

FIRST® LEGO® League Challenge SUBMERGEDSM Building Instructions

Build 12: Change Shipping Lanes

This build is 43 pieces, and 16 building steps.

Welcome to text-based instructions from Bricks for the Blind. Before you start building, here are some terms we'll be using:

- In Front of/Front: towards you.
- Behind/Back: away from you.
- Up: towards the ceiling.
- Down: towards the floor.
- Stud: the bump on a LEGO brick. Example: A 2x1 brick has two studs on it.
- Vertically: going from front to behind.
- Horizontally: going from left to right.
- Upright: pointing up towards the ceiling.
- That one/ppp: previously placed piece.
- Plate: piece with studs.
- Tile: smooth piece without studs (unless otherwise specified)
- Symmetrically: a mirror image. Example: If you place a 2x1 brick with technic connector on the front wall at the right, connector to the front, and then place another such piece symmetrically on the back wall, at the right, the technic connector of the second piece should point to the back, since it will be placed symmetrically.
- Centered-vertically: even amount of space in front of and behind the piece
- Centered-horizontally: even amount of space left and right of the piece.
- Row: studs lined up horizontally (left to right/side to side).
- Column: studs lined up upright or vertically (top to bottom/back to front).
- Standing upright: the piece is perpendicular to the ground, like a wall.
- Lying flat: the piece is parallel to the ground, like a piece of toast which fell off the table.
- Anti-stud: the portion of a piece which accepts studs, like the bottom of a plate.
- Jumper plate: a 1x2 plate with a single stud on top, or a 1x3 plate with only two studs on top.

A note on LEGO Technic™ part names. These parts are somewhat different from regular LEGO bricks. Here are some definitions in case the builder or helper is not familiar with LEGO Technic™.

Axles - An axle is a connector which has an X shaped cross-section. Because their cross section is not round, anything connected to an axle using an axle-hole will rotate with that axle. Axles are longer than they are wide, and the length of an axle corresponds with how many bricks long it is. Aka a 3L axle is three bricks long. Axles come in a variety of lengths, with a 2L axle being the shortest available. They may be combined with pins, or have circular stops on them. A stop prevents the axle from sliding through an axle-hole at a specific point on the axle.

Pins - A pin is a connector which has a circular cross section and a flanged notch out of one or both ends. This flanged notch allows them to click into bricks with a pin-hole. Pins come with and without friction ridges, which are small bumps on the pin which prevent them from rotating freely. For standard pins, black is a high friction pin, and gray is a low friction pin. A standard length pin is two brick lengths long, with a stop in the middle. This prevents a brick from being pushed from one side of the pin to the other. A 1L pin is one brick long and still retains the stop, however it also includes a hollow stud at the other end. A 3L pin is three bricks long, and only contains a stop at one side, allowing two bricks to be pushed onto the other side of the pin. Pins may also have one side which is an axle.

Lift-arms - A lift-arm is a basic structural element, similar to a brick or a plate, but usually without any studs. It is a beam with rounded ends and with holes in it, with the same spacing as the studs on a LEGO brick. lift-arms come in a variety of lengths, including a 1x1 lift-arm which looks like a cylinder. Thick lift-arms are as wide as a LEGO brick, and thin lift-arms are half as wide as a LEGO brick, but not the same thickness as a LEGO plate! The holes in a lift-arm arm may accept axles or pins. They also come in a variety of shapes, including tees, ells and triangles.

Gears - A gear is a functional element. They are typically discs with teeth on the outside, there are also worm gears which look like a spiraling cylinder! Gears connected by axles transmit or even transform rotational motion!

Axle and Pin Connectors - These elements are typically smaller than lift-arms and are used to connect some combination of pins or axles. They might have pins or axles, as well as axle or pin-holes. They have a lot of different angle combinations! The simplest just connects two axles or pins together in a straight line.

Bushes/Bushings - LEGO Technic™ uses bushes largely as spacers, but they also can reduce friction between rotating parts, or can form useful elements such as handles. Bushes are typically light gray, generally cylindrical, and have an axle-hole running through the middle. They have a flange at the front and back to make them easier to pull on and off.

Technic™ Bricks and Plates – There are also regular bricks and plates that are adapted for use with Technic™ elements. Technic™ bricks have holes for either pins or axles on the sides and are only one brick wide. One of the most common of these is a 1x2 brick with a single pin hole. Most often, these bricks have pin holes, not axle holes. Technic™ plates have holes on the flat surface between the studs and are a minimum of two bricks wide. The holes in these plates can accept pins, or can allow an axle to pass through and still spin.

For builders with low vision, or a sighted building partner who may want to follow along with the printed visual instructions that come with each set. As low vision users may benefit from viewing the instructions on a personal device where they can zoom in on content and use assistive technologies to enhance the visuals.

Sorting the pieces:

This LEGO set comes in the bag labeled 25. Sort the pieces into groups as described below. Note that where there are multiple colors of the same brick in a step, the colors will be split across two groups to make telling the difference easier for the builder! LEGO includes a few spare parts in case you lose something. Set these into their own group away from the rest, in case you need them later.

Build 12 (5 groups of bricks)

Group A contains all of the black 2L pins from this bag. These pins have friction ridges.

Group B contains all of the blue 3L pins from this bag. These pins have friction ridges.

Group C contains all of the blue 2L axle/pin combos from this bag. These pins have friction ridges.

Group 1 contains the pieces for steps 1-8.

Group 2 contains the pieces for steps 9-16.

Building Instructions:

Main build.

Open groups A, B, C and 1. You will use the pins from groups A, B and C throughout the build.

1.1. We'll start by making a small piece of ocean with a mount for a boat. Place a blue 7L liftarm in front of you, horizontally with the holes facing forward.

1.2. Push three blue 3L pins from group B, with the stop rings at the back, from the front into the leftmost, rightmost, and middle holes of the previous piece. There should be two holes between each of these pins. They will extend 2L to the front of the liftarm.

1.3. Push a black 2L pin from group A, from the front into the hole to the right of the middle hole.

2. Push a blue 2L liftarm, horizontally with the holes facing forward, from the front onto the rightmost pin so its right side is even with the liftarm behind it. Push it all the way back. Repeat this symmetrically on the left side.

3.1. Place a yellow 3x3 T-shaped liftarm in front of you, standing upright with the flat part on the bottom and the holes facing forward. The boat will mount to this liftarm.

3.2. Push a black 2L pin from group A, from the front into the leftmost hole on the bottom row of the previous piece.

3.3. Find the 3L pin at the middle of the 7L liftarm, and the 2L pin to the right of it. Push the right two holes on the bottom row of the T-shaped liftarm onto these pins. Push it all the way back so the 3L pin extends 1L to the front.

4.1. Place a blue 7L liftarm in front of you, horizontally with the holes facing forward.

4.2. Push a black 3L axle/pin combo which has a 2L axle and a 1L pin, with the pin side at the front, from the back into the second hole from the right on the previous piece. The axle should extend 2L to the back. Repeat this symmetrically on the left side.

4.3. Push this assembly, with the axles pointing to the back, from the front onto the pins on the front of the rest of the piece of ocean so the left and right sides are even.

5. Push a light gray 2L pin, from the front into the third hole from the right on the front of the assembly. This should be the only free hole on the front side. Push another light gray 2L pin, from the back into the third hole from the left on the back of the assembly. Once again this should be the only free hole on the back side. These pins do not have friction ridges so they should spin easily.

6. Push the rightmost hole of a dark blue 11L liftarm, horizontally with the holes facing forward, from the back onto the back pin from the previous step. This liftarm should extend 8 holes to the left past the rest of the assembly. Because the pin doesn't have friction ridges, this piece will flop if you lift the assembly.

7.1. Now we'll build another piece of ocean. Place a blue 7L liftarm in front of you, horizontally with the holes facing forward.

7.2. Push three blue 3L pins from group B, with the stop rings at the front, from the front into the leftmost, rightmost, and middle holes of the previous piece. There should be two holes between each of these pins. Push these pins all the way back so they extend 1L to the front and back.

7.3. Push a blue 7L liftarm, horizontally with the holes facing forward, from the back onto these three pins. Place another symmetrically on the front side.

7.4. Push a light gray 2L pin, from the front into the third hole from the right on the front of the assembly. Push another light gray 2L pin, from the back into the third hole from the left on the back of the assembly. These pins do not have friction ridges so they should spin easily.

7.5. Push the back pin from the previous step, from the front into the leftmost hole on the dark blue 11L liftarm.

8. Locate the two pins on the front of the two ocean pieces. Push a dark blue 11L liftarm, horizontally with the holes facing forward, onto these two pins. Now, if you pick up the assembly and move the two 11L liftarms in opposite directions, the two pieces of ocean should spin around!

Open group 2.

9.1. Now we will make the first half of the boat. Set the ocean assembly aside for now. Find a yellow 5x3x2 left corner quarter ellipse. This piece looks like a quarter of an elongated curved dome. It has one smooth, curved side and one hollow side. One side has an L-shaped pattern of four holes, and one long side has a row of three holes perpendicular to the L-shaped pattern. Rotate this piece so the L-shaped holes are at the left and the row of three holes is at the top. The smooth, curved side should be at the back.

9.2. Push a blue 3L pin from group B, with the stop ring at the right, from the left into the bottom hole on the left side of the previous piece. This will extend 2L to the left.

9.3. Push a black 3L axle/pin combo which has a 2L axle and a 1L pin, with the pin side at the right, from the left into the hole above the previous piece. This will extend 2L to the left.

9.4. Find a yellow 3L axle and pin connector with a perpendicular pin hole. This looks like a 3L liftarm, except that the holes on the end are axle holes that are perpendicular to the center pin hole. Place this piece in front of you, vertically with the axle holes facing left and right.

9.5. Push a blue 2L axle/pin combo from group C, with the pin side on the left, from the left into the front axle hole of the previous piece. Push another, with the pin side on the right, from the right into the back axle hole.

9.6. Push the right side of the back pin from the previous step, from the left, into the back most hole on the top row of the L-shaped hole pattern on the quarter ellipse.

9.7. Push a black 2L pin from group A, from the top into the middle hole of the 3L axle and pin connector.

9.8. Place the ocean assembly in front of you so it is horizontal, with the piece with the T-shaped liftarm sticking out of it on the left. The T-shaped liftarm should be pointing up. Rotate the boat assembly 90 degrees counterclockwise so there are three pins pointing to the front and one pointing up. Find the axle and pin which extend 2L to the front. These should be the bottom two connection points on the boat. Push these two, from the back through the two holes on the T-shaped liftarm on the left ocean piece.

10.1. Now we'll make the back of the boat. Set the rest of the build aside for now. We'll start by making a cross bar. This might be part of the boat's mast, or a handle to lift the boat. Find a yellow 2L axle connector. This looks like a cylinder which has four shallow grooves cut out of the sides so it has a vaguely X-shaped cross section, kind of like a thick axle. Place this piece in front of you with the axle holes on the left and right.

10.2. Push a yellow 3L axle, from the left into the previous piece.

11.1. Push a black 2L axle, from the right into the right hole on the 2L axle connector.

11.2. Push a yellow 2L axle connector, from the right onto the previous piece.

12.1. Place a yellow 3L axle and pin connector with a perpendicular pin hole in front of you, vertically with the axle holes facing left and right.

12.2. Push two blue 2L axle/pin combos from group C, with the pin sides at the left, into the two axle holes on the left side of the previous piece.

12.3. Slide the pin hole of the 3L axle and pin connector, from the left onto the 3L axle on the handle assembly. The orientation of the pins from the previous step does not matter at this point.

12.4. Push a yellow 2L axle connector, from the left onto the 3L axle to secure the previous assembly in place.

13.1. Push a black 2L axle, from the left into the previous piece.

13.2. Push a yellow 2L axle connector, from the left onto the previous piece.

14. Rotate the crossbar assembly so the pins are at the bottom, and the crossbar is running vertically front to back. Orient a yellow 5x3x2 left corner quarter ellipse so the L-shaped holes are at the right and the row of three holes is at the top. The smooth, curved side should be at the front. Push the pins on the crossbar, from the top into the left and right holes on the quarter ellipse.

15. Place the ocean assembly in front of you so it is horizontal, with the first half of the boat on the left. There should be two pins and one axle extending to the front from the first half of the boat. Rotate the second half of the boat 90 degrees counterclockwise so the crossbar is horizontal and the L-shaped hole pattern is at the back. Push the second half of the boat, from the front onto the pins and axle on the first half of the boat.

16. Find the pin extending up from the top of the boat. We'll put the sail there. Find a white panel fairing #3 small, smooth, long, side A. This piece has one smooth, curved side and one hollow side. It has a 2x3 L-shaped pattern of holes on one side, and no holes on the opposite side. It has two holes on one long side, and one perpendicular through hole on the opposite side. If you stand it up on the L-shaped hole pattern, with the smooth side at the back, the left side is taller than the right. Orient this so it stands upright, with the L-shaped hole pattern at the bottom, and the 3L row of holes at the front. Push the front left hole on the L-shaped hole pattern, from the top onto the pin on top of the boat.

Congratulations! Now this build is complete!

Thank you so much for building this set!

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