Chemical Reaction Hazards

Dust Explosion Hazards

Thermal Stability Hazards

Electrostatic Hazards

Regulatory

Gas & Vapour

Explosives Testing

Custom Equipment

Commissioning & Training Services

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* as at 1.12.13
Functional Specification and Deliverables -

• Carius oven - 110 - 240 V a.c / 1 kW oven
• Temperature controller and oven range 0 - 400 °C (ramp typical 0.5 °C)
• Temperature accuracy within + / - 1 °C
• Pressure range 0 - 100 barg. ¼” transducer connected via 1/16” oil filled pressure link
• Pressure accuracy within + / - 0.1 barg from 0 - 50 barg and within + / - 0.2 barg above 50 barg
• Data logging – slow log rate – every 30 sec, fast log rate – every 0.1 sec standard
• Carius system program and driver discs
• Miscellaneous cables
• Set of Carius glass tubes and miscellaneous fittings supplied as standard
• Traceable calibration (master equipment – UKAS calibrated)
• Tested with known calibration sample prior to delivery

Benefits

• Larger 10 g or 15 ml test sample size makes it easier to test a representative multiphase sample compared to other thermal stability measurement techniques
• The Carius Tube can be re-configured to enable sample addition during the duration of the test
• Enables permanent measurement of pressure and temperature to determine whether tube pressure is due to vapour pressure or permanent gas generation
• Useful preliminary screening technique prior to conducting large scale Adiabatic Dewar Calorimeter testing
Optional Extras -

- High speed 10 kHz data acquisition measurement option available in order to explore the pressure effects of more energetic materials
- Spare pressure transducers, temperature sensors and 10 g glass Carius tubes available
- Training
Benefits

- Completely adiabatic test environment with low Phi factor, high pressure reactor
- Highly accurate test results applicable directly to large scale reactors
- Permits characterisation of exothermic runaway reactions, thermal decomposition stability and evaluation of gas generation rates
- Data can specify plant protection measures e.g. emergency relief system design
- Direct venting simulation using optional tempering cell equipment
- Full range of process deviations & reactor component failure scenarios (e.g. heater / stirrer failure, effect of pumped additions with optional chemical injection pump)

- for determination of temperature and pressure data resulting from runaway chemical reactions and specifying plant protection measures, process failure scenarios, data for vent sizing using DIERS methods or advanced thermal stability analysis under low Phi factor and adiabatic conditions

Above: an Adiabatic Dewar Calorimeter (shown with electronic control unit and optional tempering cell for venting trials)

Above: the containment enclosure which Chilworth can also supply as an option
**Functional Specification and Deliverables -**

- 6 kW 3-phase 380 V - 415 V Dewar oven. 0 - 400 °C capability
- Pressure range 0 - 100 barg. Vent relief set to 23 barg
- Dewar flask set with two fully ported and populated stainless steel head assemblies (ports include potential for entry of sample thermocouple, sample pressure sensor, sample heater, stirrer motor, additional spare thermocouple)
- Electronic control unit (configured to suit various test scenarios in conjunction with the supplied software) – with built in oven temperature controller (oven temperature tracks the sample temperature reliably within 1 °C or better under steady rate of rise conditions and can follow exothermic activity of sample at rates of up to 40 - 60 °C /min). Also features sample pressure and heater power local monitors, emergency manual vent for the vessel and interfacing to all ancillary Dewar services e.g. system sensors and optional extras highlighted below
- Personal computer and LCD monitor with ADC software pre-installed
- Data acquisition card capable of monitoring and/or controlling: sample temperature, oven temperature, sample pressure, stirrer speed, stirrer torque, heater power (and also optional extras such as tempering cell pressure, tempering cell inlet and outlet solenoid operation, additional thermocouples, chemical injection pump, laboratory balance, Gas Burette. Typical log rates are: every 20 seconds for standard logging and every 0.1 second logging per channel based on the trigger point being exceeded on rate of pressure or temperature rise data
- Accuracy of pressure +/- 0.1 barg to 50 barg and +/- 0.2 barg above 50 barg
- Accuracy of temperature +/- 1 °C
- 1 x instruction manual

**Optional Extras -**

- Tempering cell
- K-type spare thermocouples and spare pressure transducers
- Additional Dewar vessels
- Additional custom configured Dewar head assemblies to meet your requirements
- Chemical injection pump for pumped addition capability
- Containment enclosure
- Gas Burette
- Spare seals and miscellaneous sundries are also available
- Training in the use of the ADC apparatus

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Benefits

- Permits laboratory quantification of gas evolution rates from chemical processes
- Simple to use
- May be connected to a Mettler RC1 set-up or to any other data acquisition system
- Volumetric measurement does not require composition of gas to be known
- Suitable for a wide range of hazardous gases with inert construction materials

Above: Gas Burette apparatus with U-tube mounting board (pictured right).

The principle of the apparatus is very simple. Gas generated by a process displaces the fluid in the U-Tube and causes a pressure increase (directly equivalent to the volume of gas evolved). The pressure increase (measured as the head of a column of liquid in the U-Tube) is recorded by a sensitive transducer mounted on the side of the U-Tube. Once the pressure reaches a pre-determined limit selected and calibrated by the operator, a solenoid valve opens and relieves the pressure by venting the gases. The pressure measured by the transducer, and the number of times the solenoid valve has activated, are recorded by link-up to a data acquisition system thus enabling the total gas evolved from the process to be calculated.
Functional Specification & Deliverables -

• Mains supply: 110 - 240 V a.c
• Accurate data up to approximately 5 cm$^3$.S$^{-1}$
• Analogue count output and analogue pressure output (1 V or 10 V full scale selectable)
• Supplied with electronic control unit, mounting back-board, Gas Burette U-Tube, solenoid outlet valve plus a spare outlet valve, pressure transducer, silicon oil, glass accessories, miscellaneous tubing and cables, 100 ml glass calibration syringe
• 1 x instruction manual

Optional Extras -

• Supply of a Gas Burette complete with hardware and software (including additional glassware) to enable Test A12 Flammability of Solids – contact with water testing to be performed
• Miscellaneous sundries
• Training

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Benefits

- Voltage and capacitance can be controlled in fine increments
- Arc gaps can be manually adjusted for researching alternative gaps being more conducive to ignition
- Delivers results to ASTM E2019 and IEC 61241-2-3 and EN standards
- Wide range of available accessories

Functional Specification & Deliverables -

- Mains Supply - 110 - 240 V a.c / 3 A
- Energy Range: 4 mJ – 2000 mJ
- 29 device capacitance bank (energy selection increments of 1 mJ)
- 0 - 15 kV adjustable high voltage power supply
- Arc gap breakdown voltage monitoring unit utilising JCI 140 internal proximity voltmeter
- Chart recorder breakdown strength monitoring software plus data card for use with PC data acquisition package which is supplied as standard (for use with a floating laptop – not supplied)
- Dust / air dispersion unit with set of acrylic Hartmann tubes with adjustable air regulator facility and rear external air inlet connection
- Niacinamide calibration sample (with known calibration data)
- 1 x instruction manual
Optional Extras -

• Glass or acrylic Hartmann tubes and electrode spares
• Training

The following is available at an additional cost -

• JCI 140 / JCI 148 Voltmeter – for self-checking calibration of high voltage output with the knowledge and confidence that the voltmeter has no detrimental loading effects on the output voltage (accuracy + / - 2%)
• Chart Recorder
• Laptop with data acquisition software pre-installed

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Benefits

- Simple to use
- New robust design
- New control unit displaying on-board temperature of both centre tube thermocouples as well as inlet pressure
- New \( \frac{1}{4} \)\(^{\prime}\) bsp inlet pressure transducer connection
- Complies with technical standards: (IEC 61241-2-1, EN 50281-2-1 & ASTM E1491-06)
- MIT data finds application in the specification of electrical equipment for use in the presence of combustible dusts and also has some application in the specification of safe drying temperature (above 110 °C) on process plant

MIT Cloud Apparatus
The MIT Cloud Apparatus provides an objective way to measure the susceptibility of a dust cloud to auto ignition in a heated environment (e.g. with plant processing temperatures above 110 °C). When most powders are dispersed in heated air, spontaneous combustion will take place provided the air temperature is high enough.

The Minimum Ignition Temperature (MIT) test measures the lowest temperature at which such ignition will take place.

**Functional Specification & Deliverables -**

- Mains supply: 100 - 120 V or 220 - 240 V operation
- 1 kW furnace heating from ambient to 1000 °C via temperature control unit
- Supplied with spare glass sealing gaskets and observation glasses, set of thermocouples, new integral control unit complete with furnace temperature controller and inlet pressure meter
- 1 x instruction manual

**Optional Extras -**

- Spare observation glasses, gaskets, thermocouples
- Training

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The 20 litre sphere test apparatus is used to determine the explosion severity (maximum pressure and speed of the explosion) of a dust cloud under specified test conditions.

**Benefits**

- Data applicable for explosion vent sizing, suppression & containment design
- Compact size compared to testing with 1 m³ sphere and uses less sample
- Allows accurate vent sizing calculations for full scale plant
- Easy to use
- Automated ignition and data acquisition system
- Optional accessories eg. seals, lifting gear to assist with head removal / refitting, Limiting Oxygen Concentration control unit together with modification service to take nitrogen feed-line and optional full commissioning and training package also available from Chilworth

The 20 litre sphere test apparatus is used to determine the explosion severity (maximum pressure and speed of the explosion) of a dust cloud under specified test conditions.

The dust is dispersed in the 20 litre explosion chamber by injecting it from a dust container pressurised with air at 20 bar. By pre-evacuating the explosion chamber, the ignition is initiated by very powerful chemical ignitors (2 x 5 kJ chemical ignitors), at atmospheric pressure. The delay time is the period between start of dispersion and ignition and is chosen to obtain results consistent with the standard 1 m³ vessel.
The pressure-time history is measured and, for each test, the maximum explosion pressure \( (P_m) \) and maximum rate of pressure rise \( \left(\frac{dP}{dt}\right)_m \) are established and recorded to a PC. The resulting data is normalised to a 1 m\(^3\) vessel. The test is conducted according to BS EN14034 parts 1, 2 & 3 & ASTM E1226.

**Functional Specification & Deliverables -**

- Mains supply: 110 - 240 V a.c operation
- 20 litre sphere for dust explosion testing
- Data control unit – interfaces with measurement piezoelectric sensors via charge amplifiers and sends pressure and control data to / from PC
- Ignitor initiation unit – sends ignite signal to chemical igniters and also filters the air and contains air inlet lines.
- Set of spare parts
- 1 x instruction manual

**Note:** customers outside the UK may, for transport logistics reasons, have to source their own igniters. Details available on request.

**Optional Extras -**

- Lifting gear
- Vacuum pump
- Ignitor storage safe
- Full commissioning and training package in safety operational aspects and use of 20 litre apparatus
- LOC control unit and 20 litre mods to accommodate this unit
- Capacitance spark unit (for researching low energy electrostatic sparking effects on ignition)

**The following is available at an additional cost -**

- PC with 20 litre software pre-loaded

For further information or a quotation, call us on +44 (0)23 8076 0722 email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
There is no better way than a live demonstration to raise awareness of dust explosion hazards. The Chilworth portable dust explosion demonstration kit gives the audience an insight into the hazards that even the smallest quantity of powder product can pose when dispersed in the form of a dust cloud through an electrostatic spark discharge ignition source. The kit is supplied with all accessories in a compact, ready to use, robust case.

Typically icing sugar or custard powder may be used for demonstration purposes. However, other products, for example metal powders and photo copier toner, may also be tested (optional glass tube recommended for ease of cleaning in those cases).

### Benefits

- Impressive visual and audio demonstration of the hazards presented by dust clouds when subjected to an ignition source
- Allows employers / teachers to simply demonstrate to employees, students and co-workers the dangers that even the smallest quantities of some powders can pose when exposed to, or in the vicinity of, an ignition source
- Compact - all accessories pack neatly away in the same case
- Portable, robust case design facilitates easy transportation
### Functional Specification & Deliverables -

- Powder dispersion unit with acrylic Hartmann tube
- 8.5 kV / 0.25 mA constant arc internal ignition source
- Hand-held control handset for arc activation and air dispersion
- Double action hand pump for pre-charging the internal air reservoir
- Rupture paper disc set
- Air line
- Electrodes
- Built in air regulator – typical default setting 4 barg
- Lightweight at just 10 kg and packed into robust case
- 1 x instruction manual

### Optional Extras -

- Glass tube to compliment, as supplied, the standard acrylic tube
- Polycarbonate protective screen
- Spare electrodes
- Spare rupture discs
For the Group A/B Classification of a dust cloud of powder product, this method requires a constant arc to be produced through the test sample. An ignition is an observation of flame propagation away from the ignition source. If at any time during the procedure an ignition is observed then the test is complete and the dust is classed as Group A Flammable.

Note that a Group B classification does not imply that the dust cannot be involved in a fire or show exothermic behaviour (self-heating). Other tests must be performed to establish this.
Functional Specification & Deliverables -

• Mains supply: 110 - 240 V a.c / 3 A
• Dust / air dispersion base complete with steel mushroom for dust cloud optimisation - typically 7 barg service air required
• 1 litre acrylic Hartmann tube (can be cleaned with warm soapy water and dried)
• Tube rupture papers (for top tube closure)
• Brass electrodes for creating arc
• Constant arc power source (10 kV)
• Remote handset (arc and air activation)
• 1 x instruction manual

Optional Extras -

• 1 litre glass hot coil tube and power source for screening of products that are to be processed on full scale plant above 110 °C (comes complete with power source, hot coil holder and wire)

Note: if a result is positive then full testing can be carried out in the MIT Cloud Apparatus CTL05 (see page 13.)

• Spare electrodes
• Spare rupture discs

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The Hartmann Pressure Tube apparatus is an explosion screening system for testing small quantities of powder product (e.g. pharmaceutical powder) and enables comparison of maximum peak pressure and maximum rate of pressure rise of powder products, under development, to be researched. Its purpose is NOT to provide highly accurate Pmax and Kst data for plant scale application, such data only being obtainable through use of a 20 litre sphere apparatus (see CTL06, page 15).

However, for comparison of samples developed in house that would initially be too expensive to produce in the quantities needed for testing within a 20 litre apparatus, this equipment is ideal. The data recorded with the Hartmann Pressure Tube apparatus must NOT be used for explosion protection measures on plant. If accurate data is needed, use a 20 litre apparatus as explained above.

**Benefits**

- Ideal for screening small quantities of powder product (e.g. 0.5 g etc)
- Perfectly honed smooth inner vessel bore lends itself to ease of cleaning following testing
- Easy removable lid for fast access
- High resolution multi-turn inlet regulator for accurate reservoir pressure setting
- Handset activation of arc and air dispersal. Arc initiation starts high speed data acquisition to PC so no pressure rate data is missed by logging at rates of 1 msec
Functional Specification & Deliverables -

- Mains supply: Volts 110 - 240 V a.c / 3 A
- Dust / air dispersion base with mushroom design to optimise internal dust cloud
- 1.2 litre stainless steel Hartmann tube
- Top removable screw cap with built-in dynamic pressure transducer and vent valve
- Viewing window (for visual observation of arc gap and flame propagation)
- Brass electrodes
- Constant arc power source (10 kV)
- Remote handset (arc & air activation)
- PC / LCD monitor with control and acquisition software included
- Electronic control unit containing high speed data acquisition card and pressure transducer charge amplifiers
- O’ring set
- High speed pressure transducer
- 1 x instruction manual

Optional Extras -

- Spare electrodes, spare viewing window, spare seals, ancillaries

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Benefits

- Excellent screening-tool for examining self-heating effects within dryers, silos and bags
- Simple to use glass test vessel enabling easy test configuration modification between either an aerated test or a diffusion test scenario
- Internal pre-heating pipework configuration
- Repeatable thermocouple location method
- Multi-channel data acquisition system supplied ready configured

Figure 1: Aerated cell with pre-heated air (top entry)  Figure 2: Powder Aerated Cell setup
The purpose of the aerated cell test is to simulate the conditions in dryers in which a hot air stream passes through the material, whilst the diffusion cell test simulates conditions in silos or bags and at the bottom of dryers where material can collect in bulk. The only difference between the two tests is with the diffusion cell test, the lid is removed from the glass test cell and there is no hot air stream passing through the material. Instead, heating occurs uniformly inside the oven so that the powder sample can be ramped-up to its target temperature gradually (typically 0.5 °C.min⁻¹) thus enabling examination of the test sample for self-heating effects within the bulk of the product held within the test cell.

If the heat developed by a reaction of substance with oxygen or by exothermic decomposition not lost rapidly enough to the surroundings, self-heating leading to self-ignition can occur. Self-ignition therefore occurs when the rate of heat production exceeds the rate of heat loss. The test procedure is useful as a preliminary screening test for powders being processed on plant.

**Functional Specification & Deliverables -**

- Mains supply: Volts 220 V - 240 V a.c / 7 A or 120 V a.c / 13 A
- 30 litre fan assisted oven (400 °C capability)
- Air flow meter fitted (adjusts flow through the pre-heating coil).
  Typical air flow is set to 0.6 l.min⁻¹
- Temperature controller (ramps oven at 0.5 °C.min⁻¹)
- Glass test vessel set each comprising cylinder closed at the base and top with sintered glass and a close fitting lid for aeration cell tests
- Thermocouples for monitoring oven temperature at several places within the powder layer within the vessel (see figure 2)
- Data acquisition software (pre-installation on optional PC recommended) for conducting either the aerated cell test (with lid) or the diffusion cell test (no lid)
- Thermocouple extension cables
- Glass vessel support stand with pre-drilled thermocouple securing holes for repeatable alignment of thermocouples
- 1 x instruction manual

The following is available at an additional cost -

- PC & LCD monitor (recommended)
- Spare glassware
- Thermocouples
- Training

For further information or a quotation, call us on +44 (0)23 8076 0722
email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
The Chilworth Basket Test Apparatus system comprises all the necessary components to permit testing in accordance with the method described by the UN Transport of Dangerous Goods - Manual of Tests and Criteria and also by P.C Bowes in the paper “Self Heating: Evaluating & Controlling the Hazards”, Buildings Research Establishment, UK, 1984, ISBN 011671364X.

Dusts and powders stored at elevated temperatures can undergo a chemical reaction leading to self-heating and possibly ignition within the bulk material. Several factors are to be considered when determining safe storage temperatures. The volume and surface area of the storage vessel, the proposed storage temperature and the storage duration should all be taken into account.

The basket test technique provides a useful modelling tool for understanding these parameters of product behaviour. The levels at which (a) ignition occurs and (b) no signs of ignition are evident are determined for baskets of typically three different volumes. From graphical analysis of this data it is possible to determine the self-heating onset temperature for any volume of material.
Functional Specification & Deliverables -

- Oven: 0 - 400 °C fan assisted with PID temperature controller
- Mains supply: 220 - 240 V single phase / 7 A or 120 V single phase / 13 A
- Thermocouples: K type, 1 metre long. Oven and sample
- Reaction vessels: 1 set stainless steel mesh basket cubes 50 mm / 75 mm / 100 mm (more can be supplied as spares) – 0.053 mm opening
- Sample support: Outer spot welded basket which permits air flow circulation to / around inner basket cubes
- Miscellaneous items: 1 x instruction manual and catchment tray
- Data acquisition card and software: Basket test apparatus data acquisition software which can be pre-installed on the recommended optional PC / monitor

Optional Extras -

- K-type thermocouples
- Baskets
- Special configuration systems such as basket test apparatus with Nitrogen blanketing
- PC with software pre-installed

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email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
The Layer ignition temperature test apparatus permits the determination of minimum ignition temperature of a given thickness of powder deposited on a hot surface. The method is used for the specification of the ‘T’ temperature rating of electrical equipment for use in hazardous areas (dusty atmospheres). It is also relevant to other industrial equipment where dust is present on hot surfaces in thin layers exposed to the atmosphere and is manufactured in accordance with IEC 61241-2 & EN 50281-2-1.

**Benefits**

- Designed for testing to IEC 61241-2, EN 50281-2-1 & ASTM E2021 for specifying the maximum surface temperature of electrical and non-electrical equipment
- Tests can be performed on a range of samples including 5, 12.5 or 15 mm depths
- Data can be recorded permanently
- Compact in size
- Novel sloping edge shield design located under the hotplate surface to permit expanding samples to run down into a drip tray located under the hot-plate unit

The Layer ignition temperature test apparatus permits the determination of minimum ignition temperature of a given thickness of powder deposited on a hot surface. The method is used for the specification of the ‘T’ temperature rating of electrical equipment for use in hazardous areas (dusty atmospheres). It is also relevant to other industrial equipment where dust is present on hot surfaces in thin layers exposed to the atmosphere and is manufactured in accordance with IEC 61241-2 & EN 50281-2-1.
CTL15 – Layer Ignition Temperature Apparatus

Functional Specification & Deliverables -

- Layer Ignition Hotplate (1250 W / 6 A, 220 - 240 V (100 - 120 V via transformer option)) single-phase. Temperature range = 0 - 400 °C
- Remote controller unit (incorporates PID temperature control). Sample may be ramped in temperature or held isothermally.
- K-type thermocouple and extension cable for both hotplate and sample
- 5 mm, 12.5 mm, 15 mm sample retaining rings supplied (100 mm diameter)
- Data acquisition hardware and software
- Acrylic sealing compound
- 1 x instruction manual

Optional Extras -

- 200 µm sieve and catchment tray with lid
- Spare sample retaining rings (rings of any height may be fabricated for you)
- Spare thermocouples
- PC and LCD monitor with LIT test software pre-installed
- Calibration services
- Training services in Layer Ignition Temperature testing

For further information or a quotation, call us on +44 (0)23 8076 0722
email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
This equipment is manufactured in accordance with the “Classification, Packaging and Labelling in the EU – testing methods” publication, test A10 (Flammability of Solids) and also with EU test A17 (oxidising solids) and UN Transport of Dangerous Goods Division 4.1 (burning rate) tests. The test serves to characterise the hazards (if any) arising from materials subjected to given stimuli. The Fire Train Test, for readily combustible solids, checks the ability of a substance to propagate combustion by igniting it and determining the burning time across a given length of that material.

As well as acting as a regulatory test, the Fire Train Test result has uses in process safety in the assessment of fire risk with powders and in helping to predict the consequences of dust fires and explosions. If testing to test A17 then please purchase optional powder cone (see options).
Functional Specification & Deliverables -

- Fire Train forming mould with anodised aluminium 90° Vee groove former, support cradle, base plate and brass holding clamps
- Test Plate: impervious, non-combustible and low thermal conductivity quartz test plate
- An ignition source is required but is not supplied due to the documentation and certification required to ship a gas cylinder overseas. A small portable hand held butane or propane cylinder with a nozzle diameter of greater than 5mm is all that is required
- Metric rule for measuring Fire Train distances
  High grade non-rusting steel rule marked in millimetres complete with UKAS calibration certificate
- Laboratory stopwatch for timing combustion and linear burning intervals
- 1 x instruction manual

All the above is packed into a hard case

Optional Extras -

- Additional fire train moulds, quartz test plates, sundries
- A small conical sample chamber for forming a powder pile (3.5 cm dia x 2.5 cm height) is available at additional cost to enable preliminary oxidiser screening of samples (Test A17 only)

Note: Preliminary screening of samples is a requirement of test A17 and is performed in the interest of safety to establish whether the solid sample has oxidising properties. If it does then no further testing is required. However, if it does not have oxidising properties then the full fire train test is then carried out.
This apparatus is designed to test for the potential of a solid substance to increase the burning rate, or burning intensity, of a combustible substance when the two are thoroughly mixed. The test is to the UN Transport of Dangerous Goods Manual of Tests and Criteria (Test 0.1) and is used to establish whether a product is an oxidizer of division 5.1 or not and, if so, whether it falls into packing group I, II or III.
CTL17 – Oxidising Solids Test Apparatus

Functional Specification & Deliverables -

- Mains supply: 220 - 240 V mains inlet / 12 V d.c output 150 W hot coil power source
- 1 x glass conical sample loading chamber (glass blown with 60° angle for optimal powder cone as per test standard requirements)
- 1 x insulated quartz plate
- 1 x roll 100 m NiCr wire (0.5 mm diameter)
- 1 x stop watch
- 1 x instruction manual

Optional Extras -

- Spare nickel chromium wire
- Quartz plates
- Glass sample loading chambers

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email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
The Auto Ignition Temperature Test is performed to enable determination of hot and cool flame auto ignition temperatures of a liquid chemical (and solid chemicals*) in air at atmospheric pressure in a uniformly heated vessel.

Auto Ignition is defined as the ignition of a material commonly in air as the result of heat liberation due to an exothermic oxidation reaction in the absence of an external ignition source such as a spark or flame.

The following standards (each with slight differences) are applicable to the test:

<table>
<thead>
<tr>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Testing to ASTM / IEC / DIN standards is possible. Relevant oven supplied (see different designs below)</td>
</tr>
<tr>
<td>• Compact oven size</td>
</tr>
<tr>
<td>• Used in our own process safety test laboratories</td>
</tr>
<tr>
<td>• Simple to use</td>
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</tbody>
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* Within certain limitations, the test can also be used to determine the auto ignition of solid chemicals which readily melt and vaporise at temperatures below the test temperature.
CTL19 – Auto Ignition Test Apparatus

Functional Specification & Deliverables -

The ASTM Method spec is covered here. For DIN standard apparatus deliverables please contact us.

- Mains supply: 220 - 240 V 50 Hz single phase furnace (other voltages are available)
- 150 - 650 °C (standard operating range)
- Capable of controlling the flask temperature within + / -1 °C up to 350 °C and + / - 2 °C from 350 °C to 650 °C
- Temperature uniformity is better than + / - 4 °C measured on the outside of an aluminium clad flask at three positions
- 10 x round bottom borosilicate flasks
- Data acquisition hardware and AIT software supplied
- Supplied with vapour temperature thermocouple, spare thermocouple and sample injection syringe set
- Pre-calibrated
- 1 x instruction manual

Optional Extras -

- PC and LCD monitor (recommended). Client to specify required operating system requirements if any
- Spare vessels for ASTM (round bottom) or DIN (conical)
- Spare syringes
- Spare thermocouples
- Spare oven insulation
- Training services

For further information or a quotation, call us on +44 (0)23 8076 0722 email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
The flammable range apparatus test method determines the lower and upper concentration limits of flammability of chemicals having sufficient vapour pressure to form flammable mixtures in air at one atmosphere pressure at test temperature. This method may be used to determine these limits in the presence of inert dilution gas. The apparatus is manufactured in accordance with ASTM E681- standard test method for Concentration Limits of Flammability of Chemicals.
Functional Specification & Deliverables -

- Flammable range fan assisted oven 220 - 240 V a.c typically 1.5 kW / 7 A (110 - 120 V a.c versions are possible)
- Temperature rating 0 - 300 °C (test operating temperature limited to 150 °C due to the PTFE head assembly)
- Safety glass window in door
- Magnetic stirrer drive
- New integral oven controller including pressure reader, temperature reader and oven controller. Also includes stirrer controller and arc controller ignition source and activation handset
- 1 ml, 3 ml, 5 ml and 10 ml disposable syringe sets supplied to get you started
- 500 µl syringe with needle
- 5 litre glass test vessel
- 1 x vacuum pump + 6 mm inlet line and exhaust hose
- Vacuum pump inlet filters, plastic-coated magnetic stirring bars
- 1 x remote handset for constant arc activation
- 2 x 5 litre covers / head assemblies with ports for sample injection, electrodes, thermocouple, vacuum/ exhaust line(s) with needle valve isolation and transducer connection (complete with cover clamps)
- 1 x pressure transducer -1 to 1 barg
- 1 set x 5 litre head rubber seal gaskets
- 1 set x septums for injection line connection
- 1 x length of tungsten constant arc electrode wire
- 1 x T-piece fitting
- 1 x 5 litre vessel support stand
- 1 x 5 litre vessel stirrer extension rod
- 2 x mains supply leads
- Comprehensive English instruction manual complete with pressure and temperature calibration and monitor manuals

Optional Extras -

Note: if the sample quantity available is unlimited, then a 12 litre system can be ordered rather than the standard 5 litre system. A 12 litre system also permits the user to test lower and upper flammable limits of refrigerant samples. Where the sample quantity availability is limited, then a standard 5 litre system is normally preferable to the customer.

The following is available at an additional cost -

- Spare transducers – pressure and thermocouples
- Spare tungsten wire, valves / tubing and vessels
- Spare 5 litre or 12 litre covers / head assemblies with ports for sample injection electrodes, thermocouple, vacuum / exhaust line(s) with needle valve isolation and pressure transducer connection (complete with cover clamps)
- 1 x 12 litre vessel support stand
- 1 set x 12 litre head rubber seal gaskets
- 1 x 12 litre vessel stirrer extension rod
- Training
Some powders are deliberately manufactured with such highly energetic behaviour, but occasionally it is an unexpected property of a new material. For regulatory compliance there are a number of screening tests which have to be performed on new materials in order that they can be safely transported. One such screening is a BAM Fallhammer test, which measures sensitivity to mechanical force, testing to UN, EU & EMTAP Regulations.

**Benefits**

- Excellent for screening products for sensitivity to impact stimuli in order to determine whether a substance is an impact sensitive explosive
- Excellent screening tool for classifying a product for transport and EU packaging and labelling classification
- Simple to use electromagnetic drop weight release mechanism
- Robust design
Functional Specification & Deliverables -

- A solid cast steel base block
- Main 100 mm diameter anvil
- A centring ring for locating the intermediate anvil on the main anvil
- 2 x Intermediate 26 mm diameter anvils
- 2 x locating rings with orifices for gas release
- 200 steel cylinders (roller bearings)
- 50 rubber ‘o’rings for steel cylinders (liquid testing only)
- 100 steel collars for steel cylinders locating
- An upper to lower cylinder distance gauge for 1 - 2 mm sample gap required for liquids
- A central column with guides (graduated scale) ready set for correct height
- A 1 kg drop weight carrier assembly
- A 1 kg weight already fitted to 1 kg drop weight assembly for a 2 kg overall
- A 5 kg drop weight carrier assembly
- A 5 kg weight already fitted to 5 kg drop weight assembly for 10 kg overall weight
- A drop weight electromagnetic release device
- An electromagnetic power supply distribution box together with electromagnet 12 V supply cable, 100 - 120 V, 220 - 240 V mains inlet supply cable and remote handset for weight release
- Electromagnet safety pin
- A 40 mm³ sample loading spatula
- A polycarbonate protective shield
- 1 x instruction manual

Optional Extras -

- Zone 22 certified control equipment for electromagnet drop mechanism
- Dust extraction facility
- Additional sets of BAM Fallhammer collars and rollers (quality / tolerance checked)
- Bespoke custom weights or other requirements may be possible (please enquire)
- Training

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email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
Some powders are deliberately manufactured with highly energetic behaviour, but occasionally it is an unexpected property of a new material. For regulatory compliance there are a number of screening tests which have to be performed on new materials so they can safely be transported. One such screening is the BAM Friction test, which measures sensitivity to sliding (rubbing) contact and to determine if the substance is too dangerous to transport in the form tested, or to classify in terms of its explosivity and labelling etc.

Functional Specification & Deliverables -

The apparatus and accessories supplied are as follows:

• 1 x Friction Tester assembly complete with base plate, cam assembly with sliding carriage, motor drive (220 / 240 V / 50 Hz or 100 / 120 V / 60 Hz), peg locating device, counterbalance arm and operating switch box
• 1 x loading arm with 9 notches for weight location
• 1 set (400 pce) porcelain pegs
• 1 set (100 pce) porcelain plates
• 1 x 0.28 kg load weight (Weight 1)
• 1 x 0.56 kg load weight (Weight 2)
• 1 x 1.40 kg load weight (Weight 3)
• 1 x 2.79 kg load weight (Weight 4)
• 1 x 5.58 kg load weight (Weight 5)
• 1 x 8.34 kg load weight (Weight 6)
• The weights above allow coverage of the desired 5 - 360 N load range
• 1 x counterbalance weight
• 1 x instruction manual
• 1 set calibration graphs for load weight locations
• All apparatus supplied by Chilworth is provided with a warranty (excluding consumables)

Optional Extras -

• Other load weights available at extra cost
• Additional sets of porcelain pegs and plates
The identification of potentially explosive or high rate decomposing properties in a material is a pre-requisite for safe handling. Any material which contains groups of known explosive properties (e.g. nitro-, peroxy, azide etc.) should be tested and examined to identify the reaction of the material to various forms of explosion initiation, namely: impact, friction and thermal initiation, the latter is shown above.

**Benefits**

- Excellent for screening products for sensitivity to heating under confinement to determine whether a substance may have explosive properties
- Excellent screening tool for classifying a product for transport and EU Packaging & Labelling Classification
- Remote burner ignition system
- Robust design
- Supplied complete with 100 Koenen shells

**Koenen Test Apparatus**
The Koenen tube test apparatus is used to determine the effect of heating under confinement on potentially explosive materials. The material under test (liquid, solid or paste) is placed within a steel tube fitted with a standard diameter orifice at one end. The tube is exposed to direct flame heating. The condition of the tube after the test provides an indication of the sensitivity of the material to heating under confinement. The apparatus is manufactured in accordance with the United Nations Transport of Dangerous Goods, Manual of Tests & Criteria and for EC regulatory classification (A.14).

**Functional Specification & Deliverables -**

The apparatus and accessories supplied are as follows:

- Support frame with 4 burners and solenoid valve (Propane Gas inlet)
- Complete set of Orifice plates comprising of the following sizes: 1, 1.5, 2, 2.5, 3, 3.5, 4, 5, 6, 8, 10, 12, 14, 16, 18 & 20 mm
- Collar assembly including 2 sizes
- 100 disposable Koenen tube shells
- Length of gas inlet hose
- Remote handset for gas inlet valve and ignitor activation
- 4 x electrical ignitor fitted and 8 x spares
- Koenen tube support rod spares x 2
- Spare Teclu burner set (4 total)
- 1 x 1 mm diameter k-type thermocouple + thermocouple extension cable
- Data acquisition card / program for monitoring heat-up during initial burner set-up
- Stopwatch

**Optional Extras -**

- Spare thermocouple, burners, igniters, orifice plates and collars, Koenen tubes
- A tamping device, to assist with packing down the material inside the Koenen tube with a known 80 Newton force (ref: UN Manual) is also available
The Time / Pressure apparatus is designed to examine the effect of an ignition on substances under confinement and in particular, the possibility that ignition might lead to a deflagration with explosive violence at pressures which can be attained with substances in normal commercial packages. The testing is conducted according to the UN Transport of Dangerous Goods Recommendations Manual of Tests and Criteria Test 1 (c) (i), Test 2 (c) (i) or Test C.1 and also to the EMTAP Manual of Tests Volume 1.

**Benefits**

- Simple to use
- Automated ignition / monitoring set-up
- Test software / hardware: graphical display showing time vs pressure trace
- Display of pressure rate of rise result between 100 & 300 psi
- Ascii file logging of data which can be imported to Excel (not supplied) for later data analysis
- Historical data program – permits the user to call up any previously saved ascii file and to view the time pressure trace of those tests

**Time / Pressure Test Apparatus**

The Time / Pressure apparatus is designed to examine the effect of an ignition on substances under confinement and in particular, the possibility that ignition might lead to a deflagration with explosive violence at pressures which can be attained with substances in normal commercial packages. The testing is conducted according to the UN Transport of Dangerous Goods Recommendations Manual of Tests and Criteria Test 1 (c) (i), Test 2 (c) (i) or Test C.1 and also to the EMTAP Manual of Tests Volume 1.
Functional Specification & Deliverables -

- PC – current up-to-date specification (it is recommended and supplied as standard)
- LCD monitor
- Time Pressure Control Unit with push button initiation of logging of data and ignition system
- Time Pressure – pressure monitor and ignition power supply unit 220 - 240 V a.c / 110 -120 V a.c
- Time Pressure Vessel and Stand
- Pressure Transducer (0-25 barg / 0-362.5 psig)
- Ignitor output cable
- Data communication cable
- Spanner for vessel end cap maintenance
- 1 x set aluminium burst discs (100 pcs)
- 1 x set lead washers (200 pcs)
- Time pressure documentation
- Time pressure software program

Optional Extras -

- Spare burst discs
- Spare lead washers
- Spare pressure transducer
- A combination unit is also available for carrying-out 057 Oxidising liquids as well as 025 Time Pressure Tests (057-025 model)

**Note:** Due to transport restrictions, primed cambric or fuse heads are not supplied as standard. These are used in conjunction with each other to form the ignition source for time pressure testing.
Suitable for testing flooring resistance and personnel glove and footwear resistance, the Chilworth Technology Floor, Glove & Footwear Test Kit enables testing to BS5958 guidelines, CENELEC CLC/TR 50404 and IEC 61340-4-5.

Flooring material and associated coatings can contribute to a build-up of electrostatic charge as a result of the motion of people, trolleys, pallet and packaging lifting devices and general furniture; for example workbenches, chairs etc. Abrupt discharge of the static charges can cause discomfort to personnel and, in extreme cases, ignition of process products if the ignition energy of the electrostatic spark discharge is above the minimum ignition energy of the product. It is possible, in such cases for products, when present in the atmosphere in the form of a dust layer or dust cloud, to ignite.

Other areas where electrostatic build-up is of concern is electronic equipment where it is possible for malfunctions to arise due to electrostatic spark discharge. It is clear that not only is flooring resistance important, but also the resistance of personnel - particularly with respect to gloves and footwear as well as garments being worn.
Functional Specification & Deliverables -

- Resistance meter – Maximum range > 200 GΩ (UKAS Calibration Certificate supplied)
- Brass hand electrode with pre-fitted 10 KΩ safety resistor installed 25 mm diameter x 160 mm
- 2 x stainless floor electrodes with conductive rubber pads each 63.5 mm dia x 105 mm = 2.5 Kg
- PTFE backing sheet: 300 mm x 470 mm x 3 mm
- Aluminium floor plate: 300 mm x 470 mm x 2.5 mm
- 1 GΩ calibration check resistor
- 5 metre earth lead
- Miscellaneous other leads (for resistance meter)
- Instruction manual

Optional Extras -

- JCI 140 portable static proximity voltmeter (0 - 20 kV Accuracy + / - 2 % no drift)
- Humidity meter (with temperature read-out) – typically within RH + / - 5 % and temp + / - 0.5 °C
- Additional sets of leads
- Other resistor values for instrument checking available
- Calibration services
- Custom floor electrodes to other standards not listed here
- Additional cut outs may be incorporated into case supplied (where possible) to cater for additional accessories

The following is available at an additional cost -

- JCI 140 portable static proximity voltmeter (0 - 20 kV Accuracy + / - 2 % no drift)
Benefits

- Simple to use
- Simple assembly / disassembly of test cell. This is especially important since cleaning of the test cell regularly between test samples is essential when performing liquid conductivity tests
- Close interference fit machined surfaces for excellent sealing when testing liquids

- for accurate measurement of the conductivity / resistivity of liquids, clothing and other applications
The liquid conductivity test apparatus is used to assess a liquid’s conductive properties by measuring the current flowing through the material when a known 10 V is applied across it with reference to ground. A heptane reference sample is used to check the equipment prior to conducting a test on liquid sample with no known conductivity data. The equipment permits testing in general accordance with BS5958.

**Functional Specification & Deliverables -**

- 10 V d.c power supply (resolution 0.1 V, accuracy + / - 2 %)
- Picoammeter (2 nA to 20 mA ranges) – 2 nA range has 10 fA resolution + / - 400 fA. Noise 20 fA. Manufacturer’s calibration certificate supplied
- Custom manufactured liquid conductivity test cell
- Miscellaneous cables (transorb in line overvoltage protection unit – protects sensitive measuring equipment from over voltage)
- Instruction manual

**Optional Extras -**

- Calibration services

**The following is available at an additional cost -**

- The JCI 155v6 Charge Decay Analyser with JCI 173 liquid sample support insert for testing charge decay time of liquids. (JCI 176 sample support base is included in this optional package).
Powders will nearly always acquire electrostatic charge during processing, the level of charge being largely determined by the violence of the process. BS5958 gives ranges of charge levels which might be expected from different processes. Whether or not these charge levels prove to be a problem, or indeed whether they can be observed at all, depends largely upon the rate at which the charge is dissipated, particularly from the bulked powder. If the bulked powder is ohmic (that is, electric current through the powder is directly proportional to applied voltage for all voltages), an indication of the severity of electrostatic problems to be expected can be obtained by measuring the resistivity of the powder. Please also refer to details of our JCI 155v6 charge decay time analyser (see: **JCI Chilworth Electrostatic Measuring Instrument Catalogue**) which is the best measuring equipment for monitoring charge decays of products that have non-exponential, as well as those that have exponential, charge decay times. The powder charge decay times (time to 1/e) of many powder products are non-exponential in nature and therefore it is important to appreciate both powder resistivity and charge decay data in conjunction when considering electrostatic risks or when applying the data to develop new products.
Functional Specification & Deliverables -

- Custom manufactured power supply with 500 V, 1 kV, 2 kV, 3 kV (fixed settings) and 0 - 10 kV (adjustable settings for other uses requiring higher voltages)
- Accuracy +/- 1 V on 500 V range, +/- 10 V (all other fixed settings), within +/- 100 V with 10k V applied on the 0 - 10 kV adjustable range.
- Maximum current draw from power supply 500 µA
- Minimum resistance measurement possible is approximately 1 - 2 MΩ – dependent on sample properties and power supply voltage output tolerances
- Custom manufactured test cell with guard ring electrode incorporated
- Picoammeter for measurement of current through or across the test sample (2 nA to 20 mA ranges) – 2 nA range has 10 fA resolution +/- 400 fA Noise 20 fA. Manufacturer’s calibration certificate supplied
- Miscellaneous cables
- In line Transorb over voltage protection unit (for protecting the sensitive pico-ammeter from over voltage)
- Powder resistivity apparatus instruction manual

Optional Extras -

- Calibration services

The following is available at an additional cost -

- JCI 155v6 Charge Decay Analyser with JCI 173 Powder Sample Support insert for testing charge decay time of powders. (JCI 176 sample support base is included in this optional package)

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email us at: info-uk@chilworthglobal.com or visit www.chilworth.co.uk
Designers of protective clothing, or any other man made material for that matter, need to know the resistivity properties of their product. For instance, depending on the nature of the target industry, the garment’s intended use may well be in a static sensitive area (such as a clean room or electronics workbench) where any charge build-up could damage electronic components. Alternatively, ignition of sensitive gases, vapours or even powders as a result of static electricity could be hazardous to personnel and result in damage to plant and equipment. Even in the retail industry, designers may need to know resistive properties of materials, since static can lead to self-clinging of fabrics, which not only causes discomfort for the wearer but also attracts dust and dirt to the garment reducing its lifetime and potentially causing an unsightly appearance.
Functional Specification & Deliverables -

- Terra Ohmeter spec
- BS EN1149 Protective Clothing Surface (volume resistivity test cell)

Optional Extras -

Other test cells can also be manufactured for testing other material types and to meet various applications:

- Ohm square test cell for basic resistivity measurements of solid materials. Can be adjusted for slightly non-uniform / irregular surfaces. (Cell constant is 1)
- Concentric ring electrode – testing in accordance with BS6524 (for measurement of surface resistivity of textile fabrics)
- Testing to BS6233 (now superseded by BS62631 for measurement of volume and surface resistivity of solid insulating materials)
- Testing to DIN 54345 pt 5 – Determination of electrical resistance of textile fabrics

The following is available at an additional cost -

- Charge decay time analysis equipment – JCI 155v6 with sample support base
- JCI 191C Automated Humidity Controlled Cabinet

Note: Where a textile fabric, garment or other material contains conductive yarns it is very important to properly understand their possible effects on resistivity measurements, which often depends on the type of resistivity cell used, or even its orientation. In these cases it is helpful, or even essential, to support the resistivity measurement with a charge decay time and capacitance loading measurement. Chilworth Technology Ltd manufactures a charge decay time analyser (JCI 155v6) which includes measurement of capacitance loading.
Processes or operations to be performed within a flammable atmosphere could create incendive discharges resulting in personnel injury and plant damage. In the worst case scenario personnel deaths or total plant destruction could result.

The gas probe incendivity test gives an indication of discharge hazards from products or materials used in a particular environment. For instance, the incendivity gas probe can be used as an assessment tool for evaluating the risk of ignition from a product or material within a flammable atmosphere, by simulating the type and volume of gas concentration associated with that which may be present on plant.

Chilworth Technology supply the Gas Probe Incendivity Calibration Station to enable a customer to obtain the optimum mixture through the gas probe by utilising the supplied high voltage power supply to create a simulated electrostatic spark discharge. By moving the earthed gas probe ball electrode towards and in the direct vicinity of the high voltage electrode, an electrostatic discharge will occur. These calibration trials precede applying the same gas / air mixture (gas concentration) to the application; for instance, the application may involve determination of whether it is possible to ignite a gas / air mixture when the gas probe earthed ball electrode is presented to the charged product under test, e.g. a Fibre Insulated Bulk Container (FIBC).
Functional Specification & Deliverables -

- Gas probe with manual quick release gas shut-off valve and gas mixing shroud
- Gas mixing unit with 2 x gauges: one for air (rotometer) and one for gas (digital mass flow meter with pre-calibrated gases selectable in memory – default is Propane). Total gas flow to the gas probe must be 0.21 litres / sec + /- 0.04 litres / sec (ref: IEC 61340-4-4)
- A 10 kV custom manufactured calibrated power supply unit with fixed 500 V, 1 kV, 2 kV, 3 kV and adjustable 0 - 10 kV front panel controls. 220 - 240 V / 100 - 120 V a.c input 10 kV output (500 µA) LED display read-out of high voltage output
- A calibration document for the 10 kV power supply included (master calibration equipment UKAS calibrated)
- A capacitance charging unit with electrode
- Instruction manual

Note: for safety reasons, the user must fit flashback arrestors on gas cylinders

Optional Extras -

- Nitrogen feed-line and separate flow-meter
- Calibration services
- Bespoke requests may also be possible

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Whenever one material moves against another, electrostatic charging may result. The net rate of charge acquisition will depend on both the rate of charge generation and the rate of charge dissipation. While measurements of resistivity and charge relaxation time (refer to JCI 155v6) reveal a material’s ability to dissipate charge, chargeability indicates its propensity to generate it. Chilworth Technology manufactures equipment for determining a material’s propensity to generate charge. Various factors will have an effect on the end results of a particular chargeability test series. These are:

1. Particle size
2. Moisture content
3. Humidity
4. Media being transited (e.g. glass, stainless steel, polypropylene or PVC etc)
5. Velocity of travel through the media

The latter two items are considered in the test procedure and are adjusted accordingly to simulate various conditions that could occur on plant.
Functional Specification & Deliverables -

- Custom made stainless steel Faraday cage and drum
- Supply of powder collection bags
- Electronic Manometer
- Electrometer
- Variable speed conveyor belt system (transit time of belt typically set to 30 s)
- 1 stainless steel, 1 glass, 1 polypropylene tube for powder transit
- Sets of leads for measurement apparatus
- Baseplate – chargeability components already pre-mounted for ease of installation
- Stainless steel funnel and support stand
- Stopwatch
- Inline orifice plate for system outlet – already fitted
- Test instruction manual detailing installation, commissioning, test procedure and routine maintenance
- Industrial vacuum suction device with Hepa filter installed
- Industrial vacuum suction device variable speed controller – already fitted
- Miscellaneous instruction manual for Electrometer (on cd), manometer and stopwatch
- Fittings for the drum inlet and outlet (already fitted)

The following is available at an additional cost -

- Digital humidity / temperature meter
- The JCI 155v6 Charge Decay Time Analyser

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Explosion pressure and Rate of Pressure Rise (Kg) values are used for designing explosion protection measures, such as explosion shock resistant apparatus. Both of these values depend on the combustible properties of the material, the ambient or start temperature and pressure, volume and shape of the vessel and ignition source (type and energy). Therefore it is necessary to standardise the conditions at which the explosion pressure and Kg values are measured. The standard test method is designed to determine the maximum explosion pressure and Kg value of a combustible liquid vapour / air mixture at ambient temperature and pressure. The tests are performed using a 5 litre, custom fabricated, metal spherical explosion chamber situated within a suitably sized oven enclosure. The pressure / time record of each explosion is recorded using computerised data logging via fast response pressure transducer and associated charge amplifiers.

The optimum ratio of fuel (sample) to oxidant (normally air) is determined by conducting a standard 5 litre test to determine the maximum explosion pressure and Kg values for the sample in question. Limiting Oxygen Concentration (LOC) tests may also be performed.
Functional Specification & Deliverables -

- 0 - 150 °C operation
- Custom fabricated stainless steel 5 litre spherical vessel (ported to accept pressure transducers). Hydro-tested to 42 bar. Complete with certificate of conformity, hydro-test certificates, test gauge calibration certificates, hydrotest procedure
- Explosion chamber head custom fabricated and ported for liquid injection, vacuum, exhaust, nitrogen inlet, thermocouple and pressure link
- Arc ignition source / high voltage output ignition source. Operated via remote push-button on control box once vaporisation of the liquid sample has occurred
- Pressure measurement system electronic timer circuit built in to charge amp enclosure control box to initiate charge amps following ignition
- Oven enclosure. Capacity: approx 60 litres
- Mains supply: 100 - 120 / 220 - 240 V single phase. Fan assisted with built in bottom stirrer
- PID temperature controller and digital pressure display
- Safety feature: Oven vent (N.B such testing should be conducted in a room facility with extraction)
- Pressure transducers – fast response 10 kHz
- Data acquisition - fast response data acquisition time resolution linked in to PC for accurate data logging

Optional Extras -

- Hastelloy sphere for testing particularly corrosive samples
- Training and calibration services

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This method determines the minimum constant air environment temperature at which thermally unstable substances undergo exothermic decomposition at conditions representative of the substance when packaged for transport. The method can be used for the determination of the SADT of a substance in its packaging, including IBC’s and small tanks (up to 2 m³).
Functional Specification & Deliverables -

• 0 - 150 °C temperature range (110 - 120 V a.c / 220 - 240 V a.c oven typically 1.5 kW)
• Efficient flask holder / stand with minimal thermal influence on test
• Custom made vessel plug / head – fast set-up
• Data acquisition system provides fast and early indication of any exothermic onset
• Debris collection fine wire mesh basket cage system – enables management and containment in the event of any flask breakages
• USB connectivity (computer option available)

Optional Extras -

• Mesh baskets, support stands thermocouples
• Bespoke software changes to cater for additional functions

The following is available at an additional cost -

• PC, LCD monitor and miscellaneous cables & accessories
Chilworth Technology manufacture a 10 kV power supply which can be used to carry out a variety of process safety tests in conjunction with other equipment, e.g. test cells and current measuring devices.

The fixed voltage settings i.e. 500 V, 1 kV, 2 kV, 3 kV and 0 - 10 kV adjustable settings, are extremely useful when conducting electrostatic tests to determine resistivity of textiles and powders etc.

The variable voltage setting is very useful for calibrating the Chilworth Technology Gas Incendivity Probe or for any other purposes requiring a variable high voltage e.g. high voltage systems research and development.

**Benefits**

- Versatile use – can be used as a power source for any of the electrostatics resistivity tests
- Variable settings – fixed 500 V, 1 kV, 2 kV, 3 kV and 0 - 10 kV adjustable settings
- Compact and lightweight
- Ease of use
CTL39 – 10 kV Power Supply

**Functional Specification & Deliverables -**

- Voltage settings: 500 V, 1 kV, 2 kV, 3 kV fixed, 0 - 10 kV adjustable
- Current output capability: 500 µA
- Mains input: 100 - 240 V a.c 1 A
- LCD display – Resolution: 10 V on 500, 1 kV, 2 kV, 3 kV ranges
  100 V on 0 - 10 kV adjustable range (above 3 kV)

**Optional Extras -**

- Calibration services

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This test is used to determine the sensitivity of substances to the effect of intense heat under defined confinement. The method yields quantitative results in the form of a limiting orifice diameter. The test can be used (in conjunction with the Koenen tube test) to formally classify a sample as a UN class 4, division 4.1 substance.

The test is conducted in accordance with the UN Transport of Dangerous Goods Recommendations, Tests and Criteria, Test E.2.
Functional Specification & Deliverables -

- Custom Dutch Pressure Vessel – stainless steel, type AISI 316
- Teclu burner
- Orifice plates – complete set of 8 including: 1.0, 2.0, 3.5, 6.0, 9.0, 12.0, 16.0, 24.0 mm. Thickness 2.0 mm ± 0.2 mm
- Aluminium bursting discs – set. Diameter 38mm. Rated burst pressure 620 + / - 60 kPa at 22 °C
- Stopwatch

Note: The customer also needs to provide propane cylinder fitted with flashback arrestor with appropriate regulator and tubing.

Optional Extras -

- Optional data card and software with Dutch Pressure Vessel calibration program for monitoring heat-up temperature rise time of 3.5 + / - 0.3 K/s gas flow of the supplied Teclu burner and / or height of the Dutch Pressure Vessel base from the burner is adjusted until this desired heat-up rate is achieved
- For R&D purposes and also for leak detection purposes, a pressure monitor and transducer system can also be purchased at additional cost (connection of pressure monitor to PC is also possible by specification of a multifunction data card at additional cost)

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In general, explosives can be divided into two classes of electrostatic risk. It is possible for an operator to accumulate 0.02 J of energy on his person and for this reason, explosives which can be initiated with energies smaller than 0.02 J require the more stringent Second Degree Precautions. If the explosive requires an energy in excess of 0.02 J for ignition, First Degree Precautions are sufficient.

The electrostatic testing of explosives is, therefore, divided into two parts; a screening test to show whether the material is unlikely to be ignited at the 0.02 J level, and a more searching procedure for those materials which are ignited at that level.

* Chilworth Technology manufacture the apparatus required for the initial screening test (i.e. test no.6). Test samples are subjected to discharges of 4.5 J, 0.45 J or 0.045 J energy.
CTL44 Electric Spark Tester

Functional Specification & Deliverables -

- Electric Spark Tester: electrical control & ignition system mounted within 19” rack
- Mains supply: 220 - 240 V a.c single phase power
- Set of polythene strips and high voltage electrodes supplied as standard
- Instruction manual
- Top vent which can be connected to room extraction
- Safety features: door interlock and electrode earthing
- Newly designed enclosure, latched side access panel to aid cleaning

Optional Extras -

- Additional polythene strips
- Additional high voltage electrodes

The following is available at an additional cost -

- PC, LCD monitor and miscellaneous cables and accessories
- Also available, the JCI 140 / JCI 148 Voltmeter combination and data card for spark monitoring (available for technical engineers and professionals)

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This test apparatus is designed to provide a quantitative assessment of the friction sensitivity of a wide range of solid explosives. Unlike the mallet friction test there is no element of impact in the stimulus.

Although any wheel and block materials of interest can be used, the standard test uses mild steel blocks and wheels of standard surface roughness. Results are expressed relative to those for standard RDX. Equipment is designed to the requirements of the Energetic Materials Testing and Assessment Policy Committee (Defence Ordnance Group) Manual of Tests (EMTAP).
Functional Specification & Deliverables -

- Rotary Friction Tester: complete with integral control system
- Power requirements: 220 - 240 V a.c single phase power supply
- Air requirements: clean air supply at 80 psi (standard clean / filtered compressed air supplies (a standard clean 7 barg standard compressed air pressure supply is acceptable regulated down to 80 psi)
- Set of grit blasted wheels and sample blocks to get started (see options)
- Sample grit blasting block
- 1 x instruction manual

Optional Extras -

- Additional wheels
- Additional blocks
- Grit blasting service

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The apparatus purpose is to determine whether a sample of liquid can sustain combustion when held at the specified isothermal temperature. The test is in accordance with UN Transport of Dangerous Goods regulations.

**Benefits**

- Compact unit (self-contained)
- Sloping skirt under hot plate – enables fall off of overspill in the event that a test sample spills on to the hotplate from the test cell
- Variable temperature ramp rate and set point facility for researching other conditions

**Sustained Combustibility Test Apparatus**

The apparatus purpose is to determine whether a sample of liquid can sustain combustion when held at the specified isothermal temperature. The test is in accordance with UN Transport of Dangerous Goods regulations.
CTL51 Sustained Combustibility Test Apparatus

Functional Specification & Deliverables -

- 1 x 1250 W hotplate (200 mm diameter) 220 - 240 V / 6 A
- 1 x remote control unit with integral PID temperature controller
- 1 x interface control cable (which interconnects the remote unit to the hotplate)
- 1 x thermocouple extension control cable
- 1 x sustained combustibility test cell (installed and fixed onto the hotplate)
- 1 x test cell temperature thermocouple (1/16” pocket)
- 1 x handheld digital k-type thermocouple reader with UKAS calibration
- 1 x set miscellaneous cables
- 1 x stopwatch
- 1 x instruction manual

Optional Extras -

- Syringes
- Spare thermocouples
- Return to base calibration services

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The Chilworth Technology Flammability of Gases test apparatus is designed for conducting physical properties testing to the European Official Journal of Tests – Test A11. This method determines whether gases mixed with air at room temperature (approx. 20 °C) and atmospheric pressure, are flammable and if so, over what range of concentrations.

Mixtures of increasing concentrations (1 % steps) of the test gas with air are exposed to an electrical spark and it is observed whether ignition occurs.
CTL52 Flammability of Gases Test Apparatus

Functional Specification & Deliverables -

• 1 x 15 kV constant arc power source
• 1 x gas flow meter base plate with ignition and timer control
• 1 x pair non return valve and pre-mixing chamber and isolation valve pre-fitted to gas flow meter base plate
• 2 x gas mass flow meters (gas flow meter digital pre-programmed gases)
• 1 x power adapter unit for gas flow meters
• 1 x set glass tube sealing membrane
• 1 x flexible gas tube
• 1 glass test tube (quick tube bayonet release mechanism fitted)
• 1 x instruction manual

Optional Extras -

• Spare glass tubes
• Calibration services

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- determines whether a fire will propagate in a dust layer once started by an external ignition source

Benefits

• Digital LED display of current flowing through the platinum wire
• Front panel fine adjustment of current flowing through the wire
• Timer cut-out incorporated - safety feature to power down the control unit if left on for ca 7 minutes
• Easy platinum wire change facility (repeatable method assuring the wire length is maintained when the wire is changed)

Burning Behaviour Test Apparatus

The Chilworth Technology Burning Behaviour unit is based on VDI 2263. It determines if, and to what degree, a fire will propagate in a dust-layer once started by an outside source. The result is either given by a “combustion number” or the rate of propagation of the fire.

The test equipment comprises a quartz plate, electrically heated glowing platinum wire at approx. 1000 °C (diameter: 1 mm, length 86 mm, current 30 A). A drying oven is also required for this test but not supplied as standard (see options overleaf).
CTL56 Burning Behaviour Test Apparatus

Functional Specification & Deliverables -

• 1 x platinum hot coil current control unit
• 1 x heater power handset (pre-wired into the control unit)
• 1 x insulating block
• 1 x glass tube
• 1 x 100 mm length of platinum wire
• 100 - 200 V / 220 - 240 V - 6 A input
• Fine coil output current control (optimum 29 to 31 A. Control derived from low voltage d.c output)
• 1 x instruction manual

Optional Extras -

• Spare platinum wire
• Spare glass tubes
• Spare insulating blocks

The following is available at an additional cost -

• A drying oven

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This test apparatus is designed to determine the potential of a liquid sample to increase the burning rate of a combustible substance when mixed to provide crucial transport and packaging / labelling data.

Benefits

- Determines potential of liquid samples to increase the burning rate of a combustible substance when mixed to provide crucial transport and packaging / labelling data
- Simple to use
- Automated ignition / monitoring set-up
- Test software / hardware: graphical display showing time vs pressure trace
- Display of pressure rate of rise result between 100 and 300 psi
- Ascii file logging of data which can be imported to Excel (not supplied) for later data analysis

Oxidising Liquid Test Apparatus

This test apparatus is designed to determine the potential of a liquid sample to increase the burning rate of a combustible substance when the two are thoroughly mixed or to form a mixture which spontaneously ignites. The liquid is mixed in a 1:1 ratio by mass with fibrous cellulose, heated in a test vessel and the rate of pressure rise measured.

The testing is conducted according to the UN Transport of Dangerous Goods Recommendations Manual of Tests and Criteria, Test O.2 and also to Test A21 of the Classification, Packaging & Labelling of Dangerous Substances in the European Union. A combined Time Pressure / Oxidising Liquids Test Apparatus (Model 025 - 057) is also available.
**CTL57 Oxidising Liquids Test Apparatus**

**Functional Specification & Deliverables -**

- 1 x test vessel complete with integral pressure transducer side arm assembly, ignition electrodes / plug and burst disc mounting connection
- 1 set of 100 aluminium burst discs (consumable / spare parts)
- 1 x ignition power control unit with built in pressure monitor
- 1 x ignition control and acquisition unit (with integral data acquisition / control cards)
- Remote operation. Power supply with 10 A capability
- 1 x 100 m Nickel Chromium wire (consumable part)
- 200 x lead washers for sealing (consumable parts)
- 1 x pressure transducer: 0 - 362.5 psig range. Accuracy = within + / - 1 % of full scale reading
- 1 x side arm with vent valve for leak detection purposes (spare)
- Cables and miscellaneous connectors
- 1 x instruction manual
- 1 x PC (of current up to date specification, complete with oxidising liquids software pre-installed)
- 1 x LCD monitor
- 1 x oxidising liquids test programme

**Optional Extras -**

- Burst discs
- Lead washers
- Nickel chromium wire
- Calibration services

**The following is available at an additional cost -**

- Combined oxidising liquids / time pressure test apparatus (Model 057 - 025)

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Laboratory professionals are often asked to source equipment for specific research conceived within their organisations where there is no ‘off-the-shelf’ solution. Our instruments experts provide a comprehensive design, fabrication and support package to meet your specifications.

**Project Examples**

**Requested:** A high pressure vapour ignition research test apparatus

**Delivered:** A complete system capable of 3500 barg at 400 °C for recording temperature and pressure data resulting from vapour ignitions at elevated starting pressure conditions.

**Requested:** Exothermic waste-stream screening calorimeter

**Delivered:** A custom, automated calorimeter linked to mixing, dosing, heating, agitating and relief equipment for short duration on-site screening of mixed waste stream samples by non-technical operators.

**Requested:** A capacitive spark discharge capability for a 20 litre sphere

**Delivered:** Development of a capacitive spark discharge system within a 20 Litre sphere by utilising the pre-existing KSEP 310 ignition firing signal.

**Requested:** A high pressure 1m³ spherical explosion powder ignition test vessel

**Delivered:** A system capable of 225 barg at 100 °C with custom dispersion and firing electronics to BS EN & ISO test standards.
Choosing the right process safety instrumentation, whether for an R&D laboratory or on-site testing, is a complex task. Our clients require a helpful, professional service, value-for-money and equipment widely proven in laboratory applications. They are entitled to complete, easy-to-follow instruction manuals, efficient after-sales support and comprehensive equipment warranties and accessories. Chilworth has built our business on these key factors for more than 25 years.

Training
We at Chilworth recognise that people developing their own process safety facilities benefit from our knowledge and assistance so staff can operate safely, competently and in accordance with set standards and protocols. We therefore provide tailored training to meet individual client requirements delivered either in our fully equipped process safety laboratories, at a client’s site or through remote access video based support. This comprehensive support extends to interpretation and application of data from our team of expert consultants.

Test Standards
Our instrumentation complies with relevant national and international standards including BS, IEC, ISO, ASTM, VDI, DIN, UN and European Union regulations such as CLP (Classification, Labelling and Packaging) and REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals). Through their in-depth understanding of industry needs gained over more than a quarter of a century, Chilworth’s consultant engineers are frequently engaged with international standards committees and are well placed to help our customers to define the details of their testing requirements, whilst offering expertise in the interpretation and application of the data. For more details on our standards compliance, please see p4.

Custom Manufacture
Chilworth also provides a custom manufacturing service for bespoke apparatus to meet either our client’s specific in-house test requirements or to meet other test standards not covered by our normal instrument range. At the end of this catalogue you will find some examples of our custom built instrumentation developed by us to address specific client needs.

Warranty
Full 12 month warranties are supplied with all equipment.

Commissioning & Maintenance
In addition to our comprehensive commissioning service, Chilworth Technology can also fulfil your contracts for repairs, maintenance, calibration and certification of our equipment consistent with a full range of quality programmes, including Good Laboratory Practice (GLP).
**Benefits**

- Calibration is conducted in accordance with UKAS & / or National Standards
- High level of accuracy
- In-house calibration equipment with accuracy to traceable standards

Regular calibration of test apparatus is integral to ensuring that equipment returns reliable, high quality results critical to the characterisation of materials and safe operation of processes.

Using a range of master test equipment, Chilworth Technology provides calibration services traceable to internationally recognised standards for our range of process safety test apparatus. In circumstances where no formal calibration is required, we offer a manufacturer’s standard performance check service to ensure dependable data.

Service contracts are also available where equipment is tested against known data samples. With the option for on-site calibration or return to our UK based service centre, whether it be formal calibration, performance check or routine maintenance and servicing, Chilworth Technology offers peace of mind through our comprehensive, professional support package for all of our process safety test apparatus.

For further details on the range of calibration, servicing and after-sales support available for Chilworth’s instruments, plus our range of training and consultancy services available globally, please email us at:

info-uk@chilworthglobal.com or call us on: +44(0)23 8076 0722