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SECTION TWO/THREE

GENERAL TECHNICAL SPECIFICATION

TESTING & COMMISSIONING

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TESTING & COMMISSIONING

2.3.1 GENERAL

This section of the Specification includes for the testing, setting to work and commissioning of all section of the works including all items of plant and equipment incorporated into the works.

Commissioning of all installations incorporated into the works under this section of the specification shall be carried out by professional, fully experienced Commissioning Engineers/Specialists.

The Contractor shall be responsible for coordinating and supervising their work.

2.3.2 NOTICE OF TESTING

A minimum of 7 days notice must be given by the Contractor of any test to be carried out on site to enable the Consulting Engineer or his authorised representative to be present if he so desires.

2.3.3 TESTING

On completion of each installation or service or sections of such installation, or services, all necessary tests shall be carried out to the pressures listed. No part of the works shall be insulated or rendered inaccessible prior to successful completion of testing to the satisfaction of the Consulting Engineer. This may entail testing in sub-section of each of the installation installations installed and all associated costs to allow this to occur shall be deemed to be incorporated and form part of the Contract.

a. Plant and Equipment

Manufacturers certificates of tests for all items of plant and equipment shall be provided by the Contractor.

b. Pipework

Heating, and Chilled Water:

7.0 bar or twice the working head, whichever is the greater hydraulically for 30 mins for all screwed pipework.

7.0 bar or twice the working head whichever is the greater hydraulically for 1 hour for all welded pipework.

The installations shall then be kept under normal working conditions for a period of 10 days to carry out adjustments and regulations, to obtain the required design conditions. The Contractor/Specialist is to provide a record of temperatures achieved within each room after a period of not more than 24 hours.

H.W.S. and T.C.W.S.:

3.5 bar or twice the working head whichever is the greater hydraulically for 30 minutes.

M.C.W.S.:

All external water mains shall be subject to a minimum hydraulic test pressure of twice the working pressure of the pipeline.

All tests shall be carried out in accordance with BS 6700 1987 Section 3, BS 5886, CP 312 and CP 2010 as appropriate for the material of the pipeline and any other special requirements of the local water company.

All tests shall be carried out to the satisfaction of the local water company's inspector, who shall be called upon to witness all tests prior to the back filling of any trenches. Contractor to include for all necessary charges.

All internal water mains shall be tested in accordance with BS 6700 1987 Section 3, Clause 14.6.

Gas: Testing and Purging

The work shall be carried out in accordance with all relevant Gas Board Regulations, BGC Codes of Practice and Booklets No. UO62/U763 and UO6/U9.

Pipework in trenches shall be tested as the works proceed.

Testing shall be by air test pressure 34m, test period 1 hr.

A calibrated mercury pressure gauge shall be used, capable of being read to 3.4 bar.

Tests shall be absolute with no allowance for leakage.

Gas Safety Regulations 1972 apply in respect of this work.

All tests shall be carried out to the entire satisfaction of the representative of the Local Gas Board who shall be called upon to witness all tests on the complete gas installation.

The Contractor shall agree details of the testing procedure with the Local Gas Board prior to commencing with the work. Test Certificates shall be submitted

to the Consulting Engineer.

Internal cleaning of gas installations shall include scavenging with steam or compressed air. Items which could be damaged shall be isolated and cleaned by appropriate alternative methods.

Sanitary Pipework:

Air tests equal to 65mm water gauge. Prior to commencing air tests all water seals on all sanitary appliances and floor gullies must be fully charged with water and all open ends of pipework i.e. vents and outfalls must be adequately plugged.

Water tests may be called for but will only apply to horizontal runs of plumbing and drainage pipework the section of drainage pipework below the lowest sanitary appliance.

c. Ductwork

All ductwork shall be tested upon completion, either as a whole, or in sections if required to enable progress to be maintained. This clause shall apply to all ductwork, both high and low velocity, and shall be in accordance with Appendix A Table 31 and Appendix B of D.W>/142.

All test holes in ductwork utilised for testing and balancing shall be fitted with air tight, removable plugs.

The Contractor shall allow for two smoke tests of each system or section of system or installation.

d. Air Systems

The Specialist shall balance and adjust each damper, grille and diffuser to attain the specified air flow rates and distribution in each air system. The Specialist shall tabulate all these readings and submit this information to the Consulting Engineer for his comments. Final damper positions shall be clearly marked.

Tests on air handling plants shall be as follows:

Measure the capacity of the fan.

Measure pressure heads of all fans as specified air quantities.

Pressure drop across EACH filter, heater and cooler battery and any other items of equipment within the systems.

Measure air temperatures to confirm "ON" and "OFF" coil conditions from all heater and cooler batteries.

Measure water pressure drop through each heater and cooler coil chiller.

Measure water temperature drop through each heater and cooler coil and chiller.

The Contractor shall allow in his price for one pulley change of each fan, as may be required.

e. Noise

The Specialist shall carry out noise level tests with a calibrated sound level meter, see clause 2.2.5 (o).

f. Refrigeration

Tests on refrigeration's and cooling circuits shall be carried out by a Specialist and cover the following.

Test pressure of 400psig for the liquid line and 200 psig for the suction line shall be applied. The system shall be considered satisfactory if there is no drop in pressure for a period of 24 hours. Pressures shall be applied by the use of either dry nitrogen or anhydrous carbon dioxide. During the test period all joints shall be checked with a halide torch. When the systems have been proved free from leaks, they shall be dehydrated by evacuating the systems to a pressure of 3mm of mercury absolute. After pressure testing and dehydration the systems shall be charged with the required amount of refrigerant fed through a dehydrator.

Where systems are of smaller capacity, is. nominally less than 15KW cooling and such, are not fitted with liquid refrigerant line sight glasses, then the correct refrigerant charge must be inserted by means of an accurance purpose designed charging machine, to ensure that the correct weight of refrigerant is included. The correct charge must be calculated as detailed in the Manufacturer's data.

Additional Information Regarding Water Chillers:

The commissioning report must show all chilled water flow rates, entering temperatures, leaving temperatures and pressure drops across the heater exchangers, for both evaporator circuits and condensor circuits (if water cooled condensors are fitted).

The electrical data must also be recorded for each compressor and condensor fan (if fitted). This data should show all starting and running currents to ensure that they are within the manufacturers data.

g. Electrical/Control Systems

The Specialist shall bring all plants and services to full working order by setting up accurately all controls both electrically and mechanically and

carrying out preliminary tests prior to official acceptance tests. These tests shall be as follows:-

Electrical measurement to determine the mains voltage for each motor, the starting current and the power taken at full specified loads and the power factor calculated.

Tests shall confirm the correct functioning of all controls, electrical and mechanical interlocks and safety devices, limit thermostats, high and low pressure switches, etc.

Electrical insulation tests and earth continuity tests for each system.

h. Soil, Waste and Rainwater Installations

The whole installation shall be soundness and performance tested. The soundness test shall be an air test carried out in accordance with the procedures and to the standards set down on BS Code of Practice 5572 1978 Section 12.3.

i. Boilers

Each boiler shall be tested/commissioned by the Manufacturer. The Contractor shall allow the costs in his price and submit a copy of the Test Certificates to the Consulting Engineer.

2.3.4 FAILURE UNDER TEST

Should any section of the works on test not conform to this section of the Specification, the Contractor shall inform the Consulting Engineer without delay. The Contractor must carry out all remedial work as necessary at his own expense to ensure the installation ultimately do conform.

If the Contractor fails to do so with a period of time not exceeding 7 days, the Consulting Engineer shall call upon the Contractor to remove all sections of the works where test results cannot successfully be achieved and reinstate the whole of the section at no additional cost to the Contract. Alternatively, the Consulting Engineer reserves the right on behalf of the Client to instruct via the Main Contractor, other parties to rectify all defective work. Should this occur, then all direct and indirect costs associated in making good defective work shall be deducted from the Contractors Interim valuations and subsequently be offset against his final account.

2.3.5 SETTING TO WORK

The Contractor shall include for setting to work after testing all items of plant and equipment installed under this Contract. The relevant manufacturer of all major items of equipment will be called upon to be present during the initial starting of any specialist item.

2.3.6 COMMISSIONING

Where specialist suppliers have been specified, commissioning of their relevant installation may be carried out by the Specialist Engineers.

Commissioning shall generally take place in compliance with the following commissioning codes issued by C.I.B.S.E.:-

Series A - Air Distribution
Series B - Boiler Plant
Series C - Automatic Controls
Series R - Refrigeration Systems
Series W - Water Distribution Systems

All necessary test points, test holes, commissioning devices, etc., shall be incorporated into the works during the installation to enable full and successful commissioning to take place. Any possible future claim for the inclusion of test points etc., for any reason whatsoever will not be entertained.

The Contractors price shall include all costs for the Specialist's Services and Test? Commissioning Equipment. The name of the Specialist shall be indicated on Appendix 1.

2.3.7 PERFORMANCE TESTING

Upon satisfactory completion of all leakage tests and commissioning, the Contractor shall allow for all costs associated with carrying out performance tests, on two separate visits, to be witnessed by the Consulting Engineer and Client.

2.3.8 INSPECTION, MEASURING AND TEST EQUIPMENT

All equipment necessary to enable the works to be successfully tested, set to work and commissioned shall be provided by the Contractor/Specialist. The Contractor/Specialist shall also make available this equipment upon request to enable the Consulting Engineer to verify that the testing and commissioning has been successfully achieved and completed.

All instruments provided by the Contractor/Specialist under this clause shall remain his property.

The Contractor shall in accordance with BS 5750 Part 1, 1987 Control, calibrate and maintain inspection measuring and test equipment, whether owned by the Contractor, on loan, or provided by others, to demonstrate with the instruments the conformance of the installation/system to the specified requirements. Equipment shall be used in a manner which ensure that measurement uncertainty is known and consistent with the requirement measurement capability.

The Contractor shall:

a. Identify the measurements to be made, the accuracy required and select the appropriate measuring and test equipment;

b. Identify, calibrate and adjust all inspection, measuring and test equipment and devices that can affect product quality at prescribed intervals, or prior to use, against certified equipment having a know valid relationship or nationally recognised standards - where no such standards exit, the basis used for calibration shall be documented.

c. Establish, document and maintain calibration procedures, including details of equipment type, identification number, location, frequency of checks, check method, acceptance criteria and the action to be taken when results are unsatisfactory.

d. Ensure that the inspection, measuring and test equipment is capable of the accuracy and precision necessary;

e. Identify inspection, measuring and test equipment with a suitable indicator or approved identification record to show the calibration status;

f. Maintain calibration records for inspection, measuring and test equipment;

g. Access and document the validity of previous inspection and test results when inspection, measuring and test equipment is found to be out of calibration;

h. Ensure that the Environmental conditions are suitable for the calibrations, inspections, measurements and tests being carried out;

i. Ensure that the handling, preservation and storage of inspection, measuring and test equipment is such that the assurance and fitness for use is maintained;

j. Safeguard Inspection, measuring and test facilities, including both test hardware and test software, from adjustments which would invalidate the calibration setting.

2.3.9 INSPECTION AND TEST RECORDS

The Contractor shall establish and maintain records which give evidence that the instruments have passed inspection and/or test was defined acceptance criteria.

2.3.10 TABULATION OF RESULTS

Certificates of tests for all plant or materials tests at the makers works shall be furnished by the Contractor to the Consulting Engineer.

Performance test data for all items of plant and equipment will also be required.

All tests carried out on site shall be ultimately witnessed, with the exception of gas installation, by the Consulting Engineer or his representative and these tests properly recorded. All commissioning figures will also be required to be recorded and tabulated. This shall include all control set points, valve and damper positions, etc. The manner in which the test, commissioning and performance figures are recorded

shall be agreed with the Consultant Engineer at least 4 weeks prior to the commencement of any tests or commissioning.

Within a period of 7 days immediately after the successful completion of any testing or commissioning duplicate copies of test certificates and tabulated commissioning figures shall be forwarded to the Engineer. Upon finalisation of the Contract and immediately prior to handover all approved test, commissioning and performance sheets shall be incorporated into the owners maintenance and operating manuals.

Note: It may be necessary for these tests to be carried out in sections to suit site conditions and/or other circumstances. The tenderer shall allow for the additions costs and any other costs related to Testing and Commissioning.