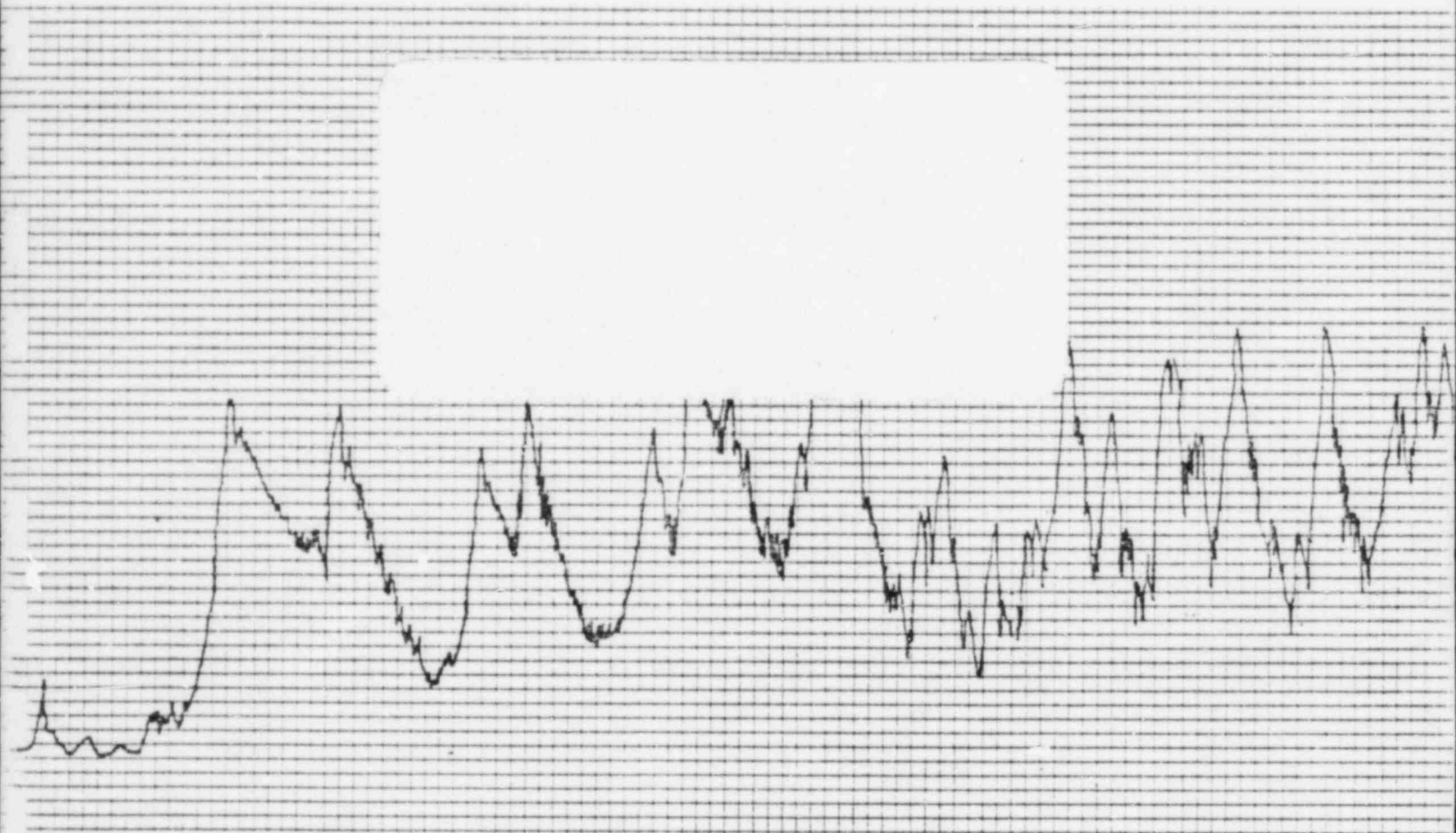


REFERENCE 5

**WYLE**

LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP



# Seismic Qualification

8309120492 830901  
PDR ADCK 05000352  
A PDR

## test REPORT

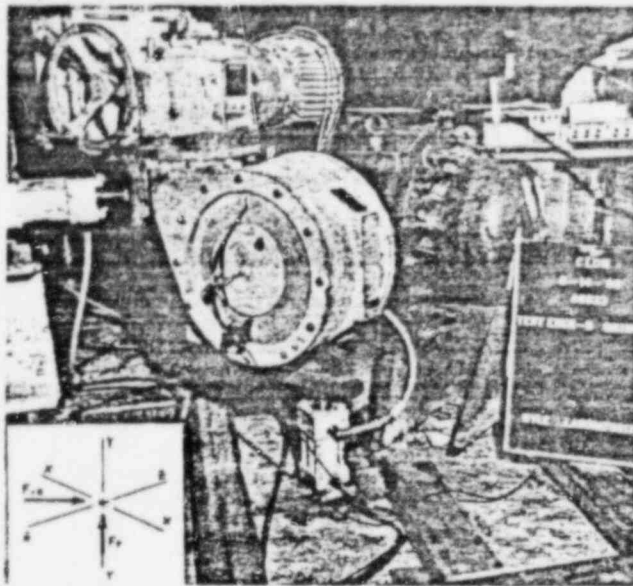
STATIC LOAD  
TEST PROGRAM

ON AN

18-INCH BUTTERFLY VALVE ASSEMBLY  
WITH LIMITORQUE OPERATOR  
(CLOW JOB NO. 82-2053-04(N)-01)

FOR

CLOW CORPORATION  
ENGINEERED PRODUCTS DIVISION  
40 CHESTNUT AVENUE  
WESTMONT, ILLINOIS 60559



# SEISMIC SIMULATION Test Report

REPORT NO. 46823-1  
WYLE JOB NO. 46823  
CUSTOMER 30-11654  
P. O. NO. \_\_\_\_\_  
PAGE 1 OF 25 PAGE REPORT  
DATE June 27, 1983  
SPECIFICATION(S) See References  
in Section 7.0

- 1.0 CUSTOMER Clow Corporation, Engineered Products Division  
40 Chestnut Avenue, Westmont, Illinois 60559  
ADDRESS \_\_\_\_\_  
2.0 TEST SPECIMEN 18-inch Lugged Wafer Stop Valve with an SMB-1-H5BC Limitorque  
Actuator  
3.0 MANUFACTURER Clow Corporation  
4.0 SUMMARY

An 18-inch Lugged Wafer Stop Valve Assembly with a Limitorque Actuator, hereinafter called the specimen, was subjected to Static Loads and Pressure Integrity Tests as required by the Clow Corporation, Engineered Products Division, Purchase Order Number 30-11654 and Wyle Laboratories' Seismic Test Procedure 541/0465/WB, dated May 25, 1983, Revision A. The test program was performed on June 14, 1983.

The test program consisted of static load testing and seat leakage testing prior to and after the load tests. The specimen was electrically powered and monitored for functional operation during the test program as required.

The specimen demonstrated sufficient integrity to withstand, without compromise of structure, electrical function, or mechanical function, the prescribed load testing.

STATE OF ALABAMA } Ala. Professional Eng.  
COUNTY OF MADISON } Reg. No. 12761

Vincent F. Kearns III

being duly sworn,  
deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

SEALED Vincent F. Kearns III  
SUBSCRIBED and sworn to before me this 29 day of JUNE, 19 83

Notary Public in and for the State of Alabama at large.

My Commission expires June 15, 19 87

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report.

PREPARED BY Billy L. Quinn 6/27/83  
B. L. Quinn

APPROVED BY James H. Paul 6/27/83  
JAMES H. PAUL

WYLE Q. A. T. R. Stinson 6/29/83  
T. R. Stinson

**WYLE**

LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP  
HUNTSVILLE ALABAMA

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4.0 SUMMARY (Continued)

Table I contains descriptions of the test runs.

Figure 1 shows a representative section of the oscillograph records of the electrical monitoring channels.

Photograph 1 shows the load test setup.

Appendix I contains the Instrumentation Equipment Sheets.

Appendix II contains the Wyle Laboratories' Seismic Test Procedure 541/0465/WB, dated May 25, 1983, Revision A.

Appendix III contains the Wyle Laboratories' Certification of Compliance No. HSV/106, dated June 27, 1983.

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5.0      STATIC LOAD TEST REQUIREMENTS

5.1      Specimen Mounting

The specimen shall be installed in a Wyle-fabricated test fixture as shown in Figure 1 of the Test Procedure (Appendix II). The test fixture shall be welded to a rigid reaction frame.

5.2      Static Load Excitation

An equivalent static load of 4.5 g\* shall be applied in line with the center of gravity of the actuator in each of the three (3) orthogonal specimen axes. The center of gravity of the actuator and a smooth, flat surface for the application of the static load shall be provided by Clow Corporation. The seat leakage differential pressure for the valve shall be simultaneously applied to the test fixture while the static load is applied. The specimen shall then be cycled while in the deflected mode as described in Paragraph 5.5.

The magnitude of the load shall be determined by multiplying the hydraulic pressure by the effective piston area of the hydraulic cylinders. The loads shall be applied simultaneously with one, two or three hydraulic cylinders. It is assumed that the static load can be applied in either the positive or negative direction.

\*Assuming an actuator weight of 1220 pounds,  
the applied (or equivalent) static load shall  
be 5490 pounds in each orthogonal direction.

5.3      Pre-test and Post-test Functional Operability

Prior to and following the application of the static loads, the specimen shall be stroked through four (4) complete operating cycles (two cycles with 368 VAC power and two cycles with 460 VAC power).

5.4      Seat Leakage Tests

Seat leakage tests shall be performed prior to and after the static load tests in accordance with the Clow Corporation "Seat Bubble Test Procedure EPS 30-49-832." The leakage test duration shall be four (4) minutes.

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5.0      STATIC LOAD TEST REQUIREMENTS (Continued)

5.5      Operability Tests

With the static loads applied, the specimen shall be stroked through three (3) complete operating cycles: Open-to-closed with internal pressure; closed-to-open with differential seat leakage pressure.

The operating time in each direction of travel shall be recorded during each operating cycle.

5.6      Electrical Power

A variable source of electrical power (368 to 460 VAC, 3-phase, 60 Hz) shall be furnished for the operation of the specimen.

5.7      Electrical Monitoring

Five (5) electrical monitoring channels shall be recorded on oscillograph recorders to monitor the following:

- 1)    A limit switch (which changes state in the opening direction).
- 2)    A limit switch (which changes state in the closing direction).
- 3)    Torque switch (which shuts off power at the end of the closing stroke).
- 4)    Operating current.
- 5)    Valve disc motion (rotary potentiometer attached to rotating disc on the actuator).

5.8      Pneumatics

Pneumatic pressure of 55 psig shall be provided to perform the leakage tests described in Paragraph 5.4 and the operability tests described in Paragraph 5.5.

---

6.0      STATIC LOAD TEST PROCEDURES AND RESULTS

6.1      SPECIMEN MOUNTING PROCEDURES

The specimen was installed in a Wyle-fabricated test fixture as shown in Figure 1 of Appendix II. The test fixture was welded to a rigid reaction frame as shown in Photograph 1.

6.2      Static Load Excitation Procedures

An equivalent static load of 4.5 g (5490 pounds-force) was applied in line with the center of gravity of the actuator in each of the three (3) orthogonal specimen axes. The seat leakage differential pressure for the valve was simultaneously applied to the test fixture while the static load was applied. The specimen was then cycled while in the deflected mode as described in Paragraph 6.5.

The magnitude of the force in the horizontal plane (X/Z axes as shown in Photograph 1) was 7764 lbf. The application of this force at a 45-degree angle (to either axis) resulted in an equivalent static load of 5490 lbf in both the X and Z axes. The magnitude of the force in the vertical axis (Y axis as shown in Figure 1) was 5490 lbf. The magnitudes of the two (2) loads were determined by multiplying the hydraulic pressures (620 psig to the horizontal, 440 psig to the vertical) by the effective piston areas of the 4-inch diameter hydraulic cylinders (12.6 square inches). The loads were applied in the directions shown in Photograph 1.

6.2.1    Static Load Excitation Results

It was demonstrated that the specimen possessed sufficient structural integrity to withstand the prescribed loads. Operational test results are presented in Table I.

6.3      Pre-test and Post-test Functional Operability Procedures

Prior to and following the application of the static loads, the specimen was stroked through four (4) complete operating cycles.

Two (2) operating cycles were performed at 460 VAC and two (2) were performed at 368 VAC.

6.3.1    Pre-test and Post-test Functional Operability Results

Stroking times recorded during cycling tests are presented in Table I.



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6.0      STATIC LOAD TEST PROCEDURES AND RESULTS (Continued)

6.4      Seat Leakage Test Procedures

Seat leakage tests were performed prior to and after the static load tests in accordance with the Clow Corporation's "Seat Bubble Test Procedure EPS 30-49-832." The leakage test duration was four (4) minutes.

6.4.1    Seat Leakage Test Results

No leakage was detected during the seat leakage tests performed prior to and after the static load tests.

6.5      Operability Test Procedures

With the static loads applied and an operating voltage of 368 VAC, the specimen was stroked through three (3) complete operating cycles: Open-to-closed with an internal pressure of 55 psig; closed-to-open with a differential seat leakage pressure of 55 psig.

The operating time in each direction of travel was recorded during each operating cycle.

6.5.1    Operability Test Results

Stroking times recorded during operability tests are presented in Table I.

A representative section of the oscillograph records of the electrical monitoring channels is shown in Figure 1.

6.6      Electrical Powering Procedures

A variable source of electrical power (368 to 460 VAC, 3-phase, 60 Hz) was furnished for the operation of the specimen during the test program.

The electrical power was connected to the specimen such that a pushbutton motor starter (furnished by Wyle) would initiate valve travel in either the closed-to-open or open-to-closed directions. During the closed-to-open stroke, the electrical power was shut off by a preset limit switch. During the open-to-closed stroke, the electrical power was shut off by a preset torque switch.



---

6.0      STATIC LOAD TEST PROCEDURES AND RESULTS (Continued)

6.7      Electrical Monitoring Procedures

Five (5) electrical monitoring channels were recorded on oscillograph recorders to monitor the following:

- 1)    A limit switch (which changed state in the opening direction).
- 2)    A limit switch (which changed state in the closing direction).
- 3)    Torque switch (which shut off power at the end of the closing stroke).
- 4)    Operating current.
- 5)    Valve disc motion (rotary potentiometer attached to rotating disc on the actuator).

6.7.1    Electrical Monitoring Results

The specimen stroking times are presented in Table I.

A representative section of the oscillograph records of the electrical monitoring channels is shown in Figure 1.

6.8      Pneumatics

Pneumatic pressure of 55 psig was provided to perform the leakage tests described in Paragraph 6.4 and the operability tests described in Paragraph 6.5.

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7.0 REFERENCES

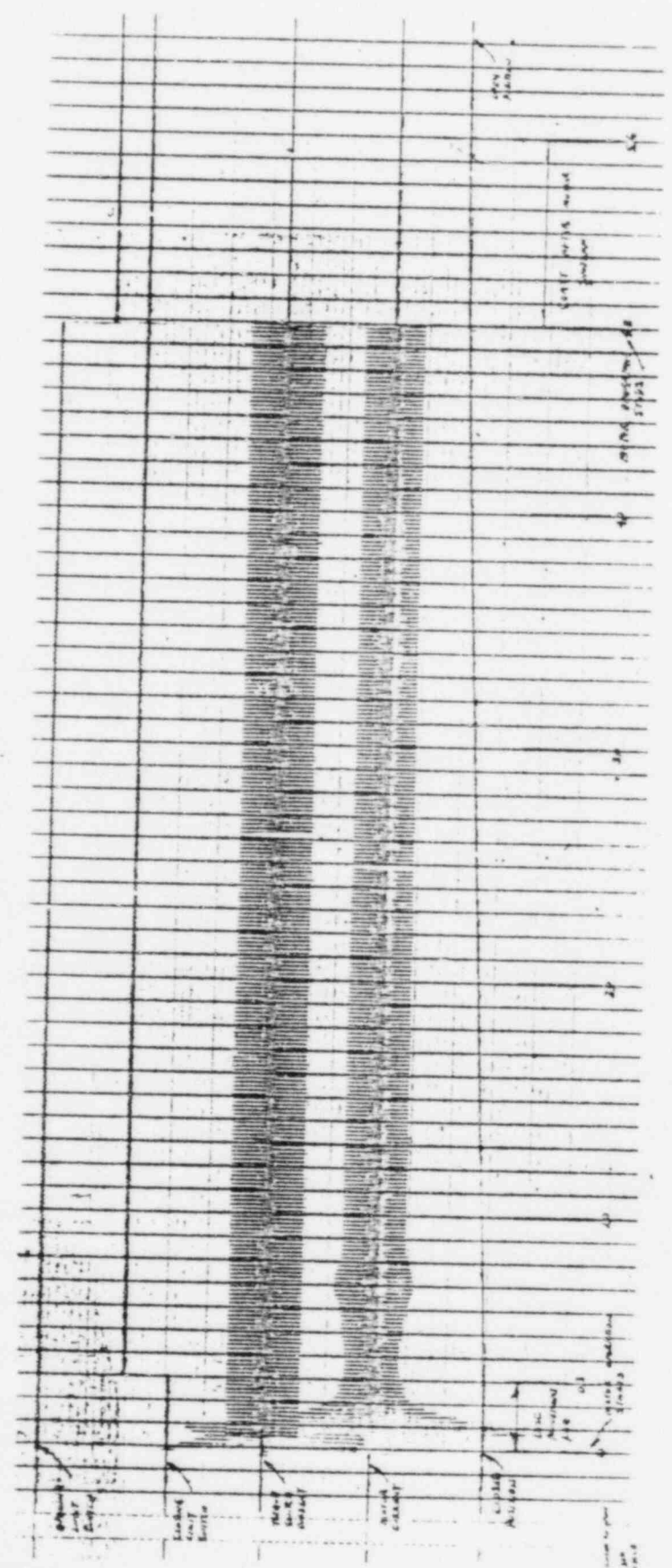
- 7.1 Clow Corporation, Engineered Products Division, Purchase Order Number 30-11654
- 7.2 Wyle Laboratories' Seismic Test Procedure 541/0465/WB, dated May 25, 1983, Revision A
- 7.3 IEEE Standard 344-1975 Specification entitled "Recommended Practices for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"
- 7.4 Wyle Laboratories' (Eastern Operations) "Quality Assurance Program" manual, dated February 1983
- 7.5 Clow Corporation's "Seat Bubble Test Procedure EPS 30-49-832," dated February 9, 1983
- 7.6 Bechtel Corporation Specifications: 8031-P-144, Revision 1, dated July 22, 1982, and 8031-G-11, Revision 15, dated May 7, 1979
- 7.7 Clow Corporation Drawing Number D-0702
- 7.8 Limitorque Corporation Drawing Number 02-442-0497-2

TABLE I

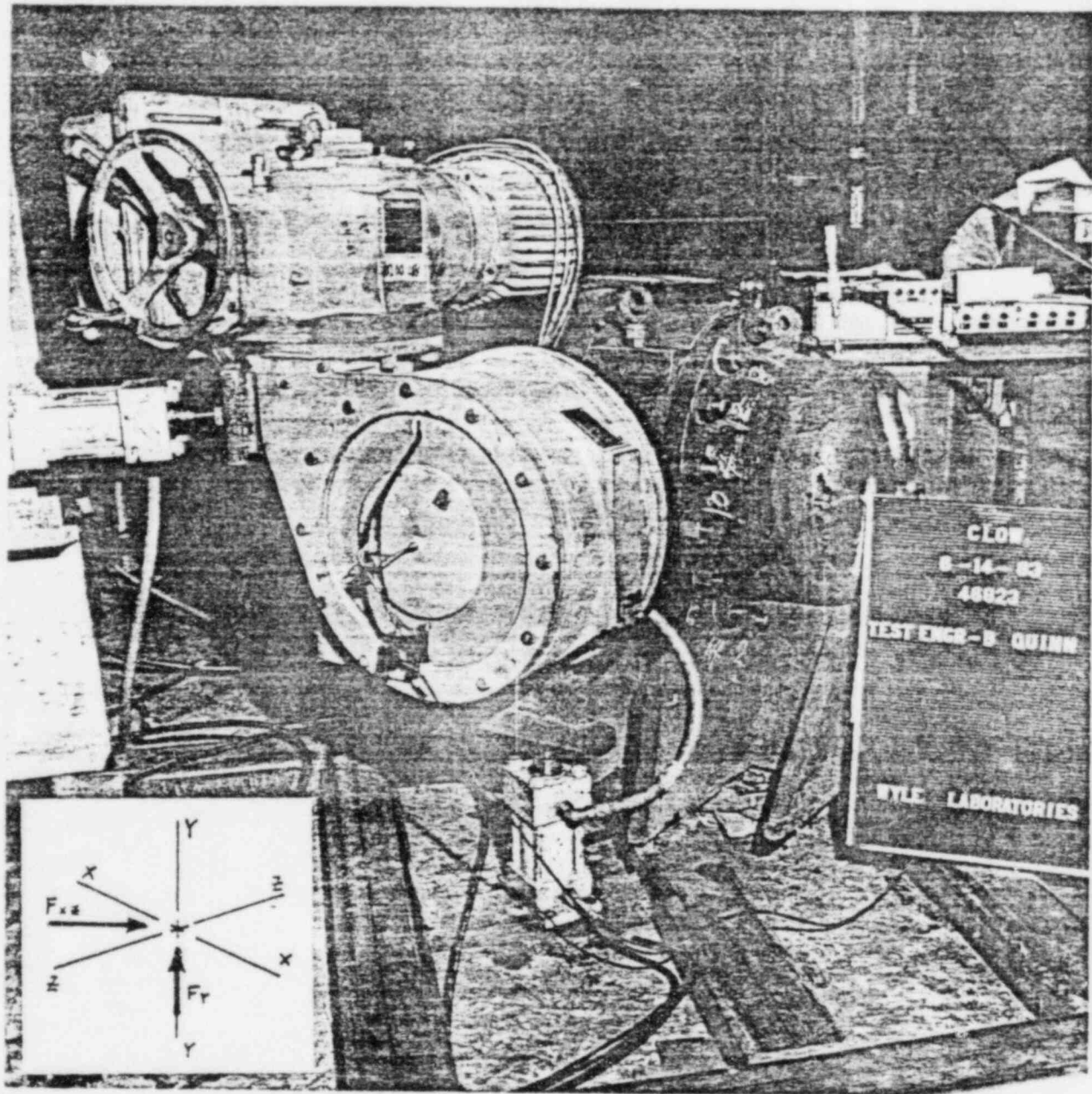
DESCRIPTION OF TEST RUNS

ROR NO.	TYPE TEST	OPERATING VOLTAGE	DIRECTION OF STROKE	STROKING TIMES (SECONDS)				REMARKS
				MOTOR OPERATION	DISC MOVEMENT TIME LAG	COAST AFTER SHUTOFF	ACTUAL DISC MOVEMENT	
1	Cycle	368 VAC	Closed-To-Open Open-To-Closed	4.8 5.1	0.3 0.5	0.8 ---	5.3 4.6	No pressure; No loads
2	Cycle	368 VAC	Closed-To-Open Open-To-Closed	4.8 5.2	0.3 0.5	0.8 ---	5.3 4.8	No pressure; No load
3	Cycle	460 VAC	Closed-To-Open Open-To-Closed	4.7 5.2	0.3 0.3	0.9 ---	5.3 4.9	No pressure; No loads
4	Cycle	460 VAC	Closed-To-Open Open-To-Closed	4.7 5.0	0.3 0.3	0.9 ---	5.3 4.7	No pressure; No load
5	Seat leakage	N/A	Closed-To-Open Open-To-Closed	---	---	---	---	55 psig; No loads
6	Cycle	368 VAC	Closed-To-Open Open-To-Closed	4.8 5.1	0.3 0.5	0.8 ---	5.3 4.6	55 psig; 4.5g loads
7	Cycle	368 VAC	Closed-To-Open Open-To-Closed	4.8 5.2	0.3 0.5	0.8 ---	5.3 4.7	55 psig; 4.5g loads
8	Cycle	368 VAC	Closed-To-Open Open-To-Closed	4.8 5.3	0.3 0.5	0.8 ---	5.3 4.8	55 psig; 4.5g loads
9	Seat Leakage	N/A	Closed-To-Open Open-To-Closed	---	---	---	---	55 psig; No loads
10	Cycle	368 VAC	Closed-To-Open Open-To-Closed	4.8 5.3	0.3 0.5	0.9 ---	5.4 4.8	No pressure; No loads
11	Cycle	368 VAC	Closed-To-Open Open-To-Closed	4.8 5.3	0.3 0.5	0.8 ---	5.3 4.8	No pressure; No loads
12	Cycle	460 VAC	Closed-To-Open Open-To-Closed	4.7 5.2	0.2 0.3	0.8 ---	5.3 4.9	No pressure; No loads
13	Cycle	460 VAC	Closed-To-Open Open-To-Closed	4.7 5.2	0.2 0.4	0.8 ---	5.3 4.8	No pressure; No loads

29 70  
66 46  
73 40  
0 40  
15 10  
11 10  
20 10  
4 0  
0 0  
0 0  
0 1



REPRESENTATIVE SECTION OF OSCILLOGRAPH RECORDS  
OF ELECTRICAL MONITORING CHANNELS



PHOTOGRAPH 1  
TEST SETUP FOR STATIC LOAD TESTING

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APPENDIX I

INSTRUMENTATION EQUIPMENT SHEETS





Page 1 of 1

Test Area "D" MACHINE

Type Test Static Load

Page No. 15  
Report No. 46823-1

Checked & Received By Benny Smith 6/10/83

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APPENDIX II

STATIC LOAD TEST PROCEDURE

Page No. 18  
Report No. 46823-1

TEST PROCEDURE NO. 541/C465/WB

DATE: May 25, 1983

Revision A

J/N 46823

## STATIC LOAD TEST PROCEDURE

FOR

## AN 13-INCH VALVE ASSEMBLY

FOR

CLOW CORPORATION  
WESTMONT, ILLINOIS

APPROVED BY: \_\_\_\_\_  
FOR: \_\_\_\_\_

APPROVED BY

PROJECT MANAGER: James H. Lovell 5/24/83

APPROVED BY: \_\_\_\_\_  
FOR: \_\_\_\_\_

APPROVED BY

QUALITY ENGINEER: J.D. Roberts 5/26/83

APPROVED BY: \_\_\_\_\_  
FOR: \_\_\_\_\_

PREPARED BY

PROJECT ENGINEER: Robert J. Quinn 5/25/83

## REVISIONS

FORM 1064-1 Rev. 4/74

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## 1.0 PURPOSE

The purpose of this test program is to seismically qualify an 18-inch Lugged Wafer Stop Valve Assembly (with a Limitorque Actuator) by statically loading the actuator and yoke of the valve with an equivalent static load of 4.5 g applied at the center of gravity of the actuator in each of the three (3) orthogonal specimen axes. The specimen temperature and humidity shall be ambient during the test program.

## 2.0 SPECIMEN DESCRIPTION AND MOUNTING

An 18-inch valve assembly (butterfly valve with an SMB-1-H5BC Limitorque actuator) as described on Clow Corporation Drawing Number D-0702, hereinafter referred to as the specimen, shall be attached to a Wyle-furnished test fixture as shown in Figure 1. The test fixture shall be welded to a rigid reaction frame.

## 3.0 STATIC LOAD

An equivalent static load of 4.5 g\* shall be applied in line with the center of gravity of the actuator in each of the three (3) orthogonal specimen axes. The center of gravity of the actuator and a smooth, flat surface for the application of the static load shall be provided by Clow Corporation. The seat leakage differential pressure for the valve shall be simultaneously applied to the test fixture while the static load is applied. The specimen shall then be cycled while in the deflected mode as described in Paragraph 4.0.

The magnitude of the load shall be determined by multiplying the hydraulic pressure by the effective piston area of the hydraulic cylinders. The loads shall be applied simultaneously with one, two or three hydraulic cylinders. It is assumed that the static load can be applied in either the positive or negative direction.

\*Assuming an actuator weight of 1220 pounds, the applied (or equivalent) static load shall be 5490 pounds in each orthogonal direction.

4.0 OPERABILITY TESTS

With the static loads applied, the specimen shall be stroked through three complete operating cycles: Open-to-closed with internal pressure; closed-to-open with differential seat leakage pressure.

The operating time in each direction of travel shall be recorded during each operating cycle.

5.0 SEAT LEAKAGE TESTS

Seat leakage tests shall be performed prior to and after the static load tests in accordance with Clow Corporation's "Pneumatic Seat Bubble Test" EPS 30-49-832. The leakage test duration shall be four (4) minutes.

6.0 PRE-TEST AND POST-TEST FUNCTIONAL OPERABILITY

Prior to and following the application of the static load, the specimen shall be stroked through four complete operating cycles.

7.0 ELECTRICAL POWER

Standard electrical power of 368 VAC, 3-phase, 60 Hz, shall be furnished for the operation of the specimen. The voltage shall be variable to 460 VAC for the pre-test and post-test baseline operability tests.

8.0 ELECTRICAL MONITORING

Five (5) electrical monitoring channels shall be provided to monitor the following:

- 1) A limit switch (which changes state in the opening direction).
- 2) A limit switch (which changes state in the closing direction).
- 3) Torque switch (which shuts off power at the end of the valve stroke).
- 4) Operating current.



8.0 ELECTRICAL MONITORING (Continued)

- 5) Valve disc motion (by attaching a rotary potentiometer to the rotating disc on the actuator).

The electrical monitoring channels shall be recorded on an oscillograph recorder.

9.0 PNEUMATIC PRESSURE

Pneumatic pressure of 55 psig shall be provided to perform the leakage tests described in Paragraph 5.0 and the cycling tests described in Paragraph 4.0.

10.0 IN-PROCESS INSPECTION

The records shall be checked for quality of performance after each test.

The specimen shall be examined for possible damage following each test.

All important loading effects shall be logged.

Photographs shall be taken of any noticeable physical damage that may occur.

11.0 REPORT

Five (5) copies of a certification-type test report for the valve shall be issued for approval subsequent to completion of testing. This report shall be signed by a Registered Professional Engineer and shall summarize the test results and conclusions, details and recommendations concerning deficiencies and repairs, and photographs of test setups, failures, test procedures, etc. The report shall also contain a list of test equipment used, calibrations, and Instrumentation Log Sheets.



APPENDIX III

WYLE LABORATORIES'  
CERTIFICATION OF COMPLIANCE

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**WYLE**

LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP

**CERTIFICATE OF COMPLIANCE**

NO.: Hsv/106  
DATE: June 27, 1983  
WYLE JOB NO.: 46823

Clow Corporation  
40 Chestnut Avenue  
Westmont, Illinois 60559

Gentlemen:

Wyle Laboratories certifies that an 18" Lugged Wafer Stop Valve with an SMB-1-H5BC Limitorque Actuator has been tested in compliance with Wyle Laboratories' Test Procedure 541/0465/WB, dated May 25, 1983, Revision A, and Clow Corporation's Purchase Order Number 30-11654 (Clow Job No. 82-2053-04(N)-01 for the Limerick Generating Station, Units 1 and 2). Additionally, these tests were performed in compliance with the guidelines of the following specifications:

- o Bechtel Corporation Specification 8031-P-144, Revision 1, dated July 22, 1982
- o Bechtel Corporation Specification 8031-G-11, Revision 15, dated May 7, 1979
- o Clow Corporation Drawing No. D-0702
- o Limitorque Drawing No. 02-442-0497-2

The results of the testing conducted under the listed specifications have been completely and correctly conducted with accurate results, as documented in Wyle Laboratories' Test Report No. 46823-1 dated June 27, 1983.

STATE OF ALABAMA }  
COUNTY OF MADISON }

James H. Powell, Supervisor

, being duly sworn,  
deposes and says: The information contained in this report is the result of complete and carefully conducted tests and is to the best of his knowledge true and correct in all respects.

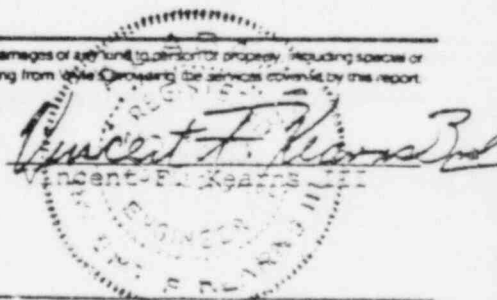
SUBSCRIBED and sworn to before me this 27th day of June, 19 83

Vincent F. Keane  
Notary Public in and for the State of Alabama-at large.

My Commission expires June 13, 19 87

Wyle shall have no liability for damages of any kind to person or property, including special or consequential damages, resulting from Wyle's providing the services covered by this report.

REGISTERED  
PROFESSIONAL  
ENGINEER



**WYLE**

LABORATORIES SCIENTIFIC SERVICES & SYSTEMS GROUP