The new Elster American Meter “2006” Sonic Nozzle Automatic Provers - SNAP™ Series III and Universal - are state-of-the-art measurement systems designed to automate and simplify the proving of gas meters.

General Information

All SNAP™ “2006” Provers use an industrialized computer with Windows XP Professional as its operating system, providing a fully automated proving process and streamlined data collection.

The SNAPS utilize three methods of determining meter test volume; a unique patented magnetic sensor assembly, meter differential proving, or an optional optical index assembly. Critical flow (SONIC) Venturi nozzles provide the volume measurement standard, and are used in combinations to create the various flow rates.

Meter accuracy is determined by comparing meter test volume to the calculated actual nozzle volume. Volumetric flow through a nozzle is a function of the following:

- Temperature
- Pressure
- Relative Humidity
- Time
- Nozzle Throat Diameter

All sonic nozzles are factory-calibrated against a certified Master Bell Prover. The calibrations of all nozzles, sensors, and the Master Bell Prover are traceable to NIST. Each sonic nozzle has its own “standard time constant” (seconds per cubic foot). On the SNAP Provers, probes are mounted at critical locations in accordance with ASME/ANSI standards to measure temperature, pressure, and relative humidity. 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 is the sum of all nozzles selected. For instance, NOZZLE 6 combines with NOZZLE 5 to provide a flow rate of 60 CFH (nominal).

Applications

<table>
<thead>
<tr>
<th>Model</th>
<th>Description</th>
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<tbody>
<tr>
<td>SNAP Series III Prover</td>
<td>Utilizes 6 sonic nozzles; flow capacity of 1000 CFH; can test residential to light commercial gas meters (to class 1000)</td>
</tr>
<tr>
<td>Standard Universal SNAP Prover</td>
<td>Utilizes 10 sonic nozzles; flow capacity of 14,000 CFH; can test commercial and industrial class meters including rotary and turbine meters</td>
</tr>
</tbody>
</table>

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

In addition to temperature, pressure, and relative humidity, 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, pressure, and relative humidity sensors and nozzle calibration data in seconds per cubic foot).
2. Time (in seconds) for a specified number of revolutions of the meter tangent mechanism.

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

Meter Proving Capacity

The SNAP™ has the capability to test all specified (by name) diaphragm TC and non-TC gas meters up to 1000 CFH (SNAP™ Series III) nominal flow rates.

Universal SNAP™ can prove rotary and turbine meters with a 14,000 CFH maximum flow rate. Higher flow rates are available upon request. A Maximum of 72 different meter types can be entered in the SNAP Prover meter file.

Data Storage

Meter performance data that is stored in the Standard and Extended data output files is saved in an ASCII (American Standard Code for Information Interchange) format that allows data to be imported for use in common software packages.

The Standard Output file contains the following meter proving results.

- Gas Company Number
- Manufacturer Number
- Index Reading
- Open Proof First
- Check Proof First
- Open Proof Last
- Check Proof Last
- Test Type (In-test or Out-test)
- Meter Class
- Meter Type
- Operator Number
- Prover Serial Number
- Number of Adjusts
- Date
- Time Out
- Meter Temperature Reject Number

The Extended Data File contains all of the information found in the Daily Record, in addition to the data selected from the list below.

- Open Target Proof
- Check Target Proof
- Other Target Proof
- Open Rate
- Check Rate
- Other Rate
- Other Proof First
- Other Proof Last
- Nozzle Temperature
- Pressure Drop (differential pressure between meter inlet and nozzle plenum)
Features

- The SNAP Series III Prover allows for 63 possible nozzle-flow combinations.
- The SNAP Series III Prover has a flow range of 25 CFH to 1000 CFH.
- The SNAP Series III Prover optional 7th nozzle provides 127 possible nozzle-flow combinations with a flow range of 25 CFH to 1675 CFH.
- The SNAP Universal Prover allows for 1023 possible nozzle-flow combinations.
- The SNAP Universal Prover has a flow range of 25 CFH to 14,000 CFH.

Each nozzle provides a specific airflow rate. By combining nozzles, other flow rates can be obtained.

Advantages

The SNAP “2006” Series III Prover offers many advantages over conventional bell provers and other sonic-nozzle provers due to their inherent design and construction.

- Shortened proving cycle. The SNAP™ Prover can test a meter in about one-fourth 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™ Prover are less than one-third the bell-prover.
- Provides consistent and highly repeatable proving results. Accuracy test repeatability of the SNAP™ Prover is typically in the range of ±0.13%.
- Improves the proving process by reducing the need for human intervention.
- Once a meter is in the “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 touch-screen menu.

Airflow Rates

<table>
<thead>
<tr>
<th>Nozzle</th>
<th>Flow Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nozzle 6</td>
<td>25 CFH</td>
</tr>
<tr>
<td>Nozzle 5</td>
<td>35 CFH</td>
</tr>
<tr>
<td>Nozzle 4</td>
<td>50 CFH</td>
</tr>
<tr>
<td>Nozzle 3</td>
<td>125 CFH</td>
</tr>
<tr>
<td>Nozzle 2</td>
<td>250 CFH</td>
</tr>
<tr>
<td>Nozzle 1</td>
<td>515 CFH (SNAP Series III only)</td>
</tr>
<tr>
<td>Nozzle 7 (Upgrade)</td>
<td>675 CFH (optional on SNAP Series III, standard on SNAP Universal)</td>
</tr>
<tr>
<td>Large Nozzle 1*</td>
<td>1500 CFH or custom rate</td>
</tr>
<tr>
<td>Large Nozzle 2*</td>
<td>2500 CFH or custom rate</td>
</tr>
<tr>
<td>Large Nozzle 3*</td>
<td>5500 CFH or custom rate</td>
</tr>
</tbody>
</table>

- An Industrialized Pentium class computer-utilizing PCI/ISA bus technology, as well as USB ports.
- Optional automated data collection. The operator does not need to collect or tabulate results during the proving process. The on-board computer saves all necessary meter proof information. At the end of the day, a supervisor can transfer all test data to a host computer. Test data can also be sent to a printer on a continuous basis.
- The prover has the ability to detect a number of testing faults. The SNAP™ “2006” checks for system leaks, high meter differential pressure, and sensor discrepancies. A diagnostic screen can be used to check major system components, such as sensor readings, valve operation, and various digital inputs.
- The SNAP™ “2006” Provers range in Capacity: 1000 CFH or an optional 1750 CFH. Universal SNAP™ provers can be customized to any flow rate.
- SNAP Series I Electronics Upgrade Kit (part number “SNAPUPIF”)
- SNAP Series II Pentium I Electronics Upgrade Kit (part number “SNAPUPIF”)
- SNAP Series II/III Pentium II Electronics Upgrade Kit (part number “SNAPUPNTF”)

Note: All upgrade kits include a new 17” USB touch screen flat panel monitor and a new SNAP “2006” computer package, described above.

- Large Meter Filter Replacement Elements (3 per pack) #94465P001
- Optical Index Sensor for #94297G015

Options

Additional Equipment – For existing SNAP™ Customers:

For customers with Series I, Series II, and Series III Provers (prior to December 2001), the following equipment may be purchased (in addition to the “Spare Parts” list included in the SNAP™ Prover Operation Manual):

- SNAP Series I Electronics Upgrade Kit (part number “SNAPUPIF”)
- SNAP Series II Pentium I Electronics Upgrade Kit (part number “SNAPUPIF”)
- SNAP Series II/III Pentium II Electronics Upgrade Kit (part number “SNAPUPNTF”)

Control Systems

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 an industrialized computer. The computer program and associated hardware energizes solenoid valves; takes pressure, temperature and relative humidity readings; and “times” the meter test. These measured variables are mathematically combined to determine the test accuracy.
Operator Touch-Screen Interface
The SNAP™ user interface is a USB XGA LCD touch-screen. Although a USB mouse and keyboard are provided with each SNAP™ “2006” Prover, 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
All SNAP™ “2006” provers use an industry standard PCI/ISA bus Pentium IV class computer system with the following specifications.
- Intel Pentium IV 2.8 GHz Processor
- 1 GB total RAM
- 2 Serial Ports
- 1 Parallel Port
- 2 USB Ports
- Standard 10/100 Ethernet
- Internal V.92 modem
- 80 Gigabyte IDE Hard-Disk Drive
- USB External CD-ROM
- USB External 3.5 inch Floppy-Disk Drive
- USB XGA 17” LCD Touch Screen

The SNAP™ Prover uses Windows XP Professional as its operating system.

On the SNAP™ “2006” Series III Provers, an Intelligent Un-interruptible Power Supply (UPS) protects the electrical components of the SNAP™ against potentially harmful power surges and interference. The UPS has a backup battery capable of powering the SNAP™ during short brownouts or power sags ONLY. The UPS is NOT designed to power the SNAP™ during power outages. Should a power outage occur with a loss of power longer than three to five minutes, the SNAP™ will automatically begin a powering-down cycle to close files and write any unsaved data to the computer’s hard drive. This function is most important when the SNAP™ is sending and receiving data within a Local Area Network (LAN).

Meter Differential-Pressure Transmitter
The SNAP™ “2006” Series III Prover employs 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 in WC). When the high set point is exceeded, an error message is displayed on the screen to indicate that the test has failed. Most meter differential-pressure limits are now a parameter in the SNAP™ Meter file, like the Default Parameters, TC/REG, INTEST/OUTTEST, etc. The Meter Differential-Pressure Transmitter is also used for proving tin and iron case meters. Meter differential pressure “spikes” and “valleys” are used to gate meter volume, providing a shortened proving cycle and a more efficient means of testing these older meters. This differential-pressure proving method, however, is not as accurate and repeatable as using an optical-index sensor, which requires a much longer proving cycle.

The SNAP™ “2006” Series III Prover also has a meter differential-pressure gauge mounted next to the touch-screen monitor. This differential gauge allows the operator to visually observe the meter’s mechanical operation during the proof open and check tests.

Bar code Reading
The SNAP™ “2006” Provers use an optional Bar Code reader that attaches via the computer’s Keyboard Port. This device is capable of interpreting all commonly used bar-code types (Code 39, UPC, etc.). This device can be used to accommodate a variety of bar-code applications, such as reading codes on meter cards or bar codes in list form.

Enhanced Pulse-Detection System
In the SNAP™ “2006” Provers, a software adaptive algorithm (or signature) is monitored. The Magnetic Sensor signal input—strength and voltage waveform for each meter is monitored to determine when a pulse is actually detected during the meter-exercise cycle. Therefore, instead of each meter having to fit a rigid set of tolerance standards for a magnetic sensor signal detection to occur (as in the older Series I SNAP™ Provers), the SNAP™ “2006” Provers monitor the meter’s unique signal. The SNAP™ translates the meter’s unique signal into a “pulse”. The result is a more reliable proving “pulse detection system”.

Network
The SNAP™ “2006” III Prover is network ready as standard equipment and support Ethernet network types. Each prover is equipped with Windows XP Professional as its operating system and a 10/100 Ethernet card as part of the Single Board Computer Assembly. The Ethernet connection facilitates connection into a Local Area Network (LAN).

Remote Diagnostics
“Remote Diagnostics” of the SNAP™ “2006” Prover is accomplished using Symantec’s PC Anywhere software. This software application allows Metrology Service Engineers to interface and observe field SNAP™ units during proving operations.

The computer’s 56K modem 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 readings.
• Two-way file transfer features.
• Remote system “re-boot” capabilities.

Leak Test
After a gas meter is clamped in position, the SNAP™ Prover will initiate an exercise cycle and undergo a leak test for the entire system. A nozzle is opened to the vacuum source and then closed when a sufficient vacuum is created between the test meter and the sonic-nozzle manifold. This vacuum is monitored using the nozzle absolute pressure sensor for a predetermined length of time. If pressure decay is found that will affect meter proof results greater than 0.1%, the SNAP™ Prover warns the operator of a “leak” 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.

Major System Components
The SNAP™ “2006” Series III Prover consists of four major subsystems:
• Vacuum Subsystem
• Shop-Air Subsystem
• Computer and Electronic Controls Subsystem (pg. 3)
• Operator-Controls Subsystem (pg. 4)

Vacuum Subsystem
As shown in Figure 1, atmospheric air is pulled through the meter under test and the nozzles using a vacuum source (normally a vacuum pump). Air enters the system through an inlet solenoid manifold. As the air leaves the meter, it passes through a 10-microm ceramic filter. This filter removes particles from the air before it passes through the sonic nozzles. The specific nozzles used are computer selected to provide the desired user-specified flow rate. The temperature \( T_m \) and \( T_o \), pressure \( P_o \), Differential Pressure \( \Delta P \), and the Relative Humidity \( RH \) are measured as shown. These variables are used to calculate the actual flow rate through the meter.

Shop-Air Subsystem
• Shop Air: 30 PSI at 1.5 CFM
• Recommended Operating Temperature: 55° F to 85° F
• Temperature-Controlled Room: ±5° F
• Recommended Relative Humidity: Less than 90%

The SNAP™ “2006” Series III Prover does not require an environment with precise temperature or humidity control. If the temperature and humidity levels are comfortable for the operator, the prover will operate efficiently.

Vacuum Requirements
The sonic nozzles operate with vacuum provided by an external pump sold by Elster American Meter, or a customer provided equivalent. These pumps produce noise levels of 78-88 dB. Elster American Meter recommends installing vacuum pumps outside the meter proving area, no more than 100 feet from the prover. The vacuum pump should be capable of delivering 1000 CHF at 12 inches of Mercury (vacuum), when the pressure is measured at the SNAP™ Prover’s rear solenoid manifold.

Suggested vacuum pump: Gast Model 6066-V107A-T339
This vacuum-pump system can provide adequate vacuum flow for:
• One SNAP™ “2006” Series III Prover (seven nozzle)
• Two SNAP™ “2006” Series III Provers (standard six nozzle units)
• A vacuum blower source is also available from Elster American Meter for use with Universal SNAP™ Provers. This provides flow for all of the Universal Nozzles.

To ensure proper vacuum operation, vacuum pumps require the following additional equipment:
• Vacuum-Relief Valve (Gast model #AA308)
• One or two Vacuum Gauges (Gast model #AA640)
• Check Valve (Gast Model #AH326A)
• Pipe (PVC recommended), 2 inch recommended diameter (not to exceed 100 feet)

Additional Connections
• Two Swivel Couplings (#55405P002) provided with SNAP™
• Three 3/4” MNPT Nipples
• One 3/4” FNPT Cross
• Two 3/4” MNPT x 1/4” FNPT Reducer Bushings
• One 3/4” FNPT Tee
• Two Flare Adapters (#93305P015) provided with SNAP™
• One 1” MNPT x 3/4” Hex Reducing Nipple, used for Gast Model 6606
• One Flexible Hose Assembly, 1” OD, 10 Feet long (#43594P045), provided with SNAP™

NOTE: PVC pipe and fittings to be supplied by customer during vacuum pump installation.

NOTE: Elster American Meter does not warrant vacuum-system equipment (Pumps, Motors, valves, gauges, etc.). Elster American Meter acts solely as a reseller of the equipment. The pump, motor and all associated equipment carries only the transferable warranty of the company that makes it. For vacuum pump technical assistance, service, or repair parts, contact your local Gast distributor.
Safety Features

The Safety subsystem provides the control interface between the operator and the computer. The safety subsystem consists of the following components:

- USB LCD Touch-Screen Monitor
- Meter “Jog” Buttons
- Meter “Clamp” Buttons
- Emergency Stop Button/Reset System
- Main Power Switch

USB XGA Touch-Screen Monitor

The 17” LCD USB Touch-Screen Monitor is located above the Computer enclosure. A power on/off switch (located on the left side of the enclosure) can be used to switch the monitor on or off without affecting the power supply to the computer. Monitor settings can be altered using the On-Screen Display (OSD) remote, which is included with the monitor.

Meter “Jog” Buttons

The Meter “Jog” buttons are located on both the right and left sides of the upper part of the prover cabinet. The operator pressed both buttons to “jog” the meter small amounts during an adjustment cycle. Both “jog” buttons must be pressed simultaneously for most meters.

Meter “Clamp” Buttons

These two buttons are located on either side of the meter test table. The operator presses these buttons when instructed by the computer during proving. Before proving can proceed, both clamp buttons must be pressed and held at the same time.

Emergency Stop

The Emergency Stop Button, located on the left side of the prover, removes power to the proving stand. The Emergency Stop Button also releases air pressure from the meter inlet and outlet arms.

Electrical Requirements

- Electrical (Controls) – 120VAC 60 HZ – 5 Amps
- Electrical Service required for the vacuum pump is 230/460 60Hz, three phase, full load amps 230V-4; 460V-2.4

Floor Plan and Service-Area Requirements

Floor Space

The SNAP™ Prover requires a floor space of three square feet. Additional room should be allowed in the front to permit the operator to move around comfortably while proving meters. Allow enough clearance around the prover so its various components can be accessed freely when necessary.

Mobility

The prover is mounted on casters for easy moving. This is particularly useful when it is desired to calibrate the SNAP™ Prover against a bell standard (Bell Interface)

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.

- Dimensions: Height 71-1/2”; Width 30”; Depth 36”
- Maximum Meter Height on table: 21.5” (Series III)
- Minimum Meter Height on Table: 11”
- Optional Meter extensions allow for smaller (compact) meters to be tested on all SNAP™ Provers.
- Weight (approximate): 450 lbs

Warranty

Elster American Meter warrants the SNAP™ “2006” Series III Sonic-Nozzle Provers to be free from defects in material or workmanship for a period of one year from the date of installation and commissioning.

(The SNAP Prover magnetic sensor assembly is Elster American Meter U.S. Patent No. 4,848,148)
SNAP “2006” Series III Provers

SNAP™ “2006” Series III Prover

Optional Software
SNAP™ data collection systems – hardware and software- designed to customer specifications
New Prover Screens), customizing of standard screens

Additional Hardware Options
Optical Index – Sensor Assembly #94297G022
Optical Index-Sensor factory upgrade kit #94297K003
Meter-Outlet Filter Elements (3 per pack) #94465P001
Domestic Meter Side-Clamp Fixture #52450K009
Rotary Meter Proving Kit (to 1000 CFH) #52750K017
SNAP™ Bar-Code Reader Kit #52710K002
Seventh Nozzle Upgrade Kit (to 1675 CFH) #52750K019

SNAP™ “2006” Series II and III Meter Adaptors

<table>
<thead>
<tr>
<th>Meter Adaptor Sizes</th>
<th>Description</th>
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<tbody>
<tr>
<td>#1 Sprague</td>
<td>80550G044</td>
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<tr>
<td>#3-4 Sprague</td>
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<tr>
<td>45 LT</td>
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SNAP™ “2006” Series III Large-Meter Adaptors

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<thead>
<tr>
<th>Meter Adaptor Sizes</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>#3-4 Sprague</td>
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</tr>
<tr>
<td>100 LT</td>
<td>80550G052</td>
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</tbody>
</table>

SNAP™ “2006” Series III Prover

Standard Equipment
• 17” LCD XGA Flat Panel Touch Screen Monitor
• Intel Pentium IV 2.8 GHz computer with 1 GB total RAM, 80 GB hard drive, USB CD-ROM and USB Floppy Disk Drive, modem, and 10/100 Ethernet port
• Windows XP Professional Operating System
• Symantec PC Anywhere software for prover “remote diagnostics”
• Standard Operational Prover Software
• Mouse and Keyboard (not required for prover operation)
• Six sonic-flow nozzles – 1000 nominal flow capacity (CFH)
• Patented Small-Meter Magnetic-Sensor Assembly
• Meter Differential Pressure Proving for tin and iron case meters
• Small and Large Meter Hand-Hole weights and Small Meter connection extensions.
• Four meter connection Sizes – For additional meter connections, please see charts to the right.

Vacuum Pump, piping and electrical connections are to be supplied and installed by customer.

Specifications provided by Elster American Meter

Available Vacuum Pump Kit:
Part # 52570K006 – Vacuum pump for one to three SNAP™ II Provers (1800 CFH capacity at 12 in. HG vacuum)
About Elster Group

A world leader in advanced metering infrastructure, integrated metering, and utilization solutions to the gas, electricity and water industries. Elster's metering and system solutions reflect over 170 years of knowledge and experience in measuring precious resources and energy.

Elster provides solutions and advanced technologies to help utilities more easily, efficiently and reliably obtain and use advanced metering intelligence to improve customer service, enhance operational efficiency, and increase revenues. Elster’s AMI solutions enable utilities to cost-effectively generate, deliver, manage, and conserve the life-essential resources of gas, electricity, and water.

Elster has a staff of over 7,500 serving customers globally in North America, Central America, South America, Europe, Asia, Africa and the Middle East.