

## **ITEM 11564.98 M - STEEL STRINGER REPAIR**

### **DESCRIPTION**

This work shall consist of repairs to the stringer indicated on the Contract Plans in accordance with the Repair Procedures shown therein. Unless otherwise shown on the plans, the work shall be done in place.

### **MATERIALS**

Materials for this work shall conform to the following:

1. Steel: This shall meet the requirements of ASTM A36M. Certified copies of mill test reports shall be given to the Engineer prior to the beginning of work.
2. Heating Torches: These shall be approximately 25 millimeter diameter, multi-orifice (rosebud) type. They shall operate on approximately 170 kpa propane - 860 kpa oxygen. Torches and tips proposed for use are subject to the approval of the Engineer.
3. Welding Electrodes: Welding electrodes shall be 4 mm diameter; AWS classification E7018. They shall be furnished in hermetically sealed containers. Immediately upon container opening the electrodes shall be placed into an electrode drying oven. They shall be dried for at least two hours, but no longer than four hours at a temperature held between 230°C and 260°C. After drying, the oven temperature shall be lowered to 120°C. The electrode shall be kept at 120°C continuously until they are used in the work. Electrodes removed from the oven shall be subject to the following time restrictions based upon relative humidity conditions.

<u>Relative Humidity</u>	<u>Time to Use</u>
Up to 70%	4 hours
70% and above	2 hours

Electrodes not used within the times allowed shall be discarded. Redrying of electrodes will not be permitted.

4. High Strength Bolts, nuts and Washers: Subsection 715-14.

### **CONSTRUCTION DETAILS**

1. Worker Protection: OSHA requirements for protection of workers engaged in removal of lead base paint and in heating and/or oxygen cutting of structural steel painted with lead base paint shall be observed. In no case shall heating or oxygen cutting of structural steel be performed without the use of protective clothing and OSHA-approved respirators by all involved workers.
2. Equipment Maintenance: All equipment shall be maintained in good working condition for the duration of this work. Malfunctioning equipment shall be repaired, or replaced, without delay.
3. Heat Straightening: Compressive stresses will be permitted up to a maximum of 137, 900 kpa. This stress limit will apply to all steel covered by this specification. Jacks or "come alongs" may be used to produce these stresses prior to and during heating. Any method

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of handling, supporting, or loading that cause the member to distort permanently (yield without the application of heat) will result in rejection of this member.

Members rejected by the Engineer due to permanent distortion shall be repaired by methods approved by the DCES. The Contractor shall submit a proposed repair procedure to the DCES for approval. The DCES will approve or modify the submitted procedure, or will substitute a repair procedure for the Contractor to follow. No work of any nature shall be done to a rejected member until the DCES's approval, or substitute repair procedure has been received by the Contractor. All work performed for reasons of permanent distortion including nondestructive tests performed by the DCES to evaluate the limit and extent of damage, will be done at the expense of Contractor. Delays to the Contractor's operations resulting from permanent distortion damage will be at his expense. No request for extensions of time will be considered.

Prior to the application of heat, paint shall be removed to bare steel on all surfaces of all members within 300 millimeters of areas to be heated. Removal shall be done by methods acceptable to the Engineer.

Heating shall be confined to the patterns described in the Repair Procedures on the Contract Plans and shall be conducted so as to bring the steel within the planned pattern to a temperature between 540°C and 620°C as rapidly as possible without overheating the steel.

Prior to the beginning of heating operations, the Contractor shall provide the Engineer with temperature-indicating crayons manufactured for 315°C, 540°C, 620°C and 680°C.

The heating torches shall be manipulated to guard against general and surface overheating. When heating thick plates, it may be necessary to occasionally interrupt heating for periods of less than one minute to allow the heat to soak into the flange and avoid surface overheating.

Quenching with water or water and air will not be permitted. Cooling with dry compressed air will be permitted after the steel has cooled to 315°C.

Any heating procedure which causes a portion of the steel to be heated to a temperature greater than 650°C shall be considered destructive heating. Destructive heating shall automatically cause rejection of the work.

Work rejected due to destructive heating shall be subject to the same restrictions and procedures as previously noted for permanent distortion of steel members by the Contractor. All repair, test and delay costs shall be borne by the Contractor.

4. Oxygen Cutting: Oxygen cutting shall be done in accordance with the requirements of the SCM, Section 6.

Prior to oxygen cutting, paint shall be removed to bare steel on all surfaces of all members within 300 millimeters of lines to be cut. Removal shall be by methods acceptable to the Engineer.

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5. Welding: Welding shall be done in accordance with the requirements of the SCM, Section 7.
6. Non-Destructive Testing: This shall be done as required by the Repair Procedure.
7. Inspection: In addition to non-destructive testing, visual inspection shall be done to all welds and base metal of the repaired stringers. Should the welds not meet the acceptance criteria of the SCM or if cracks are found in the base metal, the DCES will be immediately notified by the Engineer.

The Contractor shall submit to the DCES for approval a proposed repair procedure based upon the inspection findings. The proposal shall be subject to the approval, modification, and substitution requisites given previously for the repair of permanently distorted members. No work of any nature shall be done to, or in the vicinity of, the unacceptable welds or cracked base metal prior to the repair procedure being approved, and performed.

8. Tolerances: After heat-straightening, welding, and welding repair operations are completed, the stringer shall be measured for the tolerance of warpage and tilt of flanges. The tolerance shall meet the requirements of Section 12 of the SCM.
9. Reconnection: All steel to be reconnected shall be reconnected after repair work has been completed.

## **METHOD OF MEASUREMENT**

Measurement will be made as each stringer repaired as described in the repair procedures. Each stringer will be measured only once regardless of the number of repairs performed to that stringer.

## **BASIS OF PAYMENT**

The price bid shall include the cost of all labor, materials and equipment necessary to complete the work, except where separate payment has been provided for in the contract documents.

Approved repairs done in accordance with the requirements of the Construction Details - Inspection will be paid for in accordance with the applicable requirements of Subsection 109-05.