CUSTOMER SERVICES

CHECKS-CALIBRATIONS AND MAINTENANCE

Guaranteed smooth running of your instruments.

Planned calibration and preventive maintenance, carried out by our trained and certified technicians, are essential to guarantee your instruments run smoothly so that productivity is increased and reliable, accurate measurements are obtained.

So you can benefit from our technicians' experience, we offer:

- Calibration with validation certificates (assessment of your device and free quote within 48 hours),
- Annual maintenance contract on your site,
- Provision of verification oils,
- Tests according to your conditions of use.

ALL OF OUR INSTRUMENTS ARE GUARANTEED FOR 2 YEARS

Calibration oils available in sizes 100 - 250 - 500 ml.

SILICONE OIL	NOMINAL VISCOSITY
Oil 5 mPa·s	5 mPa·s to 23°C
Oil 50 mPa·s	50 mPa·s to 23°C
Oil 100 mPa·s	100 mPa·s to 23°C
Oil 500 mPa·s	500 mPa·s to 23°C
Oil 750 mPa·s	750 mPa·s to 40°C
Oil 1000 mPa·s	1000 mPa·s to 23°C
Oil 5000 mPa·s	5000 mPa·s to 23°C

TRAINING

Four values to meet your training needs

LAMY RHEOLOGY understands these challenges and the ongoing support requirements of our customers. Our team brings you in-depth expertise and a comprehensive training offer targeting the following 4 key values, which are essential in every laboratory and industrial environment in the world.

- AVAILABILITY: our engineers will propose regular visits so you can optimise your products and they will help you set the perfect measurement conditions.
- PERFORMANCE: our instruments are demonstrated using your samples to help you choose the right equipment for your needs.
- COMPLIANCE: IQ procedures are complied with: a technician will take charge of documenting the installation so that you can start using your equipment immediately. OQ Procedures: verification that results are obtained from the first measurement by ensuring that the equipment meets specifications in the given environment.
- EXPERTISE: rheology training sessions applied in the business: understand and explain physical phenomenon revealed by the rheological behavior and texture analyses of your formulations.

BECAUSE UNDERSTANDING EACH AND EVERY ONE OF OUR CUSTOMERS MEANS WE CAN MEET EVERYONE'S EXPECTATIONS!

RHEOLOGY KNOWLEDGE

Dynamic viscosity: η (Eta)

It is defined by the NEWTON equation: and quantify measurement of internal friction of fluid. His determination needs to apply to the fluid a Shear rate (D), and to measure the resistant Shear stress (τ) to this rotation.

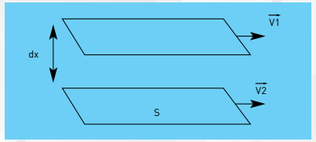
$\tau = \eta * D$ in **Pa.s**

For memory:
1 Pa.s = 10 Poises or
1 mPa.s = 1 cPoises

Shear rate: D (γ)

is the shearing which subjected by the product in the application. It is known for measurement geometries with small gap. It is not the speed of rotation of the bob (in rpm !).

Either a sheared fluid, by a laminar move (dV), between two parallel plates with a surface (S) and separate by a distance dx.



$D = dV / dx$ **in** s^{-1}

Shear stress: τ (Tau)

There is the shearing force (F), with which the sample answers to the shear rate (D), divided by the contact surface (S).

$\tau = F / S$ **in Pa** (N / m2)

Rheology:

There is the « science » of « flow ».

Associated physical measurements, realised with the hand of Rheometers, enables the visualisation of the behaviour of the product in various flow , temperature and time conditions .

Rheograms:

displayed curves of the flow behaviour of a fluid.

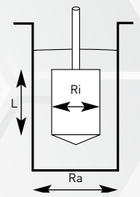
The curves $\tau = f(D)$ enables, by adapted fitting, the access to direct related parameters with the application.

Rotating viscometer:

a - With coaxial cylinders

The fluid is sheared between two coaxial cylinders, with radius Ri and Ra and a length L, by a laminar move which are breaking down in multi-layer with different angular speed from 0 (for the layer in contact with the fixed cylinder) to ω_0 (for the layer in contact with the rotating bob). The relative move of layers towards others give, a shear rate D and one Shear stress τ.

By imposing ω_0 and measuring M, the resisting torque to this rotation, we calculate D and τ according :



$\delta = Ra / Ri$ $\quad Ri / Ra \rightarrow 0.92$

Shear stress:

$T_{rep} = (1+\delta^2 / 2\,\delta^2) * (M / 2\pi LRi^2)$

Shear rate:

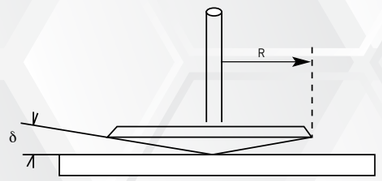
$D_{rep} = \omega * (1+ \delta 2\,) / (\delta 2 - 1)$

Rq : The determination of D is possible only if the gap is small. (i.e. DIN / ISO 3219 Standard).

b- With Cone-Plate :

The fluid is placed between a Plate and a Cone with angle δ (< 3°).

The cone, maintained to a constant speed induce a laminar shearing move. In those conditions, τ and D are constant in the gap, according :



Shear stress / Shear rate

$T = 3M / 2\pi R^3$ / $D = \omega$ / arc δ

Rq : You would be vigilant on the sample volume including in the gap, because the great influence of the radius R on the τ value !

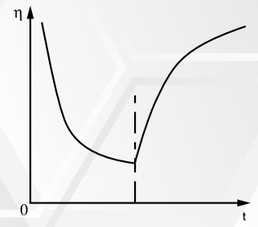
Study of different rheological behaviours

TYPE	NEWTONIAN	PSEUDO-PLASTIC	PLASTIC
Description	A sample is named newtonian when his viscosity stay constant, whatever the shear rate is. It is not necessary to define exactly the shear rate for the measurement. Just the temperature is important.	One pseudo-plastic sample has a viscosity which decrease when the shear rate increase: This flow behaviour is due to the molecules form and to their internal structure.	One sample presents a plastic behaviour, when his viscosity decrease when the shear rate increase, but from one original shear stress upper than 0, called YIELD VALUE (Tau 0), shear stress under which the product doesn't flow. It behave like a solid body.
Rheogram	Newton: $\eta = tg\ \alpha$	Ostwald: $\tau = K^* D^n$ ou n<1	Bingham: $\tau = \tau_0 + \eta_\omega * D$	Casson: $\sqrt{\tau} = \sqrt{\tau_0} + \sqrt{\eta_\omega}.\sqrt{D}$
Viscosity				
Examples	• Water: 1 mPa.s to 20° C • Oils: 150 to 400 mPa.s (motor) 300 to 800 mPa.s (gears) • Mercury: 1,5 mPa.s • Gas: 0,01 to 0, 02 mPa.s	• Coating, • Varnish, • Cosmetics, • Mineral Suspensions....	• Toothpaste, • Ointment, • Grease, • All very concentrated suspensions....

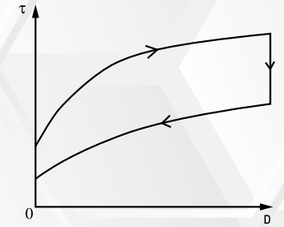
The thixotropy

One thixotropic product is a sample for which the variation of viscosity in function of shear rate is associated to a variation trough the time.

Owe talk about Thixotropy or Rheopexy, with the condition of REVERSIBLE Transformations: frozen or solidification.



Time of shearing Rest Time



Rheogram of thixotropic sample

Causes of thixotropy :

- Molecular structure
- « Château de cartes » with layers
- Particules mixing
- Ball loose Package...