AISC Night School

Thank you for joining our live webinar today.
We will begin shortly. Please standby.

Thank you.

Need Help?
Call ReadyTalk Support: 800.843.9166

Steel Construction | From the Mill to Topping Out

Smarter. Stronger. Steel.

AISC Night School

Today's audio will be broadcast through the internet.

Alternatively, to hear the audio through the phone, dial 866-519-2796. Passcode: 387037

AISC Night School

Today's live webinar will begin shortly.
Please standby.

As a reminder, all lines have been muted. Please type any questions or comments through the Chat feature on the left portion of your screen.

Today's audio will be broadcast through the internet. Alternatively, to hear the audio through the phone, dial 866-519-2796. Passcode: 387037

AISC Night School

AISC is a Registered Provider with The American Institute of Architects Continuing Education Systems (AIA/CES). Credit(s) earned on completion of this program will be reported to AIA/CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This program is registered with AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Copyright Materials

Session Description

18.8 Quality Control and Quality Assurance
December 10, 2018

How do you specify and ensure a quality steel project? The answer is in Chapter N. Chapter N has been a part of the AISC Specification for Structural Steel Buildings (ANSI/AISC 360) since 2010. Why was this added to the AISC Specification? Are these new quality requirements for fabrication and erection? What is the difference between Quality Control (QC) and Quality Assurance (QA)? How does this relate to the International Building Code (IBC)? This session will try to address these burning questions that you may have. In addition, do statistics show how a quality program is functioning while increasing productivity? The answers may surprise you.

AISC Night School Learning Objectives

- Describe the links between construction quality and building safety, serviceability and value pertaining to structural steel buildings.
- Describe how Chapter N supports effective methods in order to achieve greater uniformity in quality of structural steel construction.
- Describe the scope of the Chapter N provisions and their relationship to requirements in related codes and standards.
- Describe how a quality program can achieve building safety and increase productivity.

Night School 18: Steel Construction

From the Mill to Topping Out
Session 8: Quality Control & Quality Assurance
December 10, 2018

Lawrence F. Kruth, PE
Vice President of Engineering & Research
American Institute of Steel Construction
Chicago, IL

Smarter. Stronger. Steel.

Night School 18

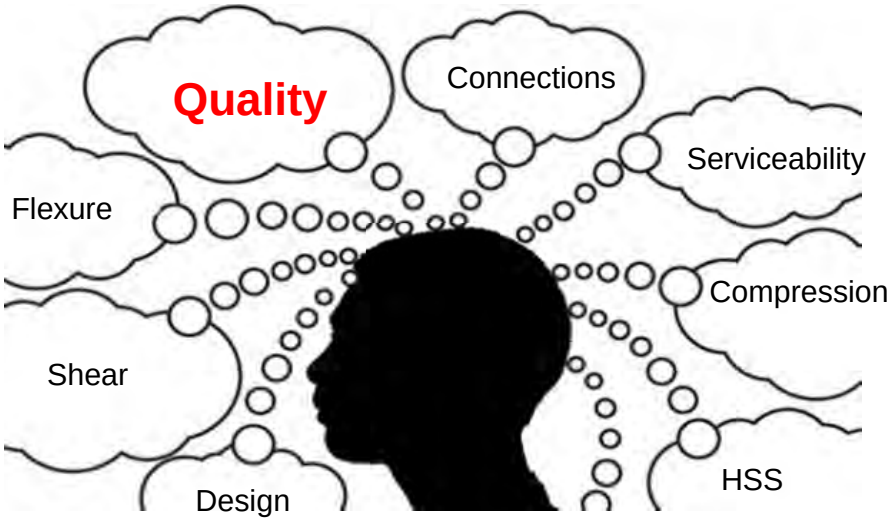
18.1 Introduction to the Steel Construction Process
18.2 The Manufacturing of Structural Steel Shapes
18.3 A Virtual, Detailed Tour of the Steel Fabrication Process
18.4 Connection Design as the Fabricator's Representative
18.5 It Doesn't Get Built Without the Erector
18.6 Erection Engineering – Stability During Construction
18.7 Field Fixes and Solutions
18.8 Quality Control and Quality Assurance

9

AISC Specification For Steel Buildings AISC 360

- Chapter A – General Provisions
- Chapter B – Design Requirements
- Chapter C – Design for Stability
- Chapter D – Design of Members for Tension
- Chapter E - Design of Members for Compression
- Chapter F - Design of Members for Flexure
- Chapter G - Design of Members for Shear
- Chapter H - Design of Members for Combined Forces and Torsion
- Chapter I – Design of Composite Members
- Chapter J – Design of Connections
- Chapter K – Additional Requirements for HSS and Box Section Connections
- Chapter L – Design for Serviceability
- Chapter M – Fabrication and Erection
- **Chapter N – Quality Control and Quality Assurance**

10



11

The Plan for Today:

Part One:

Demystifying Chapter N and the Building Code

Part Two:

Applying Chapter N and Statistical Improvement

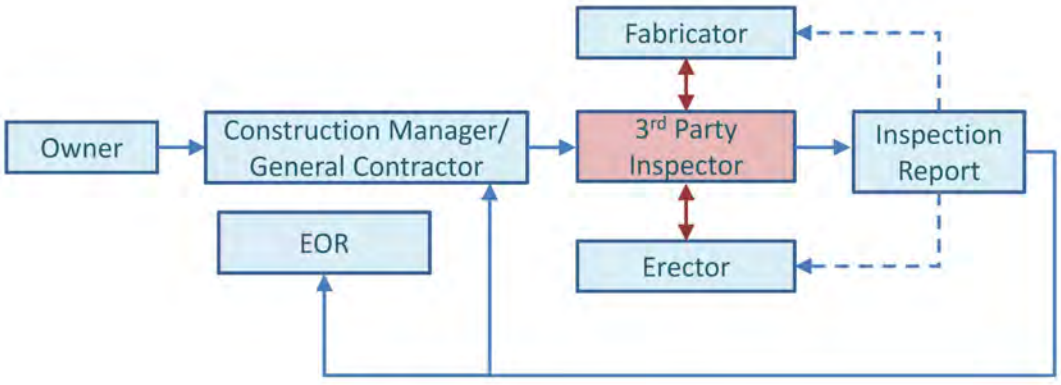
12

Demystifying Chapter N and the Building Code

Part 1

13

Typical Inspection Process



14

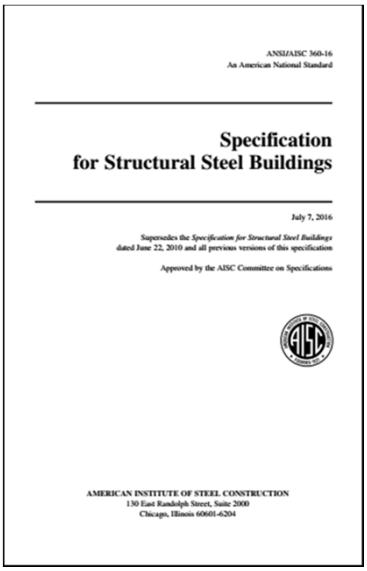
Chapter N

- Why was this added to the AISC Specification?
- What is the source of these quality requirements for fabrication and erection?
- What is the difference between Quality Control (QC) and Quality Assurance (QA)?
- What does Perform (P) and Observe (O) mean?
- How does this relate to the International Building Code (IBC)?

15

Chapter N

- **Why was this added to the AISC Specification?**


ANSI/AISC 360-16
An American National Standard

Specification
for Structural Steel Buildings

July 7, 2016

Supersedes the *Specification for Structural Steel Buildings*
dated June 22, 2010 and all previous versions of this specification

Approved by the AISC Committee on Specifications

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
130 East Randolph Street, Suite 2000
Chicago, Illinois 60601-6204

16

Why was this added to the AISC Specification?

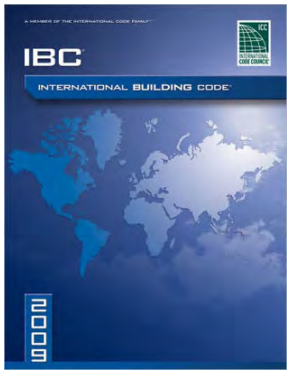
- Provide guidance of items to be listed as special inspection items
- Assure consistent quality of structural steel
  - Fabrication
  - Erection
- Require documented quality program from all Fabricators & Erectors

17

Why was this added to the AISC Specification?

Background

Building Code Requirements



- 2009 IBC Special Inspection requirements (Chapter 17) - 20 pages with significant references to outside documents

18

Typical Special Inspection List

TABLE 1704.3 REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD[a]	IBC REFERENCE
1. Material verification of high-strength bolts, nuts and washers:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	-	X	AISC 360, Section A3.3 and applicable ASTM material standards	
b. Manufacturer's certificate of compliance required.	-	X	-	-
2. Inspection of high-strength bolting:				
a. Snug-tight joints.	-	X	AISC 360, Section M2.5	1704.3.3
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation.	-	X		
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	X	-		
3. Material verification of structural steel and cold-formed steel deck:				
a. For structural steel, identification markings to conform to AISC 360.	-	X	AISC 360, Section M5.5	

19

Typical Special Inspection List

b. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents.	-	X	Applicable ASTM material standards	
c. Manufacturer's certified test reports.	-	X		
4. Material verification of weld filler materials:				
a. Identification markings to conform to AWS specification in the approved construction documents.	-	X	AISC 360, Section A3.5 and applicable AWS A5 documents	-
b. Manufacturer's certificate of compliance required.	-	X	-	-
5. Inspection of welding:				
a. Structural steel and cold-formed steel deck:				
1) Complete and partial joint penetration groove welds.	X	-	AWS D1.1	1704.3.1
2) Multipass fillet welds.	X	-		
3) Single-pass fillet welds > $^5/_{16}$"	X	-		
4) Plug and slot welds.	X	-		
5) Single-pass fillet welds ≤ $^5/_{16}$"	-	X		

20

Typical Special Inspection List

TABLE 1704.3
REQUIRED VERIFICATION AND INSPECTION OF STEEL CONSTRUCTION

VERIFICATION AND INSPECTION	CONTINUOUS	PERIODIC	REFERENCED STANDARD [a]	IBC REFERENCE
1. MATERIAL VERIFICATION OF HIGH-STRENGTH BOLTS, NUTS AND WASHERS:				
a. IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X	AISC 360, SECTION A3.3 AND APPLICABLE ASTM MATERIAL STANDARDS	-
b. MANUFACTURER'S CERTIFICATE OF COMPLIANCE REQUIRED.	-	X	-	-
2. INSPECTION OF HIGH-STRENGTH BOLTING:				
a. SNUG-TIGHT JOINTS.	-	X	AISC 360, SECTION M2.5	1704.3.3
b. PRETENSIONED AND SLIP-CRITICAL JOINTS USING TURN-OF-NUT WITH MATCHMARKING, TWIST-OF BOLT OR DIRECT TENSION INDICATOR METHODS OF INSTALLATION.	-	X		
c. PRETENSIONED AND SLIP-CRITICAL JOINTS USING TURN-OF-NUT WITHOUT MATCHMARKING, TWIST-OF BOLT OR DIRECT TENSION INDICATOR METHODS OF INSTALLATION.	X	-		
3. MATERIAL VERIFICATION OF STRUCTURAL STEEL AND COLD-FORMED STEEL DECK:				
a. FOR STRUCTURAL STEEL, IDENTIFICATION MARKINGS TO CONFORM TO AISC 360.	-	X	AISC 360, SECTION M5.5	1708.4
b. FOR STRUCTURAL STEEL , IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X	APPLICABLE ASTM MATERIAL STANARDS	
c. MANUFACTURER'S CERTIFIED TEST REPORTS. .	-	X		
4. MATERIAL VERIFICATION OF WELD FILLER MATERIALS:				
a. IDENTIFICATION MARKINGS TO CONFORM TO AWS SPECIFICATION IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X	AISC 360, SECTION A3.5	-
b. MANUFACTURER'S CERTIFICATE OF COMPLIANCE REQUIRED.	-	X	-	-

21

Typical Special Inspection List

5. INSPECTION OF WELDING:				
a. STRUCTURAL STEEL AND COLD-FORMED STEEL.				
1) COMPLETE AND PARTIAL JOINT PENETRATION GROOVE WELDS.	X	-	AWS D1.1	1704.3.1
2) MULTIPASS FILLET WELDS.	X	-		
3) SINGLE-PASS FILLET WELDS > 5/16"	X	-		
4) PLUG AND SLOT WELDS.	X	-		
5) SINGLE-PASS FILLET WELDS ≤ 5/16	-	X		
6) FLOOR AND ROOF DECK WELDS.	-	X	AWS D1.3	
b. REINFORCING STEEL:	-	-	AWS D1.4 ACI 318: 3.5.2	-
1) VERIFICATION OF WELDABILITY OF REINFORCING STEEL OTHER THAN ASTM A 706.	-	X		
2) REINFORCING STEEL-RESISTING FLEXURAL AND AXIAL FORCES IN INTERMEDIATE AND SPECIAL MOMENT FRAMES, AND BOUNDARY ELEMENTS OF SPECIAL REINFORCED CONCRETE SHEAR WALLS AND SHEAR REINFORCEMENT.	X	-		
3) SHEAR REINFORCEMENT.	X	-		
4) OTHER REINFORCING STEEL.	-	X		
6. INSPECTION OF STEEL FRAME JOINT DETAILS FOR COMPLIANCE WITH APPROVED CONSTRUCTION DOCUMENTS.		X	-	1704.3.2
a. DETAILS SUCH AS BRACING AND STIFFENING.	-	-		
b. MEMBER LOCATIONS.	-	X		
c. APPLICATION OF JOINT DETAILS AT EACH CONNECTION.	-	X		

a. WHERE APPLICABLE, SEE ALSO SECTION 1707.1 OF THE MICHIGAN BUILDING CODE, SPECIAL INSPECTION FOR SEISMIC RESISTANCE.

22

Typical Special Inspection List

SPECIAL INSPECTION REQUIREMENTS - STEEL CONSTRUCTION						
TASK		INSPECTION FREQUENCY		REFERENCED STANDARD	IBC REFERENCE	RESPONSIBLE AGENT
		CONTINUOUS	PERIODIC			
1.	INSPECTION OF STEEL FABRICATOR:			AISC QUALITY CERTIFICATION	1704.2	SI
	A. VERIFY Q/C PROCEDURES ARE AISC COMPLIANT AND CURRENT.	-	X			
2.	MATERIAL VERIFICATION OF HIGH-STRENGTH BOLTS, NUTS, AND WASHERS:			-	-	SI
	A. IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X	AISC 360, SECTION A3.3 AND APPLICABLE ASTM MATERIAL STANDARDS	-	
	B. MANUFACTURER'S CERTIFICATE OF COMPLIANCE REQUIRED.	-	X	-	-	
3.	INSPECTION OF HIGH-STRENGTH BOLTING:			AISC 360, SECTION M2.5	1704.3.3	SI/TA
	A. SNUG-TIGHT JOINTS	-	X			
	B. PRETENSIONED AND SLIP-CRITICAL JOINTS USING TURN-OF-NUT WITH MATCHMARKING, TWIST-OFF BOLT OR DIRECT TENSION INDICATOR METHODS OF INSTALLATION.	-	X			
	C. PRETENSIONED AND SLIP-CRITICAL JOINTS USING TURN-OF-NUT WITHOUT MATCHMARKING, OR CALIBRATED WRENCH METHODS OF INSTALLATION.	X	-			
4.	MATERIAL VERIFICATION OF STRUCTURAL STEEL AND COLD-FORMED STEEL DECK:					
	A. FOR STRUCTURAL STEEL, IDENTIFICATION MARKINGS TO CONFORM TO AISC 360.	-	X	AISC 360, SECTION M5.5		SI/TA
	B. FOR OTHER STEEL, IDENTIFICATION MARKINGS TO CONFORM TO ASTM STANDARDS SPECIFIED IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X	APPLICABLE ASTM MATERIAL STANDARDS		
	C. MANUFACTURER'S CERTIFIED TEST REPORTS.	-	X	-		
5.	MATERIAL VERIFICATION OF WELD FILLER MATERIALS:			AISC 360 SECTION A3.5 AND APPLICABLE AWS A5 DOCUMENTS		
	A. IDENTIFICATION MARKINGS TO CONFORM TO AWS SPECIFICATION IN THE APPROVED CONSTRUCTION DOCUMENTS.	-	X			
	B. MANUFACTURER'S CERTIFICATE OF COMPLIANCE REQUIRED.	-	X			
6.	INSPECTION OF WELDING:			AWS D1.1	1704.3.1	SI/TA
	A. STRUCTURAL STEEL AND COLD-FORMED STEEL DECK:					
	1. COMPLETE AND PARTIAL JOINT PENETRATION GROOVE WELDS.	X	-			
	2. MULTIPASS FILLET WELDS.	X	-			
	3. SINGLEPASS FILLET WELDS > 5/16"	X	-			
	4. PLUG AND SLOT WELDS	X	-			
	5. SINGLEPASS FILLET WELDS ≤ 5/16"	-	X			
	6. FLOOR AND ROOF DECK WELDS.	-	X	AWS D1.3		
7.	INSPECTION OF STEEL FRAME JOINT DETAILS FOR COMPLIANCE:			-	1704.3.2	SI
	A. DETAILS SUCH AS BRACING AND STIFFENING.	-	X			
	B. MEMBER LOCATIONS	-	X			
	C. APPLICATION OF JOINT DETAILS AT EACH CONNECTION.		X			

23

Typical Special Inspection List

SCHEDULE OF SPECIAL INSPECTIONS (PER REQUIREMENT OF CHAPTER 17 "STRUCTURAL TESTS AND SPECIAL INSPECTIONS", IBC 2009)							
#	INSPECTION TASK (CODE REFERENCE)	Y/N	SCOPE OF SERVICE	FREQUENCY - CONTINUOUS	FREQUENCY - PERIODIC	RESPONSIBLE AGENT	REFERENCE STANDARD
STEEL CONSTRUCTION (1704.3)							
ST-1	INSPECTION OF STEEL FABRICATOR (1704.2)	Y	VERIFY Q/C PROCEDURE ARE COMPLIANT AND CURRENT IF FABRICATOR IS NOT AISC CERTIFIED		X	ITA	AISC
ST-2	MATERIAL VERIFICATION (1704.3) HIGH STRENGTH BOLTS, NUTS, AND WASHERS		VERIFY IDENTIFICATION MARKINGS CONFORM TO ASTM STANDARDS SPECIFIED. REVIEW MANUFACTORS CERTIFICATE OF COMPLIANCE		X	SIER	APPLICABLE ASTM STANDARDS
	A. STRUCTURAL STEEL	Y					
	B. ANCHOR BOLTS	Y					ASTM F1554
	C. WELD FILLER MATERIAL	Y					AWS, D1.1
ST-3	ERECTION						
	A. WELDING (1704.3.1)		VERIFY CONFORMANCE WITH APPROVED SHOP DRAWINGS AND CONTRACT DOCUMENTS				AWS, D1.1
	1. COMPLETE AND PARTIAL PENETRATION GROOVE WELDS	Y		X		SIER	
	2. MULTI PASS FILLET WELDS	N		X			
	3. SINGLE PASS FILLET WELDS ≥ 5/16"	Y		X		SIER	
	4. SINGLE PASS FILLET WELDS < 5/16"	Y			X	ITA	
	5. FLOOR AND DECK WELDS	Y			X	ITA	AWS, D1.4
	B. DETAILS (1704.3.2)		INSPECTION OF STEEL FRAME JOINT DETAILS FOR COMPLIANCE WITH APPROVED SHOP DRAWINGS AND CONTRACT DOCUMENTS		X	SIER	AISC, AWS
	C. HIGH STRENGTH BOLTING (1704.3.3)		VERIFY CONFORMANCE WITH RCSC/AISC				AISC, RCSC
	1. BEARING TYPE CONNECTIONS	Y			X	ITA	
	2. SLIP-CRITICAL CONNECTIONS	Y		X		SIER	

24

Typical Special Inspection List

SCHEDULE OF SPECIAL INSPECTIONS (PER REQUIREMENT OF CHAPTER 17 "STRUCTURAL TESTS AND SPECIAL INSPECTIONS" (IBC 2009))

#	INSPECTION TASK (CODE REFERENCE)	Y/N	SCOPE OF SERVICE	FREQUENCY - CONTINUOUS	FREQUENCY - PERIODIC	RESPONSIBLE AGENT	REFERENCE STANDARD
STEEL CONSTRUCTION (1704.3)							
ST-1	INSPECTION OF STEEL FABRICATOR (1704.2)	Y	VERIFY QC PROCEDURE AREA COMPLIANT AND CURRENT IF FABRICATOR IS NOT AISC CERTIFIED		X	ITA	AISC
ST-2	MATERIAL VERIFICATION (1704.3) HIGH STRENGTH BOLTS, NUTS, AND WASHERS		VERIFY IDENTIFICATION MARKINGS CONFORM TO ASTM STANDARDS SPECIFIED IN REVIEW MANUFACTORS CERTIFICATE OF COMPLIANCE		X	SIER	AISC 360 AND APPLICABLE ASTM STANDARDS
	A. STRUCTURAL STEEL	Y			X		
	B. ANCHOR BOLTS	Y			X		ASTM F1554
	C. WELD FILLER MATERIAL	Y			X		AWS D1.1
ST-3	ERECTION						
	A. WELDING (1704.3.1)		VERIFY CONFORMANCE WITH APPROVED SHOP DRAWINGS AND CONTRACT DOCUMENTS				AWS D1.1
	1. COMPLETE AND PARTIAL PENETRATION GROOVE WELDS	Y		X		SIER	
	2. MULTI PASS FILLET WELDS	N					
	3. SINGLE PASS FILLET WELDS ≥ 5/16"	Y		X		SIER	
	4. SINGLE PASS FILLET WELDS < 5/16"	Y			X	ITA	
	5. FLOOR AND DECK WELDS	Y			X	ITA	AWS D1.4
	6. PLUG AND SLOT WELDS	Y		X		ITA	
	B. DETAILS (1704.3.2)		INSPECTION OF STEEL FRAME JOINT DETAILS FOR COMPLIANCE WITH APPROVED SHOP DRAWINGS AND CONTRACT DOCUMENTS		X	SIER	AISC / AWS
	1. DETAILS SUCH AS BRACING AND STIFFENING	Y			X	ITA	AISC
	2. MEMBER LOCATIONS	Y			X	ITA	AISC
	3. APPLICATION JOINT DETAILS AT EACH CONNECTION	Y			X	ITA	AISC
	C. HIGH STRENGTH BOLTING (1704.3.3)		VERIFY CONFORMANCE WITH RCSC / AISC				AISC, RCSC
	1. SNUG-TIGHT JOINTS	Y			X	SIER	
	2. PRETENSIONED AND SLIP-CRITICAL JOINTS USING TURN-OF-NUT AND MATCHMARKING, TWIST-OFF BOLT OR DIRECT TENSION INDICATOR	Y		X		SIER	
	3. PRETENSIONED AND SLIP-CRITICAL JOINTS USING TURN-OF-NUT WITHOUT MATCHMARKING OR CALIBRATED WRENCH	Y		X		SIER	

25

Typical Special Inspection List

PART IX - SPECIAL INSPECTIONS

A. THE OWNER'S TESTING LABORATORY SHALL PROVIDE SPECIAL INSPECTION SERVICES IN ACCORDANCE WITH THE MICHIGAN BUILDING CODE FOR THE FOLLOWING ITEMS.

1. STEEL CONSTRUCTION:
   a. ALL FIELD WELDING
   b. HIGH-STRENGTH BOLTING
   c. INSPECTION OF STRUCTURAL STEEL, BOLTING, WELDING MATERIAL
   d. WELDING OF STRUCTURAL STEEL

26

Many References Required

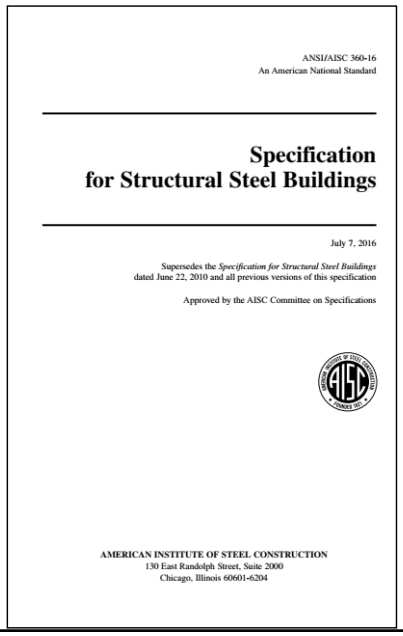
27

Why was this added to the AISC Specification?

- **Provide guidance of items to be listed as special inspection items**
- Assure consistent quality of structural steel
  - Fabrication
  - Erection
- Require documented quality program from all Fabricators & Erectors

28

Single Reference



ANSI/AISC 360-16
An American National Standard

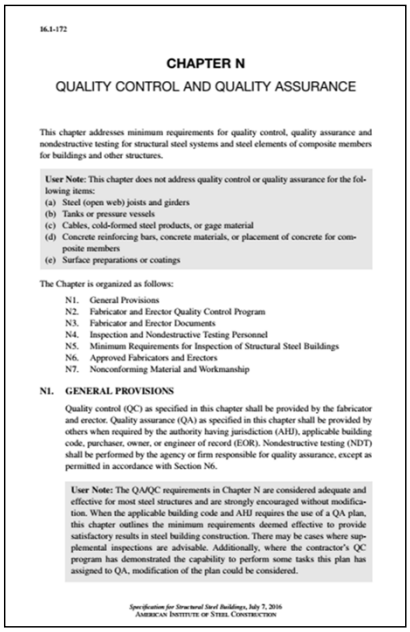
Specification for Structural Steel Buildings

July 7, 2016

Supersedes the *Specification for Structural Steel Buildings* dated June 22, 2010 and all previous versions of this specification

Approved by the AISC Committee on Specifications

AMERICAN INSTITUTE OF STEEL CONSTRUCTION
130 East Randolph Street, Suite 2000
Chicago, Illinois 60601-6204



16.1-172

CHAPTER N
QUALITY CONTROL AND QUALITY ASSURANCE

This chapter addresses minimum requirements for quality control, quality assurance and nondestructive testing for structural steel systems and steel elements of composite members for buildings and other structures.

User Note: This chapter does not address quality control or quality assurance for the following items:
(a) Steel (open web) joists and girders
(b) Tanks or pressure vessels
(c) Cables, cold-formed steel products, or gage material
(d) Concrete reinforcing bars, concrete materials, or placement of concrete for composite members
(e) Surface preparations or coatings

The Chapter is organized as follows:

N1. General Provisions
N2. Fabricator and Erector Quality Control Program
N3. Fabricator and Erector Documents
N4. Inspection and Nondestructive Testing Personnel
N5. Minimum Requirements for Inspection of Structural Steel Buildings
N6. Approved Fabricators and Erectors
N7. Nonconforming Material and Workmanship

N1. GENERAL PROVISIONS

Quality control (QC) as specified in this chapter shall be provided by the fabricator and erector. Quality assurance (QA) as specified in this chapter shall be provided by others when required by the authority having jurisdiction (AHJ), applicable building code, purchaser, owner, or engineer of record (EOR). Nondestructive testing (NDT) shall be performed by the agency or firm responsible for quality assurance, except as permitted in accordance with Section N6.

User Note: The QA/QC requirements in Chapter N are considered adequate and effective for most steel structures and are strongly encouraged without modification. When the applicable building code and AHJ requires the use of a QA plan, this chapter outlines the minimum requirements deemed effective to provide satisfactory results in steel building construction. There may be cases where supplemental inspections are advisable. Additionally, where the contractor's QC program has demonstrated the capability to perform some tasks this plan has assigned to QA, modification of the plan could be considered.

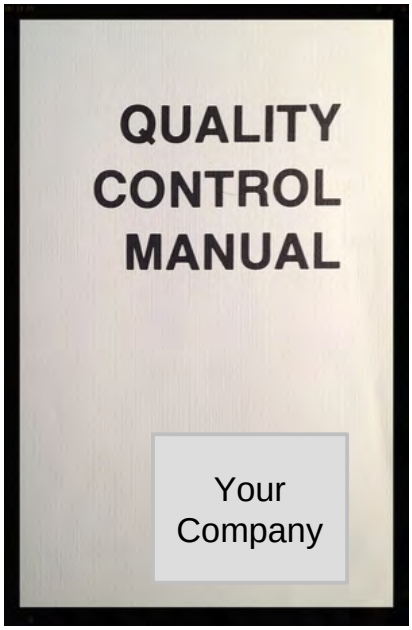
Specification for Structural Steel Buildings, July 7, 2016
AMERICAN INSTITUTE OF STEEL CONSTRUCTION

29

Why was this added to the AISC Specification?

- Provide guidance of items to be listed as special inspection items
- Assure consistent quality of structural steel
  - Fabrication
  - Erection
- **Require documented quality program from all Fabricators & Erectors**

30



31

Chapter N

What is the source of these quality requirements for fabrication and erection?

32

What is the source of these quality requirements for fabrication and erection?

TABLE N5.4-1
Inspection Tasks Prior to Welding

Inspection Tasks Prior to Welding	QC	QA
Welder qualification records and continuity records	P	O
WPS available	P	P
Manufacturer certifications for welding consumables available	P	P
Material identification (type/grade)	O	O
Welder identification system[a]	O	O
Fit-up of groove welds (including joint geometry) • Joint preparations • Dimensions (alignment, root opening, root face, bevel) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location) • Backing type and fit (if applicable)	O	O

33

What is the source of these quality requirements for fabrication and erection?

TABLE N5.4-2
Inspection Tasks During Welding

Inspection Tasks During Welding	QC	QA
Control and handling of welding consumables • Packaging • Exposure control	O	O
No welding over cracked tack welds	O	O
Environmental conditions • Wind speed within limits • Precipitation and temperature	O	O
WPS followed • Settings on welding equipment • Travel speed • Selected welding materials • Shielding gas type/flow rate	O	O

34

What is the source of these quality requirements for fabrication and erection?

TABLE N5.4-3
Inspection Tasks After Welding

Inspection Tasks After Welding	QC	QA
Welds cleaned	O	O
Size, length and location of welds	P	P
Welds meet visual acceptance criteria • Crack prohibition • Weld/base-metal fusion • Crater cross section • Weld profiles • Weld size • Undercut • Porosity	P	P
Arc strikes	P	P
k-area[a]	P	P

35

What is the source of these quality requirements for fabrication and erection?

TABLE C-N5.4-1
Reference to AWS D1.1/D1.1M (AWS, 2015)
Clauses for Inspection Tasks Prior to Welding

Inspection Tasks Prior to Welding	Clauses
Welding procedure specifications (WPS) available	6.3
Manufacturer certifications for welding consumables available	6.2
Material identification (type/grade)	6.2
Welder identification system	6.4 (welder qualification) (identification system not required by AWS D1.1/D1.1M)
Fit-up of groove welds (including joint geometry)	

36

What is the source of these quality requirements for fabrication and erection?

TABLE C-N5.4-2
Reference to AWS D1.1/D1.1M (AWS, 2015)
Clauses for Inspection Tasks During Welding

Inspection Tasks During Welding	Clauses
Use of qualified welders	6.4
Control and handling of welding consumables • Packaging • Exposure control	6.2 5.3.1 5.3.2 (for SMAW), 5.3.3 (for SAW)
No welding over cracked tack welds	5.17
Environmental conditions • Wind speed within limits • Precipitation and temperature	 5.11.1 5.11.2
WPS followed • Settings on welding equipment • Travel speed • Selected welding materials • Shielding gas type/flow rate	6.3.3, 6.5.2, 5.5, 5.20

37

What is the source of these quality requirements for fabrication and erection?

TABLE N5.6-1
Inspection Tasks Prior to Bolting

Inspection Tasks Prior to Bolting	QC	QA
Manufacturer's certifications available for fastener materials	O	P
Fasteners marked in accordance with ASTM requirements	O	O
Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	O	O
Correct bolting procedure selected for joint detail	O	O
Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	O	O

38

What is the source of these quality requirements for fabrication and erection?

TABLE C-N5.6-1
Reference to RCSC *Specification* (RCSC, 2014) Sections for Inspection Tasks Prior to Bolting

Inspection Tasks Prior to Bolting	Sections
Manufacturer's certifications available for fastener materials	2.1, 9.1
Fasteners marked in accordance with ASTM requirements	Figure C-2.1, 9.1 (also see ASTM standards)
Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	2.3.2, 2.7.2, 9.1
Correct bolting procedure selected for joint detail	4, 8
Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	3, 9.1, 9.3
Pre-installation verification testing by installation	

39

How are these Inspection Tasks Performed?

TABLE N5.4-1
Inspection Tasks Prior to Welding

Inspection Tasks Prior to Welding	QC	QA
Welder qualification records and continuity records	P	O
WPS available	P	P
Manufacturer certifications for welding consumables available	P	P
Material identification (type/grade)	O	O
Welder identification system[a]	O	O
Fit-up of groove welds (including joint geometry) • Joint preparations • Dimensions (alignment, root opening, root face, bevel) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location) • Backing type and fit (if applicable)	O	O

40

Fit-up of Groove Welds

41

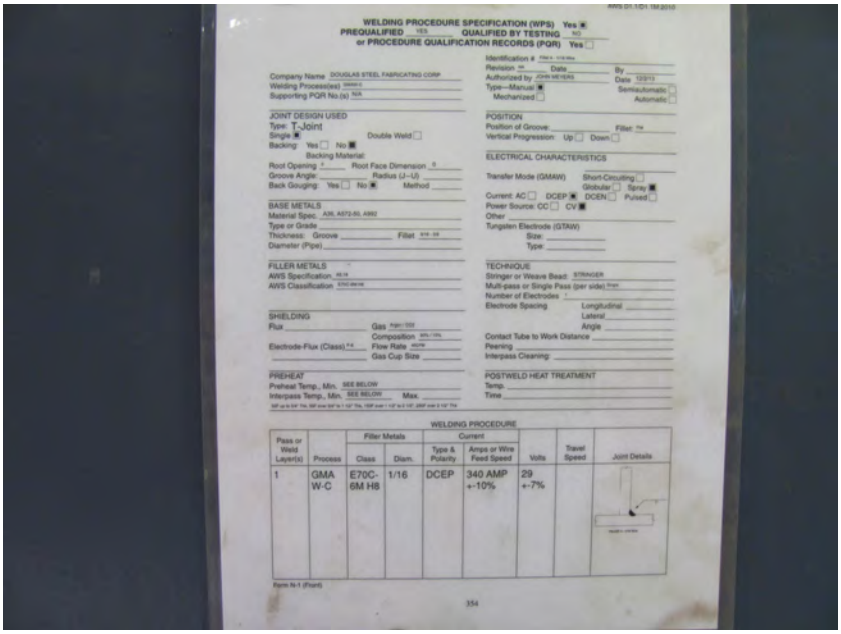
How are these Inspection Tasks Performed?

TABLE N5.4-2
Inspection Tasks During Welding

Inspection Tasks During Welding	QC	QA
Control and handling of welding consumables • Packaging • Exposure control	O	O
No welding over cracked tack welds	O	O
Environmental conditions • Wind speed within limits • Precipitation and temperature	O	O
WPS followed • Settings on welding equipment • Travel speed • Selected welding materials • Shielding gas type/flow rate	O	O

42

Welding Procedure Specification



WELDING PROCEDURE SPECIFICATION (WPS) Yes
PREQUALIFIED — QUALIFIED BY TESTING — or PROCEDURE QUALIFICATION RECORDS (PQR) Yes

Company Name DOUGLAS STEEL FABRICATING CORP
Welding Process(es) SMAW
Supporting PQR No.(s) N/A

JOINT DESIGN USED
Type: T-Joint
Single ■ Double Weld ☐
Backing: Yes ☐ No ■
Backing Material:
Root Opening — Root Face Dimension —
Groove Angle: — Radius (J–U) —
Back Gouging: Yes ☐ No ■ Method —

BASE METALS
Material Spec. A36, A572-50, A992
Type or Grade —
Thickness: Groove — Fillet —
Diameter (Pipe) —

FILLER METALS
AWS Specification —
AWS Classification —

SHIELDING
Flux — Gas —
Composition —
Electrode-Flux (Class) — Flow Rate —
Gas Cup Size —

PREHEAT
Preheat Temp., Min. SEE BELOW
Interpass Temp., Min. SEE BELOW Max. —

Identification # —
Revision — Date — By —
Authorized by JOHN MEYERS Date 12/3/13
Type—Manual ■ Semiautomatic ☐
Mechanized ☐ Automatic ☐

POSITION
Position of Groove: — Filler —
Vertical Progression: Up ☐ Down ☐

ELECTRICAL CHARACTERISTICS
Transfer Mode (GMAW) Short-Circuiting ☐ Globular ☐ Spray ■
Current: AC ☐ DCEP ■ DCEN ☐ Pulsed ☐
Power Source: CC ☐ CV ■
Other —
Tungsten Electrode (GTAW)
Size: —
Type: —

TECHNIQUE
Stringer or Weave Bead STRINGER
Multi-pass or Single Pass (per side) Multi
Number of Electrodes —
Electrode Spacing Longitudinal — Lateral — Angle —
Contact Tube to Work Distance —
Peening —
Interpass Cleaning: —

POSTWELD HEAT TREATMENT
Temp. —
Time —

WELDING PROCEDURE

Pass or Weld Layer(s)	Process	Filler Metals Class	Filler Metals Diam.	Current Type & Polarity	Current Amps or Wire Feed Speed	Volts	Travel Speed	Joint Details
1	GMA W-C	E70C-6M H8	1/16	DCEP	340 AMP +-10%	29 +-7%		

Form N-1 (Front)

354

Settings on Welding Equipment

How are these Inspection Tasks Performed?

TABLE N5.4-3
Inspection Tasks After Welding

Inspection Tasks After Welding	QC	QA
Welds cleaned	O	O
Size, length and location of welds	P	P
Welds meet visual acceptance criteria • Crack prohibition • Weld/base-metal fusion • Crater cross section • Weld profiles • Weld size • Undercut • Porosity	P	P
Arc strikes	P	P
k-area[a]	P	P

45

Weld Size

46

Weld Length

47

How are these Inspection Tasks Performed?

TABLE N5.6-1
Inspection Tasks Prior to Bolting

Inspection Tasks Prior to Bolting	QC	QA
Manufacturer's certifications available for fastener materials	O	P
Fasteners marked in accordance with ASTM requirements	O	O
Correct fasteners selected for the joint detail (grade, type, bolt length if threads are to be excluded from shear plane)	O	O
Correct bolting procedure selected for joint detail	O	O
Connecting elements, including the appropriate faying surface condition and hole preparation, if specified, meet applicable requirements	O	O

48

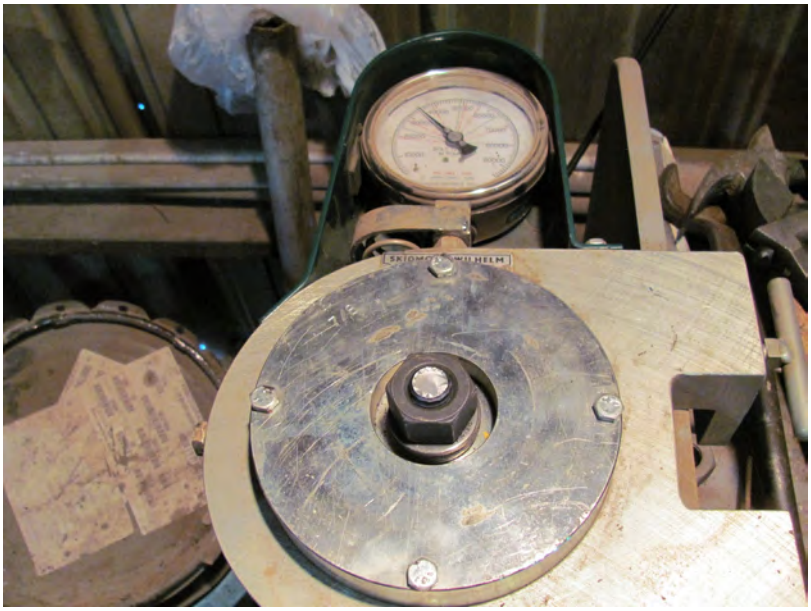
Marked with ASTM Requirements

49

Proper Bolting Procedures

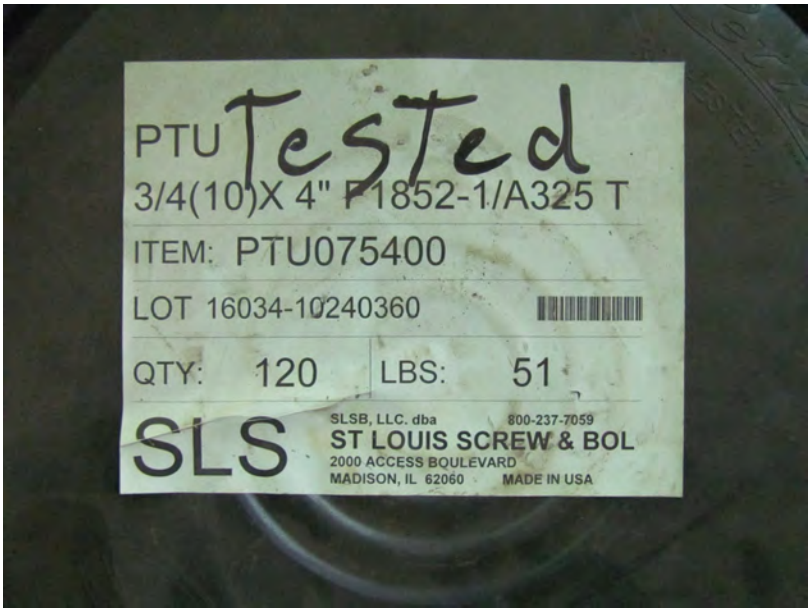
50

Pre-installation Verification



51

Pre-installation Verification



52

Pre-installation Verification

53

Pre-installation Verification

54

Pre-installation Verification

Bolt Testing

RCSC
SECTION 7. PRE-INSTALLATION VERIFICATION

7.1. Tension Calibrator
A tension calibrator shall be used where bolts are to be installed in pretensioned joints and slip-critical joints to:

(1) Confirm the suitability of the complete fastener assembly, including lubrication, for pretensioned installation; and,

(2) Confirm the procedure and proper use by the bolting crew of the pretensioning method to be used.

55

Pre-installation Verification

Bolt Testing

RCSC
SECTION 7. PRE-INSTALLATION VERIFICATION

7.1. Tension Calibrator

Commentary:

Direct tension indicators (DTIs) may be used as tension calibrators, except in the case of turn-of-nut installation. This method is especially useful for, but not restricted to, bolts that are too short to fit into a hydraulic tension calibrator.

56

Pre-installation Verification

57

Pre-installation Verification

58

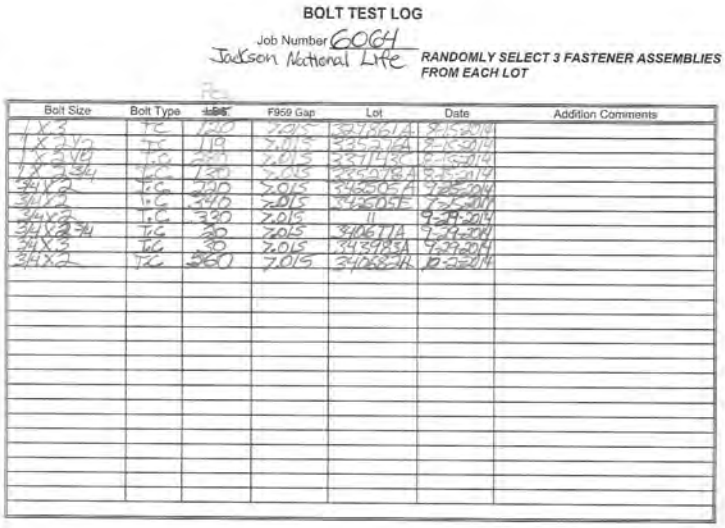
Pre-installation Verification

59

Pre-installation Verification

60

Pre-installation Verification



BOLT TEST LOG

Job Number 6064

Jackson National Life

RANDOMLY SELECT 3 FASTENER ASSEMBLIES FROM EACH LOT

Bolt Size	Bolt Type	~~Lot~~	F959 Gap	Lot	Date	Addition Comments
1X3	TC	120	2015	3271961A	9-15-2014	
1X2½	TC	119	2015	3355214A	9-15-2014	
1X2½	TC	120	2015	3371483	9-15-2014	
1X2¾	TC	120	2015	3359278A	9-15-2014	
3/4X2	TC	240	2015	3455054A	9-25-2014	
3/4X2	TC	240	2015	3455054F	9-25-2014	
3/4X2	TC	320	2015	"	9-29-2014	
3/4X2¾	TC	80	2015	3406TIA	9-29-2014	
3/4X3	TC	80	2015	3439834	9-29-2014	
3/4X2	TC	360	2015	3406834	10-2-2014	

61

Chapter N

What does Perform and Observe mean?

62

What does Observe and Perform Mean?

CONTINUOUS - PERIODIC:

IBC 2000, 2003, 2006, SECTION 1702 DEFINITIONS

SPECIAL INSPECTION, CONTINUOUS. The full-time observation of work requiring *special inspection* by an approved special inspector who is present in the area where the work is being performed.

SPECIAL INSPECTION, PERIODIC. The part-time or intermittent observation of work requiring *special inspection* by an approved special inspector who is present in the area where the work has been or is being performed and at the completion of the work.

63

What does Observe and Perform Mean?

2009 IBC Section 1702 (Terms different in 2012 & 2015)

- **Continuous Inspection**

  Special inspection by the *special inspector* who is present when and where the work to be inspected is being performed.

- **Periodic Inspection**

  Special inspection by the *special inspector* who is intermittently present where the work to be inspected has been or is being performed.

64

What does Observe and Perform Mean?

2012 & 2015 IBC Section 202

- **Continuous Special Inspection**

  Special inspection by the *special inspector* who is present when and where the work to be inspected is being performed.

- **Periodic Special Inspection**

  Special inspection by the *special inspector* who is intermittently present where the work to be inspected has been or is being performed.

65

What does Observe and Perform Mean?

2012 & 2015 IBC Section 202

Continuous

- "On-Site"
- References codes (AWS D1.1)
- Not every task on every weld.

66

What does Observe and Perform Mean?

AWS D1.1

6.5.2 Scope of Examinations. The Inspector shall **at suitable intervals,** observe joint preparation, assembly practice, the welding techniques, and performance of each welder, welding operator, and tack welder to ensure that the applicable requirements of this code are met.

Chapter N labels these Observe.

67

What does Observe and Perform Mean?

AWS D1.1

6.5.3 Extent of Examination. The Inspector shall examine the work to ensure that it meets the requirements of this code. …**Size and contour of welds shall be measured with suitable gages**…

Chapter N labels these Perform.

68

What does Observe and Perform Mean?

N5. Min. Requirements for Inspection of Structural Steel Buildings

- Items necessary for the final acceptance of a weld.
- Based on AWS D1.1 phrase, "**shall** examine the work" and "size and contour of welds **shall** be measured"

69

What does Observe and Perform Mean?

RCSC

Section 9. Inspection

When inspection is required in the contract documents, the inspector shall **ensure** while the work is in progress **that the requirements in this specification are met**.

70

Chapter N

What is the difference between Quality Control (QC) and Quality Assurance (QA)?

71

What is the difference between QC & QA?

N1. General Provisions

Minimum requirements for quality control, quality assurance and non-destructive testing for structural steel.

72

What is the difference between QC & QA?

N1. General Provisions

- **Quality Control (QC)**

  Provided by fabricator and erector.

73

What is the difference between QC & QA?

N1. General Provisions

- **Quality Control (QC)**
- **Quality Assurance (QA)**

  Provided by Others as required by:

  - Authority Having Jurisdiction (AHJ)
  - Applicable Building Code (ABC)
  - Engineer of Record (EOR)
  - Owner

74

What is the difference between QC & QA?

N1. General Provisions

- **Quality Control (QC)**
- **Quality Assurance (QA)**
- **Non-Destructive Testing (NDT)**

  Performed by the firm responsible for QA.

  Except as permitted by Section N6.

75

What is the difference between QC & QA?

N2. Fabricator and Erector QC Program

- **Procedures and Inspections**

  Perform work in accordance with the AISC *Specification* and the construction documents.

  Inspections must be documented, including non-conformances and corrections implemented.

76

What is the difference between QC & QA?

N2. Fabricator and Erector QC Program

- **Procedures and Inspections**
- **Material Identification**

To comply with *Code of Standard Practice, Section* 6.1., and

Monitored by the fabricator's quality control inspector (QCI).

77

What is the difference between QC & QA?

N2. Fabricator and Erector QC Program

- **Procedures and Inspections**
- **Material Identification**
- **Fabricator Quality Control Procedures**

Shop welding, high-strength bolting and details.
Shop cut and finish surfaces.
Shop heating for straightening, cambering and curving.
Tolerances for shop fabrication.

78

What is the difference between QC & QA?

N2. Fabricator and Erector QC Program

- **Procedures and Inspections**
- **Material Identification**
- **Fabricator Quality Control Procedures**
- **Erector Quality Control Procedures**

Field inspections similar to shop inspections.

79

What is the difference between QC & QA?

N5.1 Quality Control

- Tasks listed in tables.
- Work is performed in accordance with the *construction documents*.
  - Shop Drawings.
  - Erection Drawings.
  - Applicable referenced specifications, codes and standards.

80

What is the difference between QC & QA?

N5.2 Quality Assurance

- Tasks listed in same tables as QC.
- Work is performed in accordance with the *construction documents*.
  - Design drawings and specifications.

81

What is the difference between QC & QA?

N5.3 Coordinated Inspection

Where same task is to be performed by QC and QA:

- Inspection may be performed by 1 party only, either QCI or QAI.
- If inspection by QCI only, then:
  - Approval by EOR, and
  - Approval by AHJ.

82

Chapter N

How does this relate to the International Building Code (IBC)?

83

How does this relate to IBC?

N6. Approved Fabricators and Erectors

- **QA by Third Party, except NDT, may be waived.**
- **NDT of welds** may be performed by the approved fabricator. NDT can't be done by an approved erector.
- AISC Certification program or similar program.
- Certificate of compliance required.

84

How does this relate to IBC?

CERTIFICATE OF COMPLIANCE

Project:_____

Customer:_____

Customer Job no._____

Architect Job no._____

Company Job no._____

This is to certify that the above referenced project was fabricated and erected in accordance with the approved construction documents.

I certify that the above is true and all records pertaining to the above are on file.

Company Name

Date:_____

_____
Authorized Representative

85

How does this relate to IBC?

The 2018 IBC Section 1704.2.5.1 (ICC, 2018) states that:

Special inspections during fabrication are not required where the work is done on the premises of a fabricator approved to perform work without special inspection. Approval shall be based on the review of the fabricator's written fabrication procedures and quality control manuals that provide a basis for control of materials and workmanship.

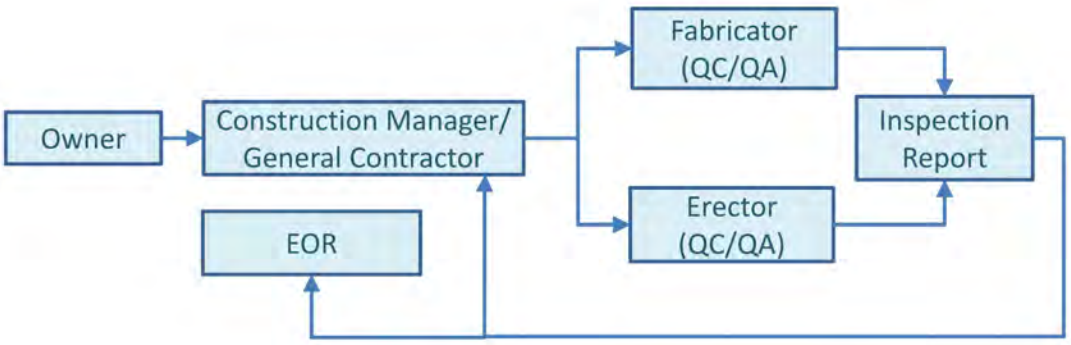
86

How does this relate to IBC?

The 2018 International Building Code (IBC) (ICC,2018) requirements for special inspection of structural steel states in Section 1705.2.1 that the requirements for Special Inspection are to be performed in accordance with Chapter N of AISC 360.

87

Coordinated Inspection Process



88

Chapter N

What is the source of these quality requirements for fabrication and erection?

One new item was added

89

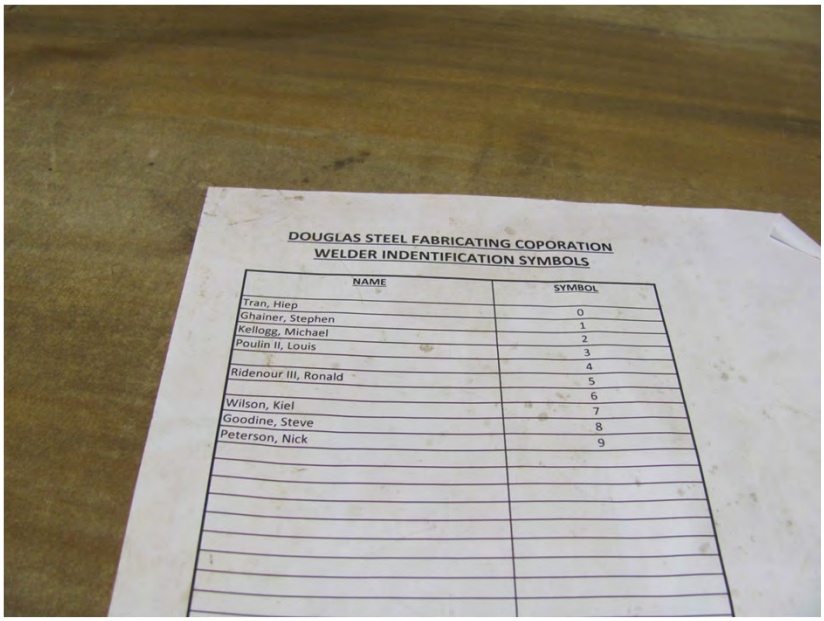
What is the source of these quality requirements for fabrication and erection?

TABLE N5.4-1
Inspection Tasks Prior to Welding

Inspection Tasks Prior to Welding	QC	QA
Welder qualification records and continuity records	P	O
WPS available	P	P
Manufacturer certifications for welding consumables available	P	P
Material identification (type/grade)	O	O
Welder identification system[a]	O	O
Fit-up of groove welds (including joint geometry) • Joint preparations • Dimensions (alignment, root opening, root face, bevel) • Cleanliness (condition of steel surfaces) • Tacking (tack weld quality and location) • Backing type and fit (if applicable)	O	O

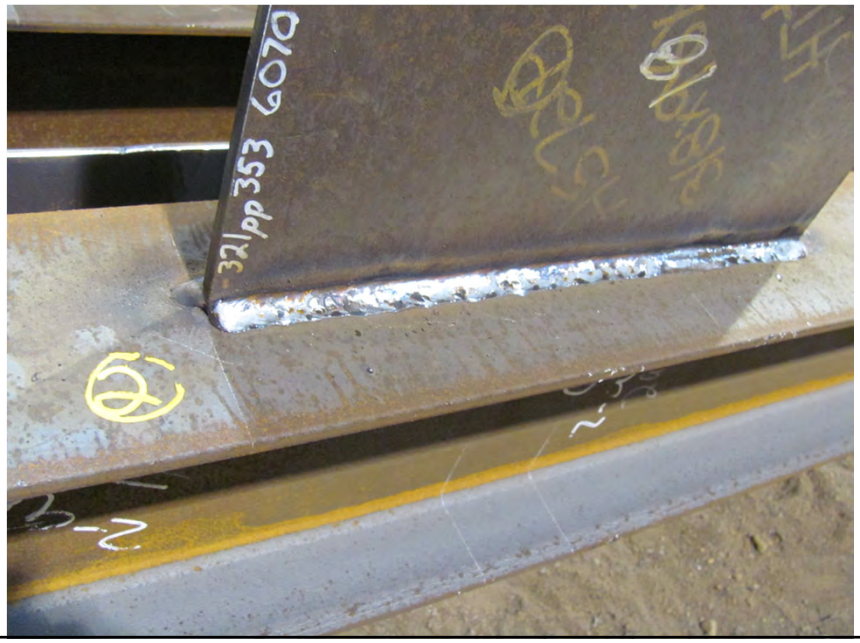
90

Welder Identification System



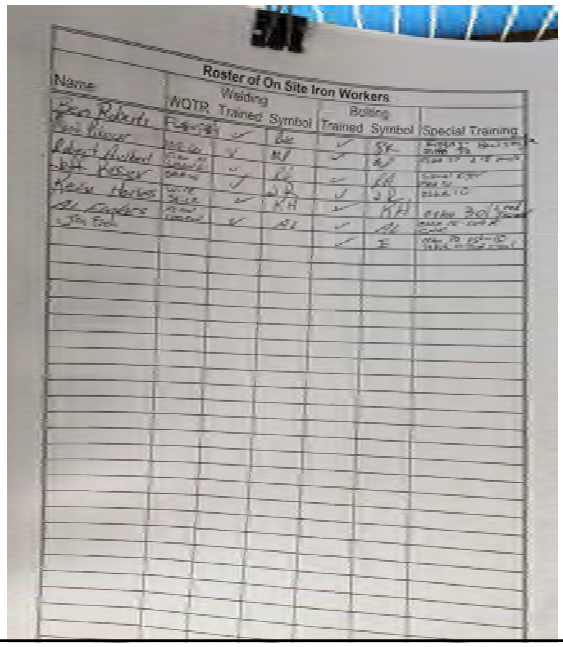
91

Welder Identification System



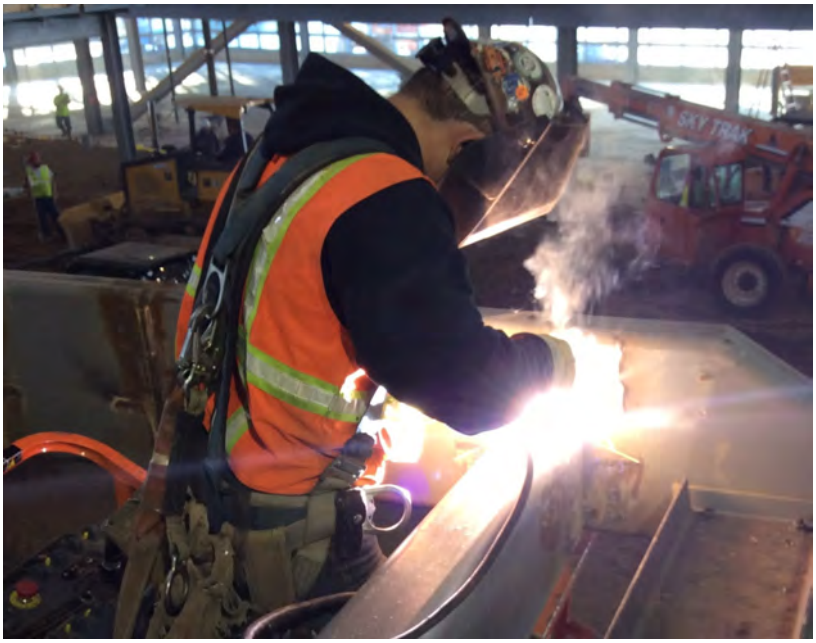
92

Welder Identification System



93

Welder Identification System



94

Welder Identification System

95

Welder Identification System

96

Bolter Identification System

97

Bolter Identification System

98

Bolter Identification System

99

Bolter Identification System

100

Field Final Inspection

Field Final Inspection Report

Area designated by Column Grid Lines	All Pieces Installed	Bolts installed per procedure	Field Weld's at all locations detailed	Inspector/ Foreman	Date and Time:	Notes:
AM-AF & A1-A3 Levels 2 & 3	Yes	Yes	Yes	Judd Converse	Date: 7-15-2014 Time:	Curtain Wall Frames Incomplete
AF-AA & A1-A3 Levels 2 & 3	Yes	Yes	Yes	Judd Converse	Date: 7-13-2014 Time:	Curtain Wall Frames Incomplete STAIR Tower Column Splices Incomplete
AM-AF-AA-A3 Levels 4 & 5	Yes	Yes	Yes	Judd Converse	Date: 7-15-2014 Time:	Cooling Tower Steel Incomplete
AF-AA-A1-A3 Levels 4 & 5	Yes	Yes	Yes	Judd Converse	Date: 7-7-2014 Time:	STAIR Tower splices also complete
~~AM-AF-A1-AR2~~ A3-A5	Yes	Yes	Yes	Judd Converse	Date: 7-10-2014 Time:	Levels 2-5, frame retest
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	
					Date: Time:	

101

Chapter N - Summation

- Why was this added to the AISC Specification?
  - Provide minimum quality standards for steel construction
  - Assure consistently high quality steel construction

102

Chapter N - Summation

- What is the source of these quality requirements for fabrication and erection?
  - It is only listing in one location the requirements of other codes such as AWS and RCSC
  - Only the welder identification system was added

103

Chapter N - Summation

- What is the difference between Quality Control (QC) and Quality Assurance (QA)?
  - QC is provided by the fabricator or erector
  - QA is provided by a third party
  - Coordinated QC & QA is permitted

104

Chapter N - Summation

- What does Perform (P) and Observe (O) mean?
  - Perform (P) inspections must be done on each joint
  - Observe (O) inspections must be done on a random basis

105

Chapter N - Summation

- How does this relate to the International Building Code (IBC)?
  - IBC 2018 has referenced AISC Specification (AISC 360) Chapter N as the requirements for Special Inspections for Structural Steel Construction.

106

Applying Chapter N and Statistical Improvement

Part 2

107

Quality Management System

Specific procedures written

- Engineering
  - Contract review
  - Document control
  - Drawing preparation
  - Sub-let detailing procedures
  - RFI procedures
  - Drawing issuing
  - Drawing changes
  - Non-conformance reporting

108

Quality Management System

Specific procedures written

- Fabrication
  - Purchasing
  - Subcontracting
  - Material Identification
  - Operation procedures
  - Welding & Bolting procedures
  - Surface preparation & painting procedures
  - In process inspections
  - Final inspections
  - Non-conformance reporting

109

Quality Management System

Specific procedures written

- Erection
  - Bolting procedures
  - Welding procedures
  - Site Specific Safety Plan
  - Site Specific Erection Plan
  - Non-conformance reporting

110

Non-conformance Reporting

Specific procedures written

- Compiled by engineering
- Shared with everyone at weekly production meeting
- Evaluated to determine the root cause
- Determine if the quality procedure needed to be changed

111

DOUGLAS STEEL FABRICATING CORPORATION

NONCONFORMANCE REPORT

RECEIVING

JOB NUMBER: PO NUMBER: PLACED ON HOLD BY:
DATE:
DESCRIPTION OF MATERIAL:
DESCRIPTION OF NONCONFORMANCE:
RESOLUTION: RESOLVED BY:
DATE:

FABRICATION

JOB NUMBER: PIECE MARK: PLACED ON HOLD BY:
DATE:
DESCRIPTION OF NONCONFORMANCE:
RESOLUTION: RESOLVED BY:
DATE:

POST DELIVERY

JOB NUMBER: **6051** PIECE MARK: **30B4** PLACED ON HOLD BY: **RAS**
DATE: **11/14/2012**
DESCRIPTION OF NONCONFORMANCE: **Right end has 4 1/2" down to first hole. Should have been 3" to match the girder (detailing)**
RESOLUTION: **Field weld clips to beam at correct location** RESOLVED BY: **RAS**
DATE: **11/14/2012**

DOUGLAS STEEL FABRICATING CORPORATION

NONCONFORMANCE REPORT

RECEIVING

JOB NUMBER: PO NUMBER: PLACED ON HOLD BY:
DATE:

DESCRIPTION OF MATERIAL:

DESCRIPTION OF NONCONFORMANCE:

RESOLUTION: RESOLVED BY:
DATE:

FABRICATION

JOB NUMBER: PIECE MARK: PLACED ON HOLD BY:
DATE:

DESCRIPTION OF NONCONFORMANCE:

RESOLUTION: RESOLVED BY:
DATE:

POST DELIVERY

JOB NUMBER: **6051** PIECE MARK: **57B1** PLACED ON HOLD BY: **RAS**
DATE: **11/7/2012**

DESCRIPTION OF NONCONFORMANCE: **Clip angles at left end of beam were missing (shop)**

RESOLUTION: **Send clip angles to field** RESOLVED BY: **RAS**
DATE: **11/7/2012**

DOUGLAS STEEL FABRICATING CORPORATION

NONCONFORMANCE REPORT

RECEIVING

JOB NUMBER: PO NUMBER: PLACED ON HOLD BY:
DATE:

DESCRIPTION OF MATERIAL:

DESCRIPTION OF NONCONFORMANCE:

RESOLUTION: RESOLVED BY:
DATE:

FABRICATION

JOB NUMBER: PIECE MARK: PLACED ON HOLD BY:
DATE:

DESCRIPTION OF NONCONFORMANCE:

RESOLUTION: RESOLVED BY:
DATE:

POST DELIVERY

JOB NUMBER: **6049** PIECE MARK: **862F1** PLACED ON HOLD BY: **TmJ**
DATE: **10/17/2012**

DESCRIPTION OF NONCONFORMANCE: **Field Cut frame down, should not have. (erection)**

RESOLUTION: **Send new frame to field** RESOLVED BY: **TmJ**
DATE: **10/17/2012**

DOUGLAS STEEL FABRICATING CORPORATION

NONCONFORMANCE REPORT

RECEIVING

JOB NUMBER: PO NUMBER: PLACED ON HOLD BY:
DATE:

DESCRIPTION OF MATERIAL:

DESCRIPTION OF NONCONFORMANCE:

RESOLUTION: RESOLVED BY:
DATE:

FABRICATION

JOB NUMBER: PIECE MARK: PLACED ON HOLD BY:
DATE:

DESCRIPTION OF NONCONFORMANCE:

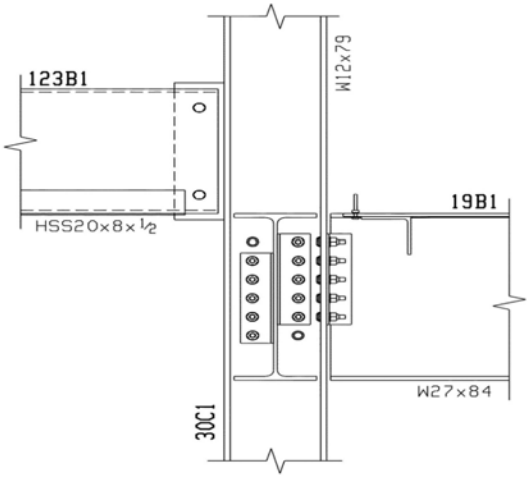
RESOLUTION: RESOLVED BY:
DATE:

POST DELIVERY

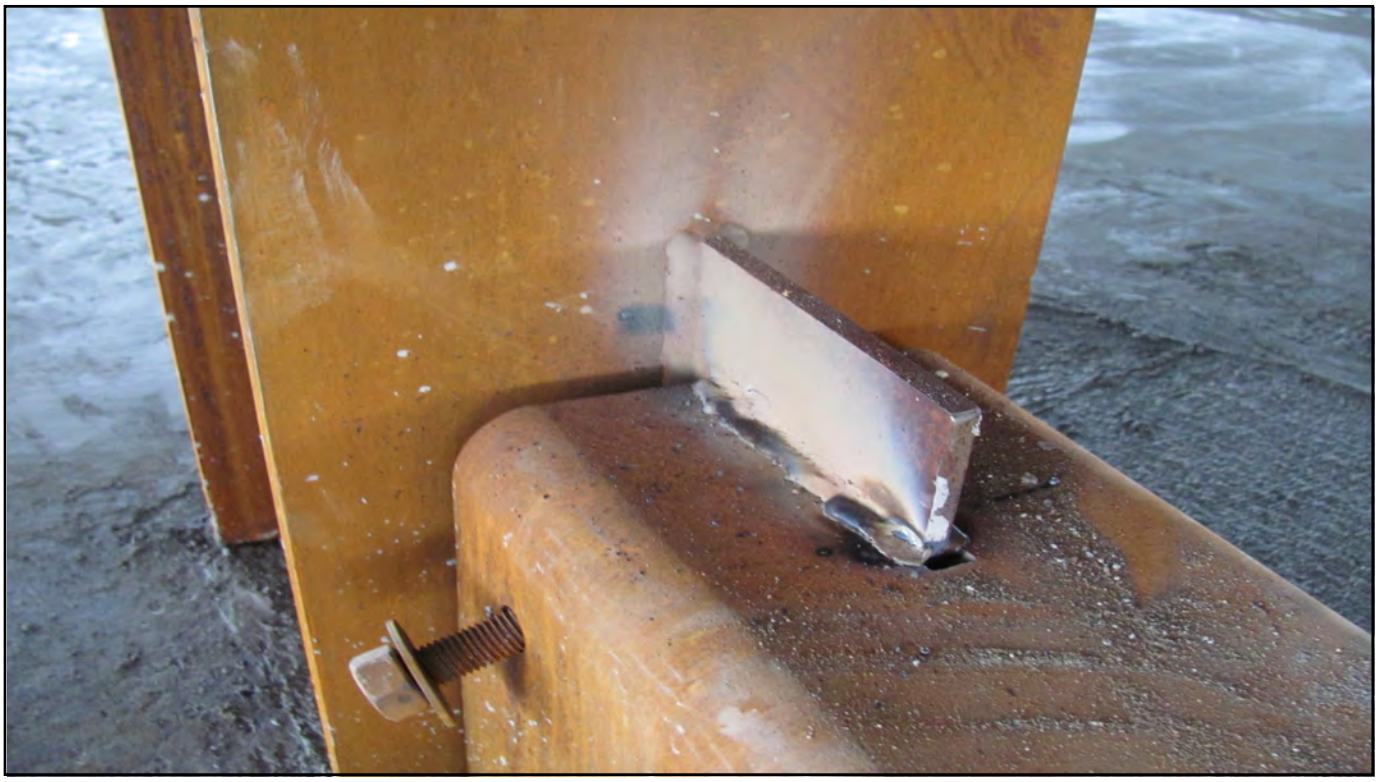
JOB NUMBER: **6031** PIECE MARK: **123B1 (E21-1)** PLACED ON HOLD BY: **RAS**
DATE: **1/28/2010**

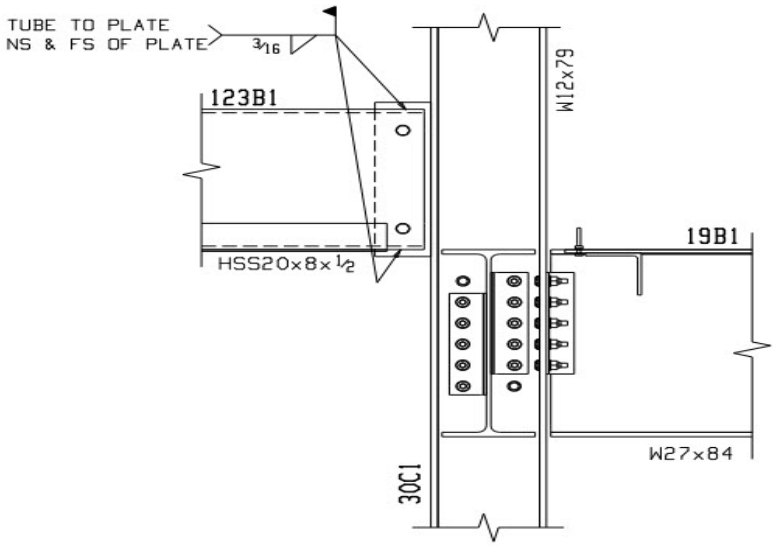
DESCRIPTION OF NONCONFORMANCE: **Beam was detailed with temporary bolted connection for field welding. Field weld detail was not shown on E-Sheet (detailing)**

RESOLUTION: **Beam field welded after noticed because of bolt failure (Detailers to cut details on e-sheets during the detailing process to help keep this from happening again)** RESOLVED BY: **RAS**
DATE: **1/28/2010**



116





120

Corrective Action Request #008

Douglas Steel Fabricating Corporation

Part #1

Reference: **7 – Detailing, Checking and Shop Drawing. Nonconformance from the month of February. Drawings not prepared in accordance with the project requirements.**
Description of Evidence: Beam was detailed with temporary bolted connection, and was intended to be field welded to complete the connection. The field weld detail was never cut on the erection drawings, therefore the beam was never fully welded.

Originator Signature:	Date: **2/3/11**
Recipient Signature:	Date:
Notes: Temporary bolted connection failed when load was induced. EOR was included in discussion on the permanent fix.	

Part #2

CAR #	Response Due date	Response Received	Evidence due by
008	2/9/11		2/9/11

121

Part #3

Probable **Root** Cause of Condition (or sources of information for a preventative action): **1. Detailer did not cut section to indicate that the connection was to be field welded.** **2. Checker did not catch the field weld detail omission.**
Action to Prevent Recurrence (determination of steps necessary to prevent a potential problem): **1. New detailing procedure to add a note to the beam in the model as it is being detailed that a field weld detail will be required on the erection diagram.** **2. Also, detail cut will be added by the detailer to the erection diagram, alerting both the detailer and checker that a field weld will be required.**

Verification by:	Scheduled Completion Date: **2/9/11**

Part #4 Corrective Action Closeout

The corrective action is/is not recommended as closed through one or a combination of the following means: • Review of controls and documentation forwarded by the auditee; • Site visit to assess conformance to the action documented in part #3 above.
Comments:

	Closure Date:	Expired and not closed Date:

122

DOUGLAS STEEL

FABRICATING CORPORATION

ENGINEERING
STANDARDS

Revised: March 23, 2011

123

Douglas Steel Fabricating Corporation
1312 S. Waverly Road
Lansing, Michigan 48917

Engineering Standards
Distribution List:

Name, Position	Location	Controlled Copy #
L. Kruth, VP Engineering, Technology & Safety	Office	CC1
D. Harris, Job Captain	Office	CC2
G. Hookey, Field Engineer	Office	CC3
C. Hustwayte, Checker	Office	CC4
P. Ingraham, Detailer	Office	CC5
T. Johnson, Detailer	Office	CC6
R. Singh, Detailer	Office	CC7
R. Steffens, Job Captain	Office	CC8
C. Colwell, Engineer	Office	CC9
Hard Copy	File	CC10
Electronic File	Engineering	CC11

The Engineering Standards have been approved by:

_____
Lawrence F. Kruth, PE, VP of Engineering, Technology & Safety

124

30. When perimeter cable is required at an HSS column or a column with a flange thickness greater than 2" provide tabs with holes shop welded to the column to pick up the perimeter cable.

31. Perimeter cable is required at the perimeter of the building, along sequence lines, and around any opening not to be decked over.

32. When detailing a member that requires field welding place a section bubble cut on the erection view where the welded joint occurs alerting both the e-view detailer and checker that a field weld section is required.

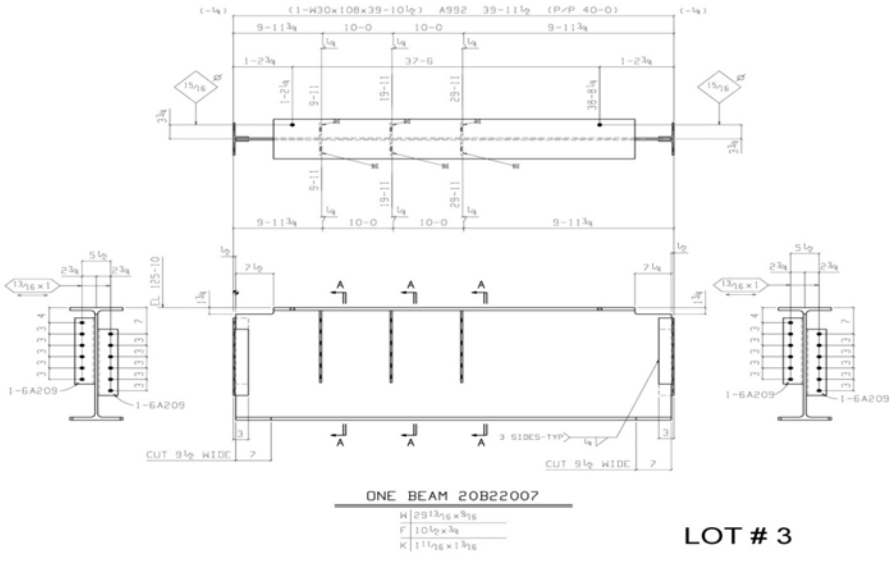
33. **OMITTED**

34. The largest diameter F1852 or F2280 bolt that is available is 1 1/8" diameter. Bolts with diameters greater than 1 1/8" must be A325 or A490.

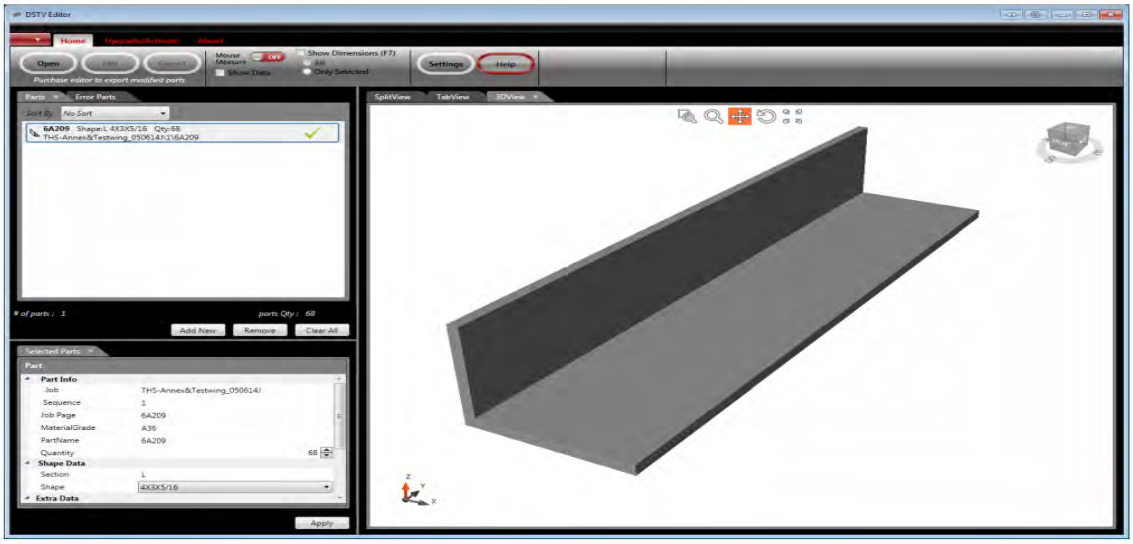
35. Bolts longer than 5" increase in length by ½" increments.

-10-

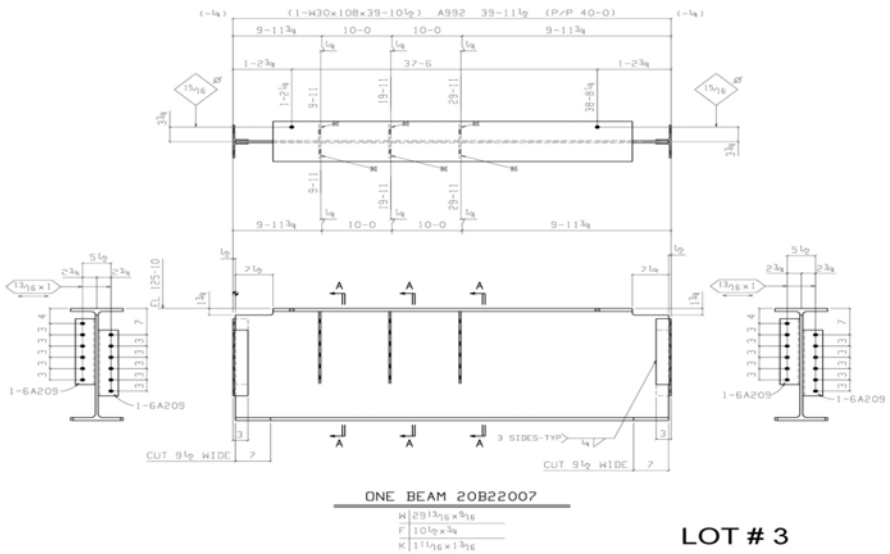
125



126



127



128

DOUGLAS STEEL FABRICATING CORPORATION

NONCONFORMANCE REPORT

RECEIVING

JOB NUMBER: PO NUMBER: PLACED ON HOLD BY:
DATE:

DESCRIPTION OF MATERIAL:

DESCRIPTION OF NONCONFORMANCE:

RESOLUTION: RESOLVED BY:
DATE:

FABRICATION

JOB NUMBER: 2526 PIECE MARK: A209 - Large Qty. PLACED ON HOLD BY: CJL
DATE: 7/11/2014

DESCRIPTION OF NONCONFORMANCE:
Holes not provided in CNC file for Angle. Holes added manually in CNC file at incorrect location
Holes were incorrect

RESOLUTION: RESOLVED BY: CJL
Final Inspection must be 100% of all pieces. DATE: 7/11/2014
All header angles still at Douglas Steel will be replaced with correct Header Angles

POST DELIVERY

JOB NUMBER: 2526 PIECE MARK: A209 - Large Qty. PLACED ON HOLD BY: CJL
DATE: 7/11/2014

DESCRIPTION OF NONCONFORMANCE:
Holes not provided in CNC file for Angle. Holes added manually in CNC file at incorrect location
Holes were incorrect

RESOLUTION: RESOLVED BY: CJL
Final Inspection must be 100% of all pieces. All header angles in the field hung in place will have a DATE: 7/11/2014
seat angle welded and the holes will be reamed. All header angles not erected will have angles removed and replaced.

Corrective Action Request **#22**

Douglas Steel Fabricating Corporation

Part #1

Reference:
SO – 2526 Improper Fabrication

Description of Evidence:
Large amount of angles provided with improper hole gauge. Original CNC file was provided with no holes, and hole gauge was added manually at the Angle line. This hole gauge was not correct. Angles will need to be replaced.

Originator Signature:	Christopher J. Lowe	Date: 7-11-14
Recipient Signature:	Lawrence F. Kruth, P.E	Date: 7-11-2014

Notes: Angles will be modified in the air, on the ground, and in our shop.

Part #2

CAR #	Response Due date	Response Received	Evidence due by
22	7-18-14	7-18-14	7-18-14

Part #3

Probable **Root** Cause of Condition (or sources of information for a preventative action):

1. CNC files were not correct.
2. CNC file was manually adjusted to add holes. Holes were added at incorrect dimension
3. Angles were welded on in the shop, and not caught by fitters
4. Angles were not checked in final inspection process

Action to Prevent Recurrence (determination of steps necessary to prevent a potential problem):

1. Increase Final Inspection to 100% for this project.
2. Create Procedure: If any item is not correct in CNC File – That item may be fixed, upon approval from the Engineering Department. Place item on hold until Engineering Department can be consulted.
3. Training will be provided to CNC operators to have any fixes to CNC files to be reviewed approved by the Engineering Department prior to item being fixed.

Verification by:	Scheduled Completion Date: 7-18-14

Part #4 Corrective Action Closeout

The corrective action is/is not recommended as closed through one or a combination of the following means:

- Review of controls and documentation forwarded by the auditee;
- Site visit to assess conformance to the action documented in part #3 above.

Comments:

This was a major cost item for a job that we did not detail, or erect. Although the CNC was not correct initially, the angles should've been measured in the fit up process, and during final inspection.

	Closure Date:	Expired and not closed Date:
	7/18/14	

131

Statistics

January 7, 2014

Breakdown of Nonconformances by Department
2013

Month	Shop		Detailing		Sublet	Supplier	Field	Other
August	$ 70.00	6055	$ 280.00	6050			$ 1,200.00 6055	
	$ 140.00	6049	$ 3,500.00	6055				
	$ 140.00	6056	$ 950.00	6055				
	$ 180.00	6056						
	$ 180.00	6056						
	$ 70.00	6056						
	$ 210.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
TOTALS:	$ 1,200.00		$ 4,730.00		$ -	$ -	$ 1,200.00	$ -

GRAND TOTAL FOR MONTH: $ 7,130.00 # ISSUED: 14

Month	Shop		Detailing		Sublet	Supplier	Field	Other
September	$ 70.00	6056	$ 120.00	6056				$ 989.00 6057
	$ 70.00	6055	$ 330.00	6054				
	$ 140.00	6056	$ 140.00	6049				
	$ 140.00	6056						
	$ 210.00	6054						
	$ 210.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 140.00	6056						
	$ 210.00	6057						
	$ 280.00	6054						
	$ 280.00	6054						
	$ 70.00	6054						
	$ 70.00	6054						
	$ 140.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 280.00	6056						
	$ 280.00	6056						
	$ 70.00	6049						
	$ 70.00	6049						
	$ 70.00	6049						
	$ 70.00	6049						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 35.00	6056						
	$ 35.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 70.00	6056						
	$ 70.00	6057						
TOTALS:	$ 3,920.00		$ 590.00		$ -	$ -	$ -	$ 989.00

GRAND TOTAL FOR MONTH: $ 5,499.00 # ISSUED: 39

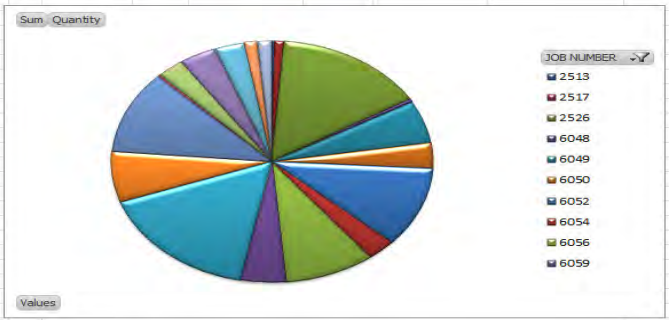
132

Statistics

2014 TOTALS:	Shop	Detailing	Sublet Detailing	Supplier	Field	Other
	59%	20%	8%	1%	10%	3%

2013 TOTALS:	Shop	Detailing	Sublet Detailing	Supplier	Field	Other
	28%	37%	26%	0%	7%	2%

Job Numbers	Sum	Quantity
2513	0.28%	1
2517	0.96%	1
2526	15.07%	1
6048	0.48%	1
6049	5.71%	3
6050	3.42%	1
6052	10.73%	8
6054	2.89%	3
6056	9.08%	5
6059	4.50%	1
6061	16.40%	15
6062	6.79%	6
6064	11.09%	21
6065	0.32%	1
6066	2.73%	3
6067	3.74%	3
6069	3.05%	4
6070	1.29%	2
6071	1.45%	4
Grand Total	100.00%	84



133

Statistics

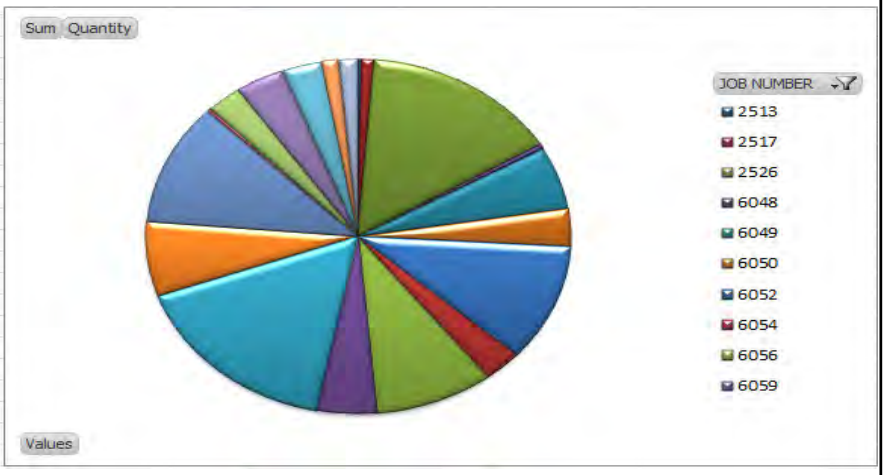
2014 TOTALS:	Shop	Detailing	Sublet Detailing	Supplier	Field	Other
	59%	20%	8%	1%	10%	3%

2013 TOTALS:	Shop	Detailing	Sublet Detailing	Supplier	Field	Other
	28%	37%	26%	0%	7%	2%

134

Statistics

Job Numbers	Sum	Quantity
2513	0.28%	1
2517	0.96%	1
2526	15.07%	1
6048	0.48%	1
6049	5.71%	3
6050	3.42%	1
6052	10.73%	8
6054	2.89%	3
6056	9.08%	5
6059	4.50%	1
6061	16.40%	15
6062	6.79%	6
6064	11.09%	21
6065	0.32%	1
6066	2.73%	3
6067	3.74%	3
6069	3.05%	4
6070	1.29%	2
6071	1.45%	4
Grand Total	**100.00%**	**84**



135

Statistics

Year	Number of Non-Conformances
2005	81
2006	121
2007	134
2008	134
2009	106
2010	97
2011	81
2012	141
2013	111
2014	84

136

Statistics

Year	Number of Non-Conformances	Cost as Percent of Yearly Sales
2005	81	0.22%
2006	121	0.15%
2007	134	0.21%
2008	134	0.21%
2009	106	0.28%
2010	97	0.35%
2011	81	0.19%
2012	141	0.22%
2013	111	0.21%
2014	84	0.20%

137

138

AISC | Questions?

Smarter. Stronger. Steel.

Individual Webinar Registrants

CEU/PDH Certificates

Within 2 business days…

- You will receive an email on how to report attendance from: registration@aisc.org.
- Be on the lookout: Check your spam filter! Check your junk folder!
- Completely fill out online form. Don't forget to check the boxes next to each attendee's name!

Individual Webinar Registrants

CEU/PDH Certificates

Within 2 business days…

- New reporting site (URL will be provided in the forthcoming email).
- Username: Same as AISC website username.
- Password: Same as AISC website password.

8-Session Registrants

CEU/PDH Certificates

One certificate will be issued at the conclusion of all 8 sessions.

8-Session Registrants

CEU/PDH Certificates

One certificate will be issued at the conclusion of all 8 sessions.

Certificates will be issued January 3-4, 2019.

8-Session Registrants

Final Exam

Issued: December 17, 2018
Due: December 31, 2018

8-Session Registrants

Access to the quiz: Information for accessing the quiz will be emailed to you by Wednesday. It will contain a link to access the quiz. EMAIL COMES FROM NIGHTSCHOOL@AISC.ORG

Quiz and Attendance records: Posted Tuesday mornings.
www.aisc.org/nightschool - click on Current Course Details.

Reasons for quiz:

- EEU – must take all quizzes and final to receive EEU
- CEUs/PDHS – If you watch a recorded session you must take quiz for CEUs/PDHs.
- REINFORCEMENT – Reinforce what you learned tonight. Get more out of the course.

NOTE: If you attend the live presentation, you do not have to take the quizzes to receive CEUs/PDHs.

8-Session Registrants

Access to the recording: Information for accessing the recording will be emailed to you by this Wednesday. The recording will be available for three weeks. For 8-session registrants only. EMAIL COMES FROM NIGHTSCHOOL@AISC.ORG.

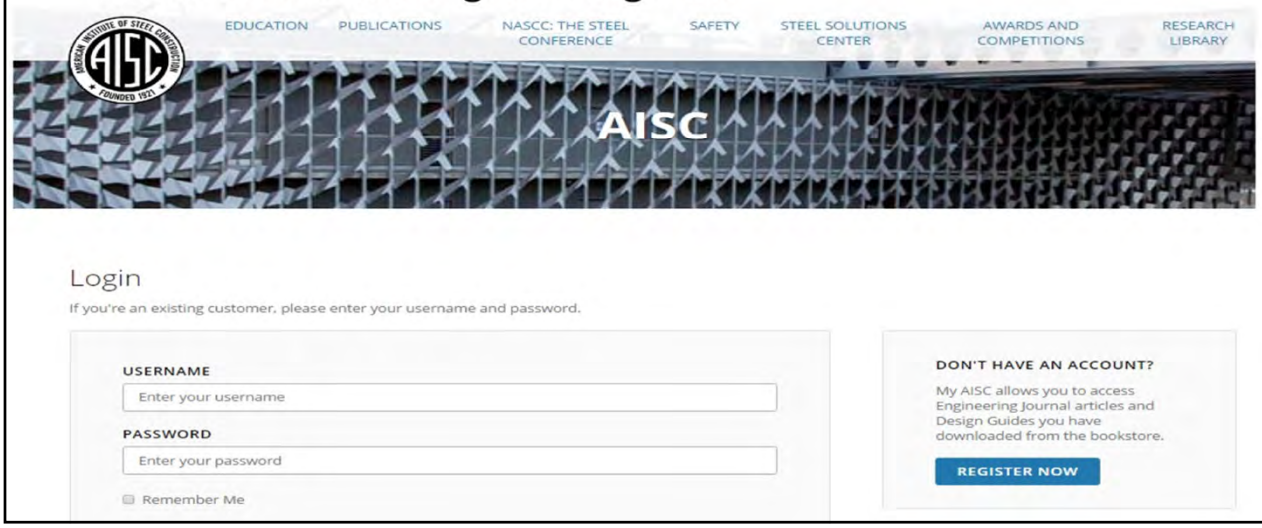
CEUs/PDHS – If you watch a recorded session you must take AND PASS the quiz for CEUs/PDHs.

Night School Resources for 8-session package Registrants

Find all your handouts, quizzes and quiz scores, recording access, and attendance information all in one place!

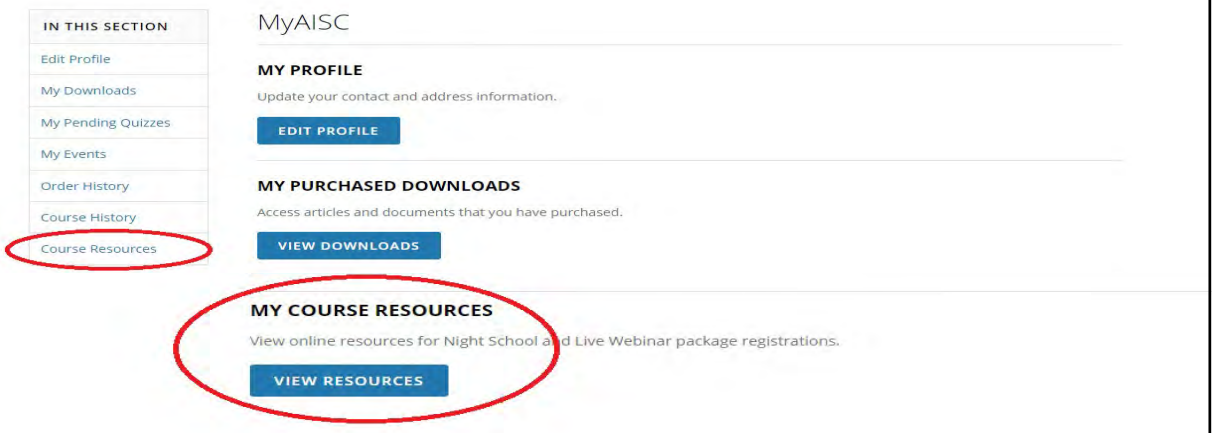
Night School Resources for 8-session package Registrants

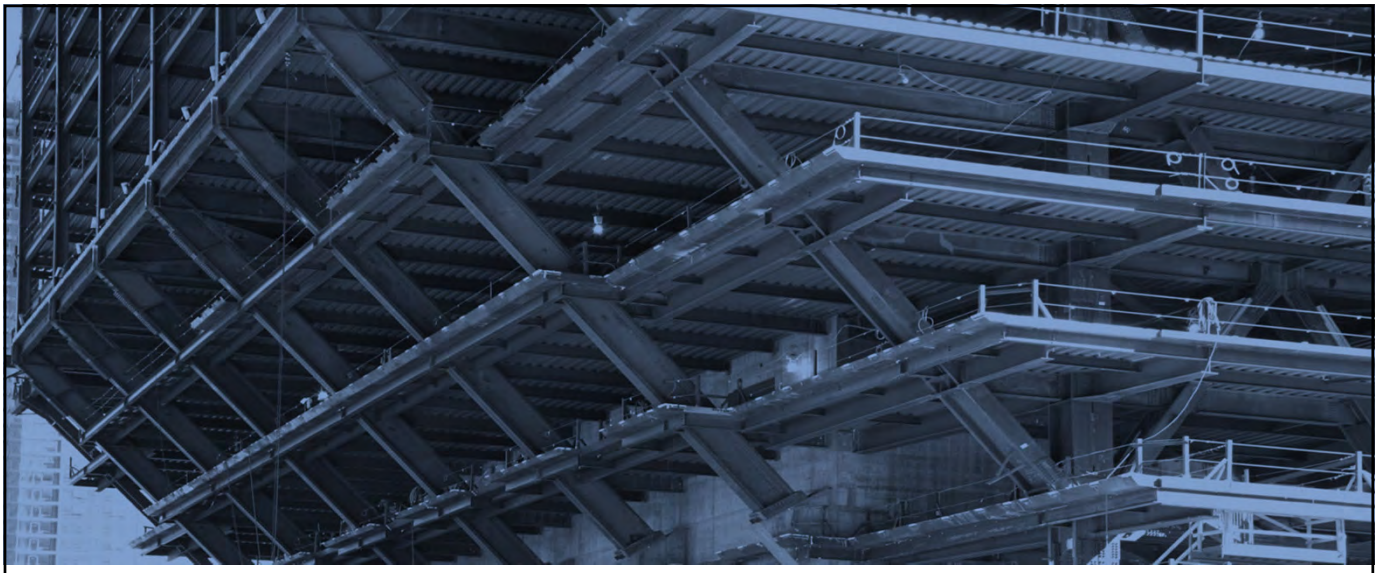
Go to www.aisc.org and sign in.



Night School Resources for 8-session package Registrants

Go to www.aisc.org and sign in.





AISC | Thank you

Smarter. Stronger. Steel.