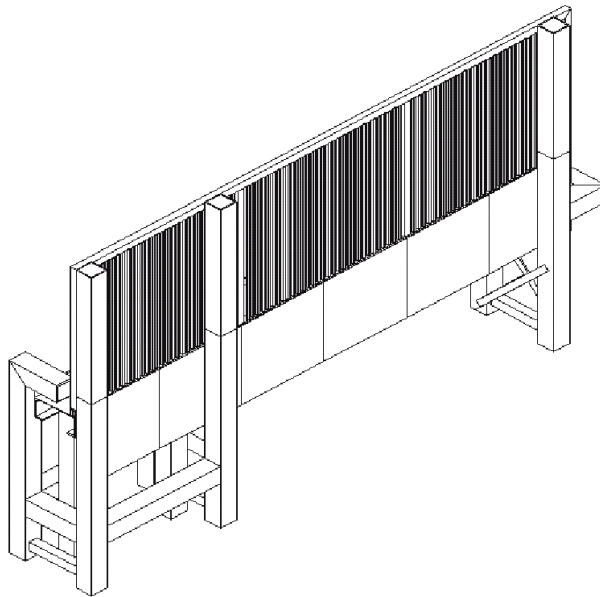




MODEL 400 SERIES SLIDING GATE VEHICLE BARRIER

INSTALLATION MANUAL



B&B ARMOR

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MADE IN THE USA



Your safety is extremely important to us. If you have any questions or are in doubt about any aspect of the equipment, please contact us.

INTRODUCTION

Welcome!

Congratulations on your purchase of a B&B ARMOR vehicle barrier. In addition to providing detailed operating instructions, this manual describes how to install, maintain, and troubleshoot your vehicle barrier. If you require additional assistance with any aspect of your vehicle barrier's installation or operation, please contact us.

With years of experience in all aspects of perimeter security and related disciplines, our products are used throughout the world to control access and to protect people, equipment, and facilities. We offer a broad range of vehicle barrier and related security services:

- Turnkey installations
- Routine barrier preventative maintenance or emergency repairs (including work on non-B&B ARMOR products)
- Spare or replacement parts
- Custom designs or special installations
- Equipment upgrades (modernize your old equipment with state-of-the-art hydraulics and control systems)
- Ancillary security equipment such as security guard enclosures, card readers, security lighting, and many other security related products.
- Technical support via telephone and possible on site support with advanced scheduling.

Safety

Your safety is important to us. If you have any questions or are in doubt about any aspect of the equipment, please contact us. While B&B ARMOR does not assume responsibility for injury to persons or property during installation, operation, or maintenance, we can provide verbal guidance, additional written instructions, or the services of a factory engineer. We're here to help you operate your vehicle barrier safely and effectively.

As the user, you are responsible for correct and safe installation, operation, and maintenance of this equipment. Users must follow the specific instructions and safety precautions located in this manual. In addition they must:

- Be aware of and follow the safety standards of the Occupational Safety and Health Administration (OSHA), as well as other applicable federal, state, and local safety regulations and industry standards and procedures. For installation outside the United States, users must also follow applicable international, regional, and local safety standards.
- Engage only trained and experienced staff to install, operate, and maintain the equipment.
- Ensure that all repairs are performed correctly, using properly trained staff and the right tools and equipment.

How to Contact Us

If you have any questions or experience any problems with your vehicle barrier—or if we can help you with any other facility security issues—please contact us directly at:

Corporate/Tech Support:

B&B ARMR

5900 S Lake Forest Dr Suite 230

McKinney, TX 75070

Phone: (800) 367-0387

Fax: (972) 385-9887

**E-mail: info@bb-armr.com
techsupport@bb-armr.com**

System Installation Record

To assist in documenting the products installed in your system, please take a minute to record the following reference information. This information can be located on the blue B&B ARMR model number plate located on the product in the cylinder access area. Additional columns are added for your convenience in documenting other components in the system.

Site:			
Job #:			
Date:			
Serial Number:			
Model Number:			
Voltage:			
Phase:			

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1. ORIENTATION

1.1 Overview

This manual addresses B&B ARMR Model 400 Series sliding cantilever gate vehicle barriers. The 400 Series barriers have high stopping power, and are designed to stop and disable a vehicle that tries to breach them. They are one in a series of anti-terrorism vehicle barrier designs manufactured by B&B ARMR.

There are currently several models in the 400 Series: Model 400, Model 400A, Model 450, and Model 450A . The general descriptions of these basic models are as follows:

- Model 400—a sliding cantilevered crash gate rated to stop a 15,000-pound vehicle traveling at 30 miles per hour.
- Model 400A—a sliding cantilevered crash beam rated to stop a 15,000-pound vehicle traveling at 30 miles per hour.
- Model 450—a sliding cantilevered crash gate similar to the Model 400 but with a higher stopping power, the barrier is rated to stop a 15,000-pound vehicle traveling at 50 miles per hour.
- Model 450A—a sliding cantilevered crash beam rated to stop a 15,000-pound vehicle traveling at 50 miles per hour.

Figure 1-1 will orient you to the three basic components of a 400 series vehicle barrier.

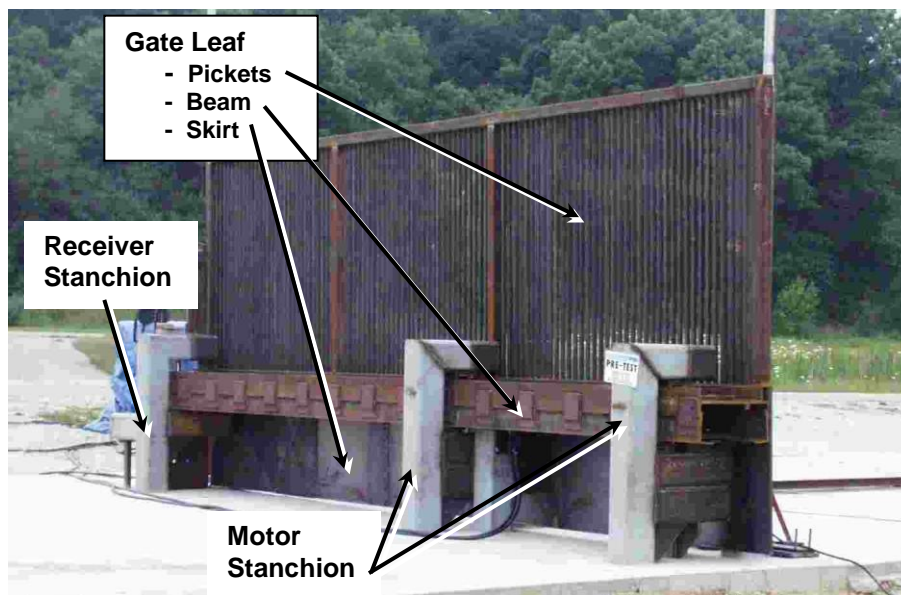
1. Gate Leaf (consisting of the pickets, the skirt, and the beam)
2. Motor Stanchion
3. Receiver Stanchion

The sub-sections below briefly describe each of the components, and additional details are provided in other sections of this manual.

1.1.1 Gate Leaf

The gate leaf (often just called the gate) consists of three parts: the pickets, the skirt, and the beam. The pickets are typically 1" square steel tubes spaced on 2.5" centers. The skirt is steel plate unless configured differently by customer. The pickets and skirt are usually assembled so that they are anti-climb, meaning there are no protrusions to serve as footholds on the vehicle-approach side of the gate leaf. The standard gate height is 108 inches (9 feet or 2.75 meters) above grade. The standard opening when the gate leaf is fully retracted is 144 inches (12 feet or 3.66 meters). This is the space through which a vehicle will pass, and corresponds to the standard width of a traffic lane.

Figure 1-1: Basic Components of a 400 Series Gate*



* This figure is for illustration only. It shows the back (non-impact) side of an unpainted 400 series vehicle barrier undergoing testing. An as-shipped unit would be fully painted and would have other finish features not shown here.

The beam part of the gate leaf is a massive steel I-beam. It provides the heavy-duty structure that stops the impacting vehicle. The stopping power is not from the beam alone, but from the manner in which the stanchions' heavy steel tubes transfer the vehicle's energy from the beam to the foundation.

While the pickets and skirt do not serve as principal structural elements, they do provide an important protective function. The height of the gate and its strength are designed to intercept and stop the attacking vehicle's load if the force of the impact launches it forward.

1.1.2 Motor Stanchion (and Associated Hydraulic and Control Unit)

The motor stanchion—which is embedded in a concrete foundation—supports the gate during opening and closing. It houses the hydraulically driven motor that opens and closes the gate (gate leaf) and also the roller wheels upon which the gate rolls as it moves. During vehicle impact, its heavy steel tubes transfer the impact loads to the foundation.

The Model 400 Series vehicle barrier operates from a complete, self-contained hydraulic and control unit housed in a sealed enclosure with locking doors mounted nearby. For information on the specific hydraulic unit mated with this gate, please refer to the associated Operation and Maintenance manual provided separately. The hydraulic unit is designed to operate for long periods with very little maintenance. It contains the hydraulic reservoir (which is not pressurized), hydraulic pump, and all of the required valves, manifolds, and flow control devices. An electric motor operates the gear-type hydraulic pump, which operates by a system pressure switch independent from the gate signal command. The hydraulic oil from the pump is drawn through a filter and into a manifold that distributes to an accumulator, then directional flow control valve. The directional control valves are energized from the PLC and control circuits to allow hydraulic oil to flow through flow control valves and out to the charlynn motor. The flow control valve monitors the gate speed. The operating logic controls the valves to ensure the correct gate position based on input controls from any set of dry contacts, such as limit switches and safety devices.

These components are sized so that the gate will open or close at about one foot per second (one meter per 3 seconds). The opening/closing speed can be varied—within limits—by adjusting hydraulic flow control valves, as described later in this manual.

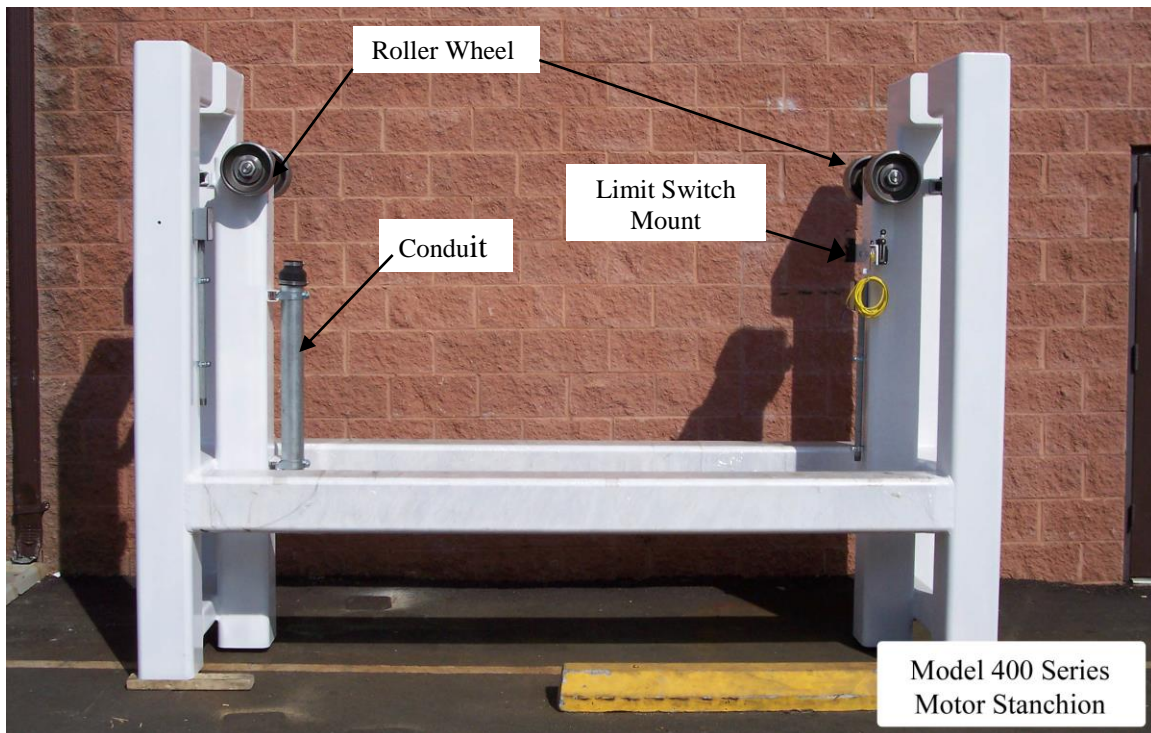
The hydraulic pumping unit also houses the electric pump drive motor and control circuitry. The motor is typically a three horsepower, 208 / 240-480 volt, three-phase motor (refer to the associated manual for variances). An overload circuit protects the motor in the event of power fluctuations. During a power failure the gate can be operated from a hand pump, and it can also be opened and closed manually. The hydraulic and control unit is typically mounted

on a concrete pad close to the motor stanchion. Conduits connecting the unit and motor stanchion carry the hydraulic lines and electrical control cables.

The unit also houses the gate control circuitry, the main components of which are the PLC (programmable logic controller) that is programmed with the gate's operating logic, the motor starter, and the motor overload protector. The control circuit is 120-volt, single-phase with 24-volt dc input. The outputs are 24-volt dc and 120-volt ac and some are customer defined for dry contacts. The unit has a built-in 120-volt convenience outlet (the customer supplies power and wiring to the box), and a master switch turns off all the power to the unit for maintenance and repairs. A disconnect is required for the 208-volt coming into the unit, and should be located close by.

The key components of the motor stanchion are shown in Figure 1-2.

Figure 1-2: Model 400 Series Motor Stanchion



1.1.3 Receiver Stanchion

The receiver stanchion—which is embedded in a concrete foundation—captures (and locks in model 450) the end of the gate in place when the gate is fully closed. During vehicle impact, its heavy steel tubes transfer the impact loads to the foundation. Because of its relatively small size compared to the motor stanchion, it has additional reinforcements (gussets, stabilizer beams, and braces). Figure 1-3 shows the key components of the receiver stanchion.

The 450 gates have a pair of two inch thick, stainless steel pins that are hydraulically raised and locked in place. A pair of proximity switches monitors the location of the pins that locks the gate from moving until they are in the full-up position. Three conduits are needed for the 450 receiver stanchion from the HPU, one for the hydraulic lines and two for control wires. The control wire is 120-volts for the IR beam and 24-volt dc for the proximity switches.

Figure 1-3: Model 400 Series Receiver Stanchion



1.2 Options

The Model 400 Series vehicle barriers are available with a broad array of options, as listed below. Consult your purchase order or other ordering documentation to determine whether your unit has the optional equipment.

- A wooden traffic control gate arm to warn the vehicle operator. This arm is positioned in front of the gate and does not rise until the gate is fully open, and it closes before the gate starts to close.
- Red/amber traffic lights. The light remains red if the gate is in any position except fully open.
- In-ground loop detector to detect the presence of a vehicle and prevent accidental closing of the gate onto the vehicle.
- Infrared safety beams to detect pedestrian traffic or as an additional vehicle sensing device.
- Keypads, card readers, or other vehicle access control devices.
- Heater and/or cooling fan for the hydraulic pumping unit.
- Heaters for the motor stanchion's hydraulic motor and for the roller wheels (for extreme winter conditions).

1.3 Specifications

Key specifications for the Model 400 Series vehicle barriers are as follows.

- Certified vehicle-stopping power as summarized in the table below.

Barrier Model	Vehicle Weight	Vehicle Speed	U.S. Department of State Rating*
400 & 400A	15,000 pounds (~6,800 kg)	30 mph (~48 kph)	K4
450 & 450A	15,000 pounds (~6,800 kg)	50 mph (~80 kph)	K12

* If you are unfamiliar with the rating system nomenclature, contact B&B ARMOR for additional information.

- Design operating frequency is 45 open and close cycles per hour.
- Design operating temperature range is 20°F – 100°F (Y°C – Y°C).

2. INSTALLATION

2.1 Introduction

We designed the Model 400 Series vehicle barriers for quick and easy installation. However, every site is different and each 400 series will vary due to the choice of options or special design features. Accordingly, the instructions below may have to be varied slightly for your particular installation. If you need help, or are unclear about any of these instructions, please contact B&B ARMR for assistance.



Your safety is extremely important to us. Be sure to follow the specific instructions presented below. You are responsible for the correct and safe installation, operation, and maintenance of this equipment.

2.2 Preliminary Considerations

Before beginning site excavation and barrier installation, note the following important considerations.

- Inspect the site and verify there are no underground utilities or overhead wires or obstructions in the excavation area.
- If possible, locate the installation away from routine foot traffic to reduce the chance for pedestrian injury from the barrier's moving gate.
- Make sure that there is adequate free area adjacent to the motor stanchion's installation location so that the vehicle barrier gate can be slid onto the stanchion after the stanchion is cemented in place.
- Locate the HPU within twenty feet of the wheel stanchion. If the pump needs to be further away from the stanchion, please contact B&B ARMR.

2.3 Typical Installation of the Motor and Receiver Stanchions

Perform the following steps to install the motor and receiver stanchions. (Always refer to your submittal for your specifications.)

- 2.3.1 Excavate the holes for the stanchions as shown in the Foundation Drawings supplied in your submittal. (See generic drawings in the drawings section). Place the stanchions in the excavation holes.
- 2.3.2 Install the axles for the roller wheels in the appropriate holes in the stanchions and tighten the setscrews against the flats on the axles. Tighten the setscrews securely, and use a locking compound on the setscrews threads if available. Use care when installing the axles, as they serve as the critical measuring point for final installation.
- 2.3.3 The tops of the axles must be 31-³/₄ inches above the roadbed height at the roadbed's highest point (If wheels are factory installed make sure they are 35-³/₄ inches above the roadbed). Adjust the stanchion's position in the excavation to bring the axles to the correct height. Use a transit to level all four points (the top of the end of each axle) and make any final adjustments in the positions of the stanchions so that the transit is reading within 1/32nd of an inch at each of the four points. It is **CRITICAL THAT THE SHAFTS ARE PERFECTLY LEVEL** for the gate to function properly. Verify also that the stanchions are plumb and level.
- 2.3.4 Place a partial pour of concrete into the excavation holes to lock the stanchions in place. Use the transit to verify the stanchions remain level and plumb.
- 2.3.5 Rough in the conduits. All conduits, fittings, sweeps, and couplings must be electrical grade (gray color); do not use plumbing type (white color). All conduits are run to the hydraulic pump unit. Accordingly, run all the conduits for your installation to the location where the hydraulic unit's concrete pad will be located. Run the conduits together and be sure the conduits are long enough to extend above the anticipated height of the hydraulic unit's pad. (See section 2.5, *Hydraulic Unit Installation*, for additional information.)
- 2.3.6 Make the final concrete pour, again making sure the axle height does not change and remain level and plumb. Remove any concrete that might have splattered inside the exposed conduits.
- 2.3.7 After the concrete has set, install the roller wheels, collars and nuts onto the axles. Place two collars (spacers) on each side of the shaft, then the wheel, then another collar, and finally the nut. Adjust the wheels and axle nuts so there is no side play in the wheels, but yet they can still be turned easily by hand. Tighten set screw on the nut. Grease the wheel bearings using the

grease fittings. The wheels may be pre-greased. Be careful not to over-grease the bearings; make sure the grease does not leak out of the sides of the bearings.

- 2.3.8 Install the four guide wheels into the guide wheel receivers on the wheel stanchion. Leave the bolts fully backed off to allow the guide wheels to insert completely into the receivers.

Figure 2.3 – Interior View of Motor Stanchion



2.4 Installing the Gate and Motor Components

Perform the following steps to install the gate (gate leaf), motor, and limit switches on the motor stanchion.

- 2.4.1 Lift the gate assembly using a crane or forklift. Guide the gate onto the first set of roller wheels, with the wheels fitting between the I-beam and the channel. Push the gate onto the second set of roller wheels.
- 2.4.2 Move the gate by hand to the halfway position. Install the stop plates onto the ends of the gate.
- 2.4.3 Attempt to slide the gate through about $\frac{2}{3}$ of its travel. If the gate binds, adjust the roller wheels to eliminate the binding.
- 2.4.4 Mount the motor and gear assembly. Mount the motor on the wheel post closest to the roadway opening, and on the side between the two single posts. Leave the motor mount in the down position with the bolts slightly loose until the motor rotation and limit switches have been tested.
- 2.4.5 Mount the limit switches. They are generally mounted on the wheel post located on the barrier's run-out side (see figures 2.4.5-a, and 2.4.5-b).
- 2.4.6 Bolt the limit switch ramps (these are 2-foot/.66-meter long sections of electrical rack mounting) so they engage the limit switches' lever arms. The ramps must be located so they engage the switches before the gate reaches the desired spot, to allow for drift. The weight of the gate will allow the gate to coast even after the limit switches are activated. Plan for the gate to travel between 4 to 6 inches after the limit switch is activated. The ramps are long to ensure the gate will not coast so far when the gate comes to a stop, that the switches' lever arms become disengaged.



Figure 1 Limit Switch Mounting

- 2.4.7 Bolt the limit switch plates so they engage the limit switches' lever arms. The plate must be located so that both limit switches are hit in the correct sequence. The first limit switch tells the controller to slow the gate down. The second limit tells the controller to stop the gate.
- 2.4.8 Grease or cosmoline needs to be added to the rack, pinion and wheel areas to prevent oxidation. This should be checked and touched up during the monthly maintenance as needed.

2.5 Hydraulic Unit Installation

Refer to separate manual for information on the specific model provide.

- 2.5.1 Typically, the Model 400 series hydraulic unit is mounted on a concrete pad. Generally, the hydraulic, electrical power, and control conduits will be run together, and all will turn up out of the concrete pad to attach to the hydraulic unit. Additional conduits may be required for traffic lights, loop detectors, and other options. Contact B&B ARMOR if you are unclear about the conduit requirements for your installation.
- 2.5.2 Place the hydraulic unit on the pad over the exposed conduits and bolt the unit in place. (The feet on the unit will accept standard concrete anchors.) If you mount the unit to an intermediate steel structure, make sure that structure is securely fastened to the pad.
- 2.5.3 Terminate the electrical power and control conduits in the electrical box and the hydraulic hose conduit to the hydraulic side of the HPU. The hydraulic conduit should be cut flush with the concrete pad. This will allow the hydraulic hose to move slightly when pressure is applied without rubbing against any sharp edges on the conduit.
- 2.5.4 Install the hose by pulling it into the conduit, making sure to protect the hose from any sharp edges. When you cut the hose to length do not cut it too short, as the hose will shrink in length when under pressure.
- 2.5.5 Connect the hoses to the fittings located on the manifold. The two fittings on the left side of the manifold operate the gate, while the set on the right operate the locking pin cylinder (model 450 & 450A only)
- 2.5.6 The hydraulic unit's oil tank holds 30 gallons. Approved hydraulic oil must be added by removing the tank lid and pouring into the tank. The tank should be filled until the oil is half way up the sight glass. (See the *Maintenance* section for oil specifications and additional details.) You may see small amounts of oil in the unit when it arrives. This is residue from factory testing prior to shipment

- 2.5.5 Connect the hoses to the motor and also the locking pin cylinder (450 & 450A only) before the system is turned on.

2.6 Control System Installation

Refer to the associated hydraulic pumping unit (HPU) manual for further clarification of the following information and any references later to the (HPU).

Install three-phase power to the lower right corner of the electrical box using the terminals marked L1, L2, L3, Neutral, and Ground.

All devices that require ac power (such as loop detector, traffic lights, and infrared beams) can get 120-volt ac from the left side of the electrical box. Turning off the switch next to the convenience outlet disconnects all of the control power.

Most other wiring is low-voltage (24-volt dc). Terminate all low-voltage inputs on the red terminal blocks at the bottom of the electrical box. Wire all switching devices (gate open, gate close, limit switches, and so on) so that each device gets 24-volt dc power from the left side of the I terminal blocks. Attach each device's input termination point wire to the appropriate I terminal block (I0, I1, I2, etc.) and the device's output termination point wire to the appropriate Q terminal block (Q0, Q1, Q2, etc.). A summary of key control wiring terminations is as follows.

Traffic Lights (120-volt ac)	Common to 120-volt neutral Red light to TLR (upper right) Amber light to TLG (upper right)
Panel Indicator Lights (24-volt dc)	Common to 24-volt dc negative Red to PLR (upper right) Green to PLG (upper right)
Open Button	Button to open gate – Normally Open Button common to I0 Button point to 24-volt dc+

Close Button	Button to close gate – Normally Open Button common to I1 Button point to 24-volt dc+
Locking Pin Open Limit Switch	Jumper required for non 450 gates Switch common to I2 Switch point to 24-volt dc+
Safety Stop Jumper	Jumper installed makes gate stop instead of open when a safety device is detected. Jump 24-volt dc+ to I3
Gate Close Limit Switch	Switch must be wired for the gate to work Switch common to I4 Switch point to 24-volt dc+
Gate Open Limit Switch	Switch must be wired for the gate to work Switch common to I5 Switch point to 24-volt dc+
Safety Devices	Switch common to I6 Switch point to 24-volt dc+
Stop Button	Button to stop gate – Normally Closed Button common to I7 Button point to 24-volt dc+
Locking Pin Close Limit Switch	Jumper required for non 450 gates Switch common to I10 Switch point to 24-volt dc+
Emergency Close Button	Closes gate regardless of Safety Devices Button common to I11 Button point to 24-volt dc+

Loop Detector – One loop detector and harness come pre-wired for use as a safety. Two loops can be wired in series and connected to inputs #7 and #8 on the loop detector harness. If you wish to use a loop as a free exit, contact B&B ARMOR for prices or wiring information.

5. TROUBLESHOOTING

The table below provides guidance on identifying and correcting issues with your Model 400 Series vehicle barrier. If you encounter problems that you cannot fix, contact B&B ARMOR and we will gladly work with you to correct them.

Model 400 Series Troubleshooting Guide

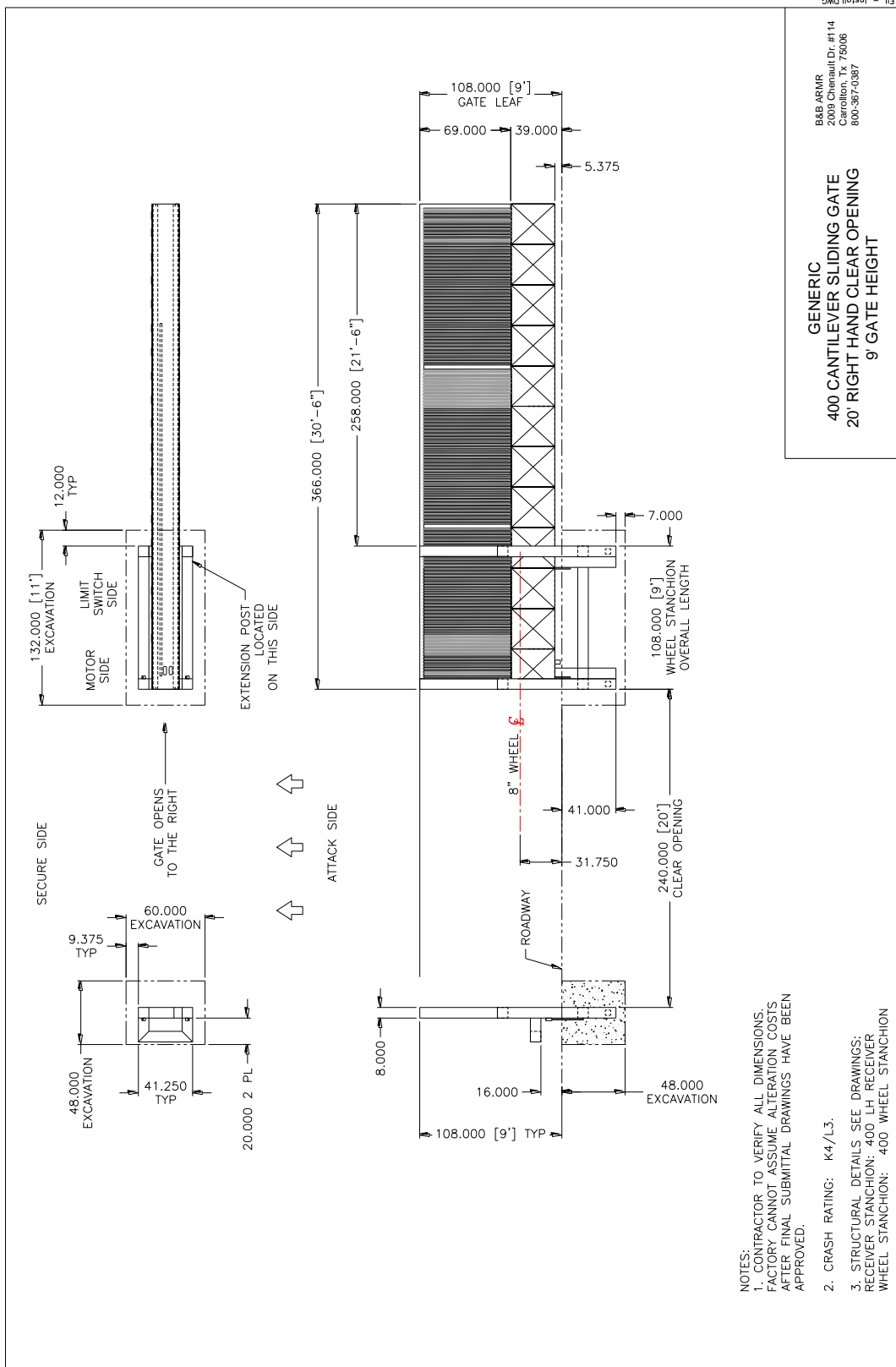
Symptom	Actions
Gate does not go open	<ol style="list-style-type: none"> 1. Check power 2. Check overload protector 3. Check pressure gauge 4. Manually open the gate by depressing the directional control valve to see if problem is mechanical or electrical. If mechanical, check for binding on the gate. If not: 5. Check PLC input 6. Check that safeties are clear 7. Check PLC output 8. Check push button operation 9. Check locking pin and proximity switch, gate will not open unless the pins are up and I3 is lit on the PLC
Gate does not go close	<ol style="list-style-type: none"> 1. Check power 2. Check overload protector 3. Check pressure gauge 4. Manually close the gate by depressing the directional control valve to see if problem is mechanical or electrical. If mechanical, check for binding on the gate. If not: 5. Check PLC input 6. Check that safeties are clear 7. Check PLC output 8. Check push button operation 9. Check locking pin and proximity switch, gate will not open unless the pins are up and I3 is lit on the PLC
HPU does not build up pressure, but is running	<ol style="list-style-type: none"> 1. Check power 2. Close pressure relief valve

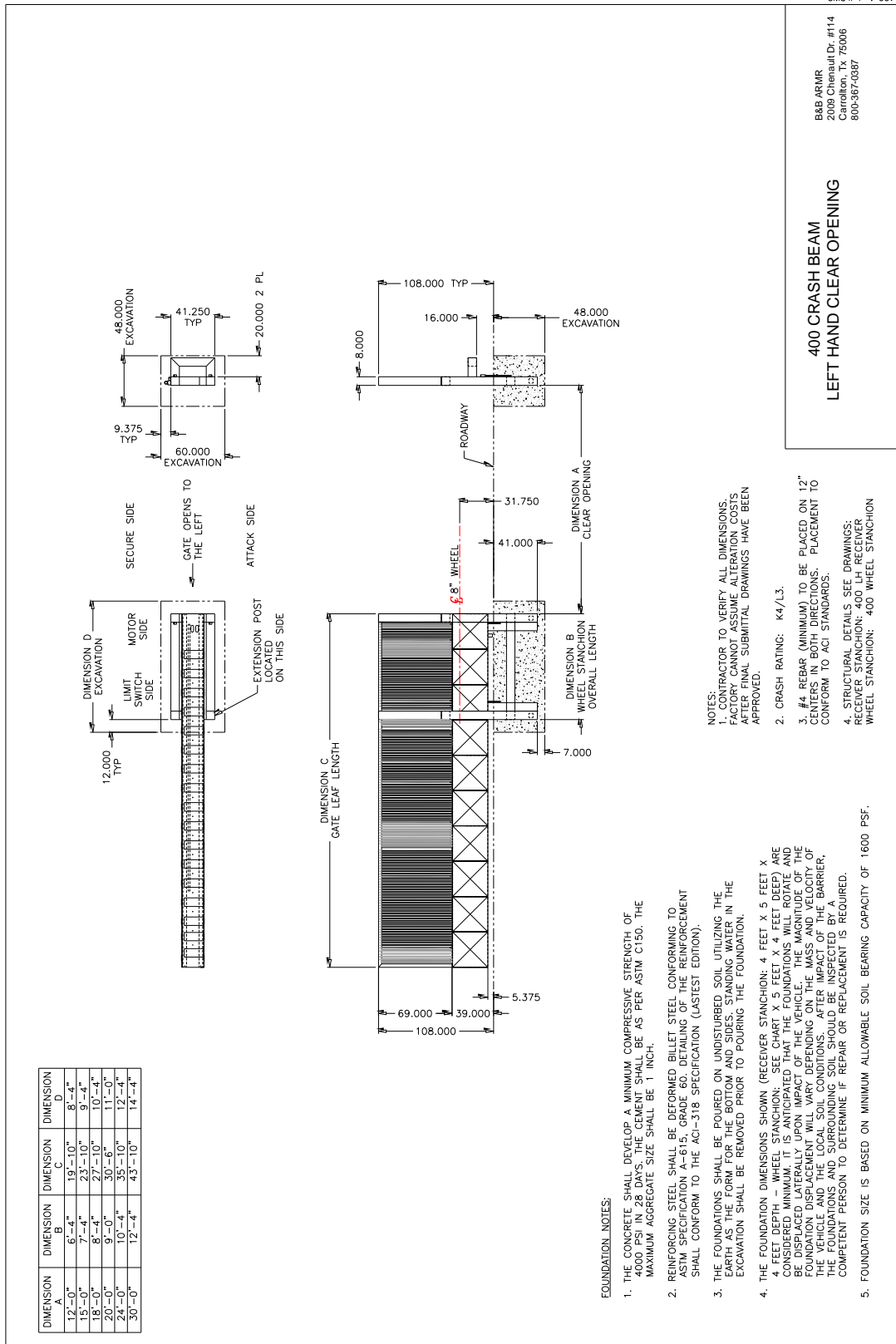
Symptom	Actions
HPU pump will not turn on	<ol style="list-style-type: none"> 1. Check power 2. Check motor overload, press <i>start</i> 3. Check motor starter 4. Check low level switch 5. Check pressure switch
Gate makes noise during operation	<ol style="list-style-type: none"> 1. Check that roller wheel bearings are greased 2. Check that gate is not moving too fast 3. Check that the guide wheels are properly adjusted 4. Check that the spur gear is properly adjusted to the gear rack
Hydraulic unit is excessively hot	<ol style="list-style-type: none"> 1. Check that the pressure relief valve is closed (fully clockwise) 2. Check that the pressure switch is adjusted to shut the motor off before 1850psi 3. Check for correct voltages
Gate moves too slowly	<ol style="list-style-type: none"> 1. Check for mechanical binds (guide wheels out of adjustment, debris under the wheels or on the inside of gate) 2. Check flow control valve
Traffic indicator light does not change	<ol style="list-style-type: none"> 1. Check proper limit switch operation 2. Check bulbs 3. Check PLC outputs
Locking pins are moving but not giving signals up or down to I3	<ol style="list-style-type: none"> 1. Check the proximity switches at the locking pin mechanism

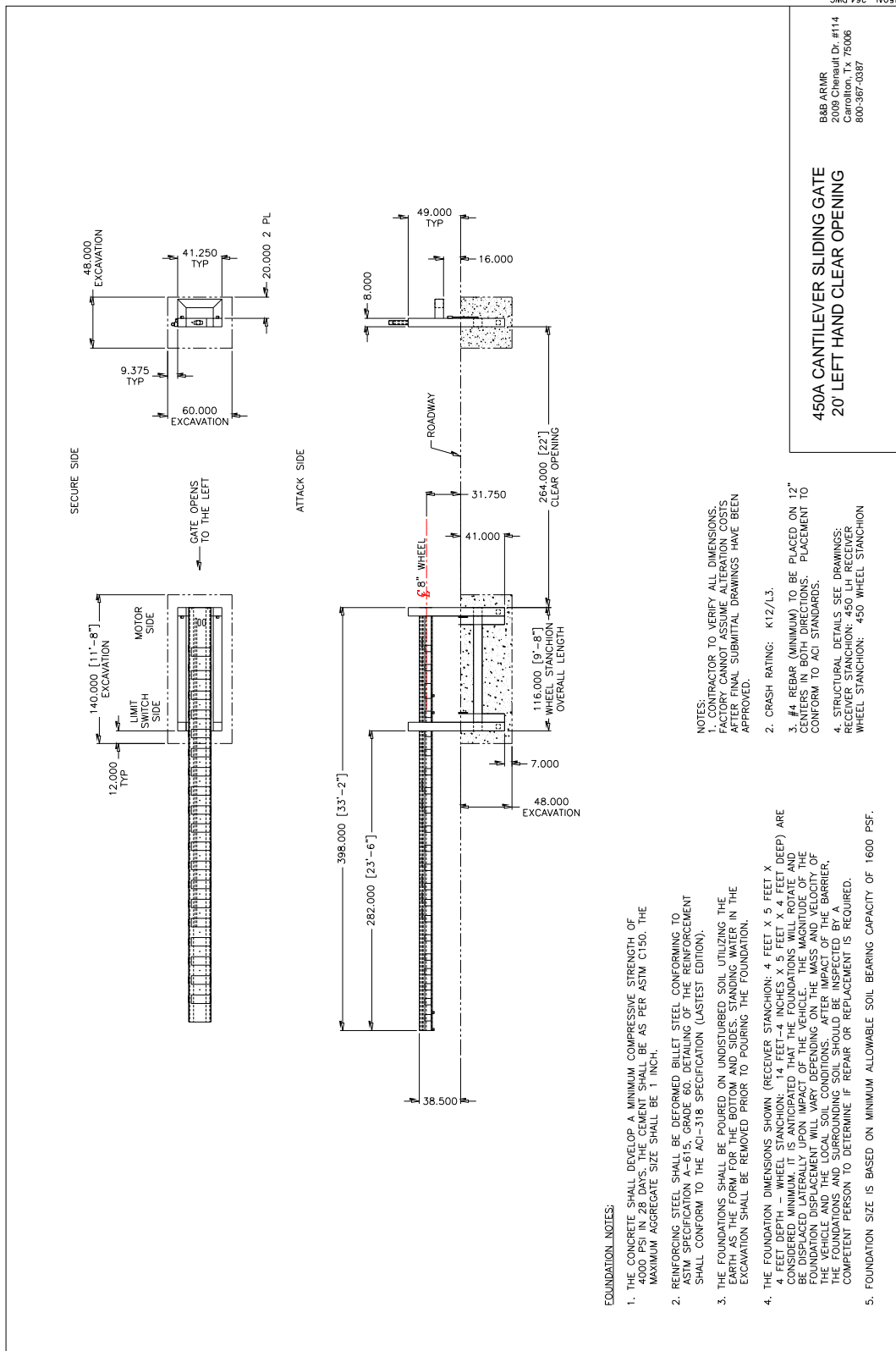
6. ENGINEERING DRAWINGS

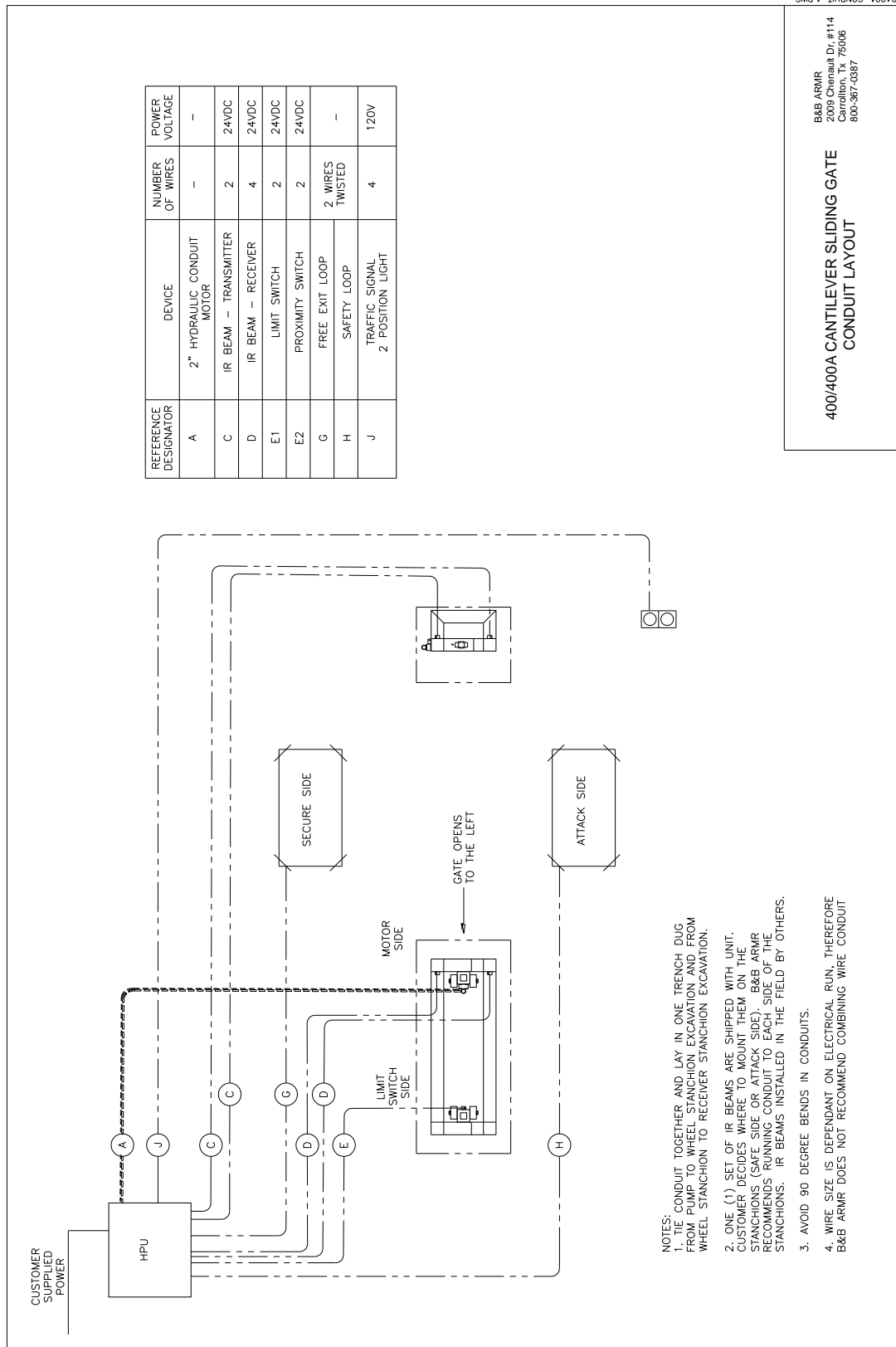
The following engineering drawings are for reference only. For job specific drawings and details please refer to the Submittal Documentation specific to the job.

For replacement components and parts breakdown, please contact B&B ARMR tech support.







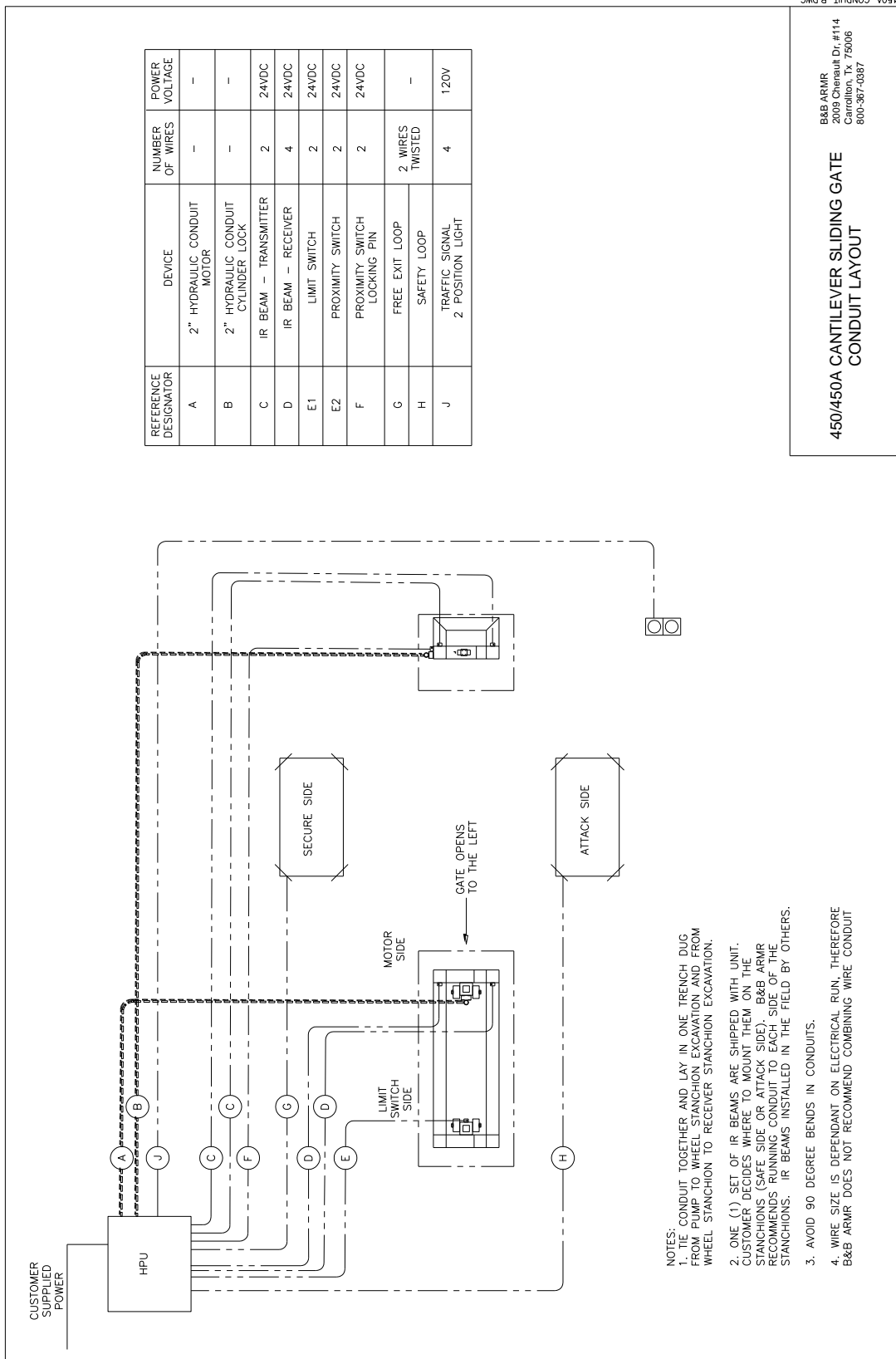


0400A-CONDUIT-A.DWG

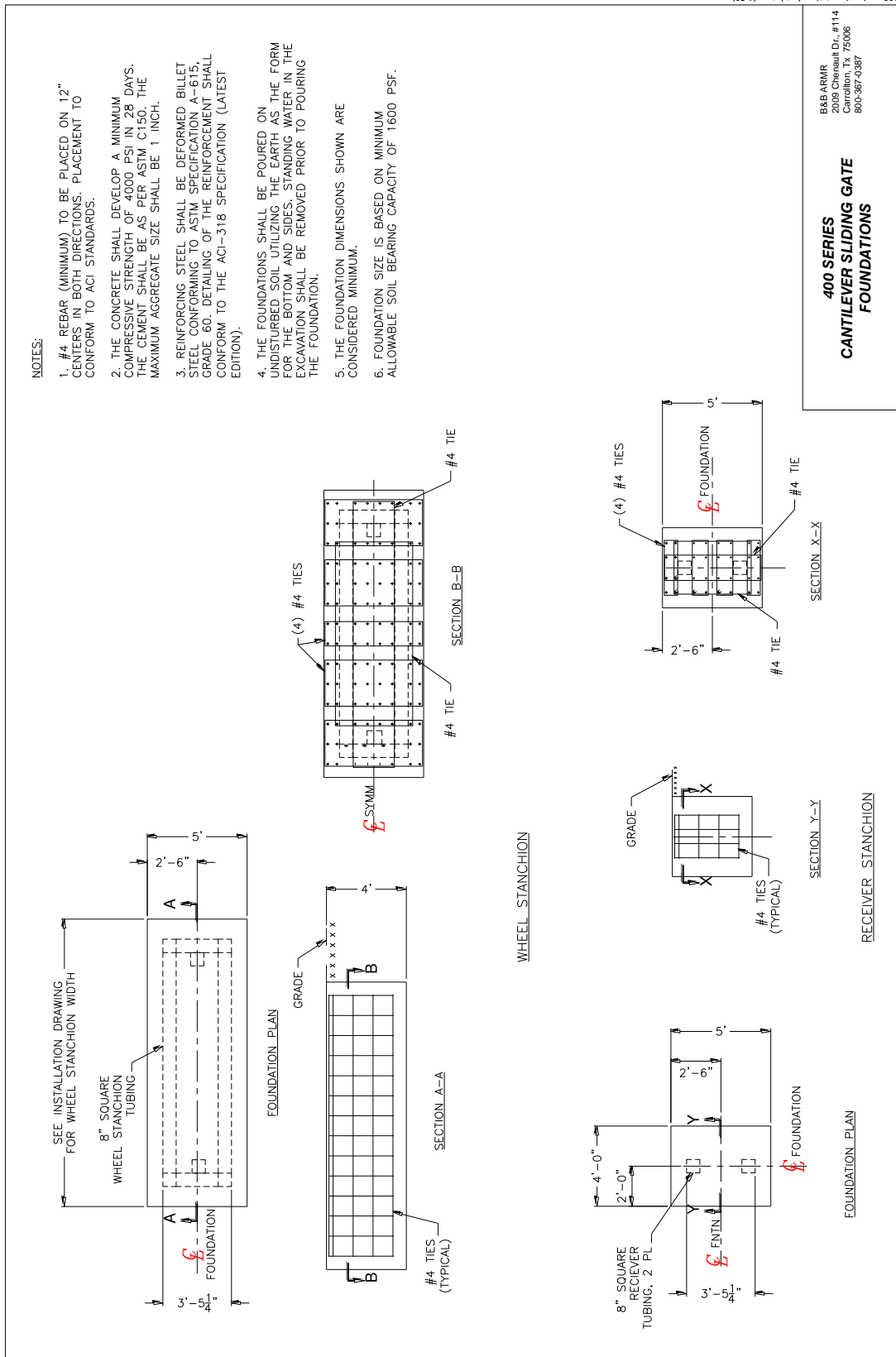
**400/400A CANTILEVER SLIDING GATE
CONDUIT LAYOUT**

B&B ARMOR
2009 Chenault Dr. #114
Carrollton, TX 75006
800-387-0387

- NOTES:**
1. THE CONDUIT TOGETHER AND LAY IN ONE TRENCH DUG FROM PUMP TO WHEEL STANCHION EXCAVATION AND FROM WHEEL STANCHION TO RECEIVER STANCHION EXCAVATION.
 2. ONE (1) SET OF IR BEAMS ARE SHIPPED WITH UNIT. CUSTOMER DECIDES WHERE TO MOUNT THEM ON THE STANCHIONS (SAFE SIDE OR ATTACK SIDE). B&B ARMOR RECOMMENDS RUNNING CONDUIT TO EACH SIDE OF THE STANCHIONS. IR BEAMS INSTALLED IN THE FIELD BY OTHERS.
 3. AVOID 90 DEGREE BENDS IN CONDUITS.
 4. WIRE SIZE IS DEPENDANT ON ELECTRICAL RUN, THEREFORE B&B ARMOR DOES NOT RECOMMEND COMBINING WIRE CONDUIT



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 3. AVOID 90 DEGREE BENDS IN CONDUITS.
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7. WARRANTY

BBRSS warranties for a period of one (1) year FOB manufacturing facility, unless otherwise specified by BBRSS in writing, from defects due to faulty material or workmanship. Damage due to handling during shipment and installation are not covered under warranty. BBRSS assumes no responsibility for service at customer site. BBRSS is in no event responsible for any labor costs under the warranty. Subject to the above limitation, all service, parts, and replacements necessary to maintain the equipment as warranted shall be furnished by others. BBRSS shall not have any liability under these specifications, other than for repair or replacement as described above for faulty product material or workmanship. Equipment malfunction or equipment failure of any kind, caused for any reason, including, but not limited to unauthorized repairs, improper installation, installation not performed by BBRSS authorized personnel, incoming supply power is outside the tolerance for the product, failure to perform manufacturer's suggested preventative maintenance, modifications, misuse, accident, catastrophe, neglect, natural disaster, are not under warranty.

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