



Test	SHRP Binder Testing 1996				SHRP Binder Testing 1997				SHRP Binder Testing 1998				SHRP Binder Testing 1999			
	Average	1 S <sub>x</sub>	2 S <sub>r</sub>	3 S <sub>R</sub>	Average	1 S <sub>x</sub>	2 S <sub>r</sub>	3 S <sub>R</sub>	Average	1 S <sub>x</sub>	2 S <sub>r</sub>	3 S <sub>R</sub>	Average	1 S <sub>x</sub>	2 S <sub>r</sub>	3 S <sub>R</sub>
401 - Rotational Viscosity @ 135°C (Pa·s)	0.26	0.036	0.0088	0.037	0.24	0.014	0.0058	0.015	0.26	0.017	0.0034	0.017	0.21	0.024	0.0044	0.024
402 - DSR 58°C, 25mm Plate, 1mm Gap, Complex Shear Modulus, G* (kPa)	1.05	0.17	0.038	0.18	0.92	0.12	0.033	0.12	1.07	0.12	0.048	0.13	0.75	0.24	0.066	0.25
403 - DSR 58°C, 25mm Plate, 1mm Gap, Phase Angle (°)	86.0	2.9	0.43	2.9	87.9	1.4	0.51	1.4	85.8	1.8	0.86	1.9	86.9	1.7	0.66	1.7
404 - DSR 58°C, 25mm Plate, 1mm Gap, G*/Sin δ (kPa)	1.06	0.18	0.034	0.18	0.92	0.12	0.033	0.12	1.07	0.12	0.048	0.13	0.75	0.25	0.065	0.25
405 - DSR 64°C, 25mm Plate, 1mm Gap, Complex Shear Modulus, G* (kPa)	0.53	0.079	0.022	0.080	0.47	0.114	0.047	0.120	0.52	0.090	0.023	0.092	0.38	0.129	0.032	0.131
406 - DSR 64°C, 25mm Plate, 1mm Gap, Phase Angle (°)	86.6	3.2	0.76	3.3	88.1	1.8	0.38	1.8	86.1	3.0	1.44	3.2	87.3	2.8	1.49	3.0
407 - DSR 64°C, 25mm Plate, 1mm Gap, G*/Sin δ (kPa)	0.53	0.083	0.023	0.084	0.47	0.116	0.049	0.122	0.53	0.090	0.024	0.092	0.38	0.130	0.032	0.133
408 - TFO/RTFO Change in Mass (%)	0.324	0.059	0.030	0.063	0.260	0.055	0.021	0.058	0.197	0.063	0.016	0.064	0.642	0.140	0.061	0.149
409 - TFO/RTFO DSR 58°C, 25mm, 1mm Gap, Complex Shear Modulus G* (kPa)	2.40	0.30	0.12	0.31	1.90	0.10	0.07	0.12	2.45	0.28	0.08	0.29	1.87	0.47	0.15	0.49
410 - TFO/RTFO DSR 58°C, 25mm, 1mm Gap, Phase Angle (°)	82.6	2.7	1.1	2.8	85.6	0.8	0.4	0.9	83.1	0.9	0.5	0.9	83.5	1.0	0.6	1.1
411 - TFO/RTFO DSR 58°C, 25mm, 1mm Gap, G*/Sin δ (kPa)	2.43	0.32	0.13	0.34	1.91	0.10	0.08	0.12	2.47	0.29	0.08	0.30	1.88	0.48	0.15	0.49
412 - TFO/RTFO DSR 64°C, 25mm, 1mm Gap, Complex Shear Modulus G* (kPa)	1.14	0.12	0.054	0.12	0.93	0.11	0.041	0.11	1.13	0.13	0.043	0.13	0.89	0.21	0.066	0.22
413 - TFO/RTFO DSR 64°C, 25mm, 1mm Gap, Phase Angle (°)	84.4	2.1	0.85	2.2	87.0	1.0	0.37	1.0	84.8	1.5	0.53	1.6	85.2	1.4	0.63	1.5
414 - TFO/RTFO DSR 64°C, 25mm, 1mm Gap, G*/Sin δ (kPa)	1.15	0.12	0.055	0.13	0.93	0.11	0.041	0.12	1.14	0.13	0.044	0.14	0.89	0.21	0.067	0.22
415 - PAV @ 100°C DSR 10°C, 8mm Plate, 2mm Gap, Complex Shear Modulus G* (kPa)	10142	4000	680	4000	12676	2090	1388	2378	12262	3171	897	3254	8139	1366	871	1540
416 - PAV @ 100°C DSR 10°C, 8mm Plate, 2mm Gap, Phase Angle (°)	42.6	1.5	0.88	1.7	43.9	0.7	0.55	0.9	40.9	2.2	0.53	2.2	44.3	1.4	0.44	1.4
417 - PAV @ 100°C DSR 10°C, 8mm Plate, 2mm Gap, G*/Sin δ (kPa)	7628	1300	480	1400	8763	1379	958	1585	7943	1883	539	1934	5755	891	547	996
418 - PAV @ 100°C DSR 13°C, 8mm Plate, 2mm Gap, Complex Shear Modulus G* (kPa)	7296	1500	650	1500	8029	1189	667	1308	8351	1701	612	1773	5424	870	454	946
419 - PAV @ 100°C DSR 13°C, 8mm Plate, 2mm Gap, Phase Angle (°)	45.6	1.6	0.68	1.7	47.4	0.6	0.49	0.7	43.4	1.6	0.45	1.6	46.7	1.3	0.50	1.4
420 - PAV @ 100°C DSR 13°C, 8mm Plate, 2mm Gap, G*/Sin δ (kPa)	5195	960	460	1000	5910	860	477	944	5712	1059	385	1105	3945	614	306	663
421 - BBR Creep Stiffness @ -18°C, 60s (MPa)	145	25	8.8	26	171	13	6.2	14	159	8	7.0	10	106	13	4.4	14
422 - BBR Slope, m, @ -18°C, 60s	0.373	0.016	0.0058	0.017	0.364	0.021	0.0086	0.022	0.341	0.014	0.0066	0.015	0.382	0.019	0.0058	0.019
423 - BBR Creep Stiffness @ -24°C, 60s	331	48	14	49	387	32	15	34	345	25	15	27	251	26	13	28
424 - BBR Slope, m, @ -24°C, 60s	0.308	0.017	0.0056	0.018	0.295	0.012	0.0065	0.013	0.287	0.010	0.0075	0.012	0.324	0.013	0.0046	0.014
425 - DT Failure Stress @ -18°C, 1mm/min (MPa)	1.16	0.30	0.15	0.31	1.19	0.02	0.29	0.29	1.15	0.27	0.32	0.37	1.59		0.37	
426 - DT Failure Strain @ -18°C, 1mm/min (%)	0.98	1.3	0.23	1.3	0.64	0.1	0.47	0.5	0.58	0.1	0.18	0.2	1.57		0.37	
427 - DT Failure Stress @ -24°C, 1mm/min (MPa)	1.77	0.33	0.32	0.40	1.64		0.30		1.32	0.21	0.18	0.26	2.87	2.20	0.55	2.25
428 - DT Failure Strain @ -24°C, 1mm/min (%)	0.44	0.36	0.055	0.36	0.34		0.072		0.17	0.10	0.039	0.10	0.93	0.71	0.217	0.73

Legend
1 Standard Deviation
2 Repeatability Standard Deviation
3 Reproducibility Standard Deviation
4 95% Confidence Limits for Repeatability (k-stat)
5 95% Confidence Limits for Reproducibility (h-stat)

(R)TFO = (Rolling) Thin Film Oven
PAV = Pressure Aging Vessel
DSR = Dynamic Shear Rheometer
BBR = Bending Beam Rheometer
DT = Direct Tension

DISCLAIMER
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