Specification for Drill String Non-return Valves

API SPECIFICATION 7NRV
FIRST EDITION, JULY 10, 2006

REAFFIRMED, DECEMBER 2012

AMERICAN PETROLEUM INSTITUTE

Specification for Drill String Non-return Valves

Upstream Segment

API SPECIFICATION 7NRV
FIRST EDITION, JULY 10, 2006

REAFFIRMED, DECEMBER 2012

AMERICAN PETROLEUM INSTITUTE

SPECIAL NOTES

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

Neither API nor any of API's employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. Neither API nor any of API's employees, subcontractors, consultants, or other assignees represent that use of this publication would not infringe upon privately owned rights.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any authorities having jurisdiction with which this publication may conflict.

API publications are published to facilitate the broad availability of proven, sound engineering and operating practices. These publications are not intended to obviate the need for applying sound engineering judgment regarding when and where these publications should be utilized. The formulation and publication of API publications is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

FOREWORD

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Generally, API standards are reviewed and revised, reaffirmed, or withdrawn at least every five years. A one-time extension of up to two years may be added to this review cycle. Status of the publication can be ascertained from the API Standards Department, telephone (202) 682-8000. A catalog of API publications and materials is published annually and updated quarterly by API, 1220 L Street, N.W., Washington, D.C. 20005.

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.

CONTENTS

Page

1 SCOPE 1

2 NORMATIVE REFERENCES 2

3 TERMS AND DEFINITIONS 2

4 REQUIREMENTS 3
4.1 General 3
4.2 Design requirements 4
4.3 Functional considerations 4
4.4 Design considerations 4
4.5 Verification test 5

5 MATERIALS 5
5.1 General 5
5.2 Metals 5
5.3 Non-metals 5
5.4 Traceability 6

6 QUALITY CONTROL REQUIREMENTS 6
6.1 General 6
6.2 Documentation retention 6
6.3 Personnel qualifications 6
6.4 Calibration systems 6
6.5 Inspection of elastomeric materials 7
6.6 Dimensional inspection 7
6.7 Thread inspection 7
6.8 Welding and brazing 7
6.9 Qualification of heat treatment equipment 7
6.10 Coatings, overlays, and surface treatments 8
6.11 Mechanical and physical properties (where required by this Standard) 8
6.12 NDE requirements 8

7 TESTING 10
7.1 General 10
7.2 Verification testing 11
7.3 General requirements for an NRV verification test facility 11
7.4 NRV verification test procedure 11
7.5 NRV Nitrogen Pressure Test 12
7.6 NRV Hydro Pressure Test 12
7.7 NRV Cycle Test 12
7.8 NRV Erosion Test (record results as per Table A.1) 12
7.9 RV Float Sub and NRV Landing Nipple testing 13
7.10 NRV Equalizing Head testing 13
7.11 Verification test for seal materials 14
7.12 Production Testing 14

CONTENTS

Page

8 IDENTIFICATION, DOCUMENTATION AND PREPARATION FOR TRANSPORT 15
8.1 Identification 15
8.2 Documentation 15
8.3 Preparation for transport 16

APPENDIX A MINIMUM TEST DATA 17
APPENDIX B API MONOGRAM 19

Tables
A.1 Minimum Test Data Collection for Drill String Non-return Valve (NRV) Sample Form 17
A.2 Minimum Test Data Collection for NRV Float Subs and Landing Nipples - Sample Form 18
A.3 Minimum Test Data Collection for NRV Equalizing Head - Sample Form 18

Specification for Drill String Non-return Valves

0 Introduction

This standard has been developed by users/purchasers and suppliers/manufacturers of Drill String Non-return Valve equipment intended for use in the petroleum and natural gas industry worldwide. This Standard is intended to give requirements and information to both parties in the selection, manufacture, testing and use of Drill String Non-return Valve equipment. Further, this Standard addresses requirements that set the minimum parameters with which the supplier/manufacturer must comply to claim conformity with this standard.

Users of this standard should be aware that further or differing requirements might be needed for individual applications. This standard is not intended to inhibit a supplier/manufacturer from offering, or the user/purchaser from accepting, alternative equipment or engineering solutions. This may be particularly applicable where there is innovative or developing technology. Where an alternative is offered, the supplier/manufacturer should identify any variations from this standard and provide details.

This document does not cover maintenance and inspection once the NRV has left the manufacturer and is in operation. These are important to the safety and reliability of the equipment and should be considered.

1 Scope

This standard was formulated to provide the minimum acceptable requirements for Drill String Non-return Valve (NRV) equipment. It covers Drill String Non-return Valves, Non-return Valve Subs, Non-return Valve landing nipples, Non-return Valve Equalizing Heads and all components that establish tolerances and/or clearances which may affect performance or interchangeability of the NRV equipment. Non-return Valve Subs, Non-return Valve landing nipples, Non-return Valve Equalizing Heads and NRVs manufactured by different facilities or manufacturers may be supplied as separate items.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

API

Spec 5CT/ISO 11960	*Specification for Casing and Tubing*
Spec 7	*Specification for Rotary Drill Stem Elements*
RP 13B-1	*Standard Procedure for Field Testing Water-Based Drilling Fluids*
RP 14B/ISO 10417	*Design Installation, Repair and Operation of Subsurface Safety Valve Systems*
MPMS, Chapter 10.4	*Determination of Sediment and Water in Crude Oil by the Centrifuge Method (Field Procedure)*

ANSI[1]/NCSL

Z540-1	*General Requirements for Calibration Laboratories and Measuring and Test Equipment*

ASME [2]

Boiler and Pressure Vessel Code,

Section II	*Materials specification*
Section V	*Nondestructive testing*
Section VIII	*Pressure vessels*
Section IX	*Welding and brazing qualifications*

ASNT[3]

SNT-TC-1A	*Personnel qualification and certification in nondestructive testing*

[1]American National Standards Institute, 25 West 43rd Street,4th Floor, New York, New York 10036.
[2]American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017-2392.
[3]American Society for Nondestructive Testing, P.O. Box 28518, 1711 Arlingate Lane, Columbus, Ohio 43228-0518.

ASTM[4]

A370	*Standard test methods and definitions for mechanical testing of steel products*
A388/A388M	*Standard practice for ultrasonic examination of heavy steel forgings*
A609/A609M	*Standard practice for castings, carbon, low-alloy, and martensitic stainless steel, ultrasonic examination thereof*
D395	*Standard test methods for rubber property—Compression set*
D41	*Standard test methods for vulcanized rubber and thermoplastic rubbers and thermoplastic elastomers — Tension*
D1414	*Standard test methods for rubber O-rings*
D1415	*Standard test methods for rubber property—International hardness*
D2240	*Standard test methods for rubber property—Durometer hardness*
E10	*Standard test method for Brinell hardness of metallic materials*
E18	*Standard test methods for Rockwell hardness and Rockwell superficial hardness of metallic materials*
E92	*Standard test method for Vickers hardness of metallic materials*
E94	*Standard guide for radiographic testing*
E140	*Standard hardness conversion tables for metals*
E165	*Standard test method for liquid penetrant examination*
E186	*Standard reference radiographs for heavy-walled [2 to 4 1/2 in. (51 to 114 mm)] steel castings*
E280	*Standard reference radiographs for heavy-walled [4 1/2 to 12 in. (114 to 305 mm)] steel castings*
E428	*Standard practice for fabrication and control of steel reference blocks used in ultrasonic inspection*
E446	*Standard reference radiographs for steel castings up to 2 in. (51 mm) in thickness*
E709	*Standard guide for magnetic particle examination*

BSI[5]

BS 2M 54	*Specification for temperature control in the heat treatment of metals*
2859-1	*Sampling procedures for inspection by attributes—Part 1: Sampling schemes indexed by acceptance quality level (AQL) for lot-by-lot inspection*
3601-1	*Fluid systems—Sealing devices—O-rings—Part 1: Inside diameters, cross-sections, tolerances and size identification code*
3601-3	*Fluid power systems—O-rings—Part 3: Quality acceptance criteria*

MIL

H-6875H	*Process for heat treatment of steel*

NACE[6]

MR0175/ ISO 15156	*Sulfide stress cracking resistant metallic materials for oilfield equipment*

3 Terms and definitions

For the purposes of this standard, the following terms and definitions apply:

3.1 AQL: Acceptance quality level.

3.2 chloride stress corrosion cracking: Cracking under the combined action of tensile stress and corrosion in the presence of chlorides and water.

3.3 design acceptance criteria: Defined limits placed on characteristics of materials, products, or services, established by the manufacturer to ensure conformance to the product design.

3.4 design verification test: Test performed to qualify a particular size, type and model of NRV equipment for a specific class of service.

3.5 end connection: NRV equipment/tubular connecting interface.

[4]ASTM, 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428.
[5]British Standards Institution, 389 Chiswick High Road, London, W4 4AL, U.K.
[6]National Association of Corrosion Engineers, P.O. Box 218340, Houston, Texas 77218-8340.

3.6 failure: Any condition of NRV equipment that prevents it from performing the design function.

3.7 fit: The geometric relationship between parts.

3.8 form: The essential shape of a product including all its component parts.

3.9 function: The operation of a product during service.

3.10 functional test: Test performed to confirm proper operation of NRV equipment.

3.11 heat treatment/heat treating: Alternate steps of controlled heating and cooling of materials for the purpose of changing physical or mechanical properties.

3.12 interchangeable: Conforming in every detail, within specified tolerances, to both fit and function of a safe design but not necessarily to the form.

3.13 manufacturer: The principal agent in the design, fabrication and furnishing of NRV equipment, who chooses to comply with this Standard.

3.14 model: NRV equipment with unique internal part(s) and operating characteristics which differentiate it from other NRV equipment of the same type.

3.15 NDE: Nondestructive examination.

3.16 NRV: A Drill String Non-return Valve.

3.17 NRV Equalizing Head: Used to equalize the NRV on surface, venting any trapped pressure prior to the removal of the NRV from the drill string.

3.18 NRV equipment: The Drill String Non-return Valve, Non-return Valve Subs, Non-return Valve landing nipples, Non-return Valve Equalizing Heads and all components that establish tolerances and/or clearances which may affect performance or interchangeability of the NRV equipment.

3.19 NRV Sub / NRV Landing Nipple: A receptacle with internal sealing surfaces in which an NRV may be installed.

3.20 operating manual: A publication issued by the manufacturer which contains detailed data and instructions related to the design, installation, operation and maintenance of NRV equipment.

3.21 operator: A user of NRV equipment.

3.22 production test: Test performed to qualify any size, type and model of NRV equipment for any class of service.

3.23 stress corrosion cracking: Cracking which results from a combination of corrosion and stress when susceptible materials are exposed to specific corrosive media.

3.24 stress relief: Controlled heating of material to a predetermined temperature for the purpose of reducing any residual stresses.

3.25 sulfide stress cracking: Cracking under the combined action of tensile stress and corrosion in the presence of water and hydrogen sulfide.

3.26 test agency: Any party which provides a test facility and administers a test program that meets the verification test requirements of this Standard.

3.27 type: NRV equipment with unique characteristics which differentiate it from other NRV equipment.

Note: The flapper valve NRV and the plunger valve NRV are examples of NRV types.

3.28 weight loss corrosion: Loss of metal in areas exposed to fluids which contain water or brine and carbon dioxide (CO_2), oxygen (O_2) or other corrosive agents.

4 Requirements

4.1 GENERAL

The user shall provide to the manufacturer the information required to define the appropriate product.

4.2 DESIGN REQUIREMENTS

4.2.1 Drawings, manufacturing specifications and the verification test results shall be retained by the manufacturer for a period of ten years after NRVs of that size, model and type are discontinued from the manufacturer's product line. NRV equipment conforming to this Standard shall be manufactured to drawings and specifications that are substantially the same as those of the NRV equipment that has passed the verification test.

4.2.2 Documentation of designs shall include methods, assumptions, calculations and design requirements. Design requirements shall include but not be limited to those criteria for size, test and operating pressures, material, environmental and other pertinent requirements upon which the design is based. Design documentation shall be clear, legible, reproducible and retrievable.

4.2.3 Design documentation shall be reviewed and verified by a qualified individual other than the individual who created the original design.

4.2.4 Changes to the design acceptance criteria which may affect verification test performance or interchangeability of NRV equipment shall require re-qualification, except that seals which have passed the applicable verification test requirements of clause 7 shall be considered interchangeable among the NRV equipment of any one manufacturer for a particular class of service.

4.2.5 NRV equipment manufactured in accordance with this Standard shall conform to one or more of the following classes of service:

Class 1: standard service. This class of NRV equipment is intended for use in wells which do not exhibit the detrimental effects caused by sand or corrosive agents.

Class 2: stress corrosion cracking service. This class of NRV equipment is intended for use in wells where corrosive agents could be expected to cause stress corrosion cracking. Class 2 equipment shall meet the requirements for Class 1 and be manufactured from materials which are resistant to stress corrosion cracking. Within this service class, there are two divisions, 2S for sulfide stress cracking service and 2C (see note) for chloride stress cracking service. Metallic materials, selected for an H_2S environment, shall be in accordance with NACE MR0175.

Note: Metallic materials suitable for Class 2C service are dependent on specific well conditions. No national or international standards exist for the application of metallic materials for this class of service.

4.3 FUNCTIONAL CONSIDERATIONS

NRV design shall permit prediction and repeatability of rates, pressures or other conditions required for operation.

4.4 DESIGN CONSIDERATIONS

4.4.1 The manufacturer shall establish rated working pressures of NRV equipment within the requirements of this Standard. These rated working pressures are commonly 34,5 Mpa, 51,7 Mpa, and 68,9 Mpa (5 ,000 psi, 7,500 psi, and 10,000 psi). Temperature effects on all the materials used in the manufacture of NRV equipment shall be considered in establishing the rated working pressure. The design shall take into account the effects of pressure containment and pressure-induced loads. Specialized conditions shall also be considered such as pressure testing with temporary test plugs. See 8.1 for pressure identification coding.

4.4.2 The manufacturer shall establish internal yield pressure, collapse pressure and minimum tensile strength ratings, excluding end connections.

4.4.3 NRV equipment design shall take into consideration the effects of temperature gradients and thermal cycles on all components. The upper temperature limit shall be the lowest high-temperature rating of any component of the NRV. The lower temperature limit shall be the highest low-temperature rating of any component of the NRV. Derating of metal mechanical properties shall be in accordance with ASME *Boiler and Pressure Vessel Code* Section II, Part D, *Material Properties*.

4.4.4 NRV equipment design shall take into account the effects of retained fluid(s) on all components. NRV equipment design shall consider the effects of sand, chlorides, corrosion inhibitors and other chemicals routinely encountered in oil and gas production and drilling operations.

4.4.5 Component and subassembly interchangeability shall be required within each manufacturer's service class, size, type and model, including pressure rating of NRV equipment. This shall extend to all facilities of the manufacturer. Components shall be designed or identified to avoid the use of non-interchangeable parts. See marking categories, 8.1, for pressure ratings.

4.4.6 Additive dimensional tolerance shall be such that proper operation of the NRV equipment is assured. This requirement applies to factory-assembled equipment and to replacement components.

4.5 VERIFICATION TEST

NRVs, NRV subs, NRV landing nipples, NRV equalizing heads, and seals shall pass the applicable verification test specified in Section 7.

5 Materials

5.1 GENERAL

The manufacturer shall have written specifications for all materials used in NRV equipment. The manufacturer shall select all materials to be suitable for a particular class of service and shall document the selection criteria. All materials shall comply with the manufacturer's written specifications.

Material substitutions, except seals, in qualified NRV equipment are allowed without verification testing provided that the manufacturer's selection criteria are documented and meet all other requirements of this Standard.

Seals that have passed the verification test requirements of 7.12 are considered interchangeable among the NRV equipment of any one manufacturer for a particular class of service.

5.2 METALS

5.2.1 The manufacturer’s specifications shall define:

a. chemical-composition limits;
b. heat treatment conditions;
c. mechanical-property limits:
    1. tensile strength,
    2. yield strength,
    3. elongation,
    4. hardness.

5.2.2 The mechanical properties specified in 5.2.1 for traceable metal components shall be verified by tests conducted on a material sample produced from the same heat of material. The material sample shall experience the same heat treatment process as the component it qualifies. Material subsequently heat-treated from the same heat of material shall be hardness-tested after processing to confirm compliance with the hardness requirements of the manufacturer’s specifications. The hardness results shall verify through documented correlation that the mechanical properties of the material tested meet the properties specified in 5.2.1. The heat treatment process parameters shall be defined in the heat treatment procedure. Hardness testing is the only mechanical-property test required after stress relieving. Material test reports provided by the material supplier or the manufacturer are acceptable documentation.

5.3 NON-METALS

5.3.1 The manufacturer shall have written procedures, and documentation of test results, for testing sealing materials to the limits for which the NRV equipment is rated.

5.3.2 The manufacturer's written specifications for non-metallic compounds shall define those characteristics critical to the performance of the material, such as:

a. compound type;
b. mechanical properties, as a minimum:
    1. tensile strength (at break),
    2. elongation (at break),
    3. tensile modulus (at 50% or 100%, as applicable);
    4. compression set;
    5. durometer hardness.

5.3.3 The manufacturer's written specifications shall include handling, storage and labelling requirements, including the cure date, batch number, compound identification and shelf life appropriate to each compound.

5.4 TRACEABILITY

5.4.1 All components, weldments, subassemblies and assemblies of NRV equipment shall be traceable except:

a. setting springs used to establish closure parameters for NRVs;
b. common hardware items such as nuts, bolts, set screws, shear pins, spacers, and shear screws.

5.4.2 Component traceability is considered sufficient when it can be traced to a job lot, which identifies the included heat or batch lot(s) and a material test report. All components in a multiheat job lot are rejectable if any heat lot does not comply with the manufacturer's written specification.

5.4.3 Traceability identification shall be sufficient to identify significant problems and permit proper corrective action and shall include assembly, subassembly and component traceability to a heat or other appropriate batch lot.

5.4.4 Traceability for NRV equipment is considered sufficient if the equipment meets the requirements of this Standard when it leaves the manufacturer's inventory.

6 Quality control requirements

6.1 GENERAL

This clause provides minimum quality control requirements to meet this standard. All quality control work shall be controlled by documented instructions which include acceptance criteria.

6.2 DOCUMENTATION RETENTION

Required documentation for quality control work shall be retained for a minimum of five years from the date of origination.

6.3 PERSONNEL QUALIFICATIONS

6.3.1 Personnel performing NDE shall be qualified in accordance with at least SNT TC1A, Level II, for evaluation and interpretation.

6.3.2 Personnel performing visual examinations shall have an annual eye examination in accordance with SNT-TC1A, as applicable to the discipline to be performed.

6.3.3 All other personnel performing inspection for acceptance shall be qualified in accordance with documented requirements.

6.4 CALIBRATION SYSTEMS

6.4.1 Measuring and testing equipment used for acceptance shall be identified, controlled, calibrated and adjusted at specified intervals in accordance with written specifications, ANSI/NCSL Z5401 and this Standard.

6.4.2 Pressure-measuring devices shall:

a. be readable to at least ± 0.5% of full-scale range;
b. be calibrated to maintain ± 2% accuracy of full-scale range.

6.4.3 If a pressure gauge is utilized, pressure measurements shall be made at not less than 25% nor more than 75% of the full span of the pressure gauge.

6.4.4 Pressure measuring devices shall be periodically calibrated with a master pressure measuring device or a dead weight tester to at least three equidistant points of full scale (excluding zero and full scale).

6.4.5 Calibration intervals for pressure-measuring devices shall be a maximum of three months until documented calibration history can be established. Calibration intervals shall then be established based on repeatability, amount of usage and documented calibration history.

6.5 INSPECTION OF ELASTOMERIC MATERIALS

6.5.1 Sampling procedures, and the basis for acceptance or rejection of a batch lot, shall be in accordance with ISO 28591 general inspection level II at a 2,5 AQL for O-rings and a 1,5 AQL for other packing elements until a documented variation history can be established. Sampling procedures shall then be established based on the documented variation history.

6.5.2 Visual inspection of O-rings shall be in accordance with ISO 36013. Other packing elements shall be visually inspected in accordance with the manufacturer's documented specifications.

6.5.3 Dimensional tolerances of O-rings shall be in accordance with ISO 36011 or equivalent. Other packing elements shall meet dimensional tolerances of the manufacturer's written specifications.

6.5.4 The durometer hardness of O-rings or other elastomeric packing elements shall be determined in accordance with ASTM D2240 or D1415. A test specimen manufactured from each batch may be used.

6.6 DIMENSIONAL INSPECTION

All traceable components, except elastomeric seals, shall be dimensionally inspected to assure proper function and compliance with design specifications and drawings.

6.7 THREAD INSPECTION

6.7.1 All API rotary shouldered-thread tolerances, inspection requirements, gauging, gauging practice, gauge calibration and gauge certification shall be in accordance with API Spec 7.

6.7.2 All other thread tolerances, inspection requirements, gauging, gauging practice, gauge calibration and gauge certification shall conform to the specified thread manufacturer’s written specifications.

6.8 WELDING AND BRAZING

6.8.1 Welding and brazing procedure and personnel qualification shall be in accordance with ASME *Boiler and Pressure Vessel Code* Section IX.

6.8.2 Material and practices not listed in ASME *Boiler and Pressure Vessel Code* Section IX shall be applied using welding procedures qualified in accordance with the methods of ASME *Boiler and Pressure Vessel Code* Section IX.

6.8.3 Each welded component shall be stress-relieved as per the manufacturer's written specifications and, where applicable, in accordance with Paragraphs UCS56 and UHA32, Section VIII, Division 1, Subsection C, ASME *Boiler and Pressure Vessel Code*. In addition, carbon and low-alloy steel weldments on Class 2 NRV equipment shall be stress-relieved in accordance with NACE MR0175 and ISO 15156.

6.9 QUALIFICATION OF HEAT TREATMENT EQUIPMENT

6.9.1 Furnace calibration

Heat treatment of production parts shall be performed with heat treatment equipment that has been calibrated and surveyed.

Each furnace shall be surveyed within one year prior to heat treatment operations. When a furnace is repaired or rebuilt, a new survey shall be carried out before heat treatment.

Batch-type and continuous-type heat treatment furnaces shall be calibrated in accordance with one of the following procedures:

a. the procedure specified in MILH6875H, Section 5;
b. the procedure specified in BS 2M 54:1991, Section 7;
c. the manufacturer's written specifications, including acceptance criteria which are not less stringent than the procedures identified above.

6.9.2 Instruments

Automatic controlling and recording instruments shall be used.

Thermocouples shall be located in the furnace working zone(s) and protected from furnace atmospheres.

The controlling and recording instruments used for the heat treatment processes shall possess an accuracy of ± 1% of their full-scale range.

Temperature-controlling and recording instruments shall be calibrated at least once every three months until a documented calibration history can be established. Calibration intervals shall then be established based on repeatability, degree of usage and documented calibration history.

Equipment used to calibrate the production equipment shall possess an accuracy of ± 25% of full-scale range.

6.10 COATINGS, OVERLAYS, AND SURFACE TREATMENTS

Coatings, overlays, and surface treatments shall be controlled by documented instructions which include acceptance criteria.

6.11 MECHANICAL AND PHYSICAL PROPERTIES (WHERE REQUIRED BY THIS STANDARD)

6.11.1 Mechanical-property test procedures and practices shall be in accordance with ASTM A370 for the metallic materials used for traceable components. Hardness testing shall be in accordance with ASTM E10 or E18 (ASTM E92 may be used when E10 or E18 cannot be applied due to size, accessibility or other limitations). Hardness conversion to other measurement units shall be in accordance with ASTM E140, with the exceptions noted in NACE MR0175 for Class 2 equipment.

6.11.2 Mechanical-property test procedures for elastomeric compound types shall be in accordance with:

a. tensile-elongation modulus:
   1. O-rings—ASTM D1414,
   2. all others—ASTM D412;
b. compression set:
   1. O-rings—ASTM D1414,
   2. all others—ASTM D395;
c. durometer hardness:
   1. O-rings—ASTM D1415,
   2. all others—ASTM D2240.

6.12 NDE REQUIREMENTS

6.12.1 Inspection personnel, supervisors, and customer representatives shall be trained and qualified in the individual NDE method inspection and the application of the applicable acceptance and rejection criteria in accordance with the reference documents mentioned in this procedure.

6.12.2 Reference documents mentioned in this procedure shall be available to inspection personnel, supervisors, and customer representatives as necessary, for the proper application of the appropriate inspection technique, discontinuity evaluation and proper disposition of the component under investigation.

6.12.3 All NDE instructions and inspection methods used within this procedure shall be approved by an authorized NDE Level III and shall have demonstrated method capabilities of providing 100% inspection coverage of the area under investigation in accordance with the inspection companies standard operating procedure (SOP).

6.12.4 All pressure-containing welds shall be magnetic-particle inspected for surface defects and shall be volumetrically inspected by radiographic or ultrasonic techniques to verify conformance with the manufacturer's written specifications.

6.12.5 For Class 2 all pressure-containing castings and forgings shall be magnetic-particle inspected for surface defects and shall be volumetrically inspected by radiographic or ultrasonic techniques to verify conformance with the manufacturer's written specifications. The manufacturer may develop AQL inspection levels based on documented variation history as required by application or user.

6.12.6 NDE methods and acceptance criteria are as follows:

6.12.6.1 Wet magnetic-particle examination

a. Method—ASTM E709.
b. Definitions:

1. Relevant indication—only those indications with major dimensions greater than 1,6 mm ($^{1}/_{16}$ in.) shall be considered relevant. Inherent indications not associated with a surface rupture (i.e. magnetic-permeability variations, non-metallic stringers, etc.) are considered non-relevant.
2. Linear indication—any indication in which the length is equal to or greater than three times its width.
3. Rounded indication—any indication which is circular or elliptical with its length less than three times the width.

c. Acceptance criteria:

1. Any relevant indication 4,8 mm ($^{3}/_{16}$ in.) or greater is unacceptable. No relevant linear indications are allowed for weldments.
2. No more than ten relevant indications in any 39 cm^2 (6 in^2.) area.
3. Four or more rounded relevant indications in a line separated by less than 1,6 mm ($^{1}/_{16}$ in.) are unacceptable.

6.12.6.2 Ultrasonic Inspection—Weldments

a. Method—ASME *Boiler and Pressure Vessel Code*, Section V, *Nondestructive Examination*, Article 5.
b. Acceptance criteria—ASME *Boiler and Pressure Vessel Code*, Section VIII, *Pressure Vessel, Division 1*, Appendix 12.

6.12.6.3 Ultrasonic Inspection—Castings

a. Method—ASTM E428 and ASTM A609.
b. Acceptance criteria—ASTM A609 ultrasonic-testing quality level , minimum.

6.12.6.4 Ultrasonic Inspection—Forgings and Wrought Products

a. Method—ASTM E428 and ASTM A388.
b. Calibration:

1. Back-reflection technique—the instrument shall be set so that the first back-reflection is 75 % ± 5 % of screen height when the transducer is placed on an indication-free area of the forging or wrought product.
2. Flat-bottom hole technique—the distance-amplitude curve (DAC) shall be based on a 3,2 mm ($^{1}/_{8}$ in.) flat-bottom hole through 101,6 mm (4 in.) of metal and a 6,4 mm ($^{1}/_{4}$ in.) flat-bottom hole for metal distances exceeding 101,6 mm (4 in.).
3. Angle beam technique—the distance-amplitude curve (DAC) shall be based on a notch of depth equal to the lesser of 9,5 mm ($^{3}/_{8}$ in.) or 3 % of the normal section thickness [9,5 mm ($^{3}/_{8}$ in.) maximum], a length of approximately 25,4 mm (1 in.) and a width not greater than twice its depth.

c. Acceptance criteria—the following forging or wrought-product defects are rejectable:

1. Back-reflection technique—indications greater than 50% of the referenced back-reflection accompanied by a complete loss of back-reflection.
2. Flat-bottom hole technique—indications equal to or larger than the indications observed from the calibration flat-bottom hole.
3. Angle beam technique—amplitude of the discontinuities exceeding that of the reference notch.

6.12.6.5 Radiographic Inspection—Weldments

a. Method—ASTM E94.
b. Acceptance criteria—ASME *Boiler and Pressure Vessel Code*, Section VIII, Division 1, *Pressure Vessel*, UW51.

6.12.6.6 Radiographic Inspection—Castings

a. Method—ASTM E94.
b. Acceptance criteria:

1. ASTM E186.
2. ASTM E280.
3. ASTM E446.

Maximum defect classification for 1, 2 and 3 above is as follows:

Type of defect	Maximum defect classification
A	3
B	2
C	2 (all types)
D	None acceptable
E	None acceptable
F	None acceptable
G	None acceptable

6.12.6.7 Radiographic Inspection — Forgings

a. Method—ASTM E94.
b. Acceptance criteria—the following defects are rejectable:
   1. Any type of crack or lap.
   2. Any other elongated indication with length greater than:

      6,4 mm ($^1/_4$ in.) for *t* up to 19 mm ($^3/_4$ in.) inclusive;

      $^1/_3t$ from *t* = 19 mm ($^3/_4$ in.) up to *t* = 57,2 mm (2 $^1/_4$ in.);

      19 mm ($^3/_4$ in) for *t* over 57,2 mm (2 $^1/_4$ in.)

Note: *t* is the wall thickness.

   3. Any group of indications in a line that have an aggregate length greater than *t* in a length of 12*t*.

7 Testing

7.1 GENERAL

7.1.1 The NRVs, NRV subs, NRV landing nipples, and NRV equalizing heads produced in accordance with this standard shall be constructed of materials in compliance with this standard and pass the verification and functional tests required by this clause.

7.1.2 The testing requirements in this standard are not represented as well conditions.

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

7.1.4 All test conditions without a specified tolerance shall be considered minimum values. The maximum value shall not exceed the minimum value by more than 10%.

7.1.5 The drift bar used in the verification test shall be provided by the manufacturer. Drift bar dimensions and a unique identifier for the bar shall be provided by the manufacturer.

7.1.6 With mutual consent between the test agency and the manufacturer, higher flow rates may be applied and used for all flow tests.

7.1.7 The objectives of the testing requirements of this clause are to qualify NRV equipment for specific classes of service and to verify proper operation of NRV equipment. Testing required for NRV equipment furnished to this standard is:

a. verification testing to qualify each size, type and model of NRV for a specific class of service, either Class 1 or combined Class 1 and Class 2;
b. verification testing of each NRV;
c. Verification testing of NRV sub(s) and NRV landing Nipple(s);
d. Verification testing of NRV equalizing heads.

7.2 VERIFICATION TESTING

7.2.1 General

a. Verification testing of design shall be preformed on NRVs, NRV subs, NRV landing nipples, and NRV equalizing head equipment and shall be described in the manufacture's written specification(s). Design verification will not be required on API connections.
b. Experimental confirmation of the design shall be documented and verified as required in 4.2.
c. Verification testing to qualify an NRV for Class 1 or combined Class 1 and Class 2 service shall be performed by manufacturer with 3rd party certifying authority inspection of test results.
d. Verification testing of NRV subs, NRV landing nipples, NRV equalizing heads and all seals shall be performed by manufacturer with 3rd party certifying authority inspection of test results.

7.3 GENERAL REQUIREMENTS FOR AN NRV VERIFICATION TEST FACILITY

7.3.1 The components of the test facility systems shall have a capacity and working pressure as required by the size and/or working pressure of the NRV to be tested.

7.3.2 The control pressure system components shall, as a minimum, consist of the items listed below:

a. fluid reservoir with a filtered vent;
b. pump;
c. a control system to operate the pump;
d. a pressure relief facility to protect the system.

7.3.3 There shall be provision for the supply of nitrogen gas to conduct the required nitrogen leak test and a gas flow meter to indicate the leakage rate.

7.3.4 A gas reservoir with a gas release device and instrumentation to measure the test parameters shall be provided.

7.3.5 The liquid test facility shall, as a minimum, consist of the items listed below:

a. test facility piping, which shall be at least 50,8 mm (2 in.) nominal diameter;
b. a fresh-water tank;
c. a sand slurry tank;
d. Marsh funnel viscometer in accordance with API RP 13B1 with required timer and graduated beaker;
e. a centrifuge with basic sediment and water (BS&W) sample flasks in accordance with API *MPMS*, Chapter 10.4;
f. circulation pumps;
g. a flow meter;
h. pressure measurement systems;
i. a time-based recorder to simultaneously record the required pressure and flow data;
j. a back-pressure regulator;
k. a high-pressure water pump.

7.4 NRV VERIFICATION TEST PROCEDURE

7.4.1 Verify that the model and serial numbers appearing on the test valve are in agreement with the manufacturer's application.

7.4.2 Perform the NRV pressure test (see 7.6).

7.4.3 Test 7.4.4 through 7.4.11 shall utilize the same NRV float insert and testing sub for all tests without redress or repair.

7.4.4 Perform the NRV float insert nitrogen pressure test (see 7.5). Test series 7.4 shall be conducted at: ambient temperature (65 – 90°F), 125°F, and 180°F.

7.4.5 Fill the testing sub with water and circulate water to displace gas out of the test section. Once gas has been displaced from the test section, discontinue water circulation.

7.4.6 Perform the NRV float insert hydro pressure test (see 7.6). Test series 7.4 shall be conducted at ambient temperature (65 – 90°F), 125°F, and 180°F.

7.4.7 Perform NRV float insert cycling test (see 7.7)

7.4.8 Perform NRV float insert erosion test (see 7.8)

7.4.9 Repeat 7.4.2 to 7.4.8.

7.4.10 If the test NRV float insert has performed within the limits specified, it has passed the verification test.

7.4.11 Summarize the verification test data, and attach completed data forms. A sample form showing minimum testing criteria is located in Table A.1. Calibration records shall be included with the verification test report. Each data form shall be signed and dated by the person(s) conducting the test.

7.5 NRV NITROGEN PRESSURE TEST

7.5.1 Make certain that there is NO liquid above and below the valve.

7.5.2 Apply 1,4 Mpa ± 0.07 Mpa (250 psi ± 10 psi for Class 1, 50 psi ± 10 psi for Class 2 S and SC) nitrogen pressure upstream (Pin end of NRV sub) of the test NRV float insert. Wait a minimum of 1 min, then measure any nitrogen leakage through the closure mechanism. Record the test valve bore pressure, the leakage rate and the start and completion times of the waiting period. The leakage rate shall not be greater than 0,14 m^3/min (5 scf/min). No detectable joint leakage shall be accepted on a retrievable NRV.

7.5.3 Repeate 7.5.2 at (25^{+5}_{-5}) % of the rated working pressure of the NRV.

7.5.4 Bleed the pressure upstream of the test NRV float insert to zero.

7.6 NRV HYDRO PRESSURE TEST

7.6.1 Make certain that there is only liquid above and below the valve.

7.6.2 Apply water pressure upstream of the test NRV insert float (Pin end of NRV sub) at (100^{+0}_{-5}) % of the rated working pressure of the valve. Record the test valve bore pressure and the time at which pressure was applied to the valve.

7.6.3 Wait for a minimum of 3 minutes after applying water pressure upstream of the test valve closure mechanism before beginning collection of water leakage from the downstream bleed valve.

Continuously collect water leakage for a minimum of 5 minutes. Record the times at which water leakage collection began and ended and the amount of water collected during the collection period. Calculate and record the average leakage rate. The average leakage rate shall not exceed 10 cm^3/min of water. No detectable external body leakage shall be accepted on a retrievable NRV.

7.7 NRV CYCLE TEST

7.7.1 Place NRV in a test assembly capable of circulation in the free flow direction of the NRV and circulation and pressure application in the restricted direction of the NRV.

7.7.2 Circulate fresh water in the free flow direction with a circulation rate to the value specified according to manufacturers' specifications, where Circulation rate is based on TFA of the tool opening. Record the water circulation rate. Record the time at which the slurry circulation begins.

7.7.3 Circulate the through the NRV at the specified rate for a minimum of 5 minutes.

7.7.4 Reverse direction of flow to restricted direction of NRV and apply psi for 15 to 30 seconds. Record pressure, time, and upstream flow rate.

7.7.5 Switch circulating direction back to free flow direction of NRV.

7.7.6 Repeat 7.7.3 – 7.7.5 one hundred times.

7.8 NRV EROSION TEST (RECORD RESULTS AS PER TABLE A.1)

7.8.1 Prepare a slurry consisting of sand and viscosified water.

7.8.2 Place NRV in a fixture capable of retaining the NRV in a vertical Postion.

7.8.3 Determine the sand content of the slurry in accordance with the API *MPMS*, Chapter 10.4. Adjust the sand content to 2% ± 0,5 % by adding 180 µm to 150 µm (80 U.S. mesh to 100 U.S. mesh) sand or diluting the slurry with fresh water.

7.8.4 Determine the viscosity of the slurry sample with a Marsh funnel viscometer in accordance with API RP 13B-1. Adjust the viscosity to 70 s ± 5 s by adding a viscosifier or diluting the slurry with fresh water.

7.8.5 The viscosity and sand content requirements specified above shall be met before proceeding.

7.8.6 Circulation of slurry through NRV shall flow in the free flowing direction of the NRV and the flow shall be turbulent through the NRV.

7.8.7 Adjust the slurry circulation rate to a minimum flow velocity of 20 ft/second. Record the slurry circulation rate, sand content and slurry viscosity. Record the time at which the slurry circulation begins.

7.8.8 Circulating temperature of slurry should be held between 60 – 180°F. Record the temperature of the circulating slurry.

7.8.9 Circulate the slurry through the test valve at the specified rate for a minimum of 200 h.

7.8.10 At the completion of the flow period, measure and record the sand content of the slurry and the slurry viscosity.

7.9 RV FLOAT SUB AND NRV LANDING NIPPLE TESTING

7.9.1 NRV float sub and NRV landing nipple verification testing

a. The minimum test apparatus shall be a test facility capable of providing and recording pressures at the rated working pressure of the NRV float sub or NRV landing nipple.
b. The manufacturer shall perform a body integrity pressure test on each size, type and model of NRV float sub or NRV landing nipple at the rated working pressure of the NRV float sub or NRV landing nipple in accordance with a documented test procedure.
c. The manufacturer shall have on file drawings which show all the applicable dimensions and tolerances of parts contained in the verification-tested NRV float sub or NRV landing nipple. Pre-test and post-test dimensional verification shall be conducted and documented by the manufacturer.
d. The manufacturer shall document the verification test procedures and results.
e. Summarize the verification test data, and attach completed data forms. A sample form showing minimum testing criteria is located in Table A.3. Calibration records shall be included with the verification test report. Each data form shall be signed and dated by the person(s) conducting the test.

7.10 NRV EQUALIZING HEAD TESTING

7.10.1 NRV equalizing head verification testing

a. The minimum test apparatus shall be a test facility capable of providing and recording pressures at the rated working pressure of the NRV equalizing head.
b. The manufacturer shall perform a body integrity pressure test on each size, type and model of NRV equalizing head at the rated working pressure of the NRV equalizing head in accordance with a documented test procedure.
c. The manufacturer shall have on file drawings which show all the applicable dimensions and tolerances of parts contained in the verification-tested NRV equalizing head. Pre-test and post-test dimensional verification shall be conducted and documented by the manufacturer.
d. The manufacturer shall document the verification test procedures and results.
e. Summarize the verification test data, and attach completed data forms. A sample form showing minimum testing criteria is located in Table A.3. Calibration records shall be included with the verification test report. Each data form shall be signed and dated by the person(s) conducting the test.

7.10.2 NRV equalizing head functional testing

a. Record the serial number.
b. Each NRV equalizing head shall be dimensionally inspected to ensure compliance with all design specifications and drawings.
c. Each NRV equalizing head shall be installed in an NRV equalizing head or test device with the manufacturer's specified NRV equipment. Each NRV equalizing head shall be verified to function as per manufacturer’s specified operation NRV equipment pressure rating.
d. The manufacturer shall document the functional-test procedure and results.

7.11 VERIFICATION TEST FOR SEAL MATERIALS

7.11.1 Test apparatus

a. Test mandrel:

1. O-rings—The test mandrel shall have an outside diameter no greater than the manufacturer's minimum diameter of the equipment on which the O-ring will be used. The outside diameter of the O-ring groove shall be the minimum diameter specified. The mandrel shall be designed so that pressure can be applied between two O-rings.

2. Other packing—The test mandrel shall have an outside diameter equal to the manufacturer's minimum diameter of the equipment on which the packing will be used. The mandrel shall be designed so that pressure can be applied between two sets of packing when the mandrel is placed inside the test nipple. The number of packing rings for each set tested shall be no greater than the number specified by the manufacturer for the equipment on which the packing will be used.

b. The test nipple shall have an inside diameter equal to the maximum diameter of the manufacturer's equipment and a finish no finer than the manufacturer's maximum specification for the equipment.

c. Test baths shall be designed to contain safely the fluids in which the seals are to be immersed and shall be capable of withstanding the test temperatures used.

7.11.2 Procedures

a. Pressure-differential test procedure:

1. Install the seals on the test mandrel and place in a test nipple, making sure the test bath fluid fills the void between the seals being tested.

2. Place mandrel and nipple in the test oil heated to the maximum temperature rating of the seals and leave for 3 h, maintaining the maximum temperature. The test oil used shall be a heat transfer oil or equivalent with an open-cup flash point of 260°C (500°F).

3. Apply pressure equal to 150% of the maximum working pressure rating of the seals between the two sets of seals and hold for 10 minutes.

4. The maximum leakage shall be less than a pressure drop equal to 1% of the test pressure in 10 min for each 500 cm^3 of test chamber volume.

b. Growth test procedure:

1. Place four seals on the test mandrel and measure the outside diameter of the seals.

2. Immerse mandrel and seals in an appropriate test oil heated to the maximum rated temperature of the seals and leave for 2 h. The test oil for Class 1 and Class 2 service shall be No. 2 diesel oil with a closed-cup flash point of approximately 74°C (165°F). The test oil for Class 2S service shall be No. 2 diesel oil as above saturated with H_2S at 24°C (75°F) and 1,7 Mpa (250 psi) (approximately 300 000 ppm H_2S).

3. Remove the test mandrel from the test bath and, immediately after removal, measure the outside diameter of the seals.

i) The outside diameter of O-rings shall be limited to a 10% increase in the cross-sectional diameter.

ii) The outside diameter of other packings shall not exceed 2% growth based on packing diameter per 38°C (100°F) above ambient temperature, and total growth shall not exceed 3,18 mm (0,125 in.).

7.12 PRODUCTION TESTING

7.12.1 NRV pressure testing shall be performed by the manufacturer on each new NRV manufactured in accordance with this Standard. The manufacturer's test facility shall be equipped with instrumentation to display and record information required by the test procedure.

a. Low Pressure Test at ambient temperature at 200 psi with water for 1 minute not to exceed 10 cm^3/min.

b. High Pressure Test at ambient temperature at Rated Working Pressure with water for 1 minute not to exceed 10 cm^3/min.

c. Body Pressure Test at ambient temperature at 1.5x Rated Working Pressure with water for 1 minute not to exceed 10 cm^3/min. No detectable external body leakage shall be accepted on a retrievable NRV.

7.12.2 Each NRV shall be serialized, and results of pressure tests delivered with the NRV upon request by customer.

7.12.3 Results of pressure tests shall be retained by the manufacturer for a period of five years after the date of sale of a specific NRV.

7.12.4 Pressure-test data shall be recorded, dated and signed by the personnel performing the tests. A sample form showing minimum testing criteria is located in Table A.1.

8 Identification, documentation and preparation for transport

8.1 IDENTIFICATION

NRV equipment furnished to this Standard shall be permanently identified as per the manufacturer's written specifications. Identification shall include:

8.1.1 The manufacturer's name or trademark.

8.1.2 The manufacturer's size, type and model.

8.1.3 A unique identifying serial number.

8.1.4 The rated working pressure.

8.1.5 The date of original manufacture.

8.1.6 The class(es) of service designation.

1. Standard service
2. Stress corrosion cracking service

2S—Sulfide stress cracking service.

2C—Chloride stress cracking service.

8.1.7 API Monogram (if applicable).

8.2 DOCUMENTATION

The content of the forms in Annex A is normative as a minimum data requirement for the documentation specified in this clause; however, the format of the forms is informative.

8.2.1 Supplied documentation

NRV, NRV float insert, NRV float sub, NRV landing nipple, NRV equalizing head shall be delivered with a manufacturer's shipping and receiving report and an operating manual.

8.2.2 Minimum contents of manufacturer's operating manual

8.2.2.1 Size, type and model.

8.2.2.2 Class(es) of service.

8.2.2.3 Operating data:

a. working pressure;
b. temperature range;
c. internal yield pressure;
d. collapse pressure (NRV float subs and NRV landing nipples equipment at maximum rated temperature);
e. tensile load strength (applies to NRV float subs and NRV landing nipples at maximum rated temperature).

8.2.2.4 Dimensional data, including dimensions of drift bar and drift sleeve, if applicable.

8.2.2.5 NA

8.2.2.6 Drawings and illustrations, where applicable.

8.2.2.7 Parts list with all necessary information for reordering, including manufacturer's contact information.

8.2.2.8 Specific details of testing should be included if the test apparatus or procedures are significantly different than those included in this Standard.

8.2.2.9 Running instructions.

8.2.2.10 Pulling instructions.

8.2.2.11 Inspection and testing procedures.

8.2.2.12 Installation and operating procedures.

8.2.2.13 Troubleshooting and maintenance procedures.

8.2.2.14 Repair procedures and limitations.

8.2.2.15 Assembly and disassembly instructions and limitations.

8.2.2.16 Operating requirements:

8.2.2.17 Storage recommendations.

8.2.3 Retained documentation

8.2.3.1 Quality control documentation shall be retained as per 6.2.

8.2.3.2 For a period of five years after the date of sale of the NRV equipment, the manufacturer shall retain and have available for inspection by the operator the documentation listed below:

a. one complete set of drawings and written specifications, standards and procedures;
b. the manufacturing quality control reports;
c. the operators' equipment failure reports and records of corrective action;
d. the functional-test files;
e. copies of mill and other test reports.
f. verification testing, see 7.4.

8.3 PREPARATION FOR TRANSPORT

8.3.1 NRV equipment shall be packaged to prevent damage due to vibration and shock while in transit.

8.3.2 Sealing surfaces and external exposed threads shall be protected. All control line ports shall be protected to prevent entry of foreign material.

8.3.3 Temporary plugs, seals and protectors shall be clearly identified.

APPENDIX A
(NORMATIVE)
MINIMUM TEST DATA

Table A.1—Minimum Test Data Collection for Drill String Non-return Valve (NRV) Sample Form

Test Location	Manufacturer
Address	Representative
	Address
	Telephone
	Qualification: Month ___Day___ Year___

Valve to be tested:

Type: NRV	Class	Model	Serial number
Rated working pressure			
Nominal size of sub			
Minimum specified ID			

N2 Pressure Test:

Pressure	Average Test Temperature	Leak Rate

Hydro Pressure Test:

Pressure	Average Test Temperature	Leak Rate

Cycle Test:

Flow Media	Pressure	Number of Cycles

Flow/Erosion Test:

Flow Media	
Velocity (20 ft/sec minimum)	
Temperature	
Hours	

N2 Pressure Test (2):

Pressure	Average Test Temperature	Leak Rate

Hydro Pressure Test (2):

Pressure	Average Test Temperature	Leak Rate

Table A.2—Minimum Test Data Collection for NRV Float Subs and Landing Nipples - Sample Form

Test Location	Manufacturer
Address	Representative
	Address
	Telephone
	Qualification: Month___Day___Year___

NRV Float Sub or Landing Nipple to be tested:

Type: NRV used with		Class	
Model		Serial number	
Rated working pressure		Nominal size of sub	
Minimum specified ID			

Hydro Pressure Test:

Pressure	Average Test Temperature	Leak Rate

Table A.3—Minimum Test Data Collection for NRV Equalizing Head - Sample Form

Test Location	Manufacturer
Address	Representative
	Address
	Telephone
	Qualification: Month____Day____Year____

NRV Equalizing Head to be tested:

Type: NRV used with		Class	
Model		Serial number	
Rated working pressure		Nominal size of sub	
Minimum specified ID			

Hydro Pressure Test:

Pressure	Average Test Temperature	Leak Rate

Function Test:

Model(s) of NRV tested with:	
Model(s) of Float Sub or Landing Nipple tested with:	

APPENDIX B
(INFORMATIVE)
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 specification requirements.

When used in conjunction with the requirements of the API License Agreement, API Specification Q1, including this standard , defines the requirements for those organizations who 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 or call 202-682-8000 or by email at quality@api.org.

API

American Petroleum Institute

2006 Publications Order Form

Effective January 1, 2006.
API Members receive a 30% discount where applicable.
The member discount does not apply to purchases made for the purpose of resale or for incorporation into commercial products, training courses, workshops, or other commercial enterprises.

Available through Global Engineering Documents:
Phone Orders: **1-800-854-7179** (Toll-free in the U.S. and Canada)
303-397-7956 (Local and International)
Fax Orders: **303-397-2740**
Online Orders: **www.global.ihs.com**

Date: _____ ❑ **API Member** (Check if Yes)

Invoice To (❑ Check here if same as "Ship To")

Name:
Title:
Company:
Department:
Address:
City: State/Province:
Zip/Postal Code: Country:
Telephone:
Fax:
E-Mail:

Ship To (UPS will not deliver to a P.O. Box)

Name:
Title:
Company:
Department:
Address:
City: State/Province:
Zip/Postal Code: Country:
Telephone:
Fax:
E-Mail:

Quantity	Product Number	Title	SO★	Unit Price	Total
	G07040	Spec 7, Rotary Drill Stem Elements		$144.00	
	CX07101	Spec 7-1, Specification for Rotary Drill Stem Elements		$134.00	
	GX5CT08	Spec 5CT, Casing and Tubing, Petroleum and natural gas industries - Steel pipes for use as casing or tubing for wells		$168.00	
	GX14B05	RP 14B, Design, Installation and Testing of Basic Surface Safety Systems, Petroleum and natural gase industries-Subsurface safety valve systems-Design, installation, operation, and redress		$92.00	
	GX13B13	RP 13B-1, Field Testing Water-Based Drilling Fluids, Petroleum and natural gas industries-Field Testing of drilling fluids-Part I-Water based fluids (Modified)		$168.00	
	H10043	MPMS 10.4, Determination of Water and/or Sediment in Crude Oil by the Centrifuge Method (Field Procedure)		$60.00	

❑ **Payment Enclosed** ❑ **P.O. No.** (Enclose Copy) _____

❑ **Charge My Global Account No.** _____

❑ **VISA** ❑ **MasterCard** ❑ **American Express** ❑ **Diners Club** ❑ **Discover**

Credit Card No.:
Print Name (As It Appears on Card):
Expiration Date:
Signature:

Subtotal	
Applicable Sales Tax *(see below)*	
Rush Shipping Fee *(see below)*	
Shipping and Handling *(see below)*	
Total *(in U.S. Dollars)*	

★ ***To be placed on Standing Order for future editions of this publication, place a check mark in the SO column and sign here:***

Pricing and availability subject to change without notice.

Mail Orders – Payment by check or money order in U.S. dollars is required except for established accounts. State and local taxes, $10 processing fee*, and 5% shipping must be added. Send mail orders to: **API Publications, Global Engineering Documents, 15 Inverness Way East, M/S C303B, Englewood, CO 80112-5776, USA.**
Purchase Orders – Purchase orders are accepted from established accounts. Invoice will include actual freight cost, a $10 processing fee*, plus state and local taxes.
Telephone Orders – If ordering by telephone, a $10 processing fee* and actual freight costs will be added to the order.
Sales Tax – All U.S. purchases must include applicable state and local sales tax. Customers claiming tax-exempt status must provide Global with a copy of their exemption certificate.
Shipping (U.S. Orders) – Orders shipped within the U.S. are sent via traceable means. Most orders are shipped the same day. Subscription updates are sent by First-Class Mail. Other options, including next-day service, air service, and fax transmission are available at additional cost. Call 1-800-854-7179 for more information.
Shipping (International Orders) – Standard international shipping is by air express courier service. Subscription updates are sent by World Mail. Normal delivery is 3-4 days from shipping date.
Rush Shipping Fee – Next Day Delivery orders charge is $20 in addition to the carrier charges. Next Day Delivery orders must be placed by 2:00 p.m. MST to ensure overnight delivery.
Returns – All returns must be pre-approved by calling Global's Customer Service Department at 1-800-624-3974 for information and assistance. There may be a 15% restocking fee. Special order items, electronic documents, and age-dated materials are non-returnable.
***Minimum Order –** There is a $50 minimum for all orders containing hardcopy documents. The $50 minimum applies to the order subtotal including the $10 processing fee, excluding any applicable taxes and freight charges. If the total cost of the documents on the order plus the $10 processing fee is less than $50, the processing fee will be increased to bring the order amount up to the $50 minimum. This processing fee will be applied before any applicable deposit account, quantity or member discounts have been applied. There is no minimum for orders containing only electronically delivered documents.

There's more where this came from.

The American Petroleum Institute provides additional resources and programs to the oil and natural gas industry which are based on API® Standards. For more information, contact:

• API Monogram® Licensing Program	Phone:	202-962-4791
	Fax:	202-682-8070
• American Petroleum Institute Quality Registrar (APIQR®)	Phone:	202-962-4791
	Fax:	202-682-8070
• API Spec Q1® Registration	Phone:	202-962-4791
	Fax:	202-682-8070
• API Perforator Design Registration	Phone:	202-962-4791
	Fax:	202-682-8070
• API ISO/TS 29001 Registration	Phone:	202-962-4791
	Fax:	202-682-8070
• API Training Provider Certification Program	Phone:	202-682-8490
	Fax:	202-682-8070
• Individual Certification Programs	Phone:	202-682-8064
	Fax:	202-682-8348
• Engine Oil Licensing and Certification System (EOLCS)	Phone:	202-682-8516
	Fax:	202-962-4739
• API PetroTEAM™ (Training, Education and Meetings)	Phone:	202-682-8195
	Fax:	202-682-8222

Check out the API Publications, Programs, and Services Catalog online at www.api.org.

API
American Petroleum Institute

Helping You Get
The Job Done Right.®

Additional copies are available through IHS
Phone Orders: 1-800-854-7179 (Toll-free in the U.S. and Canada)
303-397-7956 (Local and International)
Fax Orders: 303-397-2740
Online Orders: global.ihs.com

Information about API Publications, Programs and Services
is available on the web at **www.api.org**

1220 L Street, NW
Washington, DC 20005-4070
USA

202.682.8000

Product No. G7NRV01