

Qualification of Distributors of Metallic Materials for Use in the Petroleum and Natural Gas Industries

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Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required to conform to the standard.

May: As used in a standard, “may” denotes a course of action permissible within the limits of a standard.

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Qualification of Distributors of Metallic Materials for Use in the Petroleum and Natural Gas Industries

1 Scope

1.1 Purpose

This standard specifies requirements for the qualification of distributors of metallic materials used in the petroleum and natural gas industries.

1.2 Applicability

This standard is applicable to distributors of metallic bar, plate, and tubular products where API product standards require such services or are otherwise specified as a requirement for conformance. For organizations that manufacture and distribute metallic material, this standard only addresses the distribution portion of their processes.

NOTE This standard does not limit the responsibility of any manufacturer of commercial products using metallic materials and manufactured to an API standard from its responsibility for conformance with all applicable requirements of that API standard.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

API Specification Q1, *Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*

API Standard 20D, *Nondestructive Examination Services for Equipment Used in the Petroleum and Natural Gas Industry*

API Standard 20H, *Heat Treatment Services – Batch Type for Equipment used in the Petroleum and Natural Gas Industry*

API Standard 20M, *Qualification of Suppliers of Machining Services for Use in the Petroleum and Natural Gas Industry*

API Standard 20N, *Heat Treatment Services – Continuous Line for Equipment Used in the Petroleum and Natural Gas Industry*

AMS 2750,¹ *Pyrometry*

ISO² /IEC 17020,³ *Requirements for the operation of various types of bodies performing inspection*

ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories*

¹ SAE International, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096, www.sae.org.

² International Organization for Standardization, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, www.iso.org.

³ International Electrotechnical Commission, 3 rue de Varembé, PO Box 131, CH-1211 Geneva 20, Switzerland, www.iec.ch.

3 Terms, Definitions, and Acronyms

3.1 Terms and Definitions

3.1.1

acceptance criteria

Defined limits placed on characteristics of materials, products, or services.

3.1.2

calibration

The process of comparison to a standard of known accuracy, comparison of results against testing, measuring, monitoring, and detection equipment acceptance criteria, and, if applicable, making needed adjustment(s).

3.1.3

chemical analysis

Determination of the chemical composition of material.

3.1.4

conformance

Meeting specified requirements.

3.1.5

distributor

An organization that maintains and provides metallic bar, plate, and tubular products for resale.

3.1.6

heat treatment

A specified, timed sequence of controlled heating and cooling of materials for the purpose of changing physical or mechanical properties.

3.1.7

metallic material

Any product included in the scope of this standard.

3.1.8

mill

A factory in which metals are hot worked, cold worked, or melted and cast into standard shapes suitable for secondary fabrication into commercial product.

3.1.9

outsourced

A function or process that is performed by an external supplier on behalf of the distributor.

3.1.10

processes that require validation

Processes where resulting output cannot be verified by subsequent monitoring or measurement.

3.1.11

receiving verification

The process of ensuring the product received meets purchase requirements.

3.1.12

remote technical assessment

A technical assessment of capabilities performed using a method other than an on-site assessment.

NOTE This includes but is not limited to use of information and communication technologies to gather information, interview auditee(s), etc., and may include use of a checklist or a survey.

3.1.13**service supplier**

An organization that performs activities on behalf of the distributor.

3.1.14**sub-distributor**

A secondary distributor that is a supplier to the primary distributor.

3.1.15**traceability**

The ability to verify the history and delivery location of an item by means of documented record identification.

3.1.16**technical authority**

A competent and technically qualified person or organization with evidence to demonstrate the expertise, skills, and experience required to perform the assessment(s).

NOTE Technical authority may also be considered a subject-matter expert (SME).

3.1.17**validation**

Confirmation, through the provision of objective evidence generated from testing, that specific requirements have been fulfilled.

3.1.18**verification**

Confirmation, through the provision of objective evidence, that specific requirements have been fulfilled.

NOTE The objective evidence needed for verification can be the result of an inspection or of other forms of determination, such as performing alternative calculations or reviewing documents.

3.2 Acronyms

FBH	flat-bottom hole
MOC	management of change
MTR	material test report
NDE	nondestructive examination
QMS	quality management system

4 Distributor Qualification**4.1 Facilities and Equipment**

To conform to this standard, the distributor shall have the following capabilities, at a minimum:

- equipment to receive and ship material to customers;
- a facility to store and maintain physical inventory;
- appropriate handling and lifting equipment;
- inspection and test equipment.

4.2 Activities Performed by the Distributor

The distributor shall maintain the capability to perform the activities listed in Table 1. When these activities are not performed at the distributor's facility and are not part of a purchased service, they shall be performed by the distributor's personnel.

Table 1—Process Activities Performed by the Distributor

Item	Process Activity
1	Receiving verification
2	Traceability
3	Marking
4	Final inspection

4.3 Quality Management System (QMS)

The distributor shall establish, document, implement, and maintain at all times a QMS conforming to API Specification Q1. In addition, the distributor shall be responsible for conforming to all of the applicable requirements of this standard.

5 Responsibilities and Duties

The distributor shall ensure that:

- all functions are performed in accordance with specified standards and applicable quality control criteria;
- operations are only performed for which the distributor is adequately equipped and has personnel who are qualified against defined competencies;
- sub-tier suppliers of products or services are controlled;
- testing, measurement, and monitoring equipment is calibrated, and personnel are qualified in accordance with the requirements of the distributor's written procedure;
- the facility and equipment are properly maintained;
- any discrepancy or limitation imposed on the requested material and associated operations by such factors as size, traceability, form, shape, material, or procedure are communicated to the purchaser;
- any irregularity or deficiency noted in the purchaser's procurement documents are communicated to the purchaser; and
- formal reports of all materials supplied are promptly provided to the purchaser.

6 Personnel Training and Competency Requirements

6.1 Personnel shall be competent based on the appropriate education, training, skills, and experience needed to meet product and customer requirements. A written procedure shall define personnel competency and identify training and qualification requirements. The organization shall identify:

- roles that require a knowledge of metallic material processing and testing, and the level of knowledge;
- methods and frequency required for personnel training qualifications;

- knowledge and training necessary to address specific customer requirements;
- qualifications required for personnel performing processes that require validation; and
- method(s) used to verify the competency of personnel.

6.2 The distributor shall maintain evidence of conformity to the requirements of Section 6 of this document.

7 Distributor Process Control

7.1 General

This section addresses the minimum required controls for a distributor to supply metallic material to their customer.

7.2 Review of Order Requirements

7.2.1 An order review shall be conducted prior to the distributor's commitment to deliver the product. The distributor shall maintain a documented procedure for the review of order requirements that addresses, at a minimum, that:

- purchase order requirements are identified, reviewed, understood, and documented;
- the distributor has the capability to meet the purchase order requirements;
- when required by the purchaser, purchase order requirements are acknowledged; and
- any deviations and/or clarifications accepted by the purchaser shall be documented.

7.2.2 Where contract requirements are changed, the distributor shall ensure that relevant documents are amended and that relevant personnel are made aware of the changed requirements.

7.2.3 Records of the results of the review, including resulting actions, shall be maintained.

7.3 Control of Mills

7.3.1 General

Distributors shall maintain a documented procedure(s) to ensure that the mill has the capability to meet the established requirements for the supply of metallic materials. The procedure(s) shall conform to the purchasing requirements in API Specification Q1.

7.3.2 Initial Approval of a Mill

7.3.2.1 The distributor shall ensure the mill maintains a QMS.

7.3.2.2 In addition, the distributor shall also:

- a) maintain a documented procedure to validate the mill's initial order to the agreed-upon purchasing requirements. The documented procedure shall include requirements and acceptance criteria for the following:
 - 1) chemical analysis;
 - 2) mechanical testing;
 - 3) NDE; and

- 4) microstructure.
- b) perform an assessment of the mill's capabilities and controls through either:
 - 1) verification of an active API license for applicable products; or
 - 2) an on-site technical assessment by a technical authority; or
 - 3) a remote technical assessment by a technical authority. If the initial results do not meet the distributor's requirements, an on-site technical assessment shall be performed by a technical authority. The remote technical assessment shall include, as applicable to the scope of supply, the following:
 - i) scope of capabilities (grades, sizes, product form);
 - ii) melt practice, pouring/casting, and capacity (tonnage);
 - iii) testing capability and equipment;
 - iv) calibration of measuring and testing equipment;
 - v) outsourced activities;
 - vi) processing, such as rolling, forging, straightening, etc.;
 - vii) heat-treatment capabilities, to include heat-treatment furnace qualification, method used for instrument calibration, and quench control;
 - viii) NDE capabilities;
 - ix) certifications/records;
 - x) industry licenses or accreditation; and
 - xi) process monitoring and controls.

NOTE An example of a remote technical assessment (Mill Remote Technical Assessment) is included in Annex A for use as a guide for a distributor in preparing a remote technical assessment.

7.3.2.3 Records of the results of the mill approval, including resulting actions, shall be maintained.

7.3.3 Periodic Evaluation of a Mill

The distributor shall maintain a documented procedure for the monitoring and re-evaluation of mills. The procedure shall identify the minimum performance requirements and the process for continual monitoring of the mill against these requirements. The procedure shall address the actions required when a mill does not meet these requirements.

The mill re-evaluation shall be performed through one or more of the following:

- on-site assessment by a technical authority;
- remote technical assessment to be reviewed by a technical authority;
- review of supplier performance; or
- verification of an active applicable API license.

The distributor shall test material on a periodic basis in accordance with the applicable material standard by a laboratory approved for the required testing service, as specified in 7.4.3.

The frequency of periodic evaluation and material testing shall be based on a risk assessment of product quality and the availability of alternate sources. The risk assessment shall take into account a mill's performance history, purchasing frequency, and any changes that have occurred at the facility. The frequency shall not exceed 36 months and shall be documented.

Records of the results of the mill periodic evaluation, including resulting actions, shall be maintained.

7.3.4 Review of Order Requirements with a Mill

The distributor shall perform an order review with the mill to ensure that the product ordered meets the requirements of this standard and any additional purchase order-specific requirements.

Records of the results of the review with the mill, including any resulting actions, shall be maintained.

7.4 Control of Sub-Distributors and Service Suppliers

7.4.1 General

Distributors shall maintain a documented procedure to ensure that outsourced activities conform to specified requirements. The procedure shall conform to the purchasing requirements in API Specification Q1.

7.4.2 Initial Approval of Sub-Distributors

7.4.2.1 Distributors may procure materials from sub-distributors. The distributor shall ensure that the sub-distributor is qualified through one of the following methods:

- a) The sub-distributor demonstrates conformance to API Standard 20J; or
- b) The supplying mill for the sub-distributor has been approved by the distributor.

7.4.2.2 Additionally, the distributor shall ensure the sub-distributor maintains a QMS or meets one of the following:

- a) verification that the sub-distributor's QMS conforms to the quality system requirements specified for suppliers by the distributor; or
- b) assessment of the sub-distributor to meet the distributor's purchasing requirements; or
- c) assessment of the product upon delivery or activity upon completion.

7.4.2.3 Records of the results of the sub-distributor approval, including resulting actions, shall be maintained.

7.4.3 Initial Approval of Service Suppliers

When service suppliers are used, the distributor shall approve service suppliers through an assessment of the service supplier's capabilities and controls. The approval shall be through:

- 1) an on-site technical assessment by a technical authority; or
- 2) evidence of conformance to an applicable industry standard as defined in Table 2, reviewed by a technical authority.

Records of the results of the service supplier approval, including resulting actions, shall be maintained.

Table 2—Service Supplier Industry Standards and Distributor Performed Processes

Process	Industry Standard
Machining	Evidence of conformance to API Standard 20M MQL 2 or greater.
Material testing	Evidence of conformance to ISO 17025 for the required service.
Continuous heat treatment	Evidence of conformance to API Standard 20N or AMS 2750.
Batch heat treatment	Evidence of conformance to API Standard 20H or AMS 2750.
Nondestructive examination	Evidence of conformance to API Standard 20D, ISO 17025, or ISO 17020 for the required service.

7.4.4 Periodic Evaluation of Sub-Distributors and Service Suppliers

7.4.4.1 Requirements

The distributor shall maintain a documented procedure for the monitoring and re-evaluation of sub-distributors and service suppliers. The procedure shall identify the minimum performance requirements and the process for continual monitoring against these requirements. The frequency of periodic evaluation shall be based upon a risk assessment of product quality and the availability of alternate sources. The risk assessment shall take into account a sub-distributor or service supplier performance history, purchasing frequency, and any changes that have occurred at the facility. The planned frequency of the evaluation shall be documented.

The sub-distributor and service supplier re-evaluation shall be performed through one or more of the following:

- on-site assessment by a technical authority;
- remote technical assessment to be reviewed by a technical authority;
- review of supplier performance; or
- evidence of conformance to an applicable industry standard.

The procedure shall address the actions required when a sub-distributor or service supplier does not meet these requirements.

Records of the results of the sub-distributor and service supplier evaluation, including resulting actions, shall be maintained.

7.4.5 Review of Order Requirements with Sub-Distributors and Service Suppliers

The distributor shall ensure that the sub-distributor and service supplier can provide a product or service that meets the requirements of this standard and any additional purchase order-specific requirements.

The distributor shall maintain records of the order review, including resulting actions.

7.5 Distributor Performed Processes

The distributor may perform additional processes on the metallic material product prior to delivery to the customer. If the processes listed in Table 2 are performed, the distributor shall be in conformance with the listed standards.

7.6 Sampling for Material Testing

7.6.1 When a distributor provides a sample to a test facility for material testing, the distributor shall maintain a procedure documenting the requirements for collection and preparation of the test specimen. The procedure shall define the factors to be controlled to ensure the validity of the test results, conformance with applicable

material or test specifications, and traceability of the test specimen to the original material. This procedure shall be available where the sampling is conducted.

7.6.2 Records of sampling shall be maintained.

7.7 Inspection Requirements

7.7.1 General

The distributor shall maintain a documented procedure that defines the inspection process and acceptance criteria. The procedure shall include requirements for receiving, in-process, and final inspections, and ensure that identification and traceability of product is maintained throughout the process, as specified in 7.8.

Where sampling is used, the sampling plan shall be based on evaluation of the risk and shall be documented.

7.7.2 Receiving Inspection

The distributor shall verify that the product or service delivered meets stated purchase order requirements and associated acceptance criteria.

7.7.3 In-process and Final Inspection

The distributor shall verify that the product meets the customer's requirements. This also includes marking, packaging, and documentation requirements.

7.7.4 Records

Records of inspection shall be maintained.

7.8 Identification and Traceability

The distributor shall maintain documented procedures for control of identification and traceability throughout the process. The procedure shall include, at a minimum:

- the method of marking the product;
- the method of ensuring the physical marking is traceable to all records associated with the product;
- the method for ensuring traceability of the product back to received material after any processing during which the original marking is removed;
- the process for verification of product traceability during storage;
- the requirements for maintenance or replacement of identification and/or traceability marks;
- the method of ensuring traceability for any product during outsourced processes; and
- the method for verifying traceability upon material receipt.

7.9 Nonconforming Product

The distributor shall maintain a documented procedure to define the controls and responsibilities needed to ensure that the nonconforming product is identified and controlled to prevent its unintended use or delivery.

Records of disposition of nonconforming products shall be maintained.

7.10 Customer-supplied Property

The distributor shall maintain a documented procedure for the identification, verification, safeguarding, preservation, maintenance, and control of customer-supplied property, including intellectual property and data, while under control of the organization. The procedure shall include requirements for reporting to the customer any loss, damage, or unsuitability for use of customer-supplied property.

Records for the control and disposition of customer-supplied property shall be maintained.

7.11 Preservation of the Product

The distributor shall maintain documented procedures defining the methods used to preserve the product throughout the process to maintain product integrity.

Corrosion protection of material shall be based on material type and customer requirements.

Preservation shall include transportation, handling, storage, packaging, and protection. At a minimum, the following controls shall be addressed:

- residual magnetism;
- mechanical damage from handling;
- method of preventing dissimilar metal contact and/or contamination;
- residual chemical contamination from cleaning solutions and markers; and
- environmental exposure for alloys susceptible to corrosion.

7.12 Measuring and Testing Equipment

The distributor shall maintain a documented procedure to ensure that testing, measurement, and monitoring equipment is calibrated or verified and maintained, and that the equipment is used in a manner that is consistent with monitoring and measurement requirements. Calibration shall conform to and be traceable to nationally or internationally recognized standards, as applicable.

Records of calibration shall be maintained.

8 Management of Change (MOC)

8.1 The distributor shall maintain a documented procedure for MOC. The MOC process shall be initiated when a change is made that may impact the quality or availability of the product. The procedure shall address that an MOC is required when a change is made at the distributor, mill, sub-distributor, or service supplier level. Some examples of changes that require an MOC include but are not limited to:

- management/ownership change;
- facility location change;
- process change;
- supplier change;
- revisions to applicable industry codes that may affect material provided.

8.2 Minimum criteria to include in the MOC evaluation are:

- nature of the change;
- location where the change is occurring;
- personnel affecting product conformance;
- identification and assessment of risk due to the change;
- actions taken to address risk due to the change;
- impact of the change on the product or service.

8.3 The distributor shall notify relevant parties, including the customer when required by contract, of the change and any residual or new risk due to the change.

9 Records and Document Control

9.1 The distributor shall maintain a documented procedure to identify the controls and responsibilities needed for the identification, collection, storage, protection, retrieval, retention, and disposition of records required in this standard.

9.2 Records shall remain legible, identifiable, and retrievable. Records shall be retained for a minimum of 10 years after the date of shipment or as required by customer, legal, and other applicable requirements, whichever is longer.

Annex A

(informative)

Mill Remote Technical Assessment

This annex provides an example of an extensive mill remote technical assessment that may be used as a guide by the distributor. The form is intended to construct the basis for the remote technical assessment required by this document, and may be used as is or in part.

Mill Remote Technical Assessment (Fill a form for each separate mill, if more than one)

Date: _____

1. General

Mill Name			
Address			
Telephone number		E-mail:	
Supplier contact name		Title/function:	
Type of facility		Years in operation:	Annual capacity:

2. Product size capability

Bar:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Size range: _____
Forgings:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Size range: _____
Tubing:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Size range: _____
Plates:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Size range: _____
Others:	<input type="checkbox"/> Yes	<input type="checkbox"/> No	Size range: _____

Grades Produced (list all):

Carbon Steel	Low Alloy	Stainless	Others

2.1 Production Overview—Carbon Steel

Melting	Blast furnace	<input type="checkbox"/>	BOF melting	<input type="checkbox"/>	EAF melting	<input type="checkbox"/>	None	<input type="checkbox"/>
Refining	Vacuum Degas	<input type="checkbox"/>	Argon bubbling	<input type="checkbox"/>	Ladle refining	<input type="checkbox"/>	None	<input type="checkbox"/>
Billet/Blooms	External source	<input type="checkbox"/>	Internal billets	<input type="checkbox"/>	Both	<input type="checkbox"/>		

2.2 Production Overview—Low Alloy Steel

Melting	Blast furnace	<input type="checkbox"/>	BOF melting	<input type="checkbox"/>	EAF melting	<input type="checkbox"/>	None	<input type="checkbox"/>
Refining	Vacuum Degas	<input type="checkbox"/>	Argon bubbling	<input type="checkbox"/>	Ladle refining	<input type="checkbox"/>	None	<input type="checkbox"/>
Billet/Blooms	External source	<input type="checkbox"/>	Internal source	<input type="checkbox"/>	Both	<input type="checkbox"/>		

2.3 Production Overview—Stainless Steels

Melting	Blast furnace	<input type="checkbox"/>	BOF melting	<input type="checkbox"/>	EAF melting	<input type="checkbox"/>	None	<input type="checkbox"/>
Refining	Vacuum Degas	<input type="checkbox"/>	Argon bubbling	<input type="checkbox"/>	Ladle refining	<input type="checkbox"/>	None	<input type="checkbox"/>
Billet/Blooms	External source	<input type="checkbox"/>	Internal source	<input type="checkbox"/>	Both	<input type="checkbox"/>		

2.4 Production Overview—Other Materials

Melting	Blast furnace	<input type="checkbox"/>	BOF melting	<input type="checkbox"/>	EAF	<input type="checkbox"/>	None	<input type="checkbox"/>
Refining	Vacuum Degas	<input type="checkbox"/>	Argon bubbling	<input type="checkbox"/>	Ladle refining	<input type="checkbox"/>	None	<input type="checkbox"/>
Billet/Blooms	External source	<input type="checkbox"/>	Internal billets	<input type="checkbox"/>	Both	<input type="checkbox"/>		

3. Inspection of Blooms, Billets, Bars**Flaw Detection:**

Visual? ☐ Yes ☐ No

Product inspected: ☐ Bloom ☐ Billet ☐ Bar ☐ Coil ☐ Rod ☐ Other _____

MPI? ☐ Yes ☐ No

If yes, specify: ☐ A.C. ☐ D.C.

Product inspected: ☐ Bloom ☐ Billet ☐ Ingot

Eddy Current? ☐ Yes ☐ No

If yes, specify bar size limitation: _____

Minimum flaw size capability: _____

Flaw orientation: ☐ Longitudinal ☐ Transverse

Ultrasonic? ☐ Yes ☐ No

If yes, what type? _____

Thermal imaging? ☐ Yes ☐ No

Hot eddy current? ☐ Yes ☐ No

Conditioning is performed? ☐ Yes ☐ No

Defect working method _____

If yes, specify ☐ Chipping ☐ Grinding ☐ Scarfing ☐ Other _____

Product conditioned: ☐ Bloom ☐ Billet ☐ Slab ☐ Other _____

4. Rolling & Piercing**Rolling/Piercing**

Mill type: _____

Size range/ length capability: _____

Grades that can be rolled and pierced on this unit: _____

Reheat Furnace

Batch furnace used: _____ Number: _____

Type: ☐ Billet ☐ Bloom ☐ Ingot

Number of re-heat furnaces: _____

Furnace dimensions: _____

Fuel: _____

Type of burners: _____

Location: ☐ Top ☐ Bottom ☐ Both ☐ Sides

Waste heat recovery? ☐ Yes ☐ No

Type of hearth: ☐ Walking beam ☐ Pusher ☐ Hot skids ☐ Stationary

Number of zones: _____

Furnace computer controlled? ☐ Yes ☐ No

Number of controlling thermocouples: _____

Position of thermocouples: _____

Date of last survey: _____

Average reheat time: _____ hours

No. of billets in the furnace at one time: _____

How are billets/blooms/ingots/mapped and selected from the rolling furnaces to maintain traceability?

Cut-to-length or multiple-length bars are:

Hot sheared? ☐ Yes ☐ No

Cold sheared? ☐ Yes ☐ No

Warm sheared at a temperature of _____

If yes, are the ends stress relieved? ☐ Yes ☐ No

What is the stress relief temperature? _____

What are the typical grades that need to be stress relieved? _____

Hot sawed? ☐ Yes ☐ No

Cold sawed? ☐ Yes ☐ No

Mill computer controlled: ☐ Total ☐ Partial ☐ None

Explain how heat number traceability is maintained on the product:

Cooling bed? ☐ Yes ☐ No

If yes, what type: _____

Is product rotated? ☐ Yes ☐ No

Is product water-cooled after rolling? ☐ Yes ☐ No

Storage of product

Identify: ☐ Covered ☐ Exposed

Describe: _____

Warehouse: _____

Cutting to length

Method of cutting: _____

Straightening

Criteria for use: _____

Type of machine: _____ Configuration: _____

Surface quality controls: _____

Product IdentificationNumerical ID (stamp, tag, etc.)? ☐ Yes ☐ No

Method used to maintain heat identity: _____

Paint code? _____

Other: _____

5. Heat TreatmentIn-house treatment or is this process outsourced? ☐ In-house ☐ Outsourced

If outsourced, name of vendor: _____

Has vendor been site audited? ☐ Yes ☐ No ISO certified? ☐ Yes ☐ No

#	Name of Furnace (Manufacturer)	Type of Furnace (Batch/Continuous)	Size Range Capabilities (min/max OD)	Maximum Length
1				
2				
3				

Furnace Details☐ Batch Furnace☐ Continuous Line Heat TreatHeating method: ☐ Gas ☐ Oil ☐ Induction ☐ Electric ☐ OtherFurnace atmosphere: ☐ Reducing ☐ Oxidizing ☐ Vacuum ☐ Sealed ☐ OtherWalls: ☐ Fire brick ☐ FiberBed layout: ☐ Stationary brick ☐ Walking beam ☐ Rollers

Furnace dimensions:

Batch: _____ x _____ x _____

Continuous line: _____

Number of burners: _____ ☐ Top fired ☐ Bottom fired

Locations of burners in the furnace: _____

Furnace monitoring method: ☐ Furnace set point thermocouples ☐ Optical ☐ Other

Number of monitoring furnace thermocouples _____ Locations in the furnace: _____

Capable of using heat sink or contact thermocouples? ☐ Yes ☐ No

Any restrictions? _____

Furnace charts used: ☐ Yes ☐ No Available upon request? ☐ Yes ☐ No
 Furnace surveys conducted: ☐ Quarterly ☐ Every 6 months ☐ Annually ☐ Other _____

Furnace Survey Information:

Number of thermocouples used: _____

Is there a standard procedure used for this furnace survey? _____

Is the entire furnace mapped with thermocouples in this survey? ☐ Yes ☐ No

If no, explain: _____

Is the survey conducted with a full load or empty? _____

Furnace temperature certified for use from _____ °C/°F to _____ °C/°F

Controlled to within ± _____ °C/°F Date of last survey _____

Statistical Process Control used? ☐ Yes ☐ No

Other Furnaces

Provide the same furnace information as above for more than one furnace.

Quench Capabilities

Bath-type quench? ☐ Yes ☐ No Number of tanks: _____

Continuous-line quench? ☐ Yes ☐ No Number of lines: _____

Can as-quenched test be performed on the material? ☐ Yes ☐ No

For bath-type quench processes:

Tank Description

Quench method: ☐ Water ☐ Polymer ☐ Oil

If polymer is used, describe the method and frequency of tests to ensure the concentration is adequate:

If oil is used, describe the type of oil used: _____

Does the oil-quench process use any cooling methods? ☐ Yes ☐ No

Describe: _____

Capacity of the tank gallons: _____ Dimensions: _____

If necessary, can a sample be cut off the product prior to tempering? ☐ Yes ☐ No

Number of impellers in tank for agitation: _____ Immersion: ☐ Manual ☐ Automatic

Is agitation sufficient to ensure a good quench? ☐ Yes ☐ No

How is this determined and monitored? _____

Capable of monitoring quench temperature before and after quench? ☐ Yes ☐ No

Cooling towers used? ☐ Yes ☐ No Filtration system? ☐ Yes ☐ No

Estimated quench delay time from austenitizing furnace to beginning of quench: _____ minutes

Other Tanks

Provide the same furnace information as above for more than one tank.

For continuous-line quench process:

(Note: If the continuous line uses an immersion type quench, report the information above.)

Type of quench process used: _____

No. of spray rings used: _____ Angled? ☐ Yes ☐ No Straight? ☐ Yes ☐ No

Scale pressure spray used prior to quench? ☐ Yes ☐ No

Water pressure: _____ GPM

Is there an inside diameter quench lance used for tubing? ☐ Yes ☐ No

Is the water temperature monitored prior to quench? ☐ Yes ☐ No

Are cooling towers used? ☐ Yes ☐ No Filtration system? ☐ Yes ☐ No

Estimated quench delay time from austenitizing furnace to beginning of quench: _____ minutes/seconds

Is the material at the exit zone of the quench monitored via a temperature-monitoring device? ☐ Yes ☐ No

If no, is there sufficient evidence/tests to ensure that the material has received an adequate quench?

Describe:

6. Routine Metallurgical Testing

Lab Certified to: _____ For: _____

Chemistry

Name of unit(s) used to determine chemistry: _____

Calibration frequency: _____

Does the mill use wet _____ and dry _____ methods to determine elements?

When is the ladle analysis obtained? _____

When are product analyses obtained? _____

Typical residual element levels are:

Cu: _____ Cr: _____ V: _____ Sn: _____ As: _____ Ni: _____

Mo: _____ Cb/Nb: _____ Ti: _____ Sb: _____ Cd: _____

Is hydrogen content routinely sampled? _____

Are heats free of mercury contamination? ☐ Yes ☐ No

Mechanical Properties

Name and type of test equipment:

Testing in accordance with ASTM A370? ☐ Yes ☐ No

If no, what standard is used? _____

How often is the equipment calibrated? _____

In-house calibration, or is this process outsourced? ☐ In-house ☐ Outsourced

If outsourced, name of vendor: _____

Has vendor been site audited? ☐ Yes ☐ No ISO certified? ☐ Yes ☐ No

If third party, supply name of the vendor: _____

How are tensile specimens identified and correlated to a specific order? _____

Tensile configuration: ☐ Round ☐ Flat strip ☐ Sub-size specimens ☐ Threaded ends

Tensile charts kept on file: ☐ Yes ☐ No If yes, how long? _____

Broken tensile specimens kept for a period of time? ☐ Yes ☐ No If yes, how long? _____

Charpy Impacts

Describe the Charpy impact equipment: _____

Calibration frequency: _____

Who furnishes the Charpy specimens for the calibration? _____

What standard is used for this process? _____

Is the "V" notch of the specimens routinely checked to see if it is in tolerance? ☐ Yes ☐ No

Is an optical comparator used? ☐ Yes ☐ No

Frequency of this check? _____

Temperature capability of this equipment? From: _____ °C/°F to: _____ °C/°F

Is ASTM E23 used for this process? ☐ Yes ☐ No If no, what standard is used? _____

Can the mill evaluate lateral expansion? ☐ Yes ☐ No

Can the mill evaluate % shear of the impact specimens? ☐ Yes ☐ No

Does the mill have any capability to perform CTOD tests (ASTM E1820 or BS-7448) or other fracture toughness testing? ☐ Yes ☐ No

Hardness Testing Capabilities

Describe the hardness testing equipment in the lab:

Internal calibration: ☐ Yes ☐ No Calibration frequency: _____

External calibration: ☐ Yes ☐ No Calibration frequency: _____

Describe the hardness testing equipment in the plant:

Internal calibration: ☐ Yes ☐ No Calibration frequency: _____

External calibration: ☐ Yes ☐ No Calibration frequency: _____

Standard used for Rockwell? _____

Standard used for Brinell hardness? _____

Corrosion Testing Capabilities

Does the mill have any corrosion testing capabilities? ☐ Yes ☐ No

If yes, describe the tests and standards used:

Hardenability

Routinely checked? _____

Jominy sample:

☐ Machined ☐ Cast ☐ Rolled ☐ Forged ☐ Calculated
Can the mill calculate and report the ideal diameter (DI) per SAE or ASTM? ☐ Yes ☐ No**Macro-etch/Chemical Segregation Test ASTM E381** ☐ Yes ☐ No

If yes, specify the test method: _____

Describe sampling plan: _____

Product tested: ☐ Bloom ☐ Billet ☐ Slab ☐ Other _____

Typical macro results for alloy steels: _____

Micro Cleanliness, ASTM E45 Method A, measured ☐ Yes ☐ NoMetallographic? ☐ Yes ☐ NoImage analysis used? ☐ Yes ☐ No

Describe the typical inclusion level on your alloy steels: _____

Grain Size Determination

How is the grain size determined? _____

Method used: _____

When is the material sampled for grain size? _____

Fine grain practice (ASTM E112-grain size of 5 or finer): _____ Typical range: _____

How is the grain size reported (i.e., austenitic or ferritic)? _____

What is the typical practice for grain refinement? _____

Can the mill perform microanalysis? ☐ Yes ☐ NoCan the mill evaluate % martensite in the microstructure? ☐ Yes ☐ NoCan the mill determine ferrite content for stainless-steel alloys? ☐ Yes ☐ No ☐ NA**7. Straightening Capabilities**

Describe the type of straightening capabilities:

Is the straightening performed ☐ Hot ☐ ColdIf hot straightening is employed, is there a minimum temperature requirement? ☐ Yes ☐ No

Comment: _____

If the straightening is performed cold, is the material stress relieved after this process? ☐ Yes ☐ NoIf no, can the mill guarantee that the material did not exceed 5 % outer fiber deformation during the straightening process? ☐ Yes ☐ No

If the material is stress relieved, is it stacked, bundled, or loaded individually? _____

Comment: _____

What tolerance of straightness can we expect from the mill? _____

8. Finishing and Marking Capabilities

Can the mill perform any of the following:

Rough turning? ☐ Yes ☐ No RMS Finish _____
 Peeling? ☐ Yes ☐ No RMS Finish _____
 Grinding? ☐ Yes ☐ No RMS Finish _____
 Polishing? ☐ Yes ☐ No RMS Finish _____
 Sand blasting? ☐ Yes ☐ No
 Shot blasting? ☐ Yes ☐ No Finish _____

Does the mill stamp heat numbers on the ends of the material? ☐ Yes ☐ No

If no, what form of traceability is maintained on the material? _____

Is paint stenciling used as a standard marking practice? ☐ Yes ☐ No

If yes, is it continuous line marking or manually applied? _____

Can the mill maintain joint traceability (for tubes) and mark them accordingly? ☐ Yes ☐ No

Is there any manual or automatic grinding performed on the material to remove surface defects? ☐ Yes ☐ No

If yes, what criteria is used to determine depth of grinds? _____

Can the mill paint color codes on the end of the material, if necessary? ☐ Yes ☐ No

9. Nondestructive Testing

In-house treatment, or is this process outsourced? ☐ In-house ☐ Outsourced

If outsourced, please name vendor: _____

Has vendor been site audited? ☐ Yes ☐ No ISO certified? ☐ Yes ☐ No

List the NDE capabilities below:

Test type	Manual/Automatic	Size limits	Standard used	Rejection criteria
Ultrasonic straight beam	_____	_____	_____	_____

If automatic, number of transducers for the scan: _____

100 % of the component subject to scan? ☐ Yes ☐ No

Equipment description:

For Bars: Can the mill perform an axial straight beam from the ends of a bar? ☐ Yes ☐ No

If yes, is there a calibrated standard established? ☐ Yes ☐ No

Back reflection method used? ☐ Yes ☐ No

Axial 45 % shear wave used? ☐ Yes ☐ No

If yes, note the notch of FBH rejection criteria: _____

Test type Manual/Automatic Size limits Standard used Rejection criteria

Shear wave ultrasonic _____ _____ _____ _____

Equipment description:

Longitudinal and transverse directions tested? ☐ Yes ☐ No

Test type Manual/Automatic Size limits Standard used Rejection criteria

Eddy Current _____ _____ _____ _____

Equipment description:

Test type Manual/Automatic Size limits Standard used Rejection criteria

Flux leakage _____ _____ _____ _____

Equipment description:

Test type Manual/Automatic Size limits Standard used Rejection criteria

Magnetic particle _____ _____ _____ _____

Equipment description:

Test type Manual/Automatic Size limits Standard used Rejection criteria

Liquid penetrant _____ _____ _____ _____

Equipment description:

Test type Manual/Automatic Size limits Standard used Rejection criteria

X-ray _____ _____ _____ _____

Equipment description:

NDE operator/supervisor qualifications:

No. of inspectors NDE Level Internal qualification External qualification Industry standard used

_____ Level 1 ☐ ☐ _____

_____ Level 2 ☐ ☐ _____

_____ Level 3 Supervisor ☐ ☐ _____

- Can separate NDE reports be furnished with the mill test reports? ☐ Yes ☐ No
- Can qualification records and eye exams be furnished, if requested? ☐ Yes ☐ No
- If required, can the mill test and report residual magnetism in the product prior to shipment? ☐ Yes ☐ No
- If yes, can the mill meet a 20-gauss maximum prior to shipment? ☐ Yes ☐ No
- Does the mill use preventive maintenance procedures? ☐ Yes ☐ No
- Is maintenance an in-house or outsourced function? ☐ In-house ☐ Outsourced
- Does the mill maintain statistics on equipment maintenance? ☐ Yes ☐ No
- If so, are the maintenance statistics reviewed for improvement? ☐ Yes ☐ No
- Are there written procedures and intervals for equipment maintenance? ☐ Yes ☐ No
- Have minimum qualifications been established for each maintenance of equipment position? ☐ Yes ☐ No
- Are there training records for maintenance personnel? ☐ Yes ☐ No
- Are there management-of-change and risk management records? ☐ Yes ☐ No

10. Supplemental Questions and Comments

Are heat certifications typically supplied with the shipment? Is the certification available for electronic transmittal?
If not, explain how MTRs are sent:

Note any major scheduled plant improvements, with projected completion date(s):

Signature: _____

Name: _____

Function/Title: _____

Reviewed by: _____

Date: _____

Approved: ☐ Yes ☐ No

Date: _____

Bibliography

- [1] ASTM A370,⁴ *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*
- [2] ASTM E23, *Standard Test Methods for Notched Bar Impact Testing of Metallic Materials*
- [3] ASTM E45, *Standard Test Methods for Determining the Inclusion Content of Steel*
- [4] ASTM E112, *Standard Test Methods for Determining Average Grain Size*
- [5] ASTM E381, *Standard Method of Macroetch Testing Steel Bars, Billets, Blooms, and Forgings*
- [6] ASTM E1820, *Standard Test Method for Measurement of Fracture Toughness*
- [7] BS 7448-1,⁵ *Fracture mechanics toughness tests. Method for determination of K_{Ic} , critical CTOD and critical J values of metallic materials.*

⁴ ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org.

⁵ BSI, 12950 Worldgate Drive, Suite 800 Herndon, Virginia 20170, www.bsigroup.com.



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