

Foreword

This is a transcribed copy of the original Reynard manual for the 83FF and 84FF racing cars. The table in paragraph 14 that lists bearings and rod ends and Paragraphs 15 – 17 are copied from the 88 Reynard manual and are included here for reference.

It has been transcribed from a copy of the original and is not complete. It contains many of the typos and grammar errors contained in the original. These are found mainly in those spots of the manual where the original intent of the writer isn't clear. It also does not contain many of the diagrams that are referenced in the text. If anyone has them and would send them to me I'll include them.

This manual is an attempt to help those owners of these cars that don't have access to any of the original technical information that was provided by the factory.

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Technical Manual Reynard 83FF/84FF

These notes should help the builder to assemble a damaged car in correct sequence and to correct tolerance and fits. Careful, painstaking assembly is extremely important to extract the ultimate performance from the car without obscure handling problems. Reliability, ease of adjustment and maintenance reduce operation are also benefits of perfect assembly. It cannot not be over emphasized that if the build is not perfectly carried out during the assembly, the problems of difficult adjustments and fits will plague you all through the busy season when time never seems available to catch up. Do not overlook any points on the notes, but you may like to add personal preferences.

1.0 Initial Instructions – Panelling

- 1) All threads on chassis must be tapped out and free from paint after stove enameling. All threads are UNF – leave lightly greased.
- 2) All mount holes on chassis for wishbones, seatbelts, mounting plates etc, should be lightly drilled or reamed out to accept the appropriate bolt so that it is a free sliding fit and then left lightly greased.
- 3) The alloy firewall bulkheads may need slight fitting. Extra large diameter holes can be cut with Q max. Cutters and all sharp edges should be deburred. Bulkheads should be secured to the chassis with 1/8" diameter pop rivets spaced every 50mm.
- 4) Clamp the floorpan into position and drill 5/32" holes in the centre of the tube at every tube junction. Rivet these and scribe lines between these rivets on the underside of the floorpan. These scribe lines should now represent the centre line of the lower chassis rails and can be centre punched every 50mm along the chassis rails. Drill through with a 5/32" drill then remove the floorpan, deburr all the holes using a larger drill on the underside of the chassis and both sides of the floorpan. Relocate and rivet up starting at all corners first, using 5/32" x 3/8" long rivets.
- 5) The alloy sidepanels, radiator covers and radiator inlet duct are screwed and riveted to the chassis at 6" centres, drill holes in the new panel to fit.

2.0 Suspensions

- 1) All wishbones and drop link threads should be tapped out to a depth of at least 35mm. Trackrods and rear radius rod threads are 3/8" UNF right and left handed threads, rear top link and rear lower link threads are 1/2" UNF L/H inboard and 1/2" UNF R/H outboard. All other threads are UNF right handed. After tapping, threads should be thoroughly cleaned of swarf with petrol and blown out with an

airline. Generously relubricate with grease such as Copperslip. All threads are UNF.

- 2) The front rocker damper pickup should be drilled or reamed out to 3/8" clearance through both bushes simultaneously to ensure alignment and lubrication.
- 3) The inside bore of the front and rear rocker outer housings may have to be lightly fettled with a rotary grinder or burr since plating tends to build here and prevent slide fitting of the RB10/RS10 and ABWT8 joints respectively. A slight clearance fit of the joint in the housing can be tolerated by securing with Loctite Bearing Fit.
- 4) The nylon shouldered bushes should be pressed into the front top rockers in a press or vice. The alloy spacer should be a free sliding fit, through the nylon shouldered bushes. The caster adjustment shims are located towards the front of the car when fixing front top rockers into position. Generally the full 4mm shim will give 3 1/2° to 4° caster. The rear rocker has press fit needle roller bearings and thrust faces with hardened steel shims at each end. Keep these well greased to exclude water and dust.
- 5) The front wishbones are simple to fit providing fit the anti-dive spacers first, in the proper place. The front anti-dive spacer is inserted above the Rose joint, and the rear anti-dive spacer is inserted below the Rose joint.
- 6) The rear rocker pivot may wear after 1,000 to 1,500 miles, at the point of contact with the needle rollers. This will eventually cause play and the centre pivot need to be replaced. It is equipped with a cross drilled hole in the centre to prevent it turning when a tommy bar is located in the matching hole in the rear rocker.
- 7) Adjust all link lengths to those shown in the appendix showing equal thread each end.

3.0 Front Uprights

- 1) The front upright has been jib bored after welding so the double angular row bearing will fit accurately with a light press fit in a flypress or a vice. Do not attempt to relieve or overbore housing to obtain easier fit since the tolerances for housing fits are those recommended by the manufacturer. It may ease assembly to heat the upright in a domestic oven to 300°F. (gas mark 2) and cool the bearing in the deep freeze. Do not overheat the upright since it will melt the bearing seals when assembled. Do not apply Loctite to the inner bearing diameter.
- 2) The machined discs should have a maximum axial run out of 0.004" at the periphery. Careful angular displacement matching of the disc on the front flange may reduce this run out by rotating the disc at 90° at a time until the runout is minimized. Ensure that the disc mount registered and discs are free from swarf and burrs and tighten the four countersunk allen bolts. Do not Loctite. Fit drive-pegs. Axial disc run out can be measured with a dial gauge or a feeler gauge between the disc and caliper.
- 3) It will be necessary to fettle the front calipers very slightly to provide at least 0.05" clearance between the caliper and the wheel. Usually the caliper hydraulic plug is the point of foul, and this can be filed or disced to clear.

- 4) Use safety washers on the top and bottom ballpoints since these support the weight of the car and must not bend whilst tightening. Lockwire the top and bottom ballpost bolts ensuring there is sufficient steering lock.

4.0 Rear Uprights

- 1) Ensure that the 1/2" UNF bolt passes through the top of the upright without force. To secure rocker to upright all bolts must be tight.
- 2) The rear upright has also been jib bored so the assembly procedure can follow the same as the front upright.

5.0 Centre Bolt Wheel Fixing

- 1) Use no Loctite on wheelstud threads and always ensure they are well lubricated. Torque the large Nylock inner nuts to 140 ft-lbs and outer nuts 120 ft-lbs. DO NOT OVER TORQUE – this is very important.

6.0 Pedals

- 1) The pedal pivots and ally section channels in the chassis should be checked for clearance and Coppersliped. The pedals should freely pivot on their inserts. The 1/4" bolts should be tightened using Nylock nuts. Ensure the pedals still pivot freely when the bolts are tight.
- 2) Lockwire the 2BA bolt into the throttle pedal holding the throttle cable. Lockwire the 2BA backstop bolt or Loctite against the clamping nut.
- 3) Assemble the balance bar so that the trunnions rotate freely in the clevises and the brake balance bar thread rotate freely in the trunnions. Ensure that the brake pedal freely accepts the balance bar and that the whole assembly is lubricated with Copperslip.
- 4) Assemble with the longer thread of the balance bar towards the throttle pedal side and allow a total axial end float of 0.125" between the inside of the clevises and the outside of the pedal tube, ie. 0.062" each side.
- 5) Fit throttle stop as supplied and adjust so that the throttle touches the stop as full throttle is reached.
- 6) Tap out the pedal pad threads in the pedals 1/2" UNF and ensure the pads are easy to adjust.
- 7) Shorten any pushrod to suit the particular length desired. The thread is 5/16" UNF. Ensure there are at least six threads screwed into the clevises and the RMP5U joint is on the side of the clutch pedal at all times.

7.0 Driveline

- 1) The rear CV joints should be lightly packed with Molybium all purpose grease. Fit both rubber boots to the shaft before fitting circlips and tapping on the CV joints.
- 2) Apply a sealing compound, eg Hermatite liquid silicon gasket to both CV outer mating faces before bolting the joints to the CV outer bells and the gearbox drive flanges. This will prevent grease loss through centrifuge.
- 3) NOTE: The CV joints, especially the inboard, are subject to large amounts of heat which tends to dissipate the grease into non-existence. Inspect the outboard and repack the inboard every five races. Do not overpack.
- 4) Torque the outer 8mm x 1.25 x 48mm long Allen socket bolts into the CV bell flange to 20 ft-lbs and lockwire around the periphery. Torque the inner gearbox nuts to a similar torque ensuring the CV joint is located accurately on its distance spacer. Check all driveshaft nuts and bolts *after every 2 races*.
- 5) Check that the rear links are not out of length adjustment. Check driveshaft plunge movement throughout its full wheel travel. At least 0.25" axial movement should be available at all points of suspension displacement. This movement will be very stiff with new joints.

8.0 Steering

- 1) The rack should be filled with 50ccs of oil, eg 20W50 or Molybium all purpose grease.
- 2) The steering column upper journal should be carefully aligned with the axis of the column by slightly filing the 1/4" holes in the dash support tube bracket if necessary. The journals can be reamed out for further clearance if necessary. The column should freely spin when the journal is tight. Lubricate with Copperslip.
- 3) The rack clamps should have the correct tolerance to just nip the rack tightly, without seizing. If this does not happen when the 1/4" bolts are tightened to 20 ft-lbs, then insert some aluminum foil between the journal faces to spare apart. If too loose, the faces can be filed until the tolerance is perfect.
- 4) Fit the large steel rack stop collar with the radius outwards. Adjust equal amounts of lock each way. Fit the small rack clevises with 1/2" UNF plain locknuts and equalize the amount of thread showing on each end so that the distance between rose joint eye centres is 680mm. The milled slot in the clevises should be vertical.
- 5) The steering wheel should spin freely when all the steering is connected. If tight, check that the top and bottom ballposts joints are not tight by being too much of an interference fit in their housings. The housing can be ground if needed. All points on the steering, eg column journal, rack slides, rose joints and ball posts should be lubricated *every race* with WD40, Copperslip, oil etc.
- 6) Ensure that a set bolt is not fitted in the splined steering column U/J. A bolt with an unthreaded portion should be used at both ends to prevent the spline pulling out of the joint through exposed threads.

9.0 Anti-roll Bars

- 1) **IMPORTANT:** These should be free to rotate in their journals when tightened. The clamps can be bored or reamed out where necessary. Up to a 0.020" clearance can be tolerated. Lubricate with Copperslip.
- 2) Adjustment of the front anti-roll bars is by loosening the 7/16" hexagon nut and sliding along to stiffen or soften as desired. The rear anti-roll bar is adjusted from the cockpit by turning the vernier control or by pushing the centre control knob. When the adjustable blade is at 'cutting' the inboard end of the rear rocker at 90° then this is full stiff. When the blade is 'slicing' the inboard end of the rocker arm, then this is full soft. Adjust the cable length accordingly.
- 3) The anti-roll bar droplinks and joints may be adjusted to optimize on the droplink angularity, from full bump to full droop. On no account should the rodends neck under full bump.

10.0 Radiator

- 1) The two water radiators are located either side of the chassis. They are secured to the chassis by 1/4" UNF bolts and are joined by tubes behind the fuel tank.
NOTE: The core of the radiator is easily damaged by sharp corners, projections, etc., and should be protected by thick cardboard during assembly, also anti-freeze should be used.

11.0 Gearbox, Rear Calipers and Ancillaries

- 1) The old VW starter flange must be part removed with a hacksaw. This must be done carefully to avoid sharp edges, corners and stress concentrations which can cause the gearbox to crack and throw the handling badly. Use a starter motor mated to the adaptor plate to see where the material must be removed and finish off with a round file and emery.
- 2) Whilst the bellhousing is fitted with a starter motor, offer up to the engine. There is a clearance problem between the upper starter motor flange and the side of the engine block. Rather than cutting the starter motor which is weak anyway, machine disc or file the block and remove around 0.25" of metal adjacent to the flange. This is well worth the time spent.
- 3) Ensure that a 10-tooth starter Bendix is fitted to the starter pinion.
- 4) Securing the rear beam to the gearbox are two angle brackets which are attached via the redundant caliper mount points with 3/8" UNC bolts 3/4" long.
- 5) All gearlinkage threads should be tapped out and Copperslipped. Ensure the reaction bar slides freely in the yok and assemble well Copperslipped. Nip up the 1/4" UNF gearlever pivot bolt and slacken off half a turn. Drill the head of the nut and bolt and lockwire to each other.
- 6) The rear bent shaft with the two U/J's should be located in a position to provide sufficient angular and fore-aft movement without fouling. Locate this near the end of the end of the assembly with all the parts in position. When perfect, drill centrally on diameter, two 1/4" holes, vertically through the Hewland shaft rear

- U/J and gear rod shaft – front U/J respectively. Ensure the bolts are easily removable in situ and shorten the bolts to a minimum length to be just nipped by Nylock nuts.
- 7) Lubricate the U/Js with Copperslip. Relubricate every two races, especially after wet races. The forward gear rod can be shortened if need be.
 - 8) Remove all swarf and filings from the clutch quillshaft and Copperslip the splines lightly.
 - 9) Do not forget to fill the gearbox with two pints EP80/90 oil. Use 20W50 in cold weather.

12.0 Additional Fittings and Ancillaries

- 1) Pad abrasion is quite high and any disc wearing more than 0.025" in thickness should be replaced or very bad braking will result with the added danger of discs cracking.
- 2) The damper bumpstops should be cut with a sharp knife taking care not to score the pushrod so that they contact at front and rear according to the accompanying table in the appendix.
- 3) The seat belt crutch straps should be drilled through the floorpan 3/8" diameter and the bolts also pushed through from the underside.
- 4) The threaded portion of the dampers should be wirebrushed to remove all paint and then Coppersliped. The threaded collar should be free to rotate on damper and lubricated.
- 5) Thoroughly clean the petrol and oil tanks with petrol. The oil level is 1/2" below the baffle.
- 6) Drill the steering wheel and column boss after marking three equispaced holes on a 2.0" PCD clamp wheel centrally to boss and drill through 17/64".
- 7) Loctite or lockwire all engine bearers. *Check every race*. Handling will deteriorate if these are left loose. All engine bolt threads are metric.
- 8) The Lifeline manual fire extinguisher system is located on the left side of the car. The bottle sits just behind the fuel tank and below the catch tank.
- 9) Fit the 0.625" master cylinder to the front brakes and 0.7" to the rear.

13.0 Bodywork Fixing

- 1) The seat can be fitted by locating two 1/4" UNF bolts through the drilled holes and screwed into the rivnuts in the top chassis rail. Adjustment is provided by drilling two or three holes or slots.
- 2) Top body section locates on six pegs on the top chassis rails and is supplied trimmed to fit.
- 3) The nose section locates on the nose frame which is bolted to the front bulkhead via three 1/4" UNF bolts and should be trimmed to clear brake pipes. Nose and cockpit are Dzused to side panel. Ensure bonded nose tube locates centrally in nose frame.

- 4) Rear underbody section may need slight fitting. In general this should be a good fit. Fix to top section with rubber loops provided. Dzus fasteners may be used on side panel if desired.
- 5) The tail section is located underneath by rubber loops and on top by two Dzus TL 802B /5 overcentre clips. An installation drawing for replacement panels can be provided. These clips have a lockwire safety hold provided.

14.0 Appendix

Thread Size	Torque ft-lbs (half nut)	Torque ft-lbs (full nut or full thread depth into casting)
1/4" or M6	5-6	8-10
5/16" or M8	10-12	18-20
3/8" or M10	20-22	32-34
7/16"	40-42	68-72
1/2" or M12	50-54	78-82
3/4"	80-85	110-120
CV joint drive shaft bolts		26
Wheel flange retainer bolts		26
Centre bolt wheel fixing		120

Approximate Setting Lengths For Suspension Links Pivot To Pivot – For Guide Only

Steering rack clevis.....	680mm
Front trackrod.....	284mm
Front ARB droplinks.....	187mm
Rear toe link.....	232mm
Rear radius rods.....	782mm
Rear lower link.....	476mm

Suspension Settings

Front ride height (under pedal bulkhead).....	2" (50mm)
Rear ride height (under rear of chassis).....	2 3/8" (60mm)
Front toe-in total.....	15-20 mins.
Rear toe-in total.....	20-25 mins.
Front camber.....	1/2° - 1°
Rear camber.....	0° - 1°
Castor.....	3 1/2° - 4°

Bumpstops

Cut so that bumpstops touch at 3/4" ground clearance – front, and 1/4" ground clearance – rear.

Bumpsteer

Adjust with spacers provided on front ballpost for zero over full suspension travel. Rear – set by altering radius rod length.

Special Tools Required

Torque-wrench 20-120 ft-lbs

Lockwire soft 0.8mm

Copperslip

Bearing housing and thread Loctite, 648 and 242

Taps:

2BA, 1/4", 5/16", 3/8", 1/2", 5/8" UNF Righthand

3/8", 1/2" UNF Lefthand

1/2", 5/16", 3/8" UNC

M8, M10, M12

Set Drills: 1/16" to 1/2"

1 5/16" deep socket.

Wheel socket 1 1/8".

'D' spanners.

Spherical Joints, Rod Ends and Bearings

Location	Qty	Part No	Bore	Thread
Front lower wishbone/chassis	2	ART6ECR	3/8"	3/8" UNF
Front lower wishbone/chassis	2	ARHT5ER	5/16"	3/8" UNF
Front lower wishbone/upright	2	ARHT8ECR	1/2"	5/8" UNF
Front rocker pivot	2	ABWT8	1/2"	
Front rocker pivot	2	ABT8	1/2"	
Front rocker/upright	2	ABWT10	5/8"	
Rear rocker pivot	2	ABWT8	1/2"	
Rear rocker pivot	2	ABT8	1/2"	
Rear rocker/upright	2	ARHT8ECR	1/2"	5/8" UNF
Rear toe link/inner	2	ARHTL7ECR	7/16"	1/2" UNF LH
Rear toe link/outer	2	ART10ECR	5/8"	5/8" UNF
Rear wishbone/inner	2	ART8ECR	1/2"	1/2" UNF
Rear wishbone/inner	2	ABWT8	1/2"	1/2" UNF
Rear wishbone/outer	2	ABWT10	5/8"	
Front track link/inner	2	ARTHL5ECR	5/16"	3/8" UNF LH
Front track link/outer	2	ART6ECR	3/8"	3/8" UNF
Front ARB Drop link	4	AMR4	1/4"	1/4" UNF
Rear ARB Drop link	4	AMR5	5/16"	5/16" UNF
Gear lever mount	1	AMR6	3/8"	3/8" UNF
Gear linkage guide	2	AMR8	1/2"	1/2" UNF
Clutch rod ball joint	1	84F-07-05		10-32 UNF
Throttle cable	2	AFE3	3/16"	10-32 UNF
Rear ARB cable	1	AFE3	3/16"	10-32 UNF
Wheel bearings	4	SKF633007C		

15.0 Tracking

Before tracking the car from new, after repairing accident damage or replacing any suspension component, always preset the suspension link lengths as per the setting up advice. This will save considerable time. You will be unable to track the car successfully if there is undue play in any moving component, eg. wheel bearings, rose joints. If possible keep a spare set of wheels with the outside rim machined true specifically for tracking. If you are unable to do this ensure that the wheels are undamaged and take readings off the rim, then rotate the wheel half a turn and re-check, taking the average as the true reading.

Pre-tracking Procedure

Before you begin the tracking operation, ensure that you adopt the following procedures:

- 15.1 Check all the links are preset as per setting up data.
- 15.2 Ensure the car is mechanically sound, ie. No play in wheel bearings, rose joints.
- 15.3 Ensure that the wheel rims are true.
- 15.4 Check that tyre diameters and wear pattern is the same side to side.
- 15.5 Set tyres to the correct pressures.
- 15.6 Remove one front and one rear anti-roll bar drop link.
- 15.7 Check that the spring free lengths are the same side-to-side. If there is a difference, put the long spring on the left hand side of the car and note the difference (up to 2mm is acceptable).
- 15.8 Check that spring platforms (ie. Damper abutments) are the same side to side. If the springs are slightly different lengths, preset the platforms accordingly, ie. The left hand spring is 2mm longer than the right, preset the left hand abutment 2mm lower.
- 15.9 If the adjustable dampers are fitted, ensure that they are put on their minimum setting, not forgetting to reset them prior to testing.
- 15.10 Track car with driver and half-fuel load.
- 15.11 Track the car 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 the straight edge and camber guage across the front wheels and pack under one wheel until the gauge reads level. Repeat at the rear. Remember to allow for the depth of packing when measuring ride height.

Tracking Sequence

It is easiest to adjust castor and bump steer with the car up on stands. Ensure that the car is steady on the stands and level. Place a camber gauge across bottom chassis rails for and aft and pack until car is level in both directions.

Ride heights, wheel weights, camber, roll bar preload and toeing are checked with the car on the ground. It is possible to do the complete tracking operation on the ground in the following sequence:

- 15.12 Complete pre-tracking procedure
- 15.13 Ride heights
- 15.14 Wheel weights
- 15.15 Front castor
- 15.16 Front camber
- 15.17 Front bump steer
- 15.18 Recheck front camber
- 15.19 Rear camber
- 15.20 Rear bump steer
- 15.21 Recheck camber
- 15.22 Front toe-ins
- 15.23 Rear toe-ins
- 15.24 Recheck ride heights
- 15.25 Recheck cambers
- 15.26 Reconnect anti-roll bar drop links so that they are not under tension.

Tracking Calibration

As an aid to quick setting up, the following table gives the amount each setting is altered by making a fixed adjustment.

Setting	Adjustment	Alteration
Front caster	1 turn	0.37°
Front camber	1 turn	0.37°
Rear camber	1 turn	0.48°
Front toe-in	1/2 turn	4.4mm
Rear toe-in	1/2 turn	2.0mm
Front ride height	1 turn	2.8mm
Rear ride height	1 turn	2.6mm

16.0 Operational Guidelines

To consistently get the best from your Reynard, it is essential before you test or race, that the car is properly prepared as outlined in this manual. Particular attention should be paid to maintaining the fits and tolerances of all the moving parts of the suspension system. Any undue wear, poorly repaired accident damage, or sloppy maintenance will negate much of the car performance potential and valuable track time would be wasted trying to rectify unnecessary problems.

Regular Workshop Maintenance

- 16.1 Always clean car thoroughly every time car returns to the workshop. This is a good time to visually check all components for wear or minor accident damage as you clean. After cleaning car (either with jizer or a 50/50 mix of paraffin and petrol) hose clean with water, blow dry with an airline and WD40 all rose joints, suspension links, etc. to prevent rust. Do not WD40 discs but do dry thoroughly.
- 16.2 Make a job list based on your test or race notes and complete the major items first, ie. Send engine away for rebuilding, repair accident damage, etc. Remember to put the battery on charge.
- 16.3 Methodically check all nuts and bolts for security.
- 16.4 Check all moving parts for play, fit, security or damage, eg. rose joings, wishbones, wheel bearings, wheels, brake dics, bellcranks, anti-roll bars, dampers, etc.
- 16.5 Change gear ratios if necessary and check gearbox oil level and selection after changing ratios.
- 16.6 Check all systems:
Throttle: full throttle return action and throttle stop.
Clutch: clearance, free play and stop.
Brakes: pressure check for leaks, disc runout, brake balance bar and pushrods for security. Replace brake fluid regularly, particularly after a wet test or race.
Lightly clean discs with emery cloth.
Oil/Water: check for leaks, security or chaffing. Check levels.
- 16.7 Run engine to check oil/water systems and operation of starter motor.
- 16.8 Check Tracking: camber, castor, toe-in, bumpsteer, ride height, wheelweights, anti-roll bar preload, tyre diameter.

On-circuit Maintenance Checks

Before leaving the pits:

- 16.9 Check all fluids – oil, water, gearbox and brake fluid.
- 16.9.1 Warm engine to operating temperature. Blank oil cooler and radiators as necessary.
- 16.10 Check tyre pressures and diameters.
- 16.11 Check damper and anti-roll bar settings.
- 16.12 Check wing settings and ride heights (with driver and fuel).
- 16.13 Check wheel nuts.
- 16.14 Complete 3 or 4 laps at moderate speed then pit. Adjust radiator blanking if necessary, check wheels for security. Check tyre pressures and check engine bay for leaks.
- 16.15 Start testing remembering to monitor fluid levels, tyre pressures and wheel security and ride heights at every pit stop.
- 16.16 Try and achieve a good handling balance by adjusting anti-roll bar and wings as necessary.
- 16.17 Any handling imbalance that cannot be cured by simple adjustment will require some detective work to isolate. Before making any changes, always double check that all the basic settings are correct. “Handling Problems” are invariably a direct result of failing to operate or maintain the car properly.