

BOOK 50 C-CAR PREVENTIVE MAINTENANCE PROCEDURE
BOOK 86 A2/B2-CAR PREVENTIVE MAINTENANCE PROCEDURE

DATE ISSUED 10/10/12

PROCEDURE NO. 10-21

REVISION DATE 06/01/18

SIDE DOOR PRELOAD CHECK INSTRUCTIONS

I. Background

The side door operators of the BART vehicles require some resistance (force) to keep the gearbox output arm in its position at the door stop while the door panels are closed. This force, or “preload”, is generated primarily by the door panels pushing against each other slightly while in the closed and locked position.

II. Purpose

This procedure provides a method for checking and adjusting the amount of preload to assure the door panels and operators will not drift from the closed and locked position during mainline operation.

III. Procedure

A. Material required:

1. Standard tools:

Note: To loosen and turn the door linkage rods, a shortened 11/16” wrench and a small vice-grip as shown in the photos (page 7) will improve worker access to the linkage.

Note: Recommend tethering together the tools that will be used in the door pocket so they can be easily recovered in the event they are dropped deep into the door pocket.

2. A suction cup mounted dial indicator as shown in the photos (page 3) to measure the amount of push applied to a door panel.
3. Torque seal liquid, Stock # 80-10-49195.
4. A non-contact infrared thermometer with laser targeting (Cen-Tech item #96451 or equal)

B. Preparation:

1. Car needs to have been out of direct sunlight for at least one hour.

Note: The BART cars undergo severe dimensional changes due to radiative thermal heat load from the sun, which adversely affects reliable side door preload checks and adjustments.

2. Inverter or shop power “ON” to provide full battery voltage to the door operators.
3. Side doors being checked or adjusted must be in serviceable condition. A2/B2 car side doors must meet the requirements of PM 10-14 (timing need not be checked at this time). C1/C2 car side doors must meet the requirements of PM 10-11.
4. Check the two safety wired bolts fastening the door mechanism to the door operator to make sure neither is loose. If a loose bolt is found, remove both bolts and replace existing star washers with new ones. Retighten bolts and reapply safety wire before proceeding.

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IV. Preload Check

A. Preload Check Procedures:

Note: Use caution when working in and around door operators that are powered.

1. Using the interior crew switch, power the mating door panels "Closed".
2. Using the infrared thermal sensor, measure the temperature of the leading edge (nose) rubber seals in the target area at a distance of about 2 inches from the rubber (see photo, page 7).
3. Record the temperature in the Preload Measurement Table for the doorset in column "C", Temperature.
4. Select a door panel to disable by placing the door operator power switch to "OFF". The door cutout may be used to remove power from the door operator for this check.
5. Power the active door panel "Open" using the crew switch.
6. Mount and position the dial indicator to the disabled door panel as described in photos (page 3).
7. Apply finger pressure to the disabled door to push it toward the pocket, (see photo, page 3).

Note: This step is required so all mechanical slack is removed from the linkage and the door operator arm is up against the door stop. Do not "bounce" the door – apply steady pressure to remove all the slack in the mechanism and then slowly release. If the door operator arm is not up against the door stop, physically push the arm to the door stop and then repeat the step.

8. Rotate the face of the dial indicator to position the pointer at "0".

Note: Steps 7 and 8 may need to be repeated several times until the dial indicator repeatedly returns to zero.

9. Using the crew switch, power the active door panel "Closed".
10. Observe the dial indicator pointer after the door panels mate.
11. The active door panel should "push" the disabled door panel (see photos, page 3). Observe the dial indicator reading and repeat steps 5 and 7 through 10 several times to get a consistent reading on the dial. The consistent reading will be used as the final preload reading.
12. Record the final preload reading in the Preload Measurement Table in column "B", "As-Found Preload".

Note: This final preload reading is for the active door panel, not the one with the dial indicator.

13. Remove the dial indicator from the disabled door panel.
14. Reposition the door operator power switches (or cutouts) to the "ON" (normal) positions.
15. Cycle the door pair open and closed to confirm normal operation.

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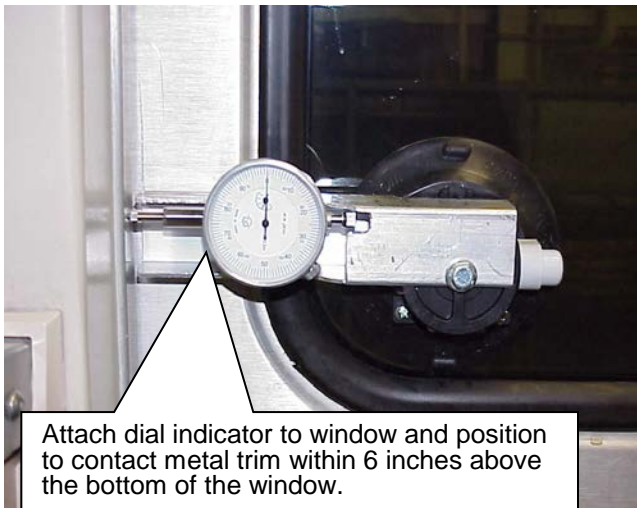
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16. Perform the preload check on the mating door panel by repeating steps 4 through 15 above.

17. Condemning criteria:

- a. PM or unscheduled check: each doorset must meet the requirements in the Preload Adjustment tables per section V for the temperature measured on the rubber seals.

Preload Check Photos:

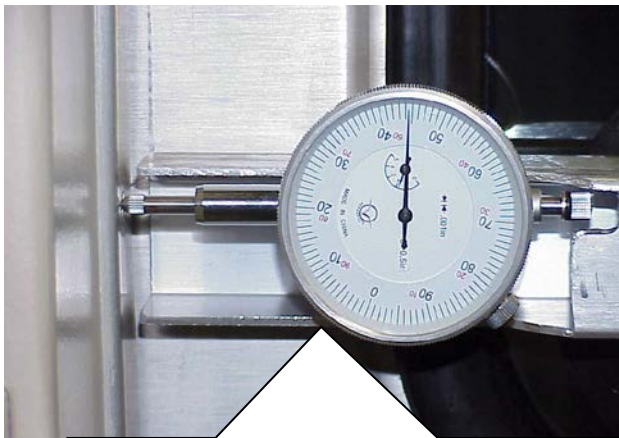


Attach dial indicator to window and position to contact metal trim within 6 inches above the bottom of the window.

Position end of tool at least 1/8 inch away from metal trim.



Verify door operator arm is against the door stop and then apply finger pressure to push the door toward the pocket to remove any slack in the mechanism. Set the dial indicator to "0".



As the doors mate, the disabled door panel should be "pushed". The preload measurement reading is indicated on the dial indicator. (0.044" in this example)

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V. Preload Adjustment

Note: Use caution when working in and around door operators that are powered.

A. Preload Adjustment Procedures:

1. Using the interior crew switch, power the mating door panels "closed".
2. Using the infrared thermal sensor, measure the temperature of the leading edge (nose) rubber seals in the target area at a distance of about 2 inches from the rubber (see photos, page 7).
3. Record the temperature in the Preload Measurement Table for the doorset in column "E", Temperature. This temperature reading will be used to determine the required preload for both panels.
4. Check that the door panels are centered within the doorway opening as follows:

- a. Visually check the position of the trailing edge seals of both door panels.

Note: When a set of door panels is properly centered, the trailing edge seal of each door should have some contact with its mating carbody seal that is mounted at the door pocket opening (see photos, page 7).

- b. If slight centering of the door panels is required, note which way the doorset needs to move to properly center the panels.
5. Select the door panel that will be disabled, which will make the other panel the active panel. Disable the door panel to be checked by placing its door operator power switch to "OFF". The door cutout may be used to remove power from the door operators for this check.

Note: If the doorset needs to be centered, choose as the active panel the one that will push the doorset toward the center.

6. Power the active door panel "Open" using the crew switch.
7. Mount and position the dial indicator to the disabled door panel as described in photos (page 3).
8. Apply finger pressure to the disabled door to push it toward the pocket, see photo (page 3).

Note: This step is required so all mechanical slack is removed from the linkage and the door operator arm is up against the door stop. Do not "bounce" the door – apply steady pressure to remove all the slack in the mechanism and then slowly release. If the door operator arm is not up against the door stop, physically push the arm to the door stop and then repeat the step.

9. Rotate the face of the dial indicator to position the pointer at "0".

Note: Steps 8 and 9 may need to be repeated several times until the dial indicator repeatedly returns to zero.

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10. Using the crew switch, power the active door panel "Closed".
11. Observe the dial indicator pointer after the door panels mate.
12. The active door panel must "push" the disabled door panel (see photo, page 3) as specified in the appropriate Preload Adjustment Table. Observe the dial indicator reading and repeat steps 6 and 8 through 11 several times to get a consistent reading on the indicator.

Note: The A2/B2 cars and the C1/C2 cars react differently to changes in temperature such that the A2/B2 cars will typically experience higher preload readings at higher temperatures while C1/C2 cars will experience lower preload readings higher temperatures.

Note: Use the A2/B2 Preload Adjustment Table when working on an A2/B2 car.

Note: Use the C1/C2 Preload Adjustment Table when working on a C1/C2 car.

13. Get access to, and then loosen the jam nuts of the linkage rod on the active door.

Note: One of the rod end bearings and jam nuts has left-hand threads, which means it will tighten or loosen opposite that of standard right-hand hardware.

14. Adjust (rotate) the linkage rod to increase or decrease the "push" and also to center the door panels if required. Try to keep both rod ends parallel and in alignment to each other.
 - a. If the amount of "push" needs to increase, the linkage rod between the operator and the door panel must be lengthened. This will move the door panel further out of the pocket and increase the nose rubber seal contact force as the panels mate.
 - b. If the amount of "push" needs to decrease, the linkage rod between the operator and the door panel must be shortened. This will move the door panel further back into the pocket and decrease the nose rubber seal contact force when the panels mate.
 - c. If there is at least 0.015 inches of preload on each panel, prior to any adjustments, it is likely that simply adjusting the linkage rod on one panel will bring both doors into spec.

15. Once the active door has sufficient preload, reset the doors to make the other panel active and disable the one just adjusted. Move the dial indicator and measure the preload of the newly active door. If required, loosen the jam nuts on the (now) active door's linkage rod and make the necessary adjustments.

Note: To achieve the specified preload on both panels, it may be necessary to make small adjustments on each panel linkage until each panel has the required preload reading.

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16. Verify that adequate rod end thread engagement exists in the linkage rod by inserting an 0.025 inch diameter wire into the inspection holes in the extension tube at each end. If the wire goes into the hole more than 0.19 inch, prevent both rod ends from rotating and then rotate the linkage rod until proper thread engagement exists.
17. Tighten the linkage rod jam nuts. The preload setting usually increases slightly when tightening the jam nuts. Keep both rod ends parallel and in alignment to each other.
18. Take a final preload measurement of each door panel to confirm that the resulting preload reading has not drifted due to tightening the jam nuts.

Note: If adjustment drifts out of tolerance due to tightening the jam nuts, the doorset must be readjusted and rechecked.

19. Apply "torque seal" to the jam nuts once the preload setting is within tolerance and final.
20. Record the final preload readings in the Preload Measurement Table in column "D", "As-Left Preload" for each door panel.

Note: This final preload reading is for the active door panel, not the one with the dial indicator.

21. Reposition the door operator power switches (or cutouts) to the "ON" (normal) positions.
22. Cycle the door pair open and closed to confirm normal operation.
23. Confirm doorset complies with 3/4-inch rod test per PM Procedure 10-12. Adjust as necessary.
24. The side door mechanical lock function is to be checked whenever work is performed on side door linkage. Verify each mechanical lock engages behind its respective door panel after a normal door close cycle. Record proper function of the lock in column "F" of the Preload Measurement Table.
 - a. For A2/B2 cars, refer to Book 86, PM 10-6.
 - b. For C1/C2 cars, refer to Book 50, PM 10-10.

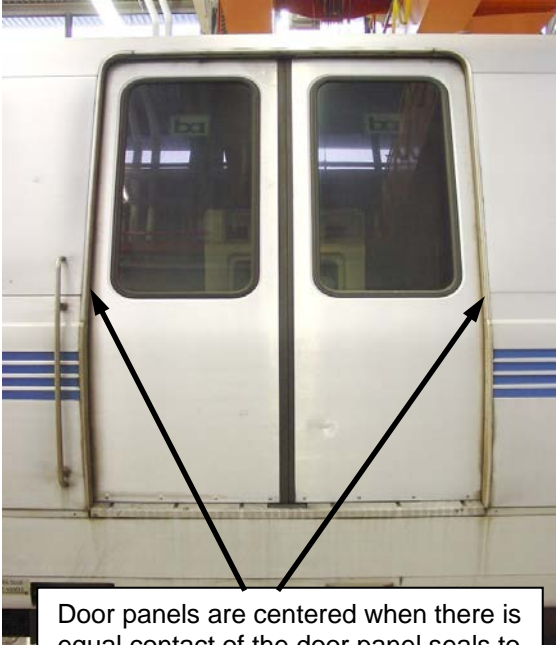
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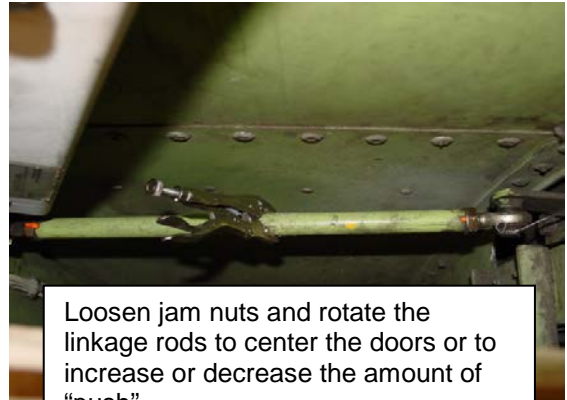
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Preload Adjustment Photos:



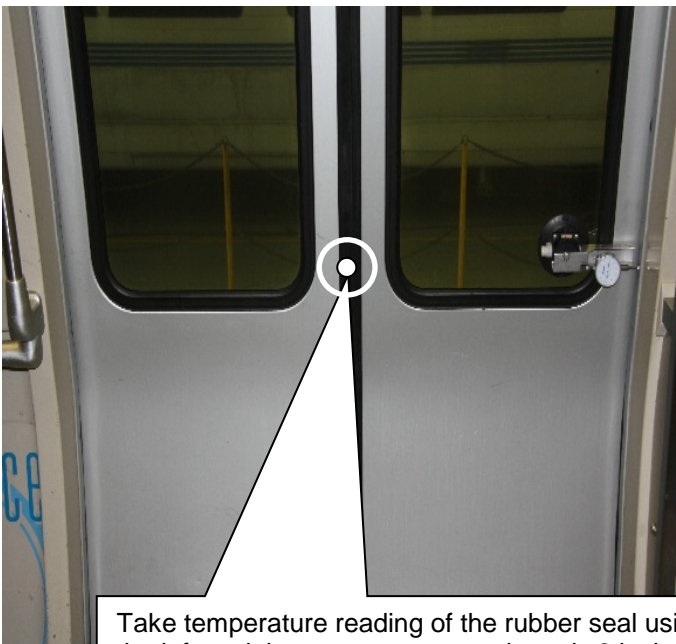
Door panels are centered when there is equal contact of the door panel seals to the carbody seals and the Mechanical locks must engage behind both panels.



Loosen jam nuts and rotate the linkage rods to center the doors or to increase or decrease the amount of "push"



A small "vice grip" and a short 11/16" wrench. Both shown are less than 5" long.



Take temperature reading of the rubber seal using the infrared thermometer, approximately 2 inches away and perpendicular to target.

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Preload Measurement Table:

Table is provided for reference only. Enter the measurements for columns "B", "C", "D" and "E" in Maximo on the work order specifications tab. Column "F" is to be entered in a separate task in Maximo.

Note: When entering preload entries in Maximo, input the value in mils (e.g., Input .345 as 345 in Maximo).

"A"	"B"	"C"	"D"	"E"	"F"
Door Position	As-Found Preload (x 0.001 inches)	Temperature of Mating Rubber Seal (degrees F)	As-Left Preload (x 0.001 inches)	Temperature of Mating Rubber Seal (degrees F)	Mechanical Lock Functions Properly?
1					
3					
2					
4					
5					
7					
6					
8					

Car No. _____ Employee No. _____ Date _____

A2/B2 Preload Adjustment Table:

Temperature (degrees F)	Preload (inches)
≥ 95	0.050 -0.005 / +0.010
80 – 94	0.040 ±0.005
60 – 79	0.030 ±0.005
≤ 59	0.025 ±0.005

C1/C2 Preload Adjustment Table:

Temperature (degrees F)	Preload (inches)
≥ 90	0.025 ±0.005
70 – 89	0.040 ±0.010
≤ 69	0.050 ±0.010