MIL-P-13326D(MR)
25 August 1987
SUPERSEDING
MIL-S-13326C
22 July 1980

MILITARY SPECIFICATION

PLATE, METAL, STEEL ALLOY; HEAT TREATED, HIGH STRENGTH; FOR WELDED STRUCTURES

This specification is approved for use by the U.S. Army Materials Technology Laboratory, Department of the Army, and is available for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers high strength, heat treated, alloy steel plate 2 inch or less in thickness for use in critically stressed welded structures (see 6.1).

1.2 Classification. The alloy steel plate is furnished in the following classes, grades and conditions as specified (see 6.1.1 and 6.2).

1.2.1 Class.

70
90
100
120

1.2.1.1 The designators (YS) for yield strength or (HB) for Brinell hardness shall be specified along with the class. The designator will be dependent on the acceptance criteria most applicable to design need (see sections 3 and 6.)

1.2.2 Grade. Classes 70 thru 120 shall be furnished in the following grades as specified (see 3.2.3 and 6.2):

Grade A - Standard impact resistance
Grade B - High impact resistance

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: Director, US Army Laboratory Command, Materials Technology Laboratory, ATTN: SLCMT-MSE, Watertown, MA 02172-0001 by using the Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC NO. A4157 /FSC 9515/

1.2.3 Condition. Unless otherwise specified (see 6.2) the steel is furnished in the following conditions at the option of the contractor:

Quenched and tempered
Normalized and tempered

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications and standards. The following specifications, and standards form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

STANDARDS

MILITARY

MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-163 - Steel Mill Products Preparation for Shipment and Storage

(Copies of standards, drawings, required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 Other publications. The following document(s) form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issue of the non-Government documents which is current on the date of the solicitation.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS

A6 - Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use
A370 - Mechanical Testing of Steel Products
A578/A578M - Straight Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications
A673 - Sampling Procedure for Impact Testing of Structural Steel
A751 - Methods, Practices and Definitions for Chemical Analysis of Steel Products
E8 - Methods of Tension Testing of Metallic Materials
E10 - Brinell Hardness of Metallic Materials
E23 - Methods for Notched Bar Impact Testing of Metallic Materials
E59 - Sampling Steel and Iron for Determination of Chemical Composition

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

(Non-Government standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein (except for associated detail specifications, specification sheets or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Chemical composition Unless otherwise specified (see 6.2), the contractor shall be responsible for selecting the chemical composition of the steel.

3.1.1 Heat Analysis. A chemical analysis of each heat shall be performed and the complete (chemical analysis) data recorded.

3.1.2 When required (see 6.2) the supplier shall provide the chemical analysis of each heat.

3.1.3 Product analysis When product analysis is specified by the procuring activity, a sample for analysis (see 6.2) shall be furnished. Samples for analysis shall be taken adjacent to or from the tension test specimen, or from a sample taken from the same relative location as that from which the tension test specimen was taken. The purchaser may analyze finished material representing each heat. Sampling shall be in accordance with ASTM Method E59. The chemical composition thus determined shall conform to the requirements of the product analysis tolerances of ASTM A6. If a range is specified, the determinations of any element in a heat may not vary both above and below the specified range.

3.2 Mechanical properties.

3.2.1 Yield strength. When 70(YS), 90(YS), 100(YS) or 120(YS) is specified (see 6.2) the minimum yield strengths shall be in accordance with table I.

TABLE I. Yield strength requirements (YS).

Class	Yield strengths, psi
70(YS)	70,000 - 90,000
90(YS)	91,000 - 110,000
100(YS)	100,000 - 120,000
120(YS)	121,000 - 150,000

3.2.2 Brinell hardness. When 70(HB), 90(HB), 100 HB) or 120(HB) is specified (see 6.2), the Brinell hardness range shall be in accordance with table II.

TABLE II. Brinell hardness requirement (HB).

Class	Brinell hardness range
70(HB)	165 - 210
90(HB)	210 - 260
100 (HB)	235 - 293
120 (HB)	277 - 321

3.2.3 Impact resistance (grades A and B). Grades A and B Charpy V-notch impact resistance for the steel classes shall be as specified in table III. The Charpy impact test specimens shall be obtained in the TL orientaion as shown in ASTM A370, i.e., the specimens shall be taken transverse to the major direction of rolling with the notch perpendicular to the plate surface so that the crack will propagate in the logitudinal direction.

TABLE III. Charpy impact resistance requirements.

Class	Minimum average V-notch Charpy impact resistance (ft-lbs) at -40 + 2 F 1/ Full size specimen 2/ Grade A	Grade B
70(YS) & 70(HB)	25	38
90(YS) & 90(HB)	22	32
100(YS) & 100(HB)	20	28
120(YS) & 120(HB)	15	25

1/ Based on a minimum of three tests.

2/ When full size specimens (10 x 10 mm) cannot be obtained, subsize samples shall be used and the Charpy impact values shall be converted in accordance with ASTM A673.

3.3 Heat treatment. Unless otherwise specified, the alloy steel plate shall be heat treated to assure that the plate meets the requirements of this specification.

3.4 Welding characteristics of plate. When required (see 6.2), the supplier shall provide certification that the steel plate meets the welding criteria of this specification.

3.4.1 Plate condition. The plate shall be free of any condition that would lead to harmful defects in the weld or plate itself.

3.4.2 Ultrasonic Examination. When specified (see 6.2), plate material shall meet the minimum requirements of Level II per ASTM A578.

3.4.3 Metallurgical Examination. When specified (see 6.2), plate material shall be free from segregated and banded microstructure when examined at 100X magnificatrion.

3.5 Dimensions and tolerances. Plate shall conform to the dimensions as specified in the drawing, contract or order (see 6.2). Tolerances on dimensions for length, width, thickness, weight, camber and flatness on sheared and rolled plates shall be in accordance with ASTM A6.

3.6 Conditioning of plates. Unless otherwise agreed upon between the supplier and the procuring activity (see 6.2) plates may be conditioned for the removal of surface imperfections or depressions in accordance with the provisions of ASTM A6.

3.7 Steel finish. Unless otherwise specified, steel shall be furnished with the as-heat treated finish. When specified (see 6.2) steel shall be furnished with a descaled finish or a descaled and oiled finish.

3.8 Identification marking. Each plate shall be marked for identification with plate size and thickness, rolling direction, the supplier's name or trade mark, the specification number, the customer's order number, class designation, supplier's test identification and the heat number. Plates under 3/8 inch thick and 36 inches square in secured lifts shall have the markings on the top plate of each lift.

3.9 Workmanship. Furnished plates shall be free of defects of a nature, degree or extent that would adversely affect the serviceability of the plate.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Lot. Unless otherwise specified, a lot shall consist of all plates of the same heat, of the same nominal thickness, having the same heat treatment, heat treated in the same facility and submitted for inspection at the same time.

4.3 Sampling.

4.3.1 Chemical composition.

4.3.1.1 Heat analysis. This analysis shall be made on a test sample preferably taken during pouring of the heat.

4.3.1.2 Product analysis. When specified, one sample shall be obtained from each lot. Samples shall be taken adjacent to or from the tension test specimen, or from a sample taken from the same relative location as that from which the tension test specimen was taken.

4.3.2 Mechanical properties. Samples shall be taken from each of two plates, randomly selected from each lot. Location of samples shall be in accordance with applicable drawings or as otherwise specified (see 6.2).

4.4 Examination.

4.4.1 Visual. All plates in each lot shall be examined for compliance with the requirement for plate conditioning (see 3.6), finish (see 3.7), identification marking (see 3.8), and workmanship (see 3.9).

4.4.2 Dimensional. All plates in each lot shall be measured for compliance with the requirements for dimensions and tolerances (see 3.5).

4.4.3 Preparation for delivery. Examination shall be made to determine compliance with the requirements of section 5.

4.5 Tests.

4.5.1 Chemical composition. Chemical analysis (see 3.1.1) shall be conducted in accordance with ASTM A751. If any sample fails to conform to the chemical requirements, the lot represented by the sample shall be subject to rejection.

4.5.2 Tension test.

4.5.2.1 Test specimen. Unless otherwise specified (see 6.2) at least two transverse tension specimens shall be taken from plates in locations specified in table IV and prepared and tested in accordance with ASTM A370. The yield strength shall be determined by the 0.2% offset method.

TABLE IV. Location of tensile test specimens.

Product form	Thickness inches	Location of central logitudinal axis of specimen
Plates	3/16 to 3/4	Standard rectangular plate specimen (ASTM A370) taken transverse to the final rolling direction with gauge length of at least 2 times the plate thickness from any as heat treated edge.
Plates	3/4 to 2	Standard 0.500-in. diameter round specimen (ASTM A370) taken transverse to the final rolling direction. The gauge length shall be at least 2 times the plate thickness from any as heat treated edge. The axis of the test specimen shall coincide with the mid thickness plane for plate 1 1/2 in. or less in thickness and midway from the mid thickness plane to the surface for plate over 1 1/2 in. in thickness.

4.5.3 Charpy V-notch impact tests. At least three Charpy V-notch impact test specimens shall be taken from each sample as obtained in accordance with 4.3.2, and shall be prepared and tested in accordance with ASTM E23. The Charpy V-notch impact test specimens from samples shall be taken in the TL

(see 3.2.3) orientation from a location midway between the top and bottom surfaces of the plate and at least 4 inches or 2T, whichever is less, from any quenched edge as well as outside the heat affected zone of an oxygen-cut edge. When the amount of material available is insufficient to obtain standard specimens, the largest attainable subsize Charpy V-notch impact specimens shown in figure 7 of ASTM E23 shall be used, and the results compared to the applicable requirements of table III.

4.5.4 Hardness tests. Brinell hardness tests shall be conducted in accordance with ASTM E10 using a 10 mm standard ball and a 3000 kilogram load. Surface scale and decarburization shall be removed from the areas where the tests are to be made. Hardness tests shall be made on the surfaces of pieces cut from the plate after heat treatment.

4.6 Rejection.

4.6.1 Examination. A lot shall be rejectable for failure to comply with the requirements for visual and dimensional examination and packaging when examined in accordance with 4.4.

4.6.2 Tests. A lot shall be rejectable for failure to meet the test requirements when treated in accordance with 4.5 (see 4.8).

4.7 Retests. When no sampling plan is provided by the procuring agency (see 6.2) and where there is evidence that indicates that the specimen was not representative of the lot material, and when the detail specification does not otherwise specify, at least two specimens shall be selected to replace each test specimen which failed. All specimens so selected for retest shall meet the requirements of the specification or the lot shall be subject to rejection.

4.8 Corrective heat treatment. Plates which have been rejected for failure to meet the mechanical requirements may be heat treated again by the manufacturer and resubmitted for inspection. Plates which fail to pass this second inspection shall be subject to rejection.

4.9 Reduced testing. At the discretion of the procuring activity, the amount of testing may be reduced provided the results on consecutive lots indicate that a uniform product meeting the testing requirements is being produced. Reduced testing shall be in accordance with a system previously approved or established by the procuring activity involved

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-STD-163 for the levels specified (see 6.2).

5.2 Marking. In addition to any special marking specified in the contract or order, shipments shall be marked in accordance with the requirements of MIL-STD-129.

6. NOTES

6.1 Intended use. The high strength, heat treated, alloy steel plates covered under this specification are intended for use in welded structures.

These steel plates are primarily intended for use in weldments that do not require stress relieving. Caution is advised when welding is required, to select the proper welding materials, methods and procedure.

6.1.1 There is no direct correlation between yield strength values and hardness ranges, and because of this fact the classification in this specification has been revised to allow the yield strength or the hardness to be specified. Dependent on design application needs, "YS" should be specified when yield strength is the desired property for assuring material acceptability or "HB" when Brinell hardness will provide adequate control of material acceptability.

6.1.2 Grade B. Grade B plates are intended for applications where higher toughness with strength is required.

6.2 Ordering data. Procurement documents should specify:

6.2.1 Procurement requirements.

a. Title, number, and date of this specification.
b. Class, grade, condition if required (see 1.2.1, 1.2.2 and 1.2.3).
c. Whether chemical analysis data of each heat is required to be furnished (see 3.1.2).
d. Whether samples are required for product analysis (see 3.1.2).
e. Whether certification of welding characteristics is required to be furnished (see 3.4).
f. When ultrasonic examination is required (see 3.4.1).
g. When metallurgical examination is required (see 3.4.2).
h. Dimensions required (see 3.5).
i. Conditioning of plates (see 3.6).
j. If different finish is required (see 3.7).
k. If special tension testing required (see 4.5.2.1) .
l. When retest procedures other than as specified in 4.7 are required (see 4.7)
m. Level of packaging required (see 5.1).
n. If special marking is required (see 5.2).
o. Location of samples for mechanical tests (see 4.3.2)

6.2.2 Contract data requirements.

When this specification is used in a procurement which incorporates a DD Form 1423 and invokes the provisions of the Defense Acquisition Regulatory System (DARS), the data requirements identified below will be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved Contract Data Requirements List (DD Form 1423) incorporated into the contract. When the provisions of DARS are not invoked, the data specified below may be delivered by the contractor in accordance with the contract requirements. Deliverable data required by this specification is cited in the following paragraphs:

Paragraph No.	Data requirement title	Applicable DID No
3.1.2	Certification Data Report	UDI-A-23264
3.4	Certificate of Compliance	DI-E-2121

(Copies of data item descriptions required by the contractors in connection with specific acquisition functions should be obtained from the acquiring activity or as directed by the contracting officer.)

6.3 Metric units. When metric dimensions are required, conversion factors can be obtained from ASTM E380 entitled "Metric Practice Guide."

6.4 Welding technique is of fundamental importance and must not adversely affect the properties of the plate material, especially in the weld heat affected zone.

6.5 Subject term (key word) listing.

weldments
impact resistance
steel plate
quenched
normalized
tempered

Custodians:
Army - MR

Preparing activity:
Army - MR

Project 9515-0659

Review activities:
Army - AR
DLA - IS

(WP# ID-0192A/DISC-0207A. FOR MTL USE ONLY)