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GENERAL CRANE INFORMATION
Following is an explanation of Nucor Building System’s (NBS) interpretation of basic crane serviceability criteria for use by the builder in properly defining the crane system. This information is based on the MBMA Low-Rise Building Systems Manual, 1996 and CMAA Specification #74, 1994 Revised.

SERVICE DUTY CLASSES
The CMAA (Ref. 74.2) has established six categories of crane service classification as a guide for determining the usage or serviceability requirements of a specific crane application. These criteria are related to number of lifts per hour, average percent of capacity per lift, speed requirements when moving the load, and height of lift. Since it is NBS standard approach to use the design procedures outlined in the MBMA Low-Rise Building Systems Manual, 1996 for crane design, Classes E and F are considered extreme special cases and are not discussed herein. Please contact NBS Estimating Department directly with questions or requests concerning Class E or F cranes. The classes are as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td><strong>Stand-By or Infrequent</strong>&lt;br&gt;This service class covers cranes which may be used in installations such as powerhouses, public utilities, turbine rooms, motor rooms and transformer stations where precise handling of equipment at slow speeds with long, idle periods between lifts are required. Capacity loads may be handled for initial installation of equipment and for infrequent maintenance.</td>
</tr>
<tr>
<td>B</td>
<td><strong>Light</strong>&lt;br&gt;This service class covers cranes which may be used in repair shops, light assembly operations, service buildings, light warehousing, etc., where service requirements are light and the speed is slow. Loads may vary from no load to occasional full rated loads with two to five lifts per hour, averaging ten feet per lift.</td>
</tr>
<tr>
<td>C</td>
<td><strong>Moderate</strong>&lt;br&gt;This service class covers cranes which may be used in machine shops or papermill machine rooms, etc., where service requirements are moderate. In this type of service, the crane will handle loads which average 50 percent of the rated capacity with 5 to 10 lifts per hour, averaging 15 feet, not over 50 percent of the lifts at rated capacity.</td>
</tr>
<tr>
<td>D</td>
<td><strong>Heavy</strong>&lt;br&gt;This service class covers cranes which may be used in heavy machine shops, foundries, fabricating plants, steel warehouses, container yards, lumber mills, etc., and the standard duty bucket and magnet operations where heavy duty production is required. In this type of service, loads approaching 50 percent of the rated capacity will be handled constantly during the working period. High speeds are desirable for this type of service with 10 to 20 lifts per hour averaging 15 feet, not over 65 percent of the lifts at rated capacity.</td>
</tr>
</tbody>
</table>
In design of the crane beam and brackets, it is also important to consider the effects of fatigue on the welds and bolted joints. This is taken into consideration by NBS as explained in the MBMA Low-Rise Building Systems Manual, 1996. AISC has defined four loading conditions in the AISC-ASD Manual of Steel Construction, 9th Ed, as follows:

<table>
<thead>
<tr>
<th>Loading Condition</th>
<th>Total No. of Loading Cycles *</th>
<th>Equiv. No. Cycles Per Day Over Life Span.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>20,000 to 100,000</td>
<td>2 to 10</td>
</tr>
<tr>
<td>2</td>
<td>100,000 to 500,000</td>
<td>10 to 50</td>
</tr>
<tr>
<td>3</td>
<td>500,000 to 2,000,000</td>
<td>50 to 200</td>
</tr>
<tr>
<td>4</td>
<td>2,000,000 and over</td>
<td>200 and up</td>
</tr>
</tbody>
</table>

* over entire life span, assuming 25 year life span.

These loading conditions define the allowable stresses on the joints of the beam and bracket. MBMA has correlated these loading conditions to the service duty classes defined by CMAA so that if a certain class is chosen, the appropriate loading condition can then be chosen from the following table:

<table>
<thead>
<tr>
<th>Service Class</th>
<th>AISC Loading Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>R ≤ 0.5</td>
</tr>
<tr>
<td></td>
<td>R &gt; 0.5</td>
</tr>
<tr>
<td>C</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

where,

\[
R = \frac{TW}{TW + RC}, \text{ for underhung monorail cranes,}
\]

\[
R = \frac{TW}{TW + 2RC}, \text{ for bridge cranes.}
\]

TW = Total weight of the crane including bridge with end trucks, hoist with trolley, and cab with walkway for cab-operated cranes.

RC = Rated Capacity of the crane.

Service Class A is not represented in the above table nor is there a value for Class B if R ≤ 0.5. This is because fatigue does not need to be considered in these cases. NBS requires only that the customer supply the Service Duty Class as defined previously for the given crane system. The customer must determine and supply this value as NBS cannot define usage in relation to the crane system. The loading condition per AISC is then determined by NBS.
TOP RUNNING BRIDGE CRANE BRACKET DETAILS

AH0010 – RUNWAY BEAM TO BRACKET CONNECTION

NOTE: SEE RAIL TO RUNWAY BEAM CONNECTION DETAILS (EITHER HOOK BOLT OR FLOATING CLAMP DETAIL) FOR ADDITIONAL CONNECTION REQUIREMENTS.

1. BOLTS MUST BE FULLY TIGHTENED.
2. BOLTS TO BE HAND TIGHTENED ONLY. THREADS MUST BE DISTORTED TO PREVENT BOLTS FROM LOOSENING.
3. FIELD SLOTTING OF LATERAL TIE BACK PLATE OR ANGLES IS NOT PERMITTED. FIELD MODIFICATION OF THIS CONNECTION WILL ADVERSELY AFFECT THE STRUCTURAL PERFORMANCE AND INTEGRITY OF THE CRANE RUNWAY SYSTEM.
AH0030 – RUNWAY BEAM TO COLUMN BRACING (UNBRACED BAY)

(2) 3/4” ø x 2 3/4” A325
BOLTS H0630/NUTS H0320

ANGLE
MK. CBA__

COLUMN

STIFFENER

CRANE BRACKET

RUNWAY BEAM

1/8” 1/8”

TOP RUNNING BRIDGE
CRANE DETAIL

RUNWAY BEAM TO COLUMN BRACING (TYPICAL UNLESS NOTED OTHERWISE)
AH0070 – RUNWAY BEAM TO COLUMN BRACING (BRACED BAY)

TOP RUNNING BRIDGE CRANE DETAIL

RUNWAY BEAM TO COLUMN BRACING (TYPICAL AT BRACED BAY)
AH0090 – Runway Beam to Bracket Connection (Double Bracket)

Note: See rail to runway beam connection details (either hook bolt or floating clamp detail) for additional connection requirements.

1. Bolts must be fully tightened.
2. Bolts to be hand tightened only. Threads must be distorted to prevent bolts from loosening.
3. Field slotting of lateral tie back plate or angles is not permitted. Field modification of this connection will adversely affect the structural performance and integrity of the crane runway system.
AH0120 – RUNWAY BEAM TO COLUMN BRACING (DOUBLE BRACKET) (BRACED BAY)

**Diagram:**
- Runway Beam
- Column
- Stiffener
- Brace Strut
- Angle MK. CBA

(2) - 3/4" φ x 2 3/4" A325
Bolts H0630/Nuts H0320
At each angle

(2) - 3/4" φ x 2 3/4" A325
Bolts H0630/Nuts H0320

Crane Bracket

1/8" gaps

**Details:**
- Top Running Bridge Crane Detail
- Runway Beam to Column Bracing (Typical at Braced Bay)
**TOP RUNNING BRIDGE CRANE AUXILIARY COLUMN DETAILS**

**AH0150 – RUNWAY BEAM TO AUXILIARY COLUMN CONNECTION**

**NOTE:** SEE RAIL TO RUNWAY BEAM CONNECTION DETAILS (EITHER HOOK BOLT OR FLOATING CLAMP DETAIL) FOR ADDITIONAL CONNECTION REQUIREMENTS.

1. **BOLTS MUST BE FULLY TIGHTENED.**
2. **BOLTS TO BE HAND TIGHTENED ONLY. THREADS MUST BE DISTORTED TO PREVENT THE BOLTS FROM LOOSENING.**
3. **FIELD SLOTTING OF LATERAL TIE BACK PLATE OR ANGLES IS NOT PERMITTED. FIELD MODIFICATION OF THIS CONNECTION WILL ADVERSELY AFFECT THE STRUCTURAL PERFORMANCE AND INTEGRITY OF THE CRANE RUNWAY SYSTEM.**

**AH0150.DWG**
AH0170 – AUXILIARY COLUMN TO FRAME COLUMN CONNECTION

(2) – 3/4” φ x 2 3/4” A325
BOLTS H0630
NUTS H0320
WASHERS H0220

1 1/2”
1 1/2”

1 1/4”
1/2”

(4) – 3/4” φ x 2 3/4” A325
BOLTS H0630
NUTS H0320
WASHERS H0220

2”
2”

COLUMN

CLIP
MK. CBC01

TIE-PLATE
MK. 01

AUXILIARY COLUMN

TOP RUNNING BRIDGE
CRANE DETAIL
COLUMN TO AUXILIARY COLUMN ATTACHMENT
TOP RUNNING BRIDGE CRANE STEPPED COLUMN DETAILS

AH0180 – RUNWAY BEAM TO STEPPED COLUMN CONNECTION

NOTE: SEE RAIL TO RUNWAY BEAM CONNECTION DETAILS (EITHER HOOK BOLT OR FLOATING CLAMP DETAIL) FOR ADDITIONAL CONNECTION REQUIREMENTS.

1. BOLTS MUST BE FULLY TIGHTENED.
2. BOLTS TO BE HAND TIGHTENED ONLY. THREADS MUST BE DISTORTED TO PREVENT THE BOLTS FROM LOOSENING.
3. FIELD SLOTTING OF LATERAL TIE BACK PLATE OR ANGLES IS NOT PERMITTED. FIELD MODIFICATION OF THIS CONNECTION WILL ADVERSELY AFFECT THE STRUCTURAL PERFORMANCE AND INTEGRITY OF THE CRANE RUNWAY SYSTEM.
AH0200 – RUNWAY BEAM TO DOUBLE STEPPED COLUMN CONNECTION

NOTE: SEE RAIL TO RUNWAY BEAM CONNECTION DETAILS (EITHER HOOK BOLT OR FLOATING CLAMP DETAIL) FOR ADDITIONAL CONNECTION REQUIREMENTS.

1. BOLTS MUST BE FULLY TIGHTENED.
2. BOLTS TO BE HAND TIGHTENED ONLY. THREADS MUST BE DISTORTED TO PREVENT THE BOLTS FROM LOOSENING.
3. FIELD SLOTTING OF LATERAL TIE BACK PLATE OR ANGLES IS NOT PERMITTED. FIELD MODIFICATION OF THIS CONNECTION WILL ADVERSELY AFFECT THE STRUCTURAL PERFORMANCE AND INTEGRITY OF THE CRANE RUNWAY SYSTEM.
CRANE STOP DETAIL

AH0220 – CRANE STOP DETAIL

FRAME COLUMN BEYOND

CRANE STOP MK. MXC01

CRANE RAIL

4" (STD)

(6) 03 "φ x 04 " A325 BOLTS H005, NUTS H006

END OF BEAM 1/2"

CRANE BEAM

(2) 3/4"φ x 2 3/4" A325 BOLTS (MK. H0630), NUTS (MK. H0320), AND WASHERS (MK. H0220)

CRANE BRACKET OR AUXILIARY CRANE COLUMN

1/8" 02 ENDWALL STEEL LINE

END OF BEAM CENTERLINE OF COLUMN

TOP RUNNING CRANE STOP

A

B

LAST REVISION DATE: 08/11/04
BY: KMC CHK: RJF

DETAIL NAME IF APPLICABLE

AH0220.DWG

4.6.14

PRODUCT AND ENGINEERING MANUAL

4.6 CRANES
AH0225 – ALTERNATE CRANE STOP DETAIL

FRAME COLUMN BEYOND

CRANE STOP MK. MXC01

CRANE RAIL

1" (STD) EDGE OF WELDED CLIP TO EDGE OF CRANE STOP BASE PLATE

CLIPS MK. CBC01 WITH A TOTAL OF (5) 3/4"Ø × 2 3/4" A325 BOLTS H0630, NUTS H0320, AND WASHERS H0220

(6) 03 "Ø × 04 " A325 BOLTS H005, NUTS H006

CRANE BEAM

(2) 3/4"Ø × 2 3/4" A325 BOLTS (MK. H0630), NUTS (MK. H0320), AND WASHERS (MK. H0220)

CRANE BRACKET OR AUXILIARY CRANE COLUMN

1/8" END OF BEAM CENTERLINE OF COLUMN

ENDWALL STEEL LINE

TOP RUNNING CRANE STOP

A

B
HOOK BOLT AND FLOATING RAIL CLAMP DETAILS

AH0230 – RAIL TO RUNWAY HOOK BOLT CONNECTION

<table>
<thead>
<tr>
<th>RAIL</th>
<th>HOOK BOLT DIAM.</th>
</tr>
</thead>
<tbody>
<tr>
<td>25#-30#</td>
<td>5/8&quot;</td>
</tr>
<tr>
<td>40#-60#</td>
<td>3/4&quot;</td>
</tr>
<tr>
<td>80#-105#</td>
<td>7/8&quot;</td>
</tr>
</tbody>
</table>

RAIL SIZE: 01
HOOK BOLT DIAMETER: 02
J O I N T  B A R S: 03

RAIL TO RUNWAY BEAM
HOOK BOLT CONNECTION
TOP RUNNING BRIDGE CRANE DETAIL
AH0240 – RAIL TO RUNWAY BEAM FLOATING CLAMP CONNECTION

RAIL SIZE: 01

JOINT BARS: 02

RAIL CLAMPS: 03

BOLT SIZE: 1” φ A325 W/ (1) LOCK WASHER

RAIL TO RUNWAY BEAM FLOATING CLAMP CONNECTION

TOP RUNNING BRIDGE CRANE DETAIL
MONORAIL/UNDERHUNG CRANES

- Underhung crane beams have rigid specifications with regard to tolerances. Many suppliers of underhung systems require hardened flanges where crane wheels come in contact with the crane beam. NBS standard approach to underhung and monorail cranes is to design for the effects on the primary structural system only. Nucor will qualify back a maximum vertical frame deflection due to crane load combination; project engineer of record needs to review this information with crane supplier. As a standard, all beams, rails, connections to main frames, etc. are by others. NBS will design the frame of the building for the vertical and lateral loads and the building longitudinal bracing for the longitudinal loads.

- There are capacity limits for the monorail and underhung cranes. For both crane types, we will not design to a CMAA service class above C. The monorail crane capacity limit is 5 tons and the underhung capacity limit is 10 tons.

- It is important to specify clearly on the sketch of the building(s) included with the order proposal the start and stop point, direction, orientation, and capacity of each monorail or underhung crane in the structure. Please also note that NBS standard connection type designed for is the “truss” type. NBS will provide a web stiffener plate to be welded in place directly over the centerline of the crane connection in the rafter by an AWS certified welder in the field. We ship this stiffener plate loose for the customer to place and weld because of the uncertainty of the exact end location of the crane attachment. This allows the customer more flexibility during erection to allow for unknowns.
AH0250 – STANDARD CONNECTION (CRANE STEEL NOT BY NUCOR)

NOTE:

- NBS IS PROVIDING FOR CRANE CAPACITY ONLY. ADDITIONAL REINFORCEMENT ON RIGID FRAMES DUE TO CRANE LOADS IS NOT BY NBS. SEE DETAIL ABOVE FOR WEB REINFORCEMENT INFORMATION AT CRANE ATTACHMENT LOCATIONS.

- ALL WELDING MUST BE PERFORMED BY AWS CERTIFIED WELDERS WHO ARE QUALIFIED FOR THE WELDING PROCESSES AND POSITIONS INDICATED. ALL WORK MUST BE COMPLETED AND INSPECTED IN ACCORDANCE WITH THE APPLICABLE AWS SPECIFICATIONS. WELD ELECTRODES USED FOR THE SMAW (OR STICK) WELD PROCESS MUST BE 70 KSI STEEL AND LOW HYDROGEN CONTENT.

UNDERHUNG / MONORAIL
CRANE ATTACHMENT POINT DETAIL

AH0250
AH0260 – OPTIONAL CONNECTION (CRANE STEEL NOT BY NUCOR)

UNDERHUNG / MONORAIL
CRANE ATTACHMENT POINT DETAIL

RUNWAY BEAM, STUB/CRANE BEAM, SWAY BRACING
AND CONNECTIONS (NOT BY NUCOR)
AH0255 – STANDARD TRANSVERSE CONNECTION (CRANE STEEL NOT BY NUCOR)

NOTE:

- NBS IS PROVIDING FOR CRANE CAPACITY ONLY. ADDITIONAL REINFORCEMENT ON RIGID FRAMES DUE TO CRANE LOADS IS NOT BY NBS. SEE DETAIL ABOVE FOR WEB REINFORCEMENT INFORMATION AT CRANE ATTACHMENT LOCATIONS.

- ALL WELDING MUST BE PERFORMED BY AWS CERTIFIED WELDERS WHO ARE QUALIFIED FOR THE WELDING PROCESSES AND POSITIONS INDICATED. ALL WORK MUST BE COMPLETED AND INSPECTED IN ACCORDANCE WITH THE APPLICABLE AWS SPECIFICATIONS. WELD ELECTRODES USED FOR THE SMAW (OR STICK) WELD PROCESS MUST BE 70 KSI STEEL AND LOW HYDROGEN CONTENT.

TRANSVERSE UNDERHUNG CRANE ATTACHMENT POINT DETAIL

LAST REVISION
DATE: 08/11/04
BY: KMC CHK: RJF

DETAIL NAME IF APPLICABLE
AH0255.DWG

4.6.21
AH0265 – OPTIONAL TRANSVERSE CONNECTION (CRANE STEEL NOT BY NUCOR)

TRANSVERSE UNDERHUNG CRANE ATTACHMENT POINT DETAIL

RUNWAY BEAM, STUB/CRANE BEAM, SWAY BRACING AND CONNECTIONS (NOT BY NUCOR)