operation and instruction manual

K23900

Kinematic Viscosity Bath

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REV K-A

Koehler INSTRUMENT COMPANY, INC.

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Petroleum Testing & Analysis Instrumentation • Custom Design & Manufacturing

CERTIFICATE OF CONFORMANCE

Kinematic Viscosity Bath
K23900

This certificate verifies that part numbers K23900, Kinematic Viscosity Bath, was manufactured in conformance with the applicable standards set forth in this certification.

Specifications:

ASTM D445
ASTM D2170
ASTM D6074
ASTM D6158
IP 71
ISO 3104
DIN 51550
FTM 791-305
NF T 60-100

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.

Vincent Colantuoni
Product Manager

Koehler Instrument Company, Inc.
1595 Sycamore Ave.
Bohemia, NY 11716
United States of America

Serial Number: _____

Date: _____

CE

EC Declaration of conformity

Koehler Instrument Company, Inc.
of 1595 Sycamore Av., Bohemia, New York USA

This declaration of conformity is issued under the sole responsibility of the manufacturer. We declare that the product listed below meets all basic requirements in accordance with the following Directive(s) by design, type, and version placed upon the market by us.

2006/42/EC The Machinery Directive by way of the Low-Voltage directive 2014/35/EU

And hereby declare that:
Equipment: **Kinematic Viscosity Bath**

Model Number(s): ***K23900***

Qualifications:

This product may only to be used in a professional laboratory setting by authorized personnel following the instruction handbook.

and

The object of the declaration described above is in conformity with the relevant union harmonization legislation. This product declaration is valid for unmodified equipment when installed and operated by authorized personnel following the instruction handbook.

Conforms to the following standards (as applicable):

Safety	Low-Voltage directive 2014/35/EU
EN 61010-1:2010	Safety Requirements for electrical equipment for measurement, control and laboratory use; by engineering design and risk review and by meeting the requirements of Hi-Pot Test (1500 VAC, 60 sec. per table 5) as detailed in the product's technical documentation.

Vincent Colantuoni
Vincent Colantuoni
Product Manager

1595 Sycamore Ave.
Bohemia, NY 11716
United States of America
October 25, 2021

www.koehlerinstrument.com 631-589-3800

Background

The goal of the WEEE Directive is to encourage design of environment-friendly products that increase reuse, recycling and other forms of recovery to reduce waste streams and applies to listed Electronic and Electrical Equipment (EEE) and Koehler's equipment falls broadly into Appendix 1A; Section 9 Monitoring and Control Equipment: Measuring, weighing or adjusting appliances for household or as laboratory equipment.

Any associated non-embedded equipment such as Lighting (Saybolt Color) and PCs/Printers also fall under WEEE. If provided with an order these ancillary items must be WEEE compliant. For these and other reasons (printer cartridges are regionalized) the equipment must be supplied through a third party supplier in Europe.

The WEEE Directive applies to electrical and electronic equipment falling under the categories set out in Annex IA provided that the equipment concerned is not part of another type of equipment that does not fall within the scope of this Directive. Annex IB contains a list of products which fall under the categories set out in Annex IA.

http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2003:037:0024:0038:en:PDF

We do not qualify for any of the 10 exemption categories.
http://www.dpa-system.dk/en/WEEE/Products/Exemptions

Professional use

For equipment defined for 'professional use' local authorities have no role to play. Producers and importers are basically responsible for collection of WEEE recyclables from the professional user and for subsequent management. A separate statement is given cataloging the items that require separation from the equipment along with basic information on subsequent processing or recycling prior to disposal of the equipment.
http://www.dpa-system.dk/en/WEEE/Products/Private-or-professional-use

Responsibility for Registration and Annual Reporting:

Koehler will not sell directly to end users in the EU and so has no responsibility to register within each EU state and to make annual reports. Koehler declares that this responsibility is born by the importer who is the first level of the distribution chain and is subject to producer responsibility. We will communicate this in writing to our distributor/importers in the EU stating they are responsible to satisfy WEEE registration and reporting requirements in the EU states where they conduct sales activities.

It is illegal to market electrical and electronic equipment covered by producer responsibility without being registered.

http://www.dpa-system.dk/en/WEEE/Producers/Whoissubjecttoproducerresponsibility

Product Design

Koehler's designs allow for complete disassembly to a modular level which usually allows for standard recycling. A qualified refrigeration system technician must be consulted when disassembling and de-commissioning any equipment with refrigeration systems.

Koehler's scientific testing equipment is robustly designed to function over a long service life and are typically repaired many times over the course of years rather than being replaced. We believe that re-use and refurbishment is the very best form of re-cycling.

All batteries must be readily removable not soldered in place.

Recycling instructions

In the event that replacement becomes necessary, we will include instructions, particularized to each instrument that informs the customer of their recycling responsibilities and giving them guidance in doing this. All Koehler equipment has been placed on the market since 13th August 2005 and so Koehler is defined as a "new WEEE producer". As such we must provide information on refurbishment, treatment, and re-use.

Our instrument manual will include this compliance statement and indicate that any collection of materials will be handled by their authorized distributor. In the event that the distributor is unreachable or is no longer a distributor for Koehler Instrument, Co., other arrangements may be made including accepting the materials directly.

Recycling is free of charge. Shipping is the responsibility of the end users. Whether shipping to a distributor or to Koehler directly, safe, properly declared, and labeled packaging and shipping expenses are the sole responsibility of the end user.

WEEE Marking

Since Koehler products are subject to the WEEE Directive we must display the WEEE symbol shown above in accordance with European Standard EN 50419 on the equipment. It must be indelible, at least 5mm in height, and clearly legible. If the equipment is too small the mark must be in the product literature, guarantee certificate, or on the packaging. Rules on marking are established in section 49 of the WEEE Order.

Koehler Instrument Company, Inc.
c/o RECYCLING
1595 Sycamore, Ave.
Bohemia, NY 11716

As a minimum the following substances, preparations and components have to be removed from any separately collected WEEE:
- Mercury containing components, such as switches or backlighting lamps (compact fluorescent lamps, CFL),
- Batteries
- Printed circuit boards if the surface of the printed circuit board is greater than 10 square centimeters (about 4 sq in.),
- Toner cartridges, liquid and pasty, as well as color toner,
- Chlorofluorocarbons (CFC), hydrochlorofluorocarbons (HCFC) or hydrofluorocarbons (HFC), hydrocarbons (HC)
- Liquid crystal displays (together with their casing where appropriate) of a surface greater than 100 square centimeters and all those back-lighted with gas discharge lamps,
- External electric cables
- Components containing refractory ceramic fibers as described in Commission Directive 97/69/EC of 5 December 1997 adapting to technical progress Council Directive 67/548/EEC relating to the classification, packaging and labeling of dangerous substances (2),
- Electrolyte capacitors containing substances of concern (height > 25 mm, diameter > 25 mm or proportionately similar volume)

2. The following components of WEEE that is separately collected have to be treated as indicated:
- Equipment containing gases that are ozone depleting or have a global warming potential (GWP) above 15, such as those contained in foams and refrigeration circuits: the gases must be properly extracted and properly treated. Ozone-depleting gases must be treated in accordance with Regulation (EC) No 2037/2000 of the European Parliament and of the Council of 29 June 2000 on substances that deplete the ozone layer (4).

Table of Contents

1. Introduction

The Koehler K23900 Kinematic Viscosity System maintains constant fluid level with up to 7 viscometers. Separate boost and control heaters allow quick heating to setpoint temperature and fine bath temperature control. Internal stirrer and baffling assure uniform bath temperature distribution. The K23900 complies with ASTM D445 temperature stability and uniformity requirements.

This manual provides important information regarding safety, technical reference, installation requirements, operating condition specifications, user facility resource requirements, and operating instructions for the Kinematic Viscosity Instrument. 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 almost 100 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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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

   ASTM Publication:
   - ASTM D445: Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)
   - ASTM D2170: Kinematic Viscosity of Asphalts (Bitumens)
   - ASTM D6074: Standard Guide for Characterizing Hydrocarbon Lubricant Base Oils
   - ASTM D6158: Standard Specification for Mineral Hydraulic Oils

2. International Organization for Standardization (ISO)
   1, rue de Varembé
   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 3104: Petroleum products – Transparent and opaque liquids – Determination of kinematic viscosity and calculation of dynamic viscosity

3. Energy Institute (IP)
   61 New Cavendish Street
   London, WIM 8AR, United Kingdom
   Tel: 44 (0)20 7467 7100
   Fax: 44 (0)20 7255 1472
   http://www.energyinstpubs.org.uk/

   IP Publication:
   - IP 71: Kinematic viscosity and calculation of dynamic viscosity
   - IP 319: Kinematic viscosity of bitumens

4. Deutsche International Norm (DIN)
   http://www.din.de

   DIN Publication:
   - DIN 51550: Determination of Kinematic Viscosity and Dynamic Viscosity

5. Federal Test Method (FTM)

   FTM Publication:
   - FTM 791-305: Kinematic Viscosity of Petroleum Products

6. Association Française de Normalisation (AFNOR)
   http://www.afnor.fr

   AFNOR Publication:
   - NF T 60-100: Kinematic Viscosity of Petroleum Products

1.3. Instrument Specifications

Models:	K23900
Electrical Requirements:	115VAC/12A – 240VAC/6A, 50/60Hz
Temperature Range:	20 -105°C (68 - 221°F)
Setpoint Temperature:	Display Resolution: +/-0.1°C. Adjustment Range: 20°C-105°C.
Bath Temperature:	Display resolution: +/-0.01ºC Display accuracy: +/-0.02ºC after calibration Bath stability: +/-0.02ºC min/max Bath uniformity: +/-0.02ºC relative to set-point temperature
Viscometer Ports:	Seven (7) Round 2” (51mm) ports
Capacity:	Seven (7) Glass Capillary Viscometers
Bath Medium:	Silicone oil with a viscosity less than or equal to 10 cSt at bath operating temperature and with flash point greater than bath operating temperature. **NOTE:** For best results, it is highly recommended to use Silicone Oil offered by Koehler Instrument, Part Number 355-001-007 or 355-001-008.
Bath Medium Capacity:	21.6 L (5.7 gal)
Altitude:	Rated for use below 2000m
Environmental Conditions:	As per section 1.4.1 of IEC 61010
Unit Dimensions: (HxWxD)	24.4 x 15.4 x 17.2 in. 62.0 x 39.1 x 43.7 cm. 72 lb / 33 kg

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 and will void 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.

Over Temperature Protection. This unit is equipped with Over Temperature Protection (OTP), which shuts the heaters and stirrer motor off to prevent over-heating. Allow the bath to cool down, correct the cause of the problem, and reset the power to return to normal operation.

Low Fluid Level Protection. This unit is equipped with Low Fluid Level Protection (LFL) to prevent operation with an insufficient volume of bath medium. Fill the bath to the proper level and reset the power to the unit to return to normal operation.

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

- K23900 Kinematic Viscosity Bath with 115V or 220V Line Cord
- Round Viscometer Port Cover (7)
- K23900 Kinematic Viscosity Bath Operation and Instruction Manual

3.2. Unpacking

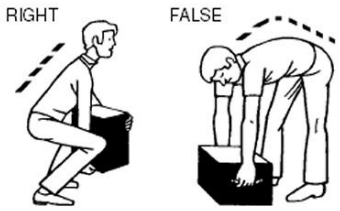
1. Check labeling for correct orientation of instrument. (e.g. This Side Up)

2. Carefully open top of box with box cutter and remove packing foam.

3. Make two additional vertical cuts, using box cutter, along length of two sides of the box and remove packing foam.

4. Extract instrument and place on suitable cart for transportation to work area / lab bench.

WARNING: Be sure two or more individuals are available for extracting and lifting instrument from box to cart and from cart to bench. Individuals must lift in accordance to proper technique. See Figure below.



5. Lift instrument from cart and place on bench.

6. 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: Make sure the instrument in placed on a firm, level table in an area with adequate ventilation. The location must be free of drafts. 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.

WARNING: Certain mechanical stresses applied to the tempered glass front panel pose a hazard to personnel. Impacts during normal operation can shatter the glass components releasing the bath fluid posing thermal burn hazards and slipping hazards. For this reason, the instrument must be operated by and accessible only to trained and authorized personnel and located in an area where this type of impact is likely to occur.

Environmental Conditions: The instrument environment must comply with the following conditions for proper setup:

- No / Low Dust
- No direct sunlight
- Not near heating or AC ventilation ducts
- No Vibrations
- Clearance from other instruments
- Temperature Range: 5 to 40°C
- Elevation to 2000 meters
- Relative Humidity: < 80%

Ventilation. A ventillation system is required when operating the unit. Flammable vapors and/or steam are generated during operation and must not be permitted to accumulate.

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. This bath is equipped with a low fluid protection feature to prevent damage, but caution should always be exercised.

4. Descriptions

4.1. Instrument Controls

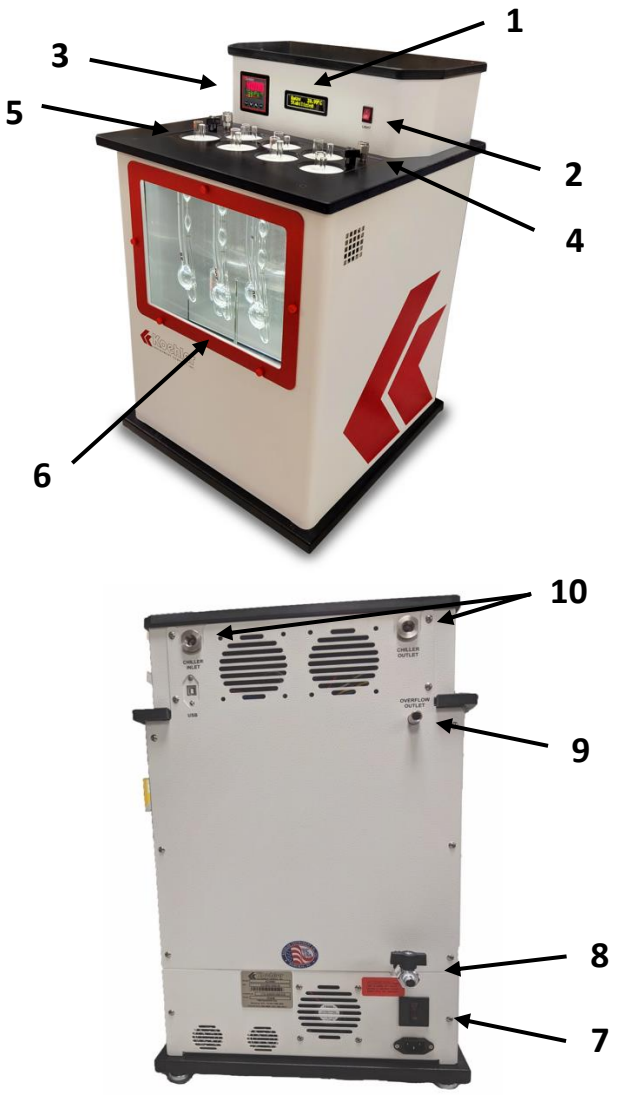


Figure 1: Instrument Descriptions

1. **Bath Temperature Display:** The display will show the bath temperature for the duration of use.

2. **Lamp Switch.** This switch controls turning **ON/OFF** the lamp for illuminating the test samples.

3. **Temperature Controller.** The temperature controller regulates the bath temperature for the test procedure. Refer to Section 4.3 for full operational details.

4. **Thermometer/Thermocouple Port:** This port allows for independent temperature measurement of the bath temperature with a thermometer or a Pt-100 RTD probe for precise temperature measurements and digital temperature controller calibration. If the controller needs to be calibrated, then please contact the Koehler technical service department.

5. **Viscometer Ports:** The viscometer, once engaged into the assembly, is placed into the bath through the viscometer ports on top of the instrument.

6. **Bath/ Bath Stirrer:** The stirrer constantly circulates bath medium to prevent temperature gradients and ensures temperature stability. When cleaning and/or servicing, please be sure to disconnect unit power to avoid possible injury.

7. **Power Switch.** This switch controls the power to the entire unit. When the power switch is in the **ON** position, the digital temperature controller, and the stirrer are powered on.

8. **Drain Valve:** This ¼" Male NPT valve is used to drain the bath for fluid replacement, cleaning, or storage.

9. **Overflow Outlet:** The ½" OD Non-Barbed Push on overflow outlet prevents overfilling of the bath and will drain any excess fluid.

10. **Chiller Connections:** These two ¼" Female NPT connections allow for the connection of an external chilling device.

4.2. Accessories for Running Tests

Glass Capillary Viscometer Tubes for K23900

Koehler offers a full selection of glass capillary kinematic viscometers, which are ordered separately from the K23900 instrument, for measuring kinematic viscosity of liquid products as per ASTM D445 and related standard test methods. All types of viscometers conform to ASTM D445 and related methods for glass capillary kinematic viscometers. All viscometers with part numbers for the automatic test are listed below. The constant for each individual viscometer is written on the Certificate of Calibration, included in the packaging.

IMPORTANT: It is recommended when using a new viscometer for the first time to run a test with suitable standard. Different locations may result in a slightly different constant.

Cannon®-Fenske Routine Viscometers

The Cannon®-Fenske Routine viscometer is a rugged and inexpensive viscometer that works well if the sample is transparent or translucent.

- For kinematic viscosity of transparent liquids up to 20,000cSt.
- Requires a sample of approximately 7mL.

Cannon®-Fenske Opaque Viscometers

The reverse flow viscometers are designed for testing opaque liquids. These viscometers wet the timing section of the viscometer capillary only during the actual measurement and must be cleaned, dried and refilled before a repeat measurement can be made. By contrast, other viscometer types commonly used to measure transparent liquids allow the sample to be repeatedly drawn up into the capillary, permitting duplicate measurements.

- For measurement of transparent and dark liquids having kinematic viscosities of up to 20,000cSt
- Requires a sample of approximately 12mL.

Ubbelohde Viscometers

Ubbelohde viscometers measure transparent liquids, and unlike the Cannon®-Fenske Routine viscometers, they maintain the same viscometer constant at all temperatures. This is advantageous when samples are to be measured at different temperatures.

- Suspended-level type viscometers are for transparent liquids of up to 100,000cSt
- Requires a sample volume of approximately 11mL.

Cannon-Fenske Routine Viscometers	Cannon-Fenske Opaque Viscometers

Part Number	Size	Approximate Constant, cSt/s	Kinematic Viscosity Range, cSt
378-025-C01	25	0.002	0.5 to 2
378-050-C01	50	0.004	0.8 to 4
378-075-C01	75	0.008	1.6 to 8
378-100-C01	100	0.015	3 to 15
378-150-C01	150	0.035	7 to 35
378-200-C01	200	0.1	20 to 100
378-300-C01	300	0.25	50 to 250
378-350-C01	350	0.5	100 to 500
378-400-C01	400	1.2	240 to 1,200
378-450-C01	450	2.5	500 to 2,500
378-500-C01	500	8	1,600 to 8,000
378-600-C01	600	20	4,000 to 20,000
378-650-C01	650	45	9,000 to 45,000
378-700-C01	700	100	20,000 to 100,000

Part Number	Size	Approximate Constant, cSt/s	Kinematic Viscosity Range, cSt
378-025-C02	25	0.002	0.4 to 2
378-050-C02	50	0.004	0.8 to 4
378-075-C02	75	0.008	1.6 to 8
378-100-C02	100	0.015	3 to 15
378-150-C02	150	0.035	7 to 35
378-200-C02	200	0.1	20 to 100
378-300-C02	300	0.25	50 to 250
378-350-C02	350	0.5	100 to 500
378-400-C02	400	1.2	240 to 1,200
378-450-C02	450	2.5	500 to 2,500
378-500-C02	500	8	1,600 to 8,000
378-600-C02	600	20	4,000 to 20,000
378-650-C02	650	45	9,000 to 45,000
378-700-C02	700	100	20,000 to 100,000

Ubbelohde Viscometers

Part Number	Size	Approximate Constant, cSt/s	Kinematic Viscosity Range, cSt
378-000-C03	0	0.001	0.3 to 1
378-00C-C03	0C	0.003	0.6 to 3
378-00B-C03	0B	0.005	1 to 5
378-001-C03	1	0.01	2 to 10
378-01C-C03	1C	0.03	6 to 30
378-01B-C03	1B	0.05	10 to 50
378-002-C03	2	0.1	20 to 100
378-02C-C03	2C	0.3	60 to 300

Part Number	Size	Approximate Constant, cSt/s	Kinematic Viscosity Range, cSt
378-02B-C03	2B	0.5	100 to 500
378-003-C03	3	1	200 to 1,000
378-03C-C03	3C	3	600 to 3,000
378-03B-C03	3B	5	1,000 to 5,000
378-004-C03	4	10	2,000 to 10,000
378-04C-C03	4C	30	6,000 to 30,000
378-04B-C03	4B	50	10,000 to 50,000
378-005-C03	5	100	20,000 to 100,000

Viscometer Holders

Koehler offers a wide range of viscometer holders for use with the K23900. The correct holder must be used with the corresponding viscometer tube for proper operation:

Viscometer Tube Type	Corresponding Holder
Cannon®-Fenske Routine Cannon®-Fenske Opaque	K23381
Ubbelohde BS/U-Tube	K23382

4.3. Temperature Controller Operation

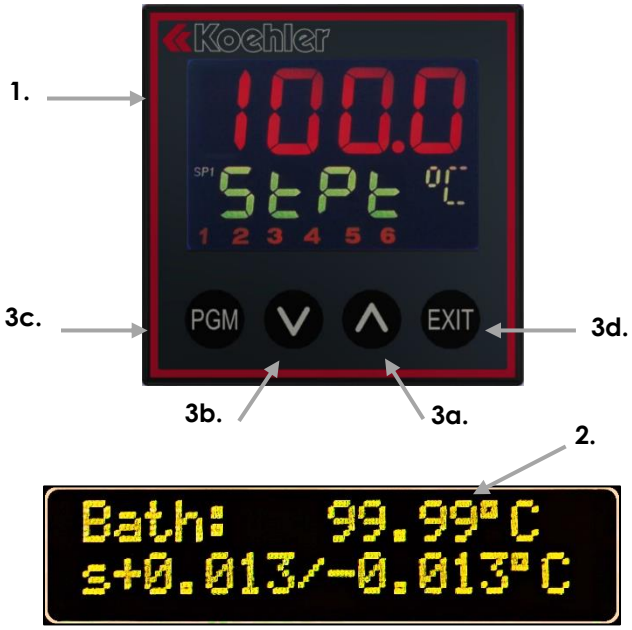


Figure 2. Temperature Controller and LCD Temperature Display

1. **Set Point Temperature Display.** The upper red LED display shows the set point temperature of the controller.

2. **Actual Temperature Display.** The LCD display shows the actual bath temperature.

3. **Control Buttons.**

   a. **Up Key.** Used to increase the set point temperature and to increase or change parameters when programming temperature controller.

   b. **Down Key.** Used to decrease the set point temperature and to decrease or change parameters when programming temperature controller.

   c. **PGM Key.** Permits scrolling through controller menu parameters.

   d. **Exit Key.** This key is used to return the temperature controller to the home page when scrolling through menu parameters. ***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 red LED display and the actual temperature will be displayed on the Bath Temperature LCD. Please allow the unit to fully equilibrate before proceeding with the test.

Temperature Calibration and Offset. Bath temperature readings are calibrated at 40°C and 100°C prior to shipment, and the bath can be calibrated at 20°C, 40°C, 60°C, 80°C or 100°C. The temperature offsets at these calibration temperatures are stored in temperature controller parameters “C20”, “C40”, “C60”, “C80” and “C100”, respectively. When turned on or when setpoint temperature is changed, the bath automatically determines what offset value is needed to correct bath temperature readings based on the selected set point temperature and programmed calibration offsets and loads it into the temperature controller’s “OFFS” temperature offset parameter. When needed, the calibration temperature offsets can be adjusted in 0.01°C increments using following steps:

a. Press PGM button on temperature controller to enter program mode and press PGM button again to enter user program mode. Lower line on temperature controller’s display will change from “StPt” to “USEr” to “dPnt”.

b. Press PGM button to program the “dPnt” parameter – “dPnt” will flash on lower line.

c. Press Up Arrow button to increase parameter setting from 1 to 2 to change the display to 2 decimal places. After a few seconds, “dPnt” will stop flashing indicating that setting was saved.

d. Press Down Arrow button as many times as needed to scroll down to the first calibration parameter “C20”, “C40”, “C60”, “C80” or “C100” to be programmed.

e. Press PGM button to program the selected parameter - “C20”, “C40”, “C60”, “C80” or “C100” will flash on lower line.

f. Press Up or Down Arrow buttons to increase or decrease calibration offset to the desired value or press EXIT button to leave value as is. After a few seconds, “C20”, “C40”, “C60”, “C80” or “C100” will stop flashing indicating that value was saved.

g. Repeat steps 4, 5, and 6 to program the next calibration parameter in sequence or skip to next step when done programming these parameters.

h. Press Up Arrow button as many times as needed to scroll back up to decimal point parameter “dPnt” and press PGM button to reprogram this parameter – “dPnt will flash on lower line.

i. Press Down Arrow button to decrease parameter setting from 2 to 1 to return display to 1 decimal place. After a few seconds, “dPnt” will stop flashing indicating that setting was saved.

j. Press EXIT button twice to exit from programming mode. The bath will now use the programmed calibration offsets to correct the bath temperatures displayed by the bath readout LCD.

4.4. Recommended Accessories

Withdrawal Bulb (K22090)
Used to pull sample into viscometer tube.

Rubber Stopper (K23311)
Used to plug viscometer tube and hold up sample prior to testing.

Operation near or below ambient temperatures. A water supply or external chiller may be used to maintain the temperature of the bath for cooler set point temperature. A chiller must be used when the set point temperature is *less than 10°C above* the ambient temperature. Set the chiller to 10°C below the set point. Connections for water or refrigerated coolant are located at the back of the bath. There are two connections: inlet and outlet. The hose connections can be secured with the appropriate fittings as required to prevent the tubing from disengaging from the connection.

5. Operation

5.1. Bath

Fill the bath with the Koehler recommended heat transfer fluid. Fill the bath with the medium from the top through one of the seven port openings using a wide neck funnel **to the bottom of the 3 Philips head screws on the tank baffle.**

NOTE: Do not attempt moving the bath when filled with fluid medium. Drain all fluid before moving or relocating the instrument. See section 7.2 of this document. Sudden starting and stopping could result in hot bath fluid being forcefully ejected from the bath. It could also result in overbalancing and tipping over the instrument.

NOTE: Do not drain the bath until the fluid is at ambient temperature.

Testing Temperature	Recommended Fluid
20 - 105°C	Koehler Instrument supplies a clear silicone heat transfer fluid, 10cSt at 25°C with high oxidation resistance and low volatility. CAS # 63148-62-9. Minimum Flash Point: 200°C (392°F). (Part # 355-001-007 (1 gal) and # 355-001-008 (5 gal))

NOTE: Do not use bath fluids that will decompose or volatilize producing flammable vapors below the maximum instrument operating temperature +25°C.

NOTE: Coloration of the Silicon Bath Oil is an indication that the Medium must be changed. See Draining instructions in section 7.3 of this document. When a decision is made to discard this material, dispose of this material and its container to a hazardous of special waste collection point. Country, State, or local laws may impose additional regulatory requirements regarding disposal. Dispose in accordance to all applicable regulations.

WARNING: Bath oils contaminated with light ends can pose a flammability hazard.

5.2. Power

Turn on the main power switch to the unit.

WARNING: 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 would be void. This bath is equipped with a low fluid protection feature to prevent damage, but caution should always be exercised.

5.3. Starting a Test

Before running a test, make sure the unit is level. Otherwise, the results will be affected.

1. Set the desired operation temperature using the temperature control (See Section 4.3).

2. Install viscometer into its viscometer holder. Carefully slide the holder onto the top of the tube:

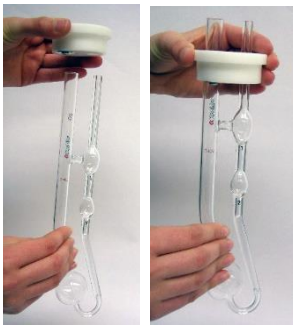


Figure 3. Viscometer and viscometer holder

3. Charge the viscometer with sample and carefully lower into the bath through the viscometer ports.

WARNING: Do not test or run materials that boil or exhibit high vapor pressure at the bath test temperature.

IMPORTANT: Allow the bath *AND* the sample enough time to reach the temperature before starting measurements. Allow 30 minutes for the bath to equilibrate. The LCD display will indicate when the bath temperature is stable. Do not add medium to the bath while a test is being performed. Additional medium will disrupt the temperature equilibrium of the bath and cause erroneous test results.

6. Safety Features

The Koehler K23900 Kinematic Viscosity System is equipped with several safety and protection features, which are described in the following sections.

 **WARNING:** The bath is **NOT** Explosion Proof.

6.1. Over-Temperature Protection

The Koehler K23900 Kinematic Viscosity System is equipped with Over-temperature Protection (OTP) circuitry, which prevents the unit from exceeding 115°C. If the unit cannot maintain the set point temperature and begins to decline, the OTP circuitry may have been activated ("High Bath Temp" will display on the LCD). 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. Low Fluid Level Protection

The Koehler K23900 Kinematic Viscosity System is equipped with Low Fluid Level Protection circuitry, which prevents the unit from operating with an insufficient volume of fluid. If this protection is activated ("Low Bath Level" will display on the LCD), turn off the main power, fill the bath with a sufficient amount of fluid and turn it back on again.

7. Maintenance

 **WARNING:** Disconnect power to the unit before servicing and accessing any internal portion of the instrument 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 K23900 Kinematic Viscosity System 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).Replacement Parts

7.2. Bath Cleaning

- To clean the instrument's exterior, which includes all painted surfaces and glass, either a solution of soap and water or laboratory grade detergent may be used.
- Apply cleaner to clean wipe or cloth, not to the instrument directly. Wipe surface clean.
- **Do Not** clean bath exterior with organic chemicals such as Acetone, Toluene, Hexane, etc.
- For more difficult cleaning of finished surfaces, a dilute solution or isopropanol in water may be used.
- It is not recommended that more aggressive solvents be used on painted surfaces since paint color will tarnish or be stripped from the instrument.
- Stainless Steel surfaces may be cleaned using a more aggressive solvent such as a stainless steel cleaner.
- Glass surfaces may be cleaned using a more aggressive solvent such as acetone, if necessary.

SHOCK AND BURN HAZARD: Only clean inside the bath when equipment is de-energized and unplugged from the mains power supply. Allow adequate time for heating coils to completely cool before cleaning.

7.3. Draining / Changing Bath Medium

WARNING: Do not begin draining the bath medium until it has reached ambient temperature.

NOTE: When a decision is made to discard this material, dispose of this material and its container to a hazardous of special waste collection point. Country, State, or local laws may impose additional regulatory requirements regarding disposal. Dispose in accordance with all applicable regulations.

1. Drain the bath by opening the Bath Drain Valve.

2. Once fully drained, be sure to close the Bath Drain Valve to avoid spillage on next use of the bath.

7.4. Replacement Parts

Part Number	Replacement Part
K23900-03237	Outer Shell Glass Window
282-016-025	115VAC Line Cord
282-018-027	230VAC Line Cord
275-103-046	Temperature Controller, 110-240V

8. 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.

8.1. Unit does not power up

- Establish that the socket outlet is providing proper and adequate voltage.
- Check if line switch is in the **ON** position.
    - The Line Switch functions as a circuit breaker and a power switch. If the breaker is tripped, the power switch will be in the OFF position
- If problem persists, please call the Koehler technical service department for assistance.

8.2. Unit is on but bath dose not heat up

- Make sure that the actual temperature reading is not higher than the set-point temperature.
- Determine if the bath fluid level is too low as the Low Fluid Level Protection (LFL) may be activated

Determine if the Overtemperature Protection (OTP) circuitry has been activated.

8.3. Bath heats up but temperature does not stabilize

- 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.

9. Service

Under normal operating conditions and with routine maintenance, the K23900 Kinematic Viscosity System 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: _____

10. 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.

11. Disposal

12.1 General Recycling Information

- No refrigerants or pressurized materials.
- No charged capacitors or components that could electrically discharge.
- No components such as springs or spring powered gears that could store mechanical energy.
- No chemical hazards from any components.
- No radiation is emitted from any components.

12.2. Disposal Information

The K23900 Kinematic Viscosity Bath is subject to the WEEE directive. Once the instrument has reached the end of its useful life, the instrument and or its components must be recycled or disposed of in accordance to Country, State, or local laws that may impose regulatory requirements regarding disposal. Dispose instrument and/or components in accordance to all applicable regulations.

The K23900 is composed of the following major components and materials:

Major Component	Material
Instrument Housing	Powder Coated, Cold-Rolled Carbon Steel 18
Tank / Bath Cover	Stainless Steel, #316
Bath Window	Soda Lime Glass
Motor	Copper Windings
Heater Coils	Inconel

NOTE: There are No Refrigerants or Hazardous Materials contained in any component.

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

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