United States
National Advisory Committee for Aeronautics
Langley Memorial Aeronautical Laboratory
Langley Field, Hampton, Virginia

Specifications
For
Designing, furnishing, and installing
Frecn - 12 equipment and purification system
For
two dimensional pressure tunnel
At
Langley Field, Hampton, Virginia
Project 551

Specification No. L-211

OCTOBER 17, 1946
SECTION II - WAGE RATES

1. Minimum Wage Rates:

(a) In accordance with the provisions of the Davis-Bacon Act, as amended, the following minimum wages have been predetermined by the Department of Labor for the crafts employed directly upon the site of this work:

<table>
<thead>
<tr>
<th>Craft</th>
<th>Per Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air tool operators (jackhammermen, vibrator)</td>
<td>$0.85</td>
</tr>
<tr>
<td>Asbestos workers</td>
<td>1.625</td>
</tr>
<tr>
<td>Asbestos workers' improvers:</td>
<td></td>
</tr>
<tr>
<td>1st year</td>
<td>0.70</td>
</tr>
<tr>
<td>2nd, 3rd, and 4th years</td>
<td>1.15</td>
</tr>
<tr>
<td>Carpenters, journeymen</td>
<td>1.30</td>
</tr>
<tr>
<td>Carpenters, apprentices:</td>
<td></td>
</tr>
<tr>
<td>1st 6 months 30 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>2nd 6 months 35 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>3rd 6 months 40 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>4th 6 months 45 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>5th 6 months 50 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>6th 6 months 60 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>7th 6 months 70 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>8th 6 months 80 percent of journeymen's rate</td>
<td></td>
</tr>
<tr>
<td>Carpenters tenders</td>
<td>0.75</td>
</tr>
<tr>
<td>Cement finishers</td>
<td>1.25</td>
</tr>
<tr>
<td>Electricians</td>
<td>1.625</td>
</tr>
<tr>
<td>Electricians' apprentices:</td>
<td></td>
</tr>
<tr>
<td>1st 6 months</td>
<td>0.65</td>
</tr>
<tr>
<td>2nd 6 months</td>
<td>0.70</td>
</tr>
<tr>
<td>2nd year</td>
<td>0.80</td>
</tr>
<tr>
<td>3rd year</td>
<td>0.90</td>
</tr>
<tr>
<td>4th year</td>
<td>1.10</td>
</tr>
<tr>
<td>Glaziers</td>
<td>1.125</td>
</tr>
<tr>
<td>Iron workers, structural</td>
<td>1.75</td>
</tr>
<tr>
<td>Iron workers, ornamental</td>
<td>1.75</td>
</tr>
<tr>
<td>Laborers</td>
<td>0.65</td>
</tr>
<tr>
<td>Lathers</td>
<td>1.625</td>
</tr>
<tr>
<td>Marble setters</td>
<td>1.625</td>
</tr>
<tr>
<td>Marble setters' helpers</td>
<td>0.75</td>
</tr>
<tr>
<td>Welders - receive rate prescribed for craft performing operation to which welding is incidental.</td>
<td></td>
</tr>
</tbody>
</table>

(b) Any class of laborers or mechanics, including apprentices, not listed in the preceding paragraph, which will be employed on this contract, shall be classified or reclassified conformably to the foregoing schedule. In the event the interested parties cannot agree on the proper classification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendation of the Contracting Officer, shall be referred to the Secretary of Labor for final determination.
SECTION XLV - STANDARD SPECIFICATIONS, HEATING

45-01. Scope:

(a) Under this Section the Contractor shall furnish labor, material, equipment, appliances and accessories necessary or incidental to a complete, satisfactorily operating heating system in conformity with drawings and as specified herein.

(b) The requirements of this Section apply only so far as they are included within the scope of the work to be done under this contract. Requirements of this Section not applicable to such work shall be disregarded.

(c) The work shall extend from the existing utility tunnel or supply and return mains throughout the area of operations. Connections to existing supply and return lines shall be made by the Contractor.

(d) The Contractors shall submit for approval four copies of catalog cuts and operating data sheets on each and every item of equipment not covered by detail drawings and forming part of the contract work included hereunder.

(e) Electrical work to be done under this Section includes all automatic controls, switching and protective devices, wiring, and electrical accessories required for the proper operation of equipment called for under this Section, including all materials and labor, up to a junction box or disconnect switch to be located adjacent to the equipment. Electrical connections between all automatic controls and equipment shall also be furnished and installed under this Section. The junction box or disconnect switch, as required by NEC with subfeeder to the main panel shall be provided under the Section covering Electrical Work. All electrical equipment furnished and installed under this Section shall meet the requirements of ELECTRICAL WORK.

45-02. Piping:

(a) Pipe two inches and over in size shall be welded. All welding shall conform to paragraph 45-03 of this Section.

(b) Horizontal steam mains shall be pitched in the direction of the flow in the pipes except runouts to risers and piping for which the pitch is indicated on drawings as being against the flow. Valves in steam piping shall be easily accessible.
All return mains and branches of the heating system shall have a minimum pitch of at least 1/2 inch in every ten feet in the direction of flow in pipes, except in vacuum-return systems.

(c) Runouts to each steam riser shall be taken out from the top of the steam main on a rise of 45 degrees and shall be pitched back toward the main.

(d) Drips where required to keep horizontal steam pipes free from condensation shall be connected through traps to return mains. All traps on drips shall have full-size valved by-passes.

(e) Pipes shall be anchored and braced where necessary to prevent vibration and excessive expansion at any point. Swing joints and other means of taking up expansion of piping shall be provided where necessary to prevent breakage or other damage.

(f) Pipe near floors, including pipe in trenches, shall be supported in iron roller stands spaced ten feet apart and bedded in the concrete floors.

(g) All steam and return risers, shall be of sizes as marked on drawing. Risers, connections from heating equipment, and traps, shall be arranged to allow for expansion and to give a neat arrangement to each connection. Steam and return risers shall have a sediment picket, not larger than 1-1/4 inches where such risers are connected to mains.

(h) All piping shall be hydrostatically tested at a pressure not less than 60 pounds per square inch.

(i) Installation of steam and return piping shall conform to Section XI. "Plumbing" paragraph 40-12, "General Installation of Pipe!"

45-03. Welding

(a) Welding shall be done as shown or called for on the drawings or as approved.

(b) All welding shall be done by the shielded electric arc process, using metallic electrodes, with the atmosphere excluded from the molten metal by the case of heavily coated welding rods or suitable gaseous envelope, or, in machine welding, a suitable deposited flux.
(c) On pipe less than four inches in diameter, welding may be done as above or by acetylene.

(d) Chill rings or liners, approved by the Contracting Officer, shall be used when any pipe or fittings are welded.

(e) All welding, except as otherwise specified, shall be done in compliance with the applicable current codes, specifications, and recommended practices of the American Welding Society.

(f) Welding and pressure vessel work shall be done in accordance with the applicable sections and paragraphs of the Code for Unfired Pressure Vessels by A S M E.

(g) Before beginning the production of welded work, the Contractor shall furnish the Contracting Officer satisfactory evidence in the form of a certificate by a testing agency approved by the Contracting Officer that each welder has, within one year of the date of this contract, satisfactorily performed the qualification tests prescribed by the A S C Code using the detailed procedure, to be followed in actual production under this contract. In the absence of such certificate each welder shall, in the presence of the Contracting Officer, perform welding on not less than two each of pipe test joints of the following types of welding: flat, horizontal, overhead and vertical. Test material shall be of same thickness and weld metal shall be deposited in the test joint in the same manner as required in actual construction. For instance, for the overhead position weld metal shall be deposited from the underside. Expense of any tests necessarily performed under this provision, not including time of Government personnel, shall be borne by the Contractor.

(h) The Contractor shall keep a record which shall show the welding operator employed on each joint, which record shall be available at any time to a representative of the Contracting Officer.

(i) Wherever there is danger of the assembled structure or member becoming warped or distorted by localized welding stresses, the welds shall be thoroughly peened with a pneumatic tool to relieve such stresses. Peening for this purpose shall be done wherever directed by the Contracting Officer.

(j) The Contractor shall establish and record a process specification that shall meet with the approval of the Contracting Officer for all kinds, types, and classes of joints and welds involved in the work and shall include the following items: Process, base metal, filler
metal, preparation of base metal, nature of welding flame, nature of electric current, current characteristics, method of welding, number of layers of beads, shielding of arc or flame, cleaning and peening, treatment of underside of groove, and removal of defects. The actual procedure followed by all welding operators shall conform to the process specifications as approved. The Contractor shall demonstrate to the satisfaction of the Contracting Officer that the procedure covered by the foregoing process specification will produce satisfactory welds with respect to the following: Soundness of welded joints, ductility of weld metal in joints, and tensile strength.

(k) The weld metal used in the welding of all joints shall be particularly adapted to the base metal and the type of joints involved.

(l) All flush members to be welded together shall be beveled or grooved to insure a good weld and the entire depth of the groove or gap shall be welded full. The welding shall be staggered instead of proceeding continuously from one end to the other.

(m) The edges of adjoining members shall be accurately and rigidly held in place while being welded in all cases where smooth surface is essential to avoid obstruction to air flow. Material shrinkage shall be anticipated and allowed for.

(n) For testing, any portion of the welded joints the Contractor shall remove a one-inch plug from welded material when so directed by the Contracting Officer.

(o) All holes that were necessary for erection, test plugs, or other purposes and will not be necessary after completion of the work shall be welded full. Those welds when on exposed surfaces and such other welds as indicated on the drawings or specified herein shall be chipped and ground flush with adjacent surfaces. In pipe welding, all holes of test plugs not necessary after completion of work shall be plugged with a capped nipple welded to the pipe.

45-04. Pipe and Fittings:

(a) All pipe for the heating system shall be standard-weight black steel conforming to Federal Specification WW-P-403a, Type II, Class A. Pipe nipples shall conform to Federal Specifications WW-N-351.
(b) All fittings, except couplings, on steam and return pipes shall be cast iron conforming to Federal Specification N-F-501b, Class 1, designed for a working pressure of 125 pounds per square inch. Flanged fittings shall be designed for a working pressure of 125 pounds per square inch and shall conform to Federal Specification N-F-406a.

(c) In lieu of screwed fittings, the Contractor may, except at unions, weld black steam and return pipe as specified above, two inches and larger, using welding rod of the same material as the pipe. Tees may be formed by welding nozzle fitting into the mains, except that no branch smaller than 1-1/4 inches shall be welded.

(d) If a pipe smaller than 1-1/4 inches is required, a 1-1/4 inch nozzle may be welded to the main with a reducing fitting to smaller size, or a factory-made saddle fitting may be used to reduce to the proper pipe size. Mitered joints and field made reducers will not be permitted.

(e) Tubular-steel, or forged fittings for welding and built-up manifolds shall conform to the same material and thickness as the pipe with which they are used. Cast-steel fittings with welding ends shall be standard, but center to face and over-all dimensions need not be adhered to. All cast-steel fittings with welding ends shall be suitable for this class of work with regard to material and wall-thickness requirements. The design of the welding fittings shall be such that no damage shall result from the welding.

(f) Eccentric reducing fittings shall be installed in all horizontal lines.

(g) No reducing bushings will be allowed. All fittings shall conform to pipe sizes.

(h) All pipes shall be of sizes noted and shall be installed as shown on the drawings. All necessary fittings shall be used, as springing of pipes will not be permitted.

(i) Pipes and fittings shall be put together with graphite or an approved compound applied to the pipe threads, not the fittings.

(j) All branch connections from the supply mains shall be taken from the top of the main or at an angle of 45 degrees above the center-line of mains. All connections shall be made so as to insure unrestricted circulation and elimination of air pockets and to permit complete drainage of system.
All fans shall be rated in accordance with the Code for Testing of Centrifugal and Disc Fans of the American Society of Heating and Ventilating Engineers.

45-17. Insulation - Pipe and Fittings:

(a) Before insulation is applied to piping, all steam, return, drip, and feed pipes, shall be tested with the required boiler pressure of steam or hydrostatically as specified in paragraph 45-19 "Tests" of this Section, in the presence of the Contracting Officer's representative. The insulation (except for the finishing canvas cover) may be applied to piping prior to test specified above, provided all fittings, welds, and flanges are left bare for the detection of possible leaks. After testing, flanges, unions, and welds shall be insulated.

(b) Unless otherwise indicated all steam pipes, return pipes, drip pipes, piping inside of ventilating units exposed to outdoor temperatures, shall be insulated with non-conducting covering as specified hereinafter.

(c) Heating piping within shop portion of buildings shall not be covered except all steam and return risers or other steam lines shall be covered to a height of 10 feet above the floors to protect personnel from burns. All other heating piping including condensate-return lines shall be covered with four ply air-cell asbestos preformed pipe covering.

(d) All pipe covering shall be of materials specified hereinafter and shall be of standard thickness unless otherwise indicated. Non-conducting cover shall be of the highest grade and installed in a first class manner by workmen skilled in their trade. All surfaces of coverings shall be smooth and even, bands evenly spaced, and canvas jackets pasted down.

(e) Covering for fittings including flanges, unions, and valves, shall be asbestos, mineral felt, glass fiber, or diatomaceous-earth plastic insulating material, of the same grade as the corresponding sectional pipe covering. All joints shall be canvassed.

(f) Diatomaceous-earth sectional covering shall be not less than 80 per cent pure and not less than 7/5 inch thick, unless a different thickness is required by the job specifications. It shall weigh not over nine pounds per cubic foot in loose form and be free from clay.
(g) Mineral or rockwool sectional covering shall conform to Federal Specification No. HH-P-366A.

(h) Felted amosite asbestos covering shall be composed of amosite asbestos fiber in a felted and laminated form to an approximate density of 12 pounds per cubic foot. The conductivity shall not be greater than that of 85 per cent magnesia.

(i) All sectional pipe covering shall have cotton jackets weighing not less than 3.8 ounces per linear yard, 37-1/2 inches wide; and covering of valves and fittings shall have a similar jacket cemented on. Jackets shall be neatly pasted down at laps. Bands shall be black, japanned steel, not less than 3/4 inch wide for covering for pipe sizes up to and including five inches and not less than one inch wide for larger sizes. Bands shall be not less than .007 inch thick. Bands shall be placed not more than 10 inches apart and at each tee there shall be three bands and at each elbow two bands. Covering shall be neatly finished where pipe hangers occur and at unions.

(j) All cement used for covering shall be that recommended by the manufacturer of the covering.

45-18. Painting:

(a) All field painting shall be performed under Section XXVIII, "Painting and Finishing." All shop and factory painting shall be done under this Section.

45-19. Tests:

(a) All piping shall be hydrostatically tested at a pressure not less than 60 pounds per square inch. After the entire heating system has been installed and all units throughout (including the heating elements of ventilating units) have been connected, and before pipe covering has been applied, the entire system, including risers, radiation, mains, etc., shall be subjected to a steam-pressure test of 15 pounds for a period of not less than five hours, which test shall be made in the presence of the Contracting Officer's representative.

(b) The Contractor shall operate and test the entire system for not less than three days, the Contractor being responsible for the safety of the system during this period. The Contractor shall make all necessary adjustments and tests to the equipment to balance the system properly and to place same in operating condition.

(c) After the completed heating system has been in normal operation for a period of two weeks, the Contractor shall check all strainers, drip traps, and dirt pockets, and remove any sediment found therein.