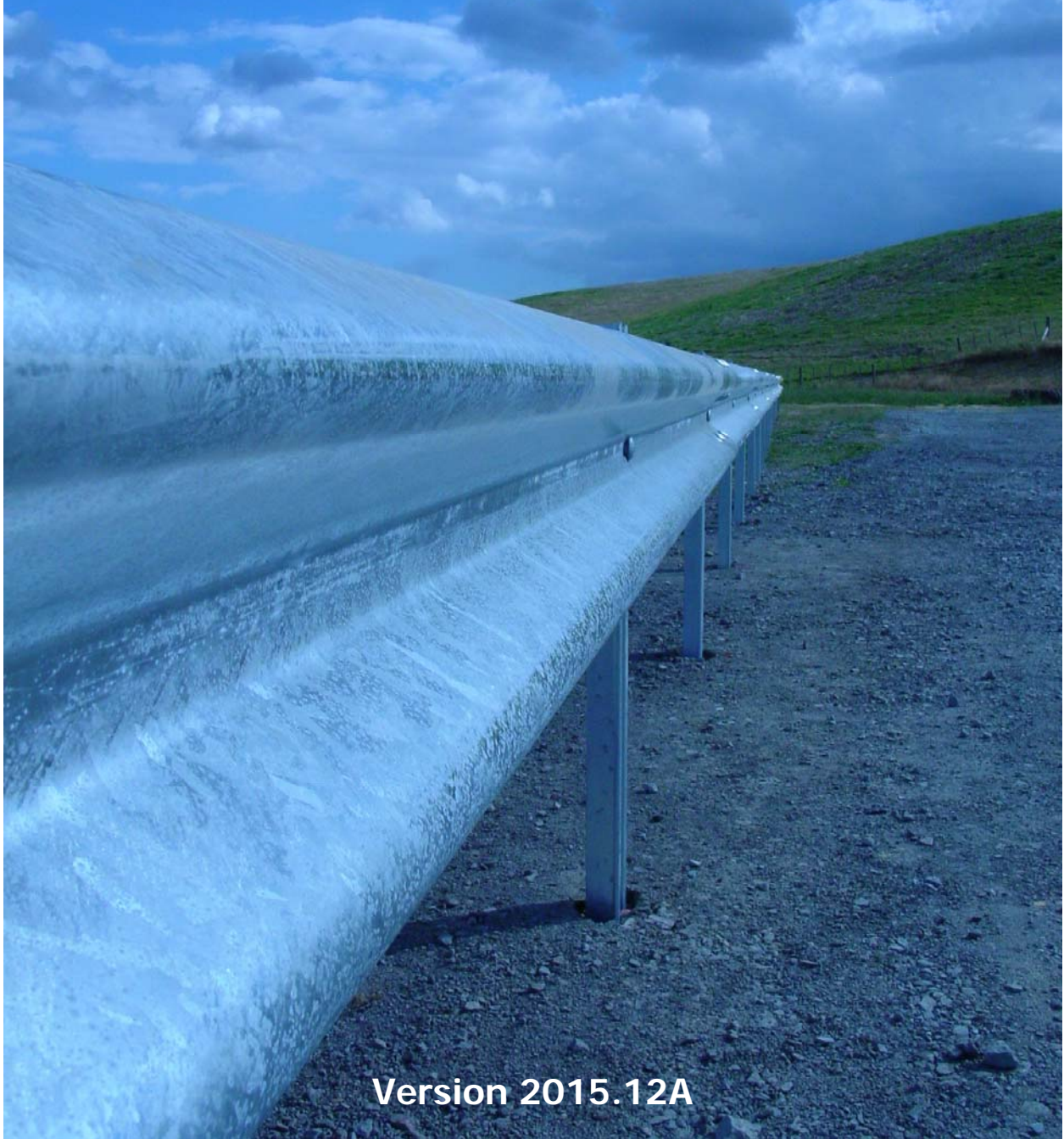


Nu-Guard-27™ & Nu-Guard-31™ Roadway Barrier System Installation Manual



Version 2015.12A



It's Our Nature. 

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INSTALLATION CONSIDERATIONS

The Nu-Guard-27™ & Nu-Guard-31™ Roadway Barrier System is installed per Federal, State & Local guidelines for highway guardrail barriers and is supplemented by the manufacturers' installation manual for detailed connection information.

This manual should be carefully reviewed prior to construction to ensure proper installation of the system.

If there is ever any doubt about any part of the installation contact Nucor Steel Marion Inc at (800) 333-4011 or your Nucor Distributor immediately.

Distributor contact information is listed on the last page of this manual.

SAFETY STATEMENT

All required traffic safety precautions should be complied with. All workers should wear required safety clothing (Examples, and not limited to, include: high visibility vests, steel capped footwear, gloves etc.)

Only authorized trained personnel should operate any machinery. Where overhead machinery is used, care must be taken to avoid any overhead hazards.

Before installing the posts, always ensure that the area is clear of underground services. (The appropriate service providers may need to be contacted)

All installers must be well clear of machinery when posts are being driven.

The posts and connection hardware are easily lifted and positioned by hand. While a w-beam guardrail panel should be moved and positioned by 2 personnel and care should be taken not to have fingers near the bolt holes while being maneuvered.

SYSTEM OVERVIEW

Current Configuration Summary

There are currently **(2)** main categories of the system.

- A) Nu-Guard-27™
 - a. Conforms to Federal Highway Administration NCHRP-350 Test Level 3 crashworthiness standards for use on the National Highway System.
 - b. This system height has been installed since 1965 on nearly every roadway corridor in the United States and elsewhere.
 - c. It is intended for use in new installations, retrofits and repair operations wherever a 27" to 31" rail height system is called for.

- B) Nu-Guard-31™
 - a. Conforms to hardware testing criteria NCHRP-350 Test Level 3 & 4 and MASH Test Level 3.
 - b. This design is intended for use in new installations and retrofits wherever a 31" rail height system is called for.

Within each category, are various styles and configurations depending upon the placement of the barrier relative to the roadway and hazards.

Post spacing throughout all systems is standardized to **6'-3" (1905mm)**.

For the appropriate overall length of barrier installation, consult your local roadway manual.

Deflection Summary

System Type	Dynamic Deflection	Working Width
Nu-Guard-27™ Test 3-11 (NCHRP-350 TL-3)	3'-9" (1143mm)	---
Nu-Guard-31™ Test 3-10 (NCHRP-350 TL-3)	2'-3" (680mm)	---
Nu-Guard-31™ Test 3-11 (MASH TL-3)	3'-5" (1050mm)	---
Nu-Guard-31™ Test 4-12 (NCHRP-350 TL-4)	4'-0" (1220mm)	5'-3 3/4" (1.62m)

Outside of tested performance limitations, the systems may also perform adequately in redirecting larger vehicles if site specific speed and angle are considered against tested values. For instance, the Nu-Guard-27™ & Nu-Guard-31™ is an acceptable barrier for tractor trailers in loading facilities to prevent accidental contact with building or drainage structures. Contact Nucor Steel Marion Inc. for guidance regarding non-roadway applications.

Site Preparation



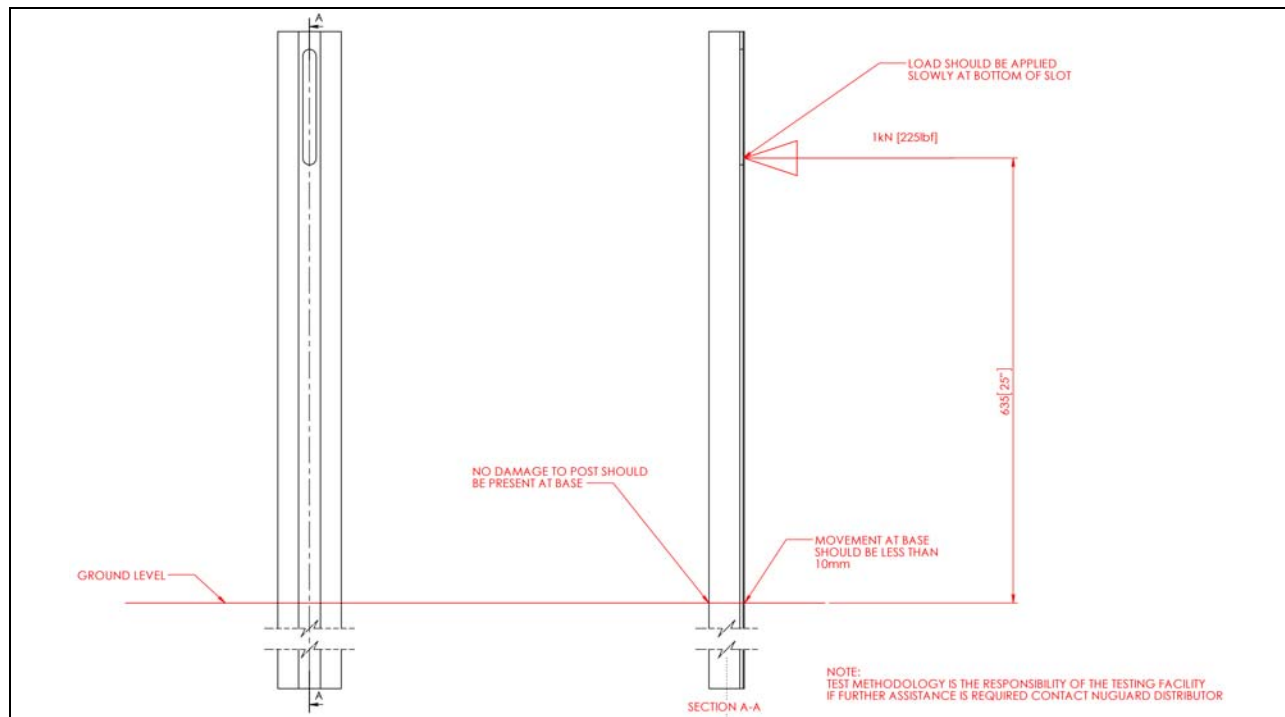
The initial layout for the Nu-Guard-27™ & Nu-Guard-31™ system should be free of hazards, obstacles, and debris.

The cross-slope should be **10:1** or flatter. Grading may be necessary. No slope changes should occur within **2' (610mm)** of the backside of post.

It is important to note that the w-beam barrier cannot be installed within a range of **1' (305mm) to 8' (2438mm)** from the bottom of a median ditch according to FHWA standards. The system can be installed in the bottom of the median ditch or within a **1' (305mm)** range either side of the median ditch. However, this is not recommended because of potential water drainage issues.

Soil Conditions

Nu-Guard-27™ & Nu-Guard-31™ posts require sufficient strength from the supporting soil to function as required and remain at the correct height. Follow the testing method shown below to determine soil conditions on site. **If it is determined that soil conditions on site do not meet or exceed these requirements, alternative installation options will need to be considered.**



Line Post Considerations

POST SPACING

The **line post spacing** is standardized at **6'-3" (1905mm)**. Alternate post spacing may be used when necessary due to conflicts with utilities, culverts, or other low-fill sites where maximum post embedment cannot be achieved. The distance between posts may be adjusted **WITHIN** a 12'-6" span, however the post spacing must **NOT** exceed 12'-6" unless a crashworthy long-span design is approved by the project engineer.

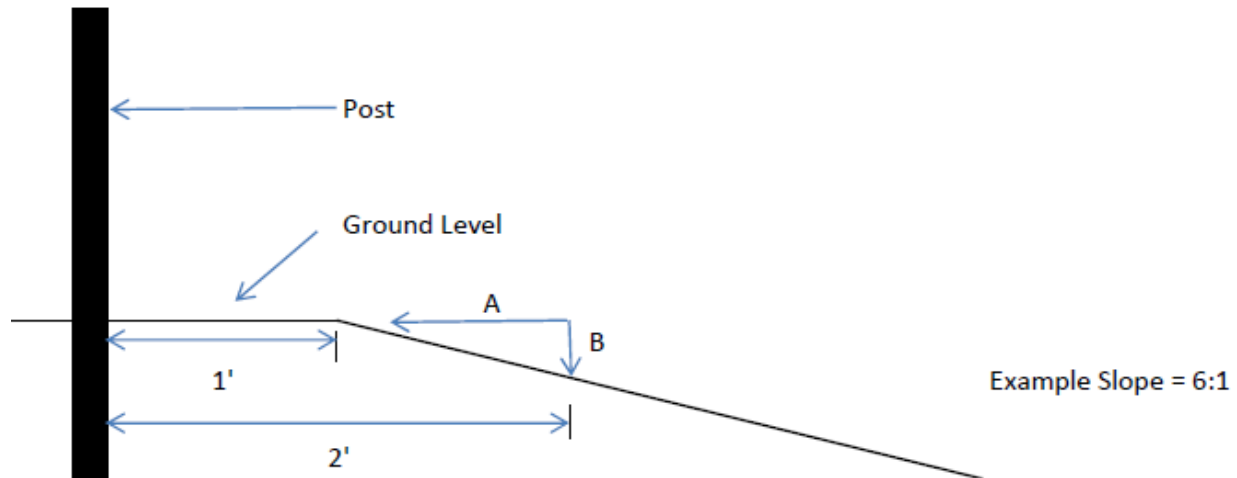
FLARE RATES

Take into consideration any local guidelines for flare rates required from approach (upstream) anchor traveling towards the hazard (downstream). Flare rates towards the roadway edge-of-pavement are important as they can influence both the driver reaction to perceived roadside obstacles (aka, the "shy line") and also the barrier deflection if flare is in excess of what is typical for a roadside barrier. (15:1 is nominal standard) See local standards flare rate and approach rail layout considerations.

POST LENGTH NEAR SLOPE BREAK POINT

There should be at least 2' (0.6m) behind the post to the slope breakpoint. If this minimum cannot be achieved, the post length should be increased to provide adequate soil resistance. Use this guidance to determine appropriate post length. **Be sure to refer to any local standards or specifications which may supersede these recommendations.**

Post Length Calculator



- 1 Measure out from the break-point to the 2.00' point from where the post was driven.
- 2 Measure down to the point where stable soil is reached.

Ex If A = 1' and the slope is 6':1', B will = 2".

- 3 If B = 1"-3", add 6" to the overall post length.
If B = 3+"-6", add 12" to the overall post length.
If B = 6+"-8", add 18" to the overall post length.
If B = 8+"-12", add 24" to the overall post length.
- 4 The slope can be as steep as 1:1 and as shallow as 10:1.
Calculations will need to be adjusted accordingly.

The normal embedment depth of typical 6' 6" post with 2 feet to the break is 3' 10", presumably all in stable soil. Using the original premise that soil stability is reached at 2 feet behind the post, and that you need the embedment depth below that level, increase the post length accordingly to provide adequate soil resistance. It is recommended to use multiples of 6" lengths rather than odd lengths.

Slope	A	=	B	Additional Post Length
4:1	1'	=	3"	6"
2:1	1'	=	6"	1'
1.5:1	1'	=	8"	1.5'
1:1	1'	=	12"	2'

LATERAL OFFSET

To determine the barrier offset from the travel lane, follow these guidelines from the FHWA. **Be sure to refer to any local standards or specifications which may supersede these requirements.**

The designer determines the barrier offset, L2, taking into consideration a number of issues. Table 4.1 lists these considerations, in order of importance.

Figure 4.2: Considerations for Selecting L2 In Order of Importance

- a. Available hazard offset
- b. Slopes in front of the barrier
- c. Presence of curbs
- d. Soil Support Behind the Barrier
- e. Available Shoulder
- f. Shy Line Offset
- g. Location

Each of these considerations is discussed below:

- Available Hazard Offset. Tables 3.2, 3.3 and 3.4 match appropriate barrier types with the available hazard offset. The hazard offset includes both the deflection distance and the depth of the barrier system. This criterion is not as important for hazards that go down, such as steep downward slopes, as for hazards that protrude upwards.
- Slopes in Front of the Barrier. Maintain a slope of 1V:10H or flatter in front of the barrier. This should include any flare in the barrier and the approach to the end treatment. Conventional cable and some of the high-tension cable systems have been successfully tested on 1V:6H slopes. Although the flatter slopes are preferable, it may be a reasonable trade-off to accept slopes as steep as 1V:6H in front of barriers if the speeds are 40 km/h (25 mph) or lower.
- Presence of Curbs. Avoid placing barriers if curbs are present. Specific criteria include:
 1. It is preferable to not use barriers with curbs at speeds 80 km/h (50 mph) and higher. If necessary, the best location for the barrier is in front of the curb. If the curb is sloped and no higher than 100 mm (4 in) the barrier may be placed flush with the face of the curb. Do not place a wall-type (CSS, PCG, or SMG) barrier on top of a curb. Remove the curb if necessary. A shoulder gutter design may be good option to a curb.
 2. Avoid placing barriers with curb present at speeds 50 km/h (30 mph) to 70 km/h (45 mph). If necessary, the best location for the barrier is in front of the curb. If the curb is sloped and no higher than 150 mm (6 in) the barrier may be placed flush with the face of the curb. Do not place a walltype (CSS, PCG, or SMG) barrier on top of a curb. Remove the curb if possible. A shoulder gutter design may be good option to a curb.
 3. It is acceptable to place curbs in line with the face of a barrier at speeds 40 km/h (25 mph) and lower.
- Soil Support Behind the Barrier Post. For strong post systems, ensure that at least 0.6 m (2 ft) are present from behind the posts to a slope hinge. At speeds 50 km/h (30 mph) and lower this criterion can be reduced to 0.3 m (1 ft). This criterion ensures the soil support necessary for the posts to resist deflection. This is not an important issue for either rigid or flexible systems. If this criterion cannot be achieved, 2.1 m (7 ft)-long posts or halved post spacing can be used to mitigate the loss of soil support. If this criterion cannot be achieved, then the strong post system will deflect more than indicated in Chapter 3 and Appendix B.

- Available Shoulder. If possible, the full shoulder should be provided plus at least 0.6 m (2 ft). This allows the shoulder to function as designed and allows a vehicle to park on the shoulder and occupants to exit out the passenger door.
- Shy Line Offset. The shy line offset, as discussed earlier, should be provided if possible. This is not usually an important issue on low volume roads.
- Location. Locate the barrier as far from the road as possible, taking into consideration all the above criteria. The further away from the edge of the traveled way, the more recovery area is available for errant vehicles and there is less barrier to build and maintain.

(*Source: FHWA, Overview of the AASHTO Roadside Design Guide Design Process,
CHAPTER 4 BARRIER DESIGN AND PLACEMENT)

Anchor Systems

The Nu-Guard-27™ & Nu-Guard-31™ system has been successfully crash-tested using a standard (2) foundation tube anchor system. This system represents a standard anchorage type currently utilized throughout the National Highway System. Many alternates and system options exist and are approved under national and local Qualified Products Listings or in Standard plans.

For **approach (upstream)** terminal systems, the Nu-Guard-27™ & Nu-Guard-31™ system must be installed with any contractor provided anchorage device which meets the appropriate test level of NCHRP-350 or MASH criteria.

For **trailing (downstream)** anchor systems, the Nu-Guard-27™ & Nu-Guard-31™ system may be installed as above with an appropriate test level of NCHRP-350 or MASH system, if necessary per applicable standards due to proximity of oncoming traffic, **-OR-** with any locally approved terminal device for “downstream and/or shielded” ends.

Alternatively, the system may be connected directly to a barrier transition on either the upstream or downstream end, and therefore allowing the usage of an approved terminal of another barrier type.



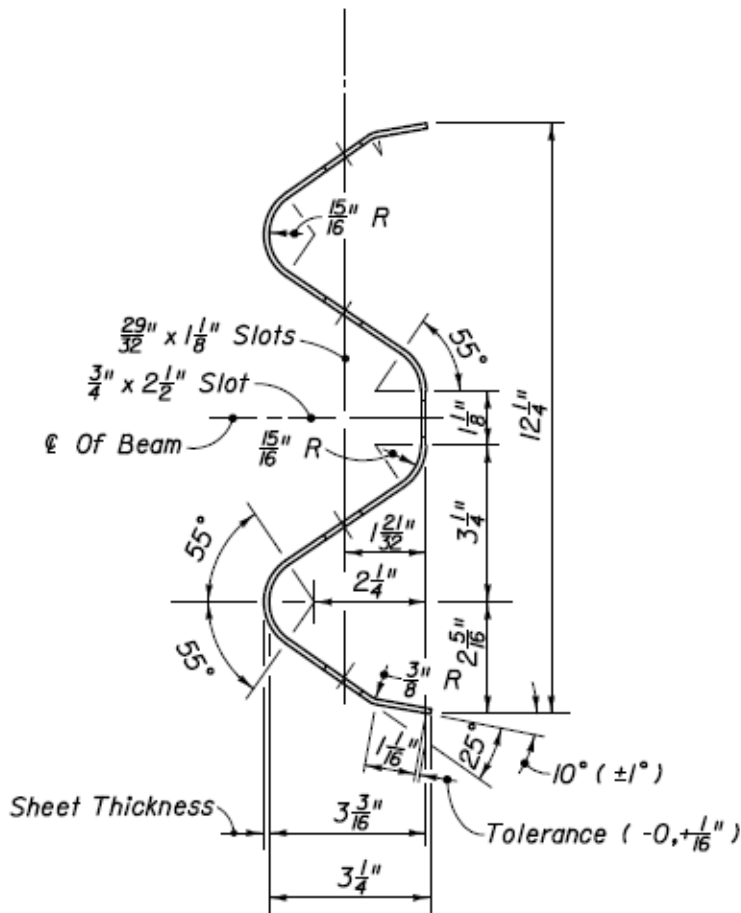
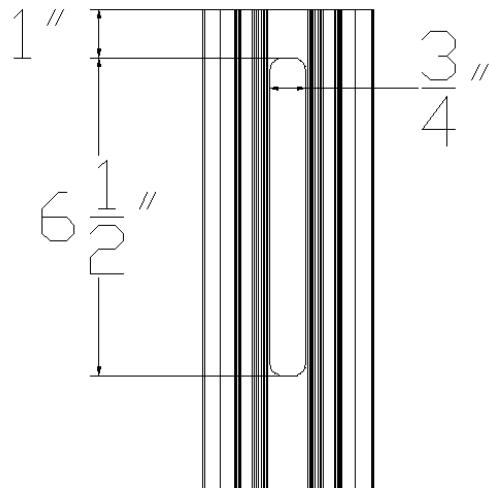
Nu-Guard-31™ Transition To A Thrie-Beam Bridge Connection

COMPONENTS

Line Posts

The system utilizes a **5# per foot (7.4 kg/m)** Rib-Bak[®] Line Post that is **6'-6" (1980mm)** long. No soil plate is required.

The Nu-Guard-27[™] & Nu-Guard-31[™] post is identifiable as it contains only a single hole (slot) in the channel. This hole is **6 1/2" (165mm)** vertical and **3/4" (19mm)** wide beginning **1" (25.4mm)** down from the top of post.



proper performance, the post bolt torque must be within the following range: 120 N-m to 140 N-m. (89 lbs-ft to 103 lbs-ft)

Beam Sections

The system utilizes a double corrugated metal guardrail beam corresponding to the requirements of **AASHTO M-180 Class A, Type II**.

Hardware

The system utilizes hardware bolts, nuts and washers meeting **ASTM A307** criteria and galvanized. Bolts are of lengths required to provide full engagement with nut depending on system placement. For roadside applications, the bolt may extend at least 1/4" (6mm) beyond the nut face to provide for a double nut, where required. For Nu-Guard-31[™] median applications, there shall only be one nut used with the threaded surface flush with face of nut and/or extending no more than 3/4" (19mm) beyond the nut face. To ensure

INSTALLING POSTS

Post Spacing

It is helpful to mark at least every **75' (22.9m)** when laying out the system to aid in placement as you install posts.

A string line should be set to aid in properly placing the posts and rail sections. It is best to mark the string at the centerline of rail, as the hole on the post can be aligned against the string during embedment.

Mark each run starting with the location of end treatments.

Then mark the position for each line post to be installed according to project plans for distance from roadway and distance to backside slopes or hazards.

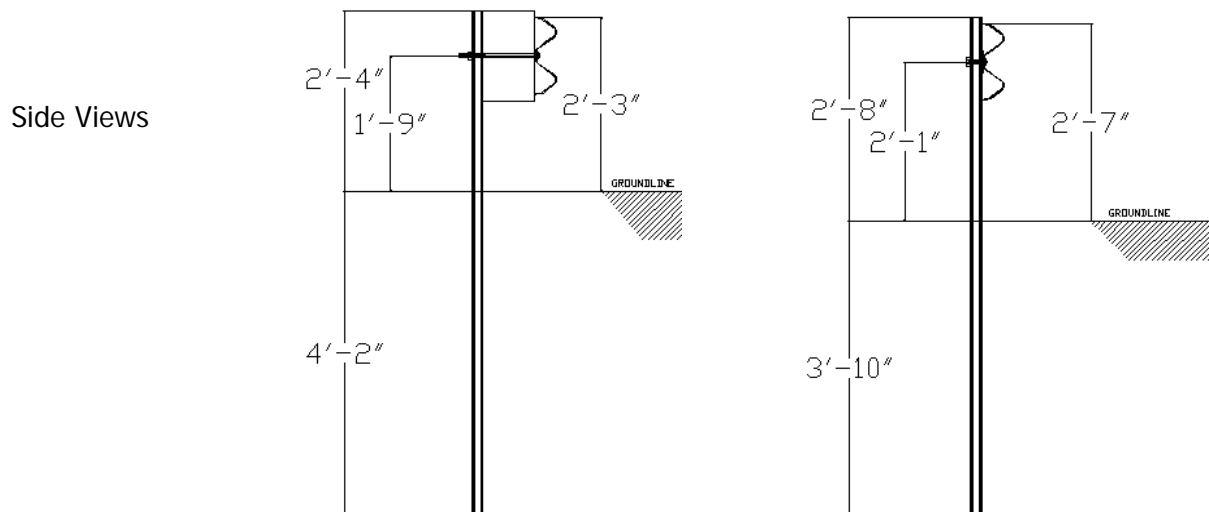


Post Elevation

The preferred method for line posts is with a post-pounding device so as not to disturb the natural soil. However, boring a hole/backfilling/tamping is also an allowable means of installation. For extremely rocky soils, use of a 4" auger, which allows the post to be positioned while leaving enough space to be filled with a suitable backfill material.

Line posts may be installed directly into sub-surface rock or pavement surfaces such as concrete or asphalt without a leave-out area.

	<u>Nu-Guard-27™</u>	<u>Nu-Guard-31™</u>
Center-line of W-Beam (string-line)	21" (533mm)*	25" (635mm)*
Embedment Depth of Post	50" (1270mm)	46" (1168mm)
Top of Post from Groundline	28" (711mm)	32" (813mm)



* For construction tolerances, please refer to FHWA Roadside Hardware Policy and Guidance for W-beam Guardrail.

Overlays

The barrier height is critical to performance of the system. If the roadway has experienced an overlay, ensure w-beam barrier heights are correct, and that the slope to the barrier does not exceed the maximum allowed.

Post Orientation

FOR ROADSIDE: Install the post with the open face of the channel facing towards the nearest roadway.



FOR MEDIAN: Install the post with the open face of the channel alternating at each post.



Nu-Guard-31™ Double-Faced Median, Galvanized & Powder Coated, New Hampshire



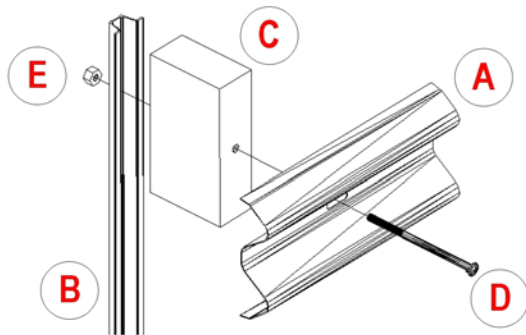
Nu-Guard-31™ Single-Faced Median, Galvanized, Michigan

INSTALLING RAIL

Being that there are different configurations based upon the system used, this chapter is broken down into two sections, one for each barrier type.

Nu-Guard-27™

For the 27" configuration, the system utilizes the following components:



A: RAIL:

W-BEAM, AASHTO M-180, CLASS A or B, TYPE II

B: POST:

5 lb./ft. (7.45 kg/m) X 6'-6" Rib-Bak® U-CHANNEL POST, NUCOR GRADE SP-80

C: BLOCK:

4" X 8" X 14" RECYCLED PLASTIC COMPOSITE, 50/50 HDPE PRIMARY/POST-RECYCLED CONTENT

D: BOLT:

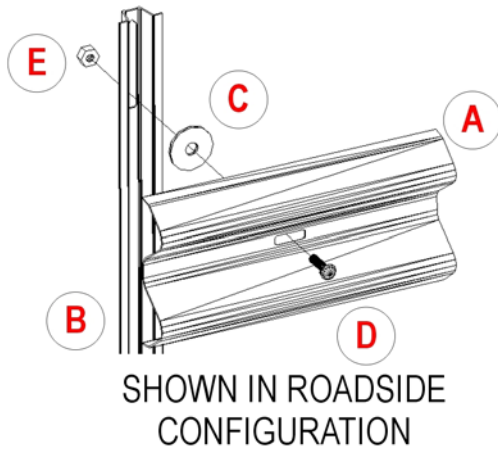
FOR ROADSIDE: 5/8" X 12" BUTTON HEAD POST BOLT, GALVANIZED, ASTM A307

E: NUT:

5/8" DOUBLE RECESSED NUT, ASTM A307

Nu-Guard-31™

For the 31" configuration, the system utilizes the following components:



A: RAIL:

W-BEAM, AASHTO M-180, CLASS A or B, GALVANIZED TYPE II

B: POST:

5 lb./ft. (7.45 kg/m) X 6'-6" Rib-Bak® U-CHANNEL POST, GALVANIZED OR POWDER-COATED, NUCOR GRADE SP-80

C: SPACER WASHER:

1/4" X 3 1/2" ROUND WASHER, GALVANIZED, ASTM A307

D: BOLT:

FOR ROADSIDE: 5/8" X 3 1/2" BUTTON HEAD POST BOLT, GALVANIZED, ASTM A307

FOR MEDIAN: 5/8" X 4" BUTTON HEAD POST BOLT, GALVANIZED, ASTM A307

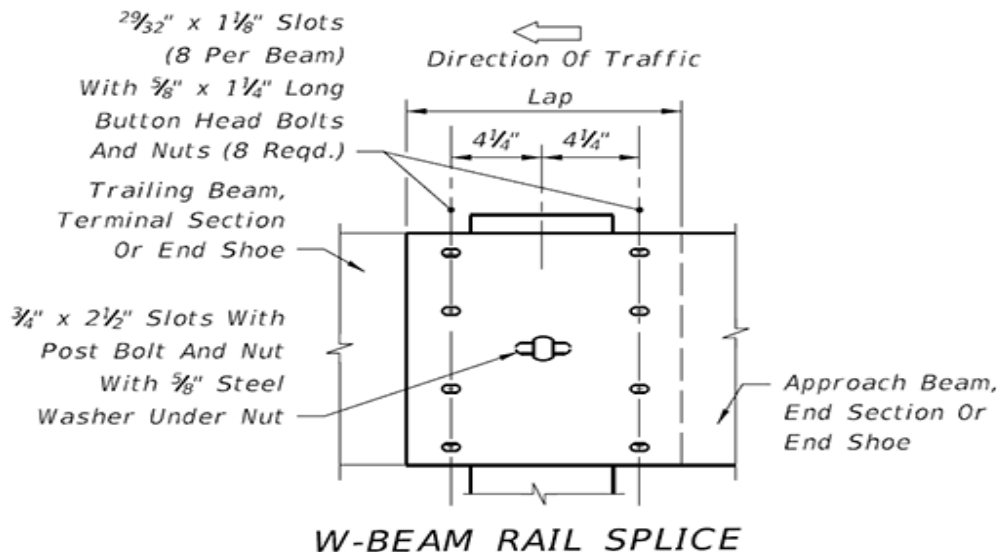
E: NUT:

5/8" DOUBLE RECESSED NUT, GALVANIZED, ASTM A307

This system may also be installed in **double-faced (median)** configuration, as represented in the following image. In which case, **a second spacer washer per post is required**. When installing in median configuration, be sure to alternate the direction of the post bolts at each post connection point.



Connection At Beam Splice



Typical Rail Splice connection detail. Source FLDOT 2014.

Shown is the standard overlap and splicing connection detail for w-beam guardrail systems. In some cases, some roadway authorities require the use **(1) additional washer under** on the post bolt at the backside of post. Be sure to check your local standards to meet compliance with hardware requirements.

Outlined below are the key steps that have been used by the manufacturer to easily install Nu-Guard-31™ median barriers once the posts have been driven:

- Splice the next guardrail panel to the existing guardrail end with 8 splice bolts and tighten.
- Insert a 24" steel rod half way through the post bolt slot of the guardrail panel and the vertical slot of the Nu-Guard-31™ post. (This will hold the panel at the correct height while the secondary panel is attached)
- Lever the existing secondary guardrail panel out laterally from the post to gain access. (This is easily achieved because this existing guardrail panel also has a 24" steel rod through the center post bolt slot at this stage and is only connected to the post and guardrail panel at the far end)
- Connect the next secondary guardrail panel to the exposed end with 8 splice bolts and tighten.
- Release the levered secondary guardrail panel so that it returns to the required position against the posts and the 24" rod fits into the center post bolt slot.
- At the newly created double sided splice join now connect the 4 guardrail panels to the post using a post bolt. Make sure that before this is done that a 3 ½" washer is positioned between the post and the guardrail panel on either side.
- Lastly remove the 24" steel rod from the completed section and set aside for use with the next guardrail panels. At this center post bolt slot, connect the panels together to the post with the same bolt and washer assembly as outlined in the previous step.

DELINEATION

System delineation should be as directed by the engineer or local standards. Alternately, at a minimum, a reflector should be located every **75' (25m)** along the length of the barrier.

Reflective washers may be used in the valley of the rail and connected under the head of the post bolt.

Post mounted delineators are also acceptable, so far as at least **8 sq. in.** of reflective surface is visible above the top edge of rail.



REPAIR & MAINTENANCE

The Nu-Guard-27™ & Nu-Guard-31™ system is designed to contain an errant vehicle impacting at NCHRP-350 Test Level 3 or 4 and MASH Test Level 3 conditions.

In testing, a length of **50' (15m)** was damaged in an impact event representative of a full-scale crash. Actual damage may be more or less depending on size of vehicle, speed and angle of impact.

The damaged sections of a system should be replaced and repaired promptly after initial impact to assure overall integrity of the guardrail barrier. Follow local guidelines for repair & replacement timeframes. Some areas require repair within 48 hours, while others allow for up to 2 weeks, so be sure to know what your local requirements are if you are in charge of barrier repair.



Refer to FHWA W-Beam Guardrail Repair Guide (Report No. FHWA-SA-08-002) for determining severity of damage and repair guidelines.

Posts:

- Damaged or bent posts will need to be replaced.
- Posts may be removed via a vertical winch or post-puller tripod device.
- In cases where the ground has been significantly disturbed from removal, be sure to backfill and tamp prior installation of the repair post.

Rail:

- The rail should be replaced if deformation has exceeded roughly 1" of lateral shape or if significant scratching of the galvanic coating layer has occurred.
- The rail must be replaced if any tearing or visible holes are located along the beam length.

Hardware:

- Bolts within the area of impact should be replaced.
- Nuts and washers may be reused so long as the galvanic coating layer has not been damaged.

Materials for Maintenance

Your NUCOR distributor carries an inventory of replacement parts for the Nu-Guard-27™ & Nu-Guard-31™ System to facilitate quick repair of an impacted system. In addition, it is recommended that DOTs or maintenance authorities keep a minimum quantity of repair parts on hand.

A general rule of thumb is to stock 2% to 4% of the total project, rounded up to the minimum order quantities (below).

Line Posts	=	50 piece bundles
Post Bolts & Nut	=	100 pieces
Splice Bolts & Nut	=	1000 pieces
Rail Sections	=	200 ft.

Please contact your distributor for up to date pricing on products.

INSTALLATION CHECKLISTS

- Is there anything in front of the barrier that might cause a vehicle to vault the barrier or make the barrier ineffective?
- Has the roadside grading been completed correctly?
- Have the soil conditions been properly evaluated for adequate density?
- Is there enough clearance between the barrier and the hazard for the expected barrier deflection?
- Is the barrier the correct height?
- Is the post spacing correct?
- Are the guardrail panels properly spliced?
- Are there irregular curves or joints where an errant vehicle might snag?
- Is there evidence of corrosion or damage to the rail? The rail should be scheduled for repair if either of these circumstances exists.
- Check to see that nuts are installed and tightened on all bolts.
- Has the washer been installed between the rail and the post on a Nu-Guard-31™ installation?
- Is there sufficient soil behind the posts to prevent them from being pushed out when the barrier is hit? Eroded or disturbed soil should be replaced and compacted.
- Is there evidence of corrosion or damage to the posts? The posts should be replaced if either of these circumstances exists.
- Has the system been properly delineated per applicable standards?

FREQUENTLY ASKED QUESTIONS

Nu-Guard-27

Is the Nu-Guard-27 system TL-3 only ?

Yes, with a designed working deflection of 45" for TL-3 applications.

Can the Nu-Guard-27 system be used at 31" rail height with TL-4 rating ?

No, it was tested and designed to be used for TL-3 applications only. The Nu-Guard-27 can be used with an offset block in rail heights from 27" to 31".

Can the Nu-Guard-27 system be used in 27" rail height applications without an offset block ?

No, it was tested with offset blocks only.

Can the Nu-Guard-27 system be used interchangeably with other 27" blocked-out systems ?

Yes, the system posts may be used interchangeably, in lieu of timber and steel posts, when maintaining strong-post W-Beam guardrails with an offset block.

Nu-Guard-31

Is the Nu-Guard-31 system TL-4 only ?

No, the Nu-Guard-31 system can be used in either MASH TL-3 or NCHRP-350 TL-3 & TL-4 applications, with a designed working deflection of 41" for TL-3 applications, and 48" for TL-4 applications.

Can Nu-Guard-31 be used with a block ?

No, it was only tested without an offset block. In cases where a block-out is required, utilize the Nu-Guard-27 system, which can be used in rail heights ranging from 27" to 31".

Can Nu-Guard-31 be used at a 29" rail height ?

No, it was tested and designed to be used at 31". For 29" rail height applications, use the Nu-Guard-27 system with offset blocks at a 29" rail height.

Can the Nu-Guard-31 system be used interchangeably with other 31" non-blocked systems ?

No, as all other current FHWA eligible 31" systems require an offset block. However, the Nu-Guard-31 system may still be connected to any crashworthy 31" mounting height guardrail terminal or transition system.

General Questions

What type of equipment is required to install Nu-Guard-27™ & Nu-Guard-31™?

Standard tools required include 1 ¼" (32mm) sockets and wrenches, measuring tape and a string line. Machinery includes post driver commonly used in driving posts. If installing the 'median' system a specialized small socket wrench is recommended.

On average, how long does it take to install a Nu-Guard-27™ & Nu-Guard-31™ Barrier?

Depending on the application and circumstances at the site, installation and assembly of the system should take a three person crew less than 2 hours to install a 150' (50m) section.

When driving the posts what can be used to prevent damage to the galvanizing on the top of the posts?

It is recommended that a timber, plastic or brass insert is fitted to the device being used to drive the posts. (Experience has shown that a brass insert will last the longest)

How easily can Nu-Guard-27™ & Nu-Guard-31™ be restored after impact?

The system is made up of very few different components and is easily repaired. Machinery will be required to lift out the damaged posts and drive the new ones. The remainder of the barrier requires only a wrench and 1 ¼" (32mm) socket to take apart and reinstate.

Are the same posts used for both the TL-3 and TL-4 Barriers?

Yes, there are no differences in any components or installation characteristics between the systems. In summary, the same barrier has passed NCHRP-350 criteria for both TL-3 and TL-4, as well as MASH TL-3 criteria.

Does your company provide spare parts?

Yes, it is important to fix a damaged barrier as soon as possible because it most probably won't perform as required when damaged. For this reason it is recommended that spare Nu-Guard-27™ & Nu-Guard-31™ key components are held by Maintenance Contractors along with the standard w-beam guardrail hardware. Replacement hardware is available from your Nucor Distributor, and recommendations for quantities to keep on hand are shown in the Repair & Maintenance section of the Nu-Guard Installation Manual.

What can Nu-Guard-27™ & Nu-Guard-31™ be connected to?

Nu-Guard-27™ & Nu-Guard-31™ systems must be anchored at either end by either an approved terminal end, transition section or w-beam guardrail. For further information consult the Nu-Guard-27™ & Nu-Guard-31™ recommended transition drawings.

Approvals & Testing Summary

B-162

Nu-Guard-27 with offset blocks & Nu-Guard-31 with no blocks, for TL-3 roadside or median applications

B-162B

Nu-Guard-31 with no block, for TL-4 roadside or median application

B-185

Nu-Guard-27 with offset blocks, installed at rail heights of 27" to 31" for TL-3 roadside or median applications

B-186

Nu-Guard-27 interchangeability with other TL-3 27" blocked-out systems

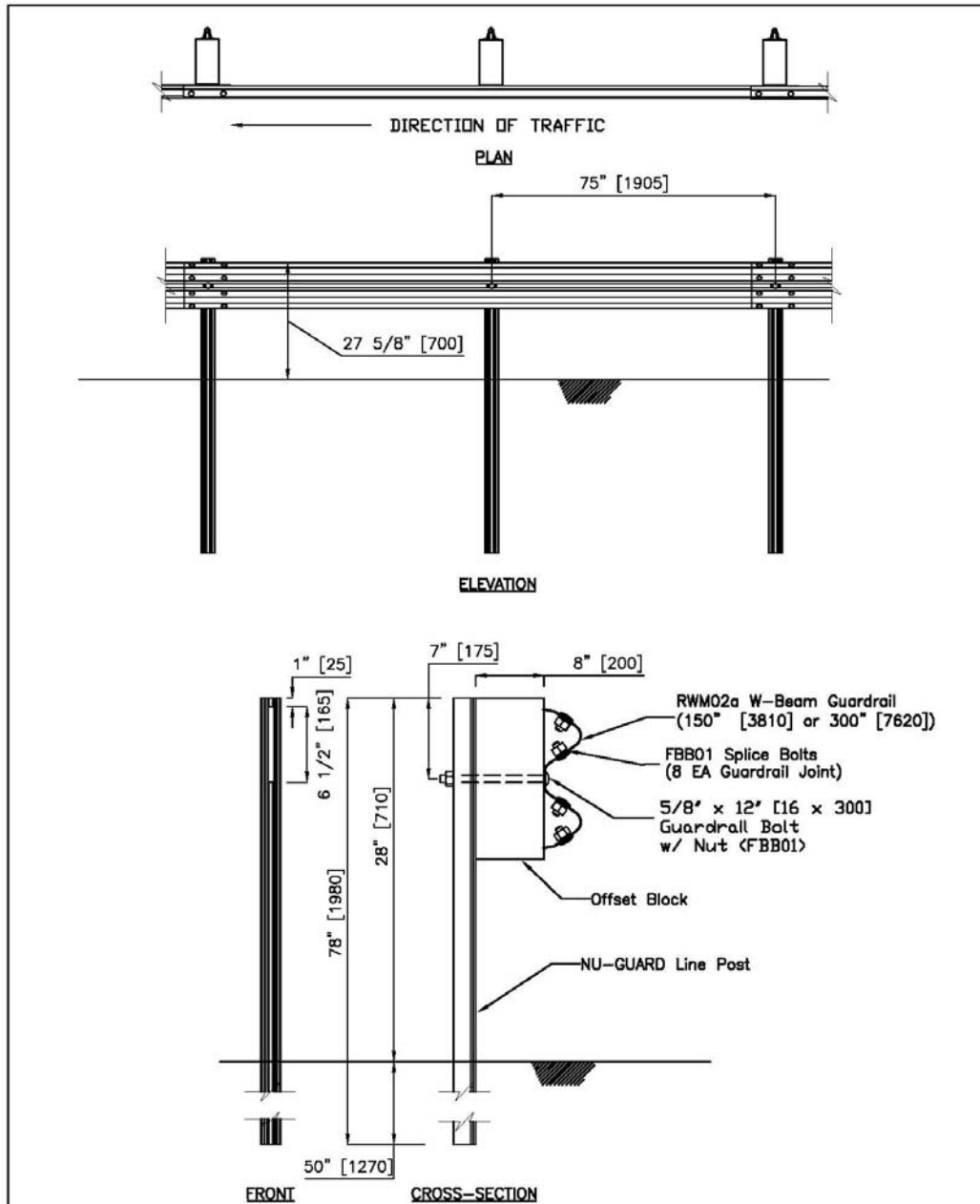
DETAILS

Barrier Systems

The following section includes details for the:

- Nu-Guard-27™ Roadside Option
- Nu-Guard-31™ Roadside Option
- Nu-Guard-31™ Median Option

Nu-Guard-27™ Roadside Option



NU-GUARD-27 ROADSIDE BARRIER

SGR32

SHEET NO.	DATE:
1 of 2	09/01/2015

INTENDED USE

The NU-GUARD-27 system is a corrugated metal w-beam barrier for use on national, state and local roadways to prevent collisions with hazards as required by safety design standards. The system is designed for roadside applications as an alternate to SGR04, for strong or weak post applications. The system may be connected to any crashworthy 27 5/8" [702] mounting height guardrail terminal or transition system. The system is to be installed on approach slopes no greater than 10H:1V, wherever a maximum working deflection of 45" [1150] is required. The system posts may be used interchangeably, in lieu of timber and steel posts, when maintaining strong-post W-Beam guardrails (SGR04).

COMPONENTS

The posts are Rib-Bak U-Channel sign posts 5 lb/ft [7.4 kg/m] fabricated from hot rolled carbon steel bars conforming to the requirements of NUCOR/Marion Steel Company Grade SP-80 with a minimum yield point of 80,000 psi [552 MPa].

Unit length = 150" [3810]

Designator	Component	Number
RWM02a	W-beam rail	1
	NU-GUARD Line Post	2
	Offset Block	2
	12" [300] Guardrail-post bolt and nut	2
FBB01	Splice bolt and nut	8

The system meets NCHRP-350 TL-3 requirements as a longitudinal barrier.

AGENCY ACCEPTANCE

FHWA Acceptance Letter [B-162](#), 09/11/2007

FHWA Acceptance Letter [B-186](#), 08/03/2009

CONTACT INFORMATION

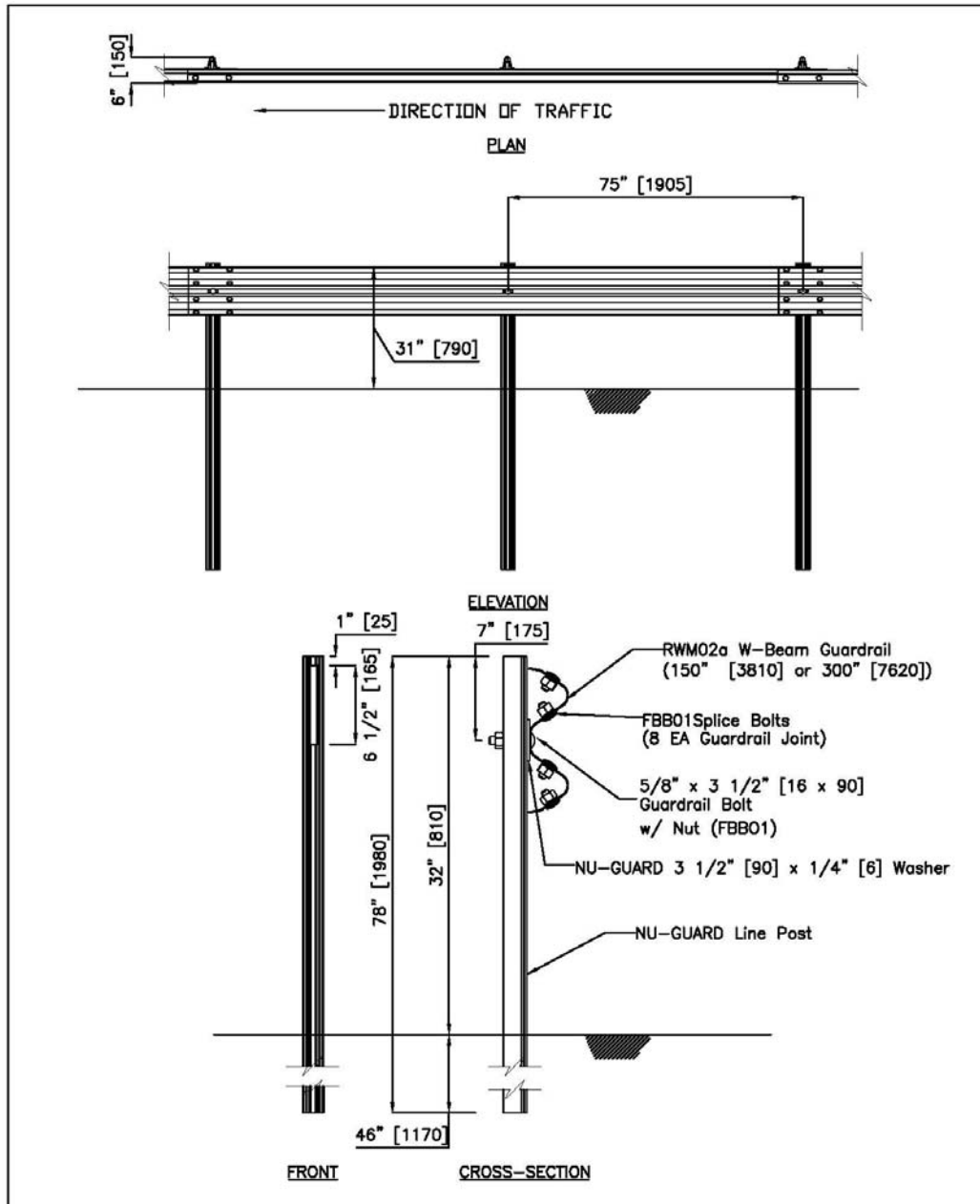
Nucor Steel Marion Inc.
912 Cheney Avenue
Marion, Ohio 43301-1801
(800) 333-4011
(740) 383-6429 Fax
www.nucorhighway.com

NU-GUARD-27 ROADSIDE BARRIER

SGR32		
SHEET NO.	DATE	
2 of 2	09/01/2015	

All Nucor Steel Marion Inc. products are produced from 100% recycled steel.

Nu-Guard-31™ Roadside Option



NU-GUARD-31 ROADSIDE BARRIER

SGR33

SHEET NO.	DATE:
1 of 2	09/01/2015

INTENDED USE

The NU-GUARD-31 system is a corrugated metal w-beam barrier for use on national, state and local roadways to prevent collisions with hazards as required by safety design standards. The system is designed for roadside applications as an alternate to SGR04, and equivalent to other 31" [790] mounting height w-beam barriers (such as SGR20), for strong or weak post applications. The system may be connected to any crashworthy 31" [790] mounting height guardrail terminal or transition system. The system is to be installed on approach slopes no greater than 10H:1V, wherever a maximum working deflection of 41" [1050] is required for TL-3 applications, and 48" [1220] for TL-4 applications.

COMPONENTS

The posts are Rib-Bak U-Channel sign posts 5 lb/ft [7.4 kg/m] fabricated from hot rolled carbon steel bars conforming to the requirements of NUCOR/Marion Steel Company Grade SP-80 with a minimum yield point of 80,000 psi [552 Mpa]

Unit length = 150" [3810]

Designator	Component	Number
RWM02a	W-beam rail	1
	NU-GUARD Line Post	2
	NU-GUARD 3 1/2" [90] x 1/4" [6] Washer	2
	3 1/2" [90] Guardrail-post bolt and nut	2
FBB01	Splice bolt and nut	8

The system meets NCHRP-350 TL-4 and MASH-08 TL-3 requirements as a longitudinal barrier.

AGENCY ACCEPTANCE

FHWA Acceptance Letter [B-162](#), 09/11/2007

CONTACT INFORMATION

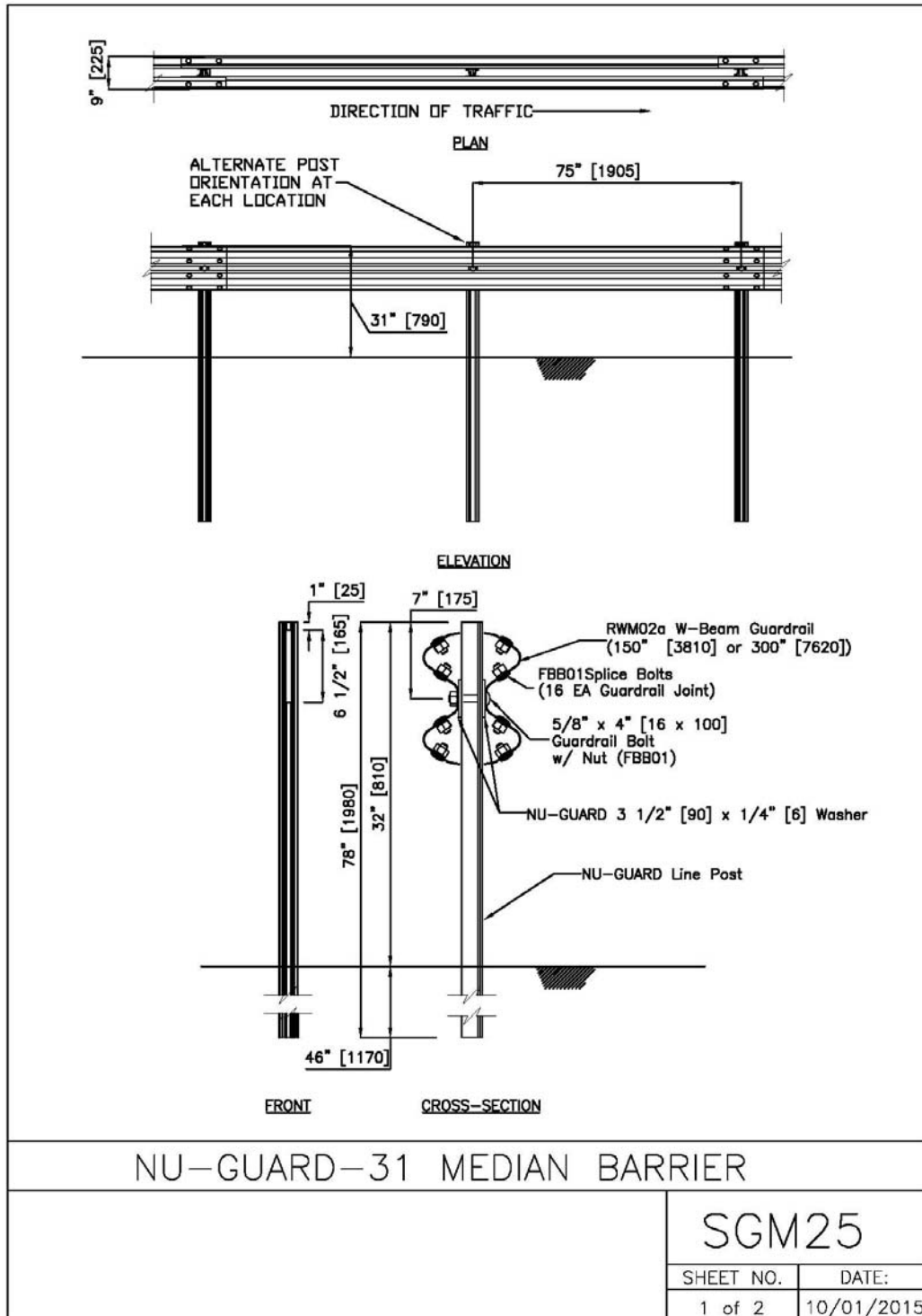
Nucor Steel Marion Inc.
912 Cheney Avenue
Marion, Ohio 43301-1801
(800) 333-4011
(740) 383-6429 Fax
www.nucorhighway.com

NU-GUARD-31 ROADSIDE BARRIER

SGR33		
SHEET NO.	DATE	
2 of 2	09/01/2015	

All Nucor Steel Marion Inc. products are produced from 100% recycled steel.

Nu-Guard-31™ Median Option



INTENDED USE

The NU-GUARD-31 median system is a corrugated metal w-beam barrier for use on national, state and local roadways to prevent collisions with hazards as required by safety design standards. The system is designed for median installations as an alternate to SGR04, and equivalent to other 31" [790] mounting height w-beam barriers (such as SGR20) for strong or weak post applications. The system may be connected to any crashworthy 31" [790] mounting height guardrail terminal or transition system. The system is to be installed on approach slopes no greater than 10H:1V, wherever a maximum working deflection of 41" [1050] is required for TL-3 applications, and 48" [1220] for TL-4 applications.

COMPONENTS

The posts are Rib-Bak U-Channel sign posts 5 lb/ft [7.4 kg/m] fabricated from hot rolled carbon steel bars conforming to the requirements of NUCOR/Marion Steel Company Grade SP-80 with a minimum yield point of 80,000 psi [552 Mpa].

Unit length = 150" [3810]

Designator	Component	Number
RWM02a	W-beam rail	2
	NU-GUARD Line Post	2
	NU-GUARD 3 1/2" [90] x 1/4" [6] Washer	4
	4" [100] Guardrail-post bolt and nut	2
FBB01	Splice bolt and nut	16

The system meets NCHRP-350 TL-4 and MASH-08 TL-3 requirements as a longitudinal barrier.

AGENCY ACCEPTANCES

FHWA Acceptance Letter [B-162](#), 09/11/2007

CONTACT INFORMATION

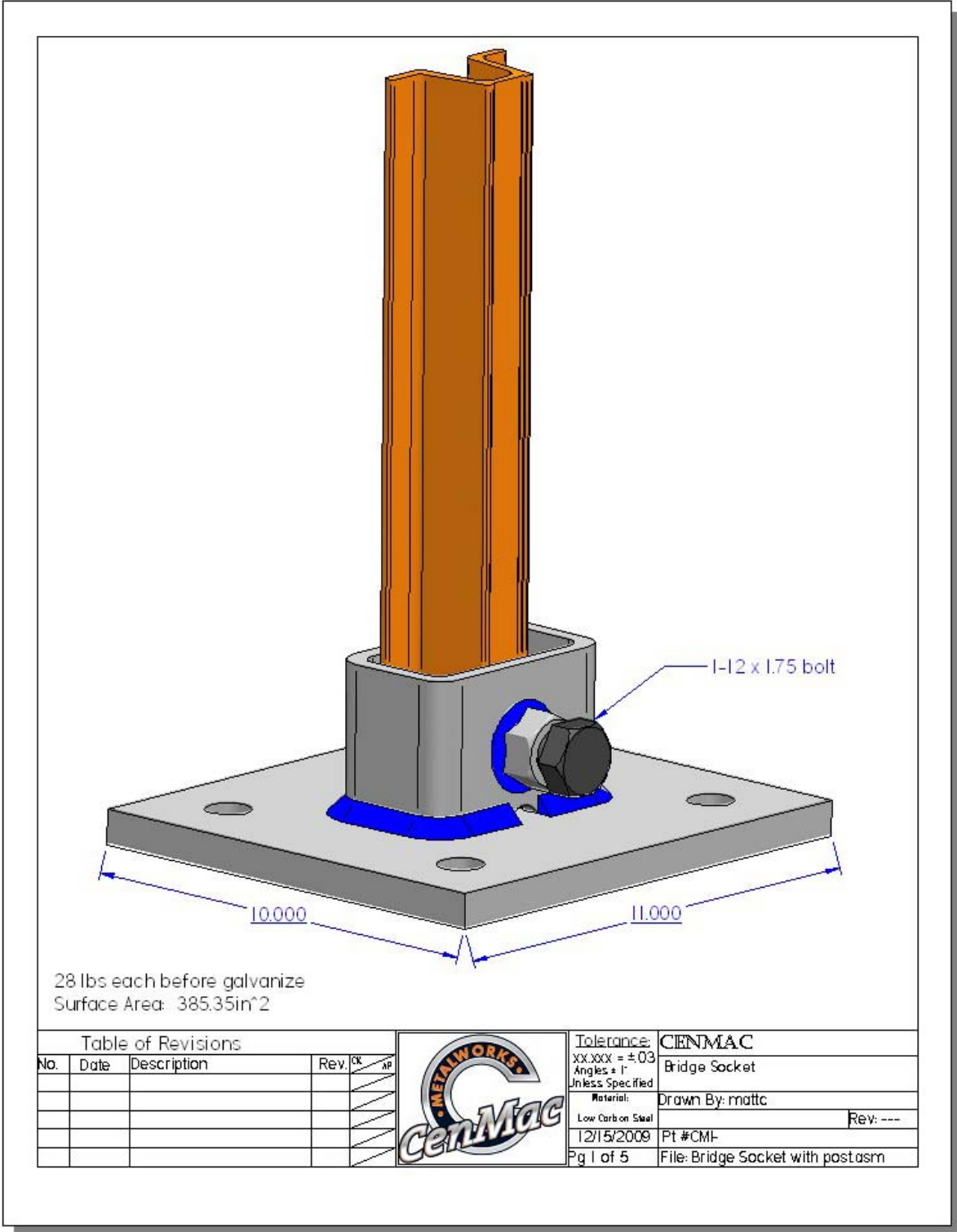
Nucor Steel Marion Inc.
 912 Cheney Avenue
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 (800) 333-4011
 (740) 383-6429 Fax
www.nucorhighway.com

NU-GUARD-31 MEDIAN BARRIER

SGM25		
SHEET NO.	DATE	
2 of 2	10/01/2015	

All Nucor Steel Marion Inc. products are produced from 100% recycled steel.

Deck & Culvert Mounted Post Attachment



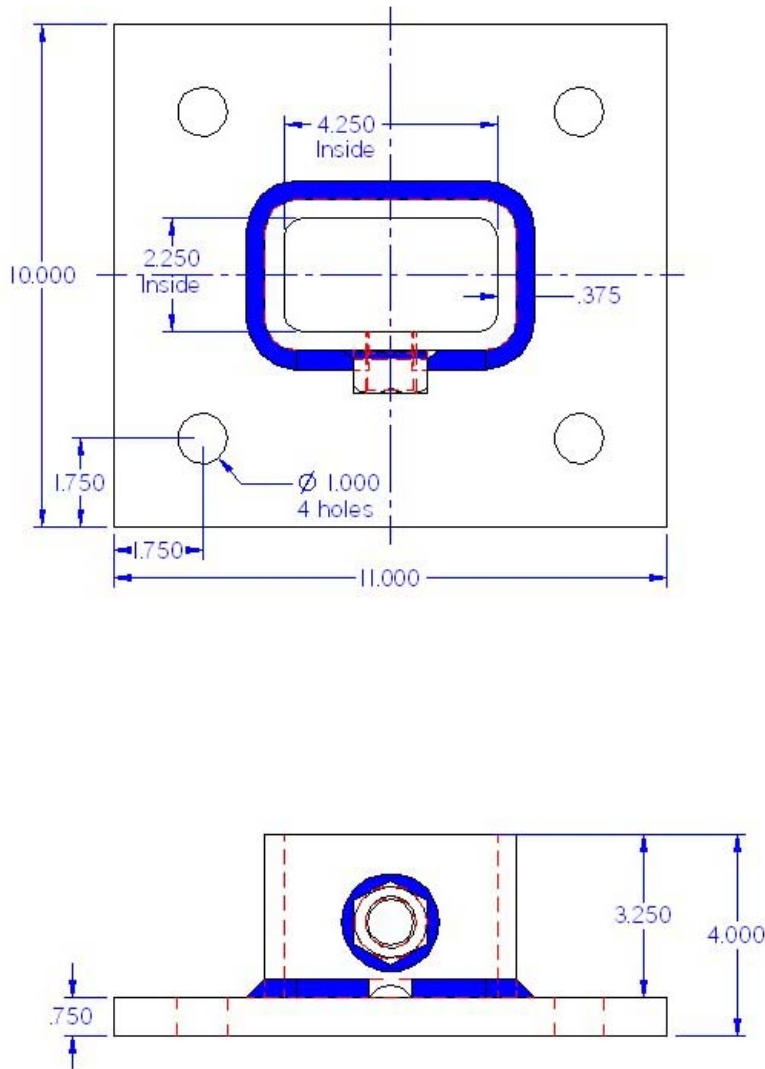


Table of Revisions				
No.	Date	Description	Rev.	OK



Tolerance: CENMAC
 XX.XXX = ±.03
 Angles ± 1°
 Unless Specified
 Material: Steel
 Low Carb on Steel
 12/15/2009 Pt #CMI-
 Pg 2 of 5 File: Bridge Socket.pwd
 Drawn By: mattc
 Rev: ---

LIMITED WARRANTY

Nucor Steel Marion Inc. (NUCOR) has tested the impact performance of its barriers and crash cushion systems, and other highway safety hardware under controlled conditions, however, NUCOR does not represent nor warrant that the results of those controlled conditions would necessarily avoid injury to persons or property.

NUCOR EXPRESSLY DISCLAIMS ANY WARRANTY OR LIABILITY FOR CLAIMS ARISING BY REASONS OF DEATH OR PERSONAL INJURY OR DAMAGE TO PROPERTY RESULTING FROM ANY IMPACT, COLLISION OR HARMFUL CONTACT WITH THE PRODUCTS OR NEARBY HAZARDS OR OBJECTS BY ANY VEHICLE, OBJECTS OR PERSONS.

NUCOR warrants that any product or component part manufactured by NUCOR will be free from defects in material or workmanship. NUCOR will replace free of cost any Product or component part manufactured by NUCOR that contains such a defect.

THE FOREGOING WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES NOT EXPRESSLY SET FORTH HEREIN, WHETHER EXPRESS OR IMPLIED BY OPERATION OF LAW OR OTHERWISE, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

NUCOR'S LIABILITY UNDER THIS WARRANTY ONLY APPLY TO PARTS NUCOR MANUFACTURE AND IS EXPRESSLY LIMITED TO REPLACEMENT FREE OF COST (IN THE FORM AND UNDER THE TERMS ORIGINALLY SHIPPED), OR TO REPAIR OR TO MANUFACTURE BY NUCOR, PRODUCTS OR PARTS NOT COMPLYING WITH NUCOR SPECIFICATIONS, OR, AT NUCOR'S ELECTION, TO THE REPAYMENT OF AN AMOUNT EQUAL TO THE PURCHASE PRICE OF SUCH PRODUCTS OR PARTS, WHETHER SUCH CLAIMS ARE FOR BREACH OF WARRANTY OR NEGLIGENCE. NUCOR SHALL NOT BE LIABLE FOR ANY INCIDENTAL, CONSEQUENTIAL OR SPECIAL LOSSES, DAMAGES OR EXPENSES OF ANY KIND, INCLUDING, WITHOUT LIMITATION, ANY SUCH LOSSES, DAMAGES OR EXPENSES ARISING DIRECTLY OR INDIRECTLY FROM THE SALE, HANDLING OR USE OF THE PRODUCTS FROM ANY OTHER CAUSE RELATING THERETO, OR FROM PERSONAL INJURY OR LOSS OF PROFIT.

Any claim by the Buyer with reference to Products sold hereunder for any cause shall be deemed waived by the Buyer unless NUCOR is notified in writing, in the case of defects apparent on visual inspection, within ninety (90) days from the delivery date, or, in the case of defects not apparent on visual inspection, within twelve (12) months from the said delivery date. Products claimed to be defective may be returned prepaid to NUCOR's plant for inspection in accordance with return shipping instructions that NUCOR shall furnish to the Buyer forthwith upon receipt of the Buyer's notice of claim. If the claim is established, NUCOR will reimburse that Buyer for all carriage costs incurred hereunder.

The forgoing warranty benefits shall not apply to (i) any Products that have been subject to improper storage, accident, misuse or unauthorized alterations, or that have not been installed, operated and maintained in accordance with approved procedures and (ii) any components manufactured by the Buyer.

TECHNICAL SUPPORT AND SALES

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