Fermilab

Particle Physics Division

Mechanical Department Engineering Note

Number: MD-ENG-251 Date: 05-28-2010

Project:----------NOvA

Project Internal Reference:

Title: ----------PIVOTER TABLE DUNNAGE

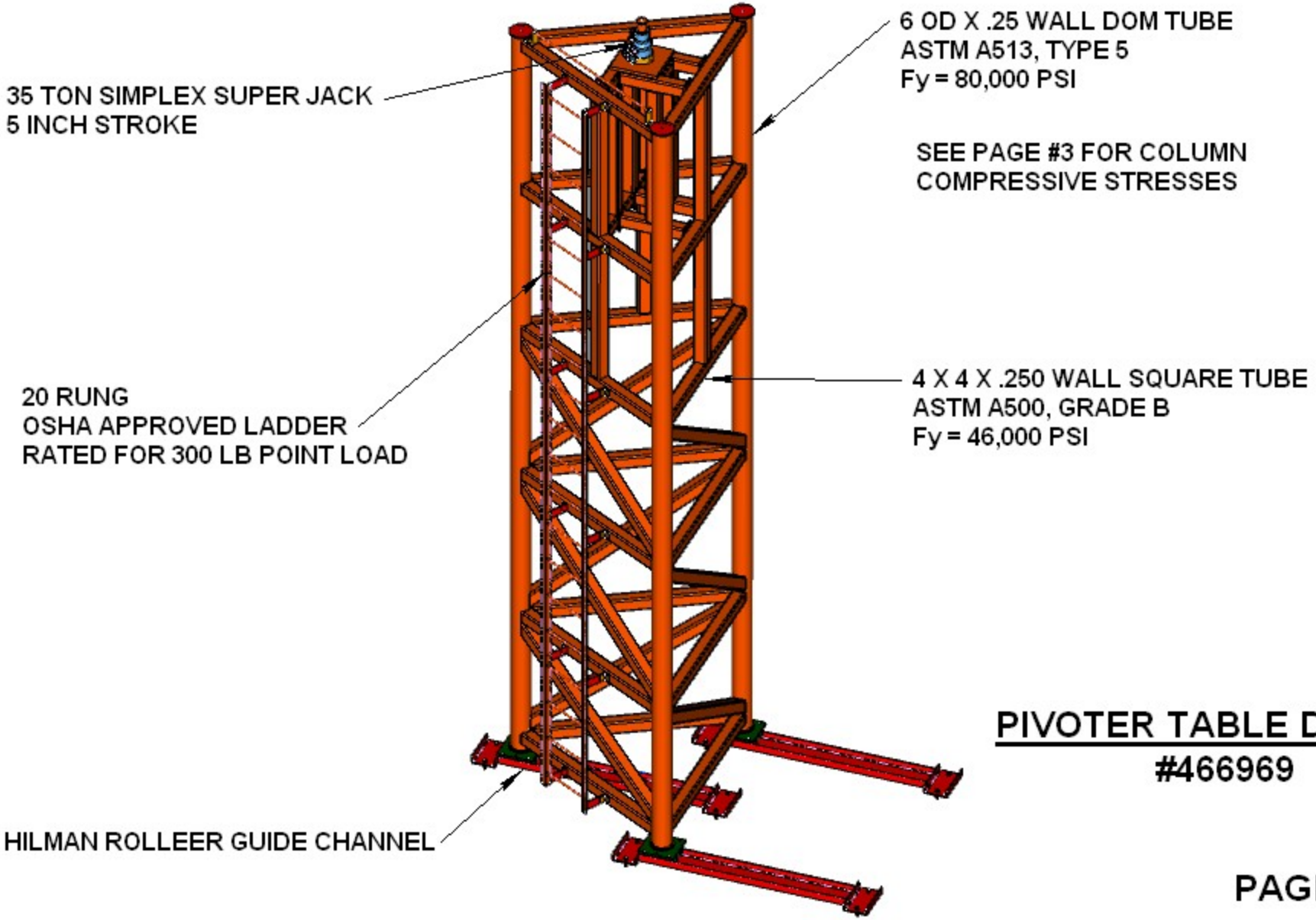
Author(s): ----------VILLEGAS

Reviewer(s): 8-11-2010

Key Words:

Abstract/Summary:---------COMPARE ALLOWABLE STRESSES AGAINST DESIGN STRESSES

Applicable Codes:----------MANUAL OF STEEL CONSTRUCTION



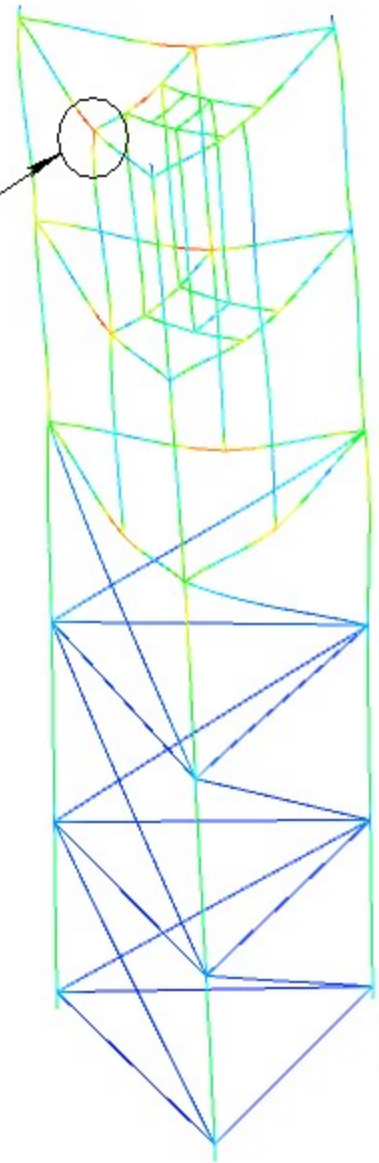
PIVOTER TABLE DUNNAGE

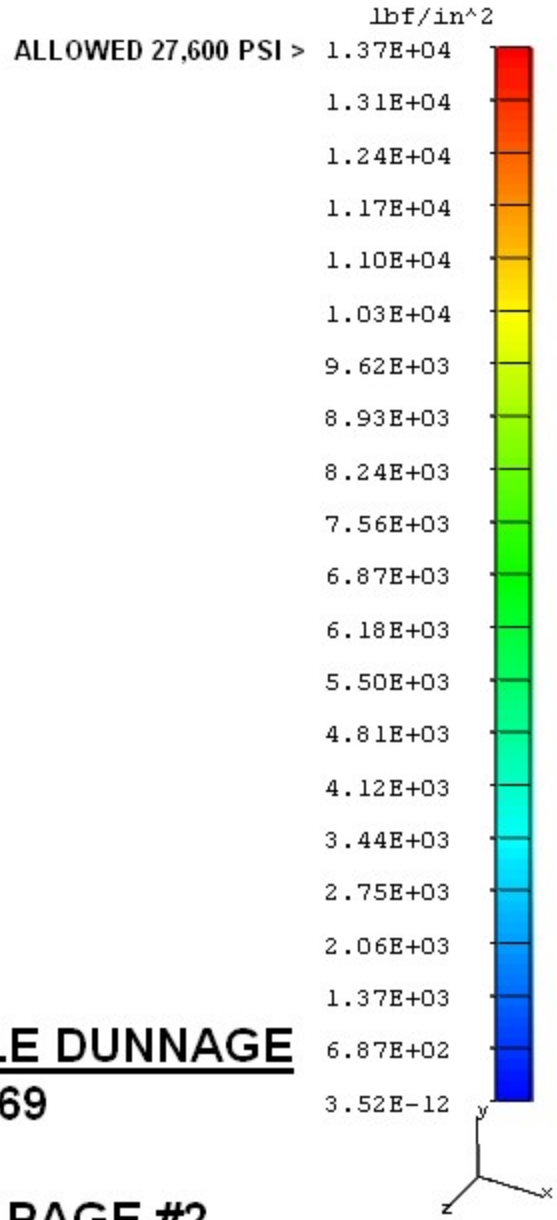
#466969

I-DEAS 12 NX Series m4: I-DEAS Visualizer

I-DEAS Visualizer
PIVOTER_TABLE_1D_DUNNAGE_FEM
35TON_LOAD_ON_CENTER
STRESS Von Mises Averaged Top shell
Beam stress: Von Mises , maximum point
Min: 1.14E-11 lbf/in^2 Max: 1.32E+04 lbf/in^2
DISPLACEMENT XYZ Magnitude
Min: 0.00E+00 in Max: 1.37E-01 in

MAXIMUM STRESS IS ON 4 X 4 .250 WALL TUBE
WITH AN ALLOWABLE STRESS OF 0.6 X 46,000 PSI = 27.600 PSI





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ENGINEERING NOTE

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SUBJECT: PIVOTER TABLE DUNNAGE
CALCULATE STRESS ON SINGLE COLUMN

NAME: Eric Collins
DATE: 05/28/10
REVISION DATE:

DETERMINE ALLOWABLE COMPRESSIVE STRESS (F_a) FOR D.O.M., 6 OD x .250 WALL TUBE, MAT'L ASTM A513, TYPE 5 (F_Y = 80,000 psi). UNBRACED LENGTH 48 INCHES.

$$A = \frac{\pi(6^2 - 5.5^2)}{4} = 4.516 \text{ IN}^2$$

ASSUME MAX. LOAD OF 35 TON REST ON SINGLE COLUMN,

COMPRESSIVE STRESS $f_a = \frac{35 \times 2000}{4.516} = \underline{15{,}500 \text{ psi}}$

$$\text{ALLOWABLE STRESS, } F_a = \frac{\left[1 - \frac{(Kl/r)^2}{2C_c^2}\right] F_Y}{\left[\frac{5}{3} + \frac{3(Kl/r)}{8C_c} - \frac{(Kl/r)^3}{8C_c^3}\right]}$$

$$\underline{\underline{F_a = 43{,}474 \text{ psi} > f_a = 15{,}500}}$$

$K = 1$

$l = 48$

$r = \frac{\sqrt{6^2 + 5.5^2}}{4}$

$= 2.035''$

$\frac{Kl}{r} = 23.6 < 200$

$C_c = \sqrt{\frac{2\pi^2 E}{F_Y}}$

$= 84.6$

I-DEAS 12 NX Series m4: I-DEAS Visualizer

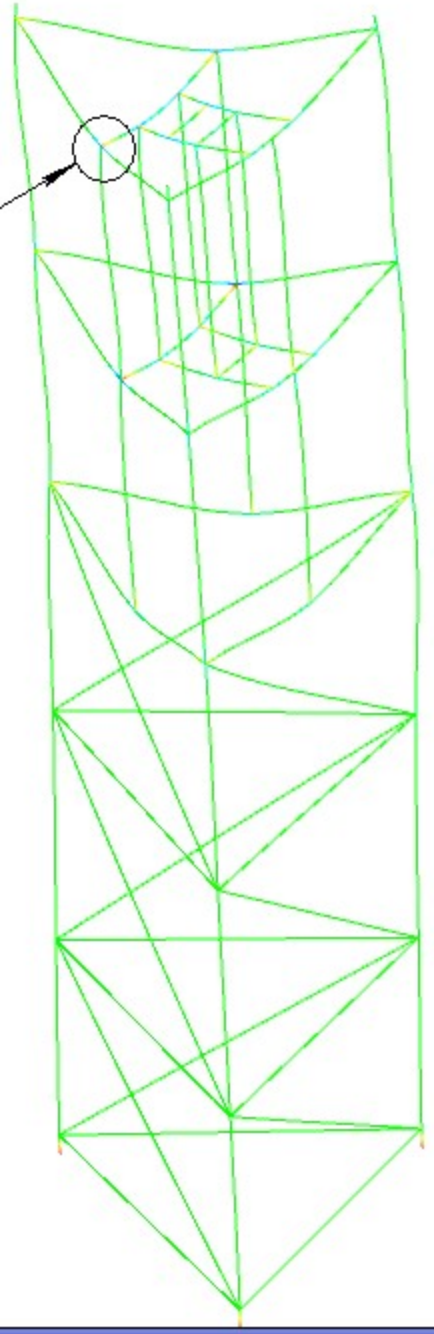
MAXIMUM FORCE ALONG 'Y' AXIS

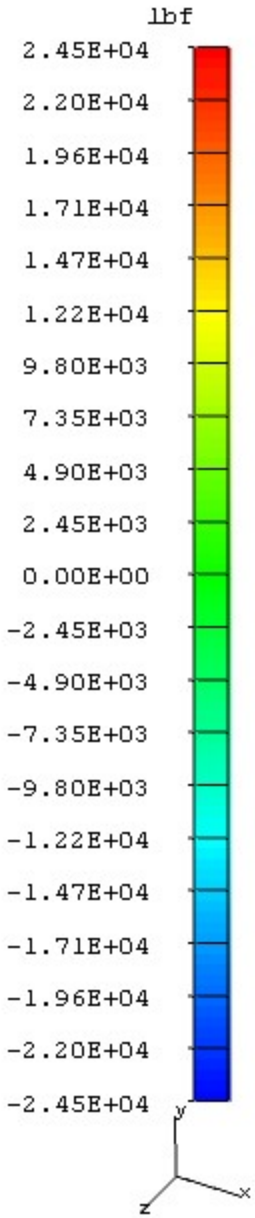
I-DEAS Visualizer
PIVOTER_TABLE_1D_DUNNAGE_FEM
35TON_LOAD_ON_CENTER
ELEMENT FORCE Y Averaged Top shell
Min: -2.11E+04 lbf Max: 2.45E+04 lbf
DISPLACEMENT XYZ Magnitude
Min: 0.00E+00 in Max: 1.37E-01 in

FROM MAXIMUM FORCE SHOWN, DESIGN FORCE ON WELD IS CALCULATED AS fw = 24500/4/4 = 1531 #/IN

USING E70XX ELECTRODE, ALLOWABLE STRESS Fv = 0.03 x 72000 = 21600 PSI

AND THE ALLOWABLE FORCE ON WELD (w = .312") IS Fw = SIN45DEG x w x Fv = 4773 #/IN > fw = 1531 #/IN





PIVOTER TABLE DUNNAGE
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I-DEAS 12 NX Series m4: I-DEAS Visualizer

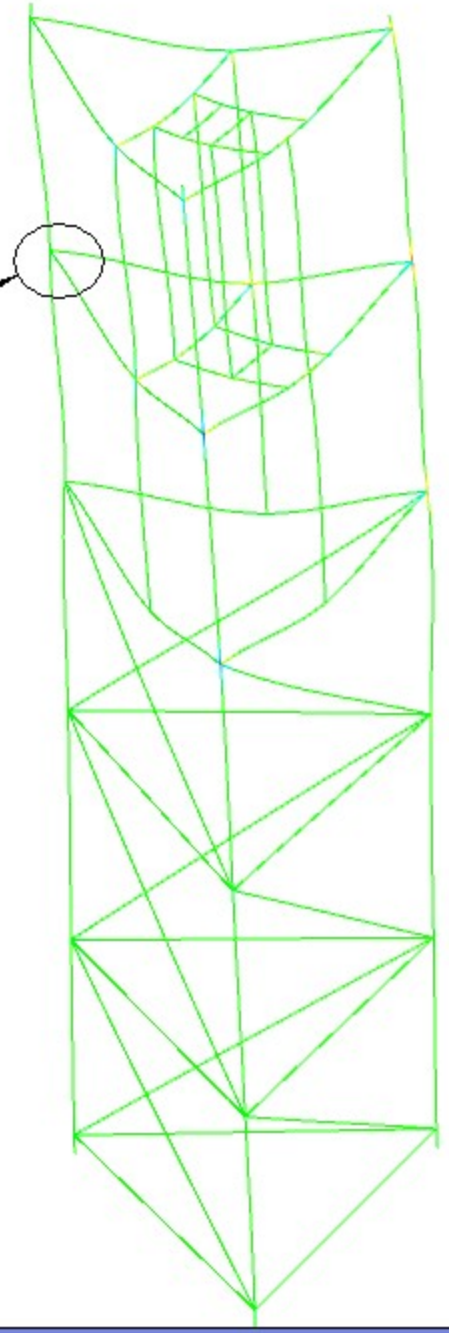
MAXIMUM MOMENT ABOUT ' X '

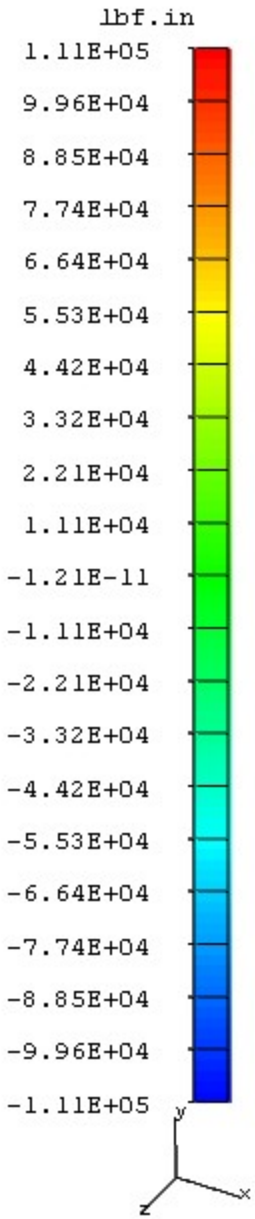
I-DEAS Visualizer
PIVOTER_TABLE_1D_DUNNAGE_FEM
35TON_LOAD_ON_CENTER
ELEMENT FORCE, Rx Averaged Top shell
Min: -9.37E+04 lbf.in Max: 8.79E+04 lbf.in
DISPLACEMENT XYZ Magnitude
Min: 0.00E+00 in Max: 1.37E-01 in

FROM MAXIMUM MOMENT SHOWN, DESIGN FORCE ON
WELD IS CALCULATED AS fw = M/Sw, WHERE M = 93700 IN-LBS
AND Sw = (4x4)+4>2 /3 = 4399 #/IN

USING ELECTRODE E70XX, ALLOWABLE
STRESS, Fv = 0.03 x 72000 = 21600 PSI

AND ALLOWABLE FORCE ON WELD IS (w = .312")
Fw = SIN45DEG x w x Fv = 4773 #/IN > fw = 4399 #/IN





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