

**INSTALLER and INSPECTOR QUICK-REFERENCE:  
2022 NRCA-MCH-10-A  
Hydronic System Variable Flow Control Acceptance**

**Purpose and Scope of the Test**

Hydronic variable flow chilled water and water-loop heat pump systems shall vary system flow rate by modulating pump speed using either a variable frequency drive (VFD) or equivalent according to section 140.4(k)6. Pump speed and flow must be controlled as a function of differential pressure, to reduce pump energy required. As the loads within the building fluctuate, control valves should modulate the amount of water passing through each coil and add or remove the desired amount of energy from the air stream to satisfy the load. In the case of water-loop heat pumps, each two-way control valve associated with a heat pump closes when not operating. The purpose of the test is to ensure that, as each control valve modulates, the pump VFD responds accordingly to meet system requirements.

**Test trigger**

Newly Constructed and Additions/Alterations: Applies to any water system that has individual pumps serving variable flow systems and having a motor horsepower exceeding 5 horsepower.  
Note that this is not required on heating hot water systems with variable flow designs or for condensing water serving only water-cooled chillers.

**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)6, 170.2(c)4Ivi; NA7.5.9; NRCC-MCH-E Table G  
The related acceptance tests for this system is:  
NA7.5.7 Valve Leakage Test – NRCA-MCH-08-A (if applicable).

**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-10-A.

**Required Tools**

Performance of this test will require measuring motor amps, water temperatures as well as possibly air temperatures. The instrumentation needed to perform the test may include, but is not limited to a clamp-on amp meter, hand-held temperature probes for ice water or drywell bath. Devices must be calibrated within the last year.

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**Estimated Time to Complete Test**

Construction Inspection: 0.5 to 1 hours (depending on availability of construction documentation – i.e., plumbing drawings, material cut sheets, specifications, sensor calibration, etc.).  
Functional testing: 2 to 4 hours (depending on familiarity with energy management system, method used to vary operating parameters, verification method for system flow and VFD power).

**Potential Issues and Cautions**

Difficulties could be encountered with manipulating the control system if not familiar with the programming language. Therefore, a controls contractor should be on-site to assist with adjusting system operation and overriding controls.

**Inspection Enforcement**

To perform the test, use the control system to manipulate system operation to achieve the desired control. At a minimum, control system programming for the operation of the central equipment, control valves, and pumps must include, but not be limited to:

- Equipment start-stop control.
- Installed and calibrated control sensors.
- Tuned control loops.

All systems must be installed and ready for system operation, including:

- Heat pumps, cooling towers, boilers, pumps, control valves, piping, etc.
- Control sensors (temperature, flow, pressure, etc.).

Verify all piping is pressure tested, flushed, cleaned, and filled with water. Verify electrical power supply to all equipment. Confirm start-up procedures for all pieces of equipment are complete, per manufacturer’s recommendations.

Document the initial conditions before overrides or manipulation of the BAS. Return all systems to their initial condition after test.

- Verify the location of the static pressure sensors meets the requirements of the Energy Code.
- Verify that the static pressure sensors have been calibrated.
- For systems with DDC to individual coils, the pressure sensor(s) has no location restriction, but are reset according to the valve requiring the greatest pressure and shall be no less than 80 percent open.

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**Acceptance Criteria**

Section 140.4(k)6 permits two general variable flow control strategies:

(1) supply pressure reset by coil demand for systems with DDC controls to the coil level and (2) fixed pressure setpoint control.

- Verify that pump operating speed responds to decrease in flow by decreasing speed to maintain system pressure to within -5 percent to +5 percent of design setpoint.
- Verify that pump operating speed responds to increase in flow by increasing speed to maintain system pressure to within -5 percent to +5 percent of design setpoint.
- Verify that system stabilizes within 5 minutes when controlling to the setpoint.