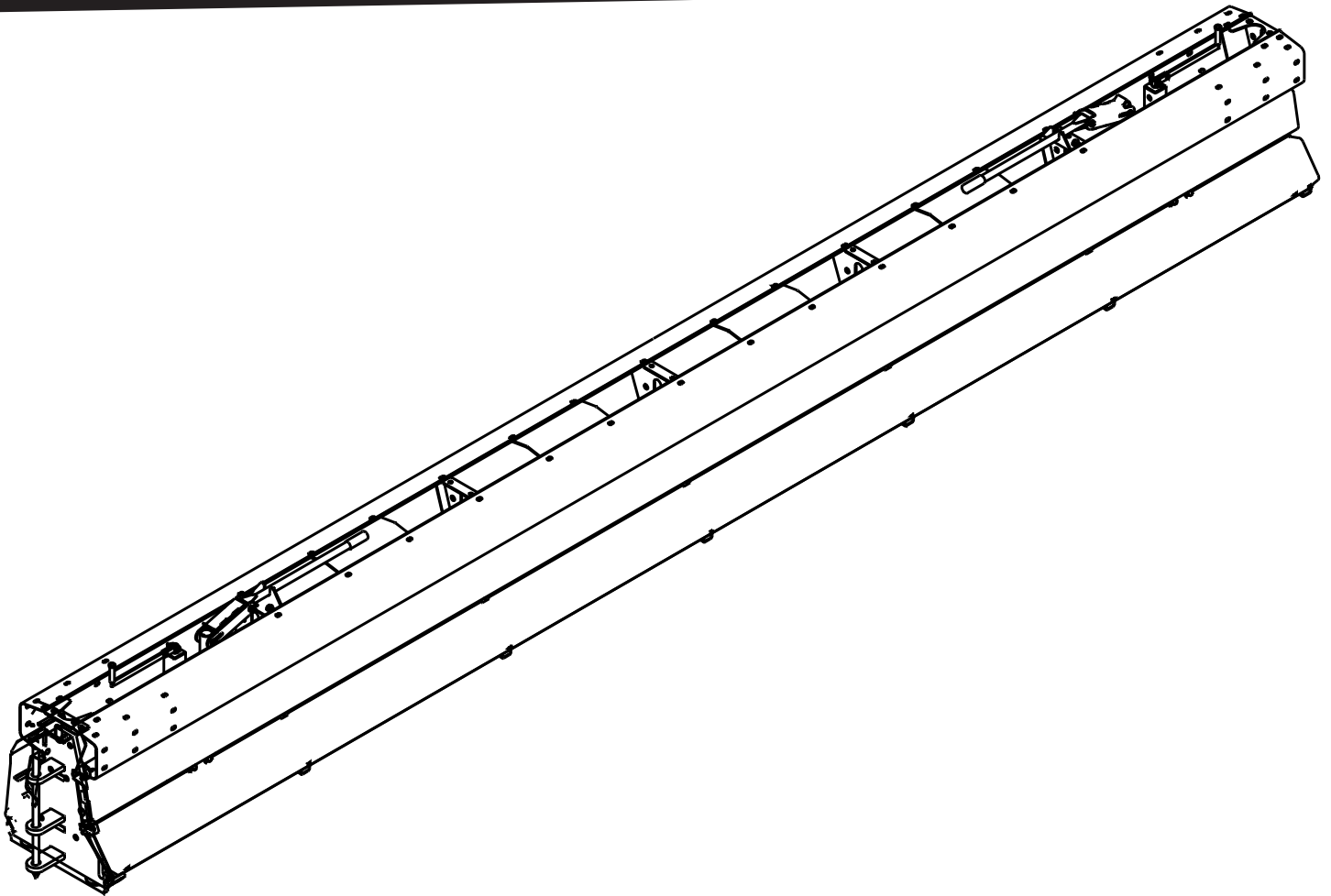


ARMORGUARD® BARRIER

NCHRP 350 TL-3 Movable Longitudinal Steel Barrier
1823784 - Installation and Maintenance Manual



BARRIER SYSTEMSTM
BY LINDSAY



Installation and Maintenance Manual Supplement ARMORGUARD® BARRIER

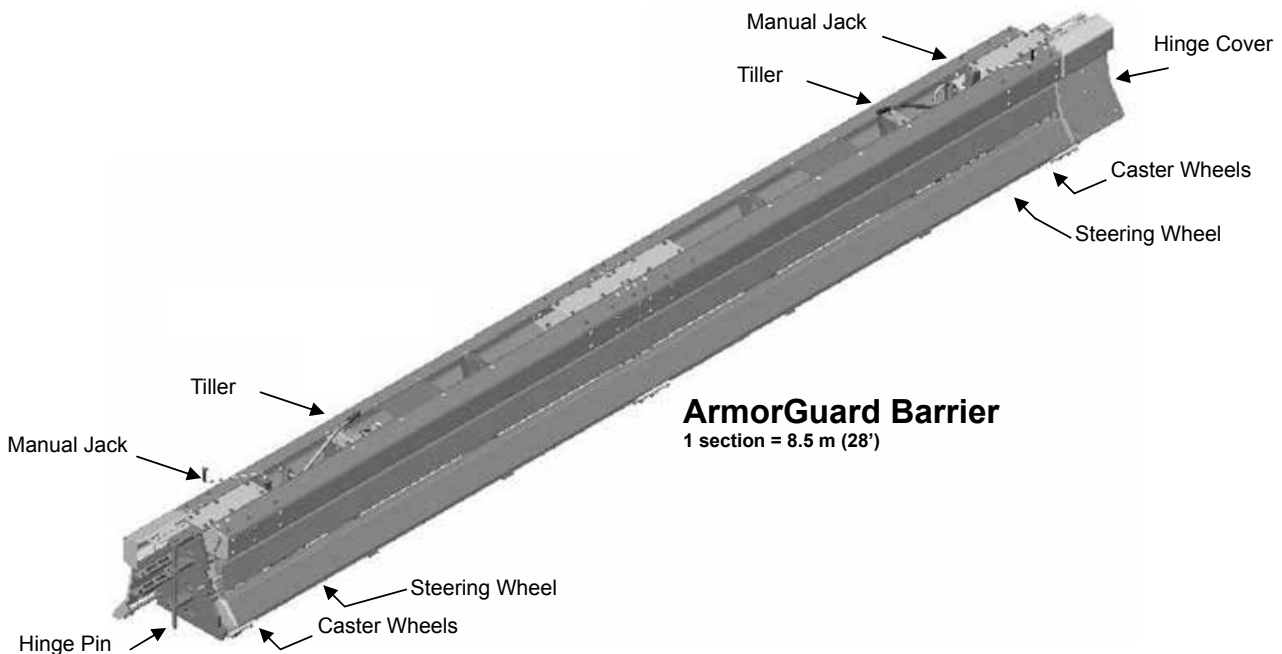
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PREFACE

The ArmorGuard Barrier (AGB) incorporates the newest roadside safety materials and engineering processes.

As with any roadside safety device, the AGB must be installed and operated properly to insure proper performance. Thoroughly review and fully understand the installation instructions and product limitations before starting the installation. Do not start the installation without the proper plans and tools required for installation.

If you need additional information or have questions about the ArmorGuard Barrier please call the Lindsay Transportation Solutions Customer Service Department at (888) 800-3691 (U.S. toll free) or (707) 374-6800.



ArmorGuard Barrier
1 section = 8.5 m (28')



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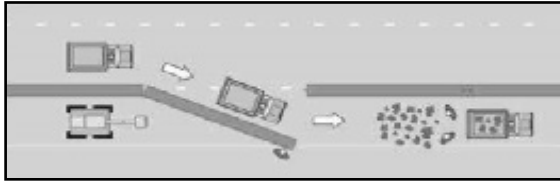
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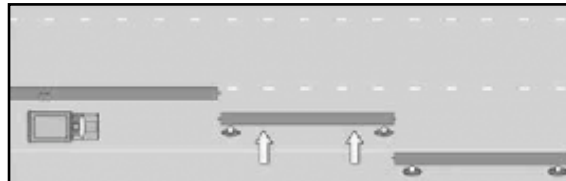
Any claim by the Buyer with reference to Products sold hereunder for any cause shall be deemed waived by the Buyer unless LTS is notified in writing, in the case of defects apparent on visual inspection, within ninety (90) days from the delivery date, or, in the case of defects not apparent on visual inspection, within twelve (12) months from the said delivery date. Products claimed to be defective may be returned prepaid to LTS' plant for inspection in accordance with return shipping instructions that LTS shall furnish to the Buyer forthwith upon receipt of the Buyer's notice of claim. If the claim is established, LTS will reimburse that Buyer for all carriage costs incurred hereunder.

The forgoing warranty benefits shall not apply to (i) any Products that have been subject to improper storage, accident, misuse or unauthorized alterations, or that have not been installed, operated and maintained in accordance with approved procedures and (ii) any components manufactured by the Buyer.

Applications and System Characteristics



Open Intermediate Sections: Provides positive protection with maximum flexibility.



Assemble in minutes: Built-in tiller wheels allow easy movement and repositioning.



Easy to Tow: The System can be towed longitudinally to create a portable work zone.



Attaches to PCB: Attach to portable concrete barrier to create safe access points.

System Characteristics:

- Minimum lengths of 68 m (Test Level 3) and 34 m (Test Level 2)
- Maximum Deflection < 2 m (Test Level 3) and < 1 m (Test Level 2)
- Barrier width approximately 710 mm (28")
- Barrier section height approximately 812 mm (32")
- Barrier section weight approximately 1500 kg (3,000 lbs.)
- All structural steel sections galvanized in accordance with ASTM 123
- System tested to NCHRP Report 350, Test Level- 3 (100 km/h – 62 mph) and Test Level-2 (70 km/h – 43 mph)
- Two people can open or close a section in less than 5 minutes, without power
- Greater than 68 m (223') can be moved longitudinally in a single pass using a pickup truck

INTRODUCTION

The ArmorGuard Barrier has been fully tested in accordance with the evaluation parameters contained in NCHRP Report 350 (Test Level 2 and 3). The system is a heavily reinforced steel barrier that was designed to offer a practical solution for including positive barrier separation in short-term construction work zones and controlled access points on long term construction projects.

The system is ideal for locations where safety and barrier portability are paramount. Freestanding barrier sections come in 8.5 meter (28 ft) lengths and multiple sections can be quickly interlocked to form a portable barrier wall in minutes.

Individual links or multiple connected sections can be raised onto wheels with a manual jack. No electrical power or sophisticated control systems are required. The barrier can be easily deployed or repositioned by hand or with a vehicle to positively separate and protect both workers and motorists. You can easily create a portable crashworthy barrier for work zones with controlled access for vehicles and equipment.

The system can be deployed on a level or sloped ($\leq 8\%$) smooth surface (concrete or asphalt pavement) or on any relatively smooth surface (gravel on base) capable of supporting the weight of the system.

SYSTEM OVERVIEW

Longitudinal barriers are highway safety devices whose primary functions are to prevent vehicular penetration and to safely redirect errant vehicles away from roadside or median hazards. The ArmorGuard Barrier is used as a portable longitudinal barrier. Each 8.5 meter (28 ft) section is hinged at both ends and a manual jack system to raise the gate section onto wheels. A steering wheel is located on both ends of each barrier section. The steering wheel is attached to a tiller handle located at the top of the barrier that can be used to steer the link section in virtually any direction.

With the tillers pointed in the same direction multiple sections of barrier can be simultaneously moved.

Large systems of barrier can be quickly moved to a new lane position or to the curb or median using a vehicle equipped with a special roller device (see Figure 16). The system is approximately 700 mm (28") wide, 830mm (33") high and 8.5 meters (28 ft) in length. The system can be easily and quickly deployed or stored without expensive electrical power supplies or sophisticated control systems.

REQUIRED TOOLS

ArmorGuard Barrier sections are delivered to the jobsite fully assembled and ready for service. No assembly is required.

Manually Lifting a Section:

- The manual lifting system allows a section to be lifted with NO tools.

For General Operations:

- Truck mounted wheel assembly (for lateral moves with a vehicle)
- Come-along (for steep slope operations)
- Chain and clevis (for loading and unloading)
- Pry/construction bar

BEFORE INSTALLATION

Placement and use of the ArmorGuard Barrier should be accomplished in accordance with the guidelines and recommendations set forth in the "AASHTO" Roadside Design Guide," FHWA memoranda and other state and local standards for longitudinal barrier.

The system is a highly engineered safety device made up of a relatively small number of parts. Before starting use of the system, become familiar with the basic elements that make up the system.

Before beginning the use of the system, check the packing list to be certain that all of the system components were included in the shipment. If any parts are found to be missing or damaged call the Lindsay Transportation Solutions Customer Service Department at (888) 800-3691 (U.S. toll free) or (707) 374-6800.

Deploying ArmorGuard Barrier at a Job Site

Picking up a section



Figure 1. Use the holes located in the tops of the inboard diaphragms as two lifting points. Lift with a hook or clevis and a suitable cable or chain. Follow OSHA guidelines for safe forklift operation.



Figure 2. Use a crane, tractor or forklift to move the sections from the transport vehicle or trailer onto the job site.

NOTE: Each 8.5 meter section weighs approximately 3000 lbs (1500 kg). While moving, keep your feet clear and never stand under a lifted section. Personnel should stand to the side and guide the section into place. Remain in control of the section being lifted at all times.

Do not pick up sections with a forklift as damage may occur to the bottom panels from the forks.

Failure to safely secure and or control a section could result in damage to the section or equipment as well as bodily injury or death. Follow OSHA guidelines for the safe fork lift operation.

Operational Instructions

A section can be lifted onto its wheels for storage or deployment by a manual jacking system.

Manual Jacking System

To manually raise a section, locate the crank on the end of a section (Figure 3). Remove the crank from its cradle and simply rotate the crank clockwise to raise the system or counterclockwise to lower the section back to the ground. (Both ends must be in the fully raised position before moving.)



Figure 3. Manually jacking a section

To avoid damage to system components, caution should be taken that each wheel assembly (hand jack) is fully deployed during moving operations and fully retracted when in use.

Moving the System with Personnel

After the section has been lifted and locked in the up position it can be moved with human power or vehicle power. The first step in any move is to position the tillers so that the section will move in the desired direction.

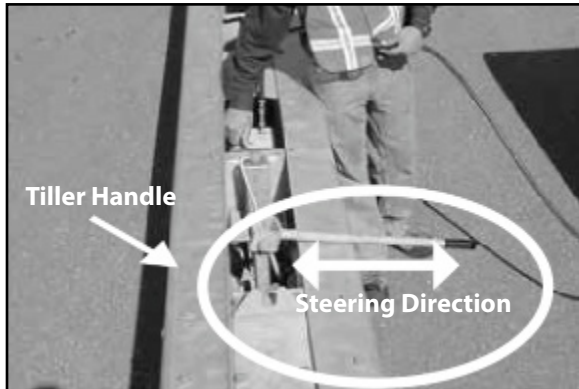


Figure 4. The Steering Wheels are connected to the Tiller Handle located on the top of each end of the barrier. Remove the Tiller Handle from its cradle and use it to position the steering wheels in the desired direction of travel.

NOTE: Failure to follow this procedure could cause damage to the steering wheels. Never force a section in a direction other than in the steering wheel direction.



Figure 5. Relocate the section, or in this case Multi-section (56') to the desired position. Typically two people can easily control and move a single link section (28') and 3 people are typically used to move a multi-section (56') as shown above.



Figure 6. (QUICK TIP) If a section is difficult to get started moving, use the Hinge Pin as a lever to start the section moving.



Figure 7. There are two different ends on a barrier section. Be sure that you have a Lower hinge matched with an Upper hinge section before installing the hinge pin.



Figure 8. When all of the holes of the two section hinges are aligned, install the hinge pin. The pin must be fully installed.

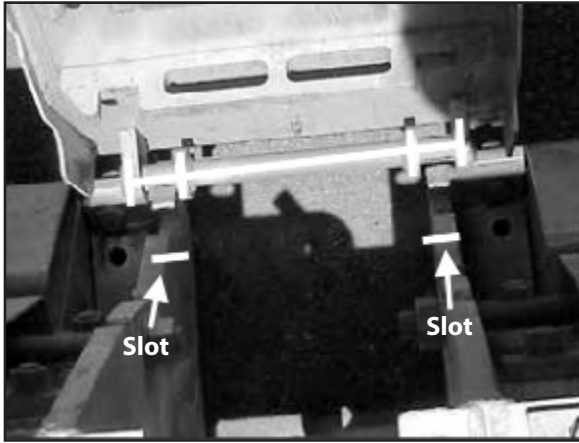


Figure 9: Install the hinge covers by first dropping the rod located on the inside bottom of the cover in the slots located on each of the hinge bases. Rotate the cover up to the closed position and install the two keeper pins through the top.

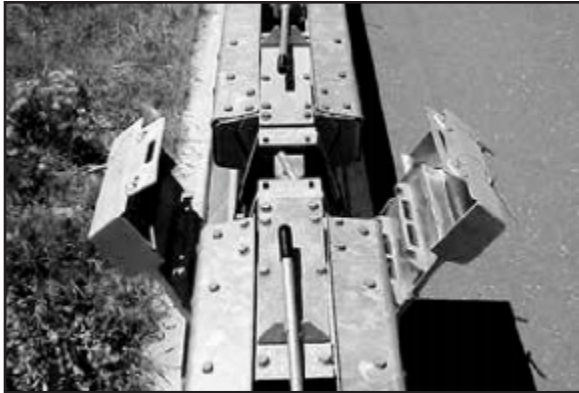


Figure 10: The hinge covers will stay upright and opened after the cover is installed as instructed above.



Figure 11: Rotate the cover up to the closed position and install the two keeper pins through the top as shown below.

The barrier section is now ready to be lowered on to the ground and put into service. Depending on how the section was raised, either activate the Air Control Panel to lower the section or hand jack the section back to the down position.

CAUTION: Keep feet clear from the edge of the section when lowering.

NOTE: For proper operation all hinge pins and hinge covers must be installed and each section must be **FULLY** lowered so that the section rests on the ground and not on the wheels.

Moving Barrier with a Vehicle

BSI manufactures a truck mounted barrier push roller adapter assembly that can be easily attached to a standard pickup. Using a vehicle, large sections of barrier can be moved quickly and safely.



Figure 12: The push rollers move the barrier sections without causing damage.



Figure 13: To deploy a barrier wall that is stored against a curb, move the end of the barrier out so that the truck can gain access.



Figure 14: Push the barrier over with the vehicle as you drive along the side of the barrier. The tiller handles must be pointed in the direction of desired movement.



Figure 15: As the wall is being repositioned personnel lower each section at its final deployment or storage position.

Relocating Sections with a Vehicle

A pickup can be used to pull large sections of barrier either at an angle or straight.



Figure 16. Attach the length of link barrier to a truck using a chain or a hinge pin as show above.



Figure 17. Pull the barrier straight or at an angle. For an angled move, all of the steering wheels (using the tiller handle) must be positioned in the desired direction. Always use caution when towing large sections of barrier.

Using AGB on Uneven Surfaces

A pickup can be used to pull large sections of barrier either at an angle or straight.



Figure 16. Use a winch or a “come along” as shown above to bring two sections together on a slope so that the hinge pin can be removed or installed.

Use caution when moving sections on a slope or on the crown of a roadway. Barrier sections roll easily and control of the sections must be maintained at all times.

The steering wheel can be used as a break to stop the movement of a section on a slope when the wheel is positioned perpendicular to the direction of the slope.

ArmorGuard Barrier Operation on Sloped Surfaces

The ArmorGuard Barrier is designed to be placed on surfaces (that are in compliance with that stated in the Product Specifications) with slopes up to 8% (<5°). The AGB shall be capable of performing in compliance with the requirements for a longitudinal barrier in the National Cooperative Highway Research Program Report 350 (NCHRP 350), Test

Level 3, when installed in this condition. However, if the AGB is to be installed on a sloped surface, provisions need to be made to always ensure that there is positive control of the system in the opening and closing operations. Lack of positive control could lead to potential injury of operating personnel or adjacent motorists if the system were to swing open or closed in an uncontrolled manner.

To ensure that the system is positively controlled, a rope, or "tether line," with a tensile capacity of at least 2000 pounds (900 kg) should be connected between the removable AGB element and the system. Anticipated lateral loading from an 8% slope should be less than 200 pounds (90 kg). Once the "tether line" is firmly connected, remove the hinge pin and then raise the system onto the wheels. The system should be raised slowly and only a small amount (to just come onto the wheels) to keep positive. If the barrier starts to move, tilt it slightly so that the rubber pads act as a friction brake and then slowly play line out to guide the section in the desired location.

Typically, the tether line should be attached between the "uphill" elements, since the moveable element will have a tendency to roll downhill when the system is raised onto the wheels.

The same tether line system can be used to pull the system back into position when it is being closed. Do not disconnect the tether line until the hinge pins are in the locked position, the barrier is lowered onto the road surface, and the system is secured.

If it is necessary to disconnect the tether line without the hinge pins being locked in place, lower the barrier to put the full weight of the section onto the rubber pads resting on the road surface and with the wheels not touching the road surface.

ArmorGuard Barrier Towing Specifications

The ArmorGuard Barrier can be rolled manually around a job site over any solid ground that can support its weight. Deep troughs or potholes are not acceptable since the wheels will drop into the depression and the barrier will high center.

The ArmorGuard Barrier can be towed short distances at low speeds. Care must be taken to ensure safety, reliability, and to limit damage and wear to the system. A smooth, flat road surface is necessary for longitudinal transfers longer than the length of the system being moved, (usually 400-1000 feet). If any of the following specifications cannot be met, the system must be alternatively transported.

Surface Conditions for Towing:

- Smooth surface capable of supporting the weight of the system
- No potholes, rumble strips, or raised pavement markers
- Less than 2 degree cross slope

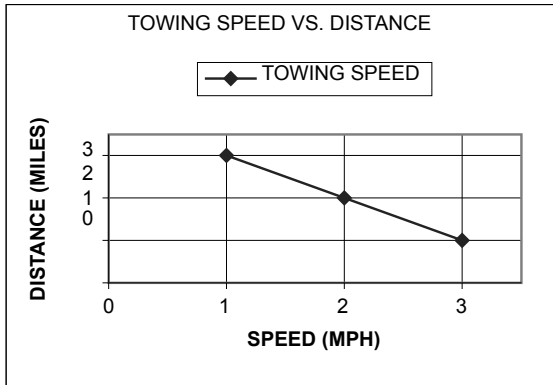
It is acceptable to tow a system across a rumble strip or raised pavement markers as long as the speed is less than 1 MPH.

Towing Control:

- A pivoting or flexible attachment should be used to connect the tow vehicle to the Link series (example: chain, strap, or link bars). This limits excessive wear to the front wheel assemblies.
- The first (3) tiller positions behind the tow vehicle must be manually steered as the tow vehicle turns to minimize scrubbing.
- Proper tethering or restraints should be used when navigating cross slopes or descents to ensure control at all times.
- Adequate personnel must be utilized to control the system while under tow. The system requires monitoring and steering corrections at various tiller locations in the series.

Towing Speed:

- Towing speed is never to exceed 3 mph –
Speeds greater than 3 mph may cause severe wheel damage
- For longer distance transfers, the speed limit reduces (see Chart)
 - 1 mile transfer ≤ 3 mph maximum
 - 2 mile transfer ≤ 2 mph maximum
 - 3 mile transfer ≤ 1 mph maximum



- Towing distance should not exceed 3 miles

Relocating Sections with a Vehicle

ArmorGuard Barrier has been rigorously tested and evaluated per the recommendations in the NCHRP Report 350 Guidelines for Test Level 3 (TL-3) longitudinal barriers. The impact conditions recommended in NCHRP 350 are intended to address typical in-service collisions.

When ArmorGuard Barrier is properly installed and maintained, the system is capable of redirecting impacting vehicles in a predictable and safe manner under the NCHRP 350 impact conditions of:

Vehicles: Pickup (2000P) and small car (820C)

Mass: 4400 lbs. (2000 kg) & 1800 lbs. (820 kg)

Speed: 62 mph (100 km/hr)

Angle: 25 degrees for pickup and 20 degrees for small car

Vehicle impacts that vary from the NCHRP 350 impact conditions described for longitudinal barriers may result in significantly different results than those experienced in testing. Vehicle impact characteristics different than or in excess of those encountered in NCHRP 350 testing (speed and angle) may result in system performance that may not meet the NCHRP 350 evaluation criteria.

Periodic Maintenance

The ArmorGuard Barrier System has been designed to minimize the need for periodic maintenance. The only periodic maintenance items that need to be addressed are as follows:

- Apply grease (Chevron EP NLGI 2 grease or equivalent) to the zerk fittings on the caster wheels at least annually.

General Inspection and Maintenance

Drive-by Inspection

Drive-by type inspections should be performed at least monthly. The purpose of the drive-by inspection is to observe for the following characteristics:

- Any evidence of vehicle impacts.
- Structural damage.
- Loose or out of place components.
- Excessive debris build-up that would not allow the system to be operated.

If any of these conditions are observed, a walk-up inspection is required.

Walk-up Inspections

Walk-up inspections should be conducted at least annually and whenever deemed appropriate from a drive-by inspection. A walk-up inspection should consist of the following items:

- Structural components – Conduct an inspection of all structural assemblies to ensure that all components are structurally sound, properly connected and there are no loose fasteners or damaged components. The hinge pins should be in position and free to move and the hinge covers properly fitted and connected. Any components observed to be nonconforming to the manufacturer's drawings should be replaced or repaired.
- Operating systems – Raise, hold, and lower the system in accordance with the operating instructions and ensure that the hinge covers, hinge pins, casters and other functional components operate in the proper manner. Any components observed to be deficient should be repaired or replaced in accordance with the manufacturer's instructions.
- General cleaning – The area around and within the internal and external operating area should be kept free

of debris that could affect either the impact performance or restrict the ability to open or close the system when needed.

For additional information regarding this product, please contact:

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Installation manual for the ArmorGuard system is subject to change without notice to reflect improvements and upgrades. Please contact Barrier Systems by Lindsay to confirm that you are using the most current installation manual and instructions.

Additional information is available from Barrier Systems by Lindsay. © Barrier Systems by Lindsay