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REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
OFFICE OF THE SECRETARY
MANILA

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DEPARTMENT ORDER)

SUBJECT: DPWH Standard Specification for
Item 737 – Mechanical Couplers
for Reinforcing Steel

113)

No.)

Series of 2016)



In line with the mandate of the Department in providing effective standard specifications in the implementation of various infrastructure projects and in view of the need of setting a standard specification for mechanical coupler, the attached **DPWH Standard Specification for Item 737 – Mechanical Couplers for Reinforcing Steel** is hereby prescribed, for the guidance and compliance of all concerned.

This specification shall form part of the revised 2012 edition of the DPWH Standard Specifications for Highways, Bridges and Airports (Volume II).

This Order shall take effect immediately.

ROGELIO L. SINGSON
Secretary

Department of Public Works and Highways
Office of the Secretary



WIN6U01301

**DPWH Standard Specification for
ITEM 737 – MECHANICAL COUPLERS FOR REINFORCING STEEL**

737.1 Description

This item shall consist of the requirements for mechanical couplers whose main function is to connect reinforcing steel bars in accordance with this Specification in areas shown on the Plans or as designated by the Engineer.

737.2 Material Requirements

All mechanical couplers shall be designed to be uniaxial. It shall be one of the following types or a combination of any of the following:

1. Sleeve-filler – commonly used for compression only. Primarily used for precast construction.
2. Sleeve threaded - designed for worldwide standard grades of rebar. Excellent for future extension application.
3. Sleeve swaged - used for joining reinforcing bars to structural steel members. Suitable to both tension and compression applications.
4. Sleeve bolted - used to join imperial, plain round or deformed reinforcing bars. Provide cost effective method of joining reinforcing bars, particularly when the fixed bar is already in place and there is insufficient space for a hydraulic swaging press.

Each component shall be die-stamped showing bar dimension and grade, model and manufacturer's identification, production lot number, and manufacturing date. Die-stamp shall be placed in a separate medium, without contact to the bars.

Any person that machines, assembles or installs the coupler shall follow the instructions provided by the manufacturer.

737. 3 Construction Requirements

737.3.1 General

Locations of mechanical couplers shall be as specified in the Working Drawings. Only the specified mechanical coupler type shall be used for application. All procedures and equipment for mechanical connections shall be according to the mechanical connector manufacturer's recommendations. Ends of reinforcing bars to be joined shall be cut nominally square. Threads cut on the ends of the steel reinforcement shall match the internal threads in the mechanical connector. Stirrups, ties, and other reinforcement shall be adjusted or relocated, if necessary, to provide the required clear concrete cover to the reinforcement. Joints between the coated reinforcing steel bars, coated splice bars and coated mechanical connectors shall be sealed/coated with epoxy according to the applicable requirements of Item 404A – Epoxy-coated Reinforcing Steel Bars per Department Order No. 46, Series of 2015.

737.3.2 Testing Apparatus and Accessories

1. Tensile Test Machine. The machine must be able to apply a tensile force greater than the ultimate tensile strength of the sample and must be accurate in accordance with ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*.

2. Slip Measurement Device. The slip measurement device shall have two dial indicators which may either be analog or digital that can measure displacement across the splice to the nearest 0.025 mm.
3. Caliper. The caliper must be accurate to within 0.025 mm.

737.3.3 Sampling

Prior to sampling, the manufacturer shall submit to the Engineer the following:

1. Original mill certificates with attached test results for the production of each coupler type, model, bar size and grade in use.
2. Installation manual secured from the manufacturer shall contain procedures for the tests on coupler type, model, bar size and grade in use.

The manufacturer shall provide the name and address of the machine shops that threaded and swaged the reinforcing steel.

For projects with sample of more than one lot, specimen must be grouped and marked in order to identify its origin. Each of the sample lot contains 500 couplers, or a fraction thereof. A random selection of four coupler per lot shall be made by the Engineer to test each type, model, bar size and grade.

Necessary demonstration of the coupler assembly shall be given by the Contractor with the supervision of the assigned Engineer. Make sure the connecting bars are straight or uniaxial all throughout since reading from bent bars creates erroneous result of slips.

The coupler and connecting bars to be used shall be compatible in order to obtain the required strength of the connection

Before the sample lot of coupler can be used, the coupler specimens must be tested and approved by the Engineer.

737.3.4 Sample Preparation

Before accepting samples, ensure each sample has these physical parameters:

1. Sample Length. Sample length may vary depending on the specifications of available equipment. For rebars sizes 25 mm Ø and smaller, sample length must be at least 1.5 m. For rebars sizes 30 mm Ø and larger, sample length must be at least 2 m.
2. Coupler Length. For mechanical couplers, the length of the coupler must be less than 10 times the nominal bar diameter.
3. Alignment. With the exception to spliced hoops, the alignment across the splice must be straightened within 7 mm in 0.9 m of length.

737.3.5 Mechanical Testing

737.3.5.1 Slip Test

The total average slip must not exceed 0.25 mm for bars with 25 mm Ø and smaller; and 0.75 mm above 25 mm Ø bars. The reference points must be established with a clear distance of 10 and 40 mm from the coupler to the connecting bars.

The total average slip shall be determined by using the procedures described below:

1. Load the coupler assembly to 21 MPa tensile stress in the smallest size connecting bar. The rate of loading during the slip test must be between 70 and 700 MPa of stress per minute.
2. Set the gauges to zero (0) using the slip measuring device.
3. Load the coupler assembly to the connecting bar with smallest diameter size using a 210 MPa tensile and hold for 30 sec.
4. Decrease the amount of tensile stress to 21 MPa and repeat the process.
5. Add the gauge reading and get the average. This shall serve as the total average slip of the sample.

737.3.5.2 Fatigue Loading

Load a coupler to the connecting bar using an increasing value of 35 MPa to 210 MPa tension for 80,000 cycles at a maximum frequency of five (5) cycles per second. Maximum frequency may vary depending on the limits set in ASTM E466, *Standard Practice for Conducting Force Controlled Constant Amplitude Axial Fatigue Tests of Metallic Materials* or ASTM E606M, *Standard Test Method for Strain-Controlled Fatigue Testing* to accommodate available test equipment. Coupler shall, at least, develop a yield strength of 125% with the spliced connecting bars.

Tensile tests shall be in accordance with ASTM A370.

737.3.5.3 Testing Project Samples

Four (4) samples from each lot shall be used for the slip, tensile and fatigue loading tests. The two (2) samples shall be tested using the slip and tensile strength tests; and fatigue loading for the remaining two (2). Make sure that at least one of the samples meet the requirements; otherwise, the whole lot shall be rejected.

737.4 Method of Measurement and Basis of Payment

Mechanical coupler shall not be measured and paid separately, but the cost thereof shall be considered as included in the contract unit price of the Items where called for.

References:

1. *American Society for Testing and Materials (ASTM)*
2. *Caltrain Standard Specifications*
3. *Texas Department of Transportation*
4. *Caltrans*
5. *American Concrete Institute (ACI)*
6. *California Test 670*
7. *Concrete Reinforcing Steel Institute (CRSI)*
8. *Lenton*
9. *Ancon Building Products*
10. *Dextra*
11. *Halfen Moment*
12. *Bar Splice Products Inc.*