pot (compression chamber) used in the Program was designed for a knock-off tube as the quick pressure-release mechanism. This demanded a thorough investigation since the time duration of the static pressure pulse (pressure-release time) applied to the piezoelectric gage was varied through use of the knock-off mechanism.

Requirements. The model reactor vessels currently used in the Containment Program are hollow, right-circular cylinders closed with rigid, radial constraints at the ends. The closures are right discs fitted concentrically with the hollow cylinder. Dynamic loading of the vessels is achieved by initiating an explosive or propellant charge located at the centroid. A detailed description of the model vessels and the associated testing is presented in reference (a). The vessels are subjected to energy releases that generate maximum excursion pressures in the time range of 100 microseconds to 100 milliseconds. Thus the time range for which the piezoelectric gages must be calibrated is clearly defined. However, from an argument presented later in the paragraph Instrumentation, the accuracy of a gage calibration that is performed on Program instrumentation for a pressure-release time of less than 10 milliseconds, over the required pressure range, will be within 1 percent for response times in the subject time range. The range of excursion pressures encountered in the model reactor vessels is 0 - 50,000 psi. Thus the general requirements for calibration of the piezoelectric gages used in this Program are to subject the gages to static pressure pulses, ranging in magnitude from 0 to 50,000 psi, for a time duration of 10 milliseconds or less and to monitor the output in terms of standard pressures and times.

Instrumentation. The instrumentation currently employed for measuring the charge developed by the piezoelectric gage when subjected to a static pressure pulse consists of six major parts. A list of these parts along with a brief description of the function of each appears as follows: (1) standard capacitors for translating the piezoelectric gage output charge to a corresponding voltage signal, (2) a precision calibration-voltage supply and divider for accurately determining the voltage sensitivity of the signal-handling circuitry, (3) a vacuum-tube-fork frequency standard for generating a steady-state waveform of high amplitude and known frequency upon which all timing operations in the system are based, (4) high-impedance amplifiers (gain of 0.78) to provide the proper impedance match between the piezoelectric gages (150,000 megohms) and the recording oscilloscope (1 megohm), (5) a recording oscilloscope for displaying the voltage-time output of the gage, (6) a trigger mechanism for initiating a sweeptrace on the recording oscilloscope screen. Items (1) through (4) are housed in the pressure instrumentation console shown in Figure 1. A view of the Tektronix Oscilloscopes and Polaroid Land Camerasis shown in Figure 2. Each of the oscilloscopes is equipped with a type 53 C Dual-Trace Plug-in Preamplifier Unit. Figure 3 is a schematic diagram of the electronic circuitry. The trigger mechanism, specially designed for the subject investigation, was an adjustable lever device coupled to an electric contact switch which, upon opening, furnished a trigger pulse (40-45 volts) to the recording oscilloscope that initiated a sweeptrace. A descriptive view of the oscilloscope triggering mechanism is shown in Figure 4.

The static sensitivity of a tourmaline gage is directly proportional to the piezoelectric constant K of the tourmaline and to the total area of the electrodes A. It is common practice to denote the gage sensitivity by KA, expressed in the units of picocoulombs per psi (pq/psi). The magnitude of the voltage developed across a standard capacitor (including cable capacitance) corresponding to an applied pressure on the gages is obtained from the following relation