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THE EFFECT OF REPEATED CHARGING AND DRYING ON THE PERCOLATION OF WATER THROUGH UNLINED FIRE HOSE

by

D. W. Fittes

SUMMARY

The percolation from unlined fire hose was found to increase with repeated charging and drying, although the amount of increase varied somewhat between the different makes of hose tested. The percolation from new fire hose was found to give some guide to its behaviour in subsequent use.

The acceptance limits for the percolation from new unlined fire hose, as specified in B.S. 2599 : 1955, were examined and possible adjustments are indicated.

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Fire Research Station, Boreham Wood, 'Herts.

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THE EFFECT OF REPEATED CHARGING AND DRYING OF THE PERCOLATION OF WATER THROUGH UNLINED FIRE HOSE

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Introduction

A knowledge of the variation of percolation from unlined canvas fire hose with repeated wetting and drying is necessary if a test on new hose is to give a guide to the percolation to be expected in service. This report describes tests which were made to investigate how the percolation through the hose varies with repeated charging and drying.

Method of test

Four makes of $2\frac{3}{4}$ in. diameter hose, A, B, C and D, were tested, three lengths each of A, B and C and one length of D being used.

The hose was repeatedly subjected to the following cycle of operations. One end of the hose was blanked off and the other connected to a water supply. A 12 ft portion of the hose was then isolated in a trough. The pressure in the hose was raised steadily to 100 lb/in? in two minutes, and was subsequently maintained at this value. The quantities of water percolating in 5, 10, 15, 25 and 35 minutes after the steady pressure was attained, were measured.

Before each cycle the hose was conditioned in an atmosphere at 40°C with a relative humidity of 60 per cent.

Results and discussion

The percolation in the two 5-minute periods from the 6th to the 10th and the 15th to the 19th minute, has been analysed; the former will be referred to as the "initial" percolation and the latter as the "final" percolation.

A typical curve of the variation of rate of percolation with time for a new hose is shown in Figure 1.

The effect of repeated charging and drying on the initial and final percolation is shown in Figure 2 and Figure 3, respectively. Inspection of these figures shows that both initial and final percolation tend to increase from cycle to cycle for all the makes of hose tested. It can also be seen from these figures that the greater the percolation from a new hose, the greater in general is the actual increase in percolation from cycle to cycle. The proportionate increase in percolation is, however, approximately the same for all the makes of hose tested.

A comparison of the initial percolation in each cycle with the initial percolation in the first cycle is given in Figure 4. Comparison of the final percolation in each cycle with the final percolation in the first cycle is shown in Figure 5. The average of all values available at each cycle (i.e. ten values in each of the 1st to 8th cycles inclusive and four values in each of the 9th to 18th cycles inclusive) was taken and best statistical straight lines were derived for Figures 4 and 5. The derived lines suggest that after eight cycles the initial percolation is likely to be 3.2 times, and the final percolation 3.5 times, that in the first cycle. The indication from samples C and D would be that percolation appears to increase steadily even after eight cycles.

Estimation of water lost by percolation

Figure 6 shows the probable proportion of water lost by percolation, assuming the following arbitrarily chosen conditions:-

Diameter of nozzle	$\frac{3}{4}$ in,
Length of hose	300 ft
Mean pressure along hose	100 lb/in. ²

The expected water delivery, if there were no percolation losses, under these conditions would be about 120 gal./min. Curves are shown for hoses having the greatest and least rates of percolation, (A and D respectively) during the first and eighth cycles. Two points corresponding approximately to the maximum permissible leakage from new hose as laid down in British Standard 2599 : 1955 for Flax Canvas Unlined Hose are also shown.

Acceptance limits for percolation

The initial and final percolations during the first cycle from three lengths of each of six makes of hose have been statistically analysed, and showed that the present British Standard limit for final percolation was rather more stringent than that for initial percolation. In Table 1, alternative limits in statistical balance are given; thus line (a) gives the existing limits, line (b) the existing initial limit and statistically equivalent final limit, line (c) the existing final limit and statistically equivalent initial limit, and line (d) the limit corresponding to the performance of the six makes of hose, based on a 95 per cent confidence level.

	Initial percolation Gal, in 5 min, period	Final percolation Gal, in 5 min, period
(a) Present British Standard limits	3 . 00	1.33
(b) Present British Standard initial limit and corresponding final limit	3,00	1.60
(c) Present British Standard final limit and corresponding initial limit	2,40	1°° 33
(d) Limits based on six makes of hose	2.91 ^ж	1 _° 55 ^۳

Table 1 - Existing and suggested percolation limits (new hose) on a 12 ft length of hose

These limits are based on a confidence level of 95 per cent, i.e. of a large number of tests on hoses of similar quality to those analysed, 95 per cent of the results can be expected to lie below these values.

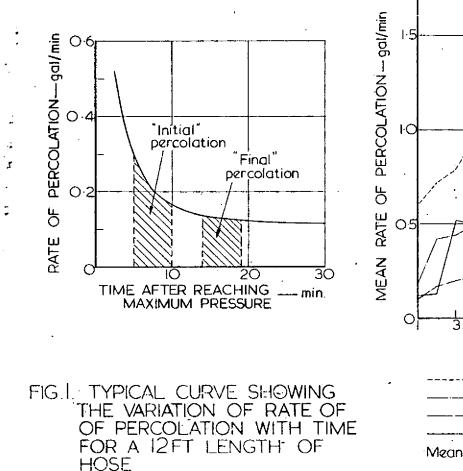
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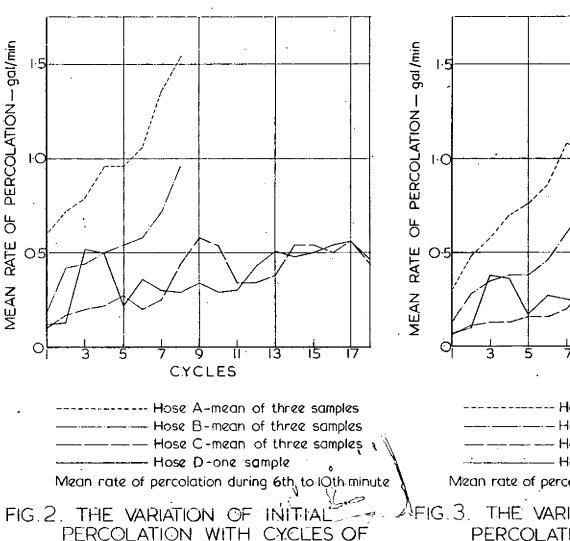
Conclusions

- 1. Both initial and final percolation tend to increase from cycle to cycle.
- 2. The greater the percolation from a new hose the greater the increase in percolation from cycle to cycle, the increase being approximately proportional to the value at the first cycle.

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CHARGING AND DRYING

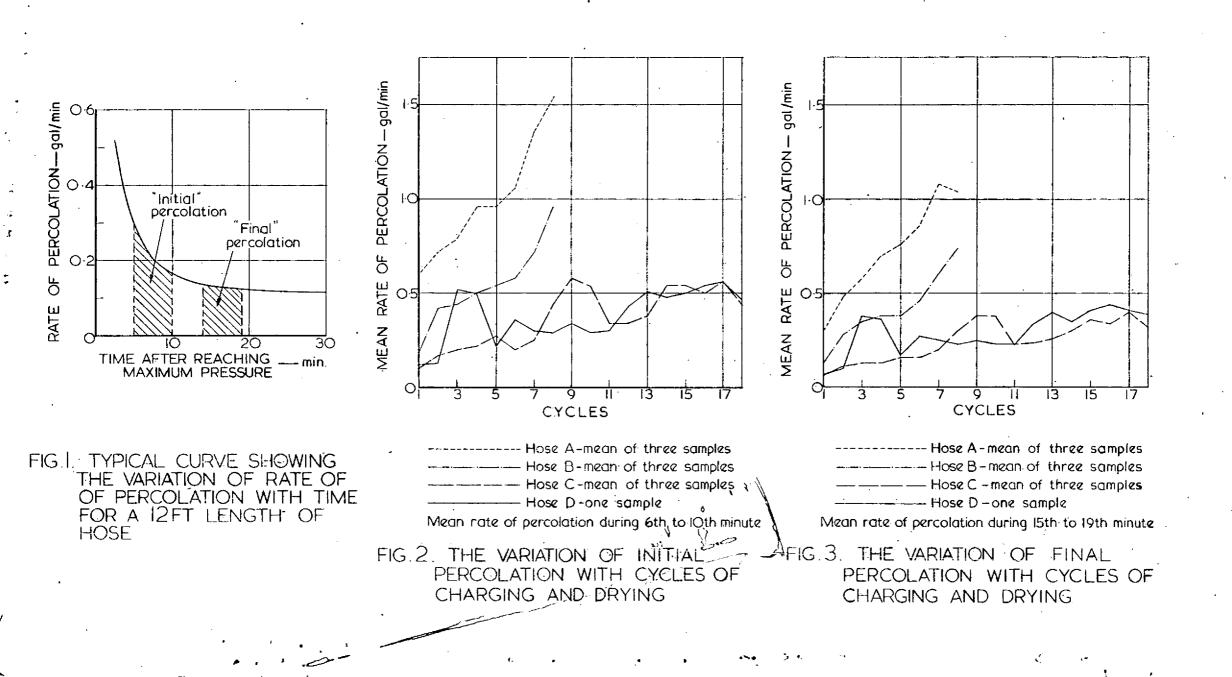
MEAN RATE OF PERCOLATION - gal/min CYCLES

-----Hose A-mean of three samples ------Hose B-mean of three samples -------Hose C-mean of three samples --------Hose D-one sample Mean rate of percolation during 15th to 19th minute

AFIG.3. THE VARIATION OF FINAL PERCOLATION WITH CYCLES OF CHARGING AND DRYING

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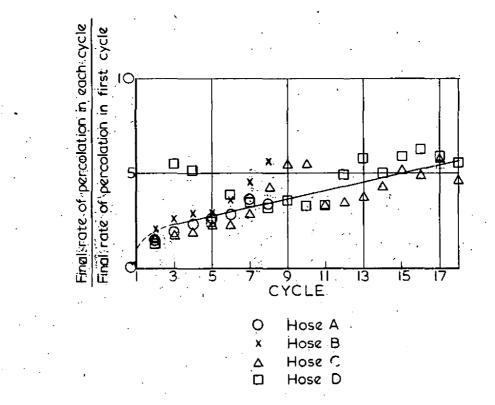


FIG. 5. COMPARISON OF FINAL PERCOLATION IN EACH CYCLE WITH FINAL PERCOLATION IN THE FIRST CYCLE

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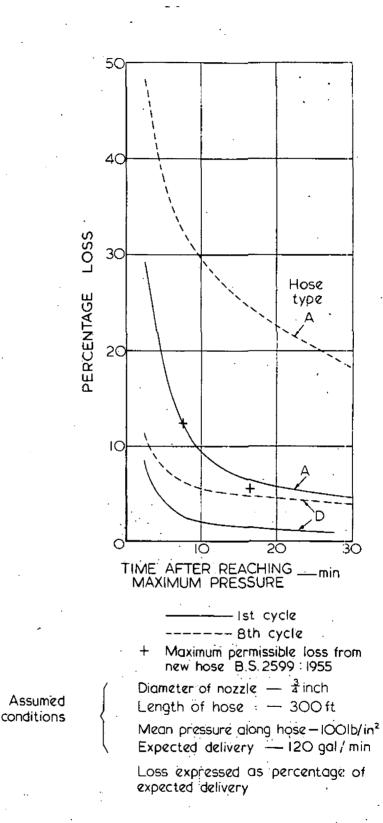


FIG 6. LOSS OF WATER BY PERCOLATION

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343

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