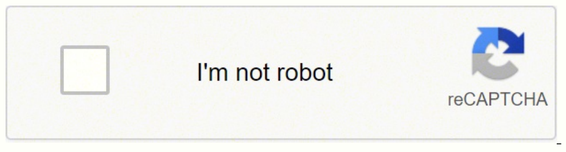


Open

Free lifting lug design spreadsheet

"LIFTING_LUG.xls" Program
Version 1.4

LIFTING LUG ANALYSIS

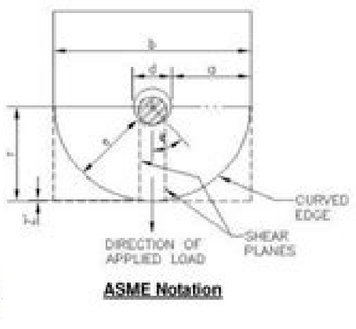
Per AISC 13th Edition ASD Manual, ASME BTH-1-2008, and "Design and Construction of Lifting Beams" by David T. Ricker

Project Name:		Client:			
Project No.:		Prep. By:		Date:	

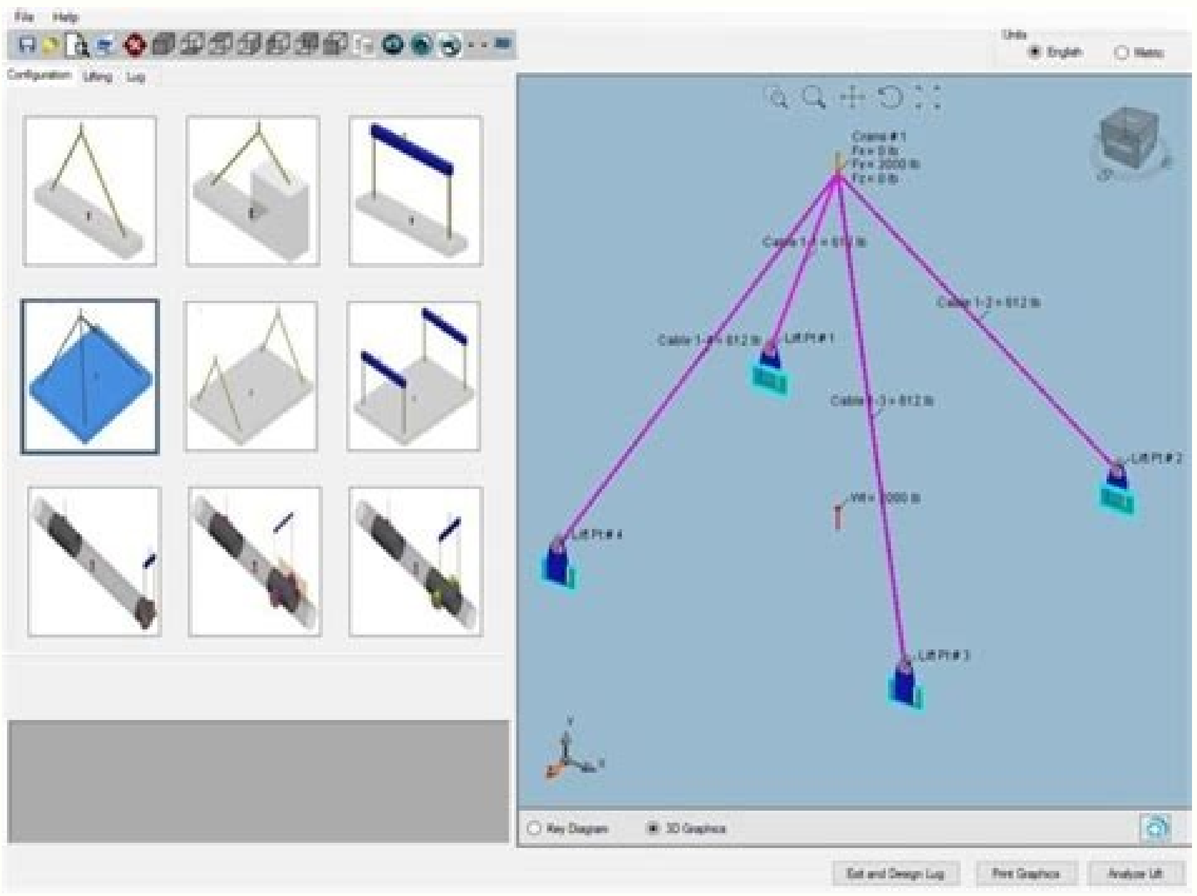
Input:

Design Parameters:

Lug Yield Strength, Fy =	36	ksi
Lug Ult. Strength, Fu =	58	ksi
Edge Dist., a =	2.500	in.
Edge Dist., e =	1.000	in.
Lug Width, b =	6.000	in.
Rounded Edge? =	No	
Will Pin Rotate Under Load? =	No	
Hole Diameter, dh =	1.000	in.
Pin Diameter, dpin =	0.750	in.
Lug Thickness, t =	0.750	in.
AISC Factor of Safety, F.S.1 =	5.0	
AISC Factor of Safety, F.S.2 =	3.1	F.S.2 = max(3, Fy/(Fu/F.S.1))
ASME Factor of Safety, F.S.3 =	3.0	Assuming Category B lifters



ASME Notation



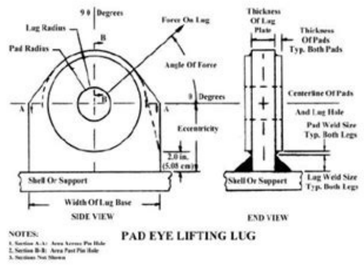
HELP FILE FOR: DESIGN OF PAD EYE TYPE LIFTINGG LUGS:

This help file is for both the ENGLISH and the METRIC programs.

DEFINITION:

The design of a lifting lug is made up of four parts; the lug plate, the weld used to connect it to a shell or structure, the bearing stress at the pin hole and the end area of the lug. The design of a lifting lug is very critical and must be done to the latest standards and codes.

For design reference, the program assumes that the lug is in the vertical position with the pin hole at the top. Further, the line of the force is assumed to be in the plane of the strong axis and the angle of the force on the lug is measured from a horizontal reference line thru the center of the pin hole. For example, at zero (0) degrees, the force would be at a right angle to the longitudinal centerline of the lug. At ninety (90) degrees, it would coincide with the longitudinal centerline of the lug. See the pad eye lug drawing below.



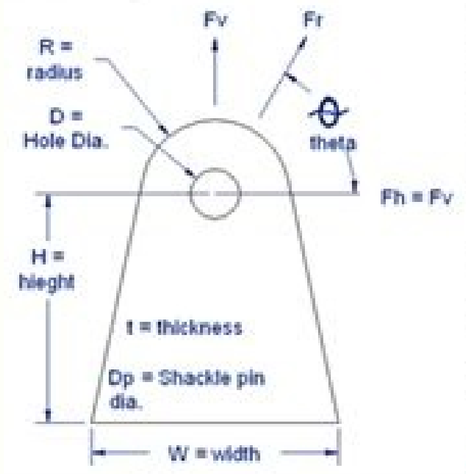
PAD EYE LIFTING LUG

The design of the end area and bearing of the lifting lug are based on the total force on the lug applied in the vertical. Their design is also based on the radius of the lug and not on the width of the lug base. The combined stress of the lug plate and the weld size are calculated from the vertical and horizontal components of the force at the specified angle. These stresses are based on the width of the lug base.

PROGRAM OBJECTIVE:

The objective of this program is to provide a design for the end area of a pad eye type-lifting lug that

Project	Platform		USER INPUT
Customer	-	Date 01/11/2007	WARNING
			PASS
Engineer	SJH	Job: Number -	PROGRAM RESULTS



H =	5.5	in
W =	6	in
t =	0.75	in
D =	1.125	in
R =	3	in
Dp =	1	in (Shackle pin Dia)
F =	10000	lbs (Actual load per lug)
I =	2	- (Impact factor) min. 2
Fv =	20000	lbs (Vertical Load) (F x I)
Fh =	10000	lbs
theta =	90	degrees
Fr =	20000	lbs (resultant force)
Lug Mat'l: =	A36	
Mat'l yield stress =	36000	psi

sketch on back for additional information

fy Shear Stress
fy = Fr/ (2 x t x (R-D/2))
fy = 5470 psi

fy Allowable Yield Stress
fy = 0.4 x Mat'l yield Stress
fy = 14400 psi

Result: Acceptable

fb + ft = Bending + Tension Stress (longitudinal)
$\frac{Fh \times H}{t \times (W^2/6)} + \frac{Fv}{t \times W} + \frac{(0.10)Fr \times I}{W \times (t2/6)}$
fb+ft = 16833 psi

fb + ft Allowable
0.6 x Yield Stress
fb + ft = 21600 psi

Result: Acceptable

fg = Bearing Stress
Fr/(0.85 x t x Dp) =
fg = 31373 psi

fg Allowable
0.9 x Yield Stress
fg = 32400 psi

Result: Acceptable

Weld Size Calculations

L Weld length =
2W + 2t = L = 13.50

Sx Section Modulus =
Wt + W^2/3 = Sx = 16.50

fb Bending Stress =
Fh x H / Sx = fb = 3333.33

fv Shear Stress =
Fh / L = fv = 740.74

ft Tension Stress =
Fv / L = ft= 1481.48

f Combined Stress =
sqrt((fb + ft)2 + Fv^2)= f= 4871.46

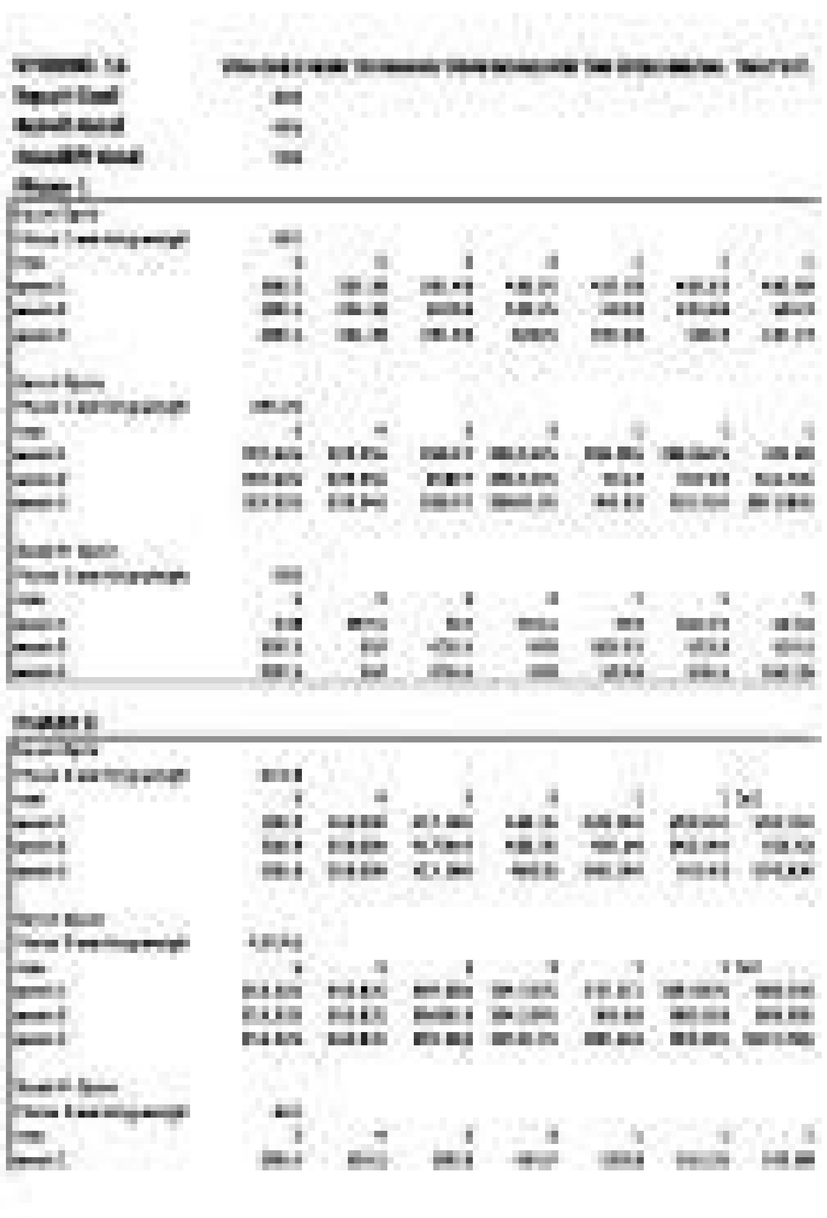
Max. Allowable Stress of Base Metal
34000

Min, Weld Size
f / fw = 0.32

Result: Weld size is Acceptable

Actual Fillet Weld Size
0.5

fw Maximun Allowable Stress
0.45 x Sa = fw= 15300



Answer to Alan: First of all don't worry all our files are safe and in general there is no problem with antivirus softwares. The verification of the failure modes and the plate section are included. Two dimensioning welding cases and configurations: fillet weld full penetration weld Useful graphical views of the lug and welding are foreseen to better define the geometry and the dimensioning parameters. Metric (S.I.) or English (U.K.) Units System can be selected for the calculation. I keep getting promise pending How to get only one random element from object? Please for any other technical questions use the dedicated email contact form. Answer to henk: you're probably referring to the message that 32bit is required. Lifting Lug Design v 3.3 - Trial version Lifting Lug Design v 3.3-Trial version.z Compressed Archive in ZIP Format 15.5 MB Spreadsheet versions list: Version 3.3: Bug fixed. Minor improvements. Version 2.0: Added verification worksheet of lifting padeyes with stiffening brackets. Anyway because the .EXE applications are not provided with certified digital signature (not yet), there is the possibility that an antivirus software or Windows firewall generates a "false positive", showing a warning message (or in worst case blocking the file). Added User values for Beta and Gamma parameters in welding verifications. Click below to download the zipped file. So try with the 32 bit version of the file. Version 2.1: New .EXE file format for the spreadsheet. The verification takes into account the guidelines in "Rules for Classification and Construction Industrial Services IV-6-4" Germanischer Lloyd Aktiengesellschaft Edition 2007 (click here to download it). When launching the .EXE file, Excel is started and the protected workbook is opened as if you had opened it the regular way. Now it is possible to select the Metric (S.I.) or English (U.K.) Units System for the calculation. The trial version has a limited number of runs from its first activation on your computer, after that it stops to work and a new activation key is needed or the full version should be purchased. Version 3.2: Some text corrections have been introduced. In this case enter in the preferences of your antivirus software and add the .EXE in its exclusion files list or temporary dactivate the Antivirs. Two stiffening brackets can be selected. Forces in the plane of the pad and transversal to it are considered. You can download the paper by clicking the button above. Loading PreviewSorry, preview is currently unavailable. The front and lateral welds are verified considering the EN 1993-1-8. Design of a lifting padeye with stiffeners The worksheet verifies a lifting padeye provided with stiffening brackets and cheek plate loaded with a sloped force. You can download a trial version of this spreadsheet for evaluation purpose. Answer to Chris Nay: The key is in the text file you've downloaded. Many sections are reported with the dimensioning verifications: Geometry definition and dimensional requirement checks. Answer to comments below: Answer to Mechanic: can you describe me the problem? Safe Working Load, SWL Spreading Length Safety Factor in Compression Yield stress of the Beam material Allowable Tensile Stress Elastic Modulus of the material (A) Design for Normal Stress (Direct Compressive Stress) **** Selecting the Section initially based on this **** (B) Design for Elastic Stability - Transverse Buckling [1] ('C) DESIGN OF ATTACHMENTS - (a) Design of eye bracket for strength (a-i) Design of eye bracket for tensile strength - FAILURE MODE - 1 (allowable tensile stress is governing) (a-ii) Design of eye bracket for bearing/crushing strength - FAILURE MODE -2 (80% of the yield stress is governing) (a-iii) Design of eye bracket for tearing strength - FAILURE MODE - 3 (50% of the yield stress is governing) (a-iv) Design of eye bracket for out-of plane buckling - FAILURE MODE - 4 (as per David T. Design of a lifting lug with overlapping plate joint subjected to a sloped force The previous lug is verified considering the case with the main plate overlapping the bottom structure with a welding line all around its perimeter. The input and output values will change as consequence. Metric (S.I.) or English (U.K.) Units System can be selected for the calculation. dayjs - not a function Javascript Ajax returning Undefined How to get the names of all involved computed CSS custom properties of a given HTML element with JavaScript? Minor corrections and various improvements. Version 1.0: new introduced file. Different worksheets are reported for a complete verification of common configurations. Lifting Lug subjected to a vertical load The verification is performed considering the reference "Design and Construction of Lifting Beams" David T. The main section parameters (shear sections, bending modulus, inertia moments…) are calculated for the stress analysis Materials definition Evaluation of the safety factors for lifting equipment Forces in the plane of the pad and transversal to it Calculus and verification of the stresses on the loaded sections due to tension, shear, bending and torsion moments Verification of the failure modes of the lug hole to: Tensile Rupture of Lug, Bearing Capacity of the Hole, Shear Yielding to Edge of Plate, Tension Tear Out to Edge of Plate Verification of fillet welds of the composed elements: main plate, stiffening brackets (vertical and bottom sections) cheek plate Useful graphical views of the geometry of the padeye are foreseen for a better definition of the configuration and dimensioning parameters. Metric (S.I.) or English (U.K.) Units System can be selected for the calculation. Version 3.0: Added English Unit System. Lifting Lug subjected to a load with given slope Lug with an applied force having an assigned sloped angle and eccentricity with respect to the hole. Ricker [1]) (a-v) Design of pin for shearing strength - FAILURE MODE - 5 (50% of the yield stress of the pin is governing) (b) Design of weld joint of the lug with other plates for shear strength (50% of allowable stress is governing) (c) Design of end plates of the adjustable bracket for tensile strength (allowable tensile stress is governing) (d) Design of weld joint for the bottom plate of the adjustable bracket for shear strength (50% of allowable tensile stress is governing) (D) DESIGN OF ATTACHMENTS - (a) Design of adjustable (Span variations) suspension bracket for strength (a-i) Design of lugs on the bracket for tensile strength - FAILURE MODE - 1 (allowable tensile stress is governing) (a-ii) Design of lugs on the bracket for bearing/crushing strength - FAILURE MODE -2 (80% of the yield stress is governing) (a-iii) Design of lug on the bracket for tearing strength - FAILURE MODE - 3 (50% of the yield stress is governing) (a-iv) Design of lug on the bracket for out-of plane buckling - FAILURE MODE - 4 (as per David T. See video PART 1. (version 1.0) See video PART 2. (version 2.0) The Part 2 contains the new verification worksheets included in the version 2.0 (lifting padeyes with stiffening brackets and lugs with overlapping plate joint). The spreadsheet you will purchase and receive is an excel file compiled in a ".EXE" application file format identified by our icon image. Version 3.1: Updated picture in sheet 2 with reference signs. The trial spreadsheet is fully working with the following limitations: A pin diameter of 20 mm (~ 0,79 in) is fixed and it cannot be modified It is not possible to open/save external spreadsheets when it runs Excel toolbar is not visible Print function is disable Copy and paste functions are disable Save function is disable What you will find in the full version No expiration date No limit for pin diameter It is possible to open/save external spreadsheets when it runs Excel toolbar is visible Print function is available Save function is available Copy and paste functions are available For support and questions contact us. Ricker [2]) (a-v) Design of shackle ring for shearing strength - FAILURE MODE - 5 (50% of the yield stress is governing) (b) Design of weld joint of the eye-bracket with the spreader beam for shear strength (50% of the allowable stress is governing) DESIGN OF ADJUSTABLE SPREADER LIFTING BEAM of Standard Profile "HEB Series" Geometry of Lifting at the each end of the HOLLOW PIPE Spreader Beam, Solved using the equations of Static Equillibrium (A) STRENGTH DESIGN - Design for FLEXURAL Bending Stress **** Selecting the Section initially based on this **** (B) STIFFNESS DESIGN - Design for DEFLECTION (C) DESIGN OF ATTACHMENTS - (a) Design of adjustable (CG location variations) suspension bracket for strength (a-i) Design of lugs on the bracket for tensile strength - FAILURE MODE - 1 (allowable tensile stress is governing) (a-ii) Design of lugs on the bracket for bearing/crushing strength - FAILURE MODE -2 (80% of the yield stress is governing) (a-iii) Design of lug on the bracket for tearing strength - FAILURE MODE - 3 (50% of the yield stress is governing) (a-iv) Design of lug on the bracket for out-of plane buckling - FAILURE MODE - 4 (as per David T. It activates the file for a limited use. Ricker, PE, AISC Engineering Journal, Fourth Quarter/1991 and its updating to 2005 AISC Manual of Steel Construction (click here to download it). Many sections are reported with the dimensioning verifications: Geometry definition and requirements check in compliance with the prescriptions reported in the reference document Materials definition Verification of the failure modes of the lug to: Tensile Rupture of Lug, Bearing Capacity of Hole, Shear Yielding to Edge of Plate, Tension Tear Out to Edge of Plate Section verification of the lifting lug's plate Welding verification between the lug and the bottom plate, using the norm Eurocode 1993-1-8:2005 and NTC 2008. The verifications of the previous case are repeated with the additional verifications of the connected bottom section to the bending effect produced by the eccentricity of the force. Also for this case two welding types are included: fillet weld and full penetration weld. In this way the antivirus allows its execution without problems. To activate it, unzip the downloaded file, run the application and insert the Activation Key you will find in the .TXT file. React map object as array? See Activation/Support page for more information. See the Activation/Support page for more details. Make Your GitHub Profile Standout To Attract Better Opportunities Whether to clone an object for a prototype Why does the DOMParser cease to exist outside of this if statement? The file seems to work. Minor corrections. Please for any technical question use the specific email contact form. After key validation, the runs count starts on your machine and a window is displayed at each launch reminding you the remained launches. To purchase the full version go back to this webpage or use the "Purchase Online" button on the window. Please write me using the contact form. Ricker [1]) (a-v) Design of pin for shearing strength - FAILURE MODE - 5 (50% of the yield stress of the pin is governing) (b) Design of weld joint of the lug with other plates for shear strength (50% of allowable stress is governing) (c) Design of end plates of the adjustable bracket for tensile strength (allowable tensile stress is governing) (d) Design of weld joint for the top plate of the adjustable bracket for shear strength (allowable tensile stress is governing) (E) DESIGN OF ATTACHMENTS - (a) Design of fixed suspension bracket for strength LIFTING ARRANGEMENT AND PADEYE DESIGN Center of Gravity Calculation "RIGGING CALCULATION For Inshore Lifting" Calculation ReferenceLifting Design Structural Steel Safe Working Load Design Map array of objects and change one property with a function that calls an API. The way to keep the alert display when viewing the production web page Previous Next The spreadsheet verifies some configurations of lifting lugs and padeyes. To run the 64 bit file you need the Excel 64 bit and probably you have the 32 bit. Added verification worksheet of lugs with overlapping plate joint. It refers to the version of Excel and not of the file.

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