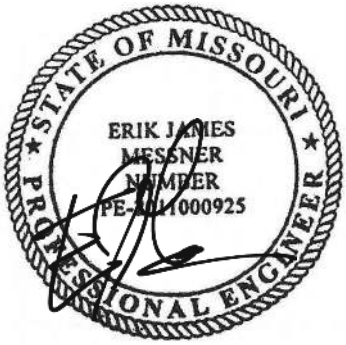
Foundation Engineering Specialists LLC

FES

Stratos Piering System Capacity Report



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EXECUTIVE SUMMARY

Foundation Engineering Specialists, LLC (FES) was hired by Stratos Piering System, LLC to review the capacity of their concentric resistance pier, the Stratos Piering System, based on the requirements of the 2012 edition of the International Building Code, Chapter 1810.3.

Per the requirements of the Code above, an engineering analysis was performed on all the components of the pier. Then a load test was performed on the shaft and soil interaction to comply with the requirements of ASTM D1143. The torsion assembly component of the pier was the controlling capacity in the design. The recommended design capacity of the pier is provided in the table below.

It is the opinion of FES that the Stratos Piering System is adequate for residential and light commercial foundation piering in the Kansas City Metro area in stiff soils (SPT blow count ≥10) at the capacity listed below. For installation in differing regions or soil conditions, FES recommends performing a site-specific load test conforming to ASTM D1143.

Pier	Ultimate Capacity	**Recommended Allowable Capacity**
Stratos Piering System (2-1/2”)	28,390 lb	**17,000 lb**

PIER DESCRIPTION

Figure 1: Elevation view of platform assembly, top segment and starter segment

The Stratos Piering System consists of 2½" diameter, 12" long steel pipe segments with nested inner tubes. The pier segments directly bear on each other with the nested tubes providing alignment. The lead segment has an oversized 3/8" cap plate that is welded to the bottom of the end segment and bears on the refusal layer of soil. After the pier is driven to refusal, a platform built from HSS6x4 tubing oriented horizontally slides over the final pier segment. The installer then jacks either side of the platform below the house and installs a "Torsion Block," consisting of a 2½" steel pipe with a nested pipe inside, a 1½" diameter solid threaded steel rod, and a ball-and-socket steel torsion joint on top. The Torsion Block threads onto the threaded rod to achieve the appropriate bearing height, and the torsion joint bears against a steel channel that is then in direct contact with the foundation. FES recommends that the channel be attached to the footing using concrete anchors for all applications, however this is not mandatory unless required by the building code of the Authority Having Jurisdiction.

See ***Appendix A: Stratos Pier System Shop Drawings*** for complete fabrication details on this system.

COMPONENT CAPACITY ANALYSIS

The most unique feature of the Stratos Piering System is the Torsion Joint. This ball-and-socket joint allows for 8 degrees of tilt of the foundation bearing surface relative to the longitudinal axis of the pier. This allowable tilt induces a nominal horizontal thrust at the contact point between the pier and the supported foundation, equal to Sin(8°) x Load. The anticipated friction force for steel-to-steel or steel-to-concrete is expected to exceed the maximum thrust induced by this allowable tilt with a factor of safety of 3.

Because every component in the system is in direct bearing, the only possible failure modes of the pier bracket are steel compression bearing failure, and column buckling at the section with the lowest radius of gyration (the section with the highest kL/r ratio). The section with the lowest radius of gyration is at the 1½" diameter threaded rod component of the Torsion Block, with account for loss in steel thickness due to corrosion. To calculate the kL/r ratio, a k value of 1.0 was used, assuming a pin-pin condition for the unsupported segment, and a maximum unsupported length of 44 inches was used (this is based on a maximum excavation depth of 32 inches, plus 12 inches to consider the last driven segment as unsupported). **This condition assumes that the soil provides complete lateral support below the last driven segment, which is only applicable in soils with SPT blow count ≥ 10. If this pier is driven in soft soils with SPT blow count < 10 during any portion of the driving process, FES recommends engaging a structural engineer to perform a buckling analysis for the specific condition.**

The maximum allowable buckling capacity of the threaded-rod section is **17,000 lb**. Per AISC, the ultimate capacity is 28,390 lb.

See ***Appendix B: Pier Component Analysis Calculations*** for complete calculations on this system. Design was based on the American Institute for Steel Construction Manual (AISC), 14th Edition.

LOAD TEST

Figure 2: Load test performed on pier in Raytown, MO

A load test was performed on the pier shaft and soil interaction conforming to the requirements of ASTM D1143 – 07: Standard Test Methods for Deep Foundations Under Static Axial Compressive Load.

The testing apparatus was constructed with W18x40 steel beams, welded to anchor caps that were bolted to four 2-7/8" helical anchors. The pier was driven to a depth of refusal (11 feet) on March 21, and the test was performed about 24 hours after the installation. Two calibrated dial indicators (tolerance of 0.001 inches) were mounted to a wood frame to calibrate the deformation of the system at the top surface of the driving platform. A precision scale (measuring to 1/64 inch) was glued to the top of the pier shaft and monitored with a transit as a secondary measurement system.

The pier was loaded in 5% increments up to the ultimate capacity of the ram used (51,600 lb). The maximum deformation measured was approximately 3/8-inch.

See ***Appendix C: Load Test Report*** for a complete report of the load test, including apparatus design and test results.

RESULTS

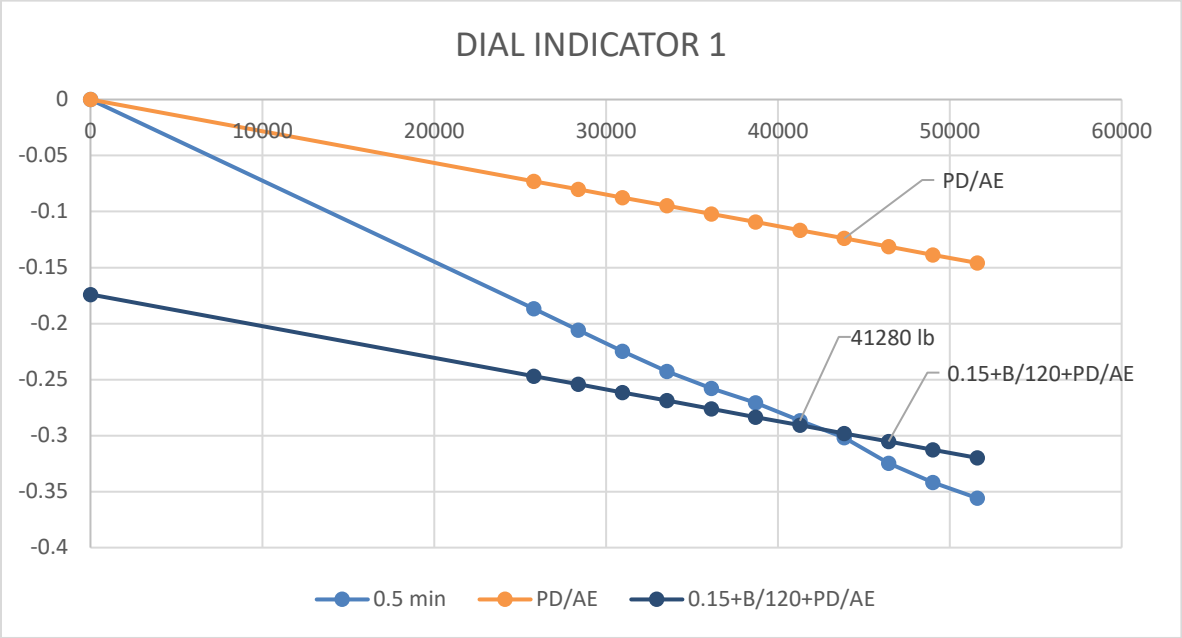


Figure 3: Plot of deformation measured at 0.5 seconds after loading and Davisson Offset Limit

The data from the load test was evaluated using the Davisson Offset Limit Method. The data from Dial Indicator 1 showed a slightly higher magnitude of deformation than that from Dial Indicator 2 (about 0.04 inches), suggesting an uneven deformation distribution during driving. This may have been due to self-corrections of the pier bearing and straightness during driving, slight eccentricities in the ram driving distributions across the cross-section and the placement of the ram and pier fit-up, and/or the tolerances of the dial indicators.

The Davisson Offset Limit Method analysis for the readings from Dial Indicator 2 suggest that the system ultimate capacity is greater than the capacity of the ram used (51,600 lb). The analysis for the readings from Dial Indicator 1 suggest that the system ultimate capacity is 41,280 lb. The actual capacity for the system tested is between these two values. However, because a reasonable means for interpolating between these two values was not collected on site (such as a measurement of coordinates of the dial indicators relative to the pier centerlines), FES recommends using the readings from Dial Indicator 1 as the most reasonable capacity of the pier and soil system.

Therefore, the maximum recommended allowable compressive capacity of the pier shaft and soil system is **20,640 lb**. This is based on a safety factor of 2.0.

LIMITATIONS

Our professional services were performed in accordance with the standards of skill and care generally exercised by other professional consultants acting under similar circumstances and conditions at the time the services are performed. No other warranty, expressed or implied, is made as to the professional advice presented in this report. No warranty of future performance is expressed or implied by the conclusions of this report.

Client agrees that information provided for this report and data is accurate to the best of their knowledge. This report and the results and recommendations herein are intended solely for the purposes specified. These results and recommendations are not suitable for use beyond the scope of the report nor beyond the specific soil conditions and pier configuration, material, sections and manufacturer used.

Appendices

- **Appendix A:** **Stratos Pier System Shop Drawings**

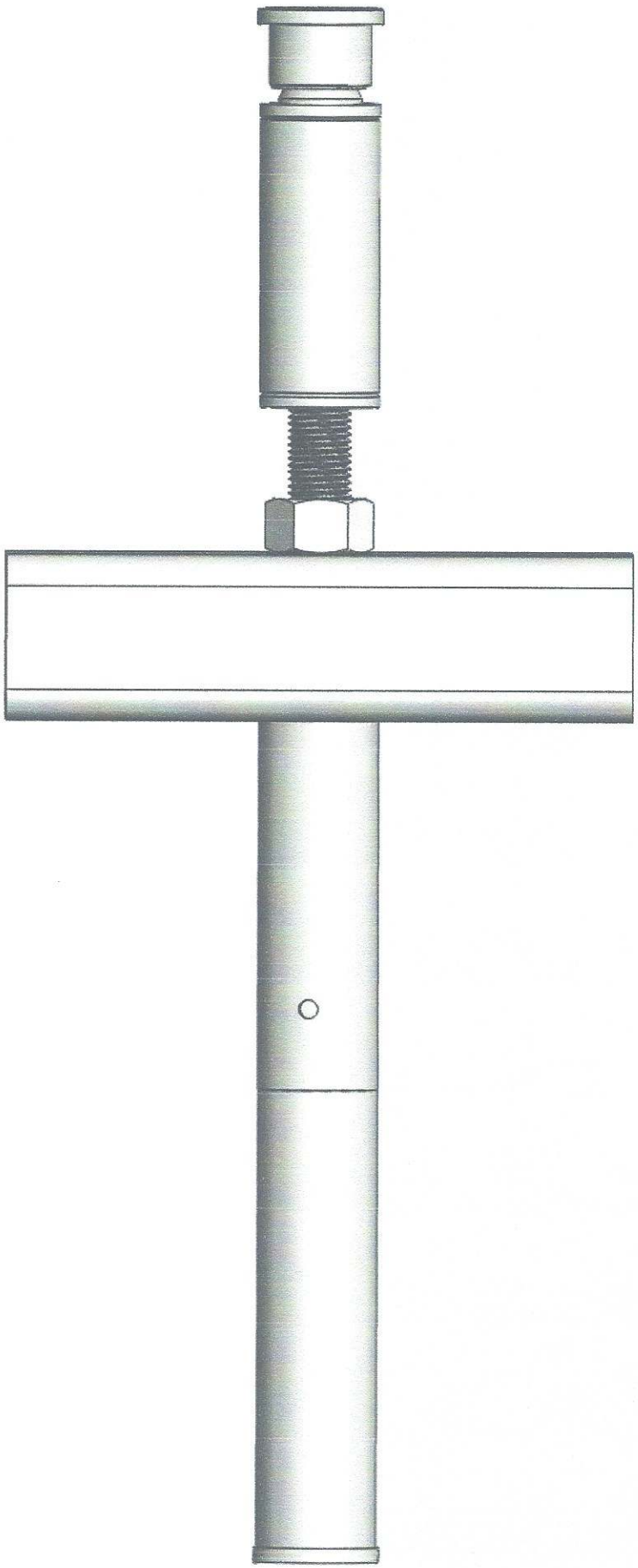
- **Appendix B:** **Pier Component Analysis Calculations**

- **Appendix C:** **Load Test Report**

- **Appendix D:** **Calibration Reports**

Appendix A

Stratos Pier System
Shop Drawings



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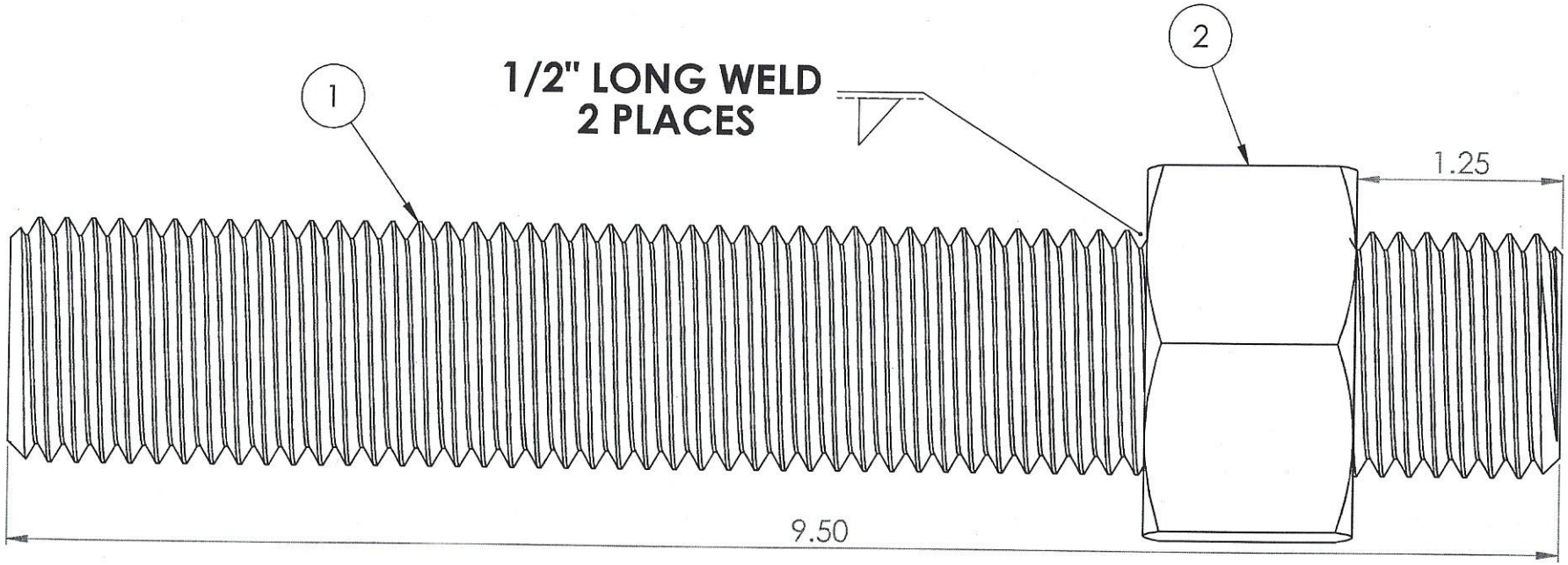

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APPLICATION		

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ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±.015
THREE PLACE DECIMAL ±.010

INTERPRET GEOMETRIC TOLERANCING PER:

FINISH

DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

MATERIAL

MIDWEST FOUNDATION

TITLE:

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A		

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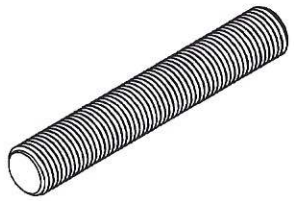

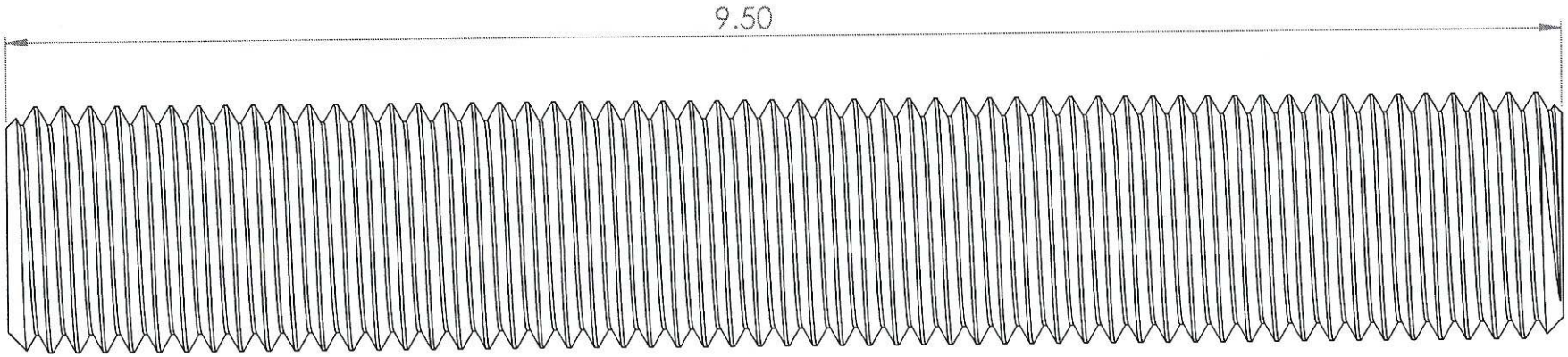

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MIDWEST FOUNDATION

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A		
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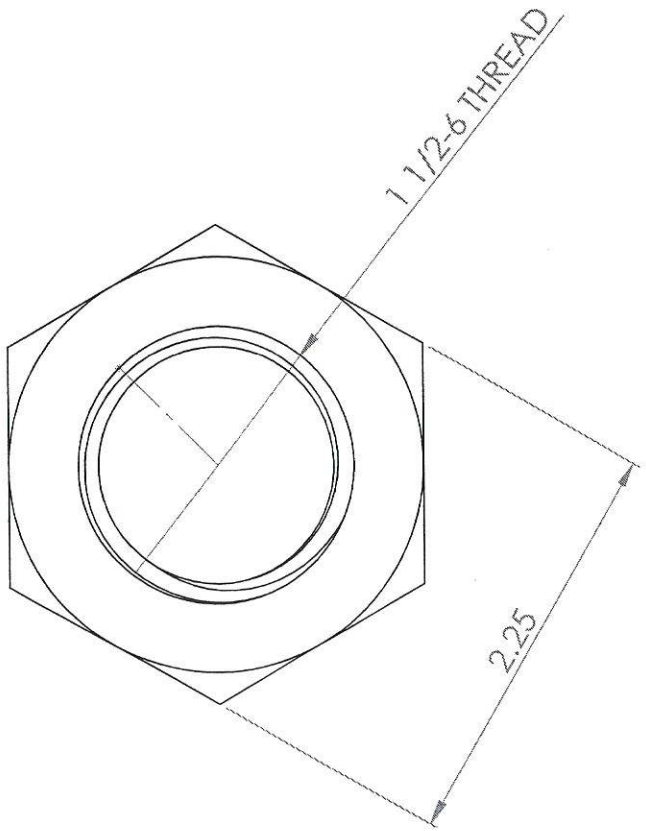

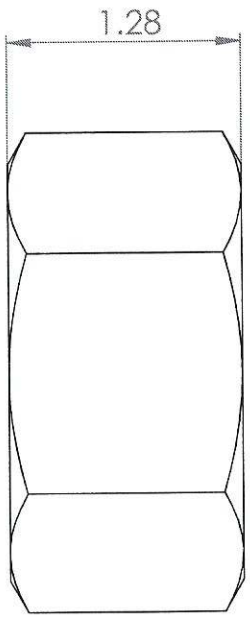

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MIDWEST FOUNDATION

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A		
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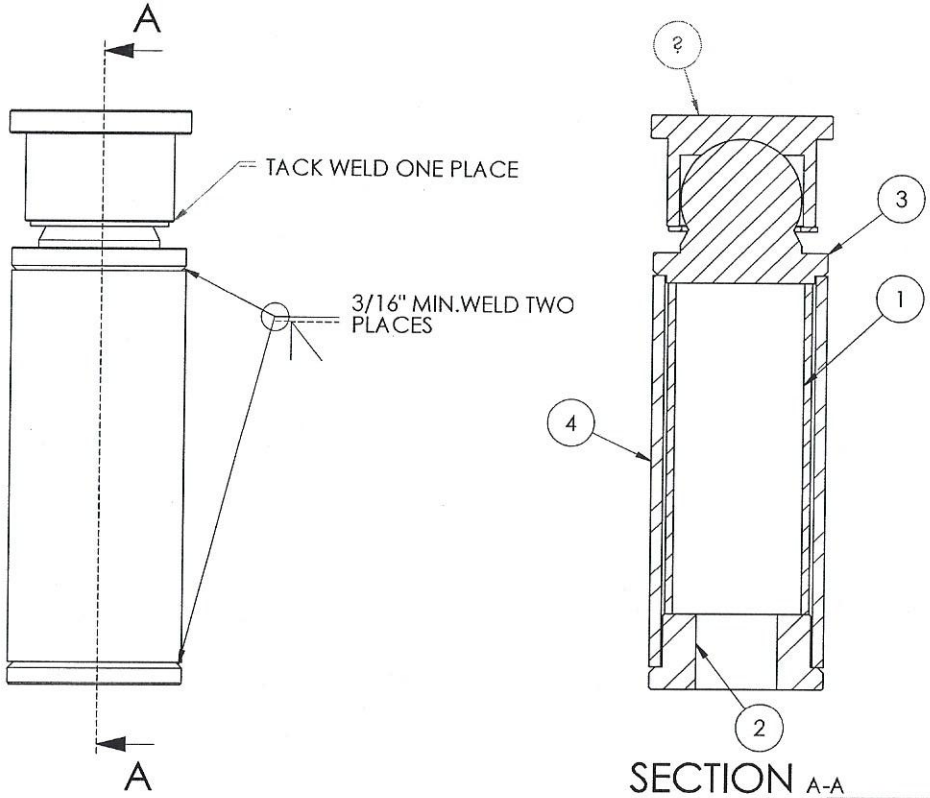

SECTION A-A

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	CHECKED			
	ENG APPR.			
	MFG APPR.			
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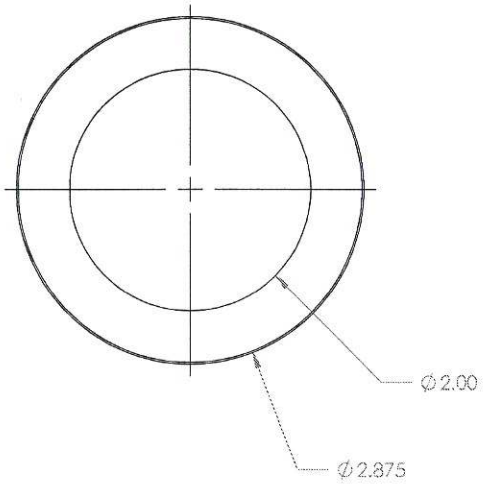

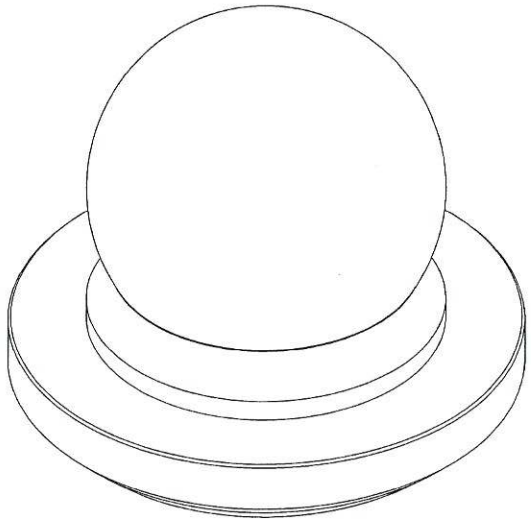

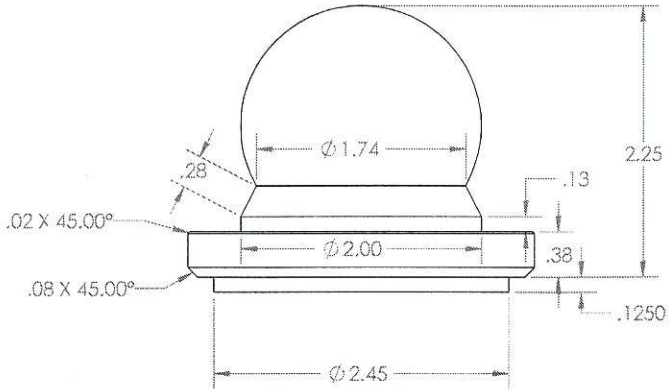

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			MATERIAL		
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MIDWEST FOUNDATION

TITLE:

TORSION BALL

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B		

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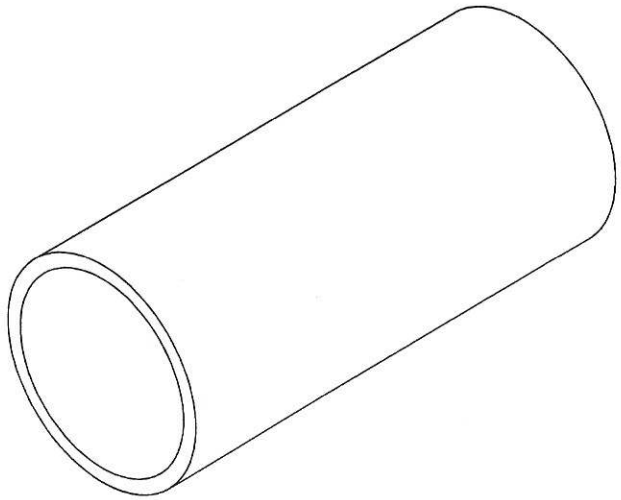

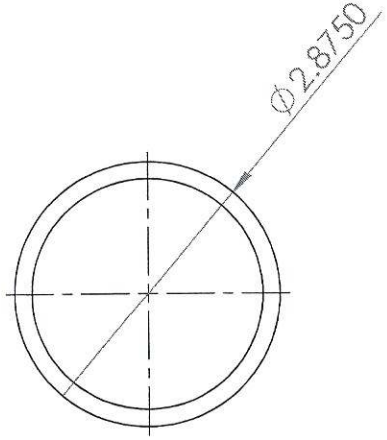

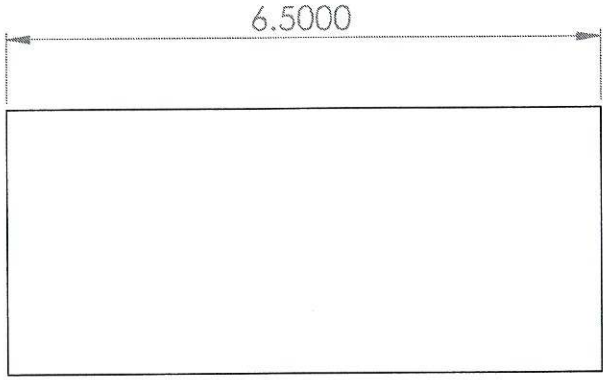

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MIDWEST FOUNDATION

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TORSION TUBE

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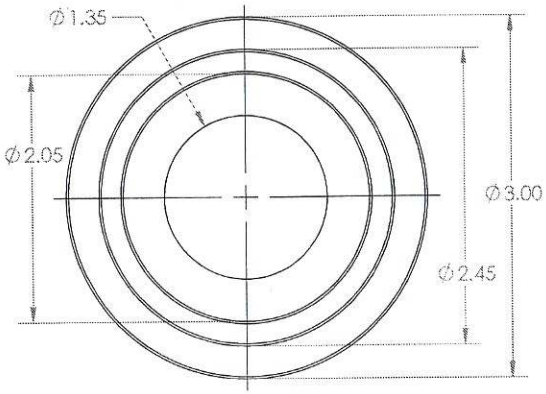

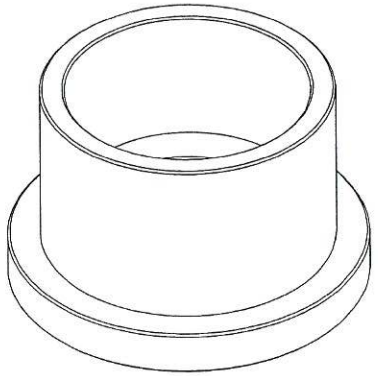

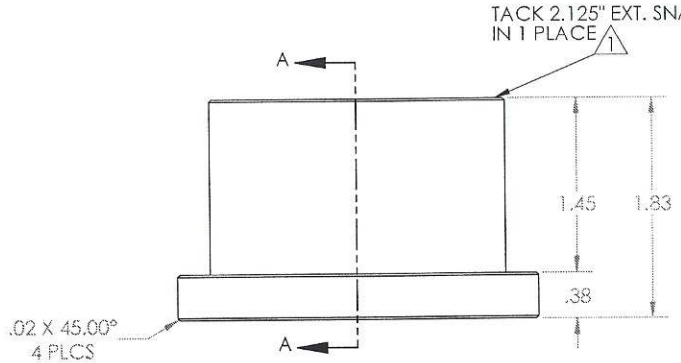

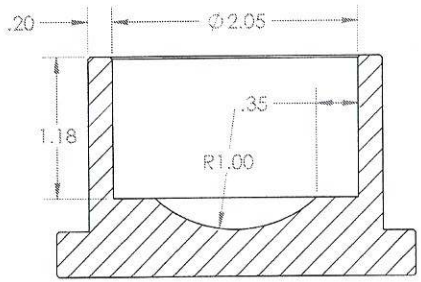

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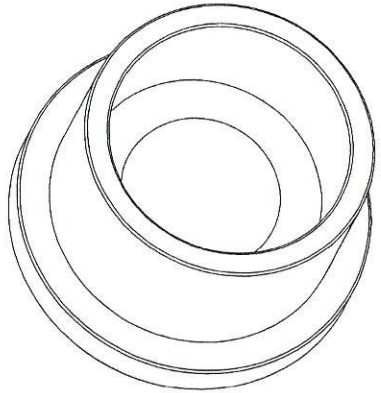

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MIDWEST FOUNDATION

TITLE: TORSION COUPLER

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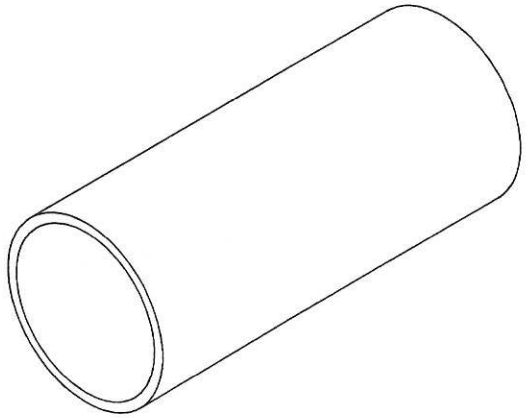

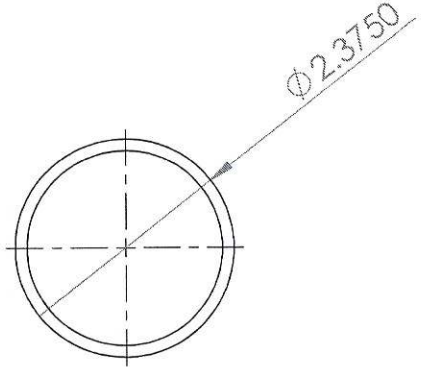

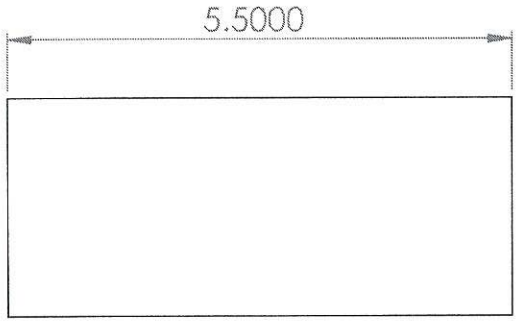

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MIDWEST FOUNDATION

TITLE:

INNER TORSION TUBE

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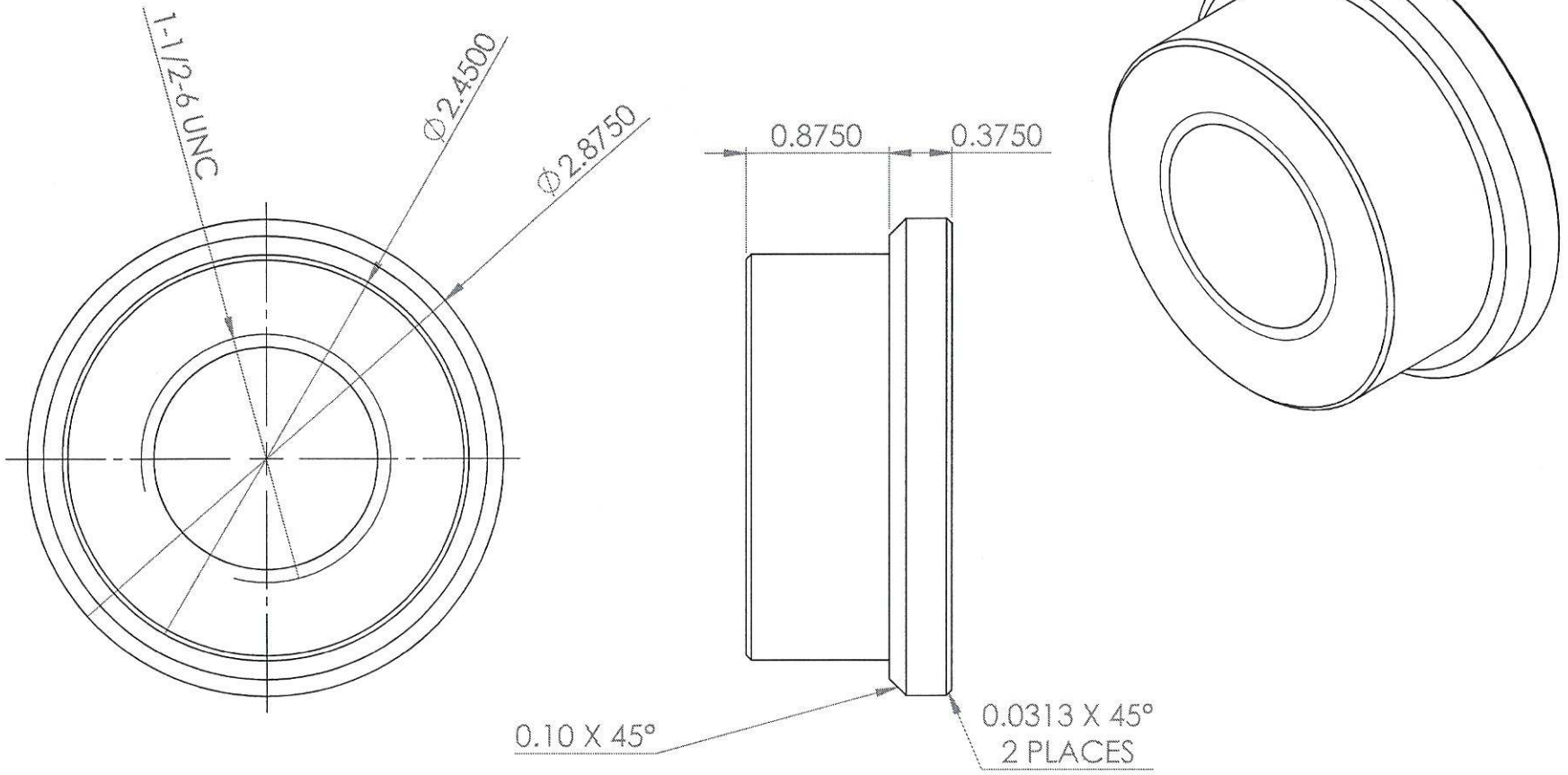

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			MATERIAL		
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APPLICATION		DO NOT SCALE DRAWING			

MIDWEST FOUNDATION

TITLE:

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A		

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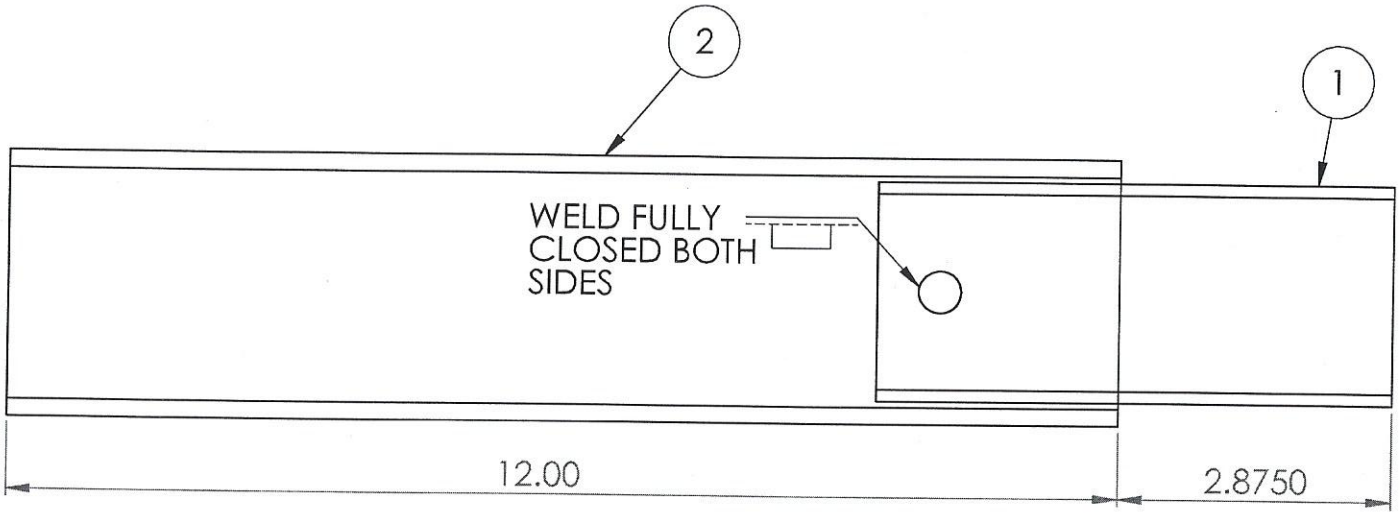

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NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

MIDWEST FOUNDATION

TITLE:

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A		
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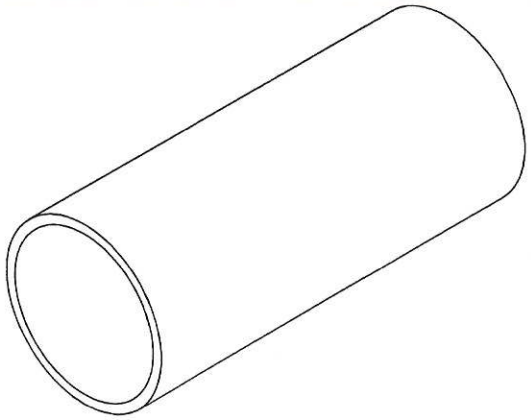

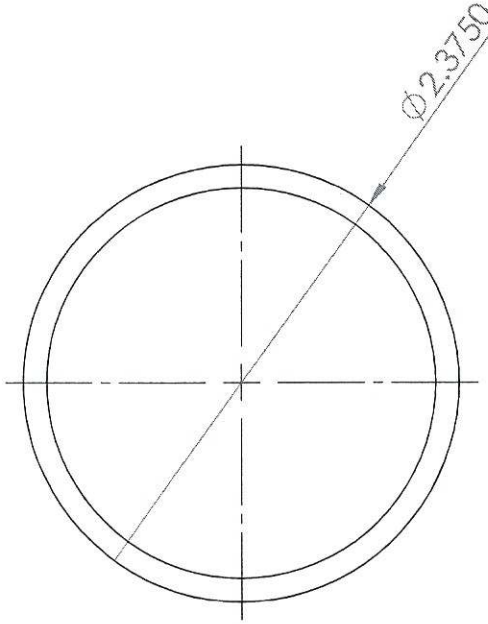

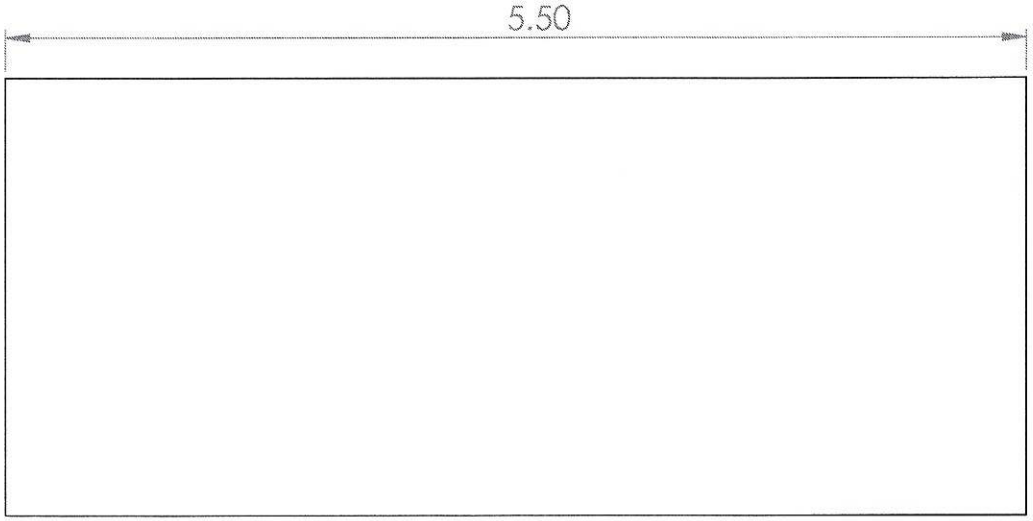

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		INTERPRET GEOMETRIC TOLERANCING PER:
NEXT ASSY	USED ON	FINISH
APPLICATION		DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

MATERIAL

2" SCH. 40 PIPE

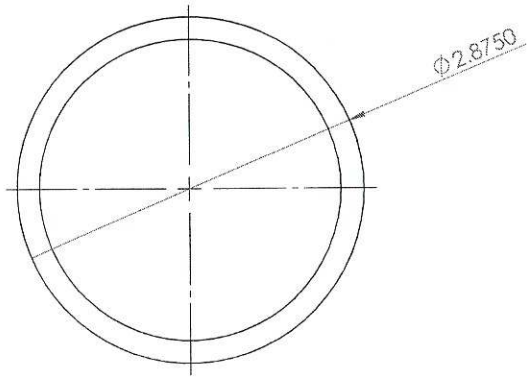
MIDWEST FOUNDATION

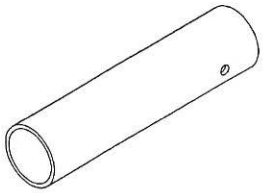
TITLE:

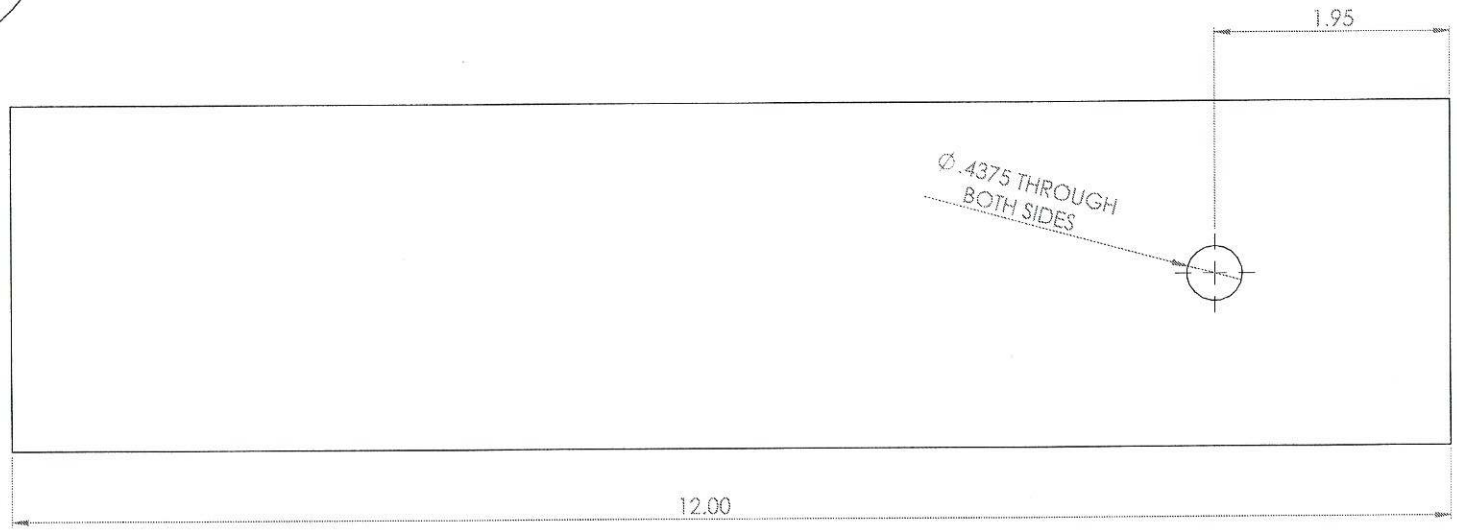
PIER SEGMENT INNER TUBE

SIZE	DWG. NO.	REV
A		

SCALE: 1:2 | SHEET 1 OF 1







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			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
			MATERIAL		
NEXT ASSY	USED ON		2 1/2" SCH. 40 PIPE		
APPLICATION		DO NOT SCALE DRAWING			

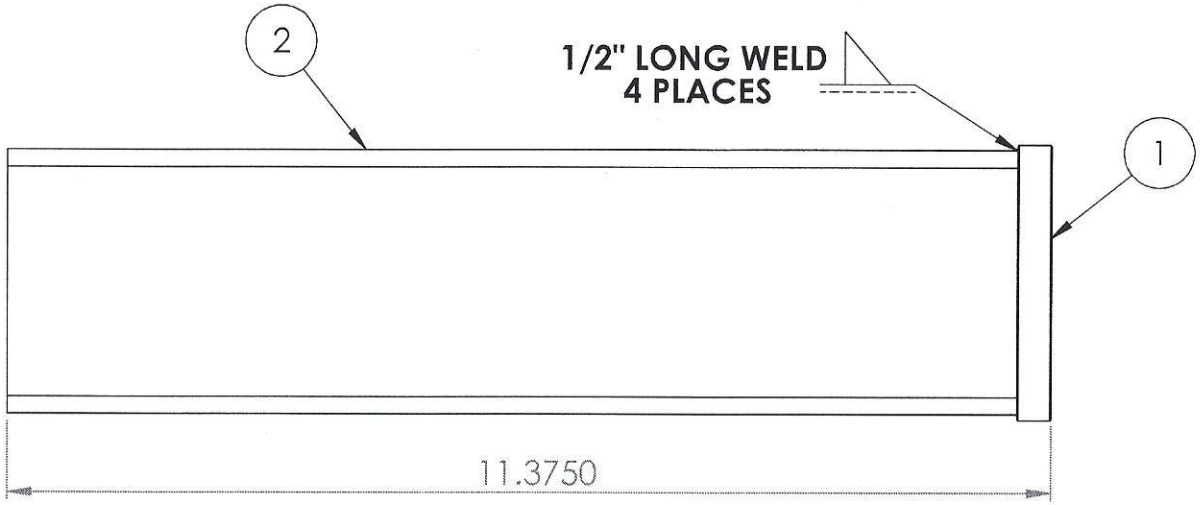
MIDWEST FOUNDATION

TITLE:

PIER SEGMENT TUBE

SIZE	DWG. NO.	REV
B		
SCALE: 1:5	WEIGHT:	SHEET 1 OF 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	starter segment cap		1
2	starter segment tube		1



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			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

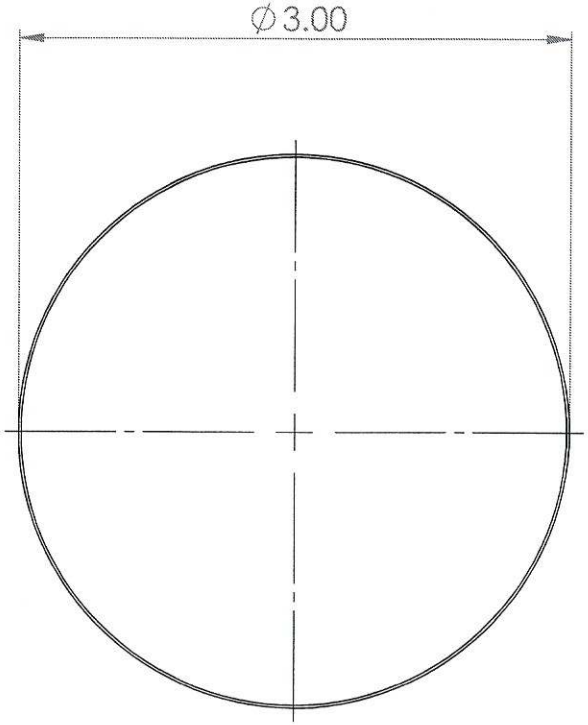
MIDWEST FOUNDATION

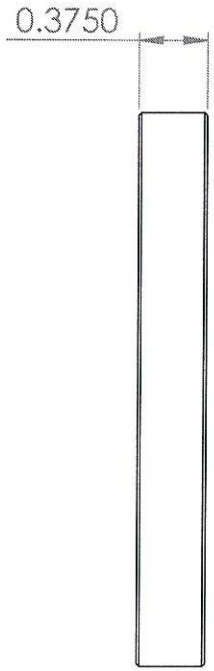
TITLE:

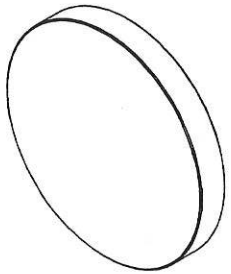
STARTER SEGMENT ASSEMBLY

SIZE	DWG. NO.	REV
A		

SCALE: 1:5 | SHEET 1 OF 1







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		DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL ±1/32 ANGULAR: MACH ± BEND ± TWO PLACE DECIMAL ±.015 THREE PLACE DECIMAL ±.010	DRAWN		
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
			MATERIAL **3/8" A-36 H.R. PLATE**		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

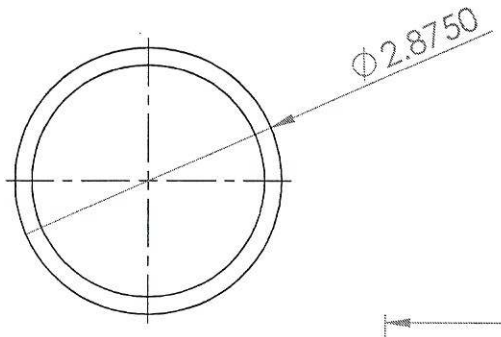
MIDWEST FOUNDATION

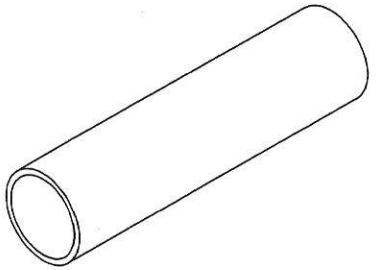
TITLE:

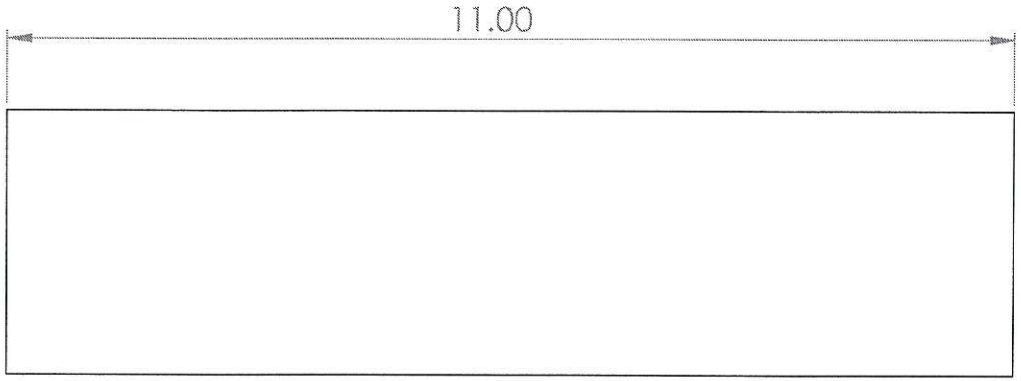
STARTER SEGMENT CAP

SIZE	DWG. NO.	REV
A		

SCALE: 1:1 | SHEET 1 OF 1







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			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
			MATERIAL **2 1/2" SCH. 40 PIPE**		
NEXT ASSY	USED ON	FINISH			
APPLICATION		DO NOT SCALE DRAWING			

MIDWEST FOUNDATION

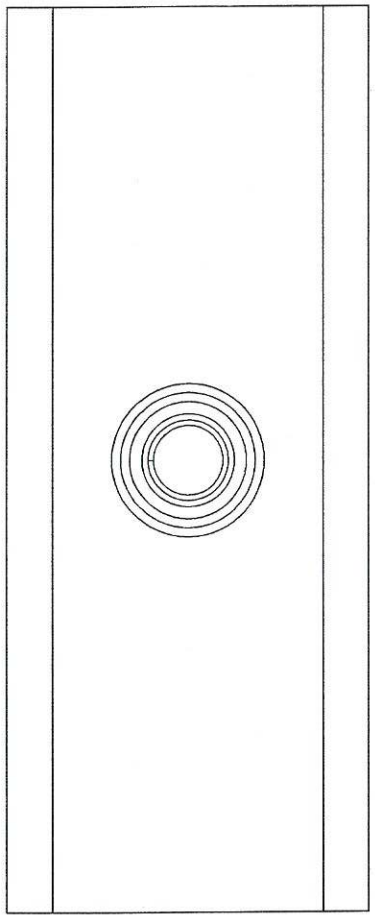
TITLE:

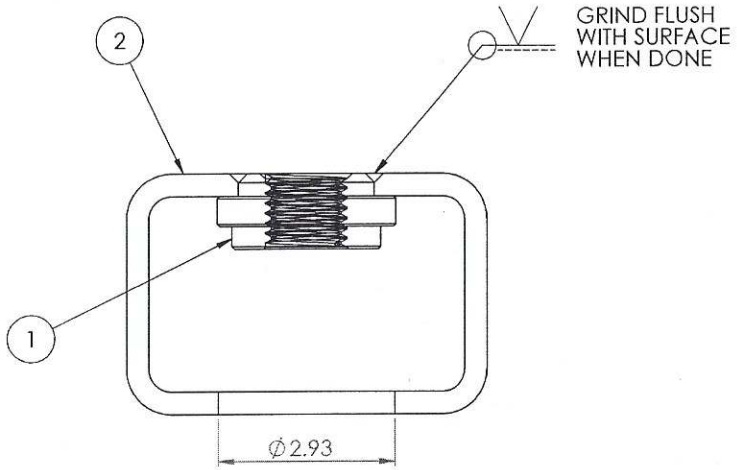
STARTER SEGMENT TUBE

SIZE	DWG. NO.	REV
A		

SCALE: 1:5 | SHEET 1 OF 1

ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	DOUBLE STEP NUT		1
2	PLATFORM		1





NEXT ASSY | USED ON
APPLICATION

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL ± 1/32
ANGULAR: MACH ± BEND ±
TWO PLACE DECIMAL ±.015
THREE PLACE DECIMAL ±.010
INTERPRET GEOMETRIC TOLERANCING PER:
DO NOT SCALE DRAWING

	NAME	DATE
DRAWN		
CHECKED		
ENG APPR.		
MFG APPR.		
Q.A.		

COMMENTS:

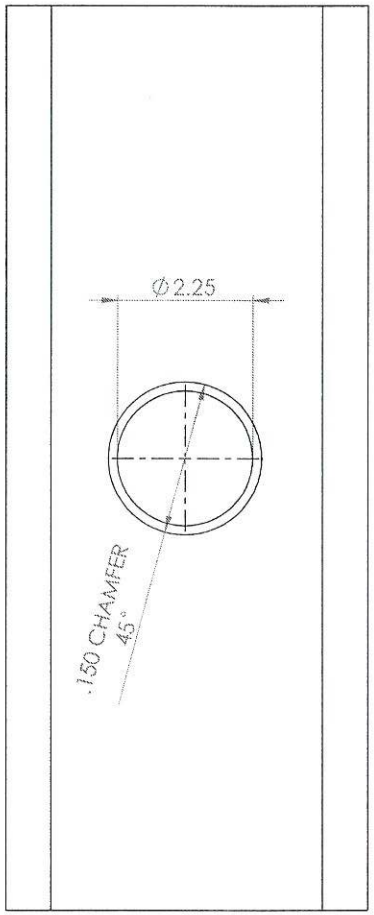
MIDWEST FOUNDATION

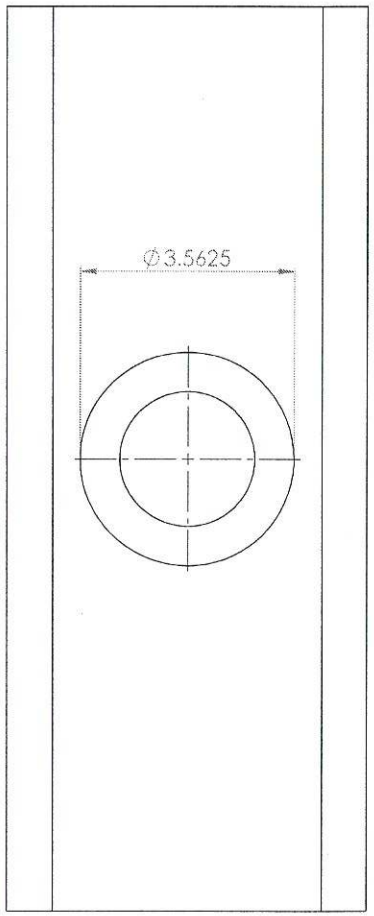
TITLE:

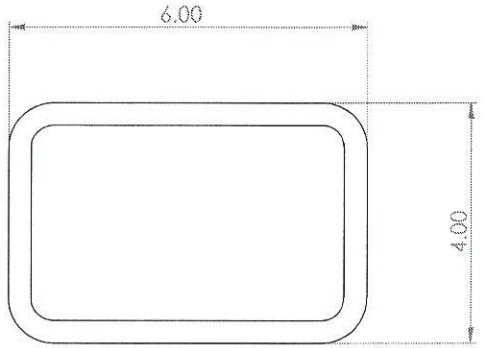
PLATFORM ASSEMBLY

SIZE B | DWG. NO. | REV

SCALE: 1:5 | WEIGHT: | SHEET 1 OF 1







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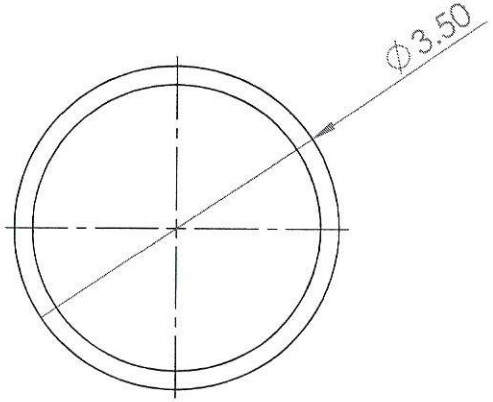
			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
			MATERIAL 4"X6"X3/8" H.R. STRUCTURAL TUBE		
NEXT ASSY	USED ON				
APPLICATION		DO NOT SCALE DRAWING			

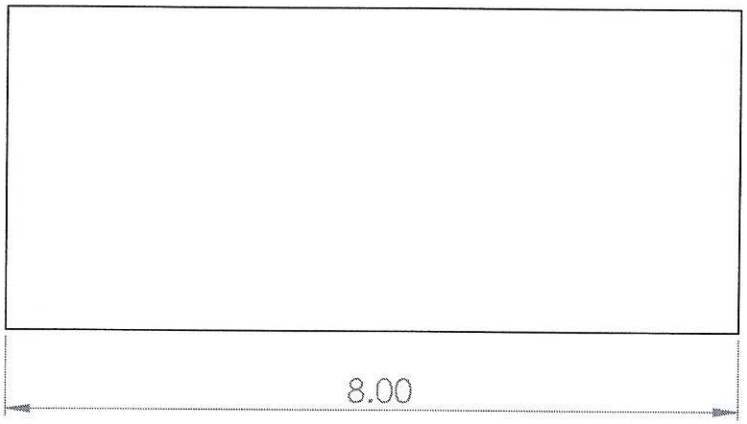
MIDWEST FOUNDATION

TITLE:

PLATFORM

SIZE	DWG. NO.	REV
B		
SCALE: 1:5	WEIGHT:	SHEET 1 OF 1





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			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
			MATERIAL		
NEXT ASSY	USED ON		**3" SCH. 40 PIPE**		
APPLICATION		DO NOT SCALE DRAWING			

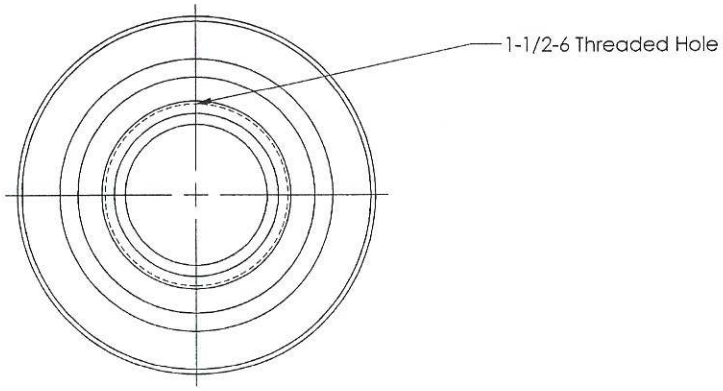
MIDWEST FOUNDATION

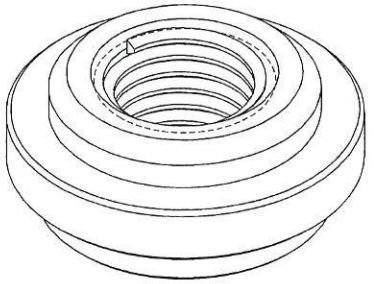
TITLE:

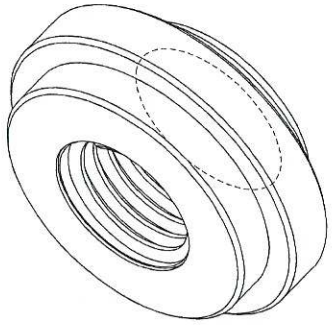
PLATFORM PIPE

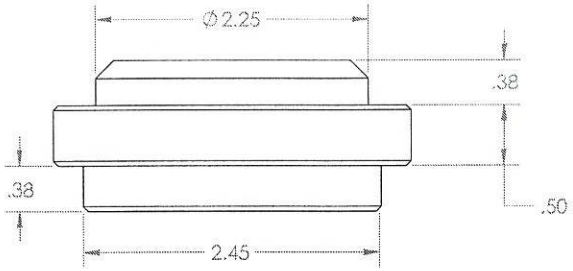
SIZE	DWG. NO.	REV
A		

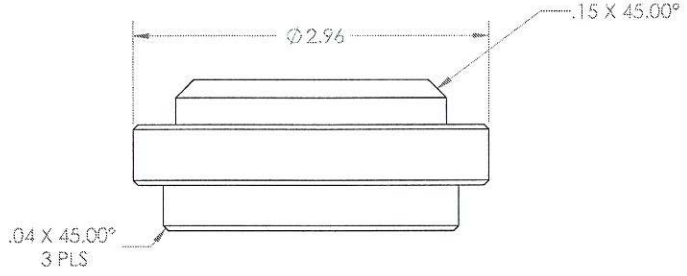
SCALE: 1:5 | SHEET 1 OF 1











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			CHECKED		
			ENG APPR.		
			MFG APPR.		
		INTERPRET GEOMETRIC TOLERANCING PER:	Q.A.		
			MATERIAL		
NEXT ASSY	USED ON		3" 1018 H.R.		
APPLICATION		DO NOT SCALE DRAWING			

MIDWEST FOUNDATION

TITLE:

DOUBLE STEP NUT

SIZE	DWG. NO.	REV
B		

SCALE: 1:1 WEIGHT: SHEET 1 OF 1

Appendix B

Pier Component
Analysis Calculations

Project Name: 17-01-25 IMPACT PIERING SYSTEM

Engineer: EJM **Date:** 3/29/2017

Foundation Engineering Specialists LLC

ALLOWABLE TILT CALCULATIONS

Tilt Force Coefficient

Max Allowable Tilt= 8.0 degrees

Max Horizontal Component= 0.14 x Load

Friction Force Coefficient

Friction Resistance= μ x Load

μ for steel to steel= 0.5

μ= 0.5 k > 0.14 OKAY

ALLOWABLE BRACKET CAPACITY

Steel in Direct Bearing

Load= 17.0 kips Bearing Area= 1.43139 in2 Hole Size= 0 in

Fy= 36 ksi No. of Holes= 0 holes

Fu= 58 ksi

Yielding Capacity, $R_n/Omega=F_y*t_p*h/1.67$= 30.9 k > 17.0 OKAY

Rupture Capacity, $R_n/Omega=F_u*t_p*(B_p-d_h*N)/2.00$= 35.3 k > 17.0 OKAY

Compression Buckling at Threaded Rod Section

Load= 17.0 kips K= 1

Rod Diameter, d= 1.464 in F_y= 36 ksi

L_b= 44 in kL/r= 120.2 < $4.71\sqrt{(E/F_y)}$= 133.7

A= 1.68 in F_e= 19.8041 ksi

r= 0.366 in Fcr/Omega= 10.1 ksi

Yielding Capacity, $P_n/Omega=F_{cr}*t_p*B_p/1.67$= 17.0 kips > 17.0 OKAY

Appendix C

Load Test Report

1.0 – General Information

Pier Type:	Stratos Piering System
Test Site Location:	10112 E 70th Terrace, Raytown, Missouri 64133
Owner:	Stratos Piering System, LLC
Structural Engineer:	Foundation Engineering Specialists, LLC

2.0 – Pile Installation Equipment

Ram:	SPX #C258C Model B (brand new out of box)
Max Ram Capacity:	25.8 Tons (51,600 lb)
Ram Stroke:	8.25 inches
Pump:	No. 9582 Model B
Pump Capacity:	10,000 psi
Force/psi Conversion Ratio:	5.16 lb force per psi

3.0 – Test Pier Details

Identification of Test Pier:	Stratos Piering System, manufactured by Stratos Piering System, LLC at Midwest Foundation Supply facilities, 5616 Raytown Rd, Raytown, Missouri 64133 **Pier segments were selected at random from manufacture's facility and signed and dated by Engineer, then delivered to test site where signed components were verified prior to installation
Target Ultimate Capacity:	51,600 lb
Pier Type and Dimensions:	Test pier is a concentric, 2 ½" diameter steel pipe resistance pier with 12" long pier segments. The pier cap is a torsion joint allowing 8° of rotation in any direction. The joint is mounted to a pipe segment ("torsion block") that serves as the female end that receives a 1 ½" diameter all-thread rod, which is then threaded into a platform assembly that sits atop the final pier segment.
Final Embedded Length:	Approximately 11 feet

4.0 – Loading Apparatus Details

ID of Anchor Piers:	TAF-288-84 8-10-12 Tubular Shaft Torque Anchors by Earth Contact Products, LLC.
Helical Ultimate Capacity:	100,000 lb
System Calculated Capacity:	22,000 lb
Max Load Per Helical:	18,000 lb

Pier Type and Dimensions:	Apparatus anchors are a concentric, 2-7/8” diameter steel pipe helical anchors with 7 ft long segments and one 12”, one 10” and one 8” diameter helical anchor plate. The shaft wall thickness is 0.262”.
Final Embedded Length:	Approximately 11 feet

5.0 – Test Pile Installation

Date Installed:	March 21, 2017
Final Penetration Resistance:	100,000 lb
Final Penetration Depth:	11 ft

6.0 – Pile Testing

Date of Test:	March 22, 2017
Temperature and Weather:	50° F, Sunny
Loading Apparatus:	See attached design and photos
Instrumentation:	Two Accusize Tools 2” stroke dial indicators, accurate to 0.001 inch, calibration reports provided in ***Appendix D.*** Mounted to 2x8 wood beams and referencing off glazed ceramic tiles glued to the driving platform top. Secondary measurements by a 1/64” scale rule glued to the shaft and referenced from a transit located approximately 15 feet from the test pier.
Testing Readings:	See attached field notes and normalized data printout

Adjustments:

1) During the initial pier installation, it was observed that the entire frame racked to the southeast. To minimize frame racking and effects on the pier test readings, a skid loader with fork attachments was parked at the southeast corner of the frame and the forks were used to sandwich the web of the steel support beam. The apparatus was then chained and ratcheted to the skid loader to provide positive anchorage. Ram pressure was applied and no further racking of the frame was noticeable.

2) Due to pier cap instability when the pier was not loaded, a reliable reading at 0 psi could not be obtained – the test began at 50% of the total test load and the first four data points were extrapolated back to a zero value.

3) At the 50% and 55% total test load drives, the dial indicator readings show a linear upward rebound between the 0.5- and 8-minute intervals. The pressure was not monitored during this time, but it is believed that the pressure was dropping during this time as the static load set in and the system (pump, reservoir, hose and ram) adjusted to the pressure.

Readings from 0.5-seconds are considered the most valid readings at these load points.

4) Between the 1- and 2-minute reading for 65% total test load, the transit was bumped – readings from the dial indicators was used to normalize the before-and-after readings from the transit.

5) The 8-minute reading at 70% total test load was mis-read, and most likely should be corrected to 1.221 inches.

6) Between the 4- and 8-minute interval for the 95% total test load, it became clear from the readings that the pump pressure was decreasing. The system was checked and a hydraulic fluid leak was found at the hose connection to the pump. The test was stopped, the hose connection was tightened, and the test at 95% total test load was conducted again. Results were normalized to the 2-minute interval of the original test.

7) During the load decreasing portion of the test, it became very difficult to decrease the pressure in a controlled, incremental way. The pressure began to bleed-off between intervals. Readings of the dial indicators AND pressure at the time of reading was recorded.

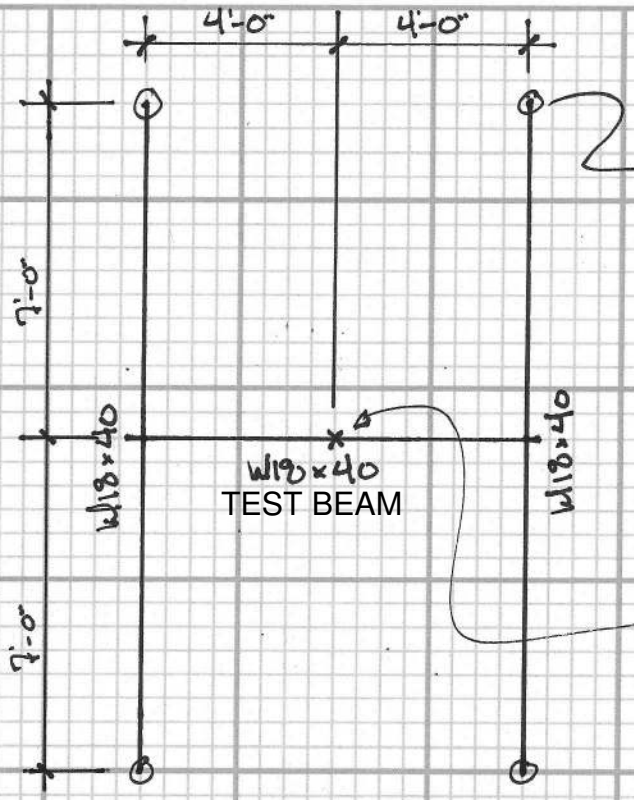

Power Team
SPX

Foundation Engineering Specialists LLC

816-265-1081
erik@fes-kc.com

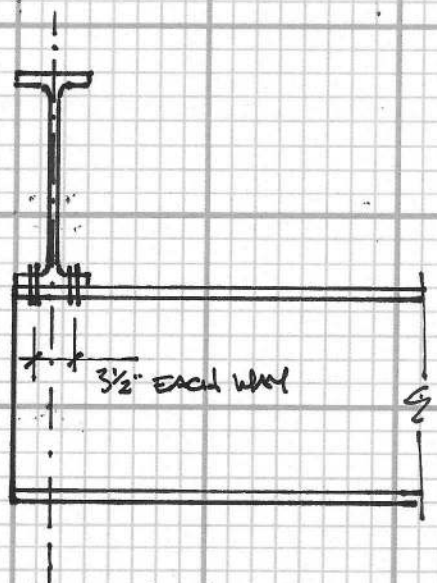
PAGE 1 OF
DATE 02/25/17

TITLE TESTING APPARATUS DESIGN
PROJECT MFS - IMPACT PIERING SYSTEM



NOTES
- A992 STEEL, TYP

FRAMING PLAN FOR APPARATUS



NOTES
- ¾" Φ A325-N BOLTS, TYP
- STANDARD HOLES

TEST BEAM UNDER SUPPORT BEAM, TYP

Foundation Engineering Specialists LLC

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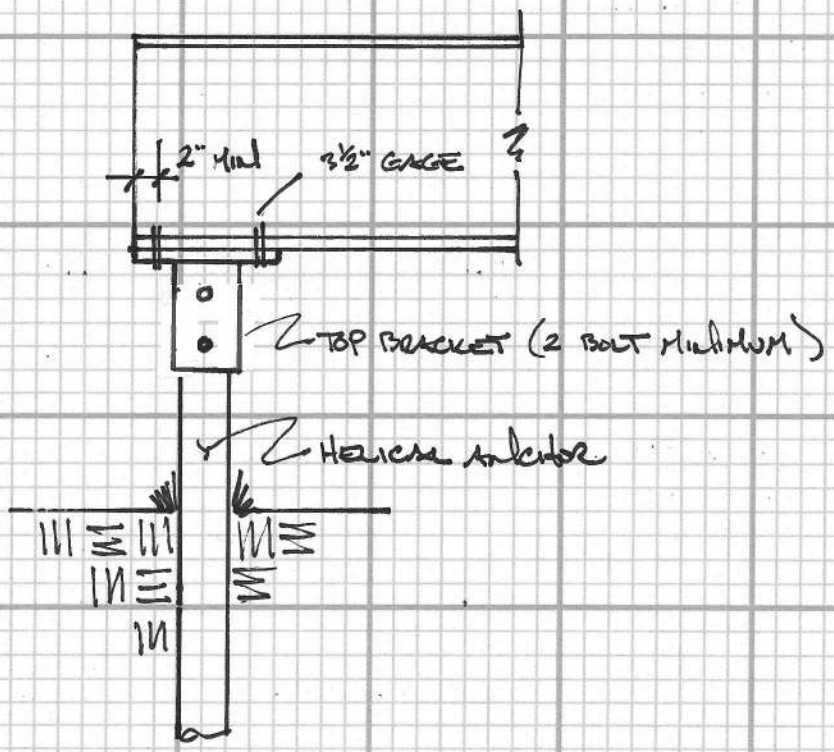
erik@fes-kc.com

TITLE TESTING APPARATUS DESIGN
PROJECT _____



NOTES

- ¾" ⌀ A325-N BOLTS
- STANDARD HOLES

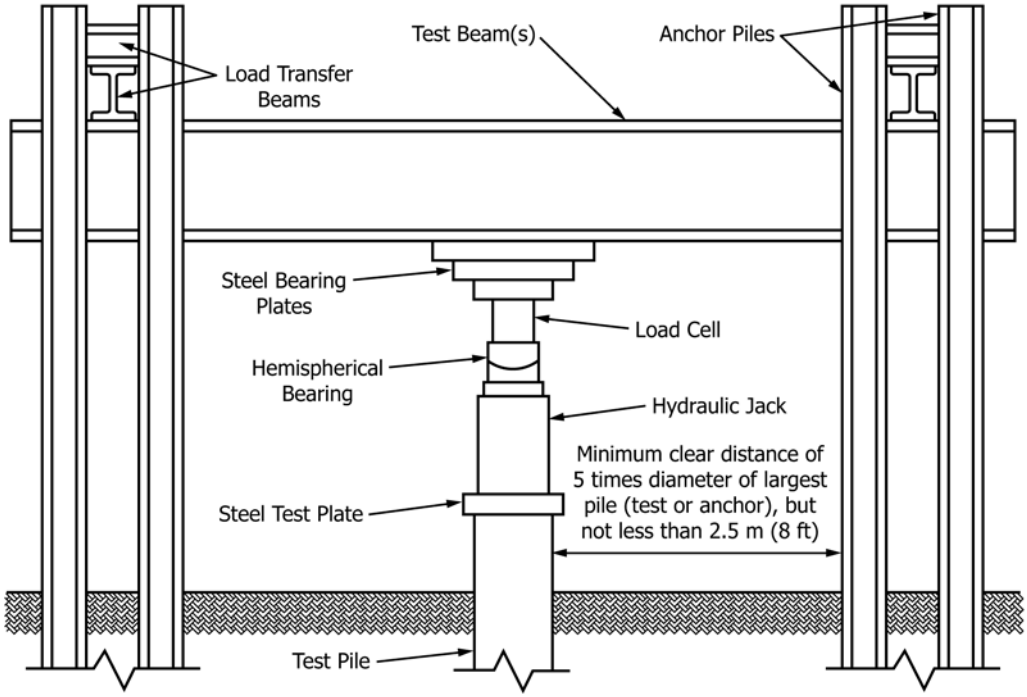


FIG. 1 Schematic of Hydraulic Jack Acting Against Anchored Reaction Frame

GENERAL APPARATUS SCHEME FROM ASTM D1143

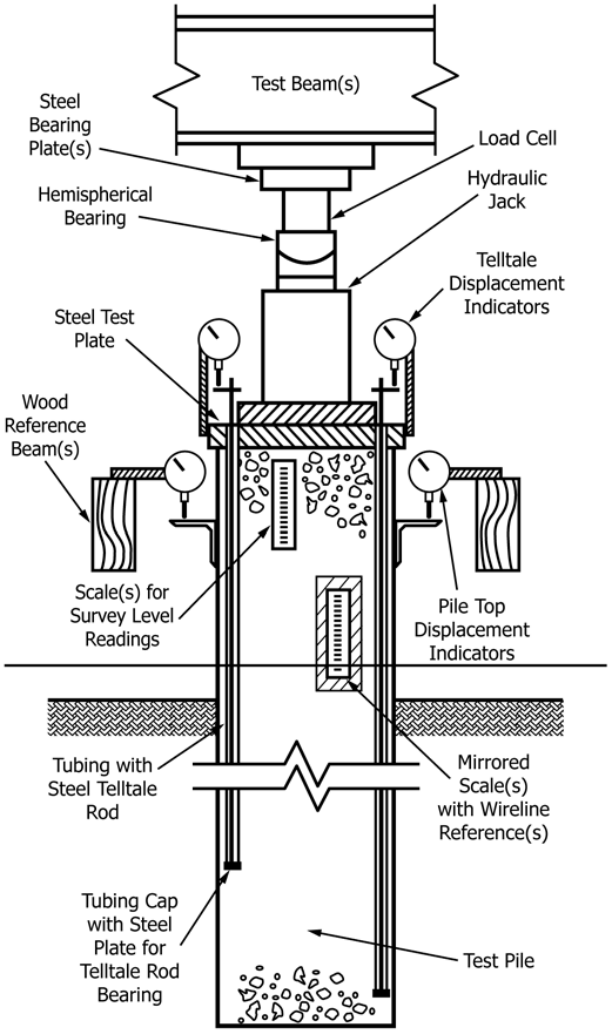


FIG. 7 Schematic of Instrumentation of Measuring Axial Pile Movements

GENERAL INSTRUMENTATION SCHEME FROM ASTM D1143
(BUT WE WON'T USE TELLTALE RODS)

Project Name: IPS TESTING APARATUS DESIGN

Engineer: EJM **Date:** 2/25/2017

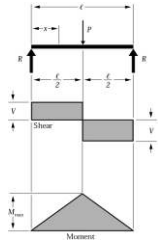
Foundation Engineering Specialists LLC

MAIN JACKING BEAM

Member Information: W-Shape

Member Size=	W18X40		kdet=	1.1875	in	Iy=	19.1	in
A=	11.8	in2	k1=	0.8125	in	Sy=	6.35	in
d=	17.9	in	T=	15.5	in	ry=	1.27	in
tw=	0.315	in	Ix=	612	in2	Zy=	9.95	in
bf=	6.02	in	Sx=	68.4	in	J=	0.81	in4
tf=	0.525	in	rx=	7.21	in	Cw=	1440	in6
kdes=	0.927	in	Zx=	78.4	in			

7. SIMPLE BEAM - CONCENTRATED LOAD AT CENTER



P=	65000	lb
L=	8	ft
Beam Modulus, E=	29000	ksi
Moment of Inertia, I=	612	in4
End Reaction, R=	32500	lb
Mmax=	130000	lb-ft
Delta,max=	0.07	in

F2. Doubly Symmetric Compact I-Shaped Members and Channels Bent About Their Major Axis

Moment, Mu=	130000	lb-ft	=	1560	k-in					
Member Size=	W18X40			Zx=	78.4	in3		Lp=	53.83	in
Member Fy=	50.0	ksi		Member Iy=	19.1	in4		Lr=	156.97	in
Unbraced Length, Lb=	96	in		Member ry=	1.27	in				
d=	17.9	in		Member J=	0.81	in4		Fcr=	82.6	ksi
tw=	0.315	in		Member Cw=	1440	in6				
bf=	6.02	in		Member ho=	17.4	in		Mp=	3920	k-in
tf=	0.525	in		c=	1.0			MnLT=	3296	k-in
Sx=	68.4	in3		rts=	1.557					

Yielding Mn/Omega=	2347	k-in			
Lateral-Torsional Buckling Mn/Omega=	1974	k-in			
Mn/Omega=	**1974**	**k-in**	**>**	**1560**	**OKAY**

Project Name: IPS TESTING APARATUS DESIGN

Engineer: EJM **Date:** 2/25/2017

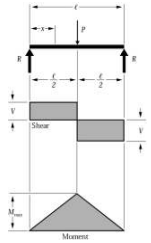
Foundation Engineering Specialists LLC

SUPPORTING ANCHOR BEAMS

Member Information: W-Shape

Member Size=	W18X40		kdet=	1.1875	in	Iy=	19.1	in
A=	11.8	in2	k1=	0.8125	in	Sy=	6.35	in
d=	17.9	in	T=	15.5	in	ry=	1.27	in
tw=	0.315	in	Ix=	612	in2	Zy=	9.95	in
bf=	6.02	in	Sx=	68.4	in	J=	0.81	in4
tf=	0.525	in	rx=	7.21	in	Cw=	1440	in6
kdes=	0.927	in	Zx=	78.4	in			

7. SIMPLE BEAM - CONCENTRATED LOAD AT CENTER



P=	32500	lb
L=	14	ft
Beam Modulus, E=	29000	ksi
Moment of Inertia, I=	612	in4
End Reaction, R=	16250	lb
Mmax=	113750	lb-ft
Delta,max=	0.18	in

F2. Doubly Symmetric Compact I-Shaped Members and Channels Bent About Their Major Axis

Moment, Mu=	113750	lb-ft	=	1365	k-in				
Member Size=	W18X40		Zx=	78.4	in3	Lp=	53.83	in	
Member Fy=	50.0	ksi	Member Iy=	19.1	in4	Lr=	156.97	in	
Unbraced Length, Lb=	84	in	Member ry=	1.27	in				
d=	17.9	in	Member J=	0.81	in4	Fcr=	105.7	ksi	
tw=	0.315	in	Member Cw=	1440	in6				
bf=	6.02	in	Member ho=	17.4	in	Mp=	3920	k-in	
tf=	0.525	in	c=	1.0		MnLT=	3474	k-in	
Sx=	68.4	in3	rts=	1.557					

Yielding Mn/Omega=	2347	k-in			
Lateral-Torsional Buckling Mn/Omega=	2080	k-in			
Mn/Omega=	**2080**	**k-in**	**>**	**1365**	**OKAY**

CONCENTRATED LOAD FROM JACK TO MAIN BEAM

Web Local Yielding (for Concentrated Compression Forces)

Load=	65.0	kips	Beam d=	17.9	in	Dist from End=	48.0	in
Bearing Length, lb=	2.0	in	Beam kdes=	0.9	in			
Beam tw=	0.315	in	Beam Fy=	50.0	ksi			

Web Local Yielding Capacity, Rn/Omega= 69.7 kips > 65.0 OKAY

Web Local Crippling (for Concentrated Compression Forces)

Load=	65.0	kips	Beam tf=	0.525	in	Dist from End=	48.0	in
Bearing Length, lb=	2.0	in	Beam kdes=	0.9	in			
Beam tw=	0.315	in	Beam Fy=	50.0	ksi			
Beam d=	17.9	in						

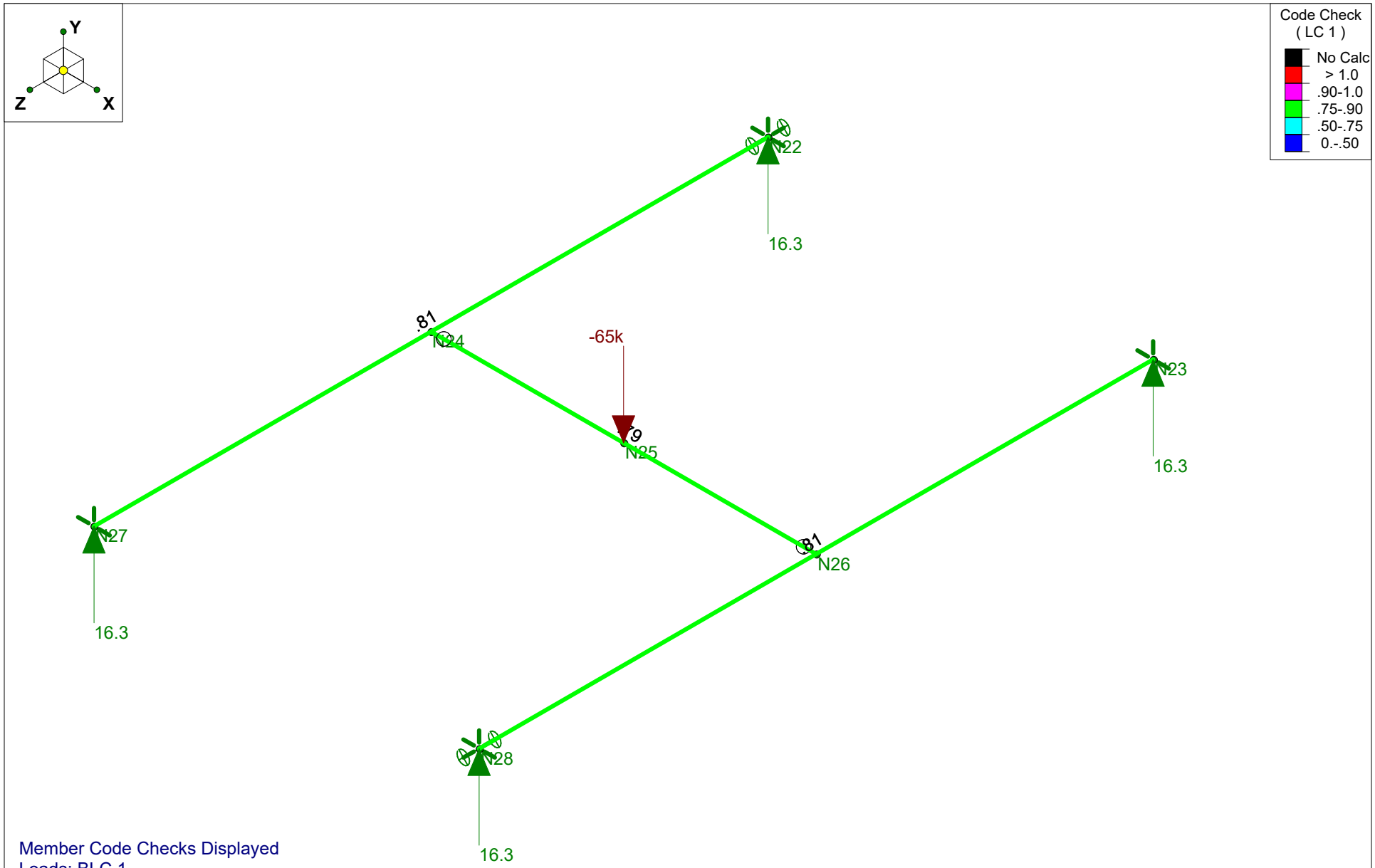
Web Local Yielding Capacity, Rn/Omega= 71.3 kips > 65.0 OKAY

CONCENTRATED LOAD FROM SUPPORT BEAMS TO ANCHORS

Flange Local Bending (for Concentrated Tensile Forces)

Load=	18.0	kips
Beam tf=	0.5	in
Beam Fy=	50.0	ksi

Flange Local Bending Capacity, Rn/Omega= 51.6 kips > 18.0 OKAY



FES	IMPACT PIERING SYSTEM TEST APPARATUS	SK - 1
EJM		Mar 29, 2017 at 1:36 PM
		MAIN MODEL.r3d

(Global) Model Settings

Display Sections for Member Calcs	5
Max Internal Sections for Member Calcs	97
Include Shear Deformation?	Yes
Increase Nailing Capacity for Wind?	Yes
Include Warping?	Yes
Trans Load Btwn Intersecting Wood Wall?	Yes
Area Load Mesh (in^2)	144
Merge Tolerance (in)	.12
P-Delta Analysis Tolerance	0.50%
Include P-Delta for Walls?	Yes
Automatically Iterate Stiffness for Walls?	Yes
Max Iterations for Wall Stiffness	3
Gravity Acceleration (ft/sec^2)	32.2
Wall Mesh Size (in)	24
Eigensolution Convergence Tol. (1.E-)	4
Vertical Axis	Y
Global Member Orientation Plane	XZ
Static Solver	Sparse Accelerated
Dynamic Solver	Accelerated Solver

Hot Rolled Steel Code	AISC 14th(360-10): ASD
Adjust Stiffness?	Yes(Iterative)
RISAConnection Code	AISC 14th(360-10): ASD
Cold Formed Steel Code	AISI S100-12: ASD
Wood Code	AWC NDS-15: ASD
Wood Temperature	< 100F
Concrete Code	ACI 318-14
Masonry Code	ACI 530-13: ASD
Aluminum Code	AA ADM1-10: ASD - Building

Number of Shear Regions	4
Region Spacing Increment (in)	4
Biaxial Column Method	Exact Integration
Parme Beta Factor (PCA)	.65
Concrete Stress Block	Rectangular
Use Cracked Sections?	Yes
Use Cracked Sections Slab?	Yes
Bad Framing Warnings?	No
Unused Force Warnings?	Yes
Min 1 Bar Diam. Spacing?	No
Concrete Rebar Set	REBAR_SET_ASTMA615
Min % Steel for Column	1
Max % Steel for Column	8

(Global) Model Settings, Continued

Seismic Code	ASCE 7-10
Seismic Base Elevation (ft)	Not Entered
Add Base Weight?	Yes
Ct X	.02
Ct Z	.02
T X (sec)	Not Entered
T Z (sec)	Not Entered
R X	3
R Z	3
Ct Exp. X	.75
Ct Exp. Z	.75
SD1	1
SDS	1
S1	1
TL (sec)	5
Risk Cat	I or II
Om Z	1
Om X	1
Rho Z	1
Rho X	1

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm (\1E...	Density[k/ft...	Yield[ksi]	Ry	Fu[ksi]	Rt
1	A992	29000	11154	.3	.65	.49	50	1.1	65	1.1
2	A36 Gr.36	29000	11154	.3	.65	.49	36	1.5	58	1.2
3	A572 Gr.50	29000	11154	.3	.65	.49	50	1.1	65	1.1
4	A500 Gr.B RND	29000	11154	.3	.65	.527	42	1.4	58	1.3
5	A500 Gr.B Rect	29000	11154	.3	.65	.527	46	1.4	58	1.3
6	A53 Gr.B	29000	11154	.3	.65	.49	35	1.6	60	1.2
7	A1085	29000	11154	.3	.65	.49	50	1.4	65	1.3

Joint Coordinates and Temperatures

	Label	X [ft]	Y [ft]	Z [ft]	Temp [F]	Detach From Diap...
1	N22	0	0	0	0	
2	N23	8	0	0	0	
3	N24	0	0	7	0	
4	N25	4	0	7	0	
5	N26	8	0	7	0	
6	N27	0	0	14	0	
7	N28	8	0	14	0	

Joint Boundary Conditions

	Joint Label	X [k/in]	Y [k/in]	Z [k/in]	X Rot.[k-ft/rad]	Y Rot.[k-ft/rad]	Z Rot.[k-ft/rad]
1	N22	Reaction	Reaction	Reaction			Reaction
2	N23	Reaction	Reaction				
3	N27	Reaction	Reaction				
4	N28	Reaction	Reaction	Reaction			Reaction

Member Primary Data

	Label	I Joint	J Joint	K Joint	Rotate(deg)	Section/Shape	Type	Design List	Material	Design Rules
1	M10	N22	N27			W18x40	Beam	Wide Flange	A992	Typical
2	M11	N24	N26			W18x40	Beam	Wide Flange	A992	Typical
3	M12	N23	N28			W18x40	Beam	Wide Flange	A992	Typical

Member Advanced Data

	Label	I Release	J Release	I Offset[in]	J Offset[in]	T/C Only	Physical	TOM	Inactive	Seismic Design ...
1	M10						Yes			None
2	M11	BenPIN	BenPIN				Yes			None
3	M12						Yes			None

Hot Rolled Steel Design Parameters

	Label	Shape	Length[ft]	Lbyy[ft]	Lbzz[ft]	Lcomp top[ft]	Lcomp bot[ft]	L-torqu...	Kyy	Kzz	Cb	Function
1	M10	W18x40	14			Lbyy						Lateral
2	M11	W18x40	8	8	8	Lbyy	8	8				Lateral
3	M12	W18x40	14			Lbyy						Lateral

Joint Loads and Enforced Displacements (BLC 1 :)

	Joint Label	L,D,M	Direction	Magnitude[(k,k-ft), (in,rad), (k*s^2/ft...
1	N25	L	Y	-65

Basic Load Cases

	BLC Description	Category	X ...	Y ...	Z G...	Joint	Point	Distributed	Area(Memb...	Surface(Pla...
1		None				1				

Load Combinations

	Description	So...	P...	S...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...	BLC	Fac...
1		Yes	Y		1	1																				

Joint Reactions

	LC	Joint Label	X [k]	Y [k]	Z [k]	MX [k-ft]	MY [k-ft]	MZ [k-ft]
1	1	N22	0	16.25	0	0	0	0
2	1	N23	0	16.25	0	0	0	0
3	1	N27	0	16.25	0	0	0	0
4	1	N28	0	16.25	0	0	0	0
5	1	Totals:	0	65	0			
6	1	COG (ft):	X: 4	Y: 0	Z: 7			

Member AISC 14th(360-10): ASD Steel Code Checks

	LC	Member	Shape	UC Max	Loc[ft]	Shear UC	Loc[ft]	Dir	Pnc/om ...	Pnt/om [k]	Mnyy/o...	Mnzz/o...	Cb	Eqn
1	1	M10	W18x40	.810	7	.144	0	y	101.717	353.293	24.95	140.497	1.316	H1-1b
2	1	M11	W18x40	.790	4	.288	0	y	224.366	353.293	24.95	164.51	1	H1-1b
3	1	M12	W18x40	.810	7	.144	0	y	101.717	353.293	24.95	140.497	1.316	H1-1b

Foundation Engineering Specialists LLC

816-265-1081
erik@fes-kc.com

PAGE_____ OF_____
DATE_____

TITLE helical design
PROJECT MFS - JPS

$P_{J,max} = 18$ kips

PROPOSED: TAF 150-84 08-10-12

Torsional of shaft:

$T_J = 70{,}000$ lb (ECP Manual, 9th Ed., pg 45)

$\frac{T_J}{\Omega} = \frac{70k}{2} = 35$ kips ✓ok

Pile cap: $T_J = 40$ kips (pg 13)

$\frac{T_J}{\Omega} = \frac{40k}{2} = 20$ kips ✓ok

Helical plate bearing capacity:

$A_g = 0.333\ ft^2 + 0.53 + 0.77 = 1.633\ ft^2$

c = undrained shear strength = 3000 psf (conservative for clay)

$N_c = 9$

$\frac{P_u}{\Omega} = \frac{(1.633\ ft^2 \times 9 \times 3000\ psf)}{2.00} = 22$ kips ✓ok

Torque correlation:

K = 10 for 1½" ϕ bar

$T_{req'd} = \frac{(2.0\ FOS \times 18k)}{10} = \boxed{3600\ ft\cdot lb}$

K = 8½ for 2⅞" ϕ bar

$T_{req'd} = \frac{(2.0 \times 18k)}{8.5} = \boxed{4235\ ft\cdot lb}$

PIER TEST FIELD NOTES

Date:	03/22/17 START AT about (APPROX) / ENDED 3 pm
Client:	IMPACT PIERING SYSTEM, LLC
Pier Name:	IMPACT PIERING SYSTEM
Jack Used:	SPX #C2580 MODEL B
Jack Load/Psi Conversion:	25.8 SQUARE INCHES = 51.6 K / 10000 psi = 5.16 # / psi
Target Allowable Capacity:	25,800 #
Test Load:	51,600 #
Loading Increments:	2580 #
Pressure Increments:	500 psi
Weather Conditions:	50° F, SUNNY, SLIGHT BREEZE / 57° @ END OF TEST

				Readings at Time Interval:					
Load Interval	Load	Pressure	Device	0.5 min	1 min	2 min	4 min	8 min	15 min
50%	25,800	5000	DI-1	1.242	1.248	1.253	1.260	1.276	
			DI-2	1.268	1.274	1.279	1.288	1.303	
			Transit	4"	"	"	"	3 3/64"	
55%		5500	DI-1	1.223	1.226	"	1.227	1.229	
			DI-2	1.255	1.259	1.260	1.261	1.263	
			Transit	3 6/64"	"	"	"	"	
60%		6000	DI-1	1.204	1.204	1.203	1.202	1.201	
			DI-2	1.243	1.243	"	1.244	"	
			Transit	3 5 7/64"	"	"	3 5 2/64	"	
65%		6500	DI-1	1.186	1.185	1.184	1.184	1.183	
			DI-2	1.230	1.230	1.230	"	1.231	MOMENT TRANS.
			Transit	3 5 5/64	"	3 4 7/64	3 4 4/64	"	
70%		7000	DI-1	1.171	1.171	1.170	"	1.169	
			DI-2	1.220	"	"	"	1.121	
			Transit	3 4 3/64	"	3 4 2/64	"	"	
75%		7500	DI-1	1.158	1.157	"	1.156	1.155	
			DI-2	1.210	"	"	"	1.211	
			Transit	3 4 1/64	"	"	"	"	
80%		8000	DI-1	1.142	1.141	1.140	1.140	1.139	
			DI-2	1.298	"	1.297	"	1.297	
			Transit	3 4 0/64	"	"	"	"	
85%		8500	DI-1	1.127	"	"	1.126	1.125	
			DI-2	1.186	1.185	"	1.184	1.184	
			Transit	3 4 0/64	"	"	"	"	
90%		9000	DI-1	1.104	1.105?	1.103	1.102	1.101	
			DI-2	1.165	1.165	1.164	1.164	"	
			Transit	3 3 9/64	3 3 8/64	"	"	"	
95%		9500	DI-1	1.087	1.086	1.085	"	1.091	LOST 1200 psi
			DI-2	1.150	1.149	"	"	1.156	PSI WHILE MEASURE MARKS
			Transit	3 3 7/64	"	3 3 6/64	"	"	
100%		10000	DI-1						
			DI-2						
			Transit						

BLOW SEAL IN HOSE CONNECT

PIER TEST FIELD NOTES

Date:	
Client:	
Pier Name:	
Jack Used:	
Jack Load/Psi Conversion:	
Target Allowable Capacity:	
Test Load:	
Loading Increments:	
Pressure Increments:	
Weather Conditions:	

				Readings at Time Interval:					
Load Interval	Load	Pressure	Device	0.5 min	1 min	2 min	4 min	8 min	15 min
50%			DI-1						
			DI-2						
			Transit						
55%			DI-1						
			DI-2						
			Transit						
60%			DI-1						
			DI-2						
			Transit						
65%			DI-1						
			DI-2						
			Transit						
70%			DI-1						
			DI-2						
			Transit						
75%			DI-1						
			DI-2						
			Transit						
80%			DI-1						
			DI-2						
			Transit						
85%			DI-1						
			DI-2						
			Transit						
90%			DI-1						
			DI-2						
			Transit						
95%			DI-1	1.080	"	1.079	1.078	1.076	
			DI-2	1.146	"	"	1.145	1.144	
			Transit	3 36/64	"	"	"	3 35/64	
100%			DI-1	1.067	1.066	1.066	1.064	1.062	
			DI-2	1.136	1.135	1.134	1.133	1.131	
			Transit	3 34/64	"	"	"	3 33/64	

				Readings at Time Interval:					
Load Interval	Load	Pressure	Device	0.5 min	1 min	2 min	4 min	8 min	15 min
95%		9500	DI-1	1.061	1.063	1.063	"	1.062	
			DI-2	1.131	1.132	"	1.133	"	
			Transit	" 3 33/64	"	"	"	"	
90%		9000	DI-1	1.063	1.064	1.064	1.063	1.063	
			DI-2	1.135	1.135	"	1.136	1.136	
			Transit	"	"	"	"	"	
85%			DI-1						
			DI-2		BLEW IT				
			Transit						
80%	7000	8000	DI-1	1.064	1.065	"	"	"	
			DI-2	1.157	1.158	"	"	1.159	
			Transit	3 33/64	3 34/64	"	"	"	
75%	7250	7500	DI-1	1.094	1.095	1.095	1.095	"	
			DI-2	1.168	1.169	1.170	1.171	"	
			Transit	"	"	"	"	"	
70% 65%	6500		DI-1	1.110	1.111	1.112	1.113	1.113	
			DI-2	1.188	1.189	1.190	1.191	1.192	
			Transit	3 34/64	"	"	"	"	
65%	5900		DI-1	1.138	1.143	1.150	1.162	1.198	
			DI-2	1.212	1.222	1.230	1.240	1.272	
			Transit	"	3 35/64	"	3 39/64	3 40/64	
60%		6000	DI-1						3500 psi
			DI-2						
			Transit						
55%		5500	DI-1		5250 psi	5000 psi		4500 psi	
			DI-2						
			Transit						
50%		5000	DI-1						
			DI-2						
			Transit						

Dial Readings at Zero (Initial)	
DI-1	
DI-2	
Transit	

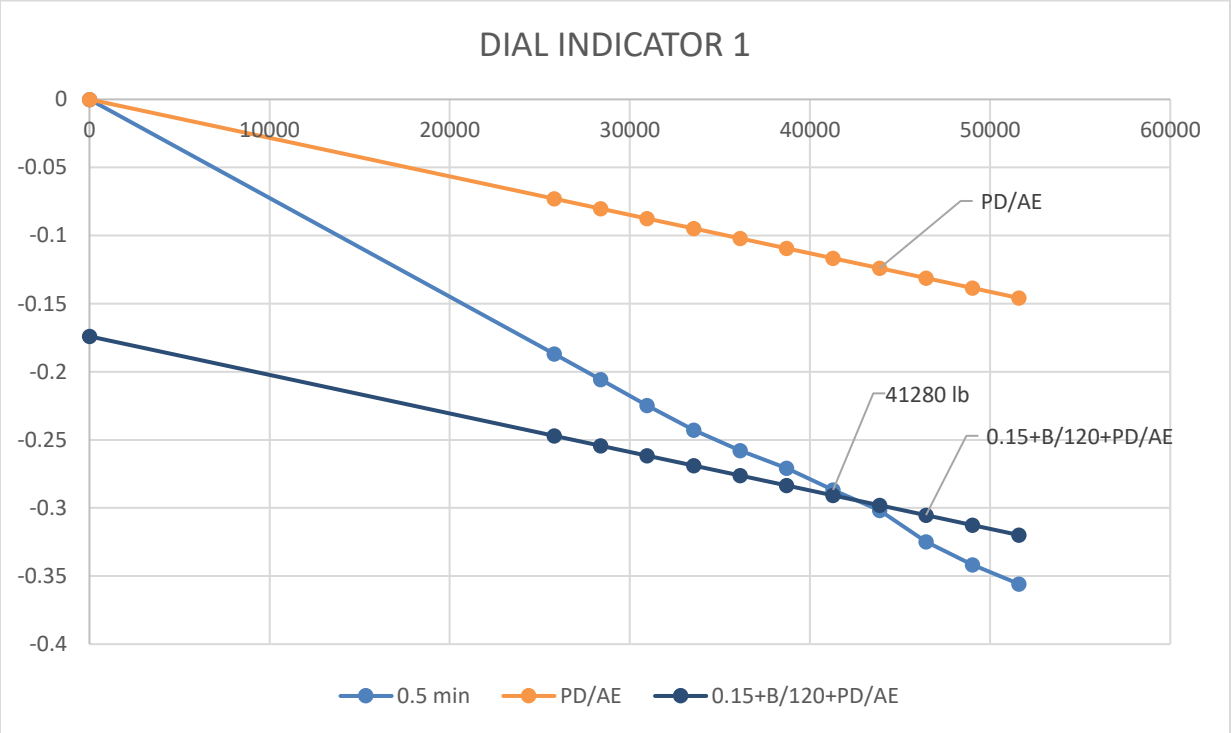
Dial Readings at Zero (Final)	
DI-1	
DI-2	
Transit	

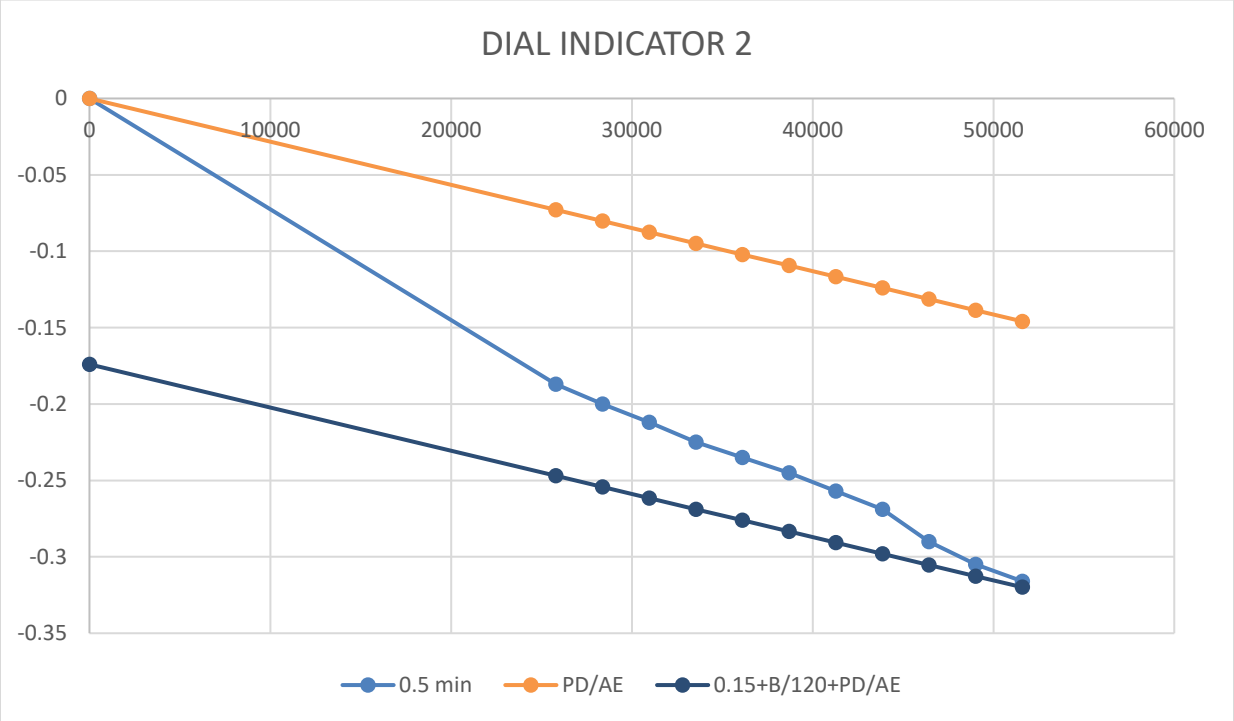
PIER TEST FIELD NOTES - NORMALIZED RESULTS

Date:	03/22/17 start at noon - end at 3pm
Client:	Impact Piering System, LLC
Pier Name:	Impact Piering System
Jack Used:	SPX #C258C, Model B
Jack Load/Psi Conversion:	2.58 short tons=51600 lb/10,000 psi=5.16 lb/psi
Target Allowable Capacity:	28,500 lb
Test Load:	51,600 lb
Loading Increments:	2580 lb
Pressure Increments:	500 psi
Weather Conditions:	50 deg F, sunny, slight breeze - 57 deg F at end of test

				Readings at Time Interval:					
Load Interval	Load (lb)	Pressure	Device	0.5 min	1 min	2 min	4 min	8 min	15 min
50%	25,800	5000 psi	DI-1	-0.187	-0.181	-0.176	-0.169	-0.153	
			DI-2	-0.187	-0.181	-0.176	-0.167	-0.152	
			Transit	-0.187	-0.187	-0.187	-0.187	-0.203	
55%	28380	5500	DI-1	-0.206	-0.203	-0.203	-0.202	-0.200	
			DI-2	-0.200	-0.196	-0.195	-0.194	-0.192	
			Transit	-0.249	-0.249	-0.249	-0.249	-0.249	
60%	30960	6000	DI-1	-0.225	-0.225	-0.227	-0.227	-0.228	
			DI-2	-0.212	-0.212	-0.209	-0.211	-0.211	
			Transit	-0.296	-0.296	-0.296	-0.312	-0.312	
65%	33540	6500	DI-1	-0.243	-0.244	-0.245	-0.245	-0.246	
			DI-2	-0.225	-0.225	-0.225	-0.225	-0.224	
			Transit	-0.328	-0.328	-0.344	-0.344	-0.344	
70%	36120	7000	DI-1	-0.258	-0.258	-0.259	-0.259	-0.260	
			DI-2	-0.235	-0.235	-0.235	-0.235	-0.234	
			Transit	-0.360	-0.360	-0.376	-0.376	-0.376	
75%	38700	7500	DI-1	-0.271	-0.272	-0.272	-0.273	-0.274	
			DI-2	-0.245	-0.245	-0.245	-0.245	-0.244	
			Transit	-0.391	-0.391	-0.391	-0.391	-0.391	
80%	41280	8000	DI-1	-0.287	-0.288	-0.288	-0.289	-0.290	
			DI-2	-0.257	-0.257	-0.258	-0.258	-0.258	
			Transit	-0.407	-0.407	-0.407	-0.407	-0.407	
85%	43860	8500	DI-1	-0.302	-0.302	-0.302	-0.303	-0.304	
			DI-2	-0.269	-0.270	-0.270	-0.271	-0.271	
			Transit	-0.407	-0.407	-0.407	-0.407	-0.407	
90%	46440	9000	DI-1	-0.325	-0.325	-0.326	-0.327	-0.328	
			DI-2	-0.290	-0.290	-0.291	-0.291	-0.291	
			Transit	-0.423	-0.438	-0.438	-0.438	-0.438	
95%	49020	9500	DI-1	-0.342	-0.343	-0.344	-0.345	-0.347	
			DI-2	-0.305	-0.306	-0.306	-0.307	-0.308	
			Transit	-0.454	-0.454	-0.469	-0.469	-0.484	
100%	51600	10000	DI-1	-0.356	-0.357	-0.357	-0.359	-0.361	
			DI-2	-0.316	-0.317	-0.318	-0.319	-0.321	
			Transit	-0.500	-0.500	-0.500	-0.500	-0.515	

				Readings at Time Interval:					
Load Interval	Load	Pressure	Device	0.5 min	1 min	2 min	4 min	8 min	15 min
95%	49020	9500	DI-1	-0.362	-0.360	-0.360	-0.360	-0.361	
			DI-2	-0.321	-0.320	-0.320	-0.319	-0.319	
			Transit	-0.515	-0.515	-0.515	-0.515	-0.515	
90%	46440	9000	DI-1	-0.360	-0.359	-0.359	-0.360	-0.360	
			DI-2	-0.317	-0.317	-0.317	-0.316	-0.316	
			Transit	-0.515	-0.515	-0.515	-0.515	-0.515	
78%	40248	7800	DI-1	-0.339	-0.338	-0.338	-0.338	-0.338	
			DI-2	-0.295	-0.295	-0.295	-0.295	-0.293	
			Transit	-0.515	-0.500	-0.500	-0.500	-0.500	
73%	37410	7250	DI-1	-0.329	-0.328	-0.328	-0.328	-0.328	
			DI-2	-0.284	-0.283	-0.282	-0.281	-0.281	
			Transit	-0.500	-0.500	-0.500	-0.500	-0.500	
65%	33540	6500	DI-1	-0.313	-0.312	-0.311	-0.310	-0.310	
			DI-2	-0.264	-0.263	-0.262	-0.261	-0.260	
			Transit	-0.500	-0.500	-0.500	-0.500	-0.500	
57%	29412	5700	DI-1	-0.285					
			DI-2	-0.240					
			Transit	-0.500					
53%	27090	5250	DI-1		-0.280				
			DI-2		-0.230				
			Transit		-0.484				
50%	25800	5000	DI-1			-0.272			
			DI-2			-0.222			
			Transit			-0.484			
45%	23220	4500	DI-1				-0.261		
			DI-2				-0.212		
			Transit				-0.437		
37%	19092	3700	DI-1					-0.225	
			DI-2					-0.180	
			Transit					-0.406	


DIAL INDICATOR 1
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
-0.4
0
10000
20000
30000
40000
50000
60000
PD/AE
41280 lb
0.15+B/120+PD/AE
0.5 min
PD/AE
0.15+B/120+PD/AE


DIAL INDICATOR 2
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
-0.35
0
10000
20000
30000
40000
50000
60000
0.5 min
PD/AE
0.15+B/120+PD/AE

Appendix D

Calibration Reports

test & measurement
The Industry Standard

Certificate of Calibration

1001183641

Customer Information

Foundation Engineering Specialist
112 Glen Arbor Rd
Kansas City, MO 64114

PO #: Verbal

Account #: BF5191
SO #: 1001061519

Instrument Identification

Instrument Id: **1001073251**

Noun: Dial Indicator, 0-2"
Mfr: Accusize
Accuracy: ±0.001"

Model: P900-S103
Serial #: N/A

Certification Information

Reason For Service: Calibration
Type Of Calibration: Normal
As Found Condition: In Tolerance
As Left Condition: Left As Found
Procedure: 33K6-4-889-1 : (D) Dial & Digital Indicators (Various)

Technician: Randy Cheatum
Cal Date: 10 MAR 17
Cal Due: 10 MAR 18
Temperature: 22.0 °C
Humidity: 24.0 %

The calibration results published in this certificate were obtained using equipment capable of producing results that are traceable through NIST to the International System of Units (SI).

Reported uncertainties and/or test uncertainty ratios (TUR's) are expressed as expanded uncertainty values at approximately the 95% confidence level using a coverage factor of K=2. A TUR of 4:1 is routinely observed unless otherwise noted on the Certificate. Statements of compliance, where applicable, are based on test results falling within specified limits with no reduction by the uncertainty of the measurement. Accredited calibration uncertainties are taken into account and available upon request. Endorsement logo and/or accreditation number indicates certificate of an accredited calibration.

Test and Measurement, Inc.'s Quality System complies with the applicable requirements of ISO/IEC 17025.

The results contained herein relate only to the item calibrated. Calibration due dates appearing on the Certificate of Calibration and label are determined by the client for administrative purposes and do not imply continued conformance to specification.

Quality Assurance Supervisor

Vice President

Calibration Standards

NIST Traceable #	Instrument ID#	Description	Model	Calibration Date	Date Due
1001166654	TM0308	Surface Plate	24x36x4	25 JUL 2016	31 JAN 2018
1001176767	TM0770	Indicator Tester	716X	13 DEC 2016	31 DEC 2017

Q3 SERVICE = QUICK / QUALITY / QUALIFIED

Printed: 10 Mar 2017 09:27 AM

test & measurement
The Industry Standard

Certificate of Calibration

1001183640

Customer Information

Foundation Engineering Specialist
112 Glen Arbor Rd
Kansas City, MO 64114

PO #: Verbal

Account #: BF5191
SO #: 1001061519

Instrument Identification

Instrument Id: **1001073250**

Noun: Dial Indicator, 0-2"
Mfr: Accusize
Accuracy: ±0.001"

Model: P900-S103
Serial #: N/A

Certification Information

Reason For Service: Calibration
Type Of Calibration: Normal
As Found Condition: In Tolerance
As Left Condition: Left As Found
Procedure: 33K6-4-889-1 : (D) Dial & Digital Indicators (Various)

Technician: Randy Cheatum
Cal Date: 10 MAR 17
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Quality Assurance Supervisor

Vice President

Calibration Standards

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