

Low Cost Residential Sprinkler Tests

These tests were carried out on Tuesday 4th July at a property due for demolition in the Huddersfield area of Kirklees in West Yorkshire.

The tests were instigated by Mr Brian Mellor M.B.E. the Crime and Fire Prevention Co-ordinator for Kirklees Neighbourhood Housing. And carried out in partnership with West Yorkshire Fire and Rescue Service who assisted with the tests and recording of the event.

Aim

The aim of the test was to see how a low cost sprinkler installation dealt with a demonstration “front room fire”

Set up



Fig 1 External view of the house used in the test

The house to be used was a brick built 3-bedroom semi-detached council house that was due for demolition. The only services left connected to the property was the water supply and from this a supply pipe was to be run from the kitchen, up to first floor level, along the floor and then dropping two sprinkler heads in to the lounge below.

The system design was based on the Branz report¹ of August 2000. The system is not a stand-alone system, rather it is integrated with the domestic supply and does not conform with any current British Standard. The tests should be viewed only as a pilot study



Fig 2 Internal view of the lounge set up



Fig 3 Internal view of the lounge set up

The lounge was the only room in the building fitted with sprinklers, furniture was minimal being an armchair and settee with cushions, a small portable TV on a wooden table, some wooden dining room chairs and a draw unit. The room was fitted with carpet. Additional sundry items were used to enhance fire loading as both the chair and settee met current furnishing safety regulations, these were newspaper, some video cassettes and an upright vacuum cleaner.

A small amount of white spirit and lighter fuel was used at the start of each test to assist in development of a fire.

Two doors opened in to the lounge one from the hall and one from the kitchen, the lounge window had the central glass pane and the right side casement window glass removed.

Technical details

The system was designed by the Leeds company Armstrong Priestley and fitted by the Kirklees Building Services department, it should be emphasised again at this point that the system supplied and fitted was for a pilot study and did not attempt to conform to any standards.

From the supply inlet in to the property 28mm copper pipe was connected to a flow meter and then laid up the wall, through the ceiling, along a bedroom floor, through a wall and across another bedroom floor. Dropped pipework was then used to position two sprinkler heads in the lounge below.



Fig 4 Supply inlet and flow meter



Fig 5 The pipe installation above the lounge

Pendant sprinkler heads were used with red bulbs designed to activate at 68°C (unfortunately these were not residential sprinkler heads).



Fig 6 One of the sprinkler heads this one is in front of the chimneybreast

An inlet main pressure to the house could not be measured but indicated supply pressure from a hydrant via 70mm hose to a fire appliance pump in the road outside was indicated at 3.5bar. Flow rate was measured at 42 litres a minute through two heads.

A battery-operated smoke detector was placed in the hallway outside the door to the lounge at ground floor level.

Test 1

The first test placed the settee in the centre of the room approximately mid way between the two sprinkler heads some newspaper and cushions were placed on the settee (As in fig 2). The door to the kitchen was closed, the door to the hall was left open

Using a small amount of white spirit, newspaper at one end of the settee was ignited, flames were then seen coming from the top edge of the settee.

The smoke detector in the hall sounded after 18 seconds and the sprinkler furthest from the chimneybreast activated after 55 seconds.

The test was ended after 2 minutes 20 seconds when the fire was found to have been extinguished by the sprinkler system.

Conclusion

For a rapidly burning fire with a rapid heat build up the sprinkler system activated and worked very effectively. It is likely that had there being an occupant in the room they would have survived.

Test 2

The same furniture was used for this test as in test 1, as fire damage to it had been minimal. The source of ignition for this test was newspaper (and white spirit) but the armchair was placed in the corner of the right chimneybreast alcove. As far back as possible. The door to the kitchen and lounge were closed.

The smoke detector in the hall sounded after 20 seconds. The chair continued to burn with small flame for some time until the combustion modified foam and timber frame became involved. The sprinkler nearest the chimneybreast activated after 12minutes. 23 seconds the second head activated shortly after.

After 20 minutes the test was terminated by intervention of a fire crew using a hose reel as the fire was developing and both sprinklers had activated and were not controlling the fire.

Conclusion

The use of a combustion modified upholstered chair produced a slow build up of smoke and heat these products were initially dissipated via the front window of the property.

When the chair became more fully involved in fire the heat released was sufficient to activate both heads within a short space of time.

Critically the position of the chair in the alcove appears to have placed most of the chair in an area where the discharge from the sprinkler head could not penetrate due to the chimneybreast acting as a shield. Spacing the head further from the chimneybreast could have overcome this problem.

However it was noted that damage to the ceiling and other contents of the room was minimal and it is thought that the sprinklers did make a significant contribution in this area



Fig 7 Test 2 after fire, chimneybreast s to the left

It is unlikely that a person in the room of origin would have survived this intense fire but this did not develop until nearly 10 minutes into the test

Test 3

The same furniture was used for this test as in test 1. The item ignited was a small portable TV placed on a wooden table in the left hand chimney alcove (see fig 3). The door to the kitchen and lounge were closed and to reduce the heat loss boarding was placed across the open window to cover 2/3 of the opening from the top. A full crisp packet placed next to the TV was used as an ignition source.

The fire developed slowly at first with a thick smoke layer slowly descending. The smoke detector in the hall sounded after 5 minutes 17 seconds (upon opening of the lounge to hall door). The fire continued to grow and became obscured to observers by the thick smoke produced.

The sprinkler head nearest to the chimneybreast eventually activated and extinguished the fire. The fire had been confined to the TV on the table.

Conclusion

The sprinkler system activated and extinguished the fire. The acrid smoke produced from the burning TV is likely to have had fatal consequences for any occupant of the room, but activation of the smoke alarm and the sprinkler system would have allowed

time for escape from upstairs rooms where a continuing developing fire would have been life threatening.

Summary

Three tests were carried out and resulted in three actuations of the sprinkler system, although at varying times in the development of the test fires. The tests indicate that this type of system will work and is worthy of further development. Further development could address the issue of tenability in the room of origin, but what is not in doubt is that activation of the system would have enabled occupiers in other parts of the house time to escape safely. To be cost effective it would need to be installed at the new build stage, and it is hoped that an early decision on this matter could lead to installations being installed in the not too distant future.

References

- 1 Cost Effective Domestic Fire Sprinkler Systems
Branz, August 2000, New Zealand Fire service Commission Research
Report Number 1, ISBN Number 0-908920-43-1

Contacts

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Acknowledgements

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| 1 | Southdale Homes, House Builders | Permission to use site |
| 2 | Bradley & Homes Demolition Contractors | Permission to use site |
| 3 | Kirklees Building Services | Installation of Sprinkler System |
| 4 | Orbis Security | Site securities |
| 5 | Yorkshire Water | Advice on water supplies |
| 6 | Kirklees Metropolitan Council Insurance | |