

**Tabel.** Data pengujian viskositas oli MPX2 pertama

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	MPX Temp Kamar	1	3	4,9	28,5	98
			9	10,2	28,5	102
			12	20,9	28,5	104,5
			30	52,8	28,5	105,6
			60	-	-	-
2	MPX Temp ± 30°C	1	3	3,7	33,6	74
			9	8,5	33,5	85
			12	16,4	33,3	82
			30	41,5	33,2	83
			60	83,6	33,2	83,6
3	MPX Temp ± 40°C	1	3	2,5	43,6	50
			9	5,7	43,3	57
			12	10,2	43,1	51
			30	25,8	43	51,6
			60	52,6	43	52,6
4	MPX Temp ± 50°C	1	3	2,3	52,1	46
			9	4,2	52,2	42
			12	7	51,9	35
			30	18,4	51,6	35
			60	37,9	51,5	36,9
5	MPX Temp± 60°C	1	3	1,8	60,2	37,9
			9	2,6	60,3	26
			12	5,2	60,2	26
			30	13,4	60,1	26,8
			60	27,8	60,1	27,8

**Tabel.** Data pengujianviskositas oli MPX2 kedua

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	MPX Temp Kamar	1	3	5	29,1	100
			6	10,1	29,3	101
			12	20,5	29,4	102,5
			30	51,6	29,5	103,2
			60	-	-	-
2	MPX Temp ± 30°c	1	3	3,3	34,5	66
			6	8	34,4	80
			12	15,9	34,1	79,5
			30	39,9	33,9	79,9
			60	79,6	33,9	79,6
3	MPX Temp ± 40°c	1	3	2,5	43,7	50
			6	5,9	43,5	59
			12	11	43,3	55
			30	26,3	43	52,6
			60	54,2	43	54,2
4	MPX Temp ± 50°c	1	3	2,5	52,5	50
			6	4,3	52,4	43
			12	7,2	51,5	36
			30	19,3	51	38,6
			60	39,8	51	39,8
5	MPX Temp ± 60°c	1	3	1,9	61,7	36
			6	3,3	61,5	33
			12	4,8	61,2	24
			30	13,2	60,9	26,4
			60	26,8	60,9	26,8

**Tabel.** Data pengujian viskositas oli MPX2 ketiga

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	MPX Temp Kamar	1	3	4,7	29,8	96
			6	9,9	29,7	99
			12	19,9	29,8	99,5
			30	50,1	29,9	102,2
			60	-	-	-
2	MPX Temp $\pm$ 30°C	1	3	4,4	33,7	88
			6	7,8	33,7	78
			12	16,2	33,6	81
			30	40,8	33,5	81,6
			60	81,2	33,5	81,2
3	MPX Temp $\pm$ 40°C	1	3	2,9	42,6	58
			6	6	42,4	60
			12	11,3	42,2	56,5
			30	28,2	42	56,4
			60	57,8	41,8	57,8
4	MPX Temp $\pm$ 50°C	1	3	2,1	53,8	42
			6	3,9	53,6	39
			12	6,8	53,5	34
			30	17,5	53,3	35
			60	34,9	53,3	34,9
5	MPX Temp $\pm$ 60°C	1	3	2,1	62,6	42
			6	3,5	62	35
			12	4,5	61,7	22,5
			30	12,8	61,6	25,6
			60	29	61,6	26

**Tabel.** Data pengujian viskositas oli Motul 3100 pertama

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	Motul Temp Kamar	1	3	6,8	29,6	136
			9	14,1	29,6	141
			12	28,9	29,6	144,5
			30	73	29,6	146
			60	-	-	-
2	Motul Temp± 30°C	1	3	5,4	33,8	108
			9	11,4	33,7	114
			12	23,8	33,6	119
			30	60,8	33,6	121,6
			60	11,9	33,4	119
3	Motul Temp ± 40°C	1	3	3,9	41,5	78
			9	8,6	41,1	86
			12	17,1	41	85,5
			30	42,9	40,9	85,8
			60	386	40,9	86
4	Motul Temp ± 50°C	1	3	3,7	53,1	74
			9	6,3	53,1	63
			12	11	53	55
			30	26,6	52,5	53,2
			60	53,8	52,3	53,8
5	Motul Temp ± 60°C	1	3	2,7	61,6	54
			9	4,9	61,2	49
			12	7,6	60,9	38
			30	19,3	60,6	38,6
			60	39,7	60,4	39,7

**Tabel.** Data pengujian viskositas oli Motul 3100 kedua

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	Motul Temp. Kamar	1	3	7	29,1	140
			6	14,5	29,1	145
			12	29,9	29,1	149,5
			30	75,7	29,1	151,4
			60	-	-	-
2	Motul Temp± 30°C	1	3	6,5	31,2	130
			6	13,2	31,2	132
			12	26,7	31,2	133,5
			30	67,4	31,2	134,8
			60	-	-	-
3	Motul Temp ± 40°C	1	3	4	43,7	80
			6	8,3	43,7	83
			12	15,7	43,5	78,5
			30	39	43,3	78
			60	79,7	42,9	79,7
4	Motul Temp ± 50°C	1	3	3,2	53	64
			6	6,1	52,3	61
			12	10,8	51,9	54
			30	27,8	51,6	55,8
			60	57,8	51,4	57,8
5	Motul Temp ± 60°C	1	3	3,6	60,8	72
			6	7,7	60,5	77
			12	12,9	61,3	64,5
			30	32,4	61	64,6
			60	51,9	60,5	51,9

**Tabel.** Data pengujian viskositas oli Motul 3100 ketiga

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	Motul Temp. Kamar	1	3	7,4	29,1	148
			6	14,9	29,1	149
			12	30,1	29,1	150,5
			30	75,7	29,1	151,7
			60	-	-	-
2	Motul Temp ± 30°C	1	3	6,6	31,5	132
			6	13	31,5	130
			12	26,6	31,5	133
			30	67,3	31,5	134,6
			60	100	31,5	100
3	Motul Temp ± 40°C	1	3	3,7	42,7	74
			6	8,1	42,5	81
			12	16,2	42,5	81
			30	40,6	42,3	81,4
			60	83	42	83,1
4	Motul Temp ± 50°C	1	3	3,1	53,8	62
			6	5,6	53,6	56
			12	10,2	53,5	51
			30	25,3	53,1	50,6
			60	53,1	53	53,1
5	Motul Temp ± 60°C	1	3	2,5	62,8	50
			6	4,5	62	45
			12	7,3	61,4	36,5
			30	18,9	61,1	37,8
			60	39	60,8	39,1

**Tabel.** Data pengujian viskositas oli BM1 pertama

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	BM 1 Temp Kamar	1	3	7,7	28,7	154
			9	15,9	28,7	159
			12	32,1	28,7	160,5
			30	80,6	28,7	161,2
			60	-	-	-
2	BM 1 Temp ± 30°C	1	3	5,5	33,9	110
			9	11,4	33,7	114
			12	23,8	33,6	119
			30	60,9	33,5	121,8
			60	-	-	-
3	BM 1 Temp ± 40°C	1	3	4,7	40,9	93
			9	9,3	40,5	94
			12	14,8	43,3	74
			30	37,9	43,1	75,8
			60	77,7	43,1	77,7
4	BM 1 Temp ± 50°C	1	3	2,9	50,7	58
			9	6,4	50,4	64
			12	11,5	50,2	57,5
			30	28,6	50,1	57,2
			60	58,4	50,2	58,4
5	BM 1 Temp ± 60°C	1	3	2,3	61,5	46
			9	4,1	61	41
			12	7,3	60,6	36,5
			30	18	60,6	37,6
			60	38,5	60,4	38,5

**Tabel.** Data pengujian viskositas oli BM1 kedua

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	BM 1 Temp Kamar	1	3	7,4	29,5	148
			6	15,1	29,5	151
			12	30,7	29,5	153,5
			30	77,3	29,5	153,5
			60	-	-	-
2	BM 1 Temp ± 30°C	1	3	6,1	34,6	122
			6	12,3	34,5	123
			12	24,8	34,5	124
			30	62,4	33,4	124,8
			60	-	-	-
3	BM 1 Temp ± 40°C	1	3	3,7	43,2	74
			6	8	43,2	80
			12	15,9	43,1	79,5
			30	40,2	43,1	80,4
			60	80,6	42,9	80,6
4	BM 1 Temp ± 50°C	1	3	2,8	54	56
			6	5,4	53,7	54
			12	10,1	53,4	50,5
			30	26,1	53,2	52,2
			60	53,8	53,2	53,8
5	BM 1 Temp ± 60°C	1	3	2,4	62,4	48
			6	4,1	62,2	41
			12	7,2	61,9	36
			30	18,2	61,5	37,4
			60	38,1	61,7	38,1



**Tabel.** Data pengujian viskositas oli BM1 ketiga

No	Fluida	Rotor	Speed (Rpm)	Percent (%)	Temperatur (°C)	Viskositas (mPas)
1	BM 1 Temp Kamar	1	3	7,4	29,6	148
			6	15,1	29,6	151
			12	30,7	29,6	153,5
			30	77,2	29,6	154,4
			60	-	-	-
2	BM 1 Temp ± 30°C	1	3	6	33,3	120
			6	12,2	33,2	122
			12	24,8	33,2	124
			30	62,6	33,2	125,2
			60	-	-	-
3	BM 1 Temp ± 40°C	1	3	3,9	42,8	78
			6	8,2	42,6	82
			12	16,4	42,4	82
			30	41,6	42,2	83,4
			60	84,8	42,1	84,8
4	BM 1 Temp ± 50°C	1	3	2,9	51,9	58
			6	5,7	51,5	57
			12	10,9	51,3	54,5
			30	28,1	51,1	54,6
			60	58	51,1	58
5	BM 1 Temp ± 60°C	1	3	2	60	46
			6	3,7	62	39
			12	6,3	62,6	36,7
			30	13,6	62,5	37
			60	38,3	61,4	38,3

**Tabel.** Data pengukuran konduktivitas termal sampel oli MPX2

Nomor Pengujian MPX 2	T1 (°C)	T2 (°C)	Tegangan Heater (Volt)	Arus Heater (A)	Daya, Qe, (Watt)	T1-T2 (°C)	Qi (Watt)	Qc (Watt)	Tebal Spesimen (m)	Luas Permukaan (m2)	K Eksperimen	Temperatur Rata-rata Spesimen (°C)
1	28,7	28,3	36	0,061	2,196	0,4	0,058621	2,137379	0,00034	0,0133	0,13659943	28,5
	30,3	28,6	74	0,124	9,176	1,7	0,249138	8,926862	0,00034	0,0133	0,13423853	29,45
	35,8	30,2	124	0,243	30,132	5,6	0,82069	29,31131	0,00034	0,0133	0,13380566	33
	41,9	32	162	0,317	51,354	9,9	1,450862	49,90314	0,00034	0,0133	0,12886054	36,95
	49,7	33	210	0,375	78,75	16,7	2,447414	76,30259	0,00034	0,0133	0,11680194	41,35
2	27,5	27,1	40	0,055	2,2	0,4	0,058621	2,141379	0,00034	0,0133	0,13685507	27,3
	29,8	28	75	0,129	9,675	1,8	0,263793	9,411207	0,00034	0,0133	0,13365958	28,9
	35,3	30,6	111	0,227	25,197	4,7	0,688793	24,50821	0,00034	0,0133	0,13330332	32,95
	42,1	33,2	152	0,303	46,056	8,9	1,30431	44,75169	0,00034	0,0133	0,12854249	37,65
	50,5	33,4	205	0,362	74,21	17,1	2,506034	71,70397	0,00034	0,0133	0,10719495	41,95
3	29	28,7	33	0,05	1,65	0,3	0,043966	1,606034	0,00034	0,0133	0,13685507	28,85
	30,9	29,4	64	0,128	8,192	1,5	0,219828	7,972172	0,00034	0,0133	0,1358666	30,15
	36,2	31,3	112	0,235	26,32	4,9	0,718103	25,6019	0,00034	0,0133	0,13356828	33,75
	43,2	33,1	163	0,308	50,204	10,1	1,480172	48,72383	0,00034	0,0133	0,12332391	38,15
	50,8	34	204	0,363	74,052	16,8	2,462069	71,58993	0,00034	0,0133	0,10893563	42,4

**Tabel.** Data pengukuran konduktivitas termal sampel oli Motul 3100

Nomor Pengujian Motul 3100	T1 (°C)	T2 (°C)	Tegangan Heater (Volt)	Arus Heater (A)	Daya, Qe, (Watt)	T1-T2 (°C)	Qi (Watt)	Qc (Watt)	Tebal Spesimen (m)	Luas Permukaan (m2)	K Eksperimen	Temperatur Rata-rata Spesimen (°C)
1	26,7	26,5	23	0,052	1,196	0,2	0,02931	1,16669	0,00034	0,0133	0,14912575	26,6
	28,9	27,4	63	0,135	8,505	1,5	0,219828	8,285172	0,00034	0,0133	0,14120093	28,15
	33,4	28,8	112	0,232	25,984	4,6	0,674138	25,30986	0,00034	0,0133	0,14065631	31,1
	39,9	31,1	155	0,305	47,275	8,8	1,289655	45,98534	0,00034	0,0133	0,13358696	35,5
	47,7	33	200	0,36	72	14,7	2,15431	69,84569	0,00034	0,0133	0,12146455	40,35
2	27,1	27	20	0,03	0,6	0,1	0,014655	0,585345	0,00034	0,0133	0,14963702	27,05
	29,2	27,6	65	0,142	9,23	1,6	0,234483	8,995517	0,00034	0,0133	0,14372537	28,4
	33,5	29	116	0,22	25,52	4,5	0,659483	24,86052	0,00034	0,0133	0,14122934	31,25
	40	30,9	160	0,301	48,16	9,1	1,333621	46,82638	0,00034	0,0133	0,13154564	35,45
	48	33,3	204	0,36	73,44	14,7	2,15431	71,28569	0,00034	0,0133	0,12396877	40,65
3	27,5	27,3	22	0,054	1,188	0,2	0,02931	1,15869	0,00034	0,0133	0,14810319	27,4
	29,6	28	70	0,129	9,03	1,6	0,234483	8,795517	0,00034	0,0133	0,14052988	28,8
	34,4	29,6	119	0,227	27,013	4,8	0,703448	26,30955	0,00034	0,0133	0,14011979	32
	40,7	32	158	0,299	47,242	8,7	1,275	45,967	0,00034	0,0133	0,13506853	36,35
	48,4	33,8	200	0,356	71,2	14,6	2,139655	69,06034	0,00034	0,0133	0,1209214	41,1

**Tabel.** Data pengukuran konduktivitas termal sampel oli BM1

Nomor Pengujian BM 1	T1 (°C)	T2 (°C)	Tegangan Heater (Volt)	Arus Heater (A)	Daya, Qe, (Watt)	T1-T2 (°C)	Qi (Watt)	Qc (Watt)	Tebal Spesimen (m)	Luas Permukaan (m2)	K Eksperimen	Temperatur Rata-rata Spesimen (°C)
1	27,7	27,5	21	0,057	1,197	0,2	0,02931	1,16769	0,00034	0,0133	0,149253565	27,6
	29,8	28,1	74	0,135	9,99	1,7	0,249138	9,740862	0,00034	0,0133	0,146479129	28,95
	34,9	29,9	125	0,232	29	5	0,732759	28,26724	0,00034	0,0133	0,144524242	32,4
	41,2	32,1	161	0,305	49,105	9,1	1,333621	47,77138	0,00034	0,0133	0,134200355	36,65
	48,8	33,8	209	0,356	74,404	15	2,198276	72,20572	0,00034	0,0133	0,123057374	41,3
2	27,8	27,6	23	0,052	1,196	0,2	0,02931	1,16669	0,00034	0,0133	0,149125745	27,7
	30,1	28,4	76	0,13	9,88	1,7	0,249138	9,630862	0,00034	0,0133	0,144824994	29,25
	34,4	29,8	119	0,223	26,537	4,6	0,674138	25,86286	0,00034	0,0133	0,143729537	32,1
	40,8	32,1	158	0,298	47,084	8,7	1,275	45,809	0,00034	0,0133	0,134604269	36,45
	49,1	33,9	213	0,359	76,467	15,2	2,227586	74,23941	0,00034	0,0133	0,124858531	41,5
3	27,8	27,6	23	0,051	1,173	0,2	0,02931	1,14369	0,00034	0,0133	0,146185896	27,7
	30,7	29	72	0,137	9,864	1,7	0,249138	9,614862	0,00034	0,0133	0,144584392	29,85
	35,2	30,3	122	0,228	27,816	4,9	0,718103	27,0979	0,00034	0,0133	0,141373098	32,75
	41,7	32,6	161	0,304	48,944	9,1	1,333621	47,61038	0,00034	0,0133	0,13374807	37,15
	49,8	34	210	0,363	76,23	15,8	2,315517	73,91448	0,00034	0,0133	0,11959134	41,9

**Tabel.** Data Konsumsi Bahan Bakar

<b>Sampel Oli</b>	<b>Nomor Pengujian</b>	<b>Waktu (Menit)</b>	<b>Volume BBM (Liter)</b>	<b>Jarak Tempuh Pada Odometer (Km)</b>	<b>Konsumsi BBM (Km/Liter)</b>
BM 1	1	7:53	0,063	4	63,49
	2	8:03	0,062	4	64,52
	3	7:48	0,065	4	61,54
	4	8:14	0,064	4	62,50
	5	7:24	0,07	4	57,14
MPX	1	7:19	0,069	4	57,97
	2	7:18	0,072	4	55,56
	3	8:03	0,068	4	58,82
	4	8:08	0,074	4	54,05
	5	7:20	0,074	4	54,05
Motul	1	7:38	0,064	4	62,50
	2	7:49	0,066	4	60,61
	3	8:01	0,073	4	54,79
	4	7:10	0,068	4	58,82
	5	7:47	0,07	4	57,14

Grafik 1 Kalibrasi  $Q_i$

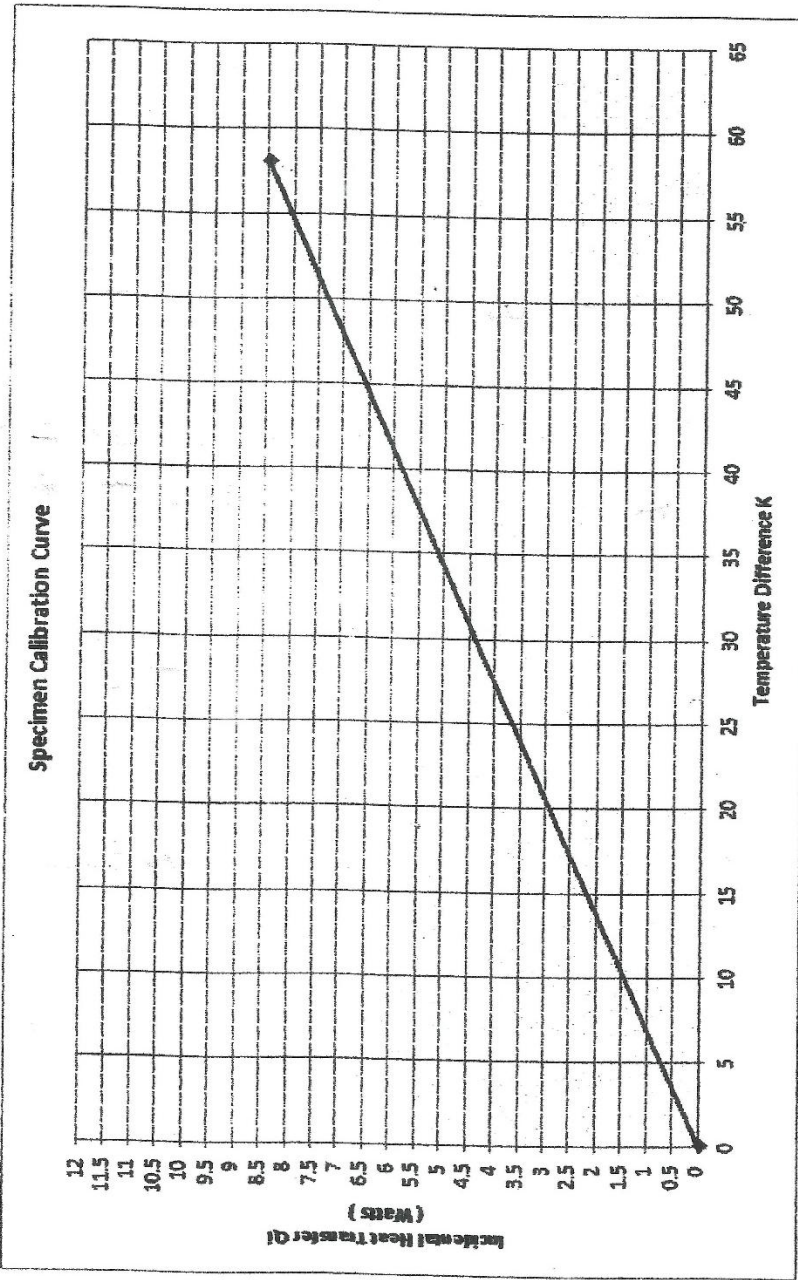


TABLE A-13

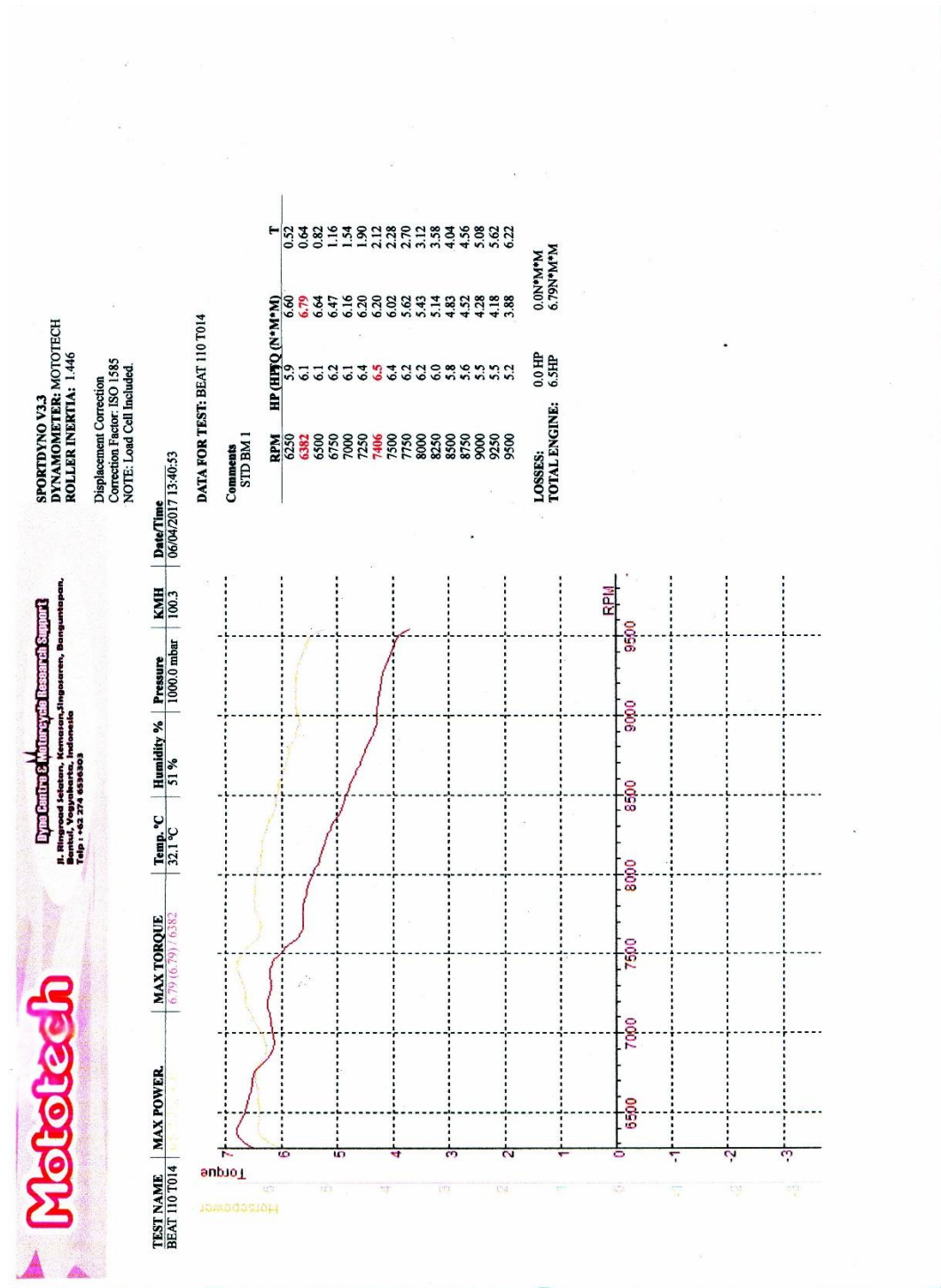
## Properties of liquids

Temp. $T, ^\circ\text{C}$	Density $\rho, \text{kg/m}^3$	Specific Heat $c_p, \text{J/kg}\cdot\text{K}$	Thermal Conductivity $k, \text{W/m}\cdot\text{K}$	Thermal Diffusivity $\alpha, \text{m}^2/\text{s}$	Dynamic Viscosity $\mu, \text{kg/m}\cdot\text{s}$	Kinematic Viscosity $\nu, \text{m}^2/\text{s}$	Prandtl Number Pr	Volume Expansion Coeff. $\beta, 1/\text{K}$
<i>Methane (CH<sub>4</sub>)</i>								
-160	420.2	3492	0.1863	$1.270 \times 10^{-7}$	$1.133 \times 10^{-4}$	$2.699 \times 10^{-7}$	2.126	0.00952
-150	405.0	3580	0.1703	$1.174 \times 10^{-7}$	$9.169 \times 10^{-5}$	$2.264 \times 10^{-7}$	1.927	0.00991
-140	388.8	3700	0.1550	$1.077 \times 10^{-7}$	$7.551 \times 10^{-5}$	$1.942 \times 10^{-7}$	1.809	0.00444
-130	371.1	3875	0.1402	$9.749 \times 10^{-8}$	$6.288 \times 10^{-5}$	$1.694 \times 10^{-7}$	1.738	0.00520
-120	351.4	4146	0.1258	$8.634 \times 10^{-8}$	$5.257 \times 10^{-5}$	$1.496 \times 10^{-7}$	1.732	0.00637
-110	328.8	4611	0.1115	$7.356 \times 10^{-8}$	$4.377 \times 10^{-5}$	$1.331 \times 10^{-7}$	1.810	0.00841
-100	301.0	5878	0.0967	$5.761 \times 10^{-8}$	$3.577 \times 10^{-5}$	$1.188 \times 10^{-7}$	2.063	0.01282
-90	261.7	8902	0.0797	$3.423 \times 10^{-8}$	$2.761 \times 10^{-5}$	$1.056 \times 10^{-7}$	3.082	0.02922
<i>Methanol (CH<sub>3</sub>OH)</i>								
20	788.4	2515	0.1967	$1.002 \times 10^{-7}$	$5.857 \times 10^{-4}$	$7.429 \times 10^{-7}$	7.414	0.00118
30	779.1	2577	0.1980	$9.862 \times 10^{-8}$	$5.088 \times 10^{-4}$	$6.531 \times 10^{-7}$	6.622	0.00120
40	769.6	2644	0.1972	$9.690 \times 10^{-8}$	$4.460 \times 10^{-4}$	$5.795 \times 10^{-7}$	5.980	0.00123
50	760.1	2718	0.1965	$9.509 \times 10^{-8}$	$3.942 \times 10^{-4}$	$5.185 \times 10^{-7}$	5.453	0.00127
60	750.4	2798	0.1957	$9.320 \times 10^{-8}$	$3.510 \times 10^{-4}$	$4.677 \times 10^{-7}$	5.018	0.00132
70	740.4	2885	0.1950	$9.128 \times 10^{-8}$	$3.146 \times 10^{-4}$	$4.250 \times 10^{-7}$	4.655	0.00137
<i>Isobutane (C<sub>4</sub>H<sub>10</sub>)</i>								
-100	683.8	1881	0.1389	$1.075 \times 10^{-7}$	$9.305 \times 10^{-4}$	$1.360 \times 10^{-6}$	12.65	0.00142
-75	659.3	1970	0.1357	$1.044 \times 10^{-7}$	$5.624 \times 10^{-4}$	$8.591 \times 10^{-7}$	8.167	0.00180
-50	634.3	2069	0.1283	$9.773 \times 10^{-8}$	$3.769 \times 10^{-4}$	$5.942 \times 10^{-7}$	6.079	0.00161
-25	608.2	2180	0.1181	$8.906 \times 10^{-8}$	$2.688 \times 10^{-4}$	$4.420 \times 10^{-7}$	4.963	0.00177
0	580.6	2306	0.1068	$7.974 \times 10^{-8}$	$1.992 \times 10^{-4}$	$3.432 \times 10^{-7}$	4.304	0.00199
25	550.7	2455	0.0956	$7.069 \times 10^{-8}$	$1.510 \times 10^{-4}$	$2.743 \times 10^{-7}$	3.880	0.00232
50	517.3	2640	0.0851	$6.233 \times 10^{-8}$	$1.155 \times 10^{-4}$	$2.233 \times 10^{-7}$	3.582	0.00286
75	478.5	2896	0.0757	$5.460 \times 10^{-8}$	$8.785 \times 10^{-5}$	$1.836 \times 10^{-7}$	3.363	0.00385
100	429.6	3361	0.0669	$4.634 \times 10^{-8}$	$6.483 \times 10^{-5}$	$1.509 \times 10^{-7}$	3.256	0.00628
<i>Glycerin</i>								
0	1276	2262	0.2820	$9.773 \times 10^{-8}$	10.49	$8.219 \times 10^{-6}$	84,101	
5	1273	2288	0.2835	$9.732 \times 10^{-8}$	6.790	$5.287 \times 10^{-6}$	54,327	
10	1270	2320	0.2846	$9.662 \times 10^{-8}$	4.241	$3.339 \times 10^{-6}$	34,561	
15	1267	2354	0.2856	$9.576 \times 10^{-8}$	2.496	$1.970 \times 10^{-6}$	20,570	
20	1264	2386	0.2860	$9.484 \times 10^{-8}$	1.519	$1.201 \times 10^{-6}$	12,671	
25	1261	2416	0.2860	$9.388 \times 10^{-8}$	0.9934	$7.878 \times 10^{-7}$	8,392	
30	1258	2447	0.2860	$9.291 \times 10^{-8}$	0.6582	$5.232 \times 10^{-7}$	5,631	
35	1255	2478	0.2860	$9.195 \times 10^{-8}$	0.4347	$3.464 \times 10^{-7}$	3,767	
40	1252	2513	0.2863	$9.101 \times 10^{-8}$	0.3073	$2.465 \times 10^{-7}$	2,697	
<i>Engine Oil (unused)</i>								
0	899.0	1797	0.1469	$9.097 \times 10^{-8}$	3.814	$4.242 \times 10^{-6}$	46,636	0.00070
20	882.1	1881	0.1450	$8.680 \times 10^{-8}$	0.8374	$9.429 \times 10^{-7}$	10,863	0.00070
40	876.0	1964	0.1444	$8.391 \times 10^{-8}$	0.2177	$2.485 \times 10^{-6}$	2,962	0.00070
60	863.9	2048	0.1404	$7.934 \times 10^{-8}$	0.07399	$8.565 \times 10^{-6}$	1,080	0.00070
80	852.0	2132	0.1380	$7.599 \times 10^{-8}$	0.03232	$3.794 \times 10^{-6}$	499.3	0.00070
100	840.0	2220	0.1367	$7.330 \times 10^{-8}$	0.01718	$2.046 \times 10^{-6}$	279.1	0.00070
120	828.9	2308	0.1347	$7.042 \times 10^{-8}$	0.01029	$1.241 \times 10^{-6}$	176.3	0.00070
140	816.8	2395	0.1330	$6.798 \times 10^{-8}$	0.006558	$8.029 \times 10^{-6}$	118.1	0.00070
150	810.3	2441	0.1327	$6.708 \times 10^{-8}$	0.005344	$6.595 \times 10^{-6}$	98.31	0.00070

Source: Data generated from the EES software developed by S. A. Klein and F. L. Alvarado. Originally based on various sources.



Grafik Dynotest Daya dan Torsi oli BM 1







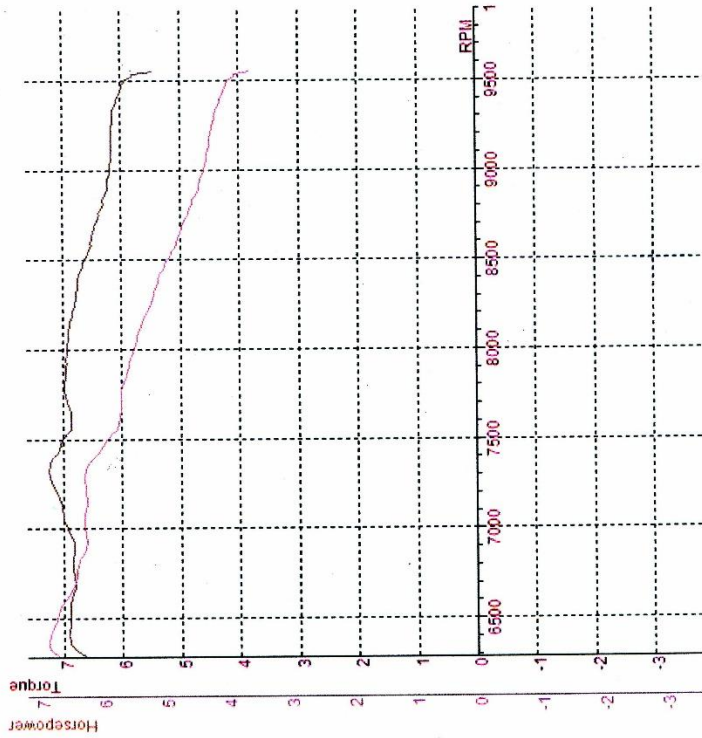
**Dyno Centre & Laboratory Research Support**  
 H. Ringroad Selatan, Kemaman, Terengganu, Bersekat, Kemaman,  
 21100, Terengganu  
 Tel: +62 274 659393

**SPORTDYNO V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KM/H | Date/Time  
 BEAT 110 T015 | 11.9 | 10.2 | 32.1 | 51 | 1000.0 mbar | 100.4 | 06/04/2017 13:41:37

DATA FOR TEST: BEAT 110 T015



Comments  
 STD BM 1

RPM	HP (HP)(N*M*PM)	T
6250	6.4	7.15
6363	6.5	7.24
6500	6.5	7.08
6750	6.5	6.76
7000	6.6	6.63
7250	6.8	6.62
7323	6.9	6.62
7500	6.6	6.26
7750	6.6	6.00
8000	6.5	5.78
8250	6.4	5.49
8500	6.2	5.18
8750	6.0	4.86
9000	5.9	4.60
9250	5.8	4.45
9500	5.6	4.16

LOSSES: 0.0HP  
 TOTAL ENGINE: 6.9HP  
 0.0N\*M\*PM  
 7.24N\*M\*PM



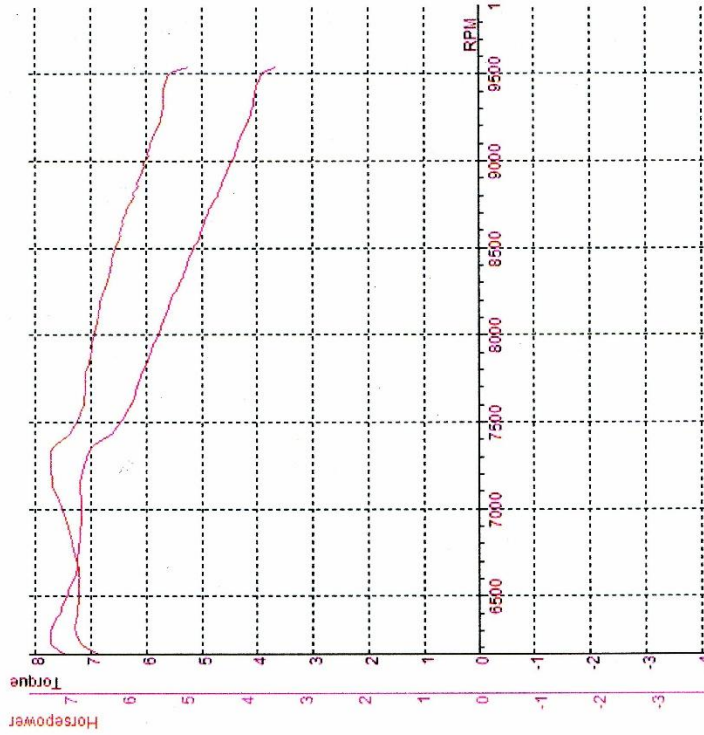
**Dynamic Centre of Motorcycles Research Support**  
 Jl. Rimporod Selatan, Kemaman, Singapore, Banguntapan,  
 Bantul, Yogyakarta, Indonesia  
 Telp 1 +62 274 688493

SPORTDYNO V3.3  
 DYNAMOMETER: MOTOTECH  
 ROLLER INERTIA: 1.46

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KMH | Date/Time  
 BEAT 110 T013 | 7.32 (7.72) | 7.26 (8.26) | 32.1 °C | 51 % | 1000.0 mbar | 100.3 | 06/04/2017 13:40:15

DATA FOR TEST: BEAT 110 T013



Comments  
 STD BM 1

RPM	HP (HP)*M	T (N*M)*M
6000	6.8	7.57
6250	6.8	7.72
6500	6.8	7.72
6750	6.9	7.42
7000	7.1	7.23
7250	7.3	7.18
7500	7.3	7.11
7750	6.8	7.05
8000	6.5	6.44
8250	6.4	6.10
8500	6.2	5.78
8750	6.0	5.47
9000	5.7	5.13
9250	5.4	4.80
9500	5.2	4.45

LOSSES: 0.0 HP  
 TOTAL ENGINE: 7.3HP  
 0.0N\*M\*M  
 7.72N\*M\*M

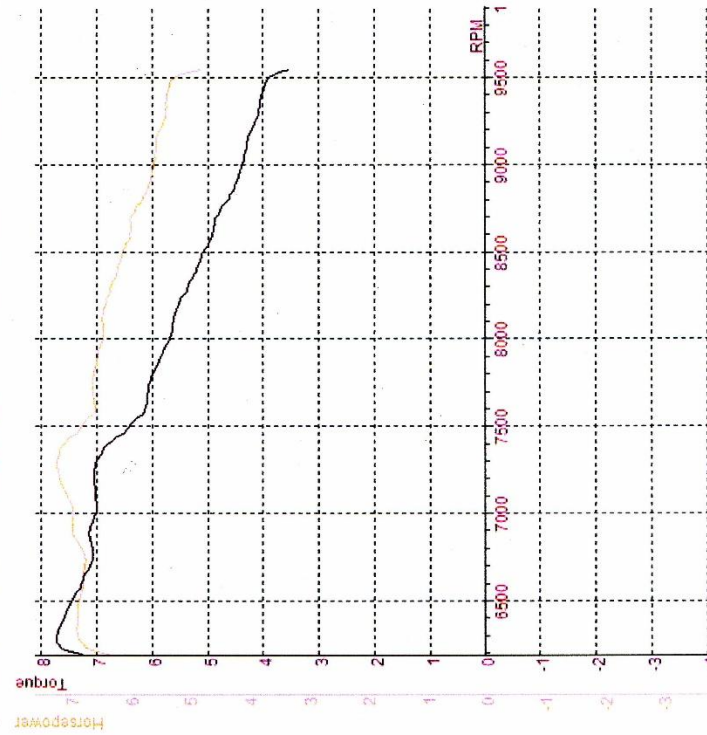


**Dyna Centre & Motorcycle Research Support**  
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 Sibolga, Yogyakarta, Indonesia  
 Telp : +62 274 883833

**SPORTDYNO V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KMH | Date/Time  
 BEAT 110 T012 | 7.72 (7.72) / 6300 | 7.72 (7.72) / 6300 | 32.1 °C | 51 % | 1000.0 mbar | 100.4 | 06/04/2017 13:39:37



DATA FOR TEST: BEAT 110 T012

Comments  
 STD BM 1

RPM	HP (HPQ (N°M°M))	T
6000	6.5	7.43
6250	6.8	7.68
6500	6.9	7.72
6750	6.8	7.43
7000	6.7	7.06
7250	6.9	7.01
7500	7.2	7.03
7750	7.2	7.01
8000	6.8	6.35
8250	6.6	6.04
8500	6.4	5.68
8750	6.3	5.42
9000	6.1	5.07
9250	5.9	4.73
9500	5.4	4.12
9500	5.2	3.88

LOSSES: 0.0 HP  
 TOTAL ENGINE: 7.2HP  
 0.0N°M°M  
 7.72N°M°M



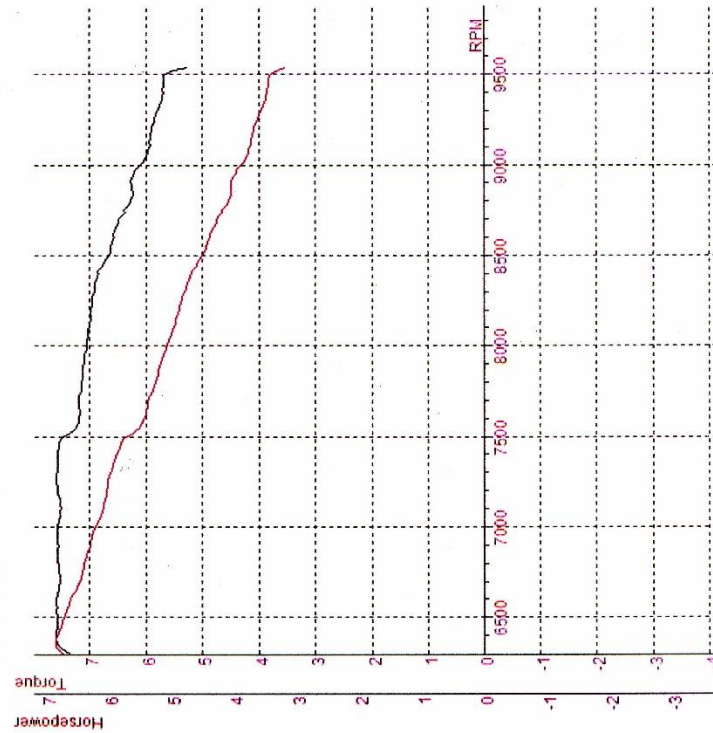
Dyna Centre & Motorcycle Research Support  
 Jl. Raya Sidiyasa, Kecamatan Sengaja, Kabupaten  
 Bantul, Yogyakarta, Indonesia  
 Telp : +62 274 838303

SPORTDINO V3.3  
 DYNAMOMETER: MOTOTECH  
 ROLLER INERTIA: 1.446

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell included.

TEST NAME | MAX POWER | MAX TORQUE | Temp °C | Humidity % | Pressure | KM/H | Date/Time  
 BEAT 110 T011 | 6.8 (6.8) / 7278 | 7.59 (7.59) / 6560 | 32.1 °C | 51 % | 1000.0 mbar | 100.2 | 06/04/2017 13:39:06

DATA FOR TEST: BEAT 110 T011

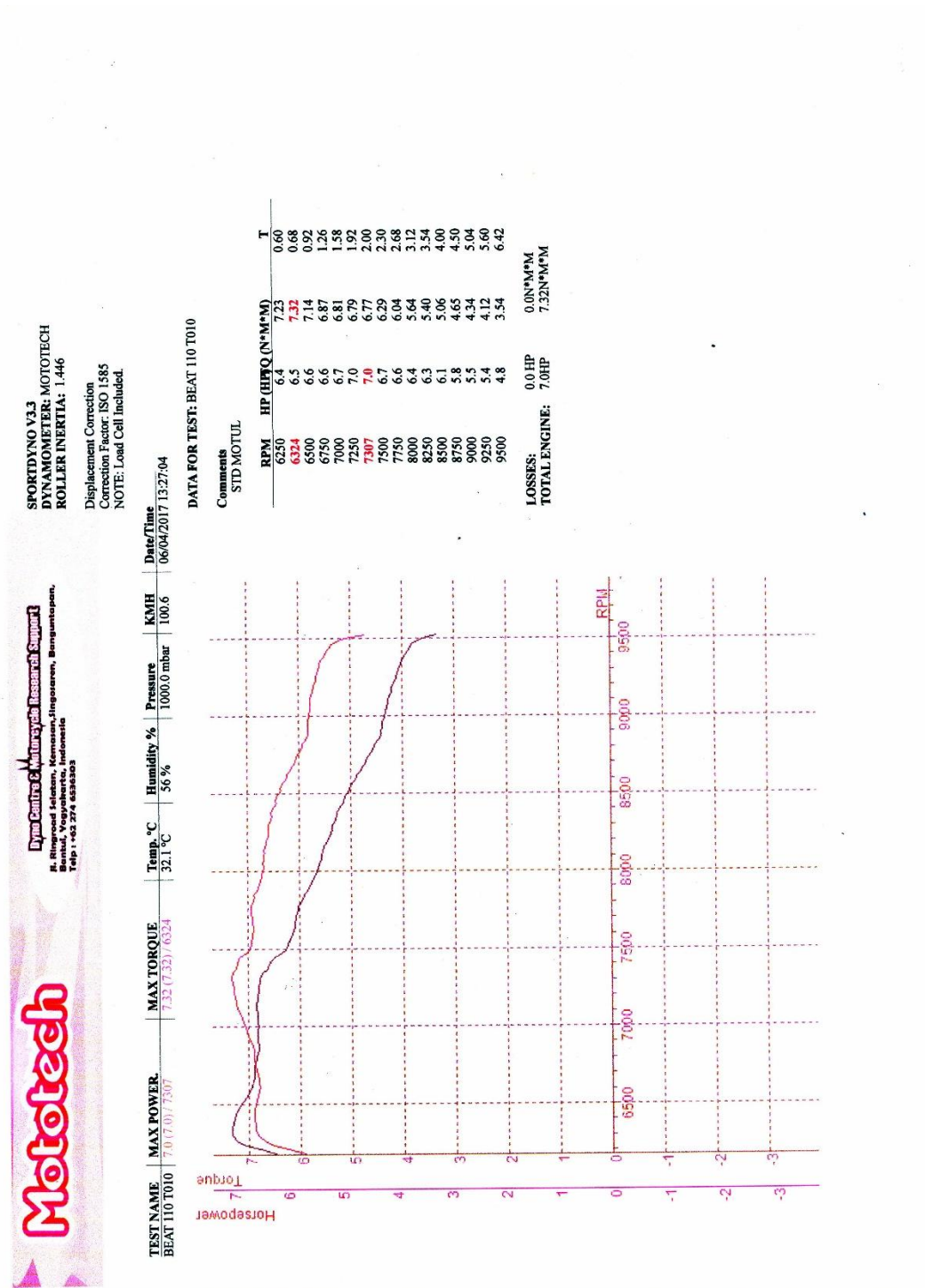


Comments  
 STD BM 1

RPM	HP (HP)	HP (N·M·M)	T
6250	6.7	7.53	0.52
6360	6.8	7.59	0.58
6500	6.8	7.43	0.76
6750	6.8	7.12	1.08
7000	6.8	6.89	1.40
7250	6.8	6.67	1.74
7278	6.8	6.65	1.78
7500	6.7	6.30	2.12
7750	6.4	5.88	2.50
8000	6.4	5.61	2.92
8250	6.3	5.36	3.36
8500	6.0	4.99	3.82
8750	5.7	4.61	4.32
9000	5.5	4.27	4.86
9250	5.3	4.01	5.42
9500	5.1	3.79	6.02

LOSSES: 0.0 HP  
 TOTAL ENGINE: 6.8 HP  
 0.0 N·M·M  
 7.59 N·M·M

### Grafik Dynotest Daya dan Torsi Oli Motul







**Dyna Centre & Motorcycle Research Support**  
 Jl. Ringroad Selatan, Kemuning, Singaperbangsa, Bekasi, Yogyakarta, Indonesia  
 Telp : +62 274 828383

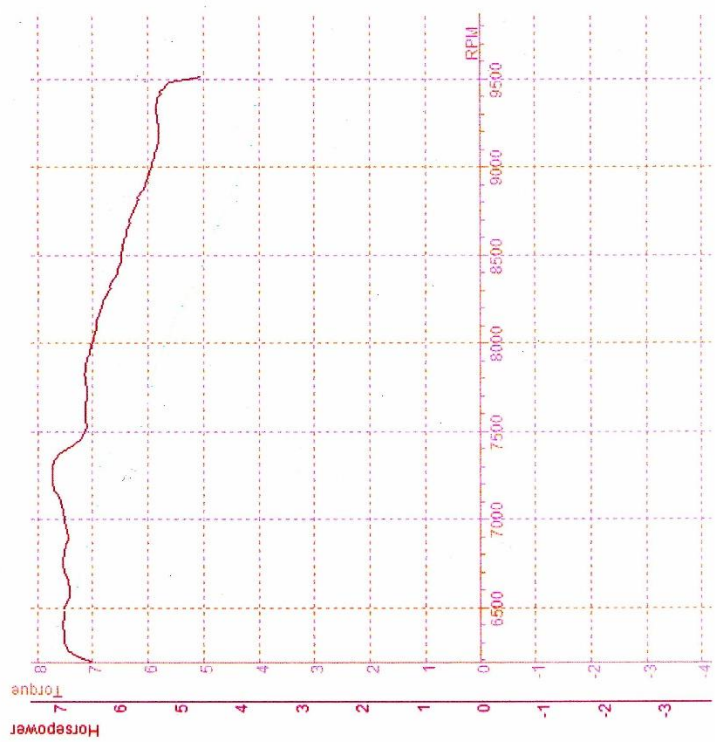
**SPORTDYNO V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KMH | Date/Time  
 BEAT 110 T009 | 7.1 (7.1) / 7287 | | 32.1 °C | 56 % | 1000.0 mbar | 100.5 | 06/04/2017 13:26:21

DATA FOR TEST: BEAT 110 T009

Comments  
 STD MOTUL



RPM	HP (HP)	HPQ (N*M*M)	T
6000	6.6	7.51	0.52
6250	6.8	7.71	0.58
6500	6.9	7.73	0.62
6750	6.9	7.46	0.90
7000	6.9	7.22	1.22
7250	7.1	6.90	1.54
7500	6.5	6.87	1.92
7750	6.5	6.13	2.26
8000	6.4	5.94	2.64
8250	6.2	5.32	3.06
8500	5.9	4.92	3.50
8750	5.7	4.63	3.96
9000	5.4	4.26	4.46
9250	5.3	4.07	5.02
9500	4.9	3.61	5.58

LOSSES: 0.0 HP  
 TOTAL ENGINE: 7.1HP  
 0.0N\*M\*M  
 7.73N\*M\*M



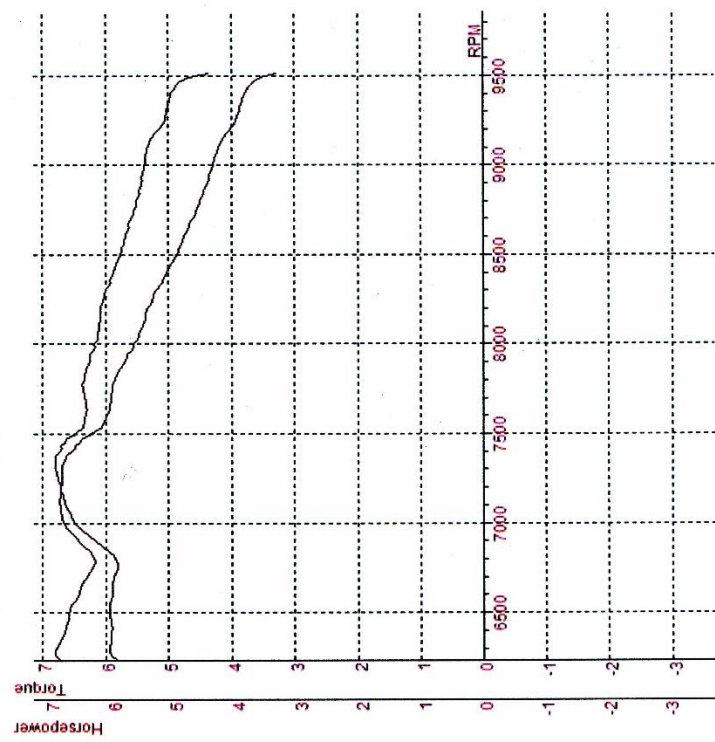
**Dyna Centre of Mechanical Research & Support**  
 R. Rirengrad Selatan, Kecamatan, Singaperbangsa, Bengkulu Selatan, Bengkulu, Indonesia  
 Telp : +62 374 638383

**SPORTDYNO V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.46**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KMH | Date/Time  
 BEAT 110 T008 | 6.9 (6.9) / 7333 | 6.80 (6.80) / 6264 | 32.1 °C | 56 % | 1000.0 mbar | 100.4 | 06/04/2017 13:25:43

DATA FOR TEST: BEAT 110 T008



Comments  
STD/MOTUL

RPM	HP (HPFQ) (N*M*MM)	T
6250	6.0	6.77
6300	6.0	6.80
6400	6.0	6.57
6500	5.9	6.20
6600	6.6	6.67
6700	6.9	6.70
6800	6.9	6.67
6900	6.9	6.16
7000	6.5	5.88
7100	6.3	5.55
7200	6.1	5.26
7300	5.9	4.87
7400	5.6	4.54
7500	5.5	4.28
7600	5.1	3.92
7700	4.4	3.29

LOSSES: 0.0 HP  
 TOTAL ENGINE: 6.9HP  
 0.0N\*M\*MM  
 6.80N\*M\*MM

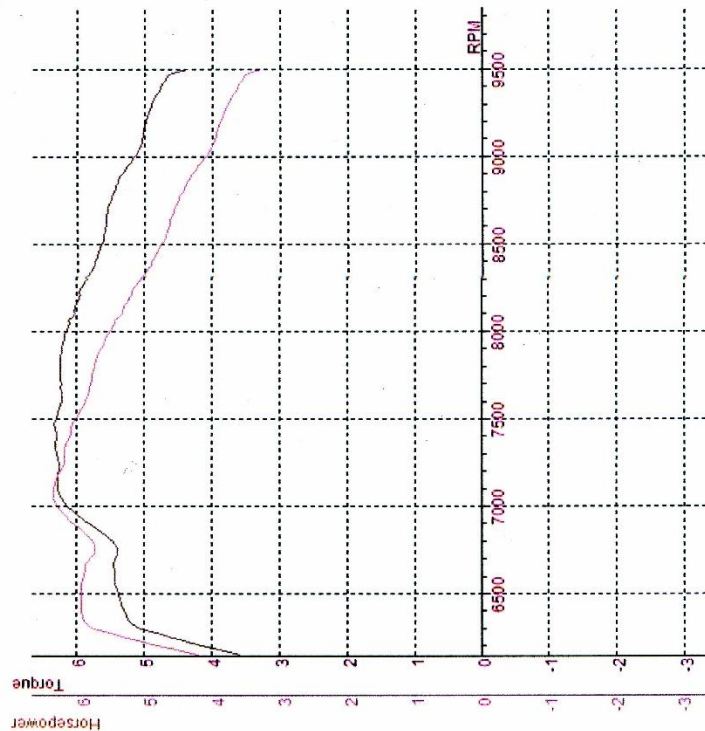


**Apex Centre of Automotive Research Support**  
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 Email: Vagus@apexcenter.com  
 Telp : +62-274-6338303

**SPORTDYNO V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KMH | Date/Time  
 BEAT 110 T007 | 6.34 HP @ 7101 RPM | 6.4 Nm @ 7474 RPM | 32.1 °C | 56 % | 1000.0 mbar | 100.3 | 06/04/2017 13:25:07



DATA FOR TEST: BEAT 110 T007

Comments  
 STD MOTUL

RPM	HP (HP)*M	HP (N*M*M)	T
6500	4.7	5.31	0.66
6500	5.5	3.94	1.06
6750	5.5	3.73	1.46
7000	6.2	6.30	1.82
7101	6.4	6.34	1.96
7250	6.4	6.19	2.20
7474	6.4	6.07	2.54
7500	6.4	6.01	2.58
7750	6.3	5.76	2.98
8000	6.2	5.49	3.42
8250	6.0	5.12	3.88
8500	5.7	4.74	4.38
8750	5.6	4.49	4.90
9000	5.2	4.08	5.46
9250	5.0	3.82	6.06

LOSSES: 0.0 HP  
 TOTAL ENGINE: 6.4 HP  
 0.0 N\*M\*M  
 6.34 N\*M\*M



**Mototech**

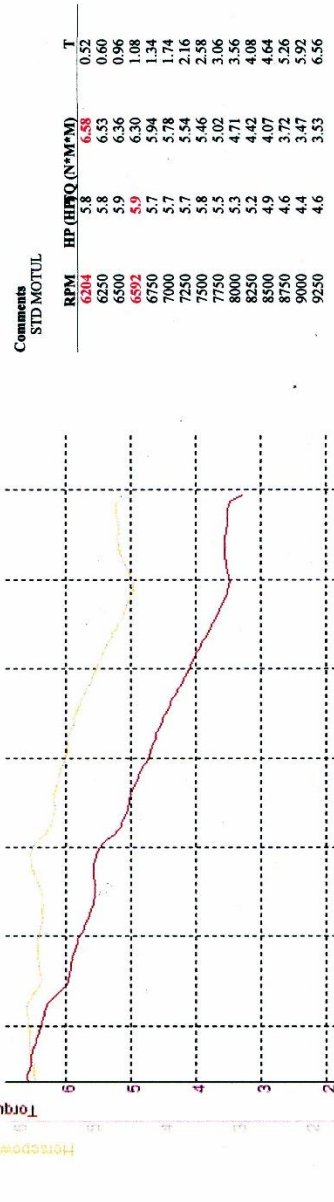
**Dyno Centre & Motorcycles Research Support**  
 R. Ringroad Selatan, Kemuning, Tangerang, Banten, Indonesia  
 Telp. +62 21 6390303

SPORTDYNO V3.3  
 DYNAMOMETER: MOTOTECH  
 ROLLER INERTIA: 1.446

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME: BEAT 110 T006  
 MAX POWER: 6.58 (6.58) / 6.204  
 Temp. °C: 32.1 °C  
 Humidity %: 56 %  
 Pressure: 1000.0 mbar  
 KMH: 100.0  
 Date/Time: 06/04/2017 13:24:25

DATA FOR TEST: BEAT 110 T006

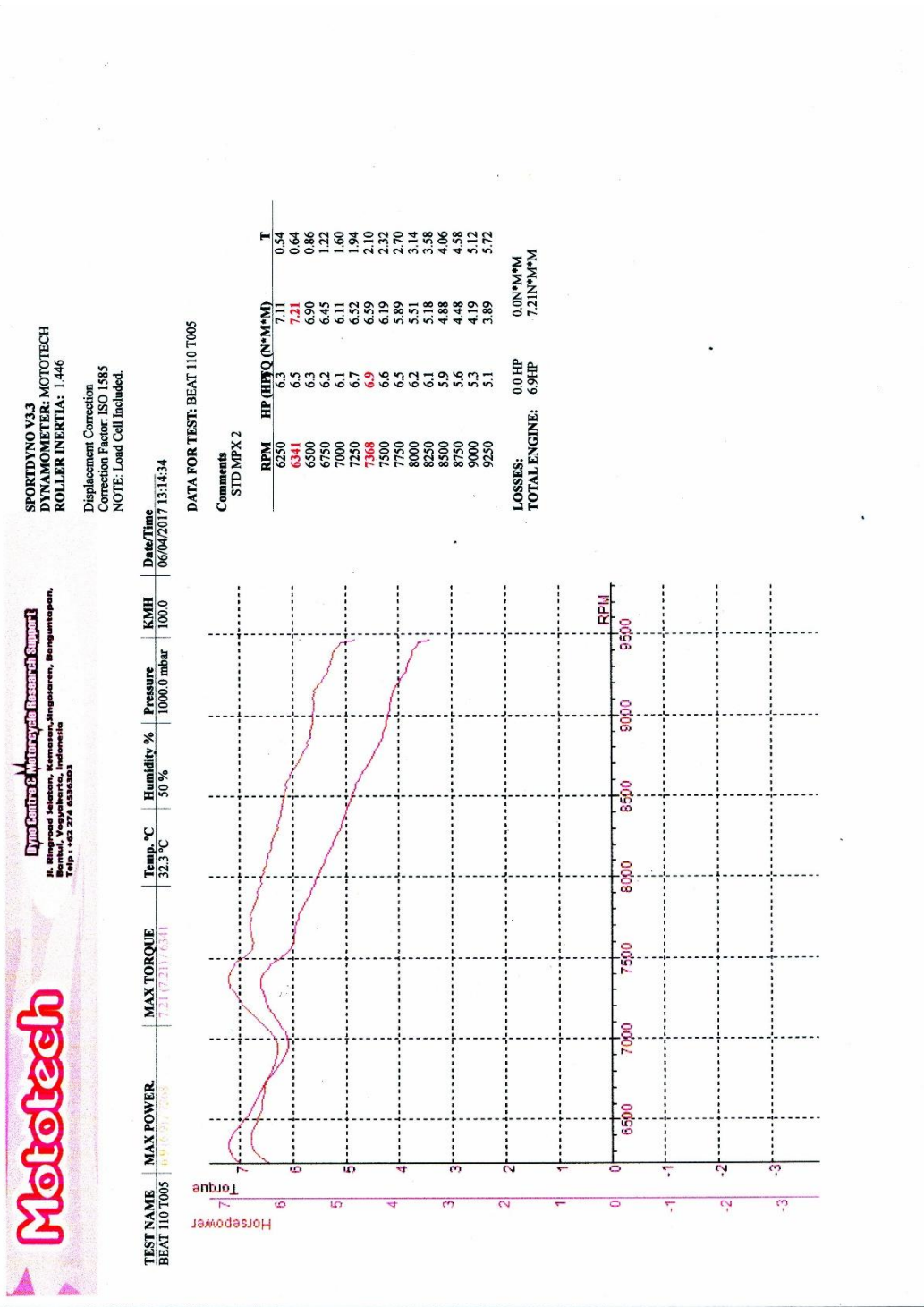


Comments  
 STD MOTUL

RPM	HP (HP)(N*M*PM)	T
6704	6.58	0.52
6250	5.8	0.60
6500	5.9	0.96
6592	5.9	1.08
6750	5.7	1.34
7000	5.7	1.74
7250	5.7	2.16
7500	5.8	2.58
7750	5.5	3.06
8000	5.3	3.56
8250	5.2	4.08
8500	4.9	4.64
8750	4.6	5.26
9000	4.4	5.92
9250	4.6	6.56

LOSSES: 0.0 HP  
 TOTAL ENGINE: 5.9 HP  
 0.0 N\*M\*PM  
 6.58 N\*M\*PM

Grafik Dynotest Daya dan Torsi Oli MPX 2





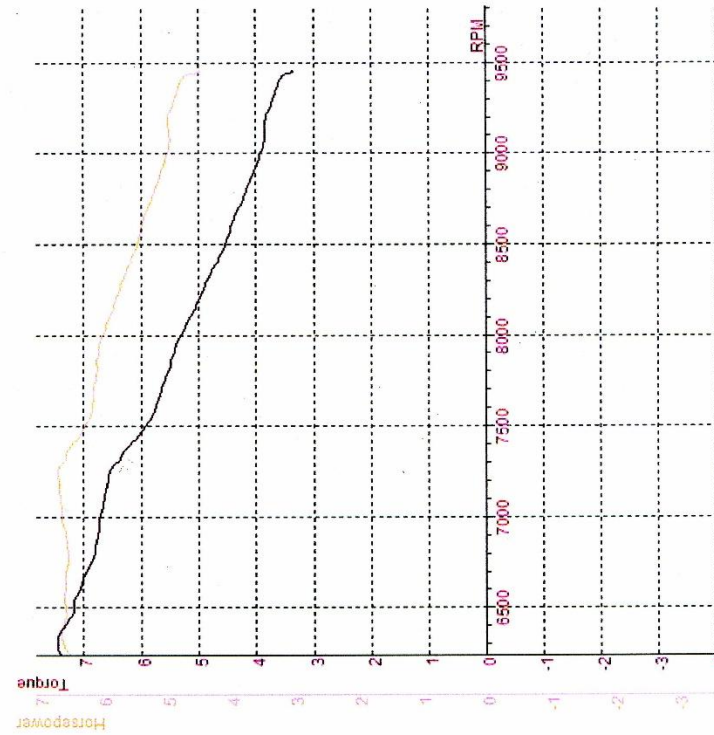
**Dyno Centre & Motorcycle Research Support**  
 H. Rong, Road Station, Kemaman, Terengganu, 21000 Kemaman,  
 Malaysia  
 Tel: +602 274 888283

**SPORTDYN0 V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KM/H | Date/Time  
 BEAT 110 T004 | 7.45 (7.45) / 6306 | 7.45 (7.45) / 6306 | 32.3 °C | 50 % | 1000.0 mbar | 100.0 | 06/04/2017 13:13:55

DATA FOR TEST: BEAT 110 T004



Comments  
 STD MPX 2

RPM	HP (HP)	HP (N·M·M)	T
6000	6.6	7.42	0.52
6250	6.6	7.44	0.54
6500	6.6	7.45	0.58
6750	6.6	7.17	0.84
7000	6.5	6.85	1.18
7248	6.7	6.72	1.52
7500	6.7	6.55	1.86
7750	6.3	6.53	1.88
8000	6.1	5.93	2.26
8250	6.0	5.57	2.68
8500	5.7	5.29	3.12
8750	5.5	4.91	3.60
9000	5.2	4.54	4.10
9250	5.0	4.22	4.66
	4.9	3.91	5.24
	4.9	3.76	5.86

LOSSES: 0.0 HP  
 TOTAL ENGINE: 6.7HP  
 0.0N·M·M  
 7.45N·M·M



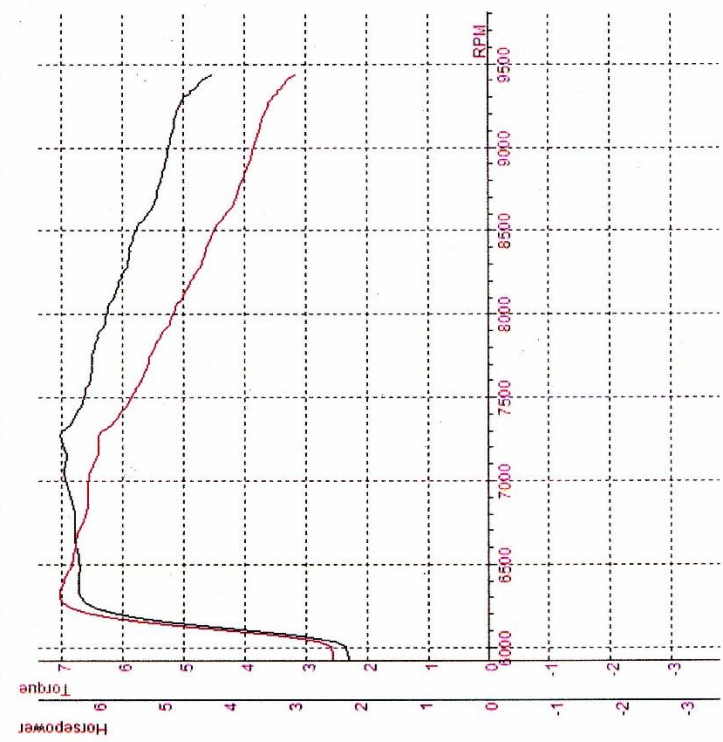
**Dyna Centre & Motorcycle Research Support**  
 Jl. Raya Sekeloa Selatan 1 No. 10, Jakarta Selatan, Indonesia  
 Telp : +62 274 638330

**SPORTDYN V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TEST NAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KM/H | Date/Time  
 BEAT 110 T003 | 6.6 (6.6)/7277 | 7.03 (7.03)/6311 | 32.3 °C | 50 % | 1000.0 mbar | 99.7 | 06/04/2017 13:13:16

DATA FOR TEST: BEAT 110 T003



Comments  
 STDMPX 2

RPM	HP (HPQ (N*M*M))	T
6000	2.2	2.59
6250	6.2	6.98
6311	6.3	7.03
6500	6.3	6.83
6750	6.3	6.65
7000	6.5	6.55
7250	6.6	6.40
7277	6.6	6.40
7500	6.2	5.86
7750	6.1	5.54
8000	5.9	5.16
8250	5.6	4.80
8500	5.4	4.48
8750	5.1	4.08
9000	4.9	3.85
9250	4.7	3.62

LOSSES: 0.0 HP  
 TOTAL ENGINE: 6.6 HP  
 0.0 N\*M\*M  
 7.03 N\*M\*M



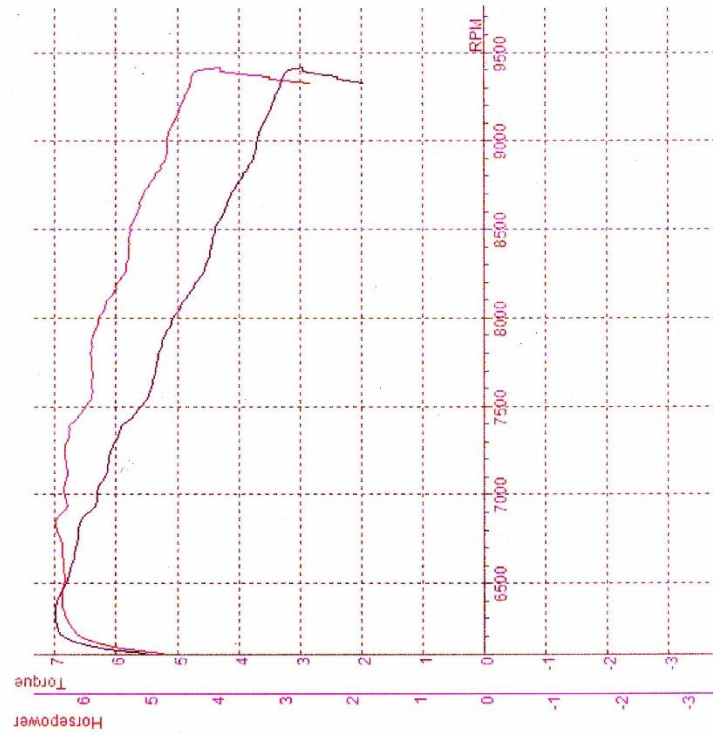
**Dyno Centre & Motorcycle Research Support**  
 H. R. Road Station, Maroon, Singapore, Brangantapan,  
 Banjar, Yogyakarta, Indonesia  
 Telp : +62 374 658393

**SPORTDYNO V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TESTNAME | MAX POWER | MAX TORQUE | Temp °C | Humidity % | Pressure | KM/H | Date/Time  
 BEAT 110 T002 | 64 (0.47) (0.65) | 6.97 (6.99) (0.56) | 32.3 °C | 50 % | 1000.0 mbar | 99.4 | 06/04/2017 13:12:54

DATA FOR TEST: BEAT 110 T002



Comments  
 STD MPX 2

RPM	HP (HP)	HP (N·m)	T
6000	5.1	5.86	0.52
6250	6.2	6.97	0.72
6336	6.3	6.99	0.82
6500	6.3	6.79	1.06
6750	6.3	6.62	1.40
6833	6.4	6.60	1.52
7000	6.3	6.31	1.78
7250	6.2	6.08	2.14
7500	5.9	5.58	2.56
7750	5.8	5.32	3.02
8000	5.7	5.06	3.46
8250	5.4	4.58	3.96
8500	5.3	4.38	4.50
8750	5.0	4.01	5.08
9000	4.7	3.70	5.70
9250	4.5	3.40	6.38

LOSSES: 0.0 HP  
 TOTAL ENGINE: 6.4 HP  
 0.0 N·m  
 6.99 N·m



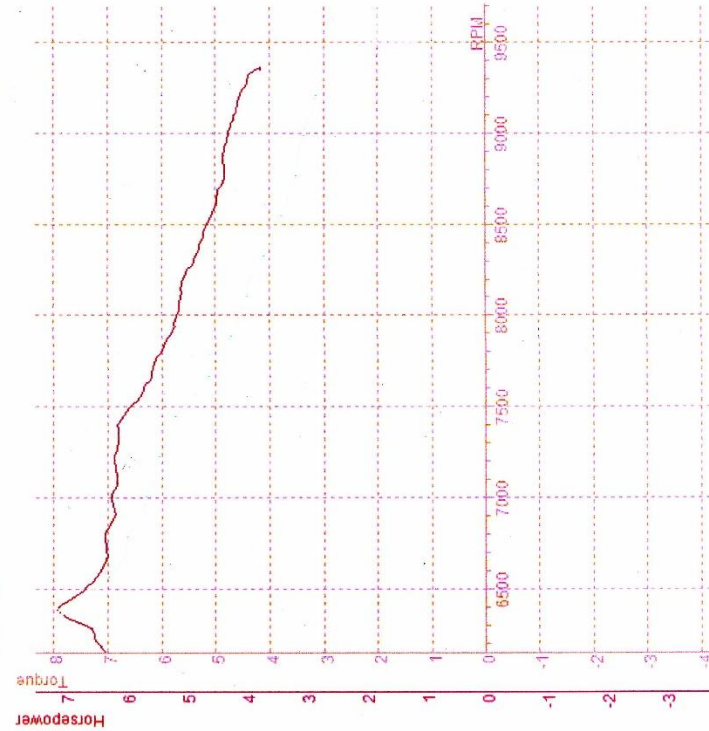
**Mototech**

**Dyno Centre & Motorcycle Research Support**  
 Jl. Ronggolaba Selatan, Makassar, Sulawesi Selatan, Banguntane,  
 Bantaeng, Yogyakarta, Indonesia  
 Telp : +62 274 659393

**SPORTDYNO V3.3**  
**DYNAMOMETER: MOTOTECH**  
**ROLLER INERTIA: 1.446**

Displacement Correction  
 Correction Factor: ISO 1585  
 NOTE: Load Cell Included.

TESTNAME | MAX POWER | MAX TORQUE | Temp. °C | Humidity % | Pressure | KMH | Date/Time  
 BEAT 110 T001 | 7.1 (7.1) / 6375 | 1000.0 mibar | 32.3 °C | 50 % | 1000.0 mibar | 98.9 | 06/04/2017 13:12:20



DATA FOR TEST: BEAT 110 T001

Comments  
 STD MPX 2

RPM	HP (HP)	HP (N·M·M)	T
6000	6.4	7.34	0.52
6250	6.5	7.39	0.62
6375	7.1	7.93	0.76
6500	6.6	7.22	0.76
6750	6.3	6.63	0.94
7000	6.2	6.28	1.28
7250	5.9	5.99	1.66
7500	5.5	5.01	2.04
7750	5.1	4.52	2.46
8000	5.0	4.25	2.94
8250	4.6	3.84	3.44
8500	4.4	3.51	3.98
8750	4.3	3.35	4.60
9000	4.0	3.05	5.24
9250	4.0	3.05	5.94
			6.68

LOSSES: 0.0 HP  
 TOTAL ENGINE: 7.1 HP  
 0.0 N·M·M  
 7.93 N·M·M