ASHRAE Standard 90.1-1999

The Top Ten Issues
You Should Know About
The New Energy Standard

presented by Rob De Boer

Purpose of Standard 90.1 - 1999

The purpose of this standard is to provide minimum requirements for the energy-efficient design of buildings, except low-rise residential buildings.
Number 10:

◆90.1 applies to the entire building

#10 - 90.1 applies to the entire BUILDING

- Envelope
- HVAC
- Service water heating
- Power
- Lighting
- Electric motors
Number 9:

◆ Control requirements for systems larger than 65,000 Btuh and 3/4 HP fans

# 9 - Off-Hour Controls

> 65,000 Btuh and 3/4 hp

- Automatic Shutdown
  - Automatic time clock w/10 hour battery back up
  - occupancy sensor
  - manually operated timer w/max. 2 hr duration
  - Security system interlock
- Setback, except radiant
- Optimum start > 10,000 cfm
# 9 - Off-Hour Controls
> 65,000 Btuh and 3/4 hp

- Automated outdoor air supply and exhaust shut-off damper controls
- Zone isolation
  - 25,000 square feet maximum zone size on one floor
  - Shut off airflow
  - Central systems capable of stable operation

Number 8:

◆ Lighting power densities are decreased for most applications
◆ There are also lighting control requirements
# 8 - Lighting Requirements

Building area lighting power densities

<table>
<thead>
<tr>
<th>Building type</th>
<th>W/ft²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital</td>
<td>1.6</td>
</tr>
<tr>
<td>Library</td>
<td>1.5</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>2.2</td>
</tr>
<tr>
<td>Museum</td>
<td>1.6</td>
</tr>
<tr>
<td>Office</td>
<td>1.3</td>
</tr>
<tr>
<td>Retail</td>
<td>1.9</td>
</tr>
</tbody>
</table>

# 8 - Lighting Requirements

Space-by-space method (W/ft²)

| Office Enclosed   | 1.5  | Dining   | 1.4 |
| Office Open       | 1.3  | Food Prep | 2.2 |
| Conference        | 1.5  | Corridor  | 0.7 |
| Training          | 1.6  | Restroom  | 1.0 |
| Lounge            | 1.4  | Active Storage | 1.1 |
| Lobby             | 1.8  |           |     |

*Power may be traded between spaces*
Lighting Requirements
Interior control requirements

- At least one control in each space
- Automatic shutoff for buildings > 5,000 ft²

Number 7:

- Applies to alterations and additions
# 7 - Applies to Alterations and Additions

- Individual components comply with requirements
- Multiple components:
  - Annual energy use ≤ compliant design

Number 6:

- Hot gas bypass is limited - for both split systems and chillers
# 6 - Hot Gas Bypass Limitation

- > 7.5 tons
- Multiple steps or continuous unloading

<table>
<thead>
<tr>
<th>Rated Capacity</th>
<th>Max Hot Gas Bypass (% of Total Capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤240,000 Btu/h (70 kW)</td>
<td>50%</td>
</tr>
<tr>
<td>&gt; 240,000 Btu/h (70 kW)</td>
<td>25%</td>
</tr>
</tbody>
</table>

**Number 5:**

- Limitation on the amount of reheat that can be done with new energy
Simultaneous Heating and Cooling - Exceptions

- Airflow limits. The larger of
  - Standard 62 zone requirements, or...
  - 0.4 cfm/ft², or...
  - 30% of supply air
  - 300 cfm, or...
  - Standard 62, 6-1 implementation
- 75% of reheat energy from site recovered or site solar

Simultaneous Heating and Cooling - Dehumidification

- Exceptions
  - Reducing supply air flow to 50%, or min. ventilation
  - Systems under 6.67 tons that can unload at least 50%
  - Systems smaller than 3.3 tons
  - Systems with specific humidity requirements (museums, surgical)
  - 75% of reheat or recool energy is recovered or solar
Number 4:

◆ Energy recovery is required for airside and waterside in specific applications

4a Energy Recovery - Airside

- Required when 70% OA and 5000 cfm total
  - 50% effectiveness
- Exceptions
  - Labs, toxic exhaust, etc.
  - Largest Exhaust < 75% outside air
4b Energy Recovery - Waterside

- Service Water Heating
  - 24 hrs per day and
  - Heat rejection > 6 MMBtuh and
  - Design SWH load > 1 MMBtuh
- Heat recovery required
  (smaller of)
  - 60% of design heat rejection
  - Preheat water to 85°F

Number 3:

- Fan pressure optimization is required for DDC/VAV systems
# 3 - Fan Pressure Optimization
Required for DDC/VAV Systems

Number 2:

- Minimum efficiency requirements have been revised for many types of HVAC equipment
# 2 - Equipment Efficiency Examples

<table>
<thead>
<tr>
<th>Type</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>20-100 ton self-contained</td>
<td>11.0 EER*</td>
</tr>
<tr>
<td></td>
<td>10.3 IPLV*</td>
</tr>
<tr>
<td>1.5 - 5.25 ton water-source heat pump</td>
<td>12.0 EER (cooling)</td>
</tr>
<tr>
<td></td>
<td>4.2 COP (heating)</td>
</tr>
<tr>
<td>≥300-ton water-cooled centrifugal chiller</td>
<td>6.10 COP</td>
</tr>
<tr>
<td></td>
<td>0.576 kW/ton</td>
</tr>
<tr>
<td></td>
<td>6.40 IPLV0.549 IPLV</td>
</tr>
</tbody>
</table>

Note: Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

Both full and part load efficiencies are required.

Number 1:

- 90.1 is the basis of the State of Michigan’s energy code.
# 1 - 90.1 is the basis for Michigan EPA Energy Act

- States must meet or exceed the requirements of Standard 90.1–1989
- U.S. DOE must evaluate any revisions to 90.1
- DOE can then obligate states to update their codes

90.1 and LEED™

- LEED (Leadership in Energy & Environmental Design)
- 90.1-1999 (or local energy code) is prerequisite
- So, if the building is to be LEED certified at any level, 90.1 is the minimum
Questions?