

SECTION 48 11 01
Boiler Tube Maintenance and Rehabilitation

PART 1 - GENERAL

1.01 DESCRIPTION

The City of Alexandria owns, operates and maintains two steam generating boilers (Units 3 and 4) at the D.G. Hunter Generating Station located at 1011 North Third Street, Alexandria, LA, 71303. The work encompassed by this contract includes the furnishing of all labor, materials and equipment necessary to diagnose problems, recommend repairs and service and maintain the boilers on an on-call basis.

1.02 RELATED WORK

A. Not applicable.

1.03 REFERENCES

All repair work must comply with any and all applicable Codes, Standards, and regulations applicable to Power Boilers. It is the obligation of the Contractor to ensure compliance with all applicable national, state, and local Codes, Standards, and/or regulations. Minimum required specifications are as listed below:

A. ASME Boiler & Pressure Vessel Code:

1. Section 1 - Power Boilers

a. Part PG - General Requirement for Construction

b. Part PW - Requirements for Boiler Fabricated by Welding

2. Section 2 – Material Specifications

a. Part A - Material Specifications for Ferrous Materials

b. Part C - Welding Filler Materials

3. Section V - Nondestructive Examination

4. Section IX - Welding and Brazing Qualifications

B. National Board Inspection Code NB-23

C. American National Standards Institute

D. The National Board of Boiler and Pressure Vessel Inspectors

E. Louisiana Administrative Code (LAC Title 55, Part V, Chapter 50)

1.04 DEFINITIONS

A. Not applicable

1.05 UNIT NO. 3

Unit No. 3 is a Babcock & Wilcox 55 MW Stirling type steam generator originally installed in 1965. Nameplate information is as follows:

Contract No.	S1-0141
Capacity	510,000 lbs/hr
Design Pressure	1,600 psi
Steam Temperature	955°F
Boiler H.S.	18,499 Sq. Ft.
Economizer H.S.	7,320 Sq. Ft.
Economizer Pressure	1,625 psi

Additional items pertaining to Unit No. 3 are as follows:

- A. The boiler is equipped with a pendant superheater but no reheater.
- B. The height of the furnace is approximately 60 feet.
- C. The unit does not have ports available for the attachment of suspended scaffolding.
- D. The boiler floor is the floor tube type.
- E. The unit is equipped with roof tubes.
- F. The unit has soot blowers and is equipped to burn fuel oil as a back-up fuel source. Fuel oil is rarely burned however, the most recent instance being a test run made in 2006.
- G. An electronic copy of the 1965 original Black & Veatch Engineering Summary is attached hereto as Exhibit A. The original document is available for review at the D.G. Hunter Generating Station main office.

1.06 UNIT NO. 4

Unit No. 4 is a Combustion Engineering Inc. 85 MW Model VU-60 steam generator originally installed in 1972. Nameplate information is as follows:

Contract No.	29269
Rated Capacity	800,600 lbs/hr
Maximum Pressure	1,665 psi
Boiler H.S.	34,400 Sq. Ft.
Water Wall H.S.	9,730 Sq. Ft.
Economizer Pressure	1,625 psi
Manufacturer No.	21322
Built To	ASME LA23769

Additional items pertaining to Unit No. 4 are as follows:

- A. The boiler is equipped with a pendulum type pendant superheater but no reheater.
- B. The height of the furnace is approximately 40 feet.
- C. The unit does not have ports available for the attachment of suspended scaffolding.
- D. The boiler floor is the floor tube type.
- E. The unit is equipped with roof tubes.
- F. The unit has soot blowers and is equipped to burn fuel oil as a back-up fuel source. Fuel oil is rarely burned however, the most recent instance being a test run made in 2006.
- G. An electronic copy of the 1973 Black & Veatch Engineering Summary is attached hereto as Exhibit B. The original document is available for review at the D.G. Hunter Generating Station main office.
- H. The boiler does not have bullnose tubing.
- I. The boiler does not have an economizer.

1.07 SERVICE REQUEST: All work under this agreement will be done on a call-out basis and at the specific request of the Alexandria Electric Production Superintendent.

1.08 RESPONSE TIME: Within one working day of receiving telephonic notification from the City, the Contractor shall contact the City regarding the proposed work to determine the scope of work and both the level and extent of the necessary response. Within 72 hours of receiving such notification, the Contractor shall mobilize such manpower and equipment as is needed and shall be on-site and ready to commence inspection work as detailed herein.

1.09 SUBMITTALS:

- A. Provide documentation of all tests, inspections and certifications required by this section.

- B. Seven days prior to commencing work, provide qualifications of all welders present at the jobsite. Welders shall possess a National Board R-Stamp as well as any other required State or local certification necessary to perform the repairs.
 - C. Seven days prior to commencing work, provide qualifications of the Authorized Inspector for the work.
 - D. Provide a current Certificate of Insurance evidencing limits of general liability, automobile liability and worker's compensation as elsewhere specified.
 - E. For all materials proposed for installation, furnish three copies of manufacturer's information evidencing that the materials meet all requirements of this specification and referenced codes.
 - F. Submit Code required Welding procedures, per ASME Code, to the Owner 7 days prior to commencing work.
 - G. If preheat or post-weld heat treatment is necessary, submit such heat treatment procedures to the Owner for review.
 - H. Submit the final completed National Board R1 form "Report of Repair" within 7 days after completion of work, and before Contractor submits final invoice for payment.
 - I. Submit a written non-destructive examination procedure for review by the City within 10 days of Contract Award.
 - J. Prior to commencing non-destructive examination work, submit information indicating current calibration for the equipment proposed for use.
 - K. Provide tube rolling and expanding methodology to the City for approval prior to commencing repair work requiring this type of connection.
 - L. Provide one copy of the tube material test report for each replacement tube.
- 1.10 UTILITIES:** The City will furnish electrical and water service necessary to facilitate the work.
- 1.11 WORKER FACILITIES:** The City will provide laydown and parking areas as well as storage areas for equipment and materials required to complete the work. The Contractor shall provide all potable water, restroom and break area facilities as are needed by his workmen during the performance of the work.
- 1.12 WELDING PROCEDURES:** The Contractor shall adopt specific procedures for performing welding operations in the shop or the field. The procedure specification shall comply with the requirements of Section IX of the ASME code and the National Board Inspection Code. The procedure specifications shall be written and shall provide all pertinent details about the methods and procedure to be used, including the following:
- A. The type of electrode or rod to be used and the shape of the welding groove
 - B. The number and sequence of the beads
 - C. The manner in which slag is to be cleaned
 - D. Peening and current characteristics, if electric welding; and
 - E. The size of the tip, the nature of the flame, and the designation of forehand or backhand technique used, if gas welding.

The procedure specification shall ensure that weld metal and welded joints comply with the characteristics required by Section IX of the ASME code and the National Board Inspection Code.

A test demonstrating the sufficiency of the procedure specification shall be witnessed by the Authorized Inspector, or evidence documenting the sufficiency of the specifications shall be provided to the inspector.

- 1.13 SITE CONDITIONS:** It shall be the Contractor's responsibility to satisfy himself, by personal investigation, of the conditions which may affect the work. Should the City furnish any record information including, but not limited to, photographs, purchasing records, repair records, inspection records, testing records, shop or setting drawings for existing equipment, previously developed reports etc. it shall be understood that such records are furnished for information purposes only and are not guaranteed as to its accuracy or completeness and that such information may not be necessarily indicative of conditions which may be encountered in the field.
- 1.14 SITE RESTORATION:** The Contractor shall protect all City owned structures and facilities during the progress of his work. Following the completion of the work, the Contractor shall remove from the site and dispose of all debris, trash and unused materials. All dumpsters or similar disposal facilities shall be furnished by the Contractor. The Contractor shall, upon completion of the work, restore the work area as nearly as possible to its original condition including the repair or replacement, at the Contractor's sole expense, of any damage to the facility.
- 1.15 SAFETY:** The Contractor shall be the sole party responsible for jobsite safety. All work shall be performed in accordance with OSHA, plant safety requirements and local requirements.
- 1.16 AIR MONITORING:** Provide all air monitoring equipment required in connection with the work.
- 1.17 WORKING HOURS:** Allowable working hours at the D.G. Hunter Generating Station will be between 7:00 a.m. and 5.30 p.m., Monday through Friday.

PART 2 - MATERIALS

- 2.01 GENERAL:** If directed by the City, the Contractor shall furnish and install new equipment and/or materials as hereinafter specified. Furnish three copies of submittal information to the City for approval.
- 2.02 FERROUS METALS:** All Ferrous metals shall meet ASME Boiler & Pressure Vessel Code, Section II, Part A - Material Specification for Ferrous Materials.
- 2.03 NON-FERROUS METALS:** Any non-ferrous metals shall meet ASME Boiler & Pressure Vessel Code, Section II Part B - Non-ferrous Material Specifications
- 2.04 WELDING MATERIAL:** All welding rods, electrodes and filler metals shall meet ASME Boiler & Pressure Vessel Code, Section II Part C - Specifications for Welding Rods, Electrodes and Filler Metals.
- 2.05 TUBING:** Few records are available regarding tube material types, diameters and wall thicknesses. The majority of tubing visually appears to be 2.50" O.D. Repairs that have been made previously have utilized SA178C 2.50" OD x 0.165" tubing. These have generally been located on the waterwall.

Bids are to be based on the following material types, diameters and wall thicknesses. In the event that different materials are encountered, a Change Order will be issued to adjust payment equitably as detailed below. The adjustment shall apply to materials only and not any variation which may be required in installation methods or techniques.

- A. Superheater Tubing:** Superheater tubing shall be bid as standard weight SA213T11 2.50" OD seamless steel pipe with 0.165" minimum wall thickness. Tubing shall be furnished in such lengths as to minimize the number of welds required for installation.
- B. All Other Tubing:** All other tubing shall be bid as standard weight SA178C 2.50" OD seamless steel tubing with 0.165" minimum wall thickness. Tubing shall be furnished in such lengths as to minimize the number of welds required for installation.

C. Change Order Procedure: In the event that tubing materials encountered in the field vary from the materials specified in 2.05(A) and 2.05(B) above, the following procedure shall be used to adjust payment under this contract:

1. The Contractor shall procure 3 current quotes for the specified materials and 3 current quotes for the materials encountered in the field. Quotes shall be for the maximum quantity of materials required to make the repairs.
2. The Contractor shall convert the quotes to dollars per linear foot if necessary (if quotes are dollars per ton, dollars per pound, etc.) and submit all information including calculations to the Owner.
3. Using the lowest price from each of the 2 sets of quotes, the Owner will adjust the payment to the Contractor using the information furnished.
4. Payment for the tubing installed will be made based on the actual lengths as completed and measured. However, the price adjustment will be made on the actual length of tubing purchased including cut-offs and waste which is not returnable by the Contractor for refund.

2.06 TUBE WELD ATTACHMENTS: All tube weld attachments (membranes, buckstays, etc.) shall comply with all requirements of the ASME Boiler & Pressure Vessel Code and NBIC-23.

PART 3 - CONSTRUCTION METHODS

3.01 GENERAL: The Contractor shall comply with all OSHA regulations, State, local or City of Alexandria requirements, D.G. Hunter Generating Station safety procedures, Contractor's safety procedures or as necessary to provide a safe environment for workers. Boiler repairs shall be made such that the boiler under repair conforms to original specifications following the work. Any repairs not covered by original specifications shall be subject to the requirements for new construction.

3.02 WORK BY THE CITY: Prior to the Contractor's arrival at the site for examination or repair work, the City will remove from service, isolate, aerate the piping system, and lockout and tag affected valves at the boiler to be repaired. If necessary to facilitate the work, the City will remove areas of firebrick and replace it following the Contractor's completion of examination or repair operations.

3.03 QUALIFICATIONS: All welders present at the jobsite shall be certified/qualified to perform repairs on Power Boilers, in accordance with ASME Code Section IX, and the National Board Inspection Code. Welders must possess authorization to perform weld repairs on Power Boilers, National Board R Stamp or equivalent, in accordance with local Jurisdictional Requirements for Repairs to Power Boilers.

3.04 NON-DESTRUCTIVE EXAMINATION: Within 72 hours of receiving the notification identified in Section 1.08, the Contractor shall mobilize such manpower and equipment as is needed to perform non-destructive examinations and shall be on-site and ready to commence examination work.

- A. The non-destructive examination of the boiler tubes shall be by the low-frequency electromagnetic technique unless otherwise authorized by the City. All flaw indications, bends, welds, viewports and other areas that are inaccessible shall be proved-up using Shear Wave (A-Scan) ultrasonic testing.
- B. Submit a written non-destructive examination procedure for review by the City within 10 days of Contract Award.
- C. For pricing purposes, the Contractor shall plan on performing a non-destructive examination on 15,000 linear feet of tubing per occurrence. A more or less price will be taken in the event that the City requests the examination of an additional or lesser quantity.

- D. Prior to commencing work, submit information indicating current calibration for the equipment proposed for use.
 - E. Furnish three copies of a complete report detailing the examination results. Including the following minimum elements:
 - 1. A written summary of the work performed including location, company, personnel involved, contact information, dates, methodology, examination techniques, results and recommendations for repair.
 - 2. Include details of the unit examined, number of feet and elevations examined, original tube thickness, inspection frequency and equipment serial numbers.
 - 3. Include a color coded tube wall map for each tube wall examined. Tube wall maps shall include a numbering system for tubing as well as height and level information allowing the City to readily locate all areas proposed for repair.
 - 4. Include a tabular summary of test results showing wall identification, tube number, test elevation, wall thickness remaining and percentage of remaining nominal wall thickness.
 - 5. Include detailed recommendations that include mandatory repairs necessary to return the boiler to operation and recommended repairs at areas of minimal Code compliance. The recommendations shall be separate from each other and shall include the Contractor's estimate of repair costs and timeframe.
- 3.05 SCAFFOLDING:** The Contractor shall furnish all scaffolding required for the completion of the work.
- 3.06 CONFINED SPACE WATCH:** Furnish such personnel for fire hole or confined space watch as may be required by OSHA regulations, State, local or City of Alexandria requirements, D.G. Hunter Generating Station safety procedures, Contractor's safety procedures or as necessary to provide a safe environment for workers.
- 3.07 WELDING:**
- A. The Contractor shall determine if any preheat and/or post-weld heat treatments are required. All preheat and post weld heat treatments are to be performed in accordance with ASME Code Section I.
 - B. The Contractor will provide at their expense, an independent Authorized Inspector, as required by Code, to review and approve the Contractor's National Board R-Stamp certification, review all welding/repair procedures, inspect all welds, and witness and approve post-repair hydrostatic testing of the boiler tubes. A visual examination of all welds by the Authorized Inspector is required without exception.
 - 1. The Authorized Inspector shall submit an independent report of all findings to the City within 10 days of the completion of the Contractor's work.
 - C. All Code welding is to be performed in accordance with the Contractor's Welding Procedure Specifications which shall be qualified in accordance with the requirements of ASME Section IX.
 - D. The Contractor will submit the final completed National Board R1 form "Report of Repair" within 7 days after completion or work, and before Contractor submits final invoice for payment.
 - E. Window welds will not be allowed.
- 3.08 REPAIR OPERATIONS:**
- A. For pricing purposes, the Contractor shall plan on removing and replacing 30 linear feet of tubing at each repair location. A more or less price will be taken in the event that the City requests that the repair length be extended or reduced.

- B. Remove such insulation, seal plates or other items as may interfere with the work. Care shall be taken during the removal process not to damage either the insulation or other City property. Any damaged items shall be replaced new by the Contractor at no additional cost to the City.
 - C. Remove and replace all boiler tubing recommended for replacement by the Examination Report or as directed by the City. Specific locations and lengths of tubing to be removed and replaced shall be closely coordinated with and agreed to by the City prior to the commencement of the work.
 - D. The City prefers that each replacement tube be a single continuous length with one weld at each end of the repair. If access limitations make such continuous repairs impractical, the Contractor shall consult with the City regarding the repair and obtain approval prior to cutting and installing the replacement tubes. The Owner shall have final approval as to allowing the cutting of tubes and the use of multiple welds in a single repair.
 - E. Wall tubes shall be replaced from 2" above the existing weld joint located in the upper section of the furnace to under the floor and welded into place. If access will not allow for welding under the floor to the stub on header, welds shall be located just above the furnace floor. The City reserves the right to modify both the length and location of tubing to be replaced.
 - F. Perform field measurements to determine bend details. Bends shall be performed by a qualified shop. Replacement tubes shall be identical in dimension and radius to the original tubes.
 - G. Babcock & Wilcox boiler tubes are attached to the buckstays at 3 to 4 tube intervals. If the tube being replaced is one of the tubes attached to a buckstay, the replacement tube shall also be attached to the buckstay.
 - H. The tube to mud drum joint design shall be in accordance with ASME Section I requirements as outlined in PWT-11 Tube Connections (expanding and rolling tube) and shall be the same as the original joint design. Joint seal welding, if used, shall be in accordance with requirements in the ASME Section I. The Contractor shall provide tube rolling and expanding methodology to the City for approval prior to commencing repair work.
 - I. The Contractor shall repair and re-install all buckstays, membranes, supports, refractory, insulation or lagging that was removed during the course of the work. Any damaged items shall be replaced with new material. All attachment welding shall be performed in accordance with ANSI/NB-23 and ASME Section I.
 - J. Weld beads and other debris may result in tube blockage, short term overheating failures, shutdowns and costly repairs. Protect the system during the installation of the work and ensure that all debris is removed following repair work.
- 3.09 TESTING:** Following the completion of repair work, the Contractor shall test each completed repair and furnish the City with three copies of a certified copy of the testing report showing zero leakage. **The Owner's water source and feedwater pumps may be used to fill the tubing and provide the initial pressurization, up to the limits of the system pressure relief valve (approximately 1475 psi). The pumps will be operated by the Owner in coordination with the Contractor. The Contractor shall be responsible for furnishing all gauges and for monitoring and maintaining the test pressure.** The requirements of the ASME Code, the National Board Inspection Code, the Boiler and Pressure Vessel Code and the manufacturer's recommendations shall apply. A certified copy of the test report shall be submitted to the Office of the State Fire Marshal along with an application for recertification and any applicable fees and charges. **Non-destructive examination in lieu of hydrostatic testing will be allowed for minor repairs, if allowed by the Code.**
- 3.10 TESTING WORK BY OTHERS:** If requested by the City, one or more sections of removed tubing shall be set aside at the Plant for metallurgical analyses by others. The Contractor shall dispose of all remaining removed tubes.

3.11 REPAIR DOCUMENTATION:

- A. Provide one copy of the tube material test reports.
- B. Provide one copy of R-1 Form to the City. The form must be signed by an Authorized Inspector.

PART 4 - MEASUREMENT AND PAYMENT

4.00 CONTRACT INITIALIZATION:

4.01 NON-DESTRUCTIVE EXAMINATION: If requested by the City, non-destructive examinations will be measured and paid for under up to two pay items.

- A. **Non-Destructive Examinations:** Non-destructive examinations, requested by the City, will be measured and paid for per each at the contract lump sum price bid per examination instance following the submittal and acceptance of the completed examination report. Such price shall be full compensation for mobilization, submittals, the physical, electromagnetic and ultrasonic examination of 15,000 linear feet of boiler tubing and the writing, compilation and delivery of three copies of the examination report. Included will be all labor, materials, tools and incidentals required to complete the work.
- B. **More or Less Tube Examination:** More or less tube examination will be measured and paid for per linear foot at the contract price bid per L.F. of tubing examination per instance requested by the City and successfully completed by the Contractor. Included will be all labor, materials, tools and incidentals required to complete the work.

4.02 TUBE REPLACEMENT: If requested by the City, the replacement of boiler tubes will be measured and paid for under up to four pay items.

- A. **Mobilization – Boiler Repair:** Mobilization – Boiler Repair will be paid for lump sum per boiler repair occurrence at the lump sum contract price bid and shall include all costs associated with mobilization, relocation of manpower and equipment to the site; for all meals and per diem costs; and for all labor, tools, equipment and incidentals required to perform the work.
- B. **Tube Replacement – Superheater:** The replacement of Superheater tubes, requested by the City, will be measured and paid for per each at the contract lump sum price bid per repair location following the completion and acceptance of the repair, regardless of the repair location. Such price shall be full compensation for mobilization, scaffolding, submittals, removal, disposal of and replacement of 30 linear feet of superheater tubing including the connections at each end; for all disposal and clean-up required in connection with the work. Included will be all welding, connections, labor, materials, tools and incidentals required to complete the work.
- C. **More or Less Tube Replacement - Superheater:** For superheater tube repairs that are longer or shorter than 30', a "more or less" price will be used to adjust the repair length payment. More or less superheater tube replacement will be measured by the linear foot and paid for (or deducted) per linear foot at the contract price bid, regardless of the repair location. Such price shall be full compensation for mobilization, scaffolding, submittals, removal, disposal of and replacement of additional superheater tubing; for all disposal and clean-up required in connection with the work. Included will be all labor, materials, tools and incidentals required to complete the work.
- D. **Tube Replacement – Economizer:** The replacement of economizer tubes, requested by the City, will be measured and paid for per each at the contract lump sum price bid per repair location following the completion and acceptance of the repair, regardless of the repair location. Such price shall be full compensation for mobilization, scaffolding, submittals, removal, disposal of and replacement of 30 linear feet of economizer

tubing including the connections at each end; for all disposal and clean-up required in connection with the work. Included will be all welding, connections, labor, materials, tools and incidentals required to complete the work.

- E. More or Less Tube Replacement - Economizer:** For economizer tube repairs that are longer or shorter than 30', a "more or less" price will be used to adjust the repair length payment. More or less economizer tube replacement will be measured by the linear foot and paid for (or deducted) per linear foot at the contract price bid, regardless of the repair location. Such price shall be full compensation for mobilization, scaffolding, submittals, removal, disposal of and replacement of additional economizer tubing; for all disposal and clean-up required in connection with the work. Included will be all labor, materials, tools and incidentals required to complete the work.
- F. Tube Replacement – All Other Locations:** Tube replacement, other than superheater or economizer tubes, requested by the City, will be measured and paid for per each at the contract lump sum price bid per repair location, between the heights above finished floor (AFF) shown, following the completion and acceptance of the repair. Such price shall be full compensation for mobilization, scaffolding, submittals, removal, disposal of and replacement of 30 linear feet of boiler tubing including the connections at each end; for all disposal and clean-up required in connection with the work. Included will be all welding, connections, labor, materials, tools and incidentals required to complete the work.
- G. More or Less Tube Replacement – All Other Locations:** More or less tube replacement will be measured and paid for per linear foot at the contract price bid per L.F. of tubing replacement requested by the City and successfully completed by the Contractor, between the heights above finished floor (AFF) shown. Such price shall be full compensation for mobilization, scaffolding, submittals, removal, disposal of and replacement of additional boiler tubing; for all disposal and clean-up required in connection with the work. Included will be all labor, materials, tools and incidentals required to complete the work.
- H. Tube Bends:** Tube bends, requested by the City, will be measured and paid for per each bend at the contract lump sum price per each bid.
1. A bend followed by a straight section of 12 or more inches followed by a second bend will be considered to be two bends.
 2. A bend with multiple radii will be considered to be one bend.
 3. A bend in multiple planes will be considered to be one bend.
 4. Tube Bends will be paid for in addition to any payment made for tubing under Items 4.02(B) through 4.02(G).

Such price shall be full compensation for measuring, removing, replacing tube bends; for all submittals, bending and clean-up required in connection with the work. Included will be all welding, bending, connections, labor, materials, tools and incidentals required to complete the work.

4.03 REPLACEMENT TUBE TESTING: The testing of replacement tubes will be measured and paid for per each at the contract lump sum price bid following the completion and acceptance of the test. Such price shall be full compensation for mobilization, submittals, reports, and physical testing of boiler tubing. Included will be all labor, materials, tools and incidentals required to complete the work.

4.04 PAYMENT ITEMS: Payment will be made under:

48 11 01 4.01 (A) Non-Destructive Examinations (Includes 15,000 L.F. of Tubing per Instance), per Lump Sum;

- 48 11 01 4.01 (B)** More or Less than 15,000 L.F. of Tubing Examination per Instance, per L.F.;
- 48 11 01 4.02 (A)** Mobilization – Boiler Repair, per Lump Sum;
- 48 11 01 4.02 (B)** **Tube Replacement – Superheater (Includes 30 L.F. of Tube Replacement), per Lump Sum;**
- 48 11 01 4.02 (C)** **More or Less than 30 L.F. of Superheater Tube Replacement per Location, per L.F.;**
- 48 11 01 4.02 (D)** **Tube Replacement – Economizer (Includes 30 L.F. of Tube Replacement), per Lump Sum;**
- 48 11 01 4.02 (E)** **More or Less than 30 L.F. of Economizer Tube Replacement per Location, per L.F.;**
- 48 11 01 4.02 (F)** **Tube Replacement – All Other Locations (_____’ AFF to _____’AFF) (Includes 30 L.F. of Tube Replacement), per Lump Sum;**
- 48 11 01 4.02 (G)** **More or Less than 30 L.F. of Tube Replacement – All Other Locations (___’ AFF to _____’AFF) per Location, per L.F.;**
- 48 11 01 4.02 (H)** Tube Bends, per Each
- 48 11 01 4.03** Replacement **Tube Testing**, per Lump Sum;

END OF SECTION 48 11 01