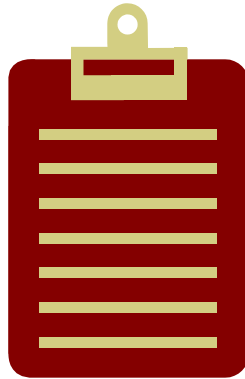


White Paper #8

January 2, 2006

ASHRAE 90.1 Common Requirements

Commercial buildings must meet the local Energy Code. If the ASHRAE Chapter 11 point-system option is used to show compliance, there are some additional things that must be provided as well as making the grade on points. By knowing this list exists and is required, you should be able to get the most from your project design and construction team.



When your commercial construction project gets a Building Permit, it must meet the local Energy Code. One of the options to show compliance is to meet the requirements of ASHRAE 90.1 Chapter 11 “Energy Cost Budget Method.” This is a point-based system where, in general, if you achieve an energy score of 100 points or less, you win. But what is not widely understood is that there are certain mandatory prescriptive requirements that must be met, in addition to meeting the energy budget or required points. This paper will identify some of the more significant ones for you – for a complete listing, you can review the ASHRAE 90.1 text in detail. As an Owner, these are things you should expect from your project. Remember, the local Energy Code and ASHRAE 90.1 Standard is there to help you get an energy efficient building.

Reference is made here to ASHRAE 90.1-2001, and subsequent modifications to it. This Standard is under what is called “continuous maintenance” because it is regularly updated and adjusted. ASHRAE stands for “the American Society of Heating, Refrigerating and Air-Conditioning Engineers.” Standard 90.1 has been the de facto standard for commercial building energy efficiency for many years, and is the basis of many local Energy Codes. In our area, there is a separate Energy Code, which is the International Energy Code (IEC) – 2003. Compliance with the IEC code does not require meeting ASHRAE 90.1 requirements, however ASHRAE 90.1 Chapter 11 (performance based compliance) is offered in the IEC as an acceptable equivalent.

Chapter 11 of ASHRAE Standard 90.1 clarifies that in addition to meeting the energy budget (the point-based system), compliance requires that “all requirements of 5.2, 6.2, 7.2, 8.2, 9.2, and 10.2 are met.” The “Mandatory Requirements” are listed in each chapter as follows:

5.2	Building Envelope	8.2	Power
6.2	HVAC	9.2	Lighting
7.2	Service Water Heating	10.2	Other Equipment

Some of the requirements are paraphrased. Extra [\[comments\]](#) add clarity or explain the value.

Partial Listing of ASHRAE 90.1 Mandatory Requirements
These are in addition to ASHRAE 90.1 Energy Budget Point Requirements of Chapter 11

<p>5.2 Building Envelope</p>	<p>Envelope Sealing: [Buildings are expected to be constructed tightly. Before the work is covered up, ask to see all the sealing around each of these penetrations. Air plenums are common – these also need to be well sealed to prevent leakage]</p> <p>The following areas of the building envelope shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:</p> <ul style="list-style-type: none"> • Joints around fenestration [glass] and door frames • Junctions between walls and foundations, between walls at building corners, between walls and structural floors or roofs, and between walls and roof or wall panels. • Openings at penetrations of utility services through roofs, walls, and floors • Site-built fenestration [glass] and doors • Building assemblies used as ducts or plenums • Joints, seams, and penetrations of vapor retarders • All other openings in the building envelope
<p>6.2 HVAC</p>	<p>Equipment Efficiencies:</p> <ul style="list-style-type: none"> • Required mechanical equipment efficiency minimum standards are listed for all types of heating and cooling equipment. • Gas-fired and oil-fired force air furnaces with input ratings $\geq 225,000$ Btuh cannot use standing pilot ignition, and must have either power venting or a flue damper. <p>[this provides assurance that the building is starting out with decent equipment efficiency]</p> <p>Load Calculations:</p> <ul style="list-style-type: none"> • Heating and cooling system design load calculations used for sizing systems and equipment are required. <p>[i.e. rules of thumb “per SF” average values, or other seat-of-the-pants methods are not acceptable – ask for a copy of the calculations]</p> <p>Controls:</p> <ul style="list-style-type: none"> • Definition of “Zone:” For the following a “zone” is defined as “a space or group of spaces within a building with heating and cooling requirements that are sufficiently similar so that desired conditions (e.g. temperature can be maintained throughout using a single sensor (e.g. a single thermostat or temperature sensor) • Zone Thermostatic Controls: The supply of heating and cooling energy to each zone shall be individually controlled by thermostatic controls responding to temperatures with the zone. • All zone and loop controllers shall use control methodology that incorporates the application of control error reduction. (this requires either floating control or “integral” (DDC) control) • Dead Band: When used to control both heating and cooling, zone thermostatic control shall be capable of providing a dead band of at least 5 degrees F. Special occupancy or special applications are exempt, such as process control, nursing homes,

data processing, museums, etc.

- **Set Point Overlap Restriction:** For heating and cooling controls within a single zone, positive means (such as limit switches, mechanical stops, or software programming) shall be provided to prevent the heating set point from exceeding the cooling set point minus any proportional band.
- **Off-Hour Controls:** HVAC systems having a design heating or cooling capacity greater than 65,000 Btu/h **[5.4 tons]** and a fan system power greater than 3 /4 hp shall have all of the following off-hour controls:
 - Automatic Shutdown (time control, occupancy control, two-hour manual timer, or interlock with security system activation (unoccupied).
 - Setback Controls (55 degree or lower unoccupied heating setting)
 - Optimum Start Controls **[adjusts start-up time for equipment to be at-temperature just in time for occupancy]**
- **Ventilation and Zone Air Flow System Controls:**
 - All outdoor air supply and exhaust hoods, vents, and ventilators shall be equipped with motorized dampers that will automatically shut when the spaces served are not in use.
 - HVAC systems serving zones that are intended to operate or be occupied non-simultaneously shall be divided into isolation areas. Zones may be grouped into a single isolation areas provided it does not exceed 25,000 SF of conditioned floor areas nor include more than one floor.
 - Each isolation area shall be equipped with independently controlled isolation devices **[motorized dampers]** capable of automatically shutting off the supply of conditioned air and outside air to and exhaust air from the area. For central systems and plants, controls and devices shall be provided to allow stable system and equipment operation for any length of time while serving only the smallest isolation areas served by the system or plant. **[The previous two items will give larger buildings the ability to be cordoned off and heated/cooled in sections if desired for energy savings]**
 - All outdoor air supply and exhaust hoods, vents, and ventilators that serve conditioned spaces shall be equipped with motorized dampers that will automatically shot when the spaces served are not in use - not required if outside air intake or exhaust is 300 CFM or less. **[these are minor air flows]**
 - Maximum damper leakage for these isolation dampers in our climate is 10 CFM per SF of damper size, at 1 in. w.c. pressure. **[the leakage spec assures you a reasonable quality damper]**
- **Ventilation Controls for High-Occupancy Areas:** Systems with outside air capacities greater than 3000 CFM serving areas having an average design occupancy density exceeding 100 people per 1000 SF shall include means to automatically reduce outside air intake below design rates when spaces are partially occupied. Ref ASHRAE 62 and local standards. Not required if acceptable heat recovery is used to pre-condition the raw outside air.

Duct Sealing:

- Seal levels are prescribed in a table, including seal requirements for return air plenums.

As-Built Drawings:

- Required to be accurate, and delivered within 90 days after the date of system acceptance.

O/M Manuals:

- For all equipment and systems provided that require maintenance, the manuals must include:

	<ul style="list-style-type: none"> ➤ Submittal data ➤ Required routine maintenance ➤ HVAC controls system maintenance and calibration information, wiring diagrams, schematics, and control sequence descriptions. ➤ A complete narrative of how each system is intended to operate, including suggested set points. <ul style="list-style-type: none"> • System Balancing: <ul style="list-style-type: none"> ➤ Required, with written report, for all HVAC systems serving zones with a total conditioned areas seceding 5000 SF. ➤ Method used for balancing shall be “proportional balancing” which reduces throttling losses. ➤ For fans greater than 1 hp, fan speed shall be adjusted to meet design flow conditions. [this means changing pulleys] ➤ For pumps over 10 hp, the impeller shall be trimmed if throttling to meet design flows conditions produces more than 5 percent of the nameplate hp. • Commissioning: HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition. For projects larger than 50,000 SF (except warehouses and semi-heated spaces), detailed instructions for commissioning HVAC systems shall be provided by the designer in plans and specifications. [Commissioning is verification that you are getting what you asked for and paid for]
<p>7.2 Service Water Heating</p>	<p>Domestic Hot Water:</p> <ul style="list-style-type: none"> • Hot Water Recirculating or Heat Trace Systems: Controls must automatically turn off the pipe temperature maintenance system during extended periods when hot water is not required. • Maximum Temperature to Lavatory Faucets: 110 degrees F. • Heat traps are required on storage water heaters and storage tanks that don't have recirculating systems. [reduces standby losses from thermal siphoning] <p>Pools:</p> <ul style="list-style-type: none"> • Pool heaters shall not use standing pilots. • Heated pools shall be equipped with a pool cover. Pools heated to more than 90 degrees F shall have a pool cover with a minimum insulation value of R-12. Exception to this is if at least 60 percent heated from site recovered energy or solar energy.
<p>8.2 Power</p>	<p>As-Built Drawings:</p> <ul style="list-style-type: none"> • Required to be accurate, and delivered within 30 days after the date of system acceptance. <p>O/M Manuals:</p> <ul style="list-style-type: none"> • For all equipment and systems provided that require maintenance, the manuals must include: <ul style="list-style-type: none"> ➤ Submittal data

	<ul style="list-style-type: none"> ➤ Required routine maintenance ➤ A complete narrative of how each system is intended to operate.
<p>9.2 Lighting</p>	<p>Automatic Interior Lighting Shutoff:</p> <ul style="list-style-type: none"> • Interior Lighting for buildings 5000 SF and larger shall be controlled with an automatic control device to shut off building lighting in all spaces, either • Time scheduling device • Occupancy Sensor • Signal from another system indicating the area is unoccupied. <p>Space Control:</p> <ul style="list-style-type: none"> • There must be individual controls for the general lighting in each zone, with separate controls for each zone of certain size (2500 SF per zone for a space of 10,000 SF, and a maximum of 10,000 SF per zone for larger spaces.) • Where space controls override the master automatic shutoff, the user override cannot exceed four hours. <p>Outdoor Lighting Efficiency:</p> <ul style="list-style-type: none"> • All outside lighting must be of a minimum efficiency (60 lumens per watt), unless required for health or safety. [this means no incandescent lighting can be used outside] <p>Outdoor Lighting Control:</p> <ul style="list-style-type: none"> • All outdoor lighting, except where lighting is used for security, safety, etc., shall be automatically turned off either by a photo cell or an astronomical time switch, when the lighting is not required. • The amount of interior lighting “Watts per Square Foot” are limited by usage, and form a Lighting Power Budget the designers need to stay within. [Ask for calculations to show that the watts per SF does not exceed the Energy Code Lighting Budget – lighting is a very large component of energy use in most buildings]
<p>10.2 Other Equipment</p>	<p>Electric Motor Efficiency:</p> <ul style="list-style-type: none"> • Minimum efficiency of electric motors is defined in a table. Basis is EPACK-1992 (U.S. Energy Policy Act)