



INMOTION ENERGY (OPC) PRIVATE LIMITED

Lubricity Tester

Extreme-Pressure & Coefficient-of-Friction Lubricity Tester for Drilling Fluids — Complete with Friction Ring/Block, EP Ring/Block and Calibrated Torque Wrench

Model No: IM-LUB-EPC

Compliant with API Friction Evaluation Procedures

INSTRUCTION MANUAL

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Inmotion Energy (OPC) Private Limited

186, 1st Main Road, Vijaya Bank Layout, Bilekahalli,

Bangalore, Karnataka – 560076, India

Tel: +91 96637 44619 | info@inmotionenergy.in | inmotionenergy.in

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<i>Introduction</i>	Every foot of hole drilled generates friction — between the bit and the formation, and along the full length of the drill string against the borehole wall. That friction climbs sharply in deep, directional and horizontal wells, showing up as rising torque and drag, and it is the drilling fluid's lubricity that keeps it in check. Judging lubricity by feel at the rig floor isn't good enough to compare one treatment against another; a controlled, repeatable friction measurement is. The Inmotion Lubricity Tester puts that measurement on the bench. A variable-frequency motor turns a friction ring against a stationary block under a known load, and the resistive torque — read off both a calibrated torque wrench and the digital display — converts directly to a coefficient of friction. The same instrument, fitted with a second ring/block pair, also runs the extreme-pressure (EP) film-strength test used to find the load at which a fluid film breaks down and the surfaces seize.
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<i>Description</i>	The IM-LUB-EPC is a variable-frequency friction and extreme-pressure tester built around a driven ring-and-block pair. A frequency-controlled conversion motor turns the friction ring at a closely held speed while a stationary test block, carried on a pivoting torque arm, is loaded against it by a calibrated torque wrench. The wrench reads applied torque directly in both N·m and in-lb, and the touchscreen panel mirrors the reading digitally alongside actual RPM and elapsed run time. Frictional drag between the ring and block is proportional to the load pressing them together — the classic $F = \mu P$ relationship — so once the applied load and resulting drag are known, the coefficient of friction μ follows directly. Because no two ring/block pairs are ground to exactly the same finish, every test is anchored to a correction factor obtained by first running the pair in distilled water, which keeps results comparable from one instrument, and one day, to the next. The instrument carries two independent readings that are easy to confuse and important to keep separate. The torque wrench on the arm sets and monitors the load applied to the block, in N·m or in-lb. The touchscreen's digital display, by contrast, shows the resulting friction-resistance index on its own 0–50 scale — this is the reading used in every coefficient-of-friction and correction-factor calculation in this manual, and it is never the same number as the applied load. A second, dedicated ring/block pair converts the same instrument into an extreme-pressure (EP) tester: run at a faster fixed speed and loaded progressively until the film breaks down and the surfaces seize, the seizure torque and the resulting wear scar give a film-strength figure for the fluid under test. One instrument, two drilling-fluid friction tests:
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- Coefficient-of-friction test — ring speed 60 rpm, standard 150 in-lb (16.95 N·m) load
- Extreme-pressure (EP) film-strength test — ring speed 1,000 rpm, load increased to seizure
- Calibrated, dual-scale (N·m / in-lb) torque wrench that sets and reads the applied load independently of the digital display
- Elevating sample-cup stand submerges the ring, block and holder with a single hand-wheel adjustment



Lubricity Tester, IM-LUB-EPC — front three-quarter view showing the torque arm, torque wrench and HMI panel

Components	Part Number	Description
	IM-LUB-EPC-01	Torque Wrench — calibrated dual-scale (N·m / in-lb) dial, mounted on the torque arm
	IM-LUB-EPC-02	Friction Ring — driven by the conversion motor for the coefficient-of-friction test
	IM-LUB-EPC-03	Friction Block — loaded against the friction ring via the torque arm
	IM-LUB-EPC-04	EP Ring — dedicated ring for the extreme-pressure film-strength test
	IM-LUB-EPC-05	EP Block — dedicated block for the extreme-pressure film-strength test

- IM-LUB-EPC-06** Elevating Sample-Cup Stand — hand-wheel and lead screw raise the stainless steel cup to submerge the ring/block
- IM-LUB-EPC-07** Touchscreen HMI + PLC Control Panel — M/C Stop-Start, Run Time, Actual Torque, Actual RPM, speed and torque presets
- IM-LUB-EPC-08** Measuring Cup — stainless steel sample cup
- IM-LUB-EPC-09** Measuring Magnifier with Scale — for reading the EP wear-scar dimensions
- IM-LUB-EPC-10** Grinding Compound, Fine and Coarse — for ring/block standardization
- IM-LUB-EPC-11** Wrench (15/16") — for the EP ring retainer nut
- IM-LUB-EPC-12** Power Cord



Calibrated torque wrench mounted on the torque arm

Reading the Torque Wrench Dial

The dial carries two scales — metric (N·m) on the inner ring, imperial (in·lb) on the outer — and two pointers. The working pointer moves with the load and is the one to read; the second, drag-linked pointer only marks the highest value reached in a run and is not used for this instrument's procedures.

NOTE

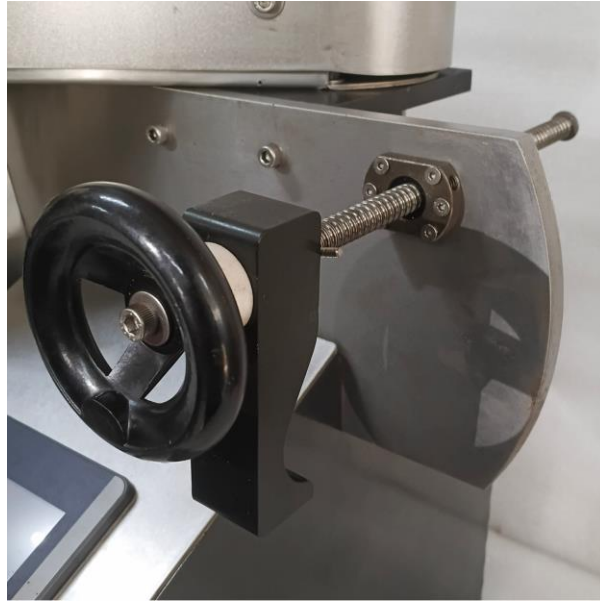
The low end of the dial (below roughly 7 N·m / 60 in-lb, marked in red) carries more than $\pm 3\%$ error. Treat readings in that band as approximate only — the standard test loads in this manual (150 in-lb for the COF test, and the higher loads reached during the EP test) sit well clear of it.



Touchscreen HMI + PLC control panel



Motor and lead-screw assembly at the base of the stand



Hand wheel and lead screw on the torque-arm assembly

Features

- Variable-Frequency Drive — a frequency-controlled conversion motor gives smooth, progressive speed control from 0 to 1,000 rpm, holding the set test speed closely through both test modes.
- Calibrated Torque Wrench — a dual-scale (N·m / in-lb), colour-banded dial sets and reads the applied load directly on the torque arm; no separate load cell to fail in the field.
- Digital Run Data — the touchscreen panel tracks run time, actual torque and actual RPM live, with one-touch presets for the 60 rpm and 1,000 rpm test speeds and the zero and reference torque calibration points.
- Two Tests, One Instrument — the standard coefficient-of-friction pair and the dedicated EP ring/block pair share the same drive and torque arm, so both drilling-fluid friction test methods run on one bench footprint.
- Elevating Sample-Cup Stand — a hand wheel on a lead screw raises the stainless steel cup until the ring, block and holder are fully submerged, then locks with a thumbscrew.
- Compact Benchtop Footprint — mounts on a rigid stand for stable readings on a rig-site bench or lab counter. Runs on AC220V 50Hz (standard) or AC120V 60Hz (USA), $\pm 10\%$.



Close-up of the torque-arm pivot and shaft assembly

Specifications

Temperature Range	Room temperature to 90°C
Power Supply	AC220V 50Hz (standard) or AC120V 60Hz (USA), $\pm 10\%$
Motor Power	750W, variable-frequency conversion motor
Torque Measured	Metric: 0–70 N·m Imperial: 0–600 in-lb
Speed Range	0–1,000 rpm, progressive speed regulation
Torque Meter Display	0–50, least count 1.0
Sample Cup	Approx. 11.5 cm diameter $\times$ 5 cm height, stainless steel
Standard COF Test Condition	Ring speed 60 ± 1 rpm; block load 444.8 N (torque wrench set to 16.95 N·m / 150 in-lb at a 38.1 mm arm)
EP Test Condition	Ring speed 1,000 rpm; load increased to seizure
Applicable Standard	API Friction Evaluation — coefficient-of-friction and extreme-pressure (EP) film-strength testing of drilling fluids

Values shown reflect standard factory specification for this instrument class per API friction-evaluation procedure. Please confirm exact figures — including overall

dimensions and shipping weight — against the calibration certificate and packing list shipped with each unit serial number.



Lubricity Tester, IM-LUB-EPC, full assembly on its stand

Operation — Coefficient of Friction Test

NOTE

Fit the friction ring and block the right way round before starting — the mating faces are matched to each other and to the direction of rotation. Forcing them on backward scores the surfaces and invalidates every reading that follows. Check the orientation shown on the ring and block against the pivot assembly (see the Components photos on page 4) before closing the holder.

1. Place the instrument on a firm, level, vibration-free bench, connect the power cord, and confirm the unit is reliably earthed.
2. Switch on at the M/C Stop/Start key and let the unit run unloaded at 60 rpm for about 15 minutes to warm up.
3. Fill the stainless steel sample cup with distilled water (approx. 260–280 mL), raise the cup stand with the hand wheel until the friction ring, block and holder are fully submerged, and lock the thumbscrew.
4. Press Zero Torque and confirm the display reads zero with the ring and block not yet in contact.
5. Rotate the torque wrench handle clockwise to bring the applied load up to 150 in-lb (16.95 N·m) and hold for the standard interval before recording.



Torque wrench being adjusted during the coefficient-of-friction test

✓ **TIP**

Run the distilled-water reference check before every test series, not just once a day — the correction factor it gives (target digital display reading 32–36, nominal 34) is what keeps results from one ring/block pair comparable to the next.

6. Record the stabilized digital display reading (the 0–50 friction-resistance index, not the torque wrench's load figure) in distilled water, and calculate the correction factor: $CF = 34 \div \text{display reading}$.
7. Release the load, clean the ring and block thoroughly, then submerge them in the fluid sample to be tested in place of the distilled water.
8. Repeat the warm-up, zero and 150 in-lb loading steps against the sample, and record the stabilized digital display reading.

⚠ **IMPORTANT**

Drilling fluids and treatment additives can be caustic or irritating on contact. Gloves and eye protection should be worn any time samples are handled.

9. Calculate the coefficient of friction resistance: $\mu = (\text{display reading} \div 100) \times \text{correction factor (CF)}$.
10. To evaluate a lubricant additive, run the same procedure on the base mud and on the treated sample, then find the percentage reduction: $(\text{base reading} - \text{sample reading}) \div \text{base reading} \times 100$.

Reporting Results

Report the coefficient of friction against the correction factor and test load used, together with the sample temperature, so later results can be compared on a like-for-like basis.

Operation — Extreme Pressure (EP) Test

1. Clean the EP ring and EP block with acetone and rinse thoroughly with deionized water; confirm the sample area is free of residue.
2. Fit the EP ring squarely onto the tapered portion of the drive shaft and secure the retainer nut with the 15/16" wrench.
3. Switch on and let the unit run unloaded at 1,000 rpm for about 5 minutes to warm up.
4. Confirm the EP block sits securely in its holder, then press Zero Torque.
5. Continue running at 1,000 rpm for about 3 minutes until the zero reading stabilizes, and position the torque arm in the torque-arm clamp.
6. Fill the stainless steel sample cup with 260–280 mL of the test fluid, place it on the lowered cup stand, then raise the stand until the ring, block and holder are submerged and lock the thumbscrew.



Close-up of the shaft and pivot assembly where the ring and block mount

7. Rotate the torque wrench handle clockwise to increase load at no more than 5 in-lb per second, continuing until either the target load is reached without seizing (a pass) or the ring and block seize.

	⚠ IMPORTANT <i>A seizure happens quickly and without much warning. Keep a hand near the torque wrench and watch the display closely once the load approaches the expected range.</i> - If the pair seizes, immediately record the torque wrench reading and the display reading, then release the load without delay. - Examine the EP block for wear, and measure the scar width and length with the measuring magnifier. - Calculate film strength: $P = T \div (1.5 \times L \times W)$, where P is film strength in psi, T is the torque wrench reading in in-lb, and L and W are the scar length and width in inches. Reporting Results Report the seizure load (or the pass load if no seizure occurred), the scar dimensions, and the calculated film strength, together with the sample temperature.
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Calibration & Standardization	Correction Factor Check Run the coefficient-of-friction procedure in distilled water before any test series. A digital display reading between 32 and 36 (nominal 34) confirms the ring and block surfaces are within tolerance; calculate the correction factor as $CF = 34 \div \text{display reading}$ and use it for that series. Block & Ring Standardization If the distilled-water reading falls outside 32–36, or the ring speed drifts outside 60 ± 1 rpm, the ring and block surfaces need re-grinding before testing continues. - Clean the surfaces and grind the center by hand. - Apply grinding compound to the friction ring, working it in by hand at 100–200 rpm with a pressure roughly equivalent to 5.6 N·m (50 in-lb) — press by hand, not with the torque wrench, since hand pressure is easier to feel and adjust as you go. Unload every 5 minutes to inspect the surfaces, and repeat 3–4 passes until the finish is even. - Clean off the grinding compound with detergent or soap. - Mix two spoons of aluminum oxide into a cup of deionized water and run it against the pair at 100–300 rpm: 3.3 N·m (30 in-lb) load for 5 minutes, then ease back to 1.65 N·m (15 in-lb) for a further 5 minutes.
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	5. Confirm the ring and block show a bright, evenly ground surface, then clean and dry both with filter paper before re-running the correction-factor check. NOTE <i>A completely stable display reading isn't realistic — friction heat and other factors mean the reading rises slightly before settling. Give the unit at least 5 minutes unloaded between the water check and the actual measurement, and take the reading at a consistent elapsed time, ideally 3–4 minutes into the load; running longer than that shortens the life of the ring and block.</i>
Maintenance	1. Wipe the ring, block and sample cup clean with filter paper immediately after each test — residue left in the ring/block gap will bind the mechanism and skew the next reading. 2. After use, do not remove the friction ring from the shaft. Wash it, and the block, through acetone → ethanol → distilled water, then dry with filter paper. 3. Coat the cleaned ring and block surfaces with a thin film of vaseline or another anti-oxidation medium before storage, and clean it off again before the next use. 4. Keep the instrument connected to a reliable earth at all times, and never move it while the power is on. 5. Keep hands, clothing and loose items clear of the ring and torque arm any time the unit is running. 6. Store the instrument clean, dry and moisture-free, and inspect it on a regular schedule; never strike it with metal tools during maintenance or servicing. NOTE <i>The friction ring and block — and the EP ring and block — are ground and matched to each other as pairs. Replacing only one half of a pair loses that matched fit and calls for a fresh round of standardization; treat each pair as a set.</i>
Transportation & Storage	Move the instrument upright wherever possible, and keep the torque arm and hand wheel from taking sideways impact — the pivot and lead screw are precision-fitted and will bind if racked out of alignment. • Ship or store in the original packaging, or an equivalent rigid case, whenever the unit will travel further than across the lab

- Keep it in a ventilated, dry area free of corrosive vapours; humidity and airborne chemical residue are the two fastest ways to pit an idle ring and block
- Leave the ring and block coated with their anti-oxidation film (see Maintenance, page 13) for any storage longer than a few days
- Avoid storing or transporting near strong vibration sources, which can work bolted joints loose over time

Troubleshooting

Symptom	Possible Cause	Recommended Action
Display stays dark after power-on	Power cord not fully seated, or supply not connected	Check the power cord connection at both ends and confirm the supply is live
Display digits unstable or scrambled	Control circuit not settled, or a fault in the control board	Power-cycle the unit; if the fault persists, the control board should be inspected by a qualified technician
Distilled-water reading falls outside 32–36	Ring or block surface worn or out of standard	Run the Block & Ring Standardization procedure (page 12)
Torque wrench reading won't hold steady	Ring speed has drifted from 60 ± 1 rpm, or load was applied too quickly	Confirm the speed preset and re-apply load smoothly, no faster than 5 in-lb per second
Inconsistent readings between otherwise identical samples	Ring/block not fully submerged, or insufficient warm-up time before loading	Confirm the cup stand is fully raised and locked, and allow the full unloaded warm-up interval before recording
Torque wrench reading looks unreliable at light loads	Reading is in the dial's red (low-accuracy) zone, below $\approx 7 \text{ N}\cdot\text{m}$ / 60 in-lb	Expected — that band carries over $\pm 3\%$ error by design; it does not affect the standard 150 in-lb test load

Still stuck after trying the above? Set the instrument aside and get in touch with Inmotion Energy (see Company & Contact Information, page 17).

Warranty and Return Policy

Warranty

Inmotion Energy (OPC) Private Limited stands behind the materials and workmanship of every instrument it ships. For eighteen (18) months from the invoice date, if a product turns out not to meet its stated specifications through no fault of the buyer, and we're notified in writing once the issue is found, we'll repair or replace it at our discretion, subject to the exclusions below.

This coverage assumes normal use, in line with the operating conditions described in this manual. It does not stretch to cover use outside those conditions, nor to flaws that were plainly visible on arrival but went unreported.

Beyond what's stated here, Inmotion Energy doesn't offer any other express or implied warranty — including, to the extent the law allows, implied warranties of merchantability or fitness for a particular purpose.

Coverage does not extend to damage or loss caused by:

- Installation, operation, or upkeep that doesn't follow this manual
- Misuse, carelessness, or accidental damage
- Grinding, standardization, or repair of the ring/block or EP ring/block pairs carried out other than as described in this manual
- Storage conditions or exposure beyond what normal field use implies
- Parts or components sourced from outside Inmotion Energy
- Ordinary wear items — the friction ring, friction block, EP ring, EP block and torque wrench calibration, for example

Returns and Repairs

Pack anything you're sending back carefully — Inmotion Energy can't take responsibility for damage caused by inadequate packaging in transit.

If you're returning a unit that isn't defective, do so within thirty (30) days of your invoice; a restocking charge may apply, and the item needs to arrive in its original condition to qualify for a refund.

Before shipping anything back, reach out to us with your invoice number, a description of the issue, and your contact details so we can set expectations. Send equipment to:

Inmotion Energy (OPC) Private Limited

Attn: Service & Repair

186, 1st Main Road, Vijaya Bank Layout, Bilekahalli,

Bangalore, Karnataka – 560076, India

Questions before then? Reach our support team at info@inmotionenergy.in.

Ordering & Replacement Parts

Send the Inmotion Energy team a note describing what you need, and we'll confirm availability and arrange dispatch. Spares, including friction and EP rings and blocks, torque wrenches and power cords, are kept in stock and shipped on request.

Have this ready when you reach out:

- Model / catalog number (IM-LUB-EPC)
- The part number and description you need (see Components, page 4)
- How many you need
- Your company name, shipping address, and a contact point



Power cord, supplied with each unit

<i>Company & Contact Information</i>	Inmotion Energy (OPC) Private Limited supplies drilling fluid products, testing instruments and oilfield equipment to operators and service companies working across India and the wider region. Our technical documentation, equipment and product lines are built around the day-to-day needs of the mud engineering and drilling fluids sector. Industries We Serve ● Onshore & offshore drilling contractors ● National & independent oil companies ● Mud engineering & testing laboratories ● Well completion & workover operations Why Choose Us ● Instruments checked against a documented standard before they ship ● Spares and replacements move fast, so downtime doesn't stack up ● Equipment and formulations built around real rig-site conditions Contact Details Inmotion Energy (OPC) Private Limited 186, 1st Main Road, Vijaya Bank Layout, Bilekahalli, Bangalore, Karnataka – 560076, India Phone: +91 96637 44619 Email: info@inmotionenergy.in Website: inmotionenergy.in
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