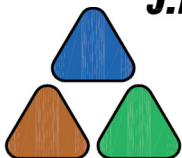


HIGH CLEARANCE SHORE

TABULATED DATA
Effective June 2, 2020



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DESCRIPTION

The Pacific Shoring High Clearance Shore is built from heavy-duty waler rails and double 2” cylinders or 3” cylinders. The strength of the waler rail allows the first strut to be placed 5’-6” from the end of the rail. The extended leg length allows the first cylinder to be placed as much as 7’-6” from the bottom of the excavation. The shoring design theory assumes that soil arching occurs and places the soil load arch location 4 ft from the bottom of the trench onto the leg of the shore. From that point, the load is carried up the cantilever leg of the shore to the cylinder. The Pacific Shoring High Clearance Shore is generally used where the pipe being laid is greater than 36” in diameter, smaller pipe diameters can be handled with conventional hydraulic trench shores. Horizontal spacing of High Clearance Shores varies and is tabulated by the strength of the hydraulic cylinders. The plywood use requirements are the same as with conventional hydraulic trench shores.

High Clearance Shores come in 8 ft, 12 ft, 16 ft, and 20 ft lengths. Allowable trench widths go up to 12 ft. Maximum depth is to 20 ft. Site-specific designs beyond these parameters are achievable when using design by a registered engineer.

GENERAL INFORMATION FOR USE OF HIGH CLEARANCE SHORE

1. The hydraulic aluminum shoring system tabulated here is based on requirements of Federal OSHA 29CFR, Part 1926, Subpart P-Excavations, and Trenches

1926.652(c)(2)-Option (2) - Designs Using Manufacturer's Tabulated Data.

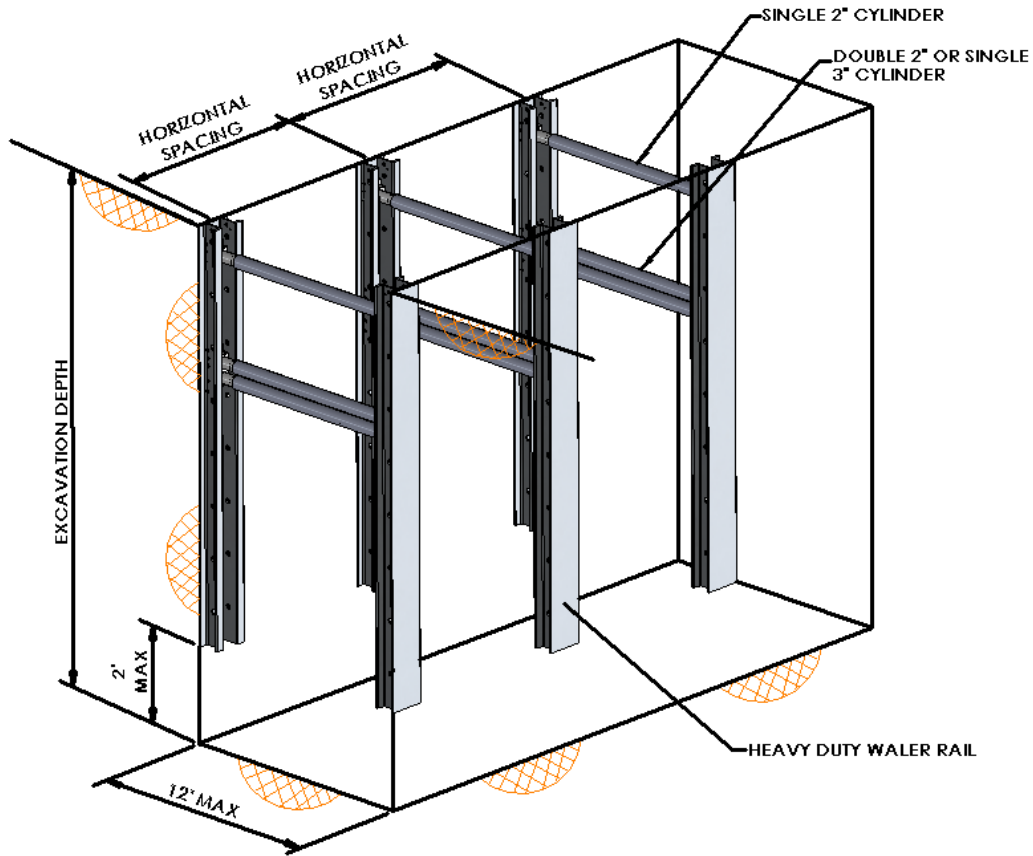
1926.652(c)(2)(i) -Design of support systems, shield systems, or other protective systems that are drawn from manufacturer's tabulated data shall be in accordance with all specifications, recommendations, and limitations issued or made by the manufacturer.

All provisions of Subpart P apply when utilizing this tabulated data. The contractor's competent person shall use this data to select allowable trench depth, vertical and horizontal shore spacing, and plywood use requirements for the Pacific Shoring High Clearance Shores. The competent person utilizing this tabulated data shall be experienced and knowledgeable of all requirements of Subpart P, and trained in the use and safety procedures for aluminum hydraulic shores.

2. Use of this tabulated data is dependent on first classifying the soil in accordance with OSHA Appendix A, Soil Classification. Classification shall be just prior to installing shoring. Soil conditions may change at a later date and require shores to be reset at a different spacing.
3. High Clearance Shores are tabulated based on the effect of a 20,000 lb surcharge load set back 2 ft from the edge of the trench and the equivalent weight effect of the OSHA soil type, see classification of soil types, 2.
4. The depth and spacing given in the tables governs the use of Pacific Shoring. Tabulated data applies exclusively to High Clearance Shores manufactured by Pacific Shoring LLC. Any alterations to the shores or variance from this tabulated data shall be indicated in a site-specific plan prepared and approved by a registered engineer.
5. Faces of excavations shall be straight and vertical and there shall be contact with the soil behind the sheeting near each cylinder. Intermittent gaps directly behind the sheeting and the soil shall not exceed 6".
6. When the lower portion of the trench is shored and the top is sloped the shoring and sheeting shall extend a minimum of 18" above the top of the vertical trench wall and the sloping beyond shall be in accordance with OSHA sloping and benching for the soil type encountered.
7. Shores shall be installed and removed from outside the trench, see installation and removal procedure.
8. The competent person shall continually monitor the shored excavation for changed conditions such as water seepage, soil movement cracks at the surface, sloughing or raveling, proper surcharge load weight less than 20,000 lbs and setback a minimum of 2 ft, and damaged shores.
9. Workers shall always enter, exit, and work inside the shored area of the trench.
10. Use lifting slings and spreader bars that are rated for the weight of the shore, plywood, and forces anticipated during removal.

CLASSIFICATION OF SOIL TYPES

1. Soil classification shall be in accordance with OSHA Appendix A and classified just prior to installing waler rail systems. Soil conditions may change at a later date and require waler rails to be reset at a different spacing.
2. The equivalent weight of OSHA soil types* is assumed to be as follows:
 - OSHA Type “A” Soil 25 PSF per ft of depth
 - OSHA Type “B” Soil 45 PSF per ft of depth
 - Type “C-60” Soil 60 PSF per ft of depth**
 - OSHA Type “C” Soil 80 PSF per ft of depth
- * These equivalent weights were adapted from OSHA 1926 Subpart P App C, Timber Shoring for Trenches, Tables C-1.1, C-1.2, and C-1.3
- ** Type C-60 soil is not identified or classified in OSHA Appendix A
3. Type C-60 soil is soil that does not qualify as OSHA Type A, or Type B, can be cut with vertical walls and will stand up long enough to safely insert and pressurize the hydraulic shore.
4. High Clearance shores may be used in OSHA Type C-80 Soil



HIGH CLEARANCE SHORE SELECTION GUIDE

GENERAL NOTES

The following tables are to be used by a competent person when selecting a waler rail system for excavation shoring. Selection steps are as follows:

1. Determine excavation parameters
 - depth
 - length
 - width
 - clearance needed from bottom of excavation to bottom of first cylinder
2. Determine OSHA soil type, A, B, or C-60,

3. Go to the table as follows;
 - **Table 1** - 8' High Clearance Shore
 - **Table 2** - 10' High Clearance Shore
 - **Table 3** - 12' High Clearance Shore
 - **Table 4** - 16' High Clearance Shore
 - **Table 5** - 20' High Clearance Shore
4. Enter table to determine allowable high clearance shore spacing and plywood requirements.

Note-Custom high clearance shores and spacing are available upon request. Use of all custom designed systems is to be in accordance with OSHA [1926.652\(c\)\(4\)](#) Option (4) - Design by a registered professional engineer.

TABLE NOTES

Cylinder Notes

1. 2" diameter aluminum cylinders shall have a 3" x 3/16" wall aluminum oversleeve that is the full retracted length of the cylinder.
2. 3" cylinders have a 4" x 3/16" wall aluminum oversleeve that shall be used in all trenches over 8 ft wide

Sheeting Notes

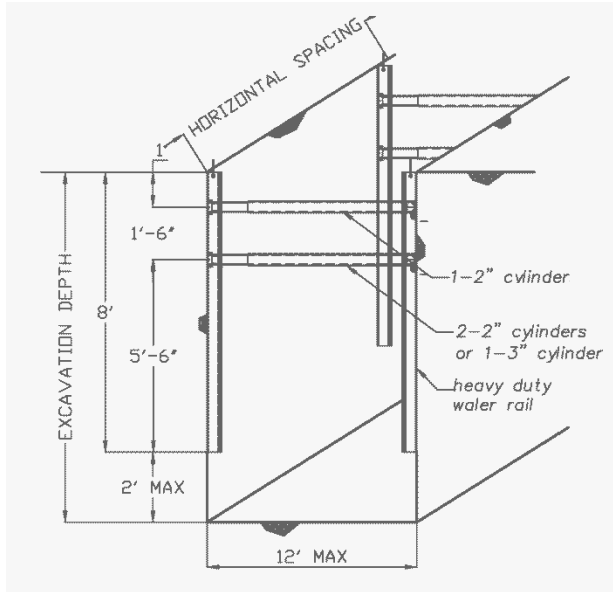
1. Plywood - **Table 1A** sheets are acceptable
2. Sheeting may be set inside trench before setting shore or may be attached to the shore.

Table 1A Bending properties for OSHA Plywood Sheeting and Poly Propylene

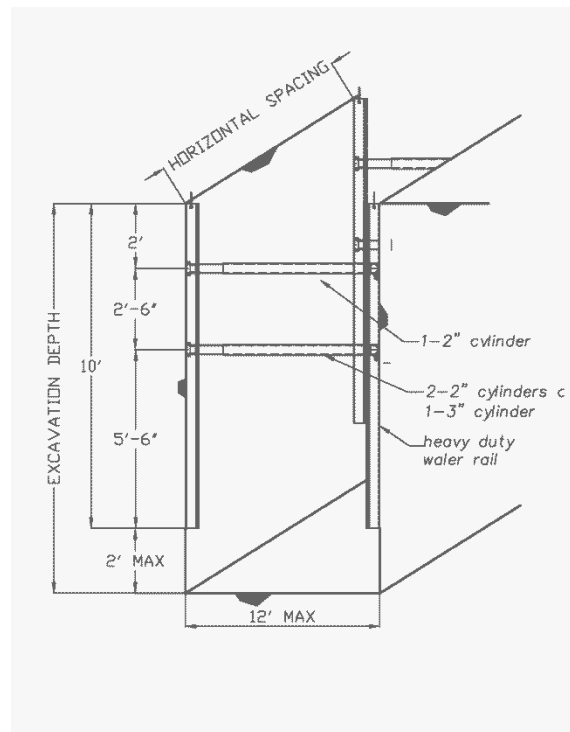
| Material | Grade Stress Level | Effective Section Modulus KS | Allowable Bending F _b |
|------------------------------------------------------------------------|--------------------|------------------------------|----------------------------------|
| 1-1/8"-2.4.1 int APA Plywood | S-2 | 0.840 in ³ /ft | 1100 psi |
| Finland Form 3/4" All-Birch 1/2" Polypropylene 1" Steel Plate | S-1 | 0.4826 | 3600 psi |

HIGH CLEARANCE SHORE SELECTION TABLES

| TABLE 1-8' HIGH CLEARANCE SHORE | | | |
|------------------------------------|------------------------------------------------|--------|-----------|
| ALLOWABLE HORIZONTAL SHORE SPACING | | | |
| Depth | OSHA Soil Type | | |
| | Type A | Type B | Type C-60 |
| 8 | 8 | 8 | 8 |
| 10 | 8 | 8 | 8 |
| 12 | 8 | 8 | 8 |
| 14 | 8 | 8 | 8 |
| 16 | 8 | 8 | 7 |
| 18 | 8 | 8 | 6 |
| 20 | 8 | 8 | 6 |
| Sheeting Requirements | | | |
| 1 | All type C soils | | |
| 2 | Type B soils over 8 ft deep | | |
| 3 | All soils over 12' deep | | |
| 4 | Always when sloughing or raveling is occurring | | |

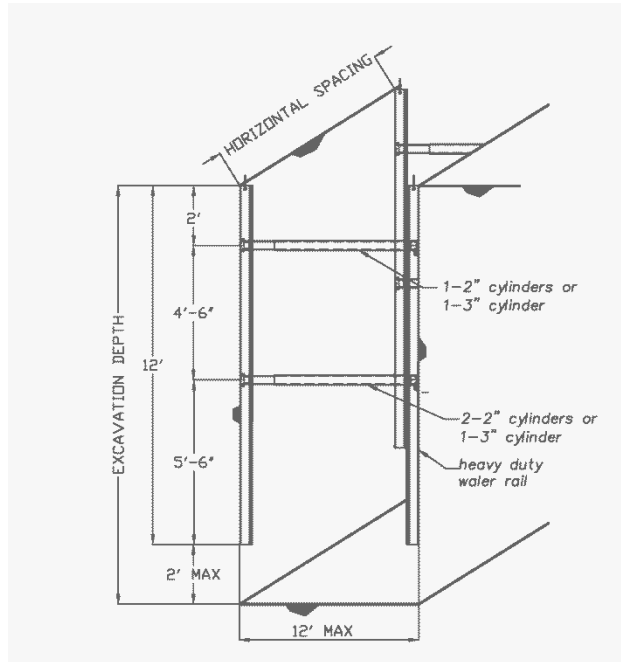


| TABLE 2-10' HIGH CLEARANCE SHORE | | | |
|------------------------------------|------------------------------------------------|--------|-----------|
| ALLOWABLE HORIZONTAL SHORE SPACING | | | |
| Depth | OSHA Soil Type | | |
| | Type A | Type B | Type C-60 |
| 10 | 8 | 8 | 8 |
| 12 | 8 | 8 | 8 |
| 14 | 8 | 8 | 7 |
| 16 | 8 | 8 | 6 |
| 18 | 8 | 8 | 6 |
| 20 | 8 | 7 | 5 |
| Sheeting Requirements | | | |
| 1 | All type C soils | | |
| 2 | Type B soils over 8 ft deep | | |
| 3 | All soils over 12' deep | | |
| 4 | Always when sloughing or raveling is occurring | | |



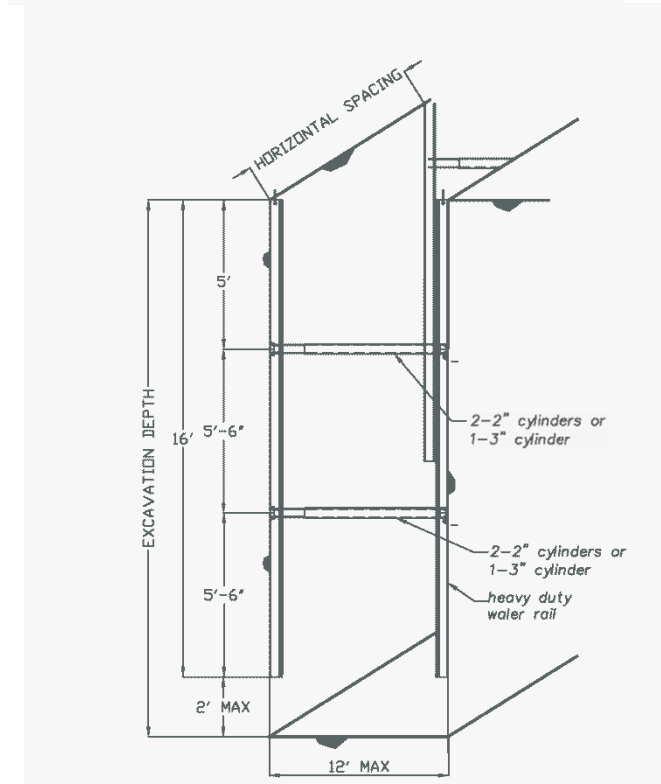
| TABLE 3-12' HIGH CLEARANCE SHORE | | | |
|------------------------------------|----------------|--------|-----------|
| ALLOWABLE HORIZONTAL SHORE SPACING | | | |
| Depth | OSHA Soil Type | | |
| | Type A | Type B | Type C-60 |
| 12 | 8 | 8 | 7 |
| 14 | 8 | 8 | 6 |
| 16 | 8 | 8 | 6 |
| 18 | 8 | 7 | 5 |
| 20 | 8 | 6 | 4 |

| Sheeting Requirements | |
|-----------------------|------------------------------------------------|
| 1 | All type C soils |
| 2 | Type B soils over 8 ft deep |
| 3 | All soils over 12' deep |
| 4 | Always when sloughing or raveling is occurring |

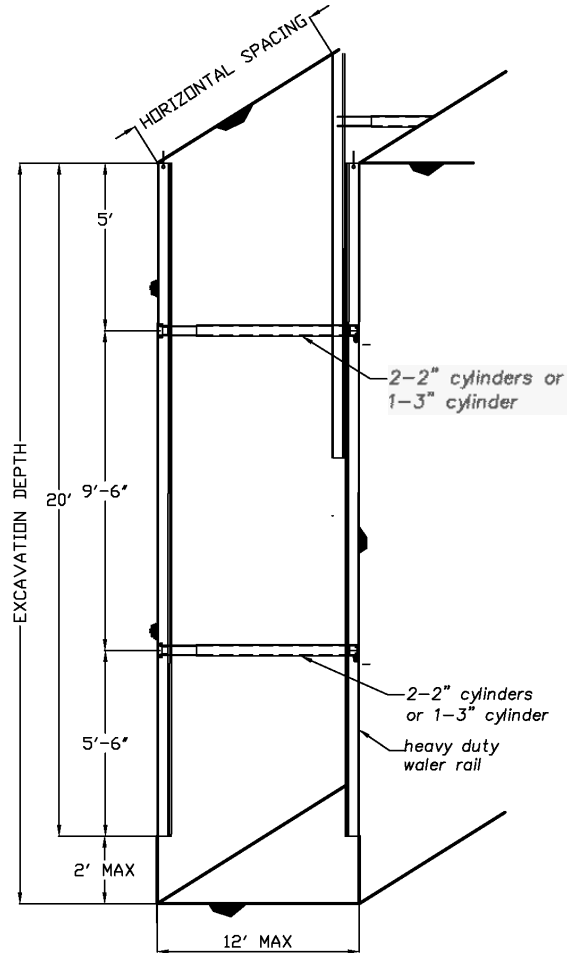


| TABLE 4-16' HIGH CLEARANCE SHORE | | | |
|------------------------------------|----------------|--------|-----------|
| ALLOWABLE HORIZONTAL SHORE SPACING | | | |
| Depth | OSHA Soil Type | | |
| | Type A | Type B | Type C-60 |
| 12 | 8 | 8 | 7 |
| 14 | 8 | 8 | 6 |
| 16 | 8 | 8 | 5 |
| 18 | 8 | 7 | 4 |
| 20 | 8 | 6 | 4 |

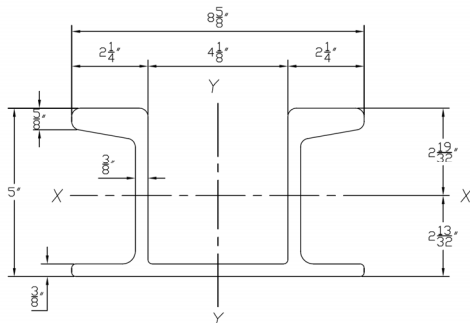
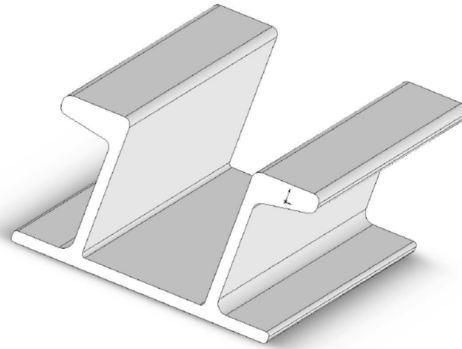
| Sheeting Requirements | |
|-----------------------|------------------------------------------------|
| 1 | All type C soils |
| 2 | Type B soils over 8 ft deep |
| 3 | All soils over 12' deep |
| 4 | Always when sloughing or raveling is occurring |



| TABLE 5-20' HIGH CLEARANCE SHORE | | | |
|-----------------------------------------|------------------------------------------------|--------|-----------|
| ALLOWABLE HORIZONTAL SHORE SPACING (ft) | | | |
| Depth | OSHA Soil Type | | |
| | Type A | Type B | Type C-60 |
| 12 | 8 | 8 | 6 |
| 14 | 8 | 6.5 | 5 |
| 16 | 8 | 6 | 4.5 |
| 18 | 8 | 5 | 4 |
| 20 | 8 | 4 | 3.5 |
| Sheeting Requirements | | | |
| 1 | All type C soils | | |
| 2 | Type B soils over 8 ft deep | | |
| 3 | All soils over 12' deep | | |
| 4 | Always when sloughing or raveling is occurring | | |



HIGH CLEARANCE SHORE ENGINEERING PROPERTIES



HEAVY DUTY
WALER RAIL

| | |
|------------------------|-------------------------|
| AREA | = 9.57 IN ² |
| WEIGHT | = 11.5 PLF |
| MOMENT OF INERTIA | = 36.34 IN ⁴ |
| SECTION MODULUS TOP | = 14.0 IN ³ |
| SECTION MODULUS,BOTTOM | = 15.1 IN ³ |
| RADIUS OF GYRATION | = 1.95 IN |

| | |
|-------------------|-------------------------|
| Rail Material | 6061-T6 Aluminum |
| Ultimate Strength | F _u = 42 ksi |
| Yield Strength | F _y = 42 ksi |

| | | |
|---------------------|-----------------------|--------------------------|
| Hydraulic Cylinders | <u>Allowable Load</u> | Oversleeve |
| 2" cylinders | 20,000 lbs | 3" x 3/16" wall aluminum |
| 3" cylinders | 45,000 lbs | 4" x 3/16" wall aluminum |

HIGH CLEARANCE SHORE INSTALLATION AND REMOVAL PROCEDURE

Installation Notes

1. High clearance shores shall be lifted with slings or spreader bars rated for the weight of the shore, attached sheeting, and anticipated forces from removal procedures. Controlled density fills or soil backfilled against the bottom leg of the rail can create high forces when pulling the shore. Attach lifting apparatus only to the lifting eyes.
2. No workers are allowed inside the trench in any area within the shore length. For example; if it is a 12 ft long shore, workers are not allowed inside the trench within 12 ft of the location the shore is being set. Workers are never allowed under moving loads.
3. Trench walls shall be vertical. Set shores in trench vertical and perpendicular to the trench wall. If the shore is not set perpendicular, there will be a resulting torque force between the rail and the cylinder connection blocks that will cause damage to the cylinders and pins.
4. When the shore is set in the proper position, pressurize the cylinders to around 1200 psi or into the green zone on the pump gauge.
5. Check shores on a daily basis prior to workers entering the trench to be sure that the cylinders are pressurized. Shores that are loose can fall vertical and then topple forward or backward into the trench.

Required for installation:

- Vertical Hydraulic Jack
- Pump with fluid and operating pressure gauge
- Release tool

Installation Procedure

- Step 1 Attach hydraulic hose to hydraulic fitting on shore. Open the valve on the pump can so that the shore cannot be pressurized. Set plywood if required and not attached to the shore into trench.
- Step 2 Lower shore into trench. Heavy or wide shores that cannot be safely lifted by one person should be set in with lifting equipment such as backhoe, boom truck, or crane.
- Step 3 Close the valve on the pump can and pressurize the hydraulic shore to between 750 and 1500 psi. Pressure gauge should hold at pressure and not indicate any loss of pressure.
- Step 4 Remove the hydraulic hose by prying off with release tool. Clip hose to top of pump to prevent contamination by dragging it in the dirt. Move to next shore location and repeat process.

While trench shores are in place

- Check at least at start of shift for loose shores. This can be done by tapping the top of the shore with a metal rod; it will sound loose, sort of like kicking a tire to see if it is flat. Remove and replace loose shores.
- Check for sloughing or raveling. If it is occurring, sheeting must be used.
- Confirm that soil classification has not changed.

Removal Notes

1. For removal, be certain the lifting apparatus is properly attached prior to rereleasing the pressure.
2. Allow hydraulics to bleed of prior to lifting the shore.

Required for Removal

- Vertical Hydraulic Shore
- Release tool
- Removal tool or lifting equipment

Removal Procedure

Step 1 Place release tool over hydraulic fitting and removal hook in handle on opposite blade.

Step 2 Push release to away to release fluid and pressure. Pull up on the removal hook to fold the shore up and then lift it out of trench.

Note - Depending on the length of the shore and width of the trench different installation procedures may be used. It is the responsibility of the contractor and his competent person to establish a safe installation and removal procedure for each application. All trench shore installers shall be instructed in the procedure prior to installing the shores.



