

FLOW COMPONENT TESTING FACILITIES API SAFETY VALVE VALIDATION TESTING



API SAFETY VALVE VALIDATION TESTING SOUTHWEST RESEARCH INSTITUTE® (SwRI®) FLOW COMPONENT TESTING FACILITIES

The Flow Component Testing Facilities (FCTF) was developed as an important part of the oil industry program of offshore safety and environmental pollution control. It provides the means for independent, third-party validation testing of gas and oil well surface and subsurface safety valves.

Certification of surface (SSV) and subsurface safety valves (SSSV) for service on the outer continental shelf (OCS) requires the successful completion of specified validation tests at an API certified, independent test agency such as the FCTF. These validation tests certify that SSVs and SSSVs meet minimum performance requirements in the areas of operational and leakage characteristics.

The test laboratory has been in operation since 1975. It is owned and operated by Southwest Research Institute and located at 6220 Culebra Road, San Antonio, Texas. Funds for the operation and maintenance of the laboratory are obtained from fees paid to SwRI by users of the laboratory. Operation and use of the laboratory is in accordance with the latest editions of API Specification 14A/ISO 10432, "Specification for Subsurface Safety Valve Equipment," and API Specification 6AV1, "Specification for Validation Test of Wellhead Surface Safety Valves and Underwater Safety Valves for Offshore Service."

The FCTF valve test laboratory is accredited through the American Petroleum Institute (API) to test safety valves in accordance with the above-referenced standards (Certificate Nos. 14A-0022 and 6AV1-0001). The facility operates under an API Q1 quality management system.

The laboratory is designed to allow for validation, experimental, and developmental tests to be conducted, with validation tests receiving the highest priority.

SUBSURFACE SAFETY VALVES (API Specification 14A, Twelfth Edition; ISO 10432: 2004)

The test laboratory performs testing on surface control (SCSSV), subsurface control (SSCSV), and injection (SSISV) valves and is capable of handling several valves simultaneously. Valve sizes may range from 2 3/8 in. to 9 5/8 in., and tests can be performed for both validation grade V3 (standard) and validation grade V2 (sandy service) applications. The validation testing for validation grade V3 and combined validation grade V2 certifications requires approximately two weeks to complete.

The FCTF has the capability to perform validation grade V1 testing (Annex G), functional testing of SSSVs, and high-rate gas closure testing (Annex K).

SURFACE AND UNDERWATER SAFETY VALVES (API Specification 6AV1, Second Edition)

One test section provides the capabilities for testing either pneumatically or hydraulically actuated surface safety valves (SSV), underwater safety valves (USV), and boarding shutdown valves (BSDV). An API 6AV1 validation test requires approximately one week to complete.

Validation testing is performed per class II and class III requirements for various sized valves and pressure ratings.

EQUIPMENT AND INSTRUMENTATION

Progressive cavity pumps and centrifugal pumps are available for liquid flow tests; the pump inventory can provide flow rates of 500 to 32,000 barrels per day. The liquid flow rate is monitored by magnetic flow meters and recorded by a data acquisition system.

Gas closure tests are performed in a separate blowdown stand. Pressurized nitrogen gas is stored in two pressure vessels with a total volumetric capacity of 1,125 ft³ for these tests. The maximum flow rate is 250 million standard cubic feet per day (MMSCFD).

The gas flow rate is monitored by differential pressure flow meters. Flowing gas pressures and temperatures are recorded by a data acquisition system for calculation of the flow rate using standard gas flow equations.

Differential strain-gauge pressure transducers are employed to sense and record the differential pressures generated across velocity actuated subsurface safety valves and surface safety valves. Pressure transducers covering a 0 to 30,000 psig range are available to monitor the hydraulic control line pressure on surface-controlled subsurface safety valves and valve bore pressure. These pressures are also recorded on a data acquisition system.

The liquid test sections are mounted on an open-sided structure inside the blast containment cell. Operations are controlled remotely by an adjacent control room for efficient operation of the nitrogen, propane, high-pressure water, hydraulic, and pneumatic control fluid systems. Up to 30,000 psig of water pressure is available for leak testing of the test valves with the high pressure being developed by a pneumatic-powered liquid pump. Hydraulic control pressure up to 35,000 psig may be developed with a pneumatic-powered liquid pump or up to 3,000 psi with a high-volume, portable power supply.

The following provides information pertinent to preparation for and scheduling of validation tests.

SCHEDULING AND APPLYING FOR A TEST

Experimental and official API 14A and 6AV1 tests may be scheduled by contacting the FCTF Project Manager or Test Supervisor. The FCTF gives each manufacturer an equal opportunity to qualify 14A and 6AV1 products. Tests are scheduled in the order that the test valves are received.

Chris Jowers
Project Manager
cjowers@swri.org
210-522-4221

Purchase orders or other payment documents should be sent to:

Mary E. Bernal
mary.bernal@swri.org
(Telephone 210-522-2335/Fax 210-522-6638)
Southwest Research Institute
P. O. Drawer 28510
San Antonio, Texas 78228-0510

All documents should reference the type of test requested, valve model, size, and serial number. When applicable, the documents should also reference any basic ordering agreement (BOA) between SwRI and the manufacturer.

A test application must be submitted for each test prior to or along with the delivery of the test valve. Testing will not be started until a completed test application is received by the FCTF. If the test application includes instructions for variations to the validation test requirements or SwRI's standard test practices, refer to the Special Procedures or Equipment section below for additional instructions.

SPECIAL TEST PROCEDURES OR EQUIPMENT

If a safety valve is of unusual design or operational characteristics, special equipment and/or procedures may be necessary to conduct the test. In addition, for standard valves, a manufacturer may specify special instructions or procedures for the test. API 14A and 6AV1 require that the manufacturer indicate any special equipment or procedures on the application, and justify that such special equipment or procedures are not less stringent than the original specification. The responsibility for furnishing special equipment shall be assumed by the manufacturer. If special equipment, procedures, or instructions are required that deviate from the requirements of the particular API specification or SwRI's standard test practices, contact the FCTF Project Manager for procedures on how to submit the valve for testing and to determine any additional cost and lead time required to complete the test. The Project Manager should be contacted well in advance of the test to minimize delays to the testing. All requested variations that deviate from SwRI's normal test practices will be documented on the test summary page. Draft wording used to document the request will be provided to the manufacturer prior to the initiation of the testing.

TEST VALVE DELIVERY AND CHECKOUT

Test valves should be delivered to:

Loren Theis, Building 196
Southwest Research Institute
9503 West Commerce
San Antonio, Texas 78238-5166

For international shipments please contact the Project Manager for more shipping details.

Functionally tested valves, each installed in a test section, shall be delivered to SwRI with operating manuals, on or before the scheduled installation date. A manufacturer's representative is allowed to aid in valve installation, checkout, and test witnessing on the scheduled date.

For subsurface safety valves (14A), the manufacturer's model and serial number must be permanently marked on the valve. For wireline valves, the valve shall be removed from the nipple or upon completion of testing to allow for validation of model and serial number. Wireline valves will need to have the capability to apply hydraulic pressure to perform the drift test with the valve removed from the test fixture.

For surface safety valves (6AV1), both actuator and valve body shall be permanently marked with manufacturer's model and serial number.

For subsurface safety valves, a copy of the functional test report, as specified in the API 14A Specification, must be included with the test application or provided with the valve upon delivery.

All test items, including test fixtures, end connections, and control line fittings, must be rated for the pressures that will be experienced during testing. All items must have been hydrostatically tested according to the requirements of API 14A; this is 150% of working pressure for items that have a working pressure below 15,000 psig and 5,000 psig above working pressure for test items that have a working pressure greater than or equal to 15,000 psig. Validation that all test items are rated for the test pressures must be documented on the test application or provided in another document prior to testing.

ADDITIONAL REQUIRED EQUIPMENT

An appropriate drift is required for all Surface Control Subsurface Safety Valves (API 14A). In addition, special tools or adapters required to remove the valve from the nipple, or to remove the lock, shall be supplied with the valve by the manufacturer.

MANUFACTURER'S ACCESSIBILITY TO THE FACILITY

A manufacturer's representative is allowed to aid in the installation and checkout of test valves prior to test initiation. During the validation test, the manufacturer's representative(s) is allowed limited access to the test facility. Appointments should be made for visits other than scheduled installations.

RETURN OF TEST ITEMS

On test completion, tested valves may be held for pickup by the manufacturer or may be shipped to the manufacturer upon request. All shipping costs are to be borne by the manufacturer.

TEST RESULTS

Within 30 days of the test completion, a certified test report will be transmitted to the valve manufacturer describing all test results. The test report will include all detailed test and supporting data required by API Specifications 14A and 6AV1. The test results will be held in strictest confidence and will be released only to the party that paid for the test. SwRI policy is as follows:

The manufacturer shall **NOT** use the name of Southwest Research Institute or any of its staff or any quotations from the test reports for purposes of publicity or advertising. This does not preclude:

- (1) The use of the test report by the manufacturer for the purpose of securing product acceptance from duly constituted federal, state, county, or municipal authorities, or from accredited standardizing committees or organizations, or
- (2) The reference in manufacturers' advertising and promotional material to end results achieved at a "**CERTIFIED INDEPENDENT LABORATORY**" or similar phrase.

Southwest Research Institute (SwRI) policies specifically prohibit the use in advertising of its name, logo and results provided by our studies. The following paragraph, extracted verbatim from SwRI contractual documents clarifies this point:

“SwRI shall not publish or make known to others the subject matter or results of the Project or any information obtained in connection therewith which is proprietary and confidential to Client without Clients’ written approval. No advertising or publicity containing any reference to SwRI, or any of their employees, either directly or by implication shall be made use of by Client or on Client’s behalf without SwRI’s written approval. In the event Client distributes any report issued by SwRI on this Project outside its own organization, such report shall be used in its entirety, unless SwRI approves a summary of abridgment for distribution.”

SwRI will retain a record copy of the test report for a period of twenty (20) years. This permits us to answer questions that may be raised after a report has been submitted and provides a basis for additional work, if required. The contents of the report and any information that comes into our possession during the course of a study are held confidential to the company conducting the study and are not disclosed to anyone without client’s prior permission.

SCHEDULE OF TEST FEES

The latest fee schedule can be provided by the Project Manager

14A TEST LAB DATA

Maximum Liquid Flow Capacity	–	32,000 B/d Fresh Water (in-house pump), 75,000 B/d (temporary pump); 10,000 B/d Sand Slurry
Maximum Gas Flow Capacity	–	250 MMSCFD at 2,700 psig
Control Line Size	–	1/4”O.D.
Control Line Connection Type	–	Standard Connections: 1/4” NPT, 1/4” medium pressure autoclave, 1/4” high-pressure autoclave, 1/4” high-pressure autoclave, or 9/16” high-pressure autoclave. For other connections, an adapter to one of the standard connections must be supplied. All fittings and tubing must be rated for the pressures that will be experienced during the validation testing.
End Connection Options	–	2”, 15,000 psi, hammer unions, Fig. 1502 2”, 20,000 psi, hammer unions, Fig. 2002 3”, 15,000 psi, hammer unions, Fig. 1502 4”, 10,000 psi, hammer unions, Fig. 1002 4”, 15,000 psi, hammer unions, Fig. 1502

Note: Safety valves rated above 20,000 psi require special end connections. Contact the FCTF Project Manager to determine the appropriate end connection configuration. Additional fees may apply for valve rated above 15,000 psi.

- End Connection Orientation – Valve Upstream End – Hammer Union Male Sub (with wing nut)
Valve Downstream End – Hammer Union Female Sub
- End Connection Removal – The 14A test requires that the valve be drifted during at the completion of testing. The end connection should be designed such that the drift bar can pass through the end connection or such that the end connection can be removed. This shall be a low torque connection or the manufacturer shall be responsible for breaking a torqued connection.
- Maximum Safety Valve Length – 20'

6AV1 TEST LAB DATA

- Pneumatic Control Line Connections – 1/2" NPT
- Pneumatic control pressure (max) – 130 psi
- Hydraulic Control Line Connection – NPT, JIC, SAE, 9/16" medium or high pressure
- Hydraulic Control Line Pressure (max) – 3,000 psi
- Safety Valve Connections – Hammer Unions (see 14A Section), contact Project Manager for Class III test connections