

# PORTLAND STREETCAR INSTRUCTIONS

## 1. THE PROTOTYPE CAR AND THE MODEL

### a. THE PROTOTYPE CAR

Seven Skoda-Inekon 10T cars were purchased by the municipally owned Portland Streetcar in 2000. The cars have been operating successfully since July 20<sup>th</sup> 2001. The system provides convenient and efficient north - south transportation for the city. See the reference section for web sites where pictures of the cars can be viewed.

### b. THE MODEL



The model started life as a 3D computer model developed using CAD. After many hours of development and reviews, the design was finalized and a master was rapid prototyped from the 3D CAD model. The master was then used to make rubber molds and the production models are cast in urethane in those molds. Car body sections have designations assigned for reference in the instructions:

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Section 'A' - front end section with pantograph

Section 'B' - center section

Section 'C' - end section without pantograph

It has been determined by testing that a single Q Car Company power unit and a trail truck is sufficient to power the model. Additional weight was not added to the model and the tracking was good.

c. **CHECK THE KIT CONTENTS** – The kit contains the following parts. Contact Island Modelworks if any parts are missing.

2 End section bodies and floors

1 Center section body and floor

1 Small roof box for the A end section

2 Large roof boxes for the C end section

1 Small 3 section box for the C end section

6 extra seats, 3 each for Sections A and C

2 Operator's cab partitions

2 Operator's Control Consoles

2 End windshields

2 sets of side glass for the ends and center sections.

d. **CAR BODY DIAPHRAGMS** – Making the folded gray paper diaphragms is described in Section 4c. The diaphragms will be equipped with styrene end plates and will be designed to slide down into the flanges on the section ends.

Complete 20 lb. gray paper diaphragms are also available from Charlie Pitts. They are priced at \$7.00 per diaphragm. Send a check or money order for \$16.00 for two diaphragms including shipping to,

Charlie Pitts

499 Nichols Street

Norwood, MA 02062

e. **DECALS** - Decals are under preparation. Details and costs will follow when available.

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## 2. REFERENCES

### a. PICTURES AND DESCRIPTIVE MATERIAL

- <http://world.nycsubway.org/us/portland/streetcar.html>
- <http://portlandstreetcar.org/>
- [http://en.wikipedia.org/wiki/Portland\\_Streetcar](http://en.wikipedia.org/wiki/Portland_Streetcar)
- <http://www.railwaypreservation.com/vintagetrolley/portland%20streetcar.htm>
- <http://www.trainweb.org/mccann/streetcar.htm>

### b. ROSTER AND COLOR SCHEMES, Attachment 1

### c. MODELING MATERIAL AND PARTS, Attachment 2

### d. CAR BODY DIAPHRAGMS, Attachment 3

## 3. CLEAN-UP AND PREPARATION

**Caution – The clean-up and preparation of urethane casting should not be rushed. The material is soft and can be easily nicked, gouged or otherwise damaged if proper caution is not used.**

- a. **CLEAN-UP** – Start by thoroughly washing the body pieces with a mild detergent in warm water. Lacquer thinner may also be helpful in removing small amounts of release agent from the castings. Use appropriate protective gear in an area with adequate ventilation.
- b. **PREPARATION** - Inspect the parts for minor imperfections that must be removed to finish the model.
  - Start by removing the flash from casting openings carefully with a fine file and/or a sharp knife blade as appropriate. Casting sprues should also be removed where they will be visible, such as on the bottom of the section floors. **Proceed slowly to avoid removing too much material or gouging the castings.**
  - Smooth any rough surfaces or edges such as,
    1. along the bottom of the body sections

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2. along the sides and bottom of floor sections and
  3. on the car body section ends where the diaphragms will attach
- Check fit-up of the plug window glass and windshields in the bodies and adjust openings as required
  - Check fit-up of the floors in the bodies and adjust as required
  - Fill any air bubbles with Squadron green or white putty and sand smooth

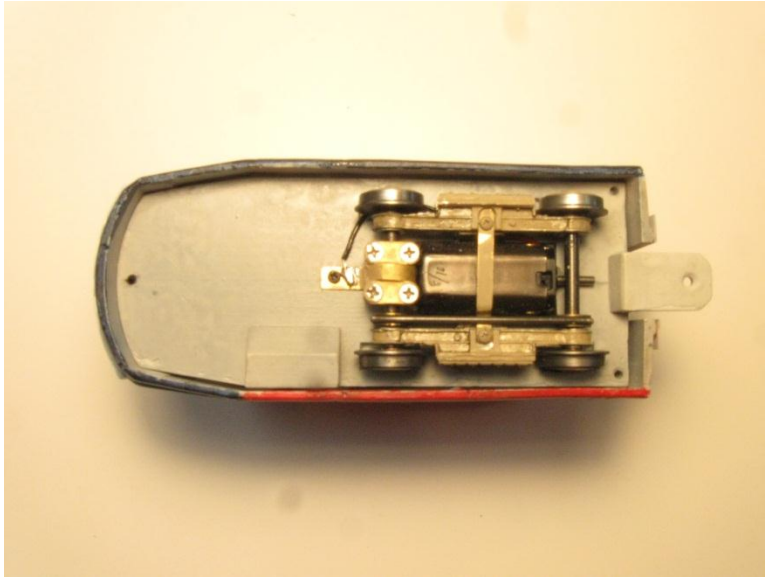
## 4. BODY ASSEMBLY AND MOUNTING THE TRUCKS

- a. **MOUNTING THE FLOORS** – The section 'A' and 'C' floors are fastened with 3 screws, 2 in the corners in the rear and 1 in the middle in the front. The section 'B' floor is fastened with 4 screws in the 4 corners of the body. A 2mm x 8mm pan head screw as sold by Northwest Short Lines is recommended because of the flat and compact head which will not require a countersink and will not protrude enough to be visible. A longer 2mm x 10mm screw may be used in the body corners but not for the end section front screws as it may poke through the dash. 1-72 machine screws may be used in lieu of the metric screws and a pan head is recommended because it will not require removing floor material for a countersink near the corner and weakening the floor. Use appropriate fastener length, tap size and drills if the substitution is made.

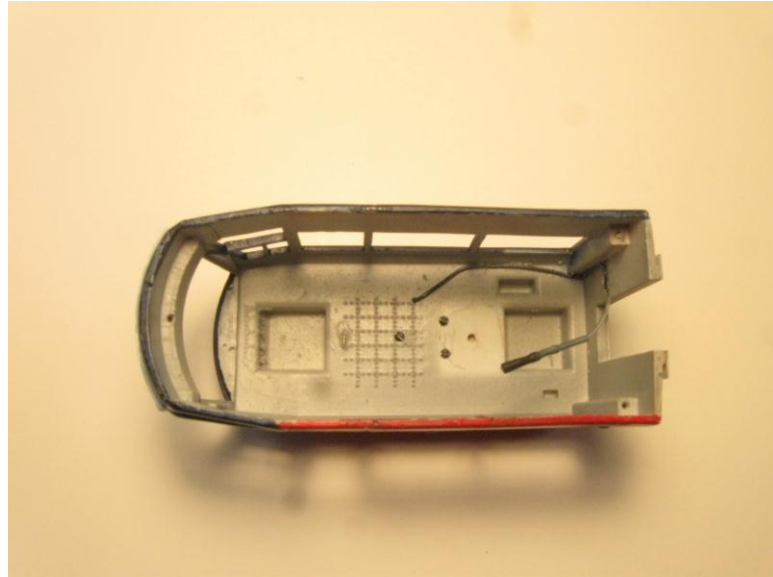
Check that the floors fit level in the bodies. It may be necessary to remove some material from the bottom of the vertical post in the corner of the body. The floor mounting screws in the body corners should be located in the center of the vertical post in the corner of the body. This should give sufficient distance of the hole in the floor from the edge of the floor. See pictures below.

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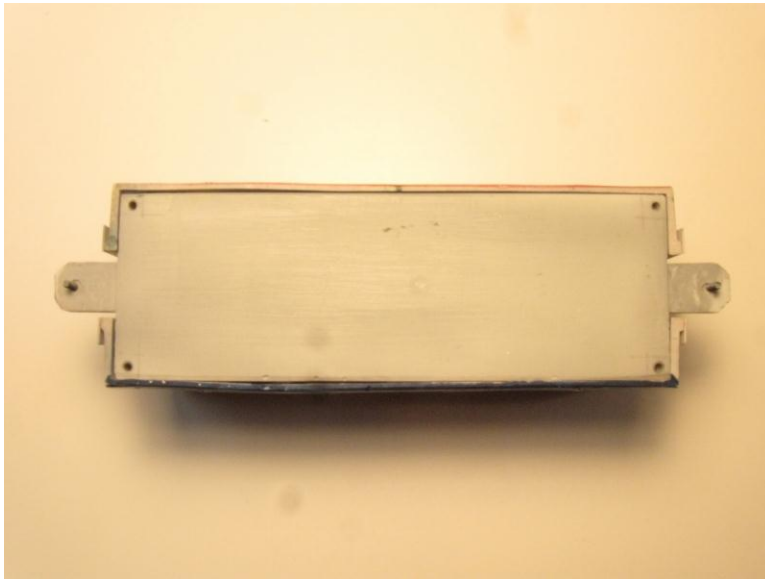
Section 'A' with truck installed. Note the anti-rotation screw in the brass clip soldered to the front of the gear box.



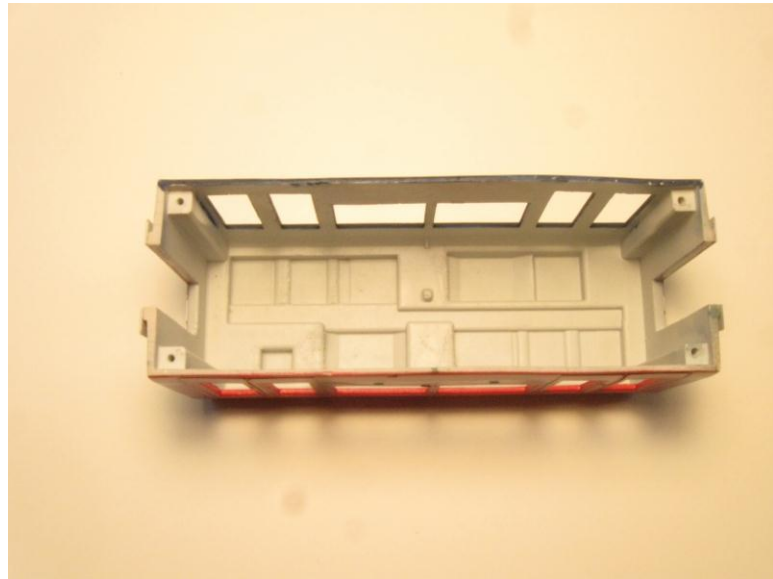
Section 'A' with floor removed showing three mounting screw holes and the three mounting screws for the pantograph mount in the roof.



Section 'B' with floor installed.



Section 'B' with floor removed showing the four mounting screw holes.



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With the floor in position, drill a vertical 1/16" hole 1/2" deep through the floor into the vertical post in the corner of the body for each floor screw in a corner. Remove the floors and up size the 1/16" hole in the floor to a 5/64" clearance hole for the 2mm screw. Tap the holes in the vertical posts in the corners of the bodies for 2mm thread.

Install the A and C section floors in the bodies and fasten the floor to the body with the corner screws. Now drill a 1/16" hole on the floor centerline, 5/16" deep from the bottom of the floor (on a 60 degree angle to the bottom of the floor), through the floor into the thickened front dasher of the end sections. Remove the floors and up size the 1/16" hole in the floor to a 5/64" clearance hole for the 2mm screw. Tap the front holes for 2mm thread in the thickened front dasher of the end sections. Insert and make up the screws to see that everything fits-up correctly. This completes mounting the floors.

- b. **INSTALLING SCREWS IN THE ARTICULATION JOINTS** – The articulation joints are designed to space the car bodies 3/4" apart when measured from the corners of the bodies. With the a 3/4" spacing between the sections and 20 lb. paper diaphragms, the car can easily negotiate a 12" radius curve. In fact the car negotiates a 10 1/2" radius on my layout and may do a little tighter.

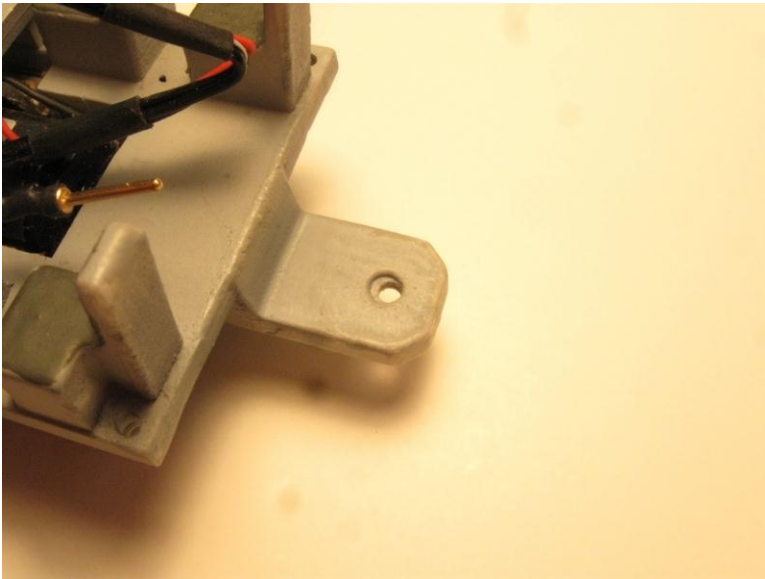
The articulation joints pivot on a 2mm x 8mm screw mounted in a threaded hole in the Section 'B' (center) joint tabs that projects downward into a conical shaped hole in the Section 'A' and 'C' joint tabs. No.1-72 machine screws may be used in lieu of the metric screws and a pan head is recommended because it will not require removing extra tab material and weakening the tab. Use appropriate fastener length, tap size and drills if the substitution is made. The arrangement allows the car to negotiate horizontal and vertical curves and uneven track that rocks from side to side. The width of the tabs and the diaphragms stabilize the center section from rocking side to side during operation. It's as simple and effective as it can be. Caution must be used when carrying the car around to prevent sections from uncoupling. Carrying in a box or on a base is recommended or alternately locking nuts could be added to slightly longer screws under the Section 'A' and 'C' joint tabs.

Locate the center of the articulation joint screw holes 3/8" from the corner of the body sections. The articulation joint screw hole location will not be exactly in the center of the depression on the tabs. Drill a 1/16" hole at the 4 locations. Tap the holes in the Section 'B' tabs for 2mm thread. Up size the 1/16" hole in the Section 'A' and 'C' tabs to a 5/64" clearance hole for the 2mm screw. Then open up the bottom of the hole in the Section 'A' and 'C' tabs to a conical shape with an X-ACTO number 11 blade. The widest portion of the hole is located at the bottom of the tab. See pictures below. This completes the articulation joints.

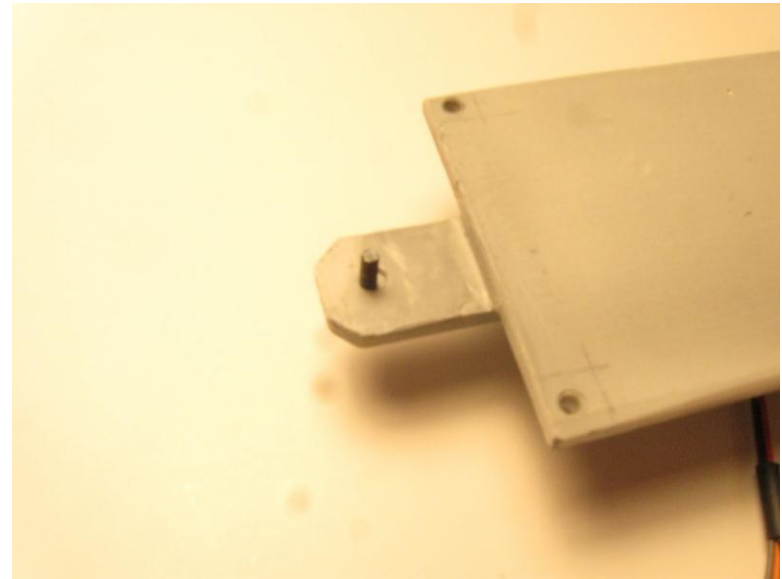


# PORTLAND STREETCAR INSTRUCTIONS

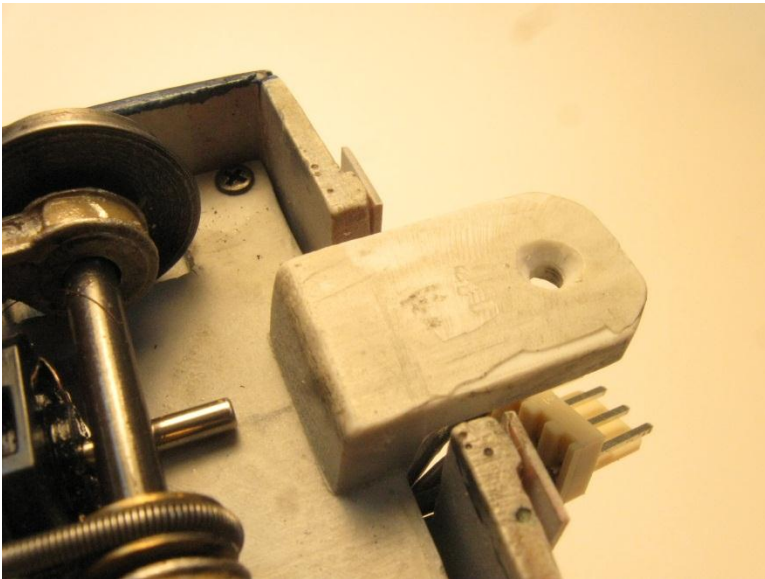
Top of Section 'A' tab.



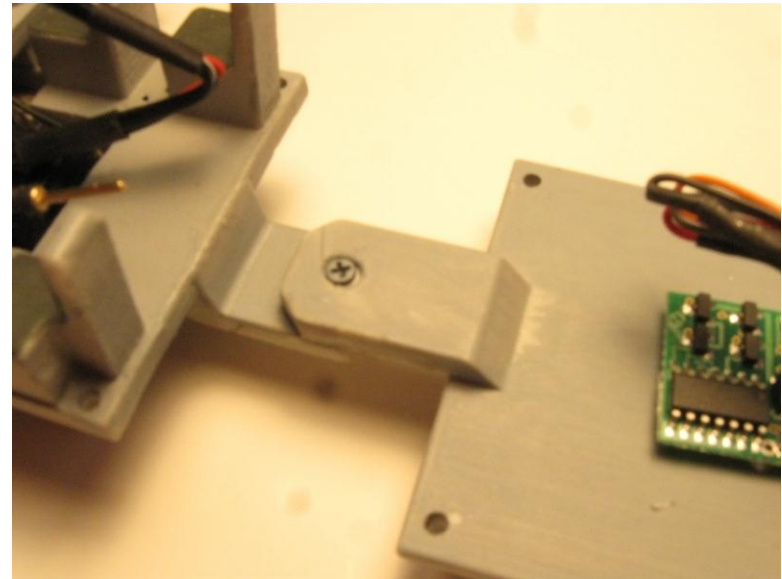
Bottom of Section 'B' tab with screw installed



Bottom of Section 'A' tab, note conical counter bore of the hole. Section 'C' should also have conical counter bore of the hole.



Top view of assembled joint for Sections 'A'/'B' and 'B'/'C'



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- c. **DIAPHRAGMS AND FLANGES** - The 2 diaphragms are 20 lb. gray paper assemblies that are folded side to side of the car body and have an opening cut in the doorway area to allow wires to pass through. They are fitted with 0.020" thick styrene end plates that slip into flanges in the car body section ends. The flanges are created by gluing a 0.020" thick styrene U shaped cutout to the raised border around the door openings in the car body ends. Be careful to avoid using too much glue and getting it in the slot created by the flange. The use of Walther's Goo or other contact cement is recommended to attach the flange to the section ends.

It is possible to make neat and functioning diaphragms by being precise in the layout, folding and assembly. The more precise you are with the layout and folding, the better the appearance will be. It may take a couple of tries, don't be discouraged, and redo them if required. Instructions and sketches are given below and in Attachment 3. The cut-outs in the paper folds between the diaphragm end plates do not have to be as large as the openings in the end plates. In fact a little more robust diaphragm can be obtained if the opening is the width of the opening in the end plate but only 1" height.

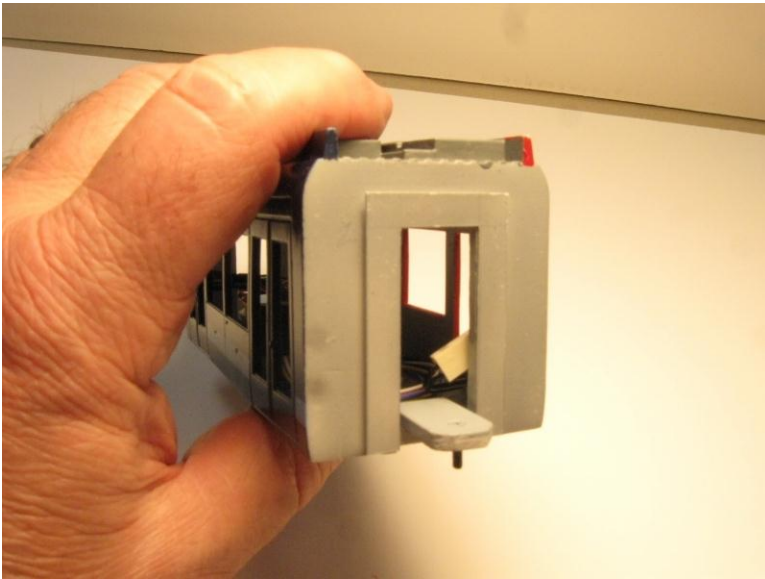
### Diaphragm Construction – See additional information in Attachment 3

- Go slow and be accurate.
- Cut-out the five, 2 1/16" high x 11" long strips of gray paper from 8 1/2" x 11" sheets. Trim the length of the strips to 9 3/4" long
- Fasten all the strips together in one "STRAIGHT" and continuous piece with Scotch Magic Tape. Use a straight edge to keep things in a straight line.
- Working from a straight edge with a small 90 degree triangle, layout the fold lines with a pencil on one side of the strip. The joints should fall approximately in the middle of a panel using the dimensions above.
- Start with a 1" wide panel, then 23 panels at 1 15/16" wide and finish with a 1" wide panel.
- Starting from either end, hold a straight edge over a fold line and slide another parallel straight edge into the held straight edge which will cause the paper to bend up.
- Remove the slid straight edge and run your fingernail along the held straight edge to cause a sharp 90 degree fold in the paper at the fold line. Proceed down the strip folding the paper up at each fold line.
- Pick the strip up and lightly make the accordion folds with your fingers. Do not put too much pressure as this will reduce the fullness of the completed diaphragm. Note that every other fold will be reversed from the original fold direction.
- Cut the end panels on each end down to approximately 1/4" wide. Note that the end panels are on opposite sides of the diaphragm.
- Line up the tops of the diaphragms and end plates and fasten the 1/4" wide diaphragm end panel to the styrene end plates with Scotch Magic Tape. Two small pieces of tape may be used to hold things in alignment while a full length of tape is maneuvered into place and returned over the top onto the other side. The portion of the tape that overlaps the in opening may be removed with an X-ACTO #11 blade.
- The top and bottom corners of the stacked-up diaphragm can now be trimmed with a single edge razor blade per Attachment 3.
- You are ready to drop the diaphragm into place between the cars. Be careful not to catch the panel folds in the flange.

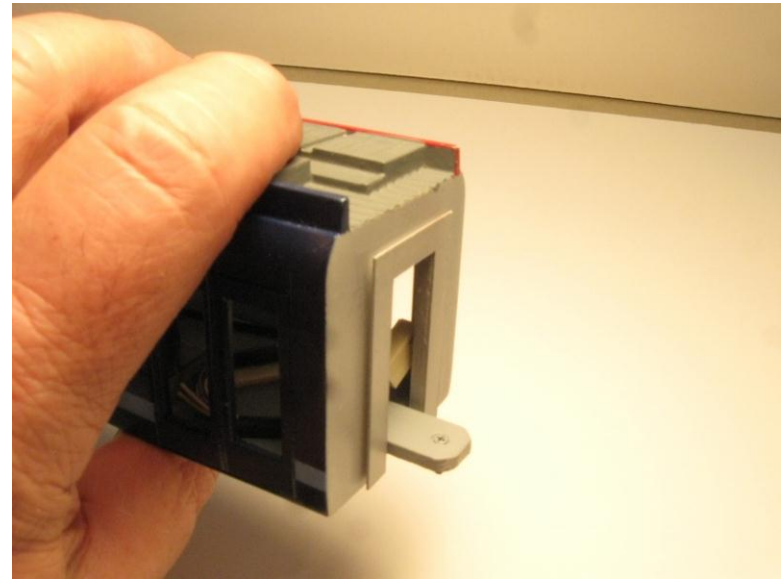


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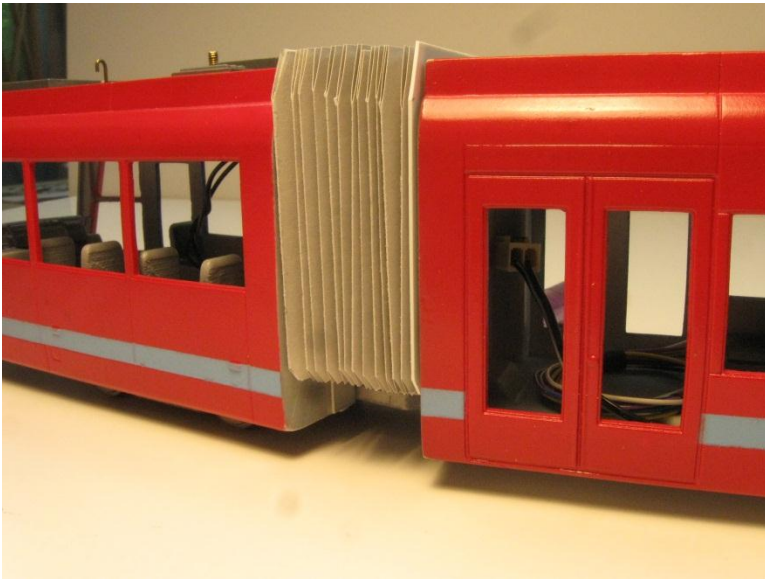
View of flange on car section end.



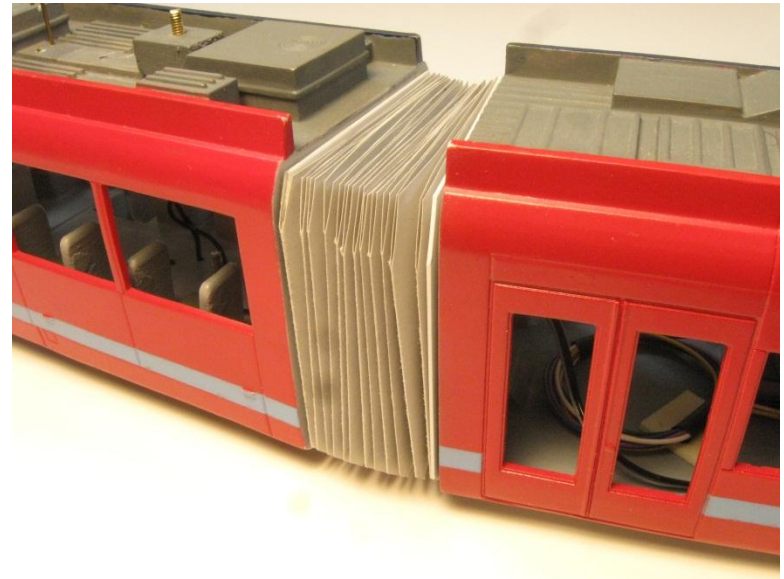
Another view of flange on car section end.



Side view of installed diaphragm.



Another view of installed diaphragm showing the end plate.

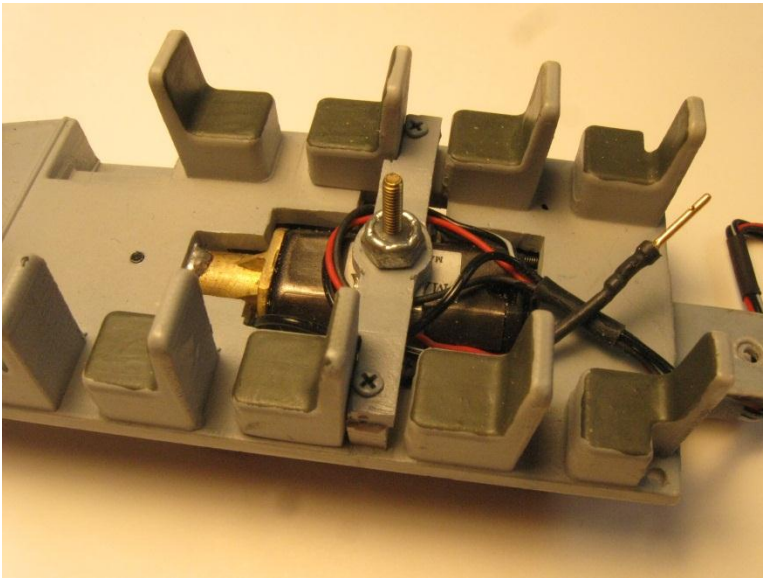


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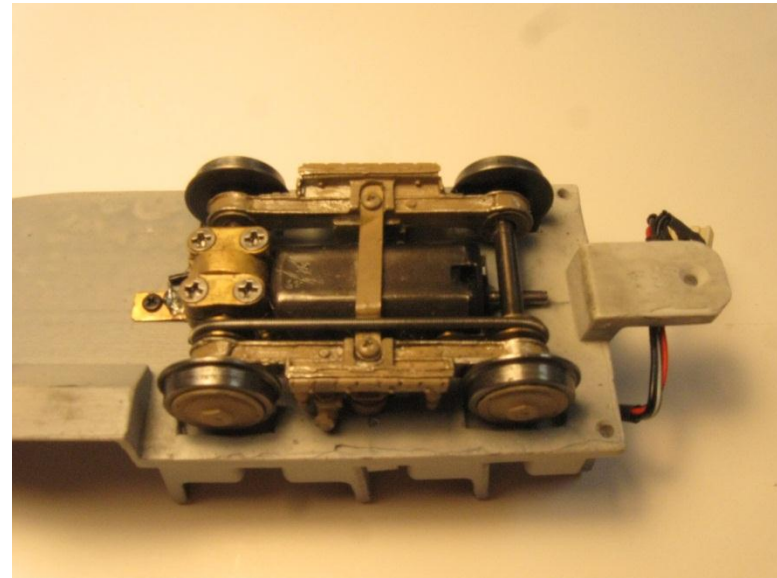
- d. **MOUNTING TRUCKS** - The truck mounting is a crucial part of the model assembly. The trucks are fastened rigidly (no movement or rotation) to the end section bodies and steer the bodies. The truck center is located at the center of the window mullion between the two windows on the right side of the 'A' and 'C' section. The car rides close to the ground and as a result the ground clearance is controlled by the truck mounting. Slots have been provided in the end section floor to resolve the interference between the bottom of the floor and the top of the wheels. A cutout in the floor will be required in the A section for a conventional power truck. The trail truck in the C section should not require a cut out but may require some material removal in the bolster area to achieve proper ride height.

Pictures for mounting a Q Car Company B3 PCC truck are given below; other truck type mountings are left to the modeler. The suggested clearance from the bottom of the side skirt to the top of the rail is  $\frac{1}{4}$ ". If the model is sitting on a flat surface on the flanges, increase this dimension to  $\frac{9}{32}$ " to account for the fact the flanges and not the treads are sitting on the flat surface. When the trucks are mounted, make a couple of blocks  $\frac{9}{32}$ " high and check the clearance between a flat surface and the bottom of the skirt at the ends of each side to assure the body sections are level. When both end sections are at the correct ride height, install Section 'B' between Section 'A' and 'C' and check the ride height of Section 'B'. Minor shimming at the articulation joint may be required. Each truck has an anti-rotation bracket soldered on. This is the easiest way to prevent rotation.

Top of section 'A' floor with power truck.



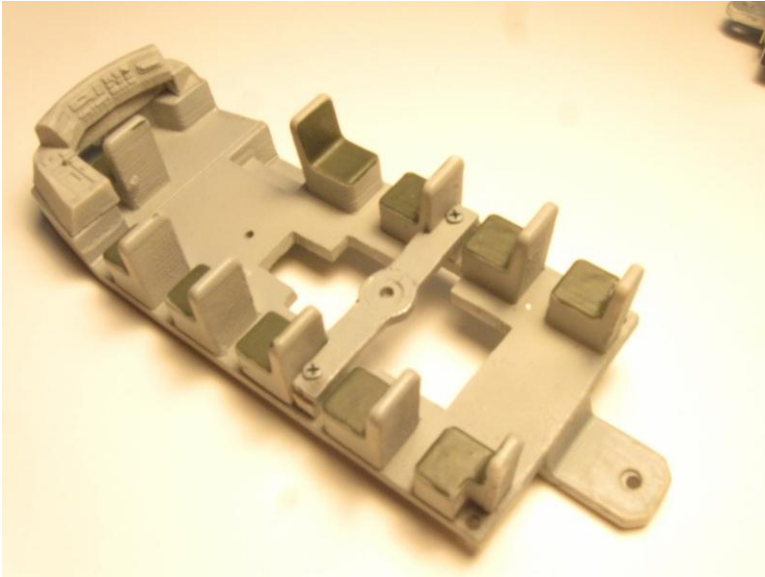
Bottom of section 'A' floor with power truck. Note anti-rotation tab.



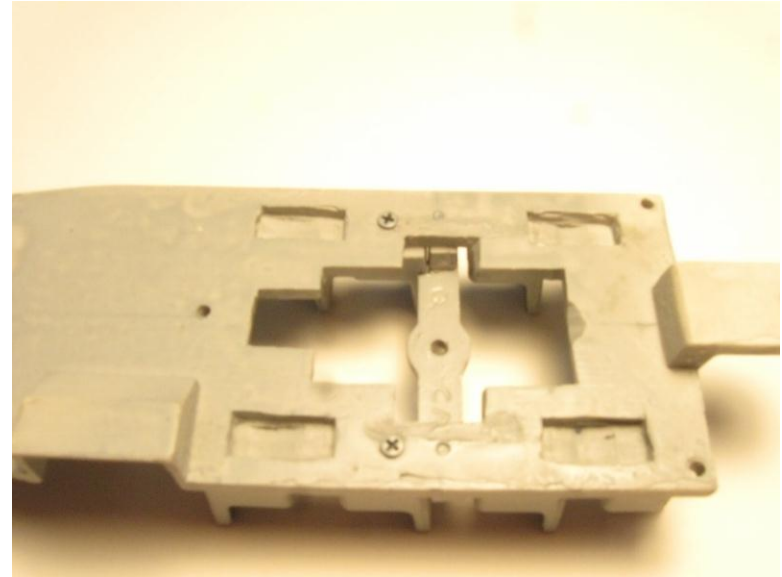


## PORTLAND STREETCAR INSTRUCTIONS

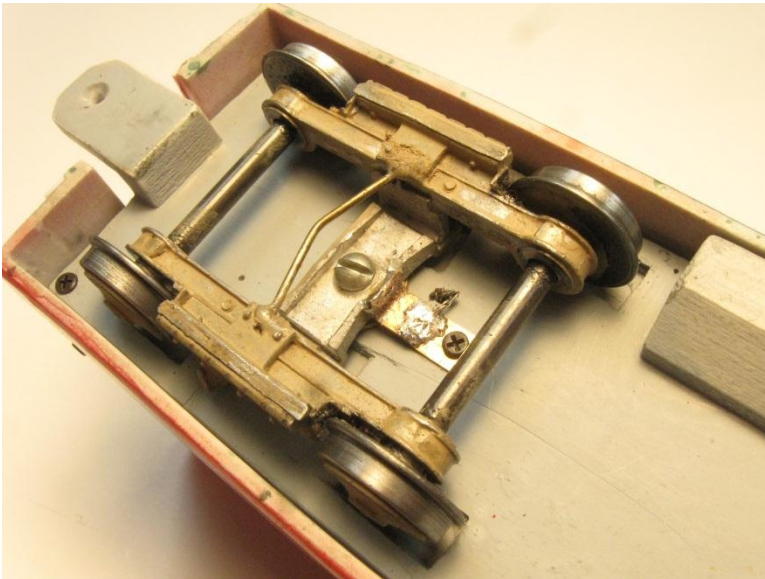
Top of Section 'A' floor and power truck opening and mount.



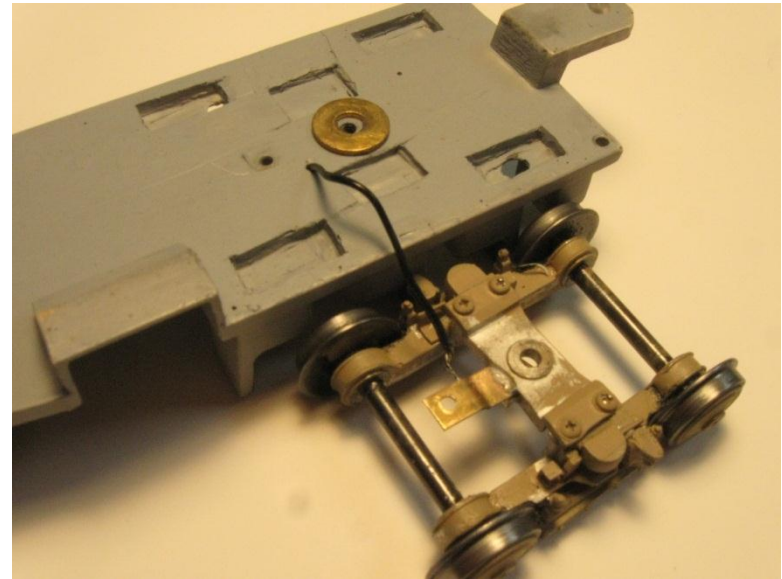
Bottom of Section 'A' floor and power truck mount.



Bottom of Section 'C' floor with trail truck. Note anti-rotation tab.



Floor with trail truck removed, from bottom. Note anti-rotation tab.



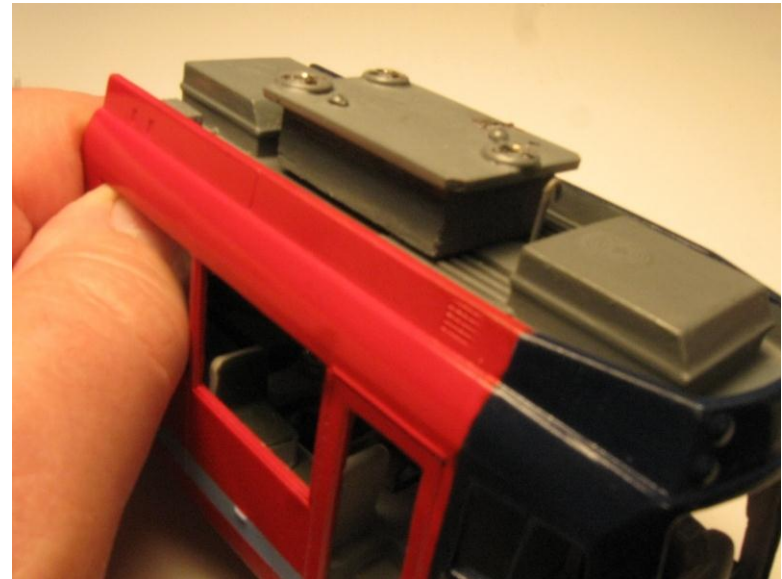
## PORTLAND STREETCAR INSTRUCTIONS

- e. **PANTOGRAPH MOUNT** - The pantograph mount on the prototype car is a 4 leg platform with legs at a very flat angle. The height of the platform will have to be determined by the modeler to suit the overhead wire height the model will operate on. A wire height of 18' to 20' is recommended unless a different standard is used. A simple balsa block topped with a PC board plate of the required shape was used as a platform on the first model assembled and works just fine. The balsa block can be fastened to the roof of the car with a couple of miniature wood screws from inside the body and the PC board plate can also be fastened to the top of the balsa block with miniature wood screws. In our case we soldered #10 dress snaps to the bottom of the pantograph and also to the PC board plate to attach the pantograph with the male portion of the snap on the base of the pantograph and the female portion on the PC board. The nubs on the upper portion on the dress snap were then filed to reduce their holding power so the pantograph would pop off if snagged and thus avoid damage to it. The pantograph is mounted with the center of the pantograph shoe over the center of the truck. The truck center is located at the center of the window mullion between the two windows on the right side of the 'A' and 'C' section.

Sommerfeldt #997 pantograph on PC board mount



PC board mount, note dress snaps soldered to the PC board



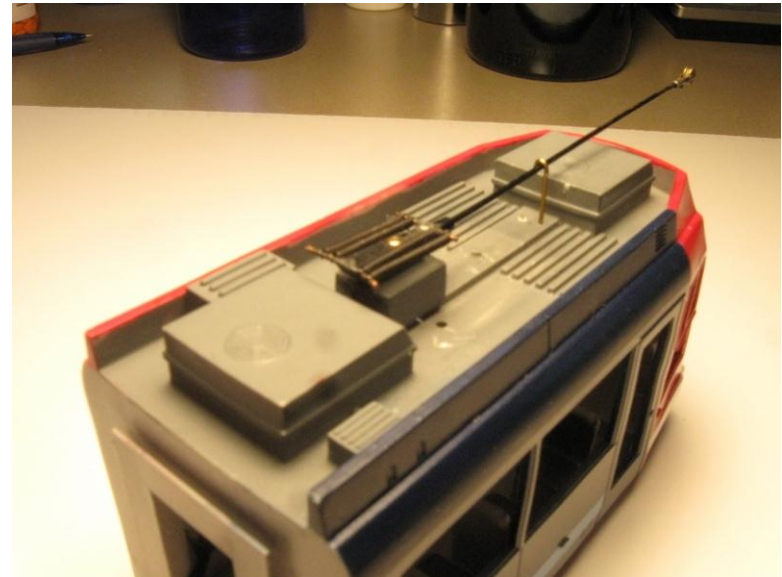
## PORTLAND STREETCAR INSTRUCTIONS

- f. **TROLLEY POLE AND MOUNT** - The trolley pole is optional but can easily solve the problem of “How do you run the car if your wire is not pantograph compatible?” We suggest mounting it on Section ‘C’ or on both Section ‘A’ and ‘C’ if a pantograph will not be used. Mounting details can differ widely depending on the modeler’s preference. We cut a  $\frac{1}{2}$ ” x  $\frac{1}{2}$ ” square of  $\frac{1}{8}$ ” plywood and drilled a  $\frac{1}{16}$ ” hole in the center. A 2-26 tap was run through the hole. The plywood square is placed on the underside of the roof inside the car. A  $\frac{1}{4}$ ” x  $\frac{3}{8}$ ” x  $\frac{1}{2}$ ” long block of basswood was also cut to lift the pole base to the proper height. A  $\frac{1}{16}$ ” hole was drilled in the center of the  $\frac{3}{8}$ ” x  $\frac{1}{2}$ ” side and a 2/56 tap run through it. A  $\frac{5}{32}$ ” hole for the pole screw was drilled on the centerline of the car over the center of the truck. The inside plywood square and the outside basswood block were fasten in position with Walther’s Goo and the pole screw was run into the hole from the bottom. Check that the screw is perfectly vertical and adjust it if it is crooked. . The pole is mounted with the pole screw over the center of the truck. The truck center is located at the center of the window mullion between the two windows on the right side of the ‘A’ and ‘C’ section.

Trolley pole, mount and hook.



Another view of trolley pole, mount and hook.



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5. **WIRING AND LIGHTING** – There are many wiring diagrams available on the East Penn Traction Club web site. We wired the car with DCC. We plan to install 12 volt LED light bars in the car body sections but have not done so yet. The wiring can vary greatly depending on the modeler's preferences, but running the wiring along the light bars in the ceiling or on the roof seem like good choices. The wiring may have to drop down at the diaphragms to pass from one section to the next or may bridge the gap in the open on the roof in a manner similar to the prototype with wire connectors with slack between the sections. The wiring installation details are left to the modeler.
6. **TEST RUN** – You are so close to doing a test run at this stage it is recommended you tie up any loose ends and test run the car before you paint it.
7. **DISASSEMBLY AND CLEANING, COLOR SCHEMES AND PAINTING** – The results of the painting effort are what will show so take your time and study the prototype car for painting details and colors.
  - a. **DISASSEMBLY AND CLEANING** – Disassemble body sections and remove trucks, pole, pantograph, electrical equipment and wiring. Wash all urethane castings again with a mild detergent in warm water. Clean any metal parts with lacquer thinner.
  - b. **PRIMING** - Two prime coats are recommended to achieve a good degree of filling and leveling of the surface. First, re-check the body sections irregularities and correct them. The first prime coat should be gone over with a scuff pad to level the surface when thoroughly dry. The second prime coat should also be gone over lightly when the coat is thoroughly dry.
  - c. **COLOR SCHEMES**
    - i. Color schemes vary considerably and don't necessarily fit a specific pattern. You will quickly note when looking at pictures in the references in Section 2.0 that the colors and sheen also vary depending on the newness of the paint job and the photographic process. Attachment 1 provides information on how the two color basic scheme is arranged on each car. One basic color starts on the end of Section 'A' (the pantograph end) and runs down the left side of the car to the Section 'C' end when looking toward the pantograph end. The other basic color starts on the end of Section 'C' and runs up the right side of the car to the Section 'A' end. The additional exterior and interior and colors are also listed in Attachment 1.
    - ii. Colors vary from paint line to paint line and sometimes in a specific paint line depending on the date of manufacture. A number of model paint lines were reviewed and stock paints that satisfied our eye for color were not found. As a result the color descriptions in



# PORTLAND STREETCAR INSTRUCTIONS

Attachment 1 are nothing more than generic color descriptions and the choice of specific colors or mixes to use for painting models is left to the modeler.

- d. **PAINTING** - Masking and the sequence of color application is left to the modeler's preferences. Decals are planned and will be available in the future. Two final coats of clear over the decals are recommended. A semi-gloss in the range of 75% gloss/25% flat will yield good results.

## 8. FINAL ASSEMBLY

- Re-install trucks, electrical equipment, lighting and wiring.
- Install windshields and side windows using canopy glue on the window flanges to secure the windows.
- Install motorman's partitions
- Test run on the bench and lubricate lightly.
- Install diaphragms – Insure that they sit level and do not catch on any wiring passing through them.
- Test run and you are ready to put the car in service.



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## ATTACHMENT 1, ROSTER AND COLOR SCHEMES

#	Car body Colors*	Sect. 'A' End & Lt Side	PSC Logo Colors	Car Sponsor Logos**
001	Dark Blue/Green	<b>Dark Blue</b>	Green & Dark Blue	Portland State University
002	Orange/Red	<b>Orange</b>	Red & Orange	Hoyt Realty
003	Green/Orange	<b>Green</b>	Orange & Green	Bridgeport Brewing Company
004	Dark Blue/Red	<b>Dark Blue</b>	Red & Dark Blue	Portland General Electric
005	Orange/Dark Blue	<b>Orange</b>	Dark Blue & Orange	The Portland Clinic
006	Green/Dark Blue	<b>Green</b>	Dark Blue & Green	Legacy Health Systems
007	Dark Blue/Red	<b>Dark Blue</b>	Red & Dark Blue	Powell's Books

\* The color descriptions in Attachment 1 are generic color descriptions and the choice of specific colors or mixes to use for painting models is left to the modeler.

\*\* Car sponsor logos are white

### Paint Colors

**Exterior Dark Blue**

**Exterior Teal Green**

**Exterior Orange**

**Exterior Red**

**Body Side Stripe - Light Blue**

**End Bumpers - White**

**Roof - Gray**

**Underbody - Buff**

**Interior Floors - Light Grey**

**Interior Walls - Off White**

**Interior Ceiling - Off White**

### Color Groups

001 Dark Blue (A end) / Green

002 Orange (A end) / Red

003 Green (A end) / Orange

004 & 007 Dark Blue (A end) / Red

005 Orange (A end) / Dark Blue

006 Green (A end) / Dark Blue

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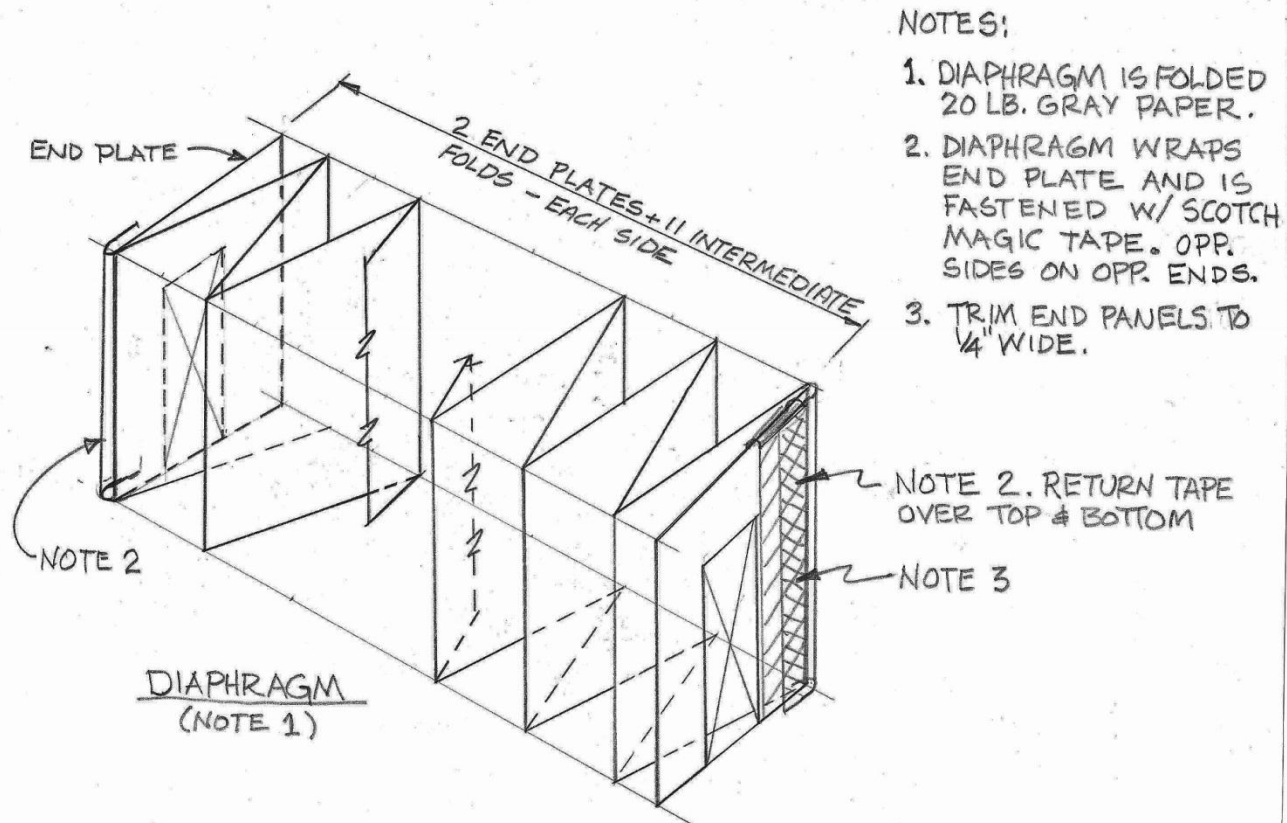
## ATTACHMENT 2, MODELING MATERIALS

<u>Necessary Material/Parts</u>	<u>Manufacturer</u>	<u>Use</u>
ACC adhesive	various	
ACC Accelerator	various	
Canopy Glue	various	Fasten in windows
0.020" thick styrene sheet	Evergreen	Diaphragm flanges and end plates
20 lb. Pastel Gray Paper	Staples	Diaphragms
Magic Tape	Scotch	Diaphragms
2mm x 8mm pan head screws	Northwest Short Lines	Floor fastening screws and articulation joints
1/16" tap drill	various	drilling holes for 2mm fasteners
5/64" drill	various	drilling clearance holes for 2mm fasteners
2mm tap	various	tapping holes for 2mm fasteners
#2 Wood Screws or equivalent	Perfect	Fastening pantograph mounting block
B3 PCC power and trail truck set	Q Car Company	power the car
#997 Pantograph	Sommerfeldt	power pick-up
*May be obtained from: Eurorailhobbies - <a href="http://www.eurorailhobbies.com/erh_list.asp?SC=O&amp;MN=24&amp;CA=&amp;ER=&amp;NA=">http://www.eurorailhobbies.com/erh_list.asp?SC=O&amp;MN=24&amp;CA=&amp;ER=&amp;NA=</a> or		
Westminster Miniatures - <a href="http://www.westminster-miniatures.com/search.php?nobox=&amp;scat=359&amp;stext=&amp;stype=&amp;sprice=&amp;pg=4">http://www.westminster-miniatures.com/search.php?nobox=&amp;scat=359&amp;stext=&amp;stype=&amp;sprice=&amp;pg=4</a>		

<u>Optional Material/Parts</u>	<u>Manufacturer</u>	<u>Use</u>
Trolley Pole	various	power pick-up

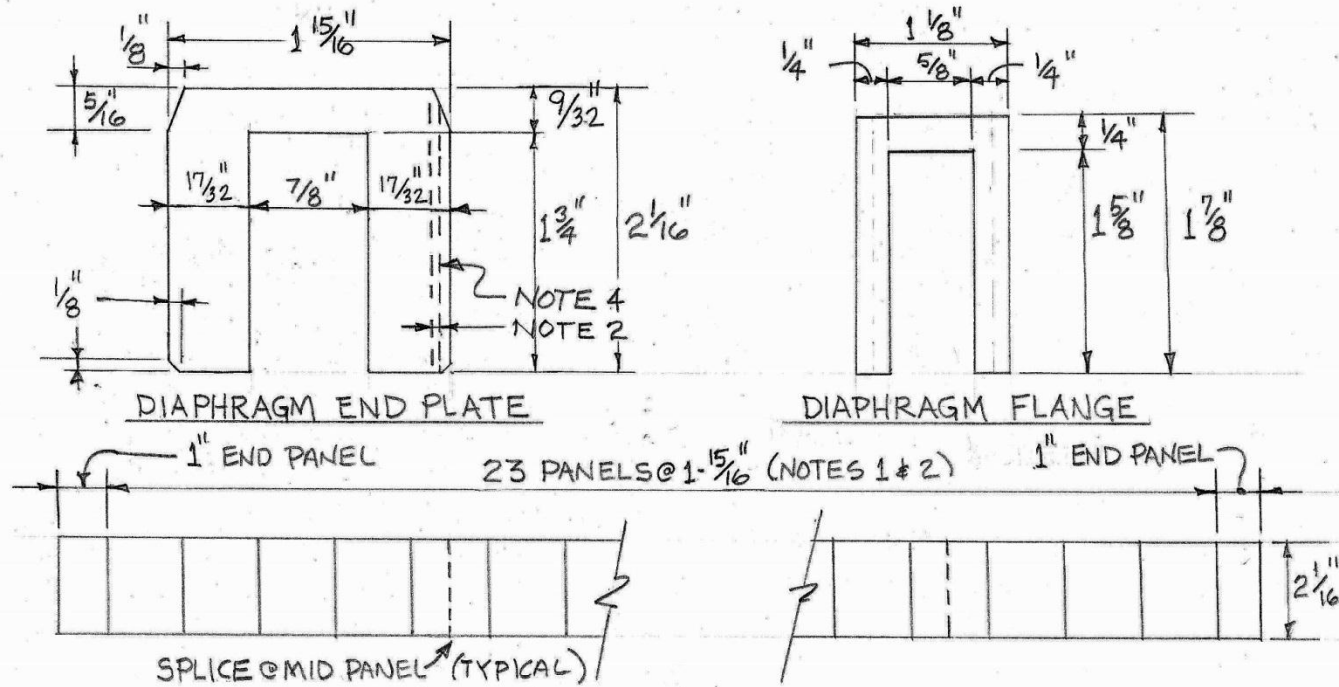
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## ATTACHMENT 3, CAR BODY DIAPHRAGMS (Page 1 of 2)



# PORTLAND STREETCAR INSTRUCTIONS

## ATTACHMENT 3, CAR BODY DIAPHRAGMS (Page 2 of 2)



### NOTES:

### DIAPHRAGM FOLD OUT

1. FOLDED PAPER DIAPHRAGM CONSIST OF 23 FULL PANELS WITH 1" PANEL @ ENDS.
2. FEATHER EDGE TO EASE PAPER FOLD AROUND END PLATE.
3. SPLICE DIAPHRAGM SECTIONS W/ SCOTCH MAGIC TAPE.
4. TRIM END PLATE ON SIDE DIAPHRAGM ATTACHES TO BY 1/16" TO EASE PAPER FOLD AROUND END PLATE.