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Heat Collectors –will they work ?

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Why we use frangible bulb automatic watermist nozzles

- Heat from a fire forms a hot gas layer at ceiling /roof level.
- Automatic nozzles are mounted at ceiling/roof level so as to be ideally positioned to detect the rise in temperature.
- This heat build-up causes one or more frangible bulbs to shatter thereby allowing their respective nozzles to open and discharge watermist.
- Watermist is delivered to the seat of the fire
- Only the nozzles in the immediate vicinity of the fire will open.

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The Problem

- Hazards where the ceiling/roof is over 5m above the flammable /combustible materials.
- Frangible bulb operation is delayed as hot gas layer takes longer to develop.
- Larger fire develops before frangible bulb operates
- Distance from nozzle to fire may be too great for effective watermist penetration of the fire plume.
- Fire size may exceed the capability of the watermist system.

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Will heat collectors work?
Have they been tested?

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Can we bring automatic nozzles closer to the fire?

- Yes BUT!
- The rising hot air plumes warm the frangible bulbs relatively slowly, as the heat transfer mechanisms are poor.
- So - can we use heat collectors (as a false ceiling)?
- Will they work?
- Have they been tested successfully?

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Tyco testing

- Tyco approached by a car manufacturer
- Vehicle test shed
- 16m roof
- Fuel spill hazard

Test arrangement

- 4 nozzles –square array
- 3m centres
- 4.3m height
- 3mm 68^{o} C frangible QR bulbs.
- 9.2 x 9.2 x 7.2m high test enclosure
- 1.5m fire tray offset in the centre of the nozzle array
- Each nozzle fitted into a 900mm diameter, 140^{o} included angle, sheet metal cone with 50mm centre opening for the nozzle.

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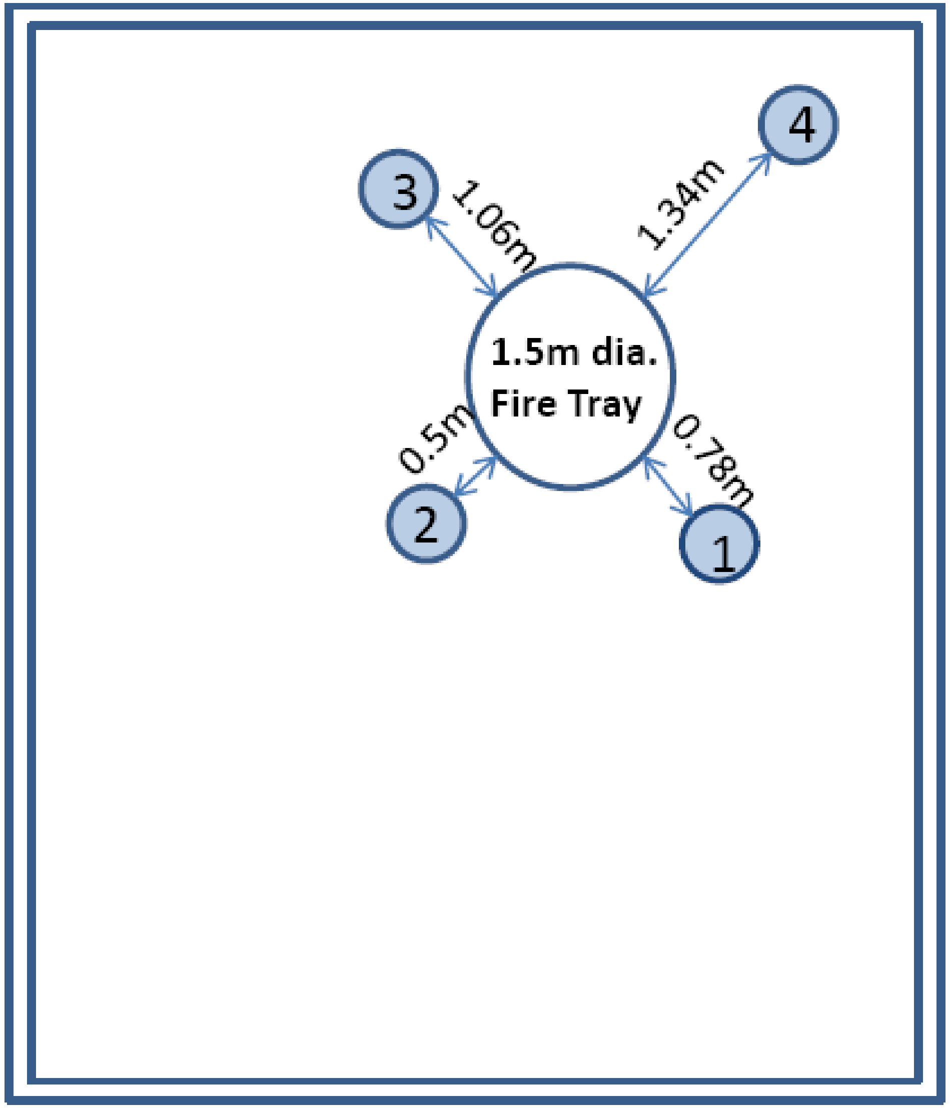
Plan of test arrangement



Instrumentation

- Thermocouples close to each nozzle
- Sensors on each bulb (to signal operation)
- Thermocouple above the fire tray at nozzle height
- Thermocouples on steelwork near roof level (6.6m)

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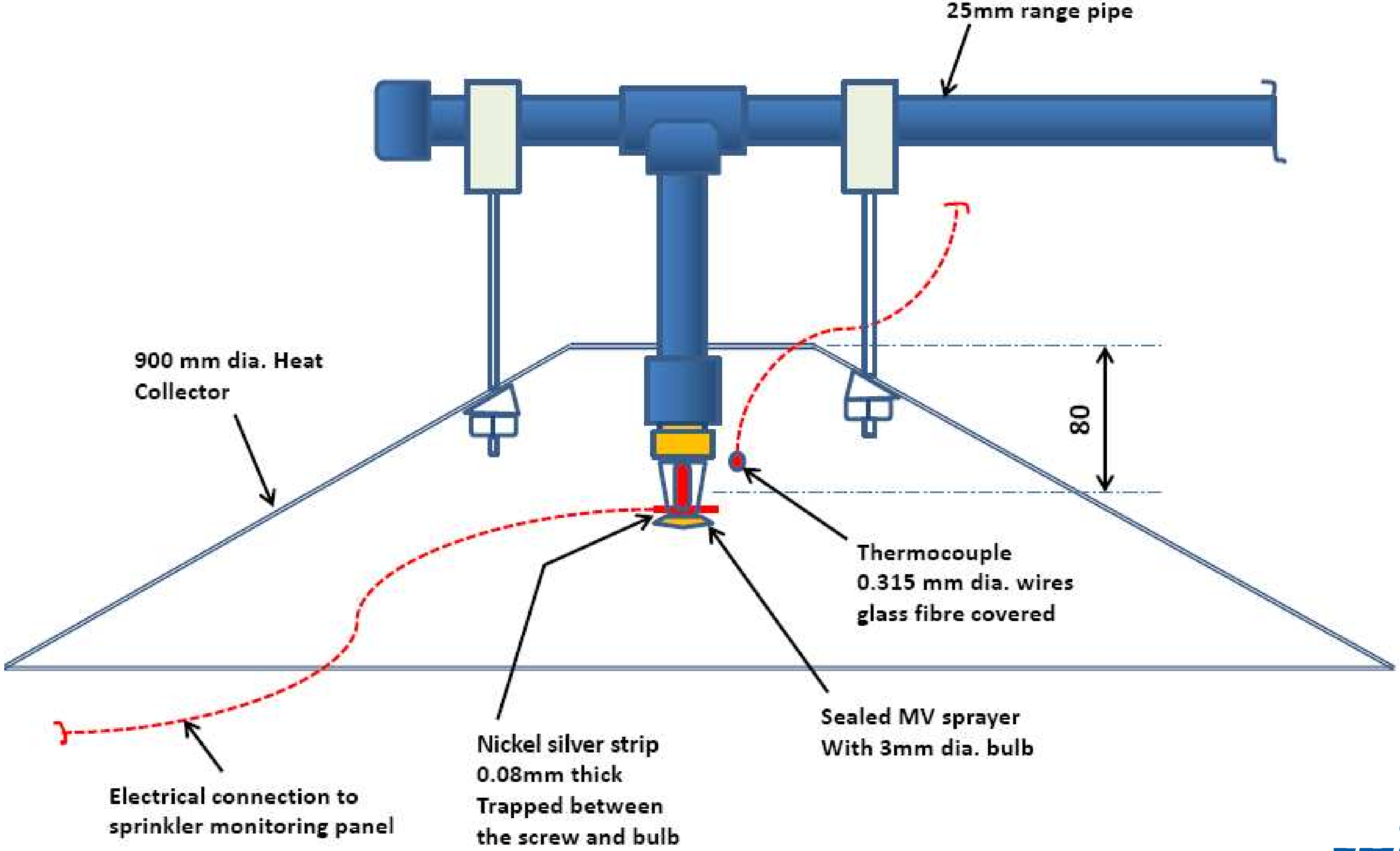
Arrangement of heat collector



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Test 1- dry test to evaluate detection
15 litres petrol -1minute 20 second full burn

time	comment
0.05	Flames steady, rising vertically
0.15	Temperature at 4.3m above fire 400^0 C
0.34	Nozzle no. 2 operated
0.45	Nozzle no. 1 operated
0.54	Radiant heat too great for personnel at 6m from the fire
1.15	Temperature at all four nozzles reach a maximum
1.23	Nozzle no. 3 operates
2.30	Roof steel temperature reaches a peak of 83^0 C
4.00	Fire burned out

Test 2 –wet test
40 litres petrol –2 minutes 50 second full burn

time	comment
0.12	Flames deviating towards nozzles 3 & 4 due to turbulence
0.16	Flames reaching roof level
0.25	Nozzle no. 3 operated
0.30	Nozzle no. 4 operated
0.43	Reduced burning rate due to nozzle discharge
1.16	Radiant heat reduced - personnel at 4.5m from the fire
2.50	Temperature traces show fire declining
4.00	Water turned off
4.30	Water turned on again
6.15	Fire out

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Test findings

- Both tests produced rapid detection / nozzle actuation times.
- In test 1 nozzles with the edge of their collectors 0.5m, 0.78, and 1.06m from the edge of the fire tray operated.
- In test 2 the discharge from the first two operating nozzles provided sufficient cooling to prevent further nozzles operating.
- The nozzle with its collector edge offset 1.34m from the fire tray did not operate.
- Test 2 peak steel temperature(projected) – 100^{o} C after 5 minutes.

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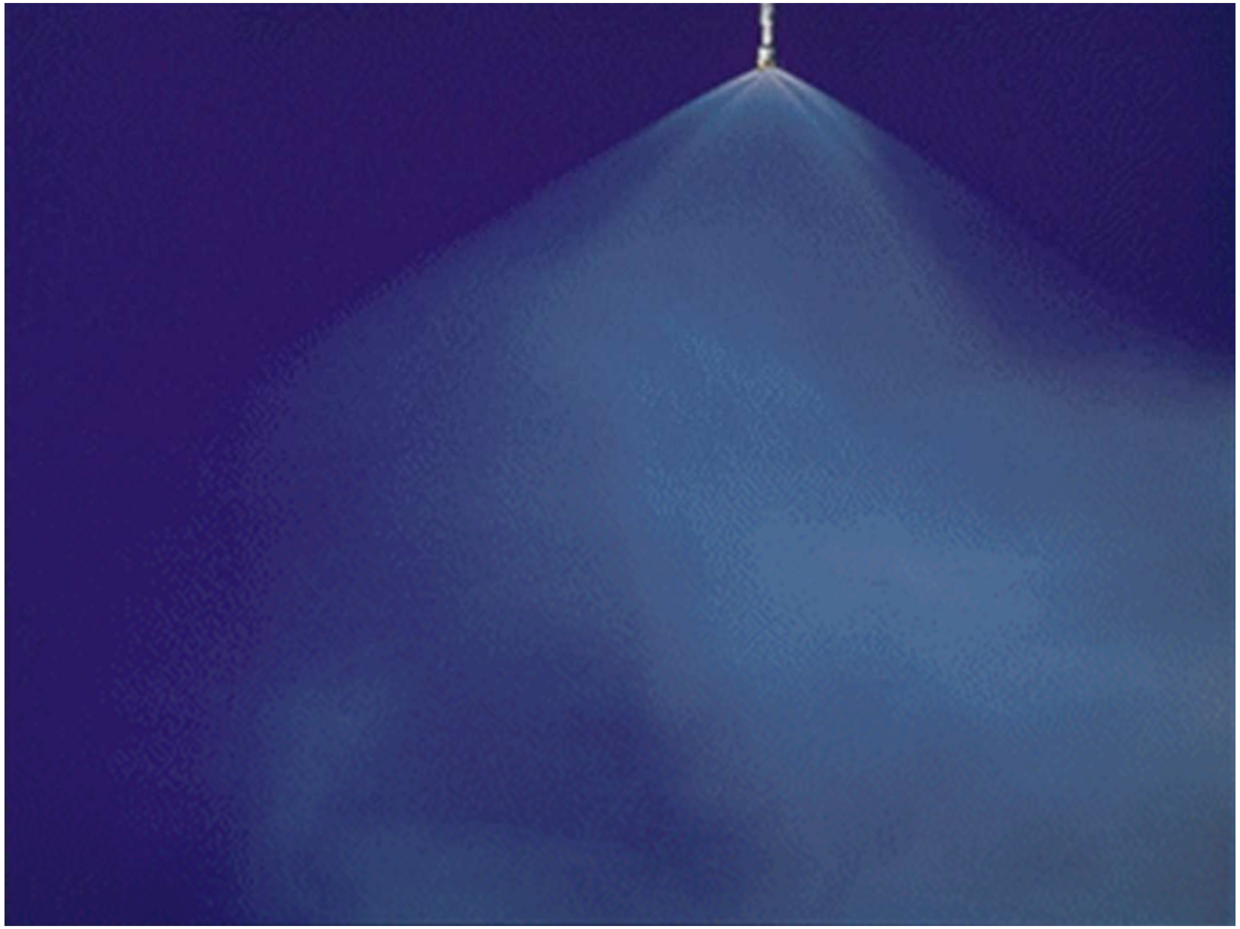
Conclusions

- The tests showed that automatic nozzles with suitable heat collectors can detect and respond to a fire, with a 1.5m diameter fuel tray, and nozzles 4.3m above and beyond the tray.
- The heat collectors need to be of sufficient size and shape to funnel heat past automatic nozzles.
- The heat collectors do not need to be directly above the fire source.
- Suitable heat collectors can provide effective detection below high ceilings.
- The size of fire and height of heat collector will affect the outcome.

Thankyou



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