HVAC Contractor Defined

HVAC contractor is the firm that is responsible for the installation for the complete HVAC system in accordance with the scope of work defined by the contract documents.
HVAC Contractor Responsibilities

- Planning The Installation
- Procuring Materials & Equipment
- Determining Means & Methods
- Performing The Installation
- System Startup & Commissioning
Typical Project Organization

- Owner
  - General Contractor
    - Roofing Contractor
    - HVAC Contractor
    - Electrical Contractor
      - Piping Contractor
      - Insulating Contractor
      - TAB Contractor
      - Controls Contractor
    - Subcontractor (1st Tier Subcontractor)
      - Subsubcontractor (2nd Tier Subcontractor)
The purpose of the BSRM is to assist the HVAC contractor in the preparation of its bid, the designer in the preparation of the construction documents including plans and specifications, and the owner in the preparation of bid and contract documents.
Use OF HVAC BSRM: Owner & Designer Outcomes

- Ensure complete HVAC bid package.
- More accurate bids.
- Smaller bid spread.
- Increased installation quality.
- More efficient installation.
- Reduced changes & disputes.
- Greater value.
Use OF HVAC BSRM: HVAC Contractor Outcomes

- Identify administrative and technical requirements that could impact the cost of performing the work.
- Identify potential problem areas to avoid.
- Prepare competitive bids that are complete that address all of the contract requirements.
- Reduce contractual and construction risk.
- Improve profitability.
HVAC BSRM Divisions

Division 00  Procurement & Contracting Requirements
Division 01  General Requirements
Division 23  Heating, Ventilating, & Air Conditioning
HVAC BSRM Parts

Part I  Administrative Requirements
Part II  Technical Requirements
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>23 00 00</td>
<td>HVAC System Requirements</td>
</tr>
<tr>
<td>23 10 00</td>
<td>Facility Fuel Systems</td>
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<td>HVAC Air Cleaning Devices</td>
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<tr>
<td>23 50 00</td>
<td>Central Heating Equipment</td>
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<tr>
<td>23 60 00</td>
<td>Central Cooling Equipment</td>
</tr>
<tr>
<td>23 70 00</td>
<td>Central HVAC Equipment</td>
</tr>
<tr>
<td>23 80 00</td>
<td>Decentralized HVAC Equipment</td>
</tr>
</tbody>
</table>
What Are Specifications?

Specifications are written instructions concerning project requirements.

Drawings show what is to be built.

Specifications describe:
- How the project is to be constructed.
- What results are to be achieved.
The Drawings are the graphic and pictorial portions of the Contract Documents, wherever located and whenever issued, showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules and diagrams.
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.
Specifications “Specify”
Technical Requirements

- Materials
- Workmanship
- Operating Characteristics
- Other Characteristics
Types Of Specifications

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

Avoid Mixed Specifications
Prescriptive Specification

The traditional method of specifying materials or techniques found in design-bid-build documents. The range of acceptable products, manufacturers, and techniques, to be adhered to by the builder is stipulated in detail. Prescriptive specifications are often used by a design-builder to contract with trade contractors and vendors.

Performance Specification

A specification expressed in terms of an expected outcome or acceptable performance standard. Often is used in design-build criteria to articulate the owner’s requirements.

Avoid Performance Specification Problems

Always Ensure That There Are Measurable Performance Criteria Specified
Codes & Standards

- Shorthand way of requiring minimum industry requirements.
- Codes and standards are often unique to each specification section.
- Codes and standards often available for all three specification parts: general, products, & execution.
- Know and understand the codes and standards.
Impact Of “Specs”

- Cost
- Schedule
- Quality

Faster - Better - Cheaper
Construction Quality: How Is It Defined?

Quality is conformance to established requirements.

Construction Industry Institute (CII), Quality Management Task Force definition.

Quality Is Determined By The Contract Documents
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.
Construction Contract

- Owner-Contractor Agreement
- Contract Conditions:
  - General
  - Supplemental
  - Special
- Drawings
- Specifications
- Addenda Issued Prior To Contract
- Other Documents Listed In Agreement
- Modifications Issued After Contract
Coordination Between Drawings & Specifications

- Drawings and specifications are meant to be complementary.
- What is called for by one is understood to be required by the other.
- Conflicts often resolved through document order of precedence included in the contract.
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. AGC documents do.
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
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
What Makes A Good “Spec”? 

- Project Specific
- Accurate & Consistent
- Up To Date
- Concise Language
- Coordinated With Drawings
Know “Spec” Requirements

Education is what you get when you read the specs …

Experience is what you get when you don’t …
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.


*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.
Superseded CSI 1995 MasterFormat™
Former 16 Division Format

- 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

Old Divisions 15 & 16 = New Facility Services Subgroup
### 2004 CSI MasterFormat™ Hierarchy

**Example: Rectangular Metal Ducts**

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>LEVEL</th>
<th>EXAMPLE</th>
<th>NUMBER</th>
<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>Group</td>
<td>---</td>
<td>---</td>
<td>Specifications</td>
<td></td>
</tr>
<tr>
<td>Subgroup</td>
<td>---</td>
<td>---</td>
<td>Facility Services</td>
<td></td>
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<tr>
<td>Division</td>
<td>1</td>
<td>23</td>
<td>HVAC</td>
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<td>Section</td>
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<td>23 31 00</td>
<td>HVAC Ducts &amp; Casings</td>
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<td>Sub-Subsection</td>
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<td>23 31 13.13</td>
<td>Rectangular Metal Ducts</td>
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<tr>
<td>User Defined</td>
<td>5</td>
<td>23 31 13.13.XYZ</td>
<td>Internal Use (e.g. Acctg)</td>
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</table>

**1995 CSI MasterFormat™ = 15810**
Construction Specifications Institute
Standard Specification Groups

- Procurement & Contracting Requirements Group
  - Procurement & Contracting Requirements (Division 00)

- Specifications Group
  - General Requirements Subgroup (Division 01)
  - Facility Construction Subgroup (Divisions 02 - 19)
  - Facility Services Subgroup (Divisions 20 - 29)
  - Site & Infrastructure Subgroup (Divisions 30 - 39)
  - Process Equipment Subgroup (Divisions 40 - 49)
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
General Requirements Subgroup Consists Of

Only Division 01 – General Requirements
Construction Contract Chain

Diagram:
- Owner
  - Owner-General Contractor Agreement
  - General Contractor (Prime Contractor)
    - General Contractor-Subcontractor Agreement
      - Subcontractor (1st Tier)
        - Subcontractor-Subsubcontractor Agreement
          - Subsubcontractor (2nd Tier)
        - Subcontractor-Supplier Agreement
          - Supplier
“Flow-Through Clause”
AIA A201/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.
CSI 2004 MasterFormat™ Specifications Group
Facility Construction Subgroup

Division 02  Existing Conditions
Division 03  Concrete
Division 04  Masonry
Division 05  Metals
Division 06  Wood, Plastics, & Composites
Division 07  Thermal & Moisture Protection
Division 08  Openings
Division 09  Finishes
Division 10  Specialties
Division 11  Equipment
Division 12  Furnishings
Division 13  Special Construction
Division 14  Conveying Equipment

Architectural Sheet Metal
CSI 2004 MasterFormat™ Specifications 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

*MasterFormat™ Breakout = Opportunity*
2004 CSI MasterFormat™
Division 21 – Fire Suppression
CSI Level 2 Content

21 00 00  Fire Suppression General Requirements
21 10 00  Water-Based Fire Suppression System
21 20 00  Fire-Extinguishing Systems
21 30 00  Fire Pumps
21 40 00  Fire-Suppression Water Storage
2004 CSI MasterFormat™
Division 22 – Plumbing
CSI Level 2 Content

22 00 00  Plumbing General Requirements
22 10 00  Plumbing Piping & Pumps
22 30 00  Plumbing Equipment
22 40 00  Plumbing Fixtures
22 50 00  Pool & Fountain Plumbing Systems
22 60 00  Gas & Vacuum Systems For Laboratory & Healthcare Facilities
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>23 00 00</td>
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</tr>
<tr>
<td>23 80 00</td>
<td>Decentralized HVAC Equipment</td>
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</tbody>
</table>
SMACNA Guide Specifications Under Development

23 31 13  Metal Ducts
23 33 13  Dampers
23 33 19  Duct Silencers
23 33 23  Turning Vanes
23 33 33  Duct Mtd Access Doors
23 33 43  Flexible Connectors
23 33 46  Flexible Ducts
2004 CSI MasterFormat™
Division 25 – Integrated Automation
CSI Level 2 Content

25 00 00 Integrated Automation General Requirements
25 10 00 Integrated Automation Network Equipment
25 30 00 Integrated Automation Instrumentation & Terminal Devices
25 50 00 Integrated Automation Facility Controls
25 90 00 Integrated Automation Control Sequences

HVAC Contractor Opportunity
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 *
Words For Today ...

Convergence & Interoperability

New Challenge: Systems Integration
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
Open Architecture Control Systems: LonMark & BACnet

ZigBee (IEEE Std 802.15.4) Wireless Bldg Controls

**Way Beyond ‘The Clapper’**

As its name implies, ZigBee sensors and switches build a network of appliances that can talk to each other, and to a central computer. This technology is less expensive than Wi-Fi or Bluetooth, and can be used to monitor and adjust the temperature, check whether a door is open, or turn on or off appliances.

**Air Traffic Control**

<table>
<thead>
<tr>
<th>Technology</th>
<th>Battery Life</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>WiFi</td>
<td>1-3 hours</td>
<td>Internet browsing, PC networking, video monitors</td>
</tr>
<tr>
<td>Bluetooth</td>
<td>4-8 hours</td>
<td>Hands-free cell phones, headsets, wireless print</td>
</tr>
<tr>
<td>ZigBee</td>
<td>2-3 years</td>
<td>Wireless switches and sensors, meter readings</td>
</tr>
</tbody>
</table>

**Environmental use**

Scientists planted sensors to monitor nesting conditions of Least’s storm petrels, left, a critically observed seabird.

**Agricultural use**

A vineyard installed sensors that track climate changes to help predict when certain grapes are ready to pick.
Mitsubishi “iGlassware”

How it Works...
System monitors fluid level of glasses through wireless connection and alerts wait staff when to ask for new drink order.

Mitsubishi Electric Research Laboratories (MERL)
http://www.merl.com/projects/iGlassware/
26 00 00 Electrical General Requirements
26 10 00 Medium-Voltage Electrical Distribution
26 20 00 Low-Voltage Electrical Transmission
26 30 00 Facility Electrical Power Generating & Storing Equipment
26 40 00 Electrical & Cathodic Protection
26 50 00 Lighting
Division 27 – Communications

CSI Level 2 Content

27 00 00 Communications General Requirements
27 10 00 Structured Cabling
27 20 00 Data Communications
27 30 00 Voice Communications
27 40 00 Audio-Video Communications
27 50 00 Distributed Communications & Monitoring Systems
2004 CSI MasterFormat™
Division 28 – Electronic Safety & Security
CSI Level 2 Content

28 00 00  Electronic Safety & Security General Requirements
28 10 00  Electronic Access Control & Intrusion Detection
28 20 00  Electronic Surveillance
28 30 00  Electronic Detection & Alarm
28 40 00  Electronic Monitoring & Control
CSI 2004 MasterFormat™ Specifications Group
Site & Infrastructure Subgroup

Division 31  Earthwork
Division 32  Exterior Improvements
Division 33  Utilities
Division 34  Transportation
Division 35  Waterway & Marine Construction
<table>
<thead>
<tr>
<th>Division</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>Process Integration</td>
</tr>
<tr>
<td>41</td>
<td>Material Processing &amp; Handling Equipment</td>
</tr>
<tr>
<td>42</td>
<td>Process Heating, Cooling, &amp; Drying Equipment</td>
</tr>
<tr>
<td>43</td>
<td>Process Gas &amp; Liquid Handling, Purification, &amp; Storage Equipment</td>
</tr>
<tr>
<td>44</td>
<td>Pollution control Equipment</td>
</tr>
<tr>
<td>45</td>
<td>Industry-Specific Manufacturing Equipment</td>
</tr>
<tr>
<td>46</td>
<td>Reserved For Future Use</td>
</tr>
<tr>
<td>47</td>
<td>Reserved For Future Use</td>
</tr>
<tr>
<td>48</td>
<td>Electrical Power Generation</td>
</tr>
</tbody>
</table>

**Industrial Sheet Metal**
Standard Specification Sections

- A specification section covers one or more segments of a project.
- Specification sections are included as needed to meet the project requirements.
CSI 2004 MasterFormat™ Specifications Group

Example Specification Section

23 64 00 Packaged Water Chillers
   23 64 13 Absorption Chillers
      23 64 13.13 Direct-Fired Absorption Chillers
      23 64 13.16 Indirect-Fired Absorption Chillers
   23 64 16 Centrifugal Water Chillers
   23 64 23 Scroll Water Chillers
   23 64 26 Rotary-Screw Water Chillers
CSI MasterFormat™ Intent

- It was never CSI’s intention for MasterFormat™ to be arranged to correspond with specialty contractor and trade assignments.*
- The purchasing specialty contractor and the installing trade are not relevant to MasterFormat™ organization.
- The purpose of the MasterFormat™ organization is to link construction requirements between complementary documents.

MasterFormat’s organizational structure used in a project manual does not imply how the work is assigned to various design disciplines, trades, or subcontractors. MasterFormat is not intended to determine which particular elements of the project manual are prepared by a particular discipline. Similarly, it is not intended to determine what particular work required by the project manual is the responsibility of a particular trade. A particular discipline or trade is likely to be responsible for subjects from multiple Divisions, as well as from multiple Subgroups.

SMACNA Contractor Opportunity Hierarchy

- Air Distribution Contractor
- HVAC System Contractor
- Mechanical System Contractor
- Environmental System Contractor
Air Distribution Contractor
Scope Of Services

- Sheet Metal:
  - Fabrication
  - Installation

- Air Distribution Equipment:
  - Procure
  - Install

- HVAC Dry Systems (Portion Division 23)
- Second Tier Subcontractor
- Business As Usual
HVAC System Contractor
Scope Of Services

- Air Distribution:
  - Sheet Metal
  - Air Distribution Equipment
- Piping
- Insulation
- Equipment (Wet)
- Water Treatment
- HVAC Controls
- Test & Balance

Self Perform Versus Subcontract
HVAC System Contractor: Advantages

- Establishes Firm As HVAC Expert
- Perform All Of CSI Division 23:
  - Greater Control Of Scope
  - Less Scope Overlaps & Gaps
- Higher On Food Chain:
  - First Tier Subcontractor
  - Closer To $’s
- Potential Higher Profits
- Greater Control Of Schedule & Work Sequence
- More Project Opportunities
- More After-Installation Service Opportunities
HVAC System Contractor: Disadvantages

- Increased Contract Size & Scope
- Subcontract Procurement & Contracting
- Subcontract Management
- Wet-Side Equipment Procurement
- Multiple Trade Management
- System Performance Risk
Mechanical Systems Contractor

- HVAC (Division 23)
- Plumbing (Division 22)
- Fire Suppression (Division 21)

Advantages & Disadvantages
Same As HVAC Contractor
Environmental Systems Contractor
Scope Of Services

- **Option #1:**
  - HVAC Systems Contractor (Division 23)
  - Integrated Automation (Division 25)

- **Option #2:**
  - Mechanical Systems Contractor:
    - HVAC (Division 23)
    - Plumbing (Division 22)
    - Fire Suppression (Division 21)
  - Integrated Automation (Division 25)
Mechanical Systems Contractor
Evolving From The Dry Side

For Starters:
- Self-Perform Your Traditional Work
- Subcontract Other Work

Gain Expertise:
- Bidding Subcontracts
- Forming Subcontracts
- Managing Subcontracts

Profitably Expand Your Firm’s Scope Of Services
2004 CSI MasterFormat™
Scope Expansion Opportunities
Division 05 - Metals

05 10 00  Structural Metal Framing
05 20 00  Metal Joists
05 30 00  Metal Decking
05 40 00  Cold-Formed Metal Framing
05 50 00  Metal Fabrications
05 70 00  Decorative Metal
2004 CSI MasterFormat™
Scope Expansion Opportunities
Division 07 - Thermal & Moisture Protection

07 15 00  Sheet Metal Waterproofing
07 27 16  Sheet Metal Membrane Air Barriers
07 31 16  Metal Shingles
07 32 19  Metal Roof Tiles
07 41 13  Metal Roof Panels
07 42 13  Metal Wall Panels
07 46 16  Aluminum Siding
07 46 19  Steel Siding
07 61 00  Sheet Metal Roofing
07 62 00  Sheet Metal Flashing & Trim
07 63 00  Sheet Metal Roofing Accessories
2004 CSI MasterFormat™
Scope Expansion Opportunities
Division 07 - Thermal & Moisture Protection

07 71 00  Roof Specialties

- 07 71 13  Manufactured Copings
- 07 71 16  Manufactured Counterflushing Systems
- 07 71 19  Manufactured Gravel Stops & Facias
- 07 71 23  Manufactured Gutters & Downspouts
- 07 71 26  Reglets
- 07 71 29  Manufactured Roof Expansion Joints
- 07 71 33  Manufactured Scuppers
## 2004 CSI MasterFormat™
### Scope Expansion Opportunities
#### Division 07 - Thermal & Moisture Protection

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>07 72 00</td>
<td>Roof Accessories</td>
</tr>
<tr>
<td>07 72 13</td>
<td>Manufactured Curbs</td>
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<tr>
<td>07 73 23</td>
<td>Relief Vents</td>
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<td>07 72 26</td>
<td>Ridge Vents</td>
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<tr>
<td>07 72 33</td>
<td>Roof Hatches</td>
</tr>
<tr>
<td>07 72 36</td>
<td>Smoke Vents</td>
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<tr>
<td>07 72 46</td>
<td>Roof Walkways</td>
</tr>
<tr>
<td>07 73 53</td>
<td>Snow Guards</td>
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<tr>
<td>07 72 63</td>
<td>Waste Containment Assemblies</td>
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<tr>
<td>07 86 00</td>
<td>Smoke Seals</td>
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<td>07 87 00</td>
<td>Smoke Containment Barriers</td>
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</tbody>
</table>
2004 CSI MasterFormat™
Scope Expansion Opportunities
Division 8 - Openings

08 90 00  Louvers & Vents
  08 91 00  Louvers
  08 92 00  Louvered Equipment Enclosures
  08 95 00  Vents
2004 CSI MasterFormat™
Scope Expansion Opportunities
Division 10 - Specialties

10 22 00  Partitions
10 26 00  Wall & Door Protection
10 51 00  Lockers
10 71 13  Exterior Sun Control Devices
10 73 00  Protective Covers
10 74 00  Manufactured Exterior Specialties
10 82 00  Grills & Screens
2004 CSI MasterFormat™
Scope Expansion Opportunities
Division 14 - Conveying Equipment

14 91 00 Facility Chutes
  14 91 13 Coal Chutes
  14 91 23 Escape Chutes
  14 91 33 Laundry & Linen Chutes
  14 91 82 Trash Chutes
Questions?