STP 1310

Tribology of Hydraulic Pump Testing

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ASTM Publication Code Number (PCN):
04-013100-12

ASTM
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959
Printed in the U.S.A.
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.
Contents

Overview—G. E. TOTTEN, G. H. KLING, AND D. J. SMOLENSKI vii

LUBRICATION FUNDAMENTALS

Testing Within the Continuum of Multiple Lubrication and Failure Mechanisms—
L. D. WEDEVEN, G. E. TOTTEN, AND R. J. BISHOP JR. 3

The Lubricant Film-Forming Properties of Modern Fire-Resistant Hydraulic Fluids—
M. RATOI-SALAGEAN AND H. A. SPIKES 21

The Effect of Refrigerants Under a Mixed Lubrication Regime—K. MIZUHARA AND
M. TOMIMOTO 38

Tribology of Hydraulic Pumps—A. YAMAGUCHI 49

PUMP TESTING

Tribological Testing With Hydraulic Pumps: A Review and Critique—R. J. BISHOP JR.
AND G. E. TOTTEN 65

Pump Testing Strategies and Associated Tribological Considerations—Vane Pump
Testing Methods ASTM D 2882, IP 281 and DIN 51389—J. REICHEL 85

Review of ASTM D 2882 and Current Possibilities—G. M. GENT 96

Section D.02.N.7 Status Report on 20VQ5 Vane Pump Test Development—
W. M. NAHUMCK AND T. MAROUGY 106

Evaluation of Vickers V-104 and 20VQ5 Vane Pumps for ASTM D 2882 Wear Tests
Using Water-Glycol Hydraulic Fluids—G. E. TOTTEN AND R. J. BISHOP JR. 118


Comparison of Vickers Vane Pump Tests Using Different Vickers Vane Pumps—
A. J. KUNZ AND E. BROSZEIT 140

Hydraulic Fluid Wear Test Design and Development—K. J. YOUNG 156
Energy Efficiency Screening Test for Hydraulic Fluids—L. A. BRONSHTEYN AND D. J. SMOLENSKI 165

Pump Tests for Hydraulic Fluid Wear Qualification—R. K. TESSMANN AND D. J. HEER 176

Standardized Hydraulic Fluid Testing—An Overview and History—J. M. JACKSON AND S. D. MARTY 186

Proposed Hydraulic Pump Testing for Hydraulic Fluid Qualification—H. M. MELIEF 200

Tribological Experiences of an Axial Piston Pump and Motor Manufacturer with Todays Available Biodegradable Fluids—K. H. WITTE AND D. K. WILLS 208

Evaluation of the Lubrication Properties of Biodegradable Fluids and Their Potential to Replace Mineral Oil in Heavily Loaded Hydrostatic Transmissions—D. G. FELDMANN AND J. HINRICH 220

Testing Method for Biodegradable Hydraulic Pressure Media Based on Natural and Synthetic Esters—A. REMMELMANN 230

FLUID CLEANLINESS

Relating Solid Contaminant Particle Size Distribution to Flow Degradation in Hydraulic Pumps—R. H. FRITH AND W. SCOTT 247

Contamination Sensitivity of Hydraulic Pumps and Valves—S. LEHNER AND G. JACOBS 261


BENCH TEST DEVELOPMENT


Importance of Mechanical Testing of Hydraulic Fluids—J. REICHEL 329

Correlating Fluid Lubrication Characteristics to Pump Wear Using a Bench Top Surface Contact Test Method—J. G. ELEFTHERAKIS AND R. P. WEBB 338

The Gamma Wear Test for Hydraulic Fluid Qualification—R. K. TESSMANN AND D. J. HEER 349

A Review of Four-Ball Methods for the Evaluation of Lubricants—J. M. PEREZ 361

Author Index 373

Subject Index 375
Overview

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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