Cementing Float Equipment Testing

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Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

Contents

Contents

Page

Tables

Cementing Float Equipment Testing

1 Scope

This specification provides testing and marking requirements for cementing float equipment to be used in oil and natural gas well construction.

2 Normative References

The following referenced documents are indispensable for the application of this document. For undated references, the latest edition of the referenced document applies (including any addenda/errata). For dated references, only the edition cited applies. However, not all documents listed may apply to your specific needs. The body of the standard should be referred to for how these documents are specifically applied.

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

API Specification 13A, *Drilling Fluid Materials*

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

For a list of other documents associated with this standard, see the Bibliography.

2.1 Use of SI and U.S. Customary Units

This document contains derived metric units (SI) and U.S. customary oilfield units. For the purposes of this document, the conversion between the systems is not exact and has been intentionally rounded to allow for ease of use in calibration and measurement.

3 Terms and Definitions

For the purposes of this specification, the following terms and definitions apply.

3.1
annulus
Area between the casing and open hole or previously set casing.

3.2
autofill (auto-fill)
A feature incorporated in the design of some float equipment that allows the flow check system(s) to be initially disengaged so fluid may pass in either direction when running a string of casing. This feature facilitates casing fill-up and may also be used for surge reduction.

NOTE This action may reduce surge pressures in the well that may otherwise be present if float valves remained closed during running of the casing.

3.3
float equipment
float equipment assembly
Casing accessories that contain one or more check valves and become part of the lower section of a casing string for the purpose of preventing the reverse flow of cement once placed in a wellbore annulus.

3.4
forward flow
Fluid movement in the direction the valve is designed to open.

3.5
manufacturer
The firm, company, or corporation responsible for the manufacturing and marking of the product to warrant that the product conforms to the specification.

3.6
product family
Float equipment developed for different casing sizes that utilizes the same design and materials (i.e. valve design, plug seats, sealant, and elastomeric materials, etc.). Product families are identified in order to qualify designs without the need to test float equipment for every casing size.

3.7
reverse flow
Fluid movement in the direction the float equipment valve is designed to close.

4 Symbols and Abbreviations

AF auto fill

ASTM American Society for Testing and Materials

D cumulative forward flow duration hours (see Table 1)

EN European standard

HT high temperature

HP high pressure

ID inside diameter

ISO International Organization for Standardization

LP low pressure

NIST National Institute of Standards and Technology

P pressure category for high pressure static test (see Table 5)

R forward flow rate for flow durability testing (see Table 3)

T temperature category for high temperature static test (see Table 4)

5 General Information

5.1 Function of Cementing Float Equipment

Cementing float equipment (float equipment) refers to one or more check valves incorporated into a well casing string whose primary purpose is to prevent cement that has been placed in the casing/wellbore annulus from flowing up the casing.

Float equipment may be used for lessening the load on the drilling rig or reducing running forces. Since float equipment blocks flow up the casing, the buoyant force acting on casing reduces the load the rig is required to carry. This can be achieved through managing the hydrostatic pressure inside the casing relative to the hydrostatic pressure outside the casing, either through managing fluid height or fluid density.

Auto-fill float equipment is a special type of float equipment that allows the casing to fill from the bottom as the casing is run into the well. This may help reduce pressure surges as the casing is lowered into the well. Auto-fill float equipment may help ensure that the collapse pressure of the casing is not exceeded. Once the casing is run, the auto-fill float equipment check valve mechanism is activated, and the float equipment is converted to “standard” equipment. The conversion is normally executed by either pumping a surface-released ball through the equipment or by circulating above a predetermined rate.

5.2 Performance of Cementing Float Equipment

There are a number of performance criteria that may be used to evaluate the suitability of a particular piece of float equipment for a given well. Float equipment should function after a fluid containing solids has been circulated through the equipment for a period of time. Flow period, flow rate, fluid temperature, and fluid properties can affect the durability of the equipment. Float equipment should be capable of withstanding a differential pressure with the higher pressure being exerted from below the check valve, and capable of functioning at the temperature to which it is exposed.

The testing procedures consist of:

a) flow durability;

b) static pressure and temperature testing.

The flow durability tests entail installing the float equipment in a flow loop and pumping a specified test fluid for a set amount of time. This is followed by applying a low backpressure to determine if the valve holds pressure. If casing fill-up equipment is being evaluated, the equipment is subjected to reverse flow of fluids for a specified time and then converted prior to testing forward flow. Following the flow durability tests, the float equipment is mounted in an apparatus that allows the equipment to be heated to elevated temperature and backpressure applied to determine if the valve leaks. This standard does not address flow or testing with fluids in a gaseous state.

6 Calibration

6.1 General

This clause defines the requirements for calibration and verification of measurements by instruments and acquisition systems used in testing cementing float equipment. The term “calibration” is used to mean either calibration or verification according to the requirements of this specification. Prior to running a test, calibrations shall be performed using instruments and devices certified and traceable to a national/international body, such as NIST, EN, ISO, or equivalent, within the previous 12 months. Equipment calibrated to the requirements of this specification is considered accurate if calibration is within the specified limits listed in 6.2 through 6.8. Calibration dates for instruments used in the tests of cementing float equipment shall be recorded on the test report.

6.2 Timers

Timers shall be accurate within ±5 seconds per hour and shall be verified over a period of no less than 12 minutes. Calibration shall use the time signal from the NIST or similar websites and radio stations. If not within required accuracy, the units shall be adjusted or replaced.

6.3 Flow Meter Systems

The flow meter system shall be capable of measuring the flow rate of the circulating test fluid being pumped through the float equipment in 0.015 m^3/min (0.1 bbl/min) or smaller increments and be accurate within ±0.015 m^3/min (±0.1 bbl/min) for the flow rate of the test being performed.

Turbine-type flow meters are susceptible to wear and may not be suitable to the tests in this specification. Turbine-type flow meters shall be volumetrically calibrated after each test. If the flow meters are found to be outside of the above accuracy, the test is invalid.

6.4 Pressure Measuring Systems

Pressure measuring systems shall be readable to ±0.5 % of the test pressure range or better and cover the range to be measured. The system shall be able to maintain ±2 % accuracy of the test pressure range. Calibration shall be done at 25 %, 50 %, 75 %, and 100 % of test pressure, using a certified deadweight tester or master gauge to ±1 % of full range or minimum gauge increment, whichever is greater.

6.5 Temperature Measuring Systems

Temperature measuring systems shall be accurate to within ±1 °C (±2 °F).

6.6 Data Acquisition System

Data acquisition shall be by chart recorder or by electronic recording, such as computer data acquisition, or both. Data shall be collected at least every 60 seconds for the duration of the test.

6.7 Volumetric Glassware and Liquid Receivers

Calibration of pipettes, graduated cylinders, and similar equipment is generally performed by the glassware supplier and can be part of the purchase specification. Users should obtain documented evidence of glassware calibration from the supplier. Calibration can be checked gravimetrically. Periodic recalibration is not required.

6.8 Balances

Balances shall be accurate to ±0.1 % of reading for measurements made at 10 g or greater up to the full scale of the balance. Balances shall be accurate to ±1 % of reading for measurement made less than 10 g. Balances shall have two-decimal-place precision at a minimum. Each range of a dual range balance shall be calibrated.

7 Flow Durability Time Categories

7.1 Categories

Four categories for flow durability testing are shown in Table 1.

Table 1—Categories of Flow Durability Tests for Float Equipment

Category	**Cumulative[a] Forward Flow Duration** Hours (0/+15 min)
D8	8
D12	12
D24	24
D36	36

[a] Cumulative forward flow duration does not require continuous flow through the test equipment. For example, a 36-hour test may be conducted over several days.

7.2 Auto-fill Equipment—Reverse Flow Test

For auto-fill equipment, prior to the conversion of the valve system, Table 2 lists the required reverse flow periods. The reverse flow rate shall be not less than 0.5 m^3/min (3 bbl/min). The actual flow rate used for the reverse flow test shall be noted on the report form. This test shall be performed prior to the flow durability test. Following the reverse flow duration test, conversion of the valve per manufacturer's recommendations shall be performed (see 10.2.2).

Table 2—Reverse Flow Duration for Casing Fill-up Equipment

Category	**Cumulative[a] Reverse Flow Duration** Hours (-0/+15 min)
AF4	4
AF8	8
AF12	12

[a] Cumulative reverse flow duration does not require continuous flow through the test equipment. For example, a 12-hour test may be conducted over several days.

8 Flow Durability Rate Categories

Four categories for forward flow rate testing are shown in Table 3.

Table 3—Forward Flow Rates for Flow Durability Testing

Category	**Flow Rate[a]** m^3/min (-0/+0.08)	**Flow Rate[a]** bbl/min (-0/+0.5)
R6	1.0	6
R10	1.6	10
R15	2.4	15
R20	3.2	20

[a] The minimum forward flow rate of 1 m^3/min (6 bbl/min) is only for use on float equipment for casing sizes 139.7 mm (5½ in.) and smaller. Larger-sized equipment may be tested using either 1.6 m^3/min or 3.2 m^3/min (10, 15, or 20 bbl/min) for the duration of the flow test.

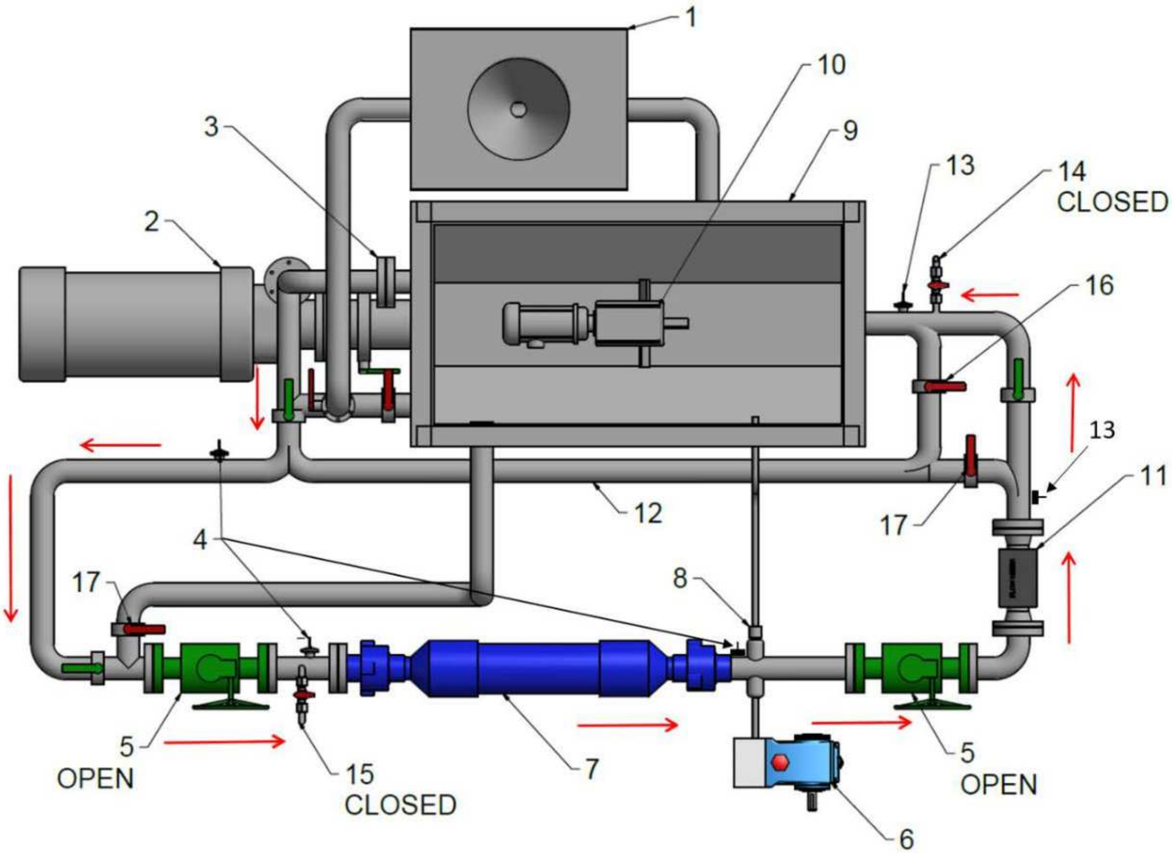
9 Apparatus and Materials

9.1 Flow Loop

9.1.1 General

The flow durability test system shall be capable of pumping the circulating test fluid through the float equipment at the circulation rate specified for the float equipment casing size range being tested within a tolerance of -0/+0.08 m^3/min (-0/+0.5 bbl/min). Flow rate and temperature of the circulating test fluid shall be measured and recorded over the duration of the test.

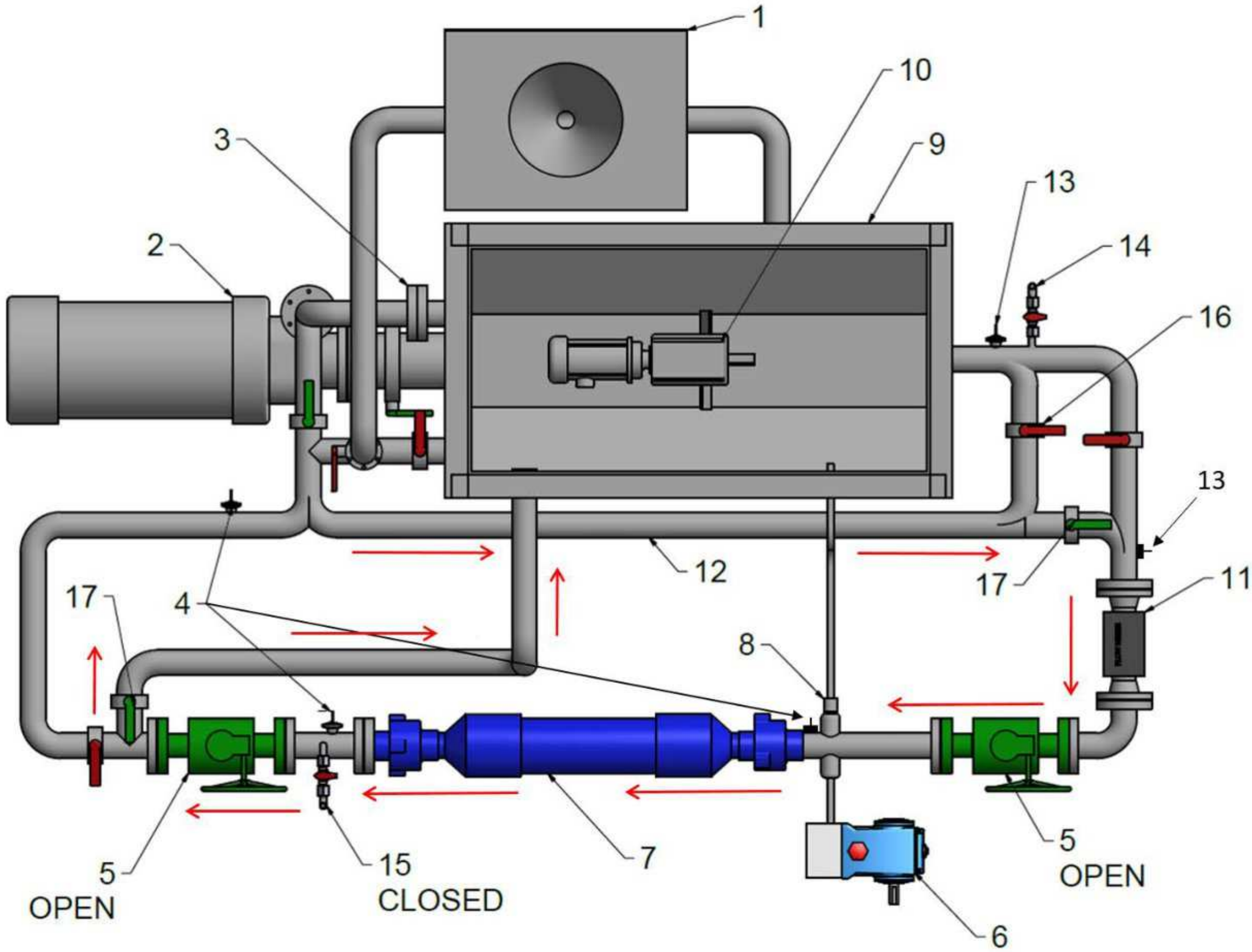
Figures 1 through 3 are example diagrams of a flow loop used for durability testing, indicate fluid flow directions, are illustrative only, and are not to scale. Other configurations are possible. The major components of the loop are the mud tank, piping network, pump, and instrumentation. These components are discussed in the following paragraphs.



Key

1	Hopper	10	Agitator
2	High volume pump	11	Flow meter
3	LP safety valve/rupture disc	12	Reverse/bypass flow line
4	Pressure transducers	13	Temperature transducer
5	HP large line valves	14	LP sample valve
6	HP pump	15	HP sample valve
7	Test piece	16	Bypass valve
8	HP safety valve	17	Reverse flow valve
9	Tank		

Figure 1—Forward Flow



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1	Hopper	10	Agitator
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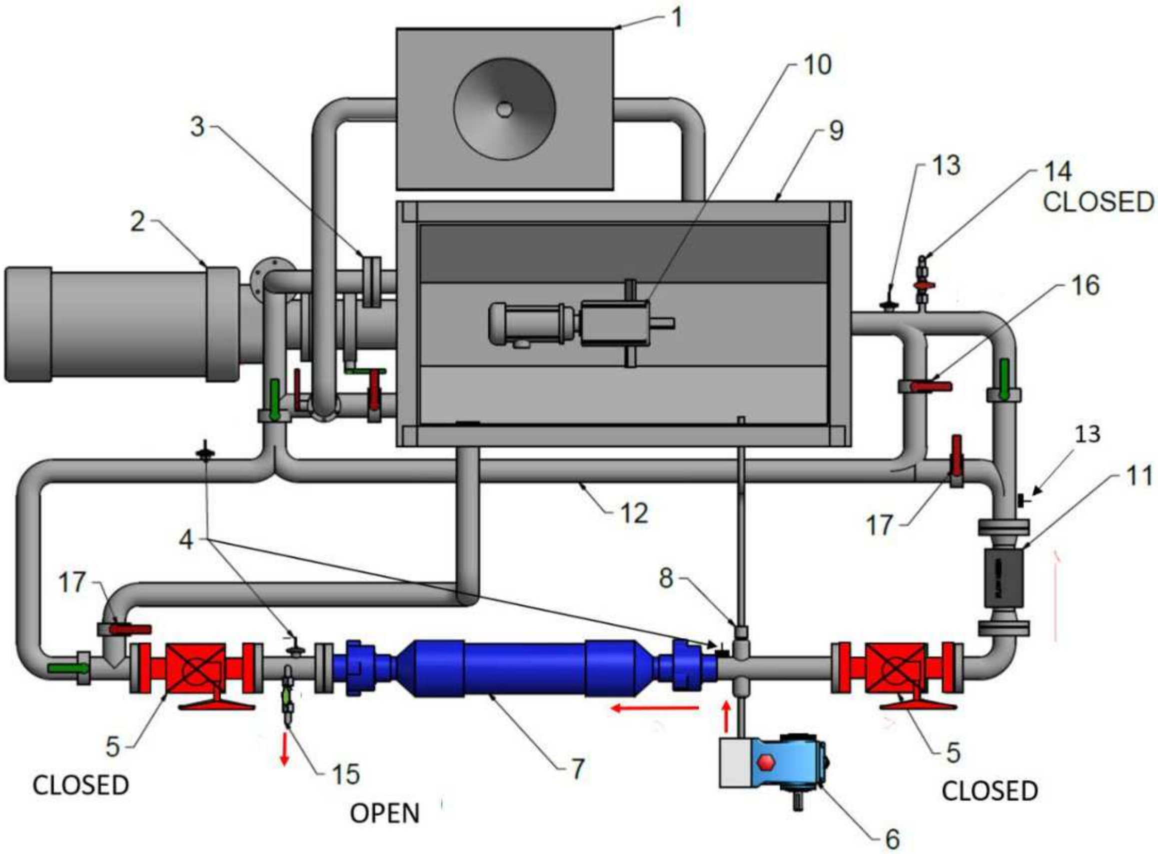
6	HP pump	15	HP sample valve
7	Test piece	16	Bypass valve
8	HP safety valve	17	Reverse flow valve
9	Tank		

Figure 2—Reverse Flow



Key

1	Hopper	10	Agitator
2	High volume pump	11	Flow meter
3	LP safety valve/rupture disc	12	Reverse/bypass flow line
4	Pressure transducers	13	Temperature transducer
5	HP large line valves	14	LP sample valve
6	HP pump	15	HP sample valve
7	Test piece	16	Bypass valve
8	HP safety valve	17	Reverse flow valve
9	Tank		

Figure 3—Backflow Pressure Testing

9.1.2 Piping Network

The piping network provides a conduit for the circulating test fluid to flow from the mud tank to the pump, through the float equipment, and return to the mud tank. The inside diameter of the piping ahead of the float equipment shall be at least as large as the float valve inlet diameter for a distance of at least three times the float valve inlet diameter. The inside diameter of the piping behind the float equipment shall be at least as large as the float valve outlet diameter for a distance of at least two times the float valve outlet diameter.

The piping system shall allow for backpressure testing to at least 700 kPa ±170 kPa (100 psi ±25 psi) and to release pressure and measure flow back or leakage across the float equipment. It shall also provide a means of taking circulating test fluid samples.

Piping and valves shall be configured and verified such that the flow meter is recording flow through the float equipment.

9.1.3 Pump System

A pump or combination of pumps shall be capable of pumping the circulating test fluid through the float equipment at the rates required for the category of the equipment being tested. An additional pump or pumps may be provided to apply the pressure required for backpressure testing and/or auto-fill float equipment conversion.

9.1.4 Instrumentation

The instrumentation for the flow loop shall include a flow meter, a temperature probe, and pressure transducers. A data acquisition system shall be provided for recording the outputs from these devices during testing. Minimum data recording rates shall conform as specified in 6.6.

Measurement of the back flow volume shall be via graduated cylinder or balance.

9.2 Circulating Test Fluid

9.2.1 Circulating Test Fluid Type

The circulating test fluid shall be a water-based drilling fluid that has the following properties:

— density: 1440 kg/m^3 to 1500 kg/m^3 (12.0 lb/gal to 12.5 lb/gal);

— sand content: 2 % to 4 % volume fraction.

The weighting material used in the test fluid shall be barite that meets the specifications of API 13A. The fluid properties shall be measured and calculated in accordance with API 13B-1. The sand used in the test fluid should be 212/75 micrometers (70/200 US mesh) silica sand.

9.2.2 Circulating Test Fluid Rheological Properties

The circulating fluid shall have the following properties at 50 °C ±3 °C (120 °F ±5 °F):

— plastic viscosity: 10 mPa●s to 50 mPa●s (10 cP to 50 cP)

— yield point: 2.4 Pa to 12.0 Pa (5 lbf/100 ft^2 to 25 lbf/100 ft^2)

— 10 s gel strength: > 1.9 Pa (> 4 lbf/100 ft^2)

10 Durability Test

10.1 Test Setup

10.1.1 Test Fluid

The test fluid shall be prepared in accordance with 9.2. The prepared fluid shall be circulated through the test loop (bypassing the float equipment) until the fluid properties have stabilized to within the requirements in 9.2 at 50 °C ±3 °C (120 °F ±5 °F). The fluid is considered stabilized when the rheological properties of two samples taken a minimum of 30 minutes apart have properties according to 9.2.

NOTE There is no temperature requirement for the fluid in the test loop, only for the rheological testing of the sample of the fluid.

10.1.2 Equipment Orientation

The float equipment for evaluation shall be mounted in the test section of a flow loop according to 9.1. The orientation of the float equipment shall be within 10° of horizontal.

The equipment shall remain in the flow loop for the duration of the flow durability test.

For testing of flapper-type float equipment, the hinge of the flapper (or at least one of the flappers on double valve equipment) shall be within 45° of the bottom (low side) so that closure is not assisted by gravity. Following the flow durability test, the hinge and spring should be inspected and the condition noted on the report form, with color photos taken before and after the test included in the report.

10.2 Procedure

10.2.1 Conventional (non-auto-fill) Float Equipment

10.2.1.1 Fluid Temperature

Fluid circulating temperature shall be recorded during the test.

10.2.1.2 Test Procedure

The following procedure shall be followed for testing conventional cementing float equipment.

10.2.1.2.1 Verify calibration documentation of instrumentation and measurement equipment in accordance with Section 6.

10.2.1.2.2 Prepare and/or validate the circulation test fluid in accordance with 9.2 and 10.1.1.

10.2.1.2.3 Install float equipment in flow loop oriented in accordance with 10.1.2.

10.2.1.2.4 Verify data collection in accordance with 6.6.

10.2.1.2.5 Begin circulation of test fluid at the desired rate to initiate the test.

10.2.1.2.6 The density and sand content of the circulation fluid shall be tested every 2 h (±15 min) and adjusted if necessary before continuing the test.

10.2.1.2.7 Circulate the test fluid through the float equipment for 4 hours (-0/+15 min).

10.2.1.2.8 Stop circulation and perform a backflow test by applying 700 kPa ±170 kPa (100 psi ±25 psi) to the high-pressure portion of the flow loop, and attempt to backflow through the valve;

10.2.1.2.9 Release pressure upstream of the float equipment by opening a bleed valve upstream of the float equipment (e.g. HP Valve 15 as shown in Figure 3), and bleed the upstream pressure. Atmospheric pressure shall be reached within 15 seconds while maintaining the 700 kPa ±170 kPa (100 psi ±25 psi) for the duration of the test.

10.2.1.2.10 Measure backflow through valve:

NOTE During the test period, any flow through the float equipment is to be measured with a graduated cylinder; alternately, the fluid may be weighed and the weight converted to a volume.

a) Weight shall be measured to within ±0.5 g. Fluid relative density may be determined using a hydrometer, in accordance to API 13J.

b) Within 2 minutes after completion of 10.2.1.2.9, the 3-minute test period shall begin;

c) The maximum allowable flow is 50 mL through the float equipment over the 3-minute test period;

d) The backpressure test requires a total of 3 minutes, and the test shall be completed within 5 minutes of opening the upstream bleed valve.

10.2.1.2.11 In the event of failure of the valve to close:

a) If the valve will not close, attempt to achieve valve closure by flowing in a reverse direction against the valve for a maximum of 19 liters (5 gallons).

b) During this process, the pressure shall not exceed 870 kPa (125 psi).

c) After closure, maintain 700 kPa ±170 kPa (100 psi ±25 psi) for the duration of the test.

d) Float equipment that does not pass this step after one attempt constitutes a failure of this test.

e) Restart circulation of the test fluid at the desired rate.

10.2.1.2.12 Repeat steps 10.2.1.2.7 through 10.2.1.2.11 for the total cumulative flow period of 8, 12, 24, or 36 hours, depending on the test category as shown in Table 1.

10.2.1.2.13 Following the final backpressure test, backpressures exceeding 700 kPa (100 psi) may be applied.

Equipment qualified for longer flow periods and a particular rate is considered qualified for the shorter time periods and equal or lower flow rates, as well.

At the end of the cumulative circulation period, remove the float equipment from the flow loop and visually inspect the equipment for any signs of abrasion or wear. Note any abnormalities in the testing report.

Proceed with the high-temperature/high-pressure test as outlined in Section 11 using the same piece of float equipment tested in the flow durability test.

10.2.2 Auto-fill Equipment

10.2.2.1 Conversion Testing

10.2.2.1.1 Circulation Rate

Following the requirements given in 10.2.1.1 and 10.2.1.2.1 to 10.2.1.2.6, circulate in the reverse direction through the float equipment no less than 0.5 m^3/min (3 bbl/min) for reverse flow as shown in Table 2.

10.2.2.1.2 Equipment Conversion

Convert the float equipment valve in accordance with the manufacturer's recommendation. Record the pressure and/or rate required to activate the check valve.

Following completion of the equipment conversion, perform the durability test for regular float equipment as specified in 10.2.1.

11 Static High-temperature/High-pressure Category Rating

The categories for static high-temperature/high-pressure testing are shown in Table 4 and Table 5.

Table 4—Temperature Categories of Static High-temperature Tests

Category	Temperature[a] °C (°F)
T200	93 (200)
T300	150 (300)
T350	177 (350)
T400	205 (400)

[a] Duration at temperature is no less than 8 continuous hours prior to testing to be held within ±5 % for the duration of the test.

Table 5—Pressure Categories of High-pressure Tests

Category	Test Pressure[a] kPa (psi)
P1.5	10,300 (1500)
P3	20,700 (3000)
P5	34,500 (5000)
P7.5	51,700 (7500)

[a] Control of pressure for this test shall be -0/+2100 kPa (300 psi).

NOTE Consideration should be given to the pressure limits of the body stock and thread couplings when performing high-pressure testing. Typically, the test pressure does not exceed 80 % of the burst rating.

The pressure test category only evaluates the capability of the float equipment to withstand the noted differential pressure with a silicone-based oil (see 12.1) during the test for specification purposes. The test does not investigate prevention of gas flow.

12 High-temperature/High-pressure Test Cell

12.1 Apparatus

A special test apparatus is recommended for applying temperature and pressure to float equipment. The apparatus shall be rated for safe operation at the temperatures and pressures required for the test category. Figure 4 is a schematic diagram of a typical apparatus for applying temperature and pressure to float equipment. Other apparatus and methods for applying temperature and pressure to float equipment are acceptable.

The test apparatus illustrated in Figure 4 consists of a chamber body with attached end caps to which the float equipment is attached. For pressure-testing float equipment, it may be more desirable to build several chambers rather than one large chamber. The chamber body, end caps, and support equipment shall be manufactured and assembled to withstand the anticipated pressures and stresses.

During pressure-temperature tests, the entire chamber (including the internal portion of the float equipment) shall be filled with a nonaqueous fluid, (with a flash point above the test temperature) such that, to the extent practicable, air is removed from the chamber. The nonaqueous fluid shall not contain viscosity enhancers or added solids.

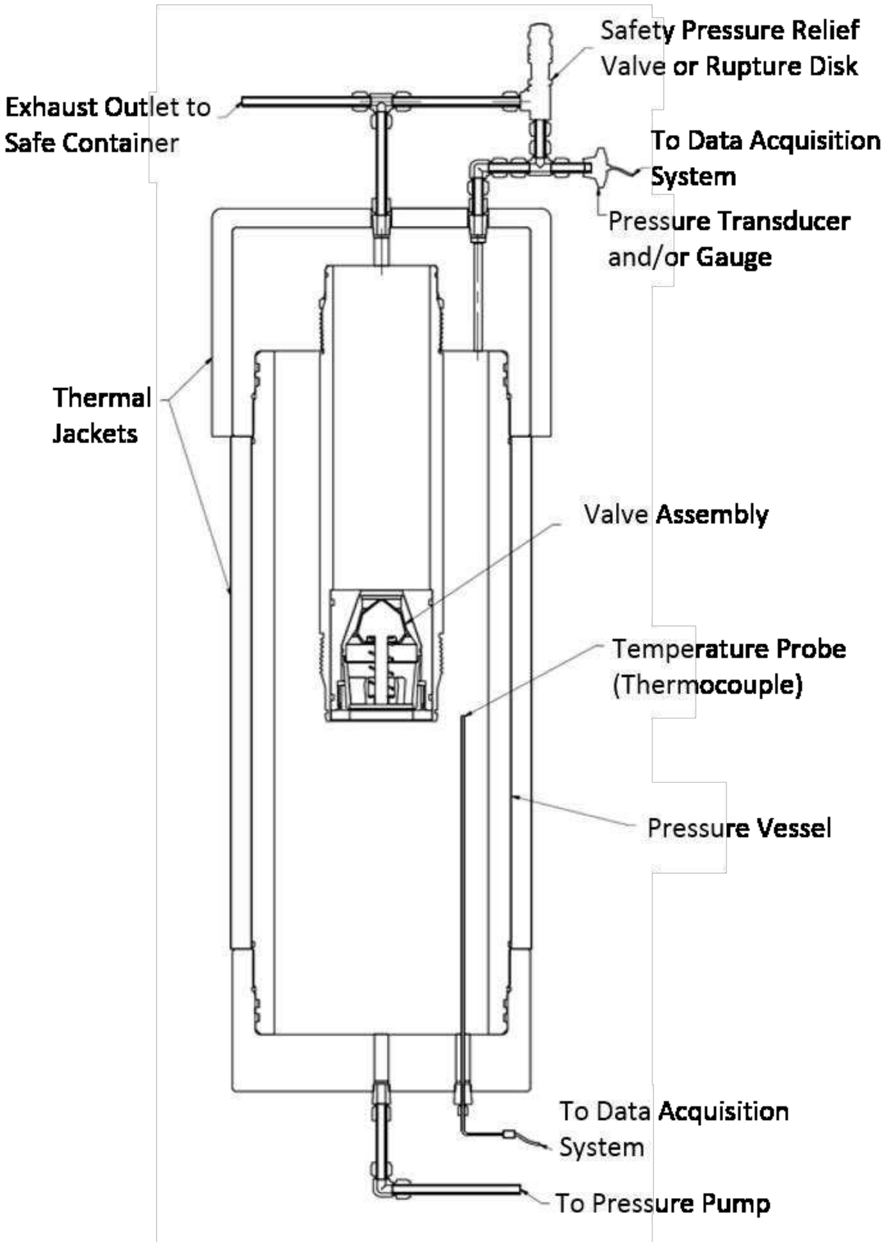


Figure 4—Typical Controlled Pressure-Temperature Test Cell

12.2 Test Cell Procedure

Prior to performing this test, the equipment shall have undergone a flow durability test in accordance with Section 10.

The following procedure shall be followed for the test cell.

12.2.1 Install the float equipment in the high-temperature/high-pressure test apparatus.

— Differential pressure of no more than 500 psi may be applied to the float equipment as needed during the 8-hour soak period.

Depending on the test category, stabilize the temperature to 93 °C (200 °F), 150 °C (300 °F), 177 °C (350 °F), or 205 °C (400 °F) according to Table 4, and maintain the test temperature within ±5 % for a period of no less than 8 hours.

12.2.2 Following the 8-hour soak period, increase differential pressure to the pressure of the test category within 30 minutes and maintain the pressure shown in Table 5. In the event of a mechanical or power failure, the test may be resumed when interruption is remedied. If the interruption exceeds 1 hour, the test must be redone.

12.2.3 Stopping the pressure test to investigate flow at lower pressures is allowable. Following each successful test step, the time to increase the pressure to the next category as shown in Table 5 shall not exceed 5 minutes per 1000 psi.

12.2.4 Measure backflow through valve:

During the test period, any flow through the float equipment shall be measured with a graduated cylinder; alternately, the fluid may be weighed and the weight converted to a volume.

— Weight shall be measured to within ±0.5 g. Fluid relative density may be determined using a hydrometer, in accordance to API 13J.

— Within 15 minutes of completion of 12.2.4, the 15-minute test period shall begin.

— The maximum allowable flow is 750 mL through the float equipment over the 15-minute test period.

— The backpressure test requires a total of 15 minutes after completion of 12.2.4.

12.2.5 Following the final pressure test, remove the float equipment from the test chamber. Note any anomalies in the testing report.

Equipment qualified for a specific temperature and pressure category is considered qualified for lower categories.

13 Extrapolation and Interpolation of Test Results

13.1 Extrapolation

Extrapolation of test results to inside diameters larger or smaller than tested is not allowed.

13.2 Interpolation

Interpolation of test results of one float equipment product family may be applied to other sizes of the same product family that meet all the following requirements.

13.2.1 To qualify float equipment by interpolation, physical tests in accordance with Section 7 through Section 12 are required of equipment with a larger and smaller ID than that piece of equipment.

13.2.2 The float equipment must have the float valve, holding mechanism(s), plug landing surface (e.g., nonrotating device, latch-down mechanism), sealant (e.g. grout, epoxy), and elastomer(s) of the same design and composition.

13.2.3 The piece of equipment being qualified by interpolation may only be qualified to the lowest temperature, pressure, flow rate, and flow durability time category of the previously tested and qualified referenced float equipment.

13.2.4 The test results of one grade of float equipment body may be applied to other grades if the minimum yield strength of the float equipment body is not exceeded at the rated pressure.

13.2.5 Static high-temperature/high-pressure testing may be used to qualify intermediate-size float equipment within a product family at a temperature and pressure category within the highest and lowest categories tested. Flow endurance tests are not required to qualify these intermediate sizes.

14 Reporting of Results

A suggested form for reporting the results of the performance testing described in this specification is shown in Annex A.

While not part of this specification, it is recommended that manufacturers report the material properties of the body of the float equipment.

15 Marking

The following marking may be made in sequential order on casing float equipment:

a) "Tested per API Spec 10F";

b) size in inches, followed by durability time (D) in hours, flow rate (R) in bbl/min, temperature (T) in °F, pressure (P) in psi/1000; and reverse flow period (AF) in hours (where applicable to auto-fill equipment).

U.S. customary units or SI units may be used.

The required markings should be located at appropriate external location to view, and appropriately sized for legibility.

Other markings or information may also be used as agreed between the purchaser and manufacturer.

Example Marking

An example of marking for 7 in. float equipment that has been tested for a flow durability time of 24 hours at 10 bbl/min and subsequently tested at 300 °F to a pressure of 5000 psi:

— Tested per API Spec 10F: 7 inch – D24 R10 T300 P5

As above, an example marking for float equipment that has auto-fill capabilities and was reverse flow tested for 12 hours given in Table 2 would read:

— Tested per API Spec 10F: 7 inch – D24 R10 T300 P5 AF12

Annex A
(informative)

Results of Performance Tests on Cementing Float Equipment

A.1 General Information

Manufacturer ____________________

Size of float equipment tested ____________________

Model number of float equipment tested ____________________

Location of plant where float equipment manufactured ____________________

Location of testing facility ____________________

Date of float equipment manufacture ____________________

Valve description ____________________

Valve material ____________________

Description of float equipment body ____________________

Type of float equipment tested ____________________

Calibration Dates:

Timer(s): ____________________ Flow Meter System: ____________________

Pressure Measurement System: ____________________ Temperature Measurement: ____________________

Data Acquisition Check: ____________________ Balances: ____________________

A.2 Flow Durability Testing

Dates of testing: ____________________

Reverse flow duration (hrs): 4 ________ 8 ________ 12 ________ (auto-fill only)

Auto-fill reverse flow rate (bbl/min):

Flow durability rate (bbl/min): 8 ________ 12 ________ 24 ________

Flow durability time (hours): 8 ________ 12 ________ 24 ________ 36 ________

Type of pump used for circulation: ____________________

Average sand concentration during test: ____________________

Maximum backflow volume to achieve valve closure: ____________________

Maximum rate to achieve valve closure: ____________________

If pass, maximum test pressure used: ____________________

If fail, total duration until failure: ____________________

If auto-fill equipment, reverse-flow pressure drop across valve: ____________________

If auto-fill equipment, pressure and/or rate to activate: ____________________

Description of valve after test: ____________________

Attach photos of equipment before and after testing: ____________________

A.3 High-Temperature/High-Pressure Testing

Dates of testing: ____________________

HT/HP test Pressure (psi): 1500 __________ 3000 __________ 5000__________ 7500 __________

HT/HP Test Temperature (°F): 200 __________ 300 __________ 350 __________ 400 __________

Type of pressure application: Internal only _________ Internal and External _________

If pass, maximum test pressure used: ____________________

If fail, maximum test pressure achieved: ____________________

Description of valve after test: ____________________

Attach photos of equipment before and after testing: ____________________

A.4 Final API Test Category

AF _________

D _________

R _________

T _________

P _________

Signature: ____________________ Title: ____________________

Name: ____________________ Contact Information: ____________________

Date Signed: ____________

Annex B
(informative)

Evaluation of Elastomers in Nonaqueous Fluids

Float equipment may be exposed to water based or nonaqueous-based fluids during normal use in oil and gas wells. This specification evaluates durability through testing with a water-based fluid that is chosen for safety, low environmental impact, and to represent a fluid with high abrasive characteristics. High-pressure static testing utilizes a silicone oil as the heating media that is chosen for safety and heat transfer capabilities.

Qualification of elastomers should include exposure of the elastomer at elevated temperature and pressure to selected test fluids. The fluids used for elastomer testing are not necessarily intended to mimic nonaqueous fluids used in well operations, but may represent standard fluids for use in specification testing.

Example methods for testing elastomers are found in ASTM D471.

Information on the resistance of the selected elastomer should be maintained by the manufacturer and available for review if requested.

Bibliography

[1] API Recommended Practice 10B-2, *Testing Well Cements*

[2] API Recommended Practice 13B-1, *Field Testing Water-Based Drilling Fluids*

[3] API Recommended Practice 13B-2, *Field Testing Oil-based Drilling Fluids*

[4] API Recommended Practice 13J, *Testing of Heavy Brines*

[5] ASTM D471, *Standard Test Method for Rubber Property—Effect of Liquids*

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