

Sand Screens

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**ISO 17824:2009 (Modified), Petroleum and natural gas industry –
Downhole equipment—Sand screens**



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ERRATA 1

Page 35, Section B.4.1.2.2: The first bullet shall be replaced with the following:

- The viscosity, at a shear rate of 5.11s^{-1} and 10.22s^{-1} , shall be in the ranges of 2 500 cP through 6 000 cP and 1 500 cP through 3 500 cP, respectively;

NOTE cP – centipoise, 1 000 cP = 1 Pa·s

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Introduction

This International Standard has been developed by user/purchasers and supplier/manufacturers of sand screens intended for use in petroleum and natural gas wells. This International Standard provides requirements and information to both parties regarding the selection, manufacture, mechanical properties and testing of sand screens. Further, this International Standard addresses supplier/manufacturer requirements that set the minimum parameters with which it is necessary that supplier/manufacturers comply to claim conformity with this International Standard.

This International Standard is structured with grades of increased requirements for both design validation and quality control. Three design validation grades (V1, V2 and V3) and three quality grades (Q1, Q2 and Q3) provide the user/purchaser the choice of requirements to meet a specific preference or application. The three quality grades provide the user/purchaser with a choice of requirements to meet a specific preference or application. Quality grade Q3 is the minimum grade of quality offered by this product standard. Quality grade Q2 provides additional inspection and verification steps, and quality grade Q1 is the maximum grade offered by this product standard. The three validation grades provide the user/purchaser with a choice of requirements to meet a specific preference or application. Validation grade V3 is the minimum grade of validation offered by this product standard. Validation grade V2 provides collapse resistance validation, and validation grade V1 provides both collapse and burst resistance validation. Design validation grade V3 and quality grade Q3 represent equipment designed and manufactured to supplier/manufacture's procedures.

Included within this International Standard are normative Annexes B and C specifying test methods for determining the burst and collapse strength of sand screens. Normative Annex D contains requirements for the determination of the maximum particle size that passes through metal-mesh sand screens. Informative Annexes E, F, G and H include measurement criteria for sand screen filter media and illustrations of the three types of sand screens. Additionally, informative Annexes I and J are included for alternative testing methods for sand screens.

It is necessary that users of this International Standard be aware that requirements above those outlined in this International Standard may be required for individual applications. This International Standard is not intended to inhibit a supplier/manufacturer from offering, or the user/purchaser from accepting, alternative equipment or engineering solutions. This can be particularly applicable where there is innovative or developing technology. Where an alternative is offered, it is the responsibility of the supplier/manufacturer to identify any variations from this International Standard and provide details.

API Specification 19SS is a U.S. national adoption of the international standard ISO 17824:2009. A list of deviations from the ISO standard is provided in Annex K and is summarized as follows.

- Annex A for the API Monogram Program was added.
- Burst and Collapse Test Annexes: the FLC pill formulation was revised and a limit was specified for the variability in the pumping rate. The 12 ga slot opening requirement for wire-wrap burst and collapse testing was eliminated.
- Wire-wrap Sand Screens: Annex H, Increased slot inspection, was removed, but 95 % slot inspection was added for Q1 quality grade requirements, and testing for wrap-wire hardness was added in the quality section. Clarification was also added on sampling plans for wire-wrap, pre-pack and metal-mesh products.
- ISO 17824, Annex C, Sized-bead test method: changed to Annex D, Determination of maximum particle that passes through a metal mesh sand screen and changed from informative to normative.
- Annexes E, F, G and H: Minor changes in their illustrations and text.
- Annexes I and J: These informative test annexes were added.

Petroleum and natural gas industries — Downhole equipment — Sand screens

1 Scope

This International Standard provides the requirements and guidelines for sand screens for use in the petroleum and natural gas industry. Included are the requirements for design, design validation, manufacturing, quality, storage and transport. The requirements of this International Standard are applicable to wire-wrap screens, pre-pack screens, and metal-mesh screens as defined herein.

Annex A contains requirements for equipment to be provided with the API monogram.

The following items are outside the scope of this International Standard:

- expandable sand screens, compliant sand screens, slotted liners, or tubing and accessory items such as centralizers or bull plugs;
- shunt screen technology, inflow control devices, downhole sensors, and selective isolation devices, even where they can be an integral part of the sand screen;
- analysis for sand retention efficiency;
- end connections of the basepipe.

2 Normative References

The following referenced documents are indispensable for the application of this document. The way in which these referenced documents are cited in the body of this standard determines the extent (in whole or part) to which they apply. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Recommended Practice 13B-1, *Recommended Practice for Field Testing Water-based Drilling Fluids*

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

API Specification 5CT, *Specification for Casing and Tubing*

API Specification 5CRA, *Specification for Corrosion-resistant Alloy Seamless Tubes for Use as Casing, Tubing, and Coupling Stock*

ASME, *Boiler and Pressure Vessel Code (BPVC) — Section VIII: Div. 1, Appendix 8: Methods for Liquid Penetrant Examination (PT)*

ASME, *Boiler and Pressure Vessel Code (BPVC) — Section IX: Welding and Brazing Qualifications*

ASTM A370¹, *Test Methods and Definition for Mechanical Testing of Steel Products*

ASTM B822, *Standard Test Method for Particle Size Distribution for metal powders and related compounds by light scattering*

ASTM E165, *Standard Practice for Liquid Penetrant Examination for General Industry*

ASTM E190, *Standard test method for guided bend test for ductility of welds*

ASTM E384, *Standard Test Method for Microindentation Hardness of Materials*

ASQ H1331², *Zero Acceptance Number Sampling Plans*

¹ ASTM International, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428, www.astm.org

ISO 2859-1³, *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

ISO 3452, *Non-destructive testing — Penetrant testing*

ISO 9000, *Quality management systems — Fundamentals and vocabulary*

ISO 9606, *Qualification testing of welders — Fusion welding.*

ISO 10414-1:2008, *Petroleum and natural gas industries — Field testing of drilling fluids — Part 1: Water-based fluids*

ISO 15614, *Specification and qualification of welding procedures for metallic materials — Welding procedure test*

ISO 16232-7:2007, *Particle sizing and counting by microscopic analysis*

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

ISO 23277, *Non-destructive testing of welds — Penetrant testing — Acceptance levels*

NIST SP 960-1, *Particle Size Characterization*

SAE ARP 598, *The Determination of Particulate Contamination in Liquids by the Particle Count Method*

ASNT SNT-TC-1A, *Personnel Qualification and Certification in Nondestructive Testing*

3 Terms and Definitions

For the purposes of this document, the terms and definitions given in ISO 9000 and the following apply.

3.1

annular gravel pack

Sized sand or synthetic proppant placed in the annulus outside the sand screen during gravel packing.

3.2

assembly

Product comprised of more than one component.

3.3

basepipe

Tubulars that have perforations or slots to allow fluid flow through the screen jacket.

NOTE See Figures F.1, G.1 and H.1.

3.4

box handling length

Axial length of blank basepipe on the upper end of the sand screen intended for make-up and handling purposes.

NOTE See dimension 2 in Figures E.4 and E.5.

3.5

common hardware

Non-traceable nuts, bolts, set screws, and spacers.

3.6

component

Individual part of an assembly.

² American Society for Quality, 600 North Plankinton Avenue, Milwaukee, WI 53203, www.asq.org

³ International Organization for Standardization, 1, ch. de la Voie-Creuse, Case postale 56, CH-1211 Geneva 20, Switzerland, www.iso.org.

3.7**design family**

Group of sand screens wherein the configuration, materials, and functionality are the same and the design stress levels in relation to material mechanical properties are based on the same criteria.

3.8**design validation**

Process of proving a design by testing to demonstrate conformity of the product to design requirements.

NOTE Design validation can include one or more of the following (this is not an all-inclusive list):

- a) prototype tests,
- b) functional and/or operational tests of production products,
- c) tests specified by industry standards and/or regulatory requirements,
- d) field performance tests and reviews.

[API Q1]

3.9**design verification**

Process of examining the result of a given design or development output to determine conformity with specified requirements.

NOTE Design verification activities can include one or more of the following (this is not an all-inclusive list):

- a) confirming the accuracy of design results through the performance of alternative calculations,
- b) review of design output documents independent of activities of design and development,
- c) comparing new designs to similar proven designs.

[API Q1]

3.10**direct-wrap sand screen**

Sand screen in which the support rib wires are in direct contact with the basepipe along the axial length.

NOTE See Annexes F and G.

3.11**downhole sensor**

Device incorporated into the sand screen to measure various downhole conditions.

3.12**drainage or support layer**

Component used in sand screens to provide structural support and/or to facilitate flow between adjacent components of the assembly.

NOTE See Figure H.1.

3.13**end ring**

Component used to seal the annular gap between the ends of the sand screen jacket and basepipe.

3.14**external drift diameter**

ID of the drift tool utilized to verify the sand screen assembly OD clearance.

3.15**filter media**

Primary filtration component of a sand screen.

NOTE For the purposes of this standard, three types are defined: wire-wrap, metal-mesh, and pre-pack.

3.16

fluid-loss control pill

Liquid-based fluid with a concentration of bridging solids that seals a screen surface (internally or externally).

3.17

inflow control device

Device that regulates flow into the production conduit.

3.18

informative

Information that is meant to enlighten the user/purchaser or supplier/manufacturer, without containing requirements.

3.19

internal drift diameter

OD of the drift tool utilized to verify sand screen assembly ID clearance.

3.20

job lot

Batch of material or components that have undergone the same process or series of processes.

3.21

job lot traceable

Ability for parts to be identified as originating from a job lot which identifies the included heat(s).

3.22

manufacturing

Process and actions performed by an equipment supplier/manufacturer that are necessary to provide finished components, assemblies, and related documentation that fulfil the requests of the user/purchaser and meet the standards of the supplier/manufacturer.

NOTE Manufacturing begins when the supplier/manufacturer receives the order and is completed at the moment the component(s), assemblies, and related documentation are surrendered to a transportation provider.

3.23

metal-mesh

Metal fabric (woven or non-woven) designed to filter solids, provide structural support and/or distribute flow.

NOTE See Figure H.1.

3.24

metal-mesh roll

Single, continuously woven length of mesh produced by the mesh manufacturer.

NOTE ASTM E2016 defines the minimum length of a roll of mesh to be 30.5 m (100 ft). There may be multiple metal-mesh rolls in a job lot.

3.25

metal-mesh sand screen

Sand screen that consists of one or more layers of metal-mesh as the filter media.

NOTE See Annex H.

3.26

micron (micrometer, μm)

An SI derived unit of length equaling 1×10^{-6} of a meter.

NOTE $1 \mu\text{m} = 0.001 \text{ mm}$, or about 0.000039 in. , $25.4 \mu\text{m} = 0.001 \text{ in.}$

3.27

normative

Instructions or procedures that shall be implemented by the user/purchaser or supplier/manufacturer in order to comply with this International Standard.

3.28**overall length**

Nominal axial length of the screen measured between the extremities of the basepipe, typically the outer face of the box connection to the outer face of the pin.

NOTE See dimension 1 in Figures E.4 and E.5.

3.29**pin handling length**

Axial length of blank basepipe on the lower end of the sand screen intended for make-up and handling purposes.

NOTE See Figures E.4 and E.5.

3.30**pore size**

Metal-mesh filter opening; typically expressed in microns.

3.31**pre-pack sand screen**

Sand screen consisting of sand or synthetic proppant used as the filter media.

NOTE See Annex G.

3.32**qualified person**

Individual with documented abilities gained through training or experience or both as measured against established requirements, such as standards or tests that enable the individual to perform a required function effectively.

3.33**sand screen**

Mechanical filtration device used to retain the formation sand or annular gravel pack while allowing the passage of fluids.

3.34**screen jacket**

Sub-assembly of the sand screen that includes filter media and associated support components and which is secured to the basepipe.

NOTE The screen jacket may include end rings, a drainage or support layer and/or a shroud.

3.35**screen jacket length**

Axial length of the screen jacket, including any end rings.

NOTE See dimension 3 in Figures E.4 and E.5.

3.36**screen size**

OD designation of the basepipe.

3.37**selective isolation device**

Device that controls flow into the production string from selected zone(s) in a well.

3.38**shroud**

Permeable cylindrical component typically forming the outermost concentric layer of a sand screen and used to provide support and protection.

NOTE See Figure H.1.

3.39**shute wires**

The wires running the short way of, or across the cloth as woven (also referred to as the shoot, fill, or weft wires).

NOTE See ASTM E2016.

3.40**shunt screen technology**

Additional flow conduits assembled onto the sand screen to allow the gravel packing slurry to bypass blockages in the annulus between the well bore and the screen OD during gravel packing operations.

3.41**slip-on sand screen**

Sand screen where the screen jacket is manufactured separately and later installed over the perforated basepipe.

NOTE See Annexes E and F.

3.42**slot**

Opening between two consecutive wrap-wires in a wire-wrap screen.

NOTE See Figure F.1.

3.43**slot size**

Width of the opening in a wire-wrap screen expressed in gauge, with one gauge equal to 25.4 μm (0.001 in.).

3.44**substantive design change**

Change to the design, identified by the supplier/manufacturer, that affects the performance of the product in the intended service condition.

3.45**support rib**

Several parallel, longitudinal supports in a wire-wrap screen jacket that are spaced apart to form the structure around which the wrap-wire is wrapped and welded.

NOTE See Figures E.1 and F.1.

3.46**target pressure**

Maximum pressure to be obtained during a validation test.

NOTE The target pressure may result from design intent, user/purchaser requirement or test facility limitations.

3.47**temperature range**

Specified range of temperature over which the product is designed to operate.

3.48**wire-wrap sand screen**

Sand screen consisting of a wrap-wire helically wrapped and welded to a cylindrical array of internal support ribs.

NOTE See Annex F.

3.49**warp wires**

The wires running the long way of the cloth as woven.

NOTE See ASTM E2016

3.50

weft wires

See shute wires.

3.51

wrap-wire

Continuous wire in a wire-wrap screen jacket that is helically wrapped around and welded to longitudinal support ribs.

NOTE See Figure F.1 and Figure G.1.

3.52

wrap-wire reel

Single continuous spooling of a formed wire.

4 Abbreviated Terms

AOQL	average outgoing quality limit
AQL	acceptance quality limit
CaCO ₃	calcium carbonate
CMM	coordinate measuring machine
COC	certificate of compliance
DTW	dutch twill weave
FEA	finite element analysis
FLC	fluid loss control
ga	gauge
ID	inside diameter
LB	box handling length
LDP	liquid dye penetrant
LP	pin handling length
LS	screen jacket length
MD	measured depth
MPP	maximum particle passed
MPS	maximum particle size
MTR	material test report
NDE	non-destructive examination
NS	near size
OD	outside diameter
OS	over size
PDW	plain dutch weave
ppf	pounds per foot

PSD	particle size distribution
PSW	plain square weave
QC	quality control
RDTW	reverse dutch twill weave
RIH	run in hole
TVD	true vertical depth
WWS	wire-wrapped screen
US	under size

5 Functional Specification

5.1 General

The user/purchaser shall provide a functional specification to order products that conform to this International Standard. The specification shall include the following requirements and operating conditions as the user/purchaser deems appropriate, and/or may identify the supplier/manufacturer's specific product. These requirements and operating conditions may be conveyed by means of a dimensional drawing, data sheet, statement of requirements, or other suitable documentation.

5.2 Product Type

The user/purchaser shall specify the sand screen type (wire-wrap screen, pre-pack screen, or metal-mesh screen) as defined by the filter media. It is recognized that there are screens that utilize one or more of these screen types in their construction; however, the product type is defined by the primary filter media.

5.3 Sand Screen Parameters

The user/purchaser shall specify the following sand screen parameters and associated tolerances, as applicable:

- a) screen jacket length(s) and pin and box handling lengths;
- b) required slot size or pore size;
- c) flow area of the sand screen for passage of fluids during well clean up, production, and any stimulation activities;
- d) nominal basepipe size, mass, grade, alloy, and end connections;
- e) external drift diameter;
- f) metallurgy requirements of screen jacket, rings, shrouds, or other components;
- g) filter media type and size;
- h) centralization: type, quantity, material, maximum OD, and location;
- i) overall length;
- j) required performance ratings. (See 6.3.2)

5.4 Well Parameters

The user/purchaser shall specify, as applicable, the following well parameters:

- a) internal drift diameter of the casing or open hole ID, and any minimum restrictions through which it is necessary for the sand screen to pass;
- b) IDs and ODs of tubing or casing sizes, the well's true vertical depth (TVD) and measured depth (MD), and a directional survey of the well with max dog leg severity, typically shown in a schematic;
- c) producing or perforation interval length.

5.5 Operational Parameters

The user/purchaser shall specify, as applicable, the following operational parameters:

- a) chemical treatment, including the chemical components, pressure, temperature, pump rate, and exposure time;
- b) fracturing/gravel packing, including proppant/gravel description, pumping rate, proppant/fluid ratio, maximum anticipated pressure;
- c) fluid/mud type (chemical components, solids loading, solids size) and density that the screens can encounter;
- d) well intervention service equipment, such as wash tools, electric line, slick line, braided line, coiled tubing, or snubbing equipment;
- e) installation methods and limitations;
- f) loading conditions: anticipated loading conditions (temperature, collapse, burst, tensile, compression and compaction loads, etc.) that can be applied to the sand screen during deployment, gravel packing process, well clean up, injection, and/or production.

5.6 Environmental Compatibility

5.6.1 General

Where the user/purchaser has material selection and/or corrosion property data of the operating environment based on historical data and/or research, the user/purchaser shall state which material(s) have the ability to perform as required within the corrosive environment. Otherwise, material compatibility shall be specified in accordance with 5.6.2.

5.6.2 Well Environment

The following shall be provided to ensure environmental compatibility, as applicable:

- a) minimum and maximum anticipated values of the temperatures, flow rates (production and/or injection), and reservoir pressure;
- b) production/injection fluid, density, chemical/physical composition, and the condition of the fluid and/or its components, being solid (sand, scale, etc.), liquid and/or gaseous, to which the product is exposed during its full life cycle;
- c) rock properties, such as particle size distribution, mineralogy, and clay content;
- d) scaling tendencies of reservoir fluids that result in inorganic and organic solid precipitates, such as scale, paraffin, asphaltenes, etc. that can plug the screen.

5.7 Compatibility with Related Well Equipment

The following information shall be provided, as applicable:

- a) size, type, material, configuration, and interface dimensions of the connection between the product and other well equipment;
- b) size, type, and configuration of other products or tools that are passed through or over the product;

- c) size, type, and configuration of other products that are used in conjunction with this product.

5.8 Design Validation Grades

This International Standard specifies three grades of design validation (V1, V2, or V3 as detailed in 6.5) for which the product may be supplied. The user/purchaser shall specify the design validation grade for each product to be provided. When no validation grade is specified, validation grade V3 shall be supplied.

5.9 Quality Grades

The user/purchaser shall specify the quality grade (Q1, Q2, or Q3 as detailed in 7.4) for each product that is provided. When no quality grade is specified, quality grade Q3 shall be supplied.

5.10 Optional Test Requirements

The user/purchaser may specify Annexes I and J for optional testing methods for sand screens.

6 Technical Specification

6.1 General

The supplier/manufacture shall prepare a technical specification that conforms to the requirements defined in the functional specification. If the technical specification does not fully meet the functional requirements, the supplier/manufacture shall identify the differences to the user/purchaser.

6.2 Technical Characteristics

The sand screen shall perform in accordance with the functional specification as stated in Section 5 and within the specifications defined in the product-specific data sheet.

6.3 Design Criteria

6.3.1 Materials

Materials shall be documented by the supplier/manufacture and shall be suitable for the requirements of the functional specification. The supplier/manufacture shall have documented specifications for all materials used in the manufacture of sand screens. All materials used shall conform with the supplier/manufacture's documented specifications that include chemical and mechanical property limits as applicable.

The user/purchaser may specify materials for the specific environment in the functional specification. If the supplier/manufacture proposes to use another material, the supplier/manufacture shall provide technical justification (e.g. supporting service history, test lab data, etc.) for the use of the proposed material in the specified environment. This applies to metallic and nonmetallic components.

Basepipe material shall conform to the requirements of API 5CT, API 5CRA, or equivalents unless otherwise specified in the functional specifications. Material substitution (excluding filter media) is a temporary change to a bill of material for a validated item which does not decrease the performance capabilities of the product. Material substitutions from those materials used in the validation tested sand screen products are allowed without validation testing as long as they meet the requirements of 6.4. The manufacturer's selection criteria for these substitutions shall be documented and the substituted material shall conform to the design, functional, and technical requirements of this International Standard.

6.3.2 Performance Ratings

The supplier/manufacture shall state the performance ratings, as applicable for each sand screen considering any temperature effects and excluding end connections. The performance ratings shall be based on the minimum specified yield strength and minimum specified material conditions. The rating of an assembled design shall be determined by the lowest capability or performance potential of any component of the assembly.

For validation grade V1 (burst and collapse), ratings shall be based on results of the validation tests in accordance with Annex B (burst) and Annex C (collapse) or scaling limitations required in 6.7.

For validation grade V2, Annex C (collapse) rating shall be based on results of the validation tests in accordance with Annex C (collapse) or scaling limitations required in 6.7.

Within each design family, the supplier/manufacturer may utilize finite element analysis (FEA), mechanical strength calculations, or other documented methods to determine performance ratings for sizes and similar configurations not tested within the limitations of scaling as outlined in 6.7.

The material's minimum specified yield strength and minimum specified material conditions shall be used in the calculations, and the calculations shall include consideration of temperature effects.

De-rating of metal mechanical properties due to temperature shall be verified by a qualified person and in accordance with:

- a) industry recognized published data,
- b) data established by the supplier/manufacturer, or
- c) data provided by the material sub-supplier.

NOTE ASME BPVC Section II, Part D contains temperature de-rated tensile strengths for many materials.

6.4 Design Verification

Design verification shall be performed to ensure that each sand screen design meets the supplier/manufacturer's technical specifications and shall include activities such as design reviews, design calculations, comparison with similar designs, and historical records of defined operating conditions. Verification results shall be reviewed and approved by a qualified person, and records of the review shall become a portion of the design documentation (see 7.2).

6.5 Design Validation

6.5.1 General

Products shall be supplied to at least the design validation grade specified in the functional specification.

The supplier/manufacturer shall document the design validation test procedure and results, and shall maintain on file material certifications and drawings that show all the applicable dimensions, materials, and tolerances of parts contained in the tested product. Pre- and post-test dimensional inspections of critical operational areas, as determined by the supplier/manufacturer, shall be conducted, documented, and maintained by the supplier/manufacturer.

Validation tests shall be conducted according to the requirements specified in the respective annexes of this International Standard.

6.5.2 Personnel

Preparation, testing, and approval of results shall be conducted by qualified personnel.

6.5.3 Procedures

The supplier/manufacturer shall develop procedures for conducting the validation tests.

6.5.4 Measuring and Monitoring Equipment

Measuring and monitoring equipment used during the validation process shall be calibrated in accordance with the requirements of 7.4.9.

All pressures are defined as gauge unless otherwise specified and shall be recorded on time-based equipment.

6.5.5 Test Report

A test report shall be prepared and approved by qualified personnel and shall be retained as part of the design validation records for the product (see 7.2). The report shall indicate the following information at a minimum:

- a) a description of the tested item, which may include size, type, model, part number, and serial number;
- b) test facility name and location;
- c) date(s) of validation testing conducted;
- d) procedures used;
- e) records demonstrating conformance to the established procedures such as test charts and test data;

NOTE Records may be electronic or hard copy.

- f) additional information required by the applicable annex describing the testing;
- g) summary of results;
- h) description of failure mechanism as applicable;
- i) approvals and date of the report.

6.5.6 Design Validation Grades

This International Standard specifies three grades of design validation for sand screens. These are listed below with a summary in Table 1. The supplier/manufacture shall document all parameters and results of the evaluations that demonstrate conformance to the validation grade. Validation tests conducted by the supplier/manufacture shall meet the requirements contained in this section. Each product tested shall pass all requirements within the limits specified, to the defined acceptance criteria, and with documentation and approval of the results.

- Design validation grade V3 shall meet the supplier/manufacture's documented validation requirements and the requirements of API Q1.
- Design validation grade V2 shall meet the requirements in Table 1 and Annex C.
- Design validation grade V1 shall meet the requirements in Table 1, and Annexes B and C.

NOTE Products qualified to higher grades of design validation may be considered qualified for the lower grades of design validation.

Table 1—Summary of Design Validation Grade Requirements

Validation test	Design validation grade		
	V3	V2	V1
Burst resistance (See Annex B)	no	no	yes
Collapse resistance (See Annex C)	no	yes	yes

6.6 Design Changes

All design changes shall be documented and reviewed against the design verification and the design validation to determine if the change is a substantive change (See 3.44). A design that undergoes a substantive change becomes a new design requiring design verification in accordance with 6.4 and design validation in accordance with 6.5. Design changes identified as nonsubstantive shall include documented justification.

The supplier/manufacture shall, at a minimum, consider the following for each design change:

- stress levels of the replaced or changed components/subassemblies relative to the base design;
- interchangeability of the replaced or changed components/subassemblies relative to the base design;

- material changes;
- functional or operational changes;
- dimensional changes.

Evaluation results and justifications of a nonsubstantive design change shall be approved by a qualified person (see 3.32) other than the person performing them, and records of the results shall become a portion of the design documentation (see 7.2).

6.7 Design validation by scaling

6.7.1 General

Scaling is the process by which the performance ratings of untested screen designs may be determined based on the results of validation-tested screen designs within a design family. The descriptions of the design families are provided below. Product scaling shall conform to the requirements of 6.3, 6.7.2, and 6.7.3.

6.7.2 Design families

A design family is a group of products whose configurations, sizes, materials, and applications are sufficiently similar that identical design methodologies can be used to establish the design parameters for each product within the family.

6.7.2.1 Wire-wrap screens

Separate design families are required for any of the following variations:

- slip-on or direct-wrap designs;
- wrap-wire size, shape, or reduced minimum specified yield strength;
- support rib size, shape, reduced minimum specified yield strength, or increased nominal circumferential arc length (see Figure 1) between support ribs;

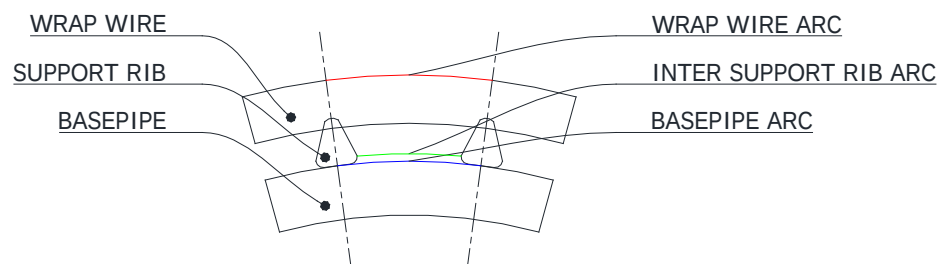


Figure 1 — Circumferential arc length examples

- screen jacket end ring designs that decrease the pressure rating of the sand screen;
- changes in nominal basepipe wall thickness, minimum specified yield strength, or perforation pattern (size, density, etc.), where the sand screen's rating depends on the basepipe's characteristics and the change reduces the sand screen's rating;
- increases in the screen slot size.

6.7.2.2 Pre-pack screens

Separate design families are required for any of the following variations:

- type of outer or inner screen jacket;

- slip-on or direct-wrap design of inner screen;
- wrap-wire size, shape, or reduced minimum specified yield strength of either screen jacket;
- support rib size, shape, reduced minimum specified yield strength, or increased nominal circumferential arc length (see Figure 1) between support ribs of either screen jacket;
- screen jacket end ring designs that decrease the pressure rating of the sand screen;
- changes in nominal basepipe wall thickness, minimum specified yield strength, or perforation pattern (size, density, etc.), where the sand screen's rating depends on the basepipe's characteristics and the change reduces the sand screen's rating;
- increases in the screen slot size;
- changes to the type or size of proppant.

If either the outer or inner screen jacket is metal-mesh, 6.7.2.3 applies.

6.7.2.3 Metal-mesh screens

Separate design families are required for any of the following variations:

- number of layers of woven or non-woven media;
- weave pattern for any layer of woven media or fiber configuration for any layer of non-woven media;
- wire diameter or count of any layer;
- a decrease in minimum specified tensile strength, yield strength, or elongation of metal-mesh;
- change in the direction of the warp or weft wires of any layer;
- drainage or support layer(s) configuration including a decrease in minimum specified tensile strength or yield strength;
- post-weaving processes, such as heat treating, calendering, forming, or welding that decreases the minimum specified tensile strength, yield strength, or elongation;
- increases in radial clearances between metal-mesh and drainage or support layer, or protective shroud or basepipe;
- protective shroud variations, including helical and longitudinal welding variations, that decrease the pressure rating of the screen;
- screen jacket end ring designs that decrease the pressure rating of the screen;
- changes in nominal basepipe wall thickness, minimum specified yield strength, or perforation pattern (size, density, etc.), where the sand screen's rating depends on the basepipe's characteristics and the change reduces the sand screen's rating.

6.7.3 Permissions of size scaling

The supplier/manufacturer may apply collapse or burst ratings, as defined in 6.3.2, for different screen sizes within a design family as follows:

- Collapse test rating: The rating for a validation-tested screen size may be applied as the rating for smaller, untested screen sizes within a design family, but shall not be applied or extrapolated to larger screen sizes, or to any screen size that has a lower collapse resistance rating for its basepipe.

EXAMPLE The collapse test rating for 139.70 mm, 25.30kg/m (5 1/2 in., 17 ppf) screen can be applied to larger masses of the same screen size or to 60.33 mm (2 3/8 in.) through 127.00 mm (5 in.) screen sizes of the same design family. It cannot be applied to 168.28 mm (6 5/8 in.) and larger screen sizes or to smaller masses of 139.70 mm (5 1/2 in.) screens.

- Burst test rating: The rating for a validation tested screen size may be applied as the rating for smaller untested screen sizes within a design family, but shall not be applied or extrapolated to larger screen sizes.

EXAMPLE The burst test rating for 139.70 mm (5½ in.) screen can be applied to 60.33 mm (2⅜ in.) through 127.00 mm (5 in.) screen sizes of the same design family. It cannot be applied to 168.28 mm (6⅝ in.) and larger screen sizes.

7 Supplier/mmanufacturer requirements

7.1 General

Clause 7 contains the detailed requirements to verify that each product manufactured meets the requirements of the functional and technical specifications. All testing and inspections for final acceptance and approval of test reports shall be performed by a qualified person. These include requirements for documentation and data control, product identification, and quality control.

7.2 Documentation and data control

7.2.1 General

The supplier/mmanufacturer shall establish, implement, and maintain documented procedures to control all documents and data that relate to the requirements of this International Standard. These documents and data shall be legible and maintained to demonstrate conformance to specified requirements. These documents include, but are not limited to, functional and technical specifications, production orders, and quality records (see 7.4.8).

All documents and data shall be retained in facilities designed to provide an environment that prevents damage, deterioration, or loss. All documents and data shall be available and auditable by the user/purchaser.

Documentation may be in the form of any type of media, such as hard copy or electronic, and shall be retained for a minimum of 10 years from the date of manufacture. This requirement applies to products manufactured after the effective publication date of this standard.

NOTE ISO 17824 contains requirements to maintain documentation for five years.

7.2.2 Design documentation

Documentation of designs shall include product drawings and specifications, methods, assumptions, calculations, and design requirements. Design validation records shall be maintained throughout the life of a design family, and shall be kept for at least 10 years after the design family is no longer manufactured.

7.2.3 Product data sheet

Product data sheets shall be supplied for quality grade Q1 or as requested by the user/purchaser and shall contain the following information, as applicable:

- name and address of supplier/mmanufacturer;
- supplier/mmanufacturer assembly or part number;
- supplier/mmanufacturer product name;
- product type;
 - wire-wrap (direct-wrap/slip-on jacket);
 - metal-mesh (multi-layer/single layer);
 - pre-pack;
- materials description;