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FIRE PROTECTION HISTORY-PART 26: SPRINKLER CORROSION (1902)

By Richard Schulte

Among the presentations made at the sixth annual meeting of the National Fire Protection Association (1902) was a presentation on the corrosion of sprinklers and sprinkler solder. The following is the text of this presentation:

"***COMMITTEE REPORT ON CORROSION OF AUTOMATIC SPRINKLERS AND SPRINKLER SOLDER.***

H. A. Fiske, Chairman.

The subject of corrosion of sprinklers and sprinkler solder has been before this Association for several years and we have already in our discussion covered the ground more or less thoroughly. In this report your committee has simply attempted to give a brief summary of the subject.

Numerous corroded sprinklers have been removed from risks in the past for test, and these tests have given us some experience with various types of corroded heads when subjected to heat, as in hot oven or water bath tests.

A year ago sample sprinklers and solder were submitted to the Professor of Chemistry at the Massachusetts Institute of Technology, and laboratory tests were made covering the various corrosive agents and their effect both on the sprinkler itself and the sprinkler solder. These tests were of a preliminary nature and were not carried far enough to be in any way conclusive, but are of some value in connection with the practical experience we have had in the field. During the past year, the Underwriters' Laboratories have subjected various types of sprinklers to corrosion tests, with special reference to the crippling or non-action of these sprinklers due to this corrosion. Add to these tests the field experience of many of our members and we have sufficient data to enable us to make certain general statement bearing on the subject.

While it would be interesting to know just what action takes place when sprinklers are subjected to various corrosive influences, our problem really deals with the practical side of the question only, that is, the mechanical effect of the corrosion upon the sprinkler head in its relation to the proper action of the sprinkler at the time of fire.

We find that corrosion of the automatic sprinklers may effect fire protection in two ways:

First, by weakening the sprinkler so that it breaks apart, thus, temporarily at least, putting the system out of commission while new sprinklers are being installed, and also introducing other undesirable features and throwing discredit on the system as a whole.

Second, by affecting the sprinkler so that it either fails to operate entirely in case of fire or its proper action is retarded.

Generally speaking, the various types of sprinklers in use are similar in their construction features and are similarly liable to be affected by corrosive influences. The metal of which they are composed do not differ materially, and the solder used is practically the same in all cases, except that this, of course, varies with high and low test heads. The sprinkler rules state that automatic sprinklers must contain no iron, steel or fibrous material subject to the effect of corrosion. This means that in practice we find sprinklers constructed of brass or similar alloy. While it is true that some types are comparatively less liable to fail when subjected to corrosive influences than others, that they are all rendered useless when such influences are at all severe, so that in dealing with this problem of sprinkler corrosion we can place all of the well-known types of sprinklers in one general class, in that they are none of them in any sense corrosion-proof.

We also find that the sprinkler solder itself is in many cases attacked, with the result that either a part or all of the solder is changed. This change in its composition may be in the nature of a general disintegration, which in time causes the solder to lose its strength, or it may be a change in only one of the metals of which the solder is composed, thus raising the melting point, or the change may consist merely of a surface incrustation which may have sufficient strength to hold the sprinkler parts together even after the unaffected solder underneath melts at the proper temperature.

In a majority of cases the corrosive vapors act more or less on the automatic sprinkler itself, and the effect is to entirely prevent the operation, this being due to the sticking or holding together of the parts rather than to any change in the solder. This leads us to the conclusion that as it does not appear feasible to make a sprinkler of absolutely non-corrosive material, nor has any sprinkler been submitted which is not susceptible to the action of corrosive vapors, the problem becomes one of protecting the sprinklers by means of a coating or covering rather than attempting any change in the construction of the sprinkler.

All that we can expect of the ordinary sprinkler head is that it will withstand mild corrosive influences, which would, generally speaking, do little more than discolor or roughen the surface of the head, and our laboratory tests go to show that most of the sprinklers now being installed are satisfactory in this respect, although in several instances changes have been asked for which will improve the head and render it less liable to stick.

In practice, we find a large variety of corrosive influences, and these influences and the conditions under which they exist are so variable that it seems difficult, if not impossible to obtain any data which will enable us to judge as to just what action will take place in any particular instance. What study we have made of the various corrosive agents and their effect on the sprinkler and the sprinkler solder also shows that the action varies with different sprinklers.

While the danger of corrosion is present in a great many classes of risks, still it appears true that this danger generally exists in only a small portion of the plant, and it is often the case that these portions constitute the damp or less hazardous part of the risk.

We find that it is not general safe to depend on visual inspection of the head, for oftentimes corrosion appears to be severe and yet the sprinkler is not rendered inoperative. On the other hand, what looks like comparatively slight corrosion will sometimes prevent the sprinkler from operating, so that wherever corrosive influences exist the sprinkler should be carefully watched and tests should be made as soon as there is any appearance of corrosive action.

Methods of determining whether sprinklers are seriously deteriorated in practice will be discussed in the report on the Committee on Field Practice.

Concerning the question of protecting a sprinkler against corrosive influences we feel that it is thoroughly practical to protect sprinklers by means of a wax-like coating, which will be effective in most if not all cases where the temperature is not too high to allow the use of the ordinary low test sprinklers, and this has already been proven by actual use, as well as laboratory tests.

It is essential that such a coating have proper adhesive qualities and be able to withstand the expansion and contraction due to varying temperatures without cracking or peeling; also considerable care is necessary in their installation to prevent scraping off any of the protective coating.

This entire question is now in the hands of the Laboratories and several coatings have been already submitted for test. The Committee on Devices will some time in the near future report their findings on each of the specific coatings. They will also take up the subject of protecting the sprinkler against dust and gummy vapors or compounds. There will then still remain the question of protecting high test sprinklers against corrosion, for at the present time, so far as the committee is aware, there is no satisfactory coating or protection for use with such high test heads.

Assuming that it is possible to coat a sprinkler so as to protect it against corrosion and not affect its sensitiveness, we can require such coated heads to be installed in all places subject to corrosive influences and thus obtain satisfactory sprinkler protection.

We cannot leave this subject without a word of caution against numerous so-called protective agents which have been used in the past, and which, in most cases at least, have proved of little value. Some of the more familiar of these are lead coating, nickel plating, coating with asphaltum or similar paint or paraffine. All metal coatings, such as are obtained by dipping or plating, will, generally speaking, be found defective, owing to the fact that such a coating is of a granular or spongy nature and not homogeneous. Vapors gradually work through such a coating and attack the metal underneath. This is also true of compounds like asphaltum paint, and corrosion takes place under the paint.

In order that any coating may property protect the sprinkler, it must form a perfect covering which will not allow the corrosive vapors to pass through it and must not be attacked by the vapors themselves. The melting point of any coating must be sufficiently high to allow its use in warm rooms or in any locality where it is safe to use the ordinary low test head.

The subject of proper fusing point for hard heads was referred to this committee, and we would report that we would consider it advisable to have four different melting points, as follows:

"Ordinary," 160 to 165°F; "intermediate," 200 to 225°F; "hard," 275 to 300°F; "extra hard," 360 to 400°F. The sprinkler when tested in hot fluid should not fail to operate between the limits named.

Each type except the "ordinary" to have the base colored with enamel paint, as follows:

Silver for the "intermediate."

Blue for the "hard".

Red for the "extra hard."

Also strut to be marked with the temperature of the solder and the date of manufacture.

Mr. Cabot. I move that the report be accepted and referred to the Executive Committee and printed.

Source: *NFPA Proceedings*, Volume 1901-1903

In the early days of sprinkler protection, industrial occupancies were the primary location where sprinklers were provided. Given the techniques utilized in manufacturing processes at the time, corrosive atmospheres were common. Hence, the problem with sprinkler corrosion.

What is most interesting about this presentation is the temperature ratings of the sprinklers proposed. Essentially, these are the same temperature ratings utilized today.

Also note the color coding scheme proposed for sprinklers with various temperature ratings.

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