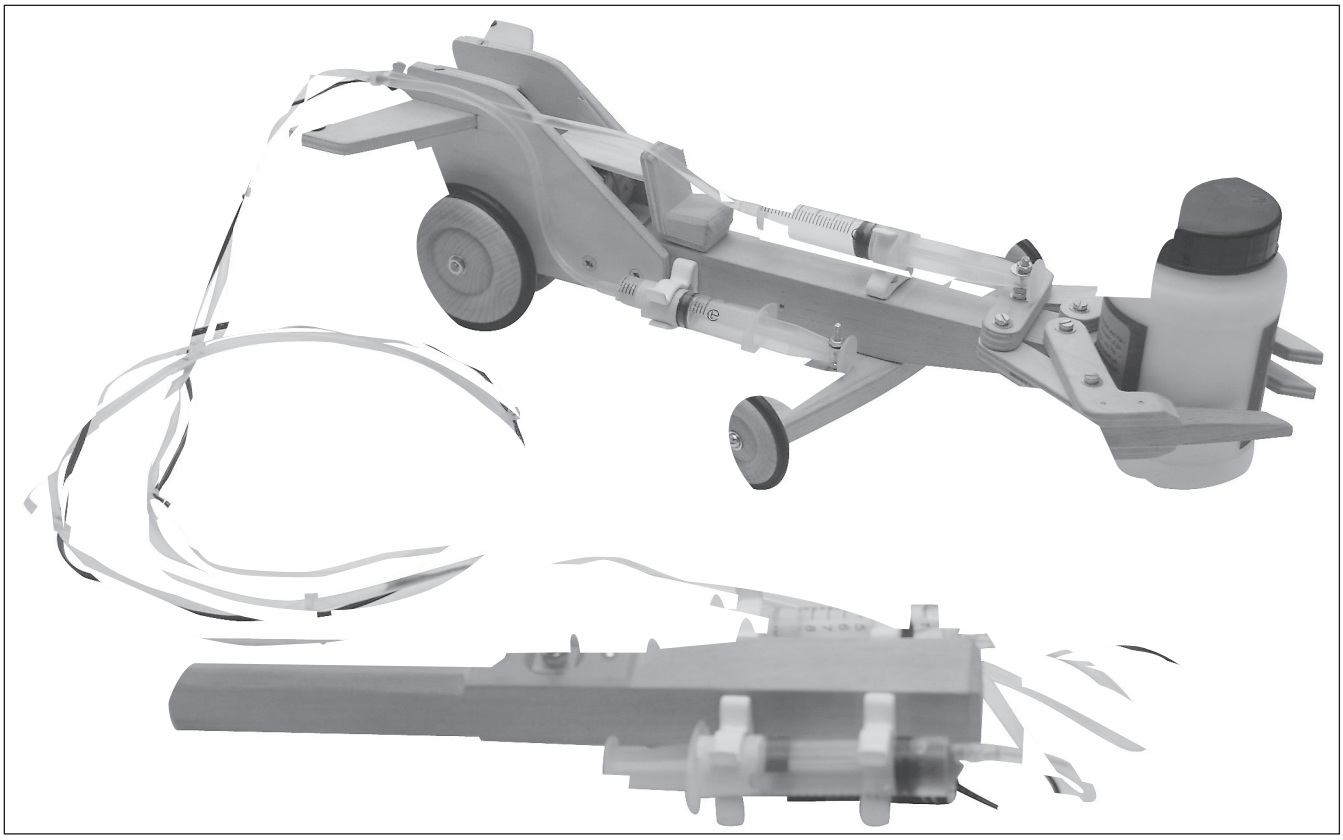
OPITEC

106.202

Vehicle with robotic arm



Please Note

The OPITEC range of projects is not intended as play toys for young children.They are teaching aids for young people learning the skills of Craft, Design and Technology.These projects should only be undertaken and tested with the guidance of a fully qualified adult.
The finished projects are not suitable to give to children under 3 years old. Some parts can be swallowed. Danger of suffocation!

1. Product Information:

Articles: Vehicle in project pack format

Use: In Design Technology , Key stage 3-4

2. Material Information

2.1 Material: Pine (Coniferous) softwood
Wood should be relatively dry before use
Plywood, multi- layered, with each layer set
in the opposite direction

Working: The wood must be planed, sawn, drilled shaped and sanded
Mark out with measurement, or use patterns

Joining: Use PVA white glue and screws

Finish: Wax (Liquid or solid)
Wood varnish (Base coat and top coat)
Staining (Coloured water soluable)
Linseed oil

2.2 Materials: PVC Tube (Polyvinylchloride= Thermoplast)
Transparent, elastic

Joining: Sliding onto syringe nozzles

Finish: No special finish necessary

2.3 Material: Syringes (PP=Polypropolene=Thermoplast)
unbreakable, small and taste free

Joining: Inserting into PVC tube

Finish: No special finish necessary

2.4. Material: Acrylic plastic sheet: Thermoplast
PMMA (Polymethymethacrlate) transparent

Working: Acrylic sheet must be sawn and polished (Use a fine saw)

Joining: Slotting and gluing (Special acrylic glue, 2 component glue)

Finish: No special finish needed

2.5 Electro-part:

Battery holder: To hold AA battery cells

Switch: For back and forwards movement

Twin cable: Multi-strand insulated

Cable: Single core- insulated

LED: Light Emitting Diode
Semi-conductor
Cathode (-) shorter wire, flattened side

3. Tools:

Saws: Use a Fret saw for holes and curves that cannot be sawn with a normal saw

Note! Fret saw blades are inserted with the teeth facing forward
Use a Fret saw table and work with slow constant strokes, turning the work as you go

Use a fine toothed Puk saw (See cat) or Dovetail saw for the pine strip and dowel

Note! Use a bench hook when sawing strip and dowel

Files/ Rasps: Use the correct grade of wood file or rasp according to the work in hand

Note! Files and rasps only cut on the forward stroke

Sanding: Use a block and sandpaper on all flat surfaces and loose sheet on curves

Drilling: Use a hand drill or electric drilling machine

Note! When using machines adhere to the safety rules: Tie all long hair back, remove jewellery and rings etc, wear safety glasses and an apron. Hold the work to de drilled in a machine vice.

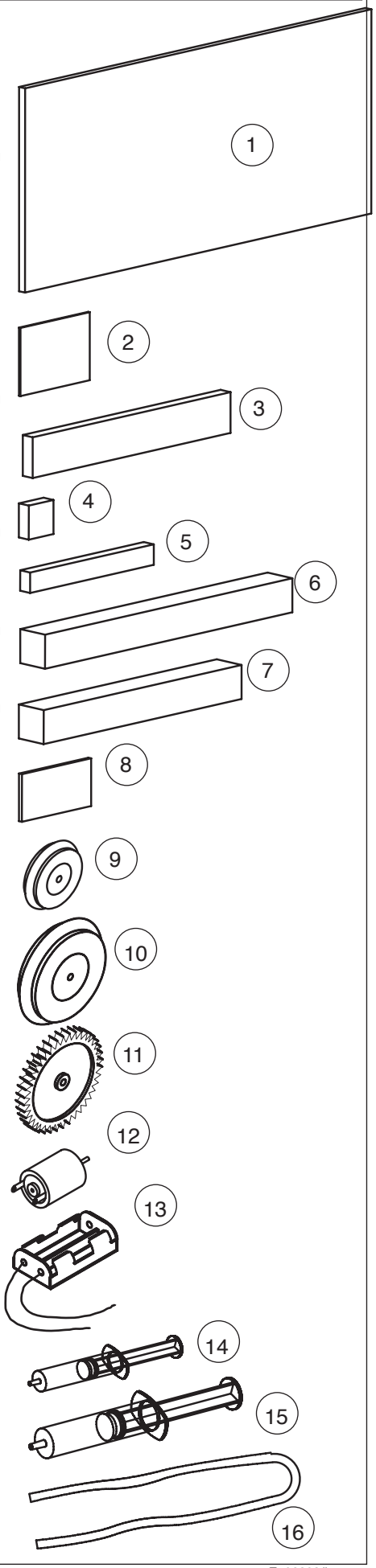
Clamping: Use clamps to hold the work whilst glue is drying. Do not over tighten them or they may leave marks

Soldering: To solder use a 15-30 Watt iron with a fine tip, Use solder with a flux core

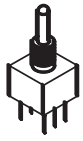
Note! soldering irons can cause burns, treat them with care. Radio Solder Contains an incorporated flux!

4. Parts list:

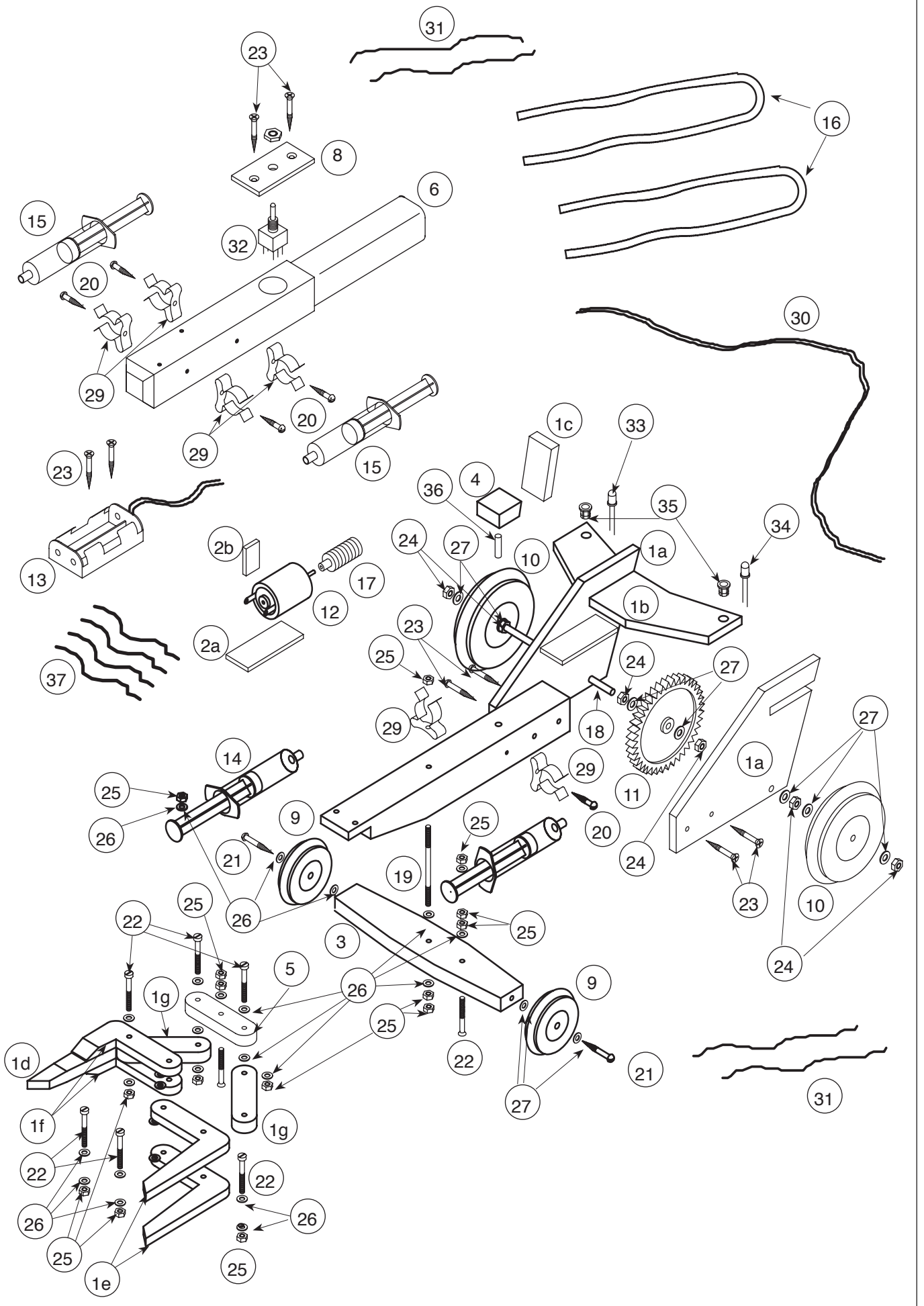
Part	Material	Quantity	Diagram
Grab arm / Seat Chssis	Plywood	1	6 x 150 x 350 mm
Motor fixing	Plywood	1	1,5 x 50 x 70 mm
Front axle	Pine strip	1	10 x 30 x 200 mm
Seat	Pine strip	1	10 x 25 x 25 mm
Grab arn	Pine strip	1	10 x 15 x 125 mm
Steering	Pine strip	1	25 x 25 x 250 mm
Chassis	Pine strip	1	25 x 25 x 200 mm
Switch cover	Acrylic	1	3 x 35 x 70 mm
Front whee	Wooden wheels with Rubbur rim	2	ø 43 mm
Rear wheel	Wooden wheels with Rubber rim	2	ø 63 mm
Drive	Gear, 58 Teeth	1	ø 60 mm
	Motor (RC 23)	1	ø 24
Power	Battery holder	1	2x UM3
	Syringe	2	5 ml
	Syringe	2	10 ml
	PVC tube	1	ø 6/4000mm



4. Parts list :

Baugruppe	Material	Quantity	Size	Diagram
Drive	Worm wheel	1		 17
Rear axle	Threaded rod	1	M4 x 100 mm	 18
Steering axle	Threaded rod	1	M3 x 100 mm	 19
Drive/ Steering/ Fixings	Screws	7	3 x 16 mm	 20
	Screws	2	3 x 25 mm	 21
	Machine screw	8	3 x 25 mm	 22
	Chipboard screw	8	3 x 20 mm	 23
	Nuts	10	M4	 24
	Nuts	15	M3	 25
	Washer	25	3,2 mm	 26
	Washer	10	4,3 mm	 27
	Brass cap	2	dia 4/0,4 x 8 mm	 28
	Spring clip	6	14-17 mm	 29
	Twin cable	1	2x0,75 mm^2/2000 mm	 30
	Insulated wire	2	500 mm	 31
	Switch	1	2 x UM (On –Off-On)	 32
	LED	1	ø 5 mm, rot	 33
	LED	1	ø 5 mm, grün	 34
	LED holder	2	ø 5 mm	 35
	Dowel	1	ø 4 x 50 mm	 36
	Wire	1	1000 mm	 37

5. Exploded diagram



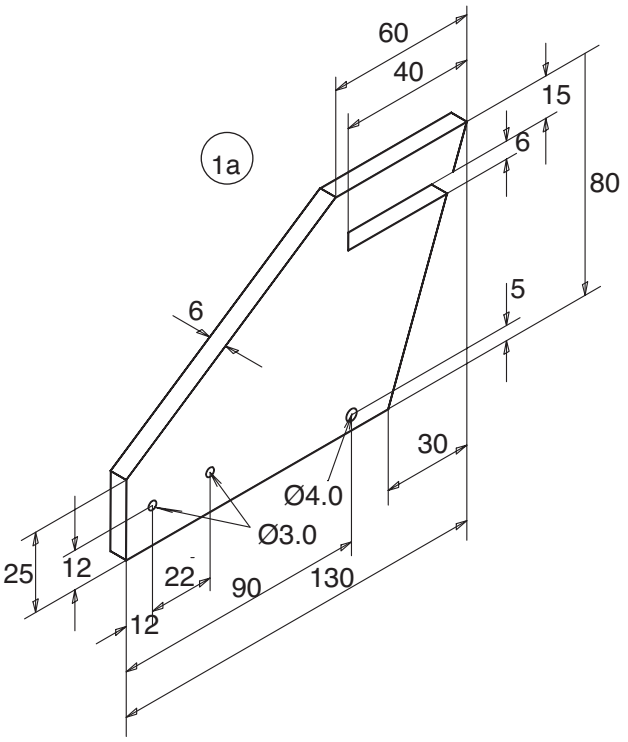
E106202#1

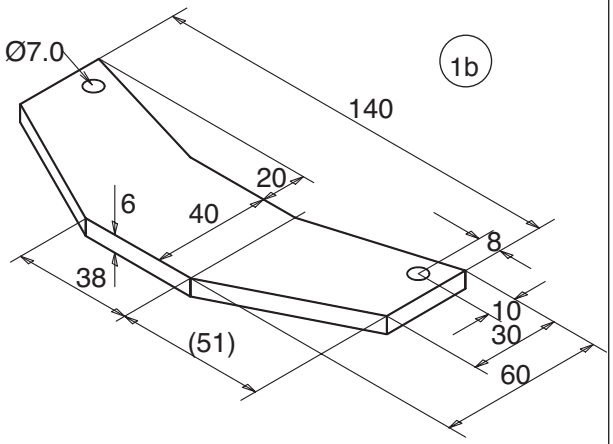
6. Planning and making overview

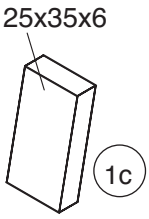
6.1 Designing and making the seat and chassis

6.1.1 Trace the shapes of the sides (1a) rear spoiler (1c) and seat back on to the plywood sheet (1) 6 x 150 x 350mm, mark out and drill out all the holes. Sand the edges

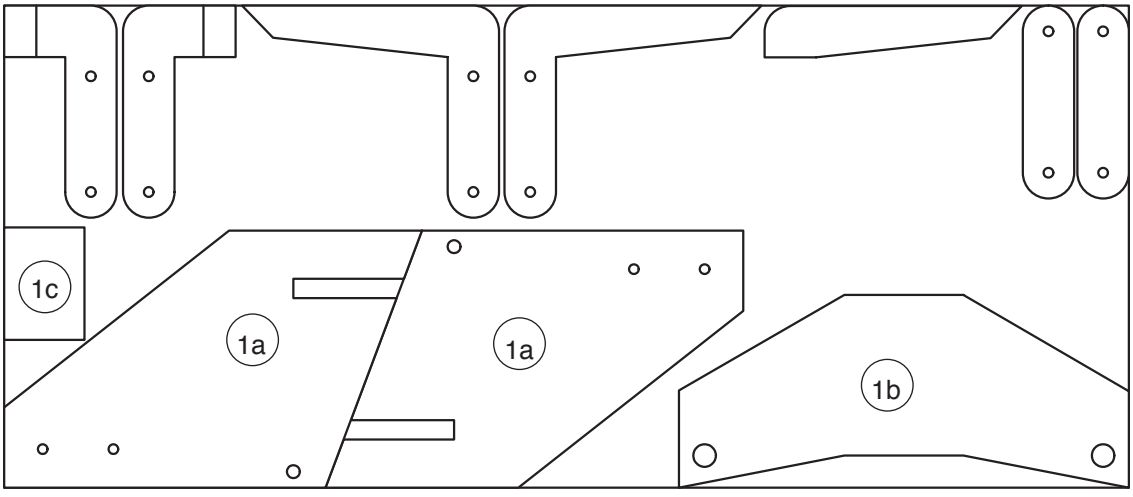
Note: Keep to the layout plan on the plywood sheet (1)
Both of the side parts (1a) can be sanded in one go





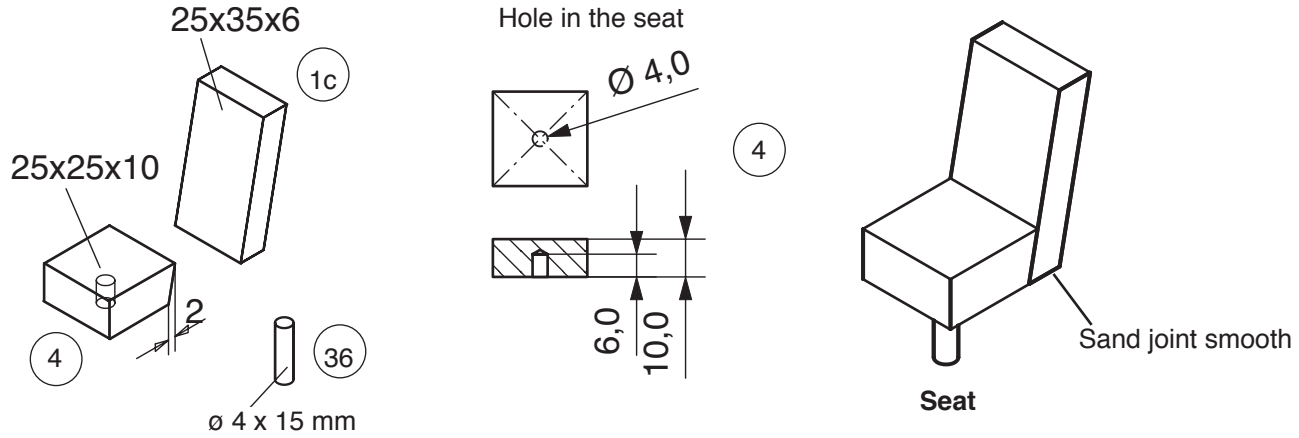


Layout plan



6.1.2 The seat is made out of the pine strip (4) 10 x 25 x 25 mm drilled through the middle with a 4mm diameter hole, approx 6mm deep. Finally chamfer and assemble the seat as shown in the diagram

Note: Whereabouts the chamfer is and make sure that the hole is underneath



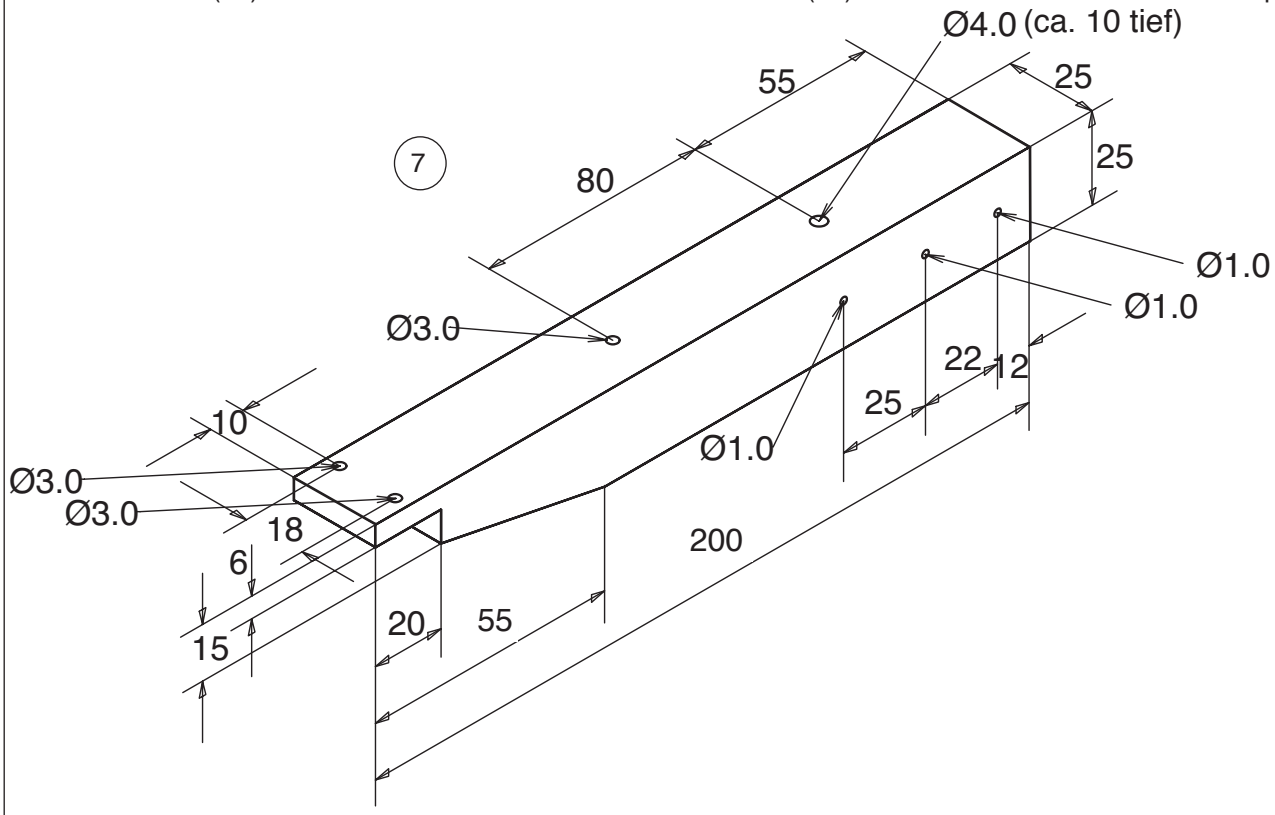
6.1.3 Glue the seat (4) to the seat back (4) and then sand the underneath of the back level with the seat.

6.1.4 Saw a 15mm length from the dowel (36) 4mm diameter x 50mm. Sand the ends and glue it under the seat

6.1.5 Mark out the pine strip (7) 25 x 25 x 200mm as shown, drill the holes and cut out the shape of the chassis

Note: The 4mm holes are only drilled about 10mm deep, all the other holes are drilled all the way through

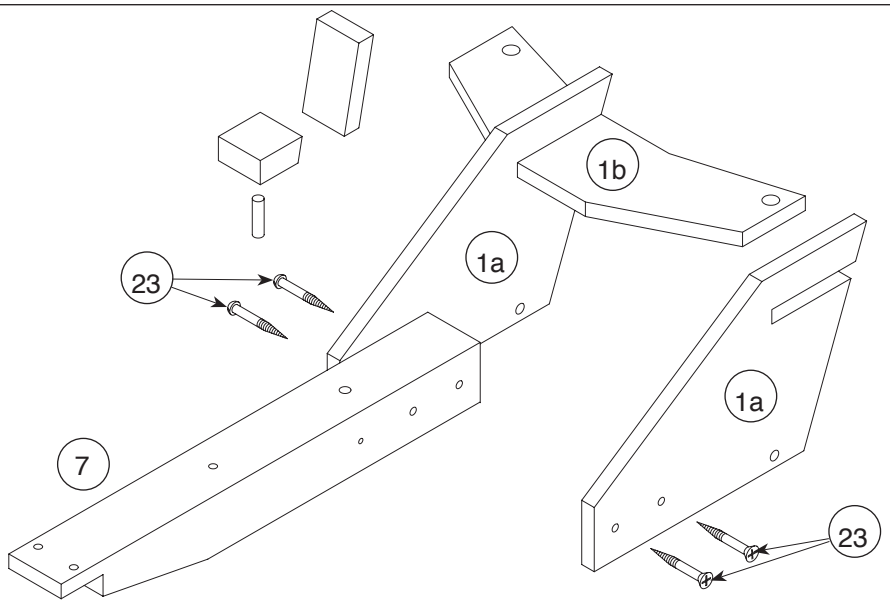
6.1.6 The sides (1a) are screwed to the chassis with two screws (23) 3 x 30mm as shown. Place the spoiler in



place between the sides but do not glue it at this point

Note: Insert the threaded rod (18) through the 4mm holes!

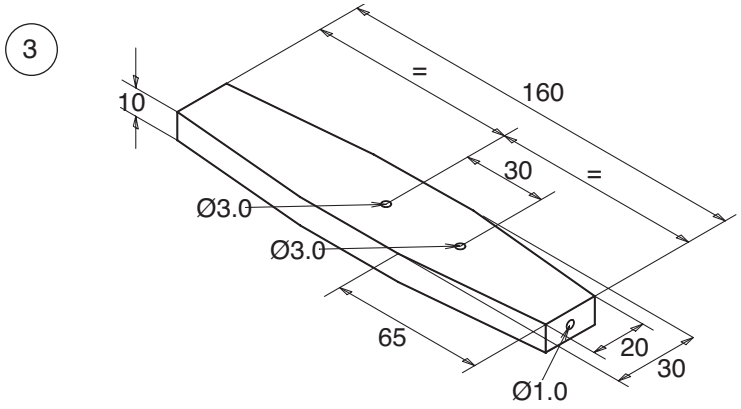
6.1.7 Place the seat in the 4mm hole but do not glue yet



6.2 Making and assembling the front and rear axle

6.2.1 Draw out the shape of the front axle on the pine strip (3) 10 x 30 x 200mm,

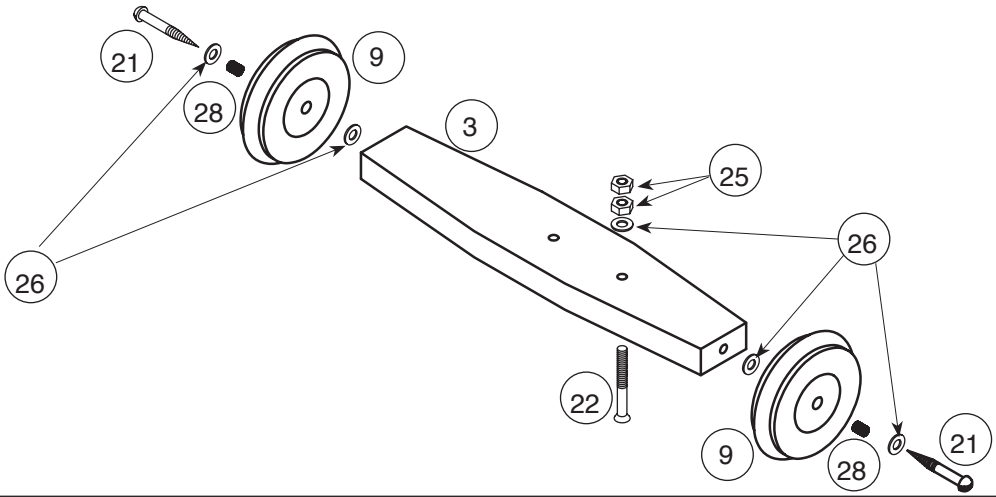
Note: The 1mm holes in the side an be drilled or made with a bradawl



6.2.2 Saw the threaded rod (18) to 85mm long and the threaded rod (19) M3 x 100 to 50m long and remove any burr from the ends

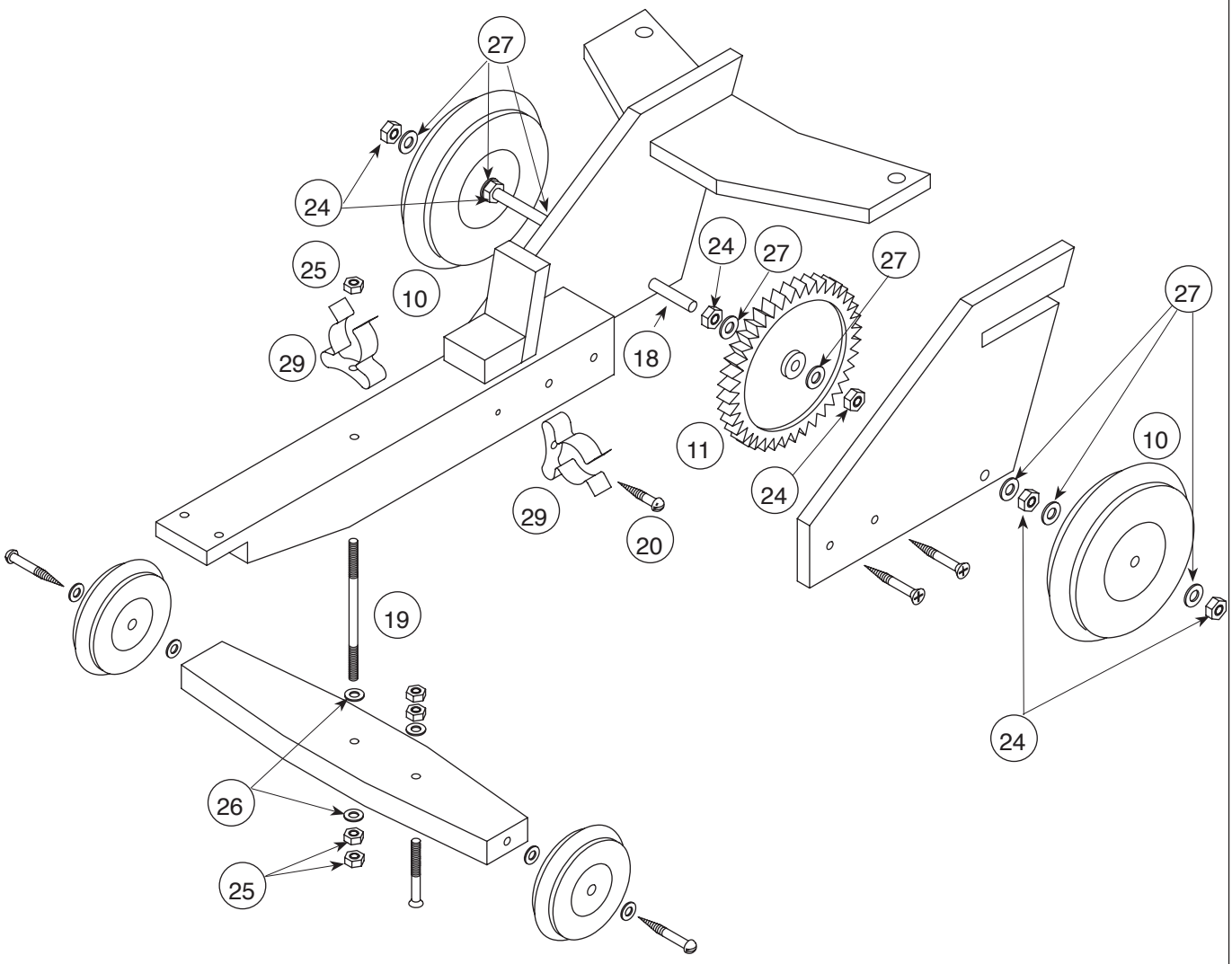
6.2.3 Insert a brass cap (28) into each of the wheels (9) Then fit each front wheel with Screws (21) 3 x25mm with two washers in the holes in the end of the front axle holder (3). Adjust the screws so that the wheels can turn easily

6.2.4 Insert a machine screw (22) 3 x 25 up from underneath through the right hand 3mm hole, place a washer on



6.2.5 Wind a nut (24) and a washer (27) about 20mm in from the end of the thread
then add a rear wheel (10) add on the outside a washer (27) and a nut (24) on the axle end.

Note: The axle should stand about 1mm proud of the nut



6.2.6 Add a washer (27) and then thread the axle in through the 4mm hole in the side part, from the inside add a nut (24) and a washer (27) then the gear (11) a further washer (27) and then another nut (24). Insert the axle through the remaining side part at the same time adjusting the gear (11) so that it is in the middle between the two side parts. Lock the nuts either side and tighten them

Note: If it helps one side part can be removed

6.2.7 From the outside now add a washer (27) and a nut (24) a further washer (27) the second rear wheel, then a washer (27) and a nut (24). Tighten the inside enough so that the rear wheel can run freely without any play

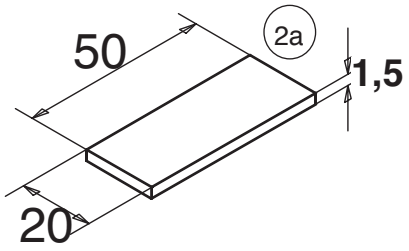
Note: Should the axle be too long saw off the protruding piece

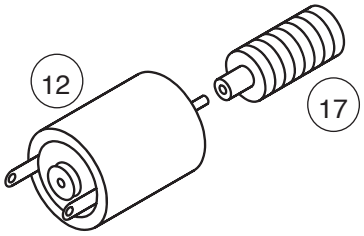
6.2.8 From one the end of a threaded rod off cut piece (19) M3 x 50mm (25) screw on two nuts and counter tighten them, then add a washer (26) and insert the threaded rod up through the middle hole in the chassis add a spring steel clip (29) and then a nut (25) and tighten it so that it can turn freely

6.2.9 Screw a steel clip (29) on the chassis side as shown using a 3 x16mm screw (20)

6.3 Mounting the motor

6.3.1 Press the motor worm (17) on the shaft (12) as shown





6.3.2 Place the motor on the chassis so that the worm is in contact with the gear

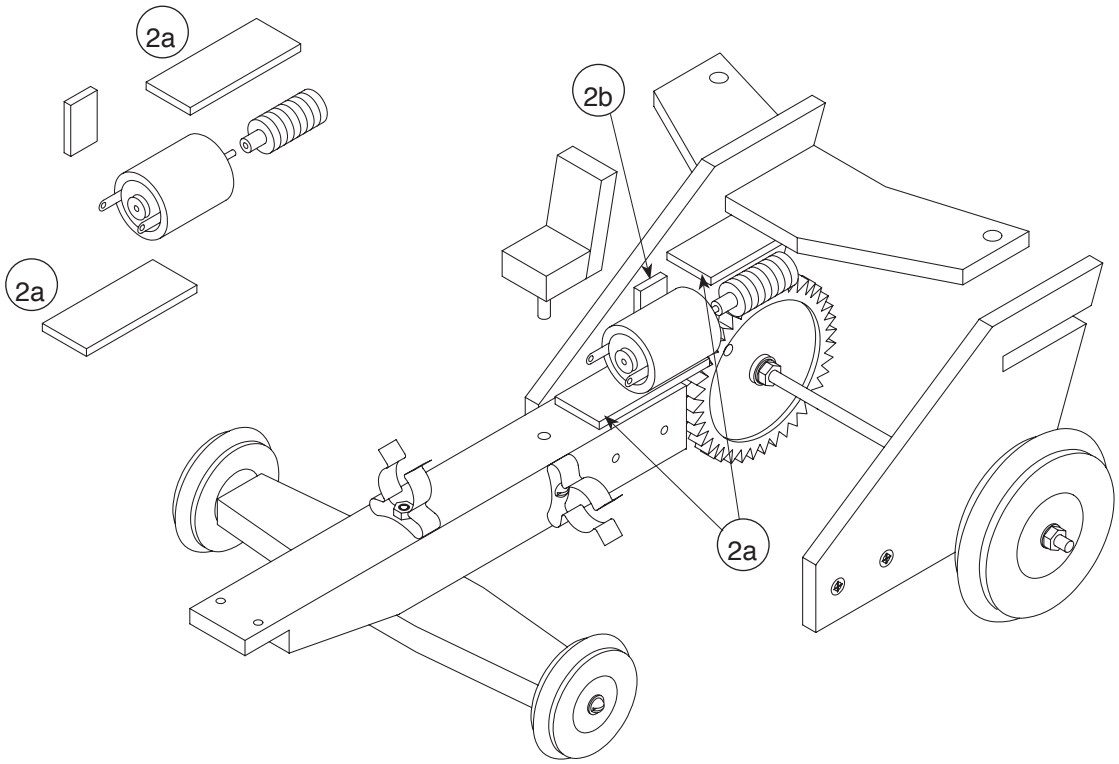
It is possible that there is no play at all between the worm and the wheel, in this case pack out under the wheel with a plywood strip (2a) 1.5 x 20 x 50mm. It is also possible

that motor does not have enough side hold, here again, a pair of small packing pieces from plywood 1.5 x 15 x 20 between the sides will hold it

Note: To trap the motor tightly loosen the side panels a little and then add the packing pieces and retighten!

If the plywood pieces are too thick they can be replaced by thin card offcuts (not included in the pack) to hold the motor

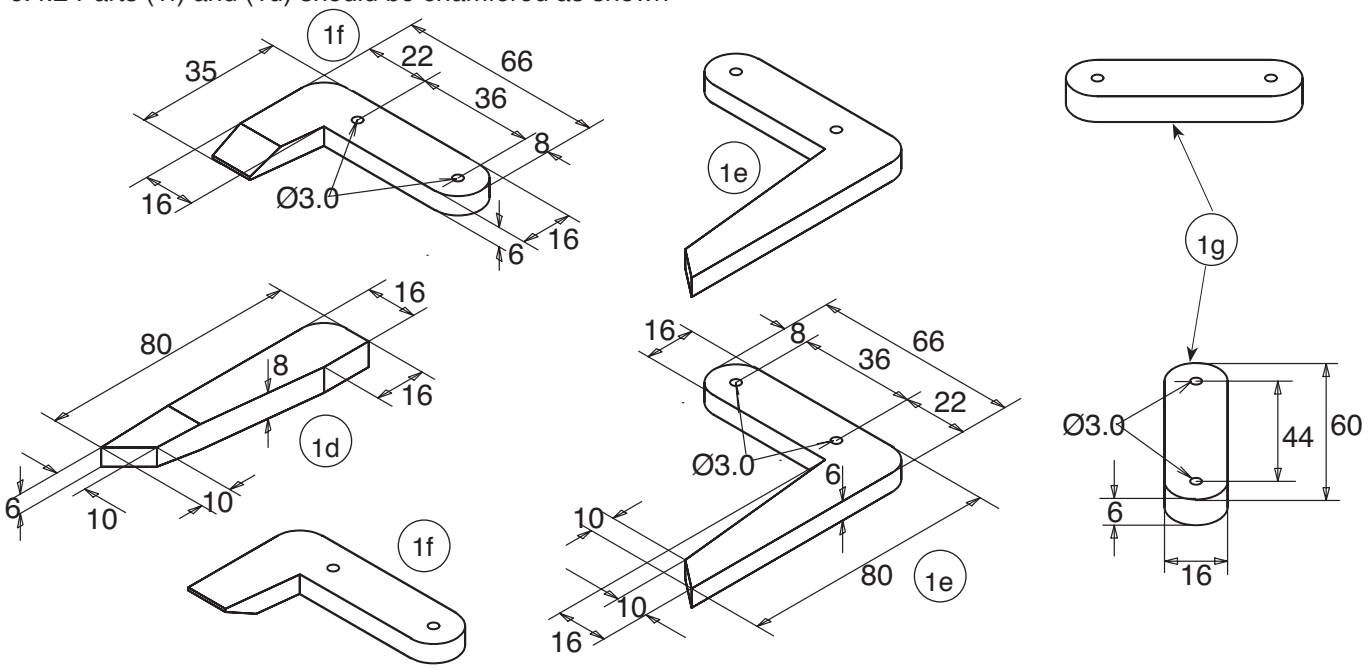
6.3.3 Place a small piece of plywood (2a) 1,5 x 20 x 50mm under the spoiler so that the worm is covered.

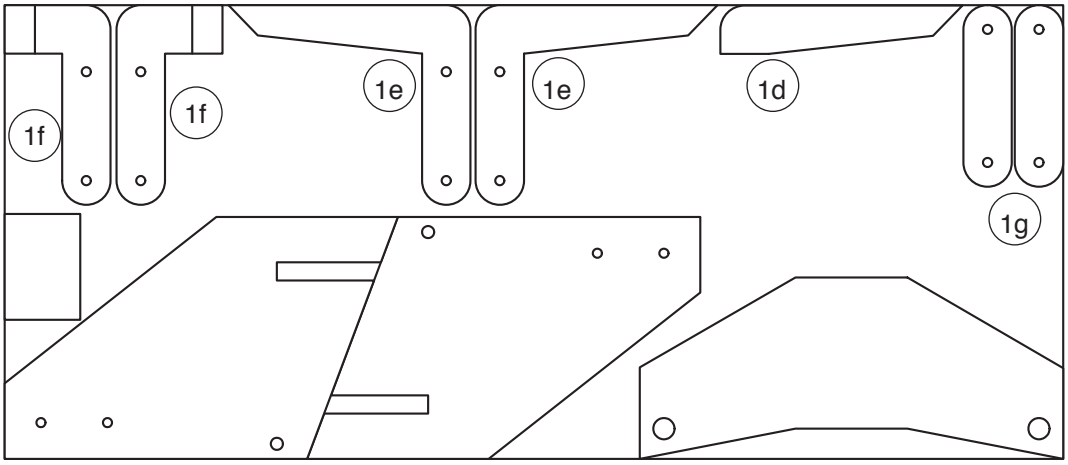


6.4 Designing and making the robotic arm

6.4.1 Mark out the parts (1d/1e/1f/1g) on the plywood sheet (1) and drill the holes , finally saw the shapes out.

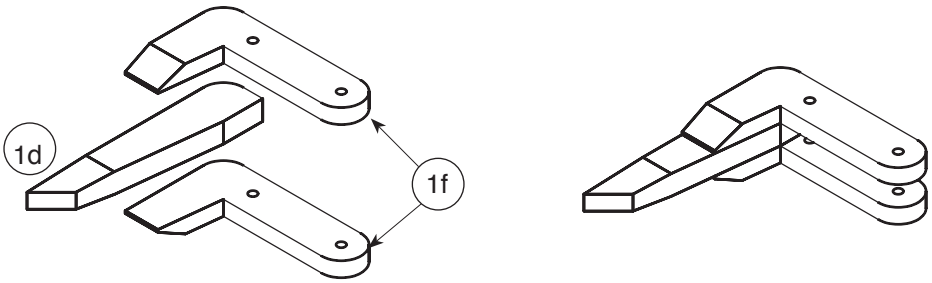
6.4.2 Parts (1f) and (1d) should be chamfered as shown



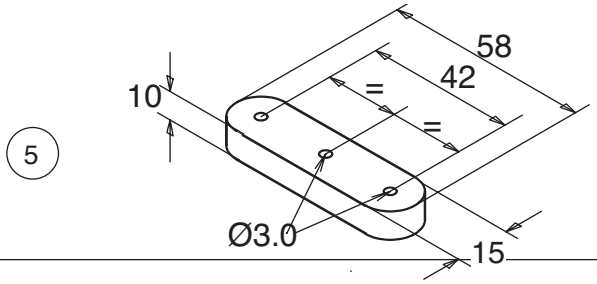


Note: There is an underneath part (1f) and a top part

6.4.3 Place part (1f) and (1d) on top of each other and glue them together



6.4.4 Mark out the sizes on part (5) on the strip (5) 10 x 15 x 125mm, drill , saw out and sand

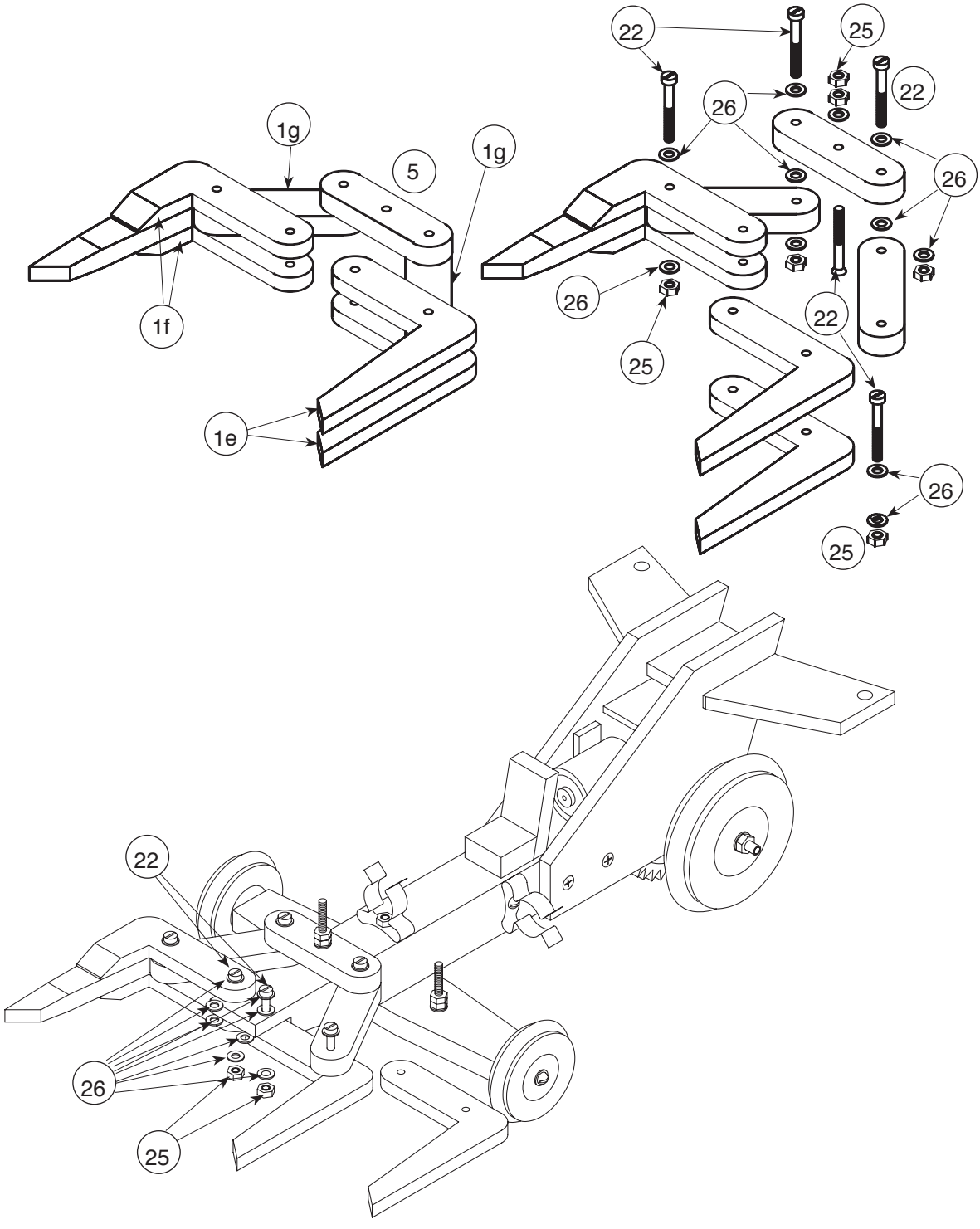


6.4.5 Using the diagram as a guide, arrange (part 1g) in between the parts (1e) and (1f) so that all the holes all line up. Finally place a washer under (26) on the machine screw threaded rod 3 x 25mm and from on top guide it in the hole. From underneath add a further washer (26) and a nut (25) and tighten so that (1g) it can turn

Note: That due to tolerances, part (1g) can stick between the other pieces (1f). By sanding the top of (1g) it will become thinner making more play possible

6.4.6 In the same way, part (5) is fixed to the free end of part (1g). To keep the friction between the parts to a low level place a washer under them (See the diagram)

6.4.7 In the middle hole in part (5) from underneath insert a machine screw (22) and then add a washer from above (26) and 2 nuts (25) Tighten and lock the nuts

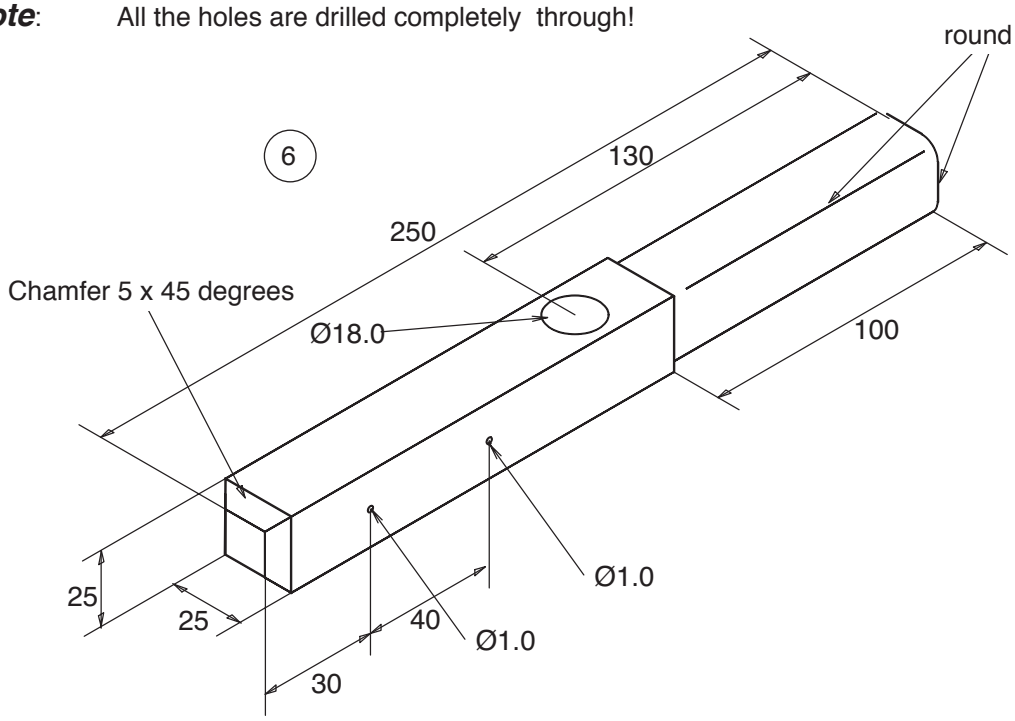


6.4.8 Place the arm on the (1e/1f) on the threaded stud pillar at the front of the chassis . To ensure there is not too much friction add a washer (26) on two screws (22) add a washer and insert them from above through the holes. From underneath add a washer (26) and a nut (25) tighten all the parts so that they move without undue play

6.5 Making and assembling the steering mechanisms (Hydraulic / Electric)

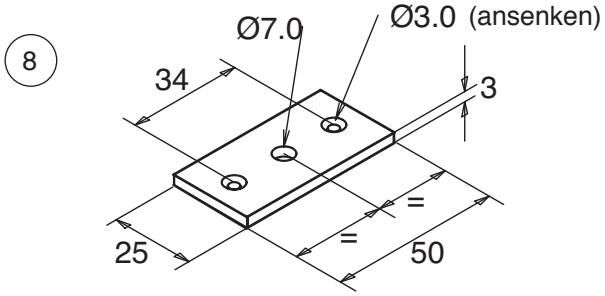
6.5.1 Measure out the sizes on pine strip (6) 25 x 25 x 250mm, drill, shape the handle, chamfer the front end

Note: All the holes are drilled completely through!



6.5.2 Mark out the acrylic strip (8) drill the holes, countersink, saw out and smooth the edges with wet & dry paper

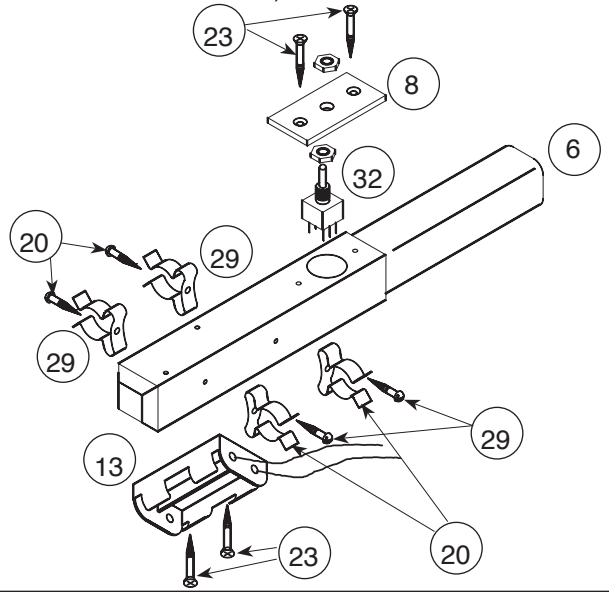
Note: Try not to remove the protective film! Mark out with a pencil or felt tip pen



6.5.3 Fix two steel spring clips (29) on each side of the hand grip with two screws (20)

6.5.4 Fit the battery holder (13) with 2 screws (23) 3 x 20 on top or underneath the hand control. (Use a bradawl to make holes) in the middle, towards the front as shown.

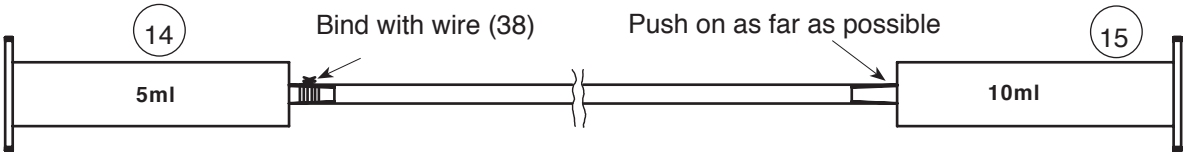
6.5.5 Fit the switch (32) in the middle of the acrylic strip (8) Then fit the acrylic strip (8) on the control arm as shown with two screws (23) (Use a bradawl to make holes first).



6.5.6 Drill a 3mm diameter hole through the two small syringe pistons (14)

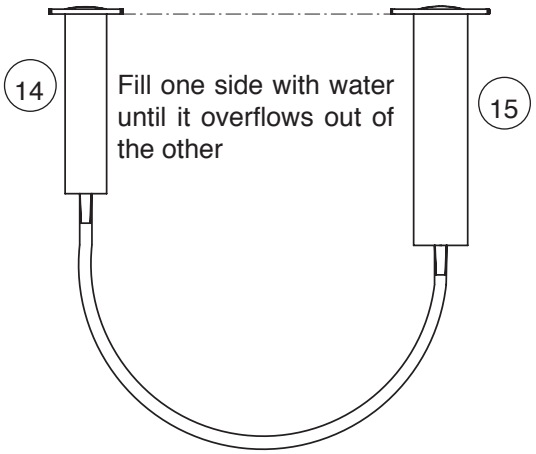
6.5.7 Cut the PVC tube (16) in half and join a small syringe (14) and a large syringe (15) together making sure the tube is pushed on either end as far as possible. Lock it on with a wire (38)

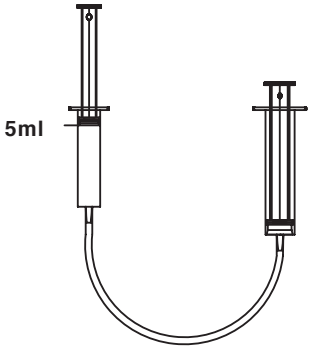
Note: To be sure you can glue the ends with a drop of super glue or two component glue before binding with the wire. (Roughen the nozzle of the syringes with glasspaper first)
Make sure that no glue blocks the nozzle!



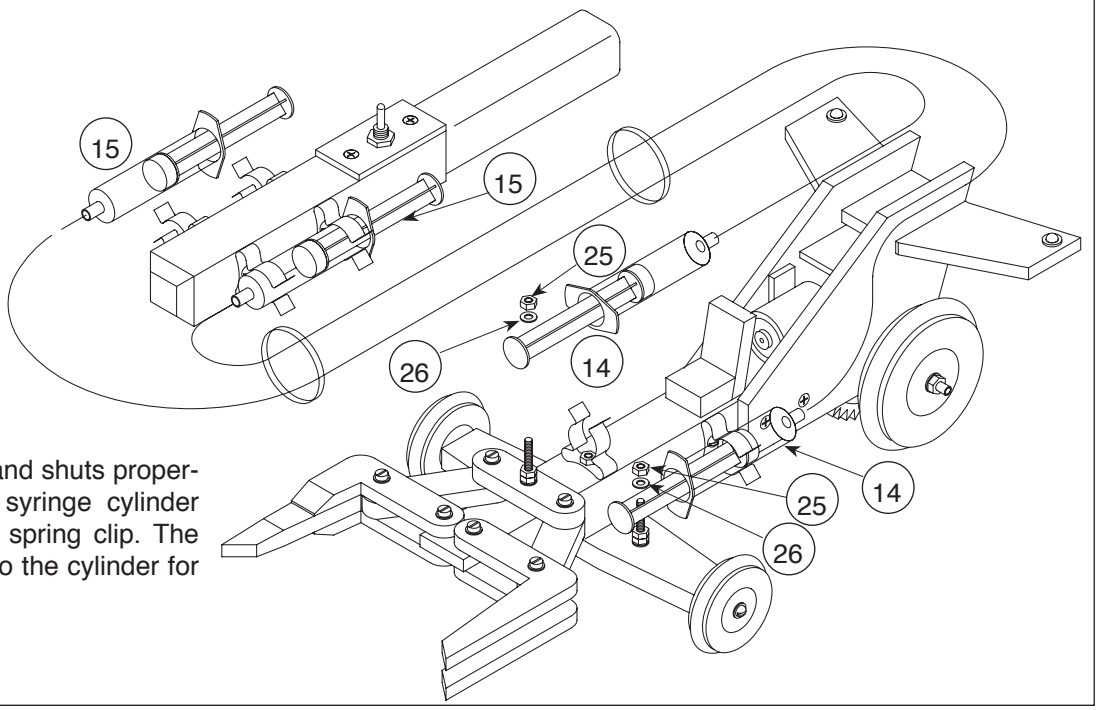
6.5.8 Fill the system with water as shown , ensuring that there are no air bubbles

Note: To identify the different controls, the water can be colour coded (Use food colouring)





Note: Be careful when pressing the on the large syringe that the plunger (piston) in the Smaller syringe does not shoot out

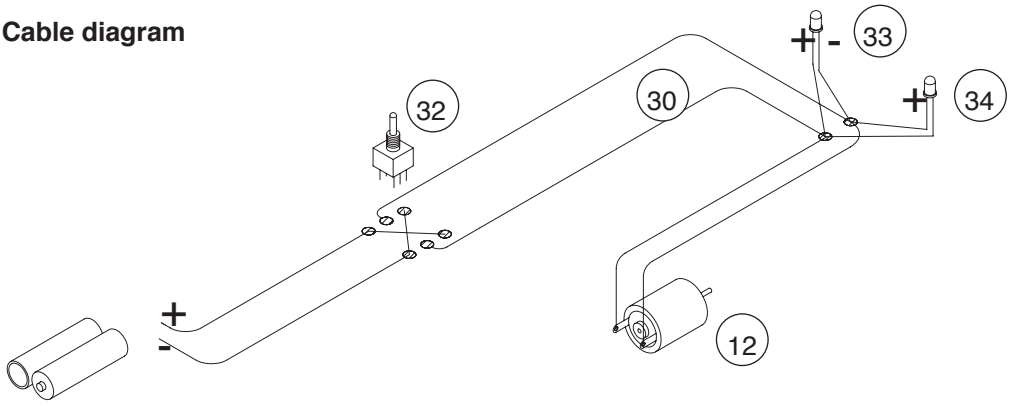


Setting up
So that the arm opens and shuts properly, the position of the syringe cylinder can be adjusted in the spring clip. The same principle applies to the cylinder for the steering

6.5.10 Bare and tin the ends of the twin cable (30). Solder the ends to the motor (12) as shown and the middle contacts on the switch (32)

6.5.11 From the insulated wire (31) cut off two 20mm lengths of different colours, bare the ends and tin them, solder the wire in a cross pattern under the switch. Join the
lower left with the upper right and the upper left and lower right hand contact,
this crossover network will allow the vehicle to be driven backwards and forwards

Cable diagram



6.5.12 Solder the battery holder(13) on the switch contacts

Note: If the wires are is too short, join on two different colours from the cable (31)
Strip and tin the ends and solder to make extensions for the battery clip
Cover the joints with insulation tape

6.5.13 Insert the Led sockets (35) from above in the rear spoiler. From underneath push the red Led (33) to the left hand holder as seen from the front and the green LED (34) in the right hand holder

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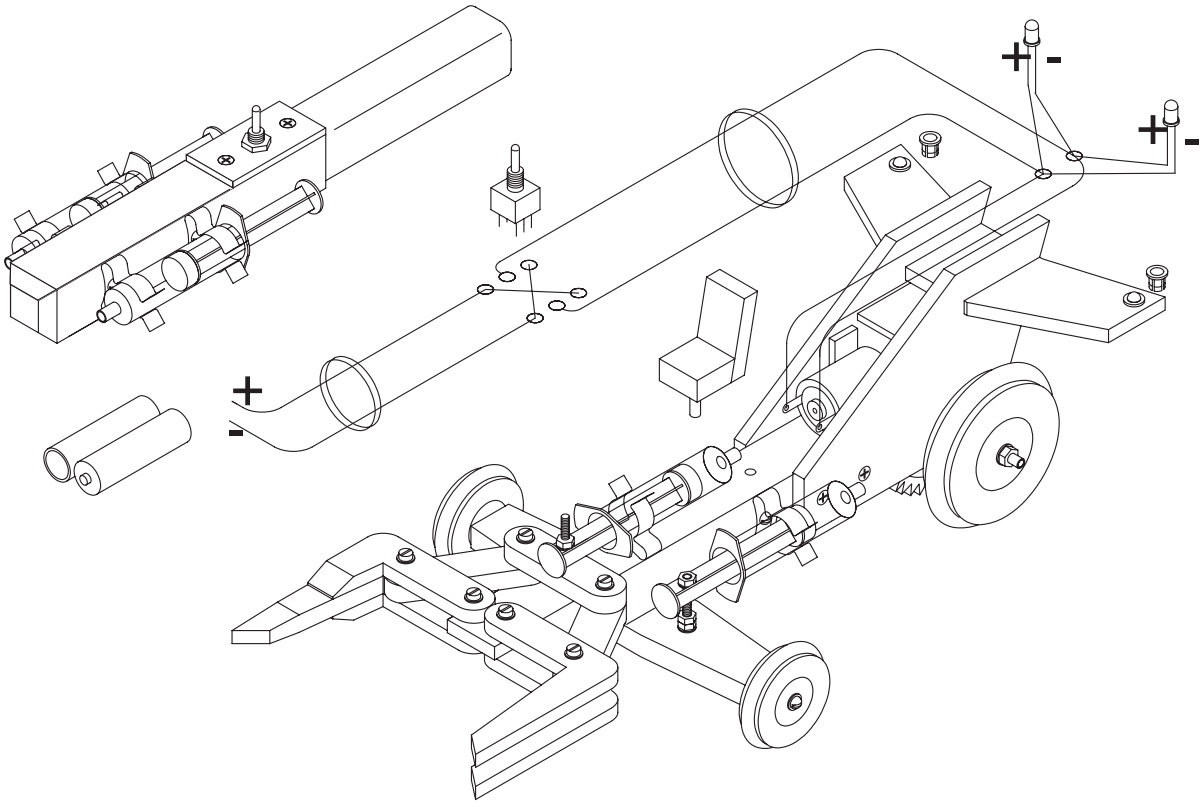
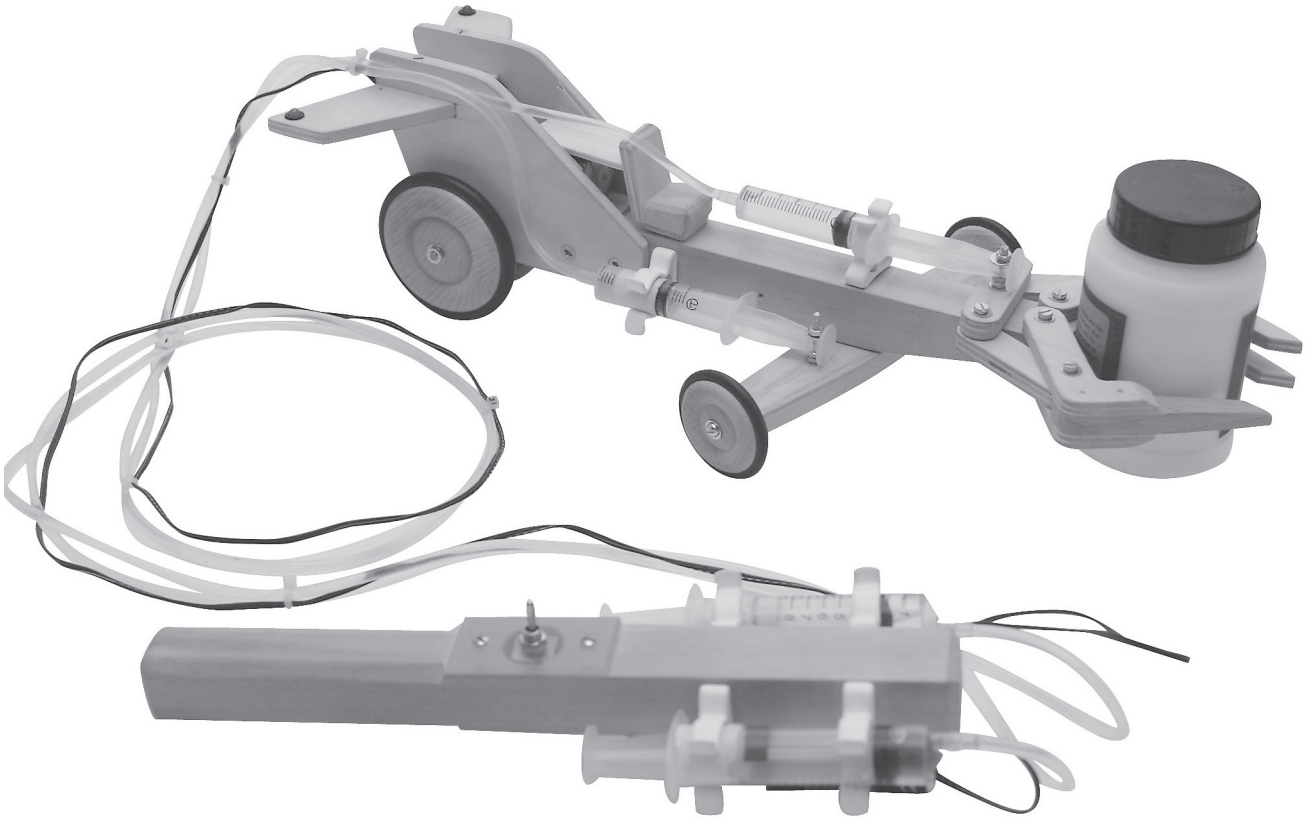
6.5.14 From the wire (31) cut four pieces (2 different colours) 150mm long, strip and tin the ends
Using two lengths of different colours join the red LED to the pole on the motor, so as the vehicle drives forward the red LED lights. To do this insert the batteries and click the switch to the forward position. With the remaining cable, colour coded connect the Anode (+pole) of the red LED (33) with the Cathode (-Pole) of the green LED and the cathode of the red LED with the Anode of the green LED



6.6 Function controls

6.6.1 Test each system for leaks and that it works. Press the large driving syringe cylinders (On the control) to se if the arm and steering works. Moving the position of the cylinders will allow for adjustments

6.6.2 Check the run of the wiring and that it does not foul any of the mechanical parts , motor and worm drive etc Tidy all the cables and tubes with wire connectors or insulation tape



Patterns

Scale 1:1