

Recommendations for

Estimating the dryness of saturated steam

Co-operating organizations

The Technical committee under whose supervision this British Standard was prepared consists of representatives from the following Government departments and scientific and industrial organizations:

- Association of British Chemical Manufacturers*
- Association of Shell Boiler Makers*
- British Iron and Steel Federation*
- British Launderers' Research Association*
- D.S.I.R. Laboratory of the Government Chemist
- Electricity Council, the Generating Board and the Area Board in England and Wales*
- Institute of Fuel
- Institute of Marine Engineers*
- Institution of Chemical Engineers*
- Institution of Gas Engineers
- Institution of Mechanical Engineers*
- Institution of Municipal Engineers
- Lloyd's Register of Shipping
- London County Council
- Ministry of Defence, Army Department
- Ministry of Defence, Navy Department*
- Ministry of Labour (H.M. Factory Inspectorate)
- National Coal Board
- National Physical Laboratory (D.S.I.R.)
- Royal Institute of Chemistry*
- Society of Laundry Engineers and Allied Trades Limited

The Government departments and scientific and industrial organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- British Electrical and Allied Manufacturers' Association
- British Sugar Refiners Association
- British Waterworks Association
- Engineering Equipment Users Association

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Foreword

This standard makes reference to the following British Standards:

BS 2690, *Methods of testing water used in industry*.

BS 3285, *Methods of sampling superheated steam from steam generating units*.

The measurement of quality of steam, i.e. its dryness (100 minus the percentage moisture content) has always presented a difficult problem, and particularly so in the conventional calorimetric methods in which the moisture which is to be measured may be considerably affected by the inevitable changes in the temperature of the steam sample during the process of determination. Whatever precautions are taken, the sampling devices, the transport of the sample, and the measuring instrument, are likely to affect the temperature and consequently the moisture content of the sample. In addition, certain types of calorimeters rely on the separation of the liquid water from the steam, which is often far from complete and may vary considerably under different test conditions. The examination by calorimetric methods, even as the average of a considerable number of determinations, may therefore not result in a precise measurement but rather in a rough indication of the steam quality.

Much more difficult, however, is the provision of representative samples of steam, particularly with high moisture contents. In this case the distribution of the moisture over the cross-section of the steam pipe is likely to be irregular, and often very irregular indeed, as can be seen from the comparison of samples from the top and the bottom of the same cross-section. Samples from conventional and even isokinetic probes have been found to indicate under 3 per cent moisture when determinations over the total flow from which the samples were taken showed 20 per cent and above. The sampling methods generally used on shell type boilers have been found to result in persistently good results irrespective of the steaming conditions, even in cases of obviously heavy priming. It must therefore be suspected that the results of many conventional steam trials are grossly, if unintentionally, misleading, especially if they indicate virtually dry steam as they do so often.

To reduce as far as possible the risk of the falsification of test results by sampling errors or temperature effects, a number of alternative methods has been selected by a long process of gradual elimination. This has led to the addition of more modern methods to the classical calorimetric one.

As the steam to be tested may vary from a few hundred lb/h at less than 100 lbf/in² (7 kgf/cm²) to many tons at near critical pressure, it has not been possible to suggest a single standard method, desirable as this might have been. The document describes therefore several alternative methods, one of which should be suitable for any given set of conditions. They provide for the fairly high degree of accuracy required in determining the dryness of steam for power production as well as for the relatively lower accuracy needed for both the testing of heating and process steam, where it is generally sufficient to determine the amounts of moisture within the far wider limits not likely to affect process plant, and the testing of the efficiency of industrial boilers. It is with these severe limitations well in mind that some of the methods in the present document have been recommended.

Much of the apparatus specified should be readily available in the type of establishment for which particular methods are intended. Full use has been made of equipment already required for steam purity determinations according to BS 3285¹⁾ in order to prevent duplication and keep capital expenditure to a minimum. The steam driers required for the separating method will serve not only for the determination of the steam quality, but also for its actual improvement in ordinary service. It is hoped that this simplicity and cheapness will lead to the more frequent use of steam quality measurement, especially in process steam installations where it is often badly needed but only rarely found. Methods for sampling superheated steam are given in BS 3285.¹⁾

NOTE Where metric equivalents are stated the figures in British units should be regarded as the standard. The metric equivalents are approximate. For more accurate conversions reference should be made to BS 350, "Conversion factors and tables".

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Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 10, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

¹⁾ BS 3285, "Methods of sampling superheated steam from steam generating units".

