

ARCHITECTURAL METAL PRODUCTS

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NAAMM — AMP 555-92  
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CODE OF STANDARD PRACTICE  
FOR THE  
ARCHITECTURAL METAL INDUSTRY  
(Including Miscellaneous Iron)

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# **CODE OF STANDARD PRACTICE FOR THE ARCHITECTURAL METAL INDUSTRY**

**(Including Miscellaneous Iron)**

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**NATIONAL ASSOCIATION OF ARCHITECTURAL METAL MANUFACTURERS**

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## **FOREWORD**

To prepare this first Code of Standard Practice for the Architectural Metal Industry, the National Association of Architectural Metal Manufacturers assembled a team of writers and reviewers whose combined experience in the architectural metal industry represents over 500 years. This experience combined with the input from other members of the Association has resulted in a document representing current industry practices which include estimating, detailing, manufacturing, fabricating, assembling and erecting of the materials used.

These industry practices may be incorporated by reference in contract documents; or in the absence of specifications to the contrary, when existing trade practices are considered in contractual relationships, these industry practices may be used in the interpretation of contracts involving architectural metals.

The Association hopes that the guidance provided by this Code from design through construction will produce economical and efficient use of design time, materials and labor so that all parties to the contract will benefit.

The practices defined herein are commonly accepted standards of the architectural metal industry although there may be some local practices that differ. The material contained herein is not necessarily suitable for all general or any particular uses. It does not provide freedom for infringing on any patent(s).

The use of this Code of Standard Practice for the Architectural Metal Industry is not intended to be a substitute for the judgement of an experienced architect or engineer in achieving a specific design requirement.

The Association does not assume responsibility for errors or oversights in the information published herein, nor for use of the information published, nor for incorporating such information in the preparation of contract documents.

## **ACKNOWLEDGMENTS**

For the preparation of this first Code of Standard Practice for the Architectural Metal Industry, the National Association of Architectural Metal Manufacturers recognizes the efforts of and expresses its appreciation to the following:

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Because architectural metal fabricators and structural steel fabricators work together on many projects, portions of this Code are based on the American Institute of Steel Construction's Code of Standard Practice. The AISC Code, first issued in 1924, has many sections applicable to both industries. NAAMM appreciates the permission of AISC to use like or similar wording from parts of their Code.

NAAMM thanks the Institute of the Ironworking Industry (I.I.I.) for their generous support in the development of the Code and thanks John J. McMahon, Executive Director of the I.I.I., for his input into the Code.

# **CODE OF STANDARD PRACTICE for the ARCHITECTURAL METAL INDUSTRY**

## **SECTION 1. GENERAL PROVISIONS**

### **1.1. SCOPE**

The practices defined herein have been reviewed by a peer committee of the architectural metal fabricating Industry. These trade practices for fabrication, installation and erection of the industry products will be used unless there are differing instructions in the contract documents. This Code of Standard Practice, as revised to date, defines and sets forth accepted norms of good practice.

### **1.2. DEFINITIONS**

**AISC Code** - The Code of Standard Practice for Steel Buildings and Bridges as adopted by the American Institute of Steel Construction.

**ANSI** - American National Standards Institute.

**Architect/Engineer** - The owner's designated representative with full responsibility for the design and integrity of the structure.

**Architectural Metal** - Metal Fabrications, Ornamental Metals, Miscellaneous Iron, Sheet Metal Fabrications, Expansion Joint Cover Assemblies, and numerous other metal products (See Section 2 and Commentary).

**ASTM** - American Society for Testing and Materials.

**AWS Code** - The Structural Steel Welding Code (AWS D1.1) as adopted by the American Welding Society.

**CODE** - The Code of Standard Practice for the Architectural Metal Industry as adopted by the National Association of Architectural Metal Manufacturers.

**CSI** - Construction Specifications Institute

**Construction Manager** - The individual or organization designated by the owner to issue contracts for the construction of the project and to purchase materials.

**Contract Documents** - The documents, including plans and specifications, which define the responsibilities of the parties involved in bidding, purchasing, supplying, and installing architectural metals.

**Contractor** - See General Contractor.



**Drawings** - See Plans, Erection Drawings, and Shop Drawings.

**Erection Drawing** - Drawings prepared by the fabricator for the field erection or installation of his product.

**Erector** - Party responsible for the installation of architectural metal products. (Sometimes referred to as Installer)

**Fabricator** - The party responsible for furnishing fabricated architectural metal products.

**General Contractor** - The individual or organization with whom the owner or the construction manager has contracted to assume full responsibility for the construction of the structure.

**Installer** - See Erector.

**III** - Institute of the Ironworking Industry.

**MBMA** - Metal Building Manufacturers Association.

**Mill Material** - Steel mill products ordered expressly for the requirements of a specific project.

**Miscellaneous Iron** - See Architectural Metal.

**NAAMM** - National Association of Architectural Metal Manufacturers.

**NOMMA** - National Ornamental and Miscellaneous Metals Association.

**Owner** - The individual or entity organizing and financing the design and construction of the project.

**Owner's Representative** - Individuals, including, but not limited to, the architect, engineer, general contractor, construction manager, designated contractually to act for the owner.

**Plans** - Design drawings prepared by the architect/engineer for the owner of the project. These drawings include floor plans, framing plans, elevations, sections, details and schedules as necessary to define the desired construction.

**Release for Construction** - The release by the owner, or his representative, permitting the fabricator to commence work under the contract, including ordering material and preparing shop drawings.

**Shop Drawing** - Drawings prepared by the fabricator for the shop fabrication of his products.

**SJI** - Steel Joist Institute

**Specifications** - Written instructions which, with the plans, define the quality of workmanship and materials to be used on a construction project. Specifications are divided into divisions conforming to MASTERFORMAT, as developed by the Construction Specifications Institute.

**SSPC** - Steel Structures Painting Council, publisher of the Steel Structures Painting Manual, Vol. 2, "Systems and Specifications."

**Sub-Contractor** - The individual or organization with whom the general contractor has contracted to furnish, install and/or erect a portion of the project.

### **1.3 RESPONSIBILITY FOR DESIGN**

1.3.1. The architect/engineer is responsible for the suitability, adequacy and legality of all aspects of design in the plans and specifications. The architect/engineer and/or the owner may solicit designs, plans, specifications and/or data from the fabricator, but the responsibility for the safety of the structure, propriety and conformance to codes and standards remains with the architect/engineer.

1.3.2. If the owner, or owner's representative, requires that the fabricator prepare designs, plans and/or specifications, he states clearly and precisely his exact requirements, including all applicable building codes and all other regulatory requirements, in the invitation to bid. The owner's architect/engineer of record assumes the responsibility for these designs. If not included in the fabricator's contract, compensation for this is negotiated separately.

1.3.3. The fabricator works with the architect/engineer in an effort to deliver a finished product which is suitable to the owner.

### **1.4. PATENTED DEVICES**

When the contract documents call for patented designs, devices or parts, the owner assumes the responsibility for all necessary patent rights and royalties so that the fabricator and/or erector is protected fully in their use, unless expressly stated otherwise in the contract documents.

## **SECTION 2. CLASSIFICATION OF MATERIALS**

### **2.1. DEFINITION OF ARCHITECTURAL METAL**

Architectural Metal includes a variety of products. Because of the variety and great number of metal products manufactured, the metals industry has adopted "MASTERFORMAT - Master List of Titles and Numbers for the Construction Industry," published by the CSI , to classify these products.

The majority of architectural metals are listed under Division 5 of MASTERFORMAT. Carpenters Iron (or Hardware) and some specialty items are classified in other divisions. Based on MASTERFORMAT, which can be referenced for a more specific and detailed list of elements [See COMMENTARY), and unless specified otherwise in the contract documents, these products consist of materials shown on the contract plans and described as:

#### **2.1.1. Metal Fabrications**

- Metal Stairs
- Ladders
- Handrails and Railings
- Gratings
- Floor Plates
- Castings
- Stair Treads and Nosings

2.1.2. Sheet Metal Fabrications  
Sheet Metal Enclosures  
Heating/Cooling Unit Enclosures

2.1.3. Ornamental Metal  
Ornamental Stairs  
Prefabricated Spiral Stairs  
Ornamental Handrails and Railings  
Ornamental Metal Castings  
Ornamental Sheet Metal

2.1.4. Expansion Joint Cover Assemblies  
Metal Plate Cover Assemblies

2.1.5. The above Broadscope and Mediumscope classifications of the CSI MASTERFORMAT include numerous Narrowscope metal fabrications many of which are listed in the Commentary. Industry practice and regional customs dictate which fabrications will be itemized in the Fabricator's bid.

## **2.2. OTHER METAL ITEMS**

The Architectural Metal classifications do not include steel, iron or other metal items identified as:

Structural steel (defined in AISC Code)  
Open-web joists, long-span joists and joist girders  
Metal decking  
Metal furring and lathing  
Stacks, tanks and pressure vessels  
Cold-formed steel framing

## **SECTION 3. PLANS AND SPECIFICATIONS**

### **3.1. BIDDING AND/OR CONSTRUCTION DOCUMENTS/ARCHITECTURAL METALS**

In order to ensure adequate and complete bids, contract documents of current issue are provided to show clearly or describe the following:

- A. Types, locations, quantities, dimensions, finishes and special treatments of all materials to be used.
- B. All required fittings, modifications, cut-outs; accessories and/or special attachments to be included.
- C. Special or unique conditions requiring special handling or fabricating of materials.
- D. Any and all unusual or unique engineering requirements.
- E. Any special or unique protective treatment requirements.
- F. Sufficient and readily understood detailing.

### **3.2. ARCHITECTURAL PLANS**

All requirements for architectural metals are shown on the architectural plans, although structural, electrical and mechanical plans may be referenced and used as supplements to define detail configurations and construction information.

### **3.3. LIMIT OF RESPONSIBILITY**

The owner's plans and specifications are assumed to be correct in all details, and the fabricator's responsibility is limited to furnishing products in accord with these documents and this Code. Any change to these plans and specifications must be authorized in writing.

### **3.4. JURISDICTION**

Where state and local boards or other regulatory agencies have jurisdiction, the owner so indicates in the contract documents.

### **3.5. DISCREPANCIES**

In the event of any discrepancy between plans and specifications, the specifications take precedence and govern. In the event of any discrepancy between written dimensions and scaled dimensions on plans, the written dimensions govern. In the event of any discrepancy between architectural plans and structural plans, the architectural plans take precedence and govern.

### **3.6. LEGIBILITY OF PLANS**

Plans are made to an adequate scale so as to be legible and to impart clearly the necessary information. A scale less than 1/8-inch to the foot is not used. To convey complex information, a larger scale is used.

### **3.7. QUALITY REQUIREMENTS FOR SPECIAL ARCHITECTURAL APPLICATIONS**

3.7.1. Samples. When specified in the contract documents, fabricator submits samples, suitable for evaluation, as agreed to by the Architect and Fabricator, of each metal finish required, using metal of the same alloy and thickness to be used for the work. Where normal color and texture variations are to be expected, two (2) or more units are included in each set to show the limits of such variations. Samples are reviewed and accepted or rejected by the architect for color and texture only. Compliance with all other requirements is the exclusive responsibility of the contractor.

3.7.2. Fabricator's Shop Mock-Up. When specified in the contract documents, fabricator constructs sample mock-ups for each type of architectural metal item, using materials, joinery, finishes and workmanship required for the permanent work. Mock-up units consist of full size units as much as practicable. Architect's acceptance of the mock-up is required before remainder of work on these items is started. Approved mock-up units may be included as part of the work, or as an added cost item for the owner.

## **SECTION 4. SHOP AND ERECTION DRAWINGS**

### **4.1. OWNER RESPONSIBILITY**

The owner, or owner's designated representative, provides complete construction plans and specifications, in a timely manner and in accordance with the contract documents, for the preparation of shop fabrication and field erection drawings. A scope of work for items required, having been agreed upon at the time of the contract, is also incorporated with these documents. This scope includes and indicates all items which are to be fabricated and erected, and which are to be only delivered.

### **4.2. FABRICATION DRAWINGS**

As required by the contract documents, the fabricator submits shop and erection drawings on a schedule formulated and agreed to at time of contract for the material to be furnished. Shop and erection drawings of built-in and/or concrete embedded items are submitted by the fabricator before other detailed items.

### **4.3. ERECTION AND INSTALLATION DRAWINGS**

4.3.1. Erection and/or installation drawings include plan drawings to establish location of items in the structure and elevation drawings as necessary.

4.3.2. Erection drawings for multi-piece items such as steel stairs have designated piece marks for all components.

4.3.3. For items such as lintels, schedules may be provided.

### **4.4. FIELD ADJUSTMENTS**

Field adjustments required for proper installation are indicated clearly on the fabricator's shop and erection drawings.

### **4.5. APPROVAL**

4.5.1. The owner, or owner's designated representative, returns to the fabricator one set of the shop drawings indicating clearly either approval or the desired changes required. After all necessary changes and/or corrections have been made, the shop drawings are resubmitted to the owner, or owner's designated representative, for final approval. Should changes be required which were not part of the agreed to scope of work, the fabricator submits in writing, the extra costs for this additional work (including engineering, material, labor, overhead and profit), for approval by the owner, or owner's designated representative. The fabricator does not proceed with any work until all drawings, changes and extra charges are approved.

4.5.2. The fabricator includes a maximum allowance of fourteen (14) calendar days in his schedule for the return of shop drawings.

#### **4.6. RESPONSIBILITY**

4.6.1. Approval by the owner, or owner's designated representative, of shop drawings prepared by the fabricator, indicates that the fabricator has correctly interpreted the contract requirements and is released to start fabrication. The fabricator is not responsible for adequacy of designs, structural configurations, material and code requirements, and the above approval constitutes the owner's acceptance of this responsibility.

4.6.2. Approval of shop drawings does not relieve the fabricator of the responsibility for accuracy of detail dimensions on shop drawings, nor the general fit-up of parts to be assembled in the field, nor for providing acceptable workmanship for all fabrication in accordance with the contract documents and this Code.

## **SECTION 5. MATERIALS**

### **5.1. MILL MATERIALS**

5.1.1. Mill tests are performed to demonstrate material conformance to ASTM specifications in accordance with the contract requirements. Unless special requirements are included in the contract documents, mill testing is limited to those tests required by the applicable ASTM material specifications. Mill test reports are retained by the fabricator; they will be furnished by him only if requested by the owner, either in the contract documents or in written instructions prior to the time the fabricator places his orders with the mill.

5.1.2. When material received from the mill does not satisfy required tolerances for camber, profile, flatness or sweep, the fabricator is permitted to perform corrective work by such means as controlled heating and mechanical straightening.

5.1.3. Corrective procedures described in ASTM for reconditioning the surface of material from the producing mill may also be performed by the fabricator, at his option, when variations are discovered or occur after receipt from the producing mill.

5.1.4. When special requirements demand tolerances more restrictive than allowed by ASTM, such requirements are defined in the contract documents, and the fabricator has the option of taking the necessary corrective measures.

### **5.2. STOCK MATERIALS**

5.2.1. Most fabricators maintain stocks of steel and alloy products for use in their fabricating operations. Materials taken from stock by the fabricator are of a quality at least equal to that required by the ASTM specifications applicable to the classification covering the intended use.

5.2.2. Mill test reports are acceptable as sufficient record of the quality of materials carried in stock by the fabricator. The fabricator reviews and retains the mill test reports covering the materials purchased for stock. The fabricator does not maintain records that identify individual pieces of stock material against individual mill test reports. Such records are not required if the fabricator purchases materials for stock under established specifications as to grade and quality.

5.2.3. Stock materials purchased under no particular specifications or under specifications less rigid than those mentioned above, or stock materials which have not been subject to mill or other recognized test reports, are used where the quality of the material could not affect the integrity or suitability of the product.

### **5.3. CERTIFICATION OF COMPLIANCE**

The fabricator may provide a Certification of Compliance in lieu of mill test reports when circumstances dictate.



## **SECTION 6. FABRICATION AND DELIVERY**

### **6.1. MATERIAL SELECTION**

6.1.1. Ferrous Metals: Most fabrication is of steel identified as low carbon such as ASTM A36. When high strength steel, or other steel ordered to special requirements, is specified, it is marked by the supplier in accordance with ASTM A6. Marked steel maintains its identity throughout fabrication to ensure that it is used properly.

6.1.2. Stainless Steel: When stainless steel is used for architectural purposes, it is the responsibility of the owner or the architect/engineer to specify alloys for uses and environments as necessary.

6.1.3. Aluminum: Aluminum used in architectural applications is furnished by the fabricator in the applicable alloy for either extruded bars and shapes or rolled sheet and plate as required.

6.1.4. Bronze: Architectural bronze is available in several grades for architectural metal design.

### **6.2. PREPARATION OF MATERIAL**

6.2. 1. Cutting is by sawing, shearing or burning by hand, machine or torch. Architecturally exposed non-welded joints have precision cut pieces, while non-exposed support components are cut to obtain maximum structural strength. Proper method of cutting is selected by the fabricator.

6.2.2. Mechanical braking, bending or forming is used when standard sections cannot be obtained.

6.2.3. Machined joints are used for oversized units or unusual joint requirements where special architectural conditions occur. The fabricator determines the locations of these machined joints in the finished product.

6.2.4. Special care is taken when selecting material for architectural purposes so that final finishes will be aesthetically acceptable. Ferrous materials will be clean (rust free); bronze, stainless steel and aluminum will be clean and substance free. Refer to 6.6 for special finishes.

### **6.3. FITTING AND FASTENING**

6.3.1. Joining is a most important part of the fabrication process since most items of architectural metal work are fabricated units assembled or joined together in the field into the finished work.

6.3.2. Architectural metal products with high visibility are given more attention to precise fitting. Fasteners should be as inconspicuous as possible.

6.3.3. Architectural metal products are attached to concrete or masonry with lag bolts and expansion shields, stud bolts or similar anchors.

6.3.4. For fasteners in steel stair construction, see "Metal Stairs Manual" (latest edition), published by NAAMM. Unless otherwise specified, the fabricator selects the type of fasteners to be used.

#### **6.4. DIMENSIONAL TOLERANCES**

6.4.1. Architectural metal products are shop fabricated and/or assembled to provide proper quality and uniformity of finished product. These products are fabricated in accordance with approved shop drawings to fit field conditions. There are no standard tolerances since tolerances vary with products. Normal manufacturing tolerances are allowable.

6.4.2. Guaranteed field dimensions should be furnished by the Contractor or, by special agreement, measured by the fabricator so the product can be in accordance with the specified design and within normal tolerances.

#### **6.5. SHOP PAINTING - STEEL**

6.5.1. The contract documents specify all the painting requirements, including members to be painted, surface preparation, paint specifications, manufacturer's product identification and the required dry film thickness, in mils, of the shop coat (and finish coat, if applicable).

6.5.2. The shop coat of paint is the prime coat of the protective system. It protects the steel for only a short period of exposure in ordinary atmospheric conditions, and is considered a temporary and provisional coating. The fabricator does not assume responsibility for deterioration of the prime coat that may result from extended exposure to ordinary atmospheric conditions, nor from exposure to corrosive conditions more severe than ordinary atmospheric conditions.

6.5.3. In the absence of other requirements in the contract documents, the fabricator hand cleans the steel of loose rust, loose mill scale, dirt and other foreign matter prior to painting, by means of wire brushing or by other methods elected by the fabricator to meet the requirements of SSPC-SP2. The fabricator's workmanship on surface preparation is considered accepted by the owner unless specifically disapproved prior to paint application.

6.5.4. Unless specifically excluded, paint is applied by brush, spray, roller coating, flow coating or dipping, at the election of the fabricator. When the term "shop coat" or "shop paint" is used with no paint system specified, the fabricator's standard paint is applied to a minimum dry film thickness of one mil.

6.5.5. Abrasions caused by handling after painting are to be expected. Touch-up of these blemished areas is the responsibility of the contractor performing field touch-up or field painting who should locally acquire the touch-up paint.

#### **6.6. SPECIAL FINISHES - INCLUDING ZINC COATINGS**

Special finishes are as prescribed in the Metal Finishes Manual (latest edition) published by NAAMM as follows:

6.6.1. Finishes for Aluminum, AMP 501.

6.6.2. Finishes for the Copper Alloys, AMP 502.

6.6.3. Finishes for Stainless Steel, AMP 503.

6.6.4. Finishes for Carbon Steel and Iron, AMP 504.

6.6.5. Applied Coatings, AMP 505.

## **6.7. DELIVERY OF MATERIALS**

6.7.1. Fabricated products are delivered in a sequence that will permit the most efficient and economical performance of both shop fabrication and erection. If the owner wishes to prescribe or control the sequence of delivery of materials, he reserves such right and defines the requirements in the contract documents. If the owner contracts separately for delivery and erection, he coordinates the work between contractors to follow the sequence as agreed to in the contract.

6.7.2. Anchor bolts, washers and other anchorage or grillage materials to be built into concrete or masonry are shipped so that they will be on the site when needed. The owner must give the fabricator sufficient time to fabricate and ship materials before they are needed.

6.7.3. The quantities of material shown by the shipping statement of the fabricator are accepted by the owner and erector (if other than the fabricator) as correct. If any shortage is claimed, the owner or erector should immediately notify the carrier and the fabricator so that the claim may be investigated.

6.7.4. If material arrives at its destination in damaged condition, it is the responsibility of the receiving party to promptly notify the fabricator and carrier prior to unloading the material, or immediately upon discovery.

## **SECTION 7. ERECTION AND INSTALLATION**

### **7.1. SCOPE**

Items of architectural metal to be erected and/or installed are enumerated in the Contract Documents.

### **7.2. RESPONSIBILITY FOR ERECTION AND INSTALLATION**

7.2.1. The erector and/or installer uses the most efficient and economical method and sequence of erection or assembly available to him consistent with the contract documents. When the owner contracts separately for fabricating and erection services, the owner is responsible for coordinating work between contractors.

7.2.2. The erector and/or installer coordinates setting drawings, diagrams, templates, instructions, and directions for assembly, installation and/or erection.

### **7.3. SITE CONDITIONS**

7.3.1. The owner, or his representative, provides and maintains adequate access roads into and through the site for the safe delivery of cranes, other necessary equipment and the material to be erected, installed or assembled. The owner, or his representative, provides the erector and/or installer firm, level, convenient and adequate space in a safe working area at the site for the operation of equipment and the erection, installation and/or assembly of material furnished.

7.3.2. The erector and/or installer examines areas and conditions under which items are to be assembled, installed and/or erected. Work does not proceed until unsatisfactory conditions have been corrected by others.

### **7.4. FOUNDATIONS AND STRUCTURES**

7.4.1. The accurate location, elevation, strength and suitability of, and access to, all foundations, piers and abutments is the sole responsibility of the owner.

7.4.2. The owner is responsible for the accurate location of building lines and walls, floor elevations and bench marks, and for furnishing the erector with a plan containing all such information.

### **7.5. ANCHOR BOLTS, OTHER EMBEDDED ITEMS AND BEARING DEVICES**

7.5.1. Anchor bolts and foundation bolts are set by the owner, unless otherwise specified in the contract documents, in accordance with an approved drawing. Locations should not vary from the dimensions shown on the erection drawings by more than the tolerances specified in the AISC Code of Standard Practice unless otherwise noted on the erection drawings. The General Contractor is responsible for protecting all bolt threads.

7.5.2. Unless shown otherwise, anchor bolts are set perpendicular to the theoretical bearing surface.

7.5.3. Other embedded items are set by the owner, unless otherwise specified in the contract documents, in accordance with approved location or erection drawings.

7.5.4. Base plates and other bearing devices are set to lines and grades established by the owner unless otherwise specified in the contract documents. The architectural metal fabricator furnishes bearing plates, leveling plates, screws, wedges and shims required in his scope of work.

7.5.5. All items under Section 7.5 are to be installed accordance with fabricator's erection drawings.

#### **7.6. CORRECTION OF ERRORS**

Accurate field measurements of installation locations prior to fabrication or manufacture should enable a satisfactory fit of architectural metal fabrications. It may be necessary in some instances to correct minor misfits by moderate amounts of field corrections such as reaming, chipping, welding and/or cutting. Corrections which cannot be made in this manner or which require other than minor changes in member configuration or architectural appearance are to be reported immediately to the fabricator by the erector. The fabricator will determine who is to correct the error and approve the most efficient and economic method of correction to be used by others.

#### **7.7. HANDLING AND STORAGE**

7.7.1. Miscellaneous Iron Without Finish Coat. The erector and/or installer takes reasonable care in the proper handling and storage of miscellaneous iron during erection operations. The owner, or his representative, is responsible for avoiding damage and/or accumulation of dirt and foreign matter.

7.7.2. Miscellaneous Iron With Finish Coat and Other Architectural Metals. The erector and/or installer is responsible for proper handling and storage of architectural metal items that have received a finish coating or have a natural finish which should be unmarred. The owner, or his representative, is responsible for avoiding damage and/or accumulation of dirt and foreign matter.

7.7.3. After installation and adjustment of architectural metal items, the owner is responsible for promptly protecting them until they are no longer subject to subsequent construction damage. At this later time the owner removes protective wrappings and performs any necessary cleaning.

#### **7.8. FIELD PAINTING**

The owner is responsible for field painting, including bolt heads and nuts, field welds and touch-up of abrasions in the shop coat of miscellaneous iron furnished without final finish.

## **SECTION 8. QUALITY CONTROL OR ASSURANCE**

### **8.1. GENERAL**

8.1.1. The fabricator maintains a quality control program to the extent deemed necessary so that his work is performed in accordance with this Code and the contract documents.

8.1.2. The erector maintains a quality control program to the extent deemed necessary so that his work is performed in accordance with this Code and the contract documents. The erector should be capable of performing the necessary erection or assembly and provides the equipment, personnel and management for the scope, magnitude and required quality of each project.

### **8.2. MATERIAL INSPECTION**

The fabricator customarily makes a visual inspection and is not required to perform any material tests. He depends on mill reports to signify that the product satisfies material order requirements. If the owner desires additional material acceptance procedures, he so specifies in the contract documents and coordinates such procedures with the fabricator.

### **8.3. WORKMANSHIP**

Quality of workmanship expected for each fabrication is specified in the contract documents with the Class level set to fit each architectural condition. Products are fabricated to Class 1 , 2, or 3.

#### **8.3.1. Class 1 (Architectural Metals).**

- a. Exposed surfaces are finished smooth with pits, mill marks, nicks and scratches filled or ground off. Defects should not show when painted or polished.
- b. Welds should be concealed where possible. Exposed welds are ground to small radius with uniform sized cove unless otherwise noted.
- c. Distortions should not be visible to the eye.
- d. Exposed joints are fitted to a hairline finish.

#### **8.3.2. Class 2.**

- a. Exposed surfaces retain mill marks and moderate irregularities not visible by naked eye at 30 feet.
- b. Exposed welds are ground with uniform sized cove.
- c. Minor distortions are permitted.
- d. Exposed joints have a maximum gap of 1/16 inch.

#### **8.3.3. Class 3.**

- a. Exposed surfaces have no improvement from mill finish except preparation necessary for galvanizing, or priming.
- b. Welds are not ground.
- c. Bolts, when used, may be exposed.

#### **8.4. SITEWORK**

8.4.1. Field Measurements. Accurate field measurements are taken prior to preparation of shop drawings and fabrication to ensure proper fitting of architectural metal work. Where taking field measurements before fabrication might delay the project, allowance is made for trimming and fitting.

8.4.2. Assembly. Items are preassembled in the shop to the greatest extent possible to minimize field splicing and assembly. Units are disassembled only as necessary for shipping and handling limitations. Units are clearly marked for reassembly and coordinated installation. Degree of assembly is at the discretion of the fabricator in coordination with the erector.

8.4.3. Handling. Architectural metal work receives minimum and careful handling to avoid damaging metal surface and finish.

#### **8.5. HISTORIC, EXTERIOR AND INTERIOR AREAS**

A list of pre-approved subcontractors who have been pre-qualified for work in the historic, exterior and interior areas should be provided by the owner in the Invitation to Bid, if such subcontractors are the only ones acceptable. If a contractor proposes to substitute subcontractors for those listed, he provides sufficient evidence of their qualifications and obtains written approval of their acceptability prior to submission of his bid.

## **SECTION 9. CONTRACTS**

### **9.1. TYPES OF CONTRACTS**

9.1.1. For contracts stipulating lump sum payments, the work to be performed by the fabricator and erector is defined by the contract documents. Plans should be clear and precise. Specifications should clearly specify products desired by the architect, engineer and owner. Method of approving alternates and/or substitutions are stated clearly.

9.1.2. For contracts stipulating price per item payments, the work required to be performed by the fabricator and erector is based upon specific identifiable items, i.e., caged ladders, bollards, rake rails, level rails, etc. The quantity of each item is based on the contract documents. The contract documents, including the specifications, specify the typical 'per item' categories and give the scope of materials and labor to be furnished.

9.1.3. For contracts stipulating unit prices, i.e., lineal feet, square feet, per pound, risers, etc., the scope of work required to be performed by the fabricator and erector is described completely, including quantity and complexity, in the contract documents. The contract documents, including the specifications, specify unit price categories and how they are to be used.

### **9.2. REVISIONS TO CONTRACT DOCUMENTS**

9.2.1. Revisions to the contract are made by the issuance of new documents or the reissuance of existing documents. In either case, all changes, additions and/or deletions are clearly indicated and highlighted, and the documents are dated.

9.2.2. A revision to the requirements of the contract documents is made by change order or extra work order by the owner or his agent to the fabricator. The contract documents must state clearly the procedures for pricing, approval and payment in a timely manner of all change orders and revisions.

### **9.3. CONTRACT PRICE ADJUSTMENT**

9.3.1. When the scope of work and responsibilities of the fabricator and erector are changed from those previously established by the contract documents, an appropriate modification of the contract price is made. In computing the contract price adjustment, the fabricator and erector consider the quantity of work added or deleted, modifications in the character of the work, and the timeliness of the change with respect to the status of material ordering, detailing, fabrication and erection operations.

9.3.2. Requests for contract price adjustments are presented by the fabricator and erector in a timely manner, and are accompanied by a description of the change in sufficient detail to permit evaluation and approval by the owner before fabrication proceeds. If the work is required prior to approval of the price change, the contract documents clearly outline the procedures to be followed and the time frame for payment by the owner which should be no later than 30 days after the work is completed.

9.3.3. The fabricator and erector submit to, and get approval from the contractor of all hourly rates, fringe benefit rates, overhead percentages, workers compensation retro increases, government mandated increases, and allowable profit margins for time and material work prior to performing the work.



9.3.4. For contract changes authorized to be performed on a time and material basis, the fabricator and erector receive written field work orders from the contractor describing and authorizing the work to be performed. The fabricator and erector have daily extra work orders signed by the contractor or his representative clearly outlining the work performed, materials used, number of workers and the hours worked. The contractor's signature approves all items as listed on the extra work order unless they are changed by the contractor or his representative at that time. The fabricator and erector are notified and approve any changes to the extra work order at the time it is signed by the contractor or his representative. After the extra work order is signed by the contractor or his representative, its contents are binding on the parties.

9.3.5. Price per item and unit price contracts have clear provisions for additions or deletions to the quantity of work prior to the time work is released for construction. Changes to the scope of work, at any time, or additions and/or deletions to the quantity of work after it is released for construction, may require a contract price adjustment to the item or unit price.

#### **9.4. SCHEDULING**

9.4.1. The contract documents specify the schedule for the performance of the work. This schedule states all critical items and/or trades that affect, or are affected by, the architectural metals so that the fabricator and erector can start their work at the designated time and continue without interference or delay to or by the owner, contractor or other trades.

9.4.2. The contractor has the responsibility to review the construction schedule with the fabricator and erector prior to commencing work and to incorporate the fabricator's and erector's specific scheduling requirements into the construction schedule.

9.4.3. The fabricator and erector have the responsibility to advise the owner and contractor, in a timely manner, of the effect any revision has on the contract schedule. The contractor has the responsibility to advise the fabricator and erector, in a timely manner, of the effect any revision has on areas of the schedule that directly or indirectly impact the progress of the architectural metal work. In both cases, all changes made to the construction schedule are mutually agreed to by the owner, contractor, fabricator and erector.

9.4.4. If the fabrication or erection is delayed significantly due to design revisions or other reasons which are attributed to the owner, architect, engineer and/or contractor, the fabricator and erector are compensated for additional costs incurred.

9.4.5. The contract documents state clearly the required schedule for shop drawing review and approval by the architect and engineer. This schedule will be incorporated into the construction schedule. Any significant delays in shop drawing approval caused by the owner, architect, engineer and/or contractor results in an adjustment of time to the construction schedule. The fabricator and erector are compensated for additional costs or delays incurred as a result of the delay in drawing approval.

9.4.6. Delivery date is directly related to the receipt of guaranteed field dimensions or the availability of completed construction so field dimensions can be taken.

#### **9.5. TERMS OF PAYMENT**

The terms of payment for the contract are outlined in the contract documents.

## **SECTION 10. FINISHES**

### **10.1. SCOPE**

Finish standards provide a means of mutual acceptability between the owner, or his representative, and the fabricator and identify conformity with product finish requirements. This section does not apply to standard shop applied primers covered in Section 6.5.

### **10.2. STANDARDS**

Finish standards are established in the Metal Finishes Manual (latest edition) and in the Sections on Metals and Alloys and Metal Finishes in the Metal Product Outline (latest edition) published by NAAMM. (See Section 6.6)

### **10.3. SHOP APPLIED FINISHES OTHER THAN STANDARD PRIMER**

10.3.1. Any special shop finishes are specified in the contract documents.

10.3.2. Shop finish application is in accordance with the product manufacturer's recommendations.

10.3.3. Any special finish applied in a location other than the fabricator's shop conforms to the requirements of the contract documents.

10.3.4. Requirements, if any, for shop inspection of sample or test finishes prior to or during fabrication are specified in the contract documents.

### **10.4. INSTALLATION**

The erector uses special care in unloading, handling and assembling to avoid damaging the finished surface.

# **COMMENTARY on the CODE OF STANDARD PRACTICE for the ARCHITECTURAL METAL INDUSTRY**

**(INCLUDING MISCELLANEOUS IRON)**

## **PREFACE**

This Commentary has been prepared to provide those who use the Code of Standard Practice for the Architectural Metal Industry with some of the background, basis and intent which influenced its provisions. Each section of the Commentary is referenced to the corresponding section or subsection of the Code. The only sections covered are those for which additional explanation appeared to be needed. The Association does not assume responsibility for errors or oversights in the information published herein nor for the use of the information published nor for incorporating such information in the preparation of contract documents.

## **SECTION C1. GENERAL PROVISIONS**

### **C1.1. SCOPE**

This Code has been written for architectural metals only and is not applicable to the following:

- 1.) structural steel buildings and bridges, which are covered by the Code of Standard Practice for Steel Buildings and Bridges, published by the American Institute of Steel Construction;
- 2.) metal building systems, which are the subject of Common Industry Practices, published by the Metal Building Manufacturers Association in their Metal Building Systems Manual;
- 3.) standard steel joists, which are the subject of the Recommended Code of Standard Practice for Steel Joists, published by the Steel Joist Institute.

NAAMM has not participated in the development of the AISC, MBMA and SJI codes and, therefore, takes no position on and is not responsible for any of their provisions.

### **C1.2. DEFINITIONS**

Architectural Metal is an all encompassing category which includes many materials, products, fabrications and methods of manufacturing. Some of the descriptions used have included miscellaneous iron, ornamental iron and miscellaneous metal. Traditionally, steel has been manufactured by steelworkers and erected by ironworkers. The use of the term iron has carried over from times when steel was not used in construction. Today, there is very little iron being used since it has been replaced by the great variety of steels available, as well as other materials such as aluminum.

While AISC and SJI have no difficulty in defining fabricated structural steel and open web steel joists as their principal products, NAAMM has a monumental task in just listing the products which fall under the umbrella of architectural metal. Even the broadscope and medium scope categories of the CSI MASTERFORMAT covered in Section 2 do not quite cover all the products. Also, the traditional trade practices in various parts of the United States place products in and out of the architectural metal category. This Code has attempted to list products and definitions in common usage.

### C1.3. RESPONSIBILITY FOR DESIGN

The fabricator is neither the architect nor the engineer of record responsible for the design. However, if required or requested, the fabricator can furnish or engage a professional engineer to review the design and calculations of the engineer of record for compliance with NAAMM specifications, Code of Standard Practice and good engineering practices. This review and any tests or design calculations required will be at the owner's expense.

NAAMM also endorses the following open letter to project owners, developers and general contractors from the AISC dated October 23, 1990:

"The purpose of this letter is to recommend caution concerning recent attempts to modify standard form construction contract documents by inserting clauses which attempt to shift a portion of project structural design responsibility from the design professional of record to steel fabricators. Most typically such clauses deal with structural connection design. These clauses have been found in contract General Conditions, Special Conditions, technical specifications, and even in notes on drawings.

"The American Institute of Steel Construction is strongly opposed to this practice in all instances where ultimate responsibility for design of the entire primary structural system is not clearly borne by a single individual, the structural engineer of record.

"If such clauses are included in construction contracts for projects with which you are currently involved, the Institute urges extreme caution and recommends that you seek the advice of counsel experienced in this particular area of construction law.

"Among the Institute's concerns are the following:

1. The structural engineer of record is the individual who can best assure safety of the completed structure. In most states this is a non-delegable responsibility. As expressed in one highly publicized decision:

"While the engineer of record may properly delegate the work of performing engineering design functions, he cannot delegate his responsibility for the structural engineering design where it concerns professional engineering functions. This responsibility is non-delegable." Duncan, et al v. Missouri Board of Architects, Professional Engineers and Land Surveyors. P. 180 of Administrative Decision, App. No. 52655 before the Missouri Court of Appeals, January 26, 1988 -- the so-called Hyatt Regency decision.

2. Attempts to delegate this responsibility from designers of record to contractors may violate engineering licensing regulations in many states. See, for example, applicable regulations for the states of Florida and New York.

3. "There is an inherent conflict between the responsibility of design professionals of record to assure safety and the interests of construction contractors to minimize costs. For this reason principles have been steadfastly applied. The separation of responsibilities was also specifically addressed by the Administrative Hearing Officer in the Hyatt Regency decision:

"Licensed professionals may be employed by the contractors, but they are no less subject to the motive of profit on behalf of their employer than any other employee. This built in conflict of interest, therefore, makes suspect any system which leaves the performance of professional engineering or architecture to such individuals and acknowledges the wisdom of the statutory scheme and construction system which presumes a lack of any such involvement..." Id. at p. 174.

4. "This practice runs contrary to the adopted policy of a number of responsible professional organizations. Included among these are:

The American Society of Civil Engineers — *Final Report and Recommendations on Assignment of Authority and Responsibility for Design of Steel Structures*. This document was jointly adopted by the Boards of Directors of the ASCE and AISC on October 20, 1985, and has been ratified as the official policy of both organizations as recently as 1989; and,

The Coalition of American Structural Engineers, a coalition of the American Consulting Engineers Council — "National Practice Guidelines for the Structural Engineer of Record," issued in November, 1989.

5. This practice amounts to an award of design services by competitive bid. As such, on public projects it may violate the provisions of the Brooks Act, 40 U.S.C. §§ 541-44 (Federal projects), or the Model Procurement Code (State projects).
6. Contract documents which require fabricators to retain or employ a specifically licensed individual not otherwise required by law or industry practice may limit the number of available bidders responding to a competitive solicitation and increase the bid price of those who do respond.
7. In instances where this practice is applied to a construction project with a complex strut system, difficulties can be experienced in dealing with shop drawing submittals if the full scope of design authority and responsibility is not clearly delineated. These types of difficulties often lead to greatly increased construction costs.

"This is an issue which has many facets. If you or your legal counsel have questions concerning this practice or wish to discuss the contents of this letter in more detail, please contact the American Institute of Steel Construction."

## **SECTION C2. CLASSIFICATION OF MATERIALS**

**C2.1.1** Metal Fabrications, formerly designated Miscellaneous Metal, is the term used to describe metal items manufactured to conventional, standard or custom designs which do not fit specifically in other Sections. It covers a large group of essential and utilitarian metal products designed to meet specific requirements in building construction.

A large majority of these products are constructed of ferrous metal, but many are of non-ferrous metal and others are a combination of both. Therefore, it is important to note on the plan drawings or in the specifications the metal to use for the product.

Metal Fabrications are made to measurements usually established on the plan drawings and subject to verification at the building, or they may be products fabricated according to a standard design, or a standard catalog product adaptable to the specific requirements.

Anchors for the installation of these products, when imbedded in concrete or set in masonry should be specified to be set by the contractor for concrete, a section of Division 3, or by the masonry contractor, a section of Division 4. Products such as rings and covers, ladder rungs, curb angles and many similar built in products should be specified to be installed by the same contractors. Other Metal Fabrications may, to better advantage, be installed as the building construction is in progress.

The finish for ferrous metal is usually a shop coat or primer as recommended by the fabricator or as specified, with additional painting after installation to be applied by the painting contractor under a section of Division 9. For ferrous metal requiring special protection against corrosion, more permanent finishes such as galvanizing, electrogalvanizing, and organic coatings are employed. Nonferrous metal may be specified to be given any of the finishes adaptable to the metal. Other finishes may be specified to meet special conditions. The specifications should clearly state the requirements.

The plan drawings should detail or indicate the design and extent of each product and establish the basic measurements as may be necessary for an adequate understanding of quantities. The specification should list each item and specify any additional requirements not given on the plan drawings. In some cases standard catalog products may be specified by name or identifying catalog numbers.

In establishing a representative list of Metal Fabrications it may be assumed that there are products which have been omitted, and others which are identified by more than one name. It is generally acknowledged that there are differences of opinion among the building trades as to which section of a division some products should be placed. The usual custom in a given locality as to where to specify some products is often determined by the bidding and manufacturing practices of the fabricator or supplier and the purchasing policy of the contractor.

Metal Stairs, specified in Mediumscope Section 05510, are classified according to both type and class. The type designation identifies the physical configuration or geometry of the stair while the class designation refers to its construction and to the general nature of its use. Four major types of stairs, which represent the majority, are listed below.

Generally, the classes normally applicable to stair types are as follows:

Straight stairs — all classes.

Circular stairs — usually architectural class but may be commercial, service or industrial class.

Curved stairs — architectural class only and always specially designed.

Spiral stairs — usually service or industrial class but may be residential, commercial or architectural class.

The class designation of stairs is a key to the type of construction, the quality of materials, details and finish. As stairs of all classes are built to meet the same standards of performance in respect to load carrying capacity and safety, their class distinctions do not represent differences in functional value but represent differences in character and appearance. It is important for the specifier to recognize that where function is the prime concern and aesthetics are of minor importance, significant economics can be achieved by specifying one of the less expensive classes.

#### **Industrial Class**

Industrial class stairs are similar in nature to any light steel construction. Hex head bolts are used for most connections and welds, where used, are not ground. Stringers may be either flat plate or open channels; treads and platforms are usually made of grating or formed of floor plate, and risers are usually open, though in some cases filled pan type treads and steel risers may be used. Railings are usually of either pipe or tubing.

#### **Service Class**

Stringers of service stairs are generally the same types as those used on stairs of the industrial class. Treads may be one of several standard types, either filled, or formed of floor or tread plate, and risers are either exposed steel or open construction. Railings are typically of pipe construction or a simple bar type with tubular newels. Soffits are usually left exposed. Connections on the under side of the stairs are made with hex head bolts and only those welds in the travel area are smooth.

#### **Commercial Class**

Stringers for this class of stairs are usually exposed open channel or plate sections. Treads may be any of a number of standard types and risers are usually exposed steel. Railings vary from ornamental bar or tube construction with metal handrails to simple pipe construction. Soffits may or may not be covered. Exposed bolted connections in areas where appearance is critical are made with counter-sunk flat or oval head bolts; otherwise hex head bolts are used. Welds in conspicuous locations are smooth and all joints are closely fitted.

#### **Architectural Class**

The materials, fabrication details and finishes used in architectural class stairs vary widely as dictated by the architect's design and specifications. As a general rule, construction joints are made as inconspicuous as possible, exposed welds are smooth and soffits are covered with some surfacing material. Stringers may be special sections exposed or may be structural members enclosed in other materials. Railings are of an ornamental type and, like the treads and risers, may be of any construction desired.

Stair components are fabricated in the shop and may be field assembled at the job site or preassembled at the plant. Pre-assembly methods are more commonly applied to commercial and service classes of stairs because of the repetitive use of identical units. Pre-assembled units for multi-storied buildings may be designed to be self-supporting so that they may be pre-erected on the building site. Such units can be stacked one upon the other and field connected to form stair towers. These stair towers can expedite building construction.

Stairs are generally constructed of carbon steel having the mechanical properties necessary to provide a safe structure. However, for special purposes, stairs may be constructed of aluminum or stainless steel. Painted finishes for carbon steel stairs require a minimum of one coat of rust-inhibitive primer prior to application of the final paint coat. Where the environment requires good resistance to corrosion, galvanized coatings may be used. Galvanized finishes may or may not be painted, depending on the appearance desired. For industrial applications the galvanized finish is entirely satisfactory. Aluminum may be painted or anodized. AISI No. 2D dull mill finish is usually specified for stainless steel. However, when a general purpose polished finish is desired, AISI No. 4 may be specified.

Metal railings are specified under Medium Scope Section 05520. Stair railings and handrails are available in a variety of designs which offer selections suitable for the most monumental building to the most utilitarian structure. The metals used are carbon steel, stainless steel, aluminum and the copper alloys. The most economical type of rail is made of metal pipe or round tubing. Such railings are widely used not only in all kinds of buildings but also on many types of outdoor structures.

Stair and railing design is strictly controlled by building codes. These codes establish minimum loads for stairs and railings, minimum heights for flights of stairs, railing baluster spacing, minimum and maximum tread and riser dimensions as well as railing heights. Special features for stairs and railings are necessary to meet the requirements of the physically handicapped. These are spelled out in ANSI Standard A117.1 and have been included, in whole or in part, in a number of building codes.

Metal bar gratings are open grid assemblies of metal bars in which the principal load bearing bars run parallel in one direction and are spaced equidistant from each other by rigid attachment to cross bars running in a perpendicular direction, or by attachment to bent connecting bars extending between them.

There are three types of construction for metal bar gratings — welded, pressure-locked and riveted. Welded gratings are fabricated by joining bearing bars and cross bars at their intersections by welding. In pressure-locked gratings the cross bars are mechanically locked to the bearing bars by deforming the bars under tremendous hydraulic pressure. For riveted gratings the bent connecting bars are joined to the bearing bars at their points of contact by riveting.

The lighter duty gratings are available in carbon steel, stainless steel and aluminum. Heavy duty gratings are available in structural carbon steel and stainless steel. Steel and stainless steel gratings may be welded, pressure-locked or riveted. Aluminum gratings are not welded.

**C2.1.2** Sheet Metal Fabrication encompasses custom sheet metal items for special purposes other than roofing and flashing applications, including custom enclosures and enclosures for heating and cooling units and piping. Some of these products are shop fabricated requiring the use of die-forming, roll-forming, brake-forming or stamping processes. Other items are formed and fitted on the job.

The material, usually thin cold-formed sheets, may be steel, plain or zinc coated, stainless steel, aluminum, copper, bronze or other copper alloys.

These items may consist of specially formed panels and trim, radiator shields, shelves or shelf coverings, table tops, kitchen hoods, chutes or chute lining (when not a mechanical installation), fireplace hoods, hammered or plain corner-stone boxes, flower box liners, and similar specialty items not normally specified in a section of another division.



The plan drawings should indicate the design and extent of the item and the specifications should list each item and specify the metal, finish and any additional information not given on the plans.

Roof metal, flashing, drains, scuppers and downspouts should be detailed and specified with Roof Metal, a Section of Division 7.

Heating, ventilating and air conditioning ducts, and other sheet metal directly connected to the mechanical equipment should be detailed and specified within a section of Division 15.

Cold-formed metal, when designed as a component of a Metal Fabrication or Ornamental Metal Product, should be detailed and specified with the Product.

**C2.1.3.** Ornamental Metal, a broadscope section, is a term used to designate a group of metal products used in building construction for functional, architectural and decorative effects, where appearance of the product is of primary consideration.

These metal products are often specially designed, lending character and beauty to every type of building construction. They offer the architect an unusual opportunity for imaginative and attractive designs. Although usually specially designed for specific locations, they may also incorporate products of standard manufacture.

Ornamental metal products are fabricated of ferrous and non-ferrous metal and require careful workmanship with skill and knowledge of specialized manufacturing techniques. The specifications should fully describe any requirements not given on the plans, including the metal and finish. Samples of finish for approval are advisable for color matching, texture, and quality characteristics.

The plan drawings should detail or indicate the design and extent of each product and establish the basic measurements as may be necessary for an adequate understanding of the requirements. When it is advisable to set anchors in concrete or masonry for anchoring these products, they should be set by the contractor for concrete, a section of Division 3, or by the contractor for masonry, a section of Division 4. The anchors and the correct location for setting should be furnished by the manufacturer.

Ornamental metal products are usually installed after the primary construction of the building is complete. Handling and installation may require protection against damage, continued until completion of the building. This requirement, including final cleaning of the metal surface, should be specified to be performed by the general contractor.

**C2.1.4** Expansion control encompasses sheet, cast and extruded metal expansion joint frames and covers, angles, plates, rods or pins for joining masonry walls, concrete walls, and concrete slabs. Expansion or control joints are also used as plastering accessories to permit plaster membranes to expand and contract without excessive stress and subsequent cracking. These plastering accessories would generally be specified in Division 9 under Lathing and Furring.

**C2.1.5.** Other metal fabrications including, but not limited to, the following:

Access doors, panels and frames  
Altar rails, gates  
Anchors, bolts, inserts, sleeves  
Anchors, clamps, dowels, wall ties  
Angles, corner guards  
Arches, gates, posts  
Ash and coal equipment  
Bar screen  
Bearing plates (for wood)  
Bicycle racks  
Brackets, beams, hooks  
Brick relief angles  
Bumpers, guards, posts  
Cable supports, accessories  
Canopies, marquees  
Carpenters iron  
Catwalks, walkways  
Chair trucks, rails and guides  
Chimney accessories  
Chutes  
Coal and ash doors  
Coat and hat racks  
Control joints  
Conveyors, including supports and tracks  
Copings, gravel stops  
Counter accessories  
Curb edge bars, angles  
Desk accessories  
Display cases  
Divider strips or bars  
Doors, (sub) frames, bucks, guards, sills, accessories  
Downspout extensions  
Ecclesiastical products  
Electrical installation accessories  
Elevator guide support beams  
Elevator sill angles  
Elevator pit and machine room accessories  
Expanded metal  
Fascias, trim  
Fences and gates  
Fire escapes  
Fireplace accessories and equipment  
Flag staffs  
Floor or wall plates  
Folding partitions and door supports  
Foot scrapers  
Framing accessories  
Glass block frames  
Grilles  
Guards  
Gymnasium accessories

Hangers and supports  
Hoist beams and hooks  
Hung plates  
Hood support framing  
Imbedded anchors  
Joist hangers, straps and stirrups  
Ladders and rungs  
Letters and numerals  
Lintels  
Lockers, bases  
Lookouts, gallery framing  
Louvers and frames  
Mat frames  
Mechanical installation accessories  
Nosings  
Precast inserts  
Projection room shutters  
Pull-in irons  
Racks  
Radiator enclosures, frames, covers, grilles  
Registers  
Roof curbs, frames  
Roof hatches, scuttles  
Seat or bench supports  
Sewage plant products  
Shelving and supports  
Shutters and frames  
Sidewalk doors and frames  
Sign framing  
Sills, window and door  
Solar screens  
Spark arrestors  
Spires  
Spandrel panels  
Stage accessories, fly galleries  
Stone anchors  
Subframes  
Thresholds  
Tie rods and plates  
Toe plates, toe guards  
Toilet partitions  
Trench edge bars, angles  
Wainscoting  
Wall vents  
Weathervanes  
Weep pipes  
Wheel guards  
Wier plates  
Window guards  
Window sills, stools, casings, mullions  
Wood truss accessories  
Woven wire products

## **SECTION C3. PLANS AND SPECIFICATIONS**

**C3.7.1.** Small samples often do not show the possible variations in color and texture to properly evaluate a product. It is advisable to specify at least a 12 in. square sample of the finish required. This usually has enough surface area to enable an architect or owner to make an acceptance decision knowing that the finished product should have a similar appearance.

**C3.7.2.** Sometimes owners or architects are not able to completely visualize how a special item of architectural metal will look. They can specify a full scale sample mock-up. If the sample is satisfactory and can be used in the finished job, there should be no additional cost to the owner since the cost should have been included in the original contract. However, if the mock-up is not satisfactory, the cost of developing this item to the owner's satisfaction is borne by the owner.

## **SECTION C6. FABRICATION AND DELIVERY**

**6.1.1.** Although frequently referred to as miscellaneous or ornamental iron, the ferrous metal used most frequently in architectural metal fabrication is steel produced to either ASTM A36 or AISI 1020. Although the latter is ordered to chemical properties only, its mechanical properties have been verified and documented by years of independent testing.

**6.1.2.** Type 304 stainless steel, which is widely used, is now designated as S 30400 in ASTM A167 and A666. There may be other alloys which might be better suited for a particular use or environment and should be so specified by the Architect.

**6.1.3.** There are many alloys available for the different aluminum shapes used in architectural metal products. Frequently used alloys are 6061-T6, 6063-T5 and 6063-T52.

## **SECTION C8. QUALITY CONTROL**

### **C8.3. WORKMANSHIP**

When specifying classes of workmanship it should be noted that for many items a Class 3 is all that is necessary. To achieve the most economical and cost effective bids, caution should be used in specifying the level of workmanship required.

Classes 1 & 2 should be called for only on specific items or areas of work where appearance is critical. The inherent costs in producing Class 1 workmanship are the highest and Class 3 the lowest.

Welding of iron, steel, stainless steel, aluminum and bronze is performed by experienced welders trained in the art of architectural welding. Selecting the correct welding procedure and welding rod to be compatible with the parent metal is the sole responsibility of the fabricator.

Exposed screws or fasteners, when required, should be specified by the Architect. Location and quantity will be shown on shop drawings for the Architect's approval.

## **SECTION C9. CONTRACTS**

### **C9.5. TERMS OF PAYMENT**

Terms of payment are based on a negotiated number of days after delivery of material and/or installation of material. Retention applies only to the erection portion of the contract and is reduced after 50% of the work is completed. If a performance or payment bond, paid for by the owner, is required by contract, then no retainage shall be required. The contract documents should allow for payments on fabricated and stored materials. Sometimes it is necessary to provide for advance payments for exotic materials and/or large quantities required to be purchased up front to maintain price protection.

## **SECTION C10. FINISHES**

The variety of finishes used on architectural metals, like other aspects of building technology, has become increasingly complex. The production of satisfactory finishes on architectural metal requires teamwork and cooperation between the metal supplier, the fabricator, the finisher, the architect and the contractor. It is not the sole responsibility of any one of these parties alone. The architect must understand the characteristics and limitations of the many finishes available, so that he may select those which are proper and appropriate for his purposes, and he should be able to clearly define his requirements. It is the responsibility of the supplier and fabricator to interpret these requirements, to furnish the appropriate alloys, and to see that all necessary steps are taken to produce the desired effects. The contractor must see that the finishes supplied are handled and installed with care, and are properly protected after installation. A satisfactory end result is the common aim of all parties, but a lack of mutual understanding can easily result in dissatisfaction. One of the aims of this Section of the Code is to minimize the likelihood of such deficiencies by encouraging a better industry performance for the benefit of all concerned.

### **General Classification of Finishes**

All of the finishes commonly used on the architectural metals can be classified as one of three principal types:

Mechanical Finishes, which are the result of physically affecting the surface of the metal by some mechanical means. This means may be the forming process itself, or a subsequent operation performed either before or after the metal is fabricated into an end-use product.

Chemical Finishes, which are accomplished by means of chemicals, and which may or may not have a physical etching effect upon the surface of the metal. Those which do are usually applied to fabricated products rather than to unformed metal stock.

Coatings, which are applied as finishes, either to the metal stock or to the fabricated product. These coatings may be either:

- a) Formed from the metal itself by a process of chemical or electrochemical conversion; or
- b) Formed by the application of some added material.

The relative importance of the three basic types of finish varies with the different metals. They are all used extensively on aluminum, but on carbon steel and iron the coatings are far more important than either mechanical or chemical finishes. The copper alloys are commonly subject to both mechanical and chemical finishes. On stainless steel the mechanical finishes are the common standard; chemical finishes and coatings are only used infrequently.

Because many of these finishes are not distinctly or uniquely suited to any one metal alone, and usages overlap considerably, the subject has not been found to lend itself to a neatly compartmented treatment, arranged either by metals or by finishes. It is advisable, therefore, to focus according to metals, treating under each metal not only those finishes which are uniquely its own, but also the mechanical and chemical finishes as applied to the metal. With certain types of applied coatings, however, the chief concern centers on the coating itself rather than on any particular substrate, and it is advisable to discuss such finishes under the heading of Applied Coatings, rather than identifying them with any one metal. The organic, laminated and vitreous coatings, however, should receive separate consideration.

### **The Function and Source of Finishes**

The function of metal finishes may be protective, decorative or both. A majority of many surface treatments known as "finishes" are not, in fact, final treatments, but only intermediate steps in a finishing process. Many are applied for protective reasons, some for reasons of appearance, and a few are simply cleaning processes. Usually several steps are required in preparing a metal surface for its specified in-use condition. All of these steps are designated, in the terms of the trade, as "finishes" though only the final treatment is actually exposed to use; the others are in fact simply preparatory treatments.

Only a few of the many available finishes are provided by the basic suppliers of the metal. In the main, these are the so-called "mill" or "as fabricated" finishes which are usually the cheapest form of mechanical finish and are available on all of the metals. Sheet stock of various metals is also available from the basic suppliers with several types of applied coatings, and aluminum and stainless steel sheet is also supplied with embossed and coined patterned textures. All of the other finishes are "process finishes" and are applied by the manufacturer or fabricator of the product or by other companies specializing in finishing work. The quality of finish on many architectural products depends largely, therefore, on the skill of the fabricator or finisher rather than on the basic supplier; but the quality of the alloys furnished by the supplier is always a factor of prime importance.

### **Variations in Appearance; the Value of Samples**

Visual uniformity of appearance may be critical in many architectural applications. Some types of finish present no problems in this respect, while others are subject to slight variations. Uniformity of appearance is often dependent upon the alloys used, and in certain mechanical finishing processes it is also affected by the equipment and speeds used in the finishing operation itself. With the non-ferrous metals, the achievement of a desired result often depends as much on specifying the right alloy as on choosing the right finish.

With rigid control of such variables, a high degree of uniformity can be achieved in any finish, but the architect should recognize that, except with opaque coatings, it is unrealistic to expect perfect uniformity of color and texture, particularly if the finish is provided by different parties or from different stocks of metal. For this reason, it is recommended that supplier or fabricator should always be consulted concerning critical requirements. The use of representative samples is usually advisable as a means of describing requirements in applications where precise appearance and quality control is essential. When color is involved, at least two samples should be used to define the permissible range of color.

### **The Choice of a Finish**

A good working knowledge of metal finishes requires more than an understanding of the technicalities of their processes and the ability to designate them properly. If the architect is to specify them intelligently he will be concerned not only with the aesthetic effect desired, but also with their practical appropriateness and their relative costs as well.

These finishes vary considerably in the amount of labor they require and consequently in their costs. Money can be wasted in the use of unnecessarily expensive finishes in locations where they can't be distinguished, and sometimes the choice of impractical finishes has needlessly complicated production processes resulting in objectionable delays and expenses. On the other hand, some important jobs have suffered because of the unwise selection of a "low cost" finish or the arbitrary decision to avoid the relatively insignificant cost of a critical finishing operation.

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*In this Section, an attempt has been made to specifically point out the limitations inherent in certain types of finishes, and to indicate their most appropriate applications as well as their relative costs. It is hoped that the architect will find this information helpful in communicating with the other members of the construction team.*

