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FIRE PROTECTION HISTORY-PART 121: 1953 (SPRAY SPRINKLER RULES DISCUSSION)

By Richard Schulte

The fifty-seventh Annual Meeting of the National Fire Protection Association was held at the Palmer House Hotel in Chicago in May 1953. Perhaps the most important issue discussed at the technical sessions of this meeting was the major changes to NFPA 13 be introduced at the meeting. These changes involved a revolution in sprinkler protection-the spray sprinkler.

The following is the text of commentary made on the proposed provisions for spray sprinklers made by Wilbur Stump, an engineer with the Bureau of Yards & Docks, United States Navy:

> "*Mr. W. D. Stump (U. S. Navy Dept., Bureau of Yards & Docks): Mr. President, there are several comments I would like to make. Since receiving the preprint of these rules, I have studied them at some length and I have a number of suggestions to offer.*
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> *Specifically, I object to increasing the load on the 6-inch risers from 250 to 275 heads. This is a line that has gradually over the years been getting up and up and up until now we are at the 275 limit. Back some 30 years ago when I first became acquainted with this thing, we had 200 and it finally crept up to 250, where they said, "Well, that is it. No more additions." But gradually they have allowed amendments to that and now we are adding another 10 per cent. Well, after all, pipe can only carry a certain quantity of water at a given pressure and it never carries more as it ages, because it corrodes and the pressure losses increase. We once-upon-a-time took out 8-inch systems. Now, we are putting them back and giving our blessing to them, and it seems to me that that is a strictly undesirable thing, to allow 400 heads on the 8-inch system, for the reason that when you have to shut one of them off, you have got a very large area unprotected, and it has always been very undesirable to do that. I can't see why it should be permitted now. In my opinion our thinking in the first place to eliminate the 8-inch system was good and I have no evidence at hand, to indicate any necessity for going to the 8-inch system except in some special cases.*

I also would like to object to the amendment to Article 521 which permits malleable iron fittings and other fittings, of other materials, not specified, and the only limitation that is put on it is simply that they must be specially designed for sprinkler work. Now, actually, we don't have a standard design for sprinkler fittings and this business of malleable iron fittings, I can tell you some very sad experiences on; and if they are not banded fittings, it is darned near impossible to make them hold.

Another thing that I object to is accepting a standard weight malleable fitting up to 300 pounds.

Now we come to the crux of the matter, Section 14. I feel that this particular section is entirely unrealistic and it is almost entirely based upon theoretical considerations, backed up by a number of laboratory results. Without depreciating at all the value of laboratory experimentation and tests, I don't believe that there are any of us smart enough or having imagination enough to set up in the laboratory, comprehensive and completely representative fires such as you will find normally in practice. I think in the complete absence of field experience with these sprinklers, this change is much too precipitous. In my opinion, it is unwise to the extent to which the apparent increase in efficiency of the spray sprinkler has been dissipated by the wider spacing. I think to permit a reduction in discharge density to approximately one-tenth of a gallon per square foot per minute for all ordinary occupancies or ordinary hazard occupancies in your fire-resistive class is not only unwise but dangerous. The fire load in many of the ordinary hazard occupancies is very heavy, even up to as high as about 500,000 B. T. U's per square foot. That produces an awful lot of fire. With existing pipe sizes which we are to use, the discharge from these heads will be very widely non-uniform and with ordinary pressure water supplies as well as multi-story buildings, it seems to me that it will be absolutely futile for us to expect deliveries of water, even up to 500 gallons a minute.

A case in point might be ordinary storage risks. Under our new storage rules 19-foot high piles are permitted. That is a serious situation from a sprinkler standpoint, as I can testify, since we have been having to accept four-tier piling, not on 25,000 cubic feet, but on a 4,000 square foot area. But, nevertheless, the same situation is involved in very high piling. Without belaboring the point, however, I suggest that you should examine the hydraulics of the ordinary hazard sprinkler system of a common type which has been looked upon in the past, at least, as a very efficient method of arrangement. I refer to the center feed type of layout with, let us say, 8 heads on either side of your feed main. If you were to calculate fully such a system using the maximum allowable spacing of 15 feet, you would find that the pressure loss would be such as to produce a tremendous variation in water discharge on the heads on the branch lines with the variation becoming accentuated and accelerated as the pressure at inlet on succeeding branch lines becomes higher and higher due to the pressure drops and the rapidly increasing delivery per head. The area that could be covered by a given quantity of water would be severely reduced and the required residual pressures in the underground would become impractically high.

I can testify to that as I have had occasion to check the delivery capacity of standard sprinkler systems and the figures absolutely amazed me. We have designed some high delivery systems and installed them where the required amounts of water to be delivered were, of course, much higher than we would expect to find, but still the size of pipes that were necessary to deliver that water were enormous.

It seems to me, as a general proposition, that it is inane, with this rule book, to reduce sprinkler design and installation closer and closer to rule-of-thumb, or perhaps you might term it the acme of a plumber's delight. We have learned a great deal about sprinkler performance over the years and have the knowledge and the capacity to develop and design automatic sprinkler systems to meet nearly any condition. This admittedly requires a modicum of engineering skill and knowledge, somewhat, perhaps, above that possessed by a plumber's helper. As a consequence, however, we throw all of that overboard and develop this pamphlet along rigid and largely inflexible lines and accept sprinkler protection which is intended to fit only the minimum conditions and, notwithstanding the fact that we are already offering only marginal protection in many of the occupancy situations, we continue to fool ourselves that we can continue to enjoy the favors of Lady Luck and consider any protection suitable upon which we can put the label, Sprinklered Risk.

Those, gentlemen, are my comments, for what they may be worth. I know that I am going to be compelled in my work to amend this section of Pamphlet 13 severely in order to offer our facilities satisfactory and suitable sprinkler protection because of the weight of combustible materials and the values which are involved in our buildings. Thank you."

Mr. Stump's comments regarding the proposed changes to NFPA 13 are rather interesting. The point regarding the fact that we lacked field experience with the use of spray sprinklers in 1953 was indeed correct, however, the same could be said about sprinkler protection when it was first introduced. Is testing in the laboratory a substitute for field experience? Apparently, in the case of the spray sprinkler, the answer to that question was yes. The spray sprinkler has been in use now for 60 years and the field testing over this period has indicated that the performance of the spray sprinkler is more than adequate.

Perhaps of more importance were Mr. Stump's comments regarding the sprinkler installation standard itself. The standard itself was indeed a "cook book" on how to design and install a sprinkler system. Rather than rely on engineering calculations to determine the size of the piping system supplying the sprinklers, the sprinkler installation relied exclusively on the pipe schedule to determine pipe sizing. The use of hydraulic calculations to determine the size of the system supply piping would have to wait for about another 20 years.

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Source: "*Proceedings of the Fifty-seventh Annual* [NFPA] *Meeting*", Chicago, Illinois, 1953.