

**TECHNICAL FILE OF
THE REED SWITCH
MOTOR (RSM)**

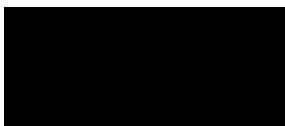
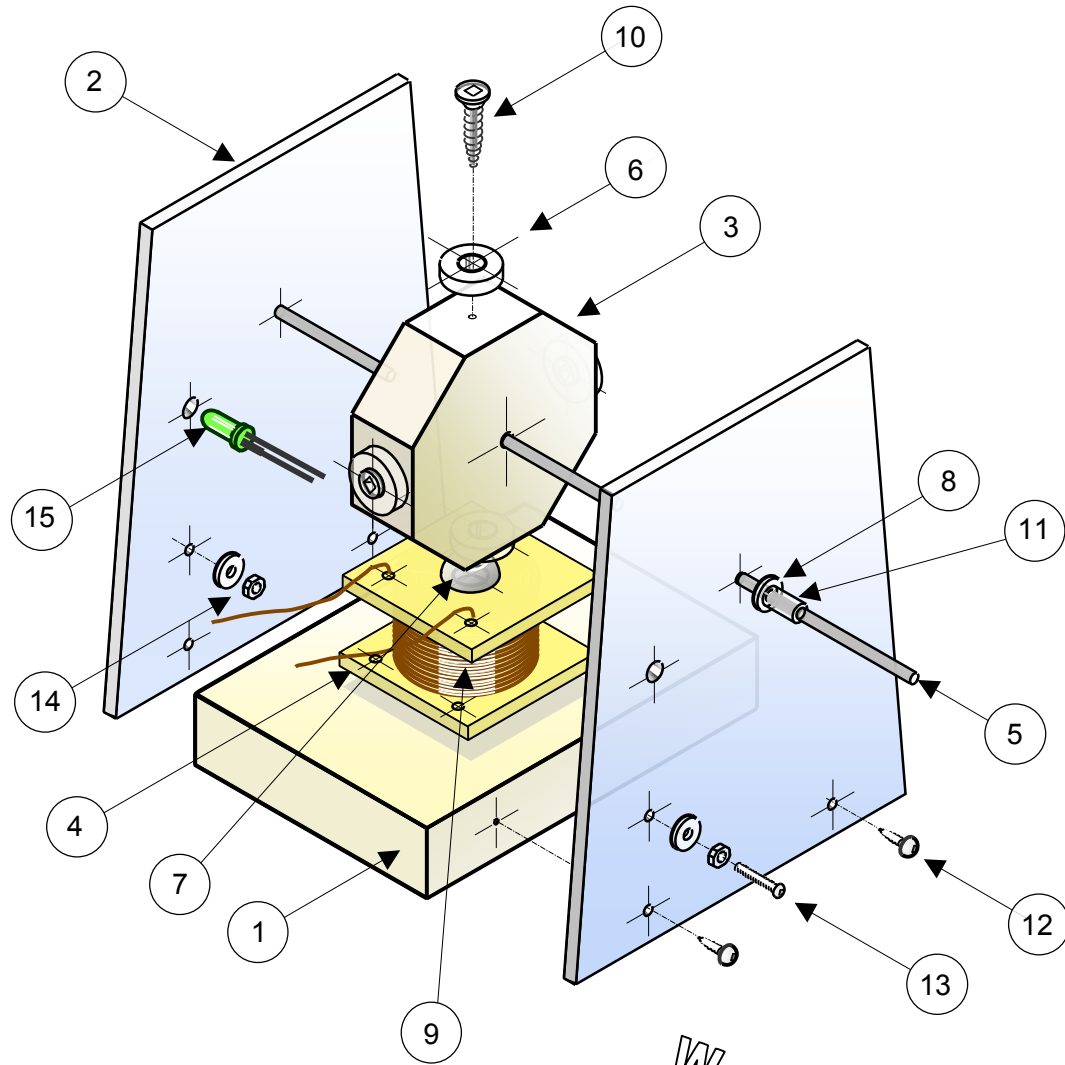


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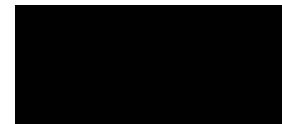
- 1. Nomenclature of the RSM**
- 2. Rotor template**
- 3. Fabrication of the base of the motor**
- 4. Fabrication of the rotor shaft brackets**
- 5. Fabrication of the electromagnet**
- 6. Fabrication of the rotor**
- 7. RSM assembly range**
- 8. Workshop safety capsules**



Working Document

NOMENCLATURE

LOC	DESIGNATION	No.	OBSERVATIONS
15	LED	1	Ø 5
14	Bolt	4	n° 6 x 32
13	Input terminals	2	Mechanical screw n° 6 x 32 x 1/2"
12	Screw – round head	4	N° 6 x 3/4"
11	Butt tube	2	Flexible vinyl tubing 1/8" int.
10	Milled cap screw	4	Wood screw n° 6 X 3/4
9	Solenoid	1	Enameled copper wire 28 gauge
8	Washer	4	n° 8 flat washer
7	Solenoid core	1	Screw 1/4" x 20 x 1 1/2"
6	Magnet	4	Rare-Earth magnet washers Ø exterior 1/2" Ø interior 1/4"
5	Rotor shaft	1	Dowel Ø 1/8", length 150
4	Solenoid butt	2	Polystyrene 35 x 35 x 3
3	Rotor	1	Pine 50 x 50 x 16
2	Side of motor	2	Polystyrene 90 x 100 x 3
1	Base of motor	1	Pine slat 64 x 90 x 16



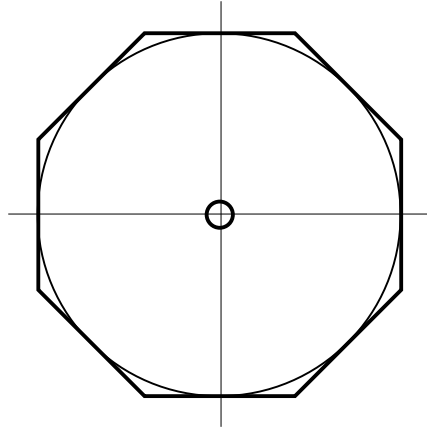
TITLE : Reed Switch Motor

GENERAL TOLERANCE ± 1mm N° 5

DATE : 10 NOV 2009

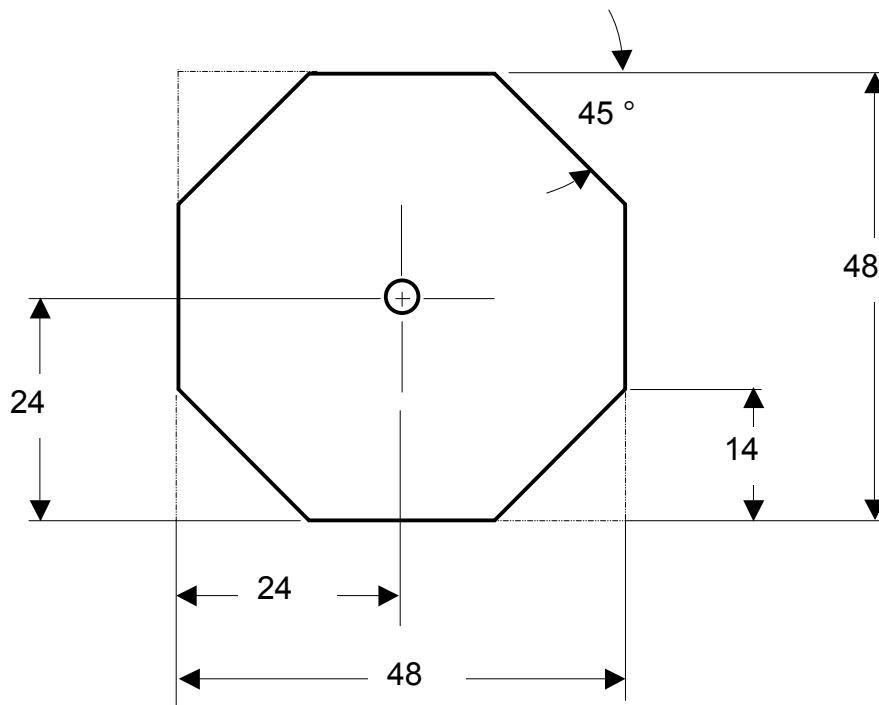
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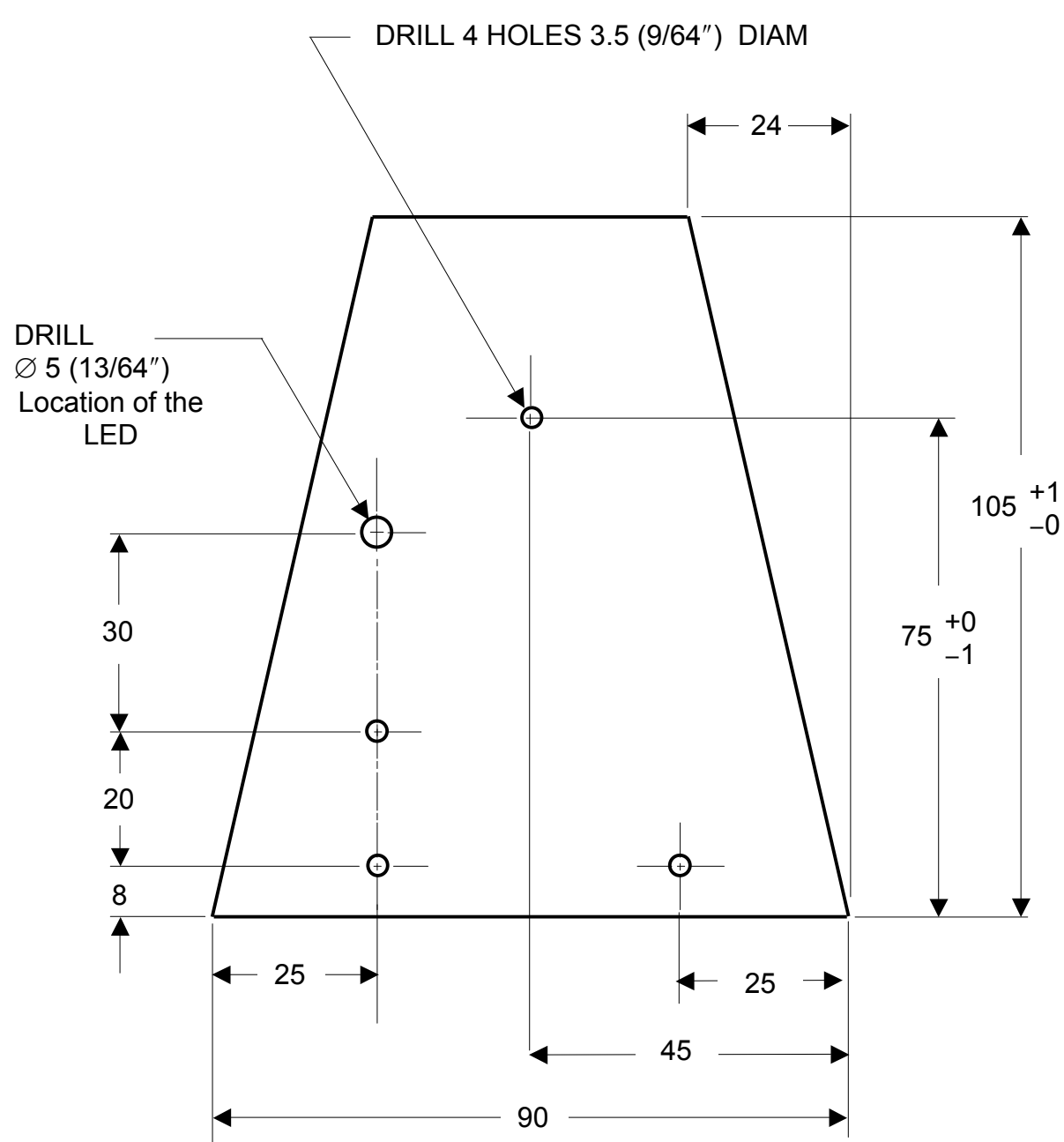
Rotor template



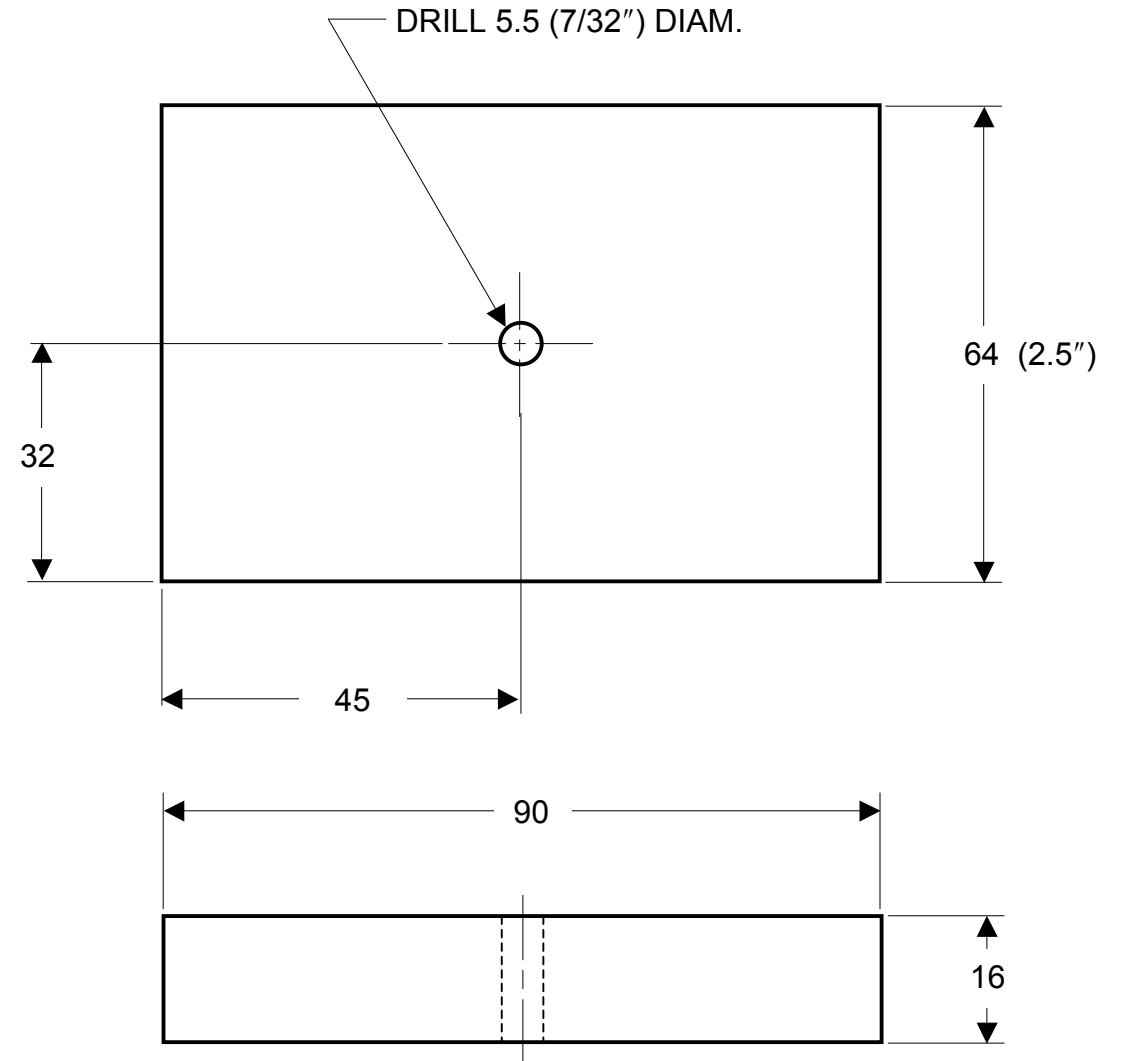
Ensure that this page is really to scale after printing.

When printing with "Acrobat Reader" it is important not to choose the "Page scaling" option in the "Print" menu.





2 - DETAIL DRAWING OF THE ROTOR SHAFT BRACKET



1 - DETAIL DRAWING OF BASE

Safety capsules

(9) Press drill



1. Wear safety glasses to protect against projections.
2. Tie long hair and roll your sleeves to avoid them becoming entangled around the chuck.
3. Do not wear bracelets, necklaces, jewellery, etc.
4. Careful! Risk of serious injury! Firmly affix materials to the table using clamps to avoid a part being hooked to the bit and spun around at great speeds.
5. Adjust the height and depth of the table and tidy the work surface before starting the drill.
6. Use a well sharpened bit, otherwise unnecessary effort could cause break the bit and cause injury.
7. Remove the chuck key immediately after having tightened the drilling tool.
8. Take the time to think about each of your gestures.
9. Respect the security perimeter on the floor. The proximity of another person could distract the user.
10. Unplug the tool from the power source before changing a bit.



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ASSEMBLY RANGE

COMPONENT: **BASE**

SET: **Reed Switch Motor (RSM)**

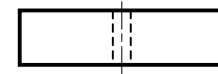
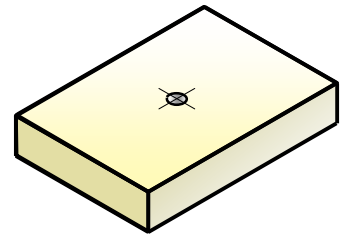
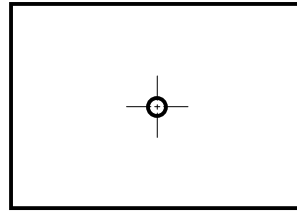
RANGE : **1**




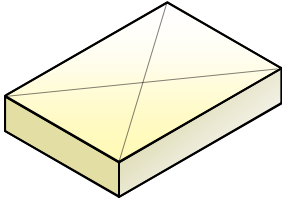
SHEET: **1 of 2**

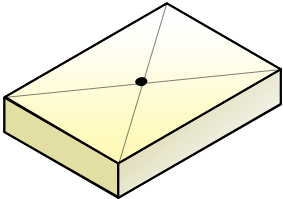
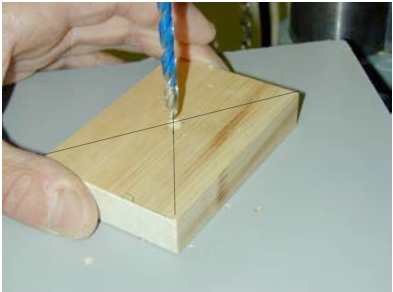
DRAWING: **2**

MATERIAL: **Pine**

NUMBER: **1**



N°	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
10	TRACING		
11	Trace a 90 mm long line on a pine slat.		<ul style="list-style-type: none"> - Ruler - Pencil - Angle iron
20	SAWING		
21	Using a mitre box, saw the base while respecting the line.		<ul style="list-style-type: none"> - Hand saw - Mitre box
30	SANDING		
31	Sand the edges.		<ul style="list-style-type: none"> - Sandpaper
40	DRILLING		
41	Find the center of the block by tracing two diagonal lines.		<ul style="list-style-type: none"> - Ruler - Pencil

FABRICATION RANGE FOR THE BASE			SHEET: 2 of 2
N°	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
42	Punch the center of the hole.		<ul style="list-style-type: none"> - Punch - Hammer
43	Using a 5.5 Ø diameter bit, drill a hole in the middle of the part.		<ul style="list-style-type: none"> - 5.5 Ø drill bit - Sensitive drill - Safety glasses

ASSEMBLY RANGE

COMPONENT: **ROTOR SHAFT
BRACKET**

SET: **REED SWITCH MOTOR (RSM)**

RANGE: **2**

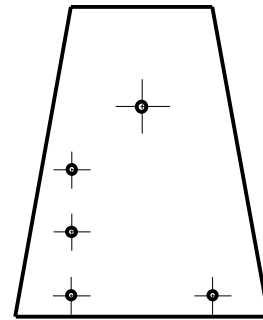
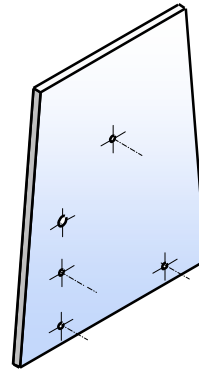
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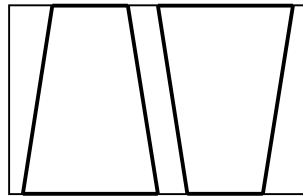

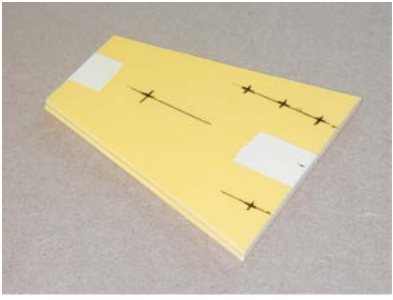
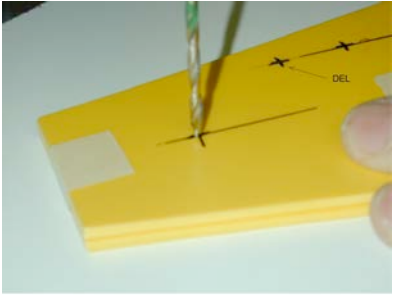
DRAWING: **2**

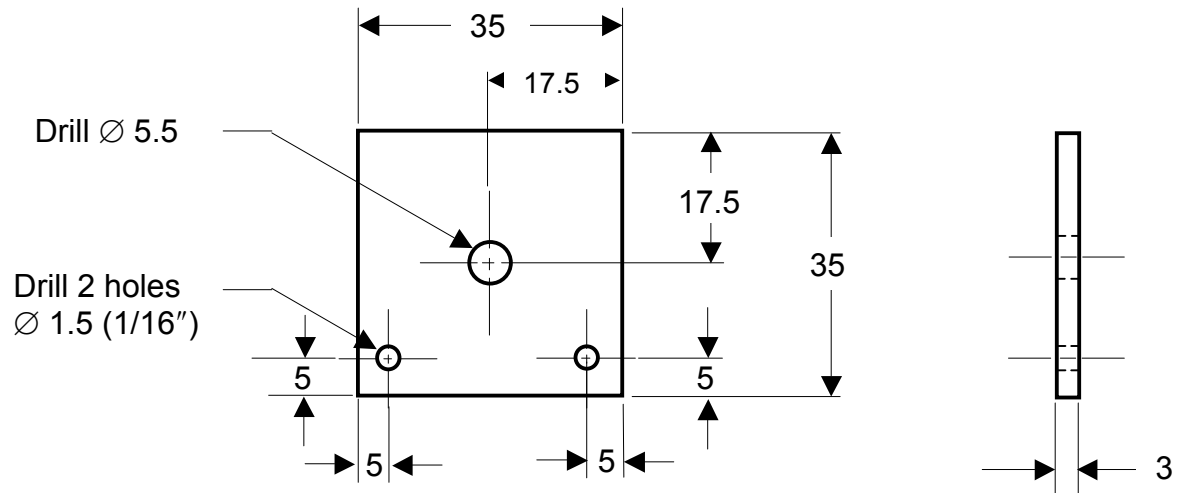
MATERIAL:

NUMBER: **2**

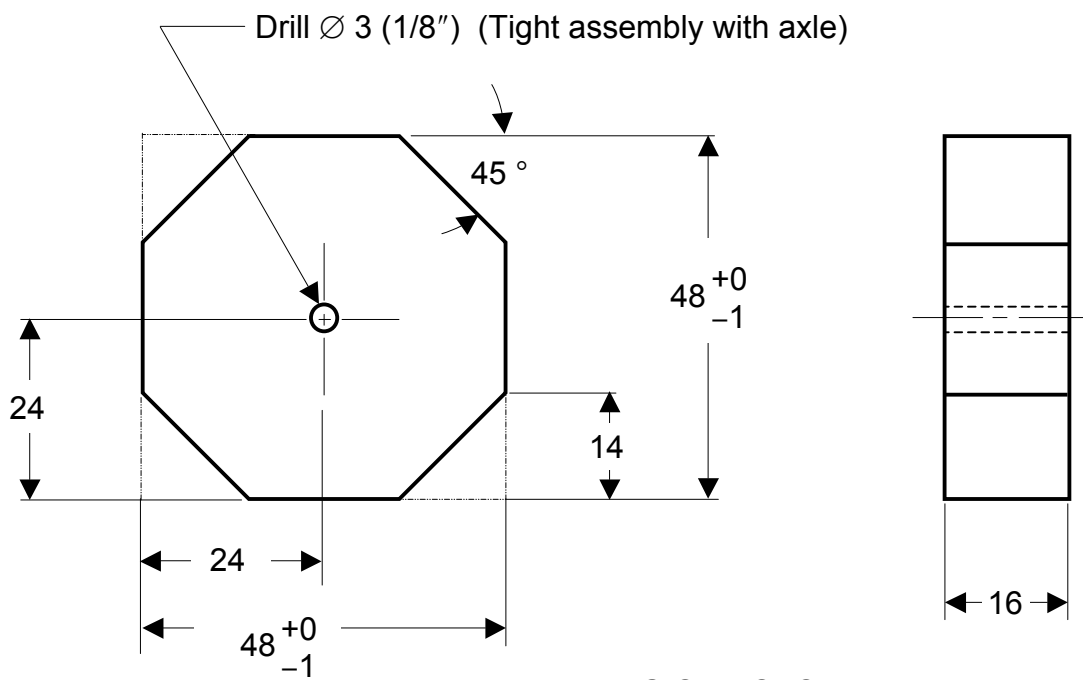
Polystyrene



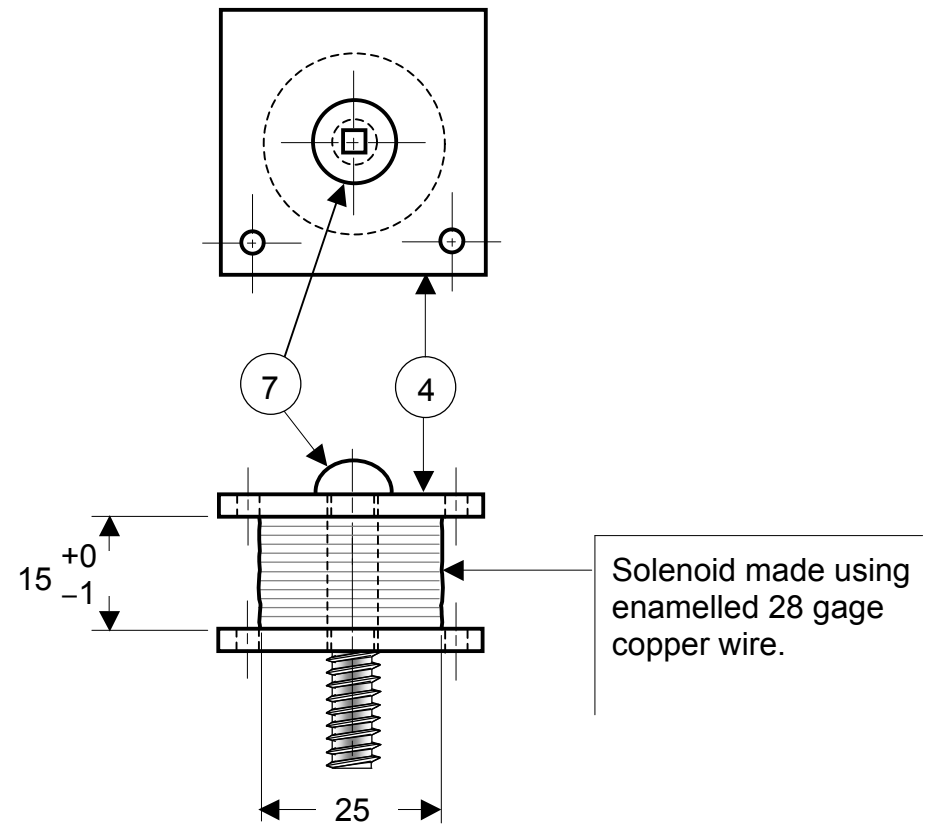
N°	PHASE, SUB-PHASE OR OPERATION	PHOTO O DRAWING	MACHINE-TOOL, TOOLS
10	TRACING		
11	In a sheet of polystyrene and referring to detail drawing n°2 , trace the side twice. Careful! Take into account the specific tolerance on drawing n°2, it will be easier to make your design.		<ul style="list-style-type: none"> - Ruler - Pencil - Angle iron - Detail drawing n°2
20	CUTTING		
21	Using a knife for plastics cut along the outline of each side.		<ul style="list-style-type: none"> - Knife for plastics - Safety ruler
22	Finish the edges with a scraper and sandpaper.		<ul style="list-style-type: none"> - Scraper - Sandpaper
30	DRILLING		
31	Using the detail drawing n° 2 , mark the locations where holes are to be drilled. Careful! Take into account the specific tolerance on drawing n°2, it will be easier to make your design.		<ul style="list-style-type: none"> - Ruler - Pencil - Detail drawing n°2 - Masking tape
32	Tape the two sides together temporarily to drill them at the same time.		<ul style="list-style-type: none"> - Punch - Hammer
33	Punch and drill all 3.5 Ø holes		<ul style="list-style-type: none"> - 3.5 Ø bit
34	Enlarge the hole that will receive the LED using the 5 Ø bit (see location on detail drawing n° 2).		<ul style="list-style-type: none"> - 5 Ø bit
35	Untape the two parts.		



4 - DETAIL DRAWING OF BUTT PLATES



3 - DETAIL DRAWING OF ROTOR



DRAWING OF SUB SET (ELECTROMAGNET)

Safety capsules

(4) Hand drill



1. Tie long hair to avoid it becoming entangled around the chuck.
2. Wear safety glasses to protect against projections.
3. Do not wear bracelets, necklaces, jewellery, etc.
4. Clean the work surface of any debris that could lead to dangerous movements or that could hamper the proper operation of the drill.
5. Use a well sharpened bit, otherwise unnecessary effort could cause break the bit and cause injury.
6. Take the time to think about each of your gestures.
7. Do not work close to a water supply (tap, drinking fountain, etc.). Water and electricity are not a good combination.
8. Unplug the tool from the power source before changing a bit.



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ASSEMBLY RANGE

COMPONENT: **ELECTROMAGNET**

SET: **Reed Switch Motor (RSM)**

RANGE: **3**

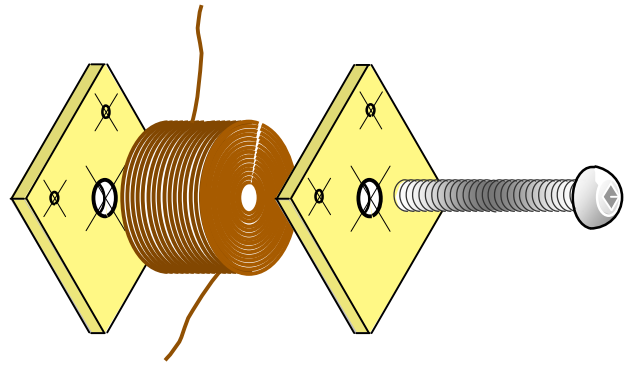
SHEET: **1 of 2**

DRAWING: **3**

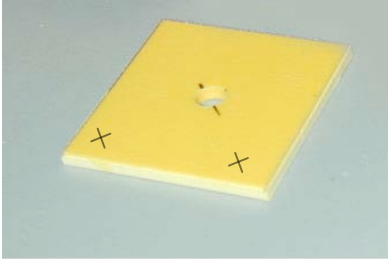

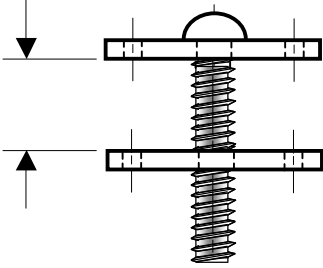
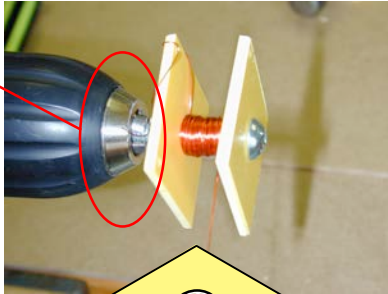
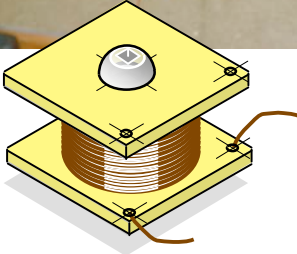
MATERIALS:

NUMBER: **1**

**Copper, polystyrene,
steel**

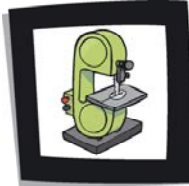


N°	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
10	TRACING		
11	<p>On a piece of polystyrene, trace two squares with 35 mm sides and mark the centers.</p> <p>These squares will be the upper and lower butts of the electromagnet.</p>		<ul style="list-style-type: none"> - Ruler - Pencil - Angle iron
20	CUTTING		
21	Using a knife for plastics cut out the two butts.		<ul style="list-style-type: none"> - Plastics knife - Safety ruler
22	Finish the edges using a scraper and sandpaper.		<ul style="list-style-type: none"> - Scraper - Sandpaper
30	DRILLING		
31	Punch the holes.		<ul style="list-style-type: none"> - Punch - Hammer
32	<p>Affix the first butt in a vise and using a 5.5mm Ø bit, drill the hole. Repeat the same operations for the other butt.</p> <p>Note: It is possible to glue the two butts together before drilling. you will avoid performing the operations twice.</p>		<ul style="list-style-type: none"> - Hand drill - Vise - 5.5 mm Ø bit

FABRICATION RANGE FOR THE ELECTROMAGNET			SHEET: 2 of 2
N°	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
40	WORK AT THE WORKBENCH		
41	Using detail drawing n°3 , mark the location of the 1.5 Ø holes.		<ul style="list-style-type: none"> - Detail drawing n°3 - Pencil - Ruler
42	Temporarily glue the two parts together to drill them.		
43	Punch the two holes.		<ul style="list-style-type: none"> - Masking tape - Punch - Hammer
44	Affix the parts in a vise and drill two 1.5 Ø holes. These holes will allow the copper wire through. Drilling the two butts will avoid having to interchange them when assembling.		
45	Screw a 1½ inch long screw (1/4-20) into the lower butt (the screw will thread the hole).		
46	Repeat the same operation with the other butt, leaving the space indicated on drawing n°3. Careful! Take into account the specific tolerance, it ensures the correct operation of the motor. Cover the threads of the screw, located between the two butts, with adhesive tape. The aim is to protect the varnish on the wire from abrasion.		<ul style="list-style-type: none"> - Vise - Screwdriver - Adhesive tape
47	Affix the two butts attached to the screw into the chuck of a drill and start to roll the copper wire close to the chuck (about 15 cm long). Roll the copper wire until the diameter of the solenoid is approximately 25 mm.		<ul style="list-style-type: none"> - Hand drill - Vise - 28 gage varnished copper wire - Calliper
48	Insert the ends of the copper wire into the 1.5 mm holes in order to affix them. Sand the two ends of the wire to remove the varnish. When soldering, the solder must be in direct contact with the copper.		<ul style="list-style-type: none"> - Sandpaper

Safety capsules

(7) Band saw



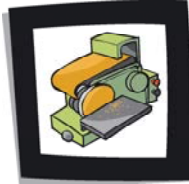
1. Wear safety glasses to protect against projections.
2. Tie long hair and roll your sleeves to avoid them becoming entangled in the mechanism.
3. Do not wear bracelets, necklaces, jewellery, etc.
4. Clean the work surface of any debris that could lead to dangerous movements or that could hamper the proper operation of the saw.
5. Use a sharp blade, otherwise unnecessary effort could cause injuries.
6. Take the time to think about each of your gestures. Keep your hands further than 5 cm. from the cut line at all times.
7. Use a pusher for small parts in order to keep your hands far from the blade.
8. Respect the security perimeter on the floor. The proximity of another person could distract the user.
9. Activate the dust hood or wear a dust mask.
10. Wear acoustic protection to avoid auditory problems if the exposure to noise attains 85 decibels for a period of 8 consecutive hours.



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Safety capsules

(8) Disk and band sanders



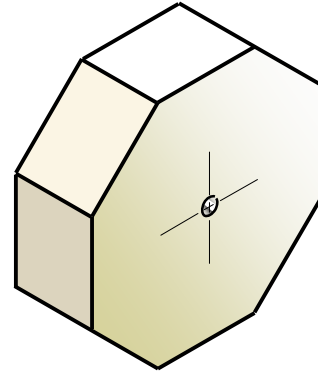
1. Wear safety glasses to protect against projections.
2. Tie long hair and roll your sleeves to avoid them becoming entangled in the mechanism.
3. Do not wear bracelets, necklaces, jewellery, etc.
4. Clean the work surface of any debris that could lead to dangerous movements or that could hamper the proper operation of the sander.
5. Take the time to think about each of your gestures.
6. Respect the security perimeter on the floor. The proximity of another person could distract the user.
7. It is compulsory that the dust hood be activated when using the disk or band sander. If you are in the presence of a cancer causing contaminant (such as silica) the mask is also mandatory.
8. Call the workshop supervisor if the belt becomes misaligned.
9. Wear acoustic protection to avoid auditory problems if the exposure to noise attains 85 decibels for a period of 8 consecutive hours.



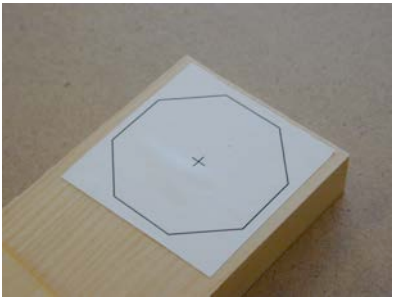
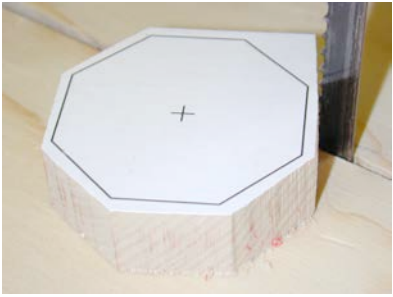

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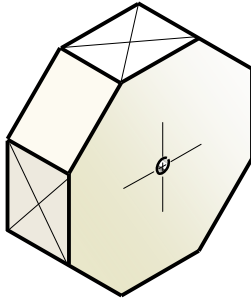



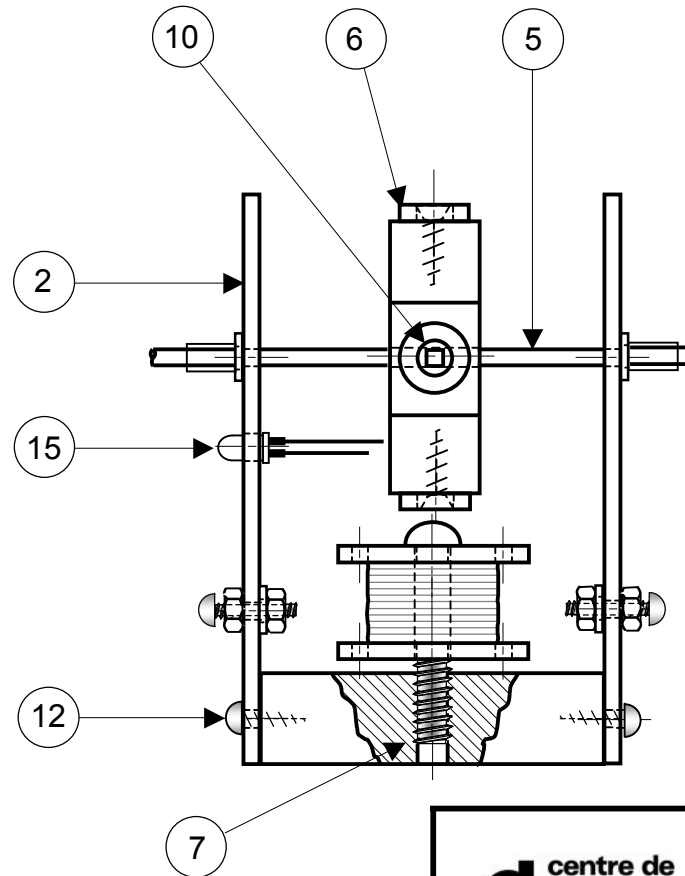
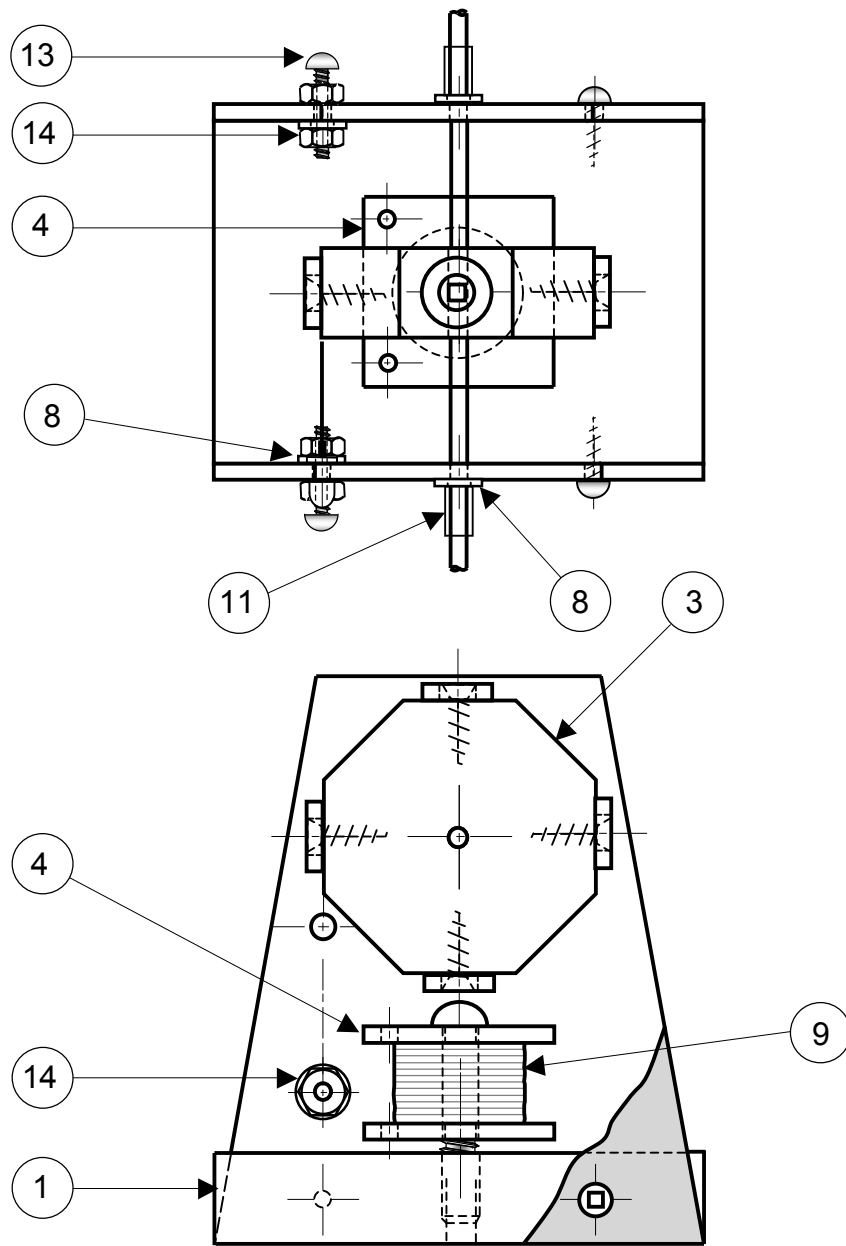
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FABRICATION RANGE	
COMPONENT: ROTOR	
SET: Reed Switch Motor (RSM)	
RANGE: 4	SHEET: 1 of 2
DRAWING: 3	MATERIAL: Pine
NUMBER: 1	

N°	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
10	TRACING		
11	Cut out a rotor template and glue it onto a wooden plank with 50mm sides.		<ul style="list-style-type: none"> - Rotor template - Scissors - Glue stick
20	CUTTING		
21	Using a saw, cut out the outline of the octagon.		<ul style="list-style-type: none"> - Hand saw or - Band saw
30	SANDING		
31	Sand the edges of the octagon, coming as close as possible to the lines, taking into account the specific tolerances on detail drawing n°3 .		- Sander
32	Measure and control the shape of the rotor so as to respect this functional dimension (drawing n°3). Note : Respecting these specific tolerances will make the design of the switch bracket much easier.		<ul style="list-style-type: none"> - Detail drawing n°3 - Ruler

FABRICATION RANGE FOR THE ROTOR			SHEET: 2 of 2
N ^o	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
40	DRILLING		<ul style="list-style-type: none"> - 3 Ø Drill bit - Press drill - Drill vise - Safety glasses
41	Using a 3 Ø drill bit, drill the hole at the center of the octagon (depending on the size of the dowel a bigger, 1/8 in. bit (3,18 mm) might be required) Note: The drill hole must be perpendicular to the surface.		
50	WORK AT THE WORKBENCH		<ul style="list-style-type: none"> - Ruler - Pencil - Hand saw - Mitre box
51	Measure and cut a 150mm long and 3mm Ø (1/8") dowel.		<ul style="list-style-type: none"> - Hammer
52	Insert the dowel into the hole of the octagon.		
53	Locate the center of the four sides (every second side) on the edge of the rotor by tracing diagonal lines.		<ul style="list-style-type: none"> - Ruler - Pencil
54	Punch and pre-drill the 4 - 2 Ø holes.		<ul style="list-style-type: none"> - Punch - Hammer - Hand drill - 2 Ø Bit
55	Screw a magnet on every second side of the octagon.		



OVERALL DRAWING OF REED SWITCH MOTOR

REF	No.	DESIGNATION
15	1	LED
14	4	Bolt
13	2	Input terminal
12	4	Round head screw
11	2	Butt tube
10	4	Milled cap screw
9	1	Solenoid
8	4	Washer
7	1	Solenoid core
6	4	Magnet
5	1	Rotor shaft
4	2	Solenoid butt
3	1	Rotor
2	2	Rotor shaft bracket rotor
1	1	Base of motor

Safety Capsules

(2) Hot glue gun



1. Watch out for burns: the gun usually attains temperatures of 120°C to 195°C.
2. Wear appropriate clothing to protect yourself against accidental drips (thigh protection, for instance).
3. Wear safety glasses to avoid projections of burning glue.
4. Place the glue gun in a safe place between uses, since it tends to drip. An aluminium plate would work well.
5. Do not work close to a water supply (tap, drinking fountain, etc.). Water and electricity are not a good combination.
6. Do not heat the glue to a greater temperature than that recommended by the manufacturer (in a flame, for example). The glue may emit toxic emanations.



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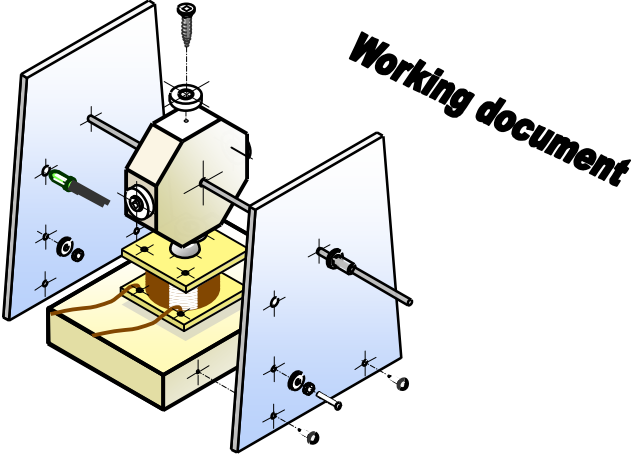
Safety capsules

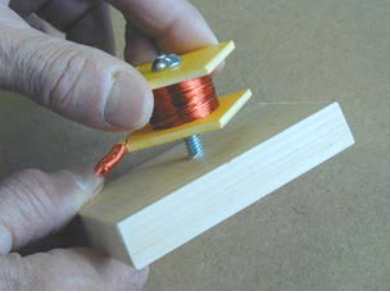
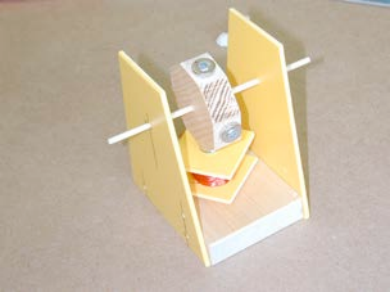

(1) Lead, tin and other soldering


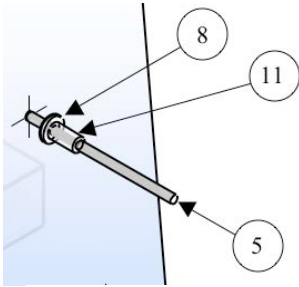
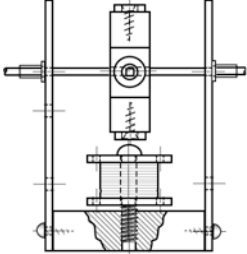
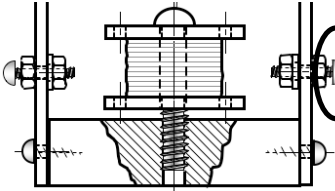
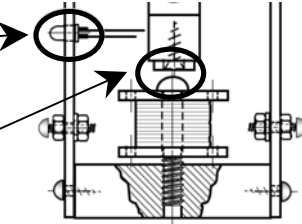
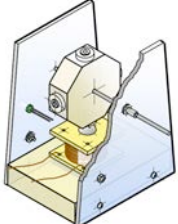
1. Watch out for burns that can be caused by the iron at more than 200°C. (Do not wear rubber or latex gloves, these substances could melt on your hands.)
2. Wear safety glasses to protect yourself from solder projections.
3. Use a soldering iron rest to avoid setting your clothing, hair, paper or plastic etc. on fire.
4. Do not shake the iron to clean it: use the sponge designed for the job.
5. Avoid touching the solder to your mouth or teeth - it is extremely toxic. (You must neither eat nor drink while soldering.)
6. Never solder components under tension.
7. Use in a well aired room or solder under the hood designed for this use in order to limit inhaling the vapours, since they are toxic.
8. Use a desoldering bulb to remove a faulty solder.
9. Wash your hands after your work, and clean the work table to avoid any risk of intoxication.

Ensure that any modification to this capsule does not compromise student safety. Any person at fault will bear the consequences of his choices.

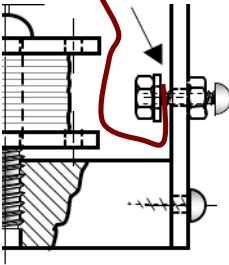
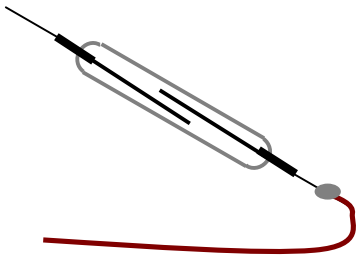
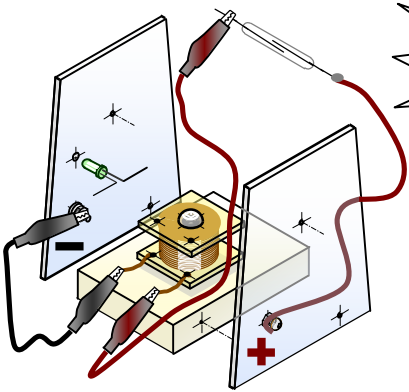
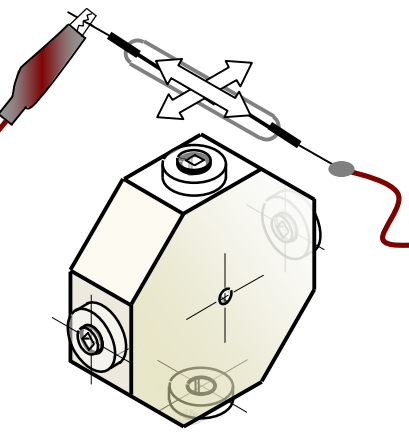


			
ASSEMBLY RANGE			
Reed Switch Motor (RSM)			
RANGE: 5		SHEET: 1 of 5	
DRAWING: 4		MATERIALS :	
NUMBER : 1		Various	
N°	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS

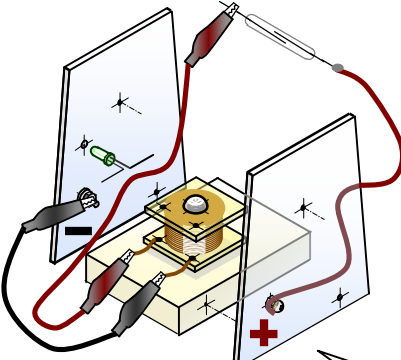
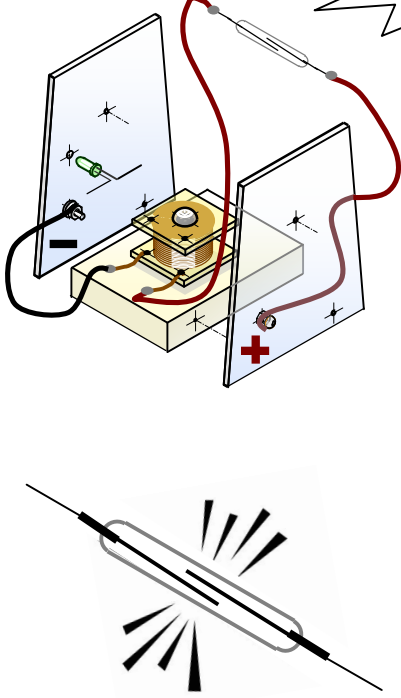
10	WORK AT WORKBENCH		
11	<p>Manually screw electromagnet onto the base.</p> <p>Note: Loosely screwing the electromagnet allows you to adjust the distance between it and the rotor magnets.</p>		
12	<p>Insert the rotor shaft into the holes in the brackets (N° 2).</p> <p>Position the brackets on the base.</p>		
13	Screw the brackets onto the base ensuring that they are well aligned.		<ul style="list-style-type: none"> - Screwdriver - N° 6 x 3/4" round head screw

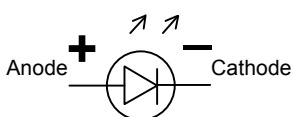
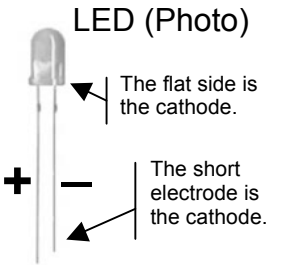
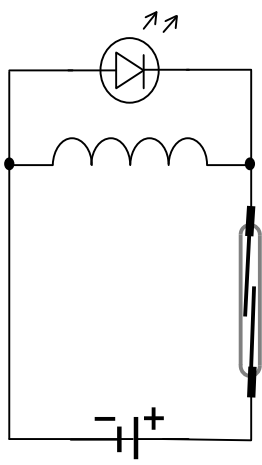
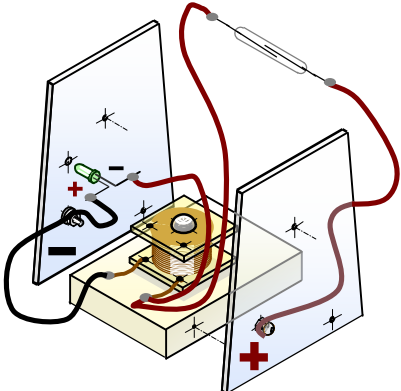
ASSEMBLY RANGE FOR THE RSM		SHEET: 2 of 5	
Nº	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
14	Measure and cut 2 - 10 mm. pieces of vinyl tubing. They will be used as butt tubes to maintain the rotor shaft in its place.		<ul style="list-style-type: none"> - Retractable blade knife - Ruler - Cutting mat or martyr
15	On the rotor shaft, insert a washer and a butt tube on each side of the motor. See N° 4 set drawing.		<ul style="list-style-type: none"> - N° 4 set drawing - Washers - Butt tubes
16	Align the rotor so that it is exactly facing the electromagnet.		
17	Screw in the two terminals to be used for the electrical connection. Note: Leave sufficient space between the head of the screw and the outer bolt. This will allow you to easily attach the alligator clip to the terminal.		<ul style="list-style-type: none"> - Screwdriver - Bolts - n° 6 x 32 x 1/2" mechanical screws - Washers
18	Insert the LED into the 5 Ø hole and glue if necessary.		<ul style="list-style-type: none"> - 5 Ø LED - Hot glue
19	Adjust the height of the electromagnet in such a way as to bring it as close as possible to the rotor. Check that the rotation of the rotor is not impeded. The motor's circuit is now ready to be wired.		

ASSEMBLY RANGE FOR THE RSM		SHEET: 3 of 5	
Nº	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS

20	Wiring the circuit		
21	Cut a 20 cm length of AWG 25 "telephone" type rigid wire. Strip the extremities to a length of 1 cm. Affix one of the extremities to the supply terminal by jamming it under the washer at the position shown by the arrow.		<ul style="list-style-type: none"> - Stripping pliers - Needle nosed pliers - Ruler - AWG 25 rigid wire - Screwdriver
22	Solder the other extremity of the wire to one of the electrodes of the magnetic switch.		<ul style="list-style-type: none"> - Soldering iron - Solder - Safety glasses
23	Connect an alligator type clip wire between the free end of the terminal of the magnetic switch and one of the terminals of the electromagnet (to simplify the drawing, the rotor has been hidden).		<ul style="list-style-type: none"> - "Alligator" type clip wire
24	Connect a second alligator clip wire between the free end of the electromagnet and the negative supply terminal.		
25	Apply 9 volts of tension on to the RSM's terminals. Put on safety glasses and bring the magnetic switch close to the magnet on the top of the motor. By finding the ideal position of the switch in relation to the magnet, the motor should start to turn. (The motor works better when the magnetic switch is not centered on the magnet).		<ul style="list-style-type: none"> - 9 volt power source - Safety glasses

ASSEMBLY RANGE FOR THE RSM		SHEET: 4 of 5	
Nº	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS

26	<p>Reverse the position of the two clips on the terminals of the electromagnet and repeat step 25.</p> <p>The motor should perform better in one or other of the two configurations.</p> <p>Identify the best configuration and continue the process with that configuration.</p>		
27	<p>Let's suppose that the configuration at right is the one that creates the greatest rotation speed in the motor.</p> <p>Replace the alligator clips with AWG telephone type rigid wires of the appropriate length.</p> <p>Affix and solder the wires as before.</p> <p>Note: When the motor turns, you should see sparks appear inside the magnetic switch. Over time, these sparks will damage the switch. Let's now add the light emitting diode (LED) to the circuit to eliminate this phenomenon to extend switch life.</p>		<p>Important! The rotor is hidden</p> <ul style="list-style-type: none"> - Stripping pliers - Needle nosed pliers - Ruler - AWG 25 rigid wire - Screwdriver - Soldering iron - Solder - Safety glasses

ASSEMBLY RANGE FOR THE RSM		SHEET: 5 of 5	
N°	PHASE, SUB-PHASE OR OPERATION	PHOTO OR DRAWING	MACHINE-TOOL, TOOLS
28	Carefully observe the diagrams at right in order to correctly polarise the LED in the circuit.	<p>LED (Symbol)</p>  <p>LED (Photo)</p> 	
29	<p>Now connect the LED while respecting the following diagram.</p> <p>Note: The positive side of the LED must be in contact with the negative side of the power supply. It goes without saying that the cathode of the LED is connected to the positive terminal of the power supply. We therefore say that the LED is reverse polarised, which is normal in the circumstances.</p>		<ul style="list-style-type: none"> - Stripping pliers - Needle nosed pliers - Ruler - AWG 25 rigid wire - Screwdriver
30	<p>Affix and solder the wires as before.</p> <p>Your RSM is now ready for you to design the switch bracket.</p> <p>Now, it's up to you to be ingenious !!</p>		<ul style="list-style-type: none"> - Soldering iron - Solder - Safety glasses