DEPARTMENT OF PRODUCTION ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY: TIRUCHIRAPPALLI - 620 015

27.12.2013

Tender Notification No.: NITT/F.NO:SIF017/PLAN2013-14 dt: 19.12.2013

With reference to the above tender notification and the pre-bid conference held on 27.12.2013 at 11.30 AM in the committee room of Physics department, the following amendments are made. All other terms and conditions mentioned in the tender document remains same.

Specification for Universal tribometer

Original tender specification	Amended specification
The Universal Tribometer should be versatile and easy to use for experimental demonstrations and research for various tribological and scratch test applications. The instrument shall be used to measure friction, wear, scratch hardness, adhesion for coatings, bulk materials etc. In addition, it should be capable of performing 3D imaging with white light interferometer. **1.1 Load range (N) and resolution (mN) :** 0.1 - 1000 and < 100 mN resolution • Test in following modes ➢ Linear load control – increase or decreasing load ➢ Constant load control ➢ Load control using close loop control (not by dead weights) **1.2 Frictional force range (N) and resolution (mN) :** 0.1 - 1000 and < 100 mN resolution (Frictional force should be directly measured with high accuracy)	The Universal Tribometer should be versatile and easy to use for experimental demonstrations and research for various tribological and scratch test applications. The instrument shall be used to measure friction, wear, scratch hardness, adhesion for coatings, bulk materials etc. In addition, it should be capable of performing 3D imaging with white light interferometer. **1.1 Load range (N) and resolution (mN) :** 0.1 - 1000 and < 100 mN resolution **(based on single or multi-range loadcells)** • Test in following modes ➢ Linear load control – increase or decreasing load ➢ Constant load control ➢ Load control using close loop control (not by dead weights) **1.2 Frictional force range (N) and resolution (mN) :** 0.1 - 1000 and < 100 mN resolution. (Frictional force should be directly measured with high accuracy) **(based on single or multi-range loadcells)**
2.1 Drives **a) Rotary drive** • Rotational speed (RPM) (min range): 0.1 -1500 (Clockwise and anti-clockwise motions) • Should include heating chamber with temperature range of 40-800°C or more for elevated temperature rotary tribo-testing. • Should include liquid container for rotary tribo-testing with liquids at room temperature. • Room temperature test with liquids at high speed (prevent splash) **b) Linear drives** **Y Long Stroke Linear Drive** ➢ For creation of linear tracks with long unidirectional reciprocating stroke. ➢ Stroke 0.1 to 60 mm or more, Speed 0.1 to 60mm/s or more **X Linear drive** ➢ For changing test radius and to create custom wear track when used with Y long stroke linear drive ➢ Stroke 20mm (minimum), speed 10mm/s (minimum)	**2.1 Drives** **An optional multi station testing to accommodate all rotary, linear and reciprocating drives.** **a) Rotary drive** **No amendment** **b) Linear drives** **No amendment**

c) Reciprocating drive– For fretting test, high speed wear test • Stroke 0.1 to 20 mm or more, Speed up to 50Hz • Should include liquid container • Should include temperature chamber (800°C or more) • Room temperature test with liquids at high speed (prevent splash) **2.2 Holders (for rotary and linear drive)** • Ball holder (minimum diameter): 1.5 mm, 6.0 mm, 9.0 mm, 10 mm • Pin holder (minimum diameter) : 6.0 mm	**c) Reciprocating drive**– For fretting test, high speed wear test • Stroke 0.1 to 20 mm or more, **Frequency** up to 50Hz • Should include liquid container • Should include temperature chamber (800°C or more) • Room temperature test with liquids at high speed (prevent splash) **2.2 Holders (for rotary and linear drive)** **No amendment**
3.1 Software The software should include following set of features for setting up the machine and handling the data: • Real time display of friction coefficient and temperature. • Easy setup of all the test parameters including rotational speed, frequency, number of laps, threshold coefficient of friction, temperature and time. • Automatic calculation of mean coefficient of friction, standard deviation and maximum/ minimum values from selected parts. • Advanced modeling software for simulation.	**No amendment**
4.1 Consumables • 440-C stainless steel balls (corresponding to the diameter of ball holder) -10 each.	**No amendment**
5.1 Imaging module **3D White light Interferometer (Integrated or stand-alone)** To generate sub-micron 3D images of wear mark, scratch sample and to calculate wear volume. Automatic XYZ Stage: 75x75x50 mm (minimum) Magnification: 10x, 20x, 50x Resolution: <0.1nm Standard sample **Note:** If stand-alone system is provided for off-line measurements, it should be manufactured by the same manufacturer to ensure full compatibility and support. No third party systems shall be allowed.	**5.1 Imaging module** **3D White light Interferometer (Integrated or stand-alone)** To generate sub-micron 3D images of wear mark, scratch sample and to calculate wear volume. Automatic XYZ Stage: **100x75x100 mm** (minimum) Magnification: **5x, 20x, 100x** **Range: 2mm or more with** Resolution < 0.1 nm Standard sample **Automatic imaging and stitching software should be provided as standard.** **Vibration free pneumatic anti vibration platform for imaging module.** **Three position manual Turret for mounting objectives to be provided** **Note:** If stand-alone system is provided for off-line measurements, it should be manufactured by the same manufacturer to ensure full compatibility and support. No third party systems shall be allowed.
6.1 Scratch module • Scratch test module to calculate scratch adhesion, scratch hardness. • Rockwell tip and suitable holder to be provided • 10N load and friction range <10mN resolution • Automatic imaging and stitching of entire wear track after the scratch test • Creation of linear, rotary or custom wear track	**No amendment**
Mandatory Requirements: • The equipment should be fully automatic and computer controlled. • Computer controlled system comprising of Personal Computer and Installed Software. • Controller should include 8-Channel, 16-bit data acquisition system up to 200 kHz.	**No amendment**

• All drives should be servo-controlled. • Should include automated calibration procedures. • Should provide options for in-situ measurement of down force, friction force, wear rate, motions and temperature.	
Note: The following additional documents are mandatory for technical qualification. Otherwise the bid will be technically rejected. a) References (with full postal address and name of the contact person with phone, FAX numbers, and E-Mail id) from at least one end-user from India and one end-user from abroad to whom the quoted model/similar model was supplied during the last three years. Any other accessories apart from the mandatory accessories and systems mentioned above may be quoted separately. Pre-installation/post-installation training expenses (including travel, boarding and lodging) should be borne by the supplier	**No amendment**

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