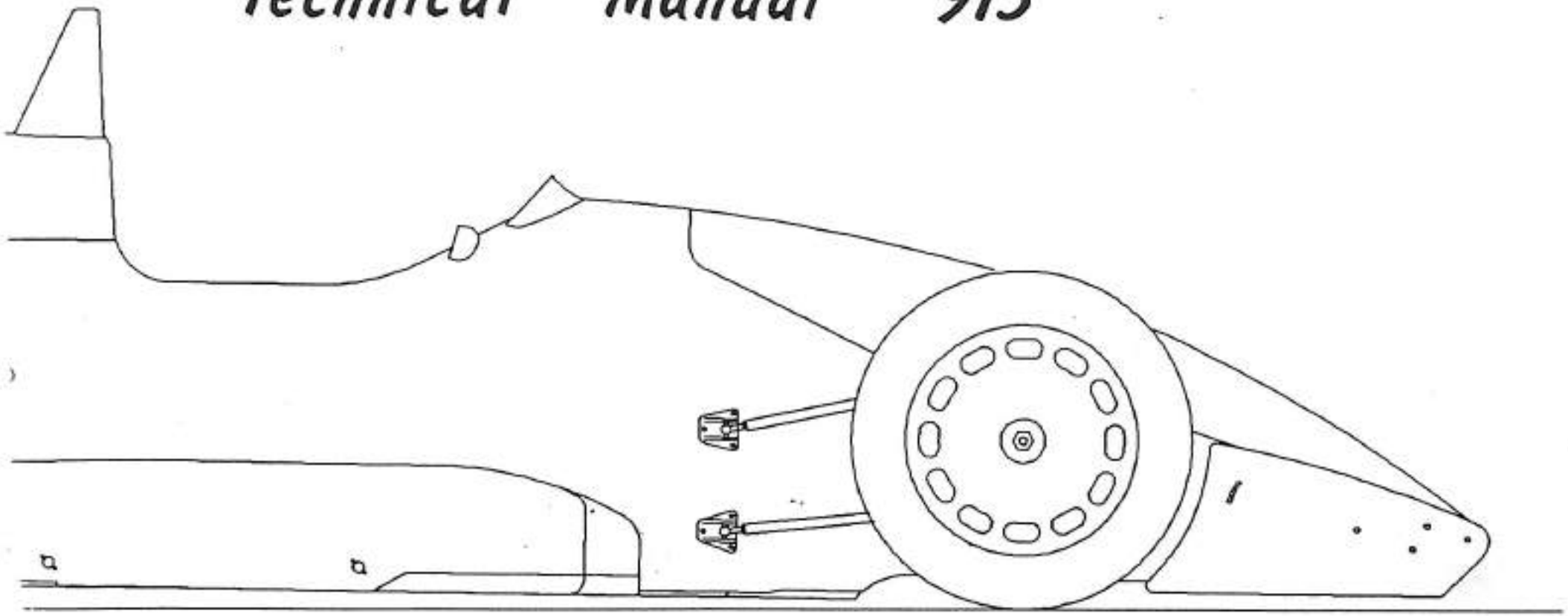
reynard

Technical Manual 913



TECHNICAL SPECIFICATION

1991 REYNARD FORMULA 3

1. CHASSIS

The chassis has been designed in conjunction with the F3000 chassis and enjoys the same construction principles.

The aluminium floor which we used to fit to the bottom of our tub is no longer required because the monocoque is complete around the whole underside.

The chassis will be stiffer and safer than any car we have ever produced.

2. FRONT SUSPENSION

The spring/damper units are now mounted on top of the new chassis. This provides a superb foundation for the bellcranks and damper mounts. Access is good for adjustment to springs and dampers. The antiroll bar mounts are fitted directly to the chassis with much improved support bearings. Adjustable or non-adjustable are available.

Bilstein dampers will be fitted with higher rebound figures to operate in line with our refined and well tested latest set ups learned from the 903B.

Geometry is improved with the roll centre now fixed firmly above ground. This will increase high speed cornering stability.

Front uprights are new: stiffer material, better wheel bearing location, improved location of wishbone/upright pick-ups and improved steering arm assembly.

Camber adjustment is now effected by shims front and rear, without affecting toes. Suspension component strength is increased in all areas.

Rear uprights are new with dual taper roller bearing to provide a low friction but rigid bearing location.

Rear suspension geometry is improved again with relation to roll centre position and camber change characteristics. A new motion ratio bellcrank is also included in the list of improvements.

The rear anti-roll bar is mounted in a more suitable manner; material and construction specification are higher.

3. AERODYNAMICS

The front wing is one piece and stretches from one side of the car to the other. This is a completely new profile and is of rigid aluminium construction.

The rear wing is our latest specification short chord wing. These two elements produce adequate downforce for all European circuits, whilst remaining a very low drag item for faster circuits. The side pods are new in design and incorporate the water radiator in the L/H side pod. The R/H side pod is much lower than previous models and contains all the car's electrical systems.

The side pods are mounted on a 9mm thick marine plywood floor which in turn is rigidly mounted to the chassis.

4. ENGINES AND THEIR FITTING

The 913 will accept all popular Formula 3 engines. The whole engine bay structure has been revised to provide a stressed 'box' around the engine. This entails fully stressed panels either side of and below the engine. These panels feed both torsional and bending loads from the gearbox/suspension assembly into the side and lower skins of the chassis.

This reduces greatly the loads that are transmitted through the engine block and sump, or more simply, if you were to remove the engine from the car the overall structure of the car would retain a large proportion of its torsional rigidity.

5. QUALITY

We are having a major quality drive for the 1991 season, throughout all areas of the company. This will affect the finished product in many ways, from thoroughness of design and material specification to machining and fabrication techniques and on to stores service. By applying a quality first approach we expect to achieve a higher level of customer satisfaction, from the moment the car leaves the factory door to beyond the end of the season. We do hope you'll join us.

All the aforementioned improvements and many others too numerous to mention have been incorporated in the Reynard 913. In short, the Reynard 913 will be faster, more stable, stronger and more efficient than any F3 car we have built before.

REYNARD 913

TECHNICAL MANUAL

1. INTRODUCTION

This manual is designed to help customers achieve and maintain optimum performance from their Reynard 913 Formula Three car.

2. DETAILS

2.1. Front Upright

These are cast aluminium and house two pre-assembled deep groove ball bearings. The bearings are a shrink fit in the upright; before assembly the bearing should be cooled in a freezer and the upright heated to approximately 120° C (250° F). Camber is adjusted by inserting shims between the steering block and upright. A 1mm shim gives 0.28° adjustment.

2.2. Rear Upright

These are steel fabrications housing two large diameter tapered roller bearings.

Preload on the bearing is set by the spacer between the bearings, and should be set at 0.002" clearance. In the absence of a setting jig, the upright should be assembled with an oversize spacer and the end-float measured. The correct size spacer for 0.002" end float should then be inserted, and the upright reassembled to check that the bearing spins freely.

2.3. Front Suspension

The front suspension is by independent fabricated steel wishbones. Droop is limited by the front dampers and the rideheight is adjusted by altering the front pushrod length. When fitting spherical joints ensure that all circlips are properly fitted and seated. Also ensure the dampers are identical length side to side (342mm). The front motion ratio is 1.29:1.

2.4. Rear Suspension

The rear suspension is by independent fabricated steel wishbones. Droop is limited by the rear dampers and rideheight is altered using the rear pushrods. Camber is adjusted by inserting shims between the wishbone and outer bearing housing. A 1mm shim gives 0.28° adjustment. The rear motion ration is 1.53:1.

2.5. Gearbox

The gearbox is a Reynard designed magnesium casting, incorporating the oil tank. It houses standard Hewland FT3 internals. A gear driven oil pump is located in the differential housing, with a protective screen over the pump inlet. This screen should be cleaned every 500 miles. The oil level should be maintained at 230mm below the top of the filler neck on the oil swirlpot.

The differential fitted as standard is a Hewland FTC 212 "powerflow". The following notes have been supplied by Hewlands:

The main "slip limiting" components in this differential are the plates located on either side of the side gear rings. These consist of two types, one connected by the spline to the outer casing, the other connected by spline to the side bevel gears. Friction between the two types of plates will occur as one road wheel begins to spin away; the greater the friction the more the slip will be limited.

To reduce the friction, plates of similar type should be arranged side by side so as to reduce the number of faces acting in friction. To maximise the friction, leaving a "solid" differential effect, plates of opposing type should be arranged side by side to maximise the number of friction faces.

An additional factor is the angle of the "cut out" or "ramp" in the side gear ring which has an effect on the characteristic of the plate locking action. Should you wish to change this, it is best done by experiment, to suit your driver.

Maintenance of this differential should be straightforward, with all components being accessible by removing the end cover. The main components to be changed regularly are the friction plates as they will wear.

2.6. Fuel Cell

The fuel cell is housed within the monocoque and satisfies FIA FT3 and SCCA regulations. An electric fuel pump feeds a fuel pressure regulator specified by the engine manufacturer. The return line should not be pressurised.

SETTING UP PROCEDURE

To ensure a consistently correct set up on the car, we recommend the following procedure is followed whenever setting up the car, especially from new, after repairing accident damage or replacing any suspension component.

The first part of this is best done in a clean, well lit workshop, with the car supported on stands and with the body work removed.

1. Check that all wishbones, track rods and toe links are set to the lengths given in the accompanying diagrams.

2. Ensure that the car is mechanically sound (i.e. there is no play in the wheel bearings, spherical joints etc.).

3. Ensure that the wheel rims are true and that there is no obvious damage.

4. Check that the tyre diameters and wear patterns are the same side to side.

5. Set the front castor by adjusting the front top wishbone rear, inboard rod ends.

6. Set the front toe, using the track rod.

7. Remove the front spring/dampers and set the front bumpsteer to zero by inserting spacers above or below the outboard rod end of the track rod.

8. Set the rear toe, using the toe link.

9. Measure the free length of the springs, and check that they are the same side to side. Check that the length of the dampers (between the mounts) is the same side to side. Pre-load the front springs the desired amount, the fitted length will then be the free length minus the pre-load.

10. Check that the rear spring platform positions are the same side to side.

11. Set the tyres to the correct pressures.

12. Remove one front and one rear anti-roll bar drop link.

13. Re-fit the spring/damper to the car and position it on the flattest piece of ground available. Check with a long straight edge and a camber gauge. If the ground is not perfectly flat, place packers under one wheel and measure with the straight edge and camber gauge between the contact patch of the front wheels until the gauge reads level, also ensuring that the packers themselves are level. Repeat this at the rear. However, you will have to remember to allow for the thickness of the packers when measuring ride height.

14. Place the camber gauge across the car, on the shear plate attached to the front casting. Set the car level, by adjusting one front push rod.

15. Set the front ride height by adjusting the length of the push rods. Always adjust the push rods equally, side to side. The front ride height should be measured under the wooden floor.

16. Set the rear ride height by adjusting the rear pushrods. The rear ride height should be measured alongside the rear (steel) skid plate, under the gearbox.

17. Set the corner weights by adjusting the rear pushrods. Also ensuring that the rear bellcranks are set to the same angle (to within half a degree) by adjusting the rear spring platforms.

18. Set the front camber by adjusting the number of shims between the steering block and upright.

19. Set the rear camber by adjusting the number of shims between the top wishbone and outer bearing housing.

20. Set the front toe using the track rod.

21. Set the rear toe using the toe link.

22. Re-check the ride heights.

23. Re-check the cambers.

24. Re-check the corner weights.

25. Finally reconnect the anti-roll bar drop links so that they are not under any tension.

REYNARD 913 SET-UP CALIBRATION

F R O N T

	ADJUSTMENT	CHANGE	CHANGE	ADJUSTMENT
Ride height/ pushrod	1 turn	3.60mm	1mm	0.27 turns
Ride height/ platform	1 turn	2.0mm	1mm	0.5 turns
Preload/Platform:				
a) Bilstein:	1 turn	1.4mm	2mm	1.4 turn
b) Koni:	1 turn	2mm	2mm	1 turn
Toe/trackrod	1 turn	1.5°/ 10.2mm	20'/ 2.3mm	0.22 turns
Camber/Shim	1mm	0.28°	0.5°	1.8mm

R E A R

	ADJUSTMENT	CHANGE	CHANGE	ADJUSTMENT
Ride height/ pushrod	1 turn	3.94mm	2mm	0.51 turns
Ride height/ platform	1 turn	2.09mm	2mm	0.96 turns
Preload/Platform:				
a) Bilstein:	1 turn	1.4mm	2mm	1.4 turns
b) Koni:	1 turn	2mm	2mm	1 turn
Toe/toelink	1 turn	1.65°/ 11.2mm	10'/ 1.1mm	0.1 turn
Camber/Shim	1mm	0.28°	1/4°	0.89mm

REYNARD RACING CARS LTD

RECOMMENDED TIGHTENING TORQUES

ISO METRIC	M6	M8	M10	M12
Torque ft lb	8.6	19.5	38.1	78.1
Torque Nm	11.6	26.5	51.7	97.3

U N F	1/4"	5/16"	3/8"	7/16"	1/2"
Torque ft lb	8.5	18	37	52	80
Torque Nm	11.5	24	50	70	108

U N C	1/4"	5/16"	3/8"	7/16"	1/2"
Torque ft lb	8	15	33	49	68
Torque Nm	11.8	20	44.5	66	92

Front and rear hubs	M8 Cap screws	26 ft lb
Wheel nuts	3/4" UNF	130/140 ft lb
	2" - 12 UN	450 ft lb

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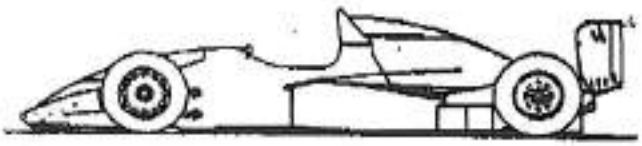
Championship Winning Car Constructors



DATE FEBRUARY 1991	COMPILED BY JBT/DB	CUSTOMER 913
CHASSIS 913	ENGINE -	DRIVER -
CIRCUIT SILVERSTONE GP	LAP LENGTH -	LAP RECORD -
TRACK CONDITIONS -		TEMPERATURE -

SETTINGS	FRONT		REAR	
RIDE HEIGHT	20 mm		4-2 . 5mm	
CASTER	5½ deg		deg	
CAMBER	left	right	left	right
	3 deg	3 deg	2.5 deg	2.5 deg
TRACK SETTING	2½ mm Total in/~~out~~		4 mm Total in/~~out~~	
DAMPER TYPE	Bilstein		Bilstein	
	bump 90	rebound 450	bump 90	rebound 450
AEON				
PACKER	mm		mm	
clearance	mm		mm	
SPRING RATE	1400 lbs/in		1600 lbs/in	
pre-load	7.5 mm		2.0 mm	
ANTI-DROOP MECH.				
ANTI-ROLL BAR	ø 3/4" in x 12 SWG		ø 1" in x 10 SWG	
setting			Stiff.	
WHEELS	STD		STD	
TYRE PRESSURES	left	right	left	right
	24 psi	24 psi	24 psi	24 psi

WINGS rear: type	STD
setting	14°
Gurney	-
lower rear wing	STD
front: setting	STD + medium ext.
Gurney	Set extension 15mm from bottom of slot

GEARBOX RATIOS	1st	2nd	3rd	4th	5th

FINAL DRIVE RATIO DIFF

NOTES Recommended Koni damper option following testing in Britain:

Front BA52 R5 B3

Rear BA82 R5 ~ B3

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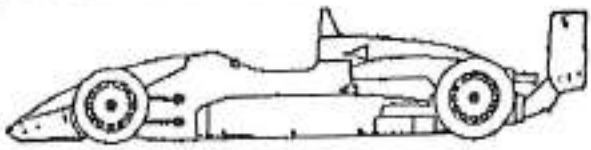
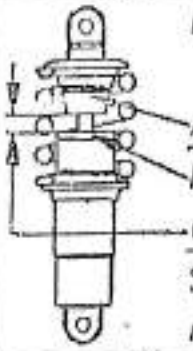


EVENT DON 1ST QUAL

DATE 22/6/91	COMPILED BY RV	CUSTOMER EDENBRIDGE
CHASSIS 913-001	ENGINE MUGEN 1054	DRIVER
CIRCUIT DON GP	LAP LENGTH	LAP RECORD
CONDITIONS		TEMPERATURE
AVON		FUEL IN

TYRE PRESSURES	COLD	HOT
CORNER WEIGHTS		

SETTINGS	FRONT	REAR
RIDE HEIGHT	14 MM	MM
CASTOR	5 DEG	DEG
CAMBER	2.1 | 2.0	1.75 | 1.7
TRACK SETTING	1 MM TOTAL ~~IN~~/OUT	4 MM TOTAL IN/OUT
DAMPER TYPE	BA52	BA72
BUMP / REBOUND	BUMP ~~4~~ / REBOUND 5	BUMP 4 / REBOUND 5
AEON / KONI	KONI 44	
PACKER	FULL MM	MM
CLEARANCE	1 MM	MM
SPRING RATE	1100 LBS/IN	1800 LBS/IN
PRE-LOAD	4T MM	1T MM
MOTION RATIO	STD	STD
ANTI-ROLL BAR	Ø 5/8 IN x 3/8 SWG	Ø 1 IN x 14 SWG
SETTING	STIFF	STIFF

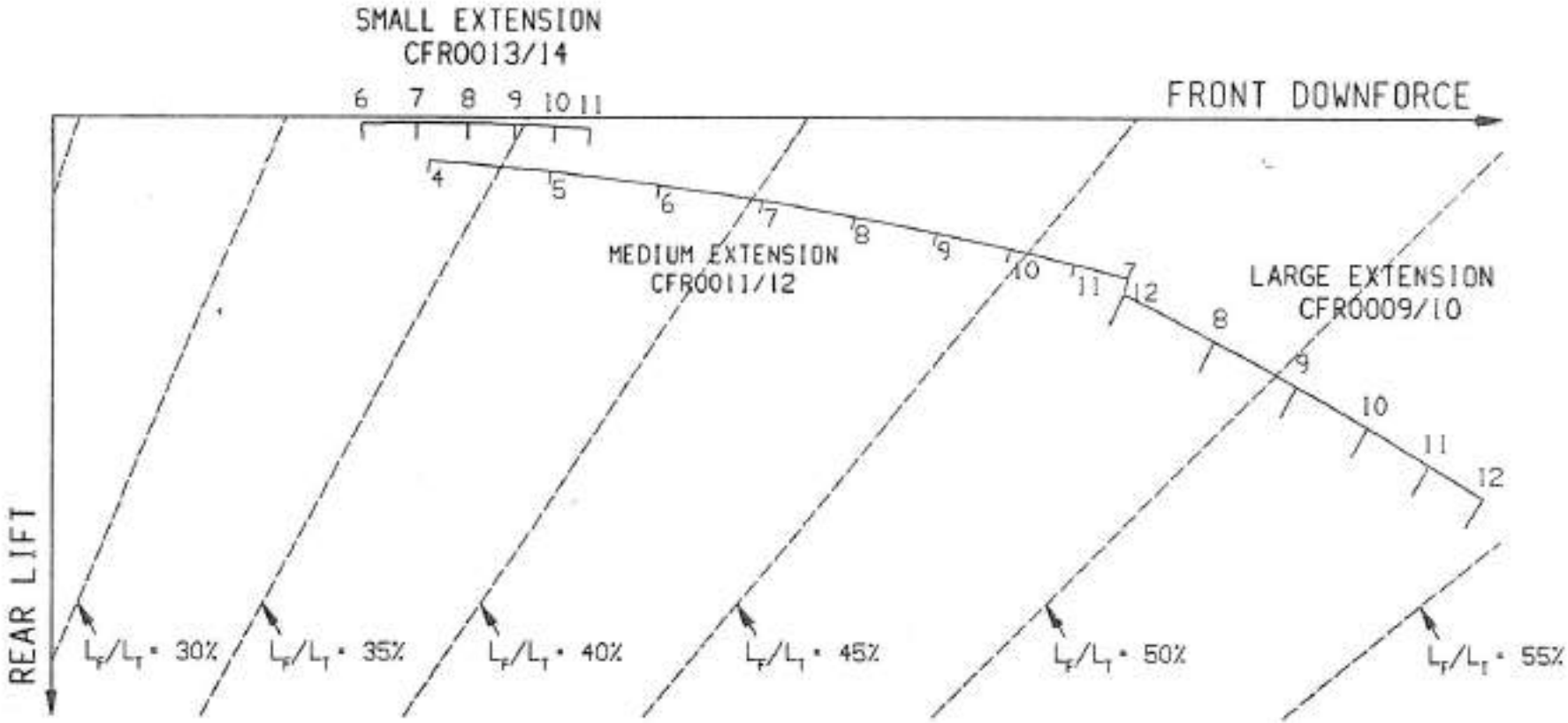


WINGS	
REAR: TYPE	VT2
SETTING	13°
GURNEY	
LOWER REAR WING	STD
FRONT: SETTING	+1 PENNY WASHER HOLE 12. NO EXT, NO GURNEY
GURNEY	

GEARBOX RATIOS	1ST	2ND	3RD	4TH	5TH
	12:31	16:25	21:29	21:25	25:26

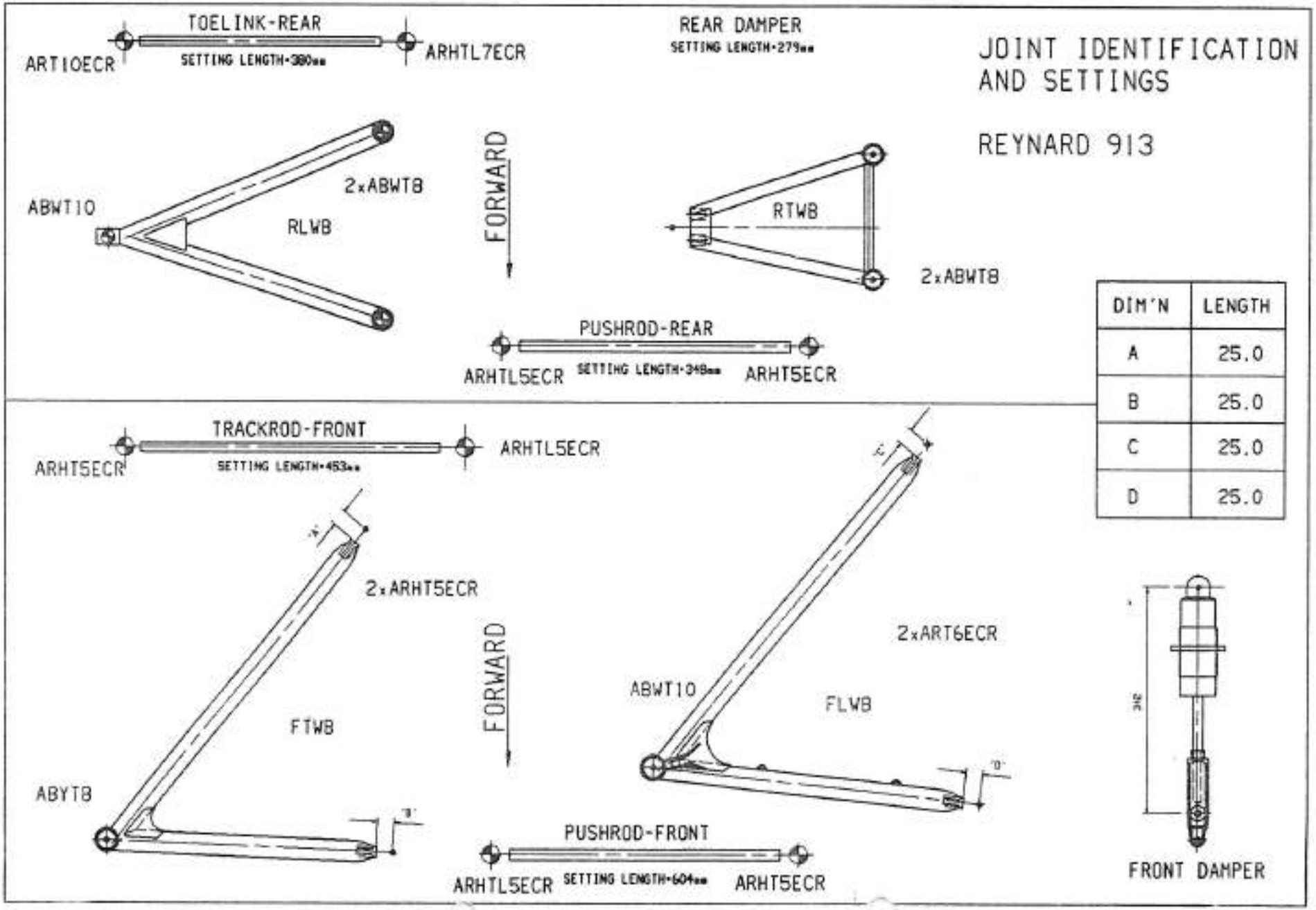
FINAL DRIVE RATIO 13:36 DIFF PFLOW 45/80.

NOTES: Rr wheel spacer.
Brake bal 7½ OUT.

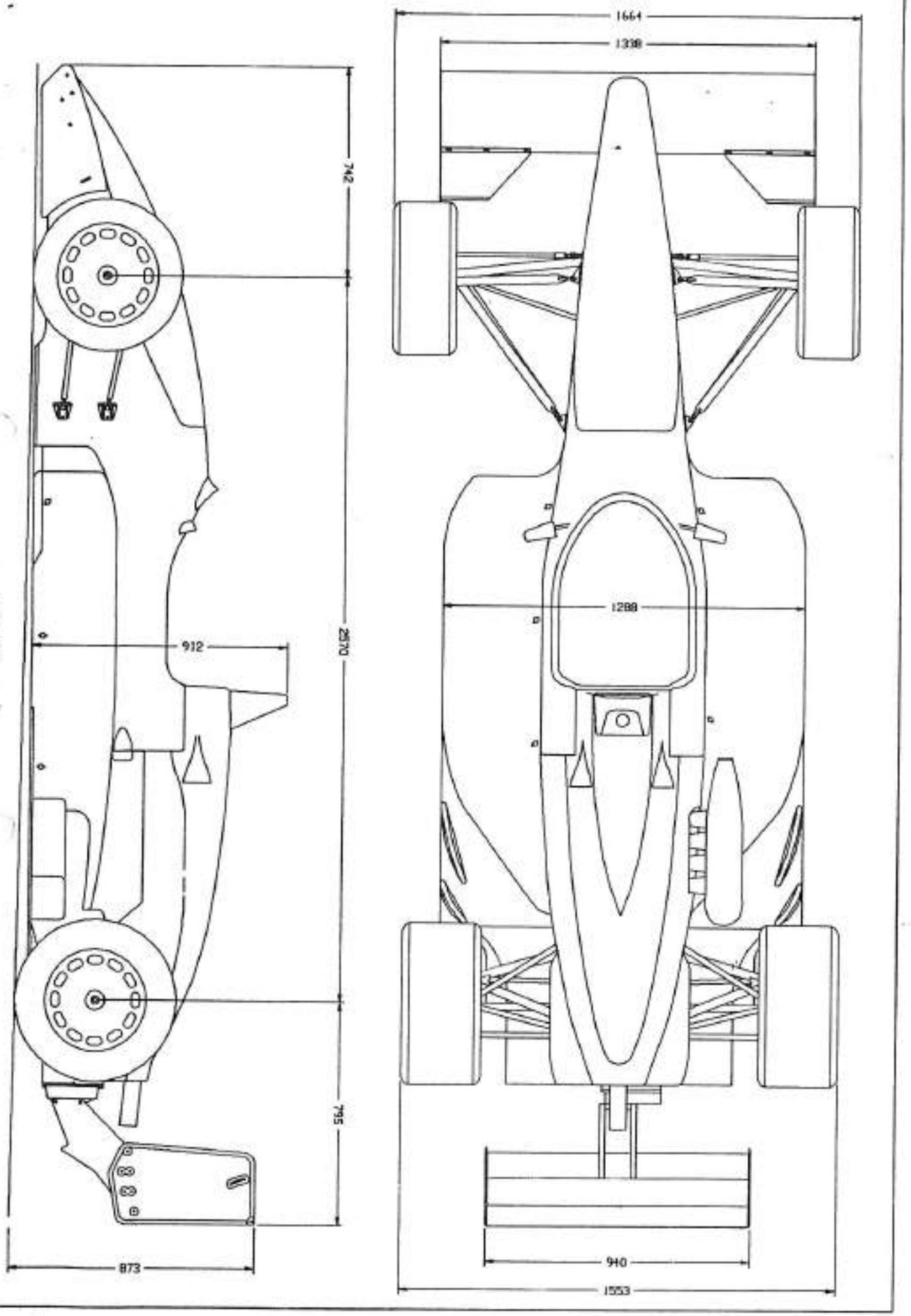


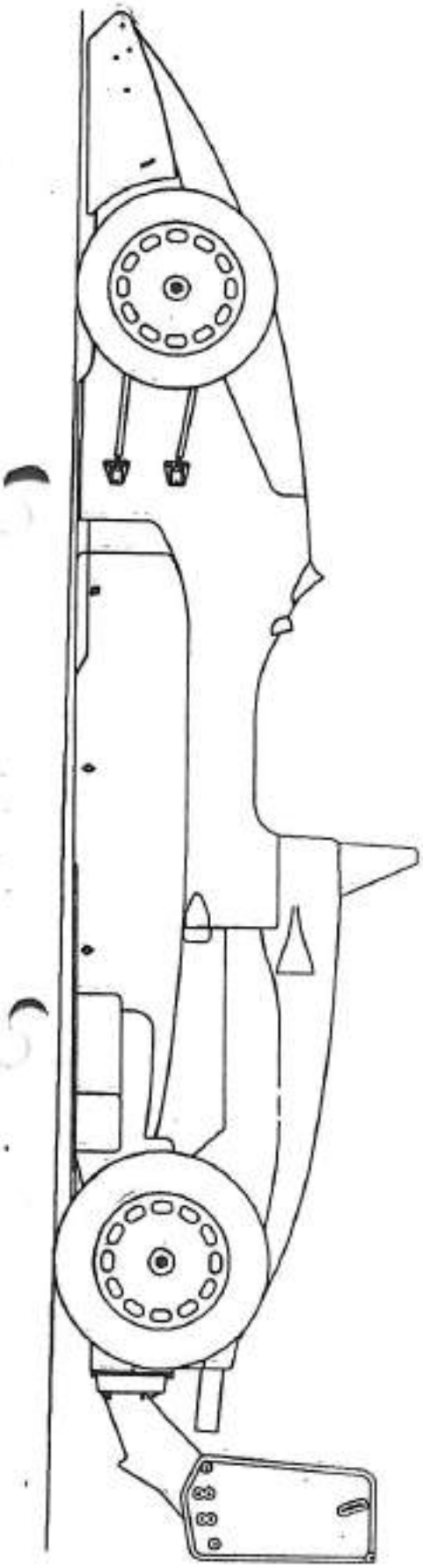
REYNARD 913 FRONT WING DOWNFORCE CHART

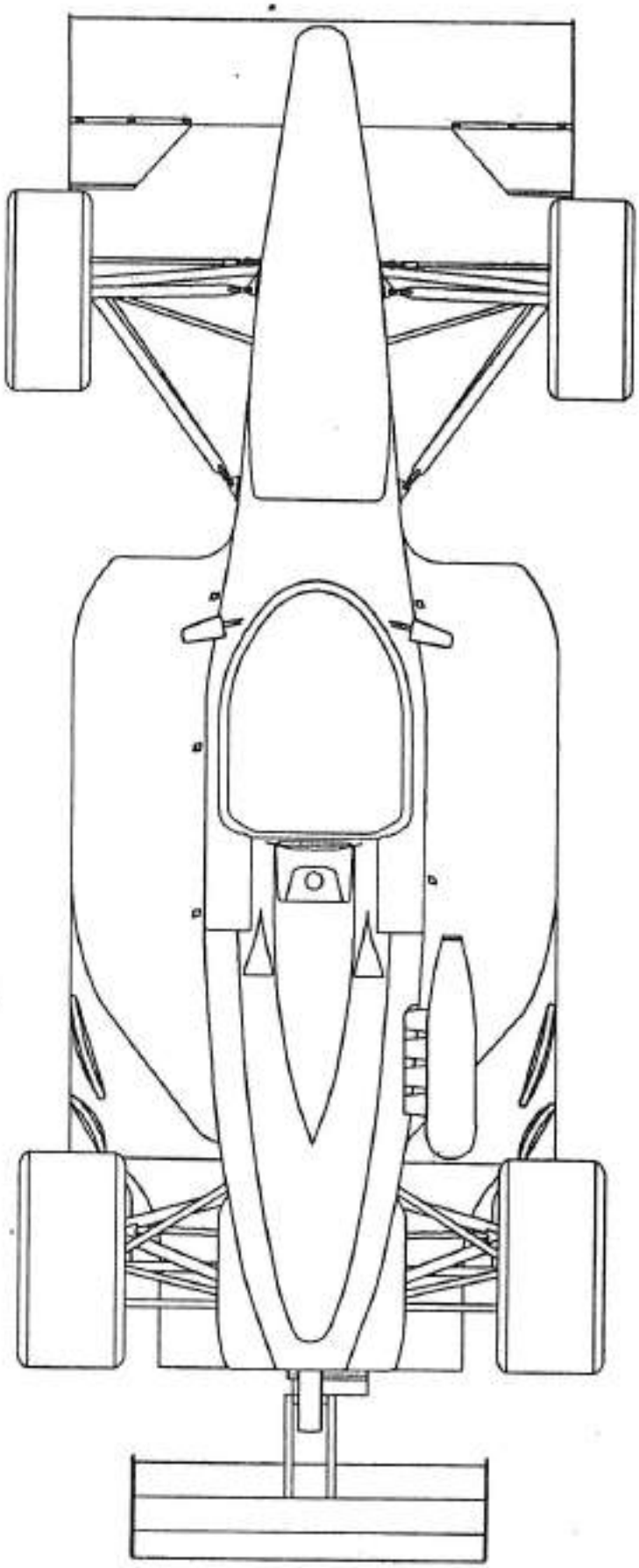
Numbers shown are angles measured over the Gurney flap to the main plane at the wing tip (against the end plate)



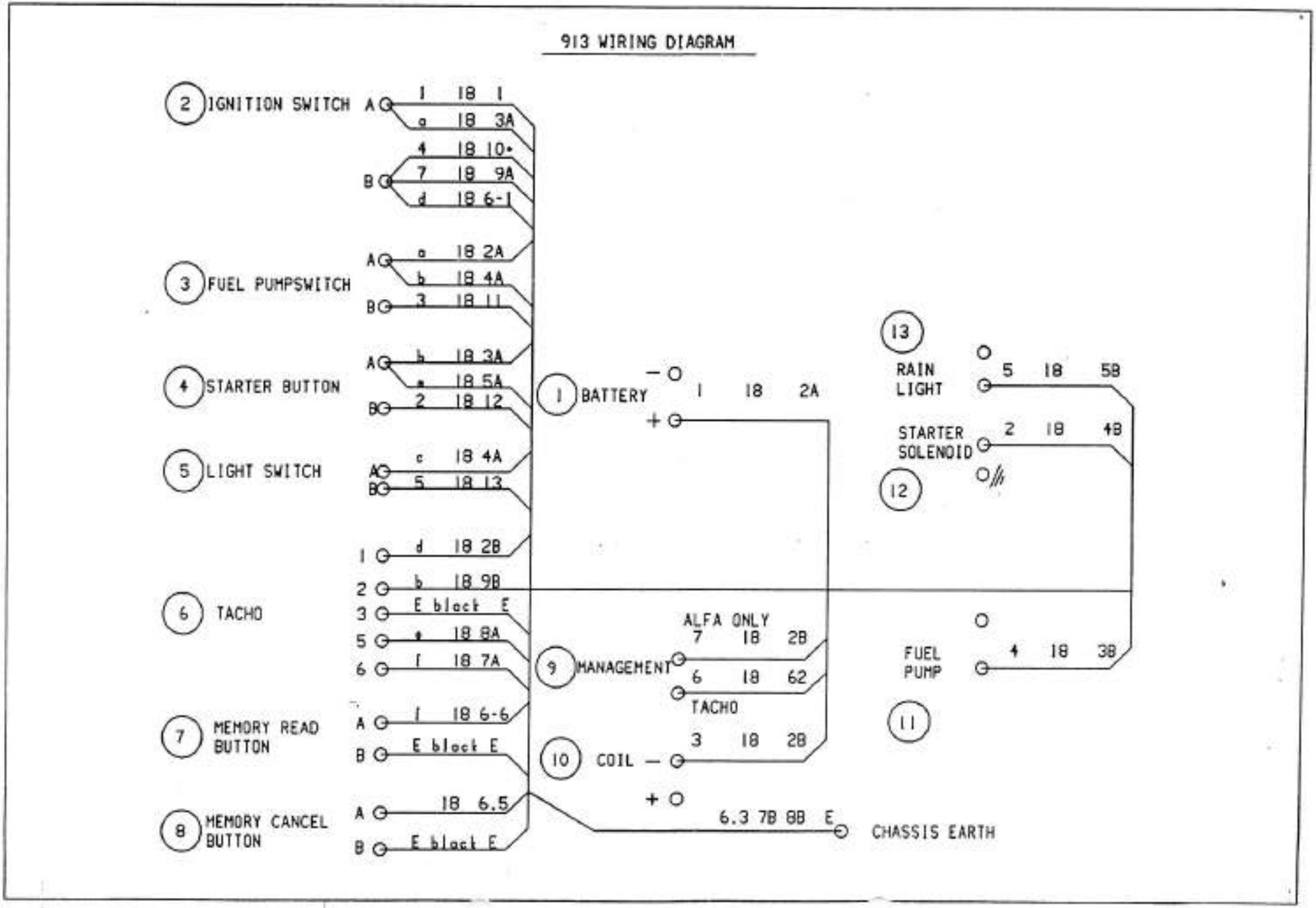
DIM'N	LENGTH
A	25.0
B	25.0
C	25.0
D	25.0

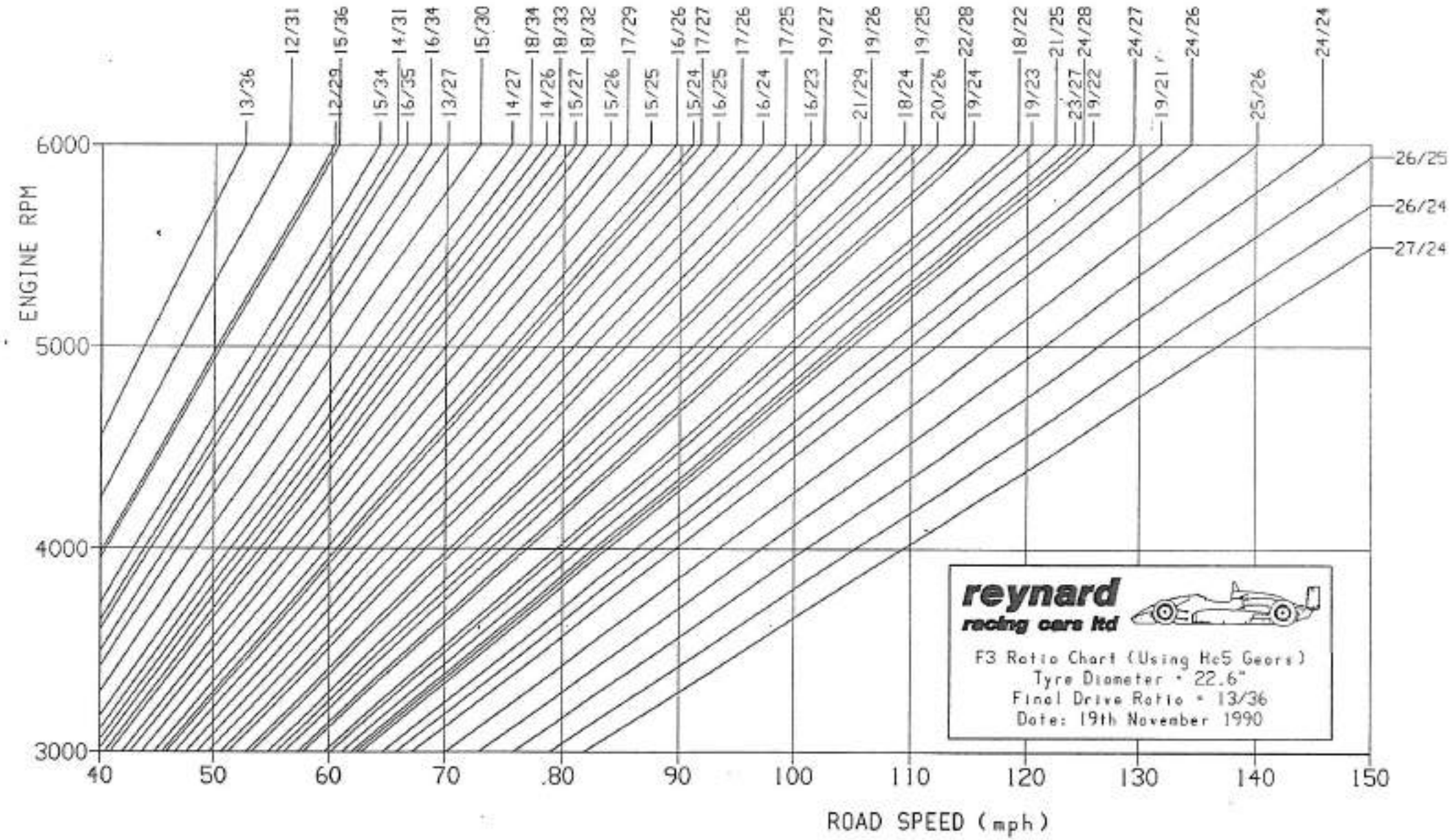

1664
1338
742
2570
912
1288
795
873
940
1553





913 WIRING DIAGRAM

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24/26
25/26
24/24
26/25
26/24
27/24
6000
5000
4000
3000
ENGINE RPM
40
50
60
70
80
90
100
110
120
130
140
150
ROAD SPEED (mph)
reynard
racing cars ltd
F3 Ratio Chart (Using Hc5 Gears)
Tyre Diameter = 22.6"
Final Drive Ratio = 13/36
Date: 19th November 1990