



CONDITIONS OF TEST FOR SEXTANTS.

*Extracted from the Report on the Physics Department for the year 1928,
of the National Physical Laboratory — Teddington. **

In view of the altered needs of navigators due to the development of wireless telegraphy and other causes, it was considered desirable to obtain the opinions of navigating authorities on the present conditions governing the certification of sextants at the National Physical Laboratory.

A conference to deal with this question was appointed and was composed of representatives of the Admiralty, Air Ministry, Mercantile Marine, British Scientific Instruments Research Association, Mercantile Marine Department of the Board of Trade, and the British Nautical Instruments Trade Association.

The Conference discussed the regulations at present in force at the Laboratory for the testing of sextants. The Conference was also requested to consider conditions for the certification of sextants for aerial use and of new types of sextant.

Two meetings were held at Teddington early in 1928. During the course of the discussion, it was pointed out the desirability of investigating the changes in the readings of sextants of different types (vernier and micrometer) after varying lengths of service, particularly in connexion with the possible development of error in the readings of sextants in which an endless tangent screw was used as a micrometer.

The report states that :

The Conference are of opinion that, while the present normal design of sextant is in general satisfactory, it is capable of improvement in certain respects for the ordinary purposes of navigation. They recommend that the tests which a sextant is required to pass for a "Class B" certificate should be such that it may be regarded as satisfactory for all normal purposes at sea, and that the "Class A" test should be such as to provide an instrument possessing higher accuracy than is represented by the above requirement, for the use of navigators who desire such an instrument. The recommendations of the Conference, which in some respects involve modifications of the existing regulations, are based upon this principle.

The Conference make no recommendations regarding the regulations for "Unclassified" sextants, although they recognise the need for this grouping.

The remainder of the Report in general deals only with the points discussed by the Conference and with their resulting recommendations. With regard to the requirements of the present regulations which are not specifically

* More detailed information will appear in *Hydrographic Review* for May 1930.

dealt with, it should be understood that the Conference consider them to be adequate and satisfactory.

Extracts from the recommendations are as follows:

(1) *General Construction of the sextant.* — In admitting that the present normal design of sextants is in general satisfactory, the Conference wish to emphasize that they are strongly of the opinion that the provision of a telescope rising piece, or its equivalent, is essential in a "Class A" instrument, while it is generally desirable in a "Class B" instrument. They are of the opinion that the rising piece need not be provided with an adjustment for the collimation of the telescope.

(2) *Graduation of Arc and Vernier.* — The Conference recommend that for both "Class A" and "Class B" sextants, the regulations should contain definite figures for the range of graduation, and that the range of graduation should enable the instrument to be read from 5 degrees below zero to 125 degrees above. It should be possible to read "Class A" instruments directly to 10 seconds, while the combined graduation and centering error in "Class A" instruments should nowhere exceed 40 seconds (or 0.2 and 0.8 minute respectively, in the case of instruments with decimal subdivision). It should be possible to read "Class B" instruments directly to one minute, while the combined graduation and centering error should nowhere exceed two minutes. It is recommended that the dividing should be as open as possible.

(3) *Reading Microscope.* — The Conference are of the opinion that a reading microscope is essential in "Class A" instruments of the vernier type, but it is not essential in "Class B" vernier instruments. A performance comparable with that of the microscopes fitted to Admiralty sextants should be required in the case of all microscope fitted. It is also considered that instruments fitted with satisfactory micrometers should be admissible to both classes "A" and "B", subject to the stipulations contained in Section (2) above. In the case of micrometer sextants submitted for "Class A", the certificate should only be granted provided the Laboratory is satisfied that the instrument is likely to remain satisfactory in practice, *i. e.*, that inaccuracies are not likely to develop and that the construction is sufficiently robust to eliminate the possibility of strains which might affect the accuracy.

(4) *Telescopes.* — The Conference recommend that the "Class A" sextant should have a minimum of three telescopes, viz:

(i) A telescope of minimum magnification 9 and minimum "apparent" field 25°.

(ii) A telescope of minimum magnification 6 and minimum "apparent" field 25°.

(iii) An erecting "star" telescope of magnification about 3 and minimum "apparent" field 15°.

(i) and (ii) might consist of one objective provided with two eye-pieces, and might be erecting or inverting according to the user's wish.

Telescopes (i) and (ii) should have a clear aperture not less than 3/4 in., and the "star" telescope not less than is now customary.

The "Class B" sextant should have at least two telescopes, which should correspond to telescopes (ii) and (iii) of the "Class A" requirements.

The Conference consider that provision of the usual cross-wires is essential in both "Class A" and "Class B" instruments, but wish to leave the questions of the spacing and size of the wires to the Laboratory.

(5) *Mirrors.* — (See also Section 7 below). While the Conference do not wish to make recommendations regarding the sizes of the mirrors, they wish to point out that the mirrors should not be sufficiently small to cut down unduly the light reaching the telescope. It is considered that instruments in which the mirrors are definitely too small should be rejected by the Laboratory.

The question of the provision of mirror adjustments is left to the Laboratory.

It is considered that it would be a good practice to supply spare mirrors with new instruments, such mirrors to be tested with the instruments by the Laboratory.

(6) *Shades.* — The Conference recommend the adoption of a minimum of three shades for the index mirror and two for the horizon mirror. The question of the tints of the shades is best left in abeyance until the work of the Committee of the British Scientific Instruments Research Association on standard neutral glasses of different tints is completed. As regards the amount of light to be transmitted by the shades, it is considered that the Admiralty standards are satisfactory.

The Conference are of the opinion that the telescope cap shades should be provided in a "Class A" sextant, but that they are not essential in a "Class B" instrument.

(7) *Standardisation.* — The question of the desirability of the standardisation of telescopes, mirrors, screw threads, etc..., was considered by the Conference. It was decided that the time is at present inopportune for such standardisation, but it is suggested that the regulations laid down for the Admiralty pattern sextants in these respects represent standards towards which it would be desirable for manufacturers to converge as a preliminary step towards standardisation.

(8) *Sextants for Aerial Use.* — It is considered that the development of sextants for aerial use is not yet sufficiently advanced to enable definite requirements to be discussed.

(9) *New Types of Sextant.* — The Conference had before them a note by the Laboratory describing a sextant of novel design by Messrs. CASELLA, and R. A. E. Sextant Mark V, intended for use in aircraft, in which the principles involved, as well as the construction, differ from those of the normal sextant; the CASELLA sextant was also inspected by the Conference. It is considered that sextants involving radical departures from the established design should not be granted certificates by the Laboratory until they have been submitted to thorough trials under service conditions at sea, and have been proved satisfactory.

(10) *Temperature Test for Sextants.* — It was suggested by a member of the Conference that the results of sextant observations made under a tropical sun might be seriously vitiated owing to the unequal heating of the exposed parts, which would throw the centre out of position relative to the arc. The desirability of submitting instruments to a test at the Laboratory to ensure that this effect did not exceed an amount to be specified was therefore discussed. As a result of this discussion the Conference do not wish to recommend the institution of such a temperature test, but they consider that it would be useful and informative if the Laboratory could carry out experiments to ascertain the effect upon sextant readings of unequal heating, such as would result from exposure to a tropical sun.

