K95701 / K95791

Shear Stability Tester

Operation and Instruction Manual

Koehler Instrument Company, Inc.
1595 Sycamore Avenue • Bohemia, New York 11716-1796 • USA
Toll Free: 1-800-878-9070 (US only) • Tel: +1 631 589 3800 • Fax: +1 631 589 3815
http://www.koehlerinstrument.com • e-mail: info@koehlerinstrument.com
Petroleum Testing & Analysis Instrumentation • Custom Design & Manufacturing

Table of Contents

1 Introduction

The Koehler Model K95701 / K95791 Shear Stability Tester is the latest design for evaluating the shear stability of polymer-containing oils in terms of the permanent loss when a sample is mechanically stressed according to ASTM D6278, D7109, and related test specifications.

The apparatus consists of a fluid reservoir, a double plunger injection pump with an electric motor drive, an atomization chamber with a diesel injector spray nozzle and a fluid cooling vessel.

This manual provides important information regarding safety, technical reference, and installation requirements, operating condition specifications, user facility resource requirements, and operating instructions for the K95701 / K95791 Shear Stability Tester. 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.

Toll Free: 1-800-878-9070 (US only)
Tel: +1 631 589 3800
Fax: +1 631 589 3815

Email: info@koehlerinstrument.com
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

- **ASTM Publication:**

ASTM D6278: Shear Stability of Polymer Containing Fluids Using a European Diesel Injector Apparatus

ASTM D7109: Standard Test Method for Shear Stability of Polymer Containing Fluids Using a European Diesel Injector Apparatus at 30 and 90 Cycles

1.3 Instrument Specifications

Models:	K95701 / K95791
Electrical Requirements:	415V 60Hz 3Ph 1.5hp 415V 50Hz 3Ph 1.5hp
Temperature Range:	Ambient to 100°C
Oil Temperature Range:	Ambient to 35°C
Flow Rate:	170 ± 5ml/min
Injector Breaking Pressure:	140 bar
Pressure Gauge Range:	0 – 200 kg/sq. cm, Glycerol Filled
Dead Volume:	20 ± 5ml
Electric Motor:	1.1 Kw / 930 RPM
Diesel Injection Fuel Pump:	Bosch PE 2A 90D 300/3S 2266
Nozzle Holder:	Equivalent to Bosch KD 43 SA 53/15
Injector Nozzle:	Equivalent to Bosch DN 8 S2

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.sigmaaldrich.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

- Shear Stability Tester
- Thermocouple
- Temperature Indicator (Oil Temperature)
- Preset Revolution Counter
- Tool Kit
- Operation and Maintenance Manual

3.2 Unpacking

Carefully unpack and place the instrument and accessories in a secure location. Use extra care while unpacking glassware. 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 shear stability tester comes well packed in a wooden crate. Move container to location of installation and remove the bolt from the wooden crate. Slide the machine from the wooden base and place it in an area with an ambient temperature of 20°C to 25°C.

Assembly Assemble the fluid reservoir, fluid cooling vessel and distributor plate. Connect to water tank by two hose pipes, the bottom tubing from the fluid cooling vessel should be connected to the water pump inlet, so that the water coming from the top tube enters the water tank.

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.

4 Descriptions

4.1 Instrument Descriptions

Fig 1: Instrument Front

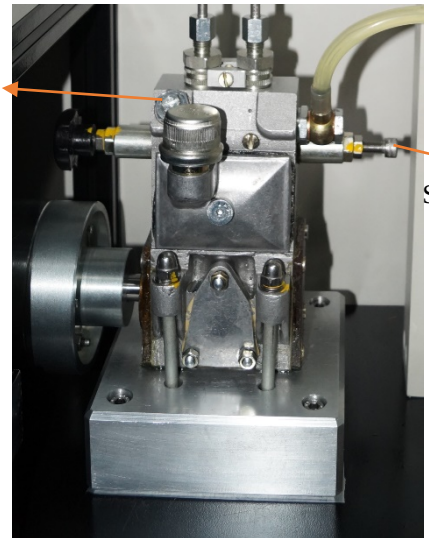

Fig2: Injection Pump

The apparatus consists of a fluid reservoir, a double plunger pump with an electric drive motor, an atomization chamber with a direct injector spray nozzle and a fluid-cooling vessel.

1. Fluid Reservoir. Open on the top, has approximately a 250 mL capacity. It is fitted with an internal fluid distributor plate. The distributor reduces the tendency of fluid channeling. The temperature is measured by a thermometer. The outlet is equipped with a three-way stopcock. The three-way stopcock is of a cone type with a non-exchangeable solid plug. Transparent plastic tubing is used to connect the three-way stopcock to the pump inlet.

2. Double – Plunger Injection Pump. Defined as Bosch PE 2A 90D 300/3S 2266. This pump is equipped with a venting screw and flow rate adjusting screw.

3. Injection Pump. Driven by a three phase electric motor, rated at a speed of 930 RPM.

4. Outlet of Injection Pump. Connected to the atomization chamber using high pressure steel tubing. The atomization chamber is used to minimize foam generation. The spray chamber is designed so that fluid under test exits from the nozzle into a chamber filled with test fluid. A drain tube fitted with a two-way stopcock is included to minimize contamination from the previous test during the system cleaning steps. The diesel injector nozzle is a Equivalent to Bosch DN 8 S 2-type pintle nozzle injector, installed in a Equivalent to Bosch KD 43 SA53/15 nozzle holder. The range of this device is from 0 to 200Kg/cm2.

5. Pressure sensing device.

Fig3: Pressure Sensing Device

A glycerol filled pressure gauge is installed and separated from the line by a pressure snubber or needle valve to suitably dampen pressure surges.The pressure device shall be occasionally pressure tested to ensure accuracy.

6. Fluid Cooling Vessel. Used to maintain the specified temperature of the test fluid as indicated at the outlet of the fluid reservoir. This vessel is a glass container with exterior cooling jacket is spherical. A distribution plate, similar in design to the distributor plate in the fluid reservoir, is positioned in the upper portion of the fluid cooling vessel is through a three – way stopcock of the same design used on the discharge of the fluid reservoir. The exterior cooling jacket is supplied with an adjustable volume of cold water.

7. External Water Tank with Motor. Must be provided for supplying running water for fluid reservoir to maintain constant temperature.

8. Counter. A counter is provided to set the test duration. Set to 930 RPM.

5 Calibration Procedure

1. Calibration of injection pump to be done by any external agency

2. Pressure gauge: Calibrate from external agency.

3. Calibration of apparatus should be done after 20 runs or 3 month's which occurs first. The procedure for calibration is mentioned.

4. Digital thermometer. Temperature calibration: Insert probe into a hot water whose temperature is already measured accurately. The display on temperature probe to be ± 2°C of measured temperature.

5. Reference used for oil calculation is RL-34/10.

This procedure is to be followed annually and in case of replacement of sensor or display module.

5.1 Calibration with Calibration Oil

Set the counter 30 times stroke (1/2 hour) and start the pump. This only warms the pump.

Removal of fluid – open the stopcock below the atomization chamber and drain the waste. Drain the fluid from the cooling jacket into a waste container. Position the lower stopcock so that all fluid in the fluid reservoir is removed to a waste container. When drainage is completed, position the lower stopcock so that the drain is closed and the pump inlet line is open.

Ensure that the ambient (room) temperature is between 20 to 25ºC

Add a minimum of 50 mL of RL34 to the fluid reservoir. Position the three-way stopcock upper, below the cooling vessel to discharge fluid into a suitable waste container and leave the stopcock open until the fluid reservoir is empty but line is still filled with fluid.

Free the apparatus of air in the line by manual compression of the flexible tube that connects the pump to the fluid reservoir. When necessary, venting screw is also used for this purpose.

Add a minimum of 50 mL of test fluid to the fluid reservoir a second time and operate the pump until the fluid reservoir is empty again but line is full.

Close the stopcock below the atomization chamber, position the stopcock below the fluid reservoir so that the line to the pump is open, and retain the position of that the line to the pump is open, and retain the position of the stopcock below the cooling jacket so that the first 50mL of RL34 can be drained into waste container.

Set the counter for automatic shut off at the required number of impulses = 27,900 (30 x n rpm).

Adjust, if necessary, the volume of fluid in the fluid reservoir to running volume.

Place the temperature measuring device in the fluid reservoir, and start the pump.

After about 10 minutes of operation, adjust the water flow to control the fluid temperature at 30 to 35º C, as measured at the discharge point of the fluid reservoir. Approximately 10 minutes of operation will be required before the temperature can be stabilized.

At approximately 10 cycles of operation, record the gage pressure reading. After 30 cycles has elapsed and the pump has stopped, open the stopcock below the atomization chamber and drain fluid into a waste container.

Open the three-way stopcock below the fluid reservoir and discharge the first 10 to 15 mL as waste in order to flush out the drain line. Discharge the remaining fluid into a clean sample container. After the fluid has drained, close the three-way stopcock.

Using test method D455, determine the kinematic viscosity at 100º C of un-sheared (untested) RL 34, as well as the sheared fluid. Use the same viscometer tube for the measurement of each oil.

6 Operation

Open the stopcock on the atomization chamber and drain any previous fluid out of the chamber. Position the three way stock below the cooling vessel to discharge into the waste container.

1. Check machine is already calibrated. Otherwise, follow procedure mentioned in calibration section.

2. Add 50 mL of test fluid to reservoir and free apparatus of air in the line by manual compression of flexible tube that connects the pump to the fluid reservoir and also by removing venting screw.

3. Operate the pump till fluid reservoir is empty but line in full.

4. Add 50 mL of test fluid a second time to the reservoir and operate pump until reservoir is empty and line in full.

5. Drain oil from atomization chamber and turn upper three-way cock so that fluid flows from cooling jacket to reservoir.

6. Add 30 mL + V_{run} (154 mL) = 184 mL.

7. Free air in the line by opening venting screw and manual compression of flexible tube that connects the pump to fluid reservoir.

8. Set the counter to three times n (30x930=2790) and start pump and allow oil to circulate until the counter shuts it down.

9. Adjust the oil level to running volume V_{run} (154 mL) by draining excess oil to waste container.

10. Set counter to 465.

11. Close upper three-way stock cock so that fluid is stored in upper cooling jacket.

12. Start the pump, when the pump stops subtract the volume now in fluid reservoir from initial reading.

13. When the difference is within ± 2.5 mL of 77 proceeds to 14.

NOTE: If the volume in the fluid reservoir is not within ± 2.5 mL, adjust the pump stroke slightly by means of the pump adjustment screw, drain the fluid from cooling jacket into the fluid reservoir and repeat steps from 6.

14. Drain entire oil from fluid reservoir and cooling jacket.

15. Pour test oil in the fluid reservoir equal to V_{run} + 30mL (184 mL)

16. Start the pump and stop when oil level = 154 mL by draining oil from cooling jacket to beaker.

17. Turn the upper three-way stock cocks so that fluid flows to the bottom of the reservoir.

18. Set counter to 930x 30 = 27,900

19. Insert the digital thermometer in the fluid reservoir.

20. Start the pump.

21. Within first 10 mins, adjust water flow to control the fluid temperature at 30 to 35^0 C, as measured at the discharge point of the fluid reservoir.

22. After 30 cycles has elapsed and the pump has stopped, open the stop cock below atomization chamber and drain fluid into waste container. Open 3 way cock and drain 15 mL oil as waster. Collect remaining fluid into a clean sample container. Remove temperature probe.

23. Determine Kinematic viscosity at 100^0C of sheared oil.

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

1. Clean the machine before and after use

2. While not in use machine should be well covered to keep it free from dust.

3. Avoid miss handling of glass parts.

4. Calibration schedule should be followed as per standards.

5. Ensure nozzle and union parts are free from particle or blockage.

6. Ensure the pressure gauge is in working condition

7. Ensure connectors are secured properly. While not in use, the machine is to be well covered to keep it dust free.

8 Service

Under normal operating conditions and with routine maintenance, the K95701 / K95791 Shear Stability 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.