

**TEST REPORT  
ENVIRONMENTAL TESTING  
OF A  
FH-SPRING RETURN ACTUATOR  
FOR  
BETTIS CORPORATION  
WYLE REPORT NO. T54455-01, REV. B**

**Bettis Corporation  
18703 GH Circle  
P.O. Box 508  
Waller, TX 77484**





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STATE OF ALABAMA }  
 COUNTY OF MADISON }

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

David R. Bailey  
 SUBSCRIBED and sworn to before me this 17<sup>th</sup> day of May, 2007  
Patricia Phillips  
 Notary Public in and for the State of Alabama at Large

My Commission expires Jan. 7, 2009

SEAL

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.

TEST BY: Tory Jones 5-16-07  
 Tory Jones, Project Engineer Date

APPROVED BY: Robert R. Bridges 5/17/07  
 Robert R. Bridges, Staff Engineer Date

WYLE Q.A.: Banda Mace 5/17/07  
 Raul Terceno, Quality Assurance Manager Date

(pap)



Cert No. 845.02



ISO 9001:2000

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## 1.0 INTRODUCTION

### 1.1 Scope

This report documents the test procedures followed and the results obtained during Dust and Water Spray Testing performed on a FH-Spring Return Actuator for Bettis Corporation. The FH-Spring Return Actuator was received at Wyle Laboratories on March 16, 2007, and subjected to an inspection upon receipt. The receiving inspection revealed the G-Spring Return Actuator to be in good condition. Testing was performed at Wyle Laboratories' Huntsville, Alabama, Test Facility April 30 through May 7, 2007. **B**

### 1.2 References

- Bettis Corporation Purchase Order No. 03-10864
- Bettis Corporation Email dated March 30, 2007
- Wyle Laboratories' Quotation No. 542/040518-R2/DB, dated February 20, 2007
- Wyle Laboratories' Quality Assurance Program Manual, Revision 2
- ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment, General Requirements"
- ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment"
- MIL-STD-45662A, "Calibration System Requirements"
- IEC 60529, Edition 2.1, dated 2001-2002

### 1.3 Test Specimen Description

The test specimen is a FH-Spring Return Actuator measuring approximately 91 inches x 23 inches x 18.25 inches. The weight of the Actuator is approximately 1,028 pounds. The Actuator Model is FH5016-SR2 and the Part No. is 147316. **B**

### 1.4 Summary

The Actuator was subjected to a Dust Test and a Water Spray Test. These tests were performed in accordance with IEC 60529, Classifications IP65, paragraphs 13.4, 13.6 and 14.2.5, Edition 2.1, dated 2001-2002.

Upon completion of all required testing, the Actuator was visually inspected for any signs of damage or degradation, along with dust and water intrusion into inlet ports. No anomalies were noted. The Actuator was returned to Bettis Corporation for post-test inspection and evaluation.

The test results contained herein apply only to the test specimen identified in this report.

## 2.0 TEST PROCEDURES AND RESULTS

### 2.1 Dust Test

One FH-Spring Return Actuator was subjected to Dust Testing in accordance with IEC 60529, Classifications IP65, paragraphs 13.4 and 13.6, Category 1, Edition 2.1, dated 2001-2002. **B**

The Actuator was placed inside an enclosed test chamber that measured 12 feet long x 8 feet wide x 8 feet high (768 cubic feet). The talcum powder concentration was 2 kg per cubic meter of the chamber volume (measuring 96 pounds) and was held in suspension by the use of circulating fans. A vacuum pump was used to extract air into the inlet area of the piston to maintain a maximum decompression rate of 8 inches of water column (0.20 mbar) throughout testing. The volume of the piston wherein air was extracted was approximately 870 cubic inches. During testing, 3 pounds of talcum powder was blown into the enclosure every 15 minutes using a blower throughout the test to maintain the talcum powder concentration. The total duration of the test was 8 hours.

At test completion, Wyle Laboratories' personnel performed a visual inspection to verify satisfactory post-test condition of the Actuator. No damage, deformation or major pressure drop under vacuum was noted. No anomalies were reported. The Actuator successfully completed all requirements for the Dust Test.

Photographs of the Actuator and test setup are presented in Attachment A. The Instrumentation Equipment Sheet for the test setup is presented in Attachment B.

### 2.2 Water Spray Test

One FH-Spring Return Actuator was subjected to Water Spray Testing in accordance with IEC 60529, Classifications IP6, paragraph 14.2.5, Edition 2.1, dated 2001-2002. **B**

The Actuator was subjected to water spray from a 6.3-mm nozzle (IP5) at a rate of 12.5 liters/minute (27.55 pounds/minute) from a distance of 2.5 m, for a duration of 3 minutes.

At test completion, Wyle Laboratories' personnel performed a visual inspection to verify satisfactory post-test condition of each Actuator. No damage, deformation or water intrusion was noted. No anomalies were reported. The Actuator successfully completed all requirements for the Water Spray Test.

Photographs of the Actuator and test setup are presented in Attachment A. The Instrumentation Equipment Sheet for the test setup is presented in Attachment B.

### **3.0 QUALITY ASSURANCE PROGRAM**

All work performed on this test program was completed in accordance with Wyle Laboratories' Quality Assurance Program.

The Wyle Laboratories, Huntsville Facility, Quality Management System is registered in compliance with the ISO-9001:2000 International Quality Standard. Registration has been completed by Quality Management Institute (QMI), a Division of Canadian Standards Association (CSA).

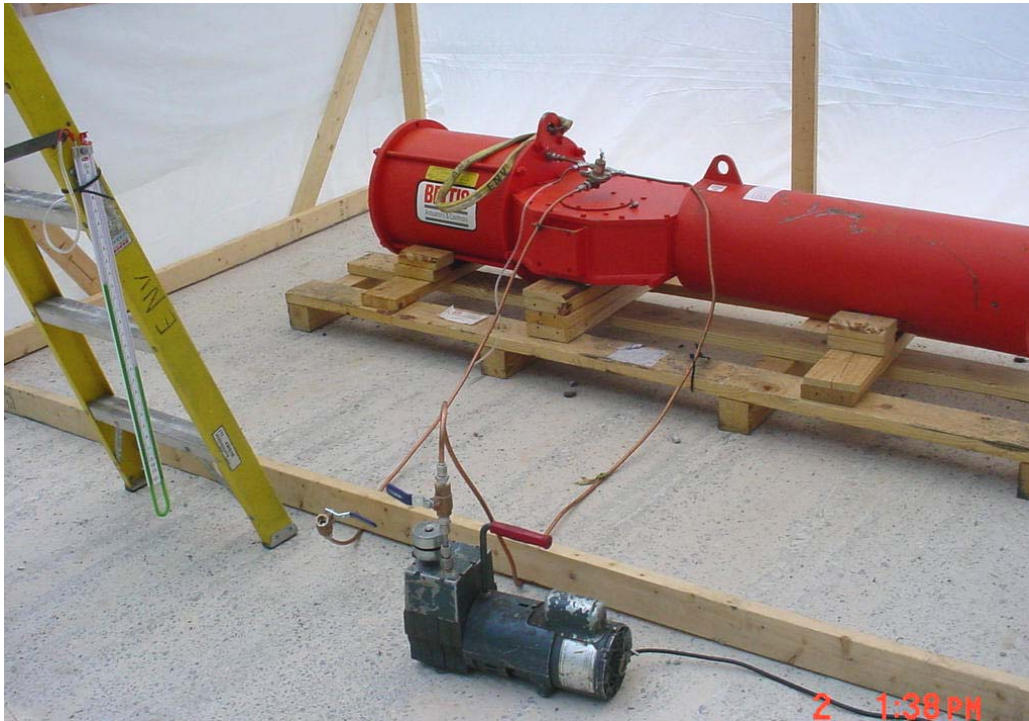
Wyle Laboratories is accredited (Certificate No.: 845.02) by the American Association for Laboratory Accreditation (A2LA) and the results shown in this test report have been determined in accordance with Wyle's scope of accreditation unless otherwise stated in this report.

### **4.0 TEST EQUIPMENT AND INSTRUMENTATION**

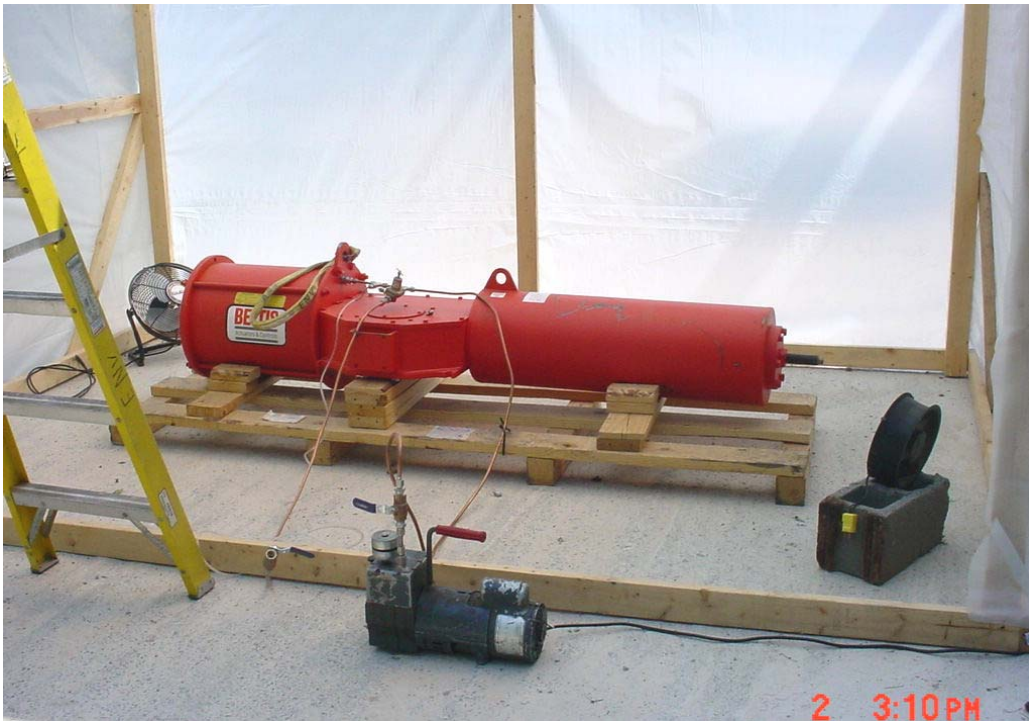
All instrumentation, measuring, and test equipment used in the performance of this test program were calibrated in accordance with Wyle Laboratories' Quality Assurance Program, which complies with the requirements of ANSI/NCSL Z540-1, ISO 10012-1, and Military Specification MIL-STD-45662A. Standards used in performing all calibrations are traceable to the National Institute of Standards and Technology (NIST) by report number and date. When no national standards exist, the standards are traceable to international standards or the basis for calibration is otherwise documented.

**ATTACHMENT A**  
**PHOTOGRAPHS**





**Photograph 1. Typical Dust Test Setup**



**Photograph 2. Typical Dust Test Setup**



**Photograph 3. Typical Dust Test Setup**



**Photograph 4. Specimen View during Dust Test**



**Photograph 5. Specimen View at the End of Dust Test**



**Photograph 6. Typical Water Spray Test Setup**



**Photograph 7. Typical Water Spray Test Setup**

**ATTACHMENT B**  
**INSTRUMENTATION EQUIPMENT SHEETS**



INSTRUMENTATION EQUIPMENT SHEET

DATE: 5/2/2007      JOB NUMBER: T54455      TYPE OF TEST: DUST  
TECHNICIAN: M CAPPS      CUSTOMER: BETTIS      TEST AREA: SITE E

No.	Description	Manufacturer	Model	Serial #	WYLE #	RANGE	ACCURACY	Cal Date	Cal Due
1	MANOMETER	DWYER	1221	1221-24	110601	12"	±1DIV	4/30/2007	7/30/2007
2	SCALE	OHAUS	15S	16898	113777	100LB	±.05%	10/19/2006	10/19/2007
3	STOP WATCH	VWR	62379-218	230112859	117689	10 HR	±0.5 SEC	1/26/2007	5/10/2007

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION:

*M. Capps* 5/2/07

CHECKED & RECEIVED BY:

Q.A.:

*[Signature]* 5-2-07  
*[Signature]* 5/2/07

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INSTRUMENTATION EQUIPMENT SHEET

DATE: 5/7/2007      JOB NUMBER: T54455      TYPE OF TEST: WATER SPRAY  
TECHNICIAN: M CAPPS      CUSTOMER: BETTIS      TEST AREA: RAIN SITE

No.	Description	Manufacturer	Model	Serial #	WYLE #	RANGE	ACCURACY	Cal Date	Cal Due
1	PRESSURE GAGE	USG	4.5"	NA	003161	30-0-60 PSI	±1% FS	3/6/2007	6/4/2007
2	SCALE	OHAUS	ISS	16898	113777	100LB	±.05%	10/19/2006	10/19/2007
3	STOP WATCH	VWR	62379-218	230112859	117689	10 HR	±0.5 SEC	1/26/2007	5/10/2007

This is to certify that the above instruments were calibrated using state-of-the-art techniques with standards whose calibration is traceable to the National Institute of Standards and Technology.

INSTRUMENTATION: *M. Capps* 5/7/07      CHECKED & RECEIVED BY: *[Signature]* 5-7-07  
Q.A.: Banda *[Signature]* 5/7/07

WH-1029A,REV,APR99