

N-E-A-T[®]

Non-Redirective Energy Absorbing Terminal



A Non-Redirective Crash Cushion End Treatment Solution for Work Zones



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A Quixote Company
Saving Lives By Design

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Installation Manual

N-E-A-T®

System Overview

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Important Introductory Notes

Proper installation of the N-E-A-T® System 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 any crash cushion without the proper plans and installation manual from the manufacturer.

If you need additional information, or have questions about the N-E-A-T System, please call Energy Absorption Systems' **Customer Service Department at (888) 323-6374**.

RETURN GOODS POLICY

Before returning any goods for credit please contact Energy Absorption Systems Inc. Customer Service Department at 1-888-323-6374 or your local distributor for proper instructions.

The N-E-A-T System is a non-redirective, energy absorbing terminal. It is used as an end treatment solution for temporary work zones. The N-E-A-T System can be attached to the ends of Jersey-shaped Portable Concrete Median Barrier, and the moveable QuickChange® Barrier. The N-E-A-T cartridge is constructed of a series of aluminum cells of various sizes and thicknesses wrapped in an aluminum skin. These cells, when impacted at the end by an errant vehicle crush upon impact to absorb the energy. The backup hardware, Transition Panels and support structures are designed so that they can be installed using only simple hand tools in a matter of minutes. After most impacts, removal of the cartridge requires only the pulling of four pins.

Crash Performance

The N-E-A-T System has successfully passed the NCHRP 350 Test Level 2 tests with both the light car and pickup truck at speeds up to 70 km/h (45 mph) at angles up to 20 degrees. It meets the NCHRP 350 Test Level 2 Criteria for non-redirective crash cushions in work zones.

The N-E-A-T® TL-1 System has successfully passed the NCHRP 350 Test Level 1 tests with both the light car and pickup truck at speeds up to 50 km/h (31 mph) at angles up to 20 degrees. It meets the NCHRP 350 Test Level 1 Criteria for non-redirective crash cushions in work zones.

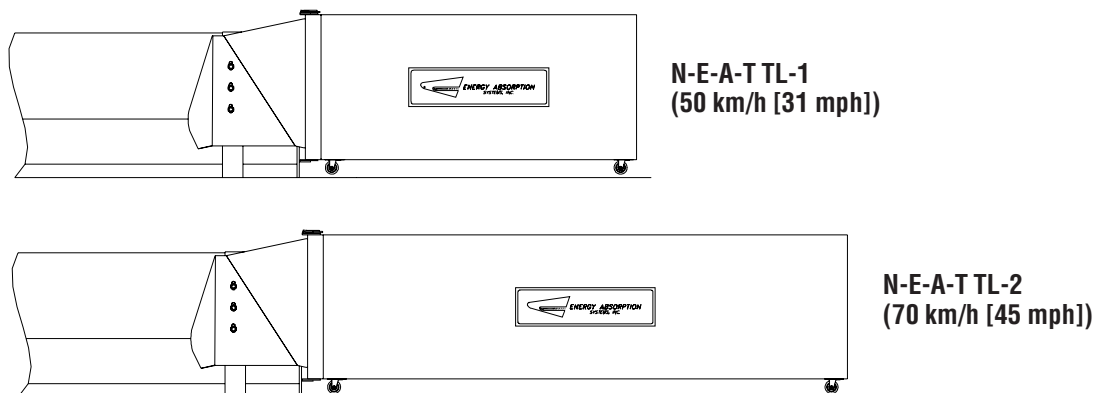


Figure 1

Installation

Required Tools

For PCMB Application:

1. 1/2" ratchet wrench with 5" extension
2. 1/2" drive sockets: 9/16", 3/4", 1 1/8"
3. 5/16" allen wrench
4. (2) 3/4" open end or box end wrenches
5. (2) 2m [6'] long steel pry bars
6. 10 mm [3/8"] thick piece of steel shim roughly 100 mm x 300 mm [4"x12"], or larger.
7. 1/2" torque wrench
(27 to 270 Nm [20 to 200 ft-lbs])
8. Large block of wood or several smaller blocks roughly totaling 250 mm x 250 mm x 250 mm [10" x 10" x 10"]
9. measuring tape
10. 3 lb. sledge hammer
11. gloves

For QMB Application:

1. Rotohammer or similar tool for drilling in concrete with 7/8" diameter concrete drill bit and compressed air
2. 1/2" ratchet with 5" extension
3. 1/2" drive sockets: 9/16", 1 1/8", 1 1/4", and 1 5/16".
4. 1 1/8" open/box end or crescent wrench.
5. 2 m [6'] long steel pry bar
6. 1/2" torque wrench
(20 to 270 Nm [15 to 200 ft-lbs])
7. 5/16" Hex wrench
8. Measuring tape
9. 3 lb. sledge hammer
10. Gloves

Note: *The above list of tools is a general recommendation. The actual number of tools required will depend on specific site conditions and the complexity of the installation.*

Site Preparation/Foundation

The N-E-A-T® System should be mounted to a fully cured 27.6 MPa (4000 psi) concrete PCMB (New Jersey Type) or QMB barrier end with approximate dimensions of 610 mm (24") wide by 810 mm (32") high. The N-E-A-T System may be positioned over concrete, asphalt or soil surface conditions having a cross slope of less than 8% and varying less than 1% over the system length.

Inspect Shipment

Before installing the N-E-A-T System, check the received parts against the shipping list supplied with the System. Make sure all parts have been received.

N-E-A-T®

Installation (cont'd.)

Note: The drawing package supplied with the N-E-A-T® System must be used with these instructions for proper assembly and should take precedence over these general instructions.

Unpacking

Care should be taken to avoid damaging the sides of the N-E-A-T cartridge when removing the shipping container and completing the system assembly. As soon as possible, place the N-E-A-T cartridge onto its swivel wheels to facilitate handling. To minimize risk of injury to yourself or the cartridge, avoid sitting on or placing tools onto the cartridge. Check the inventory of parts received against the parts list supplied with the system and make sure all parts have been received. Should any touch-up painting be required, use "Highway Safety Yellow" colored paint. If any problems are encountered, we encourage you to contact our **Customer Service Department** at 1-888-323-6374.

How to Determine Left/Right and Front/Rear

To determine left from right when installing the N-E-A-T System or when ordering parts, stand facing the hazard to be protected. Your left is the system's left and your right is the system's right. The front of the fully assembled system will be nearest you and the rear of the system will be attached to the hazard.

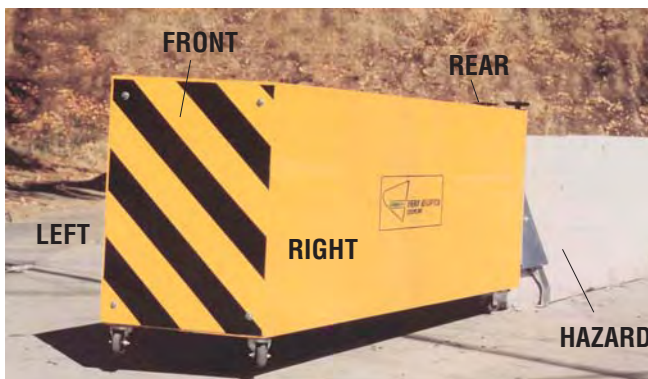


Figure 2

Installation Procedures for PCMB Applications

For standard New Jersey pin and loop PCMB, Energy Absorption Systems, Inc. has developed a quick and easy method of attaching the N-E-A-T Cartridge utilizing simple hand tools only.

Installation Summary

The PCMB is first lifted, and then shimmed so that the Lower Support Strap can be slipped under the end and bolted into place. Next, the Cartridge Support Structure is placed onto the end of the PCMB and tightened down. The N-E-A-T cartridge is then rolled and pinned into place, and the shim is removed. Then the left and right transition panels are bolted into place.

Step 1: Lifting the PCMB (See Figure 3)

WARNING!

Be careful when placing the shim under the PCMB. Your fingers and/or hands can be severely injured!

Begin the PCMB installation by lifting the end of the PCMB section. This can be accomplished by using a large block of wood and a 2 m [6'] long pry bar. Energy has found that by placing the block of wood near the bottom loop of the PCMB and utilizing it as a fulcrum and then placing one end of the pry bar under the bottom loop of the PCMB, one person can lift the end of a 3 m [10'] long section of PCMB.

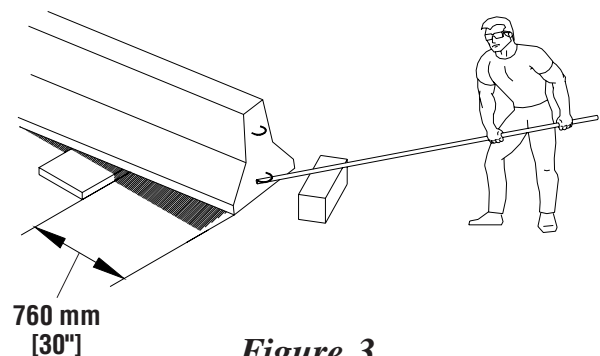


Figure 3
Lifting the PCMB

N-E-A-T[®]

Installation for PCMB Applications

Step 2: Installing the Support Strap (See Figure 4)

Slide the Lower Support Strap so that its edge is about 305 mm [12"] back from the end of the PCMB. Next, straddle the Upper Support Strap over the PCMB and align with the Lower Support Strap. Insert the 3/4 inch diameter bolts starting with the upper strap through to the lower strap and place the nuts on the end of the bolts. **HAND TIGHTEN ONLY!**

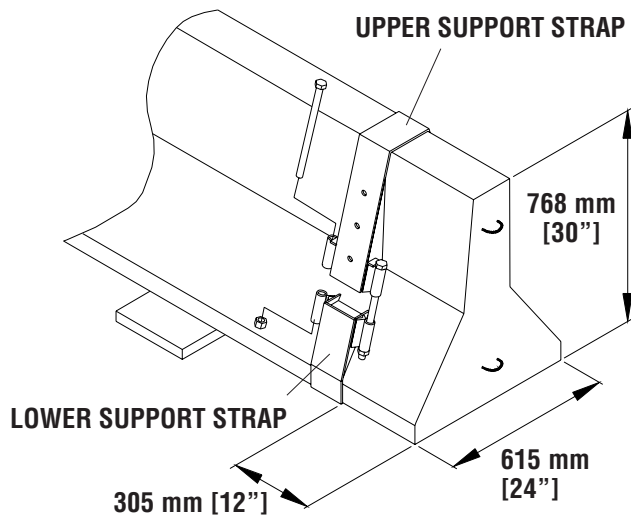


Figure 4
Support Strap Installation

Step 3: Support Structure (See Figure 5)

- Position the Support Frame so that the shorter tubes are on top. Place the flat side (that is the side opposite the tubes) onto the end of the PCMB so that the PCMB's loops protrude through the slots.
- Place a Backup Attachment Bracket over each of the two protruding loops of the PCMB so that the bracket nests into the slot of the Support Frame, and the bracket's flanges face outward. The bottom of the Support Frame should be flush with the bottom of the CMB.
- Insert the Wedges through the Backup Attachment Brackets and into the loops, one from the top and one from the bottom, as shown in Figure 3. Place a nut on top end of the 762 mm (30") long threaded 1/2" diameter rod and insert it through the upper and lower wedges. Place nut on bottom of threaded rod so that rod does not protrude past bottom of CMB. Align the bottom of the Support Frame with the bottom and centered left to right on the PCMB section. Torque to 80 Nm [60 ft-lbs].

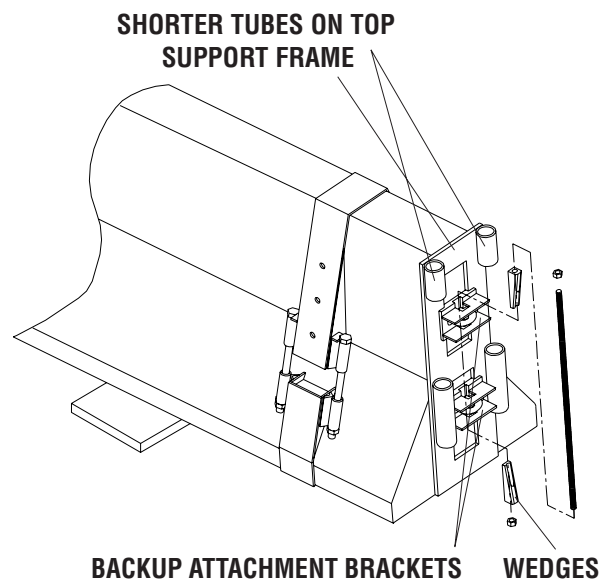


Figure 5

N-E-A-T[®]

Installation for PCMB Applications (cont'd.)

Step 4: Backup Attachment (See Figure 6)

The Backup is attached to the rear of the N-E-A-T[®] Cartridge. It is attached so the tubes are on the side away from the cartridge and the flange with the cut-out is at the bottom. There are three sets of mounting holes on the Backup. Choose the set of holes so that the bottom edge of the Cartridge will be 100 mm [4"] off the ground. In the majority of cases, the middle set of holes will result in proper cartridge height. Place the Backup onto the the rear end of the N-E-A-T Cartridge, and fasten the eight 1/2" inch nuts with their flat washers and lockwashers into place. Torque to 122 Nm [90 ft-lbs].

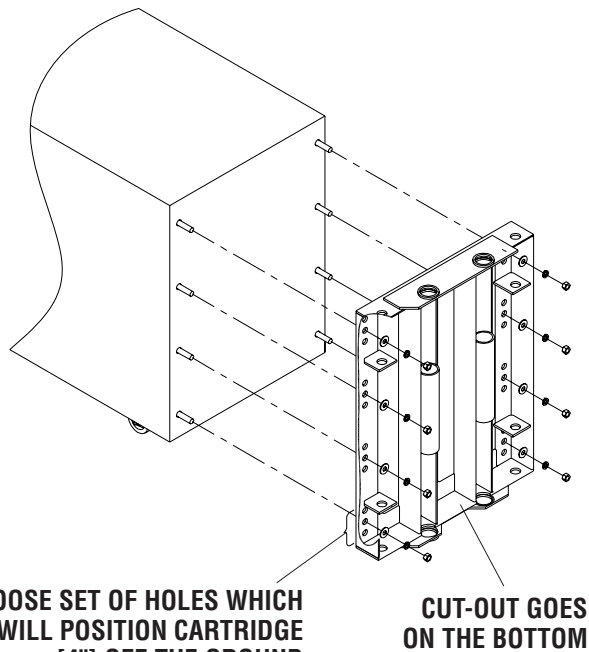


Figure 6

Step 5: Cartridge/Backup to Support Structure Attachment (See Figure 7)

Roll the Cartridge with the attached Backup against the Support Frame until the tubes on the Backup nest with the tubes on the Support Frame. It may be necessary to lift the rear end of the Cartridge so that the tubes can nest. Place the two large 38 mm [1 1/2"] diameter by 900 mm [35"] long pins into the two sets of nested tubes to hold the Cartridge into place. To get the pins to fall into place, it may be necessary to align the tubes on the Backup and Support Frame. This can be easily done by carefully lifting the front end of the N-E-A-T Cartridge with a pry bar. (Be careful not to damage the Cartridge when doing so, protect the Cartridge with a piece of scrap lumber.)

WARNING!

To avoid straining your back, use the pry bar to lift the end of the cartridge!

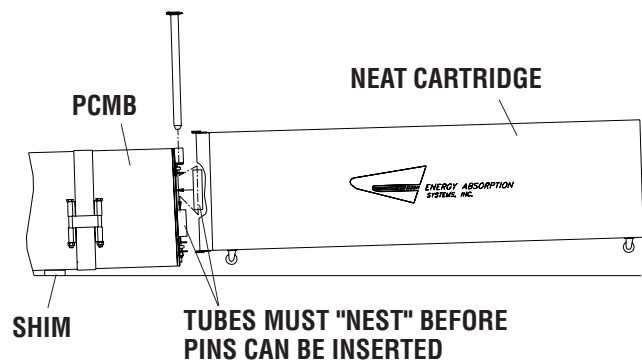


Figure 7

N-E-A-T[®]

Installation for PCMB Applications (cont'd.)

Step 6: Transition Panel Installation (See Figure 8)

The Transition Panels can now be installed. Take one of the panels and place it up against the PCMB so that the holes in the forward tabs nest with the holes on the tabs on the N-E-A-T Cartridge's Backup. When the holes are aligned, insert the 900 mm [35"] long by 25 mm [1"] diameter pins which will hold the panel into place. Repeat this step on the other side.

Insert the three 1/2" X 1 1/4" long allen head socket bolts with their 1/2"x 1 3/8" washers into the holes on the Transition Panels but do not tighten. It may be necessary to move the Strap assembly forward or rearward to align the holes on the Transition Panel with the corresponding holes on the Strap assembly. Once all the bolts are in place, they should be torqued to 81 Nm [60 ft-lbs] with the 5/16 inch allen wrench.

Now tighten the four 3/4" bolts that hold the Support Straps together. They can be accessed from below using the 1 1/8" socket and the 6" extension, torque the nuts to 250 Nm [185 ft-lbs].

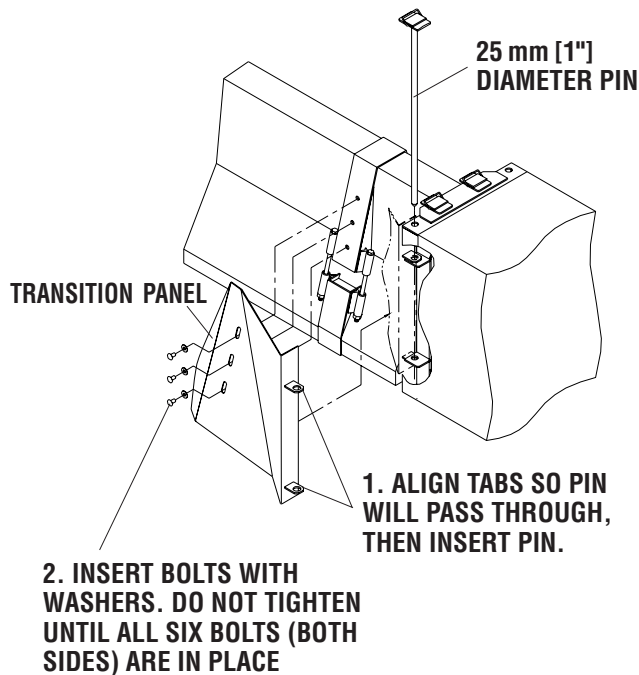


Figure 8

Step 7: Chevron Selection (See Figure 9)

The N-E-A-T Cartridge comes with uni-directional, left-hand, or right-hand bidirectional chevron markings.

Remove the four 3/8" bolts on the front of the Cartridge using the 9/16" socket, and depending upon Cartridge placement, use whichever chevron markings suit your application. Refer to MUTCD or state traffic control plan. Tighten the 3/8" bolts to 20 Nm [15 ft-lbs].

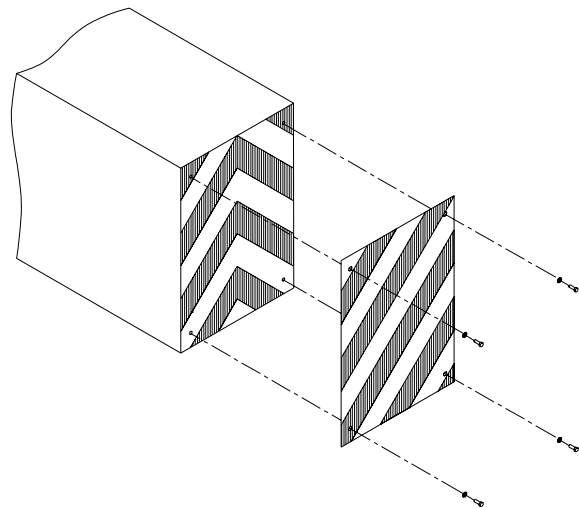


Figure 9

N-E-A-T®

Installation for PCMB Applications (cont'd.)

Step 8: Checking Installation Height (See Figure 10)

Now it is possible to remove the 10 mm [3/8"] thick shim from under the PCMB. This can be done by using the pry bar and the block of wood, this time lifting from under the backup frame.

CAUTION: Do not use the pry bar on the cartridge itself. Severe damage to the cartridge will result.

With the PCMB resting directly on the ground, measure how high the bottom of the Cartridge is from the grade. It should be 100 mm [4"] off the ground, and not vary by more than 25 mm [1"] over the length of the Cartridge.

If height adjustments are necessary, the following changes can be made:

- One of the remaining two hole patterns on the Backup can be used to raise or lower the Cartridge. The hole patterns are 38 mm [1 1/2"] apart. This adjustment method requires unpinning the cartridge from the Support Frame, removing the eight nuts from the Backup and repositioning up or down as necessary.
- It is also possible to raise or lower the Support Frame. This requires unpinning the Cartridge from the Support Frame and rolling it out of the way, loosening a Wedge tension nut, and then raising the Support Frame to the desired height before tightening the tension nut.

Moving the PCMB to Another Site

Should it be necessary to move the PCMB, first unpin the N-E-A-T® Cartridge and Transition Panels from the PCMB and roll the N-E-A-T Cartridge out of the way. Now, either the PCMB is moved to its new location or Support Frame is mounted on a PCMB at the new site. Either way, the N-E-A-T Cartridge is rolled into place and then repinned. (A second Support Structure may be favorable.)

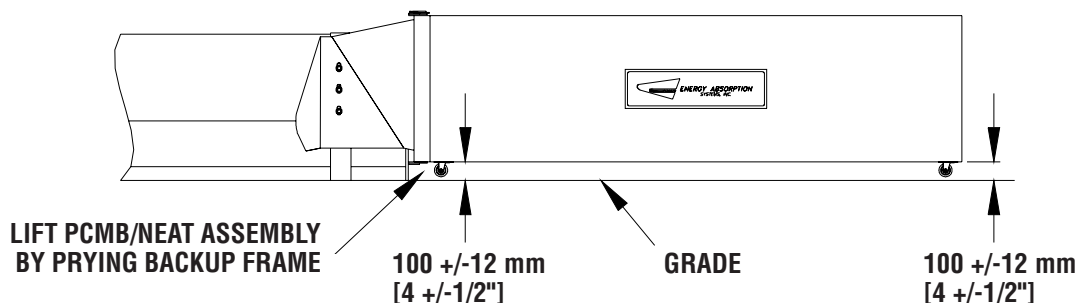


Figure 10

N-E-A-T®

Installation for QMB Applications

Installation Procedures for QMB Applications

Installation Summary

QMB installations first require the removal of the existing brackets on the front and the upper nuts on the rear of the end section, allowing the Support Frame and Transition Support to be bolted into place. Next the rear portions of the Transition Panels are pinned into place and the Backup is pinned to the forward support structure. The Transition Panels are then pinned to the Backup. Some drilling will be required for the first time installation of the system. Backup is then removed, and the Cartridge is attached to the Backup, and the MP-3 Anchor Bolts are installed through the top of the Transition support. Backup and Cartridge are then pinned to the Support Frame and Transition Panels. Details of each step follow below:

Step 1: Removal of Existing QMB Brackets (See Figure 11)

Using a 1 5/16" socket remove the existing nuts, lock washers and brackets from the end of the QMB to which the N-E-A-T will be attached. On the opposite end, pull out the pin connecting the QMB to the rest of the barrier. You may need to pry or tap this pin in order to get it out. Using the pry bar, pry the end section out about 125 mm [5"] from its neighbor. Remove the nuts and lockwashers from the top bracket only, leaving the bracket in place.

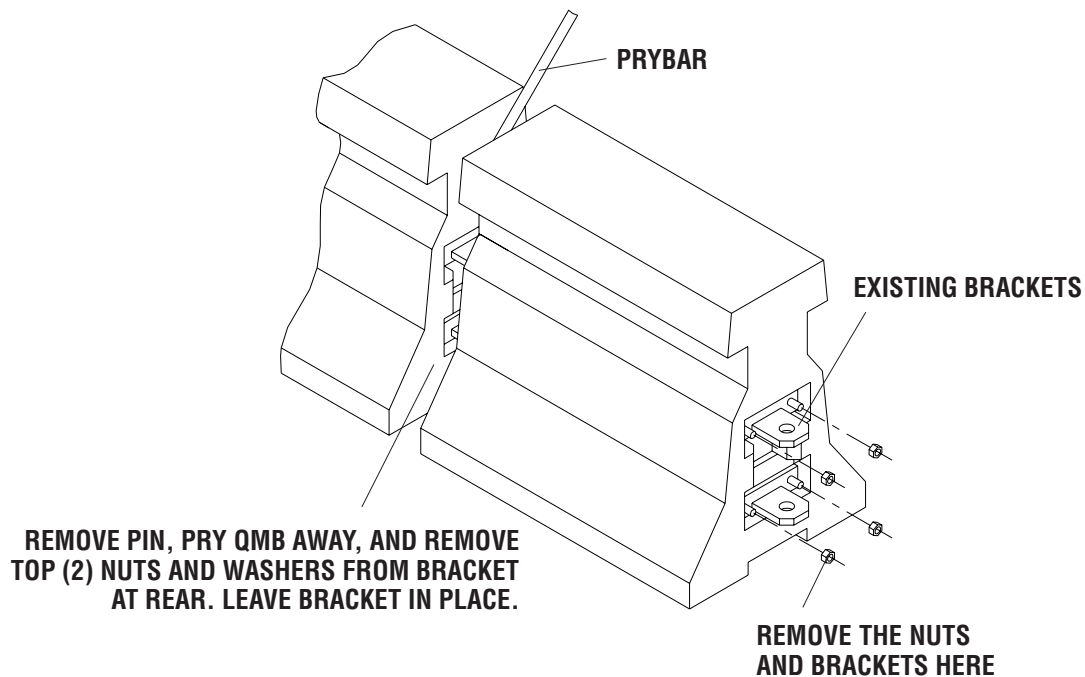


Figure 11

N-E-A-T®

Installation for QMB Applications (cont'd.)

Step 2: Install N-E-A-T® QMB Support Frame (See Figure 12)

Place the Support Frame onto the QMB's four exposed 7/8" studs on the forward end so that the shorter tubes are on top and facing away from the QMB. Place the four nuts and their lockwashers onto the studs and using the 1 5/16" socket torque to 270 Nm [200 ft-lbs].

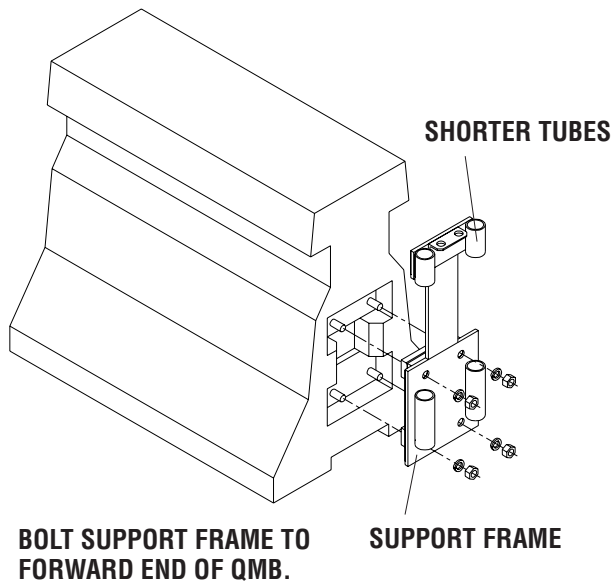


Figure 12

Step 3: Install N-E-A-T QMB TRANSITION SUPPORT (See Figure 13)

Fit the N-E-A-T Transition Support over the existing bracket and studs at the rear of the QMB. The studs fit through the holes. The longitudinal strap will fit lengthwise over the top of the QMB. Replace the nuts and lock washers on the rear studs and hand tighten. The lock washers may be positioned as shims, under the Transition Support, as necessary for best fit (Due to irregularities in QMB).

Next place the 3/4" diameter bolts, nuts, washers and lockwashers through the forward end of the strap, connecting the strap to the Support Frame. (Finger tight at this time). Torque nuts attaching rear of Transition Support to QMB to 270 Nm [200 ft-lbs]. Torque fasteners attaching Transition Support to Support Frame to 250 Nm [185 ft-lbs].

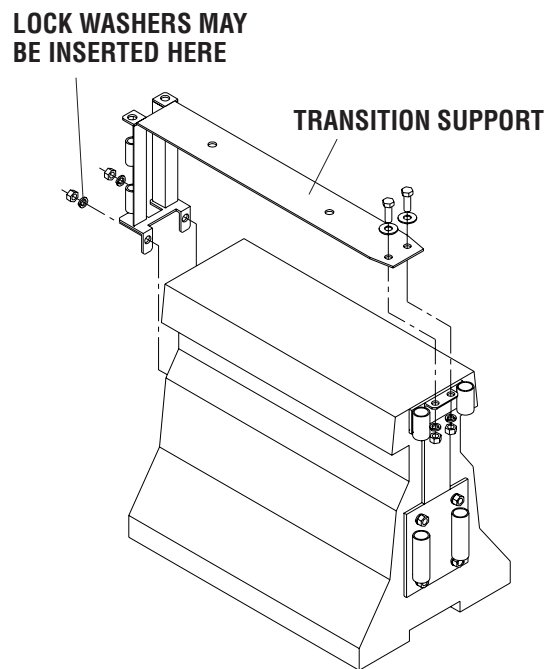


Figure 13

N-E-A-T[®]

Installation for QMB Applications (cont'd.)

Step 4: Install Transition Panel (See Figure 14)

Take one of the Transition Panels and place it against the QMB so that the tubes on the rear of the panel nest with the tubes on the rear bracket. When aligned, insert the 25 mm [1"] diameter by 355 mm [14"] long pins into the hole to hold the Transition Panel in place. Repeat on the other side of the QMB.

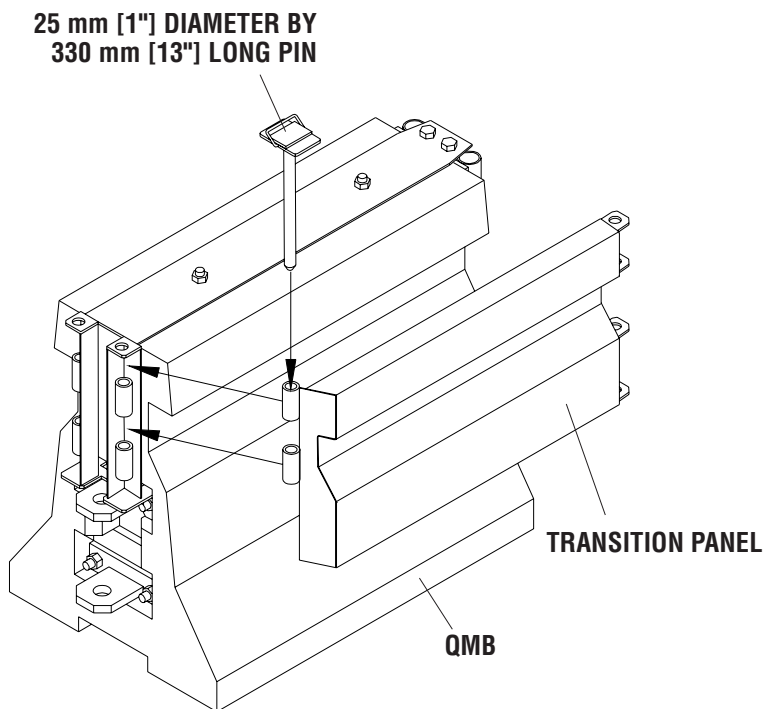


Figure 14

N-E-A-T®

Installation for QMB Applications (cont'd.)

Step 5: Attach Backup to Support Frame and Transition Panels (See Figures 15 & 16)

Loosely attach Deflectors to Backup using 1/2" allen screws and washers. Place Backup up against the Support Frame until the tubes on the Backup nest with the tubes on the Support Frame. Orient the backup so that the flange with the cutout is at the bottom. Place the two large 40 mm [1 1/2"] diameter by 900 mm [35"] long pins into the two sets of nested tubes to hold the Backup in place. (A coating of waterproof grease on the pins will ease the installation.) Next, insert the 900 mm [35"]

long by 25 mm [1"] diameter pins into the holes on the outside of the Backup to fix the Transition Panels in place. Align deflectors and tighten all allen bolts. If there is interference between the Transition Panels and the Backup, remove the Transition Panels and the Transition Support. Then add additional 7/8" lockwashers under the Transition Support as described in step 3 and shown in Figure 11. Additional 7/8" washers are included with the N-E-A-T system. Repeat the assembly described in steps 3, 4, and 5 until an adequate fit is obtained.

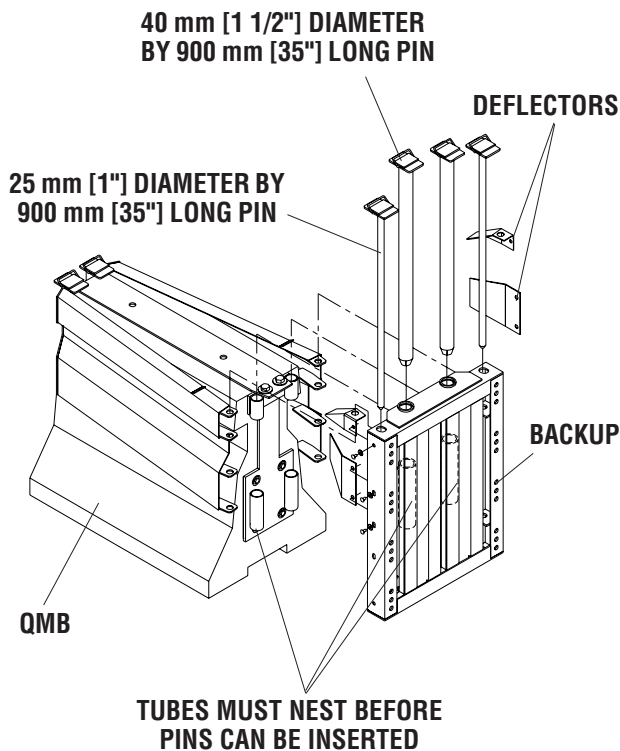


Figure 15
ISOMETRIC VIEW

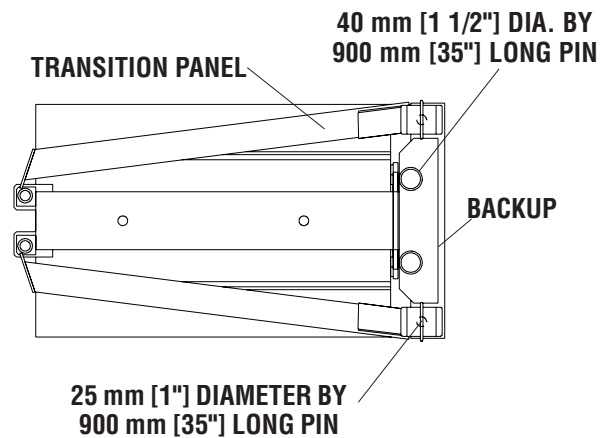


Figure 16
TOP VIEW

N-E-A-T[®]

Installation for QMB Applications (cont'd.)

Step 6: Remove Backup and install MP-3 Studs in top of QMB (See Figure 17)

Remove Backup. Two studs must be installed through the two holes in the longitudinal strap into the top of the QMB barrier. Use a concrete roto-hammer equipped with a 7/8" diameter bit to drill through the strap's holes to a depth of approximately 125 mm [5"]. Take care to drill the holes perpendicular to the surface. Install the 3/4"X6 1/2" long high strength anchor bolts in the holes using the MP-3[®] Anchoring System supplied. Follow the MP-3 Polyester Anchoring System installation procedures found elsewhere in this manual. Once the grout has hardened, per the MP-3 instructions, torque the nuts to 160 Nm [120 ft-lbs].

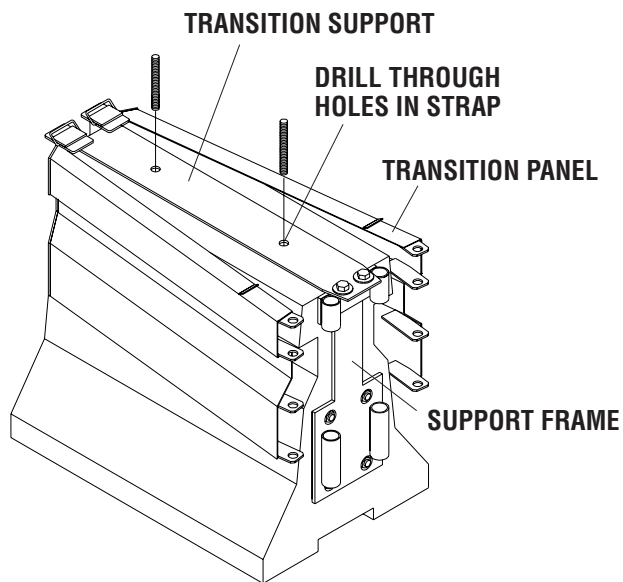


Figure 17

Step 7: Re-pin QMB to Wall (See Figure 18)

Using the pry bar on the front end of the barrier, move the end section back to its former position. Resecure it to the other barrier, using the new pin supplied with the N-E-A-T[®] System--the one with the hook on top.

CAUTION: Do not use the original pin, it will be extremely difficult to remove!

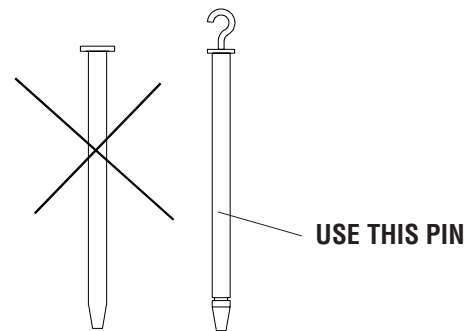


Figure 18

N-E-A-T®

Installation for QMB Applications (cont'd.)

Step 8: Attach Backup to Cartridge. (See Figure 19)

Attach the Backup to the rear end of the N-E-A-T Cartridge. It is attached with the tubes on the side away from the Cartridge and the flange with the cut-out at the bottom. There are three sets of mounting holes in the Backup. Choose the set of holes so that the bottom of the Cartridge will be 100 mm [4"] off the ground. In the majority of cases, the middle set of holes will result in proper Cartridge height. Place the Backup onto the rear end of the N-E-A-T Cartridge, and fasten the eight 1/2" nuts with their flat washers and lockwashers into place. Torque to 80 Nm [60 ft-lbs].

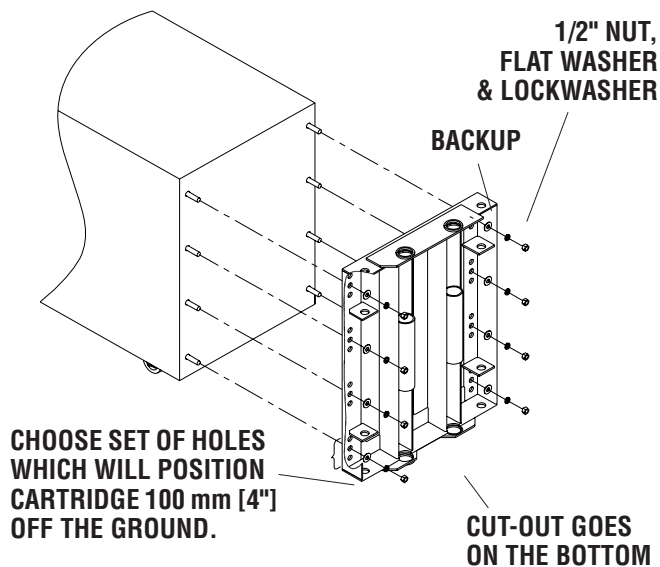


Figure 19

Step 9: Cartridge/Backup to Support Frame Attachment (See Figure 20)

Roll the Cartridge with the attached Backup up against the Support Frame until the tubes on the Backup nest with the tubes on the Support Frame. It may be necessary to lift the rear end of the Cartridge so that the tubes can nest. Re-insert the two large 40 mm [1 1/2"] diameter by 900 mm [35"] long pins into the two sets of nested tubes to hold the Cartridge into place. To get the pins to fall into place, it may be necessary to align the tubes on the Backup and Support Frame. This can be easily done by carefully lifting the front end of the N-E-A-T Cartridge with a pry bar. (Be careful not to damage the Cartridge when doing so--protect the Cartridge with a piece of scrap lumber.) Next, re-insert the 25 mm [1"] diameter by 900 mm [35"] long pins into the holes on the outside of the Backup to fix the Transition Panels into place. See Figure 19. (Ref. Figure 15)

CAUTION: Use the pry bar to lift the end of the cartridge, to protect your back!

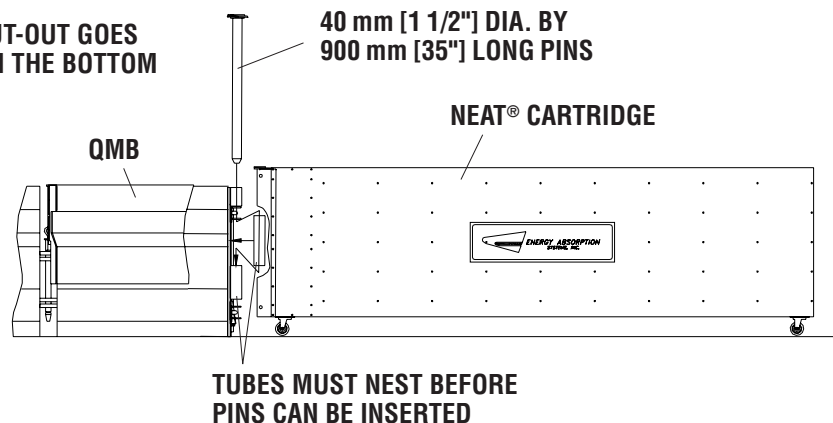


Figure 20

N-E-A-T[®]

Installation for QMB Applications (cont'd.)

Step 10: Chevron Selection (See Figure 21)

The N-E-A-T Cartridge comes with uni-directional and left, or right-hand bidirectional chevron markings. Remove the four 3/8" bolts on the front of the cartridge using the 9/16" socket, and depending upon Cartridge placement, use whichever chevron markings suit your application. Refer to MUTCD or state traffic control plan. Tighten the 3/8" bolts to 20 Nm [15 ft-lbs].

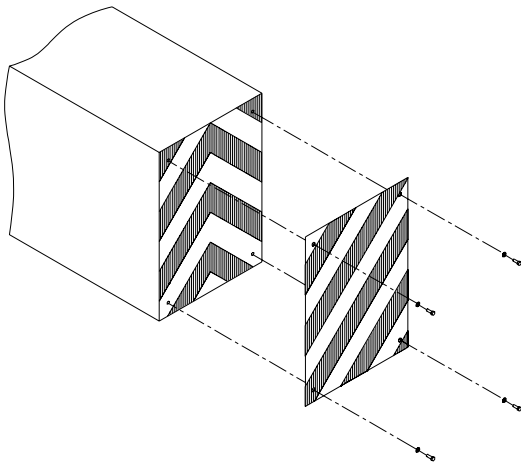


Figure 21

Step 11: Checking Installation Height (See Figure 22)

Measure how high the bottom of the Cartridge is from the grade. It should be 100 mm [4"] off the ground, and not vary by more than 25 mm [1"] over the length of the Cartridge. If a height adjustment is necessary, the following change can be made:

- One of the remaining two hole patterns on the Backup can be used to raise or lower the Cartridge. The hole patterns are 40 mm [1 1/2"] apart. This adjustment method requires unpinning the Cartridge from the Support Frame and Transition Panels, removing the eight nuts from the Backup and repositioning the backup up or down as necessary.

CAUTION: Do not use the cartridge as a lever to reposition the barrier. Severe damage to the cartridge may result.

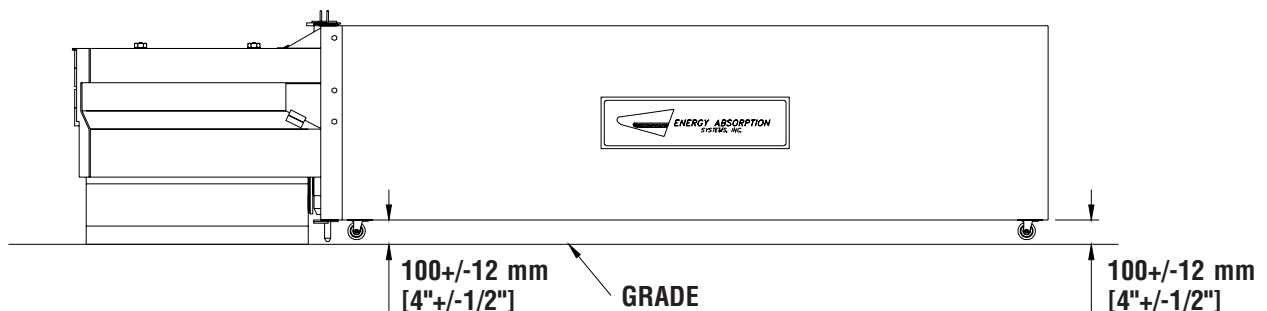


Figure 22

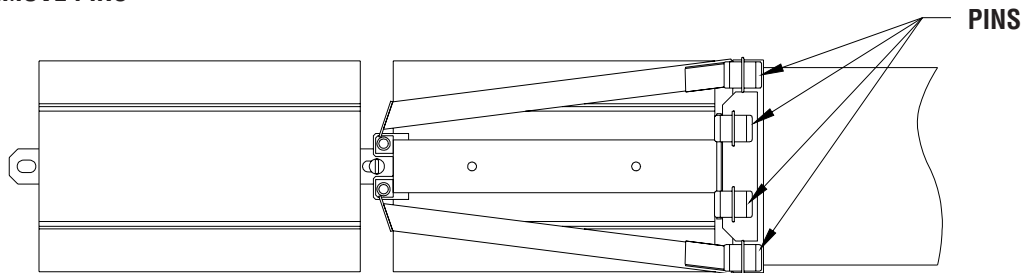
N-E-A-T®

Installation for QMB Applications (cont'd.)

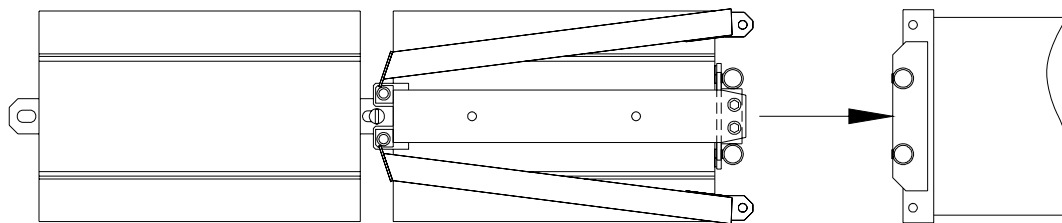
Moving the QMB

Prior to moving the QMB with the Transport and Transfer Vehicle (TTV), the N-E-A-T® Cartridge must be unpinned and rolled out of the way. Next, the Transition Panels are closed onto the QMB barrier, see Figure 23. This allows the TTV's pick-up wheels to easily ride over this section of QMB and move it as any other QMB section. Once the QMB is in its new position, the Transition Panels are opened and the N-E-A-T Cartridge is rolled up and pinned into place. See Step 9, Page 14.

STEP 1) REMOVE PINS



STEP 2) ROLL CARTRIDGE AWAY



STEP 3) CLOSE TRANSITION PANELS ONTO QMB.

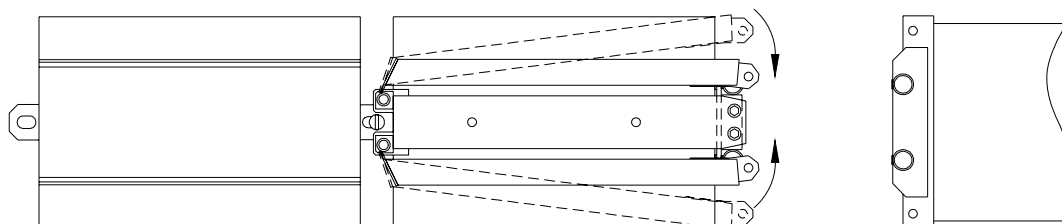


Figure 23

N-E-A-T[®]

Optional Nose Assembly Installation

Step 1 Place nose onto cartridge as shown.

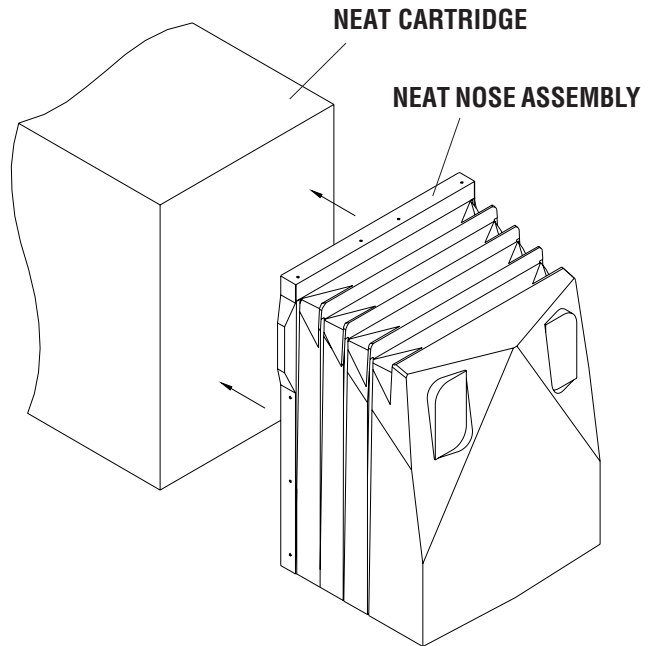


Figure 24

Step 2 Match drill 1/8" diameter holes (10 places) using nose as a template.

Step 3 Drive screw (Part no. 2706441-0000) through nose, into cartridge as shown (10 places).

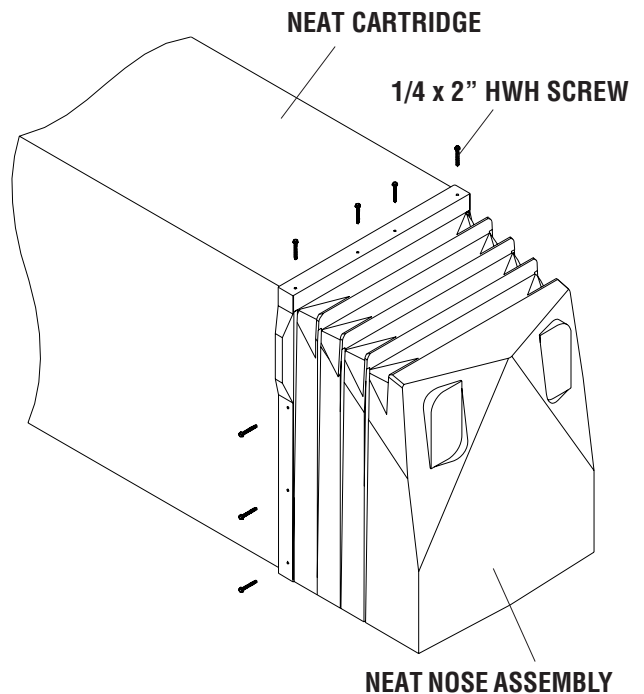


Figure 25

N-E-A-T®

Maintenance and Repair

A slow drive-by visual inspection of the N-E-A-T® System is often all that is required. If the drive by inspection indicates that maintenance is required, a walk-up inspection is necessary. Important items to check for are listed below:

1. Has the system been hit? The N-E-A-T Cartridge is disposable and cannot be repaired. Even a minor hit resulting in a light buckling of the nose section will reduce the capacity of the system to absorb energy in the event of a full design impact. Always replace a damaged Cartridge with a new one.
2. Is the Cartridge too high or too low? Proper alignment of the Cartridge is four inches off the ground, front and rear. This is critical for the Cartridge to function properly by preventing vehicle vaulting or nose-diving.
3. Are any of the pins missing? Missing or damaged pins due to tampering or vandalism must be replaced if the Cartridge is to function properly during an impact.

Limitations and Warnings

The N-E-A-T System has been tested and successfully evaluated per the NCHRP 350 guidelines for Test Level 2 (TL-2) non-redirective crash cushions. The impact conditions recommended in this guideline are intended to encompass the majority, but not all, of the possible inservice collisions.

Properly installed and maintained, the N-E-A-T System is capable of performing its function of containing, and providing controlled trajectory of the test vehicles in a predictable and safe manner under the nominal NCHRP 350 TL-2 non-redirective crash cushion impact conditions of:

Vehicles:

Small car and pickup

Mass:

820 and 2000 kg (1808 and 4409 lb)

Speed:

70 km/h (43.8 mph)

Angle:

15 deg. for small vehicle 20 deg. for pickup

The above conditions are expected worst case conditions. However, combinations different from those tested above may result in different crash results than those encountered in testing. Furthermore, impacts in excess of TL-2 impact severity or the existence of curbs or cross slopes in excess of 5% may not result in acceptable crash performance as described in NCHRP 350 relative to structural adequacy, occupant risk and vehicle trajectory factors.

N-E-A-T®

Limitations and Warnings (cont'd.)

The N-E-A-T TL-1 has been tested and successfully evaluated per the NCHRP 350 guidelines for Test Level 1 (TL-1) non-redirective crash cushions. The impact conditions recommended in this guideline are intended to encompass the majority, but not all, of the possible inservice collisions.

Properly installed and maintained, the N-E-A-T TL-1 is capable of performing its function of containing, and providing controlled trajectory of the test vehicles in a predictable and safe manner under the nominal NCHRP 350 TL-1 non-redirective crash cushion impact conditions of:

Vehicles:

Small car and pickup

Mass:

820 and 2000 kg (1808 and 4409 lb)

Speed:

50 km/h (31 mph)

Angle:

15 deg. for small vehicle 20 deg. for pickup

The above conditions are expected worst case conditions. However, combinations different from those tested above may result in different crash results than those encountered in testing. Furthermore, impacts in excess of TL-1 impact severity or the existence of curbs or cross slopes in excess of 5% may not result in acceptable crash performance as described in NCHRP 350 relative to structural adequacy, occupant risk and vehicle trajectory factors.

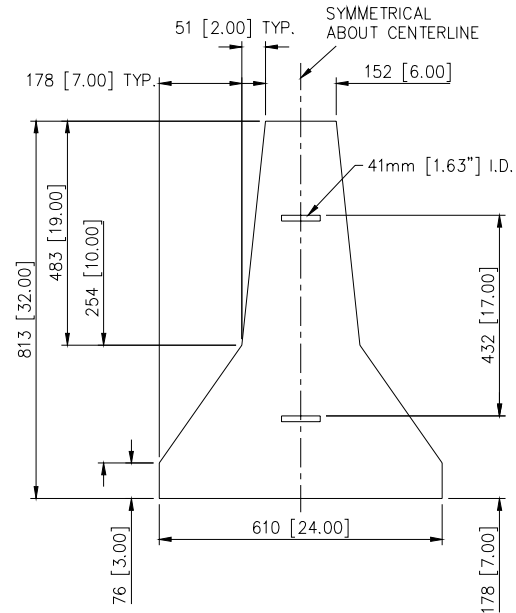


Figure 26

PORTABLE CONCRETE MEDIAN BARRIER (PCMB)*

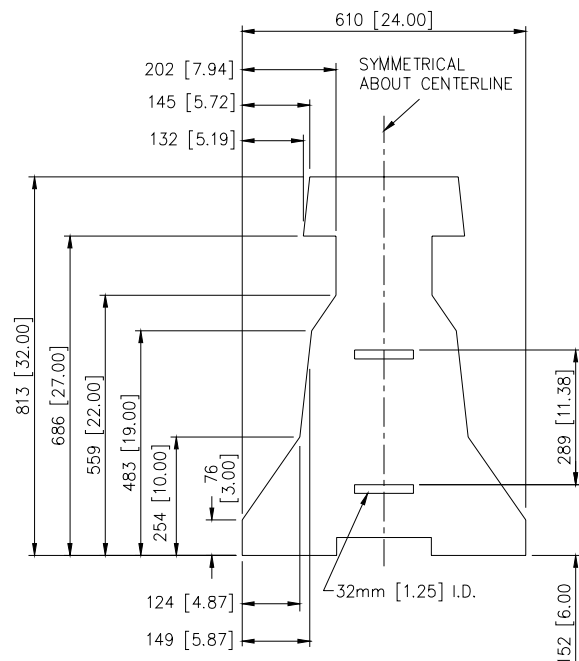


Figure 27

QUICK-CHANGE MOVEABLE BARRIER (QMB)*

***UNITS OF MEASURE ARE IN MILLIMETERS [INCHES] UNLESS OTHERWISE NOTED.**

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