Plumbing Mechanical Sheet Metal Contractors' Alliance
Joint SMACNA & ASHRAE Program
Milwaukee - October 11, 2007

Including Green Requirements In HVAC System Bidding & Contract Documents

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Green Building Defined

A building that provides the specified building performance requirements while minimizing disturbance to and improving the functioning of local, regional, and global ecosystems both during and after its construction and specified service life.

ASTM International, *Standard Terminology for Sustainability Relative to the Performance of Buildings*, ASTM Standard E 2114 – 06a, 2006.

What's In A Name?

- Green Building
- Sustainable Building
- High-Performance Building
- Etc.

21st Century Buildings

- Purpose of a building is to provide a controlled environment for occupants.
- Building is a collection of systems that provide a controlled environment.
- Systems' integration is the key to effective and efficient building operations.
- Buildings will be optimized as a system.
- Traditional approach: optimize building subsystems leaving building suboptimal.
- Building quality will be measured by its ability to efficiently support the activity it houses - not its utility bills.

MEP Systems Establish Environment

U.S. Energy Security

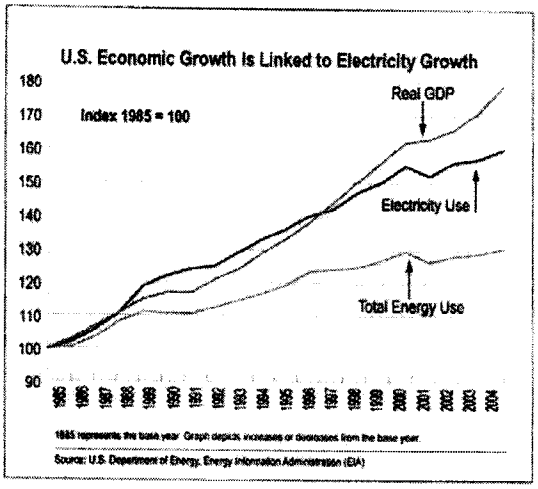
- U.S. economy depends on an adequate & steady supply of energy.
- DOE predicts 40% increase in U.S. energy consumption by 2025.
- Total energy consumption to increase more rapidly than domestic production requiring increased energy imports.
- Continued growing dependence on imported energy represents a major risk to U.S.

U.S. Electricity Demand

- DOE predicts 53% increase in U.S. electrical demand by 2025.
- Growth in demand comes from all sectors: commercial, industrial, & residential.
- 428 gigawatts of new generating capacity is needed to meet growing demand and replace retired generating units.

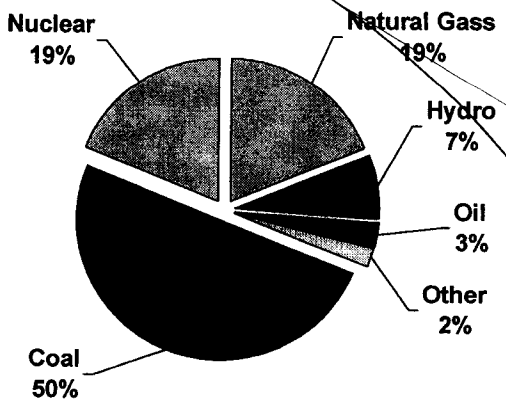
1 Gigawatt is 1 billion (10^9) watts or equivalent to powering 10 million 100-watt light bulbs simultaneously.

GDP Vs. Electricity Growth



Graph Source: Edison Electric Institute

Fuels To Generate Electricity



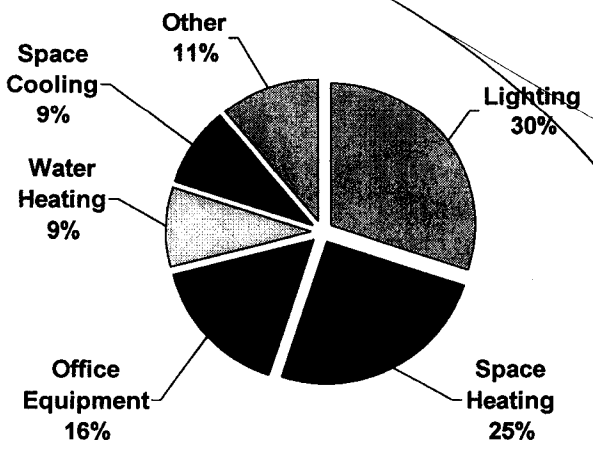
Data Source: U.S. Department of Energy, Energy Information Administration (EIA), 2005 Preliminary Data

Options For Meeting Future Demand For Electrical Energy

- Produce More
- Use Less
- Combination Of Two

Two-Pronged Approach Required

Commercial Building Energy Use



Data Source: U.S. Department of Energy, Energy Energy Efficiency & Renewable Energy (EERE) Building Technologies Program

Future Building Design

Buildings account for forty-eight percent of U.S. energy consumption and generate far more greenhouse gas emissions than any other sector. As architects, we must accept responsibility for our role in creating the built environment. We feel that it is incumbent upon the architecture profession to alter our actions and encourage both our clients and the entire design and construction industry to join us in plotting a course of measurable changes that will improve the quality of life for everyone.

R. K. Stewart, FAIA
Facilitator
AIA Sustainability Summit Task Force

Carbon-Neutral Buildings & Zero Energy Buildings (ZEBs)

- AIA "2030 Challenge" sets the goal for carbon-neutral buildings by 2020.
- ASHRAE plans to create a "Net Zero" guide for building design and construction by 2020.
- U.S. Department of Energy's (DOE) Building Technologies Program has set a goal of "zero-energy buildings" by 2025.

AIA High Performance Building Position Statements

- *Promote sustainable design including resource conservation to achieve a minimum 50 percent reduction from the current level of consumption of fossil fuels used to construct and operate new buildings by the year 2010, and promote further reductions of remaining fossil fuel consumption by 10 percent or more in each of the following five years.*
- *The AIA supports the development and use of rating systems and standards that promote the design and construction of communities and buildings that contribute to a sustainable future.*

Green Rating Systems

- USGBC LEED™
- GBI Green Globes™
- Others

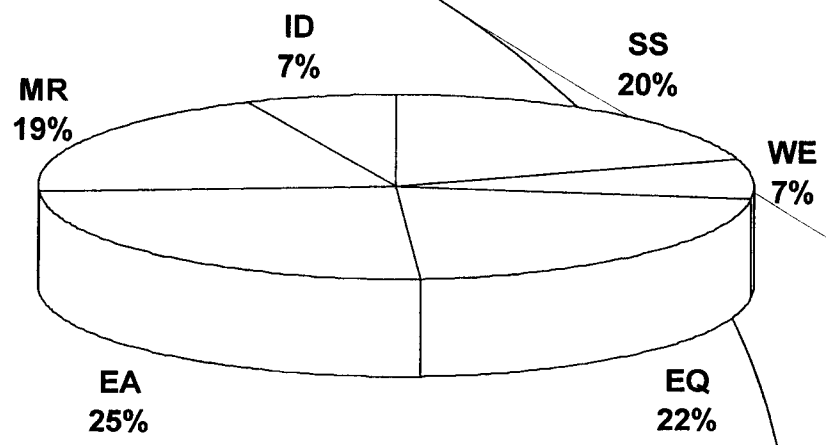
USGBC LEED™ Rating Systems

LEED Designator	Rating System Purpose	Version	
		No.	Date
NC	New Construction & Major Renovations	2.2	2005
CS	Core & Shell	2.0	2006
CI	Commercial Interiors	2.0	2005
EB	Existing Buildings: Upgrades, Operations, & Maintenance	2.0	2005
	Homes (Pilot)	1.1a	2007
	Neighborhood Development (Pilot)		2007
	Retail: New Construction & Major Renovation (Pilot)	2.0	2007
	Schools: New Construction & Major Renovation (Pilot)		2007
	Multiple Buildings & On-Campus Bldg Projects (Pilot)		2007

LEED-NC Categories

Category Designation	Category Name	Possible Points	Percent Total
SS	Sustainable Site	14	20
WE	Water Efficiency	5	7
EA	Energy & Atmosphere	17	25
MR	Materials & Resources	13	19
EQ	Indoor Environmental Quality	15	22
ID	Innovation & Design Process	5	7
Total Possible Points		**69**	**100**

LEED-NC Point Distribution



EA + EQ = 47%

LEED-NC Certification

Certification Level	Points Required	Min Pct Pts Possible For Level
Certified	26 – 32	38%
Silver	33 – 38	48%
Gold	39 – 51	57%
Platinum	52 – 69	75%

Prerequisites Vs. Credits

Energy & Atmosphere Category

EA	P1	Fundamental Commissioning Of Bldg & Energy Systems	------
EA	P2	Minimum Energy Performance	------
EA	P3	Fundamental Refrigerant Management	------
EA	C1	Optimize Energy Performance	1-10
EA	C2	On-Site Renewable Energy	1-3
EA	C3	Enhanced Commissioning	1
EA	C4	Enhanced Refrigerant Management	1
EA	C5	Measurement & Verification	1
EA	C6	Green Power	1
Total Energy & Atmosphere Category Points Possible			17

Sustainable Construction
LEED: Energy & Atmosphere

EA P1 Fundamental Building Commissioning
EA P2 Minimum Energy Performance
EA P3 Fundamental Refrigerant Management
EA C1 Optimize Energy Performance
EA C3 Enhanced Commissioning
EA C4 Enhanced Refrigerant Management
EA C5 Measurement & Verification

Example HVAC System Related Prerequisites & Credits

LEED-NC EA Prerequisite 1
Fund Cx Of Bldg Energy Systems

- Designate individual as the commissioning authority (CxA) to lead, review, and oversee commissioning process.
- CxA to review owner's Project Requirements (OPR) and design team's Basis Of Design (BOD).
- Develop & incorporate Cx requirements in construction documents.
- Develop & implement Cx plan.
- Verify installation & performance of system to be Cx'd.
- Prepare Cx report.

LEED-NC EA Prerequisite 1
Fund Cx Of Bldg Energy Systems
Systems To Be Commissioned

- HVAC&R systems and associated controls.
- Lighting and daylighting controls.
- Domestic hot water systems.
- Renewable energy systems.

LEED-NC EA Prerequisite 2
Minimum Energy Performance Requ'd

- *Design the building envelope, HVAC, lighting, and other systems to maximize energy performance.*
- Design building to comply with both:
  - ASHRAE/IESNA 90.1-2004 mandatory provisions (5.4, 6.4, 7.4, 8.4, 9.4, 10.4).
  - ASHRAE/IESNA 90.1-2004 prescriptive requirements (5.5, 6.5, 7.5, & 9.5) or performance requirements (11).

LEED-NC EA Prerequisite 3
Fundamental Refrigerant Mgt Requ'd

- *For new buildings, specify new HVAC equipment in the base building that uses no CFC refrigerants.*
- *When reusing existing base building HVAC equipment, complete a comprehensive CFC phase-out conversion prior to project completion.*
- CFC phase-out plans that extend beyond the project completion will be considered.

LEED-NC EA Credit 1
Optimize Energy Performance
Options For Achieving Credit

Option	Description	Points Possible
1	Whole Bldg Energy Simulation	1 – 10
2	Prescriptive Compliance Path	4
3	Prescriptive Compliance Path	1

LEED-NC EA Credit 1
Optimize Energy Performance
Option 1 – Whole Building Energy Simulation

Minimum Energy Cost Savings Percentage		Points
New Buildings	Existing Building Renovations	
10.5	3.5	1
14.0	7.0	2
17.5	10.0	3
21.0	14.0	4
24.5	17.5	5
28.0	21.0	6
31.5	24.5	7
35.0	28.0	8
38.5	31.5	9
42.0	35.0	10

LEED-NC EA Credit 3
Enhanced Commissioning

- Prior to start of construction documents phase, appoint independent CxA to lead, review, and oversee Cx process.
- CxA to at least one Cx review:
  - Owner's Project Requirements (OPR)
  - Basis Of Design (BOD)
  - Mid-Design Phase Documents
  - Check Review Comments In Design Documents
- Review contractor submittals for OPR & BOD compliance.
- Develop system O&M documentation for owner.
- Verify training of bldg operating personnel and occupants.
- Involve CxA in reviewing bldg operation within 10 months of substantial completion with bldg operating personnel and occupants.

Commissioning Activities

- Prefunctional Equipment Testing
- Control System Checkout & Testing
- Testing, Adjusting, & Balancing (TAB)
- Functional System Testing
- Operational Training
- Commissioning Outcomes Documentation

LEED-NC EA Credit 4
Enhanced Refrigerant Management

- Objective is to *reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming.*
- Option #1- Do not use refrigerants.
- Option #2 - Select refrigerants & HVAC&R that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. Base bldg HVAC&R equipment must comply with maximum amounts specified in EA Credit 4.

LEED-NC EA Credit 5
Measurement & Verification

- Objective is to *provide for the ongoing accountability of energy consumption over time.*
- *Develop and implement a Measurement & Verification Plan consistent with Option D:Calibrated Simulation (Savings Estimation Method 2), or Option B: Energy Conservation Measure Isolation, as specified in the International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003.*
- *The M&V period shall cover a period no less than one year of post-construction occupancy.*

Indoor Environmental Quality Category

EQ	P1	Minimum IAQ Performance	------
EQ	P2	Environmental Tobacco Smoke (ETS) Control	------
EQ	C1	Outdoor Air Delivery Monitoring	1
EQ	C2	Increased Ventilation	1
EQ	C3.1	Construction IAQ Management Plan: During Construction	1
EQ	C3.2	Construction IAQ Management Plan: Before Occupancy	1
EQ	C4.1	Low-Emitting Materials: Adhesives & Sealants	1
EQ	C4.2	Low-Emitting Materials: Paints & Coatings	1
EQ	C4.3	Low-Emitting Materials: Carpet Systems	1
EQ	C4.4	Low-Emitting Materials: Composite Wood & Agrifiber Products	1
EQ	C5	Indoor Chemical & Pollutant Source Control	1
EQ	C6.1	Controllability Of Systems: Lighting	1
EQ	C6.2	Controllability Of Systems: Thermal Comfort	1
EQ	C7.1	Thermal Comfort: Design	1
EQ	C7.2	Thermal Comfort: Verification	1
EQ	C8.1	Daylight & Views: Daylight 75% Of Spaces	1
EQ	C8.2	Daylight & Views: Daylight 90% Of Spaces	1
Total Indoor Environmental Quality Category Points Possible			15

Sustainable Construction
LEED: Indoor Environ Quality

EQ P1	Minimum IAQ Performance
EQ P2	Environmental Tobacco Smoke (ETS) Control
EQ C1	Outdoor Air Delivery Monitoring
EQ C2	Increased Ventilation
EQ C3.1	Const IAQ Mgt Plan: During Construction
EQ C3.2	Const IAQ Mgt Plan: Before Occupancy
EQ C4.1	Low-Emitting Mtls: Adhesives & Sealants
EQ C4.2	Low-Emitting Mtls: Paints & Coatings
EQ C6.2	Controllability Of Systems: Thermal Comfort
EQ C7.1	Thermal Comfort: Design
EQ C7.2	Thermal Comfort: Verification

Example HVAC System Related Prerequisites & Credits

LEED-NC EQ Prerequisite 1
Minimum IAQ Performance

- *Establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of occupants.*
- *Meet the minimum requirements of Sections 4 through 7 of ASHRAE 62.1-2004, Ventilation for Acceptable Indoor Air Quality.*
- *Mechanical ventilation systems shall be designed using the Ventilation Rate Procedure or the applicable local code, whichever is more stringent.*

LEED-NC EQ Credit 1
Outdoor Air Delivery Monitoring

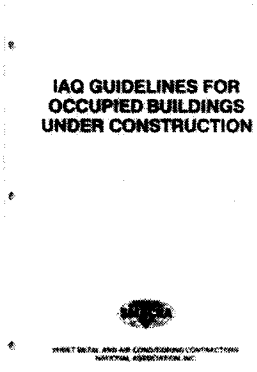
- *Install permanent monitoring systems that can provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements.*
- *Configure all monitoring equipment to generate an alarm when the conditions vary by 10 % or more from setpoint, via either a building automation system to the building operator or via a visual or audible alert to the building occupants.*
- *Install carbon dioxide and airflow measurement equipment and feed information to the Building Automation System (BAS) to trigger corrective action, if applicable.*

Included Explicitly Or Implicitly In HVAC Specifications?

LEED-NC EQ Credit 2
Increased Ventilation

- *Provide additional outdoor air ventilation to improve indoor air quality for improved occupant comfort, well-being, and productivity.*
- For mechanically ventilated spaces: *Increase breathing zone airflow by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2004 as determined by EQ Prerequisite 1.*
- For mechanically ventilated spaces: *Use heat recovery, where appropriate, to minimize additional energy consumption associated with higher ventilation rates.*

LEED-NC EQ Credit 3.1
Const IAQ Mgt Plan: During Construction
Control Measures During Construction



IAQ Guidelines For Occupied Buildings Under Construction, Sheet Metal And Air Conditioning Contractors' Association, Inc., First Edition - November 1995.

LEED-NC EQ Credit 3.1
SMACNA IAQ Guidelines During Construction
Chapter 3: Control Measures

- Contain Work Area
- Modify HVAC Operation
- Reduce Emissions
- Intensify Housekeeping
- Reschedule Work Hours
- Move Occupants

LEED-NC EQ Credit 3.1
Const IAQ Mgt Plan: During Construction
IAQ Plan Considerations

- To achieve credit IAQ plan must meet or exceed exceed requirements of Chapter 3 of SMACNA IAQ Guidelines.
- Success in this area depends on coordination and cooperation among trades as well as GC or CM.
- HVAC contractor should carefully consider these requirements and how they will be met prior to submitting bid or proposal.

LEED-NC EQ Credit 3.1
Const IAQ Mgt Plan: During Construction
Protect On-Site Materials From Moisture

Duct Cleanliness For New Construction, Sheet Metal And Air Conditioning Contractors' Association, Inc., 2000.

LEED-NC EQ Credit 3.1
Const IAQ Mgt Plan: During Construction
Duct & Material ProtectionConsiderations

- Could restrict the delivery and storage of duct and equipment on site.
- Duct and equipment openings may need to be protected when stored or during installation when not being worked on.
- May require closer coordination between fabrication shop and equipment suppliers and the field.

JIT Delivery Vs. Stacking The Floor

LEED-NC EQ Credit 3.1
Const IAQ Mgt Plan: During Construction
Temp Heat/Cool Using Permanent HVAC

- LEED-NC recommends *avoid using permanently installed air handlers for temporary heating/cooling during construction.*
- LEED-NC requires *filter media with a Minimum Efficiency Reporting Value (MERV) of 8 shall be used at each return grille, as determined by ASHRAE 52.2-1999* if permanently installed AHUs are used during construction. *Replace all filtration media prior to occupancy.*
- Consider the impact of early start-up and use of HVAC system on cleaning, filter replacement, equipment warranties, among others.

Early Start-Up Of Permanently Installed HVAC Systems, Sheet Metal And Air Conditioning Contractors' Association, Inc., Undated Position Paper.

LEED-NC EQ Credit 3.2
Const IAQ Mgt Plan: Before Occupancy

- *Reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.*
- Option 1 - Flush-Out
  - Option 1A - Prior To Occupancy
  - Option 1B - Prior To & After Occupancy
- Option 2 - Air Testing
- Flush-out can be used where occupancy is not required immediately upon substantial completion.
- IAQ testing can minimize schedule impacts but may be more costly.

LEED-NC EQ Credit 4.1
Low-Emitting Mtls: Adhesives & Sealants

- *All adhesives and sealants used on the interior of the building (defined as inside of the weatherproofing system and applied on-site) shall comply with the requirement of referenced standards.*
- Adhesives, sealants, and sealant primers must comply with South Coast Air Quality Management District (SCAQMD) Rule #1168.
- Aerosol adhesives must comply with Green Seal Standard for Commercial Adhesives GS-36.
- Included are general construction adhesives, fire stopping sealants, caulking, duct sealants, plumbing adhesives, and others.

LEED-NC EQ Credit 4.1
Low-Emitting Mtls: Adhesives & Sealants
Compliance Recommendations

- Per LEED-NC EQ Credit 4.1: *Specify low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where adhesives and sealants are addressed.*
- Verify that adhesives and sealants specified meet LEED-NC EQ Credit 4.1 requirements. Watch out for defective specs.
- Train procurement, warehouse, and field personnel regarding the required use of low-VOC adhesives and sealants.
- Establish procedures for ensuring that adhesives and sealants delivered to jobsite meet low-VOC requirements and avoid maverick purchases in the field.
- Wrong material could result in rework that impacts cost and schedule.

LEED-NC EQ Credit 4.2
Low-Emitting Mtls: Paints & Coatings
Compliance Recommendations

- Make sure that paints and coatings used on the interior of the building (defined as inside the weatherproofing system and applied on-site) comply with LEED-NC EQ Credit 4.2 requirements.
- Same recommendations as LEED-NC EQ Credit 4.1.
- Since painting may be performed by a subcontractor, HVAC contractor needs to ensure that subcontractor understands and complies with LEED-NC EQ Credit 4.2. HVAC contractor is responsible for its subcontractor's performance.

LEED-NC EQ Credit 5
Indoor Chemical & Pollutant Source Cntrl
Compliance Recommendations

- Design to minimize building occupants to potentially hazardous pollutants.
- Include permanent entryway systems to capture dirt and particulates fro entering building.
- Where hazardous gases or chemicals are used or could be present exhaust spaces in accordance with LEED-NC EQ Credit 5 requirements,
- For mechanically ventilated buildings, provide regularly occupied areas with MERV 13 or better filters for both return and outside air delivered as supply air.
- Ensure that AHUs can accommodate required filter sizes and pressure drops.

LEED-NC EQ Credit 6.2
Controllability Of Sys: Thermal Comfort

- *Provide individual comfort controls for 50% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences.*
- Operable windows can be part of the thermal control strategy.
- *Provide comfort system controls for all shared multi-occupant spaces to enable adjustments to suit group needs and preferences.*
- *Conditions for thermal comfort are described in ASHRAE Std 55-2004 and include air temperature, radiant temperature,air speed and humidity. Comfort system control for the purposed of this credit is defined as the provision of control over at least one of these primary factors in the occupant's local environment.*

LEED-NC EQ Credit 7.1
Thermal Comfort: Design

- Design HVAC systems and the building envelope to meet the requirements of ASHRAE Std 55-2004, *Thermal Comfort Conditions for Human Occupancy.*
- Demonstrate design design compliance in accordance with ASHRAE Std 55-2004 Section 6.1.1

LEED-NC EQ Credit 7.2
Thermal Comfort: Verification

- *Agree to implement a thermal comfort survey of building occupants within a period of 6 to 18 months after occupancy.*
- *Agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the the building.*
- *The plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Std 55-2004.*

LEED-NC MR Credits 2.1 & 2.2
Construction Waste Management

- *Establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals.*
- *Designate a specific area(s) on the construction site for segregated or comingled collection of recycled materials.*
- *Track recycling efforts throughout the construction process.*

LEED-NC MR Credits 2.1 & 2.2
Construction Waste Management
Meeting The Requirements

- Understand the goals set forth by the GC or CM and the HVAC materials covered.
- Know how the GC or CM is going to structure and locate collection facilities. Understand how this will impact your field productivity and address it in your bid or proposal.
- Educate your field personnel about construction waste management and the GC's or CM's construction waste management plan.
- Keep detailed records of the materials you dispose of in the format required by the GC's or CM's waste management plan. Submit disposal records on a regular basis.

Strategies For Construction Waste Minimization

- Order Only What Is Actually Needed
- Minimize Shipping & Packing Materials
- Use Standard Size Products Whenever Possible
- Consider Custom Fabricated Products
- Consider Prefabricating Product Assemblies Off Site

LEED-NC MR Credits 3.1 & 3.2 Materials Reuse

- Objective of this credit is to *reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, therby reducing impacts associated with extraction and processing of virgin resources.*
- *Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation.*

LEED-NC MR Credits 4.1 & 4.2 Recycled Content

- Objective of this credit is to *increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.*
- *Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation.*

LEED-NC MR Credits 5.1 & 5.2 Regional Materials

- Objective of this credit is to *increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous sources and reducing the environmental impacts resulting from transportation.*
- *Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation.*
- Voluntary use of regional HVAC materials will not contribute to LEED-NC certification but they will reduce shipping costs and enhance the sustainability of the project.

Is Green = Lean?

- Lean construction is all about removing waste from the HVAC contracting firm's business and construction processes.
- Green construction is aimed at removing waste from the construction process and adds an environmental dimension to lean construction.

LEED-NC ID Credit 2
LEED Accredited Professional

- Objective is to *support and encourage the design integration required by a LEED-NC green building project and to streamline the application and certification process.*
- *At least on principal participant of the project team shall be a LEED Accredited Professional (AP).*
- Not required but LEED-AP personnel can be valuable to HVAC contracting firm from both an operations and a management standpoint.

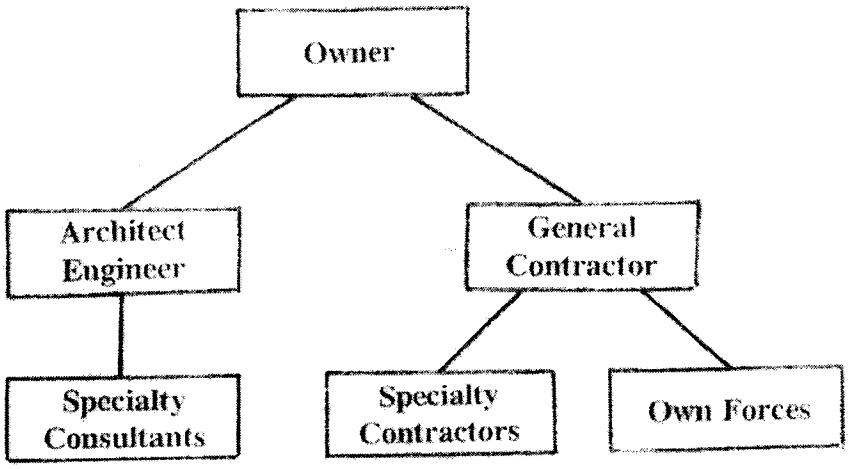
Office & Field Personnel

- Biggest problem encountered by HVAC contracting firms on green building projects is understanding the requirements and how those requirements impact both direct construction costs and project overhead.
- Responsible for work required by the green building rating system not explicitly noted in the HVAC plans & specs.
- Knowledgeable office and field personnel will help the HVAC contracting firm avoid mistake of overlooking green-related requirements in bid or proposal as well as during construction.
- GCs & CMs prefer working with specialty contractors knowledgeable in green building requirements. Reduces their risk.

Identifying Green Requirements

- Green project requirements can be required in a variety of places in the contract documents.
- Green project requirements will normally be found in the project specifications.
- Green requirements may also be incorporated into the project requirements and owner-contractor agreement by reference to local laws, codes, or regulations that include green building requirements and require that the building be certified or certifiable as a green building.

DBB Project Delivery System



"Flow-Through Clause"

AIA A201-1987 Paragraph 5.3.1

By appropriate agreement, written where legally required for validity, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by the terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities which the Contractor, by these Documents, assumes toward the Owner and Architect.

Contract Documents Defined AIA A201/Paragraph 1.1

*The **Contract Documents** consist of this Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, **Specifications**, addenda issued prior to execution of this Agreement, other documents listed in this Agreement and Modifications issued after execution of this Agreement; **these form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein**.*

Order Of Precedence

- Construction contracts sometimes contain an order of precedence in the event that there is a conflict between contract documents.
- The order of precedence determines the requirements of which of the conflicting documents take precedence.
- AIA documents do not include an order of precedence but AGC documents do.

Specifications Defined
AIA A201/Paragraph 1.1.6

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards and workmanship for the Work, and performance of related services.

Specification Types

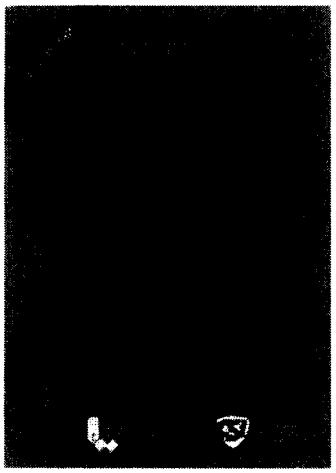
- Descriptive (Open)
- Prescriptive (Closed)
- Performance

Avoid Mixed Green Specifications

Avoid Performance Specification Problems

Always Ensure That There Are Measurable Performance Criteria Specified

CSI 1995 MasterFormat™



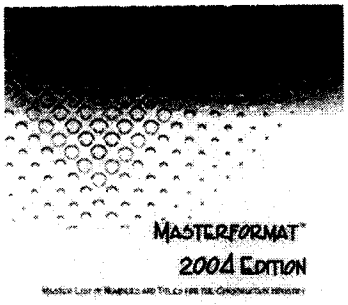
- Division 1 General Requirements
- Division 2 Site Construction
- Division 3 Concrete
- Division 4 Masonry
- Division 5 Metals
- Division 6 Wood & Plastics
- Division 7 Thermal & Moisture Protection
- Division 8 Doors & Hardware
- Division 9 Finishes
- Division 10 Specialties
- Division 11 Equipment
- Division 12 Furnishings
- Division 13 Special Construction
- Division 14 Conveying systems
- Division 15 Mechanical
- Division 16 Electrical

No Specific Location For Green-Related Requirements

CSI 1995 MasterFormat™ Commissioning Requirements

- **Division 1 - Execution Requirements**
  - **01700 Execution Requirements**
    - 01750 Starting & Adjusting
    - 01770 Closeout Procedures
    - 01780 Closeout Submittals
  - 01800 Facility Operation
    - 01810 Commissioning
    - 01820 Demonstration & Training
    - 01830 Operation & Maintenance
- **Division 15 - Mechanical**
  - 15900 Automatic Controls
    - 15950 Testing, Adjusting, & Balancing

Construction Specifications Institute MasterFormat Background



- The Construction Specifications Institute (CSI) is a professional organization whose purpose is to promote better organization and communication of construction project information.
- *MasterFormat* is a trademark of CSI.
- *MasterFormat* is a list of numbers and titles for organizing information about construction requirements, products, and activities into a standard sequence.
- Current *MasterFormat* edition is the 2004 edition.
- *MasterFormat* organizes products and information into 5 groups and 33 major divisions (Level 1 titles).
- Sixteen division format was first introduced in 1963 and was expanded to 49 (16 for future use) in the 2004 edition.

CSI 2004 MasterFormat™

Procurement & Contracting Requirements Group

00 10 00	Solicitation
00 20 00	Instructions For Procurement
00 30 00	Available Information
00 40 00	Procurement Forms & Supplements
00 50 00	Contracting Forms & Supplements
00 60 00	Project Forms
00 70 00	Conditions Of Contract
00 80 00	Revisions, Clarifications, & Modifications

Procurement & Contracting Requirements Group Consists Of Only Division 00 – Procurement & Contracting

CSI 2004 MasterFormat™

Division 00 - Procurement & Contracting

00 62 23	Construction Waste Diversion Form
00 62 34	Recycled Content Of Materials Form

CSI 2004 MasterFormat™ Speicifcations Group

General Requirements Subgroup

01 10 00	Summary
01 20 00	Price & Payment Procedures
01 30 00	Administrative Requirements
01 40 00	Quality Requirements
01 50 00	Temporary Facilities & Controls
01 60 00	Product Requirements
01 70 00	Execution & Closeout Requirements
01 80 00	Performance Requirements
01 90 00	Life Cycle Activities

General Requirements Subgroup Consists Of Only Division 01 – General Requirements

CSI 2004 MasterFormat™
Division 01 - General Requirements
Explicit Green Project Requirements

01 33 29	Sustainable Design Reporting
01 74 19	Construction Waste Mgt & Disposal
01 78 53	Sustainable Design Closeout Documentation
01 81 13	Sustainable Design Requirements
01 81 16	Facility Environmental Requirements
01 81 19	Indoor Air Quality Requirements

CSI 2004 MasterFormat™
Division 01 - General Requirements
Temporary Barriers

01 56 13 Temporary Air Barriers

01 56 16 Temporary Dust Barriers

01 56 19 Temporary Noise Barriers

CSI 2004 MasterFormat™
Division 01 - General Requirements
Building Performance Requirements

01 81 00 Facility Performance Requirements

01 82 00 Facility Substructure Performance Requirements

01 83 00 Facility Shell Performance Requirements

01 84 00 Interiors Performance Requirements

01 85 00 Conveying Equipment Performance Requirements

01 86 00 Facility Services Performance Requirements

01 87 00 Equipment & Furnishings Performance Requirements

01 88 00 Other Facility Construction Performance Requirements

01 89 00 Site Construction Performance Requirements

CSI 2004 MasterFormat™
Division 01 - General Requirements
Building Commissioning Requirements

01 91 13 General Commissioning Requirements
01 91 16 Facility Substructure Commissioning
01 91 19 Facility Shell Commissioning
01 91 23 Interiors Commissioning

Commissioning Requirements
Common To Multiple Divisions

CSI 2004 MasterFormat™ Specifcations Group

Facility Services Subgroup

Division 21	Fire Suppression
Division 22	Plumbing
Division 23	HVAC
Division 24	*Reserved For Future Expansion*
Division 25	Integrated Automation
Division 26	Electrical
Division 27	Communications
Division 28	Electronic Safety & Security

2004 CSI MasterFormat™ Facility Services Subgroup

Division 21	Fire Suppression
Division 22	Plumbing
Division 23	HVAC
Division 25	Integrated Automation
Division 26	Electrical
Division 27	Communications
Division 28	Electronic Safety & Security

1995 CSI MasterFormat™ Divisions 13, 15, & 16

2004 CSI MasterFormat™

Division 23 – HVAC

CSI Level 2 Content

23 00 00	HVAC General Requirements
23 10 00	Facility Fuel Systems
23 20 00	HVAC Piping & Pumps
23 30 00	HVAC Air Distribution
23 40 00	HVAC Air Cleaning Devices
23 50 00	Central Heating Equipment
23 60 00	Central Cooling Equipment
23 70 00	Central HVAC Equipment
23 80 00	Decentralized HVAC Equipment

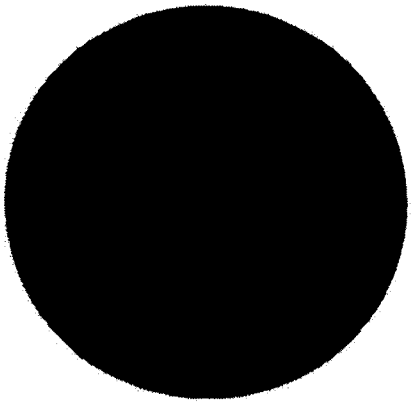
CSI 2004 MasterFormat™
Division 23 - HVAC
HVAC Commissioning Requirements

23 05 93 Testing, Adjusting, and Balancing for HVAC

23 08 00 Commissioning of HVAC

General Commissioning Requirements Are Provided In 01 91 00

2004 CSI MasterFormat™
Division 25 – Integrated Automation
Relationship To Other CSI Divisions



21 Fire Suppression
22 Plumbing
23 HVAC
26 Electrical
27 Communication
28 Safety & Security
11 Facility Systems & Equip
14 Conveying Equipment

Know "Spec"Requirements

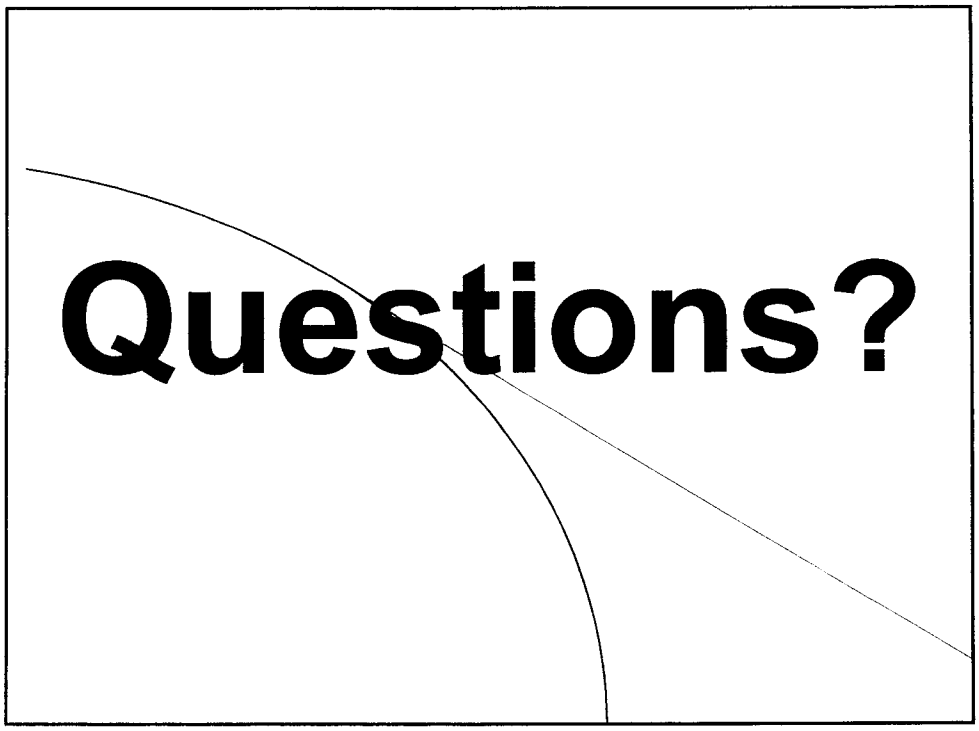
Education is what you get when you read the specs …

Experience is what you get when you don't …

Green Requirements May Not Always Be Where You Think They Are Going To Be

What Happens If Green Certification Specified Is Not Achieved?

Who Is To Blame And What Are The Damages?


Questions?