

TECHNICAL REPORT N.º 03/99

REFERENCE: Physical and chemical analysis of MILITEC-1 metal conditioner. The object was to determine the likelihood of formation of hydrogen chloride and/or hydrochloric acid from the combination of the chlorine ions found in MILITEC-1 with the water vapor often found in the lubricating systems of mechanical and hydraulic equipment.

PERFORMED BY: Professor Dr. Ramón Molina Valle.

Professor Adjunct at the **Federal University of Minas Gerais**, Department of Mechanical Engineering (UFMG - Belo Horizonte - MG - Brazil).

REQUESTED BY: Espiña e Ribeiro Comércio e Representações Ltda., MILITEC-1 representatives for the State of Minas Gerais (Brazil), *at the special written request of MERCEDES BENZ do Brasil S.A.,* Juiz de Fora, MG (Brazil), dated 23/02/99, signed by Eng.º Ferdinando Trivellato, APFM Department.

1 - HISTORY

The manufacturer of MILITEC-1 Metal Conditioner states that MILITEC-1 can be added to the lubricating oil of combustion engines, gearboxes, and general industrial equipment. In this study, several experiments were conducted with the objective of determining the chemical suitability of MILITEC-1 Metal Conditioner for this stated purpose. Different assays were performed on previously prepared samples to determine the critical parameters of the equipment, such as: chemical characterization of both the MILITEC-1 and the MOBIL OIL SAE 20W-40 multi-viscosity mineral oil used in this test; grade of miscibility of both constituents, and of these with water; acidity of the MILITEC-1/oil mixture and of these with water; and, finally, presence of chloride ions.

The final objective of this study was to determine whether or not MILITEC-1 is appropriate for use in machinery. Specifically, we sought to determine if there might be any possibility whatsoever that use of MILITEC-1 could lead to formation of hydrochloric acid within the lubrication systems of continuously functioning equipment, thereby causing gradual internal corrosion.

2 - METHODOLOGY

- I. Preparation of Samples
- II. Qualitative Characterization of samples (Oil+MILITEC-1) - Infrared Spectrum.
- III. Determination of miscibility of MILITEC-1 and Oil, and these with water in different amounts, at 90°C working conditions.
- IV. Determination of pH, of each of above generated systems at 90°C working conditions.
- V. Quantitative Analysis of Chloride Ions (Identification of Cl⁻ anions) through the atomic absorption technique - indirect method.
- VI. Quantitative Analysis of Total Acidity (volumetric neutralization and potentiometry).

Certificate

VII. Identification and Characterization of test samples constituents, using gaseous chromatography coupled to mass spectrometry (CG/MS).

3 – FINAL CONCLUSION

Under the described conditions and analysis, the multi-viscosity SAE 20W-40 mineral oil was shown to be composed of a complex mixture of long chain aliphatic hydrocarbons. The MILITEC-1 Metal Conditioner, also composed of long chain hydrocarbons, additionally showed the presence of stable chlorate esters. No chlorinated paraffins were found.

Despite the large quantities of water used in the test samples, the MILITEC-1/oil mixture continued to be *completely stable*, showing the same pH as had been measured in the absence of water. The low acidity content and stability of the MILITEC-1/oil mixture guarantees the *total absence of hydrogen chloride and/or hydrochloric acid* under the operating conditions found in the lubricating systems of mechanical and hydraulic equipment. This insures that MILITEC-1 cannot cause internal corrosion. **Thus, we conclude that MILITEC-1 is completely safe and suitable for use in machinery.**

4 - ADDITIONAL CONCLUSIONS

(Solicited by the Representative and derived from these tests):

Since MILITEC-1 Metal Conditioner is a chemically reacted compound containing chlorinated synthetic esters (no chlorinated paraffins), and is *completely stable* in the presence of humidity and heat, we can reach the following additional conclusions:

- **MILITEC-1 does not modify the chemical and/or physical characteristics of the oil to which it is added.**
- **When heated, MILITEC-1 exits totally from the oil as it reacts with, and is adsorbed by, the surface of the metal. MILITEC-1 uses the oil only as a vehicle to reach the metal.**

Belo Horizonte, September 27, 1999.

Original in Portuguese language, signed by:

Prof. Dr. Ramón Molina Valle

Mechanical Engineering Department of UFMG.

English Translation by: Jörn-Peter Dieckmann Pelka

TMA Rep. Com. Ltda. - Curitiba - PR (Branch: Joinville - SC) - Brazil.

Phones: (55 41) 333.3435 or (55 47) 426.4439 - Cellular: (55 41) 9977.0477

E-mail: jpeter@zaz.com.br