



NEXT GENERATION CALORIMETERS

3K-F INSTALLATION GUIDE

**VERSION NO: 6
DATE: 2023**

MANUFACTURED BY:



DDS CALORIMETERS

Scientific Analytical Calorimeter Solutions



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1 INTRODUCTION

Digital Data Systems (Pty) Ltd (**dds**) specializes in the design and manufacture of scientific bomb calorimeter systems for various types of industries and applications from the coal mining industry to educational institutes. **dds** bomb calorimeter systems are the most advanced combustion calorimeter systems available today. The system is used to measure the calorific value of both solids and liquids. **dds** has a wide range of systems to suit different applications and sample requirements. Please visit our website: www.ddscalorimeters.com to find out more. You have chosen the **CAL3K-F** Bomb Combustion Calorimeter System, which is best suited for fast and accurate calorimetry operations.

1.1 PURPOSE OF THIS MANUAL

It serves as a short introduction to the CAL3K-F system and the various components. It explains the very basics of operation and guides you to perform hardware tests and do the first determination. It relies on the DEFAULT setting and the factory calibration.

But there is more: Information and capability! This is not explained here but in an ON-LINE version. It is safe to say that you need a PC or laptop to change from the basic operation to a more sophisticated or suitable one.

1.2 HOW TO USE THIS MANUAL

This Manual makes use of some informative symbols or icons, to bring your attention to the text.

1.2.1 WARNING SYMBOL



This yellow triangle with an exclamation mark inside it indicates a WARNING message or a message that is instructing you NOT to do something. Please take note of this message, because if you ignore it you could damage the Calorimeter equipment.

1.2.2 INFORMATION (NOTE) SYMBOL



This white hand with a finger pointing indicates a NOTE or INFORMATIVE message. It indicates something that you need to pay attention to. Please take note of this message, as it provides special or detailed information about a particular item.

2 USER INFORMATION AND HELP AIDS

Included in your shipment is this printed Installation Guide.

The on-line Help Guide for basic system operations, trouble-shooting and solutions, application notes as well as how everything functions is available on-line and can be found at www.ddscalorimeters.com .

Please note the CAL3K-F Windows Software can be downloaded from the following link:

<https://ddscalorimeters.com/dds-software/cal3k/>



3 SYSTEM COMPONENTS

3.1 THE CAL3K-F SYSTEM CHECK LIST

The system consists of the following:

| | | | |
|----------------------------|---|--------------|-----------------|
| 3K-F | CAL3K-F Calorimeter | 1 | Received |
| 3K-MAN-KT | CAL3K-F Calorimeter Installation Kit | 1 | |
| <i>Included in Kit:</i> | | | |
| 3K-1-055 | <i>3K External 12V/1.5A Power Supply</i> | <i>1</i> | |
| 3K-1-117 | <i>Balance Cable</i> | <i>1</i> | |
| 3K-1-084 | <i>PC Cable (USB)</i> | <i>1</i> | |
| 3K-1-061 | <i>PC Keyboard (PS2)</i> | <i>1</i> | |
| 3K-4-049 | <i>Preparation Stand</i> | <i>1</i> | |
| 3K-1-081 | <i>Stainless Steel Tweezers</i> | <i>1</i> | |
| 3K-4-084 | <i>Certified Benzoic Acid Tablets (150 x 0.5g Tablets per Bottle)</i> | <i>1</i> | |
| 3K-4-106 | <i>Wire Brush</i> | <i>1</i> | |
| 3K-1-043 | <i>USB Memory Flash Drive with software, manuals etc.</i> | <i>1</i> | |
| 3K-3-18 | <i>Emergency Deflate Cap</i> | <i>1</i> | |
| INSTALLATION-MANUAL | <i>CAL3K-F Installation Guide Printed</i> | <i>1</i> | |
| 3K-2 | | | |
| 3K-2 | CAL3K Air Cooler | 1 | |
| 3K-2-KT | CAL3K Air Cooler Installation Kit | 1 | |
| <i>Included in Kit:</i> | | | |
| 3K-1-055 | <i>3K External 12V/1.5A Power Supply</i> | <i>1</i> | |
| 3K-3 | | | |
| 3K-3 | CAL3K Filling Station | 1 | |
| 3K-3-KT | CAL3K Filling Station Installation Kit | 1 | |
| <i>Included in Kit:</i> | | | |
| 3K-3-29 | <i>Nozzle O-rings used in de-filler cap & filling station</i> | <i>5</i> | |
| 3K-3-21 | <i>Oxygen Regulator Connection - Quick Fit</i> | <i>1</i> | |
| 3K-3-27 | <i>High Pressure Oxygen Pipe 4mm (3.75m) (Clear)</i> | <i>3.75M</i> | |
| 3K-3-22 | <i>De-filler Cap</i> | <i>1</i> | |
| 3K-1-080 | <i>Nozzle O-rings used in filling station</i> | <i>2</i> | |
| 3K-3-32 | <i>Allen Key</i> | <i>1</i> | |
| 3K-1-086 | <i>O-Ring Lubrication Grease tube</i> | <i>1</i> | |
| 4K-4 | | | |
| 4K-4 | CAL3K-F Thread Vessel | 2 | |
| 3K-4-KT | CAL3K-F Thread Vessel Installation Kit | 2 | |
| <i>Included in Kit:</i> | | | |
| 3K-4-096 | <i>Centre Electrode Complete</i> | <i>2</i> | |
| 3K-4-037 | <i>Outside Electrode M3</i> | <i>2</i> | |
| 3K-4-047 | <i>Crucibles</i> | <i>2</i> | |
| 3K-4-092 | <i>Deflector Plate</i> | <i>2</i> | |
| 3K-4-093 | <i>Firing Wire (1 packet of 5)</i> | <i>1</i> | |
| 3K-4-065 | <i>Firing Cotton Packet (1 packet of 100)</i> | <i>2</i> | |
| 3K-4-094 | <i>Lid O-Rings</i> | <i>5</i> | |
| 3K-4-022 | <i>Top & Bottom O-ring</i> | <i>10</i> | |



3.2 THE 3K-F CALORIMETER WITH EXTERNAL OXYGEN FILLING

The CAL3K-F uses the Dynamic method (Isothermal) of determination while still using the DRY method. The prepared vessel is filled with oxygen in the external filling station and placed in the calorimeter and the lid is closed. The rest is automatic!

| | | |
|---------------|---|-------|
| Width | - | 270mm |
| Height | - | 200mm |
| Depth | - | 380mm |
| Weight | - | 8kg |

Power - 220-240V / 12W

3.3 THE 3K-2 AIR COOLER

The air cooler requires no water, piping, or other resources. The Air Cooler is supplied with an external 12V power supply and a suitable mains cable.

The air cooler will cool the vessel in approximately 6-8 minutes to the specified setting. The operation of the cooler can be set via the USB port and the CAL3K-F application software or from the CAL3K-F The cooler is factory configured before shipment.

| | | |
|---------------|---|----------|
| Width | - | 155mm |
| Height | - | 235mm |
| Depth | - | 285mm |
| Weight | - | 3 to 4kg |
| Power | - | 12VDC |





3.4 THE 4K-4 THREAD VESSEL

The ignition and burning process is contained within a chamber so that the energy released can be measured in the form of heat. The Vessel has temperature sensors built into it, so that the temperature rise can be measured.

Because of the high pressure of oxygen required for combustion, the Vessel is classified as a “Pressure Vessel” and is consequently tested by an inspection authority to 10 times its normal pressure.

- Diameter** - 63mm
- Height** - 150mm
- Weight** - 2kg

3.5 THE 3K-3 OXYGEN FILLING STATION

The oxygen filling station is connected to the oxygen bottle via a regulator. The regulator reduces the bottle pressure to 30bar, which is adjustable. The regulated pressure is then supplied to the filling station, which shows the supply pressure. Once a vessel is placed in the filling station and the lever is lowered the vessel pressure is indicated and the actual filling progress can be observed. The filling speed is adjustable to suit the sample material.

- Width** - 220mm
- Height** - 450mm
- Depth** - 300mm
- Weight** - 4.5Kg





4 INSTALLATION

4.1 UNPACKING AND INSPECTION

There are no special precautions to be taken when unpacking your system. The following check list is for your convenience:

1. Locate and tick-off the various system components as indicated on the CAL3K-F Check List as per above.
2. Unpack and inspect all the system components such as the 3K-F Calorimeter, 3K-2 Air Cooler, 3K-3 Filling Station and the 4K-4 THREAD Vessels according to the instructions in the relevant sections in this document.
3. Inspect everything for any physical damage during transit. If damaged, consult your Agent immediately.
4. The Calorimeter has a GROUND (SAFETY EARTH) lug at the rear panel. This lug **MUST** be connected to the EARTH supply to ensure operating personal safety in case the power supply fails.
5. Verify the earth connection of the mains outlet, which you intend to use. Ask a qualified electrician to check it.
6. Connect the power supply to the mains power and to the Calorimeter. Any power supply with 12V output, 3000mA capacity, centre pin POS, can be used.
7. Do the same for the COOLER.
8. Observe that the Display on the Calorimeter comes ON. If not, check the mains connections or consult your Agent immediately.
9. Observe that the Display on the COOLER comes ON. If not, check the mains connection or contact your agent.



4.2 SETTING UP

4.2.1 PREREQUISITES

Prior to installation of the CAL3K-F System, the User must provide the following:

1. A mains outlet for the 3K-F Calorimeter and a mains outlet for the 3K-2 Air Cooler power supplies.
2. **A supply of oxygen at a pressure of 3.0Mpa (30bars) (3000Kpa)** within 4 meters of the 3K-F Calorimeter. If bottled oxygen is used, a suitable high-pressure oxygen regulator must be supplied. Digital Data Systems can supply a single stage high-pressure oxygen regulator; contact your agent for more information.
3. If a balance is supplied, ensure that a sturdy, stable weighing surface is available. A mains outlet and Balance connecting cable will also be required (balance cable supplied as part of kit).

4.2.2 SITE SELECTION

The 3K-F Calorimeter is a desktop unit, which can be installed wherever the laboratory space permits, with two restrictions:

1. The CAL3K-F system, consisting of 3K-F Calorimeter, 3K-2 Air Cooler, should be connected to a mains circuit without heavy inductive or SCR switched equipment. It is safe to have balances or other small electronic apparatuses on the same circuit. Good installation practice would be to have a separate fused mains circuit with separate earth leakage supply (or an earth current monitor, if applicable) for every system component. Future computers and peripherals installed can be connected to the same circuit.
2. The unit should be in a place with a stable temperature, not in direct sun light or in the outlet path of an air conditioner.



Please see above for the dimensions, weights, and power requirements per unit. The BALANCE data would be dependent on the make and model that you will be using.



4.2.3 ASSEMBLING THE CAL3K-F

The unit is shipped with a set of spares and some items required for operation. The operational items need to be assembled before the unit is operational. The reason we ship the lid unlatched is due to customs purposes. If customs officials wish to inspect inside the CAL3k-F calorimeter the lid is locked therefore we must ship with the lid and latches loose so that customs can inspect.

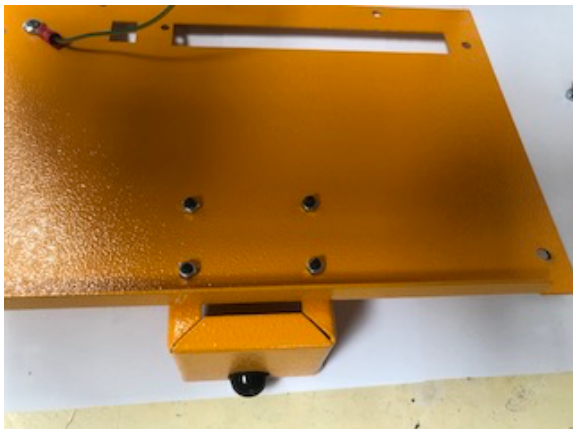
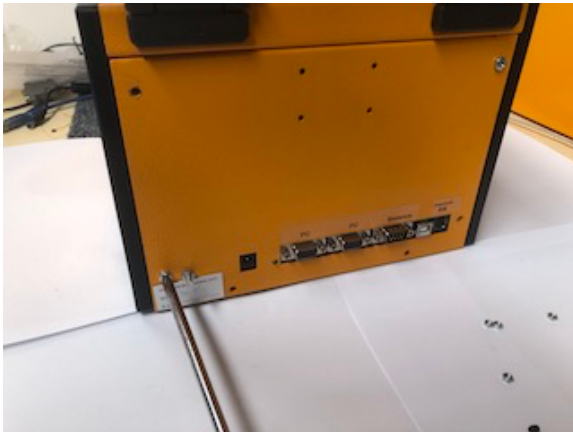
The following requires assembling on the CAL3k-F:

1. The Lid locking mechanism on the calorimeter will need to be fitted. Locate the Lid locking 'loop' and the two screws and screw the loop into the lid. The loop was removed to enable customs inspection. Do not close the lid! It opens only with power.





2. The Lid stop will also need to be fitted to the back panel of the calorimeter.
 - a. First unscrew the back panel as shown in the picture below.
 - b. Fit the Lid Stop onto the back panel as shown in the picture below using the screws supplied.
 - c. Fit the back panel back as indicated in the picture below.





5 TESTING

It is recommend to run a calorimeter hardware test and a vessel hard ware test after installation and before operation of the system.

5.1 TEST CAL3K HARDWARE

The test is activated by F9 or by:

13 CAL3K-TEST: 0

This command tests the CAL3K hardware. Once started the unit will cycle through all tests and will 'hang' on any fault. Individual test can be executed (without cycling through all preceding test) by replacing the 'YES' entry by the test number.

This test should be repeated once a day. The vessel must not be in the well.

5.2 TEST VESSEL HARDWARE

This test is activated by F7 or:

14 VESSEL-TEST: 0

The vessel must be in the well.

6 SAFETY PRECAUTIONS

6.1 CALORIMETER (3K-F)

- Connect the safety earth to the EARTH STUD on the back of the instrument. This is required when the external power supply fails
- Do not open the CAL3K for any reason whatsoever! There are no serviceable parts inside the unit.



DO NOT TAMPER WITH THE EARTHING - CONSULT A QUALIFIED ELECTRICIAN SO THAT THE EARTHING CAN BE CHECKED.

6.2 FILLING STATION (3K-3)

- Install the flexible high-pressure pipe supplied without any sharp bends.
- Check the nylon high-pressure pipe supplied for any mechanical damage before putting it under pressure.
- Secure the pipe into the quick connector and screw the connector to the pressure regulator side. Secure the pipe nuts to the pressure regulator side, then clamp the ferrule to the high pressure pipe on the gauge block side.



- If the oxygen bottle is not situated close to the Filling Station or if it is in another room or perhaps outside, then a solid, permanent installation of pressure piping should be installed, as well as a shut off valve and pressure gauge within easy reach of the 3K-3 Filling Station.
 - If bottled oxygen is used, a suitable High Pressure oxygen regulator must be supplied by your Agent, or sourced locally. Ordering this item from the factory ensures that the necessary modifications have been made to fit the 3K-3 Filling Station.
 - The oxygen bottle should be secured according to regulations.
 - Secure the pipe to the side of the filling through the supplied device
 - Do not use any oil or grease on any of the oxygen fittings or the O-rings. A very small amount of high-pressure (vacuum) grease is allowed on the O-ring to make them pliable. Wipe them clean afterwards.
- **DO NOT USE ANY OTHER PIPE OTHER THAN THE HIGH PRESSURE PIPE SUPPLIED FOR OXYGEN FILLING.**
 - **DO NOT USE THE HIGH PRESSURE PIPE IF IT HAS A SHARP BEND OR KINK, DISCARD IMMEDIATELY**



- **ALWAYS FILL THE VESSEL WITH OXYGEN TO A MAXIMUM PRESSURE OF 3000KPA (30 bar).**



- **NOTE: With some applications you may need to fill the Vessel to less than 3000KPA e.g. 1500KPA (15 bar), however this is only applicable when you have a sample which is highly combustible, for example with wood related samples.**



- **REMEMBER: You may fill the Vessel LESS than 3000KPA but NEVER more than 3000KPA.**

6.2.1 HIGH PRESSURE OXYGEN

- The type of Oxygen to be used is the standard Industrial Oxygen used for welding. A purity of 99.5% will be suitable.
- Conform to the industry standard of handling procedures for oxygen bottles.
- Secure the bottle against a wall.
- Should the Oxygen supply be in another room, make sure there is a high pressure shut off valve near the 3K-3 Filling Station installation.

6.3 COOLER (3K-2)

- There are no user serviceable parts inside.



6.4 VESSEL (4K-4)

- Handle the vessel over a table or solid surface.
- Do not drop a vessel.
- Do not overfill a vessel with oxygen: The maximum oxygen filling pressure is 30bar / 3000kPA, which is the standard for bomb calorimetry.
- Do not use any tools to open or close the vessel. If the vessel fails to deflate use the pre-scribed 'emergency deflate' procedure as outlined in the CAL3K-F Operations Manual, which uses the 3K-3-18 EMERGENCY DEFLATE tool (3K-3-18).
- Use the provided De-filler cap only, part number: 3K-3-22.
- Do not use any oil or grease on any of the oxygen fittings or the O-rings. A very small amount of high-pressure (vacuum) grease is allowed on the O-ring to make them pliable. Wipe them clean afterwards.
- Store the vessel with the lid open. Never store a vessel under pressure, always deflate using the de-filler cap.
- Clean the inside of the vessel with paper towel after every use.
- Weigh the crucible every week and discard it when it has lost 10% of its original mass.
- Discard the crucible when the bottom is distorted and extremely discoloured.
- Remove the deflector plate every week and clean the top surface. It does accumulate residue and must be clean regularly.
- Make sure to use the pipe-clamping device on the right side of the filing station for safe use.



- **NEVER OPERATE ANY UNSAFE VESSEL.**



- **NEVER IMMERSE THE VESSEL INTO COLD WATER WHEN COOLING. USE THE 3K-2 AIR COOLER OR ALLOW THE VESSEL TO COOL DOWN NATURALLY.**

- **A SUITABLE INSPECTION WARNING PERIOD OF 2000 FIRINGS, AND A STOP OPERATING LIMIT OF 2500 FIRINGS ARE PRE-PROGRAMMED FROM THE FACTORY**

THE VESSEL MUST BE INSPECTED AT REGULAR INTERVALS DEPENDING ON THE USE. A SUITABLE INSPECTION PERIOD CAN BE SET (By your agent!) AND THE UNIT WILL ISSUE AN INSPECTION WARNING AND SOON AFTER THIS IT WILL SHUT-DOWN THE OPERATION.



NOTE: THE MANUFACTURER (DDS) AND ITS AGENTS CANNOT BE HELD RESPONSIBLE FOR ANY LOSS OR DAMAGE RESULTING FROM NEGLIGENCE OR INCORRECT USE OF THEIR EQUIPMENT. IT IS YOUR DUTY AND RESPONSIBILITY TO CHECK ALL SAFETY ASPECTS OF THE CAL3K-F SYSTEM REGULARLY.



7 DAILY SAFETY STEPS

The 4K-4 vessel is a high-pressure apparatus and should be treated with care.

- Handle the vessel over a table or solid surface.
- Do not drop a vessel.
- Do not overfill a vessel with oxygen: The maximum oxygen filling pressure is 30bar / 3000kPA, which is the standard for bomb calorimetry.
- Do not use any tools to open or close the vessel. If the vessel fails to deflate use the pre-scribed 'emergency deflate' procedure as outlined in the CAL3K-F Operations Manual.
- Use the provided De-filler cap only, part number: 3K-3-22.
- Do not use any oil or grease on any of the oxygen fittings or the O-rings. A very small amount of high-pressure (vacuum) grease is allowed on the O-ring to make them pliable. Wipe them clean afterwards.
- Store the vessel with the lid open. Never store a vessel under pressure, always deflate using the de-filler cap.
- Clean the inside of the vessel with paper towel after every use.
- Weigh the crucible every week and discard it when it has lost 10% of its original mass.
- Discard the crucible when the bottom is distorted and extremely discoloured.
- Remove the deflector plate every week and clean the top surface. It does accumulate residue and must be clean regularly.
- Make sure to use the pipe-clamping device on the right side of the filling station for safe use.

[WATCH YOUTUBE VIDEO ON CAL3K-F UNPACKING AND INSTALLATION!](#)



8 WARRANTY – FOR NEW PRODUCTS

8.1 PURPOSE OF PRODUCT WARRANTY

Any part of a product is subject to ageing and eventual failure. These failures occur during normal use. The purpose of a warranty is to protect the Owner against a part failure caused by manufacturing defects in workmanship, material or design for a specific time.

8.2 OWNER'S WARRANTY

In the event of the Owner contracting directly with Digital Data Systems (Pty) Ltd “**dds**”, or in the event of the installation of a unit arising out of a contract between the Owner’s Dealer or any other party on his/her behalf and the said “**dds**”, the Owner records that notwithstanding same, this warranty is the only warranty applicable to “**dds**” units and is expressly in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose. No amendments or additions to this warranty shall be binding on “**dds**”, unless recorded in writing and signed by a duly authorised officer of the company. **“dds” agrees to repair and replace with a new or remanufactured part, any part, other than those excluded below, which after inspection, upon its return to the factory in Randburg, Johannesburg by the Owner or the authorised Dealer to which he/she returns the unit, is proven to be defective.**

Replacement of a defective part will be made only within the applicable warranty period of **12 (twelve) months from date of shipment**. Notwithstanding anything to the contrary herein, any labour involved in repairing or replacing a defective part will be charged at “**dds**” rates applicable at the time.

If upon inspection it is found that the pressure vessel was submerged in water the warranty will automatically be null and void and the owner will be responsible for the labour and parts charges.

8.3 EXCLUDED (NON-WARRANTY) PARTS

“**dds**” shall be entitled to treat this warranty as void unless the relevant warranty form (attached) is sent by registered post to “**dds**” by the Owner within 10 (ten) days from date of original installation.

Regardless of warranty-status, the Owner shall be responsible for labour charges connected with periodic maintenance requirements involving visual and functional inspection of the systems.

This warranty expressly covers the unit(s) “**dds**” supplied only and does not cover any other part, which may, as a consequence of the installation and operation of the unit, become damaged in any way whatsoever.

Special attention should be given to the safe operation of the high-pressure Vessels. The published rules are guidelines only and enclosed in this leaflet for the convenience of the User. The manufacturer is not responsible for any damages, consequential, indirect or direct, or loss whatsoever, resulting out of electrical shock, Vessel explosion, or any other cause.



8.4 WARRANTY – REPAIRED PRODUCTS

Any “**dds**” scientific product that has been repaired has a warranty period of **30 Days from date of shipment** for the Repair request only. If something else goes wrong that is not part of the original Repair, the warranty does not apply. Each product that is sent to “**dds**” for Repair is tested and checked and leaves “**dds**’s” Factory in 100% working order. It is the Owner’s responsibility to inspect any repaired product on receipt thereof and confirm in writing, any faults, errors or problems with the said product. If a fault, error or problem is reported after the 30 Day warranty period, and “**dds**” finds that the product has been damaged and requires another repair, the full cost of repair will be applicable and paid for by the Owner.

8.5 GENERAL – WARRANTY VOID

All serial numbers on any relevant “**dds**” Scientific product need to remain on the product at all times, or warranty will be void. Warranty will also be void if any of the branding stickers or decals have been removed and/or the colour of the Scientific product has been changed in any way.



8.6 WARRANTY REGISTRATION FORM

SERIAL NUMBERS (S/N): _____

Calorimeter: _____

Air Cooler: _____

Vessel(s): _____

Other: _____

DEALER NAME: _____

OWNER'S/CUSTOMER'S COMPANY NAME: _____

AUTHORISED BY: _____

INSTALLED AT: _____

TEL NO: _____ **FAX NO:** _____

CONTACT PERSON: _____

INSTALLED BY: _____

DATE INSTALLED: _____ (REPRESENTATIVE OF DEALER/AGENT)

CUSTOMER ORDER NUMBER AND DATE: _____

INSTALLATION DETAILS (LOCATION, WATER SUPPLY, AIR-CONDITIONING ETC.):

ACCEPTED IN GOOD CONDITION:

DATE: _____ **SIGNATURE:** _____

NAME (printed): _____

WITNESS: _____

I have read, understood and accepted the conditions of this warranty, the details of which are printed in this Manual.

CUSTOMER'S SIGNATURE: _____

NAME (printed): _____

DATE: _____