Elastomeric Bearings

GOODCO Z-TECH

A product of Structal-Bridges

Better Building Solutions

With more than 60 years of experience, Goodco Z-Tech is the largest fabricator of structural bearings and expansion joints in Canada. With the expertise of a competent team and equipment at the cutting edge of technology, the company can design and fabricate a wide range of products and services for highway and railway bridges and for civil engineering projects in steel and concrete.

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Elastomeric Bearings

A complete range of bridge bearings for public works and civil engineering

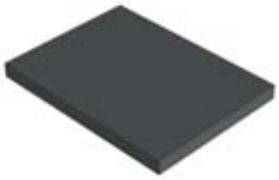
All structures are flexible and their structural integrity must be ensured under all conditions. The structural bearing is the key element that creates freedom of movement between a structure and its foundation while ensuring the transfer of vertical loads and rotation.

Elastomeric Bearings

Goodco Z-Tech elastomeric bearings are fabricated of natural rubber or neoprene. Designed and sized to meet the needs of your structure, these bearings are rigid enough to transmit the necessary loads and flexible enough to permit the rotation and movement required by the structure. They can also be used for vibration and earthquake-motion control applications.

Plain Bearings

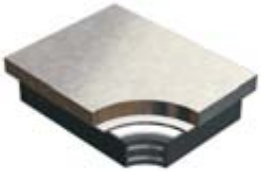
Series E
Elastomeric plain pad
Load: 7 MPa
Movement: ± 12 mm



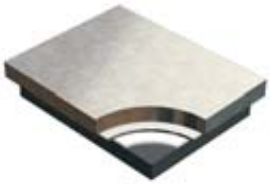
Series ER
Homogeneous fabric fiber reinforced pad
Load: 10 MPa
Movement: ± 16 mm

Series EF
Cotton duck fabric reinforced pad
Load: 14 MPa
Movement: None

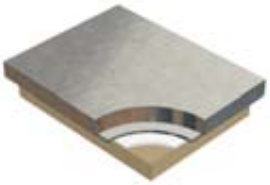
Sliding Bearings



Series ETL
Steel/stainless steel plate on EL pad with PTFE surface
Load: 7 MPa
Movement: No restriction

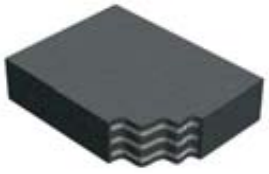


Series ETR
Steel/stainless steel plate on ER pad with PTFE surface
Load: 10 MPa
Movement: No restriction



Series ETF
Steel/stainless steel plate on EF pad with PTFE surface
Load: 14 MPa
Movement: No restriction

Laminated Bearings



Series EL
Molded steel reinforced pad
Load: 7 MPa
Movement: ± 70 mm

Thin Sliders

Series T
Variation on PTFE, Promene, and rubber
Load: 4.8 – 7 MPa
Movement: ± 6 mm

Note: For assembly details, see pages 16 and 17.

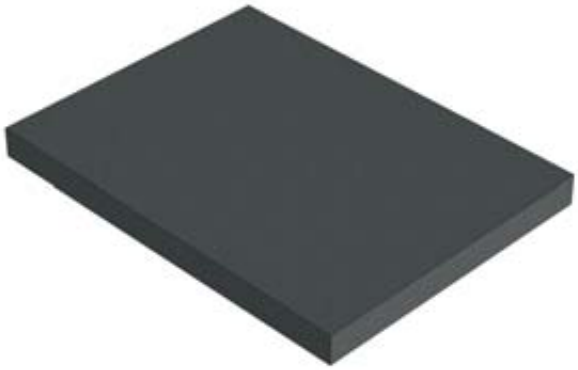
Plain Bearings – Series E

APPLICATIONS

Series E bearings can be used for bridges, viaducts, buildings, storage tanks, sealing elements, isolation, etc.

MATERIALS

Series E bearings are made of an elastomer containing either natural rubber (polyisoprene) or neoprene (polychloroprene) as the basic polymer. They are available primarily in 55 durometer hardness (Shore A) and meet the CAN/CSA-S6-06 standard, or in hardness meeting Ontario OPSS 1202. They can be molded or cut (from standard rolls) into a wide range of dimensions and thicknesses.



Rectangular*

Circular*

* Other shapes also available.

Figure E-1

Material Properties		ASTM Standard	Requirements	
Categories	**Properties**		**Polyisoprene**	**Polychloroprene**
Physical properties	Hardness, Shore A	D2240	55 ± 5	55 ± 5
	Tensile strength, MPa	D412	Minimum 17.0	Minimum 17.0
	Ultimate elongation, %	D412	Minimum 400	Minimum 400
Heat resistance	Specified test temperature	D573	70 h at 70°C	70 h at 100°C
	Change in hardness, Shore A		Maximum +10	Maximum +15
	Change in tensile strength, %		Maximum -25	Maximum -15
	Change in ultimate elongation, %		Maximum -25	Maximum -40
Compressive strain	Specified test temperature	D395, Method B	22 h at 70°C	22 h at 100°C
	Residual compression, %		Maximum 25	Maximum 35
Ozone resistance	Mounting procedure A, 20% strain, 40 ± 2°C	D1149	25 pphm, 48 h No cracks	100 pphm, 100 h No cracks
Low temperature properties	Bond between steel and elastomer laminae, N/mm	D429, Method B	Minimum 7.0	Minimum 7.0
	Brittleness at -40°C	D746, Procedure B	No failure	No failure
	Low temperature crystallization increase in hardness, Shore A	D2240	168 h at -25°C Maximum +15"	168 h at -10°C Maximum +15"

Note: Data given in Table 11.5 is from CAN/CSA-S6-06.
Other hardnesses and other grades are available to meet AASHTO, AREMA, or other standards.

Table E-1

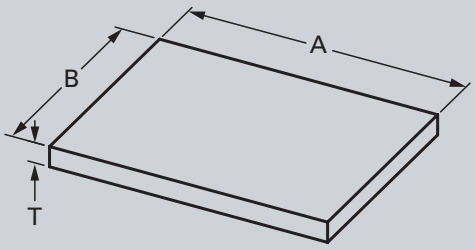


Figure E-2

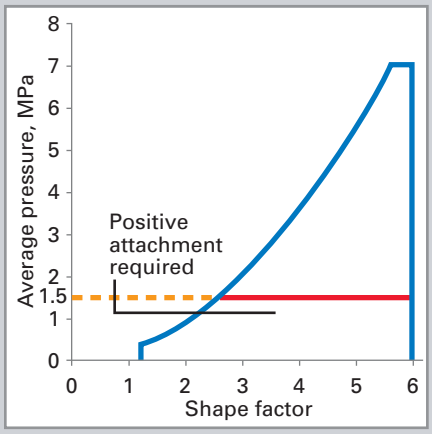


Figure E-3

Durometer	50	55	60
E_o (MPa)	2.10	2.52	3.70
k	0.73	0.64	0.57
E_∞ (MPa)	1,030	1,090	1,150

Table E-2

DESIGN

SHAPE FACTOR(S)

The behavior of an elastomeric bearing under compression is influenced by the shape factor (S), which is defined as the ratio between the loaded area of the bearing and the area that is free to bulge:

$$S = \frac{A \times B}{T \times 2\,(A+B)} \qquad (1)$$

ALLOWABLE BEARING PRESSURES

	SLS	ULS
Maximum pressure under permanent load	4.5 MPa	7.0 MPa
Maximum pressure under total load	7.0 MPa*	10.0 MPa

Where:
SLS = Serviceability limit state
ULS = Ultimate limit state
* Max : 0.22 S^2 (see Figure E-3)

These maximum pressures should be limited only to meet the two following load combination requirements:

1) Compressive load without rotation

For plain bearing pads used under compressive load only, i.e. without rotation, the maximum pad thickness can be obtained from a graph relating the average service compressive load to the pad shape factor. It should be noted that a positive attachment should be specified for minimum compressive loads of less than 1.5 MPa at SLS.

2) Compressive load with rotation

For plain bearing pads used under compressive loads and rotation, the maximum pad thickness should be such that under all service load combinations, the maximum compressive deflection Δ_c does not exceed 0.07 x T and under rotation, there is no uplift at any edge.

The average value of e_c can be determined from the following formula:

$$e_c = \frac{\Delta_c}{T} = \beta \left[\frac{\delta_c}{E_o\,(1+2k\,S^2)} + \frac{\delta_c}{E_\infty} \right] \leq 0.07 \qquad (2)$$

Where:
e_c = Compressive strain
Δ_c = Compressive deflection
T = Bearing pad thickness
E_o, k, E_∞ = Hardness constants (see Table E-2)
δ_c = Compressive pressure
β = Free slippage surface coefficient (1.8 for non-bonded plain pads)

Maximum allowable rotation (in radians) must therefore be limited to:

$$\alpha_{MAX.} \leq \frac{\Delta_c}{A/2 \text{ or } B/2} \qquad (3)$$

MAXIMUM SHEAR DEFORMATION (Δ_S)

Maximum shear deformation of a plain bearing pad is limited to 50% of the total pad thickness (T):

$$\Delta_s \leq 0.50 \times T \qquad (4)$$

Plain Bearings – Series ER

APPLICATIONS

Series ER bearings can be used for steel structures, pre-cast concrete structures, standard concrete slabs, etc. This type of bearing is particularly effective in the presence of camber and rotation causing high stress loading on the bearing pad.

MATERIALS

Series ER bearings are made of a homogeneous blend of highly ozone-resistant elastomer reinforced by a dispersion of unrestrained synthetic fabric fibers cured together to produce a tough, durable and economical bearing pad.

DESIGN

As a result of significant testing and research, the bearing pad can be recommended for the following load conditions:

- Maximum allowable bearing stress: 10 to 17 MPa*
- Maximum allowable shear deformation: 0.75 T
- Maximum allowable compressive deformation: 0.30 T
- Maximum rotation: ±0.08 rad*

Where:
T = Bearing pad thickness

* The maximum allowable bearing stress depends on the degree of rotation.

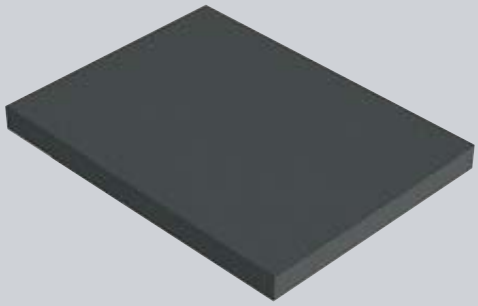


Figure ER-1

Material Properties		ASTM Standard	Requirements
Categories	Properties		Elastomer ER
Physical Properties	Hardness, Shore A	-	75 ± 5
	Compression	-	-
	Minimum ultimate, MPa		55.2
	Initial minimum cracking strain**, %		40
	Shear modulus (G), MPa	-	1.17 ± 0.34
	At 21°C under uniform compressive stress of 7 MPa and shear strain of 50% ($\frac{d_h}{t}$ x 100) when both bearing surfaces contact smooth concrete		
	G constant in all directions parallel to bearing plane		
	Tensile strength**, MPa	D412, Die C	6.9
	Tear strength**, N/mm	D624, Die B	70.1
	Oil swell (increase in volume), %	D471	Maximum 120
Heat Resistance	Heat aging	D573	-
	Variation in tensile strength, %		Maximum ±25
	Variation in elongation, %		Maximum ±25
	Variation in hardness, point		Maximum 10
Ozone Resistance	Ozone resistance, N/mm	-	52.5
	After 50 hours at 38°C in an ozone concentration of 80 pphm - tear strength		

**10% variation is allowed.

Table ER-1

Plain Bearings – Series EF

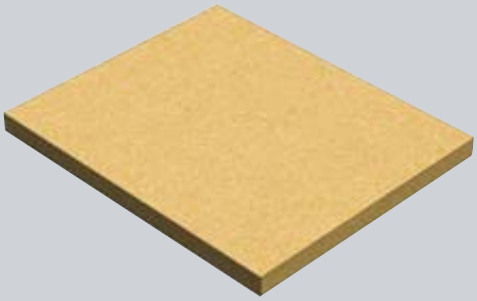


Figure EF-1

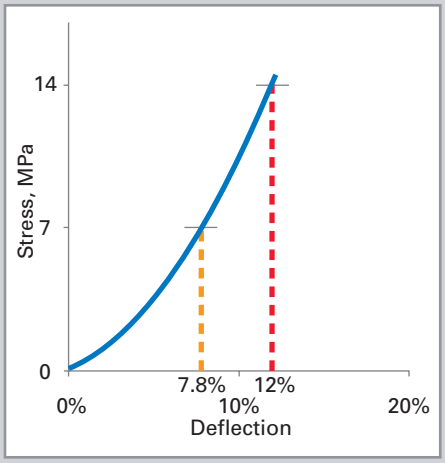


Figure EF-2

APPLICATIONS

Series EF bearings can be used for bridges, viaducts, buildings, crane rail pads, seismic and vibration isolation pads, and shock-absorbing applications.

MATERIALS

Series EF bearings are made of multiple layers of 8-ounce cotton duck with 64 folds per 25-mm thickness, impregnated and bonded with a top quality elastomer and compressed into resilient pads of uniform thickness by compression and vulcanization.

- This material meets the requirements of the following standards:
  - ASSHTO
  - LRFD Bridge Design Specifications (SI) 4th edition
  - Tested in accordance with MIL-C-882 procedures
- Hardness, Shore A: 90 ± 5
- Available thicknesses:
  3.2 mm (1/8 in.), 6 mm (15/64 in.), 8.7 mm (11/32 in.), 12.7 mm (1/2 in.), 15.9 mm (5/8 in.), 19 mm (3/4 in.) et 25.4 mm (1 in.)
- Other thicknesses can be obtained by cold vulcanization

DESIGN

• Maximum allowable bearing stress:	69 MPa
• Recommended working bearing stress:	14 MPa
• Allowable shear deformation:	None
• Compressive strain:	± 7.8% at 7 MPa ± 12% at 14 MPa
• Permanent set:	13% max. at 69 MPa
• Rotation:	± 0.01 rad
• Damping:	Superior to that of natural rubber

Rapid Transit Project 2000 and Canada Line, Vancouver, BC
Goodco Z-Tech provided 2,370 laminated bearings - Series EL, pot bearings and more than 5,150 m of strip seal expanding joints for these two projects completed in 2000 and 2006.

Laminated Bearings – Series EL

APPLICATIONS

Series EL bearings can be used for bridges, viaducts and buildings, and for seismic vibration and isolation, acoustic isolation and shock absorbing applications.

MATERIAL

Series EL bearings are molded bearings made of high quality natural rubber or neoprene with steel plates vulcanized to the elastomer in such a way that no part of the steel is exposed.

Elastomer: meets the CAN/CSA-S6-06 standard, and Ontario OPSS 1202 (see Table E-1).

Steel: conforms to ASTM A-1011 Grade 36, thickness of at least 3 mm.

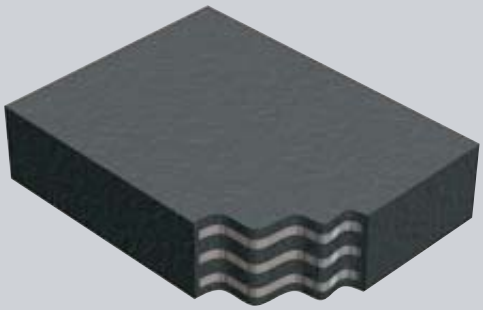


Figure EL-1

DESIGN

SHAPE FACTOR (S)

The behavior of each individual elastomer layer (t) is influenced by the shape factor which, similar to formula (1) Series E, is defined as:

$$S = \frac{A \times B}{t \times 2\,(A+B)} \qquad (1)$$

Where:
t = Thickness of each individual elastomer layer

ALLOWABLE BEARING PRESSURES

	SLS	ULS
Max. pressure under permanent load	4.5 MPa	7.0 MPa
Max. pressure under total load	7.0 MPa*	10.0 MPa

Where:
SLS = Serviceability limit state
ULS = Ultimate limit state
*Max: 0.22 S^2 (see Figure E-3)

The maximum pressures should be limited only so that the maximum compressive deflection, δ_c, does not exceed 0.07 x t under all service load combinations.

The total compressive deflection, Δ_c, is the sum of the deflection of each individual layer, δ_c, calculated according to formula (2) of Series E, except coefficient β, as follows:

β = 1.0 for layers bonded on both surfaces (inner layer)

β = 1.4 for layers bonded on only one surface (outer layer) (2)

Various bearing models – Series EL

Laminated Bearings – Series EL

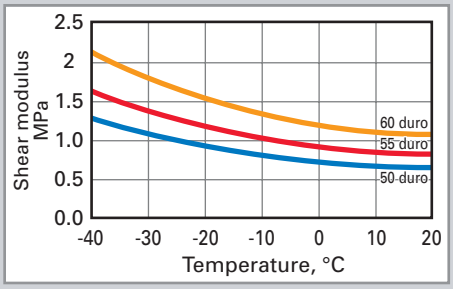


Figure EL-2

Hardness	Shear modulus G (at +20°C)
50	0.63 (MPa)
55	0.81 (MPa)
60	1.06 (MPa)

Table EL-1

Bearing – Series EL with beveled top plate

ALLOWABLE ROTATION

Similar to formula (3) of Series E, the maximum allowable rotation should be limited to:

$$\alpha_{MAX.} \leqslant \frac{\Delta_c}{A/2 \text{ or } B/2} \qquad (3)$$

MAXIMUM SHEAR DEFORMATION (Δ_S)

The maximum shear deformation of a laminated bearing pad is limited to:

$$\text{Maximum shear deformation} \leqslant 0.50 \times T_{eff} \qquad (4)$$

Where:

T_{eff} = Total rubber thickness between the laminates according to CAN/CSA-S6-06 and OPSS 1202

SHEAR STIFFNESS (K_S)

The shear stiffness is primarily influenced by the hardness of the rubber compound and by the service temperature. At -40°C, the shear modulus nearly doubles its value at +20°C (see Figure EL-2).

Therefore,
$$K_s = \frac{G \times AREA}{T.R.T.} \qquad (5)$$

Where:

G = Shear modulus as a function of the hardness and service temperature (see Table EL-1 for the precise values at +20°C or see Figure EL-2 for the values at temperatures between -40°C and +20°C).

AREA = Plan area of bearing pad

T.R.T. = Total rubber thickness

POSITIVE ATTACHMENT

Positive attachment should be provided when:

1) The maximum compressive stress under service load is $\leqslant$ 1.5 MPa

2) The force of friction, P_f, is insufficient to resist the shear force required to deform the pad, that is:

$$P_f = \mu P_v \leqslant K_s \times (\text{max. movement}) \qquad (6)$$

Where:

P_f = Friction force
P_v = Vertical load
μ = Coefficient of friction
= 0.10 to 0.15 between rubber and steel
= 0.20 between rubber and broom-finished concrete
= 0.15 between rubber and steel trowel-finished concrete

Note: For details on positive attachment, see pages 16 and 17.

Laminated Bearings – Series EL

Model No.	Dimensions			Maximum Loads				Design according to CAN/CSA-S6-06					Design according to OPSS 1202, 2008 (**)				
				SLS		ULS		Movement	Rotation under SLS TL	Shear rate (*)		Average comp. rate (***)	Movement	Rotation under SLS TL	Shear rate (*)		Average comp. rate (***)
	Width	Length	Th.	DL	TL	DL	TL			Min. @ 20°C	Max. @ -25°C				Min. @ 20°C	Max. @ -25°C	
	mm	mm	mm	kN	kN	kN	kN	± mm	Rad.	kN/mm	kN/mm	kN/mm	± mm	Rad.	kN/mm	kN/mm	kN/mm
EL302040	300 x 200		40	270	420	420	600	10.4	0.0146	1.57	2.32	236.9	Not recommended				
EL302050			50	270	420	420	600	14.0	0.0162	1.28	1.89	218.6	12.5	0.0074	1.39	2.06	402.28
EL302060			60	270	420	420	600	17.5	0.0181	1.08	1.60	198.7	17.5	0.0181	1.08	1.60	198.72
EL302070			70	270	420	420	600	21.0	0.0203	0.93	1.38	180.3	21.0	0.0203	0.93	1.38	180.34
EL302075			75	270	420	420	600	22.0	0.0169	0.90	1.33	210.9	22.0	0.0169	0.90	1.33	210.88
EL302080			80	270	420	420	600	24.5	0.0226	0.82	1.22	164.2	24.5	0.0226	0.82	1.22	164.23
EL302090			90	270	420	420	600	29.5	0.0374	0.70	1.04	103.8	28.0	0.0249	0.74	1.09	150.52
EL3020100			100	270	420	420	600	33.0	0.0390	0.64	0.95	100.1	31.5	0.0272	0.67	0.99	138.77
EL352540	350 x 250		40	394	613	613	875	10.5	0.0085	2.29	3.39	472.2	10.5	0.0085	2.29	3.39	472.23
EL352550			50	394	613	613	875	14.0	0.0093	1.87	2.76	439.2	14.0	0.0093	1.87	2.76	439.24
EL352560			60	394	613	613	875	17.5	0.0105	1.58	2.33	398.1	17.5	0.0105	1.58	2.33	398.09
EL352570			70	394	613	613	875	22.5	0.0206	1.29	1.91	218.5	21.0	0.0117	1.36	2.02	360.47
EL352575			75	394	613	613	875	25.0	0.0275	1.18	1.75	166.9	23.5	0.0158	1.24	1.84	277.47
EL352580			80	394	613	613	875	26.0	0.0207	1.14	1.69	216.7	26.0	0.0207	1.14	1.69	216.74
EL352590			90	394	613	613	875	31.0	0.0336	0.98	1.46	138.1	29.5	0.0214	1.03	1.52	210.79
EL3525100			100	394	613	613	875	34.5	0.0328	0.90	1.33	141.5	33.0	0.0223	0.93	1.38	202.77
EL3525110			110	394	613	613	875	38.0	0.0327	0.82	1.22	141.9	38.0	0.0327	0.82	1.22	141.89
EL3525120			120	394	613	613	875	41.5	0.0330	0.76	1.13	140.5	41.5	0.0330	0.76	1.13	140.53
EL403040	400 x 300		40	540	840	840	1,200	10.5	0.0054	3.14	4.65	836.8	10.5	0.0054	3.14	4.65	836.79
EL403050			50	540	840	840	1,200	14.0	0.0060	2.56	3.79	773.3	14.0	0.0060	2.56	3.79	773.30
EL403060			60	540	840	840	1,200	19.0	0.0134	2.03	3.00	380.3	17.5	0.0067	2.16	3.20	698.30
EL403070			70	540	840	840	1,200	22.5	0.0130	1.77	2.62	392.2	22.5	0.0130	1.77	2.62	392.17
EL403075			75	540	840	840	1,200	25.0	0.0173	1.62	2.40	301.7	25.0	0.0173	1.62	2.40	301.72
EL403080			80	540	840	840	1,200	27.5	0.0224	1.50	2.22	236.1	26.0	0.0132	1.57	2.32	387.21
EL403090			90	540	840	840	1,200	31.0	0.0211	1.35	2.00	249.9	31.0	0.0211	1.35	2.00	249.87
EL4030100			100	540	840	840	1,200	36.0	0.0318	1.19	1.76	169.0	34.5	0.0207	1.23	1.82	255.00
EL4030110			110	540	840	840	1,200	39.5	0.0299	1.09	1.62	179.7	38.0	0.0207	1.13	1.67	254.86
EL4030120			120	540	840	840	1,200	44.3	0.0408	0.98	1.45	132.5	43.0	0.0289	1.01	1.50	185.76
EL4030130			130	540	840	840	1,200	48.0	0.0390	0.92	1.36	139.0	46.5	0.0284	0.94	1.40	188.62
EL4030140			140	540	840	840	1,200	50.0	0.0345	0.86	1.27	152.0	50.0	0.0283	0.88	1.31	189.45
EL453540	450 x 350		40	709	1,103	1,103	1,575	10.5	0.0037	4.12	6.10	1,349.5	10.5	0.0037	4.12	6.10	1349.53
EL453550			50	709	1,103	1,103	1,575	15.5	0.0105	3.11	4.61	550.3	14.0	0.0041	3.36	4.97	1238.65
EL453560			60	709	1,103	1,103	1,575	19.0	0.0091	2.66	3.94	626.1	19.0	0.0091	2.66	3.94	626.07
EL453570			70	709	1,103	1,103	1,575	24.0	0.0172	2.20	3.26	347.5	22.5	0.0089	2.32	3.44	641.08
EL453575			75	709	1,103	1,103	1,575	25.0	0.0117	2.13	3.15	497.3	25.0	0.0117	2.13	3.15	497.26
EL453580			80	709	1,103	1,103	1,575	27.5	0.0151	1.96	2.91	391.6	27.5	0.0151	1.96	2.91	391.62
EL453590			90	709	1,103	1,103	1,575	32.5	0.0239	1.70	2.52	253.5	31.0	0.0143	1.77	2.63	412.12
EL4535100			100	709	1,103	1,103	1,575	36.0	0.0214	1.56	2.30	281.3	36.0	0.0214	1.56	2.30	281.31
EL4535110			110	709	1,103	1,103	1,575	41.0	0.0306	1.39	2.05	199.4	39.5	0.0202	1.43	2.12	297.80
EL4535120			120	709	1,103	1,103	1,575	44.5	0.0279	1.29	1.91	218.2	44.5	0.0279	1.29	1.91	218.16
EL4535130			130	709	1,103	1,103	1,575	49.5	0.0374	1.17	1.73	164.3	48.0	0.0263	1.20	1.78	231.04
EL4535140			140	709	1,103	1,103	1,575	53.0	0.0345	1.10	1.63	177.8	53.0	0.0345	1.10	1.63	177.83
EL4535150			150	709	1,103	1,103	1,575	58.0	0.0441	1.01	1.50	139.7	56.5	0.0325	1.04	1.54	188.04
EL504040	500 x 400		40	900	1,400	1,400	2,000	10.5	0.0027	5.23	7.74	2,027.9	10.5	0.0027	5.23	7.74	2,027.94
EL504050			50	900	1,400	1,400	2,000	15.5	0.0074	3.95	5.85	853.7	15.5	0.0074	3.95	5.85	853.67
EL504060			60	900	1,400	1,400	2,000	19.0	0.0130	3.18	4.71	490.7	19.0	0.0065	3.38	5.00	960.92
EL504070			70	900	1,400	1,400	2,000	24.0	0.0122	2.79	4.14	541.6	24.0	0.0122	2.79	4.14	541.55
EL504075			75	900	1,400	1,400	2,000	26.5	0.0159	2.57	3.81	419.1	25.0	0.0084	2.70	4.00	764.08
EL504080			80	900	1,400	1,400	2,000	28.5	0.0195	2.38	3.53	342.9	27.5	0.0108	2.49	3.69	605.85
EL504090			90	900	1,400	1,400	2,000	32.5	0.0169	2.16	3.20	395.9	32.5	0.0169	2.16	3.20	395.89
EL5040100			100	900	1,400	1,400	2,000	37.5	0.0251	1.91	2.82	271.0	36.0	0.0153	1.98	2.93	436.94
EL5040110			110	900	1,400	1,400	2,000	41.0	0.0217	1.76	2.61	311.8	41.0	0.0217	1.76	2.61	311.81
EL5040120			120	900	1,400	1,400	2,000	46.0	0.0298	1.59	2.35	229.4	44.5	0.0199	1.64	2.42	339.68
EL5040130			130	900	1,400	1,400	2,000	49.5	0.0265	1.49	2.20	257.1	49.5	0.0265	1.49	2.20	257.13
EL5040140			140	900	1,400	1,400	2,000	54.5	0.0345	1.36	2.02	198.6	53.0	0.0245	1.40	2.07	277.31
EL5040150			150	900	1,400	1,400	2,000	58.0	0.0312	1.29	1.90	218.8	56.5	0.0232	1.32	1.95	292.44
EL5040160			160	900	1,400	1,400	2,000	63.0	0.0392	1.19	1.76	175.2	61.5	0.0291	1.22	1.80	234.39
EL5040170			170	900	1,400	1,400	2,000	66.5	0.0455	1.11	1.64	149.6	66.5	0.0360	1.13	1.68	190.32

Table EL-2

Laminated Bearings – Series EL

Model No.	Dimensions			Maximum Loads				Design according to CAN/CSA-S6-06					Design according to OPSS 1202, 2008 (**)				
				SLS		ULS		Movement	Rotation under SLS TL	Shear rate (*)		Average comp. rate (***)	Movement	Rotation under SLS TL	Shear rate (*)		Average comp. rate (***)
										Min.	Max.				Min.	Max.	
	Width	Length	Th.	DL	TL	DL	TL			@ 20°C	@ -25°C				@ 20°C	@ -25°C	
	mm	mm	mm	kN	kN	kN	kN	± mm	Rad.	kN/mm	kN/mm	kN/mm	± mm	Rad.	kN/mm	kN/mm	kN/mm
EL554540	550 x 450		40	1,114	1,733	1,733	2,475	10.5	0.0063	5.90	8.74	1,053.9	10.5	0.0020	6.47	9.58	2,884.80
EL554550			50	1,114	1,733	1,733	2,475	15.5	0.0055	4.89	7.24	1,254.4	15.5	0.0055	4.89	7.24	1,254.38
EL554560			60	1,114	1,733	1,733	2,475	20.5	0.0118	3.93	5.82	620.3	19.0	0.0049	4.18	6.19	1,396.11
EL554570			70	1,114	1,733	1,733	2,475	24.0	0.0090	3.46	5.12	799.7	24.0	0.0090	3.46	5.12	799.65
EL554575			75	1,114	1,733	1,733	2,475	26.5	0.0118	3.18	4.71	622.1	26.5	0.0118	3.18	4.71	622.09
EL554580			80	1,114	1,733	1,733	2,475	29.0	0.0150	2.95	4.37	491.5	27.5	0.0081	3.08	4.57	887.49
EL554590			90	1,114	1,733	1,733	2,475	32.5	0.0125	2.67	3.96	585.9	32.5	0.0125	2.67	3.96	585.93
EL5545100			100	1,114	1,733	1,733	2,475	37.5	0.0185	2.36	3.49	403.7	37.5	0.0185	2.36	3.49	403.68
EL5545110			110	1,114	1,733	1,733	2,475	42.0	0.0252	2.11	3.13	296.8	41.0	0.0160	2.18	3.23	462.11
EL5545120			120	1,114	1,733	1,733	2,475	46.0	0.0219	1.97	2.91	341.8	46.0	0.0219	1.97	2.91	341.77
EL5545130			130	1,114	1,733	1,733	2,475	51.0	0.0291	1.79	2.65	259.2	49.5	0.0196	1.84	2.72	381.41
EL5545140			140	1,114	1,733	1,733	2,475	54.5	0.0254	1.68	2.50	295.9	54.5	0.0254	1.68	2.50	295.90
EL5545150			150	1,114	1,733	1,733	2,475	59.5	0.0323	1.55	2.30	234.0	58.0	0.0231	1.59	2.36	324.73
EL5545160			160	1,114	1,733	1,733	2,475	63.0	0.0378	1.44	2.14	198.3	63.0	0.0289	1.47	2.18	260.93
EL5545170			170	1,114	1,733	1,733	2,475	68.0	0.0356	1.37	2.03	212.5	66.5	0.0266	1.40	2.08	282.79
EL5545180			180	1,114	1,733	1,733	2,475	73.0	0.0433	1.29	1.90	175.3	71.5	0.0324	1.31	1.94	233.22
EL605040	600 x 500		40	1,350	2,100	2,100	3,000	11.5	0.0061	7.15	10.59	1,242.6	Not recommended				
EL605050			50	1,350	2,100	2,100	3,000	15.5	0.0042	5.93	8.78	1,764.3	15.5	0.0042	5.93	8.78	1,764.26
EL605060			60	1,350	2,100	2,100	3,000	20.5	0.0090	4.76	7.06	886.1	19.0	0.0038	5.06	7.50	1,940.97
EL605070			70	1,350	2,100	2,100	3,000	24.0	0.0069	4.19	6.21	1,130.4	24.0	0.0069	4.19	6.21	1,130.38
EL605075			75	1,350	2,100	2,100	3,000	26.5	0.0090	3.86	5.71	884.3	26.5	0.0090	3.86	5.71	884.29
EL605080			80	1,350	2,100	2,100	3,000	29.0	0.0114	3.57	5.29	701.6	29.0	0.0114	3.57	5.29	701.63
EL605090			90	1,350	2,100	2,100	3,000	34.0	0.0177	3.12	4.62	460.5	32.5	0.0096	3.24	4.80	830.27
EL6050100			100	1,350	2,100	2,100	3,000	37.5	0.0141	2.86	4.24	576.2	37.5	0.0141	2.86	4.24	576.17
EL6050110			110	1,350	2,100	2,100	3,000	42.5	0.0198	2.56	3.79	414.0	41.0	0.0123	2.64	3.91	655.75
EL6050120			120	1,350	2,100	2,100	3,000	46.0	0.0246	2.31	3.43	330.5	46.0	0.0167	2.38	3.53	487.73
EL6050130			130	1,350	2,100	2,100	3,000	51.0	0.0221	2.17	3.21	371.4	51.0	0.0221	2.17	3.21	371.38
EL6050140			140	1,350	2,100	2,100	3,000	56.0	0.0286	1.99	2.95	288.7	54.5	0.0194	2.04	3.03	422.24
EL6050150			150	1,350	2,100	2,100	3,000	59.5	0.0245	1.88	2.79	335.1	59.5	0.0245	1.88	2.79	335.10
EL6050160			160	1,350	2,100	2,100	3,000	64.5	0.0306	1.75	2.59	269.7	63.0	0.0220	1.79	2.65	372.32
EL6050170			170	1,350	2,100	2,100	3,000	69.0	0.0369	1.63	2.42	224.0	68.0	0.0271	1.66	2.47	304.22
EL6050180			180	1,350	2,100	2,100	3,000	73.0	0.0329	1.56	2.31	251.5	73.0	0.0329	1.56	2.31	251.49
EL6050190			190	1,350	2,100	2,100	3,000	78.0	0.0395	1.46	2.17	210.1	76.5	0.0297	1.49	2.21	278.31
EL6050200			200	1,350	2,100	2,100	3,000	81.5	0.0352	1.40	2.08	234.9	81.5	0.0352	1.40	2.08	234.92
EL606040	600 x 600		40	1,620	2,520	2,520	3,600	12.0	0.0049	8.58	12.71	1,590.0	Not recommended				
EL606050			50	1,620	2,520	2,520	3,600	15.5	0.0030	7.11	10.54	2,434.5	15.5	0.0030	7.11	10.54	2,434.51
EL606060			60	1,620	2,520	2,520	3,600	20.5	0.0063	5.72	8.47	1,244.5	20.5	0.0063	5.72	8.47	1,244.50
EL606070			70	1,620	2,520	2,520	3,600	25.5	0.0115	4.78	7.08	704.1	24.0	0.0049	5.03	7.45	1,568.49
EL606075			75	1,620	2,520	2,520	3,600	26.5	0.0064	4.63	6.86	1,234.8	26.5	0.0064	4.63	6.86	1,234.78
EL606080			80	1,620	2,520	2,520	3,600	29.0	0.0081	4.29	6.35	984.6	29.0	0.0081	4.29	6.35	984.62
EL606090			90	1,620	2,520	2,520	3,600	34.0	0.0125	3.74	5.54	650.8	34.0	0.0125	3.74	5.54	650.78
EL6060100			100	1,620	2,520	2,520	3,600	38.3	0.0173	3.31	4.91	472.1	37.5	0.0100	3.43	5.08	808.28
EL6060110			110	1,620	2,520	2,520	3,600	42.5	0.0140	3.07	4.55	584.1	42.5	0.0140	3.07	4.55	584.09
EL6060120			120	1,620	2,520	2,520	3,600	47.5	0.0189	2.78	4.11	434.3	46.0	0.0119	2.86	4.24	684.08
EL6060130			130	1,620	2,520	2,520	3,600	51.0	0.0230	2.54	3.76	354.8	51.0	0.0156	2.60	3.86	523.42
EL6060140			140	1,620	2,520	2,520	3,600	56.0	0.0202	2.39	3.54	408.4	56.0	0.0202	2.39	3.54	408.41
EL6060150			150	1,620	2,520	2,520	3,600	61.0	0.0255	2.21	3.27	324.3	59.5	0.0174	2.26	3.35	471.92
EL6060160			160	1,620	2,520	2,520	3,600	64.5	0.0216	2.10	3.11	381.1	64.5	0.0216	2.10	3.11	381.09
EL6060170			170	1,620	2,520	2,520	3,600	69.5	0.0265	1.96	2.90	311.8	68.0	0.0192	2.00	2.96	428.19
EL6060180			180	1,620	2,520	2,520	3,600	74.5	0.0321	1.83	2.72	258.4	73.0	0.0232	1.87	2.77	355.02
EL6060190			190	1,620	2,520	2,520	3,600	78.0	0.0278	1.76	2.60	297.3	78.0	0.0278	1.76	2.60	297.33
EL6060200			200	1,620	2,520	2,520	3,600	83.0	0.0330	1.66	2.45	251.3	81.5	0.0249	1.69	2.50	331.39
EL6060210			210	1,620	2,520	2,520	3,600	88.0	0.0388	1.57	2.32	214.4	86.5	0.0293	1.59	2.36	282.73
EL6060220			220	1,620	2,520	2,520	3,600	91.5	0.0341	1.51	2.24	243.1	91.5	0.0341	1.51	2.24	243.14
EL6060230			230	1,620	2,520	2,520	3,600	96.5	0.0395	1.44	2.13	210.3	95.0	0.0309	1.46	2.16	268.50
EL6060240			240	1,620	2,520	2,520	3,600	100.0	0.0355	1.39	2.06	234.0	100.0	0.0355	1.39	2.06	233.96

(*): For average hardness of 55 duro (Shore A) (**): November 2008 version (***): Outer layers included

Notes: The bearings listed in this table are generic. They have been designed for the maximum loads that may be applied to each of them. Smaller loads may result in smaller rotational capacities. There is no hole. All our bearings are fabricated to order. We can fabricate bearings according to the specific needs of your structure. They can be designed and fabricated according to the criteria of other codes (MTQ, AREMA, AASHTO, etc.). For greater movement, laminated bearings can be fabricated with a sliding interface (see Series ETL).

Table EL-2

Seismic and Vibration Isolation **Bearings**

APPLICATIONS
Seismic and vibration isolation bearings can be used in buildings and structures subjected to earthquake and ground-born vibration, such as that caused by nearby road or rail traffic.

SEISMIC ISOLATION
Seismic isolation is a technique for earthquake protection in which a structure is disconnected from the horizontal effects of earthquakes by a mechanism that carries the vertical load but highly reduces the transmission of the horizontal load.

VIBRATION ISOLATION
Vibration isolation is a technique that isolates structures from vertical ground motion in the frequency range of 25Hz to 50Hz, which may be produced by nearby underground transit system or other disturbing sources.

AN ECONOMIC SOLUTION
The simplest and most convenient mechanism to overcome seismic and vibration problems is the use of laminated bearings – Serie EL. These bearings can easily be designed to provide a wide range of stiffnesses and isolating properties. Furthermore, since they are easy to install and do not require any type of maintenance once installed, these bearings have been proven to be a very economical solution to seismic and vibration conditions.

Note: For more information on physical properties and design, see the section on laminated bearings – Series EL on pages 8 and 9.

Twenty Gothic Condominiums, Toronto, ON

Goodco Z-Tech offers other options for seismic isolation and earthquake resistant equipment. Contact us for more information.

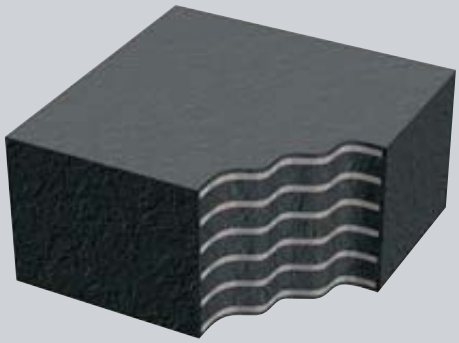


Figure EL-3

Static test on vibration isolation bearings

Dynamic test on vibration isolation bearings

Sliding Bearings – Series ETL - ETR - ETF

APPLICATIONS

Series ETL, ETR, and ETF bearings can be used for bridges, viaducts, buildings and structures where light loads to relatively large movement occur or where low resistance to horizontal movement is desired.

SERIES ETL

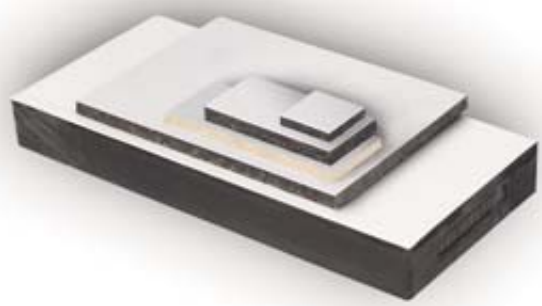
Series ETL bearings are made of molded steel reinforced bottom pad (Series EL) with PTFE vulcanized to its top surface. The top plate of this bearing is an ASTM A-36 or G40.21 300W steel plate with a 304 stainless steel, mirror finish (No.8), lower surface. The stainless steel sheet is continuously welded to the steel plate (also available according to MTQ 2008-10 requirements).

SERIES ETR

Series ETR bearings are made of a homogeneous blend of highly ozone-resistant rubber elastomer reinforced with synthetic fabric fibers (ER series) as a bottom pad with PTFE bonded to its top surface. The top plate is identical to that of the Series ETL.

SERIES ETF

Series ETF bearings are made of a multiple layers of cotton duck impregnated with natural rubber (Series EF) as a bottom pad with PTFE bonded to its top surface. The top plate is identical to that of the Series ETL and ETR.



New Yankee Stadium
New York, NY
Goodco Z-Tech provided more than 300 sliding bearings for this project, which was completed in 2008.

Sliding Bearings – Series ETL

Model No	Maximum Load	Dimensions (mm)						
	SLS TL	Top plate			Base pad			Thickness
	kN	A	B	C	D	E	F	G
ETL 100818	21	125	125	13	100	75	18	34
ETL 150818	43	175	125	13	150	75	18	34
ETL 180818	58	205	125	13	180	75	18	34
ETL 181020	64	205	150	13	180	100	20	36
ETL 201020	76	225	150	13	200	100	20	36
ETL 231020	96	255	150	13	230	100	20	36
ETL 271020	120	290	150	13	265	100	20	36
ETL 201530	210	225	200	13	200	150	30	46
ETL 251530	263	275	200	19	250	150	30	52
ETL 252035	340	275	250	19	250	200	35	57
ETL 302035	420	325	250	19	300	200	35	57
ETL 362040	444	380	250	19	355	200	40	62
ETL 402040	543	425	250	19	400	200	40	62
ETL 362540	621	380	300	25	355	250	40	68
ETL 402540	700	425	300	25	400	250	40	68
ETL 462540	805	485	300	25	460	250	40	68
ETL 502545	849	525	300	25	500	250	45	73

Table ETL-1

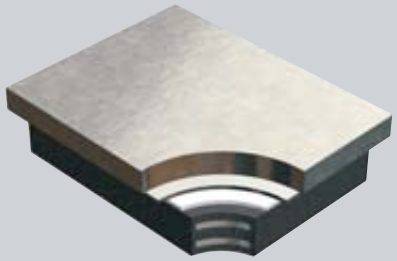


Figure ETL-1

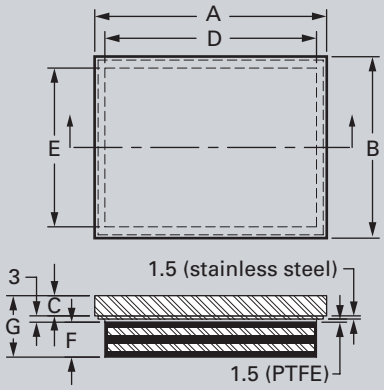


Figure ETL-2

Sliding Bearings – Series ETR

Model No	Maximum Load	Dimensions (mm)						
	SLS TL	Top plate			Base pad			Thickness
	kN	A	B	C	D	E	F	G
ETR 100813	75	125	125	13	100	75	13	29
ETR 150813	113	175	125	13	150	75	13	29
ETR 180813	135	205	125	13	180	75	13	29
ETR 181013	180	205	150	13	180	100	13	29
ETR 201013	200	225	150	13	200	100	13	29
ETR 231013	230	255	150	13	230	100	13	29
ETR 271013	265	290	150	13	265	100	13	29
ETR 201513	300	225	200	13	200	150	13	29
ETR 251519	375	275	200	19	250	150	19	41
ETR 252019	500	275	250	19	250	200	19	41
ETR 302019	600	325	250	19	300	200	19	41
ETR 362019	710	380	250	19	355	200	19	41
ETR 402019	800	425	250	19	400	200	19	41
ETR 362525	888	380	300	25	355	250	25	53
ETR 402525	1,000	425	300	25	400	250	25	53
ETR 462525	1,150	485	300	25	460	250	25	53
ETR 502525	1,250	525	300	25	500	250	25	53

Table ETR-1

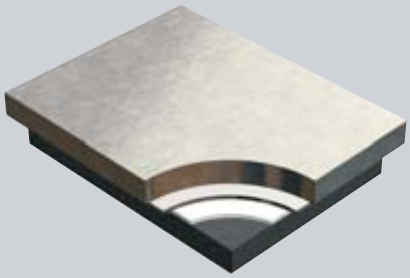


Figure ETR-1

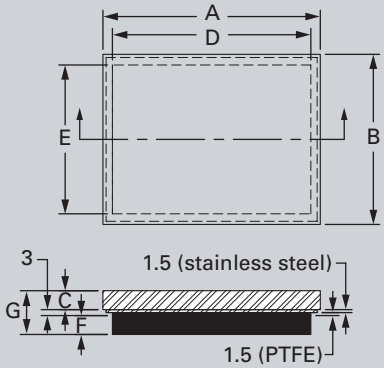


Figure ETR-2

Sliding Bearings – Series ETF

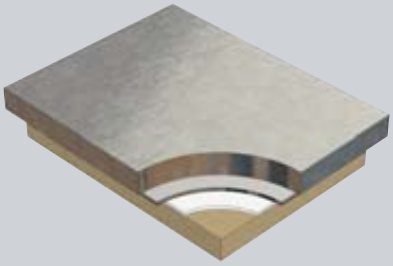


Figure ETF-1

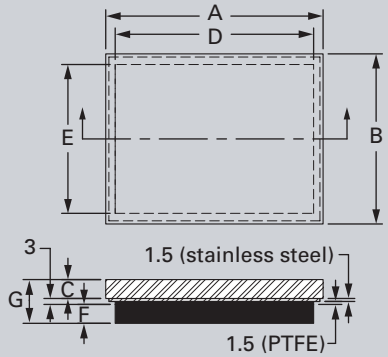


Figure ETF-2

Model No	Maximum Load SLS TL	Dimensions (mm)						
		Top plate			Base pad			Thickness
	kN	A	B	C	D	E	F	G
ETF 100813	105	125	125	13	100	75	13	29
ETF 150813	160	175	125	13	150	75	13	29
ETF 180813	190	205	125	13	180	75	13	29
ETF 181013	252	205	150	13	180	100	13	29
ETF 201013	280	225	150	13	200	100	13	29
ETF 231013	320	255	150	13	230	100	13	29
ETF 271013	370	290	150	13	265	100	13	29
ETF 201513	420	225	200	13	200	150	13	29
ETF 251519	520	275	200	19	250	150	19	41
ETF 252019	700	275	250	19	250	200	19	41
ETF 302019	840	325	250	19	300	200	19	41
ETF 362019	990	380	250	19	355	200	19	41
ETF 402019	1,120	425	250	19	400	200	19	41
ETF 362525	1,240	380	300	25	355	250	25	53
ETF 402525	1,400	425	300	25	400	250	25	53
ETF 462525	1,610	485	300	25	460	250	25	53
ETF 502525	1,750	525	300	25	500	250	25	53

Table ETF-1

Thin Sliders – Series T

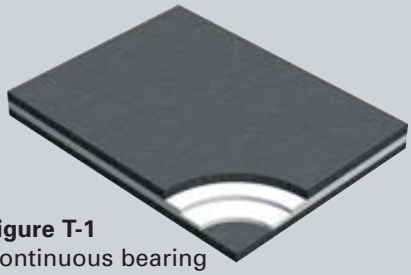


Figure T-1
Continuous bearing

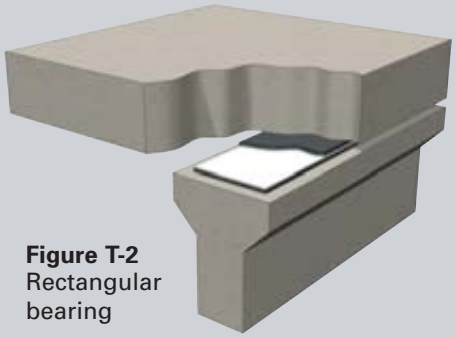


Figure T-2
Rectangular bearing

APPLICATIONS

This line of bearings fulfills the requirements for low profile inexpensive slide units. Series T bearings are used in buildings, parking garages, subways, etc., where slabs are supported on bearing walls or corbels. They are used under light loads and small movements while no rotation capacity is required.

MATERIALS

The PTFE meets the requirements of CAN/CSA-S6-06. Promene meets the requirements of the U.S. MIL-P-3054A.

DESIGN

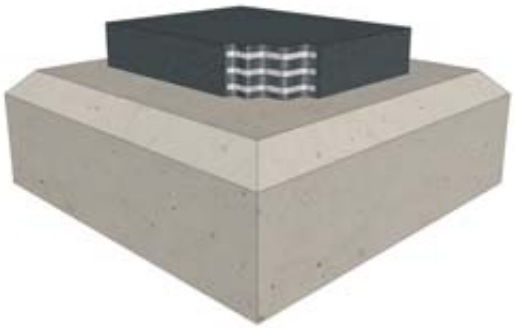
Loads vary according to the type of pad.

Selection	Description	Thickness (2 elements)	Maximum load
SERIES TP	Double layers of Promene	3 mm	4.8 MPa
SERIES TPE	Double layers of Promene covered with rubber on top and bottom	6 mm	4.8 MPa
SERIES TT	Double layers of PTFE	2 mm	7 MPa
SERIES TRR	Double layers of PTFE and rubber	5 mm	7 MPa

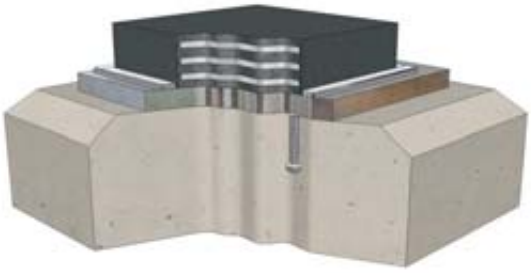
Table T-1

Bottom Connection Details

SERIES E, EL, ER, EF, ETL, ETR, ETF



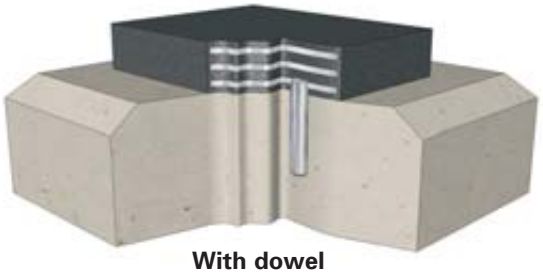
Without positive attachment



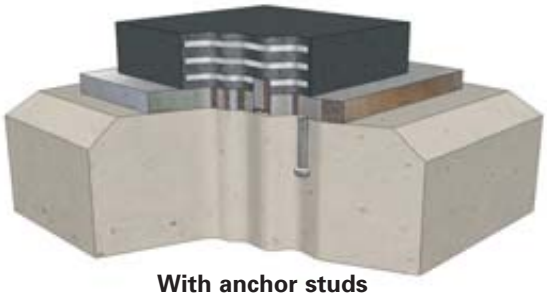
With keeper bars

Positive attachment without side load resistance

SERIES EL ONLY



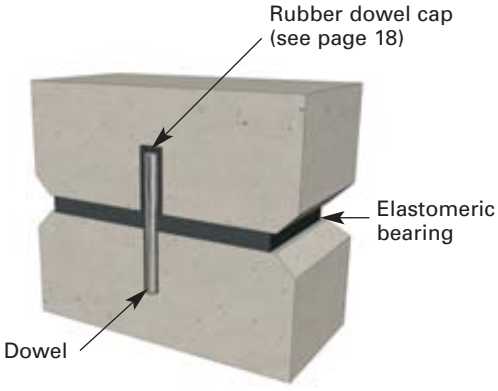
With dowel

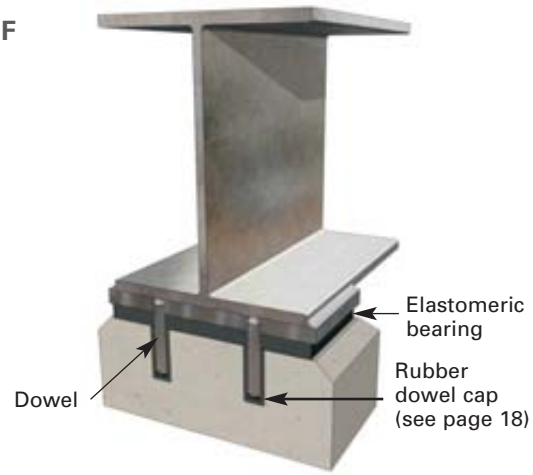


With anchor studs

Positive attachment without side load resistance

SERIES E, EL, ER, EF

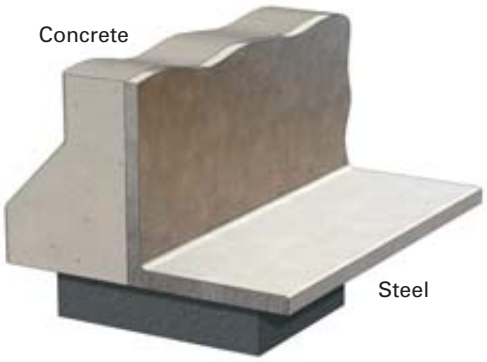




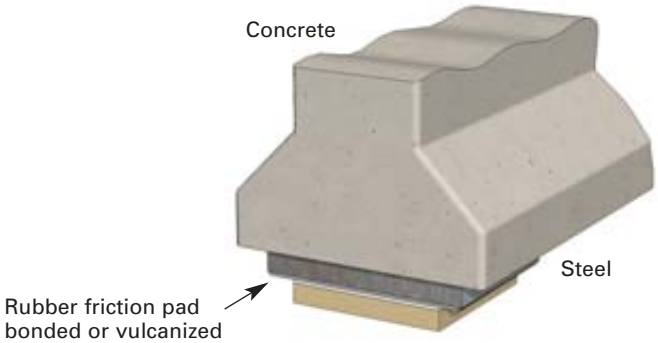
Positive attachment with side load resistance

Top Connection Details

SERIES E - EL - ER - EF

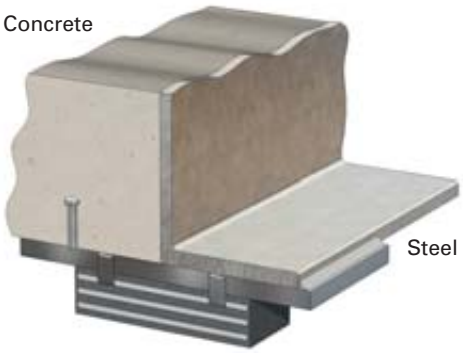


SERIES ETL - ETR - ETF

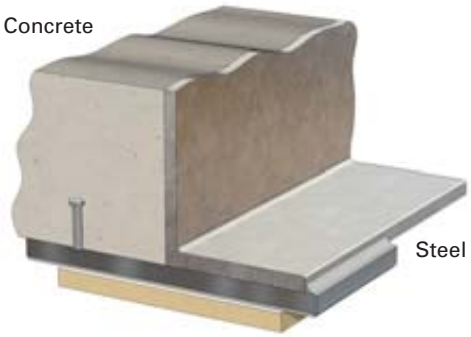


Without positive attachment

SERIE EL

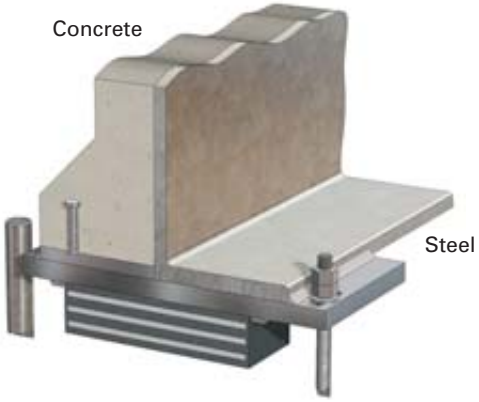


SERIES ETL - ETR - ETF

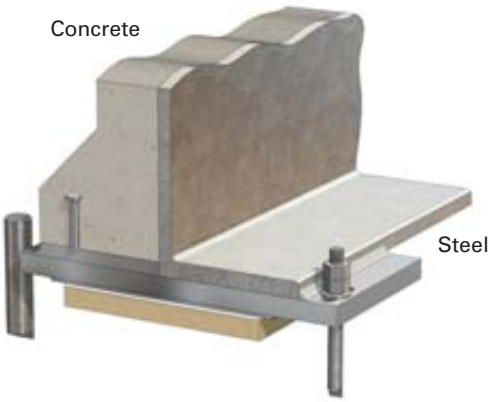


Positive attachment without side load resistance

SERIES E - EL - ER - EF



SERIES ETL - ETR - ETF



Positive attachment with side load resistance

Dowel Caps

APPLICATIONS

These caps allow vertical or rotational deflection of bearings and prevent spalling of the concrete around the pin.

They are made of the same high quality rubber as our bearing pads.

They are available for 32 mm and 38 mm (1¼ and 1½ in.) diameter dowels and in multiples of 150 mm (6 in.) in length.

Dimensions							
Metric (mm)				Imperial (in.)			
A	B	C	D	A	B	C	D
32	64	150	163	1 1/4	2 1/2	6	6 1/2
38	64	150	163	1 1/2	2 1/2	6	1 1/2

Tableau C-1

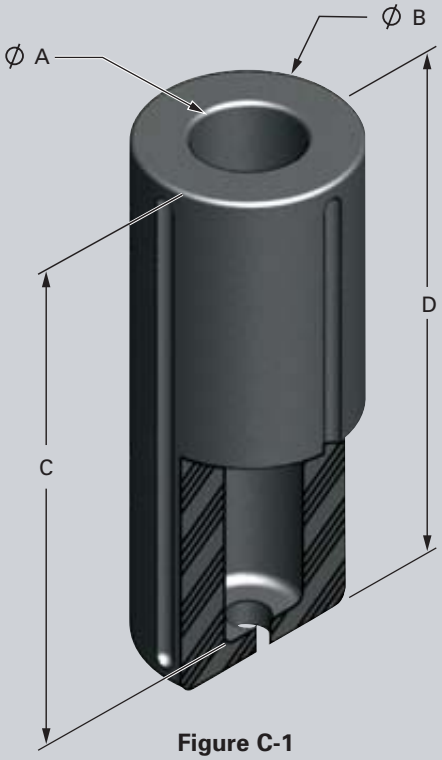


Figure C-1

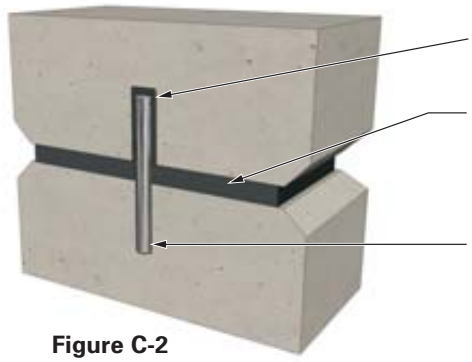


Figure C-2

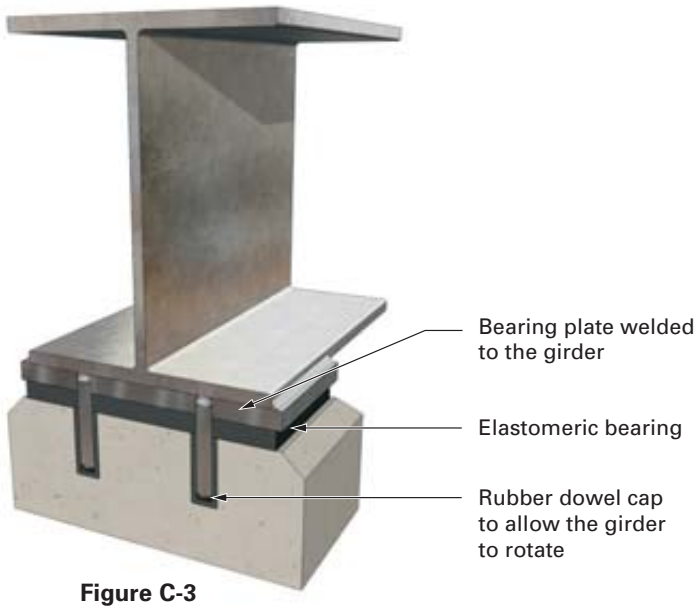


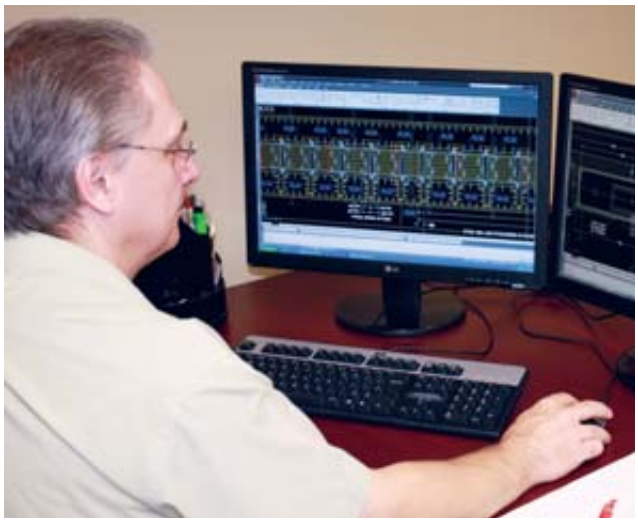
Figure C-3

Special Characteristics

QUALIFICATIONS

- W59:
  Welded steel construction
  (arc welding)
- W47.1, Division 1:
  Certification of companies
  for fusion welding of
  steel structures
- W186:
  Welding of reinforcing bars
  in reinforced concrete
  structures

CWB CERTIFIED
CSA W47.1



ENGINEERING, COMPUTER ASSISTED DESIGN
Our team of engineering and our technical design professionals are experts in AutoCad and SolidWorks.

IN-HOUSE AND LABORATORY TESTING
We are equipped to conduct the most complex and commonly requested tests to guarantee the conformity of our products.

QUALITY CONTROL
We have established a quality control system to respond to the strictest requirements of our clients.

FABRICATION
Our team of competent and experienced people uses cutting edge equipment to design and fabricate our products.

Elastomeric Bearings

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