

Ingram Roots Sample Test Results

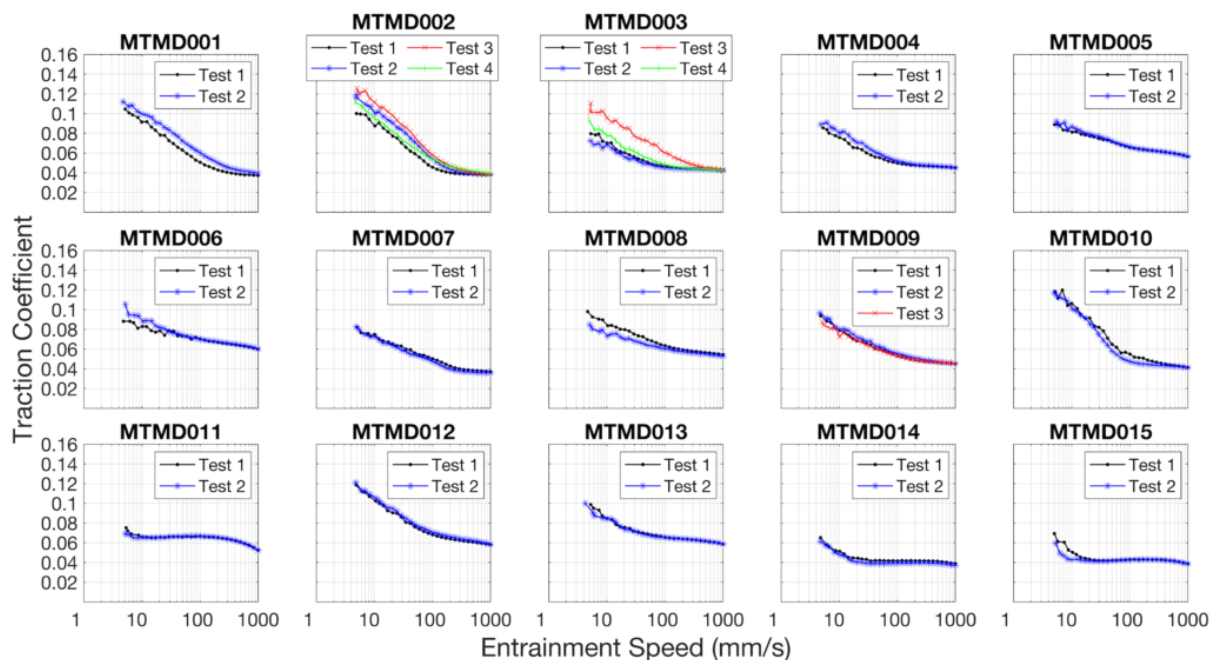
The following 15 oils were rated using the Ingram-Roots Methods:

	Application	Grade	Oil code	Description	Kinematic Viscosities (cSt)		
					40 °C	100 °C	Density, g/cc
Engine Oils	Passenger Car Motor Oil	0W15	MTMD001	Ester base fluid, low friction claims. Motor sport.	23	5.1	0.839
		0W30	MTMD002	Synthetic base fluid. API SN. ACEA C3.	71	12.3	0.84
		5W30	MTMD003	Synthetic base fluid, low SAP. API CF.	71	12	0.848
		5W20	MTMD004	Synthetic base fluid. API SN. ILSAC GF-5. Meets Ford WSS-M2C948-B	44	8.1	0.845
		20W50	MTMD005	Mineral base fluid, high SAP, for engines pre 1980s. API SF/CC.	156	17.9	0.883
	Heavy Duty Engine oil	15W40	MTMD006	Mineral base fluid. Mid-SAPs. API CJ-4, ACEA E7/E9	115	15.3	0.876
Driveline	Manual Transmission	75W90	MTMD007	Synthetic base fluid. API GL4.	75	15.2	0.869
	Automatic Transmission Fluid		MTMD008	Mineral base fluid. Dexron II (D)	39	7.5	0.867
	Automatic Transmission Fluid		MTMD009	Dexron VI	29	5.9	0.842
	Axle Fluid	75W90	MTMD010	API GL5	101	15.4	0.855
	Axle Fluid	85W140	MTMD011	API GL5	369	27	0.9
Industrial	Hydraulic fluid	VG 32	MTMD012	Mineral base fluid. DIN 51524 HLP.	32	5.4	0.867
	Hydraulic fluid	VG 46	MTMD013	Mineral base fluid. DIN 51524 HLP.	45	6.7	0.873
	Industrial gear oil	VG 220	MTMD014	Synthetic base fluid. DIN 51 517-3. Siemens approved (T7300)	223	27.9	0.851
	Industrial gear oil	VG 320	MTMD015	Synthetic base fluid. Zn free. DIN 51517-3. CLP-HC	313	36	0.853

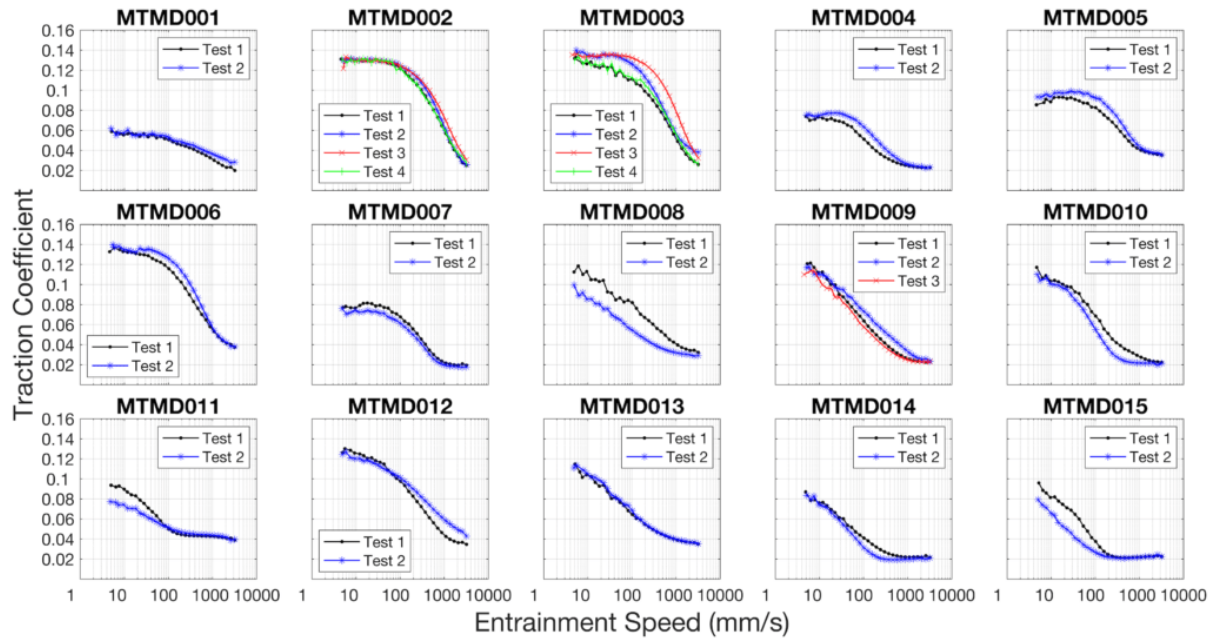
Table 1: Details of the lubricants used in this study including a short description and their physical properties

An example of the raw Stribeck curves for 15 oils at 40 °C and 100 °C along with their subsequent ratings are shown below:

Stribeck Curves at 40 °C



Stribeck Curves at 100 °C



Final Ratings

Oil Number	Application	Grade	40 °C		100 °C		
			Mixed	EHD	Boundary	Mixed	EHD
1	Engine Oils	0W15	6.9	8.5	8.8	7.7	
2		0W30	4.8	7.7	3.6	2.4	6.8
3		5W30	3.6	5.7	3.7	2.5	4.3
4		5W20	7.2	9.9	9.6	9.4	6.9
5		20W50	3.5	3.6	5.3	3.9	5.5
6		HDEO	15W40	0.9	1.7	3.1	1.7
7	Driveline	75W90	4.0	8.7	6.2	6.5	8.8
8		ATF	5.2	9.7	5.8	6.1	4.3
9		ATF	7.9	6.4	6.6	8.5	6.4
10		Axle	75W90	1.7	8.4	5.6	7.6
11	Axle	85W140		2.9	6.8	6.1	1.7
12	Industrial	Hydraulic VG 32	4.3	3.7	5.4	6.1	2.8
13		Hydraulic VG 46	4.7	7.1	6.6	6.7	3.2
14		Industrial gear VG 220		8.2	5.6	6.0	6.2
15		Industrial gear VG 320		8.2	6.3	7.8	4.3
Variation (2 x SD)			± 2.8	± 0.5	± 1.2	± 1.8	± 0.9