Slide 1

Today, we will be talking about Airside Economizers in TRACE™ 700.

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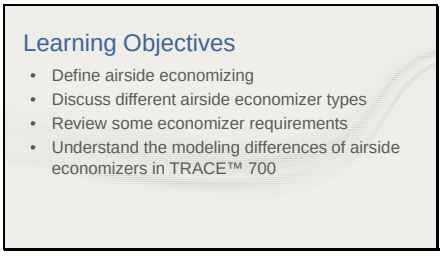

In this video we will briefly discuss what an airside economizer is and the different strategies available. We will also discuss the economizers allowed by ASHRAE Standard 90.1-2004 through 2010 as well as the new requirements as they pertain to Standard 90.1-2013.

Finally, we will learn how to model the different economizer cycles in TRACE™ 700.

Let's begin by discussing what an airside economizer is.

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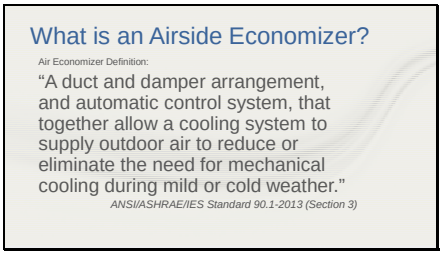

According to ASHRAE Standard 90.1-2013, an Air Economizer is defined as, "A duct and damper arrangement, and automatic control system, that together allow a cooling system to supply outdoor air to reduce or eliminate the need for mechanical cooling during mild or cold weather."

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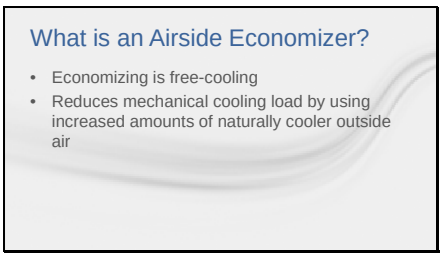

Essentially, airside economizers are a form of free cooling. By increasing the amount of outdoor or ventilation air beyond mandated minimums, the load on a cooling plant can be decreased. Using that untreated outdoor air to cool the building spaces allows the cooling plant to be disabled, saving energy and money in the process.

Many times, the outdoor air dampers will be modulated in order to mix with the return air to deliver the proper temperature to a space. This could also mean that, if the conditions warrant, the amount of ventilation air could be 100%. However, if the outdoor air conditions do not allow for free cooling to be advantageous, the economizer cycle will be disabled and only mechanical cooling will be used to condition the space or spaces.

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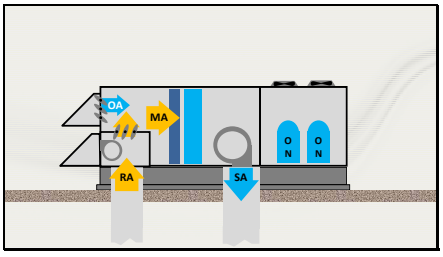

As you can see, typical operation includes the use of mechanical cooling while bringing in minimum outside air quantities.

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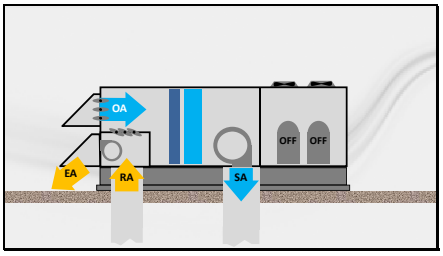

However, when the conditions are right, this outdoor-air damper opens further to bring in more outdoor air, reducing the need to operate compressors to provide cooling.

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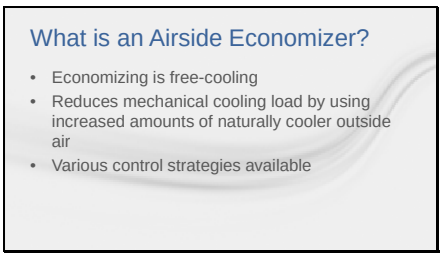

Keep in mind, as the saying goes, nothing in life is free. Bringing in untreated outdoor air could mean the introduction of more than ideal amounts of humidity and other forms of moisture to the building than is desired. As such, there are methods of economizing that deal with this issue as well. The method required may be dictated by local building codes or by Section 6.5.1.1 of ASHRAE Standard 90.1.

Additionally, when applying an airside economizer, building pressurization can become an issue with the introduction of this additional outdoor air. As such, Standard 90.1 requires the use of a relief system to prevent overpressurization.

Let's take a short look at some of the different control methods available.

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As mentioned, there are a number of different airside economizer strategies. We will go over a number of these methods and discuss how ASHRAE Standard 90.1-2013 incorporates some of them.

Fixed Dry Bulb allows a for the economizer to operate up to a high-limit. This is a fairly simple method which is based solely upon the outside air temperature.

Differential Dry Bulb compares the outside air and return air dry bulb temperatures. Economizer is able to operate until the outside air temperature is greater than the return air temperature.

Fixed Wet Bulb works in much the same manner as Fixed Dry Bulb with the exception being that the values used for control are the wet bulb temperatures.

Similarly, the Differential Wet Bulb economizer compares the outdoor and return air wet bulb temperatures in the same fashion as the Differential Dry Bulb economizer.

Fixed Enthalpy allows the economizer cycle to operate until the enthalpy of the outside air exceeds a fixed point. Usually 28 Btu/lb or 47 kJ/kg depending upon elevation.

Electronic Enthalpy uses a sensor to measure the enthalpy of the outdoor air and disable the economizer based upon a dry bulb/dew-point curve defined by the sensor manufacturer.

Differential Enthalpy works in a similar fashion to Differential Dry Bulb as it compares the outside and return air enthalpies and disables the economizer when the outside air exceeds the return air value.

Dew Point and Dry Bulb disables the economizer when either the outside air dry bulb exceeds 75°F (24°C) or the dew point exceeds 55°F (13°C).

Fixed Enthalpy with Fixed Dry Bulb allows the economizer cycle to operate unless either the outside air enthalpy exceeds 28 Btu/lb (47 kJ/kg) or the dry bulb temperature exceeds 75°F (24°C).

Finally Differential Enthalpy with Fixed Dry Bulb is similar to the Fixed Enthalpy with Fixed Dry Bulb with the exception being that instead of the economizer disable point being a fixed enthalpy, the outside and return air enthalpies are compared and the cycle is disabled based upon when the outside air enthalpy exceeds that of the return air.

The 2004, 2007 and 2010 versions of Standard 90.1 allowed for the use of Fixed and Differential Dry Bulb, Fixed, Differential and Electronic Enthalpy, and the Dew Point and Dry Bulb control methods. Modeling the Fixed and Differential Enthalpy strategies are straight-forward in TRACE™ 700 and more information on doing so can be found in the User's Manual and in the F1 Help. These methods, however, have been excluded from the 2013 version of the standard along with the Electronic Enthalpy and the Dew Point and Dry Bulb Temperatures methods. The committee's explanation for this exclusion can be found in the forward to Addendum DW of Standard 90.1-2010.

The four types allowed by 90.1-2013 are the Fixed Dry Bulb, Differential Dry Bulb, Fixed Enthalpy with Fixed Dry Bulb and Differential Enthalpy with Fixed Dry Bulb. We will now look at how to model these economizer control strategies in TRACE™ 700.

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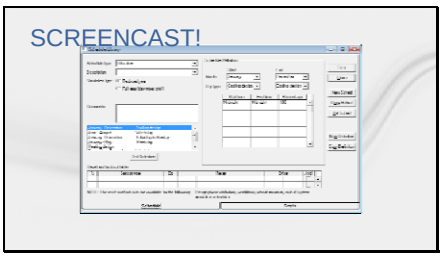

Modeling some of the Economizer methods in TRACE™ are fairly straight-forward. Take for instance the Fixed Dry Bulb method. To apply this method, users will simply navigate to the Options tab of Create Systems, select the system to which the economizer will be applied and select Dry Bulb as the type. Users will then have to set the On Point or High Limit Shut-off which is the point at which the economizer is disabled and only mechanical cooling is used. As related to ASHRAE Standard 90.1, this On-Point will vary depending upon the climate zone the building is located in but this value will vary 65° and 75°F for the United States.

It is important to note that all economizer control methods in TRACE™ are modulated and integrated, meaning that once the damper reaches it's high limit as set in the Max outdoor air field, mechanical cooling will be used to satisfy the remaining load. However, once the High Limit or On-point is reached, the ventilation airflow drops back to minimums and only mechanical cooling is used. For those keeping score, this will satisfy the requirement of integrated control specified by section 6.5.1.3 of Standard 90.1-2013.

Moving on to modeling the Differential Dry bulb method. This is a bit more complicated as users will follow the previous methodology with the exception being that instead of setting an On-Point, users will leave that field blank and instead apply a schedule which will include a lock-out table.

To create the schedule, users will need to navigate to the Library / Template Editor and create a new Utilization Schedule. I will create this one similar to the default Available (100%) schedule however, as mentioned, I will include a lockout in order to make sure the economizer does not operate if the outside air temperature is greater than the return air temperature. For more information on Schedule creation, please see our eLearning video titled TRACE™ 700 Utilization Schedules.

The simplest way to do this is to select the Available (100%) schedule, click the Copy Button, give this new schedule a name and apply the lockout in the Reset and Lockout Table. Since the default operation is 100%, the lockout will be set to 0% operation when the outside air dry bulb temperature is greater than the return air dry bulb. Click the Save Button, and that's it. Simply go back to your project file and apply the schedule in the Economizer section.

Setting up the Fixed Enthalpy with Fixed Dry Bulb and Differential Enthalpy with Fixed Dry Bulb have very similar set-ups as well and also require schedules with lockouts.

The Fixed Enthalpy with Fixed Dry Bulb requires the user to select Enthalpy as the Economizer Type. The user will also

set the fixed On-Point to 28 Btu/lb or the value required for the building location which can vary depending upon elevation. Users will then navigate to the Schedule Library and create another Utilization Schedule with a different lockout.

Again, I will copy the Available (100%) schedule, give the schedule a name and set the lockout to read 0% when the outdoor air dry bulb temperature is greater than 75°F. Again, click Save, navigate back to the Economizer section of the system and apply that schedule.

This same schedule can also be used for Differential Enthalpy with Fixed Dry Bulb. All a user will need to do to enable the comparison between the outside and return air enthalpies is to leave the On-Point field blank.

I also mentioned the requirement to relieve the building pressure to prevent overpressurization. Since TRACE™ functions on the premise of neutral pressure in each room and thus throughout the building, this pressure relief is inherent. However, if the system being modeled requires the use of relief fans to relieve the pressure, these fans will need to be modeled on the Fans tab of Create Systems using either the System Exhaust fan if all exhaust is leaving the building through the system or via the Room Exhaust Fan if exhausting air via the Room Exhaust field on the Airflows tab of Create Rooms..

As you can see, applying these economizer methods is not always straight-forward but what appears to be complicated, is solved with a small change.

Let’s take a brief look at how these different methods can impact the energy use of a building.

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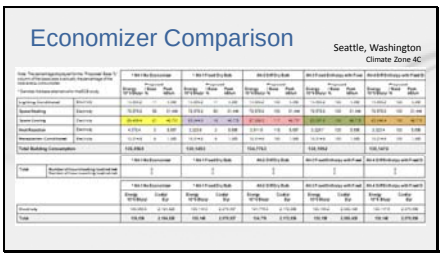

Different strategies will have different effects on a building energy model depending upon building usage, climate zone, setpoints, etc.

What you see is a comparison of the four methods allowed by Standard 90.1-2013 using the Energy Cost Budget / PRM Summary report from TRACE™. This is a simple model of a hospital building in Seattle, Washington generated using the New File Wizard. As you can see, the space cooling values vary depending upon the type of airside economizer control strategy implemented.

Again, the most effective type will depend on a number of variables but you can see that most fruitful method for this building by a narrow margin is Differential Enthalpy with Fixed Dry Bulb.

If interested in more information on the New File Wizard feature I mentioned, please see the video titled Using the New File Wizard in TRACE™ 700 in the eLearning Library section of our website.

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Last year, Trane published an Engineers Newsletter on economizers and in it, paraphrased the exceptions that apply to systems that serve comfort cooling applications.

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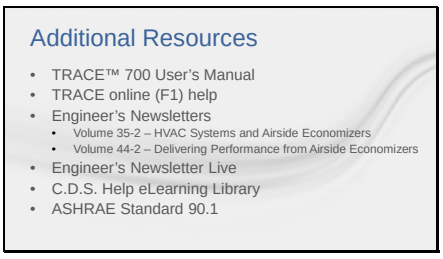

For more information on the Airside Economizer feature or any other aspects of the program, please refer to the User's Manual. There is a fully indexed pdf copy available via the Help menu.

As always, the context-sensitive F1 Help will provide you with instant access to definitions and explanations of each field within the program.

The two Engineer's Newsletters shown on Airside Economizers contain more information and detail on what was covered in today's video and our ever-growing list of eLearning videos focusing on specific topics such as this one is available via or website, www.tranecds.com.

The Engineer's Newsletter Live, "Delivering Performance from Airside Economizers" debuting in May 2016 will also include an extensive discussion on the subject and we've also referenced ASHRAE Standard 90.1 a number of times where you will find the allowable economizer types dependent upon version as well as climate zone.

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Please feel free to contact us with any and all comments and questions on this or any other topic.

Thank you for your time and we wish you continued success!