ASHRAE QATAR ORYX CHAPTER

Advancing HVAC&R to serve humanity and promote a sustainable world

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FEBRUARY 2012

Newsletter Chair Message

Hassan Sultan
Newsletter Chair
President 2011-2012
ASHRAE Qatar Oryx

When was ASHRAE Energy Standard initiated and published? What does it cover? How do we improve it? How can any participate to improve it? How it is important for the Green building rating system and assessment, etc… Many questions that I would like to answer them in brief in order to highlight once more the value of having such standards and to spread the awareness about the latest ASHRAE 90.1 Energy Standard to all.

The original ASHRAE 90 Energy Standard was initiated and published in 1975 and has been revised and improved ever since till the last edition of 2010 to provide;

- The minimum energy efficient requirements in design and construction.
- The criteria for determining compliance with these requirements.

ASHRAE 90.1 Energy Standard is a more comprehensive standard which most of the Green building rating systems are referred to, such as LEED, QSAS, etc…

It is important to know that improvement of the standard is continuously taking place through the issuance of updated editions.

ASHRAE 90.1 Energy Standard committee welcomes suggestions for improvements based on actual implementation, experience, lessons learned and expert's judgments. Users of the standard are invited to refer to the continuous maintenance procedure and submittal form available on the back of the standard.

This is to encourage all of you to suggest any amendments through the ASHRAE QATAR ORYX CHAPTER which shall be submitted to the committee for their review and consideration.

Thank you for your professional contribution to ASHRAE.

www.ashraeqatar.com

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Fouling of Heat Exchanger Surface and its Disastrous Effect on Heat Exchange Efficiency

Article by: Subrata Kar, Member– ASHRAE

As a Mechanical Engineer especially as a HVAC Engineer, every day we encounter the heat transfer through various heat exchanger surfaces namely, Plate Type Heat Exchanger, Shell and Tube Heat Exchanger, Cooling Tower, Cooling or Heating Coils, immersion type electric heating coil, and so on. In the case of an indirect heat transfer through the wall of heat exchanger, we all know that the heat transfer efficiency is maximum when the transfer surfaces are clean and free from any kind of insulating material (scale or other impurities) which inhib-its the heat transfer.

Just to examine, the disastrous effect of even a very thin layer of fouling – we take an example case of a heat exchanger – a simple hot water heat exchanger having steam in the primary circuit and domestic water in the secondary circuit. The function of the present heat exchanger is to use the heat of the steam to indirectly heat up the domestic water.

Effects of Lime Scale on Heat Transfer Efficiency

As per Basic Heat Transfer Equation:

Heat Transfer Rate = $1 / (1/\alpha_1 + S_1/\lambda_1 + S_2/\lambda_2 + 1/\alpha_2)$ W/m^2K

$\alpha_1 = 10{,}000\ W/m^2K$	Primary circuit (steam)
$\alpha_2 = 4{,}600\ W/m^2K$	Secondary circuit (water)
$S_1 = 1mm$	Wall thickness of heat exchanger element (assumed)
$\lambda_1 = 20\ W/m^2K$	Heat conductivity of heat exchanger element
$S_2 = 0.5\ mm$	Thickness of lime scale (0.5 mm thick layer of $CaCo_3$ / $CaSo_4$ = etc.)
$\lambda_2 = 0.81\ W/m^2K$	Heat conductivity of lime scale

No lime scale (Clean Heat Exchanger Surface)

Heat transfer rate $1 / [(1/10000) + (0.001/20) + (0/0.81) + (1/4600)] = 2.721\ w/m^{2\,0}k$

½ mm lime scale (Fouled Heat Exchanger Surface)

Heat transfer rate $1 / [(1/10000) + (0.001/20) + (0.0005/0.81) + (1/4600)] = 1.015\ w/m^{2\,0}k$

Reduction of heat transfer rate = $(2.721-1.015 / 2.721) \times 100 =$ **62.69% down!!!**

Fouling of Heat Exchanger Surface and its Disastrous Effect on Heat Exchange Efficiency (Continued)

Let us pause for a second and just think – the drastic energy cost that we pay everyday for keeping our heat exchange surface [or electric heater element] fouled!!!

Therefore, it is important to select the right strategy of keeping the heat exchanger clean among the various alternatives available as follows:

1. By putting a right maintenance regime to keep the heat exchanger surface always clean.
2. Whenever possible selecting a shell and tube type heat exchanger with self-cleaning & performance enhancing smaller dia solid tabulator rods in the (tubes) secondary (more maintenance prone) side. The shell and tube heat exchanger has got an advantage of easy maintainability and cleaning possibility by simply opening the terminal flanges. Also it is important to choose the durable, tough material e.g., austenitic stainless steel SS316Ti – so even if the surface is fouled – it can be cleaned thoroughly & regularly.
3. Possible introduction of an online centrifugal filtration system up-stream to a heat exchanger (especially plate & frame type) if the fluid handled is having a substantial solid suspended impurities.

In short, the key to maintain the efficiency of a heat exchanger is to keep the surface clean by whatever means and if we can do that, we can save a lot of energy and cost silently.

Subrata Kar
Member - ASHRAE, VP - BOG
Chair –Membership Promotion

Construction Week alongside its sister publication MEP Middle East will host the MEP Qatar Conference on May 23rd at the Grand Hyatt in Doha. This is a one day conference starting at 9 AM and finishing at 5 pm –Lunch and refreshments will be served.

www.constructionweekonline.com/conf/MEP-Qatar-2012

http://microsites.itp.com/mepqatar2012/agenda/

INTERVIEW

The idea of the interview has been proposed and managed by the President Hassan Sultan in order to obtain the evaluation & assessment of the ASHRAE members on the chapter's advancement and future prospects.

Q1. How is the Energy Standard ASHRAE 90.1 is supporting the Green Building rating systems such as LEED, QSAS, ESTIDAMA, etc...?

A1. ASHRAE standard 90.1 provide the base for evaluating the proposed mechanical system designs. ASHRAE 90.1-2007 appendixes G include the methodology to create the base line model which is the base to evaluate the design and determine how much saving is achieved through the proposed design.

ASHRAE 90.1 through the use of relatively insulated building envelope provides a base for reducing the heat transfer from buildings directed to green buildings designs. Another example is the use of lighting densities figure to estimate the heat dissipation from lighting fixture inside the buildings with these densities the designer is obligated to use energy efficient fixtures to reduce power consumption from lighting.

Q4. How do you see the zero net energy building achievable as already initiated by ASHRAE?

A2. There is no zero net energy building so far in industry. The ASHRAE and Green building approaches are targeting this aim. However absolute net zero is not achieved so far. Reduction in energy consumption when using green buildings techniques is increasing every day. Improve in equipment efficiency, use of on-site or off site renewable energy (wind energy, solar thermal energy, geothermal heating system, bio-fuel based electrical system,…etc)

The zero net energy require a mandatory act from the local authorities to be fully functioning to force building owners to go for more energy saving.

Hisham Hajaj
Project Principal
Stanley Consultants, Inc.

ASHRAE SEMINAR

Topic: Daikin VRV Solutions and Green Building Design

Presented By: Mr. Koji Kanaoka, Mr. Firas Kneifati, Mr. Michel Farah & Ms. Elissa Ghanem

Sponsored By: M/s. Daikin Mcquay Middle East FZE

Date: February 18th, 2012