**OCA PAD INITIATION - PROJECT HEADER INFORMATION**

- **Project #:** E-25-W66
- **Center #:** 10/24-6-R8172-0A0
- **Contract #:** AGMT DTD 940621
- **Prime #:**
- **Subprojects #:** N
- **Main project #:**
- **Project unit:** MECH ENGR
- **Project director(s):** BAIR S S III
- **Project director(s):** MECH ENGR

**Sponsor/division names:** QUAKER CHEMICAL CORPORATION / CONSHOHOCKEN, PA

**Sponsor/division codes:** 216 / 005

**Award period:** 940620 to 950420 (performance) 950430 (reports)

**Sponsor amount**

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**Does subcontracting plan apply?** N

**Title:** RECIPROCATING FRICTION TESTER

**PROJECT ADMINISTRATION DATA**

- **OCA contact:** Anita D. Rowland 894-4820
- **Sponsor technical contact**
- **Sponsor issuing office**
- **Security class (U,C,S,TS):** U
- **Defense priority rating:**
- **Equipment title vests with:** Sponsor

**Administrative comments**

INITIATION OF A *FIXED PRICE AGREEMENT FOR A TEN-MONTH PERIOD.*

*NOTE: HARDWARE ITEM DELIVERY REQUIRED, REF. SOW AND DELIVERABLE SCHEDULE.*
GEORGIA INSTITUTE OF TECHNOLOGY
OFFICE OF CONTRACT ADMINISTRATION
NOTICE OF PROJECT CLOSEOUT

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Closeout Notice Date 04/26/95

Project No. E-25-W66
Center No. 10/24-6-R8172-0A0_

Project Director BAIR S S III School/Lab MECH ENGR

Sponsor QUAKER CHEMICAL CORPORATION/CONSHOHOCKEN, PA

Contract/Grant No. AGMT DTD 940621 Contract Entity GTRC

Prime Contract No. 

Title RECIPROCATING FRICTION TESTER

Effective Completion Date 950420 (Performance) 950430 (Reports)

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Closeout Actions Required: | Y/N | Submitted |
---|---|---|
Final Invoice or Copy of Final Invoice | Y |
Final Report of Inventions and/or Subcontracts | N |
Government Property Inventory & Related Certificate | N |
Classified Material Certificate | N |
Release and Assignment | N |
Other | Y |

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Subproject/Under Main Project No. 

Continues Project No. 

Distribution Required: | Y/N |
---|---|
Project Director | Y |
Administrative Network Representative | Y |
GTRI Accounting/Grants and Contracts | Y |
Procurement/Supply Services | Y |
Research Property Management | Y |
Research Security Services | N |
Reports Coordinator (OCA) | Y |
GTRC | Y |
Project File | Y |
Other | N |
RECIPIROCATING FRICTION TESTER

Final Report to
Quaker Chemical Corporation
Lime and Elm Streets
Conshohocken, PA 19428-0873

February 1995

Scott Bair, Principal Research Engineer
Georgia Institute of Technology
George W. Woodruff School of
Mechanical Engineering
MACHINE DESCRIPTION

The Reciprocating Friction Tester is of the pin on flat type. The pin (4.76 mm dia. Stem) oscillates against the stationary flat in an arc (127 mm radius) with a nominally circular contact. Loading (up to 101 N) is by dead weight. Wear is measured by detecting the advance of the pin into the flat. The friction force on the flat is also measured. A fixture is provided so that a 0.50 inch ball may be substituted for the pin.

The pin is mounted to one end of an arm which pivots in gimbals about two axes. The arm is driven in harmonic motion about its vertical axis with a stroke of 50 mm by a crank and skotch yoke. The crank and yoke are housed in an oil bath which is sealed to the arm with a rubber bellows. A torque is applied to the arm about a horizontal axis by a loading arm and dead weight. The pin load is twice the weight on the pan plus 13 N. The flat is clamped in an oil bath with oil inlet and overflow fittings.

The crank is rotated by a variable speed DC motor which provides an average velocity of 40 to 3600 cm/min. See Table I. A furnace surrounds the test pieces and can provide a temperature of up to 250°C using two 60 W cartridge heaters in the bath and one 100 W radiator in the furnace to heat the pin and arm. One \( \frac{1}{16} \) inch thermocouple resides between the heaters in the bath block directly beneath the flat.

WEAR CALIBRATION

With a pin and flat properly installed and 4 kg on the pan, move the LVDT until the output of the LVDT signal conditioner is at mid-span (zero volts for most models). The entire
system may be calibrated for wear measurement by adding or removing leaf gauges between the pin and flat. Make measurements under load (constant load).

**FRICITION CALIBRATION**

The friction measurement system is calibrated by applying a known force by a mechanical force gauge or by dead weight and string and pulley to the side of the bath in the direction of motion.

**SPECIMENS**

The specimen triboelements consist of a round pin and a rectangular flat. The pin diameter is $0.1875\text{ inch} + 0, -.002$. the flat is $3.00 + 0, -.05\text{ inch by } 0.625 + 0, -.05\text{ by } 0.125 + 0, -.010\text{ inch thickness}$. This thickness should be uniform within $0.0005\text{ inch}$. The flat may be used for two tests by inverting it after the first test. It may also be helpful to provide a spherical surface of large radius to the pin ends to facilitate the initial running in. The pin may be replaced by a ball using the special holder. We supplied twenty pins with mushroomed head of $1.6\text{ inch}$ spherical radius.

**OPERATION OF THE TESTER**

Install the flat in the bath. Slide the flat toward the tube fittings until it touches the edge with the oil channels. Tighten the cleat screws to $2.5\text{ in-lb}$. Install the pin between the steel blocks. Tighten the 8-32 socket screws to $12\text{ in-lb}$. The cleats which retain the flat must be turned to the extreme ends of the bath. Rotate the crankshaft by hand through one revolution to check for interference.
Occasionally check the oil level in the crank housing by removing the cover. It should be at the center of the lower horizontal small (1/4 in.) shaft. The heater wire should not be plugged directly into the A/C power line. A variable power source (to 110 V) or proportional controller should be used. An on-off type controller will produce noise on the wear signal. The terminal of the piezoelectric cell should not be left uncovered. Contamination here is a major source of zero drift.
<table>
<thead>
<tr>
<th>PULLEY TEETH</th>
<th>BELT</th>
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(φ 1/4 REF)

4 3/4

(φ 5/8 REF)

1/4

1 1/4

1/6

5/8

2 3/4

GT
Georgia Institute of Technology
School of Mechanical Engineering

<table>
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<td>1/2 ( )</td>
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<tr>
<td>Heat Treatment</td>
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<td>Date</td>
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</table>
**Part Name:** CRANKSHAFT

**Material:** O-1

**Surface Finish:** 1/8" (✓)

**Heat Treatment:** S2-S5 R e.

**All Dimens. in Inches**

**Scale:** 1:1

**Designed By:** T. E. Enck

**Date:** Dec. 11, 1989

**Rev.:**
BRONZE

* 58 Re
GEORGIA INSTITUTE OF TECHNOLOGY
School of Mechanical Engineering

PART NAME: BEARING BLOCK
PART #: 1

MATERIAL: 0-1
FINISH: 1/4 (X)
HEAT TREAT: 58 Rc

DIMENSIONS: 0.005”
TOLERANCE: ± 0.003”

SCALE: 1:1

DESIGNED BY: R. Wise
DATE: 11.15.89
REV.