TEST REPORT

VALVE FIRE TEST
DOWNSTREAM SEALING (TRUNNION) BALL VALVE

PER API SPECIFICATION 6FA, THIRD EDITION

SIZE AND RATING: 6.00" - 5000 PSI

VALVE MODEL NO.: TE2000G

SwRI TEST NO.: 6-854

PREPARED FOR: YCV CORNERSTONE
7620 BLUFF POINT DR.
HOUSTON, TEXAS, USA 77086

SOUTHWEST RESEARCH INSTITUTE
SAN ANTONIO HOUSTON
DETROIT WASHINGTON, DC

REVIEW AND APPROVAL

The contents of this Test Report for SwRI™ Test Number 6-854 are correct and accurate, and all performance test results and procedures conducted by this laboratory are in compliance with API Specification 6FA, Third Edition, April 1999.

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11-14-00

Date

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Date

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VALVE FIRE TEST
PER API SPECIFICATION 6FA, THIRD EDITION

SwRI Test Number:	6-854	Valve Serial Number:	N/A
Valve Type:	Downstream Sealing (Trunnion) Ball Valve	Model Number:	TE2000G
Rating:	5000 psi	Size:	6.00
Test Date:	10/31/2000		
Valve Manufacturer	YCV Cornerstone		
Manufacturer's Representative(s):	Terry Kabel		

The purpose of this test was to evaluate the performance of a downstream sealing (trunnion) ball valve by the valve fire test procedure of API Specification 6FA, Third Edition.

1. Through Leakage During Burn:

   Average through leakage rate of 0.0 ml/min/NPS occurred during 30.00-minute burning period. Allowable rate is 400.0 ml/min/NPS.

2. Through Leakage During Cooldown:

   Average leakage rate of 28.6 ml/min/NPS occurred during 63.00-minute cooldown period. The standard does not have a requirement for the through leakage during cooldown.

3. External Leakage During Burn and Cooldown:

   Average external leakage rate of 0.0 ml/min/NPS occurred during 93.00-minute burn and cooldown period. Allowable rate is 100.0 ml/min/NPS.

4. Low Pressure Leak Test:

   Per Section 3.1.10, the low-pressure leak test is not required for this valve.

5. Valve Operation After Fire Test:

   The valve was capable of being unseated against the high-test pressure differential and moving to the open position. The test valve was provided with a gear operator, which was removed prior to the test. The gear operator was reinstalled following the cooldown and used to operate the valve.

6. High Pressure Leak Test at 3750 psi:

   Average external leakage rate 1.3 ml/min/NPS. Allowable rate is 200.0 ml/min/NPS.

7. Qualifications:

   Test valve meets the performance requirements of API Specification 6FA, Third Edition.

VALVE FIRE TEST
PER API SPECIFICATION 6FA, THIRD EDITION

SwRI Test Number:	6-854	Test Date:	10/31/2000

1. Test Conditions:

   Test pressure 3750 psig nominal (± 10%).

   Maximum allowable body cavity pressure 10000 psig.

   Time from ignition to 1400° F average flame temperature 0.88 minutes.

   Time from start of test to 1200° F average calorimeter temperature 4.98 minutes.

   Duration of burn 30.00 minutes. Duration of cooldown 63.00 minutes. Following the burn, the valve was allowed to air cool for approximately 44 minutes. The cooldown was completed by quenching the valve with water.

2. Upstream Water Reservoir Volumes:

   At beginning of burning period 86625 ml.

   At end of cooldown 72500 ml.

3. Downstream Container Water Collection:

   Collected during 30.00-minute burning period 5900 ml.

   Collected during 63.00-minute cooldown period 10820 ml.

4. Total Measured External Leakage:

   During 5.00-minute high-pressure leak test 40 ml.

VALVE FIRE TEST
PER API SPECIFICATION 6FA, THIRD EDITION

SwRI Test Number:	6-854	Test Date:	10/31/2000
Test Valve Size (NPS):	6.00 inches		

1. During Burn:

   A. Volume collected downstream during burn 5900 ml.

   B. Burn duration 30.00 minutes.

   C. Body cavity volume 8500 ml.

   D. Average through leakage = $\frac{A - C}{B \times NPS}$ = -14.4 *ml/min/NPS.* *(1)*

2. During Burn and Cooldown:

   E. Beginning reservoir level 86625 ml.

   F. Ending reservoir level 72500 ml.

   G. Volume collected downstream during cooldown 10820 ml.

   H. Cooldown duration 63.00 minutes.

   I. Average external leakage = $\frac{E - F - A - G}{(B + H) x NPS}$ = -4.7 *ml/min/NPS.* *(2)*

3. High Pressure Leak Test After Cooldown at 3750 psi.

   J. Test duration 5.00 minutes.

   K. Total external leakage during test 40 ml.

   L. Average external leakage = $\frac{K}{J \times NPS}$ = 1.3 *ml/min/NPS.*

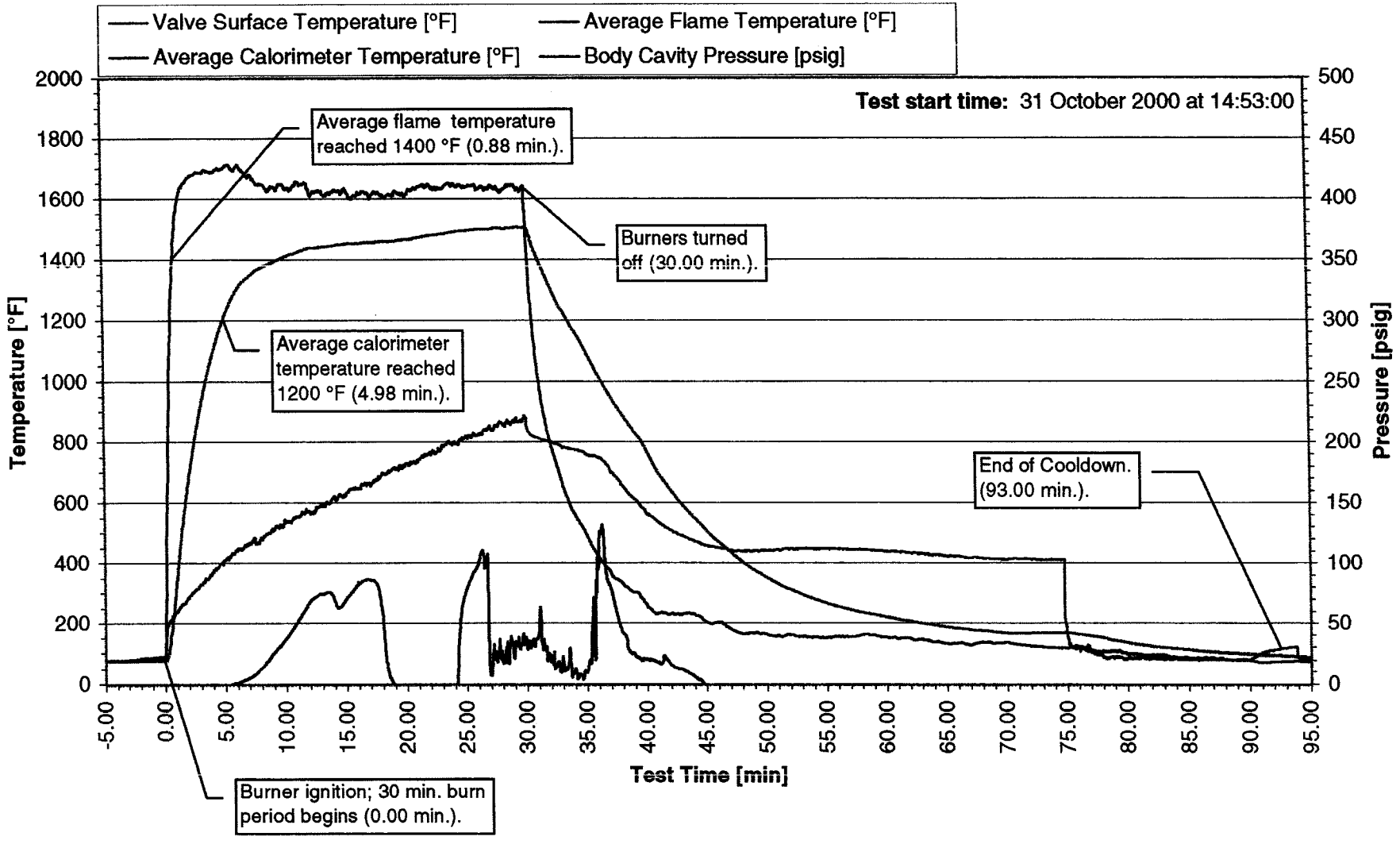
(1) ***Per Section 3.1.8, if the total volume collected downstream during the burn is less than the body cavity volume, the through leakage is assumed to have been zero.***

(2) ***The average external leakage during the burn and cooldown is calculated by subtracting the through-valve leakage and ending reservoir level from the beginning reservoir level. If the body cavity volume is a significant fraction of (or greater than) the total collected through valve leakage during the burn and cooldown, this calculation for external leakage will give a negative result. In this case, the average external leakage is assumed to have been zero.***

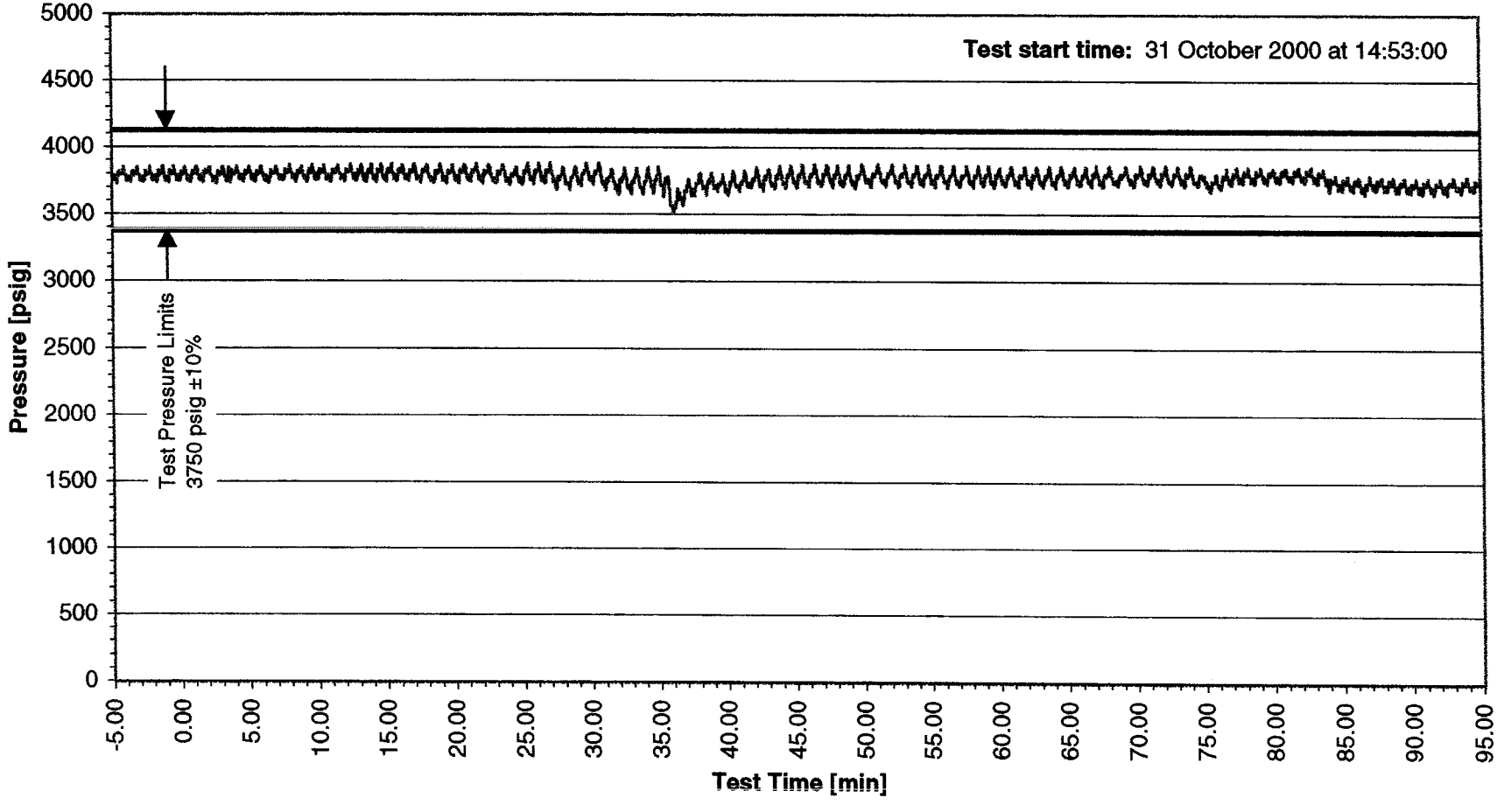
APPENDIX A

PRESSURE & TEMPERATURE DATA

SwRI Fire Test Number 6-854
Pressure and Temperature History



SwRI Fire Test Number 6-854
Test Pressure History



APPENDIX B

SwRI FACILITY DESCRIPTION

APPENDIX B

1. Test Chamber Description

1.1 Enclosure. The test chamber is located under a 34-foot high roof supported on columns, and is surrounded on three sides by 8-foot high concrete walls. Portable insulated screens placed on the four sides form a closed enclosure, as shown in Figure 1. Stainless steel flame baffles are suspended from the side screens to minimize the effect of wind gusts and to provide a "chimney" effect to direct the burner flames over the top of the test item.

1.2 Test Item Support. The piping attached to the test item is supported in vises mounted on pedestals, as shown in the elevation view of Figure 1. The upstream pedestal is fixed. The downstream pedestal can be adjusted laterally if needed to accommodate a range of sizes.

1.3 Burners. Four 3-inch self-aspirating burners are individually mounted on portable stands, with adjustable tilt angles. The stands are positioned to provide optimum envelopment of the test item by the burner flames.

2. Test Item Installation

2.1 Preparation. Upon request, all materials needed for preparation of the valve for testing will be supplied by SwRI. Assembly will be performed by SwRI personnel per the manufacturer's instructions.

2.2 Installation. The test item is installed in the test chamber as shown in Figure 1.

3. System Plumbing

3.1 Pressurization System. For low test pressures (<50 psig), a pressurized reservoir is used. For higher test pressures, a triplex pump is used with an atmospheric reservoir. A back-pressure regulator is used to control the pump output pressure. Either system can be used while the other is isolated.

3.2 Downstream System. Piping from the downstream end of the test valve is routed through a condenser consisting of a copper coil in a running water bath. The discharge from the condenser is mounted on a swinging arm whose position is set from the control room via the data acquisition/control system. The first position is over the container in which any discharge during the burning period is collected. The second position is over another container for collection of any discharge during the cooldown. The third position is away from both containers.

3.3 Body Cavity Vent and Relief System. The manufacturer will have provided a tapped port in the topmost part of the test valve body for connection of the body cavity relief system, when required. The relief system consists of a relief valve, which is actuated at the manufacturer's recommended maximum body cavity pressure, and a pressure transducer for recording the cavity pressure, as shown in Figure 1. This system is required for all dual-seated valves, which may trap liquid in the body cavity when the valve is in the closed position.

3.4 Water Quenching System. If the test valve is to be cooled by quenching, a swinging arm, containing six nozzles on a manifold, is positioned over the test valve following the burn. The swing arm and water flow are controlled remotely from the control room via the data acquisition/control system.

4. Instrumentation

4.1 Test Pressure. The upstream test pressure is measured with an electrical transducer of appropriate range tapped into the pressurization line about 20 feet upstream of the test connection, and at about the same elevation as the test connection.

4.2 Temperature. All temperatures are measured with Type K (Chromel/Alumel) thermocouples (T/Cs). The flame temperature T/Cs are 1/4" diameter rigid probes with stainless or inconel sheaths. The thermocouples for sensing body and bonnet temperatures are 1/8" diameter probes similar to the flame thermocouples. The calorimeters (if required) consist of 1/16" diameter probe embedded in 1-1/2" carbon steel cubes. If calorimeters are used, a bare wire thermocouple with braided ceramic insulation is spot-welded to the test item body, to obtain the body temperature.

4.3 Data Acquisition. A HP 34970A Data Acquisition/Switch Unit is used to log data during the test and to remotely operate the test equipment. Data is acquired from all sensors every two (2) seconds. The data acquisition/switch unit is connected to a personal computer in the control room, which runs software that allows the operator to record and visualize all data and control the test.

At the end of the test, the data is processed to obtain a plot of the temperatures and pressures during the burn and cooldown.

4.4 Calibration. Pressure transducers are calibrated periodically against traceable voltage references. The data logger input calibrations are also calibrated periodically against traceable voltage references. Thermocouple calibrations are assumed to be within standard commercial tolerances.

4.5 Video. Two video cameras are used to record the tests. One, mounted under the facility roof, provides an overhead view of the test chamber. It has pan, tilt and zoom controls to enable any desired view of the test in progress. The other camera is mounted on a pan/tilt mount, at floor level, for close-up viewing of the collection containers. This camera is also used to observe the valve during the post-cooldown operational and hydrostatic tests.

A split-screen video system in the control room allow simultaneous viewing from both camera angles. The output from both cameras is recorded on a VCR to provide a visual record of the test. The VCR format is VHS.

ELEVATION SHOWING TEST VALVE INSTALLATION

PLAN VIEW OF TEST CHAMBER

SECTION THROUGH TEST CHAMBER

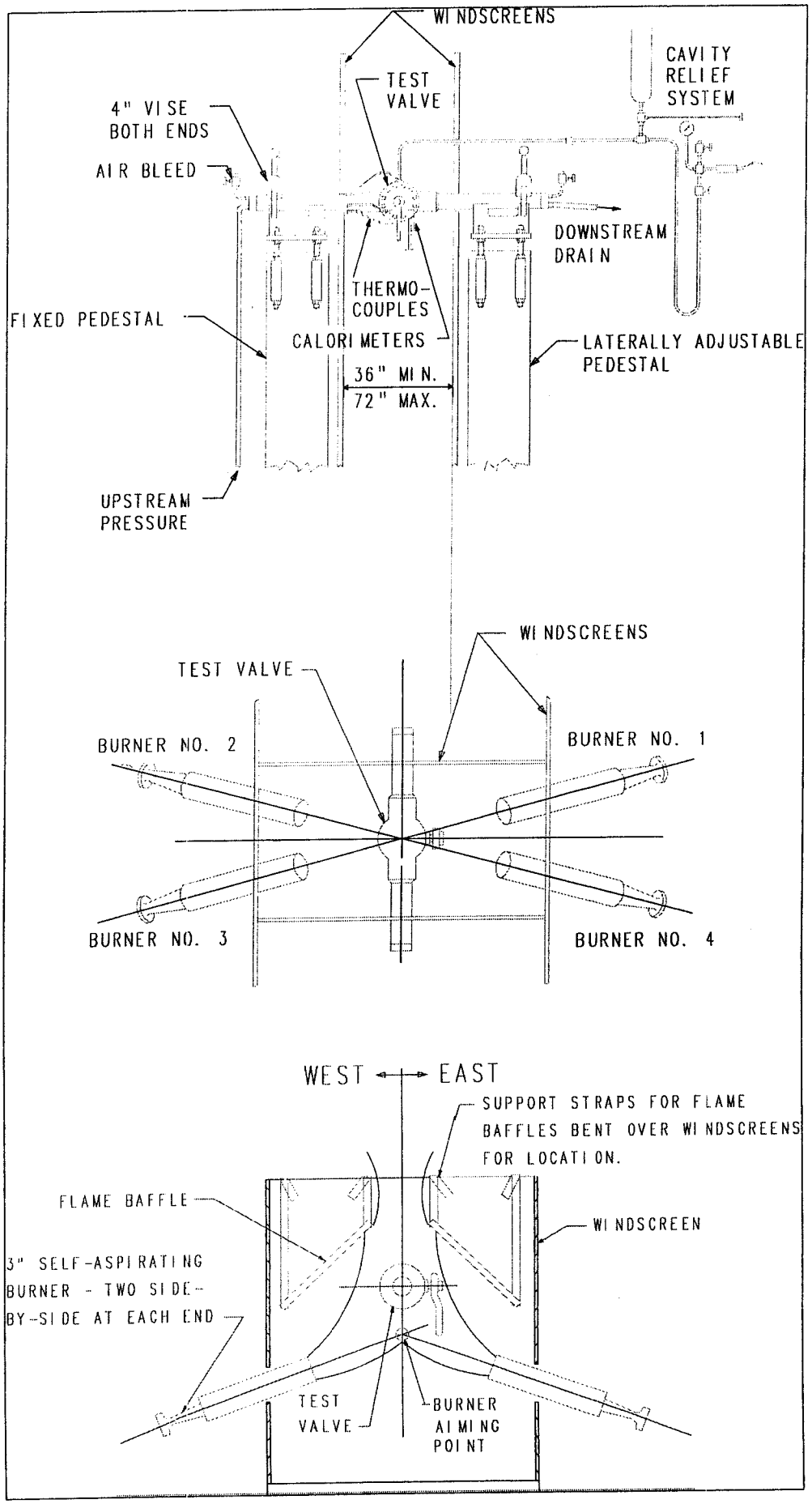


Figure 1