1284	600	200	312	362	650	471
SI-H 650/207	2740	10830	2.24	1427	650	207	313	363	700	540
SI-H 700/200	3420	11370	2.69	1684	700	200	307	367	750	669
SI-H 800/200	5710	14990	3.52	2439	800	200	307	367	850	871
SI-H 900/204	9470	21220	4.37	2921	900	204	318	378	950	1136
SI-H 1000/210	11280	22590	5.24	3403	1000	210	326	406	1050	1590
SI-H 1100/210	14930	27460	6.34	4421	1100	210	326	406	1150	1919
SI-H 1200/208	16670	28700	7.61	5170	1200	208	316	396	1250	2207

Legend:

V	Maximum vertical load at load combinations including the seismic action
F _{zd}	Maximum vertical load at non-seismic load combinations, at ULS, concurrent with 0 rotation and 10 mm horizontal displacement
K _e	Effective horizontal stiffness
K _v	Vertical stiffness
D _g	Elastomer diameter
t _e	Total elastomer thickness
h	Height excluding outer steel plates
H	Total height including outer steel plates
Z	Side length of outer steel plates
W	Isolator weight excluding anchoring elements



**BRIDGE
BEARINGS**

**ANTI-SEISMIC
DEVICES**

**EXPANSION
JOINTS**

**FITTINGS
FOR TUNNEL**

**NOISE
BARRIERS**

**DAMPING
SYSTEMS**



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