PART 1 GENERAL

1.1 Scope

.1 Performance testing of equipment.

.2 Manufacturer's startup of equipment.

1.2 Quality Assurance

.1 Use factory trained representatives and submit manufacturer's check sheets for starting all systems and equipment.

.2 Testing and certification of each backflow prevention device shall be by an "Approved Cross Connection Installation Specialist". One copy of the certificate to be submitted to the City of Edmonton Cross Connection department, and one copy is to be inserted in each O & M manual.

.3 Prior to starting, testing, balancing, adjusting, and cleaning processes, verify with Engineer any tests required to be witnessed. Provide sufficient notice to Engineer prior to commencement of procedures.

.4 Engineer shall be allowed to witness any testing, adjusting, starting, balancing, and cleaning procedures.

.5 Assume all costs associated with starting and testing, including the supply of testing or cleaning medium.

.6 Prior to starting equipment or systems, secure and review manufacturer's installation, operation, and starting instructions. Read in conjunction with procedures defined herein.

.7 Use manufacturer's or supplier's starting personnel where required to ensure integrity of manufacturer's warranty.

.8 Compare installations to published manufacturer's data and record discrepancies. Items potentially detrimental to equipment performance shall be corrected prior to equipment starting.

.9 Some processes involved in starting procedures defined in this section may be duplications of authorities verification. To facilitate expedient completion of project, arrange for authorities to assist or witness these procedures.

.10 All starting, testing, and procedures shall be in accordance with applicable portions of ASME, ASHRAE, AABC, CSA, NFPA, SMACNA, ASTM, ASPE and
as required and outlined in these specifications. In particular note the testing requirements of NFPA-20 fire pumps, and of the authorities having jurisdiction.

.11 Personnel involved in starting, testing, balancing and adjusting procedures shall be experienced in the design and operation of mechanical equipment and systems being checked and shall be able to interpret results of the readings and tests.

.12 Assume all liabilities associated with starting, testing and balancing procedures.

PART 2 PRODUCTS

Not Applicable

PART 3 EXECUTION

3.1 General

.1 Conduct performance tests to demonstrate equipment and systems meet specified requirements after mechanical installations are completed and pressure tested. Conduct tests as soon as conditions permit. Make changes, repairs, and adjustments required prior to operating tests.

.2 Gas fired appliances rated in excess of 117 kW shall be subjected to an operational test established by the Gas Protection Branch and shall pass this test before being approved for operation.

.3 Meet with Division 16 manufacturers, suppliers, and other specialists as required to ensure all phases of work are properly coordinated prior to commencement of each particular testing procedure. Establish all necessary manpower requirements.

.4 Operate and test motors and speed switches for correct wiring and sequences and direction of rotation. Check and record overload heaters in motor starters.

.5 Confirm voltages and operating amperages at full load.

.6 Failure to follow instructions pertaining to correct starting procedures may result in re-evaluation of equipment by an Independent Testing Agency selected by Owner at Contractor's expense. Should results reveal equipment has not been properly started, equipment may be rejected, removed from site, and replaced. Replacement equipment shall also be subject to full starting procedures, using same procedures specified on the originally installed equipment.
3.2 Procedures

.1 Procedure shall be identified in the following five (5) distinct phases:

a) Pre-Starting: Visual inspection.

b) Starting: Actual starting procedure.

c) Post-Starting: Operational testing, adjusting or balancing, and equipment run-in phase.

d) Pre-Interim Acceptance of the Work: Final cleaning, re-testing, balancing and adjusting, and necessary maintenance.

e) Post-Interim Acceptance of the Work: Repeat tests and fine-tuning resulting from corrective action of deficiency clean-up.

.2 Check specified and shop drawing data against installed data.

.3 Check the installation is as defined by contract documents and as per manufacturer's recommendations including manufacturer's installation check sheets.

.4 Include for the costs of an independent testing agency, selected by the Owner, to take samples of all chemically treated hydronic systems, perform lab analysis of the chemical treatment levels, and submit a written report of their findings to the Owner. Should chemical treatment levels not meet the requirements of the specifications, the Contractor shall adjust treatment levels accordingly and cover the costs of the independent testing agency to take additional samples and tests.

3.3 Contractor Testing Responsibilities

.1 The contractor shall be required to provide the following tests as part of his construction contract. For each test, a test form is to be filled out, witnessed, kept on site for the consultant to verify at any time during construction and then they are to be included in the final submission of the contractor O&M manuals.

a) Air Systems

i) Fans

- Check radiated and discharge sound power levels
- Determine rpm, air flow rates, static pressure and record on the fan curves
- Conduct fan performance test for total system volume on main air supply and exhaust units
− Conduction smoke control test to meet occupancy requirements

ii) OR Fan System
− Once OR construction has been completed, OR ductwork has been cleaned and air balancing is completed conduct a bacteria culture test to prove cleanliness of ductwork and air flow patterns.

iii) HEPA Filters
− Test as per standard 209B, 209D and DOP

iv) Mixing Chamber
− Measure temperature profile for stratification

v) Motorized Smoke Dampers
− Verify that damper strokes to fully open position
− Verify damper access
− Verify damper operation under fire alarm condition

vi) Terminal Boxes
− Measure air flow and inlet static pressure
− Verify box installation duct inlet
− Measure discharge sound power level at 3 m downstream
− Verify DDC box control volume readouts by traverse
− Measure box temperature profile
− Verify box access acceptability

vii) Air Outlets
− Take sound readings at specified air flows at outlets
− Operating room outlets to be tested as per Class I Microbiology Clean Air Act.

viii) Fire Dampers
− Test each damper to ensure proper blade movement and damper closure
− Verify damper accessibility for changing of the fusible links
ix) Ductwork

- Low pressure supply, return and exhaust ductwork is to be tested by sound and feel for leakage
- Medium and High pressure supply, return and exhaust ductwork is to be pressure tested as per requirements of Sections 15042 and 15840.

x) Packaged A/C Units

- Check unit is level
- Measure air flow and static pressure
- Entering dry bulb/wet bulb temp.
- Leaving dry bulb/wet bulb temp.
- Entering water temp.
- Leaving water temp.
- Water flow rates
- Acoustic measurements

xi) Unit Heater, Fan Coil Units

- Inlet/outlet air flows and temp.
- Inlet/outlet water flows and temp.
- Air and water pressure drop across the unit
- Fan speed setting
- Check acoustic performance

xii) Fume Hood Exhaust System

- Independent testing agent hired by the Owner will conduct fume hood operation verification tests
- This Contractor shall be responsible for:
  ♦ Pressure test of welds
  ♦ sound testing on the discharge side of the fans

b) Fire Protection System

i) Standpipe and Sprinkler Systems

- Record incoming water pressure to building once a day for 10 days
- Record flow and pressure for fire pump and jockey pump, along with inlet water pressure
- Test sprinkler system as per NFPA 13
- Test standpipe system as per NFPA 14
ii) Fire Extinguishers
   – Check that no pressure drop occurs over a 20 day period

iii) Halon Fire Extinguishers
   – Room integrity test for computer room
   – Complete system tested

iv) Fire Pump
   – Conduct system flow test with fire pump operating on emergency power
   – Contractor to conduct pretest of pump prior to arranging approval test with local authorities

c) Steam System
i) Low Pressure Steam
   – Test piping to 690 kPa for eight (8) hours

ii) High Pressure Steam
   – Test piping to 1035 kPa for eight (8) hours
   – Minimum 10% of welded joints shall be X-Ray tested

d) Hydronic Heating System
i) Boilers
   – Start up boilers as per manufacturers recommendations
   – Set up and adjust burner operation through all firing rates, and record efficiencies

ii) Control Valves
   – Record pressure drops across each valve

iii) Heat Exchangers
   – Inlet/outlet flow rates at varying design conditions
   – Inlet/outlet temperatures at varying design conditions
   – Inlet/outlet pressures at varying design conditions
   – Measured heat transfer rates
   – Test for output by adjusting outdoor reset
iv) Pumps

- Run for 12 hours. (Ensure parallel pumps are equally balanced).
- Record motor power consumption
- Calculate pump efficiency
- Measure specific gravity of fluid

v) Tanks

- Verify expansion tank level at 20°C and 93°C

vi) Piping

- Test to 1½ times the working pressure, minimum 1035 kPa, for eight (8) hours.

vii) Glycol System

- All tests to be the same as for the hot water system
- Verify glycol concentration levels

viii) Chemical Treatment System

- Acceptance tests by independent lab to provide performance guarantee

ix) Snow Melt System

- Standing pressure test of piping system
- Fill with 50/50 glycol/water to 450 kPa and retest for 24 hour period
- Verify glycol concentration level at the end of the testing period and again after 2 days of continuous circulation

e) Cooling System

i) Chillers

- Conduct chiller operational system test
- Verify chiller installation requirements for venting of rupture discs
- Verify piping for oil coolers
- Prior to chiller operation verify that strainers are in place
ii) Cooling Tower
   - Verify tower piping installation and isolation
   - Verify fan rotation
   - Verify tower fill line in place, filters installed and that sump heaters are operational
   - Check operation of tower level controls
   - Check tower basin and upper distribution pan for debris prior to start up
   - Conduct tower performance test with chiller under minimum of 60% load

iii) Pumps & Piping
   - All tests shall be the same as the hydronic heating system

iv) Chemical Treatment System
   - Acceptance tests by independent lab to provide performance guarantee

f) Plumbing Systems
i) Domestic Cold Water
   - Piping to be tested to 1035 kPa for eight (8) hours
   - Conduct pipe flushing and cleaning program with all fixtures in place
   - Conduct a water analysis after shock treatment of piping system

ii) Drainage System
   - Conduct a standing water test (30 kPa to 75 kPa) over eight (8) hour period

iii) Water Softening Equipment
   - Acceptance tests to prove performance guarantee

iv) Pure Water System
   - Contractor to flush and clean piping prior to turning the system on
   - Water quality tests to be conducted prior to turning system on
− Acceptance test by independent lab to prove performance guarantee

v) Wetmop / Drymop
− Test to minimum of 6.8 kPa for one (1) hour.

vi) Pressure Booster Pumps
− Perform load tests on pumps and record pressures and flows throughout the building
− Verify proper sequencing and control of staged pumps
− Record motor power consumption at peak flows

g) Medical Gas System
i) Source Equipment and Outlets
− All testing to be done by a certified medical gas testing agency.
− Testing standard to meet Z.305.4 M-1984 for pressure, purity and cross connections

ii) Piping
− Rough in piping to be tested to 1½ times the working pressure or 1030 kPa with nitrogen for a 24 hour period
− Random sample of five (5) brazed joints to be removed for inspection
− All components to be tested with a 24 hour standing pressure test at 20% above the normal operating pressure

h) Diesel Fuel System
i) Piping
− Test as per CSA B129
− Piping tested to 1½ times working pressure for a minimum of 10 hours
− Prior to initial use piping to be flushed and strainers cleaned

ii) Tanks
− Air test tanks at 35 kPa for 2 hours
− Verify operation of leak detection system
− Verify containment system
− Provide documentation on quantity and quality of initial fuel fill including details on additives

iii) Pumps
− Prior to operation check that filters and strainers are in place
− Check pump operation and set for proper flow
− Plot pump operating curve

i) DDC Control System
i) General
− Conduct system 7 day performance test to prove communication, loop tuning and control sequences

ii) Air Flow Measure Stations
−

j) Air Compressors
i)
ii)

k) Variable Speed Drives
i)
ii)

l) Incinerators
i)
ii)

m) BA
i)
ii)
Equipment Testing And Startup

Section 15043

Page 11

Rev. 02/00

END OF SECTION 15043