DMS-4510, Mechanical Couplers for Reinforcing Steel

Overview


This Specification must govern for the materials, composition, quality, assembly, sampling, testing of mechanical couplers, and describes the approval procedures and the Material Producer List (MPL).

Notice to Suppliers

All suppliers are hereby notified that any mechanical coupler to be used on a project must be on the list of Prequalified Mechanical Couplers. Project samples are also required for testing before use on the project.

Pre-approval

The requirements for the producer to obtain pre-approval:

♦ Initial contact and all correspondence should be sent to the Texas Department of Transportation, Construction Division, Director of Materials & Pavements Section (CP51), 125 East 11th Street, Austin, Texas 78701-2483.

♦ Furnish information and samples to the Texas Department of Transportation, Construction Division, Director of Materials and Pavements Section, 9500 Lake Creek Parkway (CP51), Austin, Texas 78717:
  • completed Form 1818 (a.k.a. Form D-9-USA-1), ‘Material Statement,’ with the proper attachments in accordance with the Department’s Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, Item 6, Article 1.A., “Buy America”
  • certified test reports showing the couplers meet all of the specified requirements
  • written instructions (see Note) that the manufacturer provides to machine shops for operations such as threading or swaging reinforcing steel, for each type, model, and bar size and grade that the coupler assembly is designed for
  • written assembly and installation instructions (see Note) that the manufacturer provides to construction projects for each type, model, and bar size and grade that the coupler assembly is designed for
  • a sample of 4 fully assembled coupler assemblies for each type, model, and bar size and grade that the coupler assembly is intended for that the manufacture desires for pre-approval

Note: These instructions must include a list of required tools, bar preparation and necessary torque ranges for proper assembly and installation.
**Note 1:** The connecting reinforcing steel must meet the requirements of ASTM A 615/A 615M Grade 60 or 75 (420 or 520). Do not mix bar grades unless it is intended to be used that way on a project.

**Note 2:** The connecting bars should be straight and uniaxial with each other and with the body of the coupler.

**Note 3:** Bent bars or bars that are not uniaxial can cause erroneously large slip readings as the action of straightening the bar during the performance of the slip test is measured as slip by the slip measuring device.

- one completely unassembled coupler body for the initial pre-approval only

**Note:** When the connecting reinforcing steel is threaded, furnish the threaded connecting bars; otherwise, do not furnish the connecting reinforcing steel with the unassembled coupler body.

- mill test reports for each size and grade of reinforcing steel used for the connecting bars and
- a breakdown of the format used for the die stamping. If the formatting of the die stamping changes, please provide the new breakdown of the format to the Director of Materials & Pavements Section (CST/M&P).

Any changes in materials, design or details on pre-approved couplers will require a new submittal for pre-approval.

- For each type, model, and bar size and grade, the Department will test the 4 assembled specimens in accordance with the Department’s, “Tex-743-I, Testing Mechanical Couplers for Slip, Fatigue, and Tensile Strength” (see Note). The Department will test 2 using the Slip Test and Tensile Strength Test, and will test the other 2 using the Slip Test, Fatigue Loading, and Tensile Strength Test.

**Note:** Please contact CST/M&P for more information on this test method.

- Pre-approved mechanical couplers will be re-approved for each 2-yr. period for the coupler to remain on the list. For each type, model, and bar size and grade of coupler, each project sample meeting ‘General Requirements’ is considered a sample for pre-approval.

**Disqualification**

For each type, model, and bar size and grade of coupler, the Department will remove a producer from the pre-approved list when:

- two consecutive project and/or random samples of the same type, model, and bar size and grade of coupler fail to meet the requirements, or
- if the coupler fails to meet the testing or requirements stated in this specification.
Re-approval

Any producer or material removed from the pre-approved list for any of the above reasons may be re-approved in no less than 1 year from the time of disqualification. Any producer requesting re-approval in less than 1 year from the date of disqualification must bear all costs.

Random Sampling and Testing

The Department reserves the right to conduct random sampling and testing of previously approved materials and to perform random audits of test reports. Department representatives may sample material from the manufacturing plant, machine shop, assembly location, the project site, and the warehouse. CST/M&P reserves the right to test samples to verify compliance with this Specification.

General Requirements

All mechanical couplers must be uniaxial design and must be one of the following types or a combination of the following types:

♦ sleeve-filler
♦ sleeve threaded
♦ sleeve swaged
♦ sleeve-bolted.

Each component of each mechanical coupler must be die-stamped with the bar size and grade for which the coupler is designed, model and manufacturer’s identification, production lot number, and date of manufacture. Do not die-stamp the reinforcing steel.

Any person that machines, assembles, or installs the couplers must properly follow the instructions provided by the manufacturer.

Slip

The total average slip must not exceed 0.010 in. (0.25 mm) for No. 14 (No. 43) bars and smaller or 0.030 in. (0.75 mm) for No. 18 (No. 57) bars measured between reference points placed on opposite ends of the coupler. The reference points must be established between 0.5 and 1.5 in. (10 to 40 mm) clear of the coupler body on the connecting bars.

The total average slip must be determined as follows:

♦ Load the coupler assembly to 30,000-psi (210-MPa) compressive stress in the smallest size connecting bar. Note: The rate of loading during the Slip Test must be between 10,000 and 100,000 psi (70 and 700 MPa) of stress per minute realized in the smallest size connecting bar.
Zero the gauges on the slip measuring device.

Load the coupler assembly to 30,000-psi (210-MPa) tensile stress in the smallest size connecting bar and hold for 30 sec.

Unload to 3,000-psi (21-MPa) tensile stress in the smallest connecting bar and hold until the gauges can be read.

Read the measurement gauges and average the results. This is the total average slip.

**Fatigue Loading**

Fatigue load a coupler from 5000-psi (35-MPa) tension to 30,000-psi (210 MPa) tension for 80,000 cycles using a sine wave form at a maximum frequency of 5 cycles per second.

The frequency of the fatigue load may be varied within limits of ASTM “E 466, Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials” or “E-606, Standard Practice for Strain-Controlled Fatigue Testing” to accommodate available test equipment.

**Tensile Strength**

After fatigue loading or not, the coupler specimen must develop at least 125.0% of the nominal yield strength in tension of the smallest size connecting bar. The rate of loading in the tensile strength test must be the same as that specified in the slip test.

**Sampling on Construction Projects**

The Department will use the following sampling and testing requirements for mechanical couplers.

*Note: Pre-approved mechanical couplers will be tested before use on each construction project.*

Prior to sampling, the manufacturer completes and submits to the Engineer:
- the original, notarized Form 1818 (a.k.a. Form D-9-USA-1), “Material Statement” with the proper attachments, in accordance with Article 6.1.A., "Buy America" and
- the written installation instructions previously obtained from the manufacturer. These instructions must be specifically for the coupler type, model, and bar size and grade in use.

Provide the name and address of any machine shops that threaded or swaged reinforcing steel.

If more than one lot of couplers is sampled from a project, coupler specimens must be identified with tags or markings identifying the sample lot the samples were taken.

The Engineer must select, at random, 4 couplers from each sample lot. These 4 couplers are considered test specimens.
Each connecting reinforcing steel bar of the test specimen must be representative in bar size and grade to the in-place installation of the couplers.

To demonstrate the Contractor staff’s ability to properly assemble the coupler, the Contractor’s staff must assemble the test specimens in the presence of the Engineer.

- The connecting bars should be as straight and as uniaxial with each other and with the body of the coupler as possible.
- Bars that are bent or that are not uniaxial can cause erroneously large slip readings as the action of straightening the bar during the performance of the slip test is measured as slip by the slip measuring device.

Submit the coupler specimens to Texas Department of Transportation, Construction Division, Materials and Pavements Section, 9500 Lake Creek Parkway, Austin, Texas 78717 for testing. CST/M&P will not test unassembled couplers.

Before the sample lot of couplers can be used, the coupler specimens must be tested and approved in accordance with Tex-743-I (contact CST/M&P for more information on this test method).

The definition of a sample lot is 500 couplers or fraction thereof, for each type, model, and bar size and grade of coupler.

**Testing Project Samples**

The Department will test, in accordance with “Tex-743-I, Testing Mechanical Couplers for Slip, Fatigue, and Tensile Strength” (contact CST/M&P for more information on this test method), 2 to 3 specimens using the Slip Test and Tensile Strength Test and 1 to 2 specimens using the Slip Test, Fatigue Loading, and Tensile Strength Test.

If any of the specimens representing a sample fails to meet any of the requirements, four additional couplers from the sample lot will be required for testing.

Two specimens will be tested using the Slip Test and Tensile Strength Test and the other 2 specimens will be tested using the Slip Test, Fatigue Loading, and Tensile Strength Test, all in accordance with “Tex-743-I, Testing Mechanical Couplers for Slip, Fatigue, and Tensile Strength.”

If all 4 additional specimens meet the requirements, the sample lot will be accepted for use in the work.

If any of the 4 additional specimens fail to meet the requirements, that sample lot of couplers will be rejected and not used in the work.

**Archived Versions**

The following archived versions of "DMS 4510, Mechanical Couplers" are available: