

**ITEM 03564.7601XX M - IN PLACE STEEL STRINGER REPAIR**

**DESCRIPTION:** The work shall consist of repairing steel stringers by means of heating, cutting and welding as described in a Repair Procedure. The work shall be done "in place" at the locations indicated by the Contract Documents.

**MATERIALS:** Material for this work shall conform to the following:

1. **STEEL:** This shall meet the requirements of ASTM A36 M and Section 715-01 or as noted on Contract Documents. Certified copies of the mill test reports shall be given to the Engineer prior to the beginning of work.
2. **PAINT AND PAINTING PROCEDURES:** These shall meet the requirements of 740-01.
3. **HEATING TORCHES:** These shall be approximately 25 mm diameter, multi-orifice (rosebud) type. They shall operate on approximately 170 kPa propane and 850 kPa oxygen. Torches and tips proposed for use are subject to the approval of the D.C.E.S.
4. **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 between 230 °C and 260°C. After drying, the oven temperature shall be lowered to 120 °C. The electrodes 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 OF 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.

5. **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.
6. **BOLTS, NUTS and WASHERS:** All bolts, nuts and washers shall conform to the provisions of ASTM A325, and 715-01, 715-14.

## **ITEM 03564.7601XX M - IN PLACE STEEL STRINGER REPAIR**

### **CONSTRUCTION DETAILS**

The work shall be done in accordance with the specified repair procedures and the following:

#### **A. HEAT STRAIGHTENING**

Compressive stresses will be permitted up to a maximum of 138 MPa. 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 of handling, supporting or loading that causes the member to distort permanently (yield without the application of heat) will result in rejection of the member.

Members rejected due to permanent distortion will be repaired by methods approved by the D.C.E.S.. The Contractor shall submit a proposed repair procedure to the D.C.E.S. for approval. The D.C.E.S. will approve or modify the submitted procedure, or he will substitute a repair procedure for the Contractor to follow. No work of any nature shall be done to a rejected member until the D.C.E.S.'s approval or a substitute repair procedure has been received by the Contractor. All work performed for reasons of permanent distortion, including nondestructive tests performed by the D.C.E.S. to evaluate the limit and extent of damage, will be done at the expense of the 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. Heating shall be confined to the patterns described herein and shall be conducted so as to bring the steel within the planned pattern to a temperature between 560 °C and 650 °C as rapidly as possible without overheating the steel.

Only truncated triangular heating patterns shall be used. The base of the triangle shall be the flange edge that is convex before heating. The apex of the heating triangle shall be truncated to a 25 mm width. The truncated end of the heating triangle shall be located at the junction of the web and flange. The heating patterns shall be marked on the flange surfaces prior to heating. The base of the heating triangle shall not exceed 250 mm regardless of flange width or thickness. Sufficient heating patterns shall be used to eliminate unsightly chording effects.

Prior to the beginning of heating operations, the Contractor shall provide the Engineer with temperature-indicating crayons manufactured for 315°C, 540°C, 600°C and 675°C. Heating shall begin at the truncated end of the heating pattern. Heating shall progress slowly toward the base of the pattern spreading with an included angle of 15 to 30 degrees. If flange thicknesses exceed 32 mm, or if cover plates of any thickness are attached to the flanges, two torches shall be used and heat shall be applied simultaneously to both the top and bottom surfaces of the flange at each heat pattern. The heating torches shall not begin to progress toward the base of the heating pattern until the truncated end of the pattern is brought up to the specified temperature. Once heating begins to progress toward the base of the pattern, the heating torches shall not be returned to the apex of the heating triangle.

The heating torches shall be manipulated to guard against general and surface overheating. When heating thick plates, it may be necessary to occasionally interrupt

## **ITEM 03564.7601XX M - IN PLACE STEEL STRINGER REPAIR**

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 675 °C shall be considered destructive heating. Destructive heating shall automatically cause the rejection of the steel. Steel 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.

### **B. OXYGEN CUTTING**

Oxygen cutting shall be done in accordance with the requirements of the NYS Steel Construction Manual, Section 6.

### **C. WELDING**

Welding shall be done in accordance with the requirements of the NYS Steel Construction Manual, Section 7.

### **D. NON-DESTRUCTIVE TESTING (N.D.T.)**

This shall be done as required by the repair procedure.

### **E. INSPECTION**

In addition to N.D.T., visual inspection shall be done to all of the repaired stringer. Should the welds not meet the acceptance criteria of the NYS Steel Construction Manual or if cracks are found in the Base Metal, the D.C.E.S. shall be immediately notified of the particulars.

The Contractor shall submit 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 near vicinity of, the unacceptable welds or cracked Base Metal prior to the repair procedure being completed. The cost of the repair shall be mutually agreed to by the Contractor and the Engineer, if the weld existed prior to the stringer repair. The cost of repair shall be borne by the Contractor if the weld is a repair weld.

### **F. TOLERANCES**

After heat-straightening, welding and/or welding repair operations are completed, the stringer shall be measured for sweep tolerances. Sweep tolerances shall be 6 mm per 3 m except that at point of impact a localized distortion of 19 mm in 1.5 m is acceptable. Dents at points of impact shall be repaired by welding and grinding.

### **G. REMOVAL, INSTALLATION AND RECONNECTION OF STRUCTURAL STEEL**

Structural steel designated to be removed shall be removed in accordance with the requirements of subsection 589-3 unless otherwise noted on the plans. All removed steel shall become the property of the Contractor and shall be removed from the work

## **ITEM 03564.7601XX M - IN PLACE STEEL STRINGER REPAIR**

site.

All new steel installations, and reconnections of existing steel shall be done in accordance with the requirements of the SCM. Installations and reconnections shall be done after stringer repair work has been completed.

### **H. PAINTING**

Painting work shall be done only after all other work has been completed. Areas from which existing paint has been removed or damaged or those areas ordered by the Engineer, shall be cleaned and painted in accordance with the applicable 18570 items as described in the special notes. In so far as it is practicable, the finish coat shall match the existing paint color. The Engineer shall be the final determiner of color match.

### **I. SUPPORT POSTS**

Support posts and jacking posts shall be erected where indicated in the Contract Documents. The contractor shall be totally responsible for the adequacy of all temporary supports. Support posts to be designed by a New York State P.E.

## **METHOD OF MEASUREMENT**

The work will be measured as each stringer is repaired and painted. Each stringer repaired will be measured for payment only once regardless of how many places along the stringer are actually repaired and painted.

## **BASIS OF PAYMENT**

The unit price bid for each stringer shall include the cost of all labor, materials and equipment necessary to complete the work, including cleaning and painting. Unacceptable existing welds for Base Metal cracks ordered repaired by the Engineer will be paid for by agreed price. No payment will be made for the repair of defects attributable to the Contractor.

No payment will be made for work specifically disallowed payment by the specification terms.