

Reply to Queries Regarding ‘Thermoelectric Power Factor Measurement System’

Modifications in specifications after queries received during and after Pre-bid

M/s SG Instruments Private Limited, New Delhi, representing LINSEIS			
Sl.No.	Existing Specification	Clarification Requested/ amendments suggested	Decision of the Committee
1.	The purpose of the instrument is to determine thermoelectric power factor (PF) by simultaneously measuring the Seebeck coefficient and electrical conductivity/resistivity. It is preferred if the machine can measure thermal conductivity also.	Your tender has requested for measuring See Beck, Electrical Conductivity and also Thermal Conductivity preferably. Can we offer two separate offers. One offer for separate See beck and Thermal conductivity and the other for a combined system.	The specification is modified as follows: The purpose of the instrument is to determine thermoelectric power factor (PF) by simultaneously measuring the Seebeck coefficient and electrical conductivity/resistivity.
2.	Should be able to measure samples with dimensions, rectangular (cross section): 2mm x 2mm x 6mm (length) to 2mm x 2mm x 20mm (length) and cylindrical of diameter 2 mm x 20 mm (length)	Sample size mentioned are not conducive to the lead intervals mentioned in the specifications. Lead interval of 3 to 8mm is not quite good in 6mm length sample. We have 4, 6 and 8mm interval possible. So 6 and 8mm are not adjustable in 6mm length. Sample length should be around 10mm. Please make necessary amendment in this area.	The specification is modified as follows: Should be able to measure samples with dimensions, rectangular (cross section): 2 mm x 2 mm x 10 mm (length) to 2 mm x 2 mm x 20 mm (length) and cylindrical of diameter 2 mm x 20 mm (length)
3.	It should also be equipped with a motorized lifting system if heavy lifting is required.	In the analysis chamber out design do not have any lift. Please remove this specification. Our system is horizontal and does not need any lift.	This specification is removed
4.	Data must be reproducible with errors less than 5% (or better)in Seebeck Coefficient in the range 10 to 500 $\mu\text{V}/\text{K}$ (or better) and electrical conductivity within 2% in the range 1-	Electrical resistivity accuracy is 10% and See Beck is 7%. Resolution of Seebeck is 10nV/K and Electrical resistivity is 10nOhm. As far as we know these are the maximum output availablein the world	The specification is modified as follows: Data must be reproducible with errors less than 7% (or better)in Seebeck Coefficient in the range 10 to 500 $\mu\text{V}/\text{K}$ (or better) and

	20000 Ohm ⁻¹ cm ⁻¹ (or better). The vendor has to demonstrate these criteria during installation.	market today. Please review and let us have your comment.	electrical resistivity within 10% in the range 1-2000Ohm ⁻¹ cm ⁻¹ (or better). The vendor has to demonstrate these criteria during installation.
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M/s ULVAC,Inc., India Branch, Secunderabad, representing ULVAC			
Sl.No.	Existing Specification	Clarification Requested/ amendments suggested	Decision of the Committee
1.	The phrase “electrical conductivity/resistivity” at three different places.	Change “electrical conductivity/resistivity” to “electrical resistivity”.	The specification is modified as follows: The phrase “electrical conductivity/resistivity” is modified to “electrical resistivity” at three different places.
2.	The purpose of the instrument is to determine thermoelectric power factor (PF) by simultaneously measuring the Seebeck coefficient and electrical conductivity/resistivity. It is preferred if the machine can measure thermal conductivity also.	Remove the specification “It is preferred if the machine can measure thermal conductivity also.”	The specification is modified as follows: The purpose of the instrument is to determine thermoelectric power factor (PF) by simultaneously measuring the Seebeck coefficient and electrical conductivity/resistivity.
3.	Operating temperature range should be at least -150 to 500 °C	Operating temperature range should be at least -80 to +800 °C	The specification is modified as follows: Operating temperature range should be at least -80 to 500 °C (or better range)
4.	Should be able to measure samples with dimensions, rectangular (cross section): 2mm x 2mm x 6mm (length) to 2mm x 2mm x 20mm (length) and cylindrical of diameter 2 mm x 20 mm (length)	Change requested as follows: Should be able to measure samples with dimensions, rectangular (cross section): 2mm x 2mm x 6mm (length) to 2mm x 2mm x 22mm (length) and cylindrical of diameter 2 mm x 22 mm (length)	Since the machine which can measure a sample with 22 mm can also measure a sample with 20 mm. So no change in the specification.

5.	Data must be reproducible with errors less than 5% (or better) in Seebeck Coefficient in the range 10 to 500 $\mu\text{V}/\text{K}$ (or better) and electrical conductivity within 2% in the range 1-20000 $\text{Ohm}^{-1}\text{cm}^{-1}$ (or better).	Change requested as follows: Data must be reproducible with errors less than 5% (or better) in Seebeck Coefficient in the range 10 to 500 $\mu\text{V}/\text{K}$ (or better) and electrical resistivity within 7% in the range 1-0.00005 Ohmcm (or better).	The specification is modified as follows: Data must be reproducible with errors less than 7% (or better) in Seebeck Coefficient in the range 10 to 500 $\mu\text{V}/\text{K}$ (or better) and electrical resistivity within 10% in the range 1-2000 $\text{Ohm}^{-1}\text{cm}^{-1}$ (or better).
6.	Must have the option to measure in the heating as well as cooling cycles	Remove "Must have the option to measure in the heating as well as cooling cycles"	This specification is removed
7.	It should also be equipped with a motorized lifting system if heavy lifting is required.	Remove "It should also be equipped with a motorized lifting system if heavy lifting is required."	This specification is removed
8.	All essential accessories (computer, printer, UPS for the whole unit, Helium gas cylinder etc.) to set-up a fully functional unit should be quoted.	Remove "UPS for the whole unit and Helium gas cylinder" from all essential accessories	Removed
9.	Comprehensive warranty for 3 Years should be provided. AMC charges for 3 years (after warranty) should be quoted separately.	Comprehensive warranty for 1 Year should be provided. AMC charges for 1 year (after warranty) should be quoted separately.	The specification is modified as follows: Comprehensive warranty for 1 Year or more should be provided. AMC charges for 3 years (after warranty) should be quoted separately.

Each bidder should provide a break-up of the price to the individual components in as much detail as possible.

The due date for the tender is extended to 21.10.2015 at 12.00 HRS (IST) and would be opened on the same day at 14.00 HRS (IST).

Thermoelectric Power Factor Measurement System: Technical Specifications (Revised)

The purpose of the instrument is to determine thermoelectric power factor (PF) by simultaneously measuring the Seebeck coefficient and electrical resistivity. It is mandatory that the instrument should be capable of measuring PF of thin films (in addition to bulk materials) through in-built facility or by providing suitable adapters. The instrument should be capable of measuring PF of organic/polymeric, organic-inorganic hybrid and/or inorganic materials. Most of these materials are expected to be air sensitive at elevated temperatures and therefore the properties should be measured in air-excluded conditions.

Operating temperature

- 1) *Operating temperature range should be at least -80 to 500 °C (or better range)*

Substrate requirement

- 1) *Should be able to measure samples with dimensions, rectangular (cross section): 2mm x 2mm x 10 mm (length) to 2mm x 2mm x 20mm (length) and cylindrical of diameter 2 mm x 20 mm (length)*
- 2) *Should support at least three measurement lead separations from 3 to 8 mm or 4 to 8 mm*
- 3) *Standard samples for instrument calibration must be supplied*
- 4) ***Must have in-built facility or special attachments/system to measure thin film Seebeck coefficient and four-terminal electrical resistivity.***

Measurements

- 1) **Must concurrently measure both the Seebeck coefficient and four-probe electrical resistance.**
- 2) **Data must be reproducible with errors less than 7% (or better) in Seebeck Coefficient in the range 10 to 500 $\mu\text{V}/\text{K}$ (or better) and electrical resistivity within 10% in the range 1-2000 $\text{Ohm}^{-1}\text{cm}^{-1}$ (or better). The vendor has to demonstrate these criteria during installation.**
- 3) *Measurement must be controlled by a computer which should be integrated with a full software package (for data collection and data analysis)*

- 4) *Must perform automatic measurement with each temperature difference at a specified temperature ($\pm 2^{\circ}\text{C}$)*
- 5) *Must eliminate dark electromotive force.*
- 6) *Must have Integrated suite/package for thin film measurements*
- 7) *Must support very high no. of data points (>100) for all operations*
- 8) *Export and import data in ASCII format*
- 9) *Multipoint calibration of parameters*

Analysis Chamber

- 1) *The chamber should be made with high quality non-magnetic quality metals which give excellent performance in varying temperatures, inert/air environment without adding to contaminations.*
- 2) *Must have vacuum pump that will ensure pressure of range of 10^{-3} mbar and compatible with the low temperature measurements, preferably scroll vacuum pump.*
- 3) *Must be able to make measurements in inert gas atmosphere and in vacuum (low pressure).*
- 4) *Appropriate chamber cooling mechanism. The skin temperature should not go beyond 50°C . Preferably, safety flow switch/alarm should be in place to stop the furnace if water flow rate is insufficient or stopped.*
- 5) *Water chiller (if required) with circulation pump must be supplied.*
- 6) *Must be able to control the furnace temperature precisely within $\pm 2^{\circ}\text{C}$, in the whole temperature range.*

Mandatory Requirements

- 1) *Power requirements should match Indian standards.*
- 2) *All essential accessories (computer, printer and cooling unit or chiller) to set-up a fully functional unit should be quoted.*
- 3) *The system/components needs CE certification*
- 4) *Vendors must furnish a list of competent national/international client base where they installed similar systems with their full contact details.*
- 5) *The supplier must furnish at least a set of spare thermocouples, sample holder, thin film holder, local heaters and other components that may need replacements on a regular basis.*
- 6) *Comprehensive warranty for 1 Year or more should be provided. AMC charges for 3 years (after warranty) should be quoted separately.*

Inspection and Training

- 1) *Supplier should furnish all the certificates from competent authorities that are required for instrument safety.*
- 2) *They should perform a thorough performance check of the involved components and furnish details such as calibration details of thermocouples, controls and set point deviations etc.*
- 3) *Supplier should provide a full training to the CSIR-NIIST personnel after installation*

Installation, commissioning and start-up

- 1) *Supplier is responsible for the installation, commissioning and start-up of their system by a specialist*
- 2) *Supplier should provide detailed information on pre-installation requirements such as support staff, utilities, space for installation (footprint of equipment) and do a process demonstration at CSIR-NIIST, Trivandrum*
- 3) *The supplier should demonstrate a complete experiment which involves measuring a standard TE material.*

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