

# STEAM TURBINE PERFORMANCE MEASUREMENT

Application

Note 6

## General Description

Pressure losses can be determined by measuring pressures at various stages of the steam turbine operating under load conditions. These losses can determine turbine efficiency, indicate compressor blade tip erosion, or other performance problems.

This application note describes a pressure safety purge system that isolates and protects inexpensive PC based pressure sensors from steam pressure media while providing high accuracy pressure measurements.

## A Safety Purge Measurement System

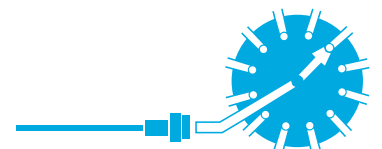
This system utilizes intelligent DSA3016 pressure scanners, incorporating relatively inexpensive piezoresistive sensors, to measure pressures in steam turbines. These sensors normally could not be used to measure liquid or high temperature steam media pressures. However, this system has a safety purge feature that isolates the sensors from the harsh media without affecting the accuracy of the pressure measurement. Two separate purge paths are used in the safety purge system. The first purge path, referred to as “cabinet purge,” uses a valve in the pressure scanner to purge input lines to atmosphere. The second purge path, referred to as “turbine purge,” uses a remote purge valve located near the system measurement connection to the steam turbine to purge those lines back to the turbine.

**Measurement mode:** Turbine measurement lines are connected to the pressure scanners. This mode is used for short periods of time when data is to be collected.

**Purge mode:** All lines are purged directing purge air to the steam turbine. Purge pressure is used to prevent moisture from making contact with the sensors. If electrical power is lost, the system will default to this mode. (See Figure 1 for system in purge mode.)

**Dormant mode:** Measurement lines are closed and the system is placed in the safe mode to conserve purge air.

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A key function of this pressure measuring system is its ability to perform a full system calibration or validate individual sensors “on demand.” Pressure sensor validation or calibration is automatically accomplished via ASCII commands to the pressure calibrator incorporated in the system main cabinet.

## System Installation and Operation

Figure 1 shows a typical system layout. The safety purge cabinet should be located above the measurement points. The measurement system (main cabinet) should be mounted 6 feet (1.8 meters) or more above the safety purge system. Gravity thus assists in keeping condensation from the pressure sensors.

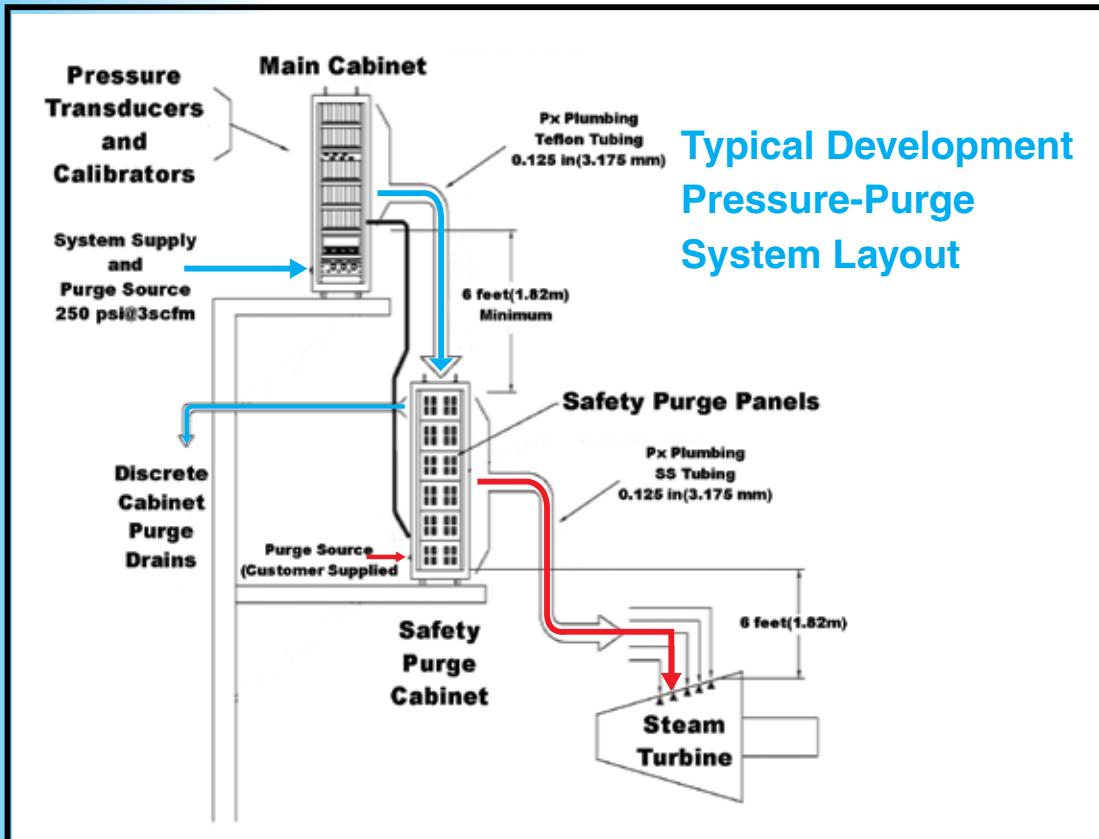


Figure 1

## Purge Flow Requirements

A customer supplied purge air or nitrogen source is required that is capable of providing purge pressures 20% greater than the maximum test pressure.

The purge pressure will move any condensate that might form in the pressure input lines back to the turbine. Purge flow will be determined by the number of pressure points, the maximum pressure to be measured, the capacity of the purge pressure source, and the test article backpressure. Purge flow meters may be installed in each line to monitor purge flow and adjust final purge pressures to the steam turbine.

## Portability

The system does not have to be permanently installed in a development test cell. A combined System/Purge cabinet can be made portable and used for performance testing several turbines at a power plant. Turbines could be monitored more frequently thus improving overall plant efficiency. A typical portable Safety Purge Performance is shown in the figure below utilizing Scanivalve's 16 channel pressure scanner model DSA3218.



*A typical DSA3218 Safety Purge System  
For Steam Turbine Efficiency Testing*

## Communication

Models DSA3016 & DSA3200 series intelligent pressure modules communicate through industry proven Ethernet TCP/IP. A system may be monitored from any PC or plant network connection using Telnet, LabView, or an OPC server.

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