1. GENERAL

1.1 INTENT

.1 Inspect, start-up and commission each system to prove that each system meets its specified operating criteria.

1.2 RELATED SECTIONS

.1 Construction Schedules: Division 1.
.2 Contractor Start-up Report Forms: Division 1.
.3 Balancing and Adjusting of Mechanical Equipment and Systems: Section 01813.
.4 Sewer System Section 02720.
.5 Sanitary Sewage Force Main System Section 02732.
.6 Mechanical Equipment and Systems Demonstration and Instruction: Section 15026.
.7 Pressure Testing: Section 15042.
.8 Cleaning and Chemical Treatment - General Requirements Section 15210.
.9 Cleaning and Chemical Treatment of Hydronic System: Section 15211.
.10 Cleaning and Chemical Treatment of Steam Boiler Systems: Section 15212.
.11 Cleaning and Chemical Treatment of Condenser Systems: Section 15213.
.12 Cleaning and Chemical Treatment of Glycol Systems: Section 15214.
.13 Cleaning and Chemical treatment of Air Washer Humidifier Systems: Section 15215.
.14 Cleaning Domestic Water Systems: Section 15219.
.15 Energy Management and Control System (EMCS) General Requirements: Section 15900.
.16 EMCS Control Sequences: Section 15900.
.17 EMCS Start-up and Testing: Section 15900.
.18 General Mechanical Starting and Testing Requirements: Section 15991.
.19 Mechanical Equipment Starting and Testing: Section 15992.
.20 Fire Alarm System Verification: Division 16.
1.3 FACTORY TRAINED REPRESENTATIVES

.1 Use factory trained representatives for starting of the following specialty systems:
   .1 Controls
   .2 Sprinkler

.2 Use manufacturers' representatives where required to maintain manufacturers' warranties.

2. PRODUCTS

Not Used.

3. EXECUTION

3.1 OPERATIONAL TESTS

.1 Operational tests are to be conducted to demonstrate that equipment and systems meet specified performance only after mechanical installations have been completed and pressure tested. Notify the Balancer and Commissioning Agent as soon as conditions permit. Make changes, repairs, adjustments, and replacements required as tests may indicate.

.2 Conduct pre-operational tests, processes and inspections in presence of the Commissioning Agent if so requested by the Commissioning Agent.

.3 Conduct final operational tests in presence of the Commissioning Agent. Vary loads to illustrate start-up and shut down sequences. Simulate emergency conditions for safety shut downs, with automatic and manual reset. Repair and retest defects until satisfactory results are achieved. Make final adjustments to suit exact building conditions.

3.2 AIR SYSTEMS

.1 Inspect air systems including ductwork layout, support, and vibration isolation before pressure testing any section of ductwork. Notify Commissioning Agent when work is ready for inspection.

.2 Power vacuum all ducts.

.3 Pressure test sections of ductwork, in accordance with Section 15042, prior to application of insulation or concealment. Include pressure testing of ductwork on commissioning schedule and notify Commissioning Agent prior to any system pressure tests.
.4 Air Handling Unit: start-up and performance verification using manufacturer’s representative. Provide 6 working days notice to the Commissioning Agent.

.5 Start up coil circulators, humidifier spray pumps, exhaust air systems, etc.

.6 Variable Volume Air Systems:

.1 Performance test and calibrate Air Flow Measuring Stations in accordance with Sections 01813 and 15995.

.2 Cooperate with all other trades including controls, balancer and electrical to prove that fan variable volume controls are operational including EMCS control software.

.7 Demonstrate operation of mixing section, blender, filters, freeze protect, fire alarm interlocks, etc.

.8 If necessary provide and change pulley drives to correct volume up or down on constant volume systems, and to correct volume up on variable volume systems.

.9 Complete and submit Air Systems Start-up report as specified in Section 15991.

.10 Conduct Mechanical Systems Demonstration and Instruction in accordance with Section 15026.

3.3 HYDRONIC SYSTEMS

.1 Inspect piping layout, pipe support, expansion provisions, slope for draining and venting, vibration isolation, etc. before pressure testing any section of pipe. Notify Commissioning Agent when work is ready for inspection.

.2 Pressure test sections of pipe, in accordance with Section 15042, prior to application of insulation or to concealment.

.3 Pressure test each completed system, in accordance with Section 15042, before any equipment is started. Notify Commissioning Agent 6 working days prior to any system pressure test.

.4 Start-up pumps.

.5 Heating appliance: perform start-up and performance verification using manufacturer’s representative. Provide 6 working days notice to the Commissioning Agent.
.6 Notify Commissioning Agent and Balancing contractor when the systems are ready for rough balancing. The systems will be rough balanced to ensure fluid circulation in every circuit. Cooling systems will be rough balanced by velocity or pressure drop measurements at each circuit or component. Heating system will be rough balanced by temperature drop measurement.

.7 Chemically clean water filled system in accordance with Section 15211 and glycol filled systems in accordance with 15214. Notify Commissioning Agent six (6) working days prior to any system cleaning.

.8 Chemically treat water filled systems in accordance with Section 15211 and glycol systems in accordance with Section 15214.

.9 Notify the Commissioning Agent and Balancing Contractor when systems are ready for final balancing.

.10 Charge chiller with refrigerant.

.11 Chiller: perform start-up and performance testing using manufacturer’s representative. Provide six[6] working days notice to the Commissioning Agent.

.12 Check system for fluid or pump noise in pipes. Rectify as necessary.

.13 Provided the flow rate exceeds that specified, shave impeller on pumps larger than 1.5 kW if current draw exceeds motor full load amps or if there is excess flow which results in excessive pipe noise in adjacent occupied areas.

.14 Complete and submit Hydronic systems Start-up report as specified in Section 15991.

.15 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15026.

3.4 STEAM SYSTEMS

.1 Inspect steam systems including piping layout, pipe support, expansion provisions, slope for draining and venting, and vibration isolation, before pressure testing any section of pipe. Notify Minister when work is ready for inspection.

.2 Pressure test sections of pipe, in accordance with Section 15042, prior to application of insulation or to concealment.

.3 Pressure test each completed system, in accordance with Section 15042, before any equipment is started. Notify the Commissioning Agent 6 working days prior to any system pressure test.
.4 Boilers: Perform start-up and performance verification using manufacturer’s representatives. Provide six (6) working days notice to the Commissioning Agent.

.5 Chemically clean boilers in accordance with Section 15212. Notify Commissioning Agent six (6) working days prior to any system cleaning.

.6 Chemically treat condensate return system in accordance with Section 15212.

.7 Notify the Commissioning Agent and Balancing Contractor when system is ready for balancing.

.8 Check system for fluid or trap noise in pipes. Rectify as necessary.

.9 Complete and submit Steam systems Start-up report as specified in Section 15991.

.10 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15026.

3.5 CONTROL SYSTEMS

.1 Pressure test completed pneumatic system, in accordance with Section 15042, before any equipment is started. Notify Minister six [6] working days prior to system pressure test.

.2 Start-Up and performance test control air compressor and drier.

.3 Load Physical Point Data Base, start/stop schedules, alarms, run time logs, trend logs, etc. into EMCS control panels in accordance with Section 15980.

.4 Commence trial use period in accordance with section 15900.

.5 Perform EMCS Physical Point verification and calibration in accordance with Section 15900. Complete and submit Control Systems verification report in accordance with section 15970 to the Commissioning Agent.

.6 Load and debug custom control software in accordance with Section 15967.

.7 Provide Operator training at EMCS terminal in accordance with Section 15026.

3.6 DOMESTIC WATER SYSTEMS

.1 Inspect domestic water systems including piping layout, pipe support, expansion provisions, and slope for draining and venting, before pressure testing any section of pipe. Notify Commissioning Agent when work is ready for inspection.
.2 Pressure test sections of pipe, in accordance with Section 15042, prior to application of insulation or to concealment.

.3 Pressure test each completed system, in accordance with Section 15042, before any equipment is started. Notify Commissioning Agent six (6) working days prior to any system pressure test.

.4 Start domestic hot water systems' circulator pumps.

.5 Domestic hot water heating appliance: Perform start-up and performance verification using manufacturer’s representative. Provide 6 working days notice to the Commissioning Agent.

.6 Balance Domestic Hot Water system return circulation circuits by temperature drop measurement.

.7 Sterilize Domestic water systems in accordance with Section 15219. Notify Commissioning Agent 6 working days prior to any system sterilization.

.8 Ensure all air chambers and expansion compensators are properly installed.

.9 Ensure entire system can be completely drained.

.10 Check operation of water hammer arrestors. Let one outlet run for ten seconds, then shut water off quickly. If water hammer occurs, replace water hammer arrestor. Repeat for each outlet and flush valve.

.11 Complete and submit Domestic Water systems Start-up report as specified in Section 15991.

.12 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15026.

3.7 PLUMBING DRAINAGE SYSTEMS

.1 Refer to Section 02720 for inspection of Sewer Systems below ground, and Section 02732 for pressure testing of Sanitary Sewage Force Mains.

.2 Inspect plumbing drainage systems including above ground drainage piping layout, pipe support, slope, venting, before pressure testing or concealing any section of the work. Notify Commissioning Agent when work is ready for inspection.

.3 Hydraulically test above ground installations within buildings in accordance with Section 15042. Notify Commissioning Agent 6 working days prior to any system pressure test.
.4 Ensure all traps are fully primed.

.5 Ensure all fixtures are properly anchored and connected to system.

.6 Flush each valve, drain each sink and operate each fixture to ensure drainage and trap anti-siphon venting is effective.

.7 Open each cleanout, cover with linseed oil and reseal each cleanout. Ensure each cleanout is fully accessible and access doors are properly installed. Check cleanouts after building finishes (flooring, wall covering) have been installed.

.8 Ensure roof drain metal domes are installed. Ensure storm piping is free of debris or roof insulation ballast. Remove caps as required. Verify insulation on piping is as specified in Section 15260.

.9 In addition to pressure tests on chemical waste piping check the following:

   .1 Chemical dilution tank installation.
   .2 Manhole at street.
   .3 Bottle traps properly installed and accessible.

.10 In addition to pressure tests check following on kitchen waste systems:

   .1 Piping is installed to withstand 82°C discharge from dishwashers, boiler blowdown, etc.

   .2 Grease trap is accessible and properly installed.

.11 Complete and submit Drainage systems Start-up report as specified in Section 15991.

.12 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15026.

3.8 STANDPIPE AND SPRINKLER SYSTEMS

.1 Inspect standpipe and sprinkler systems including piping layout, pipe support, slope for draining, before pressure testing any section of pipe. Notify Commissioning Agent when work is ready for inspection.

.2 Pressure test Standpipe and Sprinkler systems, in accordance with Section 15042, before any equipment is started. Notify Commissioning Agent 6 working days prior to any system pressure test.

.3 Ensure all equipment used has ULC labels visible.
.4 Start jockey pumps as specified in Section 15992.

.5 Ensure all valves in sprinkler system are monitored and are clearly visible.

.6 Ensure all flow switches are installed and are operational.

.7 Flush systems as follows:

.1 Fill with water, let stand at full operating pressure for one week. Drain each riser separately, then drain main.

.2 Repeat above procedure three times.

.8 Perform flow tests required by:

.1 Alberta Building Code.
.2 Authorities having jurisdiction.
.4 NFPA 14-1990 - Installation of Standpipe and Hose Systems.
.5 NFPA 20-1990 - Installation of Centrifugal Fire Pumps.

.9 Record incoming water pressure to building once a day for ten days prior to activating system.

.10 Test and place sprinkler valve into operation. Adjust pressure switches.

.11 Coordinate verification of fire alarm system with Division 16.

.13 Record pump pressure for jockey pumps and inlet water pressure.

.14 Complete and submit Standpipe and Sprinkler systems Start-up report as specified in Section 15991.

.15 Conduct Mechanical Equipment and Systems Demonstration and Instruction in accordance with Section 15026.

END OF SECTION