

CATERHAM
DESIGNED FOR RACING, BUILT FOR LIVING

SUPPLEMENTARY ASSEMBLY GUIDE CATERHAM CSR







CSR Assembly Guide Supplement

Table of Contents

Front Suspension	3
Top wishbone orientation	3
Fitting top wishbones	3
Lower wishbone orientation	3
Fitting lower wishbone	3
Rocker and pushrod assembly.....	4
Damper assembly	6
Anti-roll bar assembly	7
Differential Fitting	9
Differential.....	9
Rear Suspension Assembly	10
Top wishbone orientation	10
Fitting top wishbone	10
Lower wishbone alignment	10
Fitting lower wishbone	10
Upright assembly	10
Wheel bearing	10
Damper clevis	10
Fitting Driveshafts.....	11
Upright to wishbone joints.....	11
Fitting brake disc and drive flange.....	12
Fitting the brake calliper	12
Track control arm assembly	13
Damper assembly	13
Damper to chassis	13
Damper to upright	14
Engine ancillaries position.....	15
Breather system plumbing	16
Hose routing for breather system	16
Cooling	17
Radiator ducting	17
Cooling plumbing.....	18
Bottom radiator hose	18
Top radiator hose and water rail	19
Oil cooler circuit.....	19
Heater plumbing.....	20
Wiring Harness	21
Oil temp	21
Water temp.....	22
Radiator fans.....	22
Main power	23
Interior	24
Stalk assembly	24
Fitting the horn	24
Fitting steering wheel and boss and horn ring	25
Fitting stalks cover.....	25
Fitting the steering wheel and horn button.....	25



CSR Assembly Guide Supplement

Front Suspension

Top wishbone orientation

It is important to get the initial orientation of the wishbones correct. The top wishbone already has the ball joint screwed in and set to position. The wishbone fits to the chassis with the tapered pin of the ball joint facing downwards.

Fitting top wishbones

It is recommended that all suspension fixings are lightly lubricated with copper ease on the shank of the bolt to help servicing work. Firstly make sure you position the small aluminium sleeve into the chassis rubber on the rear most joint. The wishbone is then attached to the chassis using a $\frac{3}{8}$ UNF x $2\frac{1}{4}$ long shank bolts to pass through the joints. It is recommended that the bolts are orientated such that both nuts are located on the inside of the wishbone. This will allow for easy service in the future. See the figure1 below:



Figure 1 – Top wishbone assembly detail

Lower wishbone orientation

The lower wishbones are assembled with the circlip retaining the spherical bearing facing downwards.

Fitting lower wishbone

It is recommended that all these suspension fixings are lightly lubricated with copper ease on the shank of the bolt to help movement and servicing work. Firstly pass the lower wishbone through the aluminium side panel and align with the chassis fixing point. The front fixing is fastened to the end of the chassis using a $\frac{1}{2}$ UNF x $2\frac{1}{2}$ bolt. Under the head of the bolt place a spring washer and one plain washer before passing the bolt through the wishbone. The wishbone is then spaced with 3 plain washers between the chassis as illustrated in figure 2 on the next page

The rear fixing is fastened with a $\frac{3}{8}$ UNF x $2\frac{1}{2}$ bolt and spaced with washers either side of the wishbone. To achieve the standard caster setting it is recommended that you follow the spacing illustrated in figure 3 on the next page..



Figure 2 – Front lower wishbone assembly (front joint)



Figure 3 – Front lower wishbone assembly (rear joint)

Rocker and pushrod assembly

The rocker will be supplied with the bushes already pressed into the machined part and includes a centre pin. The pin has a small step on each end to allow plastic shim washers to locate. Place the whole assembly between the two chassis mounting points and pass a $\frac{7}{16}$ UNF x 4 bolt through the chassis bucket bush from the front of the car. (Tighten to 35lbft.) See figure 4 for more detail.

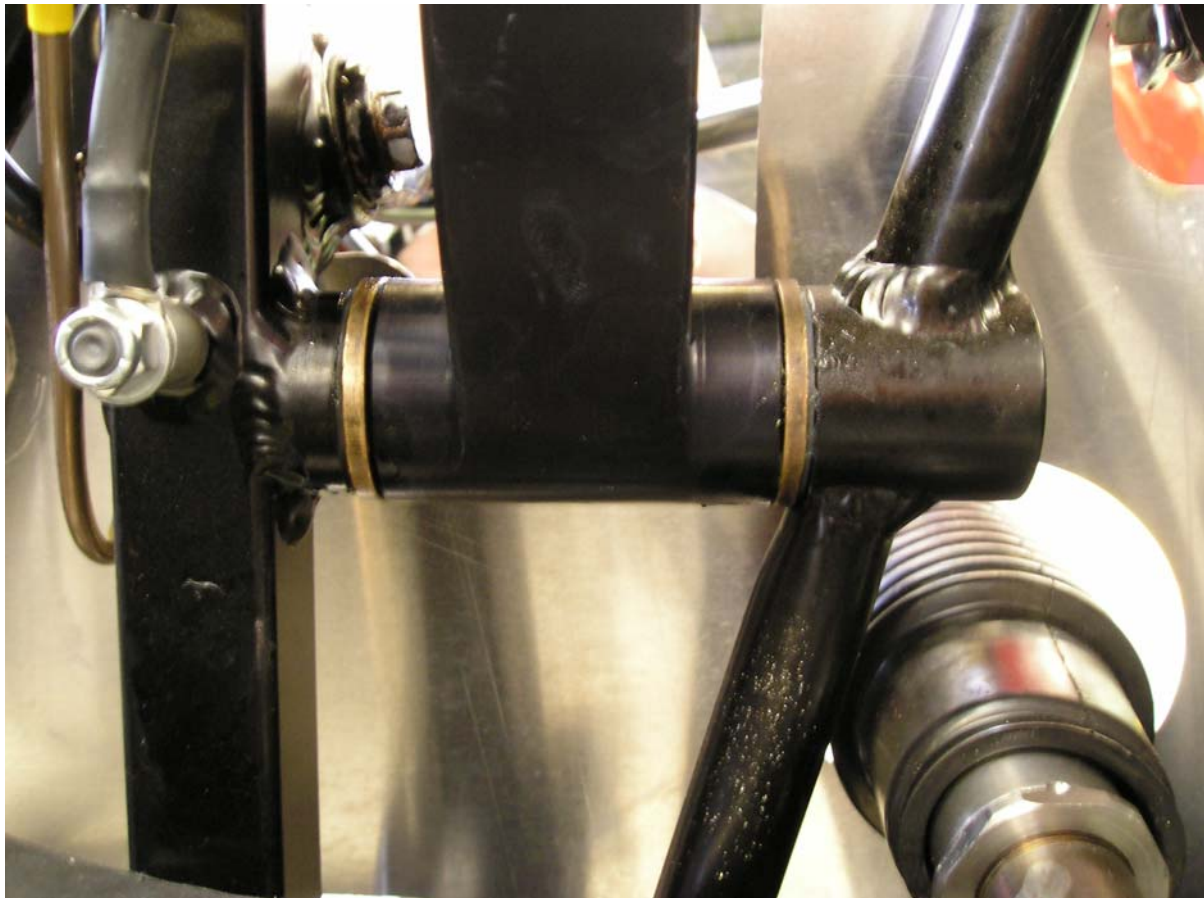


Figure 4 – Front rocker assembly detail



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The pushrod length should be set prior to fitting it to the suspension. The pushrod utilises opposite threads to allow easy adjustment. Make sure the correct rod end is screwed into each end of the pushrod, including the lock nuts. Measure the length between rod end centres and set to approximately 290mm. Ensure both rod ends are in the same plane.

One end of the pushrod is fitted to the rocker using a M10 x 50 CAP head long shank bolt. It must have a washer under the head of the bolt and under the nyloc nut. The bolt must be fitted from the front, tighten to 35lbft, see figure 5



Figure 5 – Push rod to rocker joint

Push two conical spacers into the lower rod end prior to attachment to the lower wishbone. The rod end, including cone spacers, should then fit into the mounting point on the wishbone. The correct bolt for this joint will be supplied already screwed into the wishbone, tighten to 25lbft, see figure 6.



Figure 6 – Push rod to lower front wishbone joint



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Damper assembly

Fit 4 conical spacers into the spherical joints at either end of the damper using a vice if required. The shock absorber is positioned between the rocker and lower chassis hard point. The damper body is mounted to the chassis with the spring uppermost.

First attach the damper to the rocker using a CAP head bolt. The bolt must have a washer under the head and be tightened to 35lbft. A similar washer must also be placed between the rocker and long hex fixing adapter. It is important that this bolt is passed through the joint so the long hex adapter is towards the front of the car as this doubles as an anti-roll bar fixing. See figure 7.

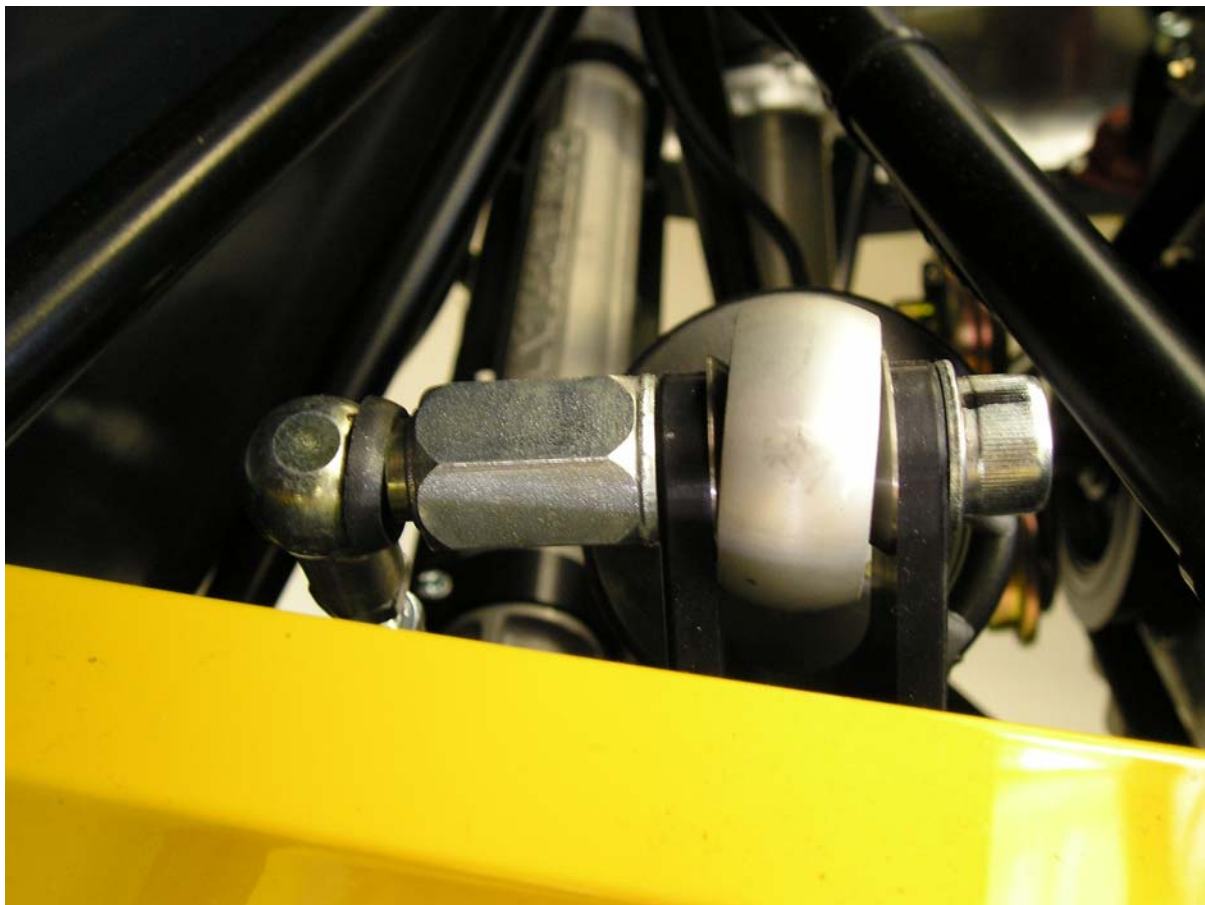


Figure 7 – Damper to rocker joint

The lower end of the damper is now positioned into the chassis mounting by raising the suspension to aid alignment. The bolt (M10 x 40) is passed through from front to rear with the horn support bracket under the head and a washer under the nut. Tighten to 35lbft. The horn support brackets are supplied straight and must be bent as shown in figure 8.

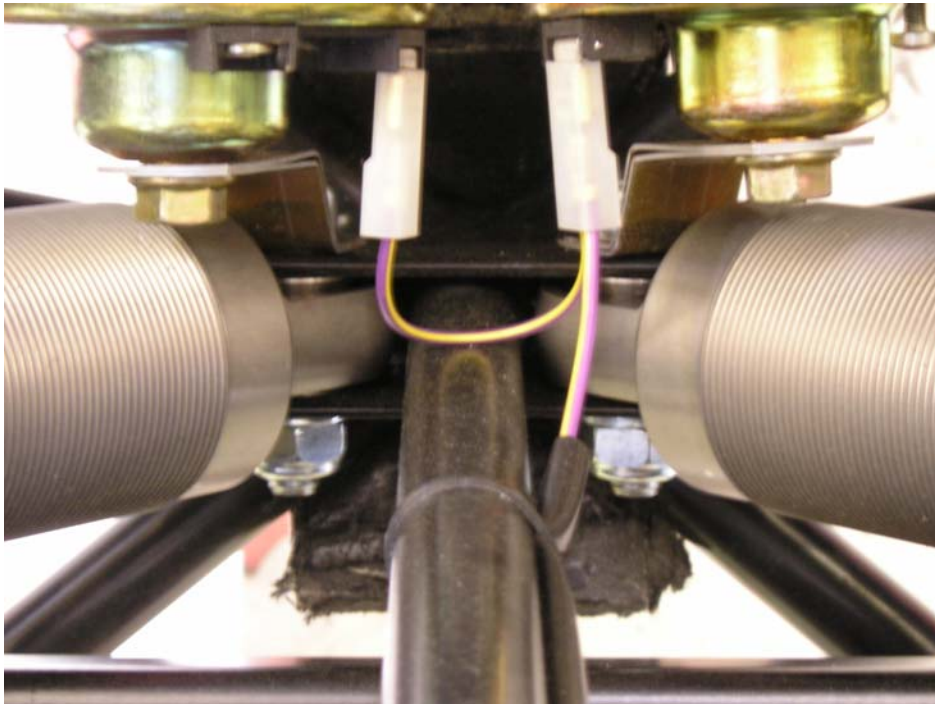


Figure 8 – Damper to chassis assembly

Anti-roll bar assembly

The anti roll bar assembly must be fitted before any of the radiator support is mounted to the car. The anti-roll bar is attached to the front of the chassis using two cotton reel rubbers supported in brackets. Push the rubbers through the brackets with the aid of rubber lubricant (WD40) and position on each end of the anti-roll bar. Use the nuts and bolts ($\frac{5}{16}$ UNF x $2\frac{1}{2}$) supplied to secure the assembly to the front of the car and tighten to 15lbft. See figure 9.



Figure 9 – Front anti-roll bar assembly



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The front anti-roll bar is connected to the hexagonal adaptor on the rocker by drop links. These drop links should be preset to 100mm and lock nuts must secure the joints at 90° orientation. It is important that the ball joint is positioned on the inner edge of the blade of the anti-roll bar. As a standard setting use the hole nearest the circular bar at the front of the chassis. For clarification, see figure 10.



Figure 10 – Front anti-roll bar assembly



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Differential Fitting

Differential

Note: Before fitting the differential make sure the prop shaft is positioned in the tunnel. Apply masking tape to the tubes in the vicinity of the differential to protect them during installation.

Insert the differential from underneath the chassis. Start by positioning the nose/drive flange into the chassis and then pivot up the main casing. Take care not to damage the plastic breather during assembly. Now the differential should be within the chassis and inline with the prop shaft.

Slide the $\frac{1}{2}$ x 13 $\frac{1}{2}$ bolt through the chassis bushes and diff initially without spacers to hang the diff and support its weight. Then fit the lower mounts, but leave loose until all the bolts are started. Use the special M12 x 65 with a $\frac{1}{2}$ shank bolt on the right hand side. Note, no spacer is required here. Use the special M12 x 105 with a $\frac{1}{2}$ shank on the left hand side and include a spacer between the differential and the chassis. See figure 11. Now remove the top bolt ($\frac{1}{2}$ x 13 $\frac{1}{2}$) and refit with spacers as shown in figure 12. Complete the installation by tightening all three bolts to 40lbft.



Figure 11 – Lower diff mounting spacer details



Figure 12 – Top diff mounting spacer details



Rear Suspension Assembly

Top wishbone orientation

Firstly it is important to ascertain the correct orientation before fitting to the chassis. The wishbones will be supplied marked with an 'L' on the bearing housing to indicate left hand side. The other unmarked wishbone is the right hand side. To ascertain which way up the wishbone is fitted take a close look at the spherical bearing. The circlip that retains the bearing should be facing upwards

Fitting top wishbone

To assemble the wishbones slide them over the bushes, already pressed into the chassis. Align the holes and pass the special long shank M10 x 65 bolt through to secure. Tighten to 35lbft. It is important to pass the bolt through from the middle of the wishbone as this will aid assembly when servicing.

Lower wishbone alignment

The lower wishbone will be marked exactly like the top, with an 'L' to distinguish left hand side. However, the spherical bearing will be retained with a circlip that must be assembled facing downwards.

Fitting lower wishbone

The lower wishbone is assembled in a similar way to the top. Slide it over the bushes, already pressed into the chassis, and utilise the same long shank M10 x 65 bolt to secure it. Tighten to 35lbft. Again, for consistency pass the bolts through from the middle of the wishbone.

Upright assembly

Wheel bearing

The wheel bearing assembly fits into the upright casting and is retained with four fine thread CAP head bolts. They pass through the upright casting and thread into the wheel bearing. All the bolts are supplied with the upright assembly. Use two M12 X 55 bolts on the lower fixings and two M12 X 45 bolts on the top fixings. Tighten to 45lbft. Ensure that the correct fine thread bolts are used to prohibit thread damage.

Damper clevis

This black anodised aluminium part connects the top of the upright to the bottom of the damper and outboard end of the wishbone. Position the clevis and secure with four bolts supplied with the upright kit. Two M6 X 20 CAP bolts are used with an M6 washer through the slots in the clevis and screwed into the casting. Tighten to 5lbft. The remaining two M6 X 35 HEX bolts are passed through the upright and screwed into the clevis. Tighten to 5lbft. As a standard setting use the silver, blue and black camber shims between the shock absorber clevis and upright. Apply a smear of thread lock to the pin and screw it into the clevis.

Drive flange and brake disc

Firstly bolt the brake disk to the back of the drive flange. Use the special shallow HEX head $\frac{3}{8}$ x 1" bolts applied with thread lock. They must be torqued to 35 ft/lb. Take care to avoid rounding the head.



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Fitting Driveshafts



Figure 13 - Driveshaft

The driveshafts supplied in the kit will both be marked 'right hand side'. However, only one will be fitted with a speed sensor toothed gear. For clarification see figure 13 above. This driveshaft must be fitted to the right hand side.

To distinguish which way round the driveshaft is fitted take a closer look at the splines on the end. The joint with a thread at the end is fitted through the wheel bearing assembly and the other end fits into the differential. Firstly assemble the driveshafts into the differential by means of a push fit.

Before assembling the wheel bearing end ensure the spacer ring is positioned on machined shaft. It is important this is fitted with the chamfer edge against the driveshaft shoulder. For details see figure ***. Next, the upright assembly can be fitted complete with wheel bearing. The wheel bearing should already be assembled into the upright and so the whole assembly can be placed over the driveshaft and aligned with the wishbones. Follow the instructions below for details on connecting the wishbones.

Upright to wishbone joints

Before fitting the upright to the chassis make sure the differential, wishbones and driveshafts are assembled.

The upright is attached to the wishbone by means of a stud screwed into the casting. The spacers supplied in the upright kit are positioned either side of the spherical bearing fitted in the wishbone. The shallow spacer is fitted first. Note it has a chamfer on the inner edge to allow it to sit flush with the shoulder of the stud. The other, deeper spacer is fitted the other side of the spherical bearing, under the nyloc nut. Note this spacer is finished with a square edge to fully support the nylon nut. It is of vital importance these spacers are fitted the correct way as suspension movement will otherwise be limited.



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Figure 14 below details the top and lower wishbone to upright joint. To clarify, the shallow spacer is between the upright and wishbone. The deep spacer is between the wishbone and nyloc nut.

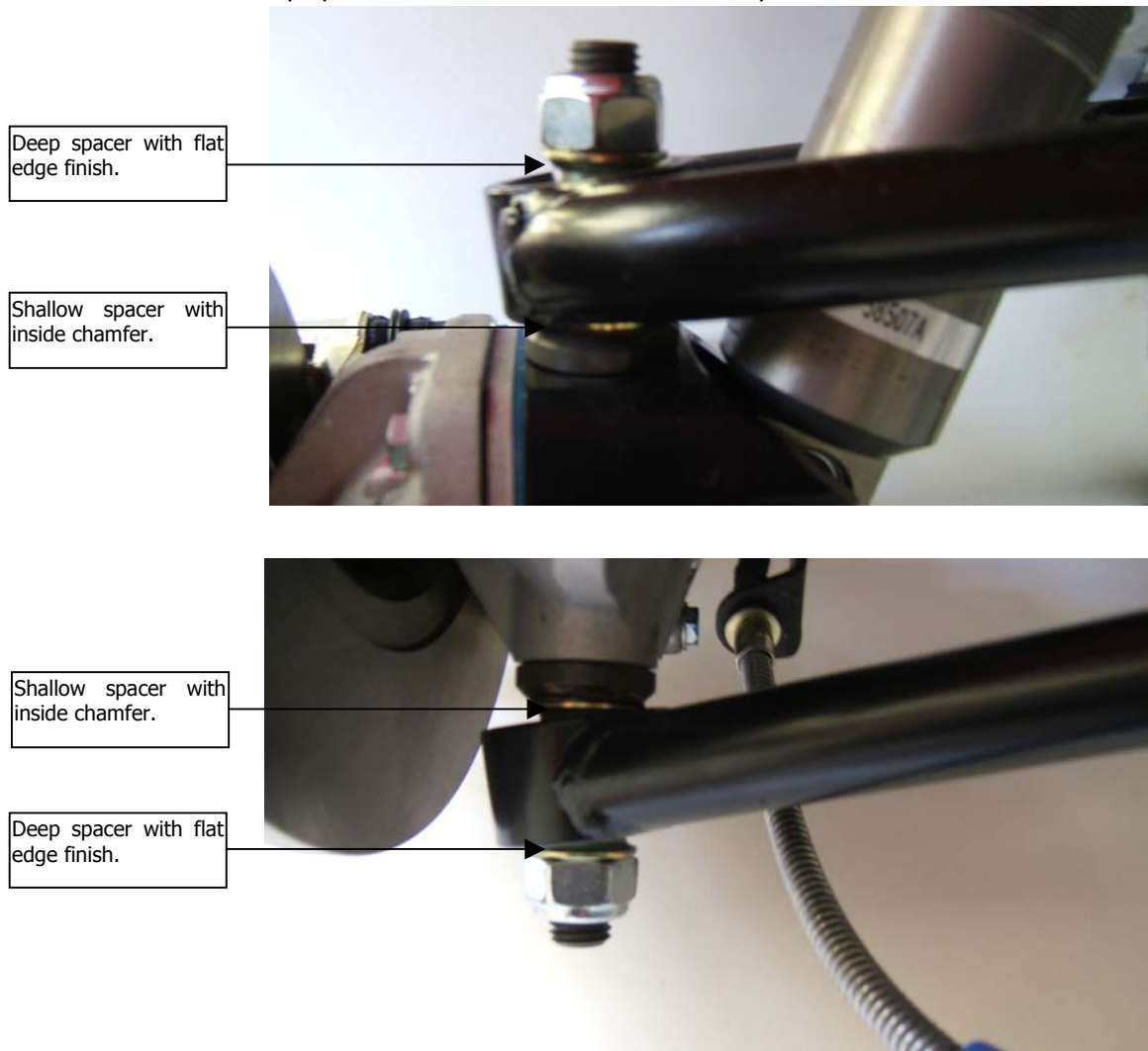


Figure 14 - Upright to wishbone joint detail

Fitting brake disc and drive flange

The brake disc is fitted to the back of the drive flange using special shallow head bolts ($\frac{3}{8} \times 1$). Apply thread lock to these bolts and torque to 30ftlb. Take care not to round the head when tightening.

To complete the upright assembly push the drive flange, complete with brake disc into the wheel bearing and locate the driveshaft spline. Finally, place the washer and nut on the end of the driveshaft and torque to 200ft/lb.

Fitting the brake calliper

Note: before fitting the brake calliper ensure the upright assembly is complete and attached to the wishbones. The driveshafts must also be in position and the hub nut tightened as described above.

The brake callipers must be fitted with the bleed valves positioned at the top. This also positions the hand brake linkage so the cable is routed below the lower wishbone.

Slide the calliper and pads over the disc and position it so the calliper lines up and meets the machined face on the upright casting. Secure with two bolts and spring washers supplied in the upright kit. Use the M10 X 70 fine thread bolt for the top fixing and the M10 X 40 fine thread bolt for the lower fixing. Tighten both bolts to 35lbft.



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Track control arm assembly

The track control arm assembly fits between the upright and chassis. The arm is fitted with left and right hand threaded rod ends. Firstly screw the lock nuts onto the rod ends and then thread them all the way into the arm. This ensures when adjusting the toe both rod ends are moved equally. To fix the arm to the chassis pass the **HEX bolt ($\frac{3}{8}$ UNF x 2")** through the top of the chassis and space the rod end with a 5mm bump steer cone on the top and 9mm cone on the bottom. Tighten the bolt to 25lbft. See the figure 15 for details.

thread Gewinde

The fixings for the connection of the track control arm to the upright are supplied in the box containing the upright. The rod end on the track control arm is fixed to the upright between a pair of cast jaws. **Firstly**, push the **shouldered top hat spacer into the lower jaw on the upright**. **Next**, slide the smallest conical spacer without split onto the M10 bolt, cone towards thread, then slide on the split conical spacer with internal matching cone nesting into the first spacer. Then insert the bolt, complete with pair of cones through the top jaw and through the rod end and then through the shoulder inserted in the lower jaw. Lock in place with k nut and tighten to 35lbft . See figure 16 for details.

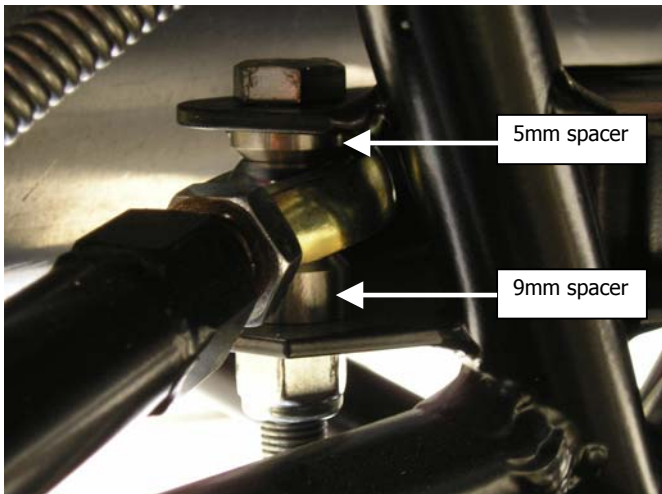


Figure 15 - Inner track control arm joint with bump steer spacer position details

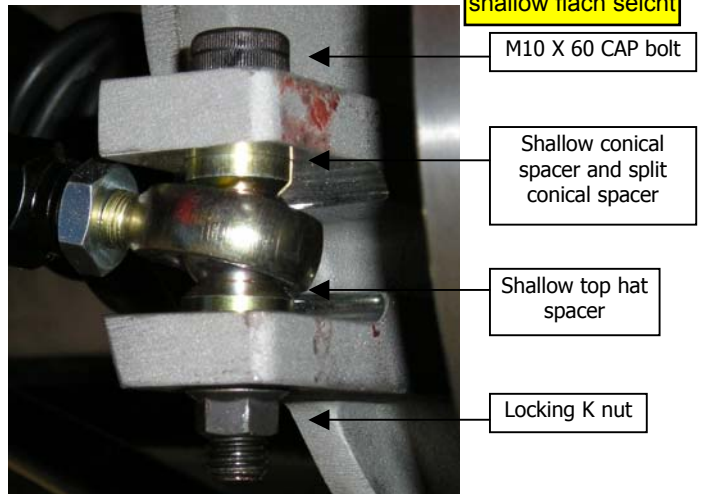


Figure 16 - Outer track control arm joint with spacer position details

Damper assembly

spacer Distanzstück

Damper to chassis

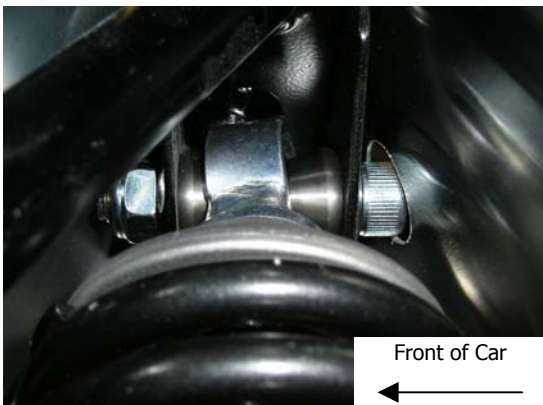


Figure 17 - Rear shock absorber to chassis joint

First push the cone spacers into the spherical bearings ready for fitting. Slide the shaft end into the chassis mount and push the CAP head **bolt (M10 x 55 long shank)** through. A half nyloc nut is used to complete the joint. See the figure 17 for details.



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Damper to upright



Figure 18 - Rear shock absorber to upright joint

The body end is attached to the clevis at the top of the upright assembly. The bolt and spacers will all be supplied with the upright. Firstly, move the suspension upwards to the shock absorber and align the holes. The top hat spacer fits into the machined recess in the upright. Pass the shallow cone, followed by the split cone onto the M10 bolt and then push it through upright and damper body. This joint is completed with a 'K' nut and tightened to 35lbft . See figure 18

NOTE:-

On the damper to upright joint ensure the spacers are correctly positioned. The top hat **must be** fitted into the machined recess. When complete, the head of the bolt must be able to sit down against the cones. This makes it sink into the upright slightly. Due to this part being utilised on the other side of the car the bolt is passed through in the opposite direction to obtain the same result.



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Engine ancillaries position

To ascertain the position of catch bottles, wiring looms and coolant plumbing refer to figure *** and *** below. Figure 19 details the layout for a 260HP spec car and figure 20 details the layout for a 200HP spec car.

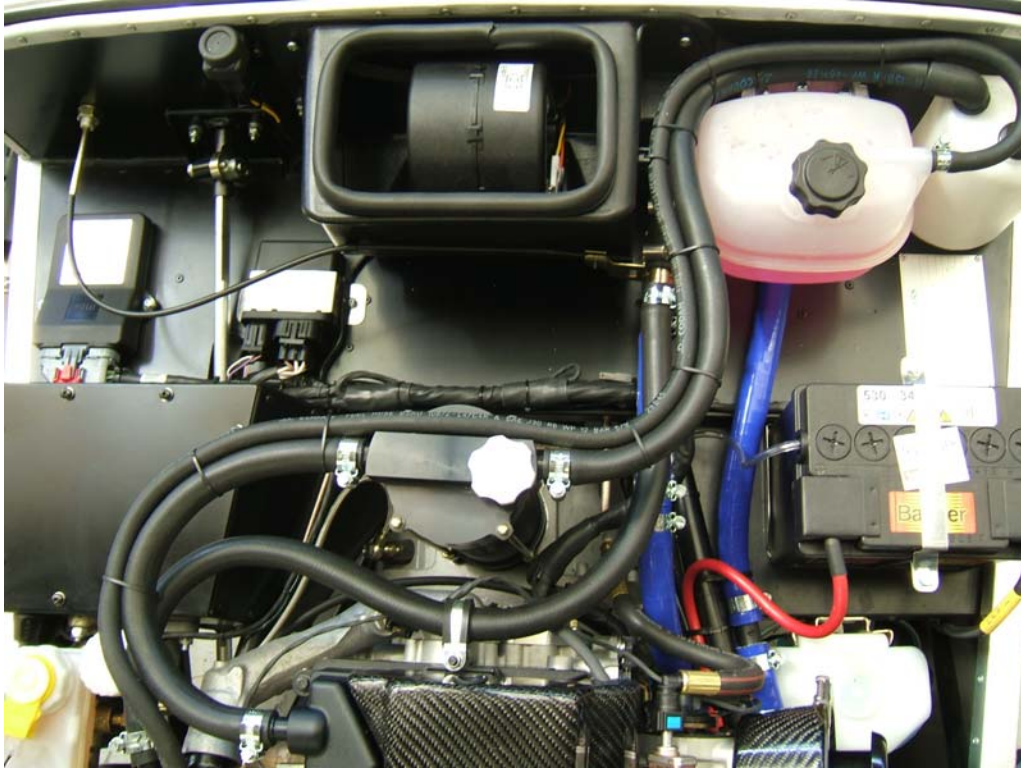


Figure 20 – 260 Spec layout details

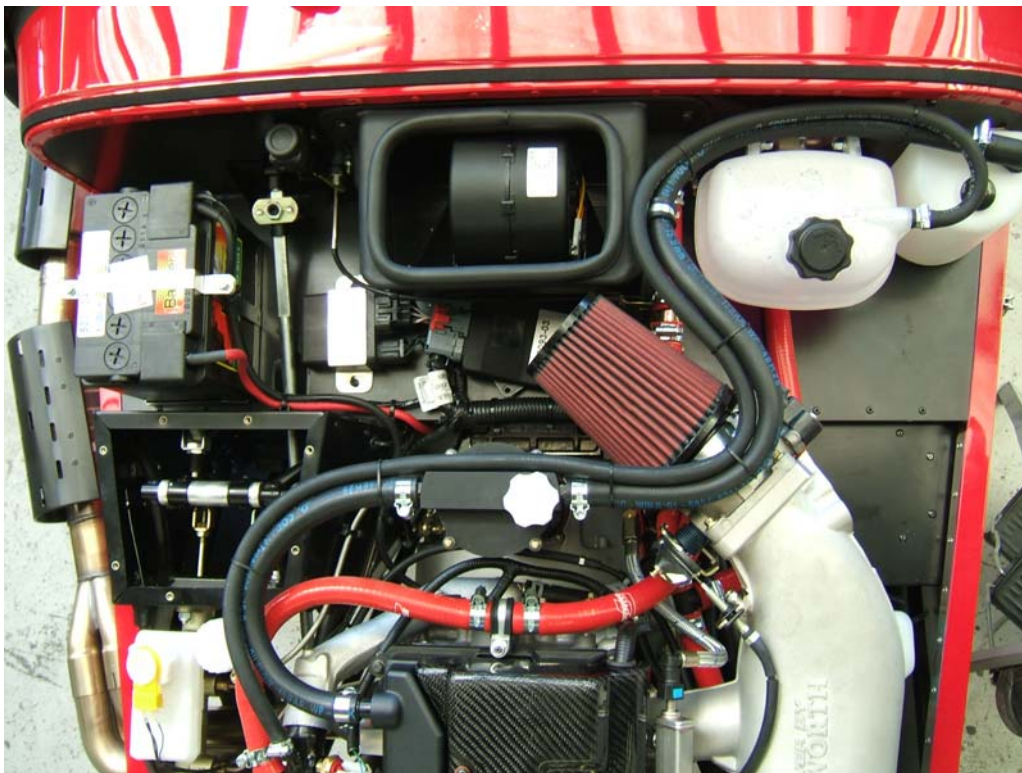


Figure 21 – 200 Spec layout details



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Breather system plumbing

Hose routing for breather system

Note: Ensure all hose used in this system is specified oil hose. It is of vital importance heater hose is not used as it is the same size. This can be differentiated by the markings "OILFLOW- 15 bar" on the correct oil hose.

The breather outlet from the camshaft cover must be routed to the right hand breather on the swirl tower. This is the right hand side of the car as if you are sitting in it. See figure 22 below.



Figure 22 - Cam cover to swirl tower breather system

The left hand breather on the swirl tower is then connected to a catch bottle, mounted on the scuttle. See figure 23.

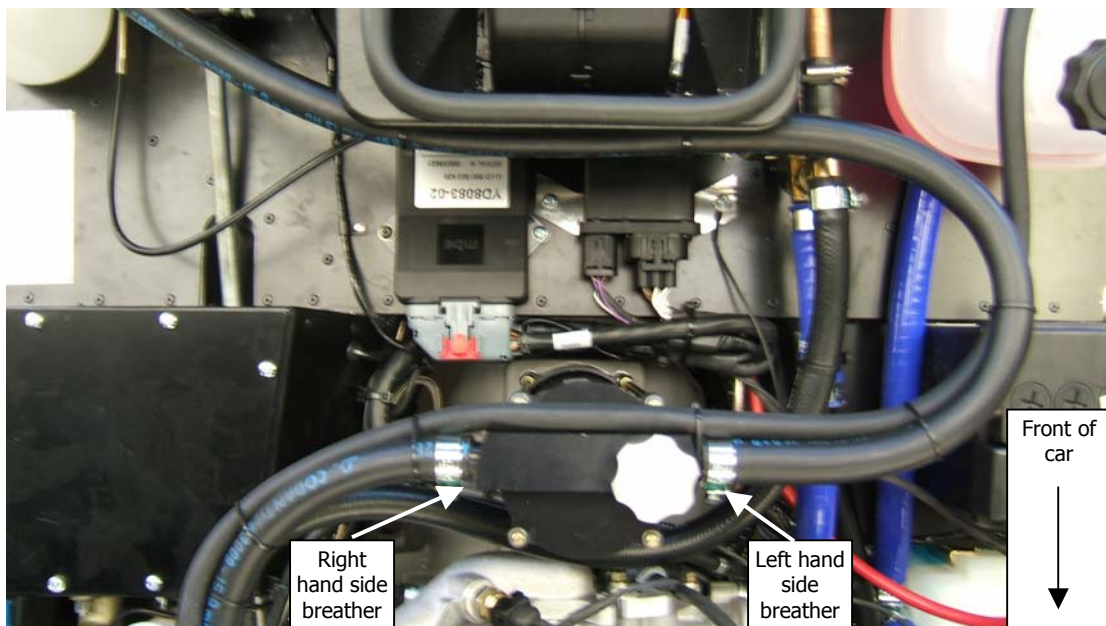


Figure 23 - Swirl tower to catch bottle breather system



Cooling

Radiator ducting

The radiator ducting consists of aluminium panels that are assembled with M5 pan head screws. Firstly assemble the cooling fans onto the support and then place it onto the back of the radiator. (Notice the riv-nuts in the fan support will line up with holes in the radiator brackets.)

Assemble the ducting using the same M5 pan head screws. It is recommended that all fixings are initially left loose and only tightened once all bolts are started. The left and right panels have a notch cut out along one edge, this is for clearance around the front anti-roll bar so ensure they are the correct way round. See figure 24 for orientation. The wider cross panel is positioned along the bottom edge. The narrow panel is located along the top edge. Once this ducting assembly is complete it is ready for the radiator and cooling fans to be positioned. Simply press the radiator into the ducting and align the riv-nuts in the fan support with the side ducting panels. Use six M6 x 20 bolts to secure all the panels to the radiator, now the complete assembly is ready to be attached to the chassis.



Figure 24 – Radiator ducting



Figure 25 – Exploded view of radiator ducting



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Figure 25 details how the complete ducting assembly bolts together and fits to the car.

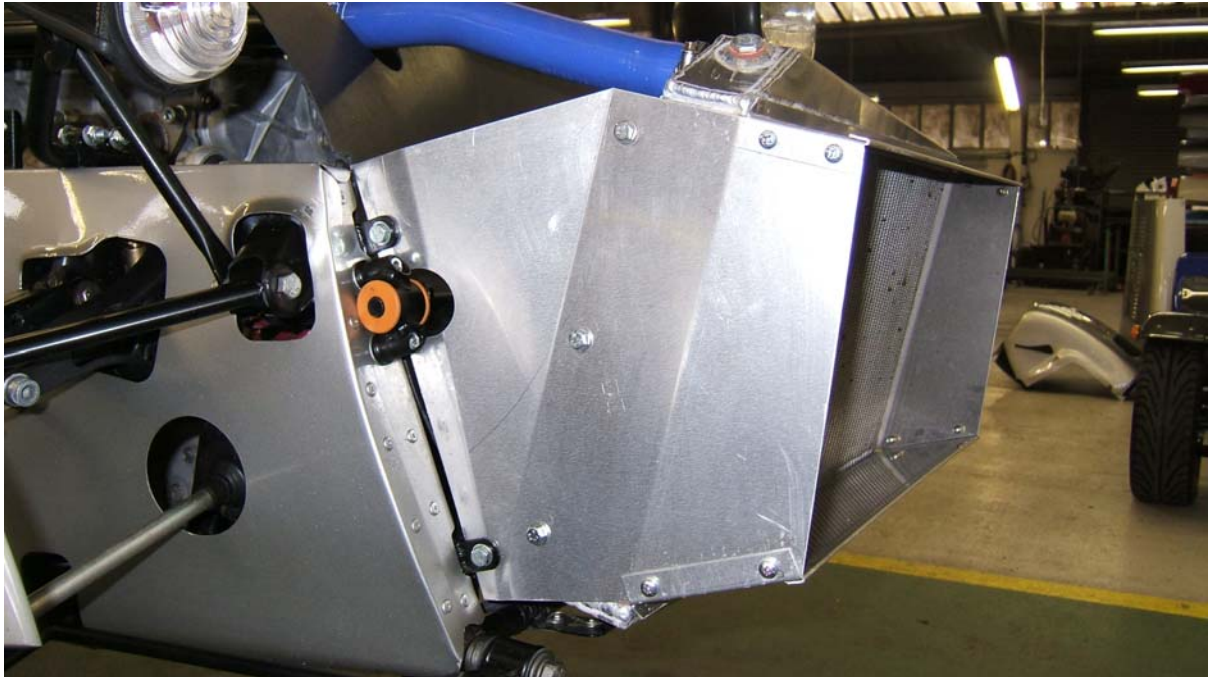


Figure 25 – Radiator ducting assembled on the car

Cooling plumbing

The cooling system consists of many jubilee clips to clamp hoses. It is recommended that all clips are tightened using a straight blade screwdriver or 7mm socket. For assembly with standard hoses it is wise to double check all hose clips once the engine is warm.

Bottom radiator hose

The bottom hose consists of three parts. See figure 26. Firstly the 'S' shaped hose is fastened to the bottom radiator outlet and routed under the steering rack to the submarine joiner. This part is a small length of aluminium tube with swaged ends and is used to join the two hoses together. The remaining hose must be fastened to the water pump inlet first and routed to join the submarine. It is necessary to trim this hose where it meets the submarine to the correct length. Finish this assembly by finally tightening all the jubilee clips.

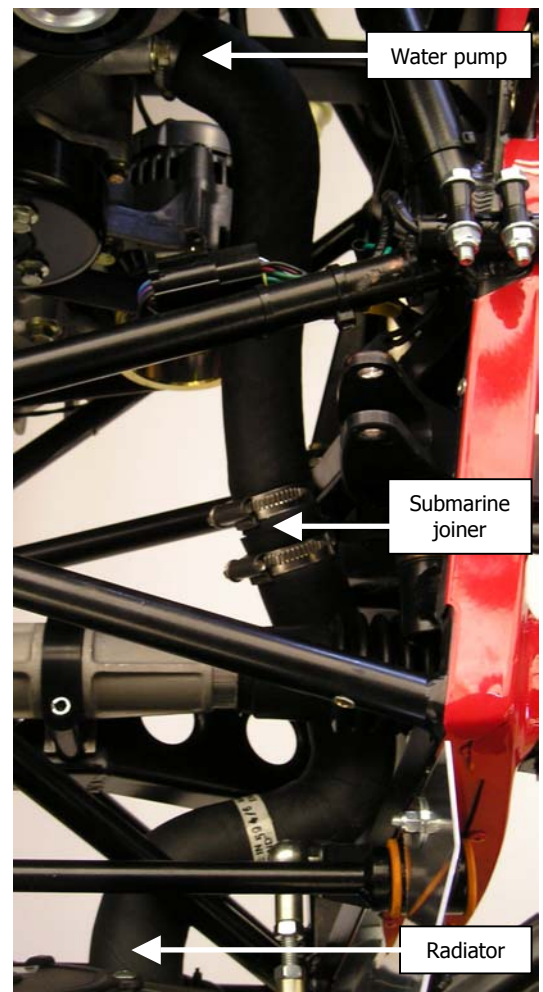


Figure 26 – Lower radiator hose



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Figure 27 – Top radiator hose

Top radiator hose and water rail

The water rail must be fitted with two 'O' rings positioned in the machined groves to provide a seal to the casting. Coat the water rail and seals in rubber lubricant before pushing it into the casting. This will help the seals stay in tact and produce a water tight joint. It is important the water rail is pushed fully home into the casting and supported with a 'P' clip that has a rubber insert. This is bolted to the head using a M10 bolt and a short aluminium spacer provided with the water rail.

It is recommended that the radiator exit ducting is fitted first because the top hose will pass through it. The top water hose must have the 90° corner removed before assembly. Cut the hose close to the corner and use the remaining section to join the water rail to the top radiator inlet. Finally to complete the assembly tighten both jubilee clips. Note, one is located the other side of the radiator exit ducting in figure 27.

Oil cooler circuit

The kit will be supplied with $\frac{5}{8}$ hose that has a moulded 90° corner on one end. This hose must run from the water pump, along the chassis rail, to the 'T' piece connector. See figure 28 and 29 below for clarification:



Figure 28 – Water circuit plumbing (water pump)

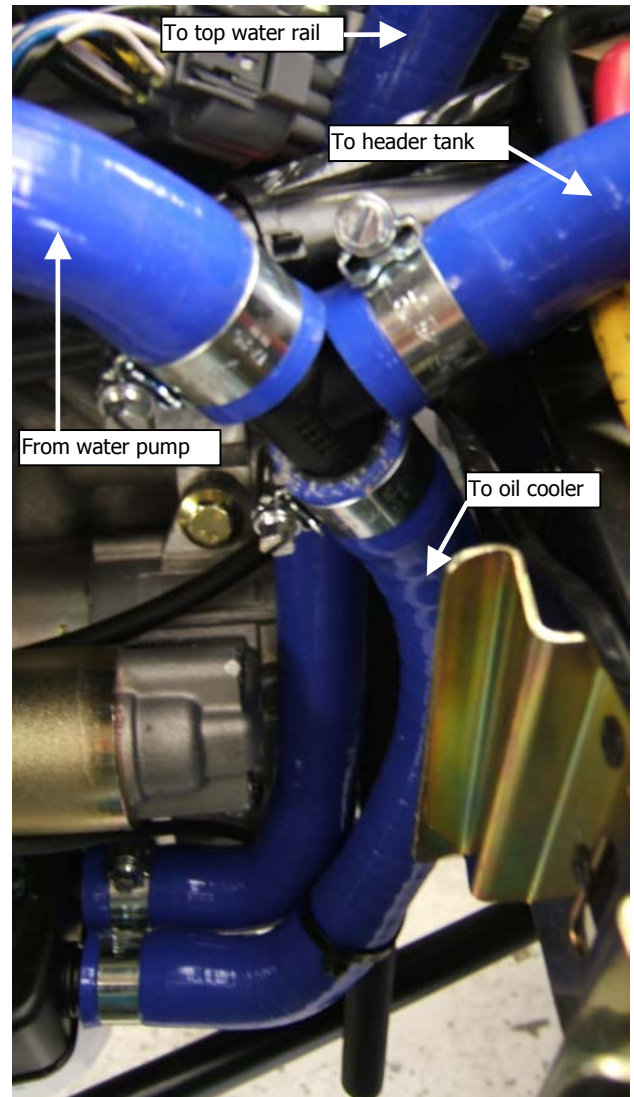


Figure 29 – Water circuit plumbing (T-piece connector and oil cooler)



Figure 30 – Water circuit plumbing (header tank)

The hose then continues on, again with another 90° bend on one end to meet the header tank positioned on the scuttle. See figure 30 for details:

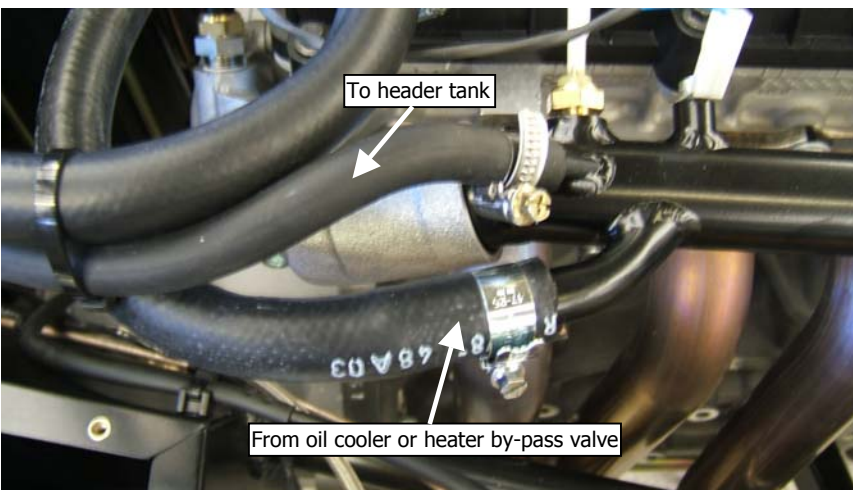


Figure 31 – Water circuit plumbing (top water rail)

The remaining outlet from the oil cooler is routed, again using another of the same moulded hose, and connected to the top of the water rail. It may be necessary to use the submarine joiner to extend this hose with plain $\frac{5}{8}$ heater hose in order to reach the top of the water rail. Note: if your car includes a heater option you must link this in to the cooling circuit. See instructions below.

The remaining hose on the water rail is a breather and must be routed back to the header tank.

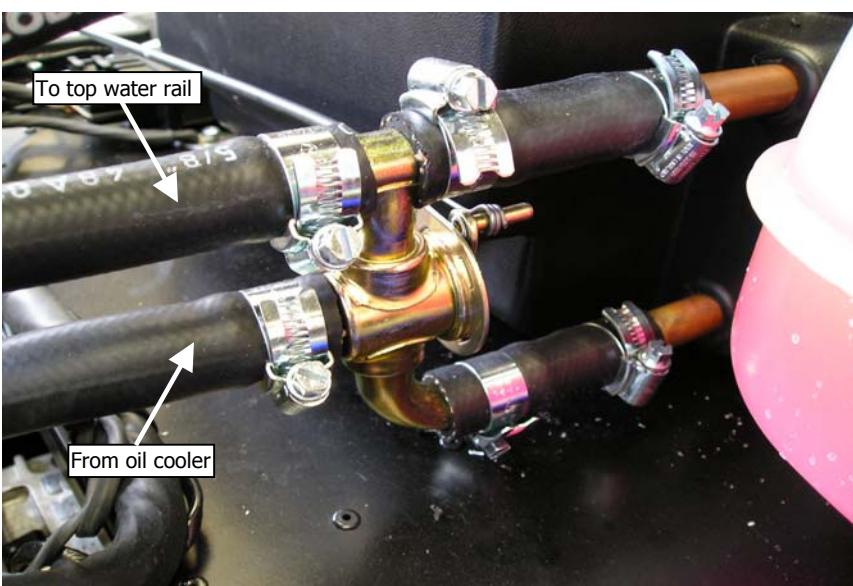


Figure 32 – Heater by-pass valve

Heater plumbing

If the car has the heater option, this must be plumbed into the water system. The circuit follows the same route as previously described with the exception that a control valve must be linked in series **between the oil cooler and top water rail**. The hose from the oil cooler outlet is fitted to the lower inlet on the heater by-pass valve. This valve will allow the water continual flow around the engine even when the heater is fully off. The outlet from the valve is then connected to the top of the water rail to complete the installation.



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Wiring Harness

The car and the engine will have individual looms fitted, which must be connected via a grey multi pin plug to complete the vehicle electrics. The connector, shown below, is a large multi-pin grey plug which will only fit together one way. See figure 33.



Figure 33 – Grey multi pin plug to connect the vehicle and engine harness together

Oil temp

The oil temperature loom is actually branched out of the vehicle loom. Near the main multi-pin grey connector should be a branch out from the main loom with two spade connectors crimped on the end. The oil temperature sensor is fitted on the left hand side of the bell housing. It will come screwed into the black blanking plug ready for connection. For a gauge dashboard simply push the connector with the black and yellow tracer wire onto the sensor and leave the remaining black wire taped neatly out the way. For a stack display dashboard connect both wires, polarity is not important.



Figure 34 – Oil temperature sender



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Water temp

The water temperature sensor is fitted into the top water rail. The wiring for this sensor is branched out from the engine loom as shown in figure 35 below. There is a small spade connector that must be screwed into the water rail to complete the earth connection. For a gauge dashboard connect the grey with red tracer wire to the sensor and earth the blue wire to the boss positioned next to it on the water rail. See the photograph to clarification. For a stack display dashboard simply connect both wires to the sensor, polarity is not important.

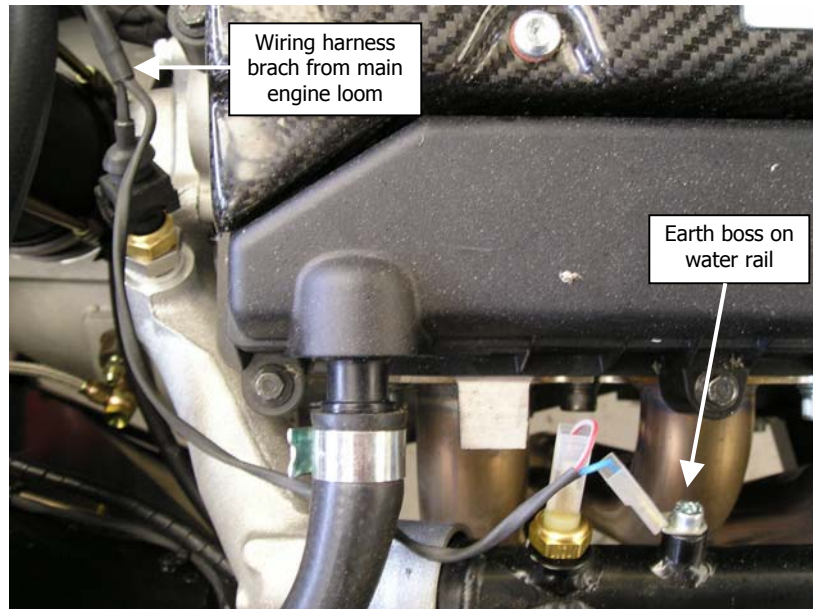


Figure 35 – Water temperature sender

Radiator fans

The radiator fans are connected to the main engine loom. The branch for the fans comes out of the main loom near the alternator and should be plenty long enough to be neatly routed to the radiator. Route the loom along chassis members ensuring it does not rub against any moving parts. The connectors plug straight into the fans. It is not important which fan is connected to each connector as they are set up to start simultaneously. See figure 36 for details.



Figure 36 – Radiator fan connections



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Main power

The main power plug is positioned in the engine loom near the starter motor. This needs to be connected to the vehicle loom via the main purple wire that is branched out near the grey multi-pin plug. Some looms are supplied with a male and female spade connection and others have a round moulded plastic plug. See figure 37 and 38 below for clarification.

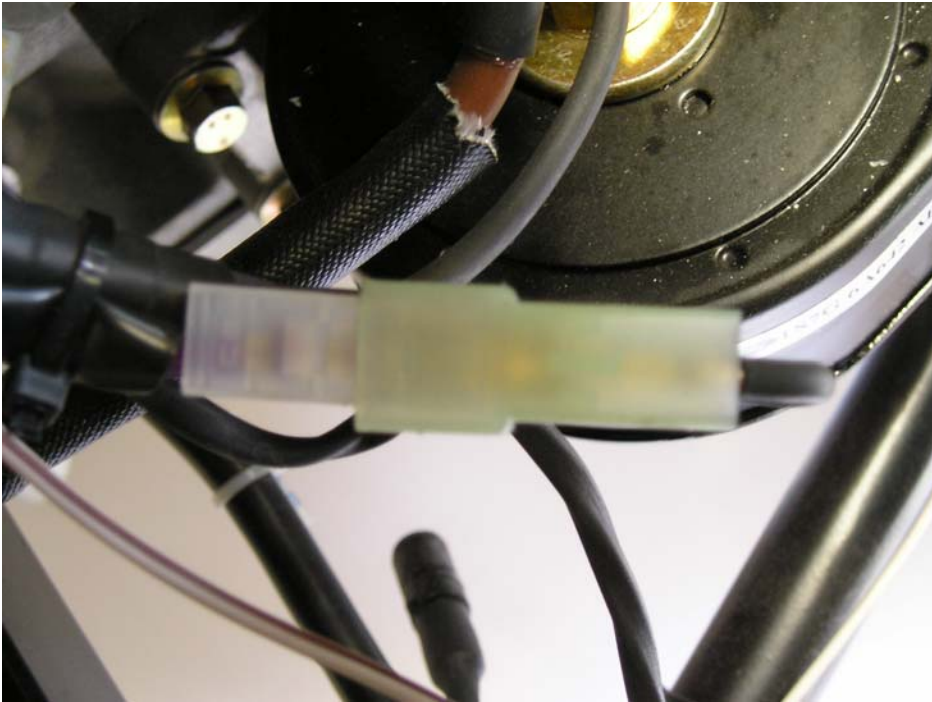


Figure 37 – Spade connection plug



Figure 38 – Vehicle loom moulded plug



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Interior

Stalk assembly

The kit will be supplied with the stalks in position, however, in order to fit the top section of the steering column it is necessary to remove the them. For details on fitting the steering column refer to the main assembly guide.

Once the column has been fitted re-assemble the stalks. Attach the main body to the two tags welded to the steering column support. Use a small aluminium spacer between these tags and the main body to obtain the correct position. See figure 39 and 40 for clarification.

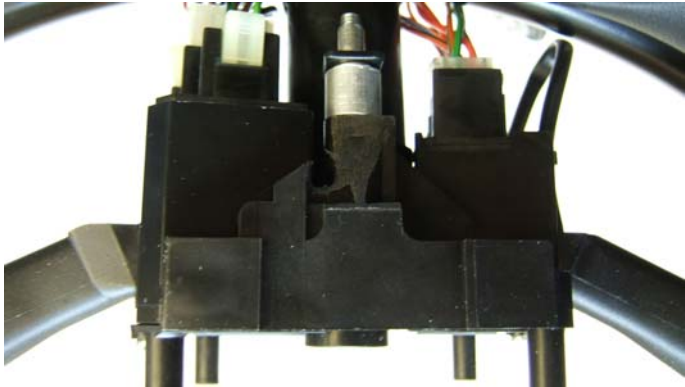


Figure 39 – Top view of main switch body

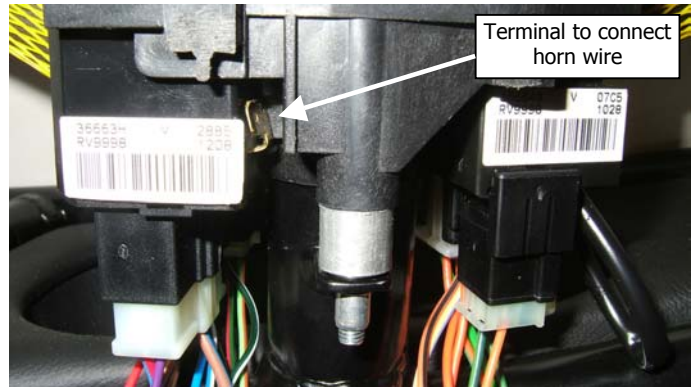


Figure 40 – Lower view of main switch body

Fitting the horn

Firstly, the horn ring and contact pin must be in position. The horn contact pin will be supplied with a plastic holder. Thread the wire through the holder and push the two parts together. This assembly is then fitted to the main stalk body. It is located in the lower fixing hole, with the wire pushed through the plastic moulding down the side of the hole. See figure 41 and 42 for details.

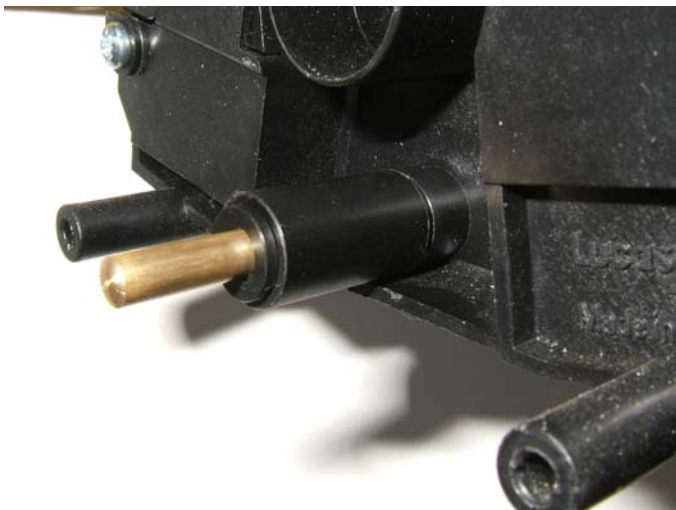


Figure 41 – Horn contact pin



Figure 42 – Wire position for contact pin

This wire must now have a female spade terminal crimped onto the end, ready for fitment to the wiring loom. This spade connector pushes onto the terminal located on the lower side of the main stalk body. See figure 39.



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Fitting steering wheel and boss and horn ring

Note: before continuing ensure the steering assembly is complete and the wheels are pointing straight ahead in order to align the steering wheel.

Firstly, attach the horn ring to the steering wheel boss. The horn ring wire being located through the hole in the back of the boss governs the position. Push the two parts together and use two self taper screws through the boss and into the horn ring to hold them together. See figure 43.

The assembly can now be positioned on the column such that the indicator cancelling pin (white) is in line with the pin in the main switch body. This is approximately at 9 o'clock. To complete the assembly tighten the steering wheel nut and ensure that the horn contact pin is touching the horn ring by adjusting the position of the top section of the steering column.



Figure 43 – Horn ring and steering wheel

Fitting stalks cover

To fit the cover push both parts over the main switch body and align the four holes. Use four self taper screws to secure the cover to the switch body. Use the small domed cap head bolts on both sides to secure the top and bottom half of the cover together. See figure 44



Figure 44 – Stalks cover

Fitting the steering wheel and horn button

Firstly, push the rubber steering boss cover over the boss. Align the steering wheel and horn button support with the boss and use the counter sunk bolts supplied to attach the wheel. The horn button is wired up by connecting the feed wire from the horn ring to the centre terminal. The other terminal is connected to earth (terminal on the horn button support). See figure 45 for details.



Figure 45 – Horn button