

Platinum Thermocouple Reference Tables

AGREEMENT ON INTERNATIONAL STANDARDS

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The publication in March 1973 of British Standard BS 4937: "International Reference Tables for Thermocouples" is a milestone in the progress towards standardisation and uniformity in the field of thermoelectric pyrometry. Few reference tables have hitherto justified the description of "international". Many have been no more than the tables of individual manufacturers, while others at best have achieved the status of national standards.

Of this latter group the tables relating to the platinum: 10 per cent rhodium-platinum and platinum: 13 per cent rhodium-platinum thermocouples are probably the most widely used and approach most closely to the concept of international. However, even for these thermocouples, international usage has been prejudiced by the existence of two separate and conflicting sets of tables, one British and one American. The American tables published in NBS Circular 561 (1), which also forms the basis for French, German and Japanese standards, differ significantly from the British tables determined by the National Physical Laboratory and adopted as a national standard in British Standard BS 1826 of 1952 (2).

These differences arose from differences in the realisation of the temperature scale by different investigators. They also reflect variations in the composition and purity of the materials used at that time.

This was clearly an unsatisfactory situation, since manufacturers have been obliged to produce separate stocks of wire to meet each standard. In the last decade this has become increasingly uneconomic.

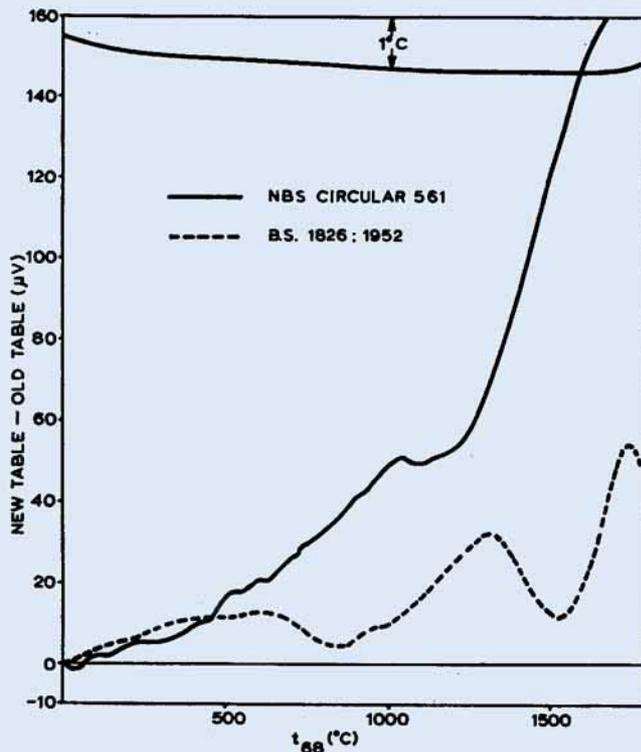
In 1965 the first positive step towards removing the anomaly of conflicting tables was taken at a meeting between representatives of Johnson Matthey and of Engelhard Industries (3). It was agreed to make a joint approach to the British Standards Institution and to the National Physical Laboratory, pledging support for new and internationally acceptable reference tables. Subsequent progress included experimental work to produce new tables (4). The work incorporated the 1968 revision to the International Practical Temperature Scale (IPTS-68).

Adoption Nationally and Internationally

The international nature of the work leading up to the publication of the new tables has ensured that they form an acceptable basis for adoption by both national and international standards organisations. The numerical differences between the old BS 1826 based on IPTS-48 and the new tables based on IPTS-68 are so small that they account for less than 1.5°C at temperatures up to 1650°C with either the 10 or 13 per cent rhodium-platinum combinations. It is therefore not surprising that the new tables enjoyed early acceptance by B.S.I. as the new British Standard BS 4937, Parts 1 and 2 (5). (Parts 3 and 4 contain revised tables for the iron: copper-nickel and nickel-chromium:nickel-aluminium thermocouples respectively.)

The new standard also bears the American letter notation. Thus the platinum: 10 per cent rhodium-platinum thermocouple is desig-

The differences between the new reference table incorporated in BS 4937 and the former standards NBS Circular 561 and BS 1826 (adjusted to IPTS-68) for the Pt:13% Rh-Pt thermocouple (4)



nated "Type S" and the platinum: 13 per cent rhodium-platinum thermocouple is referred to as "Type R".

BS 4937 supersedes BS 1826, BS 1827 and BS 1829 on 1 July 1973. After this date wire to comply with the old standards will no longer be available from British manufacturers. The only exception will be to supply for the time being rhodium-platinum wires conforming to NBS Circular 561.

Differences between the new tables and NBS Circular 561 are rather larger, amounting to about 8.5°C at 1600°C for the 13 per cent rhodium-platinum thermocouple. Nevertheless the new tables are already in the course of adoption by the American Society for Testing and Materials (A.S.T.M.) (6) and by the International Electrotechnical Commission (I.E.C.). Approval by these two bodies should lead quickly to acceptance of the new tables by all the major industrial nations.

The universal adoption of such reference tables by our increasingly industrialised society will do much to promote interchangeability of thermocouples, thereby eliminating a common source of error and confusion. Furthermore, the new values, determined by the most modern techniques have a much smoother progression than the earlier tables, thus permitting interpolation with the improved accuracy called for in modern technology.

References

- 1 National Bureau of Standards Circular 561, 1955: "Reference Tables for Thermocouples"
- 2 British Standard 1826:1952, "Reference Tables for Platinum/Rhodium vs. Platinum Thermocouples"
- 3 Private correspondence between Mr H. E. Bennett (Johnson Matthey) and Mr J. R. Knight (Engelhard Industries)
- 4 T. J. Quinn and T. R. D. Chandler, *Platinum Metals Rev.*, 1972, 16, (1), 2-9
- 5 *B.S.I. News*, 1973, (April), 11, 23
- 6 *N.B.S. Tech. News Bull.*, 1972, 56, (9), 224-225