CAL3K-AP Bomb Calorimeter

Superb Calorimeters for Today’s Analytical Needs.

A new bomb vessel with the option of the adiabatic or isothermal method. And Automatic oxygen filling on top of that. Now that’s innovative.

The CAL3K-AP uses a mixture of isothermal and adiabatic methods – while still using the dry method. It features a new air cooler and can achieve unsurpassed accuracy and repeatability. The max determination speed is up to 3 minutes. The CAL3K-AP makes use of the new bayonet vessel with new CAL3K technology.

The vessel is automatically filled with oxygen and the pressure is monitored. The oxygen filling pressure can be changed (programmed). The vessel pressure is recorded during firing and the pressure curve is optionally monitored and analysed. This gives insight to the burning process.

The CAL3K-AP Complete Systems includes : The CAL3K-AP Calorimeter, 2 bayonet bomb vessel and a CAL3K Air Cooler.

The new CAL3K-AP system presents a technology leap unsurpassed by our competitors. Although the project of designing and releasing the new bomb calorimeter system has taken much longer than we anticipated, it is definitely well worth the wait. Although the CAL3K is much smaller than its predecessor the CAL2K, it packs a massive punch when it comes to new and exciting features.

The CAL3K stands for the new technology, the “A” for the Automatic Oxygen Filling (which is an exciting new feature) and the “P” stands for Pressure.

Complete CAL3K System

The calorimeter requires a keyboard. The new lid design has two shocks which open the lid automatically. This is really a nifty new feature. The CAL3K-AP will be supplied as a complete systems which includes the calorimeter, the new air cooler and 2 bayonet vessels. The new self-locking bayonet vessels are also an exciting first for DDS.

The display has 4 lines. The first line shows what the CAL3K is doing at present, e.g. what mode the calorimeter is in.

LCD Screen

The second line shows the action the operator should take, e.g. “ENTER MASS, INSERT BOMB”, etc. The third line is reserved for keyboard command and data entry, e.g. Enter Benzoic Acid Value in MJ. The fourth line gives additional information resulting to faults and actions. If the subject help is activated then all 4 lines are used to display the help functions.

Calorimeter Well and Automatic Filling

This is the CAL3K with the lid open. The new gas shocks allow for automatic opening of the lid. The shocks open the lid to about a 45 degree angle, so that the well can ventilate after each determination.

THE ATC HEATER – ATC stands for the Ambient Temperature Control which insulates the bomb vessel from the outside environment.

BOMB WELL – The bomb well has a contact arrangement at the bottom to connect to the bomb electronics. The vessel temperature and calibration data are retrieved from this contact.

FILLING NOZZLE – The filling nozzle connects the bomb cavity to the high pressure oxygen and the deflating valve.

TOP CONTACT – Through this top contact the bomb is fired.

The electronics department is located in the blue side panel of the calorimeter. This electronics compartment is the “brain” of the calorimeter, as we like to call it. This is what makes everything work. There you will find the firing circuit and the ECU card, which can easily be removed, making maintenance quick and easy.

Operator Assistance

The CAL3K Calorimeter has some added features which will make the operators of the bomb calorimeter work a lot easier and user friendly. The CAL3K-AP now includes step-by-step procedure instructions. Screen prompts assist with step-by-step instructions to operate the calorimeter – almost like a built-in operating manual.

EVENT LOGGING – The CAL3K-AP has 63 event classifications and can store a maximum of 6800 events.

DEFAULT PARAMETER FIELDS – The CAL3K-AP has 10 default fields for different sets of factory parameters. All fields are for different operation and operating modes.

CONSUMABLE AND FIRING WIRE COUNT – This function will prompt the user as to how many firings the system has done and when the operator should replace the firing wire and o-rings.

FAULT AND FIELD TESTING CAPABILITY – The CAL3K-AP and Vessel each have a factory and a field test built in. The field test allows the operator to test the functionality without any instruments or special connections. The field testing results are also available on the Mobile Application.

CAL3K Features

Next generation calorimeters. New Innovative Features.

Exciting new features to enhance your analytical experience.

* NO WATER REQUIRED – No water bucket. No Spillage. No Measuring.
* THREE OPERATING MODES – Isothermal, Adiabatic and ISOBATIC.
* AUTOMATIC OXYGEN FILLING – Automatic oxygen filling and de-filling of the reaction vessel.
* VARIABLE FILLING PRESSURE – Allows for variable filling pressure
* 10 CALIBRATION OPENINGS – 10 Calibration openings for different applications
* HIGH SPEED DETERMINATIONS – Choose between faster or more accurate determinations
* EXTREMELY ACCURATE – Extremely Accurate (%RSD – 0.01%) determination eliminates multiple sample repeats.
* MULTIPLE COMMUNICATION CHANNELS – 2 wired and 1 wireless communication channels. 3 Simultaneous channels (RS232/USB/BLUETOOTH).
* USER FRIENDLY – User friendly operation.
* 2 OPTIONAL SYSTEM LANGUAGES – English and one alternative language.
* LOW POWER CONSUMPTION – Very low power consumption. No temperature controlling required.
* ECO FRIENDLY – Eco Friendly – small carbon footprint. No water, low power consumption.
* TEMPERATURE RANGE – Extensive temperature range from 0 degrees Celsius to 50 degrees Celsius.
* EVENT LOGGING – Built-in event logging for ~6000 events.
* FAULT FINDING – Extensive fault finding and testing.
* TEMPERATURE ACCURACY – Temperature accuracy of 20ppm (parts per million)(0.00002 degrees Celsius)
* RESULTS – Results in MJ/Kg, KJ/g, BTU/lb or Cal/g.
* COMPENSATION – Compensation for firing energy and sulphur.
* PRESET FIELDS – 10 default parameter fields for different applications
* OPERATING PARAMETERS – All operating parameters can be changed from the calorimeter
* RESTRICT ACCESS – Operating parameter access can be restricted
* LARGE STORAGE – Up to 1024 results storage
* INTELLIGENT VESSEL – Intelligent vessel with built-in temperature sensing
* LINEAR SENSORS – Linear temperature sensing with improved sensors.
* SAFETY – Continuous internal safety checks guarantee the safety of the operator
* STEP-BY-STEP HELP – Screen prompts assist with step-by-step instructions to operate the calorimeter
* BAYONET BOMB – Self-locking & self-sealing bayonet bomb vessel
* AIR COOLER – No water required to cool the bomb vessel
* BALANCE INTERFACE – Balance interface with baud speed setting
* IMPROVED INITIAL TIMING – Based on drift, stability, time, or any of the above.
* FULL LIMS SUPPORT – For the assignment, scheduling, and tracking of samples.
* MOBILE APP VIA BLUETOOTH – Mobile application compatible with Apple and Android devices (\*Optional – requires an additional Bluetooth dongle) \*Coming Soon
* FILTER DATA ON EVENTS – Extensive testing and detailed data viewing.
* CONSUMABLE COUNTING – Consumable firing wire and o-ring counting and warning.
* TEMPERATURE CONTROL – No temperature control required.
* PRESSURE SENSOR/LEAK DETECTION – Detects leaks through the o-rings and aborts the firing in the event of a leak.
* PORTS – The unit has three available ports. USB and 2x RS232 ports.

CAL3K-AP Technical Specifications

All the technical stuff. More information for the technically minded.

* LCD Display – Large display for easy viewing
* Easy to use – with 3 different operating modes
* Compact Size – Approximately 350mm x 280mm x 240mm
* Lightweight – Light weight for easy moving. Approximately 12kg.
* TUV CE Certification – Complies with ASTM, DIN and ISO International Standards
* Working (Operating) Temperature : 20°C-35°C
* Storage Temperature : 0°C-70°C
* Temperature Resolution : 0.0001°C
* Reproducibility/Repeatability : 0.01% RSD
* Resolution : 0.001 MJ/Kg
* Results per hour : 10 samples per hour using 2 bayonet bomb vessels
* Measuring range max : 99MJ, 99000J
* Working Temperature Min : 0°C
* Working Temperature Max : 50°C
* Temperature Measurement Resolution : 20ppm (parts per million)
* Cooling Medium : Air
* Type of cooling : Airflow
* Oxygen Operating Pressure Max : 40 bar
* Balance/Scale Interface : RS232
* Printer Interface : RS232
* PC Interface : USB
* Mobile App Interface : Bluetooth
* Interface External Keyboard : PS2
* Oxygen Filling : Automatic
* Degasification : Automatic
* Halogen (Decomposition) Vessel
* Analysis according to DIN 51900
* Analysis according to ASTM D240
* Analysis according to ASTM D4809
* Analysis according to ASTM D5865
* Analysis according to ASTM E711
* Analysis according to ISO 1928
* Dimensions : 350 x 280 x 240mm
* Weight : ~12.000kg
* Permissible Ambient Temperature : 0°C-35°C
* Permissible Relative Humidity : 80%
* RS232 Interface
* USB Interface
* Voltage : 220-240 / 100-120V
* Frequency : 50/60Hz
* Power Input : 12W

Bayonet Vessel

Next Generation Bayonet Bomb Vessel for the CAL3K.

The new bayonet vessel has a stainless steel body with a reduced mass and a pressed on aluminium sleeve which acts are a heat sink and temperature equalizer. This sleeve performs the task of the traditional water and stirrer.

The sensors are embedded in the vessel walls. The electronics are located in the bottom of the vessel and are vacuum encapsulated to prevent any liquid or dust from entering. The lid has three bayonet claws, and is topped with a low heat conducting plastic handle, which allows handling of warm vessel easier.

The bayonet lock is the first change you will notice in the CAL3K vessel. It is designed to leak if not engaged more than 50%. It is smaller and lighter compared to the CAL2K vessel, so it will use less oxygen and has a 10°C temperature rise for ½ gram of Benzoic Acid.

The other major change is its temperature sensors. There are only four sensors, but they are absolutely linear. This is a major advantage as the vessel can be fired at any temperature and remain perfectly calibrated. The other almost expected advantage is the improved temperature resolution. These new temperature sensors are stable at a working resolution of 0.000001°C or 1 part per million. To put this into some kind of perspective, that’s about 40 times better than the CAL2K vessel.

The next addition to the Bayonet Vessel is a new “brain”. It uses ultra-low power, which is in the region of three times less than the CAL2K vessel, which results in ultra-low heating. The new technology in the brain allowed us to harvest the temperature readings with such stability that it is possible to sense a human standing 1 meter away from the vessel. The electronics are just amazing.

So what does all this mean? Well we can now get possible results of 0.00005MJ certainty. Of course, this is not the accuracy you can expect on the final result, which is subject to moisture, sample preparation, sample consistency, weighing and operator procedure. Basically, the CAL3K can produce extremely accurate results, but is limited by your lab.

The next obvious change is the black lid. It is a special black plastic which will allow you to pick up the vessel when it is around 50°C. 50°C is just a little warm to handle, but the vessel can operate beyond this temperature. The linear sensors give the ability to have perfectly predictable linear calibration, so this means if your lab room temperature is at 20°C then you can fire the vessel three times with Benzoic Acid before it needs to be cooled. Each Benzoic Acid firing will increase the vessel temperature about 10°C.

Vessel testing happens every time it is inserted into the bomb well. The results are stored and reported back to the calorimeter. This is amazing. Each vessel has its own statistics, from o-ring count, firing wire change, misfires, maximum temperatures and the test results.

Another great benefit will be the machine assembled vessel control card (the “brain”). Improved quality and reliability. The vessel electronics are now tested three times in the factory – after assembly, then after 24 hours oven burn-in, and then finally after packaging. All the times are recorded in the vessel memory together with such information as : manufacturer, dealer/agent, customer, assigned serial number.

Bayonet Vessel Features

* REDUCED THERMAL MASS – Thermal mass reduced by 20% gives more resolution and is easier to handle.
* BAYONET LID – Bayonet lid for fast opening
* IMPROVED RESOLUTION – Greatly improved temperature resolution of 1ppm gives improved accuracy.
* REDUCED INTERFERENCE – Greatly reduced noise interference of <10ppm gives very stable results.
* IMPROVED SELF TESTING – Improved factory, field and self-testing
* IMPROVED ID SYSTEM – Improved vessel identification system of 8 fields.
* OPTIONAL HISTORY – Vessel operational history available.
* LINEAR TEMPERATURE SENSING – Very linear temperature sensing allows two determinations without cooling
* IMPROVED PARAMETERS – Improved setup parameters and temperature calibration
* CALIBRATION – 10 Calibration Fields
* TEMPERATURE RECORDING – Maximum Temperature Recording
* CONSUMABLE COUNTING – Consumable firing wire and o-ring counting and warning
* LIMIT SETTINGS – Inspection warning and limit settings
* INSPECTION RECORDS – Inspection records
* SAFETY FEATURE – Vessel will not fill with oxygen if bayonet lid is not properly sealed.