



QUARTZDYNE, INC.

A **DOVER** RESOURCES COMPANY

1020 ATHERTON DRIVE
SALT LAKE CITY, UTAH 84123 USA
801-266-6958; FAX 801-266-7985
www.quartzdyne.com

ACCEPTABLE OILS FOR USING AROUND THE QUARTZDYNE PRESSURE SENSOR

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With the ever-increasing pressures and temperatures encountered in today's downhole applications, Quartzdyne is continuing to improve its quartz pressure sensor on the inside (with proprietary cleanroom processes), and on the outside of the sensor as well. Since our inception in 1991, we have used Di-2-Ethylhexyl Sebacate as the fluid fill inside the pressure housing (around the pressure sensor). At that time, sebacate seemed the logical choice due to its extensive use in dead weight testers. In 1992, Quartzdyne developed the Series QB bellows, which isolated the pressure sensor from corrosive downhole fluids. Even after the introduction of the QB (and its siblings, the QBX, QBT, QBP, and QBM), we continued using sebacate as the fluid fill. Sebacate still remains an attractive fluid because of its low compressibility, allowing for a smaller volume bellows.

During the past six months, Quartzdyne has compared over 10 alternative fluids with sebacate. The tests were designed to establish how stable the fluids are over time at temperature. We analyzed each fluid's effect on the pressure sensor at continuous temperatures of 225°C, for periods of roughly three weeks. We determined that sebacate (a synthetic diester of sebacic acid and 2-ethylhexyl alcohol) actually breaks down at 200°C, forming a mild acid (sebacic acid). Our results indicate that the breakdown does not occur at temperatures of 177°C or less. However, temperatures of around 200°C do indeed destabilize the fluid, causing it to become acidic. Sebacic acid mildly etches the pressure sensor, which may cause a resonant frequency drift.

In response to this discovery, Quartzdyne began filling pressure transducers rated to 200°C with Paratherm NF[®] in January of 1999. In our tests, Paratherm NF[®] was determined to be one of several acceptable fluids, due to its high temperature stability to 316°C. It also has an extremely low thermal expansion coefficient, making it ideal for use in bellows. In conjunction with this announcement, Quartzdyne is releasing a list of acceptable fluids for high temperature use around our pressure sensor:

- Paratherm NF[®]
- Calflo HTF
- Coolanol[®] 35R
- Krytox[®] GPL106
- Dow Corning 200[®] Fluid, 100 cSt.
- Dow Corning 550[®] Fluid

Please note that these acceptable fluids pertain to use **inside** of the bellows, or around the pressure sensor. On the **outside** of the bellows, fluids compatible with Inconel 625 are suitable. Although silicones are stable at high temperature, we decided against using the silicones for three primary reasons: (1) silicone contamination, (2) silicones have relatively large thermal expansions, and (3) silicones are relatively compressible fluids. The latter two issues affect bellows performance, while the first issue is vital in processing a reliable sensor in the cleanroom. (We exercise strict caution in using any silicones at our facility.) Our customers are welcome to use the silicones. They will not degrade the sensor performance in any way. Here at Quartzdyne, however, we choose to minimize their usage.

If you would like us to qualify a new fluid of your choice, we will do so, free of charge. Consult the factory for more details.

Paratherm NF[®], Coolanol[®], Krytox[®], Dow Corning 200[®] Fluid, and Dow Corning 550[®] Fluid are registered trademarks of Paratherm Corporation, CIOC, DuPont, Dow Corning Corporation, and Dow Corning Corporation, respectively.

Starting in August 1999, Quartzdyne® Pressure Transducers will ship as follows:

Maximum Operating Temperature	Installed Bellows	Fluid Inside Pressure Housing (Around the Pressure Sensor)	Fluid Outside Bellows
177°C or lower	✓ Yes	Paratherm NF®	Di-2-Ethylhexyl Sebacate
177°C or lower	No	Di-2-Ethylhexyl Sebacate	Not Applicable
200°C or higher	✓ Yes	Paratherm NF®	Di-2-Ethylhexyl Sebacate
200°C or higher	No	Paratherm NF®	Not Applicable

Transducers rated to 200°C and higher will be calibrated with an installed bellows (to prevent any possible ingress of sebacate into the pressure housing at high temperature). For units shipped without a bellows, the bellows will be removed prior to shipment. The removal of the bellows will shift the calibration, but this should not present a problem, since our customers purchasing “non-bellows” units usually assemble the bellows and transducer with an intermediate sub, and then recalibrate the tool.

Quartzdyne will continue to honor the full one-year warranty on all transducers, and the two-year limited warranty on the pressure sensor. Corrosion damage to the pressure sensor voids the warranty, however.

For your convenience, we have listed the sources of the acceptable fluids. Due to recent changes in shipping regulations, we cannot purchase these fluids in bulk and ship them to you. We are permitted to ship the small quantity of fluid inside the transducer.

Paratherm NF®
 Paratherm Corporation
 tel. (610) 941-4900
 tel. (800) 222-3611
 fax. (610) 941-9191
<http://www.paratherm.com>

Calflo HTF
 Petro-Canada
 tel. (610) 941-4900
 tel. (800) 463-5212
 fax. (610) 941-9191
<http://www.calflo.com>

Coolanol® 35R
 Exxon Company USA
 Tiger Resource Center
 tel. (800) 443-9966
 fax. (713) 656-6922

Krytox® GPL106
 Dupont Corporation
 tel. (800) 424-7502
<http://www.lubricants.dupont.com>

Dow Corning Fluids
 Dow Corning Corporation
 tel. (517) 496-6000
 tel. (800) 248-2481