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RESEARCH LABORATORY**

Department of the Environment

TRRL REPORT LR 468

**FLOW CHARTS FOR THE BRITISH STANDARD
PARTICLE-SIZE DISTRIBUTION TESTS FOR SOILS**

by

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and

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FLOW CHARTS FOR THE BRITISH STANDARD PARTICLE-SIZE DISTRIBUTION TESTS FOR SOILS

ABSTRACT

This Report presents flow charts for the British Standard particle-size distribution tests for soils. The charts supplement the verbal description of the four tests given in British Standard 1377 by clearly showing the sequence of the many operations and decisions involved in each. They will be useful to engineers in soil testing laboratories, particularly during the training of staff.

1. INTRODUCTION

The procedures for determining the particle-size distribution of soils, both by sieving and by sedimentation methods, are described in detail in British Standard 1377. Although the steps are fairly simple many individual operations and decisions are involved. To assist those concerned with soil testing, therefore, flow charts have been prepared which will be found useful in supplementing the verbal description given in the Standard. These flow charts clarify the sequence of operations and decisions, resolve points not explicitly covered by the Standard, and show how the tests relate to each other. The use of the flow charts will reduce errors, remove uncertainty, and save time. They will be particularly useful during the training of operators unfamiliar with the procedures.

The sieves listed in the flow charts are given in metric sizes in anticipation of the metricated and revised edition of the Standard¹ that is in preparation. The tests comprise Test 7 of BS 1377:1967, and will be Test 8 in the new edition.

2. FLOW CHARTS FOR THE TESTS

Table 1 shows the range of sizes measured in each of the four tests given in BS 1377, and the main procedural steps involved; it should be used to select the tests appropriate for a particular soil sample.

TABLE 1

Scope of the tests for determination of the particle-size distribution
(BS 1377¹ (metric edition) Test 8)

<p>From coarse-gravel down to approximately fine-sand size (63 μm sieve) - silt and clay by difference:</p> <p><u>Test 8(A)</u> Standard method by wet sieving</p> <ol style="list-style-type: none"> 1. Dry separation on 20 mm sieve 2. Dry sieving, 75 mm - 20 mm sieves 3. Dispersion of < 20 mm material 4. Washing of < 20 mm material to remove silt and clay (< 63 μm) 5. Dry sieving, 14 mm - 63 μm sieves <p><u>Test 8(B)</u> Subsidiary method by dry sieving (Use only if it gives same results as Test 8(A))</p> <ol style="list-style-type: none"> 1. Dry sieving on all sieves, 75 mm - 63 μm 	
<p>From coarse-sand size (2 mm) down to clay (2 μm) - applicable only to soils containing 10% or more of material passing 63 μm sieve:</p> <p><u>Test 8(C)</u> Standard method for fine-grained soils (pipette method)</p> <ol style="list-style-type: none"> 1. Pretreat and disperse 2. Wet separation on 63 μm sieve 3. Dry sieving, 2 mm - 63 μm sieves 4. Sedimentation of < 63 μm material <p><u>Test 8(D)</u> Subsidiary method for fine-grained soils (hydrometer method)</p> <ol style="list-style-type: none"> 1-4 As for Test 8(C) 	

Notes on Table: The main size-fractions are defined in the Standard as follows:-

Gravel, 60 mm - 2 mm. Sand, 2 mm - 60 μm . Silt, 60 μm - 2 μm .
Clay, finer than 2 μm

The 63 mm and 63 μm sieves are close enough to 60 mm and 60 μm for practical purposes.

2.1 Sieve analysis (Tests 8(A) and 8(B))

Figure 1 is a flow chart showing the sequence of operations and decisions involved in carrying out the Standard Method by Wet Sieving, Test 8(A), and the Subsidiary Method by Dry Sieving, Test 8(B), according to the procedures described in BS 1377. A number of minor points not explicitly covered by the Standard have been incorporated in the flow chart so that a clear guide is given to what to do at every stage of the tests. Fig. 1 also includes the procedure for the initial preparation of the sample for all tests.

The following points may be noted:

1. In the procedure for the Standard Method by Wet Sieving (Test 8(A)) described in BS 1377, only the stage of washing out the silt and clay sizes is carried out wet; the sieving stages are carried out dry. However the Standard also allows other procedures to be used provided that no material other than the silt and clay fraction is lost during washing. A procedure in which all the sieving is carried out wet is given by West and Dumbleton².
2. The Standard allows a choice of appropriate sieve mesh sizes (Note 1 of Notes on Test 8(A) in BS 1377).
3. The 75 mm - 20 mm sieves can conveniently be of 450 or 300 mm diameter. If it is clear that no particles larger than 20 mm are present, then these mesh sizes may be omitted.
4. The 14 mm - 6.3 mm sieves can also conveniently be of 450 or 300 mm diameter. If it is clear that no particles larger than 6.3 mm are present then these mesh sizes may also be omitted.
5. The 3.35 mm - 63 μ m sieves are conveniently of 200 mm diameter.
6. If the weight of material retained on any sieve exceeds that allowed in Appendix A of BS 1377, that material should be divided and re-sieved in parts.
7. The material retained on the coarsest sieve employed should be inspected to see if it would be appropriate to sieve it on a coarser sieve.

2.2 Analysis of fine-grained soils (Tests 8(C) and 8(D))

Fig. 2 is a flow chart showing the operations and decisions involved in carrying out the Standard Method for Fine-Grained Soils (pipette method), Test 8(C), and the Subsidiary Method for Fine-Grained Soils (hydrometer method), Test 8(D), according to the procedures described in BS 1377.

3. ACKNOWLEDGEMENT

This Report was written in the Earthworks and Foundations Division of the Highways Department under the general direction of Mr. W.A. Lewis.

4. REFERENCES

1. BRITISH STANDARDS INSTITUTION. Methods of testing soils for civil engineering purposes. British Standard 1377. Metricated and revised edition (In preparation).
2. WEST G and M J DUMBLETON. Wet sieving for the particle-size distribution of soils. Department of the Environment, TRRL Report LR 437. Crowthorne, 1972 (Transport and Road Research Laboratory).

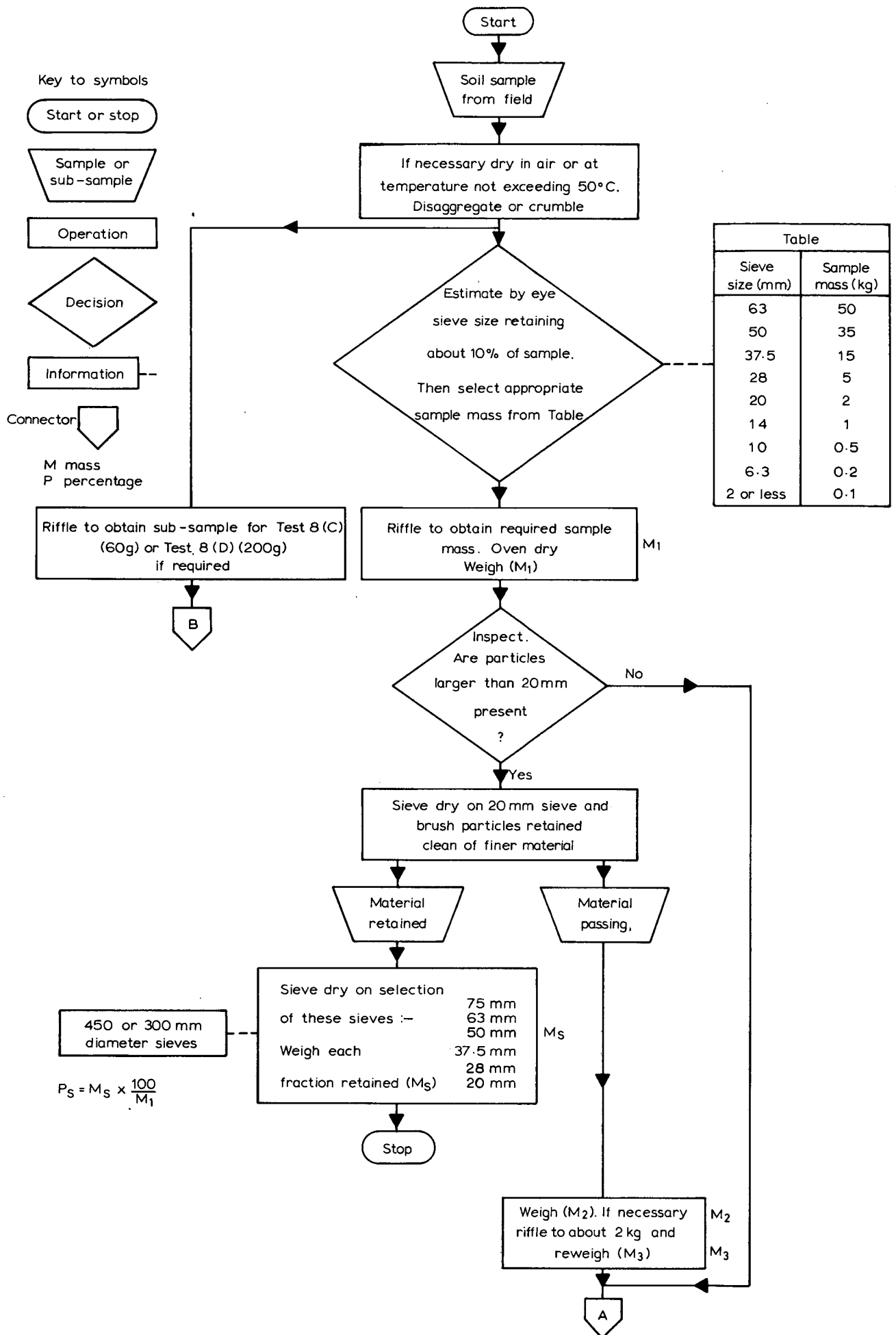


FIG 1. DETERMINATION OF PARTICLE-SIZE DISTRIBUTION: SAMPLE PREPARATION, AND METHODS BY WET AND DRY SIEVING (TESTS 8(A) AND 8(B))

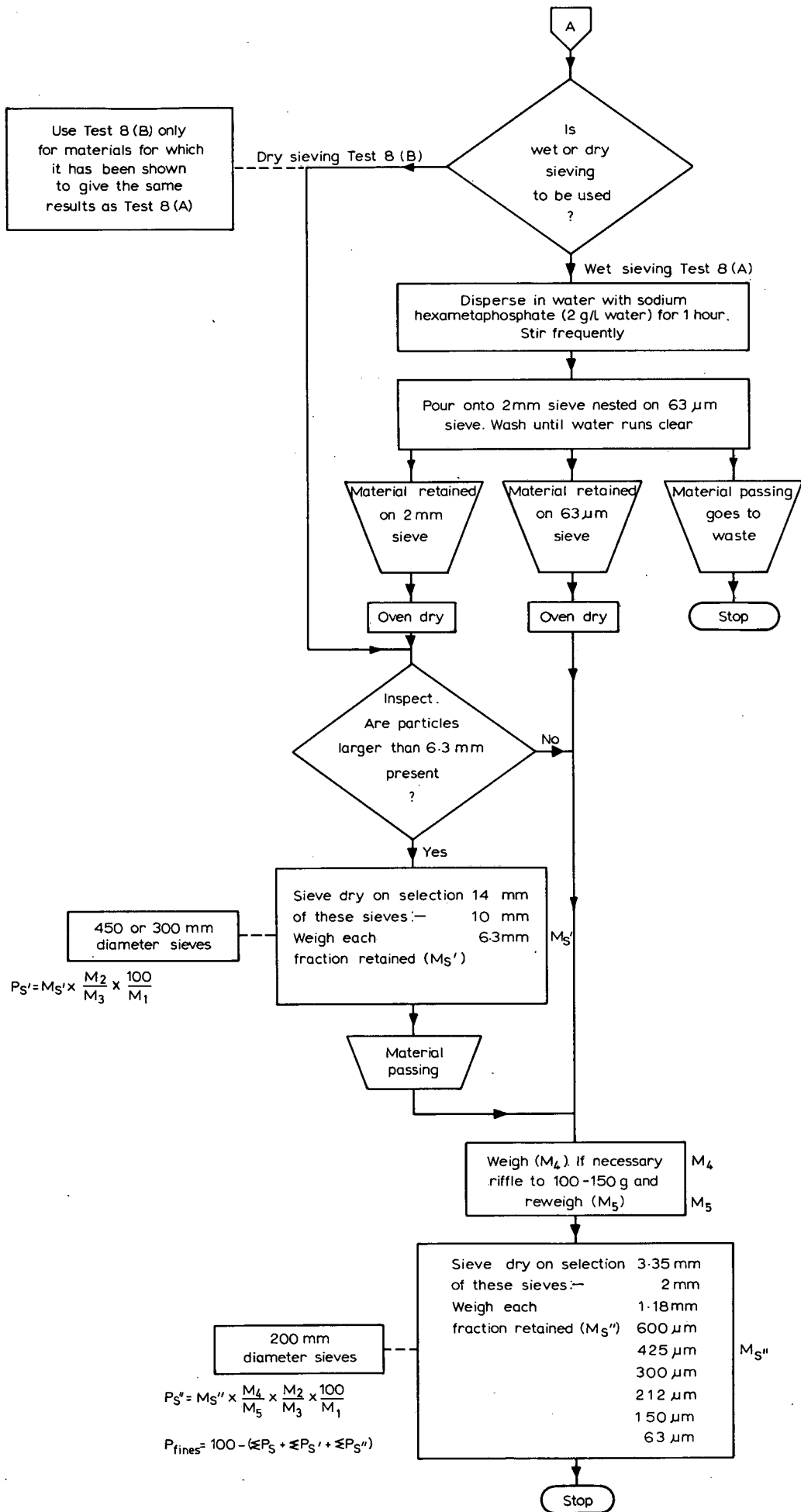


FIG. 1 (CONT.)

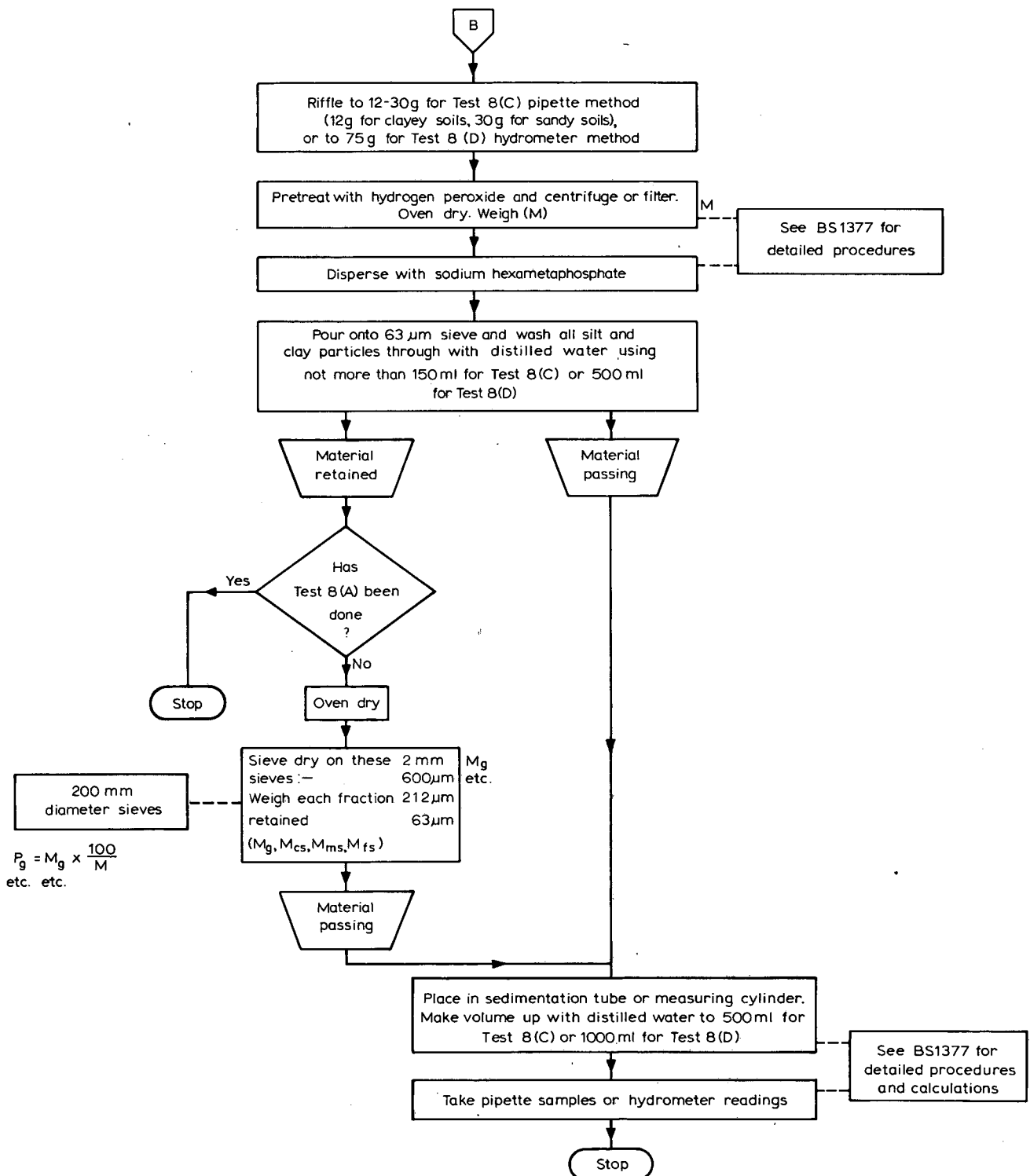


FIG. 2. DETERMINATION OF PARTICLE-SIZE DISTRIBUTION : METHODS FOR FINE-GRAINED SOILS (TEST 8(C) and 8(D)) (APPLICABLE ONLY TO SOILS WITH 10% OR MORE PASSING 63µm SIEVE)

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