

# BU Bournemouth University Design, Manufacture and Commissioning of a New Adapter Design for the Reciprocating Tribometer

## Problem Description

- Conventional specimen holder for the TE-57 reciprocating tribometer is designed for sample diameters of 9.95/9.90 mm
- However, diameter of cylindrical test specimens supplied by manufacturer had a diameter of 8 mm, determined by the diameter of EN19 stock material bar
- Diameter of specimen samples showed considerable variation in the range of  $8.0 \pm 0.1$  mm

## Motivation

- In order to address these issues, design modification was carried out based on a previous design concept (Sebastian and Bhaskar 1995)
- In the new notched design, the specimen would be centred automatically
- The issue of additional space or play in the specimen inside the holder was addressed by using two screw fasteners which would constrain the cylindrical specimen in its position without room for movement

## Effect of dimensional variation

- Leads to a loose fit for the specimen when mounted in the adapter.
- Specimen undergoes pivoting action with the fulcrum at the screw fastener which holds it in place
- Can cause the specimen to move within the adapter during reciprocating motion of the counter-surface
- Secondary movement affects sample positioning
- Also affects friction measurement
- Also creating a vertical gap

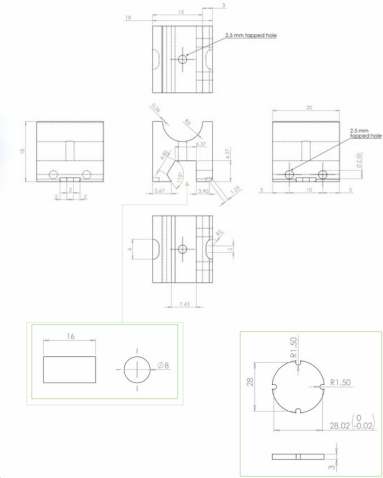
## Importance

- Local movement within the adapter induces local dynamics by introducing a wobble
- This phenomenon potentially influences the average friction measurement in the tribometer
- The specimen was held in position using a single, threaded set screw which encourages wobbling
- Also, the original adapter is not self-aligning
- The original design worked well for test specimens manufactured with very close tolerances

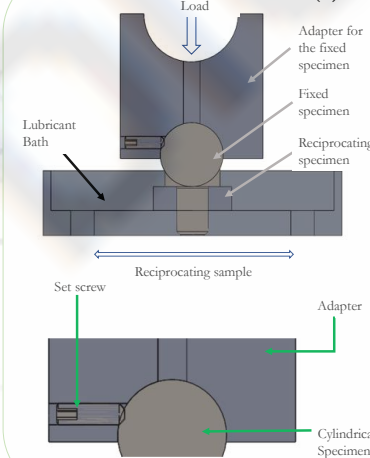
## Design and Manufacturing

- Virtual prototype adapter was designed using CAD
- Engineering drawing shows the two-dimensional design of adapter and specimens
- Physical prototype was machined using an Accutex EDM wire cutting machine
- The material used for manufacture was 01 Gauge plate in the fully annealed condition
- Composition of the gauge plate - (C-0.95 %, Mn-1.25%, Cr-0.5%, W-0.5%, V-0.2 %) following DIN17350, BS EN, ISO 4957 and ASTM A681 specifications.
- The solid block was immersed in de-ionised water
- Wire diameter of 0.25 mm was used

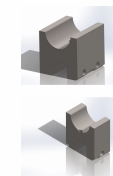
## Engineering Drawing (3)



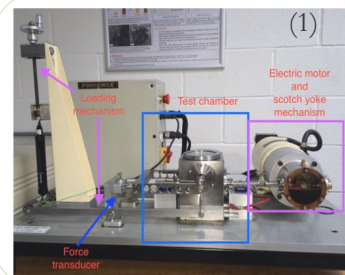
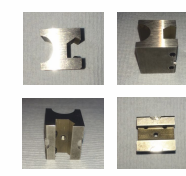
## Conventional adapter (2)



## Virtual Prototype



## Physical Prototype (4)



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This work was conducted as part of my doctoral research titled 'Design and dynamic simulation of mobile manipulators incorporating tribological analysis of 16MnCr5 and EN19 steels for assessing joint friction'

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Fig 1: The TE57 reciprocating tribometer  
 Fig 2: Conventional adapter design for the fixed sample in the tribometer  
 Fig 3: Two-dimensional drawings for new adapter design with test specimens  
 Fig 4: Virtual and physical prototypes of the adapter

## The new design

- The specimen was backed by three contacts in the holder of which two are line-contacts and two are point-contacts
- This ensured rigidity and uniform load transfer from loading mechanism onto the contact
- Recesses introduced on the bottom corners of the adapter prevented accidental contact/impact with the screw fasteners holding the reciprocating sample in position at the extreme positions of the stroke
- The issue of additional space or play of the specimen within the holder was addressed by using two screw fasteners which would constrain the cylindrical specimen in its position

## Reference

Sebastian, K. S. and Bhaskar, V. R., 1995. A new design for the pin and V-blocks tribometer. *Tribology International* [online], 28 (4), 219–223. Available from: <http://linkinghub.elsevier.com/retrieve/pii/0301679X940005B> [Accessed 21 Jun 2017].