FläktGroup SEMCO

SPECIALIZED HEALTHY AIR SOLUTIONS

APPLYING TOTAL ENERGY RECOVERY WHEELS TO LABS WITH HOOD EXHAUST:

ASHRAE 62.1-2013 COMPLIANCE: ADDENDUM K

true 3Å™

For more than two decades, the FläktGroup SEMCO True 3Å wheel has been successfully applied to some of the largest and most prestigious research laboratories in the US and globally. In many of these projects, the airflow processed by the total energy wheels involved fume hood exhaust.

Laboratories require very high quantities of outdoor air, operate continuously and typically involve stringent humidity control (dehumidification and humidification). As a result, the annual energy savings and first cost savings associated with smaller boilers and chillers made possible by the use of effective total energy recovery are substantial. These and other benefits offered by the FläktGroup SEMCO True 3Å wheel are many times greater than achievable with sensible only runaround coil alternatives. As a result, the technology has been the system of choice for many end users and engineering firms specializing in laboratory design.

Walsh Interpretation: ASHRAE Standard 62.1- 2010

A January 2011 response from the ASHRAE 62.1 committee to an interpretation request submitted by Walsh concluded that total energy recovery wheels could not be applied to applications involving laboratory hood exhaust. ASHRAE 62.1 categorizes laboratory hood exhaust as class 4 air. It also stipulates that "Class 4 air shall not be recirculated or transferred to any space nor recirculated within the space of origin." The committee concluded that all total energy recovery wheels would recirculate exhaust air back to the supply airstream.

This position was taken despite the fact, as correctly presented within the Walsh interpretation request, that both the ASHRAE Applications Handbook and AIHA/ ANSI Standard Z9.5-2003 allow for approximately 1% of exhaust air re-entrainment into the fresh air intake of a well-designed laboratory. Likewise ASHRAE Standard 110 used for the certification of fume hoods allows for acceptance even if approximately 1% of the exhausted air from the hood is recirculated back into the occupied space.

FläktGroup SEMCO, along with numerous laboratory consultants, end users and researchers responded to this interpretation by submitting a change request to reflect the fact that there had been a very successful track record established for the use of the FläktGroup SEMCO True 3Å wheel in laboratory facilities processing fume exhaust and that a significant body of research was available to confirm the effectiveness of this technology. A substantial body of field research data was also provided to the committee to show that any recirculated air associated with the recovery system is substantially less than the air that is re-entrained from the exhaust air fan to the fresh air inlet.

ASHRAE Standard 62.1- 2013 Addendum K

After much deliberation, the ASHRAE 62.1 committee agreed that the Walsh interpretation was too restrictive and that the standard required modification. The committee concluded that the decision to use total energy recovery technology with laboratory exhaust should be made by the Environmental Health and Safety (EH&S) Professionals, as it has been for the past 25 years. In early 2015, Addendum K was issued as part of a supplement to the 2013 version of ASHRAE Standard 62.1.

The impact of addendum K is that it has modified the ASHRAE Standard 62.1 2013 such that laboratory exhaust is assigned a default of Air Class 4, but explicitly allows a responsible EH&S professional to determine that a lower air class is appropriate for particular systems. The addendum specifically sates that "If they assign a lower air class, then the use of heat wheel energy recovery would be allowed. *The SSPC believes that determination of the appropriate air class is best made by a qualified professional on a case-by-case basis."*

Confirming ASHRAE 62.1 Compliance with Addendum K

Addendum K provides a path for achieving compliance with ASHRAE 62.1 by allowing the class 4 air default classification given to all laboratory exhaust airstreams to be reassigned a lower class. FläktGroup SEMCO's 20 years of experience in this field has found this assessment to be appropriate for a high percentage of laboratory projects involving hood exhaust based upon the very high dilution rates employed and the ASHRAE definition of air classes shown below.

ASHRAE Standard 62.1 has developed the following general definition of air classes:

Class 1: Air with low contaminant concentration, low sensory-irritation intensity and inoffensive odor

Class 2: Air with moderate contaminant concentration, mild sensory-irritation intensity or mildly offensive odor

Class 3: Air with significant contaminant concentration, significant sensory-irritation intensity or offensive odor

Class 4: Air with highly objectionable fumes or gases or with potentially dangerous particles, bioaerosols or gases, at concentrations high enough to be considered harmful.

Compliance with ASHRAE 62.1 is confirmed for a project where laboratory hood exhaust is to be processed by a total energy recovery device by supporting the ES&H team to complete an analysis of the exhausted air chemicals, the quantities used and exhaust airflow involved.

By comparing the exhaust air contaminant concentrations entering the energy recovery system during normal use against the appropriate "hazardous determination" metric chosen by the EH&S team; it can be determined if the exhausted air contamination concentrations are high enough to be considered harmful. If not, the exhausted airstream entering the total energy recovery device can be reclassified to Class 3.

To prove compliance with the International Mechanical Code (IMC) section on Hazardous Exhaust Systems the same analysis needs to be completed so that energy recovery (of any type) can be used. The IMC specifically exempts laboratories from a hazardous exhaust classification when they are "related to testing, analysis, teaching, research or developmental activities" where "chemicals are used or synthesized on a non-production basis" provided that the resultant exhaust air concentrations are below 25% of the lower explosion limits and less than 1% of the median lethal concentration of the substance.

Confirming Addendum K Compliance using the FläktGroup SEMCO Laboratory Risk Analysis Software

The FläktGroup SEMCO Laboratory Risk Analysis software can provide the data necessary to confirm that the exhaust air concentrations that will exist under normal use within a laboratory facility do not reach levels that would be consider "hazardous."

In this analysis, the design exhaust and outdoor airflows are used along with a specified contaminant normal use quantity and the associated chemical properties to approximate the resultant exhaust air concentration that would enter a recovery wheel system. Only chemicals having a NFPA 704 rated class of 3 or 4 would typically have to be evaluated since these chemicals would reach a "hazardous" level at much lower concentration then other chemicals used within the facility. Most university laboratories, for example, will have very few NFPA 704 class 4 chemicals on hand. If so, these chemicals would be used in very low quantities.

Using the conservative definition of hazardous exhaust employed by the IMC, the analysis would look to confirm that the exhaust air concentration for each chemical, during normal use, is below 1 percent of the median lethal concentration established. For NFPA Class 3 chemicals, the median lethal concentration range is 1,000 to 3,000 parts per million. The FläktGroup SEMCO Laboratory Risk Analysis Software would therefore be used to show that the exhaust air concentration to the recovery system under normal use would be less than between 10 and 30 parts per million for any class 3 chemicals used.

FläktGroup SEMCO is willing to help our potential customers with this evaluation. For more details please see the FläktGroup SEMCO white paper on using the Laboratory Risk Analysis Software.

Confirming 62.1 Compliance without Addendum K

As previously discussed, ASHRAE Standard 62.1 states that "Class 4 air shall not be recirculated or transferred to any space nor recirculated within the space of origin". Therefore, compliance with ASHRAE 62.1 is achieved when it can be documented that an energy recovery device does not transfer exhaust air into the supply airstream.

The ASHRAE 84 standard has incorporated a sulfur hexafluoride tracer gas test procedure which is used to quantify leakage or transfer of exhaust air into the supply airstream of any recovery device (EATR). The AHRI 1060 standard for certification defines no recirculation or transfer as any measured exhaust air transfer ratio below .1% of the challenge concentration.

FläktGroup SEMCO has a substantial database of projects where systems incorporating its True 3Å wheel in laboratory facilities have been commissioned using the ASHRAE 84 tracer gas procedure and shown to have measured carry-over levels as low as .01% of the challenge concentration. This is typically 10 times less than the re-entrainment between the exhaust fan outlet and fresh air intake concentration measured for these projects. Based on these established standards the data provides confirmation of "no recirculation of Class 4 air" in properly designed systems. Therefore, the FläktGroup SEMCO True 3Å technology is compliant with ASHRAE 62.1 when used with laboratory fume hood exhaust even in the absence of an Addendum K evaluation.

FläktGroup SEMCO SPECIALIZED HEALTHY AIR SOLUTIONS

FläktGroup SEMCO delivers smart and energy efficient Air Distribution and Air Quality solutions to support every application area. We offer our customers innovative technologies, high quality and outstanding performance supported by more than fifty years of accumulated industry experience. The widest product range in the market, and strong market presence in 65 countries worldwide, guarantee that we are always by your side, ready to deliver Excellence in Solutions.

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