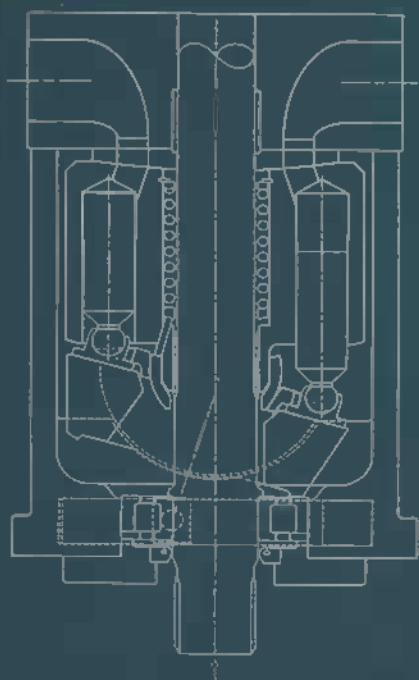


# Tribology of Hydraulic Pump Testing



George E. Totten, Gary H. Kling, and  
Donald J. Smolenski, editors



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Editors*

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The quality of the papers in this publication reflects not only the obvious efforts of the authors and the technical editor(s), but also the work of these peer reviewers. The ASTM Committee on Publications acknowledges with appreciation their dedication and contribution to time and effort on behalf of ASTM.

## Foreword

This publication, *Tribology of Hydraulic Pump Testing*, contains papers presented at the symposium of the same name, held on 4–5 December 1995. The symposium was sponsored by ASTM Committee D-2 on Petroleum Products and Lubricants and its Subcommittee D02.N on Hydraulic Fluids. George E. Totten of Union Carbide Corporation in Tarrytown, New York; Gary H. Kling of Caterpillar Inc. in Peoria, Illinois; and Donald J. Smolenski of General Motors Corporation in Warren, Michigan presided as symposium chairmen and are editors of the resulting publication.

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# Overview

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Traditionally, numerous tests have been used to determine the lubrication properties of hydraulic fluids. These tests have included both pump tests and bench tests. However, none of these tests has achieved consensus acceptance within the fluid power industry. This lack of consensus has affected everyone in the industry.

Fluid users are confronted with a myriad of data obtained from different tests, if any at all, and almost all of the tests are conducted differently with no assurance that there is any correlation with specific types of wear that may be encountered in their hydraulic pumps.

Hydraulic pump OEMs (original equipment manufacturers) face a similar dilemma in that they are continually being asked to approve the use of new fluids on the basis of test data, if it exists, that may be conducted under conditions that may have no applicability to normal hydraulic pump usage or to their pumps.

Fluid suppliers are also confronted with obtaining lubrication data that illustrates that their fluids will exhibit the expected lubrication properties in every manufacturer's pumps of all designs and bearing configurations and used in widely varying conditions, which are often severe. This problem is compounded by the fact that OEMs will not accept any test data except a use test in their own particular pump, often under unique evaluation conditions that may not correlate to the actual use conditions of the pump. Furthermore, it is impossible to evaluate every fluid in every pump under numerous evaluation conditions.

Therefore, there is a need to develop a hydraulic fluid testing protocol that will provide the desired insights into the lubrication properties of hydraulic fluids in a widely varying array of pumps and use conditions. This testing protocol should provide the user a method of specifying fluids for particular uses and use conditions. The OEM should be able to apply the data obtained from standard tests to predict the lubrication properties that would be attained with different pumps, pressures, rotational speeds, wear surfaces, and bearings. Ideally, the fluid supplier should have available standard tests accepted by everyone in the industry that can be applied cost-effectively to determine fluid lubricity in hydraulic pumps and motors. Furthermore, these lubrication data could be correlatable to the expected performance in any manufacturer's pumps and use conditions.

Thus far, the above stated objectives are only a dream. The Tribology of Hydraulic Pump Testing conference was held in Houston, Texas on December 4–5, 1995 as a first step in addressing this very complex issue. The objective of this conference was to obtain an overview both of testing procedures that have been applied and new tests that are currently being developed to successfully evaluate hydraulic fluid lubricity.

The topics addressed at this conference include the potential application of fundamental tribological principles in solving and generalizing the lubrication problems in hydraulic fluid lubrication of a broad range of pumps and motors. An overview of the most commonly encountered pump tests and new pump testing proposals was provided. The predictability of fluid contamination on pump wear was addressed. Finally, a number of bench testing procedures that are currently under evaluation to supplement or replace current pump testing procedures were discussed. This book provides a collection of the papers presented at this conference.

The tests and recommendations made by the speakers at this conference will be carefully analyzed by the newly formed "Hydraulic Pump Testing Task Force" within the ASTM D.02N committee. The task of this committee is to recommend and develop both bench test and pump

tests as appropriate to address the pressing need within the fluid power industry for more effective fluid lubrication evaluation.

Finally, *Tribology of Hydraulic Pump Testing* represents the first focused global conference addressing only the subject of hydraulic pump lubrication testing that has been held. This conference was attended by leaders in this technology from Europe, Asia, and North America. A further objective of the conference will be to facilitate continued global technical information.

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