

Installation & Adjustment Manual

Single Panel Electric Plug Door Systems



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April 2006



General Description

The Bode door systems covered in this manual are custom designed for each bus manufacturer's models, so the appearance of the panel and the dimensional locations of the components will vary, however, the procedures and adjustment techniques are the same. These doors are all single panel, pantographic action, plug type door systems. Included in each door system are the panels, rotating column/spindle drive assembly, door controller, safety systems and attaching hardware.

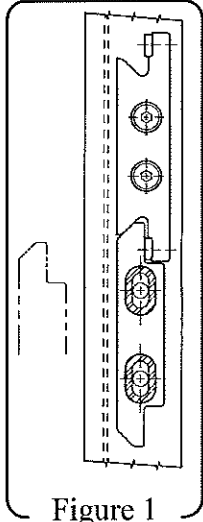


Figure 1

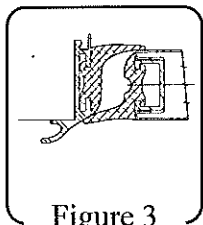


Figure 3

In the closed position, the door panel is restrained flush with the vehicle sidewall by a pair of interlocking plate cam locks at the portal edges of the panel (Figure 1). These are engaged by the lifting action of the Bode spindle drive (Figure 2). The panel is double-sealed with both an inner and outer lipped rubber seal at the top and portal edges of the panel (Figure 3). The bottom of the panel is sealed by a single seal which varies dependent on the relationship between the door panel and the edge of the lower step tread (Figure 4).

The door panel is supported at three pivot points; an upper support arm, a lower support arm and a tie rod assembly. The two support arms are located on a common rotating column and attach near the middle of the panel usually at the top edge (upper) and about one-third of the way up from the step (lower). The tie rod is normally located at the top of the panel next to the finger protection rubber, but can also be located at the bottom of the panel.

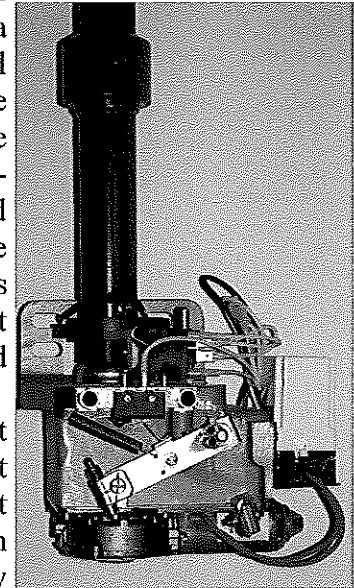


Figure 2

As the door opens, the spindle drive allows the panel to drop 3/8" (10mm) to disengage the cam locks. Once the panel has dropped, the rotating column is turned about 120° to 140° by its spindle drive. This rotation moves the panel outward and to the side of the opening. As the panel moves open, it is held approximately parallel to the bus by the tie rod. When the door panel is fully open, it comes to rest parallel with the bus, between 6" (150mm) to 10" (254mm) from the sidewall. The door system is supplied with a safety system consisting of reversing switches on the spindle drive. The spindle drive reversing system is provided to detect if a door panel lifts prematurely due to contacting an obstruction during the closing cycle. If the reversing system is activated, the door system will reopen and require a second close command to restart the closing cycle. One of the control-

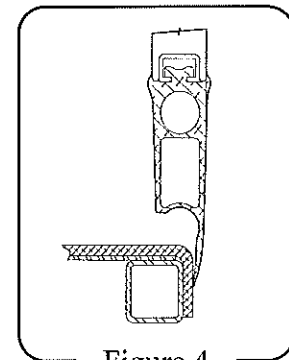


Figure 4

lers also has an electronic circuit to reverse the door based on current draw during closing. Both of these systems are turned off just prior to the door panel contacting the bus portal, so that the "lift to lock" feature does not result in a door recycle. The setting of a cam activated limit switch located at the bottom of the rotating column determines the shutoff point in the door travel. The reversing does not function in the opening cycle.

Subassemblies - Description & Operation

Door Panel Assembly

The door panel is of phenolic honeycomb core, corrosion resistant, aluminum sandwich construction. The all-welded aluminum frame is covered inside and out with aluminum skins that are secured to the frame and core material with a high strength adhesive bonding process. In addition to the adhesive bonding, the skins are also secured by crimping them over the integral lips located around the perimeter of the frame.

Also included in the door panel assembly is the door rubber, locking cams, tie rod bracket, support arm brackets, and any key locks or assist handles.

Rotating Column Assemblies

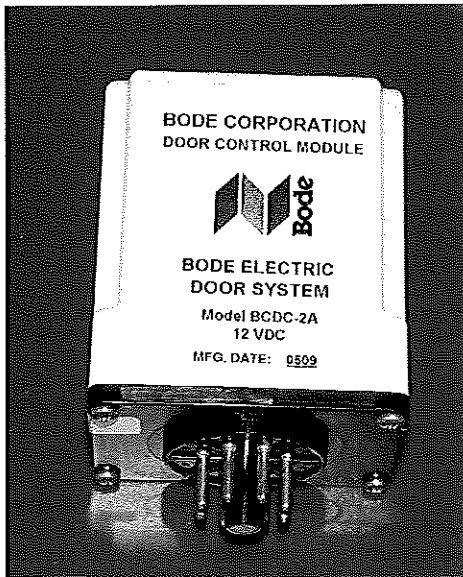
The rotating column assembly supports the weight of the door panel and supplies the motion to operate the door system. The assembly contains the spindle drive assembly, rotating column and support arms. At the heart of the *Bode Plug Door* system is the spindle drive assembly. This unit converts the rotary motion of a electric gear motor into both the rotating and lifting motion necessary to close the door panel and then lift it into the locking cams. The spindle drive also contains the control switches, reversing switches and switch rings. The door controller unit may also be located on the spindle drive. The spindle drives are uniquely left and right handed and only a few components are interchangeable.

Electrical Components

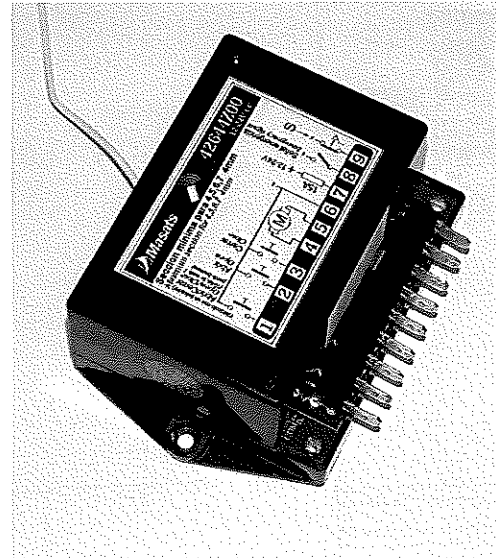
The electrical components consist of the door controller unit, the optional remote control, the electric drive motor, and the control switches on the spindle drive unit. The driver control switch and outside key switch, if present are supplied by the bus manufacturer. The purpose and function of these components are as follows:

Door Controllers

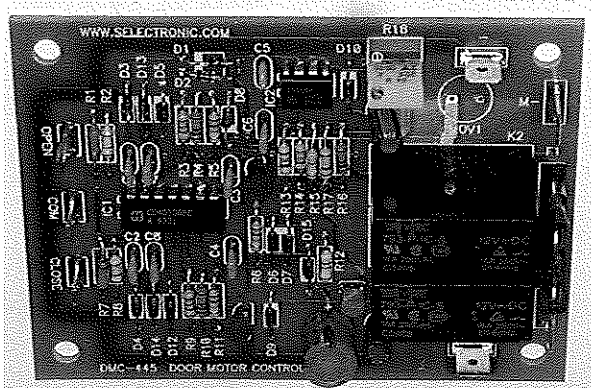
There are three possible Door Control Units for the electric plug doors. Each has a unique wiring schematic/hook-up, but all are controlled by the same type of switches. The connector types and sizes vary so the wire harnesses are not directly interchangeable.



BCDC-2A
(Plugs into 8 pin socket)



MASATS Type



DMC-445
(P. C. Board only, does not include a case)

Spindle Drive Switch Pack (Figure 15)

This is a three-switch unit consisting of a vertical reversing switch (with integral switch holder), two horizontal control switches, traveling switch holder, guide pin and switch rings.

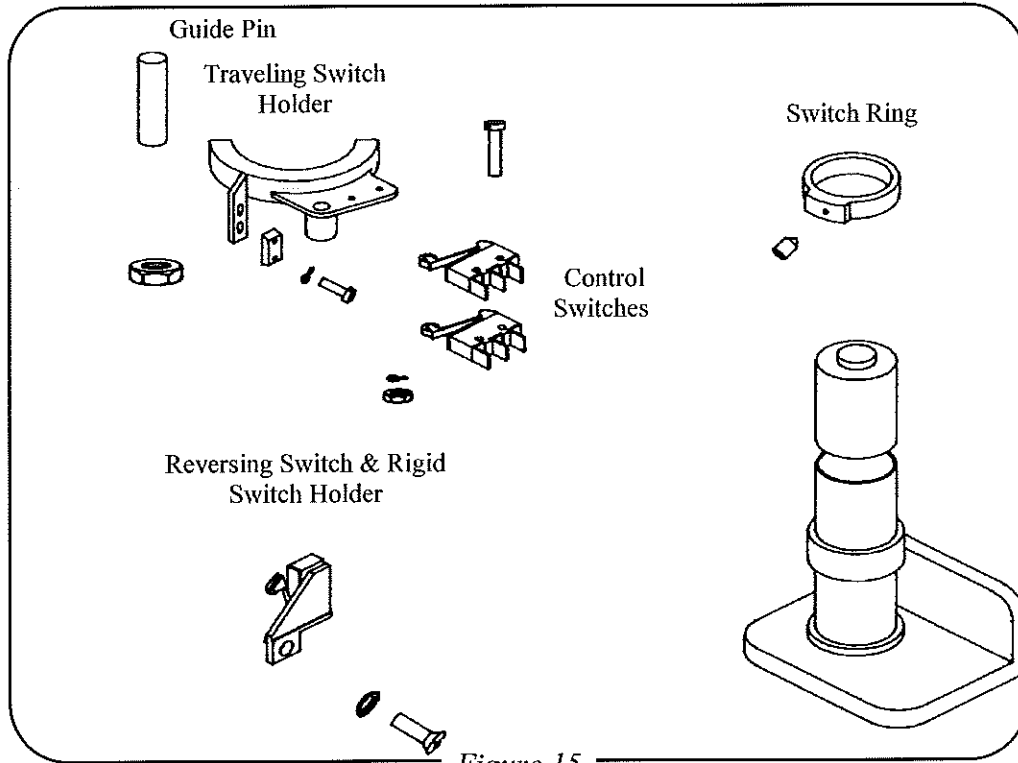
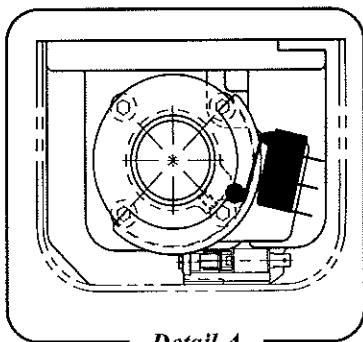
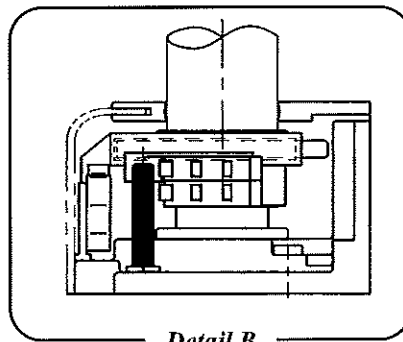


Figure 15

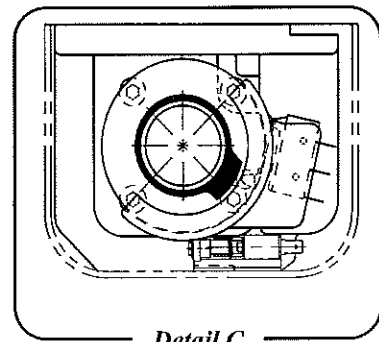
The two horizontal control switches (*Detail A*) are mounted on a traveling switch holder which lifts with the rotating column. The holder is restrained from rotating by a guide pin (*Detail B*) in the spindle drive base. The horizontal control switches are actuated by a switch ring (*Detail C*) that rotates with the rotating column. One of these switches must be used as a *Door Control Switch* to enable the sensitive edges and reversing functions, the remaining control switch can be used to control step lights, interlock circuits and other bus related functions.



Detail A

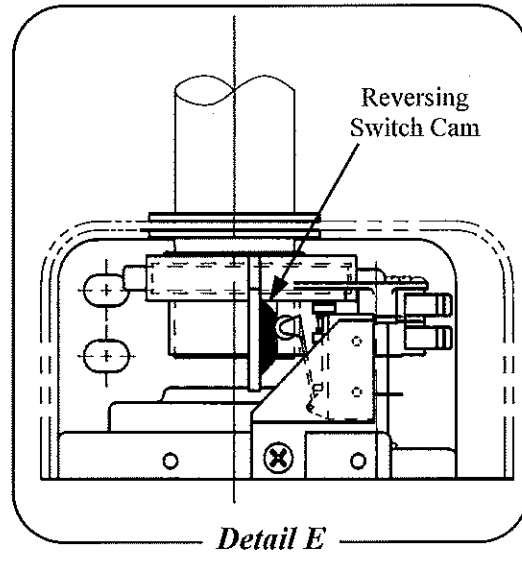
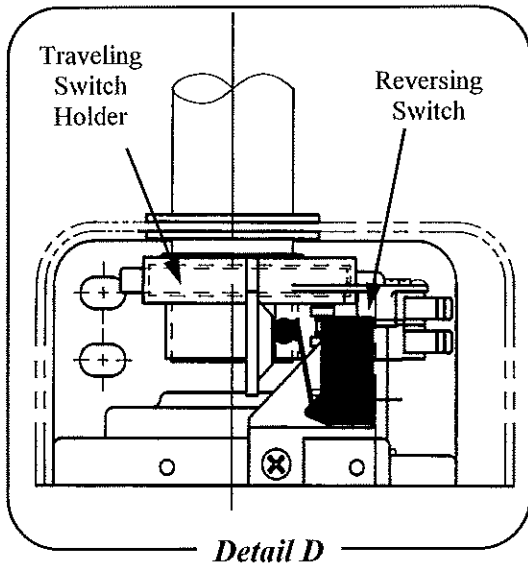


Detail B



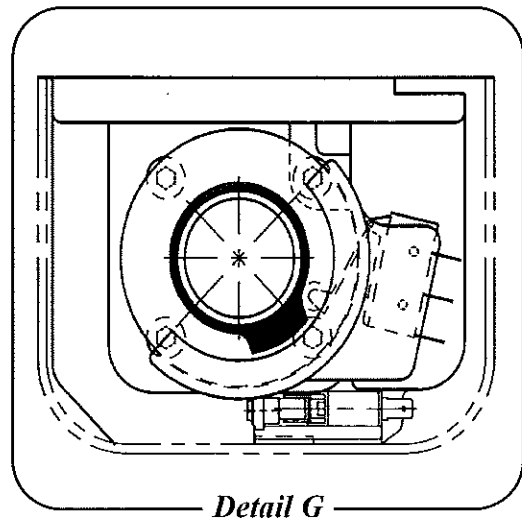
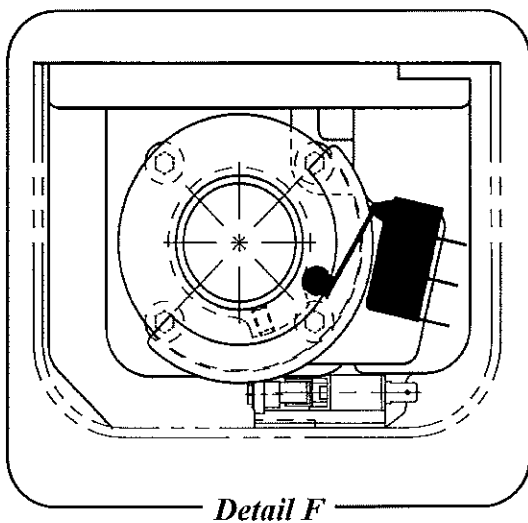
Detail C

The vertical reversing switch (*Detail D*) is mounted on a *rigid* switch holder which is attached to the spindle drive base. The *traveling* switch holder not only serves as the mount for the control switches, but also also contains the actuating cam for the reversing switch (*Detail E*). When the column rises - as the door panels lift to lock (or if an obstruction is contacted while the door is closing) - the switch holder actuating cam will operate the reversing switch (*Details D & E*). The cam is adjustable to increase or decrease the sensitivity of the reversing.



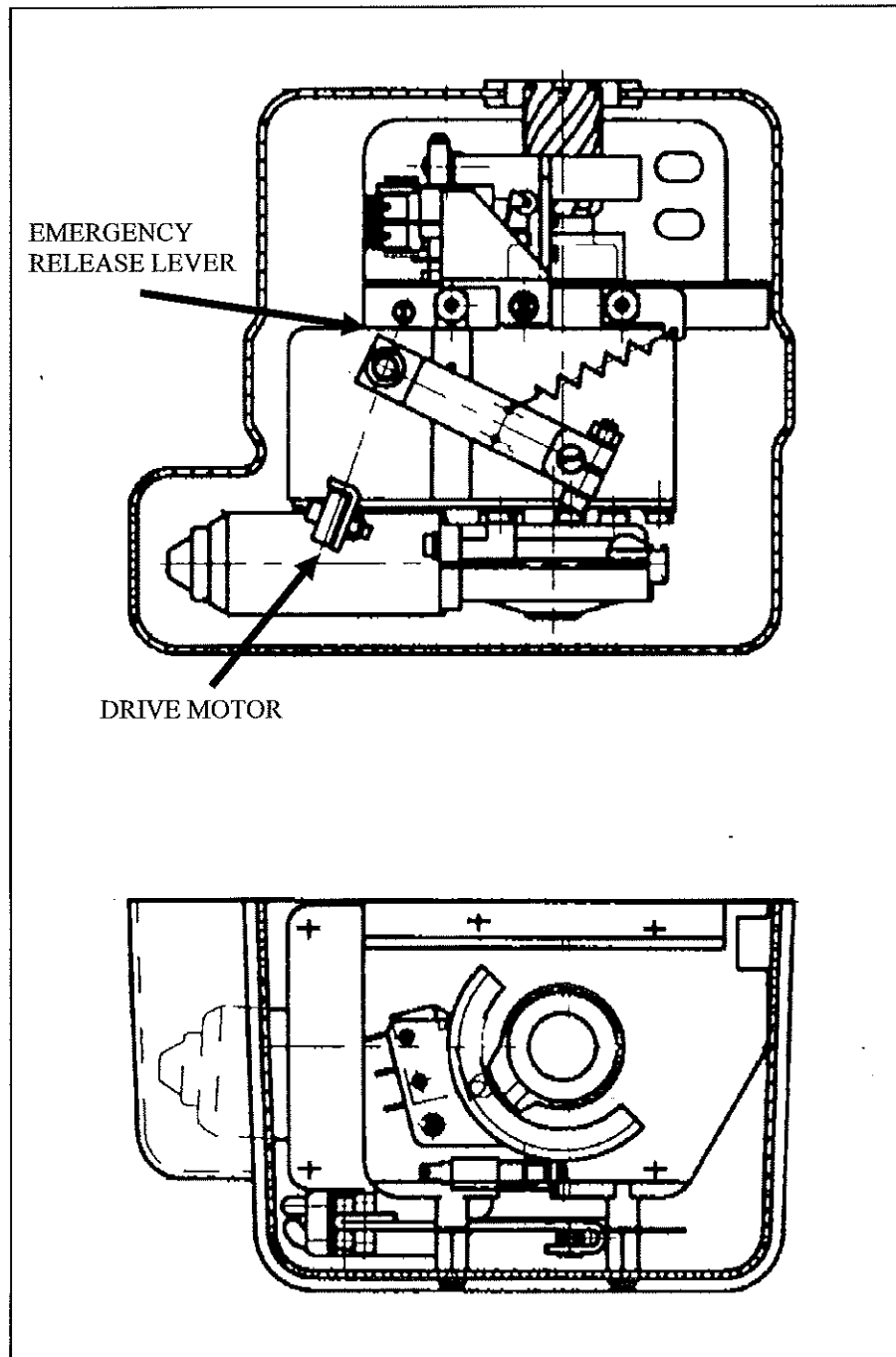
Switch Adjustment

Since the door control switch enables the sensitive edge and reversing safety systems, it is very critical that it be correctly adjusted. While the door is closing, the door control switch should be clear of the switch ring lobe as shown in *Detail F & G*. When the door panel is within approximately 1" from the edge of the step the switch ring lobe should activate the control switch as shown in *Detail A*.



Electric Drive Motor

The electric drive motor is mounted underneath the spindle drive gear case. The motor is a 12VDC motor with integral worm gear drive and spring loaded clutch. The drive gear cannot be back-driven through the pinion gear so the clutch is used to disengage the worm gear from the pinion gear to affect a manual (emergency) operation of the door. This release is also used by maintenance personnel to adjust and troubleshoot the door. The release lever is usually activated by a remotely located handle through a Bowden cable. There may be both an inside and outside handle.



System Installation

Rotating Column Assemblies

1. Verify the hole location for the upper rotating column bracket mounting (*Figure 16*) and correct if needed. Attach the bracket with the supplied hardware.
2. Verify the hole location for the tie rod bracket mounting and correct if needed. Attach the bracket with the supplied hardware.
2. Verify the hole location for the spindle drive bracket mounting (*Figure 18*) and correct if needed. Attach the spindle drive with the supplied hardware.
3. Loosen the rotating column bearing bolt until the point of the bolt is flush with the bottom of the upper rotating column bracket.
4. Lubricate the spring housing and spring with #2 lithium chassis grease and place housing and spring unit into top of column (*Figure 19*).
5. Check alignment of rotating column bearing with bearing bolt. If more than 3/8"(10mm) of misalignment exists, correct prior to proceeding.

NOTE: DIMENSIONS SHOWN ARE TYPICAL, ACTUAL DIMENSIONS ARE ON INSTALLATION PRINT

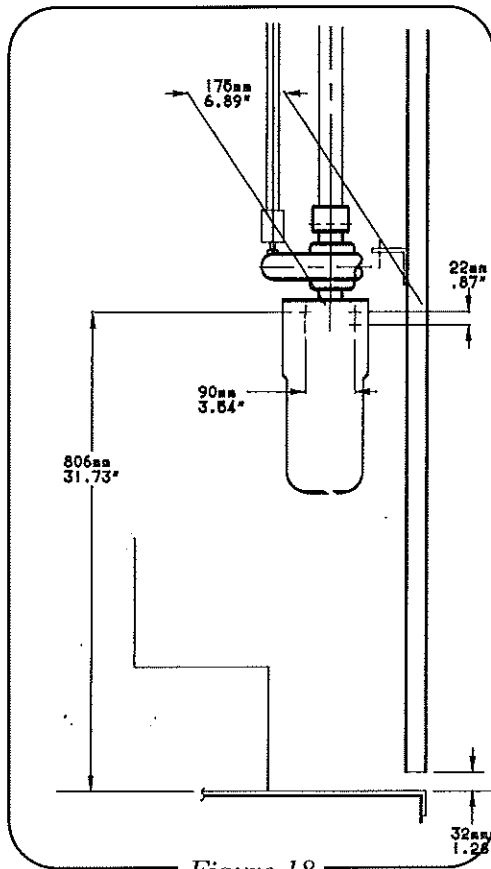


Figure 18

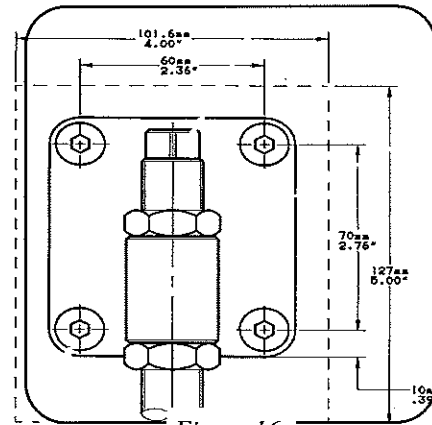


Figure 16

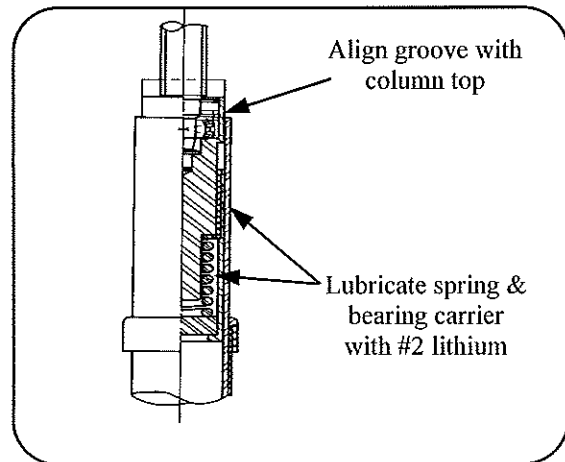


Figure 19

6. Tighten the rotating column bearing bolt until the groove in the bearing housing is flush with the top of the rotating column tube (*Figure 19*).
7. Tighten the jam nut(s) on the rotating column bearing bolt.

Portal Frame Installation

1. Measure the portal height and mark and cut each vertical portal frame member. Apply sealant to vertical portal frame members and install with #10 sheet metal screws.
2. Measure the distance between the outside edges of the vertical portal frame members. Measure the horizontal portal frame member and miter cut to length. Apply sealant to the horizontal portal frame member and install with #10 sheet metal screws.

Portal Rubber Installation

1. Lubricate portal rubber with rubber lubricant or a diluted soap mixture.
2. Hammer rubber into portal frame using a rubber mallet.
3. Secure rubber at each corner with #10 x 1/4" screw (part # 0001.04) and fabric washer (part # 0003.46)

Portal Cam Lock Installation

1. Locate mounting holes for portal locks at the position shown (*Figure 20*). Lock Reference Plane dimensions are on the Installation Print.
2. Drill four pilot holes for 5/16-18 UNC threads centered on the portal frame rubber channel.
3. Using a 3/4" diameter hole saw, cut holes through the portal rubber up to the base of the portal frame rubber channel at each portal lock mounting point.
4. Tap the holes 5/16-18 UNC.
5. Attach portal locks with 5/16-18 x 1 1/4" low head socket cap screws (part # 0002.93) and M8 wave washers (part # 0003.90).

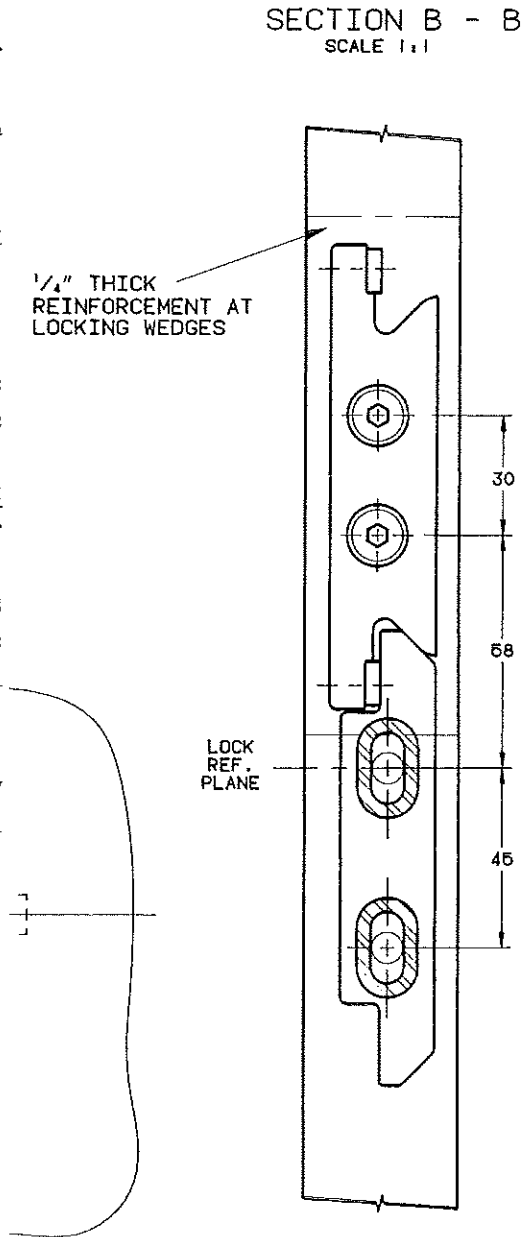


Figure 20

Electrical Connections

1. Connect the electrical systems as shown (Figure 21).

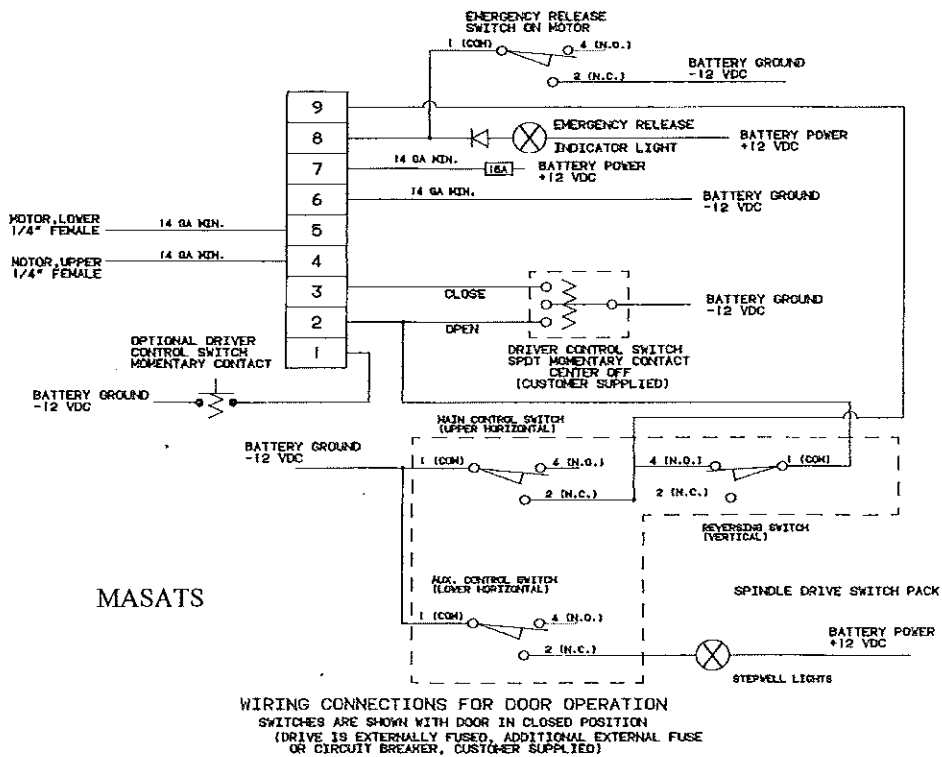
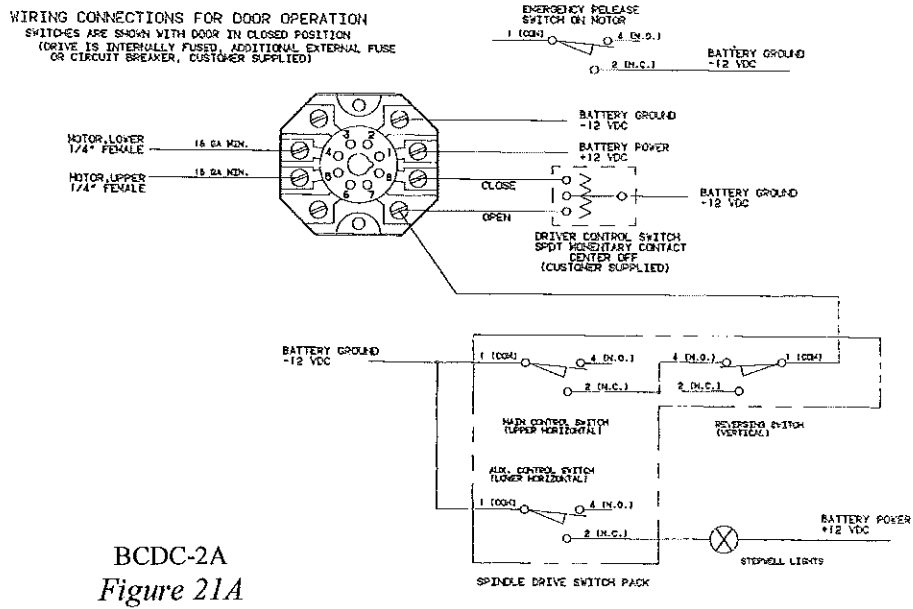
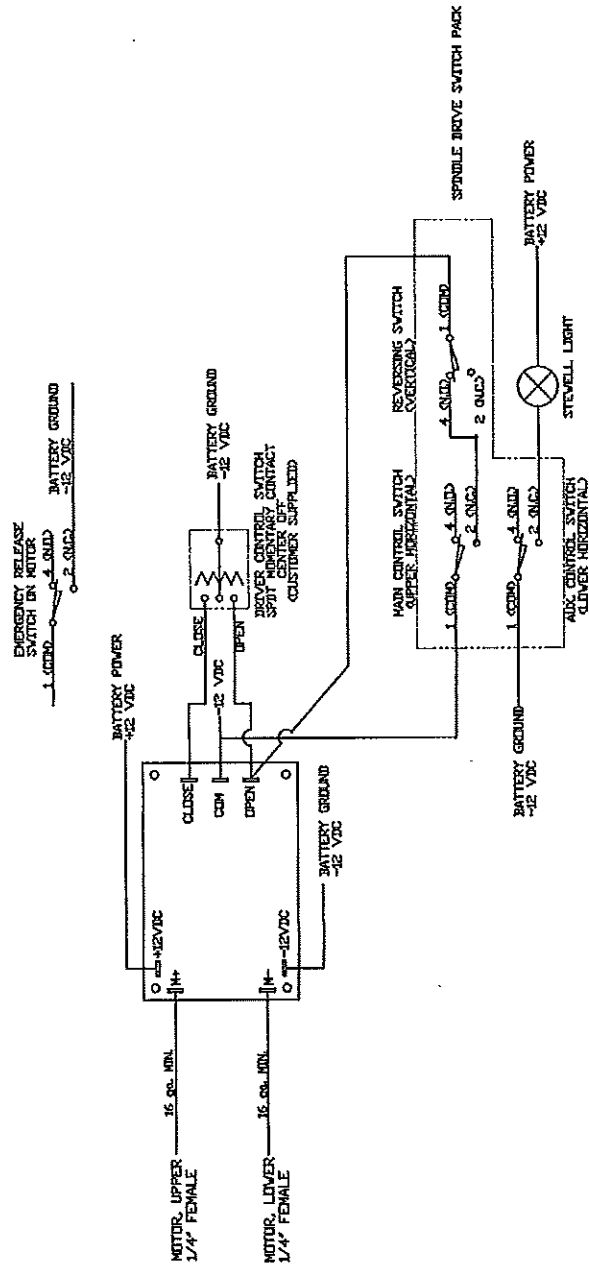


Figure 21B

DMC-445
Figure 21C

WIRING CONNECTIONS FOR DOOR OPERATION

SWITCHES ARE SHOWN WITH DOOR IN CLOSED POSITION
CIRCUITS ARE SHOWN WITH DOOR IN CLOSED POSITION
FUSE OR CIRCUIT BREAKER, CUSTOMER SUPPLIED



Panel Installation & Adjustment

1. Position support arm brackets onto support arm rod end studs with a flat washer on each side of support arm bracket (*Figure 22*) and secure with cap nut and lock washer provided.
2. Attach tie rod assemblies to the panel bracket and to portal mounted tie rod bracket.
3. Loosen the three screws attaching the lower support arm bracket.
4. Raise (or lower) panel to achieve a gap of 1/2" to 5/8" between portal rubber and door rubber directly above the support arm bracket. Move the upper arm on the column as required
5. While holding the panel closed at the top and 1/4" out at the bottom tighten the upper support arm and check gap between the upper portal rubber and door rubber. If it is less than 1/2" repeat step #4.
6. Ensure that the lower support arm bracket is vertical and retighten screws loosened in step #3.
7. Adjust tie rod so panel is flat when closed.
8. Close the panel and check for adequate overlap of the locks. There should be at least 50% side to side engagement.
9. If necessary, loosen support arm rod ends and move panel sideways to achieve proper lock overlap. When properly adjusted, there should be no contact between the rubber and locks.

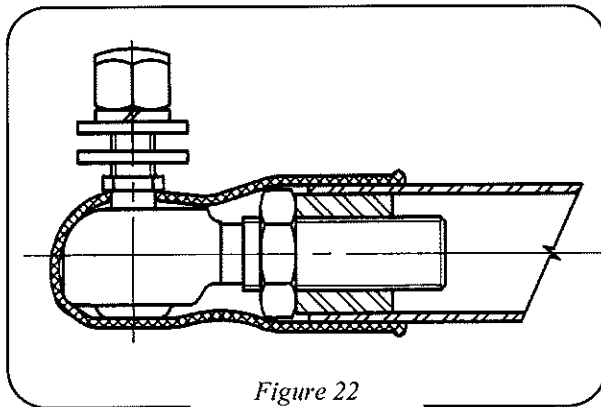


Figure 22

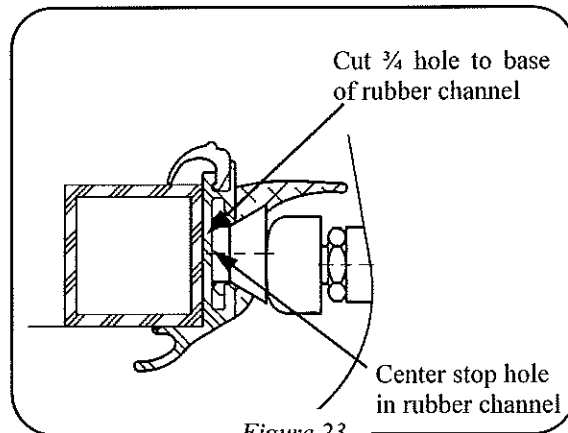


Figure 23

10. Engage the drive and close the door under power. Panel should close flat and fully engage the portal locks. When properly adjusted, the tie rod should have no preload on it when the door is fully closed under pressure.
11. Open the door panel and mark the contact point of the upper support arm stop screw.
12. Using a 3/4" diameter hole saw (with a 1/4" pilot bit) cut a hole through the portal rubber to the base of the portal frame rubber channel at each location marked in step 12 (*Figure 23*).
13. Tap the holes 5/16-18 UNC.
14. Install the support arm stop pad.
15. After ensuring that the door system is correctly adjusted and functioning properly, use the following procedure to weld the lower support arm to prevent it from slipping on the rotating column.
 - A. Clean the paint from the top of the cap side of the support arm clamp.
 - B. Follow the bus manufacturer's recommendations for welding to protect sensitive electronic equipment.

- C. Connect the ground lead directly to the support arm being welded on to eliminate the possibility of damaging the spindle drive bearings.
- D. Place a 3/8" fillet weld in the region shown (*Figure 24*).

Reversing system adjustment

- 1. Manually close the door and check the door control switch (see *Spindle Drive Switch Pack section*) operation.

Note: *Door reversing systems must be checked on a daily basis. When testing for proper operation, The reversing system is tested by stopping the panel (during the closing sequence) about 1" before seal contact. When the panel is stopped, it should begin to rise, at which time the reversing system should operate and reopen the door.*

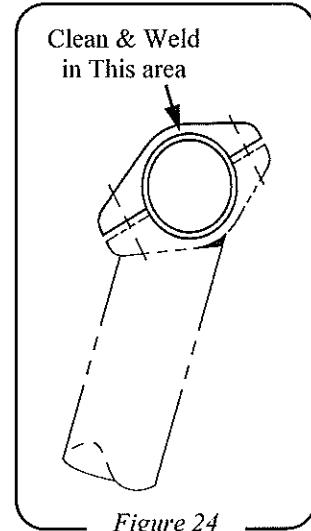


Figure 24

If the reversing system does not function correctly, the bus should be removed from service until proper safety system operation is restored.

TROUBLESHOOTING GUIDE

1. Electrical troubleshooting is addressed in the appendices for the control boxes as they are each different.
2. Door does not operate
Verify power and ground present at module
Verify module relay function
Direct power to motor leads, if door operates replace module, if not replace motor. NOTE: if motor is hot it will not function due to thermal protection. Allow to cool at least 10 minutes before testing.
3. Door will not reverse
Check wiring and switch action. Manually activate reverse switch during closing cycle. If door does not open Switch upper and lower motor leads. If door does not Reverse verify switch contact closure. Verify cam Position and switch activation (control switch)
4. Door lacks closing/lock force
Adjust potentiometer to increase current draw
5. Panel hangs on opening
Check panel position in portal. Check vertical clearance at locks. Shorten tie rod to force rear edge out faster.
6. Panel hangs on closing
Check panel position in portal. Check vertical clearance at locks. Lengthen tie rod to flatten out panel meeting portal
7. Door lifts before engaging locks or lifts while closing.
Check preload adjustment
8. Door functions erratically
Check wiring connections, worn or abraded wires, corrosion in external switches.
9. Panel appears loose
Check all bolts and nuts for tightness, check security of brackets mounted to bus.
10. Rotating column loose
Check flange nut for tightness, verify integrity of joint bar Welds, check column for wear under support arm clamps



ROUTINE MAINTENANCE

1. Daily

- A. Check door function
- B. Check operation of reversing system
- C. Check function of outside key switch/ remote

2. Weekly

- A. Verify function of emergency release system

3. Monthly

- A. Check tightness of all adjustment and mounting hardware
- B. Verify door panel alignment and cam lock engagement
- C. In winter months, lubricate rubber seals with lube or pure silicon spray
- D. Apply non-staining grease to cam lock mating surfaces

4. Quarterly

- A. In non-winter months, lubricate rubber seals with lube or pure silicon spray
- B. On high usage door systems, grease spindle drive with chassis grease. (1 to 2 pumps from a hand grease gun)

5. Semi-annually

- A. Grease spindle drive with chassis grease. (1 to 2 pumps from a hand grease gun)
- B. Clean spindle drive switch area to remove accumulated dirt and grease

