INTRODUCTION

I.

The Thermonics Precision Temperature Forcing System (PTFS) Model T-2075 was created to solve the problem of electrically testing complex semiconductor components (integrated circuits) at desired environmental temperature without changing the electrical characteristics of the room temperature test fixture used to perform the electrical test. Conventional temperature chambers require the addition of long test leads to the test fixture or test system to permit testing at temperature extremes. Thermal probes may also be used to force the temperature of a component to the desired temperature without modifying the room temperature test fixture, but this method is slow due to poor thermal conduction between the probe and the unit to be tested and the accuracy of the temperature established is questionable.

The PTFS Model T-2075 solves these problems by accurately controlling the temperature of a stream of dry gas (Nitrogen) to $\pm 1^{\circ}$ Centigrade of the desired value at the test site and forces the temperature of the component to be tested by submerging it in the stream of nitrogen (N_2) or dry air. The temperature range is $-20^{\circ}C$ to $+150^{\circ}C$ with a flow of up to 350 SCFH. This permits equivalent moving ambient velocities of 2000 LFM to be achieved to force the case of the component under test to that of the temperature controlled N_2. This inovative technique provides a fast and accurate method of forcing and sustaining the case temperature of semiconductor components available today. The operation of the T-2075 at low temperature is achieved by utilizing a vortex tube within the system. This elliminates the need for liquid nitrogen or a refrigeration system and is very reliable as the vortex tube has no moving parts and requires only pressurized dry nitrogen or dry air to operate.

II.

The PTFS controls the temperature of dry gas (N_2) or compressed air over the temperature range of -20°C to +150°C in the following manner.

The N_2 enters the PTFS at the back panel of the system and then passes through a pressure regulator for controlling the flow of gas to a desired level as set by the flow knob on the front panel of the PTFS. After the N_2 exits the pressure regulator, it passes thru a venturi which is used to measure the flow of the N_2. The pressure differential created accross the venturi is sensed by a solid state pressure transducer and converted to flow and displayed on the front panel flow meter in cubic feet per hour (C F H X 100).

After the N_2 exits the venturi, it enters the air heater through an air valve for high temperature operation which changes the temperature of the N_2 or air to the desired level as is called for by the front panel temperature controller. The case temperature of the air heater is sensed and compared to preset level to insure that the heater does not overheat and cause hazardous conditions from occuring. The gas then exits the air heater and PTFS through the rear panel and is then directed to the desired location thru a flexible hose. At the end of the hose is a solid state temperature transducer which is connected to a proportioning temperature controller through the rear panel of the PTFS. The sensed temperature will be indicated on the front panel of the PTFS. If the temperature is below the desired level, the temperature controller will turn the heater on until the desired level of temperature is reached. Once the level of temperature is established, the temperature controller will pulse the heater as required to maintain the temperature to ±1°C of the set value. The desired temperature is set by pressing the "push to set" button on the front panel of the PTFS and rotating the "Temp Set" knob on the front panel until the desired temperature is indicated. When the button is released, the actual temperature sensed will be indicated.

For low temperature operation, a toggle switch on the front panel is placed in the "cold" position and the gas flow from the venturi is switched through an air valve to flow through a heater in series with the input of a vortex tube. The vortex tube divides the gas flow to provide a source of cold gas for the PTFS output and an exhaust of warm gas which is a bi-product of the vortex process. The warm gas is exhausted to ambient. The heater in series with the vortex tube is pulsed by the temperature controller to control the output temperature of the PTFS gas flow to $\pm 1^{o}C$ of set point in the same manner as is done for operation at high temperature.