NIST
National Institute of Standards and Technology
U.S. Department of Commerce

SRM SPOTLIGHT

MARCH 2018

Inside:
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NIST SRM Exhibits
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Editor:
Regina R. Montgomery

NIST SRM 1401 Trace Metals in Frozen Human Blood

Implant devices based on metal-on-metal mechanical structures have been extensively used in human joint surgical re-habilitation for several decades. Over time, these joint systems can wear or degrade, releasing particles of potentially toxic metals such as cobalt and chromium into the blood stream. The impact on patient health is of substantial concern, and the accurate measurement of metal ions in whole blood at very low concentration levels by clinical laboratories is therefore extremely important for device failure prediction and patient health management. These types of measurements are challenging because exogenous contamination, instrument sensitivity, and interferences can easily cause measurement biases in the data. In general, laboratory performance for these types of measurements has been relatively poor. To address these issues, international regulatory agencies are establishing action levels and developing performance standards that are being assessed through proficiency testing schemes. NIST has partnered with the Centers for Disease Control and Prevention to produce a new Standard Reference Material (SRM) providing critical quality assurance support for assessing performance standards related to proficiency testing activities, as well as method development and validation. SRM 1401 Trace Metals in Frozen Human Blood consists of four vials of frozen human blood, two vials each of two different concentration levels. Each level is certified for mass fractions of chromium, cobalt, manganese, and molybdenum. The SRM has been designed to complement a similar reference material being developed by LGC in the United Kingdom.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=1401

NIST SRM 2197 Low-Energy Charpy V-Notch Specimens (Self-Verification, 2-mm Striker)
NIST SRM 2198 High-Energy Charpy V-Notch Specimens (Self-Verification, 2-mm Striker)

Charpy impact testing is a technique used worldwide since the early 1900s for characterizing the notch toughness of metals, and thereby their suitability for applications ranging from ship hulls and railroad tracks to nuclear reactor pressure vessels. Since 1989, NIST has been providing the international community with certified reference specimens, which can be used to indirectly verify a Charpy machine for compliance with the ASTM E23 standard. Up to its 2012 version, ASTM E23 only covered Charpy strikers with a radius of striking edge equal to 8 mm; the striker is the part of the pendulum that impacts and fractures the specimens. The Charpy SRMs supplied by NIST (2092, 2093, 2096, 2097, 2098) could therefore only be used to verify a machine equipped with an 8-mm striker. After ASTM E23 was revised in 2016 to include machines equipped with 2-mm strikers (radius of the striking edge = 2 mm), which were already covered by other well-established standards like ISO 148, NIST decided to certify and make available Charpy reference specimens to be used for the indirect verification of machines with 2-mm strikers. SRM 2197 (low energy) and SRM 2198 (high energy) are now available to customers in the form of Self-Verification specimens. Similar to the existing SRM 2093 and SRM 2097 (used with 8-mm strikers), customers who purchase SRM 2197 and SRM 2198 receive certificates with the corresponding certified values and expanded uncertainties of absorbed energy, and can autonomously establish, on the basis of their test results, whether their machines are in compliance with ASTM E23. Broken specimens are not returned to NIST, and no official Verification Letter is issued. Unlike SRMs for 8-mm strikers, which must be tested at -40 °C, SRM 2197 and SRM 2198 must be tested at room temperature (21 °C ± 1 °C).

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=2197
https://www-s.nist.gov/srmors/view_detail.cfm?srm=2198

NIST SRM 2492 Bingham Paste Mixture for Rheological Measurements
NIST SRM 2493 Bingham Mortar Mixture for Rheological Measurements

Over the past 20 years, the concrete industry has increased its use of rheometers to characterize the fresh flow properties of cement-based materials (e.g., grouts, conventional concrete, and self-compacting concrete). The increased interest in quantitative rheological measurements has been largely the result of the industry wanting to use increasingly complex construction materials. Commercially available rheometers can vary from table-top devices for measuring the paste component of the concrete, to large units with a capacity of 20 L for measuring concrete. Rheometer calibration is traditionally done using standard oils of known viscosity. Concrete materials, however, are a non-Newtonian dense suspension, and are more accurately characterized as a Bingham fluid, having a yield stress and a plastic viscosity. Thus, there was a need to develop a progression of SRMs having the characteristics of paste, mortar (paste with small aggregates), and concrete (mortar with large aggregates) for calibrating concrete rheometers. NIST has developed two Bingham-like materials SRM 2492 (paste) and SRM 2493 (mortar – which incorporates SRM 2492 as the paste component). Presently, SRM 2497 (concrete – which incorporates SRM 2493 as the mortar component) is being developed.

The paste SRM 2492 was certified using a parallel plate rheometer, and the SRM 2493 was certified using, for the first-time ever, computer simulation instead of physical measurements. The SRM 2493 rheological properties were calculated using a model based on a Smooth Particle Hydrodynamics developed jointly by NIST's Engineering Laboratory and Information Technology Laboratory. This model simulated the flow of a suspension composed of a non-Newtonian paste (SRM 2492) with small aggregates (1 mm glass beads). Modeling the rheological properties of SRM 2493 was essential because no physical device exists that could measure the rheological properties of the material in fundamental units and with no influence of the rheometer configuration. After obtaining the calibration factors, the operator with the certified values of the SRM 2493 can obtain rheological properties in fundamental units, independent of the rotational rheometer used. These series of SRMs constitute the first rheology reference materials designed for pastes and suspensions with 1 mm to 10 mm particles. An ASTM test method under sub-committee C01.22 (currently under ballot) would use these SRMs for calibration of rheometers.

A unit of SRM 2493 consists of four containers, one glass bottle of corn syrup (500 g), two plastic jars of limestone powder (600 g each) and one plastic jar of 1 mm glass beads (1500 g). SRM 2492 is identical to SRM 2493, but does not contain the plastic jar of glass beads. At least two batches can be produced with the materials provided. Instructions for preparing the material and for calibrating a rheometer are provided on the certificate and on the website.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=2492
https://www-s.nist.gov/srmors/view_detail.cfm?srm=2493

NIST SRM 2859 Restricted Elements in Polyvinyl Chloride
NIST SRM 2861 Restricted Elements in Polyvinyl Chloride

In collaboration with the U.S. Consumer Product Safety Commission (CPSC), NIST developed and issued two SRMs for restricted elements in polyvinyl chloride (PVC). SRM 2859 and SRM 2861 are sold as bottles containing 25 g of extruded pellets. The polymers were prepared in collaboration with Polymers Center of Excellence, Charlotte, NC. The extruded pellets passed acceptance testing for material composition variance (heterogeneity) and compatibility with X-ray fluorescence spectrometry (XRF) and inductively coupled plasma optical emission spectrometry (ICPOES) test methods. Quantitative analyses for certification were performed by NIST Chemical Sciences Division, CPSC in Rockville, Maryland, and Underwriters Laboratories (UL) in Melville, New York.

SRM 2859 is intended for validation of test methods for PVC used in products covered by the European Union directive on Restriction of Hazardous Substances (RoHS) in electrical and electronic products and similar regulations. RoHS limits are mass fractions of 0.1 % for lead (Pb), mercury (Hg), hexavalent chromium (Cr(VI)), and individual brominated flame retardants (BFRs), and 0.01 % for cadmium (Cd).

SRM 2861 is intended for validation of test methods for PVC used in products covered by ASTM International F963-11 Standard Consumer Safety Specification for Toy Safety, which contains limits for soluble amounts of the elements antimony (Sb), arsenic (As), barium (Ba), cadmium (Cd), chromium (Cr), lead (Pb), mercury (Hg), and selenium (Se) in coatings and substrates in toys. ASTM F963 has been incorporated by reference into regulations. Manufacturers find it useful to analyze materials for the total amount of each element and to estimate the maximum possible amounts of restricted compounds (BFRs and Cr(VI)) based on the test results. Published standard test methods based on XRF and ICPOES enable rapid analyses with XRF being substantially faster but less sensitive than ICPOES. Both types of test methods require calibration, and certified reference materials are needed for validation of test results.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=2859
https://www-s.nist.gov/srmors/view_detail.cfm?srm=2861

NIST SRM 2924 C-Reactive Protein Solution

C-reactive protein (CRP) is a biomarker for inflammation due to infections or other medical conditions (e.g. rheumatoid arthritis or lupus). Because persistent low levels of inflammation can also be associated with cardiovascular disease, high-sensitivity CRP (hs-CRP) assays that can detect low levels of CRP in serum are used to predict risk of heart disease combined with other mitigating factors. In a healthy individual, CRP is found at a level less than 1 milligram per liter (mg/L) in serum. Recent evidence suggests that a CRP level between 1 mg/L and 3 mg/L indicates a moderate risk of cardiovascular disease while a level greater than 3 mg/L predicts a high risk. The NIST team produced the certified reference material of pure CRP for the intended purpose of calibrating diagnostic tools and procedures that measure these low levels of CRP with greater accuracy, precision and traceability to the International System of Units (SI). A unit of the SRM contains 3 vials, each with 1 mL of a solution of recombinant CRP in aqueous buffer containing 20 mmol/L TRIS-HCl (pH 7.5), 140 mmol/L NaCl, 2 mmol/L $CaCl_2$ and a volume fraction of 0.05 % NaN_3. A certified concentration value for CRP is reported along with reference density, relative average mass and concentration values (expressed in terms of grams per liter). SRM 2924 was certified for concentration by amino acid analysis involving isotope dilution liquid chromatography-tandem mass spectrometry (ID-LC-MS/MS). This advanced measurement method was optimized and rigorously tested against an existing higher-concentration certified reference material for CRP from the National Metrology Institute of Japan. Stability of the SRM was also carefully assessed through chromatographic and mass spectrometric techniques. SRM 2924 was developed by NIST to meet the needs of the in-vitro diagnostic and research communities for a "higher order" reference material to obtain traceability to SI units. The SRM is stored and shipped frozen and must be thawed at room temperature before use.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=2924

NIST SRM 3035 Arsenic Species in Apple Juice

Arsenic appears in many chemical forms with varying degrees of toxicity. In diet, the arsenite (AsIII) and arsenate (AsV) forms are the most toxic, and the sum of these two forms of arsenic is known as inorganic arsenic (iAs). The U.S. Food and Drug Administration (FDA) established 23 µg/L of iAs in apple juice as a level of concern in 2008, and arsenic species must be determined if the content of total arsenic is >23 µg/L. In July 2013, (FDA) announced an "action level" of 10 µg/L for iAs in apple juice. NIST, in collaboration with the Centers for Disease Control and Prevention and FDA developed Standard Reference Material (SRM) 3035 Arsenic Species in Apple Juice to meet the needs in food safety measurements. SRM 3035 is intended for quality assurance and method validation in the measurement of arsenic species and total arsenic in apple juice around the regulatory guidelines and limits. A unit of SRM 3035 consists five 2 mL vials individually packaged with an oxygen absorber in an aluminized polyethylene pouch. Each vial contains approximately 1.5 mL frozen apple juice.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=3035

Renewal SRMs/RMs

NIST SRM 187f Sodium Tetraborate Decahydrate (Borax), pH Standard

The quantity pH is widely used in numerous fields, including clinical chemistry, civil engineering, environmental science, and the food and beverage industries. In part, the ubiquity of pH measurements stems from the rapid, inexpensive, and convenient analysis afforded by the glass pH electrode. To ensure reliability of pH measurements made by the glass electrode, regular calibration against standard pH buffers is necessary. These standard pH buffers are traceable to the SI via primary standards. SRM 187f is the latest renewal in the NIST SRM series of primary standard buffers for pH calibration.

SRM 187f certified pH(S) values are provided for buffer solutions prepared as a 0.01 mol kg^{-1} of borax at 5 °C temperature increments from 5 °C to 50 °C and at 37 °C. The certified pH(S) values correspond to $\log(1/a_H)$, where a_H is the conventional activity of the hydrogen ion referred to the standard state of 1 atmosphere on the scale of molality. Traceability to the SI is established following the 2002 recommendations from the Working Party on pH of the International Union of Pure and Applied Chemistry.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=187f

NIST SRM 968f Fat-Soluble Vitamins in Frozen Human Serum

In 1989 NIST developed Standard Reference Material (SRM) 968 Fat-Soluble Vitamins in Human Serum for use in validating methods for determining retinol, alpha-tocopherol, and beta-carotene in human serum/plasma. Due to the popularity and increased usefulness of this SRM, this material has since been re-issued seven times (as SRM 968a, SRM 968b, SRM 968c, SRM 968d, SRM 968e, and as the newly developed material, SRM 968f Fat-Soluble Vitamins in Frozen Human Serum). SRM 968f is a frozen human serum and consists of two concentration levels certified by NIST for total retinol, alpha-tocopherol, and gamma- plus beta-tocopherol. Non-certified values, formerly known as reference and information values, are also provided. These values include method-specific results for vitamin D metabolites and consensus results for carotenoids and other vitamin-related analytes measured by participants in the NIST Micronutrients Quality Assurance Program (MMQAP). Over the MMQAP's 34-year lifetime, NIST's Chemical Sciences Division and its predecessors supported the clinical and nutritional communities' measurement technology for selected fat- and water-soluble vitamins and related analytes in human serum through development of measurement technologies, reference materials, and interlaboratory studies.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=968f

The Silver Crown Mine site in central Colorado, USA. Photo by S.A. Wilson, USGS.

NIST SRM 2780a Hard Rock Mine Waste

Recently, NIST issued SRM 2780a Hard Rock Mine Waste, which is intended for use in checking the accuracy of analysis methods for rocks and byproducts of ore refining. A unit of SRM 2780a consists of approximately 50 g of powdered material of which 90 % passes a 150 μm (No. 100) sieve. Hard rock mine waste is the pile of rocks, usually yellow, white, or orange, that miners removed and dumped down the mountainside as they dug their tunnels to reach valuable ores and minerals. Travelling through the Rocky Mountains, one can see many such piles of rubble coloring the landscape. Because weathering can release hazardous substances from these rocks, geologists and environmental scientists analyze the materials to identify abandoned mining sites and the impacts of mining activities. Today's mining companies must perform chemical analyses of their rocky waste and tailings, the material left after removal of valuable metals.

SRM 2780a was produced from materials collected from mine waste piles in three locations in central Colorado. The U.S. Geological Survey collected and processed the mine waste into the powder form that has been certified by NIST. SRM 2780a has certified values for mass fractions of 35 elements, reference values for 26 constituents, and information values for five elements. In addition, there are values for the entire lanthanide series, except promethium (Pm). Certification analyses were a joint effort of laboratories in nine countries, including the United States, Brazil, Australia, Bulgaria, Canada, Ireland, Mongolia, Russia, and South Africa.

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https://www-s.nist.gov/srmors/view_detail.cfm?srm=2780a

SRM 1879b	Respirable Cristobalite (Quantitative X-Ray Powder Diffraction Standard)
SRM 2035b	Ultraviolet-Visible-Near-Infrared Wavelength/Wavenumber
SRM 2622a	Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 2 % mol/mol)
SRM 3120a	Germanium (Ge) Standard Solution
SRM 3165	Vanadium (V) Standard Solution
SRM 3185	Nitrate Anion (NO_3^-) Standard Solution

Certificate Revisions

This is a list of our most recent certificate revisions. NIST updates certificates for a variety of reasons, such as to extend the expiration date or to include additional information gained from stability testing. Certificates are the official source for values and expiration dates. Users of NIST Standard Reference Materials should ensure that they have the current certificates. You can print or view a copy of the current certificate at our website at *https:/www.nist.gov/srm* or contact the Office of Reference Materials at **phone** 301-975-2200, **fax** 301-926-4751, or **email** *srminfo@nist.gov*

SRM 126c High-Nickel Steel (Nominal Mass Fraction 36 % Ni) (chip form) Editorial changes	**SRM 656 Silicon Nitride Powders (Quantitative Analysis Powder Diffraction)** Editorial changes	**SRM 1486 Bone Meal** New expiration date: 01 October 2025 Editorial changes
SRM 331a Copper Ore Mill Tails New expiration date: 01 October 2027 Editorial changes	**SRM 674b X-Ray Powder Diffraction Intensity Set (Quantitative Powder Diffraction Standard)** Editorial changes	**SRM 1546a Meat Homogenate** Editorial changes
SRM 423 Molybdenum Oxide Concentrate (Powder Form) New expiration date: 01 July 2026 Editorial changes	**SRM 861 Nickel-Based Superalloy PWS 1484 (chip form)** Editorial changes	**SRM 1575a Trace Elements in Pine Needles (*Pinus taeda*)** Editorial changes
SRM 625 Zinc-Base Die-Casting Alloy A Editorial changes	**SRM 864 Nickel Alloy UNS N06600 (chip form)** Editorial changes	**SRM 1647f Priority Pollutant Polycyclic Aromatic Hydrocarbons in Acetonitrile** Editorial changes
SRM 626 Zinc-Base Die-Casting Alloy B Editorial changes	**SRM 972a Vitamin D Metabolites in Frozen Human Serum** Editorial changes	**SRM 1658a Methane in Air (Nominal Amount-of-Substance Fraction 1 µmol/mol) Lot 12-F-XX** New expiration date: 30 September 2024
SRM 627 Zinc-Base Die-Casting Alloy C Editorial changes	**SRM 1082 Cigarette Ignition Strength Standard** New expiration date: 30 June 2019	**SRM 1660a Methane and Propane in Air (Nominal Amount-of-Substance Fraction 4 µmol/mol Methane; 1 µmol/mol Propane) Lot 91-E-XX** New expiration date: 03 January 2025
SRM 628 Zinc-Base Die-Casting Alloy D Editorial changes	**SRM 1134 Low-Alloy High-Silicon Steel (disk form)** Editorial changes	**SRM 1664a Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 2500 µmol/mol) Lot 9-X-XX** New expiration date: 03 January 2025
SRM 629 Zinc-Base Die-Casting Alloy E Editorial changes	**SRM 1158 High-Nickel Steel (Nominal Mass Fraction 36 % Ni) (disk form)** Editorial changes	**SRM 1667b Propane in Air (Nominal Amount-of-Substance Fraction 50 µmol/mol) Lot 83-K-XX** New expiration date: 01 July 2024
SRM 630 Zinc-Base Die-Casting Alloy F Editorial changes	**SRM 1244 Nickel Alloy UNS N06600 (disk form)** Editorial changes	**SRM 1696a Sulfur Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 3500 µmol/mol) Lot 90-D-XX** New expiration date: 05 January 2025

SRM 1718 Nitrous Oxide in Air (Nominal Amount-of-Substance Fraction 1 µmol/mol) New expiration date: 11 August 2023	**SRM 2625a Carbon Dioxide in Nitrogen (Nominal Amount-of-Substance Fraction 3.5 % mol/mol) Lot 36-D-XX** New expiration date: 13 February 2025	**SRM 3142a Praseodymium (Pr) Standard Solution** New expiration date: 31 May 2023
SRM 1830 Soda-Lime Float Glass (Nominal Mass Fraction 0.1 % Al_2O_3) Editorial changes	**SRM 2688 Portland Cement Clinker** New expiration date: 08 March 2027	**SRM 3152a Sodium (Na) Standard Solution** New expiration date: 31 January 2021 Editorial changes
SRM 1831 Soda-Lime Sheet Glass (Nominal Mass Fraction 1.2 % Al_2O_3) Editorial changes	**SRM 2696 Silica Fume (powder form)** Editorial changes	**SRM 3181 Sulfate Anion (SO_4^{2-}) Standard Solution** New expiration date: 31 July 2019
SRM 1878b Respirable Alpha Quartz (Quantitative X-Ray Powder Diffraction Standard) Editorial changes	**SRM 2741a Carbon Monoxide in Nitrogen (Nominal Amount-of-Substance Fraction 13 % mol/mol) Lot 60-C-XX** New expiration date: 16 February 2025	**SRM 3234 Soy Flour** New expiration date: 20 August 2022 Editorial changes
SRM 1946 Lake Superior Fish Tissue Editorial changes	**SRM 2750 Methane in Air (Nominal Amount-of-Substance Fraction 50 µmol/mol) Lot 211-D-XX** New expiration date: 01 August 2021	**SRM 3667 Creatinine in Frozen Human Urine** New expiration date: 31 January 2023 Editorial changes
SRM 1951c Lipids in Frozen Human Serum New expiration date: 30 April 2023 Editorial changes	**SRM 2886 Polyethylene (Mass Average Molar Mass [M_W] 87 000 g/mol)** Editorial changes	**SRM 4321c Natural Uranium Radioactivity Standard Solution** Editorial changes
SRM 2259 Polychlorinated Biphenyl Congeners in 2,2,4-Trimethylpentane New expiration date: 30 September 2036	**SRM 2899a Ethanol-Water Solution (Nominal Mass Fraction 25 %)** New expiration date: 28 February 2032	**SRM 4352 Human Liver Environmental Radioactivity Standard** Editorial changes
SRM 2260a Aromatic Hydrocarbons in Toluene Editorial changes	**SRM 2973 Vitamin D Metabolites in Frozen Human Serum (High Level)** Editorial changes	**RM 8281 Single-Wall Carbon Nanotubes (Dispersed, Three Length-Resolved Populations)** New expiration date: 31 January 2023 Editorial changes
SRM 2374 DNA Sequence Library for External RNA Controls New expiration date: 01 October 2027 Editorial changes	**SRM 2976 Trace Elements and Methylmercury in Mussel Tissue (Freeze-Dried)** New expiration date: 01 October 2027 Editorial changes	
SRM 2391c PCR-Based DNA Profiling Standard Editorial changes	**SRM 3114 Copper (Cu) Standard Solution** New expiration date: 28 February 2021 Editorial changes	

NIST 2018 SRM EXHIBIT SCHEDULE

Pittsburgh Conference (PITTCON)
Booth #3019
February 27 – March 1, 2018
Orange County Convention Center
Orlando, FL

AACC Meeting & Clinical Lab Exposition (AACC)
July 31 – August 2, 2018
McCormick Place Convention Center
Chicago, IL

AOAC Annual Meeting & Exposition (AOAC)
Sheraton Centre Hotel
August 26-29, 2018
Toronto, ON Canada

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Prepayment Policy on NIST SRM Orders

The NIST SRM program enacted a prepayment policy effective November 13, 2017 in order to comply with federal statutes. The United States Department of Treasury has tasked all Federal Agencies to reduce & eliminate delinquent debt. Therefore, all purchases of NIST SRMs will require payment at the time of order. Customers may view a copy of the memo which will explain the policy further at

https://www.nist.gov/sites/default/files/documents/2017/09/20/srm_orders_omb_2017-09-15.pdf.

You may also speak with a SRM sales representative at 301-975-2200 and press option 1.

NIST understands that this new policy may inconvenience our customers and regret that our policy may be affecting some of those with an excellent history of doing business with the federal government. Thank you for your support of our reference materials program, we sincerely appreciate your past and continued business.

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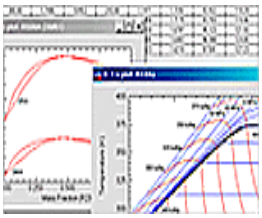

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