

**Industrial Tribology, Machine Dynamics and  
Maintenance Engineering Centre (ITMMEC)  
Indian Institute of Technology Delhi  
Hauz Khas, New Delhi-110016, India**

October 8, 2013

Ref: ITMMEC/IITD/EHL Test Rig/2013/

**Sub: Notice for Invitation of Quotations (NIQ) for Procurement of  
Elastohydrodynamic Lubrication (EHL) Test Rig**

Sealed quotations are invited for one number 'Elastohydrodynamic Lubrication (EHL) Test Rig' for ITMMEC, IIT Delhi.

**EHL Test Rig**

EHL test rig is intended for carrying out academic research work for the design and development of energy efficient generic lubricated (boundary/mixed/hydrodynamic) concentrated rolling/sliding contacts, simulating the contacts of the machine elements viz. rolling bearing, gears, cams and followers, etc.

The functioning of the rig for **the measurement of film thickness must be based on optical interferometry concept**. The rig must have features for **measuring the traction coefficient and displaying the pressure profile from the measured film thickness** at the generic concentrated line/point/elliptical contacts as functions of disc speed, contact load, slide-to-roll ratio, inlet oil temperature, etc.

The rig (i.e. setup) should be complete in all respect for its functioning and performance parameters measurement. All its units (mechanical, electronics, personal computer/Laptop, charge-coupled devices camera, etc.) should be compact in size, which can together be accommodated on a table top. The software for rig operation and performance parameters display must have features for transferring the input and output data in editable word files.

**Essential Technical Requirements/Features:**

1. Range of oil film thickness to be measured at line/point/elliptical concentrated contacts: 1 to 500 nm (accuracy;  $\pm 4\%$  )
2. Rolling speed: 0.006 to 4 m/s (accuracy;  $\pm 1$  mm/s)
3. Load applied: 0 to 50 N (accuracy;  $\pm 1$  N)

Load applied should create range of pressures at the concentrated contact: 0.05 to 1.0 GPa (and above with steel disc), and 0.05 to 0.5 GPa (and above with glass disc)

4. Temperature variation of lubricating oil ( in pot /reservoir) should be from ambient condition to 150  $^{\circ}$ C (accuracy:  $\pm 0.1$   $^{\circ}$ C)

5. Rotating discs: Steel disc (AISI 52100), 100 mm diameter, 12 mm thickness, surface finish <math> < 0.02 \mu\text{m}</math>, surface hardness > 750 Hv), and Glass disc (Optical float glass, 100 mm diameter, 12 mm thickness, coating with Cr+SiO<sub>2</sub>)
6. Ball and roller materials (AISI 52100, 0.75 inch diameter, surface finish <math> < 0.02 \mu\text{m}</math>, surface hardness > 800 Hv)
7. Provision for pure rolling and rolling with sliding between ball/roller and disc
8. Optical interferometer for lubricant film thickness measurement between glass disc and ball / roller
9. CCD (charge-coupled devices) camera; high resolution ( equal or more than 768x1024 pixels), high speed to capture the fringe images (equal or more than 25 frames per second)
10. Traction force measurement (accuracy;  $\pm 0.1 \text{ N}$  ) at the concentrated contacts using high sensitive torque transducer (4 gauge bridge, 5V excitation)
11. Oil sample reservoir: Single block stainless steel with internal channels to allow sub-ambient temperature conditions using refrigerated circulating bath.
12. RTD (Resistance Temperature Detector) probes for measuring the temperatures of steel block, ball / roller surface and lubricating oil (accuracy:  $\pm 0.1^{\circ}\text{C}$ )
13. Safety provision: Automatic shut down, if sample or ball surface temperature exceeds safety limit.
14. Software: Dedicated and proven window-based software that allows automatic control functions for film thickness and traction measurements including temperature, load, motor speeds, image acquisition and processing, display of data and storage, editing, etc., with spreadsheet and graphical data display.
15. Supplying of full set of required calibration equipment.
16. Provision for manipulating the operating variables.
17. Computer with colour printer: Branded Personal computer and colour printer (Specification of PC: Dual core processor 3.3GHz, Windows 7 professionals 32 bit, 500GB hard disc, RAM: 4 GB, 22 inch TFT monitor with 1920x1080 resolution) + Inkjet colour printer of standard configuration

### **Desirable Requirements:**

1. Measuring film thickness at more than 2 GPa Hertzian pressure, including supplying of suitable disc.
2. Capturing of vibration at the contact in presence of high speeds and loads.

## Terms and Conditions:

1. Technical and Commercial bids are to be submitted in separate sealed cover, and marked clearly on the top of the envelope, and both these envelopes should be placed inside a large sealed envelope marked with “Quotation for Procurement of EHL Test Rig”. The technical bid must include filled-up ‘Compliance Table’, indicating if the essential and desirable requirements are met or not. Compliance table is attached herewith.
2. Quoted price of the imported item at FOB (Freight on Board); IIT Delhi, inclusive of all taxes, freight, delivery, installation and onsite training charges.
3. Optional accessories of the rig and desirable requirements should be quoted separately.
4. The submitted bid needs to have detailed information / diagram, operation characteristics, etc. The rig or setup quoted should be complete in all aspects, including providing of operational and service manual, other documentation.
5. Either an Indian agent on behalf of the Principal/OEM or Principal/OEM itself can bid, but both cannot bid simultaneously for the same item in the same tender.
6. If the bidder is an authorized dealer of any manufacturer, the authorized Indian dealership certificate from the principles should be enclosed. Similarly, proprietary certificate for proprietary items should be provided.
7. In case IIT Delhi is imposed with demurrage charge due to import on CIF, the entire demurrage charge will be borne by the Indian Agent of foreign supplier.
8. **Payment after 3 weeks of satisfactory installation and working demonstration** of the Test Rig in laboratory at IIT Delhi.
9. **Delivery period:** within 3 months from the issue of supply order.
10. Comprehensive onsite Warranty for 3 years.
11. The quotations must have **validity** of at least three months.
12. IIT Delhi reserves the right to reject any or all quotations without assigning any reasons.

**Please submit the technical and commercial bids in separate sealed envelopes in favour of “Director IIT Delhi”, marked: “Quotation for Procurement of EHL Test Rig”, with attention of the undersigned.** The technical bid should include filled-up of the Compliance Table, indicating if the essential requirements are met or not. The Compliance Table is given in Annexure I. The bid must reach at the following address latest by **5:30 p.m.** of **31<sup>st</sup> October 2013 (Thursday)**.

**Dr. O. P. Gandhi**  
**ITMMEC, Room No. V 244;**  
**IIT Delhi,**  
**Hauz-Khas, New Delhi-110016, India**  
**e-mail: [opgandhi@itmec.iitd.ac.in](mailto:opgandhi@itmec.iitd.ac.in)**

### Compliance Table –EHL Test Rig Quoted

Name of the Supplier: \_\_\_\_\_

Location; Place and Country : \_\_\_\_\_

S.No.	Features	Specifications**		Reamrks
		Met (√)	Not Met (X)	
<b>Essential Features</b>				
1	Range of oil film thickness to be measured at line/point/elliptical concentrated contacts: 1 to 500 nm (accuracy; $\pm 4\%$ )			
2	Rolling speed: 0.006 to 4 m/s (accuracy; $\pm 1$ mm/s)			
3	Load applied: 0 to 50 N (Accuracy: $\pm 1$ N)  Load applied should create range of pressures at the concentrated contact: 0.05 to 1.0 GPa (and above with steel disc), and 0.05 to 0.5 GPa (and above with glass disc)			
4	Temperature variation of lubricating oil ( in pot /reservoir): Ambient to 150 °C (accuracy; $\pm 0.1$ °C)			
5	Disc material: Steel disc (AISI 52100, 100 mm diameter, 12 mm thickness, surface finish $<0.02$ $\mu\text{m}$ , surface hardness $> 750$ Hv); Glass disc (Optical float glass, 100 mm diameter, 12 mm thickness, coating with Cr+SiO <sub>2</sub> )			
6	Ball & Roller material (AISI 52100), 0.75 inch diameter , surface finish $< 0.02$ $\mu\text{m}$ , Surface hardness $> 800$ Hv)			
7	Provision for pure rolling, and rolling with sliding between ball/roller and disc			
8	Optical interferometer for lubricant film thickness measurement between glass disc and ball / roller			
9	CCD (charge-coupled devices) camera High resolution (768x1024 pixels), high speed to capture the fringe images (equal or more than 25 frames per second)			
10	Feature for measuring the traction coefficient and displaying the pressure profile from the measured film thickness  Traction force measurement (accuracy; $\pm 0.1$ N ) at the concentrated contacts, using high sensitive torque transducer (4 gauge bridge, 5V excitation)			
11	Oil sample reservoir; single block stainless steel with internal channels to allow sub-ambient temperature conditions using refrigerated circulating bath.			
12	RTD (Resistance Temperature Detector)			

	probes for measuring the temperatures of steel block, ball / roller surface and lubricating oil (accuracy; $\pm 0.1^{\circ}\text{C}$ )			
13	Safety provision: Automatic shut down, if sample or ball surface temperature exceeds safety limit.			
14	Software: Dedicated and proven window-based software that allows automatic control functions for film thickness and traction measurements including temperature, load, motor speeds, image acquisition and processing, display of data and storage, editing, etc., with spreadsheet and graphical data display.			
15	Supplying of full set of required calibration equipment.			
16	Provision for manipulating the operating variables.			
17	Branded Personal computer with colour printer (Specification of Branded PC: Dual core processor 3.3GHz, Windows 7 professionals 32 bit, 500GB hard disc, RAM: 4 GB, 22 inch TFT monitor with (or better) 1920x1080 pixels resolution) + Branded colour desk jet printer (standard configuration)			
<b>Desirable Features</b>				
1	Measuring film thickness at more than 2 GPa Hertzian pressure, including supplying of suitable discs.			
2	Capturing of vibration at the contact in presence of high speeds and loads.			

**\*\* Each feature of your supplied rig should be checked for its specification. It should be tick marked (✓) or crossed (X) under the sub-column. In case, it's a mix; this should be reflected in the Remarks column.**

**Signature:** \_\_\_\_\_

**(of the authorized person of Company submitting the quote)**

**Name:** \_\_\_\_\_

**Designation:** \_\_\_\_\_

**Place:** \_\_\_\_\_

**Date:** \_\_\_\_\_