



# PRODUCT AND ENGINEERING MANUAL

## 3.0 SPECIFICATION GUIDE

### Introduction

The following *Nucor Building Systems Specification Guide* provides the owner or design professional a detailed description of all standard Nucor products. This guide is designed to aid the architect or engineer of record in the process of specifying the best building system solution.

These comprehensive specifications cover many aspects of the Nucor product line. Since it is possible to apply the various Nucor products covered in this manual in many different ways, not all conditions are addressed. Other more detailed information is available. For the unique needs of an individual project and building design, please contact the Nucor Building Systems' Sales Department.

The 1996 Low-Rise Building Systems Manual, published by the Metal Building Manufacturers Association (MBMA), is incorporated by reference to all Nucor project specifications.

**Notice:**  
 Due to Nucor's continuous product improvement program, *all information contained herein is subject to change without notice.*

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### 1. General

#### 1.1. Scope

- 1.1.1. The building shall consist of all primary and secondary structural members, connection bolts, canopies, roof extensions, sheeting, trim, flashing, doors, fasteners, gutters, downspouts, and other miscellaneous items and accessories as specified, shown, or called for on Nucor Building Systems' drawings or order documents. Refer to the 1996 MBMA Low-Rise Building Systems Manual section entitled "Common Industry Practices" for the standards in which this guide will be used. Nucor will not provide items not specifically called for in the Nucor order documents.

#### 1.2. Dimensional Terminology

- 1.2.1. The building "width" shall be the distance from outside face of sidewall girt to outside face of sidewall girt (steel line to steel line).
- 1.2.2. The building "length" shall be the distance from outside face of endwall girt to outside face of endwall girt (steel line to steel line).
- 1.2.3. The building "eave height" shall be the distance from finished floor to top of eave strut or purlin at the steel line. For buildings with curbs or column recesses, eave height shall still be measured from the finished-floor elevation.
- 1.2.4. The "bay spacing" shall be the distance from center of primary frame to center of primary frame for interior bays. End bays shall be the distance from outside face of endwall girt (steel line) to center of first interior primary frame.
- 1.2.5. The "module spacing" on RMG-X buildings shall be the distance from outside face of sidewall girt (steel line) to center of first interior column. It is also the distance from center to center of interior columns for interior spans.
- 1.2.6. The "roof slope" shall be based on an order-specified vertical rise for each 12" horizontal run unless otherwise stated (1/4" in 12" minimum for "Nucor CFR"™; 1/2" in 12" for "Nucor Classic"™ roofs).

#### 1.3. Building Types

- 1.3.1. Solid web framing consists of members fabricated from shop-welded, hot-rolled steel sheets or plates and hot-rolled flat bars.
- 1.3.1.1. Rigid frames (RCG) are clearspan buildings with tapered sidewall columns. They are commonly used for spans from 40 feet to over 150 feet.
- 1.3.1.2. Tapered beams (TCG) are clearspan buildings suitable for smaller span buildings from 20 feet to 60 feet wide. TCG buildings utilize straight sidewall columns and horizontal bottom flange rafters.
- 1.3.1.3. Rigid frames with interior columns (RMG-X) are multi-span buildings with interior columns (number of interior columns is designated by the "X"). They provide an economical advantage on buildings from 80 feet to over 300 feet wide.



- 1.3.1.4. Single slope clearspan (RCS) or multi-span (RMS-X) buildings are available in width ranges similar to RCG and RMG-X as previously listed. All roof drainage is taken to the low sidewall.
- 1.3.1.5. Lean-to (LCS) or (LMS-X) buildings are similar to the single slope building, however, the highside column has been eliminated. The lean-to rafter is supported by the main building frame, sidewall, or endwall column.

## 2. Design

### 2.1. Design Criteria

- 2.1.1. All structural steel sections and welded plate members shall be designed in accordance with the Manual of Steel Construction – Allowable Stress Design, 9<sup>th</sup> Edition, American Institute of Steel Construction, Chicago, IL, 1989; and the latest edition of the Structural Welding Code – Steel, ANSI-AWS D1.1, American Welding Society, Miami, FL.
- 2.1.2. All light gage cold-formed structural members and exterior covering shall be designed in accordance with the Cold-Formed Steel Design Manual, 1996 Edition, American Iron and Steel Institute. All standards for the welding of cold-formed members are based upon the Structural Welding Code – Sheet Steel, ANSI/AWS D1.3-98, 1998 Edition, American Welding Society, Miami, FL.
- 2.1.3. The primary and secondary framing and covering shall be designed for all applicable loads and combinations of loads as set forth in:
  - 2.1.3.1. The specified governing building code for the order under consideration. This may be any of the standard model building codes currently published, such as: the Building Officials and Code Administrators' National Building Code (BOCA); the International Conference of Building Officials' Uniform Building Code (UBC), or the Southern Building Code Congress International's Southern Building Code (SBC). Additionally, many orders may be within states or municipalities that have their own amendments to the governing model code or that have their own independent code. In this case, loads, deflection criteria, and load combinations will be determined in accordance with this governing local code. Specification of loads and codes and design responsibility shall be as stated in Article IV, "Common Industry Practices", of the 1996 Edition of the Low-Rise Building Systems Manual from MBMA. These "common industry practices" will apply regardless of the state, local, or model code chosen.
  - 2.1.3.2. In lieu of appropriate state, local, or model codes, Article I., "Design Practices" of the 1996 Edition of the Low-Rise Building Systems Manual from MBMA shall be used to determine loads and load combinations.
  - 2.1.3.3. Design loads shall not be less than those specified in Appendix Section A22 entitled "Wind, Snow, Seismic, and Rain Data By County," of the Low-Rise Building Systems Manual, MBMA, 1996 Edition, if there is not a controlling state or local code. If the controlling state or local code specifies values that are less than those found in Appendix Section A22, the state or local code takes precedence.
- 2.1.4. The appropriate code shall be specified at the time of the building quotation.



### 2.2. Engineering Certifications

- 2.2.1. All buildings shall be designed by or under the direct supervision of registered professional engineers in accordance with the information specified to Nucor on the order documentation in compliance with Article IV, "Common Industry Practices", of the 1996 Edition of the MBMA Low-Rise Building Systems Manual. Nucor's stamping engineer is not the "Engineer of Record" for the project and cannot be construed as such.
- 2.2.2. Design calculations, certified by a professional engineer, may be purchased with the order, if requested.
- 2.2.3. A letter of certification, certified by a professional engineer, may be supplied with the building quote proposal, if requested. A letter of certification shall be provided with the order at the time the anchor bolt plans are complete.
- 2.2.4. All permit drawings shall be stamped with a professional engineer's seal in the state of the building location. Approval drawings will not be sealed. Erection drawings will be sealed only if specifically requested by the customer.

### 2.3. Non-Standard Design Loads

- 2.3.1. All building types shall be available with non-standard design loads as required by the local code or governing body provided these loads are specified on the order documents. Special dead, live, or wind loads shall be applied in the same manner as standard design loads for the type of building involved as long as MBMA design requirements are satisfied.

### 2.4. Auxiliary Design Loads

- 2.4.1. Crane and impact loads shall be applied in accordance with the Manual of Steel Construction – Allowable Stress Design, 9<sup>th</sup> Edition, American Institute of Steel Construction, Chicago, IL, 1989; Article I, Section 6 of the 1996 Edition of the MBMA Low-Rise Building Systems Manual; and the appropriate code specified with the building proposal.
- 2.4.2. Seismic loads, for buildings in areas subject to earthquakes, shall be derived using the procedure set forth by appropriate building codes specified on the Nucor order documents.

### 2.5. Load Combinations

- 2.5.1. Load combinations shall be per the appropriate building code. In lieu of any specified code, loads shall be combined per Article I, Section 9 of the 1996 Edition of the MBMA Low-Rise Building Systems Manual as follows:

D = Dead load plus specified collateral loads  
L = Roof live loads  
S = Roof snow loads  
W = Wind load  
E = Seismic load  
C = Auxiliary load (Crane, Conveyors, Etc.)



- D + L
- D + S
- D + C
- D + W
- D + S + C (See note 1)
- D + 0.5W + C
- D + S + .5W
- D + 0.5S + W
- (1.1 + 0.5 A<sub>v</sub>)D + R x S + E (See note 2)
- (0.9 - 0.5 A<sub>v</sub>)D + E

Note 1: Roof snow load(s) in this combination shall be zero when the roof snow load is less than or equal to 13 psf; 0.5 S when it is greater than 13 psf, but less than 31 psf; 0.75 S when it is equal to or greater than 31 psf.

Note 2: R = 0 when roof snow load (S) is less than 30 psf; R = 0.2 when S is equal to or greater than 30 psf.

### 3. Anchor Bolts And Foundations

#### 3.1. Anchor Bolts

- 3.1.1. Anchor bolts and base plates shall be designed to resist all column reactions. Sizes used shall be as those shown on Nucor Building Systems' drawings. The length and embedment anchorage of all anchor bolts shall be the responsibility of the foundation engineer.
- 3.1.2. Anchor bolts shall not be supplied by Nucor Building Systems and are the responsibility of the contractor or erector to furnish.
- 3.1.3. Leveling plates shall not be supplied by Nucor Building Systems unless specifically called for on the Nucor order documents.

#### 3.2. Foundations

- 3.2.1. Foundations shall be designed by a qualified registered professional engineer to accommodate the local soil conditions and meet building reaction requirements in addition to other loads imposed by building use or occupancy. It shall be the responsibility of the Engineer of Record to verify that the loading criteria defined on the Order Documents is adequate for the location of the project in question.
- 3.2.2. Neither the foundation design nor the reinforcing steel shall be supplied by Nucor Building Systems. It shall be the responsibility of the customer, contractor, or erector to obtain these items.



### 4. Drawings

#### 4.1. General

- 4.1.1. Nucor Building Systems shall supply on all orders three sets of anchor bolt drawings and reactions.
- 4.1.2. Nucor Building Systems shall supply on all orders three sets of final erection drawings.
- 4.1.3. Upon request, Nucor Building Systems shall supply three sets of permit drawings showing engineering design details, critical clearances, key connection details, material specifications, and lateral load resisting elements such as bracing, diaphragm, and shearwall layouts.
- 4.1.4. Nucor Building Systems shall supply three sets of approval drawings on specified jobs. Approval drawings shall show building layout, critical clearances, critical details, and may include permit drawing information if requested. Final fabrication will not begin until approval drawings have been returned with appropriate release signatures or appropriate instruction has been given to Nucor to release the project using a Change Order.
- 4.1.5. Nucor Building Systems does not supply shop fabrication drawings for review or approval. As-built drawings are not provided by Nucor Building Systems.
- 4.1.6. Unless noted on the Nucor order documents, all drawings are issued on 11" x 17" paper stock. Full-size prints (24" x 36") are available at an additional cost.
- 4.1.7. Nucor does not provide electronic drawing files or as-built drawings.

### 5. Structural Framing

#### 5.1 General

- 5.1.1. The term "primary structural" members or framing shall refer to any built-up, hot-rolled, or cold-form columns or framing systems which transfer their loads directly to the structure's foundation.
- 5.1.2. The term "secondary structural" members or framing shall refer to any cold-form, hot-rolled, or built-up purlins, girts, struts, bracing, or beams which transfer their loads from the cladding to the primary structural member or framing to which they attach.
- 5.1.3. Unless otherwise specified, the minimum standard design thickness of structural framing members shall be as follows:
  - Webs of welded built-up members → 0.125"
  - Flanges of welded built-up members → 0.175"
  - Cold-formed secondary framing members → 0.060"
  - Cable bracing → 0.250" / Rod bracing → 0.625"
  - Angle bracing → 0.1875"
- 5.1.4. All hot-rolled sheet, plate, and strip steel used in webs from 0.125" to 0.175" thick shall conform to the provisions of ASTM A-607 Grade 55 (55,000 psi minimum



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- yield strength). All thicknesses greater than 0.175" (to 0.5" inclusive) shall conform to ASTM A935 Grade 55 (55,000 ksi minimum yield).
- 5.1.5. All hot-rolled flat bars used in flanges shall conform to the provisions of ASTM A-529 Grade 50 Mod 55, with minimum yield of 55,000 psi.
- 5.1.6. All wide-flange, channel, and "S" shapes shall conform to the provisions of ASTM A-36 or ASTM A-572. All tube and pipe shapes shall conform to ASTM A-500, Grade B. Special pipe other than standard stock shall conform to ASTM A53, Grade B.
- 5.1.7. All hot-rolled or cold-rolled sheet and strip steel less than 0.150" thick used in fabrication of cold-formed structural members shall be of ASTM A-607, Grade 55 (55,000 psi minimum yield stress).
- 5.1.8. Cable used for diagonal bracing shall be extra high strength Grade-7 wire, Class A coating, left-hand lay, galvanized steel strand, conforming to provisions of ASTM A-475. Threaded rod and angle shall meet ASTM A-36 or A-572 Grade 50 requirements.
- 5.1.9. Structural steel members shall be sheared, formed, punched, welded, and painted by the manufacturer. All shop connections shall be welded in conformance with standards based upon the current edition of ANSI/AWS D1.1 referenced previously in this guide in Paragraph 2.1.1. Welders and welding operators are qualified as provided in this same code.
- 5.1.10. All field connections of primary structural members shall be bolted with high strength bolts and nuts (ASTM A-325) and shall be fully tightened unless otherwise specified. Secondary structural members shall be field bolted with ASTM A-307 or A-325 bolt assemblies as called for in design.
- 5.1.11. Light gage cold-formed sections shall be manufactured by roll or brake-forming. All dimensions shall be fabricated to MBMA tolerances.
- 5.1.12. All structural-framing members that are not galvanized shall be given one shop coat of a red primer. Gray primer is available at an additional cost but must be requested under special requirements of the order document and applied to a nominal thickness of .8 mil. All surfaces are in accordance to systems industry standards as cleaned of loose rust, loose mill scale, and other foreign matter by using, as a minimum, the hand tool cleaning method SSPC-SP2<sup>1</sup> prior to painting. All painted surfaces are to be reasonably free of excessive drips, runs, sags, and cracking. Reference MBMA<sup>2</sup> and AISC<sup>3</sup> for intended primer protection, proper care, erection, and function of shop prime coat.
- 5.1.13. All framing members shall have identifying marks to aid the erector in the erection of the building.

<sup>1</sup> This is found in "Surface Preparation Specification No. 2", Steel Structures Painting Manual – Systems and Specifications, Volume 2, 7<sup>th</sup> Edition, Steel Structures Painting Council, Pittsburgh, PA, 1995, pp. 35-36.

<sup>2</sup> Article IV, Section 4.2.4 of the MBMA Low-Rise Building Systems Manual, 1996 Edition, p. IV-4-1.

<sup>3</sup> Section 6.5 of the "Code of Standard Practice for Steel Buildings and Bridges", Manual of Steel Construction – Allowable Stress Design, 9<sup>th</sup> Edition, AISC, 1989, p. 5-232.

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### 5.2. Primary Structural Members

- 5.2.1. Rigid frame, sidewall columns, rafter beams, and canopy beams shall be shop-welded, built-up "I" shapes. Members shall be of constant depth or tapered, having base plates, necessary clips, and splice plates for completely field-bolted assembly and attachment of secondary members.
- 5.2.2. Rafter beams and endwall columns shall be either built-up "I" shapes, "WF" shapes, or roll-formed "C" sections as required to satisfy load and span requirements.
- 5.2.3. Interior columns shall be round pipe sections. Built-up "I" shapes or hot-rolled "WF" or tube sections shall be provided as required to satisfy certain load or order requirements.

### 5.3. Secondary Structural Members

- 5.3.1. Purlins and girts shall be roll-formed "Z" or "C" sections of adequate size and thickness as determined by the design criteria. Purlins and girts shall be either simple-span or continuous members.
- 5.3.2. Purlins for "long-bay" building layouts shall typically consist of bar joists designed under Steel Joist Institute specifications for the prescribed loads. Field welding of joist bridging and seats is the standard method for connection of joists to supporting primary structural members.
- 5.3.3. Eave struts shall be roll-formed or brake-formed "C" sections.
- 5.3.4. Wind bracing shall consist of diagonal cable, rod, or angle bracing. Adjustment to cable braces shall be made by an eyebolt assembly. Adjustment to rod bracing may be by threaded assembly. Angle bracing is not adjustable and may require final field welding.
- 5.3.5. Flange bracing shall consist of angle bracing connected to the web of the purlin or girt and to the compression flange of the primary structural member. Flange braces shall be attached to bar joists via field welding.
- 5.3.6. Base support for wall panels shall consist of a continuous base angle, base angle flash, or base girt which shall be securely attached to concrete by the contractor using powder actuated drive pins/nails, expansion anchors, or other similar anchorage.

## 6. Roof Covering – "Nucor Classic Roof"™ Panel

### 6.1. General

- 6.1.1. Minimum recommended roof slope for "Nucor Classic Roof"™ panel is 1/2" in 12".
- 6.1.2. Maximum recommended building width is 240' (gable) or 120' (single slope) for "Z" purlin roofs. "Nucor Classic Roof"™ profile shall be used in conjunction with zee or cee purlins as supports. Joists or roof beams are not acceptable support members unless specifically agreed to by Nucor's Engineering Manager.



- 6.1.3. "Nucor Classic Roof"™ (26 ga.) panel qualifies for a UL 580 Class 90® uplift rating (Construction #167) when attached to roof purlins, but only if the purlins are spaced at 5'-0" on center or less.

### 6.2. Panel Material

- 6.2.1. "Nucor Classic Roof"™ panel profile shall be precision roll-formed from 26-gage steel sheeting.
- 6.2.2. Galvalume® steel sheeting is aluminum-zinc alloy coated steel sheet with a minimum yield strength of 80 ksi in accordance with ASTM A-792, Grade 80. It has a coating thickness of .55 oz per square foot. Please refer to the material specifications for "Nucor Classic Wall"™ panel when painted roof panel is required.
- 6.2.3. Roof panels provided by Nucor Building Systems for exterior use are precision roll-formed from pre-painted Galvalume® coils. Coils to receive finish paints are subjected to a strenuous cleaning process prior to coating. Next, the coils are primer coated and oven cured. The finish coat is then applied and monitored for proper oven-cure temperature and color uniformity. Finished material is subjected to stringent quality control tests including: physical bend and impact resistance, film thickness, hardness, gloss, and color. This process is time tested and uses the industry proven modified Siliconized Polyester paint system. A 70% Kynar 500® finish is available at an additional cost upon request.

### 6.3. Panel Configuration

- 6.3.1. "Nucor Classic Roof"™ panel consists of major ribs 1-1/4" deep spaced at 12" on center with an extended purlin bearing sidelap to allow for additional sidelap support. Two minor ribs are evenly spaced in the flat area between major ribs. Net coverage is 36". The purlin bearing leg is available with Galvalume® (unpainted) panel only.

### 6.4. Fasteners

- 6.4.1. Roof panel to secondary structural fastener shall be a No. 12 self-drilling carbon steel screw, hex washer head with sealing washer, 1-1/4" long. Fastener shall have a 20-year corrosion resistant coating. Fastener shall have a painted head to match panel and/or trim color when used with painted material.
- 6.4.2. Panel to panel, flash to flash, (stitch) fastener for roof shall be a 1/4" sharp-point carbon steel screw, hex washer head with sealing washer, 3/4" long. Fastener shall have a 20-year corrosion resistant coating. Fastener shall have a painted head to match panel and/or trim color when used with painted materials.

### 6.5. Trim and Flashing

- 6.5.1. Color-coated trim and flashing shall be 26 gage. Trim shall be provided at eave, ridge, rake, and wherever necessary to ensure a properly constructed building, as defined on the Nucor order documents.



- 6.5.2. Neither counter-flashing for parapet conditions nor tie-in flashing to existing buildings shall be provided by Nucor Building Systems.
- 6.5.3. All exposed trim and flashing material shall be manufactured from galvanized or Galvalume® steel strip.
- 6.5.4. Exterior gutters and gable flash shall be manufactured in 20' lengths wherever possible.

### 6.6. Sealants

- 6.6.1. Mastic for sidelaps, endlaps, and flashing shall be an isobutylene tripolymer rubber pressure sensitive tape mastic.
- 6.6.2. Tape mastic for sidelaps shall be 3/32" thick X 1/2" wide and mastic for endlaps shall be 1/8" thick X 3/4" wide.
- 6.6.3. Tube sealants shall be of the non-hardening elastomeric type. This sealant is to be used at all trim and flashing endlaps.

### 6.7. Closures

- 6.7.1. Closures shall be closed cell polyethylene foam to match the panel configuration.
- 6.7.2. Closures shall be provided at the eave of roof panels.

### 6.8. Installation of Panels

- 6.8.1. Storage and installation of the roofing system shall be in accordance with Nucor's printed instructions.
- 6.8.2. All endlaps and sidelaps on roof panels shall be sealed with a continuous row of tape mastic to prevent air and water from infiltrating the building.
- 6.8.3. Standard maximum panel length shall be 30'. If required, lengths of up to 45' may be provided.
- 6.8.4. The use of cutting tools that damage the panel finish shall not be allowed.
- 6.8.5. Panels shall not be marked with any graphite or lead markers.

### 6.9. Clean-Up

- 6.9.1. Roof surface should be cleaned daily during construction of all filings, cuttings, screws, pencil markings, and debris to prevent damage due to oxidation of foreign materials.
- 6.9.2. Contractor shall thoroughly clean all panels, trim, and gutters of all foreign material upon completion of construction.



### 6.10. Field-Cutting Of Panels

- 6.10.1. When field-cutting or mitering “Nucor Classic Roof”™ panels, non-abrasive cutting tools such as nibblers or tin-snips shall be used. Abrasive cutting tools such as mechanical grinders, saws, shears, or scissors can damage the Galvalume® or painted finish and create excess metal shavings that can corrode the panels. The use of non-approved cutting devices may void your manufacturer’s warranty.

## 7. Roof Covering – “Nucor CFR”™ Standing Seam Roof System

### 7.1. General

- 7.1.1. Specifically included are panels, panel clips, flashing, panel splices, ridge material, and all necessary fasteners.
- 7.1.2. Minimum roof slope is 1/4" in 12".
- 7.1.3. Panels are rated for UL90® uplift rating UL580 when installed to roof support members spaced as listed in UL Construction Listing #552, supported at a maximum of 5'0 on center by either joists or purlins.
- 7.1.4. Reference "Optional Insulation Pan" under 9.5.2.

### 7.2. Panel Material

- 7.2.1. “Nucor CFR”™ profile shall be precision roll-formed from 24 gage steel. Galvalume® steel sheeting is aluminum-zinc coated steel alloy coated steel sheet with a minimum yield strength of 50,000 psi in accordance with ASTM A-792, Grade 50A. It has a coating thickness of .55 oz. per square foot.
- 7.2.2. Roof panels provided by Nucor Building Systems for exterior use are precision roll-formed from pre-painted Galvalume® coils. Coils to receive finish paints are subjected to a strenuous cleaning process prior to coating. Next, the coils are prime coated and oven cured. The finish coat is then applied and monitored for proper oven-cure temperature and color uniformity. Finished material is subjected to stringent quality control tests including: physical bend and impact resistance, film thickness, hardness, gloss, and color. This process is time tested and uses the industry proven modified Siliconized Polyester paint system. A 70% Kynar 500® finish is available at an additional cost upon request. CFR roof accessories (end dams, cinch straps, gutter brackets) are provided as unpainted.
- 7.2.3. Panel shall be factory-punched and notched at ridge, high side, and lap locations.
- 7.2.4. Panel sidelaps shall have factory-applied non-skinning Butyl mastic.

### 7.3. Panel Configuration

- 7.3.1. Panels shall have 3” deep trapezoidal ribs spaced 24” on center. Three minor ribs are spaced in the flat of the panel between the major ribs.



### 7.4. Panel Clip & Fasteners

- 7.4.1. Fixed panel clips shall only be used with panel runs of less than 120'. Floating panel clips shall be used up to a 250' panel run and shall be self-centering and allow for up to 1-1/2" expansion and/or contraction of total movement from the centered position. The clip design shall insure that movement does not occur between the panel and clip.
- 7.4.2. The panel clips shall have factory-applied mastic to insure a weather-tight installation.
- 7.4.3. Each clip shall be attached to the joist or purlin with two fasteners. Size and type will be recommended by Nucor Building Systems for the specific application. Clip fasteners for retrofit applications are not by Nucor and must be specified by the owner or his agent.
- 7.4.4. Panel endlap fasteners shall be a No. 17 self-tapping carbon steel screw, hex washer head, 1-1/4" long. Fastener shall have a 20-year corrosion resistant coating.

### 7.5. Trim and Flashing

- 7.5.1. Color-coated trim and flashing shall be 26 gage. Trim shall be provided at eave, ridge, rake, and where necessary to ensure a properly constructed building.
- 7.5.2. High eave flashing and flashing parallel to the roof panels shall accommodate the thermal expansion and contraction of the roof without damage to the roof panels or flashing. Counter-flashing for parapet conditions and flash to existing buildings are not provided by Nucor Building Systems.
- 7.5.3. All exposed trim and flashing material shall be manufactured from galvanized or Galvalume® steel strip.
- 7.5.4. Exterior gutters and gable flash shall typically be manufactured in 20' lengths wherever possible.

### 7.6. Installation

- 7.6.1. Storage and installation of the roofing system shall be in accordance with Nucor's printed instructions.
- 7.6.2. The "Nucor CFR"™ roof hand crimper is specially designed for use with "Nucor CFR"™ roof. Under no circumstances shall the Nucor crimper be used on any other manufacturer's roof system. In addition, under no circumstances is another manufacturer's crimper to be used on the Nucor "CFR"™ roof (even if they appear to be the same). Permanent damage to the seam and/or the panel finish may occur if the Nucor crimping tool is not used and shall void all warranties.
- 7.6.3. The panel splice shall have a 0.060" galvanized steel back-up plate and an 0.090" aluminum cinch strap.
- 7.6.4. The back-up plate and cinch strap shall be factory-punched to ensure proper fit.



- 7.6.5. Panel splice shall be sealed with precut tape mastic.
- 7.6.6. Standard maximum panel length shall be 55'-0".
- 7.6.7. The use of cutting tools that damage the panel finish shall not be allowed.
- 7.6.8. Panels shall not be marked with any graphite or lead markers.

### 7.7. Clean-Up

- 7.7.1. Roof surface should be cleaned daily during construction of all filings, cuttings, screws, pencil markings, and debris to prevent damage due to oxidation of foreign materials.
- 7.7.2. Contractor shall thoroughly clean all panels, trim, and gutters of all foreign material upon completion of construction.

### 7.8. Maintenance

- 7.8.1. The owner shall keep the roof free and clean of debris and corrosive materials at all times.
- 7.8.2. Gutters and downspouts shall be cleaned periodically and kept free-flowing at all times.
- 7.8.3. Flashing and sheeting interfaces shall be inspected yearly to ensure connection and water-tightness.
- 7.8.4. Endlaps, eaves, ridges, curbs, translucent panels, and other interfaces shall be inspected and maintained yearly. Normal adjustments or tightening of fasteners may be required.
- 7.8.5. The use of tar and other topical applied products shall not be permitted unless specified by the manufacturer.
- 7.8.6. Copper, lead flashing, exposed iron, or debris shall not be permitted on the roof.
- 7.8.7. Pipes to and supports for roof-supported units shall be of a non-corrosive or rust-free material. Field painting of pipes and supports may be required to resist corrosion. Condensation from roof-top units shall be piped to interior or exterior locations. Damage due to condensate water is not covered under manufacturer's warranty.

### 7.9. Erection Sequence

- 7.9.1. The "Nucor CFR"™ Roof System is designed to be erected starting from either end of the building. In rare cases, due to the building layout, it may be required to start erection drawings from a specified end. In those cases, it will be noted as such on the erection drawings.
- 7.9.2. Sequencing of steel shall be clearly marked on the order documents at the time of order entry.



### 7.10. Coordination with Other Trades

- 7.10.1. Supports for the “Nucor CFR”™ Roof System shall be provided and are required as shown in the drawings and as noted in these specifications. All necessary clearance dimensions for proper elevations relative to the roof panels have been shown. The customer shall be responsible for coordinating these dimensional requirements with other trades associated with the building roof system.

### 7.11. Erection Care

- 7.11.1. The erector must be skilled in the erection of metal building systems and is responsible for complying with all applicable local, federal, and state construction and safety regulations. This includes OSHA regulations as well as any applicable requirements of local, national, or international union rules or practices. The Erector remains solely responsible for the safety and appropriateness of all techniques and methods utilized by its crews in the erection of the metal building system and/or the CFR roof system. The Erector is also responsible for supplying any safety devices such as scaffolds, runways, nets, etc., which may be required by the governing codes to safely erect the metal building system and/or CFR roof system.
- 7.11.2. Anchorage for safety devices may be added at an additional cost provided specific connections are designed and clearly noted on the order documents. All anchorage points must be noted with exact location, magnitude, and direction of force for a fully-braced structure.
- 7.11.3. The erector of the “Nucor CFR”™ erection drawings shall exercise great care and attention to the details as shown on the erection drawings and in the “Nucor CFR”™ erection manual to insure a secure and proper fit of all components. Nucor Building Systems shall not be responsible for supervising and/or coordinating the erection of the CFR Roof System with other trades. Erection drawings take precedence when a situation differs from that shown in the erection manual.
- 7.11.4. Due consideration must be given by the erector to the effects of thermal expansion and contraction when erecting a roof tie-in to an existing structure to insure a safe, secure, weather-tight condition. Flashing for tie-ins to existing buildings is typically not included as part of the material provided by Nucor Building Systems. Refer to the sections and details for specific materials provided by Nucor Building Systems.
- 7.11.5. The erector acknowledges that all details for all conditions can be noted on the plans and that due care and judgment are required to make a safe and watertight condition. Sealants and caulks may be required based upon actual conditions encountered.

### 7.12. Field-Cutting of Panels

- 7.12.1. When field-cutting or mitering “Nucor CFR”™ roof panels, non-abrasive cutting tools such as nibblers or tin-snips shall be used. Abrasive cutting tools such as mechanical grinders, saws, shears, or scissors can damage the Galvalume® or painted finish and create excess metal shavings that can corrode the panels. The use of non-approved cutting devices may void your manufacturer’s warranty.



### 7.13. Roof-Top Units and Curb Supports

- 7.13.1. The "Nucor CFR"<sup>™</sup> Roof System is elevated above the top of the roof secondary structural members. Roof curb sub-framing must be elevated above the secondary members to the elevation of the roof panel to avoid potential water infiltration or ponding. Refer to the details for proper dimensions. Short roof clips require 1/2" of elevation and tall roof clips require 1 1/2" of elevation.
- 7.13.2. The "Nucor CFR"<sup>™</sup> Roof System is designed as a floating system. Curb framing and flashing must be designed accordingly to allow the curb system to float with the CFR roof during thermal expansion and contraction.
- 7.13.3. Roof curbs should be laid out maintaining a "3-purlin-space" rule. This rule is that a roof curb should always be located a distance of at least the equivalent of three purlin spaces from the ridge or eave of a building and from any adjacent roof openings or curbs.

## 8. Wall Covering

### 8.1. General

- 8.1.1. Wall covering shall be "Nucor Classic Wall"<sup>™</sup>, "Nucor RC Wall"<sup>™</sup>, or "Nucor Accent Wall"<sup>™</sup> panel profile, precision roll-formed from 26 gage steel.

### 8.2. Panel Material

- 8.2.1. Galvanized steel sheeting shall have a minimum yield strength of 50,000 psi in accordance with ASTM A-653, Grade 50, Type I. The galvanized coating shall be .90 oz per square foot (Class G90) in accordance with ASTM A-653. The spangle for galvanized panel is bright flat spangle in accordance with ASTM A-653.
- 8.2.2. Galvalume<sup>®</sup> steel sheeting shall be aluminum-zinc alloy coated steel sheet, with a minimum yield strength of 50,000 psi in accordance with ASTM A-792, Grade 50A, and shall have a coating thickness of .55 oz per square foot.
- 8.2.3. Wall panels provided by Nucor Building Systems for exterior use are precision roll-formed from pre-painted G90 galvanized or Galvalume<sup>®</sup> coils. Coils to receive finish paints are subjected to a strenuous cleaning process prior to coating. Next, the coils are prime coated and oven cured. The finish coat is then applied and monitored for proper oven-cure temperature and color uniformity. Finished material is subjected to stringent quality control tests including: physical bend and impact resistance, film thickness, hardness, gloss, and color. This process is time tested and uses the industry proven Modified Siliconized Polyester paint system. A 70% Kynar 500<sup>®</sup> finish is available at an additional cost upon request.

### 8.3. Panel Configuration

- 8.3.1. "Nucor Classic Wall"<sup>™</sup> panel provides a 36" net coverage and consists of major ribs 1-1/4" deep spaced at 12" on center. The minor ribs are evenly spaced in the flat area between the major ribs. The classic panel is designed for blanket insulation up to 3" thick.



- 8.3.2. "Nucor RC Wall"™ panel provides a 36" net coverage and consists of major ribs 1-1/4" deep spaced at 12" on center. The minor ribs are evenly spaced in the flat area between the major ribs. The "Nucor RC Wall"™ panel is designed for blanket insulation up to 6" thick.
- 8.3.3. "Nucor Accent Wall"™ panel is an architectural recessed fastener panel. It provides a 36" net coverage and consists of 1-1/4" deep major ribs spaced at 12" on center with a sculptured valley between the major ribs. The "Nucor Accent Wall"™ panel is designed for blanket insulation up to 6" thick.

### 8.4. Trim And Flashing

- 8.4.1. Color-coated trim and flashing shall be supplied in 26 gage. Trim shall be provided at eave, base, corners, framed openings, and where necessary to insure a properly constructed building.
- 8.4.2. All exposed trim and flashing material shall be manufactured from Galvalume®, galvanized, or painted steel strip.

### 8.5. Fasteners

- 8.5.1. Panel to structural fastener for all wall panels shall be a No. 12 self-drilling carbon steel screw, hex head, 1-1/4" long. Fastener shall have a painted head to match panel and/or trim color.
- 8.5.2. Panel to panel, stitch fastener for all wall panels shall be a No. 12 sharp point carbon steel screw, hex head, 3/4" long. Fastener shall have a painted head to match panel and/or trim color.
- 8.5.3. Fasteners required for securing trim to masonry or concrete are not supplied by Nucor Building Systems.

### 8.6. Sealants

- 8.6.1. Tube sealants shall be used at all trim endlaps, and shall be a polyurethane sealant.
- 8.6.2. Sealants not provided by Nucor shall not be used without specific approval from Nucor.

### 8.7. Closures

- 8.7.1. Closures shall be manufactured of closed-cell polyethylene foam to match the panel configuration.
- 8.7.2. Closures shall be supplied as required to provide a closed wall panel profile at the rake condition. Closures are not typically provided at the base and eave.

### 8.8. Installation of Panels

- 8.8.1. All sidelaps shall be lapped a minimum of one full rib. Panel endlaps shall be a minimum of 4" long on wall panels.



- 8.8.2. All wall panels shall be fabricated in one piece providing the length does not exceed practical limits for shipment or construction.
- 8.8.3. Storage and installation of the wall system shall be in accordance with Nucor's printed instructions.
- 8.8.4. Standard maximum panel length shall be 30'. If required, lengths of up to 45' may be provided.

### 8.9. Clean-Up

- 8.9.1. All dirt, oil, grease, fingerprints, or other contaminants shall be removed after installation to insure proper service life of the paint surface.

## 9. Accessories

### 9.1. Metal Doors & Windows

- 9.1.1. Standard doors provided by Nucor Building Systems are factory-assembled and include an insulated door leaf consisting of 22 gage galvanized steel with a baked enamel finish. Galvanized sub-jambs are factory attached for ease of installation. As an alternate, door systems can be obtained with the jambs and door frame unassembled from the factory, if so requested on the Nucor order documents.
- 9.1.2. Standard windows provided by Nucor Building Systems are factory-assembled and are self-flashing for all Nucor standard wall panel profiles. Galvanized sub-jambs are factory-attached for ease of installation.

### 9.2. Framed Openings

- 9.2.1. Framing members for overhead doors shall typically be the same depth as the girts to which they attach. Wall panel edge shall be trimmed and flashed at all openings.
- 9.2.2. Framing for overhead doors shall be primer-coated or galvanized, as required by the customer.

### 9.3. Translucent Light Panels

- 9.3.1. Translucent light panels shall be glass fiber reinforced composite panel of thermosetting polyester resins with acrylic modifiers and UV inhibitors.
- 9.3.2. Panels shall be produced to match the roof/wall panel configuration.
- 9.3.3. Panels shall weigh eight ounces per square foot.
- 9.3.4. Nominal length of panels shall be 5'-0", 10'-0", or 11'-0".
- 9.3.5. Panels shall have "Light Transmission" of 55-60% per ASTM D-1494.
- 9.3.6. Panels shall have a "Burning Rate" of less than 2" per minute per ASTM D-635.



- 9.3.7. Metal panels above and below the translucent section along the same run shall not be shorter than the length of three purlin spaces. Roof translucent panels shall not be located at the eave or ridge. Translucent panels shall have a minimum of four metal panels between each translucent one.
- 9.3.8. The buyer shall advise all parties and the owner that translucent panels are not designed for foot traffic.

### 9.4. Rake/Eave Extensions/Canopies

- 9.4.1. Roof rake/eave extensions shall consist of cantilevered extension beams or roof purlins, 2'-0" or 4'-0" beyond steel line, complete with all trim, closures, and all necessary flashing to provide a weather-tight overhang. Soffit panel is required for rake/eave extensions.
- 9.4.2. Canopies shall consist of roof panels supported by cantilevered beams and purlins, 5'-0" or 10'-0" long, complete with trim, closures, and all necessary flashing to provide a weather-tight overhang. Soffit panel may be requested on the order documents.

### 9.5. Insulation

- 9.5.1. Recommended insulation thickness (insulation supplied by others) is as follows:
  - 9.5.1.1. Wall or roof blanket insulation over 3" may cause dimpling at support locations.
  - 9.5.1.2. The maximum thickness available for use with the "Nucor Classic Roof"™ is 6" of blanket insulation. (Please note: the maximum thickness allowed under UL® 30, 60, and 90 shall be 6".)
  - 9.5.1.3. "Nucor CFR"™ standing seam roof with 3 1/4" short panel clip may be installed over blanket insulation from 3" to 4" thick.
  - 9.5.1.4. "Nucor CFR"™ with 4 1/4" tall panel clip may be installed over blanket insulation from 4" to 6" thick provided a thermal block is placed under the clip.
  - 9.5.1.5. It is recommended that insulation be used in all cases to avoid problems with condensation forming on the underside of the sheeting. This also provides a buffer between the purlins and "Nucor CFR"™ to reduce noise and possible damage due to metal-to-metal contact.
- 9.5.2. An Insulation Pan ("Nucor Classic Wall"™ liner panel, 28 gage) may be supplied at the ridge for "Nucor CFR"™ systems, but it must be requested in the order documents.

### 9.6. Liner Panel

- 9.6.1. Liner panel for a wall or ceiling is produced from a 28 gage material with a white Polyester paint coating. Liner panel is not intended to be exposed to the effects of weather, sunlight, moisture, or corrosive environments.



### 9.7. “Nucor Composite CFR”™ Roof

- 9.7.1. “Nucor Composite CFR”™ Roof shall be made up of: the previously-defined “Nucor CFR”™ roof panel deck coated with a white Polyester paint by Nucor Building Systems, rigid-board insulation (not by Nucor), a vapor barrier (not by Nucor), and 28 gage (0.6 C) deck from Vulcraft. The clip fasteners attach directly to the joist. The 28 gage, 0.6C deck is manufactured in accordance with Steel Deck Institute specifications. Nucor does not offer any warranties for liner deck.

UL® is a registered trademark of Underwriters Laboratories, Inc.

Galvalume® is a registered trademark of BIEC International.



### 10. Standard Serviceability Criteria

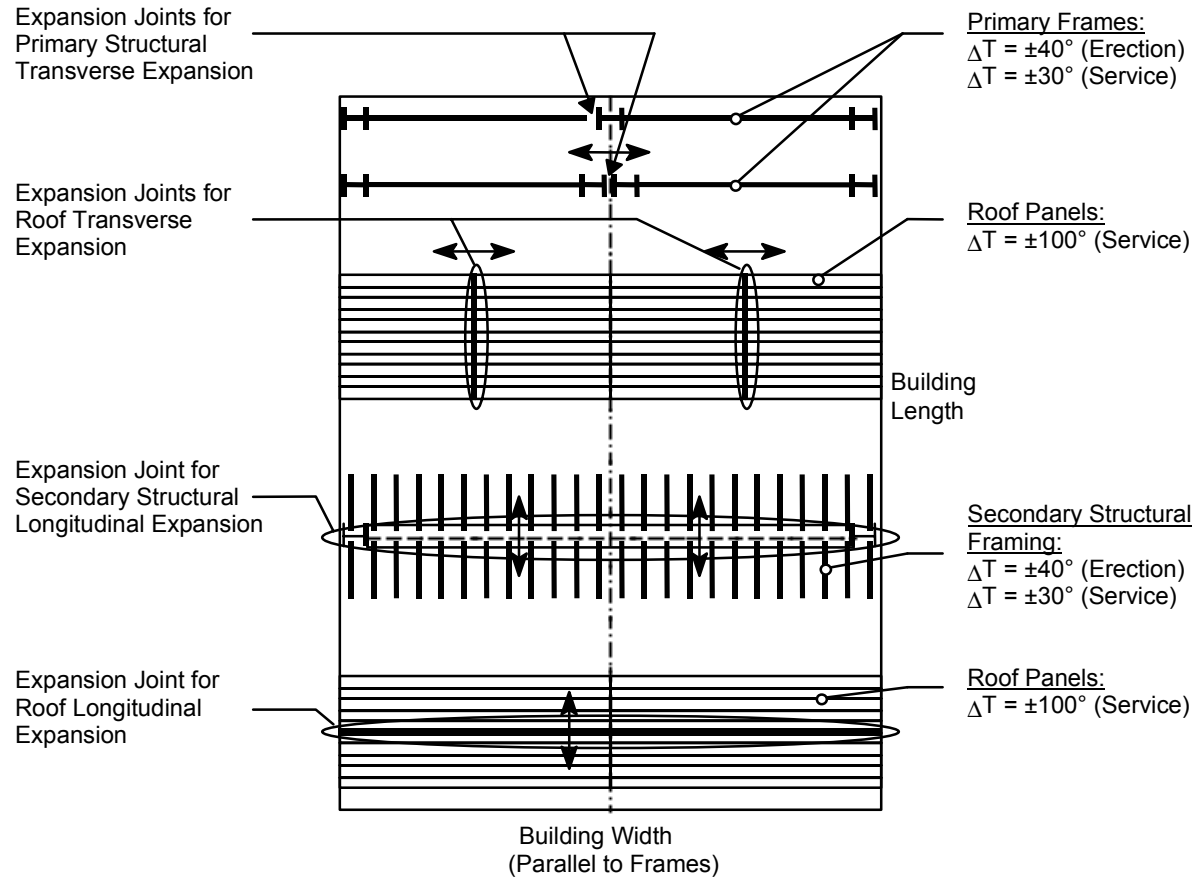
The most commonly addressed criteria in pre-engineered type buildings are deflections and thermal expansion/contraction. Most building codes are silent on serviceability requirements, leaving them up to the Project Engineer of Record or architect. However, in most cases with pre-engineered buildings, deflection limits are based upon “rules of thumb” or past experience by the building manufacturer. Nucor’s standards are based upon the American Institute of Steel Construction design guide, “Serviceability Design Considerations for Low-Rise Buildings”. Any building order will meet or exceed the following criteria unless otherwise specified on the order contract or quote proposal.

STRUCTURAL ELEMENTS	LIMIT	LOADING
<b>WALL GIRTS SUPPORTING:</b>		
Metal Walls	Bay / 90 Horizontal	10 Year Wind
Masonry or Concrete Walls	Bay / 240 Horizontal	
Dryvit, Wood, Sheetrock, Etc.	To be Specified by Customer	10 Year Wind
<b>PURLINS:</b>		
Roof Slopes $\geq$ 1/4:12	Bay / 150 Vertical	Collateral + Live/Snow Load
<b>WALL PANELS:</b>		
Metal, By NUCOR	No Special Consideration	
Other Materials	Not by NUCOR	
<b>ROOF PANELS:</b>		
Roof Slopes $\geq$ 1/4:12	Purlin Spacing / 180 Vertical Purlin Spacing / 180 Vertical	Collateral + Live/Snow Load 200 lb. Load on One Panel
<b>FRAMES SUPPORTING:</b>		
Roof Slopes $\geq$ 1/4:12	Rafter Span / 150 Vertical	Collateral + Live/Snow Load
Metal Walls	Eave Height / 60 Horizontal	10 Year Wind
Tilt-Up, Pre-Cast or Masonry Walls, Pin-Based	Wall Height / 100 Horizontal	10 Year Wind
<b>Top-Running Cranes:</b>		
Cab Operated		Crane Lateral, 10 Year Wind
Pendant Operated	Top of Rail Elevation / 100 Top of Rail Elevation / 100	Crane Lateral, 10 Year Wind
<b>TOP-RUNNING CRANE RUNWAY BEAMS:</b>		
	Bay Length / 600 Vertical	Crane Vertical w/o Impact
	Bay Length / 400 Horizontal	Crane Lateral

Due to the somewhat qualitative nature of vibration effects on a building system, Nucor will typically not have any input other than responding to specific order document requests for design criteria. Some areas where the designs are more likely to see impacts from projects specifications include: mezzanine floor designs, buildings with cranes or other similar equipment as part of the end use operation, and large structures supporting HVAC equipment. Nucor will properly address order document specifications but is not in an expert position to give guidance or direction to the matter of vibration.

### Standard Expansion Joint Requirement Summary

#### Standard Expansion Joint Requirement Summary



Expansion Joint Type (See Diagram Above)	Max. Length w/o Expansion Joint	Net ΔT (± °F)	Movement ΔL (± in)
Primary Structural (Transverse Expansion)	Not Typically Provided by NBS Unless Specified in Order Contract.		
Roof Panels: (Transverse Expansion)	Required at Primary Structural Expansion Joint.		
“Nucor CFR”™ Roof Panel	250' Panel Run	70	1.50" One Dir.
“Nucor Classic Roof”™ Panel	120' Panel Run	70	0.33" Each Dir.
Secondary Structural: (Longitudinal Expansion)			
Cold-Form Purlins	800' Metal Walls	70	1.25" Each Dir.
Open-Web Joists	550' Metal Walls	70	0.875" Each Dir.
Roof Panels: (Longitudinal Expansion)	Required at Primary Structural Expansion Joint.		
“Nucor CFR”™ Roof Panel	No Other Limits		
“Nucor Classic Roof”™ Panel	No Other Limits		

**Notes:** Roof panel net ΔT = (Panel ΔT) - (Primary Structural ΔT). When using ΔT other than shown, hold total movement.