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TODAY'S EFFICIENT ROOFTOPS

Rapid Installation and Startup

In this issue:

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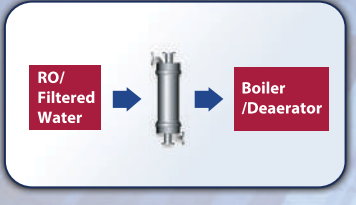

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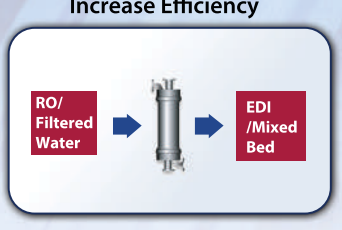
- **Improve Ion Exchange Efficiency**
  CO_2 removal to reduce mixed bed regeneration frequency
- **Minimize Chemical Use**
  Reduce employee exposure and lower disposal costs

Increase Efficiency



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EXCITING NEW ROOFTOP FEATURES

Designed for Improved Efficiency, Control

TODAY'S ROOFTOP HVAC SYSTEMS OFFER IMPROVED EFFICIENCY, better building ventilation capabilities, and advanced control functions. Rooftops are being used for an increasingly wide range of building applications. They mesh well with many current building designs for manufacturing, warehousing and offices. Unlike many applied systems, they are preassembled for rapid installation and startup, meeting many owners' need for quick building access.

Range of Sizes and Styles

Most U.S. and Canadian rooftop units are rated in tons of air-conditioning capacity (1 ton equals approximately 3.5 kW) and range in size from 6 to 150 tons, and can be installed in multiples. A prominent advantage of the rooftop approach is that it eliminates the need in the building interior for most mechanical plant equipment – chillers, air handlers, heating units, and associated equipment. Interior building space can be dedicated to primary operations.

Today's new manufacturing plant is often a single-story structure. This is done to facilitate conveyor movement of materials and to simplify future plant expansion or process rearrangement. Horizontal design makes a wide expanse of rooftop available. Larger buildings commonly use multiple rooftop units to minimize interior ducting and to permit effective zoning, as well as to distribute the physical load. For example, a single building might include manufacturing, office, and warehouse areas. Each area has separate comfort, humidity and ventilation requirements, so multiple rooftop units make sense.

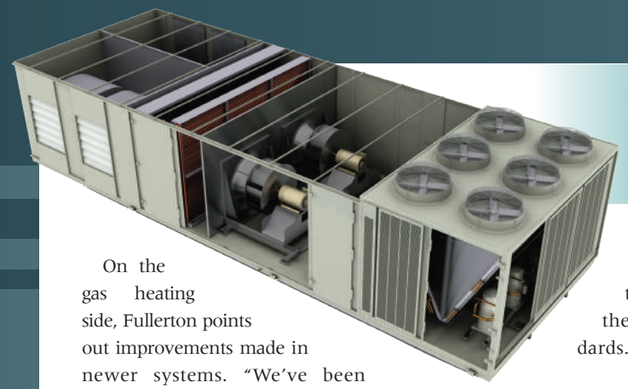
Units Combine Multiple Functions

Common elements of modern packaged rooftop units are electric compression cooling, air-handling, and solid state controls. In all but the warmest climates units also have heating components, which can either be resistance electric, heat pump or natural gas fired. Where the heat load is significant, gas is usually preferred because of lower energy costs. Common additional features include building ventilation management, humidification/dehumidification, and exhaust air energy recovery. Unit types range from catalogued units with standardized optional elements to custom designs with specific features developed for individual applications.

As building designs and regulatory requirements have evolved, rooftop units for these applications have changed as well. New units typically have higher-efficiency scroll or advanced reciprocating refrigerant compressors, often with variable outputs that give longer on-cycles for better dehumidification and smaller temperature swings. On the heating side, today's rooftops use heating modules with staged firing rates, again for higher seasonal efficiency and smaller temperature swings.

Efficiency Improvements Added

Trane, a division of Ingersoll Rand, offers a wide range of rooftop units for these applications. Al Fullerton, Unitary Product Business Leader for Trane North America, points out various areas in which the product line has evolved to meet changing building needs. Fullerton notes, "We're adding variable speed compressors to our units. The IntelliPak® 20 to 75 ton line has direct-drive supply fans available, offering lower horsepower in most applications. We also have single-zone VAV available, which modulates supply air fans to save energy and improve humidity control at part-load conditions. These features, in addition to our variable-speed outdoor fans, offer large potential energy savings over previous generation rooftops."



The Trane IntelliPak™ packaged rooftop unit is available in sizes from 20 to 162 tons, and can be factory assembled with a wide range of heating, cooling and air treatment capabilities. Photo courtesy: Trane.

On the gas heating side, Fullerton points out improvements made in newer systems. "We've been improving the turndown capability of our gas unit heater to deal with wider variation in outdoor air load on the rooftop units. On our large rooftops, we can provide up to 18 to 1 turndown. These increased turndown capabilities provide tighter discharge air temperature control when in the heating mode. This results in better occupant comfort." Higher turndown means longer operating cycles, for greater efficiency.

Economizers Reduce Operating Costs

A valuable function in rooftop units is the so-called economizer function. This is the capability of using filtered outdoor air for cooling in lieu of running the compressor, thus saving significant energy. Economizer systems test both the temperature and humidity of the outdoor air to ensure it is cool enough and dry enough to meet building comfort standards. The economizer function is used in many areas during the "shoulder" months when temperatures and humidity levels are both moderate. Use of economizer cooling is a priority in many new building efficiency standards.

According to Curran Ethridge, Senior Marketing Manager at Trane, this area has been a special priority in recent rooftop designs. "We've made great efforts to improve our products to meet and exceed current regulatory requirements, such as Title 24 in California. We have made numerous product enhancements with our high efficiency platforms, using compressor staging coupled with Human Interface controls to greatly increase integrated energy efficiency ratios (IEERs). With the addition of ultra-low leak economizers, we have found ways to meet and exceed these new energy standards."

Fan Improvements Improve Efficiency, Acoustics

Ethridge also mentions that the company has added direct-drive plenum fans as an optional item in many of their large rooftop units. These fans provide energy savings as well as acoustical benefits. He adds, "We also have several options such as propeller exhaust fans that can save energy when applied properly."

Another industry leader in rooftop comfort system technology is Daikin, which offers a range of rooftop solutions ranging in size from 3 to 150 tons. According to Julie Carver, Director of Marketing Strategy, a strong emphasis is placed on part-load efficiencies. She explains, "Part-load efficiencies – 98% of equipment operating time – are the best measure of efficiency. This is where our Rebel™ [3 to 28 ton] rooftop units excel, providing superior IEER rooftop ratings with up to 84% more total energy savings than ASHRAE's 90.1 efficiency standard."

Carver adds, "This is also the first unit to meet and exceed DOE's Rooftop Unit Challenge specification for energy savings and performance, and one of the industry's most energy efficient rooftops." She also notes that the unit features high-efficiency variable speed compressor and fan motors, advanced electric motor technologies, and indoor fans with no belt losses.

High Gas Heat Turndown Ratios

On the gas heating side, Carver points out that current models feature high turndowns to 5-10% of full capacity and modulating gas furnaces, which are provided on about 10% of today's units. Another energy saving feature for both gas and electricity is 2 inch foam panels with R-13 insulation to reduce thermal losses through the casing.

A major challenge facing building designers and operators today is meeting heightened requirements for building ventilation while still maintaining high energy efficiency levels. This is especially important for manufacturing buildings. In northern climates, the winter energy challenge is bringing in large volumes of frigid outdoor air for ventilation, while exhausting heated building air. In many areas, the even greater summer or year-round challenge is the introduction of hot, humid outdoor ventilation air. New rooftop systems often are equipped with or supplemented by heat exchangers, energy wheels, or similar devices for recovering the energy from exhaust air.

A total of 17 Daikin rooftop units were installed on this plant for ZF Transmissions. One attraction for the owner was the rapid installation cycle. Placing units on the rooftop also frees up floor space for plant operations. Photo courtesy: Daikin Applied.

Use of a helicopter for rooftop unit placement is becoming increasingly popular. It allows very short installation cycles. Photo courtesy: Daikin Applied.

Dehumidification Approaches

Several solutions are used for dealing with moist outdoor ventilation air. One is the improved capabilities of cooling systems for part-load cooling with variable speed compressors and fans. With these, the normal dehumidification function extends over longer cycles. Many newer rooftop units, including those from Trane, Daikin, Carrier and Lennox, also offer hot gas reheat dehumidification functions for ventilation air. These can continue to operate when building cooling needs are met, but continued dry ventilation air is needed.

Energy wheels in newer units make a further contribution to dehumidification when dew points are high and cooling loads are moderate. Finally, dedicated gas-fired desiccant dehumidification systems can do an excellent job of pretreating ventilation air for supply to the rooftop units. This solution is especially valuable in industries such as pharmaceuticals, snack foods, or printing, where required humidity levels are lower than can be achieved by air cooling only.

Advanced Remote Control Capabilities

Control technology for rooftop units also has evolved significantly in the past decade. Fullerton from Trane remarks, "Advanced control systems allow operators to see what is happening with their rooftop units without going to the roof. Alarms can be sent by text or email to facility management personnel when problems occur." He notes that today's control systems can also be accessed by smart phones or tablets. "We also offer 24/7 monitoring service agreements if a customer wants to outsource some of their maintenance." They offer wireless control systems, which are especially helpful in plant operations where internal operations are frequently changed and comfort or ventilation requirements change accordingly.

Daikin Applied's Intelligent Equipment™ capability offers customers powerful remote diagnostics and the ability to monitor and control their HVAC system 24/7 from anywhere in the world via mobile phone or computer. Daikin Applied also offers the ability to tap into real-time and historical data for planning preventive maintenance and to monitor equipment performance before a failure occurs.

An excellent example of the application of rooftop systems is an installation on a building expansion for ZF Transmissions in Grays Court, South Carolina. The facility manufactures automotive transmissions. The 450,000 square foot building expansion uses 12 Daikin RoofPaK™ and 5 Daikin Maverick™ units for a total capacity of over 1,000 tons. Because of tight schedules, helicopter lifts were used to put the units in place. According to Mike Bledsoe, local Daikin representative, all 17 units were placed on their rooftop locations in 90 minutes, a clear demonstration of the benefits of unit packaging.

Maintenance - Key to Efficiency and Long Life

Rooftop HVAC systems can have a long operating life – 15 to 20 years or more is not unusual. Fullerton from Trane points out, "There is no substitute for a strong preventive maintenance program. This can help avoid emergency replacement situations." Even if your rooftops are well-maintained and still operating, it might be useful to have an energy analysis performed by a qualified contractor. As Fullerton points out, "Then a proactive decision can be made whether to replace the unit based on energy savings, or to wait until a major component fails. Fixing on failure often limits the potential savings of a replacement unit, since availability of a new unit tends to drive the decision process."

Today's Units Have Advantages

Rooftops that are being installed today have clear advantages including higher operating efficiency, powerful ventilation capabilities, greater turndown ratios, and better controls. Whether owners are contemplating replacing older systems or are involved in new plant construction, the recommendation is to give the new rooftop units serious consideration. GT

MORE info

CARRIER ROOFTOP SYSTEMS
www.carrier.com/commercial/en/us

DAIKIN APPLIED ROOFTOP SYSTEMS
www.daikinapplied.com

LENNOX ROOFTOP SYSTEMS
www.lennoxcommercial.com/products

TRANE ROOFTOP SYSTEMS
www.trane.com/commercial

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Dairy Processing Industry Is Evolving

Finding Ways to Improve Energy Efficiency

AN IMPORTANT ELEMENT OF THE FOOD PROCESSING UNIVERSE IN THE UNITED STATES AND CANADA IS THE DAIRY SECTOR. This includes all of the processes that start with raw milk and produce fluid milk, condensed and evaporated milk, dry milk, cream, butter, cheese and processed cheese, yogurt, whey, ice cream, and other frozen dairy desserts.

Consolidation of Processors Continues

According to a recent U.S. DOE ENERGY STAR® Guide for dairy processors, the number of processing facilities continues to decline slowly, while the total industry production volume is increasing. There are still more than 1,500 dairy processing plants in the United States, and over 440 in Canada. They are located across both countries, with the largest numbers near dairy farms concentration.

Dean Sommer, with the University of Wisconsin's Center for Dairy Research in Madison, notes, "There has been tremendous consolidation in the industry, both in terms of closing a lot of smaller and older plants, and in terms of dairy companies buying other dairy companies. On the other hand, similar to the microbrew industry, there has been a trend in recent years for small, artisan cheese plants to spring up. So the big plants keep getting bigger and getting merged into a few huge companies, while a lot of small artisan cheese plants are starting up and creating their own niche in the cheese industry."

Most Energy-Intensive Segment

Dairy processing represents the single most energy-intensive sector of the food processing universe. Refrigeration is used extensively - not just to maintain the condition of milk, but in cheese aging, yogurt production, and for conversion of liquid milk to ice cream and frozen desserts. Certain dairy products, notably cheese and yogurt, also require cooking for a significant period of time. This heat energy is commonly provided by steam.

Major energy inputs also are needed for evaporating and drying milk, and especially for drying whey concentrates and solids. Finally, hot water -- usually provided by steam -- is used extensively for plant sanitation and system cleaning. It is an especially important input for clean-in-place (CIP) systems for storage and cooking vessels and pipelines.

Both Fuel and Electric Energy

According to the 2008 ENERGY STAR Guide, that year the dairy processing industry spent more than $1.5 billion for energy. About half of that was for electricity and half for fuel, largely natural gas. By making the right energy decisions, processes can be streamlined and product quality can be better assured.

Certain areas of energy use are especially worth improving. One such area is the efficiency of steam and hot water production. Boiler upgrade or replacement is important, particularly if plant boilers are aging, and are not optimized for current steam requirements. Where the primary use of the boiler is for hot water production, owners should consider an alternative technology – direct-contact water heating.

Advantage of Direct-Contact Water Heating

Direct-contact systems have efficiencies approaching 100% and, if properly sized, can meet the volume requirements for plant sanitation and CIP systems. In selecting a direct contact water heater, it is necessary to assure that the unit is certified by NSF International for food service applications. If a direct-contact water heating unit meets the operator's needs, the payback from replacing an inefficient boiler can be very short, in some cases a matter of months.

It is important to assure boilers are operating at peak efficiency. Older boilers should be inspected by qualified technicians. Burner controls can be replaced with digital controls that won't drift or hunt like many older systems, thus improving efficiency. Worth consideration is the addition of an oxygen-sensing capability in the exhaust stream. This will allow the burner to operate more closely to the ideal oxygen ratio.

Dairy processing plants, such as this cheese operation, use large volumes of natural gas and electricity in processing raw milk into fluid and dry milk, cheese, butter, ice cream and yogurt. All images courtesy: Wisconsin Milk Marketing Board.

Large volumes of hot water are used for manual cleanup and automated clean-in-place systems. Direct-fired water heaters are an opportunity for energy saving here.

Improving the Steam System

If the plant does not have a program for regular inspection of steam traps, one should be instituted. Dairy plants in particular use a large volume of steam, which can mean large volumes of condensate at the traps. If the traps are not functioning correctly or the condensate return piping is inadequate, condensate energy can be lost. Another article in this issue discusses this opportunity in more detail.

Some dairy processing plants still use oil as a primary fuel for boilers. This is a situation that deserves review. Natural gas as a boiler fuel is not only lower in cost, but will result in lower emissions and eliminate the need for exhaust gas treatment. In some cases, operators will want to have a dual-fuel boiler with a supply of fuel oil as a backup in the case of gas delivery restrictions or fuel curtailments.

Another opportunity for major energy savings in dairy processing plants is the use of a combined heat and power (CHP) system for onsite power. A CHP system can carry most or all of the plant electrical load. A gas turbine or an engine-generator can produce large volumes of byproduct heat for process purposes, or as the primary source of hot water for plant sanitation use. According to the DOE Guide, in 2009, only 1% of this industry's consumed electricity was generated at on-site facilities.

Taking Advantage of CHP

According to Sommer from the Center for Dairy Research, CHP could be an efficiency upgrade. However, he concurs with the DOE data, "I have seen very little of this. What we have seen is many plants installing diesel-powered generation systems for emergency purposes. On the other hand, cheese plants basically process fluids and are constantly heating or cooling fluids like milk, whey and various types of water streams." He believes CHP should be included in plant efficiency planning.

It is useful to get expert guidance on sizing and arranging such a system for optimum efficiency. In many cases, the system is sized for the peak plant electrical requirement and additional boiler fuel is purchased as needed. An alternative approach is to size the system for the thermal load and plan to sell surplus electricity back to the local utility. Careful planning and system design can pay major energy dividends.

In many dairy processing facilities, a tri-generation plant might be even more attractive. In this application, the byproduct heat from electric generation is used for both process heating and process cooling, via absorption chillers. As facilities consolidate and get larger, this option becomes even more attractive.

Spray-Drying Milk and Whey

Another dairy area that is highly energy intensive is spray-drying of milk products and whey. Sommer notes, "Most large dairy processors are large users of natural gas, both for boilers but even more importantly for spray dryers for drying of milk and whey powders. Energy costs are a significant part of the processing costs for these technologies. The falling of natural gas prices has provided price relief to many of these companies, significantly reducing their costs of drying these different products derived from milk."

According to the DOE Guide, it is most energy efficient to partially dehydrate the product to be dried first by an evaporative or membrane process. The degree of concentration prior to injection in a spray dryer is dependent on specific characteristics of the product, but experimentation to determine the optimum level is worthwhile. The DOE Guide indicates that complete steam or direct-fired drying can be up to six times as energy intensive without pre-concentration. Also, the optimum drying temperature should be determined. Often increasing the operation temperature actually reduces the overall usage for fuel or steam.

Dairy processing plants are a major opportunity for reduction of energy use, both on the electric side and on the fuel side. Because this is a very specialized industry, attention should be given to university and government research, and to recommendations of dairy processing energy experts. **GT**

MORE info

CANADIAN DAIRY INFORMATION CENTRE
www.dairyinfo.gc.ca

DOE ENERGY STAR DAIRY PROCESSING GUIDE
www.energystar.gov/ia/business/industry/downloads/Dairy_Guide_Final.pdf

WISCONSIN CENTER FOR DAIRY RESEARCH
www.cdr.wisc.edu

Refrigeration is another major energy use, as in this refrigerated cheese aging facility. Operators should consider combined heat and power (CHP) systems to meet both electrical load and the need for process heat in the plant.

Save That Condensate!

It Can Mean Big Money

PERHAPS THE BEST OPPORTUNITY for a quick payback in improving a steam system is evaluation and improvement of the condensate return system. Returning as much of the condensate as possible to the boiler feedwater stream pays rewards in two ways. Firstly, condensate is distilled feedwater that already has been treated, thus reducing the need for expensive treatment of makeup water. Secondly, condensate contains a substantial amount of heat energy. As preheated feedwater, it offers a significant reduction in fuel use for the same boiler output.

Opportunity for Saving

Steam is the main energy source for many plant operations. Steam heats water or other liquids, rotates turbines to generate electric power or mechanical energy, and is used for dozens of other process purposes. Whenever the steam gives up its energy, hot condensate is produced, and should be captured.

In some older steam systems, condensate return piping is incomplete and condensate simply drains away. In these situations, there is a clear need to extend return lines wherever possible. Older systems will also benefit from an evaluation of existing steam traps, and owners should replace or repair them as needed. Many newer steam trap designs are more efficient and have increased reliability. A steam system expert can help owners select the correct trap for each situation.

Return System is Critical

Armstrong International is a supplier of a wide range of supplies and services for steam systems. Armstrong's Nevena Iordanova is a Senior Utility Systems Engineer, and a DOE-qualified steam system expert. She emphasizes the importance of the steam trap in collecting and delivering hot condensate for return to the feedwater cycle.

She states, "The purpose of any steam system is, first, to deliver steam to a user that needs heat and, second, to return condensate back to the boiler." Most boiler system operators know that this second function often does not receive adequate attention. A review of the entire system is needed.

System Overhaul Needed

A complete overhaul of the plant condensate system usually requires the assistance of professionals that seldom are present on the plant staff. Iordanova advises, "With time, there are many changes in the plant that can have a negative effect on the condensate return system. Main header lines and central receivers normally stay the same, but the amount and quality of the condensate discharged to them changes all the time." Plant equipment is changed out, processes change or are abandoned, and new processes are added.

She notes, "These changes can accumulate to the point where condensate piping is no longer adequate, resulting in high back-pressures, water hammer conditions, and ruptured or freezing valves and pipes, with accompanying leaks." She points out, "Not only is hot condensate wasted, but the safety, integrity and reliability of the entire system goes beyond the plant's control." At this point a system study is the needed step. Companies such as Armstrong and others offer these services.

Role of the Steam Trap

Iordanova points out that steam traps, located on the border between the steam and the condensate, make condensate recovery possible. She notes, "Every trap makes sure that the condensate is removed at the moment it is formed, and is discharged downstream to the boiler house for reuse. When the steam traps are properly sized, installed and maintained, there is no need for the operators to intervene in the system to "fix" it by opening drain valves, wasting condensate, or bypassing them, wasting not only condensate but steam, too. Properly functioning steam traps are essential."

The first step is to establish a steam trap management program with a clear objective. It is essential to have frequent inspections to establish the status of each trap, and a commitment to correct indicated problems promptly. This approach sounds effective, but too often the inspections are postponed or incomplete.

Regular steam trap inspection assures that traps are functioning correctly and all available condensate is being collected. Some plants have dozens of traps and regular inspection should be performed. Photo courtesy: Armstrong International.

Steam trap monitoring systems eliminate the need for most physical inspections of the steam trap system. Systems are available with both proprietary and open protocol communications. Photo courtesy: Armstrong International.

Inspections Often Deteriorate

Commonly when a program is established, inspections are carried out as scheduled for a few months, then other priorities create postponements. Inspections can be tedious, and may require personnel crawling into tight, wet, hot spaces. The schedule begins to slip, and the number of failing traps increases. These failures are periodically corrected, but it might be months or years before the next complete inspection. The collection of condensate plummets.

One solution to this problem is to install a steam trap monitoring system with an understandable reporting output. As individual traps malfunction, maintenance workers can quickly schedule corrective actions. Iordanova says, "Armstrong suggests installing an automated monitoring system to all traps, with a priority for the high pressure and medium pressure steam traps, as they are the ones that waste the most energy. Armstrong monitoring will show an alarm for failed traps as soon as a failure occurs, minimizing the potential energy loss if the trap is repaired as soon as possible."

Steam Trap Monitoring Solutions

Iordanova explains that Armstrong has two solutions for wireless steam trap monitoring - SteamEye® and AIM®. Both systems are non-intrusive and monitor the trap operation with acoustic and temperature readings. Both systems operate on systems ranging from 15 to 1500 psig and are installed upstream from the steam trap. She notes, "The main difference between the two Armstrong solutions is that SteamEye is a proprietary system and AIM is a WirelessHART® system. WirelessHART is an open protocol which is being implemented in plants worldwide and is backed by many manufacturers."

Insulating Lines and Traps

Another important aspect of improving the condensate return system is insulating pipes and traps. High quality insulation should be used, and insulation on traps should be the type that can be removed for inspection or service. A trap monitoring system can still be used on insulated traps. According to Armstrong, only a small area on the trap is needed to attach the sensor, and this can be surrounded by insulation.

Upgrading and maintaining the condensate return system is one of the fastest paybacks possible in improving the efficiency of an industrial steam plant. Managers can start by upgrading inspection and repair schedules for steam traps. A wireless trap monitoring tool makes this job easier. It is also valuable to assure that the return piping systems is as complete as possible, and the system is adequately insulated. Expert help is available for taking all of these steps. **GT**

Condensate line and steam trap insulation conserves thermal energy for water returning to the feedwater tank. Insulation has to be removable for trap inspection and service. Photo courtesy: Shannon Enterprises.

MORE info

ARMSTRONG INTERNATIONAL
www.armstronginternational.com

BELL & GOSSETT
http://bellgossett.com/steam-specialties/traps

SHANNON/INSULTECH TRAP AND VALVE INSULATION
www.blanket-insulation.com/Insulation/trap_valve.html

SPIRAX SARCO
www.spiraxsarco.com

U.S. DOE STEAM TRAP INFORMATION
www.energy.gov/sites/prod/files/2014/05/f16/steam1_traps.pdf

BOILER MACT AND YOUR BOILER

What Are Owners Doing?

THE U.S. EPA'S NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS, generally known as the "Boiler MACT Rule," was issued in January 2013. MACT stands for "maximum achievable control technology." Affected facilities must be in compliance by January 31, 2016. Most affected boiler operators know this. Many already have modified their facilities or made other operational decisions in order to remain in compliance. The Boiler MACT Rule is separate from New Source Performance Standards (NSPS), which are another part of the EPA's Clean Air Plan.

New Emission Limitations

Boiler MACT requires industrial, commercial and institutional boilers across the nation to meet new emission limits and to follow revised work practices, including a boiler tune-up or energy assessment requirement. Boilers at major electric utility generating facilities are treated separately from industrial or institutional boilers.

The rules originally were issued in proposed form in 2003. An agonizingly long process included revision, litigation, vacation of the proposed rules, reissuance, more litigation, reissuance, and more litigation, and still more reconsideration. However, it is generally believed that the 2013 rules currently in place will remain, with few, if any, additional revisions. The 2016 compliance date still stands.

A high percentage of owners of Major Source MACT boilers burning oil, coal or other fuels are replacing these with gas-fired packaged boilers, such as this vertical unit. A side benefit is often a reduced floor space requirement. Photo courtesy: Clayton Boilers.

Size of Source Makes a Difference

The Boiler MACT rules divide the affected boilers into two groups: "Major Sources" and "Area Sources." Major Sources are those boilers that emit more than 10 million tons per year of any individual hazardous air pollutant (HAP) or 25 tons per year of all HAPs. Area Sources are those that emit less. Area Source facilities do not include commercial and residential sources or sources burning natural gas. They typically include apartment buildings, hospitals, nursing homes, schools, churches, prisons, and some small manufacturing plants burning oil, coal and other solid fuel.

Under the Rule, all existing Major Source units that burn natural gas or other clean gas fuels are required only to do an annual tune-up. Major Source units that use other than clean gas fuels are required to do a one-time energy assessment and to demonstrate compliance with emission limits on a list of HAPs. This includes most industrial boilers that use coal, coke, petroleum fuels, biomass, or gases that are not classified as "clean gases." These boilers can continue to operate only if they can meet specific emission limits for carbon monoxide, particulate matter, mercury and hydrogen chloride.

Compliance Choices

According to Bob Bessette, President of the Council of Industrial Boiler Owners, the owners of Major Source boilers were presented with a range of compliance options:

1. Install dry sorbent injection technology (promising, but still uncertain performance)
2. Install another proven control technology for all the HAP categories
3. Reduce boiler operation to "Area Source" levels, thus eliminating the HAP emission restrictions
4. Convert the existing boiler to natural gas or another clean gaseous fuel
5. Replace the existing boiler with a new natural gas boiler
6. Do nothing and shut down the boiler permanently

Bessette indicates that the potential of dry sorbent injection technology for meeting HAP emission restrictions is promising, but there is still an element of uncertainty, plus the possibility that the emission restriction levels might change in the future, possibly taking these boilers out of compliance again.

Shift to "Area Source" Status

For some non-compliant Major Source boiler operators, it is possible to reduce boiler output to "Area Source" status. This might be possible when other plant operations can be done by other energy technologies. Large manufacturing facilities that rely on steam or hot water for manufacturing or site heating purposes will typically need to remain in the Major Source category.

Conversion to Gas Can Be Complicated

Bessette notes that some boilers are being converted to natural gas operation. In these cases, sometimes it is also necessary to make significant changes in the boiler tube layout in order to efficiently extract as much heat from combustion as the boiler had previously generated. This option would most logically be done with boilers that otherwise were in sound operating condition and were not approaching the end of their life cycle.

Bessette explains that the option that many owners are choosing is to replace existing liquid or solid fuel boilers with new, packaged natural gas boilers with the appropriate steam or hot water output. The challenge is for owners who delayed making that decision, and are now encountering production backlogs at some boiler manufacturers, or with qualified installation contractors.

Trend Toward Natural Gas

Bessette indicates that the choice a majority of owners are taking is to convert to natural gas, either with an existing boiler or a new unit. He believes that this choice is being taken because the current, and even the projected, price of natural gas is stable and comparatively low. Owners generally are reluctant to adopt a control technology that is not completely proven, even if the resulting fixed cost is less than a gas conversion? And they are wary of possible future additions to the list of HAPs and other emission limits to be set by EPA in the future.

Moving Into the New Era

Bessette points out that for owners who have not had access to bulk delivery of natural gas, a considerable expenditure may be required for a gas line extension. Many installations have also made provision for firing a standby fuel such as light oil as a backup boiler fuel. This is allowable under the MACT Rule. The new age of more natural gas-fired industrial boilers will result in lower HAP emissions, reduced greenhouse gas emissions, and continuing operation of essential industrial boilers. **GT**

WHAT IS THE COUNCIL OF INDUSTRIAL BOILER OWNERS?

CIBO is an industry association that is dedicated to ensuring that industrial, commercial and institutional energy producers can continue to provide safe, cost-effective and reliable energy to sustain a strong economy. Its stated role is advocacy and sharing of accurate information to achieve safe and cost-effective solutions for industrial energy, technology and environmental issues.

For more information see the website listed below.

MORE info

COUNCIL OF INDUSTRIAL BOILER OWNERS
www.cibo.org

U.S. ENVIRONMENTAL PROTECTION AGENCY FINAL MACT RULES, 2013
www.gpo.gov/fdsys/pkg/FR-2013-01-31/pdf/2012-31646.pdf

New Process Heating Tool Available

Simplifying Plant Energy Evaluation

PERFORMING AN ENERGY EFFICIENCY ANALYSIS OF PROCESS HEATING OPERATIONS IN A FACTORY ENVIRONMENT IS CHALLENGING. Multiple calculations are necessary, and additional steps are needed to attach an accurate cost figure to the results. Recently, a new assessment tool became available to simplify these calculations, allowing managers to evaluate these manufacturing steps and to determine if there are better, less costly methods.

Process Heating a Major Energy User

In modern manufacturing, process heating consumes a large proportion of the electric and fuel energy used. Thus, to successfully assess the overall energy efficiency of a manufacturing facility, it is essential to evaluate these operations. Because multiple processes usually are involved, calculations can become dauntingly complex. What has been needed is a practical tool for assessing each operation, then collecting the results to give an overall picture.

New Tool Simplifies Calculations

The Process Heating Modeler Tool (PHMT) was developed jointly by the U.S. Department of Energy (DOE) and the Institute for Industrial Productivity (IIP). It is an enhancement of a tool first developed by IIP and DOE in 2010. PHMT is available online at no cost to users. It allows users to perform a complete plant or industrial campus process energy balance. The tool features ten process-specific energy calculators that allow users to quickly pinpoint areas of energy losses or process inefficiency within their systems.

Results from each process can be combined to give an accurate overall picture of energy use. The tool also can be used to create "what-if" snapshots of alternate energy sources or processes. Use of the tool does not eliminate the need for accurate input information. For example, a calculation input may be the thickness of thermal insulation on a particular vessel or oven, or the temperature or volume of process exhaust streams. Without accurate numbers here, the results will be questionable. However, these actual numbers are probably available or can be measured. Accurate inputs are essential.

The PHMT simplifies complex calculations of plant system efficiency, but requires collection of accurate input data. Photo courtesy: Armstrong International

Allows Owners To Manage Processes

For many manufacturing processes, energy is one of the largest components of operating costs, and these costs can often be reduced significantly by process energy analysis. PHMT makes it practical for owners to do this analysis themselves. Often the analysis will indicate opportunities for energy savings or process improvements. The same tool can be used after making the changes to verify results, for possible use in applications elsewhere. The tool allows multiple inputs including ambient temperatures, insulation thickness, and alternative energy costs. It is available online at: **https://ecenter.ee.doe.gov/EM/tools/Pages/phmt.aspx** GT

MORE info

INSTITUTE FOR INDUSTRIAL PRODUCTIVITY
www.iipnetwork.org

U.S. DOE INFORMATION ON PROCESS HEATING IMPROVEMENTS
www.energy.gov/eere/amo/process-heating-systems

WHAT IS THE IIP?

The Institute for Industrial Productivity, the organization that partnered with the U.S. DOE in creating the PHMT, is an independent non-profit organization that identifies its goal as "To accelerate the uptake of industrial energy efficiency practices by partnering with both industry and governments." The organization places priority on reducing energy use, while contributing to continued economic viability. Programs are aimed at major energy-consuming countries such as the United States, China and India, and on industrial operations that use significant amounts of energy.

David Weiss
Executive Director
Jake Delwiche
Contributing Editor

Comments may be directed to:
Gas Technology Editor
1111 W. 22nd Street, Suite 250
Oak Brook, IL 60523

energy solutions center websites

www.industrial.myescenter.com
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