# Estimate the mass density of mineral oil (SAE 46) practically at different pressures and temperatures and the development of empirical equation to calculate the density*

**Eng. Abdu lKarim Swadi Saleh****

**Dr. Farid Abou Hamed*** **Dr. Jafer Mehdi Hasan*****

**Abstract**

**The density important characteristic for being involved in a lot of theoretical analysis of hydraulic systems or lubrication systems. Many research study examined density at atmospheric pressure, for ease of measured practically or theoretically and at different temperatures, and there is research theory addressed change density when pressure is high, but certified the temperature and other research dealt with and theoretically calculate density at pressures and high temperatures. Density change and effectively with pressure and temperature, how will be found in practice? In this research will be done indirectly through the conclusion (Bulk modulus) values under different conditions of pressure and temperature and density will be calculated. Been inferred Bulk modulus practically by measuring volumetric change of mineral oil because of compressibility and at a wide range of pressure and temperatures, this procedure was designed and installed the hydraulic system for this purpose. Was reached rules the general behavior of the density mass is that when a certain pressure, the temperature increase in equal proportions leads to reduced density equal proportions almost too and theoretical results (which impose a proven Bulk modulus) and the practical results of the density of mass be nearly identical at temperatures medium (fference increases with increasing temperature. And the effect of heat greater than the effect of pressure on the mass density, as well as there are points where mutual influence equal reverse of heat and pressure, producing equal values of the mass density. Empirical equation was developed to calculate the mass density derived from the practical results of giving real values more accurate than the previously established equations.**

**Key words: mass density, mineral oil, heat and pressure, empirical equation, the hydraulic system.**

* For the paper in Arabic see pages (379-393).

**Mechanical department. Faculty of mechanical and electrical engineering. Damascus university.

*** Ass.prof. Mechanical department. Faculty of mechanical and electrical engineering. Damascus university

**** Prof. Machines and equpements department. University of technology – Baghdad – Iraq.

## References:

1- Digital Engineering Library@ McGraw-Hill (www.accessengineeringlibrary.com)Copyright © 2009 The McGraw-Hill Companies.

2- Wikipedia, the free encyclopedia registered trademark of the Nicomedia Foundation, Inc., 17 December 2011

3- The engineering Toolbox Resources, Tools and Basic Information for Engineering and Design of Technical Applications!

4- Hoberock, L.L., Thomas, D.C., Nickens, H.V.: "Here's How Compressibility and Temperature Affect Bottom-Hole Mud Pressure", OGJ, Mar 22, 1982, p. 159.

5- Kutasov, I.M.: "Water FV Factors at Higher Pressure and Temperatures," Oil & Gas J. (Mar, 20, 1989) 102-104.

6- Sorelle, R.R., Jardiolin, R.A., Buckley, P., Barios, J.R.: "Mathematical Field Model Predicts Downhole Density Changes in Static Drilling Fluids", SPE 11118, New Orleans, Sept 26-29, 1982.