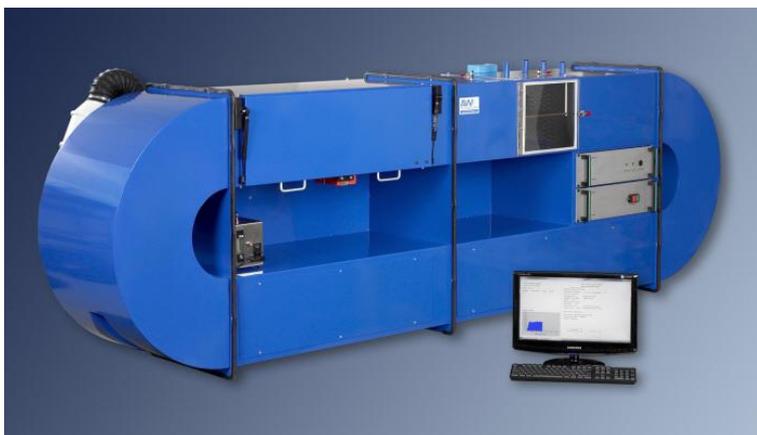


3000 SERIES FIRE DETECTOR CALIBRATION & TEST TUNNELS

Product data issue 1.80



3000 series fire detector calibration and test tunnels are suitable for use in fire detector manufacturers production facilities and for R&D testing. They are designed for accurate calibration and testing to EN54-5 (heat detectors), EN54-7 (smoke detectors), EN14604 (smoke alarms), BS5446-2 (heat alarms), and corresponding ISO standards.

The 3000 series calibration tunnels are an extended version of the 1000 series tunnels, and are designed for calibrating optical smoke detectors and smoke alarms at a fixed aerosol concentration in production. The 3400 and 3800 tunnels also includes the capability for QA testing of heat detectors at up to 20Kmin^{-1} from 25°C .

All 3000 series test tunnels feature exceptional airflow stability and testing flexibility. The smoke detector test tunnels include a paraffin oil mist aerosol generator and an optical obscuration meter. The equipment is computer controlled, with automated test cycles. A PC is supplied as standard, with PC interface card and a bespoke, comprehensive tunnel control software package. Flexible interfacing to fire detectors is also provided. A wide range of accessories is available.

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1. INTRODUCTION

There is growing evidence of the importance of various performance characteristics of fire detectors, including airflow dependence and the absolute sensitivity. In the case of smoke detectors, EN54-7 establishes a minimum performance level with a series of defined aerosol wind tunnel tests and standardised fire tests. It requires that all product lies within a defined range of sensitivities. If smoke detectors are insensitive a fire alarm may be significantly delayed, particularly in the case of slowly developing fires that are a significant risk to life. If oversensitive, there may be an increased risk of false alarm. In the case of heat detectors EN54-5 classifies the performance by means of heat wind tunnel tests into a series of closely defined classes. These are appropriate to installation for different risks, at a range of ceiling heights and in various environments.

The importance of maintaining output quality has long been recognised by major fire detector manufacturers, and has been reinforced in Europe by the introduction of revised EN54 standards, harmonised under the Construction Products Directive. These require that the manufacturer must maintain a factory production control system, and ensure that the product continuously complies with initial type test approvals. For over twenty years AW Technology has invested in the development of re-circulating smoke and heat detector test tunnel technology, and has supplied test tunnels for smoke and heat detectors to standards test laboratories and major fire detection manufacturers world-wide. Since the product launch in 2009 the AW Technology 3000 series tunnels have been established as the leading solution for detector calibration and testing.

AW Technology is the leading independent supplier of technology to the fire detection industry. It has a record of successful innovation in detector and system design, and contributes UK experts to EN standards formation. A lot of work has also been carried out in supporting smoke and heat detector production. This experience means that AW Technology is uniquely placed to understand the needs of its clients and to provide the best tunnel products and service.

AW Technology detector test tunnels are supplied with a pre-configured PC base unit. They include documentation that enables the client to start testing, and operating their tunnel. Information is also given on the wiring of the tunnel, part numbers for spares from 3rd party suppliers (i.e. RS, Farnell) and the schematic of the main PCB. This should enable a client to maintain their tunnel into the future. The tunnels include a 12 month warranty for repairs and replacement of faulty parts. AW Technology will remain available to provide help, support and repairs if required. Commissioning and training can also be provided on-site, but this is usually not needed.

2. 3000 SERIES CALIBRATION AND TEST TUNNELS

3000 series fire detector test tunnels are based on technology which has been developed over the past 20 years, and proven in tunnels supplied to customers. They are bench top designs with control electronics integrated within the structure of the tunnel. 3000 series test tunnels are ideally suited to performance testing to EN54-7 and EN54-5 for factory production control. The 3000 series tunnels are mainly intended for factory calibration of optical detectors.

The following 3000 series product variants are available:

- **3100 optical smoke detector calibration test tunnel**
This is an extended version of the 1000 series smoke only test tunnel, which includes a scatter sensor and mounting plates for up to 16 100mm diameter detectors in the tunnel. An outline drawing is presented as an appendix to this document (AWT6/720).
- **3400 optical smoke detector calibration test tunnel with heat QA test capability**
This is to the same design as the 3100 tunnel, but also includes heaters and thermal insulation to enable QA testing of heat detectors at up to 20Kmin^{-1} from 25°C .
- **3800 optical smoke detector calibration test tunnel with heat QA test and cooling**
This is a 3400 tunnel with a separate, attachable cooling unit, which can be used for smoke detector tests at 0°C to EN14604.

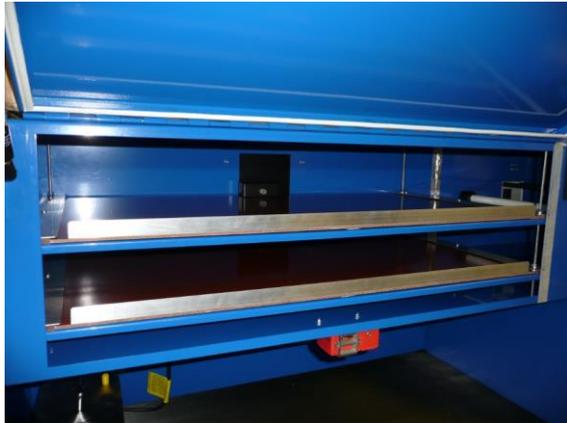


3100 rear view

3. SMOKE DETECTOR CALIBRATION AND TEST TUNNEL TECHNOLOGY

The 3000 series fire detector calibration and test tunnels are designed for calibration of optical smoke detectors and smoke alarms in production. The general arrangement is shown in an appendix to this document (AWT6/720). They are based on the 1000 series tunnels, with an additional 1m long section fitted, and has a total length of 3.1m. The additional section is used for calibration, and the door and hatch arrangement in the standard section can still be used for sensitivity measurement for QA purposes if required. The tunnel will be maintained at a constant aerosol concentration for calibration controlled by an optical scatter smoke sensor. At the start of each calibration session it will take about 4 to 7 minutes to stabilise at the required concentration

The opening for the calibrating detectors is a top hinged metal door with a Perspex window and a gas strut to support it when open. There is an electrically controlled lock unit which will unlock the door when ready for removing and replacing detectors. It will also detect closure and switch on the lock when the operator shuts the door.



Up to three detector mounting plates can be fitted in the tunnel for calibrating detectors. The plates are 784mm long (in the direction of flow) and 430mm wide, and they are made from Tufnol sheet.

With the standard two mounting plates fitted, the detector plates can each accommodate up to eight 100mm diameter detectors without significant blocking of airflow, making a total of 16 detectors in the tunnel. For smaller detectors, it is possible to accommodate more detectors on each tray.

A pair of 16 way connectors (24 way also available) can provide power and signalling to the detectors on the mounting plates. As standard, a set of 4 detector mounting plates with

connectors are supplied with the calibration tunnels, so that 2 can be used in the tunnel while 2 are outside of the tunnel for swapping detectors.

There are no wires provided to the connectors as standard, as the electrical requirements for calibrating detectors vary greatly. The circuitry required for calibration can be designed and built by the client.

To enable the integration of calibration testing by the client the following input/outputs are provided on the main tunnel control box:

- Relay output to indicate that the aerosol concentration is at the correct level (within set limits) for calibration.
- Opto-isolator input to receive a signal to indicate that calibration on a set of detectors is complete and the door can be unlocked.

In addition a serial communications interface to the tunnel PC is specified. This will enable a separate PC to control the overall function of the tunnels, and the test cycle of the detectors under calibration.

3.1. General design

3000 series test tunnels are based on a rigid, painted steel duct with curved ends. A transparent polycarbonate door at the front gives access to detectors between tests, and permits observation during tests.

Deflector vanes and flow straightening honeycomb allow a smooth, non-turbulent airflow to be achieved within the working section. The specified operating range is 0.2ms^{-1} to 1ms^{-1} for smoke detector testing, but stable operation is possible over a wider range for R&D purposes. It is recommended that the air velocity should be routinely calibrated using a suitable airflow sensor (anemometer). An anemometer with an analogue output is available as an option, and during smoke detector testing the air velocity may be feedback controlled.

The only limitations on the application of these tunnels are that the duct is not large enough to carry out the high airspeed (gusting) type test for ionisation smoke detectors, and the high luminance (dazzle) type test for optical smoke detectors. A reduced size dazzle rig is available for 3000 series tunnels to enable non-compliant tests for R&D purposes.

3.2. Increasing production throughput

The latest design of the 3000 series tunnels offers the option for new flaps in the opening of the calibration section. These flaps open and close when the calibration trays are removed and replaced in the tunnel, which minimizes the loss of aerosol when the door is open. This allows the fixed concentration to be more quickly restored after detector trays have been swapped, thereby increasing throughput.

3.3. Test aerosol

The test aerosol is paraffin mist, suitable for testing both optical and ionisation detectors. It is generated using an atomiser aerosol generator with an integral compressor. The atomiser produces a polydispersed aerosol with a dominant aerosol distribution by diameter of approximately 0.25µm, and an aerosol mass distribution maximum within the 0.5µm to 1.0µm range required by EN54-7. The aerosol is maintained in a reservoir and is fed into the recirculating air stream ensuring an even distribution across the full width of the duct. The aerosol concentration is software controlled to achieve a smooth ramp.

Aerosol is cleared from the tunnel between test cycles. The aerosol is of low toxicity, but it is recommended that the exhaust be fed to outside of the occupied area.

The paraffin oil used is supplied by VWR International (www.vwr.com) as 'Paraffin liquid colourless light GPR' catalogue number 294365H. A 250ml bottle of the oil will be supplied with the tunnel, which is sufficient for many hundreds of tests.

3.4. Optical reference sensor

An AW Technology obscuration meter is used as the standard reference when testing optical smoke detectors. The meter measures the reduction in intensity of an infrared beam. The peak wavelength is 880nm to comply with the requirements of EN54-7. The aerosol concentration is measured in terms of a proportional decrease in the intensity of the beam. The AW Technology meter is extremely sensitive and stable, and includes technology to achieve good linearity. Zero readings are taken at the start of each test, so the meter is effectively self-calibrating.

The obscuration meter is an integral assembly and may be easily demounted from the duct. It is recommended that the obscuration meter should be removed during heat ramp tests in combined smoke/heat test tunnels.

3.5. Ionisation reference sensor

A standard MIC reference sensor (not available from AW Technology) may be used for testing ionisation smoke detectors to EN54-7, and a mount and interface is available as an optional accessory. The recommended unit is the EC-912 available from DELTA in Denmark and includes a vacuum pump and control unit.

3.6. Temperature sensors

In the 3100 smoke only tunnel variants a thermocouple temperature sensor is fitted upstream of the working volume. This is used as a reference sensor to record test temperature during tests, and for control of tests up to 55C. A temperature sensor is also fitted at the rear of the electronics control box to display room temperature.

3.7. [Heaters](#) and cooling

The 3000 series tunnels with heat QA capability [contain heaters](#) for the heat detector tests. These can be used for smoke detector testing at elevated temperatures. The 3800 optical smoke detector calibration test tunnel with heat QA test and cooling can be used for smoke detector tests at 0°C to EN14604.

3.8. Air velocity sensor

An air velocity sensor can be included as an option, with airspeed displayed real time during smoke tests. If the air velocity sensor is not supplied the speed is controlled using the tachometer fitted as standard to the main fan motor.

The anemometer probe should be withdrawn from the duct during heat detector testing.

3.9. Optical scatter sensor

An optical scatter smoke sensor is supplied as standard with the 3000 series tunnels. It provides long term stability in aerosol measurement which is required while a constant density is maintained

The optical scatter sensor is mounted directly on the back of the tunnel and samples aerosol from the tunnel using a tube and a small fan. It is automatically maintained in calibration against the obscuration meter to maintain accuracy.

3.10. Dazzle test rig

The dazzle test rig specified in EN54-7 for testing the ambient light immunity of optical detectors requires 30cm diameter lamps to be used. These are too large to fit within the series 3000 calibration tunnels. If there is a requirement to carry out this test for R&D purposes, a smaller version of the dazzle test rig is available for use with the 3000 series tunnels. This has an equivalent light intensity at the detector to the rig specified in EN54-7, and if this test function is selected the on/off sequence at the start of the dazzle test is controlled automatically.

4. HEAT DETECTOR TEST TUNNEL TECHNOLOGY

4.1. General design

Heat tunnels in general may be either recirculating (closed loop), or non-recirculating (in which air is drawn in from the laboratory, heated, blown through the working section and expelled to exhaust). Non-recirculating heat tunnels require a large energy input, the temperature control can present problems (particularly with slow ramps), and it is difficult and expensive to cool the air for tests at low start temperatures. 3000 series test tunnels use

recirculating technology. This also permits combined smoke/heat detector test tunnels to be achieved in the same design.

EN54-5 requires stable temperature ramps at rates from 0.2Kmin^{-1} to 30Kmin^{-1} for heat detector type testing. The 3400 and 3800 enable tests at up to 20Kmin^{-1} which is required for factory QA testing. The air temperature and airflow within the working volume (a defined part of the working section) should be within $\pm 2\text{K}$ and $\pm 0.1\text{ms}^{-1}$ of nominal. There is also a requirement to maintain a constant mass airflow, equivalent to 0.8ms^{-1} at 25°C (i.e. the airspeed must be increased as the air becomes hotter and less dense). These requirements present technical challenges in the design of recirculating heat tunnels.

The duct is engineered to provide insulation and to present a very low thermal mass to the airflow. This construction ensures an even temperature distribution across the working volume, and also that the outer surface is safe to touch while operating at maximum temperature. The tunnel uses a high specification fan motor with feedback control, in order to achieve a constant mass airflow and a stable and predictable airspeed in the duct. Thermocouples monitor air and tunnel skin temperatures, and application specific temperature control algorithms employ feedback and predictive terms.

4.2. Temperature sensors

Thermocouple temperature sensors are fitted as follows.

- The sensor used for the temperature monitoring and control feedback, is mounted just upstream of the working volume and has a time constant of less than 2 seconds at 0.8ms^{-1} to comply with EN54-5. This sensor is also fitted in smoke detector test tunnels.
- A sensor on the inner wall of the working section is used to monitor that the surface is below the start temperature before a heat ramp test is carried out. This is also used to control the cooling system (if fitted).
- A sensor upstream of the heaters is used to detect overheating, in the unlikely event of a failure in the air circulation.
- A sensor at the rear of the electronics control boxes is used to measure room temperature.

4.3. Heaters and heater drive

The heat tunnel heaters are custom designed for this application and have a maximum operating power of 6kW . They are contained in a robust modular assembly with a low thermal mass, which span the width and height of the duct to provide equal heating throughout the cross section.

The heaters are driven via a phase angle thyristor unit, which is mounted in a steel enclosure at the rear of the tunnel. The enclosure has an isolation switch on the door, which cannot be opened when the supply is switched on. The phase angle controller has not been found to cause problems with EM emissions. However, for full compliance with EN50081-2 it may be

found necessary for the user to install a filter unit at the mains outlet. Suitable filters are available from Eurotherm (e.g. code FILTER/MON/63A/00 for single phase supplies).

A separate temperature controller and thermocouple are included, which acts as a safety cut-out, independent of the PC control.

4.4. Cooling

To enable tests at low temperature (e.g. heat ramps from 5°C start) a cooling unit is fitted to the 3800 test tunnels. This exchanges chilled air into the recirculating air stream when cooling is required. The steady state temperature is accurately stabilised by feedback control using the heaters. Cooling has the added advantage of more rapidly reducing the temperature of the test tunnel between heat ramp test cycles, which can increase throughput.

The cooling unit is floor standing, and is connected to the left hand end of the tunnel (as seen from the front) with two 150mm diameter insulated flexible ducts. It is mounted on castors to make it easy to move into position.

5. FIRE DETECTOR MOUNTING AND TEST CAPACITY

The right hand test section of the 3000 series tunnels is similar to the test section provided in the 1000 series tunnels. This test section is described here.

5.1. Detector mounting

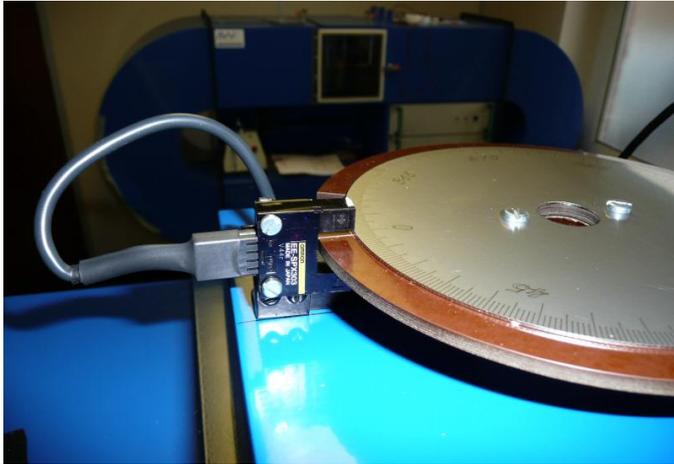
The detectors under test are mounted on plates, which may be drilled to match the mounting holes of different detector base ranges. The detector mounting plates are supported from hatches, which are designed to be easily interchangeable. The following mounting arrangements are available.

- **Hatch with fixed mounting plate (3000 or 3001)** A rectangular mounting plate is located on the centre line of the working volume, capable of accommodating up to 6 detectors (subject to test capacity limitations, see later). The rectangular mounting plate is shown in the drawing AWT6/710 in an appendix to this document.
- **Hatch with rotating detector mount (3002 or 3003)** A circular mounting plate (200mm diameter), capable of accommodating one detector, is fixed to a post, which may be raised or lowered manually within the working volume. The plate may be manually rotated through 360 degrees to carry out directional dependence tests.



Rotating detector mount in tunnel next to temperature and airspeed sensors

- **Hatch and motorised rotating detector mount with software control (3010 or 3011)** A circular mounting plate (200mm diameter), capable of accommodating one detector, is fixed to a post, which can be raised or lowered manually within the working volume. The plate may be automatically rotated under software control in user defined increments to carry out directional dependence testing.



Indicator disk on motorised rotating detector mount

5.2. Test capacity

The 3002 or 3003 hatch accommodates one 3004 flexible detector mount, on the centre line of the tunnel for testing one detector. The capacity for development, or type approval testing type approval testing is one smoke or heat detector, facing downwards. The 3010 and 3011 hatch and motorised rotating detector mount are also intended to test one detector.

The capacity of the 3000 or 3001 hatch and fixed mounting plate for production control sensitivity testing is as follows (assumes low profile fire detectors, typically 100mm in diameter):

- up to 6 smoke detectors, with 3 facing upwards and 3 facing downwards;
- up to 3 heat detectors facing downwards.

6. CONTROL ELECTRONICS AND SOFTWARE

6.1. Electronics and PC interface

The control electronics is specially designed for this application. The PC interface is a multifunction PCIe card, including ADC, DAC and digital I/O, which connects to the control electronics with a single 50-way cable.

The main functions are as follows (implemented as appropriate to the test tunnel type):

- Cold junction compensation and amplifier circuits for thermocouples.

- Measurement of voltage outputs of the obscuration meter.
- Measurement of voltage output of the optional MIC ionisation reference interface.
- Measurement of voltage output of the optional anemometer.
- Analogue voltage input (0 to 5V), which may be employed to record data from a user application or an optical scatter sensor (if fitted).
- Proportional control and speed monitoring for the circulation fan motor.
- Proportional control for the heater thyristor unit.
- Proportional control for the aerosol box fan.
- Control for the aerosol atomiser.
- Controls for cooling unit, and extract fans.
- Calibration interface
- Control and monitor of door interlock

In the right hand section, interfacing is provided as standard for up to 6 fire detectors as follows:

- Conventional detectors may be monitored using a programmable voltage (9V to 24V) supply with alarm current measurement (up to 50mA). Manual interface provided for up to 6 smoke alarms.
- Manual interface provided for up to 6 smoke alarms.
- Voltage-free sensing (opto-isolated inputs) may be used to monitor a repeat LED output, or an alarm relay in a fire detector or in a control unit. This can be used for testing addressable detectors.

6.2. Software

The test tunnel is supplied with a PC software package, which monitors and controls the system via a PCI multifunction card. The main features are as follows.

- Automatic test cycle, with easy user controls and clear prompts.
- Detector alarm monitoring, with display of sensitivity readings.
- Flexible configuration of test parameters and pass/fail criteria, with set up screens for named detector types.
- Option to carry out batch repeatability (or batch directional dependence) tests without operator intervention.
- Increase in aerosol concentration or temperature is shown as a real time graphical display.
- Detector test results are logged to text files (in a format suitable for export to a spreadsheet).
- Data on each individual ramp test may be optionally logged (for audit purposes).
- Logged data may be displayed.

Software installation is generally similar to that for most Windows based software applications. The control software and the drivers for the PCIe card are all supplied with the tunnel.

It is recommended that no other application be run during test tunnel operation.

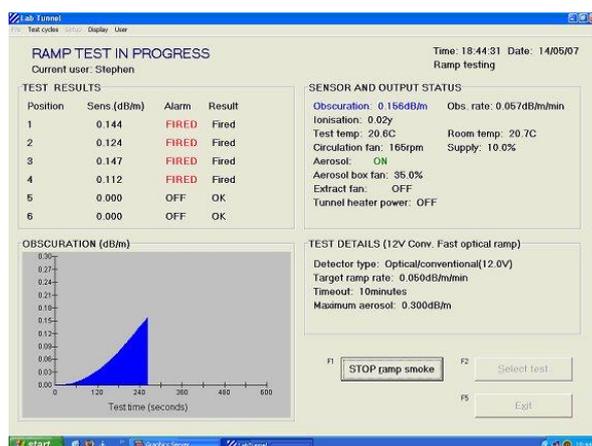
The tunnel software is written in Borland C++ Builder, and has been tested for compatibility with a range of industry standard desktop PCs running under genuine English language Microsoft Windows. The software can be supplied for either Windows 10 or Windows 7.

6.3. Desktop PC

A PC with a fitted PCIe data acquisition card is supplied with each tunnel, with the required software and drives pre-installed and tested. The software is also supplied on a CDROM.

6.4. Smoke detector test cycle

The smoke detector test is a ramp in aerosol concentration from clean air. For each detector, the aerosol concentration at alarm is displayed as the sensitivity value in units of aerosol concentration (dB/m or y). Up to 50 different named smoke ramp test profiles may be configured to meet the needs of different detectors. Named test profiles may be selected from an on-screen menu. Test limits and parameters (e.g. target rate of rise) may be configured as required.



The typical smoke detector test cycle is as follows.

- The operator installs the detectors.
- If testing ionisation detectors, the operator zeros the MIC (if fitted).

- When the operator presses start test the obscuration meter is automatically zeroed.
- The software initiates generation of aerosol and starts the ramp test.
- As each detector goes into alarm this is sensed by the software and is displayed.
- When all detectors have gone into alarm, or the maximum aerosol concentration limit has been exceeded, the test cycle is stopped.
- Fans are switched on to clear the aerosol.
- The operator is prompted to remove the detectors.

The test time is typically 5 to 10 minutes for tests to EN54-7. Longer tests at slower ramp rates will tend to be more accurate.

6.5. Smoke detector calibration test cycle

Exact smoke detector calibration procedures vary between manufacturers but the calibration process usually follows a process of measurement in both clean air and at a fixed concentration of aerosol.

The 3000 series calibration tunnels provide specific test cycles for maintaining a desired fixed concentration of aerosol in the tunnel. A convenient interface is supplied to allow a signal to be supplied to the tunnel to indicate that the calibration process is complete. Following this signal the tunnel will unlock the calibration section door and take measures to reduce the loss of aerosol while the door is open. When the trays of detectors have been changed, the door is shut and the tunnel restores the desired fixed level of aerosol as quickly as possible.

6.6. Heat detector test cycle

The heat detector test is a ramp in temperature from a stabilised starting temperature. For each detector, the result is displayed as both the elapsed time and the temperature at alarm. Up to 50 different named heat ramp test profiles may be configured to meet the needs of different detectors. Named test profiles may be selected from an on-screen menu. Test limits and parameters (e.g. target rate of rise) may be configured as required.

The typical heat detector test cycle is as follows.

- The operator installs the detectors.
- The operator presses start test and the temperature is controlled to the start temperature.
- When the start temperature stabilisation time has elapsed, the software automatically starts the configured temperature ramp.
- As each detector goes into alarm this is sensed by the software and is displayed.
- When all of the detectors in the test have gone into alarm, or the maximum temperature limit has been exceeded, the test cycle is stopped.
- Fans are switched on to cool the tunnel.
- When it is safe to do so, the operator is prompted to remove the detectors.
- If a cooling unit is fitted, this is switched on to cool the duct wall temperature to below the start temperature for the next test.

In addition to standard ramp tests, there is a capability for the following.

- A static ramp test (to EN54-5) may be carried out, with a rate of temperature rise of 1Kmin^{-1} up to a defined point, followed by a main ramp at 0.2Kmin^{-1} .
- A plunge test (for /S detectors to EN54-5) may be carried out, in which the tunnel is controlled to a fixed temperature up to 80°C .

7 MECHANICAL AND ELECTRICAL SPECIFICATION SUMMARY

The overall mechanical parameters are as follows.

- Overall size (3100 - 3800): 3.10m long * 0.70m wide * 0.93m high.
- Size of cooling unit supplied with 1700 and 1800: 0.9m long * 0.78m wide * 1.15m high.
- Weight of tunnel (3100): 140kg approx.
- Weight of tunnel (3400 - 3800): 190kg approx.
- Internal cross section of duct (3100): 450mm wide by 290mm high.
- Internal cross section of duct (3400-3800): 420mm wide by 260mm high.
- Working volume cross section for smoke detectors: 360mm * 200mm.
- Working volume cross section for heat detectors: 300mm * 75mm.
- Extract via 150mm diameter flexible duct (requires a back draught shutter).

The power supply requirements are as follows.

- 3100 requires a 230V 13A mains supply.
- 3400-3800 include a 6kW heater and require a 230V (single phase) 32A mains supply.
- Cooling unit requires separate 230V 13A mains supply.

8. DELIVERABLES AND OPTIONS

8.1. Standard deliverables

The test tunnel variant ordered comes as standard with the following.

- Control electronics.
- PC base unit with PCIe interface card installed.
- PC software
- Aerosol generator (with smoke variants).
- Hatch and fixed mounting plate for up to 6 detectors or rotating detectable mount for right hand test section
- 4 detector calibration trays 16 way connectors (24 way available) for calibration section.
- 3m length of flexible ducting.

8.2. Options

- 3000 Spare hatch with fixed mounting plate for up to 6 detectors (for 3100 tunnel).
- 3001 Spare hatch with fixed mounting plate for up to 6 detectors (for 3400-380 tunnels).
- 3002 Hatch with rotating detector mount for directional dependence testing, or for tests at a selected orientation (for 3100 test tunnel).
- 3003 Hatch with rotating detector mount for directional dependence testing, or for tests at a selected orientation (for 3400-3800 tunnels).
- 3004 Spare rotating detector mount (for use with 3002 or 3003).
- 3005 Flaps on calibration section door to reduce aerosol loss while changing trays.
- 3006 Airspeed meter ('anemometer') with analogue output integrated into the software.
- 3007 Interface and mount for MIC (standard reference for ionisation detectors).
- 3009 Dazzle test rig (non EN54-7 version for R&D application only).
- 3010 Hatch and motorised rotating detector mount with software control (for 3100 test tunnel).
- 3011 Hatch and motorised rotating detector mount with software control (for 3400-3800 tunnels).
- 3012 Addition detector calibration trays
- 3015 Tunnel stand (available fully built or flat-packed)
- 3021 Desktop PC base unit with PCI card and software pre-installed (standard).
- 3023 Customised fire detector interfaces (mechanical, electronic and software).
- 3051 Delivery by air outside of mainland UK plus insurance (Delivery Duty Unpaid).
- 3052 Delivery by land/sea outside of mainland UK plus insurance (Delivery Duty Unpaid).
- 3053 On-site commissioning (including training on operation, calibration and maintenance).

8.3 User documentation and technical support

The documentation with the equipment includes the following.

- Set up and commissioning instructions.
- User manual, which includes details of the test cycle test limits and parameters, the format of text result files and tunnel.ini adjustable parameters, and information on routine calibration and maintenance.
- Specification of detector interfaces.
- Electronics circuit schematic of the control electronics.
- Wiring details of leads.

Technical support is available by telephone or by E-mail.

