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# Specification for Steel Plates, Quenched-and-Tempered, for Offshore Structures

API SPECIFICATION 2Y  
FIFTH EDITION, DECEMBER 2006

EFFECTIVE DATE: JUNE 2007



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Upstream Segment

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## FOREWORD

This specification is under the jurisdiction of the API Subcommittee on Standardization of Offshore Structures.

The purpose of this specification is to provide standards for the purchase of quenched-and-tempered steel plate suitable for use in welded offshore structures.

Nothing in this specification shall be interpreted as indicating a preference by the committee any material process. In the selection of materials and processes, the purchaser must be guided by experience and by the service for which the plate is intended.

Changes to the previous edition are noted by bars in the margins.

Shall: As used in a standard, "shall" denotes a minimum requirement to conform to the specification.

Should: As used in a standard, "should" denotes a recommendation that which is advised but not required in order to conform to the specification.

Suggested revisions are invited and should be submitted to the Standards and Publications Department, API, 1220 L Street, NW, Washington, DC 20005, [standards@api.org](http://standards.api.org).

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# Specification for Steel Plates, Quenched-and-Tempered, for Offshore Structures

## 1 Scope

### 1.1 COVERAGE

This specification covers two grades of high strength steel plate for use in welded construction of offshore structures, in selected critical portions which must resist impact, plastic fatigue loading, and lamellar tearing. Grade 50 is covered in thicknesses up to 6 in. (152 mm) inclusive, and Grade 50 is covered in thicknesses up to 4 in. (100 mm) inclusive.

1.1.4 It is intended that steel produced to Grade 50 of the basic API Spec 2Y, without Supplementary Requirements, be at least equivalent in minimum performance and, therefore, in service application, to the corresponding grades listed in Sections 5 through 7 of API Spec 2Y and API Spec 2W.

1.1.2 API Spec 2Y steels are intended for fabrication primarily by cold-forming and welding. The welding procedure is of fundamental importance and it is presumed that procedures will be suitable for the steels and their intended service. Because of the characteristic high YS/TS ratio of quenched-and-tempered steels, users may want to consider welding consumables which avoid undermatching of the metal. Conversely, the steels should be amenable to fabrication and welding under shipyard and atmospheric conditions.

### 1.2 POST MANUFACTURING HEATING

1.2.1 Due to the characteristics of quenched-and-tempered material, plates manufactured to this Specification cannot be formed or stress-relieved at temperatures above the tempering temperature used during manufacture without some risk of sustaining irreversible and significant losses in strength and toughness. If warm-forming is required, the tensile and notch toughness properties of the finished component shall be verified and the properties shall conform to the requirements of the specification. The plates may be post-weld heat treated at a temperature higher than that used during manufacture, providing the test coupons are subjected to a thermal cycle to simulate such fabrication operations, as described in Supplementary Requirement S9. Verification or simulation is not necessary for heating at temperatures not exceeding 400°F (205°C).

1.2.2 The primary use of these steels is in tubular joints, stiffened plate construction, and other cross-sections where portions of the plates will be subject to tension in the thickness direction (Z-direction). Supplementary Requirement S4 provides for through-thickness (Z-direction) testing of the plates by the manufacturer and specifies limits for acceptance. Supplementary Requirement S1 provides for ultrasonic examination of the plates by the manufacturer and specifies limits for acceptance.

1.2.3 For applications where through-thickness properties are required but Z-direction testing has not been specified, Supplementary Requirement S5 provides a low-sulfur steel intended to reduce the size and number of sulfide inclusions in the plate. Supplementary Requirement S5 is neither a substitute for Supplementary Requirement S4, Through Thickness Testing, nor a guarantee of a minimum level of through-thickness ductility.

1.2.4 The notch toughness requirements specified in Section 7 are suitable for application below water, or above water in areas of temperate climate (14°F [10°C] minimum service temperature). Cold-formed materials have less toughness due to straining than that of the original flat plates, especially in those areas aged by the attachment welding of structural braces. The requirements for plates in Section 7 fall into consideration typical losses in toughness due to straining and aging. Supplementary Requirements S7 and S8 deal with the strain-aging problem, and consideration should be given to invoking Supplementary Requirements S7 and/or S8 when the strain exceeds 5% or when (Nitrogen x % strain) exceeds 0.040.

1.2.4.1 For application with lower service temperatures, lower test temperatures should be considered. Supplementary Requirement 52 provides for impact tests at temperatures other than specified in Section 7 or Supplementary Requirement S 12. Supplementary Requirement 52.1 provides for Drop-Weight Slit Charpy U-bolt testing at  $-60^{\circ}\text{C}$ . Supplementary Requirement S2.2 provides for such testing at temperatures less than  $0^{\circ}\text{C}$  but other than  $-60^{\circ}\text{C}$ .

### 1.3 PREPRODUCTION QUALIFICATION

Supplementary Requirement 511 and Section 3 of API RP 2Z, dealing with CTOD testing of the weld wear-affected zone and with resistance to hydrogen cracking, respectively, address problems which are not normally dealt with in a "commodity grade" steel specification. These problems are not unique to Q&T steels, but arise because

- a. Users may be expecting higher performance from Q&T steels than is available with conventional steels (e.g., superior notch toughness), and
- b. This is a performance specification which accommodates a variety of different steelmaking practices, rather than a recipe which completely defines all particulars of chemistry, process, and quality control (essential variables).

It is intended that Supplementary Requirement S11 shall apply only as specified in advance by the purchaser. In many cases it may be possible to rely on prior data assembled by the steelmaker, provided no essential variables of the process have been changed.

## 2 Referenced Documents

RP2A-WSD	<i>Planning, Designing and Constructing Fixed Offshore Platforms—Working Stress Design</i>
Spec 2H	<i>Carbon Manganese Steel Plate for Offshore Platform Tubular Joints</i>
Spec 2W	<i>Steel Plates for Offshore Structures, Produced by Thermo-Mechanical Control Processing (TMCP)</i>
Spec 2Z	<i>Preproduction Qualification for Steel Plates for Offshore Structures</i>
ASTM <sup>1</sup>	
A 6/A 6M	<i>Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and</i>
A 370	<i>Standard Test Methods and Definitions for Mechanical Testing of Steel Products</i>
A 578/A 578M	<i>Standard Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications</i>
A 673/A 673M	<i>Standard Specification for Sampling Procedure for Impact Testing of Structural Steel</i>
E 10	<i>Standard Test Method for Brinell Hardness of Metallic Materials</i>
E 23	<i>Standard Test Methods for Notched Bar Impact Testing of Metallic Materials</i>
E 208	<i>Standard Test Method for Conducting Drop-Weight Test to Determine Nil-Ductility Transition Temperature of Ferritic Steels</i>

## 3 General Requirements for Delivery

3.1 Material furnished to this specification shall conform to the applicable requirements of A 6/A 6M, as modified

2 Plates are ordered to Supplementary Requirement S11 may be weld repaired in accordance with ASTM A 6/A 6M. Separate welding procedure qualifications shall be made for each nominal chemical composition of the plate material and filler metal to be used. Low hydrogen electrodes and welding processes shall be used.

3 Welding procedures for repairing plates ordered to Supplementary Requirement 511.3, CTOD Testing of Weld Heat Affected Zone, shall be subject to approval by the purchaser.

<sup>1</sup>American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428-2959, www.astm.org.



## 4 Manufacturing

### 4.1 MELTING

The steel shall be made by open hearth, basic oxygen, or electric furnace process.

### 4.2 HEAT TREATMENT

4.2.4 The plates shall be quenched-and-tempered by cooling to a temperature below (53 S°C) after reheating to a temperature between 1510°F (815°C) and (925°C) to produce an austenitic structure, holding a sufficient time to attain uniform temperature throughout the material, quenching in a suitable liquid medium, and tempering at a temperature in the range - 705°C).

## 5 Chemical Requirements

5.1 The steels shall conform to the requirements chemical composition, as determined by heat analysis, prescribed in 1 and to the requirements of 5.2 through 5.5.

5.2 The Carbon Equivalent (*CE*) of the heat analysis shall be calculated by both of the following equations:

$$CE = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15$$

$$Plot \quad C \quad Si/30 \quad (Mn \quad Cu \quad Cr)/20 \quad Ni/60 \quad Mo/15 \quad V/10 \quad SB$$

5.3 The maximum Carbon Equivalent shall be as prescribed in Table 2.

5.4 Any element intentionally added or which appears in the carbon equivalent calculation shall be reported.

5.5 Vanadium, zirconium, cerium and other rare earth elements not be intentionally added without the specific approval of the purchaser.

5.5.4 any of the above elements are added, the plate must have additional markings as per Section 8.1.e.

Table 1—Chemical Requirements (Heat Analysis, %)

Element	Grade 50	Grade
Carbon, max.	0.12	0.12
Manganese'		
to 1½ in. (40 mm) incl.	1.15—1.15	1.15
over 1½ in. (40 mm)	1.15-	1.15—
max.	0.03	0.03
max.	0.010	
Silicon	0.05—0.50	0.05—0.50
Phosphorus, max.	0.75	1.0
Chromium, max.	0.25	0.25
Molybdenum, max.	0.05	0.15
Nickel, max.	0.35	0.35
Titanium		
ES 0.005	0.005—0.02	—0.02
? > 0.005	0.005—0.02	—0.02
Niobium (Columbium), max.	0.03	0.03
Nitrogen, max.'	0.02	0.12
Copper, max.'	0.0005	
Aluminum		
Acid soluble or total	0.015—0.055	0.015—0.055
		0.02—

"Sec 5.2, 5.0, and 5.5.

'Nitrogen and boron shall not be intentionally added,

Nitrogen may be 0.013 max.. titanium is 0.01—0.02

Table 2—Carbon Equivalent Maximums

Grade	Thickness	CE	Pcm
Grade 50	To 1½ in. (40 mm) incl.	0.39	0.22
	Over 1½ in. (40 mm) to 3½ in. (90 mm) incl.	0.41	0.25
	Over 3½ in. (90 mm) to 6 in. (150 mm) incl.		0.24
Grade	To 1½ in. (40 mm) incl.	0.42	0.23
	Over 1½ in. (40 mm) to 4 in. (100 mm) incl.	0.45	0.25

## 6 Mechanical Requirements

- 6.1 The material, as represented by the test specimens, shall conform to the requirements prescribed in Table 3.
- 6.2 One tensile test shall be taken from each corner of each plate as required and tempered.

Table 3—Tensile Requirements

Property	Grade 50	Grade
Yield Strength, ksi (MPa)		
$t \leq 1$ in. (25 mm)	50 – 75 (345 – 517)	60 – — 621
$t > 1$ in. (25 mm)	50 – 70 (345 – 483)	60 – 85 (414 – 586)
Tensile Strength, ksi (MPa)	63	75 (517)
Elongation in 2 in. or 50 mm, min., %		
• Elongation in 8 in. or 200 mm, min., %	18	16

## 7 Notch Toughness Requirements

7.4 One Charpy V-notch impact test, consisting of three transverse specimens, shall be made on each plate as required and tempered. The specimens shall be taken from the mid-width and mid-thickness locations of the plate, and tested in accordance with ASTM A 673. Specimen size, test temperature and minimum energy requirements are shown in Table 4.

Due to the low carbon and sulfur contents, the strength of the full-size specimens will exceed the limit of ASTM E 23. To prevent the producer has the option of testing subsize specimens to any of the combinations of specimen size, energy requirement, and test temperature of Table 4, as indicated—Options A through E.

Table 4—Notch Toughness Requirements, Charpy V-Notch Testing

Grade	Option	Specimen Size in.	Specimen Size mm	Minimum Average Energy ft-lb (J)	Minimum Single Value ft-lb (J)	0.197 × 0.394 0.295 × 0.394 0.197 × 0.394
			10 × 10	30 (41)	25 (34)	–40 (–40)
	C		7.5 × 10	30 (41)	25 (34)	–40 (–40)
	D		5.0 × 10	30 (41)	25 (34)	–40 (–40)
					19 (26)	–50 (–46)
					13 (18)	–80 (–62)
	A		10 × 10			–40 (–40)
	B		7.5 × 10			–40 (–40)
			5.0 × 10			–40 (–40)
	D		7.5 × 10			–50 (–46)
			Test Temperature F (°C)			–80 (–62)

7.2 If the average energy value of a set of three specimens is less than the average value specified, or if the energy value of one specimen is less than the energy value specified for a single specimen, the tests shall be made as follows:

- a. Retest three additional specimens. The energy of each specimen must equal or exceed the minimum average energy value specified.
- b. If required energy values are not obtained upon test, the plate shall not be accepted without further reheat treatment and retesting.

7.3 After reheat treatment, specimens must be obtained and qualified as prescribed in 7.1.

## 8 Marking

8.1 Each plate shall be legibly steel die stamped, unless stenciling is specified by the purchaser, with name or brand of the manufacturer, heat and slab (plate) number, and API 2Y and grade at one end of the plate, for plates thicker than 12 in. (300 mm) from any edge.

Plates thicker than 1 in. (25 mm) thickness may be stenciled instead of stamped.

The following information shall also be marked as applicable:

- a. The API monogram may be applied to products complying with the requirements of this specification, but only by authorized manufacturers (see Appendix C).
- b. Grade 5 shall be marked API 2Y—50.  
Grade 60 shall be marked API 2Y
- c. If any elements previously referenced in Section 5.5 are added to the plate, the plate shall be marked with a “C” adjacent to the “Y” and the markings listed in 8.1.1 (e.g., API 2YC—SP).

## APPENDIX A—SUPPLEMENTARY REQUIREMENTS

By agreement between the purchaser and the material manufacturer, and when specified on the purchase order, the following Supplementary Requirements shall apply.

### S1 Ultrasonic Examination

**51.1** Pulse Echo ultrasonic examination shall be performed on each plate in accordance with ASTM Specification A 578/A 578M *Standard Specification for Alloy and clad Steel Plates for Special Applications*. Acceptance Standard—Level A shall be used. Any area where one or more discontinuities produce a continuous total loss of back wall reflection accompanied by continuous indications on the same plane that cannot be encompassed within a circle whose diameter is 3 in. (75 mm) shall be cause for rejection.

51.2 Examination reports shall be furnished for each plate, the areas with more than 50% loss of back reflection shall be located on the sketch.

**5.1.3** Optionally, and with prior consultation and agreement, Level C inspection may be used.

### S2 Notch Toughness Test at Lower Temperature

**52.4** Notch toughness tests shall be made in accordance with the requirements of Section 7 or Supplementary Requirement 512 and shall meet the requirements of Table S2-I in lieu of the requirements of Table 4 or Supplementary Requirement S12.2.

**52.2** Impact tests may be made at temperatures lower than those specified in Table 4 or Supplementary Requirement 512.2 and other than those specified in Table S2-I. The *testing* temperature shall be specified by the purchaser and agreed to by the material manufacturer.

**52.3** If the design condition requires a higher energy value, energy values higher than those stated in Table S2-1 may be specified subject to agreement between the purchaser and the material manufacturer.

### S3 Additional Tension Test

Two tension tests shall be taken on each plate as received and tempered. The test specimens shall be taken from a corner of the plate at both ends.

### S4 Through-Thickness (Z-Direction) Testing

**54.1** This Supplementary Requirement covers the procedure and acceptance standards for the determination of reduction-of-area using a tension test specimen whose axis is parallel to the surfaces of steel plates with nominal thickness  $\geq 1/2$  in. (12.5 mm) and greater. Definitions shall be in accordance with ASTM A 370.

**54.2** *Number of Test Specimens.* Two tests shall be taken from each plate as-rolled (parent plate).

**54.3** *Orientation of Test Specimens.* The longitudinal axis of the test specimens shall be perpendicular to the surface of the plate.

**54.4** *Location of Test Specimens.* One test specimen shall be taken at the ingot axis or cast slab longitudinal centerline at its intersection with each edge or end of the plate.

**54.5** *Preparation of Test Specimens.* Specimens shall be prepared as follows:

a. Prolongations shall be joined to opposite surfaces of the plate being tested, with their axes coincident. The joining method used should be one which results in a minimal heat-affected-zone in the portion of the plate being tested. Friction

(inertial), stud, electron beam, or shielded metal-arc welding methods have proven to be suitable. Pi elongation materials shall be selected so that tearing shall occur in the plate portion of the specimen.

b. Specimens shall be machined to the form and dimensions of the 0.500 in. (12.5 mm) minimum specimen of Figure 5 of ASTM A 370 *Terminology and Definitions*, except for the plate thickness less than 1/2 in. (32 mm) where the 0.350 in. (8.75 mm) test specimen may be used.

c. The full plate thickness shall be contained within the uniform section with no taper permitted. The length ("G" in Figure 5 of ASTM A 370) of the cylindrical section of the test piece shall be adjusted as necessary to contain the plate thickness within a uniform diameter throughout the section.

#### 52-1—Notch Toughness Requirements at Lower Temperatures Drop-Weight Testing— No-Break at =67°F (−55°C), or Charpy Impact Testing

Grade	Specimen Size in	Specimen Size mm	Minimum Average Energy ft lb (J)	Minimum Single Value ft-lb (J)	°F (°C)
70	0.394 × 0.394	10 × 10	30 (41)	25 (J4)	−76 (−60)
60	0.394 × 0.394	10 × 10	35 (48)	30 (41)	−76 (−60)

**54.6 Testing.** Tensile testing shall be conducted in accordance with the requirements of ASTM A 370.

**54.7 Acceptance Standards.** Standards for the acceptance of through-thickness testing shall be as follows:

a. Each test specimen shall exhibit a minimum reduction-of-area of 30%. If one of the two specimens from a plate is below 30%, but not below 25%, a test of two additional specimens from a location adjacent to the failed specimen shall be made, and both of these additional determinations shall equal or exceed 30%.

b. Minimum reduction-of-area limits higher than stated in Supplementary Requirement 54.7.a may be specified subject to agreement between the material manufacturer and the purchaser.

**54.8 Durability.** Plates accepted in accordance with this procedure for through-thickness testing shall be identified by stamping or stenciling "Z" adjacent to marking otherwise required (i.e., API 2Y-50Z).

## SS Low Sulfur Steel For Improved Through-Thickness Properties

**55.1 Intent.** The intent of this supplementary requirement is to provide, by chemical control, plates with low levels of sulfide inclusions and thereby a reduction of the potential for lamellar tearing of the plate in the area of attachment wells.

**55.2 Chemical.** The steels shall conform to the requirements for chemical composition prescribed in Table 1, except that the maximum content of sulfur on heat analysis shall be 0.006%.

**55.3 Through-Thickness Testing.** Through-thickness (Z-direction) tensile testing is not required by this Supplementary Requirement.

**55.4 Marking.** Plates accepted in accordance with this supplementary requirement shall be identified by stamping "LS" adjacent to marking otherwise required (i.e., API 2Y-50LS).

## S7 Low Nitrogen Content for Improved Notch Toughness in Strain-Aged Condition

**S7.1** The nitrogen content shall be 0.009% maximum on heat analysis.

## S8 Strain-Aged Charpy V-Notch Impact Tests

**58.d** Charpy V-notch impact test coupons representing the thickest and thinnest plate of each heat shall be uniformly strained  $\geq 5\%$ , or more if specified, in axial tension and aged at 460°F (250°C) for one hour at temperature prior to clamping the test specimens. The test results shall meet the requirements of Section 7.

## S9 Simulations of Postweld Heat Treatment

S9.4 A second set of test coupons shall be subjected to a simulated postweld heat treatment provided by the manufacturer that is representative of the thermal treatment to which the material will be subjected during fabrication. The temperature range, time at temperature, and cooling rates shall be as specified on the order.

## 510 Hardness Testing

This Supplementary Requirement covers the procedure and acceptance standards for surface hardness testing of steel plates furnished under this specification.

The hardness test shall be made by the J3000 hardness method as described in ASTM E 10 using a 3000 J/g load. By agreement, other hardness test methods may be used and their measurements converted to Brinell values. The hardness measurement shall be made on both top and bottom surfaces of specimens removed from the end of the plate as permitted. The mill surface and any decarburized layer shall be removed prior to testing. Not less than four hardness measurements shall be made on each plate, all of which must be within the acceptance limits shown below. If any individual measurement is outside the acceptance limits shown below, two additional measurements may be performed adjacent to the original impression. Both of the new measurements must comply with the acceptance limit in order to invalidate the original measurement.

**S10.3** The acceptance limits shall be as follows:

Grade 50	131—207 HBN
Grade 60	By agreement

## S11 Preproduction Qualification

S11.4 This Supplementary Requirement provides for prequalification by special welding and mechanical testing of a specific chemical composition range, in combination with specific steelmaking and rolling procedures, from a specific producer. The purpose of this Supplementary Requirement is to minimize the amount of trace and testing necessary to prepare and certify welding procedures at the fabrication yard.

**511.2** The specific testing required shall be that contained in Sections 3 or 4 or both of API RP 2Z, as specified on the purchase order. Prior qualification by a material manufacturer may be accepted for fulfillment of this Supplementary Requirement if documentation acceptable to the purchaser is provided.

A significant change in chemical composition or processing shall require either a separate full qualification (for major change) or an accelerated re-qualification (for minor change) as described in Section 5 of API RP 2Z.

**S11.3** Crack tip opening displacement (CTOD) testing of weld heat affected zone shall be performed in accordance with Section 3 of API RP 2Z, which provides for testing over the following range of conditions:

Heat input: 0.8 to 4.5 kJ/in. (20 to 114 J/in.)

Preheat: 100° to 250°C (212° to 480°F)

Required CTOD for Grade 50:

plates 3 in. (75 mm) and under in thickness:

0.25 mm at  $-10^{\circ}\text{C}$  (0.010 in. at  $14^{\circ}\text{F}$ )

plates over 3 in. (75 mm) in thickness:

0.3 mm at  $-10^{\circ}\text{C}$  (0.015 in. at  $14^{\circ}\text{F}$ )

Testing to a wider range of heat input, wider range of preheats, higher CTOD values, or lower test temperature, is permitted at the option of the material manufacturer or when specified by the purchaser, and shall be deemed to satisfy the minimum requirements of this Supplement.

S14.4 Weldability testing shall be conducted in accordance with Section 4 of API RP 2Z using two types of tests representing different levels of restraint: the Controlled Thermal Severity (CTS) test for moderate restraint, and the V-Groove test for high restraint.

## S12 Notch Toughness Using Drop-Weight Testing

**S12.1** 1 Prep-Weight tests shall be conducted. One plate per 50 ton lot or part thereof of the plates in each heat  $\frac{1}{2}$  inch (16 mm) or more in thickness shall be tested. The plate tested shall be the thickest gage in each 50 ton (45t) lot.

**S12.2** Drop-Weight tests shall be in accordance with ASTM E 205 on two P-3 specimens from the selected plate(s). The specimens shall be taken adjacent to the tensile test coupons and tested at  $-30^{\circ}\text{F}$  ( $-35^{\circ}\text{C}$ ). Both specimens shall meet the "no break" criteria at the test temperature, and the results shall be recorded.

S12.2.3 If one specimen fails ("breaks") on any plate tested, retests may be made as follows:

- Retest two additional specimens from each plate for which a specimen failed. Each of these two retest specimens must pass ("No Sreak").
- If any of the specimens fail upon retest the lot shall not be accepted without reheat treatment and repeating the tensile, Charpy V-notch impact, and drop weight tests.

## S13 Surface Quality

For applications where surface quality is considered critical, plates are to be finished in the blasted and inspected conditions. The depth of rolled-in scale or clusters of pits shall not exceed 0.015 in. (0.381 mm) and shall not result in an unfavorable condition. However, isolated individual pits not over 0.030 in. (0.762 mm) deep are acceptable provided plate thickness is not reduced below the specified minimum. Other surface imperfections such as tears, seams, snakes, blisters, scabs, etc. are not acceptable and must be conditioned without reducing the thickness below minimum. The surface imperfections may be removed by grinding provided each ground area is well paired and grinding does not reduce the thickness of the plate below minimum.

## S14 Thickness Tolerance

By agreement between purchaser and supplier, plates can be ordered to  $\frac{1}{2}$  standard over tolerance for thickness shown in ASTM A 6/A 6M.





## APPENDIX B—SUGGESTIONS FOR ORDERING API SPEC 2Y STEEL PLATE

In placing orders for steel plate to be manufactured in accordance with API Spec 2Y, the purchaser should specify the following on the purchase order:

Specification	API Spec 2Y
Quantity Size	As Required
Grade	50 60
Mill Inspection by Purchaser	State Advance Notice Requirements
Delivery Date and Shipping Instructions	As Required
Supplementary Requirements	As Required

The purchaser should state on the purchase order its requirements concerning the following Supplementary Requirements, which are optional with the purchaser.

Note: Section 5 of this specification addresses the supplementary requirements.

- 51 Ultrasonic Examination
- 52 Notch Toughness at Low Temperatures 
  - 52.1 Notch Toughness at
  - 52.2 Notch \_\_\_\_\_ at Other Than W0°C or
  - 52.3 3 HicJacr Notch Toughness Energy Values
- 53 Additional Tension test
- 54 Through-Thickness (Z direction) Testing
- 55 Low Sulfur Steel for Improved Through-Thickness Properties
- 57 Low Nitrogen Content for Improved Notch \_\_\_\_\_ in   
Strain-Aged Condition
- 58 Strain-Aged Charpy V Notch Impact Tests
- 59 Simulated Post-Weld Heat Treatment
- 510 Hardness Testing 
  - Preproduction Qualification
  - S 1.3 CTOD testing of weld heat affected zone
  - S i .4 Weldability (Hydrogen Cracking) test 
    - CP (Conventional Preheat) Level of Performance
    - MP (Modified Preheat) Level of Performance
- 512 Notch Toughness Using Drop Weight
- 513 Surface Qualify 
  - Thickness Tolerance



## APPENDIX C—API MONOGRAM

The API Monogram Program allows an API Licensee to apply the API Monogram to products. The use of the Monogram on products constitutes a representation and warranty by the Licensee to purchasers of the products that, on the date indicated, the products were produced in accordance with a verified quality management system and in accordance with an API product specification. The API Monogram Program delivers significant value to the international oil and gas industry by linking the verification of an organization's quality management system with the demonstrated ability to meet specific product specifications.

When used in conjunction with the requirements of the API License Agreement, API Specification Q1 defines the requirements for those organizations that wish to voluntarily obtain an API License to provide API Monogrammed products in accordance with an API product specification.

API Monogram Program Licenses are issued only after an on-site audit has verified that the Licensee conforms to the requirements described in API Specification Q1 in total.

For information on becoming an API Monogram Licensee, please contact API, Certification Programs, 1220 L Street, N. W., Washington, DC 20005. Call 202-682-8000 or by email at [certification@api.org](mailto:certification@api.org).