



*Greater efficiency supports patient care.*

## Practice Preventive Maintenance of Major HVAC Equipment

*All ECM content was independently developed and reviewed to be vendor-, product-, and service provider-neutral.*

### Description

Establish regular and specific preventive maintenance schedules for all HVAC equipment to optimize efficiency, maximize estimated useful life, and maintain a level of indoor air quality that supports the well-being of patients, staff, and visitors.

### Project Talking Points

- Preventive maintenance enhances energy efficiency, and optimal efficiency often results in energy savings, thus reducing costs (see Benefits Calculator page).
- Preventive maintenance extends the life of equipment by keeping it operating designed. Preventive maintenance is less expensive than early replacement of equipment.
- A comprehensive preventive maintenance program increases compliance with Joint Commission Environment of Care (EC) standards.
- Proactive scheduling of maintenance activities, rather than waiting until a disruption in service occurs, improves system reliability and reduces labor resources required to maintain systems and equipment.
- Preventive maintenance supports planning and budgeting for major component upgrades.
- Preventive maintenance can be performed with in house maintenance staff or with trusted contractors.

### Triple Bottom Line Benefits

- **Cost benefits:** Preventive maintenance extends the life of equipment, enhances efficiency, and improves reliability. Some cost benefits are easier than others to quantify, but anticipated savings make the effort worthwhile.
- **Environmental benefits:** Reducing energy use always has an environmental benefit through reduction of emissions associated with energy production and delivery.

- **Social benefits:** Equipment down time, controllability and thermal comfort may be improved as a result of improvements made to equipment during preventive maintenance, which can enhance patient, visitor, and staff experience.

## Purchasing Considerations

- Establish standards for purchasing maintenance items, whether you plan on keeping a stock of standard items such as fan belts, light bulbs and filters or if the stock will be elsewhere and how to replenish the stock
- Determine the specifications for all maintenance items so the person in charge of ordering will correctly purchase the needed items

## How-To

1. Engage purchasing to establish standards for stocking maintenance items, which items to purchase and when. If the decision is made to outsource preventive maintenance, set expectations with your preferred contractor.
2. Use a computerized maintenance management system (CMMS)—one that is integrated into the building automation system, if possible—to manage the preventive maintenance program. The CMMS should ideally track and document inspections, meeting minutes, and actions taken, and trigger maintenance alerts.
3. Consult with the safety officer to assure that HVAC equipment that may be considered “critical” by Joint Commission standards meets the required annual preventive maintenance standards and that maintenance is properly documented.
4. Develop a “systems narrative” of the building HVAC system, including heating, cooling, ventilation, and building control systems. If available, use the facility’s operations and maintenance manual to document sequence of operations, efficiency goals, anticipated performance and system/equipment-specific training materials.
5. Develop a preventive maintenance plan and schedule, including a scheduled annual review of the overall preventive maintenance program.
6. Examples of preventive maintenance practices include:
  - Boilers: Cleaning, descaling, and water treatment.
  - Cooling towers: Cleaning to maximize condenser performance.
  - Chillers: Removing calcium carbonate from copper tubing.
  - Water-cooled systems: Inspecting and testing for leaks; calibrating sensors. Consider opening and closing all valves on a regular interval. Validate that when commanded closed control valves are not leaking.

- Building Automation System: Use calibrated handheld devices to check the building automation system sensors for accuracy; Check your building automation graphics for any sensors that appear to be reading incorrectly; Ensure actual valve and damper status matches BMS
7. Provide regular training for operations & maintenance personnel on how to calibrate and maintain HVAC equipment so that it operates at a level of efficiency in alignment with the design intent.

## Tools

[ENERGY STAR Maintenance Checklist](#)

[Portland Energy Conservation Operation and Maintenance Service Contracts](#)

## Case Studies

- Howard Hughes Medical Institute
  - Goal of preventive maintenance program is to assure that equipment meets or exceeds its expected life cycle without any major failures. Use the CARE routine: "clean, adjust, repair, examine."
  - Prioritize system maintenance based on how directly each piece of equipment supports critical facility functions. This hierarchy also informs calculations on the true cost of maintaining and replacing equipment.
  - Regular training is essential to the success of the preventive maintenance program.
- University of Alabama, Birmingham
  - The preventive maintenance program uses a computerized system to summarize weekly preventive maintenance tasks.
  - The preventive maintenance group is responsible for testing and fine-tuning HVAC equipment so that HVAC mechanics are available to respond to heating and cooling requests from building occupants.

## Regulations, Codes and Standards, Policies

- American Society for Healthcare Engineering, Health Facility Commissioning Guidelines <https://energent.link/AHAguidelines>
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
  - Level 1, Walk-Through Analysis <https://energent.link/z8t>
  - Level 2, Energy Audit, Energy Survey and Analysis <https://energent.link/z8t>

## ECM Synergies

- Establish baseline for current energy consumption.
- Retrocommission HVAC controls.
- Check and repair thermal envelope.
- Perform economizer maintenance.
- Replace air-handling unit (AHU) filters regularly.
- Evaluate steam traps for repair or replacement.

## Educational Resource

Pacific Northwest National Lab, Building Retuning Training

- Energy University Courses
  - HVAC Thermodynamic States
  - Boiler Types and Opportunities for Energy Efficiency
  - Combustion Processes
  - Fan Systems I: Introduction to Fan Performance
  - Fan Systems II: Fan Types
  - Fan Systems III: Improving System Efficiency
  - Fan Systems IV: Improving System Efficiency

## More Resources

- U.S. Department of Energy, Energy Efficiency & Renewable Energy Building Technologies Program:
  - Efficient Hospital Boilers Result in Financial, Environmental and Safety Payoffs <https://energent.link/miy>
  - Hospitals Benefit By Improving Inefficient Chiller System <https://energent.link/y96>
  - Hospitals Realize Fast Paybacks from Retrofits and O&M Solutions <https://energent.link/6e795>
  - Hospitals Realize Greatest Savings Through Formal Energy Management Program <https://energent.link/din>
  - Hospitals Save Energy and Money by Optimizing HVAC Performance <https://energent.link/c347a>
  - [Operations & Maintenance Best Practices](#)
- U.S. Environmental Protection Agency (EPA), ENERGY STAR:
  - [Energy Star Building Upgrade Manual](#)
- Babcock, Glenn A. [Because Temperature Matters: Maintaining Cooling Towers](#), ASHRAE Journal (March 2005), pp. 46-51.

- BetterBricks
  - O&M Best Practices, Cooling Towers <https://energent.link/xqp>
  - Maintenance Schedule for Cooling Towers <https://energent.link/84d>
- Pacific Northwest National Lab, Building Retuning Training <https://energent.link/5d806>
- **[Building Owners and Manager Association \(BOMA\), Preventive Maintenance: Best Practices to Maintain Efficient & Sustainable Buildings](#)**
- U.S. Department of the Interior, Bureau of Reclamation, Hydroelectric Research and Technical Services Group, *Facilities Instructions, Standards, and Techniques* Volume 4-1A: *Maintenance Scheduling for Mechanical Equipment.* <https://energent.link/5q1>

## ECM Descriptors

### Energy

Category List:

- Building and Maintenance
- Commissioning
- HVAC
- Operations

ECM Attributes:

- Optimize Operations
- Repair or Optimize Existing Systems (fix what you have)

Improvement Type:

- Commission/Retro-Commission
- Retrofit/Renovations
- New Buildings
- Operations and Maintenance

Department:

- Engineering/Facilities Management

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