



Evaluating Facility Maintenance for Existing Building Commissioning

A Process Within A Process

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AIA Quality Assurance



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Learning Objectives

1. Recognize the basic organizational objectives for a facility maintenance program (define what Maintenance is)
2. Explain the differences between different types of maintenance commonly encountered in the field
3. Explain key issues that effect maintenance activities and processes in an organization
4. Advise Owners on the effectiveness of their maintenance programs during existing building commissioning

What is Maintenance?

CYA- Care of Your Assets

- Definition – The **process** of maintaining or preserving someone or something, keeping something in good condition
- Maintenance is different things to different organizations- to some organizations it is a fully staffed activity, others it is contract management, others it's a hybrid, others it is non-existent.
- Evaluation begins with a focus on the basics
 - What needs to be maintained?
 - Who does the maintenance?
 - What does it cost to do it? What does it cost if we don't ?
- In EBCx, we need to understand the organization, its goals and capacities BEFORE we start our evaluations – put maintenance questions in pre-visit questions to the Owner.



OK, so why is maintenance important to an Owner?

Items key to maintenance value considerations

- Asset Protection and Preservation
- Occupant Safety and Comfort
- Staff Efficiency
- Energy use reduction
- Financial Impact- ROI vs Cost on Bottom Line

In House or Out House Maintenance?

In House

Advantages

- Control of process
- Staffing to meet needs
- Familiarity with equipment/ systems
- Faster response
- Inventory control
- Versatility
- Records/ History
- Access

Disadvantages

- Salaries and benefits
- Competency is Owner's responsibility
- Specialty tools

Out of House

Advantages

- Cost savings (pay by work order or repair)
- Limited inventory costs
- Technical competency
- No staffing costs
- Specialty tools and equipment

Disadvantages

- Loss of control of process
- Slower response time
- Familiarity with equipment/ systems
- Versatility
- Records/ History
- Access



Other Maintenance Considerations

- Size, type and complexity of building and systems- can affect decisions on quality and capability of in house staffing/ contracting
- Availability of Training- in house often does not train on new technology or changes in operational issues (changes in codes or requirements) that affect building maintenance
- Turnover- in house burn out because of hours, wages, motivation vs. service contractor turnover and experience
- Purchasing power for parts and supplies- availability of discounts for volume purchases often favors service contractors
- Records- capabilities of staff, leveraging computer programs, proof of service, accountability.
- Seasonal or predictive maintenance on critical equipment (boilers/ chillers, etc.) – cost factor
- Some areas seeing trend towards split responsibilities- first line maintenance in house, preventive or more complicated work contracted out.

What to include in a typical maintenance program evaluation?

- Building Equipment (HVAC, generators, etc.)
- Building Systems (Elevators, Life Safety, etc.)
- Building interiors/ exteriors/ landscape (if in scope)
- Production Equipment (if in scope)
- Maintenance Equipment
- Maintenance Practices
- Maintenance Records (or lack thereof)
- Maintenance Capabilities
- Financials - Cost vs. ROI

Common Types of Maintenance Programs Encountered

IM- IGNORED Maintenance
INCOMPLETE Maintenance
INCOMPETENT Maintenance

PM- PREVENTIVE Maintenance – Basic functions often done on a periodic basis (filter changes, etc.)
PREDICTIVE Maintenance – Based on trends or monitoring performance
PANIC Maintenance or Run To Failure (if it ain't broke, don't fix it. When it breaks-panic) RTF=WTF

CM- CORRECTIVE Maintenance- often performed as the result of preventive or predictive maintenance. Can be scheduled later or repair as noticed.

DM- DEFERRED Maintenance- Know it has to be done but put it off till we have to panic or can afford it.



Preventive Maintenance

- Activities focus on the basics (filters, belts, lube, etc.)
- Can be done periodically or based on other criteria (equipment cycles, seasonal, etc.) or other planned or scheduled basis
- Whole system inspections (start at the beginning)
- Proper timing is important
- Effective- target at least 80-90% of maintenance is preventive maintenance
- Identify issues - corrective maintenance scheduled or performed immediately.



Predictive Maintenance

- Monitors and trends equipment conditions
- Allows proactive replacement of worn or defective components before failure.
- Usually technology based
 - vibration analysis on rotating equipment
 - infrared thermography on components or electrical connections
 - lubrication analysis
- Computer trending of key components (run time, etc.)
- Commonly used on production equipment or other equipment where failure would be catastrophic

Panic Maintenance (Reactive Maintenance)

- Wait till it breaks, then fix it
- Most common form of maintenance seen in the field
- Costly- often costs 3 to 4 times more to repair than preventive maintenance because it includes tangible and intangible costs- (Source- Association of Facilities Engineers)

Tangible costs – parts, labor, lost production

Intangible costs – downtime costs (workers standing around waiting for repairs, worker complaints about comfort, etc.)

- Decreased life of equipment

Example- Fan or Motor Shaft Bearing Failure

- Preventive Maintenance
Problem with bearing noted
Part ordered
Maintenance Scheduled
Replacement Performed
during “down time”
Equipment back on line

Work flow not interrupted
Costs kept down
No loss of usage

- Panic Maintenance
Part fails
Equipment is off line
Figure out what broke
Send someone to get parts
Replacement performed while
equipment is supposed to be in-
service
Equipment back on line
Equipment usage lost
Time loss to get parts
Possible loss of production
Employees standing around
waiting for repair
Possible overtime costs

Three part process for Maintenance Evaluation

1. Pre- Inspection Survey (Scoping it out before you arrive)

Ask the Owner-

- Age of the building and equipment
- Equipment only or entire facility inspection?
- Staffing (if in house) or contract? (How many, qualifications, turnover rate?)
- Annual costs for maintenance (estimate)?
- Records keeping (manual, data base, full CMMS capability)
- Objectives- why do you do maintenance? (cost avoidance, extend equipment life, decrease energy usage, etc.)
- How do you communicate maintenance needs and tasks? (work orders, phone, random notes, etc.)
- Priority- how important is maintenance in the organization?

2. On site evaluation- (Investigative Phase)

Understand what the current maintenance practices are

Talk with maintenance staff- Build rapport - get input on procedures, effectiveness, workload, service equipment, etc. Involve service provider if partially or entirely outsourced.

Physical plant inspection (take a look at equipment, building, critical assemblies, etc.)

Evaluate qualifications and training- Do we have custodians doing technician's work or is service provider qualified and familiar with the plant and equipment? Is training available? What level?

Examine Maintenance Records- (Work orders, repair and maintenance records, service invoices, equipment data sheets or CMMS, O&M's)

In short-

Do they have what they need to do the job correctly?

Physical Plant Inspection

- Scope out the shop- is it organized?
 - Do they have common parts on hand?
- Ask about tools and equipment- do they have access to what they need to do the work?
- Inspect equipment in the facility- pay attention to the basics
- Take a look at the general condition of the building- it will tell you about pride in work and the facility
- Consider the age of the facility and equipment. Does the condition match the maintenance expectations?
- Document issues and take pictures
- Keep your eyes, ears, and mind OPEN when doing the inspection

Plant and Equipment

- Overall condition- does the age match the condition?
- Are basics being covered? Filters, belts, lubrication?
- Cleanliness- is the equipment clean inside and out?
- HVAC- Coils, dampers, control linkages, valves, ducts- condition and serviceability
- Production- belts, conveyers, chains, bearings, motors
- First Line Maintenance (Production)
- Safety (missing shrouds/guards, sharp edges, open electrical, etc.)
- Spaces surrounding equipment (lighting, cleanliness, contamination, access, etc.)



Look What I Found!

Filter install date- 1/28/2009
Picture- 2/28/2012
37 Months!
Sure they do PM's
Pictures courtesy Craig Hawkins





Filter Issues?

Lubrication Issues



Belts (or lack thereof)



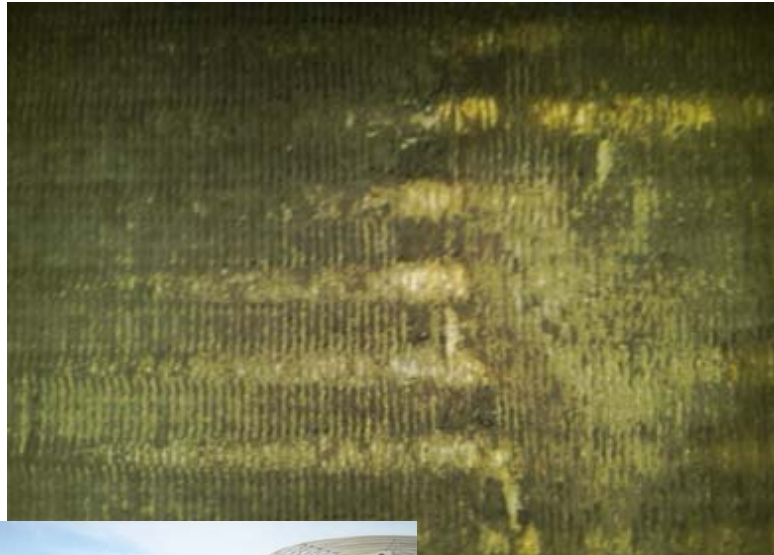


Fluid leakage



Dampers

Coils



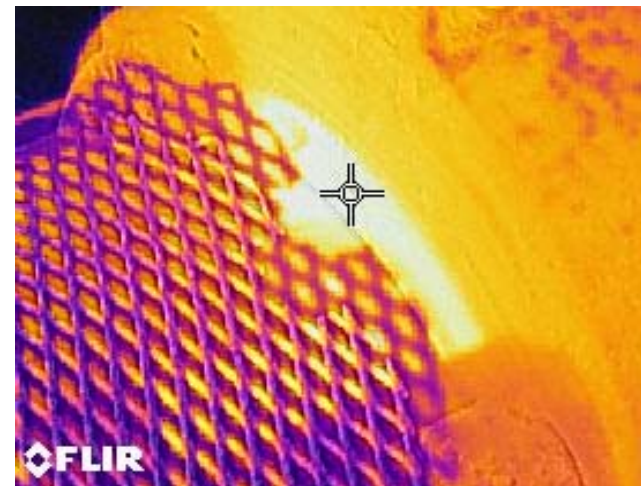
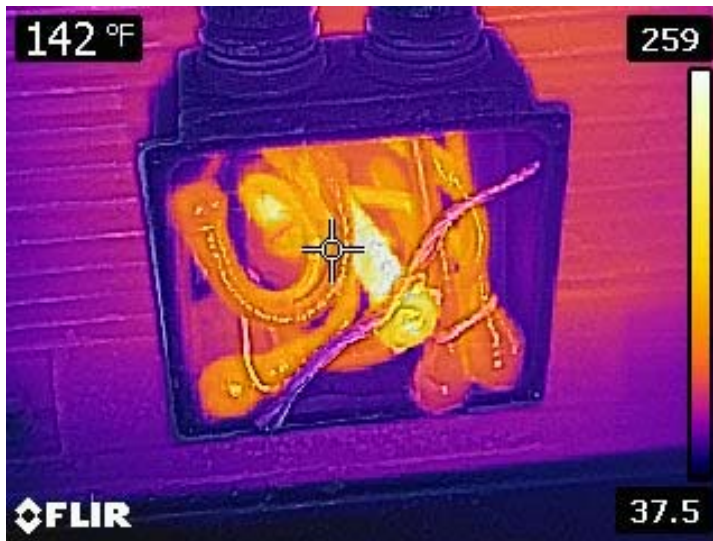


Old Equipment or
Components





Infrared hot spots indicate issues





Typical Areas of Failure in Maintenance Process

- Work Management- How do they do it?
- Maintenance Records- Are they adequate?
- Department/ Company Management-
Emphasis on what?
- Training- Is it available? Is it adequate?
- Attitude – Expense or Investment?

Work Management or How Do They Run Things?

- Is there an established maintenance process?
- Do they use a work orders? Is there a backlog or is it current? Is there deferred maintenance?
- What records to they keep on hand? O&M's? As Builts?
- Scheduling System- manual?, data base?, CMMS?
Do they use it?
- Do they have a DDC system? Do they use for diagnostics or troubleshooting?
- Do they have trades people or general maintenance staff?
- Do they contract out some or all of maintenance functions?
- Longevity of staff or experience with contractor?

Maintenance Records

Paper or CMMS- it's all the same

- Records needed for effective maintenance programs
 - Basic equipment information- Mfg, model, SN, where to get parts, service vendors, common parts on hand (belts, filters, etc.), electrical information (voltage, amperages, fuses, breakers)
 - Basic service schedule- when do we do what to keep it running
 - Basic maintenance procedures- how to do it right
 - O&M Manuals including equipment submittals- are they sufficient?
 - Control diagrams and sequences
 - History of repairs/ maintenance

Management

1. **Misplaced emphasis** – short term cost versus long term ROI- maintenance costs too much money versus proper maintenance can save bottom line dollars and extend equipment life
2. **Lack of support** for maintenance staff or contracting agency- no tools or parts to do the work, no training on equipment, no follow up with contractors on issues, incomplete or no O&M manuals- creates high burnout factor
3. **Lack of a process** to identify issues before things break – no preventive maintenance program, records lacking or non-existent.
4. **Lack of proper or competent supervision** – No supervisor or lead person, lead person not adequately trained
5. **Lack of involvement** by employees, staff, and management- not offering opportunities to improve the process, no training, etc.

Training

- Is there a need for more training (or training in general)?
Needs typically fall in three categories: 1. People- skills and knowledge 2. Work processes and procedures 3. Equipment and procedures
- Determine type needed-
Improve technical skills or general knowledge- Teach appropriately and combine methods to address needs
- What type of program works best?
Work centered learning or academic training: **Work centered learning involves the employees. Workers tend to support what they help create which yields real, tangible learning. Academic training- employees not involved in creation- Tech says “I have all the answers and I’m going to tell you what’s best” Leads to mastery of topic, not mastery of skills. Combination training often works the best.**

ROI- Maintenance Expense or Investment

- Maintenance can contribute 15-40 % of product or service cost
Materials costs; labor costs; downtime (availability) costs; energy costs
- Recent APPA and Ozanne Analytics Report- \$1.00 spent in preventive maintenance saves \$2.73 panic maintenance cost
- If you can cut the maintenance cost percentage by doing PM, you can increase profits (tangible) and decrease complaints from occupants (intangible)
- Typical cost savings-
 - Savings from enforcing warranties
 - Energy Cost Savings
 - Quality Cost Savings
 - Capital Investment Cost Savings (Life Cycle, Replacement)

To get buy-in from a reluctant Owner, show them how to decrease the bottom line

3. Evaluation

- Remember, every building and organization is different!
- Be Honest- but aware of work culture and priorities
includes resistance to change, progressive vs. regressive management
- Point out issues- not problems. Issues can be resolved- win-win proposition
- Problems are often perceived as a win-lose proposition (resentment/ resistance to change).
- Be detailed - include pictures, comments, examples.
- Make recommendations that are within reach first, then
- Propose longer range solutions for consideration
- Point out benefits (longer equipment life, cost savings, ROI, etc.)



Summary

- Definition of maintenance - CYA
- Different types of maintenance (IM, PM,CM)
- Three Part Process for Maintenance Evaluation
- Typical examples of maintenance gone wrong
- Discussed common issues in maintenance programs
- Discussed key organizational issues
- Suggested evaluation points to be considered

Remember- There's no Normal Day in the Maintenance Department





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