Introduction to ASHRAE SPC 191

Standard for the Efficient Use of Water in Building Mechanical Systems

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Introduction

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- Chair ASHRAE standard 191 (2015 – present)
- Co-Chair ASHRAE Technical Committee 2.8 Energy:Water Nexus Subcommittee (2015 – present)
- Senior Sustainable Design Consultant at Affiliated Engineers, Inc. Madison, WI (2009 to present)
Agenda

- Purpose and Scope
- Development History – 8 years and counting
- Mechanical
- Process
- Water Balance
- Appendix A & B
Purpose and Scope

• The purpose of this standard is to provide minimum requirements for the design of building mechanical systems that limit the volume of water required to operate HVAC systems.

• This standard provides minimum criteria that:
  • Apply to new buildings and renovation projects (new portions of buildings and their systems) and the surrounding site: a building or group of buildings that utilize a single submittal for a construction permit or which are within the boundary of a contiguous area under single ownership.
  • Addresses water consumption through the concept of water use efficiency implemented during design and construction of residential, commercial, institutional, and industrial projects.
  • The provisions of this standard do not apply to:
    • Storm or building waste water management, except as a means of reducing potable water use.
    • Industrial process systems.
Standard 191 History

• A panel was convened in the mid 2000’s to discuss creating a comprehensive standard to cover all aspects of water use in the built environment.

• Co-sponsors include: ASHRAE, ASPE, AWWA, USGBC

• Logistical issues and a lack of urgency and leadership led to the standard having limited development and little consensus.
  • No trade association “owns” water.
  • Less than 1/3 of committee membership were ASHRAE members.
  • Base versus stretch standard.
  • Water wasn’t politically/financially important.
Timeline

• SPC 191P formed: 2008

• First public review: 2012

• Title, Purpose, Scope change: 2015

• First public review: Summer 2016
  • Submit paper work by May 20th.
## Scope Change

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<th>Before 2015</th>
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<td>• Landscape</td>
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<td>• Mechanical</td>
<td>• Process</td>
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<td>• Plumbing</td>
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<td>• Process</td>
<td>• <strong>Quantify but not regulate</strong></td>
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<tr>
<td>• Quantification</td>
<td>landscape nor plumbing</td>
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Mechanical Water Highlights

• Water quality
  • Testing water to validate quality and compatibility with equipment.
  • Includes potable and non-potable
  • Water treatment plan

• Metering
  • Whole building potable and non-potable
  • Cooling towers, evaporative cooling, boilers and hot water heaters (thresholds)

• Equipment (cooling towers, evaporative systems, boilers, etc.)
Process Water Highlights

• Commercial Food Service, Commercial Laundry, Medical, Laboratory

• Identify gaps in current codes/standards and fill them, but don’t repeat or contradict other codes/standards

• Sampling of scope:
  • Animal watering system
  • Steam sterilizers
  • Dipper wells
  • Reverse osmosis
  • Lab sinks and washers
Water Balance

• Educating for users on usage volumes in less water stressed or low cost areas where there isn’t a big driver for water savings yet.

• Basis for more stringent codes, standards, and guidelines to build upon and set higher performance targets.

• Issues:
  • Water vs. water cost?
  • Sewage or potable water only?
  • Requirements for water stressed regions?
    • What defines a water stressed region?
## Water Balance

### Sources (partial list)
- Rainwater
- Air-conditioning condensate
- Reject water from reverse osmosis treatment systems and similar devices
- Graywater (water from showers and baths, clothes washers, and hand washing lavatories)
- Stormwater
- Cooling tower blowdown

### Sinks (partial list)
- Cooling tower makeup (evaporation, blowdown, and drift)
- Humidification
- Landscape irrigation, including irrigation of vegetative roofs
- Plumbing fixtures
- Process water
- Any other end-uses
Appendix A: Water Usage Intensity

- Water Usage Intensity
  - Gallon per year per:
    - Square foot,
    - Patient bed,
    - Occupant, etc.

- Establish a target WUI value by building type and location based on previously measured data. (EPA, CBECS, etc.)

- Depending on scope designers may prefer to use target value approach to comply with Water Balance requirements.
Appendix B: Whole Building Water Model

Mechanical systems can be quantified with energy models
• Humidification & cooling coil condensation
  \[ m_{Cond} = m_{airflow} \times \Delta HR \]
• Boiler Blowdown
  \[ \dot{m}_{BD} \left[ \frac{lb}{hr} \right] = \dot{Q}_{Steam} \left[ \frac{Btu}{hr} \right] \times \frac{1}{h_{Steam} \left[ \frac{Btu}{lb} \right]} \times f_{Blowdown} \]
• Cooling tower evaporation
  \[ \dot{Q}_{water} = m_{water} \times c_P \times (T_{water,i} - T_{water,o}) \]
  \[ \dot{m}_{CT-Water} = m_{CW} \times \Delta T_{Tower} \times b_{EVAPORATION} \left[ \frac{gal}{hr} \right] \]
  \[ V_{CONDENSER} \left[ \frac{gal}{hr} \right] \times \Delta T_{COOLING-TOWER} \left[ ^\circ F \right] \times \frac{Btu}{lb - ^\circ F} \]
  \[ = \frac{\Delta T_{COOLING-TOWER} \left[ ^\circ F \right] \times \Delta T_{CONDENSER} \left[ ^\circ F \right] \times \frac{Btu}{lb - ^\circ F}}{H_v \left[ \frac{Btu}{lb} \right]} \]
References

Questions

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