

# Technical Report

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## NA-LUBE<sup>®</sup> BL-1400

### Ashless Multifunctional Antiwear Hydraulic Fluid Package Performance in Group I Base Oil

**NA-LUBE BL-1400** is used to formulate antiwear hydraulic fluids according to Parker Hannifin (Denison) HF-0, HF-1, HF-2 (see Note on page 2), ISO 6743/4 (HM, HV), DIN 51524 parts 2 and 3 (HLP, HVLP), AFNOR NF E 48-603 (HM, VM), SS 155434, VDMA 24318, SEB 181 222 and U.S. Steel 127 and 136.

The table below demonstrates the performance of **NA-LUBE BL-1400** in a Group I Base Oil.

| Tests   | 0.60% NA-LUBE<br>BL-1400<br>Group I<br>ISO VG 32 | 0.45% NA-LUBE<br>BL-1400<br>Group I<br>ISO VG 46 | 0.60% NA-LUBE<br>BL-1400<br>Group I<br>ISO VG 46 | Most Severe<br>Requirements  |
|---|--|--|--|--|
| <b>Base Oil</b>   |  |  |  |  |
| <b>Steel Corrosion</b><br>(ASTM D 665, DIN 51 585) A&B  | Pass / Pass                                      | Pass / Pass                                      | Pass / Pass                                      | DIN 5154/SEB181 222<br>Pass  |
| <b>Copper Corrosion</b><br>(ASTM D 130, DIN 51 759)<br>3 hours, 100°C<br>3 hours, 125°C<br>24 hours, 100°C  | 1a<br>1a<br>1a                                   | 1a<br>1a<br>1a                                   | 1a<br>1a<br>1a                                   | DIN 51524: 2 max<br><br>-<br>SEB 181 222: 1max   |
| <b>Demulsibility</b><br>(ASTM D 1401, DIN 51 599)<br>Oil-Water-Emulsion (ml)<br>Time (minutes)  | 41-39-0<br>10                                    | 40-40-0<br>10                                    | 40-40-0<br>10                                    | Thyssen TH-N<br>256 132<br>40-37-3 min<br>20 max   |
| <b>RPVOT (ASTM D 2272)</b><br>(150°C, H <sub>2</sub> O, O <sub>2</sub> , Fe and Cu catalysts)<br>Lifetime (minutes)   | 396  | 321  | 455  | US Steel<br>120 min  |
| <b>TOST (ASTM D 943)</b><br>(95°C, H <sub>2</sub> O, O <sub>2</sub> , Fe and Cu catalysts)<br>Hours to TAN 2 mg KOH/g   | 3650   | 2500   | 3650   | DIN 51524<br>1000 min  |
| <b>1000 Hour Sludge (ASTM D 4310)</b><br>(95°C, H <sub>2</sub> O, O <sub>2</sub> , Fe and Cu catalysts)<br>After 1000 hours:<br>Sludge (mg)<br>TAN (mg KOH/g)<br>Copper (mg)<br>Iron (mg)   | 38.6<br>0.17<br>1.3<br>15.5                      | 82.5<br>0.31<br>2.2<br>-1.0                      | 69.7<br>0.21<br>6.4<br>6.8                       | Parker Hannifin<br>(Denison) HF-0<br>100 max<br>1 max<br>200 max<br>50 max                   |
| <b>Cincinnati Milacron (ASTM D 2070)</b><br>(168 hours, 135°C)<br>Viscosity Change, (%)<br>Acid Number, 168 hours (mg KOH/g)<br>Color, 168 hours<br>Copper Rod Appearance<br>Copper Weight Loss (mg)<br>Iron Rod Appearance<br>Iron Weight Loss (mg)<br>Sludge (mg/100ml) | <3<br>0.21<br>4<br>2<br>0.9<br>1<br>0.5<br>9.8   | <3<br>0.20<br>5<br>3<br>1.4<br>1<br>0.0<br>16.1  | <3<br>0.19<br>5<br>2<br>1.7<br>1<br>0.1<br>9.6   | P-70<br>5 max<br>Report<br>Report<br>5 max<br>-10 max<br>no color<br>-1.0 to + 3.5<br>25 max |
| <b>Air Release (DIN 51589-1)</b><br>50°C (minutes)  | 3  | 3  | 3  | DIN 51524<br>5 max (ISO VG 32)<br>10 max (ISO VG 46)   |
| <b>Foaming (ASTM D 892)</b><br>Sequence I 25°C (ml/ml)<br>Sequence II 95°C (ml/ml)<br>Sequence III 25°C (ml/ml)   | 0 / 0<br>0 / 0<br>0 / 0                          | 0 / 0<br>0 / 0<br>0 / 0                          | 0 / 0<br>0 / 0<br>0 / 0                          | SEB 181 222<br>100 / 0<br>50 / 0<br>100 / 0  |

(see reverse side)

**NA-LUBE® BL-1400**  
Ashless Multifunctional Antiwear Hydraulic Fluid Package  
Performance in Group I Base Oil

(continued)

| Tests  | 0.60% NA-LUBE<br>BL-1400                  | 0.45% NA-LUBE<br>BL-1400                  | 0.60% NA-LUBE<br>BL-1400               | Most Severe<br>Requirements  |
|--|---|---|--|--|
| Base Oil   | Group I<br>ISO VG 32                      | Group I<br>ISO VG 46                      | Group I<br>ISO VG 46                   |  |
| <b>Hydrolytic Stability (ASTM D 2619)</b><br>Copper Loss (mg/cm <sup>2</sup> )<br>Acidity of Water Layer (mg KOH/25g)<br>TAN in Oil, 0 hours / 48 hours (mg KOH/g)<br>Insoluble Content (%)<br>Appearance of Copper Strip<br>(According to ASTM D 130) | 0.04<br>2.17<br>0.18 / 0.19<br>None<br>1b | 0.05<br>2.18<br>0.18 / 0.20<br>None<br>1b | 0<br>2.13<br>0.22 / 0.24<br>None<br>1b | <b>Parker Hannifin<br/>(Denison) HF-0</b><br>0.2 max<br>4 max            |
| <b>Four Ball Wear (DIN 51350-3)</b><br>1500 rpm / 1 hour / 300N (mm)<br>1800 rpm / 1 hour / 400N (mm)  | 0.42<br>0.57                              | 0.41<br>0.52                              | 0.38<br>0.48                           | --<br>--   |
| <b>FZG Gear Test A 8.3/90 (DIN 51389-2)</b><br>Damage Load Stage   | >12                                       | >12                                       | >12                                    | <b>DIN 51524:</b> 10 min<br><b>SEB 181 222:</b> 12 min                   |
| <b>Vickers Vane Pump Type V 105-C<br/>(DIN 51389-2)</b><br>Weight Loss Ring (mg)<br>Weight Loss Vanes (mg)   | --<br>--                                  | --<br>--                                  | 2.1<br>4.1                             | <b>SEB 181 222</b><br>60 max<br>15 max                                   |
| <b>Vickers 35VQ25A</b>   | Pass                                      | --  | --                                     | <b>M-2950-S &amp; I-286-S</b><br>Pass                                    |
| <b>Denison Filterability</b><br>Pore Size: 1.2 µm<br>Aging: 2% H <sub>2</sub> O, 5 minutes, 21°C<br>Filtration Time (1x 100 ml)<br>Procedure A Dry (seconds)<br>Procedure B with Water (seconds)   | 182<br>333                                | 212<br>390                                | 169<br>299                             | <b>Parker Hannifin<br/>(Denison) TP 02100</b><br><br>600 max<br>2x A max |
| <b>AFNOR Dry (E 68690)</b><br>Filterability Index  | 1.03                                      | 1.06                                      | 1.04                                   | --   |
| <b>AFNOR Wet (E 68691)</b><br>Filterability Index  | 1.33                                      | 1.25                                      | 1.22                                   | --   |

The results shown reflect data generated by King Industries' Technical Service Laboratory. Actual results may vary depending on the additive package, base oil, and test equipment design.

Note: ISO VG 32, 46 and 68 hydraulic fluids formulated with **NA-LUBE BL-1400** at 0.6% have been approved in both Group I and Group II base stocks by Parker Hannifin (Denison) for HF-0, HF-1 and HF-2 requirements. A Technical Report for performance in a Group II base oil is also available.

For Samples or Technical Service, contact King Industries or your King representative.

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Revision date: 24 SEPT 2015

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