11:49:09 OCA PAD INITIATION - PROJECT HEADER INFORMATION 06/28/94

Active

Project #: E-25-W66 Cost share #: Rev #: 0
Center # : 10/24-6-R8172-0A0 Center shr #: OCA file #:
Work type : RES
Contract#: AGMT DTD 940621 Mod #: INITIATION Document : AGR
Prime #: Contract entity: GTRC

Subprojects ? : N CFDA:
Main project #: PE #:

Project unit: MECH ENGR Unit code: 02.010.126
Project director(s):
BAIR S S III MECH ENGR (404)894-3273

Sponsor/division names: QUAKER CHEMICAL CORPORATION / CONSHOHOCKEN, PA
Sponsor/division codes: 216 / 005

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

Sponsor amount	New this change	Total to date
Contract value	31,214.00	31,214.00
Funded	31,214.00	31,214.00
Cost sharing amount		0.00

Does subcontracting plan apply ?: N

Title: RECIPROCATING FRICTION TESTER

PROJECT ADMINISTRATION DATA

OCA contact: Anita D. Rowland 894-4820

Sponsor technical contact

ROBERT D. EVANS, PH.D.
(215)832-4314

QUAKER CHEMICAL CORP.
CORPORATE TECHNICAL CENTER
ELM STREET
CONSHOHOCKEN, PA 19428-0873

Sponsor issuing office

QUENTIN D. CRAFT,DIR. CORP. TECH.
(212)832-4314

QUAKER CHEMICAL CORP.
SAME

Security class (U,C,S,TS) : U ONR resident rep. is ACO (Y/N): N
Defense priority rating : supplemental sheet
Equipment title vests with: Sponsor GIT X

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

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)

Closeout Actions Required:	Y/N	Date 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 _____	N	_____

Comments_____
_____

Subproject/Under Main Project No. _____

Continues Project No. _____

Distribution Required:

Project Director	Y
Administrative Network Representative	Y
GTRI Accounting/Grants and Contracts	Y
Procurement/Supply Services	Y
Research Property Managment	Y
Research Security Services	N
Reports Coordinator (OCA)	Y
GTRC	Y
Project File	Y
Other _____	N
_____	N

RECIPROCATING 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).

FRICTION 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 inch + 0, -.002. the flat is 3.00 + 0, -.05 inch by 0.625 + 0, -.05 by 0.125 + 0, -.010 inch thickness. This thickness should be uniform within 0.0005 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 inch spherical radius.

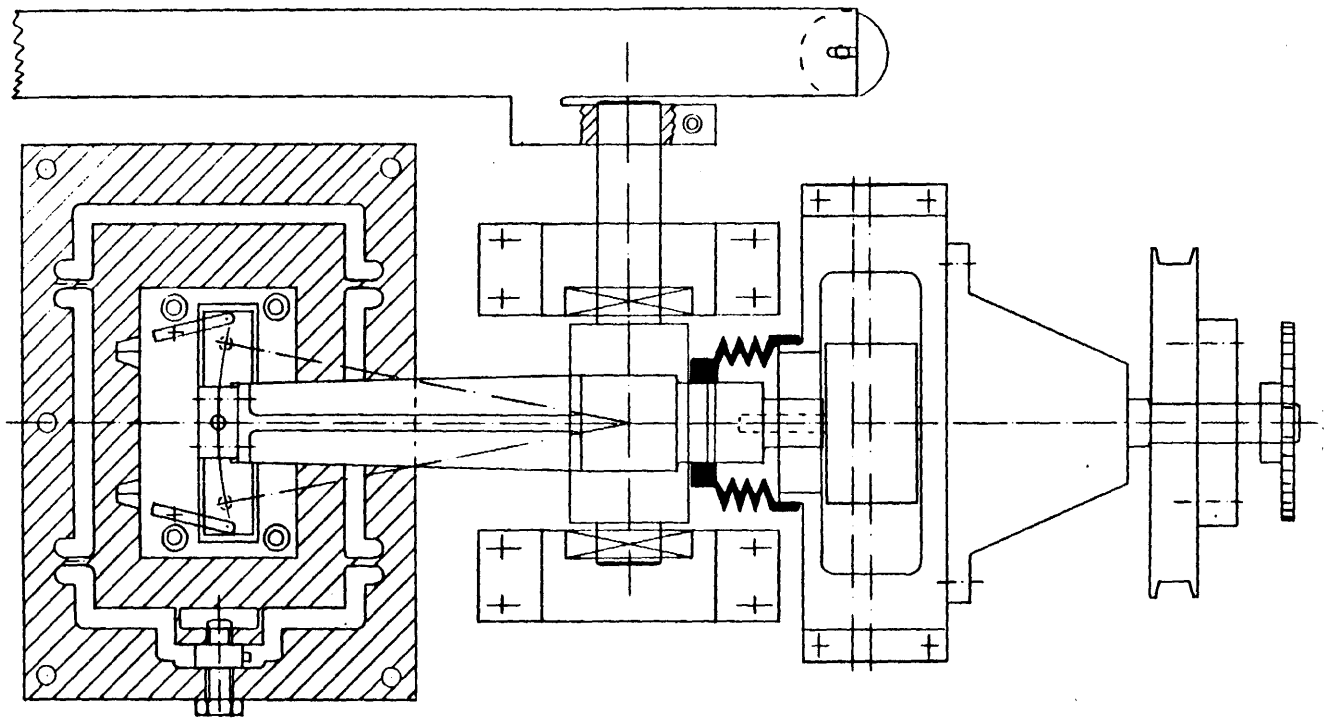
OPERATION OF THE TESTER

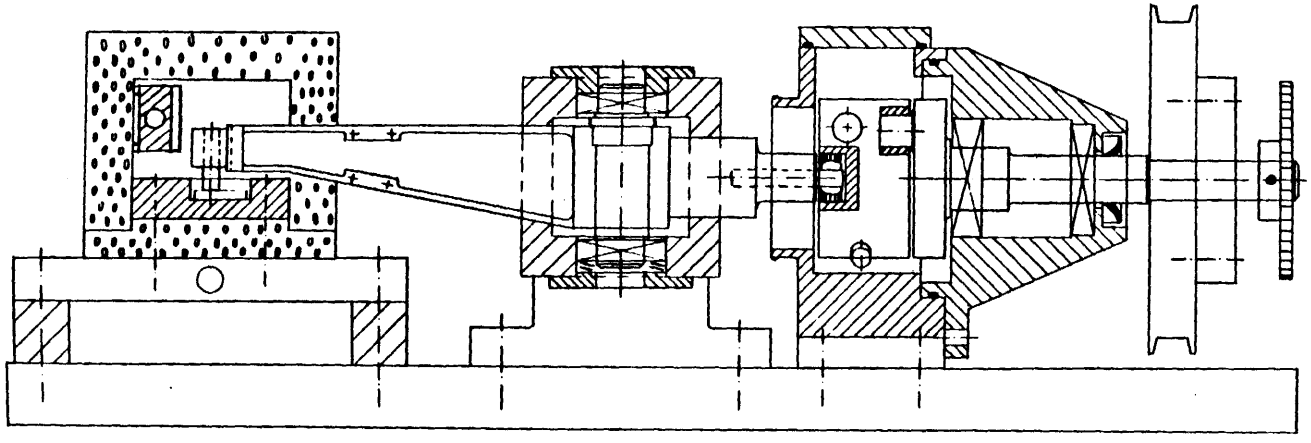
Install the flat in the bath. Slide the flat toward the tube fittings until it touches the edge with the oil channels. Tighten the cleat screws to 2.5 in-lb. Install the pin between the steel blocks. Tighten the 8-32 socket screws to 12 in-lb. The cleats which retain the flat must be turned to the extreme ends of the bath. Rotate the crankshaft by hand through one revolution to check for interference.

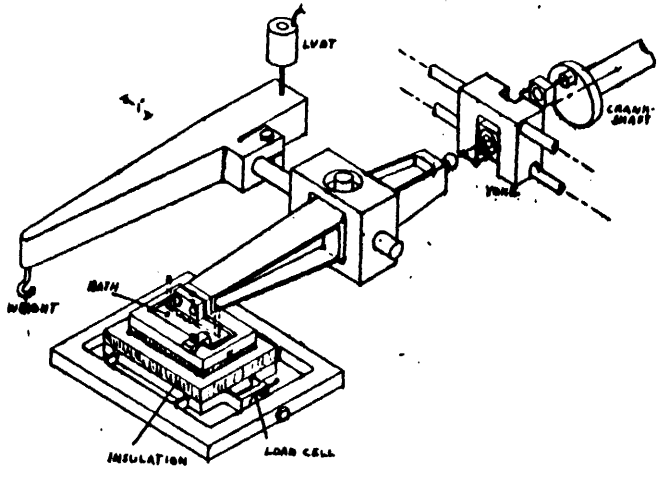
Occasionally check the oil level in the crank housing by removing the cover. It should be at the center of the lower horizontal small (1/4 in.) shaft. The heater wire should not be plugged directly into the A/C power line. A variable power source (to 110 V) or proportional controller should be used. 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 I. VELOCITY SELECTION

PULLEY TEETH		BELT	VELOCITY RANGE cm/min	
Motor Pulley	Crankshaft Pulley		Low	High
18	36	270L050	40	900
36	36	300L050	100	1800
36	18	270L050	300	3600

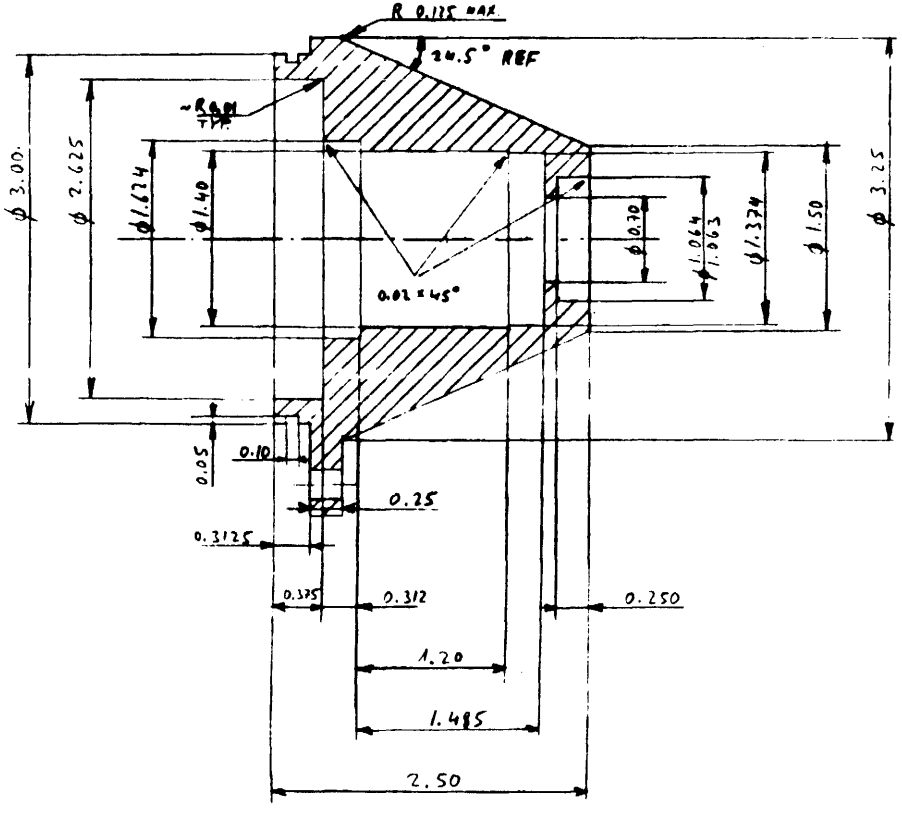


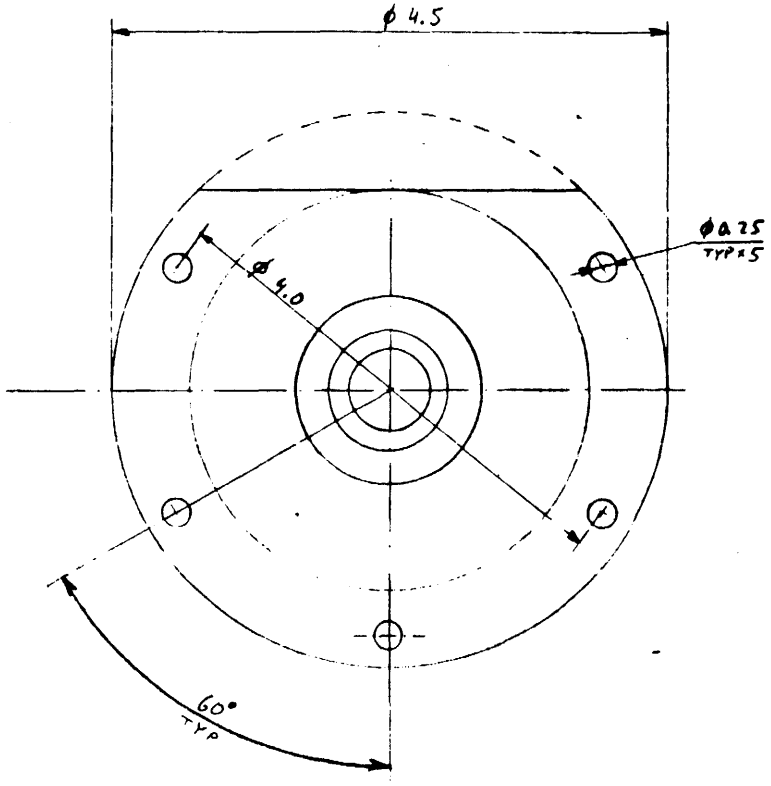




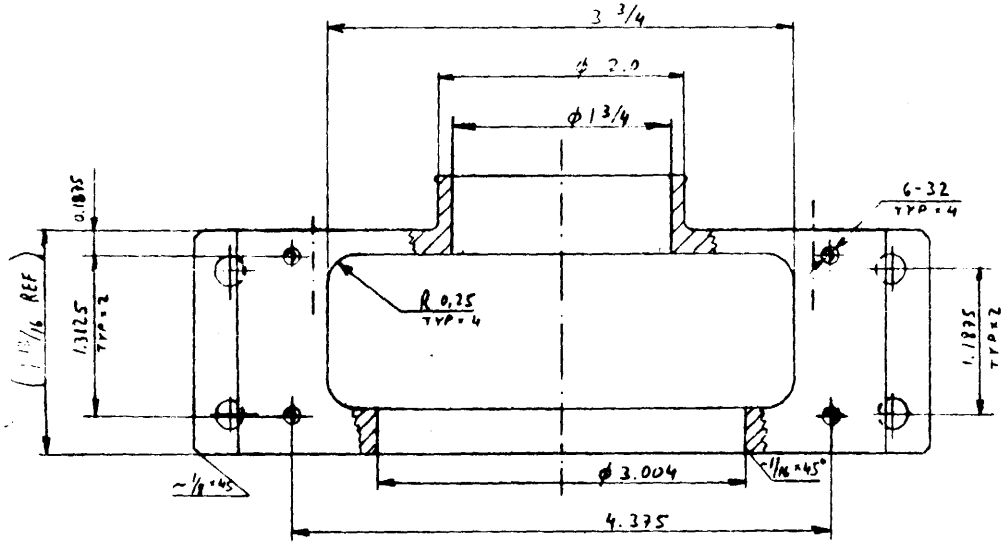
40% of Full Size

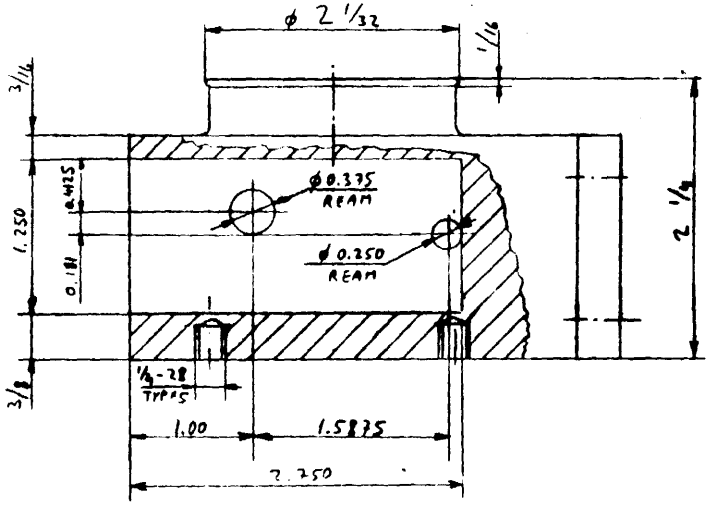
GT	Georgia Institute of Technology School of Mechanical Engineering		
Part Name: HIGH TEMP. FRICTION-WEAR TESTER			Part No.:
Designed By:	S. Bair A. Tran	Date: 11. 15. 89	Rev.

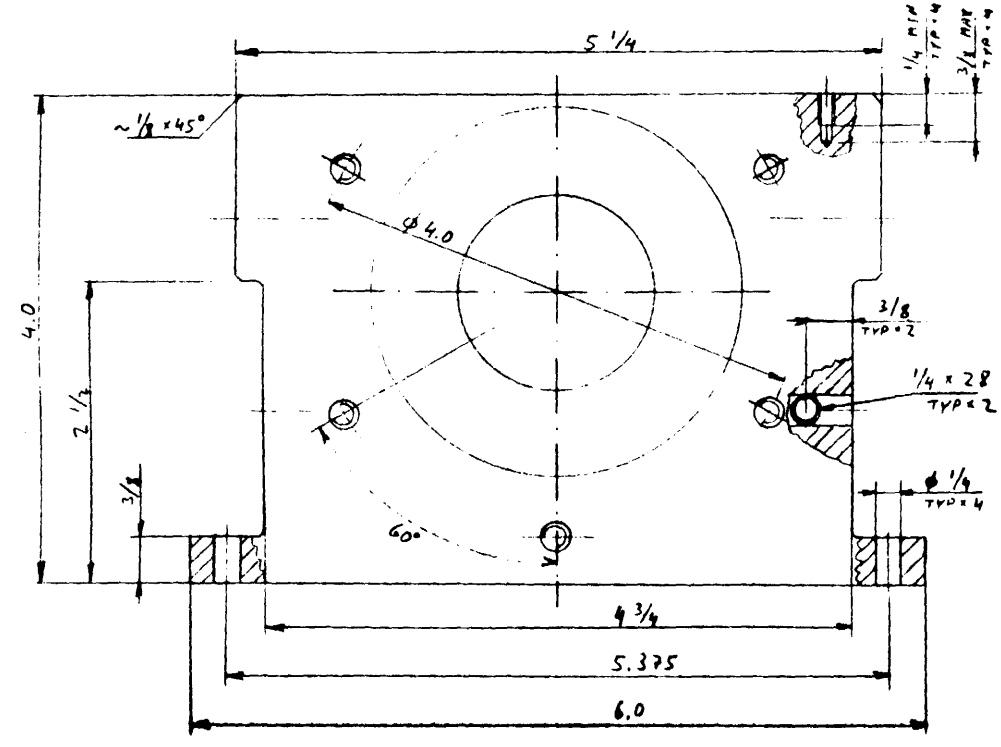




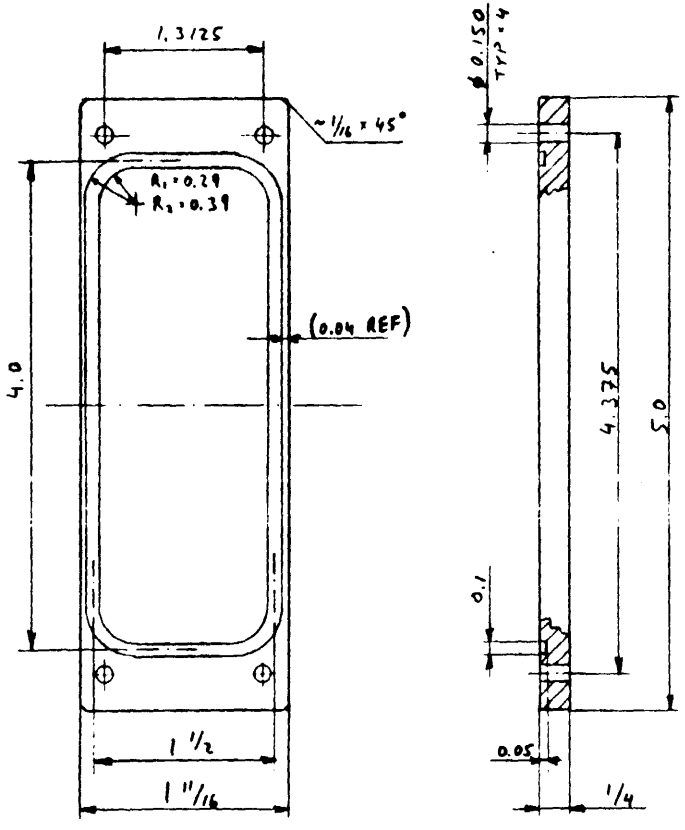
GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: BEARING HOUSING		Part No.:
Material: AL. 2024	Surface Finish: 125 (✓)	Heat Treatment:
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: [redacted] A. Tran	Date: 11. 15. 89	Rev.





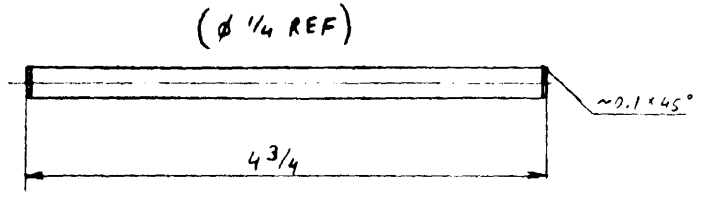


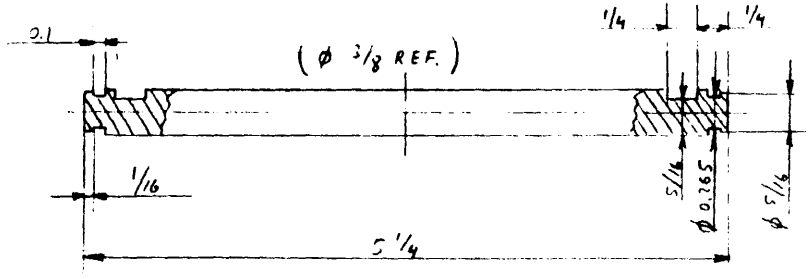
GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: CRANK HOUSING		Part No.:
Material: AL. 2024	Surface Finish: 125 (✓)	Heat Treatment:
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: K. Bibb A. Tress	Date: 11. 15. 89	Rev.



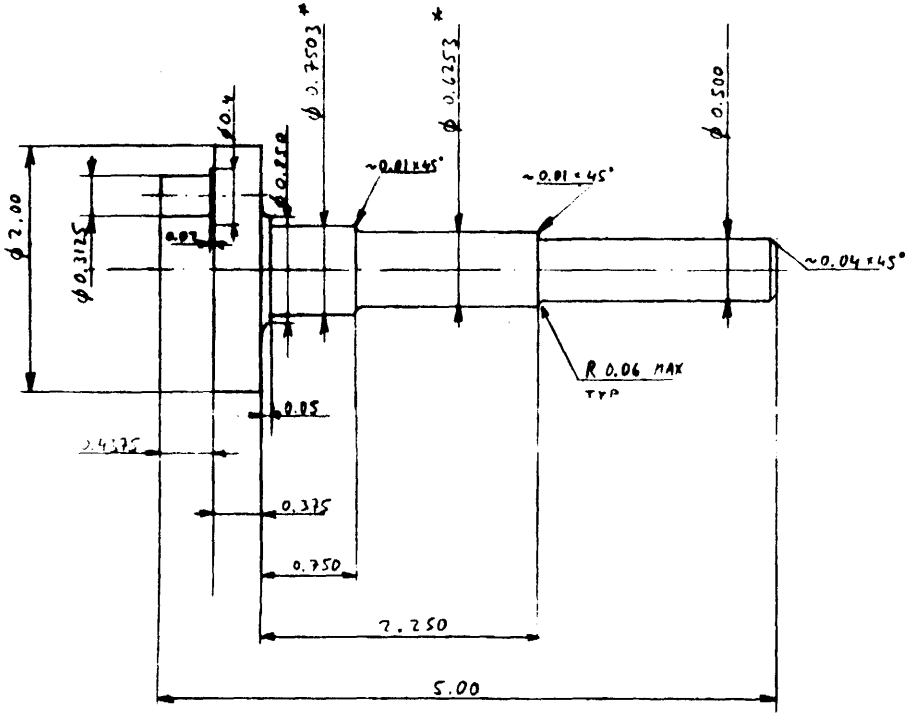
AL. 2024

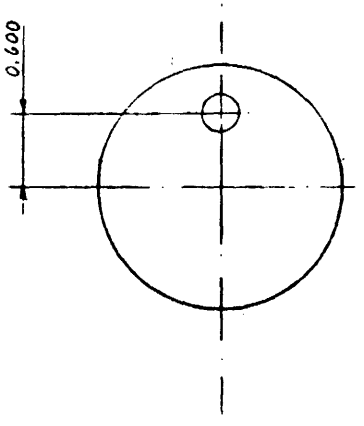
GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: COVER		Part No.:
Material: AL. 2024	Surface Finish: 125 (√)	Heat Treatment:
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: [redacted] A. Tran	Date: 11.15.89	Rev.





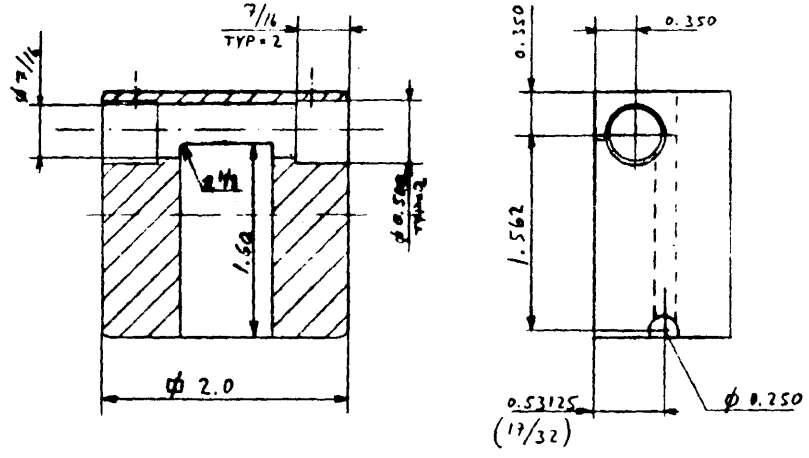
GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: SMALL SHAFT LARGE SHAFT		Part No.:
Material: O-1	Surface Finish: 125 (✓)	Heat Treatment: 58 R_c
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: E. Bilir A. Tran	Date: 11.15.89	Rev.

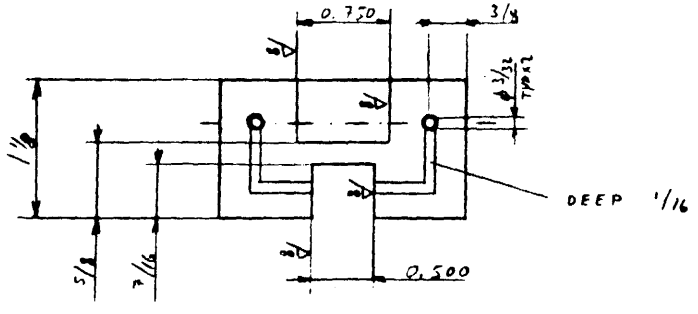




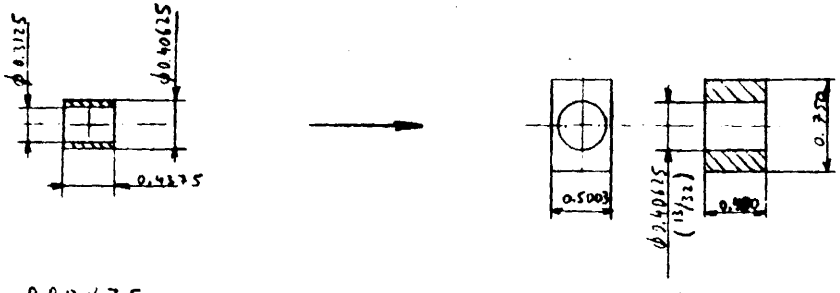
* BEARING I.D. + 0.0003"

GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: CRANKSHAFT		Part No.:
Material: O-1	Surface Finish: 125 (√)	Heat Treatment: 52-55 R_c
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: E. Bair A. Tress	Date: 11.15.89	Rev.





GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: SCOTCH YOKE		Part No.:
Material: AL. 2024	Surface Finish: 125 (√)	Heat Treatment:
All Dimen. in inches Scale: 1:1	Gen. Tol: ± 0.005"	Ang. Tol: ± 10'
Designed By: [redacted] A. Tran	Date: 11. 15. 89	Rev.

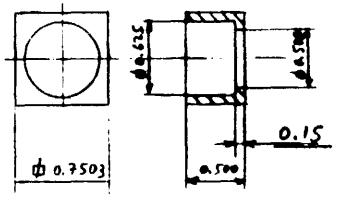


BRONZE

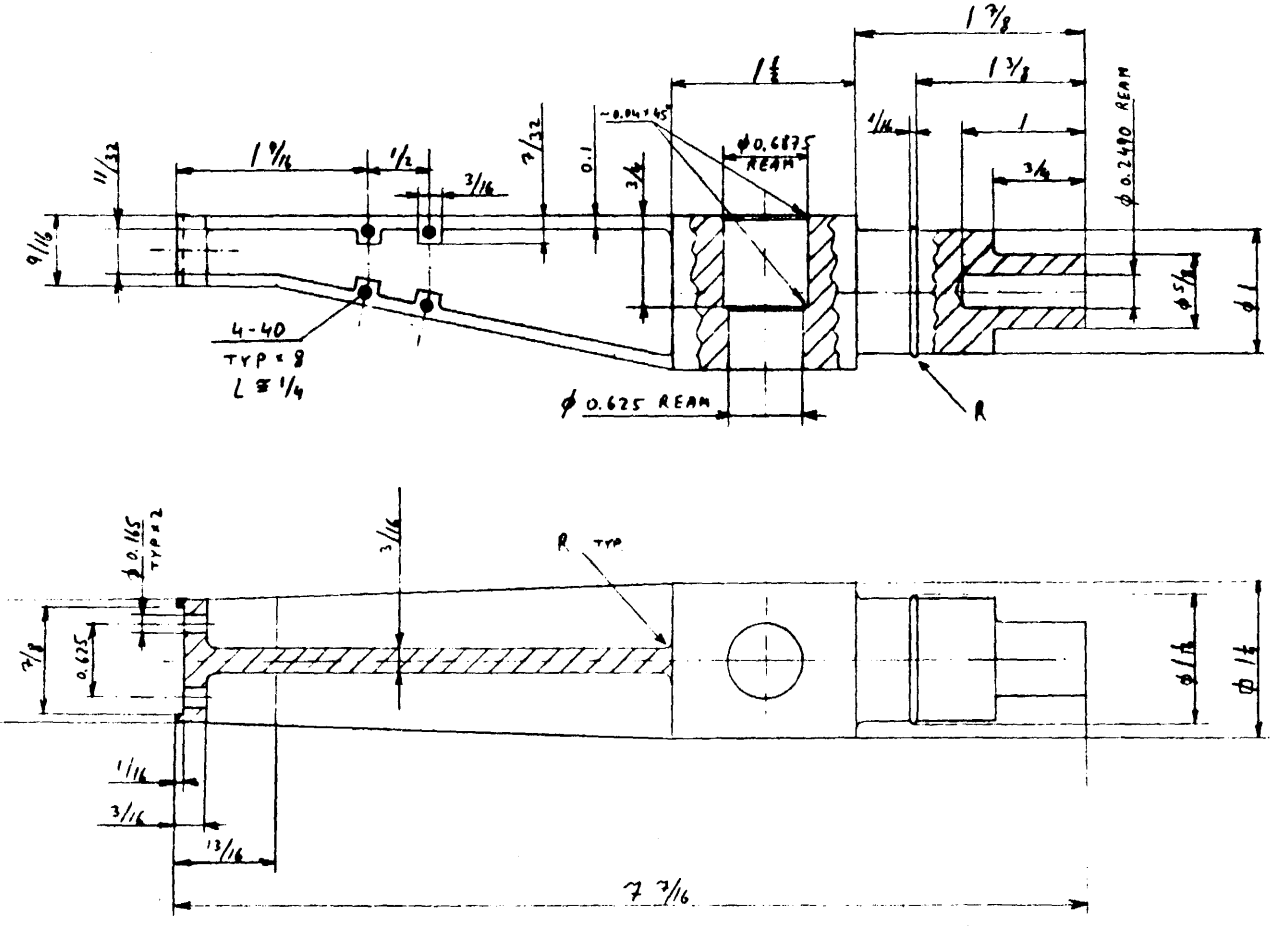
O-1

* 58 R_c

GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: SLIDE BLOCK		Part No.:
Material: BRONZE, O-1	Surface Finish: 125 (✓)	Heat Treatment: *
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: E. Ellis A. Tress	Date: 11.15.89	Rev.



GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: BEARING BLOCK		Part No.:
Material: O-1	Surface Finish: 125 (√)	Heat Treatment: 58 R_c
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: E. Bills A. Treu	Date: 11. 15. 89	Rev.



GT Georgia Institute of Technology School of Mechanical Engineering		
Part Name: MAIN ARM		Part No.:
Material: S.S. 416	Surface Finish: 125 (✓)	Heat Treatment:
All Dimen. in inches Scale: 1:1	Gen. Tol.: ± 0.005"	Ang. Tol.: ± 10'
Designed By: [redacted] A. Tree	Date: 11.15.89	Rev.