

1 AIA LU/HSW

Learning Objectives

After reading this article, you should be able to:

1. Identify and recognize the characteristics of high-performance metal building systems as defined by national standards.
2. Investigate the design potential to create low-rise, nonresidential buildings of all types that use single-sourced metal building packages.
3. Assess the inherent efficiencies in design and construction by using an integrated project-delivery process that brings all parties together to work cooperatively.
4. Specify metal building system packages, and formulate appropriate selections related to specific projects.

AIA COURSE #K1806Z

Specifying the Latest in Metal Buildings

Properly specify a high-performance building system to meet design vision and exceed owner expectations

Sponsored by: Metal Building Manufacturers Association (MBMA) | *By Peter J. Arsenault, FAIA, NCARB, LEED AP*

Low-rise, nonresidential buildings are routinely designed and constructed using structural steel, cold-formed steel and a variety of wall cladding and metal roofing materials. This approach provides inherent economies over heavier and more labor-intensive materials such as concrete or masonry and offers great design flexibility. With all of these benefits, it is easy to see why metal building manufacturing companies have developed and evolved over more than 60 years to provide single-source packages of steel structures, wall enclosures, roof systems, fenestration, trim, and accessories. While we refer to these companies as metal building manufacturers, they actually represent forward-thinking, single-source suppliers. These companies can be engaged in an integrated project-delivery process that has routinely streamlined or fast-tracked project time schedules, concentrated warranty responsibility, and helped meet otherwise challenging construction budgets. In this course, we look at some of the reasons that this packaged metal building approach to design and construction accounts for roughly 40 percent of the low-rise nonresidential buildings each year. We also provide detailed guidance on how to specify a complete package that meets or exceeds everyone's expectations on a project.



Photo courtesy of the MBMA

Metal buildings have evolved and grown for over 60 years to the point that they now account for roughly 40 percent of all new low-rise, nonresidential construction.

METAL BUILDING TECHNOLOGY

Ever since the late 1800s, steel-framed buildings have emerged as a lighter-weight, more cost-effective, and more versatile means to design and construct buildings than masonry or concrete. During the 1900s, the technology to use steel in buildings expanded beyond cast iron or hot-rolled steel beams and columns to include cold-formed shapes, siding, roofing, and other components. Following World War II, entire building packages began to be provided that were manufactured from steel and other metals and offered the opportunity to streamline the design and construction process. With increasing demand for these types of low-rise, nonresidential buildings, a group of companies that designed, manufactured, and marketed metal buildings came together in 1956 to form the Metal Building Manufacturers Association. More commonly known as the MBMA, this is the trade association that has represented and helped the industry grow over the past 60-plus years (www.mbma.com). Its activities include education, research, advocacy, and other programs on behalf of the entire metal building industry.

As one of its better known efforts, the MBMA partnered with the International Accreditation Service (IAS) to implement a comprehensive, robust quality-assurance program. Known as IAS AC472: Inspection Programs for Manufacturers of Metal Building Systems, it is the most comprehensive quality-assurance accreditation program of its kind and is designed specifically for manufacturers of metal building systems. It is based on detailed quality-control requirements that must be independently inspected at least annually to maintain accreditation. By setting this high standard of excellence, the industry has been able to demonstrate its competence while gaining the trust of design professionals and building owners.



Video courtesy of the MBMA

Play this short video to see an overview of the modern state of metal building manufacturing.

The notable design and construction attribute that sets metal buildings apart from others is the use of a single-source supplier to provide a full, coordinated building package. This includes both in-house engineering design services and a complete package of building structure and enclosure products needed to create a low-rise nonresidential construction project of virtually any type. The process starts when an architect provides the overall building design and specification requirements for a metal building package that is reviewed by a manufacturer. Based on this information, the needed in-house structural engineering is performed for the metal building products with a corresponding price quote. Once that is approved, then fabrication can take place not only for the structural steel framing system but also for the full building enclosure, including a metal roofing system, metal wall system, and all accessory and trim components needed for a complete installation. Some supporting products and materials, such as insulation, glazing, doors, and accessories, may also be provided to round out the package. Once fabricated to meet the design, then the full building package is trucked to the project site. The on-site erection and installation of the entire structural and building enclosure package can then be performed by a local contractor, or preferably, by a certified and trained contractor/installer.

After completion, single-sourced metal buildings need not look any different than or be otherwise distinguishable from buildings that rely on multiple subcontractors and suppliers. That is because metal buildings are constructed to meet the drawings and specifications just like any other nonresidential building. Also, there is no limit on the size, shape, configuration, or finishes used in designing and constructing a metal building. Many are finished with metal wall panels, but many others are finished with other exterior building materials, such as tilt-wall, CMU, brick, wood, stucco, or EIFS. Virtually any look or design approach can be accommodated. Accordingly, some of the most common building types to take advantage of metal building systems include aviation facilities, government buildings, health care, recreational buildings, open structures, restaurants, retail stores, auto dealerships, K-12 schools, higher-education buildings, offices, places of worship, manufacturing plants, and warehouses. The reality is that virtually any low-rise building type that has a need or interest in a faster, more cost-effective delivery process than using multiple suppliers and installers is an excellent candidate for a metal building system.

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Photo courtesy of the MBMA

Metal buildings have virtually unlimited design possibilities for size, shape, style, exterior appearance, and interior finishes. Shown here is the Aiken Technical College Center for Energy and Advanced Manufacturing in Aiken, South Carolina.

INTEGRATED DESIGN AND CONSTRUCTION CONSIDERATIONS

For many decades, the traditional method for delivering a project to an owner (i.e., providing the design, fabrication, and construction of a building) has been notably fragmented and often inefficient. Many design, construction, and building owner groups have recognized this issue, which has led to a growth in alternative forms of project delivery. Design-build is one alternative approach that has become popular in many parts of the country and may be suitable for some metal buildings. However, design-build is not always practical, and there are legal implications depending on the state where it is practiced. Regardless, finding ways for designers, contractors, and fabricators to work together has long been seen as a positive and beneficial aspect of working with a single-source metal building company.

The American Institute of Architects (AIA) recognizes and promotes integrated project delivery (IPD) that provides an alternative project-delivery approach as a means for all stakeholders (owner, design professionals, constructors, fabricators, suppliers, etc.) to share in the success of a project together. It is based on mutual trust and collaboration, with all parties coming to the table from the outset of a project to provide input and expertise from their respective fields. When the project is successfully carried out, everyone benefits and shares in the financial rewards. If there are challenges, then everyone contributes toward solutions and shares the financial risks.

Metal building projects are well suited for IPD and other types of collaborative project delivery. At the first formative stages of a project, the architect, owner, and consulting engineers can identify and work with a metal building manufacturer based on qualifications and availability in a particular geographic area. Note that many metal building manufacturers will typically require the use of their own proprietary contracts and ordering documents as part of any other contractual relationship since they are tailored specifically for the metal building industry. That is quite workable as long as everyone is able to review and incorporate them into the overall multilateral agreements. This is part of the expertise that the manufacturer can bring based on its proven means to capture all pertinent metal building related information, contributing significantly to a complete and accurate transfer of information for the project.

The benefits of this type of collaborative approach to the design team are numerous. It begins with a fully integrated design and construction team being

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at the table sooner (i.e., during the design stage) and made up of all parties to provide input, expertise, and informed decision making. This means that the design and construction process can be concurrent and multilevel rather than limit itself to a process that is only linear. Communications between all parties throughout the process is typically based on 2-D and 3-D digital documentation and other computerized processing for full coordination and integration of all building systems and components. Risk in all its forms is collectively managed and appropriately shared, meaning that team success is directly tied to project success.



Photo courtesy of the MBMA

By using a collaborative approach to project delivery, innovative designs can mix with efficient construction to meet the needs of the building owner and occupants.

How does this play out in a typical building project? During design, the information being input into a computer model is based on actual, not prototypical, parameters. This virtual “building” of the project means that details at the level of fabrication drawings can be input, thus eliminating the need for shop drawing reviews later. This would apply to the structural steel system and all building enclosure systems selected, such as walls, roofing, siding, openings, etc. As soon as the building structure is designed, then the foundation design can be finalized, allowing site and concrete work (separate from the metal building package) to begin sooner—all while details of the metal building package are being finalized and fabricated. The scheduling of the delivery and assembly of the metal building package can then be finished, while an approved metal building contractor/erector can prepare to provide the on-site work needed.

At this point, all of the following construction can take place as part of the metal building package to efficiently erect the structure and assemble the components that make up the building:

- Structural steel erection, including primary columns, beams, bents, etc., plus secondary members, including purlins, girts, bracing, etc.;
- Metal roofing system, including roof panels, clips and purlins, insulation, flashing, opening accessories, and all other related elements;
- Exterior wall system, including wall panels, exterior siding, girts (if applicable), insulation, and air and water barriers (depending on the specific wall system);
- Windows and other glazing, including translucent roof or wall panels;
- Doors including personnel and non-personnel doors;
- Rain gutters and downspouts; and

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- Accessories and add-ons, such as louvers, roof ventilation, curbs, solar panels etc.

When it comes to assuring quality control for on-site contractors, a fairly recent program spearheaded by the Metal Building Contractors & Erectors Association (MBCEA) in consultation with MBMA members is worth noting. Similar to the previously mentioned AC472, a separate accreditation is available for the contractors that do the field assembly and erection of metal building packages. Referred to as IAS AC478: Accreditation Criteria for Inspection Practices of Metal Building Assemblers, this program addresses on-site quality management, system review, and inspections. To achieve accreditation, contractors must demonstrate that they have the personnel, organization, experience, knowledge, management procedures, and commitment to assemble metal building systems in accordance with specified requirements. The accredited companies must also comply with a documented safety and training program and are subjected to periodic job-site inspections from independent auditors as well as IAS examiners to verify continued compliance with the AC478 criteria.

Once an accredited contractor has installed the full metal building package, the remaining work can be completed by other selected contractors or subcontractors as needed. This work can include exterior finishes and trim that are not based on metal components (i.e., masonry, EIFS, etc.), interior partitions and separations, and all mechanical, electrical, and plumbing work within the enclosed building. The project can then be completed with interior finishing work for walls, floors, and ceilings.



Photo courtesy of the MBMA

An IAS-accredited metal building manufacturer can provide all of the structural and building enclosure portions of a custom-designed metal building, while an IAS-accredited contractor can erect and assemble that building on-site.

Overall, the integrated collaboration with a metal building manufacturing company allows for a complete building enclosure using a streamlined design and construction process. Following through on the rest of the project allows for better coordination of the work that precedes it, comes after it, or is completed concurrently. This has been shown repeatedly to save time and expense for a building. Achieving better control of both benefits everyone involved.

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SPECIFICATIONS FOR METAL BUILDING SYSTEMS

With a good understanding of the characteristics and capabilities of metal buildings, it is important to remember that the design team still needs to design the building and specify the systems, just as in any construction project. The design and layout will be directed by the talent and expertise of the design team and be fully informed by input from the other stakeholders. The specifications will need particular attention to detail to assure that everything is properly thought through and coordinated. Fortunately, when specifying metal buildings, many components can be consolidated into a single specification section instead of multiple sections for structure and enclosure. This simplifies the process for spec writers, contractors, and suppliers and also allows for greater focus on coordination. In a standard CSI or Master Spec format, the usual location to include this spec is in Section 13 34 19 – Metal Building Systems.

When assembling the information to prepare the specifications, there are some excellent reference materials available. One of the best is the latest edition (2012) of the MBMA Metal Building Systems Manual (www.techstreet.com/mbma/standards/metal-building-systems-manual?product_id=1909749#jumps), which provides very detailed and comprehensive information for designing and specifying metal buildings. This publication is based on extensive experience within the metal building industry, making it very relevant and focused on the particular items that need to be addressed for successful metal building projects. In particular, Chapter IV – Common Industry Practices is often referred to and cited for overall and specific coordination and administration of the work. This manual may be available from a local metal building manufacturer rep or installer, or it can be ordered directly from the MBMA. There are also standard performance specifications that the MBMA offers as a free download for both metal buildings and metal roofing systems (www.mbma.com/Performance_Specifications.html). Having these resources available and referring to them in the preparation of specifications for a project can be invaluable for the information provided and the potential for time savings.

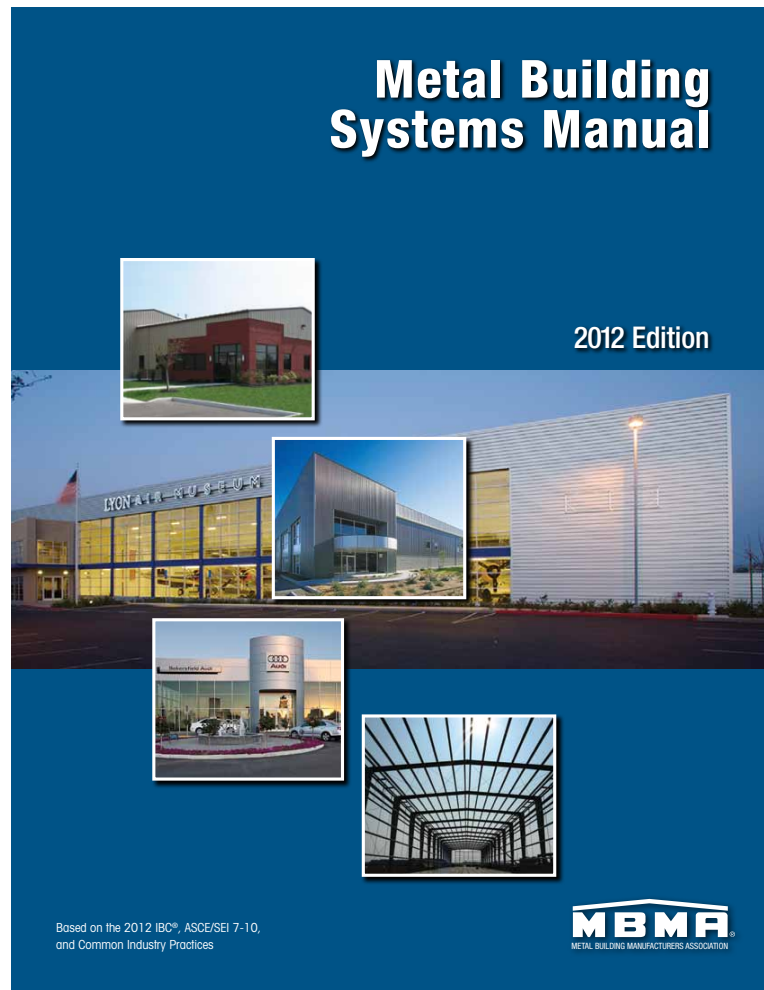


Photo courtesy of the MBMA

The Metal Building Systems Manual is an excellent resource for designing and specifying metal buildings.

Based on the above, some of the relevant items to address in a standard three-part specification format are highlighted in the following sections.

Part 1: General

This is the place to provide the general criteria for the metal building package. Keep in mind, however, that each manufacturer has some specific common practices, standard part profiles, and details relevant to their particular system. Hence, if a specific manufacturer has not been selected, then it's better to provide general performance criteria that can be flexible to accommodate differences or alternatives between manufacturers. If a specific manufacturer has been selected, then coordination with their particular system can be stated and specified accordingly.

Description of the Metal Building System

This is intended to be the place to provide a summary for the particular project being specified. As such, it should provide a short overview of the types of things included in the specification section. This can include the type of structural frame, including primary and secondary framing elements, lateral bracing, wall and roof systems, accessories, and pertinent building size and shape references, either in summary or by referring to architectural and engineering drawings.

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Related Specification Sections

Since the metal building system will need to be coordinated with work by other trades, the related sections that may be impacted should be called out here. This could include things like concrete work for foundations where structural steel is supported or requires anchor rods, leveling plates or grout. Related sections could also include any metal components, doors, windows, skylights, or joint sealing provided by others that interact with the metal building. Finish painting of metal surfaces by other trades and underground drainage piping should also be identified where applicable.

Referenced Standards

There are many recognized standards that apply to the various aspects of a metal building package. Some are based on the latest referenced standards in the International Building Code, and others are simply recognized by the metal building industry. For a complete list of applicable standards, see the MBMA Metal Building Systems Manual or the Performance Specifications. Then only reference the ones that are actually relevant to the specification section being written.



Photo courtesy of the MBMA

All of the general requirements for a metal building should be included in Part 1 of a standard three-part specification.

Design Requirements

This is the place to list the fundamental performance requirements that a metal building manufacturer will need to comply with. To begin with, it is useful to state something similar to “The building shall be designed by the manufacturer as a complete system. All components of the system shall be supplied or specified by the same manufacturer.” This basic criteria helps assure single-source responsibility and coordination of components. Next, it is useful to point out the applicable codes that need to be complied with related to the jurisdiction where the building is being constructed. This will include the appropriate versions of the Building Code, Energy Conservation Code, or ASHRAE standard, and any other applicable codes or standards. Then, the basic design loads for the building need to be stated, including applicable determinations for dead loads, live loads, collateral loads, (i.e. added dead loads hung from the building system, such as ceiling-hung electrical equipment, sprinklers, etc.), snow loads, seismic loads, and deflection requirements. The American Institute of Steel Construction (AISC) Design Guide #3 on Service-

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ability Considerations for Steel Buildings can be referenced for the appropriate deflection and drift criteria.

Submittals

If an integrated project-delivery process is not pursued, then particular information may need to be verified by the specifier prompting the need for submittals. Only the information that is substantially different from the contract documents should need to be requested as a submittal. Anything that is subsequently submitted and reviewed will then be relied upon by the metal building manufacturer as the basis for final fabrication, especially if there are any deviations between the contract documents and the submittals. Therefore, a thorough review, commentary, and ultimate approval of any submittals requested is critical and needs to be done in a timely manner to assure fabrication and construction schedules are met.

Quality Assurance

For work quality related to steel members and systems, the most common references are found in the MBMA Metal Building Systems Manual and the AISC Specification for Structural Steel Buildings (AISC 360).

Qualifications

There are three things to address here related to qualifications of the companies or individuals involved. The first is for the manufacturer who should be required to be accredited under the IAS AC472 program discussed earlier. The second qualification is for the design of the structural steel system, which shall be done by a licensed, professional engineer. The third is for the contractor who performs the building erection and assembly and shall be accredited under the IAS AC478 program described previously.

Warranty

A number of different warranty types may be possible and should be clearly called out since they affect the pricing of the final package. Metal exterior roof and wall panel warranties generally are available to include coverage against metal substrate perforations. Paint warranties generally include coverage for exterior prefinished color against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Roof warranties may be available through the metal building contractor to include coverage for weather tightness of building enclosure elements after installation. It is best to check with the manufacturer and contractors to determine the type and extent of available warranties in order to understand all of the options.

Part 2: Products

In preparing a specification for a metal building package, many different product types are included in this single Division 13 section, instead of multiple specification sections across different divisions. Therefore, all of the different products that make up the metal building package need to be identified and specified here as well as shown appropriately on the drawings. Common products are identified as follows but should be selected and used only as appropriate to a particular specification for a particular project.

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Photo courtesy of the MBMA

All of the products that make up a metal building package, from structural steel to accessories and everything in between, need to be identified in the metal building system specifications.

Structural Steel

The specification needs to distinguish between the requirements for primary framing (i.e., structural shapes, welded frames, etc.) and secondary framing (i.e., rollformed purlins, girts, etc.). The grade and quality of the steel for each of these structural components should be listed as well as any criteria for their respective finishes (primed, galvanized, etc.). Typically, the metal building manufacturer will use this performance information and the building design to identify the rest of the engineered structural steel. Note that fasteners and connections are part of any steel fabrication and construction. Metal building packages feature bolted connections and typically do not require any field welding to be called for. This aspect of a metal building structural system contributes directly to the speed of erection and overall time savings.

Roof System

A metal roof system is a key part of the appeal of a metal building since it can provide a long-lasting, watertight solution for both low-slope and high-slope roofing. There are, of course, choices that need to be made and specified in order to obtain the desired look and performance of the roof. The basic sheet steel stock should be called out, including any coating (typically 55 percent aluminum-zinc coated for low slope and painted galvanized for high slope). The next choice is the type of metal roofing (standing seam, ribbed, lap, other) as well as whether concealed or exposed fasteners are desired, which will lead to the thickness (gauge) and fabricated profile of the metal panels. Manufacturers will often have specific profiles and seaming conditions that have been tested for things like hydrostatic pressure (low slope), air pressure, and wind uplift according to standard UL or ASTM testing protocols, so the specific profile should be selected according to project needs. Here too, fasteners play an important role particularly for demonstrating successful testing results, so the proper fastener type, size, and material need to be identified and provided as part of the roof system package. All other related items for a complete roof system need to be identified as well, such as soffit panels and coordinated eave and rake elements.

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For all of the roof system items, both the exposed and non-exposed metal surfaces need a final factory-applied finish. These can include a basic galvanized metal finish, a factory-painted finish, or a premium-quality polyvinylidene fluoride (PVDF) finish. Most manufacturers will include a multilayer approach to the finish and add in other protective or high-performance layers options too. For example, the finish can be treated to create a high solar reflectance contributing to a “cool roof” as recognized by national programs and standards for green and sustainable buildings. Whatever selection is made, the specific color(s) and treatments need to be selected and identified for each of the different faces of the various roofing system products.

Final accessories or related materials need to be called out for roofing too. Sealant is usually a part of all metal roofing systems and should be specified here, either as the manufacturer’s standard type or by identifying sealant performance requirements. In some cases, solar electric panels are installed using clamps that work very effectively on the standing seams of metal roofing. If those are needed, they should be specified and identified as appropriate.

Roof insulation is part of the roof system and may or may not be provided by the building manufacturer. If it is provided, then the required R-value per inch of insulation or the total assembly U-factor needs to be specified. Metal buildings can utilize a multitude of high-performance insulation options, which can meet or exceed energy conservation code requirements. ASHRAE 90.1 and the International Energy Conservation Code (IECC) have specific prescriptive requirements for metal buildings, although many metal building designers often utilize software tools such as COMcheck (free from the U.S. Department of Energy) to show energy-code compliance using the envelope trade-off approach. As such, there are several ways that insulation can be specified in a metal building, including laminated metal building insulation, cavity fill insulation (typically certified under NAIMA 202), and various liner systems installed between and over the roofing purlins. Other approaches use rigid insulation above the structure and protect the interior face accordingly. In any of these approaches, the details between the insulation installation and the connection of the metal roofing need to be coordinated to assure that the insulation is not compromised and that the metal roofing is securely and properly attached through the insulation to the appropriate structural components. This coordination is especially critical if the insulation is being provided “by others” since the metal building manufacturer can obviously not take responsibility for the work of others. The details of roof insulation should be thoroughly understood and specified accordingly to assure the best all-around outcomes.

Wall Systems

Metal building wall systems are not usually based on metal studs and framing but rather on enclosure and insulation approaches similar to metal roofs. Hence the types of materials and products that need to be specified are similar. If metal cladding is part of the design, then selection of the type of exterior metal wall panel (flat, ribbed, insulated metal panels, etc.) is the first choice to make, followed by the grade, gauge, and treatment of the metal. Further, specific pieces for wall trim, corners, and related wall system accessories will need to be specified. In this regard, it is often best to review the standard profiles and assembly details of a manufacturer to assure compatibility and weather tightness. All related details for finish and color (interior and exterior faces) along with appropriate fasteners and sealants need to be identified in the specification for a complete wall system.

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Photo courtesy of the MBMA

A variety of wall systems are available with different appearances that can be provided, even on the same building.

Insulation of metal building walls is commonly performed in one of two ways. In the first common option, NAIMA 202 metal building insulation is placed between the structural components with or without an interior facing liner and secured in place. It may then be covered over, or not, with an interior finish system as selected by the design team and likely installed by others. In the second common option, insulated metal panels (IMPs) can be selected and specified. This product uses a solid core of rigid insulation (commonly urethane) sprayed between an inner and outer metal facing. The panel is non-structural, meaning it does not carry any building loads directly. However, since it is quite rigid and installed across the wall girts and purlins, it transfers any dead loads and wind loads directly to the primary building structure. If this option is selected, it needs to be specified based on information from the IMP manufacturer with particular attention to sealing between the panels. In either insulation choice, the wall insulation R-value or the assembly U-factor needs to be specified.

Doors and Frames

Metal doors and frames may or may not be provided by a particular metal building manufacturer. If they aren't, the details for the openings and framing need to be coordinated in the design and contract documents and specified in the appropriate Division 8 specification sections. If doors and frames are provided as part of the metal building package, then the coordination will be part of this Division 13 specification and internal to the manufacturer. When provided, they can take two common forms: personnel doors (i.e., standard swinging or sliding doors) and larger, non-personnel doors for equipment and vehicles (i.e., overhead doors, coiling metal doors, etc.). As such, the specification should be very clear on the type, size, and manufacturer of the doors and frames since there may be several choices available. The locations and pertinent identifying information for the various types should be shown on drawings and in door schedules. If there are wind rating requirements for the doors that need to match the envelope requirements for the building design, those need to be identified. All other details of the doors, including type, thickness, construction, finish, fire rating, and operation, should be called out in the specifications, or specific model numbers should be given that document that information. Hardware should also be addressed since it may or may not be provided with the doors. Typically, hardware is provided as part of any non-personnel doors, and there are likely options for

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type, material, finish, locking, weather sealing, etc. Standard personnel doors will likely need a separate hardware specification based on project preferences.

Glazing: Windows, Skylights, and Translucent Panels

Providing natural light into a metal building is no different than any other building. That means the specific glazing types used need to be identified and coordinated with the rest of the building system. If standard windows are incorporated, they may be provided as part of the building package and need to be identified by manufacturer, make, type, and model. The same is true for skylights. In either case, the performance requirements for energy conservation should be stated with reference to testing and labeling (as appropriate to manufactured units) by the National Fenestration Rating Council (NFRC). The four common criteria here are overall U-factor (the whole unit, not just the glass), solar heat gain coefficient (SHGC), air infiltration rate, and condensation resistance factor. Information such as this that is applicable to all units should be stated in the specifications, while locations and types should be shown on the drawings or in a typical window/glazing schedule.

Metal building manufacturers have also offered an option of manufactured glazing panels that essentially take the place of one or more metal panels. This is an efficient and effective means for bringing in daylight in either walls or roofs using clear, white, translucent, or even insulated glazing panels. They are often corrugated or ribbed in some fashion and made from fiberglass-reinforced resin with the capability of sustaining a 200-pound concentrated load on a 1-foot square located anywhere on the panel without rupture. They can also be rated for wind and fire resistance. If these are part of the project, then they need to be part of the specification.

Gutters and Downspouts

Metal building manufacturers are able to fabricate all types of metal products. Since many low-rise buildings use a roof that drains to the edges rather than to internal drains, gutters and downspouts are commonly offered as part of the metal building package to appropriately collect and divert rainwater away from the finished buildings. The particular profile, metal type, and color all need to be selected. The sizing of the gutters and downspouts can either be done by a member of the design team or the relevant standards, and local data can be provided for the metal building manufacturer to do the sizing.

Accessories

There are some additional items that can be provided as part of the metal building package. Ventilating the roof system is often needed, so roof ventilators, ridge vents, or other similar items can be specified and provided. In cases where mechanical equipment, hatches, skylights, or similar items require a roof penetration and curb, the metal building manufacturer can fabricate and provide the needed curbs. This has the benefit of being coordinated with the rest of the roofing system and eliminates the need to bring in an outside subcontractor just to accommodate this condition. Similarly, wall louvers may be needed to move air into or out of the building. By specifying these as part of the metal building package, they can be sized and fit to work with the rest of the wall panel system. All pertinent details of any of these building accessories need to be called out, including product types, sizes, relevant standards for water or wind, screening where appropriate, as well as all finish and color information.

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Photo courtesy of the MBMA

A complete installation includes all components for all parts of the building, even if they are used in tandem with things not provided by the metal building manufacturer, such as the wood components shown here.

Fabrication

Some of the products in the metal building package are prefabricated, such as doors, windows, etc., and need no further attention in this part of the specification. However, anything that is fabricated by the metal building manufacturer from basic materials needs to be identified here based on the processes and quality standards to fabricate those materials into their final form, shape, or assemblage. The MBMA Metal Building Systems Manual's Common Industry Practices chapter is most often referenced as the standard for fabricating primary and secondary framing, particularly for cold-formed or builtup components. Hot-rolled members are typically fabricated according to AISC standards for the particular shape (e.g., pipe, tube, rolled structural shapes). Painting and finishing of structural members is based on the Society for Protective Coatings (SSPC) standards for cleaning, priming, and coating at the factory.

Fabrication of nonstructural items such as roof and wall panels, gutters, downspouts, flashings, and trim also need to be specified. Commonly, manufacturer's standard profiles and colors are selected for these items. If custom elements are sought, then they should be discussed ahead of time with the metal building manufacturer or be identified as provided and coordinated by others. Either way, specific details of fabrication, such as hemmed edges, connection types, and fabrication of related hangars or straps, all need to be called out.

Part 3: Execution

As with any specified product or system, the installation requires multiple steps that need to be clearly articulated in the specification in order to receive the best results. The MBMA Metal Building Systems Manual's Common Industry Practices chapter should be referenced and referred to in all of the following conditions.

Examination and Preparation

Require that all conditions exist for the satisfactory installation of the metal building, and correct any that are not acceptable.

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Field Quality Control

Field personnel qualifications, including IAS AC478 accreditation, should be stated. Further, erection tolerances should be identified in accordance with the MBMA Manual unless engineering or contractual requirements state otherwise.

Framing Erection

The MBMA Manual should be followed for setting base plates with templates, installing primary and secondary framing members, structural fastening using bolts, field welding, and temporary guys and bracing. No field cutting or modification of structural members should be allowed without the expressed approval of the metal building manufacturer. Any damaged or exposed primer shall be touched up following erection.

Roof and Wall Panel Installation

The installation of all roof and wall panel systems shall be performed in accordance with the manufacturer's instructions and recommendations and industry standards for a full, weathertight, and sealed end result.

Insulation Installation

If provided, insulation must be carefully installed per manufacturer's instructions, energy-code requirements, and industry standards for a fully and continuously insulated installation.

Doors and Glazing

All door and glazing products shall be installed consistent with the recommendations of the manufacturer of the specific products and in accordance with the metal building manufacturer instructions and guidelines.

Gutters and Downspouts

In addition to being properly installed on the building, gutters and downspouts need to be appropriately directed to surface or underground drainage areas as determined by site conditions and contract documents.

Flashings, Trim, and Accessories

All remaining items need to be installed appropriate to their location and details shown on the drawings.

Completion

Once the metal building package is completely assembled, then final cleanup and spot repairs, etc. may be needed and should be called for as needed.

In the end, a properly specified metal building package should be complete and coordinated with other building products, systems, and materials, all with the goal of minimizing any surprises or delays in the field.

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Photo courtesy of the MBMA

Properly designed and specified, metal buildings provide an appropriate solution for many different building types.

CONCLUSION

Architects have a choice in how low-rise, nonresidential buildings of all types are designed and constructed. While buildings that are designed, bid, and entirely field constructed by multiple subcontractors under the auspices of a general contractor or construction manager have been common, a more streamlined approach of integrated project delivery is taking hold. Metal building systems that come from a single-source supplier for structure and building enclosure provide an appealing alternative for successful project delivery incorporating a collaborative approach. Design professionals of all disciplines who recognize and embrace the design opportunities, construction efficiencies, and overall project-delivery improvements possible with metal building systems can take advantage of these realities to realize tangible benefits for themselves and for the building owners that they serve.

For additional videos showing more about this building type or to further view the range of possibilities, visit www.mbma.com. For answers to general questions about metal buildings, visit www.mbma.com/Learn_FAQ.html.



The Metal Building Manufacturers Association (MBMA) serves to promote the metal building systems industry. Its membership represents more than \$2.4 billion in annual sales and accounts for approximately 50 percent of the total non-residential low-rise construction market in the United States. Follow MBMA on LinkedIn or Twitter @LearnAboutMBMA.

Today, the MBMA represents more than 40 building systems member companies who are all IAS AC472 accredited and operate 65 full-scale manufacturing plants worldwide that employ more than 12,000 people. Collectively, they represent the vast majority of the capacity to provide metal buildings in the United States. In addition, more than 70 associate members act as ancillary manufacturers or suppliers of components and services in support of the primary manufacturing suppliers. Over the years, and with the support of all of these members, extensive research and testing has helped the industry produce advanced engineering and innovative systems that are able to perform better and at a lower cost than more traditional building approaches in the low-rise market.

ONLINE PORTION

QUIZ

1. The MBMA sponsored program known as IAS AC472: Inspection Programs for Manufacturers of Metal Building Systems is:
 - a. the most comprehensive quality-assurance accreditation program of its kind.
 - b. designed specifically for manufacturers of metal building systems.
 - c. based on detailed quality-control requirements that must be independently inspected at least annually to maintain accreditation.
 - d. **All of the above**

2. The benefits of a collaborative approach in the design and construction of metal buildings include all of the following EXCEPT:
 - a. a fully integrated design and construction team is at the table sooner (i.e., during the design stage).
 - b. **a typical, linear design and construction process must be followed.**
 - c. the collaboration is made up of all parties to provide input, expertise, and informed decision making.
 - d. the design and construction process can be concurrent and multi-level.

3. Which of the following is NOT normally considered part of a metal building package?
 - a. **Concrete foundation work**
 - b. Structural steel fabrication and erection
 - c. Roof and wall enclosure systems
 - d. Doors and windows

4. When assembling the information to prepare specifications for a metal building, an excellent reference source is:
 - a. any general publication about metal buildings.
 - b. **the MBMA Metal Building Systems Manual.**
 - c. only information from the American Institute of Steel Construction (AISC).
 - d. only information from the Metal Building Contractors & Erectors Association (MBCEA).

5. This basic criteria to help assure single-source responsibility and coordination of components for a metal building is based on:
 - a. taking the lowest bid.
 - b. allowing the metal building spec to be divided up between contractors.
 - c. **the fabrication design being done by the manufacturer as a complete system, with all components supplied or specified by the same manufacturer.**
 - d. simply having everyone involved from the beginning of the project.

6. Qualifications requirements need to address the manufacturer, who should be required to be accredited under the IAS AC472 program, the designer of the structural steel system, which shall be done by a licensed, professional engineer, and the contractor, who shall be accredited under the IAS AC478 program.
 - a. **True**
 - b. False

7. A key part of the appeal of a metal building that can provide a long-lasting, watertight solution for both low-slope and high-slope conditions is:
 - a. a metal wall panel system.
 - b. metal accessories and trim.
 - c. **a metal roof system.**
 - d. gutters and downspouts.

ONLINE PORTION

8. Metal building wall systems are not usually based on metal studs and framing but rather on enclosure and insulation approaches similar to metal roofs.
 - a. **True**
 - b. False

9. Which of the following is NOT defined as a metal building accessory available as part of a metal building package?
 - a. Roof ventilators or ridge vents
 - b. Roof curbs to hold equipment or other items
 - c. Wall louvers
 - d. **Storefront glazing**

10. Field quality control for the erection and assembly of metal buildings should be based on IAS AC478 for contractor accreditation with erection tolerances identified in accordance with the MBMA Manual, unless engineering or contractual requirements state otherwise.
 - a. **True**
 - b. False