

# BUILDING RESEARCH NOTE

## CENTRAL BUILDING RESEARCH INSTITUTE, INDIA

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### AUTOMATIC FIRE SPRINKLERS (FUSIBLE ELEMENT TYPE)

#### Introduction

Automatic sprinklers constitute a form of fixed, fire protection equipment in buildings. They consist basically of a heat responsive element set in a body with two yoke arms, a nozzle and a deflector plate. Essentially, they act as closures to openings in a pipe layout system charged with water under pressure and are designed to open when the temperature exceeds a predetermined level. When fire starts and hot gases accumulate near the roof (where these sprinklers are fitted) raising of the temperature considerably above the ambient makes the sprinklers open as soon as their designed release temperature is exceeded. Water discharges on to the fire in the form of a spray consisting of water droplets of different sizes (Fig. 1) (coarse droplets to penetrate the hot gas plume, fall on the fire and control or extinguish it and finer droplets, deflected sideways and upwards, to cool the hot gas layer) This cooling prevents opening of more sprinklers than necessary and reduces smoke and heat levels. Ideally, only a few sprinklers in the vicinity of the fire should open. The water discharge helps to control the fire even if it does not extinguish it altogether. Flow of water initiated by opening of one or more of the sprinklers causes an alarm to sound and the drop in pressure, occasioned by the flow, actuates a pump connected to the sprinkler layout which helps to raise and hold the pressure at the desired level. Although automatic sprinklers with fusible release element are being manufactured and are available in other countries, in India, only automatic sprinklers with quartzoid bulb release elements are being marketed by a well-known firm which is

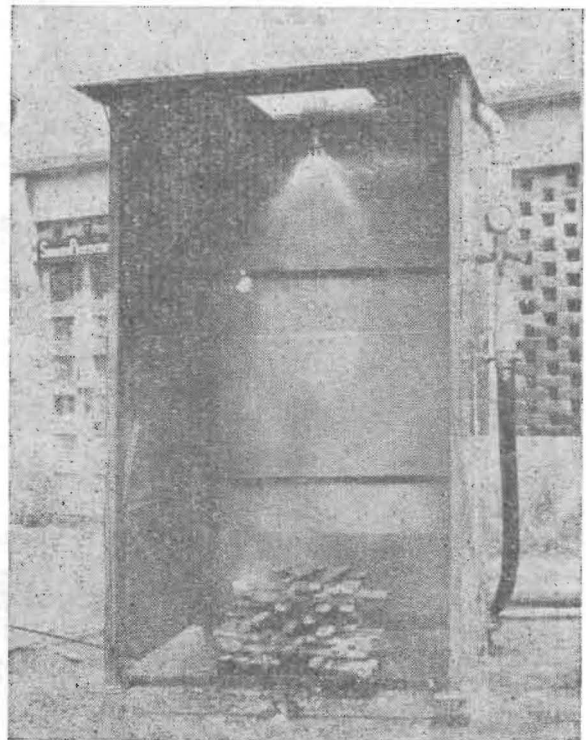


Fig. 1 Extinguishment of Fire by Sprinkler

believed to import the functional part viz., the, quartzoid bulb and fit it into sprinkler bodies manufactured in India. Automatic sprinklers with quartzoid release element are said to be suitable only when there is a preponderance of heat energy radiated from fire, whereas automatic sprinklers with fusible release elements of the type developed at this Institute are superior to the quartzoid bulb type as in most fires, convective heat transport and transfer processes predominate.

The automatic sprinkler with the fusible release element developed at this Institute (Fig2) thus fills a felt-need for sprinklers of this type. It should be cheaper to manufacture than the quartzoid bulb type and should be readily acceptable by users. Its relative cheapness would permit its wider adoption and help to promote fire protection and fire safety measures in buildings of all types. This sprinkler has other advantages over sprinklers of similar type being manufactured and marketed in other countries. The number of parts in the release linkage mechanism has been reduced to the minimum and the nozzle or orifice part has been separated from the body so that it can be replaced separately unlike any other sprinklers of the same type in use in other countries where the sprinkler requires to be replaced as a whole.

The automatic sprinkler with the fusible release element developed at the Fire Research Division,

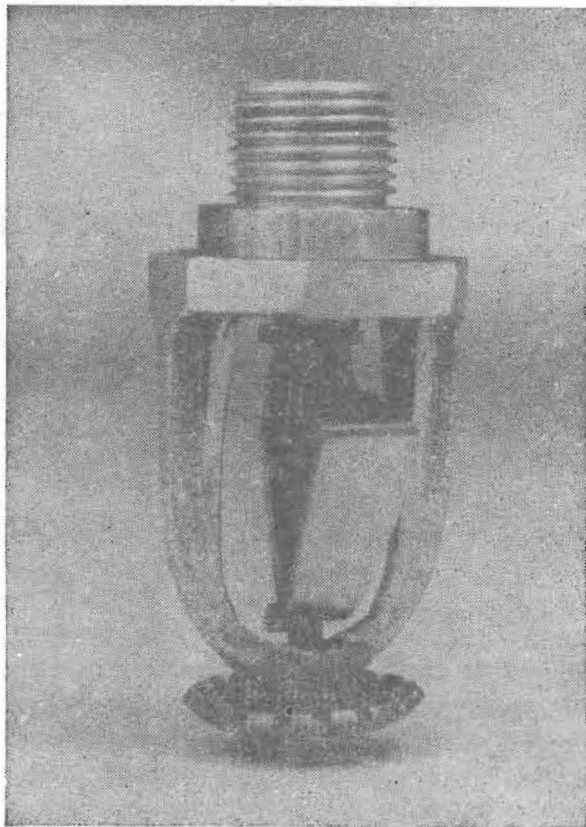


Fig. 2 Automatic Fire Sprinkler (Fusible Element Type).

Central Building Research Institute, will be cheaper not only in capital cost but also in running expenses as only parts have to be replaced and not the sprinkler in its entirety.

### 1. Product and its Application

Automatic sprinklers, as explained earlier, constitute a vital fixed fire protection measure in Industrial high rise buildings. Being automatic in operation, they eliminate the human element which is prone to failure. They act as fire detectors as well as fire extinguishers and help to hold the fire in check. Attacking the fire at its formative stage and reducing the smoke and heat levels as they do, they render the task of the fire fighters easier. Again, preventing spread of fire through their early action, they reduce fire losses. In locations such as basements, where smoke logging can occur, and on floors in high rise buildings beyond the reach of municipal fire fighting equipment, they are not just desirable but are a must. A fully sprinklered building which is provided with automatic sprinklers not only in difficult locations but on all floors is a 'safe' building, as the record of automatic sprinklers in early fire attack and control is a creditable and enviable one.

### 2. Demand Potential

Growing fire consciousness and increasing fire safety appreciation in the country coupled with intensified regulatory activity are bound to promote installation of automatic sprinkler protection on a wider scale. Availability of an indigenously developed and manufactured sprinkler with cheaper installation and operational costs should positively assist sprinklerization of all types of buildings in general and industrial and high rise buildings in particular. Liberal incentives being offered by the Tariff Advisory Committee and the General Insurance Corporation of India for sprinklerization will help stepping up the market and demand potential.

### 3. Performance Requirements

Automatic sprinklers are required to meet the Indian standard specification IS : 1972-1981.

Important performance requirements are that.

- (a) the sprinkler remains watertight when fitted in the piping layout opening with a water pressure of 25 bars acting on it (Fig. 3).
- (b) the sprinkler possesses a 'time-constant' of  $1\frac{1}{2}$  to  $2\frac{1}{2}$  min when this is determined in a prescribed manner (Fig. 4).
- (c) It opens without 'lodgement' of peices of such size that can obstruct the flow and water stream break-up when subjected to an ambient temperature which rises to  $250^{\circ}\text{C} \pm 20^{\circ}\text{C}$  in  $1\frac{1}{2}$  min (Fig. 5) and,
- (d) it satisfies a prescribed water distribution test (Fig 6).

#### 4. Novel Features

- (i) Responds faster and has a time constant of the order of 1.8 min. only.
- (ii) Replaceable nozzle avoids whole body replacement.
- (iii) Number of operating parts reduced to minimum.
- (iv) Wider coverage

- (v) Cheaper and easy to fabricate
- (vi) Satisfies FOC Requirents
- (vii) Import Substitute.



Fig. 3 Leak Resistance Test Apparatus

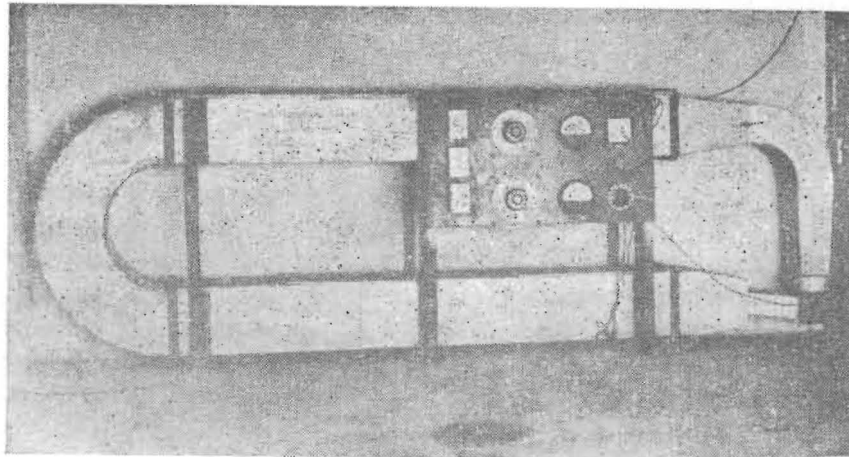


Fig. 4 Closed Circuit Wind Tunnel for Thermal Test

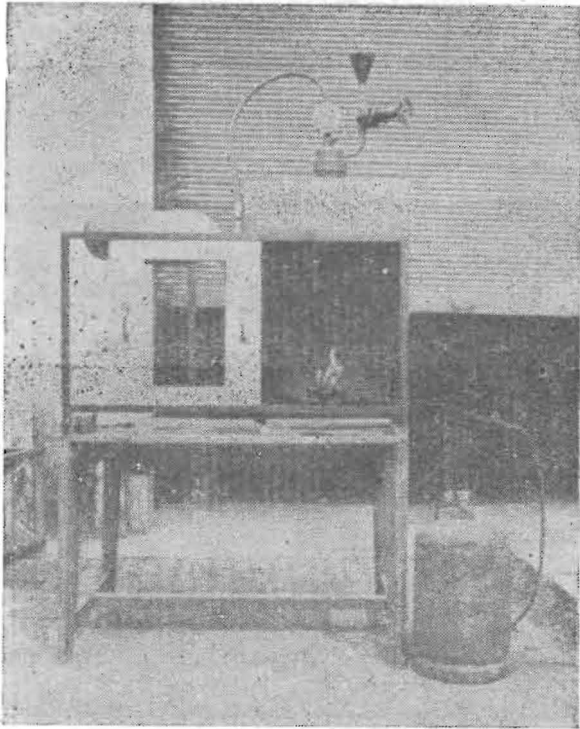


Fig 5 Functional Test Oven

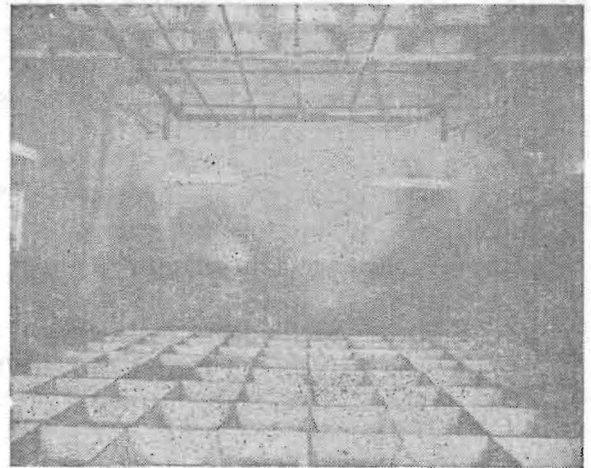


Fig 6 Distribution Test Set-up

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Prepared by : A.K. Gupta,  
S.B. Gupta and Gopal Krishan

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