Test Case 07 – HVAC system and schedule

Test Description: HVAC is an essential building service system in every new and retrofit construction. It is also a critical component for evaluating a building's energy performance as well as indoor air quality. To enhance the data interoperability, it is suggested that not only geometric, but also HVAC data can be exported from a BIM model. This test case focuses on testing a BIM software, when the described data is available, is capable of exporting HVAC data into a gbXML model. The HVAC system is a simple gas-based furnace adapted from the description in ASHRAE 90.1 Appendix C.

Spaces / Rooms:
There is one space in this test model named as "level_1_space_1".

Special Considerations:

1. The model is 10' x 10' x 10' (center line)
2. HVAC shall have the following characteristics
    a. A constant-volume fan control with fan efficiency of 0.7
    b. An electrically-provided cooling with constant COP equal to 3.0
    c. A gas furnace with constant thermal efficiency equal to 0.8
    d. Zone design OA is 5.3 CFM/person and 0.64 CFM/m2
    e. Design heating temperature is 70°F and design cooling temperature is 74°F
3. The order of the equipment should be on/off or constant volume fan, direct expansion cooling coil, gas furnace. The specification for each of the components are listed in Table 1, Table 2, Table 3. Operation schedule is detailed in Table 4.
4. All the walls face to an orientation shall be named as: "[orientation]_wall_[custom index]"
5. All the other surfaces shall be named as their function, such as "interior_wall_[custom index]"
6. The custom index is an index to differentiate the same type surfaces. The tester can decide how to label the custom index.

Table 1. Fan Properties

Property	Unit	Value
Motor in Air Stream	-	1
Air Stream Fraction	-	0.9
Delta P	Pa	75
Control	-	Cycling
Efficiency	-	0.7

Table 2. Cooling Coil Properties

Property	Unit	Value
Efficiency (COP)	-	3.0
Capacity	kBtu/h	85

Table 3. Heating Coil Properties

Property	Unit	Value
Efficiency	-	0.8
Energy Type	-	NaturalGas
Capacity	kBtu/h	102

Table 4. HVAC operation schedule (On/off schedule)

Schedule Type	Time period	Value
Year	All weeks	Week schedule type
Week	All days	Day schedule type
Day	1-5 AM	0
	6 AM – 10 PM	1
	11-12PM	0

Guideline for creating the BIM model:

Figure 1 shows a 3-dimensional isometric view of this test model.
Figure 2 shows a typical floor plan to indicate dimensions and directions of the space, with wall thickness. The dashed line represents the profile of the shading of the roof.
Figure 3 shows a typical section view to indicate positions and dimensions of the slab floor, the height of the roof and the ceiling element.

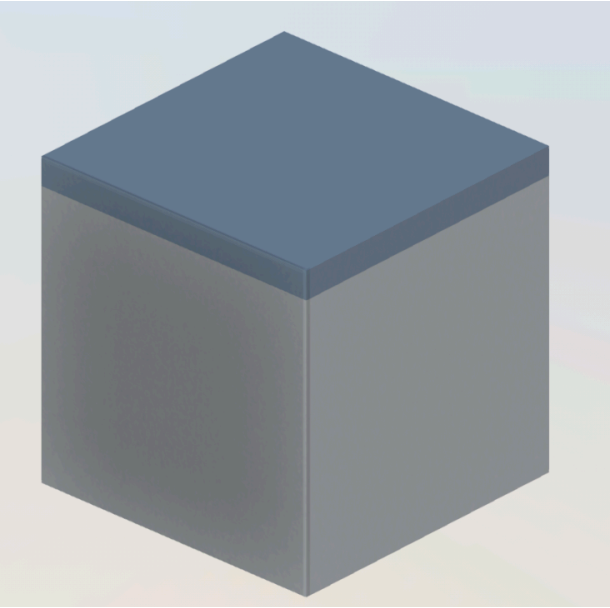

Figure 1. Isometric View

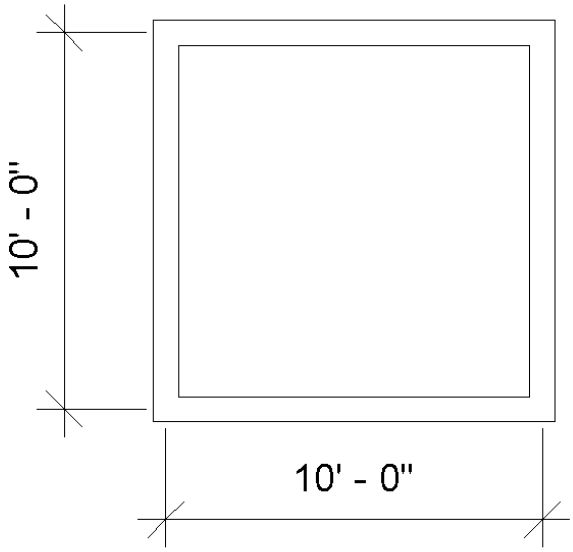

Figure 2. Floor and Ceiling Plan View

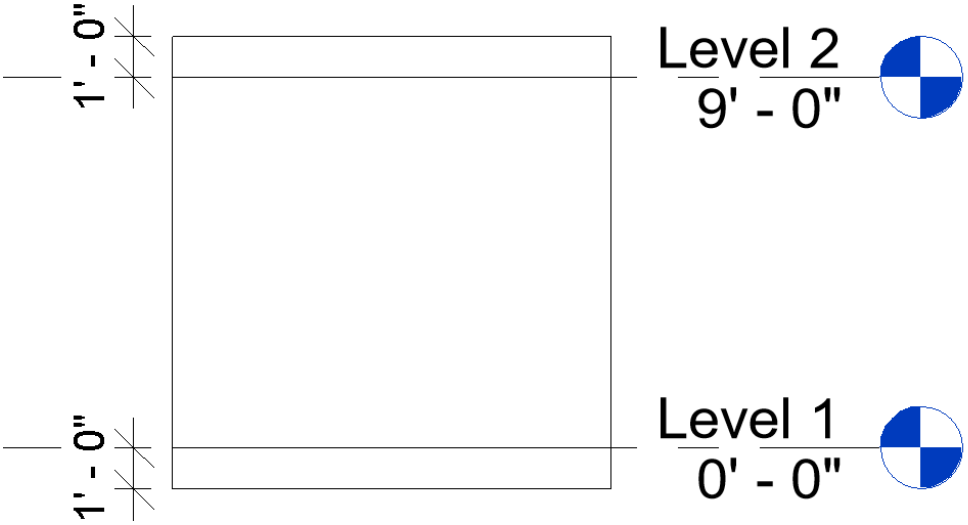

Figure 3. Section View

Expected Outcomes:

In gbXML model, all the relevant fields can be identified and the values match Table 1, 2, 3 and 4.

Common Outcomes and Test Results:

One typical issue could be mis-ordered components. The order of the air loop equipment inside the air loop element is important in the gbXML because it defines the placement of equipment in the real installation inside an air handling unit.