KANSAS DEPARTMENT OF TRANSPORTATION
SPECIAL PROVISION TO THE
STANDARD SPECIFICATIONS, EDITION 2015

Delete SECTION 744 and replace with the following:

SECTION 744

STRUCTURAL METALS FABRICATION

744.1 DESCRIPTION

Shop fabricate the structural metal according to the Contract Documents. This specification applies to all welded steel structures or items covered by American Welding Society (AWS) D1.1-2015, "Structural Welding Code – Steel", all welded aluminum alloy structures covered by the AWS D1.2-2014, "Structural Welding Code – Aluminum", and all stainless steel items covered by the AWS D1.6-2007, "Structural Welding Code – Stainless Steel". This specification applies to the welding of all tubular structures, ancillary bridge products (drain system, expansion devices, steel bearings, etc. that are not welded to bridge superstructure components), or miscellaneous fabricated items. See **SECTION 705** for the fabrication of structural steel for bridges on highway and public roads carrying vehicular traffic and the field welding of structural steel to steel highway bridge components.

744.2 MATERIALS

a. General. Provide materials that comply with the applicable requirements.

Castings	**DIVISION 1600**
Structural Steel	**DIVISION 1600**
Structural Steel Tubing	**DIVISION 1600**
Steel For Bridge Drain Systems	**DIVISION 1600**
Welded Stud Shear Connectors	**DIVISION 1600**
Steel Fasteners	**DIVISION 1600**
Steel Pipe	**DIVISION 1600**
Aluminum Alloys	**DIVISION 1600**
Fencing	**DIVISION 1600**

b. Preliminary Shop Requirements.

(1) Point of Fabrication. Within 10 business days after signing the contract, notify the appropriate KDOT office and the Bureau Chief of Construction and Materials in writing of the firm (name and location) that will fabricate the structure. Produce and fabricate all structural steel within the Continental United States (see **SECTION 106.1**).

(2) Shop Drawings. The Contractor or fabricator must submit shop drawings of structural steel, structural aluminum alloys, and castings according to **SECTION 105**. Do not perform any fabrication until the approved shop drawings are in the hands of the Inspector and fabricator, and the Engineer has authorized fabrication. Any purchase of materials before fabrication authorization is at the Contractor's risk.

Changes on approved shop drawings or contract plans are subject to the approval of the Engineer. Notify the Engineer with a record of such changes. Submit revised sheets of the same size as the shop drawings originally submitted.

Show approved welding procedure numbers in the tail of weld symbols on submitted shop drawings. Submit 2 copies of each procedure requiring approval to the Bureau of Construction and Materials. All weld procedures referenced in a set of shop drawings must be approved before the shop drawings can be approved.

Provide a diagram on the shop detail plans giving sufficient dimensions for accurate fabrication and inspection of the structure.

The Contractor is responsible for the correctness of the shop fit-up and field connections, even though the shop drawings have been approved by the Engineer. See **SECTION 105**.

(3) Notice of Beginning of Work. In order to provide inspection, notify the Engineer before beginning work in the shop. Give a minimum of 24 hours' notice before beginning work in shops in the State of Kansas, and give a minimum of 7 calendar days' notice before beginning work in shops in the contiguous United States.

(4) Material Acceptance. Submit to the Bureau Chief of Construction and Materials, 1 copy of each mill test report for each heat number to be used before the layout, and use such steel in the fabrication of the structure. If no shop inspection is provided by KDOT, submit mill test reports (Type A certifications) in accordance with **SECTION 2601**.

Submit a fabricator's guarantee indicating that the attached certified mill test reports pertain to all heat numbers used in the structure, and all material complies with the Contract Documents. Include the following in the guarantee:

- fabricator's name;
- KDOT project number;
- structure or station number;
- fabricator's purchase order number;
- list heat numbers;
- size and shape of pieces;
- number of pieces to be used for each size of each heat; and
- steel or aluminum alloy producer's name and the ASTM or AASHTO designation for the material that is required in the Contract Documents.

The guarantee must include the notarized signature of an official of the company who is authorized to legally bind the statement on the company's behalf.

All structural steel shall comply with the ASTM A 6 quality requirements until released for shipment.

Dependent on the material being used, repair welding shall comply with the requirements of AWS D1.1, "Structural Welding Code - Steel" or AWS D1.2, "Structural Welding Code – Aluminum", with the corresponding exceptions and additions noted later in this section, or AWS D1.6, "Structural Welding Code – Stainless Steel".

The term "mill" means any rolling mill or foundry where material for the work is manufactured. When any ASTM or AASHTO steel is specified in the Contract Documents, the mill must certify that the material complies with the specified chemical and physical requirements.

The fabricator must obtain written permission from KDOT to substitute a grade of steel or aluminum alloy that is not indicated in the Contract Documents for one that is shown in the Contract Documents.

(5) Facilities for Inspection and Testing. During all hours of operation allow the Engineer free access to all parts of the work and the shop where fabrication is performed.

Provide an enclosed office area for the exclusive use of the Engineer at the location of fabrication. The area must satisfy the requirements of a Field Office (Special) in **SECTION 803**, except as modified below:

- Minimum floor area = 120 square feet;
- Single workbench or table - 30 inch by 8 feet (minimum dimensions);
- Desk - 30 inch by 5 feet, with drawers;
- Swivel desk chair with arm rests;
- Waste paper basket; and
- Storage/Filing cabinet with lock and key

When directed by the Engineer, promptly repair or replace any damaged or non-functioning items. Provide parking near the office with direct accessibility to the office and shop.

(6) Test Specimens - Provide "all-weld-metal" tension specimens and specimens for other weld tests as directed by the Engineer. Preparation and possible shipment of specimens are subsidiary to the fabrication of the structure.

(6.1) – Steel Bar, Plate, Shapes. When directed by the Engineer, prepare 4 inch by 24 inch test specimens of the base metal. Orient the specimen so the direction of rolling is according to the latest edition of ASTM A 6.

(6.2) – Steel Tubes and Pipes, Aluminum Alloy Products – When directed by the Engineer, prepare base metal or product specimens of the dimensions specified by the Engineer.

c. Handling. Conduct the loading, transporting, unloading and storing of structural steel to keep the metal clean, above ground and free from injury. Use protective devices or softeners to safeguard plate edges.

Store structural steel, either plain or fabricated, above the ground on platforms, skids or other supports, and keep free from corrosion, dirt, grease and other foreign matter. Store girders and beams upright with sufficient support to prevent warping or change in design camber.

d. Shop Fabrication.

(1) Identification. All pieces of all grades of steel and aluminum alloy used in fabrication of main members must bear the heat number assigned by the rolling mill. Preserve the heat number until the Engineer advises the fabricator that the unit is acceptable for cleaning and painting. Identify the grade of steel as specified in ASTM A 6.

(2) Straightening Material. All mill material must be straight before being laid out for work. If straightening is required, do not injure the metal. Heat straightening must comply with AWS D1.1, "Structural Welding Code - Steel" or AWS D1.2, “Structural Welding Code – Aluminum”, as applicable for the material being used. Submit the proposed heat straightening procedure to the Engineer for approval. Sharp kinks and bends are cause for rejection of the material. Steel mill material must not exceed dimensional tolerances outlined in the latest edition of ASTM A 6.

(3) Welding and Gas Cutting. Dependent on the material be used, perform welding and gas cutting of structural steel and aluminum alloy according to the requirements of the AWS D1.1, "Structural Welding Code - Steel" or AWS D1.2, “Structural Welding Code – Aluminum”, with the corresponding exceptions and additions noted later in this section, or AWS D1.6, “Structural Welding Code – Stainless Steel”.

(4) Finish. Neatly finish all work. Carefully and accurately shear and clip. Fabricate finished members true to line and detailed dimension, and free from twists, bends, open joints or other defects.

(5) Welded Stud Shear Connectors. Apply welded stud shear connectors to the designated structural steel members during shop fabrication.

If the circumstances warrant, and if the Engineer approves the Contractor’s procedures, welded stud shear connectors may be field applied. Approval is based on demonstrating to the Engineer’s satisfaction, that the Contractor can:

- remove any shop applied coating removed from the top flange without damaging the structural member;
- weld the stud shear connectors to the structural member; and
- blast clean and prime coat the top flange and stud shear connectors.

(6) Shop Assembly for Final Inspection. Unless otherwise provided both in writing and shown on the approved shop drawings, assemble, securely support, adjust and maintain to proper line, grade, camber and suitable clearances all members.

After the assembly is completely set up, the fabricator’s quality control personnel must check blocking, sweep and bearing-to-bearing measurements prior to any checking by the Engineer.

(7) Shop Painting. Prepare the structural steel surfaces and shop paint the prepared surfaces according to **SECTION 714**.

(8) Shop Bolted Connections. Perform all bolting according to **SECTION 712.**

(9) Overhead Sign Structures, Cantilever Sign Structures, Bridge Mounted Sign Attachments, High Mast Light Poles, Lighting and Traffic Signal Poles.

(9.1) Except as noted in (9.2), nondestructively test 100% of all complete joint penetration (CJP) groove welds.

(9.1.1) Use Radiography Testing (RT) or Ultrasonic Testing (UT) when the thickness of the thinnest connecting material is 1/4 inches or more.

(9.1.2) Except as noted in (9.1.3), use Magnetic Particle Testing (MT) when the thickness of the thinnest connecting material is less than 1/4 inches.

(9.1.3) Use RT for all CJP welds in High Mast Light Poles when the thickness of the thinnest connecting material is less than 1/4 inches.

(9.2) For mast arms having an OD of less than 6 inches (measured anywhere along it length), MT 100% of the mast arm to pole connection CJP welds on a random 1 out of 4 structures, or fraction thereof.

(9.3) Except as noted in (9.5), inspect partial penetration groove welds and fillet welds on a random 1 out of 4 structures, or fraction thereof. For each structure selected, inspect:

(9.3.1) a minimum of 4 inches out of every 48 inches of all partial penetration groove welds, including the 4 inches nearest a connection. Use MT.

(9.3.2) 100% of all tube-to-transverse plate (i.e. flanges, base plates, connection plate, etc.) welds. Use MT.

(9.3.3) 100% of the perimeter hand hole welds. Use MT.

(9.3.4) 100% of all welds connecting a device or accessory to the tube wall. Use MT.

(9.3.5) 100% of the mast arm-to-pole connection welds when the OD of the mast arm is less than 6 inches (measured anywhere along it length). Use Visible Liquid Penetrant Testing (PT).

(9.4) After galvanizing, UT only those tube-to-transverse plate CJP groove welds noted on the shop drawings as needing this additional inspection.

(9.5) For all aluminum alloy structures or structural components, use PT to inspect partial penetration groove welds and fillet welds as follows:

(9.5.1) 100% of all tube-to-transverse plate (i.e. – base plate, flange plate, etc.) welds.

(9.5.2) 100% of all stiffener/connection plate welds at base plate. Inspect welds to base plate and to main member.

(9.5.3) 100% of all connection/stiffener/gusset plate welds at flanged connections in truss or end supports. Inspect welds to flange and to main member.

(10) Overhead Sign Structures. After heading the 7/8 inch diameter rivet used in the Truss to End Support Coupling, the minimum flange thickness can be no less than 3/8 inches, measured at any point along the head's circumference.

(11) Steel Bridge Bearings. At the option of the Engineer, steel bearing device inspection will require that either 1 device in 10, or fraction thereof, be tested 100%, or a10% of each device will be tested using PT or MT. When tested at the 1 in 10 rate, the Engineer will select which device to test. When tested at the 10% rate, the Engineer will select the weld locations to test, which can vary from device to device. The welding of dissimilar metals is not prequalified.

(12) Rejection. Repair or replace rejected items as directed by the Engineer.

(13) Release for Shipment. Do not release fabricated elements for shipment from the fabrication or paint shop without approval of the Engineer.

e. Supplemental Requirements to the Structural Welding Code - Steel. The section and paragraph references cited in the paragraphs below are to AWS D1.1-2015.

Add two new subsections 1.10 and 1.11, as follows:

SUBSECTION 1.10 EQUIPMENT CHECK

Each DC generator shall have a service check by an NEWA member, a commercial electrical equipment company or by the fabricating plant's electrical maintenance engineer once each year. A service certificate shall be issued with each equipment check and shall be available for inspection by the Engineer.

SUBSECTION 1.11 TEMPORARY WELDING AND TACKING

The attachment of temporary fabrication, erection and construction items to main members by welding or tacking is prohibited except by written permission from the Bureau Chief of Construction and Materials. Permissible locations for such welds and tacks shall be only at locations shown on approved shop drawings or at locations designated in writing by the Engineer.

SUBSECTION 2.4.5 PLUG AND SLOT WELDS

Add the following paragraph 2.4.5.5:

Plug and slot welding is prohibited without the written approval of the Engineer. As a requirement for approval, all plug and slot welding shall be QC tested by nondestructive testing at no cost to the state. The type of testing shall be determined by the Engineer.

SECTION 3 PREQUALIFICATION OF WPSs

Add the following notes to Table 3.1:

- Only low hydrogen electrodes shall be used.

SUBSECTION 3.2 WELDING PROCESSES

Delete the first sentence of paragraph 3.2.2 and replace with the following:

ESW or EGW shall not be used. GTAW and GMAW-S welding may be used, provided the WPSs are qualified in conformance with the requirements of Clause 4.

SUBSECTION 4.2 GENERAL REQUIREMENTS - QUALIFICATION

Add the follow to paragraph 4.2.1.1:

All PQR tests must be witnessed by the Engineer, another state's representative approved by the Engineer, or an independent third party approved by the Engineer. If representatives from other states or third parties witnessed a test, provide records of the test signed by the witness. All mechanical and nondestructive tests performed by independent laboratories on qualification specimens will be at no charge to the State. Provide signed documentation of the independent lab's test results to the Engineer. When requested by the Engineer, allow KDOT access to the test samples and the independent lab's radiographs for inspection.

Add the following to paragraph 4.2.2.2:

All tests must be witnessed by the Engineer, another state's representative approved by the Engineer, or an independent third party approved by the Engineer. If representatives from other states or third parties witnessed a test, records of the test must be signed by the witness.

Add a new paragraph 4.2.4:

4.2.4 Additional Testing. The Engineer may order tests of welders, welding operators, tack welders, or WPSs whenever there is evidence that unacceptable welds are being or have been produced. This additional testing is at the fabricator's expense. The Engineer may disqualify personnel working for the fabricator who fail the additional testing, who commit serious violations of the specifications, or who repeatedly exhibit poor workmanship on KDOT projects.

Revise paragraph 4.3.3 as follows:

Replace "those authorized to examine them." with "the Engineer."

SUBSECTION 5.25 REPAIRS

Add the following to paragraph 5.25.2:

Do not use mechanical straightening methods without the approval of the Engineer, even when used in conjunction with the application of heat.

SUBSECTION 6.1 INSPECTION – GENERAL REQUIREMENTS

Add the following to paragraph 6.1.2.1:

This type of inspection shall not be performed by an inspector or their assistants who are, or were previously, engaged in the welding, the general assembly, or the application of coatings.

SUBSECTION 6.14 NONDESTRUCTIVE TESTING (NDT) PROCEDURES

Delete paragraphs 6.14.4 and replace with the following:

6.14.4 When magnetic particle testing (MT) is used, the procedure and techniques shall be in accordance with the dry powder magnetic particle examination of welds using the yoke method. The yoke method shall be performed according to ASTM E 709, and the standard of acceptance shall conform with Clause 6, Part C, of this code.

(1) The yoke method shall be performed using half-wave rectified direct current or alternating current.

(2) Electromagnetic yokes shall have lifting forces complying with **TABLE 744-1**.

TABLE 744-1: ELECTROMAGNETIC YOKE SPACING		
Current Type	**Yoke Pole Leg Spacing (YPS)**	
	2"≤YPS<4"	**4"≤YPS≤6"**
AC	10 lbs.	Not Applicable
DC	30 lbs.	50 lbs.

6.14.4.1 Prior to MT, the surface shall be examined, and any adjacent area within a minimum of 1 inch of the surface to be tested, shall be dry and free of contaminants such as oil, grease, loose rust, loose sand, loose scale, lint, paint, welding flux, and weld spatter.

Cleaning may be accomplished by detergents, organic solvents, descaling solutions, paint removers, vapor degreasing, sand or grit blasting, and ultrasonic cleaning methods.

6.14.4.2 The poles shall be oriented in two directions approximately 90 degrees apart at each inspection point, to detect both longitudinal and transverse discontinuities. The pole position shall overlap as testing progresses to insure 100 percent inspection of the areas to be tested. Discontinuities are best detected when their axis is

normal to the magnetic lines of force. Therefore, the yoke technique is most sensitive to discontinuities whose major access is normal to a line drawn between the two poles.

6.14.4.3 A report of magnetic particle examination shall be prepared and provided to the owner.

(1) The report shall include the following minimum information:

(a) Part identification
(b) Examination procedure number (if applicable)
(c) Date of examination
(d) Technicians name, certification level, and signature
(e) Name and signature of contractors or owners, Inspectors, or both who witnessed the examination
(f) Examination results
(g) Equipment make and model
(h) Yoke spacing used
(i) Particle manufacturer's name and color

(2) One copy of the report shall be provided to the contractor for the owner.

Add the following to paragraph 6.14.5:

For detecting discontinuities in non-magnetic materials including stainless steel to stainless steel or stainless steel to carbon steel, visible liquid penetrate testing (PT) will be used in lieu of MT. The standard methods, set forth in ASTM E 165 shall be used for PT inspection, and the standards of acceptance shall conform to Clause 6, Part C, of this code.

SUBSECTION 6.17 RADIOGRAPHIC TESTING (RT) - PROCEDURE

Delete paragraph 6.17.9 and replace with the following:

6.17.9 FILM SIZE - When the joint thickness is less than 3 inches, radiographs shall be 4 1/2 inches x 17 inches in size. When the length of the joint is such that more than one radiograph is required, one of the films may be shortened to 4 1/2 inches x 10 at the contractor option. When joint thicknesses are 3 inches or greater, the minimum film size shall be 7 inches x 17 inches. Larger radiographs may be required in areas where there have been excessive repairs or where there are joints with unusual dimensions.

Delete paragraph 6.17.12 and replace with the following:

6.17.12 One radiograph identification number shall be painted on the steel no closer than 3/4 inch from the weld edge at each radiograph location. Corresponding lead numbers shall be superimposed on the painted numbers to produce an image on the radiograph. A combination of letters and numbers may also be used. Two location dots shall be painted on the steel at each radiograph location no closer than 3/8 inch from the weld edge. The dots shall be placed at a random distance from the steel plate edges which are perpendicular to the length of the weld. The dots shall be placed in different locations for each radiograph location. One lead arrow shall be placed so that its tip is superimposed on each of the two location dots. A location letter shall be painted immediately under each arrow and a lead letter shall be superimposed on each painted letter. When radiographs are viewed, only those films representing the same joint should have location arrows and location letters perfectly superimposed. Any additional information shall be produced on the radiograph no less the 3/4 inches from the edge of the weld either by pre-printing or by placing lead letters and numbers on the steel. See Figures 1 and 2. Information required to be shown on the radiograph shall include: the complete KDOT bridge number, initials of the radiographic inspection company, initials of the fabricator, the fabricator's shop order number, the radiographic identification number, the date, and the weld repair number if applicable.

Add a new paragraph 6.17.14:

6.17.14 Unless otherwise noted on the shop drawings all butt welds will be evaluated as tension welds.

f. Supplemental Requirements to the Structural Welding Code - Aluminum. The section and paragraph references cited in the paragraphs below are to AWS D1.2-2014.

Add 2 new subsections as follows:

SUBSECTION 1.9 EQUIPMENT CHECK

Each DC generator shall have a service check by an NEWA member, a commercial electrical equipment company or by the fabricating plant's electrical maintenance engineer once each year. A service certificate shall be issued with each equipment check and shall be available for inspection by the Engineer.

SUBSECTION 1.10 TEMPORARY WELDING AND TACKING

The attachment of temporary fabrication, erection and construction items to main members by welding or tacking is prohibited except by written permission from the Bureau Chief of Construction and Materials. Permissible locations for such welds and tacks shall be only at locations shown on approved shop drawings or at locations designated in writing by the Engineer.

SUBSECTION 2.6 PLUG AND SLOT WELDS

Add the following paragraph 2.6.9:

Plug and slot welding is prohibited without the written approval of the Engineer. As a requirement for approval, all plug and slot welding shall be QC tested by nondestructive testing at no cost to the state. The type of testing shall be determined by the Engineer.

SUBSECTION 3.1 GENERAL REQUIREMENTS – QUALIFICATION

Revise item (5) as follows:

Replace “those authorized to examine them.” with ”the Engineer.”

Add 3 new paragraphs as follows:

3.1.1 All PQR tests must be witnessed by the Engineer, another state’s representative approved by the Engineer, or an independent third party approved by the Engineer. If representatives from other states or third parties witnessed a test, provide records of the test signed by the witness. All mechanical and nondestructive tests performed by independent laboratories on qualification specimens will be at no charge to the State. Provide signed documentation of the independent lab’s test results to the Engineer. When requested by the Engineer, allow KDOT access to the test samples and the independent lab’s radiographs for inspection.

3.1.2 All welder, welding operator, and tack welder tests must be witnessed by the Engineer, another state’s representative approved by the Engineer, or an independent third party approved by the Engineer. If representatives from other states or third parties witnessed a test, records of the test must be signed by the witness.

3.1.3 Additional Testing. The Engineer may order tests of welders, welding operators, tack welders, or WPSs whenever there is evidence that unacceptable welds are being or have been produced. This additional testing is at the fabricator’s expense. The Engineer may disqualify personnel working for the fabricator who fail the additional testing, who commit serious violations of the specifications, or who repeatedly exhibit poor workmanship on KDOT projects.

SUBSECTION 4.22 CONTROL OF DISTORTION AND SHRINKAGE

Add the following to paragraph 4.22.4:

Do not use mechanical straightening methods without the approval of the Engineer, even when used in conjunction with the application of heat.

SUBSECTION 5.1 INSPECTION – GENERAL REQUIREMENTS

Add the following to the first section of paragraph 5.1.1:

Fabrication/erection inspection by the contractor shall not be performed by an inspector or their assistants who are, or were previously, engaged in the welding, the general assembly, or the application of coatings.

SUBSECTION 5.10 RADIOGRAPHIC TESTING (RT) - PROCEDURE

Delete paragraph 5.10.9 and replace with the following:

5.10.9 FILM SIZE - When the joint thickness is less than 3 inches, radiographs shall be 4 1/2 inches x 17 inches in size. When the length of the joint is such that more than one radiograph is required, one of the films may be shortened to 4 1/2 inches x 10 at the contractor option. When joint thicknesses are 3 inches or greater, the minimum film size shall be 7 inches x 17 inches. Larger radiographs may be required in areas where there have been excessive repairs or where there are joints with unusual dimensions.

Delete paragraph 5.10.12 and replace with the following:

5.10.12 One radiograph identification number shall be painted on the steel no closer than 3/4 inch from the weld edge at each radiograph location. Corresponding lead numbers shall be superimposed on the painted numbers to produce an image on the radiograph. A combination of letters and numbers may also be used. Two location dots shall be painted on the steel at each radiograph location no closer than 3/8 inch from the weld edge. The dots shall be placed at a random distance from the steel plate edges which are perpendicular to the length of the weld. The dots shall be placed in different locations for each radiograph location. One lead arrow shall be placed so that its tip is superimposed on each of the two location dots. A location letter shall be painted immediately under each arrow and a lead letter shall be superimposed on each painted letter. When radiographs are viewed, only those films representing the same joint should have location arrows and location letters perfectly superimposed. Any additional information shall be produced on the radiograph no less the 3/4 inches from the edge of the weld either by pre-printing or by placing lead letters and numbers on the steel. See Figures 1 and 2. Information required to be shown on the radiograph shall include: the complete KDOT bridge number, initials of the radiographic inspection company, initials of the fabricator, the fabricator's shop order number, the radiographic identification number, the date, and the weld repair number if applicable.

Add a new paragraph 5.10.14:

5.10.14 Unless otherwise noted on the shop drawings all butt welds will be evaluated as tension welds.

FIGURE 1

ITEMS TO BE PAINTED FOR RADIOGRAPHIC IDENTIFICATION

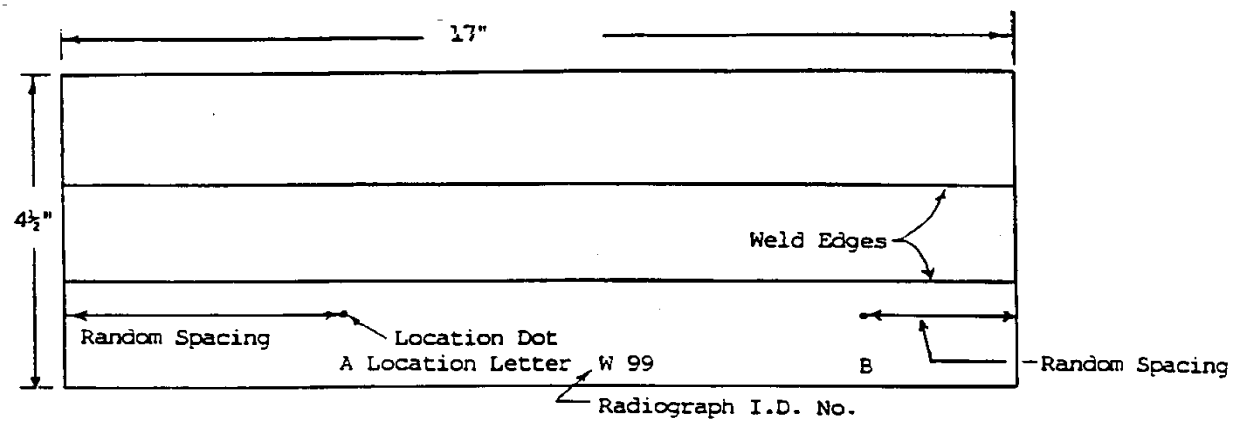
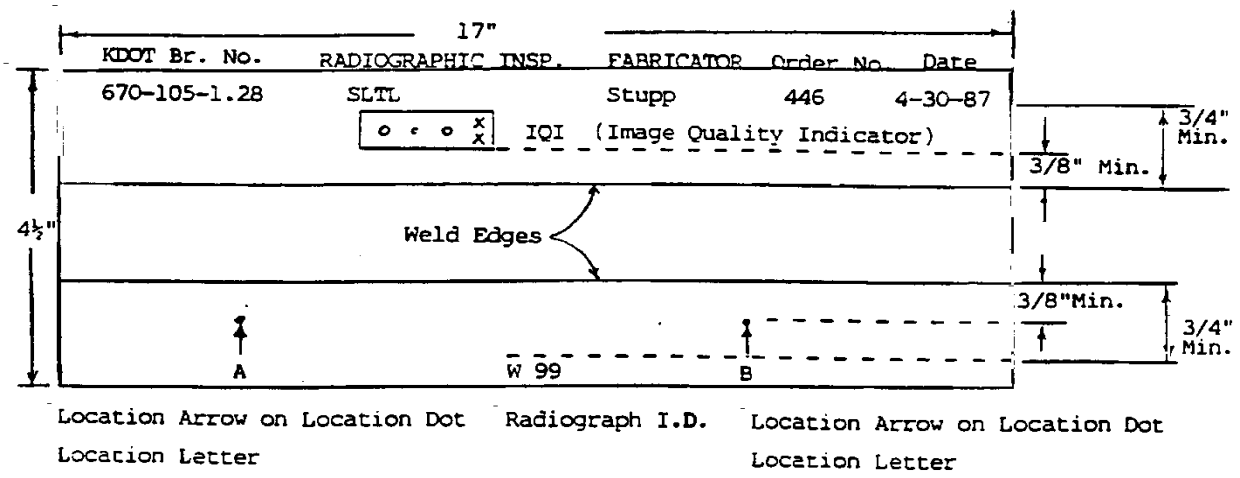


FIGURE 2

LEAD CHARACTER PLACEMENT FOR RADIOGRAPHIC IDENTIFICATION



744.3 MEASUREMENT AND PAYMENT

The Engineer will not measure fabrication of new structural steel or aluminum alloy for separate payment.