INSTALLER and INSPECTOR QUICK-REFERENCE: 2022 NRCA-MCH-17-A Condenser Water Supply Temperature Reset Controls

Purpose and Scope of the Test

The intent of the test is to verify that the water supply (from water-cooled chillers, served by cooling towers) temperature is automatically reset as indicated in the control sequences; based upon building loads, outdoor air wet-bulb temperature, or another appropriate control variable. All cooling tower system components (e.g., fans, spray pumps) should operate per the control sequences to maintain the proper condenser water temperature and pressure set points.

Chilled water plants serve many buildings, responding to the varying cooling loads throughout the year. As the loads vary, the chilled water supply temperatures adjust to satisfy the new operating conditions. Often, water-cooled chilled water plants can decrease the condenser water temperature in times of high cooling load. This occurrence can be demonstrated by running the cooling tower fans at a higher speed, staging on additional fans, or varying water distribution across the tower fill by closing and opening bypass valves. As a result, the cooling tower produces an energy penalty; however, the chiller efficiency and the overall plant efficiency improves.

The purpose of this test is not to evaluate whether a particular control sequence is the most appropriate for the facility, but whether the system follows the intended control sequence.

Test trigger

Newly Constructed and Additions/Alterations: All new condenser water temperature reset controls installed on new or existing chilled water systems with a cooling tower must be tested.

There is no code requirement that chilled water plants employ this type of control. However, if condenser water temperature reset is implemented, then it must be tested per the Energy Code.

Exceptions: Hydronic systems that use variable flow to reduce pumping energy in accordance with section 140.4(k)6, and healthcare facilities are not subject to this test.

Relevant Energy Code References and Required Compliance Documents

Title 24, Part 6 of the California Building Code, Building Energy Efficiency Standards (Energy Code) sections 140.4(k)4, 160.3(d), 170.2(c)4.I.iv; and NA 7.5.16.

Who Can Perform the Test

This test must be performed by an acceptance test technician certified by a CEC-approved Acceptance Test Technician Certification Provider, using compliance document NRCA-MCH-17-A.

INSTALLER and INSPECTOR QUICK-REFERENCE: 2022 NRCA-MCH-17-A Condenser Water Supply Temperature Reset Controls

Required Tools

Performance of this test will require measuring water temperatures, and possibly air temperature, relative humidity, system pressures, and system flow rates. The instrumentation needed to perform the test may include, but is not limited to:

- Hand-held temperature probe to calibrate or check existing sensors.
- Humidity sensor or wet bulb temperature probe / psychrometer.

Installed sensors should be checked for accuracy and may be used for testing where appropriate. Any instruments used for testing or checking other sensors must have been calibrated within the past year, with date of calibration noted on the Acceptance Document.

Estimated Time to Complete Test

Construction Inspection: 1 to 3 hours (depending on availability of construction documentation – i.e., plumbing drawings, material cut sheets, specifications, etc. – as well as sensor calibration records).

Functional testing: 2 to 5 hours (depending on familiarity with BAS, method employed to vary operating parameters, ambient conditions, building loads, and time interval between control command and system response).

Potential Issues and Cautions

Condenser water temperature reset is most effective on a moderately warm day. When testing during cold weather conditions, make sure that freeze protection controls are installed and functional to prevent equipment damage. Also ensure the conditioned spaces do not fall below safe temperatures, as this may cause discomfort or unsafe working conditions.

If conducting this test during hot weather conditions, make sure the chiller load amps don't increase as the condenser water temperature decreases. If so, you will need to conduct this test on a cooler day. Likewise, stop the test if the chiller begins to surge.

This test does not require operation of the plant equipment across all operating stages, so it is not necessary, nor desirable, that the system experience peak load conditions. However, the system cooling load must be sufficiently high to run the test. If necessary, artificially increase the load to perform the functional tests, or wait until a time of stable chiller operation. If necessary, reverse Steps 1 & 2 in the functional test based on atmospheric conditions and building loads.

If the system is designed to employ variable flow simultaneously with temperature reset, allow the system to operate as programmed but take care that the water flow rate stays within the minimum and maximum flow rate limits for the chiller(s) and cooling tower(s). Minimum flow through a cooling tower is important to provide even water distribution and full wetting of the fill to prevent scaling.

INSTALLER and INSPECTOR QUICK-REFERENCE: 2022 NRCA-MCH-17-A Condenser Water Supply Temperature Reset Controls

Potential Issues and Cautions (cont.)

Exemption: There is an important exemption associated with this functional test to provide flexibility given the range of chilled water plant operations, as follows: If the control sequence differs significantly from that implied by the tests, and / or has already been tested during the building commissioning process, attach a description of the control sequence, a description of the tests that were done to verify the system operates according to the sequence, the test results, and a plot of any associated trend data.

Inspection Enforcement

- Check if the condenser water supply system and control system are installed per the system design, as documented on the building plans or as-builts.
- Check if condenser water supply temperature control sequence, including condenser water supply high and low limits, are available and documented in the building documents.
- Check if all cooling tower fan motors are operational, cooling tower fan speed controls are installed, operational, and connected to cooling tower fan motors per OEM start-up manuals and sequence of operation.
- Check if cooling tower fan control sequence, including tower design wetbulb temperature and approach, are available and documented in the building documents.
- Check if the following temperature sensors are installed per plans: outdoor air dry-bulb and wet-bulb, entering condenser water, and leaving chilled water. Note any discrepancies on the Acceptance Document.
- All ambient dry bulb temperature, and relative humidity/wet bulb sensors used by controller must be factory calibrated (with certificate), field calibrated by TAB technician or other technician (with calibration results), or field checked against a calibrated reference standard by test technician (with results). Attach supporting documentation to the Acceptance Document.
- When field calibrating temperature sensors, it is recommended that you perform a "through system" calibration that compares the reference reading to the reading at the EMCS front end or inside the controller (e.g., it includes any signal degradation due to wiring and transducer error).
- Document the following from the control system or using test sensors.
  - Current outdoor air-dry bulb and wet bulb temperatures.
  - Current entering condenser water supply temperature.
- Current leaving chilled water temperature.

INSTALLER and INSPECTOR QUICK-REFERENCE:
2022 NRCA-MCH-17-A
Condenser Water Supply Temperature Reset Controls

Acceptance Criteria

Functional Test: System must meet the following criteria during the test:

- Condenser water temperature controls modulate as intended.
- Actual condenser water supply temperature changes to meet new set point within ± 2°F.
- Cooling tower fan(s) stage properly and/or adjust speed accordingly to meet target set point.
- Chiller load amps change in accordance with new condensing temperature.

Follow the **Construction Inspection** and **Functional Testing** instruction on NRCA-MCH-17-A.