Sonic Nozzle Auto Prover

Technical Specifications
Diagram of the System

Figure 1
Flow Rate at
3 bar (m³/h) | Flow Rate at
7 bar (m³/h) | Remarks  
---|---|---|
0.107 | 0.016 | 0.04 | Residential Gas Meters  
0.185 | 0.048 | 0.12  
0.463 | 0.3 | 0.7  
0.655 | 0.6 | 1.4  
0.926 | 1.2 | 2.8  
1.465 | 3 | 7  
2.24 | 8.3 | 19.39 | Industrial Gas Meters for (G6~G40) up to 65 M³  
3.2 | 16.93 | 39.58

All sonic nozzles are third-party calibrated by Korea Research Institute for Standards and Science against a Master Bell Prover. All sensors including pressure transmitter, thermometer, etc. are calibrated by the same calibration body. Calibrations of all nozzles, sensors, and the Mater Bell Prover are traceable to NIST. Each sonic nozzle has its own calibrated “standard time constant”. One the SNAP probes are mounted at critical locations in accordance with ASME/ANSI standards to measure temperature and pressure. The SNAP computer uses all sensor values to calculate nozzle volume and meter proof.

When a flow rate is entered while setting meter test conditions, the computer determines which nozzle or nozzle combinations will produce the closest rate to the one selected. When two or more nozzles are selected, the resulting flow rate(nominal) is the sum of all nozzles selected.

When a given flow rate is selected by the user, the computer activates the appropriate nozzle solenoid valve(s) to achieve the desired air flow rate.

In addition to temperature and pressure, the prover needs two values to determine the correct volume of air flowing through the gas meter:

1. Sonic velocity of the air through the nozzles(computed from the temperature and pressure, and nozzle calibration data)
2. Time for a specified number of revolutions of the meter tangent mechanism.

The proof of the meter is a function of the volume per revolution and the parameters listed above.

Meter Proving Capacity

The SNAP has the capability to test G4 type diaphragm TC and non-TC gas meters.

Standards

Meter performance data that is stored in the standard and extended data output files is saved in database files and MS Excel files. Therefore the resulting data can be imported for use in common software packages.

Design Features

The SNAP offers many advantages over conventional bell provers and other sonic-nozzle provers due to their inherent design and construction.

- **Shortened proving cycle.** The SNAP can test a meter in about half the time it takes a bell to complete the same operation.
- **Occupies less Space than a standard bell prover.** The bulk and floor space requirements for the SNAP are less than one-fourth the bell prover requirements.
- **Provides consistent and highly repeatable proving results.** Accuracy test repeatability of SNAP is typically in the range of ±0.2%.
- **Improves the proving process by reducing the need for human intervention.** Once a meter is in “clamped” position, the prover takes over until the test is complete.
- **Minimizes human error within the proving process.** The operator’s job is confined to placing, removing, and adjusting meters while following precise instructions from the menu.
- **A PC with Pentium IV, 2.4 GHz Processor.**
- **The prover has the ability to detect a number of testing faults.** It checks for system leaks, high meter differential pressure, and sensor discrepancies. A diagnostic screen prompt can be used to check major system components, such as sensor readings, valve operation, and various digital inputs.

Test Description

Leak Test

After a gas meter is clamped in position, the SNAP will initiate an exercise cycle and undergo a leak test for the entire system. The differential pressure is monitored for a predetermined length of time. If the decay of pressure is greater than set value, an alarm goes off warning the user of the leakage problem and stops the test. Note that this leak test is a system-leak test for the overall
proving integrity and is not equivalent to a meter-hydrostatic or “dip-tank” test.

**Control System**

**Computer and Electronic-Controls Subsystem**

The computer and electronic-controls subsystem provides the intelligence and the controls necessary to run the proving process. To calculate the correct sonic-nozzle flow rates, the prover uses modern electronics and a sophisticated personal computer technology. The computer program and associated hardware energizes solenoid valves; takes pressure, temperature, etc.; and times the meter test. These measured variables are mathematically combined to determine the meter accuracy.

**Operator Touch-Screen Interface (Optional)**

The SNAP user interface is a serial SVGA touch-screen monitor. Although a mouse and keyboard are provided with each system, all interface can be performed through the touch-screen monitor. This subsystem provides switches, push-buttons, and displays to allow the operator to communicate with the system by entering pertinent data and performing specific tasks as instructed by the computer.

**Control Hardware and Software**

The SNAP uses an industry-standard PCI ISA BUS Pentium-IV computer system with the following specifications:

- Intel Pentium IV 2.4GHz Processor
- 512 MB DDR
- 2 serial ports
- 1 parallel port
- 2 USB ports
- Standard 10/100 Ethernet Network Card
- 2 Internal Modems
- 80 giga-byte Hard Disk
- 1.44 mega-byte floppy disk
- G-Force 4M × 440, 64 VGA Card
- Samsung 106-key keyboard
- Optical Mouse
- Operating System : Windows 2000/XP

The SNAP uses a meter differential pressure transmitter. The computer monitors the high set point, which corresponds to the user’s maximum allowable meter differential pressure (e.g. 0.5 inches WC). When the high set point is exceeded, an error message is displayed on the screen to indicate that the test has failed.

**Bar-Code Reading (Optional)**

The system can be configured to use bar-code reader capable of interpreting all commonly used bar-code types (Code 39, UPC, etc.).

Enhanced Pulse-Detection System

The system waits for the pulse signal and flags an error when the signal is not detected for a certain set period of time.

**Network**

The system is network ready as standard equipment and supports Ethernet-network types. Each prover is equipped with Windows 2000/XP as its operating system and a 10/100 Ethernet Network card. The Ethernet connection facilitates connection into a Local Area Network (LAN).

**Remote Diagnostics**

“Remote Diagnostics” of the system can be accomplished using a software such as Symantec’s PC AnyWhere. This software application allows Metrology Service Engineers to interface and observe field units during proving operations. The computer’s Ethernet provides the hardware interface between Metrology and the field SNAP provers. The following functions can be accessed “remotely” using the described technology:

- Control of digital inputs and outputs – more specifically, nozzle solenoid valves. For safety reasons, meter-clamp operations cannot be accessed remotely.
- Visual observation of real-time sensor reading.
- Two-way file transfer features
- Remote system “re-boot” capabilities

**Construction**

**Major System Components**

The SNAP consists of four major subsystems:

1. Air Supply Subsystem by Compressor
2. Shop-Air Subsystem
3. Computer and Electronic Controls Subsystem
4. Operator Controls Subsystem

**Air Supply Subsystem by Compressor**

As shown in Figure 1, the air is fed into the system using a compressor. The air then goes through several filters and dryers to filter out dust particles and dry out moisture from the air. The system doesn’t require the measurement of Relative Humidity because the air is completely free from moisture and the measurement is not affected by it. The air then enters into the sonic nozzle bank (manifold). The specific nozzles used are computer selected to provided the desired user-specified flow rate (G4 for the current model). The temperature, pressure and differential pressure are measured to calculate the actual flow rate through the meter.

**Shop-Air Subsystem**

This subsystem provides the regulated compressed air required to actuate the cylinders that move the meter-
clamp arms up and down.

**Operating Requirements**

**Shop Air** : Clean air of at least 2 bar
**Operating Temperature** : 0 ~ 50  ℃ (Can be extended)
No temperature-controlled room is required because the temperature is measured independently(20 ℃ ± 2 ℃)

**Compressed Air Requirement**
The sonic nozzles operate with the compressed air provided by an external pump (usually installed in a separate location to prevent the noise). The compressor should have the capacity to deliver the air flow of maximum flow for G4 gas meters.

Note: The compressor should be purchased by the user. Jain Technology can recommend suitable compressor models. In such cases, Jain does not warrant the compressor system (i.e. pumps, motors, valves, gauges, etc.).

**Electrical Requirements**

- **Power Supply** – 220V AC, 60Hz

**Floor Plan and Service Area Requirements**

**Floor Space**
Dimension of the System : 356(W) x 83(D) x 108(H) mm

- **Front View**
  - 1,320
  - 2,240
  - 1,895
  - Unit: mm

- **Side View**
  - 60
  - 490
  - 825
  - 1070
  - 280

The prover requires additional room in the front in order to allow the operator to move around comfortably while proving meters. Allow enough clearance around the prover so its various components can be accessed freely when needed.

**Mobility**
The prover cabinet is mounted on casters for easy moving. This is particularly useful when it is desired to calibrate the prover system agains a bell standard.

The front casters can swivel easily to allow the prover to move conveniently in any direction. The front casters are also equipped with a locking mechanism to prevent any movement while the prover is in a stationary position for operation.

**Warranty**

Our Sonic Nozzle Auto Prover is to be from defects in materials or workmanship for a period of one year from the date of installation and commissioning.

**System Specifications**

- **Type** : Sonic Nozzle Type
- **Accuracy** : 0.25%
- **Number of Meters Proved at one Setup** : 8
- **Test Ranges** : 0.016 ~ 7m³/h (Expandable to 39.58 m³/h with the addition of nozzles)
- **Application** : Testing of errors on residential and industrial diaphragm type gas meters

**System Components**

1) **Thermometer** (4 ea)
2) **Manometer**
   a. Differential Pressure (3 ea)
   b. Atmospheric Pressure (1 ea)
   c. Nozzle Pressure (1 ea)
3) **Nozzle Bank** (1 ea)
4) **Sonic Nozzle** (3 ea)
5) **Diverter** (1 ea)
6) **Regulator** (2 ea)
7) **Controller & Diagnostic SW** (1 ea)
8) **Automatic Air Valve** (3 ea)
9) **Computer & Printer** (1 set)
10) **Prover Test Bench** (1 ea)
12 Calibration for
   a. Thermometer (4)
   b. Manometer (5)
   c. Sonic Nozzle (3)
   d. Box (1)

**Inquiry**

For any questions, please consult with us at the following point of contact;

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