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Simulation of FMP-10X8

Date: Tuesday, February 21, 2017
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Study name: FMP-10X8
Analysis type: Linear Static

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Description

FRONT MOUNTING PLUS BRACKET

PART NUMBER: FMP-10X8
MATERIAL: ASTM A36
THICKNESS: 0.375

Assumptions

Comments:

1) ANALYSIS IS VALID FOR THE FMP-10X8 BRACKET ONLY
2) 400 LB LOAD IS DISTRIBUTED EVENLY OVER ENTIRE TOP OF BRACKET SURFACE
3) FASTENER ANALYSIS WAS NOT CONSIDERED
4) BRACKET MOUNTED TO INFINITELY STIFF COUNTERTOP/WALL (NO DEFLECTION OF COUNTERTOP/WALL)
5) ALL RESULTS NEED TO BE VERIFIED BY PHYSICAL TESTING AS BOUNDARY CONDITIONS MAY VARY FROM INSTALLATION TO INSTALLATION

Units

Unit system:	English (IPS)
Length/Displacement	in
Temperature	Fahrenheit
Angular velocity	Hertz
Pressure/Stress	psi

Material Properties

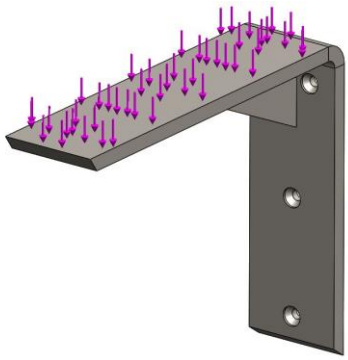
Model Reference	Properties	Components
	**Name:** WELDED ASTM A36 **Model type:** Linear Elastic Isotropic **Default failure criterion:** Max von Mises Stress **Yield strength:** 33800 psi **Tensile strength:** 58000 psi **Elastic modulus:** 2.9e+007 psi **Poisson's ratio:** 0.26 **Mass density:** 0.283 lb/in^3 **Shear modulus:** 1.133e+007 psi	

Comments:

FMP-10X8 BRACKET IS MANUFACTURED ON CENTERLINE STEEL EQUIPMENT

Loads and Fixtures

Fixture name	Fixture Image	Fixture Details
Fixed-1		**Entities:** 4 face(s) **Type:** Fixed Geometry
Roller/Slider-1		**Entities:** 1 face(s) **Type:** Roller/Slider

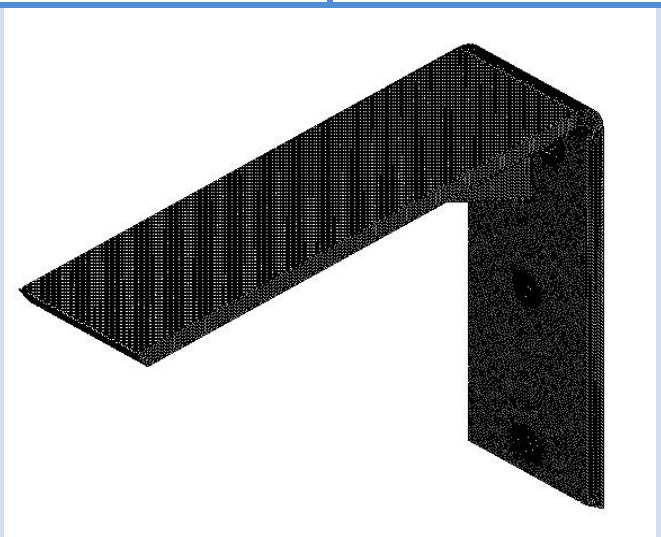
Load name	Load Image	Load Details
Force-1		**Entities:** 1 face(s) **Type:** Apply normal force **Value:** 400 lbf

Mesh information

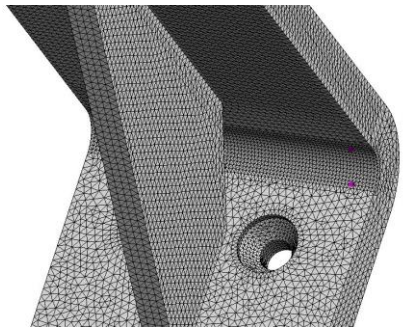
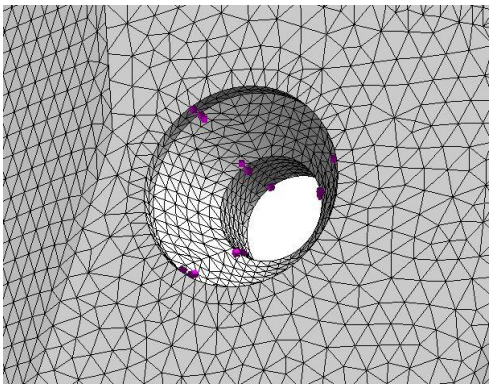
Mesh type	Solid Mesh
Mesher Used:	Standard mesh
Automatic Transition:	Off
Include Mesh Auto Loops:	Off
Jacobian points	4 Points
Element Size	0.0625 in
Tolerance	0.003125 in
Mesh Quality Plot	High

Mesh information - Details

Total Nodes	725751
Total Elements	496921
Maximum Aspect Ratio	5.8677
% of elements with Aspect Ratio < 3	99.8
% of elements with Aspect Ratio > 10	0
% of distorted elements(Jacobian)	0
Time to complete mesh(hh;mm;ss):	N/A
Computer name:	N/A

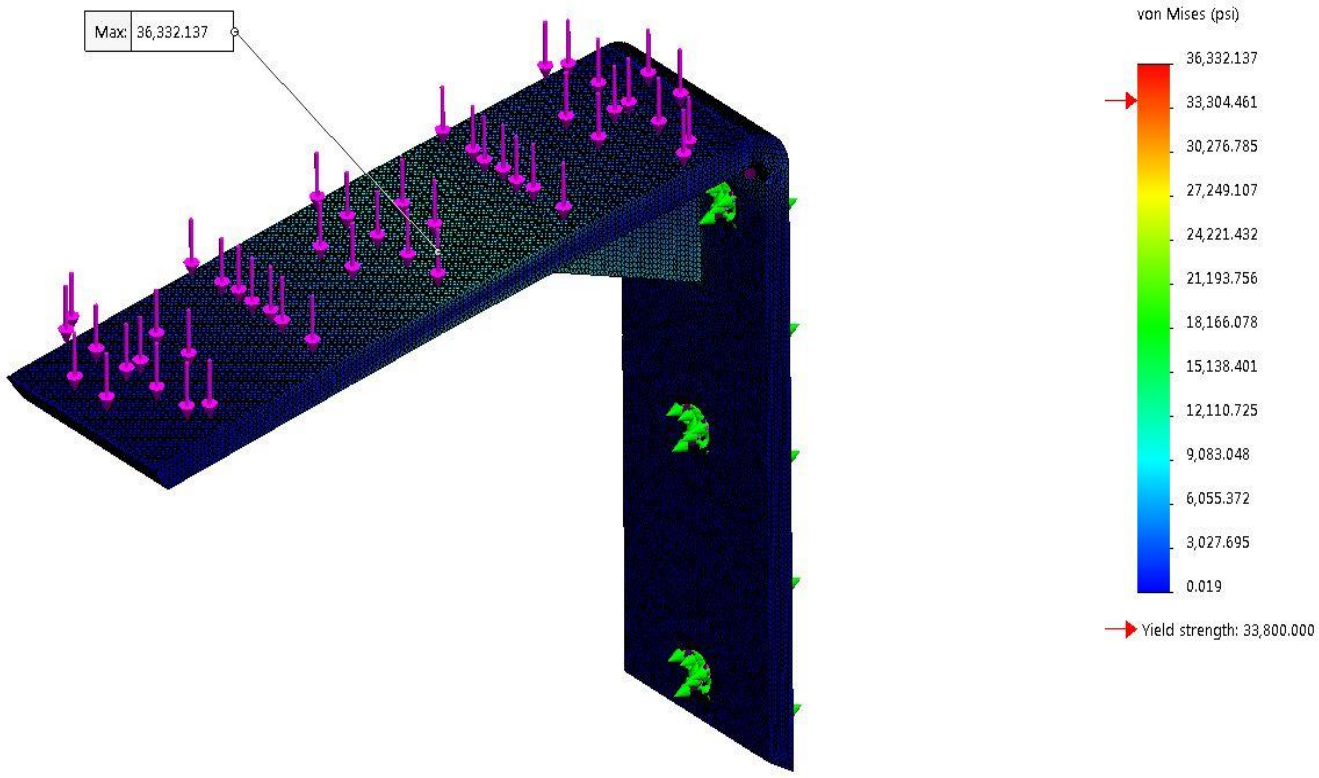


Mesh Control Information:

Mesh Control Name	Mesh Control Image	Mesh Control Details
Control-1		**Entities:** 1 face(s) **Units:** in **Size:** 0.03 **Ratio:** 1.5
Control-2		**Entities:** 12 face(s) **Units:** in **Size:** 0.03 **Ratio:** 1.5

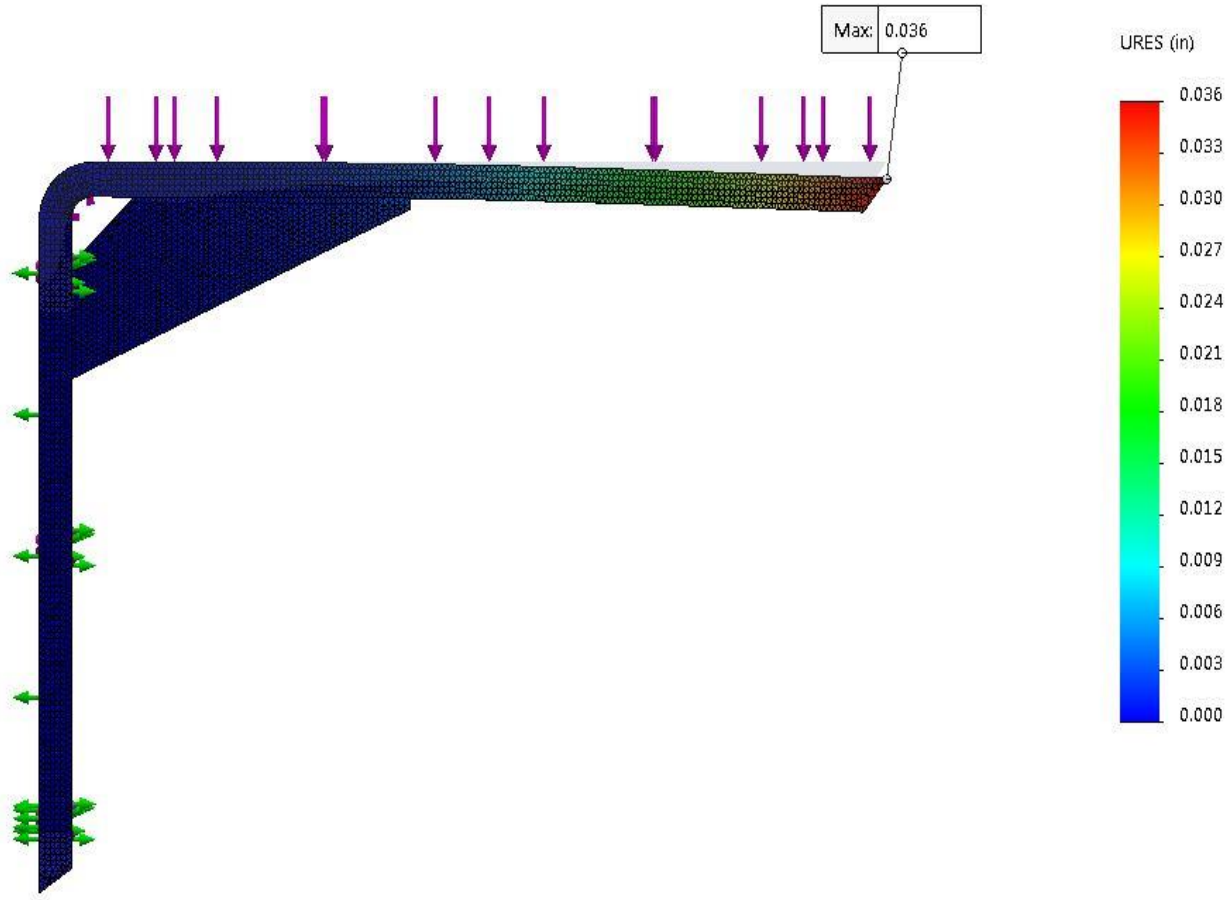
Study Results

Name	Type	Min	Max
Stress	VON: von Mises Stress	0.019 psi Node: 16991	36,332.137 psi Node: 658979



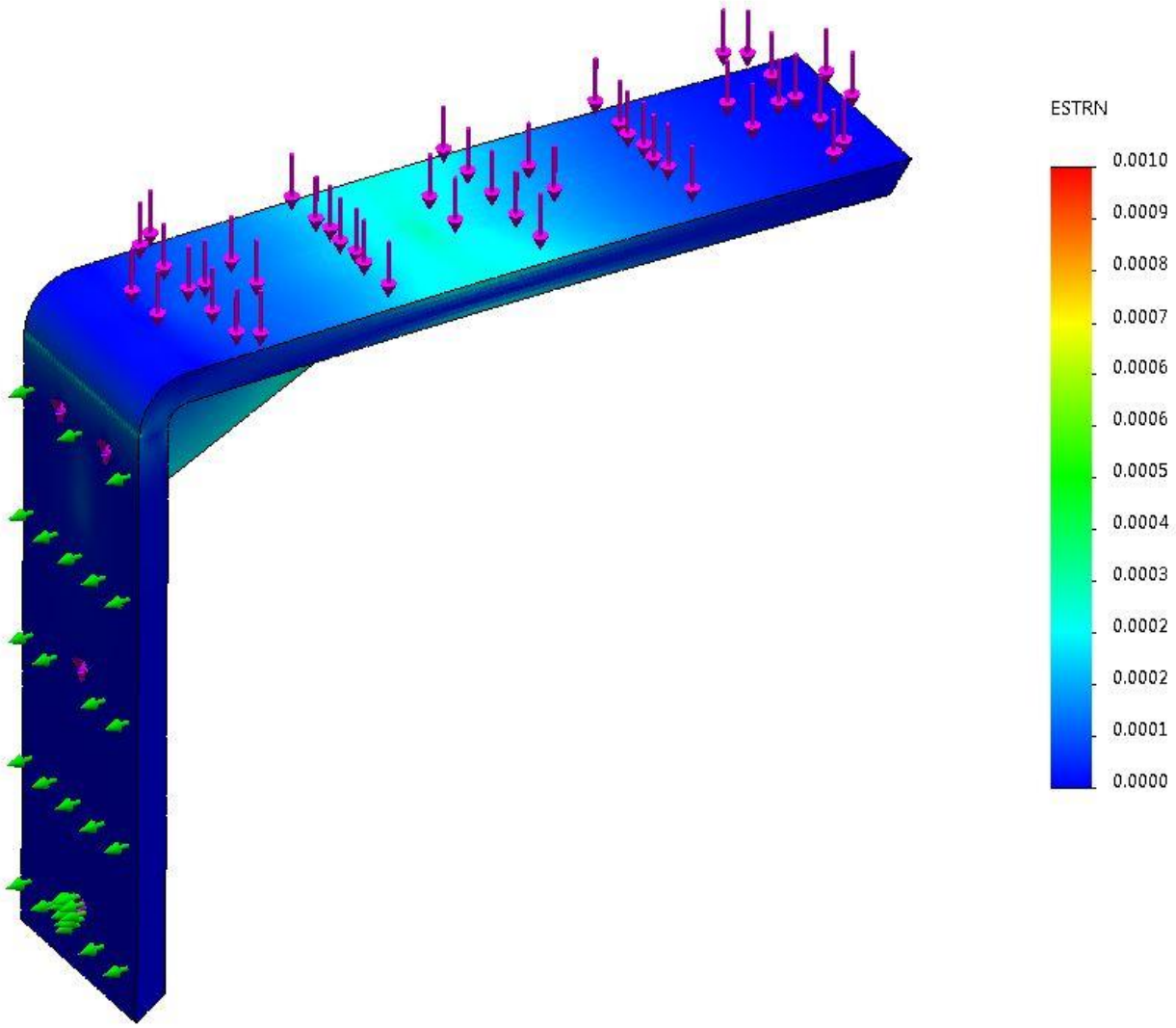
FMP-10X8_ANALYSIS:400 LBS-Maximum Von Mises Stress

Name	Type	Min	Max
Displacement	URES: Resultant Displacement	0.000 in Node: 1	0.036 in Node: 22247



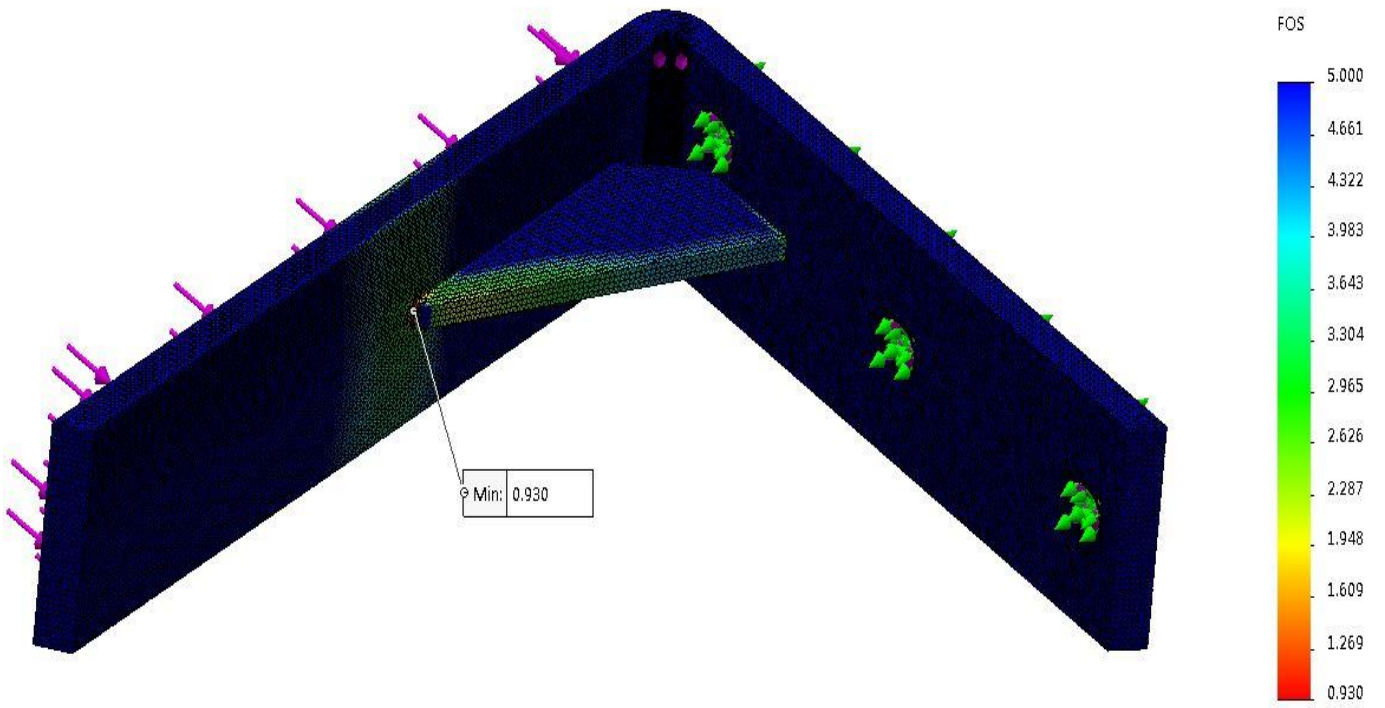
FMP-10X8_ANALYSIS:400 LBS-Maximum Displacement

Name	Type	Min	Max
Strain	ESTRN: Equivalent Strain	0.0000 Element: 93111	0.0010 Element: 61061



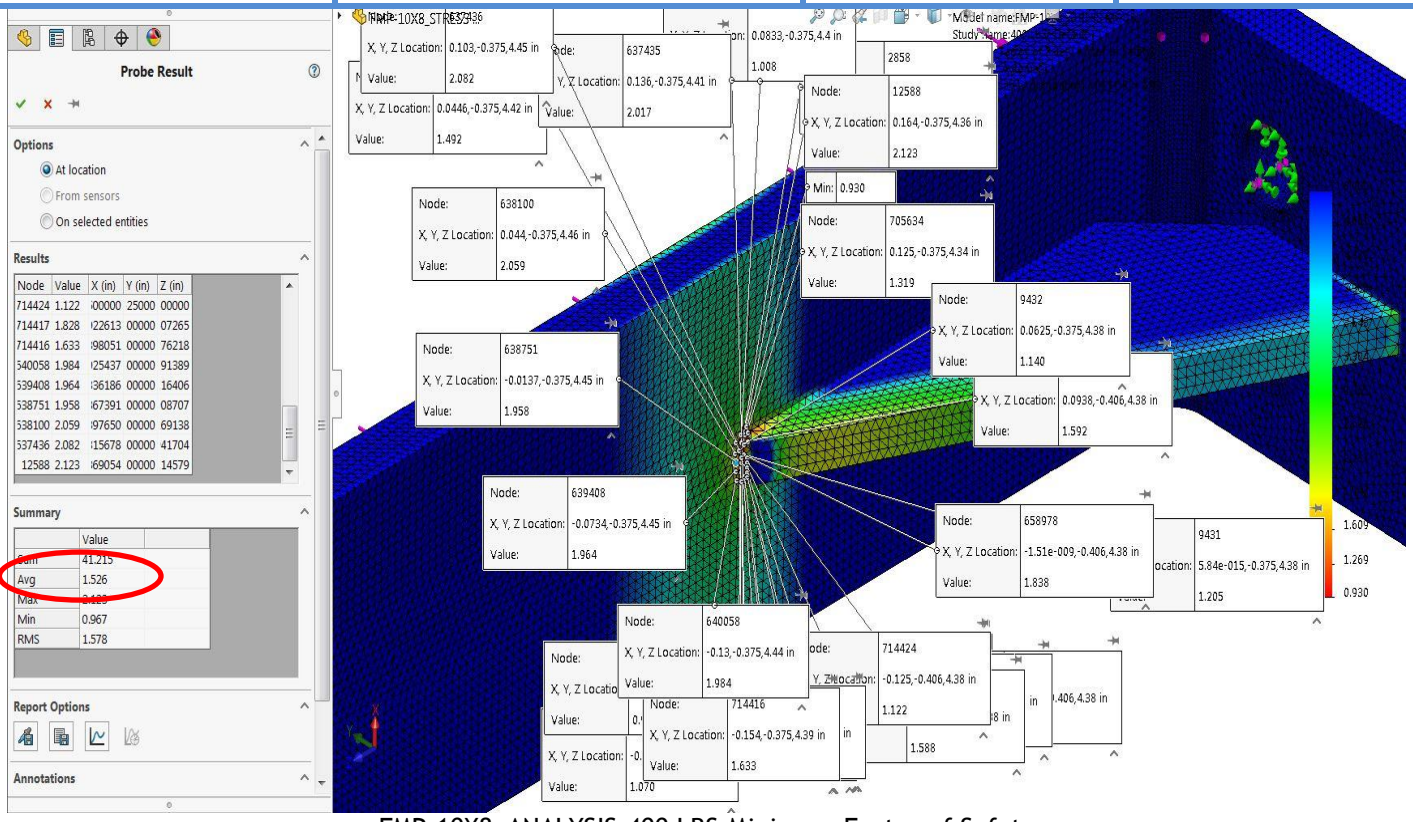
FMP-10X8_ANALYSIS:400 LBS-Strain

Name	Type	Min	Max
Factor of Safety	Automatic	0.930 Node: 658979	1,813,546.750 Node: 16991



FMP-10X8_ANALYSIS:400 LBS-Minimum Factor of Safety

Name	Type	Min	Max
Factor of Safety	Automatic		



FMP-10X8_ANALYSIS:400 LBS-Minimum Factor of Safety

Comments:

LOADING THE BRACKET WITH A 400 LB LOAD, DISTRIBUTED EVENLY TO THE TOP SIDE OF THE BRACKET, A SAFETY FACTOR OF 0.930 (LESS THAN THE DESIRED VALUE OF 1.5 WAS OBSERVED). HOWEVER, AFTER FURTHER REVIEW, THIS SAFETY FACTOR OF LESS THAN 1.5 WAS DETERMINED TO BE ERRONEOUS AND AN ARTIFACT OF MESHING AND FIXED BOUNDARY CONSTRAINT ASSUMPTIONS. FURTHER INTERROGATION OF THE FEA MESH IN THE DIRECT VICINITY OF THE COUNTERSINK FASTENER HOLE, FOUND THAT AN AVERAGE SAFETY FACTOR OF 1.526 WAS OBSERVED AND THUS THE ANALYSIS WAS ENDED.

Conclusion

Comments:

A DISTRIBUTED LOAD OF 400 LBS CAN BE SAFELY APPLIED TO THE TOP FACE OF THE BRACKET WITH A MAXIMUM DISPLACMENT OF 0.036 INCH. THE SAFETY FACTOR FOR THE FMP-10X8 BRACKET WITH A 400 LBS LOAD IS 1.5, THIS MEANS THAT NO PERMANENT DEFORMATION OF THE BRACKET WILL BE EXPERIENCED UNTIL A LOAD OF 600 LBS, OR GREATER, HAS BEEN APPLIED (ASSUMING SAME LOAD DISTRIBUTION). ONCE A LOAD OF 600 POUNDS OR GREATER HAS BEEN EXPERIENCED THE BRACKET WILL EXCEED ITS YIELD STRENGTH AND WILL EXPERIENCE PERMANENT DEFORMATION. DUE TO SMALL MATERIAL DIFFERENCES, MANUFACTURING INCONSISTENCIES, FASTENER TYPES, MOUNTING IMPERFECTIONS, ETC. CENTERLINE STEEL SUGGESTS THAT THE FMP-10X8 BRACKET NEVER EXCEED A DISTRIBUTED LOAD OF 400 LBS.

FOR SOME CUSTOMERS MINIMIZING DEFLECTION IS PARAMOUNT. THE TABLE BELOW SHOWS THE CORRELATION OF LOAD (LBS) VS. DEFLECTION (INCHES). IF MINIMIZING DEFLECTION IS OF UTMOST IMPORTANCE USE THE TABLE BELOW TO DETERMINE YOUR APPLICATIONS MAX LOADING PER BRACKET.

LOAD vs. DEFLECTION TABLE	
LOAD (lbs.)	DEFLECTION (inches)
100	0.011
200	0.022
300	0.027
400	0.036