



## **K29300**

# **HIGH TEMPERATURE EVAPORATION LOSS TESTER**

## ***OPERATION AND INSTRUCTION MANUAL***

REV B

***Koehler Instrument Company, Inc.***

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Petroleum Testing & Analysis Instrumentation • Custom Design & Manufacturing



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## **CERTIFICATE OF CONFORMANCE**

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### **High Temperature Evaporation Loss Tester K29300**

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This certificate verifies that part number K29300, High Temperature Evaporation Loss Tester, was manufactured in conformance with the applicable standards set forth in this certification.

Specifications:                      **ASTM D2595**  
    **ASTM D2878**

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 Koehler K29300 High Temperature Evaporation Loss Tester and Data Acquisition Software is the latest design for performing evaporation loss tests on lubricating greases at temperatures of up to 316°C (600°F) according to the ASTM D2595 test method and related test specifications. The K29300 can also perform the ASTM D2878 test method with the installation of the Oil Sample Cup assembly (purchased separately).

This manual provides important information regarding safety, technical reference, installation requirements, operating condition specifications, user facility resource requirements, and operating instructions for the High Temperature Evaporation Loss Tester and Data Acquisition Software. 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

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 D2595: Standard Test Method for Evaporation Loss of Lubricating Greases Over Wide Temperature Range
- ASTM D2878: Standard Test Method for Estimating Apparent Vapor Pressures and Molecular Weights of Lubricating Oils

### 1.3 Instrument Specifications

Models:	K29300
Electrical Requirements:	220-240V 50/60Hz, Single Phase, 10.4A
Temperature Range:	93 to 316°C (200 to 600°F)
Sample Temperature Stability:	±0.3°F
Exit Air Temperature Control:	Two 0-500W Variable control heaters and Type IC thermocouples (K29310 Digital Thermometer sold separately)
Exit Air Temperature Stability:	±1.1°C (±2°F)
Capacity:	2 Samples
Air Flow Control:	2 externally mounted flowmeters capable of maintaining 2L/min flow at standard temperature and pressure
Heating Device:	Aluminum Block

### 1.4 Software Specifications

PC System Requirements:	Intel® Pentium II Processor or similar (minimum)
Operating System:	Windows® 98 SE, 2000, NT, XP, Vista

Memory Requirements: 256Mb RAM (512Mb RAM recommended) 15 Mb Hard Disk Space (minimum)

Other Two RS-232 communication ports  
Microsoft® Excel (97 or above)

## 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>.

## 3 Getting Started

The instructions for preparing the equipment assume that the user is aware of the contents of this document, which lists the warranty conditions and important precautions.

### 3.1 Packing List

- K29300 High Temperature Evaporation Loss Tester
- K29300-Manual High Temperature Evaporation Loss Tester and Data Acquisition Software Operation and Instruction Manual
- K29540 Evaporation Cell Assembly with Grease Sample Cup (2)
- K293-0-12 Thermocouple (2)

Additional Accessories (purchased separately):

- K29320 / K29329 Digital Thermometer
- 250-000-03F/C ASTM 3F / 3C Thermometer
- K29530 Evaporation Cell Assembly with Oil Sample Cup (Required for ASTM D2878)
- K29540 Evaporation Cell Assembly with Grease Sample Cup
- 373-115-001 / 373-230-001 Electronic Balance

### 3.2 Unpacking

Carefully unpack and place the instrument and accessories in a secure location. The unit is shipped in a wooden crate with the unit packed in an upright position. Remove the top lid of the box and remove all cleats and hold-downs. Next, remove the sides of the crates and remove the bath from the crate by lifting the bottom. Install 4 adjustable feet, removed from shipping. Place the tester on a firm level table capable of holding 175 lbs in an area with adequate ventilation or in a hood. Remove all packing and wrappings from around the unit, thermocouples and thermocouple supports. Ensure that all parts listed on the packing list are present. Inspect the unit and all accessories for damage. If any damage is found, keep all packing materials and immediately report the damage to the carrier. We will assist you with your claim, if requested. When submitting a claim for shipping damage, request that the carrier inspect the shipping container and equipment. Do not return goods to Koehler without written authorization.

### 3.3 Setup

**Equipment Placement.** The unit may be leveled by making minor turning adjustments to the feet located at the base of the unit. Please note that Koehler does not supply a level with this equipment. Connect the flowmeter to the filtered air supply in accordance with the ASTM method. Calibrate the thermocouples to the temperature

recorder to be used (not supplied). Install and adjust the thermocouples in the thermocouple support tube per the ASTM method. Install test thermometer.

**Ventilation.** A fume hood or exhaust system is required when operating the unit. Flammable vapors and/or steam are generated during operation and must not be permitted to accumulate. A canopy-style hood may be used if the height from the top of the unit to the canopy is 5 feet or less. The exhaust blower should have a rating of 1000 C.F.M. or greater.

**Power.** Connect the line cords to properly fused and grounded receptacles with the correct voltage as indicated in section 1.3 or on the back of the unit.

**WARNING:** For safety, disconnect the power when performing any maintenance and/or cleaning. Do **NOT** turn the power on unless the bath is filled with the proper medium; otherwise, damage may occur to the unit and the warranty will be void.

### 3.4 Software Installation

1. **Installation.** Insert the CD-ROM into the CD tray of the PC. The CD should automatically display the setup screen. If this does not happen within 10 seconds, browse the files on the CD-ROM and double click on the setup file (setup.exe) to start the installation. Follow the instructions on the screen to setup the software. The software is ready to run once the installation has been completed.

**NOTE:** When first installed, the software is in demo mode, it must be registered in order for the software to work with the unit.

2. **Registration.** Start the program and then go to >> Help >> Register. A registration screen will appear with a registration number (Refer to Figure 1, below). E-mail Koehler at software@koehlerinstrument.com or call with the registration number for the unlock code. Once the software has been registered, it must be restarted before tests are run.

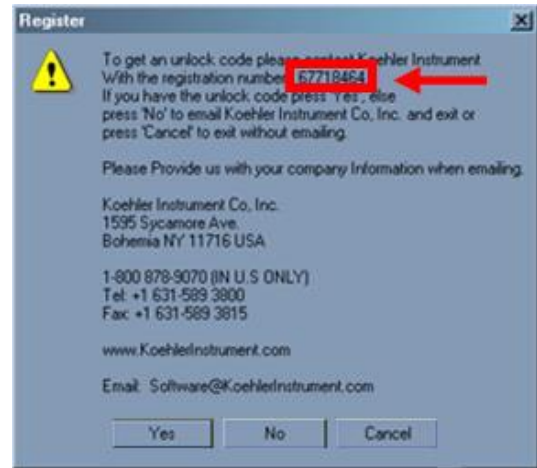


Figure 1. Registration Screen

## 4 Descriptions

### 4.1 Instrument Controls

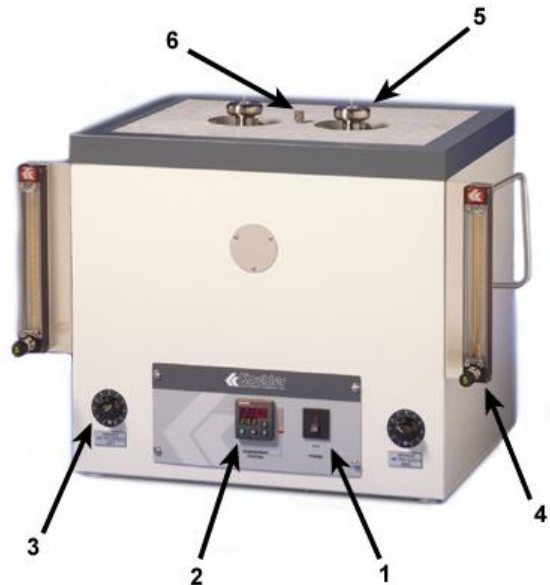


Figure 2: Instrument Descriptions

1. **Power Switch.** This switch controls the power to the entire unit. When the power switch is in the **ON** position, the digital temperature controller is powered on.
2. **Temperature Controller.** The temperature controller regulates the oven (sample) temperature for the test procedure. Refer to Section 4.2 for full operational details.
3. **Variable Air Pre-heater Knob.** Located on left and right front of the unit. Used to regulate



the amount of heat input to the left and right 0-500W variable control heaters. Air temperature can be displayed by means of a Digital Thermometer not included with the apparatus. These control knobs can be used together with the Digital Thermometer to maintain air temperature within  $\pm 1.1^{\circ}\text{C}$  ( $\pm 2^{\circ}\text{F}$ ).

4. **Flowmeter.** Located on left and right side of the unit. Air flow through the apparatus can be regulated by means of the valve located at the bottom of the flowmeter. Capable of maintaining 2 L/min flowrate at standard temperature and pressure per ASTM specification.
5. **Evaporation Cell Assembly.** Consists of a Sample Cup (either Grease or Oil), Hood, Cover and Eduction Tube, Gasket, and Thermocouple Tube and Supports. Sample cup holds the sample while heated air passes over its surface. A thermocouple is placed inside the assembly, where it detects the air temperature and is then displayed on the digital thermometer readout.
6. **Thermometer Holder:** Location where ASTM 3C or 3F thermometer is to be placed. The thermometer detects the temperature of the heating oven.

## 4.2 Temperature Controller Operation

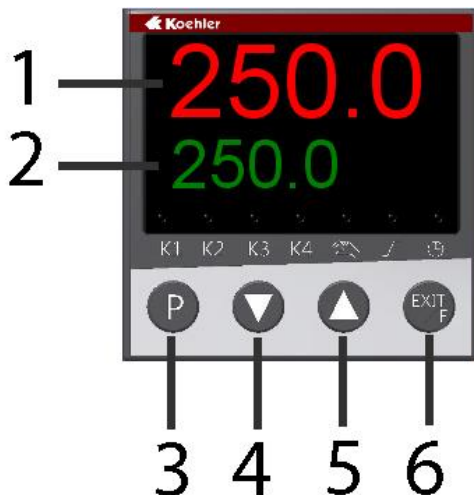


Figure 4. Temperature Controller

1. **Process Temperature Display.** The upper red LED display shows the process temperature as read from the RTD probe.
2. **Set Point Temperature Display.** The lower green LED display shows the set point temperature of the controller.
3. **Programming Key.** Permits scrolling through controller menu parameters. One Level Forward
4. **Down Key.** Used to decrease the set point temperature and to decrease or change parameter values when programming the temperature controller.
5. **Up Key.** Used to increase the set point temperature and to increase or change parameter values when programming the temperature controller.
6. **Exit / Function Key.** This key is used to exit or leave a level. One level backward

**IMPORTANT NOTE:** The digital temperature controller for the unit comes pre-programmed from the Koehler factory. Please do NOT attempt to re-program the digital temperature controller as this will void the product warranty. If assistance is required, please do not hesitate to contact the Koehler technical service department.

**Setting the Temperature.** Set the desired operating temperature by adjusting the set point with the up and down keys. The set point will be displayed in the lower green Set Point LED display and the actual temperature will be displayed in the upper red Process LED display. Please allow the instrument to fully equilibrate before proceeding with any testing.

**Temperature Calibration.** This routine allows the digital temperature controller to be calibrated to a certified thermometer.

- a. Use a certified calibrated measuring device to acquire the temperature. Calculate the difference between the measuring device and the Process value displayed on the controller.
- b. Press the program key two times until **PCt** is displayed in the lower green LED display. Press the DOWN key. CAL will display on the lower green display. If there

is a value observed in the upper red LED display, add it to the calculated difference obtained in the previous step. This is the offset value.

- c. Press the Program Key. The lower green display will flash. Use the up or down keys to adjust to the new calibration offset value on the upper red display calculated in the previous step. When the value has been entered, the controller will automatically store the value. The lower green display will stop flashing. If further adjustments are necessary, press the Program Key again. Resume regular operations by pressing the Exit / Function key two times. Verify if the new calibration is correct by observing the upper red display and comparing the value with the calibrated reference device.

**Auto Tune.** This routine allows the digital temperature control to learn the heating parameters needed for any particular set point temperature. This operation should be done when installing a new unit, after replacing or changing the bath medium type, or utilizing a different temperature set point 20% different from the previously used set point temperature.

- a. Set the operating temperature to the desired setting.
- b. Press the up and down arrow buttons simultaneously for about 5 seconds. When Auto Tune is active, the lower green LED display will blink **TUNE**. Auto Tune will automatically toggle off when the set point temperature is reached. Auto tune can be terminated by pressing the up & down buttons simultaneously again.

## 5 Operation

### 5.1 Preparation of Apparatus

1. Be sure to thoroughly clean all parts of the evaporation cell assembly before proceeding with test method.
2. Connect the cover-education tube to the hood. Adjust thermocouple tube so that the bottom of the tube is flush with face of the hood as shown. Insert thermocouple in tube and adjust so that tip is flush

with bottom edge of tube. Fasten the thermocouple securely in this position by compressing the top edge of the tube. Remove the tube thermocouple assembly and disconnect the hood from the cover-education tube.

3. Place the cover-education tube thermocouple assembly and gasket in the heating device (oven). Fasten the cover securely in position.

4. Adjust the temperature of the heating device to maintain the test temperature and control within  $\pm 1.0^{\circ}\text{C}$  ( $\pm 2.0^{\circ}\text{F}$ ) using the micro-processor based temperature controller (1). Verify correct temperature reading using the thermometer.

5. Regulate the air flow through the assembly to 2 L/min at standard temperature and pressure using the flowmeter valve located at the bottom of the flowmeter (4).

6. By regulating the air preheater, adjust the exit air temperature to the specified test temperature within  $\pm 1.1^{\circ}\text{C}$  ( $\pm 2^{\circ}\text{F}$ ) using the Variable Air Pre-heater Knobs (3) and Digital Thermometer (sold separately).

7. Maintain the temperatures of the heating device (oven) and exit air and the air flow rate for at least a half hour prior to test.

8. Proceed with test procedure according to required ASTM Test method.

## 6 Safety Features

The Koehler K29300 High Temperature Evaporation Loss Tester is equipped with several safety and protection features, which are described in the following sections.

### 6.1 Over-Temperature Protection

The Koehler K29300 High Temperature Evaporation Loss Tester is equipped with Over-temperature Protection (OTP) circuitry, which prevents the unit from exceeding unsafe operating temperatures. If the unit cannot maintain the set point temperature and begins to decline, the OTP circuitry may have been activated. Please follow these steps.

1. Turn off the unit power switch and disconnect the line cord.

2. Determine the source of the problem and correct the situation.
3. Restart the unit. Monitor the operations to ensure that the unit is operating properly. If you are still experiencing trouble, please contact Koehler technical service for assistance.

## 6.2 Over-Power Protection

The Koehler K29300 High Temperature Evaporation Loss Tester is equipped with Over-power Protection circuitry, which prevents the unit from unsafe electrical conditions. If power to the unit is lost, then turn off the main power and turn it back on again. The main power switch also functions as a circuit breaker.

## 7 Maintenance

**WARNING.** Disconnect power to the unit before servicing to avoid exposure to high voltages and/or temperatures which may result in personal injury or death. If you have any questions about maintaining your equipment, then please do not hesitate to contact the Koehler technical service department.

### 7.1 Routine Maintenance

The K29300 High Temperature Evaporation Loss Tester requires little routine maintenance to provide many years of continuous service. However, over the course of time, some instrument parts may need to be replaced. When ordering replacement part(s), please provide the model number, serial number, and product shipment date of your equipment so that we can ensure you will receive the proper replacement part(s).

### 7.2 Replacement Parts

Part Number	Description
190-240-003	Ring Heater, 500 W, 240V
220-240-002	Cartridge Heater, 650 W, 240V
010-230-004	Wattstat, 230V
265-203-001	Temperature Probe
K293-0-12	Thermocouple
K293-0-12	Flowmeter
K293-0-14A	Gasket
K145-8	Thermometer Ferrule
050-001-028	Switch, Single Pole, 15A
275-103-044	Temperature Controller 100-240V
271-015-004	Circuit Breaker, 2 Pole, 15A



## 8.2 K293-0-12 Flow Meter Calibration Chart

092-04-ST		FLOWMETER CALIBRATION DATA		092 / 130
=====		=====		=====
CUSTOMER		CUST. P.O.No		REF.CURVE NUMBER
=====		=====		=====
				0701-02-03
=====		=====		=====
Max.Flow	Min.Flow	Units	Metered Fluid	Date
4562.0	460.0	std. ml/min	air	5-Jul-2001
Model Number		Metering Temperature		70.0 °F
Tube Number		Metering Pressure		14.70 psia
Serial Number		Metering Density		0.001200 g/ml
Float Material		Density at STD.Cond		0.001200 g/ml
Float Density		Metering Viscosity		0.01812 cp
STD. Conditions		Accuracy		std.
Room Temperature		Barometric Pressure		741.0 mm of Hg
=====		=====		=====
SCALE READINGS AT CENTER OF FLOAT				
=====				
Scale		Flow		
Reading				
[mm]				
150	---	4562.0		
140	---	4328.0		
130	---	4101.0		
120	---	3822.0		
110	---	3549.0		
100	---	3294.0		
90	---	3041.0		
80	---	2734.0		
70	---	2419.0		
60	---	2103.0		
50	---	1801.0		
40	---	1497.0		
30	---	1172.0		
20	---	828.0		
10	---	460.0		



## 9 Troubleshooting

**WARNING:** Troubleshooting procedures involve working with high voltages and/or temperatures which may result in personal injury or death, and should only be performed by trained personnel. Please do not hesitate to contact Koehler for assistance.

### 9.1 Unit does not power up

1. Establish that the socket outlet is providing proper and adequate voltage.
2. Check if Overpower Protection circuitry located directly behind the temperature controller inside the front tray has been activated.
3. Check if line switch is in the **ON** position.
4. If problem persists, please call the Koehler technical service department for assistance.

### 9.2 Unit is on and keeps resetting into start up routine

- For 220V units, make sure that the socket outlet is greater than 215V.
- Check if there is a steady and reliable power source.
- Make sure the connector plug on the rear panel is firmly plugged in.

### 9.3 Unit is on but block does not heat up

- Make sure that the actual temperature reading is not higher than the set-point temperature.
- Determine if the temperature controller is properly calibrated by comparison to an ASTM standard thermometer.
- Determine if the Overtemperature Protection (OTP) circuitry has been activated.

## 10 Service

Under normal operating conditions and with routine maintenance, the K29300 High Temperature Evaporation Loss 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: \_\_\_\_\_

## 11 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.

## 12 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.

### **13 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

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.