

BBR.

BRODIE BRITTAIN RACING LIMITED

Oxford Road (A43)
Brackley Northamptonshire
NN13 7DY England
Telephone 01280 702389
Facsimile 01280 705339

20th October, 1997.

Mr Christian Holm
JMH-Engineering
Toftekaersvej 151
DK-2860 Soeborg
Denmark

Dear Christian,

Please find enclosed documents relating to original Mazda test.

I hope this is sufficient for your needs.

Kind regards.



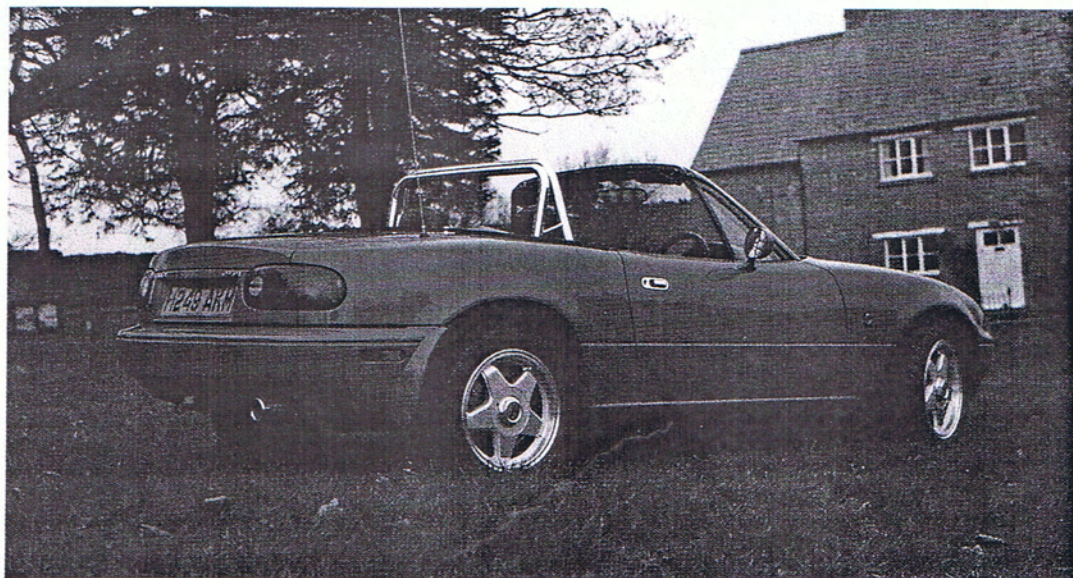
GP. Ken Brittain

(Encs.)

The sensational

BBR MAZDA MX-5 Turbo

Level 1 0-60 in 6.6 secs. 0-100 in 17.5 secs. Top speed 133mph £2,702.50 (inc. VAT) installed. Allow one day to fit.



Our MX5 Turbo conversion commissioned by Mazda UK brings a new dimension to effortless power and driveability. The technically advanced MX5 turbo kit comprising some 68 parts had to endure over 300 hours dyno testing to extreme conditions plus thousands of miles road testing to prove durability. The heart of the conversion is the Garrett T25 turbo controlled by BBR's advanced engine management control computer. Our turbo conversion kit does not affect the 3 year Mazda (UK) warranty and is available from 60 selected Mazda dealers.

The press described the vehicles:

The MX5 Turbo – it impressed us. The new turbo engine package is, not to beat about the bush, staggeringly good, achieved without compromising any of the details that make the original MX5 so appealing.

The real story here is the excellent BBR Turbo conversion – it's fun time! Snap the gear lever through its gate at 6,000rpm and in no time at all your hair will be standing on end.

The engine delivers the goods in a superbly

consistent rush and with no lag. You could be fooled into thinking there was a normally aspirated 2 litre engine under the bonnet. Power is lifted to 150bhp + 32 per cent, so overtaking becomes effortless as the car's looks always promised.

Performance Car January 1991

Fast Lane December 1990



BBR MX5 Accessories

BBR MX5 Stainless steel 'Targa' bar

D.I.Y. \$500 Fitted \$600

D.I.Y. £295 Fitted £345

BBR MX5 Suspension pack includes:

- BBR progressive ride road springs, Koni adjustable shock absorbers and
- BBR front anti roll bar

D.I.Y. \$700 Fitted \$900

D.I.Y. £295 Fitted £495

BBR non catalytic stainless steel silencer

\$250 £139.50

Stainless steel pipe only

\$ £49.00

BBR Hi flow K&N air filter

\$ 18 £26.95

ALL PRICES + VAT



B.B.R. LIMITED SLIP DIFFERENTIAL



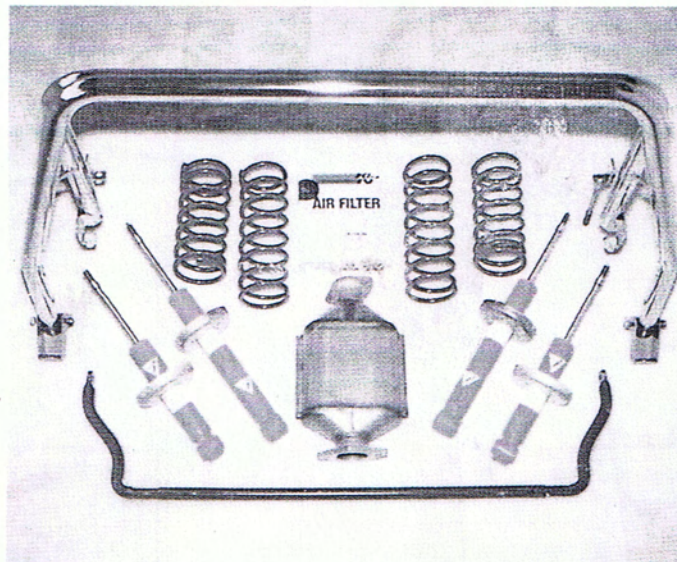
This differential is race-proven over many seasons by B.B.R. and uses the multi-clutch plate system. Will handle in excess of 250bhp. A must for the serious driver.

£582 INC. VAT

B.B.R. NORMALLY ASPIRATED (NON TURBO) PERFORMANCE CAMS

£352.50 INC. VAT

These B.B.R. dyno developed cams give better low down pick up and improved mid range power. Power is raised to 124bhp, with no loss of fuel consumption. Easily fitted in 2 hours.



Level 2 Mazda MX5 turbo 232bhp!

As an addition we offer our full Level 2 conversion which brings power up to a shattering 230+ bhp.

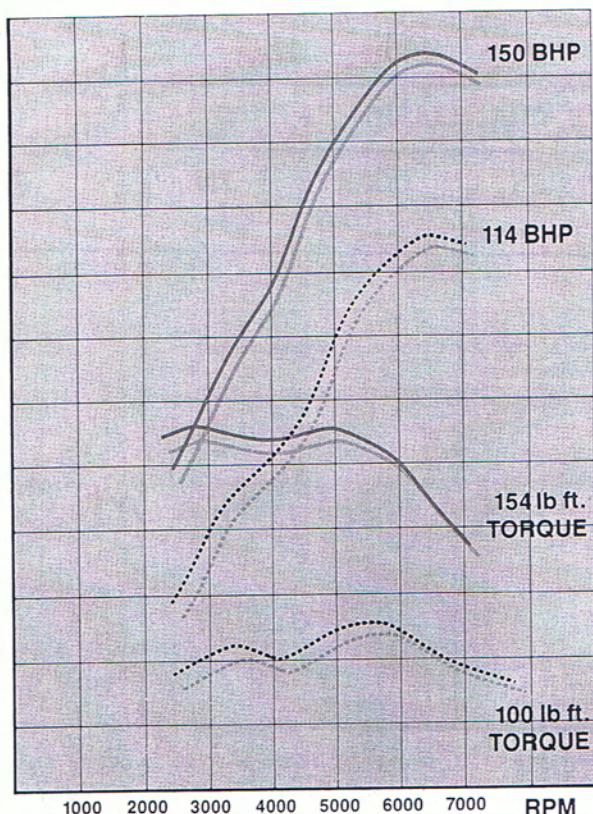
This involves a full engine rebuild with low compression pistons, gas flowed and modified cylinder head, hi flow injectors, modifications to the air mass flow meter, fitting a large capacity intercooler, a full BBR 2 1/4" stainless steel exhaust system and extensive modifications to the engine management system, plus limited slip differential, full BBR suspension pack and BBR twin stainless steel 'Targa' bar.

Power is raised to 232+ bhp with 218lbs ft torque, giving 0-60mph times of around five seconds and 0-100mph in 11.2 seconds!

Cost fitted: £7,495 + VAT.

This price includes the Level 1 turbo kit.

MX-5 TURBO ——— MX-5 STANDARD



SUMMARY

	TORQUE	BHP
MX-5	100	114
BBR MX-5 TURBO	154	150

PERFORMANCE COMPARISON

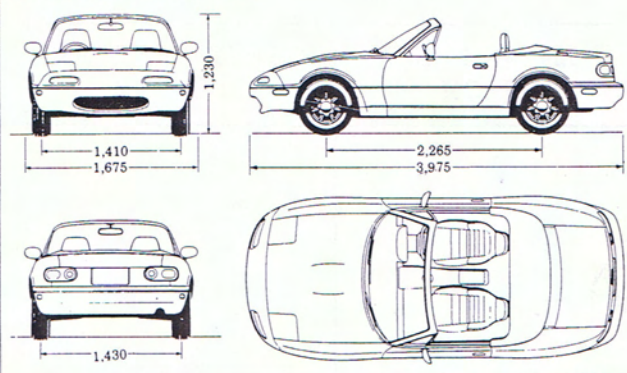
	Mazda MX-5	Mazda MX-5 BBR Turbo
Max. Speed	121 mph	130 mph
0-60 mph	8.7 seconds	6.8 seconds
Max. Power	114 BHP	150 BHP
Max. Torque	100 lb ft/ 5500rpm	154 lb ft/ 5500rpm

All performance figures supplied by Brodie Brittain Racing.

MAZDA MX-5 BBR TURBO

- Garrett T25 turbocharger with integral wastegate control and water cooling
- Exhaust manifold cast in high temperature alloy with stainless steel heat shield
- Air-to-air intercooler and associated pipework – cast to match existing engine finishes
- Competition-standard hoses throughout
- Auxiliary engine management computer
- Boost phase fuel injection control with 3-dimensional mapping
- Super and Premium unleaded fuel grade switchover for optimum performance*
- Standard catalyst retained
- Stainless steel exhaust downpipe
- Modified sump
- BBR Turbo Identification badges
- New induction system brace
- Modified power-steering, water and oil system pipework
- Maximum Output – 150 bhp at 6500 rpm
- Maximum Torque – 154 lb ft at 5500 rpm
- Kerb Weight (approx.) – 985 Kg.

DIMENSIONS (mm)



* This vehicle is equipped with an exhaust catalyst and must use unleaded fuel.

The warranty on the BBR TURBO conversion runs for the duration of the vehicle's 3 year manufacturer's warranty.

mazda

Mazda Cars (UK) Limited
77 Mount Ephraim Tunbridge Wells Kent TN4 8BS

MEMORANDUM

MCL GROUP

From Technical Liaison Engineer
To Service & Parts Director
Service Manager
Technical Controller

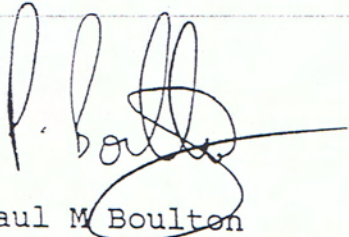
28 August 1990

MAS 06

cc Chief Executive

MX-5 Turbo Test at MIRA

Please find attached my report on the MX-5 Turbo testing recently carried out at MIRA and Bruntingthorpe.

A handwritten signature in black ink, appearing to read 'P. Boulton', with a long horizontal stroke extending to the right.

Paul M Boulton
Technical Liaison Engineer

PMB/jbj

MX-5 TURBO TEST AT MIRA

1. Objective

The object of the MX-5 Turbo test was threefold:

- a. Handling evaluation, taking into consideration the extra torque and horsepower of the turbo car, and whether different wheels, tyres or suspension parts were required.
- b. Establish the top speed of the Turbo MX-5.
- c. Establish the 0 - 60 mph time, quarter mile time and terminal velocity after 1 mile of the Turbo MX-5, compared to the standard MX-5.

2. Testing

- a. The handling evaluation was primarily carried out by a Dunlop test driver, for professional information feedback, and John Bailey. This part of the testing was conducted on the Dunlop handling circuit at MIRA, highlighted in blue on the attached map. This consisted of testing the standard MX-5, TWM's MX-5 Turbo and BBR's Turbo MX-5 on a variety of tyres, including the standard wheels and tyres, Dunlop D40's and D40 M2's. A full report on the handling evaluation will be received from Dunlop in due course.
- b. & The speed and acceleration testing was carried out on pink circuits, as marked on the attached map, by another Dunlop test driver and Paul Boulton. These tests consisted of testing the standard MX-5, to set a control time, TWM's Turbo MX-5 and retesting the standard MX-5 to check the control time, and see whether the technique or conditions had changed. Graphs and table forms are attached showing the results.
- c.

Continued/...

Type 3: 1

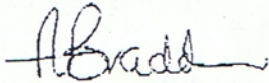
- 2 -

Test Condition

Vehicle Speed
Idling (Rpm)
Absorbed Power
Pressure in cr

We trust these
require any fu
me.

Yours sincerel



A. Braddon
Project Engine

3. Conclusion

Although the achieved 0 - 60 mph time of 10 seconds close to the 8.75 seconds recorded by MC or the recorded by Autocar and Motor, a re-check of the at the end of the day, with the same drive combination, proved that the technique and the car not changed measurably to upset the times achieved by the Turbo car.

The fact that MC and Autocar and Motor magazine recorded faster times does not matter too much, as the conditions at MIRA for both surface, weather and driver are undoubtedly different to those used by MC and Motor.

The fact remains that the difference in acceleration between the standard car and the Turbo car has been measured. It has been found that the Turbo car is faster to 60 mph in straight line top speeds and, most importantly, accelerating through the gears.

A further test day took place at Bruntingthorpe Ground on 20 August using the BBR prepared MX-5 Brodie as the test driver. This vehicle used the standard engine and tyres (D40 M2) and the standard catalyst, and achieved a 0 - 60 mph time of 7.4 seconds - with one person 7.8 seconds with two people (comparing with 7.9 seconds for the MIRA test), and a top speed of 124 mph (125 mph run) after a 2 mile run.

The top speed was unaffected by the speed onto the test track. A standing start achieved 124 mph and starting at 85 mph achieved 124 mph. This would appear to be the top speed of the MX-5 Turbo. Unfortunately, a standard car was not available for comparison. David Brodie in a standard car at Bruntingthorpe under those conditions may have achieved far faster or slower times and speeds than those in any other test session. This should be taken into account when comparing graph 1 results.

Continu

4. Recommendations

As an experienced test/race engineer for a successful motor cycle race team, I would say that although a proper objective was not given at the start and a standard MX-5 was not available at Bruntingthorpe, the results gained are representative of the performance of the cars on the days and under the conditions that they were tested.

From the results of the testing and from my own experience, both driving and as a passenger, I would recommend that modifications are made in the following order:

1. The BBR suspension kit is fitted as the first part of the tune up kit to cure the lift off oversteer, improve stability and increase cornering speeds.
2. The Turbo kit is fitted to improve speed and acceleration.
3. The wheels and tyres and any other body parts are fitted as a cosmetics package.

As the orders of kits 1 and 2 are not beneficial to the MCL marketing of the Turbo kit, then they must be reversed in their order. I still feel that the suspension kit is worthwhile and would be the first modification I would make to a vehicle.

The wider tyres and wheels made the 0 - 60 times at MIRA slower and so would be a later conversion.

Also on a personal note, I would like to see 125 mph and a stronger top end feel to the engine available every time the car is driven fast, not just after 2 miles (at least) of straight level road. The car definitely feels to run out of power at around 115 mph. To go faster needs more straight, more room, more power or an aerodynamics package.

Both David Brodie and I feel that the brakes are competent enough for the conversion as it stands at the moment. We also feel that a complete package offering suspension, turbo charging and cosmetics would not affect sales due to its cost.

Continued/...

Other Recommendations

1. Leave the car as it is now and wait for the MC Facelift.
2. Keep the conversion 'in house' and fit the BP 1.8 GT engine from the 323 BG GT (138 bhp).
3. Fit the BBR Suspension kit.
4. Fit the BBR Turbo conversion.



Paul Boulton
Technical Liaison Engineer

28 August 1990

PMB/jbj

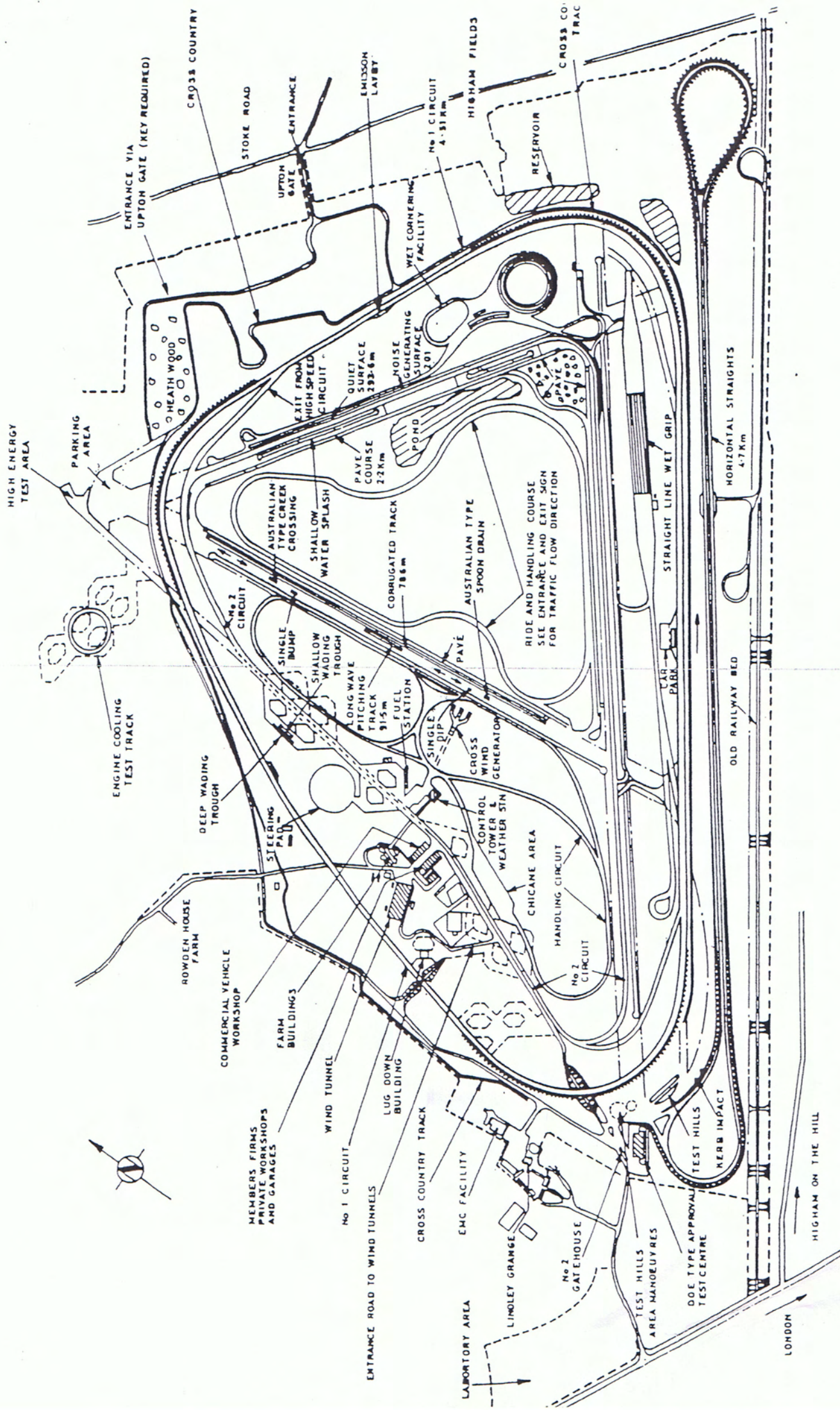


Figure 1 The MIRA Proving Ground, showing the layout of the test tracks

MX-5 IND. R.P.M.	14" WHEELS AND TYRES		15" WHEELS AND TYRES	
	MX-5 SPEEDO IND. MPH	FLOWTRONIC IND. MPH	MX-5 SPEEDO IND. MPH	FLOWTRONIC IND. MPH
1,000	-	-	-	-
2,000	37	37	37	37
3,000	57	57	57	57
4,000	75	73	75	73
5,000	94	90	94	90
6,000	110	106	110	106
6,000-6,700	125	118	123	116

IG. 1 Shows speed and gearing difference between 14" wheels and tyres and 15" wheels and tyres. Top speed tests with two people, 1/4 tank of fuel and control speed of 102 mph at end of banked section.

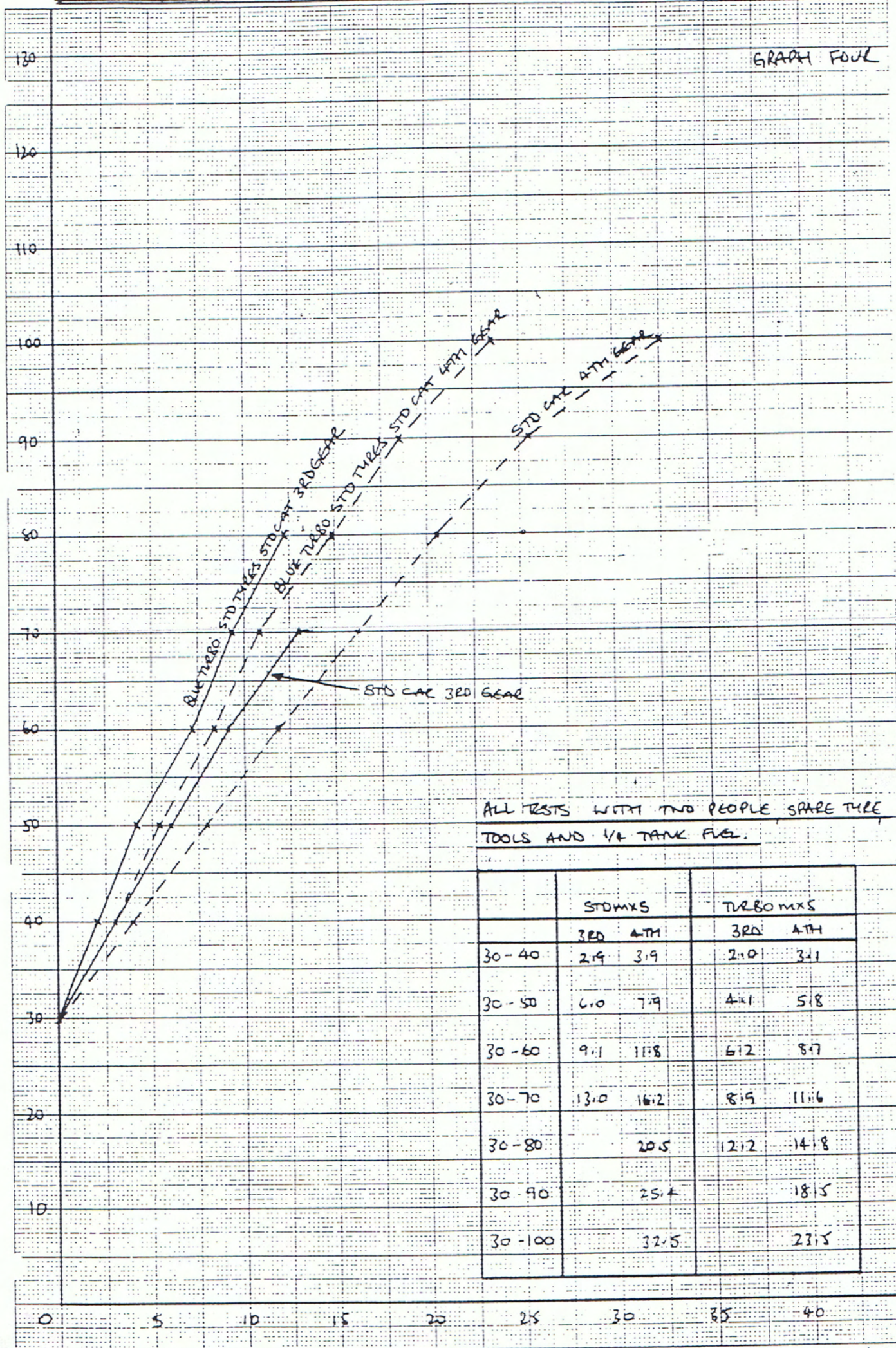
VEHICLE INDICATED RPM	CRYPTON INDICATED RPM		
	TWM MX-5 TURBO BBR ECU	TWM MX-5 TURBO MC ECU	TWM NEW MX-5 MC ECU
1,000	970	-	-
2,000	1,910	1,910	-
3,000	2,950	3,000	-
4,000	3,970	3,970	-
5,000	4,990	4,900	-
6,000	5,750	5,800	5,800
7,000	6,600	6,600	6,600

IG. 2 Shows rpm comparison between crypton revcounter and two MX-5 vehicles to show MX-5 revcounter accuracy, assuming accuracy of crypton revcounter.

3RD AND 4TH GEAR ACCELERATION AT MIRA FOR STD MX5 AND TURBO MX5 Chartwell

GRAPH FOUR

M P H T O R E C O R D S



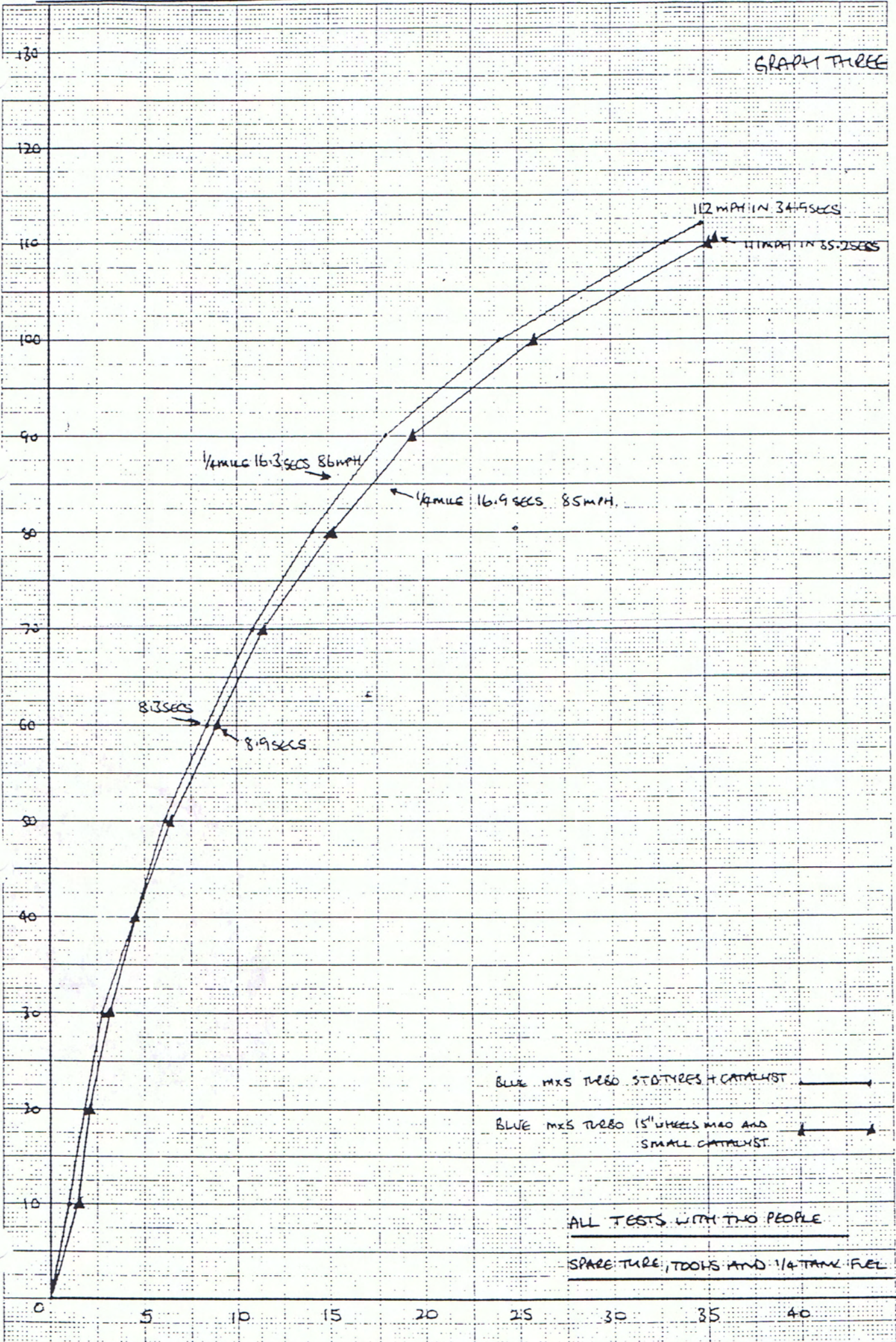
ALL TESTS WITH TWO PEOPLE, SPARE TIRE, TOOLS AND 1/4 TANK FUEL.

	STD MX5		TURBO MX5	
	3RD	4TH	3RD	4TH
30-40	2.9	3.9	2.0	3.1
30-50	6.0	7.9	4.1	5.8
30-60	9.1	11.8	6.2	8.7
30-70	13.0	16.2	8.9	11.6
30-80		20.5	12.2	14.8
30-90		25.4		18.5
30-100		32.5		23.5

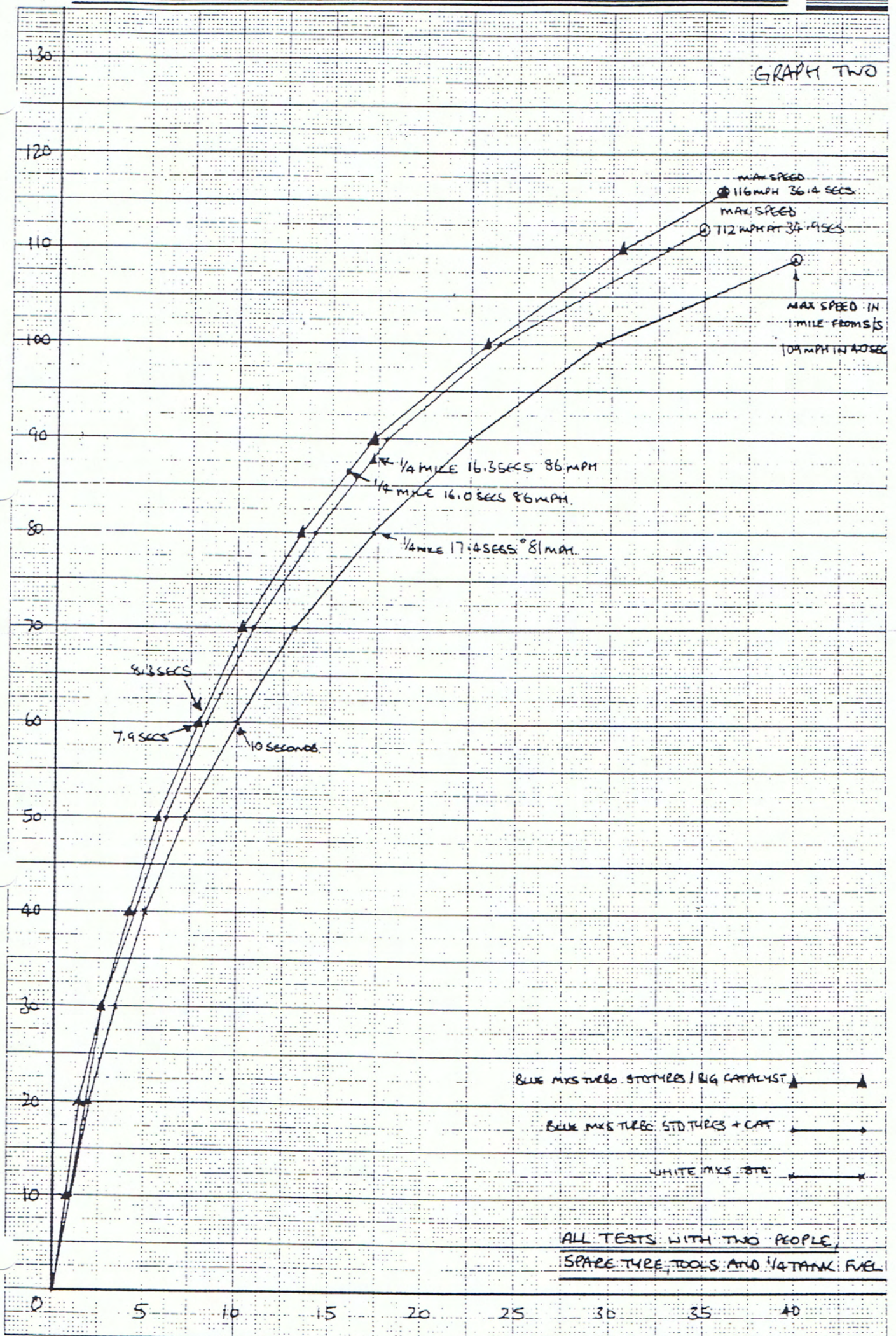
STANDING START ACCELERATION TESTS FOR MX5 TURBO AT MIRA

Chartwell

GRAPH THREE



GRAPH TWO

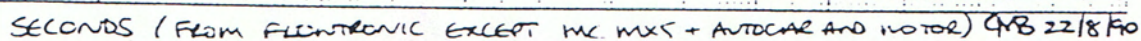
M P H
F R O M
2 0 0 - 1 2 2 5 1 1

SECONDS (FROM ELECTRONIC)

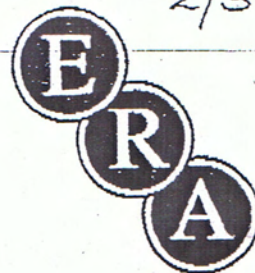
948 16/8/90

Chartwell

GRAPH ONE



ENGINEERING RESEARCH AND APPLICATION



Engineering Research
and Application Ltd
London Road, Dunstable
Bedfordshire, LU6 3UR
Telephone 0582 662301/608000
Facsimile 0582 666213
Telex 826833

Our Ref: AB/SJK

January 7, 1991

Mr. S.G. Edwards
Mazda Cars (UK) Limited
Unit 4
Chapman Way
Tunbridge Wells
Kent
TN2 3EE

Dear Sidney,

Please receive the test results for the emission testing carried out on your Mazda MX-5 Turbo.

As discussed we have used the load and inertia data from the documents you supplied, the emission results are as follows:

Type 1: Average Emission of Gaseous Pollutants after a Cold Start

	Carbon Monoxide (g/km)	Hydrocarbon (g/km)	Oxides of Nitrogen (g/km)
Emitted Mass	2.08	0.140	0.220
Limit Value	2.11	0.25	0.62

Type 2: Carbon Monoxide Emission Test at Idling Speed

Carbon Monoxide (Corr Vol%)	0.008	0.010	0.008
Engine Rpm	800	830	1080

N.B. 800 Rpm was the lowest speed attained

- 2 -

Type 3: Verifying Emissions of Crankcase Gases

Test Condition	1	2	3
Vehicle Speed (Kph)	0	50	50
Idling (Rpm)	830	--	--
Absorbed Power (Kw)	0	1.7	2.89
Pressure in crankcase (Kpa)	- 0.72	- 0.78	- 0.790

We trust these results meet with your approval however should you require any further information please do not hesitate to contact me.

Yours sincerely,



A. Braddon
Project Engineer

MOTOR INDUSTRY RESEARCH ASSOCIATION

Huneeaton, Warwickshire

METEOROLOGICAL DATA on Date 150890

AVERAGED DATA with the exception of PEAK Wind Speed & Precipitation

Time	B.Pressure mbars.	Temp. deg.C	R.H. %	Precip. min wet	Wind S. mph	Wind Pk. mph	Wind D. deg
0910	990.94	+ 17.11	88	0	15.82	25.50	200.00
0920	991.06	+ 17.42	88	0	14.62	22.50	203.75
0930	990.80	+ 17.86	87	0	15.98	24.80	198.75
0940	990.76	+ 18.07	86	0	15.57	24.00	205.00
0950	990.94	+ 18.19	86	0	13.43	19.90	210.00
1000	990.88	+ 18.56	85	0	13.17	21.40	208.75
1010	990.90	+ 18.90	83	0	13.76	21.10	211.25
1020	990.82	+ 19.39	80	0	14.39	24.00	215.00
1030	990.72	+ 19.49	78	0	15.06	25.50	212.50
1040	990.60	+ 19.54	77	0	15.88	25.90	217.50
1050	990.68	+ 19.60	75	0	14.15	25.50	221.25
1100	990.56	+ 19.72	73	0	14.27	24.40	222.50
1110	990.28	+ 19.78	72	0	15.33	25.90	212.50
1120	990.70	+ 19.45	73	0	15.36	24.40	218.75
1130	990.62	+ 19.96	73	0	13.61	24.00	217.50
1140	990.36	+ 19.98	70	0	16.06	26.20	211.25
1150	990.34	+ 20.07	69	0	16.18	34.40	217.50
1200	990.20	+ 20.16	68	0	17.74	31.40	212.50
1210	990.36	+ 19.90	68	0	16.57	26.60	211.25
1220	990.40	+ 19.84	68	0	16.03	26.60	218.75
1230	990.34	+ 20.33	66	0	15.94	29.90	225.00
1240	990.22	+ 20.47	66	0	15.63	27.70	218.75
1250	990.16	+ 20.42	66	2	16.56	28.10	215.00
1300	990.26	+ 19.91	67	1	17.36	29.90	215.00
1310	990.24	+ 20.01	66	0	16.11	30.30	222.50
1320	990.28	+ 19.99	68	3	15.46	28.10	215.00
1330	990.16	+ 19.51	71	6	16.50	32.90	226.25
1340	990.10	+ 19.35	73	5	14.79	25.90	213.75
1350	990.16	+ 19.07	78	10	12.07	24.00	210.00
1400	989.86	+ 19.70	76	2	12.73	24.00	225.00
1410	989.74	+ 20.11	71	4	15.25	25.10	222.50
1420	989.82	+ 20.32	69	0	14.62	22.50	215.00
1430	989.70	+ 19.99	73	7	11.86	22.90	218.75
1440	989.96	+ 18.34	84	10	13.95	28.10	223.75
1450	989.80	+ 18.82	81	3	13.06	22.20	221.25
1500	989.78	+ 19.08	79	1	13.65	25.50	222.50
1510	989.62	+ 18.98	83	3	12.91	21.40	218.75
1520	989.42	+ 19.02	82	0	14.07	22.20	220.00
1530	989.70	+ 19.19	78	8	14.91	26.20	232.50
1540	989.66	+ 19.68	77	1	13.17	22.90	231.25
1550	989.70	+ 20.28	73	0	12.57	25.10	243.75
1600	989.72	+ 20.49	65	0	13.21	22.50	238.75
1610	989.82	+ 20.47	65	0	11.13	21.80	251.25
1620	989.94	+ 20.30	61	0	13.39	26.20	256.25
1630	989.90	+ 20.11	59	0	13.99	30.30	261.25
1640	989.84	+ 20.12	57	0	14.62	28.10	250.00
1650	989.88	+ 20.12	55	0	15.47	27.40	257.50
1700	989.86	+ 19.84	60	0	12.28	23.30	266.25
1710	990.06	+ 19.81	59	0	11.80	22.90	268.75
1720	990.04	+ 19.81	56	0	14.76	25.10	257.50
1730	990.16	+ 19.70	57	0	13.10	23.30	261.25
1740	990.20	+ 20.27	55	0	13.11	24.00	258.75
1750	990.32	+ 19.93	52	0	14.46	30.70	252.50
1800	990.44	+ 19.79	56	0	11.16	19.90	253.75
1810	990.36	+ 20.13	54	0	12.22	24.80	261.25
1820	990.30	+ 20.23	50	0	13.14	27.70	257.50
1830	990.48	+ 20.04	52	0	11.13	26.20	262.50
1840	990.58	+ 20.18	51	0	11.42	21.80	250.00
1850	No Data						
1900	No Data						

LEISTUNGS - DIAGNOSE

KFZ-Typ : Mazda Mx5
Motor-Typ : 1,6l
Kennzeichen :

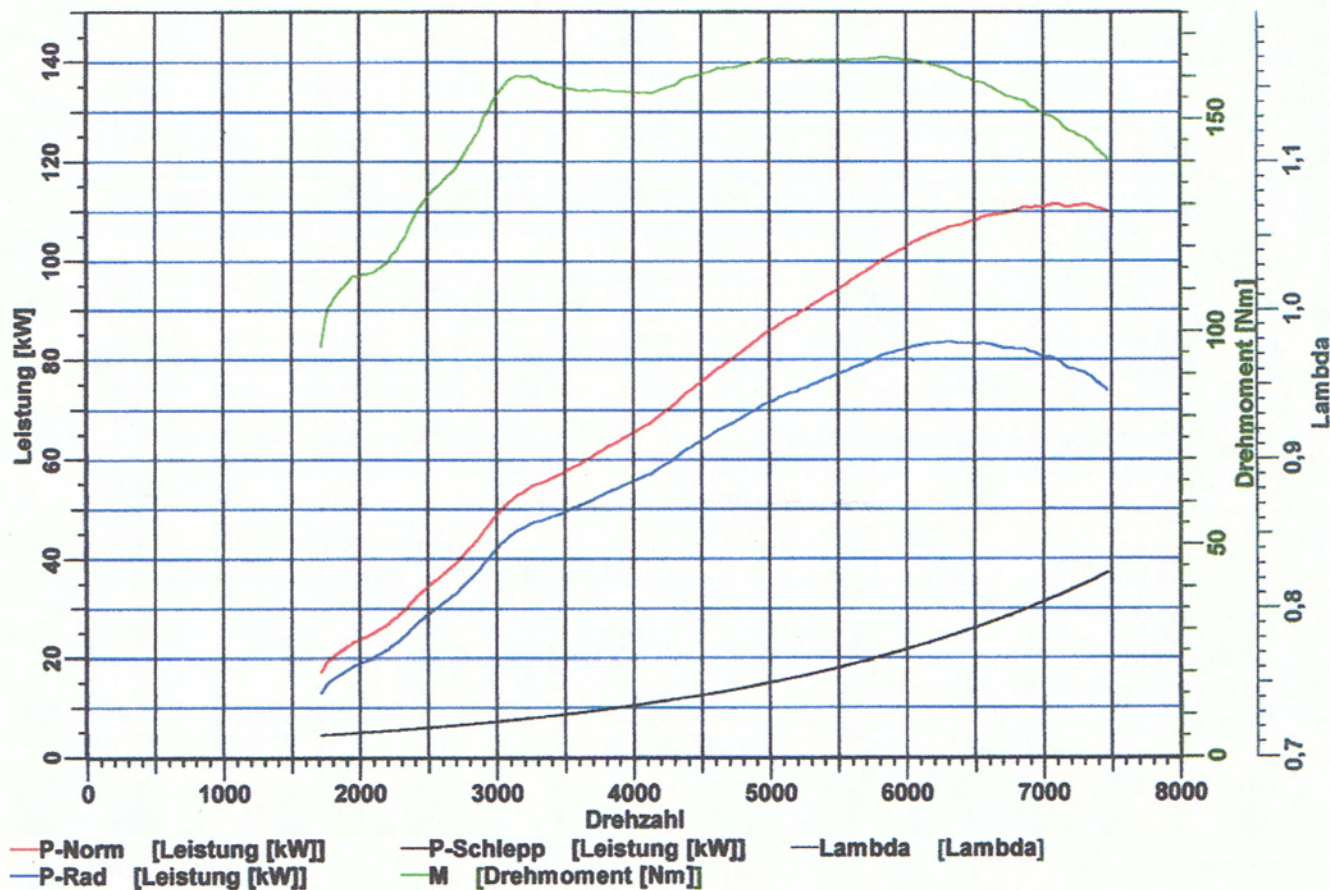
Messung : mit Turbolader
Kunde : I.L.
Prüfer :

Datum : 06.12.01

Uhrzeit : 12:24

Messsystem: VIROP 1.10

Leistungsprüfstand: Maha LPS 13 ALLR



Leistungs-Daten

Norm-Leistung	P-Norm	: 111,5	kW (151,6	PS) nach DIN 70020
Motorleistung	P-Mot	: 112,6	kW (153,1	PS)
Radleistung	P-Rad	: 80,2	kW (109,1	PS)
Schleppleistung	P-Schlepp	: 32,4	kW (44,1	PS)
Drehmoment	M	: 164,5	Nm	

Maximale Leistung bei	V (km/h)	: 207	RPM (1/min) : 7090
Maximales Drehmoment bei	V (km/h)	: 170	RPM (1/min) : 5840

Maximale Geschwindigkeit	V-max (km/h)	: 218	Gang Nr. : 4
Maximale Drehzahl	RPM-max	: 7470	

Luftdruck (hPa)	: 1023	Öltemperatur (°C)	: 90
Lufttemperatur (°C)	: 20	Ladedruck (bar)	: 0,0
Lambda (λ) bei P-max	: 0,00		