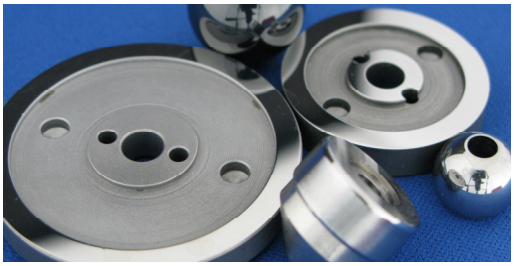
PCS Instruments

MTM specimens

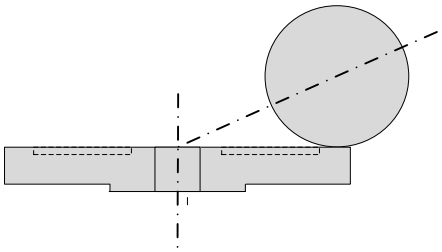
The Mini Traction Machine is a bench top precision traction measurement instrument. It provides fully automated traction mapping of lubricants and other fluids. The traction is generated between a upper specimen (ball or barrel) in contact against a rotating disc. The upper specimen can be either rotating or stationary.



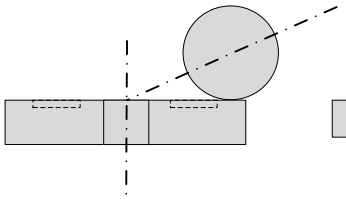
Standard specimen configurations

The standard MTM specimens are made of AISI 52100 steel. See overleaf for further materials. Several sizes of specimens are available, giving the user access to a wide range of contact pressures. The schematics below are the specimen configurations at actual size.

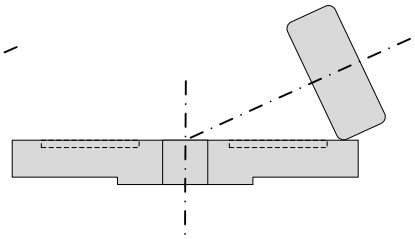
3/4" ball on 46 mm disc



1/2" ball on 32 mm disc



Barrel on 46 mm disc



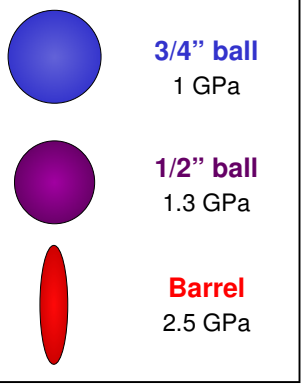
Contact shapes and pressures

The most commonly used configuration, the 3/4" ball on disc, creates a point contact, allowing contact pressures up to 1.25GPa.

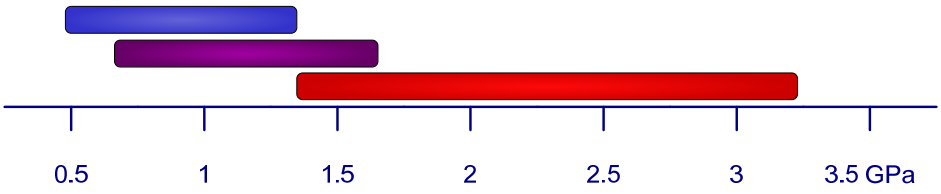
The 1/2" ball generates a higher contact pressure and the smaller size makes it compatible with the PCS mini-pot and with some surface analysers .

The small radius of the barrel creates a high pressure elliptical contact. This specimen has recently been used to investigate scuffing.

Contact shape and pressure at 37N - Scale 1/100



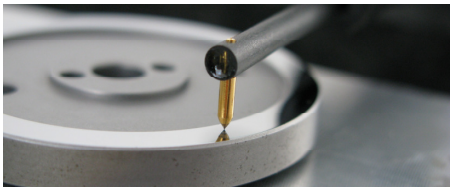
Contact pressures available (load range 5-75N) for each steel specimen configuration:



Hardness and surface finish

The MTM steel discs can be tailored to your needs with a choice of surface finish from rough (Ra > 0.5 µm) to mirror finish (Ra < 0.01 µm).

The discs can be heat treated to achieve various hardness, from fully annealed (185HV) to through hardened (760 HV).



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Specimen material choice

MTM balls and discs have been manufactured in a wide selection of materials, in response to specific customer requirements. Below is information on some of the existing specimens. Please contact PCS to discuss alternative material composition, finish or hardness.

Selection of steels

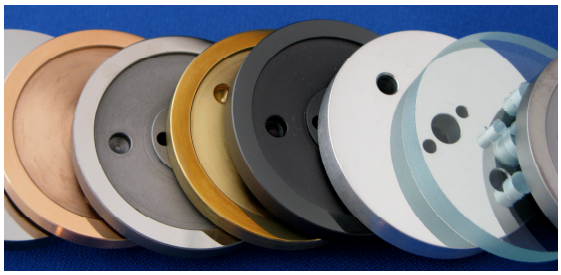
The selection of steels has been recently broadened to include M2 tool steel. Its high tempering temperature means it can be heated up to 550°C without softening.

This property makes the M2 specimens suitable for most coating processes such as sputtering, PVD and CVD.

Material	Indicative available hardness	Comments
AISI 52100 (EN31)	185 to 760 HV	Bearing steel, through hardened
AISI 8620	200 to 760 HV	Low alloy steel suitable for case hardening
AISI 1015 (EN32)	200 to 760 HV	Contains no chrome. Suitable for case hardening
AISI 316	150 HV	Austenitic stainless steel
AISI 440C AISI 420S29	200 to 650 HV	Heat treatable martensitic stainless steels
Tool steel M2	Up to 800 HV	Suitable for coating (DLC for example)

Non ferrous metals and others materials

While the surface finish influences the lubrication regime, the material components affect the surface chemistry in the contact (additives reaction). Studying specific applications is possible with the MTM as the specimens can be manufactured from a range of materials.



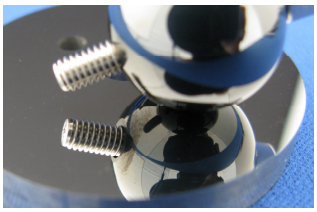
Non ferrous metals
Bronze
Copper
Brass
Aluminium alloy

Other materials
Tungsten carbide WC
Glass
Elastomer discs
Elastomer O rings

Using a material with different mechanical properties allows a wider range of contact pressures (up to 4.1 GPa between a steel barrel and a tungsten carbide disc).

Non ferrous metals have typically a low hardness (<200HV), whereas WC specimens are much harder (>1500 HV). This hardness enables a very fine surface finish.

For information on elastomers testing configurations, consult pcs-instruments.com.



Mirror finish on WC disc

Coatings

PCS can supply DLC (diamond like carbon) coated 52100 steel specimens [a-C:H coating, sp3 ~ 50%, H ~ 40%]. The coating process runs at a temperature low enough to not significantly soften the specimens.

For coating processes involving a temperature greater than 200°C, the specimens can be made of M2 tool steel. These specimens are sold uncoated or coated as required.

Specimens can also be supplied coated using a chemical process. For example, electroless nickel plating can deposit a layer of nickel-phosporous alloy of various percentage of phosphorus.