



We Are Engineers: Chesswood Festival of Speed



Goblin Car Instruction Manual



Team number: _____

Names:



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Tools you will need:

- Allen key selection. A 'T' bar type 4mm key is recommended for the chassis screws
- Battery powered drill with drill bit selection (3mm and 6mm required)
- Screwdriver selection
- Assorted Metric spanners – 8mm, 10mm, 13mm and 19mm in particular
- A small adjustable spanner may be useful!
- Pliers
- Small Hammer
- Electrical sticky tape and cable ties
- Fine flat file
- Fine 'wet and dry' abrasive paper (800-1000 grade)
- Masking Tape
- Electrical Insulating Tape
- *Recommended* - Light oil such as 3-in-1
- *Recommended* – Thread Locking Compound such as Loctite Threadlock

Safety First

Always wear goggles when drilling or using other hand tools. Keep long hair tied back.



1: Chassis Team

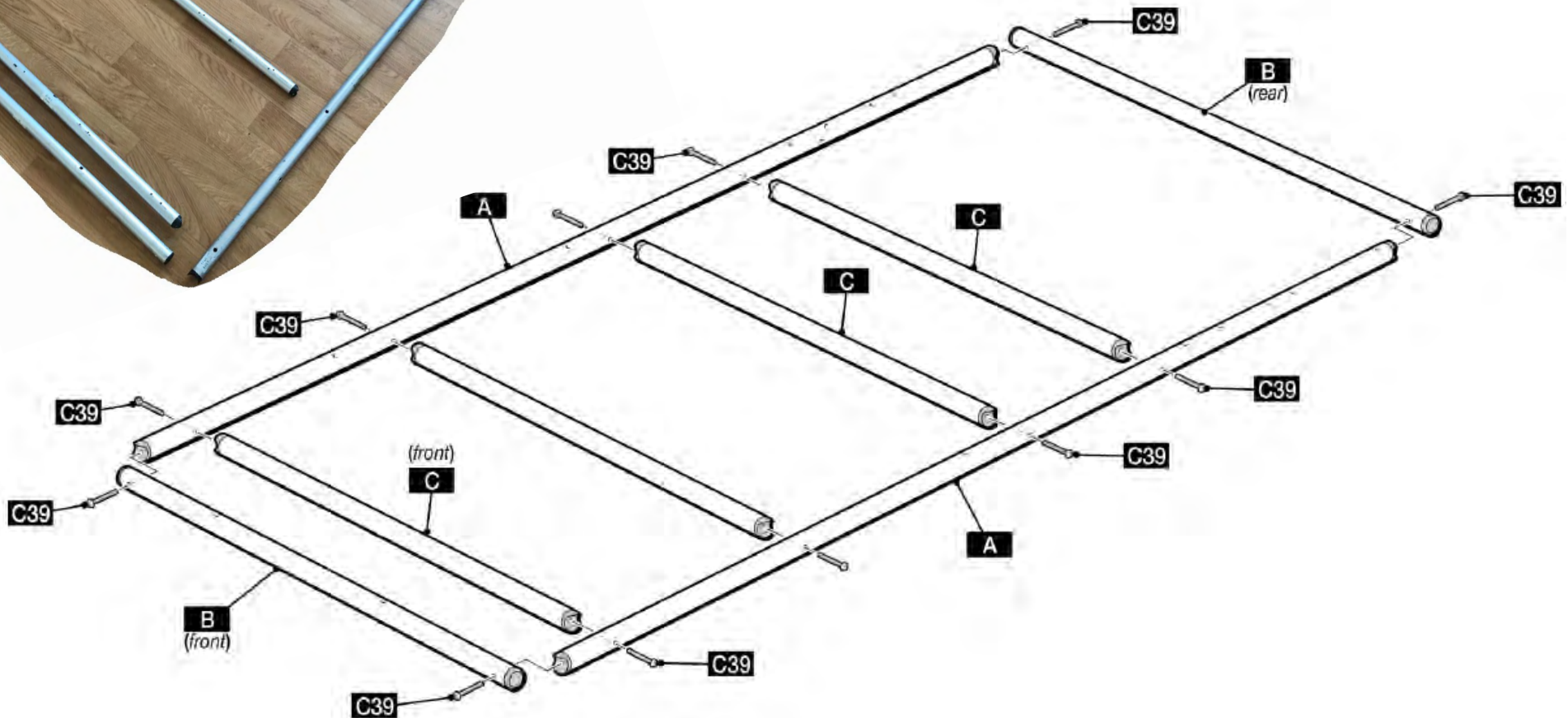
- Start with the bottom frame of the chassis. Lay the two tube marks A on the floor (they are left and right handed so be careful here) and place the B and C tubes in place, make sure the C tube with a hole through it is placed at the front.
- Before screwing any on you can slide two of the C33 bracket (for the seatbelt) on to the A tubes between where the rear two C tubes will be (one on each A tube) and two onto the rear C tube. This is easier than forcing them on later!
- Now you can start inserting chassis screws, starting with the B tubes, followed by the C tubes. You may gently tighten them with an Allen key, careful not to tighten them right up at this point.
- Then lay out the top frame. The D tubes are left and right handed again. Make sure you have the GA tubes have the holes on the left hand side and the GB tube holes need to be on the right hand side. **Make sure the D tubes are the right way up, the 6th hole from the back should slant backwards for the roll bar to fit to later!** Add on the E tube too, with the holes facing upwards. Again screw in the chassis screws in loosely for now.
- Take the bottom frame, and fit the F tubes so they are on top of it, and all pointing inwards. **Don't tighten them up quite yet!**
- Now put the top frame on top of the F tubes, and put the rest of the screws in. Add in the front J tubes.
- With the H tubes loosely in position you can start to tighten the screws on your chassis. **Don't tighten up any tubes with extra holes in too much; you want to be able to twist them to make lining things up later much easier!**

Handy tip

- Once the chassis is together it may be much easier for it to be placed on some chairs, having it in the air will be much easier to work on and add parts to.

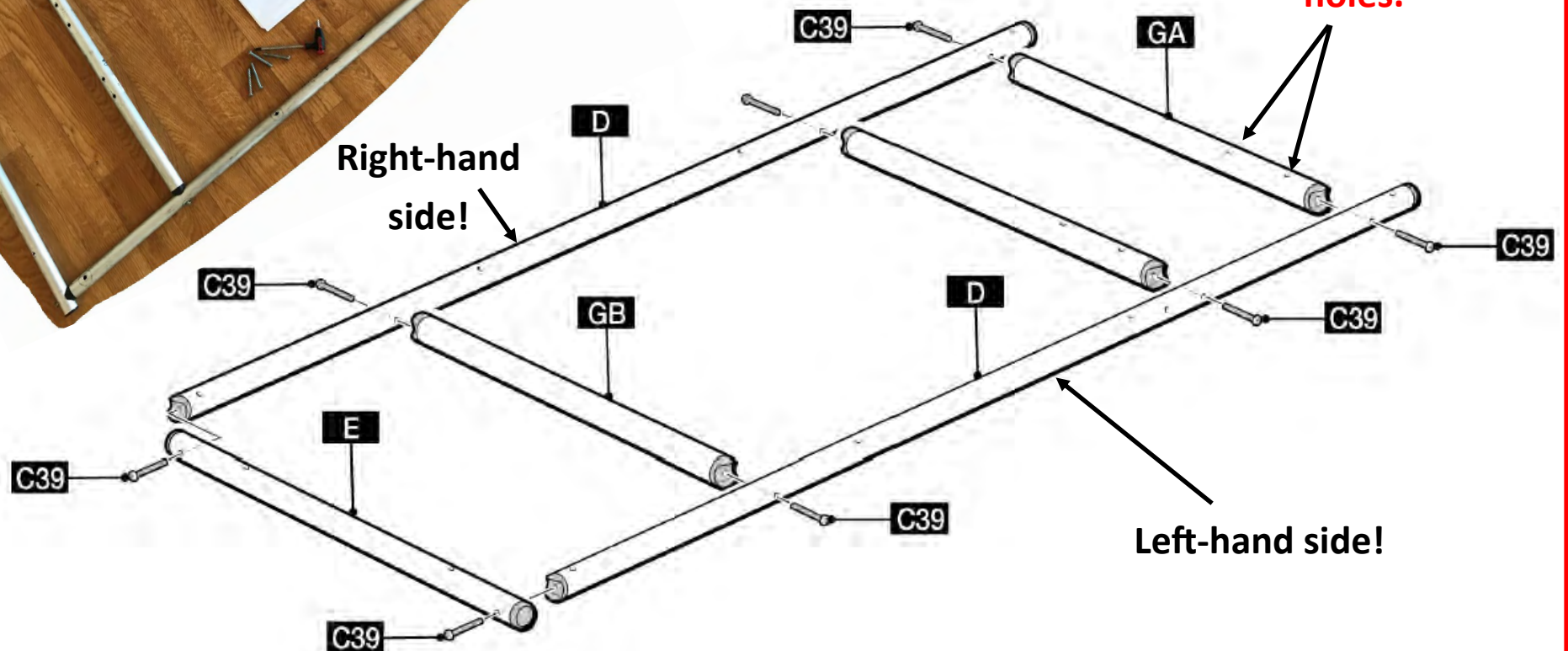
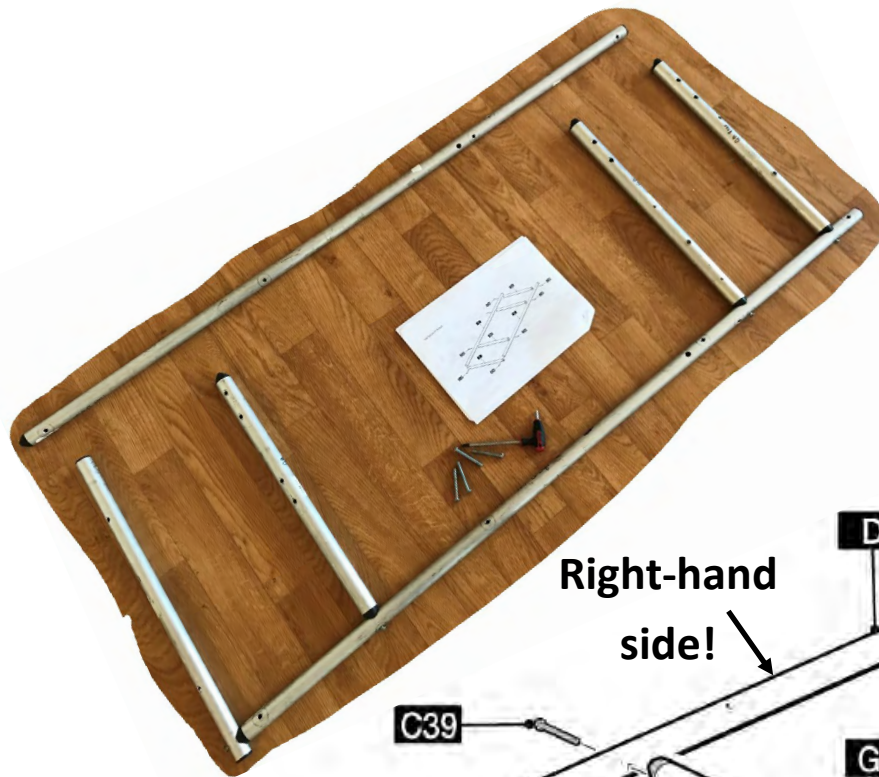
1: Chassis Team

Bottom frame of chassis



1: Chassis Team

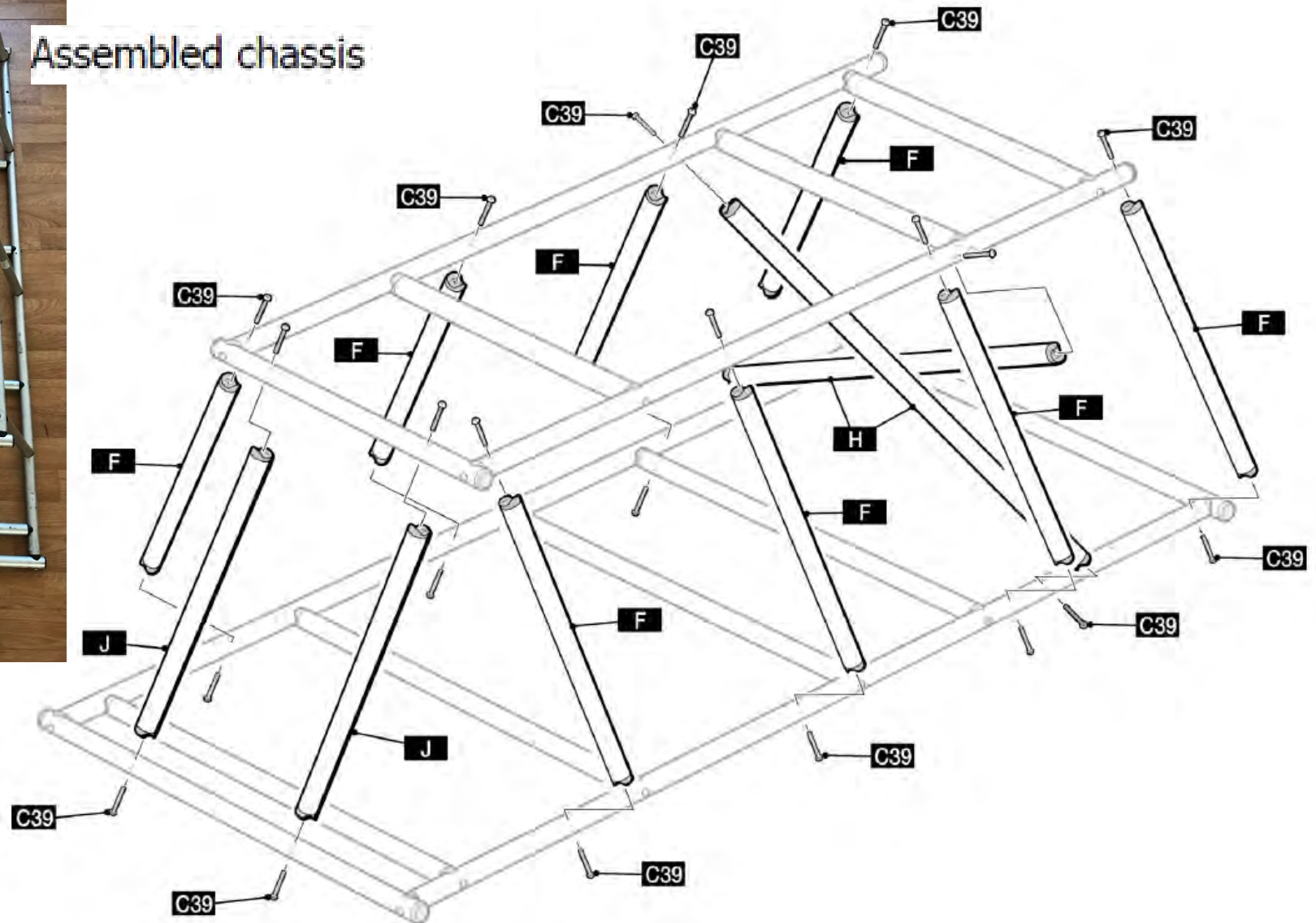
Top frame of chassis



1: Chassis Team



Assembled chassis





1: Chassis Team



To tighten the chassis screws, start by hand screwing them in place. Once it is partly screwed in, use the Allen Key tool to screw it in completely. Ensure it is tightly secured.

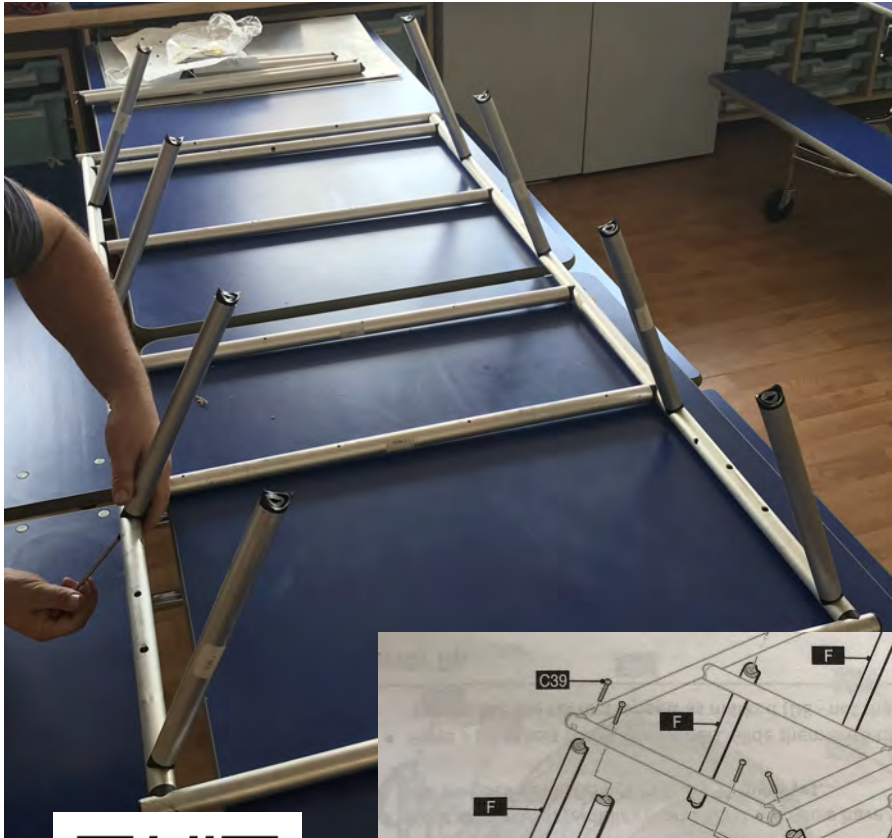


Watch the video to see the Allen key in motion.

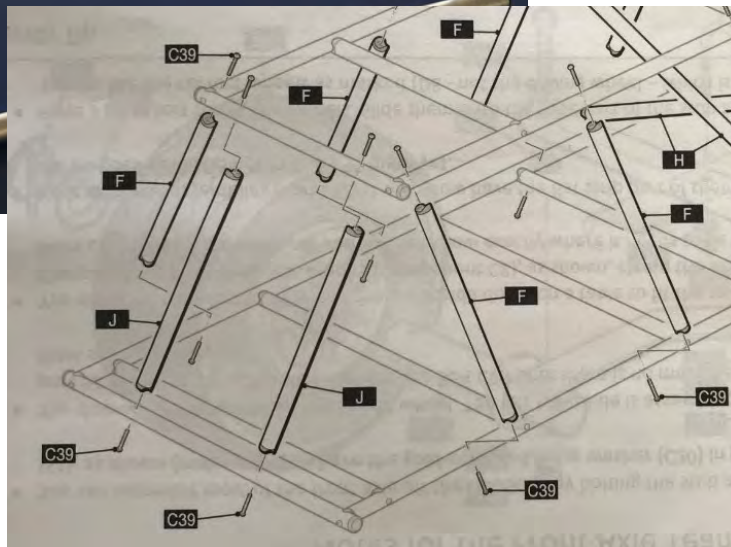




1: Chassis Team



Watch the video to see
the F poles being joined to
the A poles.





2: Front Axle Team

- You can assemble most of the front axle off the car. Start by bolting the stub axles (Part S2) to the square axle tube (S1), as shown (**make sure you have the gold-coloured brass washer (C20) in place**).
- The diagram shows the front right hand wheel. The left hand side is assembled in the same way, but does have a part S2 to mirror the other side. Tighten the Bolt C29 until there is no movement up and down, but it can still turn from side to side easily.
- You may find it easiest to have the chassis upside down on a table to fit the axle or to hang the parts from the Chassis (if it is on chairs). The u-bolts (Component C8), as shown, clamp the axle to the A tubes. Only tighten the U-bolts up gently to start with, as you will not know exactly where it needs to be finally positioned yet.
- Your stub axle assemblies (Parts S2) should now have the flat strip part of them pointing towards the rear of the car on both sides. Do not fit Parts S5 quite yet...
- Have a go at test fitting the wheels. Slide them onto the tube part of the stub axle and follow with C23/C30. Be sure to use the correct wheels as marked (D8 - not the driving wheel – which is different from the other three!)

Handy Tip

When you come to finally fit your wheels, put a small amount of oil inside the centre of the wheel to lubricate the bearings. **You will go much faster!!** You can also smear a little oil on the joints between S1, C20 and S2.

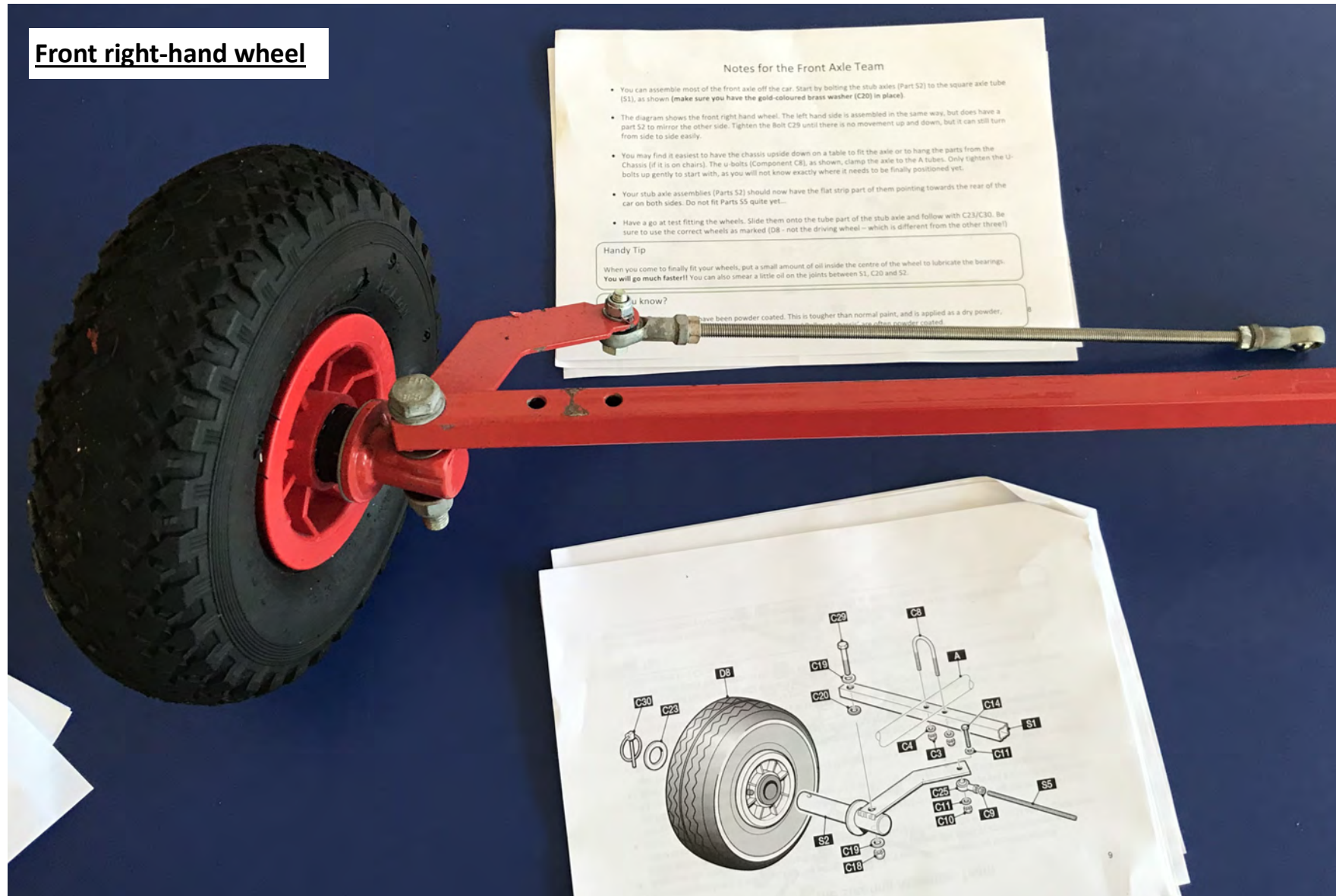
Did you know?

The axle parts of the Goblin have been powder coated. This is tougher than normal paint, and is applied as a dry powder, before being baked in a special oven. Motorbike frames and Rally car chassis' are often powder coated.



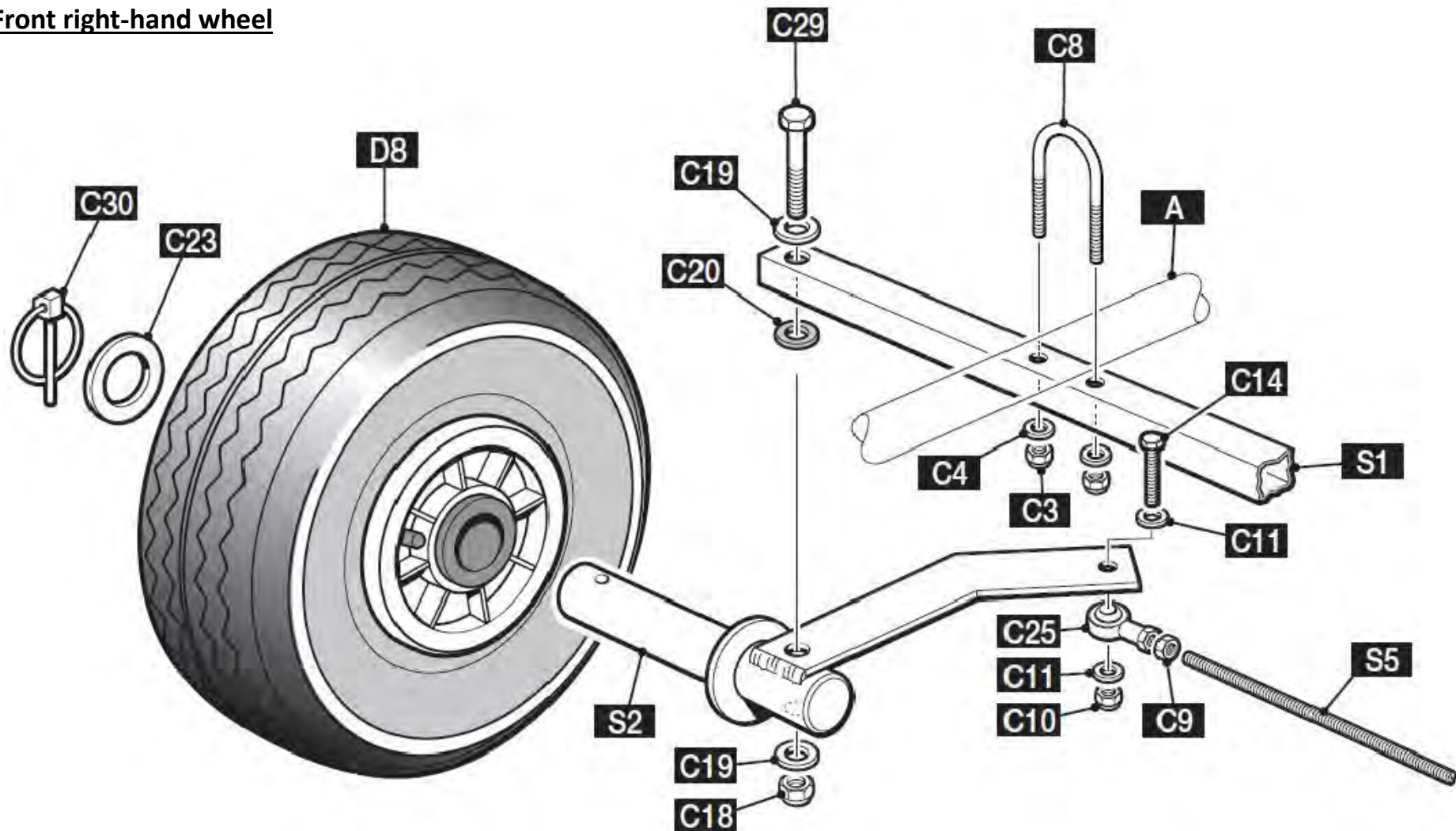
2: Front Axle Team

Front right-hand wheel

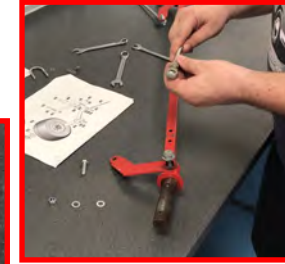
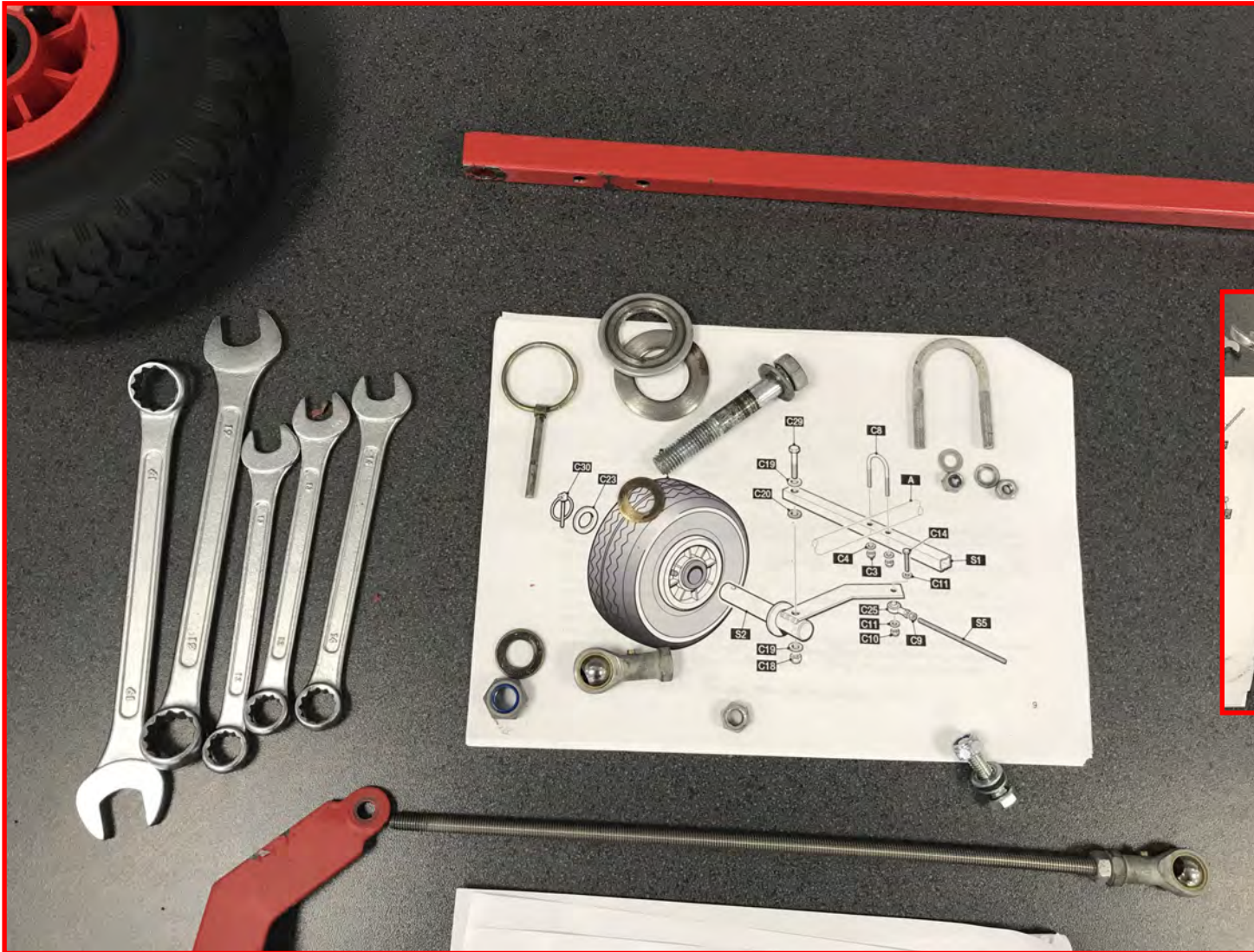


2: Front Axle Team

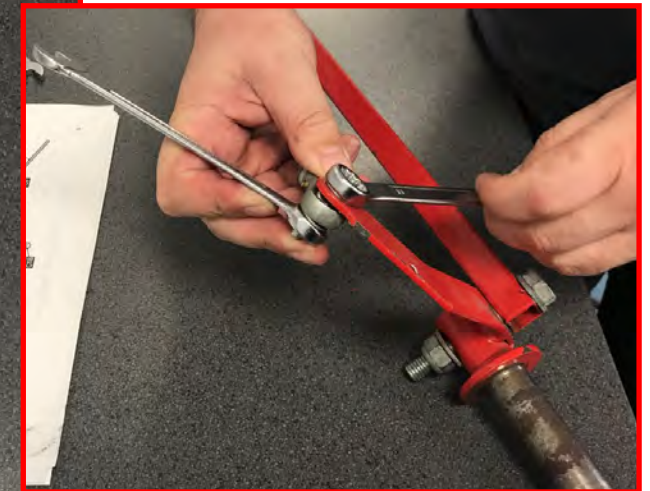
Front right-hand wheel



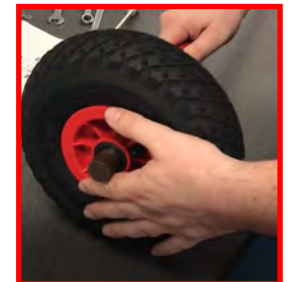
2: Front Axle Team



Watch the video to see the construction of the front axle.



**Watch the video
to see the wheel
being put on.**





2: Rear Axle Team

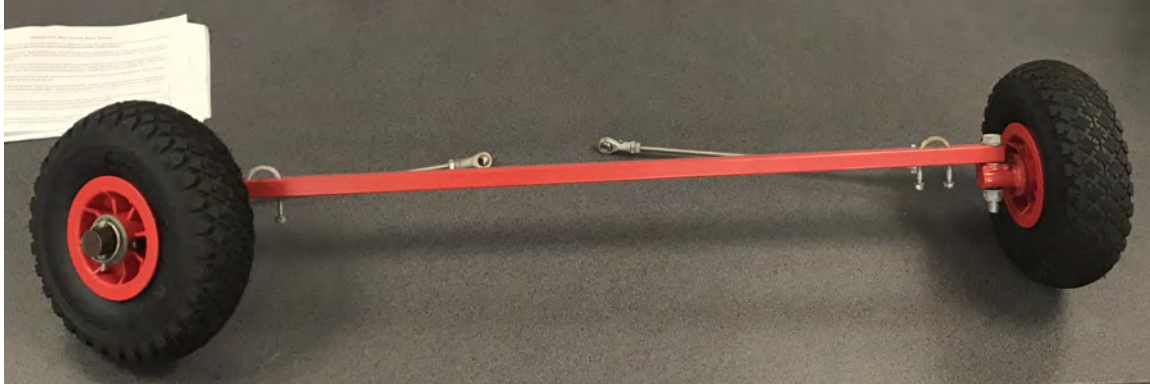
- The rear axle on the Goblin is quite a long job to assemble, and it is important that it is correct, as everything must be aligned for the car to work at its best. Most of the axle can be assembled off the car. **It is a good idea to use a thread-locking compound such as 'Loctite Threadlock' on components like C1, C22 and C36.**
- The right hand side has a wheel the same as the front wheels (D8). The axle on this side has two small holes towards the end.
- Slide A7 on to the axle until it lines up with the inner most hole. Tap a roll pin (C24) through the holes, you could line them up with a small drill bit or similar, also try using something steady to hold the axle whilst you do so, a vice would be ideal, but even leaning on some wood would work to support it whilst you tap the pin in!
- Now attach the brake disc (A6) to A7 using the C1 screws, doing this after tapping the roll pin in will prevent you damaging the break disk! The disc will have a directional arrow, so make sure it is facing the right way, remember it will be turning with the wheels.
- Slide on the centre part of the bearing (D6). Don't tighten its small grubscrews (C36) onto the axle just yet.
- Tap another C24 pin through the outermost hole in the axle, until it protrudes an equal amount from both sides. Again try and support the axle whilst you do this.

Did you know?

The rear axle was made using solid Aluminium and has been shaped by a **Computer Aided Manufacturing (CAM or CNC)** machine which is programmed by a person on a computer to create a more accurate product, but within a shorter space of time than it would possible to, by hand.

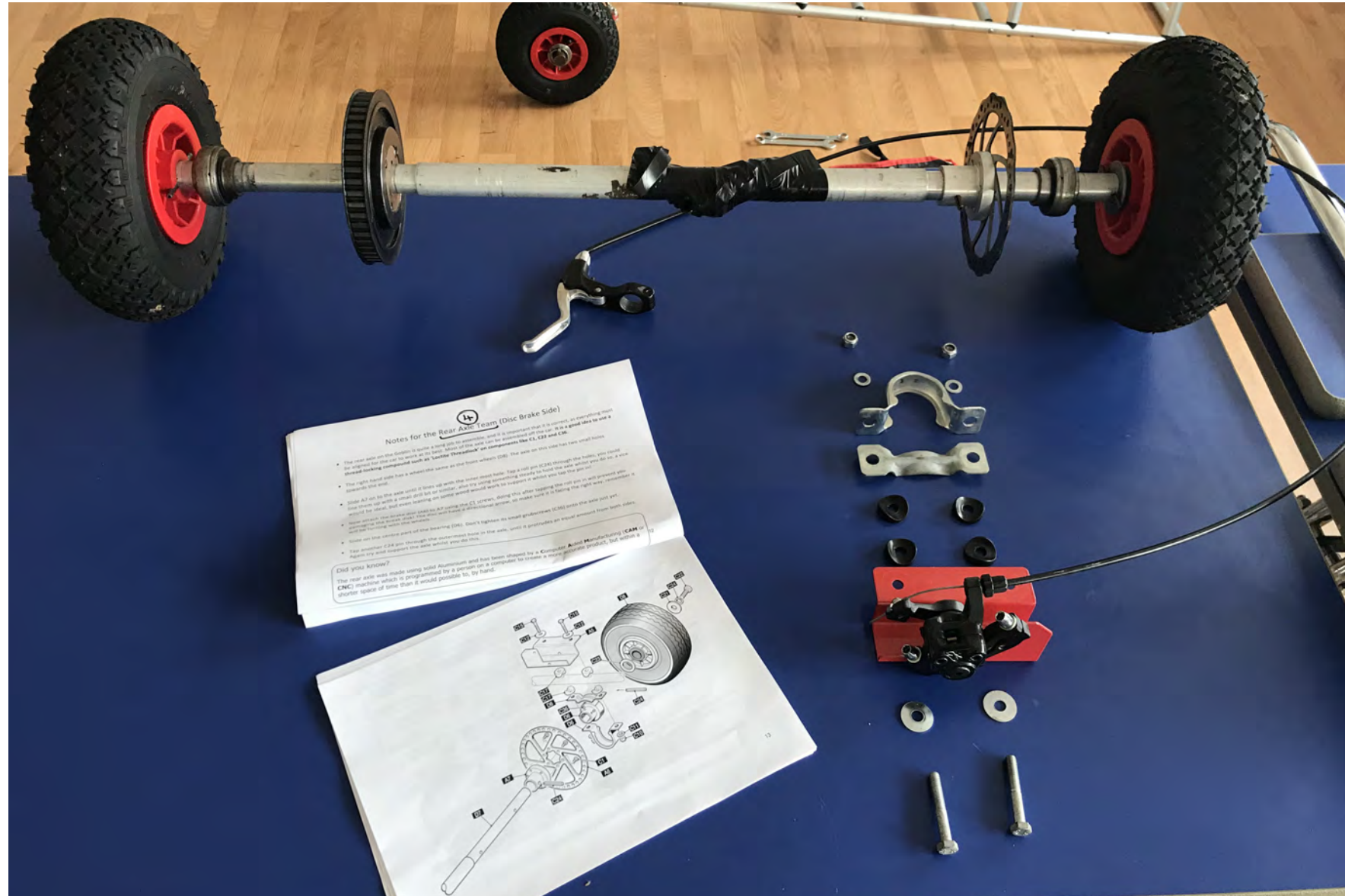


2: Rear Axle Team





2: Rear Axle Team

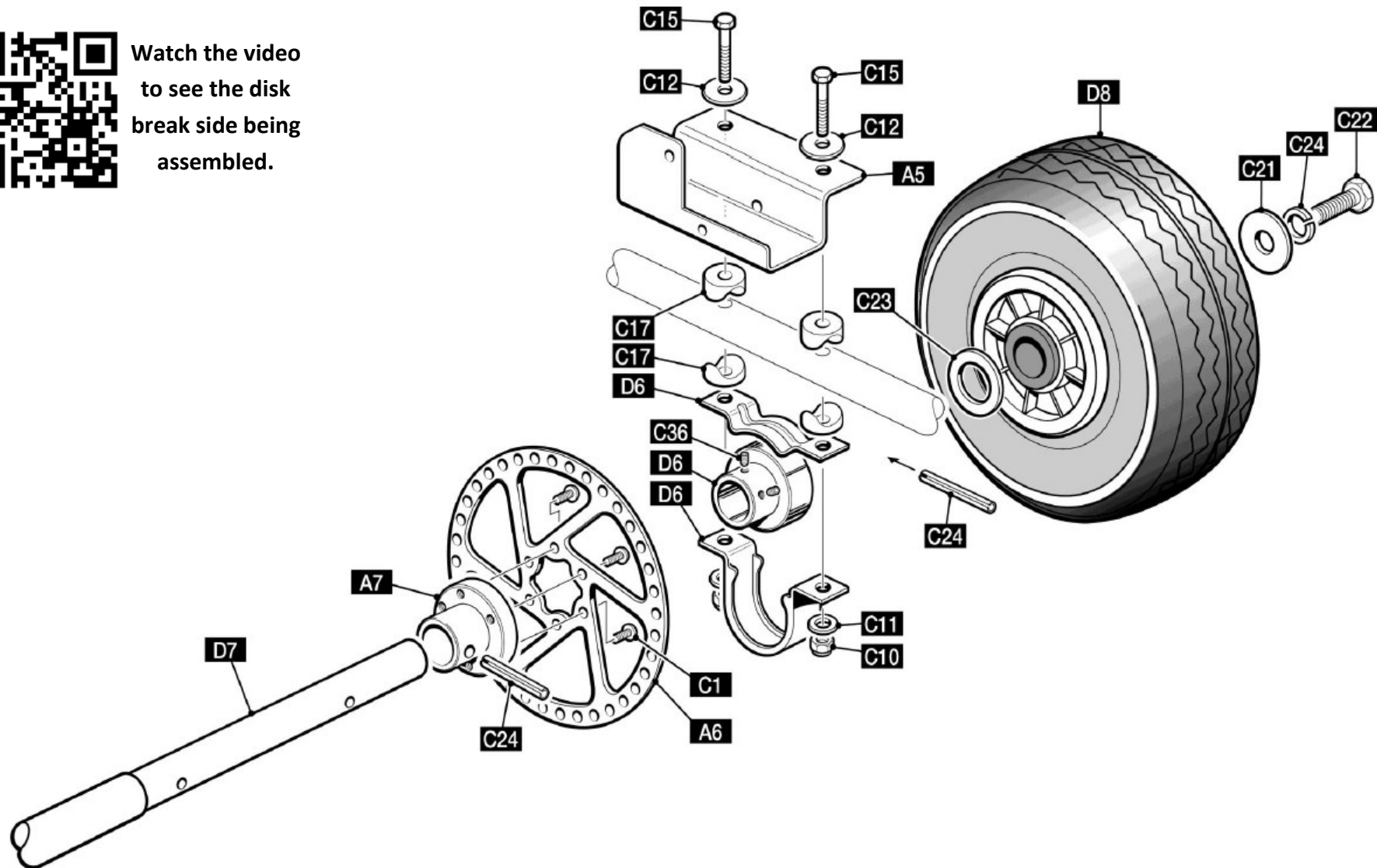




2: Rear Axle Team— Disc Brake Side



Watch the video
to see the disk
break side being
assembled.





2: Rear Axle Assembly Team—Disc Brake Side

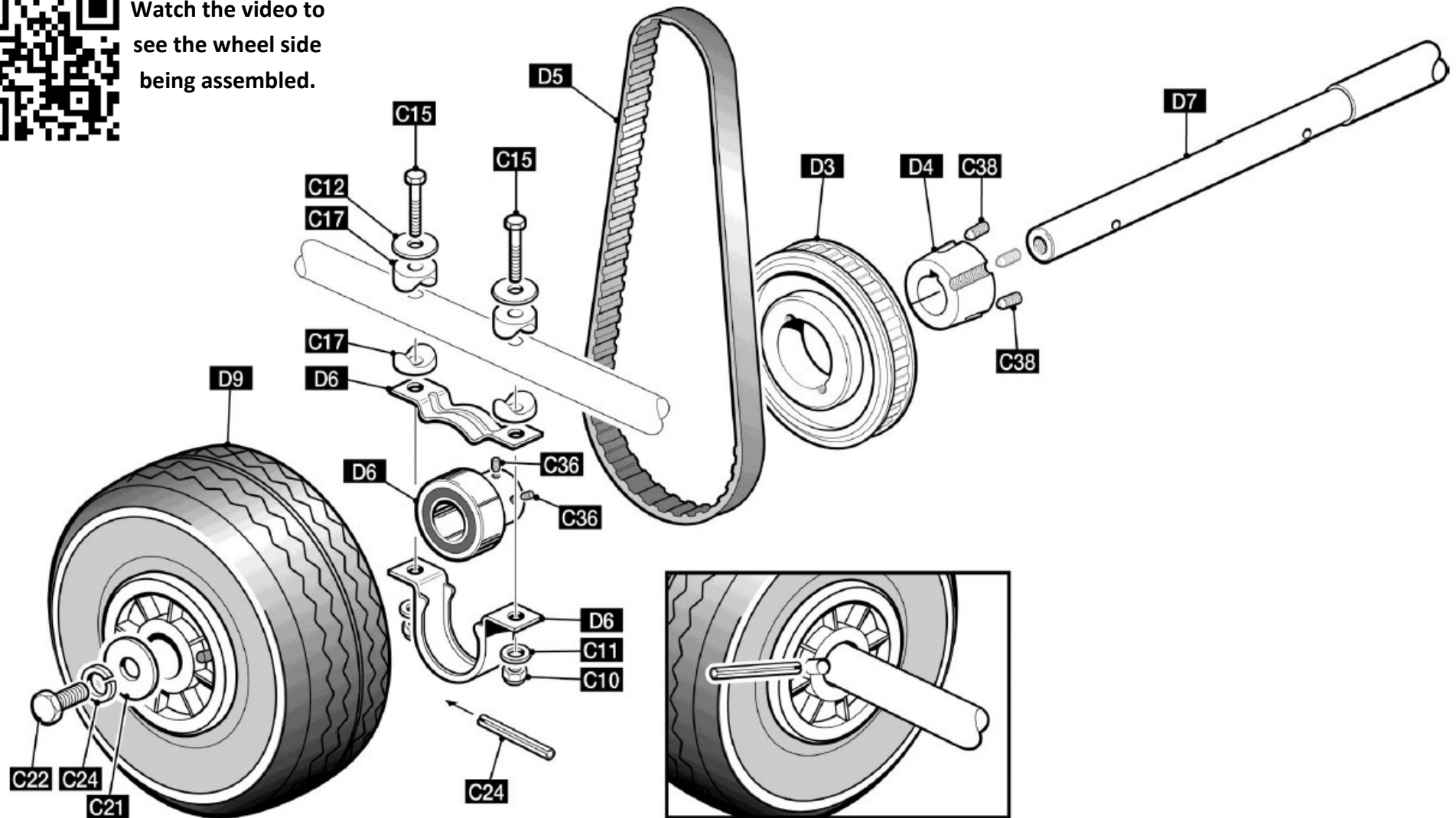




2: Rear Axle Team (Driven Pulley & Wheel Side)



Watch the video to
see the wheel side
being assembled.





2: Rear Axle Team (Driven Pulley & Wheel Side)

- As you will now have the disc of the disc brake on the axle, take care not to put much weight on the axle or you may bend the disc slightly.
- Working from the other end of the axle, slide on the taper lock bush (D4), with the smaller diameter end of the taper facing outwards. Very loosely place the large pulley (D3) over D4. The two 'half-holes' that are not threaded on D4 should correspond with the two threaded holes in D3. Loosely insert the grubscrews (C38) into the corresponding holes.
- Now make sure you put the drive belt (D5) around the axle as you will not get it on once the axle is fitted! It is always a good idea to pop a spare one on there too; you can tape it to the axle in between components so it is a ready spare!
- Slide on the bearing D6, exactly how you did it on the Disc Brake Side.
- Tap a roll-pin, C24, through the outer hole in the axle until it protrudes an equal amount each side. **This pin locates in the slot in your drive wheel (D9), and transmits the drive from the axle to the wheel.**

Handy Tip!

To loosen the taper lock bush, D4, remove the two grubscrews C38, and tighten one of them into the third hole (the threaded hole in the taper lock bush D4). This pushes off the pulley and should allow you to move D4.

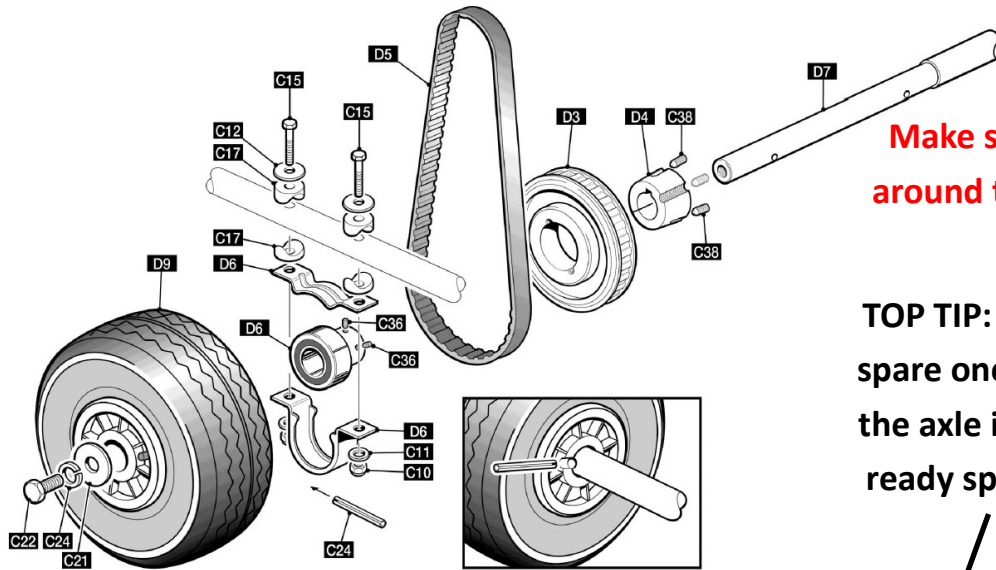
Did you know?

Changing the D3 pulley for a larger pulley (with more teeth) would 'gear' your car down, and make it slower. A smaller pulley would make it go faster – just like the sprockets on a bicycle, or the gears in a car gearbox.

Remember though that changing any mechanical parts on the Goblin is banned!



2: Rear Axle Team (Driven Pulley & Wheel Side)



Make sure you put the drive belt (D5) around the axle as you will not get it on once the axle is fitted!

TOP TIP: It is always a good idea to pop a spare one on there too; you can tape it to the axle in between components so it is a ready spare if yours breaks during a race on race day!





2: Rear Axle Team (Fitting to Chassis)

- The brake calliper (A4) comes as two parts and will need to be fitted together as shown, using the screws also found in the same packet. Fit the completed brake calliper to its bracket (A5) exactly as shown in the drawing. The C5 front screw is best tightened through the hole in the opposite side of the bracket, and must be tightened now.
- Start on the drive (large pulley) side, pushing the C15 bolts through the chassis from the top, with components C12 and C17 in place. Place the flat part of the bearing (D6) housing onto the bolts. Then place the centre part of the bearing onto this (on the axle), and clamp in place with the final part of the bearing housing and then C11 and C10 underneath loosely – **do not tighten these yet.**
- Repeat on the disc brake side, ensuring that the brake caliper and bracket are fitted as shown; above the chassis tube A. **Locate the disc brake on the axle between the brake pads in the caliper. The bearings might need moving to be tightened in the correct position.**
- Now tighten up the bearing clamping bolts (C15). Move the axle side to the side gently until it is perfectly aligned in the centre of the brake caliper (A4). **Finally, tighten the bearing grubscrews (C36).**
- You can now fit the wheels as shown. Make sure the drive wheel (D9) has the slot in it **properly located** on the roll pin (C24) at this end of the axle, and you use the spring washer (C43). At the other end, **make sure you have a washer (C23)** between the roll pin and the wheel (D8) – this wheel must be free to rotate. Ensure that the screws C22 are tightened properly – you don't want the wheels falling off!

Handy Tips!

A race can be won or lost on the extra friction caused by a rubbing disc brake – spend time aligning it carefully!



3: Steering Team

- The steering column is also your steering wheel, and transfers your arm movement to the front wheels.
- Assemble the small components onto the front C tube as shown. Tighten the nut (C9) against the large washer (C12). Screw the whole steering column onto this bolt (C16), until it is close to the washer (C11) allowing not much more than 90 degrees movement left or right.
- Fit the plastic (nylon) column support block (S3) exactly as the diagram shows. If the steering column angle is not correct, carefully twist the front C tube using **both hands** until correct. You might like to put a drop of oil inside the plastic block. The steering should be smooth with no play in it. Tightening or loosening the mounting bolts on Part S3 can alter the resistance.
- Now you can take the two S5 parts – the steering linkages, screw a nut (C9) on both ends and then wind on the rod end bearings (part C25) to each end.
- Make sure the steering 'wheel' is in the central position, and both front wheels are pointing straight ahead. If they are not, adjustments can be made by winding the connecting rods S5, into or out of Parts C25. **However, at least 10mm of S5 must be inside Parts C25.**
- When satisfied, tighten up the fixing bolts at both ends of the steering rods, and the back nuts (C9).
- Fit the drivers isolator line M up with the two remaining holes. Slide a C7 in to each of the holes using a C4 washer either side and tighten using a C3 on each bolt.
- Then you can place the isolator in the larger diameter hole and bolt it to plate M using two C6 bolts, four C4 washers and two C3 nuts.

Handy Tip!

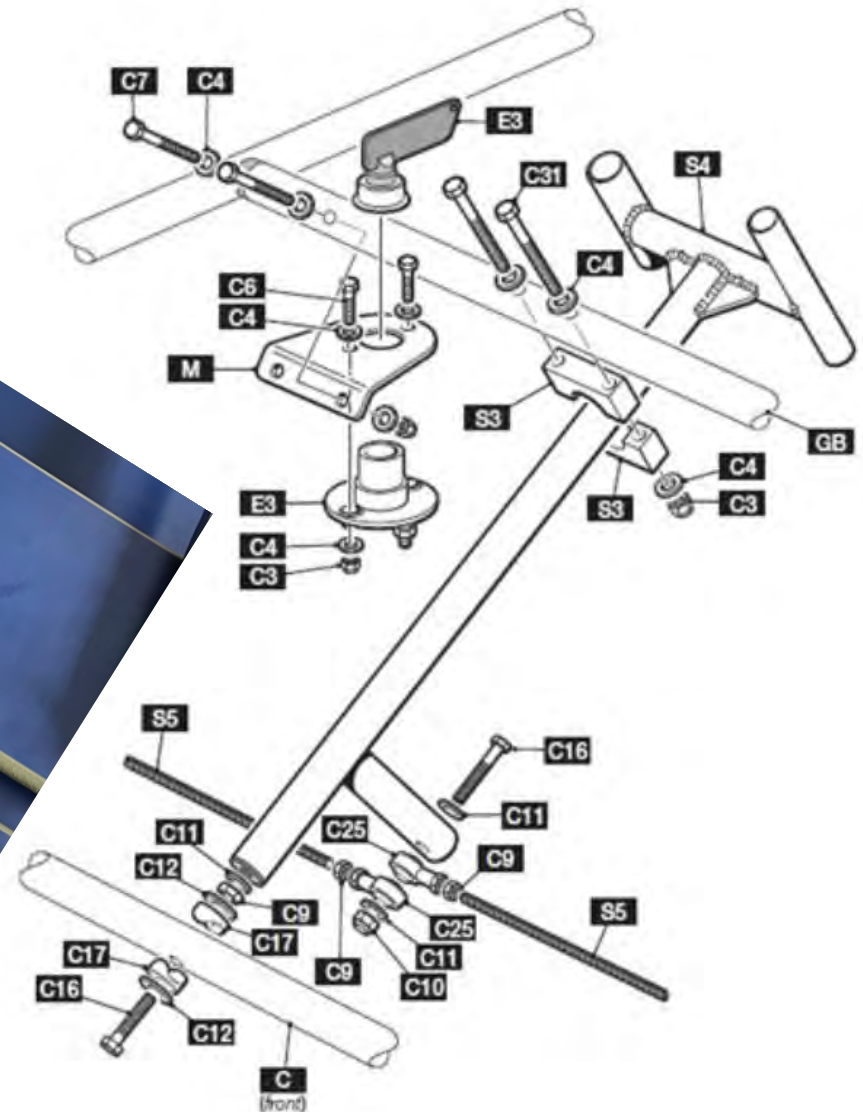
Friction is one of the biggest forces slowing your Goblin down. If your front wheels are not parallel to each other you are creating unnecessary friction which can sometimes feel as bad as driving through sand.



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3: Steering Assembly Team





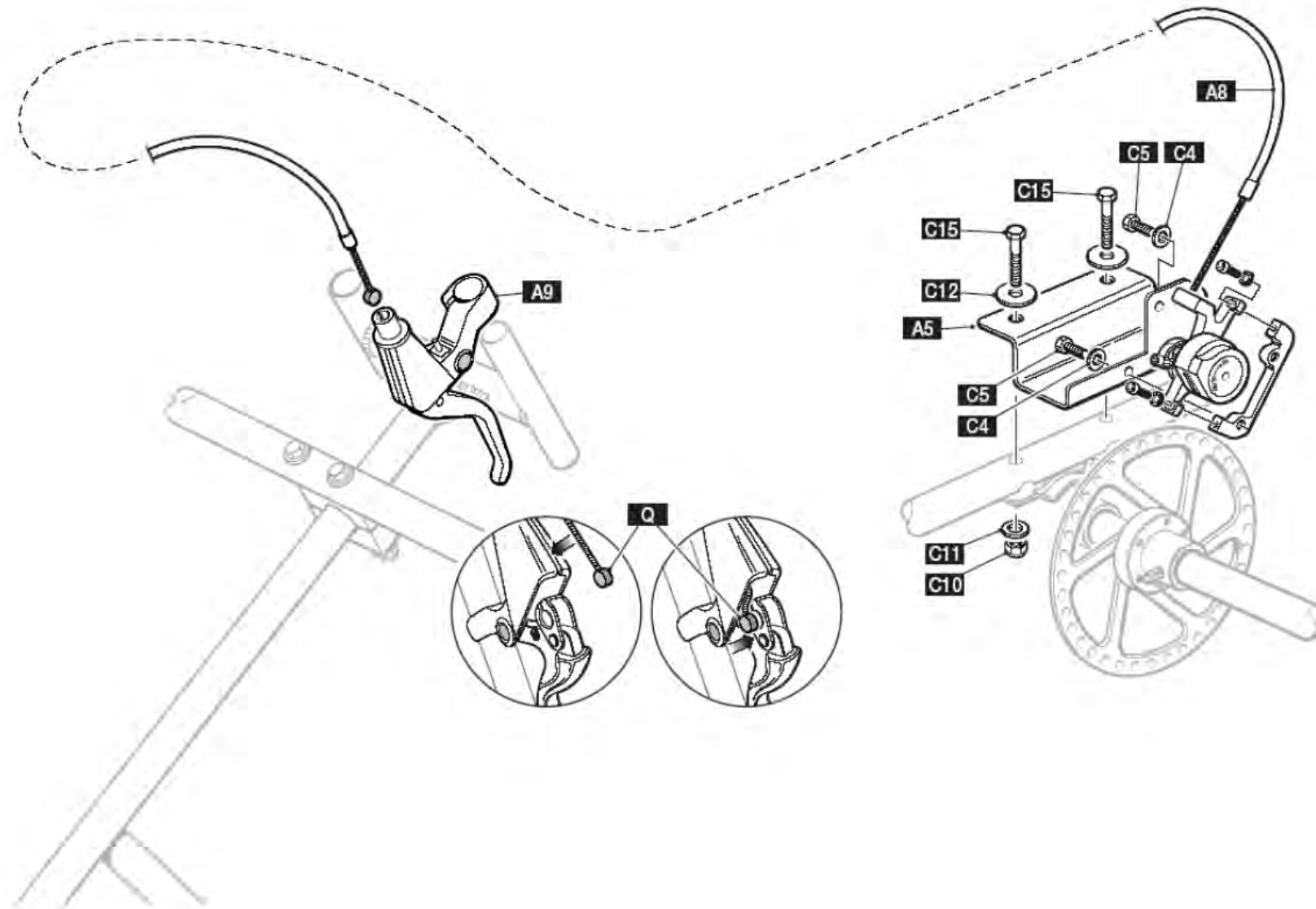
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3: Steering Assembly Team



3: Connecting up the brakes





3: Connecting up the brakes





3: Connecting up the brakes

- By now the brake disc and caliper should be in their final positions.
- Fit the Brake Lever (Part A9) to the steering column, and tighten in your preferred position.
- The brake cable fits to the lever just as it does on a bicycle. Place the end of the brake cable (Q) through the hole in the brake lever (A9). Continue feeding part Q down through the lever, squeezing the handle may make this process easier. Slot part Q into the small hole at the base of the handle for the brake lever. When squeezed, the brake should now pull on.
- Run the cable from the lever down the top right-hand chassis tube (A), keeping all bends open and gentle. Make sure the first bend is big enough to allow the steering to move fully both ways.
- Fix the cable inner at the caliper end using the small screw C42, trapping the cable under its washer. The outer should be located in the caliper body.
- If the cable needs shortening, use a pair of strong wire cutters to cut the inner and outer one at a time.
- Check the function and adjust to suit. When all is ok, tape or cable tie the cable to the chassis tube.

Handy Tip!

The most important thing to remember is that any friction will slow down the Goblin. If the brakes are rubbing on your bicycle, it makes it more difficult to pedal and you might not go as fast... and it is just the same on a Goblin – rubbing brakes will make the motor turn slower, and the car will then go slower!



4: Motor Mounting

- First of all, bolt the motor mounting plate (Part L) to the GA tubes using the components shown. **Remember that the battery isolator mounting plate (Part M) uses the same fixings at the rear of the Part L.**
- Insert the long screws (C14) into the motor plate slits as shown, using washers (C11). Fix the motor to part L using the washers (C11) and bolts (C10) as shown.
- Slide the small pulley (Part D2) onto the motor shaft. This may take a bit of force and a bit more than sliding the part, be careful not to damage the pulley and use something softer than the part so not to damage it to 'tap' it in to place. Keep going until it is close to the main motor case. Lock the small grub screw onto the **flat part** of the motor shaft, the closer to the motor casing the better, but don't let them touch!
- When both pulleys are lined up perfectly (see the Handy Tip below), finally tighten the grub screws in the taper lock bush (Part D4), and stretch the belt (D5) on to the pulleys. Tension the belt by sliding the motor forwards or backwards on its screws (C14), until you can't squeeze it more than 10mm between thumb and first finger. **When viewed from the rear the belt should be vertical and the motor horizontal for best results!**

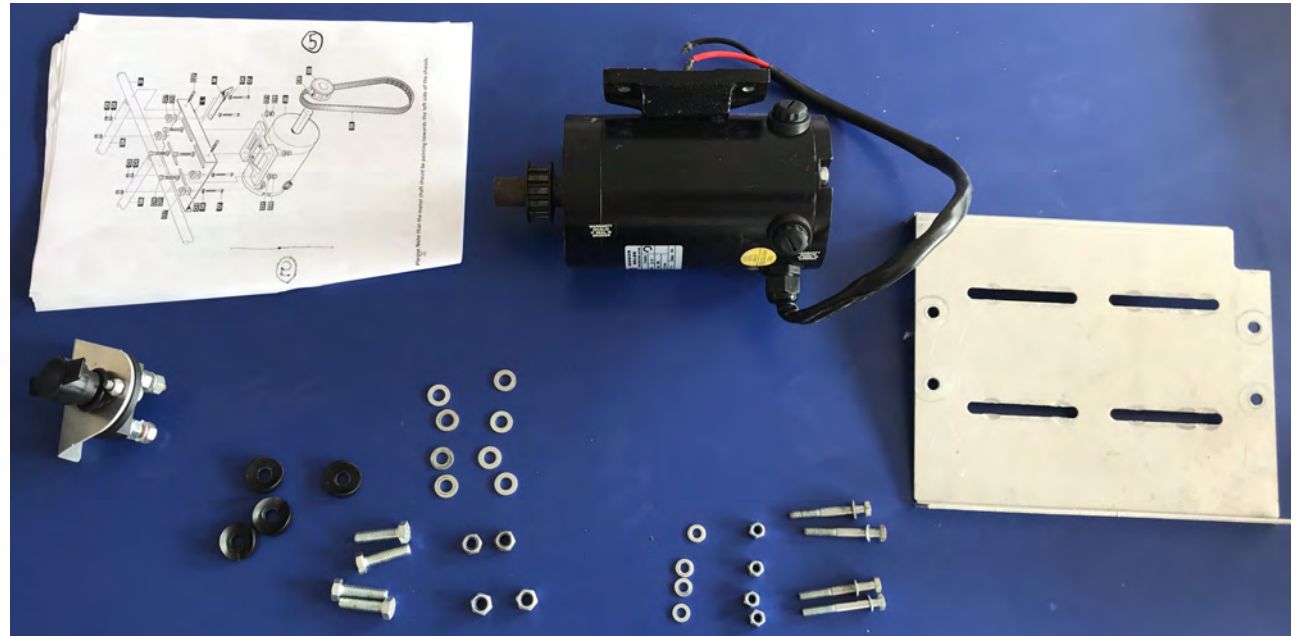
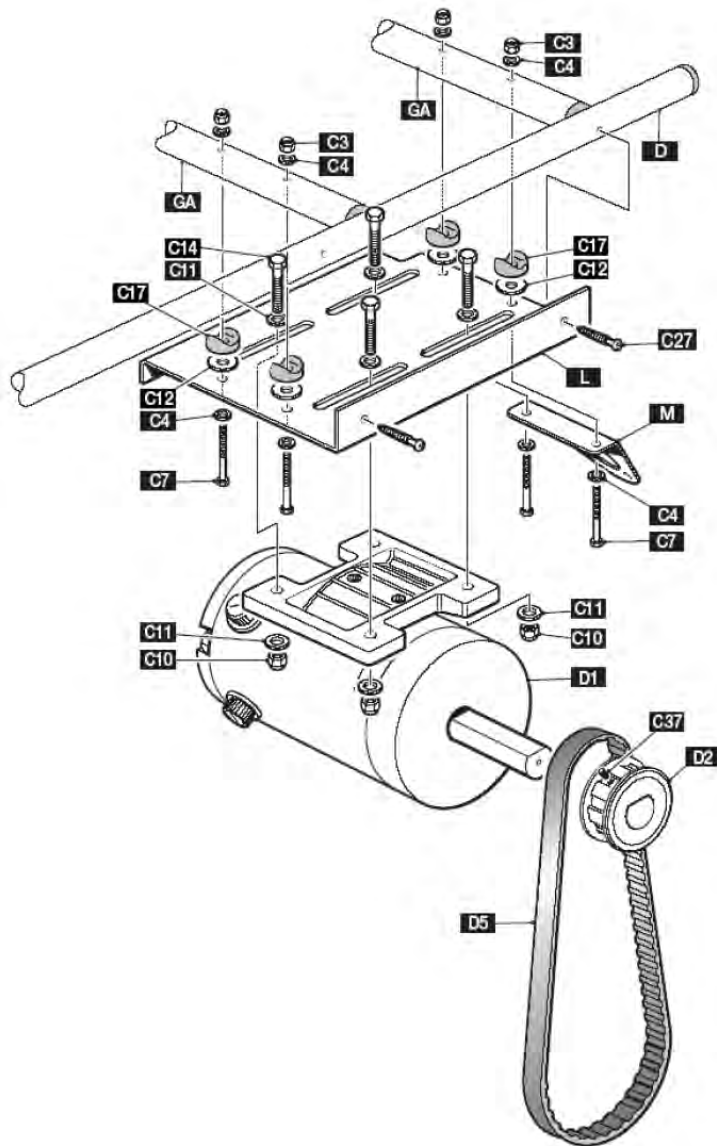
Handy Tip!

Line up the small pulley exactly above the large pulley, by using a straight edge. Move the pulleys on their shafts to find the best position. If the pulleys are out of line it could cause the belt to break, or extra friction, which will make your Goblin slower than some of the others.

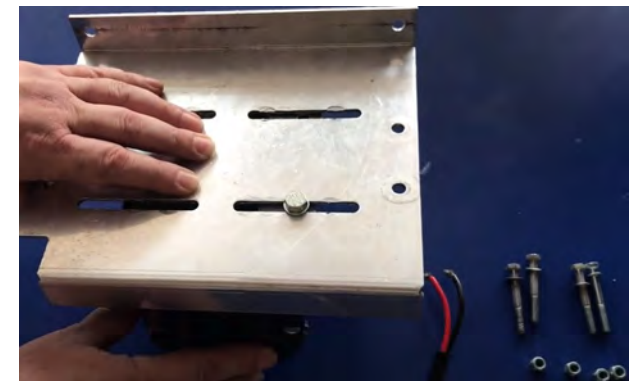
Did you know?

The electric motor on the Goblin is usually used in an electric powered wheelchair! (Although the Goblin is of course a bit faster than a wheelchair!!)

4: Motor Mounting



Watch the video to
see the motor being
mounted.





4: Motor Mounting



Watch the video to see
the mounted motor
being fastened to the
chassis.





4: Fitting the Battery Box

- The battery box (Part K) is easy to fit! You might like to fit the electrical components to it first as shown on the electrical diagram (after notes for wiring team); it will be less fiddly off of the car.
- Slide the box in from below the two rear GA tubes, squeezing the box slightly to allow it to hook over the top of the tubes. It should be positioned close to the right hand A tube.
- Carefully drill the fixing holes in the GA tubes, using a drill bit and the six holes in the battery box as guides. It may be a good idea to pop the battery clamp bolts in first (C6) loosely so the box stays still and your holes remain lined up, to be as accurate as possible screw each C26 screw in after drilling the hole, just loosely for now. **Safety First - Always wear goggles and gloves when drilling.**
- Once complete you can tighten each of the screws.
- Then you are ready to put the batteries in!

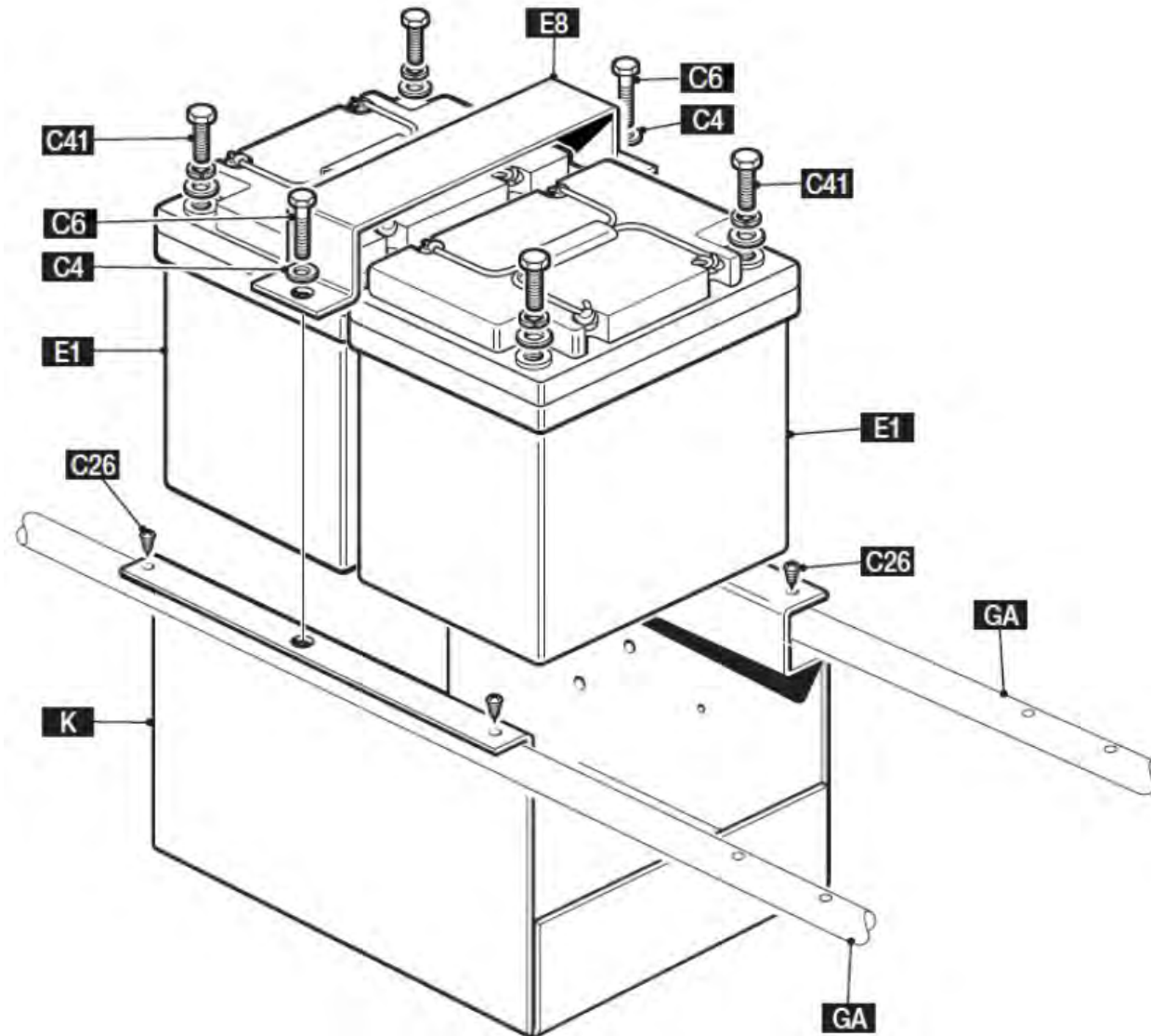
Handy Tip!

During a wet weather race, water may cause some of the electrical components to not function correctly. You might like to design a plastic cover to keep them dry – it could be part of your bodywork.

Did you know?

You must never place anything across the top of the batteries. Metal objects touching both battery terminals at the same time will 'short-circuit' the battery. Be especially careful when you are transporting your batteries.

4: Fitting the Battery Box

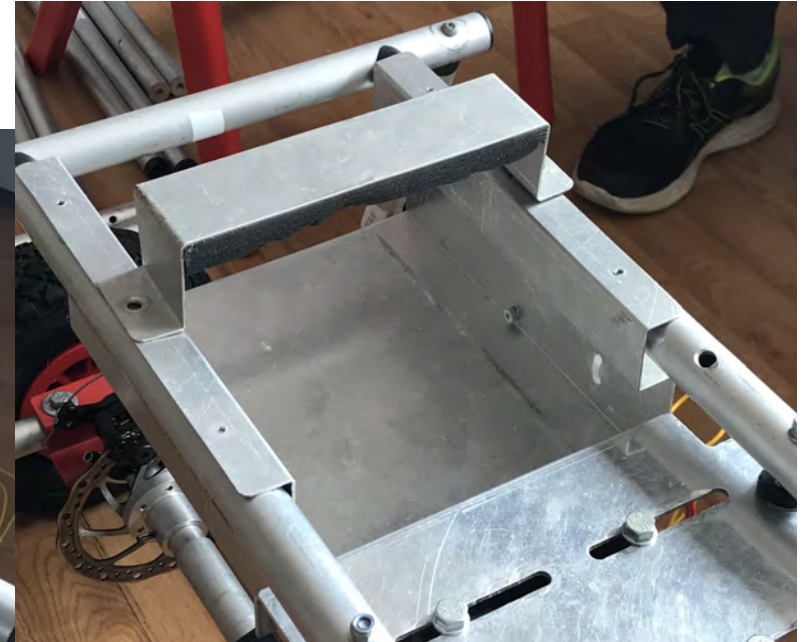
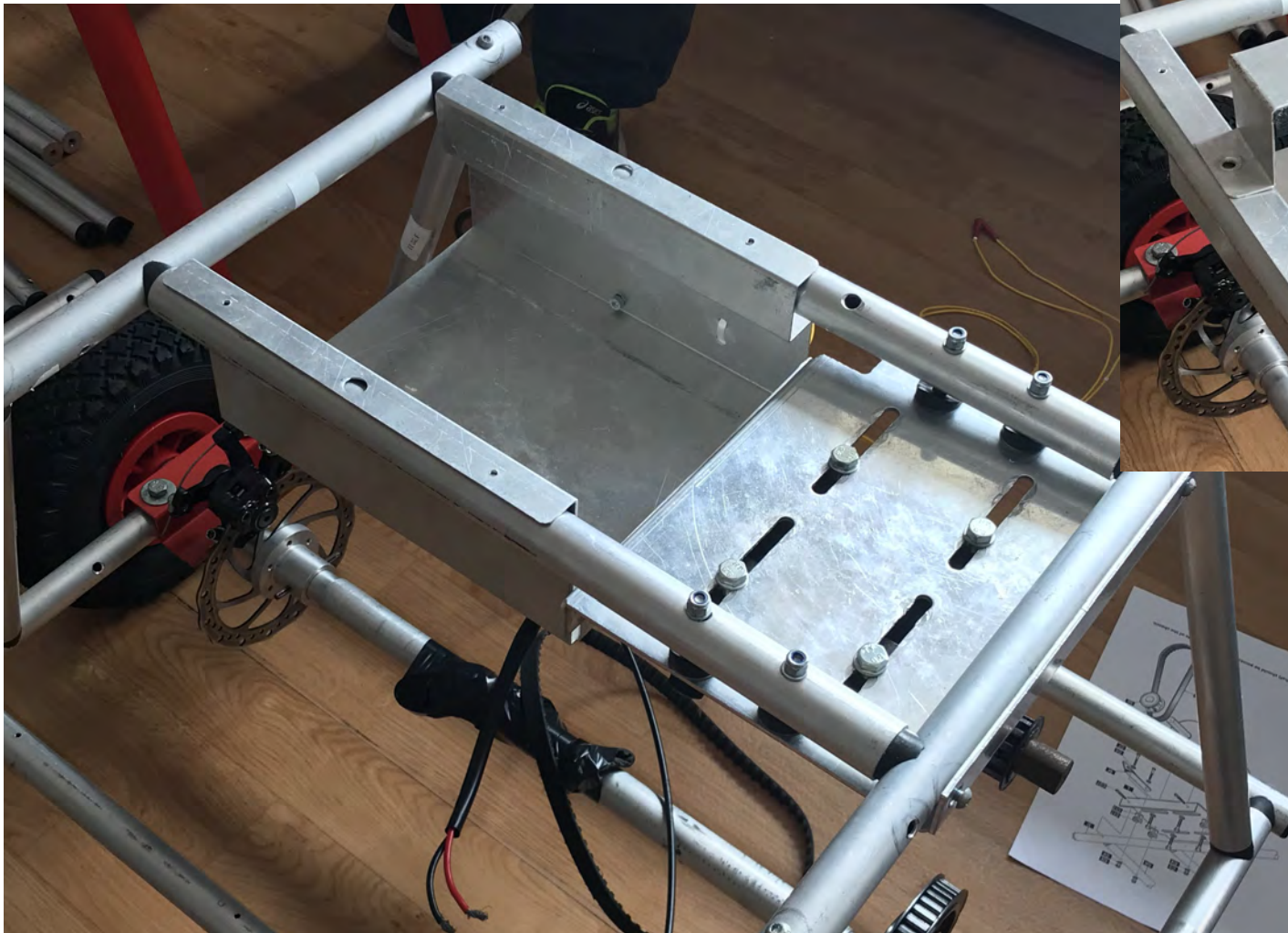




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4: Fitting the Battery Box





5: Wiring Team

- Fix all the Parts to the back of the battery box (Part K) first, looking at the main drawings for positions. See wiring diagram which would have come with your instructions (on the CD).
- Connect the wires in order – start with the wire labelled *A*! The wiring diagram can be found in the documents you received with your Goblin!
- Secure the long wires *H, J, F and L* to the top chassis tube (Part D). To do this you can use cable ties or sticky tape.
- Make sure you leave enough wire for your steering wheel to turn both ways when the *H* and *J* wires are connected.
- When all the wires are connected, get your teacher to lift up the back of the car carefully, and press the button! If all your wires are connected correctly, and the Drive System is complete, the wheels should turn!

Handy Tip!

With your two **12 volt** batteries connected together as the wiring diagram shows, they are working in **SERIES**. This means that the wires coming out of them are using power from both, and you get **24 volts!**

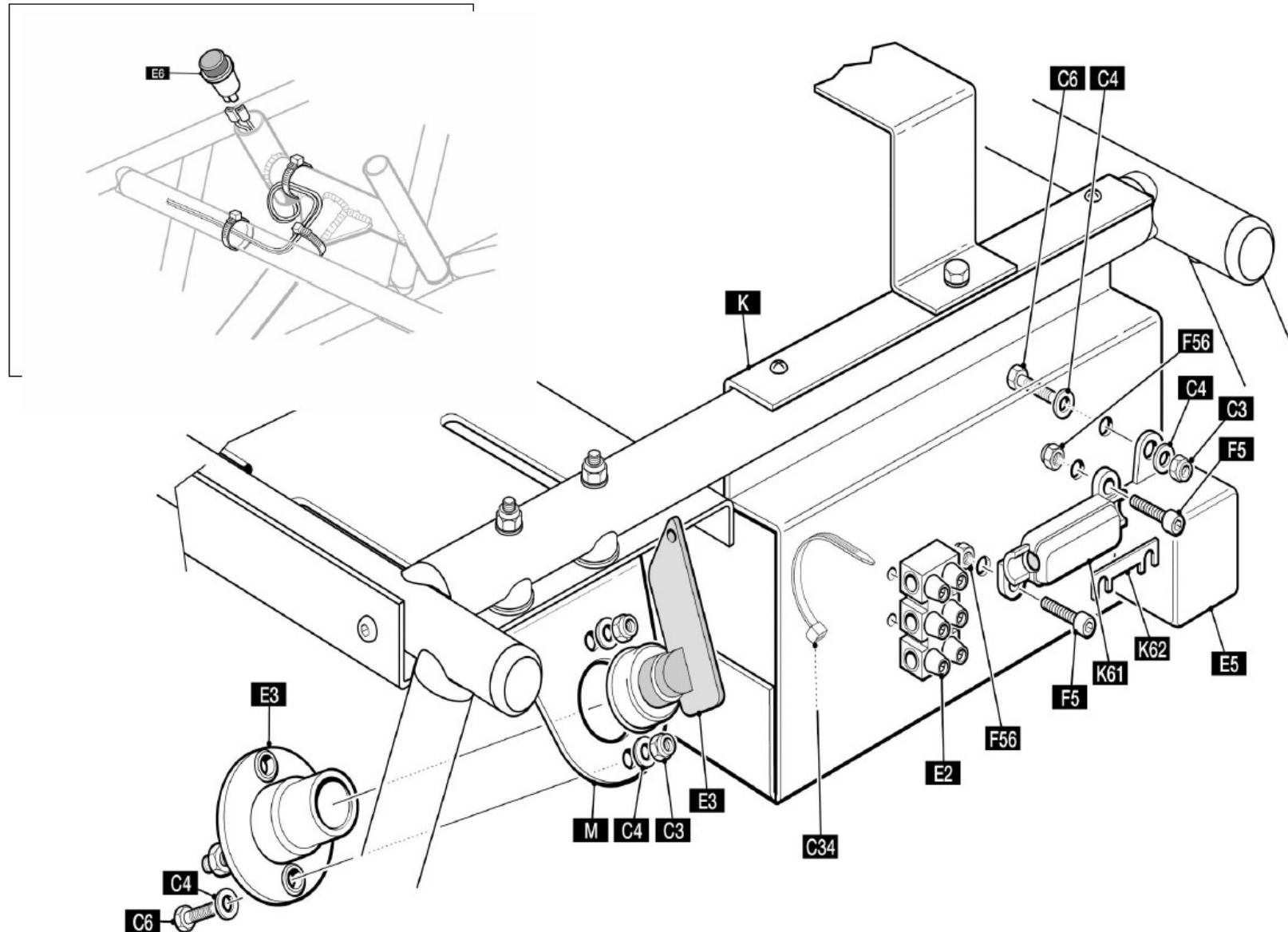
Because your motor is designed to use **24 volts**, it works at full speed with the batteries connected like this.

If you only connect up one of the batteries you get **12 volts** and the motor works at **half the speed**. This makes the car move at half its usual speed, which can be great for test-driving!

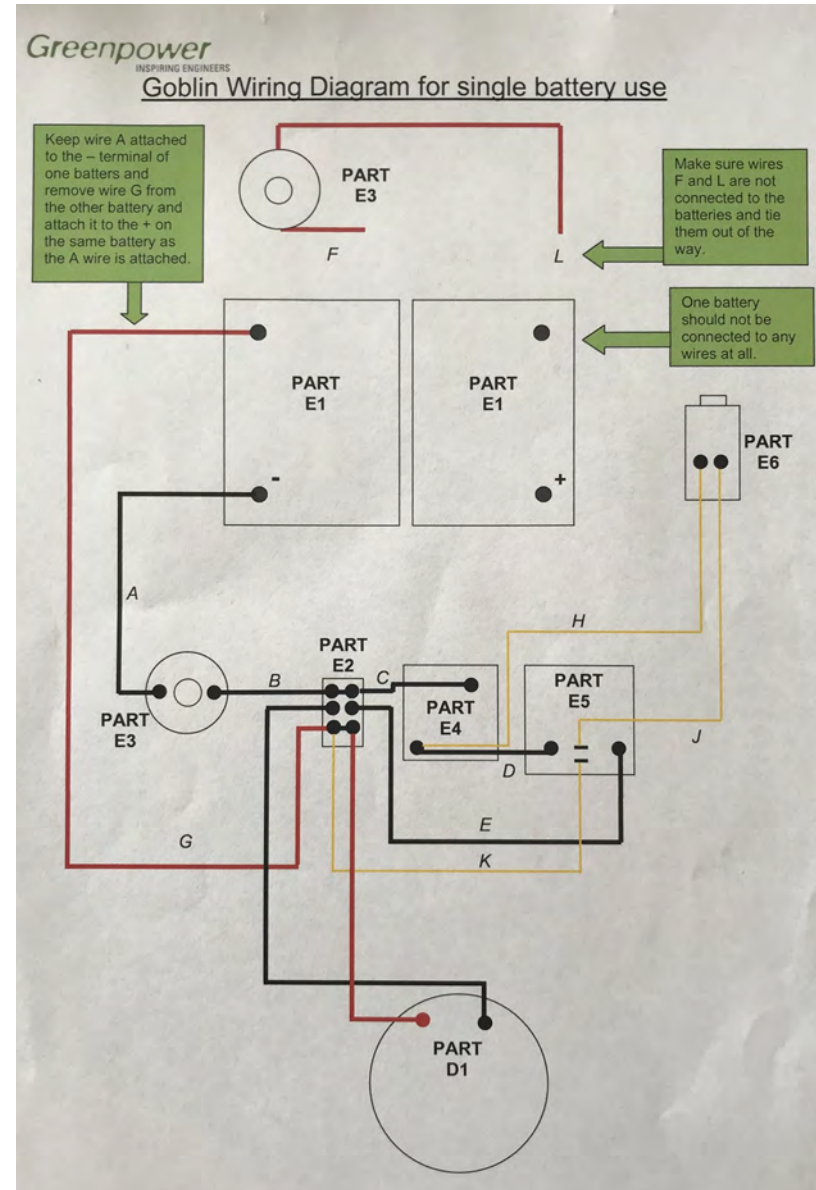
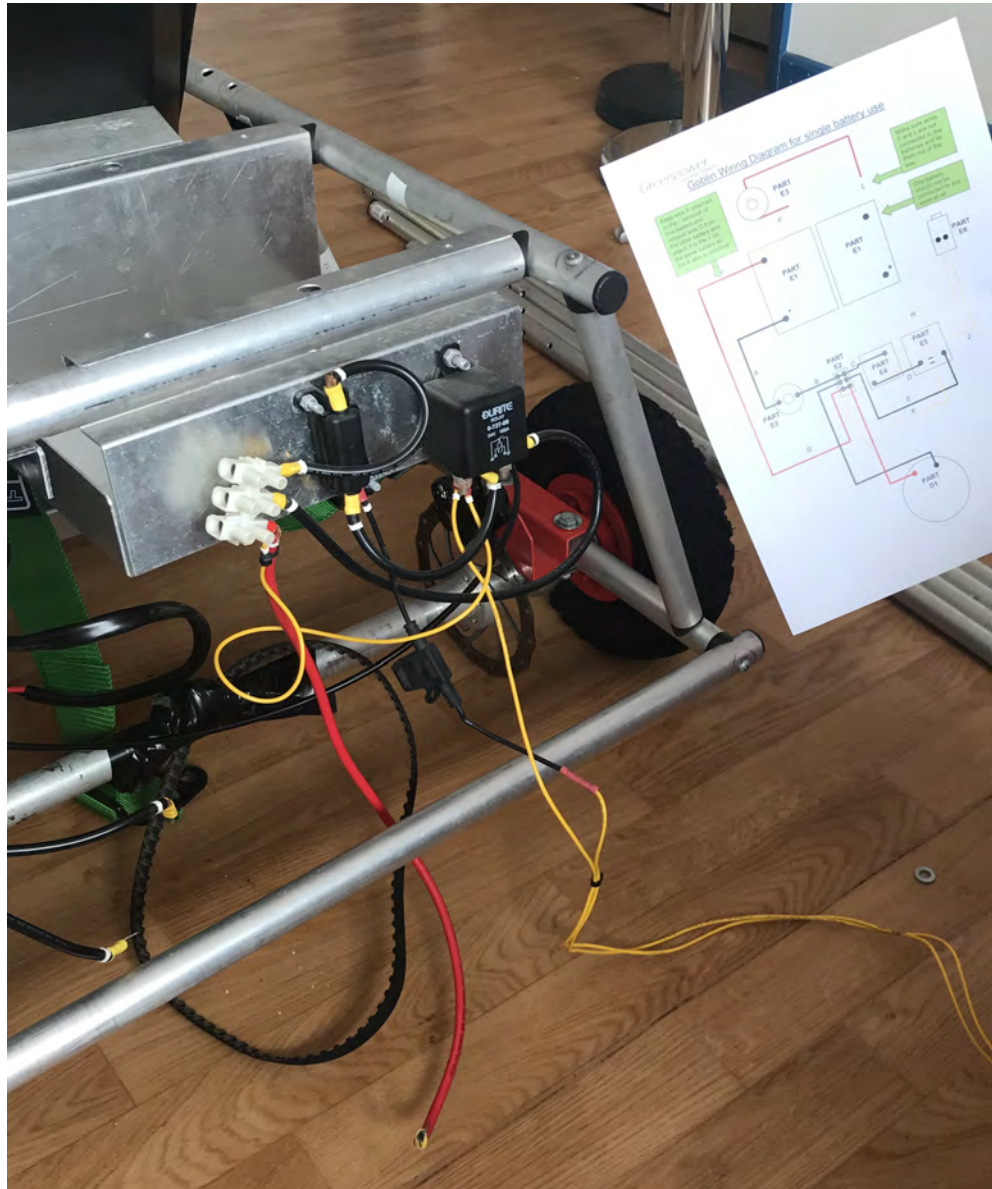
Did you know?

Part E5 is called a relay. It is basically a clever switch which means only small wires need to go to your Push Button. Road cars have loads of relays in them – they switch on things like electric windows, sunroofs and locks.

5: Wiring Team



5: Wiring Team





5: Bodywork Team—Fitting the floors

- The front floor panels (Parts N) also limit the amount of steering movement, so hold them in place before fixing them in place to check the steering is satisfactory. Attaching them against the F tubes is ideal.
- ▢ Then place the central floor panel (Part P) in position, with the front end of it overlapping the front floor panels.
- ▢ Carefully drill fixing holes in the C tubes, using a small drill bit, screw in the self-tapping screws loosely as you go.
- ▢ Tighten all the screws once all the holes have been drilled.
- ▢ Tape over the floor joints with duct tape or similar.

Handy Tip!

Carefully measure where you need to drill the holes for fixing down the floors – try and make them equally spaced, as it will look more professional! Also make sure they are central on the tube to provide a solid fixing.

If you find the drill bit slips across the floor panels when trying to start drilling the holes, put a bit of masking tape over the area where you will be drilling – this gives the drill bit some grip.

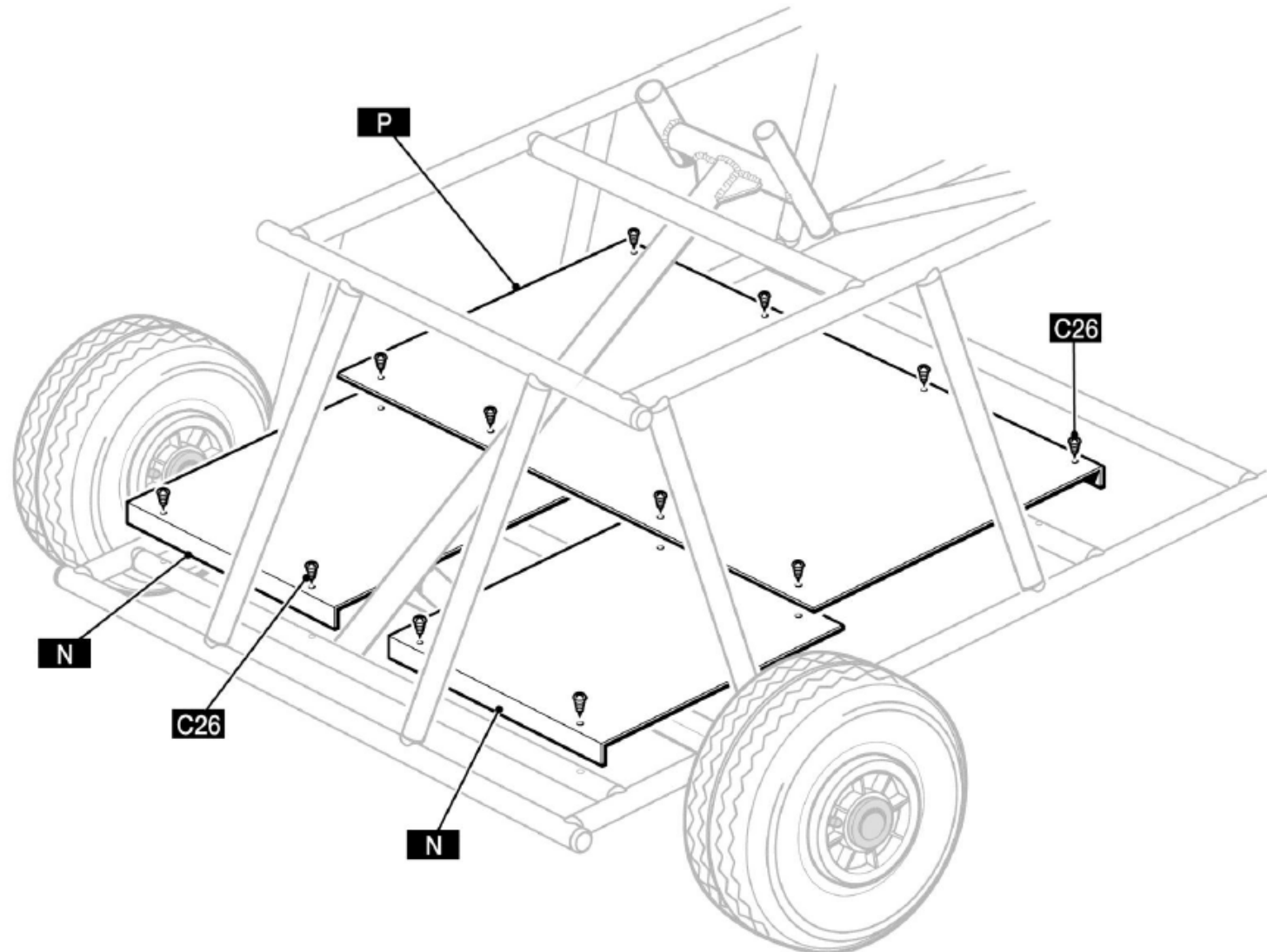
Did you know?

Although Goblins are limited to 15 miles per hour, they use the same motor that secondary schools use to power their own designs of Greenpower 'Formula 24' cars at over 40 miles per hour!

Will you be joining a secondary school that enters Greenpower Formula 24?! Check out **www.greenpower.co.uk** to see which schools are involved.



5: Bodywork Team—Fitting the floors





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5: Bodywork Team—Fitting the floors





5: Bodywork Team—Roll bar

- The roll bar is a safety feature, which hopefully will never be tested in any car. (It also makes a very handy push-ing point for starting the car!).
- To mount the roll bar place the roll bar on the D tubes near the back and push a C15 through each side of A2 (ensuring that C12 and C17 are present) as shown in the diagram on the next page.
- Tighten the C15 to secure the roll bar in place.
- The Roll Bar Brace (A1) is fixed using two chassis screws (C35), one in the top, and one at the bottom.

Handy Tip!

With the roll bar removed, you should find the Goblin will fit in the back of most estate cars.

Did you know?

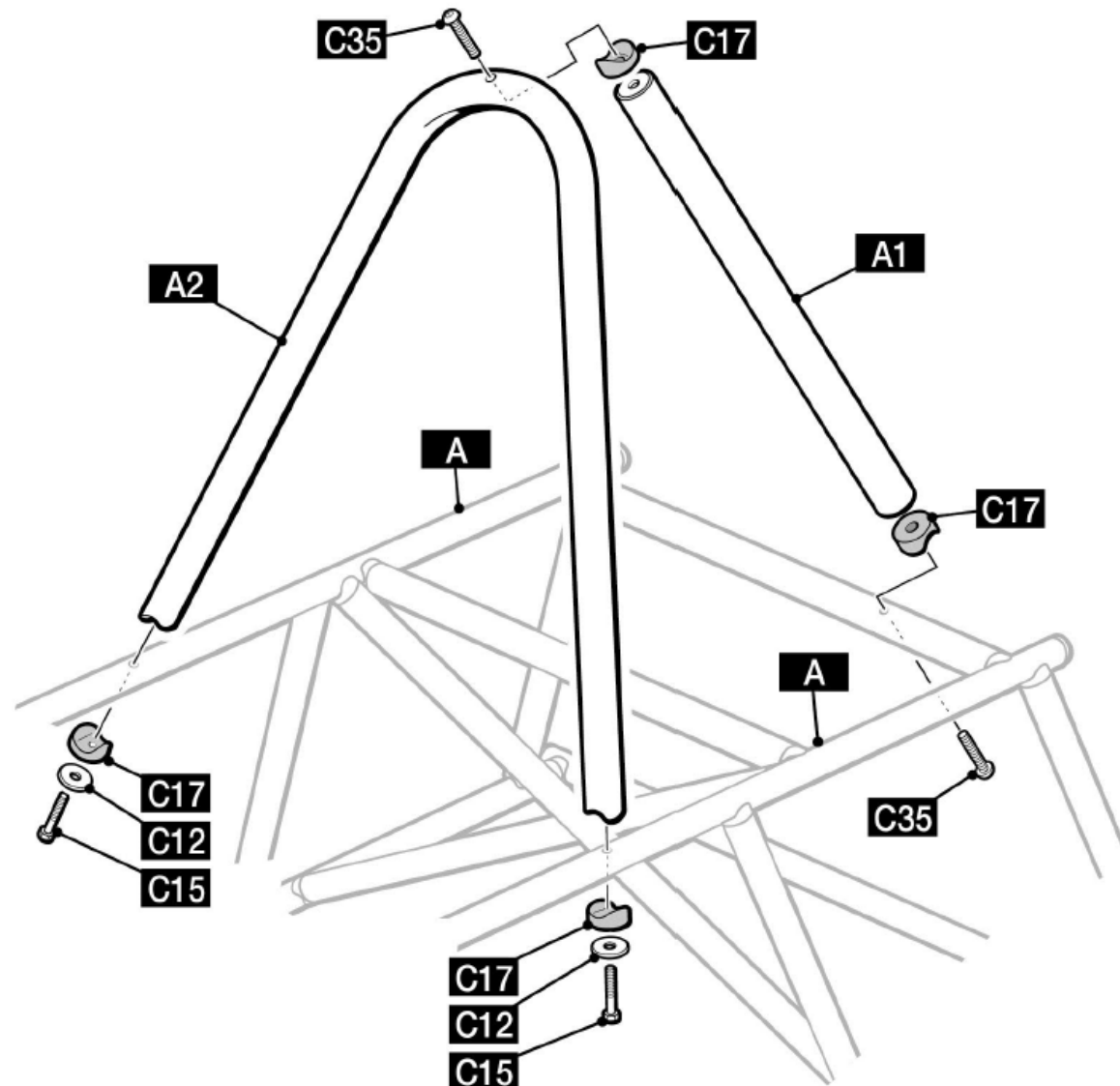
Have you been wondering whilst building the car what a **nyloc nut** is?

Well, nyloc nuts are used in places where a normal nut might come undone by itself due to vibrations, or in places where it is extremely important that the nut doesn't come undone. An example would be on the steering mechanism of your Goblin, or anywhere in an aeroplane!

Have a look at one of the nyloc nuts on your Goblin, such as Component C10, and notice the small blue ring around the inside of the nut at the top. This is made of the plastic nylon, and grips the thread of the bolt you are using it on, preventing it from being undone without using tools.

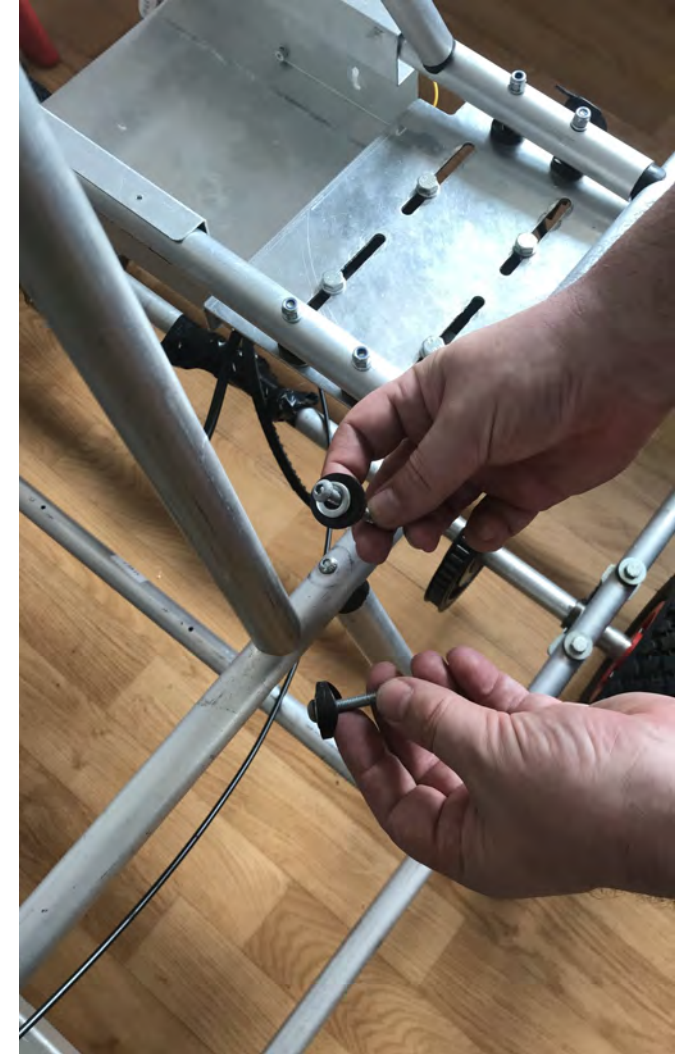


5: Bodywork Team—Roll bar





5: Bodywork Team—Roll bar





5: Bodywork Team—Fitting the seat

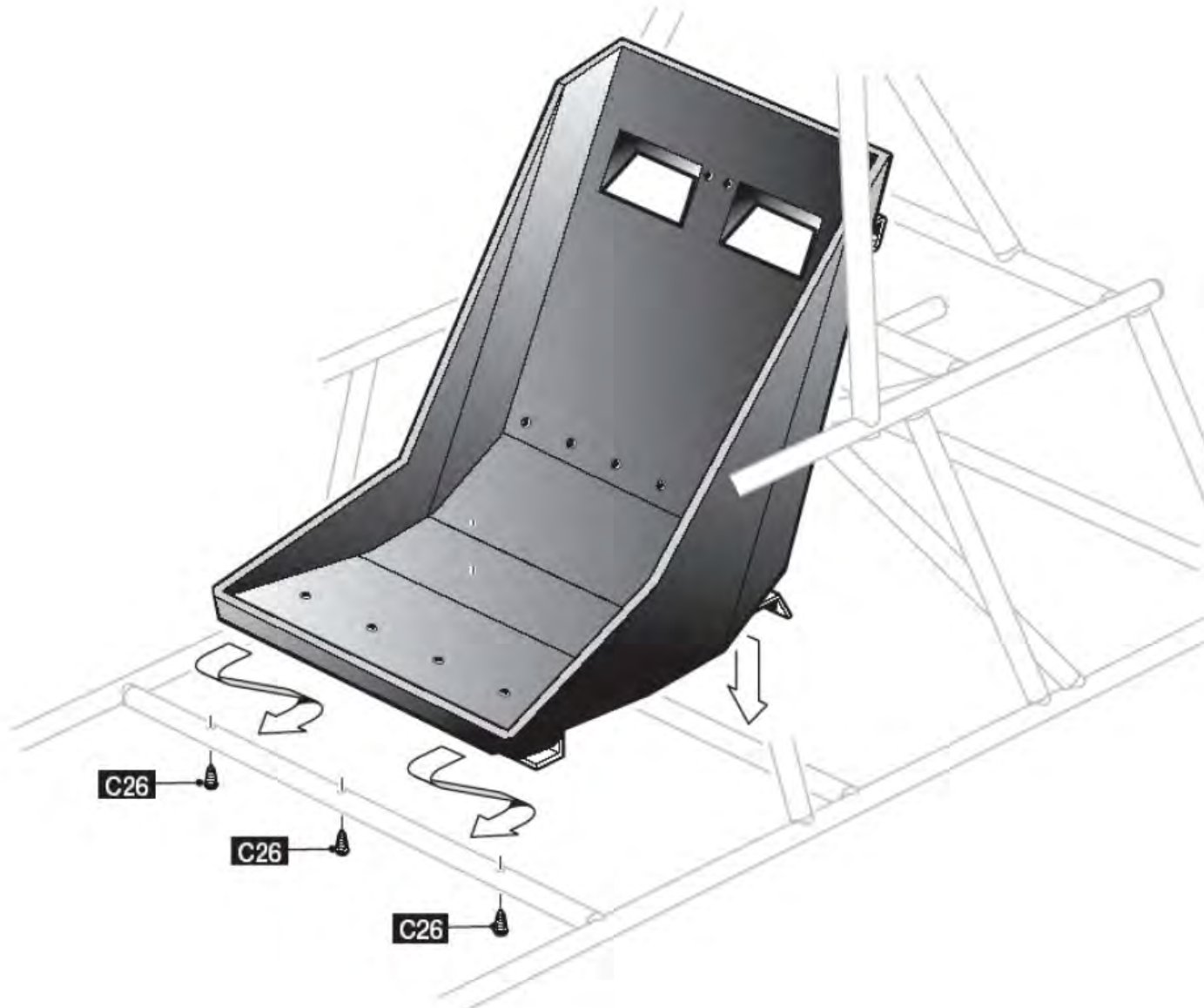
- The Goblin kit comes with black plastic seat which is very easy to fit. The two silver brackets underneath the seat fit over the C tube in front of the H bars and the front of the seat fixing to the 3rd C tube from the front.
- The seat should sit with the back resting against the diagonal H tubes and the base resting on the C tube below.
- Fix the front of the seat using 3 C26 screws. The C33 Q clips used to fix the rear straps of the 4 point harness prevent the seat from moving side to side.

Did you know?

Primary schools have been building and racing Goblins since 2001. There are now hundreds of them right around the country, from Aberdeen in Scotland to Kit Hill in Cornwall.



5: Bodywork Team—Fitting the seat





5: Bodywork Team—Fitting the seat





6: Bodywork Team—Fitting the seatbelt

- The rear straps of the harness should run behind the H tubes, and thread over the C tube at the back of the seat.
- Component C33 is used to fix all four points, with the fixings as shown. C33 will need opening up with a pair of strong pliers, then closing back round the tubes if you didn't place it on earlier when building the chassis.

Do not drill holes in the tube to fix the seatbelt.

- The clips supplied may not tighten up fully on the tube, but they will not move once the driver is strapped in.
- Each driver **must** have the straps adjusted to suit their size whilst driving.
- Please note the C33 on you're a tube will be in front of the C tube, this isn't clear in the diagram, on your Goblin there isn't space behind!!

Buying Spare Parts

You can order spare parts from us at Greenpower, either check out our website or send your order to:

E-mail – sales@greenpower.co.uk

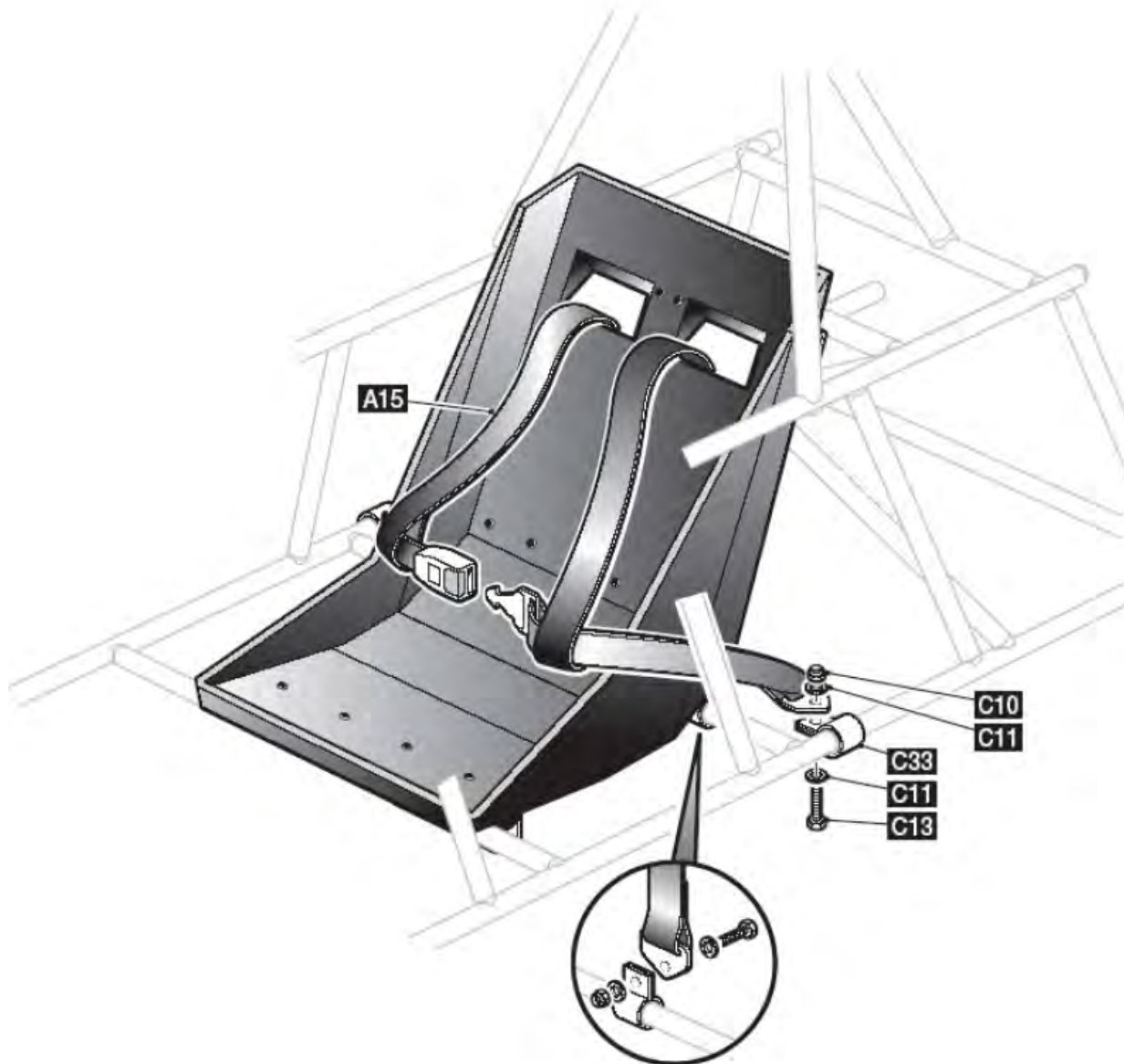
Fax – **01243 553498**

Post – **The Greenpower Centre, Arundel Road, Fontwell, West Sussex, BN18 0SD**

OR order some items online at www.greenpower.co.uk

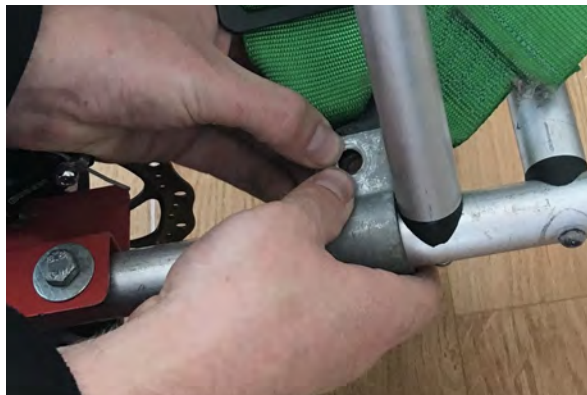


6: Bodywork Team—Fitting the seatbelt





6: Bodywork Team—Fitting the seatbelt





6: Bodywork Team

- The bodywork on a Goblin should be decorative, and we leave it to your imagination to do what you want with it!
- The most popular choice of bodywork is 'Correx' or 'Corroflute' (corrugated plastic) which is used to make estate agents For Sale signs etc. But think about alternatives such as foam board, cardboard, Papier-mâché, aluminium sheet or even very thin plywood. **Keep it as light as possible!**
- Try to fix your chosen bodywork on with duct tape or cable ties, as more holes in the chassis tubes will weaken them.
- Be creative and make something really different – you want to stand out on race day!
- If you have sponsors for your car, remember to incorporate their logos into the bodywork design.

Handy Tip!

Don't forget you will always need quick access to the big battery isolator switch, and don't make it difficult for the driver to get in and out – you will need to practise pitstops too.

Did you know?

We have seen Goblins with many different bodywork coverings... From flattened coke cans to toilet rolls!!! At our events we have prizes for the best bodywork and greenest bodywork, so be creative!



Test Driving and Driver Training

- If you are satisfied the car is fully set-up, try giving it a test drive! The bodywork need not be fully in place for this.
- To start, train each driver in the handling of the Goblin, by pushing the car around quickly with them in the car. Let the driver get used to the steering, and function of the brake. Put out some obstacles and practise turning in and out of them.
- When each driver has tried this, you can conduct the first powered runs. It is important that these take place on a large tarmac or very hard grass area.
- It is usually best to run the car on one battery at first, i.e. 12 volts, until the driver is used to the handling and brakes. This makes the car run at half its usual speed. To operate the car like this, simply disconnect wire F completely, and connect wire G to the positive (+) terminal on the same battery that A is connected to the negative terminal (-). Please see the diagram included with your Goblin documents!
- Ensure each driver is wearing helmet, gloves, goggles, and long sleeves and trousers. When the driver is comfortable and there is a clear open area, turn on the battery isolator and give the car a gentle push. It should pull away. If there is a prolonged rasping noise from the belt, it is slipping and requires a little tightening.
- The driver should now practise turning in and out of well-spaced cones or markers, freewheeling when turning. At first, practise using the power only in a straight line, and freewheeling in corners.

Important Safety Notice

As well as wearing all the clothing described above, drivers with long hair **must** tuck it into their helmet.



Test Driving and Driver Training

As we have said throughout this manual, unnecessary friction will slow you down! Go through some final checks before testing, races, and also after each race:

1. Ensure the brake disc **is not rubbing**. If it is, wind the brake pad adjusters in or out, or adjust axle position.
2. Tyre pressures. Inflate to around 30psi – never run the car on soft tyres.
3. Is the belt tension ok? It will loosen after the first few runs and will need re-tightening.
4. Are the front wheel bearings oiled with light oil?
 - Do not use very thin oils like WD40 as they will wash away all grease or oil and end up running dry.
5. Are the front wheels parallel? – check with a tape measure between them front and back.
6. Check the steering movement is free and smooth. Adjust immediately if not.
7. Is the brake functioning correctly? – It should be capable of locking the rear wheel.
8. Ensure all nuts and bolts are tightened correctly, including grub screws C36, C37 and C38.
9. Charge the batteries. Never leave them discharged. (See below).

Fault Finding

The most common problem is the motor stopping because the circuit breaker (E4) has tripped. It allows you to re-set it after a few minutes using the red lever. It will trip if there is excessive friction, including running the car on soft ground, or on a very tight course.

If you have **any** other problems, please contact us:

E-mail - becci@greenpower.co.uk

T – 01243 552305

Ask questions on our forum at www.greenpower.co.uk

Important Battery Notice:

The batteries are AGM type batteries. This means they cannot leak or spill, and are therefore very safe.

They cannot however be charged like normal batteries. **Only use the slow or trickle charge setting on a battery charger, or acquire a battery charger that is limited to 14.1 volts charging rate.**

Never leave them discharged, and always remove from charge as soon as they are fully charged.



Y6 We Are Engineers: Chesswood Festival of Speed (Goblin Cars) — Knowledge Organiser



Key Knowledge

Learn this information

Know how to use each tool safely and correctly:

General:

- Use a hand tool for the job it was manufactured to perform.
- Inspect tools for cracks, chips and wear. Discard damaged tools promptly.
- Be sure handles are fixed firmly onto tools working end.
- Make sure you know what you are doing before you start.
- Position your body securely while working with the tool.
- Wear eye protection.
- Always tie back long hair and tuck it out of the way.
- Make sure any loose clothing (tie) is tucked away or rolled back/taken off.
- **Concentrate!** No matter how trivial the task seems.

Hammer:

- Strike the hammer with the face parallel to the surface being struck. Glancing, off centre blows can throw dangerous splinters into the air or catch fingers.
- Do not use a hammer to strike another hammer.
- Never use a striking tool with a loose or damaged handle.

Screwdrivers:

- For fitting the Goblin floor panels you will need to drill the holes first.
- The blade tip should fit the slot in the screw without hanging over the edge.
- Do not strike a screwdriver handle with a hammer - it may break/ slide off.
- Never use the handle as a striking tool.
- **Concentrate!** - If the blade slips, you could get hurt.

Electrical Equipment:

- Make sure you use the correct size drill bit to drive in a screw. If you use the incorrect size the bit may slip off.
- Make sure all wires are out of the way of not only your working area but also anyone who will be moving around that area.
- Make sure all electrical tools are turned off after use and put on a bench that is out of the way and safe.
- Do not touch the drill bit immediately after operation - it may be extremely hot.

Moving parts

The Goblin does include moving parts. The car should never be worked on with the batteries connected. No one should be wearing baggy clothing that may get stuck in moving parts (e.g. tie) and long hair should always be tied back.

Electrics

The batteries are heavy and should be moved with great care. *Electricity is dangerous - touching both terminals of the batteries with anything metal will result in a burn.*

Team work

By working together in groups or pairs, risk of injury is greatly reduced.

Getting in and out of the Goblin

Always make sure the Goblin is turned off before getting out. The driver should exit from the left hand side (the side without the wires running along the chassis). The next driver should get in from the same side.

When exiting or entering the car the driver should hold on the brake to stop the Goblin from moving.

When the driver is in the Goblin they are in control and no one else should be turning the car on or off.

Testing the car

The car should be tested in a big enough space to allow easy manoeuvring with plenty of run off.








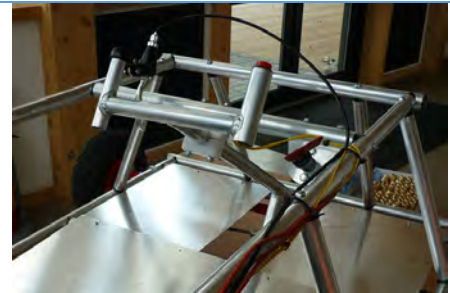



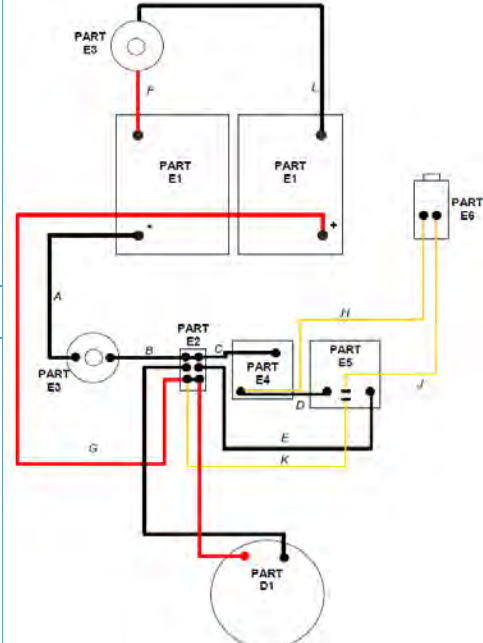
Please note; the Goblin should never be lifted from the back axle and the button pressed to test if it is working.

Key Vocabulary

Understand these key words

Word	Definition	Word	Definition
Vehicle	A machine used for transporting people or goods.	Chassis	The base frame of a car, carriage, or other wheeled vehicle.
Motor	A machine powered by electricity or internal combustion, that supplies motive power for a vehicle.	Steering	The mechanism in a vehicle which makes it possible to steer it in different directions.
Battery clamp	A brace, band, or clasp for holding the battery securely.	Assembly	The action of fitting together the component parts of a machine.
Axle	A steel rod that connects the front and rear wheels to the car. Responsible for turning the wheels when the driver accelerates.	Front	The side or part of an object that presents itself to view or that is normally seen or used first.
Roll bar	A metal bar that strengthens the vehicles frame and protects the occupants if the vehicle overturns.	Rear	The back part of something.
Tool	Often a hand-held device used to carry out a particular function.	Mount	Place or fix (an object) on a support.
Bodywork	The metal outer shell of a vehicle.	Wiring	A system of wires providing electric circuits for a device.
Drive pulley	A pulley that is attached to a power source, that when in use puts force on a belt (or cable or chain).	Logo	A symbol or other small design adopted by an organization to identify its products/vehicle.
Regulations	A rule or directive made and maintained by an authority.	Merchandise	Goods to be bought and sold.
Components	A part or element of a larger whole, especially a part of a machine or vehicle.	Portfolio	A collection of works or documents that are representative of a person's/groups skills and accomplishments.

Y6 We Are Engineers: Chesswood Festival of Speed (Goblin Cars) — Knowledge Organiser

A complete goblin	A complete goblin front	A complete goblin side view	Steering
			
Top view of brake	Brake calliper	Brake calliper and disc	Steering wheel
			
Front left wheel	Wheel bearing	Wheel bearing and drive belt	Goblin wiring diagram
			
Rear view of drive belt	Side view of drive belt	Rear electrical components	
