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# DOUBLE-TEE FLEXIBLE CONNECTION

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U.S. PATENT NO. US8800232



## GUIDE SPECIFICATION 05 50 10 - METAL FABRICATIONS

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**NOTE TO SPECIFIER: NOTES TO SPECIFIER ARE DESIGNATED BY [ ]. SPECIFIER IS TO SELECT OPTIONS AS APPLICABLE.**

## **Part 1 - GENERAL CONDITIONS**

### **1.01 DESCRIPTION**

- A. Installation of anchored Double-Tee Flexible Connection for reinforcement or replacement of existing double-tee shear connections.

### **1.02 RELATED DOCUMENTS**

- A. Drawings and General Provisions of Contract, including General Conditions and other Division 1 Specifications Sections, apply to the Work of this Section.

### **1.03 QUALITY ASSURANCE**

**[NOTE TO SPECIFIER: EOR TO DETERMINE SPECIFIC INSPECTION AND SPECIAL INSPECTION REQUIREMENTS. THE FOLLOWING IS A GUIDE FOR REFERENCE]**

- A. Examine Drawings and Specifications prior to bidding or executing work. Notify the Engineer of Record (EOR) immediately should omissions or errors be discovered.
- B. Special Inspections: This project is subject to the requirements of Special Inspections. All shop drawings showing details and layouts of connections shall be reviewed and approved by the EOR.
  - 1. The Owner will engage the services of a qualified Special Inspector for this project. The Special Inspector, will confirm that the provisions of Chapter 17 of the IBC, Special Inspections and Tests, and will provide and/or supervise inspection and testing requirements, as necessary. The Inspector will perform his duties, insofar as possible, in such a way that neither fabrication nor erection is unnecessarily delayed or impeded.
  - 2. Bolted Connections: Shop bolted and field bolted connections will be inspected to confirm compliance to Sections 2, 3 and 8 of AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts". Observe calibration procedures for calibration devices used on the project and monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is properly used to tighten all bolts.
    - a. Visually inspect all bolted connections to verify that connection is fully compacted.
    - b. Slip Critical / Tension Control Connections and Connections Subject to Axial Tension: The installation and tightening of all tension control connections will be observed to assure that the specified procedure was followed to achieve the pretension specified in Table 8.1, AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".
    - c. Witness pre-installation verification testing of tension control bolt assemblies in accordance with Section 7 of AISC "Specification for Structural Joints Using ASTM A325 or A490 Bolts".

3. Post Installed Anchors: Installation of post installed anchors shall be inspected in conformance with Chapter 17 of the IBC and ACI 318: 3.8.6, 8.1.3, 21.1.8., and D.9.
  - a. The special inspector must verify that the installation is in accordance with the requirements of applicable Codes, manufacturer's published installation instructions (MPII), and relevant evaluation reports (ICC-ES ESR or other) for the product.
  - b. The special inspector shall witness \_\_\_\_% of anchor installations to verify the following:
    - i. Hole depth and cleaning are per the MPII for the specified effective embedment depth.
    - ii. Calibrated torque wrenches are used to tighten the installed anchors to the manufacturer's specified torque.
- C. Testing: The Owner shall retain the services of a testing and inspection agency. The testing and inspection agency shall perform the following:
  1. Inspect high-strength bolted connections, perform required tests and inspections, and prepare test reports.
  2. Review mill test reports and certify compliance with Specification requirements.
  3. Perform additional tests as may be necessary to reconfirm any noncompliance of the original work, and as may be necessary to show compliance of corrected work.
- D. The Contractor shall coordinate with the testing agency or the Owner's representatives. Do not continue with work until the items are inspected any necessary modifications or repairs are performed.
- E. Where applicable, pullout tests shall be performed in accordance with the Anchor Manufacturer's requirements for fasteners and adhesives, respectively, to verify condition of the deck/substrate and to confirm expected pullout values.
- F. Perform mockups for Double-Tee Flexible Connection installation. Upon approval, mock-ups may be incorporated into construction. Mockup shall be accepted prior to further installation begins.

#### 1.04 SUBMITTALS

- A. Samples of each primary components to be used in the Double-Tee Flexible Connection and the manufacturer's current product data sheet for each component.
- B. Shop Drawings: Submit shop drawings including complete details and schedules for fabrication and assembly of structural steel members, procedures and diagrams.
  1. Include details of cuts, connections, holes, and other pertinent data.

2. Provide setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed by others.
- C. Submit producers' or manufacturers' data for the following, including data to show compliance with specified requirements:
  1. Double-Tee Flexible Connection
  2. Post Installed Anchors
  3. Tension Control Bolts, Nuts, and Washers

### 1.05 EXPERIENCE AND QUALIFICATIONS

- A. Post Installed Anchor Installer Qualifications: All personnel installing post installed anchors shall be trained by the Manufacturer for installation of their anchors.

### 1.06 DELIVERY STORAGE AND HANDLING

- A. All products delivered to the job site shall be in the original unopened containers or wrappings bearing all seals and approvals.
- B. Handle all materials to prevent damage. Place all materials on pallets and fully protect from moisture.
- C. As a general rule all adhesives shall be stored at temperatures between 40°F (4°C) and 80°F (27°C). Read product data sheets and instructions contained on adhesive canisters for specific storage instructions.
- D. All flammable materials shall be stored in a cool, dry area away from sparks and open flames. Follow precautions outlined on containers and read product Safety Data Sheets (SDS).
- E. Any materials which are determine to be damaged are to be removed from the job site and replaced at no cost to the Owner.
- F. Safety Data Sheets (SDS) shall be available at the job site at all times

## Part 2 - GENERAL CONDITIONS

### 2.01 GENERAL

- A. Double-Tee Flexible Connection (DTFC) shall be manufactured by NORTHFORD STRUCTURAL CONNECTIONS LLC (NSC) of Northford, Connecticut. (203/777-0751) – U.S. Patent No.8800232.
- B. Components that are other than those supplied or manufactured by NSC shall be submitted for review and acceptance by the Engineer of Record (EOR).

**[NSC RECOMMENDATIONS FOR PRODUCTS NOT SUPPLIED OR MANUFACTURED BY NSC ARE FOR THE CONVENIENCE OF THE SPECIFIER; THE EOR SHALL VERIFY SUITABILITY OF THE CONNECTION AND THE COMPONENTS FOR THE JOB SPECIFIC APPLICATION. THE SPECIFICATIONS, INSTALLATION INSTRUCTIONS, LIMITATIONS, AND RESTRICTIONS OF THE RESPECTIVE MANUFACTURER'S PRODUCTS MUST BE REVIEWED BY THE EOR FOR ACCEPTABILITY FOR THE INTENDED USE WITH NSC PRODUCTS.]**

## **2.02 MATERIALS**

- A. Double-Tee Flexible Connection (DTFC) shall be a manufactured connection designed to allow flexibility transverse the double-tee deck joint but for which gravity (wheel) loads and seismic shear loads are transferred. Material shall be:
1. Stainless Steel: Type 304, ASTM A167 with a minimum tensile strength of 31 ksi and a minimum yield strength of 73 ksi.

## **2.03 TENSION CONTROL BOLTS**

- A. Tension-Control, High Strength Threaded Fasteners: **[NOTE: EXPERIENCE HAS SHOWN THAT DTFC BOLTS BELOW A MAINTAINED JOINT ARE NOT TYPICALLY SUBJECT TO CORROSIVE ENVIRONMENT. SHOULD CORROSION BE ANTICIPATED, STAINLESS-STEEL BOLTS CONFORMING TO ASME B18.2.1 HEAVEY HEX HEAD WITH APPROPRIATE NUTS (ASME B18.2.2 HEAVEY HEX HEAD) AND WASHERS (ASME B19.21.1) SHOULD BE CONSIDERED. ALTERNATIVELY, SHOULD CORROSION OCCUR, THE BOLTS ARE READILY INSPECTABLE AND CAN SIMPLY BE REPLACED]**
1. Quenched and tempered medium-carbon steel bolts complying with ASTM A325 / F1852 Type 1.
  2. Quenched and tempered medium-carbon steel heavy-hex nuts complying with ASTM A563.
  3. Quenched and tempered hardened washers complying with ASTM F436
  4. Finish: Mechanically deposited zinc coating, ASTM B 695, Class 50 **[GALVANIZING IS RECOMMENDED]**

**2.04 POST INSTALLED ANCHORS: [THE FOLLOWING ANCHORS ARE SUGGESTED; EOR TO VERIFY SUITABILITY]**

- A. Adhesive Anchors: Manufactured by the Hilti Corporation (800/879-8000)
  - a. Anchor: Hilti HAS-R 304 SS threaded rods (ASTM F593)
  - b. Adhesive: HIT-HY200 adhesive manufactured by Hilti Corporation
- B. Dual Action Anchors: Manufactured by the Hilti Corporation (800/879-8000)
  - a. Hilti KH-EZ CRC screw anchor
  - b. Adhesive: KHC adhesive capsules manufactured by Hilti Corporation
- C. Mechanical Erection Anchors: Manufactured by the Hilti Corporation as follows:  
Anchor: Hilti KB-TZ SS304

**2.05 DIAMETER AND EMBEDMENT AS INDICATED ON DRAWINGS. [DIAMETER AND EFFECTIVE EMBEDMENT AS REQUIRED BY MANUFACTURER; EOR TO VERIFY SUITABILITY]**

- D. Drill bits shall be supplied by anchor manufacturer.

**Part 3 - EXECUTION****3.01 GENERAL**

- A. The Contractor, Owner's Representative, and Engineer of Record (EOR) shall attend a pre-construction conference.
- B. Post-installed anchors shall be installed in strict conformance with Manufacturer's recommendations.

**3.02 SUBSTRATE CONDITION**

- A. Contractor shall be responsible for acceptance or provision of proper substrate to receive Double-Tee Flexible Connection. The substrate shall be clean, smooth, dry, free of water, ice, loose and foreign material, oil, grease and other contaminants. Spalls and other concrete defects shall be repaired. Do not begin work until deleterious conditions have been corrected. The concrete deck and existing construction must be structurally sound to provide adequate anchorage of post installed anchors.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**[NOTE TO SPECIFIER: USE MINIMUM ONE DTFC PER EXISTING CONNECTION. ADD ADDITIONAL DTFC AS REQUIRED FOR SHEAR REQUIREMENTS. IT IS RECOMMENDED THAT ALL SHEAR CONNECTORS BE REPLACED ALONG A JOINT; HOWEVER, DETERMINATION OF QUANTITY AND LOCATIONS REMAINS THE RESPONSIBILITY OF THE ENGINEER.]**

**[OPTION: ADD DTFC TO EXISTING JOINTS FOR REINFORCEMENT OF EXISTING CONNECTIONS. RECOMMENDED REINFORCEMENT INCLUDES MINIMUM THREE (3) DTFC EQUALLY SPACED IN TRAVEL LANE.]**

### 3.03 DTFC LAYOUT AND LOCATION REQUIREMENTS

- C. All existing shear connections along a single double-tee joint should be replaced at minimum one for one with DTFC. Additional DTFC may be required depending on shear loading.
  - 1. Place DTFC minimum 12" from existing connections.
- D. Do not cut reinforcement unless approved by EOR in writing. Use pachometer, ferroskan, or other appropriate device as necessary to locate reinforcement such that it can be avoided during drilling operations.
- E. Double-Tee Flexible Connection (DTFC) assembly is to be used as layout template and guide for drilling anchor holes.

### 3.04 DTFC INSTALLATION - GENERAL

- A. Assemble DTFC and spacer assembly prior to installation. Insert tension control bolt assemblies with washer located under the nut at the vertically slotted hole in the bent plate. Hand tighten tension control bolts. Do not fully tighten at this time.
- B. Drill erection holes and install erection bolts and bent plate assembly.
- C. With bent plate assembly in place, mark holes for expansion anchors.
- D. Remove nuts and spacer and rotate DTFC plates out of way and drill and clean anchor holes in conformance with manufacturer's instructions.
- E. Reassemble DTFC spacer and bolts. Tighten erection bolts such that flange connection assembly is in full contact with concrete surface and hand tighten bolts such that all ply's are in full contact.
- F. Install adhesive anchors as noted below and allow to cure.
- G. Install washers and torque nuts on post installed anchors per Manufacturer's requirements.
- H. Fully tighten tension control bolts.

### 3.05 POST INSTALLED ANCHOR INSTALLATION

- A. Install post installed anchors in strict conformance with Manufacturer's requirements. Should Manufacturer's requirements exceed these specifications, they shall govern.

- B. Identify location of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in drilling to avoid damaging existing reinforcement and embedded items unless otherwise directed by EOR. Notify engineer if reinforcement or embedded items are encountered during drilling.
  - 1. Use a pachometer, ferroskan or other means to precisely locate reinforcement in prior to drilling for the installation of post installed anchors.
- C. Drill holes utilizing drills and bits of size and type recommended by the manufacturer.
- D. Drill holes perpendicular to concrete surface utilizing flange connection plates as drilling guide and template. Avoid reinforcement to extent possible.
- E. Blow out hole with blast of compressed air from oil free compressor two times. Wire brush hole and then blow out with two more blast of compressed air. Continue this operation until all dust and debris is removed.
- F. Apply adhesive in accordance with manufacturer's recommendations utilizing supplied mixing nozzles and dispensing equipment. Discard initial adhesive as recommended.
- G. Install anchors in strict accordance with manufacturer's recommendations and specifications.
- H. Protect anchored reinforcement from impact or movement that would be detrimental to bond until the adhesive has set reached tabulated design strength.
- I. Using calibrated torque wrenches, torque nuts at post installed anchors to torque recommended by Manufacturer.
- J. Tighten tension-control bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

### 3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified Special Inspector and Independent Testing and Inspecting Agency to ensure compliance with Chapter 17 of the IBC.
- B. The Contractor shall furnish such facilities and provide such assistance as may be required for carrying out the inspection prescribed herein, including providing access to inspection areas.
- C. Contractor shall correct deficiencies that inspections and laboratory test reports have indicated to be not in compliance with requirements. Additional tests will be performed as may be necessary to confirm compliance of original work.

### 3.07 CLEAN UP

- A. Perform daily clean up and removal from the site of all empty containers, scrapings, surplus materials and other debris resulting from these operations.

**End of Section 05 50 10 – Metal Fabrications**

**DISCLAIMER**

**Nothing contained in any NSC materials relieves the user of the obligation to read and follow the warnings and instruction for each manufactured product as set forth in the current Product Data Sheet, product label and Safety Data Sheet prior to product use.**

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