EXPERIMENT MANUAL

Hero

Sound-Sensing Robot

Let's go!
With my special hearing abilities I can locate and follow you.

THAMES & KOSMOS

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Thames & Kosmos UK LP, Cranbrook, Kent, TN17 3HE, United Kingdom | 01580 713000 | thamesandkosmos.co.uk

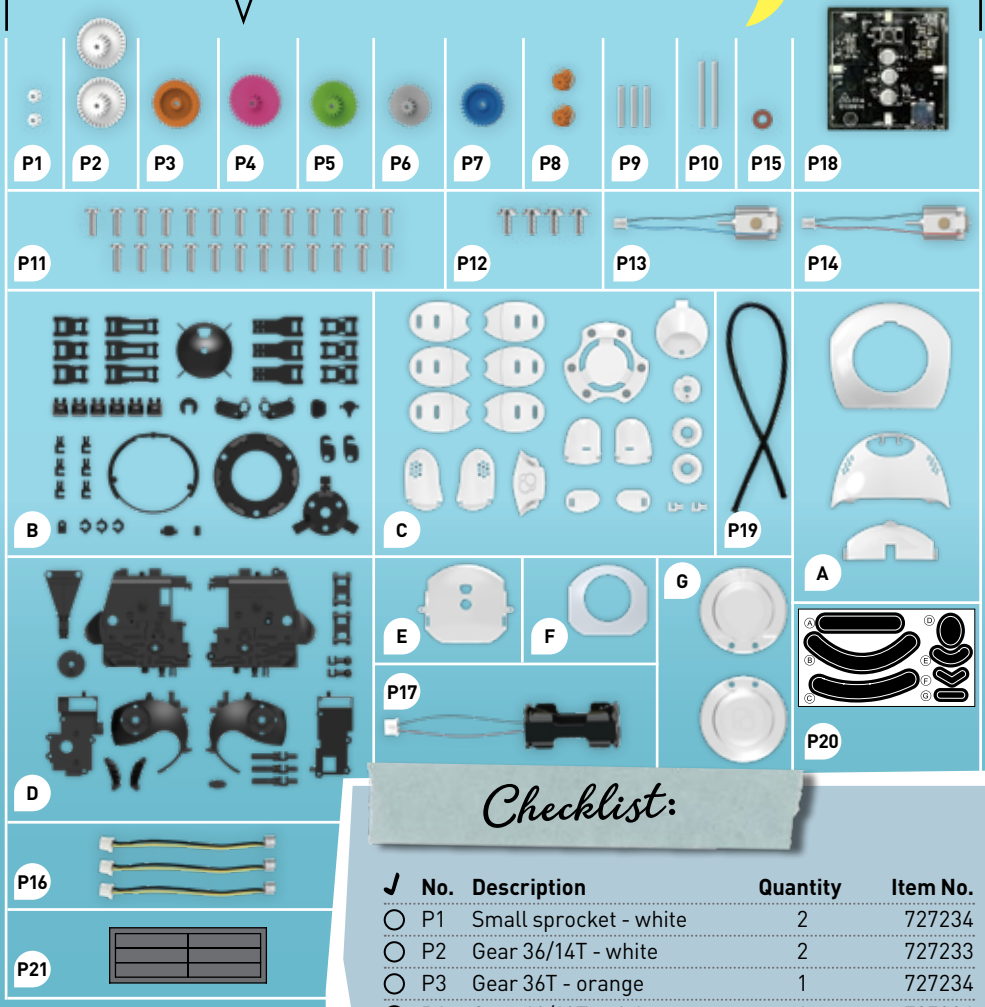
KIT CONTENTS

Good to know!

Do you have any questions or are you missing any parts? Our tech support team will be happy to help!

US: 1-800-587-2872
UK: 01580 713000

What's in your experiment kit:



Checklist:

✓	No.	Description	Quantity	Item No.
○	P1	Small sprocket - white	2	727234
○	P2	Gear 36/14T - white	2	727233
○	P3	Gear 36T - orange	1	727234
○	P4	Gear 40/10T - pink	1	727234
○	P5	Gear 36/14T - green	1	727233
○	P6	Gear 32/10T - gray	1	727233
○	P7	Gear 32T - blue	1	727233
○	P8	Sprocket 10T - orange	2	727234
○	P9	Short metal rod	3	727233
○	P10	Long metal rod	2	727234
○	P11	Screw	25	727233
○	P12	Wide head screw	4	727234

YOU WILL ALSO NEED:

Diagonal cutters or scissors and nail file, Phillips-head screwdriver (PH1 size recommended), 4 AAA batteries (1.5-volt, type LR03), marker

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TIP

YOU WILL FIND ADDITIONAL INFORMATION IN THE CHECK IT OUT SECTIONS ON PAGES 50 AND 51.

✓	No.	Description	Quantity	Item no.
○	P13	Motor with connecting cable (blue and black)	1	727557
○	P14	Motor with connecting cable (red and black)	1	727558
○	P15	Washer	1	727556
○	P16	Microphone with connecting cable	3	727556
○	P17	Battery compartment with connecting cable	1	727559
○	P18	Hero circuit board	1	727561
○	P19	Elastic cord	1	727556
○	P20	Sticker sheet	1	727560
○	P21	Foam sticker sheet	1	727556
○	A	Frame A with parts A1-A3	1	727226
○	B	Frame B with parts B1-B20	1	727227
○	C	Frame C with parts C1-C14	1	727228
○	D	Frame D with parts D1-D14	1	727229
○	E	Eye covering, clear	1	727231
○	F	Eye covering, opaque	1	727232
○	G	Frame G with parts G1-G2	1	727230

Wow! That's a lot of parts!

620398-02-081223

SAFETY INFORMATION

WARNING! Not suitable for children under 3 years. Choking hazard — small parts may be swallowed or inhaled.
Store the experiment material and assembled models out of the reach of small children.

WARNING: This toy is only intended for use by children over the age of 8 years, due to accessible electronic components. Instructions for parents or caregivers are included and shall be followed.

WARNING. This kit contains functional sharp edges or points. Do not injure yourself!

Warning. To be used under the direct supervision of an adult. Keep the toy out of reach of children under 8 years old.

Keep packaging and instructions as they contain important information.

Assembly must be performed under adult supervision.

Do not pick up the robot during operation.

Keep hands, hair, and clothing away from the moving parts when the robot is powered on.

Avoid hitting people, animals, and household furniture with the robot.

SAFETY FOR EXPERIMENTS WITH BATTERIES

- The wires are not to be inserted into socket-outlets. Never perform experiments using household current! The high voltage can be extremely dangerous or fatal!
- To operate the models, you will need four AAA batteries (1.5-volt, type LR03), which could not be included in the kit due to their limited shelf life.
- The supply terminals are not to be short-circuited. A short circuit can cause the wires to overheat and the batteries to explode.
- Different types of batteries or new and used batteries are not to be mixed.
- Do not mix old and new batteries.
- Do not mix alkaline, standard (carbon-zinc), or rechargeable (nickel-cadmium) batteries.
- Batteries are to be inserted with the correct polarity (+ and -). Press them gently into the battery compartment. See page 41. This page shows how the batteries are inserted, removed, and changed.
- Always close battery compartments with the lid.
- Non-rechargeable batteries are not to be recharged. They could explode!
- Rechargeable batteries are to be removed from the toy before being charged.
- Exhausted batteries are to be removed from the toy.
- Dispose of used batteries in accordance with environmental provisions, not in the household trash.
- Avoid deforming the batteries.
- The toy is not to be connected to more than the recommended number of power supplies.
- As all of the experiments use batteries, have an adult check the experiments or models before use to make sure they are assembled properly. Always operate the motorized models under adult supervision. After you are done experimenting, remove the batteries from the device compartments.

NOTES ON DISPOSAL OF ELECTRICAL AND ELECTRONIC COMPONENTS

The electronic components of this product are recyclable. For the sake of the environment, do not throw them into the household trash at the end of their lifespan. They must be delivered to a collection location for electronic waste, as indicated by the following symbol:

Please contact your local authorities for the appropriate disposal location.

IMPORTANT INFORMATION

Dear Parents and Supervising Adults,

Children want to be amazed, understand, and create new things. They want to try everything out and do it for themselves. They want to know! They can do all of this with Thames & Kosmos experiment kits. We hope you and your child have a lot of fun experimenting with your Hero: Sound-Sensing Robot.

— Before building and experimenting, read the instructions together with your child and discuss the safety information together. Stand by to assist your child with any challenging steps of assembly or usage.

— If your child is working on a table top, give them something to work on to prevent damage to the furniture.

— Particular care must be taken when cutting the plastic parts out of the frames, as sharp points can be created. These can be removed with the help of diagonal cutters or scissors and a nail file. Please supervise your child whenever they are using scissors or diagonal cutters until you feel they are ready to use the tools independently.

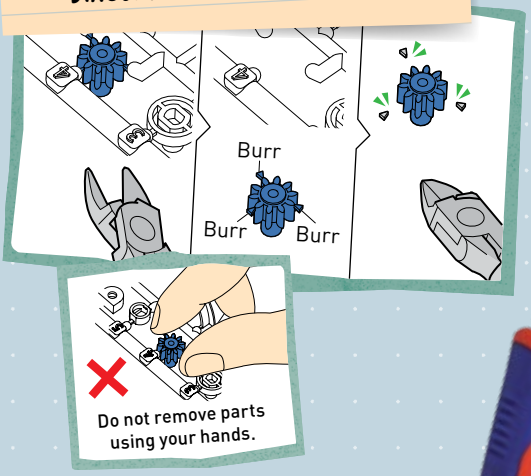
— Hero should not be grabbed or picked up while it is moving. Hands, hair, and clothing should be kept away from moving parts. Avoid hitting people, animals, and household furniture with the robot.

— And most importantly: Have fun!

TIP

IMPORTANT:

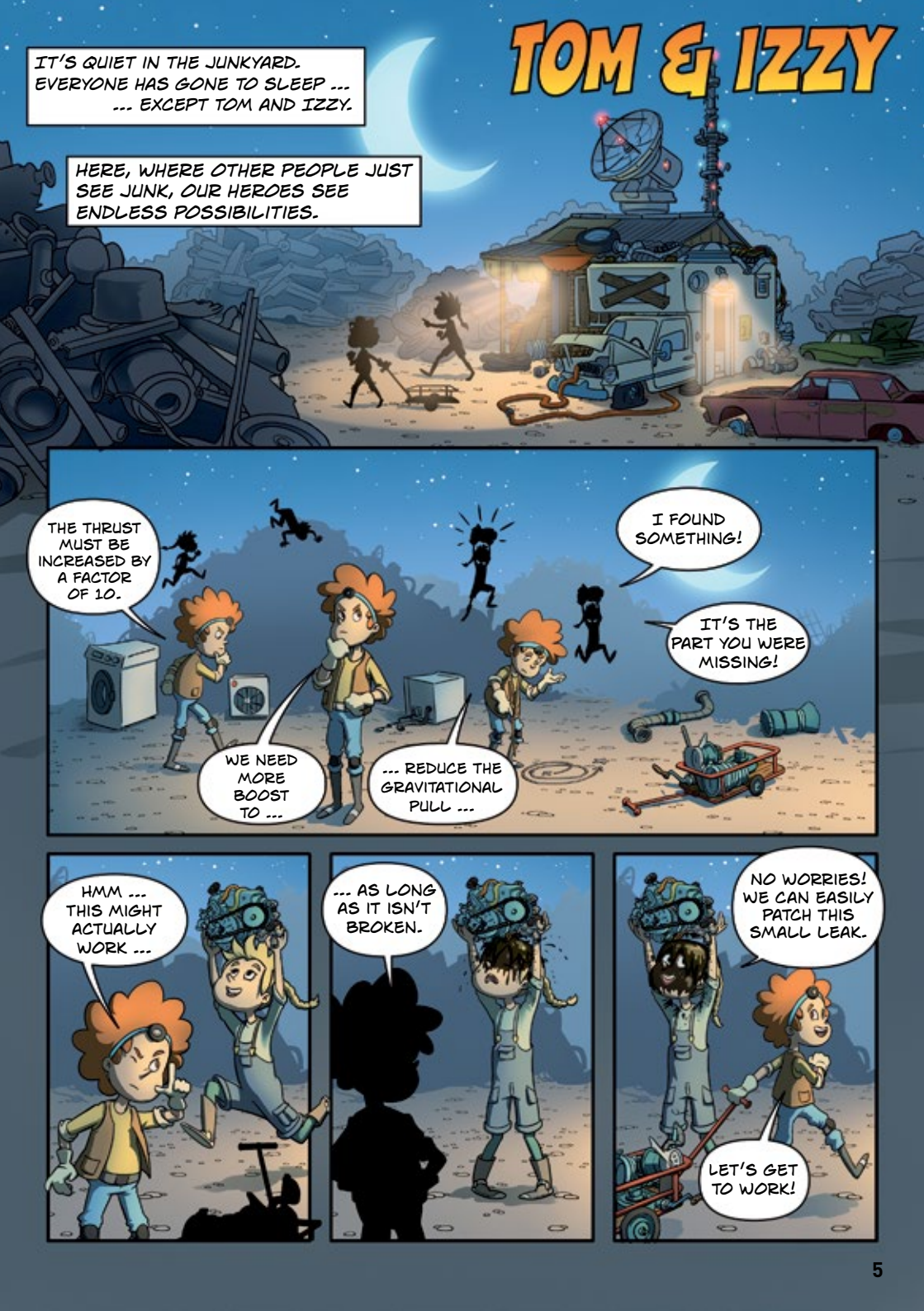
REMOVE THE PARTS FROM THE FRAMES ONLY WHEN THEY ARE NEEDED. REMOVE EXCESS MATERIAL (BURRS) BEFORE ASSEMBLY USING A DIAGONAL CUTTER OR A NAIL FILE.



THE RIGHT TOOL

The right tool can make assembling your model much easier and it can also make your model work better in the end. It is best to cut the plastic parts out of their frames with a small diagonal cutter (such as those used for electronics work) or model pliers. Using these tools, the parts can be precisely cut so that no burrs remain on the parts and there is no need to file them down. If you don't have these pliers at home, you can use scissors and a nail file. Normal scissors do not cut as precisely as a diagonal cutter, so you may have to file some of the rough edges down with the nail file.


hero
... AND THE MYSTERIOUS FOG!

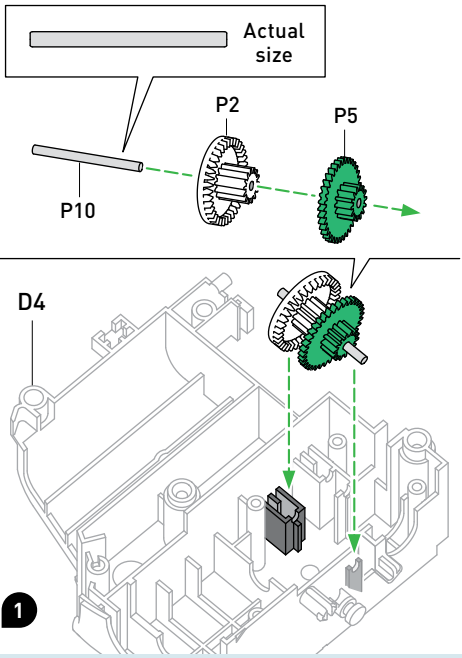

TOM & IZZY
IT'S QUIET IN THE JUNKYARD. EVERYONE HAS GONE TO SLEEP ...
... EXCEPT TOM AND IZZY.
HERE, WHERE OTHER PEOPLE JUST SEE JUNK, OUR HEROES SEE ENDLESS POSSIBILITIES.
THE THRUST MUST BE INCREASED BY A FACTOR OF 10.
I FOUND SOMETHING!
IT'S THE PART YOU WERE MISSING!
WE NEED MORE BOOST TO ...
... REDUCE THE GRAVITATIONAL PULL ...
HMM ... THIS MIGHT ACTUALLY WORK ...
... AS LONG AS IT ISN'T BROKEN.
NO WORRIES! WE CAN EASILY PATCH THIS SMALL LEAK.
LET'S GET TO WORK!

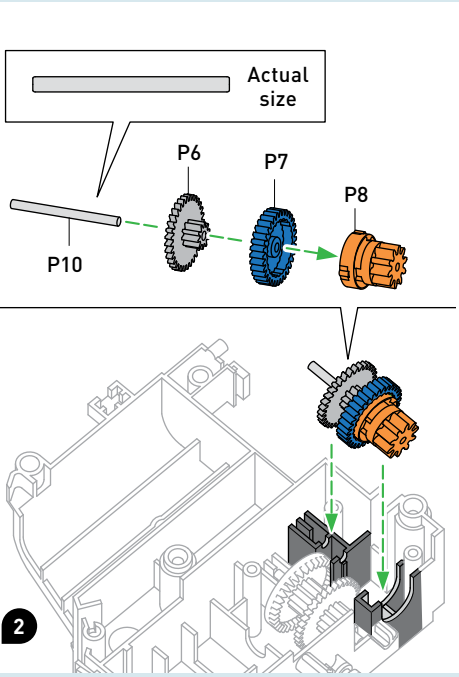

IZZY CAN REPAIR ANYTHING. SHE IS A GENIUS WHEN IT COMES TO MECHANICS.
TOM, ON THE OTHER HAND, IS A SCIENTIST THROUGH AND THROUGH.
HE'S ALWAYS GAME TO TRY OUT AN EXPERIMENT!
TOGETHER, THESE TWO CAN BUILD ANYTHING!
I THINK IT'S READY!
YES! WE DID IT!
NOTHING CAN STOP US NOW!
WHERE SHOULD WE FLY TO FIRST?
WHEREVER WE WANT!
WE CAN GO ANYWHERE!

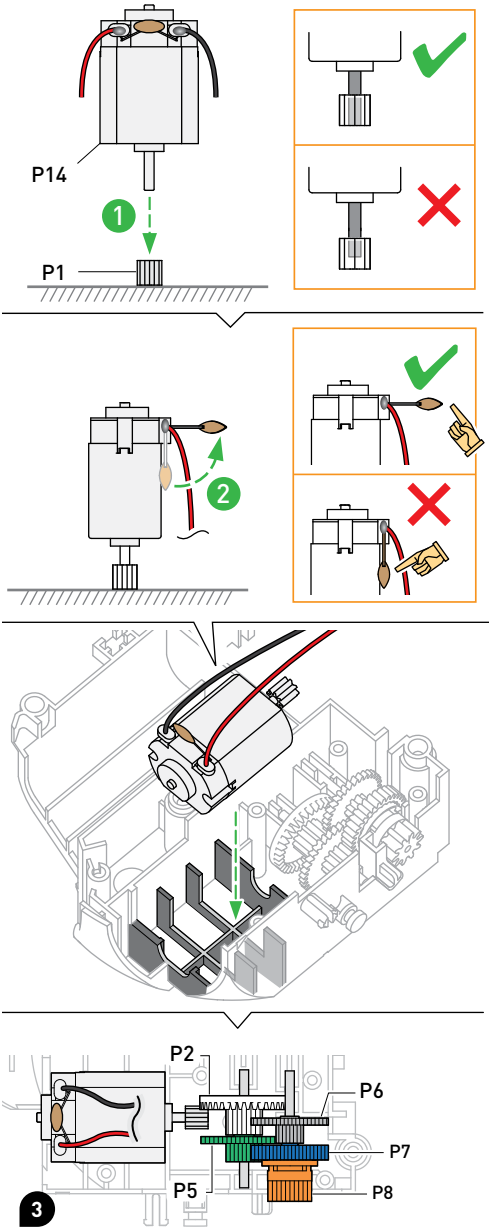
CONTINUED ON PAGE 44

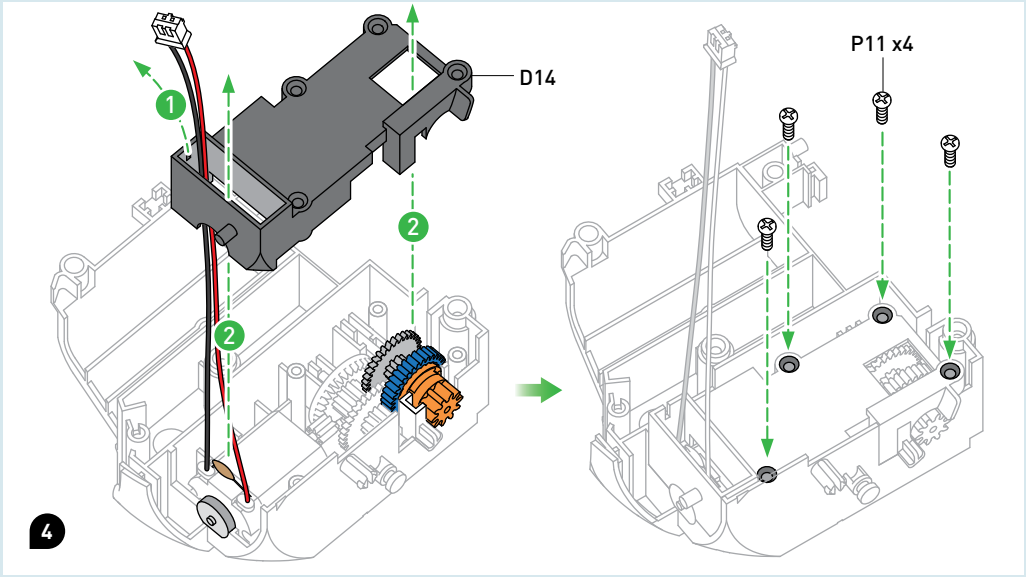
ASSEMBLY VIDEO

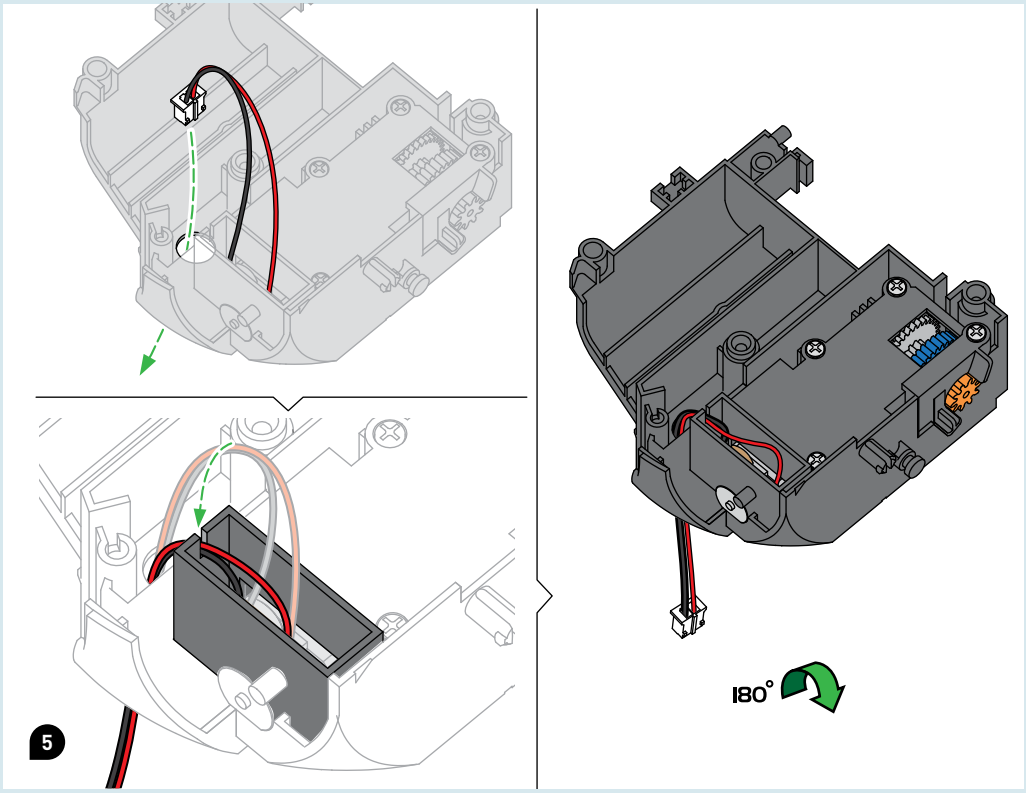
Scan this QR code for a step-by-step assembly video.

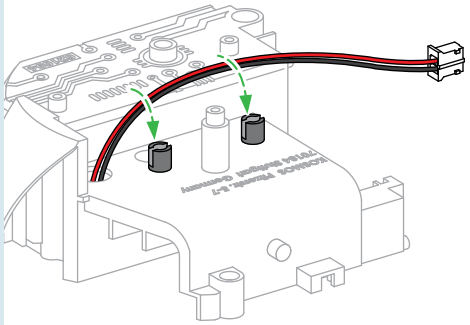


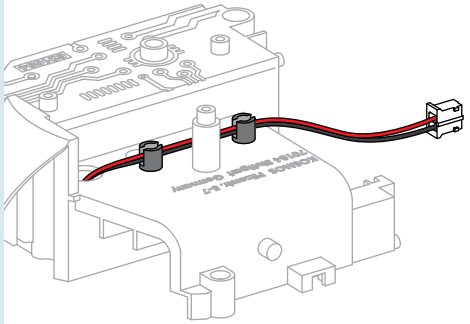




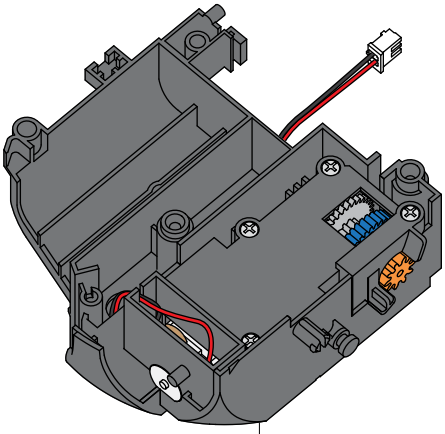

D14
P11 x4
1
2
2
4


180°
5





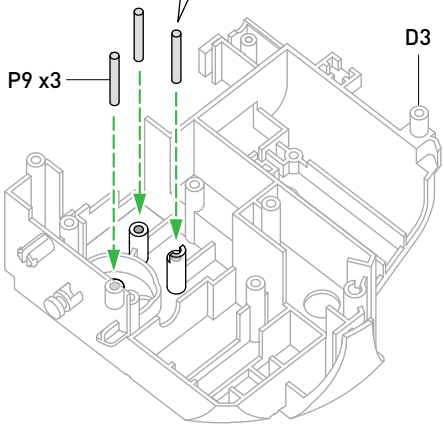
180°

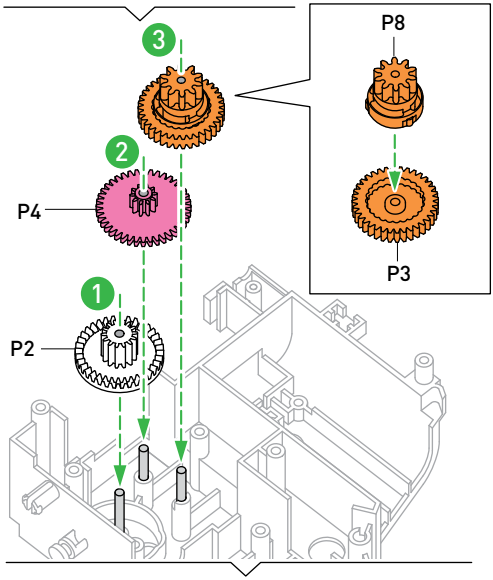


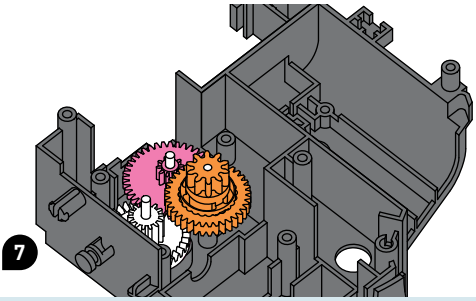
6

Body Module - Left

Actual size







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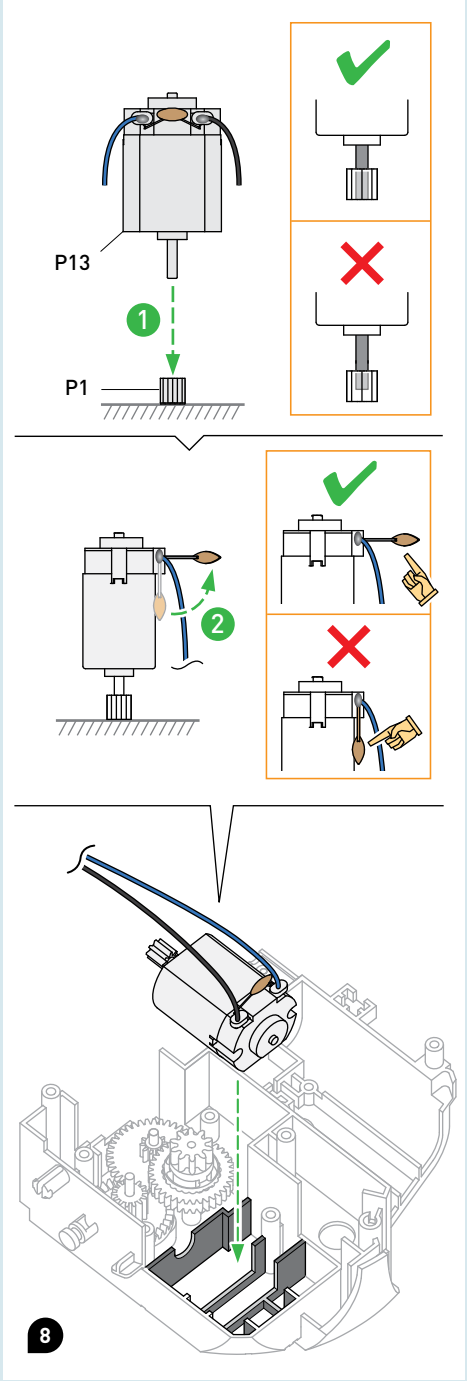
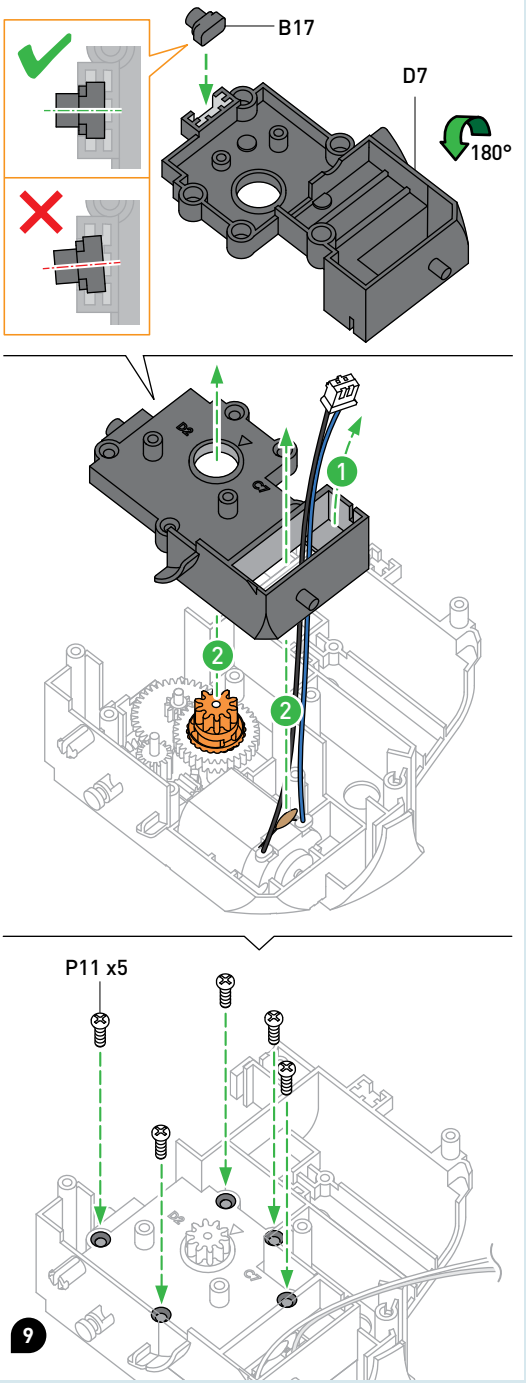
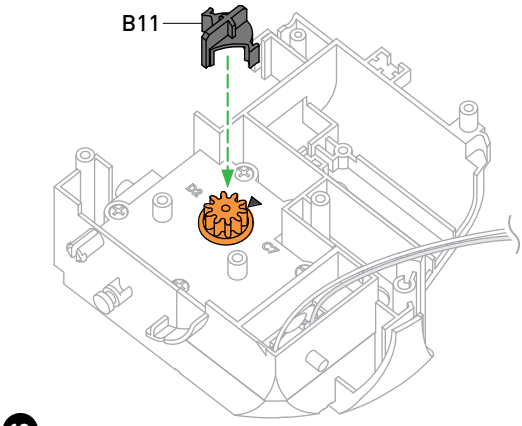
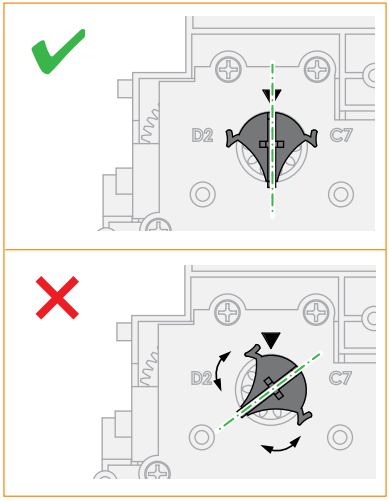

P13
1
P1
2
8


B17
D7
180°
1
2
2
P11 x5
9





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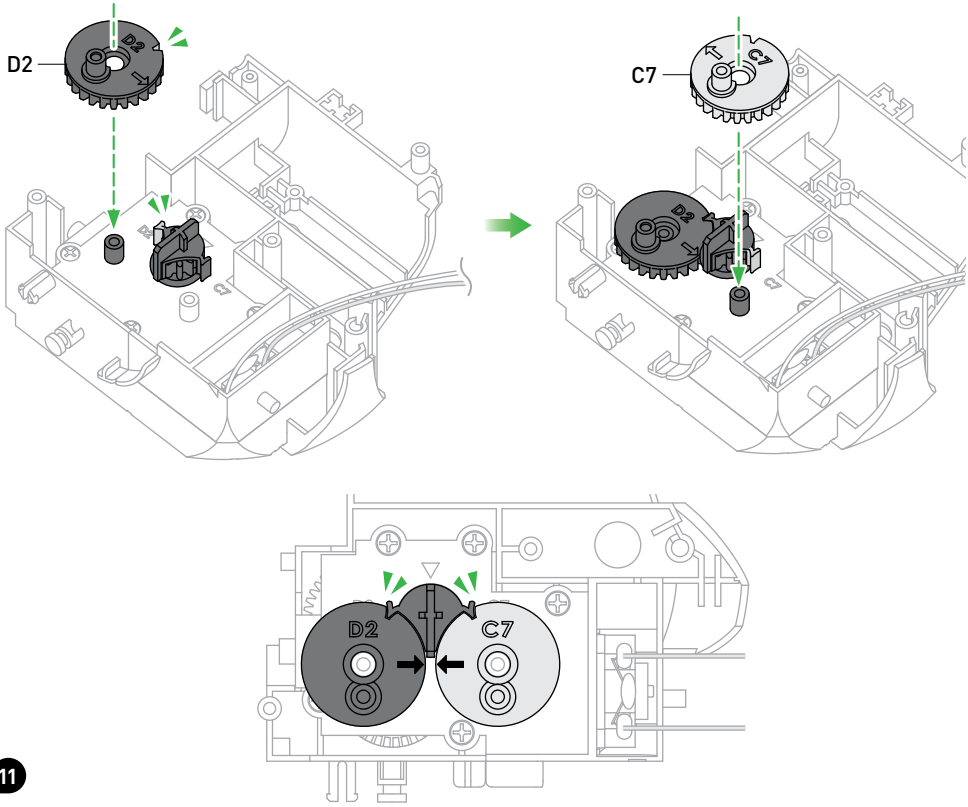

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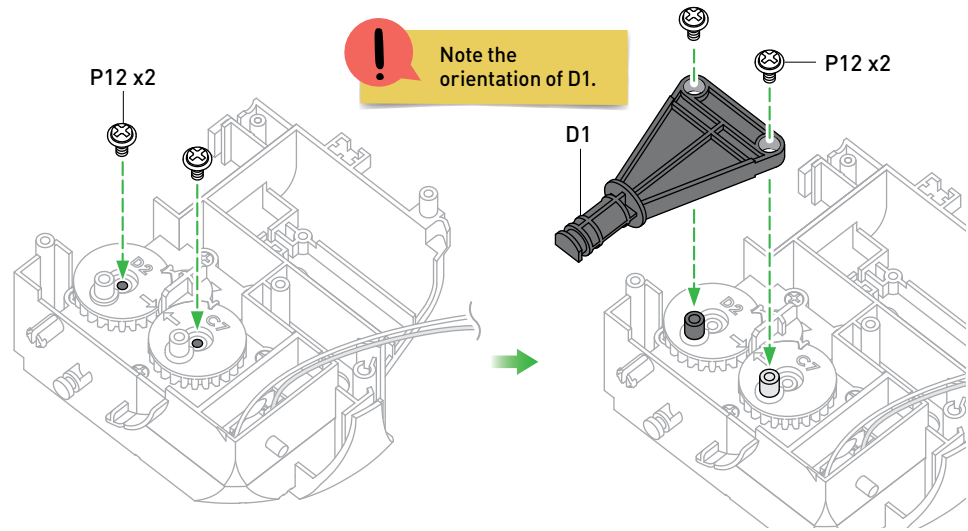
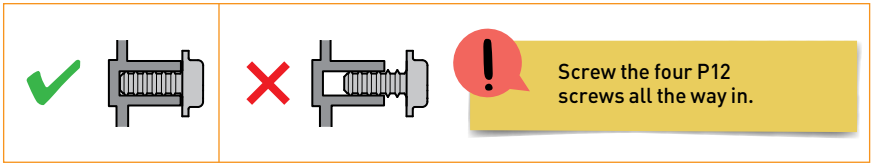
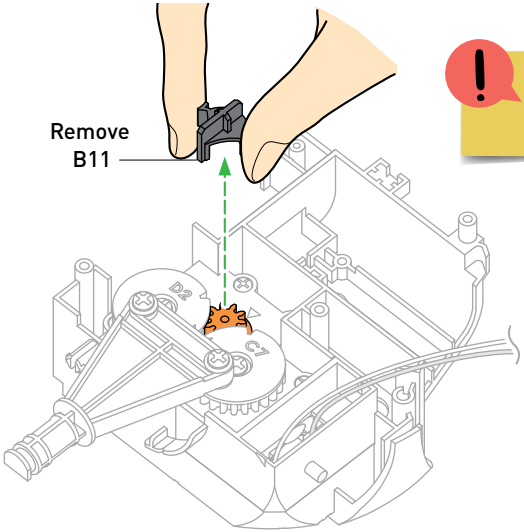
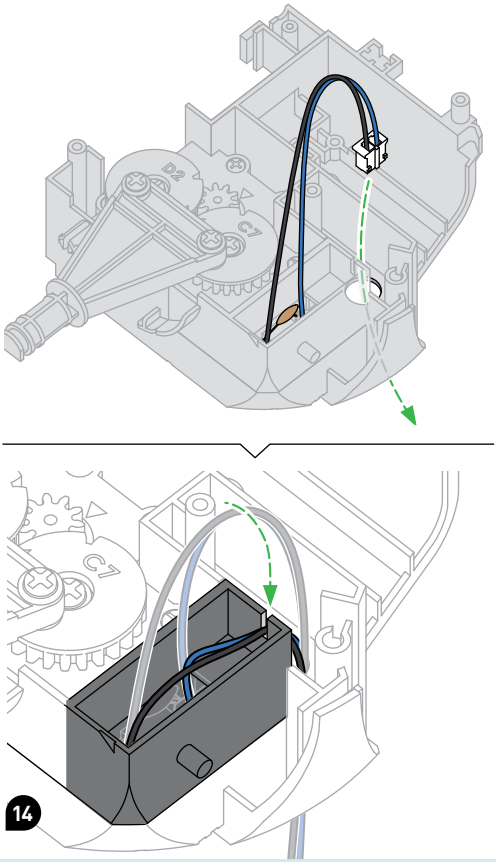

P12 x2
Note the orientation of D1.
P12 x2
D1
D2
C7


Screw the four P12 screws all the way in.

12


Remove B11
Do not remove B11 until you have finished step 12.
D2
C7

13



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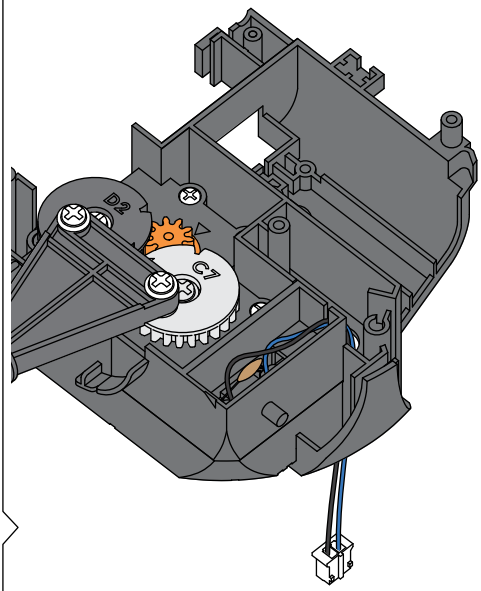

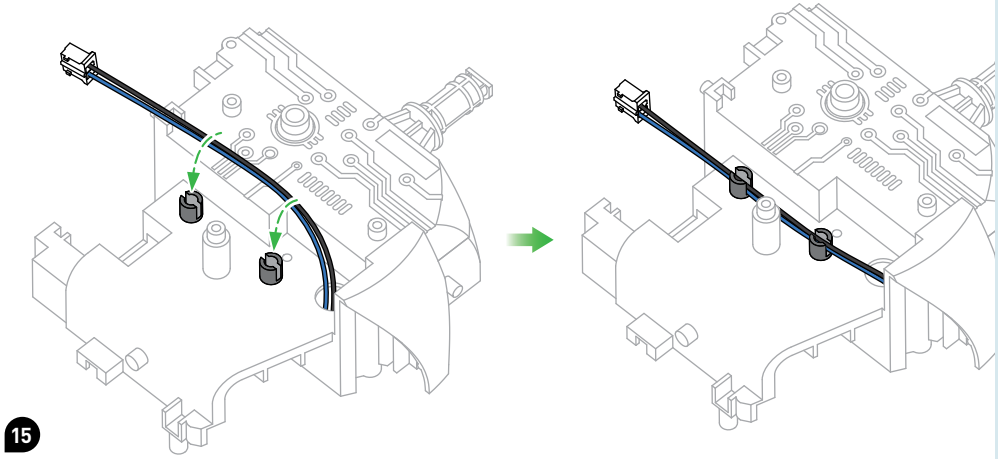

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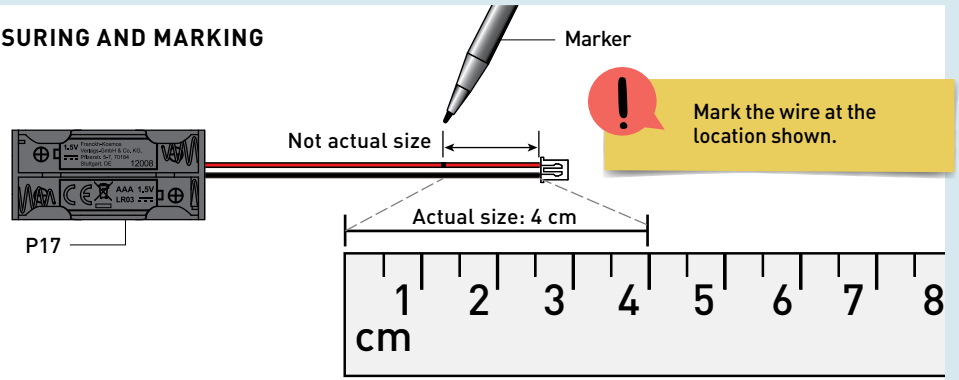
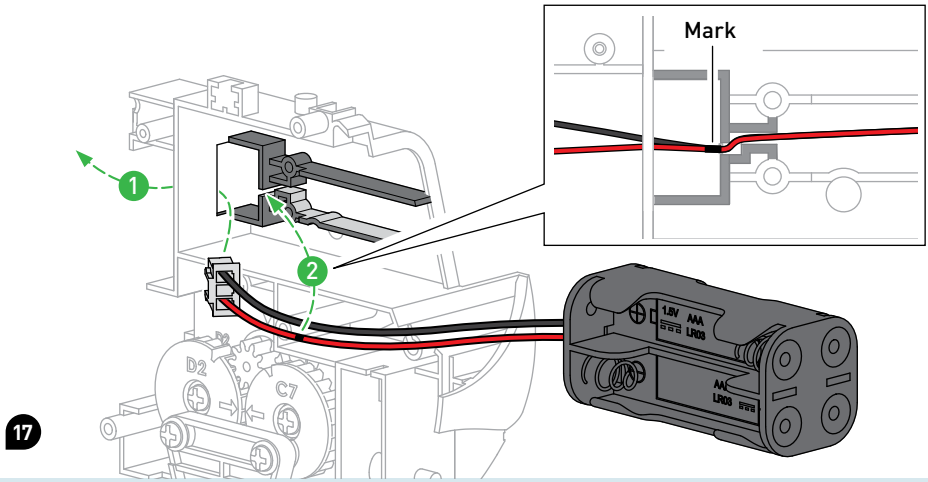
MEASURING AND MARKING



Mark the wire at the location shown.

16



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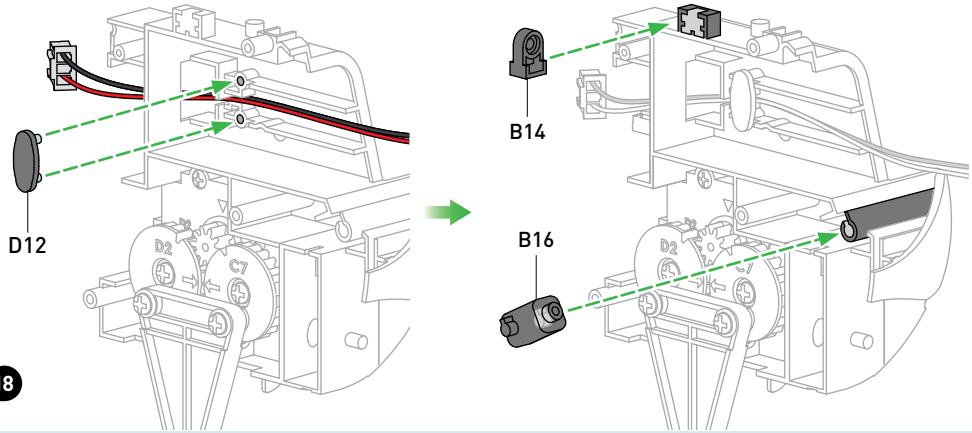

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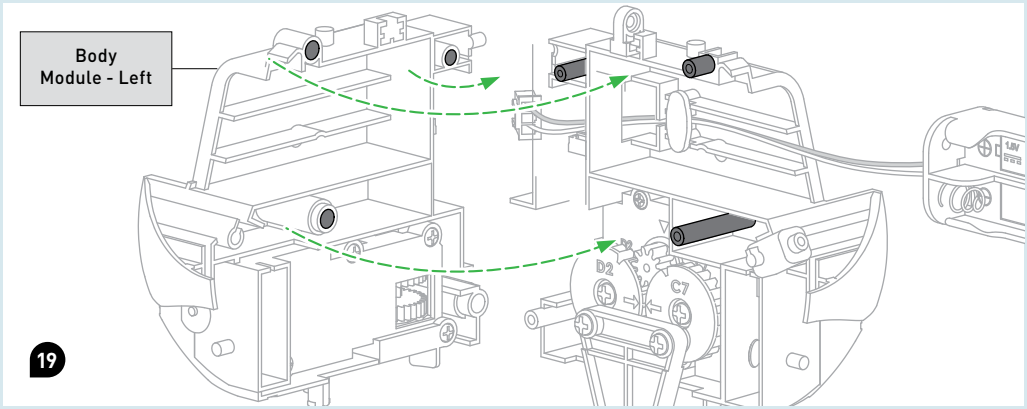
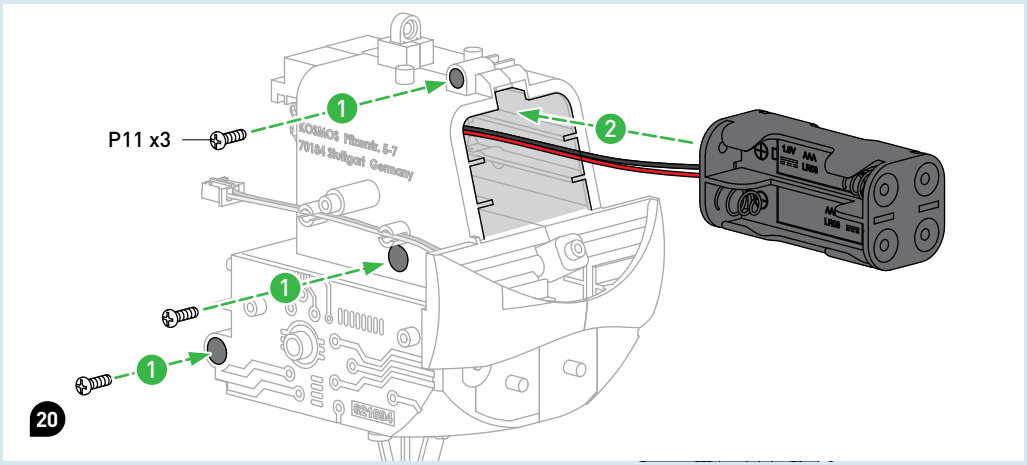
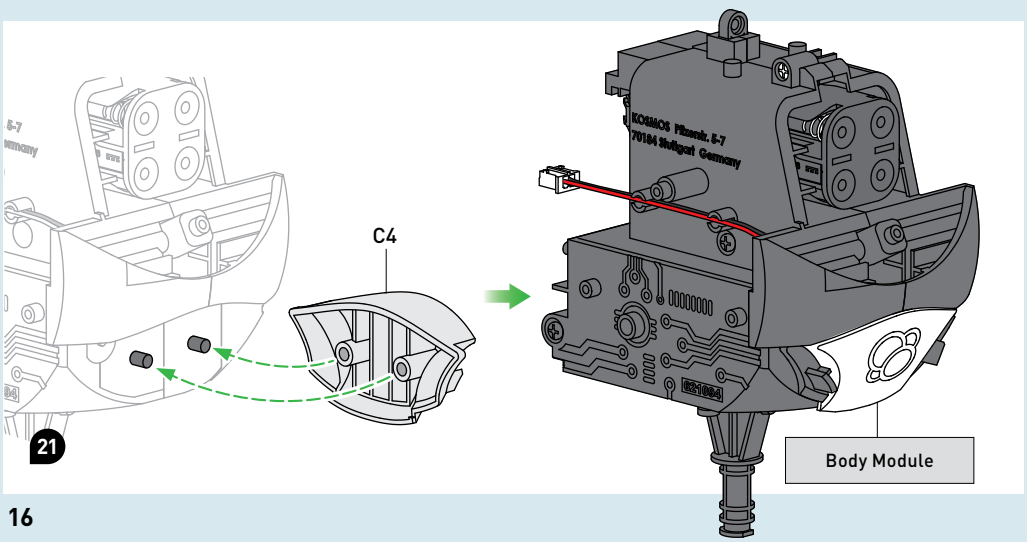
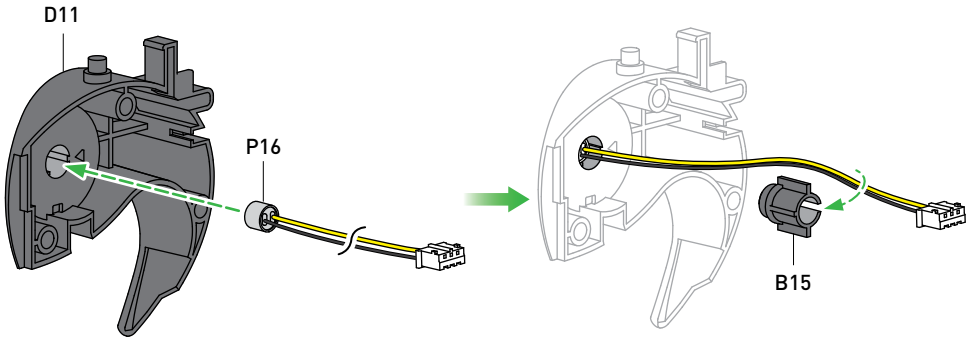
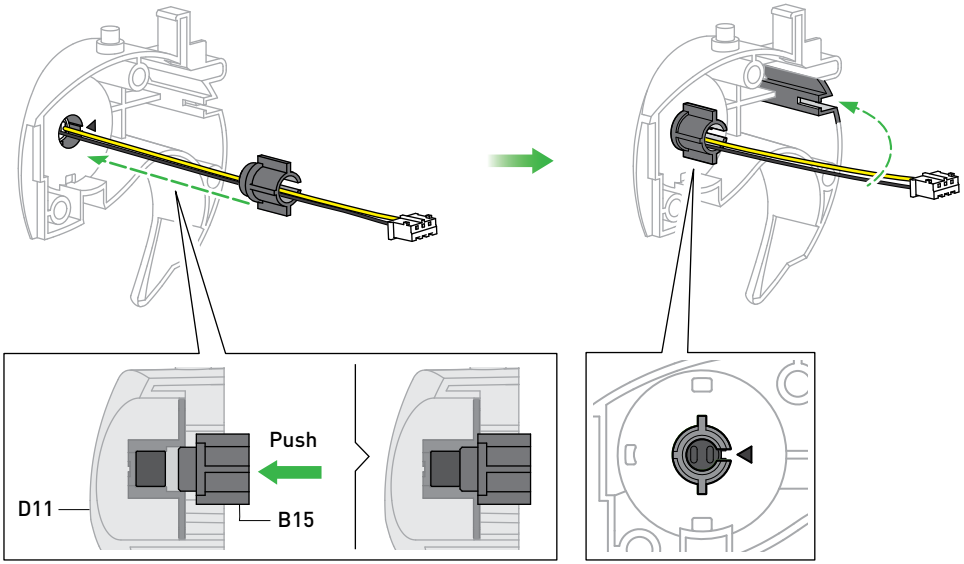
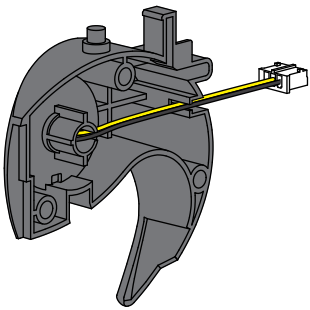

Body
Module - Left
19


P11 x3
1
2
1
1
20


C4
KOSMOS Pfizenstr. 5-7
70184 Stuttgart Germany
Body Module
21







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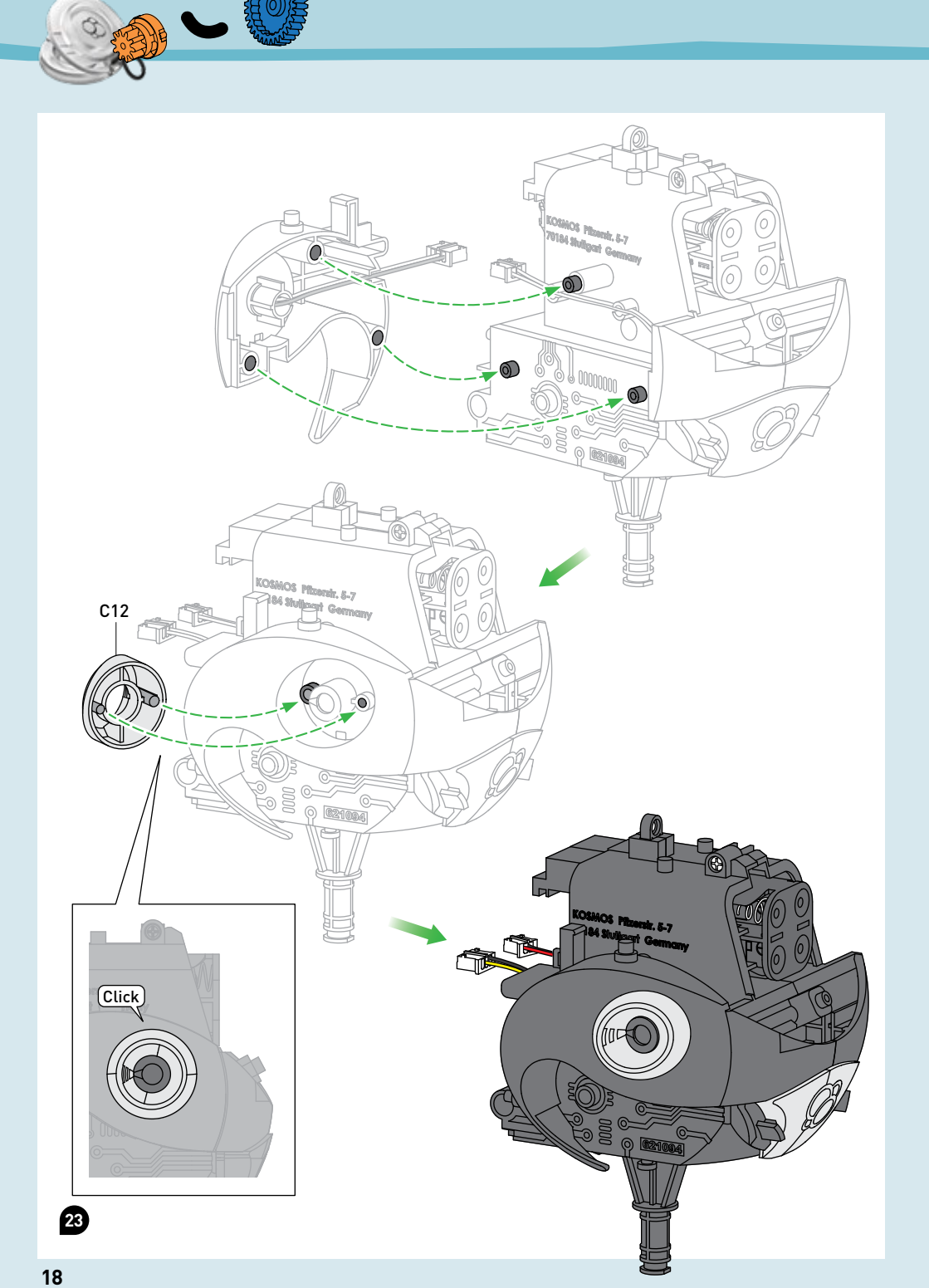
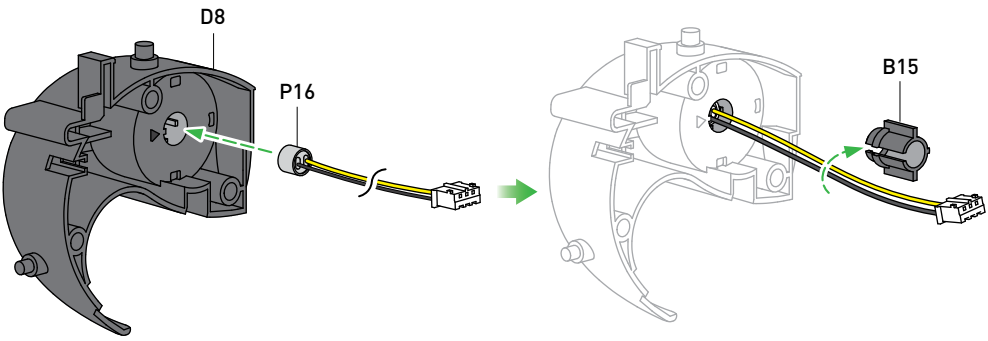
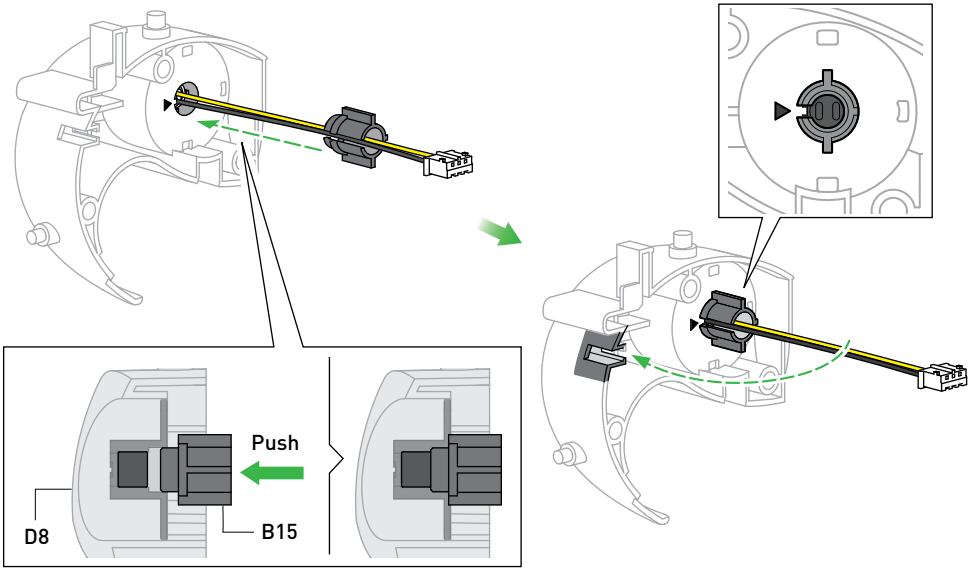
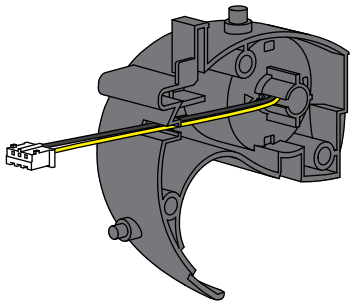

KOSMOS Pfizenstr. 5-7
70184 Stuttgart Germany
621004
C12
Click
23







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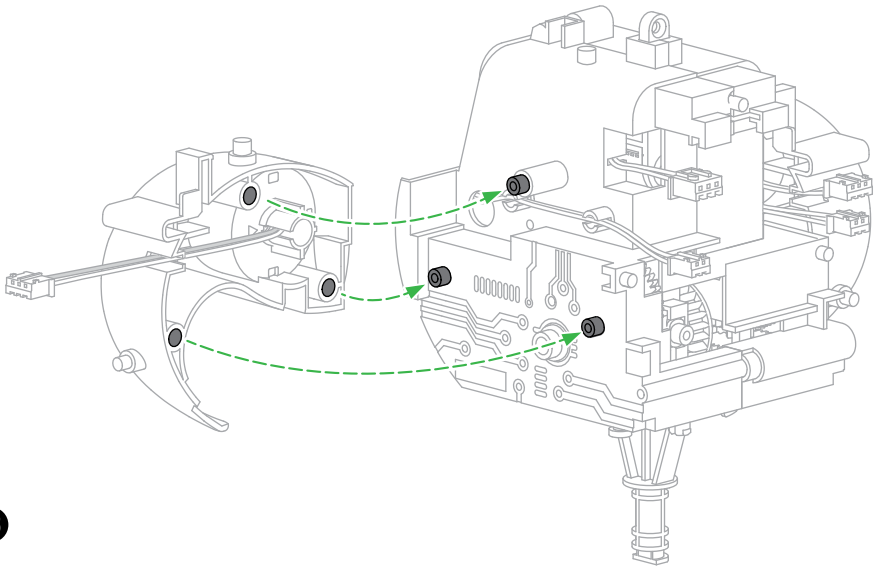

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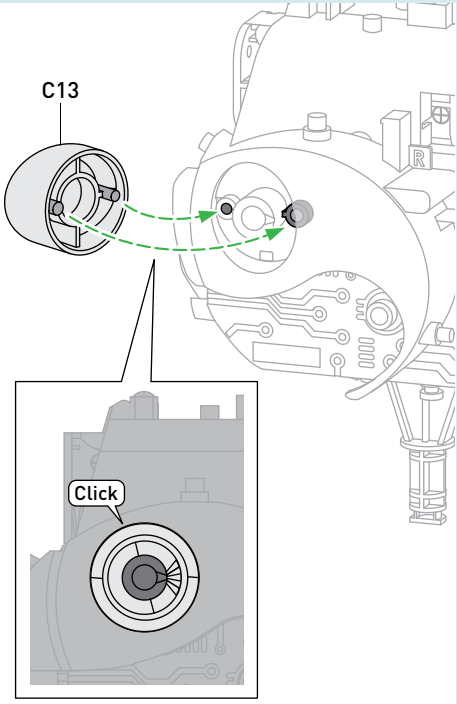
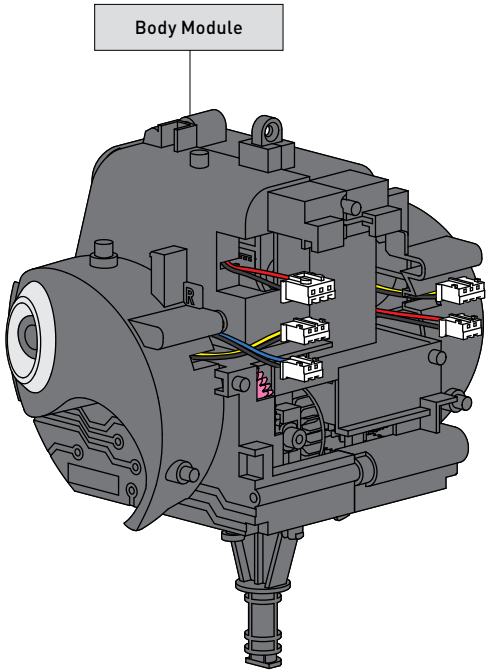
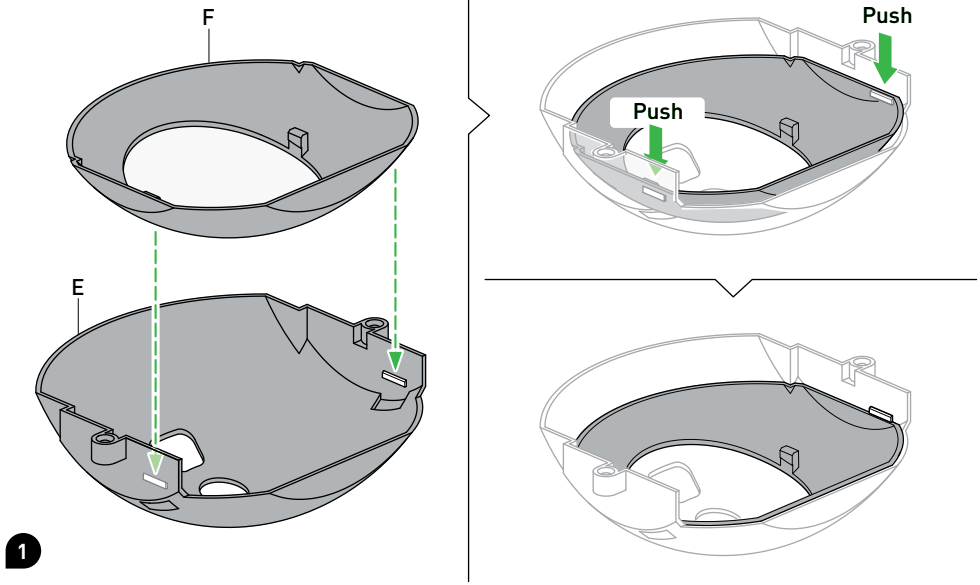


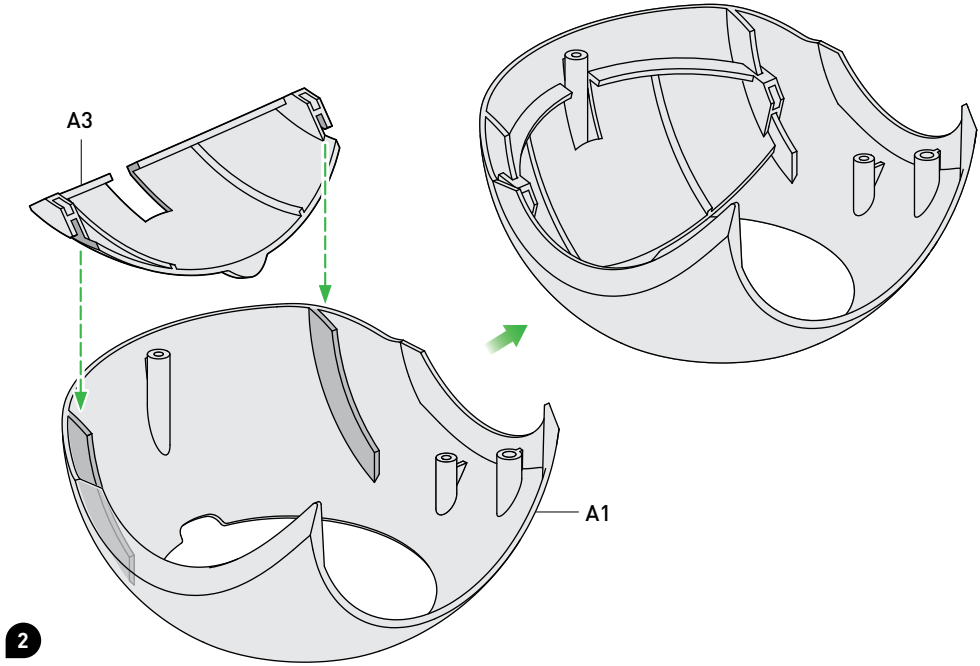
26

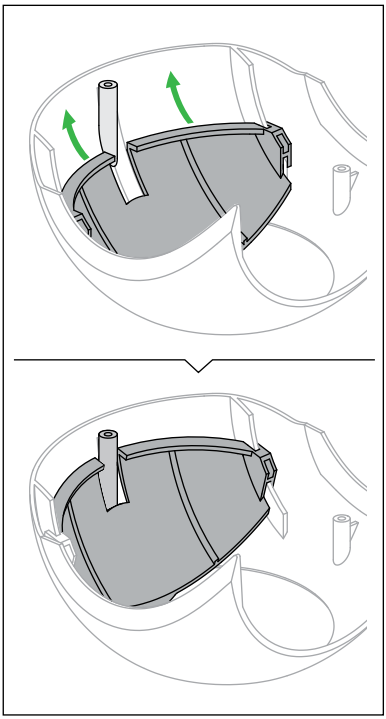


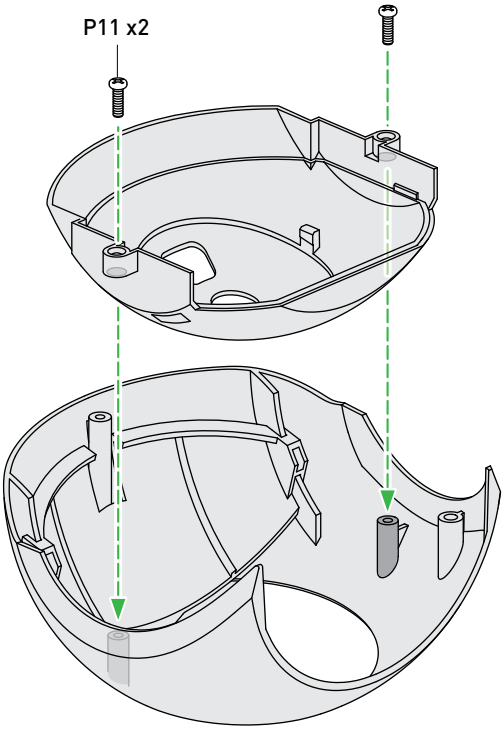
27

HEAD ASSEMBLY









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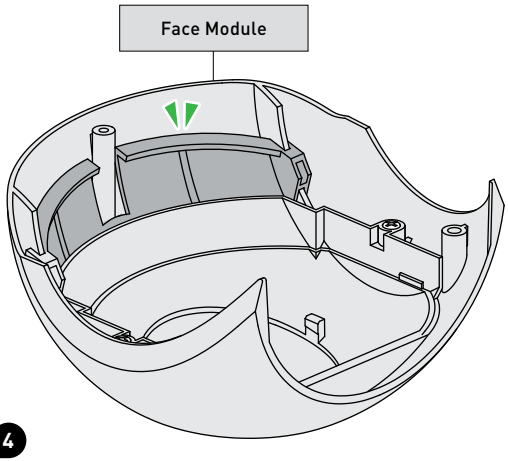

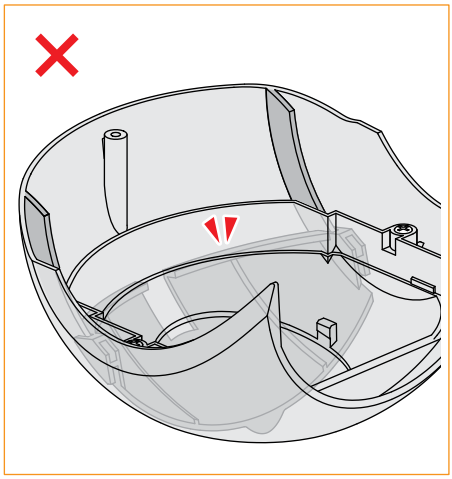

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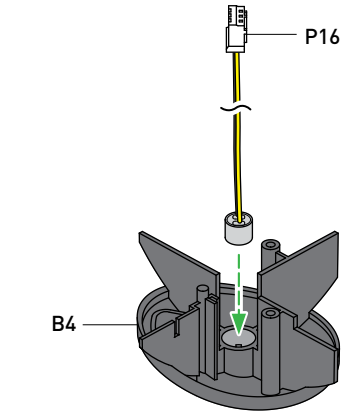

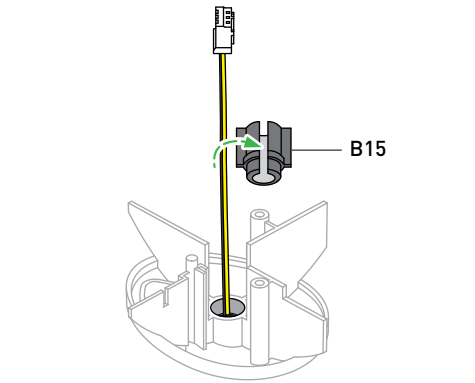

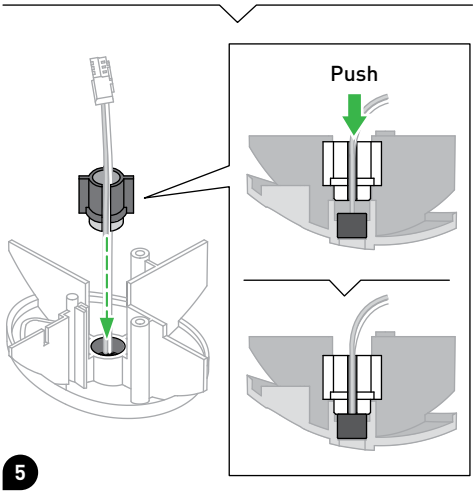

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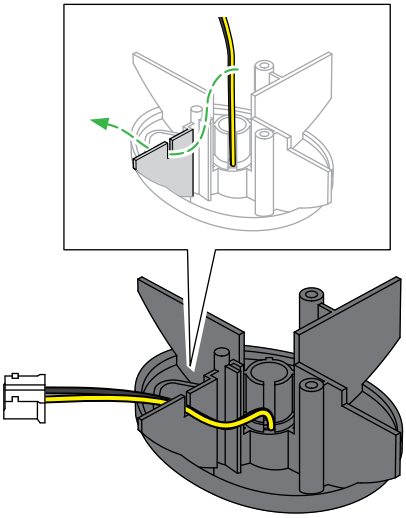

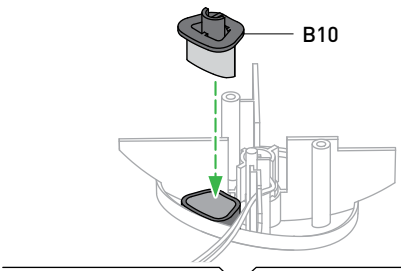

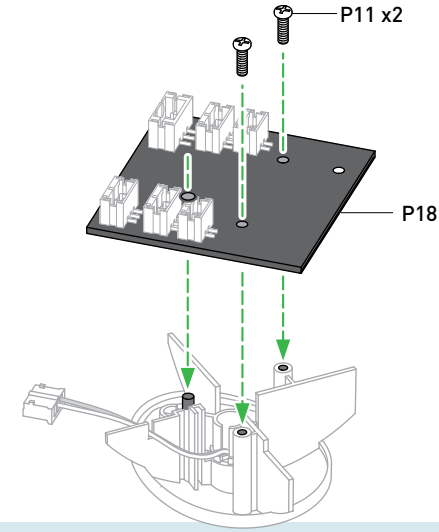

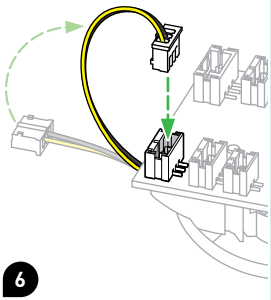

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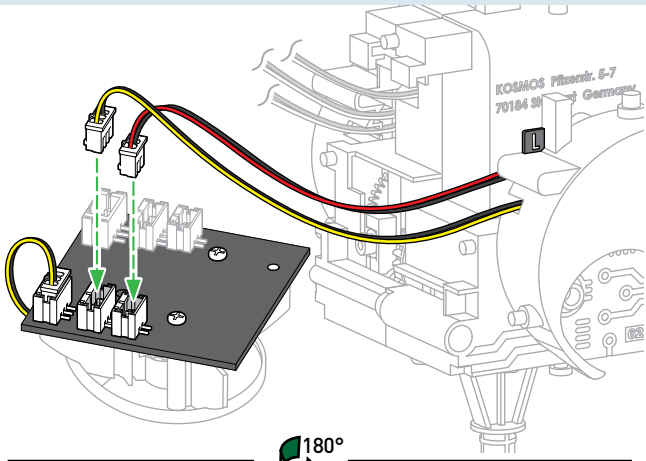
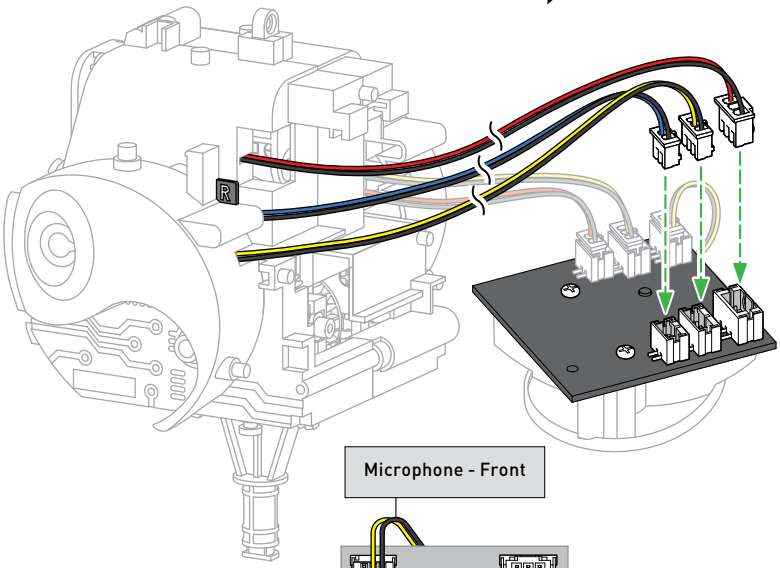
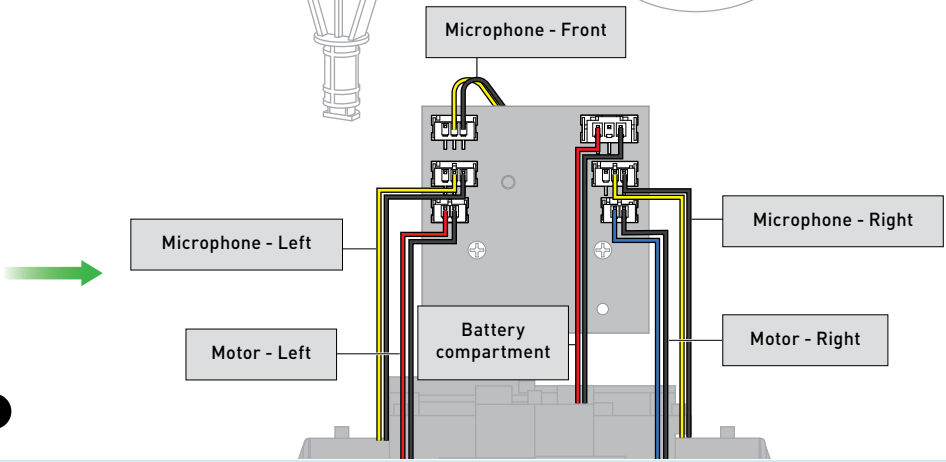
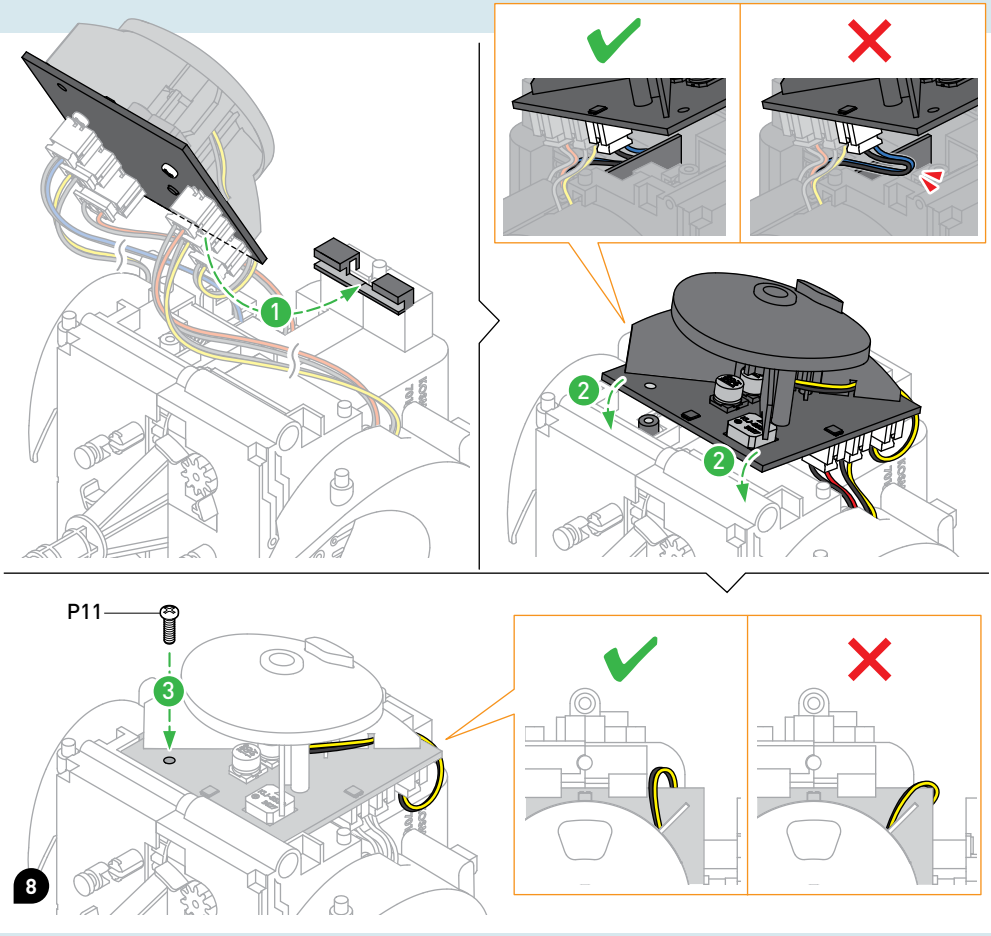

L

180°

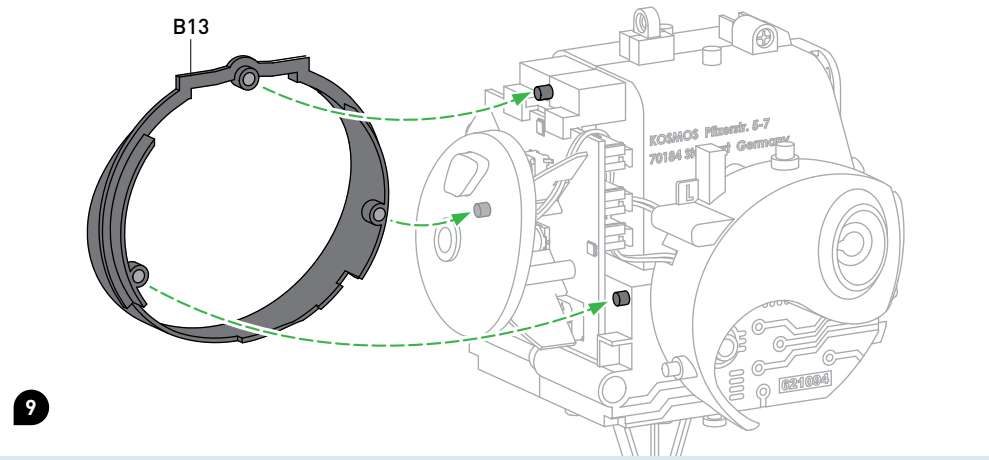

R


Microphone - Front
Microphone - Left
Microphone - Right
Battery compartment
Motor - Left
Motor - Right

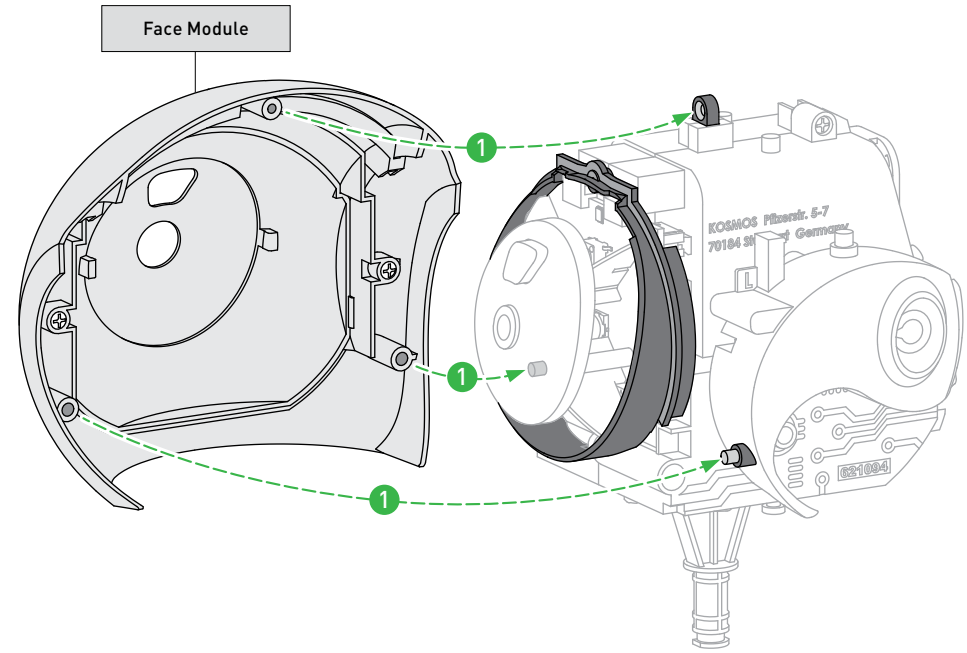
7

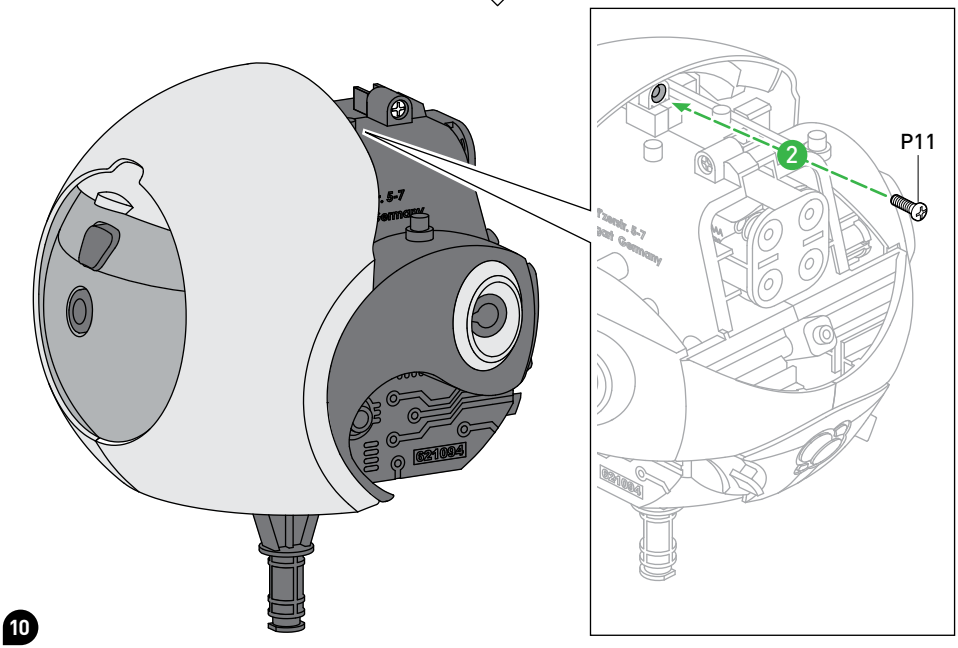


8



9





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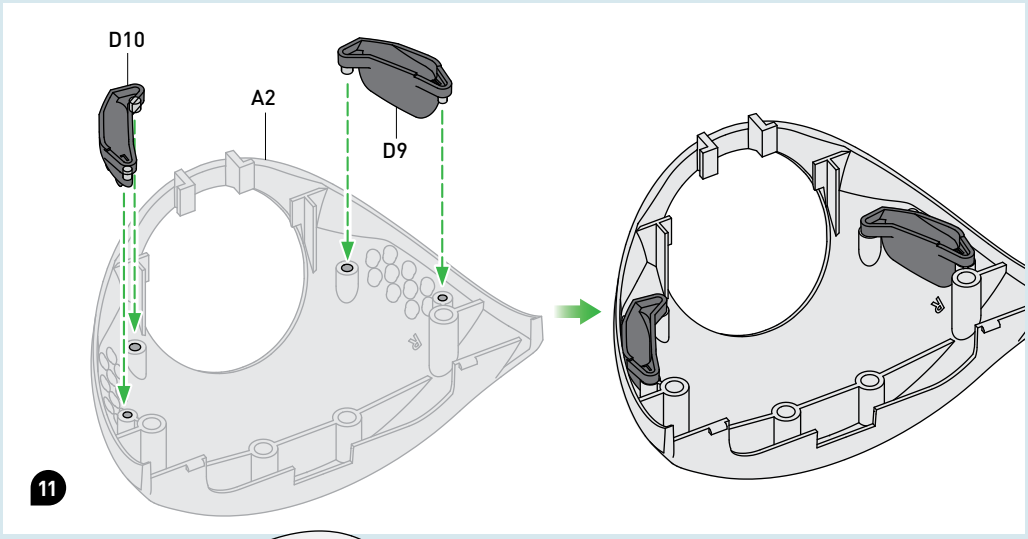
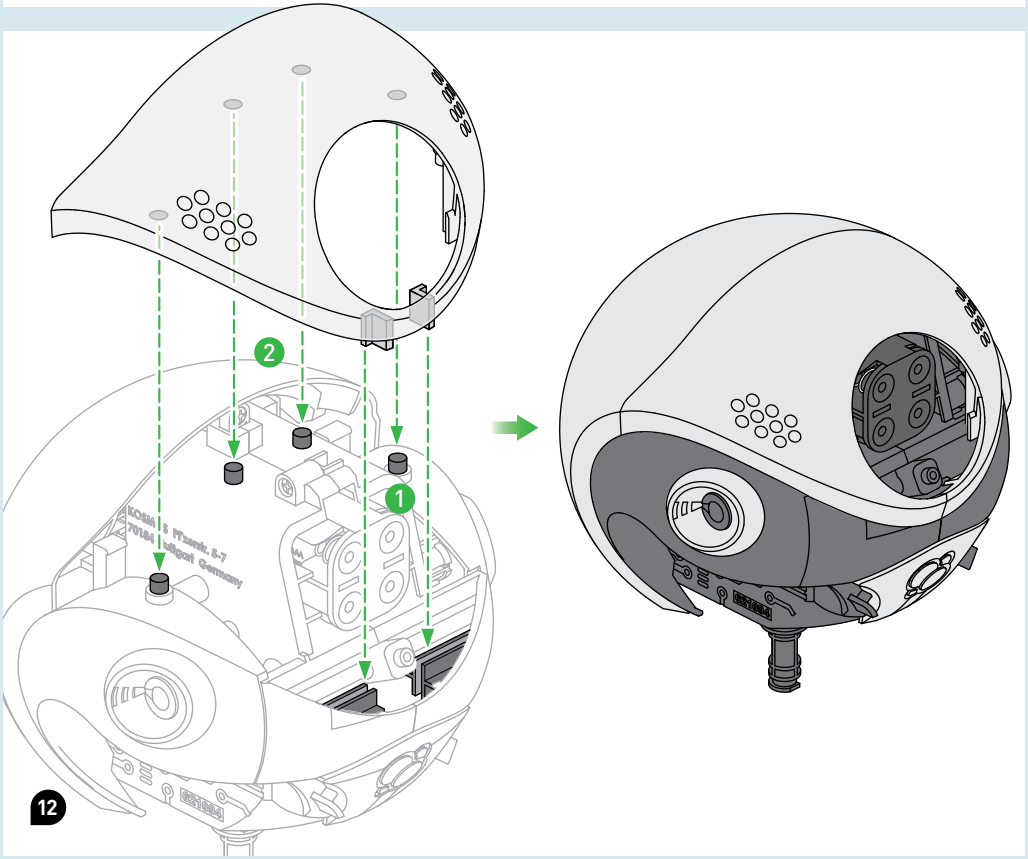
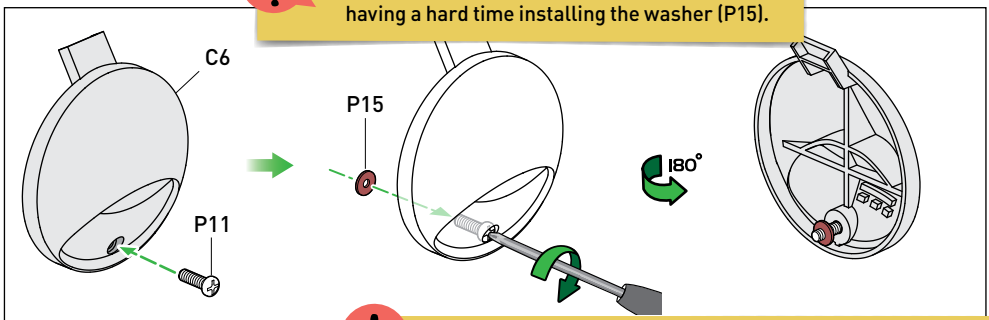
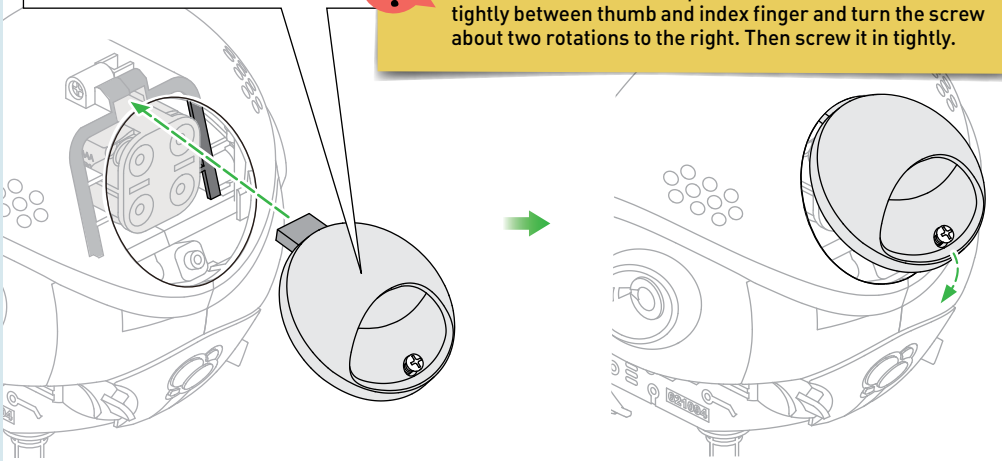

D10
A2
D9
11

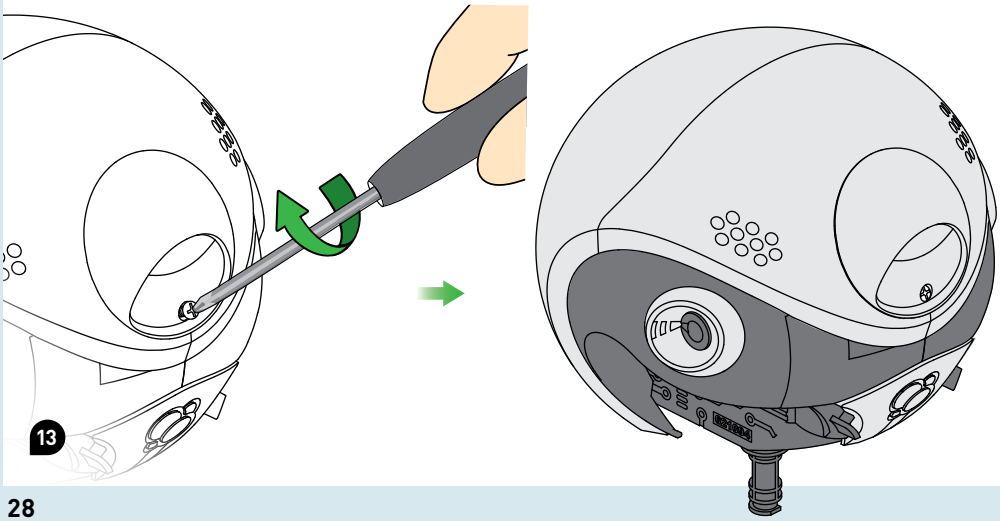

2
1
12

Ask an adult to help you with this step, if you are having a hard time installing the washer (P15).



Place the washer on the tip of the screw. Hold the washer tightly between thumb and index finger and turn the screw about two rotations to the right. Then screw it in tightly.



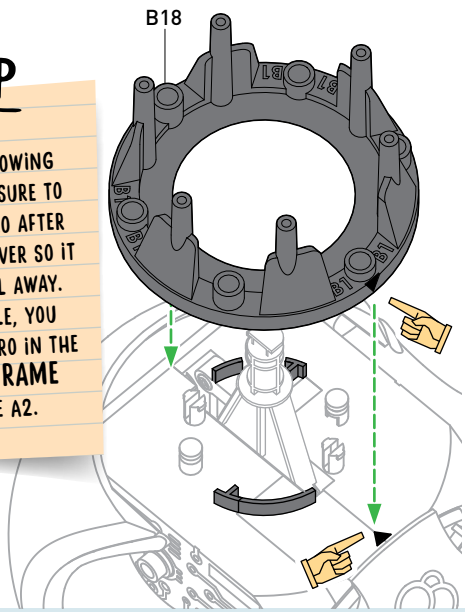


13

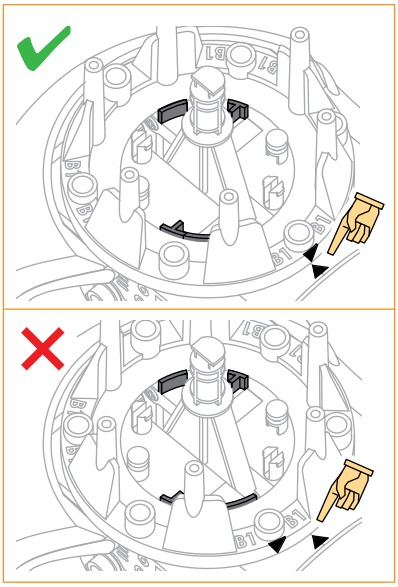
LEG ASSEMBLY

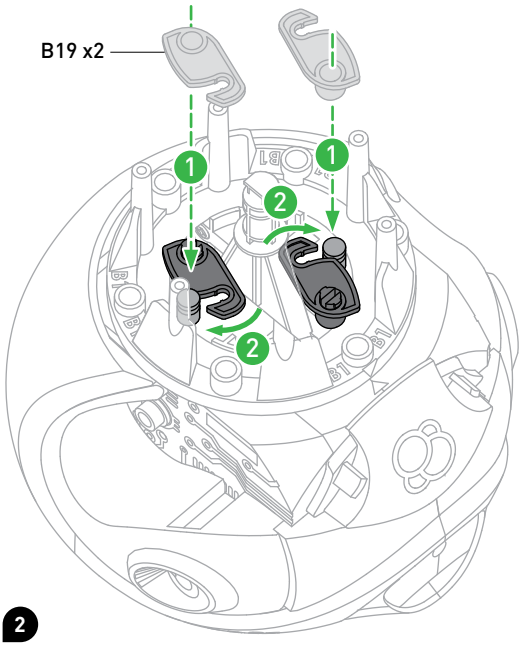
TIP

FOR THE FOLLOWING STEPS, MAKE SURE TO STABILIZE HERO AFTER YOU TURN IT OVER SO IT DOESN'T ROLL AWAY. FOR EXAMPLE, YOU COULD SET HERO IN THE EMPTY A FRAME IN SPACE A2.



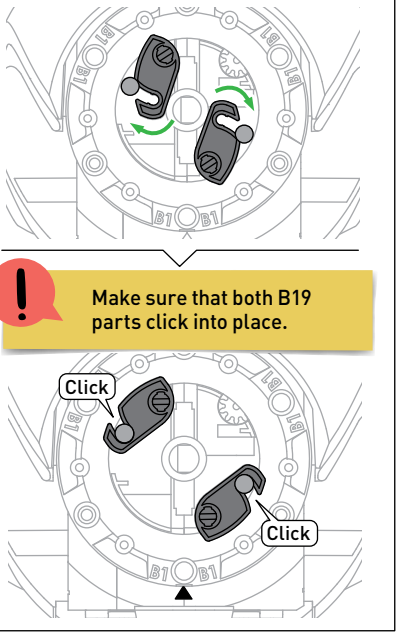
1

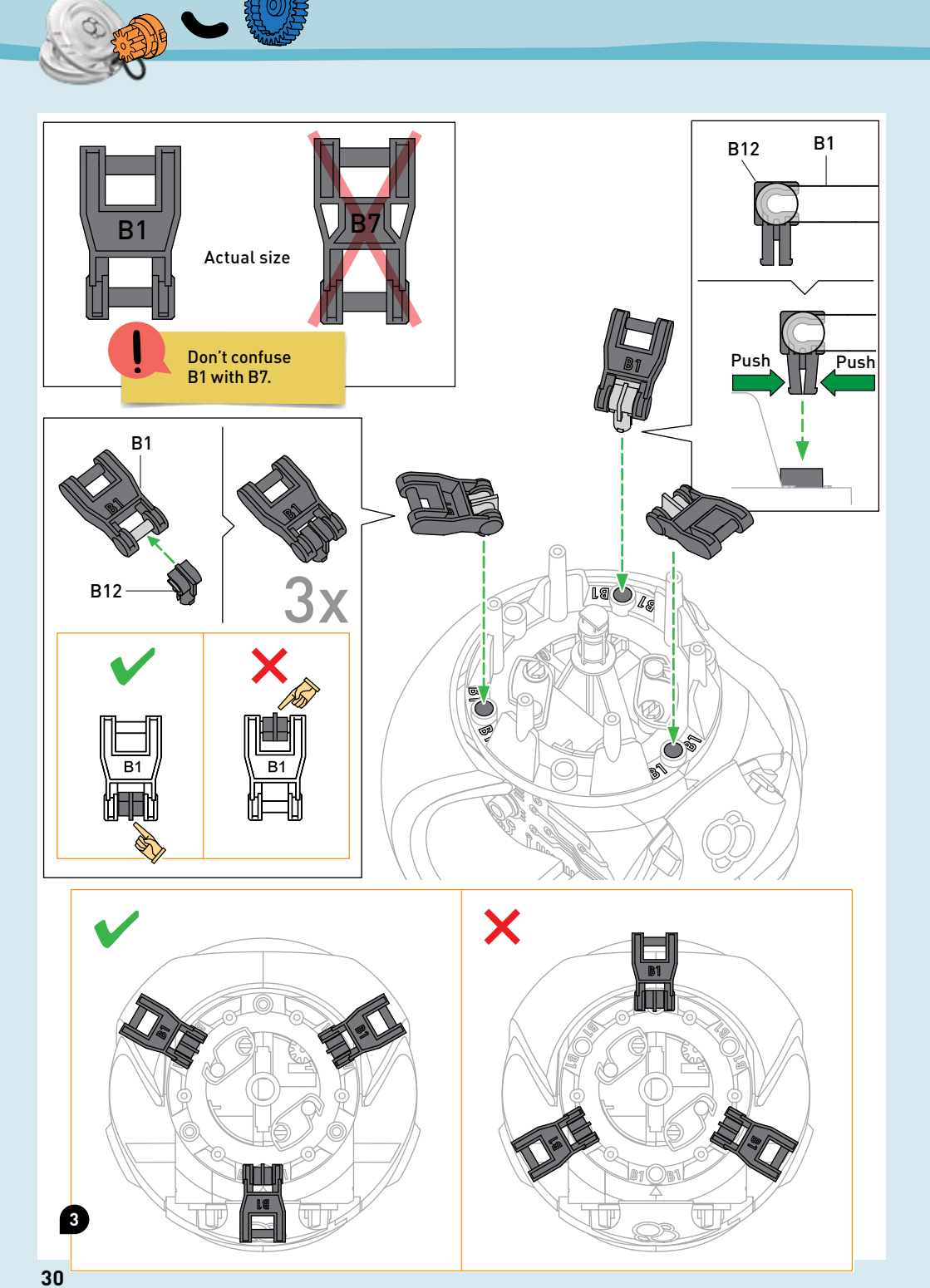


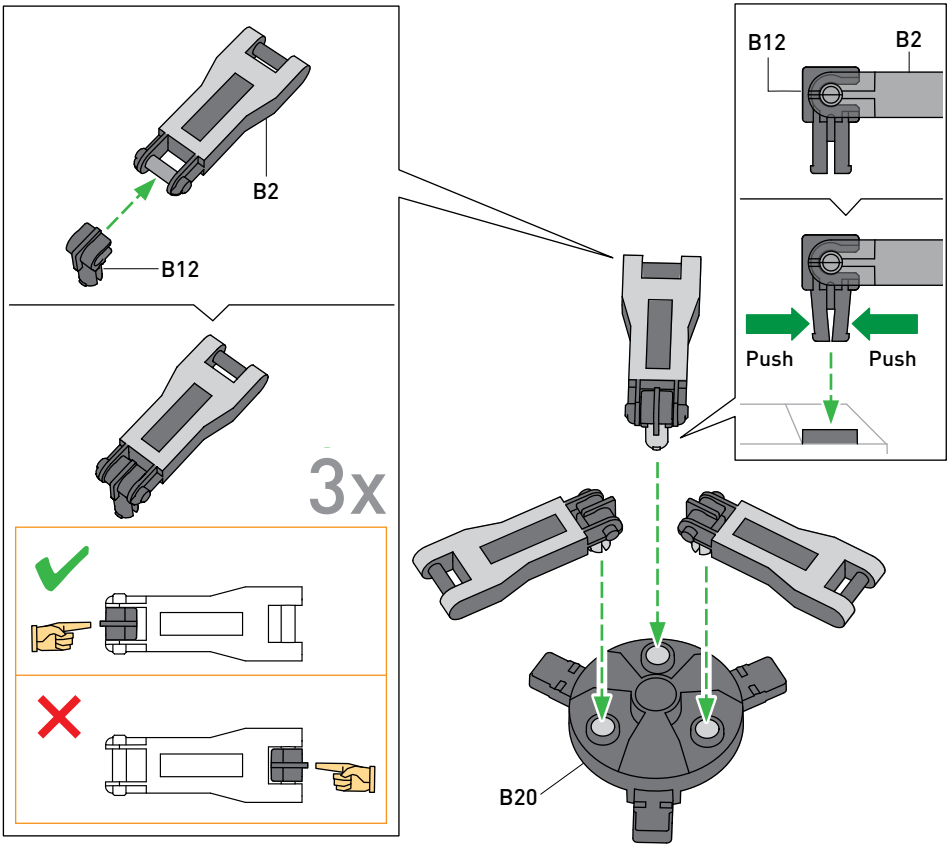


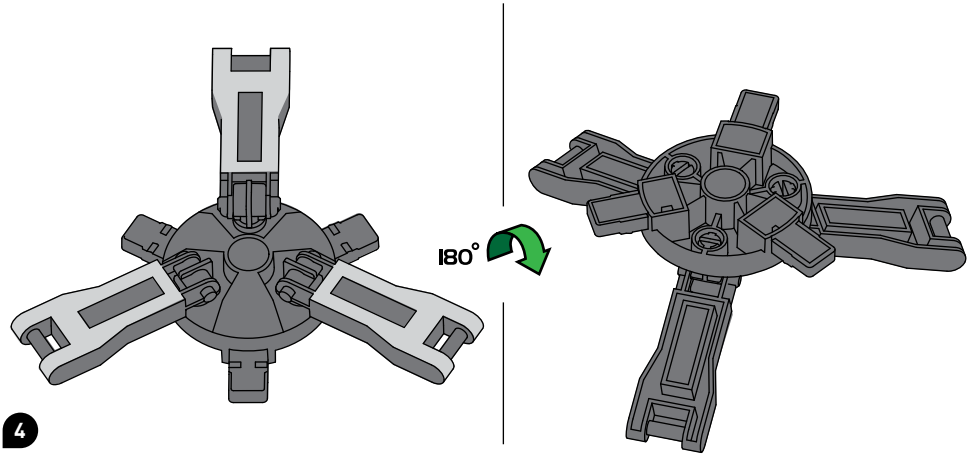
2

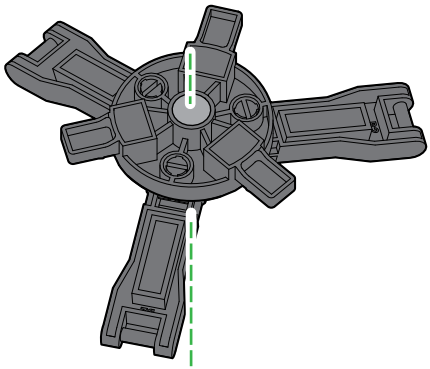
Top view

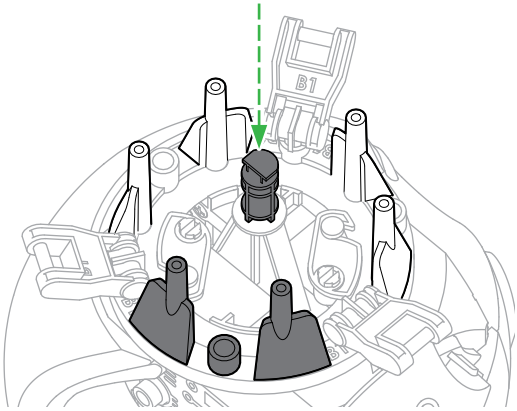


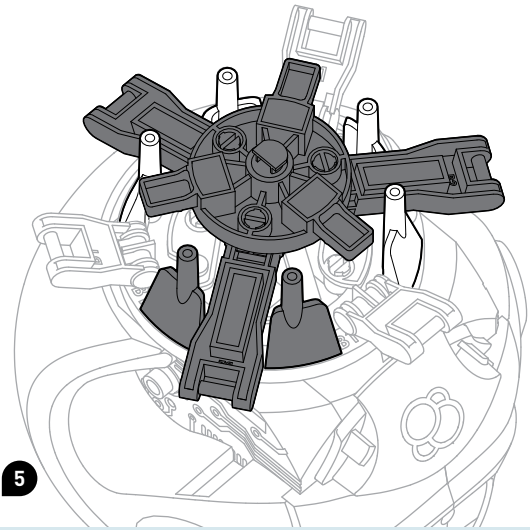

B1
B7
Actual size
Don't confuse
B1 with B7.
B12
B1
Push
Push
B1
B12
3x
B1
B1
B1
3


B2
B12
3x
B12
B2
Push
Push
B20


180°
4

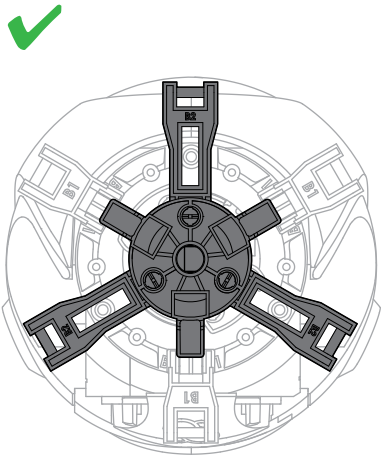


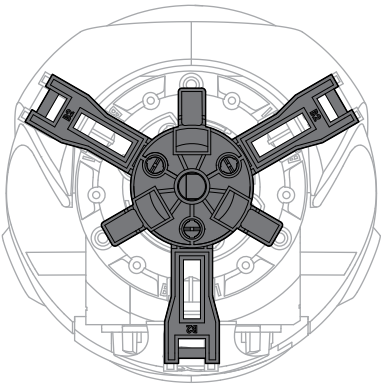


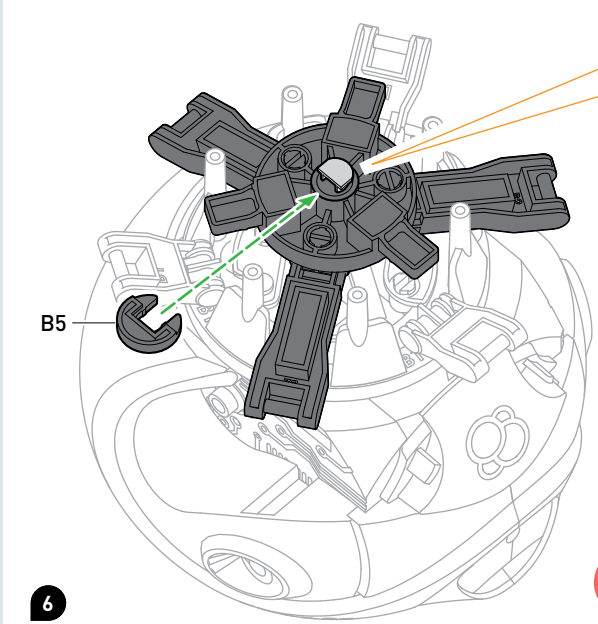


5

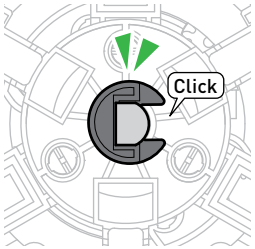
Top view





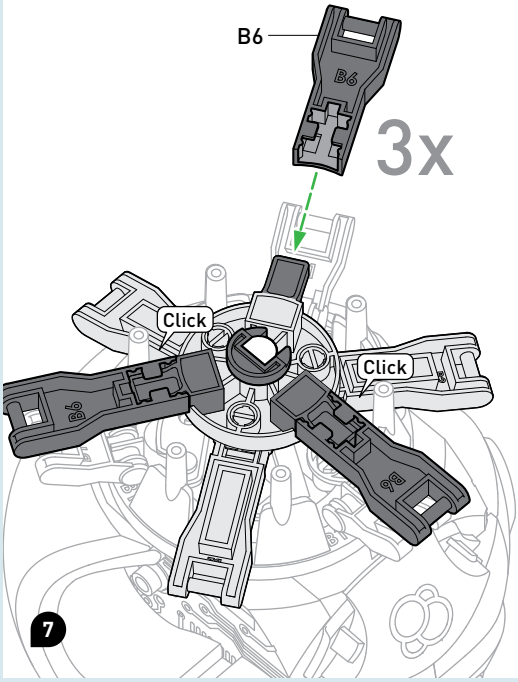


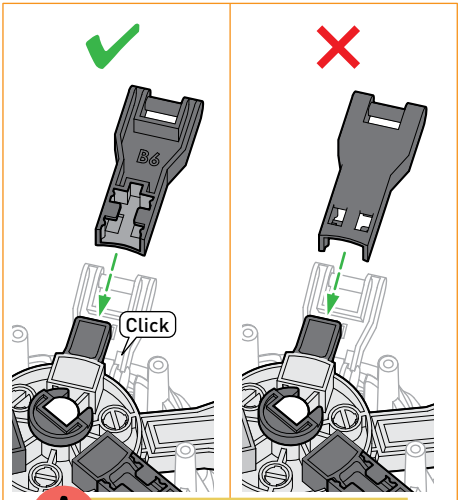
Top view



Make sure B5 is installed correctly.

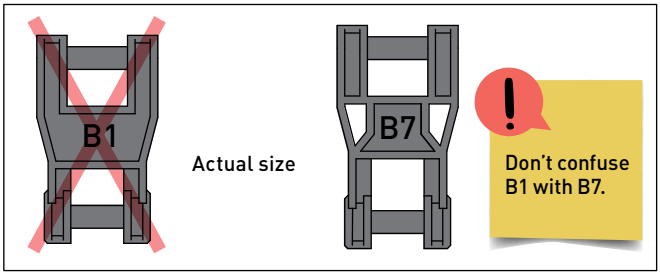
6

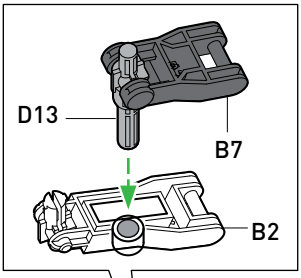


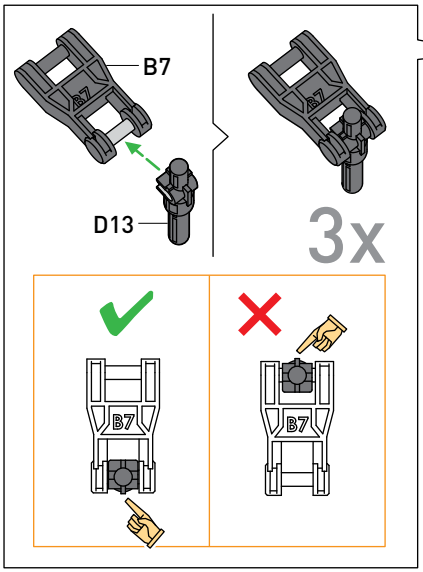


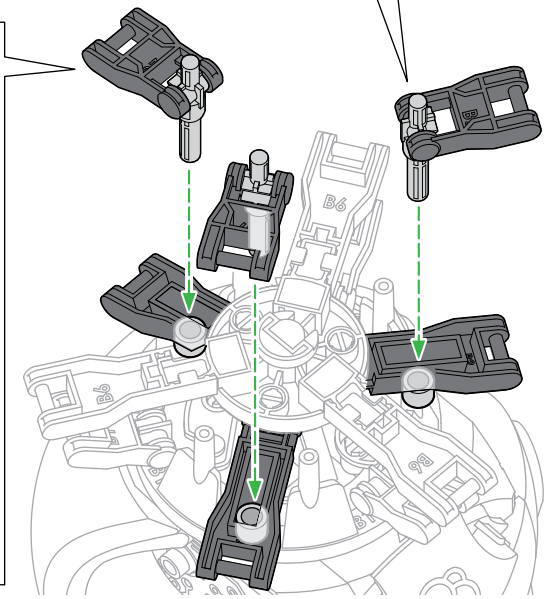
Make sure B6 is installed correctly.

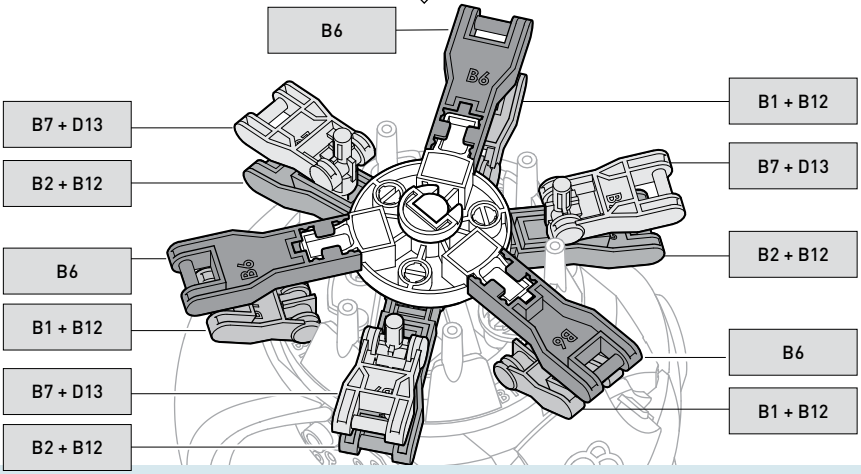
7


B1
Actual size
B7
Don't confuse B1 with B7.

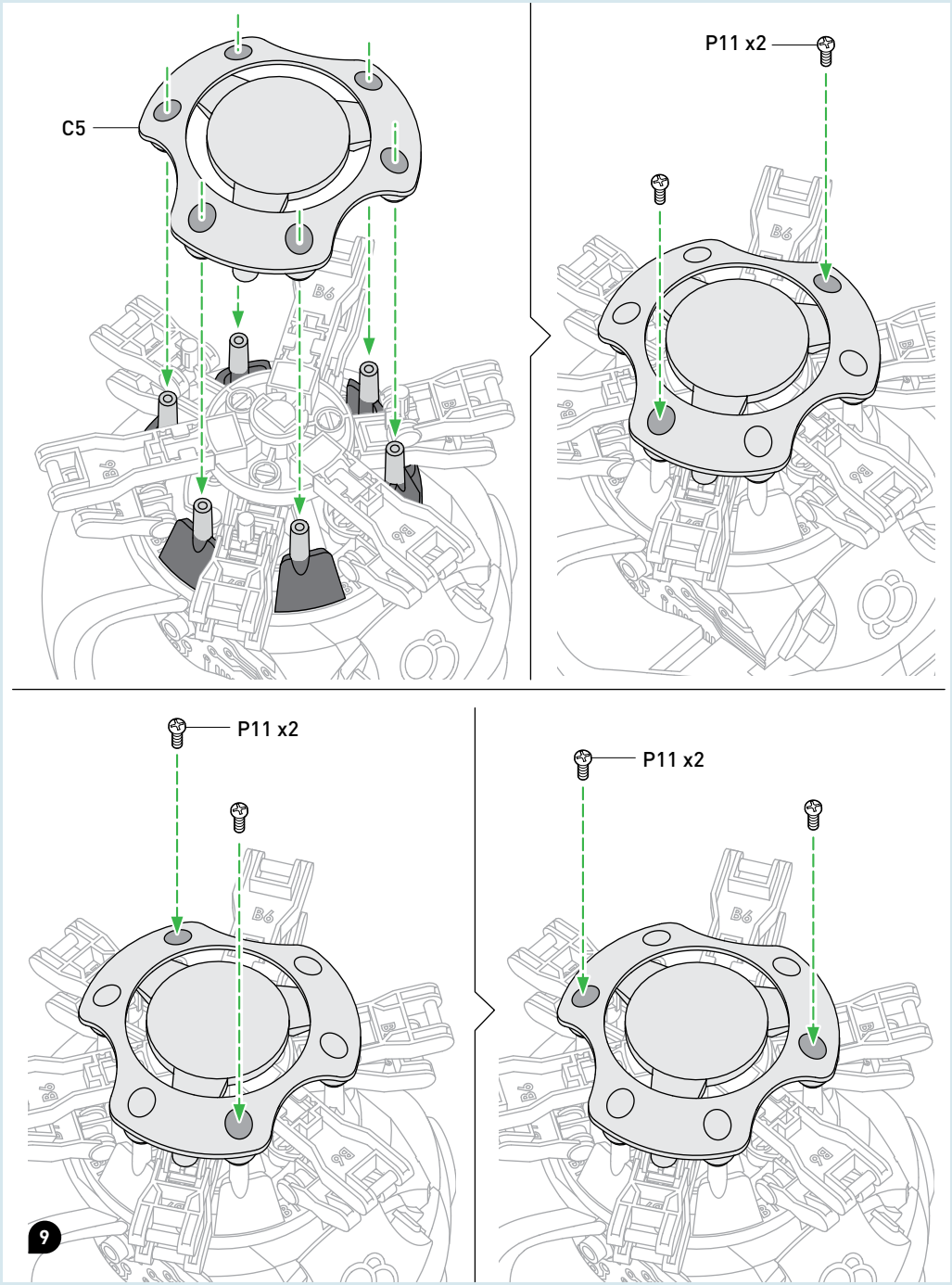

D13
B7
B2


B7
D13
3x
B7
B7

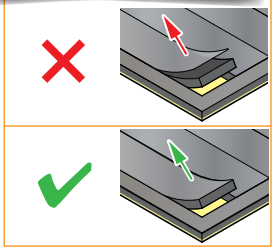


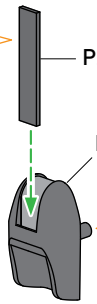

B6
B7 + D13
B2 + B12
B6
B1 + B12
B7 + D13
B2 + B12
B1 + B12
B7 + D13
B2 + B12
B6
B1 + B12

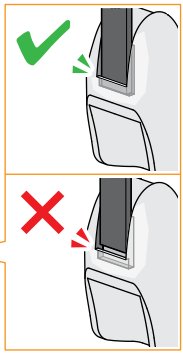
8

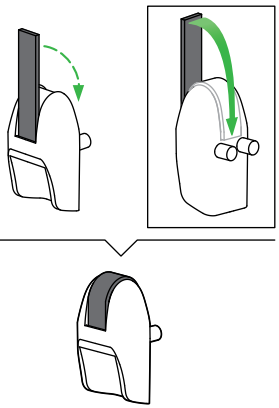

C5
P11 x2
P11 x2
P11 x2
9

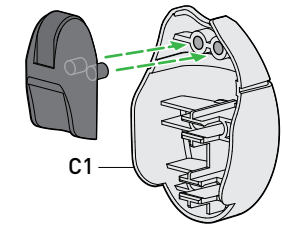
Do NOT tear the shiny foil off of the foam stickers.



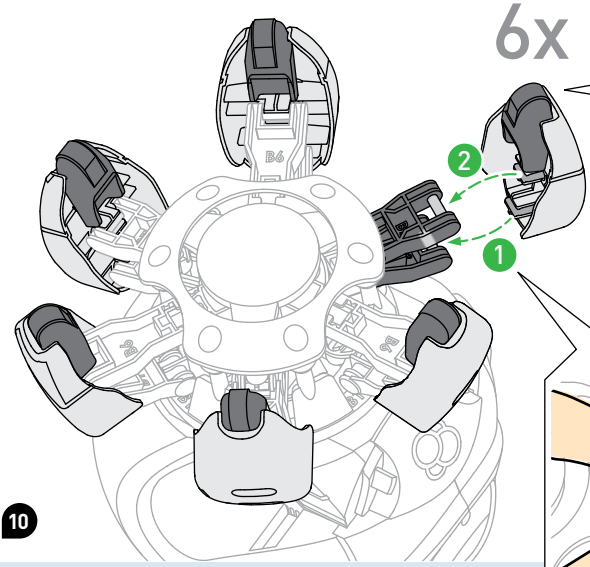


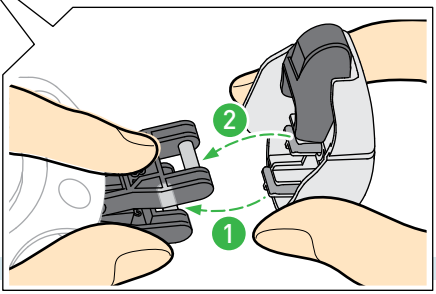






6x





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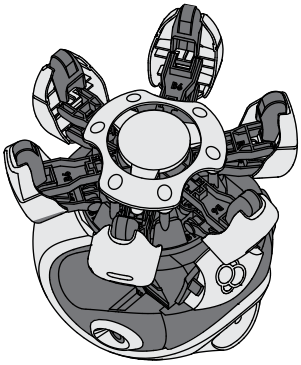
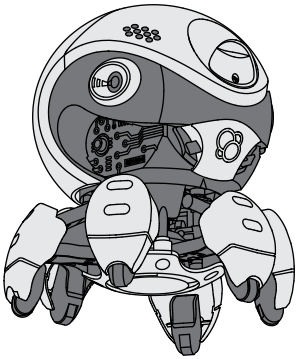
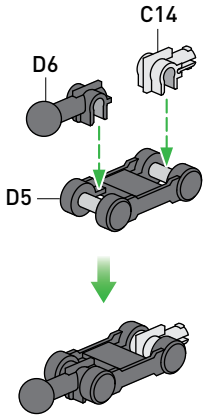


180°



11

ARM ASSEMBLY



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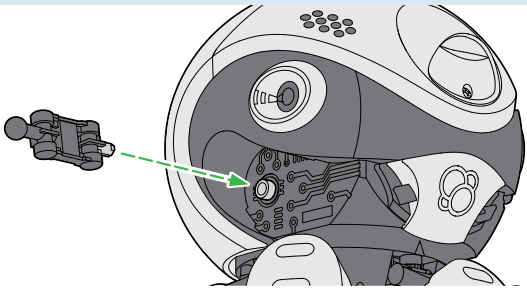

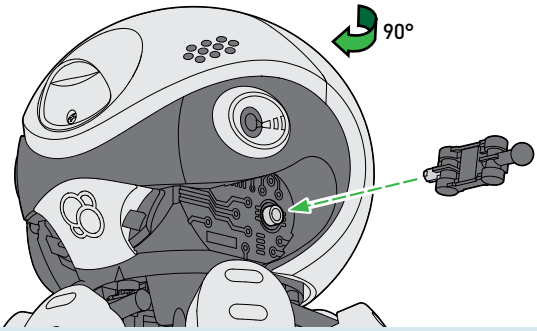

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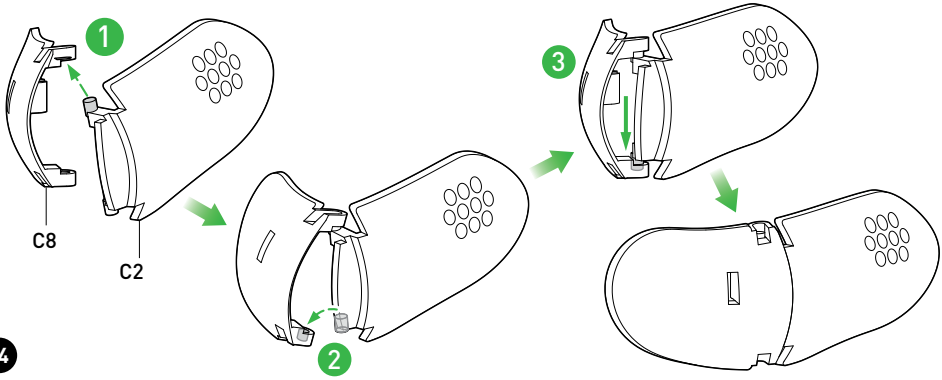

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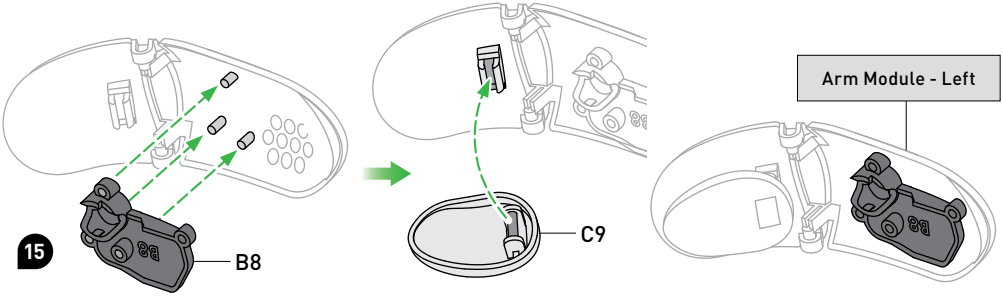

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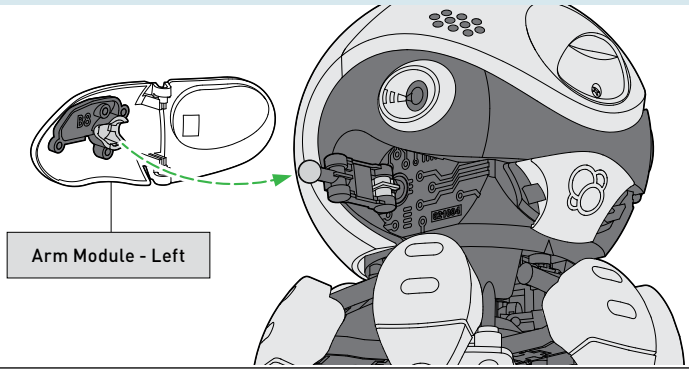

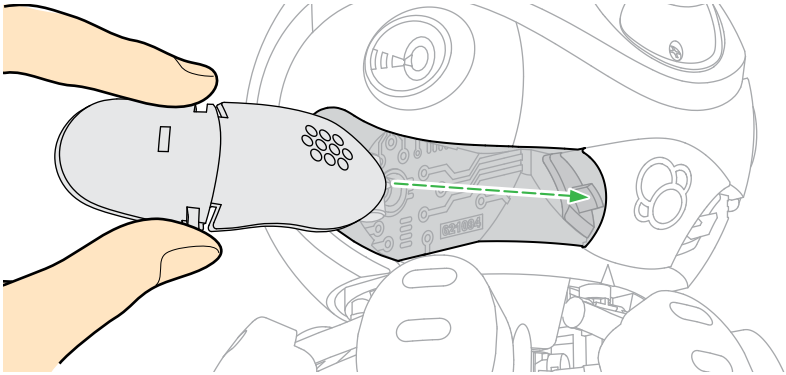

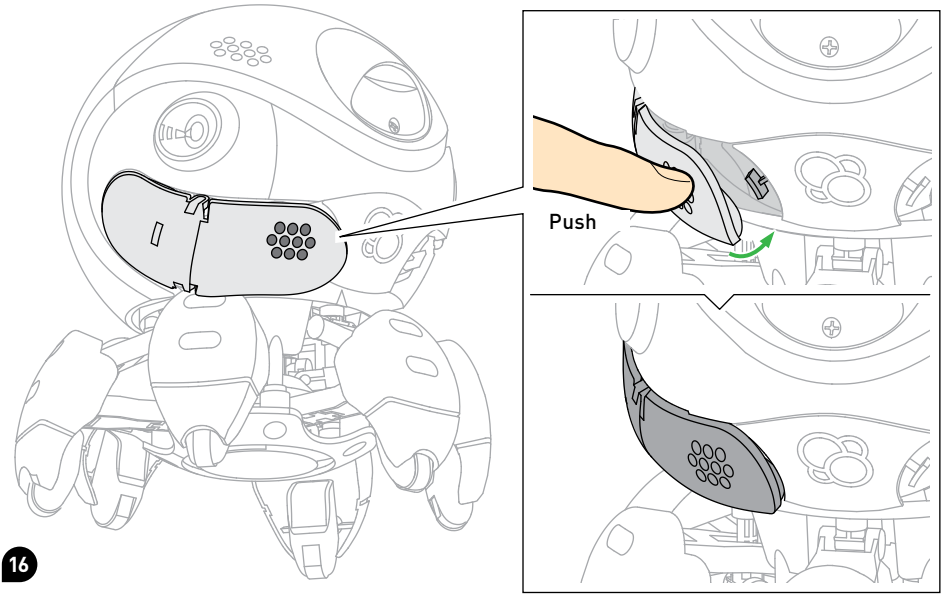

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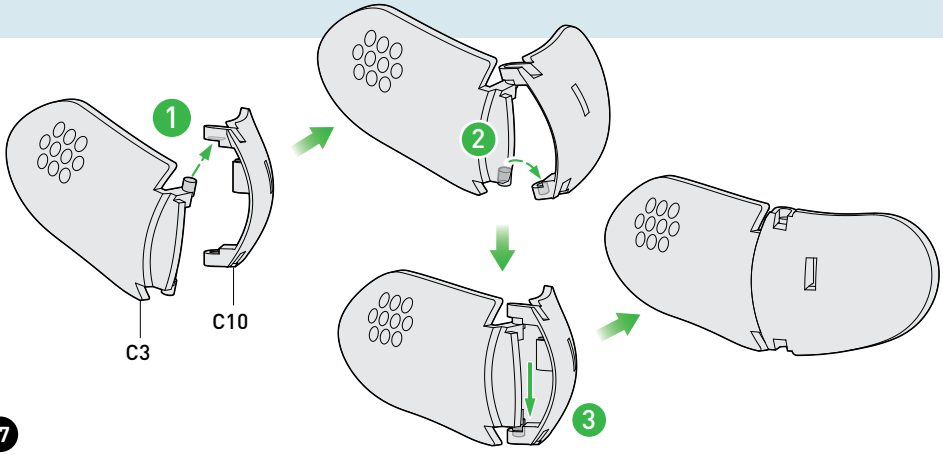

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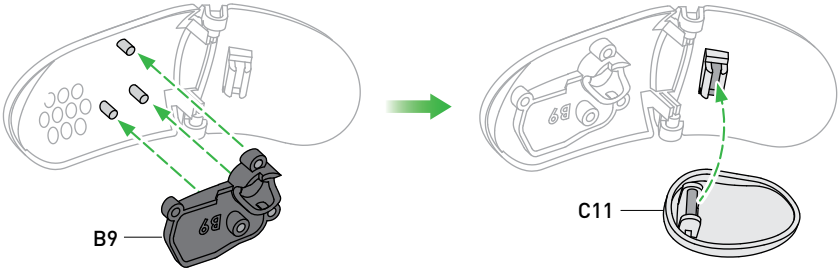

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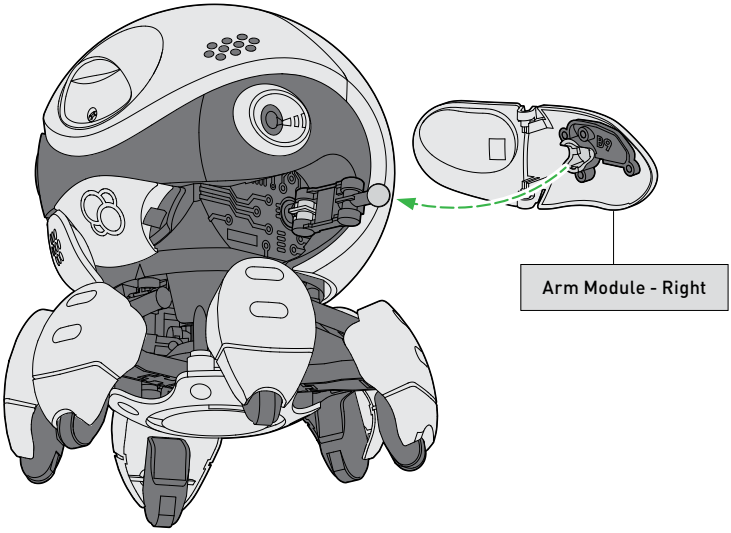

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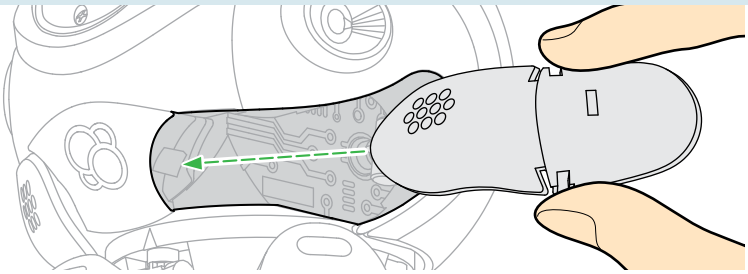

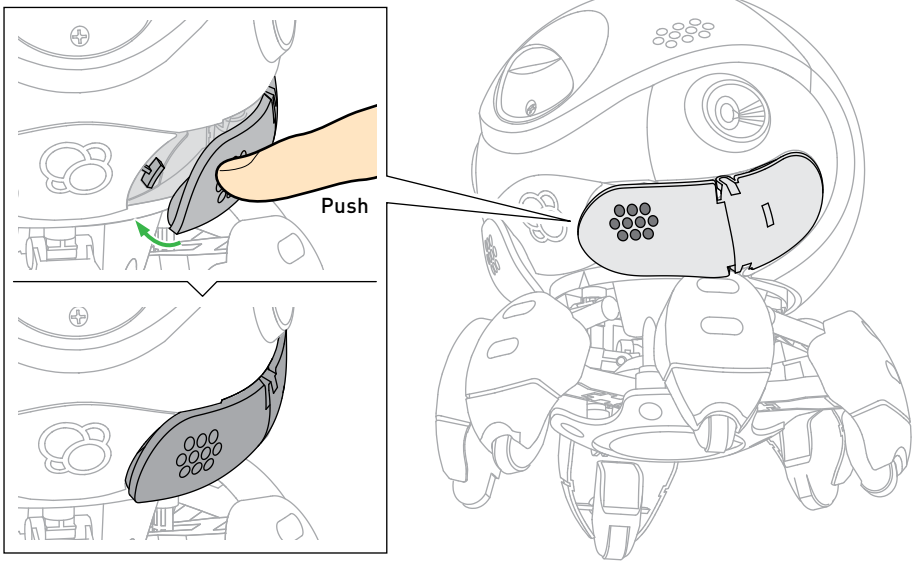

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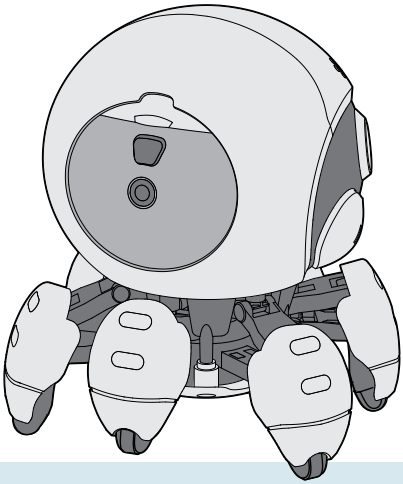
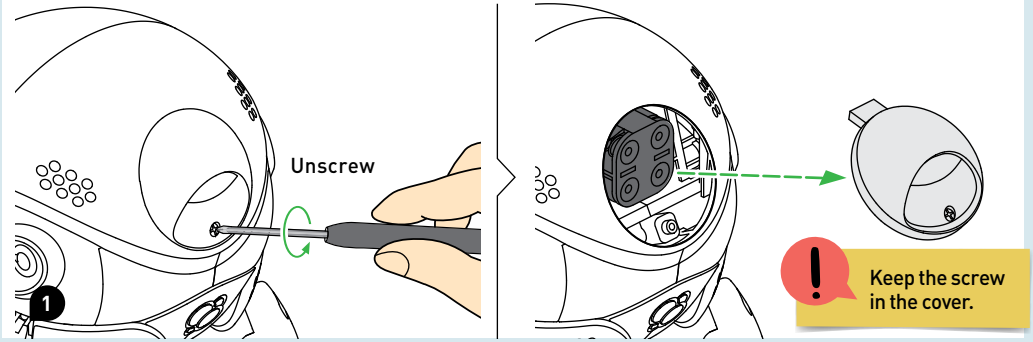
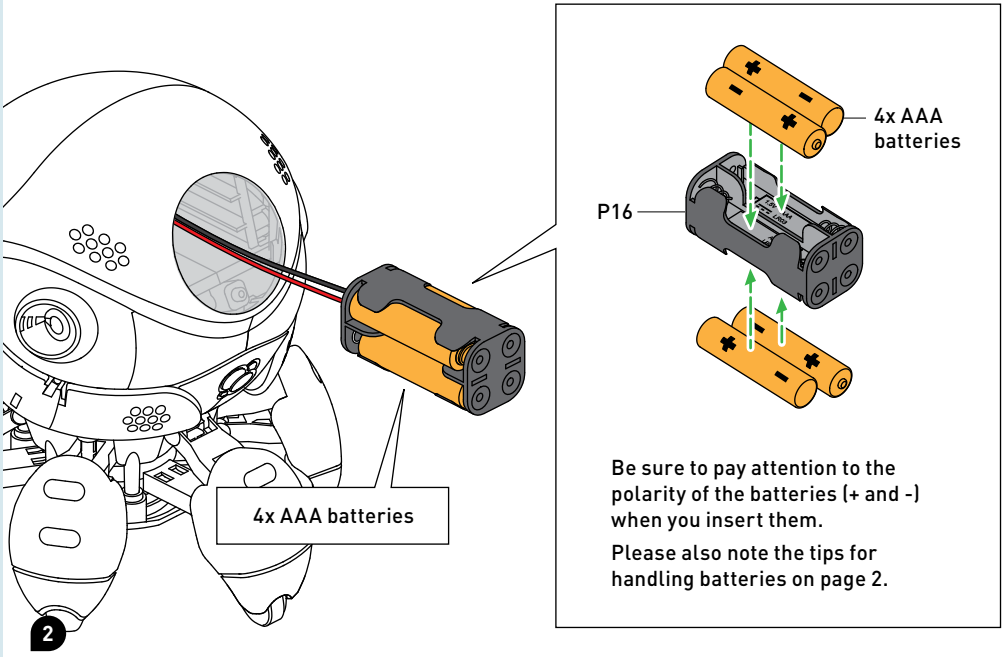
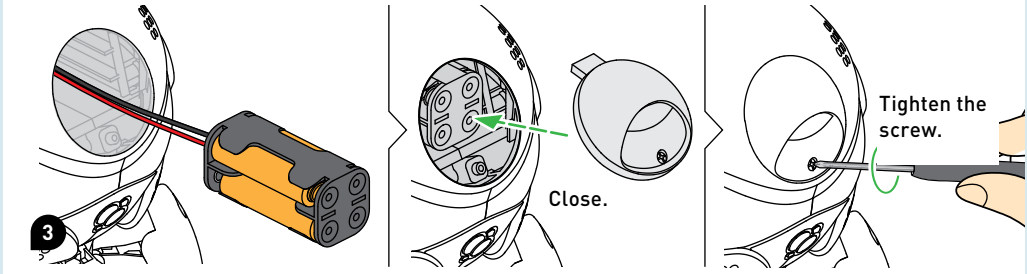


Done!

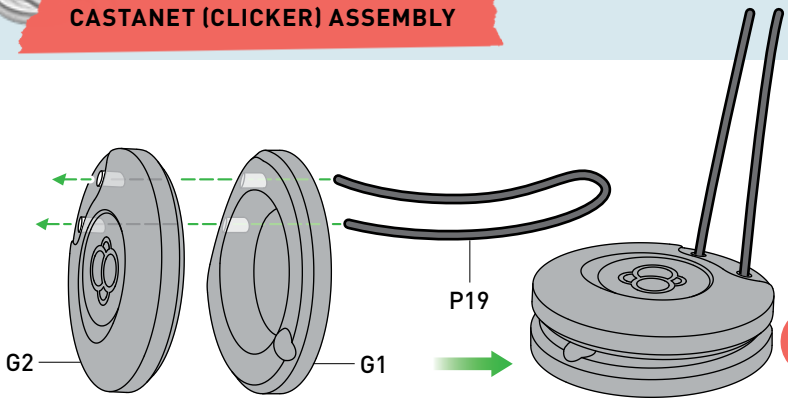
INSTALLING AND REPLACING THE BATTERIES



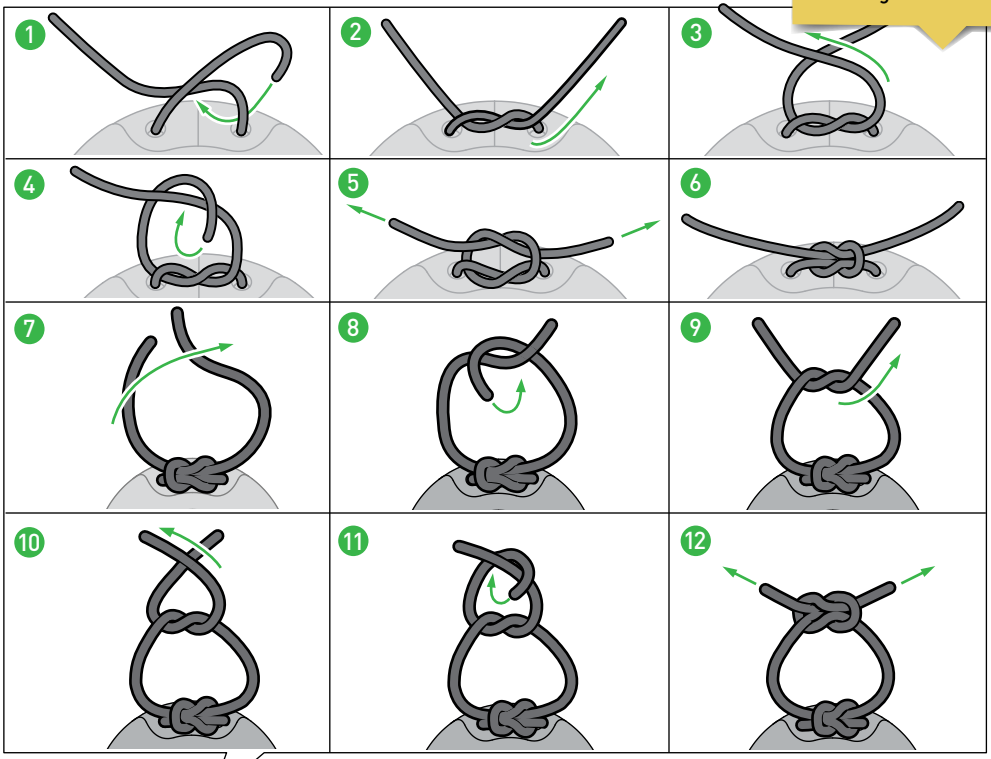


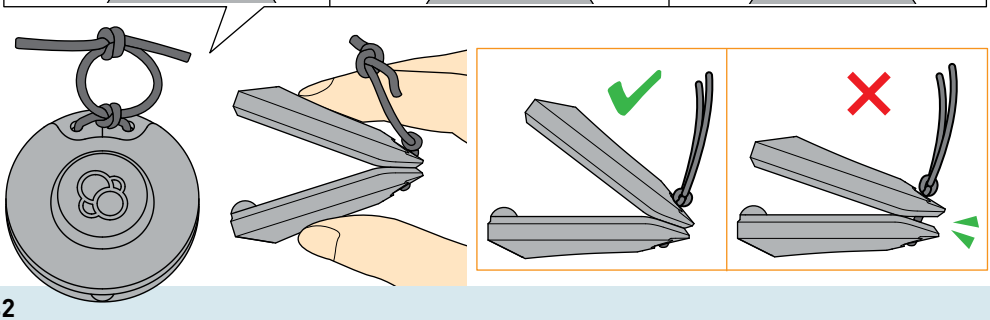


CASTANET (CLICKER) ASSEMBLY

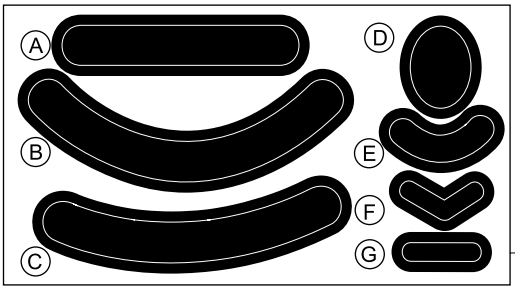


Pull the cord tight and tie a tight knot.





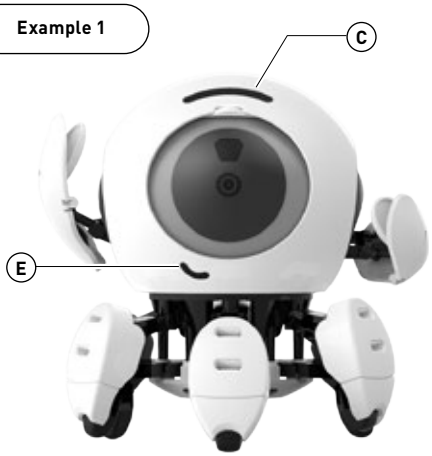
STICKER PLACEMENT



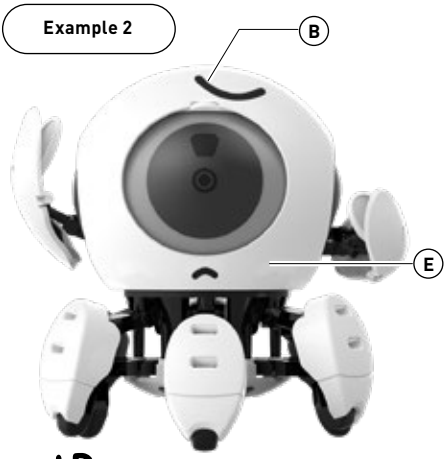
You can use the reusable black stickers along with Hero's movable eyelid to create different moods and facial expressions. The stickers are reusable, so after you use one, you can return it to the sheet and use it again later to create a different expression.

P20

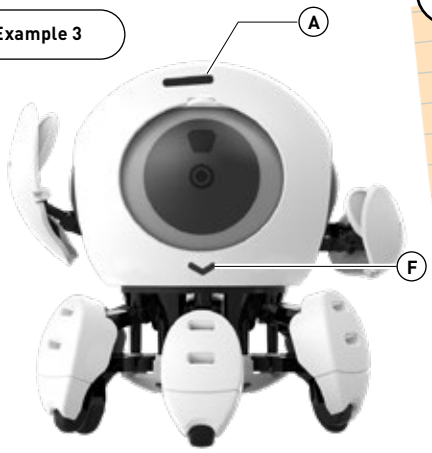
Example 1



Example 2

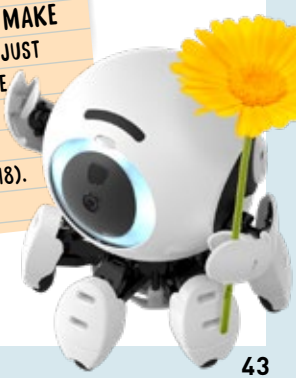


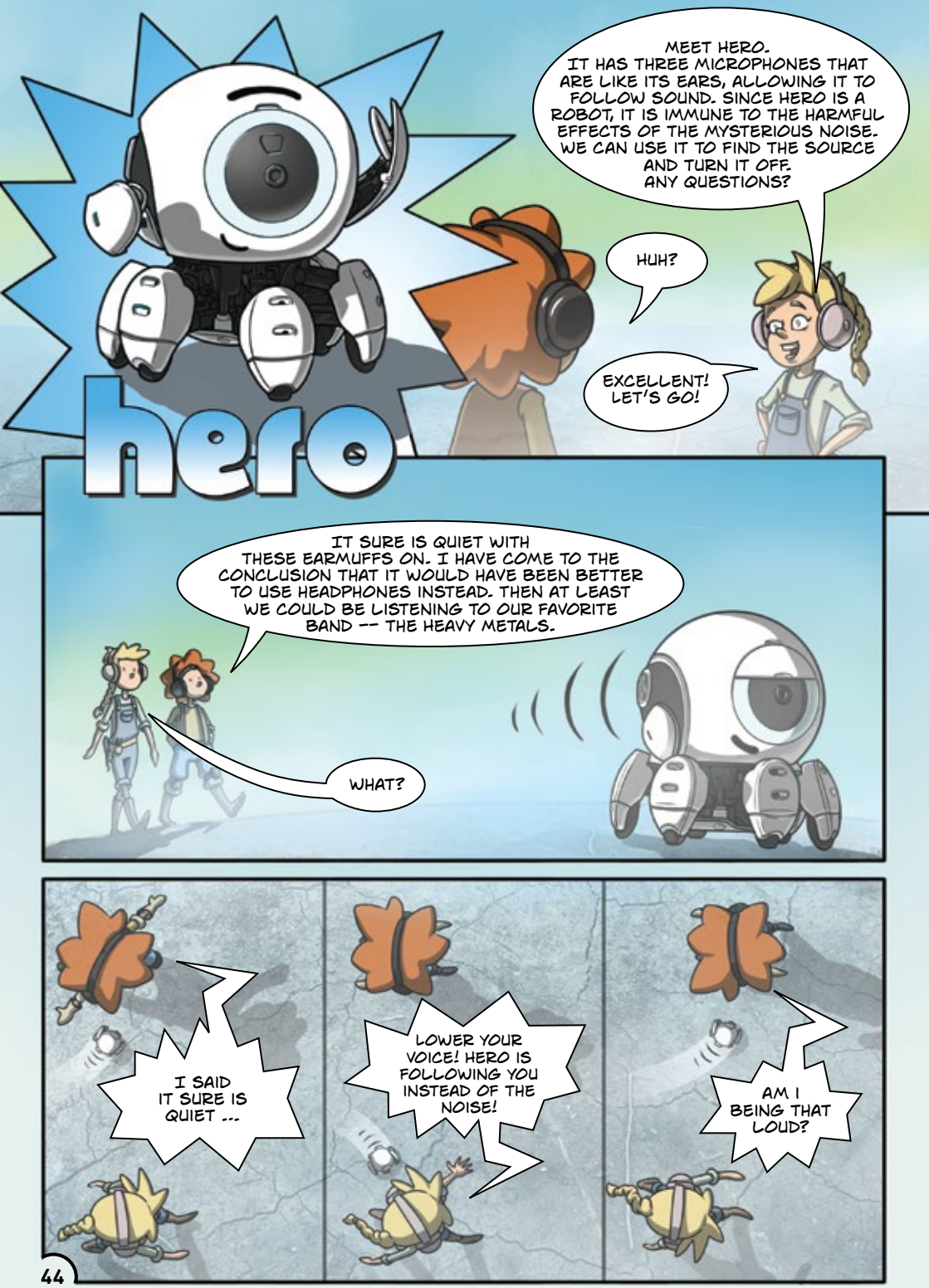
Example 3

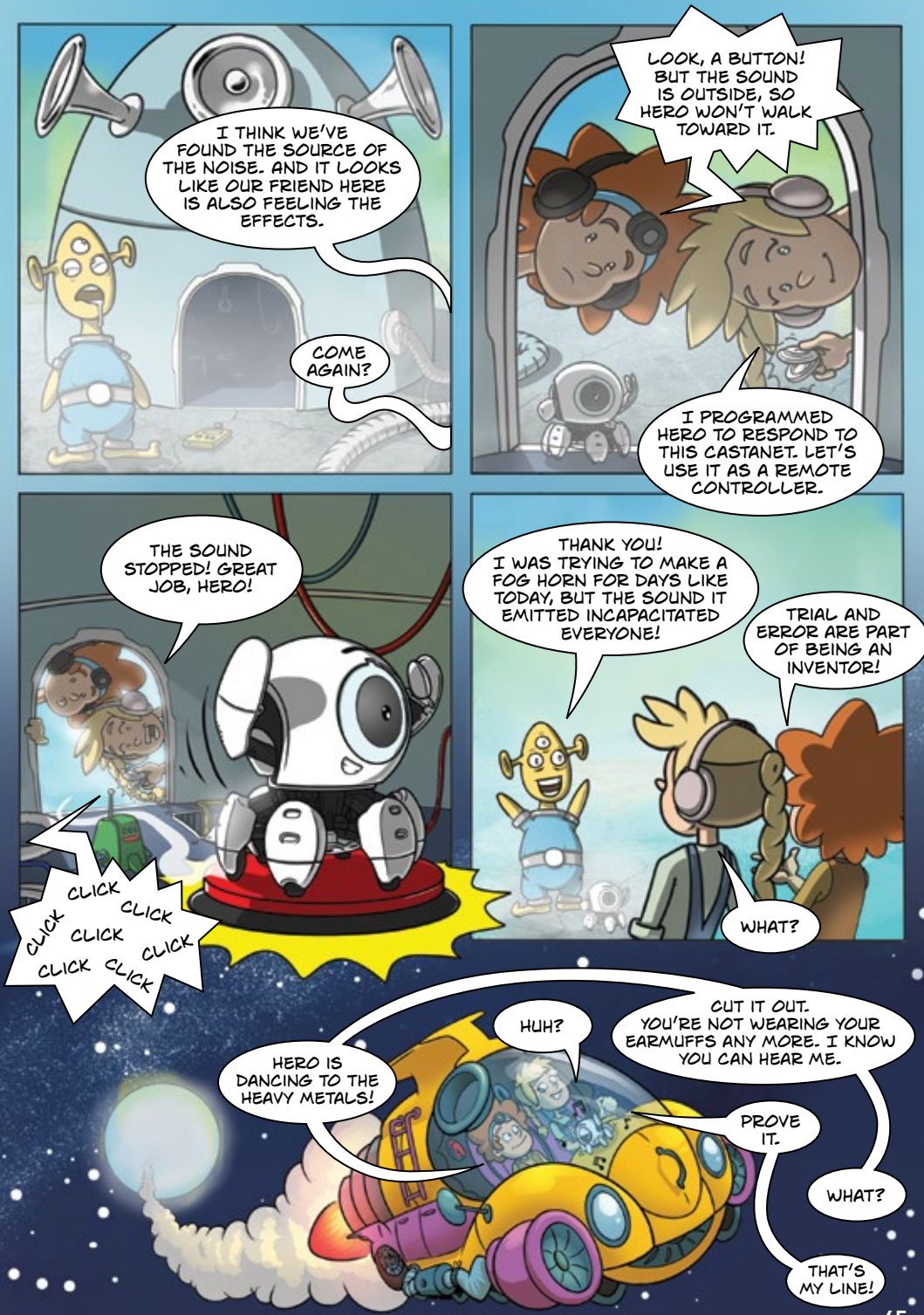


TiP

HERO'S ARMS SWIVEL UP AND DOWN. YOU CAN SWIVEL THEM UP FOR A GREETING GESTURE OR PUT A FLOWER IN ITS HAND TO MAKE SOMEONE HAPPY – JUST USE THE CASTANET TO MOVE HERO IN THE DIRECTION OF SOMEONE YOU LIKE (SEE PAGE 48).




hero
MEET HERO. IT HAS THREE MICROPHONES THAT ARE LIKE ITS EARS, ALLOWING IT TO FOLLOW SOUND. SINCE HERO IS A ROBOT, IT IS IMMUNE TO THE HARMFUL EFFECTS OF THE MYSTERIOUS NOISE. WE CAN USE IT TO FIND THE SOURCE AND TURN IT OFF. ANY QUESTIONS?
HUH?
EXCELLENT! LET'S GO!
IT SURE IS QUIET WITH THESE EARMUFFS ON. I HAVE COME TO THE CONCLUSION THAT IT WOULD HAVE BEEN BETTER TO USE HEADPHONES INSTEAD. THEN AT LEAST WE COULD BE LISTENING TO OUR FAVORITE BAND -- THE HEAVY METALS.
WHAT?
I SAID IT SURE IS QUIET ...
LOWER YOUR VOICE! HERO IS FOLLOWING YOU INSTEAD OF THE NOISE!
AM I BEING THAT LOUD?

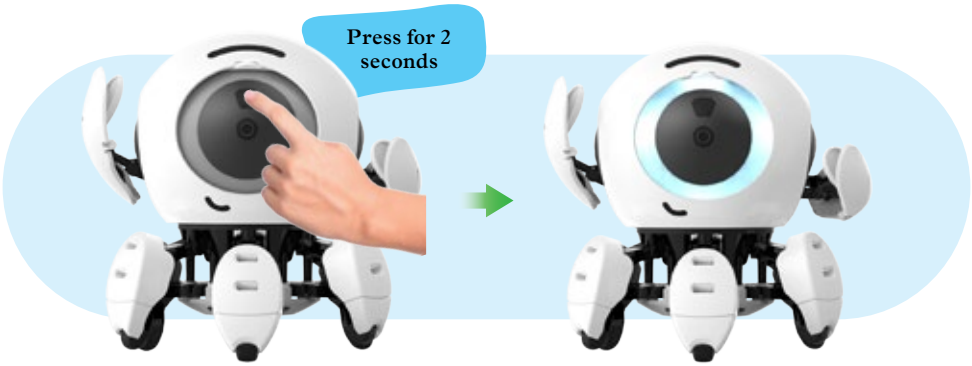

I THINK WE'VE FOUND THE SOURCE OF THE NOISE. AND IT LOOKS LIKE OUR FRIEND HERE IS ALSO FEELING THE EFFECTS.
COME AGAIN?
LOOK, A BUTTON! BUT THE SOUND IS OUTSIDE, SO HERO WON'T WALK TOWARD IT.
I PROGRAMMED HERO TO RESPOND TO THIS CASTANET. LET'S USE IT AS A REMOTE CONTROLLER.
THE SOUND STOPPED! GREAT JOB, HERO!
CLICK CLICK CLICK CLICK CLICK CLICK CLICK CLICK
THANK YOU! I WAS TRYING TO MAKE A FOG HORN FOR DAYS LIKE TODAY, BUT THE SOUND IT EMITTED INCAPACITATED EVERYONE!
TRIAL AND ERROR ARE PART OF BEING AN INVENTOR!
WHAT?
HERO IS DANCING TO THE HEAVY METALS!
HUH?
CUT IT OUT. YOU'RE NOT WEARING YOUR EARMUFFS ANY MORE. I KNOW YOU CAN HEAR ME.
PROVE IT.
WHAT?
THAT'S MY LINE!

LET'S START

Hero is very easy to operate, because it only has one button that controls all of its functions. It also has a ring around its eye that lights up in four segments. This lets Hero display the mode that it is in.

SWITCHING ON AND STANDBY MODE

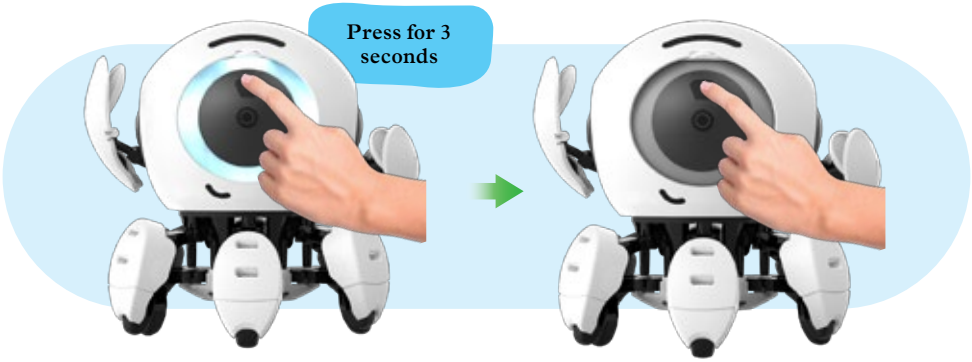
To switch Hero on, simply press the button for **two seconds** until its eye lights up. Now Hero is in standby mode and awaiting your input.



Hero is a little impatient. If you make it wait, it will stamp its feet and beep to remind you that it is waiting. If you make Hero wait longer than 60 seconds, it will switch itself off.

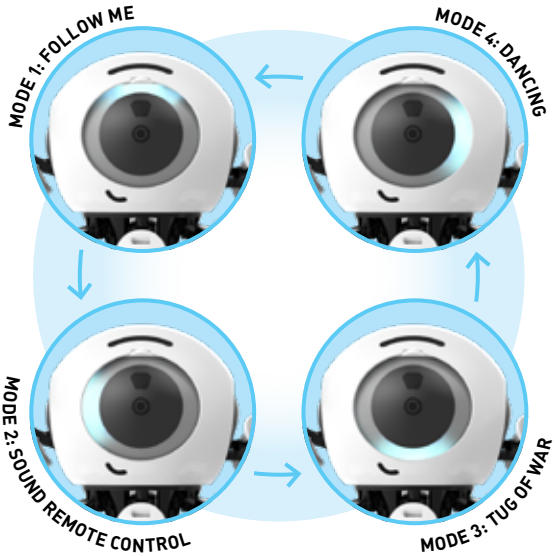
SWITCHING OFF

To switch Hero off, press the button for **three seconds** until you hear a beep. Then Hero will shut down, indicated by a series of lights and beeps until its eye goes dark.



HERO'S PLAY MODES

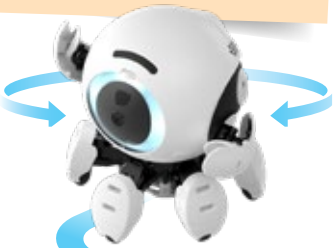
You can activate the individual modes by pressing the button. The modes can be selected at any time as shown here. Hero's eye will then display the mode that it is currently in.



TIP

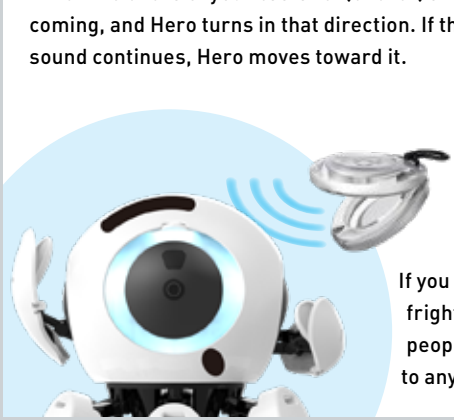
· HERO WORKS BEST IN A QUIET ENVIRONMENT WHERE IT WON'T GET CONFUSED BY TOO MUCH BACKGROUND NOISE.

· HERO CAN ALSO LISTEN TO HAND CLAPPING OR FINGER SNAPPING SOUNDS. OF COURSE, THESE SOUNDS CAN VARY A LOT DEPENDING ON WHO MAKES THEM. THE CASTANET (CLICKER), ON THE OTHER HAND, IS RELATIVELY CONSISTENT, SO HERO'S RESPONSE TO THE CASTANET WILL BE MORE CONSISTENT.



MODE 1: FOLLOW ME

In this mode, Hero can locate and follow sounds. That means that it recognizes the direction from which the clicks of your castanet (clicker) are coming, and Hero turns in that direction. If the sound continues, Hero moves toward it.



If you click too loudly and too close to Hero's face, it becomes frightened and takes a step backwards. That happens to people and animals too, so never use the castanet right next to anyone's ear.

MODE 2: REMOTE CONTROL BY SOUND

In this mode, the castanet works as a remote controller, so Hero will respond to the number of clicks. Hero's eye will indicate, by the number of lights, how many clicks it registered.

- 1 click: Go forward/backward
- 2 clicks: Turn right
- 3 clicks: Turn left
- 4 clicks: Stop!

MODE 3: TUG OF WAR

If you choose this mode, Hero will await your click as the starting signal. Once you give the starting signal, you will hear a brief countdown, and then it begins: Hero tries to move backwards. Your goal is to stop Hero by clicking rapidly — as if you were pulling on an invisible rope. If you manage to do it, you win the game — and Hero will show that it isn't happy to have lost.
If you lose, Hero wins and performs a happy dance.

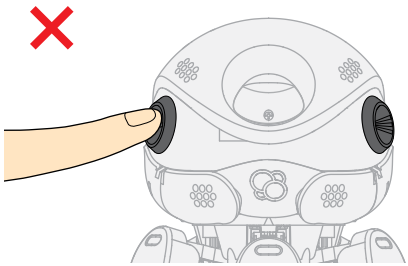
Hero always wants to play three rounds, with each round increasing in difficulty. If you lose a round, the game is over. If you win all three rounds, you win the game.

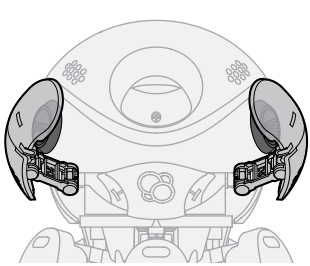
MODE 4: DANCING

In this mode, Hero is in a party mood. Play some music, and Hero will dance to it. It is particularly fond of music with clear and powerful bass tones!

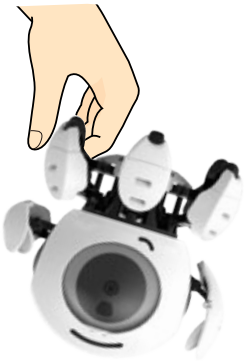
HANDLING HERO

Never cover the microphone with your hands or Hero's hands.

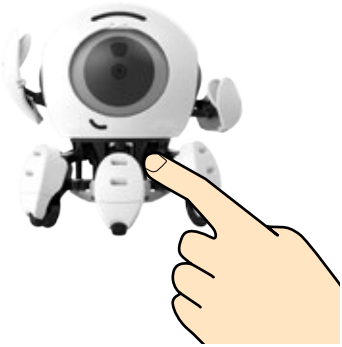




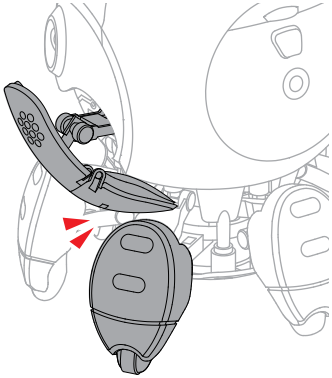
Never pick Hero up like this.



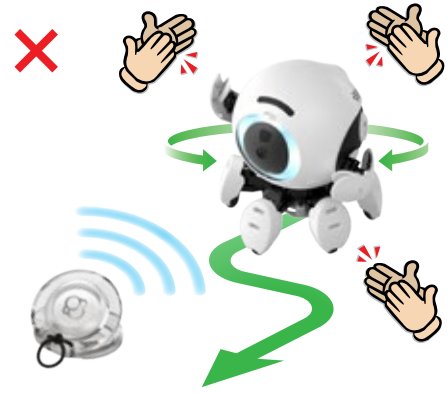
Never insert your fingers between moving parts.



Make sure that Hero's hands never touch its feet; they may bump into each other during operation.



Hero can become confused and behave in unexpected ways if there are multiple sound sources present at one time.



CHECK IT OUT

What is Sound?

Every sound that we hear is caused by sound waves impacting our ears — the organs of hearing and balance. You can't see these waves, but you can picture them like the ripples that spread out when a stone is thrown into water. The castanet produces sound waves that spread out in all directions through the air. When these waves hit our ears, they are converted into signals that are sent to our brain where we perceive the signals as clicks.

Ring-like spread of waves

How Does Hero's Super-Hearing Work?

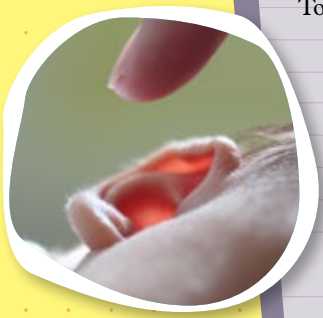
As you saw during the assembly process, Hero's head contains three microphones installed in different locations. These microphones are Hero's ears. All three are connected together to a sound sensor. And this is how it works: When the sound of the castanet strikes Hero's microphones, the circuit board (P18) in its head compares the volume of the sound arriving at all three microphones. The microphone that detects the loudest sound is the one closest to the sound source. That's how Hero knows in which direction to turn. If, for example, the microphone on the left side of its head registers the highest volume, Hero knows that it has to turn to the left. Then, if the microphone in its eye registers the highest volume, Hero moves straight ahead.

HOW DOES "SPATIAL HEARING" WORK IN PEOPLE?

While humans only have two ears — compared to Hero's three — we are very good at telling where a sound is coming from. The reason for that is that our brain is a lot better than Hero's electronics at processing signals.

To do that, we make use of several skills:

- First, just like Hero, we perceive tiny differences in volume, since our ears are on opposite sides of our head.
- We can also register the most minute differences in the timing of sounds. If one ear is closer to the source of a sound than the other, the sound will first strike the closer ear and the ear that is farther away a tiny bit later.
- On top of all that, we don't just use our ears to tell direction — we use our entire body. We can actually feel loud sounds when the sound waves strike our body, by use of fine hairs, for example, which help us to determine the direction that the sound is coming from.



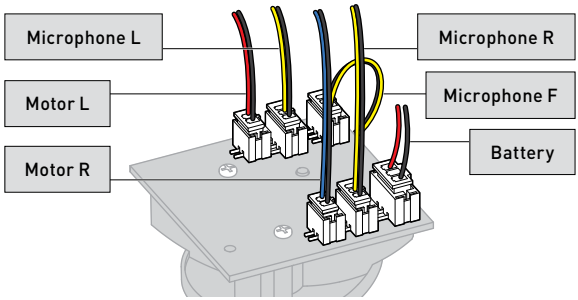
When a sound comes at us from the side, it strikes our two ears at slightly different times and at slightly different volumes, since our ears are on the opposite sides of our heads.

PROBLEM

What should I do if Hero doesn't respond after I switch it on?

SOLUTION

1. Check to make sure that the batteries were installed correctly, with the correct polarity (+ and -). See page 41, step 2.
2. Make sure that all cables and wires are firmly and properly connected. See page 24, step 7.



PROBLEM

What should I do if Hero doesn't move and it emits a "da-da-da" sound, even though the gears seem to be working?

SOLUTION

1. Check that B5 is installed properly. See page 33, step 6.
2. Make sure that B11 was removed. See page 13, step 13.
3. Check whether the P12 screws are screwed in tightly. See page 13, step 12.

PROBLEM

What should I do if Hero wobbles when it moves?

SOLUTION

Check to be sure that B1 and B7 weren't mixed up. See pages 30 and 34.

PROBLEM

What does it mean if the LEDs blink three times?

SOLUTION

It means that the batteries are dead. Please replace them with new ones, as described on page 41.

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