## Hot Water Coil Valve Leakage

### Author

* Danny Studer, NREL (design)
* Brian Ball, NREL (measure coding)

### Description

The valves that control the flow of hot water to heating coils can sometimes leak, adding unwanted heat to the airstream during cooling operation. Adding this extra heat means that extra chilled water is needed to bring the air down to the desired temperature. Identifying and fixing these leaks can help save cooling energy.

### Modeler Description

This Measure actually introduces coil leakage to the model; to determine savings, you should apply this to an unleaking baseline model, and the savings will be the inverse of normal. This measure introduces leaks to hot water heating coils in VAV air handlers with hot water reheat. This is modeled by increasing the coil outlet setpoint by 5C anytime the system is in cooling mode. This causes the hot water flow rate to increase.

### Use Case Types

Retrofit, New Construction

### Arguments

“run\_measure” is a choice argument that determines whether or not the Measure is applied during a given run.

### Initial Condition Message

The initial model contained at least one VAV system with hot water heating and reheat.

### Final Condition Message

The following systems had leakage introduced to the hot water coils in their air handlers: #{sys\_1}, #{sys\_2}...

### Not Applicable Messages

Not applicable if no VAV system with hot water heating and reheat was found.

### Warning Messages

### Information Messages

### Error Messages

### Code Outline

Modeling strategy taken from “Energy Savings Modeling of Standard Commercial Building Retuning Measures: Large Office Buildings” (1).

* Check each AirLoopHVAC to determine whether it is a VAV system with hot water heat and reheat or not.
  + First, check if the airloop.supplyFan is a FanVariableVolume
  + Second, make sure that airloop.supplyComponents contains at least one CoilHeatingWater
  + Third, make sure that airloop.demandComponents has at least one AirTerminalSingleDuctVAVReheat with a CoilHeatingWater as the heating coil.

If the system is a VAV system with hot water heat and reheat:

* For each VAV terminal on the airloop, create a sensor for the heating rate of the reheat coil.

EnergyManagementSystem:Sensor,

VAV{#\_#},

{NAME OF HOT WATER COIL IN VAV TERMINAL},

Heating Coil Heating Rate;

* Create a sensor for the VAV system’s mixed-air outlet node temperature

EnergyManagementSystem:Sensor,

VAV{#}\_MA\_Temp,

{NAME OF MIXED AIR NODE NAME ON OA SYS},

System Node Temperature;

* Create a sensor for the supply air node setpoint temperature

EnergyManagementSystem:Sensor,

VAV{#}\_TempSP,

{NAME OF SUPPLY OUTLET NODE},

System Node Setpoint Temperature;

* Create an actuator for the setpoint of the heating coil in the air handler

EnergyManagementSystem:Actuator,

VAV{#}\_HeatC\_TempSP,

{NAME OF OUTLET NODE OF AHU HW COIL},

System Node Setpoint,

Temperature Setpoint;

* Create the program and calling manager

EnergyManagementSystem:ProgramCallingManager,

LeakageHeat\_Manager{#},

AfterPredictorAfterHVACManagers,

AHU{#}HWCoilLeakage;

EnergyManagementSystem:Program,

AHU{#}HWCoilLeakage,

! Determine if any of the reheat coils are calling for heating

SET HW\_Flow = 0,

IF VAV{#\_#} > 0,

SET HW\_Flow = 1,

ENDIF,

…

! Change the heating coil outlet setpoint

IF HW\_Flow == 1,

IF VAV{#}\_MA\_Temp < VAV{#}\_TempSP,

SET VAV{#}\_HeatC\_TempSP = VAV1\_TempSP,

ELSE,

SET VAV1\_HeatC\_TempSP = VAV1\_MA\_Temp + 5,

ENDIF,

ELSE,

SET VAV{#}\_HeatC\_TempSP = VAV{#}\_TempSP,

ENDIF;

### Tests

**This measure applies to:**

1. Large Office
2. Secondary School
3. Large Hotel
4. Hospital

**This measure does not apply to:**

1. Small Office
2. Medium Office
3. Primary School
4. Stand-Alone Retail
5. Strip Mall
6. Supermarket
7. Quick Service Restaurant
8. Full Service Restaurant
9. Small Hotel
10. Outpatient Healthcare
11. Warehouse
12. Midrise Apartment

**Test results:**

### References

1. Energy Savings Modeling of Standard Commercial Building Re-tuning Measures: Large Office Buildings, PNNL 2012, Fernandez, Katipamula, Wang, Huang, Liu