

ENERGY RECOVERY SYSTEMS

Terminology: For the purposes of this writing the terms *energy recovery* and *heat recovery* have been used interchangeably as have been the terms *total energy* and *enthalpy*.

Approved Technologies: Energy recovery systems shall utilize proven/approved technologies.

ASHRAE: Air handling and/or exhaust systems shall incorporate energy recovery capability as required by *ASHRAE Standard 90.1*. Further, application of energy recovery technologies beyond that required to satisfy these requirements is encouraged. Such decisions shall be based upon life cycle cost analysis as developed below.

Life Cycle Cost: It is the policy of the University of Illinois at Urbana-Champaign to make facility design decisions based upon life cycle cost comparison of viable options. However, assignment of numerical values to intangible factors such as aesthetics and human comfort can make life cycle cost analysis very difficult. This is not the case with energy recovery system analysis. To the degree that utility costs are known, hard numbers can be assigned to both first cost and long term operating costs. Thus, decisions regarding the incorporation of energy recovery systems/equipment beyond that required by *ASHRAE Standard 90.1* shall be made on this basis.

Total Energy Recovery: As applied to air systems...Unless inappropriate for a specific application (rare) or unachievable within practical limitations, an air-to-air type heat recovery system shall be employed. Further, unless impractical or inappropriate, a total energy recovery system shall be utilized -- i.e. one that transfers both sensible and latent heat (e.g. an enthalpy wheel). Heat recovery system type must be determined early in a project, prior to the assignment of equipment room location and size. In order to install an air-to-air system, supply and associated exhaust air systems must be located adjacent to each other.

Sensible Heat Recovery: In cases where it is inappropriate or impractical to install a total enthalpy heat recovery system, a sensible-only system may be employed.

Such systems include the following: plate heat exchangers, side-by-side heat pipes, "horseshoe" heat pipes, sensible wheels and run-around loops. Of these, run-around loops are the least desirable but are typically the only option when supply and associated exhaust air systems must be located remotely from each other. Note: When horseshoe heat pipes are used, adequate access shall be provided between heat pipes and associated cooling coils to facilitate coil cleaning. This requirement is easily overlooked.

Run-Around Loop: If a run-around loop system is used, it is preferred that it be independent of other heating systems (e.g. preheat system).

Combination Systems: When supported by life cycle cost analysis and when practical to install, a combination system shall be utilized. This involves the installation of total heat recovery and sensible-only recovery equipment within a single unit/system. Examples of combination systems include:

- Total energy wheel / sensible energy wheel
- Total energy wheel / side-by-side heat pipe
- Total energy wheel / horseshoe heat pipe
- Total energy wheel / run-around loop

Economizer: Where applicable (e.g. systems with a substantial amount of return air) and as supported by life cycle cost analysis, an air-side economizer shall be provided in conjunction with a heat recovery system.

Laboratory Exhaust: When an energy recovery system is utilized in conjunction with exhaust airflow that contains toxic or noxious fumes, a system design that limits cross-contamination to an acceptable minimum shall be employed. This does not necessarily rule out the use of a total energy wheel. In fact, total energy recovery shall still be treated as the default, or starting point, for laboratory ventilation system design. See section within these *General Guidelines* entitled *Laboratories, Chemical and Biological*.

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Corrosion Resistance: All heat recovery system components exposed to corrosive fumes shall be constructed of appropriate, durable, corrosion resistant materials (e.g. stainless steel, phenolic coatings, ceramic materials, etc.)

Isolation/Access: Each heat recovery device that is located within an air distribution / exhaust air system that is of a critical nature such that continuous operation of the air system is required (e.g. a typical fume exhaust system) shall be configured such that it can be isolated, taken out of service and accessed for cleaning, maintenance or repair while leaving the system in operation (e.g. by installing a bypass duct and isolation dampers). Further, it shall be configured such that this can be accomplished without exposing service personnel to system airflow and/or harmful contaminants (as would be the case in a fume exhaust system application). This requires that the accessed area be maintained at a positive air pressure relative to any contaminated air stream with which it could potentially communicate. Exception: As with filters, when approved by the using agency and F&S Engineering Services, this requirement may be waived. In doing so it is understood that the exhaust system will be taken out of service as required.

Cleaning: Provision shall be made for routine cleaning of heat exchange surfaces. Such provision includes incorporation of drain pan(s) for water wash-down as well as isolation/access features as identified above.

Filtration: Filtration shall be provided upstream of each heat recovery device located in an outdoor and/or exhaust air stream. Each air stream shall be filtered by a minimum of one MERV 8 (30% efficient) filter bank. As with isolation/access requirements filters/housings in contaminated air streams shall be configured such that filters can be changed during system operation without “unloading” filter contents (dust/debris/contaminants) into the air stream and without exposing service personnel without exposing service personnel to harmful contaminants. (MERV Rating is per *ASHRAE Standard 52.2*. Filter % efficiency is dust spot efficiency rating per

ASHRAE Standard 52.1.) Exception: The exception stated above in the paragraph entitled *Isolation/Access* applies in this case as well.

Kitchen Exhaust: It is acknowledged that heat recovery devices are typically not installed in kitchen exhaust air streams due to concern about grease fouling. However, in spite of the current norm, consideration shall be given to the application of heat recovery in such systems. Potential limitations of applicable codes must be considered.

Water Systems: Consideration shall also be given to the application of heat recovery opportunities to water/fluid systems to the degree that such application is supported by life cycle analysis and is practical to achieve. Example: The use of steam condensate to preheat domestic hot water.

Heat Recovery Chillers: The use of heat recovery chillers as an economical source of simultaneous heating and cooling has come into its own. The application of such to building systems holds potential for substantial reduction in energy consumption. Given that a measure of year-round cooling load exists on campus there is opportunity for application of this technology. Note: Given that the cumulative year-round cooling load is limited, the installation of a heat recovery chiller that utilizes the central chilled water system as a “heat sink” must be approved by the Energy Services Division within F&S.