THE INSTITUTE OF PETROLEUM

PETROLEUM MEASUREMENT MANUAL

THE PERFORMANCE OF TURBINE METERS IN LOADING GANTRIES - A REVIEW OF PROVING AND TEST DATA

Petroleum Measurement Paper No. 9

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Supplement to Petroleum Measurement Manual, Part X, Meter Proving, Section 10, Recommended UK Operational Practice for Proving Turbine Meters in Loading Gantries

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FOREWORD

The Petroleum Measurement Committee of the Institute of Petroleum is responsible for the production and maintenance of standards and guides covering the various aspects of static and dynamic measurement of petroleum. These are issued as separate Parts and Sections of the Institute's *Petroleum Measurement Manual*, which was first published in 1952.

Membership of the IP working panels is made up of experts from the oil industry, equipment manufacturers, cargo inspectors and government authorities. Liaison is maintained with parallel working groups of the Committee on Petroleum Measurement of the American Petroleum Institute, and is extended as necessary to embrace other organizations concerned with quantitative measurement in other countries and in other industries.

Users are invited to send comments, suggestions, or details of experience with this issue to:

The Technical Manager, Standards
Institute of Petroleum
61 New Cavendish Street
London W1G 7AR
United Kingdom

The *Petroleum Measurement Manual* is widely used by the petroleum industry and has received recognition in many countries by consumers and the authorities. In order to promote their wide adoption internationally, it is the policy to submit selected standards through the British Standards Institute to Technical Committee TC 28 - Petroleum Products and Lubricants - of the International Organization for Standardization (ISO/TC 28) as potential International Standards.

A full list of the Parts and Sections of the *Petroleum Measurement Manual* (PMM) is available on request from the Institute of Petroleum.

Note:

The IP *Petroleum Measurement Manual* is recommended for general adoption but shall be read and interpreted in conjunction with weights and measures, safety and other regulations in force in the location where it is to be applied. Such regulatory requirements shall have precedence over the corresponding clauses in the Manual except where the requirements of the Manual are more rigorous, when its use is recommended. The Institute disclaims responsibility for any personal injury, or loss or damage to property howsoever caused, arising from the use or abuse of any Part or Section of the Manual.

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J Miles	Consulant
J H R Phipps	Institute of Petroleum (Editorial)

Company affiliations are those that applied at the time the document was being drafted.

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INTRODUCTION

Petroleum Measurement Manual, Part X, Section 10, (Reference 1) specifies the procedures for proving turbine meters in road or rail loading gantry installations. The procedures are based on those employed for proving positive displacement (PD) meters, but make allowance for the special requirements of turbine meters. Many of the problems associated with the use of turbine meters in the limited space available and with the variations of pipework in gantry installations have been appreciated for some time. The magnitude of the effects and the actions that may be taken to mitigate them are less well understood.

The pressure to introduce turbine meters arose from the fact that their capital costs are significantly less than the equivalent PD meter. Several gantries were therefore equipped with turbine meters in the 1980s and early 1990s, as a result of which the industry has generated a significant amount of data on their performance, both through special test programmes and through routine proving. This *Petroleum Measurement Paper* presents data derived from this work (made available by the oil companies involved) and from technical development programmes sponsored by the IP, to provide the basis for the proving recommendations in Reference 1.

Summaries of the results are presented and discussed below under three separate headings:

— Data derived from routine proving operations.
— Data generated during field tests or trials.
— Data produced in flow laboratory tests or other tests under controlled conditions.

Inevitably with data drawn from such a range of sources, there will be differences in the test procedures and the corrections employed. However, in this document each set of results is self-consistent and it is reasonable to argue that meter performance variations in different installations provide a realistic basis for comparison.

Most of the companies supplying data have asked that the sources should not be identified. As a consequence of this, none of the sources is identified.