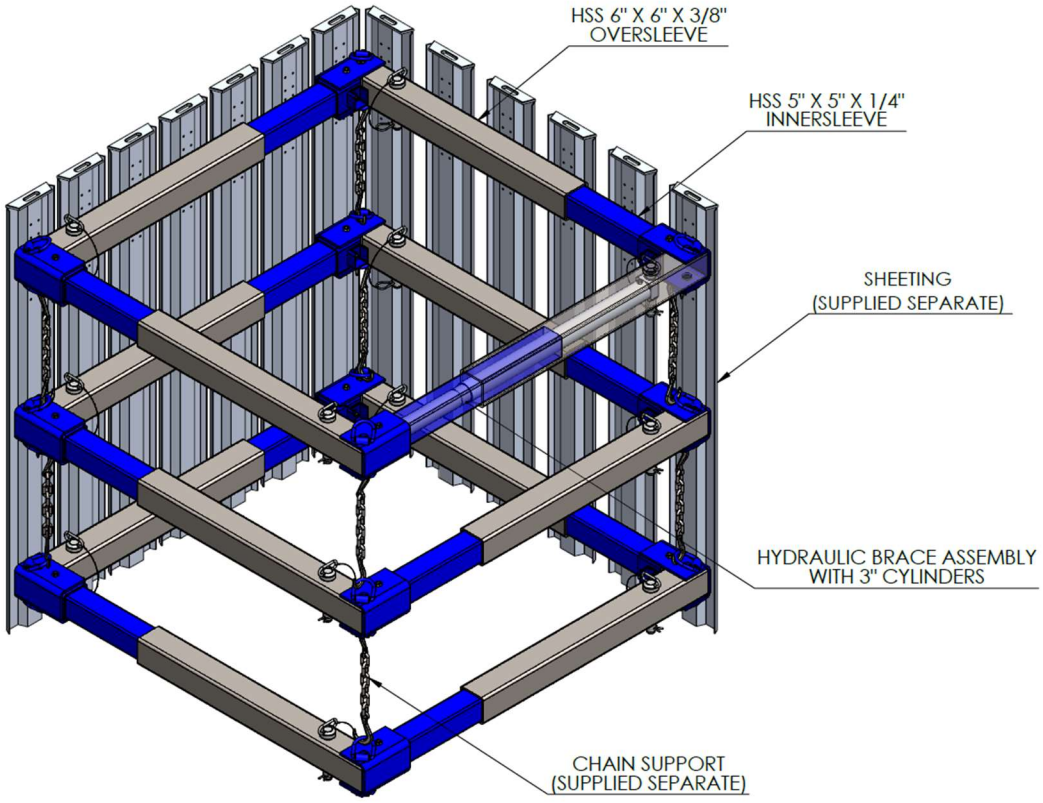
4 WAY HYDRAULIC BRACE SYSTEM

TABULATED DATA
Effective March 19, 2021



Pacific SHORING
Quality Driven, Lead Time Focused

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3/19/2021

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Contents

Description

The Pacific Shoring 4 Way Hydraulic Brace System is constructed from 3” aluminum hydraulic cylinders, 6” square HSS sections and a corner bracket. A 3” hydraulic cylinder with a 3 ft stroke and the proper length HSS section provide excavation lengths and widths from 4 ft to 29 ft. The HSS 6”x6”x3/8” wall extension oversleeve can be obtained separately and used with the system. This tabulated data provides for frame allowable vertical spacing of 2ft, 3ft, 4ft, and 5ft. The closer the spacing the stronger the system will be. Larger length, width, and depths may be achieved using design by an engineer. Sheeting is required behind bracing frame. Any type of sheeting such as plywood, timber, aluminum or steel sheet piling, and shotcrete or concrete, may be used provided the system is tabulated or calculated for maximum allowable spans. The system is intended to be completely assembled and lifted into place from outside the excavation.

This shoring system is generally used for manhole pits, utility pits and small bore pits. The frames can generally be lifted in with backhoes and boom trucks; however, extreme caution should be used to make sure that allowable lift configurations for the equipment are not exceeded.

General Information for use of Pacific Shoring 4 Way Hydraulic Brace System

1. The 4 Way Hydraulic Brace 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, box wall, and strut configuration. 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 4 Way Hydraulic Brace System applications.

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 4 Way Hydraulic Brace. Soil conditions may change at a later date and require revaluation of the strength and allowable depth.

3. 4 Way Hydraulic Brace System is tabulated based on the effect of a 20,000 lbs 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 **Tables 1-1** and **1-2** governs the use of Pacific Shoring 4 Way Hydraulic Brace System and not tabulations given by other manufacturers. This tabulated data applies to 4 Way Hydraulic Brace Systems manufactured by Pacific Shoring, LLC. Any alterations to the boxes 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 vertical and the shoring walls shall be within 12 in of the excavation wall.

6. 4 Way Hydraulic Brace Systems shall be installed and removed from outside the trench, see installation and removal procedure.

7. 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 that may damage the shores.

8. Workers shall always enter, exit, and work inside the shored area of the trench.

9. The lowest element, either the sheeting or the frame of 4 Way Hydraulic Brace System must be set a maximum of 2 ft from the bottom of the excavation. The trench depth is the full distance to the bottom of the excavation.

Classification of Soil Types

1. Soil classification shall be in accordance with OSHA Appendix A and classified just prior to installing 4 Way Hydraulic Brace System. Soil conditions may change at a later date and require 4 Way Hydraulic Brace Systems 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 4 Way Hydraulic Brace System

Determining 4 Way Hydraulic Brace System Configurations

Shoring use and configurations shall be determined by the user (employer and designated competent person). The following steps are necessary to properly configure and construct a 4 Way Hydraulic Brace System.

1. Define soil type in accordance with OSHA Appendix A

2. Determine surcharge loading. All shoring equipment is designed for a maximum of a 20,000 lb surcharge load set back 2 ft from the edge of the trench. Larger loads shall be set back further or reduced. The competent person shall have training and knowledge in proper determination of surcharge loads.

3. Determine length, width, and depth of shoring requirement.

4. Determine existing facilities and depths that they will enter into the shoring configuration.

5. Determine depths, locations, and clearance requirements of facilities that will be constructed inside the shoring.

6. Determine allowable vertical spacing for the shoring frame as follows:

    a) Use **Table 1-1 or 1-2 - Allowable Vertical Spacing of the 4 Way Hydraulic Brace Frame.**

    Using maximum required length and vertical spacing determine allowable depth.

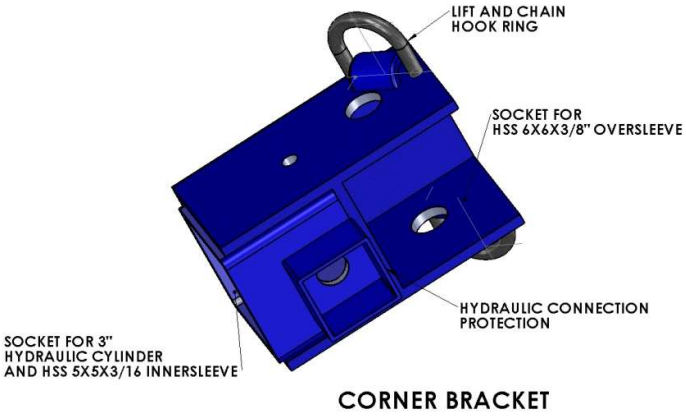
    Example-The excavation is to be 10 ft wide by 16 ft long by 10 ft deep in C-60 soil.

    Entering **Table 1-1** or **Table 1-2** find the vertical spacing that is greater than or equal to 10 ft deep.

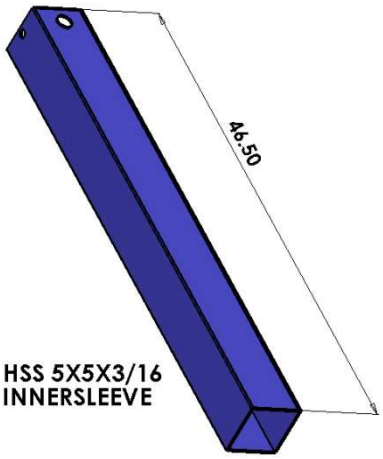
    In C-60 soil the with a maximum frame length of 16 ft frames at 3 ft on center can go 13.2 ft deep (greater than the required 10 ft depth).

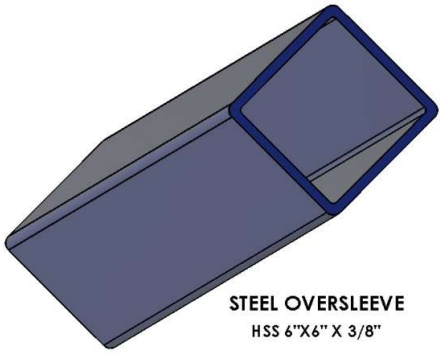
7. Calculations are based on material strength, not deflection criteria.

4 Way Brace System Components

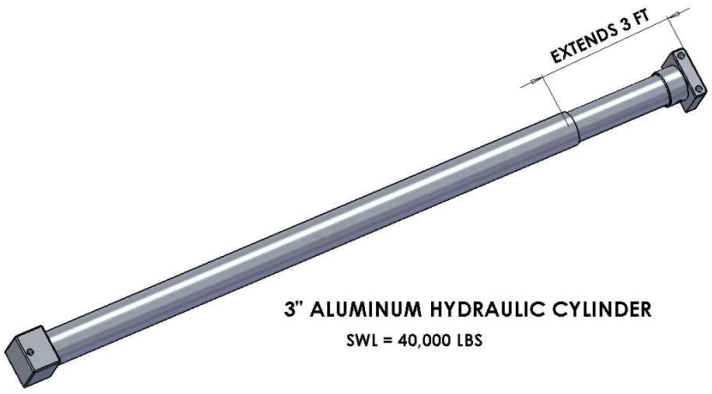


CORNER BRACKET

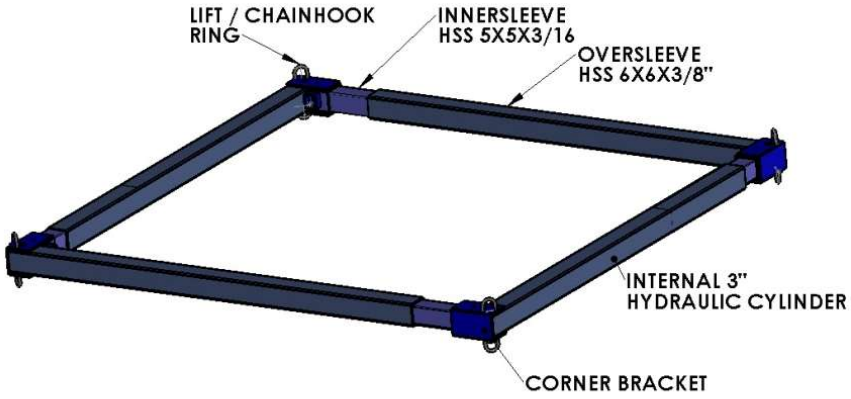




STEEL OVERSLEEVE
HSS 6"X6" X 3/8"



3" ALUMINUM HYDRAULIC CYLINDER
SWL = 40,000 LBS



HYDRAULIC BRACE FRAME ASSEMBLED

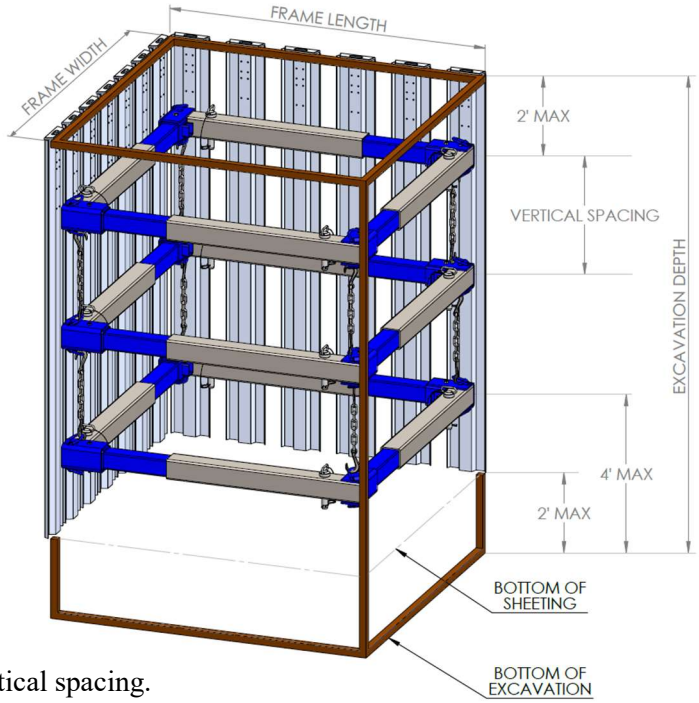
Hydraulic brace components are assembled, rigged, and set from outside the excavation

Allowable Depth for 4 Way Brace with Frame length and Vertical Spacing

Use the following tables to determine the allowable vertical spacing of the 4 Way Hydraulic Brace Frame.

- **Table 1-1 52-88 Cylinder Size**
- **Table 1-2 40-64 Cylinder Size**

Sheeting Table		
Designation	Material	Grade/Yield Stress
(1)	1-1/8"-2.4.1 int APA Plywood	S-2
(1)	Finland Form 3/4" All-Birch	S-1
(2)	1" Steel Plate	ASTM A36
(3)	Steel Sheet Pile (Minimum Section Modulus = 2.5 in^3/ft)	ASTM A328
(4)	Aluminum Sheet Pile (Minimum Section Modulus = 1.13 in^3/ft	6061-T6



Note: Designation (1) cannot be used for 5’ vertical spacing.

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4 WAY HYDRAULIC BRACE SYSTEM TABULATED DATA

Table 1-1: Maximum Depth of Excavation (52-88 Cylinder Size)																		
Weight* (lbs)	Frame Length (ft)		5' O.C. Vertical Spacing				4' O.C. Vertical Spacing				3' O.C. Vertical Spacing				2' O.C. Vertical Spacing			
	Min	Max	A-25	B-45	C-60	C-80	A-25	B-45	C-60	C-80	A-25	B-45	C-60	C-80	A-25	B-45	C-60	C-80
1122	5	8	25.0	25.0	25.0	24.1	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
1234	9	12	25.0	20.0	15.0	11.5	25.0	25.0	19.0	14.5	25.0	25.0	25.0	19.5	25.0	25.0	25.0	25.0
1346	10	13	25.0	16.5	12.5	9.5	25.0	21.0	15.5	12.0	25.0	25.0	21.5	16.0	25.0	25.0	25.0	24.5
1459	11	14	24.5	13.5	10.5	8.0	25.0	17.5	13.0	10.0	25.0	24.0	18.0	13.5	25.0	25.0	25.0	20.5
1571	12	15	20.5	11.5	8.5	6.5	25.0	15.0	11.0	8.5	25.0	20.0	15.0	11.5	25.0	25.0	23.5	17.5
1683	13	16	17.5	10.0	7.5	5.5	22.5	12.5	9.5	7.0	25.0	17.5	13.0	10.0	25.0	25.0	20.0	15.0
1795	14	17	15.0	8.5	6.5	NA	19.5	11.0	8.0	6.0	25.0	15.0	11.5	8.5	25.0	23.0	17.5	13.0
1907	15	18	13.0	7.5	5.5	NA	17.0	9.5	7.0	5.5	23.5	13.0	10.0	7.5	25.0	20.5	15.5	11.5
2019	16	19	11.0	6.5	NA	NA	14.5	8.5	6.5	NA	20.5	11.5	8.5	6.5	25.0	18.0	13.5	10.0
2131	17	20	10.0	5.5	NA	NA	13.0	7.0	5.5	NA	18.0	10.0	7.5	6.0	25.0	16.0	12.0	9.0
2243	18	21	8.5	NA	NA	NA	11.5	6.5	NA	NA	16.0	9.0	7.0	NA	25.0	14.0	10.5	8.0
2355	19	22	7.5	NA	NA	NA	10.0	5.5	NA	NA	14.0	8.0	6.0	NA	22.5	12.5	9.5	7.0
2468	20	23	6.5	NA	NA	NA	9.0	NA	NA	NA	12.5	7.0	5.5	NA	20.5	11.5	8.5	6.5
2580	21	24	5.5	NA	NA	NA	8.0	NA	NA	NA	11.5	6.5	NA	NA	18.5	10.5	8.0	6.0
2692	22	25	NA	NA	NA	NA	7.0	NA	NA	NA	10.0	6.0	NA	NA	16.5	9.5	7.0	5.5
2804	23	26	NA	NA	NA	NA	6.0	NA	NA	NA	9.0	NA	NA	NA	15.0	8.5	6.5	NA
2916	24	27	NA	NA	NA	NA	5.5	NA	NA	NA	8.0	NA	NA	NA	13.5	7.5	6.0	NA
3028	25	28	NA	NA	NA	NA	NA	NA	NA	NA	7.5	NA	NA	NA	12.5	7.0	5.5	NA
3140	26	29	NA	NA	NA	NA	NA	NA	NA	NA	6.5	NA	NA	NA	11.5	6.5	NA	NA

*Weights refer to (1) ring assembly of equal length extensions.
O.C. = On center.

Table 1-2: Maximum Depth of Excavation (40-64 Cylinder Size)																		
Weight* (lbs)	Span Length (ft)		5' O.C. Vertical Spacing				4' O.C. Vertical Spacing				3' O.C. Vertical Spacing				2' O.C. Vertical Spacing			
	Min	Max	A-25	B-45	C-60	C-80	A-25	B-45	C-60	C-80	A-25	B-45	C-60	C-80	A-25	B-45	C-60	C-80
928	4	6	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
1041	7	9	25.0	25.0	25.0	20.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
1153	8	10	25.0	25.0	21.0	15.5	25.0	25.0	25.0	20.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
1265	9	11	25.0	22.0	16.5	12.5	25.0	25.0	21.0	16.0	25.0	25.0	25.0	21.5	25.0	25.0	25.0	25.0
1377	10	12	25.0	18.0	13.5	10.5	25.0	23.0	17.5	13.0	25.0	25.0	23.5	17.5	25.0	25.0	25.0	25.0
1489	11	13	25.0	15.0	11.5	8.5	25.0	19.0	14.5	11.0	25.0	25.0	19.5	14.5	25.0	25.0	25.0	22.5
1601	12	14	22.5	12.5	9.5	7.0	25.0	16.0	12.0	9.0	25.0	22.0	16.5	12.5	25.0	25.0	25.0	19.0
1713	13	15	19.0	10.5	8.0	6.0	24.5	13.5	10.5	8.0	25.0	18.5	14.0	10.5	25.0	25.0	21.5	16.0
1825	14	16	16.0	9.0	7.0	NA	21.0	11.5	9.0	6.5	25.0	16.0	12.0	9.0	25.0	25.0	18.5	14.0
1938	15	17	14.0	8.0	6.0	NA	18.0	10.0	7.5	6.0	25.0	14.0	10.5	8.0	25.0	21.5	16.5	12.5
2050	16	18	12.0	7.0	NA	NA	15.5	9.0	6.5	NA	22.0	12.0	9.0	7.0	25.0	19.0	14.5	11.0
2162	17	19	10.5	6.0	NA	NA	13.5	7.5	6.0	NA	19.0	11.0	8.0	6.0	25.0	17.0	12.5	9.5
2274	18	20	9.0	NA	NA	NA	12.0	7.0	NA	NA	17.0	9.5	7.0	5.5	25.0	15.0	11.5	8.5
2386	19	21	8.0	NA	NA	NA	10.5	6.0	NA	NA	15.0	8.5	6.5	NA	24.0	13.5	10.0	7.5
2498	20	22	7.0	NA	NA	NA	9.5	5.5	NA	NA	13.5	7.5	5.5	NA	21.5	12.0	9.0	7.0
2610	21	23	6.0	NA	NA	NA	8.5	NA	NA	NA	12.0	7.0	NA	NA	19.5	11.0	8.0	6.0
2722	22	24	5.5	NA	NA	NA	7.5	NA	NA	NA	10.5	6.0	NA	NA	17.5	10.0	7.5	5.5
2834	23	25	NA	NA	NA	NA	6.5	NA	NA	NA	9.5	5.5	NA	NA	16.0	9.0	6.5	NA
2947	24	26	NA	NA	NA	NA	6.0	NA	NA	NA	8.5	NA	NA	NA	14.5	8.0	6.0	NA
3059	25	27	NA	NA	NA	NA	NA	NA	NA	NA	8.0	NA	NA	NA	13.0	7.5	5.5	NA
3171	26	28	NA	NA	NA	NA	NA	NA	NA	NA	7.0	NA	NA	NA	12.0	6.5	NA	NA

*Weights refer to (1) ring assembly of equal length extensions.
O.C. = On center.

Table Notes

1. Interpolation between tables is OK.
2. Tables assume dewatering is to the bottom of the excavation.
3. Tables assume a maximum surcharge of 20,000 lbs.
4. Hydraulic frames must be firmly supported at allowable spacing using chains or cables with a factor of safety of 5:1 resulting in a minimum safe working load of 1000 lbs
5. Hydraulic Frames must be used in conjunction with a sheeting system. See tabulated data or engineering calculations for the sheeting system to be used. The least span from vertical spacing given in these tables or allowable spans for the sheeting will control the design
6. Tabulated Depths are limited to 20 ft deep. Additional depth may be achieved when the design is by a registered civil engineer.
7. The expanded length weight is the same as the retracted length weight
8. Frame rigging equipment should have a safe working load with a 5:1 factor of safety
9. A competent person shall determine lifting equipment capacity and allowable lift radiuses.
10. A competent person shall add all other additional loads such as rigging weight, wind forces, and dynamic load from swinging and moving.
11. 6”x6” extension cut sheets available (contact Pacific Shoring).

Geometric Properties for Engineering Design

HSS6x6x3/8

Area =	7.58	IN^2
r =	2.28	IN
Weight =	27.41	plf
S =	13.20	IN^3
Z =	15.80	IN^3

HSS5x5x3/16

Area =	3.28	IN^2
r =	1.96	IN
Weight =	11.96	plf
S =	5.03	IN^3
Z =	5.89	IN^3

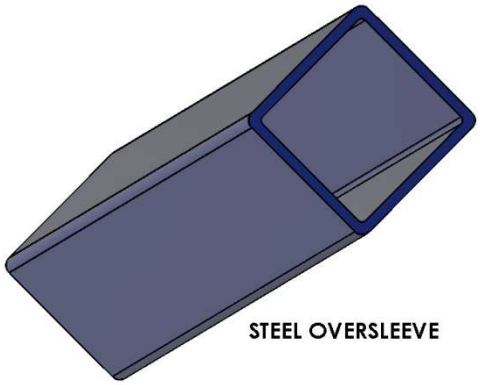
Material - Steel

ASTM A500-GR B

F_y= 46 ksi

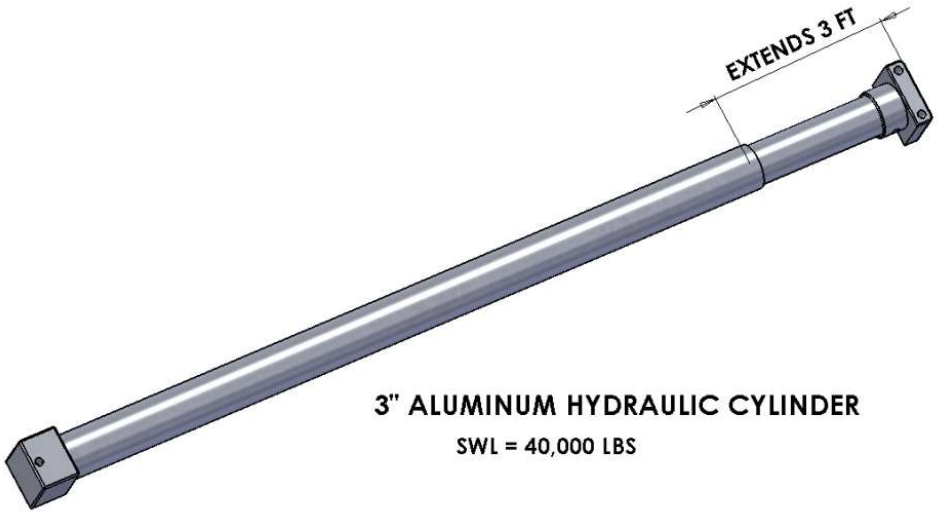
F_u= 58 ksi

E = 10000 ksi



STEEL OVERSLEEVE

3” Aluminum Hydraulic Cylinder



3" ALUMINUM HYDRAULIC CYLINDER

SWL = 40,000 LBS

4 Way Hydraulic Brace System Installation and Removal

Installation Procedure

A competent person trained in installation and safe use of the system shall be present during installation. Prior to start of the excavation the sheeting and 4 Way Hydraulic Brace System should be at the site and assembled so that the shoring equipment can be installed immediately following the excavation work. The excavation walls should be vertical, straight, and square. The sheeting may be placed prior to setting the frames or after they set in place.

Step 1 Assemble the frame on the surface.

Step 2 Attach lifting harness.

Step 3 Lower shore into trench with properly situated and adequately sized lifting equipment such as backhoe, boom truck, excavator, or crane.

Step 4 Pressurize hydraulics at all 4 corners to minimum 750 psi.

Step 5 Set frames from bottom to top.

Step 6 Use chain support to top of sheeting and between frames to prevent the frames from falling vertically. This may be performed from inside the excavation immediately following installation of the sheeting and frames and prior to performing production work inside the shored excavation.

- Develop a hazard analysis for the procedure.

Removal procedure

Step 1 Develop a removal plan that addresses the following:

- All rigging and release of hydraulics must be performed from a safe secure location.
  - This may require separate rigging harnesses for each ring so that workers do not have to reenter the hole after a ring has been removed.
  - The Hydraulic release tool must be long enough to operate from outside the excavation.

- Alternatively the frames can be removed as backfill is progressing.
  - This requires that the hydraulics must be collapsed enough to allow the frame to pass inside the frames above.
  - It also requires that there is enough room for the frame to pass between the frame and the production work that has been constructed inside the shoring.

Safe Handling and Use of 4 Way Hydraulic Brace Systems

- Most shoring related accidents happen while setting and removing shoring equipment. There should always be a competent person trained and familiar with the shoring system being used at the site during installation.
- Prior to starting the excavation work at the shoring location the competent person should verify that all components and their attachments, bolts, pins, hydraulic pumps, assembly equipment, etc. is present at the site.
- Develop an installation plan and hazard analysis prior to starting the work.
- Check the adequacy and condition of all lifting and rigging equipment
- Provide safe access such as ladders for workers to enter and exit the shoring system.
- Use cables and slings for lifting that have a 5:1 factor of safety. A competent person is to determine the total lift weight.
- Confirm that dewatering is to the bottom of the excavation and that if there is a potential for water inside the excavation there is adequate pumping equipment available at the site.
- There should not be voids behind the sheeting. Backfill all voids with excavated material or small 3/8” minus rock. If the retained soil runs out from behind the sheeting it may be required to use flowable grout to seal it up.
- Check hydraulics at the start of every shift to be sure that they have not bled off.
- Monitor surcharge loading throughout the life of the shoring system installation. A competent person shall determine the proper setback for all surcharge loads over 20,000 lbs.