

# **Air & Water balancing Method Statement**

## **METHOD STATEMENT**

### **1. AIR BALANCING**

#### **A. Fan Coil Units**

- 1 Check that all automatic controls are fully commissioned and operating properly
- 2 All pre-commissioning checks have been carried out
- 3 Select the specified speed of the Fan Coil
- 4 Set all the dampers in the grill outlet at full open position
- 5 Take initial total flow of the unit by adding up all the measured volume from each outlets (initial scan)
- 6 Compare the reading against the designed flow. Find out the percentage of the design flow.
7. Find out the index outlet (i.e. which has the very low percentage of reading) from the initial scan.
8. Keep the index outlet damper fully open ( i.e. opposed blade damper of grill )
9. Then throttle the air volume at each outlet to get the design percentage of flow proportionally by using the Flow hood ( balometer ).
10. Each time when you throttle the outlet by closing the diffuser / grill damper, the index outlet air flow raises gradually. Measure the index point each time.
11. By the time the last outlet is completed, air volume at all outlets including the index are proportionally balanced.
12. Note all the readings at all outlets and keep records.

#### **B. Ventilation Fan (Extract Fan)**

1. Check that all pre-commissioning checks has been carried out.
- 2 Measure the motor ampere & fan rpm of all fans and shall be set to provide total air volume within acceptable tolerances
3. Fan speed & motor current shall not exceed the maximum allowable range set by the manufacture
4. Set all the main duct & branch duct dampers at full open position
5. Check the total flow of the fan by traverse method, flow will be set to 105 % of design.
6. Check the flow in all branches and find out the index branch
7. Balance the branches in proportion with the same percentage of total flow by adjusting the volume control dampers and keeping the index branch damper at fully open position.
- 8 Measure the index branch and proportionally balance it to the same percentage.

## **9 TERMINAL BALANCING (Using Anemometer & Flow Hood )**

- Measure the flow at each outlet of the terminal branches
  - Find out the index terminal and keep the damper fully open
  - Balance the other outlets proportionally to the same percentage of flow set in the branch duct.
  - Check the flow in each outlet and record including the index terminal
10. Take the total flow in the main duct again and record by using traverse duct method.
11. After Total System balance, the following values shall be measured and recorded:
- Fan RPM
  - Motor voltage and amperes
  - Static pressure entering the Fan
  - Static pressure leaving the fan
12. Static pressure entering and leaving the fan shall be measured as follows:
- Static pressure readings leaving the fan shall be taken as far as from the fan as is practical, but shall be before any restrictions in the duct (such as duct turns )
  - No readings shall be taken directly at the fan outlet or through the flexible connection
  - Static pressure entering the fan shall be measured in the inlet duct upstream of any flexible connection and downstream of any duct restriction.
  - Static pressure entering a double inlet fan shall be measured through the wall of the plenum, which houses the fan
  - In all cases, the reading shall be taken to represent as true a value as possible.
- True value is actual measured static pressure .

## **C. AIR HANDLING UNIT**

1. Set the fan rpm to provide design total air quantity within acceptable limits.
2. Fan speed shall not exceed the maximum allowable rpm as established by the fan manufacturer.
3. Set all the main duct & branch duct dampers and outlet dampers at full open position.
4. Check the total flow of the fan by duct traverse method, flow will be set to 105 % of design flow
5. Check the flow in all branches and find out the index branch.
6. Balance the branches in proportion with the same percentage of total flow by adjusting the volume control dampers and keeping the index branch dampers at fully open condition.
7. Measure the index branch and proportionally balance the air terminals.
8. The final setting of fan rpm shall not result in overloading the fan motor in any mode of operation. Dampers shall be modulated, and the ampere of the supply fan motor shall be

measured to ensure that no motor overload can occur.

9. After Total System Balancing, the following values shall be recorded:

- a. Fan rpm
- b. Motor voltage and current
- c. Entering static pressure
- d. Leaving static pressure.

#### **D. BALANCING AIR TERMINALS PROCEDURE:**

Depending upon location and access to air terminals, various types of airflow measuring instruments will be utilized to record the actual airflow at terminals.

Assuming adequate access provided, a direct reading balometer would be used which gives a direct reading of volume rather than velocity, which cancels out the need for effective grille areas, terminal configuration consideration and velocity corrections.

If access is restricted then a rotating vane anemometer shall be used and the velocity reading obtained would be converted to volume (velocity x free area = volume) and a comparison between the pitot traverse reading will be made to obtain a correction factor which would be incorporated to give a true velocity reading . Alternatively, the effective area provided by the register / grille manufacturer will be incorporated in the design velocity calculations.

1. Air quantities shall be measured according to CIBSE Application Guide 3/89 Standards.
2. Any main branch may be chosen to start with but as normal practice and having carried out a rough balance of main and sub-branches, start with the most remote branch and then sub-branch.
3. Locate the terminal, which is discharging the lowest percentage of its design flow rate. This is generally the last terminal in the run. if not, adjust the damper in the last terminal unit until it is working with the same percentage as the lowest one previously measured.
4. Measure the flow from the terminal next to the index and work out the percentage flow as close as possible to that of the index. Fix the damper in position.
5. Repeat the procedure for the next terminal, again comparing it with the index.
6. As the dampers are closed along the run, more air will be driven towards the downstream terminals and the volume of air discharged at the terminal index will rise. This does not affect the balancing procedure since each terminal being adjusted is related in turn with the index.
7. When all the terminals have been balanced on a sub-branch, each terminal will be running with an equal percentage of the design flow rate, within the allowable tolerances.
8. The flow rates at each terminals must be measured and recorded. Once again a

summation should be made to check that the total is in reasonable agreement with the measured sub-branch flow.

9. Test results shall be recorded in the approved test sheets and documents.

## **E. STAIRWELL PRESSURIZATION FAN**

1. Check all pre-commissioning checks has been carried out.
2. Check Fire alarm interfacing and actuation will be done by the specialist.
3. Set the all dampers in the grill outlet at full open position.
4. Take the initial flow of fan by adding up all the measured volume from each outlet (Initial scan)
5. Compare the readings against the design volume, find the percentage of design flow rate.
6. Find the index outlet (least favoured outlet) from the scan.
7. Keep the index outlet damper fully open.
8. Then throttle the air volume at each outlet to get the design percentage of flow proportionally by anemometer with effective area.
9. Each time when you throttle the outlet by closing the damper, the index outlet the air flow rises gradually, measure the index point of each time.
10. Balance the air volume at all terminal (Including index) proportionally.

### **11. PRESSURE MEASUREMENT**

- Fan functional will be checked.
- All fire doors are closed during fan running will be confirmed.
- Differential pressure measurement will be carried out between the floor & stair.
- Record the readings and compare with the specified pressure.

## **2-CHILLED WATER BALANCING**

The aim of balancing is to apply a disciplined procedure of adjustment to water flow rates throughout a system to meet the particular requirements of the design. The balancing of water flow rates should be carried out to specified tolerances (which may vary for different sections of the same system).

### **F. SECONDARY PUMPS**

#### **Pump shut-off head test**

To verify the performance of the pump, the following tests shall be carried out in order to measure and compare against the manufacturer pump data's.

1 Connect a suitable differential pressure gauge across the suction and discharge pressure test points of the pumps.

2 Set all the supply, return valves and control valves in the system at full open position (Cooling coil valve fully open to cooling coil, chilled water flow through the AHU etc.).

3 With the pump on running condition, slowly close the discharge valve for a period of less than 1 minute. Effort should be made to obtain the readings as rapidly as possible in order to minimize the time that the pump is shut off.

4. Determine the shut-off pressure differential, check against the manufacturer data to zero flow then slowly re-open the discharge valve.

5. Where the test results coincides with the manufacturers test data proceed to next paragraph. Where this is not the case, draw a curve parallel to that shown on the published data, starting at the shut-off head pressure.

6. Record the total pressure with the differential pressure gauge at full flow rate and read the actual flow from the manufacturers data, or from the corrected graph curve as appropriate.

#### **G. Preliminary Flow Rate Check**

With all valves are fully open, measure and record the total actual flow rate and compare this with the total system design flow rate. Where necessary, close the main regulating valve to provide a flow of approximately 110 % design flow rate.

#### **H. Balancing the chilled water main, branches, sub branches, risers, header & terminal by proportionally**

1. Keep all the DRV's & isolating valves at fully open position.
2. Take the initial flow across the heat exchangers.
3. Record the flow and compare with the design flow.
4. Measure the initial flow at all the risers.
5. Find out the index branch riser (lower percentage of volume)
6. Keep the DRV of the index riser at fully open position.
7. Throttle the other risers proportionally to the same percentage of total flow measured.
8. Monitor the index percentage after throttling each riser as it increases gradually.
9. By the time the last riser is complete, the flow is balanced at all risers including the index riser.
10. Record the reading of all the risers.

The same method (proportional balancing) can be followed for branches & sub-branches of the Fan Coil Units and Air Handling Units located at the various floors.

## **I. WITNESSING**

After satisfactory completion of Testing, Adjusting and Balancing of the Air- Conditioning & Ventilation system company will submit test report to the consultant for witnessing the same.