Preventive Maintenance
• Fountain of Youth for HVAC
• Successful Learning Environment
• Bonus Strategies
James D. McClure, P.E.

Learning Objectives:
1. Know types of maintenance
2. Be able to use ASHRAE STD 180 to establish HVAC PM: Minimum level PM & frequency
3. Know benefits of HVAC PM including occupant comfort, IAQ, energy efficiency, reduced outages, and extended equipment life.

Learning Objectives Cont:
4. Be able to communicate benefits and need for HVAC PM to your own organizations.
5. Learn two key additional strategies to leverage ASHRAE STD 180 HVAC PM
6. Recognize and communicate Integrated Team Approach opportunities for enhanced Preventive Maintenance.

Howdy!
“Choosing not to do HVAC Preventive Maintenance is like never changing the oil in your car”
Why Maintenance?

- Increases equipment life & reliability
- Reduces size & scale & number of repairs
- Lowers maintenance costs through better use of labor & materials
- Reduces emergency repairs & overtime
- Improved parts control
- Reduces energy costs by 5% to 20%
- For the public good (IAQ, Safety, Security, etc.)

Types of Maintenance

- Emergency
- Reactive
- Deferred
- Routine
- Preventive
- Predictive

Preventive Maintenance

- Series of actions performed that are designed to detect, preclude, or mitigate degradation of a system or its components
- Time-based maintenance

HVAC PM

“Where to Start”?

- ASHRAE Standard 180
- Manufacturer’s Recommendations
- Local Conditions
- Master Plan
- Retro Commissioning

HVAC PM

- Preventive Maintenance
  1. ASHRAE STD 180P
  2. STD. Practice for Inspection and Maintenance of Commercial Building HVAC Systems
  3. Intent of STD
     - Guide maintenance entire system
     - Minimum level PM & frequency
     - Code language
     - Occupant thermal comfort, IAQ, energy
     - New & existing buildings
ASHRAE STD 180: HVAC PM

- “Owner responsibility to look at PM for extending life”

Gas/Electric RTU’s

<table>
<thead>
<tr>
<th>Maintenance Activities</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check integrity of panels and fasteners. Replace fasteners as needed to maintain equipment integrity.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Lubricate field serviceable bearings.</td>
<td>Every 60 days</td>
</tr>
<tr>
<td>Check combination disconnect, control panel for deterioration, moisture problems, condensation, and condensation products. Clean, test, and adjust control panel for proper operation.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check for dirt or evidence of biological growth. Clean as necessary.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check evaporator coil for dust damage. Repair or replace as needed.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Check for dirt or evidence of biological growth. Clean as necessary.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check fan blades for balance and particulate buildup and fan motor for proper operation.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Check for dirt or evidence of biological growth. Repair or replace as needed.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check coil for dirt or evidence of biological growth. Clean as necessary.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check belts for tension, wear, cracks or glazing. Replace as needed.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Visually inspect internal ductwork for integrity and, if applicable, ensure insulation has not degraded. Correct as needed.</td>
<td>Twice yearly</td>
</tr>
</tbody>
</table>

Heat Pumps, Split System

<table>
<thead>
<tr>
<th>Maintenance Activities</th>
<th>Frequency</th>
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<tbody>
<tr>
<td>Change air filters.</td>
<td>Every 60 days</td>
</tr>
<tr>
<td>Check wiring and connectors for tightness, signs of overheating, or disconnection. Tighten as necessary.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Check gas piping and gas stop for leaks and loose connections. Tighten as necessary.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Check gas piping and gas stop for leaks and loose connections. Tighten as necessary.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Check all for dirt or evidence of biological growth. Clean as necessary.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check for dirt or evidence of biological growth. Clean as necessary.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Change air filters.</td>
<td>Every 60 days</td>
</tr>
<tr>
<td>Check wiring and connectors for tightness, signs of overheating, or disconnection. Tighten as necessary.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Check condenser coil for dirt and glazing.</td>
<td>Twice yearly</td>
</tr>
<tr>
<td>Lubricate field serviceable bearings.</td>
<td>Annually</td>
</tr>
<tr>
<td>Check coil for dirt or evidence of biological growth. Clean as necessary.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Visually inspect exposed ductwork for integrity and, if applicable, ensure insulation has not degraded. Correct as needed.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check bearing coil for proper operation. Repair or replace as needed.</td>
<td>Before beginning of cooling season</td>
</tr>
<tr>
<td>Check control system for evidence of improper operation. Adjust, repair, or replace components as required.</td>
<td>Twice yearly</td>
</tr>
</tbody>
</table>

Air Distribution Systems

<table>
<thead>
<tr>
<th>Maintenance Activities</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visually inspect grille, registers, and diffusers for dirt accumulation. Clean or replace as needed.</td>
<td>Annually</td>
</tr>
<tr>
<td>Lubricate field serviceable bearings and dampers.</td>
<td>Annually</td>
</tr>
<tr>
<td>Check for dirt or evidence of biological growth. Repair or replace as needed.</td>
<td>Annually</td>
</tr>
<tr>
<td>Visually inspect ductwork for integrity and, if applicable, ensure insulation has not degraded. Correct as needed.</td>
<td>Annually</td>
</tr>
<tr>
<td>Visually inspect applicability for insulation integrity. Repair or replace as needed.</td>
<td>Annually</td>
</tr>
</tbody>
</table>
HVAC PM – STD 180 @ Region 10 ESC

- Base Year
  - 42 calls
  - $87,088
- PM Year One
  - 27 calls
  - $39,088
  - No Outages!

HVAC Preventive Maintenance

“It’s the right thing to do”

HVAC PM

Homework
- Mfr’s Instructions
- ASHRAE 180 STD
- Local Conditions
- Master Plan
- Retro-Commissioning

Go To Bat for HVAC PM

Hit A Home Run!
- Extend Equipment Life
- Comfort, IAQ, Energy
- Fewer Service Calls
- Higher Attendance

HVAC PM “Plus”

Northwest ISD
Dr. Charles Ashby
- NISD Experience – Steele Accelerated H.S.
- 18 yr. old package DX RTU’s
- No budget for replacement
- Accomplished ASHRAE STD 180
- Cost $16,000 parts plus NISD Technician for a Summer
- Goal to Extend life of equipment for at least 2 years

HVAC PM “Plus”

<table>
<thead>
<tr>
<th>Before</th>
<th>After (1 yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electric Cost</td>
<td>$90,000/yr</td>
</tr>
<tr>
<td>Service Calls</td>
<td>25/yr</td>
</tr>
<tr>
<td>Comfort Complaints</td>
<td>Numerous</td>
</tr>
</tbody>
</table>

- PM with STD 180
- Worked From Master Plan
- Included Retro-Commissioning
Tyler ISD’s Master Plan

☑️ Master Plans: Infrastructure
  • Includes PM for HVAC
  • Interactive continuous master plans

☑️ Results
  • Infrastructure in good condition
  • Good learning environment
  • Reduced operating costs
  • Energy efficiency
  • Extended life

Tyler ISD PM - HVAC

“TISD is getting more life from the HVAC equipment than originally anticipated”, Tim Loper, Director of Facilities, Tyler ISD

PM Opportunities Beyond the Equipment Component

Stop  Look  Listen  Communicate

☑️ Master Planning
  • Define
  • Benefits
  • Impact on IAQ

☑️ Retro-Commissioning
  • Define
  • Benefits
  • Impact on IAQ

Common Ground

• Great learning environment
• Sustainable environment
• Building performance
• Cost effective
• Avoiding contamination
• Avoiding damage
• Prevention & management
• Plan development
• Monitoring

Integrated Team Approach

• Design
• Construction
• Operation
• Maintenance
• Custodial activities
• Building usage
• Safety/Security
Common Goals

Prevent problems before they occur

BE PROACTIVE

Examples of Common Ground

• Teamwork
• Communication

Energy, Maintenance, IPM, IEQ & Safety

Secure Access Panels

Energy, Maintenance, IPM, IEQ & Safety

Eliminate Excess Moisture

Energy, Maintenance, IPM, IEQ & Safety

Seal openings in building envelope

Energy, Maintenance, IPM, IEQ & Safety

Repair broken windows
Energy, Maintenance, IPM, IEQ & Safety

Maintain exterior ducts

Estes, McClure & Associates, Inc.
Engineering and Consulting

Energy, Maintenance, IPM, IEQ & Safety

Make sure exterior doors close & have weatherstripping

Estes, McClure & Associates, Inc.
Engineering and Consulting

Energy, Maintenance, IPM, IEQ & Safety

Keep birds & pests away from buildings & equipment

Estes, McClure & Associates, Inc.
Engineering and Consulting

Energy, Maintenance, IPM, IEQ & Safety

Eliminate standing water

Estes, McClure & Associates, Inc.
Engineering and Consulting

Basic Needs

• Food
• Water
• Shelter

“Eliminate”

Estes, McClure & Associates, Inc.
Engineering and Consulting

IPM & IEQ

Use mesh screens

Estes, McClure & Associates, Inc.
Engineering and Consulting
Avoid using mechanical rooms as storage
“Trojan horse syndrome”

Avoid using or keep areas clean

Monitor

Lunch anyone?

A Bird’s Eye View

Report

Maintain Integrity

Secure envelope

Keep It Dry

Maintain
Energy, Maintenance, IPM, IEQ & Safety

Exclusion

Secure Envelope

Prevent Access

Cover It Up

Energy, Maintenance, IPM, IEQ & Safety

Include It

Seal It Up

Barrier Strips

Slope Away from Building

Energy, Maintenance, IPM, IEQ & Safety

Custodial – IPM – Maintenance

• Dry If You Do Damp If You Don’t!
• Remember It’s Not Clean Unless It’s Dry!

IPM & Maintenance

REPAIR WATER LEAKS
IPM, Maintenance, IAQ, Security

CONDUCT MASTER PLANNING SURVEYS ON-SITE

HVAC Preventive Maintenance

Conclusions (How)
- ASHRAE STD 180 Start Place
- Add Mfg. Inst, Local Conditions
- Master Plan
- Retro-Commissioning
- Team Effort

HVAC Preventive Maintenance

Conclusion (Why)
- Improve IAQ
- Improve Energy Efficiency
- Comfort Better
- Fewer Service Calls
- Extend Equipment Life
- Higher Attendance
- Save $

HVAC Preventive Maintenance

Action Plan (Mindset)
- View School As Whole
- Be Alert
- Observe
- Communicate (Team)

HVAC Preventive Maintenance

Action Plan (In District)
- Gathering Status
- Determine If Have Formal Written PM-HVAC
- Define How Many Comfort & IAQ Complaints Last Year
- Determine If Have HVAC Master Plan
- Determine If Retro-Commissioning Accomplished
- Determine If Departments Work Together As A Team

HVAC Preventive Maintenance

Action Plan (In District)
- Write-Up Benefit
  - Master Plan – HVAC
  - HVAC PM & STD 180
  - Retro-Commissioning
- Use Case Studies Shown
- Set Up Meeting With Administration To Recommend
  - Master Plan – HVAC
  - HVAC PM Plan
  - Identify Schools That Would Benefit From Retro-Commissioning
HVAC Preventive Maintenance

Action Plan (In District)
- Follow-Up After Presentation/Meeting
- Set Goals
- Communicate –Team
- Communicate Success
- Be A Role Model

Preventive Maintenance

- Conclusions
- Questions

THANK YOU
“Be A Role Model”