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BURST TESTING OF LOW PRESSURE MKS BARATRON SENSORS (U)

by

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DOE Contract No. **DE-AC09-89SR18035**

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Savannah River Technology Center
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WSRC-TR-93-420

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Retention: Lifetime

Key Words: Pressure Gages,
Pressure Measurement,
Manometer

Date: August 2, 1993

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Burst Testing of Low Pressure MKS Baratron® Sensors

Summary. Pressure sensors from ten MKS series 390 and 690 Baratron® capacitance manometers were hydrostatically burst tested by the Engineering and Materials Technology Department (E&MT). Four MKS series 390 Baratron® 0-10 torr sensors had an average case burst pressure of 915 psig. Five MKS series 690 Baratron® 0-1 torr sensors had an average case burst pressure of 1301 psig, and one MKS series 690 Baratron® 0-1000 torr sensor had a case burst pressure of 938 psig.

Introduction. Because of the high accuracy attainable, MKS Baratrons® are used extensively in Research and Development applications in Hydrogen Technology Section (HTS) laboratories for pressure measurement. Various models of these pressure transducers are capable of measuring pressures up to 25000 mm Hg (torr). However, certain applications in our laboratories require accurate measurement of very low pressures. The 0-1 torr and 0-10 torr series 690 Baratron® sensors were chosen for this application. The 690 series is an upgraded version of the older 390 series. The 690 sensor is smaller than the 390 sensor both in external dimensions and internal measurement volume.

Most of the manifolds used for HTS experimental applications are rated to pressures of 100-200 psig. In order to use a low pressure sensor on the manifold, the sensor must either be provided pressure protection or shown that it will not fail at the relief pressure for the manifold. The latter was the goal of these tests. Although the instrument may be permanently damaged by over-pressurization, the integrity of the manifold will not be compromised if the components can be rated at a high enough pressure. Administrative controls would be used to protect the instrument from pressure damage.

MKS Instruments, Inc. provided six model 690 series Baratron® sensors for these tests. These included five 0-1 torr sensors and one 0-1000 torr sensor. These sensors were fabricated using standard methods, however, they were rejected for failing to meet calibration specifications. Additionally, four model 390 series 0-10 torr sensors were obtained for this test from HTS laboratories. These instruments failed to meet calibration specifications during periodic recalibration.

Description of Test. The Baratron® transducers were disassembled to remove the sensor unit from the housing containing the heater and other electronics. The units were burst using water and a hand pump. The sensors and all lines were purged with water to remove as much air as possible prior to the tests. Pressure was measured on a Teledyne Taper strain gauge 0-4000 psi pressure transducer which was calibrated in the range 0-2000 psi. Burst pressures were recorded from a local display dedicated to this transducer.

Results. All of the units failed in the weld which sandwiches the diaphragm between the two halves of the sensor assembly. The 690 series sensors showed more deformation before bursting than the 390 series, however, the case burst pressures for the 690 series are significantly higher than for the 390 series. The results of the tests are summarized in the Table below:

390 SERIES BARATRONS

Serial Number	Model Number	Range	Burst Pressures (psig)	
			Diaphragm	Case
950K39	390HA00010	10 torr	518	695
936B45	390HA00010	10 torr	551	945
628B4	390HA00010	10 torr	509	1100
845I68	390HA00010	10 torr	424	922
AVERAGE			500.5	915.5
ST.DEV.			54.1	166.9

690 SERIES 1 TORR BARATRONS

Serial Number	Model Number	Range	Burst Pressures (psig)	
			Diaphragm	Case
318BG08	690HA00001	1 torr	334	1573
318BG09	690HA00001	1 torr	321	1274
320AU04	690HA00001	1 torr	315	1450
233AW06	690HA00001	1 torr	353	1021
316AY02	690HA00001	1 torr	380	1188
AVERAGE			340.6	1301.2
ST.DEV.			26.4	216.8

690 SERIES 1000 TORR BARATRON

Serial Number	Model Number	Range	Burst Pressures (psig)	
			Diaphragm	Case
314BK05	690HA01000	1000 torr	741	938

Conclusions. The test showed that the Baratron® low pressure sensor is a robust unit. The newer 690 series showed a somewhat lower diaphragm burst pressure than the older 390 series, however, the case burst pressure for the 690 series was significantly higher than for the 390 series. When used on a 180 psig manifold, either sensor provides a very large safety factor of 5.1 to 7.2.

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