

Fig. 1

Comparative Examples	Comp. Ex. A	Comp. Ex. B	Comp. Ex. C
Group III	46.00	45.50	45.50
Group IV	24.46	25.55	25.55
Group V - Ester	5.00	5.00	0.00
Group V - Alkylated Naphthalene	0.00	0.00	5.00
Dispersant 1 - carboxylate-capped PIBSA	5.20	0.00	0.00
Dispersant 2 - uncapped PIBSA	0.00	4.33	4.33
Detergent 1 - metal salicylate or mixtures	3.00	2.35	2.35
Detergent 2 - metal sulfonate or mixtures	0.00	0.00	0.00
Viscosity Modifier 1 - diblock olefin copolymer	5.00	5.00	5.00
Viscosity Modifier 2 - star olefin copolymer	5.50	5.50	5.50
Viscosity Modifier 3 - star olefin copolymer	0.00	0.00	0.00
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.00
Additive Package	5.84	6.77	6.77
TOTAL	100.00	100	100

Fig. 1 (Cont.)

Comparative Examples	Comp. Ex. D	Comp. Ex. E	Comp. Ex. F
Group III	48.50	48.36	45.50
Group IV	27.70	27.50	32.00
Group V - Ester	0.00	0.00	0.00
Group V - Alkylated Naphthalene	0.00	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	0.00	0.00	0.00
Dispersant 2 - uncapped PIBSA	4.33	5.00	4.33
Detergent 1 - metal salicylate or mixtures	2.35	2.35	0.00
Detergent 2 - metal sulfonate or mixtures	0.00	0.00	1.33
Viscosity Modifier 1 - diblock olefin copolymer	5.00	5.00	5.50
Viscosity Modifier 2 - star olefin copolymer	5.50	5.50	4.10
Viscosity Modifier 3 - star olefin copolymer	0.00	0.00	0.00
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.00
Additive Package	6.62	6.29	6.62
TOTAL	100	100	100

Fig. 1 (Cont.)

Comparative Examples	Comp. Ex. G	Comp. Ex. H	Comp. Ex. I
Group III	45.67	45.71	46.00
Group IV	26.10	25.00	25.51
Group V - Ester	5.00	5.00	5.00
Group V - Alkylated Naphthalene	0.00	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	0.00	0.00	5.20
Dispersant 2 - uncapped PIBSA	4.33	5.00	0.00
Detergent 1 - metal salicylate or mixtures	1.63	2.35	0.00
Detergent 2 - metal sulfonate or mixtures	0.00	0.00	1.33
Viscosity Modifier 1 - diblock olefin copolymer	5.00	5.00	5.00
Viscosity Modifier 2 - star olefin copolymer	5.50	5.50	5.50
Viscosity Modifier 3 - star olefin copolymer	0.00	0.00	0.00
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.00
Additive Package	6.77	6.44	5.84
TOTAL	100.00	100.00	100.00

Fig. 2

Examples	Ex. 1	Ex. 2	Ex. 3
Group III	46.00	47.00	47.25
Group IV	19.04	29.45	30.00
Group V - Ester	5.00	0.00	0.00
Group V - Alkylated Naphthalene	0.00	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	5.20	0.00	0.00
Dispersant 2 - uncapped PIBSA	0.00	4.33	4.33
Detergent 1 - metal salicylate or mixtures	3.00	0.00	2.35
Detergent 2 - metal sulfonate or mixtures	0.00	1.93	0.00
Viscosity Modifier 1 - diblock olefin copolymer	6.42	5.00	4.20
Viscosity Modifier 2 - star olefin copolymer	0.00	5.50	4.50
Viscosity Modifier 3 - star olefin copolymer	9.50	0.00	0.00
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.90
Additive Package	5.84	6.77	6.47
TOTAL	100	100	100

Fig. 2 (Cont.)

Examples	Ex. 4	Ex. 5	Ex. 6
Group III	30.73	41.37	46.00
Group IV	34.00	23.36	19.91
Group V - Ester	5.40	5.40	5.00
Group V - Alkylated Naphthalene	0.00	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	0.00	0.00	0.00
Dispersant 2 - uncapped PIBSA	4.33	4.33	4.33
Detergent 1 - metal salicylate or mixtures	3.00	3.00	3.00
Detergent 2 - metal sulfonate or mixtures	0.00	0.00	0.00
Viscosity Modifier 1 - diblock olefin copolymer	6.42	6.42	6.42
Viscosity Modifier 2 - star olefin copolymer	0.00	0.00	0.00
Viscosity Modifier 3 - star olefin copolymer	9.50	9.50	9.50
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.00
Additive Package	6.62	6.62	5.84
TOTAL	100	100	100

Fig. 2 (Cont.)

Examples	Ex. 7	Ex. 8	Ex. 9
Group III	30.41	54.05	46.00
Group IV	45.00	20.00	25.56
Group V - Ester	5.00	5.40	5.00
Group V - Alkylated Naphthalene	0.00	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	5.20	0.00	5.20
Dispersant 2 - uncapped PIBSA	0.00	4.33	0.00
Detergent 1 - metal salicylate or mixtures	2.20	3.00	2.00
Detergent 2 - metal sulfonate or mixtures	0.00	0.00	0.00
Viscosity Modifier 1 - diblock olefin copolymer	2.00	3.60	4.60
Viscosity Modifier 2 - star olefin copolymer	4.20	0.00	4.90
Viscosity Modifier 3 - star olefin copolymer	0.00	3.00	0.00
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.90
Additive Package	5.99	6.62	5.84
TOTAL	100	100	100.00

Fig. 3

Comparative Examples	Comp. Ex. A	Comp. Ex. B	Comp. Ex. C
Bench Data:			
KV100	11.9	11.9	12.2
KV40	64.8	64.4	67.3
KV100 (Base Oil Only)	4.3	4.2	4.2
HTHS at 150 °C	3.5	3.5	3.5
CCS at -35 °C	5930	5570	5990
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.12	0.05	0.07
Average Outlet Roller Follower Clearance (mm)	0.20	0.29	0.08
Average Total Roller Follower Clearance (mm)	0.16	0.17	0.08
Rear-Side Counterbalancer wear (mm)	0.00	0.04	-
Front-Side Counterbalancer wear (mm)	0.03	0.04	-
GM Roller Follower Wear Test			
Average Pin Wear (mils)	0.77	-	-
Cleanliness, merits	9.5	-	-
Gasoline valve train wear, microns	15	-	-
Fuel Economy, % Improvement	2.6	-	-

Fig. 3 (Cont.)

Comparative Examples	Comp. Ex. D	Comp. Ex. E	Comp. Ex. F
Bench Data:			
KV100	12.1	12.4	11.9
KV40	66.1	67.9	65.8
KV100 (Base Oil Only)	4.2	4.2	4.5
HTHS at 150 °C	3.5	3.5	3.5
CCS at -35 °C	5690	6000	6010
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.05	0.07	0.13
Average Outlet Roller Follower Clearance (mm)	0.07	0.13	0.19
Average Total Roller Follower Clearance (mm)	0.11	0.10	0.16
Rear-Side Counterbalancer wear (mm)	-	-	-
Front-Side Counterbalancer wear (mm)	-	-	-
GM Roller Follower Wear Test			
Average Pin Wear (mils)	-	-	-
Cleanliness, merits	-	-	-
Gasoline valve train wear, microns	-	-	-
Fuel Economy, % Improvement	-	-	-

Fig. 3 (Cont.)

Comparative Examples	Comp. Ex. G	Comp. Ex. H	Comp. Ex. I
Bench Data:			
KV100	12.3	11.9	11.8
KV40	67.1	65.4	64.5
KV100 (Base Oil Only)	4.2	4.4	4.3
HTHS at 150 °C	3.5	3.5	3.5
CCS at -35 °C	5860	6130	5630
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.07	0.06	0.06
Average Outlet Roller Follower Clearance (mm)	0.12	0.10	0.19
Average Total Roller Follower Clearance (mm)	0.09	0.08	0.12
Rear-Side Counterbalancer wear (mm)	-	-	-
Front-Side Counterbalancer wear (mm)	-	-	-
GM Roller Follower Wear Test			
Average Pin Wear (mils)	-	-	-
Cleanliness, merits	-	-	-
Gasoline valve train wear, microns	-	-	-
Fuel Economy, % Improvement	-	-	-

Fig. 4

Examples	Ex. 1	Ex. 2	Ex. 3
Bench Data:			
KV100	12.2	12.1	12.2
KV40	62.7	66.1	66.4
KV100 (Base Oil Only)	4.6	4.6	4.3
HTHS at 150 °C	3.5	3.5	3.5
CCS at -35 °C	5920	5660	6370
CCS at -30 °C	-	-	-
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.04	-	0.06
Average Outlet Roller Follower Clearance (mm)	0.04	0.06	0.06
Average Total Roller Follower Clearance (mm)	0.04	0.06	0.06
Rear-Side Counterbalancer wear (mm)	0.04	0.03	0.02
Front-Side Counterbalancer wear (mm)	0.11	0.04	0.05
GM Roller Follower Wear Test			
Average Pin Wear (mils)	-	-	-
Cleanliness, merits	9.5	-	-
Gasoline valve train wear, microns	-	-	-
Fuel Economy, % Improvement	2.6	-	-

Fig. 4 (Cont.)

Examples	Ex. 4	Ex. 5	Ex. 6
Bench Data:			
KV100	12.2	12.0	12.3
KV40	63.8	63.2	63.3
KV100 (Base Oil Only)	4.5	4.5	4.6
HTHS at 150 °C	3.5	3.5	3.5
CCS at -35 °C	5860	5910	6080
CCS at -30 °C	-	-	-
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.03	0.04	0.03
Average Outlet Roller Follower Clearance (mm)	0.02	0.04	0.03
Average Total Roller Follower Clearance (mm)	0.02	0.04	0.03
Rear-Side Counterbalancer wear (mm)	0.03	0.04	-
Front-Side Counterbalancer wear (mm)	0.09	0.05	-
GM Roller Follower Wear Test			
Average Pin Wear (mils)	-	-	-
Cleanliness, merits	9.6	9.6	-
Gasoline valve train wear, microns	-	-	-
Fuel Economy, % Improvement	2.6	2.5	-

Fig. 4 (Cont.)

Examples	Ex. 7	Ex. 8	Ex. 9
Bench Data:			
KV100	12.0	7.8	12.2
KV40	71.5	39.0	65.0
KV100 (Base Oil Only)	6.0	4.0	4.3
HTHS at 150 °C	3.6	2.6	3.5
CCS at -35 °C	-	4200	5770
CCS at -30 °C	5460	-	-
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.03	0.03	0.06
Average Outlet Roller Follower Clearance (mm)	0.03	0.03	0.05
Average Total Roller Follower Clearance (mm)	0.03	0.03	0.06
Rear-Side Counterbalancer wear (mm)	0.00	0.01	0.02
Front-Side Counterbalancer wear (mm)	0.03	0.02	0.10
GM Roller Follower Wear Test			
Average Pin Wear (mils)	0.41	-	-
Cleanliness, merits	9.4	9.5	-
Gasoline valve train wear, microns	15	2	-
Fuel Economy, % Improvement	2.0	4.1	-

Fig. 5

	Comp. Ex. A	Comp. Ex. J	Comp. Ex. K
Group III	46.00	46.00	0.00
Group IV	24.46	25.00	70.96
Group V - Ester	5.00	5.00	5.00
Group V - Alkylated Naphthalene	0.00	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	5.20	5.20	5.20
Dispersant 2 - uncapped PIBSA	0.00	0.00	0.00
Detergent 1 - metal salicylate or mixtures	3.00	2.35	3.00
Detergent 2 - metal sulfonate or mixtures	0.00	0.00	0.00
Viscosity Modifier 1 - diblock olefin copolymer	5.00	5.00	4.00
Viscosity Modifier 2 - star olefin copolymer	5.50	5.50	6.00
Viscosity Modifier 3 - star olefin copolymer	0.00	0.00	0.00
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.00
Additive Package	5.84	5.95	5.84
TOTAL	100.00	100	100

Fig. 5 (Cont.)

	Comp. Ex. L	Ex. 7	Ex. 10
Group III	46.11	30.41	46.00
Group IV	25.00	45.00	26.00
Group V - Ester	5.00	5.00	5.00
Group V - Alkylated Naphthalene	0.00	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	5.20	5.20	0.00
Dispersant 2 - uncapped PIBSA	0.00	0.00	4.33
Detergent 1 - metal salicylate or mixtures	2.20	2.20	2.35
Detergent 2 - metal sulfonate or mixtures	0.00	0.00	0.00
Viscosity Modifier 1 - diblock olefin copolymer	5.00	2.00	5.00
Viscosity Modifier 2 - star olefin copolymer	5.50	4.20	5.50
Viscosity Modifier 3 - star olefin copolymer	0.00	0.00	0.00
Viscosity Modifier 4 - polymethacrylate	0.00	0.00	0.00
Additive Package	5.99	5.99	5.82
TOTAL	100	100	100

Fig. 5 (Cont.)

	Ex. 11	Ex. 8
Group III	50.41	54.05
Group IV	20.00	20.00
Group V - Ester	5.00	5.40
Group V - Alkylated Naphthalene	0.00	0.00
Dispersant 1 - carboxylate-capped PIBSA	5.20	0.00
Dispersant 2 - uncapped PIBSA	0.00	4.33
Detergent 1 - metal salicylate or mixtures	3.00	3.00
Detergent 2 - metal sulfonate or mixtures	0.00	0.00
Viscosity Modifier 1 - diblock olefin copolymer	4.40	3.60
Viscosity Modifier 2 - star olefin copolymer	4.80	0.00
Viscosity Modifier 3 - star olefin copolymer	0.00	3.00
Viscosity Modifier 4 - polymethacrylate	1.20	0.00
Additive Package	5.99	6.62
TOTAL	100	100

Fig. 6

	Comp. Ex. A	Comp. Ex. J	Comp. Ex. K
Bench Data:			
KV100	11.9	12.2	12.0
KV40	64.8	66.3	66.8
KV100 (Base Oil Only)	4.3	4.3	4.4
HTHS at 150 °C	3.5	3.5	3.5
CCS at -35 °C	5930	5730	5320
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.12	0.14	0.11
Average Outlet Roller Follower Clearance (mm)	0.20	0.27	0.17
Average Total Roller Follower Clearance (mm)	0.16	0.21	0.14
GM Roller Follower Wear Test			
Average Pin Wear (mils)	0.77	0.52	-

Fig. 6 (Cont.)

	Comp. Ex. L	Ex. 7	Ex. 10
Bench Data:			
KV100	12.0	12.0	12.1
KV40	66.3	71.5	66.3
KV100 (Base Oil Only)	4.4	6.0	4.3
HTHS at 150 °C	3.5	3.6	3.5
CCS at -35 °C	-	-	5820
Engine Data:			
Diesel Polycyclic Endurance Test			
Average Inlet Roller Follower Clearance (mm)	0.05	0.03	0.04
Average Outlet Roller Follower Clearance (mm)	0.19	0.03	0.05
Average Total Roller Follower Clearance (mm)	0.12	0.03	0.05
GM Roller Follower Wear Test			
Average Pin Wear (mils)	-	0.41	0.35

Fig. 6 (Cont.)

	Ex. 11	Ex. 8
Bench Data:		
KV100	12.2	7.8
KV40	64.2	39.0
KV100 (Base Oil Only)	4.3	4.0
HTHS at 150 °C	3.5	2.6
CCS at -35 °C	5700	4200
Engine Data:		
Diesel Polycyclic Endurance Test		
Average Inlet Roller Follower Clearance (mm)	0.06	0.02
Average Outlet Roller Follower Clearance (mm)	0.10	0.03
Average Total Roller Follower Clearance (mm)	0.08	0.03
GM Roller Follower Wear Test		
Average Pin Wear (mils)	0.47	-

Fig. 7

Step	Speed [1/min]	Load [Nm]	Time [s]
1	1000	100	120
2	2000	176	120
3	1200	128	120
4	2200	176	120
5	1400	172	120
6	2400	176	120
7	1600	176	120
8	2600	176	120
9	1800	176	120
10	1800	176	120
11	2000	176	120
12	3000	176	120
13	2200	176	120
14	3200	174	120
15	2400	176	120
16	3400	172	120
17	2600	176	120
18	3600	170	120
19	2800	176	120
20	3800	168	120

Fig. 7 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
21	3000	176	120
22	4000	156	120
23	3200	174	120
24	4200	136	120
25	3000	176	120
26	4000	156	120
27	2800	176	120
28	3800	168	120
29	2600	176	120
30	3600	170	120
31	2400	176	120
32	3400	172	120
33	2200	176	120
34	3200	174	120
35	2000	176	120
36	3000	176	120
37	1800	176	120
38	2800	176	120
39	1600	176	120
40	2600	176	120

Fig. 7 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
41	1400	172	120
42	2400	176	120
43	1200	128	120
44	2200	176	120
45	1000	100	60
46	0	0	60
Engine Start			
47	1000	138	120
48	2000	242	120
49	1200	176	120
50	2200	242	120
51	1400	237	120
52	2400	242	120
53	1600	242	120
54	2600	242	120
55	1800	242	120
56	1800	242	120
57	2000	242	120
58	3000	242	120
59	2200	242	120
60	3200	239	120

Fig. 7 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
61	2400	242	120
62	3400	237	120
63	2600	242	120
64	3600	234	120
65	2800	242	120
66	3800	231	120
67	3000	242	120
68	4000	215	120
69	3200	239	120
70	4200	187	120
71	3000	242	120
72	4000	215	120
73	2800	242	120
74	3800	231	120
75	2600	242	120
76	3600	234	120
77	2400	242	120
78	3400	237	120
79	2200	242	120
80	3200	239	120

Fig. 7 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
81	2000	242	120
82	3000	242	120
83	1800	242	120
84	2800	242	120
85	1600	242	120
86	2600	242	120
87	1400	237	120
88	2400	242	120
89	1200	176	120
90	2200	242	120
91	1000	138	60
92	0	0	60
Engine Start			
93	1000	175	120
94	2000	308	120
95	1200	224	120
96	2200	308	120
97	1400	301	120
98	2400	308	120
99	1600	308	120
100	2600	308	120

Fig. 7 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
101	1800	308	120
102	2800	308	120
103	2000	308	120
104	3000	308	120
105	2200	308	120
106	3200	305	120
107	2400	308	120
108	3400	301	120
109	2600	308	120
110	3600	298	120
111	2800	308	120
112	3800	294	120
113	3000	308	120
114	4000	273	120
115	3200	305	120
116	4200	238	120
117	3000	308	120
118	4000	273	120
119	2800	308	120
120	3800	294	120

Fig. 7 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
121	2600	308	120
122	3600	298	120
123	2400	308	120
124	3400	301	120
125	2200	308	120
126	3200	305	120
127	2000	308	120
128	3000	308	120
129	2800	308	120
130	3800	294	120
131	2600	308	120
132	3600	298	120
133	2400	308	120
134	3400	301	120
135	2200	308	120
136	3200	305	120
137	2000	308	60
138	0	0	60
Engine Start			

Fig. 8

Step	Speed [1/min]	Load	Time [s]
VL_1000	1000	100%	180
VL_1250	1250	100%	180
VL_1500	1500	100%	180
VL_1750	1750	100%	180
VL_2000	2000	100%	180
VL_2500	2500	100%	180
VL_3000	3000	100%	180
VL_3500	3500	100%	180
VL_3750	3750	100%	180
VL_4000	4000	100%	180
VL_4400	4400	100%	180
VL_4500	4500	100%	180

Fig. 9

Step	Speed [1/min]	Load [Nm]	Time [s]
QD_1350_VL	1350	100%	300
QD_1350_350	1350	350	30
QD_1350_300	1350	300	30
QD_1350_250	1350	250	30
QD_1350_200	1350	200	30
QD_1350_150	1350	150	30
QD_1350_100	1350	100	30
QD_1350_80	1350	80	30
QD_1350_60	1350	60	30
QD_1350_40	1350	40	30
QD_1350_20	1350	20	30
Step	Speed [1/min]	Load [Nm]	Time [s]
QD_1500_VL	1500	100%	300
QD_1500_400	1500	400	30
QD_1500_350	1500	350	30
QD_1500_300	1500	300	30
QD_1500_250	1500	250	30
QD_1500_200	1500	200	30
QD_1500_150	1500	150	30
QD_1500_100	1500	100	30
QD_1500_80	1500	80	30
QD_1500_60	1500	60	30
QD_1500_40	1500	40	30
QD_1500_20	1500	20	30

Fig. 9 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
QD_2000_VL	2000	100%	300
QD_2000_400	2000	400	30
QD_2000_350	2000	350	30
QD_2000_300	2000	300	30
QD_2000_250	2000	250	30
QD_2000_200	2000	200	30
QD_2000_150	2000	150	30
QD_2000_100	2000	100	30
QD_2000_80	2000	80	30
QD_2000_60	2000	60	30
QD_2000_40	2000	40	30
QD_2000_20	2000	20	30
Step	Speed [1/min]	Load [Nm]	Time [s]
QD_2500_VL	2500	100%	300
QD_2500_400	2500	400	30
QD_2500_350	2500	350	30
QD_2500_300	2500	300	30
QD_2500_250	2500	250	30
QD_2500_200	2500	200	30
QD_2500_150	2500	150	30
QD_2500_100	2500	100	30
QD_2500_80	2500	80	30
QD_2500_60	2500	60	30
QD_2500_40	2500	40	30
QD_2500_20	2500	20	30

Fig. 9 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
QD_3000_VL	3000	100%	300
QD_3000_400	3000	400	30
QD_3000_350	3000	350	30
QD_3000_300	3000	300	30
QD_3000_250	3000	250	30
QD_3000_200	3000	200	30
QD_3000_150	3000	150	30
QD_3000_100	3000	100	30
QD_3000_80	3000	80	30
QD_3000_60	3000	60	30
QD_3000_40	3000	40	30
QD_3000_20	3000	20	30
Step	Speed [1/min]	Load [Nm]	Time [s]
QD_3500_VL	3500	100%	300
QD_3500_350	3500	350	30
QD_3500_300	3500	300	30
QD_3500_250	3500	250	30
QD_3500_200	3500	200	30
QD_3500_150	3500	150	30
QD_3500_100	3500	100	30
QD_3500_80	3500	80	30
QD_3500_60	3500	60	30
QD_3500_40	3500	40	30
QD_3500_20	3500	20	30

Fig. 9 (Cont.)

Step	Speed [1/min]	Load [Nm]	Time [s]
QD_4000_VL	4000	100%	300
QD_4000_300	4000	300	30
QD_4000_250	4000	250	30
QD_4000_200	4000	200	30
QD_4000_150	4000	150	30
QD_4000_100	4000	100	30
QD_4000_80	4000	80	30
QD_4000_60	4000	60	30
QD_4000_40	4000	40	30
QD_4000_20	4000	20	30
Step	Speed [1/min]	Load [Nm]	Time [s]
QD_4400_VL	4400	100%	300
QD_4400_250	4400	250	30
QD_4400_200	4400	200	30
QD_4400_150	4400	150	30
QD_4400_100	4400	100	30
QD_4400_80	4400	80	30
QD_4400_60	4400	60	30
QD_4400_40	4400	40	30
QD_4400_20	4400	20	30

Fig. 10

Step	Speed	Load	Time per step	Overall running time
	[1/min]	[Nm] or %Throttle	[s]	[min]
1	0	0%	300	5.0
2	4500	100%	180	8.0
3	4500	100%	300	13.0
4	1000	100%	120	15.0
5	5200	100%	30	15.5
6	1500	100%	330	21.0
7	5000	100%	19	21.3
8	1000	200	15	21.6
9	1000	100%	180	24.6
10	4900	100%	19	24.9
11	1100	200	15	25.1
12	1100	100%	180	28.1
13	4800	100%	19	28.5
14	1200	200	15	28.7
15	1200	100%	180	31.7
16	4700	100%	19	32.0
17	1300	200	15	32.3
18	1300	100%	180	35.3
19	4600	100%	19	35.6
20	1400	200	15	35.8

Fig. 10 (Cont.)

Step	Speed	Load	Time per step	Overall running time
	[1/min]	[Nm] or %Throttle	[s]	[min]
21	1400	100%	180	38.8
22	4500	100%	19	39.2
23	1500	200	15	39.4
24	1500	100%	180	42.4
25	4400	100%	19	42.7
26	1600	200	15	43.0
27	1600	100%	180	46.0
28	4300	100%	19	46.3
29	1700	200	15	46.5
30	1700	100%	180	49.5
31	4200	100%	19	49.9
32	1800	200	15	50.1
33	1800	100%	180	53.1
34	4100	100%	19	53.4
35	1900	200	15	53.7
36	1900	100%	180	56.7
37	4000	100%	19	57.0
38	2000	200	15	57.2
39	2000	100%	180	60.2
40	3900	100%	19	60.6

Fig. 10 (Cont.)

Step	Speed	Load	Time per step	Overall running time
	[1/min]	[Nm] or %Throttle	[s]	[min]
41	2100	200	15	60.8
42	2100	100%	180	63.8
43	3800	100%	180	66.8
44	2200	200	15	67.1
45	2200	100%	180	70.1
46	3700	100%	180	73.1
47	2300	200	15	73.3
48	2300	100%	180	76.3
49	3600	100%	180	79.3
50	2400	100%	180	82.3
51	3500	100%	180	85.3
52	2500	100%	180	88.3
53	3400	100%	180	91.3
54	2600	100%	180	94.3
55	3300	100%	180	97.3
56	2700	100%	180	100.3
57	3200	100%	180	103.3
58	2800	100%	180	106.3
59	3100	100%	180	109.3
60	2900	100%	180	112.3

Fig. 10 (Cont.)

Step	Speed	Load	Time per step	Overall running time
	[1/min]	[Nm] or %Throttle	[s]	[min]
61	3000	100%	180	115.3
62	1500	100%	300	120.3
63	4500	100%	300	125.3
64	0	0%	120	127.3
65	0	0%	300	132.3
66	4500	100%	180	135.3
67	1000	100%	120	137.3
68	5200	100%	30	137.8
69	1500	100%	330	143.3
70	4500	100%	420	150.3
71	4500	0%	180	153.3
72	4500	100%	420	160.3
73	4500	0%	180	163.3
74	1500	100%	300	168.3
75	4500	100%	300	173.3
76	0	0%	120	175.3

Fig. 11

Examples	12	13
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	2	2
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	85	85
Group II base stock	-	30
Group III base stock	30	0
Group IV base stock	50	50
Group V base stock	5	5
	100	100

Fig. 11 (Cont.)

Examples	14	15
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	2	2
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	2	2
Group II, III, IV, V base stock and/or mixtures	85	85
Group II base stock	0	30
Group III base stock	30	0
Group IV base stock	50	50
Group V base stock	5	5
	100	100

Fig. 11 (Cont.)

Examples	16	17
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.5
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	2	2
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	1
Group II, III, IV, V base stock and/or mixtures	86	84.7
Group II base stock	0	30
Group III base stock	31	0
Group IV base stock	50	49.7
Group V base stock	5	5
	100	100

Fig. 11 (Cont.)

Examples	18	19
Formulation Components		
Tungsten & Sulfur-containing compounds	0.5	0.5
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	2	2
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	2
Group II, III, IV, V base stock and/or mixtures	86.7	84.7
Group II base stock	0	30
Group III base stock	31.7	0
Group IV base stock	50	49.7
Group V base stock	5	5
	100	100

Fig. 11 (Cont.)

Examples	20	21
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	0	0
Mg and/or Ca salicylates	2	0.3
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	2	2
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	87	88.7
Group II base stock	0	33.7
Group III base stock	32	0
Group IV base stock	50	50
Group V base stock	5	5
	100	100

Fig. 12

Examples	22	23
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	5	5
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	82	82
Group II base stock	0	32
Group III base stock	32	0
Group IV base stock	45	45
Group V base stock	5	5
	100	100

Fig. 12 (Cont.)

Examples	24	25
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	5	5
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	2	2
Group II, III, IV, V base stock and/or mixtures	82	82
Group II base stock	0	32
Group III base stock	32	0
Group IV base stock	45	45
Group V base stock	5	5
	100	100

Fig. 12 (Cont.)

Examples	26	27
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.5
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	5	5
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	1
Group II, III, IV, V base stock and/or mixtures	83	81.7
Group II base stock	0	32
Group III base stock	33	0
Group IV base stock	45	44.7
Group V base stock	5	5
	100	100

Fig. 12 (Cont.)

Examples	28	29
Formulation Components		
Tungsten & Sulfur-containing compounds	0.5	0.5
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	5	5
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	2
Group II, III, IV, V base stock and/or mixtures	83.7	81.7
Group II base stock	0	32
Group III base stock	33.7	0
Group IV base stock	45	44.7
Group V base stock	5	5
	100	100

Fig. 12 (Cont.)

Examples	30	31
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	0	0
Mg and/or Ca salicylates	2	0.3
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	5	5
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	84	85.7
Group II base stock	0	35.7
Group III base stock	34	0
Group IV base stock	45	45
Group V base stock	5	5
	100	100

Fig. 13

Examples	32	33
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	10	10
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	77	77
Group II base stock	0	30
Group III base stock	30	0
Group IV base stock	42	42
Group V base stock	5	5
	100	100

Fig. 13 (Cont.)

Examples	34	35
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	10	10
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	2	2
Group II, III, IV, V base stock and/or mixtures	77	77
Group II base stock	0	30
Group III base stock	30	0
Group IV base stock	42	42
Group V base stock	5	5
	100	100

Fig. 13 (Cont.)

Examples	36	37
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.5
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	10	10
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	1
Group II, III, IV, V base stock and/or mixtures	78	76.7
Group II base stock	0	30
Group III base stock	31	0
Group IV base stock	42	41.7
Group V base stock	5	5
	100	100

Fig. 13 (Cont.)

Examples	38	39
Formulation Components		
Tungsten & Sulfur-containing compounds	0.5	0.5
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	10	10
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	2
Group II, III, IV, V base stock and/or mixtures	78.7	76.7
Group II base stock	0	30
Group III base stock	31.7	0
Group IV base stock	42	41.7
Group V base stock	5	5
	100	100

Fig. 13 (Cont.)

Examples	40	41
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	0	0
Mg and/or Ca salicylates	2	0.3
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	10	10
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	79	80.7
Group II base stock	0	33.7
Group III base stock	32	0
Group IV base stock	42	42
Group V base stock	5	5
	100	100

Fig. 14

Examples	42	43
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	15	15
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	72	72
Group II base stock	0	32
Group III base stock	32	0
Group IV base stock	35	35
Group V base stock	5	5
	100	100

Fig. 14 (Cont.)

Examples	44	45
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	15	15
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	2	2
Group II, III, IV, V base stock and/or mixtures	72	72
Group II base stock	0	32
Group III base stock	32	0
Group IV base stock	35	35
Group V base stock	5	5
	100	100

Fig. 14 (Cont.)

Examples	46	47
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.5
Mg and/or Ca sulfonates	2	2
Mg and/or Ca salicylates	2	2
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	15	15
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	1
Group II, III, IV, V base stock and/or mixtures	73	71.7
Group II base stock	0	32
Group III base stock	33	0
Group IV base stock	35	34.7
Group V base stock	5	5
	100	100

Fig. 14 (Cont.)

Examples	48	49
Formulation Components		
Tungsten & Sulfur-containing compounds	0.5	0.5
Mg and/or Ca sulfonates	1	2
Mg and/or Ca salicylates	2	1
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0	0
Olefin-based polymers (block, star, and/or mixed)	15	15
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.8	0.8
Silicone compounds	0.1	0.1
Alkoxyated alcohols	0	2
Group II, III, IV, V base stock and/or mixtures	73.7	71.7
Group II base stock	0	32
Group III base stock	33.7	0
Group IV base stock	35	34.7
Group V base stock	5	5
	100	100

Fig. 14 (Cont.)

Examples	50	51
Formulation Components		
Tungsten & Sulfur-containing compounds	0.2	0.2
Mg and/or Ca sulfonates	0	0
Mg and/or Ca salicylates	2	0.3
Borated and/or non-borated succinimides	5	5
Dialkyl and/or diarylamines	0.75	0.75
Phenolic derivatives	0.75	0.75
Oleic acid derivatives	0.5	0.5
Olefin-based polymers (block, star, and/or mixed)	15	15
Polymethacrylates	0.3	0.3
Fumarate vinyl acetate-based polymers	0.1	0.1
Zinc dialkyl dithiophosphate (1°, 2°, and/or mixed)	0.3	0.3
Silicone compounds	0.1	0.1
Alkoxyated alcohols	1	1
Group II, III, IV, V base stock and/or mixtures	74	75.7
Group II base stock	0	35.7
Group III base stock	34	0
Group IV base stock	35	35
Group V base stock	5	5
	100	100