



**DDS CALORIMETERS**

Scientific Analytical Calorimeter Solutions

**DDS CALORIMETERS**

[www.ddscalorimeters.com](http://www.ddscalorimeters.com)

Manufacturers of CAL2K/CAL3K Oxygen Bomb Calorimeters

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# CAL2K MAINTENANCE MANUAL



**VERSION 3.3**

MANUFACTURED BY DIGITAL DATA SYSTEMS (PTY) LTD.  
AND PART OF THE DDS CALORIMETERS BRAND





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## HOW TO USE THIS MANUAL

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

### 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.

### 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.

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## CALORIMETER INTRODUCTION

- Manages the temperature received from a Vessel, and presents it in the various forms
  - Calculates a CV
  - Provides access to the Vessel
  - Restarts the temperature sampling in the Vessel every 6 seconds
  - Provides access to other CAL2K-1 Calorimeters
  - Provides large storage for results
  - Provides interface to a balance
  - Provides RS232 interface to a PC
  - Manages the SAMPLE ID and MASS (HEAP)
  - Provides the Cooler with the ambient temperature
  - Provides firing control
  - Manages calibration curves in the Vessel
  - Has a Serial interface to the Vessel
  - Interfaces to the display and keyboard
  - Provides beeper and pilot light outputs
  - Insulates the Vessel from the environment during a determination
- 

## CALORIMETER SELF-TEST MENU



For details of all the Keypad (Keyboard) button functions, please refer to the Operational Manual, section Calorimeter Components.




To enter the Self Test Menu press  then . Press  to proceed through the Menu Options or  to terminate.

1. **Show ambient and Vessel temp:** This displays the ambient temperature inside the Calorimeter and the temperature of the Vessel that is inserted in the Well (chamber inside the Calorimeter).
2. **Flash lamp & LCD:** The back ground light of the LCD display and the pilot lamp on the front panel will flash alternatively.
3. **Show fire / supply volt:** This will display the voltage on the firing capacitors and also the DC voltage coming out of the switch mode power supply. The firing voltage should be the same as the voltage set up in the menu, unless the Vessel has just fired. In this case the voltage should be increasing until it reaches the set value. The supply voltage should be 9,0 volts +/- 0,1V.
4. **Fire at target voltage:** For this option to operate, a Vessel with Firing Wire, must be in the Calorimeter's Well and the Calorimeter's Lid closed. The Vessel will now be fired every time the preset voltage is reached. The capacitor (firing) voltage is displayed on the screen.
5. **Show lid and wire sense:** This shows if the Calorimeter's Lid is open or closed and if a firing wire is present or not. The Lid of the Calorimeter must be closed to sense the Firing Wire of the Vessel inserted into the Well.
6. **Show real-time every sec:** This shows the date and time and updates every second. The date format is DDMMYY. The time format is HHMMSS.
7. **Display test :** Every block of the screen is turned on, i.e. every block should be black.
8. **Tests 8 to 15 have not been assigned**

## CALORIMETER SELF-TEST REPORT

Serial Number :	Date : / /	Name :
		CHECK
A) Connect mains power to the Calorimeter and ensure the display is operational		
B) Connect the PC and download standard set up		
C) Enter the Test Routine by pressing  then 		

Proceed through the tests as follows (press  to go to the next test):



**NOTE: Only the bottom line of the display is operational in the test routine.**



	CHECK
<p><b>TEST 1: SHOW AMBIENT&amp;VESSEL TEMP:      AA.A    BB.BBBB</b></p> <p>AA.A        =        Ambient temperature</p> <p>BB.BBBB    =        Vessel temperature if Vessel is inserted in the well (will be 00.0000 if no Vessel is inserted)</p>	
<p><b>TEST 2: FLASH LAMP AND LCD:</b></p> <p>The lamp on the front panel and the LCD backlight will flash alternatively.</p>	
<p><b>TEST 3: SHOW FIRE / SUPPLY VOLT:      FF.F    S.S</b></p> <p>FF.F        =        Firing voltage - should 30 +/- 0.2 volts (check firing voltage in setup program should be 30V) S.S = Supply voltage – should be 9.0 +/- 0.1 volts</p>	
<p><b>TEST 4: FIRE AT TARGET VOLTAGE:</b></p> <p>This will only operate if a vessel with Firing Wire is inserted into the well and the lid is closed. The Vessel will fire and then the voltage will build up back to 30volts at which stage the Vessel will fire again. Open the well lid and remove the Vessel</p>	
<p><b>TEST 5: SHOW LID AND WIRE SENSE:      OPEN      OPEN</b></p> <p>Close the Lid of the Calorimeter</p> <p>Display will now show:                      <b>CLOSED      OPEN</b></p> <p>Open the Lid of the Calorimeter, insert the Vessel with Firing Wire and close the Lid</p> <p>Display will now show:                      <b>CLOSED      CLOSED</b></p>	
<p><b>TEST 6: SHOW REALTIME EVERY SEC.      DDMMYY HHMMSS</b></p> <p>The display will increment every second.</p> <p>DD = Day</p> <p>MM = Month</p> <p>YY = Year</p> <p>HH = Hour</p> <p>MM = Minute</p> <p>SS = Second</p>	
<p><b>TEST 7: DISPLAY TEST:</b> All segments of the LCD will be black (dark)</p>	



To EXIT the Test Routine press the CLEAR button.

## CALORIMETER MAINTENANCE

The CAL2K-1 Calorimeter needs very little maintenance. The Calorimeter should never be opened, as there are no serviceable parts inside.

- Always keep the Calorimeter clean.
- Ensure that the Vessel Well is clean – blow out any dirt with compressed air if necessary.
- Ensure that both connections to the Vessel (one in the lid and one in the base) are clean and that they do not stick down when depressed.
- If the Vessel Well or Lid Polystyrene is damaged, call a service technician or your local Agent to replace them.
- If the Keyboard or the display fails, call a service technician or your local Agent.





- Always ensure that the Door Knob of the Lid latches correctly, as this incorporates the lid microswitch and is also a safety device to prevent the Lid from lifting in case of a Vessel failure.

## OPENING AND CLOSING OF THE CALORIMETER



**WARNING: REMOVE THE POWER CABLE FROM THE UNIT BEFORE STARTING THIS PROCEDURE.**

### OPENING THE CALORIMETER

1. Remove all connections from the rear panel.
2. Remove the 2 screws on either side of the Well cover.
3. Remove the 6 screws around the edge of the back panel.
4. Slightly lift the Well cover.
5. Remove the rear panel straight backwards.
6. Once the rear panel has been removed completely it can be tilted down.
7. Lift off the Well cover taking care not to strain any of the wires. The cover can now be placed next to the unit.

Any work that is required inside the Calorimeter can now be done.

### CLOSING THE CALORIMETER

1. Replace the cover ensuring that it slides into the slot at the front and no wires are trapped on the sides.
2. Re-fit the rear panel. Ensure that NO wires are trapped, especially around the power module.
3. Ensure the power supply slides in straight.
4. Press the rear panel firmly in.
5. Press the Well cover down.
6. Loosely fit the 6 screws around the rear panel and the 2 on either side of the Well cover. (You may have to press down on the cover to get the screws started.)
7. Now tighten all 10 screws.
8. Re-fit all connections to the rear panel.
9. Plug in mains.
10. Check that the display starts.

### EXCHANGE OF MAIN PCB CONTROL CARD

This will be required if a new software (firmware) version for the main PCB card is released.

1. Open the unit as described above.
2. Locate the main card. This is a gold, anodized metal box.
3. Remove the M3 nut that secures the card to the rear panel.
4. Tilt the card slightly forwards until it is free of the mounting screw.
5. Remove the card. Be CAREFUL not to touch the pins on the card. ALWAYS hold the card by the metal case.
6. Fit the new card in the same way as you removed the old card. Ensure it is the correct card!
7. Re fit the M3 nut to secure the card.
8. Close the unit as described above.



9. Check the loaded parameters.
10. Run a CV to ensure that the Calorimeter is operational.
11. REMEMBER to send the old Main PCB Card to **dds**.

### VESSEL CONNECTION

Ensure that the Vessel Well inside the Calorimeter is clean. Blow out the chamber with compressed air if necessary. Ensure that both connections to the Vessel are clean and that they do not stick down when depressed. To gain access to the connections, do the following:

1. Open the Calorimeter as described above.
2. Remove the Well polystyrene from the aluminum housing.
3. Remove the connections to the base card.
4. Remove the card.
5. The connections can now be serviced.
6. Re-fitting is the reverse procedure.
7. Close the Calorimeter as described above.

### POLYSTYRENE REPLACEMENT

If the Vessel Well or Lid polystyrene of the Calorimeter is damaged they must be changed.

#### WELL POLYSTYRENE

Proceed exactly the same as for Vessel connection removal above. Except in this case you will need to discard the old polystyrene and replace it with the new one.

#### LID POLYSTYRENE

- Open the Calorimeter as described above to gain access to the Lid Contact wire.
- Remove the old lid polystyrene. This may need to be destroyed to get it out.
- Remove the Lid Contact wire.
- Clean the inside of the Lid.
- Fit the wire from the new Lid.
- Remove the paper backing on the foam of the new Lid.
- Glue in the new Lid ensuring that it is central. In the newer versions of the CAL2k, the Lid and Lid Contact Polystyrene set come complete and need to be screwed into the Calorimeter's Lid.
- Close the Calorimeter as described above.

### LID CONTACT REPLACEMENT

The Lid polystyrene and Lid Contact come as a complete unit. See Lid Polystyrene above.

### KEYBOARD, DISPLAY AND AUXILIARY POWER SUPPLY

If the Keyboard (Keypad), Display or Auxiliary Power Supply fail, they must be replaced.

1. Open the Calorimeter as described above.
2. Removed the associated connectors.
3. When removing the screws and spacers, take careful note of where they are placed so that the unit can be re-assembled correctly.
4. Replace the keyboard, display or auxiliary power supply as required.





5. When replacing the keyboard ensure that no keys touch the casing, as this would cause them to stick down.
6. Re-assemble the screws and spacers.
7. Close the Calorimeter as described above.

### DOOR KNOB, LATCH AND LID SWITCH

Always ensure that the Door Knob latches correctly as this incorporates the lid switch and is also a safety device to prevent the lid from lifting in case of a Vessel failure. To remove the Door Knob, do the following:

1. Open the Lid of the Calorimeter.
2. Remove the 3 screws that hold the Knob to the bracket.
3. Fit the new Door Knob in the same way as you removed the old one.

To remove the Latch and Lid Switch:

1. Open the Calorimeter as described above.
2. Disconnect the lid switch cable from the auxiliary power supply.
3. On the inside of the unit, slide the bracket off the door latch.
4. Two "sellock" pins hold the lid switch in.
5. Press out the pins.
6. Insert the new lid switch.
7. Press in the pins.
8. Insert the latch into the housing and fit the holding bracket.
9. Re-connect the wiring.
10. Close the Calorimeter as described above.

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## TECHNICAL INFORMATION FOR THE CAL2K-1 CALORIMETER

### POWER SUPPLY AND DISTRIBUTION

Power to the unit is supplied from a "pre-regulated" supply, which has multiple voltages (220/110), and frequency capabilities.

Switch mode power supply specifications:

- 3 Pole AC inlet IEC320-C14
- Full output 3-48V safety approved
- Short circuit protection
- Over load/temp. protection
- 100% full load burn-in test
- Fully enclosed plastic case
- Approvals: UL/CUL/TUV/CB/CE
- Low cost/OEM brand acceptable
- 1 year warranty
- AC input range 90-264VAC/0.5A



- Inrush current cold start, <30Apeak at 230VAC
- Hold up time 8ms at full load, 115VAC input
- Over load protection pulsing mode, auto recovery
- Operating temperature 0-30°C at 100% load, 40°C at 60% load
- Withstand voltage I/P-O/P: 3KVAC, I/P-FG: 1.5KVAC, 1min
- Safety standards UL 1950, CSA 22.2, TUV EN60950
- EMI standards EN55022 class B, EN61000-3-2, 3
- EMS standards EN61000-4-2, 3, 4, 5, 6, 11, ENV50204

## BALANCE INTERFACE

The Balance interface is:

- 2400 baud
- 1 start bit
- 7 data bits
- 1 parity bit
- 1 stop bit

The Balance is a “receive” only. The message is scanned for decimal point info. and the stability indication "g", before accepting the balance weight.

## COOLER

- Measures cold/hot and left/right pad temperatures
- Measures ambient temperature from the CALORIMETER
- Serial interface to the Vessel
- Measures the Vessel temperature
- Manages the right/left pad power
- Interfaces to the front panel display and push buttons
- Provides a serial RS232 PC interface

## COOLER BASIC OPERATION

The Cooler senses temperatures and switches the cooling elements (pads) accordingly. The following temperatures are sensed:

RIGHT SIDE	:	Cool
		Hot
LEFT SIDE	:	Cool
		Hot
AMBIENT	:	From the CAL2K-1 Calorimeter
VESSEL	:	Through communication



The set-up LOW/HIGH temperatures control the Pad cooling. The pad current is on until the cold side has reached its limit or the hot side has reached its HIGH limit. The Vessel and ambient temperatures are compared, and the Door Lock is operated or released.

**COOLER BASIC TEST PROCEDURE**

Serial Number :	Date : / /	Name :
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	CHECKS
<b>CONNECT MAINS TO THE COOLER AND CHECK THE LEDs</b> Power ON Ambient Fault ON Auxiliary FLASHING	
<b>PRESS THE "T" BUTTON FOR "TEST"</b> All LEDs should illuminate (except "Auxiliary" which should still be flashing)	
<b>PLACE THE VESSEL IN THE COOLER'S WELL</b> "Vessel in Well" LED should illuminate after 6 seconds Remove the Vessel from the Well.	



**WARNING:** The above tests **MUST** be done within 5 minutes, as there is no water connected to cool the peltier elements.

	CHECKS
<b>CONNECT THE AMBIENT CABLE BETWEEN THE COOLER AND CALORIMETER</b> Ambient Fault LED will go OFF Right On LED, will go ON Left On LED, will go ON	
<b>PRESS THE "I" BUTTON FOR "IDLE"</b> Idle LED, will go ON Right On, LED will go OFF Left On, LED will go OFF	
<b>PRESS THE "W" FOR "WAKE UP"</b> Idle LED, will go OFF Right On LED, will go ON Left On LED, will go ON	
<b>MONITOR THE COOLER</b> Monitor the cooler continuously as the pads are now cooling WITHOUT a water supply. After a few minutes the pads would have cooled down and the hot blocks will be hot. Left Over Temp LED comes ON Left On LED will go OFF Right Over Temp LED comes ON Right On LED will go OFF	
<b>PRESS THE "I" BUTTON FOR "IDLE"</b> Allow the hot blocks to cool down for 15 minutes	
<b>VESSEL INSIDE THE COOLER WELL</b>	





Insert a Vessel into the Cooler Well. After 6 seconds the Cooler will “Wake Up”. Idle LED, will go OFF Right On LED, will go ON Left On LED, will go ON Vessel in Well LED, will go ON	
<b>HEATED VESSEL INSIDE THE COOLER WELL</b> Remove the Vessel. Heat the Vessel about 5 degrees more, by placing hot water inside the Vessel and replace it into the Cooler Well. After 6 seconds, the following should be displayed: Close Doors LED, will go ON Vessel Cooling LED, will go ON Close the doors – they should latch closed Press the “D” Button “Open Doors” – the doors should open	
Unplug the Cooler as soon as the Tests have been completed. For more comprehensive tests connect the water supply to the Cooler and a PC to the Calorimeter to monitor the temperatures.	

### COOLER MAINTENANCE

The Cooler needs very little maintenance. The Cooler should never be opened, as there are no serviceable parts inside.

- Clean Vessel base to ensure that the Vessel sits neatly and central and that the contacts meet successfully with the base of the Vessel and its contact rings.
- Ensure the base contact operates freely.
- The contacts are spring loaded and when pressed down and released they should return to their original position.

### OPENING AND CLOSING OF THE COOLER



**WARNING: REMOVE THE POWER CABLE FROM THE COOLER BEFORE STARTING THIS PROCEDURE.**

#### OPENING – COVER REMOVAL

1. Remove the power cable.
2. Remove the ambient cable.
3. Remove the 2 screws on each side of the unit.
4. Lift off the cover.
5. The earth wire to the cover is still attached and should only be removed if necessary.

Any work required can now be carried out.

#### CLOSING – COVER REPLACEMENT

1. Replace the earth wire to the cover if it was removed.
2. Replace the cover onto the unit, ensuring that the front is clipped in correctly.





3. Fit the 2 screws on either side.

### VESSEL CONNECTIONS INSIDE THE COOLER

Clean the Vessel Base to ensure that the Vessel sits neatly in the base so that the contacts meet successfully with Vessel's contact rings. Ensure both contacts still operate freely. The contacts are spring loaded and when pressed down and released they should return to their original position. Blow out the Cooler's Well with compressed air if necessary. To replace or service the Vessel Holder and connection, do the following:

1. Open the Cooler as described above.
2. Remove the connection to the Vessel Holder.
3. Turn the Cooler on its side.
4. Remove the 3 screws underneath that hold the holder down.
5. The Vessel Holder can now be serviced or replaced.
6. Before re-fitting the 3 screws from underneath, ensure the correct rotation of the holder.
7. Re-fit the connection to the holder.
8. Replace the cover as described above.

### VESSEL HOLDER ADJUSTMENT/INSPECTION

1. EARTH CONNECTION. The heads of the 3 mounting screws must protrude sufficiently for the base ring of the Vessel to sit on them.
2. OUTER RING. The ring is spring loaded so it must pop back up after it has been pressed down and released. There is no adjustment on this ring.
3. CENTRE PIN. This pin is also spring loaded so it must pop back up after it has been pressed down and released. It can be adjusted by moving the M4 locking nuts up and down the pin shaft.
4. To ensure both the outer ring and centre pin are making proper contact, place a Vessel onto the holder and see that both connections move down when depressed by the Vessel.

### COOLER PADS AND PELTIER ELEMENT

#### REMOVAL OF THE LEFR OR RIGHT PAD (COMPLETE UNIT)

1. Open the Cooler as described above.
2. Turn off the water supply.
3. Remove the water connections from the rear panel and allow the Cooler to drain.
4. Remove both water connections from the pads.
5. Remove the hot and cold sensor connectors.
6. Remove the peltier element connector.
7. Remove both the top and bottom lock nuts that hold the pad to the swing arm.

#### REMOVAL OF THE PELTIER ELEMENT

1. Remove the 2 screws that hold the two parts of the pads together.
2. Separate the two parts and remove the element. TAKE NOTE OF THE POLARITY.
3. Clean the surfaces of the two parts.

#### REPLACEMENT OF THE PELTIER ELEMENT

1. Smear each surface of the element with heat sink compound.
2. Place the element on one surface ensuring correct polarity.



3. Screw the two parts together ensuring they stay parallel by alternatively tightening each screw by a small amount.
4. Re-fitting the pad is the reversal of removing it.
5. Ensure that the internal water pipes do not get any twists in them.
6. Check for water leaks.

### DOOR LOCK MECHANISMS

The Cooler's Door Lock Mechanisms (left and right) are parts that should never break. If the Cooler is handled in the correct manner, these parts should last for the lifetime of the Cooler. Remember that when you close the Cooler's doors, you do NOT need to exert any force and you can just gently pull the doors together and the magnets embedded within the Door Locks will attract each other and pull the doors closed.



**WARNING: Be careful NOT to knock the magnets when inserting the Vessel into the Cooler. It is best to insert the Vessel vertically into the middle, so as not to knock against the Door Locks.**

Should it occur that the Door Locks have been damaged by the User, then new Door Locks can be ordered from your Agent. When fitting the replacement Door Lock Mechanisms for the CAL2K-2 Cooler, please take note of the following important information:

1. Check the polarity of the wires before plugging in the connectors.
2. Make sure of the correct colours of the wires when connecting. When plugged together, Red must go to Red and Black must go to Black.

If the incorrect connection/polarity is made, the Cooler doors will not work correctly.

### COOLER POWER SUPPLY

Removal and re-fitting of the Power Supply:

1. Open the Cooler as described above.
2. **NOTE: Some capacitors may still be charged.**
3. Remove the 4 screws that hold down the power supply cover.
4. Disconnect the wires from the power supply.
5. Remove the power supply.
6. Re-fitting the power supply is the reversal of removing it.
7. Ensure the earth wire is connected to the cover of the power supply.

### COOLER MAIN PCB CARD

Removal and re-fitting of the Cooler Main PCB Card:

1. Open the Cooler as described above.
2. Remove all the connectors from the main card.
3. Remove the 6 nuts that hold it in place.
4. The card can now be removed, and replaced with a new card.
5. Fit the new card ensuring that the keys do not touch the housing.



6. Replace the nuts.
7. Replace the wiring onto the correct connectors.
8. Replace the cover.

## FILLING STATION MAINTENANCE

- Fill the Vessel with oxygen up to a MAXIMUM pressure of 3000kpa.
- Adjust the filling rate.

## FILLING STATION O-RING REPLACEMENT

It is strongly suggested the following checks be made every 3 months or sooner depending on the number of firings you perform per day, as well as the type of sample you are analyzing. A sample which ignites easily (highly combustible) will cause the o-rings to perish a lot faster than a substance which is less combustible.

- Verify the oxygen flow rate and re-adjust the Flow Adjustor if necessary. The rate of flow should be adjusted to fill a Vessel in approx.45 seconds. Replace O-ring if necessary.
- Check all pressure pipe connections for leaks.
- Check the nozzle O-ring and replace if worn. Apply light film of Silicon grease, to ensure it does not stick to the Vessel.
- The Piston O-Ring is the same part as that for the Nozzle O-Ring, but it does not get worn down as frequently as the Nozzle O-Ring. Check the Piston O-Ring at least once a year and replace if worn.



**WARNING: Please DO NOT apply silicon grease to any o-rings on the Vessel. You may apply a light film of silicon grease on the nozzle o-ring of the Filling Station, however it is advised not to apply grease to any other o-rings in order to prevent explosions!**

Before an O-ring is replaced, turn the oxygen supply OFF at the bottle and release the pressure in the pipes by filling a Vessel until both gauges on the Filling Station read zero.

## HIGH PRESSURE PIPE

A brass Ferrule is supplied inside the nut where the High Pressure Pipe (CAL2K-3-OP) needs to be attached to the Gauge Block. Place this Ferrule inside the High Pressure Pipe and tighten it to the nut on the Gauge Block. The other end of the High Pressure Pipe will need to be attached to the High Pressure Oxygen Regulator. **dds** provides an Oxygen Regulator Connection with the Filling Station Installation Kit, but this is not a universal connection and may not work for some oxygen regulators. If the oxygen regulator is purchased from **dds**, the oxygen regulator gets a special fitting on it in order for it to be attached to our Filling Station.

## NOZZLE

The O-ring in the Nozzle, which seals onto the Vessel's lid valve, is replaced by unscrewing the cover (knurled nut) at the end of the Nozzle. (A pair of round jaw pliers may be required to grip the nut, but generally it should be hand tight and can be opened by hand). Once the knurled nut has been removed the o-ring can be replaced. Lubricate the



new o-ring with a very SMALL amount of silicon grease before use. The knurled nut can now be replaced onto the nozzle.

### PISTON

There is an O-ring between the Nozzle and the Piston. To replace this O-ring the two pressure pipe connections to the Nozzle must be removed FIRST. The Nozzle can now be unscrewed from the Piston. To stop the Piston from turning when the Nozzle is unscrewed, we suggest that the arm be put down in the latched position. The O-ring can now be changed. The O-ring on the Piston is the same as the Nozzle O-ring. Before re-assembly, ensure that the nipple inside the Nozzle is in place. Screw the Nozzle back onto the Piston and then re-attach the two pressure pipe connections.

### NIPPLE (INSIDE THE NOZZLE)

To replace the O-ring on the nipple proceed as in the "Piston" O-ring above until the Nozzle and Piston are separated. Now remove the Nipple from the Nozzle, replace the O-ring on the Nipple and re-assemble as above. Use the same Viton O-ring which is used on the Vessel's Centre Electrode for the Nipple's O-ring.

### FLOW ADJUSTOR

To replace the O-ring on the screw Flow Adjustor, unscrew the adjustor completely and remove it. The O-ring must now be cut off the Adjustor and a new one put on. The Adjustor can now be screwed back in completely using your hand to tighten.



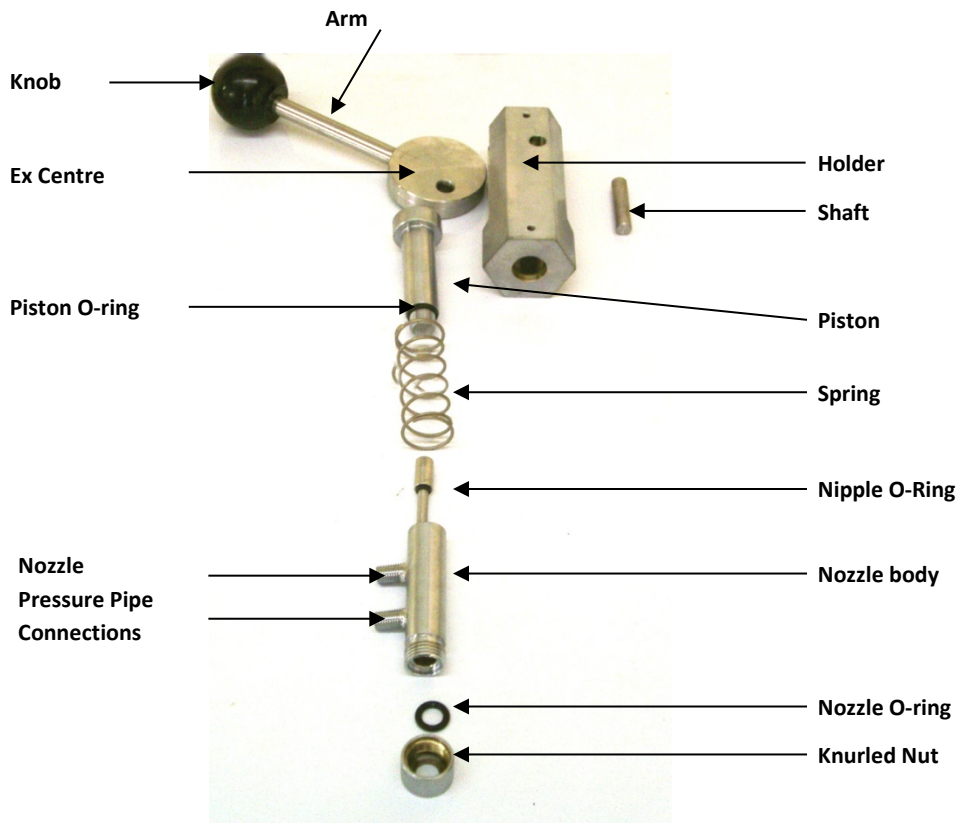
**WARNING: DO NOT over tighten as this can damage the plastic seal (Nipple).**

Now un-screw the Adjustor about 1/4 to 1/2 a turn outwards. The filling flow must now be adjusted by trial error as explained in the Operating Manual in the section about "Adjustments" for the Filling Station.

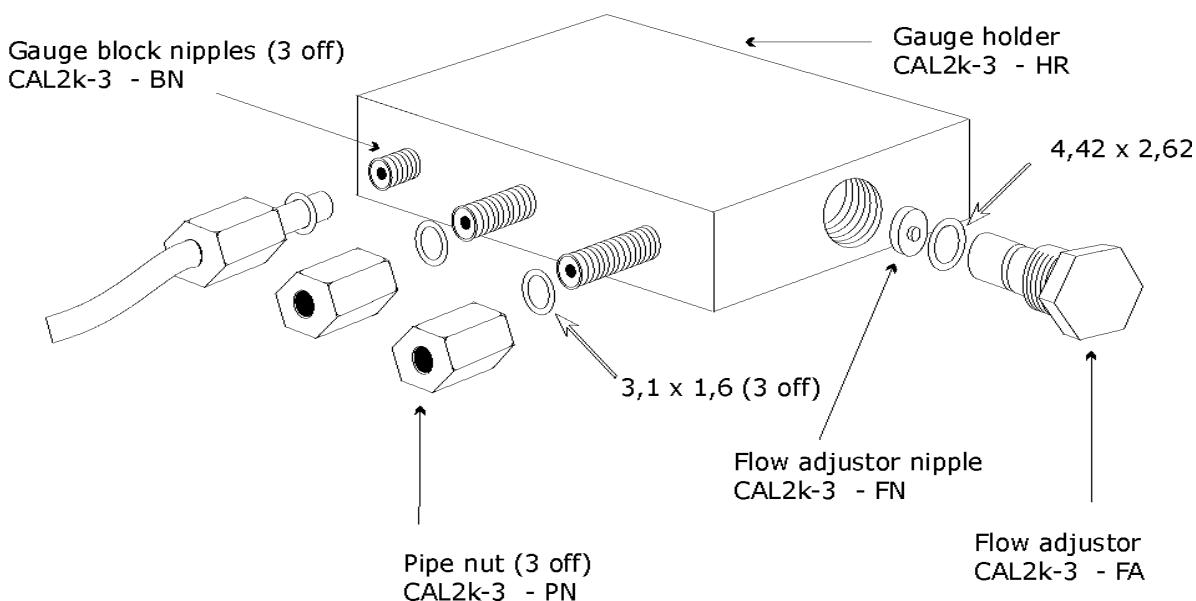
### FLOW ADJUSTOR NIPPLE

To replace the plastic seal (Nipple) inside the Flow Adjustor, proceed as in the Flow Adjustor procedure above BUT with exception. When the Adjustor is removed, apply high pressure oxygen to the oxygen pipe in order to "blow out" the nipple from the Flow Adjustor hole. Take the new Nipple and place a small amount of glue on it and place it onto the end of the Adjustor. The glue is required to hold the Nipple in place so that you can replace the Adjustor into its hole for tightening.

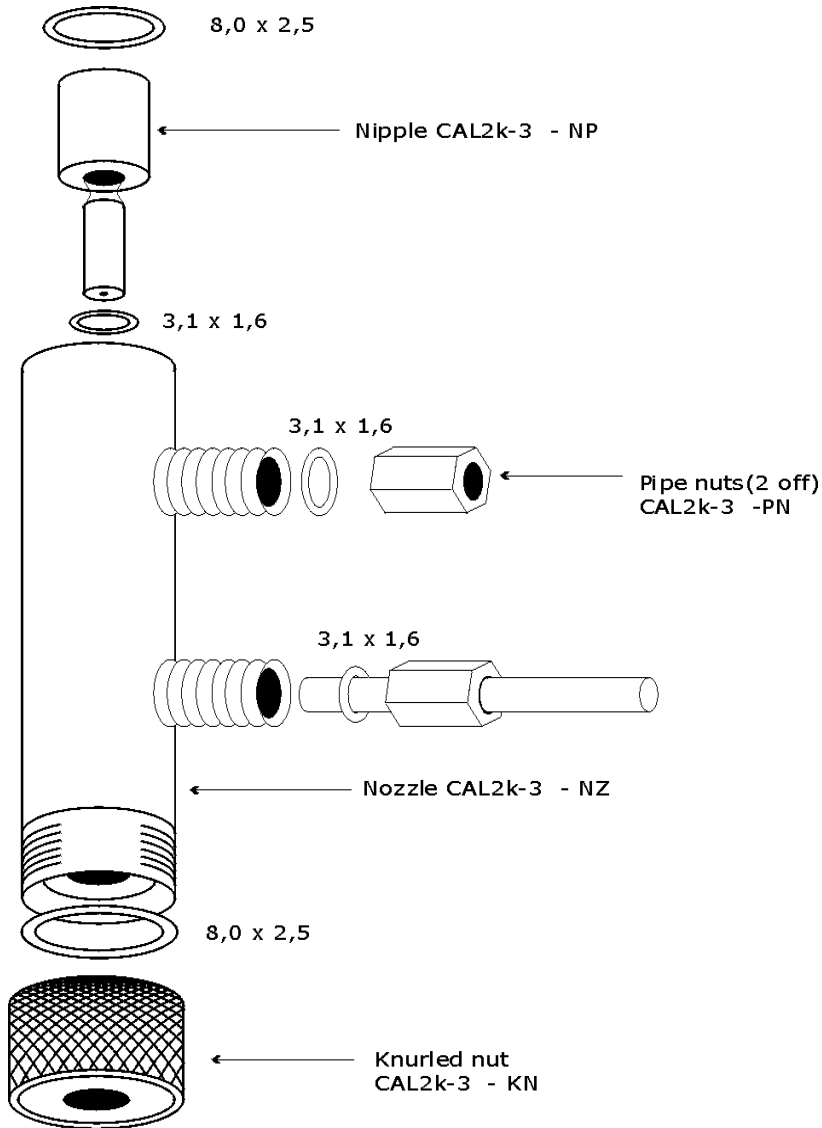




**FIGURE 1. : FILLING STATION - MAIN INTERNAL PARTS**



**FIGURE 2. : FILLING STATION - GAUGE BLOCK PARTS**



**FIGURE 3. : FILLING STATION - NOZZLE PARTS**



## VESSEL MAINTENANCE

- Measures up to 8 sensors in high resolution
- Calculates the average of all sensors
- Converts all readings to degrees Celsius
- Stores up to 10 calibration curves
- Retains a firing counter
- Retains manufacturing information
- Provides a serial interface to the CAL2K-1 Calorimeter

## VESSEL SAFETY

**The Vessel is a pressure Vessel and as such needs to be treated with care and respect.**



**NEVER fill or immerse the Vessel with water when cooling or cleaning.**

- The o-rings in the Lid Assembly must be replaced at regular intervals. In some cases it will be after as little as 5 firings, in other cases as much as after 50 firings. Your situation and sample type will dictate how often you will need to replace o-rings.
- The Vessel must be kept clean at all times.
- The Vessel will be pressure tested by a recognised inspection authority after every reconditioning at the **dds** Factory.
- Adherence to the above will prolong the life of the Vessel and extend the time interval between reconditionings.

## COUNTER

The built-in counter will prevent the Vessel from operating after 5000 firings but will give a warning after 4000 firings.

## RECONDITIONING


Every 6 months a service engineer must inspect the threads for excessive wear and tear. If the wear is excessive the Vessel must be returned to the **dds** Factory for reconditioning. Irrespective of time, the vessel must be returned to the factory for inspection and possible reconditioning after 5000 firings.

## VESSEL MAINTENANCE SCHEDULE

The Vessel design incorporates several O-rings and other consumable items and parts, which require checking, cleaning and/or replacing on a regular basis. Although the frequency of replacement of consumables is a function of usage, sample quality and Vessel cleaning techniques, the following Vessel maintenance schedule provides a useful guideline:



**NOTE: This is A GENERAL GUIDELINE and depending on the quality of the sample, the maintenance schedule may need to be followed more regularly. i.e. With a substance which ignites easily (highly flammable) the o-rings may only last 5-10 firings (sometimes less) and therefore it may be necessary to change the o-rings more often. Please do take note of this and use this maintenance schedule as a GUIDELINE only.**

ITEM/PART NUMBER	CLEANING/REPLACEMENT FREQUENCY	METHOD
<b>VESSEL BODY CAL2K-4-BD</b>	Clean every 10 to 50 firings.	Scrub with water and detergent. Use wire brush on threads.   <b>DO NOT immerse the Vessel in water. DO NOT wet the Vessel contact PCB when cleaning or cooling.</b>
<b>VESSEL CAP CAL2K-4-CP</b>	Clean every 10 to 50 firings.	Scrub with water and detergent. Use the supplied wire brush on threads.
<b>LID ASSEMBLY (ELECTRODE ASSEMBLY) CAL2K-4-CL</b>	Clean residue after each CV. Clean fully every 10 to 50 firings.	Dismantle and scrub all parts with water and detergent. Use wire brush to remove deposits. Dry and reassemble, change o-rings if necessary.
<b>TOP ELECTRODE O-RING CAL2K-4-CR</b>	Replace every 5 to 50 firings. Check after every 5 firings to confirm.	Remove deflector plate from lid. Unscrew centre electrode remove old o-ring and replace.
<b>BOTTOM ELECTRODE O-RING CAL2K-4-CR</b>	Replace every 5 to 50 firings. Check after every 5 firings to confirm.	Follow the steps as above and remove old o-ring and replace.
<b>LID O-RING CAL2K-4-LR</b>	Replace every 20 to 50 firings. Check after every 20 firings to confirm.	Remove deflector plate from lid. Remove old o-ring and replace with a new one. Ensure the new o-ring fits snug in the o-ring cavity.
<b>DEFLECTOR PLATE CAL2K-4-DP</b>	Replace when heavily corroded and cannot be cleaned.	Remove and replace.
<b>CENTRE ELECTRODE CAL2K-4-CE</b>	Replace whenever necessary.	Remove deflector plate. Unscrew valve screw. Change electrode and o-rings. Reassemble.
<b>OUTSIDE ELECTRODE CAL2K-4-OE</b>	Replace whenever necessary.	Remove deflector plate. Unscrew the electrode and change with a new one. Reassemble.

After every determination clean the inside of the Vessel with a paper towel to remove any residue or moisture. Clean the threads on both the Vessel body and Vessel Cap using the Wire Brush.

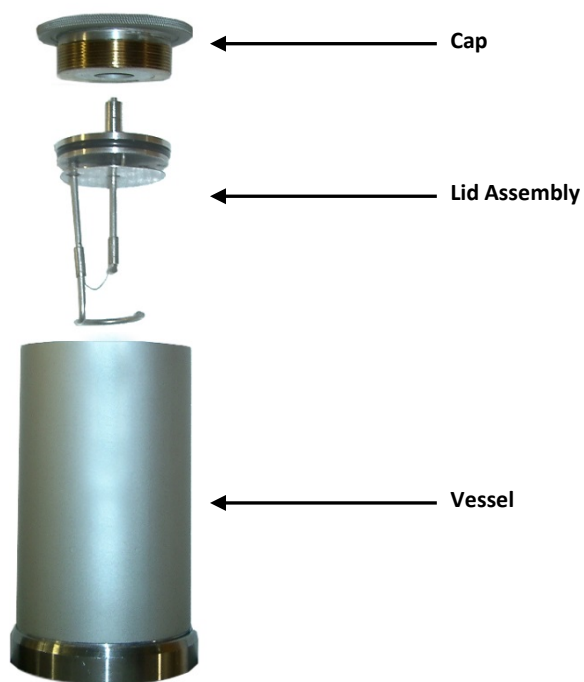


FIGURE 5. : VESSEL - MAIN COMPONENTS



FIGURE 4. : VESSEL – BASE VIEW

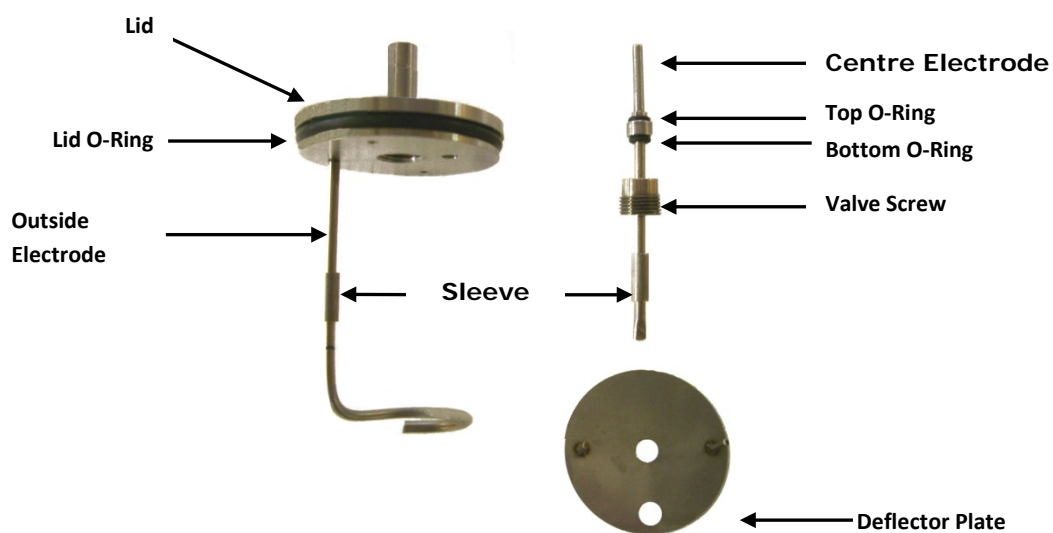


FIGURE 6. : VESSEL – LID ASSEMBLY PARTS



## CERTIFICATIONS



# C E R T I F I C A T E

No. TRQS 3043004-C

Licence Holder:

Digital Data Systems (Pty) Ltd)  
PO BOX 35872  
Northcliff  
2115  
South Africa

Manufacturer:

Digital Data Systems  
22 Arbeid Avenue  
Strydom Park  
Randburg  
South Africa

Product:

CAL2k-1 Calorimeter  
CAL2k-e2k Calorimeter  
CAL2k-ECO Calorimeter  
CAL2k-2 Cooler  
CAL2k-3 Filling Station  
CAL2k-4 Vessel  
-  
-  
-

Requirements:

73/23/EEC  
89/336/EEC  
97/23/EEC  
-  
-  
-  
-

We certify the compliance of the above product with the stated requirements in accordance with the rules and procedures of our Product Certification programme, and license the holder to affix thereto our Test Mark:



J B Peters Pr Eng

TÜV Rheinland Quality Services (Pty) Ltd  
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