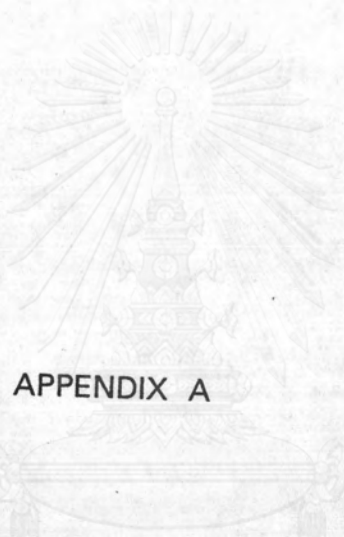


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APPENDIX A

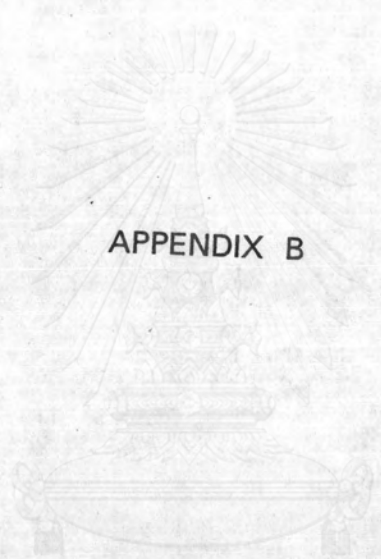
FAKULTAS HUKUM
UNIVERSITAS INDONESIA

APPENDIX A

SPECIFICATION OF PALM OIL

QUALITY SPECIFICATION

F.F.A. AS OLEIC ACID	0.1 %		MAX
P.V. (Meq/Kg) EX - FACTORY	1.0		MAX
I.V. (WIJS)	57 - 62		
M & I	0.1 %		MAX
LOVIBOND COLOUR 5 1/4" CELL	30	Y	MAX
	3.0	R	MAX
C.P.	5	C	MAX
GLC :			
C 12	=	0.0 - 0.3	
C 14	=	1.0 - 1.2	
C 16	=	35.0 - 37.0	
C 18	=	3.0 - 3.5	
C 18:1	=	44.0 - 46.0	
C 18:2	=	11.0 - 13.0	



APPENDIX B

CHONJU NATIONAL UNIVERSITY
Chonju National University

Typical Test Figures
Base Oil HVI 60

Appearance		Visual	Clear & Bright
Colour		ASTM D-1500	0.5
Density @ 15° C	kg/l	ASTM D-1298	0.867
Flash Point, Closed	°C	ASTM D-93	216
Pour point	°C	ASTM D-97	-15
Viscosity, Kinematic @ 40 °C	cst	ASTM D-445	25.63
	@ 100 °C cst	ASTM D-445	4.7
Viscosity Index		ASTM D-2270	100

HVI 60 is a paraffinic base oil refined from crude oil for use as a blending component of lubricating oils and greases.

Typical Test Figures
Base Oil HVI 160 B

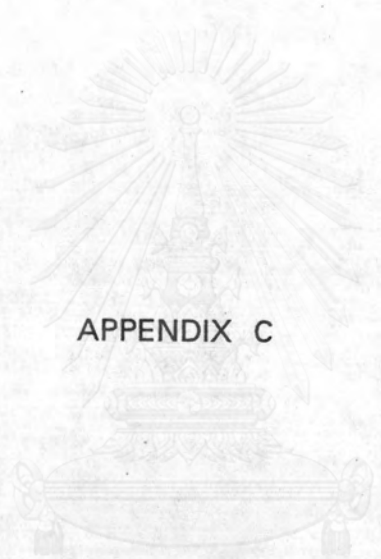
Appearance		Visual	Clear & Bright
Colour		ASTM D-1500	<2.5
Density @ 15° C	kg/l	ASTM D-1298	0.8900
Flash Point, Closed	°C	ASTM D-93	240
Pour point	°C	ASTM D-97	-9
Viscosity, Kinematic @ 40 °C	cst	ASTM D-445	95.2
	@ 100 °C cst	ASTM D-445	10.8
Viscosity Index		ASTM D-2270	97

HVI 160 B is a paraffinic base oil refined from crude oil for use as a blending component of lubricating and greases.

Typical Test Figures
Base Oil HVI 650

Appearance		Visual	Clear & Bright
Colour		ASTM D-1500	<5
Density @ 15° C	kg/l	ASTM D-1298	0.906
Flash Point, Closed	°C	ASTM D-93	270
Pour point	°C	ASTM D-97	-9
Viscosity, Kinematic @ 40 °C	cst	ASTM D-445	487.2
	@ 100 °C	cst	ASTM D-445
Viscosity Index		ASTM D-2270	95

HVI 650 is a paraffinic base oil refined from crude oil for use as a blending component of lubricating and greases.



APPENDIX C

จุฬาลงกรณ์มหาวิทยาลัย
CHULALONGKORN UNIVERSITY

**Determination of sulphur content of
petroleum products Flask-combustion method
(IP 242)**

1. Scope

This method describes a procedure for the determination of total sulphur in petroleum products with sulphur contents exceeding 0.2 %wt, including gas oils, fuel oils, residues, some lubricating oils, and some crudes. The method should not be used on products more volatile than gas oil.

2. Apparatus

2.1 Combustion Flask—made of borosilicate glass of 500 to 1000 ml capacity and provided with a conical B24 ground glass stopper with a fused-in platinum wire. The platinum wire carries a U-shaped platinum gauze or a platinum gauze basket. Examples of suitable apparatus are illustrated in Fig.1.

2.2 Safety Shield—of suitable design to protect the operator while carrying out manipulative operations during the combustion stage.

2.3 Teflon Sleeves

2.4 Syringe

2.5 Lighter—Any suitable type of small flame fed with a sulphur-free fuel.

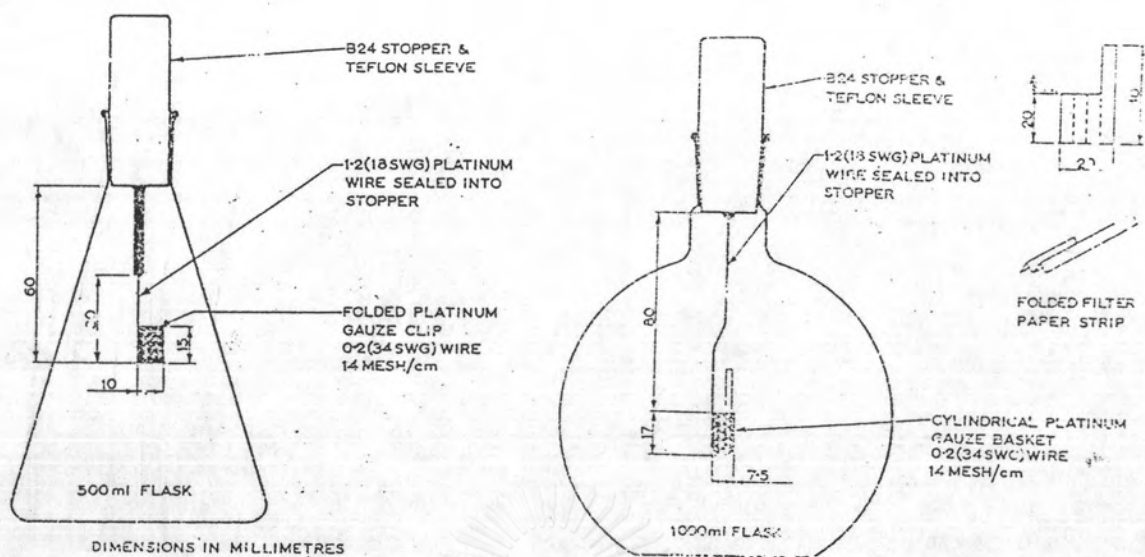


Figure 1 Combustion flask assembly.

2.6 Microburette Assembly

2.7 Photoelectric Colorimeter

2.8 Daylight Blue Lamp

2.9 Magnetic Stirrer

3. Reagents and Materials

3.1 Filter Paper—Ash-free filter paper (e.g. Whatman No.40). Prepare strips of the size and shape given in Fig.1. Fold the strips along the dotted lines to an M-shape, and store in an open bottle in the vicinity of the balance.

3.2 Absorbent Pellets—Prepare these from cellulose wadding B.P.C. standard.

3.3 Oxygen—free of sulphur compounds and extraneous matter.

3.4 Hydrogen Peroxides—1.5% w/v solution. Dilute 30% w/v hydrogen peroxide with distilled water shortly before use.

3.5 Isopropanol

3.6 Thorin Indicator Solution—0.2% wt aqueous solution of thorin (disodium 4-(2-*arsonophenylazo*)-3-hydroxynaphthalene-2,7-disulphonate). Protect from light and label

CAUTION-POISON.

3.7 Sulphuric Acid Solutions—standard 0.005N and 0.01N

3.8 Perchloric Acid—10 %w.

3.9 Barium Perchlorate Solutions—0.005N and 0.01N. Dissolve 0.975 and 1.95 g respectively of barium perchlorate trihydrate in 200 ml of distilled water, and make up to 1 litre with isopropanol. Adjust the apparent pH of the solution to 3/4 with a few drops of 10% perchloric acid.

4. Procedure

4.1 Weigh to the nearest 0.1 mg about 30 mg of sample on to the middle of a prepared filter paper strip.

4.2 Introduce into the flask 4 ± 0.5 ml of the 1.5% w/v hydrogen peroxide solution. Replace the air in the flask by passing a rapid stream of oxygen through the flask for 30 sec.

4.3 For conical flasks of the type illustrated in Fig.1 , hold the flask in one hand behind the safety screen. Ignite the filter paper fuse with a sulphur-free flame and immediately insert the stopper into the flask, holding it firmly in place. Rapidly but carefully invert the flask and hold it in an inclined position. Ensure that the flame does not touch the walls of the flask and that the absorption liquid forms a seal at the neck of the flask. Avoid tilting the flask at too great an angle otherwise the sample may fall out of the holder.

4.4 When the combustion is completed, shake the flask for about 1 min and allow to stand for 10 min. Wet the rim between the combustion flask and the stopper with isopropanol and open the flask allowing the liquid to be drawn in. Wash the stopper, neck of the flask, and the platinum gauze with isopropanol using a total of 16 ml of isopropanol. Place the stopper to one side.

4.5 Add 3 drops of thiorin indicator solution and titrate with the standard 0.01N barium perchlorate solution to the first permanent colour change from yellow to pink.

5. Calculation

Calculate the sulphur content of the sample by means of the following equation.

$$\text{Sulphur, \%w} = \frac{(V-v) \times N \times 1603}{w}$$

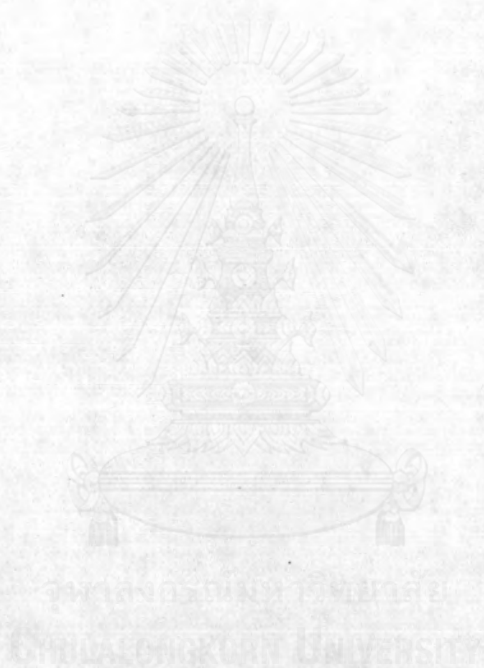
w

where V = volume of barium perchlorate solution
used for sample titration;

v = volume of barium perchlorate solution
used for blank titration;

N = normality of the barium perchlorate solution;

w = weight of sample in milligrams.



Standard Test Methods for Pour Point of Petroleum Oils : ASTM D 97-87

1. Scope

This test method is intended for use on any petroleum oil. A procedure suitable for black oils, cylinder stock, and nondistillate fuel oil. A procedure is testing the fluidity of a residual fuel oil at a specified temperature.

2. Apparatus

2.1 Test Jar, clear cylindrical glass, flat bottom, 30 to 33.5 mm inside diameter, and 115 to 125 mm height. To indicate sample height the jar should be marked with a line 54 ± 3 mm above the inside bottom.

2.2 Thermometers, having ranges and conforming to the requirements in Specification E1 for thermometers.

2.3 Cork, to fit the test jar, bored centrally for the test thermometer.

2.4 Jacket, metal or glass, watertight, cylindrical, flat bottom, 115 mm in depth, 42 to 50 mm inside diameter. It must be supported firmly in a vertical position in the cooling bath.

2.5 Disk, cork or felt, 6 mm thick to fit loosely inside the jacket.

2.6 Gasket, The gasket may be made of rubber, leather, or other material that is

elastic enough to cling to the test jar and hard enough to hold its shape.

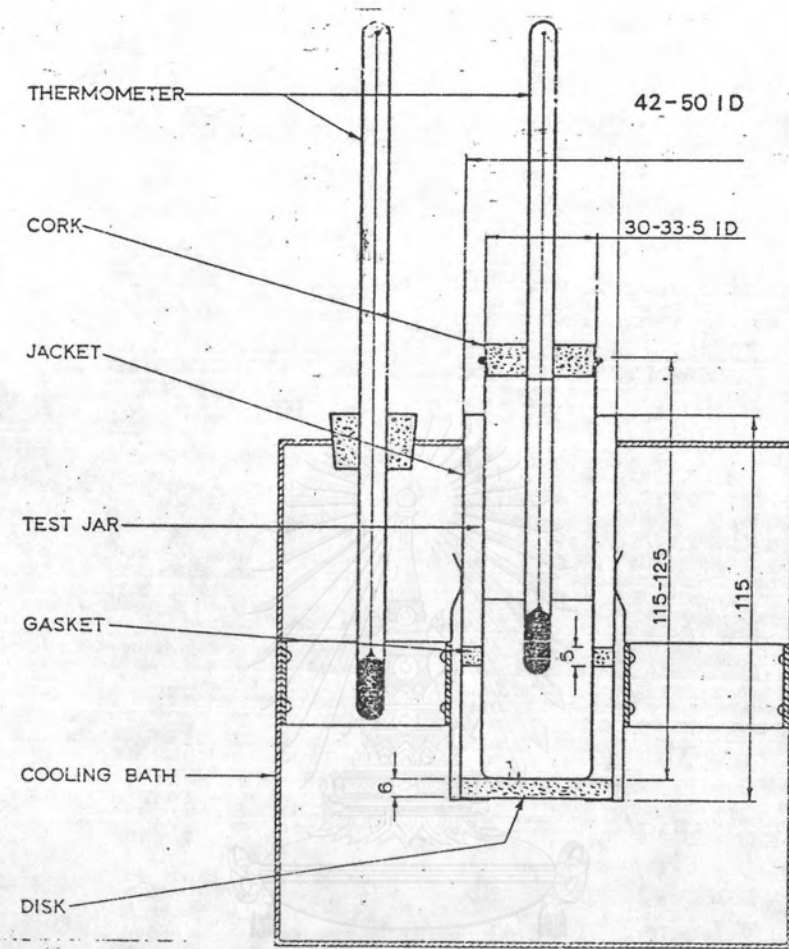


Figure 1 Apparatus for Pour Point Test.

2.7 Bath or Baths, maintained at prescribed temperatures with a firm support to hold the jacket vertical.

3. Reagents and Materials

The technical grade are appropriate for low-temperature bath media.

3.1 Acetone

3.2 Alcohol, Ethanol

3.3 Alcohol, Methanol

3.4 Petroleum Naphtha

3.5 Solid Carbon Dioxide

4. Procedure

4.1 Pour the oil into the test jar to the level mark. When necessary, heat the oil in a water bath until it is just sufficiently fluid to pour into the test jar.

4.2 Close the test jar with the cork carrying the high-pour thermometer. Adjust the position of the cork and thermometer so the cork fits tightly, the thermometer and the jar are coaxial, and the thermometer bulb is immersed so the beginning of the capillary is 3 mm below the surface of the oil.

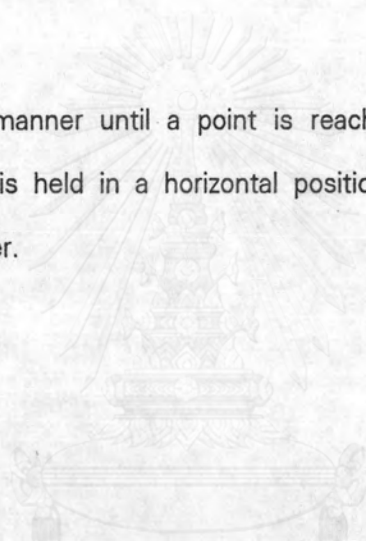
4.3 See that the disk, gasket, and the inside of the jacket are clean and dry. Place the disk in the bottom of the jacket. Place the gasket around the test jar, 25 mm from the bottom. Insert the test jar in the jacket. Never place a jar directly into the cooling medium.

4.4 After the oil has cooled to allow the formation of paraffin wax crystals, take great care not to disturb the mass of oil nor permit the thermometer to shift in the oil ; any

disturbance of the spongy network of wax crystals will lead to low and erroneous results.

4.5 Pour points are expressed in integers that are positive or negative multiples of 3 °C. Begin to examine the appearance of the oil when the temperature of the oil is 9 °C above the expected pourpoint. At each test thermometer reading that is a multiple of 3 °C below the starting temperature remove the test jar from the jacket. To remove condensed moisture that limits visibility wipe the surface with a clean cloth moistened in alcohol (ethanol or methanol).

4.6 Continue in this manner until a point is reached as which the oil shows no movement when the test jar is held in a horizontal position for 5 s. Record the observed reading of the test thermometer.



**Standard test method for detection of
Copper corrosion from petroleum products
by the Copper Strip Tarnish test : ASTM D 130-88**

1. Scope

This test method covers the detection of the corrosiveness to copper of aviation gasoline, aviation turbine fuel, automotive gasoline, natural gasoline or other hydrocarbons having a Reid vapor pressure no greater than 18 psi (124 kPa).

2. Apparatus

2.1 Test Tubes, 25 by 150 mm.

2.2 Provide a bath capable of being maintained at a constant temperature of $50 \pm 1^{\circ}\text{C}$ ($122 \pm 2^{\circ}\text{F}$) or $100 \pm 1^{\circ}\text{C}$ ($212 \pm 2^{\circ}\text{F}$), or both, and having suitable supports to hold the test tubes in a vertical position and immersed to a depth of about 100 mm (4 in.). Either water, oil, or aluminum block baths are suitable.

2.3 Copper Strip Corrosion Test Bomb, constructed of stainless steel according to the dimensions as given in Fig. 1, and capable of withstanding a test pressure of 100 psi (689 kPa). Alternative designs for the bomb cap and synthetic rubber gasket may be used provided that the internal dimensions of the bomb are the same as those shown in Fig. 1. Provide a 25 by 150 mm test tube as a liner for holding the sample.

2.4 thermometers

2.5 Polishing Vise, holding the copper strip firmly without marring the edges while polishing.

2.6 Viewing Test Tubes, flat, are convenient for protecting corroded for close inspection or storage.

3. Materials

3.1 Wash Solvent : Any volatile, sulfur-free hydrocarbon solvent may be used provided that it shows no tarnish at all when tested at 50 °C (122 °F). Knock tetst grade isooctane is a suitable solvent and should be used in case of dispute.

3.2 Polishing Materials : Silicon carbide grit paper of varying degrees of fineness including 65 m (240 grit) paper or cloth, also a supply of 105 m (150 mesh) silicon carbide grain and pharmaceutical grade absorbent cotton (cotton wool).

3.3 Copper Strips :

- Specification : Use strips 12.5 mm (0.5 in) wide, 1.5 to 3.0 mm (1/6 to 1/8 in) thick, cut 75 mm (3 in) long from smooth-surfaced, hard-temper, cold-finished copper of 99.9 + percent purity ; electrical bus bar stock is generally suitable.

- Remove all surface blemished from all six sides of the strip with silicon carbide paper.

4. Procedure

A polished copper strip is immersed in a given quantity of sample and heated at a temperature and for a time characteristic of the material being tested. At the end of this period the copper strip is removed, washed, and compared with the ASTM Copper Strip Corrosion Standards.

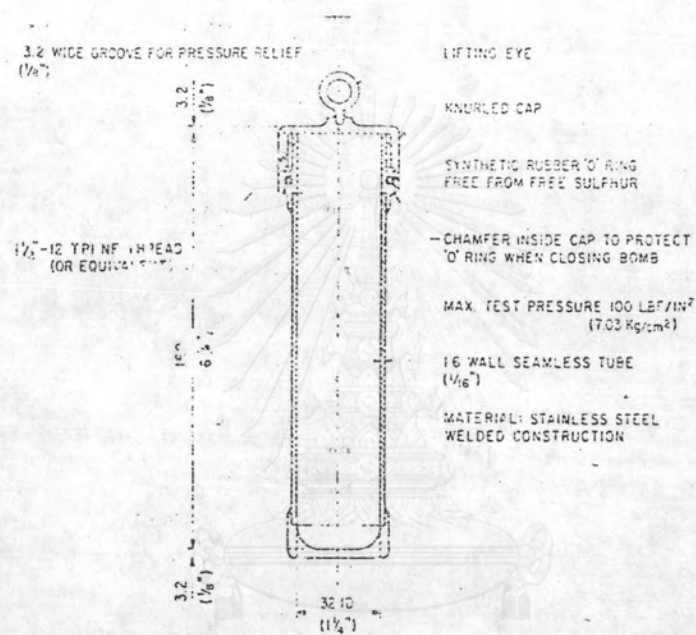


Figure 1 Copper Strip Corrosion Test Bomb.

**Standard Test Method for Kinematic Viscosity
of Transparent and Opaque Liquids
(and the Calculation of Dynamic Viscosity)
ASTM D 445-88**

1. Scope

This test method covers the determination of the kinematic viscosity of liquid petroleum products, both transparent and opaque, by measuring the time for a volume of liquid to flow under gravity through a calibrated glass capillary viscometer. The dynamic viscosity can be obtained by multiplying the measured kinematic viscosity by the density of the liquid.

2. Apparatus

2.1 Viscometers

2.2 Viscometer Holders; to enable the viscometer tube suspended in a similar position as when calibrated. The proper alignment of vertical parts may be confirmed by using a plumb line.

2.3 Viscometer Thermostat and Bath

2.4 Temperature-Measuring Device

2.5 Timing Device

3. Method

The time is measured in seconds of a fixed volume of fluid to flow under gravity through the capillary of a calibrated viscometer under a reproducible driving head and closely controlled temperature. The kinematic viscosity of the measured flow time and the calibration constant of the viscometer.

4. Calculation

Calculate the kinematic viscosity, ν , from the measured flow time, t , and the instrument constant, C , by means of the following equation:

$$\nu = Ct$$

where:

ν = kinematic viscosity, cSt (mm^2/s)

C = calibration constant of the viscometer, cSt/s, and

t = flow time, s.

**Standard Test Method for Measurement of
Extreme-Pressure Properties of Lubricating Fluids
(Timken Methods) ASTM D 2782-83**

1. Scope

This test method covers the determination of the load-carrying capacity of lubricating fluids by means of the Timken Extreme Pressure Tester.

2. Apparatus

2.1 Timken Extreme Pressure Tester

2.2 Sample Feed Device, for supplying the test specimens with fluid.

2.3 Loading Mechanism, for applying and removing the load weights without shock at the uniform rate of 0.91 to 1.36 kg/s (2 to 3 lb/s).

2.4 Timer

3. Reagents and Materials

3.1 Acetone

3.2 Stoddard Solvent of White Spirit

3.3 Test Cups, of carburized steel, having a Rockwell Hardness "C" Scale Number of 58 to 62, or a Vickers Hardness Number of 653 to 756. The cups have a width of 0.514 ± 0.002 in., a perimeter of 6.083 ± 0.009 in., a diameter of $1.938 \pm 0.001, -0.005$ in. and a maximum radial run-out of 0.005 in. The axial surface roughness should lie between 0.51 and 0.76 μ m (20 and 30 in.)

3.4 Test Block, with test surfaces 0.485 ± 0.002 in. wide and 0.750 ± 0.016 in. long, of carburized steel, having a Rockwell Hardness "C" Scale Number of 653 to 756. Each block is supplied with four ground faces and the surface roughness should lie between 0.51 and 0.76 μ m (20 and 30 in.)

4. Preparation of Apparatus

4.1 Clean apparatus with stoddard solvent or white spirit and acetone and blow dry.

4.2 Select a new test cup and block, wash with stoddard solvent or white spirit and dry with a clean soft cloth or paper. Immediately before use rinse the test cup and block with acetone and blow them dry. Do not use solvents such as carbon tetrachloride or others that may inherently possess load-carrying properties which may effect the results.

4.3 Assemble the tester carefully (Fig. 3), placing the test cup on the spindle and making certain that it is well seated, drawing it up firmly but avoiding possible distortion from excessive tightening. Place the block in the test block holder and adjust the levers so that all the knife edges are in proper alignment. Exercise special care in placing the spring of the spring-weight platform assembly (selection of which will depend on the loading device) in the

groove of the load-lever arm to avoid premature shock to the test block when the load is applied. To ensure that the test block, test block holder, and lever arms are properly aligned and seated coat the test block and test cup with the lubricant to be tested, and rotate the machine slowly for a few revolutions either by hand or by suitable control mechanism. When the parts are in alignment, the fluid will be wiped off the cup over its entire width.

5. Procedure

5.1 Fill the reservoir of the tester to within 76 mm (3 in.) of the top (approximately 3 L or 3 qt) with the fluid to be tested. Preheat the fluid to 37.8 ± 2.8 °C (100 ± 5 °F)

5.2 Set the discharge valve at full open. Allow the lubricant to flood the test cup and block. When the sump is about half filled with the fluid, start the motor and run for 30 s to break-in. If the equipment used is equipped with acceleration control, start the motor and increase the spindle speed gradually to achieve 800 ± 5 rpm after 15 s. Run for a further 15 s to complete the break-in.

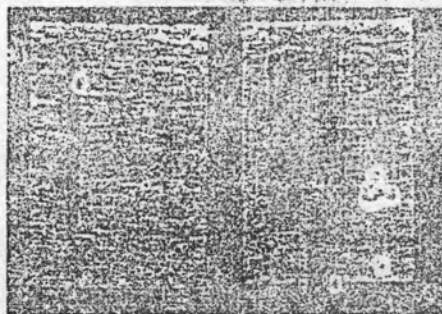
5.3 After a break-in period of 30 s, start the timer and apply at 8.9 to 13.3 N/s (2 to 3 lbf/s), a load that is less than the expected score load. In the absence of a better estimate, a starting load of 30 lbf is recommended. Then allow the machine to run 800 ± 5 rpm for 10 min + 15 s after load application is initiated, unless a score is detected before that period.

5.4 If, after the load has been applied, scoring is evident by vibration or noise, stop the tester at once, turn off the flow of lubricant, and remove the load. Since the excessive heat developed with deep scoring may alter the surface characteristics of the entire block, discard the test block.

5.5 If no scoring is detected, allowed the tester to run for 10 min + 15 from the start of the application of the load. At the end of the 10 min + 15 s period, reverse the loading device and remove the load from the lover arm. Turn off the motor, allow the spindle to come to rest, then turn off the flow of fluid. Remove the load level and inspect the condition of the test block surface at 1* magnification.

5.6 If no score is observed, turn the test block to expose a new surface of contact and, with a new test cup, repeat the test.

Typical OK
No Scoring



Improper Setup

FIG. 1 Test Blocks Showing Various Types of Scar

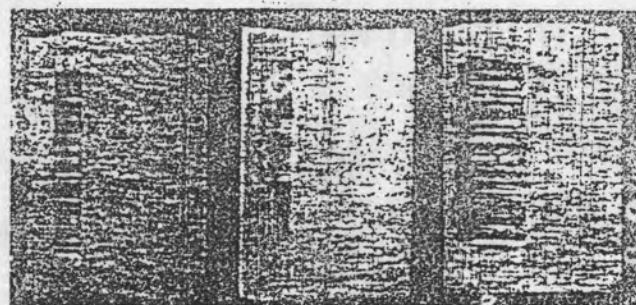


Figure 1. Test Blocks Showing Various Tpyes of Scar.

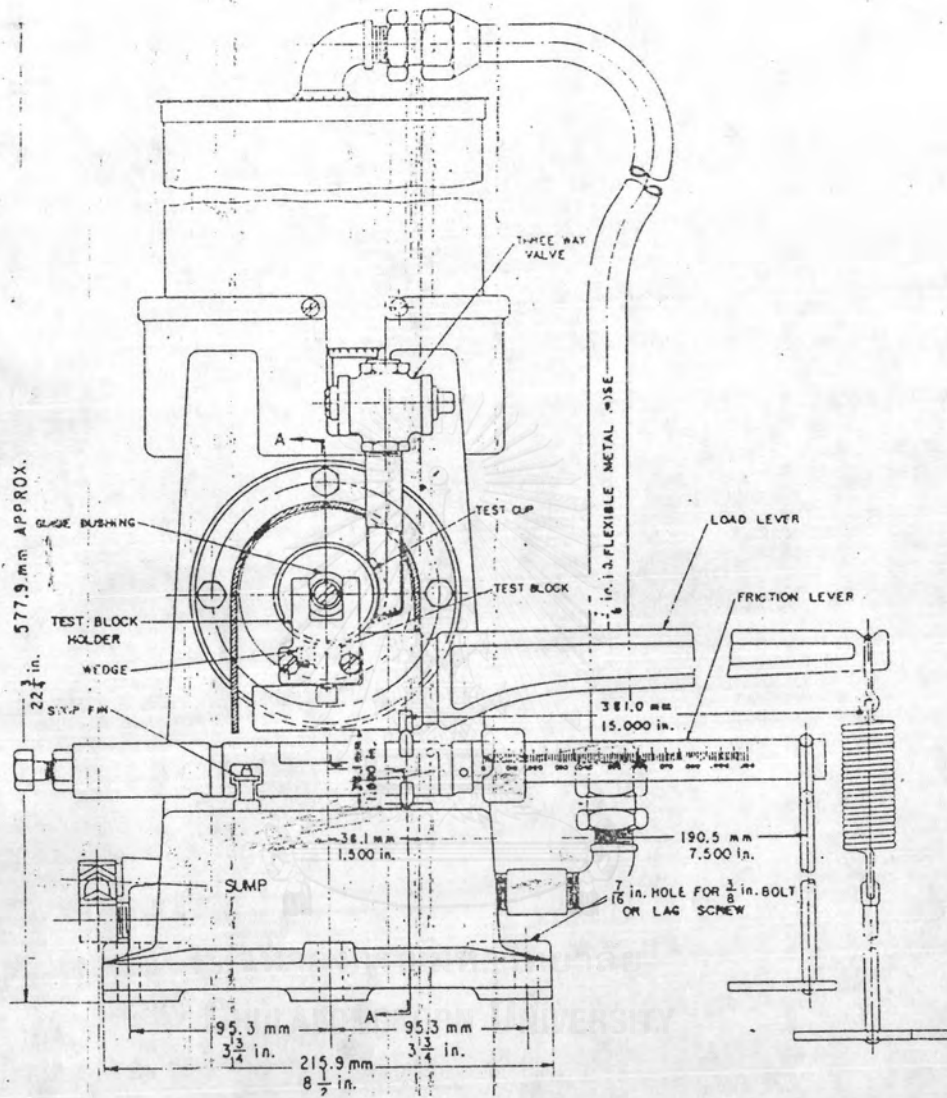


Figure 2. Timken Tester.

VITA

Miss Soamwadee Suwanakijboriharn was born on April 16, 1969 in Bangkok. She received a Bachelor's Degree of Science, Chemistry, with Second Class Honours from Kasetsart University in 1990. She has been a graduate student of the Multidisciplinary Program of Petrochemistry and Polymer, Graduate School, Chulalongkorn University, since 1990.

