Testing, Pre-commissioning & Commissioning of Fan Coil Units

Before commencement of testing & commissioning activity, the supervisor must ensure that pre-commissioning of the FCU is complete and approved. All Installations & Pressure Testing of Pipe/ Duct works have been completed & approved by the consultant. Relevant documents or certificates shall be presented at the time of inspection if required by the Consultant.

Permission to start testing & commissioning or Civil Clearances has been given by the main contractor. All relevant Shop drawings shall be available & approved by the consultant. Safe access shall be provided by the Main Contractor thru Work Permit in coordination with the Safety in charge at site.

Inspect the relevant area for any possible clashes with other services. Check for other services, making sure that there is no interference between each service & adequate access to work and for future maintenance can be maintained.

Pre Commissioning Procedure for Fan Coil Units

- Ensure that the units are installed correctly &undamaged.
- Ensure that all units sections are thoroughly clean and free from installation debris.
- Ensure that the filters are free from dust.
- Ensure that all access panels and blanking plates are in position and are secured.
- Ensure that all electrical wirings comply with the project specification & requirements. All electrical components, where applicable are provided with all necessary safety, protection and isolating devices.
- Check that the coil faces are free from debris and check all coil connection leaks.
- Ensure that all air is vented from both coils and the system independently.
- Check that the small gap between coil cheek plate and the drain tray has not been blocked by site debris.
- Introduce water to the condensate tray to verify free flow of water into the drain.

Final Preparations Prior to Start-up/Commissioning

- Make sure Power is OFF.
- Install thermostats and perform any other final wiring as applicable. Check the unit for any loose wires.
- Clean unit thoroughly. Remove dirt and debris from unit, especially drain pan, drain line, motor and fan. Pour water into drain pan to check that drain operates properly.

- Rotate fan wheel by hand to be sure wheel is free and does not rub housing The units belt drives are factory set at the speed required for the design specifications specified when ordered. These drives may be adjusted to achieve different speed by qualified personnel during air system balancing.
- Check that clean air filter of proper type & size is installed in unit filter rack after commissioning.
- Ensure that all panels and filters are installed before checking fan operation. Turn ON power to the unit.
- Turn ON water supply. Open all valves. Check for leaks. Recheck pitch of suspended units.
- Turn Power ON. (Close unit electrical disconnect).Ensure power is OFF before making any adjustments inside the unit.

ECM (Electronically Commutated) Blower: The ECM Blower is controlled by one of three control boards, depending on the options ordered with the unit.

- Check fan and motor operation. Motor to fan wheel rotation must match the airflow direction.
- Be sure drain line is properly and securely positioned and that the line is clear. Pour water into drain to check operation.
- Set unit air delivery of required blower RPM. Adjust fan motor pulley as follows:
- Loosen setscrew on movable pulley flange.
- Screw flange toward fixed flange to increase fan speed and away from fixed flange to decrease speed.
- Reset setscrew.
- Check belt tension. The drive belt should be tensioned to allow ½ to ¾ inch deflection at the mid-point between pulleys with moderate pressure.
- Inspect the unit for loose wires, correct blower wheel operation, and loose or missing access panels or doors. Unless otherwise required for balancing and start-up procedures, units should not be operated without proper ductwork, supply/return air grilles, access panels and/or doors in place.
- Do not exceed motor nameplate FLA (full load amps.) Operator must confirm motor current draw before putting unit into service and again after air balancing the system.
- Prior to the water system start-up and balancing, chilled/hot water systems should be flushed to cleanout dirt & debris which may have collected in the piping during construction. During this procedure, the system should be flashed from the supply riser to the return riser through a cross-over loop at the end of the riser column, and all unit service valves must be in closed position. This prevents foreign matter from entering the unit and clogging the valves and metering devices. Strainers should be installed in the piping mains to prevent this material from entering the units during normal operation.

- Vent all air from unit coil and related piping. If air vent is manual, release air by turning air vent screw 1½ turns counter clockwise with screwdriver. When a steady stream of water begins to escape, close valve. If vent is automatic, trapped air will be released automatically. Vent releases air slowly, usually dripping water into the drain pan in the process.
- Make sure all service valves are open and that the motorized control valves, if supplied are set for automatic operation.

Start-up Procedures/ Commissioning

- Before beginning any start-up operation, the start-up / commissioning personnel shall familiarize themselves with the unit, options and accessories, and control sequence to understand the proper system operation. All personnel should have a good working knowledge of general start-up procedures and have the appropriate start-up and balancing guides.
- The building must be completely finished including doors, windows and insulation. All internal walls and doors should be in place and in normal position. In some cases, the interior decorations & furniture may influence overall system performance. The entire building should be as complete as possible before beginning any system balancing.
- Except as required during start-up and balancing operations. No fan coil units should be operated without all the proper ductwork attached, supply &return grilles in place and all access doors and panels in place and secure.
- Start-up procedures vary depending on time of year (summer or winter) and building characteristics.
- Start –up in cooling mode requires that proper care be given to avoid condensation problems. Condensation forms on surfaces that are colder than the dew point of the surrounding air. If a unit is started and is piped with low-temperature chilled water in a hot, humid atmosphere, condensation will form on many parts of the unit. In order to avoid excessive condensation, higher temperature water should initially be used (approx. 60-70°F) and set fan coil control at low or medium fan speed. Be sure the fan current does not exceed motor nameplate values. Also, outside air supply fans and bathroom and kitchen exhaust fans should be off.
- As the building temperature drops, the chilled water temperature can be gradually reduced until it reaches 50°F. At this point the outside air fans can be turned ON. When the chilled water temperature is reduced to its design point, the exhaust fans can be turned ON.
- After initial start-up and some conditions running of the unit, it is recommended that the following are checked, the motor full load current, the filter condition, the condensate and drains have free flow& no leaks,

the valve connections have no leaks and that the controls operate correctly.

Air System Balancing

- All duct stubs, grilles, filters and return access panels must be properly installed to establish actual system operating conditions BEFORE beginning Air Balancing Operations.
- Each individual unit and the attached ductwork is a unique system with its own operating characteristics. For this reason, air balancing is normally done by balance specialists who are familiar with all procedures required to properly establish air distribution and fan system operating conditions. These procedures should not be attempted by unqualified personnel.
- Units with no ductwork have air volumes predetermined at the factory by supply grille size and normally do not require air balancing other than selecting the desired fan speed. Units furnished with optional dampers on supply grilles may require some small adjustments to “fine tune” the air delivery to each grille. Opposed blade balancing dampers are not available for all grilles on a unit with electric heat.
- After proper system operation is established, the actual unit air delivery and the actual fan motor amperage draw for each unit should be recorded inconvenient place for future reference.

Water System Balancing

- A complete knowledge of the hydronic system, along with its components and controls, is essential to proper water system balancing. This procedure should not be attempted by unqualified personnel. The system must be complete, and all components must be in operating conditions BEFORE beginning water system balancing operations.
- Each hydronic system has different operating characteristics depending on the devices and controls used in the system. The actual balancing technique may vary from one system to another.
- After proper system operation is established, the appropriate system operating conditions such as various water temperatures and flow rates should be recorded in a convenient place for future reference.
- Before & during water system balancing, conditions may exist due to incorrect system pressures which may result in noticeable water noise or undesired valve operation. After the entire system is balanced, these conditions will not exist on properly designed systems.

FCU Controls Operation

- Before proper control operation can be verified, all other systems must be operating properly. The correct water & air temperatures must be present for the control function being tested. Some controls and features are designed to not operate under certain conditions. For example, on a two

pipe cooling/heating system with auxiliary electric heat, the electric heater cannot be energized with hot water in the system.

- A wide range of controls, electrical options and accessories may be used with the equipment. Some controls and features may vary from one unit to another; care should be taken to identify the controls used on each unit and their proper control sequence.

General Test Methods for Fan Coil Units

- The test of fan coil units shall be performed in a calibrated or balance calorimeter. The test under heating / cooling conditions shall be carried out by keeping the water and the air rating conditions by reconditioning the equipment, whose capacity (water and air side) can be measured and controlled to balance with high precision the performance of the unit. For the unit under test so to maintain the rating air wet bulb conditions.
- In the surround room of the test balanced chamber, a dry bulb temperature shall be inside surfaces of the calorimeter compartments, should be of non-porous material with all joints sealed again air and moisture leakage. Access doors should be tightly sealed against air moisture leakage by use of gaskets or other suitable materials.
- The units shall be tested at a medium speed.

Air dry-bulb and wet-bulb Measurements Points

It is intended that the specified test temperatures surrounding the unit being tested should simulate as nearly as possible the normal conditions of use of such unit. The point of measurement of specified test temperatures should be such that the following conditions are fulfilled:

1. The measured temperatures should be representative of the temperature surrounding the unit, and simulate the conditions encountered an actual application.
2. At the point of measurement on specified test temperatures of air should not be affected by air discharged from the test unit. This makes it mandatory that the temperatures are measured upstream of any recirculation produced by the test unit.
3. If the conditions of air movement and airflow patterns in the calorimeter compartments are favourable, the temperatures may be measured at the outlet of the reconditioning equipment.
4. If it has been established that the unit being tested does not produce any bypassed air from discharge to intake opening, the specified temperatures maybe measured immediately upstream of such intake opening.

Water Inlet & Outlet Pressure & Temperature Measurement Points

The water inlet & outlet temperature should be measured with a sensor dipped in the insulated pipe connection to avoid any risk of incorrect measurement caused by stratification and medium flow course. The inlet & outlet temperature sensors should be as close as possible to the unit under

test so to have a high precision measurement. If the distance between the unit temperature sensors could not be reduced too much due to particular set-up, the pipe insulation could be improved to avoid any thermal dispersion.

The water pressure sample points should be located in the middle of a rectilinear peace of insulated pipe with the following characteristics:

- Constant diameter equal to the unit under test.
- A minimum length of ten times the unit under test connection diameter.
- The available static pressure should be measured at the discharge air way cross section of the unit by a series of pressure tapping.
- The water mass flow rate and the set points shall be set to have the water inlet and outlet temperature at 70/60°F.

Condensate Measurements

- During a cooling capacity test, the condensate produced by the unit under test should be drained and collected to measure the water condensate mass flow rate. Also the water supplied to the humidifier should be checked so to control the precision on the condensate mass flow rate measurement.

Drain Trap (P-Trap)

- A drain trap may be required by local codes and is recommended for odour control. The differential height inlet to outlet must be at least 1 inch. W.G greater than the total static pressure of the unit. The differential height of the outlet bottom of the trap must not be less than the total static pressure of the unit.
- Provide a trap of at least 2 inch near the end of the drain line to prevent odours from entering the rooms.

Sound/ Noise Level Measurement

- The sound/ noise level spectrum of the unit in 1/3 frequency bands shall be measured in sequence for each speed of choice.
- Between the measurements it is important to wait some time to have more stability in the operating conditions.
- If the sound pressure level spectrum contains some discrete frequency components in one or more bands, this shall be recorded and written in the test/commissioning forms.
- The background noise in 1/3 frequency bands shall be measured for each speed of choice without equipment running while the system is set as for the sound pressure level acquisition of the unit for each speed of choice.
- The background noise shall be at least 6db below the sound pressure level measure in each frequency and of the frequency range.
- The test shall include sound power levels per 1/3 octave band for all the operating points of the ducted FCU and a weighted sound power level expressed in (dB) calculated from the spectrum.

Vibration Test

- Testing for equipment vibration is necessary as an acceptance check to determine whether equipment is functioning properly and to ensure that objectionable vibration noise are not transmitted. As the vibration acceptance test is based on root mean square (r.m.s.) velocity (m/s) only, frequency measurement is not required. Vibration measurement shall be taken after the equipment had been running for 2 weeks.
- Record the operating speeds of the equipment indicated on the nameplates & drawings.
- Determine the acceptance criteria from the specification.
- Perform visual and audible checks for any apparent rough operation of the equipment or any defective bearings, misalignment, etc.
- Measure & record vibration at bearings of driving and driven components in horizontal, vertical and if possible axial directions. There should be at least one axial measurement for each rotating component (fan motor, pump motor).