# FEE SCHEDULE

## To Order

**PHONE:** (301) 975-2002  
**TELEX:** TRT 197674NIST UT  
**FAX:** (301) 975-2128

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**JANUARY 1992**
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CHAPTER I
POLICIES

A. INTRODUCTION

The physical measurement services of the National Institute of Standards and Technology (NIST) are designed to help the makers and users of precision instruments achieve the highest possible levels of measurement quality and productivity. The hundreds of individual services you will find listed in this Fee Schedule constitute the highest order calibration services available in the United States. They directly link a customer's precision equipment or transfer standards to national measurement standards. These services are offered to public and private organizations and individuals alike.

B. TYPES OF SERVICES

You will find three types of physical measurement services described in this document: Calibration Services, Special Tests, and Measurement Assurance Programs.

Calibrations and Special Tests generally designate those NIST services that check, adjust, or characterize particular instruments, devices, and sets of standards on a one-time-per-request basis. The customer, in most cases, ships an item requiring calibration to the appropriate NIST laboratory in Gaithersburg, MD, or Boulder, CO, as noted in this Fee Schedule. The calibrated item is shipped back to the customer, followed, under separate cover, by a report of test procedures and results.

Measurement Assurance Programs, or MAPs, are quality control programs for calibrating a customer's entire measurement system. In a typical MAP, a stable artifact or set of artifacts—called transfer standards—are first measured by NIST and sent to a customer's laboratory for a series of measurements. The transfer standards are then returned to NIST for remeasurement, along with the participating laboratory's results. NIST reports its comparative findings to the customer and, when necessary, offers guidance on how to achieve and maintain measurement quality.

Successful use of a NIST MAP requires that the customer make periodic measurements of in-house check standards to estimate the random error and to ensure that the measurement process remains in a state of statistical control. Unless a laboratory has a measurement quality control program to monitor continuously its own measurement process parameters, there is little point in participating in a MAP.

PLEASE NOTE: NIST does not audit, regulate, or accredit metrology laboratories as part of the MAP service. Whatever steps a participating laboratory may take to improve its measurement process are undertaken voluntarily.

C. CRITERIA FOR QUALITY ASSURANCE

All the measurement services described in this document meet rigorous criteria for quality assurance. Calibration Services and MAPs satisfy the most demanding and explicit requirements in that these services are carried out regularly under pre-established and well-defined conditions; the measurement processes involved are well-characterized, stable, and statistically controlled; and quality-control procedures are well-defined and strictly followed. Furthermore, each Calibration Service or MAP is planned and documented to permit continuity of service over time.

A Special Test is so designated for one or more of the following reasons: 1) the specific type of calibration is seldom requested, thus precluding the maintenance of a large statistical base for controlling the measurement process, 2) the test requested is unique, or 3) the service is still under development—meaning the measurement or calibration methods are still being perfected or all the quality-control documentation has yet to be completed.

D. FEES

NIST recovers the cost of providing calibration services by charging a fee for each calibration performed. These fees range from a low of less than $150 for calibration of a laboratory thermometer to $50,000 or more for special tests of large microwave antenna systems.
The costs of services are listed in this Fee Schedule, which is updated and published, effective January 1, annually to reflect changes in prices and services. Even so, many services are performed at cost and you must provide the technical contact with an exact description of work before receiving a price quote. In this document, fees for such services are denoted to be "at cost". Request a free copy of the current Fee Schedule or the Calibration Services Users Guide by writing or calling the Calibration Program (see section I).

Firm prices or not-to-exceed prices (including "at cost" items) are only guaranteed in writing on the Acceptance copy of the NIST Form 64 sent to the customer or in writing from the Calibration Program. "At Cost" items are those services for which the price varies depending on the particular device submitted and the particular measurements requested. A phone estimate can normally be provided.

NOTE: PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

For detailed information on prices please refer to the contacts listed in this Fee Schedule or the Calibration Program.

For non-Federal sponsors, the U.S. Treasury regulations require late charges based on the current value of funds to Treasury be assessed for each 30 day period or portion thereof that the payment is delayed. Therefore, each non-Federal contract or agreement should contain terms for payment as well as a provision for imposition of late charges.

E. REPORTS OF TEST RESULTS

Reports on calibrations or other services are regarded as the property of the customer. Copies are not supplied to other parties except as required by federal law or requested in writing by the customer. The results of calibrations and tests performed by NIST apply only to a particular instrument or standard at the time of test unless otherwise clearly stated.

F. TRACEABILITY

Many Federal regulations and contracts require regulated organizations or contractees to verify that the measurements they make are "traceable" and to support the claim of traceability by auditing records for equipment used in the calibration process. This regulatory requirement implies the ability to relate individual measurement results through an unbroken chain of calibrations to a common source, usually U.S. national standards as maintained by NIST, or intrinsic standards based on fundamental constants of nature with values assigned or accepted by NIST. To adequately establish an audit trail for traceability, a proper calibration result should include: the assigned value, a stated uncertainty, identification of the standard used in the calibration, and the specification of any environmental conditions of the calibration where correction factors should be applied if the standard or equipment were to be used under different environmental conditions.

NIST is supportive of the practice of making the user aware of traceability and providing the user details as to how traceability was established; however, at the same time NIST cannot condone the prominent display of its name on proprietary products or in the advertising of them (see section G).

NIST does not define nor enforce traceability. Moreover, NIST is not legally required to comply with traceability requirements of other federal agencies; nor do we determine what must be done to comply with another party’s contract or regulation calling for such traceability. However, NIST can and does provide technical advice on how to make measurements consistent with national standards.

G. REFERENCES TO NIST IN ADVERTISEMENTS

NIST test results or reports shall not be used to indicate or imply that the National Institute of Standards and Technology approves, recommends, or endorses the manufacturer, supplier, or user of any instruments or standards or that NIST in any way guarantees or predicts the future performance of items after calibration or test. No reference shall be made to NIST or to reports or results furnished by NIST in any advertising or sales promotions which would indicate or imply that NIST approves, recommends, or endorses any proprietary product or proprietary material. (For more information please request Letter Circular 1128).
H. DISCLAIMER

Commercial products—materials and instruments—are identified in this document for the sole purpose of adequately describing experimental or test procedures. In no event does such identification imply recommendation or endorsement by the National Institute of Standards and Technology of a particular product; nor does it imply that a named material or instrument is necessarily the best available for the purpose it serves.

I. QUESTIONS AND INQUIRIES

This Fee Schedule is a supplement of NIST Special Publication 250, Calibration Services Users Guide. These documents are designed to make the task of selecting and ordering an appropriate calibration service as quick and easy as possible. Nevertheless, questions will arise. When they do, we urge you to call or write for immediate clarification. Address general questions and lengthy inquiries to:

Calibration Program  
National Institute of Standards and Technology  
Building 411, Room A104  
Gaithersburg, MD 20899-0001  
Telephone: (301) 975-2002  
Telefax: (301) 926-2884

If you have a technical question concerning a specific service, contact directly one of the NIST staff members responsible for that calibration area. Consult the section of this document that describes the service in question for names, addresses and telephone numbers.
CHAPTER II
ORDERING INSTRUCTIONS - DOMESTIC CUSTOMERS

A. TURNAROUND TIME

Normal turnaround time for NIST calibration services varies greatly, usually from several weeks to six months, depending on the type of service requested and fluctuations in workload. Some services are only provided on a scheduled basis with appointments made many months in advance of the service date. To avoid unnecessary scheduling or administrative delays in the calibration process, always make prearrangements with the technical contact for the service you intend to utilize. See section B for more information on prearrangements.

B. PREARRANGEMENTS AND SCHEDULING

Services are best arranged in advance, beginning with a call or letter from the customer to a NIST staff member directly responsible for the desired service. See the appropriate technical section of this Fee Schedule or the separate Users Guide to determine whom to call or write. This advance communication can clear up any questions you may have, clarify the policies and procedures briefly described here, and permit you to tentatively schedule a calibration date. Following the initial communication, you will immediately need to fill out and send in a purchase order and prepare and ship the item according to the procedures described below. If a calibration must be scheduled far in advance, you may arrange to delay shipment of the item until shortly before the scheduled date; you must however, submit the purchase order—complete with the name and number of the desired service—before a firm calibration date can be assigned. When NIST receives your valid purchase order and assigns a firm service date, you will be notified by mail to confirm the order.

C. PURCHASE ORDER

Send a purchase order to the address listed in the appropriate technical section of this Fee Schedule, or in the separate Users Guide, before you ship an item for calibration. The purchase order must:

1) State both the name and number of the NIST service being requested. FAILURE TO INCLUDE THE ORDER NUMBER WILL SERIOUSLY IMPEDE SCHEDULING AND SERVICE.

2) Clearly identify the item(s) being sent for calibration, including any serial number(s).

3) Give the name, address, and telephone number of the requesting company’s procurement officer.

4) Give the name, address, and telephone number of the requesting company’s technical contact, if different from above.

5) List separately the instructions for return shipment, insurance, mailing of the test report, and billing. (Federal or state agency requests for calibration services should be accompanied by a document authorizing that the cost of the service be billed to the agency.)

6) Clearly state any special or necessary conditions of test—such as operating frequency or temperature.

7) Clearly state the customer identification number; i.e., social security number (EIN) for consumer customers; tax identification number (TIN) for commercial customers; or agency location code (ALC) for government customers.

8) Give instructions on the purchase order if the final test report is to be handled in a special manner.

PLEASE NOTE: Receipt of orders by NIST does not imply acceptance of any provisions set forth in the order that are contrary to the policy, practice, or regulations of the National Institute of Standards and Technology or the U.S. government. In general, NIST will not sign any affidavits, acknowledgment forms, or other documents that may be required by company policy governing the procurement of goods and services.
D. SHIPPING, INSURANCE, AND RISK OF LOSS

Ship an instrument or standard to the address to which you mailed your purchase order. Adhere rigorously to the following procedures:

1) Ship only items in good repair. Apparatus in disrepair will not be calibrated. If defects are found after calibration has begun, the procedure will be terminated, a report issued, and a charge levied for work completed.

2) Use strong, reusable packing materials and containers marked clearly and indelibly on the outside with the requestor's name, address and the following notation: REUSABLE CONTAINER, DO NOT DESTROY.

3) Follow any special shipping procedures given in the technical sections of the Calibration Services Users Guide, particularly those sections covering radiation and dosimetry measurements.

4) Insure the shipments to and from NIST and clearly state the method of return shipment. NIST will not assume liability for loss or damage unless such loss and damage result solely from the negligence of NIST personnel. If return shipment by parcel post is requested or is suitable, NIST will prepay the return shipment but will not insure it. When no shipping or insurance instructions are furnished, NIST will return the shipment by common carrier, collect and uninsured.

PLEASE NOTE: Fees for NIST services do not include shipping costs.
CHAPTER III
SPECIAL INSTRUCTIONS -- FOREIGN CUSTOMERS

A. CRITERIA FOR PROVIDING SERVICE

The National Institute of Standards and Technology (NIST) is authorized to provide measurement services, including calibrations, for organizations or individuals located outside the United States. NIST policy requires that the Calibration Program review each request to determine if such a service is available in the requestor's country. Foreign customers must provide the following information:

1) A justification why NIST should perform this service, if an official standards laboratory in the country of the requestor's provide such service.

2) A description of the instrument or standard to be tested, particularly if it is not manufactured in the U.S.

3) A detailed description of the measurements that are needed or indicate the test order number as given in the Calibration Services Users Guide (NIST SP-250) or the separate Fee Schedule (NIST SP-250 Appendix).

4) A description of any special requirements that might affect the decision to provide the service. For example, will a need exist for adjustments to the instrument or will the time period be restricted in which the device is available for measurement?

B. SPECIAL INSTRUCTIONS

If the request for the measurement service is accepted by NIST, the requesting organization will be notified of the cost of service and will be given the identification of the NIST laboratory that will perform the measurements. The requesting organization must then complete the following steps:

1) Contact the NIST technical unit that will provide the service to determine the schedule.

2) Send a purchase order to the Calibration Program. Provide complete addresses for returning the instrument and for mailing the calibration or test report.

3) Send prepaid by check payable in U.S. dollars to the Calibration Program for the full cost of the service. The check must be drawn on a U.S. bank. NIST cannot begin the service until full payment has been received.

4) Ship the instrument or standard to the appropriate NIST technical unit. You must prearrange shipment with a customs broker for entry of the instrument into the U.S. with prepaid transportation from the port of entry. Air freight is most satisfactory. Entry bond is required for instruments not manufactured in the U.S. If arrangements are made with a broker in the country of origin, that broker should, in turn, have a U.S. customs broker in or near the port of entry who must arrange for the entry of the instrument and its transportation to NIST. Direct arrangements can be made with customs brokers located in Washington, DC/Baltimore, MD, metropolitan area or in the Denver, CO, area, as appropriate. These brokers must arrange for transportation to the port of exit after testing is completed.
C. FOREIGN INQUIRIES

Foreign customers requiring additional information or clarifications can get assistance by addressing all calls or correspondence to:

Calibration Program  
National Institute of Standards and Technology  
Building 411, Room A104  
Gaithersburg, MD  20899-0001  
United States of America  
Telephone: (301) 975-2002  
Telefax: (301) 926-2884  
Telex: TRT 197674NIST UT
# CHAPTER IV

## DIMENSIONAL MEASUREMENTS

### A. Length Measurements

**Technical Contacts:**
- John R. Stoup (10010C-10050S)
- William B. Penzes (10020C)
- Ronald G. Hartsock (10030C-10040S)
- Theodore D. Doiron (10060S)
- Ralph Veale

**Mailing Address:**
A107 Metrology
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

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<tr>
<td>10010C</td>
<td>Gage Blocks</td>
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<td>10020C</td>
<td>Line Standards</td>
<td>At Cost</td>
</tr>
<tr>
<td>10030C</td>
<td>Surveying and Oil Gaging Tapes</td>
<td>At Cost</td>
</tr>
<tr>
<td>10040S</td>
<td>Special Tests of Surveying Leveling Rods</td>
<td>At Cost</td>
</tr>
<tr>
<td>10050S</td>
<td>Special Tests of Length Standards</td>
<td>At Cost</td>
</tr>
<tr>
<td>10060S</td>
<td>Special Tests of Sieves</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

### B. Diameter Measurements

**Technical Contacts:**
- John R. Stoup (11010S-11070S)
- Dennis Everett (11020C)
- Ralph Veale

**Mailing Address:**
A107 Metrology
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

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<tr>
<td>11010S</td>
<td>Special Test for Plug Gages: External Diameter Standards</td>
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<td>11020C</td>
<td>Measuring Wires for Threads and Gears</td>
<td>At Cost</td>
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<tr>
<td>11030S</td>
<td>Special Test of Spherical Diameter Standards: Balls</td>
<td>At Cost</td>
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<tr>
<td>11040S</td>
<td>Special Tests of Internal Diameter Standards: Ring Gages</td>
<td>At Cost</td>
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<tr>
<td>11050S</td>
<td>Special Tests of Length and Diameter</td>
<td>At Cost</td>
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<tr>
<td>11060S</td>
<td>Special Tests of Step Gages</td>
<td>At Cost</td>
</tr>
<tr>
<td>11070S</td>
<td>Special Diameter Measurements, by Prearrangement</td>
<td>At Cost</td>
</tr>
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</table>
### C. Complex Dimensional Standards

**Technical Contacts:**

- Edgar G. Erber (12010C-12020S)  
  (301) 975-3468
- Theodore D. Doiron (12030S)  
  (301) 975-3468
- Ralph Veale  
  (301) 975-3502

**Mailing Address:**

A107 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

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<td>12010C</td>
<td>API Threaded Plug and Ring Gages</td>
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<td>12020S</td>
<td>Special Tests of Threaded Plug and Ring Gages</td>
<td>At Cost</td>
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<td>12030S</td>
<td>Special Tests of Two-Dimensional Gages</td>
<td>At Cost</td>
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<tr>
<td>12040S</td>
<td>Special Complex Dimensional Tests, by Prearrangement</td>
<td>At Cost</td>
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### D. Optical Reference Planes & Roundness Standards

**Technical Contacts:**

- John R. Stoup (13010S)  
  (301) 975-3471
- Yun H. Queen (13020S-13030S)  
  (301) 975-3468
- Ralph Veale  
  (301) 975-3502

**Mailing Address:**

A107 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

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<td>13010S</td>
<td>Optical Reference Planes (Flats)</td>
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<td>13020S</td>
<td>Special Tests of Roundness</td>
<td>At Cost</td>
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<tr>
<td>13030S</td>
<td>Special Tests of Roundness Calibration Specimens</td>
<td>At Cost</td>
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### E. Angular Measurements

**Technical Contacts:**

- Yun H. Queen (14010C-14040S)  
  (301) 975-3468
- Ralph Veale  
  (301) 975-3502

**Mailing Address:**

A107 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001
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<td>14010C</td>
<td>Angle Gage Blocks</td>
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<td>14020S</td>
<td>Special Tests of Optical Polygons</td>
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<td>14030S</td>
<td>Special Tests of Rotary and Indexing Tables</td>
<td>At Cost</td>
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<td>14040S</td>
<td>Special Tests of Wedges</td>
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<td>14050S</td>
<td>Special Angular Measurements, by Prearrangement</td>
<td>At Cost</td>
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**F. Laser Measurements**

Technical Contacts:  
Jack Stone (14510S)  
Ralph Veale  

Telephone:  
(301) 975-5638  
(301) 975-3502  

Mailing Address:  
A107 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001  

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<td>14510S</td>
<td>Laser Frequency/Wavelength</td>
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</table>

**G. Surface Texture**

Technical Contacts:  
Arie Hartman  
Cynthia K. Rymes  

Telephone:  
(301) 975-3475  
(301) 975-4081  

Mailing Address:  
A117 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001  

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<td>15010C</td>
<td>Roughness Calibration Specimens</td>
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<td>15020C</td>
<td>Surface Roughness Comparison Specimens</td>
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<tr>
<td>15030C</td>
<td>Step Height Measurements</td>
<td>555</td>
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H. Hydrometers

Technical Contacts: Telephone:
John F. Houser (301) 975-5956
George E. Mattingly (301) 975-5939

Mailing Address: 105 Fluid Mechanics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

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<td>16010C</td>
<td>Reference Standard Hydrometers</td>
<td>At Cost</td>
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</table>

I. Volume and Density

Technical Contacts: Telephone:
John F. Houser (301) 975-5956
George E. Mattingly (301) 975-5939

Mailing Address: 105 Fluid Mechanics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

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<td>17010C</td>
<td>Volume Standards</td>
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<td>17020S</td>
<td>Special Tests of Volume Standards</td>
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<tr>
<td>17040S</td>
<td>Special Tests of Density: Liquids</td>
<td>At Cost</td>
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</tbody>
</table>
CHAPTER V
MECHANICAL MEASUREMENTS

A. Flow Rate Measurements

Technical Contacts:  
G. Paul Baumgarten  
George E. Mattingly

Telephone:  
(301) 975-5957  
(301) 975-5939

Mailing Address:  
105 Fluid Mechanics  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

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<tr>
<td>18010C</td>
<td>Single Turbine Meters</td>
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<td>18020C</td>
<td>Tandem Turbine Meters</td>
<td>At Cost</td>
</tr>
<tr>
<td>18030C</td>
<td>Flow Rate Meters (Direct Reading in Flow Rate Units)</td>
<td>At Cost</td>
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<tr>
<td>18040C</td>
<td>Head Class Flow Measurement Devices</td>
<td>At Cost</td>
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<tr>
<td>18050S</td>
<td>Special Tests for Liquid and Gas Flow Rates</td>
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B. Flow Measurements at Cryogenic Temperatures

Technical Contact:  
Jennifer L. Scott

Telephone:  
(303) 497-3684

Administrative and Logistics: Kathy Hillen

Telephone:  
(303) 497-3753

Mailing Address:  
M.C. 832.20  
National Institute of Standards & Technology  
325 Broadway  
Boulder, CO 80303-3328

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<td>18800S</td>
<td>Special Tests of Cryogenic Liquid Flow</td>
<td>At Cost</td>
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C. Airspeed Measurements

Technical Contacts:  
Norman E. Mease  
J. Michael Hall  
George E. Mattingly

Telephone:  
(301) 975-5959  
(301) 975-5947  
(301) 975-5939

Mailing Address:  
105 Fluid Mechanics  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001
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<td>19010C</td>
<td>Pitot-Static Tubes 1.3 to 67 (3 to 150 mph)</td>
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<tr>
<td>19020C</td>
<td>Low Airspeed Instruments .076 to 10.2 m/s (15 to 2,000 fpm)</td>
<td>At Cost</td>
</tr>
<tr>
<td>19030S</td>
<td>Meteorological Airspeed Instrumentation 1.3 to 67 m/s (3 to 150 mph)</td>
<td>At Cost</td>
</tr>
<tr>
<td>19040S</td>
<td>Special Tests for Airspeed Instruments</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

D. Mass Standards

Technical Contact: Jerry G. Keller

Telephone: (301) 975-4218

Mailing Address: A147 Sound
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

Shipping Address: National Institute of Standards & Technology
A147 Sound
I-270 at Quince Orchard Road
Gaithersburg, MD 20899
Attn: J. G. Keller

Note: For Weights larger than 50 lb (30 kg), contact Jerry G. Keller prior to shipment.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>22010C</td>
<td>Weight Set (1 mg to 100 g)</td>
<td>3410</td>
</tr>
<tr>
<td>22020C</td>
<td>Weight Set (1 mg to 1 kg)</td>
<td>4120</td>
</tr>
<tr>
<td>22030C</td>
<td>Weight Set (2 to 30 kg)</td>
<td>2230</td>
</tr>
<tr>
<td>22040C</td>
<td>Single Weights (1 mg to 1 kg)</td>
<td>495</td>
</tr>
<tr>
<td>22060C</td>
<td>Single Weights (2 kg to 30 kg)</td>
<td>700</td>
</tr>
<tr>
<td>22080C</td>
<td>Single Weights (&gt; 30 kg to 1200 kg, 2 double substitution weighings)</td>
<td>At Cost</td>
</tr>
<tr>
<td>22100C</td>
<td>Single Weights (&gt; 1200 kg to 30,000 kg)</td>
<td>At Cost</td>
</tr>
<tr>
<td>22110C</td>
<td>Single Weights (&gt; 30 kg to 1200 kg, calibrated in a weighing design)</td>
<td>At Cost</td>
</tr>
<tr>
<td>22130C</td>
<td>Single Weights for Dead Weight Pressure Testers (13 lb - 50 lb)</td>
<td>315</td>
</tr>
<tr>
<td>22140C</td>
<td>Single Weights for Dead Weight Pressure Testers (&gt; 50 lb)</td>
<td>At Cost</td>
</tr>
<tr>
<td>22150C</td>
<td>Single Weights for Dead Weight Pressure Testers (&lt; 13 lb)</td>
<td>190</td>
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<tr>
<td>22170S</td>
<td>Special Mass Measurement Services</td>
<td>At Cost</td>
</tr>
<tr>
<td>22180M</td>
<td>Measurement Assurance Program for Mass</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
E. Force Measurements

Technical Contacts:  
Simone L. Yaniv  
Robert W. Peterson  
Telephone:  
(301) 975-6655  
(301) 975-6649  

Mailing Address:  
221 Engineering Mechanics  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
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<tbody>
<tr>
<td>23010C</td>
<td>Force Transducers (to 25,000 lbf, 1 mode)</td>
<td>1040</td>
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<tr>
<td>23020C</td>
<td>Extra observation</td>
<td>14</td>
</tr>
<tr>
<td>23030C</td>
<td>Additional bridges</td>
<td>255</td>
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<tr>
<td>23040C</td>
<td>Force Transducers (to 25,000 lbf, 2 modes)</td>
<td>1850</td>
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<tr>
<td>23050C</td>
<td>Extra observation</td>
<td>19</td>
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<tr>
<td>23060C</td>
<td>Additional bridges</td>
<td>370</td>
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<tr>
<td>23070C</td>
<td>Force Transducers (25,001 to 112,000 lbf, 1 mode)</td>
<td>1285</td>
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<td>23080C</td>
<td>Extra observation</td>
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<td>23090C</td>
<td>Additional bridges</td>
<td>315</td>
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<td>Force Transducers (25,001 to 112,000 lbf, 2 modes)</td>
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<tr>
<td>23110C</td>
<td>Extra observation</td>
<td>37</td>
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<tr>
<td>23120C</td>
<td>Additional bridges</td>
<td>540</td>
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<td>23130C</td>
<td>Force Transducers (112,001 to 300,000 lbf, 1 mode)</td>
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<td>23140C</td>
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<td>23150C</td>
<td>Additional bridges</td>
<td>435</td>
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<tr>
<td>23160C</td>
<td>Force Transducers (112,001 to 300,000 lbf, 2 modes)</td>
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<td>23170C</td>
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<td>63</td>
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<td>23180C</td>
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<td>855</td>
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<td>23190C</td>
<td>Force Transducers (300,001 to 1,000,000 lbf, 1 mode)</td>
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<td>23200C</td>
<td>Extra observation</td>
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<tr>
<td>23210C</td>
<td>Additional bridges</td>
<td>570</td>
</tr>
<tr>
<td>23220C</td>
<td>Force Transducers (300,000 to 1,000,000 lbf, 2 modes)</td>
<td>5555</td>
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<tr>
<td>23230C</td>
<td>Extra observation</td>
<td>71</td>
</tr>
<tr>
<td>23240C</td>
<td>Additional bridges</td>
<td>1025</td>
</tr>
</tbody>
</table>
F. Vibration Measurements

Technical Contact: Beverly F. Payne  
Telephone: (301) 975-6639

Mailing Address: A149 Sound  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Freq. Range</th>
<th>Peak Accel</th>
<th>% Uncer</th>
<th>Fee ($)</th>
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<tbody>
<tr>
<td>24010C</td>
<td>Pickup Sensitivity</td>
<td>2 to 160 Hz</td>
<td>0.2 to 2g</td>
<td>±1 to ±2</td>
<td>1215</td>
</tr>
<tr>
<td>24020C</td>
<td>Pickup Sensitivity</td>
<td>10 to 3500 Hz</td>
<td>2 to 10g</td>
<td>±1 to ±2</td>
<td>2110</td>
</tr>
<tr>
<td>24030C</td>
<td>Pickup Sensitivity</td>
<td>10 Hz to 10 kHz</td>
<td>2 to 10g</td>
<td>±1 to ±2</td>
<td>3695</td>
</tr>
<tr>
<td>24040S</td>
<td>Shock Measurement</td>
<td>10 Hz to 10 kHz</td>
<td>50 to 5000g</td>
<td>±3 to ±5</td>
<td>At Cost</td>
</tr>
<tr>
<td>24050S</td>
<td>Pickup Sensitivity</td>
<td>3 kHz to 20 kHz</td>
<td>4 to 200g</td>
<td>±1 to ±3</td>
<td>At Cost</td>
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<tr>
<td>24060S</td>
<td>Special Vibration Tests, by Prearrangement</td>
<td></td>
<td></td>
<td></td>
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</table>

G. Acoustic Measurements

Technical Contacts: Victor Nedzelntisky  
Telephone: (301) 975-6638  
David J. Evans  
Telephone: (301) 975-6637

Mailing Address: A147 Sound  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25010C</td>
<td>Pressure Response: WE Type 640AA microphones or equivalent (e.g., Tokyo Riko Type ECL MR103; Bruel &amp; Kjaer Type 4160, Bruel &amp; Kjaer Types 4144 or 4132 with DB0111 adapter), 50 to 10,000 Hz.</td>
<td>2225</td>
</tr>
<tr>
<td>25020C</td>
<td>Pressure Response: WE Type 640AA microphones or equivalent (e.g., Tokyo Riko Type ECL MR103; Bruel &amp; Kjaer Type 4160; Bruel &amp; Kjaer Types 4144 or 4132 with DB0111 adapter), 50 to 20,000 Hz.</td>
<td>2755</td>
</tr>
<tr>
<td>25030C</td>
<td>Pressure Response: Tokyo Riko Type ECL MR112; Bruel &amp; Kjaer Type 4134, or equivalent half-inch microphones, 50 to 20,000 Hz.</td>
<td>2545</td>
</tr>
<tr>
<td>25040C</td>
<td>Pressure Response: Tokyo Riko Type EC MR112, Bruel &amp; Kjaer Type 4134, or equivalent half-inch microphones, 50 to 20,000 Hz.</td>
<td>3310</td>
</tr>
</tbody>
</table>
### H. Ultrasonic Reference Block Measurements

**Technical Contact:** Gerald V. Blessing  
**(301) 975-6627**  
**Mailing Address:** A147 Sound  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26030S</td>
<td>Special Tests of Area</td>
<td>740</td>
</tr>
<tr>
<td>26040S</td>
<td>Special Test of Area Amplitude Titanium or Steel Ultrasonic Reference Blocks - Set of Eight Blocks</td>
<td>At Cost</td>
</tr>
<tr>
<td>26050S</td>
<td>Special Tests of Distance Amplitude Aluminum Reference Blocks - Set of Fifteen Blocks</td>
<td>980</td>
</tr>
<tr>
<td>26060S</td>
<td>Special Test of Distance Amplitude Titanium or Steel Ultrasonic Reference Blocks - Set of Fifteen Blocks</td>
<td>At Cost</td>
</tr>
<tr>
<td>26070S</td>
<td>Special Test of Distance/Area Amplitude (Basic Set) Aluminum, Titanium or Steel Ultrasonic Reference Blocks - Set of Eight Blocks</td>
<td>At Cost</td>
</tr>
<tr>
<td>26080S</td>
<td>Special Tests of Velocity Reference Blocks</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

### I. Ultrasonic Transducer Measurements

**Technical Contact:** Steven E. Fick  
**(301) 975-6629**  
**Mailing Address:** A147 Sound  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26100C</td>
<td>Ultrasonic Transducer Power Output; Radiation Pressure</td>
<td>At Cost</td>
</tr>
<tr>
<td>26110C</td>
<td>Ultrasonic System Power Output; Calorimeter</td>
<td>At Cost</td>
</tr>
<tr>
<td>26120S</td>
<td>Special Tests of Ultrasonic Transducers</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
J. Acoustic Emission Transducer Measurements

Technical Contact: Gerald V. Blessing
Telephone: (301) 975-6627

Mailing Address: A147 Sound
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>26200C</td>
<td>Acoustic Emission Transducer Amplitude and Phase Sensitivity versus Frequency</td>
<td>At Cost</td>
</tr>
<tr>
<td>26210S</td>
<td>Special Tests of Acoustic Emission Transducers and Sensors</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
CHAPTER VI
THERMODYNAMIC QUANTITIES

A. Pressure Measurements

Technical Contacts:  
Stephen W. Doty (29010C, 29030C)  
R. Gregory Driver (29010C, 29030C, 29040S)  
Walter Markus (29010C, 29030C)  
Donald B. Ward (29020C, 29035C)  

Mailing Address:  
A55 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29010C</td>
<td>Deadweight Piston Gages</td>
<td>3100</td>
</tr>
<tr>
<td>29020C</td>
<td>Controlled Clearance Piston Gages</td>
<td>At Cost</td>
</tr>
<tr>
<td>29030C</td>
<td>Pressure Gages and Transducers</td>
<td>At Cost</td>
</tr>
<tr>
<td>29035C</td>
<td>Mercurial Barometers and Manometers</td>
<td>At Cost</td>
</tr>
<tr>
<td>29040S</td>
<td>Special Tests of Pressure Gages</td>
<td>At Cost</td>
</tr>
</tbody>
</table>


B. Vacuum and Low Pressure Standards Measurements

Technical Contacts:  
Richard W. Hyland (30010C-30025C, 30040S, 30050S)  
Albert Filipelli (30029C-30038C, 30050S)  
Stuart A. Tison (30060S-30061C)  

Mailing Address:  
A55 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

Shipping Address:  
National Institute of Standards & Technology  
I-270 at Quince Orchard Road  
A52 Metrology  
Gaithersburg, MD 20899

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
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<tbody>
<tr>
<td>30010C</td>
<td>Absolute Low Pressure Transducers</td>
<td>3080</td>
</tr>
<tr>
<td>30011C</td>
<td>Up to Two Additional Transducer (Cost per Unit)</td>
<td>2340</td>
</tr>
<tr>
<td>30020C</td>
<td>Differential Low Pressure Transducers Relative to Vacuum</td>
<td>3080</td>
</tr>
<tr>
<td>30021C</td>
<td>Up to Two Additional Transducers (Cost per Unit)</td>
<td>2485</td>
</tr>
<tr>
<td>30025C</td>
<td>Ball-Type Deadweight Tester</td>
<td>3810</td>
</tr>
<tr>
<td>30029C</td>
<td>Molecular Drag Gages, Without Customer Controller</td>
<td>3560</td>
</tr>
</tbody>
</table>
30030C Molecular Drag Gages, With Customer Controller 2975
30031C Molecular Drag Gages, Additional Ball or Gas 2095
30034C Ionization Gages, $10^4$ to $10^1$ Pa, Nitrogen Gas 3560
30035C Ionization Gages, $10^5$ to $10^1$ Pa, Nitrogen Gas 4435
30036C Ionization Gages, $10^7$ to $10^1$ Pa, Nitrogen Gas 5315
30037C Ionization Gages, Additional Filament or Gas for Above Tests At Cost
30038C Ionization Gages, NIST Supplied Gage Tube for above Tests 305
30040S Special Tests of Low Pressure Gages At Cost
30050S Special Tests of Vacuum Gages At Cost
30060S Special Tests of Leak Artifacts At Cost
30061C Helium Glass or Quartz Permeation Leaks, $2 \times 10^{14}$ to $2 \times 10^8$ mol/s 3515

C. Laboratory Thermometers

Technical Contact: Jacquelyn A. Wise
Telephone: (301) 975-4822

Mailing Address: B128 Physics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

Shipping Address: National Institute of Standards & Technology
I-270 at Quince Orchard Road
A242 Physics
Gaithersburg, MD 20899
Attn: J. A. Wise

NOTE: The minimum number of test points per thermometer is two. Fahrenheit ranges are not direct conversions of the celsius ranges.

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>31010C</td>
<td>Laboratory Thermometers (0 to 150 °C) (32 to 300 °F)</td>
<td>140/pt</td>
</tr>
<tr>
<td>31020C</td>
<td>Laboratory Thermometers (151 to 315 °C) (301 to 600 °F)</td>
<td>230/pt</td>
</tr>
<tr>
<td>31030C</td>
<td>Laboratory Thermometers (316 to 550 °C) (601 to 1022 °F)</td>
<td>350/pt</td>
</tr>
<tr>
<td>31040C</td>
<td>Laboratory Thermometers (-1 to -110 °C) (31 to -166 °F)</td>
<td>170/pt</td>
</tr>
<tr>
<td>31050C</td>
<td>Laboratory Thermometers (Liquid N$_2$) (-196 °C or -321 °F)</td>
<td>170/pt</td>
</tr>
<tr>
<td>31070C</td>
<td>Calorimetric Thermometers</td>
<td>800</td>
</tr>
<tr>
<td>31080C</td>
<td>Beckmann Thermometers</td>
<td>845</td>
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<tr>
<td>31100C</td>
<td>Quantity Tests of Liquid-In-Glass Thermometers</td>
<td>At Cost</td>
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</tbody>
</table>
31110S Special Tests of Thermometers (0 to 150 °C) (32 to 300 °F) 140/pt
31120S Special Tests of Thermometers (151 to 315 °C) (301 to 600 °F) 230/pt
31130S Special Tests of Thermometers (316 to 550 °C) (601 to 1022 °F) 350/pt
31140S Special Tests of Thermometers (-1 to -110 °C) (31 to -166 °F) 170/pt
31150S Special Tests of Thermometers (Liquid N₂) (-196 °C or -321 °F) 170/pt
31200S Preliminary Exam or Ineligible Thermometer 39
31250S Additional Copy of Report 24
31260S Special Thermometry Services, by Prearrangement At Cost

D. Thermocouples, Thermocouple Materials, and Pyrometer Indicators

Technical Contacts: Telephone:
George W. Burns (301) 975-4817
Margaret G. Scroger (32010C-32101C, 32150S) (301) 975-4818
Jacquelyn A. Wise (32110C-32147C) (301) 975-4822

Mailing Address: National Institute of Standards & Technology
B128 Physics
Gaithersburg, MD 20899-0001
For: 32010C-32101C, 32150S
Attn: G. W. Burns or M. G. Scroger
For: 32110C-32147C
Attn: J. A. Wise

Shipping Address: National Institute of Standards & Technology
I-270 at Quince Orchard Road
Gaithersburg, MD 20899
For: 32110C-32101C, 32150S
Attn: G. W. Burns or M. G. Scroger, B229 Physics
For: 32110C-32147C
Attn: J. A. Wise, A242 Physics

COMPARISON CALIBRATIONS, TEMPERATURE MEASURED WITH THERMOCOUPLE

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Items</th>
<th>Temp. Range °C</th>
<th>Points</th>
<th>Min. Length mm</th>
<th>Est. Temp. °C</th>
<th>Uncert. °C</th>
<th>Fee ($)</th>
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<tbody>
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<td>TC Type</td>
<td>TC</td>
<td>Range °C</td>
<td></td>
<td></td>
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<tr>
<td>32010C S</td>
<td>0-1450</td>
<td>1°C or 1°F Interv. Table</td>
<td>700</td>
<td>0 to 600</td>
<td>0.5</td>
<td>705</td>
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<tr>
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<td>600 to 1100</td>
<td>0.7</td>
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<tr>
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<td></td>
<td></td>
<td>1450</td>
<td>2</td>
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<td>32020C R</td>
<td>0-1450</td>
<td>&quot; &quot;</td>
<td>700</td>
<td>0 to 600</td>
<td>0.5</td>
<td>705</td>
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<td></td>
<td>600 to 1100</td>
<td>0.7</td>
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</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>1450</td>
<td>2</td>
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<tr>
<td>Test No.</td>
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<td>Fee ($)</td>
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<tr>
<td>---------</td>
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<tr>
<td>32030C</td>
<td>B 0-1750 &quot; &quot; 1000 0 to 600 (3 μV) 1110</td>
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<td>32031C</td>
<td>B 800-1750 &quot; &quot; 1000 800 to 1100 0.7 705</td>
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<tr>
<td>32040C</td>
<td>E 0-1000 4 to 15 700 1 705</td>
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<tr>
<td>32041C</td>
<td>J 0-760 4 to 15 700 1 705</td>
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<td>32042C</td>
<td>K 0-1100 4 to 15 700 1 705</td>
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<tr>
<td>32043C</td>
<td>N 0-1100 4 to 15 700 1 705</td>
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<tr>
<td>32044C</td>
<td>T 0-400 4 to 15 700 1 705</td>
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<tr>
<td>32050C</td>
<td>Comparison calibration, two point minimum, per point, for all items above 290/pt</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32060C</td>
<td>Each additional table of results at 1° C or 1° F intervals, for Type S, R, or B at later date 200</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32061C</td>
<td>Each additional table of results at 1° C or 1° F intervals, for Type S, R, or B at time of test 115</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32070C</td>
<td>Thermocouple materials tested against Pt Thermoelectric standard, 4 to 15 points, 700 mm minimum lengths 705</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CALIBRATION AT METAL FREEZING POINTS, MINIMUM DIAMETER 0.4 mm, FREEZING POINT DETERMINATION AT Au, Ag, Sb, AND Zn

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>32090C</td>
<td>S 0-1450 Table, 1° C or 1° F interv. and equations to generate table 1000 at freezing points 0.2 1810</td>
</tr>
<tr>
<td>32091C</td>
<td>Type S, freezing point determination, per point, two point minimum 580</td>
</tr>
</tbody>
</table>

CALIBRATION OF PYROMETER INDICATORS

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Items</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32100C</td>
<td>Portable Potentiometer, first dial or range 465</td>
<td></td>
</tr>
<tr>
<td>32101C</td>
<td>Portable Potentiometer, each additional dial or range 250</td>
<td></td>
</tr>
</tbody>
</table>

COMPARISON CALIBRATION OF THERMOCOUPLES OR THERMOCOUPLE MATERIALS TESTED AGAINST Pt THERMOELECTRIC STANDARD, TEMPERATURE MEASURED WITH PLATINUM RESISTANCE THERMOMETER, MINIMUM LENGTH 36 INCHES, TWO POINT MINIMUM

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Items</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>32110C</td>
<td>Range -110 to 315 °C and Liquid N₂ (-196 °C) or -166 to 600 °F and Liquid N₂ (-321 °F) 215/pt</td>
<td></td>
</tr>
</tbody>
</table>
Table at one degree intervals for Type T thermocouple for any of the following options: (The cost of the table will be in addition to the calibration per point covered under fee schedule terms numbered 32110C-32120C.)

32141C Option 1: Table from -196 to +300 °C (-321 to +572 °F), calibration points at -196, -110, -50, +100, +200, +300 °C

32142C Option 2: Table from -196 to +100 °C (-321 to +212 °F), calibration points at -196, -110, -50, +50, +100 °C

32143C Option 3: Table from -110 to +300 °C (-166 to +572 °F), calibration points at -110, -50, +100, +200, +300 °C

32144C Option 4: Table from -110 to +100 °C (-166 to +212 °F), calibration points at -110, -50, +50, +100 °C

32145C Option 5: Table 0 to 300 °C (32 to 572 °F), calibration points at +100, +200, +300 °C

32146C Option 6: Table from -110 to 0 °C (-166 to +32 °F), calibration points at -110, -50 °C

32147C Option 7: Table from -196 to 0 °C (-321 to +32 °F), calibration points at -196, -110, -50 °C

32150S Special Tests of Thermocouples and Thermocouple Materials At Cost

E. Resistance Thermometry

Technical Contacts:

Earl R. Pfeiffer (0.65 K to 84 K) (301) 975-4821
Gregory F. Strouse (83 K to 962 °C) (301) 975-4803

Mailing Address: B128 Physics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

Shipping Address: National Institute of Standards & Technology
I-270 at Quince Orchard Road
B04 Physics
Gaithersburg, MD 20899

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>33010C</td>
<td>Capsule PRT (13.8 K to 30 °C)</td>
<td>6265</td>
</tr>
<tr>
<td>33020C</td>
<td>Capsule PRT (13.8 K to 157 °C)</td>
<td>6265</td>
</tr>
<tr>
<td>33030C</td>
<td>Capsule PRT (13.8 K to 232 °C)</td>
<td>7080</td>
</tr>
<tr>
<td>33040C</td>
<td>Capsule PRT (54 K to 30 °C)</td>
<td>4680</td>
</tr>
<tr>
<td>33050C</td>
<td>Capsule PRT (54 K to 157 °C)</td>
<td>4680</td>
</tr>
<tr>
<td>33060S</td>
<td>Capsule PRT (54 K to 232 °C)</td>
<td>5495</td>
</tr>
<tr>
<td>33070C</td>
<td>Capsule PRT (84 K to 30 °C) Ar to Ga</td>
<td>3140</td>
</tr>
</tbody>
</table>
33080C  Capsule PRT (84 K to 157 °C) Ar to In 3140
33090C  Capsule PRT (84 K to 232 °C) Ar to Sn 3870
33100C  Capsule PRT (0 °C to 30 °C) TPW to Ga 1655
33110C  Capsule PRT (0 °C to 157 °C) TPW to In 1655
33120C  Capsule PRT (0 °C to 232 °C) TPW to Sn 2390
33130C  Capsule PRT (234 K to 30 °C) Hg to Ga 2405
33140C  Germanium and Rhodium-Iron Resistance Thermometers (0.65 K to 24.6 K) 6590
33150C  Long Stem PRT (83 K to 0 °C) Ar to TPW 2240
33160C  Long Stem PRT (83 K to 30 °C) Ar to Ga 2975
33170C  Long Stem PRT (83 K to 157 °C) Ar to In 2975
33180C  Long Stem PRT (83 K to 232 °C) Ar to Sn 3710
33190C  Long Stem PRT (83 K to 420 °C) Ar to Zn 3710
33200C  Long Stem PRT (83 K to 661 °C) Ar to Al 4930
33210C  Long Stem PRT (234 K to 30 °C) Hg to Ga 2240
33220C  Long Stem PRT (234 K to 157 °C) Hg to In 2975
33230C  Long Stem PRT (234 K to 232 °C) Hg to Sn 3710
33240C  Long Stem PRT (234 K to 420 °C) Hg to Zn 3710
33250C  Long Stem PRT (234 K to 661 °C) Hg to Al 4930
33260C  Long Stem PRT (0 °C to 30 °C) TPW to Ga 1330
33270C  Long Stem PRT (0 °C to 157 °C) TPW to In 1330
33280C  Long Stem PRT (0 °C to 232 °C) TPW to Sn 2225
33290C  Long Stem PRT (0 °C to 420 °C) TPW to Zn 2225
33300C  Long Stem PRT (0 °C to 661 °C) TPW to Al 4185
33310C  Long Stem PRT (0 °C to 962 °C) TPW to Ag 5240
33320C  Additional Copy of Table from Results of 33010C - 3310C at Time of Test 110
33330C  Additional Copy of Table from Results of 33010C - 33310C at a Later Date 260
33340C  Minimum Charge for Unsuitable Thermometer 280
33350S  Special Tests of Resistance Thermometers At Cost
33360S  Special Tests of Thermometric Fixed-Point devices At Cost
33370M  Measurement Assurance Program for Temperature (83 K to 420° C) Ar to Zn 10510
33380M  Measurement Assurance Program for Temperature (83 K to 661° C) Ar to Al 11960
33390M  Measurement Assurance Program for Temperature (0° C to 962° C) TPW to Ag 14890
F. Radiation Thermometry

Technical Contacts:
- Charles Gibson
- Robert D. Saunders
- Edward Hunter

Mailing Address: A221 Physics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>35010C</td>
<td>Optical Pyrometers (1 range between 800 to 2400 °C, 4 to 12 points)</td>
<td>2865</td>
</tr>
<tr>
<td>35020C</td>
<td>Optical Pyrometers (per range in addition up to 4200 °C)</td>
<td>1910</td>
</tr>
<tr>
<td>35030C</td>
<td>Additional Interpolated Values</td>
<td>120/pt</td>
</tr>
<tr>
<td>35040C</td>
<td>Optical Pyrometers (3 or fewer points, 800 to 4200 °C)</td>
<td>1435</td>
</tr>
<tr>
<td>35050C</td>
<td>Ribbon Filament Lamp (6 to 16 points, 800 to 2300 °C)</td>
<td>2390</td>
</tr>
<tr>
<td>35060C</td>
<td>Ribbon Filament Lamp (5 or fewer points, 800 to 2300 °C)</td>
<td>1910</td>
</tr>
<tr>
<td>35070S</td>
<td>Special Tests of Radiation Pyrometers</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

G. Humidity Measurements

Technical Contacts:
- Peter H. Huang
- James R. Whetstone

Mailing Address: A303 Physics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

Shipping Address: National Institute of Standards & Technology
I-270 at Quince Orchard Road
B349 Physics
Gaithersburg, MD 20899
Attn: P. Huang

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36010C</td>
<td>Dew-Point Hygrometers (+25 to -15 °C)</td>
<td>3640</td>
</tr>
<tr>
<td>36020C</td>
<td>Dew-Point Hygrometers (-70 to -15 °C)</td>
<td>7285</td>
</tr>
<tr>
<td>36030C</td>
<td>Electric Hygrometers</td>
<td>At Cost</td>
</tr>
<tr>
<td>36040C</td>
<td>Electrolytic Hygrometers</td>
<td>At Cost</td>
</tr>
<tr>
<td>36050C</td>
<td>Aspirated Hygrometers</td>
<td>At Cost</td>
</tr>
<tr>
<td>36060C</td>
<td>Pneumatic Bridge Hygrometers</td>
<td>At Cost</td>
</tr>
<tr>
<td>36070S</td>
<td>Special Tests of Humidity</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
H. Total Heat Flux Gauges

Technical Contact: Kenneth D. Steckler

Mailing Address: A345 Polymers
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>36510S</td>
<td>Special Tests of Total Heat Flux Gauges</td>
<td>460</td>
</tr>
</tbody>
</table>

Telephone: (301) 975-6678
CHAPTER VII
OPTICAL RADIATION MEASUREMENTS

A. Photometric Measurements

Technical Contacts:
Jonathan E. Hardis
George Eppeldauer

Mailing Address: B306 Metrology
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>37015C</td>
<td>Luminous Intensity Rental Program</td>
<td>4220</td>
</tr>
<tr>
<td>37025C</td>
<td>Luminous Intensity-Submitted Lamp</td>
<td>1745</td>
</tr>
<tr>
<td>37035C</td>
<td>Color Temperature Determination on Lamp Submitted for 37025C</td>
<td>820</td>
</tr>
<tr>
<td>37080S</td>
<td>Special Tests for Luminous Flux of Incandescent Lamps</td>
<td>At Cost</td>
</tr>
<tr>
<td>37140C</td>
<td>Airway Beacon Lamps for Color Temperature (500 W, 1 point in range, 2000-3000K)</td>
<td>1975</td>
</tr>
<tr>
<td>37150C</td>
<td>Each Additional Color Temperature</td>
<td>1230</td>
</tr>
<tr>
<td>37160C</td>
<td>Color Temperature Equation (4 points and interpolation equation)</td>
<td>3590</td>
</tr>
<tr>
<td>37170C</td>
<td>Opal Glass Luminous Directional Transmittance Standards</td>
<td>785</td>
</tr>
<tr>
<td>37180S</td>
<td>Special Photometric Tests</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

B. Spectrophotometric Measurements

Technical Contacts:
P. Yvonne Barnes (38010C-38060S)
Kenneth L. Eckerle (38070M-38080M)
Lawrence E. Fink (38090S-38100S)

Mailing Address: B306 Metrology
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>38010C</td>
<td>Spectral Transmittance Filters (Cobalt Blue Glass)</td>
<td>1165</td>
</tr>
<tr>
<td>38020C</td>
<td>Spectral Transmittance Filters (Copper Green Glass)</td>
<td>1140</td>
</tr>
<tr>
<td>38030C</td>
<td>Spectral Transmittance Filters (Carbon Yellow Glass)</td>
<td>1140</td>
</tr>
<tr>
<td>38040C</td>
<td>Spectral Transmittance Filters (Selenium Orange Glass)</td>
<td>1140</td>
</tr>
<tr>
<td>38050C</td>
<td>Wavelength Standards (Holmium Oxide Glass)</td>
<td>1005</td>
</tr>
<tr>
<td>38060S</td>
<td>Special Tests of Spectral Transmittance and Reflectance</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
38070M  Measurement Assurance Program for Retroreflectance - Complete Package  9315
38071M  Retroreflectance MAP - Sheeting Standards or Prismatic Standard with Colored Filters  7180
38072M  Retroreflectance MAP - Sheeting Standards and Prismatic Standard without Colored Filters  7180
38073M  Retroreflectance MAP - Sheeting Standards or Prismatic Standard without Colored Filters  4990
38074M  Retroreflectance MAP - Colored Filters Only  2905
38080M  Measurement Assurance Program for Transmittance  4455
38090S  Special Tests of X-Ray and Photographic Step Tablets  At Cost
38100S  Special Tests of Microcopy Resolution Test Charts  At Cost

C. Radiometric Measurements

Test No.  Description of Services  Fee ($)  Telephone:
John K. Jackson (39010C-39060S)  (301) 975-2330
Chris L. Cromer (39070C-39080S)  (301) 975-3216
Thomas C. Larason (39070C-39080S)  (301) 975-2334
Sally S. Bruce (39070C-39080S)  (301) 975-2323

Mailing Address:  A221 Physics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

D. Radiometric Standards in the Ultraviolet

D.1 Standard Sources

Technical Contact:  Mervin Bridges  Telephone:  (301) 975-3228

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<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40010C</td>
<td>Spectral Irradiance Standard, Argon Mini-Arc (140 to 330 nm)</td>
<td>3475</td>
</tr>
<tr>
<td>40020C</td>
<td>Spectral Radiance Standard, Argon Mini-Arc (115 to 330 nm)</td>
<td>3475</td>
</tr>
<tr>
<td>40030C</td>
<td>Spectral Irradiance Standard, Deuterium Arc Lamp (165 to 200 nm)</td>
<td>At Cost</td>
</tr>
<tr>
<td>40040S</td>
<td>Special Tests of Radiometric Devices in the Near and Vacuum Ultraviolet</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

### D.2 Standard Detectors in the Far Ultraviolet

**Technical Contact:**
L. Randall Canfield
Telephone: (301) 975-3728

**Mailing Address:**
B119 Radiation Physics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>40510C</td>
<td>Detector Standard, Windowless Photodiode (5 to 122 nm)</td>
<td>3595</td>
</tr>
<tr>
<td>40511C</td>
<td>Recalibration of Detector Standard (5 to 122 nm)</td>
<td>2895</td>
</tr>
<tr>
<td>40520C</td>
<td>Detector Standard, Windowless Photodiode (18 to 122 nm)</td>
<td>2610</td>
</tr>
<tr>
<td>40521C</td>
<td>Recalibration of Detector Standard (18 to 122 nm)</td>
<td>2155</td>
</tr>
<tr>
<td>40530C</td>
<td>Detector Standard, Windowless Photodiode (52 to 122 nm)</td>
<td>1625</td>
</tr>
<tr>
<td>40531C</td>
<td>Recalibration of Detector Standard (52 to 122 nm)</td>
<td>1170</td>
</tr>
<tr>
<td>40540C</td>
<td>Uncalibrated Windowless Photodiode</td>
<td>705</td>
</tr>
<tr>
<td>40560C</td>
<td>Detector Standard, Windowed Photodiode (116 to 254 nm)</td>
<td>6515</td>
</tr>
<tr>
<td>40561C</td>
<td>Recalibration of Detector Standard (116 to 254 nm)</td>
<td>1415</td>
</tr>
<tr>
<td>40599S</td>
<td>Special Tests on Detectors from the Near Ultraviolet (320 nm) to the Soft X-ray Region (5 nm)</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

### E. Laser Power and Energy

**Technical Contacts:**

- Thomas R. Scott (303) 497-3651
- Aaron A. Sanders (303) 497-5341

**Administrative and Logistics:** Kathy Hillen (303) 497-3753
<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>42110C</td>
<td>Laser Power and Energy Meter Calibrations</td>
<td>1310</td>
</tr>
<tr>
<td>42111C</td>
<td>Same as 42110C, Additional Wavelengths or Power Levels</td>
<td>925</td>
</tr>
<tr>
<td>42120M</td>
<td>Laser Power and Energy Measurement Assurance Program (MAP)</td>
<td>1895</td>
</tr>
<tr>
<td>42130C</td>
<td>Optical Fiber Power Meter Calibrations</td>
<td>980</td>
</tr>
<tr>
<td>42131C</td>
<td>Same as 42130C, Additional Wavelengths</td>
<td>665</td>
</tr>
<tr>
<td>42140M</td>
<td>Optical Fiber Power Meter Measurement Assurance Program (MAP)</td>
<td>1825</td>
</tr>
<tr>
<td>42150M</td>
<td>Low Level Laser Measurement Assurance Program (MAP)</td>
<td>4230</td>
</tr>
<tr>
<td>42160C</td>
<td>Pulsed 10.6-\mu m Laser Calibrations</td>
<td>4230</td>
</tr>
<tr>
<td>42170S</td>
<td>Special Tests for Laser Power and Energy Meters, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>42180S</td>
<td>Special Tests for Optical Fiber Power Meters, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
CHAPTER VIII
IONIZING RADIATION MEASUREMENTS

A. Radioactivity Sources

Technical Contacts:
Jacqueline M. Calhoun
Pamela A. Hodge (43030C-43050C)

Administrative and Logistics: Cassandra Beck

Mailing Address: C114 Rad. Physics
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001
Attn: Cassandra Beck

Shipping Address: Health Physics (Radioactivity Group)
National Institute of Standards & Technology
I-270 at Quince Orchard Road
Gaithersburg, MD 20899
Attn: Jacqueline M. Calhoun

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>43010C</td>
<td>Gamma-Ray-Emitting Radionuclides in Solution (Half Lives Greater than 15 Days)</td>
<td>1215</td>
</tr>
<tr>
<td>43020C</td>
<td>Gamma-Ray-Emitting Radionuclides in Solution (Half Lives Less than 15 Days)</td>
<td>1865</td>
</tr>
<tr>
<td>43030C</td>
<td>Alpha-Particle-Emitting-Solid Sources, NIST 2 (\pi\alpha) proportional counter</td>
<td>915</td>
</tr>
<tr>
<td>43040C</td>
<td>Alpha-Particle-Emitting Solid Sources, NIST 0.8 (\pi\alpha) defined-solid-angle-counter</td>
<td>915</td>
</tr>
<tr>
<td>43050C</td>
<td>Alpha-Particle-Emitting Solid Sources, using both counting systems</td>
<td>1255</td>
</tr>
<tr>
<td>43060S</td>
<td>Special Test of Beta-Particle-Emitting Solution Sources - Liquid Scintillation Counting</td>
<td>2640</td>
</tr>
<tr>
<td>43070S</td>
<td>Special Tests of Beta-Particle-Emitting Solution Sources - Other Techniques</td>
<td>At Cost</td>
</tr>
<tr>
<td>43090S</td>
<td>Special Tests of Alpha-Particle-Emitting Solid Sources</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

B. Neutron Sources and Neutron Dosimetry

Technical Contacts:
E. Dale McGarry (44010C, 44020C, 44100S)
Robert B. Schwartz (44060C, 44100S)
Edward W. Boswell (44010C-44060C)

Mailing Address: A135 Reactor
National Institute of Standards & Technology
I-270 at Quince Orchard Road
Gaithersburg, MD 20899-0001

Shipping Address: Health Physics (Neutron Field Standards Group)
National Institute of Standards & Technology
I-270 at Quince Orchard Road
Gaithersburg, MD 20899

Telephone:
E. Dale McGarry (301) 975-6205
Robert B. Schwartz (301) 975-6203
Edward W. Boswell (301) 975-6207
C. Dosimetry of X-Rays, Gamma-Rays, and Electrons


Telephone:
Bert M. Coursey (All Tests) (301) 975-5584 Paul J. Lamperti (46010C-46050S) (301) 975-5591 James T. Weaver, Jr. (47010C, 47011C, 47040S) (301) 975-5586 Debra Bensen (47010C) (301) 975-5556 Christopher G. Soares (47030C-47036C, 47040S, 48010M-48020S) (301) 975-5589

Shipment of Instruments: National Institute of Standards & Technology I-270 at Quince Orchard Road C214 Radiation Physics Gaithersburg, MD 20899 For: 46010C-46050S Attn: P. J. Lamperti For: 48010M-48020S Attn: C. G. Soares

Shipment of Sources: National Institute of Standards & Technology I-270 at Quince Orchard Road B131 Radiation Physics Gaithersburg, MD 20899 For: 47010C-47040S Attn: Health Physics/J. T. Weaver (For Gamma-Ray Sources) Attn: Health Physics/C. G. Soares (For Beta-Particle Sources)

C1 X-RAY AND GAMMA-RAY MEASURING INSTRUMENTS

Test No. Description of Services Fee ($)

46010C Radiation Detectors - Calibration/Correction Factor, One Beam Quality (See Table 13) 1695

46011C Each Additional Beam Quality or Condition 860

46020C Passive Dosimeters - Irradiation of Up to Six, One Beam Quality 1220

46021C Up to Six Additional Dosimeters at Same Set-Up and Beam Quality 480

46030S Special Tests of High-Gain Electrometers - Charge Sensitivity, One Set of Switch Positions, with 46010C/46011C, by Prearrangement 1075
**C.2 GAMMA-RAY SOURCES, BETA-PARTICLE SOURCES, AND MEASURING INSTRUMENTS**

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>47010C</td>
<td>Gamma-Ray Sources Similar to NIST Standards -- 60Co or 137Cs Having Air-Kerma Strengths 10 to 1500 (\mu\text{Gy m}^2\text{h}^{-1}), and 125I or 192Ir Sources: Same Type Seeds Used to Calibrate Reentrant Chamber Having Air-Kerma Strengths 0.1 to 30 (\mu\text{Gy m}^2\text{h}^{-1}).</td>
<td>2520</td>
</tr>
<tr>
<td>47011C</td>
<td>Each Additional Gamma-Ray Source of Same Radionuclide</td>
<td>2465</td>
</tr>
<tr>
<td>47030C</td>
<td>Beta-Particle Sources Calibrated Surface Dose Rate</td>
<td>1345</td>
</tr>
<tr>
<td>47035C</td>
<td>Beta-Particle Sources Calibrated for Radiation Protection</td>
<td>1105</td>
</tr>
<tr>
<td>47036C</td>
<td>Ionization Chambers Calibrated with Beta Particle Sources for Radiation Protection</td>
<td>1105</td>
</tr>
<tr>
<td>47040S</td>
<td>Special Tests of Gamma-Ray and Beta Particle Sources</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

**C.3 DOSIMETRY OF HIGH-ENERGY ELECTRON BEAMS**

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>48010M</td>
<td>Dose Interpretation of NIST-Packaged Ferrous-Ferric (Fricke) Dosimeters Irradiated by Customer—Three Dosimeters (Two for Irradiation, One Control)</td>
<td>600</td>
</tr>
<tr>
<td>48011M</td>
<td>Each Additional Dosimeter</td>
<td>245</td>
</tr>
<tr>
<td>48020S</td>
<td>Special Tests of Electron-Beam Dosimeters</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

**D. Dosimetry for High-Dose Applications**

**Technical Contacts:**

Marlon L. Walker  
(301) 975-5593

William L. McLaughlin  
(301) 975-5559

James M. Puhl  
(301) 975-5581

**Mailing Address:**  
Attn: J. Puhl  
C229 Radiation Physics  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>49010C</td>
<td>Calibration irradiations of Customer Supplied Dosimeters with (^{60}\text{Co}) Gamma Rays</td>
<td>650</td>
</tr>
<tr>
<td>49020C</td>
<td>Dose Interpretation of NIST Transfer Dosimeters Irradiated by Customer</td>
<td>2170</td>
</tr>
<tr>
<td>49030C</td>
<td>Dose Interpretation of Each NIST Transfer Dosimeter Package in Addition to Those Supplied under 49020C</td>
<td>715</td>
</tr>
<tr>
<td>49040S</td>
<td>Special Tests of Dosimeters by Reading with Spectrophotometer Optical Density at One to Five Wavelengths (Each Dosimeter)</td>
<td>105</td>
</tr>
<tr>
<td>49041S</td>
<td>Spectrophotometric Readings of Dosimeters, Ultra-Violet and Visible Spectrum Scan (Each Dosimeter)</td>
<td>300</td>
</tr>
<tr>
<td>49050S</td>
<td>Special Measurement Services for Dosimeter Response</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
CHAPTER IX
ELECTROMAGNETIC MEASUREMENTS

A. Resistance Measurements
A.1 DC Resistance Standards and Measurements

Technical Contacts:  
Ronald F. Dziuba  
Norman B. Belecki  

Telephone:  
(301) 975-4239  
(301) 975-4223

Administrative and Logistics: Denise D. Prather  
(301) 975-4221

Mailing Address: B146 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
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<tbody>
<tr>
<td>51100S</td>
<td>Special Resistance Measurement Services by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>51110M</td>
<td>Measurement Assurance Program Services for Resistance</td>
<td>At Cost</td>
</tr>
<tr>
<td>51130C</td>
<td>Standard Resistor, Thomas-Type, 1 Ω</td>
<td>1385</td>
</tr>
<tr>
<td>51131C</td>
<td>Standard Resistor, Evanohm Wirewound High Precision, 10 kΩ</td>
<td>1825</td>
</tr>
<tr>
<td>51132C</td>
<td>Standard Resistor, Four-Terminal 0.0001 Ω</td>
<td>1240</td>
</tr>
<tr>
<td>51133C</td>
<td>Standard Resistor, Four-Terminal 0.001 Ω</td>
<td>895</td>
</tr>
<tr>
<td>51134C</td>
<td>Standard Resistor, Four-Terminal 0.01 Ω</td>
<td>895</td>
</tr>
<tr>
<td>51135C</td>
<td>Standard Resistor, Four-Terminal 0.1 Ω</td>
<td>895</td>
</tr>
<tr>
<td>51136C</td>
<td>Standard Resistor, Four-Terminal 1 Ω</td>
<td>895</td>
</tr>
<tr>
<td>51137C</td>
<td>Standard Resistor, Four-Terminal 10 Ω</td>
<td>895</td>
</tr>
<tr>
<td>51138C</td>
<td>Standard Resistor, Four-Terminal 100 Ω</td>
<td>795</td>
</tr>
<tr>
<td>51139C</td>
<td>Standard Resistor, 1 kΩ</td>
<td>795</td>
</tr>
<tr>
<td>51140C</td>
<td>Standard Resistor, 10 kΩ</td>
<td>795</td>
</tr>
<tr>
<td>51141C</td>
<td>Standard Resistor, 100 kΩ</td>
<td>795</td>
</tr>
<tr>
<td>51142C</td>
<td>Standard Resistor, 1 MΩ</td>
<td>795</td>
</tr>
<tr>
<td>51143C</td>
<td>Standard Resistor, 10 MΩ</td>
<td>1280</td>
</tr>
<tr>
<td>51144C</td>
<td>Additional Voltage</td>
<td>1280</td>
</tr>
<tr>
<td>51145C</td>
<td>Standard Resistor, 100 MΩ</td>
<td>1280</td>
</tr>
<tr>
<td>51146C</td>
<td>Additional Voltage</td>
<td>1280</td>
</tr>
<tr>
<td>51147C</td>
<td>Standard Resistor, 1 GΩ</td>
<td>1280</td>
</tr>
<tr>
<td>51148C</td>
<td>Additional Voltage</td>
<td>1280</td>
</tr>
<tr>
<td>51149C</td>
<td>Standard Resistor, 10 GΩ</td>
<td>1280</td>
</tr>
</tbody>
</table>
A.2 High-Voltage Standard Resistors

Technical Contacts:  
Telephone:
Martin Misakian  
(301) 975-2426
William E. Anderson  
(301) 975-2423

Mailing Address:  
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Gaithersburg, MD 20899-0001

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National Institute of Standards & Technology  
I-270 at Quince Orchard Road  
Gaithersburg, MD 20899  
Attn: M. Misakian, Bldg. 220, Room B351

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>51210C</td>
<td>High-Voltage Standard Resistors</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

A.3 High-Frequency Standard Resistors

Technical Contacts:  
Telephone:
George M. Free  
(303) 497-3609
P. J. Moore  
(303) 497-5284

Administrative & Logistics: Kathy Hillen  
(303) 497-3753

Mailing Address:  
M.C. 813.10  
National Institute of Standards & Technology  
325 Broadway  
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>51310S</td>
<td>High-Frequency Standard Resistors; Two-Terminal</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
### A. AC Resistors

Technical Contacts:

T. Michael Souders  
Barry A. Bell

Mailing Address: B162 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
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<tbody>
<tr>
<td>51410S</td>
<td>Special Test of AC Resistors, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

### B. Impedance Measurements (Except Resistors)

#### B.1 Low-Frequency Capacitance and Inductance Measurements & Standards

Technical Contacts:

Y. May Chang  
Norman B. Belecki

Administrative and Logistics: Denise D. Prather

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Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
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<tbody>
<tr>
<td>52110S</td>
<td>Special LF Impedance Measurements, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>52130C</td>
<td>Standard Fixed, used-Silica Dielectric Capacitor (10 and 100 pF at 100, 400, or 1000 Hz)</td>
<td>2410</td>
</tr>
<tr>
<td>52131C</td>
<td>Additional Frequency Points</td>
<td>2410</td>
</tr>
<tr>
<td>52140C</td>
<td>Fixed Three-Terminal, High-Precision Standard Capacitor with Coaxial Connectors (1 frequency, high accuracy under controlled conditions, 100, 400 or 1000 Hz)</td>
<td>750</td>
</tr>
<tr>
<td>52141C</td>
<td>Additional Frequency Points</td>
<td>750</td>
</tr>
<tr>
<td>52150C</td>
<td>Physical Tests to Qualify Three-Terminal Air Capacitor for Measurement under 52140C</td>
<td>675</td>
</tr>
<tr>
<td>52160C</td>
<td>Fixed Three-Terminal Standard Capacitor with Coaxial Connectors (1 frequency, laboratory conditions, 100, 400 or 1000 Hz)</td>
<td>475</td>
</tr>
<tr>
<td>52161C</td>
<td>Additional Frequencies</td>
<td>475</td>
</tr>
<tr>
<td>52170C</td>
<td>Two or Three-Terminal Solid Dielectric Standard Capacitor (66-2/3, 100, 400, 1000, or 10,000 Hz)</td>
<td>380</td>
</tr>
<tr>
<td>52171C</td>
<td>Additional Frequencies and/or steps (for decade capacitors)</td>
<td>380</td>
</tr>
<tr>
<td>52180C</td>
<td>Fixed Inductor, Self or Mutual (100, 400, 1000, or 10,000 Hz)</td>
<td>675</td>
</tr>
<tr>
<td>52181C</td>
<td>Additional Points</td>
<td>675</td>
</tr>
</tbody>
</table>
B.2 High-Frequency Standard Capacitors and Inductors

Technical Contacts:  
George M. Free  
P. J. Moore  
Administrative & Logistics: Kathy Hillen

Mailing Address:  M.C. 813.10  
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Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
<th>At Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>52210S</td>
<td>Two-Terminal Low-Loss Standard Capacitors - 10 kHz to 250 MHz; 1 pF to 1000 pF</td>
<td></td>
<td>At Cost</td>
</tr>
<tr>
<td>52211C</td>
<td>Two-Terminal Low-Loss Standard Capacitors, (High Accuracy) 1 MHz; 50, 100, 200, 500 and 1000 pF</td>
<td>435</td>
<td></td>
</tr>
<tr>
<td>52220S</td>
<td>Three-Terminal Low-Loss Standard Capacitors - 100 kHz, 1 MHz; 10² pF to 10³ pF</td>
<td></td>
<td>At Cost</td>
</tr>
<tr>
<td>52221C</td>
<td>Three-Terminal Low-Loss Standard Capacitors (High Accuracy) 100 kHz, 1 MHz, 10¹, 1, 10² and 10³ pF</td>
<td>465</td>
<td></td>
</tr>
<tr>
<td>52310S</td>
<td>Two-Terminal, High-Q Standard Inductors (10² µH to 1 H)</td>
<td></td>
<td>At Cost</td>
</tr>
</tbody>
</table>

B.3 Power-Frequency Capacitors

Technical Contacts:  
James K. Olthoff  
William E. Anderson

Mailing Address:  B344 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001

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Gaithersburg, MD 20899  
Attn: J.K. Olthoff, Bldg. 202, Room 167

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
<th>At Cost</th>
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</thead>
<tbody>
<tr>
<td>52400C</td>
<td>Power-Frequency Capacitors</td>
<td></td>
<td>At Cost</td>
</tr>
</tbody>
</table>

B.4 Q-Standards

Technical Contacts:  
George M. Free  
P. J. Moore  
Administrative & Logistics: Kathy Hillen

Mailing Address:  M.C. 813.10  
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325 Broadway  
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
<th>At Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>
Mailing Address: M.C. 813.10
National Institute of Standards & Technology
325 Broadway
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>52710C</td>
<td>Inductive Q-Standards; 50 kHz - 45 MHz, 0.25 μH to 25 mH</td>
<td>285</td>
</tr>
<tr>
<td>52711C</td>
<td>Each Additional Frequency for 52710C</td>
<td>87</td>
</tr>
</tbody>
</table>

C. Voltage Measurements
C.1 DC Voltage Measurements and Standards

Technical Contacts: June E. Sims (301) 975-4238
Richard L. Steiner (301) 975-4226
Norman B. Belecki (301) 975-4223

Administrative and Logistics: Denise Prather (301) 975-4221

Mailing Address: B146 Metrology
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Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53110S</td>
<td>Special DC Voltage Measurements, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>53120M</td>
<td>Measurement Assurance Program for DC Voltage</td>
<td>4675</td>
</tr>
<tr>
<td>53130C</td>
<td>First Saturated Standard Cell in a Group</td>
<td>920</td>
</tr>
<tr>
<td>53131C</td>
<td>Each Additional Cell</td>
<td>545</td>
</tr>
<tr>
<td>53140C</td>
<td>Platinum Resistance Thermometer Temperature Determination for Standard Cell Calibration</td>
<td>290</td>
</tr>
<tr>
<td>53150C</td>
<td>Unsaturated Standard Cells</td>
<td>440</td>
</tr>
<tr>
<td>53160C</td>
<td>Tests of Solid State Voltage Reference Standard (1 Output, 1-10 V)</td>
<td>1025</td>
</tr>
<tr>
<td>53161C</td>
<td>Each Additional Output</td>
<td>335</td>
</tr>
<tr>
<td>53180S</td>
<td>Special Handling (Equipment Pickup or Delivery)</td>
<td>92</td>
</tr>
<tr>
<td>53190S</td>
<td>Special Handling (Cleaning, Minor Repair, Return Service Charge)</td>
<td>160</td>
</tr>
</tbody>
</table>

C.2 AC Voltage Measurements

Technical Contacts: Nile M. Oldham (301) 975-2408
Barry A. Bell (301) 975-2419
Mark E. Parker (301) 975-2413

Mailing Address: B162 Metrology
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<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53200S</td>
<td>Special Tests of High-Accuracy Digital Multimeters, Multifunction Calibrators, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>53201S</td>
<td>Special Tests of Low-Voltage AC-DC Transfer Standards, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

### C.3 AC-DC Thermal Voltage and Current Converters (To 1 MHz)

**Technical Contacts:**
- Joseph R. Kinard
- Norman B. Belecki

**Mailing Address:**
B146 Metrology
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53350C</td>
<td>Set up Charge (No Test Points Included) for a Standard or Standards set for AC-DC Difference (Voltage or Current)</td>
<td>375</td>
</tr>
<tr>
<td>53351C</td>
<td>First Point on a Voltage or Current Range</td>
<td>600</td>
</tr>
<tr>
<td>53352C</td>
<td>Additional Points within a Voltage or Current Range (Additional Frequency/Voltage or Frequency/Current Points)</td>
<td>195</td>
</tr>
</tbody>
</table>

### C.4 RF-DC Thermal Voltage and Current Converters (100 Hz - 1 GHz)

**Technical Contacts:**
- Gregorio Rebuldela
- Darlene Seibold

**Mailing Address:**
M.C. 813.10
National Institute of Standards & Technology
325 Broadway
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>53405S</td>
<td>Special Tests of AC Thermal Voltage Converters, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>53410C</td>
<td>Low Frequency TVC Calibration at One Frequency Selected from Those Given in Table 16 at Rated Voltage in the Range 0.1 - 50 V</td>
<td>430</td>
</tr>
<tr>
<td>53411S</td>
<td>Additional Frequency Selected from Table 16 for Same TVC as in 53410C</td>
<td>195</td>
</tr>
<tr>
<td>53412S</td>
<td>Same as 53410C, Except Customer Designates a Single Frequency (in Same Frequency Range) Other Than Those Given in Table 16</td>
<td>At Cost</td>
</tr>
<tr>
<td>53413C</td>
<td>Low Frequency TVC Calibration at One Frequency Selected from Those Given in Table 16 at Rated Voltage in the Range 50 - 200 V</td>
<td>460</td>
</tr>
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</table>
53414C Additional Frequency Selected from Table 16 for Same TVC as in 53413C 245
53415S Same as 53413C, Except Customer Designates a Single Frequency (in Same Frequency Range) Other Than Those Given in Table 16 At Cost
53420C High Frequency TVC Calibration at One Frequency Selected from Those Given in Table 17 at Rates Voltage in the Range 0.1 - 7.5 V 555
53421C Additional Frequency Selected from Table 17 for Same TVC as in 53420C 285
53430S Peak-to-Peak Detector Calibration at One Frequency Selected from Those Given in Table 18 at 1.2 V Applied RF Voltage At Cost
53431S Additional Frequency for Peak-to-Peak Detector in Test 53430S At Cost
53440S Special Tests of RF Micropotentiometers, by Prearrangement At Cost
53441C RF Micropotentiometer Calibration at one Frequency Selected from the Frequency Bands Given in Table 19 285
53445S Special Calibration of RF Micropotentiometer (Output Voltage Range, 200 to 200,000 µV at Frequency Range, 0.05 to 1000 MHz) with Reduced Limits of Uncertainty At Cost

C.5 Data Converters

Technical Contacts: Telephone:
T. Michael Souders (301) 975-2406
Barry A. Bell (301) 975-2419

Mailing Address: B162 Metrology
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

Test No. Description of Services Fee ($) At Cost
53500S Special Data Converter Services, by Prearrangement
53510C A/D or D/A Converter, Linearity Errors at 1024 Points, 10 Bit-Correction Coefficients, and Superposition Errors 815
53520C A/D or D/A Converter, Differential Linearity Errors at 2(N-1) Points (N = No. of Bits) 155
53530C A/D Converter, Equivalent RMS Input Noise 270
53540S A/D or D/A Converter - Offset and Gain Errors Relative to U.S. Legal Volt At Cost

D. Precision Ratio Measurements

D.1 Inductive Dividers

Technical Contact: Telephone:
Norman B. Belecki (301) 975-4223
Administrative and Logistics: Denise D. Prather (301) 975-4221
<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54110S</td>
<td>Special Ratio Measurements and Tests of Inductive Voltage Dividers, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>54120C</td>
<td>Inductive Voltage Dividers - (Single Frequency, Voltage to be Specified, Each Setting of 3 Most Significant Dials)</td>
<td>1905</td>
</tr>
<tr>
<td>54121C</td>
<td>Additional Frequency Points</td>
<td>1905</td>
</tr>
<tr>
<td>54130C</td>
<td>Inductive Voltage Dividers - (Single Frequency, Voltage to be Specified, Each Setting of Most Significant Dial Only)</td>
<td>1190</td>
</tr>
<tr>
<td>54131C</td>
<td>Additional Frequency Points and/or Low Voltage Points</td>
<td>1190</td>
</tr>
</tbody>
</table>

D.2 Resistive Dividers

**Technical Contacts:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Telephone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Martin Misakian (DC Measurements)</td>
<td>(301) 975-2426</td>
</tr>
<tr>
<td>Richard J. Van Brunt (60-Hz Measurements)</td>
<td>(301) 975-2425</td>
</tr>
<tr>
<td>Gerald J. FitzPatrick (Pulsed Measurements)</td>
<td>(301) 975-2737</td>
</tr>
</tbody>
</table>

**Mailing Address:**

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Gaithersburg, MD 20899-0001

**Shipping Address:**

National Institute of Standards & Technology
I-270 at Quince Orchard Road
Gaithersburg, MD 20899
For: 54210C-54211S
Attn: M. Misakian, Bldg. 220, Room B351
For: 54212C-54213S
Attn: R. J. Van Brunt, Bldg. 202, Room 167
For: 54214S
Attn: G. J. FitzPatrick, Bldg. 202, Room 106

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54210C</td>
<td>Resistor and Resistive Dividers - Total Resistance or Voltage Ratio, Two Direct Voltage Levels Between 10 kV and 150 kV</td>
<td>1360</td>
</tr>
<tr>
<td>54211S</td>
<td>Special Tests of Resistor and Resistive Dividers at Direct Voltage Levels, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>54212C</td>
<td>Resistor and Resistive Dividers at 60 Hz, Voltage Ratio and Phase Angle, between 10 kV and 100 kV rms</td>
<td>At Cost</td>
</tr>
<tr>
<td>54213S</td>
<td>Special Tests of Resistor and Resistive Dividers at 60 Hz, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>54214S</td>
<td>Special Tests of Resistor and Resistive Dividers Under Pulsed High Voltage Conditions, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
D.3 Capacitive Dividers

Technical Contacts:  
Robert E. Hebner, Jr.  
Richard J. Van Brunt (60 Hz Measurements)  
Gerald J. FitzPatrick (Pulsed Measurements)

Telephone:  
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(301) 975-2425  
(301) 975-2737

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Gaithersburg, MD 20899  
For: 54310S  
Attn: R. J. Van Brunt, Bldg. 202, Room 167  
For: 54311S  
Attn: G. J. FitzPatrick, Bldg. 202, Room 106

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
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<tbody>
<tr>
<td>54310S</td>
<td>Special Tests of Capacitive Dividers at 60-Hz, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>54311S</td>
<td>Special Tests of Capacitive Dividers Under Pulsed High-Voltage Conditions, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

D.4 Mixed Dividers

Technical Contact:  
Gerald J. FitzPatrick

Telephone:  
(301) 975-2737

Mailing Address:  
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<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54410S</td>
<td>Pulse-Voltage-Measuring Systems Including Kerr Cells</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

D.5 Voltage and Current Transformers

Technical Contacts:  
James K. Olthoff (Voltage Transformers)  
Thomas L. Nelson (Current Transformers)

Telephone:  
(301) 975-2431  
(301) 975-2416

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Gaithersburg, MD 20899  
For: 54510C-54513C  
Attn: J. K. Olthoff, Bldg. 202, Room 167  
For: 54520C-54522C  
Attn: T. L. Nelson, Bldg. 220, Room B165
<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>54510C</td>
<td>Voltage Transformer, Ratio &amp; Phase Angle, at 60 Hz on 1 Range, 1 Secondary Voltage, 1 Burden Primary $V_{rms} \leq 150$ kV</td>
<td>1360</td>
</tr>
<tr>
<td>54511C</td>
<td>Same as 54510C, Additional Similar Transformer at Same Time</td>
<td>985</td>
</tr>
<tr>
<td>54512C</td>
<td>Same as 54510C and 54511C, Additional Burden or Range</td>
<td>300</td>
</tr>
<tr>
<td>54513C</td>
<td>Same as 54510C - 54512C, at Each Secondary Voltage</td>
<td>89</td>
</tr>
<tr>
<td>54520C</td>
<td>Current Transformer, Ratio &amp; Phase Angle, 1 Range at 1 Frequency, 1 Burden, Secondary Currents 0.5, 1, 2, 3, 4, 5 A, Primary Current Not Over 12,000 A</td>
<td>2125</td>
</tr>
<tr>
<td>54521C</td>
<td>Current Transformer, Ratio &amp; Phase, 1 Secondary Current, Additional Combination of Range, Frequency, and Burden, Primary Current Not Over 12,000 A</td>
<td>190</td>
</tr>
<tr>
<td>54522C</td>
<td>Current Transformer, Ratio &amp; Phase at Each Additional Secondary Current, Same Combination of Range, Frequency, and Burden as 54520C or 54521C</td>
<td>145</td>
</tr>
<tr>
<td>54600S</td>
<td>Special Tests of Dividers and Transformers, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

E. Phase Measurements and Air Navigation Aids

E.1 Phase Meters and Standards

Technical Contacts:

Raymond S. Turgel  (301) 975-2420
Barry A. Bell       (301) 975-2419
Mark E. Parker      (301) 975-2413

Mailing Address:  B162 Metrology
National Institute of Standards & Technology
Gaithersburg, MD 20899-0001

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55110S</td>
<td>Special Tests of Phase Standards and Related Instruments, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>55120C</td>
<td>Phasemeters - One Combination of Input Voltages (0.5 V to 100 V $V_{rms}$) at one Frequency (2 Hz to 50 kHz) - the Input Voltage Ratio Shall Not Exceed 10</td>
<td>620</td>
</tr>
<tr>
<td>55121C</td>
<td>Phasemeters - Each Additional Combination of Input Voltages (0.5 V to 100 V $V_{rms}$) at the Same or at a Different Frequency (2 Hz to 50 kHz) - the Input Voltage Ratio Shall Not Exceed 10</td>
<td>180</td>
</tr>
<tr>
<td>55130C</td>
<td>Phasemeters - One Combination of One Input Voltage (0.5 V to 770 120 V $V_{rms}$) and One Input Current (0.5 to 5 A $I_{rms}$) at One Frequency (2 Hz to 5 kHz)</td>
<td>855</td>
</tr>
<tr>
<td>55131C</td>
<td>Phasemeters - Each Additional Combination of One Input Voltage (0.5 V to 120 V $V_{rms}$) and One Input Current (0.5 to 5 A $I_{rms}$)</td>
<td>260</td>
</tr>
<tr>
<td>55140C</td>
<td>Phasemeters - One Input Voltage (0.5 V to 120 V $V_{rms}$) and another Input Voltage (0.5 V to 100 V $V_{rms}$) at One Frequency (2 Hz to 5 kHz)</td>
<td>855</td>
</tr>
</tbody>
</table>
E.2 Very-High-Frequency Omnidirectional Range (VOR) Measurements

Technical Contacts:

Neil T. Larsen  
David H. Russell

Administrative & Logistics: Kathy Hillen

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Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>55210C</td>
<td>VOR Bearing-Angle Indicators, 12 Bearing Angles Over the Range 0 to 330 Degrees</td>
<td>At Cost</td>
</tr>
<tr>
<td>55211C</td>
<td>Calibration of VOR Bearing-Angle Indicator at Each Additional Angle</td>
<td>At Cost</td>
</tr>
<tr>
<td>55220C</td>
<td>VOR Generators, 12 Bearing-Angle Equivalent Signals Over the Range 0 to 330 Degrees</td>
<td>At Cost</td>
</tr>
<tr>
<td>55221C</td>
<td>Calibration of VOR Generator at Each Additional Angle</td>
<td>At Cost</td>
</tr>
<tr>
<td>55230S</td>
<td>Special VOR Tests</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

F. Power and Energy Measurements, Low-Frequency

Technical Contacts:

Andrew J. Secula  
Thomas L. Nelson

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Gaithersburg, MD 20899  
Attn: A. J. Secula, Bldg. 220, Room B165

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>56110S</td>
<td>Special Tests of AC-DC Wattmeters, by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>56200C</td>
<td>Watt, Watthour, Var, Varhour Meter, Initial Two Determinations of Same Meter at 60 Hz</td>
<td>1695</td>
</tr>
<tr>
<td>56201C</td>
<td>Each Additional Determination Same Meter at 50 Hz</td>
<td>115</td>
</tr>
<tr>
<td>56202C</td>
<td>Initial Two Determinations of One or Two Meters Run Simultaneously with the First (56200C)</td>
<td>1505</td>
</tr>
</tbody>
</table>
G. Microwave Measurements

G.1 Bolometer, RF and Microwave

Technical Contacts:  Telephone:
Ronald A. Ginley  (303) 497-3634
Manly P. Weidman  (303) 497-3516
Administrative & Logistics: Kathy Hillen  (303) 497-3753

Mailing Address:  M.C. 813.10
National Institute of Standards & Technology
325 Broadway
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>61110S</td>
<td>Effective Efficiency and Reflection Coefficient of Coaxial Thermistor Mounts at Specified Frequency in Range 0.1 to 10 MHz</td>
<td>At Cost</td>
</tr>
<tr>
<td>61111S</td>
<td>Each Additional Frequency for 61110S</td>
<td>At Cost</td>
</tr>
<tr>
<td>61120S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 10 MHz Intervals within 10-100 MHz</td>
<td>830</td>
</tr>
<tr>
<td>61121S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 25 MHz Intervals within 100-500 MHz and 1000 MHz</td>
<td>830</td>
</tr>
<tr>
<td>61122S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 10 MHz Intervals within 100-100 MHz and 25 MHz Intervals within 100-500 MHz and 1000 MHz</td>
<td>1330</td>
</tr>
<tr>
<td>61123S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 50-MHz Intervals within 1-2 GHz</td>
<td>1170</td>
</tr>
<tr>
<td>61124S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 100-MHz Intervals within 2-4 GHz</td>
<td>1170</td>
</tr>
<tr>
<td>61125S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 200-MHz Intervals within 4-8 GHz</td>
<td>1170</td>
</tr>
<tr>
<td>61126S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 200-MHz Intervals in the Range 8-12.4 GHz</td>
<td>1170</td>
</tr>
<tr>
<td>61127S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 250-MHz Intervals in the Range of 12.4-18 GHz</td>
<td>1170</td>
</tr>
<tr>
<td>61128S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 1-GHz Intervals in the Range 1-18 GHz</td>
<td>1615</td>
</tr>
<tr>
<td>Test No.</td>
<td>Description of Service</td>
<td>Fee($)</td>
</tr>
<tr>
<td>----------</td>
<td>----------------------------------------------------------------------------------------</td>
<td>----------</td>
</tr>
<tr>
<td>61129S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Coaxial Thermistor Mounts at 1-GHz Intervals in the Range 18-26 GHz</td>
<td>3150</td>
</tr>
<tr>
<td>61144S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Rectangular Waveguide Thermistor Mounts at 200 MHz Intervals within 8.2-12.4 GHz (WR90)</td>
<td>1295</td>
</tr>
<tr>
<td>61146S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Rectangular Waveguide Thermistor Mounts at 250-MHz Intervals within 12.4-18.0 GHz (WR62)</td>
<td>1295</td>
</tr>
<tr>
<td>61147S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Rectangular Waveguide Thermistor Mounts at a Specified Frequency within 18-26.5 GHz (WR42)</td>
<td>At Cost</td>
</tr>
<tr>
<td>61148S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Rectangular Waveguide Thermistor Mounts at a Specified Frequency within 26.5-40 GHz (WR28)</td>
<td>At Cost</td>
</tr>
<tr>
<td>61149S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Rectangular Waveguide Thermistor Mounts at a Specified Frequency within 42-46 GHz (WR22)</td>
<td>At Cost</td>
</tr>
<tr>
<td>61155S</td>
<td>Calibration Factor, Effective Efficiency, and Reflection Coefficient of Rectangular Waveguide Thermistor Mounts of Specified Frequency within 94-96 GHz (WR10)</td>
<td>At Cost</td>
</tr>
<tr>
<td>61190S</td>
<td>Special Microwave and RF Power Measurement Services, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

G.2 Attenuators, RF and Microwave

Technical Contacts: John R. Juroshek, Ronald A. Ginley, Manly P. Weidman

Telephone: (303) 497-5362, (303) 497-3634, (303) 497-3516

Administrative & Logistics: Kathy Hillen (303) 497-3753

Mailing Address: M.C. 813.10 National Institute of Standards & Technology 325 Broadway Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Service</th>
<th>Fee($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>61210S</td>
<td>Coaxial Fixed Variable Attenuators, Frequency Range 10 MHz to 26 GHz, Attenuation 0 to 50 dB</td>
<td>At Cost</td>
</tr>
<tr>
<td>61211C</td>
<td>Coaxial Fixed and Variable Attenuators Measured at 30 MHz, Attenuation 0 - 120dB</td>
<td>At Cost</td>
</tr>
<tr>
<td>61215C</td>
<td>Waveguide - Below Cutoff (Piston) Attenuators, Coaxial Connectors, Measured at 30 MHz, Attenuation 0 - 120 dB (Total Insertion Loss)</td>
<td>At Cost</td>
</tr>
<tr>
<td>61230S</td>
<td>Rectangular Waveguide Fixed and Variable Attenuators, Specify Frequencies for Waveguide Sizes WR10, WR22 and WR42 0 - 50 dB</td>
<td>At Cost</td>
</tr>
<tr>
<td>61240S</td>
<td>Attenuation Measurements of Three-Port and Two-Port Devices at 1.25 MHz, 0 - 6 dB</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
G.3 Coaxial and Waveguide Terminations, Reflection Coefficients

Technical Contacts: Telephone:
John R. Juroshek (303) 497-5362
Ronald A. Ginley (303) 497-3634
Manly P. Weidman (303) 497-3516

Administrative & Logistics: Kathy Hillen (303) 497-3753

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National Institute of Standards & Technology
325 Broadway
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>61310S</td>
<td>Complex Reflection Coefficient of Coaxial Terminations, Frequency Range 10 MHz to 26 GHz</td>
<td>At Cost</td>
</tr>
<tr>
<td>61320S</td>
<td>Complex Reflection Coefficient of Rectangular Waveguide Terminations with Standard Flange Connectors, Specify Frequency for Waveguide Sizes WR10, WR22, WR28, WR42</td>
<td>At Cost</td>
</tr>
<tr>
<td>61340S</td>
<td>Special Reflection Coefficient Measurements, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

G.4 Phase Shifters, RF and Microwave

Technical Contacts: Telephone:
Ronald A. Ginley (303) 497-3634
Gene Marler (303) 497-5455
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<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>61410S</td>
<td>Coaxial Fixed and Variable Phase Shifters; Characteristic Phase Shift Difference; Precision Connectors; Measured at 30 MHz, Range 0-360°</td>
<td>At Cost</td>
</tr>
<tr>
<td>61411S</td>
<td>Coaxial Fixed and Variable Phase Shifters; Characteristic Phase Shift Difference; Precision Connectors; Frequency Range 1 - 26 GHz, Phase Range 0-360°</td>
<td>At Cost</td>
</tr>
<tr>
<td>61420S</td>
<td>Variable Rectangular Waveguide Phase Shifters; Phase Shift Difference; Specify Frequencies for Waveguide Sizes WR10, WR22, WR28, WR42, Range 0-720°</td>
<td>At Cost</td>
</tr>
<tr>
<td>61450S</td>
<td>Special Tests of Phase Shifters, by Prearrangement</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
### G.5 Dimensional Verification of Coaxial Air Line Standards

**Technical Contacts:**
- John Juroshek
- Ronald A. Ginley
- Manly P. Weidman

**Administrative & Logistics:** Kathy Hillen

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Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>61510S</td>
<td>Dimensional Measurement of Air Lines and Verification of Characteristic Impedance from Dimensional Measurements</td>
<td>At Cost</td>
</tr>
</tbody>
</table>

### G.6 Dielectric Material Measurements

**Technical Contacts:**
- William A. Kissick
- Eric Vanzura

**Administrative & Logistics:** Kathy Hillen

**Mailing Address:**
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325 Broadway  
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
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<tbody>
<tr>
<td>61620S</td>
<td>Special Tests for Dielectric Materials 0.05 to 18 GHz</td>
<td>At Cost</td>
</tr>
</tbody>
</table>
H. Noise Temperature Measurements

Technical Contacts:  
J. Wayde Allen  
Sunchana Perera  
Administrative & Logistics: Kathy Hillen

Telephone:  
(303) 497-5871  
(303) 497-3546  
(303) 497-3753

Mailing Address:  
M.C. 813.02  
National Institute of Standards & Technology  
325 Broadway  
Boulder, CO 80303-3328

<table>
<thead>
<tr>
<th>Test No.</th>
<th>Freq.</th>
<th>Connector Type</th>
<th>Device Requirements/Services</th>
<th>Fee ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>62020S</td>
<td></td>
<td></td>
<td>Special Noise Temperature Measurements (Electromagnetic), by Prearrangement</td>
<td>At Cost</td>
</tr>
<tr>
<td>62100S</td>
<td>MHz</td>
<td>Coaxial</td>
<td>VSWR &lt; 1.2</td>
<td>1600</td>
</tr>
<tr>
<td>30</td>
<td>N (Prec.)</td>
<td></td>
<td>Temperature 77K - 15,000K</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>APC 3.5</td>
<td>14 mm</td>
<td>ENR &lt; 17 dB</td>
<td></td>
</tr>
<tr>
<td>62101S</td>
<td></td>
<td></td>
<td>Additional Devices with the Same Connector Type</td>
<td>1425</td>
</tr>
<tr>
<td>62110S</td>
<td>GHz</td>
<td>Coaxial</td>
<td>Reflection Coefficient &lt; 0.2</td>
<td>1655</td>
</tr>
<tr>
<td>1 - 12</td>
<td>N (Prec.)</td>
<td></td>
<td>Temperature 77K - 15,000K</td>
<td></td>
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<td></td>
<td>APC 3.5</td>
<td>14 mm</td>
<td>ENR &lt; 17 dB</td>
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<tr>
<td>62111S</td>
<td></td>
<td></td>
<td>Additional Device with the Same Connector Type and Calibration Frequency</td>
<td>1410</td>
</tr>
<tr>
<td>62112S</td>
<td>GHz</td>
<td>Coaxial</td>
<td>Reflection Coefficient &lt; 0.2</td>
<td>2570</td>
</tr>
<tr>
<td>1 - 12</td>
<td>APC 3.5 mm</td>
<td></td>
<td>Temperature 77K - 15,000K</td>
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<tr>
<td></td>
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<td></td>
<td>ENR &lt; 17 dB</td>
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<tr>
<td>62113S</td>
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<td>Additional Device Tested at the Same Frequency</td>
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<td>GHz</td>
<td>Waveguide</td>
<td>Reflection Coefficient &lt; 0.2</td>
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<tr>
<td>2.6 3 - 95</td>
<td>WR284</td>
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<td>Temperature 77K - 15,000K</td>
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<tr>
<td>3.95 - 5.85</td>
<td>WR187</td>
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<td>ENR &lt; 17 dB</td>
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<td>5.85 - 8.2</td>
<td>WR137</td>
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<td>7.05 - 10</td>
<td>WR112</td>
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<td></td>
<td>Additional Device with the Same Connector Type and Calibration Frequency</td>
<td>2360</td>
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I. Electromagnetic Field Strength and Antenna Measurements

I.1 Microwave Antenna Parameter Measurements

Technical Contacts:

Andrew G. Repjar (63100S-63400S)
Katherine Mac Reynolds (63100S)
Michael H. Francis

Administrative & Logistics: Kathy Hillen

Mailing Address: M.C. 813.10
National Institute of Standards & Technology
325 Broadway
Boulder, CO 80303-3328

<table>
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<tr>
<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
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<td>Gain and Polarization Calibrations of Standard Antennas Using Extrapolation Range</td>
<td>At Cost</td>
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<tr>
<td>63200S</td>
<td>Measurement of Pattern, Gain and Polarization of Arbitrary Antennas Using Near-Field Scanning Techniques</td>
<td>At Cost</td>
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<tr>
<td>63300S</td>
<td>Special Test Services for Calibration of Probes Used with Near-Field Scanning Facilities</td>
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<tr>
<td>63400S</td>
<td>Special Consulting, Advisory, and Other Services</td>
<td>At Cost</td>
</tr>
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</table>
I. 2 Field Strength Parameter Measurements

Technical Contacts:  
Galen H. Koepke  
Motohisa Kanda  
Administrative & Logistics: Kathy Hillen  

Mailing Address: M.C. 813.10  
National Institute of Standards & Technology  
325 Broadway  
Boulder, CO 80303-3328

<table>
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<th>Test No.</th>
<th>Description of Services</th>
<th>Fee ($)</th>
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<tbody>
<tr>
<td>64100S</td>
<td>Special-Test Services for Antenna/Field Strength/Measurements, Using the Transverse Electromagnetic (TEM) Cell Method, (10 kHz - 300 MHz)</td>
<td>At Cost</td>
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<tr>
<td>64200S</td>
<td>Special-Test Service for Antennas/Field Strength/Measurements, Utilizing the Open Field Method</td>
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<td>64300S</td>
<td>Special-Test Service for Antennas/Field Strength/Reflectivity Measurements, Utilizing the Anechoic-Chamber Method</td>
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J. Pulse Waveform Measurements

Technical Contact:  
William L. Gans  

Mailing Address: B162 Metrology  
National Institute of Standards & Technology  
Gaithersburg, MD 20899-0001  

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<thead>
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<th>Description of Services</th>
<th>Fee ($)</th>
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<tbody>
<tr>
<td>65100S</td>
<td>Impulse Generator Spectrum Amplitude (50 Ohm)</td>
<td>At Cost</td>
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<tr>
<td>65200S</td>
<td>Fast Repetitive Broadband Pulse Parameters (50 Ohm)</td>
<td>At Cost</td>
</tr>
<tr>
<td>65300S</td>
<td>Network Impulse Response (Frequency Domain Parameter $S_{21}$) of Coaxial Network 10 MHz to 10.0 GHz, 0 to ± 40 dB</td>
<td>At Cost</td>
</tr>
<tr>
<td>65301S</td>
<td>Additional 65300S Item Tested at Same Time as First</td>
<td>At Cost</td>
</tr>
<tr>
<td>65400S</td>
<td>Pulse Time Delay Trough Coaxial Transmission Lines</td>
<td>At Cost</td>
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CHAPTER X
TIME AND FREQUENCY MEASUREMENTS

A. Time and Frequency Dissemination

Technical Contacts:  
George Kamas (Frequency)  
David W. Allan (Time)  

Administrative & Logistics: Kathy Hillen

Mailing Address: M.C. 847.50  
National Institute of Standards & Technology  
Boulder, CO 80303-3328

Shipping Address: M.C. 847.50, Room. 4039  
National Institute of Standards & Technology  
325 Broadway  
Boulder, CO 80303

<table>
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<th>Description of Services</th>
<th>Fee ($)</th>
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<tr>
<td>76100S</td>
<td>Special Tests of Time and Frequency; Frequency Measurement Service - (Frequency delivered to user's site)</td>
<td>Initial one-time fee 4,950 + monthly charge 500</td>
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<tr>
<td>76110S</td>
<td>Special Tests of Time and Frequency; Global Time Service (Frequency and Time delivered to user's site)</td>
<td>14,100/year</td>
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B. Oscillator Characterization

Technical Contact:  
James E. Gray

Administrative & Logistics: Kathy Hillen

Mailing Address: M.C. 847.50  
National Institute of Standards & Technology  
325 Broadway  
Boulder, CO 80303-3328

Shipping Address: M.C. 847.50, Room. 2019  
National Institute of Standards & Technology  
325 Broadway  
Boulder, CO 80303-3328

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<tr>
<td>77100C</td>
<td>Precision Oscillator Frequency Calibration</td>
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<td>77110C</td>
<td>Characterization of Atomic Time and Frequency Standards</td>
<td>1995</td>
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<td>77120C</td>
<td>Characterization of Precision Oscillators: Time Domain</td>
<td>990</td>
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<tr>
<td>77130C</td>
<td>Characterization of Precision Oscillators: Frequency Domain</td>
<td>990</td>
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<tr>
<td></td>
<td>Characterization of Precision Oscillators: Frequency Domain, High Accuracy Option</td>
<td>At Cost</td>
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<tr>
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<td>---------</td>
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<tr>
<td>77131C</td>
<td>Special Time/Frequency Measurements: Oscillators and Other Components</td>
<td>At Cost</td>
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CHAPTER XI

ANNOUNCEMENTS/SEMINARS

The announcements which follow concern notification of changes in services and information about future NIST Measurement Seminars. Specific technical questions regarding the services described in these announcements should be referred to the points of contact indicated. General policy questions regarding NIST measurement services should be referred to the Calibration Program.

It should be recognized that in many cases where NIST calibration services are not advertised, special arrangements can sometimes be made on a case-by-case basis (NIST workload permitting) if it can be shown that there is a critical need for a NIST calibration.

NEW SERVICES

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<tr>
<td>30061C</td>
<td>Helium Glass or Quartz Permeation Leaks, 2 x 10^{-14} to 2 x 10^{4} mol/s</td>
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REDUCTION IN SERVICES

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<td>31060C</td>
<td>Laboratory Thermometers (Liquid O,) (-183 °C or -297 °F)</td>
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<td>Special Tests of Thermometers (Liquid O,) (-183 °C or -297 °F)</td>
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<tr>
<td>32130C</td>
<td>Liquid O, (-183 °C) or (-297 °F)</td>
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CHANGE OF ADDRESS

The Physical Measurement Services Program name has been changed to Calibration Program and was relocated to Building 411, Room A104, Gaithersburg, MD 20899-0001.

The Pulse Waveform Measurements, Test numbers 65100S-65400S, have been moved to our Gaithersburg site. Technical Contact: William L. Gans, (301) 975-2502, B162 Metrology, Gaithersburg, MD 20899-0001.

NIST MEASUREMENT SEMINARS

NIST holds seminars and workshops activities that provide advice and assistance on measurements and calibrations so that laboratories outside NIST can make measurements consistent with national standards as maintained by NIST. Participation is open to a limited number of persons from measurement and standards laboratories who meet appropriate prerequisites relating to education, work experience, and current professional activity.

Each seminar lasts from one to five days and its meetings are devoted to lectures, group discussions, and laboratory demonstrations. A course may be canceled if registration is insufficient. However, in the past, requests for enrollment have nearly always exceeded the numbers that could be accommodated. Laboratory directors who wish to have members of their staff attend any of these courses are therefore urged to send, as soon as possible, a letter of application to the individual named in the course descriptions below. Applications should also be accompanied by a check, billing authorization, or purchase order for the stated fee.

Acceptance of qualified applicants, on the basis of first come first served, other things being equal, will be made by letter not later than 4 weeks prior to the scheduled date of the course. Detailed information on schedules and housing will be available at that time. Those accepted will be expected to study the assigned reading material before coming to the course and should be prepared to discuss their own experiences with related problems.
ELECTRICAL MEASUREMENT ASSURANCE PROGRAMS WORKSHOP

Description: This NIST/NCSL EMAP workshop consists of lectures and computer-aided instruction sessions on statistical concepts and electrical metrology, and is intended to provide the necessary background needed to apply statistical process control and other quality assurance concepts to standards and calibration laboratory operations. It is intended for degreed metrology practitioners and senior technicians having a mathematical background at the advanced algebra level or higher.

Technical Contact: Norman Belecki (301) 975-4223
Course Length: 5 days
Dates: Not Scheduled: Call for information.

PRECISION THERMOMETRY WORKSHOP

Description: This workshop gives an integrated instruction in Temperature Scales, Platinum Resistance Thermometry, Thermistor Thermometry, Vapor Pressure and Gas Thermometry, Liquid-in-Glass Thermometry, Thermocouple Thermometry and an overview of Radiation Thermometry. Material to be covered includes the International Temperature Scale of 1990 and its use in the laboratory; thermometers and instrumentation, including automatic data acquisition; the treatment of calibration data; and innovations in thermometry. Time will be split between lecture sessions and hands-on measurements in the laboratory.

The workshop is especially intended for calibration laboratory personnel and others who wish to undertake precision temperature measurements. Applicants should possess undergraduate training in physics or engineering and should have some laboratory experience in metrology.

Arrangements: Attendance will be limited to 16. Fee: To be determined. Dates: March 9-13, 1992 and October 19-23, 1992. Apply to: Lori Phillips (301) 975-3881, NIST, A903 Administration, Gaithersburg, MD 20899.

CALIBRATION AND USE OF PISTON GAGES

Description: These seminars are held to help industrial and other users attain the highest possible accuracy in pressure measurements with piston gages. The seminar is directed at engineers and senior technicians. The two-day seminar presents information on the theory of piston gages, elastic distortion, design and types, calibration of controlled clearance piston gages, calibration by cross-float, error analysis, computer programs, demonstration of cross-float, hydrostatic weighing and transducer calibrations. The seminar closes with a tour of the laboratory, and a discussion of research and development work in the field of pressure measurements.

Arrangements: Attendance will be limited to 12. Fee: $650. Dates: April 22-24, 1992. Apply to: Tammie Grice (301) 975-2775, NIST, A903 Administration, Gaithersburg, MD 20899.

VACUUM CALIBRATIONS USING THE SPINNING ROTOR GAGE

Description: NIST will be conducting a two and one-half day workshop on the use of the spinning rotor (or molecular drag) gage to calibrate ionization gages in the pressure range $10^{-4}$ to $10^{-1}$ Torr ($10^{-4}$ to $10^{1}$ Pa).

There will be one-half day of lecture followed by demonstrations in the laboratory, one full day of using the gages to perform calibrations, and one-half day of follow-up discussions, questions, and visits to the vacuum facilities.

Arrangements: In order to permit maximum use of the gages, the number of participants is kept to four per system (a maximum of sixteen participants per workshop). Fee: To be determined. Dates: May 18-20, 1992. Apply to: Ana Salazar (301) 975-4840, NIST, A55 Metrology, Gaithersburg, MD 20899.
TIME AND FREQUENCY SEMINAR

Description: This seminar is intended for engineers, scientists and laboratory technicians involved in the application and use of time and frequency services and measurements. Topics include:

- SHORT TERM STABILITY
- LONG TERM STABILITY
- STATISTICS OF OSCILLATORS
- PHASE NOISE MEASUREMENTS
- CHARACTERISTICS OF COMMERCIAL FREQUENCY STANDARDS
- TIME COORDINATION
- TIME KEEPING AND TIME SCALES
- TIME DISSEMINATION METHODS
- PROPAGATION EFFECTS ON RADIO TRANSMISSIONS
- NIST SERVICES
- MEASUREMENT TECHNIQUES
- PERFORMANCE AND SPECIFICATIONS OF QUARTZ OSCILLATORS RELATING TO MIL-O-55310B


GAGE BLOCK CALIBRATION COURSE

Description: This three day course will emphasize the concepts, techniques, and apparatus used in gage block calibration. The faculty will consist of members of the Dimensional Metrology Group. The course will consist primarily of lectures, although the attendance will be restricted to encourage discussion between the instructors and class. There will also be laboratory visits for informal discussions with the NIST staff. Topics include:

- INTRODUCTION
- GAGE BLOCKS
- STATISTICS
- PROCESS CONTROL - AN INTRODUCTION
- THE HOW AND WHY OF CALIBRATION DESIGNS
- GAGE BLOCK COMPARATORS
- CALIBRATION PRELIMINARIES
- CORRECTIONS TO MEASUREMENTS
- CALIBRATION - NIST PROCEDURES
- SURVEY OF COMMON INDUSTRY PRACTICES
- INTERFEROMETRY
- INTERFEROMETRIC MEASUREMENTS
- LENGTH FROM INTERFEROMETRY

Arrangements: Attendance will be limited to 25. Fee: $750. Dates: November 1992. Apply to: Lori Phillips (301) 975-3881, NIST, A903 Administration, Gaithersburg, MD 20899. Technical contact: John Stoup (301) 975-3471.

SHORT COURSE IN LASER MEASUREMENTS

Description: The three-and-one-half-day course will emphasize the concepts, techniques, and apparatus used in measuring laser parameters and will include a visit to the NIST laser measurement laboratories. The faculty will consist of laser experts from NIST, industry, and other government agencies. A degree in physics or electrical engineering or equivalent experience is assumed, and some experience in the use of lasers is desirable. Topics include:

- OPTICS FOR LASER MEASUREMENTS
- ATTENUATION TECHNIQUES
- LASER OPERATION
- BASIC LASER POWER/ENERGY STANDARDS
- LASER POWER/ENERGY MEASUREMENT TECHNIQUES
PULSE MEASUREMENTS
TRANSFER STANDARDS
BEAM PROFILE MEASUREMENTS
DIODE LASERS
LASER MEASUREMENTS FOR OPTICAL COMMUNICATIONS
STATISTICS AND ERROR ANALYSIS
LASER SAFETY
DETECTORS

Technical Contact: Thomas Scott (303) 497-3651
Course Length: 3 1/2 days
Dates: Not Scheduled: Call for information.
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