SPECIAL PROVISIONS
FOR
HANGER ASSEMBLY

Johnson County
HDP-3715(652)--71-52

Effective Date
April 19, 2016

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

156031.01 DESCRIPTION

This item shall include all furnishing, fabricating, testing and installing of the hanger assemblies in accordance with the details shown on the plans and these special provisions. Hanger assembly shall consist of structural strands, anchor sockets, bridge bowl, embedded steel assemblies, grout pad, threaded rods, nuts, washers, and strand spacers.

All work is to be performed in accordance with the final approved erection procedure as specified in Special Provisions For Erection Of Concrete Arch Spans, the plans and as directed by the Engineer. All hanger design computations, working drawings and methods and procedures for installing hangers shall be sealed by a Professional Engineer licensed in the State of Iowa.

The Contractor installing the structural hangers must be able to demonstrate the successful installation of no less than five multiple hanger systems of similar type prior to beginning work on this project. Identification of these projects, along with contact information for an owner's representative or written verification from the owner, shall be submitted to the Engineer for review and approval.

The hanger manufacturer shall show previous history in the design and fabrication of structural strand hangers and anchor sockets. Documentation showing a minimum of 5 years of experience and ten bridge installations shall be provided to the Engineer for review and approval. Qualifications of the structural strand manufacturer shall be provided to the Engineer at the pre-construction conference.

156031.02 MATERIAL

A. Structural Strand

Bridge hangers shall be a minimum of 2.563 inch diameter structural strand meeting the requirements of ASTM A586 with Grade 2 wire. All wires shall receive a Class C galvanized coating throughout. Bridge hangers shall have a minimum breaking strength of 394 tons. Except as noted herein, the hangers shall be pre-stretched and properly coiled or rolled on reels. Any kinked or damaged strand will be rejected. Straightening of bent wires shall not be permitted.

B. Anchor Sockets

Anchor sockets shall meet the requirements of ASTM A148, Grade 105/85 with Supplementary Requirement S9, or approved equal. All sockets and any accessory bolts, washers, nuts and pins shall be hot dip galvanized in accordance with ASTM A153. Bolt threads shall be recut after galvanizing and painted with galvicon zinc rich paint or approved equal. Damaged galvanized coating shall be repaired in accordance with Materials I.M. 410.

Anchor sockets shall be attached to the hanger cable strand with zinc that complies with ASTM B6, High Grade, or better.

C. Embedded Structural Steel Assemblies

Embedded Structural Steel Assemblies for Hanger Anchorages shall meet the requirements of ASTM A709 Grade 50.

Pipes shall meet requirements of ASTM A53, Type S, Grade B XXS. Pipes shall be milled to bear on bracket and anchorage plate and shall be precompressed by tensioning of the Hanger Anchor Bolts during the Hanger Installation Procedure.

D. Grout

The grout inside of pipes shall be in accordance with the grout listed in the Special Provisions For Post-Tensioning. This includes venting information and testing requirements.

E. Threaded Bolts, Nuts and Washers

Hanger anchor bolts shall meet the requirements of ASTM F 1554 Grade 105. Threaded bolts, nuts and washers shall be hot dip galvanized in accordance with ASTM A153. Bolt threads shall be recut after galvanizing and painted with galvicon zinc rich paint or approved equal. Damaged galvanized coating shall be repaired in accordance with Materials I.M. 410.

Where double-nuts are located on the hanger anchorage assembly, the lower nut is intended to facilitate the structural connection of the anchor rod to hanger assembly.

The top seal nut is intended to provide a water-tight seal to the top of the hanger bracket. Contractor shall verify all top seal nuts are snug-tight to ensure a water-tight seal is achieved.

DTI's for anchor bolts shall meet the requirements of ASTM F2437.

F. Neoprene

Neoprene used for the hanger spacer shall conform to the requirements of Section 4195.02 of the Standard Specifcations.

156031.03 CONSTRUCTION

A. Working Drawings

1. The Contractor shall submit working drawings of structural hangers, anchor sockets, and other accessories, to the Engineer for review. Working drawings shall be prepared in accordance with the general requirements of Section 1105 of the Standard Specifications. Approval of the working drawings by the Engineer is required prior to fabrication. The Engineer shall review the working drawings for general conformance with the design drawings and erection plan as required by the Special Provision For Erection Of Concrete Arch Spans. The approval of the working drawings by the Engineer shall in no way relieve the Contractor from any responsibility of performing the work in accordance with the contract documents. The Contractor shall anticipate a 30-day review period by the Engineer. Working drawing review for the hangers will not proceed prior to the approval of the erection plan. The review period shall begin on the day the submittal is received by the Engineer. All submittals not approved and requiring re-submittal shall be subject to the above review time period, with the review time beginning anew for each such re-submittal.

2. Suitable identification marks of an approved type shall be used on all strands and accessories in order to facilitate proper erection.

3. Details regarding size of reels and methods of protecting strands for handling and shipping shall be included with the working drawing submittal.

4. A mark number and heat number shall be placed upon each anchor socket casting. Finished dimensions of anchor socket castings shall be shown in the working drawing submittal.

5. Diagrams and details of proposed installation methods shall be included in the working drawing submittal. The Contractor shall calculate the theoretical lengths of all strands, between sockets, under full dead load tension for measurement in the shop and shall show dimensions in the working drawing submittals. The hanger loads noted in the “Hanger Force Schedule” equal to the "Dead Load” as shown in the approved erection plan shall be used for the above computation.

6. The computed modulus of elasticity for each strand shall be submitted.

7. The construction industry also refers to working drawings as shop drawings.

B. Fabrication

1. Structural Strand

- The strand shall be manufactured on machines of sufficient size to insure good workmanship. Once the manufacture of the strand has been started, no changes shall be made as to the grade of wire, construction or lay of strand, or other factors which would affect the uniformity of the product.

- All hanger strands shall be prestretched by stressing each strand with a load equal to 55 percent of the breaking strength in straight tension. Maintain and/or repeat loading until the strand reaches a stable condition as defined by ASTM A586. The modulus of elasticity of each strand shall be determined in accordance with ASTM A586 requirements.

- The hanger strand shall be measured in the shop for the various hanger lengths while under tension equal to the Dead Load as shown in the Hanger Force Schedule on the approved working drawings.

- At the time the hanger strands are measured, the Contractor shall mark a longitudinal line between sockets and shall paint a continuous stripe on the strand. The stripe shall be of a color which is readily visible during hanger installation. The hangers shall be installed such that the stripe is to be located on the side of the hanger facing the bridge deck. Hanger strands shall be erected with sockets in the same relative position to each other as existed when strands were measured and painted with stripe in straight line. The stripe shall be straight after installation.

2. Anchor Sockets

- The anchor sockets for hanger strands for the upper and lower hanger anchorages shall be similar in size and shape to those detailed on the plans. The Contractor shall not deviate from the details shown on the plans unless approved by the engineer. The sockets shall be designed for suitable attachment to the strands and shall provide for transmission of the strand loads in accordance with approved working drawing details. Anchor socket strength shall be at least that required for the connecting strand. Each socket shall be proof loaded to 55% of the minimum breaking strength of the strand.

- The anchor sockets shall be attached to strands in accordance with procedures submitted to the Engineer prior to fabrication, and as required to meet the tests herein specified. The Contractor shall exercise care to ensure socket and strand alignment and that the lengths of the strands after socketing are correct. Check measurements shall be made under total dead load shown on plans for each strand and any variation from the correct length shall be recorded. Correct lengths shall be determined and a written verification of correct lengths shall be submitted to the Engineer for final approval. Hanger strands shall be fabricated with tolerance of +/- 1/4 inch.

- The wires of a strand shall be cleaned of grease and other impurities after being splayed in preparation for socketing by a carefully controlled process that will assure no harm is done to the wire galvanizing coating. The strand wires adjacent to the socket shall be re-lubricated after socketing.

- The basket of the socket shall be preheated to expel moisture and to prevent the molten zinc from congealing before it has completely filled the narrow lower end of the basket. Strands will be rejected if the socketing procedure results in bare wires within the socket.

- The anchor sockets shall be attached to the hanger strand with zinc that complies with ASTM B6, High Grade, or better. Place molten zinc at the lowest practical temperature so as to minimize the effect of heat on the strands. The zinc temperature shall be recorded at the time of pouring for each socket and submitted to Engineer as written verification of correct lengths.

C. Testing

1. Wire

- The Contractor shall test the zinc-coated steel wire used in the strand prior to fabrication for tensile properties in accordance with ASTM A586.

- The Contractor shall make the tests for ultimate strength with specimens cut from both ends of each single length or coil of zinc-coated wire. The Engineer will witness as many of these tests as may be necessary to satisfactorily demonstrate that the wire meets the requirements of these specifications. When requested by the Engineer, the Contractor shall make check tensile tests of any coils selected at random by the Engineer.

- The Contractor shall make the test for stress at 0.7% elongation on samples from at least 10% of the coils as manufactured. If the strength at 0.7% elongation as so determined falls below the required strength on any lot of wire, the Engineer may require that all coils of such lot be tested and will reject all individual coils which do not meet strength requirements.

- The Contractor shall make tests for coating (weight and adherence) on samples of not less than 5% of the coils of any lot of wire. The Contractor shall be prepared to increase the percentage of coils tested for coating at the request of the Engineer. If tests of any of these coils fail to meet the requirements, the Engineer may require that all coils of such lot be tested. If less than 80% of the coils pass the test, the entire lot will be rejected. Any coil failing to meet the aforementioned requirements will be rejected by the Engineer.

2. Strand

- The Contractor shall determine the modulus of elasticity of each strand in accordance with ASTM A586 requirements.

- After prestretching, the Contractor shall cut from each prestretched length of strand, one piece not less than 100 inches long and test it for strength and elasticity. The ends of the test pieces shall be socketed with sockets of a design similar to those to be used in this project. If, after three or more tests of prestretched strands have been made, the Engineer finds that the strength and elasticity have sufficient uniformity, one test may be made thereafter from each manufactured length of strand instead of one from each prestretched length. When examined visually, sockets used in the tests that show distress after testing will be rejected by the Engineer.

- The Contractor shall clearly demonstrate that strands shall show a well-defined and uniform elastic stretch and recovery under stressing.

3. Anchor Sockets

- Each anchor socket casting shall be inspected for quality control in accordance with the following.

- Each casting shall be visually examined for defects in accordance with current edition of Federal Specification RR-S-550E, “Sockets, Wire Rope.” All defects judged to be unacceptable by the standard as determined by the Engineer shall be repaired to the satisfaction of the Engineer or the casting shall be replaced with a new casting. The Contractor shall perform additional non-destructive tests at each rejectable defect to determine the type and amount of repair, where repairs are required. The Engineer shall have final authority as to the repairability of a casting. Such additional non-destructive tests may be radiograph, ultrasonic, magnetic particle, or liquid penetrant. These non-destructive tests shall be performed at the sole expense of the Contractor and shall be incidental to the contract unit price bid for “HANGER ASSEMBLY.” At the Engineer’s option, large repairs in any type or grade of casting may require heat treatment in accordance with ASTM A148 requirements.

- All inspections required above shall be performed by a commercial testing laboratory approved by the Engineer as being qualified to perform such work. Non-destructive tests shall be performed by the same approved laboratory in accordance with the appropriate Supplementary Requirements of ASTM A781. Certified test reports shall be furnished to the Engineer for review. The Engineer shall have final authority as to the suitability of a repaired casting. All laboratory costs shall be at the expense of the Contractor and shall be incidental to the contract unit price bid for Hanger Assembly.

- Sufficient coupons of a design approved by the Engineer shall be cast directly to the castings to provide at least one tensile and one bend test specimen per melt and annealing charge for smaller castings.

- Test specimens shall be machine bent to 1 by 1/2 inch in sections with the corners rounded to a radius of not over 1/16-inch.

- The bend test specimens shall be cold bent through an angle of 120 degrees around a pin 1-inch in diameter with no cracking on the outside of the bent portion.

- If the results of the physical tests of any casting do not conform to the specified requirements, such casting or lot, as the case may be, may be re-heat-treated, but only one such re-heat-treatment will be permitted.

- In addition to the tension tests required by ASTM A148, Charpy Impact tests shall be made in accordance with ASTM A781, S9. If the Charpy V-notch impact test values

are less than 15 foot pounds at 40º F for any heat, the sockets represented by that heat will be rejected.

4. Socket and Strand Testing

In order to confirm the effectiveness of the fabricated hanger strand and anchor socket, the Contractor shall prepare at least three test specimens (using strand and sockets of similar size, type and material as those specified) for test purposes. Stress test specimens shall be at least 25 strand diameters long, with anchor sockets (selected at random from those which are to be used for this project) attached to each end and shall be tested to destruction in a suitable testing machine. Sockets used for these tests shall not be re-used for the final structure. The tests shall develop the ultimate strengths above specified in this Special Provision. Two out of the three specimens must meet these criteria. The one specimen that failed these criteria must have failed at or above 95% of ultimate strength. The average failure strengths of all three specimens must exceed ultimate strengths specified in this Special Provision. If the specimen group does not pass the test, the Contractor shall test three additional specimens. The material and method of socketing shall be the same for both test specimens and bridge strands. Failure of all specimens shall occur only in the strand. Failures within the anchor sockets shall be cause for rejection.

5. Certification

The Contractor shall furnish certified test reports covering all tests specified herein to the Engineer.

D. Installation

1. The Contractor shall be responsible for geometric control of construction so that the completed structure will conform to the lines, grades, and dimensions shown on the plans. Competent engineering and surveying personnel and equipment shall be provided to establish and verify elevations and alignment of the concrete arch at every stage of the hanger stressing sequence.

2. A record of all surveys, check readings, adjustments, and corrections shall be maintained and all data submitted to the Engineer. The Contractor shall determine the need for the amount of adjustment that may be required in subsequent hanger stressing operations to achieve the desired profile. All proposed adjustments to the hangers shall be submitted to the Engineer for review prior to stressing subsequent hangers.

3. Sufficient computations and analysis shall be provided for the structure to reasonably assure that hanger stressing will achieve the computed dead load hanger stress and bridge geometry within the tolerances noted in the Special Provision For Erection Of Concrete Arch Spans.

4. Care shall be exercised during hanger erection to prevent damage to the steel components of the hanger, sockets and anchorages. All damage shall be repaired to the satisfaction of the Engineer.

5. Before grouting operations for the steel pipes begin, a joint meeting of the Contractor, grout manufacturer's field representative and the Engineer will be conducted to discuss the grouting operation plan, required testing, corrective procedures and any other issues requested by the Engineer. To allow adequate time for trained inspection staff to get to the job site, provide the Engineer with advance notice (of at least 3 days) prior to the beginning of the grouting operations. Grout the annular space between the pipe and anchor bolt after the tensioning of the anchor bolts has been completed for each hanger assembly as specified herein and in accordance with plans and procedures in the final approved erection plan, working drawings and as approved by the Engineer. Grout all hanger pipes and anchorage bolts assemblies within 7 days of bolt tensioning. See "Special Provisions For Post-Tensioning" for additional information on the grouting procedure.

156031.04 METHOD OF MEASUREMENT

Lump Sum. No method of measurement.

156031.05 BASIS OF PAYMENT

The cost of furnishing, fabricating, testing, transporting, erecting, tensioning and protecting the hanger strands, anchor sockets, anchorages, miscellaneous hardware, grout pad and for all materials, labor, tools and equipment necessary to complete the work as required by the Special Provisions, on the Plans and approved erection plan and working drawings. Work completed, accepted and measured as provided above will be paid for at the contract unit price bid per lump sum for Hanger Assembly.