TABLE B.3 - GEOTRACES System
Note: Some of the figures below are estimates for Appendix B illustration only.

REQUIRED DATA	Operator/Designer Response	
Deployment Type	*Station Keeping-Deep Water*	*Allied manual clearly indicates A-frame is only designed for lifting. 30 degrees off vertical is generally considered for normal vessel motions. If towing limiitation were desired, it could be investigated with Allied and incorporated into the MCD.*
Provide a brief narrative of scientific purpose and the equipment to be deployed. A drawing or drawings of the proposed "system" or "component" architecture is to be appended showing, for example, tension member angles and potential loadings (Principal, Secondary & Worst Case) relative to the various system elements. Provide information on the vessel or vessels (size(s), type(s), UNOLS or not, etc.) intended for the system deployment, its/their area(s) of operation and the likely weather conditions to be encountered.	This system is used to deploy and recover a trace metal clean rosette for the GEOTRACES project. It is made up of specially designed portable components provided by the science project that bolt to the ship's deck structure as shown in Sheet 2. Typcial deployments are 2000m and can be greater than 75% of the water depth.	
Provide Primary Deployment Information:		
Package Description	GEOTRACES Rosette	
Maximum Package Weight	1102 lbs (500 kgf)	
Base Package Mass	1102 lbs (500 kgf)	
Added Mass to Include Captured and Entrained Added Mass (E.G., Water/Mud)	Entrained water included above	
Maximum Hydrodynamic Resistance	200 lbs (up-cast)	
Dynamic Factors	1.27 g vertical (Assuming Global AGOR side quarter deployment, See Glosten document XXXXX)	*It is possible to use dynamic factors less than the Appendix A requirement of 1.75 if the characteristics of the vessel are known. 1.75 is the requirment (based on ABS) if you don't know anything else.*
Tension Member Type and Breaking Load. Either Nomial Breaking Load (NBL) or Assigned Breaking Load (ABL) per Appendix A	Cortland cable; 16,500 lbs	
Maximum Tension Member Weight (In Water)	190 lbs	
Maximum Tension Member Mass	882 lbs	
Tension Member Factor of Safety per Appendix A	7.5 per Cortland	
Tension Member Maxmimum Permissible Tension (MPT) or SWL	2204 lbs	
Maximum Anticipated Depth/Length of Deployment	2000m	
Maximum Allowable Depths of Water	Unlimited	
Deployment/Water Depth Ratio	*Near 100 % depending on station depth*	
Principal Loading	*1492 lbs (rosette, entrained water, resistance, cable weight in water)*	
Secondary Loading	*2774 lbs (dynamic effect on total mass = 1.27 g)*	*This exceeds MPT of the Cortland cable. Appendix A calculations should be checked. Operatiions can proceed by confirming actual loading with the cable monitoring system. This is an indictor that the operation should be prepared to make operational decisions to reduce loading.*
Worst Case Loading	*16,500 lbs (Rosette fouls in submerged wreck)*	*This results in the DLT for an Inspected Vessel like KNORR.*
Load Limiting Device or Conditions (Section B.4)	None	*Use on a LLD on an Inspected Vessel would have to be approved by USCG.*
Maximum Anticipated Operating Tension (MAOT):	16,500 lbs	*Per Appendix B Section B.4 (No LLD and vessel large enough to impart this level on loading)*
Design Line Tension (DLT):	16,500 lbs	
Ultimate Design Load (UDL):	Unknown	
Maximum Permissimble Tension (MPT):	2200 lbs	*This is what you would set the alarm on the cable monitoring system to as well as Auto-Render/Recover (if fitted). Auto-Render/Recover could be used on an uninspected vessel as a LLD, but not an inspected vessel (yet).*
MAOT < or = DLT?	**Yes (OK)**	*Without a LLD, MAOT must be less than DLT*
Other Emergency Means of Package or Tension Member Detachment	None	
Other Means for Package Control	None	
Description of Fail Safes in the Event of Power Loss or Mechanical/Electrical Failure of System Components	None	

GEOTRACES LHS - KNORR

Note: Some of the figures below are estimates and are provided for Appendix B illustration purposes only.

COMPONENT	UDL (LBS)	DLT (LBS)	MPT (LBS)	Comments
1. Handling Apparatus				
GEOTRACES A-Frame	Unknown	24,795 lbs (7500kgf x 1.5)	4,860 lbs (2,205 kgf) R(max) = 6,135 lbf at DLT	Allied manual and supporting calculations provided to WHOI contain all of the necessary information to quickly and easily develop the MCD, including deck bolt reactions. Outboard position bolt loads are shown since unlikely DLT will be seen in the inboard position. The assembly drawing could be easily modified to show all pertenant information and the manual verbiage used for the written document. At the current time, this frame is rated for "Station Keeping" only.
2. Winch				
GEOTRACES DYNACON Winch with Owner-supplied Deck Mating Foundation	Unknown	Unknown	9,636 lbs R (max) = 2,490 lbs vert at 16,500 lbs DLT	MPT is assumed from the Glosten deck bolt calculations. MCD needs development through Science Party or Winch Pool with interface from DYNACON. **This process should confirm that winch can withstand at least 16,500 lbs.** MCD should also give bolt loads on standard DYNACON pattern to check attachment to base frame (which is assumed to have been done during design of the frame). If needed, reactions a varying tensions can be acheived by simple ratios.
3. Tension Member				
Cortland	16,530 lbs (7500 kgf)	16,530 lbs (7500 kgf)	**2204 lbf (1000 kgf)**	DYNACON winch design meets Appendix A requirements for FS 2.0 on steel cables. Synthetics not yet covered by Appendix A. SWL based on Cortland spec sheet (FS = 7.5)
4. Blocks/Sheaves				
GEOTRACES Block	Unknown	20,000 lbs	10,000 R = 20,000	MCD needs development, but easily available from vendor spec sheets and verified through testing. See standard block MCD format. MCD should include padeye reaction at MPT which is normally 2x MPT
5. Hardware				
WHOI Provided 1" Deck Bolts		Proof Load?	R Vert = 7,500	From deck bolt spec sheet. 7500 is estimate and may be closer to 9000 lbs. **Greater than R from winches and A-frame**
GEOTRACES Provided 1/2" Shackle at Block	Unknown	> 20,000	R = 20,000	From Crosby spec sheet
6. Deck Bolting Pattern				
KNORR 1" 24x24 O/C Deck Sockets at deck edge (??)			R Vert = 9000 lbs	From deck bolting pattern MCD. It is unclear whether or not the 9000 lbs is for the deck bolt or deck socket. KNORR may have had added strengthening done for the sockets at the deck edge. this should be shown in the MCD If these forces are factored down by 1.5 to 16,500 DLT, deck bolt loads would be Approximately 6135/1.5 = 4090 lbs. **In eithe case, greater than R from the A-frame > OK**
KNORR 1" 24x24 O/C Standard Deck Sockets			R Vert = 5000 lbs	From deck bolting pattern MCD. **Greater than R from the A-frame > OK**
System Maximum Permissible Tension (MPT)			**2204 lbs**	
System Design Line Tension (DLT)		**16,500**		


DYNACON, Inc.
BRYAN, TEXAS USA

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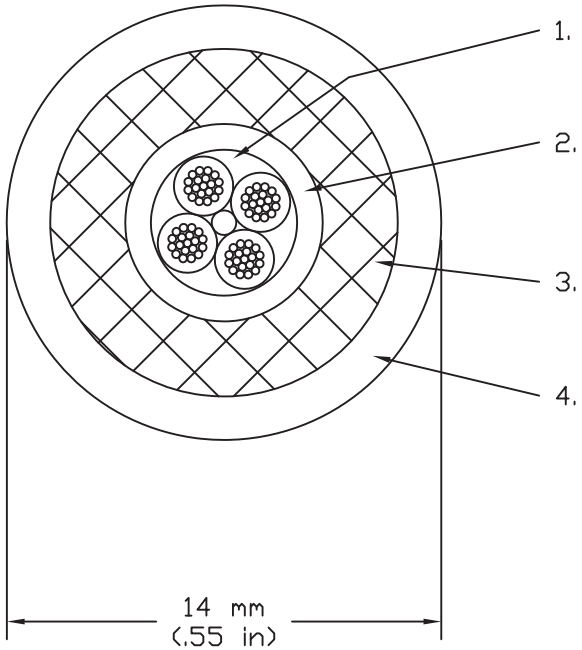
REV.	DESCRIPTION	DATE	BY
–	ORIGINAL RELEASE	10/27/06	CJM



NOTES:

1. Core:
   #18 AWG twisted quad: central nylon monofilament, stranded tinned Copper wire, EPC conductor insulation (color coded), curable Silicone void filler, Mylar tape wrap, 1 place
2. Extruded Polyurethane core jacket, nominal .75 mm wall thickness, yellow
3. Torque balanced Vectran braided strength member
4. Extruded Polyester outer jacket, nominal 1 mm wall thickness, black

OPERATING PARAMETERS:

OPERATING TEMPERATURE: −40°C TO +80°C

MINIMUM RECOMMENDED BEND RADIUS: 250 mm

RATED WORKING LOAD: 1000 kgf

RATED BREAK STRENGTH: 7500 kgf

CALCULATED WEIGHT IN AIR: 200 kg/km

CALCULATED WEIGHT IN SEA WATER: 43 kg/km

ELECTRICAL CHARACTERISTICS (nominal):

#18 AWG COND:

dcR= 19 Ohms/km/conductor

Voltage rating= 600 V

Cortland Cable Company
44 River St. - POB 330
Cortland, N.Y. 13045
PHONE: 607 753-8276
FAX: 607 753-3183
E.MAIL: cortlandcable@cortlandcable.com

Electro Mech Cable

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS ARE IN INCHES

ALL VALUES NOMINAL

SIZE	QUOTE NO.	LEVEL	DWG NO.	REV
A	710-4437	A	EV710272	–

SCALE	DATE	SHEET
4:1	10/27/06	1 of 1

TECHNICAL MANUAL
A-11
ALLIED MARINE CRANE

S/N 2221

MANUFACTURED BY

Allied Systems COMPANY
21433 S.W. OREGON ST., SHERWOOD 97140, OR U.S.A.
PHONE: 503.625.2560 • FAX: 503.625.7980
E-MAIL: cranes@alliedsystems.com
WEBSITE: http://www.alliedsystems.com

Please check the Allied Systems website regularly for updates to the technical manual.

SAFETY SUMMARY

- **Do not overload the A-Frame.** Always operate within the rated capacity of the A-Frame and rigging. Refer to the nameplate for this A-Frame's lifting capacity.
- Inspect slings, chokers and other rigging devices frequently for cuts, abrasion, rust, kinks or other damage. Do not use suspected defective equipment to lift or move a load.
- Always wear appropriate safety clothing and use prescribed safety equipment—head, foot, hand and eye protection, etc.
- Accurately place the load, keeping in mind how you expect the load to respond when released.
- Lower and remove the load before leaving the A-Frame or securing hydraulic power.
- Maintain proper clearance from energized equipment. If the A-Frame contacts energized equipment—stay clear of the A-Frame and prevent anyone else from coming in contact with the A-Frame. If you are on the A-Frame, stand fast—**Do not jump off**.

MAINTENANCE SAFETY

- Unless properly serviced, this A-Frame can be extremely dangerous.

Qualifications:

- In order to ensure safety, each person working on this A-Frame must have the necessary skills, information, tools and equipment. Do not attempt to make adjustments, or perform repairs unless you are authorized and qualified to do so.

Do Not Work Alone:

- Never attempt to service energized equipment alone. Someone capable of rendering aid in the event of accidental shock must be present.
- Do not rely on the hydraulic system to support any part of the A-Frame during maintenance or lubrication. Never stand under an A-Frame component that is supported only by the hydraulic system. Ensure components are resting on their mechanical stops or supported with appropriate safety stands during maintenance or lubrication.
- Unless otherwise directed in this manual, never attempt servicing while power is applied. Tag the "START" switch and/or the disconnect switch with a **"DO NOT START"** sign when required.
- Never attempt servicing while the A-Frame is moving or the hydraulic power unit is running. Lower the load and secure power.

Equipment Safety:

- **Test Equipment.** Ensure test equipment is in good condition.
- If an instrument must be held while taking measurements, ground the case of the instrument before energizing equipment.
- Do not touch live equipment or personnel working on live equipment while holding a multimeter. Some types of measuring devices should not be grounded—do not hold such devices while taking measurements.
- **Heavy Equipment.** Prevent personal injury or equipment damage by using a lifting device with a lifting capacity greater than twice the weight of any equipment to be lifted.
- **Pressurized Equipment.** Wear safety goggles when working on or near pressurized equipment.
- Lower all loads and relieve all hydraulic pressure before disconnecting hydraulic lines. Otherwise, the load could fall on you or pressurized hydraulic oil could cause severe personal injury. Never try to stop a hydraulic leak with any part of your body.
- Be aware of the hazards of pressurized hydraulics:
  - » Wear personal protective equipment, such as gloves and safety glasses, whenever servicing or checking a hydraulic system.
  - » Assume that all hydraulic hoses and components are pressurized. Relieve all hydraulic pressure before disconnecting any hydraulic line.
  - » Never try to stop or check for a hydraulic leak with any part of your body; use a piece of cardboard to check for hydraulic leaks.
  - » Small hydraulic hose leaks are extremely dangerous, and can inject hydraulic oil under the skin, even through gloves.
  - » Infection and gangrene are possible when hydraulic oil penetrates the skin. See a doctor immediately to prevent loss of limb or death.

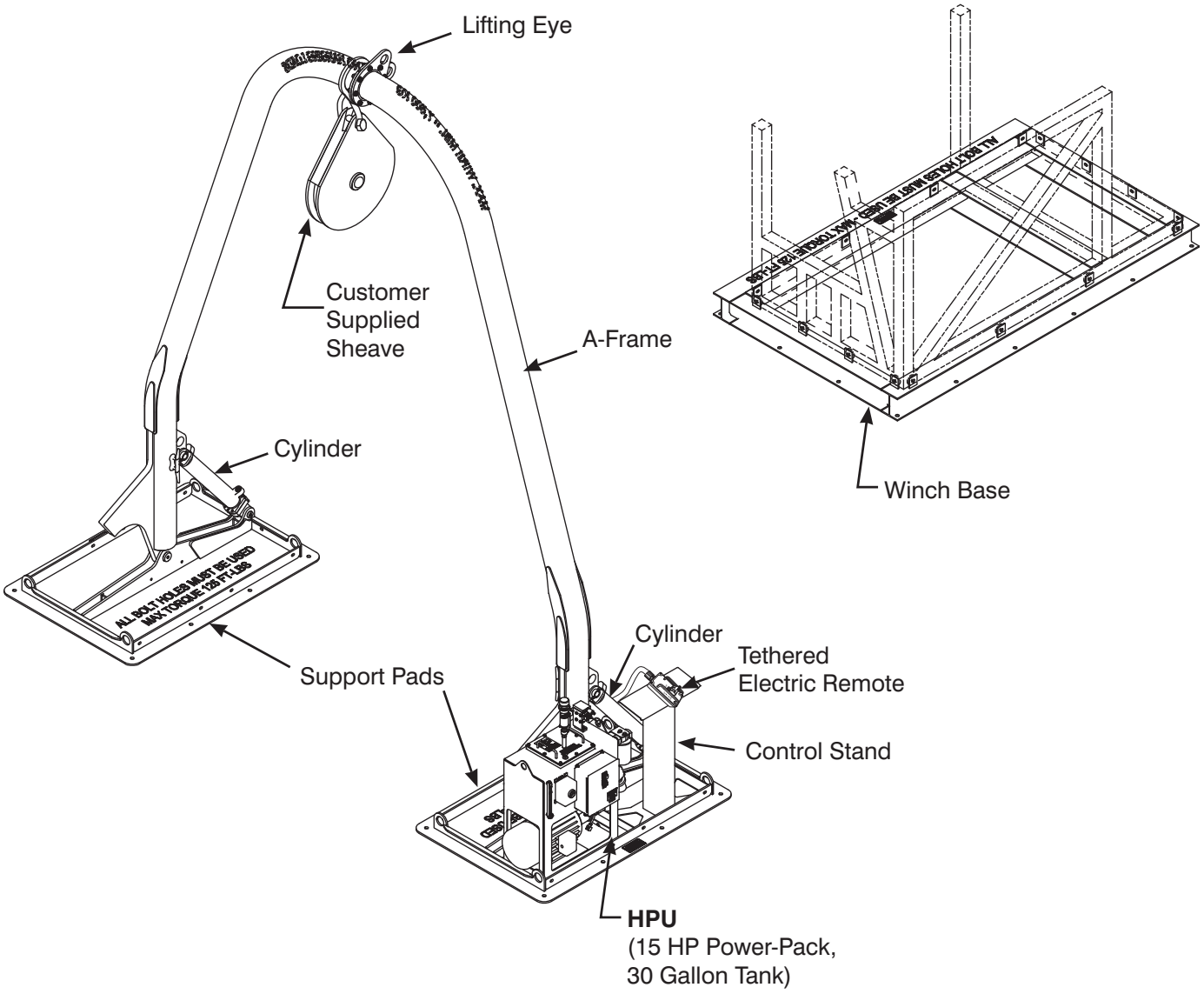


Figure 1-1. Component Identification

1 - 1

CHARACTERISTICS	DESCRIPTION
Ratings:	**NOT PERSONNEL RATED**
Wire Rope	Customer Supplied
Electrical Requirements:	440 vac. 3-Phase, 60Hz, 30 AMP
Hydraulic System:	
Operating Pressure	2,200 psi
Relief Pressure	2,500 psi
Required Pump Output	12 gpm
Temperature Range	0˚ F to 180˚F (-17˚ to 82˚ C)
Hydraulic Fluid	Mobil DTE 13M
Hydraulic Power Unit:	
Pump	Gear Pump
Motor	15 hp, 440V/3, 3-Phase, 60Hz, 1800 rpm
Return Filter	10 Micron Element (externally mounted, screw on)
Tank	30 Gallon Capacity
Control Valve:	1-Section, Lever Actuated and Electro/Hydraulic Proportional
Winch:	Customer Supplied Dynacon
Cylinders:	
Stroke	23.38"
Bore Diameter	4" Diameter
Extended Length	65.88"
Retracted Length	42.5"
Stem Diameter	2"
Environmental:	
Atmospheric	A-Frame and equipment will withstand frequent soaking by salt-spray and ambient atmospheric conditions.
Temperature	A-Frame and equipment will operate within ambient temperature range of 0˚ to 100˚ F (-17˚ C to 38˚ C).
Humidity	A-Frame and equipment will withstand effects of relative humidity ranging from 0 to 100% under operating and stowage conditions.

Table 1-1. Reference Data

Model A-11
A-Frame Weight .....7,300 lb. (3,311 Kg)
Rated Load.....2205 lb. (1000 Kg)

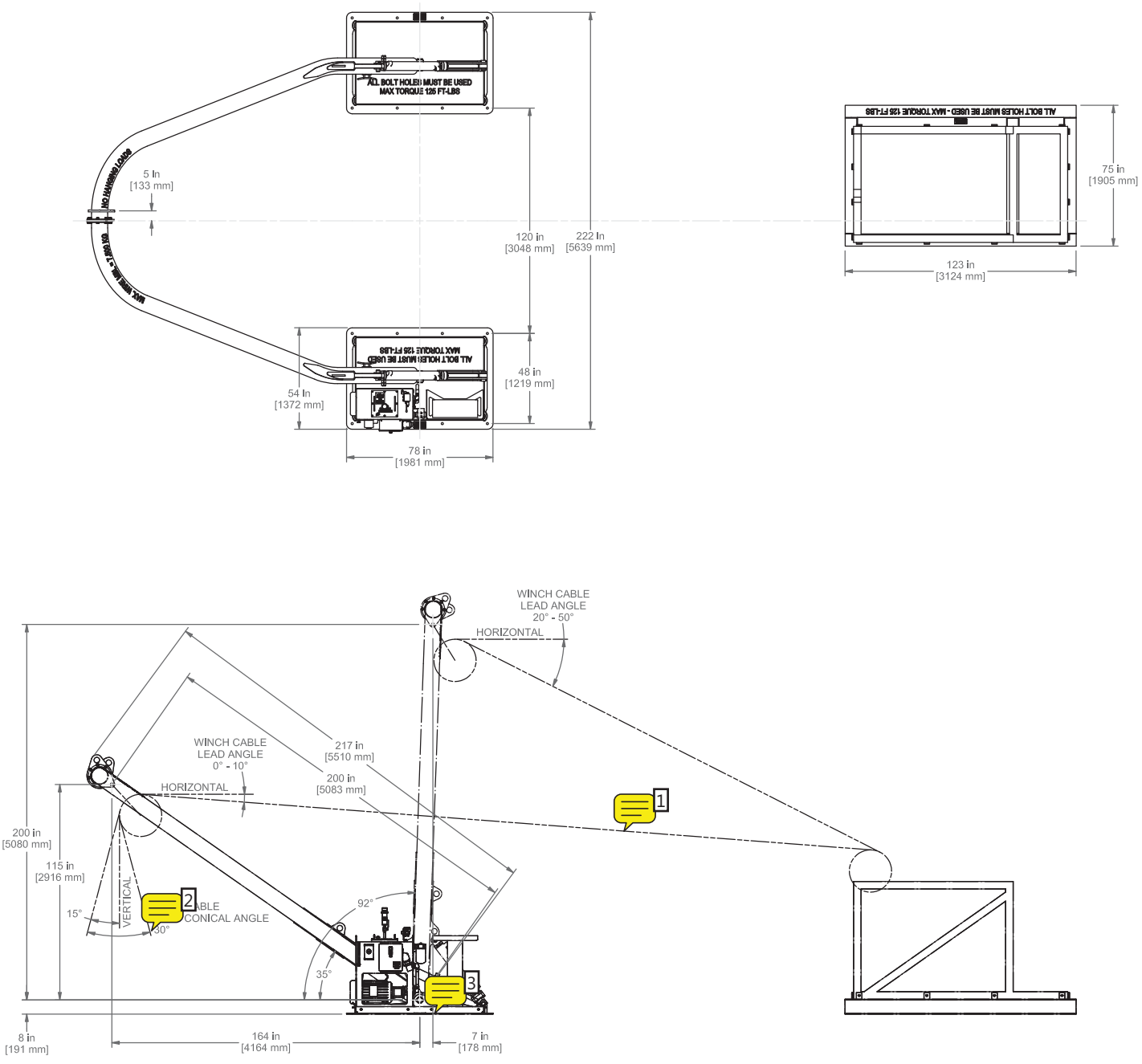


Figure 1-6. Dimensional Data

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Show MPT here.

Number: 2 Author: NSFUSER Subject: Sticky Note Date: 2/4/2012 3:08:21 AM
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Number: 3 Author: NSFUSER Subject: Sticky Note Date: 2/4/2012 3:08:59 AM
Add maximum deck bolt reactions here.

CHAPTER 3
FUNCTIONAL DESCRIPTION

3.1 INTRODUCTION

The model A-11 A-Frame is a part of the UNOLS Geotraces Overboarding System. It's purpose is to support the wire rope from the Geotraces Winch that is attached to a winch base frame mounted to the vessel's deck. The Geotraces System deploys and retrieves scientific equipment.

The functions and capabilities of the A-Frame are the result of several systems working together: A-Frame; Operator Controls; Hydraulic System; Electrical System; and the Hydraulic Power Unit.

3.2 MECHANICAL SYSTEM

3.2.1 A-Frame

Figure 3-1. The A-Frame, Support Pads, Cylinders, Sheave (customer supplied), Winch Base, and Winch (customer supplied) are structural members that support the load. The support pads are bolted to the deck. The cylinders control the deployment and retrieval motions of the boom.

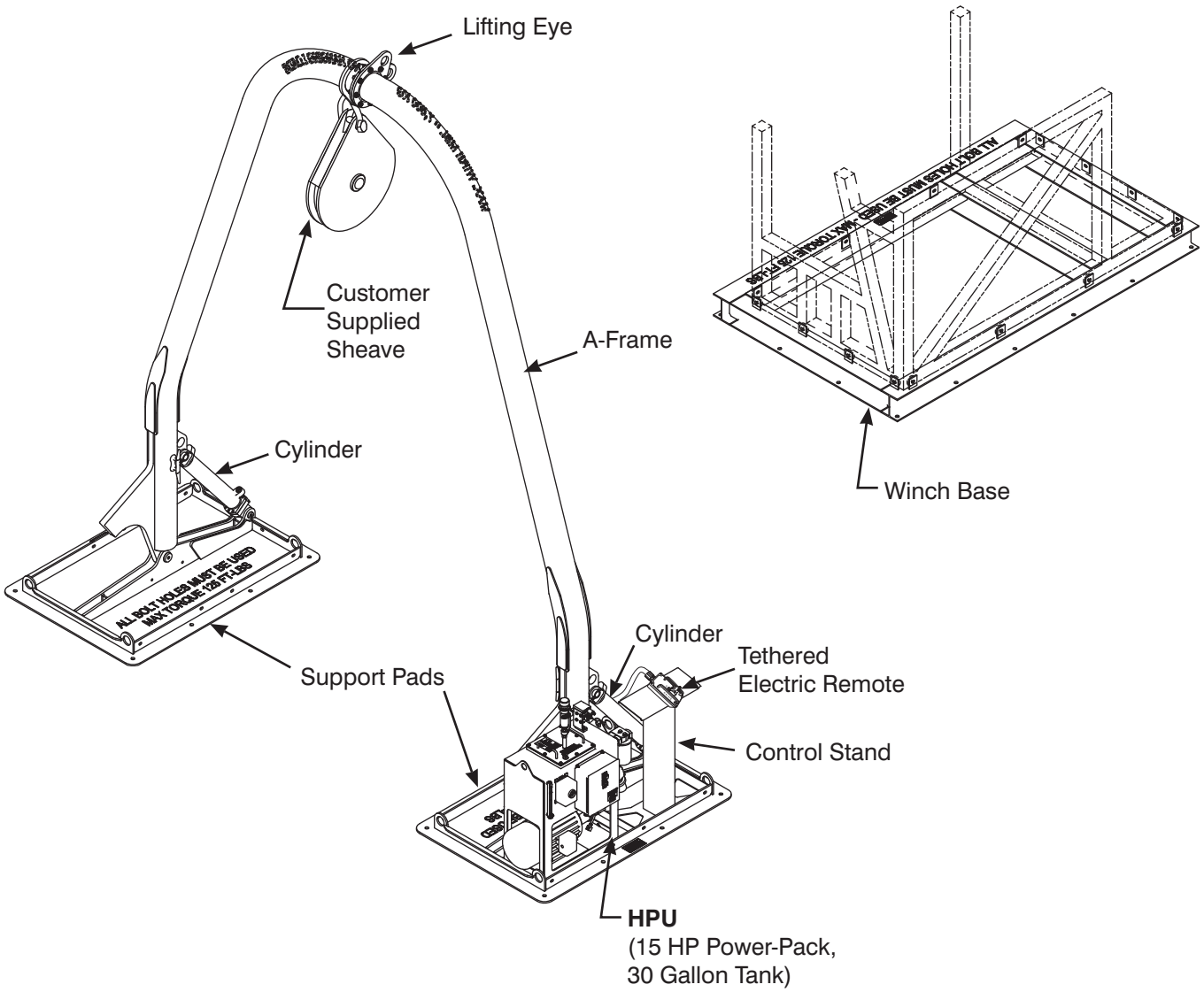

Figure 3-1. Component Identification

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Number: 1 Author: NSFUSER Subject: Sticky Note Date: 2/3/2012 12:10:12 PM
This is the intro language of a typical MCD.

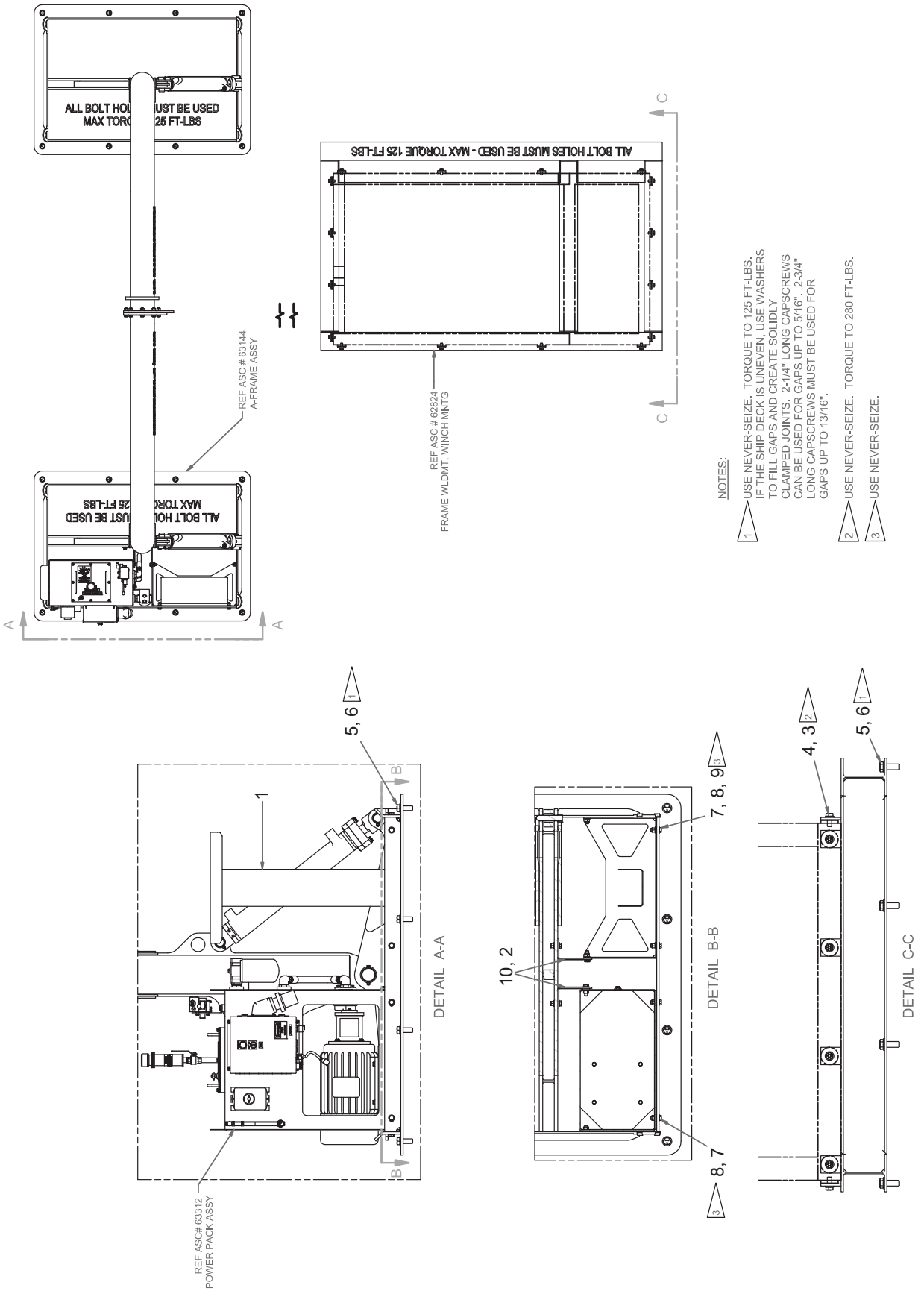


Figure 7-12. A-Frame Installation

CHAPTER 8
INSTALLATION

8.1 GENERAL

This chapter is provided to assure a smooth and satisfactory installation of the A-Frame, model A-11, S/N 2221.

1. See Figure 8-1 for shipping layout and component weights. Have a crane available that will safely lift the A-Frame assembly including the electric motor and the hydraulic power unit (6,000 lb).
2. When installing the A-Frame, check for adequate pivoting clearance between the A-Frame and the ship's structures or any other deck mounted equipment.

IMPORTANT! The welded torque requirement (125 ft-lb) on the base pad only applied to the base pad mounting bolts. Please refer to the torque values in Chapter 7 or in specific assembly or service steps in this book for all other fasteners.

8.2 A-FRAME INSTALLATION

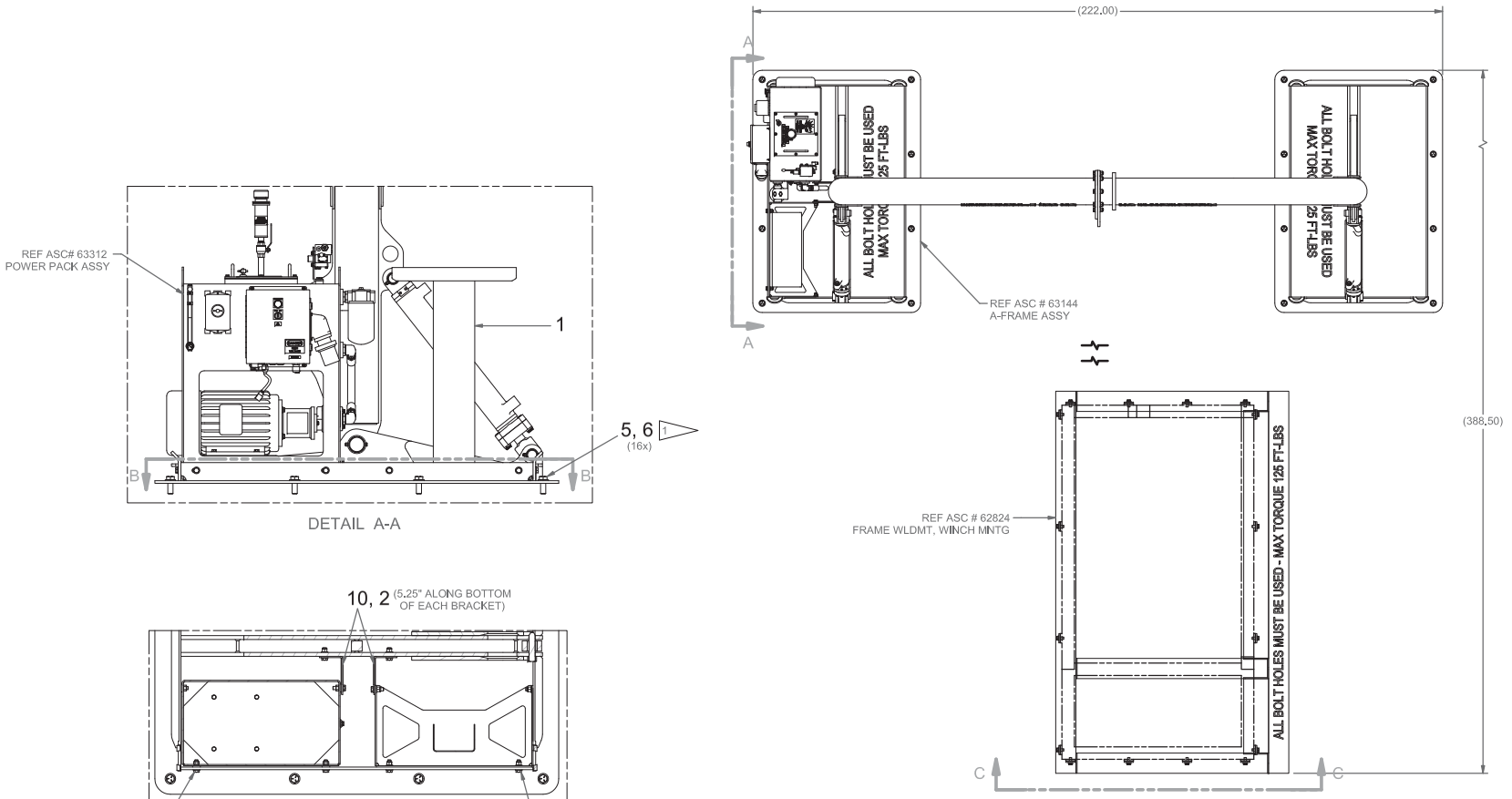
8.2.1 Install Base Pads

1. Lift the A-Frame over the mounting flange so that the base assembly attachment points will be centered over the deck attachment points.
3. Position the A-Frame base pad and cylinder assembly so that all attachment points are in the correct position with the deck. Install (16) 1 UNC X 2 3/4 Zinc HX HD capscrews (P/N 18670W), (16) 1" flat washers (P/N 221780W) under each capscrew and tighten as indicated in Figure 8-1.

IMPORTANT! If the ship deck is uneven, use 1" washers (P/N 221780W) to shim the base pads if the gap between the base pads and the mounting surface exceeds 5/16" to create solidly clamped joints. 2-1/4" (P/N 18677W) long capscrews can be used for gaps up to 5/16". 2-3/4" (P/N 18670W) long capscrews must be used for gaps up to 13/16".

Using Never-seize, torque the base pad mounting bolts to 125 ft-lb.

Figure 8-1. Base Pad



NOTES:

1. USE NEVER-SEIZE. TORQUE TO 125 FT-LBS. IF THE SHIP DECK IS UNEVEN, USE WASHERS TO FILL GAPS AND CREATE SOLIDLY CLAMPED JOINTS. 2-1/4" LONG CAPSCREWS CAN BE USED FOR GAPS UP TO 5/16". 2-3/4" LONG CAPSCREWS MUST BE USED FOR GAPS UP TO 13/16".
2. USE NEVER-SEIZE. TORQUE TO 280 FT-LBS.
3. USE NEVER-SEIZE.

LEGEND:

1. Console Stand
2. Bracket
3. Washer (3/4")
4. Capscrew (3/4-10 UNC x 1.75)
5. Capscrew (1-8 UNC x 2.75)
6. Washer (1")
7. Capscrew (5/8 - 11 UNC x 2 (SS))
8. Washer (5/8" (SS))
9. Nut (5/8" -11(SS))
10. Neoprene "U" Channel

Figure 8-11. Installation Drawing

DESIGN CALCULATIONS

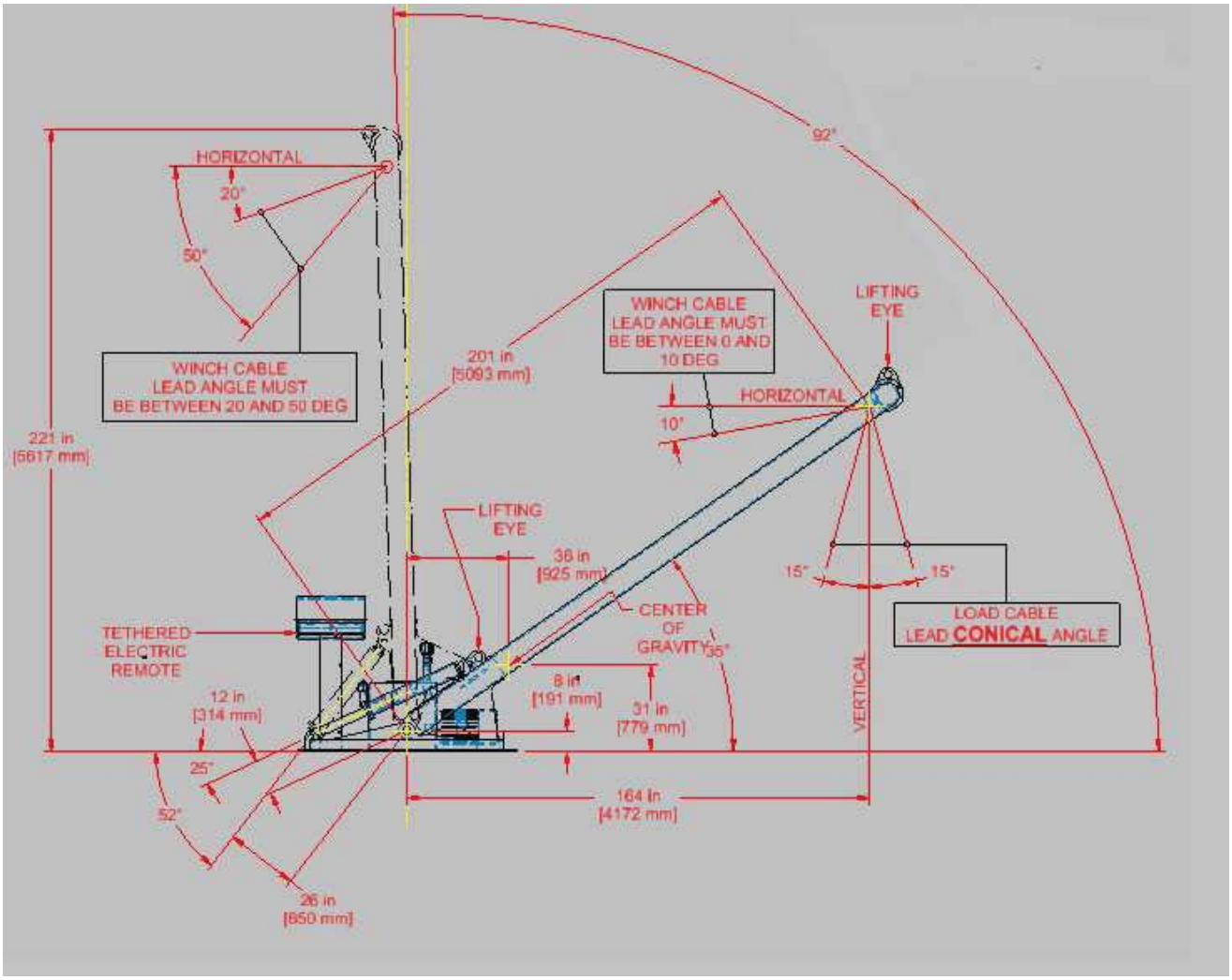
Allied Systems Company, Allied Marine Crane
Model: A-11, S/N: 2221
Calculations by: Bob Nourse
August 6, 2010

TABLE OF CONTENTS

DESIGN CALCULATIONS

Allied Systems Company, Allied Marine Crane
Model: A-11, S/N: 2221
Calculations by: Bob Nourse
August 6, 2010

Section 1 - Design Layout



SECTION 2 - Deployed Position

The A-Frame is designed to have a SF of 1.5 with a cable tension equal to the breaking strength of the cable.

The max loading is in the deployed position at 164 in Load Radius when the winch cable lead angle is 10 deg below horizontal and the load cable conical angle is 15 deg outboard from vertical

The breaking strength of the wire is 7500 kgf.

SECTION 2.1 - A-FRAME FEA

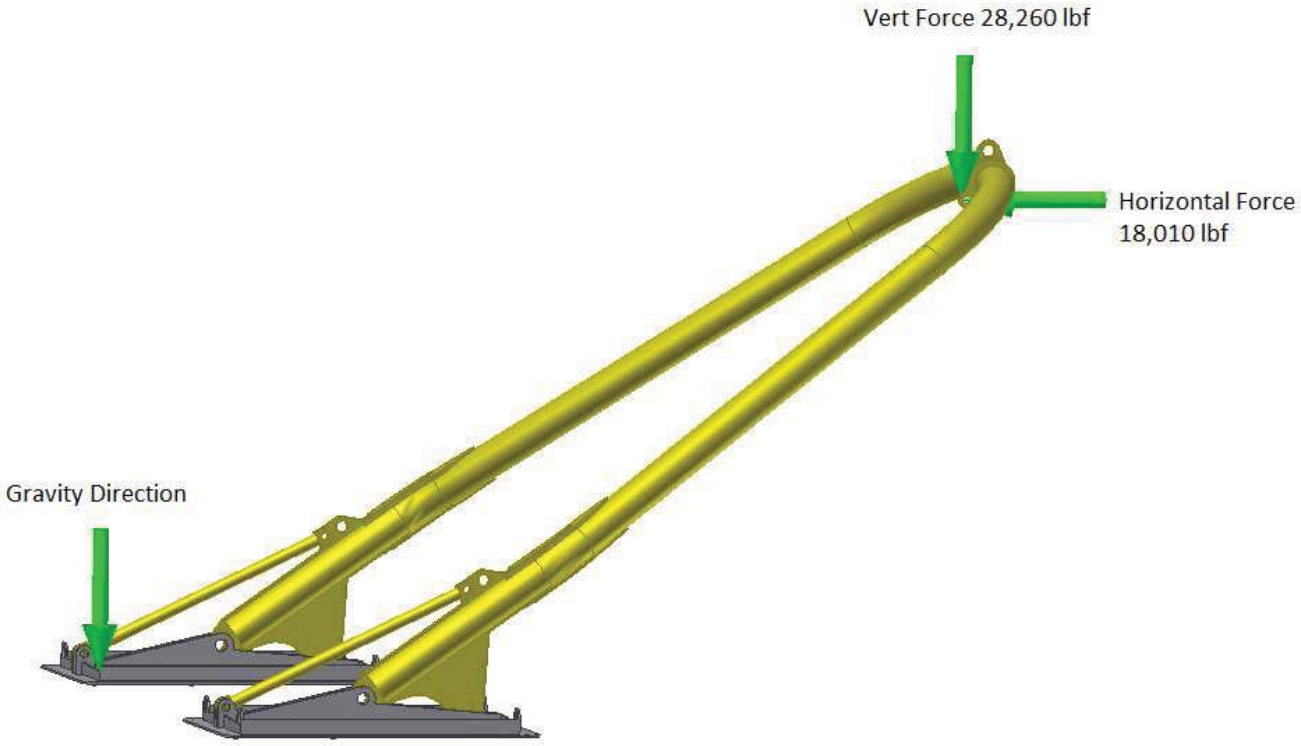
SECTION 2.1.1 - LOADING

The design cable tension is $F := 7500 \cdot kgf \cdot 1.5 = 2.48 \times 10^4 \cdot lbf$

The horizontal component is $Fy := F \cdot \cos(10 \cdot deg) - F \cdot \sin(15 \cdot deg) = 1.801 \times 10^4 \cdot lbf$

The vertical component is $Fz := F \cdot \sin(10 \cdot deg) + F \cdot \cos(15 \cdot deg) = 2.826 \times 10^4 \cdot lbf$

An FEA model was created and Analyzed using Autodesk Inventer Pro Rel 10



Forces and Accelerations were applied as shown.
The cylinder was modeled as a fixed link with pin joints at each end

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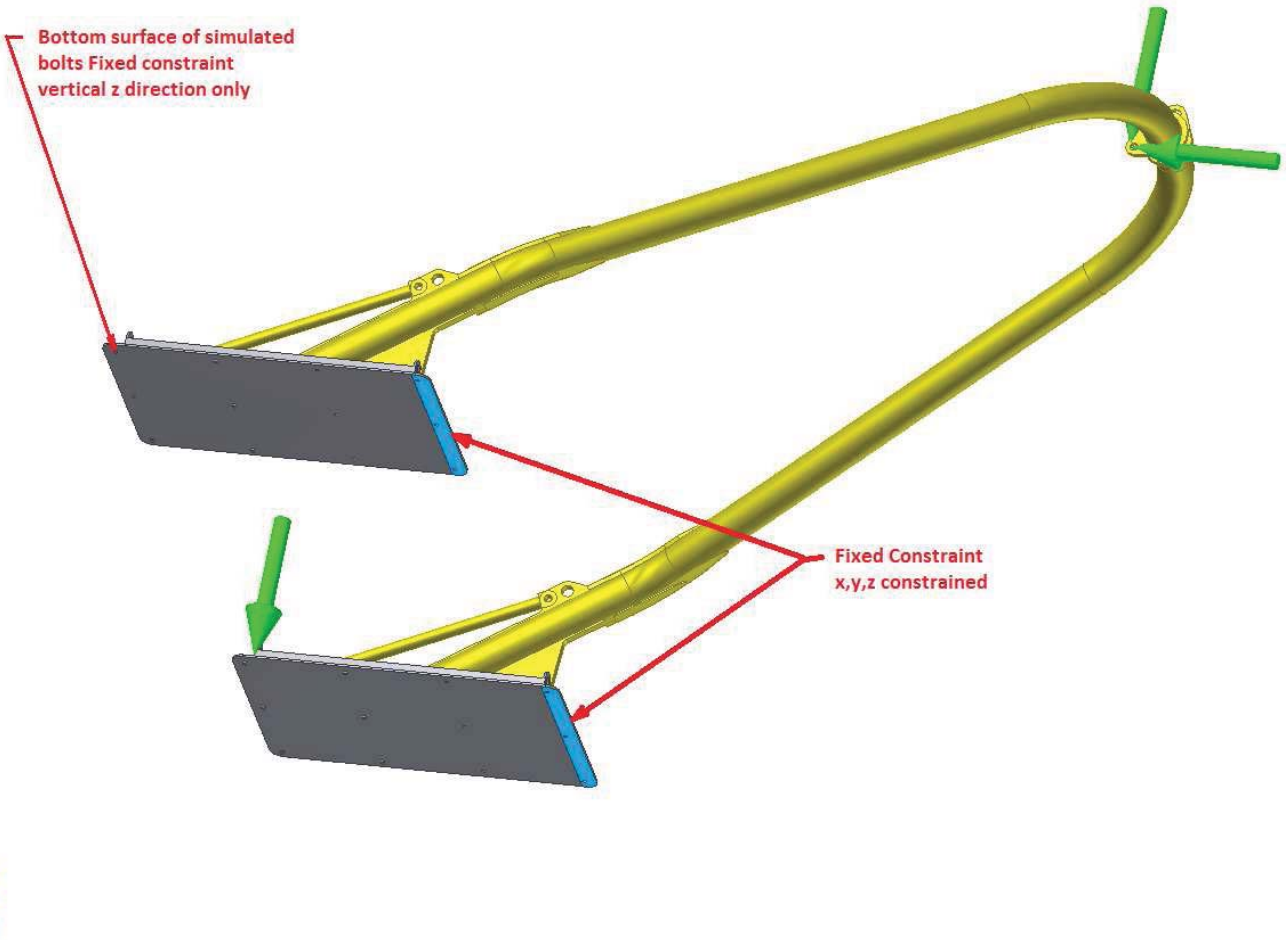
Believe this should be shown as 7500x2.204x1.5. 2.204 is the conversion to lbf. 1.5 appears to be the Sub-Chapter U minimum FS. the 24,795 lbf is correct from a calculation standpoint. However, the 1.5 at this stage is not required as long as the FEA shows allowable stresses are not exceeded. There may be FS of top of FS in this case. There may be more capacity in this frame than shown which could be investigated with Allied. This is important to know.

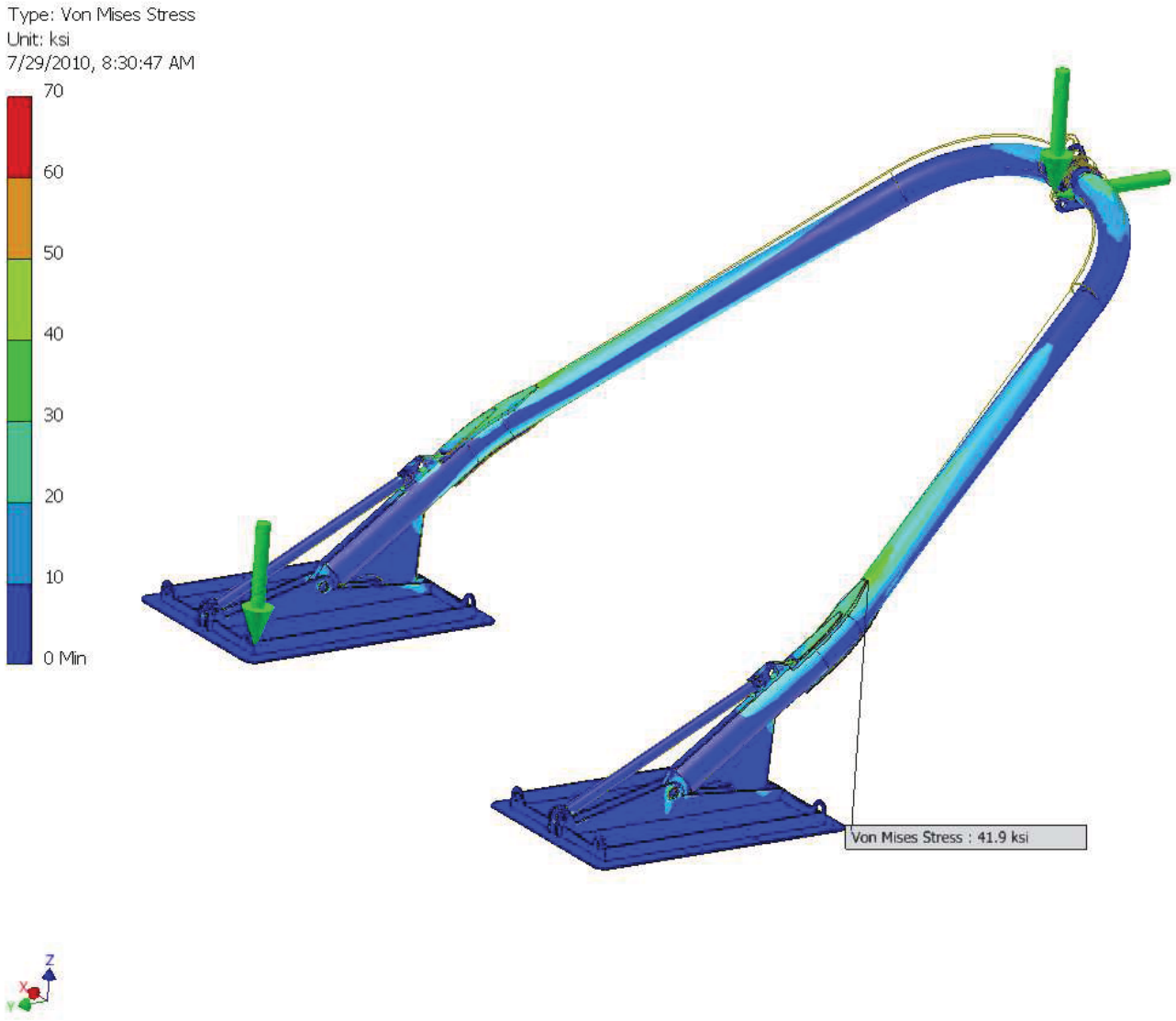
SECTION 2.1.2 - CONSTRAINTS



Constraints were applied as shown. In order to model spring characteristics of the Mounting bolts they were modeled as a 1" dia cylinder extending 1/2 in below the bottom of the Base Plate. This distance is equal to the thickness of the Base Plate and simulates the minimum spring length of the mounting bolts

SECTION 2.1.3 - STRESS RESULTS

RESULTS: Von Mises Stress



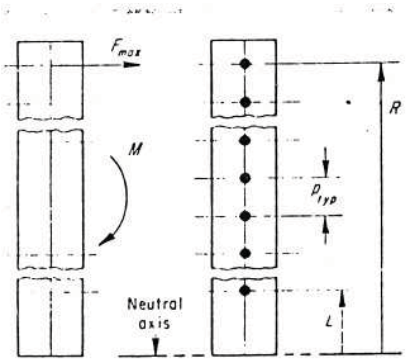
SECTION 2.2 - PAD BOLT FORCE CALCULATIONS

Check bolt loads manually

Max Bolt Force $FBmaxallowable := 9000 \cdot lbf$

$Moment := Fz \cdot 164 \cdot in - Fy \cdot 201 \cdot in \cdot \sin(35 \cdot deg) = 2.133 \times 10^5 \cdot ft \cdot lbf$

Formula for bolt force



p = pitch
L = distance of first bolt from neutral axis
N = number of bolts in pattern

$$F_{max} = \left(\frac{R}{k_2 p^2}\right) M$$

where:

$$k_2 = \frac{N}{6}\left[6\alpha(\alpha + N - 1) + (2N - 1)(N - 1)\right]$$

and,

$$\alpha = \frac{L}{p}$$

Special Case: For $N = 1$, use any convenient value for p, except zero.

In this case take the neutral axis as the first bolt so L=0 and α=0

$p := 2 \cdot ft$

$N := 4$

$R := 6 \cdot ft$

$$k2 := \frac{N}{6} \cdot (2 \cdot N - 1) \cdot (N - 1)$$

There are 6 columns of bolts 3 on each pad

Max Bolt force $$FBmax := \frac{R}{k2 \cdot p^2} \cdot \frac{Moment}{6} = 3.809 \times 10^3 \cdot lbf$$

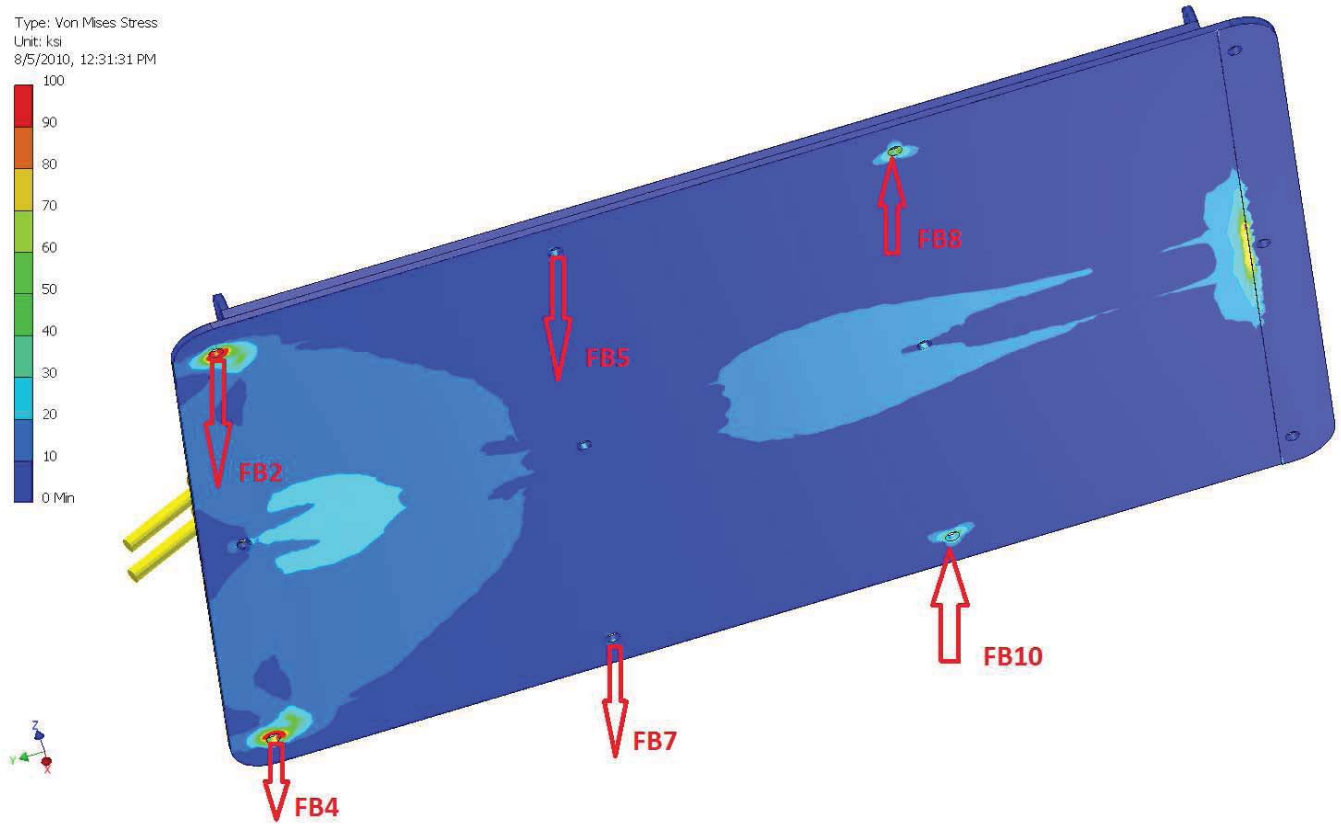
If we do not use the center column on each pad then there will be 4 columns

$$FBmax := \frac{R}{k2 \cdot p^2} \cdot \frac{Moment}{4} = 5.713 \times 10^3 \cdot lbf$$

These calculations assume the pad is stiff so also run FEA on the pads to find stresses and Bolt Forces

SECTION 2.3.4 - BOLT FORCE RESULTS

Bolt forces were as shown



$FB2 := 6135 \cdot lbf$ $FB5 := 160 \cdot lbf$ $FB8 := 1461 \cdot lbf$ Compression

$FB4 := 6133 \cdot lbf$ $FB7 := 157 \cdot lbf$ $FB10 := 1459 \cdot lbf$ Compression

If the center row of bolts is not used the loadings are acceptable and less than 9000 lbf

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Number: 1 Author: NSFUSER Subject: Sticky Note Date: 2/4/2012 5:00:59 AM
Is this allowable for a deck bolt or a deck socket?

SECTION 3 - Inboard Position

For the inboard Position

The A-Frame is designed to have a SF of 1 with a cable tension equal to the breaking strength of the cable in the Inboard 2 blocked condition

The max loading in the inboard position at 164 in Load Radius when the winch cable lead angle is 20 deg below horizontal and no load on the hook

The breaking strength of the wire is 7500 kgf

SECTION 3.1 - A-FRAME FEA

SECTION 3.1.1 - LOADING

The design cable tension is $F := 7500 \cdot kgf = 1.653 \times 10^{4} \cdot lbf$

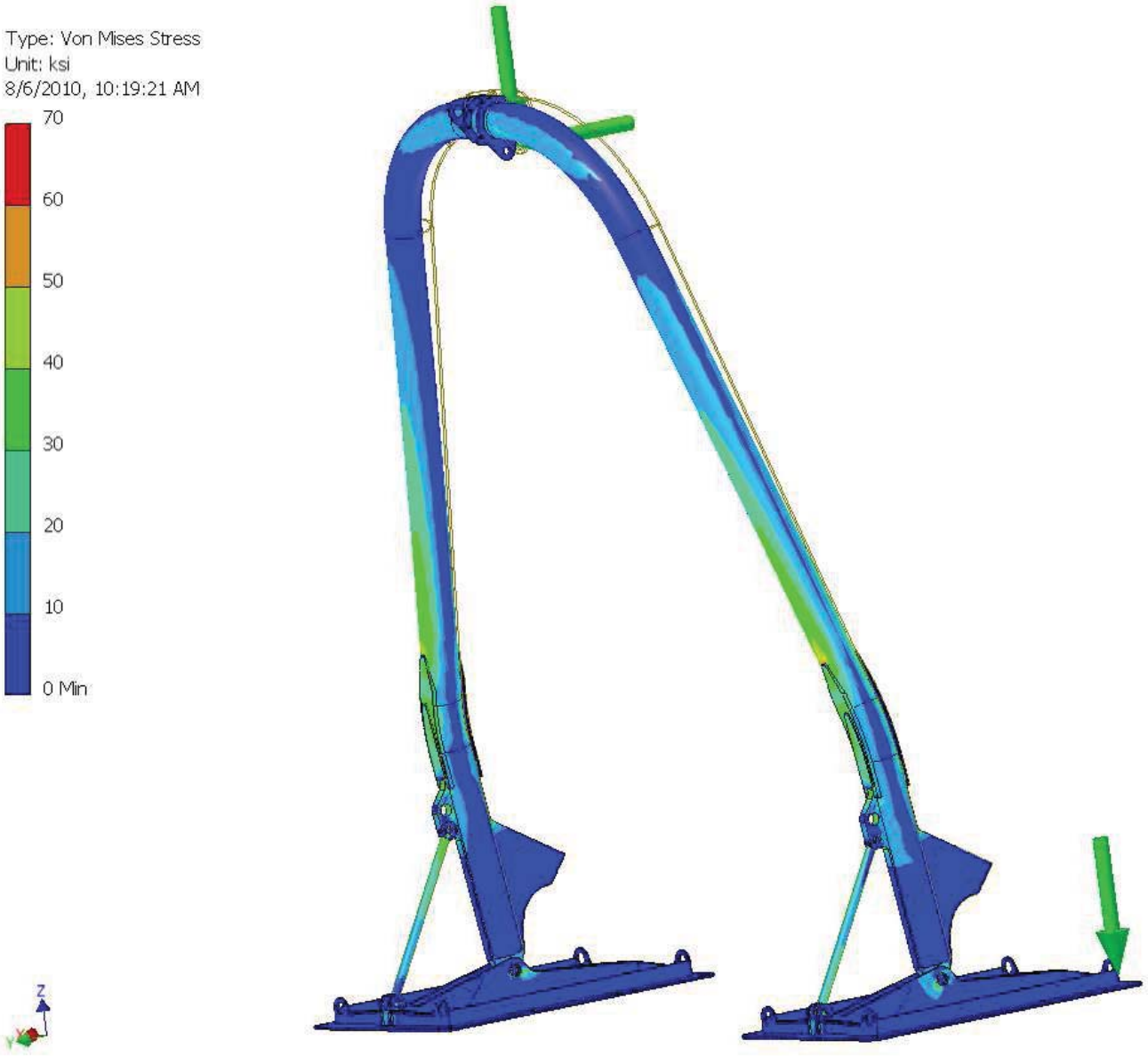
The horizontal component is $Fy := F \cdot \cos(20 \cdot deg) = 1.554 \times 10^{4} \cdot lbf$

The vertical component is $Fz := F \cdot \sin(20 \cdot deg) = 5.655 \times 10^{3} \cdot lbf$

FEA model file = geotraceassy6-fea

SECTION 3.1.3 - STRESS RESULTS

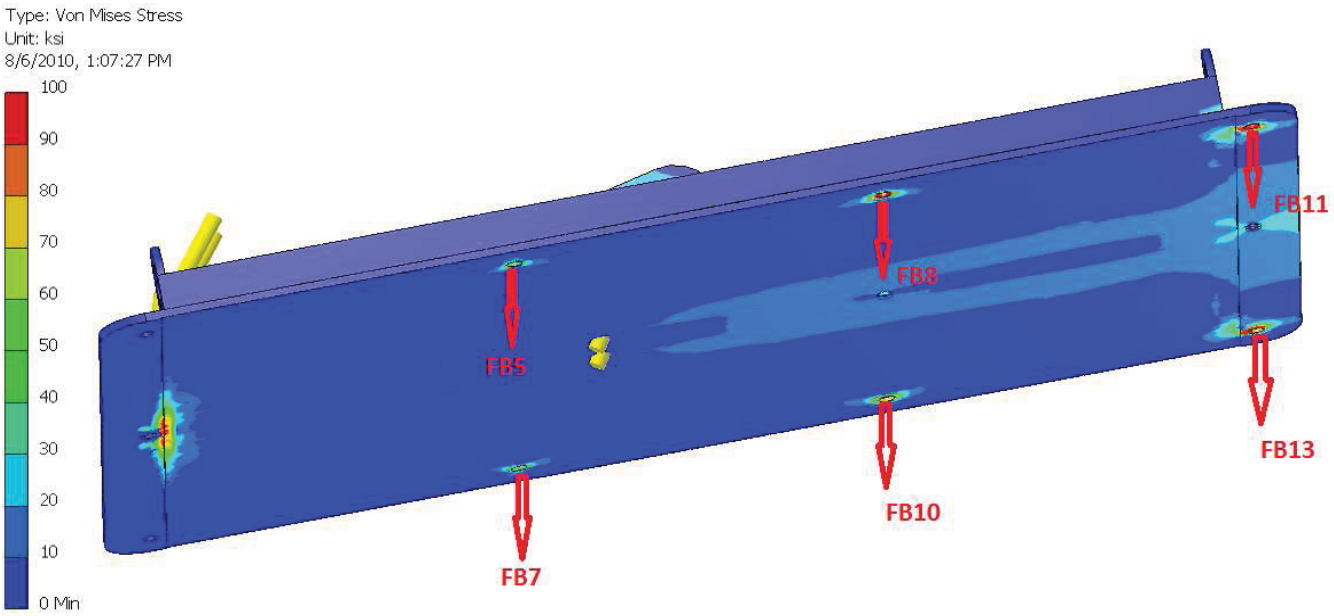
Von Mises Stress Rsults:



Stresses in the A-frame are less than 60,000 psi so OK

SECTION 3.3.4 - BOLT FORCE RESULTS

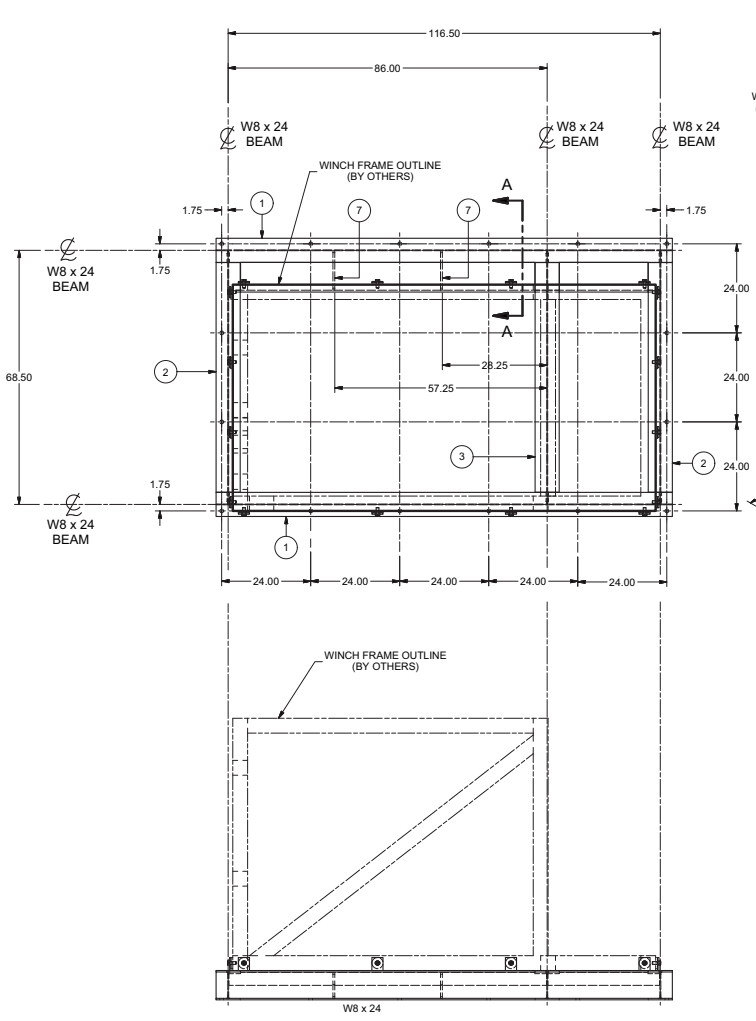
Bolt Force Results are Below

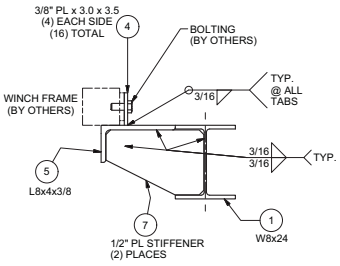


$FB5 := 767 \cdot lbf$ $FB8 := 2226 \cdot lbf$ $FB11 := 8202 \cdot lbf$

$FB7 := 760 \cdot lbf$ $FB10 := 2230 \cdot lbf$ $FB13 := 8203 \cdot lbf$

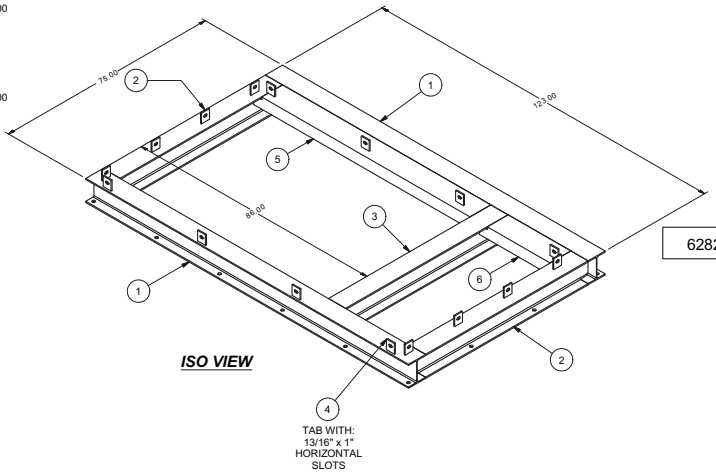
All Bolt Forces are less than 9,000 lbs





SECTION A-A

BILL OF MATERIAL			
ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	62822	BEAM; W8 x 24 x 123.00" (A36)
2	2	62821	BEAM; W8 x 24 x 68.19" (A36)
3	1	62823	BEAM; W8 x 24 x 68.19" (A36)
4	16	62829	PLATE; 0.38 x 3.00 x 3.50
5	1	62830	L 8 x 4 x 1/2" x 85.625 in
6	1	62831	L 8 x 4 x 1/2" x 30.125 in
7	2	62832	PLATE; STIFFENER



ISO VIEW

62824

A	5-13-2010	8x4x1/2 ANGLE was 6x4x3/8 TAB 13/16x1 SLOTS were 15/16 HOLES	JT
REV.	DATE	DESCRIPTION	BY CHK

INCH

TOLERANCE CHART
(UNLESS OTHERWISE SPECIFIED)
FOR MACHINED DIMENSIONS
DIMENSIONS ARE IN INCHES
THIRD ANGLE PROJECTION

ANGULAR	MACHINED
X = ± 2°	X.X = ± 0.1"
X.X = ± 0.5'	X.XX = ± 0.03"
X.XX = ± 0.33'	X.XXX = ± 0.005"

SIM. TO -
CRITICAL DESIGNATION
S/N:
MATERIAL
SIZE
SPEC - N/A
CODE RM - N/A
EST. GROSS WT. - N/A
EST. PIECE WT. 1012.43 - Lb's
TEMPLATE BY

SUB ASSY	QUA.	MODEL
	1	
	0	

Allied Systems COMPANY

TITLE: WLDMNT; WINCH MTG. FRAME

BY JRT | SCALE 1=? | DWG NO 62824 | SHEET 1 OF 1 | REV. A
CHK | DATE 4/13/2010

Geotraces Winch Base Frame

Bolt Loading Calculations

Summary of Load Cases and Bolt Load Calculations

NOTE: This analysis assumes a fully rigid foundation.

Based on AISC Steel Construction Manual, 13th edition, Part 7 (black book)

Eccentricity Normal to the Plane of the Faying Surface - pg 7-9

Reference 1: Dynacon Drawing *Storage Winch General Assembly* , No 1007-1001-01, Revision -

Reference 2: Allied Systems Drawing *Widmnt; W[1]g. Frame* , No 62824, Revision A.

W_{WINCH}	9,636	lb =	9.6 kips
$Break_{WIRE}$	7,500	kgf =	16.5 kips

[2]x upward angle of wire = 44.2 deg

T_z	11.5	kips
T_y	11.9	kips

The below load cases are identified as worst loading

Case		Px	Py	Pz	Mx	My	Mz
A	Horizontal Wire	0.0	-16.5	0.0	1,240	0	-314
B	Max Vert Wire Angle	0.0	-11.9	11.5	1,027	-219	-225
C		0.0	0.0	0.0	0	0	0
D		0.0	0.0	0.0	0	0	0
		kips	kips	kips	kip-in	kip-in	kip-in
Case	B	0.0	-11.9	11.5	1,027	-219	-225

Number of Bolts in Group	16		total bolts
Nominal size of Bolts	1.0	in	
Minor Diameter of Bolt Thread	0.865	in	Per AISC 13th Edition, Table 7-18
Bolt Grade	1		A307
Allowable Tensile Stress	45	ksi	Per AISC 13th Edition, Table J3.2 (use with nominal diam)
Allowable Shear Stress	24	ksi	Per AISC 13th Edition, Table J3.2 (use with nominal diam)
Allowable Tensile Load	17.7	kips	Per AISC 13th Edition, Table 7-2
Allowable Shear Load	9.42	kips	Per AISC 13th Edition, Table 7.1, within thread plane
c (dist from CG to farthest bolt)	69.97	in	
cx	36.00	in	
cy	60.00	in	

Shear Loading in Bolts

Shear per bolt due to Px

rpx	0.00	kips	Px/n

Shear per bolt due to Py

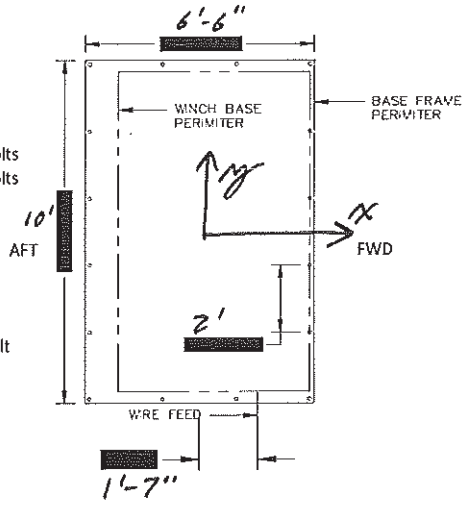
rpy	-0.74	kips	Py/n

Shear of most remote bolt due to Mz

Ix	12,064.30	in^4	From Bolt Group Only with ALL bolts
Iy	2,895.78	in^4	From Bolt Group Only with ALL bolts
Ab	0.79	in^2	Bolt area
Ip	19,048	in^2	Ix+Iy/Ab
rmx	-0.71	kips	Mz/cy*Ip
rmy	-0.43	kips	Mz/cx*Ip

Sum Horiz and Vert Shear Forces

ra	1.37	kips	Maximum Shear in Any Bolt
	9.42	kips	Maximum Allowable Shear per bolt



Tensile Loading in Bolts

Axial Loading due to Fz

ratz	0.72	kips	Pz/n

Tensile Loading due to Mx

Ix	69,832		Ic from Mx
c	116.71		c_{max} from Mx
ratx	1.35	kips	Mx*c/Ix * Ab

Tensile Loading due to My

Iy	28,686	in^4	Ic from My
c	70.82	in	c_{max} from My
raty	-0.42	kips	My*c/Iy * Ab

Combine Bolt Tensions

rat_p_fwd	2.49	kips
rat_p_aft	1.64	kips
rat_s_fwd	-0.20	kips
rat_s_aft	-1.05	kips

Combined Tensile and Shear Loading

fv	1.74	ksi	required shear stress
Fnt'	45.00	ksi	[3]minal Tensile Strength modified to include shear
Rn	17.67	kips	Available Tensile Strength
rat_max	2.49	kips	Max Actual Tension
rat_allow	5.00	kips	Max Allowable (1/0.6=1.67 SF) Socket Load per AGOR Socket Study

Bolt Loading is Below Allowable Limit and is OK

By WLM, 10 January 2012

Job 09112.01

Checked By: KMB Date: 10 JAN 2012

Page: 26

Number: 1 Author: NSFUSER Subject: Sticky Note Date: 2/4/2012 3:58:37 AM
This is either DLT or MPT (max line pull?) From DYNACON. This needs to be clearly shown in the winch MCD.

Number: 2 Author: NSFUSER Subject: Sticky Note Date: 2/4/2012 4:00:12 AM
This is the breaking strength of the cable. Note that it is NOT multiplied by 1.5. Glosten has this correct. This supports the observation that there may be more capacity in the A-frame, but in the end, the deck bolting pattern may be the limiting component due to geometry.

Number: 3 Author: NSFUSER Subject: Sticky Note Date: 2/4/2012 3:34:16 AM
Maximum deck bolt reaction at DLT.

Geotraces Winch Base Frame

Bolt Loading Calculations

Rotation around x axis - Concerns Mx moment only

Bolt Group and Compression Block Calculation

depth of section 121.5

component	Qty	Dia (in)	y (in)	A (in^2)	I (in^4)	A*y (in^3)	$A*y^2$ (in^4)
Row 1	4	1.0	121.5	3.142	0.196	382	46377
Row 2	2	1.0	97.5	1.571	0.098	153	14932
Row 3	2	1.0	73.5	1.571	0.098	115	8486
Row 4	2	1.0	49.5	1.571	0.098	78	3849
Row 5	2	1.0	25.5	1.571	0.098	40	1021
Row 6	0	1.0	1.5	0.000	0.000	0	0
				9.42	0.59	768	74665
	beff (in)	d (in)	d/2 (in)				
Compression Block	63	4.79	2.395	301.770	576.987	723	1731
				311.19	577.58	1491	76396

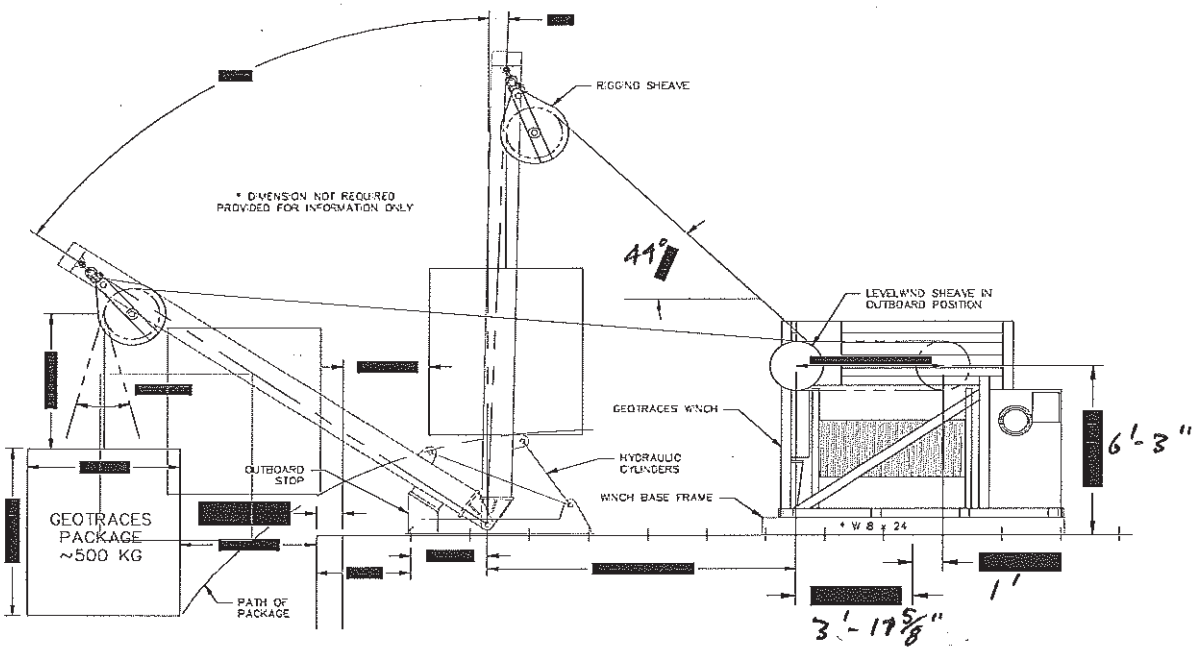
For Entire Bolt Group and Compression Block

A	311.19 in^2	
c	4.79 in	sum(A*y)/sum(A)
c_{max}	116.71 in	
c_{min}	4.791 in	
I_o	76,974 in^4	sum(I) + sum($A*y^2$)
I_c	69,832 in^4	Io - $A*c^2$
r	14.98 in	sqrt(I_c/A)
SM_{max}	14,576 in^3	I_c/c_{min}
SM_{min}	598 in^3	I_c/c_{max}
y	76.71 in	$C_{max\,bolt} - d_{compression\,block}$
Sum Ab	9.42	sum bolt area
Sum Ab * y	722.97	
beff * d * d/2	722.74	

Adjust d so that above two lines equal each other.
Adjust d to make equal to cmin

For Bolt Group Only

A	9.42 in^2	
c	81.50 in	sum(A*y)/sum(A)
c_{max}	81.50 in	
c_{min}	40.00 in	
I_o	74,666 in^4	sum(I) + sum($A*y^2$)
I_c	12,064 in^4	Io - $A*c^2$
r	35.78 in	sqrt(I_c/A)
SM_{max}	302 in^3	I_c/c_{min}
SM_{min}	148 in^3	I_o/c_{max}



By WLM, 10 January 2012
Job 09112.01
Checked By: KCB Date: 10 JAN 2012

Geotraces Winch Base Frame

Bolt Loading Calculations

Rotation around y axis - Concerns My moment only

Bolt Group and Compression Block Calculation

depth of section 73.5

component	Qty	Dia (in)	y (in)	A (in^2)	I (in^4)	A*y (in^3)	A*y^2 (in^4)
Row 1	6	1.0	73.5	4.712	0.295	346	25458
Row 2	2	1.0	49.5	1.571	0.098	78	3849
Row 3	2	1.0	25.5	1.571	0.098	40	1021
Row 4	0	1.0	1.5	0.000	0.000	0	0
				0.000	0.000	0	0
				0.000	0.000	0	0
				7.85	0.49	464	30328
	beff (in)	d (in)	d/2 (in)				
Compression Block	123	2.680	1.34	329.640	197.301	442	592
				337.49	197.79	906	30920

For Entire Bolt Group and Compression Block

A	337.49 in^2	
c	2.68 in	sum(A*y)/sum(A)
c_{max}	**70.82** in	
c_{min}	**2.684** in	
I_o	31,117 in^4	sum(I) + sum(A*y^2)
I_c	28,686 in^4	Io - A*c^2
r	9.22 in	sqrt(I_c/A)
SM_{max}	10,687 in^3	I_c/c_{min}
SM_{min}	405 in^3	I_c/c_{max}

For Bolt Group Only

A	7.85 in^2	
c	59.10 in	sum(A*y)/sum(A)
c_{max}	59.10 in	
c_{min}	14.40 in	
I_o	30,328 in^4	sum(I) + sum(A*y^2)
I_c	2,896 in^4	Io - A*c^2
r	19.20 in	sqrt(I_c/A)
SM_{max}	201 in^3	I_c/c_{min}
SM_{min}	49 in^3	I_c/c_{max}

y	56.42 in
Sum Ab	7.85
Sum Ab x y	443.12
beff x d x d/2	441.72

Adjust d so that above two lines equal each other.

Adjust d to make equal to cmin

By WLM, 10 January 2012

Job 09112.01

Checked By: YAB Date: 10 JAN 2012