

THE SWATCH GROUP

RESEARCH AND DEVELOPMENT LTD

Moebius

**Lubricants & Epilames
for Watches
In between Art & Science**

Presentation Plan

1. Presentation of the Moebius Division

- History & Few Figures

2. Lubricants Properties

- Generalities
- A specific system & Chemical diversities

3. Production Processes

- An example with a synthetic grease

4. Tribology Aspects & Constrains

- Stribeck curves
- Technical constrains

5. Specialties

- Epilame
- Fluorescent Lubricants (FL line)

6. Technical data

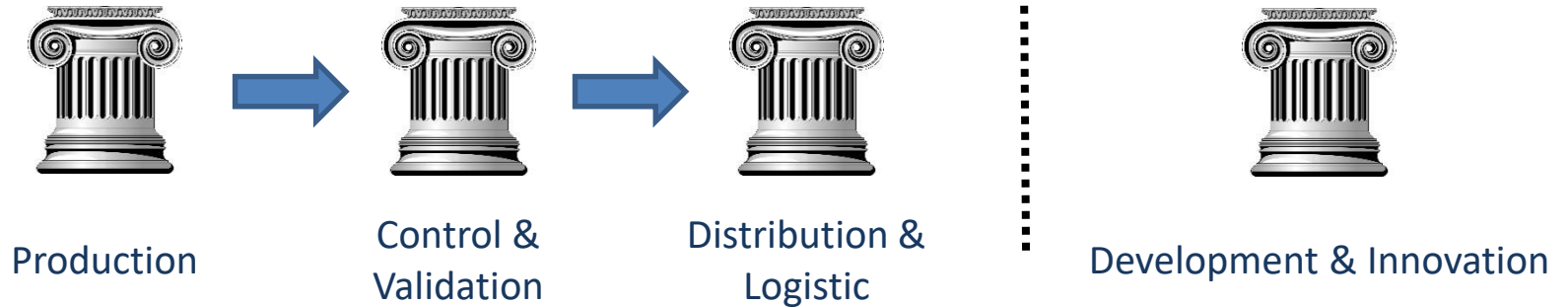
- TDS
- Lubchart

More than 160 Years of History

- 1855** "H. Moebius und Sohn" was founded by a watchmaker master called Hermann Moebius (Germany).
- 1892** Research and development and distribution are exclusively done in Basel (Switzerland).
- 1900 - 1950** Moebius activity is dedicated on improving the Natural oils.
- 1955 - 1970** In collaboration with the Swiss Watchmaker Research Laboratory (LSRH) in Neuchatel (Switzerland) Moebius developed synthetic oil.
- 2008** The Swatch Group acquired Moebius which became a division of The Swatch Group Research and Development Ltd.
- 2010** The Moebius division moved from Allschwil to Itingen in a more appropriate industrial environment.

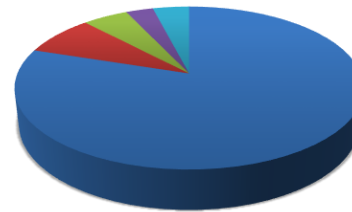
Few Figures

Moebius is a very small company : 7 full time equivalents



Almost exclusively dedicated to the Watch Market

- ~ 60 standard products
- ~ 100 products counting specialties



- Watchmaking industry
- Automotive
- Camera
- Aviation
- Others

Unique know-how and international renown Present all over the world
27 distributors
12 countries

Lubricant Properties

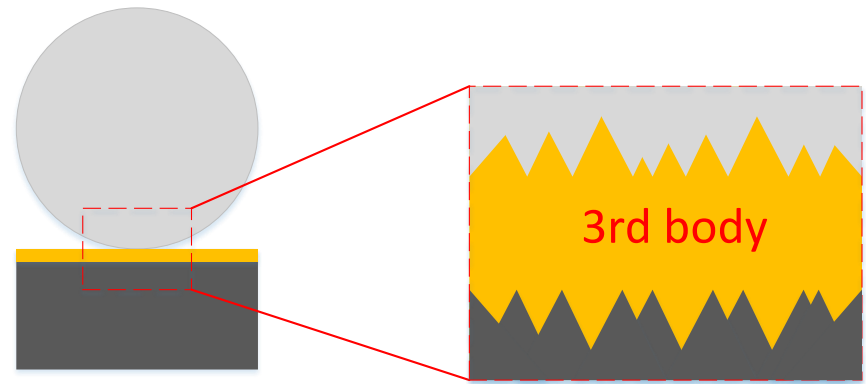
Generalities

What is a lubricant ?

In a tribological system a lubricant is generally considered as a third body interacting between 2 counterparts in motion.

The main purpose of using lubricant is :

- **Ease friction between two materials**
Reduce energy dissipation
Maximize the efficiency
- **Reduce or avoid wear into the contact**
Increase life time of the pieces
- **Contribute to limit overheating and heat dissipation**

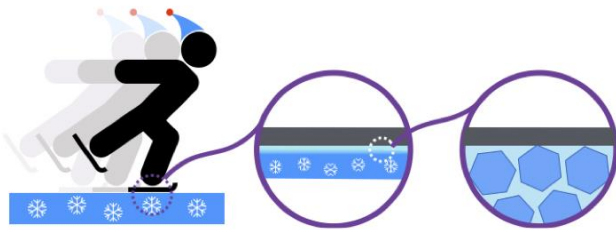


A specific system

What is the chemical nature of a lubricant ?

Depending on the system (material, pressure, speed motion, temperature, ...) and the application the ideal lubricant could be very different.

Ice skating



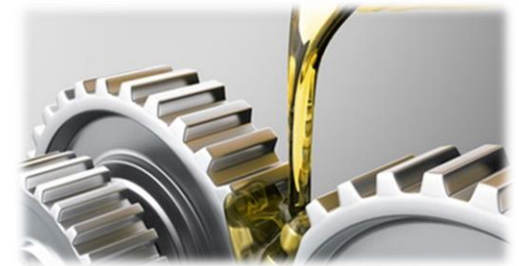
Water film

Body articulation



Complex protein mixture

Mechanisms / Motor engine

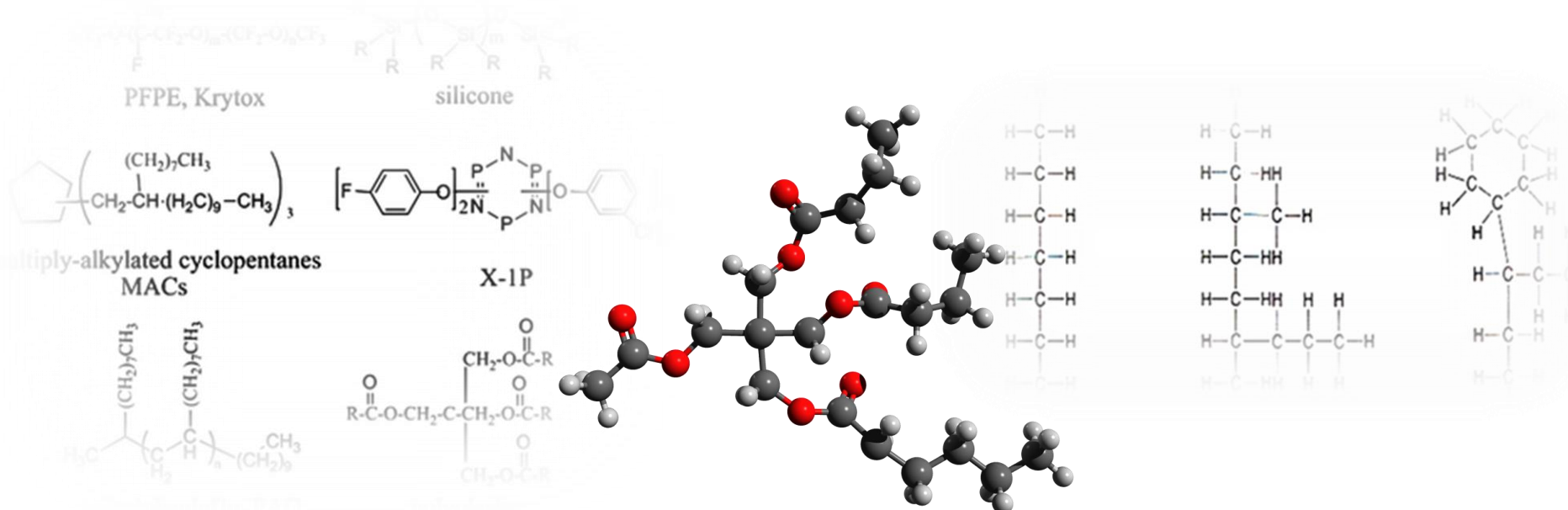


Oils & greases

An efficient lubricant is dedicated to a specific system

Chemical Diversity

Common lubricants are mainly based on alkane chain chemistry usually called “greasy chains”.



The properties of a lubricant is dictated by its chemistry and its molecular interactions with surfaces.

Categories of product

The lubricant composition can be described by 3 groups:

Basis Oils: Defined as a more or less viscous liquid. It can be Natural, Mineral or Synthetic.

Grease & Thickener: Grease is defined as a solid at room temperature (from hard to soft). Thickener is used to transform an oil into a grease.

Additives & Solid lubricants: Specific molecules used to enhance the properties of the lubricant and enlarge their scope of use.

A lubricant is a very unique combination of different products from these groups to achieve the best performances for a specific application:

A specific tribological system

Moebius Products



Epilames

Oils

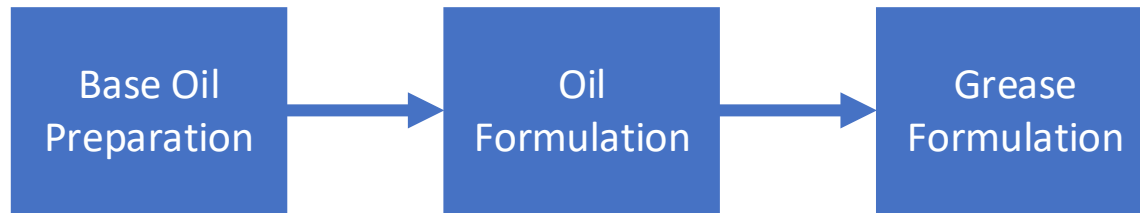
Greases

Lubrication is essential. Only the good lubricant dispensed at the appropriate place can ensure the movement will function well over the years.

Production Processes & Quality

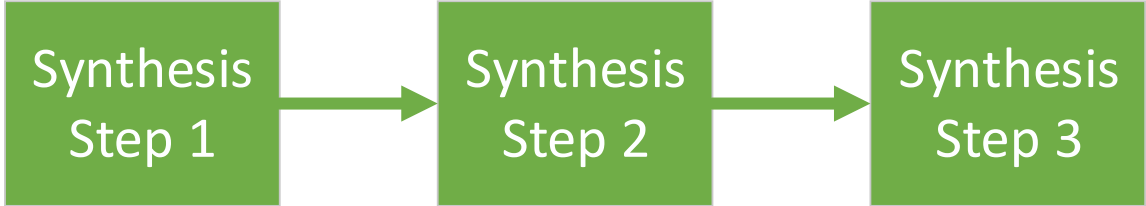
Production Processes

An example of a grease formulation:



Up to 6 Months

Base Oil Preparation -> Oil Formulation -> Grease Formulation



Reaction



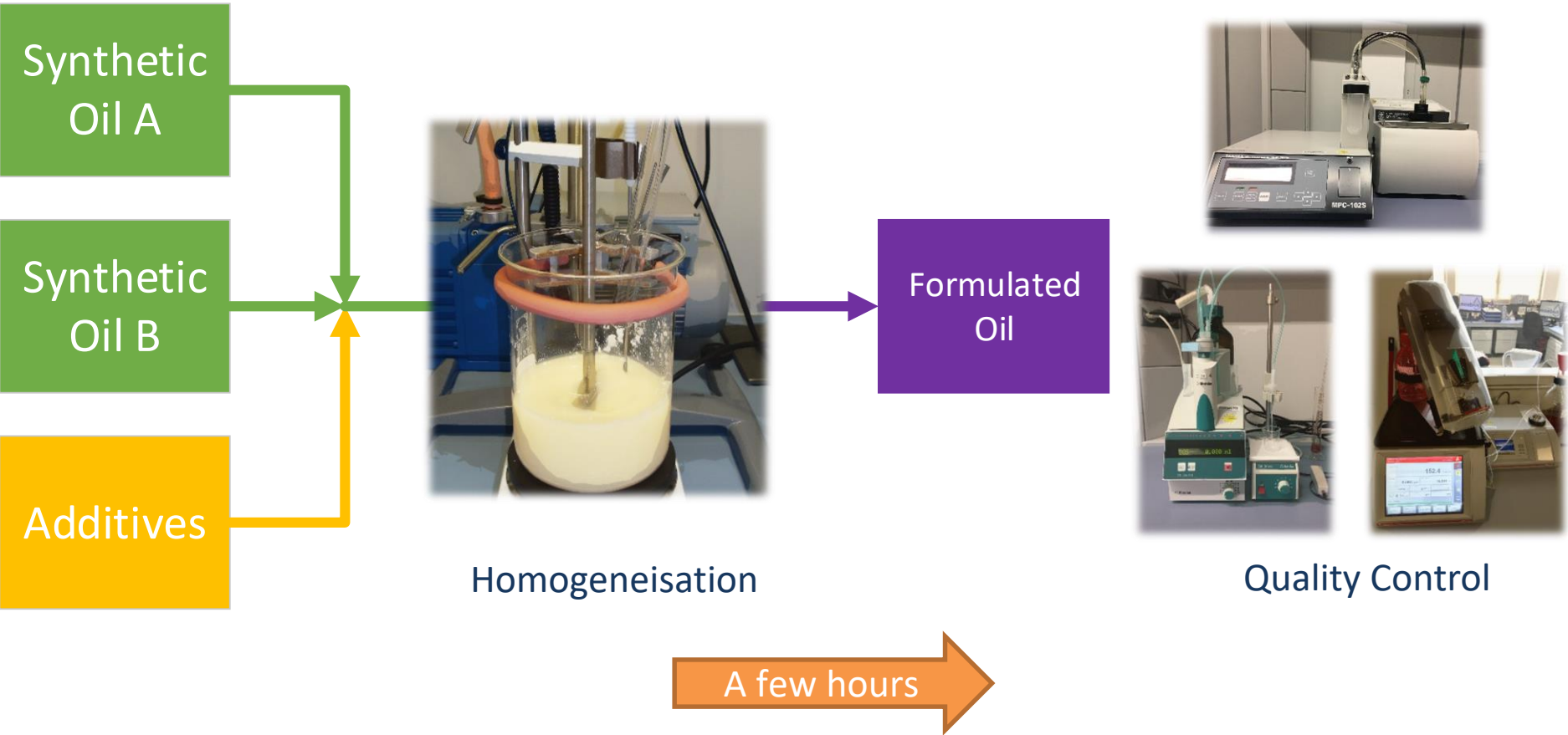
Purification



Quality Control



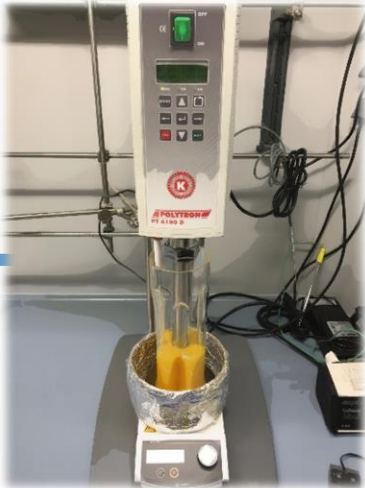
Base Oil Preparation -> Oil Formulation -> Grease Formulation



Base Oil Preparation -> Oil Formulation -> Grease Formulation

Formulated Oil

Thickener



Formulation & 1st Homogeneisation



2nd Homogeneisation



Quality Control

A few hours/days

A few days

Tribology & Constrains

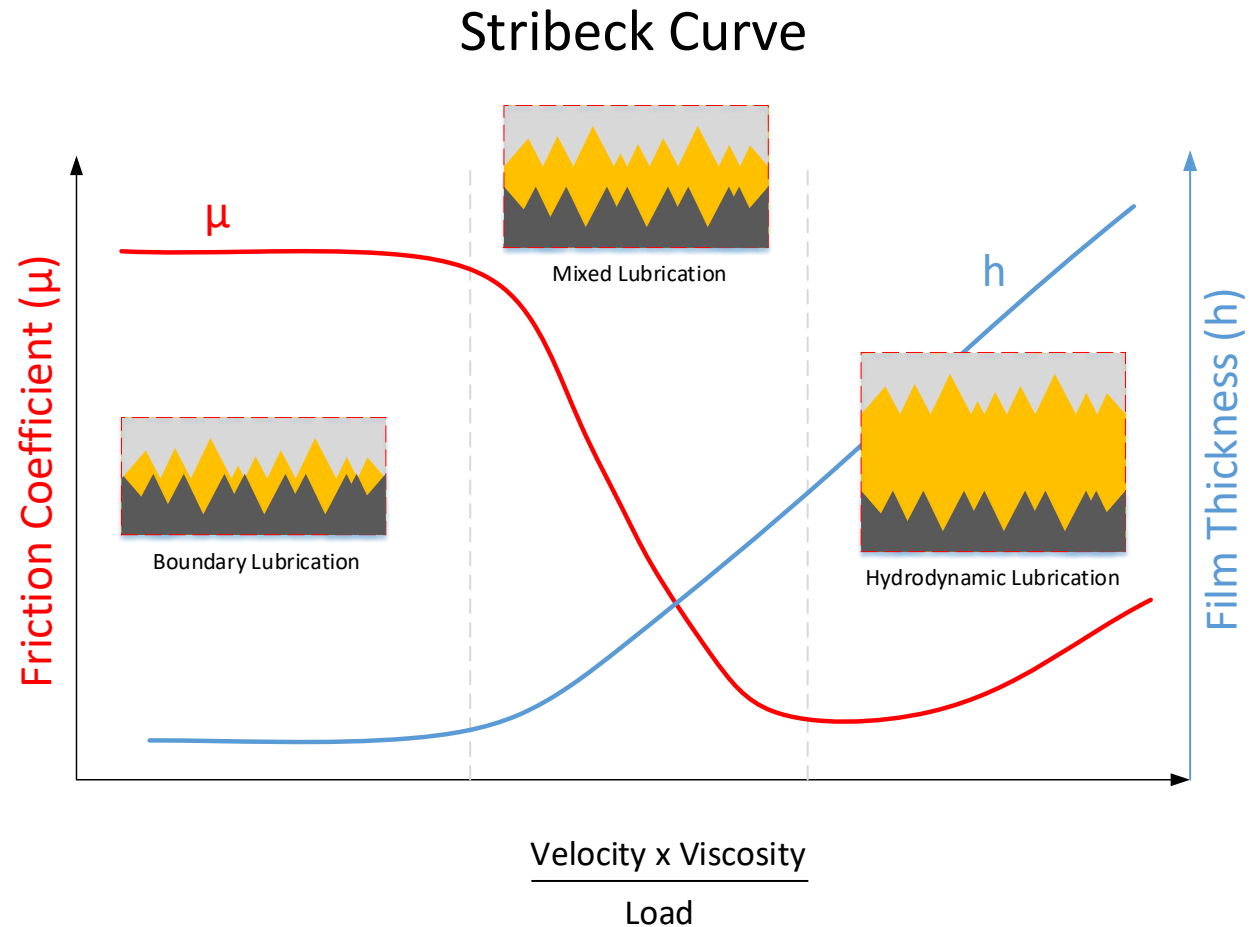
Tribological Aspect

3 Domains of lubrication

- Boundary
- Mixed
- Hydrodynamic

3 Important parameters

- Speed
- Viscosity
- Load



All 3 domains can be found in a watch movement

Product Specificities - Barrel

To lubricate the barrels wall the need to be

- Tacky to avoid loosing energy (unwanted disarming)
- Avoid wear
- Resistant to high pressure



Moebius 9500 Specificity :

- Tackiness
- HP resistance
- Wear protection

Technical Constraints

Properties

Friction, sealing, adhesion, low evaporation, ...

Aesthetic constraints

It could not alter the surface/ material aspect
Epilame should be invisible, ...

Environmental constraints

Stability against temperature and humidity variation



Regulation constraints

Toxicity, norms & legislation

Materials & application constraints

Corrosion, compatibility, low quantity

Aging and handling constraints

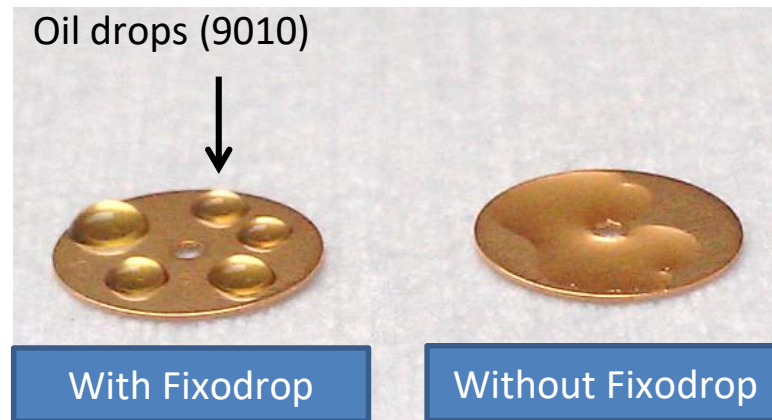
Fluidity, not much spreading, stability
(Long life lubricant required)

Epilames & Specialties

Epilames

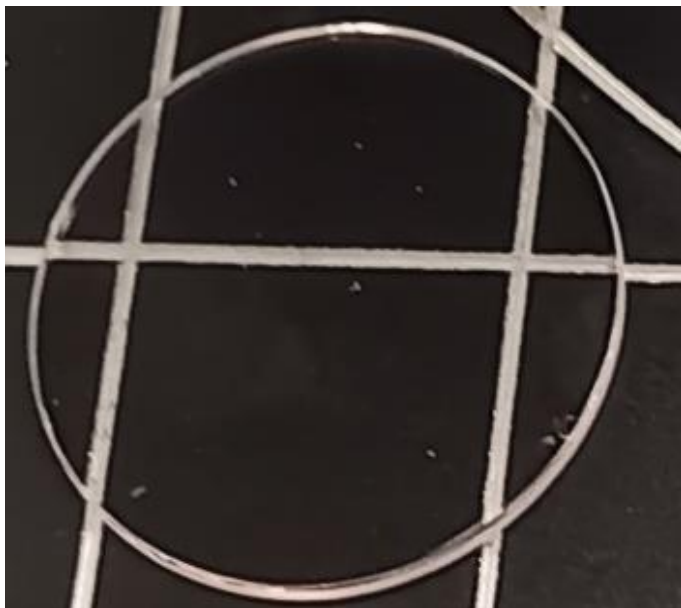
Why is it important to use the **Fixodrop** epilame?

An Epilame is an anti-spreading agent. It help to maintain the lubricant drop in the contact. Using an Epilame is of a **major importance** in the process of lubrication



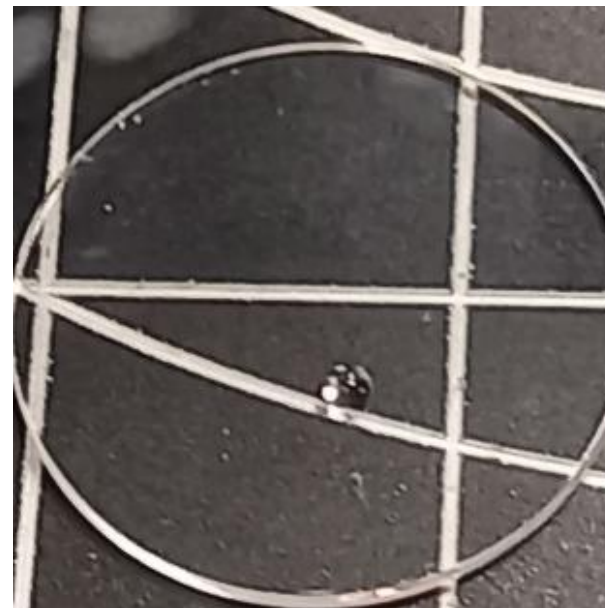
**Enough lubricant into the contact is necessary to ensure the function.
Fixodrop helps solving lubricant quantity issues by keeping the oil at its place.**

Epilame effect on oil spreading



No epilame
30 min after deposition

Oil drop disappeared due
to spreading



With epilame
60 min after deposition

No spreading observed

Wash Resistant Epilames

Prevent the spreading of lubricants

new

..... Resistant to washing solutions
(Rubisol, organic solvents,...)

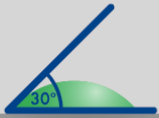
..... Fast and simple
surface treatment

..... Invisible

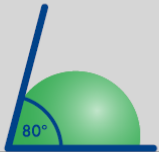
Epilames

Angle of contact

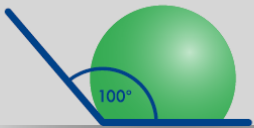
An epilame is considered effective when the contact angle of an oil is above 40°.



Epilame effect too weak

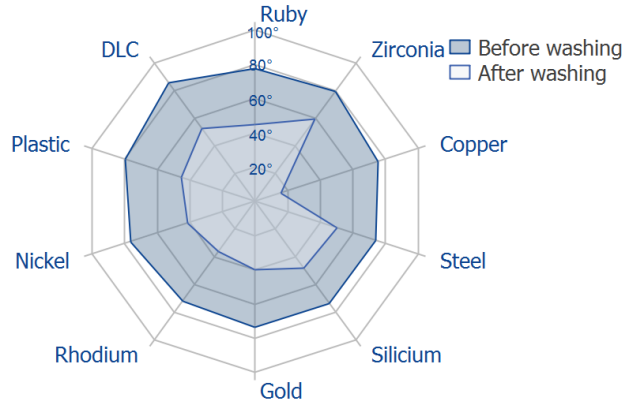


Desired epilame effect

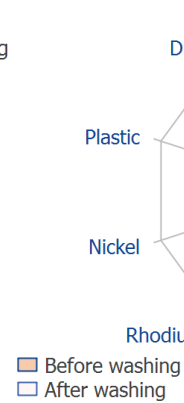


Epilame effect too strong

FIXODROP ES/BS 8981



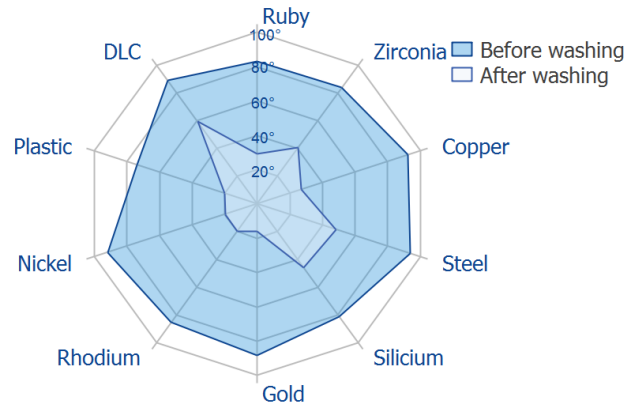
FIXODROP ES/WR-P 7071



FIXODROP ES/WR-S 7061



Competition A

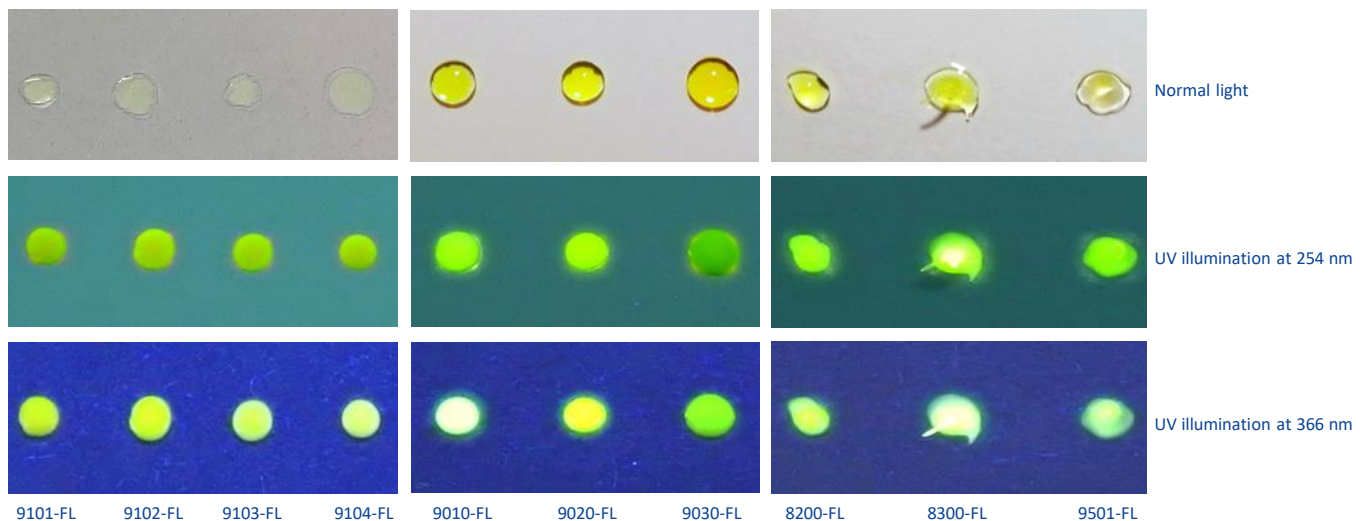


- Fast and simple surface treatment
- Lowers the surface energy of the materials
- Non-wetting (hydrophobic and oleophobic)
- Invisible treatment

Fluorescent Lubricants

The FL (fluorescent) assortment has been developed to facilitate the visualization

- Specific fluorescent tracer in very low amount
- Same lubricant properties



Under UV light, the drop of lubricant emits a green yellow light (around 550 to 600 nm).

Warning:

An adequate filter system must be in place to allow safe viewing of light emission because UV light is harmful to the eyes

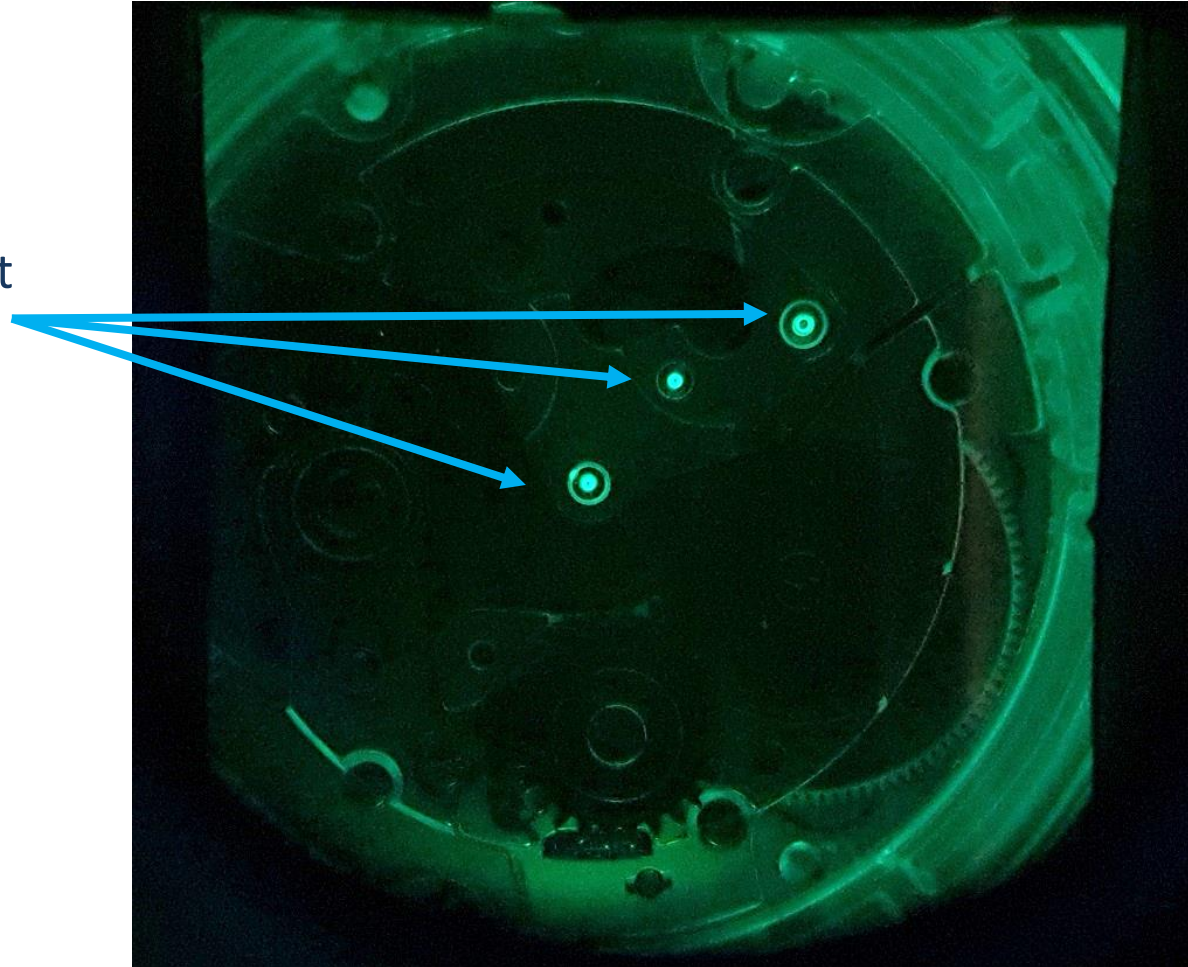
Moebius LubeTracker Device



- **Easy visualization** of our FL lubricants (9010-FL, 9104-FL, ...)
- **No harmful UV-Light** (white light only)
- **Cost effective** – No need of an expensive UV filtered equipment
- **Customable.** Use your own watchmaker loop

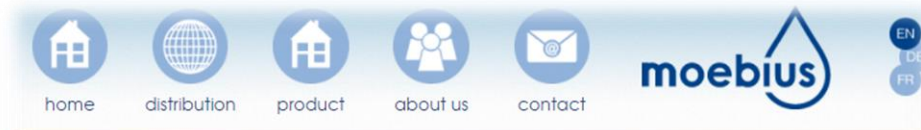
On a Watch Movement Using the LubeTracker

Fluorescent Lubricant
(9010-FL)



Technical Data

Internet Site



high quality products, guaranteeing an ideal lubrication of your products.



oils



greases



epilames



specialities

Identify your needs by consulting our product selection chart and product catalog

[Lubrication Chart](#)

[Product Catalog](#)

Discover our newest FixoDrop assortment and our fluorescent lubricants line !

[FixoDrop Set](#)

[Fluorescent Line](#)

Oils

Product Name	Picture	Article	Viscosity 20°C (mm ² /sec)	General use	Tech	Security
Synthetic oils						
Synt-A-Lube		9010	150	100% synthetic universal fluid thin oil with very good resistance to aging and good resistance to pressure. With an excellent lubricity and outstanding adhesion, this oil is ideal for regulating parts and fast mobiles. Suitable for all materials.		
Synt-A-Lube		9010-B	150	Blue variant of oil 9010.		
Synt-A-Lube		9010-Film	150	This variant of the oil 9010 contains a film forming agent that is suitable for forming an effective lubricating film.		
Synt-A-Lube		9010-FL	150	The addition of a fluorescent tracer makes it possible to visualize the presence of small quantities of oil under UV light. The lubricating properties are identical to the standard 9010 oil.		
Synt-A-Lube		9014	100	100% synthetic universal fluid thin oil with a very good resistance to aging whose viscosity is intermediate between 9030 and 9010.		
Synt-A-Lube		9015	150	100% synthetic fluid thin oil with a very good resistance to aging. Offering good lubricating power and a remarkable adhesion, this oil is ideal for fast mobiles. Especially recommended for the lubrication of plastics.		

<http://www.moebius-lubricants.ch/en>

Technical Data Sheet

How to read a technical data sheet of Moebius product?


TECHNICAL DATA

SYNT-A-LUBE 9010
Synthetic oil for high precision micromechanics





moebius

Description

100% synthetic universal fluid thin oil based on ether and aliphatic alcohol with excellent resistance to ageing and good resistance to pressure. Also very effective for use under wet conditions.
With excellent lubricity and outstanding grip, this oil is ideal for regulating parts and fast mobiles. Suitable for all materials. Also available in blue (9010-B).



Technical features (indicative values)

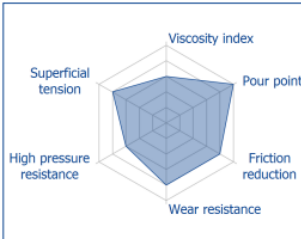
Appearance	Pale blue-green	Unctuousness / Lubricity	
Viscosity at 0°C	625 cSt	Viscosity / Texture	
Viscosity at 20°C	150 cSt	Ageing resistance / Stability	
Viscosity at 40°C	52 cSt	Adhesion / Grip	
Pour point	-42 °C	Compatibility	Plastics and metals
Density at 20°C	0,907 g/ml	Application	Universal
Refraction index at 20 °C	1,474	Shelf life	6 years
Acidity	2,4 mg KOH / g	Temperature range	-30 °C to +70 °C

Application fields

Fine universal oil to be used for :

- Precision micromechanics (watch, timer, measuring devices, tools, ...)
- Instrumentation and counters (automotive, aeronautic, naval,...)
- Micro motors and stepper motors
- Cameras and optical instruments
- General mechanics (office equipment, fans,...)
- Lubrication of fast mobiles with low torque (pendulum pivots, escapements, certain wheels,...)

Radar chart




Storage

We advise keeping Moebius products in their original packaging in a clean and dry place, protected from light, ideally at a temperature of 15 to 26 °C.
After opening we recommend keeping the products for a maximum of 12 months.

MOEBIUS A division of The Swatch Group Research & Development Limited / moebius@moebius-lubricants.ch

A COMPANY OF THE SWATCH GROUP



www.moebius-lubricants.ch

← Short description of the product.

← Important physicochemical data and Quick view of the main lubricant information.

← Example of typical use for the lubricant Quick view of important properties of the lubricant.

← Storage recommendation and QR code to access our internet site.

Quick graphical view ease the comparison between our products.

Lubrication Table



LUBRICATION TABLE

Functions	Calibers Dimensions 5" – 18"	Calibers Large dimensions (Pendulum, clock, alarm clock)	Quartz movements
Balance staff, fast mobiles with small torque	9010 / 8000 9030 (low temperature) 9040 (ultra-low temperature)	9020 / 8030	9000 / 9024
Pivoting mobiles with medium to large torque	9101* / 9102* / 9103* / 9104* / D-5	9101* / 9102* / 9103* / 9104* / D-5	
Escapement lift and escape wheel	9415 / 941 / 9010	9415 / 9020	
Barrel spring	8200 / 8141 / 8201		
Barrel walls	8217 / 8212 (Aluminum) 8213 (Brass) / 9500	8141 / 8201 / 9500	
High friction, cannon-pinion, hand setting, various chrono- mechanism	9501 / 9504 / 9520-FL / 9550 K-6** / L-5**	9504 / 9520-FL / 9550 / K-6**	
Winding mechanism, calendar	9101* / 9102* / 9103* / 9104* D-5 / K-6** / L-5**		
Pull-out and push pieces, winding mechanism, spring pin	8300 / 8301 / 8302		8300 / 8301 / 8302
Packing O-ring for water tightness and external parts	8513 / 8516 / H-10	8513 / 8516 / H-10	8513 / H-10
Ball bearing, springs	V106		
Inversion wheel, clicks	V105		

* The choice of viscosity depends on the power reserve.
The Synt-HP oils (9101, 9102, 9103, 9104) are preferentially in use for ruby bearings. For brass bearings, we recommend Microgliss D-4 or D-5.

** In certain conditions, these products may be preferred over standard products. For optimal effectiveness these products can also be dissolved in petrol type solvents, used in dip lubrication before lubrication with the standard product.





Thank you for your attention

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