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THE EFFECT OF A COMMERCIAL AEROSOL ON THE RATE OF RECOVERY OF WETTED ELECTRIC MOTORS

by

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FIRE RESEARCH STATION

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SUMMARY

An investigation was carried out into the improvement of the insulation recovery rate of wetted electric motors by use of a commercially prepared aerosol. No marked difference in recovery rate was observed between treated and untreated motors.

KEY WORDS: Aerosol, Electrical equipment, Sprays, Water

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MINISTRY OF TECHNOLOGY AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

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INTRODUCTION

In order to reduce replacement costs and delays in return to normal working of factories it was suggested by the London Salvage Corps that a commercially available aerosol might be used to facilitate more rapid recovery of electric motors wetted by clean mains water and steam during fire fighting.

This reports describes tests carried out to examine this possibility.

MATERIALS AND EQUIPMENT

Motors: The electric motors used in the tests are tabulated below.

Table 1
Types and condition of motors used in tests

Number of motors	Supply (Number of phases)	Power	Type of casing	Condition
2	I	$\frac{1}{3}$ HP	Totally enclosed	Unused
2	I	$\frac{1}{4}$ HP	Ventilated	Used
2	III	$\frac{1}{4}$ HP	Ventilated	Unused
1	III	$\frac{1}{2}$ HP	Ventilated	Used
1	III	$\frac{1}{4}$ HP	Ventilated	Used

In the case of the three phase used motors a pair of similar motors were not available and so the tests were carried out on a pair of motors which were similar in all respects except power rating, one $\frac{1}{4}$ HP and one $\frac{1}{2}$ HP.

In the case of the totally enclosed single phase motors three 13 mm (0.5 in) holes were drilled in each end of the casing to facilitate thorough wetting.

Aerosol

The agent used was an English aerosol designed to "displace and seal out water". The makers recommendation included use for 'Motors and Windings' and it was stated on the can that megohm measurements before and after application would indicate progressive improvement towards operating conditions.

Resistance measuring equipment

(i) For low range measurement (zero to 100 k ohms) a small 1.5 volt operated meter was used.

(ii) For the higher range (100 k ohms to 500 M ohms) a hand wound Megohm tester, developing 500 volts, was used.

PROCEDURE

The main series consisted of four tests and in each test a pair of similar motors were tested for insulation resistance between "live and earth" with a Megohm tester. The motors were then thoroughly wetted by spraying steam and tap water through the ventilation holes in the motor casing. In the case of the totally enclosed single phase motors the steam and water were injected through the holes drilled in the casing for that purpose. With the three phase used motors the steam and water were also injected through the junction boxes from which the covers had been removed as well as through the ventilation holes, which were too small and poorly positioned to facilitate thorough wetting.

Throughout the process of wetting the motors were turned occasionally to ensure complete and even wetting of the windings. The excess water was allowed to drain out of the bottom of the motor whilst mounted on the bench through the various ventilation and drain holes provided. After wetting, the insulation resistance was measured and one of each pair of motors was treated with the aerosol, spraying through the same holes as was previously done with the water and steam. The insulation resistance was immediately measured again and thereafter at intervals to follow the comparative rates of recovery of each pair of motors. In each test the motors were run under no load for one or two hours under full voltage at periods varying from 10 minutes to 3 hours after wetting.

In two further tests two of the used untreated motors (I and III phase) were rewetted as before and the junction box cover of each removed. The junction box and terminal assembly was dried using a portable domestic hair drier. Insulation resistance measurements were taken before and after drying each motor This experiment was carried out in order to examine the contribution of the junction box and terminal assembly to the overall lowering of insulation resistance when wet, and to determine the effects of drying with hot air the most easily accessible part of the motor.

RESULTS

Test 1. Single Phase, unused motors.

Before testing: the insulation resistance of both motors was 100 M ohms. Apart from a small improvement immediately after treatment with the aerosol the rate of recovery of both motors was almost identical. During the first 3 hours the recovery rate was slow but after running for 1½ hours both motors improved sharply and within 70 hours both had recovered to their original value of 100 M ohms (see Fig.1).

Test 2. Single Phase, used motors.

Before testing: the insulation resistance of both motors was 100 M ohms. As in the previous test a slight improvement was noted on treatment with the aerosol but the subsequent rate of recovery of both motors was almost the same. As before, running the motors produced considerable improvement and after 100 hours both motors had recovered to 90 M ohms (See Fig.2).

Test 3. Three phase, unused motors.

Before testing: the insulation resistance of both motors was 100 M ohms Unlike the first two tests no initial improvement was shown immediately after treatment but the overall rates of recovery of both motors were similar with the highest rate of recovery after running for a short time. After 100 hours the treated motor had recovered to 80 M ohms and the untreated motor 90 M ohms. (See Fig.3).

Test 4, Three phase, used motors.

Before testing: the insulation resistance of both motors was 100 M ohms. As in tests 1 and 2 a slight improvement was noticed in the treated motor immediately after spraying with the aerosol. The treated motor was turned on to run 10 minutes after wetting and allowed to run for 1½ hours without incident. The untreated motor was switched on 30 minutes after wetting and allowed to run for 1½ hours, also without any apparent detriment. As in previous tests the initial recovery rates of both motors was slow with some improvement after running. The overall recovery rate of both motors were similar and after 70 hours both had recovered to 100 M ohms. (See Fig.4).

A composite graph of tests 1 to 4 is plotted in Fig.5. It can be seen from this graph that no marker difference exists between the recovery rates of treated and untreated motors.

Test 5. Single phase used motor (junction box dried with hot air)

The insulation resistance after wetting was 20 K ohms and after 3 minutes drying with the hot air blower was found to have risen to 21 K ohms.

Test 6. Three phase used motor (junction box dried with hot air)

The insulation resistance after wetting was 3.5 K ohms and after 3 minutes drying with the hot air blower was found to have risen to 3.6 K ohms.

CONCLUSIONS

1. The use of the aerosol tested did not provide any marked increase in the rate of recovery of wet electric motors as observed by insulation resistance measurement.

2. The most rapid recovery rates were observed during and immediately following the periods when the motors were running.

3. The tests indicated that it was possible to run a motor as little as 10 minutes after wetting without apparent detriment.

4. In all tests the motors recovered to acceptable working insulation values within 100 hours after wetting.

5. Removing the junction box and drying the terminal assembly with a hot air blower did not appreciably improve the insulation resistance.

ACKNOWLEDGMENT

Mr. Griffiths of the London Salvage Corps helped in the experimental work.

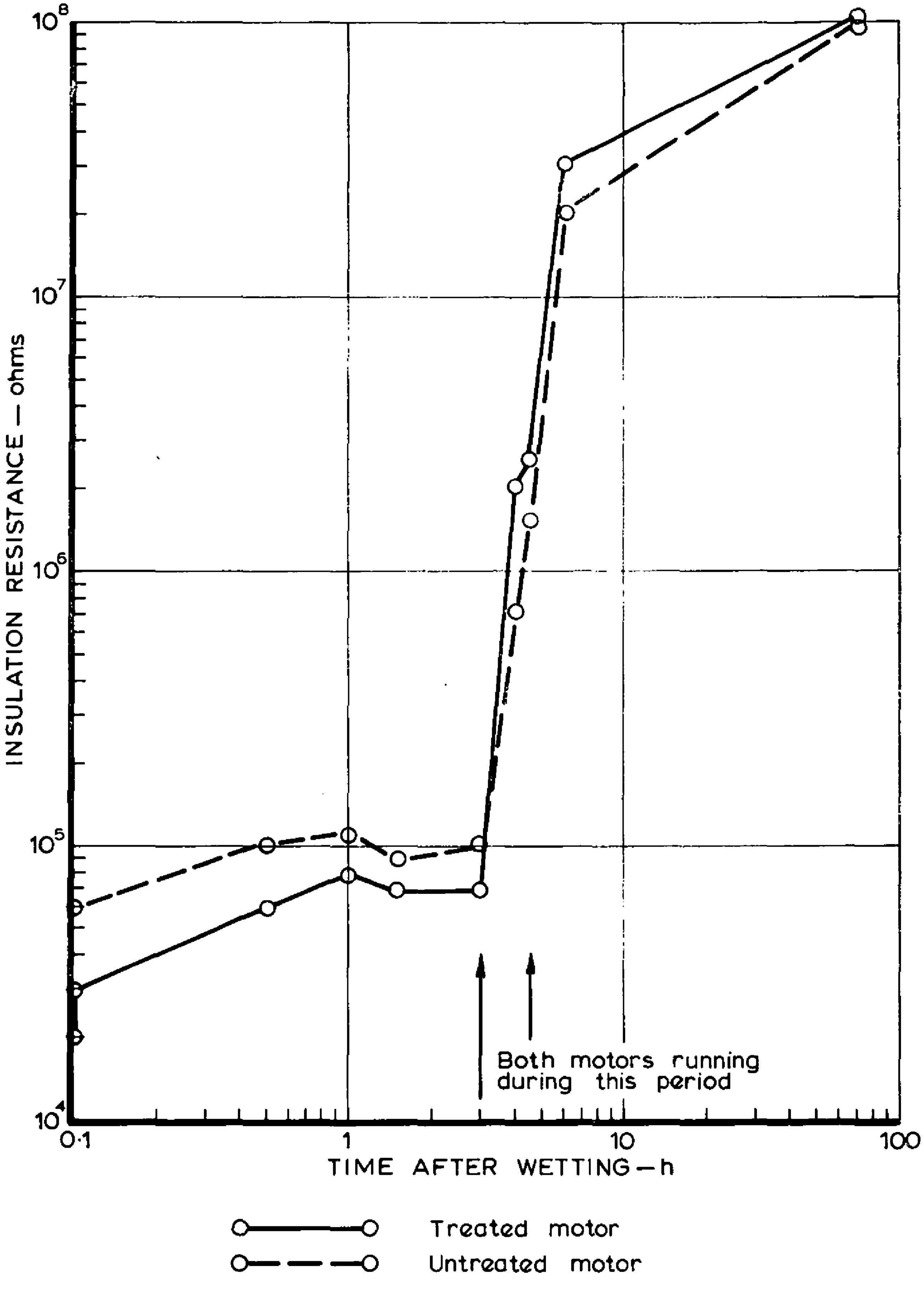

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FIG. 1. SINGLE PHASE, UNUSED MOTORS

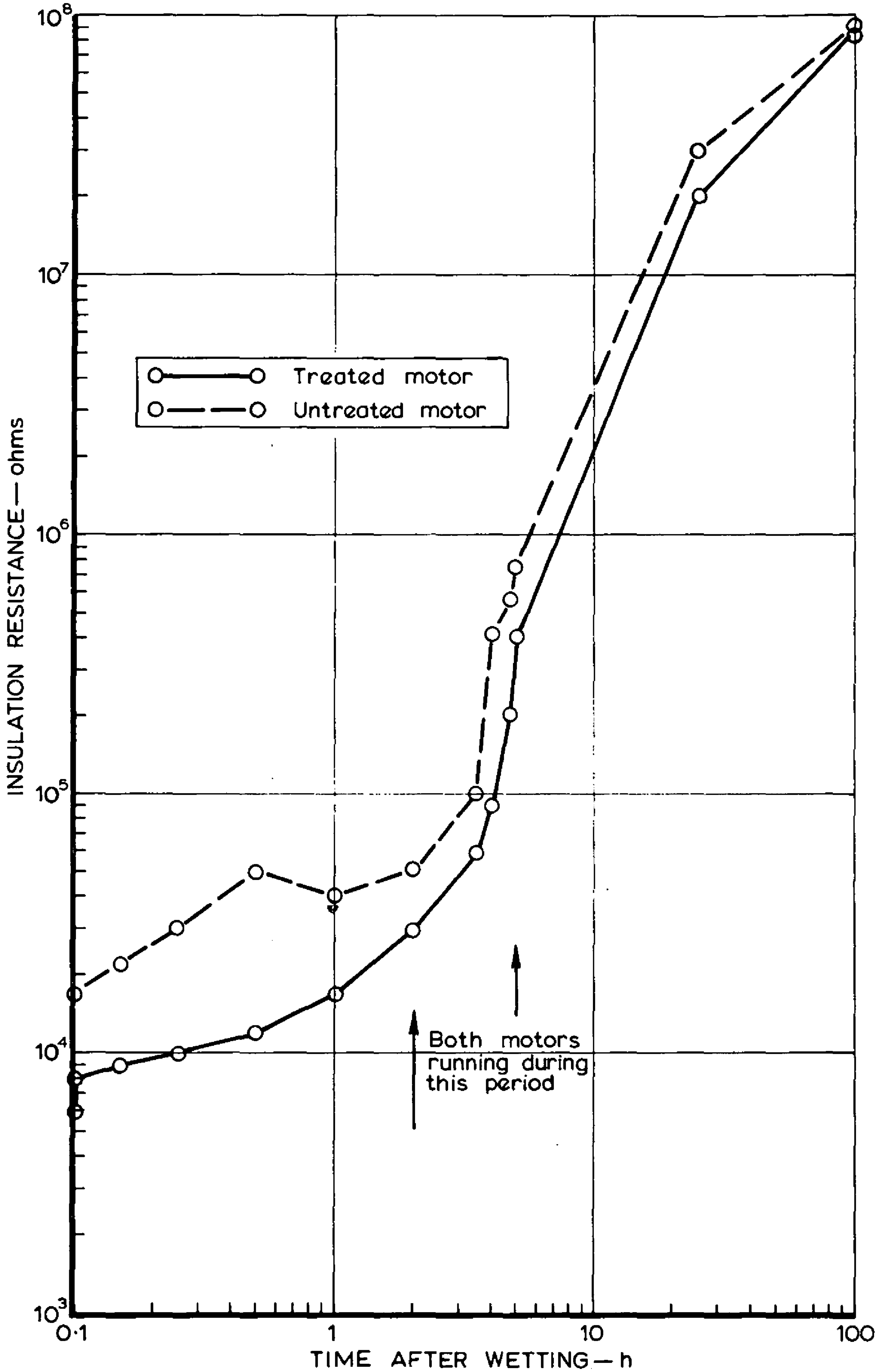

FIG. 2. SINGLE PHASE, USED MOTORS

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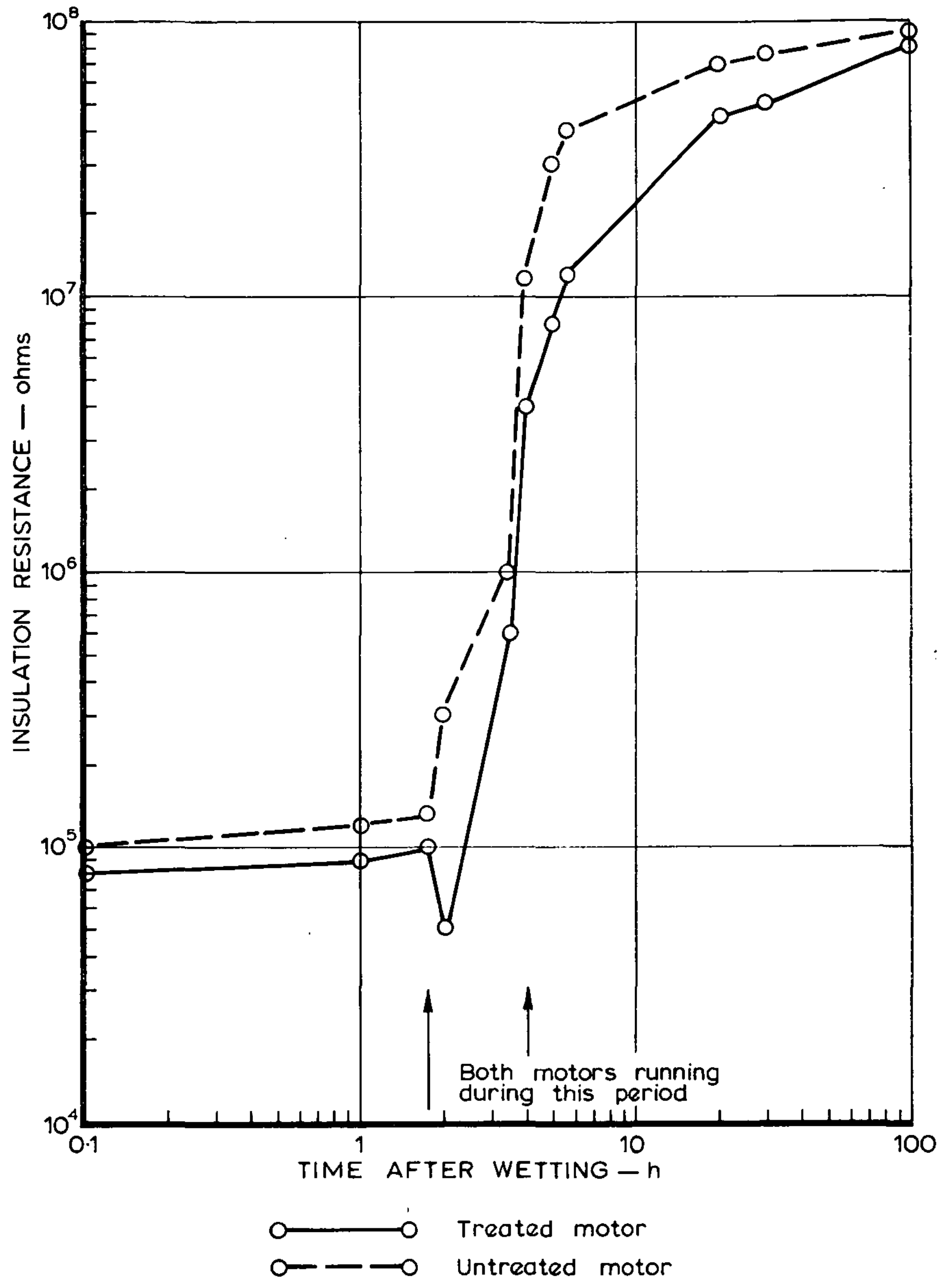

FIG. 3. THREE PHASE, UNUSED MOTORS

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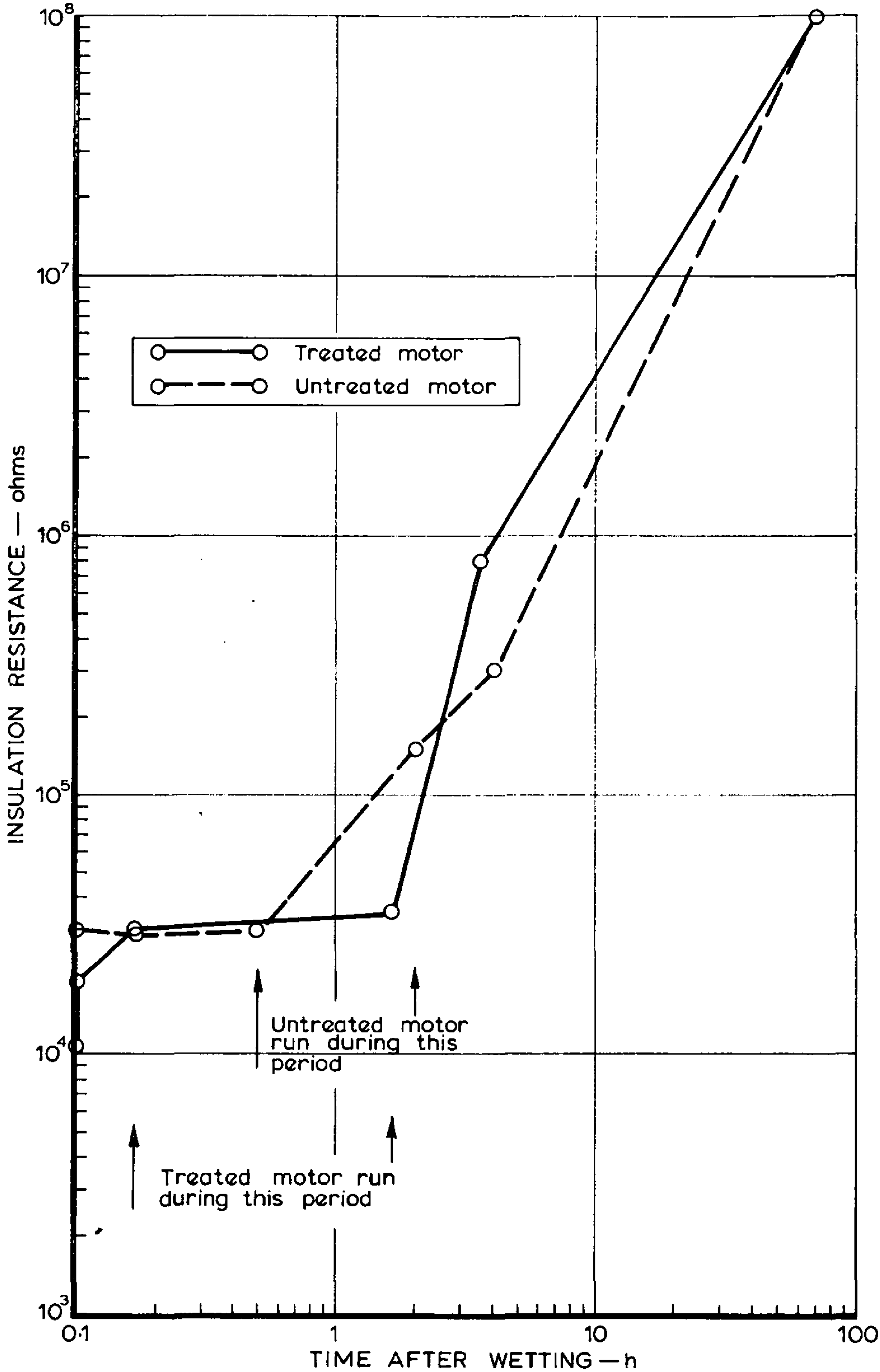

FIG.4. THREE PHASE, USED MOTORS

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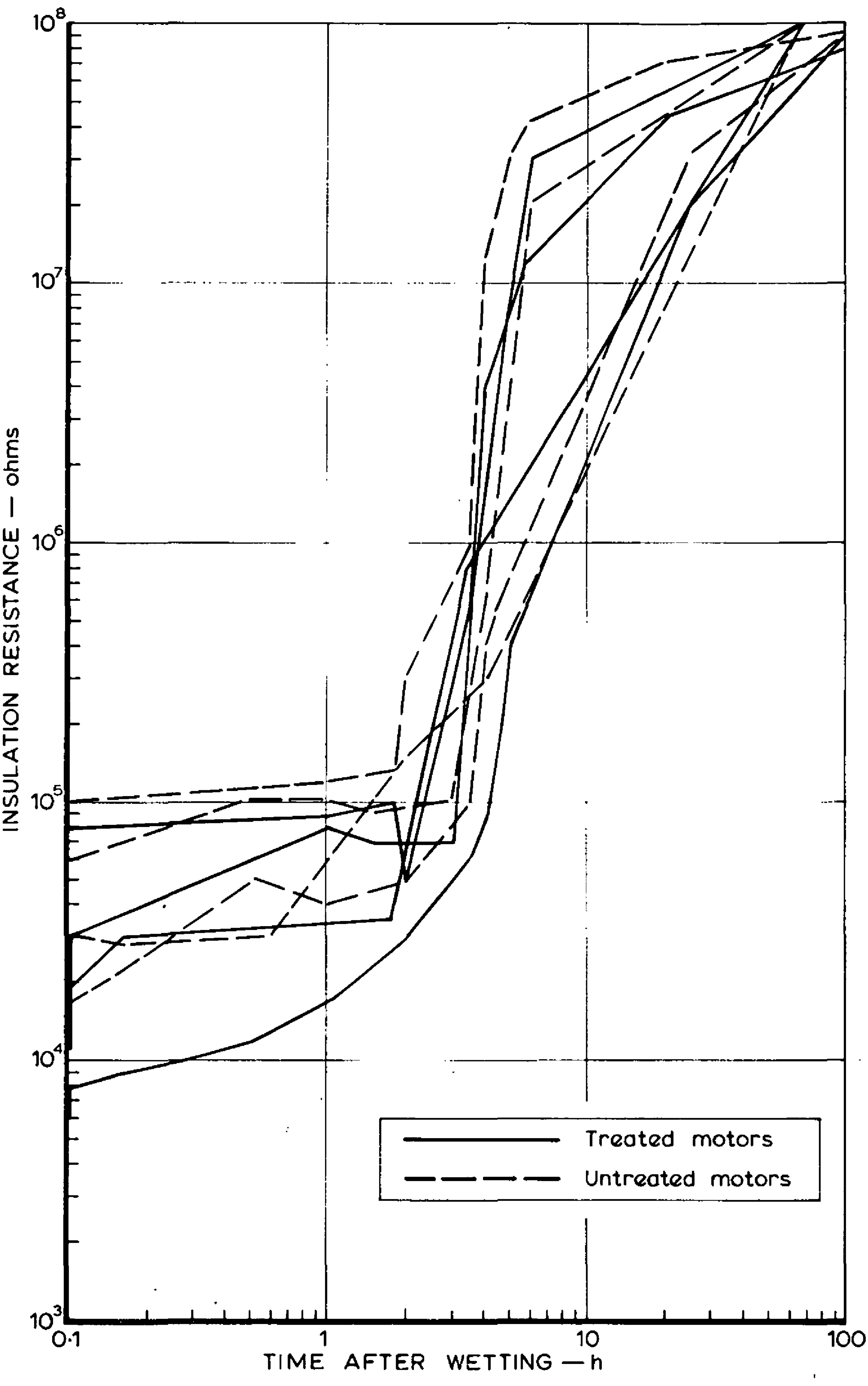

FIG. 5. COMPOSITE GRAPH OF TESTS 1 TO 4

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