

# STP 491



AMERICAN SOCIETY FOR TESTING AND MATERIALS

# HYDRAULIC SYSTEM CLEANLINESS

A symposium  
presented at the  
Seventy-third Annual Meeting  
AMERICAN SOCIETY FOR  
TESTING AND MATERIALS  
Toronto, Ont., Canada, 21-26 June 1970

ASTM SPECIAL TECHNICAL PUBLICATION 491

List price \$4.50  
04-491000-12



AMERICAN SOCIETY FOR TESTING AND MATERIALS  
1916 Race Street, Philadelphia, Pa. 19103

© BY AMERICAN SOCIETY FOR TESTING AND MATERIALS 1971  
Library of Congress Catalog Card Number: 70-151113  
ISBN O-8031-0125-6

NOTE

The Society is not responsible, as a body,  
for the statements and opinions  
advanced in this publication.

Printed in Baltimore, Md.  
June 1971

## Foreword

The Symposium on Hydraulic System Cleanliness was given at the Seventy-third Annual Meeting of the American Society for Testing and Materials held in Toronto, Ont., Canada, 21-26 June 1970. The symposium was sponsored by Committee D-2 on Petroleum Products and Lubricants. J. J. Weaver, Shell Oil Company, presided as symposium chairman.

## **Related ASTM Publications**

**Significance of ASTM Tests for Petroleum Products,  
STP 7-B (1957), \$3.50**

# Contents

Introduction	1
Hydraulic Oil Cleanliness: A Key to N/C Machine Maintenance—O. H. ARNDT	3
Maintenance of Cleanliness of Hydraulic Fluids and Systems—L. B. BARA- NOWSKI	18
Fluid Conditioning for Servo Systems—J. N. CORONEOS	29
Improve System Contamination Control and Increase System Efficiency— J. P. DUNCAN	34
Requirements for an Effective Program in Fluid Contamination Control— E. C. FITCH, JR.	39
Contribution of Hydraulic Fluids to System Contamination—E. A. KIRNBAUER	50
Status Report on the Tech O/F-7 Contamination Methods Program—D. A. MARLOW AND A. BEERBOWER	69
Filtering—From the Moon to the Mines—W. J. MARSH	78

# Introduction

---

Experience in the hydraulic industry indicates that there is a need for test methods to deal with problems caused by dirt in hydraulic systems. Representatives of industry have asked Technical Division N to consider the possibility of developing applicable test methods. To achieve a better understanding and definition of the problems, we have organized our symposium to discuss the various aspects of industrial hydraulic system cleanliness. We planned the symposium to include contributions from a wide range of interested parties. Our authors represent users of hydraulic systems, equipment manufacturers, filter manufacturers, technical societies, and educational institutions.

We believe that the authors have done an excellent job for us. Their papers show the benefits and problems associated with hydraulic system cleanliness and demonstrate the need for test methods to evaluate filters and measure contamination. It is hoped that Technical Division N will undertake the development of these test methods. Our symposium and the following list of D-2 Committee, ASTM Standards are suggested as guides for such an undertaking.

## *ASTM Standards Relating to System Cleanliness*

### *Sampling*

- D 2388 Field Sampling of Aerospace Fluids in Containers
- D 2407 Sampling Airborne Particulate Contamination in Clean Rooms for Handling Aerospace Fluids
- D 2429 Sampling Aerospace Fluids from Components
- D 2437 Open-Bottle Tap Sampling of Noncryogenic Fluid Systems
- D 2535 Sampling for Particulates from Aerospace Components with Convoluters
- D 2536 Sampling Particulates from Reservoir Type Pressure-Sensing Instruments by Fluid Flushing
- D 2537 Sampling Particulates from Storage Vessels for Aerospace Fluids by Vacuum Entrainment Techniques (General Method)
- D 2542 Liquid Sampling of Noncryogenic Aerospace Propellants

### *Sample Processing*

- D 2391 Processing Aerospace Liquid Samples for Particulate Contamination Analysis Using Membrane Filters

*Tests for Contamination*

- D 893 Test for Insolubles in Used Lubricating Oils
- D 1404 Estimation of Deleterious Particles in Lubricating Grease
- D 2273 Test for Trace Sediment in Lubricating Oils
- D 2276 Test for Particulate Contaminant in Aviation Turbine Fuels
- D 2387 Test for Insoluble Contamination of Hydraulic Fluids by Gravitimetric Analysis
- D 2390 Microscopic Sizing and Counting Particles from Aerospace Fluids on Membrane Filters
- D 2430 Tests for Identification of Metallic and Fibrous Contaminants in Aerospace Fluids
- D 2546 Test for Identification of Solder and Solder Contaminants in Aerospace Fluids

*Filters*

- D 2499 Method of Test for Pore Size Characteristics of Membrane Filters for Use with Aerospace Fluids
- D 2767 Test for Liquid Flow Rate of Membrane Filters

*Acknowledgment*

I wish to thank K. G. Henrikson, Mobile Oil Corp.; R. C. Givens, Texaco Inc; P. K. Schacht, Rex Chainbelt Inc.; R. H. Schmitt, Mobile Research and Development Co.; and W. M. Schrey, U.S. Steel Research, for their work and guidance in organizing the symposium.

*J. J. Weaver*

Shell Oil Company;  
symposium chairman.

