Presentation Synopsis

Heating, Ventilating and Air Conditioning

Building Condition Assessment

Vancouver, B.C.

Prepared for:

EPIC

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1 INTRODUCTION

This report has been prepared as a supplement to a presentation on HVAC systems in terms of building condition assessment.

2 STEPS TO CONDUCTING YOUR HVAC ASSESSMENT

The following is an overview of the assessment process. Take along your tape measure, flashlight and camera, and follow these steps.

2.1 Assemble Documentation

Before you start looking at a building's heating, ventilating and air conditioning system, it is helpful to retrieve available documentation. Since most mechanical system components are behind walls and above ceilings, drawings and reports can tell you things about the mechanical systems that would take quite a bit of effort to figure out on site.

A good starting point is to get information on the building age, along with mechanical drawings, operating and maintenance manuals and past reports. Drawings can at times be a challenge to retrieve. If you have the patience and time, you can usually get something from the local municipality.

Knowing the building's age will give you some hints on special issues that might arise. For example, asbestos was used in pipe insulation fittings and duct tape over a certain period of time. If you are looking at a building over 15 years old, you can generally anticipate impeding failures of lower quality equipment such as rooftop equipment, natural draft fin-tube boilers and the like. Once the building is over 25 years, even the more robust mechanical equipment tends to fail or be unreliable.

2.2 Interview

If you are not familiar with the building yourself, ask the janitor and/or maintenance engineer about the history of the building. For example, has the piping system been leaking; have occupants complained about indoor air quality? Find out which contractors service the air conditioning, heating and plumbing systems, and give them a call. They are often willing to share their repair records, at least verbally. Also don't forget to ask building occupants how they perceive the building's condition. They might not know much about mechanical systems, but their comments can often help focus your investigation.

2.3 Walk Through

Start by walking through the occupied spaces. Look for ceiling tile stains, water stains on walls, mould formation, and the condition of visible components such as thermostats, and radiator valves.

Next pop up ceiling tiles and look through access panels. See if the ducts are insulated, and check duct and pipe hangers. If there is a heat pump or fan coil system in the ceiling, see if tempered outdoor air ("primary air") is ducted to these units. For any equipment in the ceiling spaces, check condition, supports, and connections. For air conditioning units, check condensate drains.

Next have a look at service rooms such as janitor's rooms. Check if these rooms are properly ventilated (i.e., separate exhaust).

If the roof is a flat one and you can safety get up there, get right on it and walk around. Inspect plumbing vent pipes and rooftop equipment such as makeup air units, air conditioning units, condensing units, and exhaust fans.

End your tour in the main mechanical room. This is where you will need to spend quite a bit of your time. Cover the following:

1. Piping: Look for leaks, presence/condition of insulation, support.
2. Boilers: tag information, pressure relief valves, settings, casing
3. Pumps: noise, leaks
4. Expansion tanks: are they water logged?
5. Certificates: are they posted? Are they current?
6. Seismic: Are boilers, tanks and gas meters secured?
7. Fire protection: Are pipe penetrations fire stopped?

2.4 Summarize & Prioritize

Do a financial and risk assessment. Think about the implications of loosing a particular piece of equipment. (Is there redundancy?) Divide up your observations into maintenance and capital improvement categories.

Decide if testing would be merited. Consider:

1. Indoor air quality tests (CO, humidity, etc.)

2. Boiler efficiency tests

3. Furnace heat exchanger integrity

Next decide if further studies would be merited. For example, an energy study might be beneficial.

Finally, decide if systems need to be re-commissioned.

Write your report and get ready for the next assessment.

3 HVAC SYSTEMS

3.1 Types

As part of your assessment, you will have to figure out the type(s) of HVAC systems a building has. The following chart correlates different HVAC systems with what you should see.

System Type	What You See In			
	Ceiling Spaces	Mechanical Rooms	Roofs	Walls
Single Zone Rooftop Units	Only ducts	Only plumbing	RTU's	--
VAV	VAV boxes	Variable speed drives	--	--
Reheat	Hot water pipes and coils in ducts or in boxes	Boilers	--	--
Water Source Heat Pumps	Uninsulated piping Heat pump units Ducts	Small boiler	Cooling Tower	--
Hot Water Heating	Hot water pipes	Boilers		Radiators or ceiling panels

Once you have figured out the type of system(s) you have, it is helpful to gain a better understanding of how these systems function. The American Society of Heating, Ventilating and Air-Conditioning Engineers (ASHRAE) is a great resource for this. Important aspects to become familiar with include:

1. Major components.

2. Functions (how the system works).
3. Flexibility (how well the system can be adapted to future uses).
4. Overall reliability and typical failure points.
5. Operating and maintenance costs.
6. How to assess general condition, code compliance, safety and indoor air quality.

Some types of systems to become familiar with include:

1. Single zone air systems
2. Reheat systems
3. Variable volume systems
4. Induction systems
5. Unit ventilators
6. Dual duct and multizone systems
7. Chilled water (chillers & towers)
8. Heat pumps (air/air, water, ground source

Some important components to become familiar with include:

1. Fans
2. Cooling coils (direct expansion & chilled water)
3. Heating coils
4. Radiant ceiling panels
5. Humidification systems
6. Dampers
7. Filters
8. VAV boxes

9. Pumps
10. Boilers
11. Cooling Towers
12. Variable speed drives
13. Controls

3.2 Functions

To properly assess an HVAC system, it is helpful to understand the reason the system is there in the first place. The primary functions of HVAC systems are thermal comfort and indoor air quality control. Both of these primary functions should be considered. For example, an air conditioning unit might adequately provide cooling, but it may be inadequate in terms of ventilation delivery or the unit itself may be creating indoor air quality problems due to poor maintenance, poor installation, or failure.

3.3 Assessment

Do-it-yourself items:

1. Equipment exterior (casings)
2. Leaks
3. Noises
4. Maintenance records

Ask the experts:

1. Internal condition (e.g., heat exchangers)
2. Destructive testing
3. Specialized measurements

4 RESOURCES

1. ASHRAE: http://www.ashrae.org/

2. BOMA: http://www.boma.org/

3. EPA: http://www.epa.gov/

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