

Vulcan Gate™



*Portable Safety Barrier System
For Speeds Up To 100 Km/h [62 mph] (TL-3)*



**ENERGY ABSORPTION
SYSTEMS, INC.**

*A Quixote Company
Saving Lives By Design*

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Product/Installation

Vulcan Gate™

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System Overview

Important Introductory Notes

Proper installation of the Vulcan Gate is essential to assure maximum performance. Take the time to review the installation instructions and product limitations thoroughly before performing the necessary work. Do not attempt to install the Vulcan Gate without the proper plans and installation manual from the manufacturer.

Note: The drawing package provided with the Vulcan Gate is site specific and should take precedence over the drawing package provided in this manual. These drawings are for reference only and may not be up to date.

If you need additional information, or have questions about the Vulcan Gate, please call: **Energy Absorption Systems, Inc. Customer Service Department at (888) 323-6374.**

Features

The Vulcan Gate is a longitudinal barrier and gate in one system. When closed, the Vulcan Gate is a positive, crashworthy longitudinal barrier. The Vulcan Gate opens to provide passage through permanent or temporary longitudinal barrier.

The Vulcan Gate provides several unique advantages over traditional median barrier openings:

- Eliminates exposed barrier ends that threaten motorist safety
- Provides positive and crashworthy protection for errant vehicles
- Prevents dangerous and illegal U-turns
- Mitigates traffic congestion and air pollution caused by delayed traffic.
- Offers the opportunity for an alternative traffic flow pattern
- Allows more efficient highway maintenance operations
- Improves emergency response times

Function

When closed, the Vulcan Gate functions as a longitudinal barrier to safely redirect an errant vehicle away from a roadside or median hazard. The Vulcan Gate provides acceptable structural adequacy, occupant risk and vehicle trajectory for the TL-3 longitudinal barrier test conditions set forth in the National Cooperative Highway Research Program Report 350 (NCHRP 350).

The Vulcan Gate smoothly redirects vehicles after a side angle impact within the test parameters and evaluation criteria of NCHRP 350.

The Vulcan Gate also functions as a highway gate which opens to allow emergency vehicle and rerouted traffic access through the existing median or roadside barrier.

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Construction

The Vulcan Gate is constructed of two or more Vulcan segments that pin together. These sections are placed at the center of an opening in longitudinal barrier to form a continuous longitudinal barrier. The segments are pinned together and easily unpinned and moved to form an opening for vehicle access.

The sides of the Vulcan Gate assemblies are constructed of AASHTO M180 thrie-beam panel and lower skirt sections and have sufficient tensile strength to resist design speed vehicle impacts.

Exterior and most interior surfaces are corrosion resistant per ASTM A-123.

The outermost ends of the Vulcan segments are equipped with hinges and transitions that are placed against the ends of the existing longitudinal barrier.

Each Vulcan segment is equipped with wheels attached to jacks that allow the segments to be lifted and rolled as required.

The hinge section has sides constructed of AASHTO M180 thrie-beam and lower skirt sections that are strong enough to resist design speed vehicle impacts. The hinge consists of two mirror image sections, a center connection pin and hinge latch. The hinge latch,

when placed in the appropriate location, allows the Vulcan Barrier to pivot.

The transition sections are to be anchored to the roadway. The longitudinal barrier directly adjacent to the transitions are to be anchored to the roadway unless permanent longitudinal barrier is used.

Conformance

The Vulcan Gate™ has been tested to and conforms with the current guidelines used by the Federal Highway Administration (FHWA) as recommended in the National Cooperative Highway Research Program Report 350 (NCHRP 350) TL-3 and has been accepted by the FHWA.

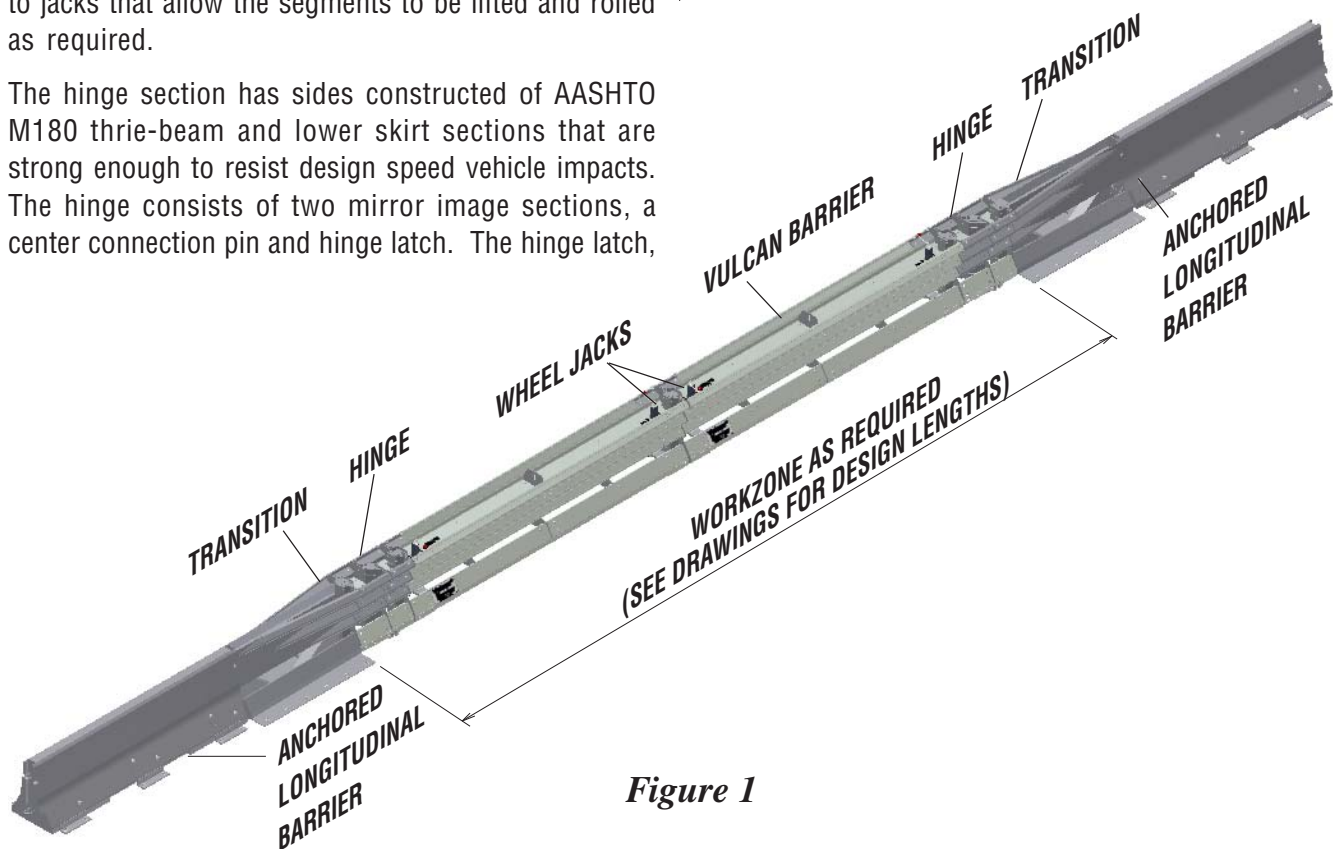


Figure 1

Vulcan Gate™

General Product Specifications

I. General

- A. The Vulcan Gate system shall be designed and manufactured by Energy Absorption Systems, Inc. of Chicago, Illinois.
- B. The gate shall be a crashworthy longitudinal barrier, which opens to varying lengths depending on the number of Vulcan sections.
- C. The gate profile shall not exceed 546mm (21.5 in.) wide by 813mm (32 in.) tall and the gate shall be comprised of at least 2 Vulcan segments each weighing approximately 395 kg (871 lbs.).
- D. The gate is designed for sites with less than 8% longitudinal grade and less than 4% lateral cross slope.

II. Description of System

- A. The gate shall be constructed of 2 or more Vulcan segments that pin together. These sections shall be placed at the center of an opening in longitudinal barrier to form a continuous longitudinal barrier. The segments shall be pinned together and easily unpinned and moved to form an opening for vehicle access.
- B. The sides of the gate assemblies shall be constructed of AASHTO M180 thrie-beam panel and lower skirt sections and have sufficient tensile strength to resist design speed vehicle impacts.
- C. Exterior and most interior surfaces shall be corrosion resistant per ASTM A-123.
- D. The outermost ends of the Vulcan segments shall be equipped with hinges and transitions that attach to the ends of existing longitudinal barrier.
- E. Each Vulcan segment shall be equipped with wheels attached to jacks that allow the segments to be lifted and rolled as required.
- F. The hinge section has sides constructed of AASHTO M180 thrie-beam and lower skirt sections that are strong enough to resist design speed vehicle impacts. The hinge consists of two mirror image sections, a center connection pin and hinge latch. The hinge latch, when placed in the appropriate location, allows the Vulcan Barrier to pivot.
- G. The transition sections shall be anchored to the roadway.
- H. The longitudinal barrier directly adjacent to the transitions shall be anchored to the roadway..

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General Product Specifications (cont'd.)

III. PERFORMANCE CRITERIA

- A. The gate shall be fully tested to and meet the recommended structural adequacy, occupant risk, and vehicle trajectory criteria set forth in the National Cooperative Highway Research Program Report 350 for the Test Level 3 for Longitudinal Barriers, impact conditions of 820 to 2000 kg (1808 to 4409 lb.) vehicles at speeds to 100 km/h (62.2 mph) and angles up to 25 degrees when properly installed according to the manufacturer's recommendations.
- B. The gate shall be capable of preventing vehicle penetration, vaulting, and underriding during Test Level 3 Length Of Need with Transition (TL-3 LON/T) impacts and shall smoothly redirect the vehicle.
- C. For TL-3 LON/T impacts, detached debris shall not show potential for penetrating the vehicle occupant compartment or present a hazard to other traffic, pedestrians or workers in a work zone. The vehicle shall remain upright during and after the collision. Moderate rolling, pitching, and yawing may occur.
- D. The impact velocity of a hypothetical front seat passenger against the vehicle interior, as calculated from the longitudinal vehicle acceleration and 600mm (23 5/8 in.) forward displacement, and the lateral vehicle acceleration and 300mm (1ft.) lateral displacement shall be less than 12 m/s (39.3 ft./s). The highest 10 ms average vehicle acceleration in the longitudinal and lateral directions subsequent to the instant of passenger impact shall be less than 20 g's.
- E. The gate shall be fully operational after minor impacts and must remain a positive physical and visual barrier before and after design speed impacts.
- F. The gate shall be resistant to jamming from -30 to 500C (-22 to 1220F) in the absence of snow and ice and/or severe debris buildups.

IV. DESIGN AND SELECTION CRITERIA

- A. Design, selection, and placement of the gate shall conform to applicable guidelines in:
 - 1. U.S. Department of Transportation. Federal Highway Administration. "Manual on Uniform Traffic Control Devices" Washington, D.C. U.S. Government Printing Office, 1988.
 - 2. American Association of State Highway and Transportation Officials. "Roadside Design Guide" Washington, D.C.: AASHTO, 1989.
- B. Installation of the gate shall be accomplished in accordance with the recommendations of Energy Absorption Systems, Inc. in the Vulcan Gate Product/Installation Manual.

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System Design

Application

The Vulcan Gate can be used in many applications.

Some examples are:

- * Median or verge installations
- * Emergency Cross-over Access
- * General road maintenance performed by road authorities, contractors, local municipalities etc.
- * Road construction
- * Lane closures
- * Toll plazas
- * Road Resurfacing
- * Excavation or culvert protection
- * Detours or diversions
- * Bridge repairs
- * Temporary or permanent installations
- * Variety of approved end terminals available or option to "TAPER THROUGH CLEAR ZONE".

In order to design the most appropriate Vulcan Gate System for a given site, this manual helps to answer the following questions:

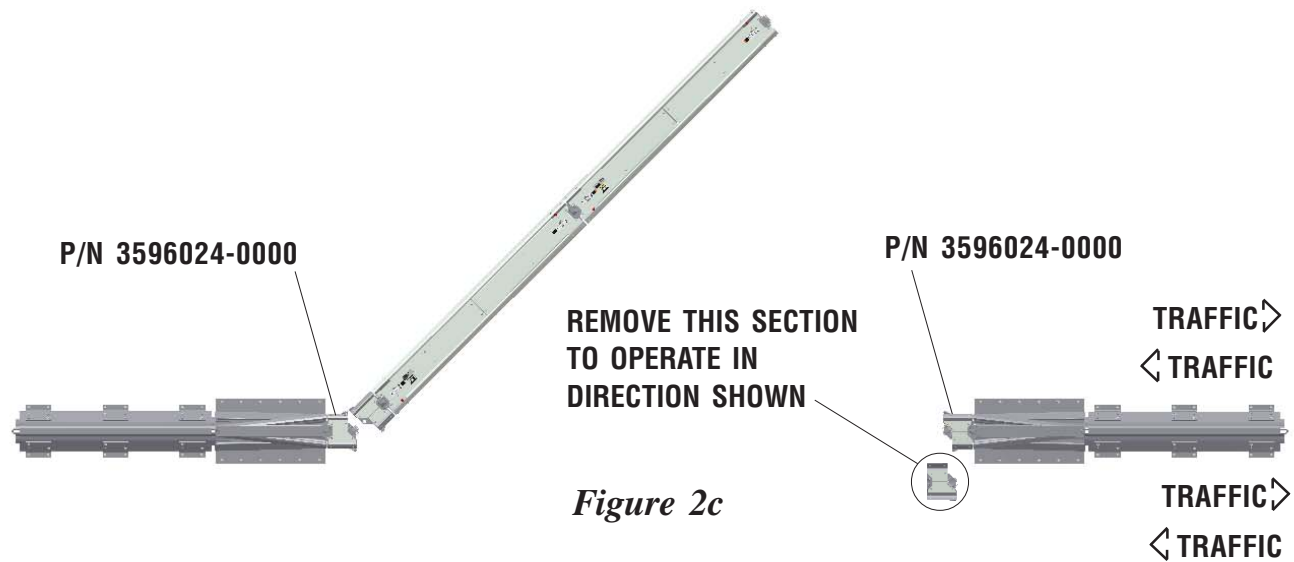
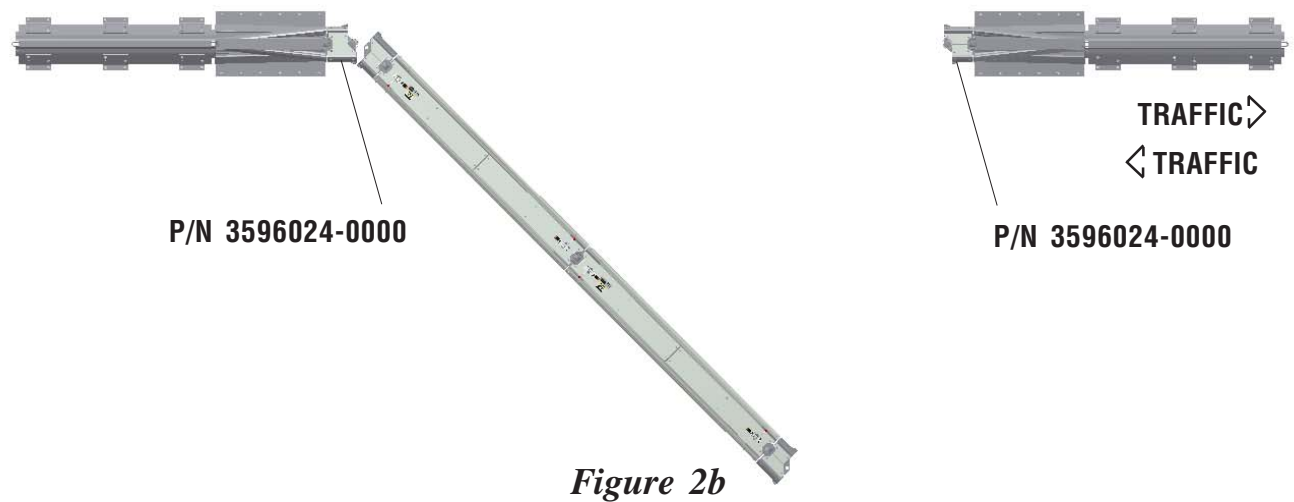
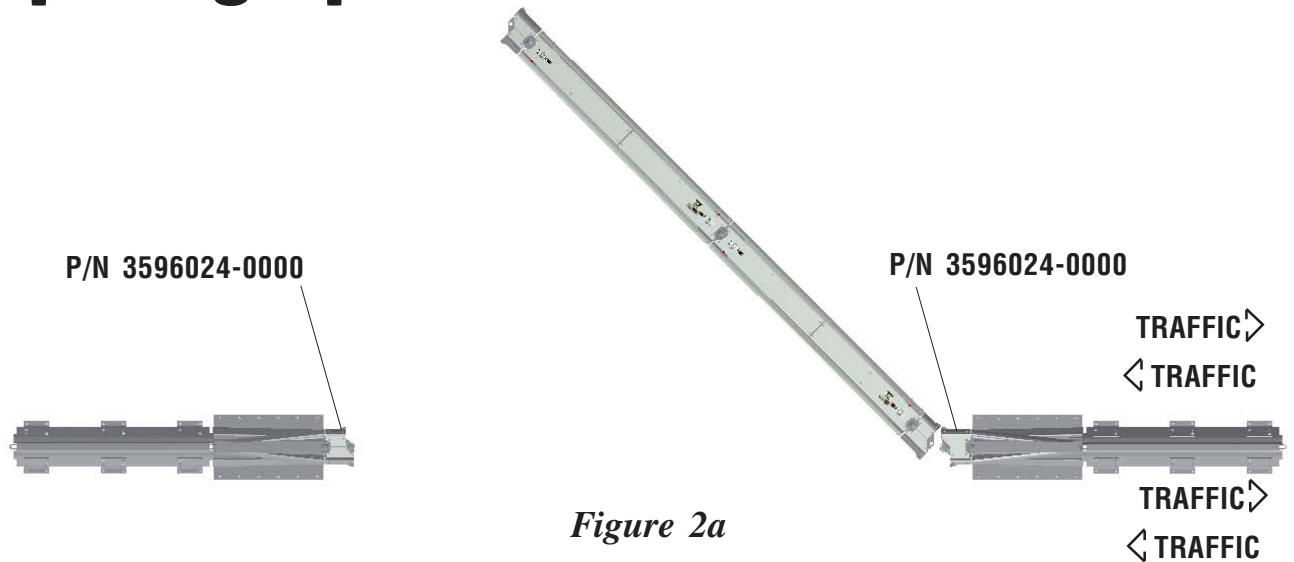
- * Is the Vulcan Gate appropriate for my site?
- * What is the application? What warrants the use of the Vulcan Gate?
- * How long or short can the gate be?
- * How much clear zone is available, and how much is required for the correct functioning of the System?
- * Are there curves, slopes or curbs present which may not suit the Vulcan Gate?

The purpose of this manual is to supply some basic application information about the Vulcan Gate and to detail its performance when tested to NCHRP 350.

If you would like further assistance, please contact Energy Absorption Systems' **Customer Service Department. See the back cover for the phone numbers.**

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Opening Options



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Opening Options (Cont'd)



REMOVE THIS SECTION
TO OPERATE IN
DIRECTION SHOWN

P/N 3596024-0000

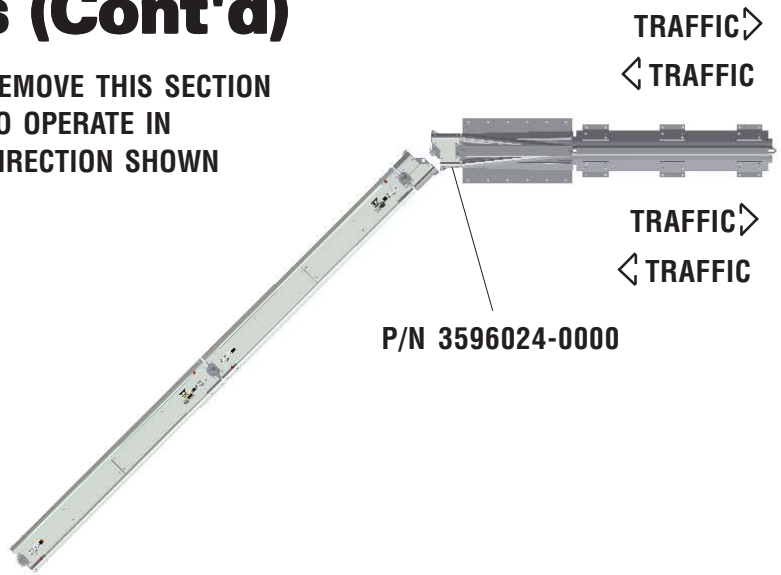
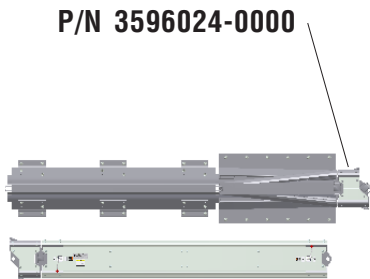
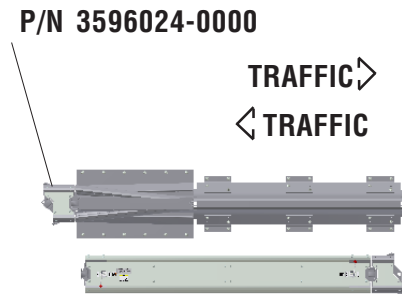


Figure 2d

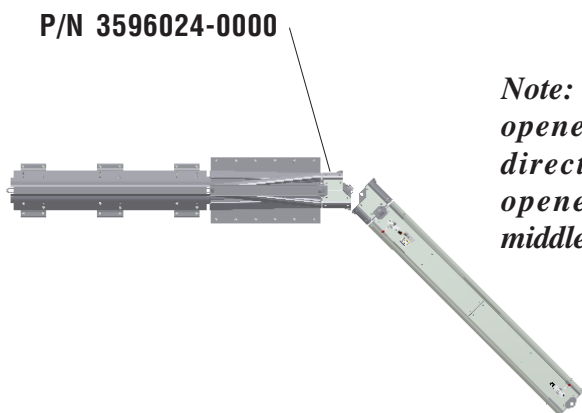


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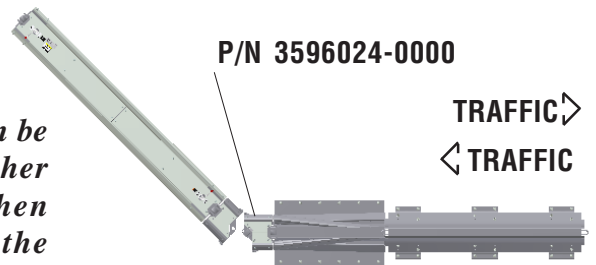
P/N 3596024-0000

Figure 2e - Open Along barrier



P/N 3596024-0000

*Note: Gate can be
opened in either
direction when
opened in the
middle.*



P/N 3596024-0000

TRAFFIC >
< TRAFFIC

Figure 2f - Open Middle Opposite

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Components

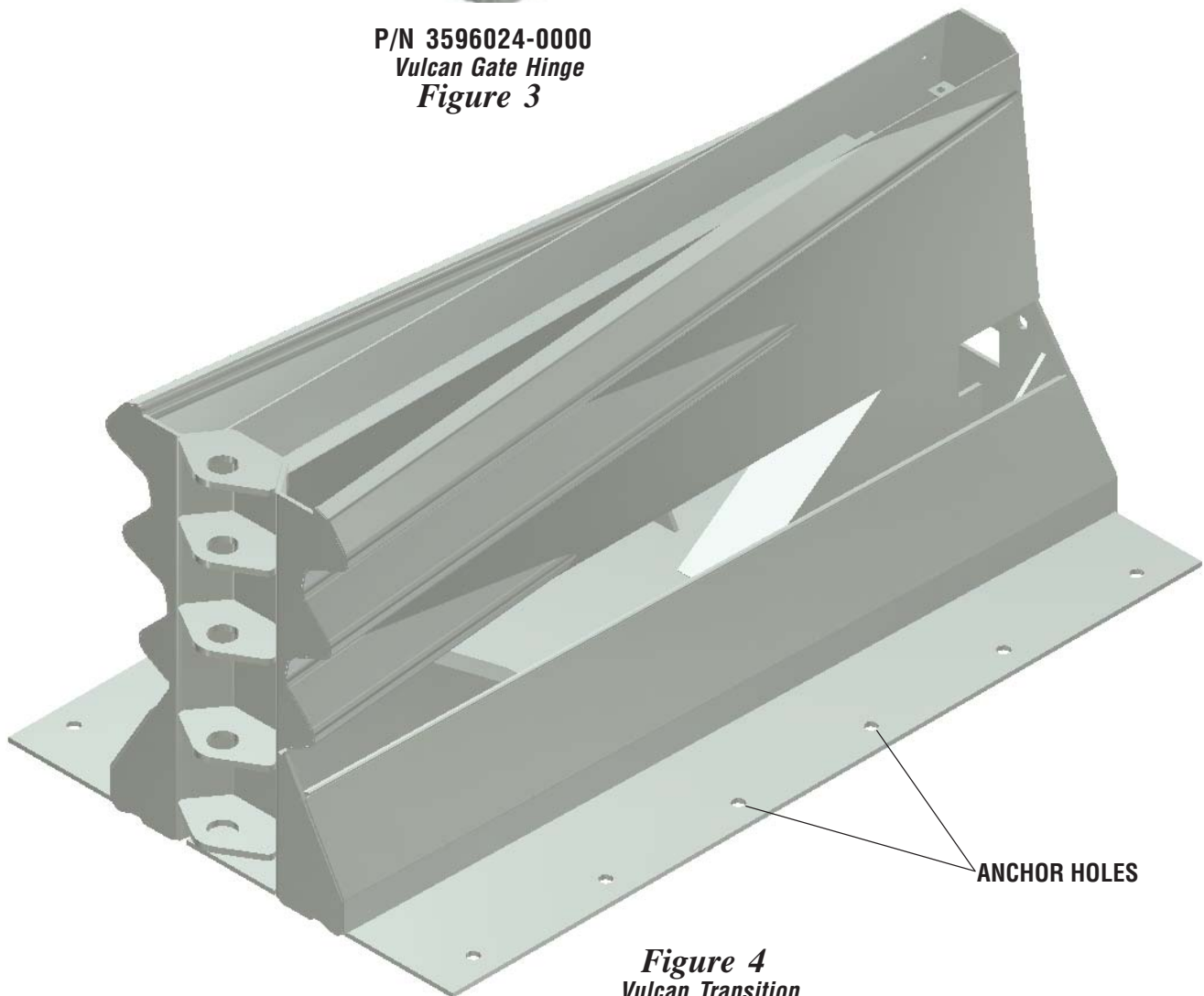
GATE DIRECTION
ARROW

CENTER CONNECTION
PIN

LATCH PIN

HINGE JOINT

P/N 3596024-0000
Vulcan Gate Hinge
Figure 3



ANCHOR HOLES

Figure 4
Vulcan Transition

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System Design (cont'd.)

Length Of Need

Length of need (L.O.N.) is defined as the total length of a longitudinal barrier needed to shield an area of concern. It is also described as that part of a longitudinal barrier or terminal designed to contain and redirect an errant vehicle. The L.O.N. varies depending on what void the Vulcan Gate is filling.

The Vulcan Gate is deployed as a safety barrier which can be placed in the middle of CMB or Vulcan following the criteria of the design drawings are met. The Vulcan Gate is deployed longitudinally and incorporates various sections of Vulcan Barrier that require specific opening sizes.

Vulcan Gate Expected Lateral Deflection

The Vulcan Gate, since it is made up of Vulcan Barrier, has been considered to pass all NCHRP 350 test criteria where maximum dynamic deflection was experienced. The TL-3 deflection results on the Vulcan Gate for the 2000P @ 25 degrees was at 1.1 m [3'-7"]. This test was directly positioned at the hinge and transition of the unit to determine vehicle pocketing. Depending on the location of the impact and the number of Vulcan Barrier sections, the deflection may be closely related to the Vulcan Barrier Deflection shown in the Vulcan Manual for Vulcan firmly anchored at both ends. Expected lateral deflection more typical of real world conditions is related to impact angle and impact severity, which can be calculated and may vary from expected values due to site conditions.

2000 kg Pick-up Truck Test - Vulcan Gate

Deflection is 1.1 m [3'-7"] for the 25° impact at 100 kph [62 mph] (TL-3)

Note: Deflection will be less than 1.1 m [3'-7"] for impacts less than 25° and below speeds of 100 kph[62 mph]

Deflection calculations are based on the TL-3 BLON

The TL-3 results for the 2000P @ 25 degrees are taken directly from NCHRP 350 test results and represent the maximum dynamic deflection experienced. Deflections shown for smaller impact angles and for lower speeds are calculated values based on nominal impact severities of the lower test speeds. No actual test for this vehicle mass and impact angle was carried out on this system.

Dynamic deflection represents the maximum amount of lateral movement of the system. Testing has confirmed

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System Design (cont'd.)

that the permanent static deflection is approximately 10% less than the dynamic deflection.

Actual deflections may vary from expected values due to site conditions.

Other Considerations

Certain conditions may effect the performance of the Vulcan Gate. Since every job site is unique, the designer needs to consider the following conditions when incorporating the Vulcan Gate in the design.

Curves

The ends of each section are constructed with knuckles that interlock with those of other segments. The end knuckles are vertically aligned to accept a steel connecting pin. The pin securely joins the sections for maximum impact performance. The sections can swivel up to 6 degrees at the pin for easy positioning around work areas or following road contours. See figure 5.

Typical installation of Vulcan Gate should be in straight runs with minimal curvature.

IMPORTANT!

In order to limit system deflection in critical areas such as past the work zone or other hazards, installation of the limiting spacers between the barrier segments is required.

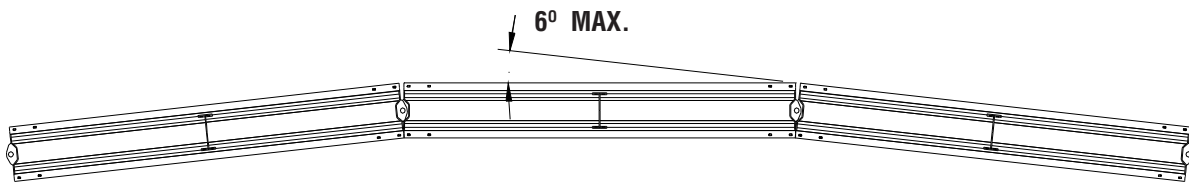


Figure 5

Slopes

Cross slopes

The Vulcan Gate may be placed on cross slopes up to 5% (3 deg.) (Figure 6).

Longitudinal slopes

For Vulcan Gates placed on slopes that exceed 5% (3 deg.) call Customer Support (888) 323-6374. (Figure 7).

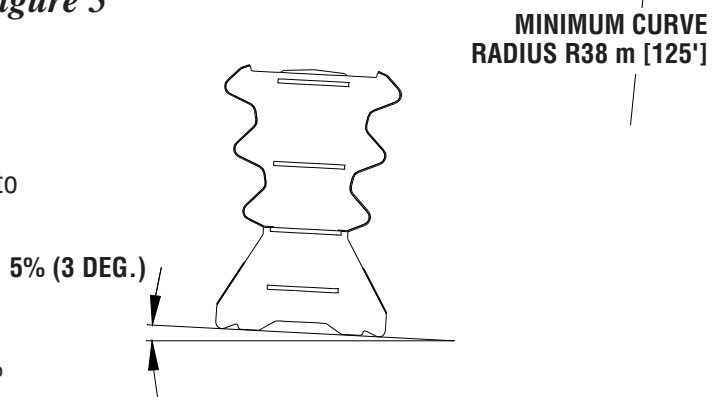


Figure 6

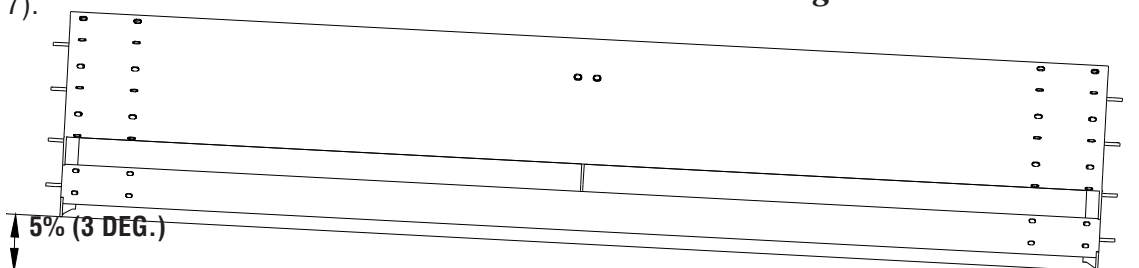


Figure 7

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Hills

The Vulcan Gate has the ability to conform to a hill up to 20:1 (see figure 8). Please note the maximum longitudinal slope in Figure 7.

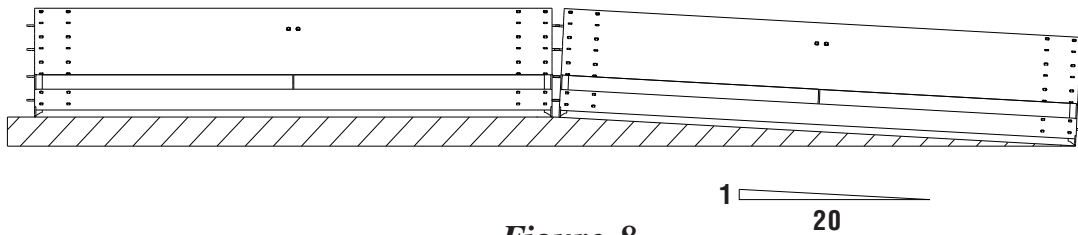


Figure 8

Ditch

The Vulcan Gate has the ability to conform to a ditch up to 20:1 (see figure 9). Please note the maximum longitudinal slope in Figure 7.

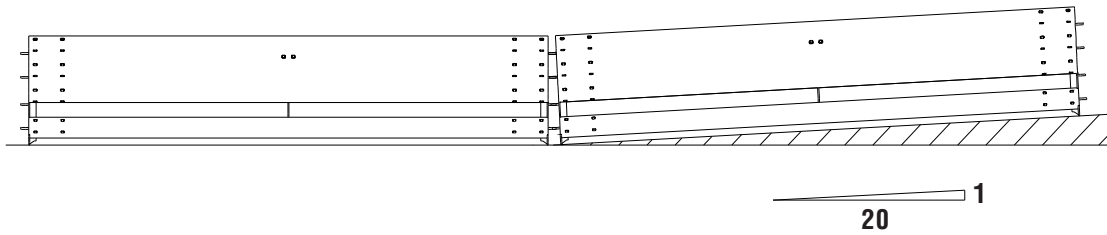


Figure 9

Curbs

The Vulcan Gate should **NOT** be placed directly against curbs that can prevent its lateral movement (see figure 10).

Trenches

The Vulcan Gate should **NOT** be placed directly up to trenches or excavations where the necessary deflection of the system in the event of an impact may result in barrier failure. Reference to safe working widths is detailed in the deflection summary.

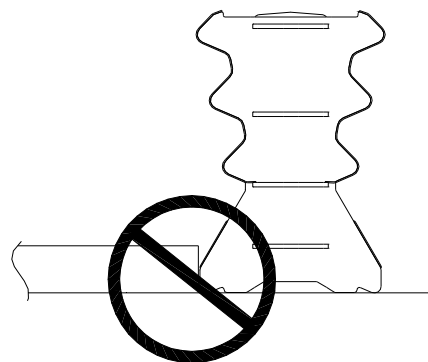


Figure 10

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Installation

Preparation

Begin preparing for the installation by thoroughly reviewing the specified barrier location, layout and orientation as per the approved traffic management plan.

Determine the number of segments required for the installation. The installed length of each Vulcan segment is 4 meters [13'-6"]. Consideration must be given to determine if an end treatment is required and allow for the length of the treatment in determining segments required. A visual inspection should be carried out to confirm the suitability of all segments. Should visible damage be evident in any segments, they should be sent for inspection and refurbishment prior to use.

WARNING!

The correct safety equipment and approved traffic management must be used as required for any installation using the Vulcan Barrier.

Required Tools

For a typical installation, the recommended tools and equipment are:

1. Vulcan Gate Product/Installation Manual
2. Traffic control plan and approval (as required)
3. Traffic control equipment (as required)
4. A truck mounted crane or forklift suited to a minimum 400 kg [900 lbs] lift and appropriate slinging gear. **The Vulcan Barrier is designed to stack up to 3 segments in height so provision must be made to lift from a height of 2.4 meters [7'-10 1/2"] plus the tray height.**

Deployment

1. Begin deployment at the upstream traffic end of the site and work downstream. Work from the non-traffic side of the installation whenever possible. Unloading proceeds much faster if one person remains on the truck and two people work on the ground. If site conditions permit, a fourth person can drive the truck so that segments can be unloaded continuously as the installation is progressing.
2. Align the segments according to the specified configuration and layout in the traffic control plan.

Caution: Refer to the deflection on page 10 when determining minimum clearance between barrier and hazard.

Caution: The existence of any cross slopes in excess of 5% (3 deg.) or curbs may create a vaulting effect on the impacting vehicle.

3. Insert two transitions (one at the beginning of system and one at the end) and attach to existing longitudinal barrier. Anchor adjacent barrier only as specified per manufacturers instructions. Anchor Transition as specified per manufacturer's instructions.

IMPORTANT!

4. Attach the hinge sections to the transitions with the connecting pins. Ensure top tab of pins is on swinging side of gate and that gate direction arrows are pointing to the median opening. (See Figure 11)

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Installation (Cont'd)

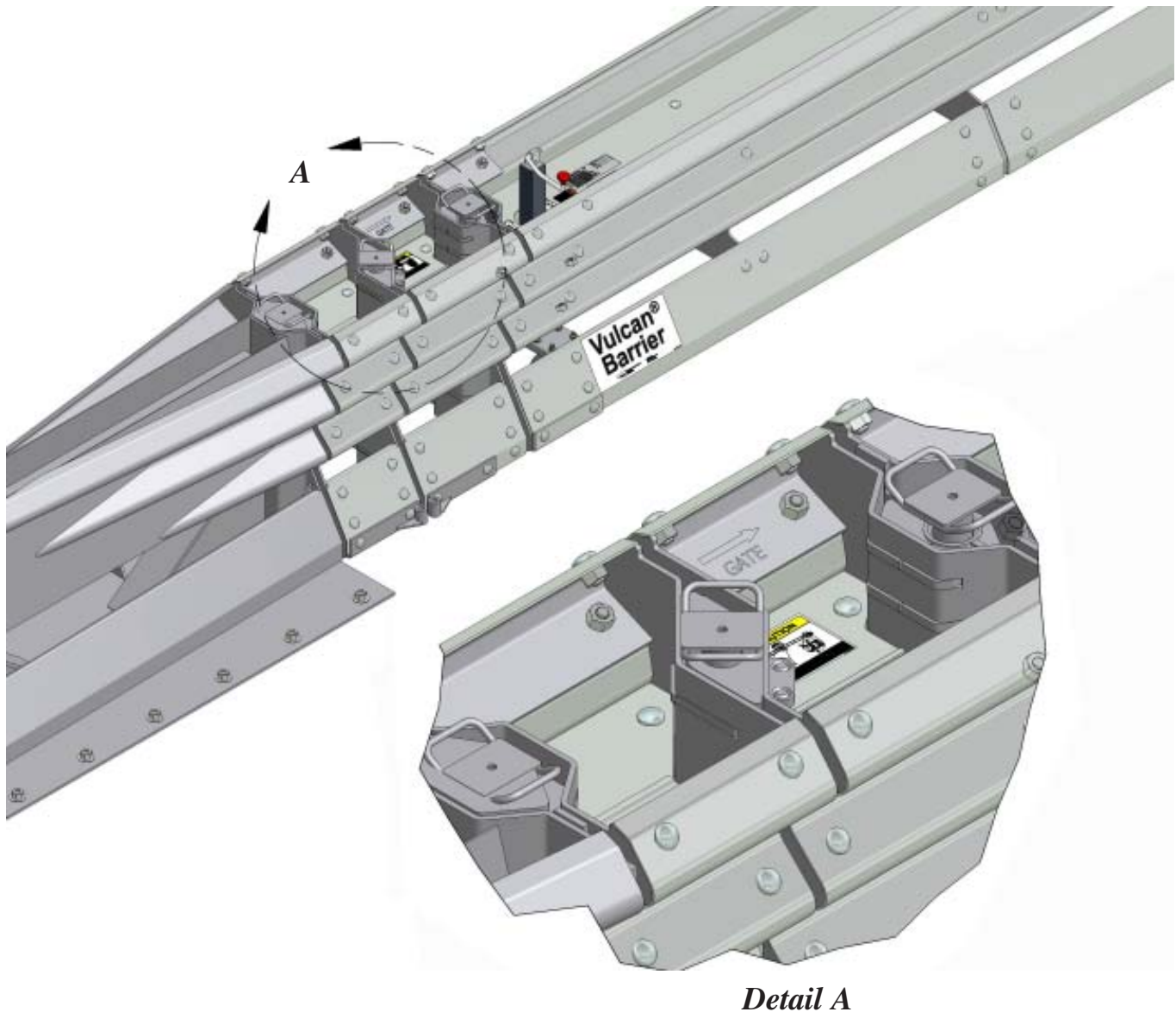


Figure 11

5. Bring the segments together and insert a connecting pin through the overlapping end knuckles at each joint. Push the pin in until it is flush with the top of the segments.
 - * Spacers (P/N 2796007-0000) are used to minimize joint rotation. Energy Absorption Systems recommends installing spacers for optimum performance and minimum lateral deflection.
6. After the system is in place and pinned together, make sure the jacks on each Vulcan Barrier section are in the raised position and all barriers are completely settled on the roadway.
7. Check to make sure all connection pins remove easily. Lubricate as needed (WD40) and reposition Vulcan and Hinge if necessary

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IMPORTANT!

Ensure that the deflection limiting spacers are installed between all segments where the minimum deflection of the system is desired i.e. Beginning of Length Of Need (B.L.O.N.).

Deployment is now complete. Take the time to double check the integrity of the system so as to confirm functionality.

Retrieval

Retrieval is a reverse of the instructions for deployment.

Inspection

A visual inspection of each barrier segment is required prior to shipping.

As the Vulcan Gate is modular by design, it is essentially made up of three main components, which can all be replaced thus ensuring a long service life from the Vulcan Barrier.

Barrier segments which show evidence of prior impact should be thoroughly inspected for any sign of distortion or disfigurement.

Should any Vulcan segment, hinge or transition show signs of distortion or disfigurement, it must be refurbished prior to re-use.

Required Tools

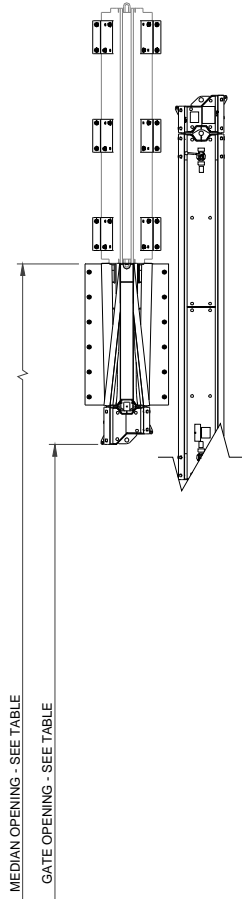
- Transport truck
- Sledge hammer
- Pry bar
- Generator (power for optional accessories)
- A truck mounted crane or forklift suited to a minimum 400 kg [900 lbs] lift and appropriate slinging Gear if crane is used.
- 22 mm (7/8") Concrete Drill Bits (*Two Fluted)
- Grinder, Hacksaw or Torch (optional)
- Drill Motor
- Drill Bits: 1/16" through 7/8"

* Energy Absorption Systems recommends using two fluted drills to achieve optimum tensile strength when installing the MP-3 anchoring system.

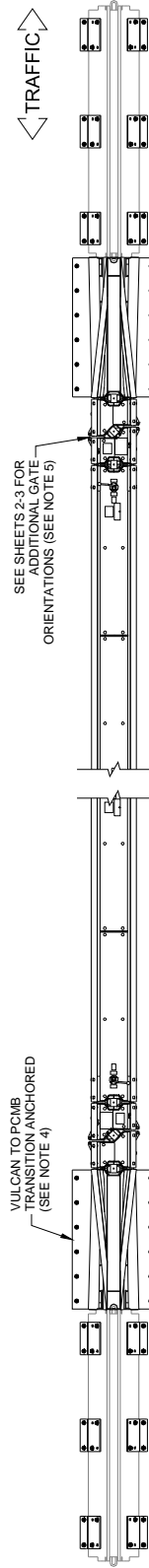
- Roto Hammer
- Standard Hammer
- Heavy Duty Impact Wrench
- Standard adjustable wrench
- 1/2" drive sockets: 9/16", 11/16", 3/4", 15/16", 1 1/8", 1 1/4"
- Deep Sockets: 5/16", 1 1/4"
- Ratchet and attachments for the above sockets
- Breaker Bar: 1/2" x 24"
- Torque Wrench: 200 ft-lbs.
- Crescent Wrench: 300 mm [12"]
- Impact Wrench: 1/2"
- Lubrication (WD40)

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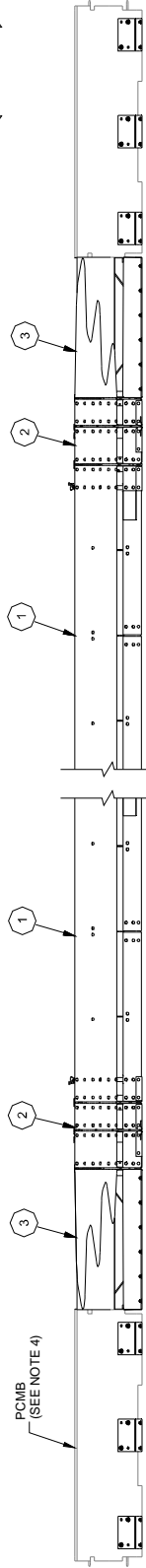
MODEL #	MEDIAN OPENING	GATE OPENING	35596000-1000 (QTY)	35596024-0000 (QTY)	35596008-0000 (QTY)
VG2000	13.31m [43'-8"]	8.99m [29'-5 1/2"]	2	2	2
VG3000	17.46m [57'-3 1/2"]	12.79m [41'-11 1/2"]	3	2	2
VG4000	21.61m [70'-10 1/2"]	17.28m [56'-8"]	4	2	2
VG5000	25.75m [84'-6"]	21.42m [70'-3 1/2"]	5	2	2
VG6000	29.90m [98'-1"]	25.57m [83'-10 1/2"]	6	2	2



PLAN (OPEN)



PLAN (CLOSED)

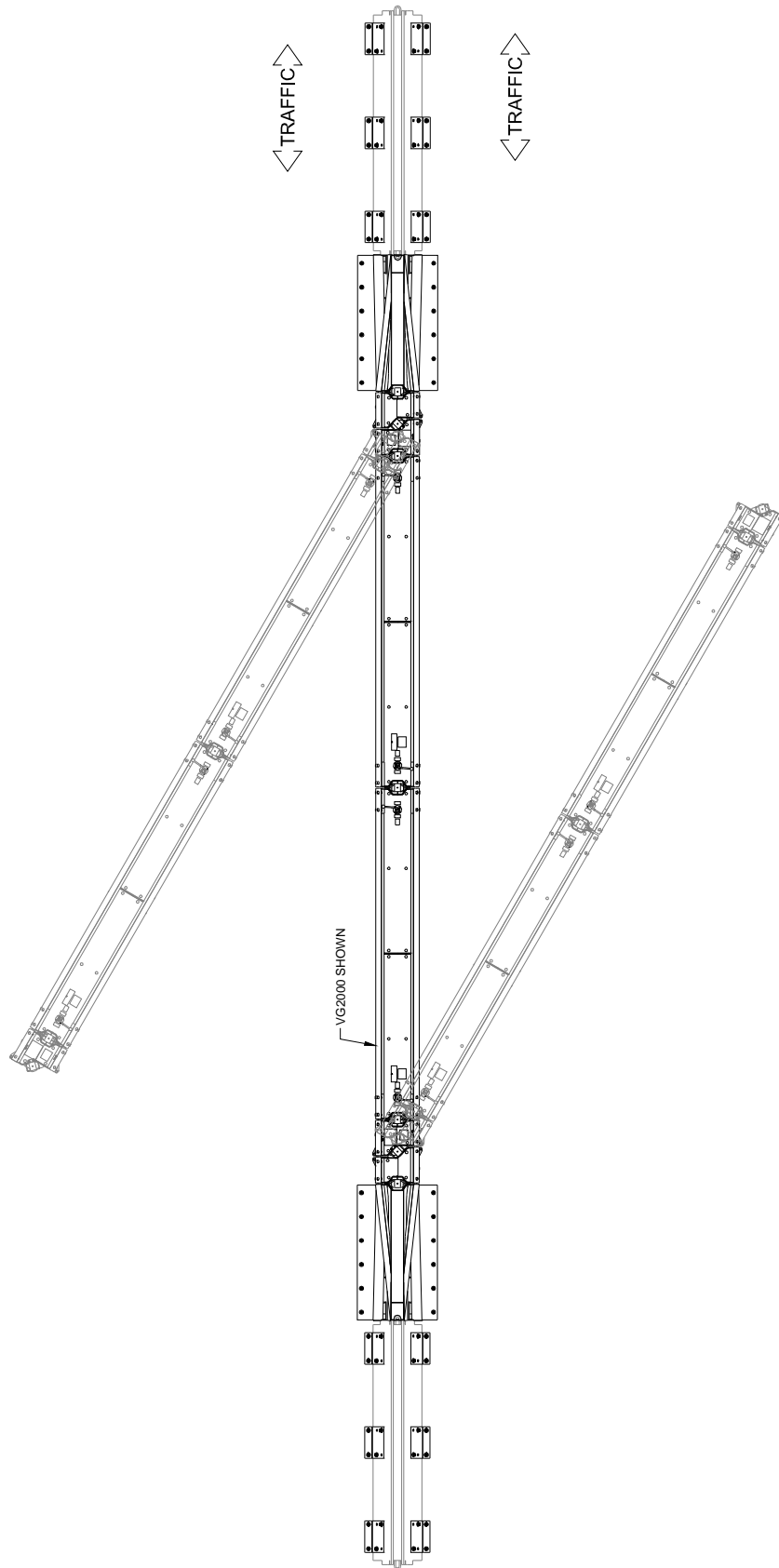


ELEVATION (CLOSED)

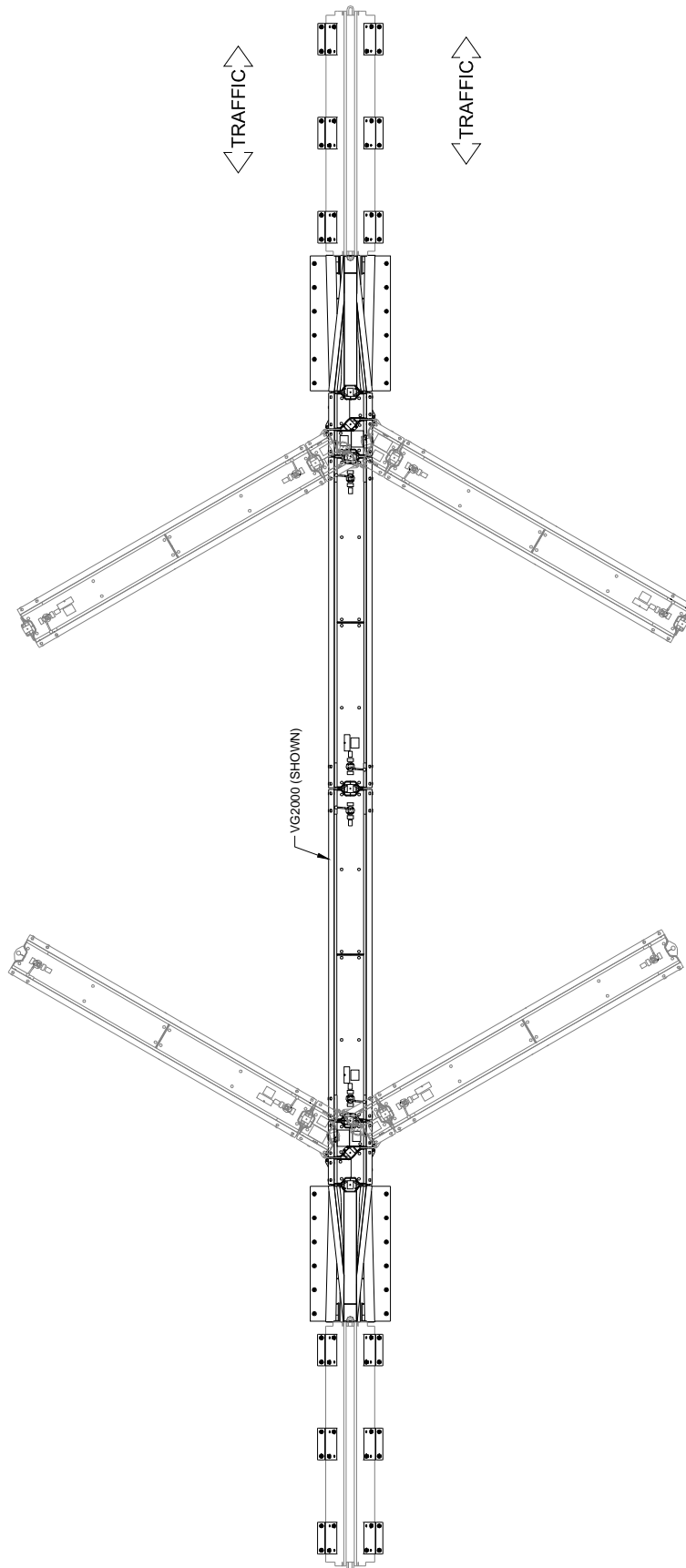
- NOTES:
- SEE VULCAN BARRIER PRODUCT MANUAL FOR A DESCRIPTION OF ITS IMPACT PERFORMANCE CHARACTERISTICS AND DESIGN LIMITATIONS BEFORE PLACING A SYSTEM AT A GIVEN SITE. INFORMATION AND ADDITIONAL COPIES OF ABOVE MANUAL ARE AVAILABLE BY CALLING 800-368-3333.
 - VULCAN BARRIERS NEED TO BE PAINTED AND SIGNS USED.
 - JACK WHEELS SHALL BE RETRACTED WHEN BARRIER IS NOT BEING MOVED.
 - TRANSITIONS AND ADJACENT PCMB SHALL BE ANCHORED. SEE REFERENCE DRAWING 35596008-0000.
 - REFER TO VULCAN MANUAL FOR OPERATIONAL PROCEDURES AND OTHER OPTIONS.

1	VULCAN w/JACKS
2	HINGE
3	TRANSITION

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Anchoring (Transitions/CMB)

The Vulcan Gate has essentially two anchored ends that attach to the hinge/connector that allows the Gate to operate and open to the desired position. The anchored ends are crucial to the system, in that they keep the system from moving if it is impacted.

These anchored end components are called transitions. They transition typically from Vulcan Barrier to various longitudinal barriers.

The transition is not connected to the adjacent barrier which requires that the first section of longitudinal barrier be securely anchored, using the MP-3 Anchoring System or any other approved anchors.

Contact Energy Absorption Systems Customer Support for anchor options. (888) 323-6374.

Vulcan Gate Anchoring Alternatives

The Energy Absorption Systems MP-3 Polyester Anchoring System is the standard anchor recommended for use with the Vulcan Gate System.

Occasionally, the MP-3 System may not fulfill all requirements of a particular installation, (such as removal of the anchors after a temporary installation, certain bridge deck applications or embedment in varying road surfaces) so Energy Absorption Systems has qualified alternative anchoring systems that may better fit the requirement.

Please contact Energy Absorption Systems Customer Support at (888) 323-6374 for alternative anchoring recommendations if the MP-3 Anchoring System does not meet your specific site needs.

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MP-3® Polyester Anchoring System

The MP-3 Polyester Anchoring System is a quick and easy way to securely anchor crash cushions and other common highway devices. MP-3 features high pullout strength, superior vibration resistance, and exceptional durability.

Each MP-3 kit contains a can of MP-3 resin, hardener, cold weather promotor, studs, washers, and a complete safety sheet. The cold weather promotor shortens hardening time by as much as seven hours. Both vertical and horizontal installations are possible using the MP-3 System.

Vertical Installations

Note: Read MP-3 Instructions before starting.

WARNING!

Do not allow the MP-3 Resin or Hardener to contact skin or eyes. See material safety data sheet supplied with the MP-3 kit for first-aid procedures. Use only in well-ventilated area. Do not use near open flame.

WARNING!

Wear safety goggles and gloves during installation.

1) Prepare the concrete pad

The anchor bolts (Studs) that anchor the Vulcan Gate to the concrete pad must be those shipped in the kit or of high strength steel (830 MPa [120,000 psi] minimum tensile strength or equal.) These Studs must be set in minimum 28 MPa [4000 psi] concrete. Allow the concrete to cure a minimum of 7 days before installing MP-3.

2) Drill holes

Note: Energy Absorption Systems recommends using two fluted drills to achieve optimum tensile strength when installing the MP-3 anchoring system.

Use the part that is to be anchored as a drilling template. Drill the holes 3 mm [1/8"] larger than the stud diameter to the recommended depth, using a rotary percussive drill. Full strength will not be achieved if a diamond drill is used. Refer to the MP-3 installation instructions provided with your kit. Check to be sure all the holes are drilled to the proper depth and aligned with the part to be anchored. Refer to Table A.

Table A

MP-3 Anchoring Information

Stud size	Concrete bit size	Minimum Depth	Recommended Torque
3/4" x 6 1/2"	22 mm [7/8"]	125 mm [5"]	165 Nm [120 ft-lbs]
3/4" x 7"	22 mm [7/8"]	140 mm [5 1/2"]	165 Nm [120 ft-lbs]
3/4" x 7 1/2"			
3/4" x 8 1/2"			
3/4" x 18"	22 mm [7/8"]	420 mm [16 1/2"]	<15 Nm [<10 ft-lbs]

3) Clean the holes

Blow the concrete dust from the hole, using oil-free compressed air. Thoroughly brush it with a stiff-bristled brush, and then blow it out again. If the hole is wet, completely flush it with water while brushing. Then blow it clean, using oil-free compressed air.

4) Mix the resin and hardener

Wearing gloves and safety goggles, remove the lids from the MP-3 Part A-Resin and Part B-Hardener containers. Pour Part B into Part A, then mix vigorously for 30 seconds to form MP-3 grout (an anchor stud may serve as a stirring rod).

5) Add cold weather promotor (in cold weather)

For faster hardening in cold weather, Promotor may be used. Add the entire contents of the partially filled Promotor container to the MP-3 grout; then mix for an additional 30 seconds. Use immediately because the MP-3 grout will thicken quickly. Refer to Table B for hardening times.

6) Pour grout into holes

WARNING!

Do not use Promotor when the temperature is above 15 degrees Celsius (60 degrees Fahrenheit). Grout will harden too quickly.

Vulcan Gate™

MP-3® Polyester Anchoring System (cont'd.)

Crimp the mouth of the can to form a spout, and pour the MP-3® grout mixture down into the hole through the part. Fill the hole 1/3 to 1/2 full.

Caution: Do not overfill or underfill the hole. If the hole is overfilled, there will not be enough grout to use all of the anchor studs/kit. If hole is under-filled the grout may not develop the required pull out strength.

7) Add the washers and nuts

Place a flat washer onto the stud; then thread a nut on until **1 or 2 threads of the NUT** are left exposed.

8) Insert Studs in holes and wait for grout to harden

Push the stud down through the part to be anchored and into the hole. Give the stud several twists in the MP-3 to wet the threads.

Caution: Do not disturb or load the stud until the MP-3 material has hardened (see Table B for hardening times).

9) Torque the nuts

Once the grout has hardened, torque the nut to the recommended values. (See Table A.) Now no threads of the nut should be exposed.

Table B
Approximate Hardening Times (hrs)

Temperature		No	With
(C)	(F)	Promoter	Promoter
>26	>80	1/2	N/R*
22-26	70-79	1	N/R*
16-21	60-69	2	N/R*
10-15	50-59	4	3/4
4-9	40-49	8	1
-1-3	30-39	N/R*	1 1/2
<-1	<30	N/R*	N/R*

* Not recommended. Contact Energy Absorption Systems Inc.'s Customer Service Department for more information.

Horizontal Installations

The horizontal MP-3 kit is the same as the vertical kit except that a cartridge for a standard caulking gun is supplied in the horizontal kits and the resin for the horizontal kits is a thixotropic (TX) resin. The TX-Resin is a gelled resin designed to keep the grout in place in horizontal holes during installation.

When using the horizontal MP-3 kits follow the vertical instructions with the following exceptions:

1) Thread dispensing tip onto dispenser

Prior to mixing the grout, carefully thread the dispensing tip onto the dispenser.

2) Pour mixed grout into dispenser

Once the grout is mixed crimp the mouth of the can to form a spout, and pour the MP-3 grout into the open end of the dispenser (use mixing stud to scrape out the portion remaining in the can). You may use the box to hold the dispenser upright. Close the box lid and poke the dispenser tip into the top of it. Seal the dispenser with the plunger provided.

3) Place dispenser in caulking gun and dispense grout

Cut off the small end of the dispenser tip. Place the dispenser into a caulking gun and dispense until MP-3 TX grout reaches the tip of the dispenser, then release pressure. Push the dispenser tip through the part to the bottom of the hole and dispense while slowly withdrawing the tip.

Caution: Do not overfill or underfill the hole. Fill hole approximately 1/3 to 1/2 full. If the hole is overfilled, there will not be enough grout to use all of the anchor studs/kit. If hole is under-filled the grout may not develop the required pull out strength.

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MP-3® Polyester Anchoring System (cont'd.)

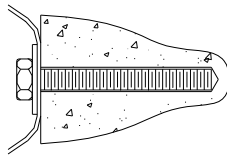
4) Add the washers and nuts

Put washer and nut on stud leaving nut flush with end of stud. See figure 22.

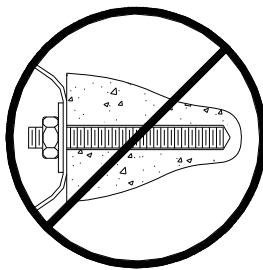
5) Insert Studs into holes

Push stud through part to be anchored and into hole. Twist the stud in the MP-3® grout to wet the threads.

Note: In Horizontal Applications the stud should be flush with the top of the nut. See Figure 22.



CORRECT



INCORRECT

Figure 22
MP-3 Horizontal Installation

Caution: Do not disturb or load the stud until the MP-3 material has hardened (see Table B for hardening times).

6) Torque the nuts

Once the grout has hardened, torque the nut to 165 Nm [120 ft-lbs.].

MP-3® Installation Cautions

1) Shelf life

If the shelf life of the MP-3 has expired (see MP-3 kit for expiration information), mix a small amount of MP-3 in the proportions of one part A to two parts B by volume. If the material does not set according to the instructions, contact Energy Absorption Systems, Inc. for guidance.

WARNING!

Do not use the MP-3 if the material fails to set up, Part A-Resin has gelled (for vertical applications), or TX-Resin is NOT gelled (for horizontal

2) Steel rebar

If steel rebar is encountered while drilling an MP-3 anchor bolt hole, apply one of the following solutions:

A. Using a diamond core drill or rebar drilling tool, drill through the rebar only, then switch back to the concrete bit and drill into the underlying concrete until the proper hole depth is reached.

Caution: Do not drill through rebar without first obtaining permission to do so from the local project engineer.

B. Drill a new hole down at an angle past the rebar to the proper depth. Anchor the stud by completely filling both holes with MP-3.

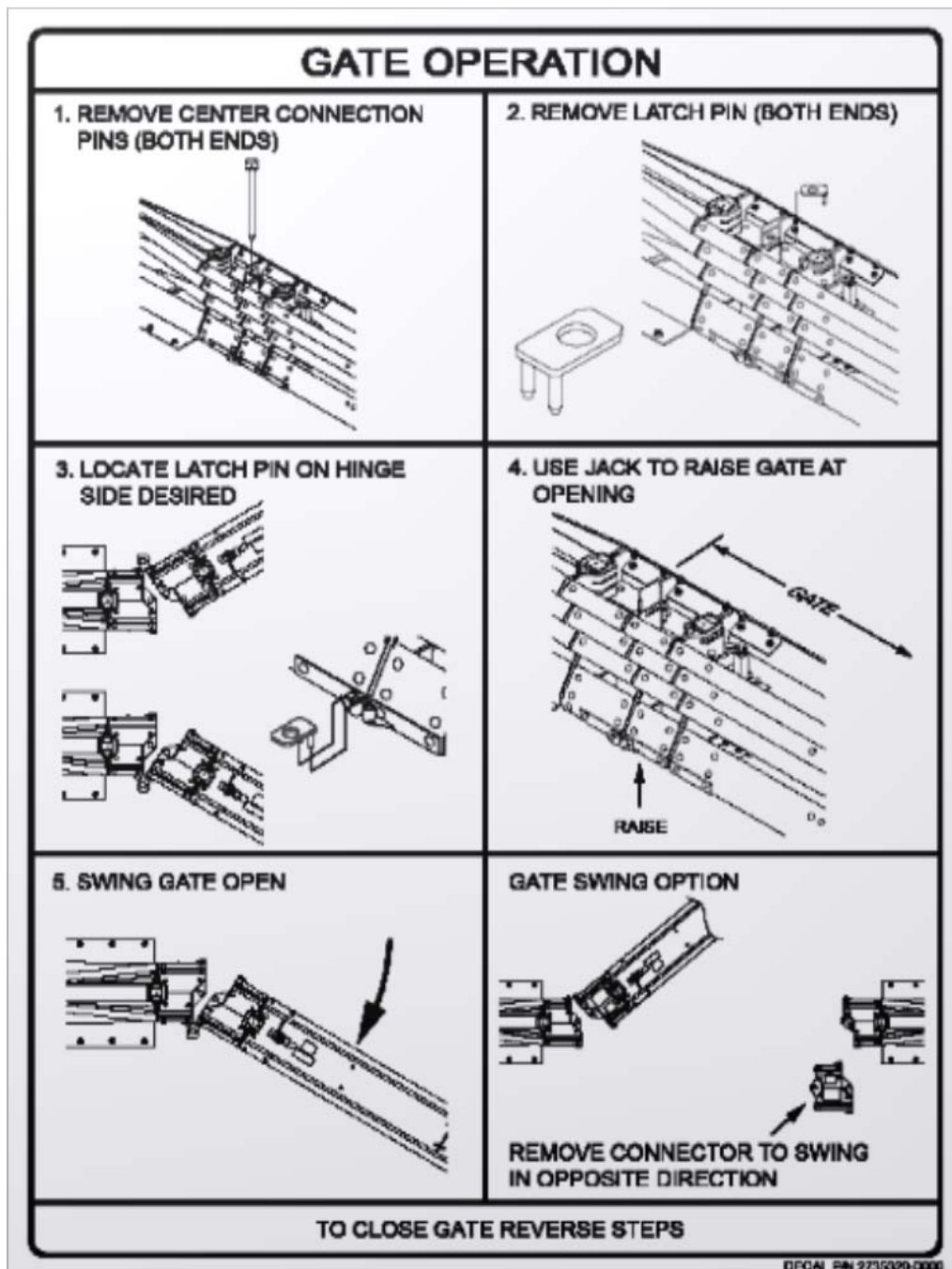
Vulcan Gate™

Operation

CAUTION: Thoroughly check to ensure the Vulcan Gate is clear of people, debris or obstructions before operating.

IMPORTANT: Do not attempt to move the gate before reading the manual in its entirety. Read all warning labels on the barrier.

CAUTION: The weight of the VulcanGate may cause the sections to swing into workzone traffic. Use extreme caution while operating the gate.



Vulcan Gate™

Maintenance and Repair

Each Vulcan Gate is made up of three main components, all of which are fully replaceable as designed to ensure a long service life.

The Vulcan Barrier is bolted together using standard guardrail bolts so any individual component can be easily removed and replaced.

Barriers which show evidence of impact will require close inspection of all struts, braces and supports showing particular attention to weld point integrity.

The hinge and transition sections are made to unpin from the barrier and CMB for easy replacement. As with all components after impact, inspect for any structural deformation and replace components as necessary.

It is not recommended to self-repair any components as this will compromise the integrity of the barrier in regard to its original design specification. Any damaged sections must be replaced with original modular sections supplied by the manufacturer. Failure to do so could compromise the performance of the Vulcan Gate.

Details of the Vulcan Gate assembly are contained throughout this manual.

Limitations and Warnings

The Vulcan Gate has been fully tested and evaluated as per the recommendations of NCHRP 350.

The Vulcan Gate is capable of decelerating and redirecting an errant vehicle (820 kg and 2000 kg [1808 lbs and 4409 lbs]) at speeds up to 100 km/h [62 mph] (Test Level 3) and angles up to 25 degrees with maximum slope/cross slope of 3 degrees in deployment.

To provide for adequate performance in the event of an impact, the Vulcan Gate must be deployed and maintained in accordance with the manufacturer's instructions, NCHRP 350, and local authority guidelines.

Impacts that exceed the design capabilities described in this manual (vehicle weight, speed and impact angle) may not result in acceptable crash performance as described in NCHRP 350 relative to structural adequacy, occupant risk and vehicle trajectory factors.

Vulcan Gate™

Notes:

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Notes:

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Notes:

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