National Institute of Standards & Technology

Specifications

Standard Reference Instrument Series 6010

Spinning Rotor Gauge (SRG) Spring Transport System (STS)

Description: The Spinning Rotor Gauge (SRG) Spring Transport System (STS) is a mechanism that contains an SRG and is used both during the calibration and transport of the SRG. The STS includes the SRG, which is a steel ball of bearing quality, the spring transport mechanism, and a shipping container. The user of the STS may provide their own electronic controller with electronic measurement head/cable, or these can be provided as a separate configuration. When properly operating, the calibration of the SRG for any particular gas species depends only the physical properties of the rotor (ball bearing) such as the diameter, density, and surface conditions, and does not depend on the electronic control or cables. This device is a transfer standard and must be recalibrated at NIST periodically to maintain its accuracy and traceability. The STS allows the SRG to be transported under vacuum and fully immobilized, which provides the user improved calibration stability when compared to transporting the SRG without such a mechanism using standard shipping methods. The STS also includes a shipping container that will minimize the shock experienced by the unit during transport.

The STS can provide users high accuracy calibrations or measurements directly at a customer's facility or even be used as an artifact in interlaboratory comparisons (ILC). The system can be setup onsite with relative ease and used to calibrate high-vacuum sensors. This provides a method to calibrate sensors such as other SRGs or ionization gauges that are prone to damage or sensor drift from vibration or shock that is common during the removal procedure or shipping. The STS obtains its direct NIST traceability and traceability to the International System of Units (SI) via calibrations against the NIST high-vacuum standards.

The spinning rotor gauge STS uncertainty at the time of calibration is no different than that of a spinning rotor gauge calibration. The reported uncertainty for an SRG calibrated with NIST's spinning rotor gauge calibration service is typically within the range of 0.3% to 0.4% ($k = 2$). The STS offers improved calibration stability or drift between calibrations. A 2007 study based on NIST's calibration service customers suggests that the calibration stability of SRGs not using a STS is typically within 2%. A recent study authored by NIST and co-authored with other national metrology institutes suggests that the using the STS will result in calibration stabilities better than 0.75%.

Gerald T. Fraser, Chief
Sensor Science Division

Steven J. Choquette,
Director, Office of Reference Materials
Material Measurement Laboratory

Gaithersburg, MD 20899
Certificate Issue Date: 06 April 2017

Design, assembly and technical measurements leading to the production of this SRI were performed by J.A. Fedchak and J. Scherschligt, NIST Sensor Science Division.

Support aspects involved in the issuance of this SRI were coordinated through the NIST Office of Reference Materials.

Specifications: NIST provides the STS as a Standard Reference Instrument (SRI) with calibration against NIST's high-vacuum standards. The NIST SRS SRI is offered in two configurations SRI 6010. The STS systems are packaged by NIST and are constructed from custom parts and commercially available components. A shipping container specifically designed for the unit will be provided. The overall uncertainty of the STS system includes the uncertainty at the time of calibration combined with the calibration stability. The SRS is calibrated using NIST's high-vacuum standards with uncertainties typically in the range of 0.3% to 0.4% ($k = 2$); the calibration stability depends on the history and conditions of the user's SRS and can be determined from repeat calibrations at NIST or another SI-traceable metrology lab. The calibration stability of the device is expected to be better that 0.75% in most cases. The uncertainty when used at the user site will depend upon the particular apparatus and conditions at the user site, such as temperature and mechanical stability, temperature and pressure gradients, etc. It is recommended that the operators follow the best practices and perform regular calibrations and intercomparisons.

NIST researchers continue to develop and improve the STS. NIST is providing the STS through the SRI program with prices derived such that NIST is reimbursed for all costs associated with duplicating the current design.

The SRG STS systems have the following specifications and features.[1]

A) A 4.5 mm diameter rotor made of ball bearing quality steel: 440C stainless steel or E52100 alloy steel.
B) A UHV compatible thimble that contains the rotor, mounted to an all-metal UHV compatible vacuum valve. Two tines on the thimble flange will hold the SRG suspension head (user must provide). The valve port shall be DN 40 (35). The specified valve will be good for 1000 closings and not require a torque wrench, such as the VAT series 54 valve or equivalent.
C) A spring mechanism attached to the valve seat which will fully immobilize the rotor when the valve is closed.
D) The STS includes the spring-transport mechanism and shipping container. The spring-transport mechanism will be full assembled and under vacuum when provided to the customer. It will be placed in a specially designed shipping container intended for re-use by the customer.
E) A calibration report of the first rotor calibration.
F) The electronics controller and suspension head/cable are provided in one of the configurations, but user provided in the other.

[1] Commercial equipment, instruments or materials used in this SRI were found to meet requirements specified. Such identification does not imply recommendation or endorsement by the National Institute of Standards and Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Delivery and Shipping: Unless otherwise agreed by the parties, shipping terms shall be EXW (Incoterms 2010). NIST will prepare packaging for shipment of the STS SRI. Shipping crate dimensions and weight will be included in each quote. Customers are responsible for arrangement of shipping pickup at NIST as well as all customs duties and import fees.

Installation: Customer is responsible for setup at their location. Manuals and/or quick start guides will be provided for setup procedures.

Support: NIST staff will provide manuals and will respond to any questions or assistance needed during the setup or initial operation of the STS.

Technical requirements at installation site: Customers must provide the following:

A) A laboratory that is temperature stabilized to ± 2 °C.
B) A high-vacuum system with a DN 40 (35) port for mounting the STS.
C) For customers with SRI 6010, control electronics with cable/suspension head must be provided by the user at the site. An MKS Instruments SRG-3 or SRG -2CE controller with a SH700-V3 control head is sufficient for operation of the STS.
D) Technical personnel familiar with high-vacuum systems and the operation of spinning-rotor gauges.

Users of this SRI should ensure that the Specifications Certificate in their possession is current. This can be accomplished by contacting the Office of Reference Materials: telephone (301) 975-2200; fax (301) 948-3730; e-mail srminfo@nist.gov; or via the Internet at http://www.nist.gov/sri.