

# Special Specification 4005

## Modular Bridge Joint System



### 1. DESCRIPTION

Design, fabricate, test, and install a modular bridge expansion joint system consisting of multiple elastomeric seals, center beams, edge beams, and support bars.

### 2. GENERAL REQUIREMENTS

Provide a fully assembled system conforming to latest AASHTO LRFD Bridge Design Specifications and accommodating the movements indicated on the plans. Turn the center beams and edge beams up into the parapet as shown in the plans. Provide the joint system as one continuous unit without field splices, with seals unless installed, unless otherwise approved. Limit the movement range of the joint seals to 3 in. Do not use box-type seals.

- 2.1. Provide elastomeric seals that:
- are mechanically held in place by steel edge beams and center beams;
  - are supplied and installed in one continuous piece, without splices;
  - are installed using a seal lubricant-adhesive;
  - have a shape that promotes self-removal of debris during normal operations and uses multiple cells and a double web; and
  - do not protrude above the top of joint.
- 2.2. Provide center beams that:
- are individually supported by independent support bars that are welded to the center beams and
  - incorporate an equidistant control system that ensures uniform spacing of the seals and develops its maximum compressive force when the joint is at its maximum opening.
- 2.3. Provide support bars that:
- incorporate stainless steel sliding surfaces welded to the support bar and
  - are suspended over the joint opening by sliding elastomeric bearings.

### 3. MATERIALS

- 3.1. General Requirements. Galvanize steel components in accordance with Item 445, "Galvanizing." Hardware used for temporary support during construction need not be galvanized. Do not use aluminum components.
- 3.2. Metals. Furnish metals in conformance with Item 442, "Metal for Structures," and the following:
- Provide ASTM A 709, Grade 50, 50S, 50W, or HPS 50W steel for center beams, edge beams, and support bars.
  - Provide ASTM A 240, Type 316 stainless steel with 2B finish for cladding the sliding surfaces of the support bars. Use 16-gauge minimum thickness. Protect finished surfaces from damage during fabrication, shipment, and installation.
- 3.3. Seals, Bearings, and Springs. Provide seals with durometer, a hardness range between 55 and 70 in accordance with ASTM D 2240, minimum tensile strength of 2,000 psi, and elongation at break of 250% in

accordance with ASTM D 412 and compression set at 72 hr. at 212°F of 40% in accordance with ASTM D 395.

Provide slide bearings and precompressed springs fabricated as steel reinforced elastomeric pads with a polytetrafluoroethylene (PTFE) sliding surface. Provide elastomer formulated from previously unvulcanized 100% virgin polychloroprene rubber polymers meeting the material property requirements of AASHTO M 251, Table 1. Do not use components manufactured from polyurethane compounds. Furnish PTFE material that is 100% virgin Teflon®, woven PTFE fabric, or dimpled PTFE conforming to the requirements of ASTM D 4894 or D 4895 and other requirements of the *AASHTO LRFD Bridge Design Specifications*.

- 3.4. High-Strength, Nonshrink Grout. Use high-strength nonshrink grout to fill the gap, when less than 3 in., below the bottom of the expansion joint's support boxes. Provide 5,000 psi minimum compressive strength.
- 3.5. Concrete. Furnish the same class of concrete used for the bridge deck to cast the blockout.

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## 4. CONSTRUCTION

- 4.1. Fabrication. Submit shop drawings and design calculations bearing the seal of a licensed professional engineer, and fabricate the joint system in accordance with Item 441, "Steel Structures," and the requirements of this Item. Fabricate and ship the expansion joint set to a mean temperature of 70°F. Test and design structural elements following the guidelines provided in NCHRP Report 402 "Fatigue Design of Modular Bridge Expansion Joints," as well as the provisions of the *AASHTO LRFD Bridge Design Specifications*.
- 4.1.1. Shop Drawings. In addition to the requirements of the standard specifications, include:
- plan elevation and section of the joint system for each movement range and roadway width, showing dimensions and tolerances;
  - step by step installation procedure for the joint and seals including adjustments for temperature;
  - all ASTM, AASHTO, or other material designations;
  - details for temporary attachment to the superstructure;
  - bridge rail cover plate details;
  - lifting locations and mechanisms for shipping, handling, and setting; and
  - welded center beam splices.
- 4.1.2. Design Calculations. Provide design calculations for all structural elements. Include a fatigue design and a strength design when appropriate for all structural elements and connections.
- 4.2. Installation. Follow the procedures outlined on the shop drawings. Form a blockout in the slab for the expansion joint conforming to the plans and approved shop drawings. Install the joint system after the beams have rotated due to the slab placement to ensure that the support boxes are parallel to the support bars. Do not use curing compound or deck sealers on the surface of the blockout.

Thoroughly clean the blockout surfaces prior to installing the expansion joint. Adjust the setting dimensions, once in place, to the average daily temperature by means of prestressing devices furnished by the manufacturer and that accompany the expansion joint assembly to the jobsite. Follow the manufacturer's instructions shown on the shop drawings. Set and carefully shim the expansion joint system line and grade until the joint's uppermost plane matches the finished roadway profile. Positively fix the edge beams and support boxes in position by anchorage to concrete, welding, or other methods approved by the Engineer. The joint system must be fully operational before the blockout is filled with concrete. Completely fill the gap between the support boxes and the blockout with concrete or high-strength grout if the gap between the bottom of the support box and top of the supporting superstructure is less than 3 in. Use methods and equipment recommended by the grout manufacturer and approved by the Engineer. Place and thoroughly compact the blockout concrete to ensure adequate concrete consolidation around all joint elements. Finish and cure the concrete in the same manner as the concrete deck. Remove all forms and debris from the seals and between the edge beams after the concrete is cured.

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**5. MEASUREMENT**

Modular bridge joint systems will be measured by the foot along the centerline of the joint at the surface of roadway and up into the parapet.

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**6. PAYMENT**

The work performed and materials furnished in accordance with this Item and measured as provided under "Measurement" will be paid for at the unit price bid for "Modular Bridge Joint System" of the size (minimum total movement capacity) specified. This price is full compensation for furnishing materials, services, labor, tools, equipment, and incidentals necessary to design, fabricate, inspect, test, and install the expansion joint system as specified.