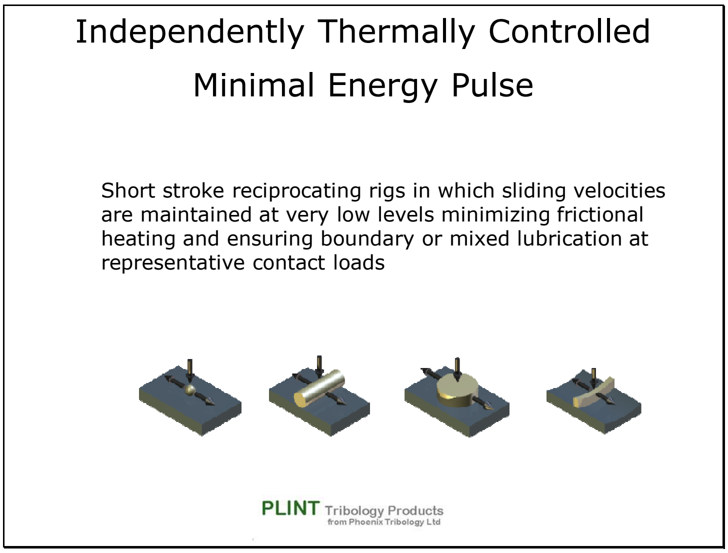
Guidance – Thermally Independent Minimal Energy Pulse Machines

Extract from:

https://www.phoenix-tribology.com/wp-content/uploads/products/guidance/Tutorial-Tribology-Testing.pdf



Independently thermally controlled minimal energy pulse machines are the short stroke reciprocating rigs, in which, although sliding velocities may be low, the rate of events (specimen passes or asperity contacts) may be high. These are machines in which sliding velocities are maintained at low levels in order to minimize frictional heating and to ensure, in the case of lubricated tests, boundary lubrication at representative contact loads.

By minimizing frictional heating we have the opportunity to control the contact temperature by controlling the bulk temperature of the test specimens, thus allowing contact temperature to be controlled as an independent variable. High repetition rates can be achieved without significant increases in sliding speed and corresponding loss of control of contact temperature.

Independently Thermally Controlled Minimal Energy Pulse

- Short stroke reciprocating rigs:
  - Sliding velocities low to minimize frictional heating
  - Boundary lubrication at representative contact loads
  - Rate of events (specimen passes or asperity contacts) high and cyclic
  - Low sliding speed thus no loss of control of contact temperature
  - Energy Pulse replaced by external heating
  - Emulate intimate contact conditions
- Uses:
  - For research and development applications
  - Lubricant chemistry and lubricated wear mechanisms
  - Wear studies of coatings, ceramics and ceramic composites

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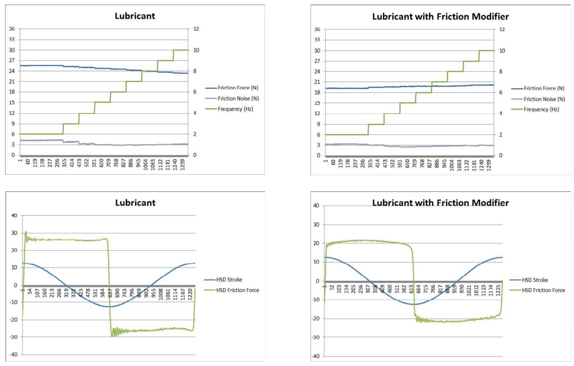
These devices (except in the case of the piston ring on liner contact near end stroke) do not model exactly the real contact to be investigated, but aim to emulate the intimate contact conditions, in a controllable and accessible way.

One of the principal advantages of the reciprocating test is that the direction of motion and the direction of surface finish can be the same. With the uni-directional specimens, for example, pin on disc, the orientation of grain structure or surface finish as presented to the pin varies as the disc rotates.

Historically these rigs have been used for fundamental and applications studies in the lubricants field with a particular emphasis on the lubricant chemistry and lubricated wear mechanisms. These rigs have an obvious similarity to the motion experienced by many practical components that have cyclic energy inputs, such as gears and cams and followers. They are also used for wear studies of coatings, ceramics and ceramic composites.

There are an increasing number of standards based on short stroke reciprocating tests covering dry and lubricated wear of ceramics, metals and ceramic composites, measurement of friction, wear and extreme pressure properties of lubricating greases and measurement of the diesel fuel lubricity.

Independently Thermally Controlled Example Data



As with the sliding/rolling machines, we can generate a whole range of different wear and failure mechanisms in the boundary or mixed lubrication regime, not by altering the sliding speed as with the thermally self-regulating devices, but by varying the contact temperature by external heating.