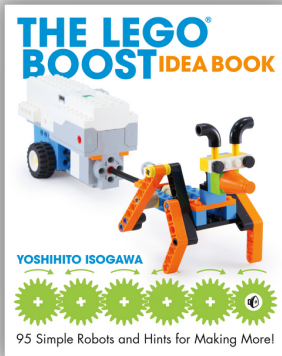




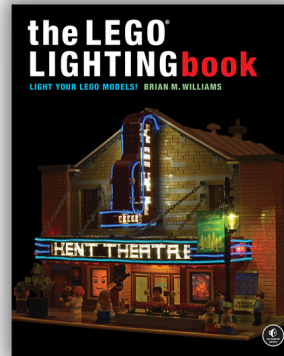
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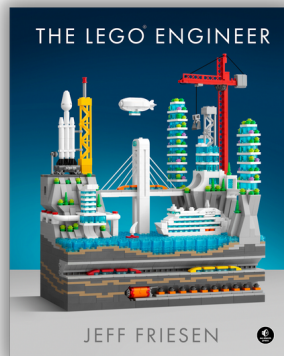
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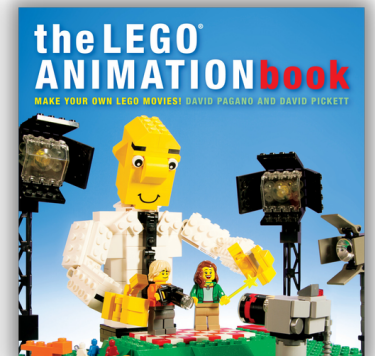
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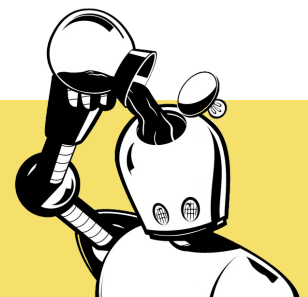


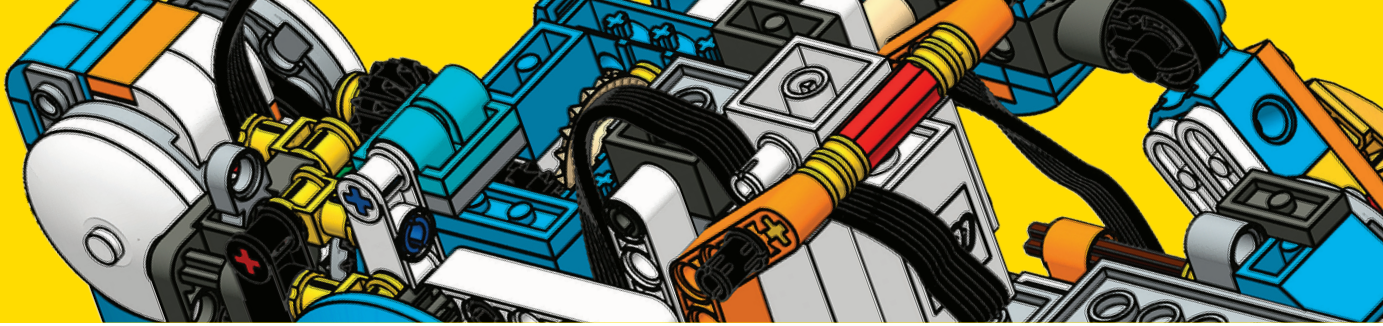
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the complete parts reference

Here's a detailed overview of all the pieces in your LEGO BOOST kit. You can also identify LEGO elements precisely by their LEGO ID, which is printed on the LEGO BOOST test pad.

bricks

FIGURE S-1 shows the LEGO bricks included in the LEGO BOOST set; their names are listed in TABLE S-1. For each type of brick, only one color is shown, even when you can find the part in more than one color in the LEGO BOOST set, as listed in the table. LEGO bricks are measured and identified by the number of the studs they have on top. The smaller number always comes first, so you say “a 2-by-4 brick,” not “a 4-by-2 brick.” The width of a 1x1 LEGO brick is the *Fundamental LEGO Unit*, or *module* (1 module or 1M is about 8 mm). The LEGO building system is based on this unit, and this consistent unit of measurement will allow you to add your existing LEGO collection to your BOOST robots.

FIGURE S-1 LEGO bricks, including the one decorated with a robot face pattern

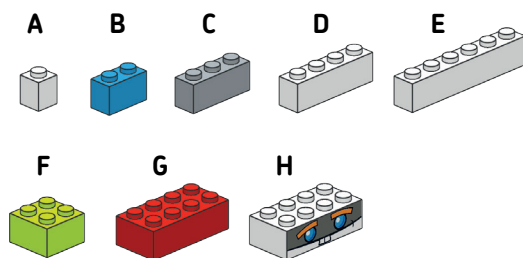


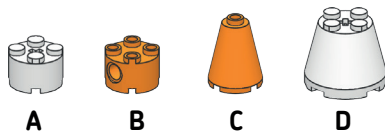
TABLE S-1 the bricks

LABEL	NAME	COLOR
A	1x1 brick	white
B	1x2 brick	dark azure, transparent dark blue, transparent red
C	1x3 brick	grey
D	1x4 brick	white, black
E	1x6 brick	white
F	2x2 brick	lime green, dark grey
G	2x4 brick	red, black
H	2x4 brick	white, robot face pattern

round bricks

FIGURE S-2 and **TABLE S-2** show the *round bricks* included in the set. This category contains round bricks with an axial cross hole, round bricks with a pass-through pin hole, and cones.

FIGURE S-2 Round bricks and cones



NOTE:

When a part has a third dimension expressed in LEGO units, as in “2x2x2,” that third number is the height. The height is measured in bricks, not LEGO units, though.

TABLE S-2 the round bricks

LABEL	NAME	COLOR
A	brick 2x2 round with cross hole	white
B	brick 2x2 round with pin hole	orange
C	cone 2x2x2	orange
D	cone 3x3x2	white

Technic bricks

FIGURE S-3 and TABLE S-3 show the *Technic bricks* included in the set. The Technic bricks have holes passing through them. Technic bricks are measured by the number of their studs. Except for the 1x1 Technic brick (A), there are no Technic bricks with an odd number of studs.

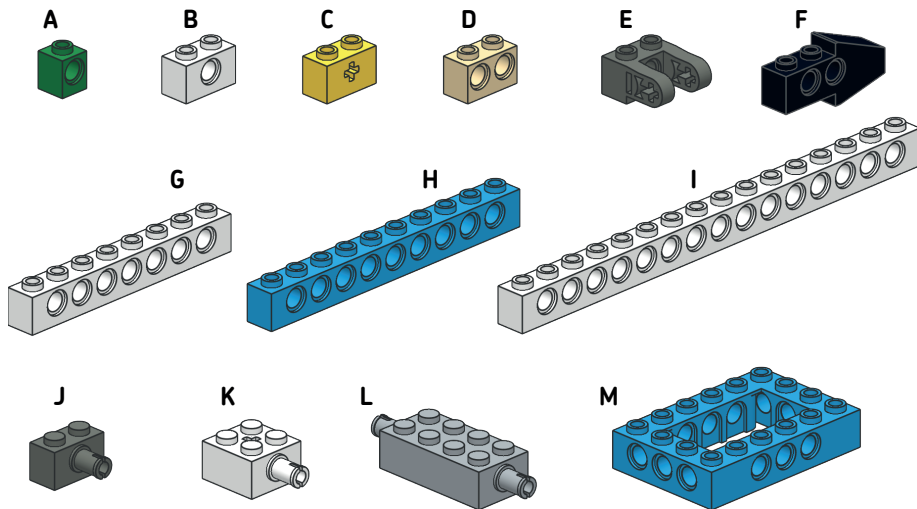


FIGURE S-3 LEGO Technic bricks

TABLE S-3 the Technic bricks

LABEL	NAME	COLOR
A	Technic brick 1x1 with hole	green
B	Technic brick 1x2 with hole	white
C	Technic brick 1x2 with cross hole	yellow, red, green
D	Technic brick 1x2 with holes	tan
E	Technic brick 1x2 with two liftarms	dark grey
F	Technic brick 1x4 with wingfront	black
G	Technic brick 1x8	white
H	Technic brick 1x10	dark azure
I	Technic brick 1x16	white
J	brick 1x2 with pin	dark grey
K	brick 2x2 with pin and cross hole	white
L	brick 2x4 with pins	grey
M	Technic frame 4x6	dark azure

plates

This category includes classic LEGO plates, plates with clips, plates with ball hinges, dishes, wing plates, and Technic plates.

regular plates

FIGURE S-4 shows the regular plates; their names are listed in TABLE S-4.

FIGURE S-4 LEGO plates

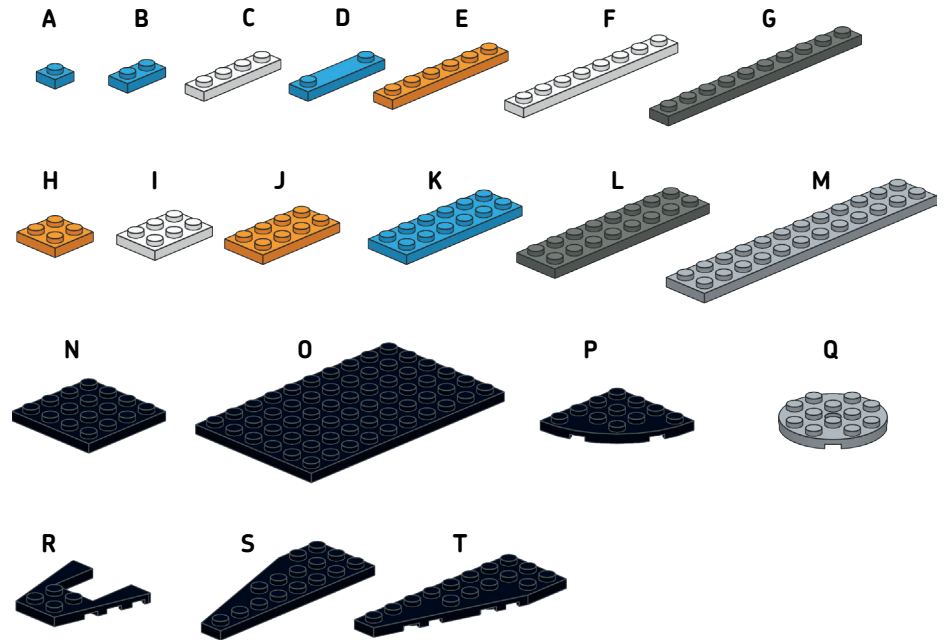


TABLE S-4 the LEGO plates

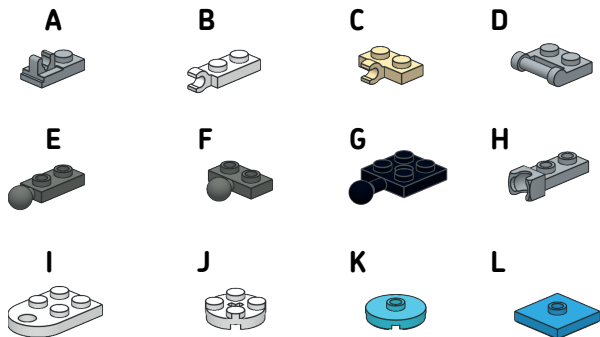
LABEL	NAME	COLOR
A	plate 1x1	dark azure
B	plate 1x2	dark azure, dark grey
C	plate 1x4	white, dark grey
D	plate 1x4 with two studs	dark azure
E	plate 1x6	orange
F	plate 1x8	white
G	plate 1x10	dark grey, black
H	plate 2x2	orange, grey
I	plate 2x3	white, dark azure

TABLE S-4 the LEGO plates (continued)

LABEL	NAME	COLOR
J	plate 2x4	orange, black
K	plate 2x6	dark azure
L	plate 2x8	dark grey
M	plate 2x12	grey
N	plate 4x4	black
O	plate 6x10	black
P	plate 4x4 corner round	black
Q	plate 4x4 round	grey
R	wing 4x4	black
S	wing 3x8 right	black
T	wing 3x8 left	black

hinges, joints, and jumpers

FIGURE S-5 shows the *special plates*; their names are listed in TABLE S-5. Some of these plates have clips or ball joints and sockets to build hinges. There are also plates that have just one stud on top; use these for half-unit spacing. They are unofficially called “jumper plates” because they allow you to “jump” half a unit.

**FIGURE S-5** Special LEGO plates**TABLE S-5** the special LEGO plates

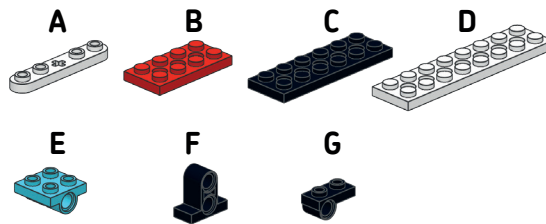
LABEL	NAME	COLOR
A	plate 1x2 with clip on top	grey
B	plate 1x2 with horizontal clip on end	white
C	plate 1x2 with horizontal clip on side	tan

TABLE S-5 the special LEGO plates (continued)

LABEL	NAME	COLOR
D	plate 1x2 with handle	grey
E	plate 1x2 with ball joint on end	dark grey
F	plate 1x2 with ball joint on side	dark grey
G	plate 2x2 with towball	black
H	plate 1x2 with ball joint socket	grey
I	plate 2x3 with hole	white
J	plate 2x2 round with cross hole	white
K	jumper plate 2x2 round	medium azure
L	jumper plate 2x2	dark azure

technic plates

FIGURE S-6 shows the *Technic plates*; their names are listed in TABLE S-6. Technic plates have round holes between the studs to allow axles to pass through. Plates E, F, and G have horizontal holes.

FIGURE S-6 Technic plates**TABLE S-6** the LEGO Technic plates

LABEL	NAME	COLOR
A	Technic rotor with 2 blades	white
B	Technic plate 2x4	red
C	Technic plate 2x6	black
D	Technic plate 2x8	white
E	Technic plate 2x2 with holes	medium azure
F	Technic tile 1x2 with two holes	black
G	Technic plate 1x2 with underside hole	black

tiles

Tiles are like plates without studs. You can use tiles for decorative purposes, to make flat surfaces, or to build sliding structures (that is, with a brick or a plate sliding onto them). Tiles are shown in **FIGURE S-7**, and their names are listed in **TABLE S-7**. Tiles have a little groove along their bottom edge to make it easier to detach them. You can use the sharp end of the LEGO element separator as lever to do so (see instructions for using the brick separator on page 6 of the book).

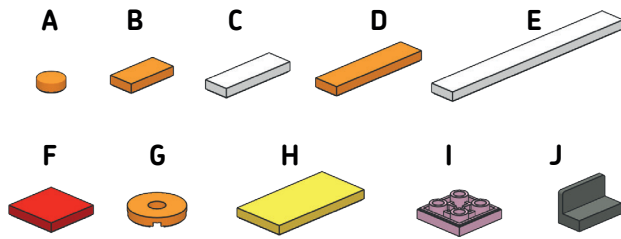


FIGURE S-7 LEGO tiles

TABLE S-7 the LEGO tiles

LABEL	NAME	COLOR
A	tile 1x1 round	orange
B	tile 1x2	orange
C	tile 1x3	white
D	tile 1x4	orange
E	tile 1x8	white
F	tile 2x2	red, blue
G	tile 2x2 round with hole	orange
H	tile 2x4	yellow, red, blue, green, black, white
I	tile 2x2 inverted	pink
J	panel 1x2x1	dark grey

dishes

FIGURE S-8 shows the *dishes*; their names are listed in **TABLE S-8**. The round slide shoe (**A**) was introduced to help LEGO ships slide more easily across carpet. It can be attached to the underside of a flat structure whenever you need to reduce its friction with the surface it slides on.

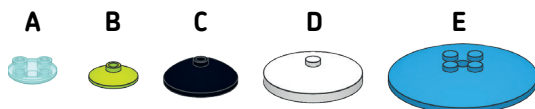


FIGURE S-8 Dishes

TABLE S-8 the dishes

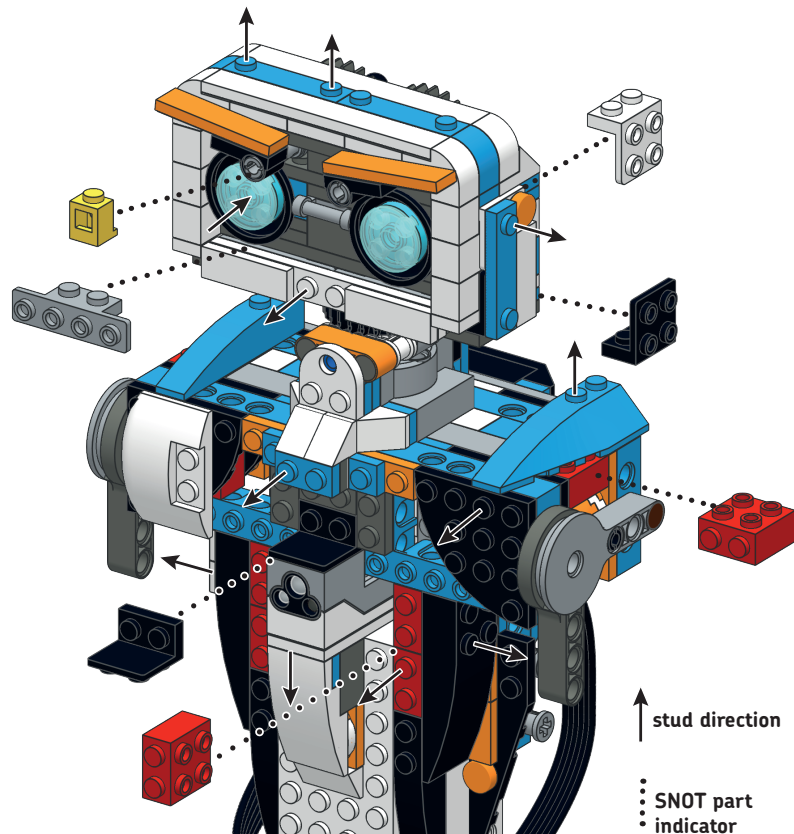
LABEL	NAME	COLOR
A	round slide shoe 2x2	transparent light blue
B	dish 2x2	lime green
C	dish 3x3	black
D	dish 4x4	white
E	dish 6x6	dark azure

SNOT elements

SNOT, an acronym coined by the online LEGO community, stands for *Studs Not On Top*. These elements allow you to build in different directions, such as to the side or even upside down. In **FIGURE S-9**, you can see how this technique was used in Vernie's construction.

Notice that the sensor is mounted upside down and that the studs of the part that forms the eye are facing backward. Do you recognize that part? Exactly, that's the slide shoe you saw above!

FIGURE S-9 Vernie features a lot of examples of the SNOT building technique.



The *SNOT building technique* can make your models look more beautiful, but it can also strengthen assemblies. **FIGURE S-10** and **TABLE S-9** list the SNOT elements. The brackets are described by their number of vertical studs and horizontal studs.

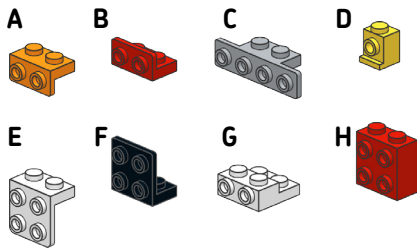


FIGURE S-10 SNOT elements

TABLE S-9 the SNOT elements

LABEL	NAME	COLOR
A	bracket 1x2, 1x2 down	orange
B	bracket 1x2, 1x2 up	red
C	bracket 1x2, 1x4 down	grey
D	1x1 brick with headlight	yellow
E	bracket 1x2, 2x2 down	white
F	bracket 1x2, 2x2 up	black
G	plate 2x2x2/3 with two studs on the side	white
H	brick 1x2x2 with studs on the side	red

slopes and curved bricks

FIGURE S-11 and **TABLE S-10** show *slopes* and *curved bricks*. These elements are mostly used as decorative parts or to replace bricks to get more interesting designs. Sometimes, slopes and curved bricks can be used to build small ramps or bevel borders to ease the sliding of objects inside a slot. The slope elements are named by the angle in their name; for example, *slope brick 45 2x2 inverted*. The element labeled **A** is also known as the “cheese slope” because its shape resembles a slice of cheese.

FIGURE S-11 Slopes and curved bricks

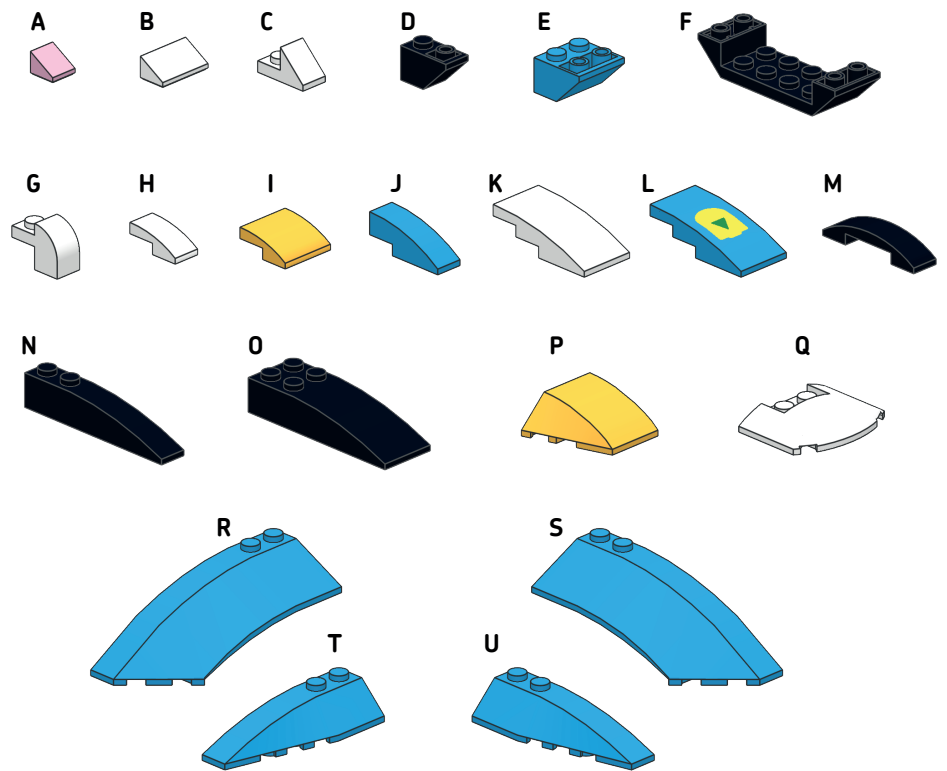


TABLE S-10 the slopes and curved bricks

LABEL	NAME	COLOR
A	slope brick 31 1x1	pink
B	slope brick 31 1x2	white
C	slope plate 45 1x2	white
D	slope brick 45 1x2 inverted	black
E	slope brick 45 2x2 inverted	dark azure
F	slope brick 45 2x6 double inverted	black
G	brick 1x2 with curved top	white, dark azure
H	slope brick curved 1x2	white, dark azure
I	slope brick curved 2x2	yellowish orange
J	slope brick curved 1x3	dark azure
K	slope brick curved 2x4	white, dark azure
L	slope brick curved 2x4	dark azure, with program start icon pattern

TABLE S-10 the slopes and curved bricks (continued)

LABEL	NAME	COLOR
M	slope brick curved 1x4 double	black
N	slope brick curved 1x6	black
O	slope brick curved 2x6	black
P	slope brick curved 3x4 without studs	yellowish orange
Q	slope brick curved 3x4 with studs	white
R	shell brick 3x8x2 left	dark azure
S	shell brick 3x8x2 right	dark azure
T	shell brick 2x6 left	dark azure
U	shell brick 2x6 right	dark azure

beams

Beams are the studless equivalent of Technic bricks. This category includes straight beams and angular beams (sometimes called *liftarms*). Beams can have round holes where you can fit pins, or cross holes where you can insert axles or axle pins. **FIGURE S-12** shows these parts; their names are listed in **TABLE S-11**. The beams are measured by counting their holes. For example, a straight beam with three holes is a *3M beam*. The number of holes in a beam corresponds to the length of the beam. As for the bricks, their size is expressed in Fundamental LEGO Units or modules.

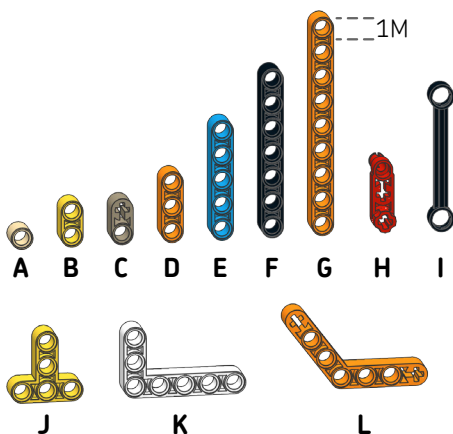


FIGURE S-12 Beams and liftarms

TABLE S-11 the beams and liftarms

LABEL	NAME	COLOR
A	1M beam	tan
B	2M beam	yellow
C	2M beam with cross hole	dark tan
D	3M beam	orange
E	5M beam	dark azure
F	7M beam	black
G	9M beam	orange
H	3M liftarm with pin	red
I	6M link with ball sockets	black
J	T beam	yellow
K	3x5 angular beam (L beam)	white
L	4x4 angular beam	orange

connectors

Many parts in the LEGO BOOST set are connectors. Some may seem unrelated to the others, but they all do one basic thing: they connect parts. When building with wood, we use nails, glue, staples, screws, and so on to connect pieces. In the wonderful LEGO Technic realm, we use pins, axles and bushes, axle connectors, and the various cross blocks.

pins and axle pins

Pins hold beams together when fitted inside their round holes. Pins are divided into two groups: pins with friction and pins without friction. **FIGURE S-13** and **TABLE S-12** show pins and 3M pins, axle pins, pins with towballs, and some special 3M pins. This last category is represented by the pin with a stop bush (also called a *bushing*) and two kinds of long axle pins.

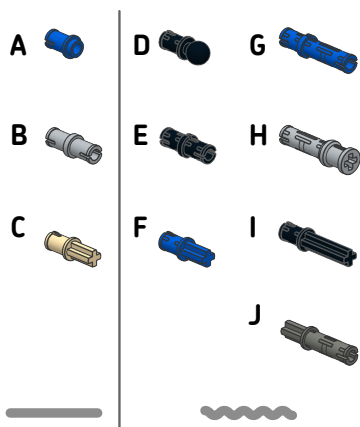


FIGURE S-13 The Technic pins and axle pins. The straight line signifies the smooth pins (A-C); the wavy line indicates pins with friction (D-J).

TABLE S-12 the Technic pins and axle pins

LABEL	NAME	COLOR
A	pin 1/2 with stud	blue
B	pin without friction	grey
C	axle pin without friction	tan
D	pin with towball	black
E	pin with friction	black
F	axle pin with friction	blue
G	3M pin with friction	blue
H	3M pin with stop bush	grey
I	3M axle pin with 2M axle	black
J	3M axle pin with 2M pin	dark grey

The *pins without friction* (A, B, and C in FIGURE S-13) turn smoothly and freely in the Technic holes. They are color coded: 2M pins are always grey, while 3M pins and axle pins are tan. Pins without friction are used mainly to connect moving beams. An axle pin without friction can be used to hold a gear so that it can turn freely. A 3M pin without friction (tan) exists, but it's not included in the LEGO BOOST set.

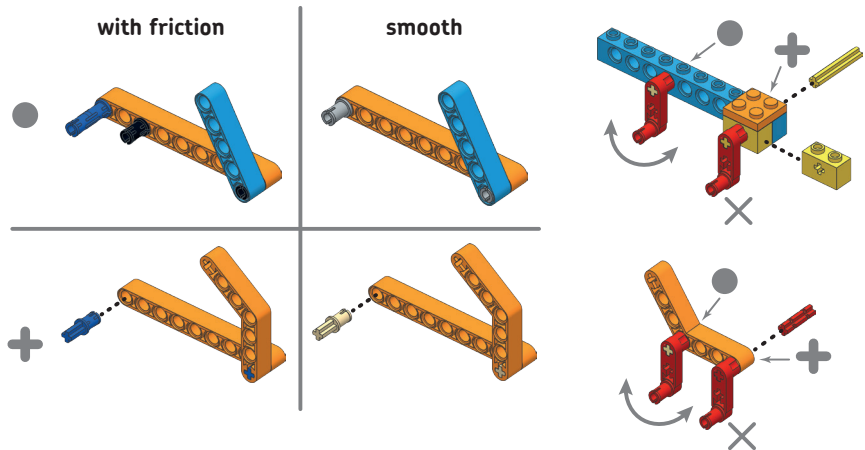
The *pins with friction* (D through J) have ridges that increase friction and make the pin harder to turn. These also prevent connections from rattling. The pins are color coded to help you identify their function. The 2M pins with friction are always black, and 3M pins and axle pins with friction are blue. The 3M pins with stop bushes come in many colors, but they're light grey in the BOOST set. There are also special 3M axle pins (I and J).

Pins with friction are great for building structures because they hold beams together better than pins without friction.

crosses and holes

Build the following assemblies. Each one has a symbol to help you pick the right pieces. Pins with friction (black or blue) are on the left, and smooth pins (grey or tan) are on the right. A plus (+) indicates axle pins, and a circle indicates round pins.

- Once you've built the assemblies, hold the orange beam and try to make the inclined beam swing. What happens in each case?
- In the rightmost assemblies, hold the Technic brick or the angular beam and try to turn the red cranks. Which one is the easier to turn? (It's a trick question.)



axles and bushes

Axles are designed to transfer rotational movement—for example, from a motor shaft to a wheel. Axles can also be used to hold structures together. Sometimes called *cross axles* because of their shape, they fit perfectly into parts that have cross holes, such as gears, angular beams, and cross blocks.

Like beams, axles come in many lengths. You can measure an axle by putting one next to a brick and counting the studs in the brick. You can also measure an axle by putting one next to a beam and counting the holes. Once you get used to working with axles, you will be able to sort them by size at a glance, without measuring them. This superpower really amazes people—and will save you a lot of time!

Axles are color coded, as you can see in **FIGURE S-14**: the 2M, 4M, and 10M axles are red, and the 3M and 7M axles are yellow. The BOOST set includes a special tan 4M axle (**4c**) with a cylindrical stop in the middle, as well as some axles with a stop (**3s**, **4s**, **5s**, and **8s**). In these axles, the stop looks like a built-in bush, and it *stops* the axle from passing through a hole or a cross hole. In the 4M axle, the stop in the middle stops the axle from passing completely through a cross hole.

In **FIGURE S-14**, there are also two *bushes*, labeled **B1** (yellow, 1 half-module thick) and **B2** (red, 1 module thick). You'll usually fit these bushes over axles to prevent them from coming out of holes, or you'll use them to keep space between two or more elements of a structure. Since the bushes are mainly used with axles, I've listed them with the axles here.

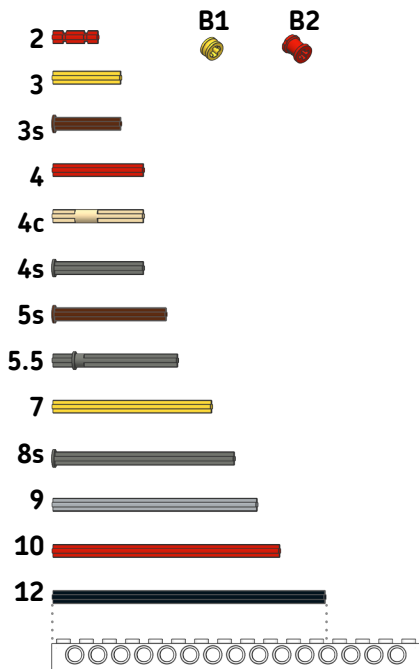


FIGURE S-14 Axles and bushes (the Technic brick at the bottom is shown for comparison)

cross blocks and connectors

Here comes the fun! *Cross blocks* are essential to studless building because they allow you to build—and think—in three dimensions. **FIGURE S-15** shows the cross blocks and the connectors, and **TABLE S-13** lists their names. The angle connector labeled **H** is part of a large family of connectors; you can identify these by the number embossed on their body. The part labeled **I** can be used as a gear box to hold 90-degree-coupled 12z and 20z bevel gears. The end of the curved connector labeled **M** can accept axles but can also fit on studs.

FIGURE S-15 The cross blocks and connectors

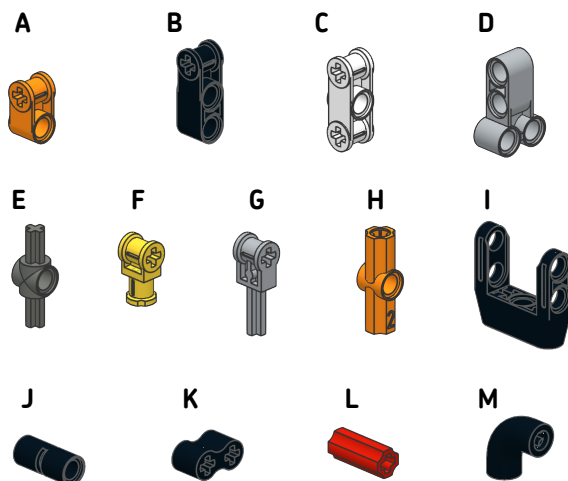


TABLE S-13 the cross blocks

LABEL	NAME	COLOR
A	2M cross block	orange
B	3M cross block	black
C	3M double cross block	white
D	3M cross block 2x3	grey
E	1M beam with two axles	dark grey
F	connector with axle holes	yellow
G	connector with axle and axle hole	grey
H	angle connector #2	orange
I	gearbox cross block	black
J	pin joiner round	black
K	2M flexible axle joiner	grey
L	axle connector	red
M	curved tube with axle holes	black

It would take pages and pages to show you all the combinations of elements you can build with cross blocks and connectors. The best way to learn how to use these is to draw your inspiration from the projects in this book and from the many Technic models in the wild.

hinges

FIGURE S-16 shows elements that you can assemble to form *hinges*; TABLE S-14 lists their names. These hinges cannot freely rotate. They resist rotation, holding their position better than two beams connected by a black pin with friction. Try connecting them and clicking them around. You can rotate hinge **A+B+C** in two ways (it has two moving axes and so two degrees of freedom), while hinge **D+E** bends just one way.

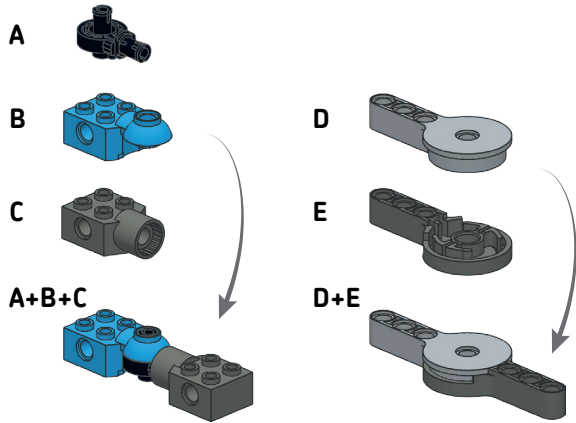


FIGURE S-16 Parts that you can assemble into hinges

TABLE S-14 the hinge elements

LABEL	NAME	COLOR
A	pin with friction and snap joint	black
B	Technic brick 2x2 with vertical snap joint	dark azure
C	Technic brick 2x2 with snap joint socket	dark grey
D	3M beam with snap joint pin	grey
E	3M beam with snap joint socket	dark grey

gears

Gears mesh with other toothed parts to transmit movement. FIGURE S-17 shows the gears included in the EV3 set, with their corresponding names in TABLE S-15. The LEGO gears are identified by their number of teeth, as indicated in their name followed by *z*; for example, a 24-tooth gear is called a *24z gear*.

FIGURE S-17 The gears included the LEGO BOOST set

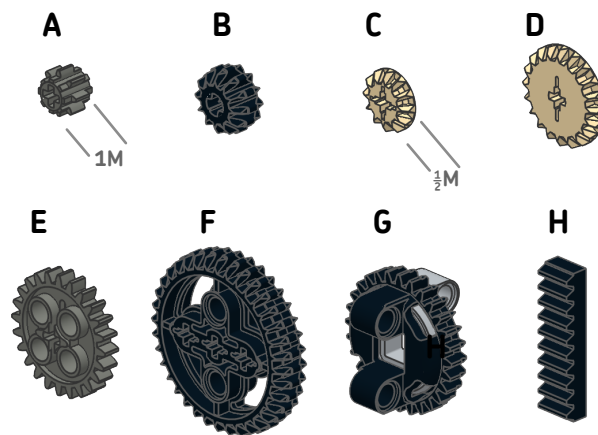


TABLE S-15 the gears

LABEL	NAME	COLOR
A	8z gear	dark grey
B	12z double-bevel gear	black
C	12z bevel gear	tan
D	20z bevel gear	tan
E	24z gear	dark grey
F	36z double-bevel gear	black
G	28z turntable	black/grey
H	gear rack	black

Most gears are 1M thick, with the exception of the 12z and 20z bevel gears, which are both one half-module thick. The 24z gear (E) is a spur gear, but the word *spur* can be omitted when naming it (16z and 40z spur gears also exist in the LEGO system). The 28z turntable (G) can be used to attach rotating parts that cannot be pulled apart (see Vernie’s neck in FIGURE S-9) and allows you to pass an axle through its center. A *gear rack* (H) is like an unrolled gear that allows you to transform rotation into linear motion.

studless vs. studded styles

The LEGO BOOST set includes both *studded* and *studless* parts, and if you know how to mix them together, you'll get sturdy and beautiful models. Now that you've seen all the pieces, try building the simple models in **FIGURE S-18** to get a sense of the two building styles. Each one achieves the same goal, but a bit differently.

- Simple gear system attached on Technic bricks and on beams. There's a two-plate offset between bricks to put the gears' axles at the right distance.
- Building at a right angle. The holes of the two black beams are not aligned horizontally. Can you find a different solution?
- Gear box with axles forming a right angle. The studless version is more compact.

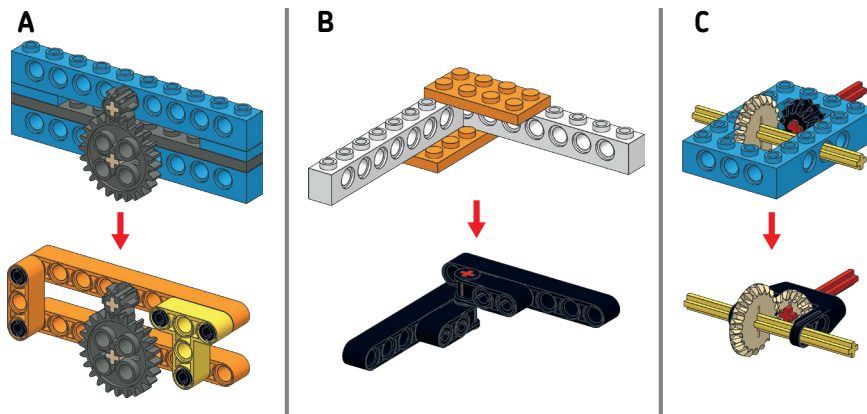


FIGURE S-18 Some example assemblies comparing studded and studless building techniques

wheels and treads

The simplest and most efficient way for your robots to move is on wheels. The LEGO BOOST set contains two medium wheels with rubber tires, some large plastic wheels, some tiny wheels, sprocket wheels of two sizes, and tread links to assemble treads complete with orange rubber pads to enhance the tread's grip. **FIGURE S-19** shows the various types of wheels and treads in the set, and **TABLE S-16** lists their names.

FIGURE S-19 The wheels, tires, and treads

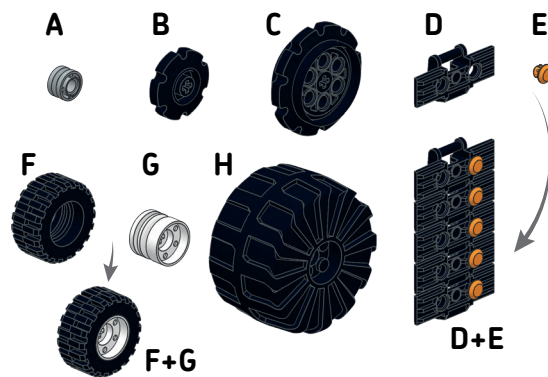


TABLE S-16 the wheels, tires, and treads

LABEL	NAME	COLOR
A	small wheel	grey
B	small sprocket wheel	black
C	large sprocket wheel	black
D	tread link	black
E	rubber pad	orange rubber
F	tire 30.4x14	black rubber
G	wheel rim 14x18	white
H	hard plastic wheel	black

LEGO tires have their dimensions printed on their edge; for example, 30.4×14. The measurements are in millimeters. In this example (G), 30.4 mm is the tire’s diameter, and 14 mm is its width.

miscellaneous pieces

This category includes hemispherical parts, wings, claws, a dart with a shooter mechanism, rubber bands, and the LEGO element separator. The LEGO rubber bands are color coded; the ones included in the BOOST set are white and have a 15 mm diameter (when not stretched). The miscellaneous parts are shown in FIGURE S-20 and listed in TABLE S-17.

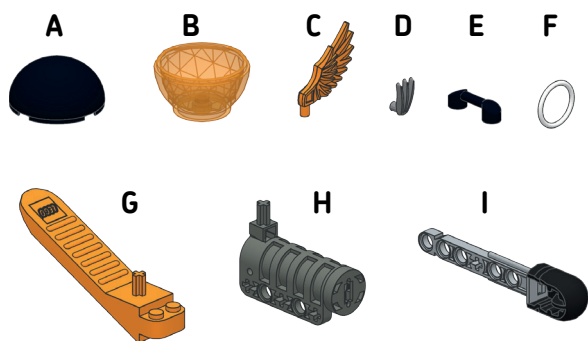


FIGURE S-20 The miscellaneous pieces

TABLE S-17 the miscellaneous pieces

LABEL	NAME	COLOR
A	dome 4x4	black
B	faceted hemisphere	transparent orange
C	wing	orange
D	claws	silver
E	telephone receiver	black
F	rubber band	white
G	element separator	orange
H	Technic shooter	dark grey
I	Technic dart	grey/black rubber

