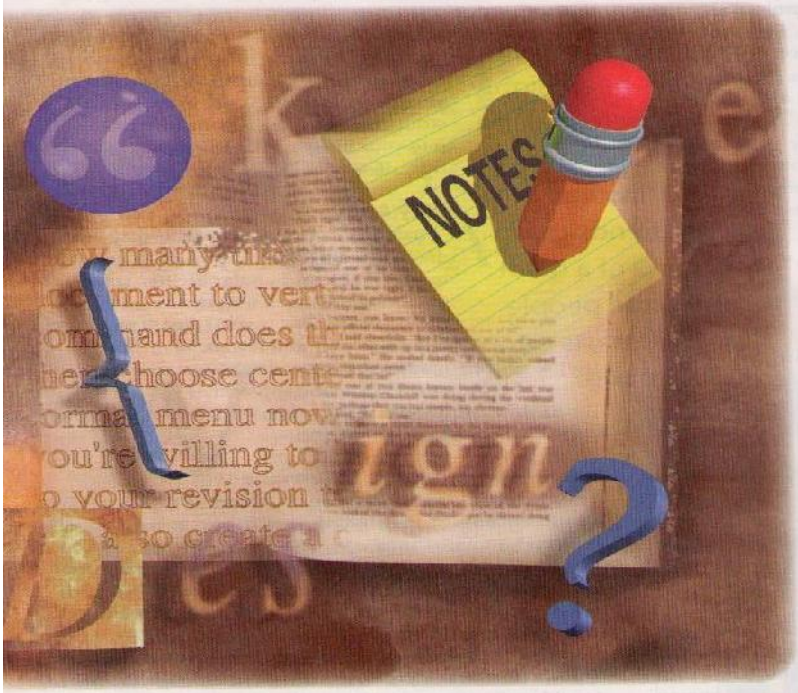
Commissioning from a Contractor's Perspective: Providing Value to



By Mark Woehrle

Any time you can add value to your service activity, it will help you in the long run. Key among your goals should be to reduce warranty calls, provide a higher level of customer satisfaction and thereby differentiate yourself from your competitors. You can build a profitable business with commissioning. It's been an opportunity for additional revenue for us at Shaw Mechanical, and a nice change of pace from the everyday contracting activities.

Shaw Mechanical has established a set of procedures for commissioning and retrocommissioning which other contractors can implement in their service regimen. In this article, I will review what you can expect if commissioning is specified on your project; enumerate Shaw Mechanical's procedure for retrocommissioning; examine common problems we encounter, and opportunities for improvement.

What is Commissioning?

Essentially, commissioning is a process used to document the performance of HVAC systems, with the intent to verify compliance with the owner's project requirements and/or the contract documents.

To take it another step into the value arena, commissioning also provides opportunities to improve energy efficiency, and better meet the requirements of the facility. A typical testing and balancing (T&B) report will often provide a list of derivations from the original design. Our experience is that the testing and balancing process alone is not adequate to check out the control system and to verify systems operating in the auto mode. With commissioning, the idea is to take it to another level, not just find deficiencies. You can recommend changes in sequence of operations, and try to implement them. There are many things that can be done that don't cost a lot of money. Those opportunities should be identified and implemented if possible.

Mechanical Contractor's Role in Commissioning

If commissioning is specified on one of your projects, your responsibilities will be outlined in Division 1 of LEED Prerequisite EA1, as well as the mechanical sections (15 or 23). Additionally, an outline of each participant's responsibilities will be included (commissioning agent (CxA), architect, engineer, construction manager, mechanical contractor, control contractor and testing and balancing contractor).

As the mechanical contractor, you need to be aware of the additional expenses associated with meeting LEED requirements. You can expect additional costs for temporary and permanent air filtration. Plan to spend 3-4 times the labor on commissioning that you normally would on start up. The mechanical contractor is required to attend meetings and complete start up sheets that the engineer or consultant provides. Finally, the CxA comes to the site and you demonstrate the HVAC systems operation for them. While commis-

the Owner

sioning can be painful for the mechanical contractor during the check out process, the long term benefits make if well worthwhile. We've found warranty calls reduced and overall customer satisfaction to be higher on jobs that have been commissioned.

Commissioning 'Tools' at Any Level

Commissioning essentials include the following:

• A staff of experienced technicians with an understanding of commercial comfort systems. Those who regularly participate in the start up process and run warranty calls are best suited.

• Up to date plans and specifications.

• Approved submittals including the controls schematics and sequences of operation.

• A complete T&B report. With retrocommissioning, it's handy to have this report; the T&B contractor may have identified some of the problems, which helps you key in on the issues.

•Access to the DDC system. Remote access is helpful to spend additional time monitoring how a system is operating.

• High quality thermometers, gauges, digital sling psychrometer and electrical multi-meter are required.

• Flow hood, duct traverse kit and hydronic flow meter would be helpful but not necessary if you have a T&B sub. Ask the T&B sub to spot check equipment where performance is found to be sub-par.

• Forms for the field technicians to fill out. We use Excel spread sheets which cover each piece of equipment and system.

Essential Commissioning Practices

Chiller Assessments

• What is the alarm history? The chiller controller tells you the history of the unit, including the frequency of nuisance alarms, number of start/stops and run time to evaluate the equipment cycling.

• Are we getting design LWT from each chiller and what's the Delta T?

• Is the CHWS temp to the facility at design?

• What capacity are the chillers running at, and are they being staged per the sequence of operation?

• Are two chillers running, when one machine could carry the load?

• Review history of chiller operation to see if chillers are running nights and weekends during unoccupied times?

• For water-cooled chillers, we examine the condenser water supply (CWS) temperature and the split on the condenser water.

• Is condenser water optimization being used?

• What is the water quality?

Cooling Tower Assessments

• Our main concern with cooling towers is the operation of open loop water treatment and water consumption. We find that the set up on the open loop controllers it typically incorrect. There's a tendency to be lazy when setting up controllers, and what we see is that either the probe gets dirty and shows high conductivity, or they have the setting too low. The conductivity of makeup water will determine how low the system conductivity can be set. The idea is to get as many cycles out of the water as possible without experiencing water quality problems that will be detrimental to the equipment.

• We record water consumption over time, and compare it to building tonnage. If the inhibitor and biocide is operating on a timer, we'll re-configure the control panel so that chemical use matches tonnage.

• We will also determine whether or not we can change the control sequence to use all the towers at one time, which maximizes surface area, and can effectively lower the condenser water supply temperature to the chillers.

• We evaluate the cleanliness of the hot deck and cold water basin, and check for scale and build up. Finally, we confirm proper water level and operation of the fill valve.

Pump Assessments

• If the pumps are controlled by VFDs, are they in the auto mode?

• Of key importance: are the secondary pumps maintaining the differential pressure (DP) set point, and is the differential pressure setting reasonable, or could we lower it? We find that there is too little time spent on determining the correct DP setting which contributes to long term operational problems with the chilled water system operation. Specifically, the secondary pumps overdrive the primary causing reverse flow through the bypass. With reverse flow through the bypass, another primary pump and chiller has to operate even though the building tonnage does not require it.

• Is water flow through the bypass/de-

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coupler line in normal or counter flow?

• Are pressures on the closed loop reasonable? Make up water pressure and expansion tank set up should be examined f pressures are too high.

• Verify that standby pumps will be activated in the event of a main pump failure.

• Look for wear on the pump couplings, an indicator of misalignment.

Building Automation System Assessment

•Does the BAS system show all the points and have the specified graphics?

• Do the control sequences match what's specified?

• Verify calibration of the control devices. This is an often over-looked, but extremely critical item. A freeze-stat that reads high could result in a coil that freezes. A humidity sensor that reads high could cause the system to run in dehumidification mode un-necessarily.

• Point-to-point mapping. An example would be finding a VAV box wired to the thermostat in the adjacent space.

• Are the chillers interfaced, if specified?

• Verify time of day schedules and set points for occupied and unoccupied modes. A typical example would be to have occupied cooling set points at 74F, and unoccupied set points at 80F. We examine air handler and chiller plant activity in off-hours, and ask the owner if the space is critical for that 80F. Do you need to activate the entire chiller plant because it reaches 81F in an electrical room, IDF room, or another room that can be taken out of the logic; or we can raise their activation temperature to 85F.

• Is the system ventilation turned off (low occupancy mode) at start up and shut down? That simply involves shutting off makeup air and exhaust during periods of low occupancy. There's no reason to condition outside air if the building isn't occupied. Plus, it cools down quicker. If you start it at 7AM and it's occupied at 8AM, you definitely want low occupancy mode during that time.

•Are the interlocks functioning between fans and air handlers? You must avoid situations with exhaust fans operating without their respective AHU which could put the building in a negative pressure.

Air Handling Unit Assessments

•Record splits on coils.

•Record outside air quantities if there is an airflow monitoring station. Calibration of the AFMS is critical.

•Record split on waterside.

•Is the VFD in auto?

•What are the relative positions or return and outside air dampers?

•Record static pressures.

•Is the AHU maintaining static pressure set point? Does the static pressure set point seem reasonable or could we lower it?

•Verify dehum and CO2 settings.

Fan Powered Boxes/VAVs

•Record leaving air temps.

•Record CFM delivered vs. specified.

•Are the specified CFM values entered correctly in the building automation system?

•Verify heater operation.

• Record temperature rise on heating coils and record amperage if it's electric. Amperage will help verify that all stages are operating.

Test Unique Sequences

Test operation of any unique systems such as EHPA (enhanced hurricane protection area), smoke evacuation, stairwell pressurization, and fire alarm.

• Last, but not least, you need an experienced individual to review the completed paperwork and to write up notes, observations and recommendations based upon the findings. This is where the real value is provided. We're elevating the process from filling out forms and making observations to explaining why things are happening and making corrective recommendations.

Shaw Mechanical's Approach & Process

We start out with report notes, which summarize problems and provide our recommendations. Next, we look at operating conditions of the overall building such as pressurization, CO_2 and humidity levels. The next focus is on the control system, and then, the central energy plant. The BAS sequence, particularly as it relates to the CEP and hydronic systems, is where we see the biggest opportunity for improvements. Lastly, we work through the airside equipment and systems.

Conclusion

Formal, specified commissioning is becoming increasingly popular, due to LEED certification and rising energy costs. However, having access to control systems on your projects is a must, to troubleshoot problems and assist your customer in operating their facility. We recommend that you embrace commissioning as a way to reduce warranty costs, improve customer satisfaction, and differentiate yourself from competitors.

Commissioning can be a simple process, and applied to solving your customers' most common comfort problems. You don't necessarily have to commission an entire building. You can see how the chiller plant is operating, and analyze that particular problem. That's what we do every day, to respond professionally to our customers. Many contractors have trouble responding to these type of problems, and lose customers by not providing concrete data.

It costs money, but we depend on the repeat business generated by excellent service. CB

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