



**Industry:** Power

**Process:** Converting geothermal energy into electricity

**Application:** Measuring steam before it enters the turbine. Two measurements are required for each turbine, one on the high pressure side and one on the low pressure side.

**Measurement Challenge/Difficulty:** Geothermal steam contains a significant amount of non condensable gasses making the measurement deviate from the steam tables. Main constituents (other than steam) are H<sub>2</sub>S, C<sub>0</sub>2, N, Ar, Hg(vapor). The percentage of each of these gasses changes over time. Changes are typically stable and can be monitored by sample on a periodic basis. The V-Cone provides consistent mixing of these gasses for a stable and repeatable signal. Measurement is corrected by incorporating the density of the combined gasses to the steam table measurement in percentages. Measurement accuracy can be in the +/-1% of rate range over a 5:1 flow turndown utilizing this method(based on a primary gas calibration).

**Previous Method:** Averaging pitot tubes are the standard device for this application.

**Solution:** H.P. & L.P. steam are both typically transmitted in line sizes ranging from 24" to 40" in diameter. The V-Cone is easily constructed in these line sizes. Typically geothermal steam has extreme velocities. They can be in excess of 200 feet per second. The V-Cone lends itself to these special applications due to its sizing flexibility. Beta ratio's in the 0.75 to 0.85 are typically used. Flow turndown and accuracy are better than the traditional pitot due to the annular design. Because of the low mass involved, reduced meter runs are required when pitot tubes are used. The sensing holes do plug up regularly making it necessary to remove the pitot on a regular basis. The extreme velocities can damage insertion pitots when they are removed (under pressure) periodically for cleaning.

**Date Installed:** 1st quarter 1992

**Literature No.**

24509-89

**Industry:**

Power

**Niche Market:**

Geothermal Power

**Process:**

Main steam measurement into turbines

**Product:**

Power for grid

**Fluid:**

Steam

**Viscosity & Sp. G.**

**Flow Rate:**

50,000 to 250,000  
pounds per hour

**Pressure:**

HP = 100 PSIG nom.  
LP = 4.5 PSIG nom.

**Temperature:**

225° to 300°F

**Size:**

24" to 40" Dia

**Date:**

1st quarter 1992

**Submitted by:**

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