



Owners Manual

Table of Contents

Section	Description	Page
1.	Warnings.....	3
2.	Limited Warranty.....	4
3.	General Info (Materials/Tools).....	5
4.	Doghouse Specifications.....	5
4.1	New Construction Doghouses.....	5
4.2	Doghouse End Space.....	7
4.3	Existing Houses (Retrofits)	7
5.	Installation Instructions.....	8
5.1	Doghouse measurements.....	8
5.2	Install lower support wood 2x4.....	8
5.3	Install First Vertical Rail.....	8
5.4	Install Bottom Horizontal Rail.....	9
5.5	Install Second Vertical Rail.....	9
5.6	Hang Shutters.....	10
5.7	Install Top Horizontal Rail.....	10
5.8	Attach Flap Seal.....	11
5.9	Installing Tie-Bars.....	12
5.10	Mounting Shaft Support Brackets.....	12
5.10a	Mounting Shaft Hangers (Option).....	13
5.11	Caulk Perimeter of Shutter Sections.....	14
5.12	Install Drive Shaft and Pinions.....	14
5.13	Install Di-Drive (P/N 710A6TSK).....	15
5.14	Install Rack Arms.....	15
5.15	Set Pinions.....	16
5.16	Setting Open/Close Switches.....	17
5.17	Final Adjustment (if needed).....	19
6.	Parts List Drawings.....	20
7.	Specifications.....	21

Warnings

- **Disconnect all Electrical Power before entering a Doghouse with Tunnel Shutters® installed.**

Tunnel Shutters® operate using a Rack and Pinion drive system that opens and closes the shutters with great force, which could cause bodily injury. Never enter the Doghouse area unless electrical power has been disconnected from the Tunnel Shutters® Gear/motor.

- **When powered and operating the Shutters for the first time ensure they are not raised up too high or damage to both the Shutters and surrounding structure could occur.**
- **When using Shaft Hangers ensure you do not raise the Shutters up into the Hanger frame or extensive damage could occur.**

Please read and understand all instructions in this manual before installing Tunnel Shutters®.

2. Limited Warranty

All products are warranted to be free from defects in material and workmanship for a period of two (2) years from the date of purchase if installed and used in strict accordance with the installation instructions. Liability is limited to the sale price of any products proved to be defective or, at manufacturer's option, to the replacement of such products upon their return. No products are to be returned to the manufacturer, until there is an inspection and a return-goods authorization.

All complaints should be directed first to the authorized distributor who sold the product. If satisfaction is not obtained or the name of the distributor is not known, write the manufacturer that appears below.

This limited warranty is expressly in lieu of any and all representations and warranties expressed or implied, including any implied warranty of merchantability or fitness for a particular purpose. The remedy set forth in this limited warranty shall be the exclusive remedy available to any person. No person has authority to bind the manufacturer to any representation or warranty other than this limited warranty. The manufacturer shall not be liable for any consequential damages resulting from the use of our products or caused by any defect, failure or malfunction of our products. (Some areas do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.)

This warranty gives you specific legal rights and you may also have other rights that vary from area to area.

Warrantor:

Tunnel Shutters® Inc.
P.O. Box 71746
Newnan, Georgia, USA 30271
Phone: 770-301-6982
email: info@tunnelshutters.com

3. General

Tunnel Shutters® come in 4 foot wide modular units that connect together allowing a continuous run of Shutters for any required lengths. The modular units can be divided into as many “sectional groups” as desired. An additional Gear/Motor machine will be required for each section or group of Shutter units. Currently the only machine authorized for use with Tunnel Shutters® is the Di Drive by Diversified.

Required Materials: Straight Pressure treated 2x4s (equal to length of Tunnel openings)
Heavy nails or deck screws to install support 2x4s, and Silicone Caulking.

Required Tools: Cordless Drills with 1/2” and 9/16” nut drivers, 2 ft Carpenters Square, 3 ft Level, Allen Wrenches (4mm), Sockets/Wrenches for 5/16, 3/8, 7/16, 9/16, and 17mm bolt/nut heads, Marker pen, tape measure, and a hammer. Work bench or Saw horses. Also required is a “Z” square tool for easy installation of the torque tube support brackets when installing in doghouses. This simple tool will be provided with each shipment of Tunnel Shutters. You will not require the “Z” tool if you are using the “Hangers” for the torque tube supports.

4. Framing Specifications

Shutter units can cover window/tunnel openings with heights of 4 to 6 feet high and run for any required length of opening as required. The individual Shutter units are exactly 4 feet wide on center, so the total length of the window/tunnel opening should equal a distance that is divisional by 4 (ex. 16, 40, 88, 100 feet) and then subtract 2 inches from this length.

The wall studs of should be spaced 4 feet on center to align with the Shutter’s “Vertical Rails” (also 4 feet on center) as these rails require center support behind them. However, houses with Stud spacing that is not 4 feet on center can have a vertical **2x4** stud placed behind each shutter Vertical Rail. This will provide the required support behind the Shutter’s Vertical Rails. The wall studs need to be flush with the header and footer of the window opening to properly support the Vertical Rails. In most cases this can easily be done by covering the wall Studs with the same plywood that is on the header/footer of the wall.

It is also recommended that 1 to 2 feet of wall space area is available at each end of the window/tunnel opening to ensure clearance for the Di Drive machine and provide tolerance for the ends of the Tunnel Shutters® sections (picture on page 7).

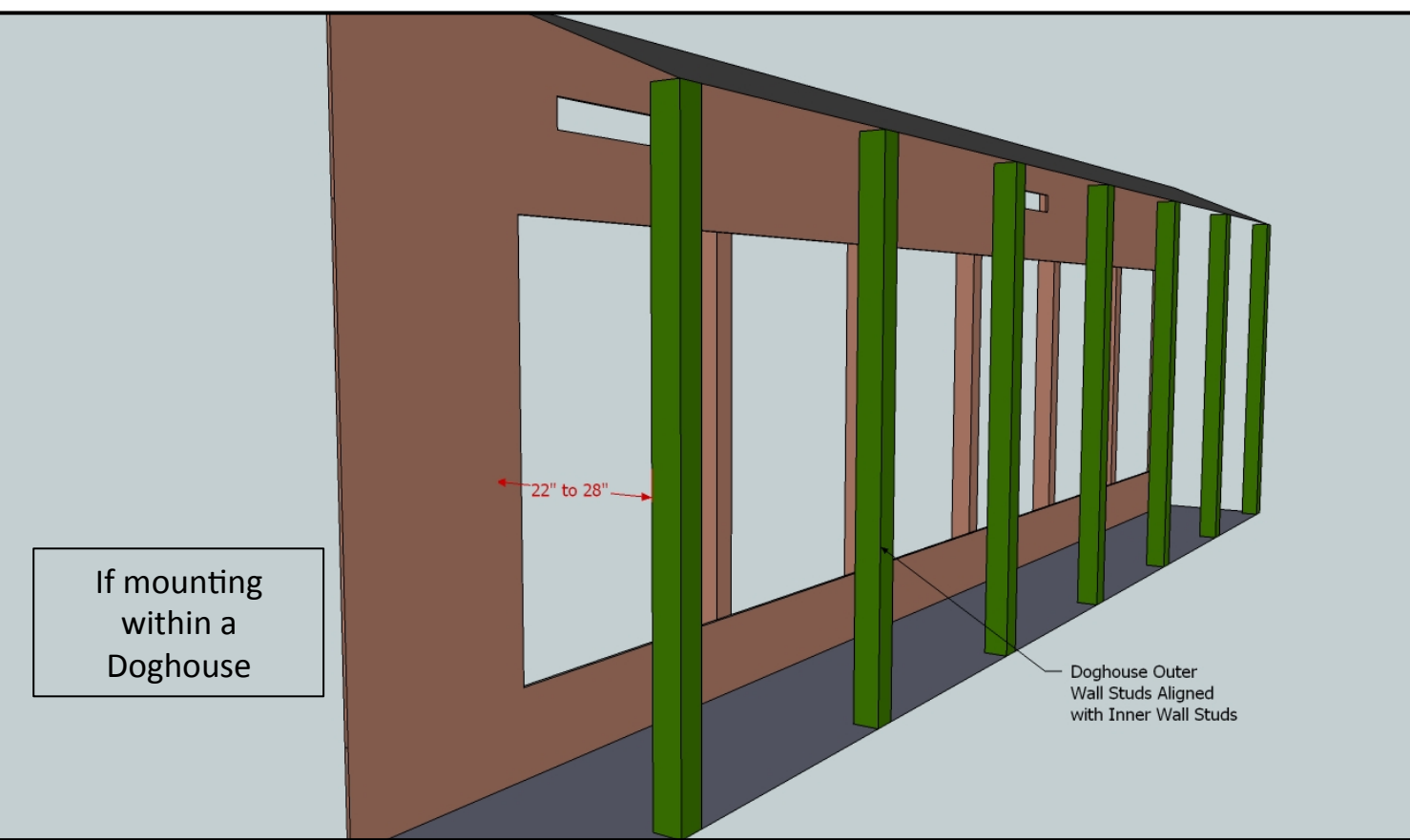
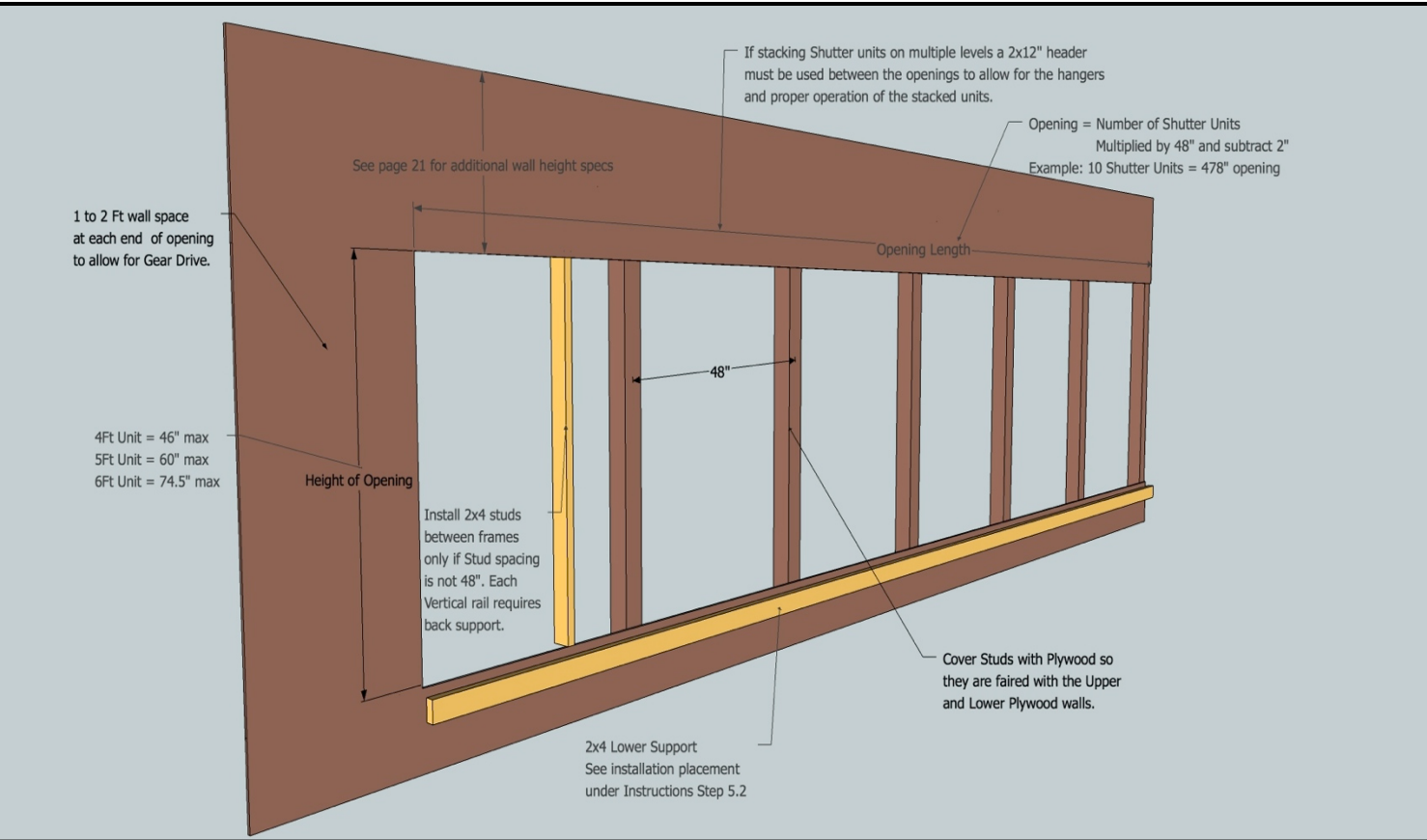
4.1 New Construction Doghouses

For construction of new houses it is recommended that the Doghouses have a minimum height of 8 Ft. (inner wall), the Studs placed on 4 Ft centers, the tunnel window opening is no higher than 59 inches, the window opening is kept low on the wall with the bottom of the window sill no higher than 12 inches from the floor, **and the Doghouse internal width is 22 to 28 inches wide.** It is also necessary to cover the Studs with the same thickness of plywood so the Studs are faired evenly with the Wall surfaces.

It is also recommended that the **chicken wire** is placed under the plywood of the inner wall and Studs of the Doghouse.

See the drawings on the next page (6) for new construction specifications.

Please follow the following specifications for construction:



4.2 Doghouse End Space

At both ends of the doghouse allow approximately 1 to 2 feet of plywood covered wall area. This will ensure clearance for the DI Drive and provide tolerance for the ends of the Tunnel Shutters® sections.

If this space is not available (**Retrofits**) you may also mount the DI Drive outside of the Doghouse and cut a small hole for the Drive Shaft to enter the Doghouse through.

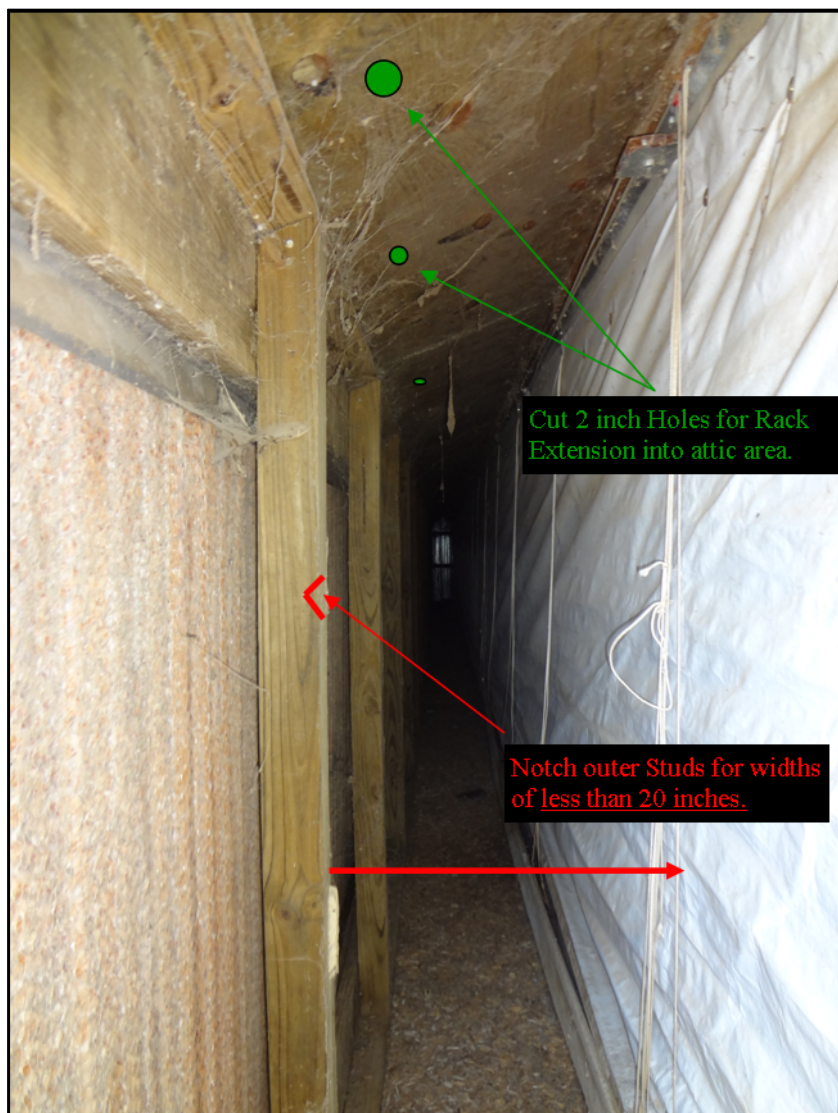


4.3 Existing Houses (Retrofits)

Tunnel Shutters® can be installed into almost any existing Doghouse. Here are a couple of items to consider for your retrofit:

1. Dog Houses with low ceilings (less than 8 ft) may require a small (2 inch) hole drilled into the ceiling to allow the top of each Rack to extend up into the attic area when the Shutters are fully opened.

2. Narrow Doghouses (Less than 20 inches wide) may simply need the outer 4x4 wall Studs notched to allow installation of the Rack and Pinion Drive Shaft to maintain a recommended 75 degree angle opening of the Shutters. **For Example:** A Doghouse that only has a width of 19 inches would require a 1 inch notch cut into the outer 4x4 studs to allow the Shutters to open to a recommended angle of 75 degrees. **For Doghouses of 19 inches wide or less you can also open the Shutters to a slightly lower angle as needed to accommodate the Shutters into your existing houses.**



5. Installation Instructions

5.1 Doghouse Measurements

Measure the doghouse window overall length. Each Shutter unit is 4 feet wide so ensure that you will have wall space available at each end of the window to fasten the last installed Shutter unit to.

For 4 foot stud spacing make sure the Shutters are spaced equally so the Shutter Vertical Rails are backed by the inner wall studs for added structural support.

If the house construction has wall stud spacing other than 4 feet, then add a wood 2x4 Sill half way up the window to structurally support the back of the Shutter's Vertical Rails no matter where they fallout of alignment with the wall studs. Another option is to install a 2x4 stud vertically directly behind each Vertical Rail. This will also ensure there is no additional air flow restrictions.

5.2 Install lower support wood 2x4

Place a Vertical Rail (with Bottom and Top Coupler already installed) up against the window/tunnel opening. Using the Vertical Rail as a guide place it in the lowest possible position on the wall, but the Top Coupler must not be below the top of the window opening. Now mark a line under the Bottom Coupler. This mark will be the reference line for the top of the wood 2x4. Measure the distance from this line up to the bottom of the window sill and continue to mark this distance the length of the opening. You may use a chalk line if desired, but always maintain the same distance down from the bottom of the window sill.

Install a pressure treated 2x4 along this reference line the length of the opening using deck screws/nails. The Shutter Units will be supported by this 2x4 so ensure it is fastened securely to the wall.



5.3 Install First Vertical Rail

With a Bottom Coupler and Bottom Rail installed into the first Vertical Rail, hold the rail in position while resting on the 2x4 wood support. Using a Square tool ensure the rail is 90 degrees level in the upright position. Using one of the supplied 3 inch Stainless wood screws fasten the Vertical rail to the wall using the pre-drilled hole at the top of the rail. Then insert one additional screw through the middle of the rail between the two bulb seals (this second screw is only installed on the 1st and last Vertical Rail of the Shutters run).

If the first or last Vertical Rail are too close to the end wall to apply a bead of caulking down the outer side (sec 5.11), then apply caulking to the back side of the first/last Vertical Rail before screwing it into position.



5.4 Install Bottom Horizontal Rail

The Bottom Horizontal Rail has 3 pre-drilled holes through it. Insert a Bottom Coupler into one end of a Horizontal Rail and then insert the other end of the Rail into the Bottom Coupler that was just installed into the 1st Vertical Rail. **Note:** It is easier to slide the Bottom Horizontal Rail onto the Bottom Couplers when installing from an outward angle as shown in photo #2.

Before screwing the Rail down to the 2x4, run a small bead of Caulk behind the Bottom Coupler (pic 3) and slip on the next bottom rail to the other end of the coupler. Then secure the first Bottom Horizontal Rail to the 2x4 by installing three, 3 inch Stainless steel screws. **Do Not over tighten as this will damage the plastic rail. Be sure all coupler and rail joints are tight before screwing down.**

Now run a bead of Caulking (clear) along the inside edge of the Bottom Horizontal Rail (pic 4).



5.5 Install Second Vertical Rail

Place a second Vertical Rail down onto the exposed Bottom Coupler, but do not secure in place. Using two Top Couplers and one Top Horizontal Rail (1 pre-drilled hole facing you) hold the Vertical Rail and the Top Horizontal Rail into position.

Now in position the Shutter's framing should be square and ready to screw to the wall. It is a good idea to check the upright angle of each Vertical Rail with a Carpenters Square as you continue to connect each unit (step 5.3). **It is critical that the Shutter's Frame (Vertical & Horizontal Rails) remain square as they are being installed.**

Secure the Second Vertical Rail to the wall by using a 3 inch Stainless Screw fastened through the hole at the top of the Vertical Rail (pic 3).

Now remove the two Top Couplers and the Top Horizontal Rail and set aside for later (pic 4).



5.6 Hang Shutters

To Begin, slide one Spacer down each inner track of both Vertical Rails. The Spacers create the support and proper separation of each Shutter and will also provide the bushing for each hinge bracket.

Now slide a Shutter down the inner tracks of each vertical rail by aligning the ends of the hinges with the open slots of the Vertical Rails. **Be careful to keep the Shutter in a level position as it slides down the tracks to avoid damaging the hinges.** The Shutter will also need to be held in a slightly open position so it does not bind on the Bulb seals of the Vertical Rails as you slide it down the tracks.

Now with the bottom Shutter in position continue to add a Spacer on each side followed by another Shutter until all four Shutters have been hung. The Top Shutter should be the one with the hanging flap seal attached to it.

Note: 2 of the Shutters in each box will need the Hinges and Tie Bracket attached to the Shutter panels using the provided screws. This is to reduce shipping costs and prevent possible damage during shipping. A make shift work bench or saw horses are recommended on site for ease of installation.

Repeat Steps 5.4, 5.5, and 5.6 until all Shutter Units have been installed for the entire section or side of the house.



5.7 Install Top Spacers/Coupler and Horizontal Rail

Now that all the Shutters have been hung, **install two small Spacers** as shown under the Top Coupler and on top of the Top Shutter Hinges. Re-install the Top Horizontal Rail into position as described in section 5.5. It may be necessary to only partially slide each Top Coupler down into each Vertical Rail as you continue with each unit, so as to create enough space before pushing them completely down together.

The Top Horizontal Rail is then secured by Stainless Steel 3 inch wood screw installed through the holes of the rail. **Do not over tighten or it will cause damage to the rail.**



5.8 Attach Flap Top Seal

Begin by tucking the adjacent Seals in together between the two bulb seals for each top Shutter. Make sure to overlap each seal the same way for each joint (left over right or right over left). Next, install the Retainer strip below the ridge of the seal.



Fasten the Retainer Strip with screws to the flat face of the Top Rail just below its center screw. The ends of the Retainer should be placed at the middle of each Top Coupler.



Next, fasten a screw through both overlapping seals to secure them to the Vertical Rails and also at each end rail.
Update: Use Large Washer under screw head. Washer provided with hardware.
Do Not over tighten causing damage to the seal.



5.9 Installing Tie-Bars

Using the four larger holes in the Tie-Bar, attach to each of the 4 Shutters using the bolts/nuts provided.

Do Not over tighten as this could cause damage to the Tie-Bar Brackets. The bolt only needs to thread through to the Teflon of the nut and no further.

The Bar should be positioned as shown in this picture, with the long end of the Bar at the top Shutter. The Bar should also be positioned where the holes are closer to the Shutter side.



5.10 Mounting Shaft Support Brackets

(Installation with Doghouses of up to 28" wide, otherwise see Hangers on next step)

Using a standard Adjustable Drywall Square and a small Level (attached as shown) mark the placement of the Shaft Support Brackets.

Ensure the Bushing Plate is inserted into the Support Bracket but not tightened down. Now, rest the long section of the Drywall Square directly on top of the Shutter's Top Rail and pushed firmly against the doghouse inner wall.

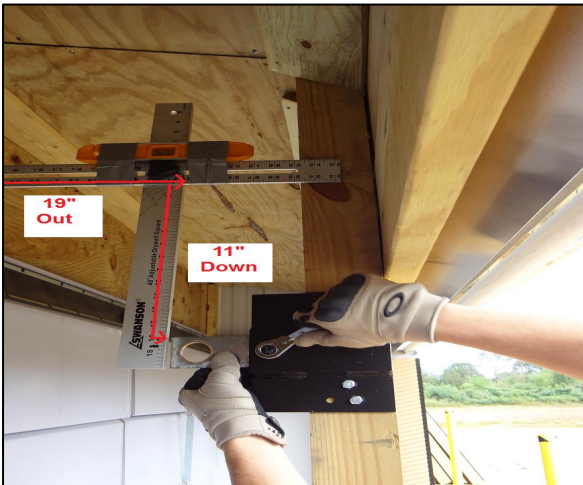
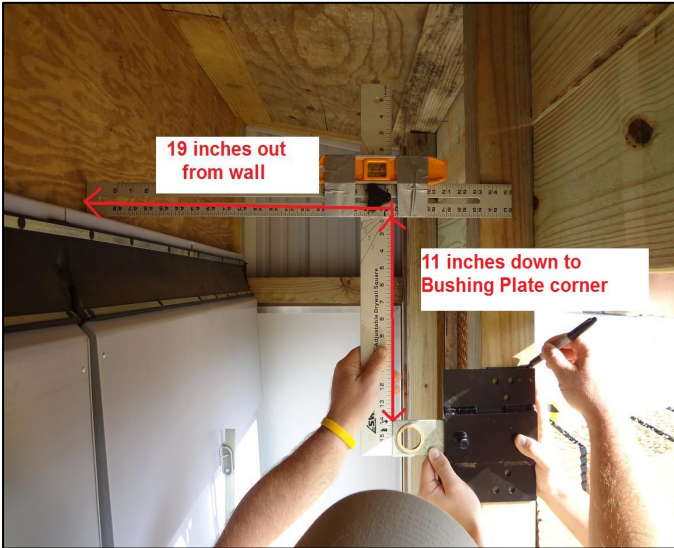
With the Square's measurements set to exactly **19 inches out and 11 inches down to the top corner of the Bushing Plate**, hold at a level position and mark the correct placement of the Shaft Support Bracket as shown in the picture.

Using this mark on the outer Stud, attach the Shaft Support Bracket using the 4 Lag bolts. Two bolts at top and two bolts in the bottom of the Bracket. Continue this process for each Shutter unit.

With all the Support Brackets installed, use the Drywall Square and hold in the same position as described above. Now, slide the Bushing Plate to the correct position again (top corner at 11 in. down), and lock into position by tightening the adjustment bolt on the Support Bracket.

Do not deviate from this procedure as it ensures the correct position of the Drive Shaft to the Shutter units, even though the framing of the house walls may be distorted.

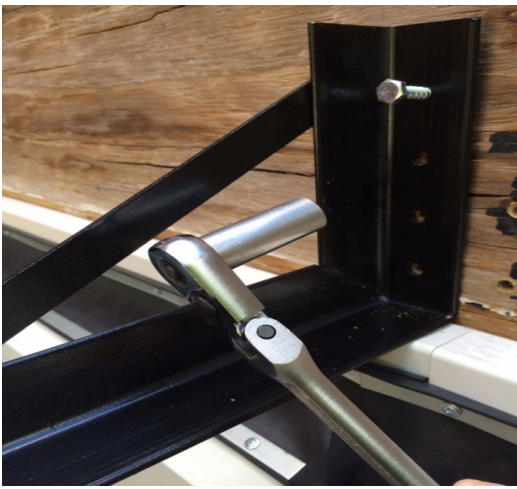
Note: Our **"Z" Square** tool is now available to order. This tool eliminates having to make measurements or the need of a drywall square and level for Shaft Bracket installations.



5.10a Mounting Shaft Hangers (option)

As an option, you may use our Shaft support **Hangers** in place of the Brackets. The Hanger is ideal for installing Shutters where there is no outer dog house wall available. The Hanger would be used for all outdoor installations or in cases of very wide dog-houses (28 inches or more).

Simply rest the attaching end of the Hanger directly on top of the Top Shutter Rail and drill 4 pilot holes for lag bolts. **The hanger must be positioned so the bolts screw into the frame of the house and not just the plywood.**



Ordering Hangers:

You will require one Hanger per Shutter Unit on houses with 4ft spaced frames. Houses with 5ft spaced framing will require one Hanger per stud every 5 feet. **8 inches of space above the Top Rail is required for Hanger installations.**

Note - Hangers are required for all outdoor Installations or when any dog-house is wider than 28 inches.



5.11 Caulk Perimeter of Shutter's Section

Using a quality outdoor flexible Caulking Sealer (clear), run a bead of caulking along the top of the Shutter's section where the Upper Rails contact the plywood wall.

Also, run a bead of Caulking down the sides of the two Vertical Rails that are at each end of the Shutter's section where they contact the plywood walls.

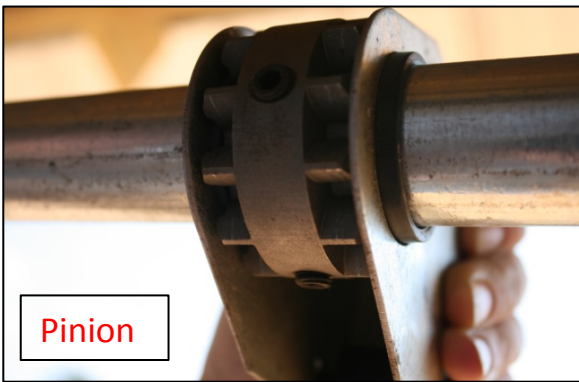


5.12 Install Drive Shaft and Pinions

Begin by sliding the Shaft sections through the Bushing Plate supports while also installing one Pinion on the Shaft for every Shutter Unit. **Do not forget to install the Pinions or you will have to remove the Shaft and start over.** At this time it is also important to make sure that none of the Shaft connecting bolts will be in the way of the Pinion's placement, which is directly in line with the Tie-Bars. Slide the Shaft as needed to avoid this. You may also need to remove one of the Bushing Plates at the end of the section to make it easier to install the Shaft up into the Doghouse. Re-install the Bushing Plate (Sec - 5.10) once the complete Shaft run is in position, inside of the house.



Once all the Shafts are in place, connect together utilizing the swaged ends and secure with the 2" (grade 8) Shaft bolts/nuts and tighten. (It may be necessary to run a 3/8" drill bit through the Shaft holes if they are not perfectly aligned for the bolts.)



If possible, install the Shaft sections so the Di-Drive end will have the pre-drilled open swaged end available, so it can slide over the gear shaft. This will eliminate having to drill a 3/8" hole through the Shaft for the gear connection.



5.13 Install Di-Drive Gear/Motor (Part No. 710A6TSK)

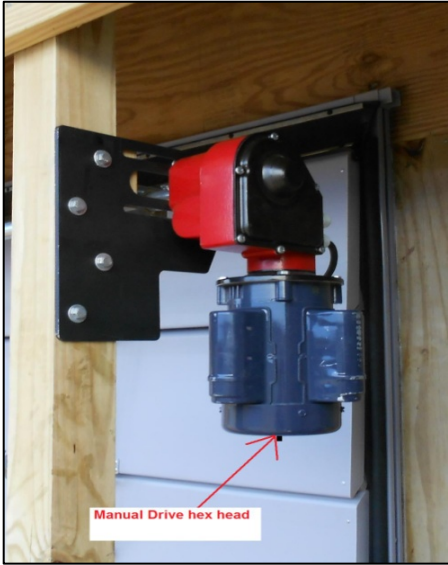
With the drive Shaft and Pinions now installed, begin by placing the **Di-Drive Mounting Plate** into position by aligning the center slot with the hanging Shaft. Place a long level on the Shaft to ensure it is entering the mounting plate at a level position, while also keeping it in straight alignment with the first Bushing Plate (you may use the Square tool to verify this). The Shaft may be positioned anywhere within the slot area, however place it in a position where as the mounting plate can easily be fastened to the Stud.

Attach the plate first with two lag bolts in the middle two holes, then drill through the top and bottom holes and install two carriage bolts and tighten. (Recommend the Stud be at min. a 4x4 structure)

Before securing the Di-Drive to the Mounting Plate, hold the Di-Drive in position and ensure the first Shutter unit will clear the gear/motor when the Shutters are in the full open position. The Di-Drive can be installed motor end up, down, or even horizontally if required. Take into account that the manual drive connection is on the bottom of the motor. **Therefore, the motor would need to be in a position where it could be easily driven by a hand-held drill if there was a loss of electrical power to the house.**

Using the 4 attaching Bolts and Washers, mount the Di-Drive to the plate through the upper and lower slots while the Shaft is in the correct position as described above.

Now with the Di-Drive secured to the plate, slide the Shaft over the gear drive end and secure by inserting 1 Shaft bolt (grade 8) through the Shaft and Gear drive and tighten the nut securely.



5.14 Install Rack Arms

Insert the Rack Arms (end with no bolt hole) up into each of the Pinions. Align the bolt hole end of the Rack with the **top** remaining hole on each Tie-Bar. Before installing the bolt ensure the two Set Screws are accessible on the Pinions. If not, remove the Rack Arm from the Pinion and turn the Pinion wheel to another position, then re-insert the Rack Arm and re-check that the Pinion set screws are now accessible with the Rack Arm attached to the Tie-Bar.

Now install the bolt through the Rack Arm and the Top hole of the Tie-Bar and secure with the nut. (**Do not over-tighten**)



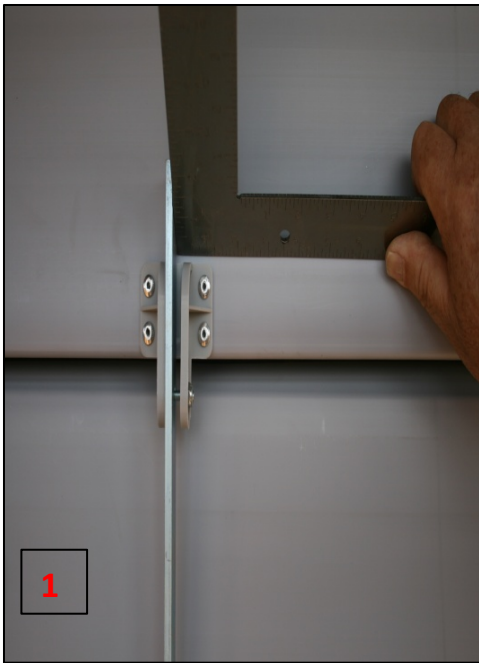
5.15 Set Pinions

Using a 2ft Carpenter's Square hold one edge of the square firmly up against the side of the top section of the Tie-Bar and parallel to the Top Shutter lower edge (see pic 1).

Now lay the other edge of the square directly on the center of the Rack Arm. The edge of the square should split the channel of the Rack Arm (see pic 2).

With the Pinion sitting in this position, mark both sides of the Pinion onto the shaft using a permanent marker. This will be the exact location of the Pinion which will be directly in line with the Tie-bar.

With all Shutter Units hanging freely and in the exact same near closed position, firmly tighten down both set screws with a 4mm Allen wrench while the Pinion is positioned on the marks. Continue this procedure for each Pinion.

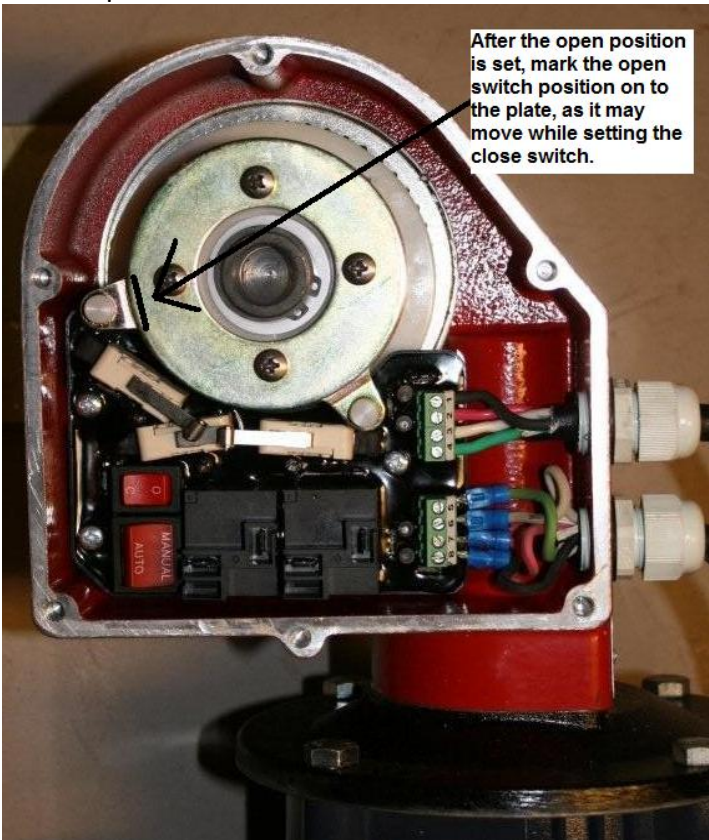


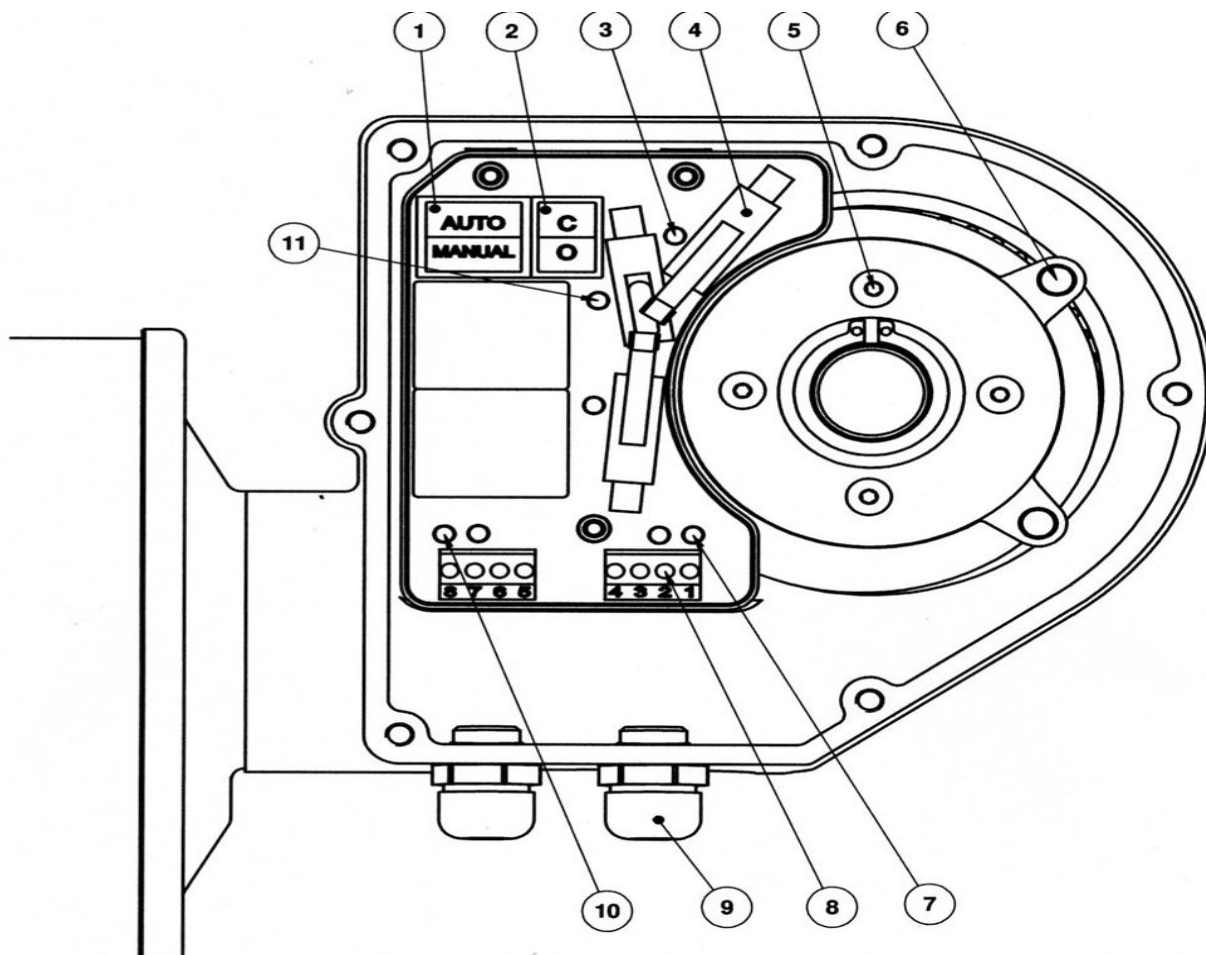
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5.16 Setting Open/Close Switches

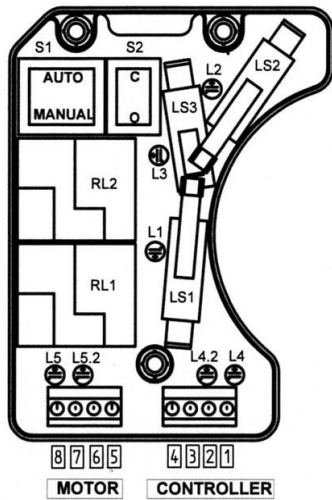
Reference pictures on pages 17 and 18 for the following procedures:
Limit Switch Setting Procedure

- Move Switch (1) to "MANUAL" and Switch (2) to "OFF," which is the center position.
- Connect the wires from the controller to Terminal Blocks (8) as shown in wiring diagram.
- Apply power to the unit from the controller on either the open or close circuit.
- Loosen the limit switch plate Screws (5) so that that the two Limit Switch Plates (6) can be moved by hand with slight friction resistance.
- ***Check to insure that motor rotation is in sync with limit switches.*** With the Open/Close switch run the motor each direction and depress the Limit Switch (4) being approached by the pin (6). If motor rotation is not in sync with the switches, reverse leads to motor 7 and 8 and test again. If motor leads are reversed the power leads 1 and 2 may also need to be reversed.
- Starting with the less accurate position requirement side (the Open position), rotate the motor to the desired limit position using the "Open"/"Close" Switch (2). (Watch that limit switch Pins (6) will not touch either Limit Switch (4) during this procedure)
- **Carefully watch the Shutter system move up to the open position ensuring the top of the Rack Arms will not hit the ceiling of the Doghouse and the Shutters will not contact the Hangers.** It is a good idea for at least two people to watch while the Shutters are being opened for the first time.
- **Do Not open the Shutters past 90 degrees or high enough to hit the Shaft Hangers above or damage will occur.**
- Once they are open stop the motor and set the open switch (the lamp near the activated Limit Switch will be alight when the switch is made). If less than 90 degrees is desired then set the open switch per your requirements.
- **Note:** there is no air restriction with the Shutters set to any angle above 75 deg.
- Using a marker pen, mark the position of the Open Limit Switch onto the switch plate to ensure it is kept in the same location while the Close Switch is being set. See pic below:
- After Setting the Open Limit position, rotate the motor to the other limit position (Closed position), using the "Open"/"Close" Switch (2).
- While closing the Shutter Units watch the Shutters closest to you and stop the motor as soon as they are tight against the Vertical Rail bulb seals. In this position, most if not all of the Shutter units should be closed tight. **If an individual Shutter unit is not as tight as the others than it can be fine adjusted (see section 5.17)**
- While holding the Open adjustment Pin (6), rotate the other (Closed position) Pin (6) until the Lamp near the second activated Limit Switch alights.
- Tighten the 4 Limit Switch Screws (5).
- Verify proper adjustment by using the "Open"/"Close" Switch (2) and Limit Switch Lamps (3).
- Finally, switch the "Auto"/"Manual" Switch to the "AUTO" position if no further adjustments are needed.



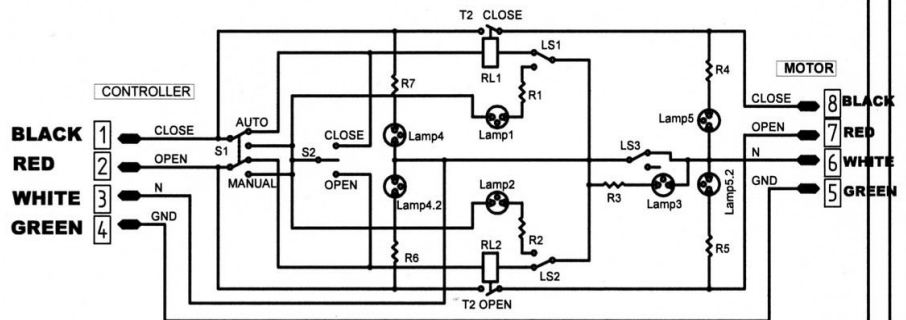


ITEM	DESCRIPTION	QTY.
1	SWITCH- AUTO / MANUAL	1
2	SWITCH- OPEN / CLOSE	1
3	LAMP- LIMIT SWITCH	2
4	LIMIT SWITCH	2
5	SCREW- LIMIT SWITCH	4
6	PIN- LIMIT SWITCH	2
7	LAMP- INPUT	2
8	TERMINAL BLOCK	2
9	CONNECTOR- PANEL	2
10	LAMP- MOTOR	2
11	LAMP- OVERRIDE	1



Product Schematic Graph

LS1 - CLOSED SWITCH
LS2 - OPEN SWITCH
LS3 - SAFETY SWITCH



Circuit Schematic Graph

WHEN THE DRUM IS ATTACHED TO THE GEAR THE BELT SHOULD BE WOUND CLOCKWISE

THE BOLT TO ATTACH THE GEAR TO PLATE IS 10MM
THE BOLT TO ATTACH THE GEAR TO MOTOR IS 3/8"

5.17 Final Adjustment (if needed)

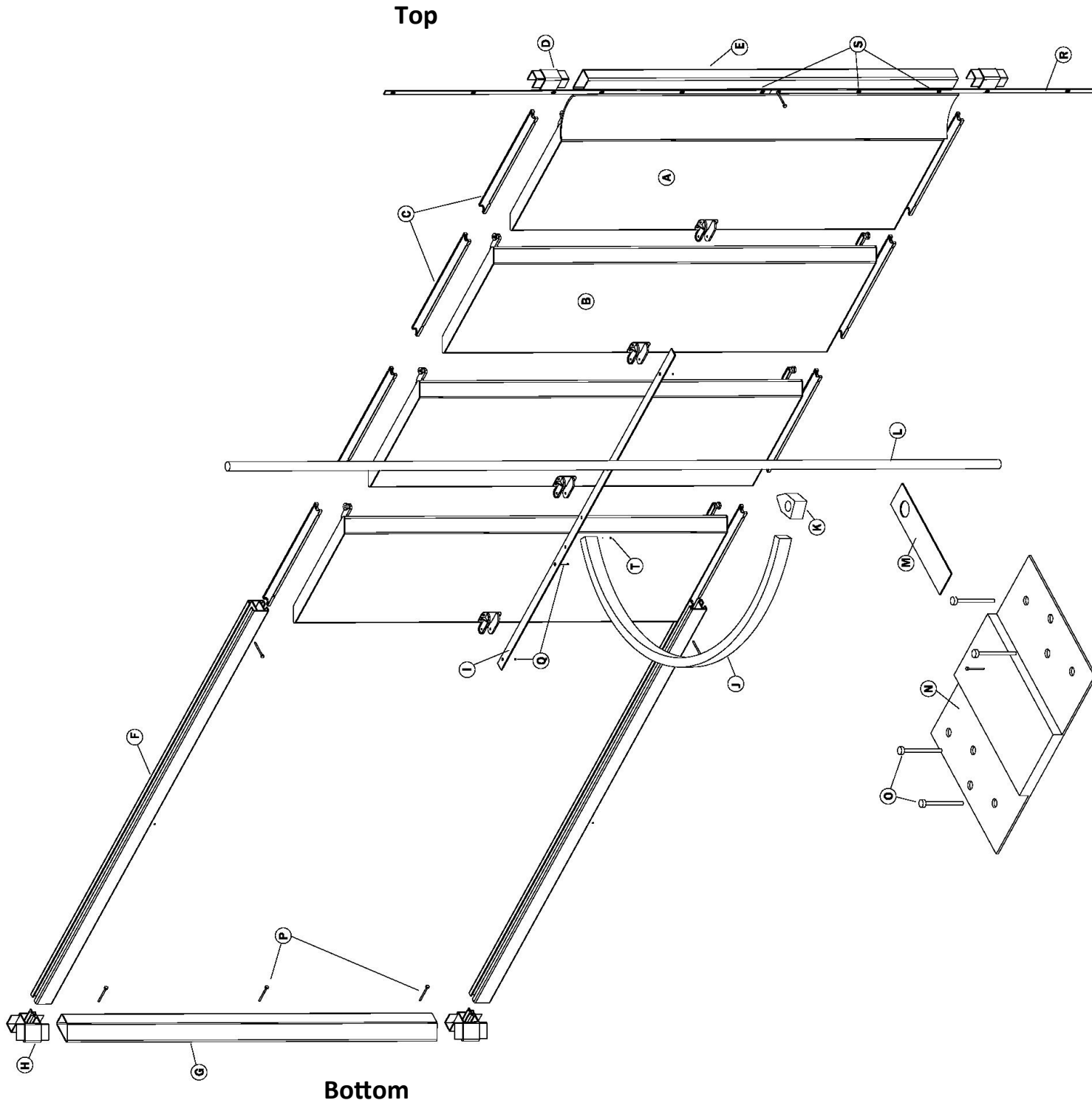
After closing the full section of Shutters described in section 5.16, you may have a Shutter unit that is not completely tight against the seals, usually caused by the house walls not being straight. If this is the case then follow the steps below. If several of the Shutter units are not tight, then adjust the Close switch of the Di-Drive to a slightly more closed position (section 5.16).

- Loosen the two set screws of the Shutter unit that is not fully closed (you may need to run the motor open a little to gain access to the screws).
- Fully close the entire section of Shutters using the motor.
- With all the Shutter sections in the fully closed position, manually apply closing pressure to the Tie-Bar and Rack Arm while rotating your Allen wrench in the Pinion set screw in an upward motion (see pic). Then tighten down the set screw while this pressure is applied to the Rack Arm.
- This individual Shutter unit should now be closed tight against the seals as all the others. You may do this step all at once if several units are not completely tight.



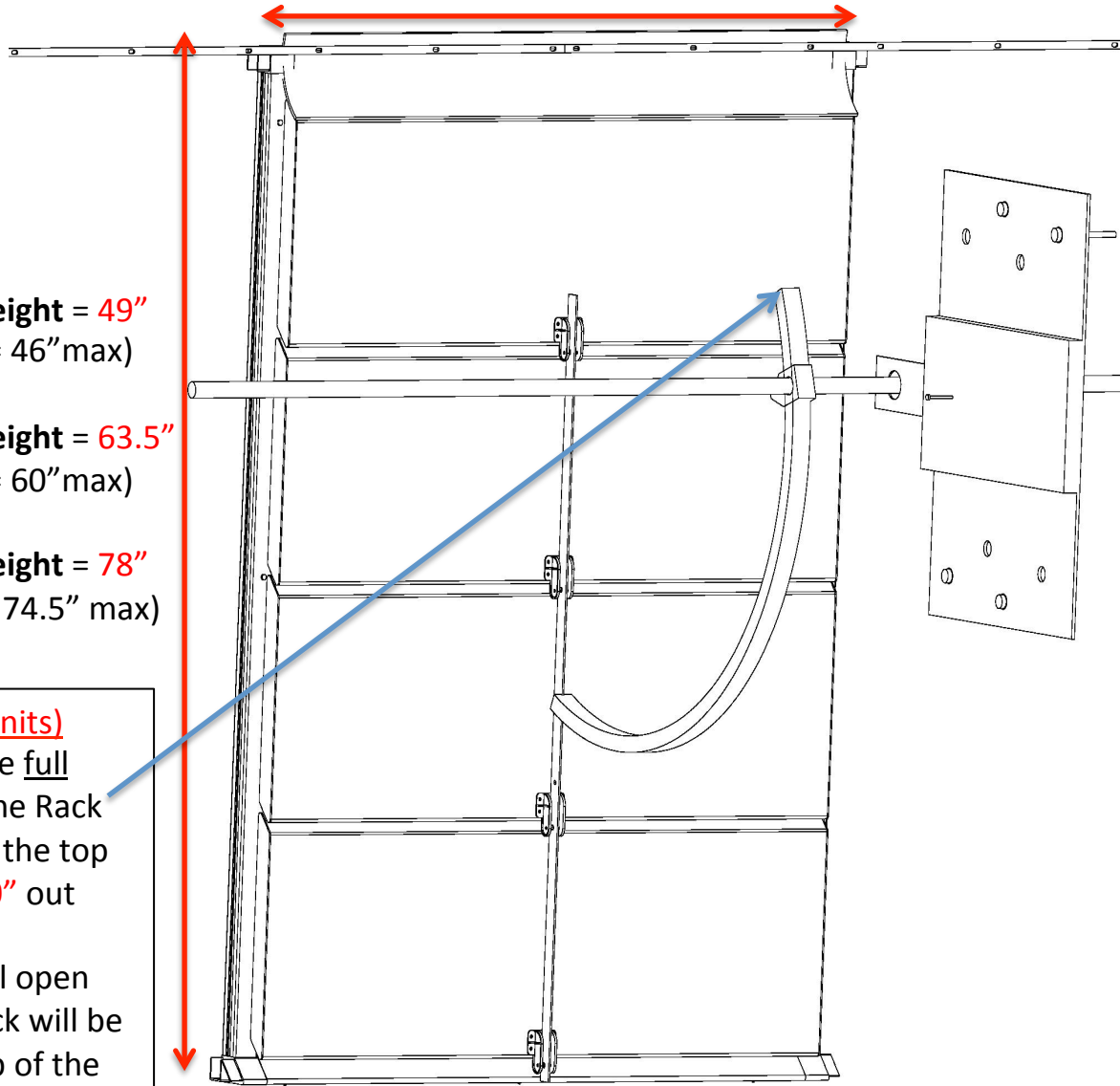
Parts List

- A) Qty 1 Top Shutter with flap seal
B) Qty 3 Shutter
C) Qty 8 Spacer
D) Qty 2 Top Coupler
E) Qty 1 Top Rail
F) Qty 2 Vertical Rail
G) Qty 1 Bottom Rail
H) Qty 2 Bottom Coupler
I) Qty 1 Tie Bar
J) Qty 1 Truck
K) Qty 1 Pinion
L) Qty 1 Pipe
M) Qty 1 Pipe Support
N) Qty 1 HD Bracket
O) Qty 4 Lag Bolt
P) Qty 8 Wood Screw
Q) Qty 4 #10 Machine Screw and Nut
R) Qty 2 Retainer Strip
S) Qty 8 Christmas Tree Rivet
T) Qty 1 1/4-20 Bolt and Nut



Specifications

Width = 48" for all units



4 Ft unit overall Height = 49"
(window height = 46" max)

5 Ft unit overall Height = 63.5"
(window height = 60" max)

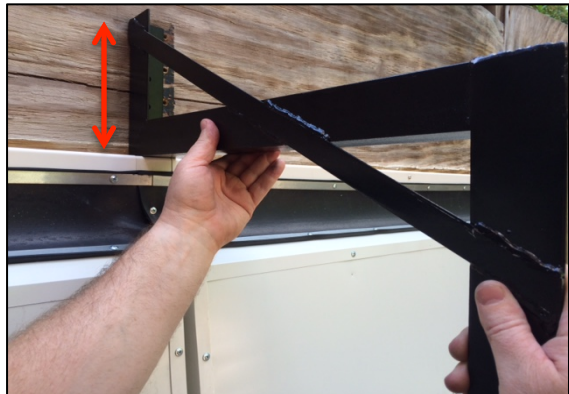
6 Ft unit overall Height = 78"
(window height = 74.5" max)

Note: (5' and 6' Units)

When Shutters are full open the top of the Rack will be **12"** above the top of the unit and **20"** out from the wall.

4' Units: when full open the top of the Rack will be **18"** above the top of the unit.

Note: 8 inches needed above Shutter unit if installing **Shaft Hangers**.



This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.