



## K16503, K16593, K16504, K16594 RAPID FLASH TESTER, OPEN CUP

### *OPERATION AND INSTRUCTION MANUAL*

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# CERTIFICATE OF CONFORMANCE

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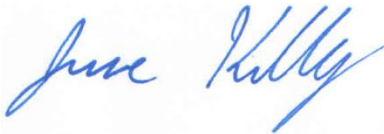
## Rapid Flash Point Tester K165XX

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This certificate verifies that part number K165XX, Rapid Flash Point Tester, was manufactured in conformance with the applicable standards set forth in this certification.

Specifications:	ASTM D3278
	ASTM D3828
	ASTM D4206
	DOT CFR 49-173.115
	IATA
	ISO 9038

This unit is tested before it leaves the factory, to ensure total functionality and compliance to the above specifications and ASTM standards. Test and inspection records are on file for verification.



**Jesse Kelly**  
**Application Engineer**  
**Koehler Instrument Company**



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## 1 Introduction

The Rapid Tester of the open cup type is designed for quickly ascertaining the flash point of a volatile material or to determine the sustained burning (combustibility) of liquid mixtures. Instruments utilize equilibrium, open cup technology.

This manual provides important information regarding safety, technical reference, installation requirements, operating condition specifications, user facility resource requirements, and operating instructions for the Rapid Flash Tester, Open Cup. This manual should also be used in conjunction with applicable published laboratory procedures. Information on these procedures is given in section 1.2.

### 1.1 Koehler's Commitment to Our Customers

Providing quality testing instrumentation and technical support services for research and testing laboratories has been our specialty for more than 50 years. At Koehler, the primary focus of our business is providing you with the full support of your laboratory testing needs. Our products are backed by our staff of technically knowledgeable, trained specialists who are experienced in both petroleum products testing and instrument service to better understand your requirements and provide you with the best solutions. You can depend on Koehler for a full range of accurate and reliable instrumentation as well as support for your laboratory testing programs. Please do not hesitate to contact us at any time with your inquiries about equipment, tests, or technical support.

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**<http://www.koehlerinstrument.com>**

## 1.2 Recommended Resources and Publications

Test cup and test jet assembly are dimensionally in accord with ASTM, ISO and BSI requirements as delineated in their standards:

1. American Society for Testing and Materials (ASTM)  
100 Barr Harbor Drive  
West Conshohocken, Pennsylvania 19428-2959, USA  
Tel: +1 610 832 9500  
Fax: +1 610 832 9555  
<http://www.astm.org>  
email: [service@astm.org](mailto:service@astm.org)

#### ASTM Publication:

- ASTM D4206: Sustained Burning of Liquid Mixtures using the small scale open-cup apparatus

2. International Organization for Standardization (ISO)  
1, rue de Varembe  
Case postale 56  
CH-1211 Geneva 20, Switzerland  
Tel: 41 22 749 01 11  
Fax: 41 22 733 34 30  
<http://www.iso.org>

#### ISO Publication:

- ISO 9038: Test for Sustained Combustibility of Liquids

3. British Standards Institute  
389 Chiswick High Road  
London  
W4 4AL  
United Kingdom  
Tel: 44(0)20 8996 9001  
Fax: 44(0)20 8996 7001  
<http://www.bsigroup.com>

#### Accepted by:

- CPSC: United States Consumer Products Safety Commission
- DOT: United States Department of Transportation
- EPA: United States Environmental Protection Agency
- NFPA: National Fire Protection Association
- OSHA: United States Occupational Safety and Health Administration

### 1.3 Instrument Specifications

<b>Models:</b>	K16503, K16504 K16593, K16594
<b>Electrical Requirements:</b>	98-132V, 50/60Hz 196-264V 50/60Hz
<b>Flash Point Temperature Range:</b>	-36° to 212°F -30° to 100°C
<b>Temperature Display:</b>	Digital °F/°C LCD display and mercury-in-glass thermometer.
<b>Cup Type:</b>	Open, equilibrium test
<b>Operational Sample Size:</b>	2ml to 212°F (100°C)
<b>Repeatability:</b>	In accordance with Industry Test Method
<b>Reproducibility:</b>	In accordance with Industry Test Method
<b>Dimensions:</b>	15.0x3.4x5.3 in. (38.1x8.64x16.25 cm)
<b>Net Weight:</b>	10lbs (4.6kg)

## 2 Safety Information and Warnings

**Safety Considerations.** The use of this equipment may involve *hazardous* materials and operations. This manual does not purport to address all of the safety problems associated with the use of this equipment. It is the responsibility of any user of this equipment to investigate, research, and establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

**Equipment Modifications and Replacement Parts.** Any modification or alteration of this equipment from that of factory specifications is not recommended voids the manufacturer warranty, product safety, performance specifications, and/or certifications whether specified or implied, and may result in personal injury and/or property loss. Replacement parts must be O.E.M. exact replacement equipment.

**Unit Design.** This equipment is specifically designed for use in accordance with the applicable

standard test methods listed in section 1.2 of this manual. The use of this equipment in accordance with any other test procedures, or for any other purpose, is not recommended and may be extremely hazardous.

**Chemical Reagents Information.** Chemicals and reagents used in performing the test may exhibit potential hazards. Any user must be familiarized with the possible dangers before use. We also recommend consulting the Material Data and Safety Sheet (MSDS) on each chemical reagent for additional information. MSDS information can be easily located on the internet at <http://siri.uvm.edu> or <http://www.sigma-aldrich.com>.

**WARNING:** Flash point testers aid in determining the temperature at which application of a test flame causes the vapors of a sample to ignite under specified conditions of test. Flammable and potentially explosive materials are involved in the presence of a source of ignition. It is the direct responsibility of the user to establish appropriate safety and health practices for all personnel. The test procedures contained in this manual are for reference purposes only. The user of the Rapid Tester® is to follow the instructions, warnings, and the cautions contained in the industry test methods.

Under no circumstances should this product be used except by qualified, trained personnel and not until the instructions, labels or other literature accompanying it have been carefully read and understood and all precautions followed as set forth herein.

## 3 Getting Started

### 3.1 Unpacking

Carefully unpack, account for and inspect the Rapid Tester, thermometer, fuel supply, syringe, cord and plug and optional accessories if ordered. Inspect each item for possible shipping damage. Be careful not to discard any components that may be enclosed in packing material.

### 3.2 Assembly

1. Place instrument on a level bench top in a draft free area.
2. Remove the two screws from the thermometer hold down bracket and remove the bracket.

Remove the wood dowel thermometer substitute if provided.

3. Remove the thermometer from its shipping tube and inspect. If the mercury column is separated, the thermometer must be cooled and the mercury shaken down into the bulb.
4. Each instrument is supplied with a small package of Heat Transfer Compound. Apply the compound to the bulb of the thermometer so that full contact will be made with the walls of its well when inserted into the cup.
5. Insert the thermometer carefully into the test cup. Rotate the thermometer to position the scale for convenient reading of degrees Fahrenheit or Celsius. Position the thermometer so that its end which is the high temperature reading will be fully under the clip. Replace the thermometer hold down clip. Insert and hand tighten the two holding screws. To avoid breaking the thermometer, do not tighten the screws to cause more than a soft contact of the clip on the glass.
6. The primary power cord has an internationally uniform plug for connection to the instrument. The plug which mates with the U.S. standard, 115v grounded receptacle is standard. For 230V service or export, the cord does not include a plug. Its three conductors are stripped of insulation and ready for termination in user supplied plug. The record contains three No. 18 AWG conductors. When attaching the plug, be sure to connect the green, ground conductor. The instrument circuitry is internally grounded to its enclosure and integral power cord receptacle.
7. Check that the instrument primary power switch is in the OFF (switch depressed to "O") position.
8. Be sure that the instrument is connected internally with the jumpers in the terminal positions for your voltage, either 115 or 230V nominal. The label below the primary power receptacle states the voltage connection. If there is a question, remove the four screws which hold the upper chassis to the lower unit. Gently lift the upper chassis and place upside-down on protective material such as foam. Check the terminal positions for primary power to transformer conductors and to the heaters.

Review with the Connection Diagram in section 7.3. Change as necessary. Then reassemble.

9. Connect the power cord to the instrument and then to your power supply receptacle.
10. Engage the threads of the fuel supply valve assembly to the external adapter. Be sure that threads are fully engaged to prevent leakage of gas. Press the clear tubing onto the fuel supply valve and onto the gas inlet of the test jet assembly. Be sure that the stops for the test jet assembly are located as shown in Figure 1 dependent on the specific test method requirement.
11. Press primary power switch to "I" (ON). Adjust temperature control knob while depressing Preset and turn temperature control knob to cause digital readout to be at approximately 149°F (65°C). Release the Preset switch. The digital readout and the mercury-in-glass thermometer will indicate rising cup temperature. Turn the temperature control knob counterclockwise and switch instrument primary power switch to "O" OFF.

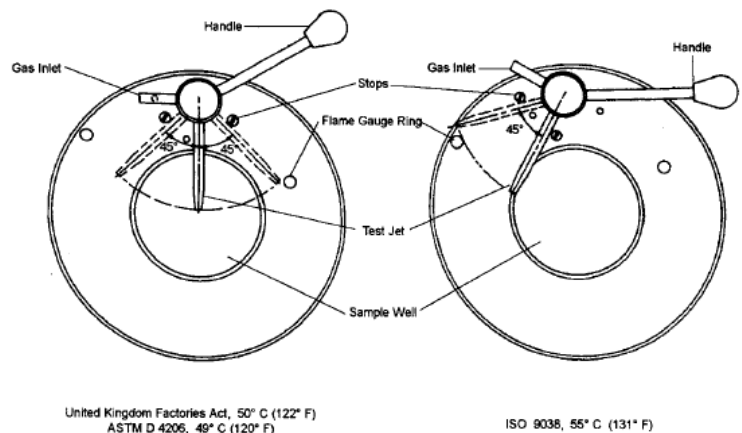


Figure 1. Test Jet Assembly



### 3.3 Preparation of Dry Ice/Acetone Slurry (Optional)

Solid carbon dioxide in equilibrium with carbon dioxide vapor at one atmosphere will provide cooling to a temperature as low as  $-78.5^{\circ}\text{C}$  /  $109.3^{\circ}\text{F}$ . The liquid acetone provides good thermal contact throughout the bath. It also prevents air from diluting the carbon dioxide gas at the surface of the dry ice. The test cup must not be cooled to a temperature below  $-38.4^{\circ}\text{C}$ , the freezing point of mercury.

1. Extinguish the pilot and test flames.
2. Remove the top cover of the refrigerant charged cooling block and fill the cylinder one-quarter to one-half full with acetone. **DO NOT FILL TO HIGHER LEVEL.**
3. Pulverize some dry ice with a grinder or by wrapping chunks of dry ice in a towel and crushing them with a mallet.

**WARNING:** Use tongs or insulated gloves when handling dry ice.

4. Add small quantities of pulverized dry ice to the cylinder with a spatula. This dry ice will evaporate almost immediately and cause considerable foaming at the surface.
5. Add additional, small amounts of pulverized dry ice, waiting after each addition until the foaming subsides.
6. Eventually, some dry ice will begin to accumulate at the bottom of the cylinder. At this point, small chunks of dry ice can be added without causing serious foaming.
7. Stir the mixture to ensure temperature uniformity. There should be a slow but steady stream of carbon dioxide bubbles rising from the bottom of the refrigerant charged cooling block.
8. Replace the top cap to prevent excess venting of acetone vapor.
9. Remove the bottom cap just before inserting the cooling block into the test cup.

## 4 Descriptions

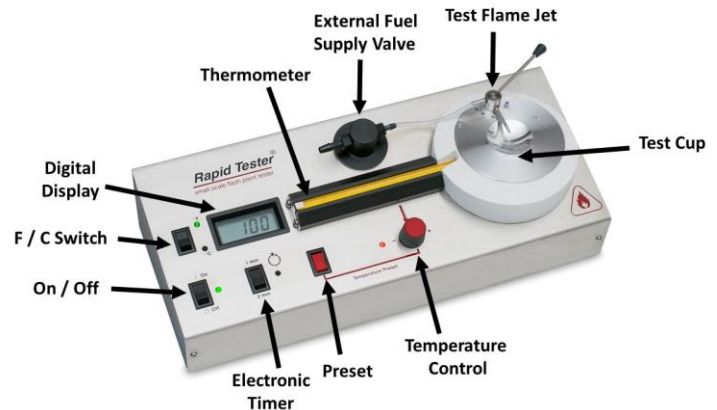


Figure 2. Instrument Descriptions

### Electrical Circuitry

The primary voltage of 115/230V, 50/60 Hz is regulated to provide instrument control which is virtually constant. Each instrument is internally connected for user's nominal voltage of 115 or 230v prior to shipment. Its voltage connection is stated below the primary power inlet.

### Sample Size

The sample size is 2ml.

### Syringe

An adjustable syringe is standard. It includes a holder with adhesive backing to allow mounting on, for example, a laboratory bench or onto the Rapid Tester enclosure above the digital display. Spacers are provided to simplify 2 ml sampling. To test materials of higher viscosity such as adhesives, a 2 ml by volume sample is placed directly into the cup by use of a spatula (user supplied).

### Temperature Displays

The Open Cup Model operates within the temperature range of  $-36$  to  $212^{\circ}\text{F}$  ( $-38$  to  $100^{\circ}\text{C}$ ). The refrigerant charged cooling block is required for below ambient testing. The standard thermometers read to low temperatures of  $32^{\circ}\text{F}$  and  $0^{\circ}\text{C}$ . For lower temperatures, the ( $-36$  to  $105^{\circ}\text{F}$ ) or ( $-38$  to  $40^{\circ}\text{C}$ ) thermometers will be needed. The thermometers are traceable for accuracy to the U.S. National Institute of Standards and Technology (formerly U.S. National Bureau of Standards).

The digital temperature indicator complements the thermometers and a simple switch action changes the reading to either °C or °F. Its range is ambient to 212°F (100°C). The digital temperature indicator provides instantaneous readings as compared to a mercury-in-glass thermometer which gives an average indication at the instance of reading. Therefore the slight fluctuation is a reminder of instant and actual temperature portrayal and the need to record the average or the digit between the high and low.

If the average digital temperature display differs by more than 2°F or 1°C from the thermometer reading, it may be desirable to cause the Rapid Tester to heat within the range of your normal temperature usage, from low to high temperature. Record the thermometer readings and simultaneously the digital display every 20°F or 10°C to provide data points for a graph depicting any variation. This graph can then be referenced when recording the digital display and correcting to the thermometer.

Set-a-temp control permits simple adjustment and automatic regulation of test temperatures higher than ambient. Press the Preset switch while turning the temperature control knob until the target temperature is displayed. Release the switch and set-a-temp takes over. The test cup is automatically heated until the target temperature is attained. The instrument automatically maintains the target temperature. Slight movement of the temperature control knob may be necessary to obtain a specific target temperature.

### Test Cup

Instrument utilizes open cup type equilibrium test technology. Dimensions of test cup and test jet assembly meet the exact dimensional requirements of applicable domestic and international standards which are:

ASTM D4206  
ISO 9038  
BS 3900 Parts A11  
United Kingdom, The Factories Act, 1961  
Highly Flammable Liquids and Liquefied  
Petroleum Gases Regulation, 1972

The standard cup is aluminum with excellent thermal conductivity property.

The test cup is insulated with 1 inch (2.54 cm) surrounding sides and 1.5 inch (3.81 cm) at its bottom of low thermal conductivity ceramic fiber. When the test cup is at 200°F (93°C), the cold face

temperature of the ceramic is 100°F (38°C). This attention to restricting heat flow achieves a higher degree of repeatable flash points than feasible in prior designs. Heating rate for the aluminum cup is in the order of 10 minutes from ambient, 68°F (20°C) to 212°F (100°C).

### Timer

An electronic timer includes switching for either 1 or 2 minutes and an associated red LED. The light glows red when the timer is actuated and is switched off when the period elapses and a signal is emitted. A separate source for 15 second timing must be supplied by the user for sustained burning (combustibility) testing.

### Cooling Block (optional)

The Metal Cooling Block is primarily used to help lower the cup temperature quickly to prepare for the next test. One or more may be stored in a refrigerator for this purpose.

For some testing at elevated temperatures, it may require one or more applications to cause required cooling.

### Refrigerant Charged Cooling Block (Optional)

This accessory is a thermally insulated cylinder with an aluminum alloy base (for thermal transfer) which covers the test cup recess. It includes a top and bottom cover.

For test temperature above 40°F/5°C, the cylinder may be charged with a mixture of crushed ice and distilled water.

For temperatures below 40°F/5°C, the cylinder may be charged with a dry ice/acetone slurry. Refer to Section 3.3 for directions to prepare a dry ice/acetone slurry.

**WARNING:** Safety glasses and gloves should be used when preparing acetone/dry ice slurry. Dry ice can cause painful burns if allowed to contact bare skin. Serious injury will result if the mixture splashes into eyes.

### Repeatability and Reproducibility

As the test cup with is in accord with dimensions required by applicable standards, the repeatability and reproducibility are also in accord with the respective standards. Refer to ISO Standard 9038 for composition of samples provided for interlaboratory test of sustained burning (combustibility).

## 5 Operation

### 5.1 Flash Point Determination

#### 5.1.1 Ambient to 212°F (100°C) Testing

1. Inspect sample well and test jet assembly for cleanliness and freedom from contamination.
2. Switch instrument to "I" (ON).
3. Adjust temperature control knob while depressing Preset switch until digital meter reads a temperature that is at least 9°F (5°C) below expected flash point temperature. Release Preset switch.
4. When the digital display reaches the Preset temperature, the red light will extinguish. It may be necessary to make a slight adjustment using the temperature control knob. The red light will glow whenever the instrument is heating the cup to maintain the specified temperature.
5. Be sure that the syringe is clean and dry. Draw 2 ml of sample [after target temperature is reached and discharge into the sample well.
6. Open the gas control valve and light test jet flame. Turn the gas control valve clockwise to reduce the test flame. Adjust test jet flame size with the gas control valve to match the 0.157 inch (4mm) diameter gauge ring on the surface of the test cup.
7. When the time has elapsed, slowly and uniformly move test jet flame over the sample from the left stop to the right stop over a period of 1 second while watching for a flash. The material has flashed if a comparatively large flame appears and propagates over the surface of the liquid. Sporadically, when near the actual flash point temperature, application of the test flame may give rise to a blue halo (circular band); this should be ignored.
8. Close gas control valve after each test. Record barometric pressure. Report FLASH or NO FLASH. *Once the test flame has been applied to the sample, the test is terminated and a fresh sample must be used for each successive test.*
9. To prepare for the next test, soak up the sample using paper tissues and clean the sample well. Clean the syringe.
10. If no flash has been observed at the initial estimated flash point temperature, repeat the test at a 9°F (5°C) higher temperature. Again, if no flash is observed, repeat the test at additional 9°F (5°C) higher intervals until a flash is observed.
11. If a flash was observed during the initial test, use a test temperature 9°F (5°C) lower and repeat the procedure. If a flash is again observed, repeat at 9°F (5°C) lower intervals until no flash is observed.
12. Having established a flash within two temperatures 9°F (5°C) apart, repeat either procedure at 2°F (1°C) intervals from the lower of the two temperatures until a flash is observed. Record the temperature of the test when the flash occurs as the Actual Flash Point.
13. Close gas control valve after each test.
14. Record the barometric pressure.
15. This flash point will be to the nearest 2°F. If closer accuracy is needed, further testing at a 1°F (0.5°C) lower temperature is required.

#### 5.1.2 Sub-Ambient Testing

When the tests are to be made at temperatures lower than ambient, it is necessary to use the sub-ambient thermometer. This substitution should be carried out in accordance with Section 3.2, Assembly. When the sub-ambient thermometer is installed, care must be taken not to exceed +105°F (+40°C).

1. Switch instrument to "O" (OFF).
2. Lower test cup temperature by use of the Refrigerant Charged Cooling Block. For flash point temperatures above 40°F (5°C), a mixture of water and crushed ice placed in the cylinder may be suitable. For temperatures below 40°F (5°C), the cylinder may be charged with a dry ice/acetone slurry. Refer to Section 3.3 for directions to prepare dry ice/acetone slurry.
3. Cool the sample and syringe in a cooling medium to a temperature approximately 10 to 20°F (5 to 10°C) below the estimated flash point temperature.

4. Remove the cooling source and dry the test cup.
5. Ensure that the syringe is clean and dry. Charge with 2 ml of sample. Introduce the sample into the sample well using the syringe, both of which have been pre-cooled to a temperature of 10 to 20°F (5 to 10°C) below the target temperature. Do not switch on the timer!
6. Open the gas control valve and light the test jet flame. Adjust test jet flame size with the gas control valve to match the 0.157 inch (4mm) diameter flame gauge ring.
7. Allow the cup temperature to rise under ambient conditions. When the specified temperature is reached, slowly and uniformly open and close the test jet flame over the sample from the left stop to the right stop over a period of 2 seconds while watching for a flash. The material has flashed if a comparatively large blue flame appears and propagates over the surface of the liquid. Sporadically, when near the actual flash point temperature, application of the test flame may give rise to a blue halo (circular band); this should be ignored.
8. Close gas control valve after each test. Record barometric pressure. Report FLASH or NO FLASH. *Once a test flame has been applied to the sample, the test is terminated and a fresh sample must be used for each successive test.*
9. To prepare for the next test, soak up the sample using paper tissues and clean the sample well. Clean the syringe.
10. If no flash has been observed at the initial estimated flash point temperature, repeat the test at a 9°F (5°C) higher temperature. Again if no flash is observed, repeat the test at additional 9°F (5°C) higher intervals until a flash is observed.
11. If a flash was observed at the initial estimated flash point temperature, use a test temperature 9°F (5°C) lower and repeat the procedure. If a flash is again observed, repeat at additional 9°F (5°C) lower intervals until no flash is observed.
12. Having established a flash within two temperatures 9°F (5°C) apart, repeat either procedure at 2°F (1°C) intervals from the lower of the two temperatures until a flash is observed. Record the temperature of the test when the flash occurs as the Actual Flash Point.
13. Close gas control valve after each test.
14. Record the barometric pressure.
15. This flash point will be to the nearest 2°F. If closer accuracy is needed, further testing at a 1°F (0.5°C) lower temperature is required.

## 5.2 Flash/No Flash Test

### 5.2.1. Ambient to 212°F (100°C) Testing

1. Inspect sample well and test jet assembly for cleanliness and freedom from contamination.
2. Switch instrument to "I" (ON).
3. Adjust temperature control knob while depressing Preset switch until digital meter reads required temperature. Release Preset switch.
4. When the digital display reaches the Preset temperature, the red light will extinguish. It may be necessary to make a slight adjustment using the temperature control knob. The red light will glow whenever the instrument is heating the cup to maintain the specified temperature.
5. Be sure that the syringe is clean and dry. Draw 2 ml of sample after target temperature is reached and discharge into the sample well.
6. Open gas control valve and light test jet flame. Turn the gas control valve clockwise to reduce the test flame. Adjust the test jet flame size with the gas control valve to match the 0.157 inch (4mm) diameter gauge ring on the surface of the test cup.
7. When the time has elapsed, slowly and uniformly move the test jet flame over the sample from the left stop to the right stop over a period of 1 second while watching for a flash. The material has flashed if a comparatively large flame appears and propagates over the surface of the liquid. Sporadically, when near the actual flash point



temperature, application of the test flame may give rise to a blue halo (circular band); this should be ignored.

8. Close gas control valve after each test. Record barometric pressure. Report FLASH or NO FLASH. *Once a test flame has been applied to the sample, the test is terminated and a fresh sample must be used for each successive test.*
9. To prepare for the next test, soak up the sample using paper tissues and clean the sample well. Clean the syringe.

### 5.2.2. Sub-Ambient Testing

1. When tests are to be made at temperatures lower than ambient, it is necessary to use the sub-ambient thermometer. This substitution should be carried out in accordance with Section 3.2 -Assembly. When the sub-ambient thermometer is installed, care must be taken not to exceed +105°F (+40°C).
2. Lower test cup temperature by use of the Refrigerant Charged Cooling Block. For flash point temperatures above 40°F (5°C), a mixture of water and crushed ice placed in the cylinder may be suitable. For temperatures below 40°F (5°C), the cylinder may be charged with a dry ice/acetone slurry. Refer to Section 3.3 for directions to prepare dry ice/acetone slurry.
3. Cool the sample and syringe in a cooling medium to a temperature approximately 10 to 20°F (5 to 10°C) below the specified temperature.
4. Remove the cooling source and dry the test cup. Ensure that the syringe is clean and dry. Charge with 2ml of sample. Introduce the sample using the syringe, both of which have been pre-cooled to a temperature 10 to 20°F (5 to 10°C) below the target temperature. Do not switch on the timer!
5. Open the gas control valve and light test jet flame. Adjust test jet flame size with the gas control valve to match the 0.157 inch (4mm) diameter gauge ring on the surface of the test cup.
6. Allow the cup temperature to rise under ambient conditions. When the specified temperature is reached, slowly and uniformly move the test jet flame over the sample from the left stop to the right stop over a period of 1 second while watching for a flash. The material has flashed if a comparatively large flame appears and propagates over the surface of the liquid. Sporadically, when near the actual flash point temperature, application of the test flame may give rise to a blue halo (circular band); this should be ignored.

7. Close gas control valve after each test. Record barometric pressure. Report FLASH or NO FLASH. *Once a test jet flame has been applied to the sample, the test is terminated and a fresh sample must be used for each successive test.*

8. To prepare for the next test, soak up the sample using paper tissues and clean the sample well. Clean the syringe.

## 5.3 Sustained Burning Test/Combustibility Test

### 5.3.1. Testing at 120°F (49°C)

1. Inspect sample well and test jet assembly for cleanliness and freedom from contamination.
2. Switch instrument to "I" (ON).
3. Adjust temperature control knob while depressing Preset switch until digital meter reads required temperature. Release preset switch.
4. When the digital display reaches the preset temperature, the red light will extinguish. It may be necessary to make a slight adjustment using the temperature control knob. The red light will glow whenever the instrument is heating the cup to maintain the specified temperature.
5. Be sure that the syringe is clean and dry. Draw 2ml of sample after target temperature is reached and discharge into the sample well.
6. Set timer by pressing its switch to "1 min."
7. Open the gas control valve and light test jet flame. Turn the gas control valve clockwise to reduce the test flame. Adjust the test jet flame size with the gas control valve to match the 0.157 inch (4mm) diameter gauge ring on the surface of the test cup.

8. When the time has elapsed, swing the test jet flame into a position over the center of the sample well. Hold in this position for exactly 15 seconds and then return it to the left stop. Close gas control valve.
9. Observe and time the duration of the burning of the specimen following the return of the test jet flame to the left stop. Repeat the test with a fresh specimen and determine the mean time of burning. A sample is considered to sustain burning or is combustible if the specimen ignites when the test jet flame is over the sample well and burning is sustained for more than 15 seconds after the test jet flame is removed or flashes and burns when the test jet flame is at the left stop prior to it swinging to the center of the sample well.
10. Close gas control valve after each test.
11. Record barometric pressure.
12. Report results in accordance with ASTM Test Method D4206 or The Factories Act, 1961, United Kingdom.
13. Once a test flame has been applied to the sample, the test is terminated and a fresh sample must be used for each successive test.

## 5.4 Sustained Combustion

### 5.4.1. Testing at 55°C (131°F)

1. Inspect sample well and test jet assembly for cleanliness and freedom from contamination.
2. Switch instrument to "I" (ON).
3. Adjust temperature control knob while depressing Preset switch until digital meter reads a temperature of 55°C (131°F). Release Preset switch.
4. When the digital display reaches the preset temperature, the red light will extinguish. It may be necessary to make a slight adjustment using the temperature control knob. The red light will glow whenever the instrument is heating the cup to maintain the specified temperature.

5. Be sure that the syringe is clean and dry. Draw 2ml of sample after target temperature is reached and discharge into the sample well.
6. Set timer by pressing its switch to "1 min."
7. Open the gas control valve and light test jet flame. Turn the gas control valve clockwise to reduce the test flame. Adjust the test jet flame size with the gas control valve to match the 0.157 inch (4mm) diameter gauge ring on the surface of the test cup.
8. After 1 minute, swing the test jet flame into the test position over the edge of the pool of liquid. Hold it in this position for exactly 15 seconds and then return it to the "OFF" position while observing the behavior of the specimen. The test jet flame shall remain lighted throughout the test. Repeat the procedure with a new test specimen but heating time of 30 seconds.
9. For each test observe and record:
  - Whether there is a sustained combustion or flashing of the test portion before the test flame is moved into position.
  - Whether the test portion ignites while the test jet flame is in the test position, and, if so, how long combustion is sustained after the test jet flame is returned to the "OFF" position.
10. Carry out duplicate determinations.
11. Interpretation of observations:
  - The sample shall be determined as not sustaining combustion (pass) or sustaining combustion (fail). Sustained combustion shall be reported if one of the following occurs with either of the test specimens at either of the equilibrium temperature heating periods:
    - When the test flame is in the left stop position, the test portion ignites and sustains combustion
    - The test portion ignites and sustains combustion for more than 15 seconds after the test flame has been returned to the left stop position.

- Intermittent brief flashing shall not be interpreted as sustained combustion. Normally at the end of the 15 seconds, the combustion has either clearly ceased or continues; in case of doubt the sample shall be determined to have sustained combustion and to fail.
12. Close gas control valve after each test. Record barometric pressure. Report results in accordance with International Standard ISO 9038. *Once a test flame has been applied to the sample, the test is terminated and a fresh sample must be used for each successive test.*

## 5.5 Fire Point Determination

### 5.5.1. Ambient to 212°F (100°C) Testing

1. Inspect sample well and test jet assembly for cleanliness and freedom from contamination.
2. Switch instrument to "I" (ON).
3. Adjust temperature control knob while depressing Preset switch until digital meter reads a temperature that is at least 9°F (5°C) above expected flash point temperature. Release Preset switch.
4. When the digital display reaches the Preset temperature, the red light will extinguish. It may be necessary to make a slight adjustment using the temperature control knob. The red light will glow whenever the instrument is heating the cup to maintain the specified temperature.
5. Be sure that the syringe is clean and dry. Draw 2 ml of sample after target temperature is reached and discharge into the sample well.
6. Set timer by pressing its switch to "1 min".
7. Open the gas control valve and light test jet flame. Turn the gas control valve clockwise to reduce the test flame. Adjust the test jet flame size with the gas control valve to match the 0.157 inch (4mm) diameter gauge ring on the surface of the test cup.
8. When the time has elapsed, slowly and uniformly swing the test jet flame into a position over the center of the sample well

over a period of 1 second. The material is at its fire point temperature if the specimen ignites and sustains burning for 5 seconds.

9. Close gas control valve after each test. Report burning time and temperature. *Once a test flame has been applied to the sample, the test is terminated and a fresh sample must be used for each successive test.*
10. Repeat test at 2°F (1°C) intervals either increasing or decreasing sample well temperature until sustained burning time of 5±1 second is determined. Record sustained burning time and temperature.

## 6 Calibration

### 6.1 Barometric Pressure Correction

When the barometric pressure differs from 760 mm Hg (101.2 kPa), calculate the flash point temperature by means of the following equations:

$$\begin{aligned}\text{Calculated flash point} &= F + 0.06 (760 - P) \\ &= C + 0.03 (760 - P)\end{aligned}$$

Where: F,C = observed flash point, °F (or °C) and  
P = barometric pressure, mm Hg.

Determine the corrected specification flash point by the following equation:

$$\begin{aligned}F &= S - 0.06 (760 - P) \\ C &= S - 0.03 (760 - P)\end{aligned}$$

Where F,C= flash point to be observed to obtain the specification flash point at the standard pressure (P).

S= Specification flash point

## 7 Maintenance

### 7.1 Test Cup Fails to Heat

- Check electrical supply and power cord. Be sure power switch is "O" (OFF). Disconnect power cord. Use 1/4 inch (0.64cm) wide screw driver blade and turn fuse holder cover counterclockwise. Test fuse. Replace if necessary, install and replace fuse cover. Reconnect power cord.
- Check temperature control potentiometer. Disconnect primary power cord. Remove thermometer by disengaging the two screws

on the thermometer hold down bracket. Remove and place thermometer where it will not be damaged. Remove four screws, two front and two at back which hold top cover to base of instrument. Remove top cover carefully and invert onto soft material to cushion switches, etc. Remove the three conductors from the electronic circuit board terminal strip. Test potentiometer. It is rated 2K ohms, 10 turns. Replace as necessary.

- Check condition of the following by sequentially removing their conductors from the electronic circuit board terminal strip and replacing the conductors after test component is found to be operational:
  - Separately, check that the two cartridge heaters are each rated 115V, 50W.
  - Primary conductors from transformer. Check for continuity of the two primary windings.
  - Conductors from primary power receptacle. Check for continuity between conductors and blades in receptacle.

## 7.2 Temperature Control Does Not Regulate

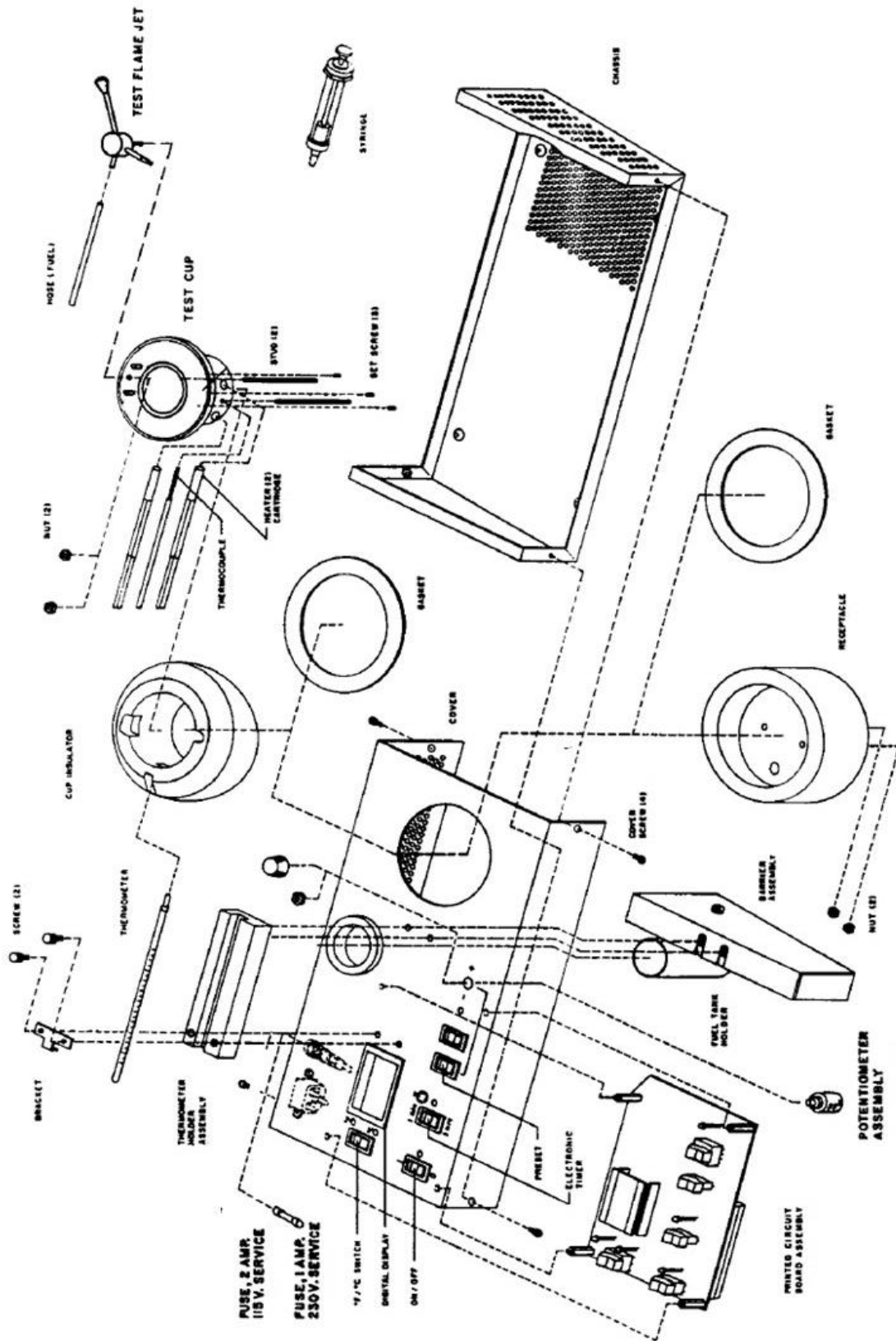
- If electronic circuit board is potential cause, replace it. Identify and remove all conductors not from circuit board. Remove the four hold down screws. Pry board gently to cause switch retainers to release. When installing a circuit board be sure that the four switches and five LEDs are oriented to be inserted into the switch bezels and LED cups. Replace screws and conductors.
- If the thermocouple is suspect, replace by:

- Disconnect the thermocouple leads and cartridge heater leads from the circuit board terminals. Release the conductors from retaining devices. Remove the nuts from the two studs at the bottom of the white ceramic thermal insulator. Remove the ceramic insulator and protect the conductors as they slip through their outlet.
- Disengage the set screw in the base of the test cup. The thermocouple can be drawn from the test cup. Reverse when installing a replacement.
- If either cartridge heater requires replacement, a similar procedure is required. The two set screws in the bottom of the test cup each retain a cartridge heater. Disengage the threads of a set screw releases the inoperative heater. Draw out and replace the heater. Engage the threads of the set screw until it holds the cartridge heater in place. Do not over tighten as the heater jacket could be pierced. Re-assemble.

**WARNING:** When reassembling be sure to align the thermometer holder channel, entrance of test cup insulator and thermometer well in test cup. Use a ¼ inch (0.64 cm) rod. If not aligned, the thermometer will not fit.



### 7.3 Assembly Diagram



## 8 Service

Under normal operating conditions and with routine maintenance, the Rapid Open Cup Flash Tester should not require service. Any service problem can be quickly resolved by contacting Koehler's technical service department either by letter, phone, fax, or email. In order to assure the fastest possible service, please provide us with the following information.

Model Number: \_\_\_\_\_

Serial Number: \_\_\_\_\_

Date of Shipment: \_\_\_\_\_

## 9 Storage

This laboratory test instrument is equipped with electrical components. Storage facilities should be consistent with an indoor laboratory environment. This testing equipment should not be subjected to extremes of temperature and/or moisture.

This equipment was shipped from the factory in a corrugated cardboard container. If long term storage is anticipated, re-packing the instrument in a water-resistant container is recommended to ensure equipment safety and longevity.

## 10 Warranty

We, at Koehler, would like to thank you for your equipment purchase, which is protected by the following warranty. If within one (1) year from the date of receipt, but no longer than fifteen (15) months from the date of shipment, Koehler equipment fails to perform properly because of defects in materials or workmanship, Koehler Instrument Company, Inc. will repair or, at its sole discretion, replace the equipment without charge F.O.B. its plant, provided the equipment has been properly installed, operated, and maintained. Koehler Instrument Company must be advised in writing of the malfunction and authorize the return of the product to the factory. The sole responsibility of Koehler Instrument Company and

the purchaser's exclusive remedy for any claim arising out of the purchase of any product is the repair or replacement of the product. In no event shall the cost of the purchaser's remedy exceed the purchase price, nor shall Koehler Instrument Company be liable for any special, indirect, incidental, consequential, or exemplary damages. KOEHLER INSTRUMENT COMPANY, INC. DISCLAIMS ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF FITNESS FOR A PARTICULAR PURPOSE. Please save the shipping carton in the event the equipment needs to be returned to the factory for warranty repair. If the carton is discarded, it will be the purchaser's responsibility to provide an appropriate shipping carton.

## 11 Returned Goods Policy

To return products for credit or replacement, please contact Koehler Customer Service with your purchase order number, our packing list/invoice number, the item(s) to be returned and the reason for the return. You will be issued a Returned Authorization (RA) number, which must be prominently displayed on the shipping container when you return the material to our plant. Shipping containers without an RA number prominently displayed with will be returned to the sender. Goods must be returned freight prepaid. Returns will be subject to a restocking charge, the application of which will depend upon the circumstances necessitating the return. Some returns cannot be authorized, including certain products purchased from outside vendors for the convenience of the customer, products manufactured on special order, products shipped from the factory past ninety (90) days, and products which have been used or modified in such a way that they cannot be returned to stock for future sale.



## Notes

[illegible]



## Notes

[illegible]