Watermist protection of domestic and residential occupancies – approvals approach

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Introduction

- Domestic and residential hazard
- Domestic and residential research
- Watermist research
- Approval

Fire Hazard

- Fire scenarios
- Fire consequences
- Fire protection objectives

Consequences of fires in dwellings

According to UK fire statistics[1], each year most fires in buildings attended by local authority fire and rescue services are fires in dwellings, and most fire deaths and injuries occur as a result of people being overcome by smoke or toxic gases. Accidental fires which result in deaths in dwellings most frequently start in rooms defined by "the lounge, living or dining room" followed by rooms defined as "the bedroom or bed sitting room".

Fire scenarios in domestic and residential premises

Examples of fire scenarios in domestic and residential premises are:

- lounge fire due to ignited candle placed too close to a television, causing the television to catch fire, which spreads to curtains and furniture
- lounge fire due to matches or smokers' materials into a waste paper bin causing a waste

Domestic buildings
Individual dwellings for occupation as single family units used, constructed or adapted to be
or principally for human habitation
dwelling houses, individual
transportable

Residential buildings
Buildings for multiple occupation. This includes apartments, residential homes, Houses in Multiple Occupation (HMO), blocks of flats, boarding houses, aged persons' homes, nursing homes, residential rehabilitation accommodation and dormitories. This does not include secure accommodation or asylum centres

Dwellings
Buildings occupied by households, excluding hotels, hostels and residential institutions and including mobile homes

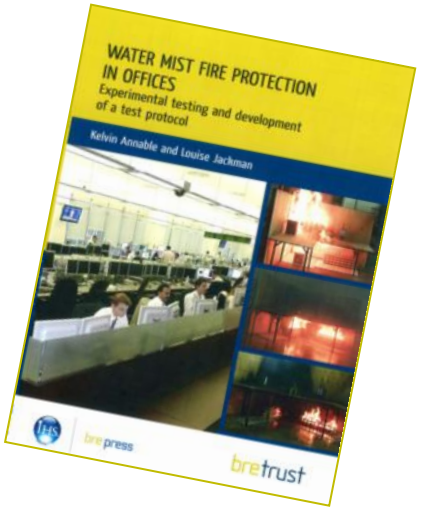
BRE Research and testing (public domain)

- 1970s+ USA residential sprinkler research
- 2000s SP, NZ, Canada experimental research
- 2000s UK experimental research
  - House fires and calorimetry fires
  - Compartment fires
  - Benchmark sprinkler fires
  - Care homes
  - Concealed/recessed
- 2007+ Watermist test
  - Prisons tests
  - Office tests
  - Domestic and residential tests

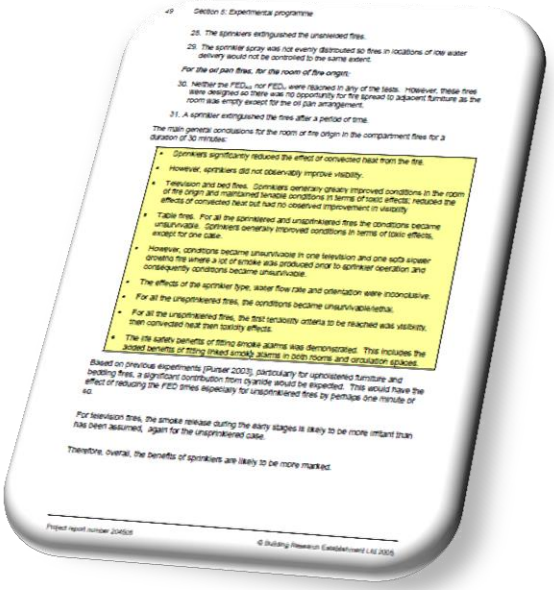
http://www.bre.co.uk/page.jsp?id=402

Research findings

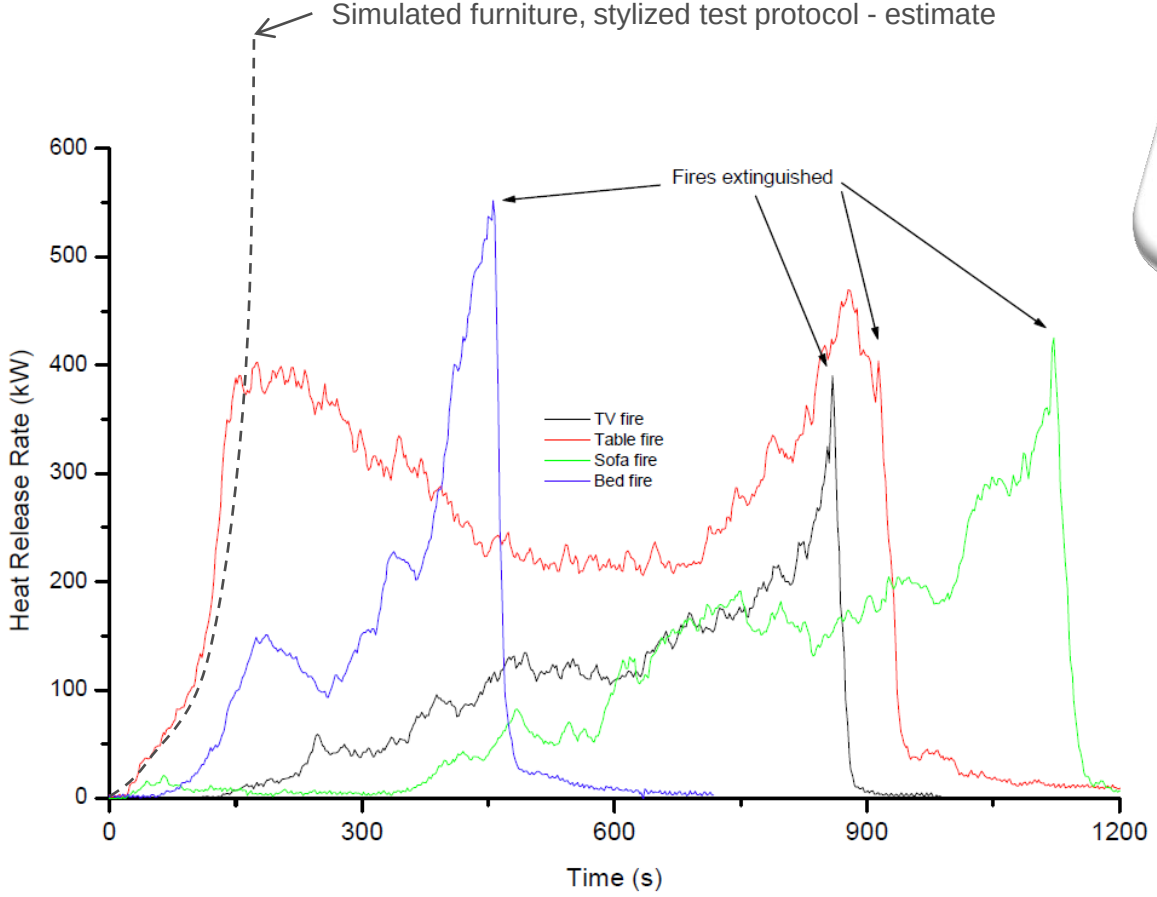
- Fast flaming vs slow smoky
- Tenability
- Large open space vs compartment
- Ventilation
- Nozzles spacing & flowrate
- Pass/fail criteria



Fast flaming vs slow smoky

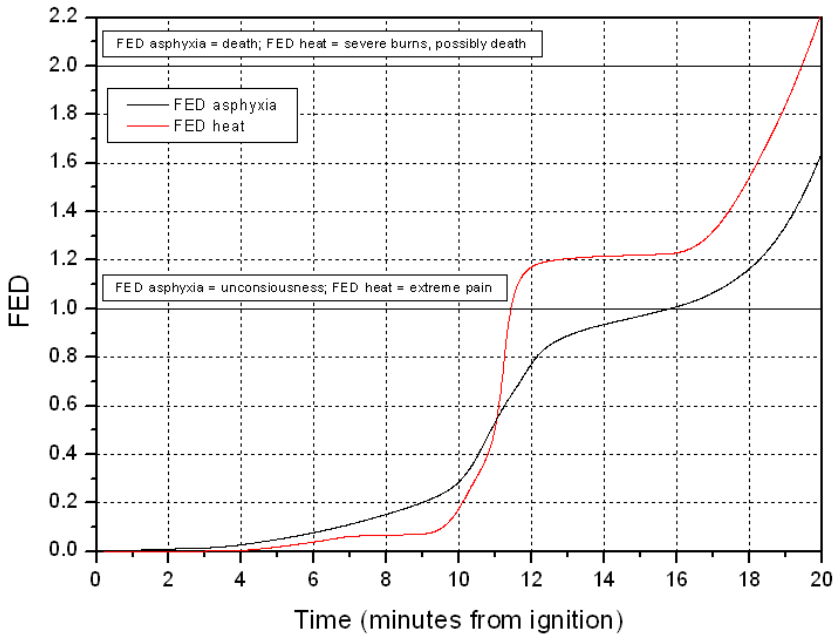


Simulated furniture, stylized test protocol - estimate



Tenability - Fractional Effective Dose

- House fires (2004)
- Prison fires (2008)



Large open space vs compartment

- In open
  - 850° C above crib
  - Not control

- In compartment, open door
  - 120° C at ceiling
  - Control

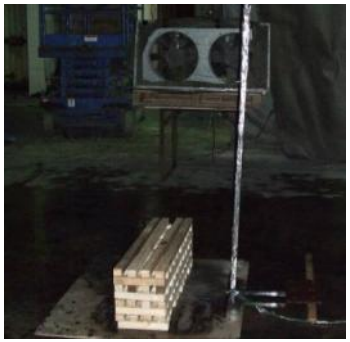
- Nozzle offset from fire 1.8 m, manual extinguishment < 20 mins

Ventilation

- Open test scenarios
- Droplets blown, no control

- Compartment test scenarios
- Different behaviour

- Proving tests needed for ventialation scenarios



Nozzle spacing and flowrate

– 6.25 m^2 spacing (5 mm/min)

– 9 m^2 spacing (3.5 mm/min)

Pass/fail criteria

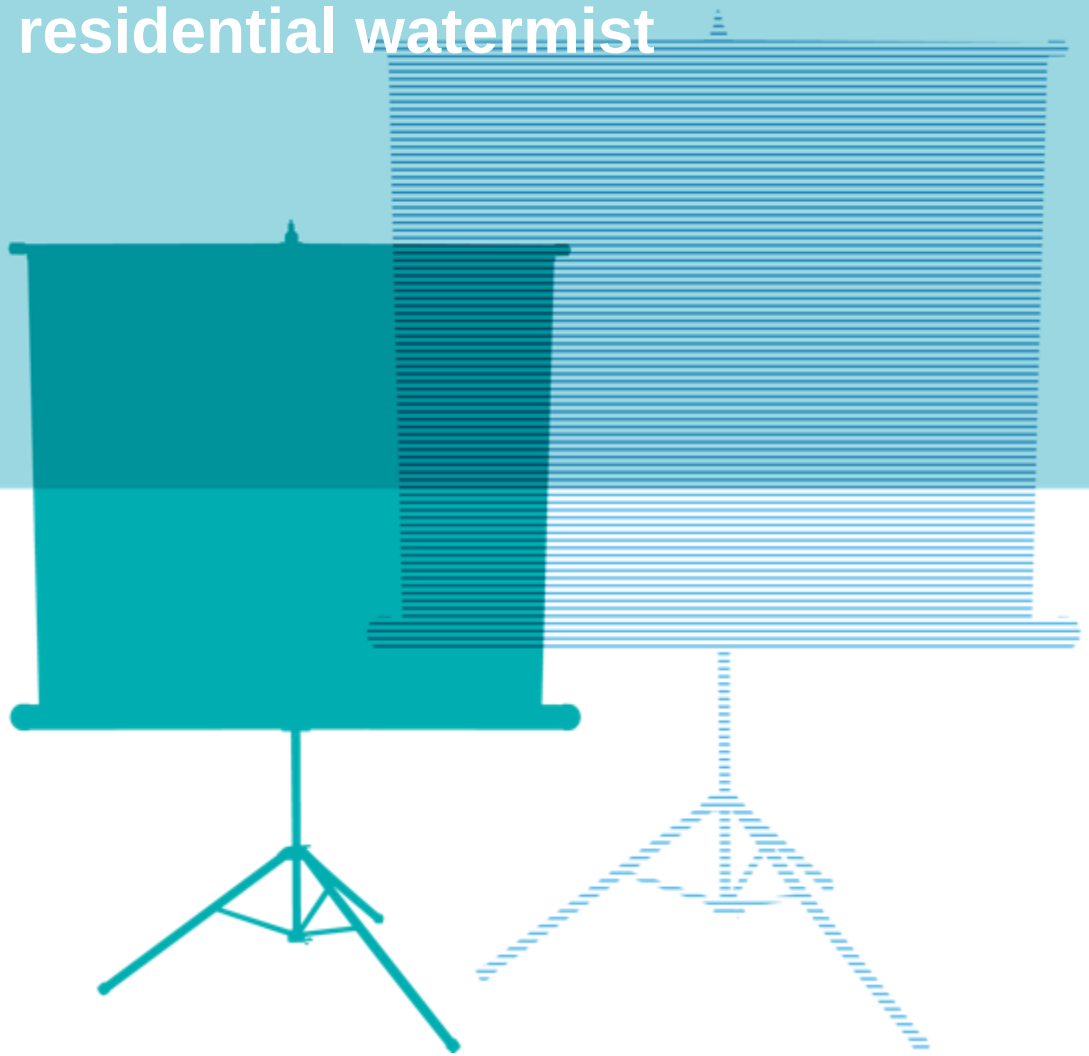
- Temperature criteria for timely operation
- Temperature criteria for compartment tenability
- Temperature criteria for suppression control, prevention of flashover, limited damage

Domestic and residential simulated furniture fire test

- Add video

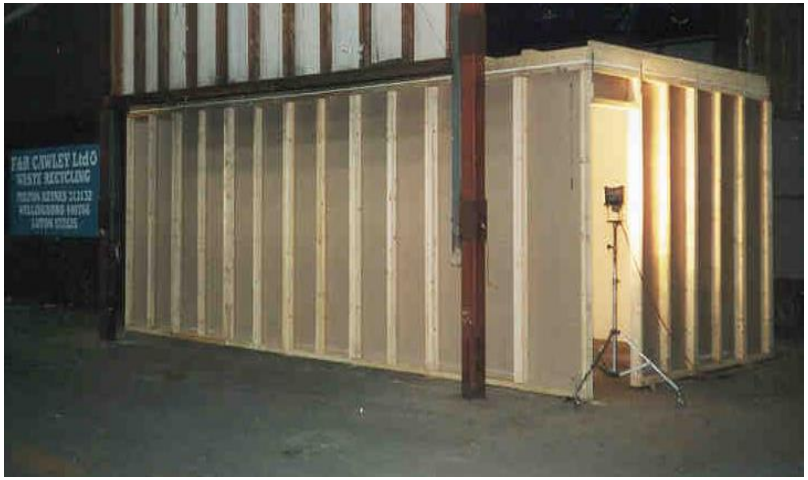
- http://www.youtube.com/watch?v=o8uNq1rOA-o&feature=c4-overview&list=UU1raz2K0b4YMPOZqmN-qBlA

Fire test protocol
for domestic and residential watermist



Fire test protocol

- DD 8458-1:2010, *Residential and domestic watermist systems – Part 1: Code of practice for design and installation*
- Fire test protocol based on fire test for residential sprinklers BS 9252
  - e.g. ceiling heights, nozzle locations, additives
- With additional consideration for:
  - fire load positions
  - ventilation conditions
  - ceiling height (optional up to 5m)

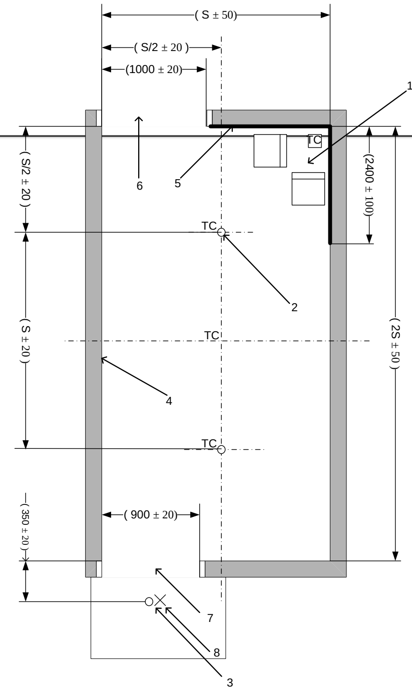


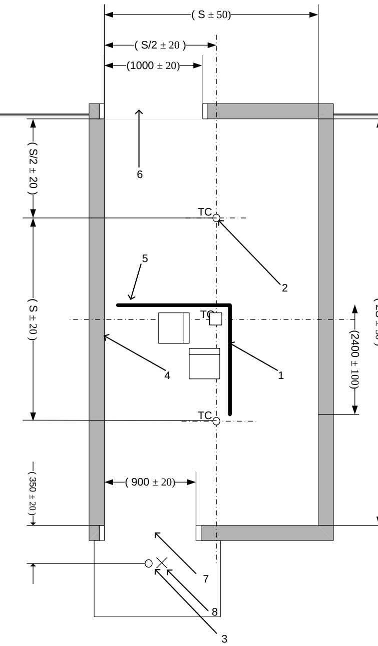
DD 8458-1 - test arrangements

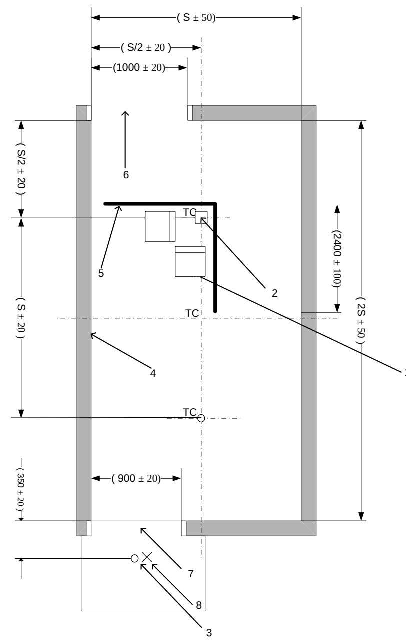
- 8 m by 4 m by 2.5 m high
- Two open doorways
- Two nozzles
- ‘Dummy’ nozzle near open doorway outside room
- Untreated plywood wall lining (12mm)
- Two polyether non FR-treated foam sheets
- A wood crib, eight layers of wood sticks on top of a heptane tray
- Cotton wicks soaked in heptane

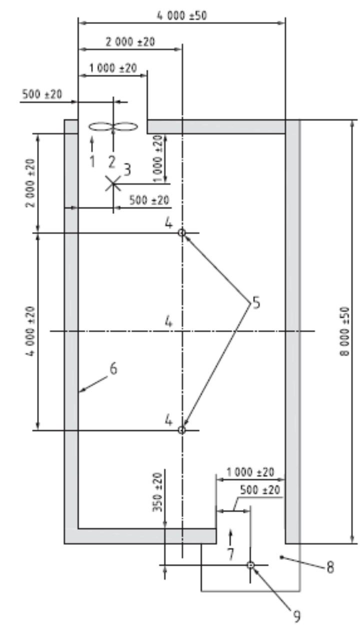
DD 8458-1 - five tests

- Corner
- Fuel package between two nozzles
- Fuel package beneath one nozzle
- Ventilation 1 – greatest challenge fuel package with ventilation
- Ventilation 2 – As per ventilation 1, but with the ventilation provided from the opposite end of the test room









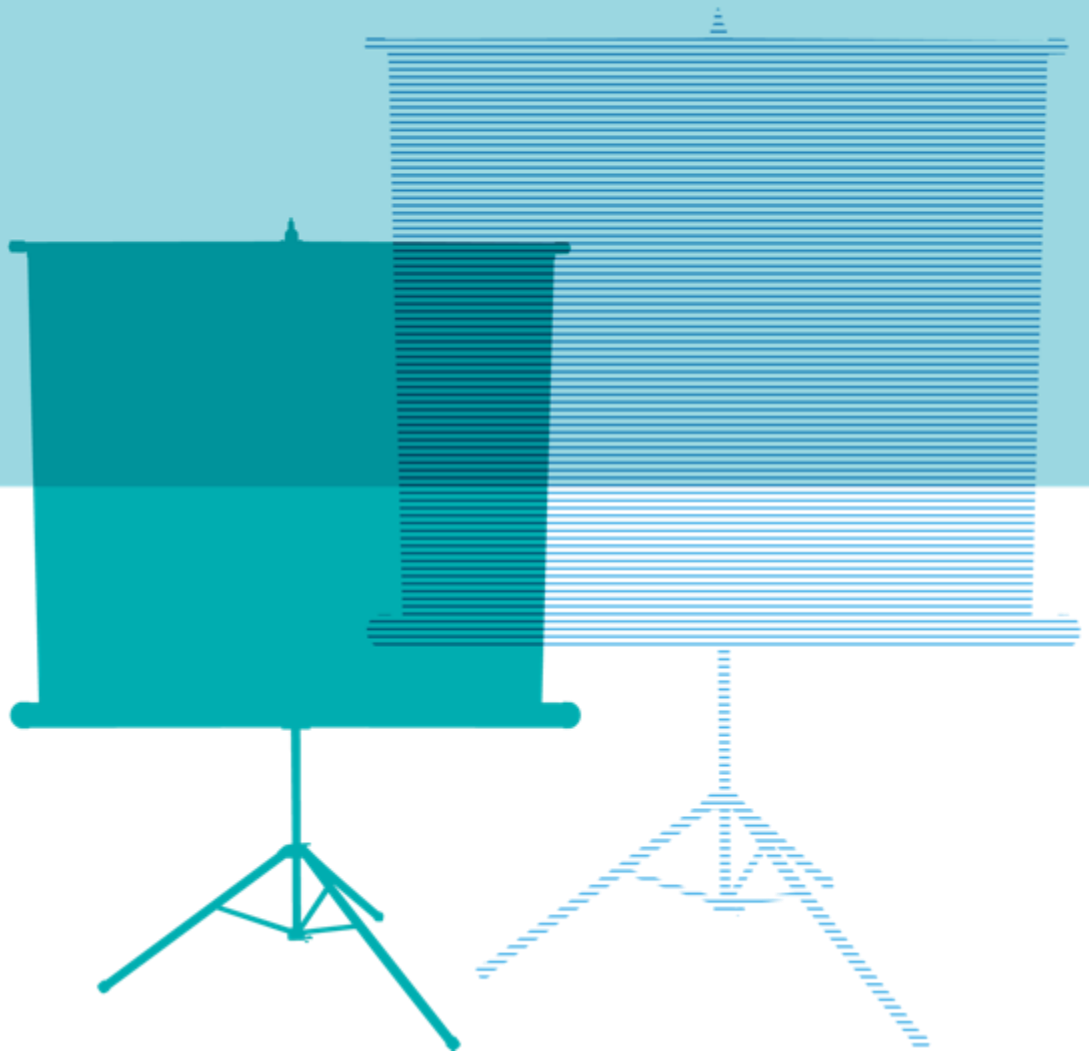
DD 8458-1 - acceptance criteria

- Control test fire for 10 mins (domestic) 30 mins (residential), after operation
- Acceptance criteria are:

Thermocouple location	**Maximum allowable temperature (^{o}C)**
75 mm below underside of ceiling	320
1.6 m above floor	95
1.6 m above floor	55 (for not more than any 120 s interval)
Ceiling temperature - embedded 6.5 mm above the underside of the ceiling	260

- Temperatures should be declining 2 minutes after operation
- Third ‘dummy’ nozzle, shall not operate

Approval



Specifer/approver requirements

- Understand watermist and understand fire
- Confirm scope of application - room type, floor area, ceiling height, ventilation, ‘standard’ fire load
- Inspect fire performance reports
  - Check test house credentials
  - Check test report compliance to scope and standard
  - Check watermist system details
  - NOTE: small differences in parameters (system or test) can make a big difference to the outcome
- Check design against standards and test report
- Check component tests and approvals
- Check installation and maintenance

Approval methodology

- Approvals are based on evidence
- Compliance with standards
- Assessment of staff, processes and systems
- Periodic audits, including testing as appropriate
- Listing and approval

LPCB watermist approvals

- Component tests
- System verification
  - Design methodology assessment
- Fire performance tests
- Certification assessment

Component tests

Water distribution nozzles Water control valves Water check valves Water pipe, fittings and couplings	Water pumps Water tank and valves Water flow, level pressure switches Water manifold	Water strainers and filters Water pipe hangers Manual release Water additive

- Examination
- Marking
- Strength test
- Internal pressure test
- Leakage test
- Corrosion tests
- Function tests
- Operation tests
- Long term ageing tests
- Thermal shock test
- Nozzle clogging test
- Pump running test

System verification

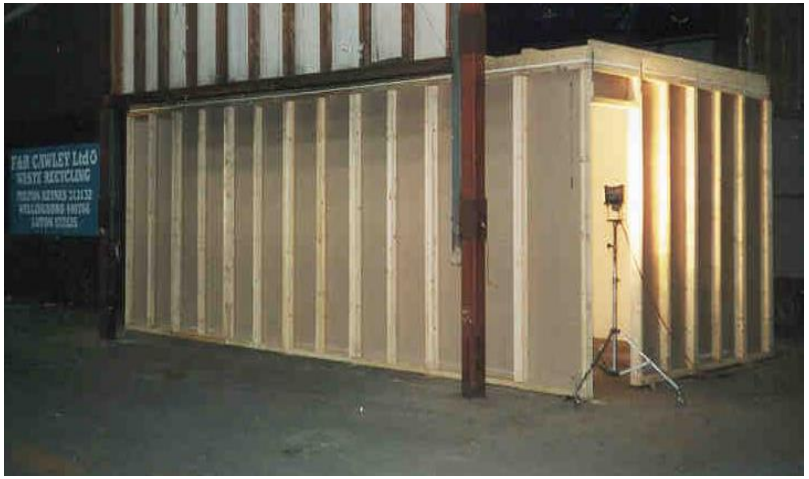
- Bespoke systems
- Design manuals
- Hydraulic calculations

- System verification tests
- Water delivery tests with complete watermist system

- Design methodology assessment
- Design manual review

Fire performance tests

- Manufacturers' watermist system
- Fire test protocol, DD 84589 part 1 (5 tests)
  - Simulated furniture
- Additional tests for maximum pressure and higher ceiling



Certification assessment

- Assessment of performance requirements of components, systems and fire tests against standardised methodologies
- Assessment of quality control, ISO 9001
- On-going assessments of product, system and management through regular Factory Production Control (FPC) and product audits.

Certificate and listing

- Product description
- Scope of application, for domestic and residential occupancies

Area type	Parameter	Limits
Bedrooms and sleeping areas Living rooms Kitchens Common rooms (some) Corridors Lofts	Floor area of compartment	32 m^2 or tested area
	Ceiling height	2.5 m or tested height up to 5 m
	Ventilation	≤ 1 m^3/s total, from any source
	Fire load	“Normal” layouts covered

Summary

- Watermist standard - based on comprehensive research and testing
- Watermist product testing - against application specific test protocols
- Third party approvals - increase confidence in product and system performance

Thank you

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Domestic and residential fire test video
(with and without sprinklers)

- BREVideoUK
- http://www.youtube.com/watch?v=o8uNq1rOA-o&feature=c4-overview&list=UU1raz2K0b4YMPOZqmN-qBlA