

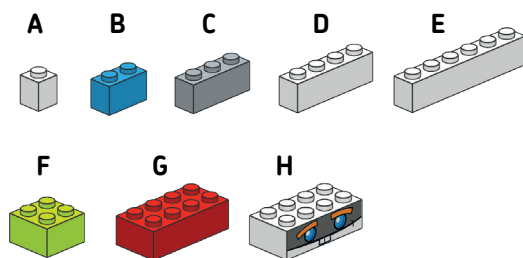
# the complete parts reference

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



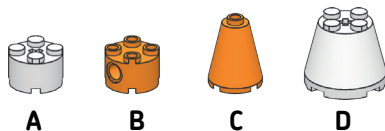
**TABLE S-1** the bricks

| 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.

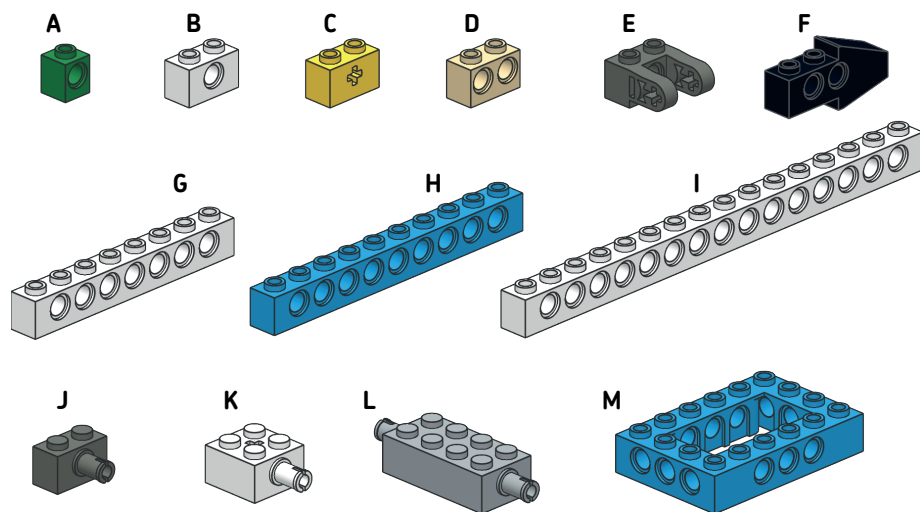


FIGURE S-3 LEGO Technic bricks

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

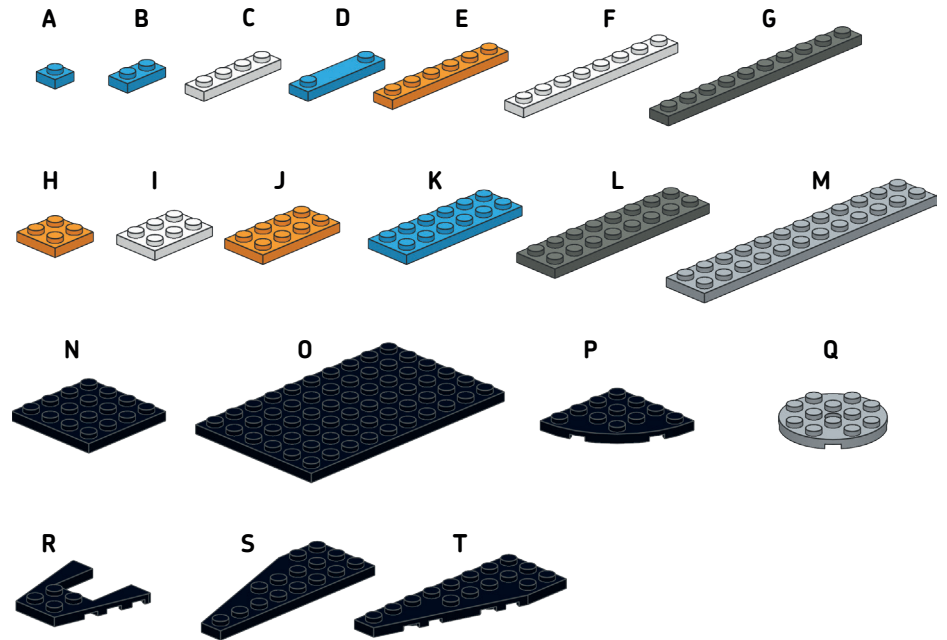


TABLE S-4 the LEGO plates

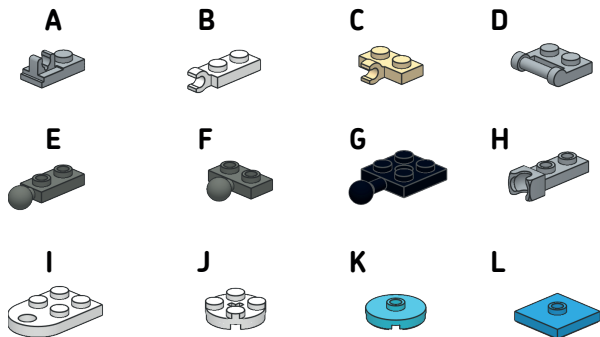
| LABEL | NAME                     | COLOR                 |
|-------|--------------------------|-----------------------|
| A     | plate 1x1                | dark azure            |
| B     | plate 1x2                | dark azure, dark grey |
| C     | plate 1x4                | white, dark grey      |
| 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   |

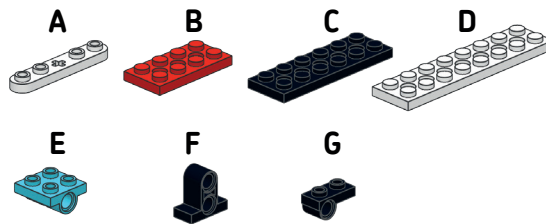
**TABLE S-5** the special LEGO plates (continued)

| 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

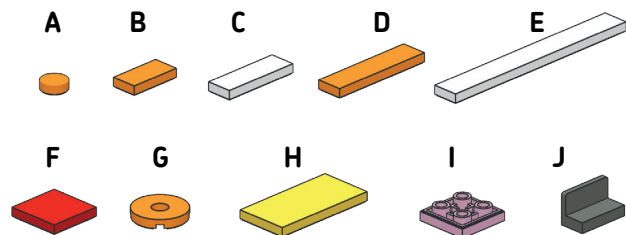


**TABLE S-6** the LEGO Technic plates

| 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).



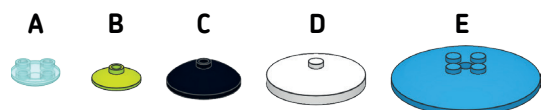
**FIGURE S-7** LEGO tiles

**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

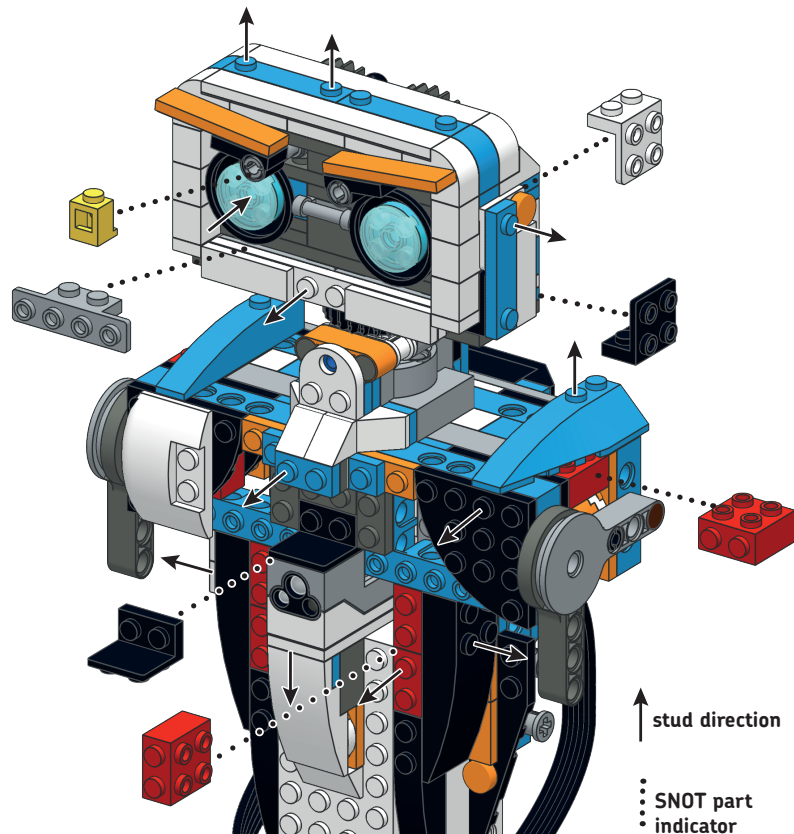
| LABEL | NAME                 | COLOR                  |
|-------|----------------------|------------------------|
| A     | round slide shoe 2x2 | transparent light blue |
| B     | dish 2x2             | lime green             |
| C     | dish 3x3             | black                  |
| D     | dish 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.

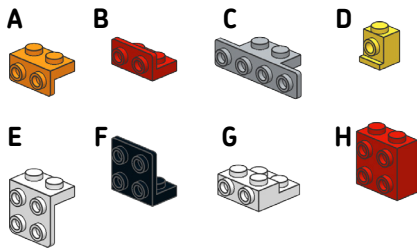
Notice that the sensor is mounted upside down and that the studs of the part that forms the eye are facing backward. Do you recognize that part? Exactly, that's the slide shoe you saw above!

**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

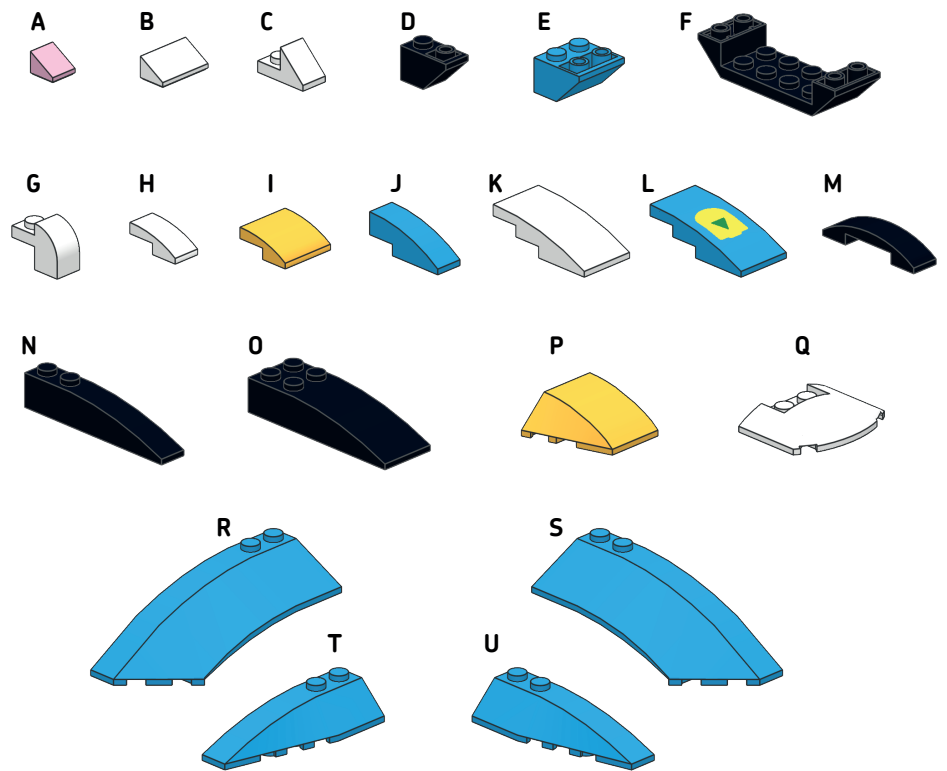
**TABLE S-9** the SNOT elements

| 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

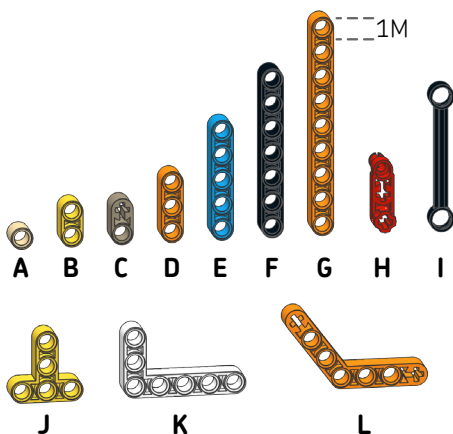
| LABEL | NAME                               | COLOR                                       |
|-------|------------------------------------|---|
| A     | slope brick 31 1x1                 | pink  |
| B     | slope brick 31 1x2                 | white                                       |
| C     | 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

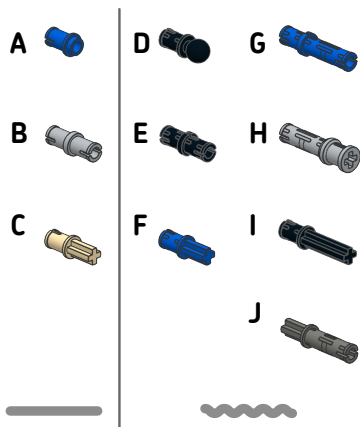
| LABEL | NAME                      | COLOR      |
|-------|---------------------------|------------|
| A     | 1M beam                   | tan        |
| B     | 2M beam                   | yellow     |
| C     | 2M beam with cross hole   | dark tan   |
| D     | 3M beam                   | orange     |
| 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.

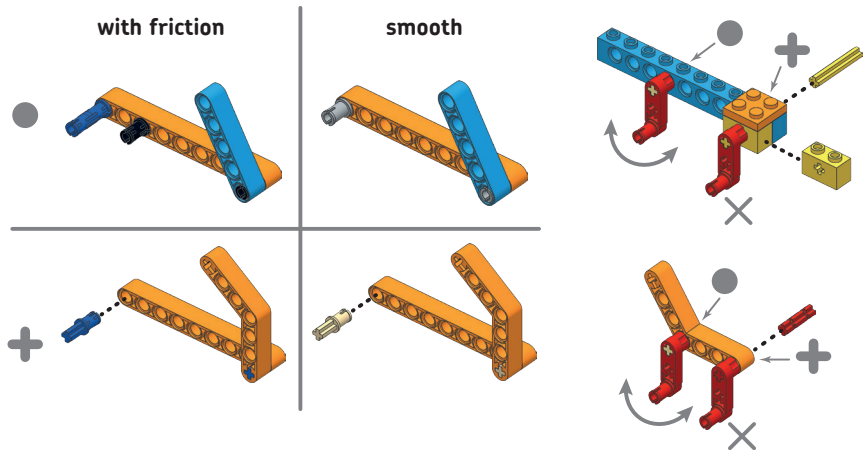
The *pins with friction* (D through J) have ridges that increase friction and make the pin harder to turn. These also prevent connections from rattling. The pins are color coded to help you identify their function. The 2M pins with friction are always black, and 3M pins and axle pins with friction are 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.)



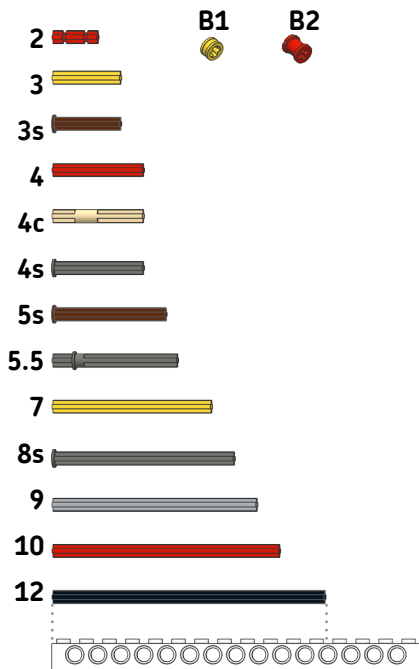
## axles and bushes

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.

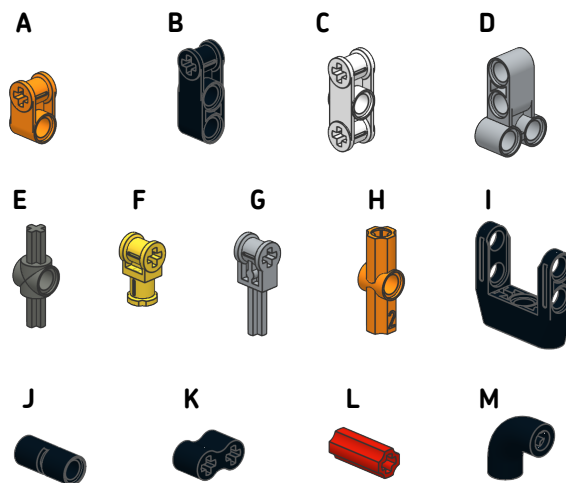


**FIGURE S-14** Axles and bushes (the Technic brick at the bottom is shown for comparison)

## 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.

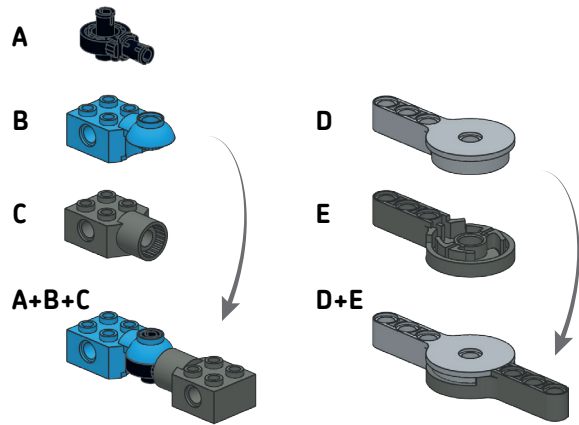


FIGURE S-16 Parts that you can assemble into hinges

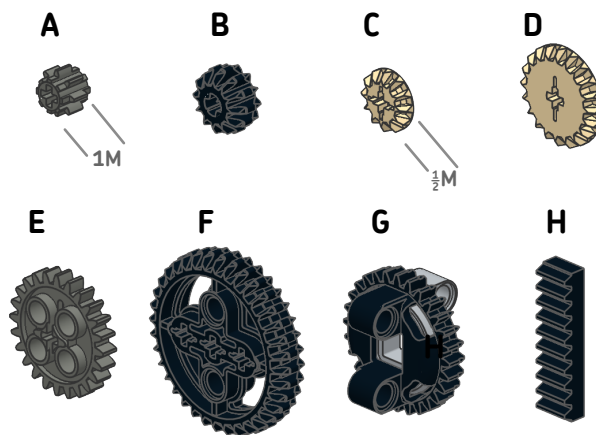
TABLE S-14 the hinge elements

| 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

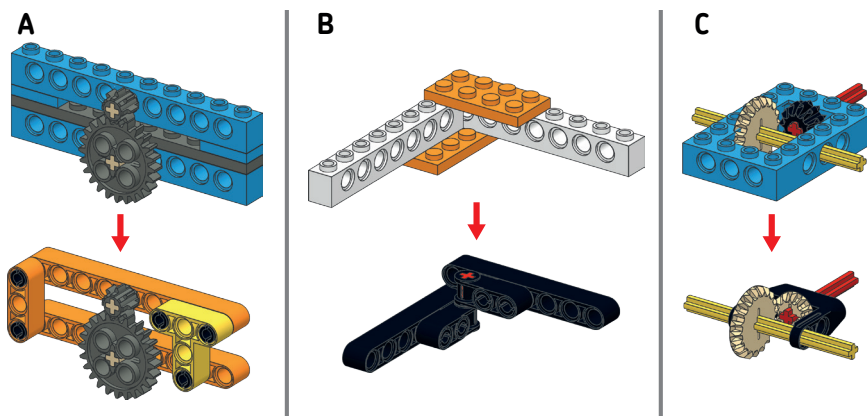
| LABEL | NAME                  | COLOR      |
|-------|-----------------------|------------|
| A     | 8z gear               | dark grey  |
| B     | 12z double-bevel gear | black      |
| C     | 12z bevel gear        | tan        |
| D     | 20z bevel gear        | tan        |
| E     | 24z gear              | 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.

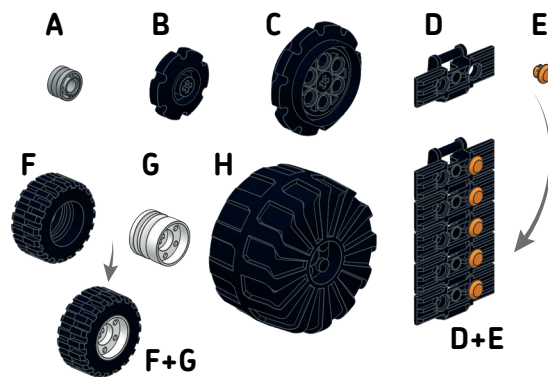


**FIGURE S-18** Some example assemblies comparing studded and studless building techniques

# 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



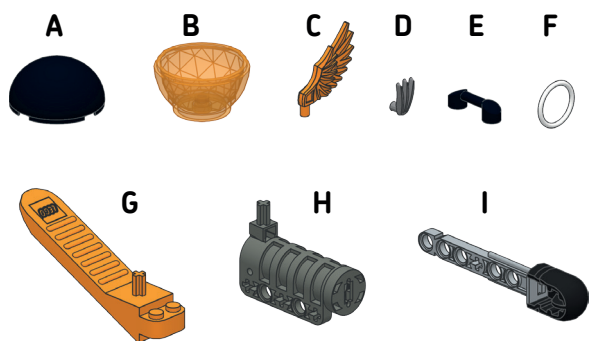
**TABLE S-16** the wheels, tires, and treads

| 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  |

