



**DEVELOPMENTAL SPECIFICATIONS  
FOR  
MODULAR EXPANSION JOINT ASSEMBLY**

**Effective Date  
October 17, 2023**

**THE STANDARD SPECIFICATIONS, SERIES 2023, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.**

**23014.01 DESCRIPTION.**

This work shall consist of furnishing materials, services, labor, tools, equipment and incidentals necessary to design, fabricate, inspect, test, certify and install the Modular Expansion Joint Assembly (MEJA) as specified herein. Additionally, this work will consist of the design, detailing and submittal of calculations and drawings for reinforcing steel required in the modular joint blockout in the bridge slab and if applicable in the bridge abutment backwalls. Minimum reinforcing requirements are provided in the design plans. The Contractor's engineer shall design and detail reinforcing meeting or exceeding these minimum requirements. The fabrication and installation of the galvanized barrier rail cover plates is also included herein. Contractor shall submit details of the barrier rail conduit expansion fitting in conjunction with the modular joint and barrier rail cover plate details for simultaneous review.

**A. General Requirements.**

1. Contractor shall provide a MEJA to accommodate the design movements. Contractor shall provide a MEJA that is either a single support bar system with sliding yokes or a welded multiple support bar system furnished by one of the approved manufacturers listed in [Materials I.M. 557, Appendix G](#).
2. Contractor shall provide a MEJA with a single layer preformed elastomeric seal mechanically held in place by steel edge beams and center beams. Support the center beams on individual support bars for a welded multiple support bar system or on common support bars for a single support bar system. Allow for a maximum of 3 inches of movement in each elastomeric seal. Suspend the support bars over the joint opening using support boxes with internal sliding elastomeric bearings. For a welded multiple support bar system, a large support box to enclose the multiple support bars will be permitted. Control the joint opening with equidistant mechanisms that develop their maximum compressive force at the widest joint opening. In addition to any support of the joint from above prior to concreting, support the MEJA in the blockout from below with a positive support system at each support box designed to level the joint to the proper grade and slope.

## **B. Design and Testing Requirements.**

1. The MEJA shall be designed in accordance with the AASHTO LRFD Bridge Design Specifications, 7<sup>th</sup> edition, plus current interims, including the modifications and exceptions noted herein.
2. Fabrication and construction shall be in accordance with the AASHTO LRFD Bridge Construction Specifications, 3rd edition, including the modifications and exceptions noted herein.
3. Prior to fabrication, submit complete details of the MEJA together with an installation and water tightness plan to the Engineer for approval. The following information shall be included in the submittal:
  - a. Complete reinforcing bar layout for the expansion joint blockouts based on the reinforcing layout and limitations provided in the plans. Integrate this layout with bars extending from the deck slab and if applicable the abutment backwall. The minimum reinforcing steel in the top of the blockout shall be No. 5 (No. 15) bars at 12 inches on center, in both directions. Provide complete details of the blockout reinforcing on design and shop drawings.
  - b. Plan and section views of the MEJA showing dimensions and tolerances. Provide a minimum of 3/8 inch material thickness for all structural steel elements.
  - c. Provide support boxes with a minimum steel thickness for 3/8 inch. For support boxes wider than 16 inches, provide a width to thickness ratio not to exceed 45.
  - d. Design and detail support bar bearing locations to provide adequate bearing stress resistance and avoid excessive edge loading of the blockout concrete. Provide calculations detailing satisfaction of this requirement.
  - e. In addition to the design requirements of AASHTO LRFD 14.5.6.9.4, design the support boxes to transfer stresses from wheel loads applied to the top surface of the box in the blockout areas and transferred through the box to the supporting concrete. Use the AASHTO LRFD tandem axle loads for the Strength Limit State design. Fatigue loading is in accordance with AASHTO 14.5.6.9.4. For the distribution of wheel loads to the support boxes, perform design calculations using a contact area measuring 20 inches (500 mm) wide and 10 inches long in accordance with AASHTO LRFD 3.6.1.2.5. Do not assume any benefit to load distribution from the concrete cover. Apply impact as required for the Strength and Fatigue Limit States.
  - f. Design the joint at the Strength Limit State for effects of snowplow loading in accordance with the requirements of AASHTO LRFD 14.5.1.2.
  - g. Detail all welded and bolted center beam or support bar joints and all shop or field splices.
  - h. When support bars are welded to center beams, use complete penetration groove welds and ultrasonically test 100% of the welds.
  - i. Provide complete details of all components and assemblies incorporated into the MEJA.
  - j. Provide all ASTM, AASHTO or other material designations.
  - k. Provide details of shipping, lifting, support and alignment details.
  - l. Provide temperature adjustment data in accordance with values shown in the plan drawings.
  - m. Provide a certificate of compliance with the AISC Quality Certification Program for Simple Steel Bridges for vendor-fabricated joints. Provide a certificate of compliance with the AISC Quality Certification Program for Major Steel Bridges for joints fabricated using third-party fabricators.
  - n. Provide certification that welding inspectors have current certification under AWS QC1, Standard for Qualification and Certification of Welding Inspectors.
  - o. Document that nondestructive test technicians are certified by ASNT.
  - p. Provide Manufacturer's certificate of compliance for PTFE sheet / fabric.
  - q. Provide sealed engineering drawings and calculations prepared by a Professional Engineer licensed in the State of Iowa for the proposed MEJA including designs for both

the Fatigue and Strength Limit States as described by AASHTO LRFD Bridge Design Specifications, 6th Edition, Section 14.5.6.9 and referenced articles therein. At a minimum, all AASHTO requirements will be followed.

- r. Provide test data and reports indicating the joint type, including all structural details, has been tested for compliance with NCHRP 402 – “Fatigue Design of Modular Bridge Expansion Joints.” Provide certification that the design to be furnished has passed the requirements of the Opening Movement and Vibration Test (OMV), the Seal Push Out Test (SPO) and the Fatigue testing requirements of AASHTO LRFD Bridge Construction Specifications, 3rd Edition, Chapter 19, Appendix A, as verified by an independent testing agency.
  - s. Provide a manufacturer’s recommended maintenance and repair plan for the MEJA for review and approval of the Engineer. The plan should include a detailed description of recommended and required maintenance activities including maintenance inspection requirements, wear tolerances, methods for determining wear or deterioration, and procedures for replacing worn parts.
  - t. Detail any temporary bridging that may be required to allow construction traffic to cross the joint prior to complete installation. If construction traffic will not be permitted to cross the joint, include this in the installation plan as a restriction on operations.
  - u. Provide final accepted versions of all of the above documents to the Contracting Authority on a CD-ROM in Adobe Acrobat PDF format at the completion of the project.
4. In addition to a required longitudinal movement range as specified in the plan drawings for each location, provide a joint having the additional movement capabilities:
- Transverse movement, 1.0 inch.
  - Vertical movement, 1.0 inch.
  - Rotation about longitudinal axis, 1 degree.
  - Rotation about transverse axis, 1 degree.
  - Rotation about vertical axis, 1/2 degree.

#### **23014.02 MATERIALS.**

Furnish materials new and without defects. Remove defective materials from the jobsite at no additional cost. Materials for MEJA shall consist of the following:

- A. **Blockout Concrete:** High Performance Structural Concrete, or as specified.
- B. **Reinforcing Steel:** Epoxy Coated, [Section 4151](#) of the Standard Specifications.
- C. **Preformed Neoprene Strip Seal and Lubricant Adhesive:** [Section 4136](#) of the Standard Specifications and AASHTO M 220.
- D. **Structural Steel:** Section 4152 of the Standard Specifications, hot dip galvanized per [Materials I.M. 557, Appendix G](#).
- E. **Stainless Steel:** ASTM A 240 Type 304, with 2B finish.
- F. **Stainless Steel Mating Surfaces:** ASTM A 240/A 240M Type 304. Minimum No. 8 mirror finish for mating surface. Minimum 16 gauge thickness for the stainless steel plate.
- G. **PTFE:** 100% virgin Teflon, woven PTFE fabric or dimpled PTFE, AASHTO Section 18.8, Division II.
- H. **Bolts, Nuts, Washers and other hardware:** Shall conform to the requirements of [Materials I.M. 557, Appendix G](#) including galvanizing.
- I. **Urethane Foam:** ASTM D 3574.

- J. Springs, bearings, and equidistant devices to be the same material composition and formulation, Manufacturer, fabrication procedure, and configuration as those used in the prequalification tests.

**23014.03 CONSTRUCTION.**

- A. Fabricate the modular expansion joint assembly at facilities owned and operated by the manufacturer that is responsible for the design of the joint assembly. The facility must have a current AISC Simple Steel Bridge Certification. Alternately, provide a joint fabricated by an AISC Major Steel Bridge Certified fabricator with experience in fabricating MEJA's. Provide written certification of the fabricators experience. Provide welding conforming to ANSI/AASHTO/AWS Bridge Welding Code D1.5-2008.
- B. Fabricator shall thoroughly clean and remove excess galvanizing material from interior portions of steel extrusions prior to installing elastomeric seals.
- C. Remove all debris from the concrete blockout prior to placing the concrete. Protect the joint blockout and MEJA from damage during all phases of construction. Use bridging to span the joint blockout during construction. Submit details of the bridging to the Engineer for approval.
- D. Damage to the joint system during shipping, handling or installation shall be cause for rejection of the system.
- E. Repair damage to the corrosion protection system to the satisfaction of the Engineer.
- F. Design the MEJA, fabricate and deliver to the job site as a continuous unit. Field welding of the MEJA is not permitted.
- G. Provide single piece seals. Seals will be installed in the shop, except when indicated otherwise. No splices are permitted. Joint seals are not permitted to extend above the joint. Design and detail the joint to allow for seal removal and replacement with a minimum of 1.25 inch space between adjacent center beams.
- H. Provide edge beams and center beams machined or extruded to form the required profile. Multiple pieces welded to form the profile or bent / crimped to form the required profile are not permitted.
- I. Coordinate upturns at the exterior gutter lines with the barrier rail cover plate and conduit expansion and fitting details.
- J. Provide a minimum of 3 inches of concrete cover above the top of the joint support boxes. As a minimum, install rebar in the blockout as directed on the plans. Provide a minimum of 2 inches of concrete under the support boxes. Provide a minimum of 2 inch clear cover to support boxes and anchor studs to the vertical face of the blockouts. Coordinate these requirements with the design and detailing of the blockouts and girder end copes. Blockout dimensions shall be reduced or enlarged as necessary to accommodate a particular joint design. Modify girder and if applicable the abutment backwall design accordingly if blockout dimensions and support slab details are to be changed. Submit calculations and drawings documenting all proposed changes from the as-designed drawings. Calculations and drawings shall be sealed by a Professional Engineer licensed in the State of Iowa.
- K. Furnish a joint such that the bearings and slide assemblies are removable and replaceable.
- L. Install the joint system in strict accordance to the manufacturers recommendations. A minimum of 2 weeks preceding installation of the first joint, furnish to the representative, three copies of a detailed installation plan and instructions.

- M. Arrange for an employee of the joint manufacturer to be present during installation of the joint to assist with any technical or construction issues. Adhere to all recommendations made by the manufacturer representative made both on site and off site. Arrange for the Manufacturer's representative to certify to the Contracting Authority in writing that the installation adheres to the manufacturers recommended installation procedures.
- N. Furnish a system to expand or compress the joint system evenly to the desired joint opening for given installation temperatures. Temperatures correspond to structure temperature, not air temperature. Final adjustment of the joint opening shall be based on the manufacturer's recommendation immediately prior to placing the blockout concrete. Use a temperature sensing device to measure the slab temperature on the lower surface of the slab at both ends of the blockout. Use an average of these readings to determine the structure temperature at time of installation. Adjust the joint based on these structure temperature readings.
- O. Align the joint to the roadway grade and cross-section. Install the joint flush with the top of deck.
- P. Provide a level top of joint allowing no more than 1/8 inch differential elevation between any center beams and the edge beams measured using a straight edge between the two edge beams.
- Q. Provide uniform gaps for all joint seals. The allowable difference in gaps at either end of a joint seal is 1/2 inch maximum.
- R. To reduce corrosion potential, electrically isolate the MEJA by not connecting the bridge deck reinforcement to the MEJA.
- S. Place concrete to completely fill the blockout. Thoroughly consolidate the concrete under the support boxes to completely fill the area. Do not use vibrators to move concrete. Prevent concrete from entering inside the support boxes or otherwise interfering with the proper operation of the joint system. Prior to placing the blockout concrete, coat all existing concrete with an approved bonding compound.
- T. Do not allow construction vehicles to apply live load to the joint for a period of 72 hours. Use bridging to allow for passage of construction vehicles.
- U. **Leak Testing.**
  - 1. After installation of all neoprene glands at one modular expansion joint, the contractor shall perform watertight integrity tests at the deck level to detect any leakage. The tests are to check for leakage at the upturned ends of the expansion device and for leakage along the expansion device across the deck. The contractor may conduct a single test of the entire device including upturned ends or may conduct separate tests of upturned ends and one or more tests of overlapping lengths between the upturned ends.
  - 2. At each upturned end of the expansion device, the contractor shall block out on the deck at least 3 feet of the expansion device leading to the upturned end and flood the area. A minimum water depth of 3 inches shall be maintained at the gutter line for at least 30 minutes. During the test, the inspector shall observe for any overflow at the upturned end. At the conclusion of the test the inspector will examine the underside of the joint for leakage. The expansion device is considered watertight if the inspector observes no overflow during the test and if no dripping water or water droplets are visible in the underdeck areas near the upturned end.
  - 3. The contractor shall test the expansion device between upturned ends by blocking out and covering the device with ponded or flowing water to a depth of at least 1 inch at all points, for at least 30 minutes. Vertical curb surfaces may be tested with an unnozzled hose delivering

approximately 1 gallon per minute directed to flow over the entire curb height for 30 minutes. At the conclusion of the test, the inspector will examine the underside of the joint for leakage. The expansion device is considered watertight if no dripping water or water droplets are visible in the underdeck areas along the full length of the expansion joint. Damp concrete that does not show dripping water or water droplets is not considered a sign of leakage.

4. If the expansion device leaks at an upturned end or along its length, the contractor shall locate the leak(s) and take repair measures to stop the leakage. The repair measure's shall be as recommended by the manufacturer and approved by the engineer prior to beginning corrective work.
5. If measures to eliminate leakage are taken, the contractor shall perform subsequent watertight integrity tests subject to the same conditions as the original test.

**23014.04 METHOD OF MEASUREMENT.**

- A. Modular Expansion Joint Assembly will be paid for in linear feet at the quantity shown in the contract documents.
- B. Modular Expansion Joint Assembly Leak Testing will be paid for by count at the quantity shown in the contract documents.

**23014.05 BASIS OF PAYMENT.**

- A. The contract unit price for the Modular Expansion Joint Assembly will be full and complete payment for all materials, labor, tools, equipment, inspection, services, and incidentals necessary to furnish and install the modular expansion joint assemblies as specified and at the locations shown in the plans. Also included are the design, detailing and construction of the MEJA blockout including required submissions to the Engineer as well as fabrication and installation of the galvanized barrier rail cover plates.
- B. The contract unit price for Modular Expansion Joint Leak Testing will be full and complete payment for all labor, tools, equipment, services, and incidentals necessary to test each modular expansion joint, perform repairs if needed, retest following any repairs, and performing an additional leak test immediately preceding the final inspection of the bridge.