CENTER FOR ENERGY AND ENVIRONMENT

Technical Fact Sheet

Multifamily Facility Management Services

SINGLE PIPE STEAM BALANCING

Description:

A major and almost universal cause of energy waste in single pipe steam (SPS) heated buildings is uneven heating. Opening windows to cool down apartments was part of the original system design. The thermostat is generally adjusted to satisfy the coolest apartment, causing overheating in other parts of the building. Since higher temperatures increase heat loss, this overheating translates directly into higher fuel bills. In Minneapolis (a cold climate town) for example, this cost is generally estimated as an increase in heating costs of 3% for each 1° F of overheating. Uneven heating occurs for several reasons and the procedure for steam balancing must address each of these inherent problems:

- excessively short boiler cycles;
- large time differences in steam arrival to different parts of the building;
- lack of zone control and improper radiator sizing.

To gain proper control of the length and timing of the boiler cycle, a control with an adjustable differential must be installed. The adjustable differential allows the user to lengthen the boiler cycle to ensure that steam is produced and distributed throughout the building before the boiler cycles off. Other features to look for include "remote sensing" capability and night setback. Remote sensing discourages tampering by allowing the control to be installed in the boiler room, while two or more temperature sensing probes serve as control points in the building. The location of these remote sensors is critical. The setback feature saves energy when the building is unoccupied or when occupants are asleep. (Setback options in multifamily buildings are more limited than commercial buildings since occupants' schedules can vary widely, but even minor setbacks are effective.) Another feature of the control should ideally be spring-time shutoff of the heating system. All of these features can be found from at least one specialized control manufacturer. In addition, all but the spring-time shut-off can be found in particular thermostats available from several standard control companies; in this case, spring-time shut-off can be provided by a separate control manufactured by the same companies.

To reduce time differences in steam arrival, oversized main line air vents (MLAV) need to be installed on the main steam distribution line(s) in the basement. These vents will enhance the flow of steam down the main lines and retard the flow up into close risers. The result is that distant risers receive steam more quickly and close risers receive steam more slowly. In addition, large individual radiator air vents should replace conventional vents on the radiators farthest from the boiler. In conjunction with MLAV, these individual vents can significantly

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reduce the steam fill time lag between near and distant radiators. Finally, broken radiator inlet valves and vents should be repaired or replaced so that all radiators are in good working order

To provide a certain amount of individual zone control, a thermostatic radiator valve (TRV) can be installed on the air vent of larger radiators in selective apartments that tend to overheat. TRVs respond to temperature changes near the radiator and close the air vent if the temperature goes above a set point. TRVs work best in conjunction with proper boiler cycle control since they do not affect the operation of the boiler itself and can only prevent steam from entering a particular radiator at the *beginning* of a cycle.

To compensate for missing or improperly sized radiators in the building, it may be necessary to reinstall or rearrange existing radiators in a few locations. It should only be done when necessary, but in some cases good balance cannot be achieved without it (for example, in apartments where radiators have been removed, or in basement apartments that formerly relied *exclusively* on the main line distribution pipes as their heat source).

How to implement:

The procedure described can be successfully implemented in four stages:

1. Building Survey
2. Installation
3. Assessment
4. Fine Tuning

A certified building consultant can conduct a building survey, which is used to determine the feasibility of different control options as well as to identify locations for the installation of remote sensors. The survey should also include specific recommendations regarding how many larger main line air vents and larger radiator air vents to install, as well as suggestions on where to locate them.

The second stage is the actual installation of the remote sensing cycle control, larger main line air vents and larger radiator air vents. A qualified, licensed contractor should be hired to complete the installation of the new control and main line air vents. Radiator air vents can either be installed by this same contractor or by qualified, trained maintenance staff.

The assessment stage is completed by the building's own maintenance staff and its purpose is to determine how the improved system is working. A combination of tenant surveys and selective apartment temperature monitoring should be undertaken to determine the degree of temperature imbalance still remaining in the building. Tenant surveys can also help identify broken radiator valves and vents or missing radiators. To maximize savings, the lowest comfortable thermostat setting for the building should also be found.

During fine tuning any problems identified by the assessment stage are addressed. This may include replacing individual radiator vents to increase or decrease venting capacity, adjusting thermostat settings, installing TRVs in select apartments that continue to overheat, repairing or replacing broken radiator valves or vents, installing or rearranging radiators, and possibly weatherizing specific apartments that are chronically cold. Most, if not all, of this work can be completed by trained maintenance staff. Otherwise, a contractor should be hired.