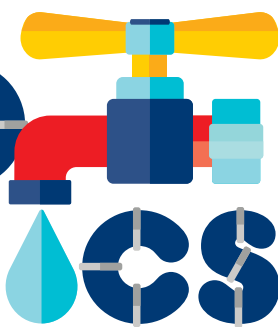


**FIRST
LEGO
LEAGUE**

2017/2018 Robot Game Field Setup



**HYDRO
DYNAMICS** SM



2017/2018 Robot Game Field Setup

The Field is where the Robot Game takes place.

- It consists of a Field Mat, on a Table with Border Walls, with Mission Models arranged on top.
- The Field Mat and the LEGO® elements for building the Mission Models are part of your Challenge Set.
- The instructions for building the Mission Models are [HERE](#).
- The instructions for how to build the Table and how to arrange everything on it are below.

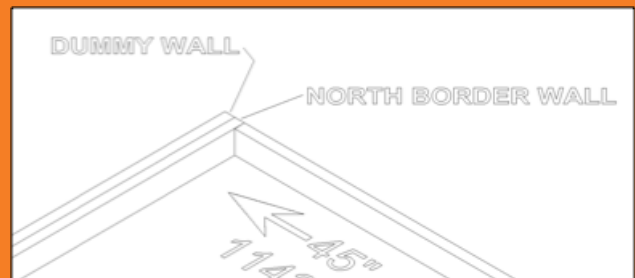
Table Construction

The Robot Game takes place on a Table with specific features, so you'll need to build one to practice on if you don't already have access to one. With weight, height, simplicity and cost in mind, a simple design is offered here, but as long as your surface is smooth, and your Border Walls are sized and located properly, how you build the understructure is up to you. The construction is simple, but does require some wood-working skill.

At a tournament, two Tables are placed back to back, but you only operate on one Table, so you only need to build one Table to practice on.

DUMMY WALL

Most Robot Games have a "shared" Mission, whose Mission Model(s) rest partly on your Table, and partly on the other team's Table, which is connected to your Table's north side. You don't need to build a second table, but you do need to build the necessary part of the other team's Table, so the shared Mission Model(s) can be positioned correctly. Here are the instructions for building one Practice Table, including its Dummy Wall:



MATERIALS

Material	Quantity
Challenge Set (Mission Model LEGO elements, Mat, Dual Lock™)	1
sanded plywood (or other very smooth board) 96" X 48" X at least 3/8" (2438mm X 1219mm X 10mm)	1
*two-by-three, 8' (2438mm) [actual cross-section = 1-1/2" X 2-1/2" (38mm X 64mm)]	6
flat black paint	1 pt. (1/2 L)
coarse drywall screws, 2-1/2" (64mm)	1/2 lb. (1/4 kg)
saw horses, about 24" (610mm) high and 36" (914mm) high	2

*NOTE: Tables with "two-by-four" walls are legal and common, but we're slowly phasing them out at tournaments. You may make your Practice Tables with two-by-four walls, but **you must be prepared to play on tables whose walls could range in height anywhere between 2-1/2" (64mm) and 3-1/2" (90mm), as shown in the diagram on the following page.**

PARTS

Part	Make From	Dimensions	Paint	Quantity
Table surface (A)	plywood	96" X 48" (2438mm X 1219mm)	no	1
long Border Wall (B)	two-by-three	96" (2438mm)	yes	3
short Border Wall (C)	two-by-three	45" (1143mm)	yes	2
*stiffener (D)	two-by-three	48" (1219mm)	no	4
saw horse	purchase	H = 24" (610mm) W = 36" (914mm)	no	2

*If you are using a table surface thicker than 1/2" (13mm) check for warpage/distortion – you may not need stiffeners.

ASSEMBLY

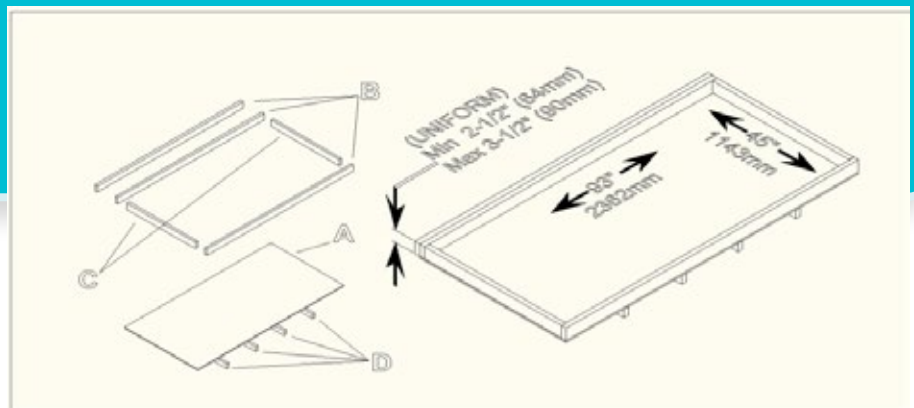
STEP 1 - See which face of the plywood (A) is least smooth, and consider that the bottom face. On the bottom face, clamp, then screw on the stiffeners (D) about every 18" (457mm). Be sure screw heads and splinters don't protrude.

STEP 2 - On the top face of the plywood, locate, clamp, and screw on the Border Walls (B,C) around the top perimeter.

- The inside wall-to-wall dimensions must measure $93\pm\frac{1}{8}"$ by $45\pm\frac{1}{8}"$ ($2362\pm 3\text{mm}$ by $1143\pm 3\text{mm}$).

- The height of B and C must measure between $2\text{-}\frac{1}{2}"$ (64mm) and $3\text{-}\frac{1}{2}"$ (90mm).
- All order Walls must be the same height as each other on all Tables at a tournament. Border heights at a tournament may be different than those on your practice Table.

STEP 3 - Place this table top on short saw horses (or milk crates, or anything else short and solid).



Field Mat Placement

STEP 1 - Vacuum the table top. Even the tiniest particle under the Mat can give the Robot trouble. After vacuuming, carefully run your hand over the surface and sand or file down any protruding imperfections you find. Then vacuum again.

STEP 2 - On the vacuumed surface (never unroll the Mat in an area where it could pick up particles), unroll the Mat so the image is up and its north edge is near the north/double Border Wall (note the location of the double wall in each Table sketch below). **Be very careful to not let the mat kink from bending in two directions at once.**

STEP 3 - The Mat is smaller than the playing surface by design. Slide and align it so that there is no gap between the south edge of the Mat and the south Border Wall, then center the Mat east-west, with equal gaps at left and right.

STEP 4 - With help from others, pull the Mat at opposite ends and massage out any waviness away from the center and re-check the requirement of Step 3. It is expected that some waviness will persist, but that should relax over time. Some teams use a hair dryer to speed the relaxation of the waviness.

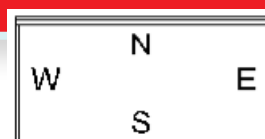
STEP 5 - OPTIONAL - To hold the Mat in place, you may use a thin strip of black tape at the east and west ends. Where the tape sticks to the Mat, it may cover the Mat's black border only. Where the tape sticks to the Table, it may stick to the horizontal surface only, and not the Border Walls.

STEP 6 - For a competition setup, Dummy Walls are not needed. Secure two Tables north-to-north. **The total span of Border between two Tables must measure between 3" (76mm) and 4" (100mm).**

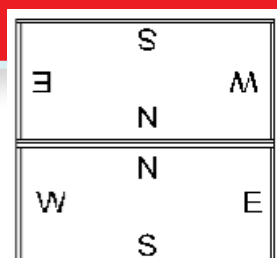


PRACTICE TABLE

TOURNAMENT TABLE



PRACTICE TABLE



TOURNAMENT TABLE

Mission Model Construction

BUILD THE MISSION MODELS

Use the LEGO elements from your Challenge Set, and instructions from [HERE](#). It will take a single person four to five hours to do this, so it's best done in a team construction party. For any team members with little or no experience building with LEGO elements, Mission Model construction is a great way to learn. This step is also a nice time for new team members to get to know each other.

QUALITY - The Models must be built **PERFECTLY**. "Almost perfect" is not good enough. Many teams make several building errors and practice all season with incorrect Models... When these teams later compete on Fields with correct Models, the Robot fails. The team incorrectly blames the Robot, the tournament organizers, or bad luck for the failure. Best practice is to have several people check for correctness. **Please!**

Mission Model Arrangement and Setup

DUAL LOCK - Some Models are "secured" to the Mat, while others are simply "placed" on the Mat. Each place on the Mat where a Model needs to be secured has a box with an "X" in it. The connection is made using the re-usable fastening material from 3M called "Dual Lock," which comes with the LEGO elements in your Challenge Set. Dual Lock is designed to "lock" to itself when two faces of it are pressed together, but you can unlock it too. The application process for the Dual Lock is only needed once. Afterward, the Models can simply be locked onto the Mat or unlocked. To apply Dual Lock, proceed one Model at a time...

STEP 1 - Stick one square, adhesive side down, on each box you see on the Mat with an "X" in it. For half-sized boxes, cut the squares in half.

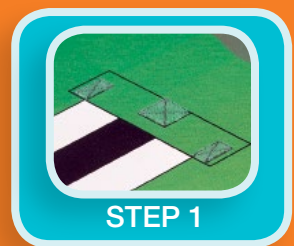
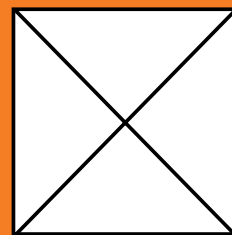
STEP 2 - Press a second square on top of each of those, "locking" them on, adhesive side **up**. TIP: Instead of using your finger, use a bit of the wax paper the squares came on.

STEP 3 - Align the Model exactly over its mark, and lower/press it onto the squares.

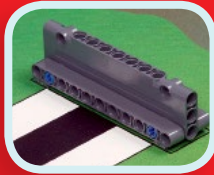
CAUTION - Pay attention... Some Models which seem symmetrical in fact have a directional feature somewhere.

- Be sure to place each square precisely on its box, and each Model precisely over its marks.
- When pressing a Model down, press down on its lowest solid structure instead of crushing the whole Model. Pull on that same structure if later you need to separate the Model from the Mat.

TIP - For large and/or flexible Models, apply only one or two pairs at a time. There's no need to do it all at once.



Mission Models (Simple Setups and Definitions)



BARRIERS



HOUSE



FIRETRUCK



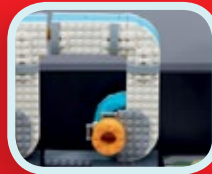
PENALTIES



FLOWER



FILTER



PUMP ADDITION



FAUCET



SLINGSHOT



CURBS



RAIN



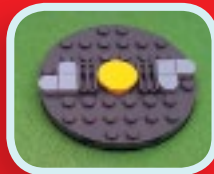
RAIN CLOUD AND RAIN



FOUNTAIN



BASE



MANHOLE COVER
WEST



MANHOLE COVER
EAST



SLUDGE



BROKEN PIPE



TRIPOD TARGETS



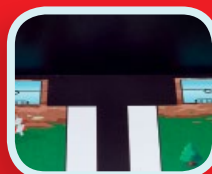
WATER WELL TARGET



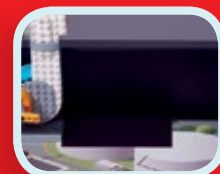
WATER TARGET



SLINGSHOT TARGET



PIPE CONSTRUCTION TARGET



PUMP ADDITION TARGET

NOTES FOR SIMPLE SETUPS AND TARGETS

BARRIERS: Secure each one with its smooth side facing west. There are six of these.

HOUSE: Secure the model, then lift the fire up, and push the yellow beam under it.

FIRETRUCK: Place loose, carefully parallel with marks. If Firetruck rolls by itself, level the Table enough to stop it.

PENALTIES: Give these to the referee. These are not needed on a practice field.

FLOWER: Secure with flower part down.

FILTER: Secure the model, then lift the lock lever (with a black ball on it), and pull the yellow plunger south to its mark.

PUMP ADDITION: Place loose.

FAUCET: Secure with cup's white/blue part flipped all the way down. Handle spins smooth, with a little resistance.

SLINGSHOT (Water Purifier): Install a Rain and the Dirty Water into the Slingshot, and close its black bar to keep the yellow plunger up. Waters must be flat-side down. Rain or Dirty Water can be installed in either side randomly.

CURBS: Secure Curbs with wedges facing the circles.

RAIN: See SLINGSHOT and RAIN CLOUD AND RAIN.

RAIN CLOUD AND RAIN: Secure with cloud part facing east. Move and hold yellow bar north while evenly spreading 8 Rain into the top. Perfectly even spread is not expected.

FOUNTAIN: Secure with fountain parts down.

BASE: The quarter-circle at southwest is Base. In Base, loosely store the Water Well, Tripod, the Optional Loop, both New Pipes, three Big Waters, and the loaded Slingshot. You may keep all these Models anywhere in Base, or in other approved off-Table storage.

MANHOLE COVERS: Place loose. Either cover can go on east or west mark, and spin is random.

SLUDGE: Place loose on the Water Treatment model per details below.

BROKEN PIPE: Place loose in the Pipe Repair setup per details below.

TRIPOD TARGETS: These large circles only. Either of these two large circles is a valid Tripod target.

WATER WELL TARGET: This large circle only.

WATER TARGET: Place loose. This target is movable during the match within a range described in Mission M16.

SLINGSHOT TARGET: Extends to the east wall. Does not include the barrier.

PIPE CONSTRUCTION TARGET: Extends to the north wall.

PUMP ADDITION TARGET: Extends to the north wall.

Mission Models (Advanced Setups)

STEPS FOR PUMP SYSTEM

STEP 1: Locate Dual Lock pairs exactly and only in the places shown.



PUMP SYSTEM STEP 1

STEP 2: Secure the model to the north Border Wall within its marks.



PUMP SYSTEM STEP 2

STEP 3: Load a Big Water into the model.



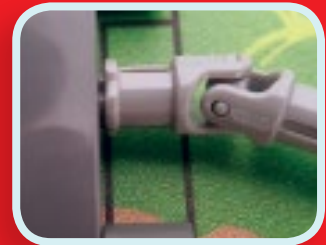
PUMP SYSTEM STEP 3



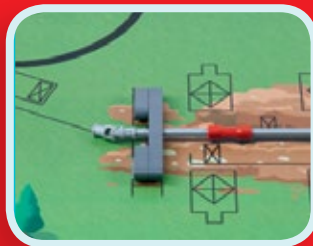
WATER TREATMENT STEP 1



WATER TREATMENT STEP 2



STEP 2 NO RUBBING



WATER TREATMENT STEP 3



WATER TREATMENT STEP 4



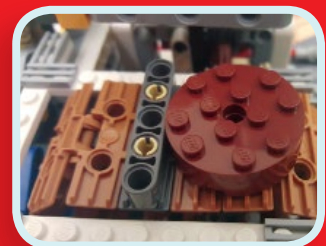
WATER TREATMENT STEP 5



WATER TREATMENT STEP 6



WATER TREATMENT STEP 7



STEP 7 RESET AND LOADED

Steps for Water Treatment

STEP 1: Secure the toilet as shown, with the east axle joined to it.

STEP 2: Join the center axle and secure the east bearing, keeping the center axle perfectly above its mark AND so the joiner is not rubbing tightly against the bearing.

STEP 3: Keeping the center axle perfectly above its mark, secure the west bearing.

STEP 4: Secure the two Water Treatment model's guides, then remove them (STEP 4 shows them secured).

STEP 5: Join the west axle and Water Treatment model, and fit the model as accurately as possible onto its mark.

STEP 6: Secure the guides, allowing the model a LITTLE bit of wiggle room (STEP 6 shows the model set/loaded).

STEP 7: To set the model, lift the white tank while pushing the gray bar west, then load the Sludge and a Big water.

TESTING: Push the Toilet's yellow lever down and hold it there. The push should take very little force, and should cause the Water Treatment model to eject the Big Water and Sludge. If there is binding, re-trace each step carefully.

MISSION MODELS (Advanced Setups)



PIPE REPAIR STEP 1a



PIPE REPAIR STEP 1b



PIPE REPAIR STEP 2



STEP 3



STEP 4

Steps for Pipe Repair

STEP 1a, 1b: Secure the ramps by tilting them up for access. Secure an end pad first, then the remaining three together.

STEP 2: Push the ramps down and apply the Dual Lock for the black pipes if you haven't already.

STEP 3: Without any force, set the black pipes over their marks, but NOT letting them rub the center axle. When you're SURE the black pipes are not rubbing the axle, that's the place to press them down.

STEP 4: Place the Broken Pipe as centered as possible between the ramps and black pipes. Be sure the loop is vertical and parallel to the ramps.

Field Maintenance

- **BORDER WALLS** - Remove any obvious splinters, and cover any obvious holes.
- **FIELD MAT** - Make sure the Mat touches the south Border Wall, and is centered east to west. Avoid cleaning the Mat with anything that will leave a residue. Any residue, sticky or slippery, will affect the Robot's performance compared to a new Mat (many tournaments use new Mats). Use a vacuum and/or damp cloth for dust and debris above and below the Mat. To get marks off, try a white-plastic pencil eraser. When moving the Mat for transport and storage, be sure not to let it bend into a sharp kink point, which could affect the Robot's movement.

Tournaments using new Mats should unroll the Mats as far in advance of the tournament day as possible. For control of extreme curl at the east or west edges of the Mat, black tape is allowed, with a maximum of ¼" (6 mm) overlap. Foam tape is not allowed. Do not put Dual Lock under the Mat, or use it for anything other than securing Mission Models as described.

- **MISSION MODELS** - Keep the Mission Models in original condition by straightening and tightening solid connections often. Ensure that spinning axles spin freely by checking for end-to-end play and replacing any that are bent.



Notes

<http://www.firstlegoleague.org>
<http://www.firstinspires.org>

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