

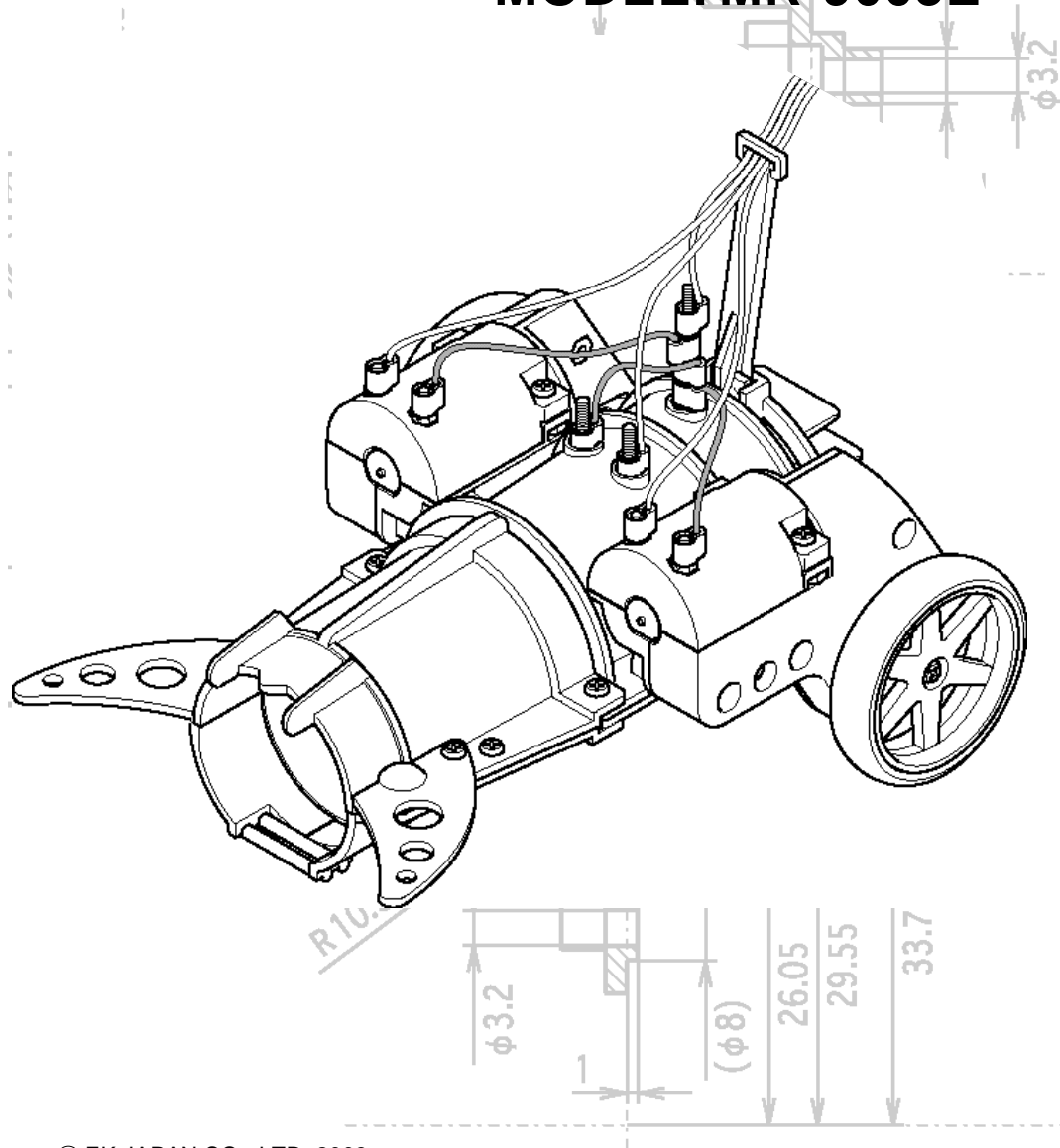
9003E-01

Lot.No.

MOVIT[®]

AIR SHOOTER

MODEL: MR-9003E



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Contents

Product Information	3
. Assembly of Mechanical Parts	
1. Necessary Tools for Mechanical Assembly	4
2. Before Assembling Mechanical Parts	4
3. Parts List	6
4. Assembly of Controller	8
5. Assembly of Body	12
6. Let's Operate!	22
7. How to Play	23
. Technical Data	
1. Explanation of Controller	24
2. Explanation of Mechanism	26
. Explanation of Molding	
1. Molding Procedure	28
2. Molded Plastic Parts	30
. Explanation of Plastic	
1. Characteristic of Plastic	32
2. Where Plastics are used?	32
3. Future of Plastic	34
V. Story about PC board	
1. What is a PC board?	36
2. Where PC board is used?	36
3. Structure of PC board	38
. Spare Parts List	39



PRECAUTION

Read this instruction manual carefully before getting started. Have your parents or someone who can help you read the instruction manual with you. Keep this instruction manual for future reference.

Be careful when handling the tools such as a penknife and a diagonal cutter.

Handle the small and sharp parts carefully.

Keep the product out of reach of small children. Do not assemble the product where small children can reach and touch it. They may get injured or put the parts / small vinyl bags into their mouth. Immediately dispose of the packaging materials and the left over parts sensibly.

Do not short-circuit the printed circuit board, electronic parts, or power supply terminals. It will result in overheating of the parts and batteries, causing injury and fire.

Do not insert the wires into socket outlets. It will cause damage and injury.

Keep fingers out of the moving sections, such as wheels, legs, gears and motor shafts.

Do not hinder the movement of moving sections by force. Remove the hindrances in the moving sections, such as a piece of thread, before operating. Otherwise, the motor will overheat, causing injury and fire.

The specifications and forms of this product are subject to change without prior notice.

Product Information

AIR SHOOTER MR-9003

Outline

AIR SHOOTER is a do-it-yourself mechanical kit to make a wheel drive machine with three motors, operated by a wired controller. The moving features of AIR SHOOTER are: forward, backward, right and left turns, made by its controller. The third motor is used to catch and shoot a ball by using air fan. It is a new sensual robot that uses unprecedented operational sense. Creative performance fields and rules will make your game more exciting. Let's play a game with other MR-90XX series!

Specifications

Power Source / "AA" alkaline battery X 4 pcs
(not included)

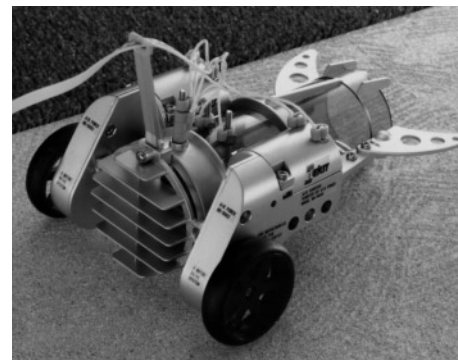
Power Consumption / Maximum approx. 900 mA
(when all three motors operating)
Approx. average 550 mA

Battery Duration / Approx. 2.5 hours
(continuous operation average)

Size / Body: W135 X H130 X D200 (mm)
(projection not included)

Controller: W95 X H126 X D31 (mm)
(projection not included)

Wire: 2m



Certain technical terms are used in this instruction manual due to give you specific knowledge about electronics and mechanics, which will help you to understand other technical texts in the future.

【Colored example】

* For coloring the machine, carefully read the "Notes for coloring" on page 40, in advance.



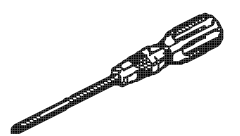



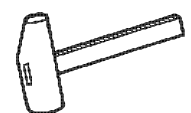
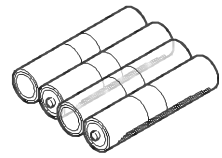
CAUTION

Pay attention to the following instructions for the use of batteries.

1. Place the batteries in the correct polarity (+ & -).
2. Never short-circuit, dismantle, heat the batteries, or dispose of them in a fire. They may leak or explode and cause injury.
3. When you finish playing, remove the battery. Exhausted batteries are to be removed from the product.
4. Do not wet the batteries or battery holder. If they get wet, remove the batteries from the holder and wipe them off thoroughly.
5. Do not mix old and new batteries. Do not mix alkaline, standard (carbon-zinc) or rechargeable (nickel-cadmium) batteries. Do not use the rechargeable batteries. Use only the batteries of the same types as recommended.

Assembly of Mechanical Parts

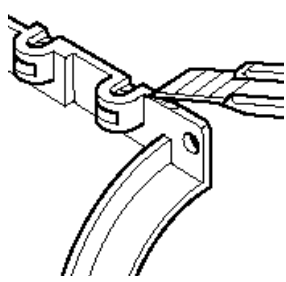
1. Necessary Tools for Mechanical Assembly

<p>⊕ Screwdriver (M3)</p>  <p>Use for turning screws.</p>	<p>Diagonal Cutter</p>  <p>Use for cutting parts off the frame.</p>	<p>Pen Knife</p>  <p>Use for cutting off unnecessary projections and burrs.</p>
<p>Long-nose Pliers</p>  <p>Use for handling parts and holding nuts when screwing.</p>	<p>Hammer</p>  <p>Use for installing pinion gears, etc.</p>	<p>Batteries (not included)</p>  <p>"AA" alkaline battery X 4 pcs</p>

2. Before Assembling Mechanical Parts

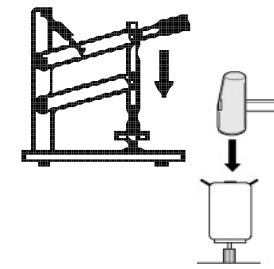
• Molded Parts

Detach all the parts from the runners with a diagonal cutter and cut off unnecessary projections neatly. They may affect the function of the product. Please scrape them off thoroughly with a penknife or a file.



• Driving shaft into gears

The motor shaft must be pressed into gears. To reduce the shock and protect the gears and cranks, using a lever is recommended. However, if one is not available, tap the gears and cranks gently so as not to damage them. Please pay careful attention to the procedure.



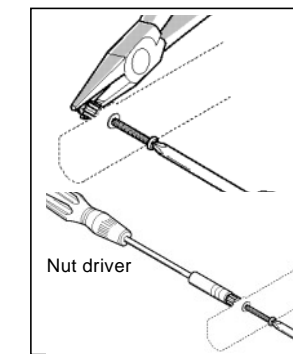
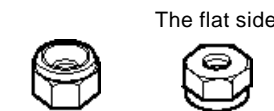
• Tightening of nuts and screws

Tighten nuts and screws properly, or they may come loose. Overtightening may also cause damage. Tighten them just enough to work properly.



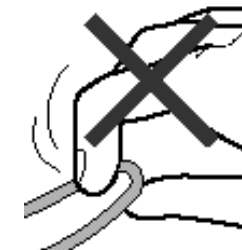
• Tightening the lock nut

Lock nut is a special kind of nut, which has a nylon ring inside in order to prevent the nut from becoming loose while the assembled kit is operating. When screwing into a lock nut, its direction is important : it needs to be screwed from the flat side of the nut. When screwing into a lock nut, more power is needed compared to a regular nut. Use a screwdriver with a bigger handle, so that the power for turning the screw is used more efficiently. Use long-nose pliers or a nut driver to hold the nut, when screwing.





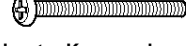
















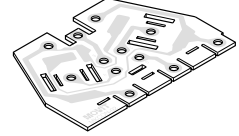
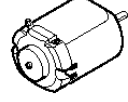


• Parts made of Rubber

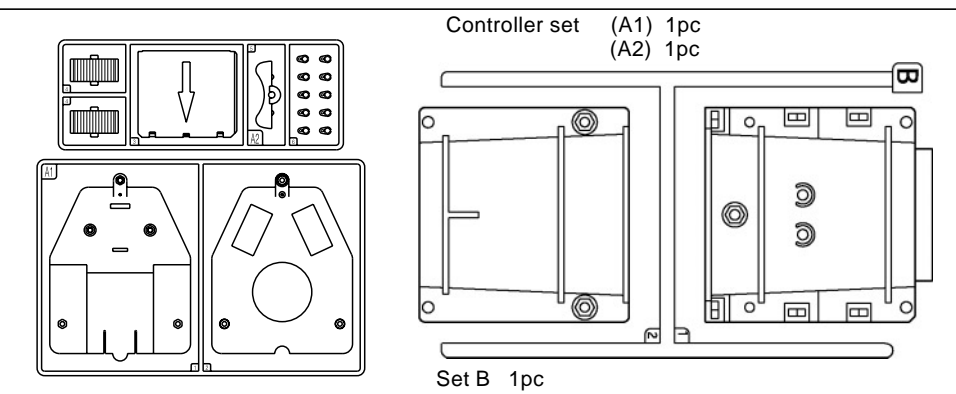
Parts made of rubber will stretch. Be careful not to stretch them too much or they will break. Use a diagonal cutter to detach the parts.



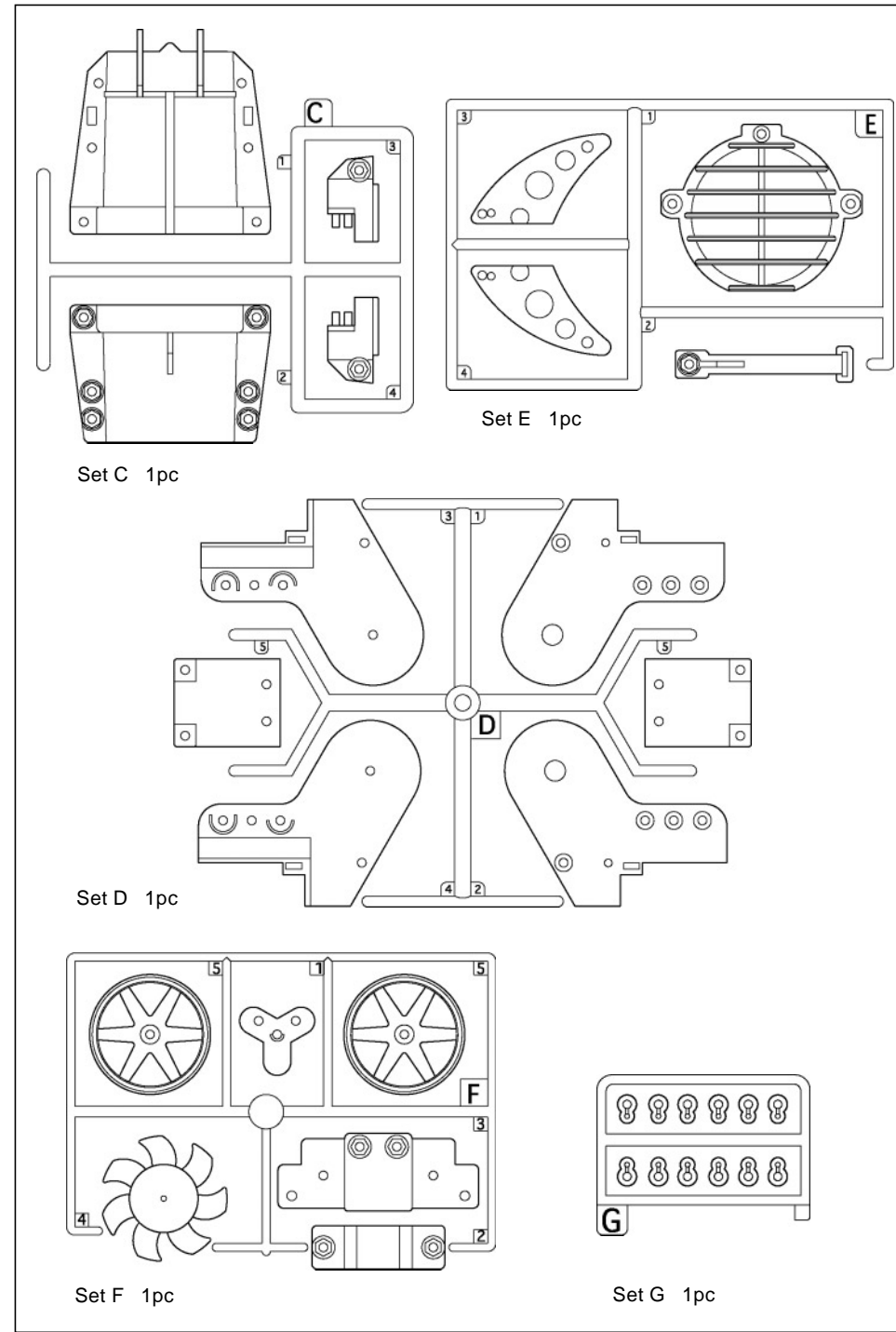
3. Parts List

* Check the parts by marking a blank box.
 * Some parts may have lines called weld lines formed through the resin treatment.
 They have no effects on assembly and function.

Screw (small) 46pcs 	Screw (medium) 2pcs 	Screw (large) 3pcs 	Nut 4 9pcs 	Lock nut 2pcs 
*Spare Parts: There may be extra screws and nuts. Keep and use them as spare parts.				
Ball 1pc 	Pinion gear [12 teeth] 2pcs 	Flat spur gear with pinion (large) [60 teeth, 12 teeth] 2pcs 	Flat spur gear with pinion (medium) [36 teeth, 12 teeth] 2pcs 	
Flat spur gear with pinion (small) [24 teeth, 12 teeth] 2pcs 	Crown gear with pinion [36teeth, 12 teeth] 2pcs 	Spacer 2pcs 	Wire 3pcs 	
Switch contact A 1pc 	Switch contact B 2pcs 	Battery contact for positive 1pc 	Battery contact for negative 1pc 	Battery contact for +and - 3pcs 
Battery contact for PCB 3pcs 	Printed Circuit Board 1pc 	Motor 3pcs 	Tire 2pcs 	4-Line Wire 1pc 



6



7

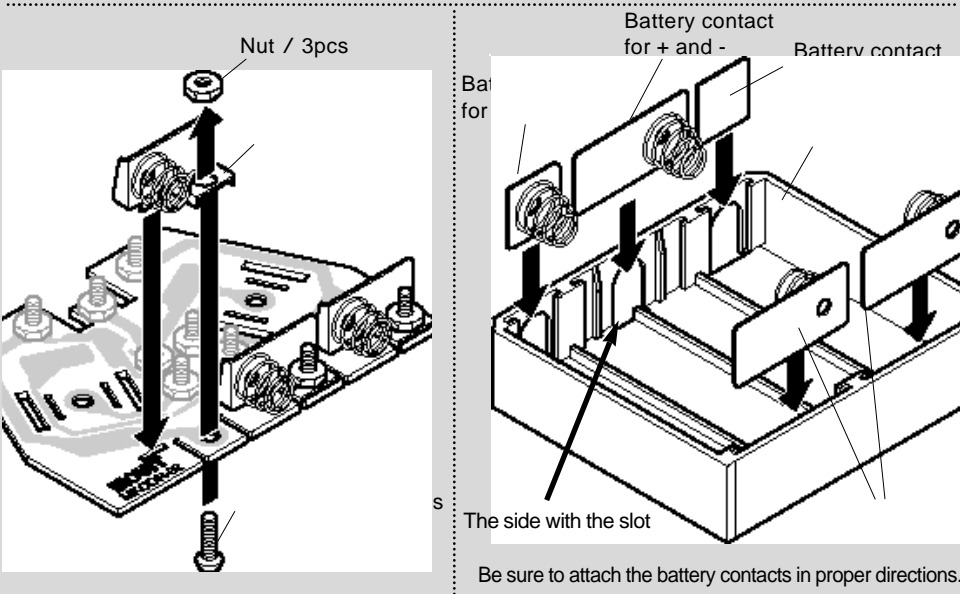
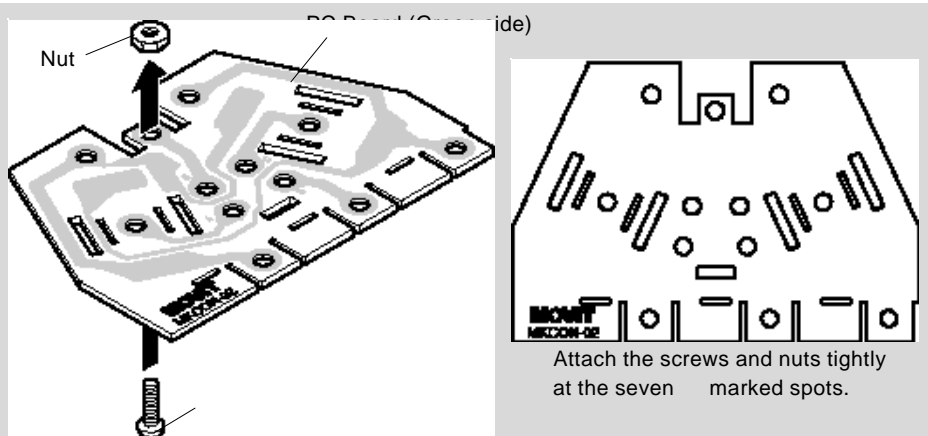
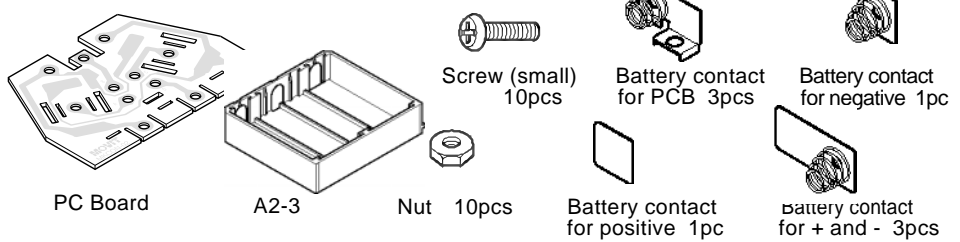
Assembly of Mechanical Parts

Assembly of Mechanical Parts

4. Assembly of Controller

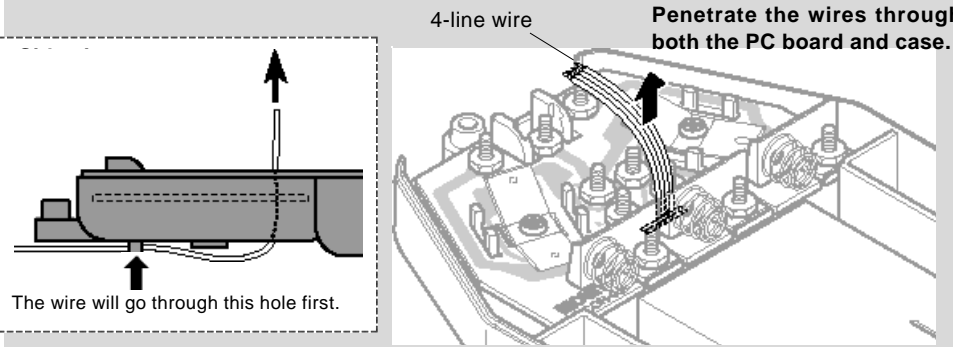
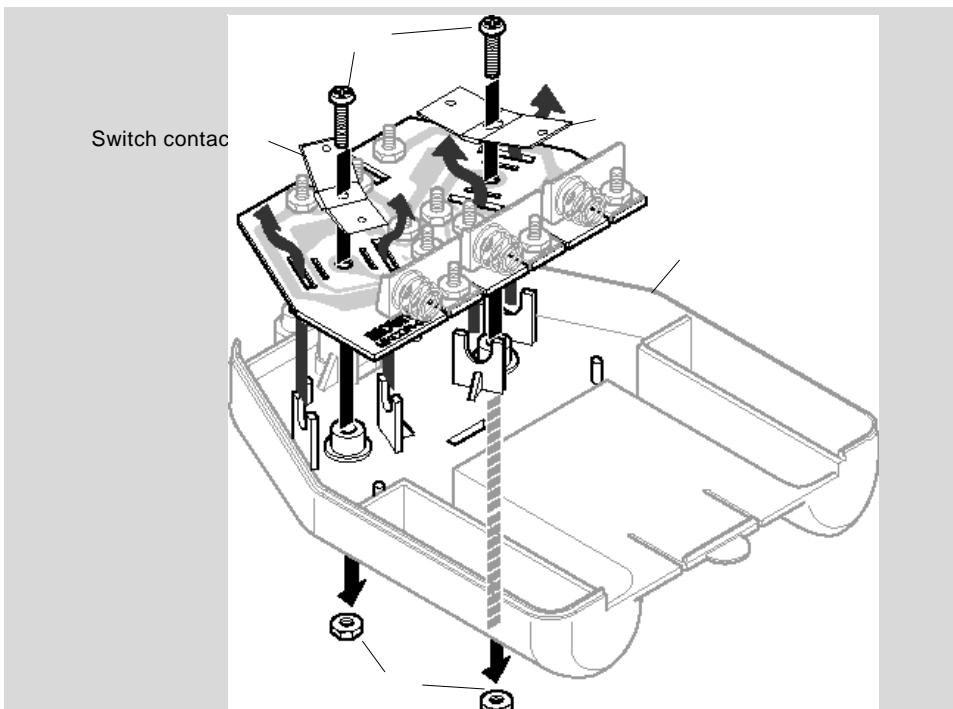
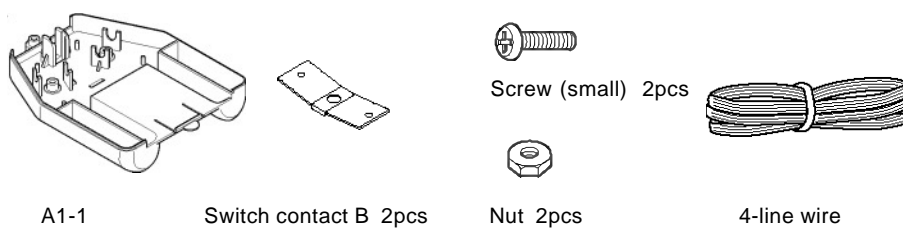
Assembly of PC board and battery holder

*Check the fitting of the battery holder in a blank box before assembling.



Attachment of PC board

Assembled PC Board from



Assembly of Mechanical Parts

Assembly of Mechanical Parts

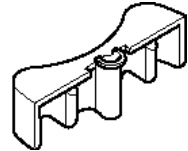
Wiring of PC board and attachment of rotor switch



A2-6 4pcs

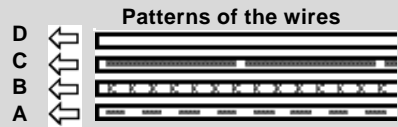
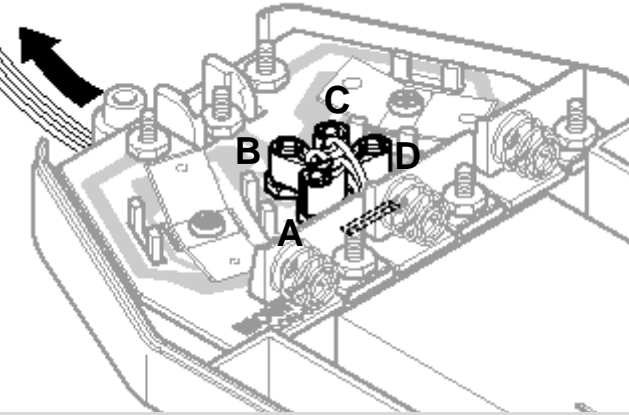


Switch contact A 1pc



A2-5

Pull out the 4-line wire.

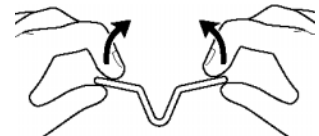


How to attach the wires

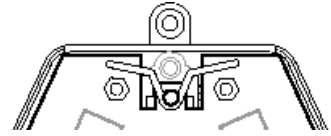
- 1) Put the wire through the smaller hole of A2-6.
- 2) Only bend the stripped end of the wire and put it into the larger hole of A2-6. When the wire sticks out from the hole, trim it with a diagonal cutter.
- 3) Attach the A2-6 to the respective screw, inserting it into the larger hole with the stripped end.

How to attach the contact A

Bend both end as shown a little to fit it in.
*Do not bend too much.

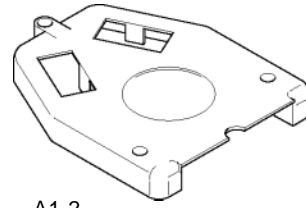


Top view of switch contact A

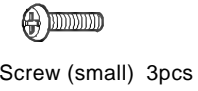


Attachment of upper cover

Assembled battery holder from



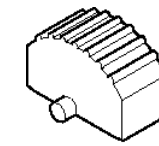
A1-2



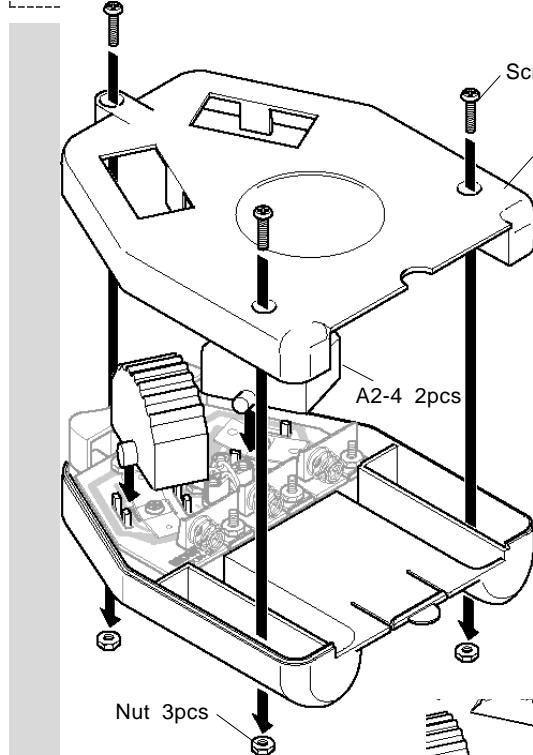
Screw (small) 3pcs



Nut 3pcs

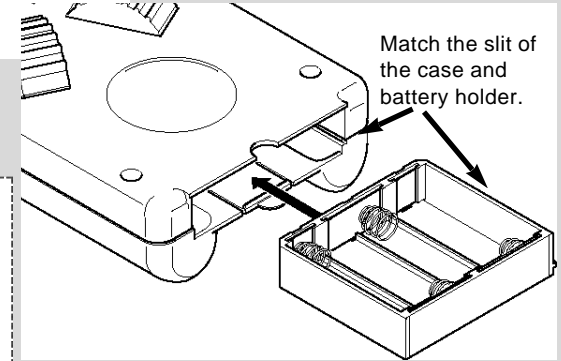


A2-4 2pcs

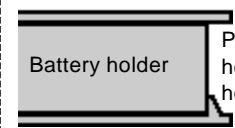


Caution!

Do not put in the batteries yet. Otherwise, the ends of the 4-line wire may short and cause excess heat, explosion or fire to the batteries.



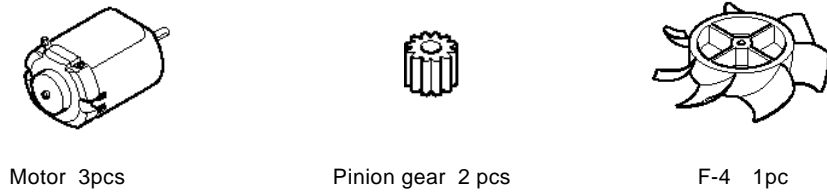
Side View



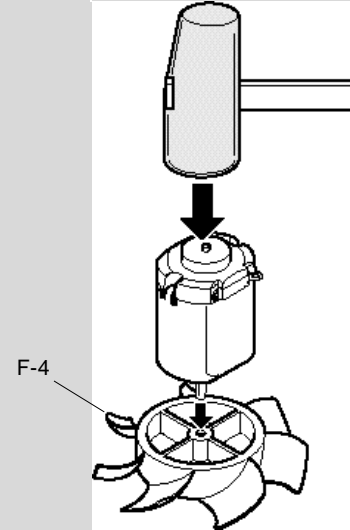
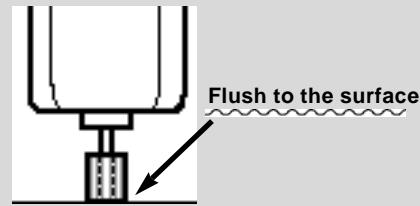
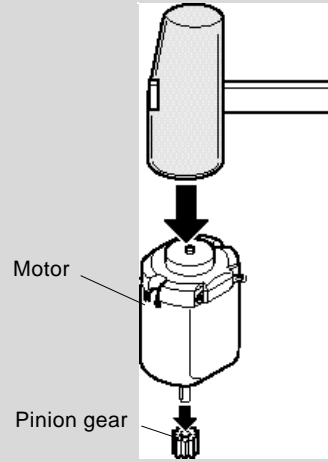
Push the battery holder until it is hooked.

5. Assembly of Body

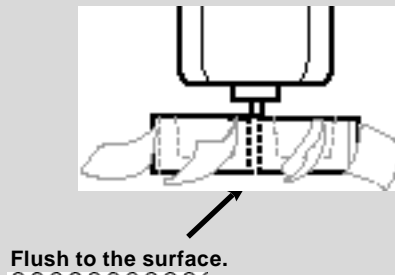
Attachment of Motor



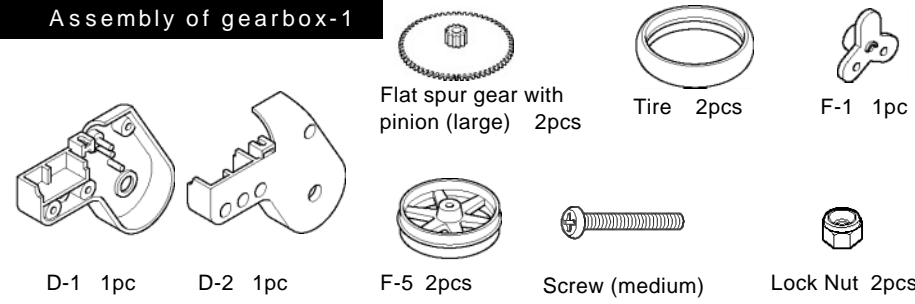
Make two sets Motor and Pinion gear Flush to the surface.



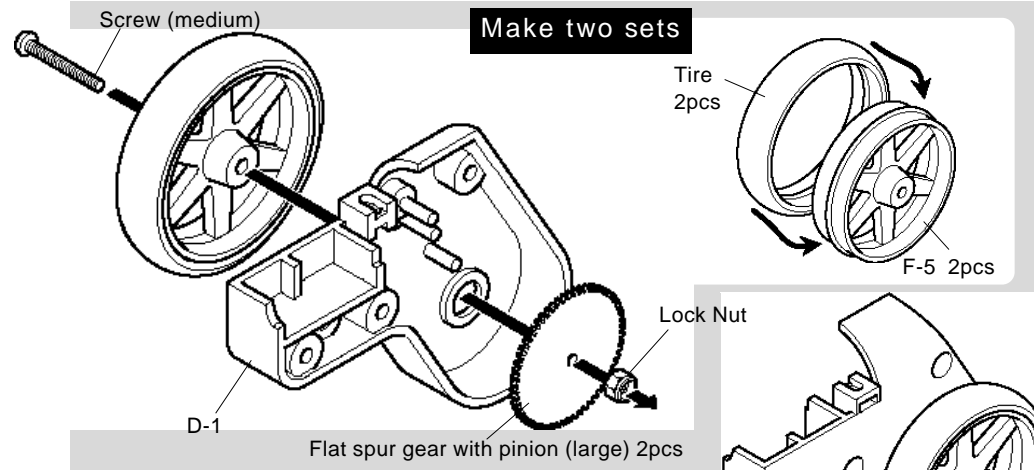
***Caution!**
Be careful when installing the fan because it is fragile.



Assembly of gearbox-1

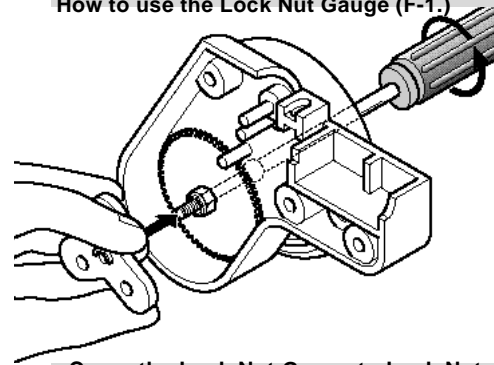


Make two sets

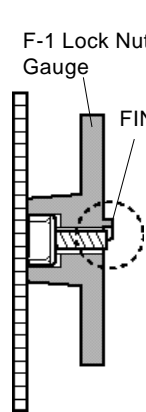


Assemble the left side (D-2) using the same method.

How to use the Lock Nut Gauge (F-1.)



Cover the Lock Nut Gauge to Lock Nut as the picture. Hold Lock Nut Gauge firmly, and screw by screwdriver.
If Lock Nut Gauge does not screw well, please refer page 5 to tie Lock Nut.

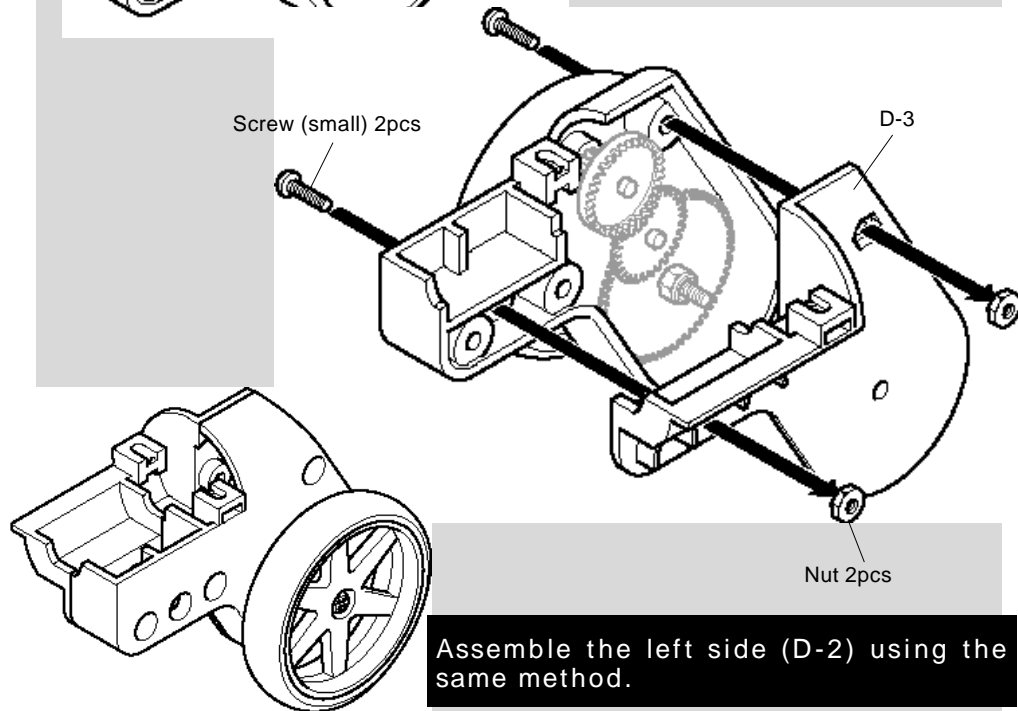
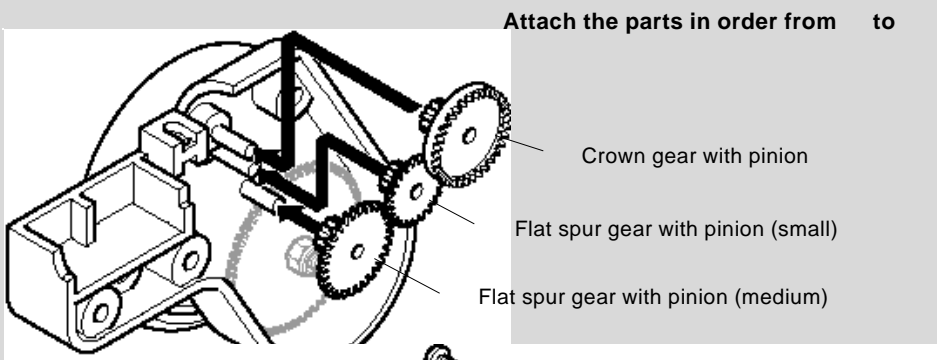
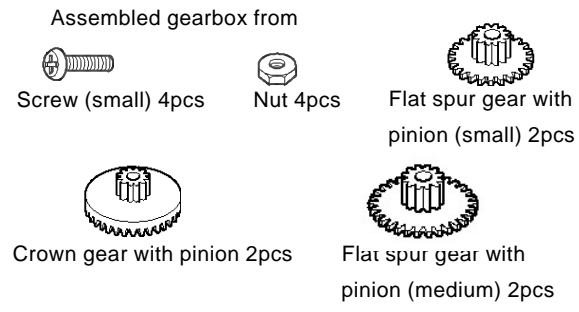
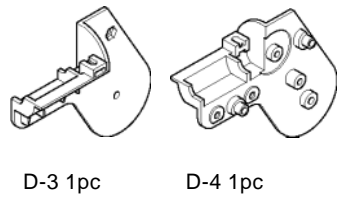


F16.A
INCORRECT
Screw does not go far enough through the hole.
correction: tighten more.

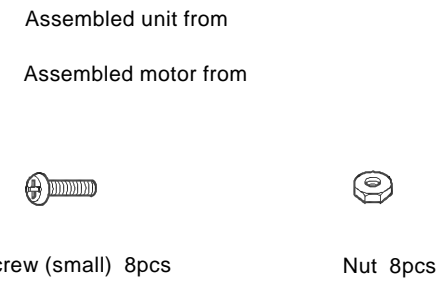
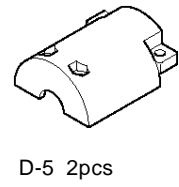
F16.B
CORRECT
Screw in proper position through the hole. The screw must not protrude beyond the fin.

F16.C
INCORRECT
Screw is tightened too much and is beyond the fin
correction: loosen the screw.

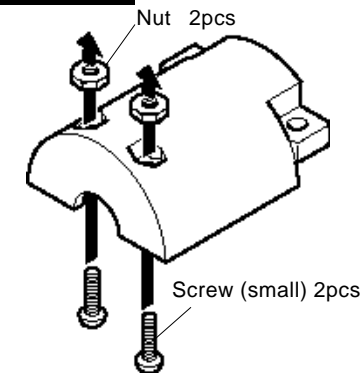
Assembly of gearbox-2



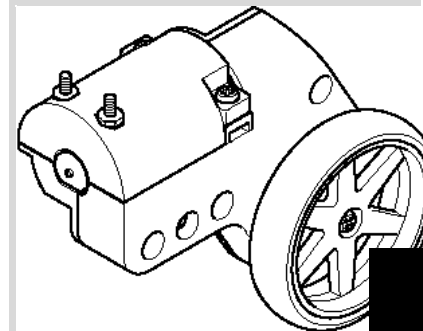
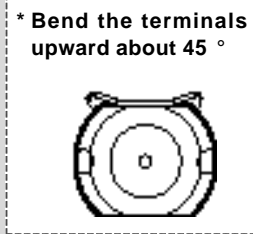
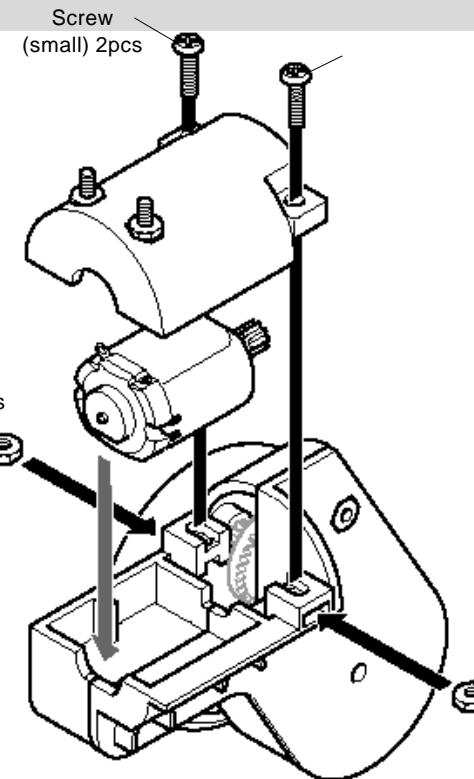
Assembly of gearbox-3



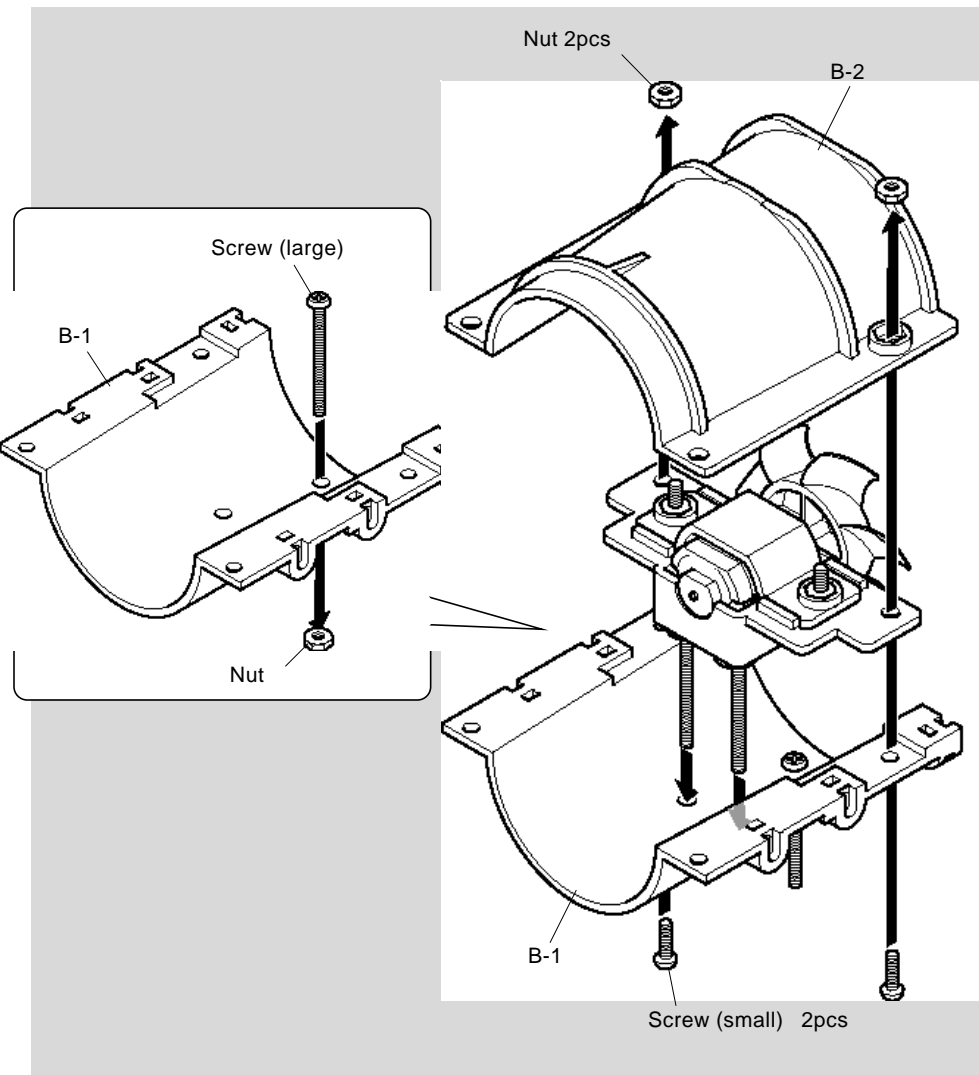
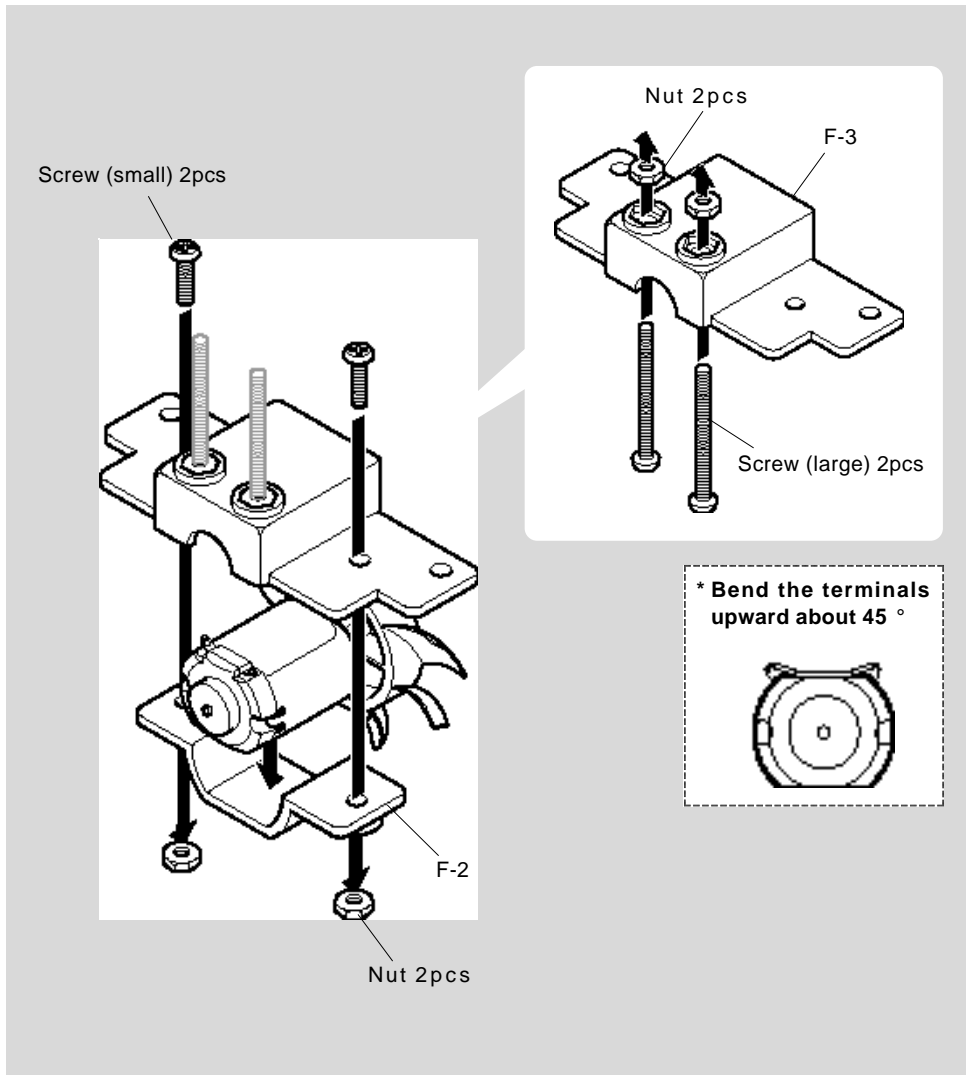
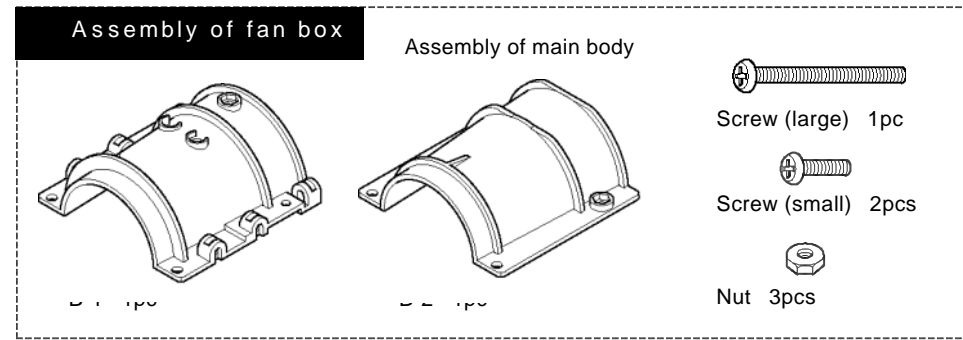
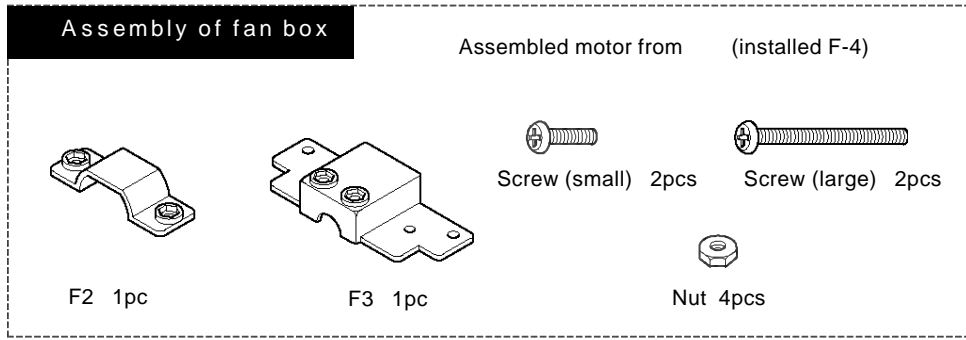
Make 2 sets



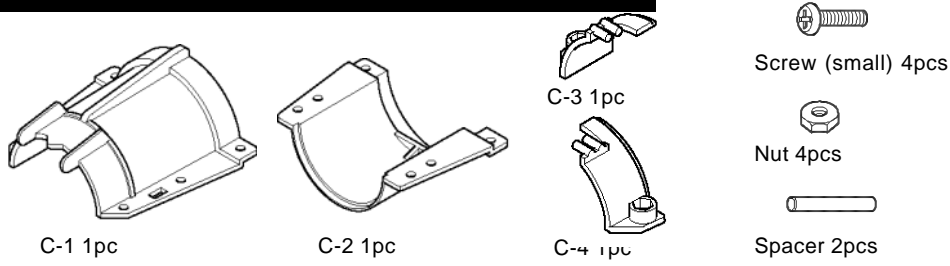
Attach the parts in order from to



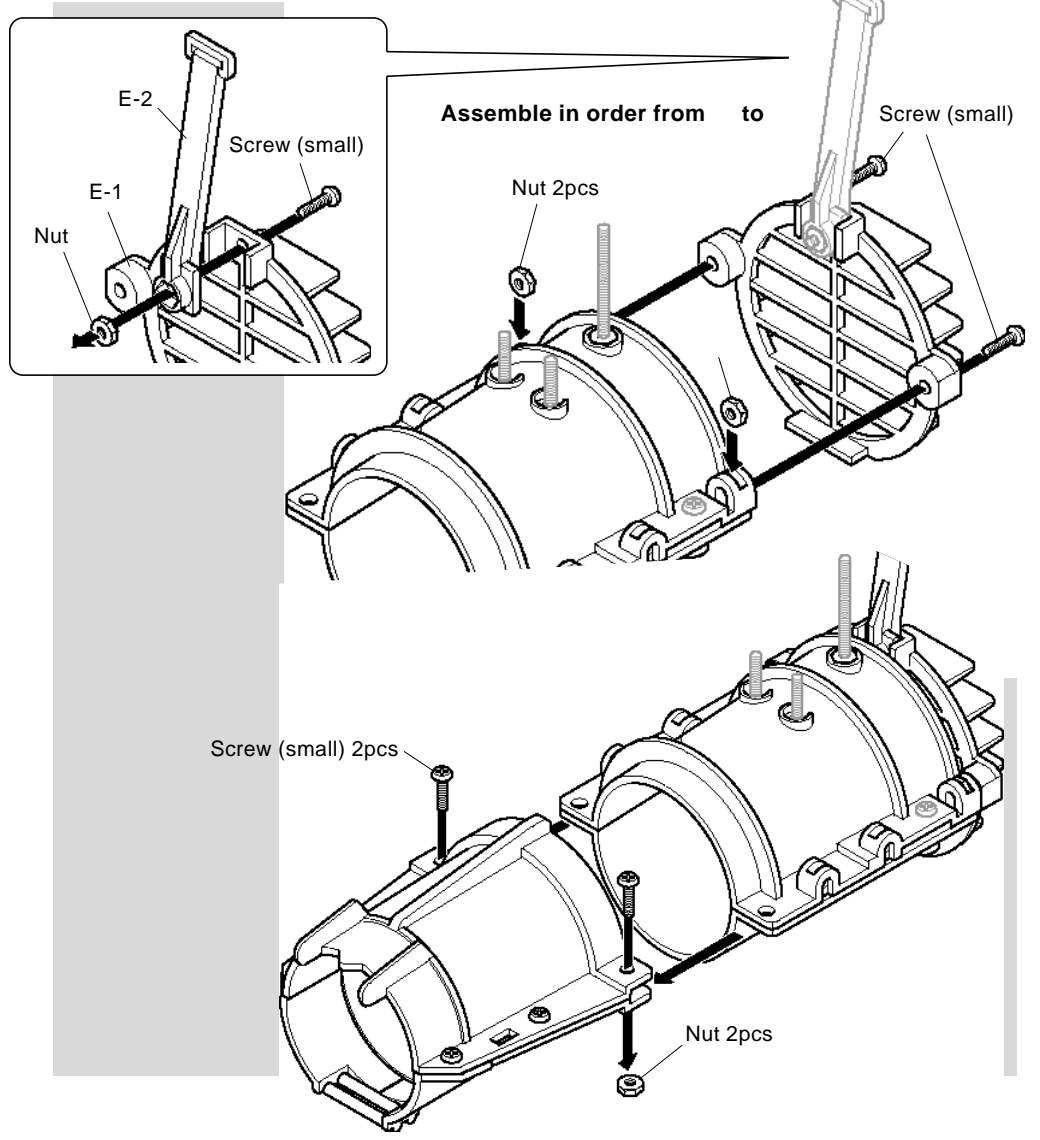
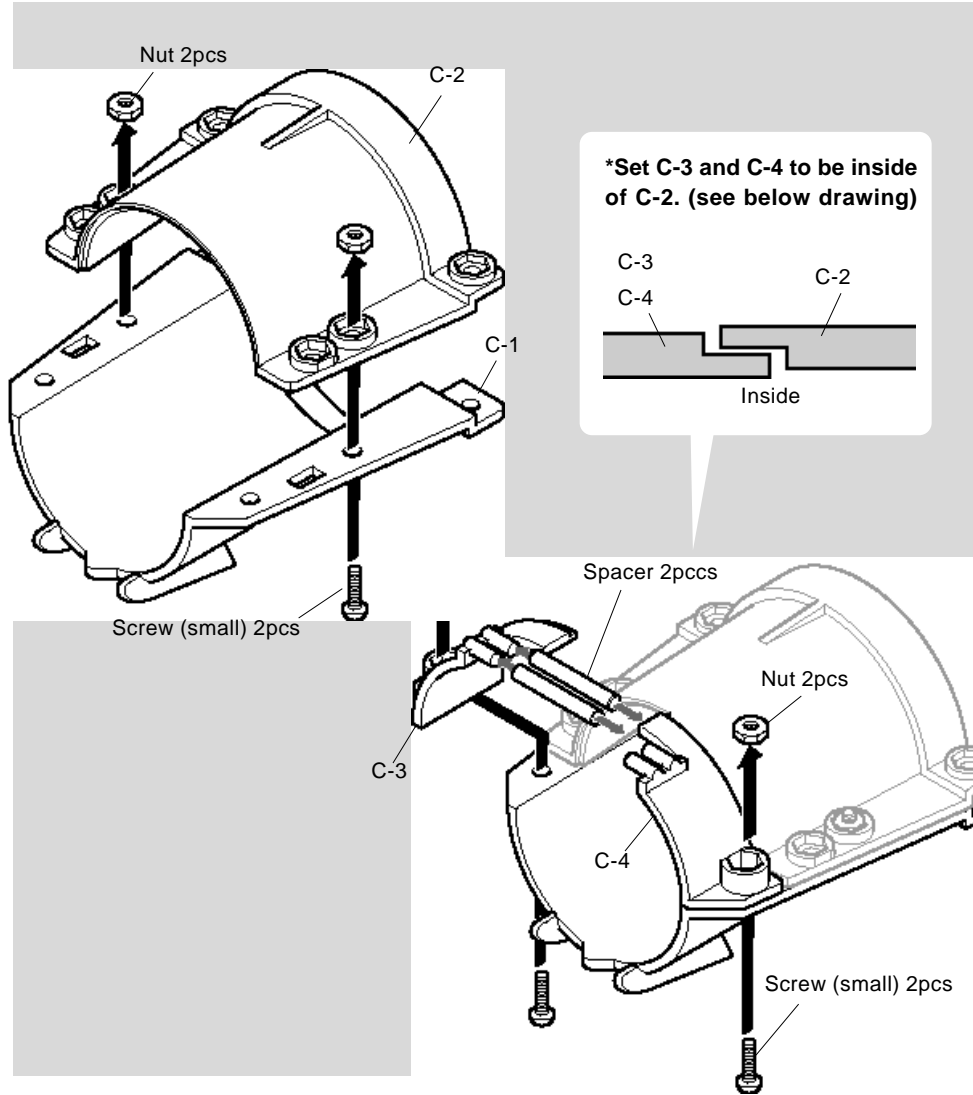
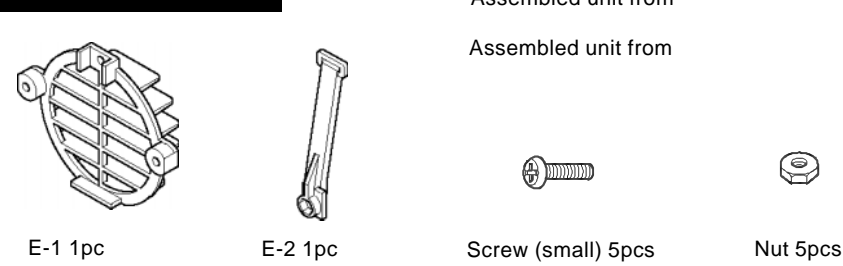
Assemble the left side (D-2) using the same method.



Assembly of fan box. Assembly of front body



Assembly of rotor



Assembly of Mechanical Parts

Assembly of Mechanical Parts

Assembly of Mechanical Parts

Assembly of Mechanical Parts

Assembly of gearbox & ball guard

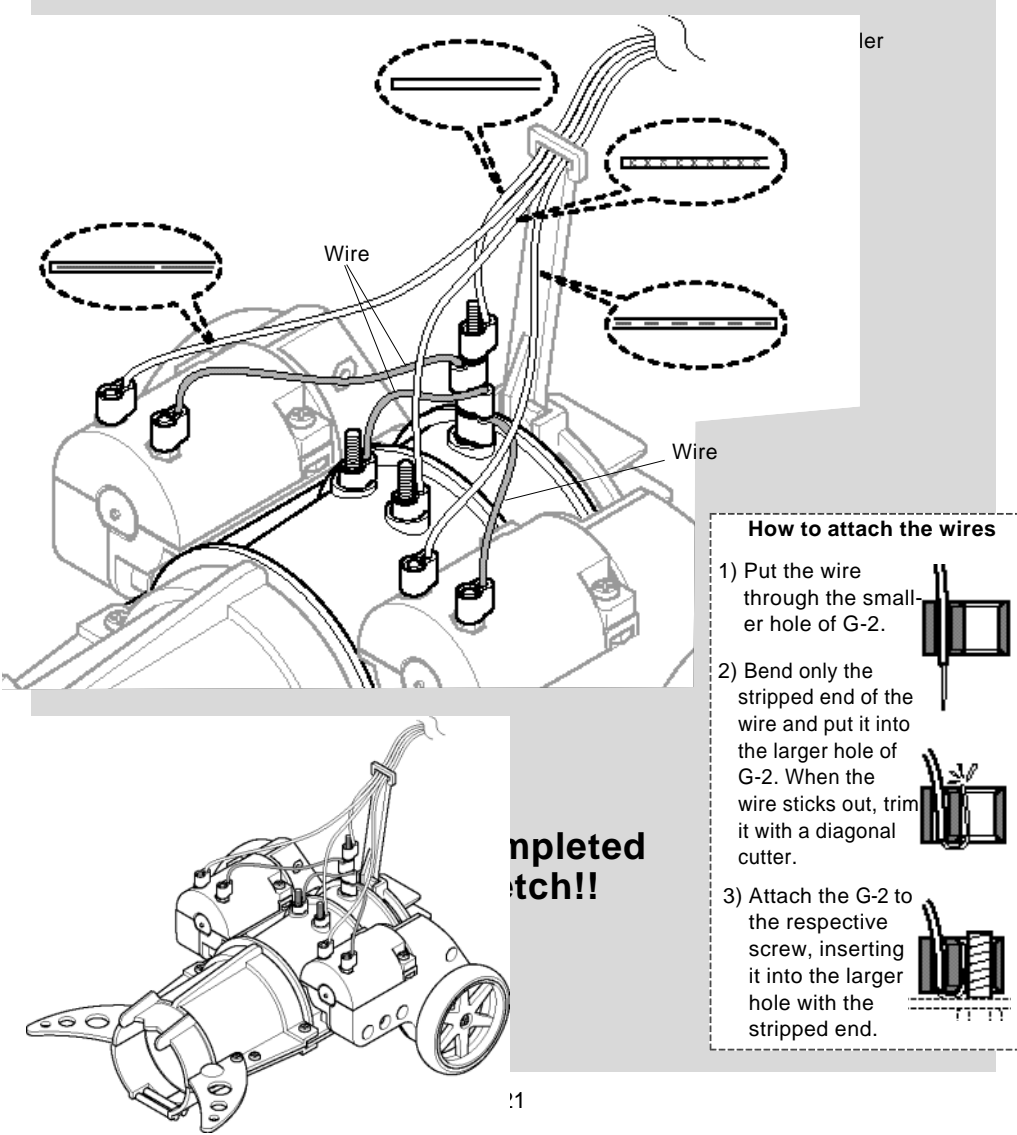
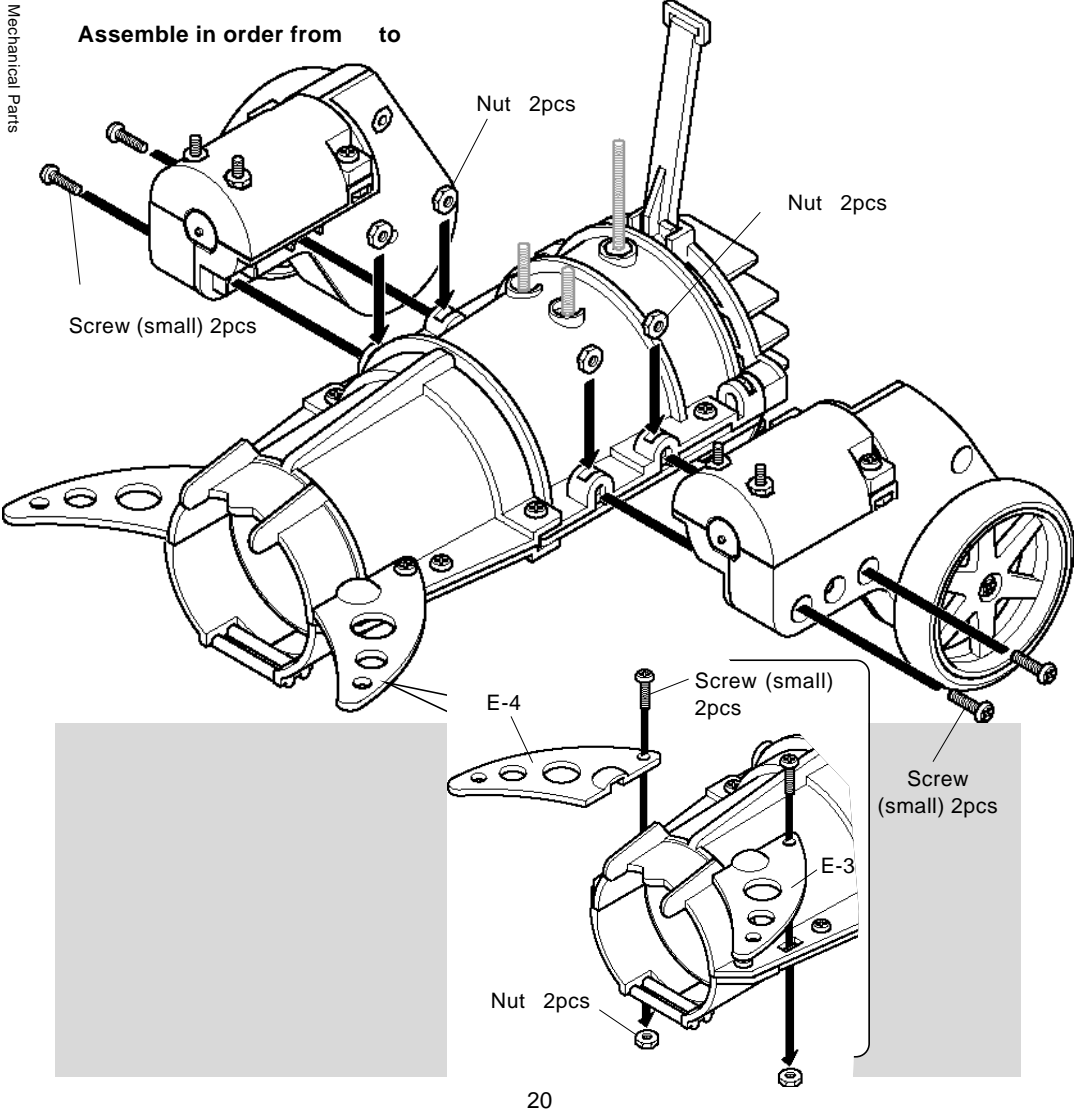
Assembled unit from
Assembled unit from

E-3 1pc E-4 1pc Screw (small) 6pcs Nut 6pcs

Wiring ~ Completing

Assembled unit from

G-1 10pcs Wire 3pcs Controller



How to attach the wires

- 1) Put the wire through the smaller hole of G-2.
- 2) Bend only the stripped end of the wire and put it into the larger hole of G-2. When the wire sticks out, trim it with a diagonal cutter.
- 3) Attach the G-2 to the respective screw, inserting it into the larger hole with the stripped end.

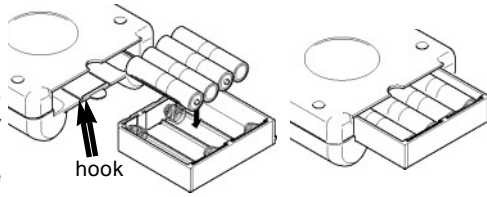
6. Let's Operate!

How to install the batteries

Power Source / "AA" alkaline battery X 4 pcs (not included)

Place the batteries in the battery holder of the controller. Make sure of the correct polarity (+ & -).

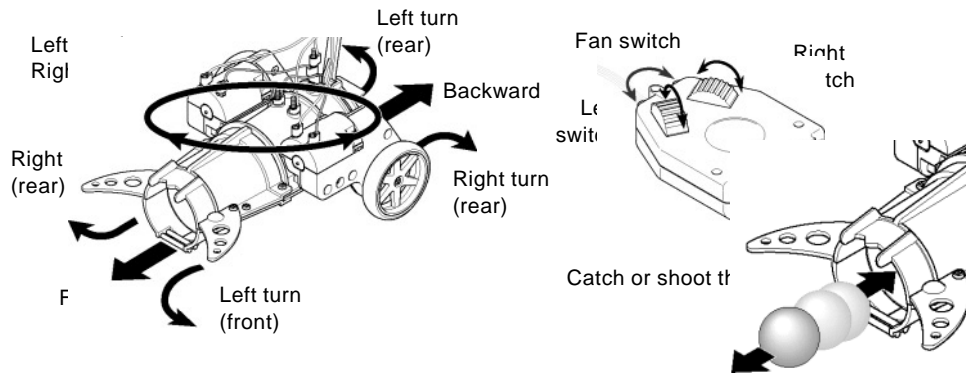
Insert the battery holder to the controller in the correct direction.



- * Place the battery terminal side inward.
- * Insert the battery holder until it is hooked.
- * When bending the battery contacts, make the terminal stand up a little.

How to operate

By using the controller switches, AIR SHOOTER will perform unrestricted moves: forward, backward, rotation, etc. With the rotor switch, it will catch and throw the ball.



Check here when the machine is not operating properly.

Problem	Check
• The machine does not move at all.	<ul style="list-style-type: none"> • Check the polarity of the batteries. • Check the wiring for the controller and body. • Check that the screws and motor terminals are contacting. If not, look over step and in "Assembly of Body."
• The machine does not move as controlled.	<ul style="list-style-type: none"> • Check the wiring of the body and controller: the wire patterns, installing location.
• The legs do not rotate, though the gears are rotating.	<ul style="list-style-type: none"> • Check that the lock nut is screwed in tightly, referring to step in "Assembly of Body."
• The machine moves a little crooked when going forward (backward.)	<ul style="list-style-type: none"> • Check the power of the batteries. When the battery charge is low, the machine tends not to move straight. Change with new batteries. • The machine contains a driving motor on each left and right side. Because the assembly and parts (size, shape, etc) are not exactly identical, it may cause this alignment problem.

7. How to Play

After assembling AIR SHOOTER, let's play.

AIR SHOOTER is able to keep the ball inside and shoot it out. It will be fun to play games with friends.

Suggested games

In order to play a game, there must be rules. The rules will vary in different types of games. The following examples are games and their rules.

Soccer game	Game objectives : Make two teams of 1 to 3 players, and shoot the ball to opponent's goal to score like soccer.
<p>Rules</p> <ul style="list-style-type: none"> • The field size Use a ping-pong table. Install fences around the table, and goals on both sides. • Play time The first half is 5 minutes, half time: 1 minute, the second half : 5 minutes. If the score is tied, then there are 2 minute-halves as an overtime. During the overtime, the team who gets the first goal, the V goal (Victory Goal), wins. If the score is still the even after overtime, the winner will be decided by a penalty-kick (PK) goal, which is played by shooting the ball at the target spot inside the goal. 	<p>Ping-pong table (Install fences around the table.)</p>

Gathering balls	Game objectives : Make teams of 1 to 3 players. Place many balls on the field. The team, which made more goals than the other in the limited time, wins the game.
<p>Rules</p> <ul style="list-style-type: none"> • The field size Use the same field as . • Play time The time limit is 6 minutes. When the scores are even after the six minutes, then there is a 2 minute-overtime. If the game still ties, play a time trial race. First, place the machines at the end line of the field. They will compete the time to get the ball at the middle of the field and shoot it. 	<p>Hint Please use ping-pong balls. When the balls roll around the field too fast, make a small hole (2 ~ 3 mm in diameter) in the ball, then, put in small cut-up pieces of rubber bands to adjust the stability.</p> <p>Make a small hole. Put in small cut-up pieces of rubber bands.</p>

Make many other creative and fun games and rules.

Technical Data

AIR SHOOTER is able to make various movements by using three motors. How are the motors controlled? In this section, let's talk about the AIR SHOOTER controller mechanism.

1. Explanation of Controller

• About the controller

AIR SHOOTER is able to move forward, backward, rotate and shoot the ball by controlling the motor's rotating direction, with three switches on the controller.

The controller: 1. turns on and off each motor, 2. decides the direction of rotation of each motor.

• About turning on the motor

To turn on the motor, electric current needs to be flowing into the motor. There are paths (printed patterns) on the printed circuit board, through which the electric current can pass. When the switch on the controller is pushed, the switch contact inside is also pushed in and makes a path for the electricity to run through.

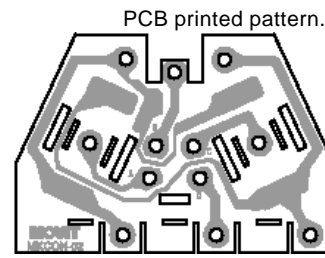
• Deciding motor direction

The rotating direction of the motor will be decided by the direction of the electric current. When the electric current is reversed, the motor will start turning the other way. How does this have to do with the controller?

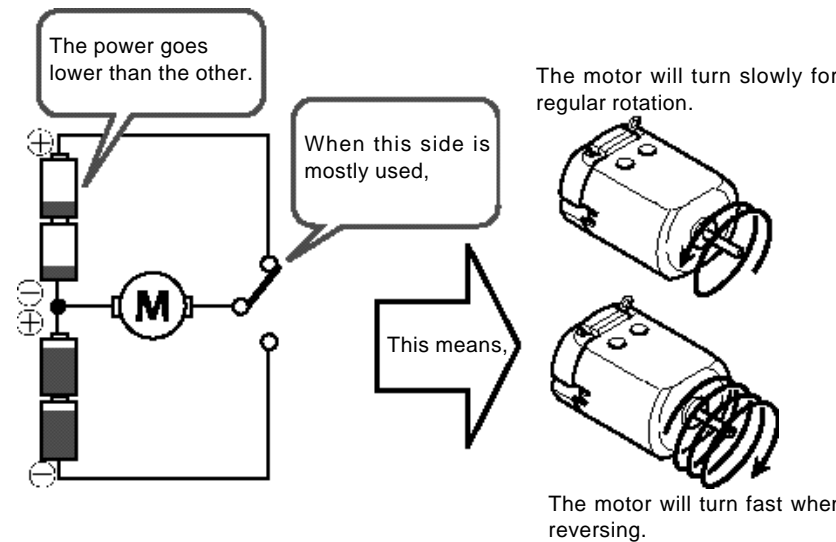
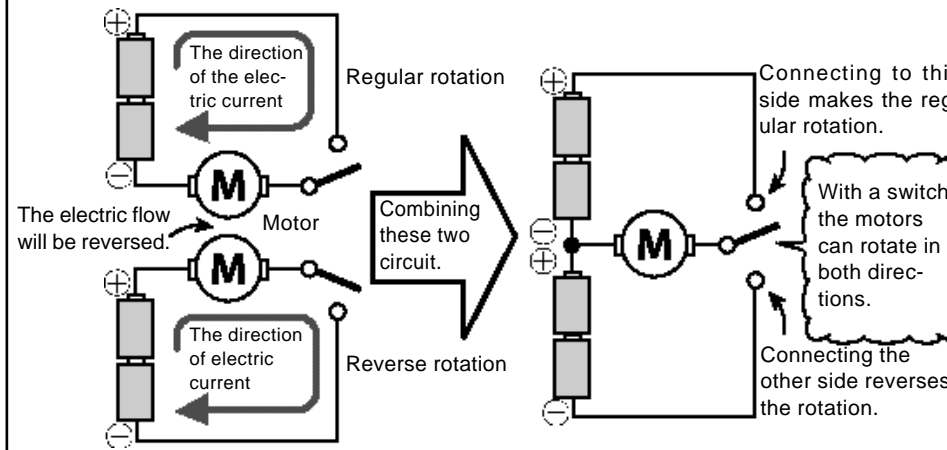
There are two power circuits for each motor, which will decide the rotating direction as shown in the illustration. The switches of the controller will decide which circuit the motor should connect with.

The advantage of this system is that the circuit pattern is simple. However, when the motor is turning only in one direction, the battery side which is providing the power will be consumed more than the other side. In other words, when the machine is moving forward much more, the forward movement becomes very slow; the backward movement remains very fast. To solve this issue, side motors are designed to use the opposite battery pairs when the machine is moving forward or backward.

• To turn on the motor



When the switch contact is pushed, it connects with the printed pattern and the electric current will flow.



2. Explanation of Mechanism

AIR SHOOTER. uses the "gear mechanism," which transmits the rotational power from the motor to the wheels and rotors. Gears are used for many devices around you. They have not only the function to transmit the power but other important roles. Here are various functions of the gears.

• Changing the direction of rotation

The first role of the gears is changing the direction of rotation. Between the two connected gears, when the first gear rotates clockwise, the next gear rotates counterclockwise. In case of the pinion gear on the motor and the crown gear installed in this robot, the rotational axis changes to 90 degrees. The gears change the direction of the rotation and axis to make desirable mechanisms for the robot.

• Changing the rotating speed

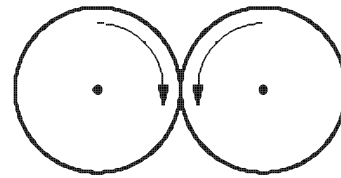
The gears can change the rotating speed. When the first gear with 10 teeth is engaged with the 40 teeth gear, a complete rotation of the first gear will make the next gear rotate only 10 teeth, which is one-fourth of a complete rotation. This means that the rotating speed has been reduced to one-fourth. A motor spins thousands of times per minute, however, it is too fast to move the legs. By combining the gears, the rotating speed becomes slower and easier to control.

• Changing the torque

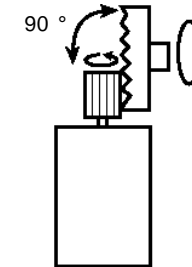
The gears change the rotating power called *torque*. The motors used for this robot have only small power and cannot move the legs. Then, how does the robot gain more power? Let's see the engagement of a small pinion gear and a flat spur gear with pinion, for instance. The small pinion transfers the torque to larger gear at the Point A where they are engaged. Supposing that gears work as a lever, when the power is applied on the point (A), which is far from the center of the flat gear (Fulcrum), Point B will obtain larger power than the power on Point A. By using this principle, the robot achieves enough power to run the legs. The torque is related to the rotating speed. When the gear combination is changed under the condition that the motor runs with the same speed: The faster the gear rotation is (small gear ratio), the lower the power, and vice-versa. They are inversely proportional. Therefore, when the gear rotation becomes too fast, the robot may not have enough power to move smoothly.

Functions of Gears

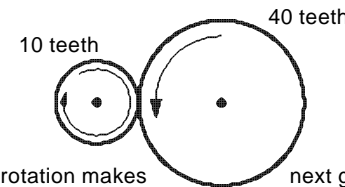
1) Changing the direction of rotation



The direction of rotation becomes opposite.

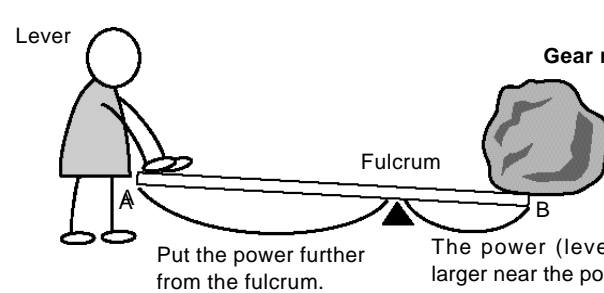


2) Changing the rotating speed



One rotation makes next gear rotate one-fourth. The speed is reduced to one-fourth.

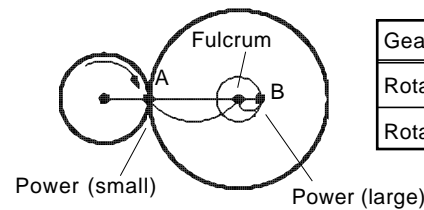
3) Changing the torque



Put the power further from the fulcrum. The power (leverage) becomes larger near the point to the fulcrum.

$$\text{Gear ratio} = \frac{\text{the number of motor rotation}}{\text{the number of the last gear rotation}}$$

Gear



Gear ratio	Low	High
Rotating speed	High	Low
Rotating power	Small	Large

Explanation of Molding

1. Molding Procedure

The robot has many plastic parts for its body and the controller. There are many plastic products around you also. When you compare the same plastic parts from the same products, you can see they have exactly the same form. Otherwise, the parts could not fit with the matching parts or the products would have uneven quality. Then, how are these plastic parts made to be same? The technique called "molding" is used to make the plastic parts. There are many ways to mold the plastic.

• Injection molding

Injection molding needs more than two pieces of metallic molds. The mold is processed with tools for cutting, holing and making posts to shape an exactly opposite surface to the plastic part, which will be molded.

When the molds are fitted together, there will be opening inside made from the above carving process, and the melted plastic will be injected there. The plastic will be taken out from the molds after it cools down and becomes solid. In this way, plastic parts are produced to have the same shape.

It is similar to making waffles. The mold is a waffle iron and the melted plastic is batter, so that the completed plastic parts will be waffles.

The injection molding is used to make the plastic with a rather complicated shape, such as the parts used for this robot.

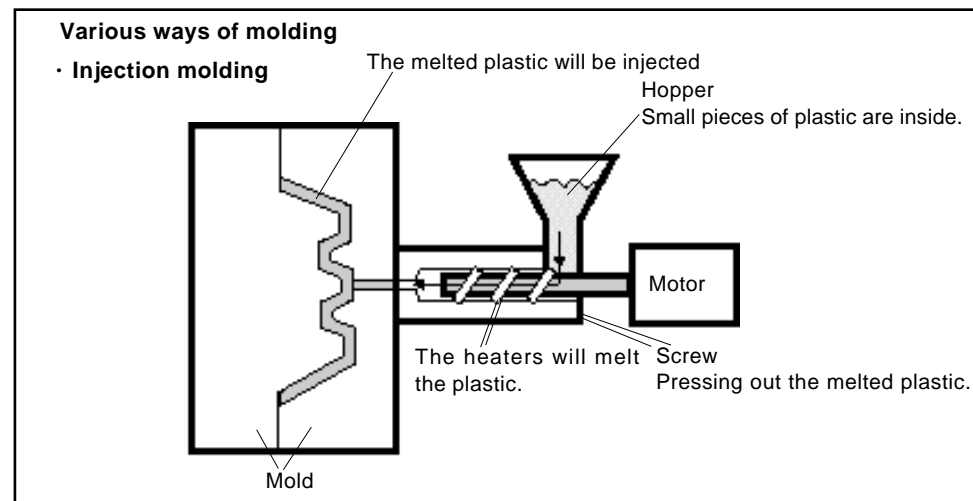
• Extrusion molding

Extrusion molding is used for plain plastic parts, such as plastic sticks and boards. A plastic stick is made through pressing out the melted plastic from a round opening. The board is made through a thin flat opening. Changing the shape of the opening, various kinds of plastic can be made. The section deciding the shape is called a *die*. It can be compared to a tube of toothpaste. The mouth of the tube is a die and toothpaste is melted plastic. If the mouth of the tube had a star shape, you could squeeze out star shaped toothpaste. The star shaped plastic can be produced in the same way.

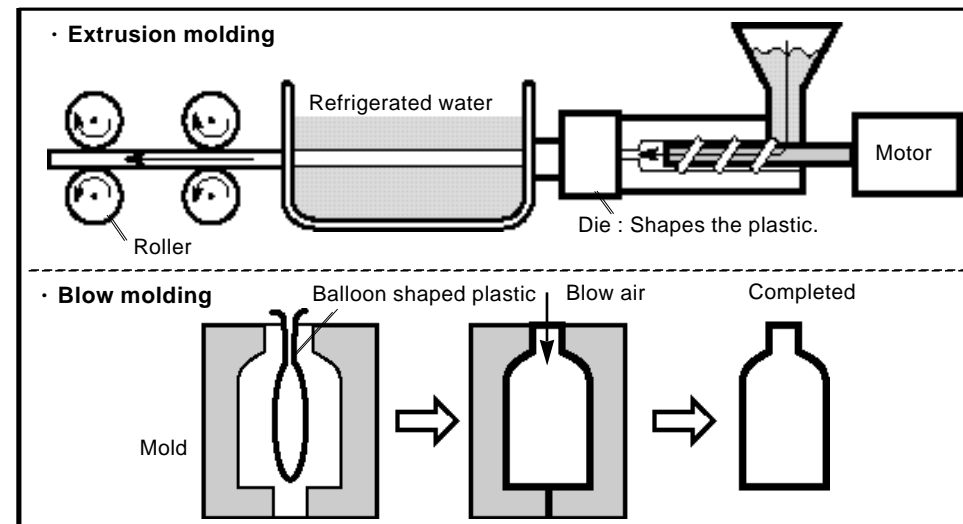
• Blow molding

Blow molding is for making hollow objects, such as a plastic bottle. The outer surface of the bottle could be formed with injection molding but inner space cannot be made. To make the hollow, the mold for making the inside wall would be needed, but it could not be taken out from the inside of the plastic bottle. The blow molding uses air to make the inside hollow. The melted plastic in a form of a balloon will be placed between the molds, and air will be blown inside. Then, the plastic bottle is made when it cools and becomes solid.

There are also other molding methods, such as vacuum molding and foam molding.



28



29

2. Molded Plastic Parts

The plastic parts made by these molding techniques have some characteristics. You can find them on the parts used for this robot as well as other plastic parts around your house. Here, the typical phenomena is explained in the case of injection molding.

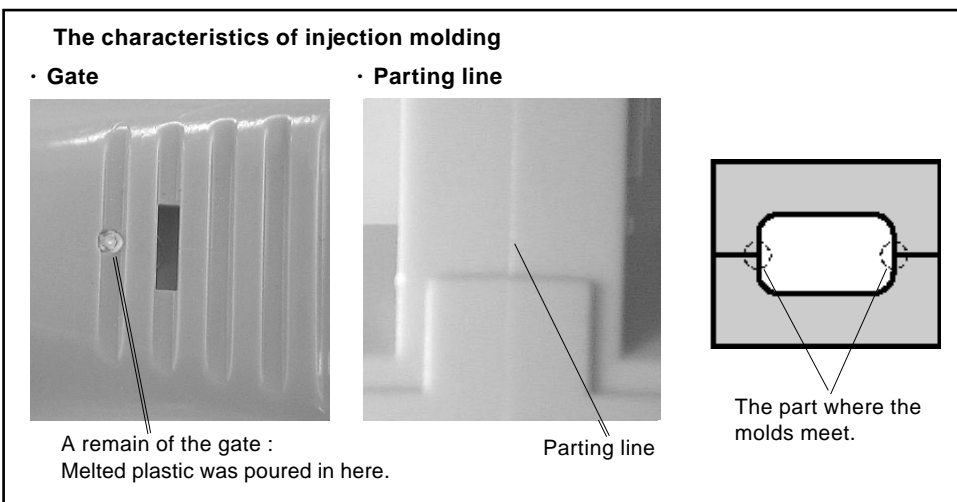
• Gate

In injection molding, there must be a gate to pour in the plastic. The solid plastic taken out of the molds has the extra amount at the gate and it will be cut off to finish the part. Therefore, the plastic part made by injection molding has a remain of the gate. Let's try to find the marks of the gates on the various plastic parts. Since cutting off the extra plastic at the gate makes a mark on the plastic part, the gate is often located at the position, where it will not be noticed.

• Parting line

The melted plastic will be pressed into the molds to spread all over the inside. Though the molds are joined tightly, there will be partings between the molds, and the melted plastic will get into there, making the line on the surface. This line is called the parting line. Since the parting of the molds makes this line, it is usually designed in such a way that the parting lines will not be noticeable on the finished product.

Explanation of Molding



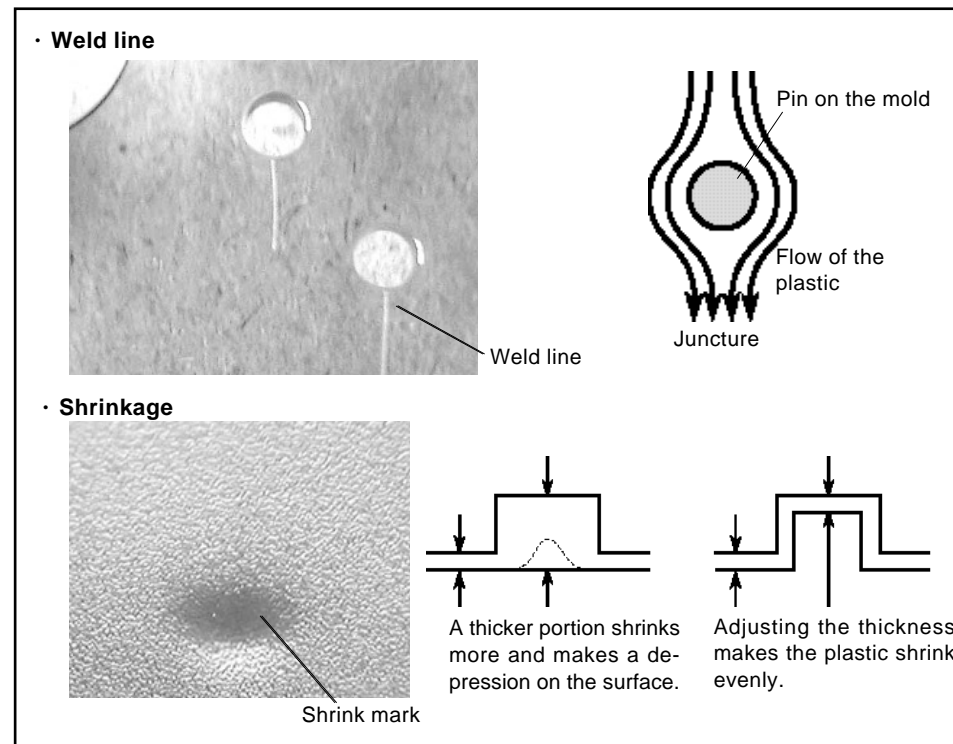
• Weld line

As explained in the previous pages, the molds have the shape exactly opposite of the plastic part. Therefore, to make a projection on the plastic, the mold must have a hole for it, and to make a hole in the plastic, the mold needs to have a pin for it. When the mold has the pin, it will divide the stream of the melted plastic. But the divided streams will soon join again passing around the pin, leaving a trace of the juncture. This trace is called a weld line. When you look at the plastic surface around the hole made by the pin on the mold, you may be able to find the line grown from the hole. The mold surface is also designed to have a good flow of the melted plastic to avoid making the weld line.

• Shrinkage

Plastic shrinks a little when it hardens. How much it shrinks depends on the material and the thickness of the plastic. When the thickness of the plastic is uneven, a thicker portion will shrink more than other portions. The shrinkage differential affects not only the appearance but also the size of the plastic part. To prevent this, the molds are designed to make the thickness of plastic even.

Explanation of Molding



Explanation of plastic

There are many things which use plastics around us. Maybe we will have hard time to find products that are not using plastic. Plastic is such an essential material. When we explain the plastic more minute, it is a material that is able to fabricate freely from heating and pressurization, and it is removed synthesized synthetic rubber, synthetic fiber, synthetic leather, and called as synthetic resin. It sounds like difficult, doesn't it? Let's explain about plastic that we don't know unexpectedly even plastic is familiar material to us.

1. Characteristic of plastic

At first, plastic was used for substitute of woods or metal. You will be surprised that cutting board and bath tub are made by wood once upon a time. Bucket and fan are made by metal. As you know these materials changing to the plastic, because we are using advantage of plastic.

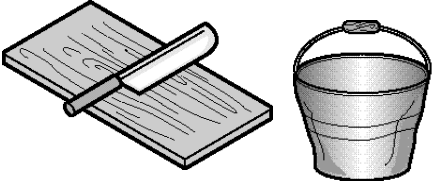
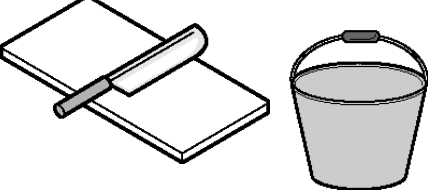
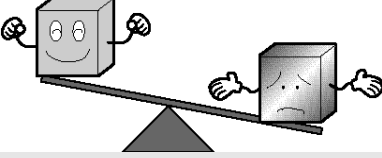
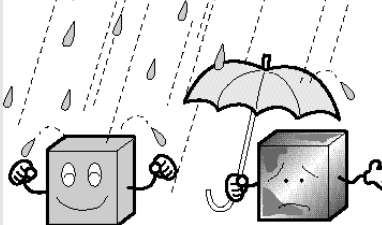
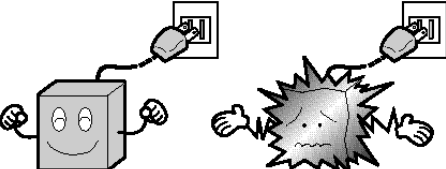
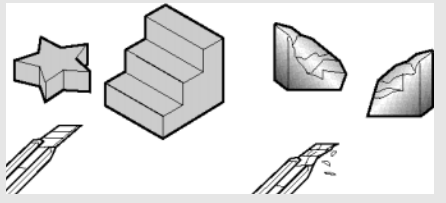
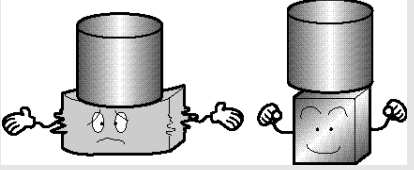
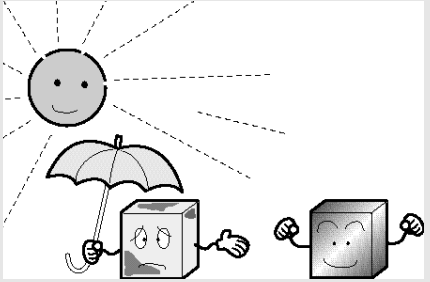
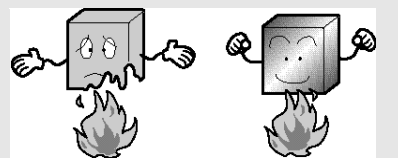
As we mentioned the advantage of plastic, it is "light," "strong at water," "doesn't rust," "doesn't pass electricity," "easy to proceed," "possible to be colored and transparent," "doesn't pass fever," and etc. Of course there are some faults, such as "easy to change a shape than metal," "easy to break than metal," "easy to get a clack," "weak at heat," "change a shape from ultraviolet ray," and etc. Plastic has some faults, however, its advantage is very attractive. Recently, by devising plastic material, it is becoming not easy to break, strong at heat, not easy to change shape, and etc., and active for you.

2. Motor Mechanisms

Kind of plastics are changed by place to use, how to use, and shape. Plastic can be divided into two sections. First one is the plastic that becomes tender by rising temperature (thermoplastic.) Second is the plastic that becomes tender by rising temperature, but if we raise the temperature more higher, it becomes hard (thermosetting.) However, this is too big range to define plastic. Usually we call plastic as thermoplastic and thermosetting. Let's explain some of plastics (we cannot explain everything of plastic, because there are numerous kinds of plastic.)

• Plastic bag, Vinyl bag

When you go to shopping at convenience store or mall, you will receive plastic bag or vinyl bag. These bags are made by very thin plastic. Usually, we call vinyl bag that is made by polyethylene chloridized vinyl, and plastic bag that is made by polyethylene.

<p>• Past</p> 	<p>• Present</p> 
<p>• Advantage</p> <p>Light</p>  <p>Strong at water, not to be rusted</p>  <p>not to pass the electricity</p>  <p>Easy to process</p> 	<p>• Fault</p> <p>Easy to change</p>  <p>Color changes</p>  <p>Weak at heat</p> 

• **Tanks in the aquarium**

Tanks in the aquarium are mostly made by plastic. Acrylic that has been pasted many is used for tanks. Acrylic is lighter than glass, not easy to break, and same transparency as glass.

• **Plastic bottle**

As you know well, drink bottles are made by plastic (not all of them.) Plastic bottle is made Polyethylene Terephthalate. Do you know that cutting finely Polyethylene Terephthalate is same as Polyester, which is used for clothe.

• **CD (compact disk)**

When you listen music, you listen by using CD & CD player. Do you know CD is made by plastic. "Polycarbonate" is the plastic that is used for CD. Polycarbonate is used for things need strong power, and to be transparent.

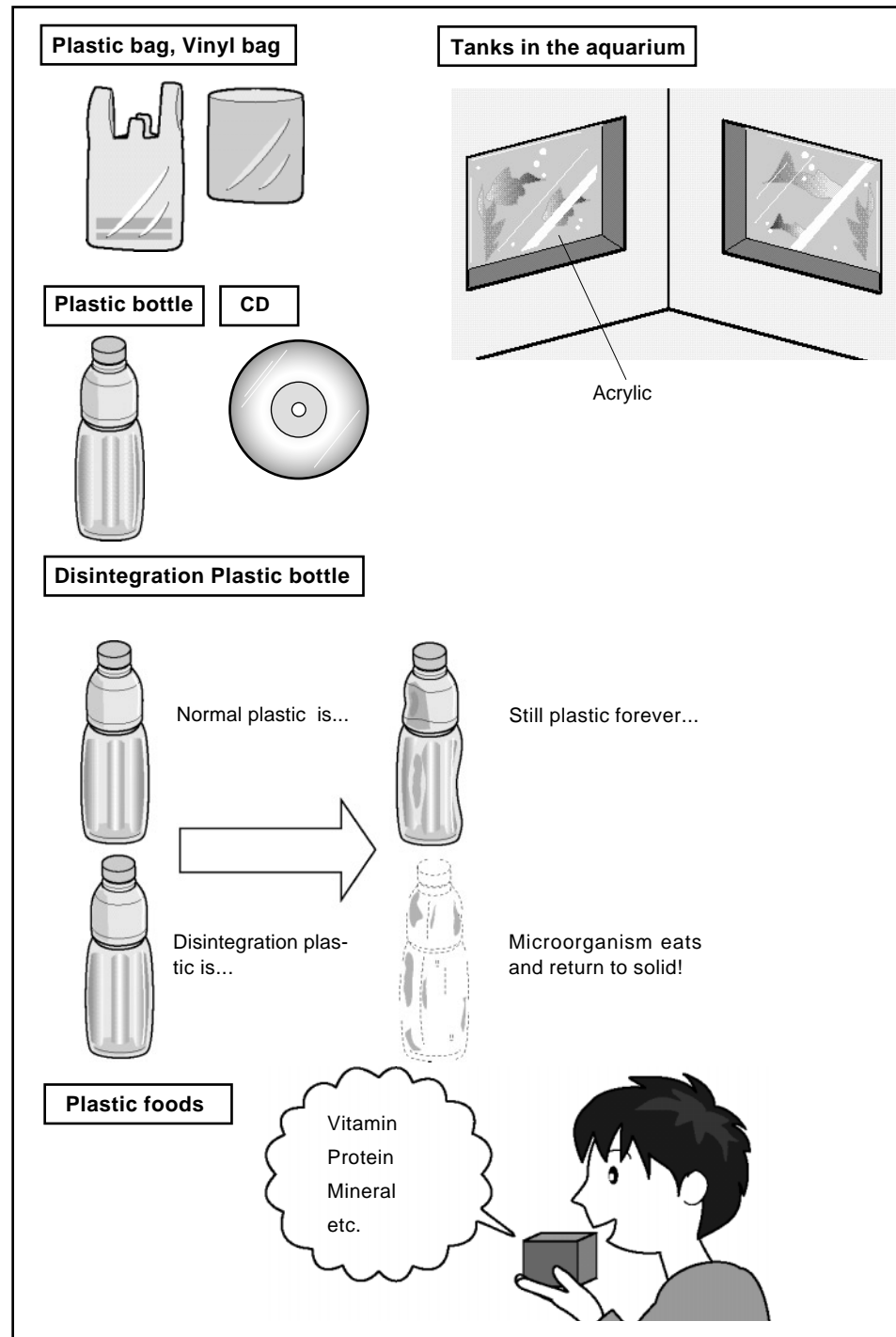
Polycarbonate is such a strong plastic that is not easy to be elastic, and change shape by temperature. Moreover, there is numerous plastic products such as telephone, bath tab, washbasin, bucket, tape, contact lens, personal computer, and etc. Each products use plastic's characteristic and nature.

Explanation of Plastic

3. Types of Motors

Recently, the concern to ecology increases and recycling of plastic parts attracts attention. By using existing shape to recycle or gather same materials and melt them by heat and chemicals. These could be other products later. Recently, package of the products show material of plastic to distinguish each material easily. Recently, a gift box has a printing of plastic material, to make easier to recycle. Moreover, new material "resolution plastic" is now focused on. If we say "resolution plastic" more easier, it is a plastic that microorganism eats in the solid, so the plastic results later. In fact, the plastic returns to solid. Usual plastics never changes their shapes forever. Disintegration plastics are dissolved as same as plants and animals, so it is very good for ecology.

Plastic will evolve more and more. Now plastic has been developing new type. Some plastics can be eaten, some of them are gone through the electric current. Maybe some house will be made by plastic in the future. Also, foods are made by plastic, which can be saved more than ten years. These foods will taste good, and good nutrition. Let's research for plastic more and more if you have a time. It might be fun to research!



Explanation of Plastic

Story about PC board

When you assembled the controller of AIR SHOOTER, you used PC board, didn't you. All electric machines have PC board surely. Let's talk about this PC board.

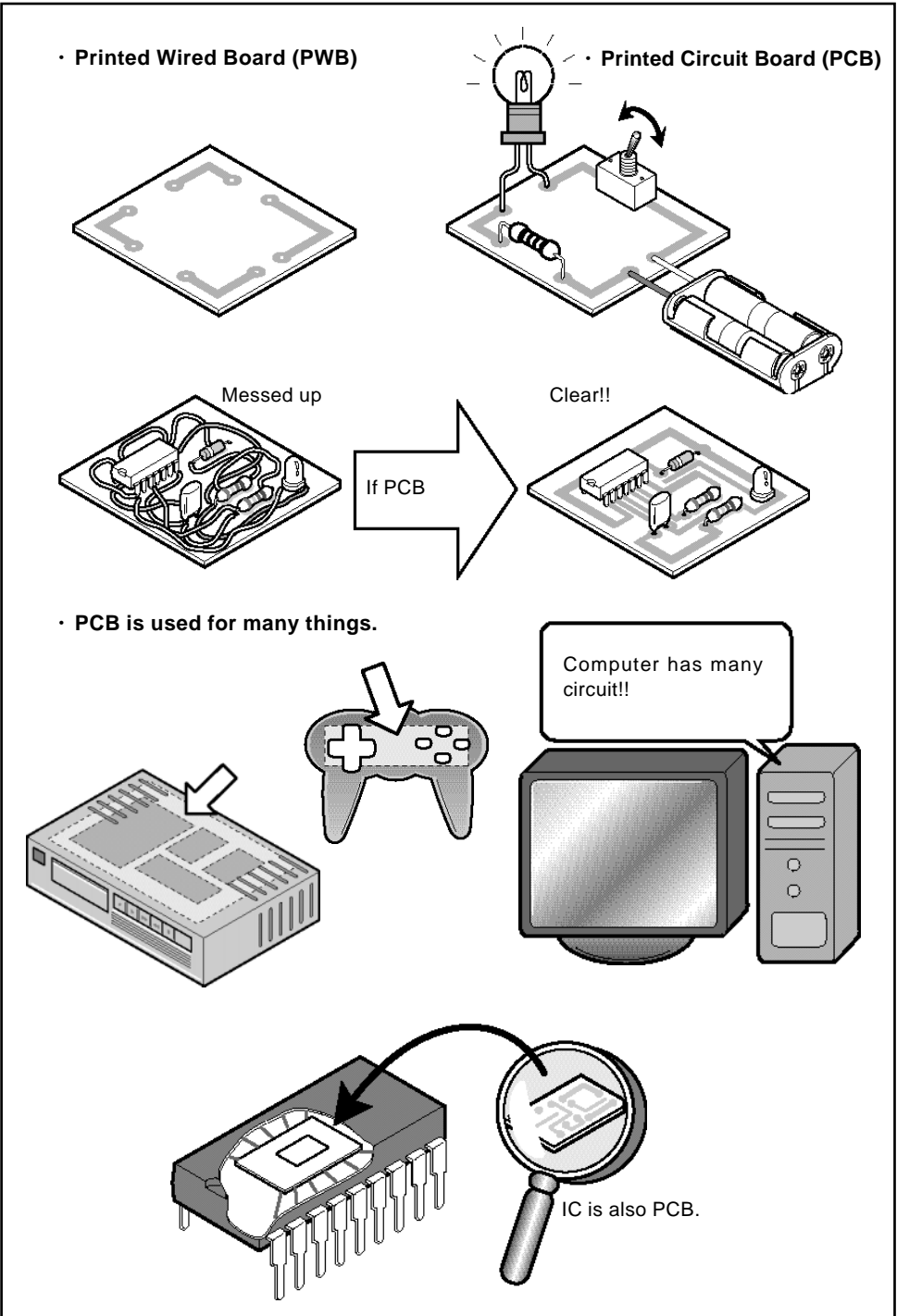
1. What is a PC board?

PC board is formally called as "Printed Wired Board," It is formed not to move the material that lets through the electricity, to board surface of the way that let electricity go through. Actually, the electric circuit usually see, electric parts and switch have installed with. Normally, we call it as "PCB."

By the way, why do we need PCB? Because we don't have to use vinyl wire to wiring, so that will be small and light. Moreover, if there are many wires, it causes many mistakes. And vinyl wire might be cut sometimes. PCB solves this problem as well.

2. Where PC board is used?

You may hard to find the electric machines that is without a circuit board. However, circuit board has some electricity, to avoid electric shock, circuit board is installed to the place that is uneasy to touch. For example, let's look at video from side and back. You can see circuit board from crevice of radiation. The circuit board has many electric parts, to act as video from these electric parts. If you see electric machines, there are smaller and bigger size of circuit. By the way, if we make circuit more smaller, what is going to be? Of course, parts are also smaller size. Then these parts become IC that you know well.

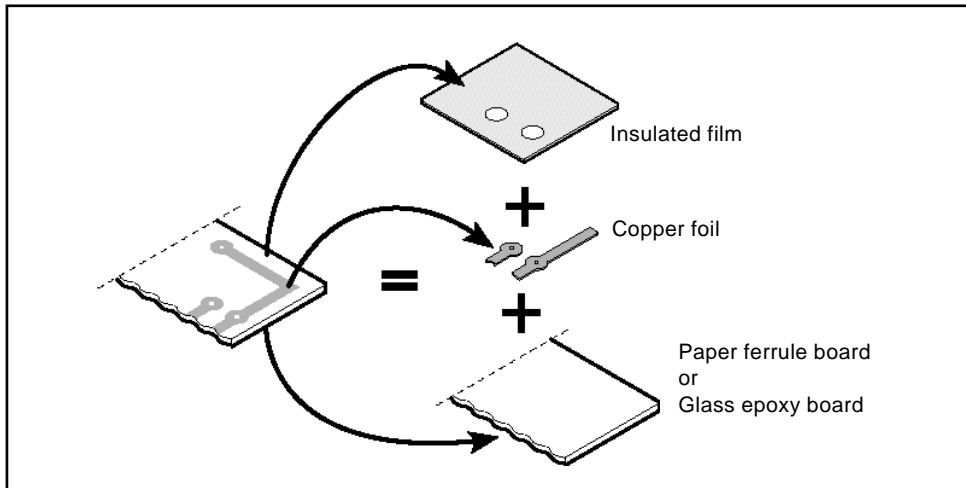


3. Structure of PC board

Here, let's explain the structure of PC board. It may be hard to understand.

Generally, PCB is made by these three materials, a board that acts as the base, copper foil that acts as the wiring, and insulated film that cover the copper foil. The board is usually made by paper ferrule (paper and ferrule resin) or glass epoxy (glass and epoxy resin.) These boards are used properly for place and temperature. The copper film is that copper made as very flatten, and it is the part that let electricity through. The board has the copper film only one side is called one-sided PCB, both side is called double-sided PCB, both side and inside is called multilayer PCB. AIR SHOOTER has the board with copper film only one side, so it is one-sided PCB. The insulated film is the thin film that does not let electricity go through. Let's think as transparent vinyl is attached. If copper film is naked, it's very dangerous, it may cause electric short from dust and etc. So insulated film is used to avoid electric short. It is same as wire, its both sides' points are naked and we can see copper wire, others are covered by vinyl.

Moreover, to do not to get a rust, flux is applied to avoid the air. PC board is made by this structure. It is kind of easy structure, isn't it? When these PC board are attached to electric parts and switch, such as mechanical parts, electric parts can be performed. PC board is not only for less wiring, also parts can be installed same position. In fact, it is very useful for mass production. PC board will be lighter and smaller, and be active in our life.



Spare Parts List

Part No.	Description	
901001M	Controller set	A1
901002M		A2
900301M	Set B	
900302M	Set C	
900303M	Set D	
900304M	Set E	
900305M	Set F	
900306M	Set G	
4400196	Screw (small)	M3 x 10
4400233	Screw (medium)	M3 x 20
4400271	Screw (large)	M3 x 30
4410041	Nut M3	
4410089	Lock nut M3	
4600039	Pinion gear 12 teeth	
4600176	Flat spur gear with pinion (small) 24 teeth : 12 teeth	
4600251	Flat spur gear with pinion (medium) 36 teeth : 12 teeth	
901007M	Flat spur gear with pinion (large) 60 teeth : 12 teeth	
4600138	Crown gear with pinion 36 teeth : 12 teeth	
4420156	Spacer	3 x 20
901009M	4 line wire	2m
901010M	Wire	White 100mm
901011M	Switch contact A	
901012M	Switch contact B	
901016M	Battery contact +	
901017M	Battery contact -	
901018M	Battery contact + and -	
901019M	Battery contact for PCB	
901013M	Motor	Type 130
901014M	Tire	
901015M	Ball	
Inst 9003	Instruction Manual	9003E

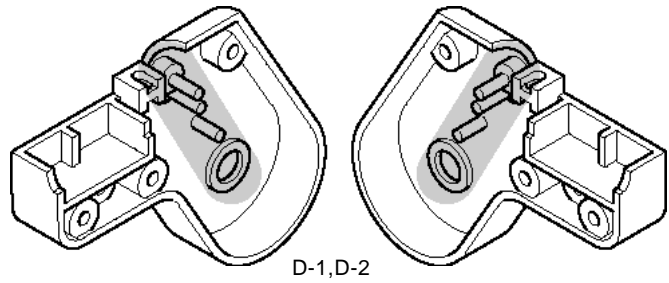
When ordering parts, please include the following :

- 1. Name, address, and phone number.**
- 2. Model name and Model number.**
- 3. Part number, description, and quantity.**

For spare part prices, please contact us.
(Our Company details are on front of this manual.)

Notes for coloring

Please use the paint for plastic models and follow the instructions given by its manufacturer for usage when coloring the machine.
Do not put paint on the gear rotating sections, holes and other moving sections.
It may cause malfunction of the movements because of the extra thickness of the paint.
Read the instruction manual before coloring.
For a better result, paint should be put on the parts before assembling.



Do not paint the driving sections, such as the marked bosses for gear attachment.

Manufactured by



EK Japan Co., Ltd.
FUKUOKA, JAPAN.

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EK JAPAN CO., Ltd.



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