Build a Human Habitat on Mars:

Exhibit Technical Manual

Science Museum of Minnesota®

NISE NATIONAL INFORMAL STEM EDUCATION NETWORK

Build a Human Habitat on Mars Exhibit Technical Manual:

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Shipping and Packing Information

Exhibit pieces are boxed, stretch wrapped, and banded to a pallet. Total dimensions are 96" long x 35" wide x 54" high. Each pallet weighs 390 lbs. The pallet will be delivered on a tractor trailer. Trailer length is 53’; total length of rig is 85-90’. The trailer will have a liftgate. Each pallet will have an attached shipping label pouch which includes shipping information and a copy of this technical manual

Image shows 3 exhibits palletized for shipment. You will receive 1 pallet.

Shipping label pouch

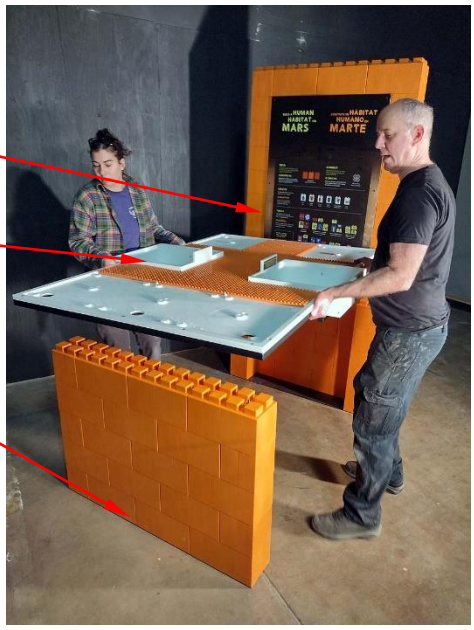
Exhibit Assembly Instructions

The following instructions apply to the Build a Human Habitat on Mars exhibit fabricated by the Science Museum of Minnesota.

Included Parts

Table Components:

1. Tall Leg Assembly (EverBlocks with metal base & graphics)
2. Tabletop Assembly (with part bins)
3. Short Leg Assembly (Everblocks with metal base)



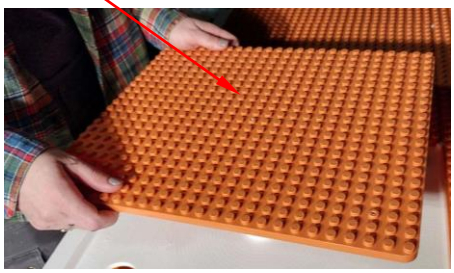
Box with Small Parts:

4. Orange landscape building blocks (9 bags)

5. Gray connector building blocks (2 bags)

6. Icon building blocks with stickers (1 bag)

7. Orange tabletop baseplates (5 each)

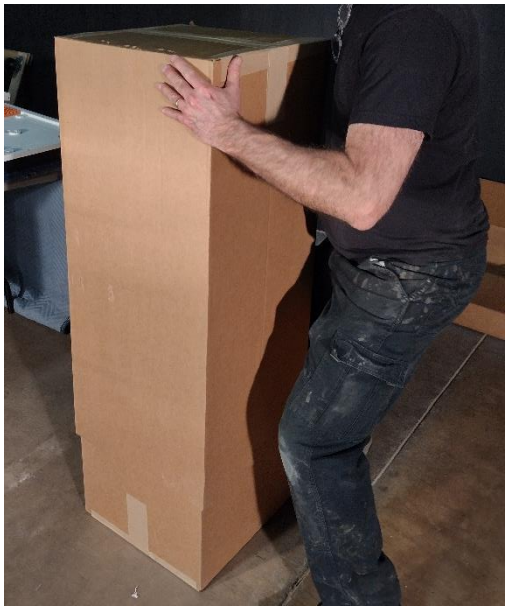


8. Challenge cards with hanger chain (2 sets)

9. Pan head screws & 9/16” socket with drive handle (1 bag)

10. Mesh bag for washing building blocks (1 each)

Carton with 4 Stools:



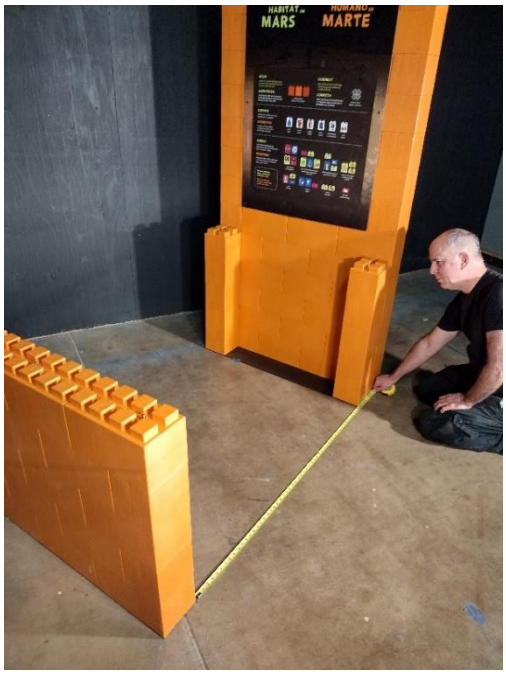
Assembly Tools

#2 Phillips screwdriver

Drill/Driver with #2 Phillips bit (optional)

9/16” socket with drive handle (included with exhibit)

Table Assembly Sequence



1. Space Short Leg Assembly and Tall Leg Assembly 54-1/2" apart, from inside face of Short Leg to inside face of leg extensions at Tall Leg.

Short Leg Assembly is symmetrical and may be oriented with either face to inside of table.

Inside Face of leg extension at Tall Leg

Inside face of Short Leg

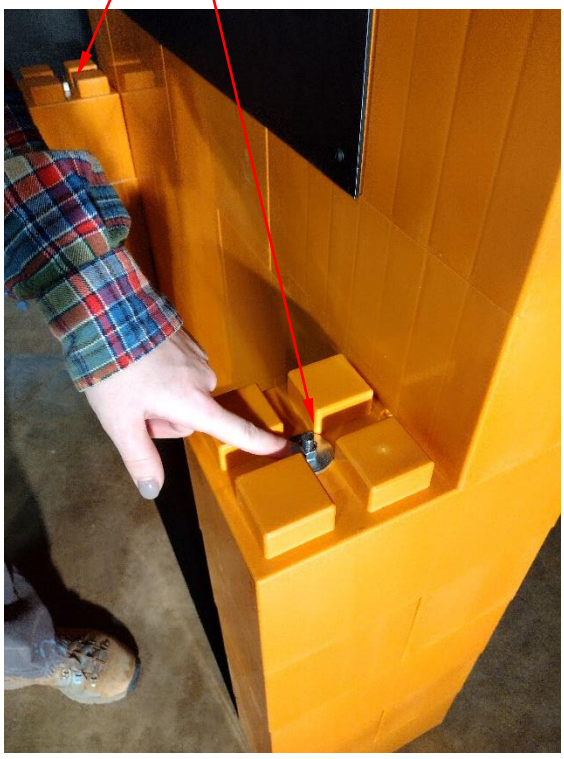
2. Using the 9/16” Socket & Handle, Remove the 3/8” hex nuts and fender washers from the top of the threaded rods at both the Short Leg and Tall Leg Assemblies.

   There are three (3) nuts with fender washers at the Short Leg Assembly and two (2) nuts with fender washers at the Tall Leg Assembly.

9/16” Socket & Handle

3/8” Hex Nut and Fender Washers at Short Leg Assembly (3 each)

3/8” Hex Nut and Fender Washers at Tall Leg Assembly (2 each)



3. With one person on each side of the Tabletop Assembly, carry the tabletop over the Short Leg and lower it onto Both the Short Leg and the extensions on the Tall Leg.

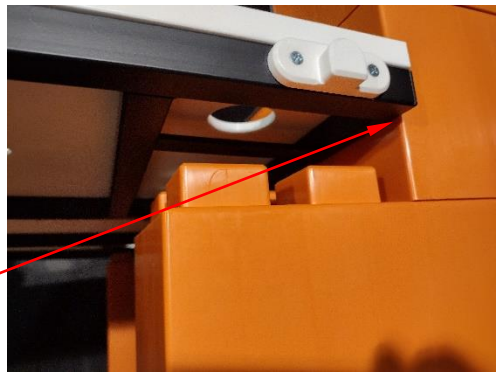
Note that the end with two (2) missing tiles goes over the Tall Leg extensions, and the end with three (3) missing tiles goes over the Short Leg.

The top may drop right into position when initially lowered. If not, be sure that it is stable before either person lets go.

If it doesn't settle directly into place, double check your measurement between Leg Assemblies. If it is only slightly off, the top can be lowered onto the extensions at the Tall Leg first before both installers move to the Short Leg. ***Be sure to keep your fingers clear of the space between the Tabletop metal frame and the EverBlock studs before the top is lowered!***

Bring Tabletop edge directly up against the inside face of the Tall Leg Assembly before lowering onto the EverBlock extensions

The steel frame at the Tabletop will slide directly over the studs on the EverBlock extensions.



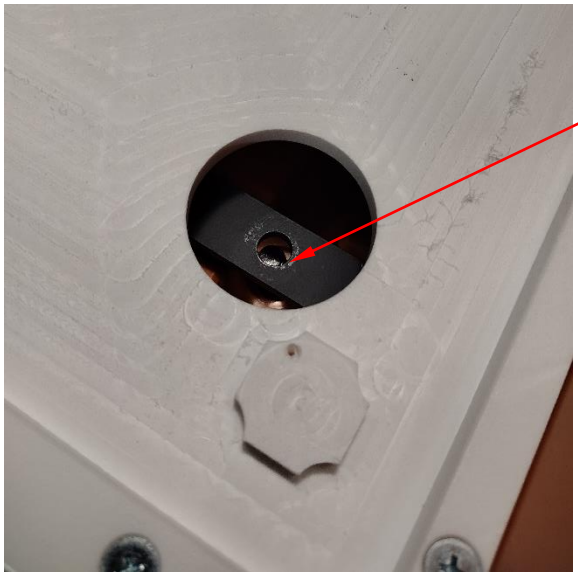
4. If the top is grossly out of position and your measurement between Leg Assemblies is off, it is best to lift the top off, set it aside, and re-align the legs before repeating Step 3.
5. After the Tabletop is placed over the Tall Leg extensions, it can be worked over the studs on the EverBlocks at the Short Leg Assembly. With one person lifting the tabletop from the end, the other person can shift the Short Leg Assembly into final position. ***Be sure to keep your fingers clear of the space between the Tabletop metal frame and the EverBlock studs before the top is lowered!***

The steel frame at the Tabletop will slide directly over the studs on the EverBlock extensions.

The steel frame at the Tabletop will slide directly over the studs on the EverBlocks at the Short Leg Assembly.

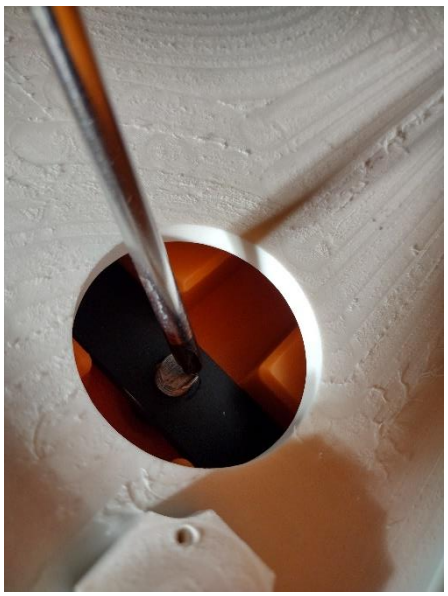
Tabletop in final position

6. The steel sub-frame at the Tabletop has clearance holes drilled in 5 locations to allow the 3/8" threaded rod ends inside the Short Leg Assembly and Tall Leg extensions to pass through. The threaded rod ends may not immediately pass through the holes.



3/8" threaded rod end caught below Tabletop metal subframe member.

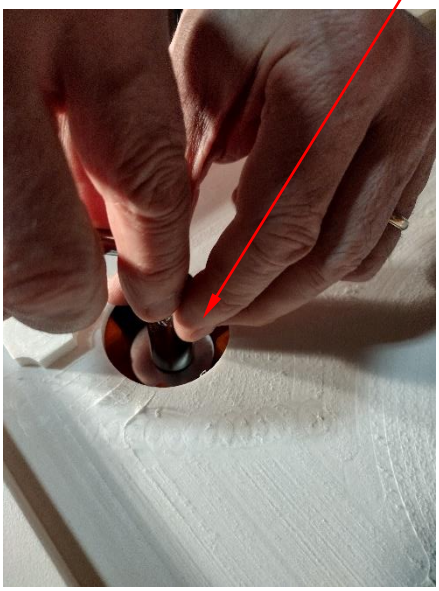
7. Using the end of a Phillips screwdriver, apply pressure to the end of the threaded rod and draw it toward the center of the sub-frame hole. The Tabletop will drop into place over the rod. Repeat for all five (5) threaded rods.



8. Replace the five (5) sets of 3/8” fender washer and hex nuts that were removed earlier. Three (3 sets at the Short Leg and two (2) sets at the Tall Leg extensions.

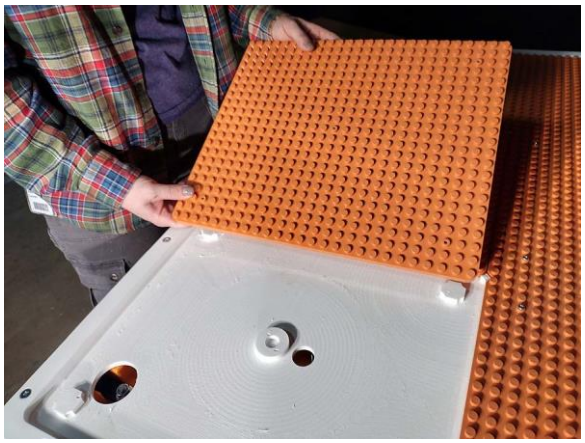
Finger-tighten the nuts and washers against the metal straps of the Tabletop sub-frame, then snug them up with the 9/16” socket and handle. **Do not overtighten!** Snug with the socket + an additional 1/4-1/2 turn should be plenty. The Tabletop will be slightly compressed against the Leg Assemblies, without crushing the orange EverBlocks.

Finger-tighten fender washer and 3/8” hex nut at 5-each threaded rod ends



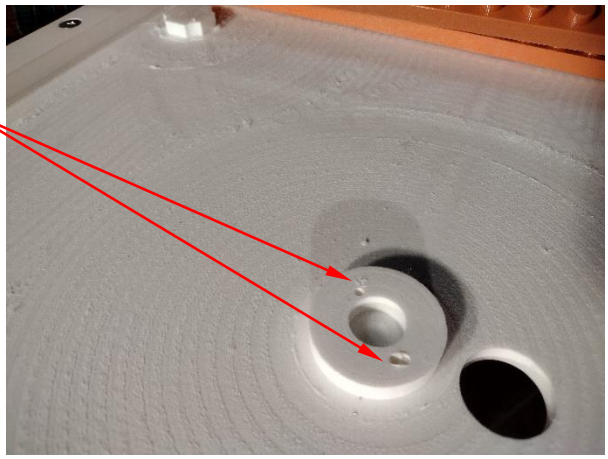
Snug up 3/8” hex nuts with socket and handle.

9. Place the five (5) loose orange baseplates onto the Tabletop to cover the Leg Assembly holes. The baseplates are interchangeable, but are rectangular and will only fit in one direction. They will drop over the studs incorporated into the white Tabletop when correctly oriented.

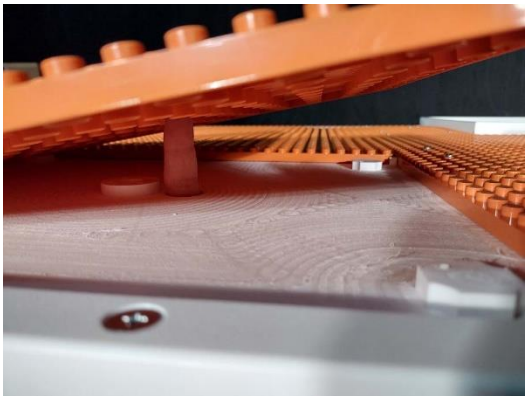


Each baseplate will be secured with five (5) pan head screws. The screw at the 'center' of each baseplate is slightly off-center. Two holes have been provided at the corresponding white studs in the Tabletop. When a baseplate is set into place, its 'center' hole will align with one of these two holes.

One of these two holes will align with 'center' hole of orange baseplate when it is set in place



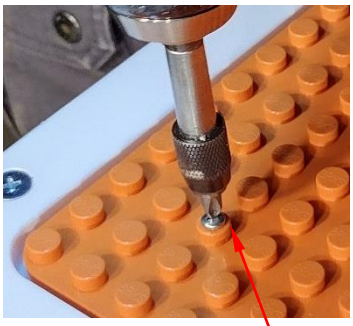
If you need to remove a baseplate for any reason, finger holes have been provided in the Tabletop to allow them to be pushed up from below



10. Secure each orange baseplate to the Tabletop with five (5) of the supplied Phillips pan head screws, through the pre-drilled holes in the baseplate and into the pre-piloted holes in the studs on the white, HDPE plastic Tabletop.

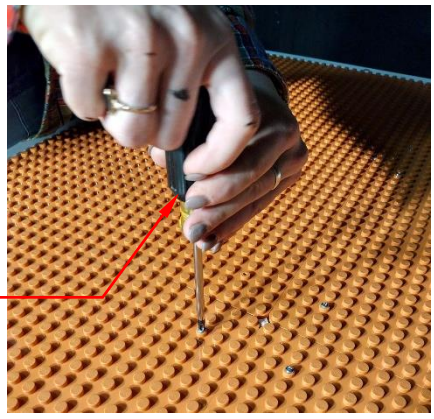
    This may be done with a manual #2 Phillips screwdriver, or with a drill/driver. ***Be careful if using a drill/driver so as not to overtighten the screws and crack the baseplate studs!***

Five (5) pan head screws per orange baseplate

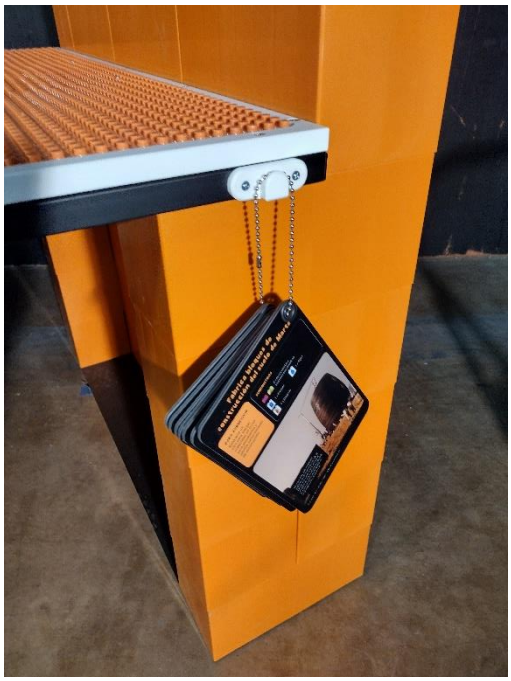


Pan head screw

Final tightening with a manual screwdriver is recommended to prevent overtightening and cracking a baseplate stud



11. Distribute the nine (9) bags of orange landscape building blocks, two (2 bags) of grey connector building blocks, and the bag of icon building blocks with stickers between the part bins



12. Hang a set of Challenge Cards over the two (2) hooks provided – one at each side of the tabletop near the tall end.

13. Unpack the carton of four (4) stools, unwrap them, and set them around the exhibit.

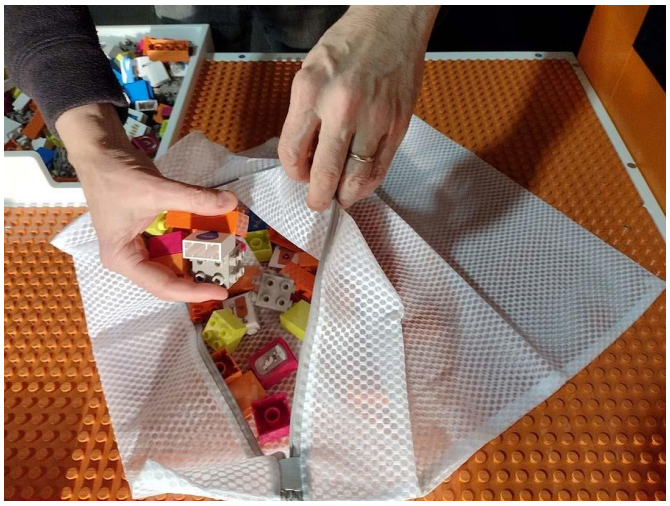
Exhibit Disassembly and Shipping

If you need to disassemble the piece to ship to another host site, please follow the reverse of the assembly instructions. The exhibit is not designed to be moved and shipped as an assembled unit. If not disassembled, the exhibit may be damaged, and may not fit through facility doorways or into a delivery vehicle. If you plan to ship the exhibit, consider saving the original pallet and packing materials for re-use.

Cleaning Instructions

The orange landscape building blocks, grey connector building blocks, and stickered icon building blocks can all be washed in a Washing Machine.

1. Place them in the supplied mesh laundry bag and zip close.
2. Wash on a warm (*not* hot), delicate cycle.
3. Use a small amount of mild, liquid detergent (Kirkland brand Ultra Clean Free & Clear detergent worked well in testing).
4. Air dry only, on a soft towel.
5. Do *not* wash building blocks in a dishwasher due to risk of parts or the bag melting to a heating element.

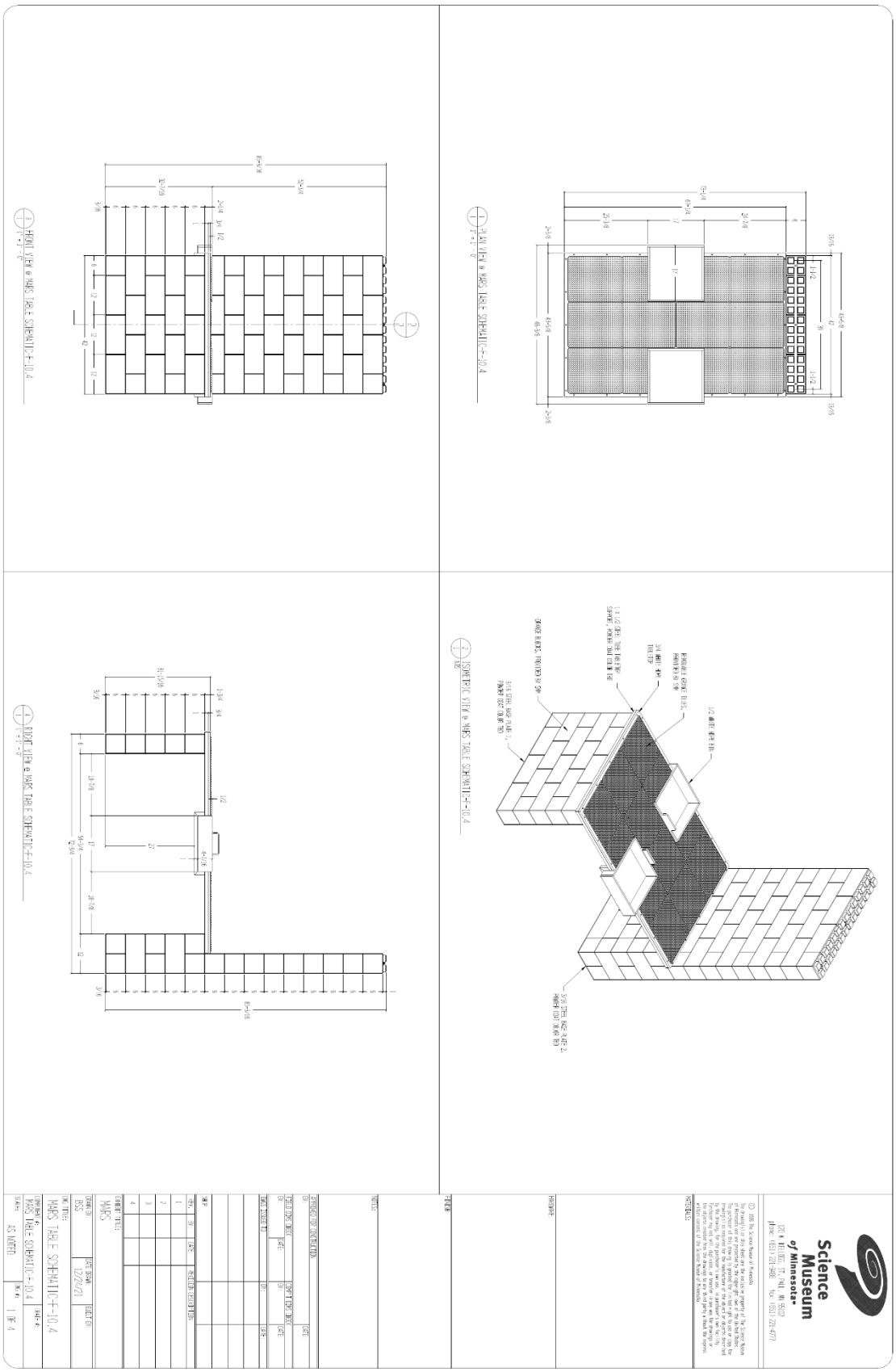


All other exhibit parts -including exhibit table surfaces, stools, and faces of exhibit graphics, may be cleaned and sanitized with a food-grade solution of ½ oz chlorine bleach per gallon of water, applied with a spray bottle and wiped down with a clean rag. Do *not* increase the concentration of bleach, as this will require secondary rinses with clear water, and may eventually damage exhibit finishes.

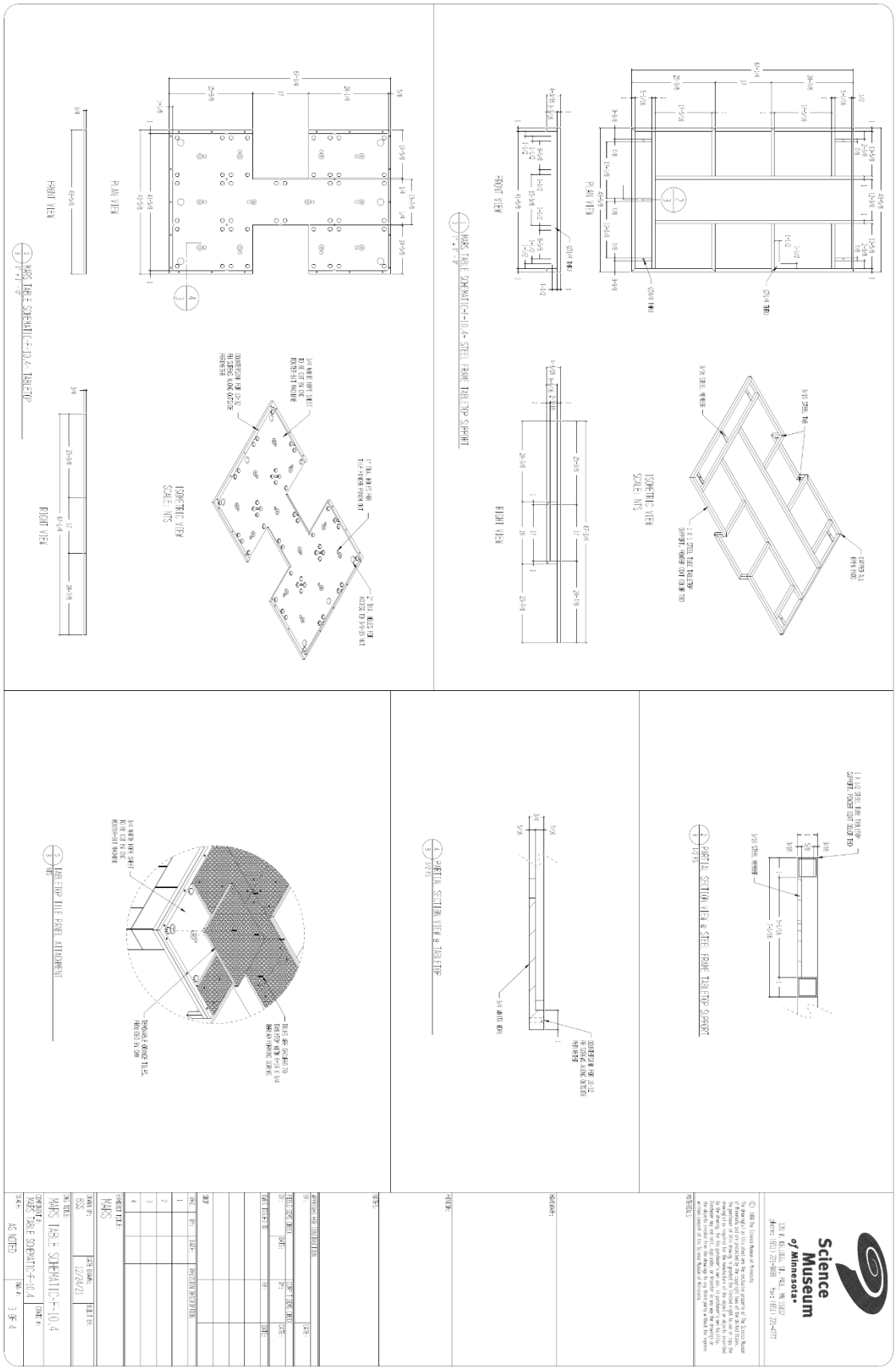
Exhibit Construction Drawings

The following 4 pages contain reduced-size reproductions of the Mars Table Construction Drawings.

For Architectural D sized layouts (24" x 36"), see https://www.nisenet.org/marshabitat.


FRONT VIEW @ MARS TABLE SCHEMATIC-F-10.4
PLAN VIEW @ MARS TABLE SCHEMATIC-F-10.4
RIGHT VIEW @ MARS TABLE SCHEMATIC-F-10.4
ISOMETRIC VIEW @ MARS TABLE SCHEMATIC-F-10.4
Science Museum of Minnesota
MARS TABLE SCHEMATIC-F-10.4
AS NOTED
1 OF 4

EARTH VIEW @ MARS TABLE SCHEMATIC-F-10.4
SECTION VIEW @ MARS TABLE SCHEMATIC-F-10.4
DETAILS @ MARS TABLE SCHEMATIC-F-10.4
Science Museum of Minnesota
MARS TABLE SCHEMATIC-F-10.4
MARS
SCS
12/24/21
AS NOTED
2.0F-4


PLAN VIEW
FRONT VIEW
RIGHT VIEW
ISOMETRIC VIEW
SCALE: NTS
MARS TABLE SCHEMATIC-F-10.4 STEEL FRAME TABLETOP SUPPORT
MARS TABLE SCHEMATIC-F-10.4 TABLETOP
PARTIAL SECTION VIEW & STEEL FRAME TABLETOP SUPPORT
PARTIAL SECTION VIEW @ TABLETOP
TABLETOP TILE PANEL ATTACHMENT
Science Museum of Minnesota
MARS TABLE SCHEMATIC-F-10.4
AS NOTED

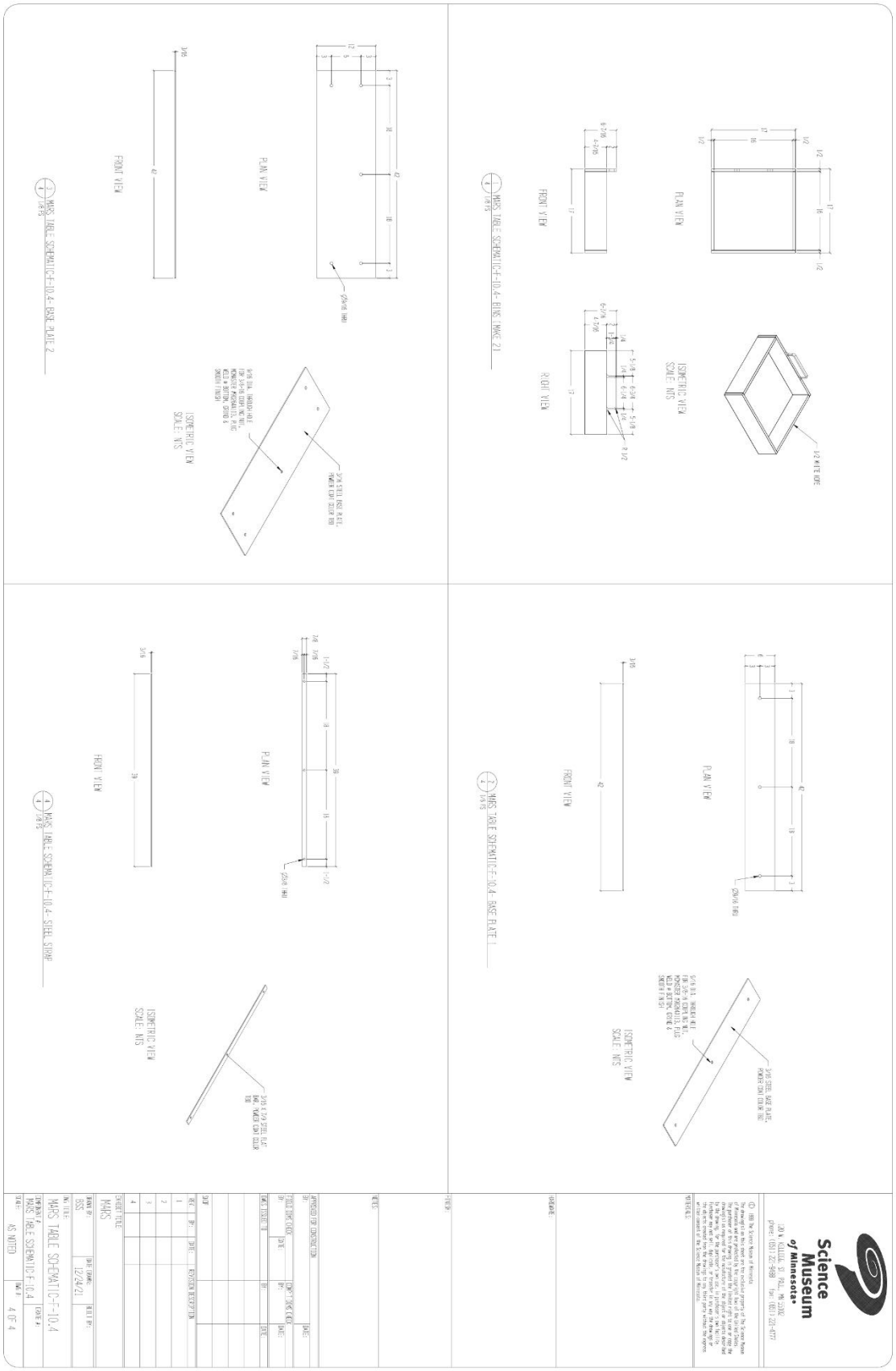

MARS TABLE SCHEMATIC-F-10.4- BASE PLATE 2
MARS TABLE SCHEMATIC-F-10.4- BINS MAKE 21
MARS TABLE SCHEMATIC-F-10.4- STEEL STRAP
MARS TABLE SCHEMATIC-F-10.4- BASE PLATE 1
PLAN VIEW
FRONT VIEW
ISOMETRIC VIEW
SCALE: NTS
Science Museum of Minnesota
MARS TABLE SCHEMATIC-F-10.4
12/24/21
AS NOTED
4 OF 4

Exhibit Graphics Package

Below is a list of the fonts and color palette used for the exhibit graphics:

MARS EXHIBIT

FONTS

Dbt Writing Black Bold
headline, subheadings, body text

Avenir Black
image credits

Dbt Writing Medium Regular
body text

Avenir Roman
body text, image credits

COLORS

LAB: PANTONE 388 C
HEX:#e0e721
RGB: 224 231 33
CMYK: 3 0 86 9

LAB: PANTONE 150 C
HEX: #ffb25b
RGB: 225 178 91
CMYK: 0 30 64 0

LAB: PANTONE 1375 C
HEX: #ff9e18
RGB: 225 158 24
CMYK: 0 45 96 0

HEX: #101c2b
RGB: 16 28 43
CMYK: 88 76 54 68

The following 7 pages list all graphics in the exhibit by SMM graphic name and ID number along with a reduced-size reference image for each item. Information is also included regarding print media, substrates, and overlaminates used for each graphic, along with the quantity supplied with the exhibit.

Copies of high-quality PDFs as well as original Adobe InDesign, Adobe Illustrator, and other related files for graphic reproduction may be found here: https://www.nisenet.org/marshabitat. The files are laid out for large-quantity, professional printing of the original exhibits. Partners are free to use these files to produce replacement graphics but are responsible for sourcing their own vendors to adapt files and print in small quantities.

100.GR.01 Entry Graphic

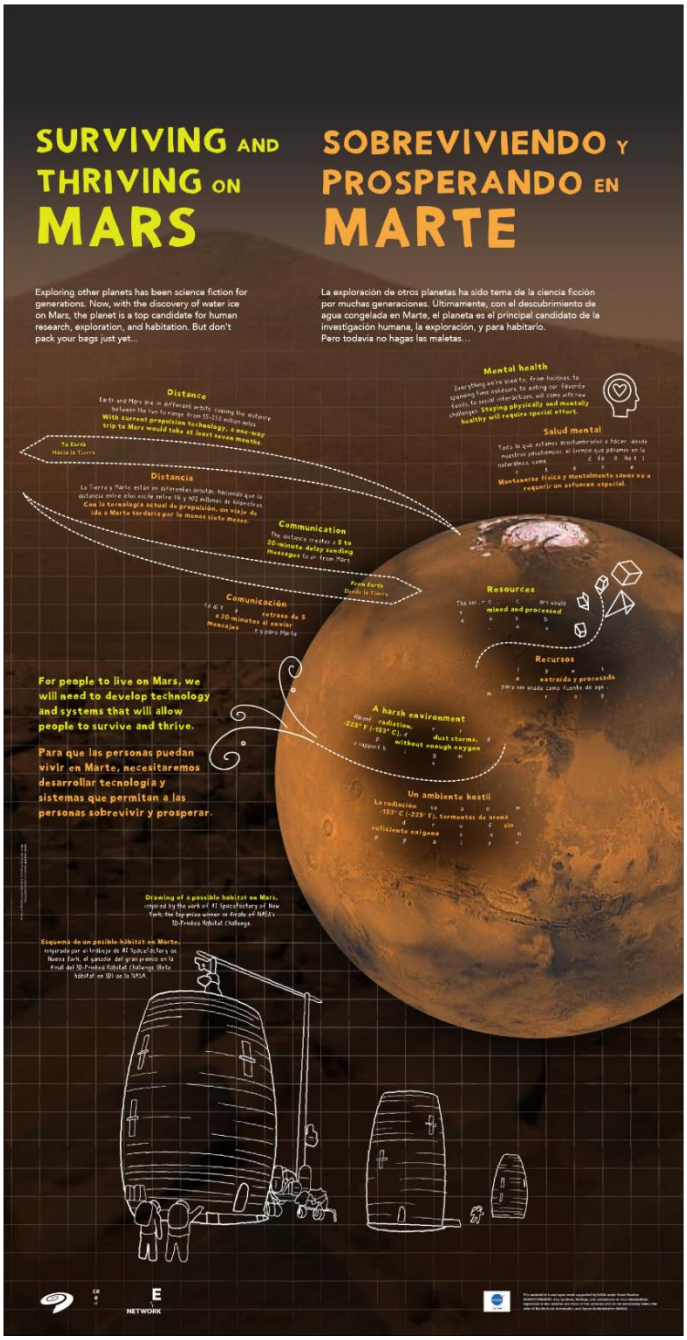
41" x 80.1875"

One copy per Exhibit, mounted to 3mm black Sintra

Sihl PhotoGloss 3171 print film

DryTac Emerytex PST51164 overlaminate

PSA29510 SureTacWhite adhesive film for mounting to substrate



200.GR.01 Main Instruction Graphic

30" x 42"

One copy per Exhibit, mounted to 3mm black Sintra

Sihl PhotoGloss 3171 print film

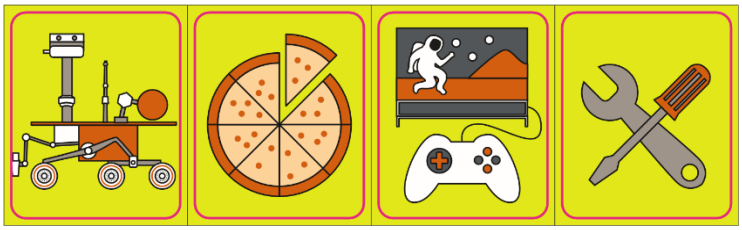
DryTac Emerytex PST51164 overlaminate

PSA29510 SureTacWhite adhesive film for mounting to substrate

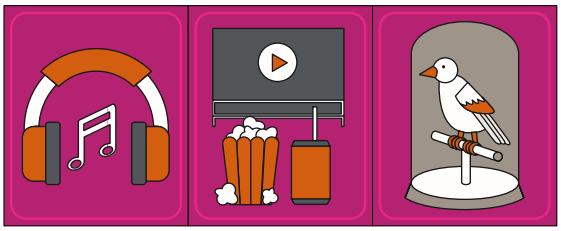
300.GR.01 Bin Instruction Label
6.25" x 1.75"
Two copies per Exhibit, mounted to 3mm black Sintra
Sihl PhotoGloss 3171 print film
DryTac Emerytex PST51164 overlaminate
PSA29510 SureTacWhite adhesive film for mounting to substrate
Red outline is a non-printing cut line

Tall Building Block Labels (Stickers)
Printed on HP Permanent Adhesive Vinyl
Laminated with 3M Envision 8548G
Red line denotes non-printing cut profile

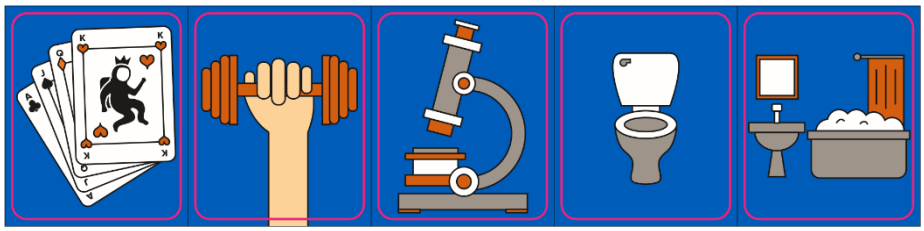
400.GR.03, GR.05, GR.06, GR.08
1.15” x 0.65”
10 Copies per Exhibit



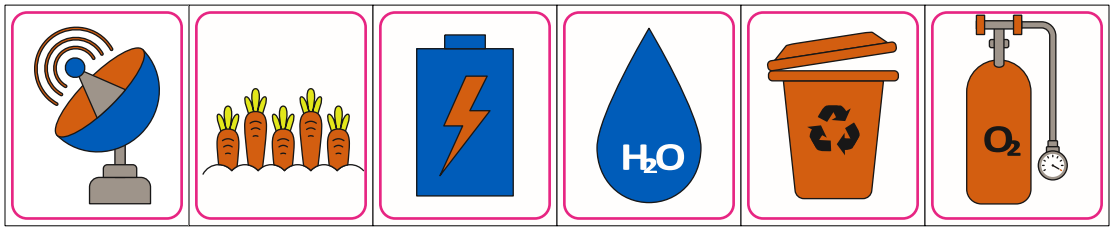
400.GR.01, GR.04, GR.09
1.15” x 0.65”
10 Copies per Exhibit



400.GR.02, GR.07, GR.10, GR.11, GR.12
1.15" x 1.4"
10 Copies per Exhibit

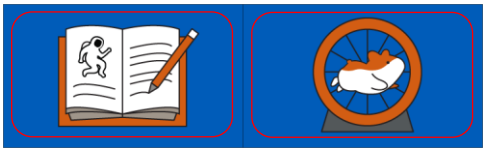


400.GR.13, GR.14, GR.15, GR.16, GR.17, GR.18
1.15" x 1.4"
25 Copies per Exhibit

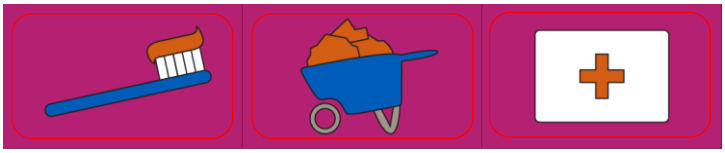


Short Building Block Labels (Stickers)
Printed on HP Permanent Adhesive Vinyl
Laminated with 3M Envision 8548G
Red line denotes non-printing cut profile

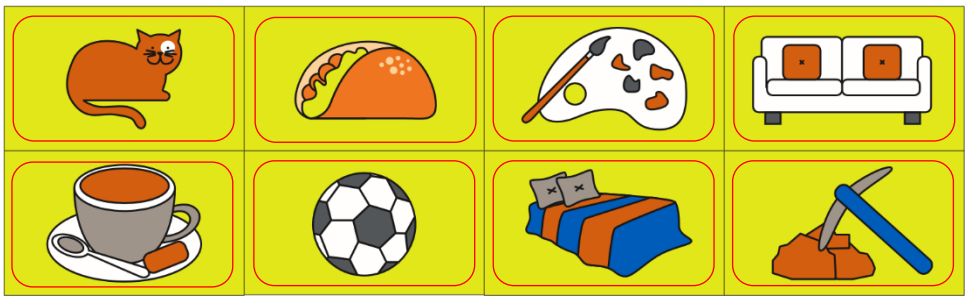
401.GR.03, GR.08
1.15” x 0.65”
10 Copies per Exhibit



401.GR.01, GR.10, GR.13
1.15” x 0.65”
10 Copies per Exhibit

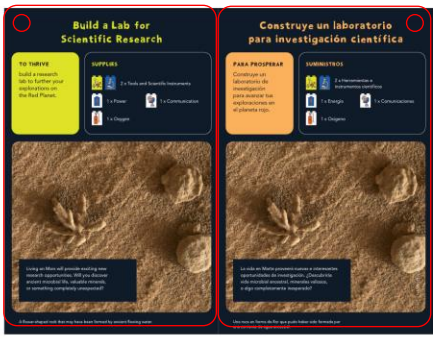


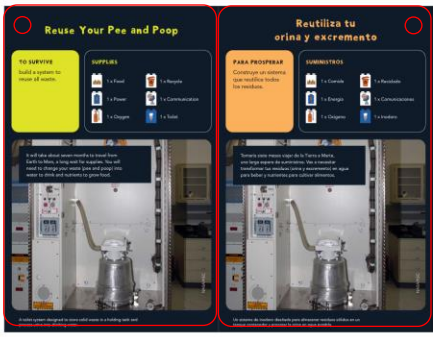
400.GR.02, GR.04, GR.05, GR.06, GR.07, GR.09, GR.11, GR.12
1.15” x 0.65”
10 Copies per Exhibit

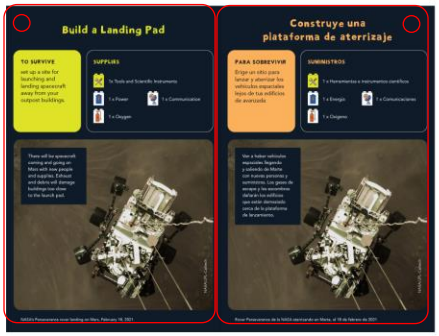


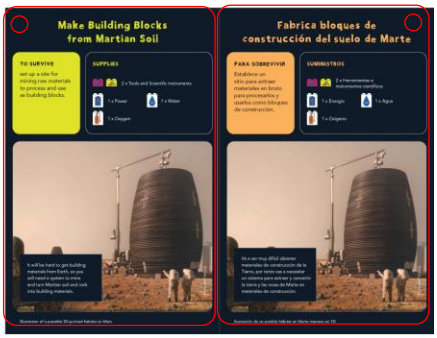
500.GR.01-14 Challenge Cards (7-card Set, English & Spanish mounted back-to-back

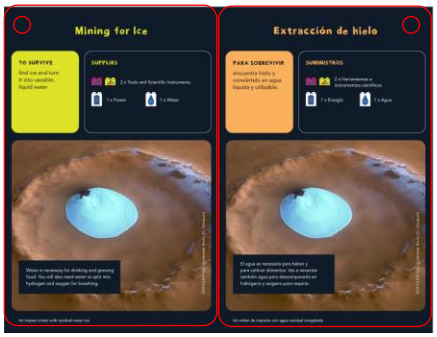
6" x 9"
2 Copies of 7-card Set per Exhibit, mounted to 0.030” black styrene
Sihl PhotoGloss 3171 print film
DryTac Emerytex PST51164 overlaminate
PSA29510 SureTacWhite adhesive film for mounting to substrate
Red outline is a non-printing cut line











600.GR.01-04 Stool Seat Tops

12” x 12”

2 copies per Exhibit, mounted to 3mm black Sintra

Sihl PhotoGloss 3171 print film

DryTac Emerytex PST51164 overlaminate

PSA29510 SureTacWhite adhesive film for mounting to substrate

Routed to circular profile

Replacement Blocks

EverBlock® Modular Building Blocks

The large blocks used for the table end sections are EverBlocks, all in the 12” x 6” full block configuration. *The blocks used in the exhibit were custom molded to match Pantone 7577C.* Their stock color ‘Orange’ may be a close match if replacements are needed.

EverBlock Systems
3236 California St. NE
Minneapolis, MN 55418
United States Of America
844-325-5457
sales@everblocksystems.com
https://www.everblocksystems.com/12-x-6-full-block/

Big Briks™

The exhibit building blocks are all in the Big Briks format from Strictly Briks®. Replacement parts might be found at https://strictlybriks.com/product-category/brik-sets/big-briks/. A contact form is available online.

Strictly Briks is a subsidiary of Cap Hill Brands. The custom colored Big Briks used in the Exhibit were sourced in large quantities through Cap Hill Brands. Going directly to Cap Hill for replacement parts will only work for large quantity orders. General contact email for Cap Hill is: hello@caphillbrands.com

BigBriks are compatible with Lego® Duplo® building blocks. You may use Duplo building blocks as replacement blocks.

The following 4 pages include a listing of all Big Briks used in the exhibit.

Big Brik Baseplates and Big Brik Quantities per Exhibit

CK

3/30/2023

Stud Configuration

Order Item #	Item Description	Face	Depth	Total Stud Count	Block Height	Pantone Color Match #	Quantity per Table	Notes
1	Baseplate: Stackable Baseplate BB 16.25" x 13.75"	26	22	572	NA	7577C	13	*Measured dimension: 16.375" (415.9mm) x 13.875" (352.4mm)*
2	Build Block A1: Big Block 4 x 2 - single height	4	2	8	1X	7577C	30	*'Primary Topo/Brick' color*
3	Build Block A2: Big Block 4 x 2 - single height	4	2	8	1X	1595C	15	*'Extra Brick' color #1*
4	Build Block A3: Big Block 4 x 2 - single height	4	2	8	1X	718C	15	*'Extra Brick' color #2*
5	Build Block B1: Big Block 2 x 2 - single height	2	2	4	1X	7577C	30	*'Primary Topo/Brick' color*
6	Build Block B2: Big Block 2 x 2 - single height	2	2	4	1X	1595C	15	*'Extra Brick' color #1*
7	Build Block B3: Big Block 2 x 2 - single height	2	2	4	1X	718C	15	*'Extra Brick' color #2*
8	Build Block C1: Big Block 2 x 1 - double height	2	1	2	2X	7577C	30	*'Primary Topo/Brick' color*
9	Build Block C2: Big Block 2 x 1 - double height	2	1	2	2X	1595C	15	*'Extra Brick' color #1*
10	Build Block C3: Big Block 2 x 1 - double height	2	1	2	2X	718C	15	*'Extra Brick' color #2*
11	Survive Block C1: Big Block 2 x 1 - double height	2	1	2	2X	White	25	*Communication/Satellite Dish*

12	Survive Block C2: Big Block 2 x 1 - double height	2	1	2	2X	White	25	*H_2O/Water Drop*
13	Survive Block C3: Big Block 2 x 1 - double height	2	1	2	2X	White	25	*Power/Battery*
14	Survive Block C4: Big Block 2 x 1 - double height	2	1	2	2X	White	25	*Crops/Carrots*
15	Survive Block C5: Big Block 2 x 1 - double height	2	1	2	2X	White	25	*Waste/ Recycle Bin*
16	Survive Block C6: Big Block 2 x 1 - double height	2	1	2	2X	White	25	*O_2/Oxygen Tank*
17	Thrive Block B1: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Mining/Pickaxe and Stone*
18	Thrive Block B2: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Art/Paintbrush and Palette*
19	Thrive Block B3: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Sports/Soccer Ball*
20	Thrive Block B4: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Pets/Cat*
21	Thrive Block B5: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Comfort/Sofa*
22	Thrive Block B6: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Comfort/Nice Bed*
23	Thrive Block B7: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Food/Taco*
24	Thrive Block B8: Big Block 2 x 2 - single height	2	2	4	1X	388C	10	*Drink/Coffee*
25	Thrive Block C1: Big Block 2 x 1 - double height	2	1	2	2X	388C	10	*Entertainment/TV and Gamepad*
26	Thrive Block C2: Big Block 2 x 1 - double height	2	1	2	2X	388C	10	*Explore/Mars Rover*

27	Thrive Block C3: Big Block 2 x 1 - double height	2	1	2	2X	388C	10	*Work/Wrench and Screwdriver*
28	Thrive Block C4: Big Block 2 x 1 - double height	2	1	2	2X	388C	10	*Food/Pizza*
29	Thrive Block B1: Big Block 2 x 2 - single height	2	2	4	1X	300C	10	*Write/Journal and Pen*
30	Thrive Block B2: Big Block 2 x 2 - single height	2	2	4	1X	300C	10	*Pets/Hamster and Hamster Wheel*
31	Thrive Block C1: Big Block 2 x 1 - double height	2	1	2	2X	300C	10	*Exercise/Arm with Dumbbell*
32	Thrive Block C2: Big Block 2 x 1 - double height	2	1	2	2X	300C	10	*Bathroom/Toilet*
33	Thrive Block C3: Big Block 2 x 1 - double height	2	1	2	2X	300C	10	*Research/Microscope*
34	Thrive Block C4: Big Block 2 x 1 - double height	2	1	2	2X	300C	10	*Bathroom/Sink and Bathtub*
35	Thrive Block C5: Big Block 2 x 1 - double height	2	1	2	2X	300C	10	*Entertainment/Playing Cards*
36	Thrive Block B1: Big Block 2 x 2 - single height	2	2	4	1X	675C	10	*Mining/Wheelbarrow with Rocks*
37	Thrive Block B2: Big Block 2 x 2 - single height	2	2	4	1X	675C	10	*Hygiene/Toothbrush*
38	Thrive Block C1: Big Block 2 x 1 - double height	2	1	2	2X	675C	10	*Entertainment/Headphones with Music*
39	Thrive Block C2: Big Block 2 x 1 - double height	2	1	2	2X	675C	10	*Entertainment/Movie, Popcorn, and Soda*
40	Thrive Block C3: Big Block 2 x 1 - double height	2	1	2	2X	675C	10	*Pets/Bird in Cage*

41	3D Connector Block	2	2	20	2X	402C	130	*A cube with 4 studs at 5 faces (top + 4 sides) and open bottom*
42	Thrive Block B3: Big Block 2 x 2 - single height	2	2	4	1X	675C	10	*Medical/First Aid*

'DIY' Exhibit

Anyone interested in replicating this exhibit is welcome to do so. Previous sections of the manual contain fabrication drawings, links to all graphic files and materials used for print production, and specifications for custom molded parts. For anyone interested in creating their own version, here are a few suggestions:

Building Blocks

- This exhibit uses Strictly Briks® Big Briks™building blocks, base plates, and 3D connector blocks, which are available for purchase online through Strictly Briks® or Amazon. These blocks connect with Lego® Duplo®-style blocks of all kinds. Feel free to use similar resources you may already have, or start with an online source such as the following to purchase building blocks:

  https://strictlybriks.com/

  https://www.bricklink.com/v2/main.page

  https://www.lego.com/en-us/pick-and-build/pick-a-brick

  Note: When purchasing Big Briks, stock colors may be limited but should be sufficient to identify each type of part by a different color.

Table Construction

- The orange baseplates can be screwed down to a plywood tabletop using #6 pan head screws, 5-per baseplate. Look in the Exhibit Assembly Instructions for corresponding images.
- As mentioned in the Replacement Blocks section, the large blocks used for the table ends are EverBlocks®, all in the 12" x 6" full block configuration. *The blocks used in the exhibit are custom molded to match Pantone 7577C.* Their stock color 'Orange' may be a close match.

Stickers for Icon Building Blocks

- 8-1/2" x 11" (Letter) and 11" x 17" (Tabloid) white, printable vinyl sticker sheets are available at many office supplies stores and online. Amazon has a selection of letter-sized material, and some options in tabloid-sized sheets.

  There are PDF templates available to produce single exhibit sets of replacement vinyl stickers using your own printer. These are the only graphics print files set up for small quantity printing. The replacement sticker files may be found at https://www.nisenet.org/marshabitat.

  SMM has not tested printing on materials other than those used in the production version of the exhibit. You will need to test the suitability of sticker material you purchase for print quality, and adhesion to your building blocks.

Replacing Building Block Stickers

- To remove old stickers from building blocks, peel off as much as possible. Any remaining vinyl can be scraped off with a stiff squeegee or an old credit card. Denatured isopropyl alcohol (91%) will help with any adhesive removal. Do NOT use acetone, lacquer thinner, or strong citrus solvents, as they will etch or dissolve the ABS plastic.

- As noted above, 8-1/2" x 11" (Letter) and 11" x 17" (Tabloid) white, printable vinyl sticker sheets are available at many office supplies stores and online. Using the PDF templates available you can print replacement vinyl stickers, but again, please note that you will want to test your stickers on the building blocks to ensure the right print quality and adhesion.

  Replacement Sticker files may be found at: https://www.nisenet.org/marshabitat

Acknowledgment of Support

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