

Hydraulic Fluid Efficiency References

- 1) SAE 750693. "Effect of VI Improver on the In-Service Viscosity of Hydraulic Fluids". R.J. Kopko and R.L. Stambaugh, Fuel and Lubricants Meeting. Houston, Texas. June 3-5, 1975.
- 2) Technische Akademie Esslingen, 7th International Symposium –January 1990, "Can Hydraulic Oil Performance be Estimated by the Viscosity Index, "C.D. Neveu, R.L. Stambaugh", Esslingen, January 1990.
- 3) E.N. Ganic and T.G. Hicks, The McGraw-Hill Handbook of Essential Engineering Information and Data, McGraw-Hill, New York, Chapter 13, Engineering Thermodynamics, Fuels and Combustion, Pages 13.98-13.99, 1991

(Heavy-Duty Diesel Fuel Consumption Rates:)

Table 13.11 lists fuel consumption rates from 0.23- 0.27 kg/kWh for various types of diesel engines. Our OEM contacts at Volvo, Komatsu, Mack tell us that the state of the art engines currently are designed to consume 0.20-0.21 kg/kWh.

We selected 0.22 kg/kWh for our calculations.

- 4) I. Makkonen, "Performance of Seasonal and Year-Round Hydraulic Oils in Forestry Machines", FERIC Technical Note TN-251, Forest Engineering Technical Research Institute of Canada, 12/96.
- 5) P.W. Michael, S.N. Herzog, T.E. Marougy, "Fluid Viscosity Selection Criteria for Hydraulic Pumps and Motors". NCFP paper I00-9.12 presented at the International Exposition for Power Transmission and Technical Conference. 4-6 April 2000, Chicago, IL, USA.
- 6) G.E. Totten, Handbook of Hydraulic Fluid Technology, Marcel Dekker, New York, 2000, p. 27.
- 7) D.G. Placek and C.W. Hyndman, "Cost and Performance Advantages of Multigrade Hydraulic Fluids", Proceedings of the 7th Annual Fuels & Lubes Asia Conference, February 2001, Bangkok, Thailand.
- 8) D.G. Placek, "Study Examines Multigrade Fluids for Forestry Equipment" Hydraulics and Pneumatics, Penton Media, Vol. 54, No. 3, March 2001.
- 9) NFPA Recommended Practice T2.13.13-2002. "Fluid Viscosity Selection Criteria for Hydraulic Motors and Pumps". 2002. www.nfpa.com
- 10) S.N. Herzog, C.D. Neveu, D.G. Placek, "Influence of Oil Viscosity and Pressure on the Internal Leakage of a Gear Pump". Presented at the 57th Annual STLE meeting, May 19-23, 2002, Houston, TX, USA.

- 11) S.N. Herzog, C.D. Neveu, D.G. Placek, "Predicting the Pump Efficiency of Hydraulic Fluids to Maximize System Performance". NCFP I02-10.8/SAE OH 2002-01-1430 presented at the IFPE / SAE Off-Highway Meeting, March 19-23, 2002 Las Vegas, NV, USA.
- 12) C.D. Neveu, R. Cocks, P Hutchinson, "A Study of the Dependence of the Volumetric Efficiency of a Vane Pump on Pressure and Viscosity", ISFL-2002, Proceedings of the Third International Symposium on Fluids and Lubricants, New Delhi, India, October 7-9, 2002
- 13) D.G. Placek, S.N. Herzog, C.D. Neveu, "Reducing Energy Consumption with Multigrade Hydraulic Fluids", 9th Annual Fuels and Lubes Asia Conference, Singapore, January 21-24, 2003.
- 14) S.N. Herzog, C.D. Neveu, D.G. Placek, "Boost Performance and Reduce Costs by Selecting the Optimum Viscosity Grade of Hydraulic Fluid", Lubrication and Fluid Power Expo, Indianapolis, IN, May 4-8, 2003.
- 15) S.N. Herzog, C.D. Neveu, D.G. Placek, "Selecting the Optimum Viscosity Grade of Hydraulic Fluid", Lubrication and Fluid Power Magazine, November-December 2003, p. 7-12.
- 16) L. Henriksson, C.D. Neveu, S.N. Herzog, D.G. Placek, "Improving Pump Efficiency and System Performance by Selecting the Optimum Fluid Viscosity Grade", The 8th Scandinavian International Conference on Fluid Power, SICFP '03, Tampere, Finland, May 7-9, 2003.
- 17) C.D. Neveu, S.N. Herzog, D.G. Placek, "Selecting the Optimum Hydraulic Oil to Meet the Viscosity Requirements of Major Pump Manufacturers", The 10th Annual Fuels and Lubes Asia Conference, Shanghai, China, March 2-5, 2004.
- 18) S.N. Herzog, Hyndman, C.W., Simko, R.P., C.D. Neveu, "Effect of Operation Time on Oil Viscosity and Pump Efficiency", NCFP paper I05-9.3 presented at the International Fluid Power Exposition (IFPE), March 16, 2005, Las Vegas, NV, USA.
- 19) C.D. Neveu, S.N. Herzog, Placek, D.G., Alibert, M.J., Hedrich, K., "Influence of Viscosity Increase on the Rate of Temperature Increase of Hydraulic Fluids", NCFP paper I05-13.4 presented at the International Fluid Power Exposition (IFPE), March 17, 2005, Las Vegas, NV, USA.
- 20) B. Jones, "Eliminating Seasonal Fluid Changeouts" Industrial Lubrication, Vol. 3, No. 1, Summer 2005, p. 17-19.
- 21) H. Hamaguchi, "Introducing Maximum Efficiency Hydraulic Fluids", The 11th Annual Fuels and Lubes Asia Conference, Beijing, China, March 15-18, 2005 .

- 22) S.N. Herzog, C.D. Neveu, D.G. Placek, "The Benefits of Maximum Efficiency Hydraulic Fluids", Machinery Lubrication, July-August 2005, Volume 5, Number 4, p. 42-48.
- 23) C. Elmore, "High Performance Fluids – RohMax MEHF shows the way to more efficient systems" OEM Off-Highway, September 2005, Vol. 23, No. 6, p. 56-58
- 24) H. Görlitzer, M.J. Alibert, S.N. Herzog, C.D. Neveu, "Dependence of Pump Flow Rate on the Viscosity of High VI Hydraulic Oils", Proceeding of the 15th International Colloquium Tribology, Technische Akademie Esslingen, Stuttgart, Germany, January 17-19, 2006.