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1202.01   SCOPE

This specification covers the requirements for Materials, design, and fabrication of plain and steel-laminated elastomeric bearings for bridges and for approach slab bearings and ballast wall bearings.

1202.01.01   Specification Significance and Use

This specification is written as a provincial-oriented specification. Provincial-oriented specifications are developed to reflect the administration, testing, and payment policies, procedures, and practices of the Ontario Ministry of Transportation.

Use of this specification or any other specification shall be according to the Contract Documents.

1202.01.02   Appendices Significance and Use

Appendices are not for use in provincial contracts as they are developed for municipal use, and then, only when invoked by the Owner.
Appendices are developed for the Owner’s use only.

Inclusion of an appendix as part of the Contract Documents is solely at the discretion of the Owner. Appendices are not a mandatory part of this specification and only become part of the Contract Documents as the Owner invokes them.

Invoking a particular appendix does not obligate an Owner to use all available appendices. Only invoked appendices form part of the Contract Documents.

The decision to use any appendix is determined by an Owner after considering their Contract requirements and their administrative, payment, and testing procedures, policies, and practices. Depending on these considerations, an Owner may not wish to invoke some or any of the available appendices.

1202.02 REFERENCES

When the Contract Documents indicate that provincial-oriented specifications are to be used and there is a provincial-oriented specification of the same number as those listed below, references within this specification to an OPSS shall be deemed to mean OPSS.PROV, unless use of a municipal-oriented specification is specified in the Contract Documents. When there is not a corresponding provincial-oriented specification, the references below shall be considered to be to the OPSS listed, unless use of a municipal-oriented specification is specified in the Contract Documents.

This specification refers to the following standards, specifications, or publications:

**Ontario Ministry of Transportation Publications**

Laboratory Testing Manual:
- LS-427 Method of Test for Compressive Deformation of Plain Bearings
- LS-428 Method of Test for Compressive Deformation of Laminated Bearings
- LS-429 Method of Test for Parallelism of Steel Laminates of Laminated Bearings

Structural Manual:
- Division 1 - Exceptions to the Canadian Highway Bridge Design Code CAN/CSA S6 for Ontario

**CSA Standards**

- S6-14 Canadian Highway Bridge Design Code

**ASTM International**

- D 395-16 Standard Test Methods for Rubber Property - Compression Set
- D 412-15a Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
- D 429-14 Standard Test Methods for Rubber Property - Adhesion to Rigid Substrates
- D 1149-16 Standard Test Method for Rubber Deterioration - Cracking in an Ozone Controlled Environment
- D 2240-15 Standard Test Method for Rubber Property - Durometer Hardness
American Association of State Highway and Transportation Officials (AASHTO)

M251-06 (2016) Plain and Laminated Elastomeric Bridge Bearings

1202.03 DEFINITIONS

For the purpose of this specification, the following definitions apply:

**Effective Elastomer Thickness** means the sum of the thickness of all layers of elastomer, excluding outer layers of laminated bearings.

**Elastomer** means a compound containing virgin natural polyisoprene (natural rubber) or virgin polychloroprene (neoprene).

**Laminated Bearing** means a bearing composed of elastomer laminates separated by and fully bonded to steel plates.

**Plain Bearing** means a bearing, which consists wholly of elastomer.

**Plan Dimension** means the dimensions of an object, when viewed perpendicular to the top of the object.

**Proposal** means a Contractor’s submission for which engineering design is required that provides a written:

a) Alternative to requirements specified by the Owner in the Contract Documents;

b) Course of action or undertaking by the Contractor as delegated by the Owner in the Contract Documents.

1202.04 DESIGN AND SUBMISSION REQUIREMENTS

1202.04.01 Design Requirements

1202.04.01.01 Design

The bearings, including any fasteners or dowels, shall be designed according to CAN/CSA S6 and the Structural Manual, Division 1.

1202.04.01.02 Elastomer Thickness

The effective elastomer thickness for plain bearings shall be greater than or equal to 15 mm and less than or equal to 25 mm.

1202.04.01.03 Steel Thickness

The thickness of the internal steel plates for laminated bearings shall be greater than 3 mm and less than 5 mm.

1202.04.02 Submission Requirements

1202.04.02.01 General

Within 30 Days of the Contract award, the name and address of the supplier and manufacturer of the bearings shall be submitted in writing to the Contract Administrator.
Proposals shall bear the seal and signature of the design and checking Engineers.

When another authority is involved, all submissions shall be made a minimum of 5 weeks prior to the commencement of work.

1202.04.02.02 Working Drawings

At least 1 week prior to commencement of bearing fabrication, 1 hardcopy set and 1 electronic PDF copy of Working Drawings for the bearings shall be submitted to the Contract Administrator for information purposes only. An Engineer shall affix his or her seal and signature on the Working Drawings verifying that the drawings are consistent with the Contract Documents and sound engineering practices.

A sealed and signed copy of these drawings shall be kept on site prior to and during the installation of the bearings.

These drawings shall clearly indicate the following:

a) Specified bearing design data (Dead Load and Total Load at SLS and ULS, movement at SLS, rotation at SLS).

b) The number and thickness of internal steel plates.

c) Compressive stiffness.

d) Shear stiffness at 20 °C and -40° C.

e) Bearing alphanumeric identification.

1202.04.02.03 Manufacturer’s Certification

Upon completion of fabrication and prior to installation of the bearings, with the exception of approach slab bearings and ballast wall bearings, a certificate of compliance signed by the manufacturer, shall be submitted to the Contract Administrator. The certificate of compliance shall include test results according to Table 1 and shall state that the fabricated bearings are according to the Working Drawings and Contract Documents.

1202.05 MATERIALS

1202.05.01 General

Reclaimed material shall not be incorporated in the finished bearing.

1202.05.02 Materials for Elastomeric Plain and Steel Laminated Bearings

1202.05.02.01 Steel

Internal steel plates for laminated bearings shall be rolled mild steel with a minimum yield strength of 230 MPa.
1202.05.02.02 Elastomers

Elastomers shall be according to the following:

a) Virgin natural polyisoprene or virgin polychloroprene elastomer shall be the only raw polymers permitted.

b) The physical properties of any polyisoprene and polychloroprene used shall be according to the requirements of Table 1.

1202.05.02.03 Compressive Deformation

Compressive deformation of laminated elastomeric bearings shall not exceed 0.05 of the effective elastomer thickness when tested according to LS-428 and this specification.

Compressive deformation of plain elastomeric bearings shall not exceed 0.06 of the effective elastomer thickness when tested according to LS-427 and this specification.

1202.05.03 Approach Slab Bearings and Ballast Wall Bearings

The physical properties of elastomer used for the manufacture of approach slab bearings or ballast wall bearings shall be according to the following:

a) Hardness, when tested according to ASTM D 2240 shall be 55 ± 5 Shore A.

b) Minimum tensile strength shall be 15 MPa, when tested according to ASTM D 412, Method A.

c) Minimum ultimate elongation shall be 400%, when tested according to ASTM D 412, Method A.

1202.07 PRODUCTION

1202.07.01 Plain Bearings

Plain bearing pads shall be moulded individually, cut from moulded strips or slabs of the required thickness, or extruded and cut to length.

1202.07.02 Laminated Bearings

Laminated bearings shall be moulded under pressure as a single unit and heated in moulds that have a smooth surface finish.

Steel plates shall be according to the following:

a) All steel plates shall be of uniform thickness.

b) Internal steel plates shall be free from sharp edges.

c) Steel plates shall be completely bonded on all surfaces to the elastomeric material during molding. The cover on the vertical side surfaces shall be 6 mm. The cover on the top and bottom surfaces shall be 5 mm, except that no cover is required over pintle holes.

d) When pinnles are specified in the Contract Documents, the depth of pintle holes shall be such that the pintle engages only one steel plate through the entire thickness of the plate.
Elastomer laminates shall be of uniform thickness.

**1202.07.03 Identification**

Each laminated elastomeric bearing shall be marked with the date of manufacture (i.e., yyyy-mm-dd) and an individual alphanumeric identification. The alphanumeric identification shall consist of the designated identification letter of the supplier and source followed by the letter I for polyisoprene or C for polychloroprene and a five-digit number. Bearings shall be sequentially numbered. The characters shall be not less than 10 mm in height, stamped or engraved into two adjacent sides, with the indentations or protrusions not less than 1 mm in width and 1 mm in depth.

Plain, approach slab and ballast wall bearings shall be marked every 1 m with the name of manufacturer, the date of manufacture, and the lot number.

**1202.07.04 Tolerances**

<table>
<thead>
<tr>
<th>Description</th>
<th>Tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bearing thickness ≤ 40 mm</td>
<td>0 to + 3 mm</td>
</tr>
<tr>
<td>Bearing thickness &gt; 40 mm</td>
<td>0 to + 6 mm</td>
</tr>
<tr>
<td>Bearing plan dimension</td>
<td>0 to + 6 mm</td>
</tr>
<tr>
<td>Thickness of individual layers of elastomer</td>
<td>± 20%</td>
</tr>
</tbody>
</table>

Deviation from plane parallel to theoretical surface:

- Top and bottom: 1 in 200
- Sides: 1 in 100

Steel laminates tested according to LS-429. 0.25 $T_e$

Cover to embedded steel on vertical side surfaces: -1 to + 4 mm

Cover to embedded steel on top and bottom surfaces: -1 to + 2 mm

Pintle hole diameter: 0 to + 2 mm

Position of pintle holes relative to each other: ± 2 mm

**1202.08 QUALITY ASSURANCE**

**1202.08.01 General**

Bearings shall be acceptable if they meet the requirements of this specification.

**12.02.08.02 Acceptance of Physical Properties of Elastomers for Laminated and Plain Bearings**

Bearings physical properties shall be acceptable if they meet the requirements of Table 1 of this specification.
1202.08.02.01  Retesting of Physical Properties of Elastomers for Laminated and Plain Bearing

The Contractor may request, in writing, retesting the physical properties of elastomers for any sample within five Business Days of receiving notification of rejection of the lot. Retesting shall be done on the remaining piece of sample representing the failed acceptance test result. The results of the retest shall be used for acceptance determination and shall be binding on both parties. If the retesting results in rejection of the lot, the Contractor shall bear the cost of the retesting. If the retesting results in the material passing all test criteria, the retesting charge shall be paid by the Owner.

1202.08.03  Acceptance of Compressive Deformation

1202.08.03.01  Compressive Deformation of Laminated Bearings

The method of testing bearings shall be according to LS-428. The increment in compressive deformation of laminated bearings shall not exceed 0.05 of the effective rubber thickness, when the bearing load is increased from an initial pressure of 1.5 MPa to a pressure of 7 MPa.

1202.08.03.02  Compressive Deformation of Plain Bearings

The method of testing of plain bearings shall be according to LS-427. The increment in compressive deformation of plain bearings shall not exceed 0.06 of the thickness of the bearing when the bearing load is increased from an initial pressure of 20% of the average pressure to the average pressure, and not greater than 7 MPa.

1202.08.03.03  Compressive Deformation Retesting

The Contractor may request, in writing, retesting of compressive deformation within five Business Days of receiving notification of rejection of the lot. Retesting shall be done on the same sample. The results of the retest shall be used for acceptance determination and shall be binding on both parties. If the retesting results in rejection of the lot, the Contractor shall bear the cost of the retesting. If the retesting results in the material passing all test criteria, the retesting charge shall be paid by the Owner.

1202.08.04  Acceptance of Approach Slab Bearings and Ballast Wall Bearings

Approach slab bearings and ballast wall bearings shall be acceptable if properties meet the requirements of this specification.
# TABLE 1
Physical Requirements for Polyisoprene and Polychloroprene

<table>
<thead>
<tr>
<th>Property</th>
<th>Test</th>
<th>Requirements</th>
</tr>
</thead>
</table>
| Shear modulus $G_{RT}$, MPa @ 20 °C (Note 1) | ASTM D 4014, Annex A1, as modified by AASHTO M251 | Polyisoprene: 0.80 ± 0.15  
Polychloroprene: 0.80 ± 0.15 |
| Shear modulus $G_{LT}$, MPa @ -40 °C (Note 2) | ASTM D 4014, Annex A1, as modified by AASHTO M251 | Not more than 3 times the value at room temperature  
$G_{LT} \leq 3 G_{RT}$ |
| Tensile strength, MPa | ASTM D 412, Method A | minimum 17.0  
minimum 17.0 |
| Ultimate elongation, % | ASTM D 412, Method A | minimum 400  
minimum 400 |
| Heat resistance | ASTM D 573 | 70 h at 70 °C  
70 h at 100 °C |
| Change in hardness, Shore A | ASTM D 2240 | maximum +10  
maximum +15 |
| Change in tensile strength, % | ASTM D 412, Method A | maximum -25  
maximum -15 |
| Change in ultimate elongation, % | ASTM D 412, Method A | maximum -25  
maximum -40 |
| Compression set, % (Note 3) | ASTM D 395, Method B | 22 h at 70 °C  
22 h at 100 °C |
| Ozone Resistance | ASTM D 1149, Method B, Procedure B1  
20% strain, 40 ± 2 °C | 25 pphm, 48 h  
no cracks  
100 pphm, 100 h  
no cracks |
| Peel bond test, N/mm | ASTM D 429, Method B | minimum 7.0  
minimum 7.0 |

Note:
1. Shear Modulus shall be determined at ambient temperature in accordance with ASTM D 4014 Annex A1 modified as follows: the initial cycles shall be taken to a strain of 0.7 and on the last cycle the shear modulus shall be determined at 0.5 strain.
2. Shear Modulus testing shall be performed with the test specimen in an enclosed freezer unit capable of maintaining the specified conditioning temperature. A ± 25 percent strain cycle shall be applied for a period of 100 seconds. The first three-quarter cycle of strain shall be discarded and the stiffness shall be determined by the slope of the force deflection curve for the next half cycle of loading.
3. All test specimens of steel laminated bearings used for compression set test ASTM D 395, Method B, shall be prepared from the representative bearing pads and may consist of a single layer or multiple layers of elastomer.
Appendix 1202-A, November 2016
FOR USE WHILE DESIGNING MUNICIPAL CONTRACTS

Note: This is a non-mandatory Commentary Appendix intended to provide information to a designer, during the design stage of a contract, on the use of the OPS specification in a municipal contract. This appendix does not form part of the standard specification. Actions and considerations discussed in this appendix are for information purposes only and do not supersede an Owner’s design decisions and methodology.

Designer Action/Considerations

No information provided here.

Related Ontario Provincial Standard Drawings

No information provided here.