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## **PBG-100/120/140/160**

### **SYSTEM MANUAL**

**Automated Motorized Hydraulic Traffic Controller**

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*This manual describes the operational requirements of the  
PBG Hydraulic Traffic Control System  
as it is normally configured on site.*

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## **Section 1 - Pre-Installation Planning and Considerations**

### **1.1 WARNINGS AND NOTICES**

The Spike Systems Hydraulic Plate Barrier Gate (PBG) is designed to regulate the flow of traffic through a secure control point. The PBG is also designed and manufactured to ensure personnel safety when the equipment is operated properly and all safety precautions are strictly followed.

Persons responsible for the operation and field maintenance of the system should read this manual carefully before attempting to operate the equipment or perform any service or adjustment procedures.

The Warnings, Cautions, and Notes in this manual represent the following information:

- A **WARNING** is an operation, procedure or condition that can cause injury or death.
- A **CAUTION** is an operation, procedure or condition that can cause damage to the equipment.
- A **NOTE** provides helpful information.

The warnings and cautions that follow apply to all parts of this manual.

- WARNING:** POTENTIALLY LIFE-THREATENING HAZARDS MAY EXIST DURING EQUIPMENT OPERATION. ONLY QUALIFIED PERSONNEL SHOULD ATTEMPT TO OPERATE, SERVICE OR MAKE ADJUSTMENTS TO THE HYDRAULIC TRAFFIC CONTROL SYSTEM EQUIPMENT.
- WARNING:** FOLLOW THE PRECAUTIONARY INSTRUCTIONS EXACTLY. DO NOT TAKE SHORTCUTS. DO NOT ASSUME THAT SOMEONE ELSE HAS ACTED ON YOUR BEHALF. IF ANY RULE OR PRECAUTION IS NOT CLEAR TO YOU, SEE YOUR SUPERVISOR BEFORE USING THE MACHINE.
- WARNING:** THIS UNIT CONTAINS A THERMALLY FUSED ELECTRIC MOTOR. IF THE MOTOR STOPS, DO NOT ASSUME POWER IS NOT PRESENT. UNEXPECTED MOTOR START-UP IS POSSIBLE AFTER THE PROTECTOR TRIPS. DISCONNECT POWER FROM CIRCUIT BEFORE PERFORMING ANY SERVICE TO THE MOTOR. WHEN POWER IS RECONNECTED, RESET PROTECTOR BEFORE ACTIVATING SYSTEM.
- WARNING:** TO AVOID PERSONAL INJURY, BE AWARE THAT VOLTAGES ARE PRESENT IN THE HYDRAULIC TRAFFIC CONTROL SYSTEM. VOLTAGES AS LOW AS 28 VOLTS CAN CAUSE SERIOUS INJURY UNDER SOME CONDITIONS. DO NOT BE MISLED BY THE TERM LOW VOLTAGE.

**NOTE:** Spike Systems assumes no liability for accident or injury incurred through improper installation, operation, maintenance and use of this equipment.

## 1.2 Product Model Numbers

The PBG-100/120/140 and /160 are available with clear widths of 10, 12, 14, and 16 feet, respectively, as shown in the table below.

Model Number Guide	Spike PBG System	Orientation	Buttress Options	Clear Width
	PBG-100	RH or LH	SB or DB	10'
	PBG-120	RH or LH	DB	12'
	PBG-140	RH or LH	DB	14'
	PBG-160	RH or LH	DB	16'

### Legend

<b>RH</b>	Right Handed (placement of Control Cabinet as you drive toward the PBG system.)
<b>LH</b>	Left Handed (placement of Control Cabinet as you drive toward the PBG system.)
<b>SB</b>	Single Buttress (One or two Control Cabinets and no Non-Control Cabinet). The PBG-100 can be configured with a Control Cabinet on the right or left side, with NO Non-Control Cabinet. Also, two PBG-100 systems can be combined with a Control Cabinet on each side (and no Non-Control Cabinets) for a total Clear Width of 20'. When this configuration is used, there can be up to a four-foot gap between systems for a total Clear Width of 24'.
<b>DB</b>	Double Buttress (One Control Cabinet, one Non-Control Cabinet).

## 1.3 Product Family Description and Specifications

The PBG family is an automated hydraulic Plate Barrier Gate that is surface mounted. The product line is designed primarily to prevent against unauthorized vehicles from either entering or exiting a secured control point. Using hydraulic and solid state components, and with its customizable control logic, it can easily be adapted to variety of uses, for example, revenue control, rental car agency, security checkpoints, and others.

<b>Operating Time:</b>	Cycle to lower barrier 3 seconds
	Cycle to raise barrier 3 seconds
<b>Drive Configuration:</b>	Automated hydraulic control power unit, with tie-rod Hydraulic Cylinders
<b>Power Requirements:</b>	1-1/2 HP, 110V Single-phase 18A. The unit can be built to meet any local power requirement as to voltage, frequency and phase
<b>Finish:</b>	Powder Coat: Red or Yellow standard.
<b>Control Circuit:</b>	The system is completely pre-wired requiring only the connection of the power feed and the control circuits. The circuits and power connections are terminated at the wire connector strips in the electrical control box located in the locked hydraulic Control Cabinet. The controls are pre-wired to accommodate a wide range of control options including: remote open and close from multiple locations; radio open and close; open by card reader, guard shack, key switch or vehicle detector
<b>Options:</b>	Radio Receiver-Remote Radio Control, High Security Card Readers, Key Lock Switch, Directional Indication System

## **1.4 Right or Left Side Configuration**

All PBG system configurations are shipped from the factory as either a right or left hand control, depending on the specific installation requirements. For the purposes of this manual, all drawings depict a left hand control. However, all installation steps are the same regardless of orientation of the Barrier Gate and control.

Spike PBG systems ship to the installation location with all possible assembly and installation steps pre-performed by the factory. Each system is specifically configured to match and address each sales order prior to shipment to the installation location.

The client is responsible for running necessary power to the installation location(s) with separate conduit for low voltage controls. These controls often connect between the Control Cabinet and a guard shack, but optionally can also attach to card readers and other optional system inputs. Prior to commencing any installation steps, the installer should ensure that all power and data connections have been properly installed, connected and configured.

## 1.5 Spike Systems Plate Barrier Gate (PBG) Product Family Overview

### 1.5.1 PBG-100 As Installed and Dimensions for Installation Planning

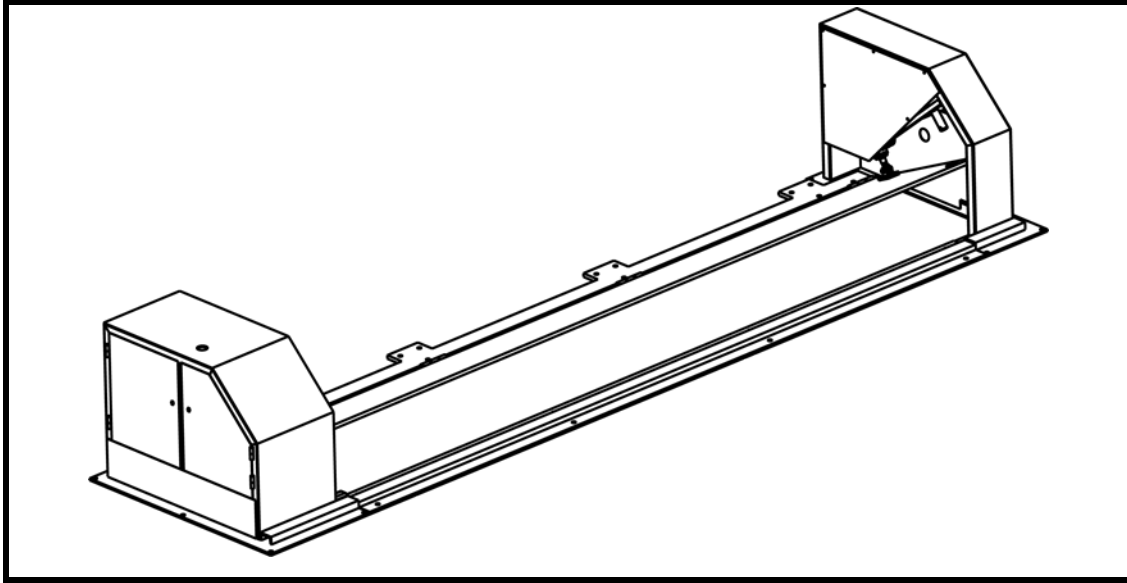
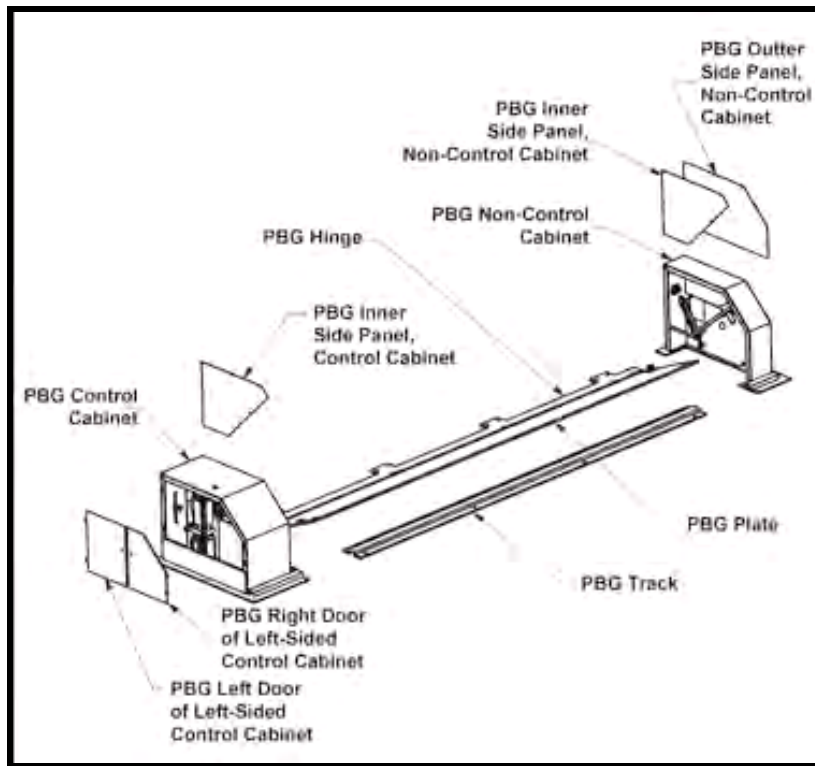


Figure 1 -- PBG-100 As Installed and Dimensions for Installation Planning

PBG-100	Clear Width	Plate Width	System Width	Slab Width	Depth
	10' (120")	11'	13'	14'	50"
PBG-120	Clear Width	Plate Width	Overall Width	Slab Width	Depth
	12' (144")	13'	15'	16'	50"
PBG-140	Clear Width	Plate Width	Overall Width	Slab Width	Depth
	14' (168")	15'	17'	18'	50"
PBG-160	Clear Width	Plate Width	Overall Width	Slab Width	Depth
	16' (192")	17'	19'	20'	50"



### **1.5.1 PBG System Family Parts Identification and Shipping Contents**



**Figure 2 – PBG Product Family Major Component Identification**

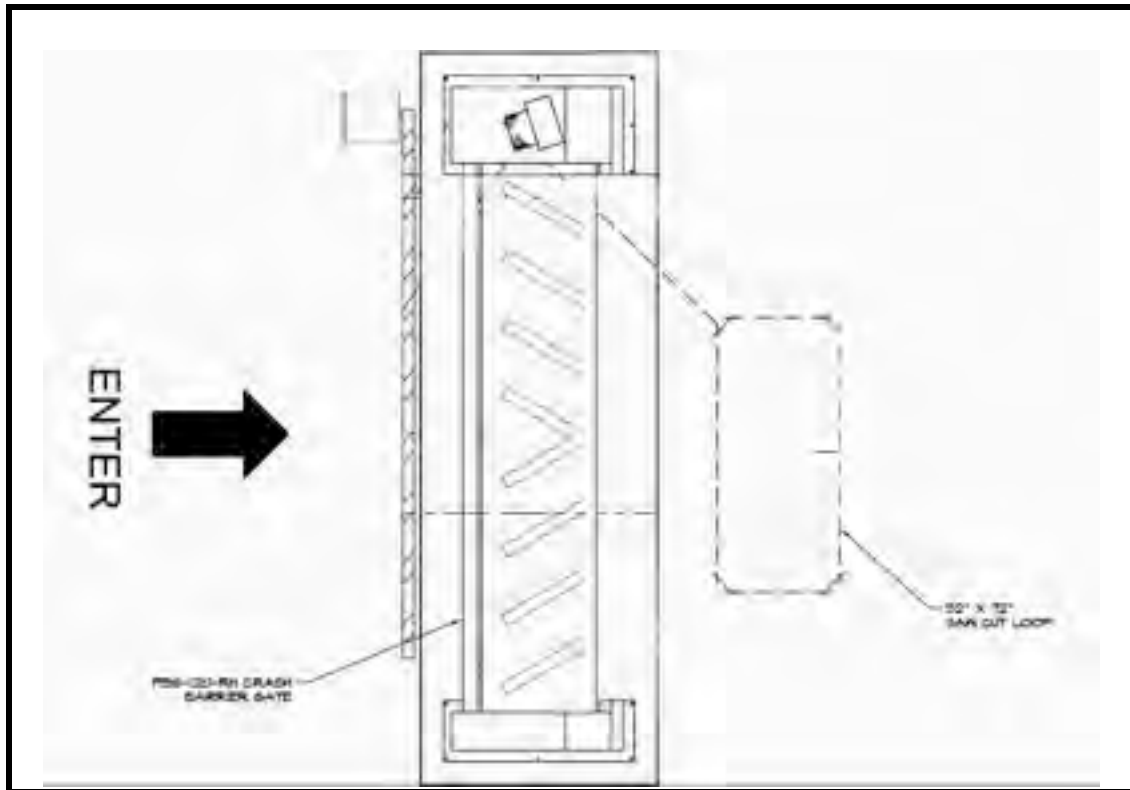
### **Shipped Components Not Pictured**

- Clevises and associated attachment hardware for hydraulic cylinders. Two hydraulic cylinders, one each are pre-installed to mounted clevis hardware on the inside of the Control Cabinet and one to the clevis on the inside of the Non-Control Cabinet. The lower ends of hydraulic cylinders are to be attached to welded clevis assemblies on the Plate Barrier
- Two rubber hydraulic hoses, rolled and stored in the Control Cabinet
- Standard and optional safety signs
- Pre-turned wires for Inductive Control Loops and electronic unit to be installed on TB-1 within Control Cabinet
- Traffic Control lighting and associated installation equipment
- Lower-cost traffic barrier assembly (option)

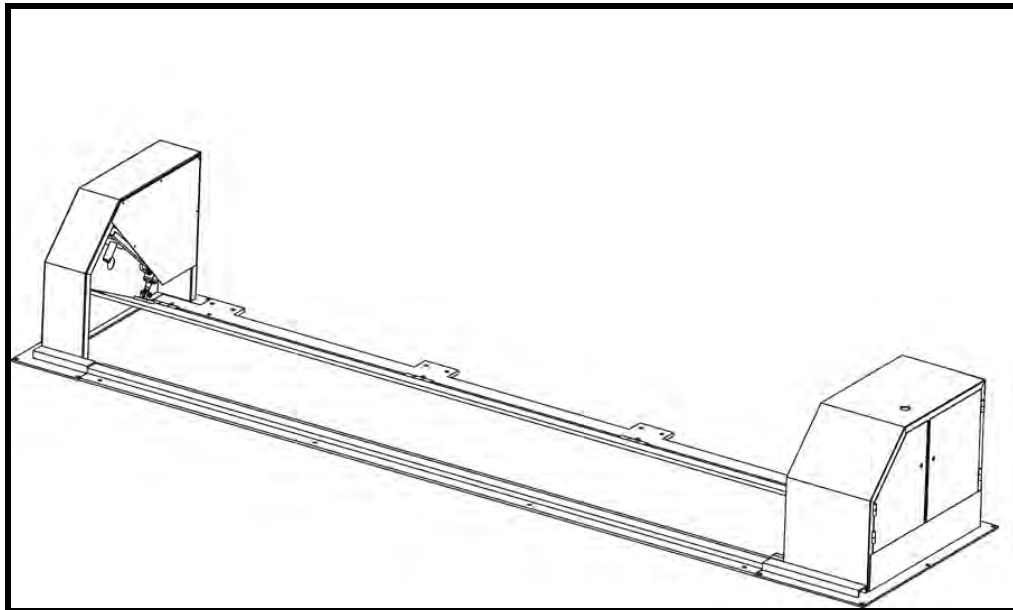




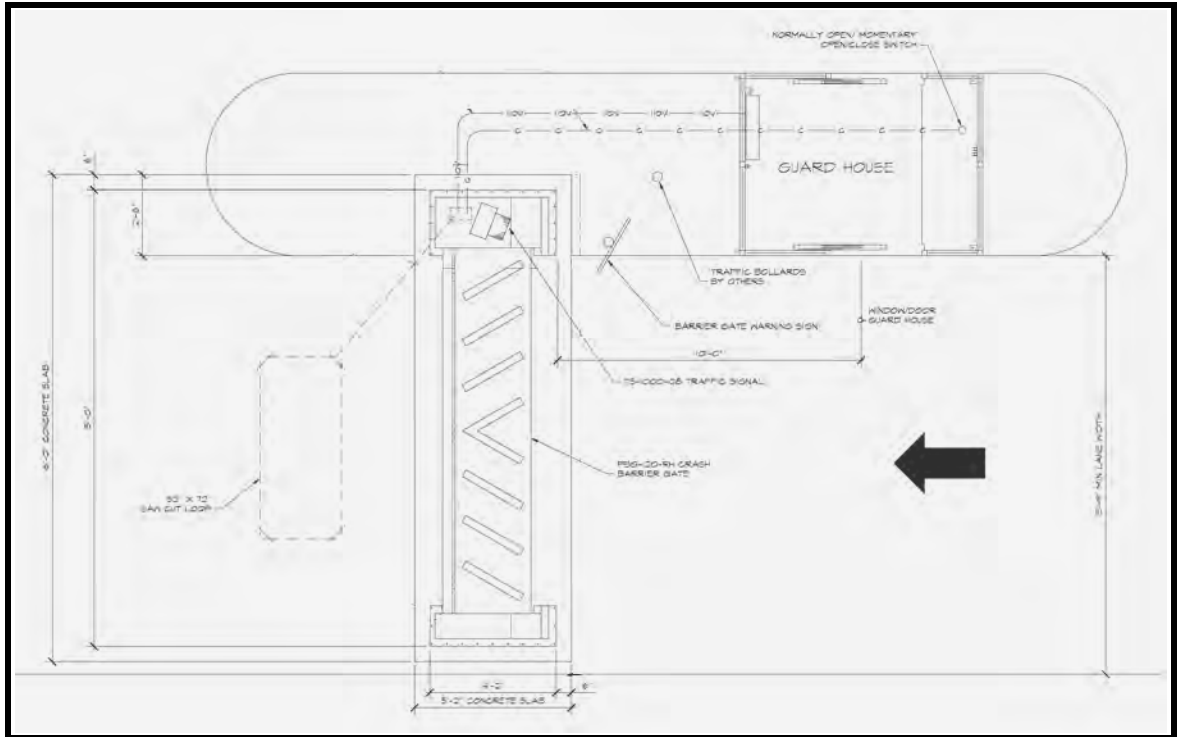
### **1.6.3 Sample PBG-120 RH and LH Layout**



**Figure 5 -- PBG-120 LH DB (Left Handed, Double Buttress)**



**Figure 6 -- PBG-120 RH DB (Right Handed, Double Buttress)**



**Figure 7 -- PBG-120 RH DB (Right Handed, Double Buttruss)**

### 1.6.4 Sample PBG-160 RH and LH Layout

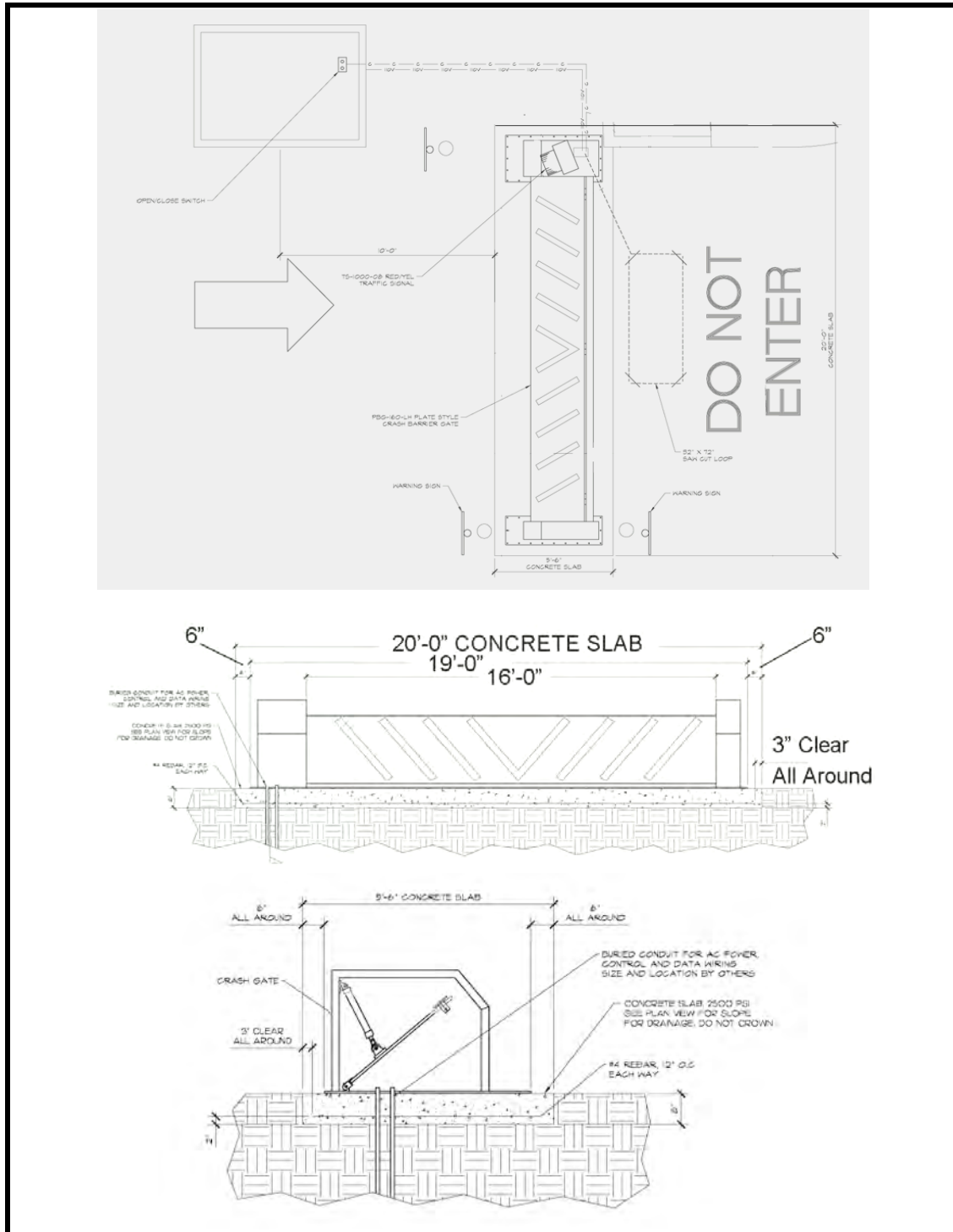
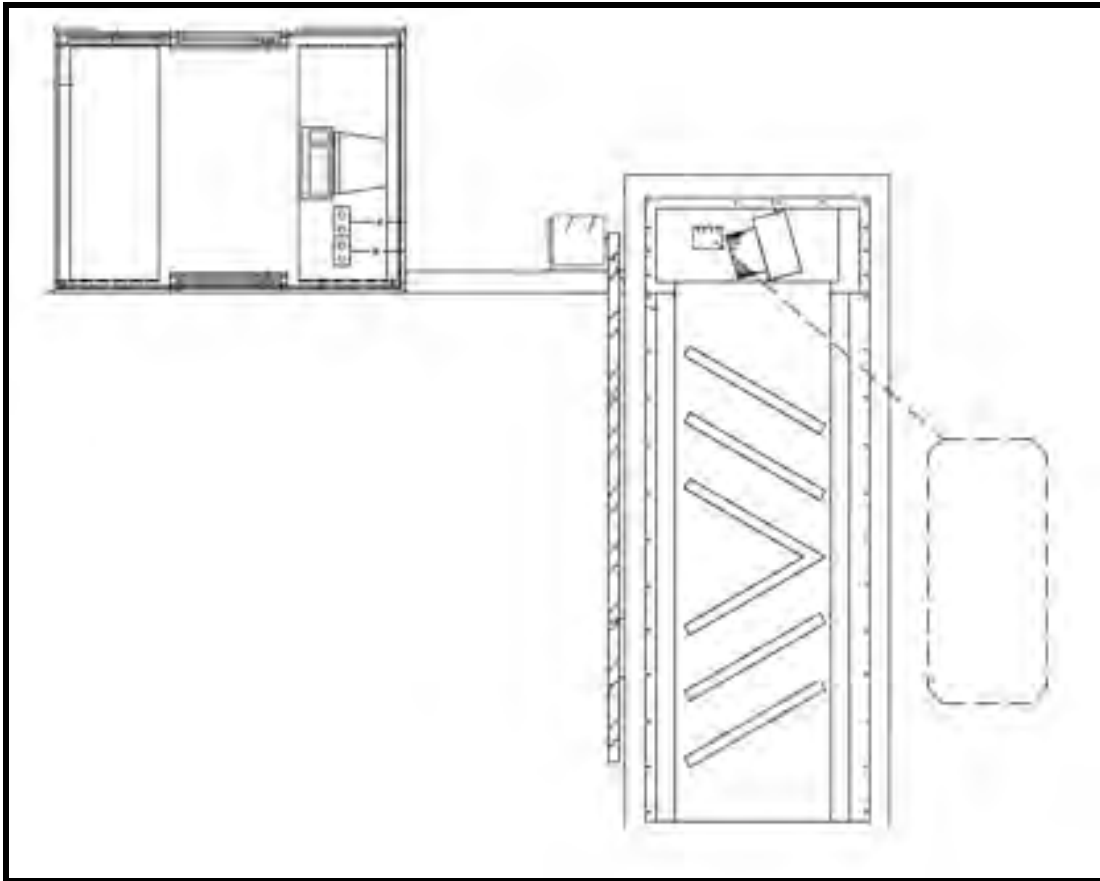
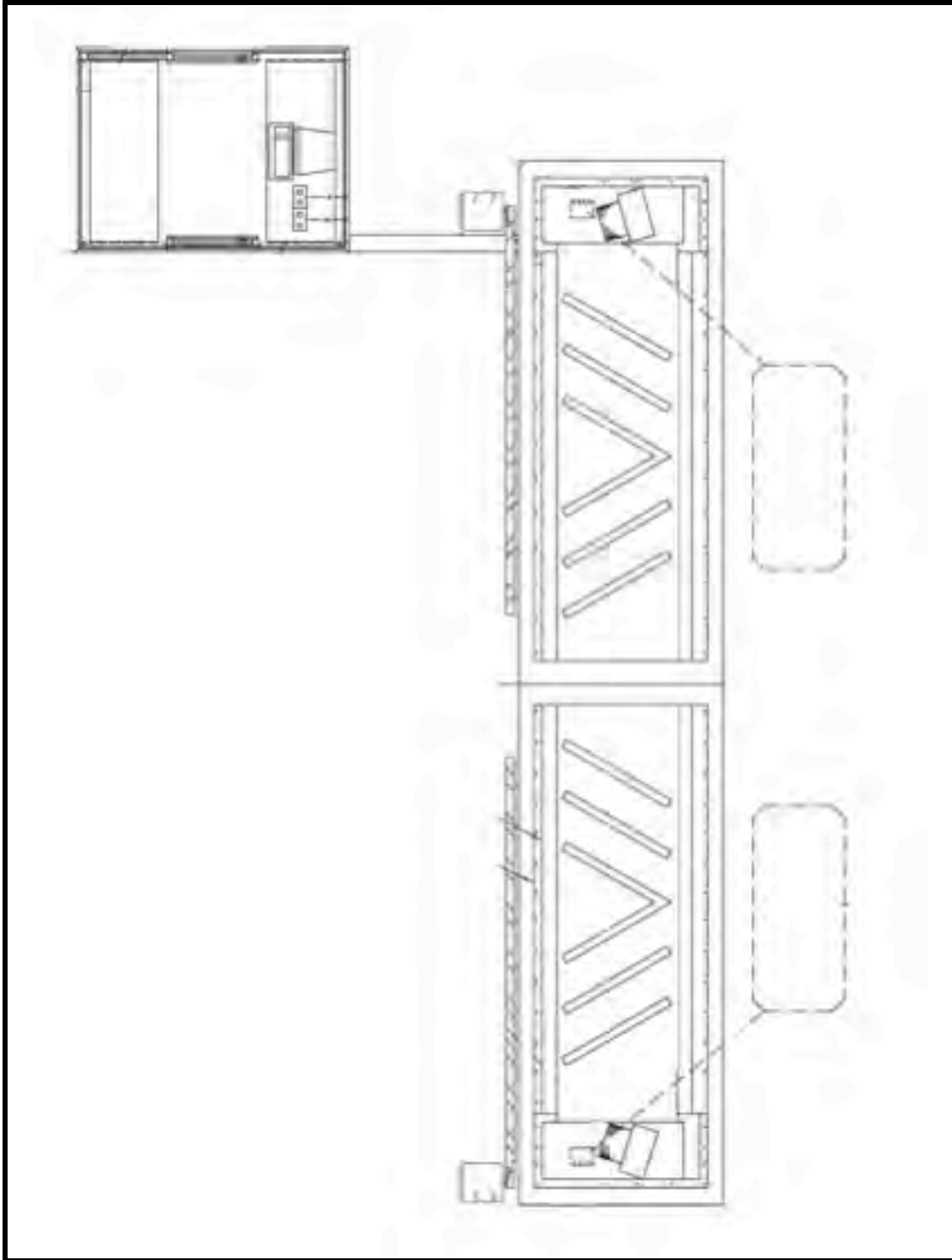


Figure 8 -- PBG-160 LH DB (Left Handed, Double Butress)

### **1.6.5 Sample PBG-100 Special Layouts**

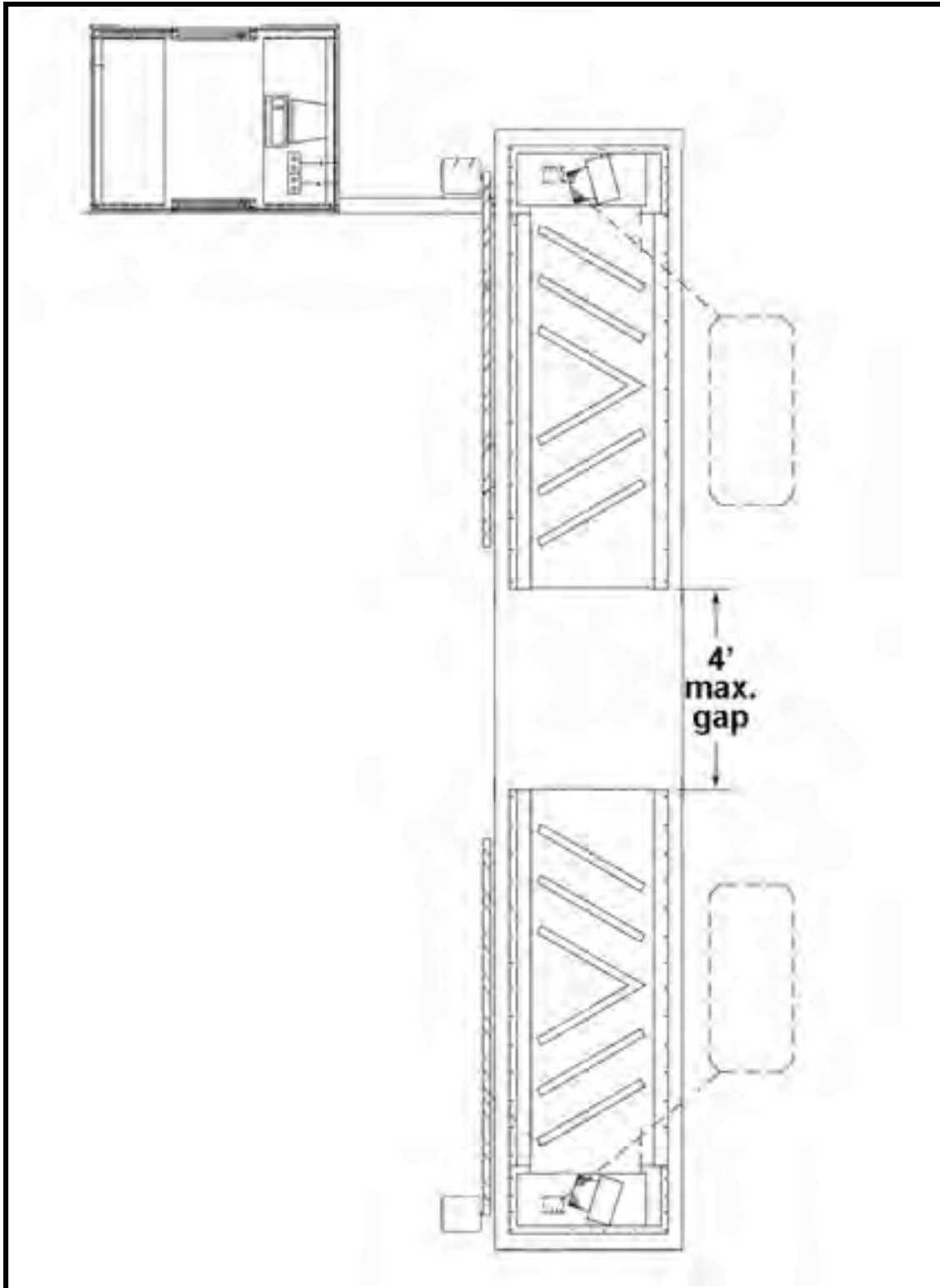


**Figure 9 -- PBG-100 LH SB (Left Handed, Single Butress)**



**Figure 10 -- PBG-100 LH-RH DB (Left & Right Handed, Double Buttress)**





**Figure 11 -- PBG-100 LH-RH DB (Left & Right Handed, Double Butress)**

Typical Lane Layout with Maximum System Gap

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## Section 2 – Physical Installation

### 2.1 Installation Planning

Often when a Spike System is installed, another lower-cost barrier gate is installed in front of the Spike Systems unit. This is to protect against damage caused by low-speed and inadvertent actions by the driver. These lower cost gates are available from Spike systems. Typically, a Magnetic Autocontrol MicroDrive MHTM is most commonly installed for this purpose. These secondary gates can be installed before, during or after the installation of the Spike Systems barrier. The MHTH is packaged separately and has a comprehensive installation manual that should be referenced throughout the installation process. Detailed information on these systems can be found on the Internet at:

<https://magneticgateopeners.com/store/pdfs/microdrive-manual.pdf>.

### 2.2 Installation Preparation: System Unpacking

All PBG systems are shipped to the installation site on custom designed pallets. An example is shown below. **NOTE** – Use a forklift or a sufficient number of laborers to lift the shipped pallets, the Control Cabinet (shown on the left), and the Non-Control Cabinet (shown on the right), the Plate Barrier Gate assembly (not pictured). The use of safety gloves is advised whenever lifting or handling PBG cabinets and components. Unbolt the Control and Non-Control Cabinets from the custom pallet using a 1/2" wrench or ratcheting socket.

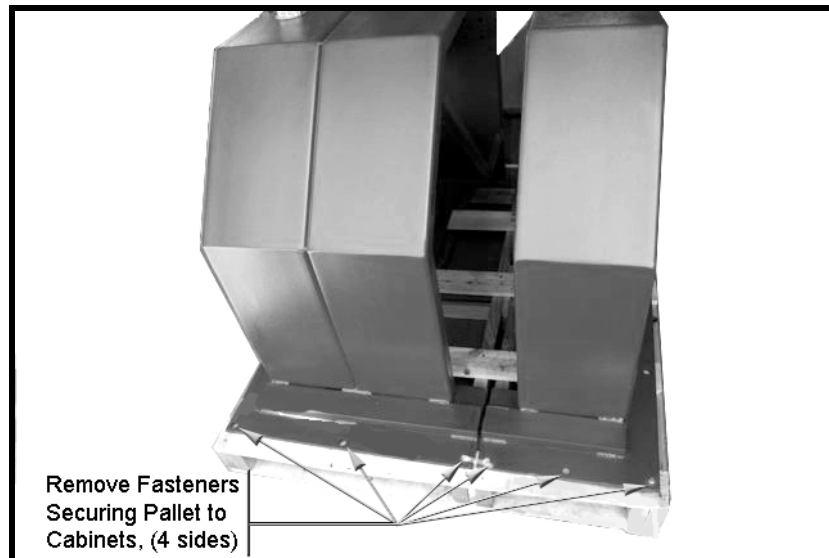


Figure 12 -- Control and Non-Control Cabinets Secured to Shipping Pallet

Tool Required	Tool Type	Tool Specification
	½" Wrench/Socket	To remove hardware securing system cabinets to pallets
	Safety Gloves	

## 2.3 Plate Barrier Gate Component Weights

Component(s) Weights	Component(s)	Weight (pounds)
<b>Cabinets</b>		
	Pallet with Control and Non-Control Cabinet	860
	Control Cabinet	495
	Non-Control Cabinet	330
<b>Barrier Plates</b>		
	PBG-100 Plate	1015
	PBG-120 Plate	1200
	PBG-140 Plate	1385
	PBG-160 Plate	1569

All weights are *approximate* and may vary or change without notification.

Prior to any installation process, ensure that the area where the Spike System is to be installed is free of any debris to ensure that all components rest squarely on the ground.

Tool Required	Tool Type	Tool Specification
	Broom and dust pan; air compressor and or vacuum cleaner	As available to clean surface where system is to be installed

## 2.4 Plate Barrier Gate (PBG) System Installation

For ease of installation, it is recommended that the inner panels be removed from the Control and Non-Control Cabinet assemblies. The illustration below shows both inner panels exploded from the assembly view of a PBG-100.

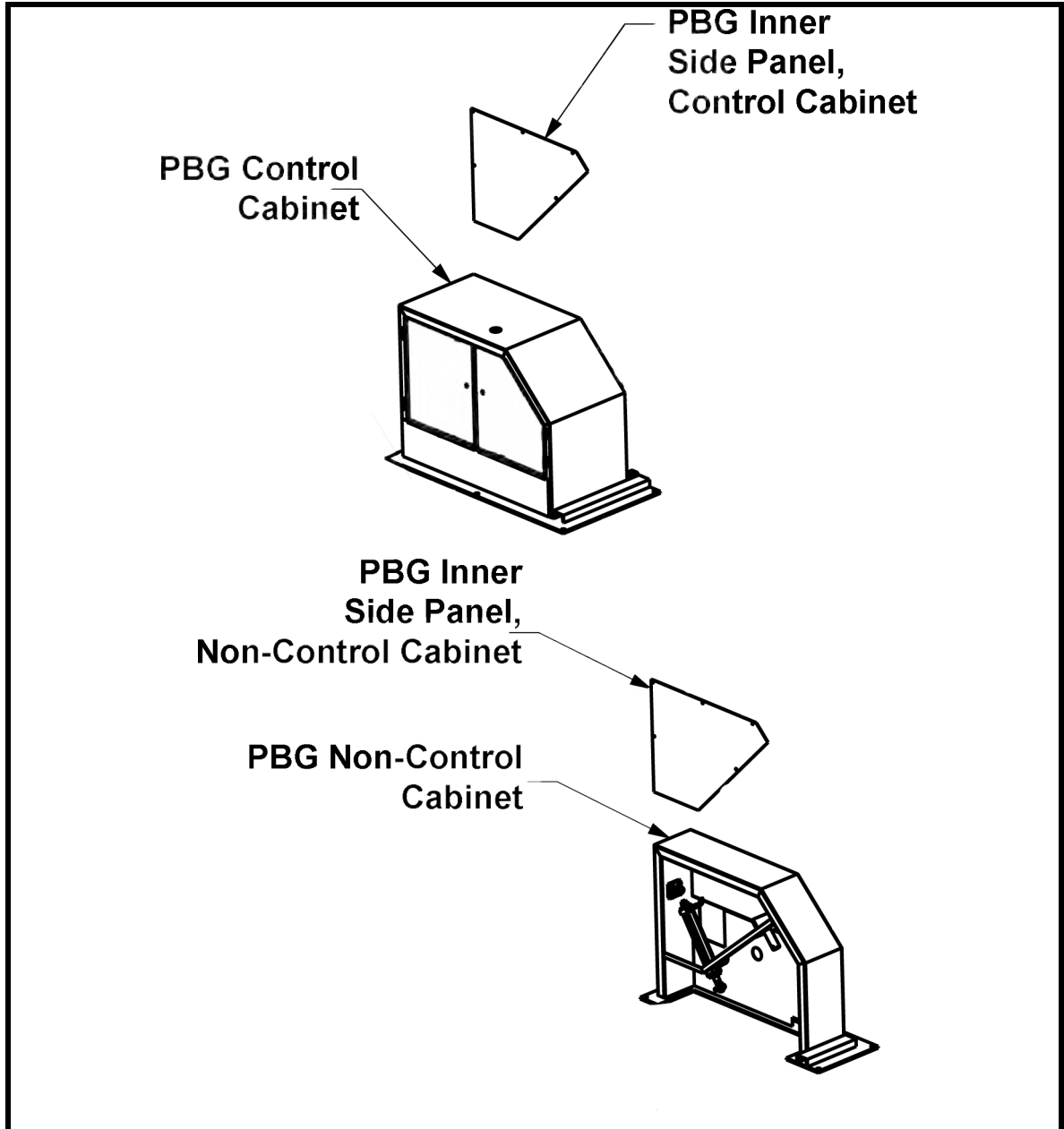


Figure 13 – Inner Panel Removal from Control and Non-Control Cabinets

Tool Required	Tool Type	Tool Specification
	Wrench/Socket	7/16"

## 2.5 Pre-Installation: Ensure Power and Data Conduits are in Place

Verify that the client-supplied power conduit and any low voltage data connections, for example to a guard shack for a control switch, are properly installed beneath where the Control Cabinet will be secured.

Any other options to be installed, for example cabling for an electronic card reader, should have the conduit run to the Control Cabinet prior to positioning the Control Cabinet in place. Once the Control Cabinet has been anchored to the ground, it is very difficult to route any cabling into the unit. (Drilling into the side of the unit is not recommended.) For this reason it is imperative to ensure that all power and control data wiring be properly installed prior to installation. Cabling for control data must always be run in a separate conduit from AC power.

## 2.6 Pre-Installation Considerations: Inductive Loop Vehicle Detector

If the installation is to include an Inductive Control Loop Detector, the rectangular loop should be cut and prepared prior to the system installation process.

**IMPORTANT NOTE** -- the cut that leads from the loop to the area under the Control Cabinet must be cut and extended under the base of the cabinet prior to any other installation steps.

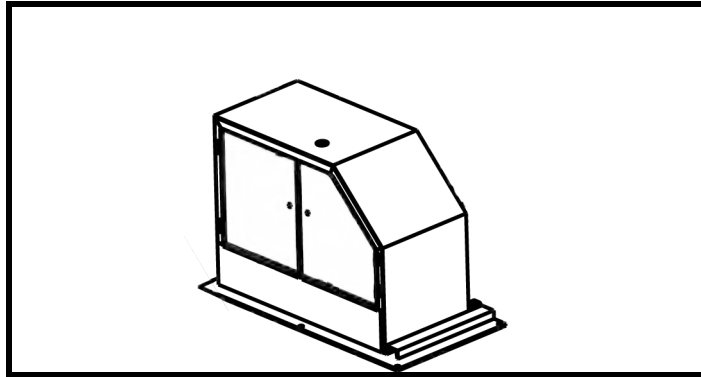
**REFERENCE NOTE** – Though the Control Loop is shown “after” the PBG system in Figure 8, Loops can be installed on both sides of the PBG, or “before” or “after” the PBG, depending on client design, installation and operational requirements.

Tool Required	Tool Type	Tool Specification
	Concrete Saw	3/16" Blade depth set to 2", unless otherwise specified
	Inductive Loop Vehicle Detector or Saw Cut Control Module (option)	As supplied by factory
	Broom, vacuum or air compressor	To clean debris after saw cut is performed
	Pizza wheel, putty knife or screwdriver	To place wires into cut groves evenly
	Sealant for Inductive Loop Vehicle Detector or saw cut loop	Self-leveling concrete (Sikaflex SL or similar)

## 2.7 Saw Cut Inductive Loop Vehicle Detector as Preparation for Installation

If the installation is to include an Inductive Loop Vehicle Detector (saw cut control loop), follow the instructions precisely as defined by the option's manufacturer.

To prepare the installation for a saw cut loop, first place Control Cabinet in desired location for temporary positioning only.



**Figure 14 – Temporary Placement of Control Cabinet to Mark Location of Saw Cut Beneath the Control Cabinet**

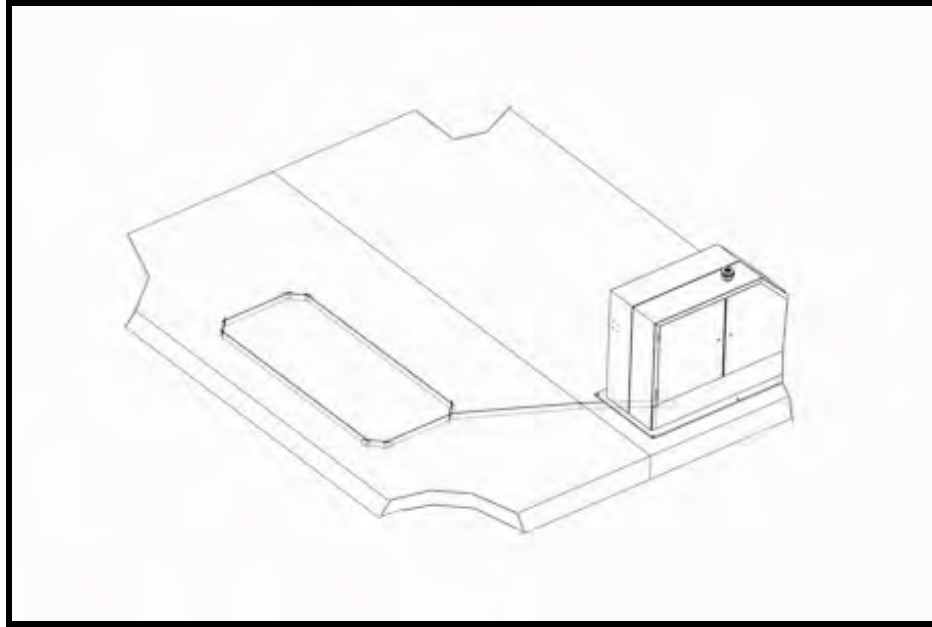
Tool Required	Tool Type	Tool Specification
	Forklift for unit placement	If a forklift is not available, use sufficient labor to lift and place the Control Cabinet in position

Mark the path for saw cut underneath where cabinet will be installed. The location of where the Inductive Loop Vehicle Detector wires should be routed out of the saw cut loop will be near where power and other data conduit will be located under the Control Cabinet

Once the path for the saw cut control wires has been established, remove the cabinet from its temporary installation position to gain access to the ground beneath.

Saw cut the path under where Control Cabinet will be located.

The hidden line figure below shows the extension of the cut to the proper approximate location beneath the Control Cabinet.



**Figure 15 – Inductive Loop Vehicle Detector (Saw Cut Loop) Beneath Cabinet**

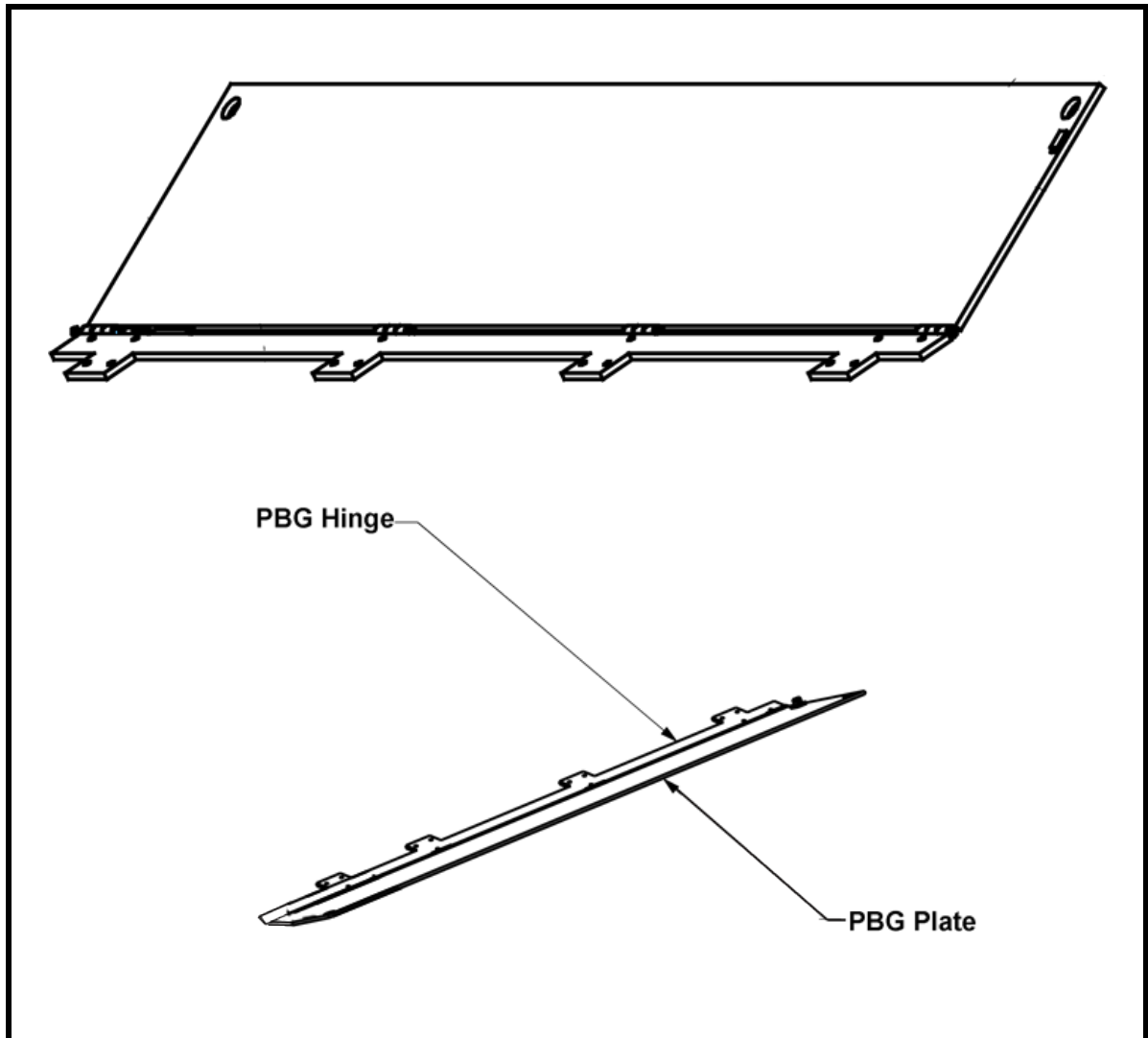
Refer to Appendix B for further information on the Optional Inductive Vehicle Detector installation.

Note -- Ensure there is enough spare loop wire by leaving at least 12 inches of slack (beyond what is required to reach the control panel termination point) as a service loop.



## **2.8 Plate and Cabinet Placement and Preparation (Left Hand Shown)**

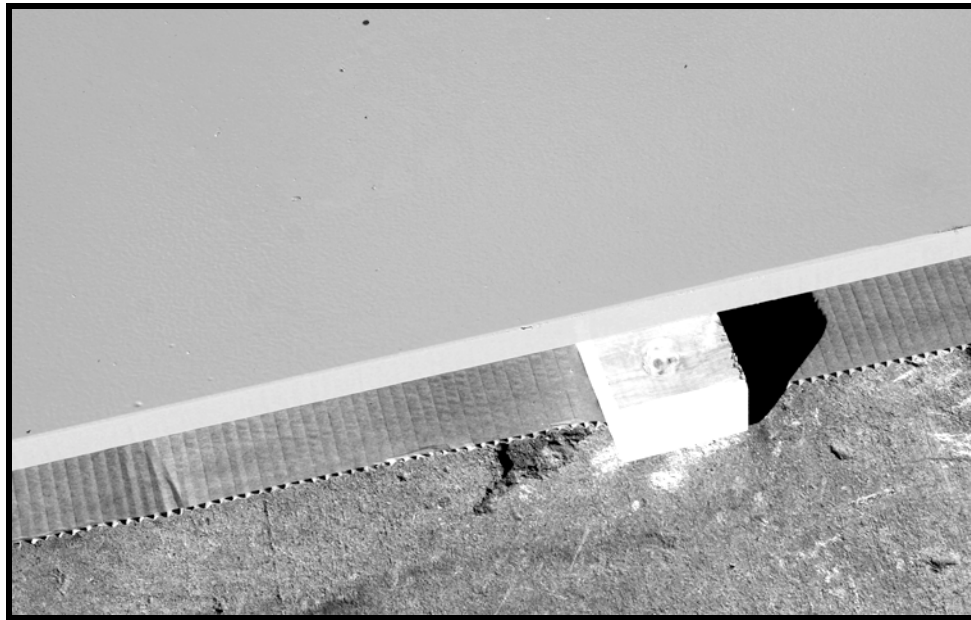
First, place a large piece of cardboard down to protect the PBG plate from being scratched or marred by the concrete surface. Take great care in placing the plate to ensure that it is precisely located where it will be installed permanently. The non-hinged end of the plate assembly should be propped up by blocks as shown.



**Figure 16 – Placement of the Plate on the Ground, Propped Up**



**Figure 17 – Wood Blocks Used Under the Plate, 3 Locations (1 of 3)**



**Figure 18 – Wood Blocks Used Under the Plate, 3 Locations (2 of 3)**



**Figure 19 – Wood Blocks Used Under the Plate, 3 Locations (3 of 3)**

### 2.8.1 Position the Control Cabinet Close to the and Plate Barrier

Place the Control Cabinet near the Hinge and Plate Assemblies. In the figure below, a Left Handed configuration is shown.

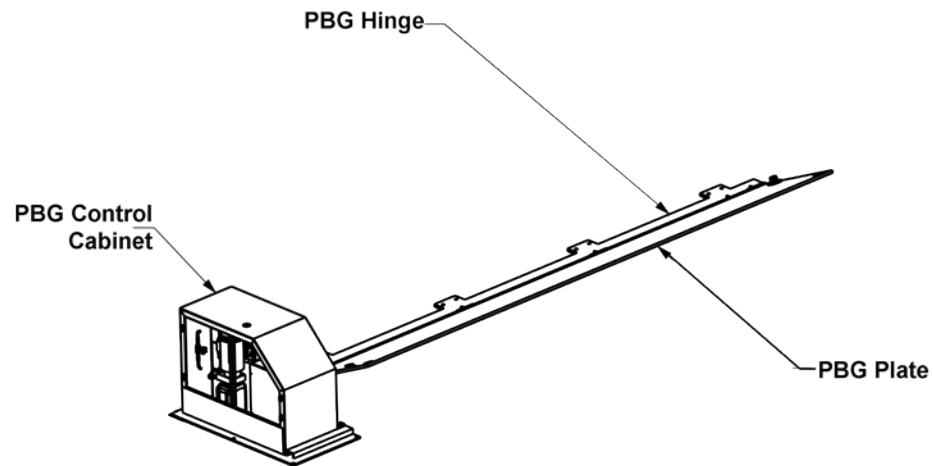


Figure 20 -- Locate Control Cabinet near the Plate and Hinge for Installation

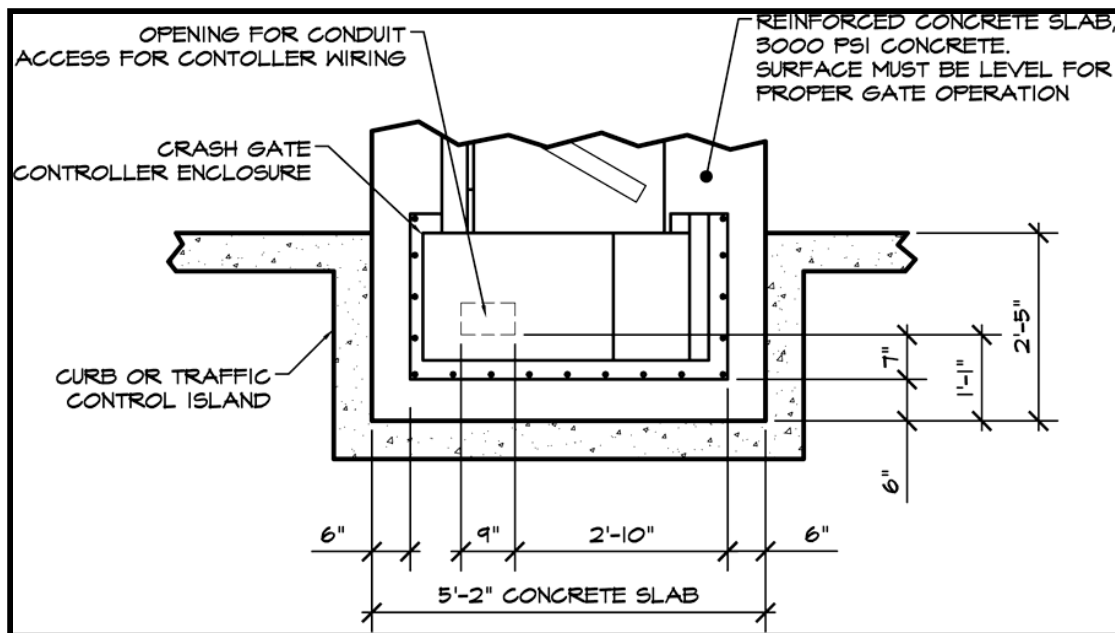
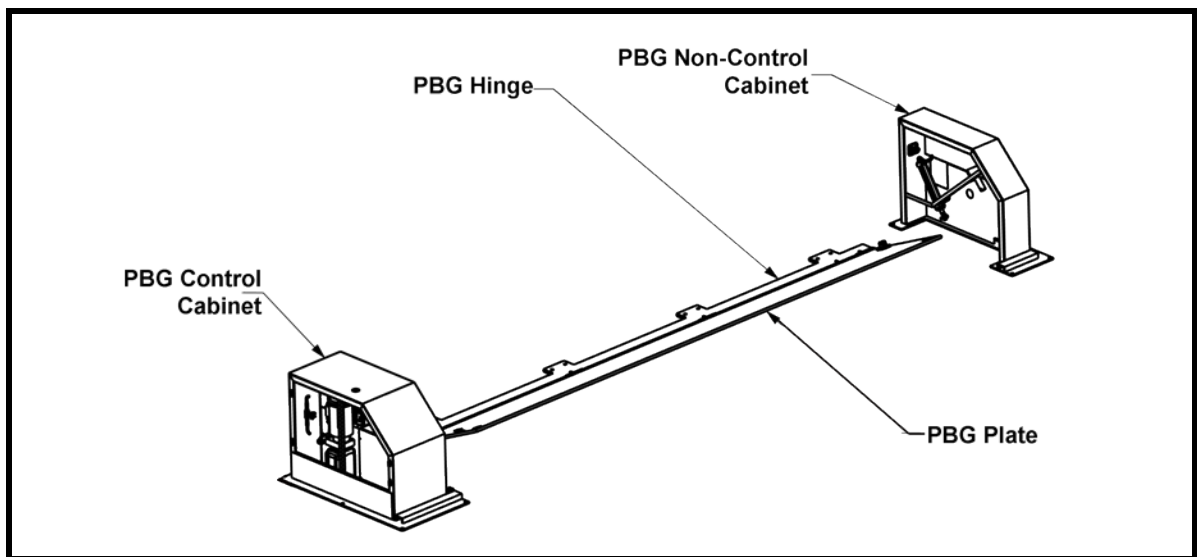


Figure 21 – Placement of Control Cabinet Relative to Client Installed Conduit

### 2.8.2 Position the Non-Control Cabinet Close to the Plate Barrier

Place the Non-Control Cabinet near the plate, leaving a foot or two of distance initially.

Tool Required	Tool Type	Tool Specification
	Forklift for unit placement	If a forklift is not available, use sufficient labor to lift and place the Control Cabinet in position



**Figure 22 -- Locate Non-Control Cabinet near the Plate and Hinge for Installation**

Place the Non-Control Cabinet in approximate location across from the Control Cabinet. Do NOT permanently anchor the Non-Control Cabinet at this time because its position will need to be adjusted when the Barrier Gate is installed.

### 2.8.3 Hydraulic Cylinder Installation to Barrier Plate

Install the Hydraulic Cylinders to the Plate Barrier in two places (right and left sides of Plate) as shown below.

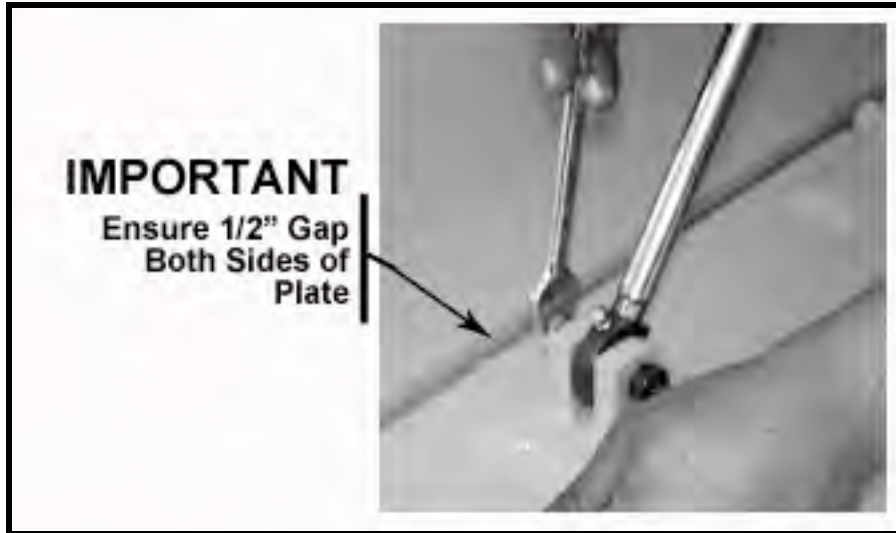


Figure 23 -- Secure Hydraulic Cylinder to Plate, 2 sides

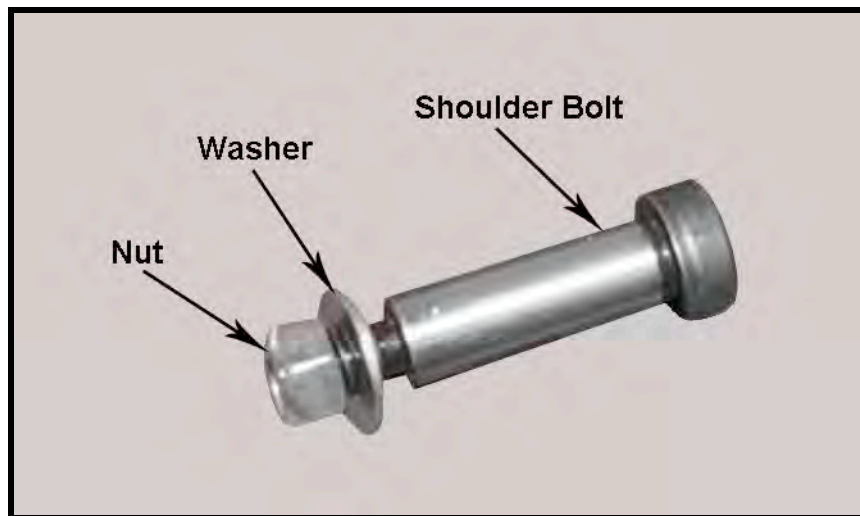


Figure 24 -- Hardware for Mounting Hydraulic Cylinders

Tool Required	Tool Type	Tool Specification
	Wrench/Socket	9/16" (for Nut)
	Allen Wrench	1/4" (for Shoulder Bolt)

## **Section 3 – Hydraulic, Electrical, and Control Installation**

### **3.1 Hydraulic Hose Installation**

The factory pre-installs a set of hydraulic hoses to the Hydraulic Cylinder in the Control Cabinet. The two hydraulic hoses that are coiled up in the Control Cabinet are threaded from the Control Cabinet through the track to the Non-Control Cabinet. Once routed through the track, the two hoses are attached to the Hydraulic Cylinder in the Non-Control Cabinet.

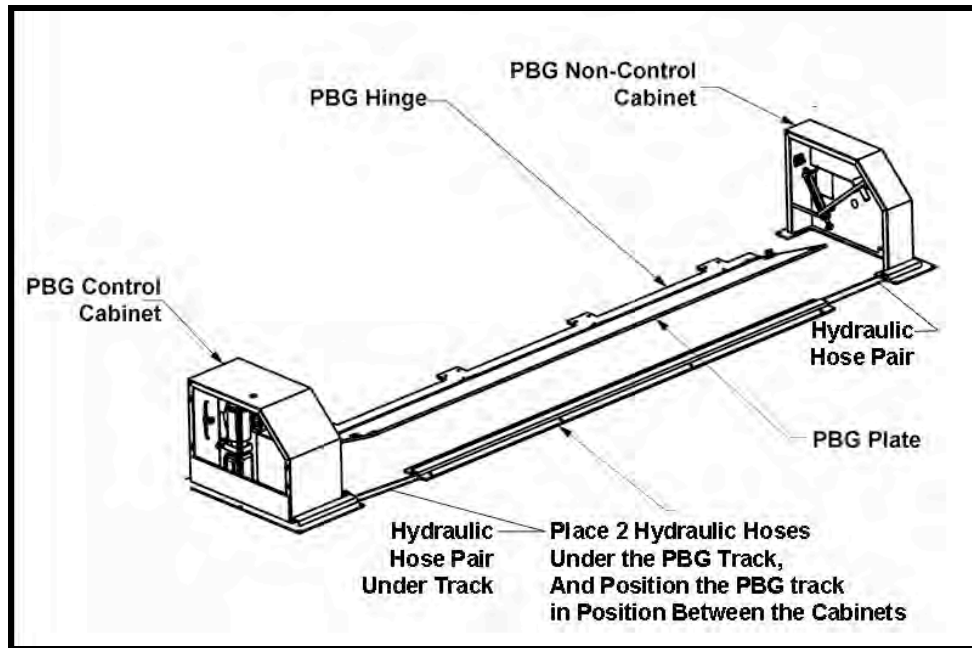
The two hoses that are to be threaded through the track are coiled up in the Control Cabinet as shown below. Start this portion of the installation by uncoiling the hydraulic hoses and extending them fully to ensure that there are no kinks or bends in the hoses.



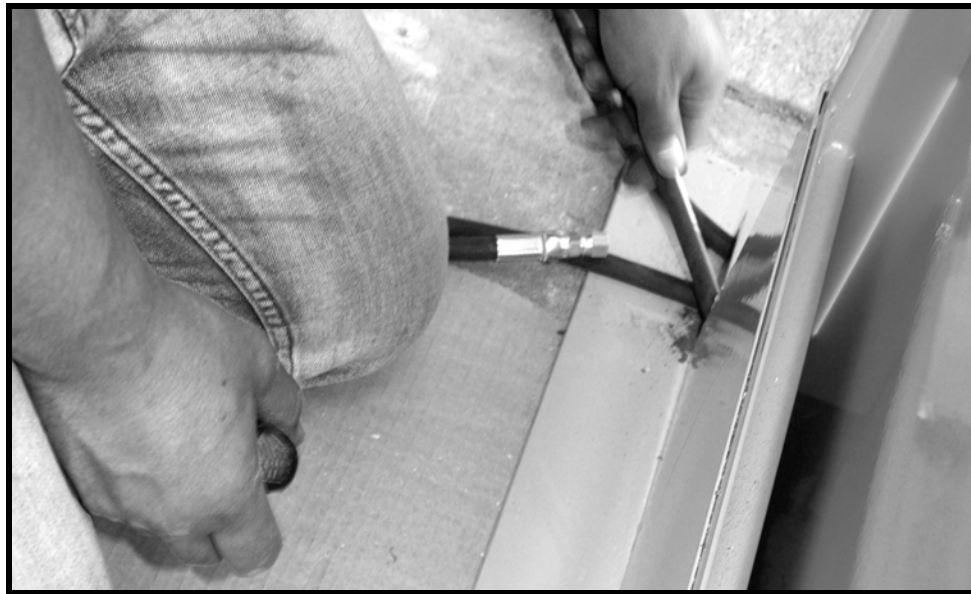
**Figure 25 – Hydraulic Hose Location, As Shipped, Inside Control Cabinet**

To connect the hydraulic hoses to the Hydraulic Cylinder in the Non-Control Cabinet, place the hoses on the ground and carefully position the track over the hoses ensuring that the track does not pinch or rest on any segment of hose.





**Figure 26 – Two Hoses Routed Through Track to Non-Control Cabinet**



**Figure 27 – Pulling Two Hydraulic Hoses Through PBG Control Cabinet**





**Figure 28 – Two Hoses Routed to Non-Control Cabinet**



**Figure 29 – Placing Track in Position Above Hoses.**

BE VERY CAREFUL TO NOT PINCH EITHER HOSE

WHEN POSITIONING THE TRACK

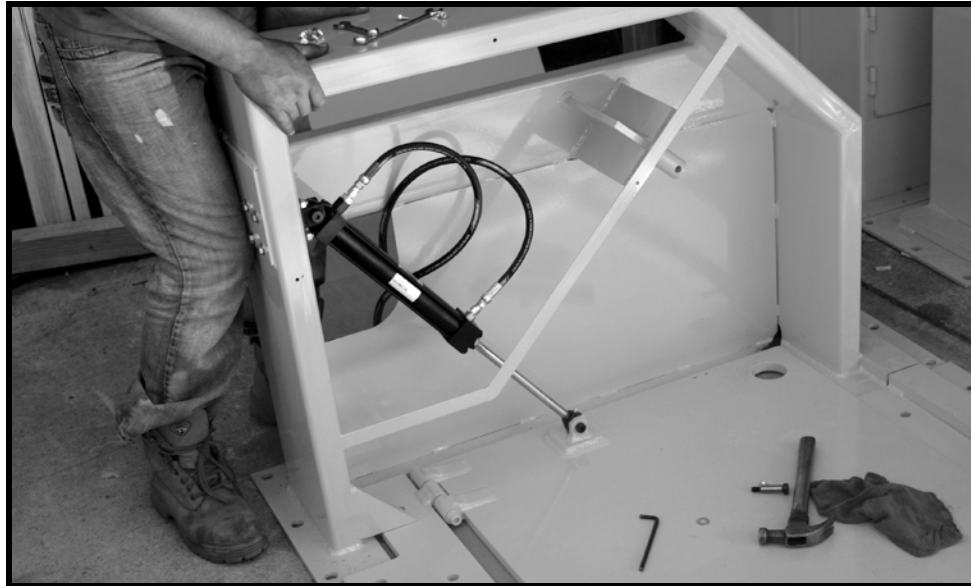
When the hoses have been extended through the track to the Non-Control Cabinet, carefully route the hoses to the location of the Hydraulic Cylinder on the Non-Control Cabinet ensuring that there are no kinks or sharp bends in the hydraulic hoses.

Attach the hydraulic hoses to the Hydraulic Cylinder in two locations in the Non-Control Cabinet. The Control Cabinet hoses are already attached.

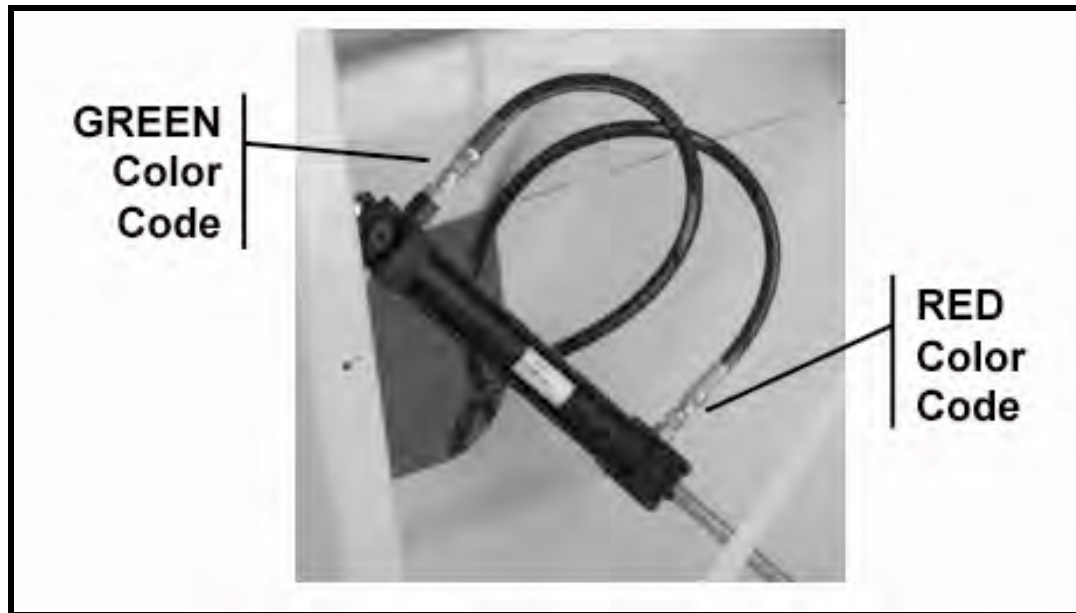
**NOTE** – Both hydraulic hoses are color coded to correspond to color codes on the hydraulic cylinder. Ensure that the RED coded hose is attached to the RED coded location on the hydraulic cylinder in the Non-Control Cabinet. In a similar fashion, ensure that the GREEN coded hose is attached to the GREEN coded location on the hydraulic cylinder in the Non-Control Cabinet.

**NOTE:** The RED hose is attached to the TOP of the Hydraulic Cylinder, and the GREEN hose is attached to the BOTTOM, corresponding to the color code markings on both the hoses and the Cylinder.

When the system is fully installed and is operated for the first time, if the motor engages but the plate does not move, ensure that the hoses are correctly installed. If the hoses are reversed, the system will try to close an already closed gate.



**Figure 30 – Minor Positional Adjustments**



**Figure 31 – Hydraulic Hose Connection, Non-Control Cabinet**

Tool Required	Tool Type	Tool Specification
	Wrench	9/16" to attach Hydraulic Hoses, 2 locations

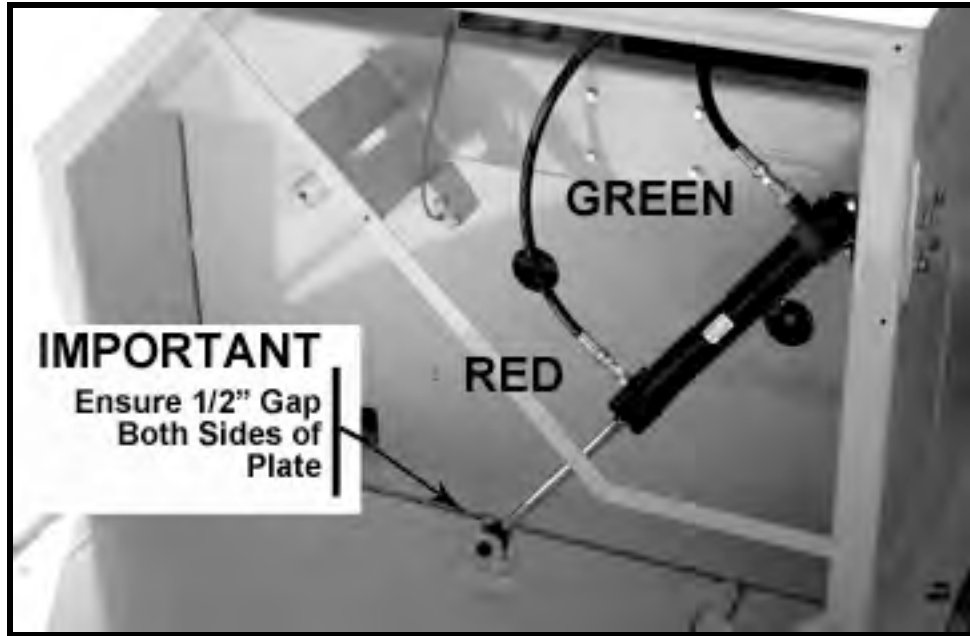


Figure 32 – Hydraulic Hose Connection, Control Cabinet

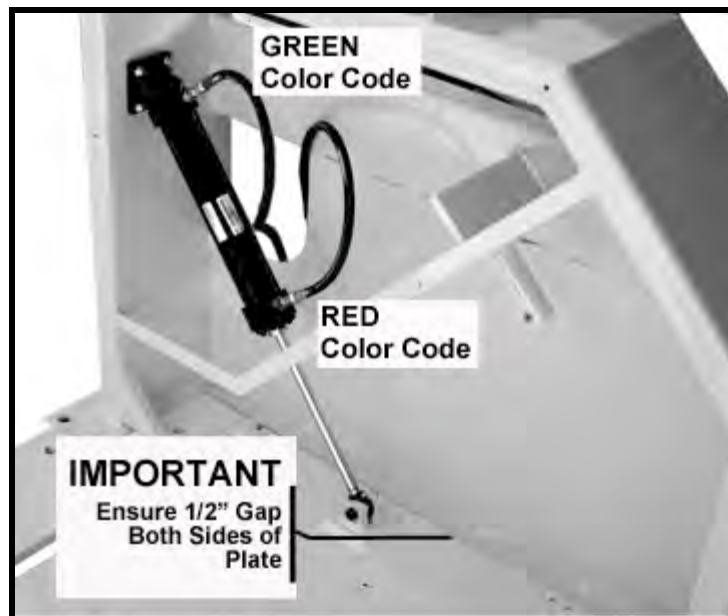


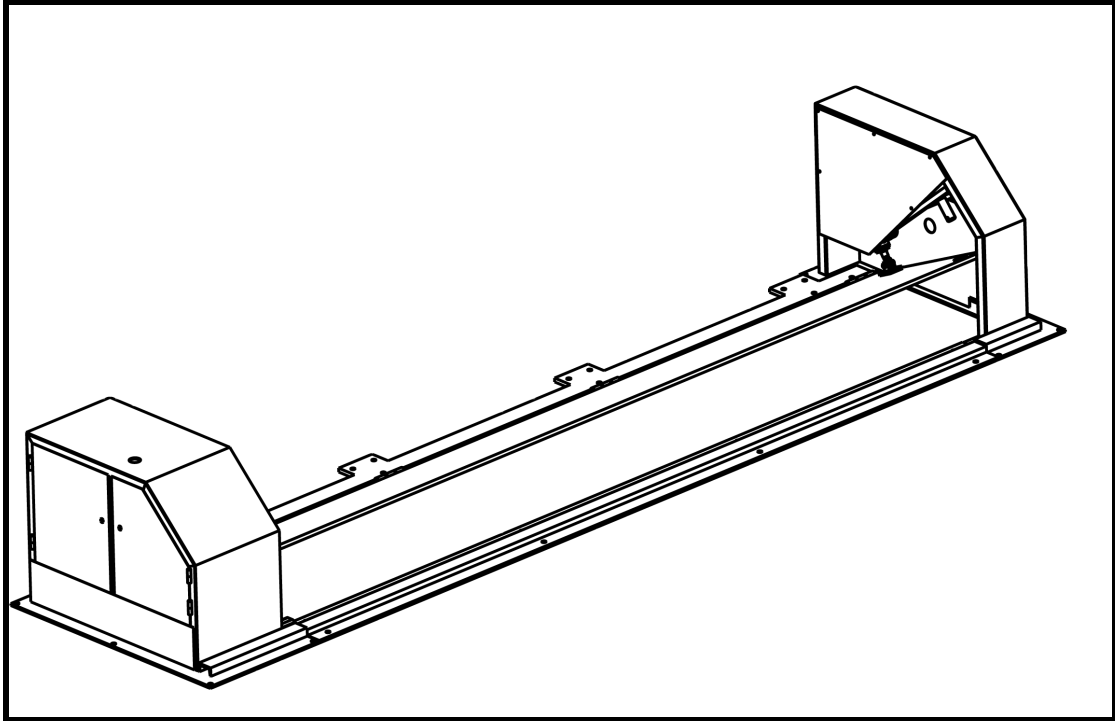
Figure 33 – Hydraulic Hose Connection, Non-Control Cabinet

Make sure that the hydraulic hoses are not kinked anywhere and do not rub against any sharp edges inside the Control Cabinets and the PBG Track.

### **3.2 Installation of Concrete Anchors**

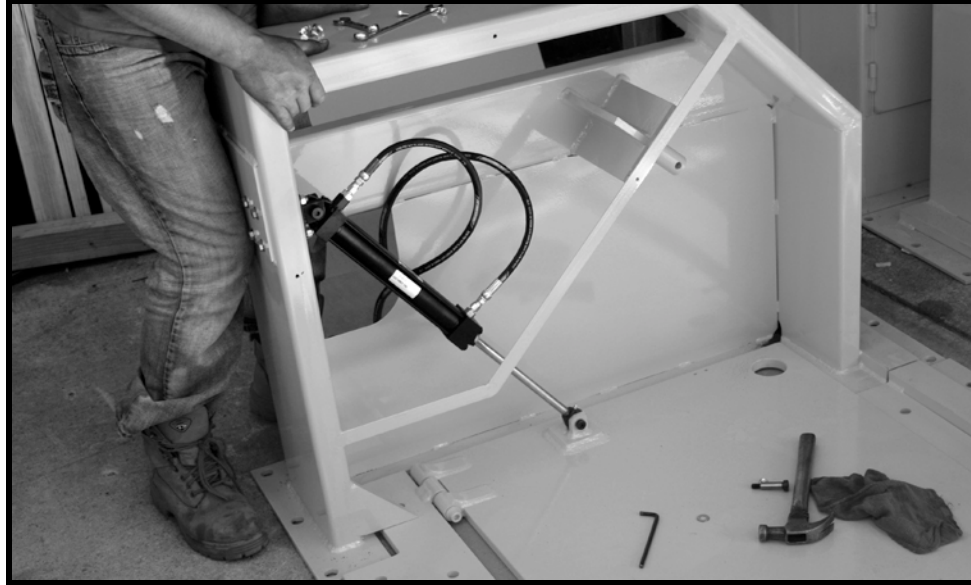
#### **3.2.1 System View Prior to Anchor Installation**

Before concrete anchors are installed, the PBG system should resemble the figure below.



**Figure 34 -- System View Prior to Anchor Installation**

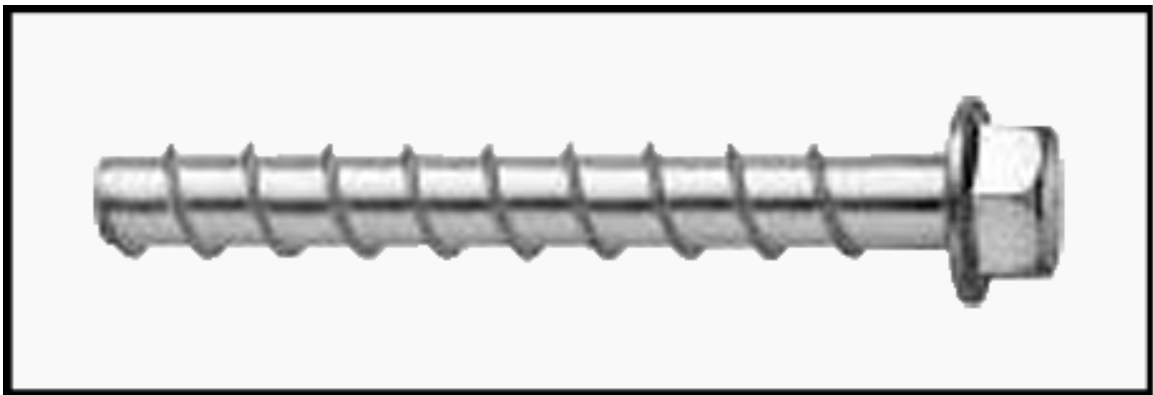
Make adjustments as needed to ensure that both cabinets are  $\frac{1}{2}$ " from the Plate on both sides prior to anchoring



**Figure 35 – Adjust Cabinet Locations to Ensure ½” Gap between Plate and Cabinets**

### ***3.2.2 Anchor Bolt Installation***

Spike PBG systems are anchored to the ground with Hilti 4” x 5/8” concrete anchors as shown in Figure 49. Use a 5/8” masonry drill bit to pilot holes for the anchors at least 4 inches deep. Remove all dust and debris with an air compressor and ensure that the pilot holes are as clean as possible.



**Figure 36 – Hilti Concrete Anchor Bolt (4” x 5/8”)**

Tool Required	Tool Type	Tool Specification
	Hammer Drill or similar for concrete drilling	
	Concrete Bit	5/8" masonry bit. Drill a minimum depth of 4"
	Air Compressor or similar	To remove dust and debris from drilling
	Wrench/Socket	15/16"
	Concrete Anchors	5/8" x 3.5" Hilti Concrete Screw Anchor



**Figure 37 – Drilling Pilot Holes for Concrete Anchors**





**Figure 38 – Cleaning Pilot Holes After Drilling**



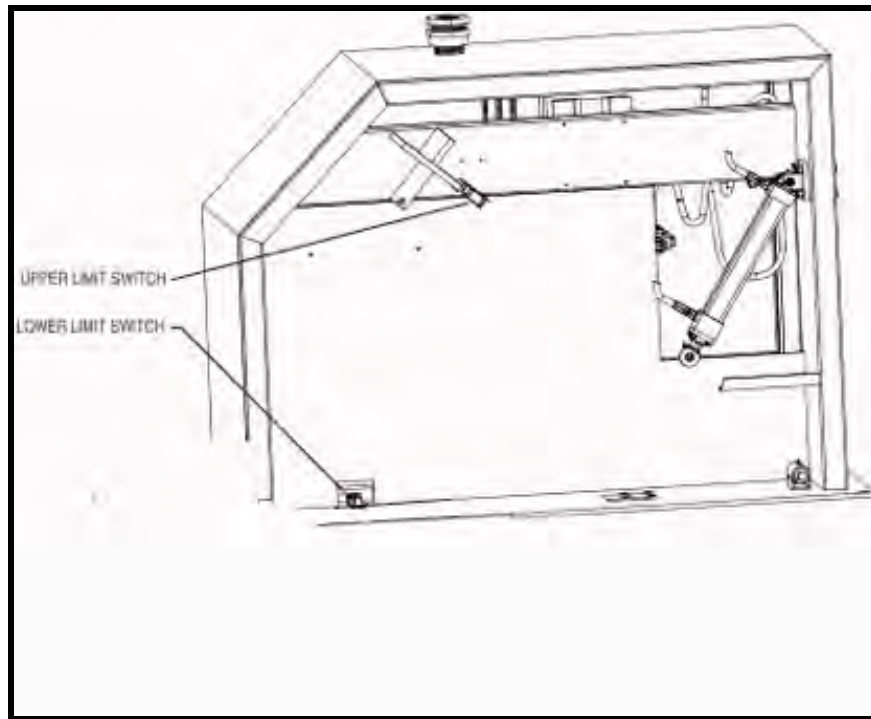
**Figure 39 – Secure Anchors with Wrench for Final Attachment**



### **3.3 Verify Proper Alignment of Upper Limit Switch within Control Cabinet**

Verify that the Barrier Gate, when elevated, makes proper contact with upper limit switch in the Control Cabinet. (Note that the Non-Control Cabinet does not have limit switches.)

It may be necessary to make a slight adjustment to the upper control limit switch location by bending the bracket slightly to ensure proper contact with the Barrier Gate arm in the raised position.



**Figure 40 – View of Upper and Lower Limit Switches, Control Cabinet**



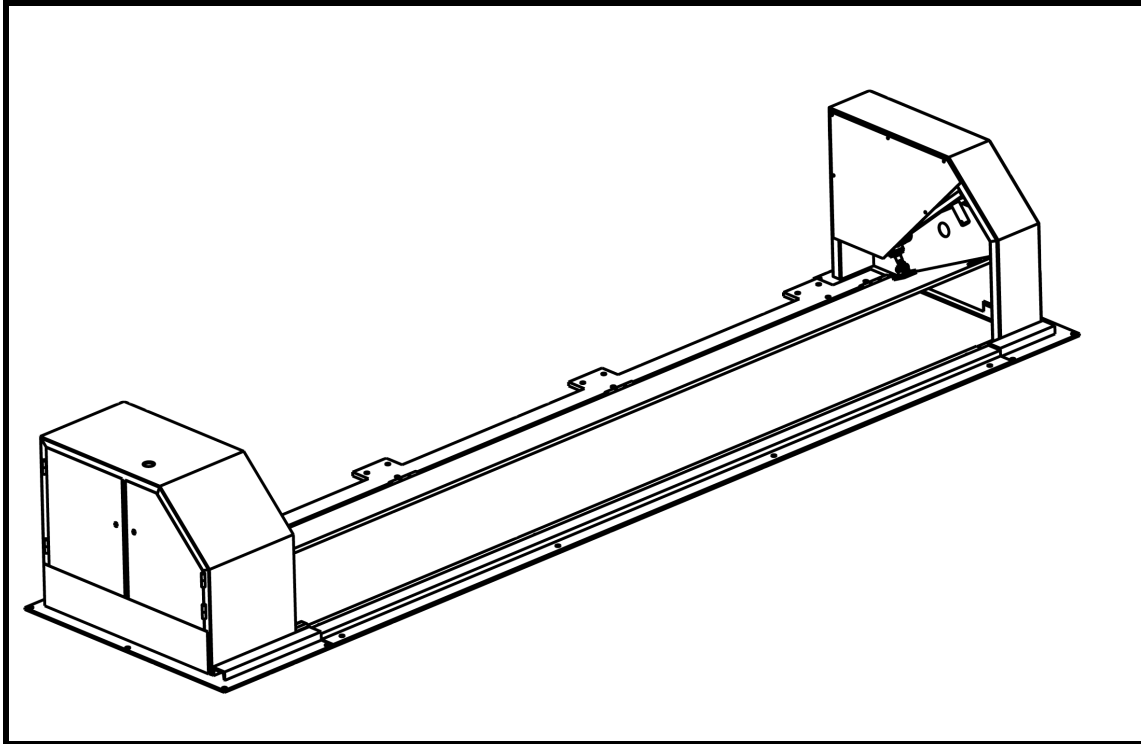
**Figure 41 – Location of Upper Limit Switch, Control Cabinet**



**Figure 42 – Location of Lower Limit Switch, Control Cabinet, Reference Only**

### 3.4 Replace Inside Panels for Control and Non-Control Cabinets

At this time, replace the inner panels of both the Control and Non-Control Cabinets as shown in the figure below.



**Figure 43 – Replacement of Inner Panels Control and Non-Control Cabinets**

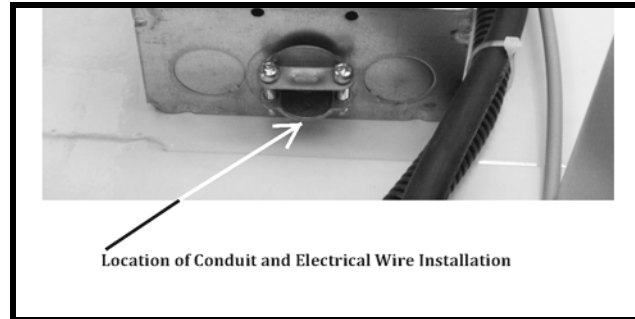
Tool Required	Tool Type	Tool Specification
	Wrench/Socket	7/16 "

### 3.5 AC Power Connection

The client-supplied power is to be connected to the 4-gang junction box via flexible conduit. The flexible conduit and power wires are to be routed through the bottom of the junction box in the location shown in the photo below. Local code may require that a licensed electrical contractor perform this step.

**NOTE** – The Switch on the 4-gang junction box, when switched to the ON position, allows power to flow to the Spike system from the AC power source.

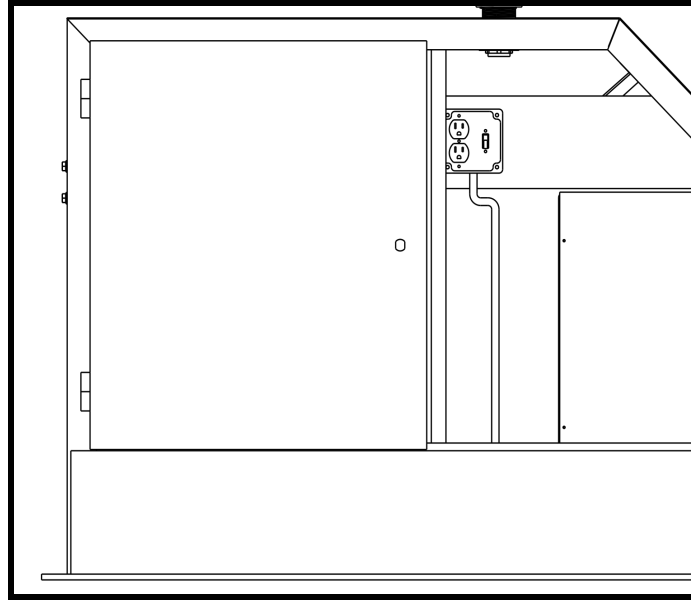
**WARNING** -- When servicing the system, this switch should be placed in the OFF position and the power going to the junction box should be shut off at the breaker box. When AC power is OFF at this switch and breaker box, voltages may still be present within the Spike System Control Box. Use caution.



**Figure 44 – AC Power Junction Box Inside Control Cabinet**

Tool Required	Tool Type	Tool Specification
	Flexible Conduit	To connect power conduit stub-up to 4 gang box
	Conduit Fitting	To connect flexible conduit to client-installed rigid conduit
	Flat Blade Screw Driver	To open junction box and terminate power cables
	Wire Strippers	To make electrical connection (Licensed contractor)

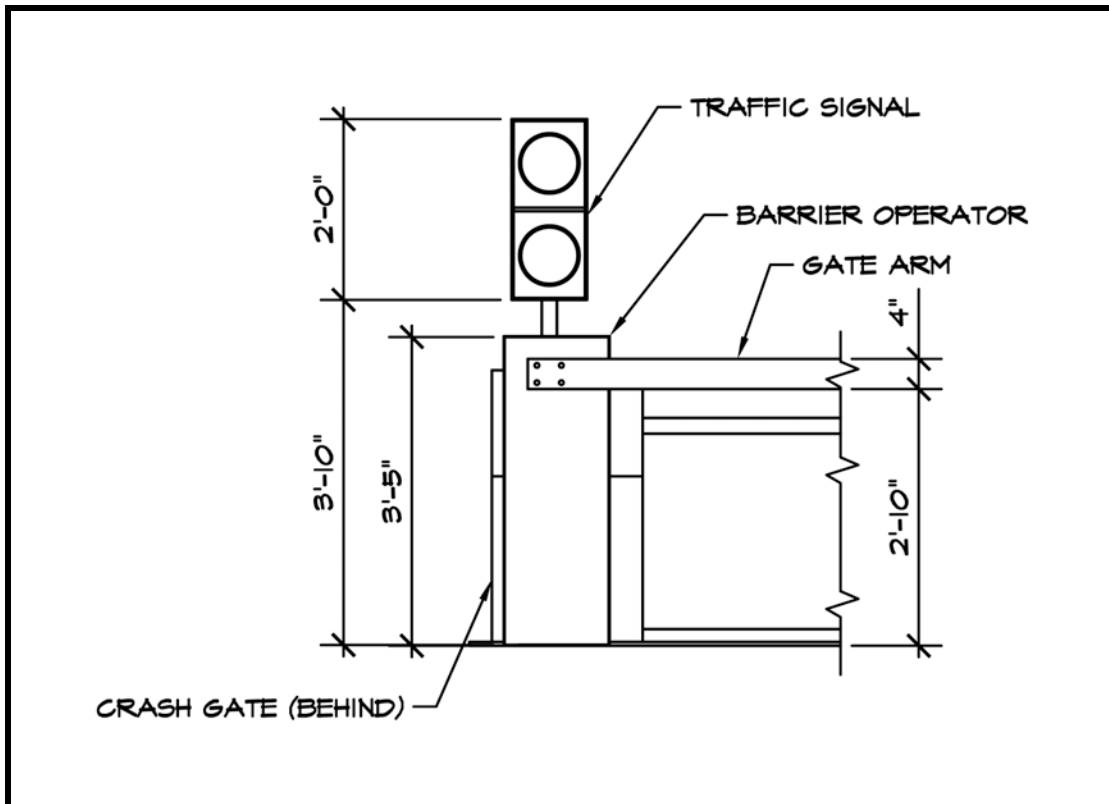
The figure below shows a typical routing of the flexible conduit that will provide power to the PBG system. A locally licensed electrical contractor should perform electrical power connection to the Spike System.



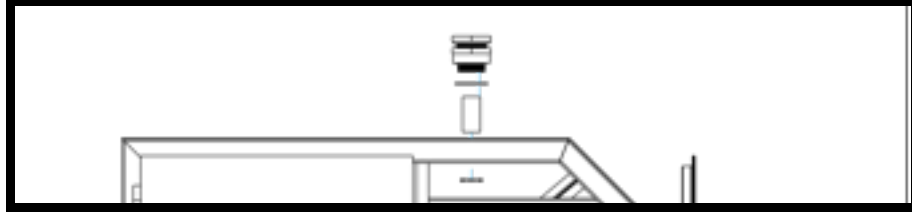
**Figure 45 – Location of Flexible Conduit Installation to AC Junction Box**

(Note: The bend in the flexible conduit should be more gradual than depicted above.)

### 3.6 Traffic Control Signal Mounting



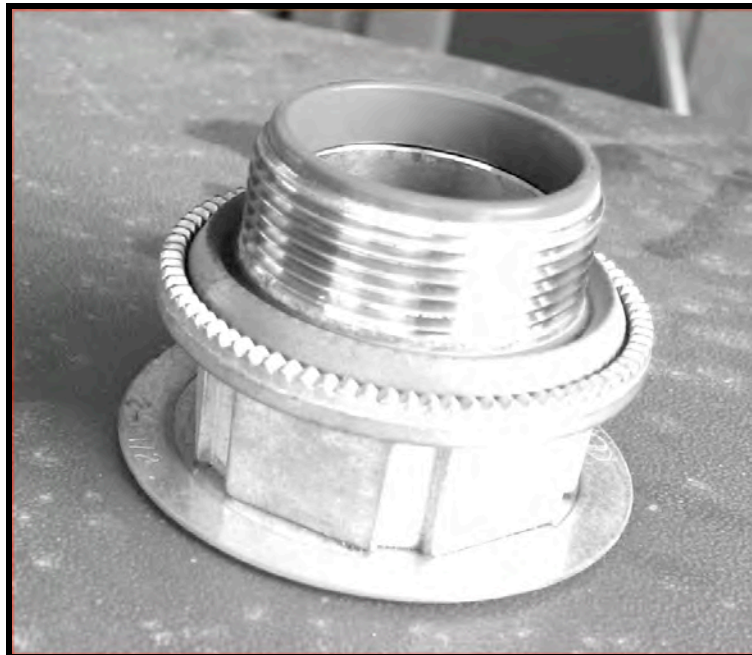
**Figure 46 – Traffic Control Lighting Installation Guidelines**



**Figure 47 – Location of Traffic Control Mounting Adapter, Control Cabinet**

Install the traffic control light fixture as shown in the figure above. This step is often performed at the factory. Thread the wires for the signal through the pole and flange for attachment at the control panel.

Tool Required	Tool Type	Tool Specification
	Channel Locks	Large size to secure mounting hardware



**Figure 48 -- Assembled Traffic Control Mounting Adapter, Control Cabinet**

### ***3.6.1 Wiring for Traffic Control Signal***

As shown in the figure below, the wiring for the traffic control signal terminates on TB2 (terminal block on right side). The yellow light signal connects to terminal 9, the red light signal wire connects to terminal 10, and the common wire connects to terminal 47.

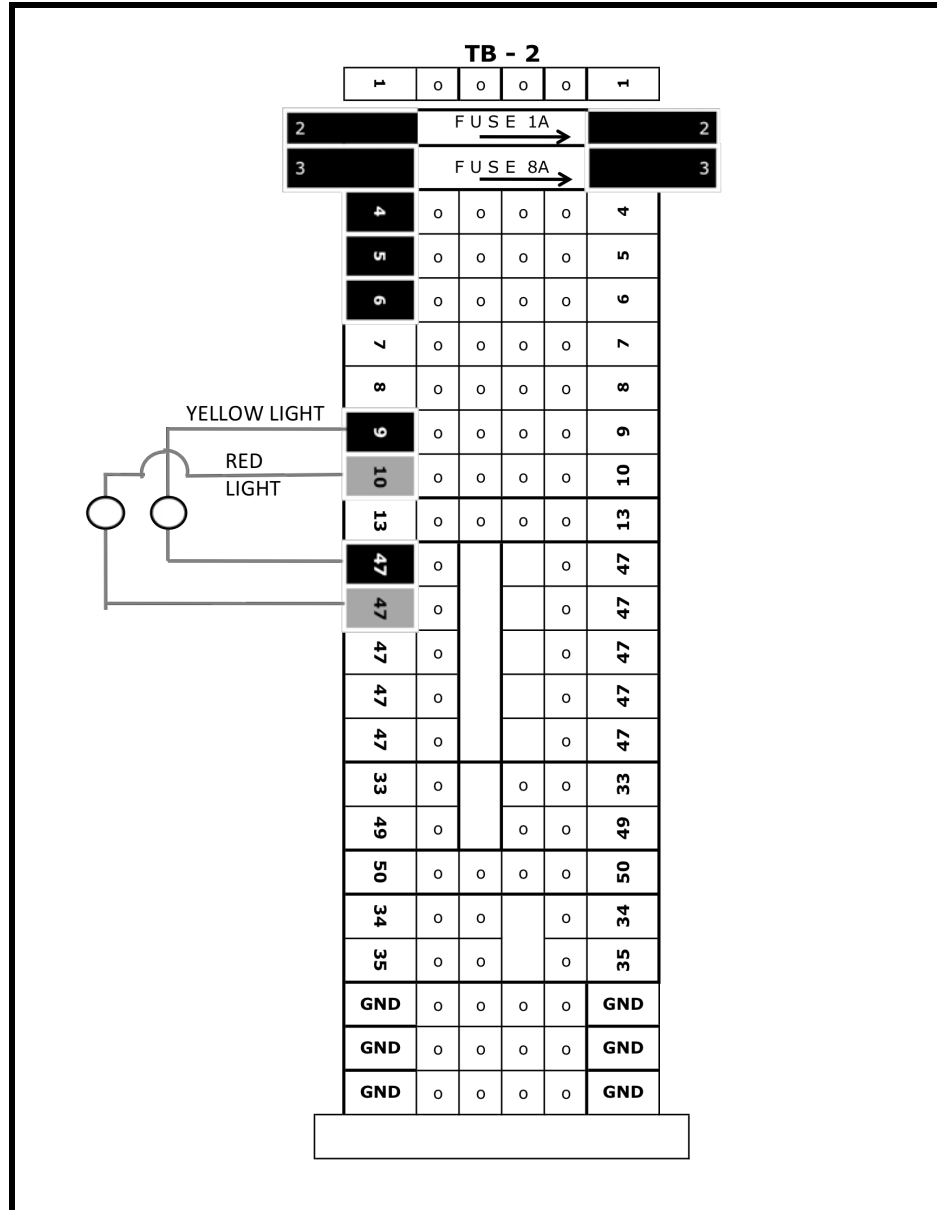


Figure 49 – Traffic Control Signal Wiring

Tool Required	Tool Type	Tool Specification
	Screw Driver	Flat, Small
	Wire Strippers	If required for cable connection

### 3.7 Wiring for Remote Operating Switch (Guard Shack, Typically)

As indicated in the figure below, a field connection barrier operated switch or control is wired to TB2. The Common wire is attached to terminal 4, the Open wire is attached to terminal 5, and the Close wire is attached to terminal 6.

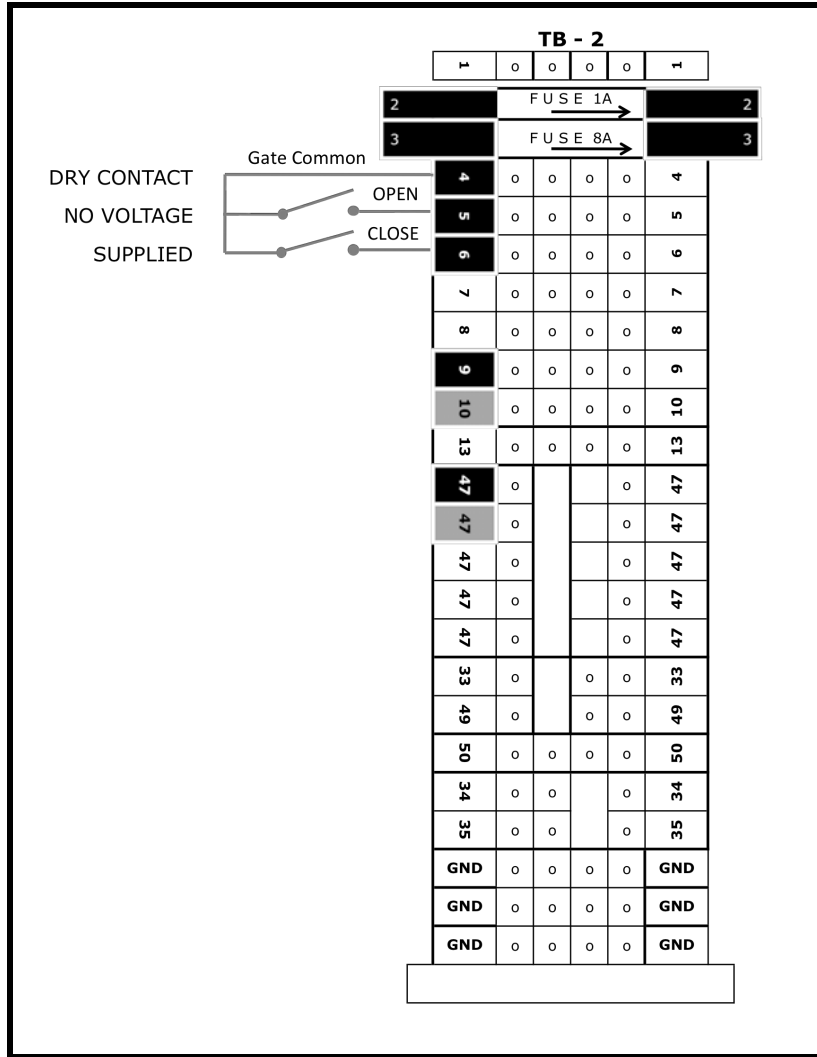


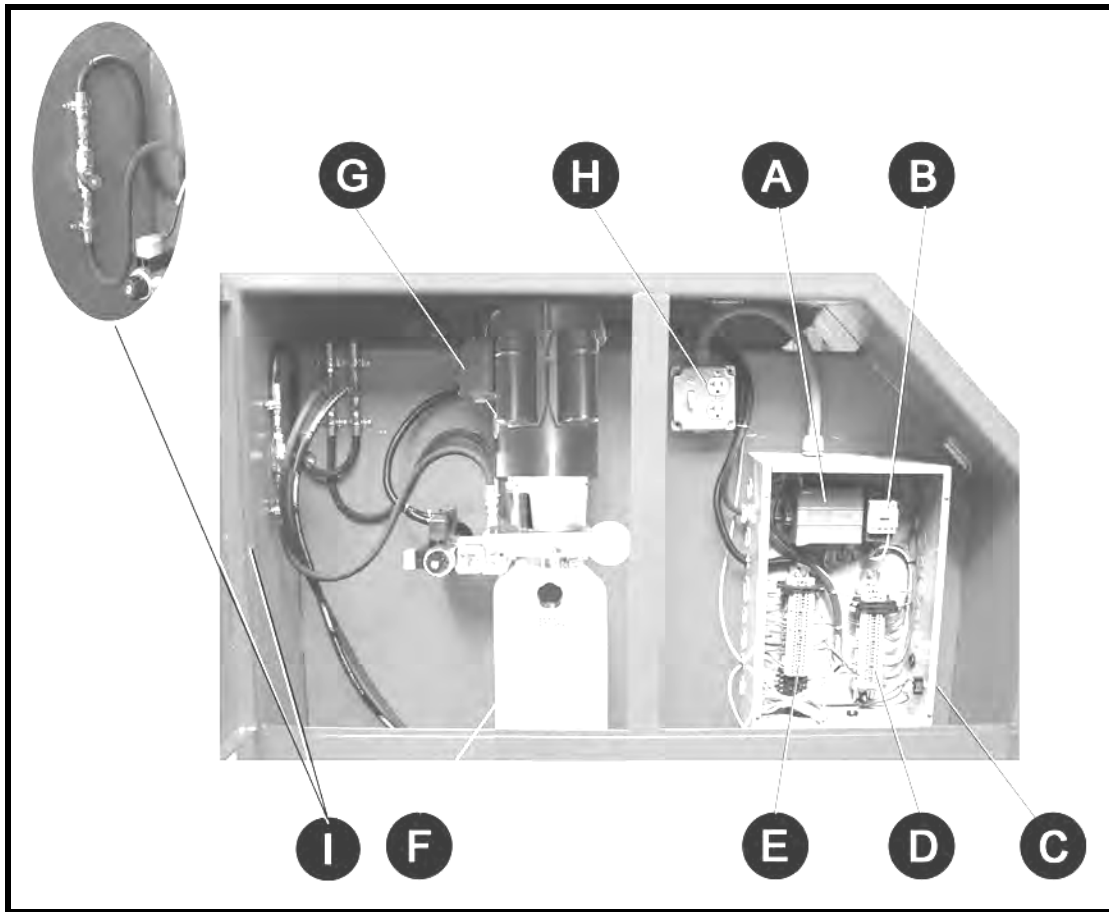
Figure 50 – Installation Location of Field Connection Barrier Operator

Tool Required	Tool Type	Tool Specification
	Screw Driver	Flat, Small
	Wire Strippers	If required for cable connection



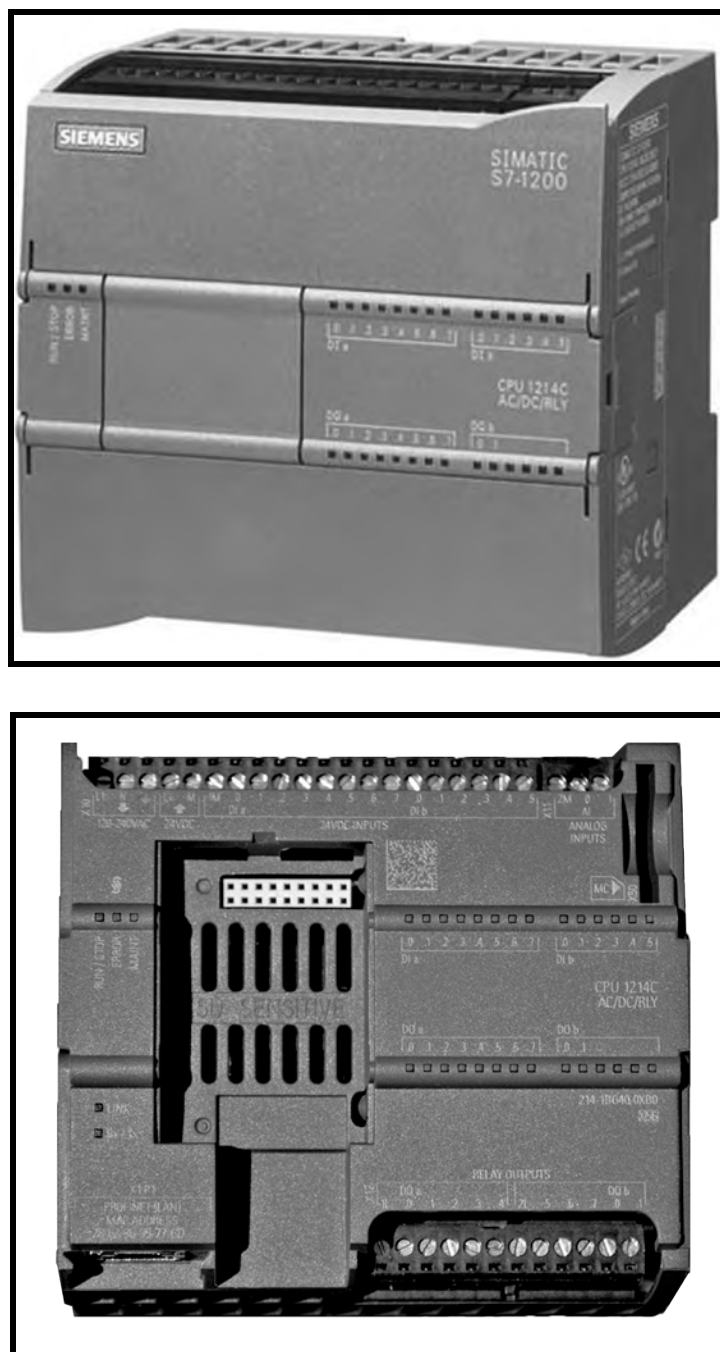


### 3.8 Installation Electrical Reference Information



Component Identification	Photo Callout	Component
	A	Siemens S7-1200 PLC
	B	Schneider Control Relay LC1 D25
	C	Momentary On-Off Toggle Switch
	D	TB2 Terminal Block
	E	TB1 Terminal Block
	F	Hydraulic Fluid Reservoir
	G	Leeson 1.5 HP Motor/Pump
	H	AC Junction Box with Master Power Switch
	I	Flow Control Valve

**Figure 52 – Electronic Control Panel Components, Control Cabinet**



**Figure 53 – Siemens S7-1200 PLC, Control Cabinet -- With (Top) and Without (Bottom) Covers Removed**

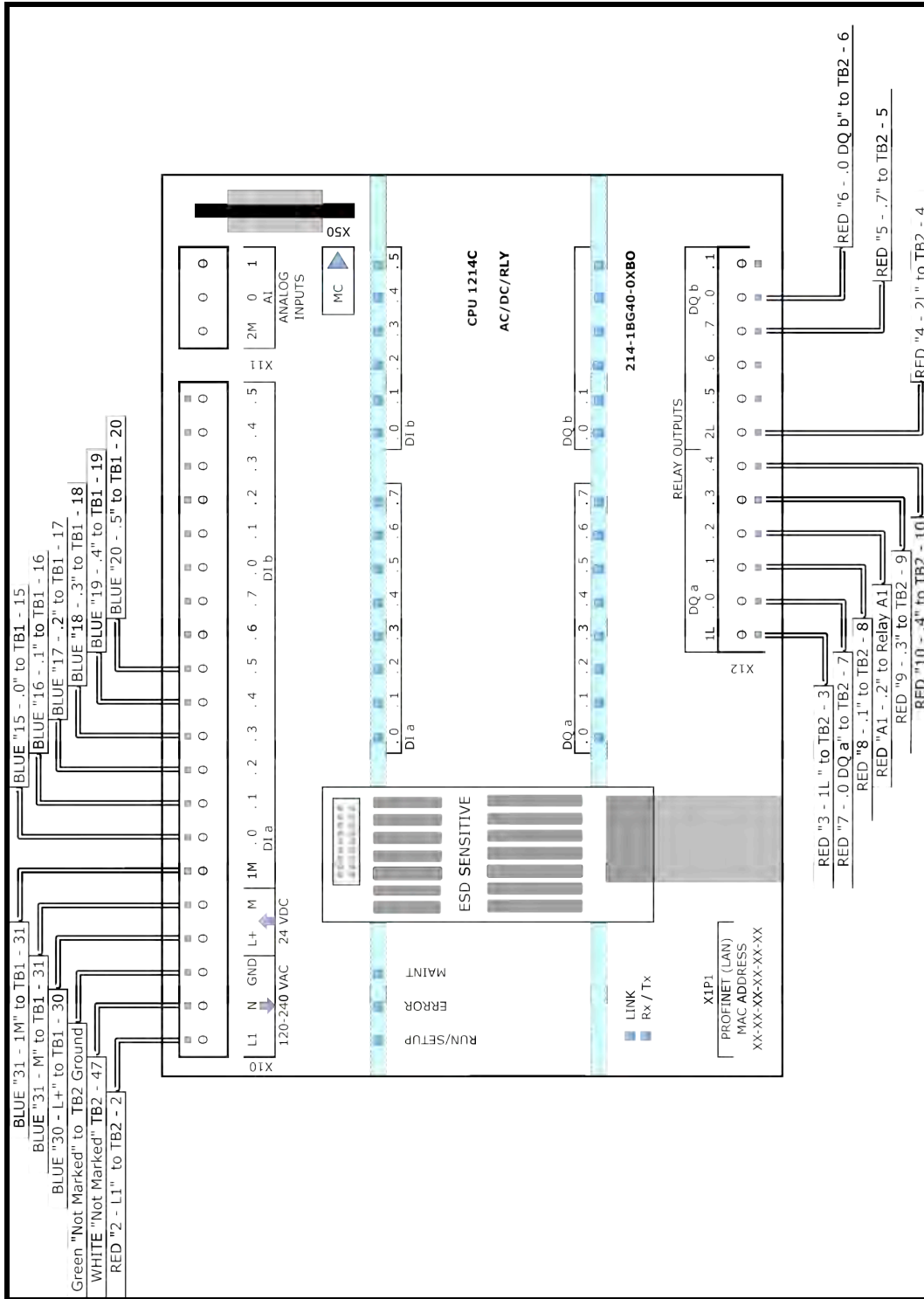


Figure 54 – Siemens PLC Wiring Scheme

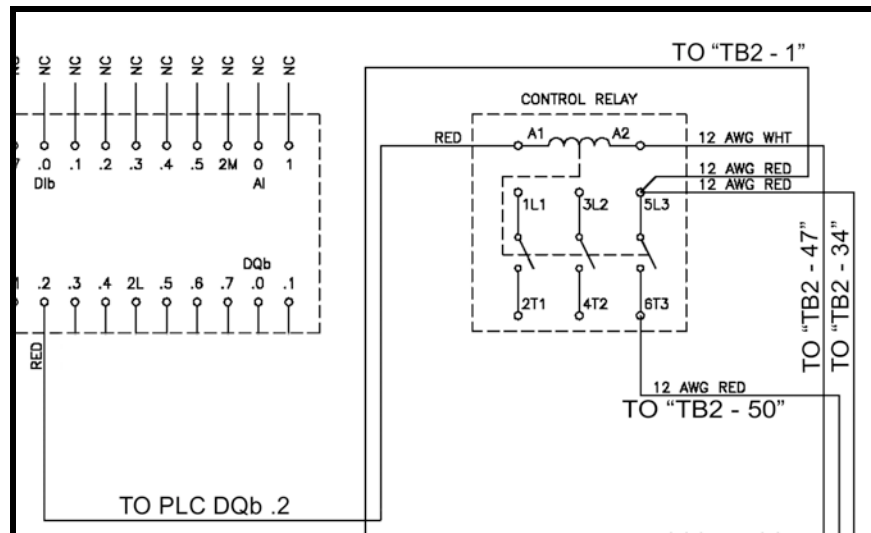
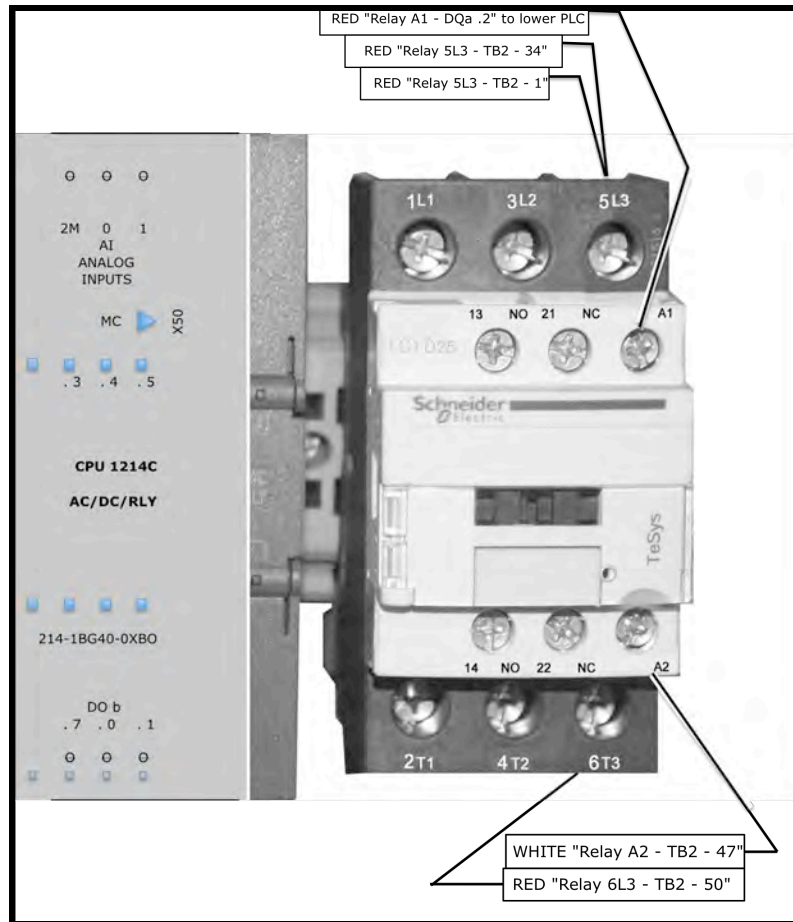


Figure 55 – Schneider LC1 D25 Relay, Control Cabinet

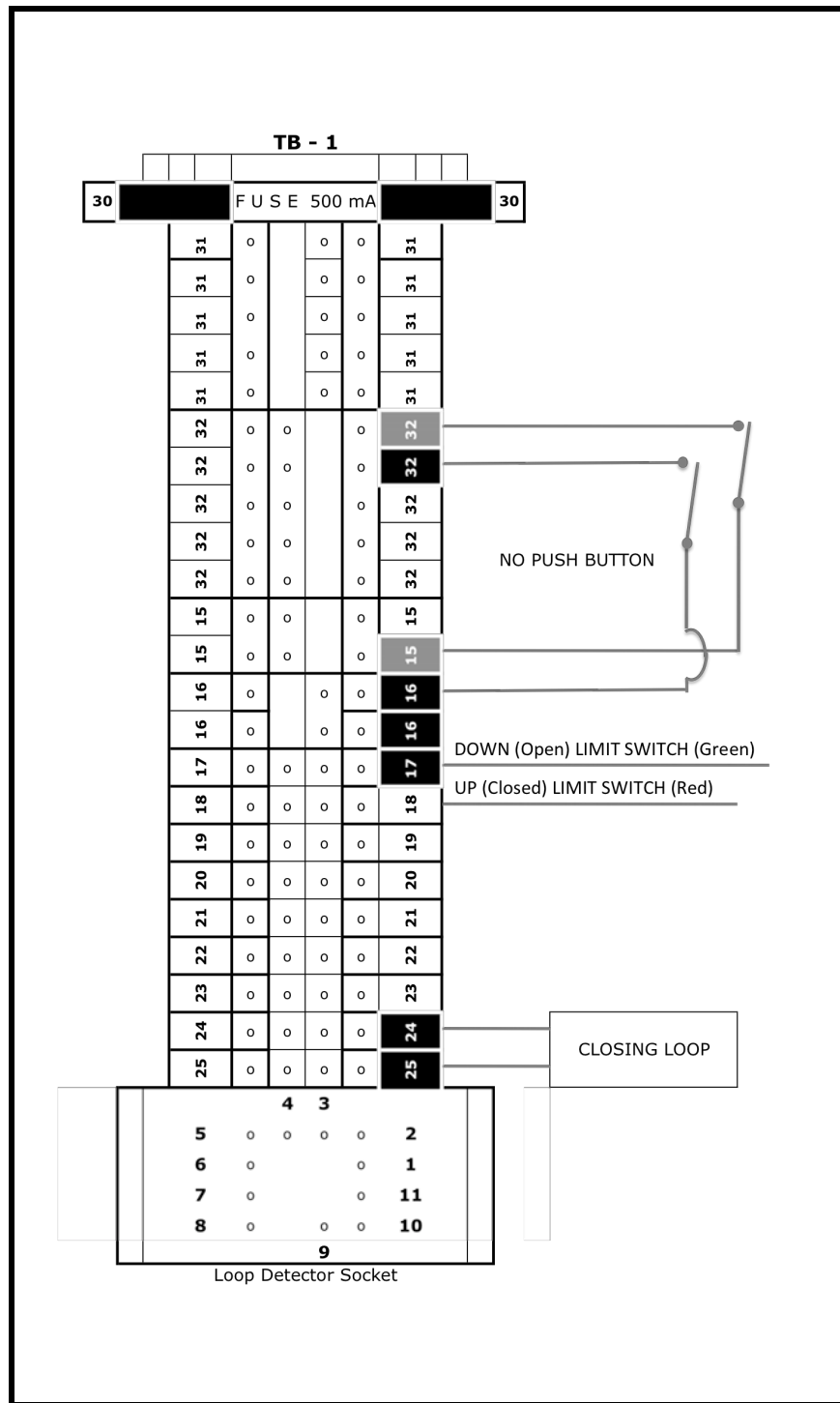
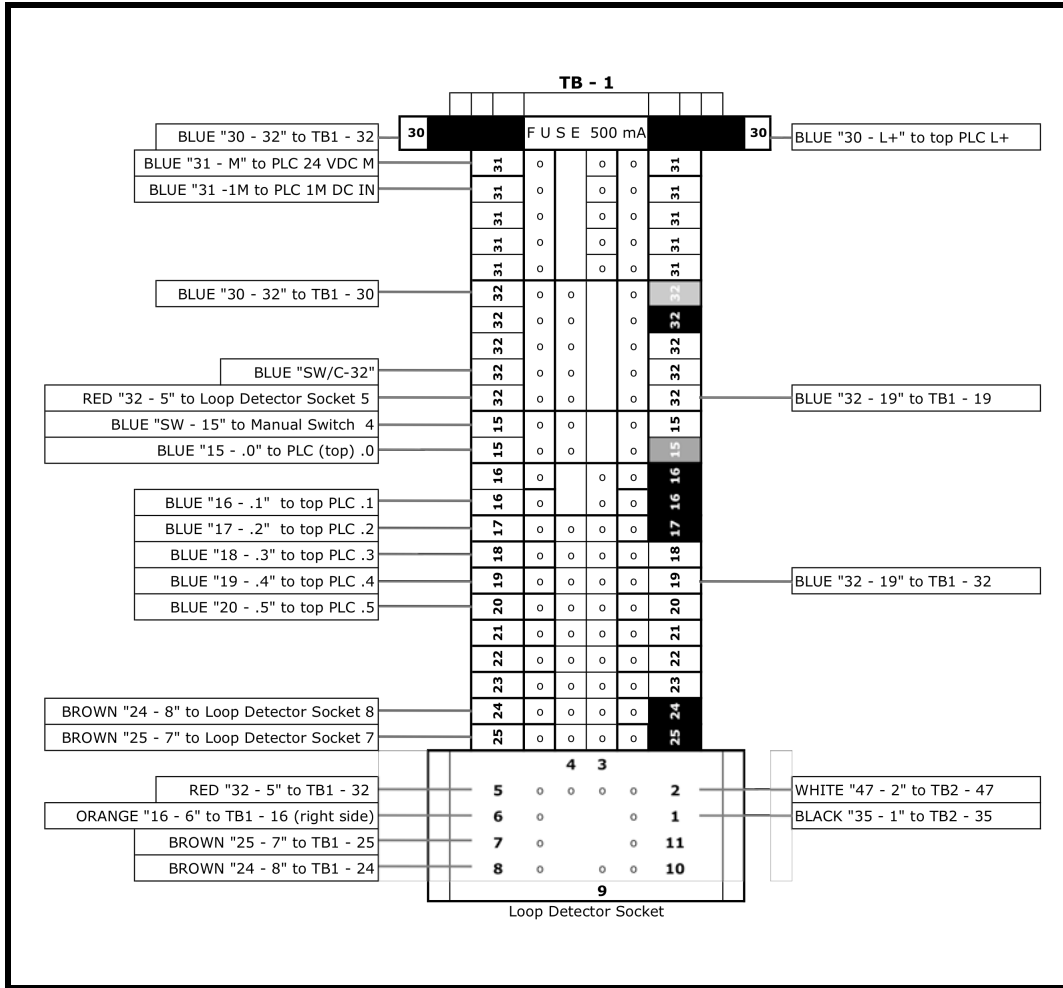


Figure 56 – TB 1 Terminal Block, Installation Wiring, Control Cabinet



**Figure 57 – TB 1 Terminal Block, Factory Wiring, Control Cabinet**

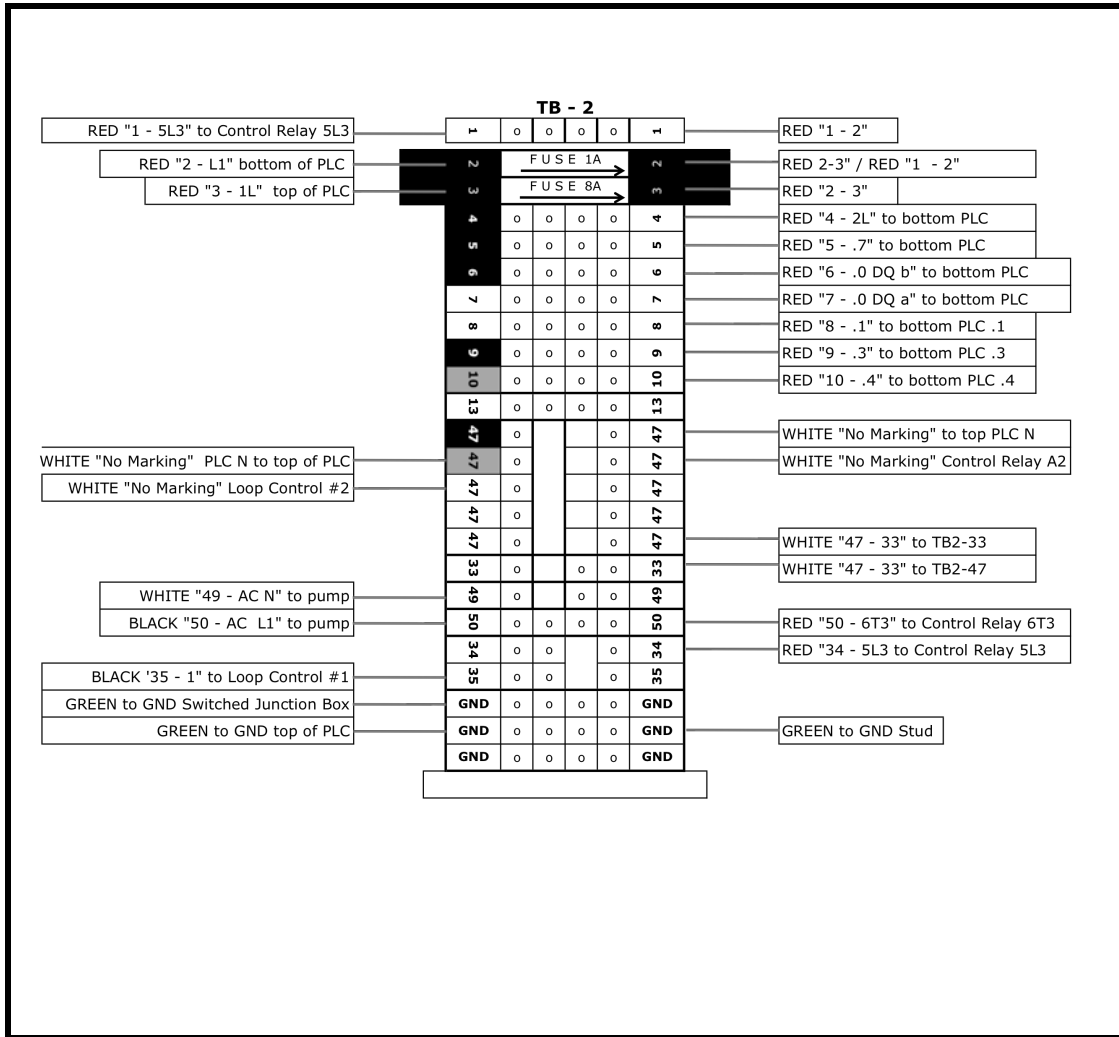


Figure 58 – TB 2 Terminal Block, Factory Wiring, Control Cabinet



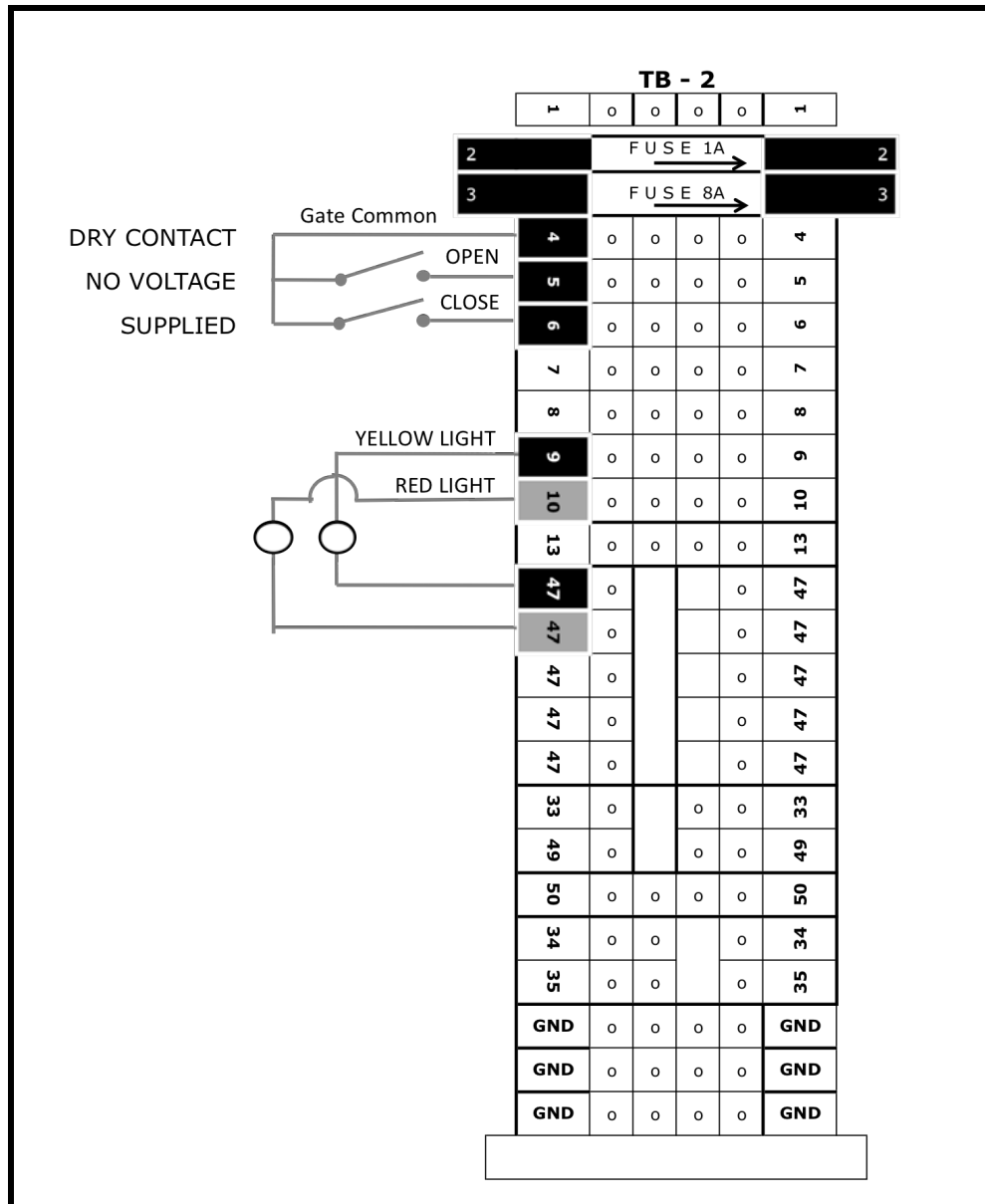
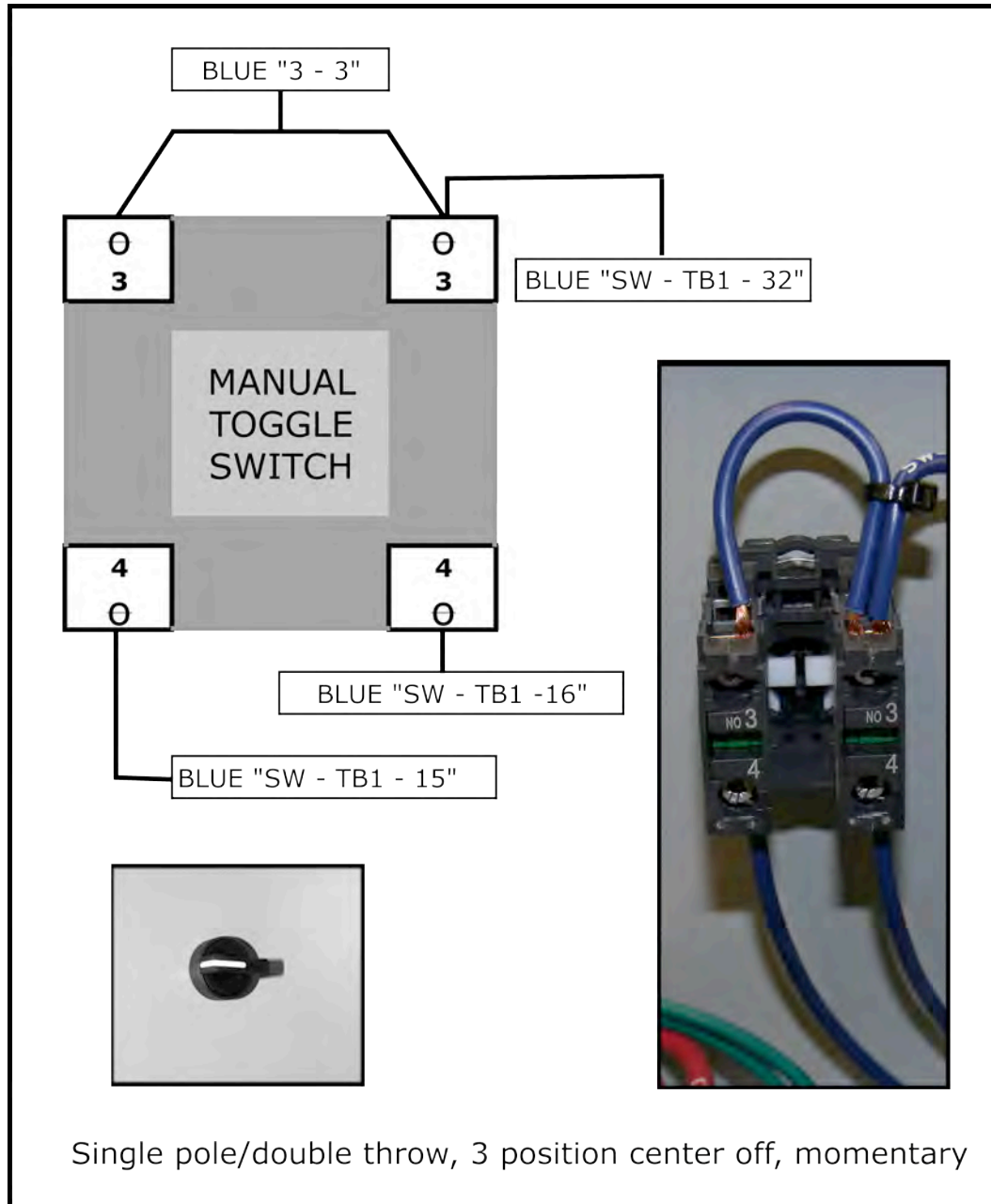


Figure 59 – TB 2 Terminal Block, Installation Wiring, Control Cabinet



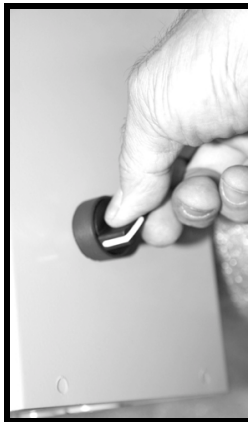
**Figure 60 – Momentary On/Off Operation Switch, Wired at Factory, Control Cabinet**



**Figure 61 – Momentary Switch in OFF or Neutral Position**



**Figure 62 – Momentary Switch in Up (Raise) Gate or Barrier Plate**



**Figure 63 – Momentary Switch for DOWN or Lower Gate or Barrier Plate**

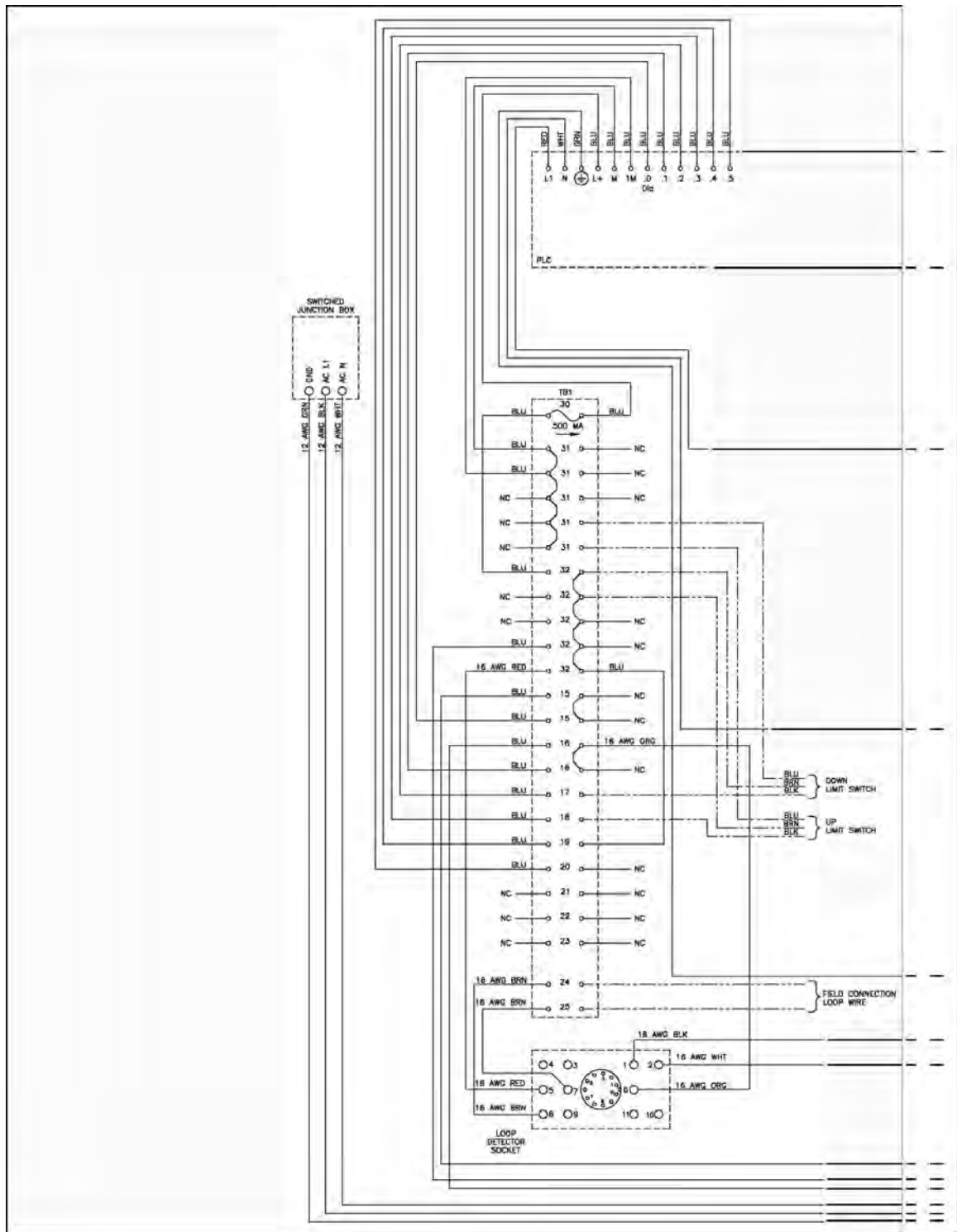


Figure 64 – Left Side Electrical Schematic, Control Cabinet

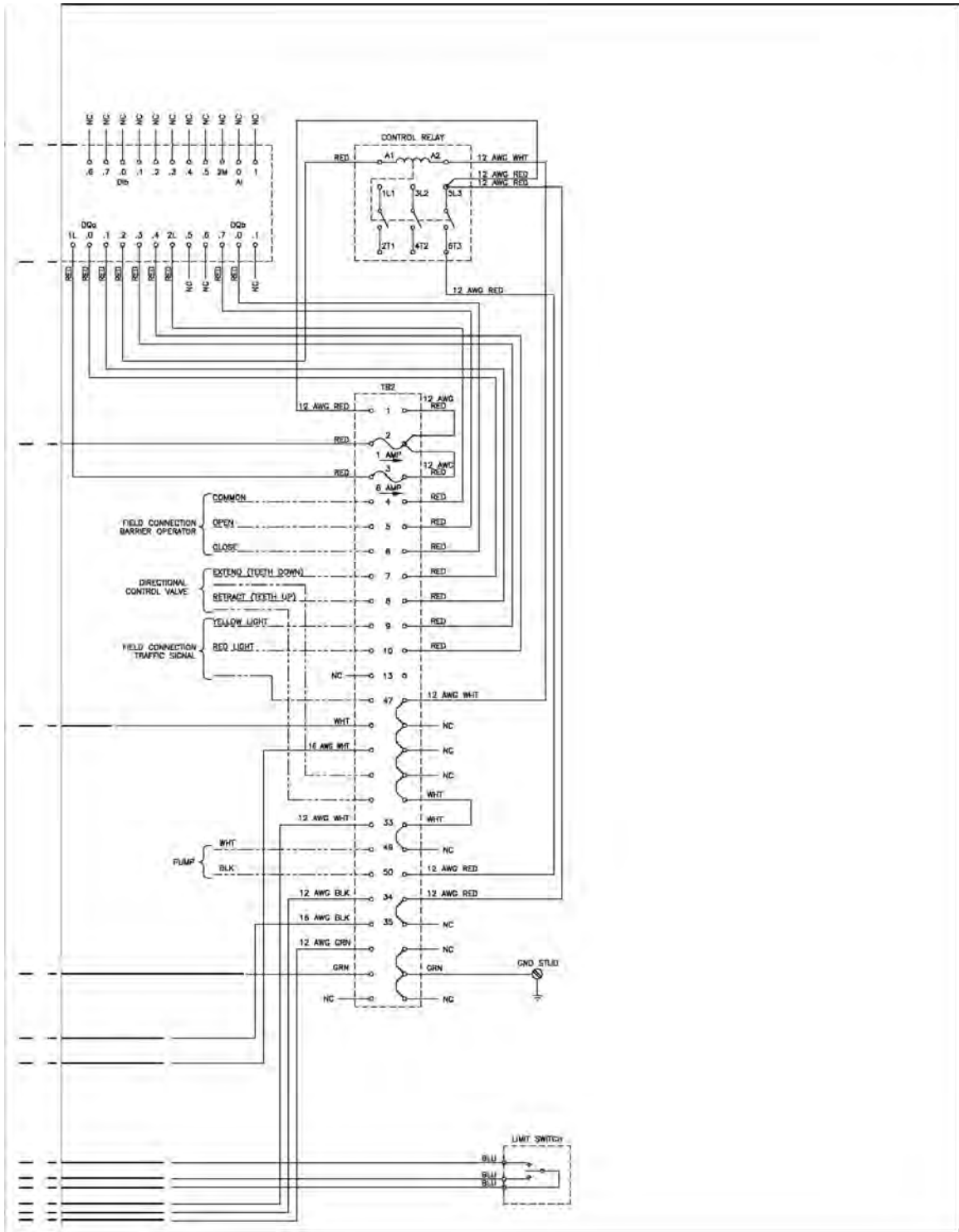


Figure 65 – Right Side Electrical Schematic, Control Cabinet



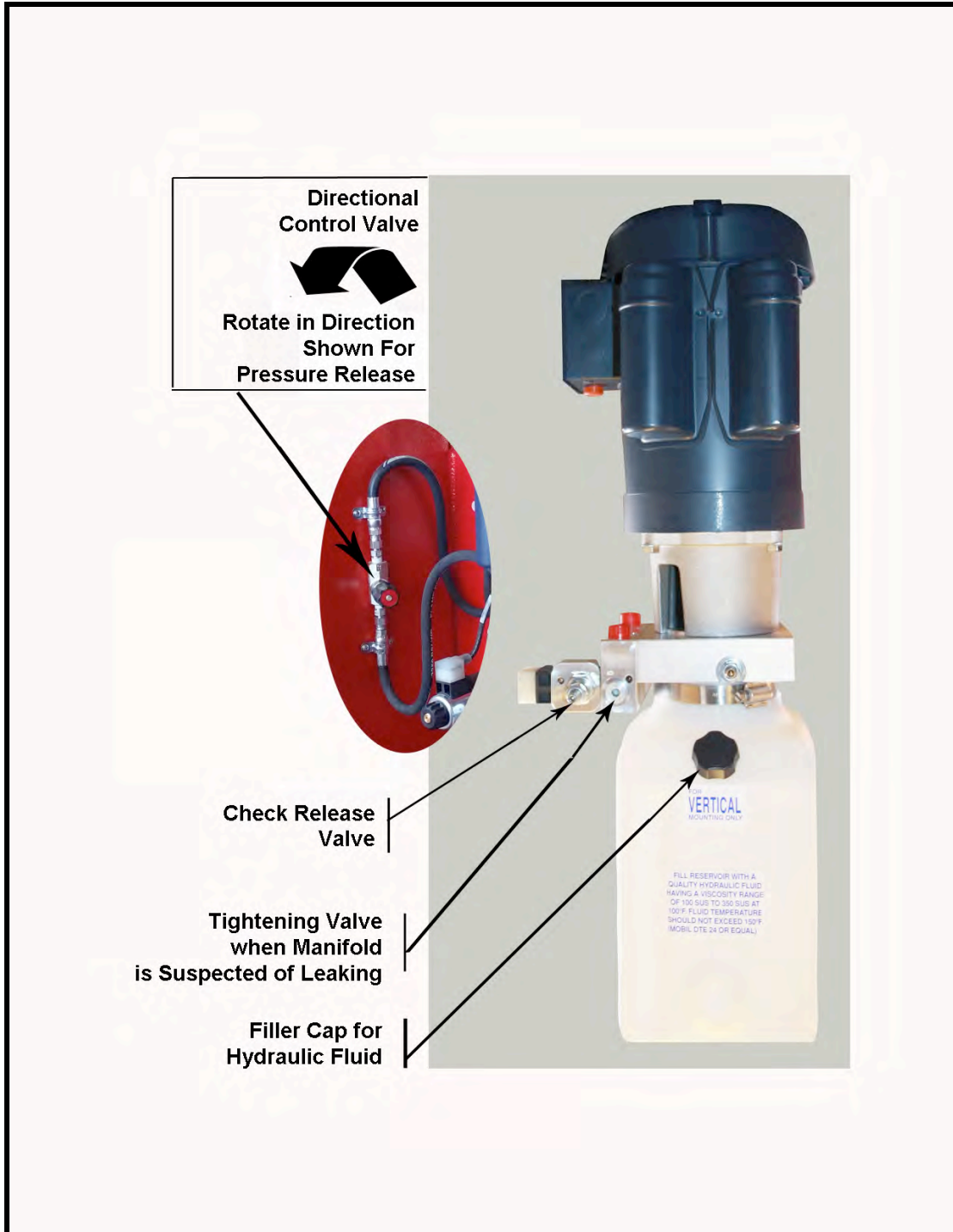


Figure 67 – Motor/Pump and Fluid Reservoir, Control Cabinet



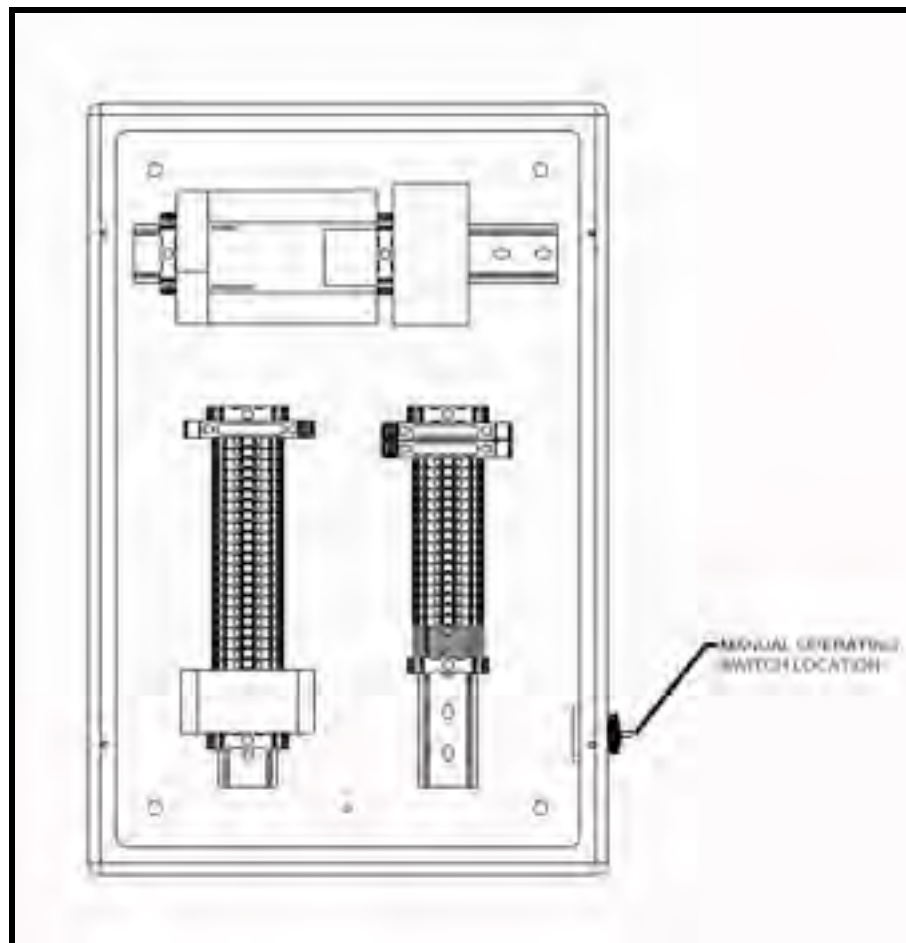


## **Section 4 - System Operation and Maintenance**

### **4.1 Barrier Gate Manual Operation**

When all electrical connections have been made for the system, including all options, apply power to the system via the AC circuit breaker. Next, ensure that the power switch on the 4-gang electrical junction box is placed in the ON position.

Before testing the remote access devices (for example from a control shack), it is recommended that the system operation be tested using the manual operating switch, located on the outside of the electronic control compartment within the Control Cabinet. This switch is identified in the figure below. When system functionality has been verified from the manual operating switch, verify all other system controls.

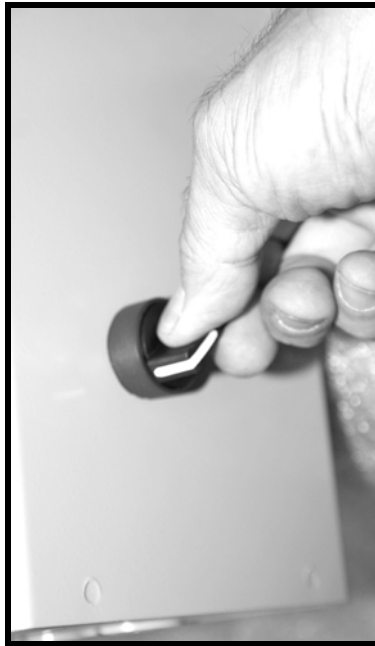


**Figure 68 – Manual Operating Switch Location**

### **4.2 Barrier Gate Emergency Operation: Manual Gate Lowering**

If it ever becomes necessary to lower a Barrier Gate manually, for example in the event of power loss or other unusual situation, open the locking door on the Control Cabinet to gain access to the system hydraulic pump. As pictured below, turning the pump

release valve in the clockwise direction will allow the gate to go down manually. Ensure that this valve is turned in the opposite direction (counter-clockwise) once system operation has been restored.



**Figure 69 – Manual Gate Lowering in Case of Power Loss or Other Unusual Event**

## **4.3 Important Hydraulic Power Unit (Pump) Information**

### ***4.3.1 Observations and Recommendations***

When connecting AC current, please observe the indicated rotation of the electric motor. Running the motor in the opposite direction of the indication will result in shaft seal damage. All electric connections should be done according to local standards. Failure to comply with local standards **and use of non-certified components may result in injury**. All hydraulic connections should be made, and the proper fluid should be present in the reservoir before, running the Hydraulic pump.

### ***4.3.2 Seal Kits and Components***

To obtain a seal kit, the model number and serial number of the power pack is needed. Most parts are available separately, however the pump is only replaced in whole and separate trust-plates or loose shafts cannot be obtained. In order to ensure the quality and performance of our product, all Hydraulic pumps are tested for performance at the factory.

#### **4.3.3 Hydraulic Hose Connections**

Hoses and fittings connected to the pump should be clean and free of any burs, oxidation and carbon deposits. The hydraulic connections must be of adequate pressure rating, and should be inspected on a regular basis to avoid leakage or possible bursting due to high pressure. The size of the hydraulic connections must be determined with the oil flow of the hydraulic pump in mind (1000 PSI) to avoid backpressure in the system. This could create unwanted heat buildup. **The fluid level in the reservoir should be monitored at regular intervals.** A fluid level below the intake strainer will cause damage to the pump due to cavitations of the pump. The hydraulic pump is designed to stand vertically.

#### **4.3.4 Pump Adjustments**

Since the hydraulic pump has a fixed displacement pump installed, oil flow is constant and determined by the speed of the electric motor. Therefore, the pump flow cannot be adjusted. The adjustment for the pressure relief valve will adjust pressure only. It will not increase pump flow. The relief valve is set to a pressure specified when the hydraulic pump was tested. The specified pressure applies to the specific system in which it is installed. The setting can be changed in the field and should be as close as possible to the maximum working pressure of the system. The standard pressure relief valve protects the pump; it should only be adjusted if the pressure reaches an unwanted high level. It is an emergency valve only. It should not be blocked off or turned in completely to avoid bursting of components. Removing the cap nut and loosening the lock nut make adjustments. A clockwise rotation of the adjustment stem increases the pressure and a counter-clockwise rotation decreases pressure. The lock nut should be tightened after adjustment, and the cap nut should be re-installed to avoid changing the setting by vibration and to avoid hydraulic fluid leakage.

Please contact the factory if you have any questions or concerns relating to your hydraulic pump.

#### 4.3.5 On-Going Maintenance Tasks: Hydraulic Pump

<b>WARNING:</b> BEFORE YOU USE A MATERIAL, REFER TO THE MANUFACTURERS' MATERIAL SAFETY DATA SHEETS FOR SAFETY INFORMATION. SOME MATERIALS CAN BE DANGEROUS.
---

##### Scheduled Maintenance

Period	Maintenance
Daily	Check HPU manifold for leakage.
Weekly	Check HPU reservoir fluid level.
Semi-Annually	Change hydraulic fluid (heavy use).
Annually	Change hydraulic fluid (moderate use).

##### Material Part Numbers

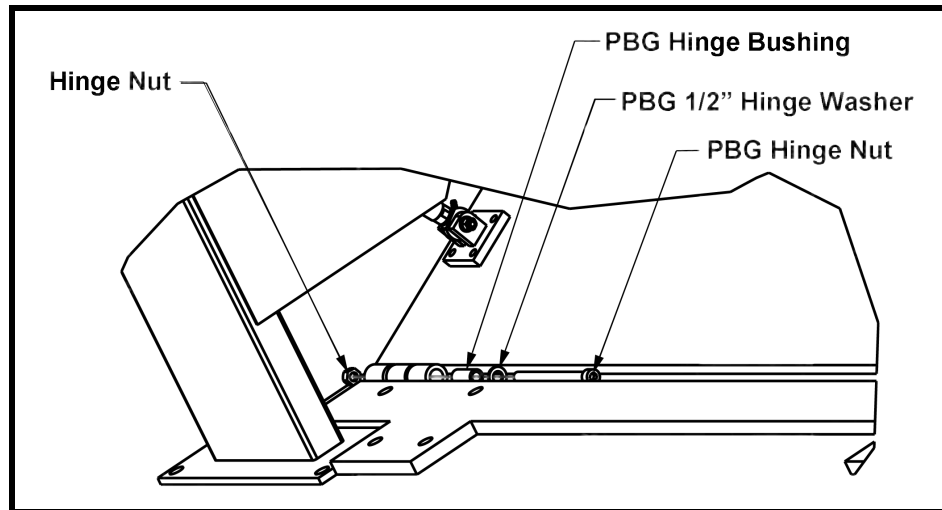
Description	Brand	Part No.	Quantity
Hydraulic Fluid	DEXRON III ATF Fluid	HO-2	3 Liters

#### 4.4 Possible Field Repair Tasks

The following sections provide information on possible field replacement tasks that may be required. When the Spike System is initially shipped, these tasks have already been completed by the factory. These instructions will aid the client maintenance staff repair and replace certain items should they become damaged during normal system operation

##### 4.4.1 Plate Replacement

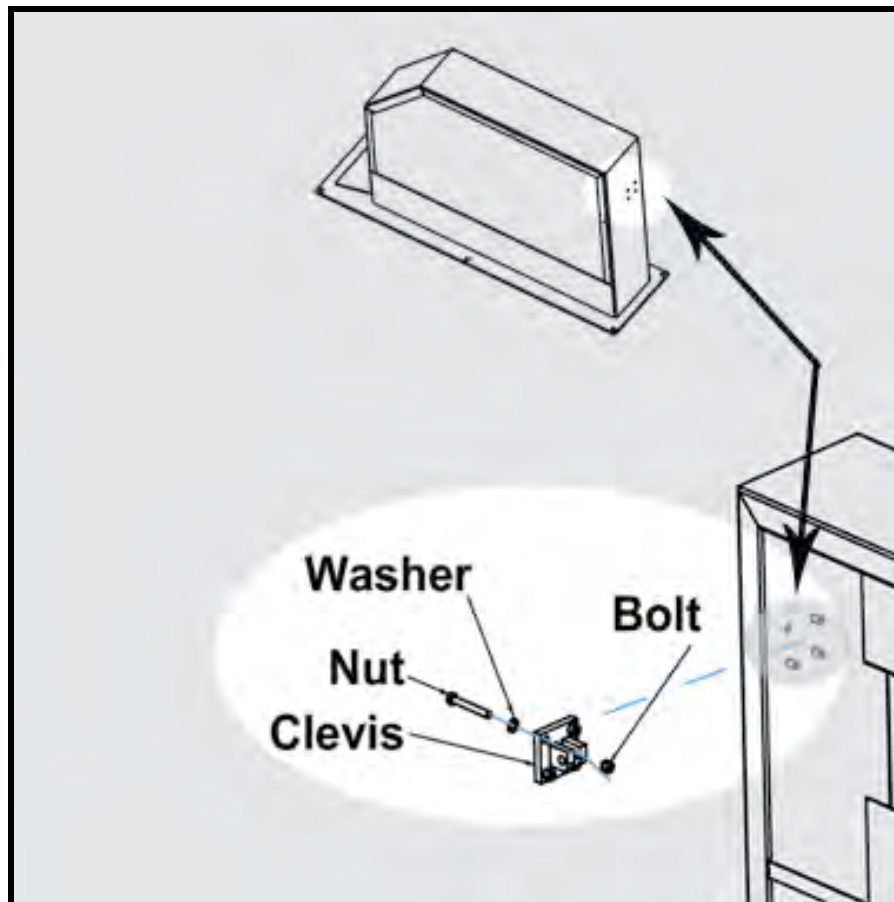
If it is ever necessary to attach a new Plate to the hinge assembly, use the following as a guideline for attaching the two components.



**Figure 70 – Replacing a Damaged Plate to a Non-Damaged Hinge Assembly**

Tool Required	Tool Type	Tool Specification
	Wrench/Socket	9/16" (for bolt)
	Allen Wrench	¼" (for nut)

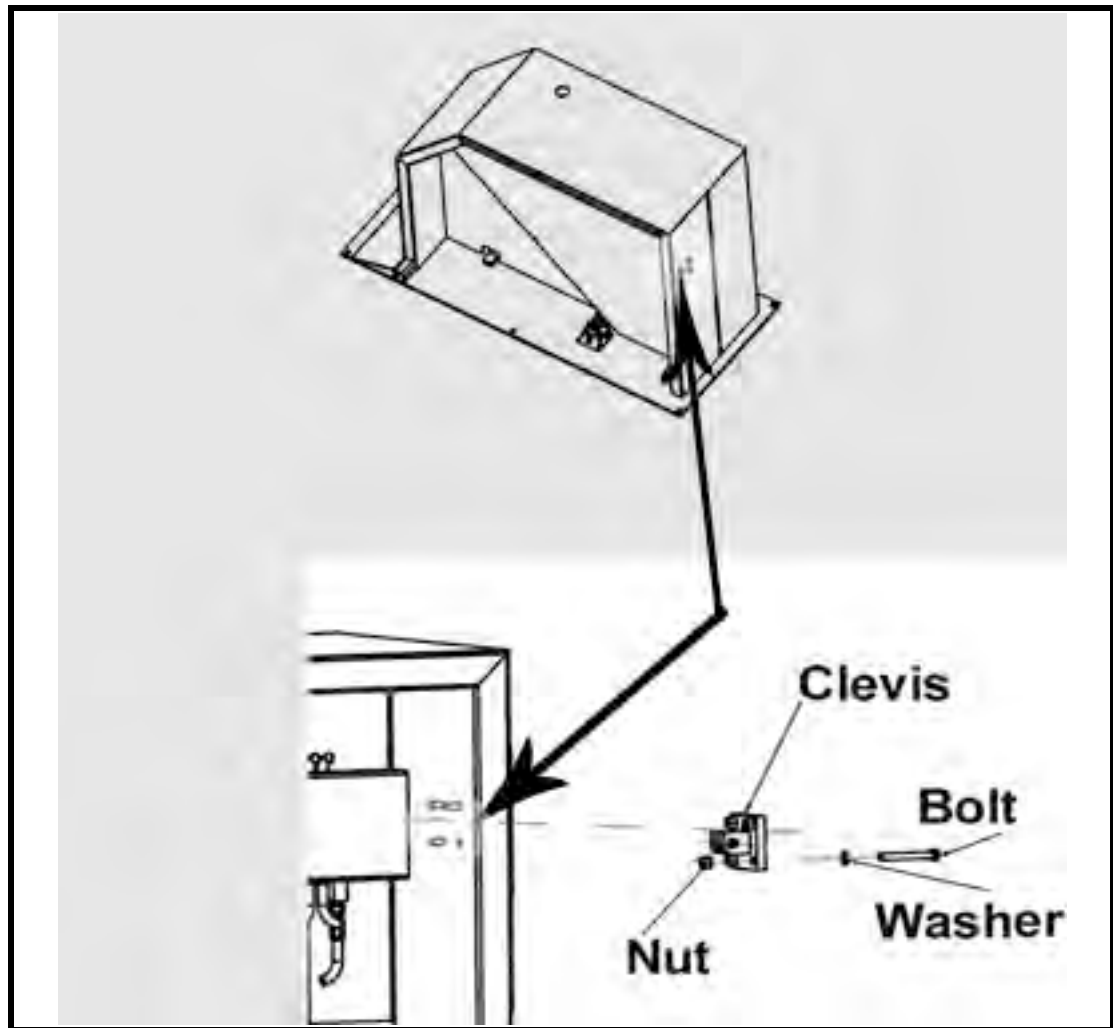
#### **4.4.2 Clevis Installation, Non-Control Cabinet**



**Figure 71 – Clevis Installation, Non-Control Cabinet**

#### **4.4.3 Clevis Installation, Control Cabinet**

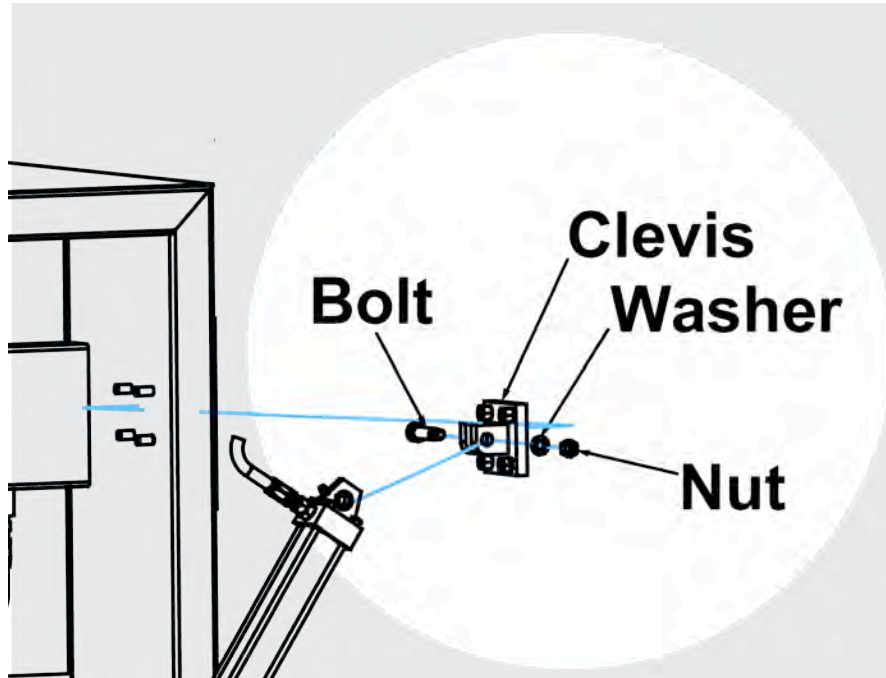
Using nuts, washers and bolts (four each), install a clevis to the inner wall of the Control Cabinet as indicated in the illustration below.



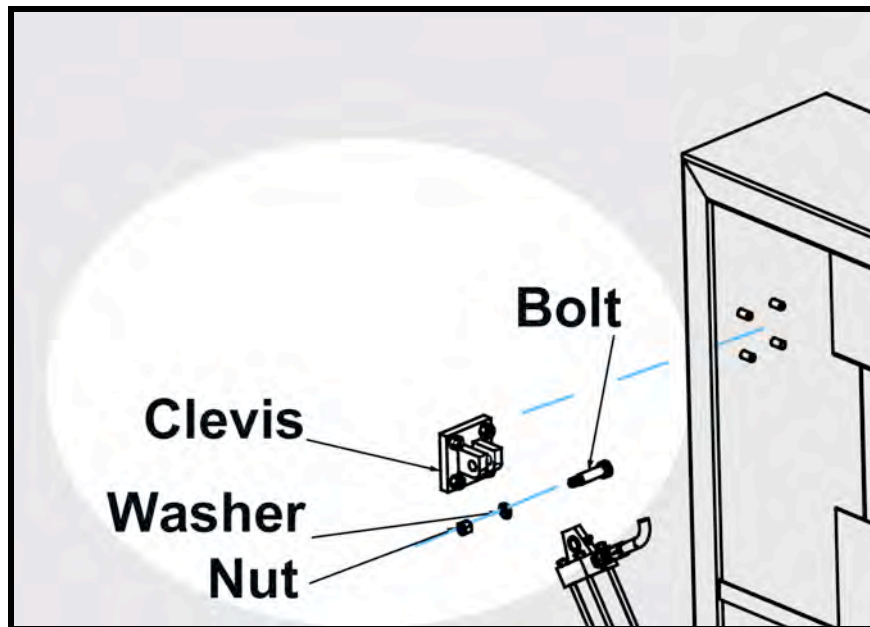
**Figure 72 – Clevis Installation, Control Cabinet**

Tool Required	Tool Type	Tool Specification
	Wrench/Socket	9/16" (for bolt)
	Allen Wrench	1/4" (for nut)

#### **4.4.4 Hydraulic Cylinder Installation, Control and Non-Control Cabinet**



**Figure 73 – Hydraulic Cylinder Installation, Control Cabinet**



**Figure 74 – Hydraulic Cylinder Installation, Non-Control Cabinet**



## 4.5 Maintenance Reference Information

### Gate Access Controller I/O

Terminal No.	PLC Address	Description	Voltage	Notes
L1	X	Main Power Terminal Block	110 VAC	
1	X	Switched Power Terminal Block	110 VAC	
2	X	PLC Fuse Block	110 VAC	Fuse size 1A
3	X	PLC Output Fuse Block	110 VAC	Fuse size 8A
47	X	Neutral	110 VAC	
49	X	Pump Neutral	110 VAC	Pump Terminal
50	X	Pump Power	110 VAC	

### Gate Access Controller Input 24 VDC

Terminal No.	PLC Address	Description	Voltage	Notes
30	X	Fuse block F4 +24 VDC fusing PLC power supply (to PLC L+)	+24 VDC	Fuse size 500mA
31	X	-24 VDC PLC sensor power return	-24 VDC	
32	X	Fused from F4 +24 VDC fusing PLC sensor power supply (PLC L+ to TB1 30)	+24 VDC	Fused @ 500mA
15	Dla .0	Trip signal (OPEN)	Sinking 24 VDC	
16	Dla .1	Retract signal (CLOSE)		
17	Dla .2	Limit switch signal (Down position)	Sinking 24 VDC	
18	Dla .3	Limit switch signal (Up position)	Sinking 24 VDC	
19	-	-	-	
20	-	-	-	
21	-	-	-	
22	-	-	-	
23	-	-	-	
24	-	Loop Wire	-	
25	-	Loop Wire	-	

### Gate Access Controller Output

Terminal No.	PLC Address	Description	Voltage	Notes
4	2L	Gate arm controller signal common	N/A	No power from controller
5	.7	Gate arm controller signal open dry contact	N/A	No power from controller
6	DQb .0	Gate arm controller signal closed dry contact	N/A	No power from controller
7	DQa .0	Solenoid Control Valve (down/open) Extend Down	120 VAC	
8	DQa .1	Solenoid Control Valve (up/close) Retract UP	120 VAC	
9	DQa .3	Traffic Control Light (Green/Yellow)	120 VAC	
10	DQa .4	Traffic Control Light (Red)	120 VAC	
11	-	-	-	
12	-	-	-	
13	DQa .2	Pump contactor	120 VAC	

**Terminal Board 1**

<b>From</b>	<b>To</b>
30 Jumper 32	
32	Inductive Loop Detector 5 (Red)
32	Down Limit Switch (Brown)
32	Up Limit Switch (Black)
30	Dla L+
31	PLC Dla M (24VDC -) PLC Dla 1M Down Limit Switch (Blue) Up Limit Switch (Brown)
22	NC
21	NC
20	PLC Dla .5
19	PLC Dla .4
19 Jumper 32	(Blue)
23	NC
18	PLC Dla .3 Up Limit Switch (Blue)
17	PLC .2 Down Limit Switch (Blue)
16	Inductive Loop Detector 6 Toggle Switch A (Orange)
15	PLC .0 Toggle Switch A (Blue)

### Terminal Board 2

From	To
Jumper 1 to 2	-
Jumper 2 to 3	-
1	Schneider, 5L3 (Red)
4	PLC 2L (Red)
5	PLC DQb .7
6	PLC DQb .0
7	PLC DQa .0
8	PLC DQa .1
9	PLC DQa .3
10	PLC DQa .4
13	NC
47	Relay A2 (White)
Jumper 47 to 33	White Wire
50	Relay 6T3
34	Relay 5L3
GND	Ground Stud
GND	PLC GND
GND	Switched Junction Box (Green Wire)
35	Loop Detector Socket Pin 1 (Black)
34	Pump (Black Wire)
49	Switched Junction Box AC N (White)
47	Directional Control Valve
47	Directional Control Valve
47	Control Loop Socket 2 (White)
47	PLC N (White)
47	Field Connection Traffic Signal
13	NC
10	Traffic Signal Red Light
9	Traffic Signal Yellow Light
8	Directional Control Valve Retract (Teeth Up)
7	Directional Control Valve Extend (Teeth Down)
6	Barrier Operator Close
5	Barrier Operator Open
4	Barrier Operator Common
3	PLC – 1L
2	PLC – L1
1	Control Relay 5L3

### Inductive Loop Vehicle Detector Model LMA-1150-HV

1	AC Line 120V TB-2 35
2	AC Neutral TB2-47
3	NC
4	NC
5	Output Relay, Common TB-1 32
6	Output Relay, Normally Open (Closes for DETECT) TB1-16
7	Loop Input TB1-25
8	Loop Input TB1-24
9	NC
10	NC
11	NC

### Schneider LC1 D25

(Relay)	
A1	Siemens PLC DQa .2 (Red)
A2	TB2-47 (White)
1 L1	
2 T1	
5L3	TB2-1 (Red) TB2-34 (Red)
6T3	TB2-50 (Red)

### Manual Override Switch (Wired at Factory)

Up	TB1-15
Center	TB1-32
Down	TB1-16



## **Appendix A - Warranty**

**SPIKE SYSTEMS, Inc.**, hereinafter referred to as **Spike Systems**, warrants its products will be free from defects in workmanship and materials when installed, and used and serviced as intended, for a period of one (1) year from date of original invoice.

PBG – Automated Hydraulic Plate Barrier Gate

Model Numbers – PBG-100/-120/-140/-160

**Spike Systems** agrees to repair or replace, at **Spike Systems** choice and expense, any defective product at no additional charge. This warranty extends only to the original Purchaser. It is not transferable to anyone who subsequently purchases, leases, or otherwise obtains the Product from the original Purchaser. This warranty does not cover road surfaces, concrete or other structures, underground equipment or fittings, repair labor, travel time, mileage, shipping, or freight charges, taxes, preventive maintenance and inspections or the replacement of items that are by nature, consumable. No allowance for damages to equipment due to power fluctuations will be considered; a clean power supply is the responsibility of the customer. The warranty is voided if any modifications, changes or additions to the equipment are performed without written approval from **Spike Systems**. In addition, this warranty may be voided or further limited if required and/or recommended repairs, maintenance, or inspections are not carried out as specified, or if defect is due to normal wear, misuse, abuse, accident, installation not in accordance with instructions or applicable codes, unauthorized repair or incidents commonly referred to as Acts of God. **Spike Systems** retains the right to the final determination as to the cause of any defect.

Except for the warranties set forth herein, **Spike Systems** disclaims all other warranties, expressed or implied or statutory, including but not limited to the implied warranties of merchantability, or fitness or suitability for any particular purpose, activity or location.

**Spike Systems** will in no event be liable for any loss of business, profits, data or use, or any direct, indirect, incidental or consequential damages resulting from any such defect in materials or workmanship. You agree that repair, replacement or refund, as applicable, under this warranty described herein is your sole and exclusive remedy with respect to any breach of the **Spike Systems** Limited warranty set forth herein.





## Appendix B – Optional Inductive Loop Vehicle Detector Installation

### For Specific Installation Instructions, Refer to Manufacturer's Documentation

Cut the rectangle for Inductive Loop Vehicle Detector per manufacturer's instructions and ensure that the loop makes proper connection to the cut that runs under the Control Cabinet. Ensure there is enough spare loop wire to reach the control panel, leaving at least 12 inches of slack (beyond what is required to reach the control panel termination point) as a service loop.

Specific installation instructions can be found at the following Internet sites.

<http://www.editraffic.com/>

<http://www.renoae.com>

### B.1 Inductive Loop Vehicle Detector (Saw Cut Control Loop) General Guidelines

Use the table below as a guideline for cutting the saw cut loop to correspond with the Spike Systems PBG system being installed.

Saw Cut Guideline	Spike Systems Model	Saw Cut Rectangle Dimensions
	PBG-100 (10')	32"-48" x 6'
	PBG-120 (12')	32"-48" x 6'
	PBG-140 (14')	32"-48" x 6' or custom size (Note 1)
	PBG-160 (16')	32"-48" x 6' or custom size (Note 1)

**Note 1** – All systems that include an Inductive Loop Vehicle Detector option ship with sufficient material for a 4' x 6' saw cut loop. It may be advisable in some cases to create a custom saw cut loop for certain installations. To do this, locally acquire sufficient lengths of 18 or 16-gauge wire (14 gauge is acceptable if 16 or 18 gauge are not available). Hand-twist the locally acquired wire per manufacturer's specification for twists per foot. Install the module within Control Cabinet as per normal instructions.

When all saw cuts have been made, blow out any debris and moisture from the sawed area with an air compressor or similar device. Ensure that no sharp objects are in the cut tracks.

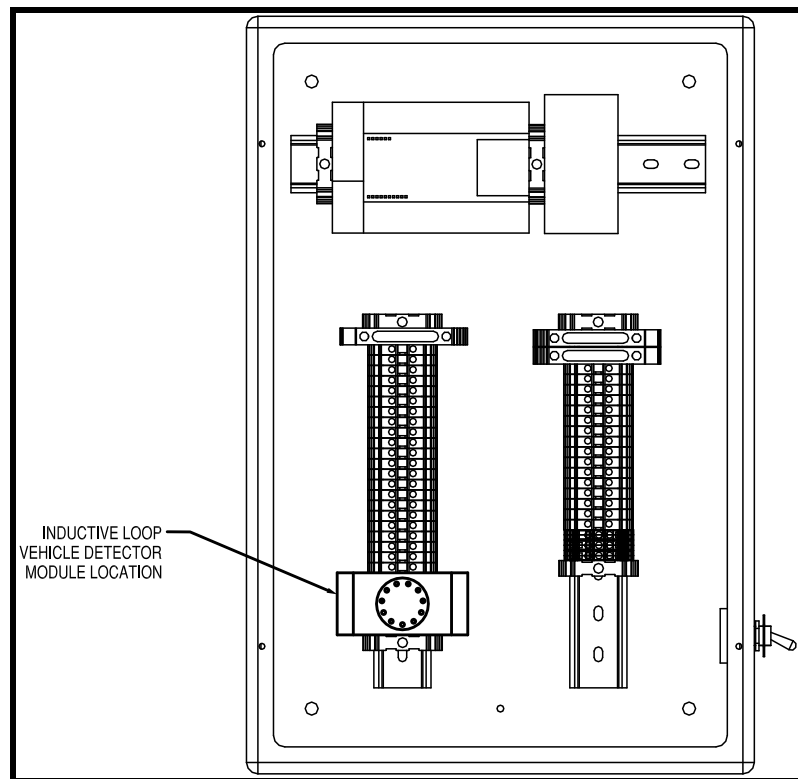
Place Inductive Loop Vehicle Detector wires in place by positioning the wires over the cuts, ensuring the proper twists per foot per manufacturer instructions. Standard 4' x 6' loops are shipped with proper wire twists in place.

Using a pizza wheel, putty knife or screwdriver, carefully press wires into cut groves.

Once all wires are in place, seal the cut groves with self-leveling concrete or Sikaflex SL Self-Leveling Sealant or similar. It is important to do this before the Control Cabinet is permanently installed.

## **B.2 Inductive Loop Vehicle Detector (Saw Cut Control Loop) Relay Connection**

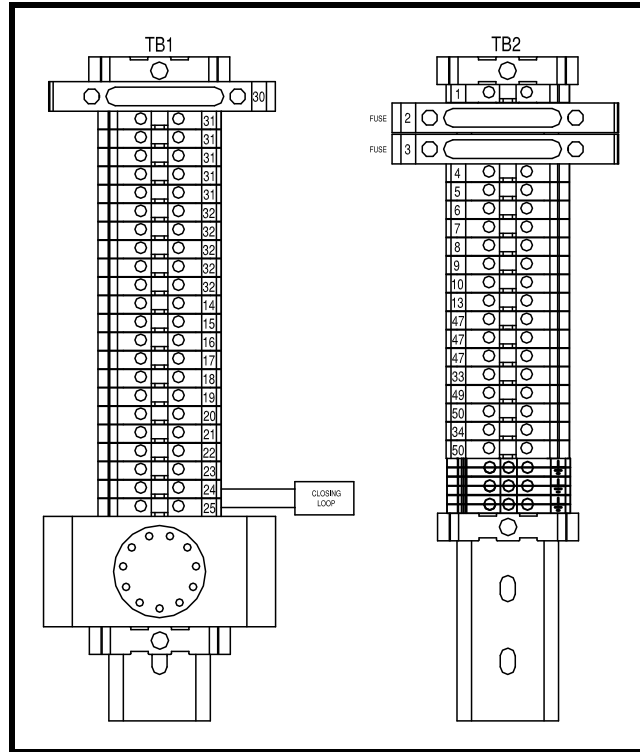
The figure below indicates the location where the Inductive Vehicle Loop Detection module is to be attached within the electronic control panel. The pins on this device are keyed so that there is only one correct way to plug in the module. Attach the loop wires to pins 24 and 25 on the Terminal Block marked TB1. Note – TB1 is the vertical terminal on the left in the figure below, and TB2 is on the right.



**Figure 75 – Installation Location of Optional Inductive Vehicle Detection Module**  
(Saw Cut Control), Control Cabinet)



**Figure 76 – Typical Inductive Vehicle Detection Module (Saw Cut Control)**



**Figure 77 – Wiring of Optional Inductive Vehicle Detection Module**  
(Saw Cut Control), Control Cabinet

Tool Required	Tool Type	Tool Specification
	Screw Driver	Flat, Small
	Wire Strippers	If required for cable connection

## **Appendix C - General Safety**

### **C.1 General Safety Considerations**

The following safety instructions, and any/all applicable local, city, state and federal regulations/laws/codes are to be observed for the installation and operation of this barricade.

1. Locate the barrier away from pedestrian traffic and restrict all pedestrian traffic away from the barricade.
2. Locate the barricade far enough from the street so an exiting or entering vehicle can clear the barricade completely while waiting to pull into or out into traffic.
3. The closing and opening actions must be observed. The mounting of operating switches or signals outside the field of direct view is not permissible; there must be a line of site between the barrier and the control switches.
4. It is forbidden for person or goods to be anywhere within the swing zone or the barrier while in operation. Severe damage. Injury or loss of life may occur.
5. Provide adequate nighttime illumination of the unit and signs warning of its presence.

### **C.2 Safety Signs**

The following illustrations depict safety-related signs that are available from Spike Systems to address a range of possible client needs.







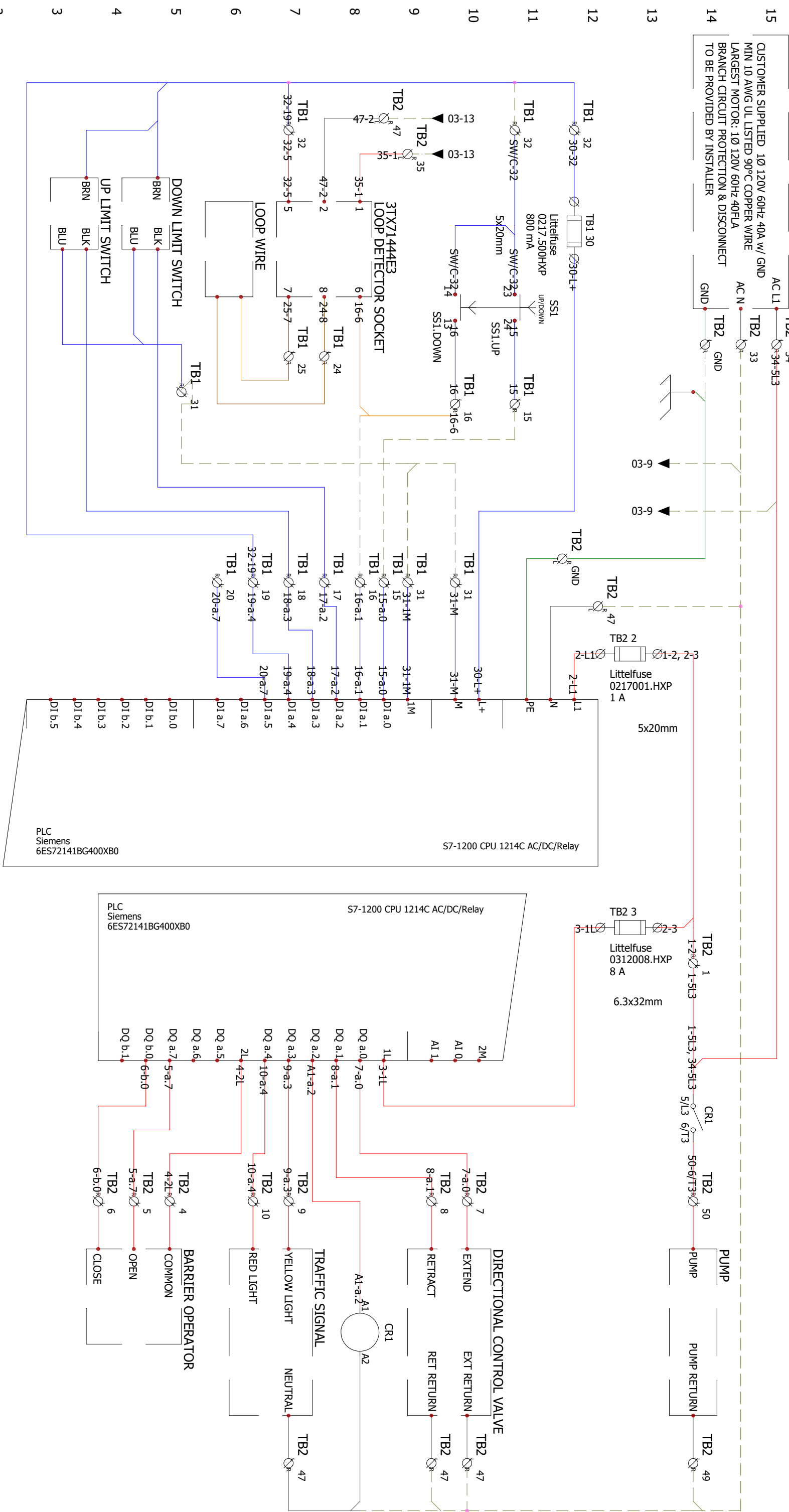








## SWITCHED JUNCTION BOX



1	2	3	4	5	7	8	9	10	11	12	14	15	16	17	18	20	21	22	23	24				
<div>HEITEK</div> <div>A U T O M A T I O N</div> <div>PH 602.269.7931 FX 602.269.8037</div> <div>www.heitek.com   info@heitek.com</div>					2102 W. Quail Ave. Ste. 4 PHOENIX, ARIZONA 85027					<div>Spike Systems</div> <div>3623 S 7th Street Phoenix, AZ 85040</div>														
CONTRACT N° : HTA-SSS-091615-000-00					LOCATION: L1					Spike System Control Panel														
										Schematic														
APPROVED BY: shillmeyer APPROVED DATE: 4/3/2017					DRAWN BY: shillmeyer DATE: 1/9/2017					CHECKED BY: shillmeyer CHECKED DATE: 4/3/2017														
										SHEET : 03 OF: 11														