

**STANDARDS, REGULATIONS & TESTING RESULTS**

**FOR**

**THE TG SPORTS (1955)**

**Utilising Mazda Miata MX5 donor parts**

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**20 April, 2007**

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## **Background**

The TG SPORTS (1955) is a Semi Built Vehicle (SBV). This means that the car has been delivered to the customer as completed with the following exceptions.

1. All Mazda Miata MX5 mechanicals, including,
  - Complete suspension
  - Complete braking system
  - Engine, transmission, mounts etc
  - Seats and their runners
  - Complete steering system
  - Wheels
  - Complete electric system
  - Complete exhaust system
  - Complete petrol tank and delivery system
  - Seat belts
2. Windscreen glass
3. Tyres
4. Instruments
5. Any other options selected by the customer

The customer is then to attach the Mazda parts to the vehicle using the parts from the donor Mazda. This means that the Mazda fasteners are reused exactly as per original. No modification of any parts, with the exception of the Power Plant Frame (PPF) is required.

Australian Design Rule	Australia	<b>ADR</b>
Single Vehicle Approval	UK	<b>SVA</b>
Low Volume Vehicle Technical Association	New Zealand	<b>LVVTA</b>

Where the Rule numbers have been included there is often an alternative. This is where the authorities have deemed it as an equivalent technical requirement.

## **THE TG SPORTS (1955) SPECIFICATIONS**

### **CHASSIS**

Semi monocoque chassis with full Automotive Engineering Design including frontal crash impact area.

### **SUSPENSION**

Mazda Miata MX5 fully independent front and rear suspension.

### **STEERING**

All standard rack and pinion steering from Mazda Miata MX5  
Collapsible steering column from Mazda Miata MX5

### **BRAKES**

All disc brakes, lines and hoses from Mazda Miata MX5.

### **FUEL SYSTEM**

Mazda Miata tank with return line, fuel lines and filters.

### **ELECTRICAL**

All new wiring looms including computer loom.  
All new instruments, speedo, rev counter, temperature gauge, fuel gauge, etc available from Classic Instruments USA.  
All new lights to International Standards.

### **BODY**

Grill All chrome on brass hand crafted with stainless slats and solid brass octagonal cap.  
Bonnet All 1.2mm electro galvanised steel with genuine louvres and stainless steel hinge.  
Push button catches.  
Doors Fibreglass with side intrusion protection. Stainless steel burst resistance hinges, double action burst proof catches.  
General Fibreglass gel coat. Coremat is added to give stone protection in mudguard areas.

### **INTERIOR & WEATHER PROTECTION**

Dashboard.  
Impact crash strip installed on top of dash area.  
Quality cut pile Carpet.  
Seats etc as per Mazda Miata MX5. Low Back Bucket style also available as optional.  
Stainless steel soft Top fittings, with top quality English 'Everflex' vinyl top and zippered sidescreens.

### **WHEELS/TYRES**

As per Mazda Miata MX5 donor or optional chrome on wire wheels.

### **GENERAL**

All seen fasteners are stainless steel. Windscreen is aluminium channel extrusion.  
2 speed wipers with intermittent position as per Mazda Miata MX5.  
Windscreen washers  
Chrome bumpers.  
New radiator.

## **TG/Mazda Miata MX5 specifications**

### **Motor and transmission**

Mazda Miata MX5 1600 116 BHP @ 6500 RPM  
or 1800 133 BHP @ 6500 RPM

### **Suspension**

#### **Weights**

Front suspension (no wheels)	69.5 kilos (153.25lb)
Rear suspension (no wheels)	96 Kilos (211.5lb)
1600cc motor and manual transmission	170 kilos (374.75lb)
1800cc motor and manual transmission	179.6 kilos (396lb)
Manual Transmission only	37 kilos (81.5lb)
Auto transmission only	63 kilos (139.5lb)
1600cc motor only	133 kilos (293.2lb)
1800cc motor only	142.6 kilos(314.4lb)

### **TG/MX5 comparisons**

	<b><u>TG Sports</u></b>	<b><u>Mazda MX5</u></b>
TG chassis only	210 kilos (462.95lb)	
TG weight at front axle Mazda wheels(1800cc)	477.7 kilos (1053.1lb)	520 kilos (lb)
TG weight at rear axle Mazda wheels (1800cc)	491.6 kilos (1083.66lb)	520 kilos (lb)
TG total weight 5 Mazda wheels(1800cc)	969.25 kilos (2136.8lb)	1040 kilos (2293lb) With spacesaver
TG total weight with wire wheels (1800cc)	1000kilos	

	<b><u>TG Sports</u></b>	<b><u>Mazda MX5</u></b>
OA length	3740 mm (147.25")	3948mm (155.4")
OA width	1655 mm (65")	1676mm (65.9")
OA height	1220 mm (48")	1224mm (48.2")
Wheelbase	2440 mm (96")	2265mm (89.2")
Track, front with wire wheels	1460 mm (57.5")	1410mm (55.5")MX5 wheels
Track, rear with wire wheels	1500mm (59")	1428mm (56.2")MX5 wheels
Weight of each Mazda Miata MX5 wheel including tyre		13.1 kilos (28.8lb)
Weight of Mazda Miata MX5 space saver spare		7.5 kilos (16.5lb)
Weight of each wire wheel including tyre		19.25 kilos (42.4lb)

### **Crate dimensions**

Cubic dimensions	4300mm x 2000mm x 1140mm
Weight	800 kilos

## **TG Sports Itemised list**

### **Supplied in the SBV kitset.**

1. Chassis
2. Unpainted main body tub fastened and glued to chassis above.
3. Front and rear guards bolted to tub and chassis above.
4. Doors, with catches, hinges, and side intrusion bars fastened to tub above.
5. Bonnet tops, sides, and grill attached to tub above.
6. Radiator in place on chassis.
7. Bumpers attached to chassis.
8. Carpet supplied but not glued in place. Painting has to be completed first.
9. Windscreen posts and frame supplied, not fitted. No glass.
10. Windscreen wiper spindles in place on tub.
11. All lights are attached, headlight inners not supplied.

### **Items, services not included in the SBV price.**

1. Windscreen glass.
2. Items on our options list.
3. Bleeding of brake and clutch lines.
4. Modification of PPF, exhaust, driveshaft etc.
5. Instruments.

### **Supplied and fitted by the customer all taken from the Mazda Miata MX5 donor.**

1. Motor and Gearbox complete with all sensors and their plugs, accelerator cable, nuts, bolts, engine mounts, engine mount caps, airbox, computer and the entire wiring loom. Any relays, igniters etc which make the engine go.
2. Steering column, complete with shroud, all switches, ign switch, all bolts and fasteners, all slide washers, all U/JT's and extensions, Steering wheel,
3. Side repeaters
4. Complete front suspension assembly, all fasteners, bushes, steering rack, brake lines, etc.
5. Complete rear suspension assembly with all fasteners, bushes, brake lines.
6. Wheels and wheel nuts. Jack. **Plus a 5th wheel** the same as the other 4
7. Driveshaft with fasteners.
8. Battery, and hold downs, cables.
9. Windscreen wiper motor and its first arm.
10. Handbrake and all its fasteners and cables,
11. Interior lights, misc. switches, if required,
12. Seats and their slides and fastenings,
13. Fuel tank complete with all senders, pumps, check valves, hoses and cap, boot covers
14. Heater motor, heater radiator, and hoses,
15. Clutch m/c complete with all fastenings and lines,
16. Brake m/c and booster complete with all fastenings and lines, pedal switch.
17. Radiator fan, namely the engine one. Radiator hoses.
18. Horns.
19. Exhaust system.
20. Seatbelts.
21. Petrol filter, carbon canister.
22. Headlamp inners (glass) and wiring loom and plugs. MB model only. 1989—1999
23. PPF (power plant frame) complete with all fasteners

## **Brakes**

The Mazda MX5 braking system has been reused in its entirety, including hoses, calipers, booster m/cylinder, handbrake etc. New brake and fuel lines are available attached to the chassis but only on customer request.

No modification to the system or any part is required.

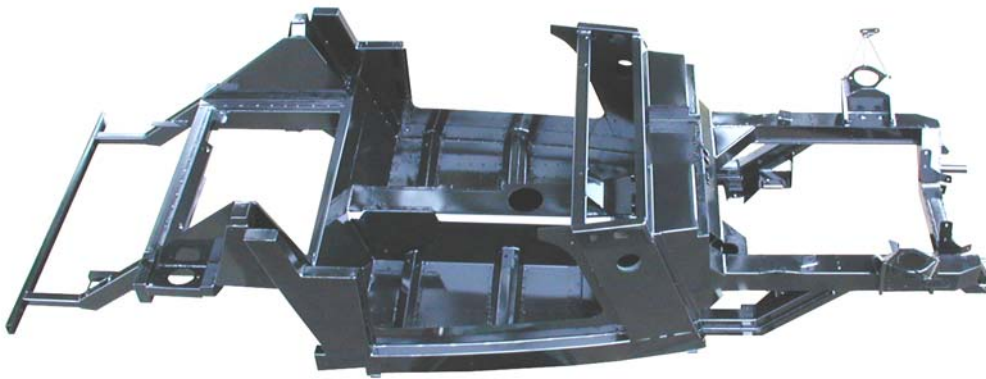
Warning systems for lo level fluid and handbrake on is reused.

## **Demisters.** **ADR 15/01**

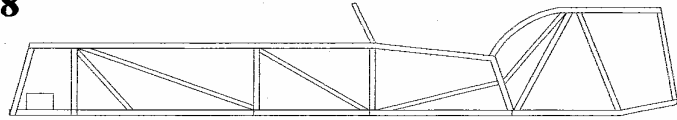
These are driven by the original Mazda MX5 fan through the heater element with air being delivered by 30mm reinforced ducting to slotted outlets in front of each front seating position of the windscreen.

## **Chassis.**

The chassis is of semi monocoque design. Refer to engineers report for beaming, and torsional calculations.



**Walter Wing**  
**MIE Aust C P Eng #557538**  
36A Greenmount Drive  
Greenmount  
Auckland  
New Zealand



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## **Torsional and Beaming Tests on TG Sports**

Make : T Car  
Model : TG Sports  
Year : 2003  
VIN : 7A9MMT0103A014097  
Mods : New chassis designed to accept Mazda MX5 running gear.  
GVM : 1290 kg  
Track : 1460mm front 1500mm rear

I have supervised the Beaming and Torsional Testing of the above vehicle to Queensland Transport test requirements for the above vehicle.

A report form Test No. 0904 is attached

The vehicle was loaded with a passenger weight of 272kg and a torque load of 4679Nm. A load of 272kg was used in the beaming test which was conducted separately.

The measured maximum deflection of 35mm, and torsional stiffness of 5378 Nm/deg, meets the criteria for an Individually Constructed Vehicle (four cylinder).

I am a charter professional engineer with the Institute of Engineers Australia. My membership number is 557538. I am currently a Low Volume and Heavy Vehicle Certifier approved by the Land Transport New Zealand.

Yours sincerely,

Walter Wing ME

15/3/05

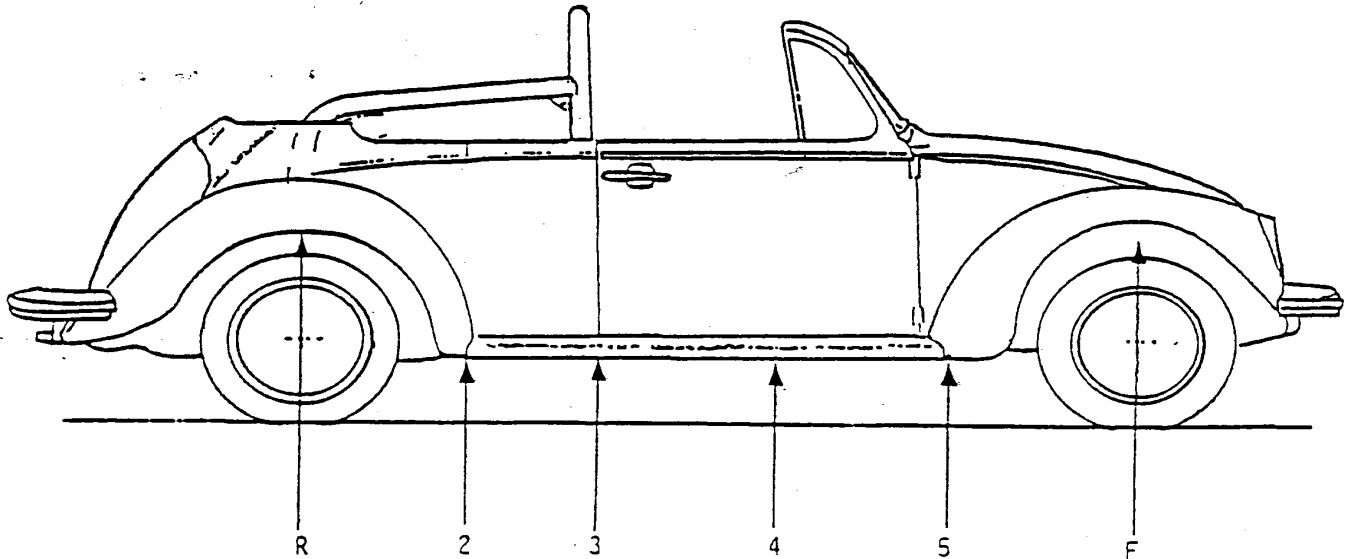


TEST NO. 0304

FORM NO. LT1

## REPORTING FORM

## BEAMING AND TORSIONAL TESTING - LT1



## Gauge Positions

## Longitudinal Dimensions

R - 2 ..... 580 ..... (mm)  
 R - 3 ..... 1050 ..... (mm)  
 R - 4 ..... 1520 ..... (mm)  
 R - 5 ..... 1955 ..... (mm)  
 R - F ..... 2440 ..... (mm)

## Transverse Dimensions

RR - LR ..... 1640 ..... (mm)  
 R2 - L2 ..... 1300 ..... (mm)  
 R3 - L3 ..... 1250 ..... (mm)  
 R4 - L4 ..... 1130 ..... (mm)  
 R5 - L5 ..... 850 ..... (mm)  
 RF - LF ..... 850 ..... (mm)

## BEAMING TEST

Gauge Position Deflection-Load applied (mm)

Deflection-Load removed (mm)

	Left	Right	Left	Right	Average	Left	Right	Left	Right	Average
			red*	red*	red*			red*	red*	red*
R	0.00	0.02	..0..	..0..	..0..	-0.11	0.02	..0..	..0..	..0..
2	0.40	0.40	0.33	0.30	0.32	0.00	0.03	0.05	0.01	0.04
3	0.56	0.51	0.43	0.27	0.35	0.08	0.02	0.13	0.02	0.07
4	0.508	0.50	0.32	0.27	0.30	0.01	0.01	0.05	0.01	0.03
5	0.56	0.43	0.32	0.14	0.23	0.00	0.01	0.02	0.00	0.01
F	0.30	0.36	..0..	..0..	..0..	0.00	0.01	..0..	..0..	..0..

\* Deflections reduced to datum line through points 'R' and 'F'.

TEST NO. 0904

FORM NO. LT1

## TORSIONAL TEST

Gauge Position	Load applied (mm)				Load removed (mm)			
	Deflection		Rotation	Rotation reduced*	Deflection		Rotation	Rotation reduced*
	Left (mm)	Right (mm)	(°)	(°)	Left (mm)	Right (mm)	(°)	(°)
R	-1.83	0.59	0.08	0.0	-0.10	0.02	0.004	0.0
2	-0.84	1.10	0.09	0.01	-0.15	0.20	0.015	0.01
3	-2.11	2.45	0.21	0.13	-0.25	0.14	0.017	0.013
4	-5.59	6.50	0.61	0.53	-0.36	0.32	0.034	0.030
5	-4.93	6.40	0.76	0.68	-0.46	0.33	0.053	0.049
F	-5.98	8.13	0.95	0.87	-0.53	0.12	0.044	0.040

\* Rotations reduced by subtracting rotation in rear plane LR-RR.

## Load Details

## Deflection

Vehicle Mass ..... 1040 ..... kg

Number of Seating Positions ..... 2 .....

Total Load Applied ..... 272 ..... kg

GVM (Load + Vehicle Mass) ..... 1290 ..... kg

## Torsion

Vehicle Track - Front ..... 1460 mm .....

- Rear ..... 1500 mm .....

Load Applied ..... 212 ..... kg

Moment Arm  
(from vehicle centre line) ..... 2250 mm .....

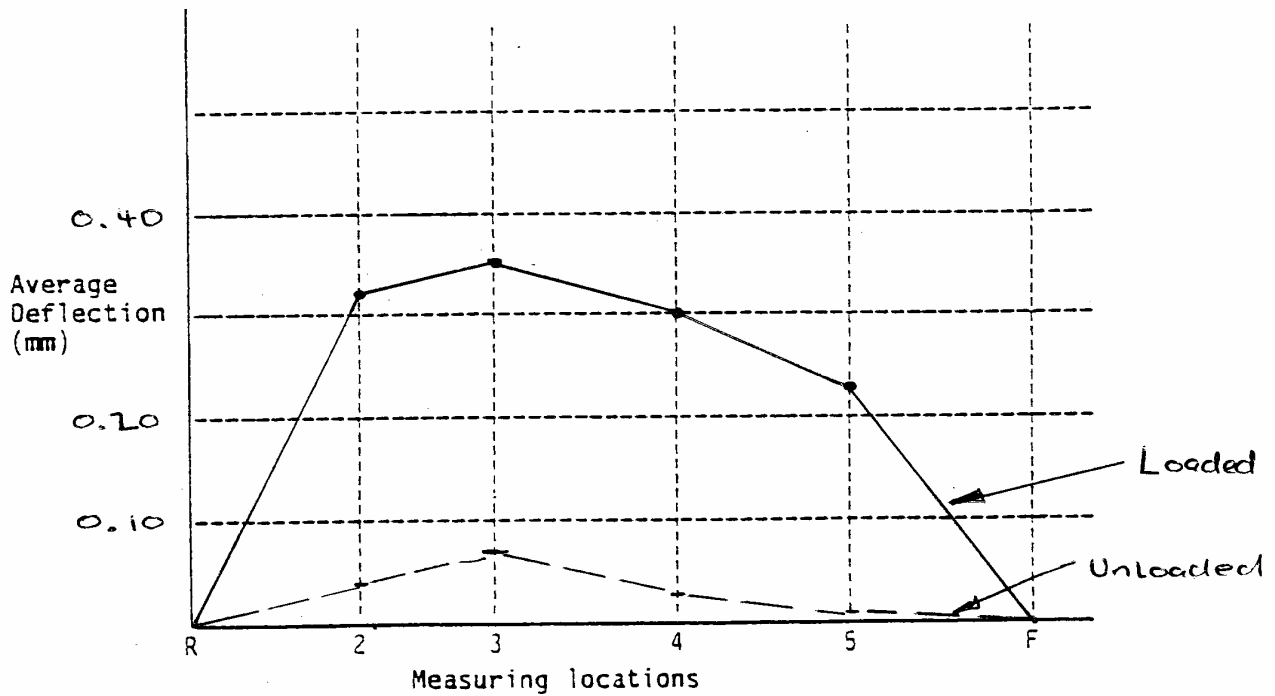
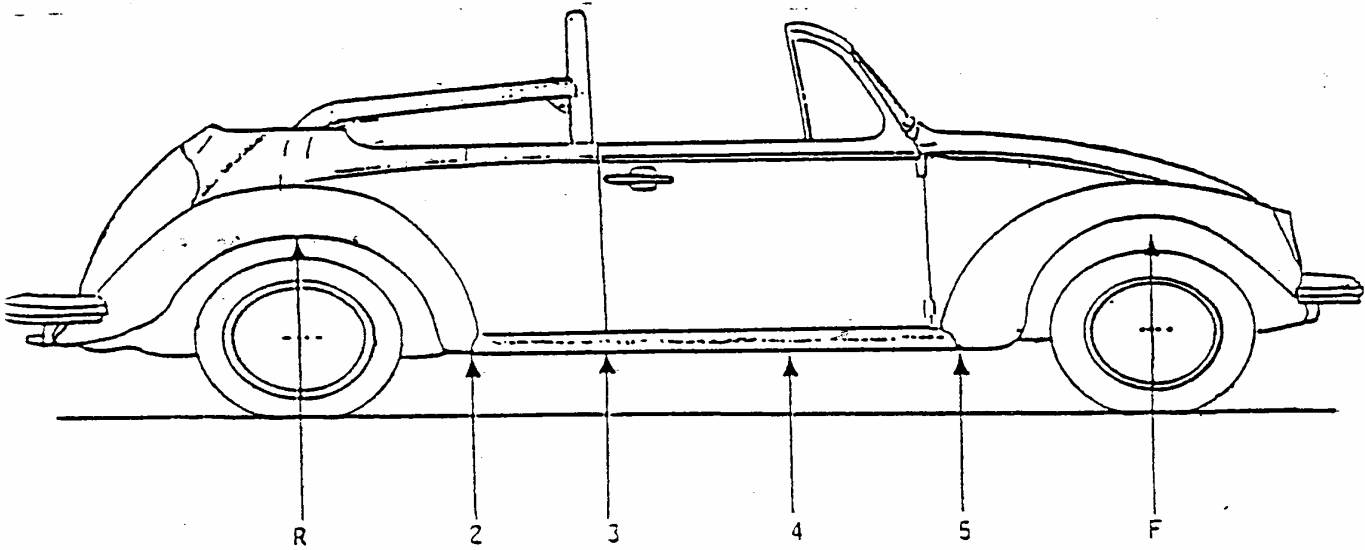
Make T CAR ..... Model TG Sports Year of Manufacture 2003

Chassis No. or VIN 7A9MMT0103A014097 .....

Vehicle Modifications New sports car .....

TEST NO. 0904

FORM NO. LT1



NOTES

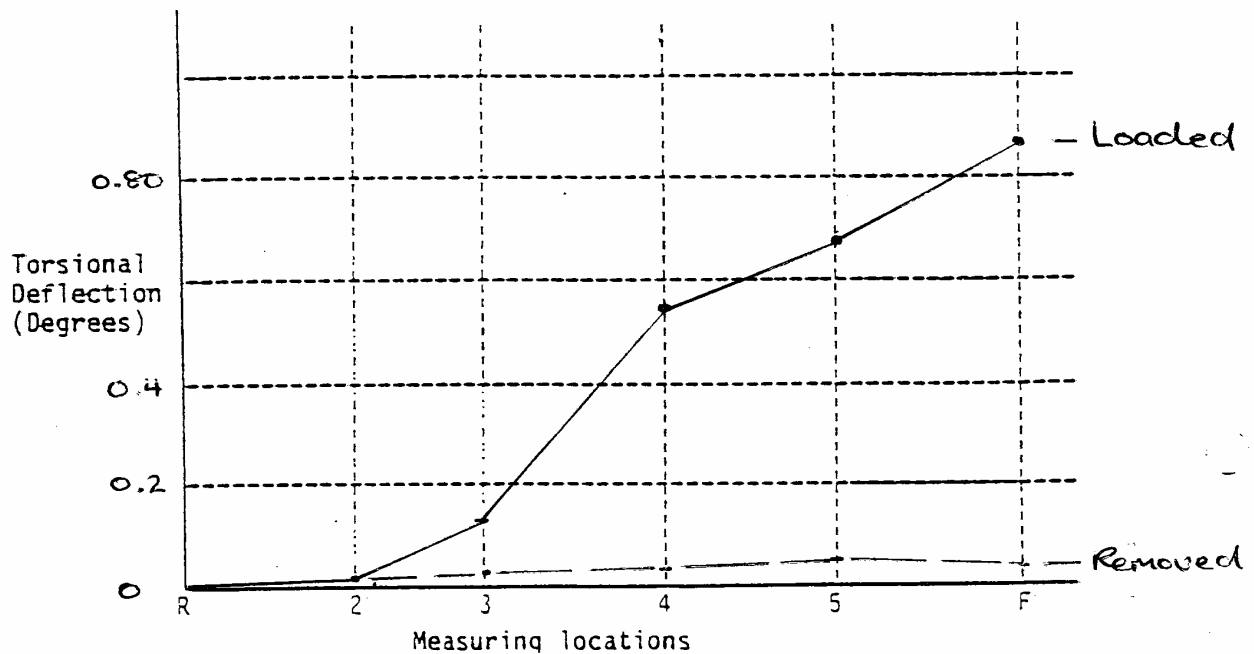
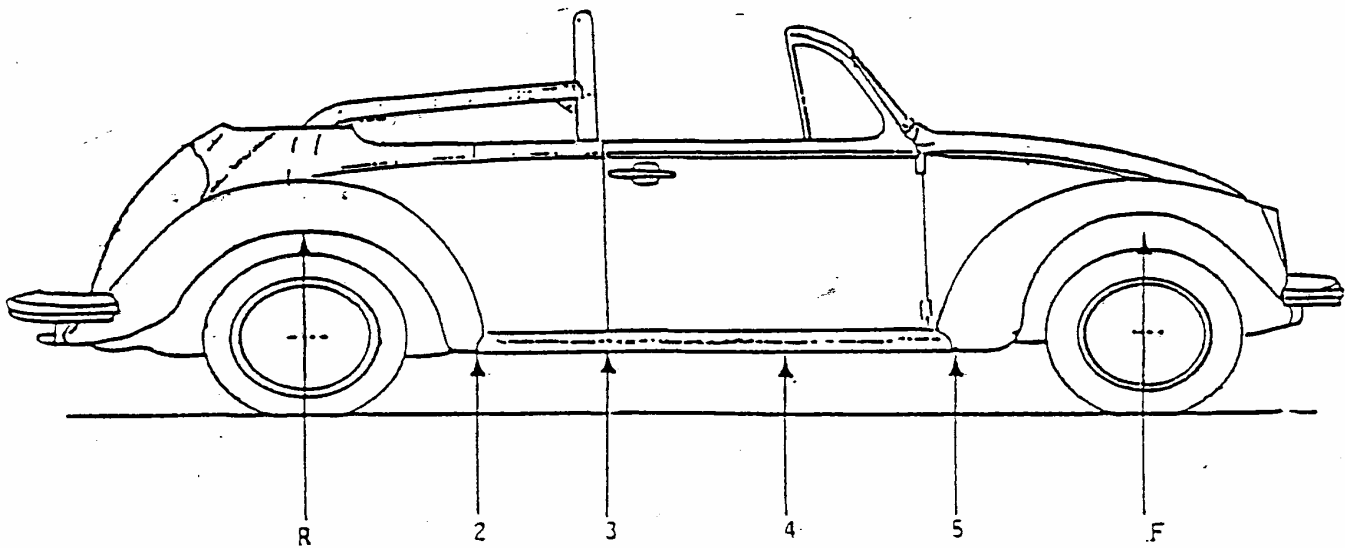
Meets requirements < 1.25mm maximum deflection.

## SECTION LT

## BEAMING AND TORSIONAL TESTING

TEST NO. 0004

FORM NO. LT1



## NOTES

Moment = 4679 Nm

Torsional Stiffness = 5378 Nm/deg

OR &gt; 4000 Nm/deg 4 cylinder

Test conducted by: Walter Wing

Signature: *Walter Wing*

Authorised Officer No: /

Date: 4/9/04

MIE Aust CPEng #557538

TEST NO. 0904

FORM NO. LT1

## CHECKLIST

## BEAMING AND TORSIONAL TESTING - LT1

(Y = Yes)(N = No)

## 1.0 TEST PROCEDURES

- 1.1 Has the Gross Vehicle Mass (GVM) been determined by adding the unladen mass to the payload capacity of the vehicle?  
(In the case of a passenger carrying vehicle, the payload shall be 68kgs for each seating position)
- (Y) N

## 2.0 JIG MEASUREMENTS

- 2.1 Is the vehicle to be tested mounted through the hubs with springs or dampers etc. made incompressible or replaced by spacers?
- (Y) N
- 2.2 Are the deflections to be measured at the points shown in Figures 1 and 2?
- (Y) N

## 3.0 BEAMING AND TORSIONAL TEST PROCEDURE

- 3.1 Has the unmodified vehicle been tested in accordance with the details outlined in the "General Requirements" section?
- Y N (N/A)
- 3.2 Has the modified vehicle been tested in the same manner as the unmodified vehicle?
- Y N (N/A)

NOTE: All hinged panels are to be ajar at all times and fuel tank filled to 75% capacity.

## 4.0 DATA RECORDING

- 4.1 Has all test data, loadings etc. been recorded on the standard testing reporting forms?
- (Y) N

TEST NO. 0904

FORM NO. LT1

- 4.2 Has a graphical plot of the average of the deflection on the left and right hand sides at each measuring location along the wheelbase with the applied load and again with the load removed been provided for the vehicle? ☒ Y N
- 4.3 Has a plot of the vehicles angular deflection at each measuring location along the wheelbase with the load applied and again with the load removed also been provided? ☒ Y N
- 4.4 Have the beaming deflection plots been reduced to a zero datum line through points "R" and "F" to eliminate the contribution of jig movement etc. in absolute values? ☒ Y N
- 4.5 Have the angular deflections been similarly reduced by subtracting the rotation measured in the plane "RR-LR" from each absolute rotation value? ☒ Y N
- 5.0 ACCEPTABLE CRITERIA
- 5.1 Do the beaming deflection of the modified vehicle meet the acceptable criteria guidelines? ☒ Y N
- 5.2 Do the torsional deflections of the modified vehicle meet the acceptable criteria guidelines? ☒ Y N

**NOTE:** Completed test data reporting forms are to be attached to this checklist.

If the answer to any question is "NO" the modification is not acceptable.

Make T CAR Model TG Sports Year of Manufacture 2003

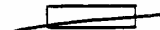
Chassis No. or VIN 7A9MMTC0103A014097

Vehicle Condition

As originally manufactured



Modified



If the vehicle was tested in modified form, indicate plan nos. to which it was constructed or the AO number of the authorised officer who certified the design and his/her design no.

Authorised Officer No. /

Design No. /

M

## **Doors**

The doors have a **side intrusion** section. ADR 29/00, or FMVSS 214-FR16801 and amendment FR17015

**See engineering report.**

The doors are rear hinged and have **Stainless steel hinges** with bearings. ADR 2, or ECE R 11/00 to 11/02

**See engineer's report.**

The door **catches** are double action burstproof type as used in Morgan and Landrover vehicles. ADR 2, or ECE R 11/00 to 11/02

**See manufacturers and testing laboratory reports.**

Where required a door bolt has been fitted with an audible alarm (UK only).

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**Tests on TG Sports**

**DOOR SIDE INTRUSION BEAMS**

**Introduction**

The doors have side intrusion beams which have been designed to pass ADR 29/00.

Each door has a fabricated two piece steel beam, which incorporates the mounting points for the door latch and hinges. This is screwed to a GRP door moulding.

The steel beam consists of a 2mm electrogalv outer plate and a 3mm electrogalv double top hat pressing inner plate. These pieces are plug welded together to form a beam, with the GRP moulding as the outer cover.

The unladed weight of the vehicle = 1040kg  
= 10202N

ADR 29/00 minimum loading requirements – without seats installed.

Initial crush resistance  $0.83 \times 10.202 = 8.468 \text{ kN}$

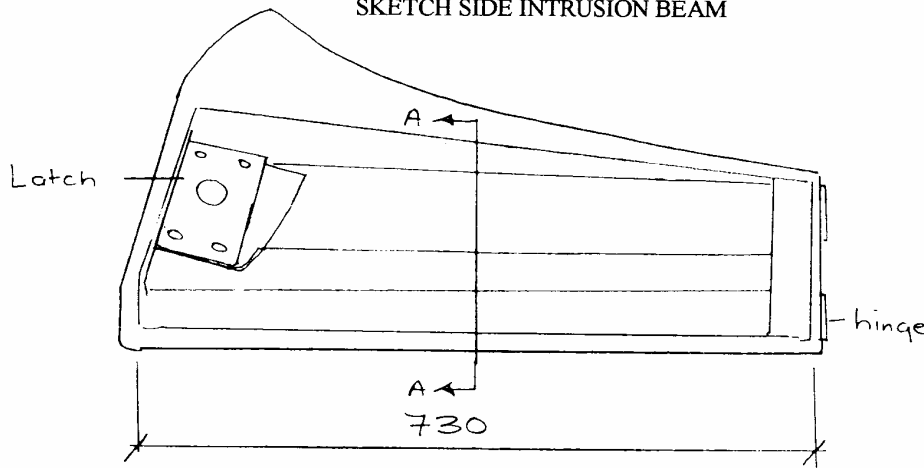
Intermediate crush resistance  $1.30 \times 10.202 = 11.01\text{kN}$

Peak crush resistance  $2.0 \times 10.202 = 22.02\text{kN}$

Initial crush resistance is the average force exerted over the first 155mm of deflection.

Intermediate crush resistance is the average over the first 310mm, and the peak crush resistance is the maximum force measured the test which must load the door to a minimum of 310mm up to a maximum deflection of 460mm.

SKETCH SIDE INTRUSION BEAM





## LOADING CONDITION

The door beam is designed to plastic deform as the test load is applied laterally to the door. The sketch on the next page shows the idealised deformed beam, with the 305mm diameter loading device.

Where –

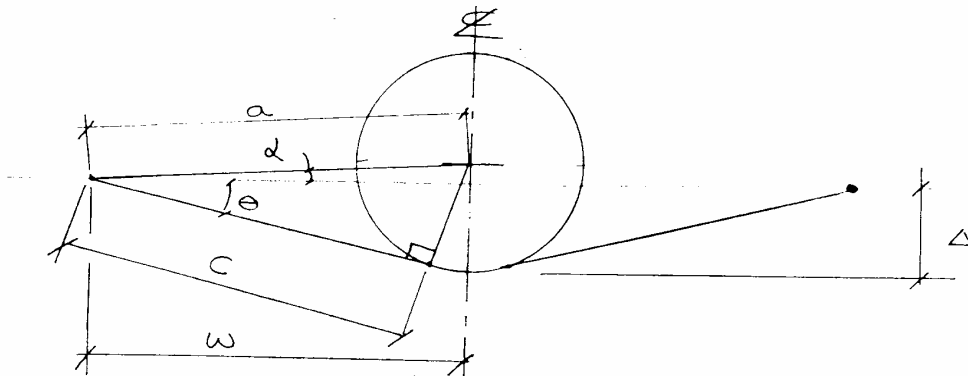
$$W = \text{half span/ length} = 730/2 = 365 \text{ mm}$$

$$C = \sqrt{W^2 - 2\Delta R + \Delta^2}$$

$$\alpha = \arctan \frac{(R - \Delta)}{W}$$

$$\theta = \arctan R/C - \alpha$$

## IDEALISED DEFLECTION



The fully plastic section modulus for the door beam is equal to

$$= 20068 \text{ mm}^3$$

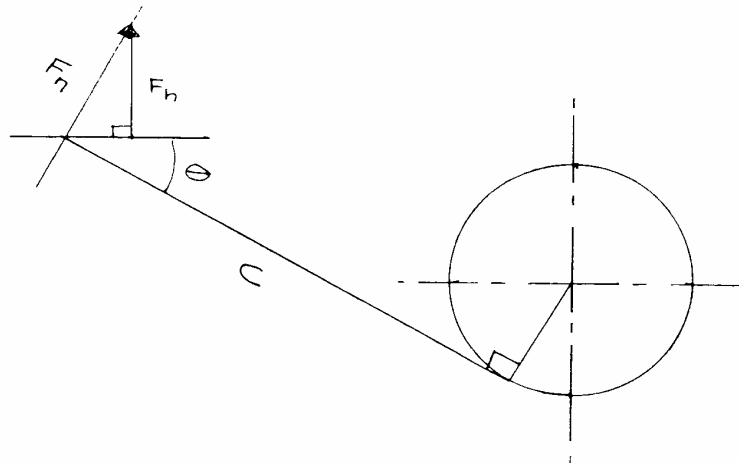
The yield stress of the electrogalv steel sheet is 250Mpa

Therefore the fully plastic moment

$$= 250 \text{ Mpa} \times 20068 \text{ mm}^3$$

$$= 5017000 \text{ Nmm}$$

The idealised diagram below shows the lateral and the normal force on the ends of the door beams necessary to produce the plastic deformation



Where  $F_n$  is the force in the normal direction of the beam. The total force to produce a set deflection is equal to

$$2 \times F_n$$

Where

$$F_n \times C = f_y \times MPL$$

$$F_n = \frac{f_y \times MPL}{C}$$

$$F_n = \frac{5017000}{C}$$

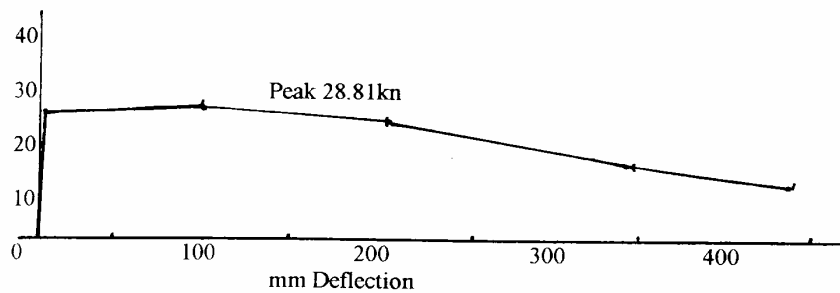
$$F_n = F_n \cos O$$

Therefore

$$\text{Total Force} = 2F_n = 2 \times \frac{5017000}{C} \cos O$$

The figures for various deflections is calculated on the following spread sheet and graph.

FORCE DEFLECTION GRAPH



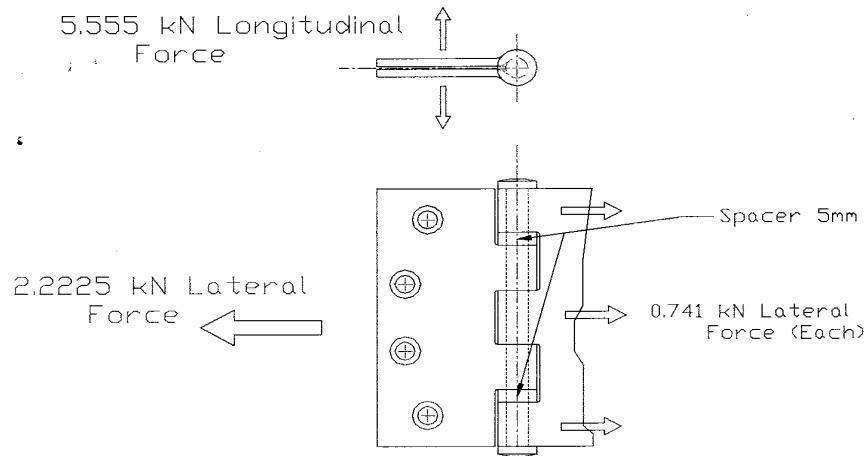
Peak crush resistance is greater than 22kN (28.8kN) therefore meets the ADR 29/00 requirements.

Diagram 8 shows a side elevation of a roof structure. It features a series of trusses supported by a horizontal base. The roofline is composed of several segments, including a curved section on the right side. A small square is visible in the bottom left corner, and a vertical line is present near the center of the structure.

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## 19

bushes and the maximum bending moment occurs over the 5mm spacers. Considering that there are two hinges per door, the longitudinal force per hinge is shown in figure 2.



**Figure 2 Pin and Bracket Loads Per Hinge**

Maximum Bending moment on pin =  $1.8517 \text{ kN} \times 5 \text{ mm} / 2 = 4.63 \text{ Nm}$

Section properties of 8mm diameter shaft

$$\text{Area} = \pi r^2 = 50.26 \text{ mm}^2$$

$$\text{Section Modulus} = Z = \pi d^3 / 32 = 50.26 \text{ mm}^3$$

Stress on shaft

$$F_{BM} = BM / Z = 4.63 / 50.26 = 92.1 \text{ MPa}$$

$$F_{\text{Shear}} = V / A = 1.8517 \text{ kN} / 50.26 = 36.8 \text{ MPa}$$

$$\text{Combined Maximum Stress} = 92.1/2 + \text{SQRT}((92.1)^2 + 36.8^2) = 105 \text{ MPa}$$

Acceptable less than yield stress of 250 MPa

#### STRESS ON BRACKET AND FASTENERS

Stress on hinge bracket due to tensile load on pin:

$$F_T = 5.555 \text{ kN} / 2(17.5 \times 3 \times 2) = 26.45 \text{ MPa}$$

Acceptable less than yield stress of 250 MPa

Stress on fasteners due to longitudinal force

$$F_T = 5.555 \text{ kN} / 4 / 20.23 \text{ mm}^2 \text{ (Tensile area M6 bolt)}$$

$$= 68.4 \text{ MPa ok}$$

Stress levels due to lateral loads are less due to lower loads. The rest of the door hinge bracket is supported by the door frame and hinge pillar.

## **Testing of Latches 9/01223 & 4 with Strikers 9/01581 & 2 (12/4/06)**

### **Scope**

To test the above latches in the transverse and longitudinal directions, to 10KN (Spec 8.9KN) and 12KN (Spec 11.1KN) respectively. At these forces the latches should not fail.

### **Apparatus**

The special purpose built tensile test machine built by Ross Manufacturing will be used to undertake the testing. The parts will be held using special locating fixtures.



### **Results**

#### **Test 1 – Transverse (resistance to door opening)**

The latch (Pt Number 9/01223) and Striker (Pt Number 9/01582) were set and subjected to a force of 10KN (Spec 8.9KN). Test undertaken on 10/3/06

The parts did not fracture during the test and the latch could be seen still connected to the striker.

The latch (Pt Number 9/01224) and Striker (Pt Number 9/01581) were set and subjected to a force of 10KN (Spec 8.9KN). Test undertaken on 7/4/06

The parts did not fracture during the test and the latch could be seen still connected to the striker.

## **Test 2 – Longitudinal**

The latch (Pt Number 9/01223) and Striker (Pt Number 9/01582) were set and subjected to a force of 12KN (Spec 11.1KN). Test undertaken 10/3/06.

The parts did not fracture during the test and the latch could be seen still connected to the striker.

The latch (Pt Number 9/01224) and Striker (Pt Number 9/01581) were set and subjected to a force of 12KN (Spec 11.1KN). Test undertaken 7/4/06.

The parts did not fracture during the test and the latch could be seen still connected to the striker.

## **Conclusions**

Parts passed the tests as detailed above.

The strength bearing parts on these latches are the same as the Landrover Rear End Door latches. The above information refers to the strength of the latch and the striker only. It is the responsibility of the customer to ensure that the complete application meets with the required legislation.

Report Written By M Wollacott: Signed  
Weston Body Hardware  
Crossgate Rd  
Park Farm  
Redditch  
B98 7SK  
United Kingdom

Dated: 12/04/06

## **Engine and Transmission.**

The engine and transmission are from the donor Mazda MX5. Local regulations will dictate emission requirements.

## **Exhaust.**

The exhaust from the Mazda MX5 can be reused again depending on local requirements.

## **Exterior.**

All edges of fibreglass parts have been given a radius of not less than 2.5mm.

The Grill and windscreen parts have all been given a radius of not less than 2.5mm.

Bumpers, depending on local requirements, will either be of standard type, round bar, or elliptical.

Chassis, depending on local requirements, may have 6mm rod welded to leading edges, UK only.

Bonnet fixing is two lift butterfly tops fastened with two catches each site. The bonnet top is unable to open if unfastened.

## **Fibreglass.**

See Queensland University test results.



**PHYSICAL INFRASTRUCTURE CENTRE  
RESEARCH, INVESTIGATION AND DEVELOPMENT**

**TEST REPORT No:** CET 4602 **DATE:** 23 October 1996

**CLIENT:** Mr Stuart Walters  
PO Box 793  
MALENY QLD 4552

**REFERENCE:** Mr Stuart Walters

**TEST DATE:** 22 October 1996

**TEST DESCRIPTION:** To determine:  
a) Tensile and Flexural Strengths  
b) Barcol Hardness  
c) Fibreglass to initial specimen weight ratio on fibreglass sample

The tests were carried out on a Tinius Olsen Grade 'A' Universal Testing Machine; serial number: 98420.

**TEST SPECIFICATION:**

British Standard 2782 Part 3, 1976. \* Tensile Test - Method 320 E.  
British Standard 2872 Part 3, 1978. \*\* Flexure Test - Method 335 A.

**SAMPLE DATA:** The client delivered two (2) fibreglass panels of nominal dimensions 600 mm x 600 mm x 4 mm, with one panel being of single skin construction and the other being a sandwich panel, to the Queensland University of Technology, Structures Laboratory. The panels were unmarked. The panels were beige in colour. Only the single skin panel was tested.

- \*
  - i) End pieces are not used.
  - ii) Nominal sample dimensions are average of three sets of measurements.
  - iii) Sample thickness dimensions are taken to nearest 0.1 mm due to hand laid up material.
- \*\*
  - i) Nominal sample dimensions are average of three sets of measurements.
  - ii) Sample thickness dimensions are taken to nearest 0.1 mm due to hand laid up material.

**Faculty of Built Environment and Engineering  
Queensland University of Technology**

Page 1 of 5

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GARDENS POINT CAMPUS 2 GEORGE STREET GPO BOX 2434 BRISBANE Q 4001 AUSTRALIA PHONE (07) 3864 2111 FAX (07) 3864 1529

Campuses: Gardens Point (city), Kelvin Grove, Carseldine World Wide Web: <http://www.qut.edu.au/>  
QUT International: Locked Bag No 2 Red Hill Q 4059 Australia Phone +61 7 3864 3142 Fax +61 7 3864 3529



**SPECIMEN PREPARATION:**

The specimens were cut on a diamond saw, with water being supplied to the saw's cutting edge.

No pre-test conditioning was requested or carried out.

**BARCOL HARDNESS TEST:** The results given, are the average of several readings taken.

SMOOTH SIDE	39
ROUGH SIDE (Filed Smooth)	51

**BURN TEST:**

DIMENSIONS (mm)	INITIAL WEIGHT (g)	WEIGHT OF RESIDUE (g)	FIBRE TO INITIAL SPECIMEN WEIGHT RATIO
40.8 x 60.55 x 4.6	14.9	5.6	38 %

**BURN RESIDUE:**

The burn residue was comprised of chopped strand matting.

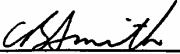
**MODE OF FAILURE:**

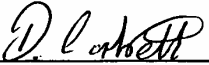
TENSILE TEST	
Centre Line Failure	Specimen 2, 4, 5, 6, 8, 9
Lower In Jaw Failure	Specimen 7
Upper In Jaw Failure	Specimen 1, 3, 10

**FLEXURE TEST:** All specimens failed at point of loading.

**NOTE:**

- a) All specimens were loaded to failure as required in BS 2872 - Part 3.
- b) All of the specimens were not parallel about their thickness.
- c) Specimens will be retained for a period of 3 months from the test date.

  
TESTING OFFICER  
C SMITH

  
CHECKING OFFICER  
D CORBETT

TENSILE TEST				
Distance between Jaws		140 mm		
Rate of Loading		10 mm/min		
Date of Test		22-Oct-96		
Ambient Temperature		20 °C		
NO.	DIMENSIONS (mm)	ULTIMATE LOAD (kN)	ULTIMATE TENSILE STRENGTH (MPa)	
1	25.7	4.6	16.50	139.6
2	25.4	4.6	15.65	133.9
3	25.3	4.6	15.65	134.5
4	25.3	4.4	16.85	151.4
5	25.4	4.4	16.00	143.2

FLEXURAL TEST				
Span		75 mm		
Rate of Loading		10 mm/min		
Date of Test		22-Oct-96		
Ambient Temperature		20 °C		
NO.	DIMENSIONS (mm)	ULTIMATE LOAD (N)	ULTIMATE FLEXURAL STRENGTH (MPa)	
*11	14.9	4.7	660.0	225.6
12	14.9	4.5	655.0	244.2
13	15.0	4.6	690.0	244.6
14	14.6	4.6	630.0	229.4
15	14.7	4.6	640.0	231.5

The results tabulated below are from specimens which were cut from the sample at 90° to those above.


6	25.7	4.3	17.60	159.3
7	24.0	4.4	16.30	154.4
8	24.1	4.3	15.10	145.7
9	24.9	4.2	15.20	145.3
10	25.2	4.3	16.30	150.4

*16	14.9	4.2	515.0	220.4
17	14.6	4.3	535.0	223.0
18	14.8	4.4	600.0	235.6
19	14.7	4.3	545.0	225.6
20	14.4	4.5	640.0	246.9

Ave Tensile Strength (MPa)		Ave Tensile Modulus (MPa)	
Specimen Nos.		Specimen Nos.	
1-5 = 141		1-5 = 8100	
6-10 = 151		6-10 = 8200	
1-10 = 146		1-10 = 8200	

Ave Flexural Strength (MPa)		Ave Flexural Modulus (MPa)	
Specimen Nos.		Specimen Nos.	
11 & 16 = 226		11 = 6900	
12-15 = 237		16 = 6700	
17-20 = 233		12-15 = 7300	
		17-20 = 6800	

\* Indicates that the load was applied to the rough inner surface of this specimen. On all other tests the load was applied to the smooth surface.

  
TESTING OFFICER  
C SMITH

  
CHECKING OFFICER  
D CORBETT

## **Interior**

### **Dashboard**

Using just the fibreglass dashboard, this has a 19mm radius on its bottom edge for passenger protection.

Using the wooden insert, this has a 5mm bottom radius and has attached a 20mm rubber piping attached.

All instruments are within the steering wheel area.

Switches are all recessed.

There is a dash crash strip on the scuttle area for passenger protection.

Depending on regulations speedo can be either MPH or KPH.

Depending on regulations instrument lights can be dimmed.

.

**Lighting and signaling.**  
**ADR 13/00, or ECE R 48/00 or 48/01**

**Refer drawings for positions.**

**Headlamps** can be from the early Mazda MX5 but generally these are of new manufacture and have 'E' or 'ADR' markings. They are standard 7" type and are either sealed beam or Halogen along with hi and lo beams. ADR 46/00, or ECE R 1/01, 5/02, 5/02, 8/03, 8/04, 20/01, 20/02, 30/01, or 30/02

The **side lights**, are incorporated in the headlight unit. ADR 49/00

**Front indicators** are marked SAE 90.

**Rear indicators** are incorporated in the tail lights.

**Side repeater indicators**, if required, have marking in their glass.

ADR6/00, or ECE R 6/00 or 6/01

**Refer drawings for positions and fact sheet for specs.**

**Reflectors** are incorporated in the tail lights. ADR47/00, or ECE R 3/02

**Refer drawings for positions and fact sheet for specs**

**Number plate light** has 2 bulbs and is mounted directly above plate. ADR 48/00, or ECE R 4/00

**Refer drawing for positions and fact sheet for specs.**

**Taillights** are mounted at 90 degrees to the road and incorporate tail, stop, indicator, reflector, units.

ADR 13, or ECE R 48/1 or 48/02

**Refer drawing for positions and fact sheets for specs.**

**Stoplights** are incorporated in tail lights. ADR 49/00, of ECE R 7/01

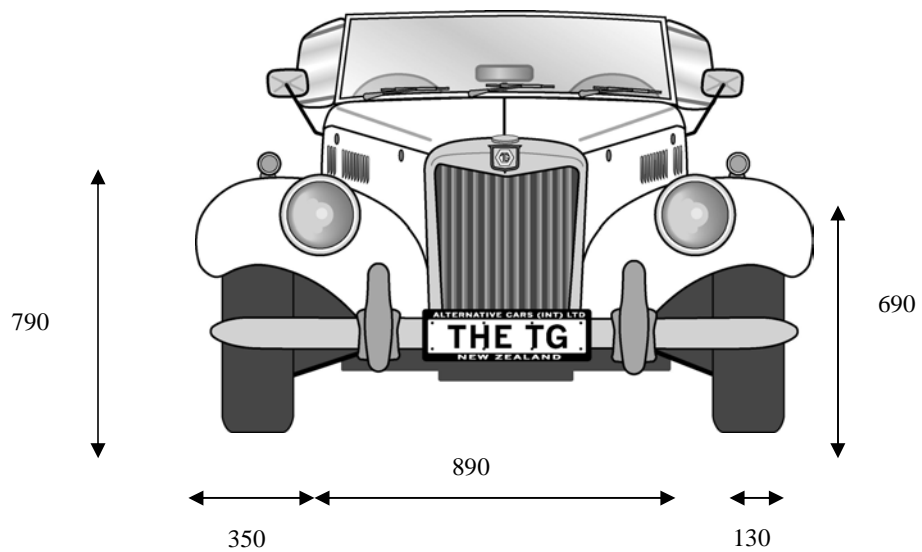
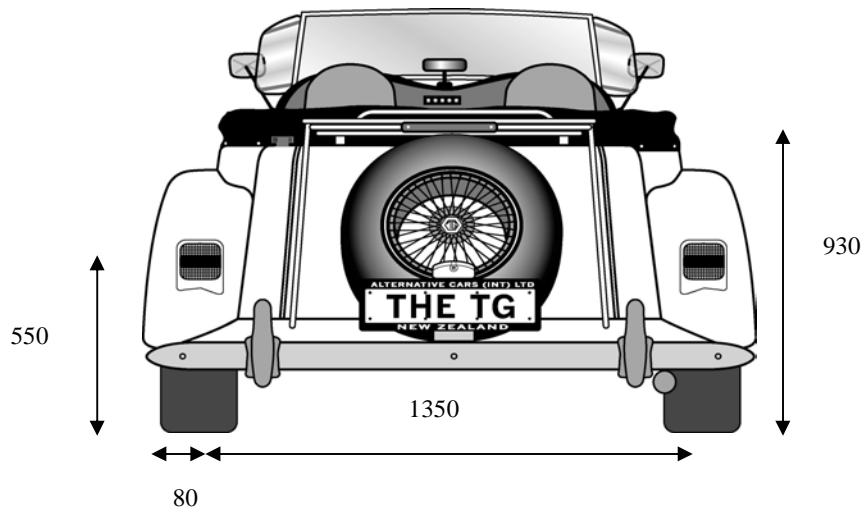
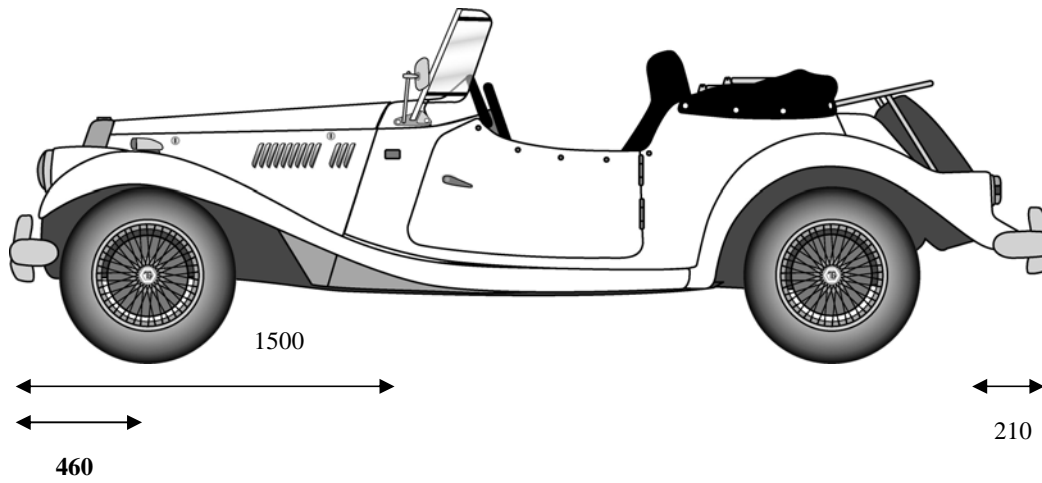
**Refer drawing for positions and fact sheets for specs**


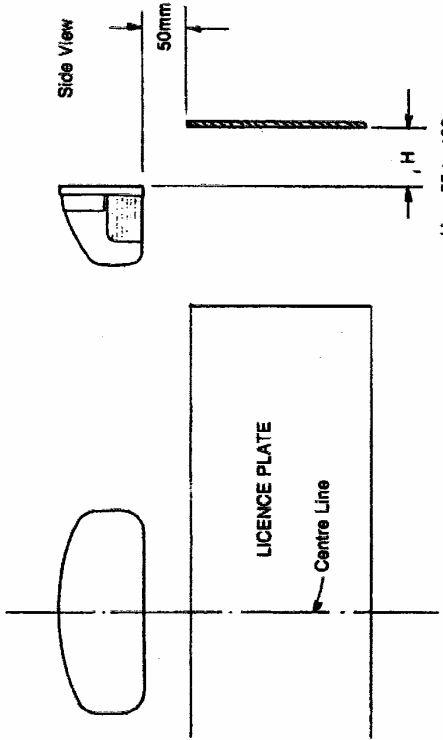
**Hi stoplight** is incorporated into the luggage carrier. ADR 60/00, of FMVSS 108.


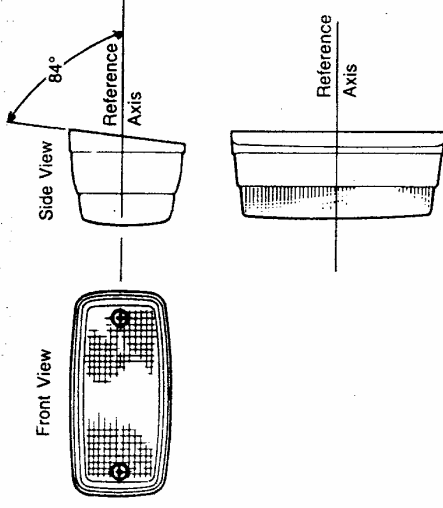
**Refer drawing for position and fact sheet for specs.**

**Reverse lights** (ADR 1, or ECE R 23/01) and **rear fog lights** (ADR 52/00), if required have been fitted as aftermarket items.

**Lighting position measurements in mm**



INSTRUCTION SHEET for: <b>Part No. 2557</b>					
<b>ADR — APPLICATION AND MOUNTING INSTRUCTIONS</b> ADR 48/00 LICENCE PLATE LAMP					
<b>ONE LAMP MUST BE MOUNTED AS FOLLOWS:</b> <ul style="list-style-type: none"> <li>— Lamp mounting surface must be parallel with the licence plate surface.</li> <li>— Lamp must be fitted central above the licence plate, refer to diagram.</li> </ul>					
<b>ADR 13/00 INSTALLATION REQUIREMENTS:</b> <ul style="list-style-type: none"> <li>— A tolerance of <math>\pm 3</math> degrees applies on all mounting details.</li> <li>— Geometric visibility:             <ul style="list-style-type: none"> <li>Vertical: From 5 degrees above to 5 degrees below the horizontal.</li> <li>Horizontal: From 30 degrees left to 30 degrees to the right.</li> </ul> </li> </ul>					
		H = 55 to 100 mm			
LENS IDENTIFICATION NUMBER: 4151					
CATALOGUE NUMBER	ENGINEERING NUMBER	SE-FORM NUMBER	COMPLIANCE NUMBER	ADR 51/00 GLOBE	ADR APPLICABLE
2557	900667-03	LP2557A	793148	T4W (2 off)	48/00
AMENDMENTS				ADR COMPLIANCE VERIFIED	ISSUE DATE:
				<i>K. Hunter</i>	1/3/1992
				911-352-50	

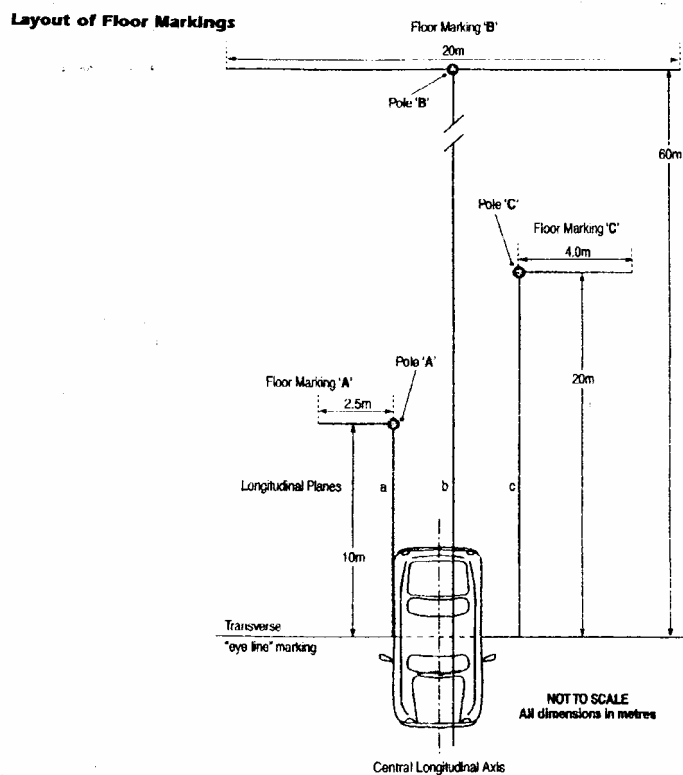
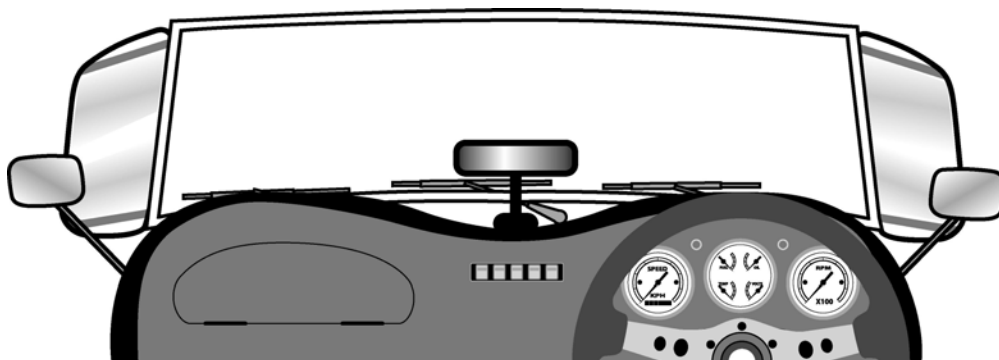
INSTRUCTION SHEET for: <b>Part No. 1413</b>					
<b>ADR — APPLICATION AND MOUNTING INSTRUCTIONS</b> ADR 1/00 REVERSING LAMP					
<b>LAMP MUST BE MOUNTED AS FOLLOWS:</b> <ul style="list-style-type: none"> <li>— Lamp mounting surface must be 84 degrees to the ground.</li> <li>— Lamp reference axis must be parallel to the vehicle longitudinal axis.</li> </ul>					
<b>ADR 13/00 INSTALLATION REQUIREMENTS:</b> <ul style="list-style-type: none"> <li>— A tolerance of <math>\pm 3</math> degrees applies on all mounting details.</li> <li>— Geometric visibility:             <ul style="list-style-type: none"> <li>Vertical: From 15 degrees above to 5 degrees below the horizontal.</li> <li>Horizontal: From 45 degrees inboard to 45 degrees outboard.</li> </ul> </li> </ul>					
		Reference Axis			
LENS IDENTIFICATION NUMBER: 8708R23					
CATALOGUE NUMBER	ENGINEERING NUMBER	SE-FORM NUMBER	COMPLIANCE NUMBER	ADR 51/00 GLOBE	ADR APPLICABLE
1413	002694-00	RL 1413 A	784892	P21W	1/00
AMENDMENTS				ADR COMPLIANCE VERIFIED	ISSUE DATE:
				<i>K. Hunter</i>	1/3/1992
				911-351-57	

INSTRUCTION SHEET for: <b>Part No. 2396</b>		HELLA®		
<b>ADR — APPLICATION AND MOUNTING INSTRUCTIONS</b> ADR: 6/00 CAT 2, 48/00, 49/00 REAR COMBINATION LAMP <b>LAMP MUST BE MOUNTED AS FOLLOWS:</b> <ul style="list-style-type: none"> <li>— Lamp mounting surface must be vertical to the ground.</li> <li>— Lamp reference axis must be parallel to the vehicle longitudinal axis.</li> <li>— Lamp centre line must be vertical and central to the licence plate.</li> <li>— Lamp housing edge is 6mm above and 55mm in front of licence plate.</li> <li>— Licence plate must be square to the ground.</li> </ul> <b>ADR 13/00 INSTALLATION REQUIREMENTS:</b> <ul style="list-style-type: none"> <li>— A tolerance of <math>\pm 3</math> degrees applies on all mounting details.</li> <li>— Geometric visibility:               <ul style="list-style-type: none"> <li>Vertical: From 15 degrees above to 15 degrees below the horizontal.</li> <li>Horizontal: From 45 degrees inboard to 80 degrees outboard.</li> </ul> </li> <li>Licence Plate:               <ul style="list-style-type: none"> <li>5 degrees above to 5 degrees below 30 degrees left to 30 degrees right.</li> </ul> </li> </ul>				
LENS IDENTIFICATION NUMBER: 54519				
CATALOGUE NUMBER	ENGINEERING NUMBER	SE-FORM NUMBER	ADR 51/00 GLOBE	ADR APPLICABLE
2396	905002-01	FR 2396 A FL 2396 A LP 2396 A	C5W/C21W C21W C5W	49/00 6/00 CAT 2 49/00
COMPLIANCE NUMBER		7742735 7791234 7931413	8/000(49/00 CAT S3)	
AMENDMENTS				
ADR COMPLIANCE VERIFIED: <i>J. Mawds</i> ISSUE DATE: 1/3/1992				
911-352-31				

INSTRUCTION SHEET for: <b>Part No. 5243</b>		HELLA®			
<b>ADR - APPLICATION AND MOUNTING INSTRUCTIONS</b> Hella MATRIX LED HIGH MOUNTED STOP LAMPS <b>LAMP MUST BE MOUNTED AS FOLLOWS:</b> <ul style="list-style-type: none"> <li>- The Lamp complies with ADR 60/00 (49/00 CAT S3) when mounted with its lens vertical to the ground and its ref. axis parallel to the vehicle longitudinal axis.</li> <li>- Lamp, when spoiler is mounted, must be sealed against dust and moisture ingress.</li> </ul> <b>ADR 13/00 INSTALLATION REQUIREMENTS</b> <ul style="list-style-type: none"> <li>- A tolerance of <math>\pm 3</math> degrees applies on all mounting details.</li> <li>- Geometric visibility:               <ul style="list-style-type: none"> <li>Vertical: From 15 degrees above to 5 degrees below the horizontal.</li> <li>Horizontal: From 45 degrees inboard to 45 degrees outboard.</li> </ul> </li> </ul>					
LENS IDENTIFICATION NUMBER: 027547					
CATALOGUE NUMBER	ENGINEERING NUMBER	CRN NUMBER	COMPLIANCE NUMBER	ADR 51/00 GLOBE	ADR APPLICABLE
5243	959071-XX	23071	8-5243-08	N/A LED	80/00(49/00 CAT S3)
AMENDMENTS					ADR COMPLIANCE VERIFIED: <i>J. Mawds</i> ISSUE DATE: 10/98
959 089-01					
Hella-New Zealand Limited, Pakuranga					

**ADR 14 or ECE R 46/00 or 46/01**

Exterior are of "Harley Davidson" brand.





### **Pedals**

All new components are used for brake, clutch, and accelerator pedals.

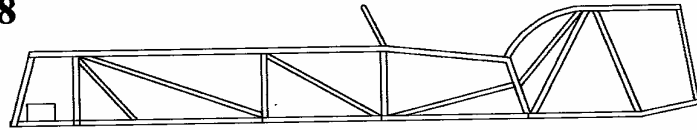
### **Seats and seat mounts.**

The Mazda MX5 seats and their slides are reused in their entirety, including their original fasteners.

**See engineer's report for seat mounts to chassis mounting calculations**

**Walter Wing**  
**MIE Aust C P Eng #557538**  
**36A Greenmount Drive**  
**Greenmount**  
**Auckland**  
**New Zealand**

**Phone 09 271 2604**



**Fax 09 271 2614**

## **Calculations on TG Sports**

### **SEAT MOUNTS**

#### **Introduction**

The seat mounts are incorporated into folded top hat sections made from 3mm and 2mm panel steel which is welded to the floor pan. The cross members span the gap between the transmission tunnel and the sill. The MX5 seats are attached to the car using their original mounting points. Captive nuts are welded to the underside of the top hat sections. The seats are retained with four M8 high tensile bolts. The seat mountings meet the requirements of ADR 3/02. and 22/00.

#### **LOADING CONDITION**

ADR 3/02 and 22/00 loadings are 20g seat mass, 530Nm moment, and a head restraint load of 890N at 665mm from the seating reference point.

The Mazda MX5 seat has a mass of about 20kg, and the centre of gravity height is approximately 120mm from the base.

Therefore the worst load case is under 890N at 665mm:

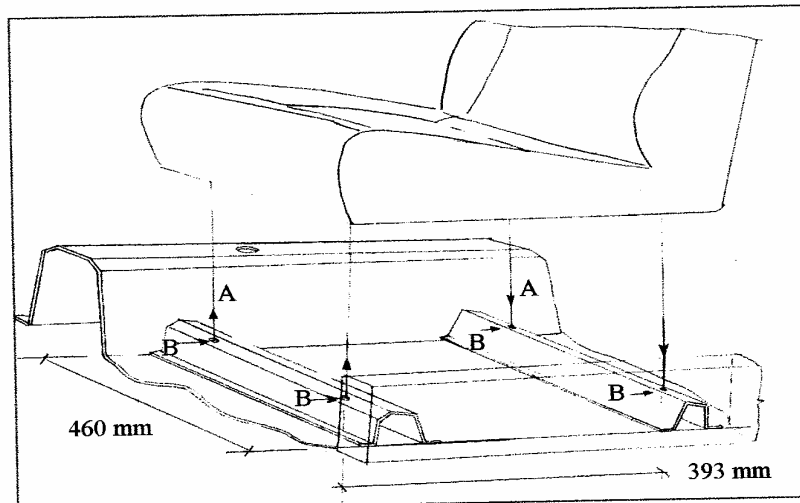
This gives a moment of

$$M = 890\text{N} \times (120 + 665) \text{ mm} \\ = 700 \text{ Nm}$$

The seat mounting cross members are spaced at 393 mm apart. Therefore the loads on the each cross member are equal to:

$$F = 700 / 393 = 1.781 \text{ kN}$$

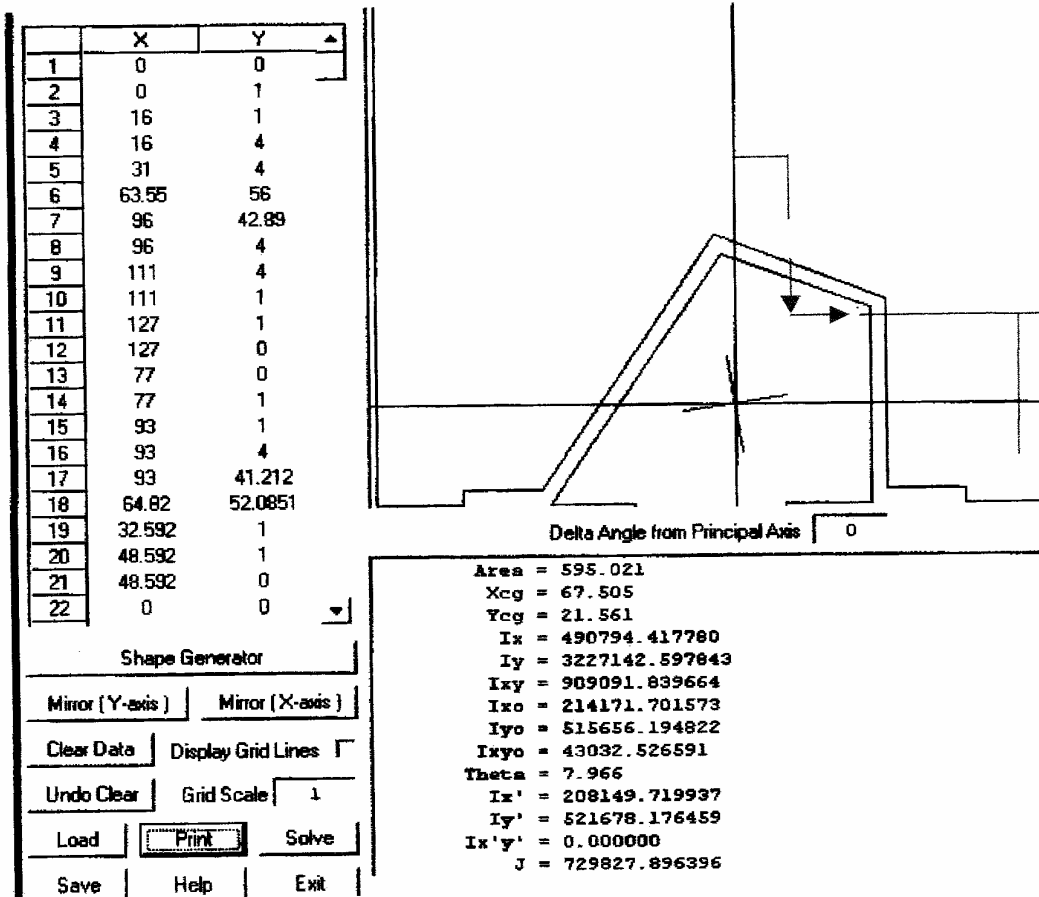
This load is shared between two mounting points about 360 mm apart. Each mounting point has a vertical load of  $A = 890.5 \text{ N}$  and a horizontal load of  $B = 222.5 \text{ N}$ .



**SKETCH SEAT MOUNTING**

## STRESS IN CROSS MEMBERS

The seat loads were considered to be equal for each cross member, therefore the worst case would be on the rear cross member. The beam is assumed to be simply supported by the sill (100x50x2 RHS) and the transmission tunnel. The beam, formed by the top hat section, is assumed to incorporate a section of the floor pan. The floor was assumed to extend 16t each side of the beam flange. The properties of this section are shown below:



Section modulus

$$Z_{xx} = 214171.7 / (56 - 21.56) = 6219 \text{ mm}^3$$

$$Z_{yy} = 515656 / 67.5 = 7639 \text{ mm}^3$$

Bending Moments

$$M_{xx} = 890.5 \times (460 - 360) / 2 = 44.5 \text{ Nm}$$

$$M_{yy} = 222.5 \times (460 - 360) / 2 = 11.1 \text{ Nm}$$

Torque

$$T_{zz} = 890.5 \times 12.27 + 222.5 \times 42.89 = 20.5 \text{ Nm}$$

Stress

$$F_{xx} = M_{xx} / Z_{xx} = 44.5 \text{ Nm} / 6219 \text{ mm}^3 = 7.08 \text{ MPa}$$

$$F_{yy} = M_{yy} / Z_{yy} = 11.1 \text{ Nm} / 7639 \text{ mm}^3 = 1.45 \text{ MPa}$$

$$V_{xx} = T_{ryy} / J = 20.5 \times 34.439 / 729827.9 = 1 \text{ MPa}$$

$$V_{yy} = T_{rxx} / J = 20 \times 67.505 / 729827.9 = 1.9 \text{ MPa}$$

$$V_{xx} = F_{xx} / A = 222.5 / 595 = .4 \text{ MPa}$$

$$V_{yy} = F_{yy} / A = 890.5 / 595 = 1.5 \text{ MPa}$$

$$\begin{aligned} \text{Combined Stress } F &= \text{SQRT} ( F_{xx}^2 + F_{yy}^2 + 3 \times V^2 ) \\ &= 10 \text{ MPa} \end{aligned}$$

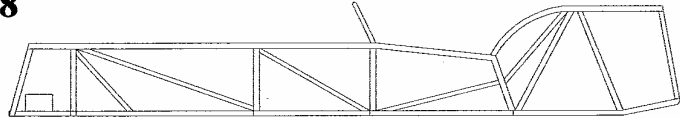
Much less than yield stress of material ( 250 MPa ), therefore seat mounts are adequate.

### **Seat belts and seat belt anchorage.**

The Mazda seat belts are reused in their entirety including the original fasteners. Local regulations dictate standards.

**See engineer's reports for anchorage and positional calculations.**

**Walter Wing**  
**MIE Aust C P Eng #557538**  
 36A Greenmount Drive  
 Greenmount  
 Auckland  
 New Zealand



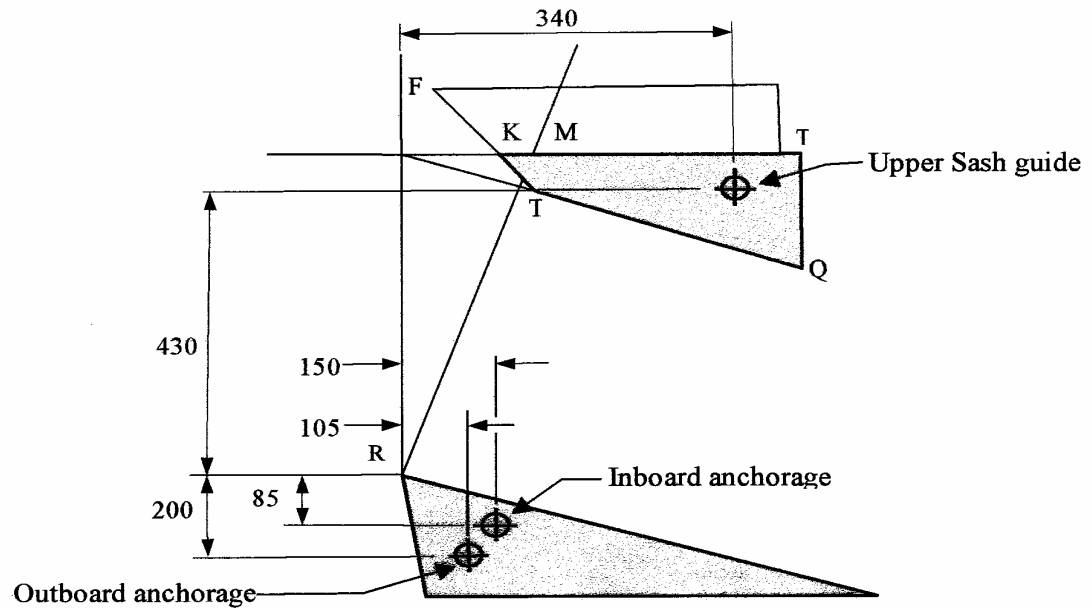
Phone 09 271 2604 Fax 09 271 2614 wwing@free.net.nz

## **SEAT BELT ANCHORAGE POSITIONS: TG SPORTS**

The original Mazda MX5 seat belts and seats are used, with similar or exactly the same mounting points as the donor vehicle. The seat belt anchorages positions are designed to meet the requirements of ADR 5/04 and NZ LVV Standard 175 - 00.

### **Layout of Anchorages**

From section 11 of ADR 5/04, the upper sash guide must lie in Area A. The position of Area A is defined in figure 1. Since S, the transverse distance is less than 200mm, the Area A is extended to include the area enclosed by KPQT. The transverse distance S, equals 175 mm. Therefore the construction details for Area A are:



$$\begin{aligned} CR &= 315 + 1.6 \times S = 595 \text{ mm} \\ RB &= 260 + S = 435 \text{ mm} \end{aligned}$$

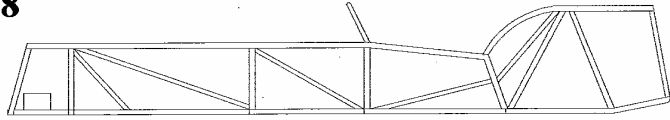
$$\begin{aligned} MJ &= 1.3 \times S = 227.5 \text{ mm} \\ MP &= 250 \text{ mm} \end{aligned}$$

The seat back angle is 20 degrees. The upper sash guide position is 340mm behind and 430mm above the seating reference point R. It meets the location requirements by lying inside area KPQT.

The lap seat belt anchorages lie behind 25 degrees to 80 degrees to the horizontal, and are more than 165mm apart.

The Seat Belt Anchorages meet the position requirements of ADR 5/04 (ECE R 14/02).

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**36A Greenmount Drive**  
**Greenmount**  
**Auckland**  
**New Zealand**



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Fax 09 271 2614

## **Calculations on TG Sports**

### **SEAT BELT ANCHORAGES**

#### **Introduction**

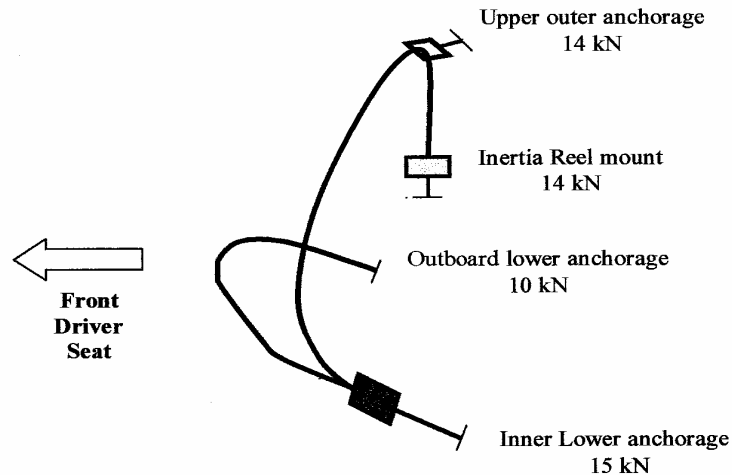
The original Mazda MX5 seat belts are used, with similar or exactly the same mounting points as the donor vehicle. The outer upper anchorage separates the sash guide from the inertia reel anchorage. The lower seat belt anchorages are located in the sills and centre tunnel section. All anchorages have 3 mm steel mounting plates with 7 / 16 UNF captive nuts. The seat belt anchorages are designed to meet the requirements of ADR 5/02 and NZ LVV Standard 175 - 00.

#### **Loading Condition**

The anchorage loads from NZ LVV Standard 175 - 00 are used. These are slightly higher than those in ADR 5/02. The following loads were used, with forces in the webbing direction:

Upper Sash Outer Anchorage	22 kN (Used 14 kN down to reel and 14 kN to shoulder on TG due to the near horizontal sash angle)
Outer reel anchorage	14 kN
Lower outer anchorage	10 kN
Lower inner anchorage	15 kN

Figure 1 shows the seat belt loads involved.



**Figure 1 NZ LVV 175-00 Loads**

## UPPER OUTER ANCHORAGE

The load directions are shown in figure 2. It is assumed that the sash angles are; 20° inboard and 10° vertical, from the shoulder to the sash guide.

Loads at A (At sash guide)

$$F_{xa} = 9.27 \text{ kN}$$

$$F_{ya} = 2.29 - 14.0 = 11.17 \text{ kN}$$

$$F_{za} = 4.724 \text{ kN}$$

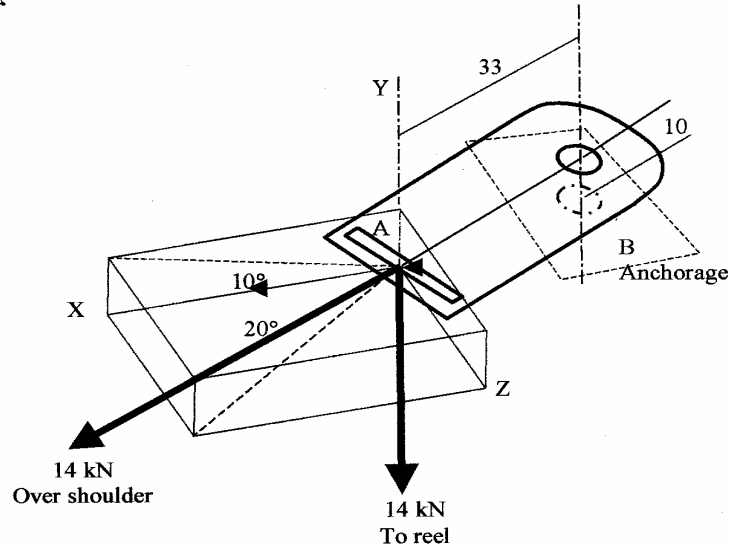


Figure 2 Sash Guide Loads

$$F_{xb} = 9.27 \text{ kN}$$

$$F_{yb} = - (2.29 - 14.0) = -11.17 \text{ kN}$$

$$F_{za} = 4.724 \text{ kN}$$

$$M_{zb} = 11.17 \text{ kN} \times 33 \text{ mm} + 10 \text{ mm} \times 9.27 \text{ kN} = 461.3 \text{ Nm}$$

$$M_{xb} = 4.724 \text{ kN} \times 10 \text{ mm} = 47.2 \text{ Nm}$$

The structure supporting the upper outer anchorage is shown in figure 3. The main frames are fabricated from 100x50x2 RHS. The sash and inertia reel anchorages are fabricated from 2mm panel steel, with 7/16UNF captive nuts and 3mm steel backing plates. The highest stress point is at section BB, where the panel steel structure extends above the RHS reinforcement.

### At Section BB

In the worst case ignoring the double folded rear flange, the beam can be approximated by a 150x65 mm box with 2mm walls. The section modulus about the Z and X axis is

$$Z_z = (b d^3 - b_0 d_0^3) / (6 d)$$

$$Z_x = (d b^3 - d_0 b_0^3) / (6 b)$$

$$= (150 \times 50^3 - 146 \times 46^3) / (6 \times 50)$$

$$= (50 \times 150^3 - 46 \times 146^3) / (6 \times 150)$$

$$= 15129.8 \text{ mm}^3$$

$$= 28435.3 \text{ mm}^3$$

$$\text{Area} = (b d - b_0 d_0) = 150 \times 5 - 146 \times 46 = 784 \text{ mm}^2$$



$$= 73.4 \text{ MPa}$$

Much less than yield stress of material ( 250 MPa ), therefore seat belt anchorage is adequate.

#### At Inertia Reel Mount

The inertia reel mount is shown in figure 2, and consist of a 7/16 UNF captive nut welded to a 2mm plate. The worst load case is considering bearing of bolt shank on the hole in the 2mm plate.

$$\begin{aligned} F_p &= F / A = 14 \text{ kN} / (2 \times 12) \text{ mm}^2 \\ &= 583.3 \text{ MPa} \\ F_{p \text{ Allowable}} &= 2.1 F_y \text{ from AS 3990} \\ &= 525 \text{ MPa} \end{aligned}$$

Slightly higher than allowable, but this does not include the restraint from the welds on the captive nut.

Consider two 5mm fillet welds each 10mm long.

$$\text{The weld area } A_w = 0.707 \times 5 \times 10 \times 2 = 70.7 \text{ mm}^2$$

The weld stress in shear equals

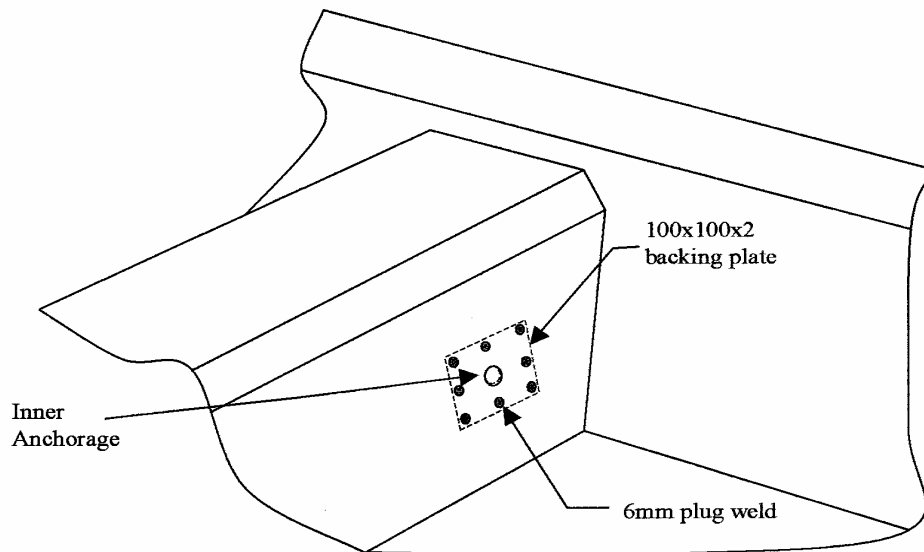
$$\begin{aligned} \tau &= F / A_w \\ &= 14 \text{ kN} / 70.7 \text{ mm}^2 \\ &= 198 \text{ MPa} \end{aligned}$$

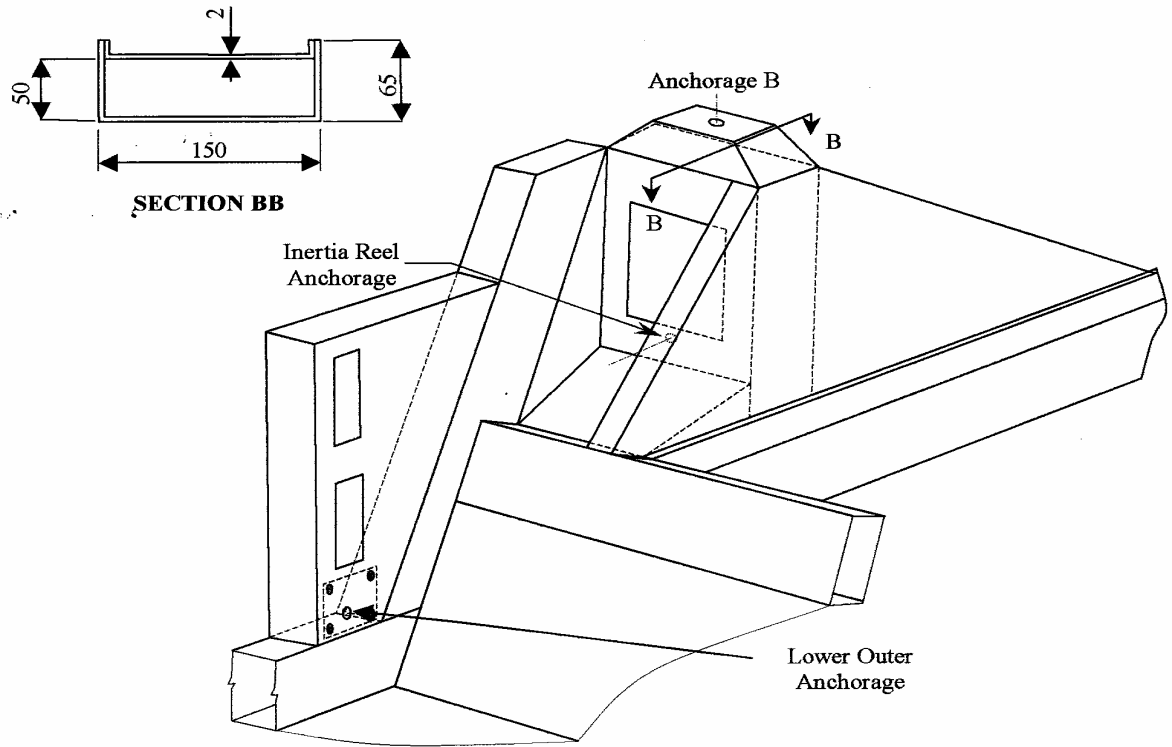
$$\begin{aligned} \text{Ok less than } \tau_y &\approx 0.60 \times f_{yw} \\ &= 0.60 \times 410 \text{ MPa} = 246 \text{ MPa} \end{aligned}$$

Therefore anchorage is adequate.

#### Inner Lower Anchorage

The inner lower seat belt anchorage is attached the transmission tunnel with a 100x100x2 mm backing plate and captive 7/16 UNF nut. The tunnel is fabricated from 2mm panel steel, and is of similar dimensions to that of the MX5. The backing plate is retained by eight 6 mm plug welds.





**Figure 3 Upper Sash & Inertia Reel Anchorage**

**Stress at Section BB**

The forces and bending moments at BB are

$$F_{xb} = 9.27 \text{ kN}$$

$$F_{yb} = -11.17 \text{ kN}$$

$$F_{zb} = 4.724 \text{ kN}$$

$$F_{xb} = 9.27 \text{ kN}$$

$$M_{zb} = 11.17 \text{ kN} \times 33 \text{ mm} + 40 \text{ mm} \times 9.27 \text{ kN} = 739.4 \text{ Nm}$$

$$M_{xb} = 4.724 \text{ kN} \times 40 \text{ mm} = 189 \text{ Nm}$$

The stress levels at BB are

$$F_x = M_x / Z_x = 189 \text{ Nm} / 28435.8 \text{ mm}^3 = \pm 6.65 \text{ MPa}$$

$$F_z = M_z / Z_y = 739.4 \text{ Nm} / 15128.9 \text{ mm}^3 = \pm 48.87 \text{ MPa}$$

$$F_y = F_x / A = 11.17 \text{ kN} / 784 \text{ mm}^2 = -14.2 \text{ MPa}$$

$$\tau_x = F_x / A = 9.27 \text{ kN} / 784 \text{ mm}^2 = 11.8 \text{ MPa}$$

$$\tau_z = F_z / A = 4.724 \text{ kN} / 784 \text{ mm}^2 = 6.0 \text{ MPa}$$

$$\text{Combined Stress } F = \sqrt{((F_x + F_y + F_z)^2 + 3(\tau_x^2 + \tau_z^2))}$$

**Figure 4 Tunnel and Inner Lower Anchorage**

The shear area of each plug weld equals

$$\begin{aligned} &= 2 \times \pi \times 3^2 \\ &= 56.55 \text{mm}^2 \end{aligned}$$

Therefore the shear stress on each plug weld is

$$\begin{aligned} &= 15 \text{kN} / (8 \times 56.55) \\ &= 33 \text{ MPa} \end{aligned}$$

Ok much less than 246 MPa, inner lower anchorage is adequate.

#### **Outer Lower Anchorage**

The outer lower anchorage is shown in figure 3. This is attached to the door hinge post, which is a fabricated box section made from 2mm panel steel. The anchorage is located in the bottom corner, and is framed by 100x50x2mm RHS sections. The anchorage has a 50x50x2mm backing plate, and a 7/16 UNF captive nut. The backing plate is retained by four 6 mm plug welds.

Therefore the shear stress on each plug weld is

$$\begin{aligned} &= 10 \text{kN} / (4 \times 56.55) \\ &= 44 \text{ MPa} \end{aligned}$$

Ok much less than 246 MPa, outer lower anchorage is adequate

### **Steering.**

**ADR 10/01, ECE R 12/01, 12/01, or 12/02**  
**FMVSS203-32-FR 2414**

The Mazda MX5 steering system is reused in its entirety.

An extension is used that has been manufactured with correct splines and is held in place using a chassis mounted bearing.

An additional Mazda MX5 universal joint is used.

The column itself is of collapsible variety, has an anti theft lock, and is held in place using the original fasteners.

## Vin identification

### ADR 16/01



### Set up of world VIN number

1 <sup>st</sup> position	7	indicates Pacific region	
2 <sup>nd</sup> position	A	Identifies New Zealand	
3 <sup>rd</sup> position	9	Indicates manufacturer of less than 500 vehicles per annum	
Positions 4 to 7 indicate attributes of vehicle			
4 <sup>th</sup> position	M	Indicates suspension used,	Mazda
5 <sup>th</sup> position	M	Indicates motor used	Mazda
6 <sup>th</sup> position	T	Indicates model	TG Sports
7 <sup>th</sup> position	0	Not allocated	
Positions 8 to 10 indicate date of manufacture			
8 <sup>th</sup> position		1 <sup>st</sup> digit of Month of manufacture	
9 <sup>th</sup> position		2 <sup>nd</sup> digit of month of manufacture	
10 <sup>th</sup> position		Year of manufacture, last digit, eg 2005 = 5	
11 <sup>th</sup> position	A	Chassis manufacturer code	
Positions 12 to 14 are Manufacturers codes			
12 <sup>th</sup> position	0	Fixed by Standards New Zealand (ID low volume)	
13 <sup>th</sup> position	1	Fixed by Standards New Zealand (ID low volume)	
14 <sup>th</sup> position	4	Fixed by Standards New Zealand (ID low volume)	
Positions 15 to 17 Number of chassis			
15 <sup>th</sup> position		Numbers one through nine	
16 <sup>th</sup> position		Numbers one through nine	
17 <sup>th</sup> position		Numbers one through nine	

**NOTE letters I, O, and Q are never used**

## **Wheels and Tyres**

The Mazda wheels and tyres can be reused in their entirety including wheel nuts. It is recommended to install new tyres, and local regulations will dictate requirements.

If the Mazda MX5 wheels are used this will allow for a 30mm rear, and a 35mm overhang at the front guards.

## **Windscreen washers.**

### **ADR 16/01**

These are electric after market type and have a capacity of 1 litre.

## **Windscreen wipers**

### **ADR 16/01**

A 3 bladed system is used utilising the electric motor and first arm of the Mazda MX5. The motor is switched for 2 speed plus intermittent.

**See engineer's report for wiped area.**

