

TECHNICAL SPECIFICATION OF
BALANCING, TESTING & COMMISSIONING

GENERAL DESCRIPTION

This section of the specifications sets out the basic requirements for testing & commissioning of the air-conditioning installation. All testing & commissioning, calibration, setting of equipment and controls associated with this installation shall be performed and the Contractor shall supply all necessary instruments, materials and labour for this.

The Contractor shall be responsible for the complete and thorough testing, commissioning and adjusting of the systems and equipment installed and to bring into safe and reliable operation of the entire air-conditioning installation.

The Contractor shall undertake all acceptance tests required as hereinafter specified.

All pipework, which is to be encased or concealed, shall be tested and approved before finally enclosed.

Before the commencement of acceptance test, the Contractor shall have brought the installation to a state of practical completion and shall have completed all of the preliminary testing and adjusted the equipment to its proper running order.

During the testing period, no modifications, adjustments or other works on the installation shall be carried out without the permission of the SO. Should there be any contravention of this requirement, the results of all test completed may be rejected and a retest ordered.

No acceptance test shall be carried out except in the presence of the SO or his assigned representative.

Should the installation fail to perform in accordance with the requirements of the specifications, the SO may reject the whole or any part of the works.

NOTICE

Notice of tests shall be in accordance to the preliminary section of the specifications.

RECORDS

Test reports shall be in accordance to the specifications. The Contractor shall prepare and provide printed testing & commissioning record forms of approved format.

PIPEWORK

As pipe installation proceeds and before pipes are concealed or insulated, hydrostatic pressure test shall be applied and held for twenty-four (24) hours. The piping test pressure to be applied shall be 150% of working pressure or 1,400kPa, whichever is higher. In the event of any drop of pressure during the test periods, the leaks shall be found, made good and the line retested. Caulking of joints will not be permitted. Pressure shall not show a drop of more than 1% in twenty-four (24) hours. Hydrostatic pressure tests shall be carried out with all valves in position.

Refrigerant piping shall be tested to suit the refrigerant used. The method of test shall be to fill the system with anhydrous nitrogen or other approved gas to required pressure and inspect all joints after having covered them with a soap film with all valves shut. The pressure shall be maintained within 1% for twenty (20) hours.

The Contractor shall ensure that all pressure gauges, control valves, flow switches, regulators, joints and fittings that have operating pressure below the test pressure are isolated.

After the pressure test, all pipes shall be flushed clean in sections. The Contractor shall ensure that flushing water do not pass through coils.

All water circuits shall be balanced. The water circuit shall be so adjusted to enable 120% rated flow through the furthest cooling coil from the pump when the throttle valve is in fully open position.

All control valves shall be tested for pressure drop and flow rate against the ratings given by the Contractor. When settings are finalised, the spindle and yoke shall be clearly marked with a prick punch and the flow control valve hand wheels removed.

Particular care must be taken to exclude all air from the system during tests.

DUCTWORK

During the installation stage, all high and medium pressure ductwork shall be pressure tested in sections.

Prior to the startup of air moving equipment the Contractor shall ensure that all duct plenums, sound attenuators, duct accessories and AHU rooms are clean.

The Contractor shall ensure that all dampers and fire dampers in particular are in the correct positions.

The Contractor shall ensure that the entire ductwork is commissioned to allow the designed maximum flow into each and every branch of ductwork under all operating conditions.

AIR DISTRIBUTION SYSTEM

All fans shall be tested & commissioned in strict accordance to the manufacturer's recommendations. The fan system shall be tested & commissioned for air performance in accordance to the guidelines as set out in Fan Application Manuals and AMCA Standard 210.

All registers, grilles, diffusers and dampers shall be correctly adjusted to give required design air quantities as indicated in the drawings and specifications.

All fixed dampers shall be set and the final position shall be clearly and permanently marked.

Air movement in the conditioned spaces shall be as uniform as practicable and temperature differential in the occupancy level shall not exceed 1°C. The Contractor shall ensure a two (2) hours response time, to attend to complaint relating to poor performance of air diffusion and to readjust air diffusion equipment to suit the different requirements of the conditioned spaces' occupants.

CONTROL SYSTEM

All control systems shall be calibrated under operating conditions until smooth and accurate operating conditions are attained. Control settings shall then be permanently marked on the control equipment. All calibration procedures shall be properly recorded.

The Contractor shall check, test and adjust each and every sensor, controller, actuator and other accessories for the smooth and linear operation, set point ranges and like. The complete system shall be tested for instability, lasting, offsets and other such defects or inadequacies.

All necessary costs for the adjustments and replacements shall be borne by the Contractor.

SOUND AND VIBRATION

Sound and Vibration Level

The Contractor shall conduct vibration level measurement of all equipment and noise level measurement in various spaces.

Testing on Completion

Should the tests show that noise and vibration is in excess of those specified, balancing of equipment is incorrect and or vibration transmission through mountings, hangers etc. is excessive, the Contractor shall correct the installation at his own cost. Further tests shall then be carried out at the Contractor's cost to show that the noise and vibration levels have been reduced to the limits specified.

Sound level readings shall be taken at times when the building is unoccupied or when activity in surrounding areas and background noise levels in areas tested are at a minimum and relatively free from sudden changes. Readings shall be taken with no other equipment operating and with all plant capable of transmitting sound to the space tested in operation.

The SO shall approve all apparatus used for sound and vibration measurements.

Noise levels shall be measured with a sound level meter fitted with an octave band analyzer and conforming to IEC 179 and IEC 225. Overall sound levels shall be read on 'A' scale of the meter and octave band sound levels on an octave band analyzer connected to the meter with its 'C' scale network in use.

ELECTRICAL

The Contractor shall submit Type Test and Routine Test Certificates by recognized Testing Authorities. Such tests shall be carried out in accordance with the relevant Singapore Standard or British Standards or approved alternative applicable Standards.

The Contractor shall be responsible for the testing of the switchboard and certifying that it is safe before supply is energized and that all the equipment complies with the requirements of this specification. Generally such test shall include:

- Demonstration that all equipment is installed and all wiring connected so that the board functions as required.
- Test of accuracy of all measuring instruments
- Continuity, phasing out and insulation resistance testing
- Protective equipment testing

PERFORMANCE TEST

The Contractor shall submit performance tests to ensure that the equipment and systems perform to the requirements of the specifications.

RECORDS

Temperature and humidity shall be recorded for up to one (1) week at 1 minute intervals in each zone or area served by each AHU to ensure that the design condition is achieved.

All testing & commissioning procedures, checklists, results, records etc. shall be complied and properly catalogued to be submitted to the SO.

All instruments used for testing & commissioning shall have valid calibration certificates from approved authorities. The calibration certificates shall be submitted together with the testing & commissioning report.

PROVISION FOR RETROFIT INSTALLATIONS

The Contractor shall ensure that all retrofit installations will be made with provisions for proper testing and commissioning can be performed.