5022TA

BELOW-THE-HOOK LIFTING DEVICE
Engineering Note Cover Page

Lifting Device Numbers:

FNAL Site No/ _____ Div. Specific No. 175 Asset No. _____

If applicable If applicable If applicable

ASME B30.20 Group: (check one)
(X) Group I Structural and Mechanical Lifting Devices
[ ] Group II Vacuum Lifting Devices
[ ] Group III Magnets, Close Proximity Operated
[ ] Group IV Magnets, Remote Operated

Device Name or Description BLOCK ASSY TABLE AND SHIPPING FIXTURE

Device was (check all applicable)
[ ] Purchased from a Commercial Lifting Device Manufacturer. Mfg Name _____
[ ] Designed and Built at Fermilab
(X) Designed by Fermilab & Argonne and Built by a Vendor. Assy drawing number 444464
[ ] Provided by a User or other Laboratory
[ ] Other: Describe _____

Engineering Note Prepared by GUARINO/VILLEGAS Date 04-05- 2010/04-15- 2010

Engineering Note Reviewed by WOODS/FANG Date 10-27/2010/04-28-2010

Lifting Device Data:

Capacity 14,200 LB

Fixture Weight 6,400 LB

Service: [X] normal [ ] heavy [ ] severe (refer to B30.20 for definitions)

Duty Cycle N/A 8, 16 or 24 hour rating (applicable to groups III, and IV)

Inspections Frequency VISUAL INSPECTION BEFORE EACH USE

Rated Load Test by FNAL (if applicable) Date 05-20-2010 Load 100%load test (14200#)

[ ] Check if Load Test was by Vendor and attach the certificate

Satisfactory Load Test Witnessed by: E.M.VILLEGAS/J.VOIRIN/K.KEPTHART/A.DIAZ/ M.SHOUN

Signature (of Load Test Witness) Elle. Villegas 05/20/2010

Notes or Special Information:

SEE INGRID FANGS' INDEPENDENT VERIFICATION OF THIS ANALYSIS ON ENG'G NOTE #171

FRAME WEIGHT----------6,800#
IPND BLOCK DRY WEIGHT---------14,200#

MATERIAL, ALL SHAPES : ASTM A992
YIELD STRESS = 50 x 10^3 PSI

MATERIAL, TUBING : ASTM A500 GR B
YIELD STRESS = 46 x 10^3 PSI

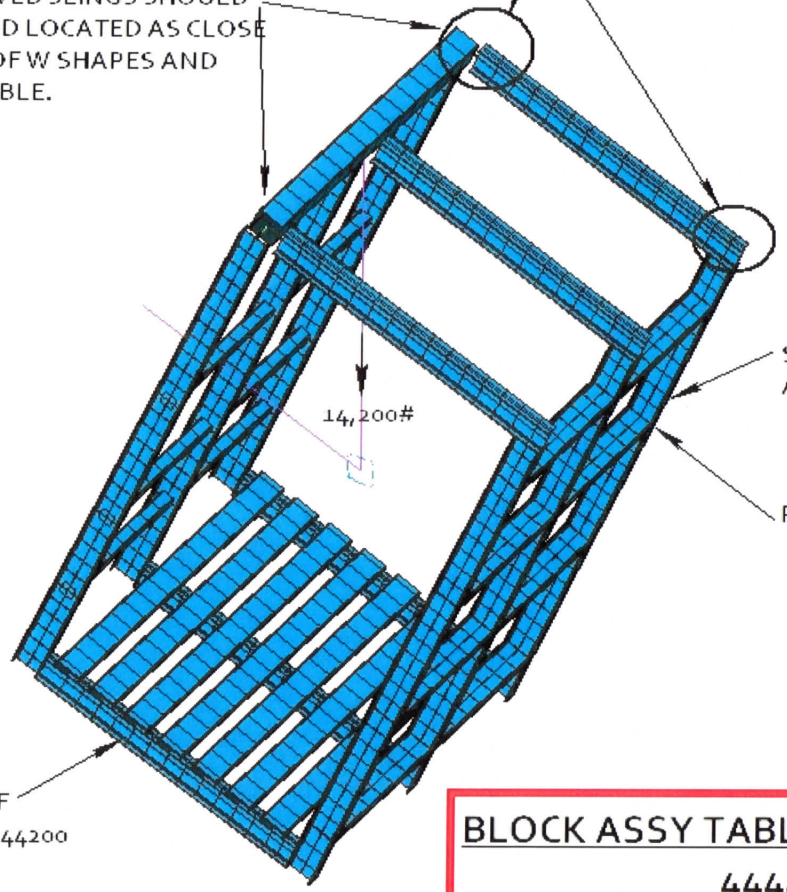
MATERIAL, PLATE & BAR STOCK: ASTM A36
YIELD STRESS = 36 x 10^3 PSI

ALL BOLTS , GRADE 5
YIELD STRESS = 92 x 10^3 PSI

ALL WELDS, ELECTRODE E70XX
YIELD STRESS = 60 x 10^3 PSI

SEE PAGE # 4 FOR BOLT SIZING
AND PAGE #6 FOR WELD SIZING

PICK POINTS, WEB SLINGS SHOULD BE CHOKED AND LOCATED AS CLOSE TO JUNCTION OF W SHAPES AND TUBE AS POSSIBLE.



SEE PAGE #2 FOR STRESS ANALYSIS

AND

PAGE #3 FOR BENDING MOMENTS

SEE PAGE #5 FOR 3-D ANALYSIS OF INPND LFTG FIXT BASE WLDNT # 444200

BLOCK ASSY TABLE & SHPG FRAME
444464

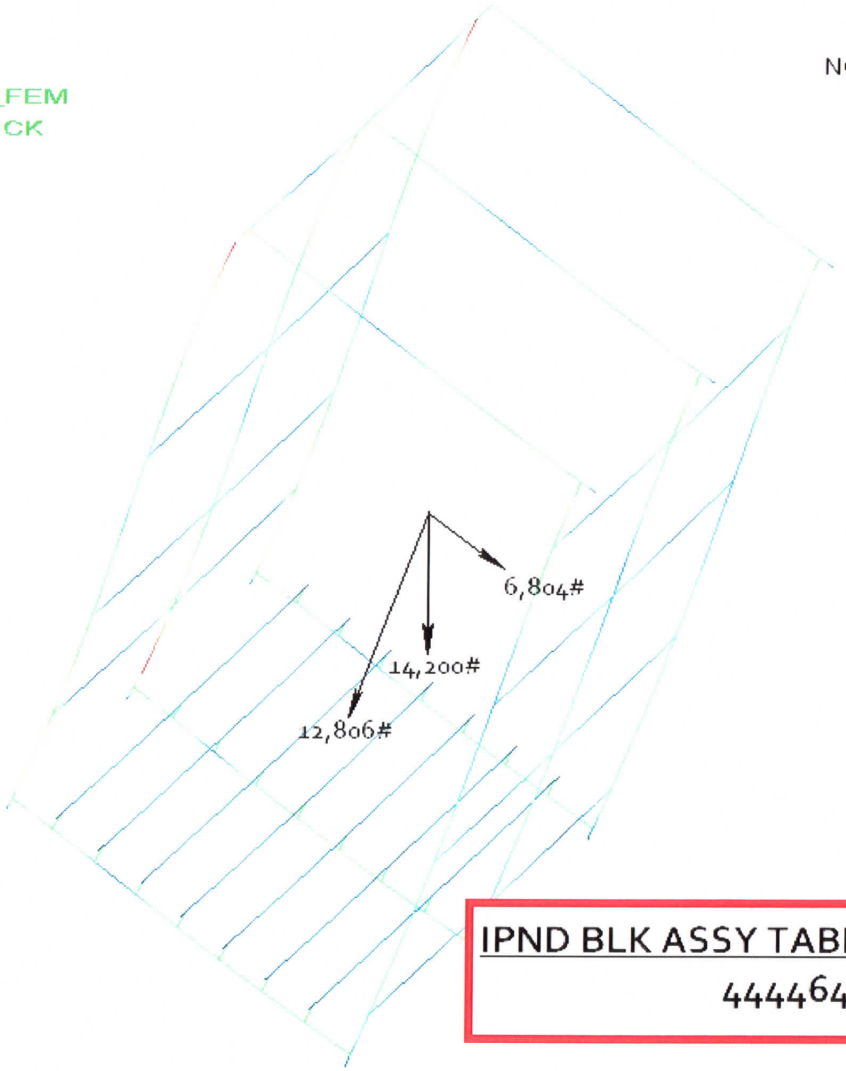
I-DEAS 12 NX Series m2: I-DEAS Visualizer

IPND_BLOCK_ASSY_AND_SHPG_FIXT_1D_FEM
14200LB_FLOATG_CORNER_DIAGONAL_PICK
STRESS Von Mises Averaged Top shell
Beam stress: Von Mises , maximum point
Min: 1.85E-11 lbf/in^2 Max: 1.14E+04 lbf/in^2
B.C. 1,DISPLACEMENT_1,LOAD SET 1
DISPLACEMENT XYZ Magnitude
Min: 0.00E+00 in Max: 4.15E-01 in

MATERIAL, ALL SHAPES : ASTM A992
ALLOWABLE STRESS = 50 x 10^3 / 3 = 16,667 PSI

MATERIAL, TUBING : ASTM A500 GR B
ALLOWABLE STRESS = 46 x 10^3 / 3 = 15,333 PSI

MATERIAL, PLATE & BAR STOCK : ASTM A36
ALLOWABLE STRESS = 36 x 10^3 / 3 = 12,000 PSI



lbf/in^2
NOTE ALL ALLOWABLES > 1.14E+04
1.08E+04
1.03E+04
9.68E+03
9.11E+03
8.54E+03
7.97E+03
7.40E+03
6.83E+03
6.27E+03
5.70E+03
5.13E+03
4.56E+03
3.99E+03
3.42E+03
2.85E+03
2.28E+03
1.71E+03
1.14E+03
5.70E+02
1.85E-11

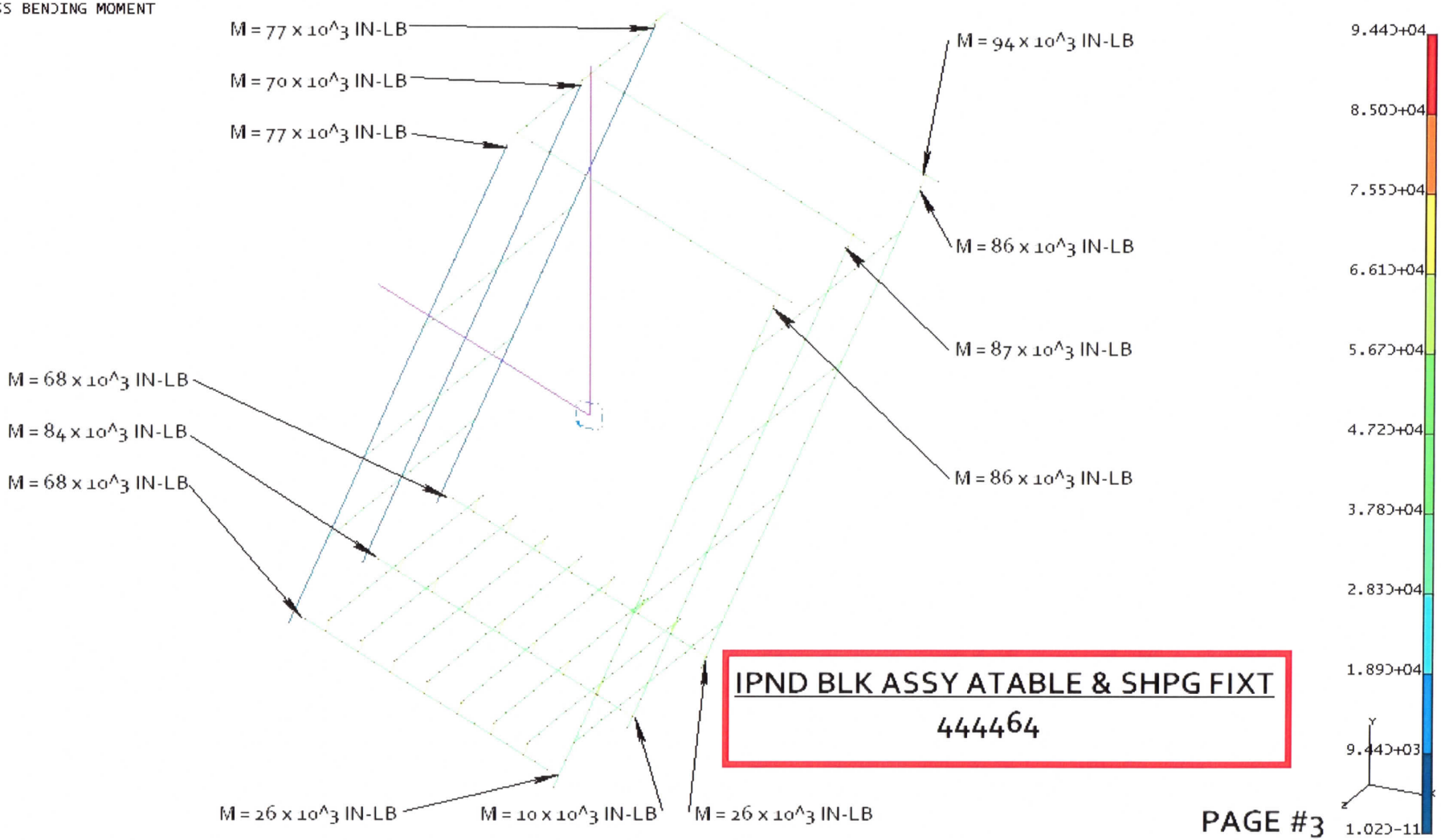
IPND BLK ASSY TABLE & SHPG FIXT
444464

PAGE #2

C:\PPD_IDM_PPD106188\EMV_NOvA_IPND_FIXTUREING_03-15-2010.mf1

RESULTS: 4- B.C. 1,ELEMENT FORCE_4,LOAD SET 1
MAGNITUDE - MIN: 1.02E-11 MAX: 9.44E+04
Data component: SRSS BENDING MOMENT

VALUE OPTION:ACTUAL



IPND BLK ASSY ATABLE & SHPG FIXT
444464

PAGE #3

FERMILAB

ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE
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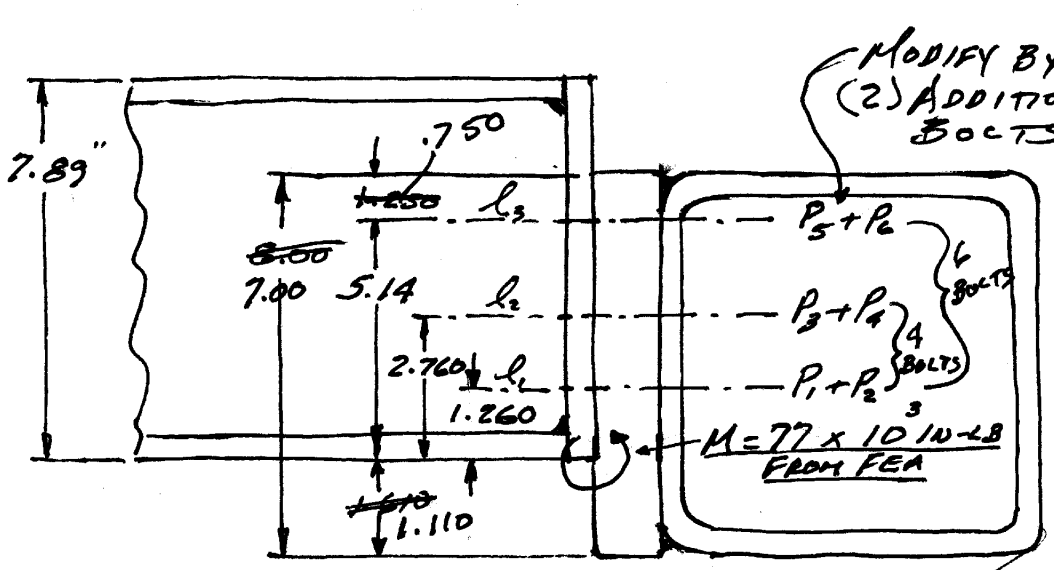
SUBJECT: CALCULATE LOADS ON 5/8-11, BOLTS AT PICK POINT CONNECTION

NAME: E. McManus

DATE: 04/15/10 REVISION DATE:



(4) 5/8-11, GRADE 5 BOLT CONNECTION (AS DESIGNED)

BOLT YIELD STRESS = 92×10^3 psi

ALLOWABLE LOAD = $(92 \times 10^3/3) \times .226 = 6{,}931$ #

$\frac{P_1}{l_1} = \frac{P_2}{l_1} = \frac{P_4}{l_2}$

$P_1 = P_2 = \frac{l_1 P_4}{l_2}$

$M = l_1(P_1+P_2) + l_2(P_3+P_4)$

$= 2l_1(P_2) + 2l_2(P_4)$

$= \frac{2l_1^2 P_4}{l_2} + \frac{2l_2(P_4)}{1}$

$= .513 P_4 + 5.52 P_4$

$75 \times 10^3 = 6.433 P_4$

$P_4 = 11{,}659$ # $> 6{,}931$ # NOT GOOD!

(6) 5/8-11, GRADE 5 BOLTS CONNECTION (AS MODIFIED)

$\frac{P_1}{l_1} = \frac{P_2}{l_1} = \frac{P_6}{l_3}$

$P_1 = P_2 = \frac{l_1 P_6}{l_3}$

$P_3 = P_4 = \frac{l_2 P_6}{l_3}$

$M = l_1(P_1+P_2) + l_2(P_3+P_4) + l_3(P_5+P_6)$

$= 2l_1(P_2) + 2l_2(P_4) + 2l_3(P_6)$

$= 2l_1\left(\frac{l_1 P_6}{l_3}\right) + 2l_2\left(\frac{l_2 P_6}{l_3}\right) + 2l_3(P_6)$

$= \frac{2l_1^2 P_6}{l_3} + \frac{2l_2^2 P_6}{l_3} + \frac{2l_3 P_6}{1}$

$= .618 P_6 + 2.964 P_6 + 10.28 P_6$

$M = 13.862 P_6$

$P_6 = 5{,}555$ # $< 6{,}931$ # OK

IPND_LFTG_FIXT_BASE_WLDNT(PALLET)FEM
14200LB_LOAD_EMPTY
STRESS Von Mises Averaged Top shell
Min: 8.93E-01 lbf/in^2 Max: 8.72E+03 lbf/in^2
B.C. 1,DISPLACEMENT_1,LOAD SET 1
DISPLACEMENT XYZ Magnitude
Min: 0.00E+00 in Max: 1.32E-02 in

MATERIAL ALL SHAPES: ASTM A992
ALLOWABLE STRESS = 50 x 10^3 / 3 = 16,667 PSI

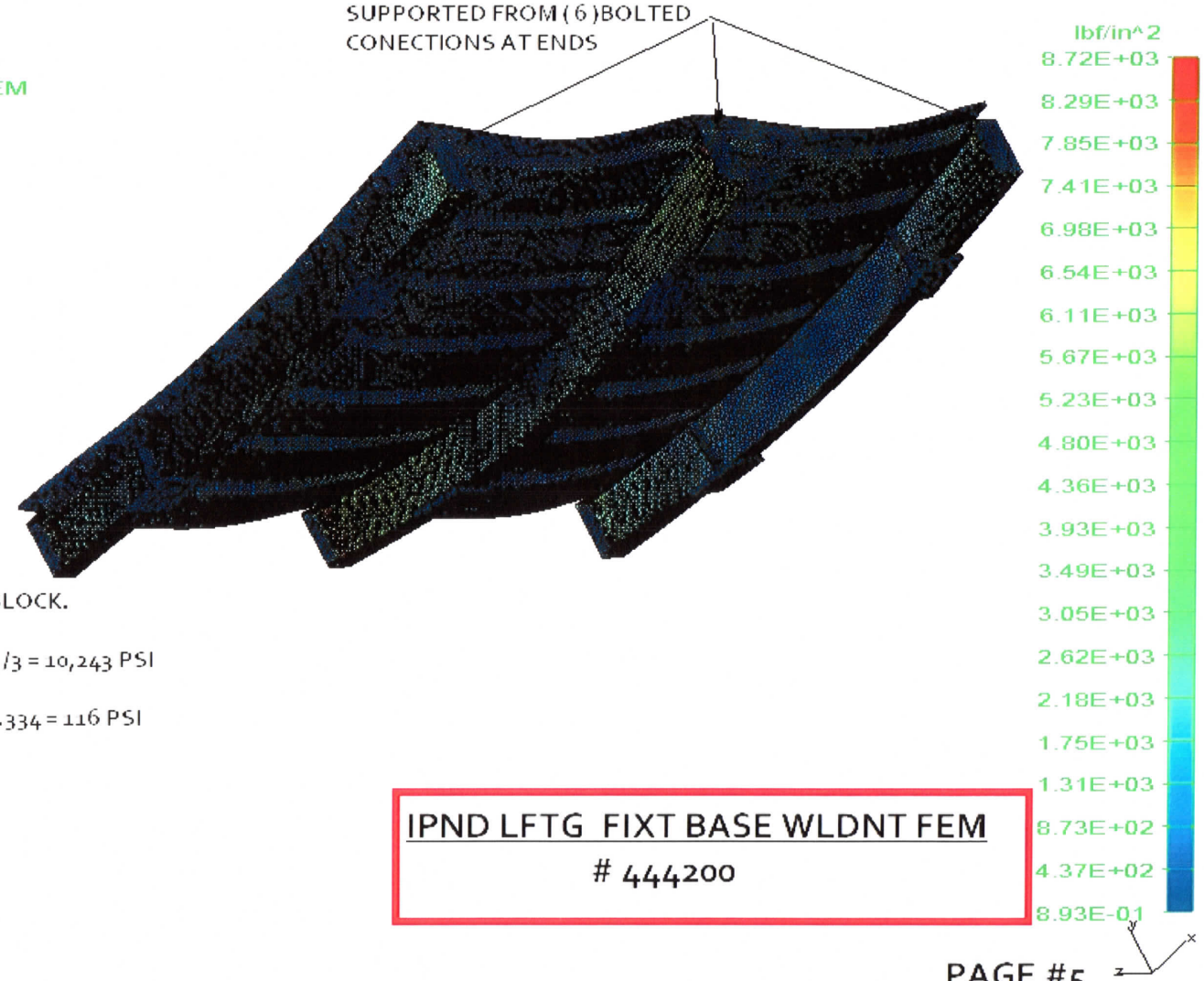
MATERIAL TUBING : ASTM A500 GR B
ALLOWABLE STRESS = 46 x 10^3 /3 = 15,333 PSI

MATERIAL PLATE : ASTM A36
ALLOWABLE STRESS : 36 x 10^3 /3 = 12,000 PSI

(48) 3/4-10 GRADE 5 BOLTS IN SHEAR SUPPORT
PALLET WEIGHT OF 2539# PLUS 14,000# WEIGHT OF BLOCK.

ALLOWABLE STRESS ON EACH BOLT = 92 x 10^3 x .334 /3 = 10,243 PSI

DESIGN STRESS ON EACH BOLT = (2539 + 14,200) /48 x .334 = 116 PSI



IPND LFTG FIXT BASE WLDNT FEM
444200

FERMILAB
ENGINEERING NOTE

SECTION	PROJECT	SERIAL-CATEGORY	PAGE
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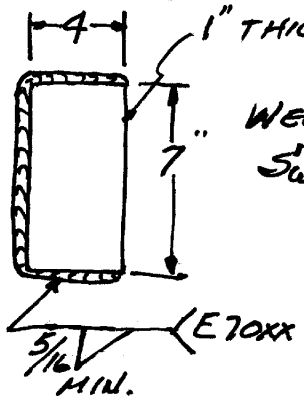
SUBJECT: WELD STRENGTH IN CRITICAL AREAS

NAME: E.M. Dillman

DATE: 04/15/2010 REVISION DATE:

DETERMINE WELD STRENGTH ON PICK POINT (BACK-UP PLATE) CONNECTION, $M = 77 \times 10^3$ IN-LB FROM PAGE #3.



WELD SECTION MODULUS

$S_w = 4 \times 7 + \frac{7^2}{6}$

$= 36.2$

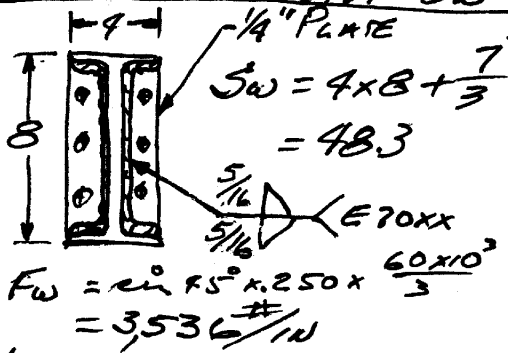
$f_w = \frac{M}{S_w} = \frac{77 \times 10^3}{36.2}$

$= 2127 \#/IN$ DESIGN

$F_w = \sin 45^\circ \times .312 \times \frac{60 \times 10^3}{3}$

$= 4,412 \#/IN$ ALLOWED $> f_w$ (OK)

WELD STRENGTH ON 3/4" THICK END PLATE ON W8 x 10 (1/2" + 1/4")



$S_w = 4 \times 8 + \frac{7^2}{3}$

$= 48.3$

$f_w = \frac{77 \times 10^3}{48.3}$

$= 1,594 \#/IN < F_w$ (OK)

$F_w = \sin 45^\circ \times .250 \times \frac{60 \times 10^3}{3}$

$= 3,536 \#/IN$

WELD STRENGTH ON BOTTOM CONNECTION, $M = 94.4 \times 10^3$ IN-LB

SAME $S_w = 48.3$ AS ABOVE

$f_w = \frac{94.4 \times 10^3}{48.3}$

$= 1,954 \#/IN < F_w$ OK

KONECRANES

HYSTER