



K41091
MICRO CONRADSON CARBON RESIDUE
AND ASH TESTER

OPERATION AND INSTRUCTION MANUAL

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Petroleum Testing & Analysis Instrumentation • Custom Design & Manufacturing

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1 Introduction

The Koehler K41091 Micro Carbon Residue and Ash Tester is the latest design for performing carbon residue testing in accordance to the ASTM D4530 and D189 test methods and related test specifications.

This manual provides important information regarding safety, technical reference, installation requirements, operating condition specifications, user facility resource requirements, and operating instructions for the micro carbon residue and ash 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.

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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 D4530: Standard Test Method for Determination of Carbon Residue (Micro Method)
- ASTM D189: Standard Test Method for Conradson Carbon Residue of Petroleum Products

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 10370: Petroleum Products – Determination of Carbon Residue – Micro Method
- ISO 6615: Petroleum Products – Determination of Carbon Residue – Conradson Method

3. Energy Institute (IP)
61 New Cavendish Street
London, W1M 8AR, United Kingdom
Tel: 44 (0)20 7467 7100
Fax: 44 (0)20 7255 1472
<http://www.energyinstpubs.org.uk/>

IP Publication:

- IP 398: Petroleum Products – Determination of Carbon Residue – Micro Method
- IP 13: Petroleum Products – Determination of Carbon Residue – Conradson Method

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

DIN Publication:

- DIN 51551: Testing of Lubricants and Liquid Fuels – Determination of Carbon Residue – Conradson Method

1.3 Instrument Specifications

Model: K41091

Electrical Requirements: 230V 50/60Hz
1500W 16A

Temperature Range: Ambient to 800°C
(1472°F)

Environment Operating Temperature: 15 to 30°C

Temperature Resolution: ± 0.1°C

Furnace Temperature Sensor Type: K Type Thermocouple

Furnace Temperature Sensor Calibration: By Keyboard

Furnace Type: Direct Conformance to ASTM D4530

Cooling of the Furnace: Accelerate by internal turbine at 500°C and set point +20°C

Gas Connection on back of instrument: Quick connect coupling for Rilsan Tube 4mm

Gas Connection on pipe end: Quick connect coupling ¼ Bsp conical to screw

Maximum Upstream Gas Pressure: 2.5 Bar (250 kPa)

Minimum Upstream Gas Pressure: 1 Bar (100 kPa)

Gas Type: Air - Nitrogen

Capacity: 12 small Vials
4 small and 3 large Vials
6 large Vials

Results Storage Capacity: 99

PC Output: RS232 Port (2)

Test Programs: 2 Preprogrammed
18 User Programmable

Maximum Heating Rate: 15°C/min

Over temperature Protection Limit: By regulated secondary thermocouple at 900°C

Microprocessor Safety Apparatus: Watchdog Hardware

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>.

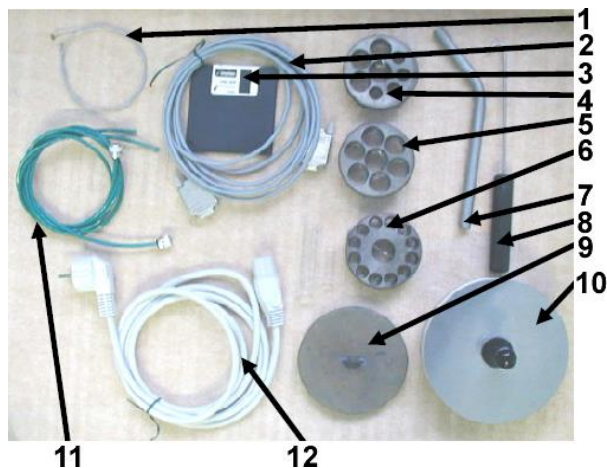
3 Getting Started

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

- K41091 Micro Carbon Residue and Ash Tester
- Cleaning Cable (1)
- RS232 Serial Cable (2)
- Software Disc (3)
- Mixed Vial Holder (4)
- Large Vial Holder (5)
- Small Vial Holder (6)
- Pipe Chimney Extension (7)
- Hook for Safe Hot Lid Handling (8)
- Hot Lid (9)
- Insulating Lid (10)
- Gas Connection Tubing (11)
- Power Cord (12)
- K41091-Manual Micro Carbon Residue and Ash Tester Operation and Instruction Manual

Number designations refer to Figure 1 below:



Additional Accessories and Consumables Available (order separately):

Part No.	Description
K41000-7	Gas Connection Kit - 2 Gas Outputs
K41000-9	Holder for 25-50-100 g Porcelain Crucibles
K41000-1	Pack of 6 Porcelain Crucibles, 120 ml, Tall Form

K41000-10	Pack of 6 Porcelain Crucibles, 40 ml, Tall Form
K41000-11	Pack of 6 Porcelain Crucibles, 80 ml, Low Form
K41000-2	2 mL Borosilicate Glass Sample Vial
K41000-3	16 mL Borosilicate Glass Sample Vial
K41100-3	16 ml vials (pack of 144) for single use
K41100-4	2 ml vials (pack of 144) for single use
K41000-4	2 ml Quartz sample vial, re-usable (Ash Content Test)
K41000-5	16 ml Quartz sample vial, re-usable (Ash Content Test)
K41000-8	4 ml Borosilicate glass sample tube (MRC test)

3.2 Unpacking

Carefully unpack and place the instrument and accessories in a secure location. Ensure that all items 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. Place the instrument on a firm, level table in an area with adequate ventilation or in a hood. 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. The apparatus has had to be at room temperature for several hours before to be energized in order to avoid the risk of condensation.

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.

Gas. The gas circuit of the apparatus can be connected to a maximum gas pressure of 2.5 bars (250 kPa) with the pipes and collar accessories provided.

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 - Front

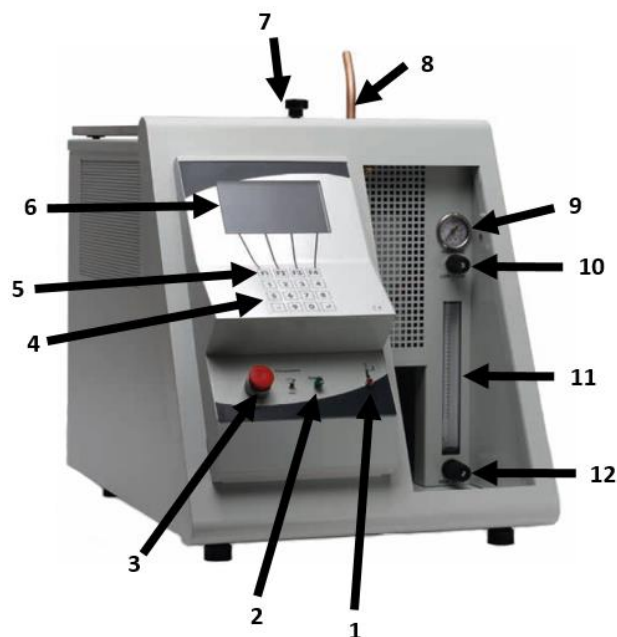


Figure 2: Instrument Descriptions_Front

1. **Heat Light.** Indicates to user that the furnace is heating.
2. **Power Button.** This button controls the power to the entire instrument.
3. **Emergency Stop Button.** Pushing this button turns off the power to the entire unit.
4. **Numeric Keypad.** For entering sample data and parameter values for testing.

5. **Key Function Buttons.** For navigation through the instruments sub-menus.

Note: The function of these buttons and subsequent display icons will change depending on the menu the user is in.

6. **Display.** For user-friendly control of the instrument.

7. **Insulating Cover.** For enhanced temperature stability of the oven.

8. **Exhaust Port.** Insert Chimney Pipe Extension to safely direct oven exhaust and vapors away from user and into a vent.

9. **Pressure Gauge.** Displays pressure measurement of inlet Gas (Air/Nitrogen).

Note: Gas Pressure can only be adjusted by an external regulator at the source.

10. **Fine Gas Flow Adjust Knob.** For minimal regulation of the gas flow into the oven.

Note: It is recommended to adjust the gas flow with the Course Gas flow adjust knob prior to this adjustment.

11. **Flowmeter.** Measures the Flow Rate of the gas entering the oven.

12. **Course Gas Flow Adjust Knob.** For regulating the gas flow entering the oven.

4.2 Instrument Descriptions - Back

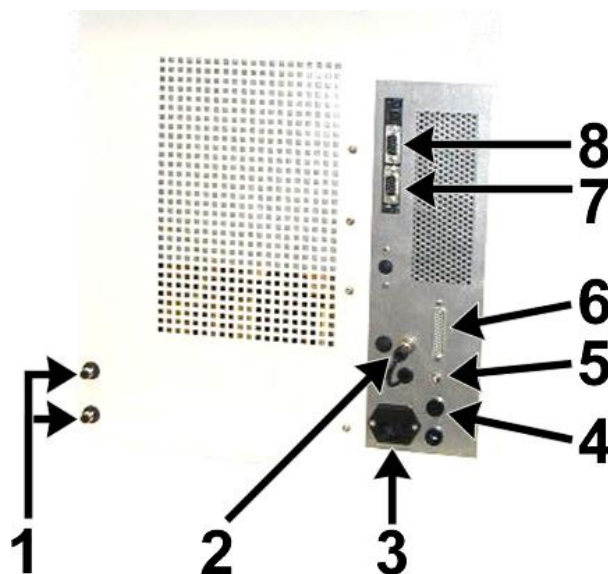


Figure 3: Instrument Descriptions_Back

1. **Gas Inlet Connections.** For connection of Air and Nitrogen Gas to the instrument from an external source.
2. **Thermocouple Port.** For connection of Furnace Thermocouple.
3. **Power Outlet.** For connection of line cord plug.
4. **Fuse Port.** Location for Fuse replacement.
5. **Watchdog Shutdown Button.** Turns off microprocessor to perform maintenance procedures.
6. **Parallel Port.** 25 Pin Type Parallel Port for connection to a Printer.
7. **Serial Line 1.** For connection to external PC.
8. **Serial Line 2.** Not used in instrument.

5 Operation

5.1 Instrument Start-up

WARNING: An apparatus showing traces of an impact or any damage following shipping or unpacking should not be operated.

WARNING: The apparatus must be held at room temperature for several hours before turning on the power in order to avoid risks caused by condensation.

NOTE: Give detailed attention to the lid and the top opening of the furnace for condensation. The lid ensures that the furnace is sealed.

1. Depending on the desired use (carbon residue or ash), the apparatus must be connected to a source of nitrogen providing a maximum pressure of 2.5 Bar (250 kPa) and possibly to a source of air at a maximum pressure of 2.5 Bar (250 kPa). In order to keep a stable flow during testing, the gas supply will have to be regulated with a pressure reducer to stabilize the pressure upstream.

NOTE: During the first test of using the instrument, which should be done without sample, it is essential to check the value of the gas flows and to adjust them according to the pressure upstream of the gas.

WARNING: Do not connect any additional extension to either the chimney or the supplied

Chimney Extension Pipe in an attempt to further evacuate the exhaust fumes. The chimney must remain free to ensure optimal exhaust of the system. Any connection on the chimney or its extension pipe would be likely to cause:

- Condensates in the piping of the apparatus
- A backpressure which would disturb the test by modifying the flows and cause leaks on the hot lid of the furnace.

2. Connect the line cord to properly fused and grounded receptacles with the correct voltage as indicated in section 1.3 and to the receptacle on the back of the unit.

WARNING: For each type of test or method used the apparatus must be placed under a hood to properly and safely evacuate the exhaust fumes generated by the instrument.

3. Number designations for the following set of directions refer to Figure 4 below:
 - a. If necessary, unbolt the Emergency Stop Button (1)
 - b. Switch on the apparatus, by using the circuit breaker under Lift Door beneath the Numeric Keypad.
 - c. If necessary, switch on the differential (2) then switch on the circuit breaker (3)
 - d. Press the Power Button to turn on the instrument (4)
4. The apparatus will begin to boot and the standby display screen will appear after approximately 20 seconds.
5. The furnace will then begin heating to a standard temperature of 50°C. The furnace will also revert back to this temperature in between tests. 50°C is a factory preset value and can be adjusted by accessing the Setpoint Function from the instruments menu screen. See section 6.2.

WARNING: If the apparatus is powered off for a period of more than 3 weeks, the accumulator of the microprocessor board is discharged. The instrument will completely reset including its internal date and time. In the event that this does occur, it is necessary to reset the date and time using the maintenance function from the instrument menu. All other parameters will be saved in the "flashEeprom" memory. In the event of the microprocessor discharge, all operation parameters will be saved.

6. Basic Functions of the Apparatus:

The apparatus has been designed to perform tests for both carbon residue and ash.

WARNING: It has been determined that at the higher temperatures of 775°C for the Ashing test, the temperature stability of the furnace is outside the acceptable range of testing standards.

Two preprogrammed test procedures have been developed and implemented into the instrument.

Program No. 1: Micro Carbon Residue

Start T (°C)	End T (°C)	Duration (min)	Gas Flow
50	50	10	NIT
50	500	36	nit
500	500	15	nit
500	50	1	NIT

Program No. 2: Ash

Start T (°C)	End T (°C)	Duration (min)	Gas Flow
50	50	10	NIT
50	775	60	NIT
775	775	120	AIR
775	50	1	AIR

Where:

Air = Low Flow Air
nit = Low Flow Nitrogen
AIR = High Flow Nitrogen
NIT = High Flow Nitrogen

During a test procedure, the instrument follows the temperature profile of the program selected and also manages the gas flow (air or nitrogen) following the sequences defined in the program.

NOTE: The gas flow rate (**High and Low Flow**) must be adjusted and set manually before starting the test.

Flow meter Calibration Scale as per ASTM D4530

30mm = 150mL/min
120mm = 600mL/min

NOTE: It is possible to follow the temperature of the furnace by connecting an External PC to Serial Line 1 and using the Data Acquisition Software provided with the accessories of the instrument.

NOTE: The calculation of residue percentage can also be determined by the apparatus. Inputting the initial and final weight of the samples into the software will then calculate the residue percentage automatically.

5.2 Starting a Test

WARNING: For either program selected, the Instrument must be placed under a hood to evacuate the fumes generated by the furnace during testing. When performing an Ashing Test, it is highly recommended to reduce the light distillation products in the sample by using nitrogen to avoid any risk of spontaneous combustion. **Rapid Combustion must not be performed in the Furnace!**

WARNING: It is essential to understand the standard test method of the test to be performed.

WARNING: It will be necessary to work with a hot furnace and samples before and after each test run. Therefore, it is required for the operator to use Personal Protective Equipment (PPE) and the suitable accessories provided with the apparatus.

WARNING: When conducting an Ashing Test it is required to use quartz vials (sold separately). The vials provided with the instrument are of borosilicate glass and are intended for only the Micro Carbon Residue Test.

1. Check that the condensate tank is empty.

WARNING: The oven temperature must be below 100°C before checking the condensate tank.



Figure 5: Condensate Tank Check

2. Remove the Insulating Lid

3. Remove the Hot Lid with the provided hook accessory.



Figure 6: Hot Lid Handling

4. Check that the furnace exit is not clogged by calamine. If this is the case please see the maintenance section of this manual.
5. Place the sample vial holder with desired samples in the furnace with the hook accessory provided.

NOTE: Be cautious of the walls of the furnace as the surface is maintained at an above ambient temperature prior to testing.



Figure 7: Sample Vial Holder Handling

6. Replace the Hot Lid with the hook accessory to ensure a tight seal.
7. Replace the Insulating Lid on the Furnace.
8. Make sure the Gas Feeder Valves from the Gas Source are Open.
9. Check that the ventilation hood is running and that the chimney extension pipe is properly installed on the Furnace Chimney.
10. Begin the test by pressing the "Go" key on the display panel.
11. Enter the ID number for each sample.

12. If desired, enter the weights of the samples. This allows for an automatic calculation of the percentage (ratio) of residue remaining at the end of the test.
13. Choose the desired program (Micro Carbon Residue or Ash).
14. Confirm the launching of the test by pressing "Go" once again on the display panel.
15. The instrument will then sound a series of beeps. The display will now indicate the temperature of the furnace, the duration of the test, the current segment of the test program running, and the limiting values of the temperature of the current segment.



Figure 8: Display Parameters during Test

16. At the end of the test, the instrument will indicate the status to the operator on the display. Wait for this message before removing the samples from the furnace.

NOTE: Although the instrument authorizes the user to remove the samples, it is necessary to be extremely careful because of the high temperature of the furnace and samples.

5.3 Control Panel Operation

5.3.1 Creation of New Programs

In addition to the Two (2) factory preinstalled programs, the user may create custom programs.

Each program is comprised of 4 segments just as the preprogrammed procedures are structured.

Each temperature segment is defined by its initial temperature and its final temperature.

The user must then also define the time duration of each segment as well as the type of gas and its flow rate.

The maximum time duration is 240 minutes per segment. The type of gas flow to choose from is listed in section 5.1 of this manual.

NOTE: The Temperature Rate must not exceed 15°C per minute in order to maintain the condition of the Furnace.

Creation or Modification:

1. From the main menu press the “Go” key located at the bottom left corner of the screen.
2. Next press the “Program” key at the bottom right corner of the screen.
3. Enter the number of the program to modify or create. This will bring you to the screen illustrated in Figure 9 below.

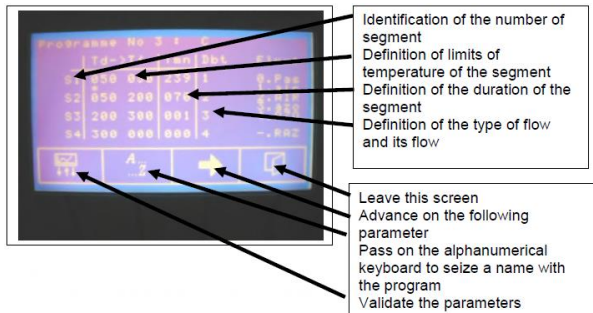


Figure 9: Program Parameter Screen

4. Pressing the “Validate the Parameter” key displays the type of gas and flow available.
5. **Alphanumeric Keyboard Function.** Pressing the “A...Z” key displays a table with column headings and lines allowing the user to select a letter, figure or symbol for inputting a sample ID or naming a newly created program. Please see Figure 10 below:
6. **Weight Input Function.** This function makes it possible to enter the weights of the samples so that the apparatus can make a calculation after the weights entered at the end of the test. When entering a weight value, the numbers will start on the operators left and scroll to the right as additional numbers are entered. To enter the desired value it may be required to enter a number of “Zeros” after the value has been entered. The standard number of significant figures is shown below:

XX.XXXXX G

For example, to enter 2.45 G, the user must enter 2, then 4, then 5 followed by three Zeros. This places the two (2) in the single digit place resulting in the desired value.

7. **Set Point Function.** This function allows the user to input the idle set point temperature of the furnace between tests. This value is limited to the range from 20 to 80°C
8. **Standby Function.** This function allows the user to shut down the apparatus via the control panel without having to switch off the circuit breaker or push the emergency stop button. This method of shut down avoids restarting the circuit breaker at the time of the next power up. Upon activation of this function, the instrument automatically shuts down after a few seconds.

5.3.2 Software Configuration Functions

The following functions are accessible via the Software Function.

From the main menu press the “Configuration Key” located at the bottom right corner. During this functions’ first use a password is not required to enter this menu. A password must be created in the “New Password” function screen to implement this security feature. Once in the Software Function Menu, press next and enter the “New Password Function” screen. See step 5 below for further detail on this function.

1. **Buzzer Function.** This function allows the user to choose between a continuous buzzer that sounds at the end of the test until the operator turns it off or a buzzer that sounds for 3 minutes.
2. **Stop Ventilation Function.** This function is automatically set to 20°C above the Idle Set Point Temperature value. The minimum value for this set point is 80°C. The fan starts at 500°C and stops at the Idle set point plus 20°C.
3. **Stop Safety Function.** This function allows the user to set a safety temperature limit. This temperature is measured on the Furnace temperature probe. If a malfunction occurs and the temperature of the furnace exceeds this value, the microprocessor cuts the heating

of the furnace. This value can be adjusted from 600 to 900°C.

4. **Remote Loading Function.** This function allows for reloading of the software or for installing a new version of the software via the Serial port located on the back of the instrument.
5. **New Password Function.** This function allows for the user to create and change the password allowing access to the Maintenance and Configuration Functions of the instrument. Enter the desired password and follow the steps indicated on the display.
6. **Name Apparatus Function.** When the instrument is delivered, the "name of the apparatus" is its serial number. This number appears, amongst other printouts, on the logbook of the instruments configuration. This function allows for users who wish to rename the apparatus, change its name via the alphanumeric function screen.
7. **Graphic Impression Function.** The function allows the user to choose between a simplified version of the results or a graphical result printout.
8. **Printer Function.** This function allows the user to select the print out format to be either 40 or 80 characters in width.

5.3.3 Hardware Configuration Functions

The following functions are accessible via the **Hardware Function**. From the main menu press the "Configuration Key" located at the bottom right corner. After entering the user password, the following menu will feature the aforementioned "**Software Function**" key as well as the "**Hardware Function**", "**Date/Time**" and "**Help**" keys. Press the "**Hardware Function**" key which is the second button from the right.

1. **Language Function.** This function allows the user to convert the screens and the impressions within the instrument from between English and French.
2. **Unit Function.** This function allows the user to choose the unit of measure for the temperature of the furnace. Either in degrees Celsius or Fahrenheit.

3. **Calibration Function.** This function allows the user to calibrate the furnace temperature probe.

3.1 Physical Calibration. This calibration is done by entering three (3) temperature points via the keyboard. Enter these points by first replacing the furnace thermocouple with a temperature simulator. To do this, open remove the furnace thermocouple from the port located on the back of the instrument (Section 4.2, Point 2) and replace with the temperature simulator. The instrument will now be able to communicate with the simulator. It is recommended to use 50°C, 250°C, and 500°C as your points of calibration. After the calibration, it is highly recommended to print the configuration logbook of the instrument. By doing so, you will have a copy of the calibration performed and will be able to refer to the values entered.

3.2 Point Calibration. This calibration allows the user to input the calibration values previously determined and found on a Configuration Logbook without having to repeat a physical calibration with the temperature simulator.

3.3 View Calibration Function. This function allows the user to see the calibration values on the display.

4. **Offset Temperature Function.** This function allows the user to input the temperature offset for the cold welding compensation sensor of the furnace thermocouple. The user must simply enter a correct room temperature value which will act as an offset temperature.

5. **Test Function.** This function is mainly used for instrument maintenance. This function allows the user to control each physical function of the instrument to ensure proper operation. This includes instrument heating, electro-valve, turbine, and buzzer function.

5.1 Self Diagnosis. The function allows the user to automatically run a complete cycle of operation for each element of the apparatus and print out a report to make an instrument diagnosis.

5.2 Logbook Function. This function allows the user to print the Configuration Logbook which features all the current

parameters and configuration of the instrument. It is highly recommended to print this logbook before and after each and every change made by the user to the instrument. This makes it possible to track calibrations, parameter and other configuration values which may have been modified inadvertently.

6. **Date/Time Function.** This function allows the user to setup the date and time of the instrument.

WARNING: If the instrument is left off for a period of three weeks, the date and time will reset. In this event, it is required to use this function to re-enter date and time values for reporting purposes.

6 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.

The K41091 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).

6.1 Maintenance Checks

1. Before each test it is recommended to check the Furnace and Condensate Tank for Clogging and Overflow. The handling of these condensates or residues requires much precaution. These residues are very toxic and require the user to wear Personal Protective Equipment (PPE) when handling.
2. Before each test it is recommended to check the furnace exhaust. The exhaust must be free from calamine. If the apparatus has calamine deposits in the furnace exhaust, it is recommended to remove the deposits using the cleaning cable provided.

6.2 Routine Maintenance

Depending on the frequency of use and the type of samples being tested, it is recommended to perform routine maintenance procedures. For example, an Ash Test would reduce the amount of deposits formed in the furnace but would generate many condensates. With Ash Testing, it is then necessary to frequently monitor the condensate tank as well as the furnace exhaust.

6.2.1 Cleaning of Furnace Opening and Hot Lid

The top opening of the Furnace seals by means of the metal-metal contact between the furnace and the hot lid. Therefore, it is critical to check that the lid is free from any shock or impact damage. Also, ensure both the hot lid and the furnace opening rim is free from any calamine deposits.

Use steel wool to clean the hot lid and furnace opening of all deposits. Take careful attention not to damage the metal. **Do not use an abrasive cloth or other material when cleaning.**

NOTE: Each furnace and hot lid are manufactured and factory test together to ensure proper sealing of the furnace. They are both assigned an identical given number. See Figure 10 below: Before testing, make sure the lid and furnace have matching numbers.



Figure 10: Hot Plate ID Number

6.2.2 De-Carbonizing the Furnace

The exit at the bottom of the furnace is a major point of calamine deposition and accumulation. It is recommended to cleaning this area regularly using the cleaning cable provided. See Cleaning Steps below:

- When the Furnace is off and at room temperature, remove the condensate tank.
- Remove the insulating lid, then the hot lid.
- Insert the cleaning cable through the top of the furnace and into the bottom exit. See Figure 11 below:



Figure 11: Cleaning Cable_Top View

- Grab the end of the cleaning cable from where the condensate tank normally sits. See Figure 12 below:



Figure 12: Cleaning Cable_Bottom View

- With a back and forth movement and directing the cable in all direction simultaneously, clean the pipe of all calamine deposits.
- Check the state of the chimney and chimney extension pipe for calamine deposits and clean in the same manner.

6.2.3 Temperature Check of the Furnace

To check the temperature of the furnace it is necessary for a control thermocouple to be in place. In order to make this possible, the hot lid has a small thermocouple port located along the outside. If the actual temperature of the furnace does not correlate to the reading on the instrument, check the calibration of the furnace thermocouple. See the location of the thermocouple port in Figure 13 below:

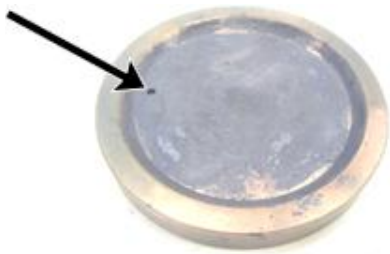


Figure 13: Hot Lid Thermocouple Port

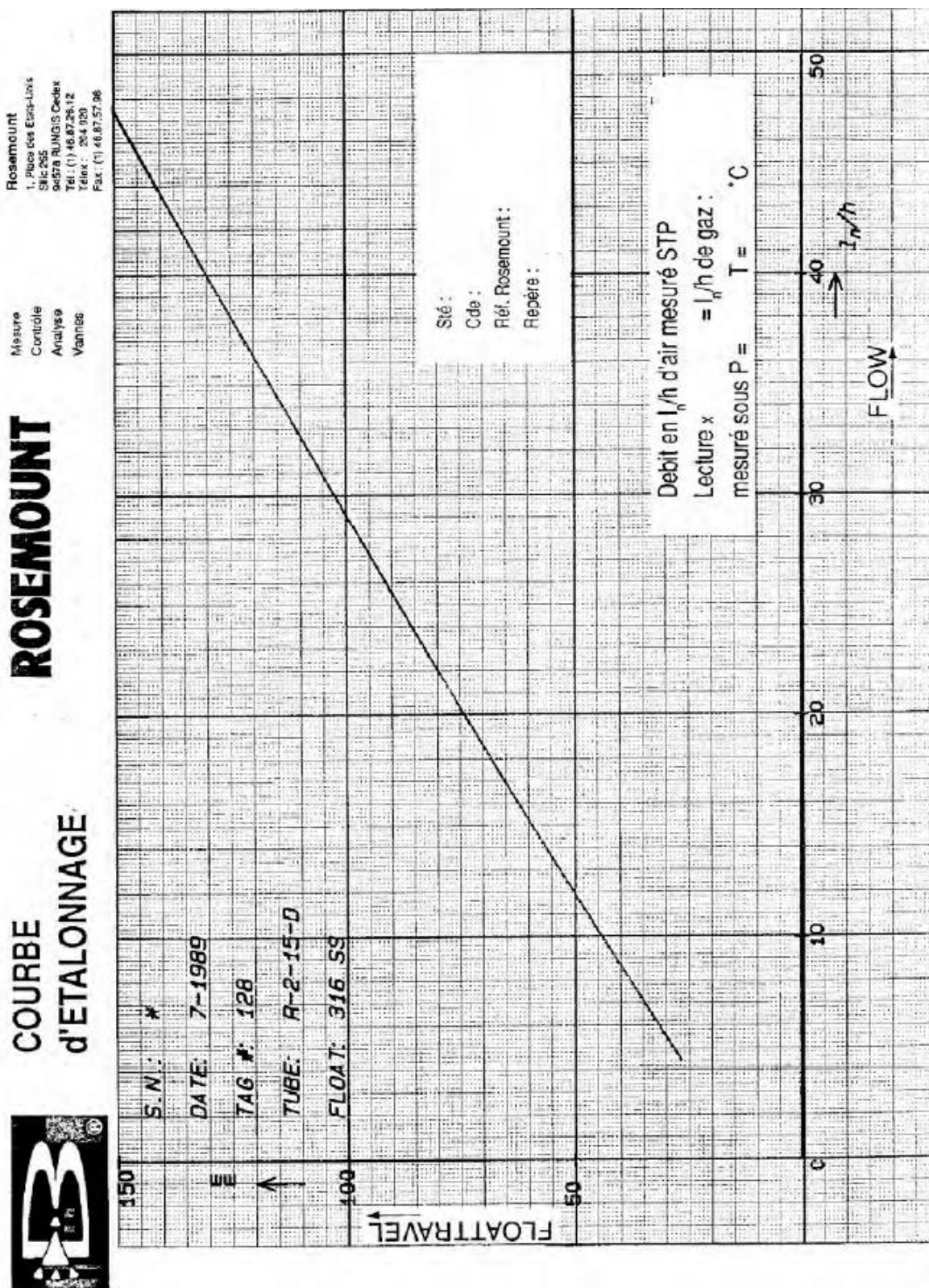
6.3 Replacement Parts and Accessories List

Please Inquire with Koehler Customer Service for item part numbers.

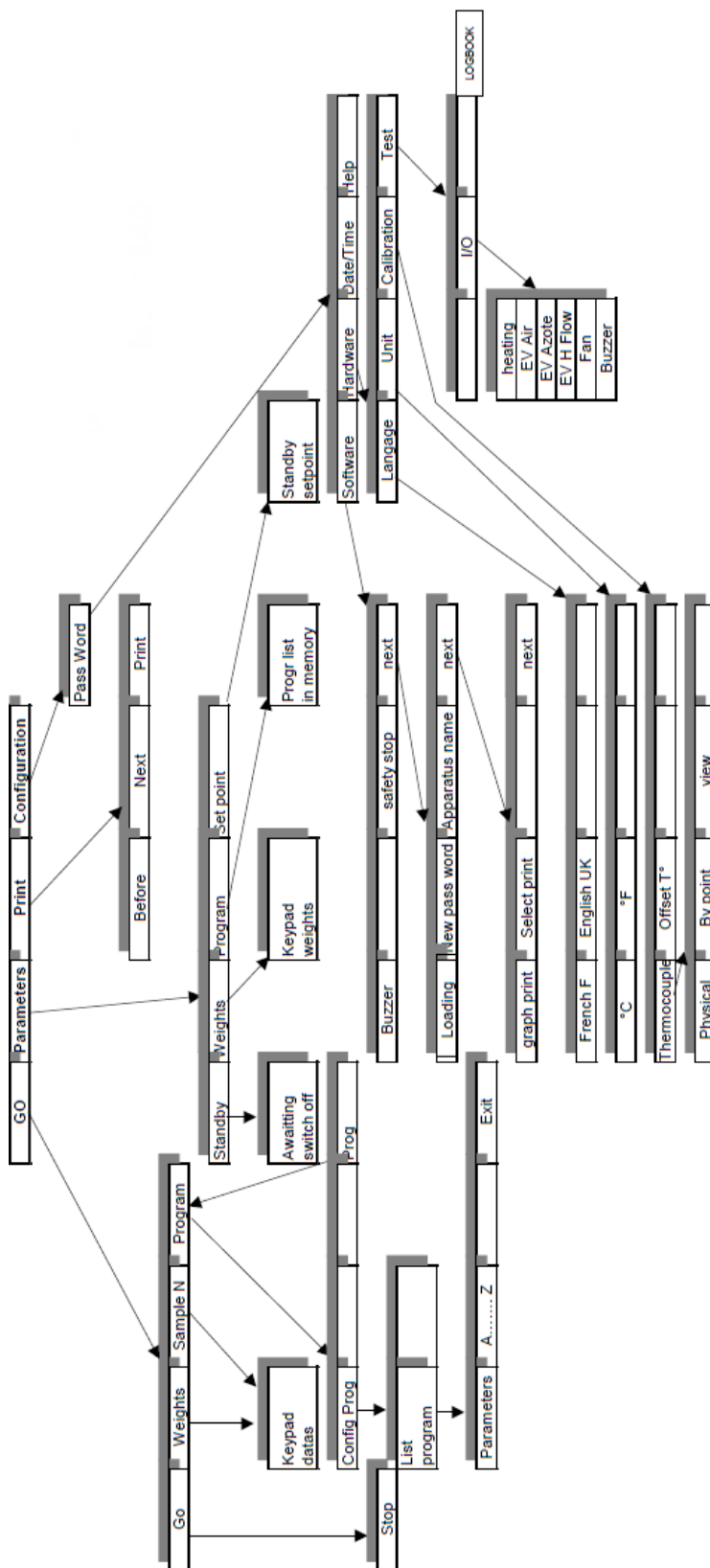
Description
Cleaning Cable
Mixed Vial Holder
Small Vial Holder
Large Vial Holder
Chimney Extension Pipe
Gripping Hook
Complete Furnace
Furnace Thermocouple
Safety Thermocouple
Thermal Printer
Paper for Thermal Printer
Insulating Lid
Small Vial, Borosilicate
Large Vial, Borosilicate
Long Vial, Borosilicate
Borosilicate Vial, 12mm dia, 72mm height
Support for Porcelain Crucible
Control Thermocouple w/ cable
Furnace Thermocouple Calibration Cord
Upstream Pressure Gauge
Condensate Tank
Joint for Condensate Tank
Flowmeter
Connection Tubing for Gas Source, 1m
Gas Connection Kit
Cooling Harness

7 Diagrams

7.1 Flow Meter Calibration Chart



7.2 Function Flow Chart



8 Service

Under normal operating conditions and with routine maintenance, the K41091 Micro Carbon Residue and Ash 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]