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saving energy and
taxpayer dollars in
federal facilities

Purchasing Specifications for Energy-Efficient Products

Legal Authorities

Federal agencies are required by the Energy Policy Act of 2005 (P.L. 109-58) and Federal Acquisition Regulations (FAR) Subpart 23.2 to specify and buy ENERGY STAR®-qualified products or, in categories with no ENERGY STAR label, FEMP-designated products which are among the highest 25 percent of equivalent products for energy efficiency.

| Performance Requirement for Federal Purchases | | |
|---|------------------------|---------------------------------|
| Type | Rated Capacity (Btu/h) | Thermal Efficiency ^a |
| Gas / Water | 300,000 - 10,000,000 | 80% E _t |
| Gas / Steam | 300,000 - 10,000,000 | 79% E _t |
| #2 Oil / Water | 300,000 - 10,000,000 | 83% E _t |
| #2 Oil / Steam | 300,000 - 10,000,000 | 83% E _t |

a) Thermal efficiency (E_t), also known as “boiler efficiency” or “overall efficiency,” is the boiler’s energy output divided by energy input, as defined by ANSI Z21.13. In contrast to combustion efficiency (E_c), thermal efficiency accounts for radiation and convection losses through the boiler’s shell.

Buying Energy-Efficient Boilers

This purchasing specification applies to low- and medium-pressure boilers used primarily in commercial space heating applications. It does not apply to high-pressure boilers used in industrial processing and cogeneration applications. Specify boilers that meet the thermal efficiency levels shown in the *Performance Requirement* table. Select only boilers rated under the certification program run by the Hydronics Institute of the Gas Appliances Manufacturers Association (GAMA, see *For More Information*). The Hydronics Institute publishes a directory listing the combustion and thermal efficiencies for all commercial boilers.

Agencies must use ENERGY STAR-qualified and FEMP-designated performance requirements for all procurements of energy-consuming products and systems including guide and project specifications, and construction, renovation and service contracts. They should also be used in evaluating responses to solicitations. In contracts and solicitations, agencies must specify that commercial boilers meet or exceed the thermal efficiencies shown above. Model language to assist agencies with incorporating these performance requirements into their procurement documents is available at http://www.eere.energy.gov/femp/procurement/eep_modellang.cfm.

Agencies can claim an exception to these requirements through a written finding that no ENERGY STAR-qualified or FEMP-designated product is available to meet the functional requirements, or that no such product is life-cycle cost-effective for the specific application.

Sizing and Part Load Performance

A boiler system should be capable of meeting the building’s peak heating demand and also operating efficiently at part-load conditions. Selecting the right system and properly sizing a boiler requires knowledge of both the peak demand and load profile. If building loads are highly variable, as is common in commercial buildings, designers should consider installing multiple small (modular) boilers. Modular systems are more efficient because they allow each boiler to operate at or close to full rated load most of the time, with reduced standby losses. Other efficient options for handling variable loads are condensing boilers and modulating boilers (which can run at partial capacity instead of cycling on and off).



Buyer Tips

There are many options in boiler equipment and controls that can enhance energy performance: stack gas heat recovery equipment, such as air preheaters and economizers; condensing heat exchangers, which also utilize stack gas waste heat; turbulators (fin enhancers) to improve heat transfer and balance of gas flows between tube banks; water recovery equipment, to reuse heat from blowdown and water return condensate; outdoor temperature controls, which control the system loop temperature according to outside temperatures; electronic ignition devices; increased boiler and piping insulation; and high performance (including power) burners. While the efficiency of water and steam boilers are similar, water boilers and their distribution systems tend to have lower maintenance requirements.

Maintenance and Operation Tips

Several diagnostic and preventive procedures are important to maintaining efficient operation. Flue gas temperature monitoring is useful in detecting efficiency and operation problems. Maintaining steady excess air levels (with an oxygen trim system) ensures that burners will mix air and fuel efficiently. The Boiler Efficiency Institute provides maintenance and operation manuals for boilers and boiler controls (see *For More Information*). Low water levels can damage boilers, so water levels must be checked frequently. Water treatment prolongs the life of a boiler as well as increasing its efficiency. Waterside and fireside surfaces should be cleaned annually. Sludge and sediment should be removed from steam boilers daily.

| Cost-Effectiveness Example (5,000,000 Btu/h Gas-fired Water Boiler) | | | |
|--|------------|----------------|-----------------------------|
| Performance | Base Model | Required Level | Best Available ^a |
| Thermal Efficiency (E _t) | 78.0% | 80.0% | 86.5% |
| Annual Energy Use (therms) | 96,200 | 93,700 | 86,700 |
| Annual Energy Cost | \$57,700 | \$56,250 | \$52,000 |
| Lifetime Energy Cost | \$856,000 | \$835,000 | \$775,000 |
| Lifetime Energy Cost Savings | — | \$21,000 | \$81,000 |

a) Does not include condensing boilers, whose higher efficiencies are not captured by the ANSI Z21.13 test method.

Cost-Effectiveness Assumptions

The cost-effectiveness example assumes a natural gas price of 60¢/therm, the average at federal facilities in the US. Annual Energy Use is based on 1,500 equivalent full-load hours per year. Lifetime Energy Cost is the sum of discounted values of the Annual Energy Cost, based on an assumed boiler life of 25 years. Future gas price trends and a discount rate of 3% are based on federal guidelines (effective April 2006 to March 2007).

Understanding the Cost-Effectiveness Table

In the example shown above, a 5,000,000 Btu/h gas-fired water boiler with a thermal efficiency of 80.0% is cost-effective if its purchase price is no more than \$21,000 above the price of the *Base Model*. The *Best Available* model, with an efficiency of 86.5%, is cost-effective if its price is no more than \$81,000 above the *Base Model*.

FEMP provides a Web-based cost calculator for boilers. Go to <http://www.eere.energy.gov/femp/procurement/> and click on “Energy Cost Calculators” in the left hand column. Select “Boilers” to open the page with the cost calculator and enter your data into the “Input Section.” Click on “Calculate” at the bottom of the page and the output section will display results that better reflect your energy costs and operating hours.

For More Information:

EERE Information Center
1-877-EERE-INF or 1-877-337-3463
www.eere.energy.gov/femp/procurement/

American Council for an Energy-Efficient Economy (ACEEE) has an online *Guide to Energy-Efficient Commercial Equipment*, which includes a section on HVAC systems. Phone: (202) 429-0063
www.aceee.org

GAMA's Hydronics Institute publishes the I=B=R Ratings for Boilers, Baseboard Radiation, and Finned Tube (Commercial) Radiation, a directory of commercial boilers with certified performance ratings. Phone: (703) 425-7060
www.gamanet.org

ASHRAE publishes the Cooling and Heating Load Calculation Manual. Phone: (800) 527-4723
www.ashrae.org

American Boiler Manufacturers Association (ABMA) publishes a directory of commercial and industrial boiler manufacturers that offer equipment and services for boilers. Phone: (703) 356-7172
www.abma.com

Boiler Efficiency Institute publishes maintenance and operating manuals on commercial and industrial boilers. Phone: (800) 669-6948
www.boilerinstitute.com

Lawrence Berkeley National Laboratory provided market research and life cycle cost analysis in support of this purchasing specification. Phone: (202) 646-7950

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.



U.S. Department of Energy

Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable