



**MECHANICAL
INSTALLATION INSTRUCTIONS
VEHICLE ARREST SYSTEM**

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MECHANICAL INSTALLATION INSTRUCTIONS **DELTA PHALANX® STYLE BARRIERS**

Safety Precautions

At all times observe good safety practices when working on either the electrical or mechanical system. Particular attention should be paid to the danger of working on the Barrier when the power is on. Barriers are powerful hydraulic presses that can easily crush anything in their way. Keep hands free of the mechanism when the power is on or the HPU is up to pressure. Turn off the electric power and bleed the hydraulic pressure down to zero before working on any part of the system. Traffic should be controlled around the Barrier during any work so that vehicular accidents do not occur if the Barrier should happen to rise. After work is complete, do not allow traffic over the Barrier until all control and safety functions have been verified to be properly working.

Foundation

The Barrier foundation frame is to be cast in place. The outside of the Barrier foundation frame is the form, no additional flashing or forming should be necessary. The installation may be performed by removing the Barrier ram wedge prior to placing the foundation frame into position in the foundation excavation. See the above precautions about working under the Barrier. Disassembly of the Barrier is outlined in the Maintenance section of this manual.

The excavation for the foundation frame can be individual for each Barrier in a set or the foundation can be common for all Barriers if more than one is installed. We recommend the common foundation as providing the strongest Barrier system. See the appropriate foundation drawing in the Drawing Section of the manual. The foundations shown on Delta drawings, unless specially noted, are designed on a soil load bearing factor of 1.5 tons/ft² [14,600 kg/m²]. Only a very boggy or migrating site would require additional foundation.

In multiple barricade installations where two or more units are cast into a common foundation, the inter unit spacing can be reduced from any desired spacing to zero if required by the layout. Reinforcement in the inter barrier area should be distributed uniformly while repeating the placement pattern described in the single barrier foundation design.

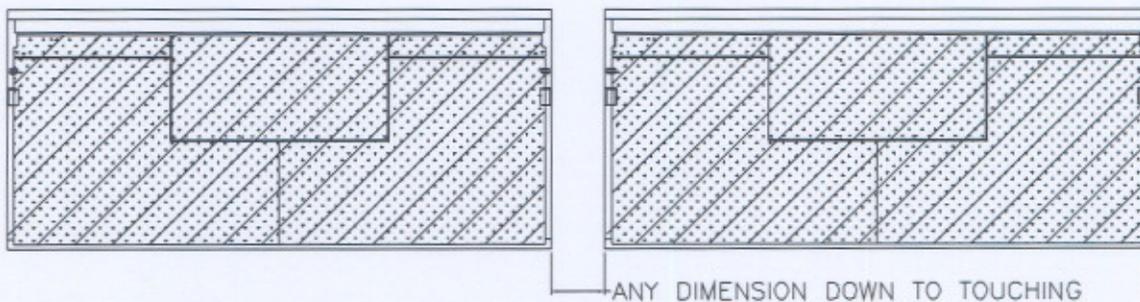


Figure 1 - Two Barriers shown side by side - any required distance between them is possible

Care should be taken to mount the Barrier in an area that is not subject to flooding. Additionally, the roadway should be crowned in the area of the Barrier to prevent standing water from draining into the Barrier foundation frame. It is not necessary for the Barrier to be level or plumb to operate. If the roadway is not level the Barrier may be placed to match the contour; however, be sure the appearance factor is considered. An installation where the equipment is not level even if it follows the terrain can be distracting.

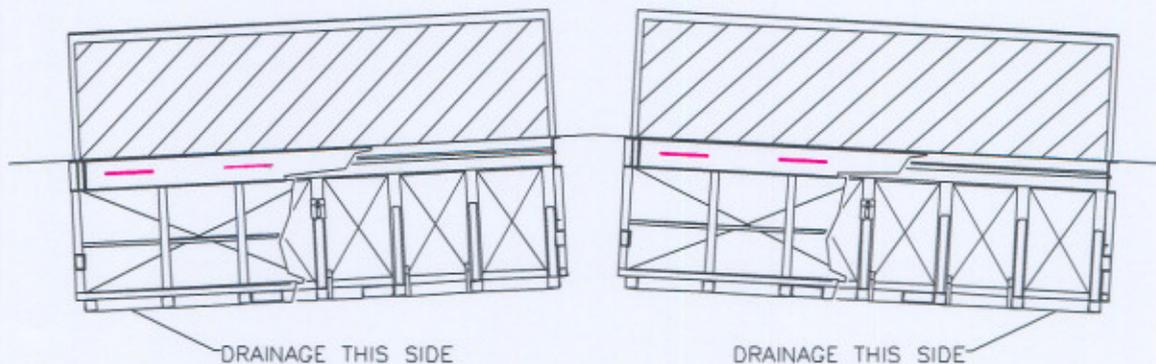


Figure 2 - Two Barriers shown side by side and following the slope of the road. While this is a satisfactory method of installation, the appearance factor should also be considered. Note that the drains must be placed in the low side of the Barriers

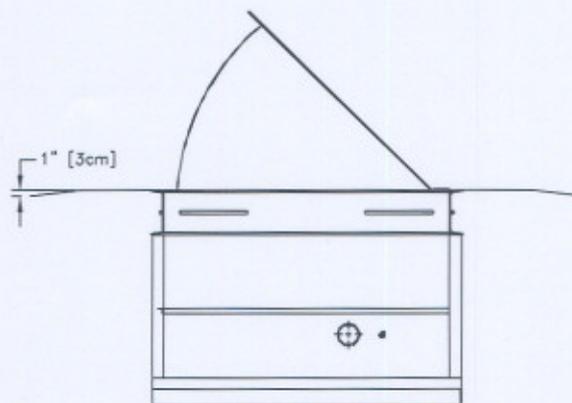


Figure 3 - The Barriers should be placed on a crown above the surrounding roadway to prevent excessive water from draining into the Barrier foundation frame.

The Barrier can be secured in the foundation by leveling with concrete blocks or if desired held to temporary wooden frames to assure alignment during the pour. Before the pour, the frame of the Barrier should be checked for straightness. This can be accomplished by using a string line along each side. Pouring concrete with the sides (especially the front) curved in can allow the barrier ram to hit the frame before obtaining full height. Call the factory if the string line detects the frame more than 0.20 inch [5 mm] out of line.

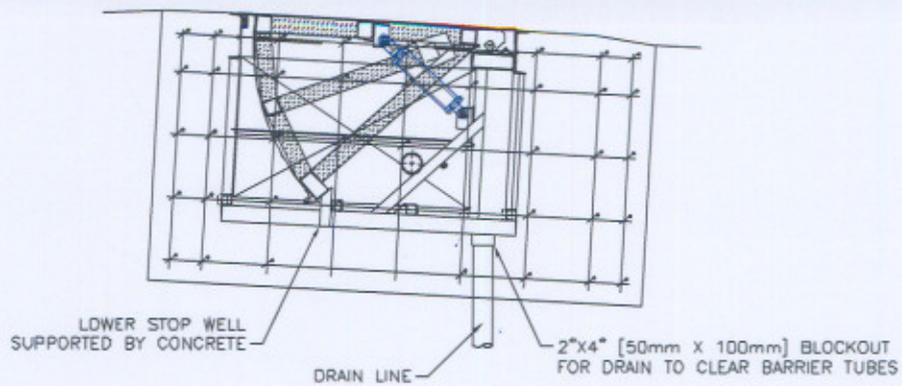


Figure 4 - Cross-section through the Barrier frame. Note that an approximately 2" x 4" [50mm x 100mm] block-out is required across the foundation slab to drain past the Barrier longitudinal structural members. Since the Barrier is sloped towards the rear, the drain is placed along the rear edge of the Barrier frame. The concrete should be well bedded in the area of the lower wedge stop (shim or grout in this area if not well supported by concrete).



Figure 5 - Delta Phalanx Barrier installed in roadway ramp. Note the trench drain in the rear to minimize the amount of water that the Barrier drainage must handle.



Figure 6 - Delta Phalanx lower wedge stop. Check that the stop is well supported from underneath. Shim or grout as necessary for support. Check that the Barrier wedge rests on the stop when in the fully lowered position.

Environmental Control

Delta Scientific Corporation's vehicle Barrier systems can be used in all geographical areas. Since the early 1980's, Delta Barriers have been successfully installed in locations just south of the Arctic Circle (Oslo and Stockholm), in extremely cold areas of the United States such as Idaho Falls and Grand Forks, and in all the capital cities of Europe. Tropical installations include more than thirty locations within ten degrees latitude of the Equator. In between, installations run from temperate areas to Middle East desert sands.

Heating

Cold climate installations require the use of heaters to maintain proper oil viscosity and to eliminate the possibility of snow or ice blocking the Barrier mechanism. Depending on the hydraulic power unit size and rating, Delta supplies heaters ranging from 60 to 500 watts @ 120/240 volts for the oil reservoirs. The hydraulic hoses to the Barriers are to be run below the frost line where temperatures are a relatively constant 45 to 55°F [7 to 13°C]. If desired, the ducts carrying these hoses can be heat traced at time of installation.

The Barriers themselves may require heaters, the ratings of which are determined by the length of the Barrier and available operating voltage. Ratings in the range of 1,000 to 2,000 watts are common.

Delta strongly recommends that the entire roadway in the immediate vicinity of the Barriers be heat traced. This is to minimize the chance that a vehicle could lose control or traction in front of the Barriers. Also, in many cases, guard and/or inspection personnel will need to work on a vehicle in front of the Barriers. The heat tracing will reduce the personnel dangers of working on snow and ice.

Roadways containing Barriers cannot be plowed. The snow plows will shear top plate bolts and damage inspection covers. Only hand clear snow around the Barriers. Snow removing chemicals such as salt should also not be used around the Barriers as the corrosion of the steel components will be greatly accelerated.

Drainage provisions in Barriers subject to freezing will also need some consideration. Heat tracing of the drain lines and/or sump well heaters may be needed to help remove the melted snow and ice from the Barrier foundations.

Cooling

Barrier installations in areas where the temperatures are frequently above 100°F [38°C] should have the hydraulic power units located in temperature controlled equipment rooms or be equipped with oil coolers. The simplest but least effective method is an air cooled heat exchanger. Very large surface areas are required to cool oil to 160°F [71°C] when only 130°F [55°C] cooling air is available. A more compact installation can be realized if a water cooled heat exchanger is located in the reservoir tank. Typically, less than one gallon per minute [4 liters per minute] of water at 100°F [38°C] or less is required. If the water stream can be returned to a cooling tower or other closed loop system, no waste of water is incurred.

Sand and Dust

Barrier locations in sand or dust areas require a few additional precautions. The hydraulic power units should be mounted in equipment rooms that can be pressurized to maintain positive air flow out of the room. This minimizes the accumulation of sand, dust and other abrasive materials on the hydraulic equipment where it could find its way into the oil and sensitive mechanical devices. Filter and fluid changes may be more frequent than at other installations.

Barriers in sand swept areas may need to have the foundation frames cleaned frequently. This is usually accomplished by using an industrial type vacuum to sweep out the accumulated debris. Sand accumulation can be minimized by placement of suitable fences or walls around the Barrier area.

Drainage

Drainage and protection against subsurface water is important. A bed of aggregate under the Barrier(s) will handle rain water in most circumstances. Especially wet locations should have the Barrier provided with a drain line plumbed to a sump well or sewer as appropriate.

While the machine is designed for harsh environments, prolonged submersion will eventually cause both appearance and operating deterioration.

Corrosion

Very occasionally a site is both wet and unfriendly, i.e., either highly acid or basic. In these cases, anodic protection is recommended. Delta will be happy to review specific job locations and make suitable recommendations where such protection is needed.

Interconnect

Provisions for electrical and hydraulic feed should be made prior to pouring the foundation of the Barrier.

The access area of the Barrier is provided with a 3.5" IPS pipe sleeve. We recommend that 3" PVC pipe be run from the hydraulic power unit to this sleeve to provide a conduit through which hoses can be pulled. Alternately, rigid steel pipe can be run from the HPU to the Barrier directly buried in the ground. See the Mechanical System Theory section of this manual for a discussion of the various ways to interconnect the Barrier with the HPU.

Access to the optional fully up and fully down limit switches, heaters and front face light conduits are also in the access box. Rigid metallic conduit or equal is to be run to them. Be sure that appropriate fittings are used that will allow wire to be pulled. It is too late to correct this error after the concrete is poured!

Concrete Notes and Specifications Note, these are minimum requirements only. You may exceed these requirements with no reduction in the rating of the equipment.

- 1) Contractor shall verify and be responsible for all dimensions and conditions at the job site.
- 2) Foundation concrete may be placed directly into neat excavations, provided the sides of the excavation are stable. Where caving occurs, provide shoring. Type and method of shoring shall be at the contractor's option.
- 3) The excavation shall be kept dry at all times. Groundwater, if encountered, shall be pumped from the excavation.
- 4) Concrete shall be laboratory designed, machine mixed, producing 3,000 psi [20,68 Mpa] at 28 days.
- 5) Cement shall be tested Portland cement conforming to ASTM C150, Type I or II.
- 6) Aggregates shall conform to ASTM C33. Maximum size of aggregate shall be 1.5 inch [38 MM].
- 7) Reinforcing steel shall be deformed bars conforming to ASTM A615, Grade 60 (60,000 psi [413,7 Mpa]).
- 8) Hooks and bends shall conform to AIC Standard 318, latest revision. Inside diameter of hooks and bends shall be at least 6 bar diameters.
- 9) Provide spacer bars, chairs, spreaders, blocks, etc, as required to positively hold the steel in place. All dowels shall be firmly wired in place before concrete is poured.
- 10) Concrete shall be conveyed from the mixer to final deposit by methods that will prevent separation or loss of materials. Troughs, buckets or the like may be used to convey concrete. In no case shall concrete be allowed to free drop more than 5 feet [1,5 M].

- 11) Concrete shall be thoroughly consolidated by suitable means during placement and shall be thoroughly worked around reinforcement, embedded fixtures and into corners of forms.
- 12) Concrete shall be maintained above 50°F [10°C] and in a moist condition for at least 7 days after placement. Adequate equipment shall be provided for heating concrete materials and protecting concrete during freezing or near freezing weather.
- 13) Where exterior wall face requires shoring and/or forming, the forms shall be substantial and sufficiently tight to prevent leakage. Forms shall not be removed until the concrete is 7 days old.
- 14) Backfilling shall be done by depositing and tamping into place clean sand or pouring lean concrete. Water jetting shall not be allowed.
- 15) Conduits and pipes of aluminum shall not be embedded in concrete unless effectively coated or covered to prevent aluminum/concrete reaction or electrolytic action between aluminum and steel.
- 16) Construction joints not indicated on the drawings shall not be allowed. Where a construction joint is to be made, the surface of concrete shall be thoroughly cleaned and all laitance and standing water removed.
- 17) Contractor shall be responsible for the protection of all adjacent areas against damage and shall repair or patch all damaged areas to match existing improvements.
- 18) Contractor shall keep the construction area clean at all times and at completion of work remove all surplus materials, equipment and debris and leave the premises in a clean condition acceptable to the owner or owner's representative.