BONDED PRE-STRESSED CONCRETE SLABS

OPEN-AIR BLAST TESTING

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EXECUTIVE SUMMARY

This report provides the background, test set-up information, and results for the open-air blast testing of eight simply supported, two-way, precast pre-stressed/post-tensioned (PT) concrete slabs with varying conventional reinforcement and pre-stressing/PT levels.

The PT slabs in the main portion of the testing program sustained support rotations ranging from 0.4 degree to 3.0 degrees. The corresponding damage level for these tests would roughly range from Superficial Damage to Heavy Damage as defined in CSA S850-12 or ASCE 59-11. However, from the extent of concrete disengagement observed in Test 3, it would appear a 3.0-degree rotation is approaching the PT slab's upper limit state for non-hazardous damage (i.e., near a transition from Heavy to Hazardous Damage).

The test results seem to indicate that the actual response limits would fall between the currently published limits for pre-stressed concrete (lower bound) and conventionally reinforced concrete (upper bound) elements. Moreover, comparing the results for tests on slabs subjected to a similar blast threat, it appears that the increase of pre-stressing level from 725 psi (5 MPa) to 1450 psi (10 MPa) may only have a marginal effect on slab flexural response to blast loading. Additional testing and/or detailed analysis that can account for concrete disengagement, as well as shear and/or concrete-crushing controlled behavior (e.g., finite element modeling), should be performed to justify any modification to the currently published response limits and further examine the effects of pre-stressing/post-tensioning in blast applications.

1 INTRODUCTION

Considering the properties of pre-stressing steel and the level of compression in concrete, pre-stressed concrete members should respond with lower deflections under blast loading than similarly-sized, conventionally reinforced members. However, the available acceptance criteria for pre-stressed concrete in typical structures, provided in Canadian standard CSA S850-12, "Design and Assessment of Buildings Subjected to Blast Loads," and American standard ASCE 59-11, "Blast Protection of Buildings," as well as in the PCI's Blast-Resistant Design Manual (First Edition), are significantly more stringent than for conventionally reinforced concrete. The technical basis for the difference is unclear.

Therefore, given the number of existing pre-stressed concrete containment structures and new builds of similar construction anticipated in Canada, the U.S., and worldwide, there is a need to define design provisions for pre-stressed concrete elements with all specificities of nuclear structures (e.g., reinforcement ratio and detailing, pre-stressing level), which could potentially use more relaxed acceptance criteria than for typical structures, if warranted. This information would be beneficial for vendors, designers, regulators, and standards development organizations worldwide. This project originated as a joint effort of three different standards committees: Joint ASME Section III Division 2 – ACI 359, ACI 349, and ACI 370.

Toward that objective, sponsors from industry, regulatory agencies, and standards developing organizations (SDOs) who have a direct interest in nuclear structures have committed funds to sponsor this research project to test pre-stressed concrete slabs under blast loading. The main sponsors are the Canadian Nuclear Safety Commission (Client), Daewoo Institute of Construction Technology, EDF/SEPTEN, Swiss Federal Nuclear Safety Inspectorate (ENSI), Institute for Radiological Protection and Nuclear Safety (IRSN), Radiation and Nuclear Safety Authority (STUK), and ASME.

ASME ST-LLC tasked Stone Security Engineering (Stone) to perform a series of blast tests on simply supported, two-way pre-stressed concrete slabs to achieve a range of responses based on the research proposal from the Special Working Group of Modernization reporting to the Joint ACI-ASME Committee on Concrete Components for Nuclear Service (BPV III).

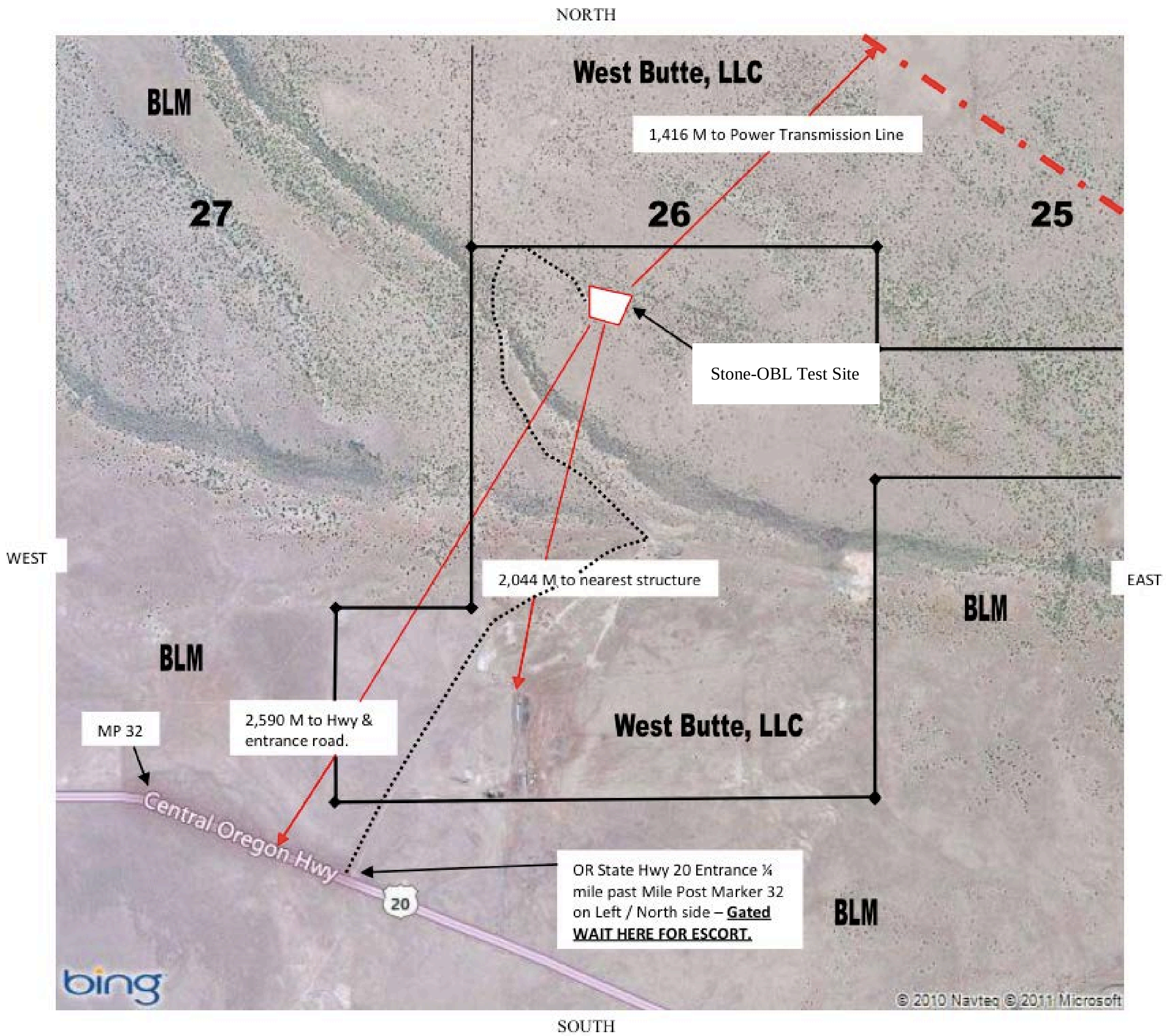
The eight slab specimens were 10-5/8 inches (270 mm) × 16 feet (4880 mm) × 16 feet (4880 mm) in dimensions. Two layers of conventional flexural reinforcement and local shear reinforcement around lifting points were included in each slab. Pre-stressing in the concrete was introduced using post-tensioned (PT) tendons. The parameters that varied were the pressure loading, conventional reinforcement ratio, and level of pre-stressing.

This report provides the background for the open-air blast testing of the precast, pre-stressed slabs, and summarizes results for a total of nine blast tests performed on the eight slabs. An overview of the testing facility is provided in Section 2. A description of the test specimen and supporting steel frame construction is provided in Section 3. The open-air testing procedure, including instrumentation, explosive material and quantities used, and documentation recorded, and relevant pre-stressed concrete slab response limits are discussed in Section 4. Results are presented in Section 5. Some conclusions are noted in Section 6. Slab specimen calculations and drawings, relevant certifications, and pre-test and post-test documentation information are provided as appendices.

2 STONE-OBL BLAST TESTING SITE

The full testing program was carried out using the reinforced concrete test fixture on the Stone-OBL blast testing site. The blast testing site is located in Deschutes County, Oregon approximately 30 miles east of Bend, Oregon. The property area is approximately four acres. The site, shown in Figure 2-1, is located approximately 4600 feet (1400 m) from the nearest utility, 6700 feet (2000 m) from the nearest structure, and approximately 8500 feet (2600 m) from the nearest public roadway.

Figure 2-1: Site Location



2.1 Site Layout

The blast testing site is accessed from the northwest corner of the property via a private access road. Construction areas were provided along this road, as shown in Figure 2-2, for each test slab specimen for a total of eight mud mats. The test specimens were assembled and cured on-site. In-process mud mat construction is shown in Figure 2-3.

Figure 2-2: Site Layout

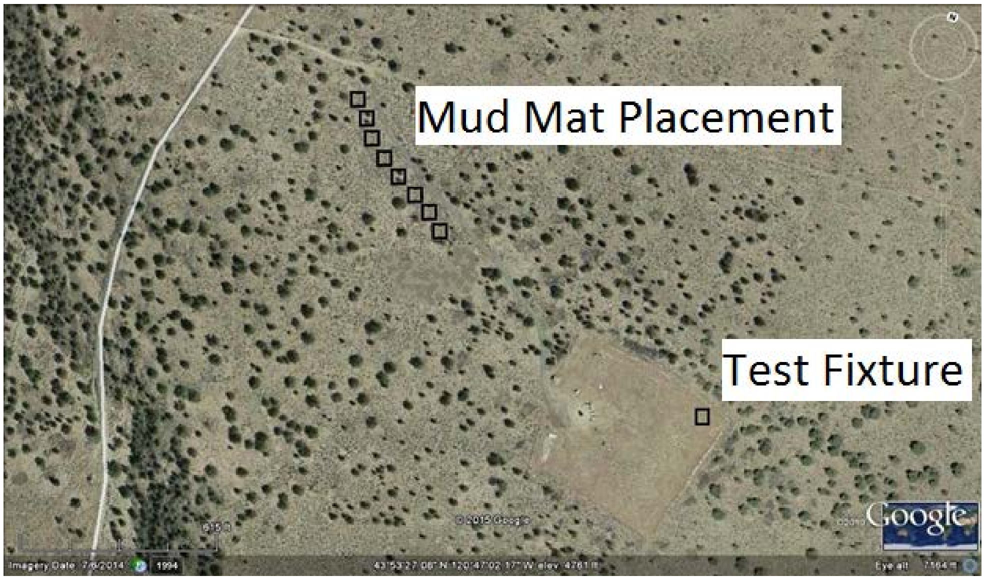


Figure 2-3: Mud Mat Construction

The Stone-OBL test fixture is located in the northeast corner of the site, as shown in Figure 2-2. Testing instrumentation and equipment were located and isolated behind the test fixture in belowground storage.

2.2 Reaction Structure

The reaction structure, as depicted in Figure 2-4, has maximum exterior dimensions of 25 feet (7620 mm) wide × 19 feet (5790 mm) tall × 14 feet (4270 mm) deep. The instrumentation chamber has interior clear dimensions of 15 feet (4570 mm) × 15 feet (4570 mm) × 12 feet (3660 mm). An embedded steel plate is present around the fixture opening, which includes 1-inch (25mm) diameter coil inserts spaced 12 inches (305 mm) on center. The reaction structure is constructed of 2-ft (610mm) thick heavily reinforced concrete walls, with equally thick roof and floor slabs, positioned on a shallow thick foundation above the bedrock. Concrete blocks were secured above and behind the structure during testing for horizontal stability.

Figure 2-4: Reaction Structure

The access opening on the side of the reaction structure was generally covered during testing with concrete blocks to limit overpressure and debris from entering the area behind the test panel.

3 TEST SPECIMENS

A total of eight concrete panels (four distinctive designs as shown in Table 3-1) were cast with different levels of mild steel reinforcement and applied compressive force due to tensioned strands commonly used in nuclear containment structures, and as agreed upon by the Client and project sponsors. The panel dimensions were 10-5/8 inches (270 mm) × 16 feet (4880 mm) × 16 feet (4880 mm). The targeted minimum concrete compressive strength was 6000 psi (41.4 MPa). The panels were cast at the testing site and post-tensioned after the concrete achieved sufficient concrete strength. Figure 3-1 shows a representative slab during construction as observed at the inspection site visit. Appendix A summarizes the initial reinforcement calculations and provides drawings for the test slab specimens.

Table 3-1: Test Specimen Summary

Slab Design Type	Panel Number	Stress Level	Mild Steel Reinforcement Level
A	1, 5	725 psi (5 MPa)	5.9 lb/ft^3 (95 kg/m^3)
B	3, 7	725 psi (5 MPa)	13.7 lb/ft^3 (220 kg/m^3)
C	2, 6	1450 psi (10 MPa)	5.9 lb/ft^3 (95 kg/m^3)
D	4, 8	1450 psi (10 MPa)	13.7 lb/ft^3 (220 kg/m^3)

Figure 3-1: Slab Observed During Inspection Site Visit

3.1 Post-Tensioned Strand Stress Level

Slabs were post-tensioned using the VSL 6-4 strand Post-Tensioning System. Strands were placed in 72/21 flat ducts measuring 1.378 inches (35 mm) high × 3.386 inches (86 mm) wide. The ducts, which have a capacity of four strands each, were centered in the thickness of the slabs in one direction and staggered in the other direction to minimize the eccentricity of the applied force.

Slabs were post-tensioned with 0.6-inch, Grade 270 strands (15mm, Grade 1860) complying with ASTM A416. Lower level stress strands were pulled to approximately 60% of f_{pu} to reach the overall target stress level and provide a relatively uniform amount of post-tensioning throughout the slab; higher level stress strands were pulled to 85% of f_{pu}. Each lower level stress strand was pulled 35.0 kips (156 kN); each higher level stress strand was pulled 49.6 kips (220 kN). VSL confirmed that their systems have been validated beyond these target values and have been tested up to 95% of f_{pu}.

The length of the post-tensioned strands was 16 feet (4880 mm). Anticipated anchorage seating was ¼-inch (6.4 mm). With a strand seating loss, the anticipated force in the lower level stress strand was approximately 26.5 kips (118 kN); the anticipated force in the higher level stress strand was approximately 41 kips (182 kN). Related calculations are provided in Appendix A.

Slab designs A and B were stressed to approximately 725 psi (5 MPa). These panels had 14 ducts (56 strands) in both directions. Slab designs C and D were stressed to approximately 1450 psi (10 MPa). These panels had 18 ducts (72 strands) in both directions.

VSL stressing protocols, field pull data, and VSL certification of the final product for compliance with the design requirements are included in Appendix B.

3.2 Mild Steel Reinforcement Level and Slab Construction

Two levels of mild steel reinforcement were provided in the test specimens. Slab design A and C contained approximately 5.9 lb/ft^3 (95 kg/m^3) of reinforcement. Slab designs B and D contained approximately 13.7 lb/ft^3 (220 kg/m^3) of reinforcement. There were two mats of rebar in each panel, one top and bottom. Each mat contained the same number of bars going in both directions. No batch testing was performed on the mild steel reinforcement.

For Slab designs A and C, each mat contained #4 (1/2-inch or 12.7mm) reinforcement at 6 inches (152 mm) on center. For Slab designs B and D, each mat contained #5 (5/8-inch or 15.9mm) reinforcement at 4 inches (102 mm) on center.

Six-inch octagonal shaped spiral reinforcement was designated by the supplier as adequate bursting stress reinforcement for all the slabs. U-bars with the same size as the reinforcement used in the mats were added at 6 inches (152 mm) on center around the perimeter of each slab and were placed as close as possible to the edges. U-bars were placed between the trumpets at the same spacing as the mild steel reinforcement. Additional shear reinforcement (i.e., five 5-ft long #4 rebar) at each lifting loop point was added to account for stress concentrations.

Slab construction was closely supervised and inspected prior to pouring the concrete. Average concrete compressive strengths at 28 days and estimated tensile strengths are given in Table 3-2. Appendix A provides tensile strength calculations. Appendix C summarizes the field inspections for the slabs and provides more detailed concrete crushing data.

Table 3-2: Concrete Crushing Test Summary

Panel Number	Compressive Strength at 28 Days	Estimated Tensile Strength
1A	7830 psi (54.0 MPa)	1170 psi (8.1 MPa)
2C	7620 psi (52.5 MPa)	1140 psi (7.9 MPa)
3B	6980 psi (48.1 MPa)	1050 psi (7.2 MPa)
4D	8990 psi (62.0 MPa)	1350 psi (9.3 MPa)
5A	9430 psi (65.0 MPa)	1410 psi (9.8 MPa)
6C	7520 psi (51.8 MPa)	1130 psi (7.8 MPa)
7B	8290 psi (57.2 MPa)	1240 psi (8.6 MPa)
8D	7370 psi (50.8 MPa)	1110 psi (7.6 MPa)

3.3 Supporting Steel Frame Construction and Panel Installation

Supporting steel framing was fabricated and installed to hold the concrete slab during testing and to mimic simply supported boundary conditions. Two general steel framing set-ups were used throughout the testing program—one for the first two tests (trial portion) and one for all subsequent tests (main portion).

Framing Set-Up 1: Test 1 and Test 2

For Test 1 and Test 2, the test panel was generally held in place between a pair of 1 1/2-inch (38mm) diameter steel roller bars on all four sides—one welded to an HSS 12×6×1/2 perimeter frame, and the other welded to the embedded plate within the reaction structure. The roller bar on the embedded plate was positioned such that the center of the roller bar was offset 2.5 inches (64 mm) from the 15 foot (4570 mm) × 15 foot (4570 mm) opening within the reaction structure. The perimeter frame was tied directly to the reaction structure with 1-inch (25mm) diameter steel coil rods spaced 12 inches (305 mm) apart, which compressed these elements together. Five-inch (127mm) wide flat clamp plate frames were introduced to each side of the panel such that the steel roller bars did not make direct contact with the concrete panel face. Sketches of these primary steel framing elements are shown in Figure 3-2. The steel pedestals, examples of which are shown in Figure 3-3, were intended to provide ample clearance for the threaded rods and the post-tensioned duct ends protruding from the bottom edge of the panel. A ¼-inch (6.4mm) gap was maintained between the top of the pedestals and the base edge of the test slab. Guiding plates were also provided along the vertical panel edges.

Figure 3-2: Sketches of Simple Supports Used in Test 1 and Test 2

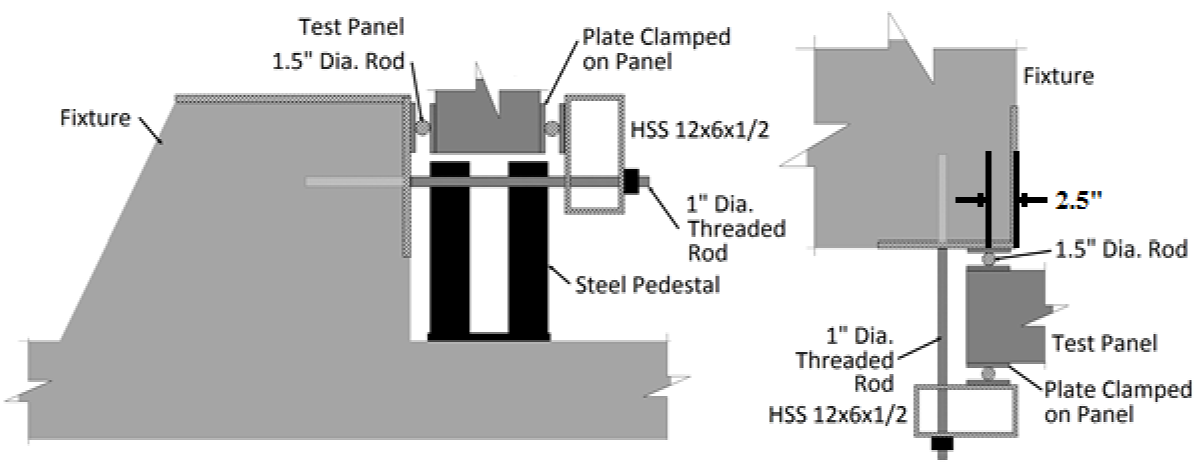


Figure 3-3: Steel Pedestals Used in Test 1 and Test 2

Figure 3-4 shows a panel from the first two tests being lifted into position by a crane. The final installed slab and framing set-up for Test 1 and Test 2 is illustrated in Figure 3-5. Some modifications were made to the steel frame between the end of Test 1 and onset of Test 2. These changes are described in Section 5.2.

Figure 3-4: Lifting of Slab with Crane for Installation onto the Test Fixture (Framing Set-Up 1)

Figure 3-5: Installed Panel within Framing Set-Up 1

Framing Set-Up 2: Test 3 through Test 8

Following Test 2, a stiffer steel framing system was incorporated for the main portion of the testing program. In the updated configuration, the slab was generally held in place between a pair of 3-inch (76mm) diameter steel roller bars on all four sides—one welded to an HSS 12×6×5/8 perimeter frame, and the other welded to the embedded plate within the reaction structure. The roller bar on the embedded plate was positioned such that the center of the roller bar was offset 2.5 inches (64 mm) from the 15 foot (4570 mm) × 15 foot (4570 mm) opening within the reaction structure. The perimeter frame was stiffened with HSS 3×3×3/8 L-sections spaced 12 inches (305 mm) apart, which were in turn bolted to ½-inch (13mm) thick plate assemblies protruding from the reaction structure. The perimeter frame was also tied directly to the reaction structure with 1-inch (25mm) diameter steel coil rods spaced 12 inches (305 mm) apart. A series of ½-inch (13mm) thick clamp plates were also provided between the test slab and roller bars. Sketches of the primary steel framing elements used for the stiffer steel framing system are shown in Figure 3-6 and Figure 3-7.

Figure 3-6: Steel Framing Set-Up 2 Layout (Isometric View)

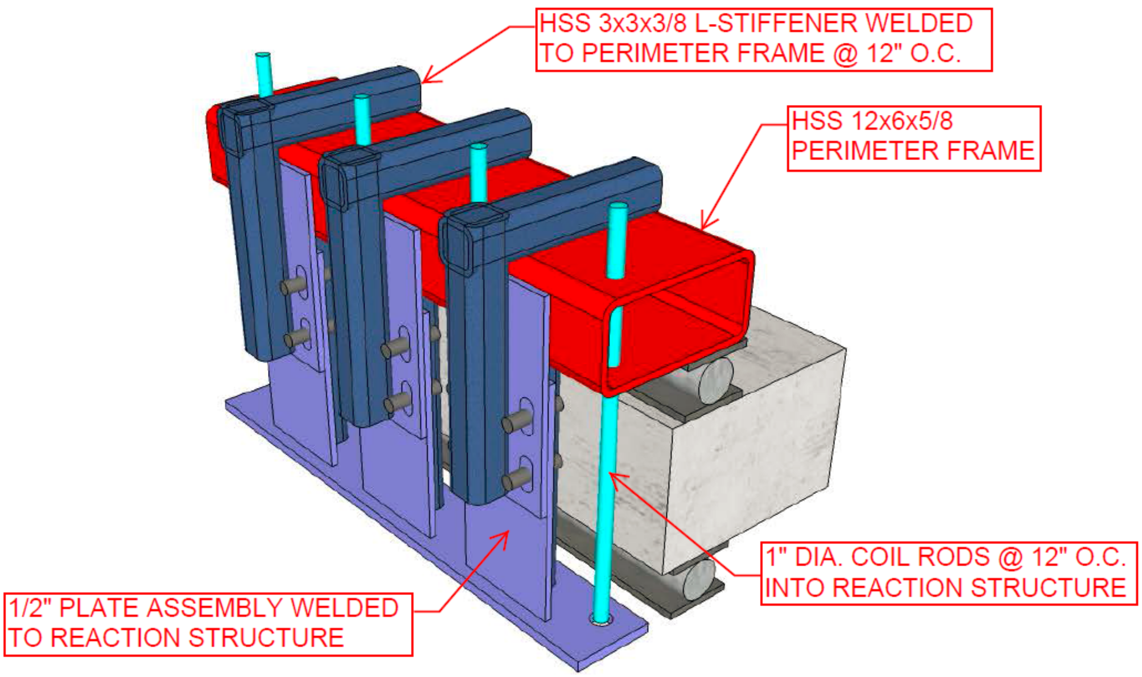
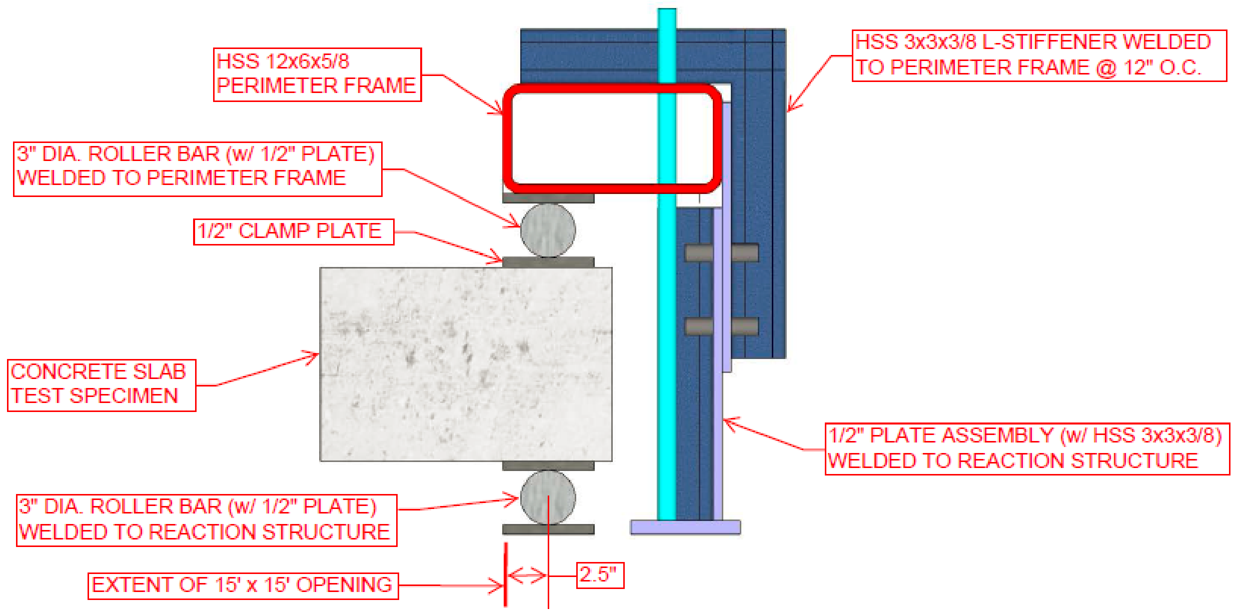


Figure 3-7: Steel Framing Set-Up 2 Layout (Section View)



Prior to testing, the test slab within Framing Set-Up 2 rested on six pedestals, each comprised of two HSS 8×6×1/2 members filled with grout and capped with a ½-inch (13mm) thick cover plate welded to the HSS members. The test slab was allowed to bear directly on the short HSS 4×3×3/8 sections that were located on top of the cover plate. A bolted ½-inch (13mm) thick bracket assembly was used to connect each pedestal with the stiffened perimeter frame. A sketch of the primary pedestal elements used within Framing Set-Up 2 is shown in Figure 3-8.

Figure 3-8: Steel Framing Set-Up 2 Pedestal (Isometric View)

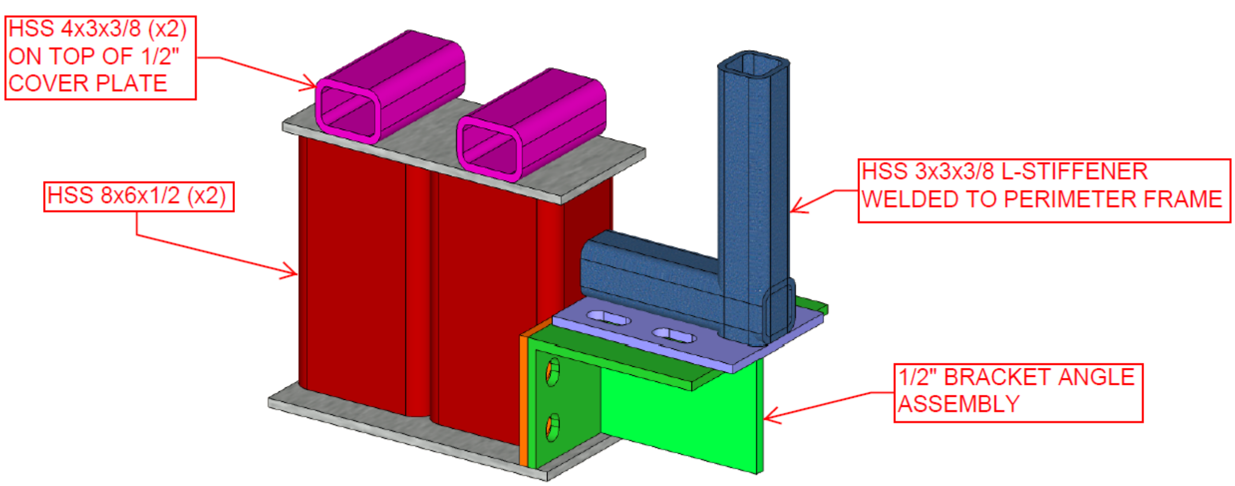


Figure 3-9 shows a panel using the stiffer steel framing system being lifted into position by a crane. The final installed slab and set-up for Test 3 through Test 8 is illustrated in Figure 3-10.

Figure 3-9: Lifting of Slab with Crane for Installation onto the Test Fixture (Framing Set-Up 2)

Figure 3-10: Installed Panel within the Stiffer Framing Set-Up 2

4 OPEN-AIR BLAST TESTING PROCEDURE

This section summarizes the instrumentation used to record testing information, the explosives materials and quantities used to generate the blast wave that loaded the slab specimens, and the program test matrix. Summaries of the pre-test and post-test documentation used and recorded, as well as the applicable response limits for pre-stressed concrete slabs, are also discussed in the following subsections.

4.1 Instrumentation and Test Documentation

The electronic instrumentation was set to trigger upon explosive detonation and consisted of several different types of sensors to document the PT slab response to the blast load:

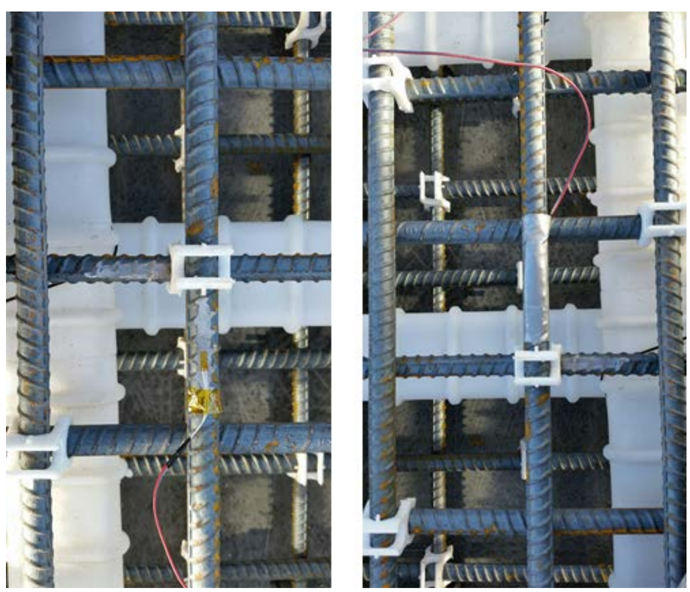
- Strain gauges inside the test panel
- Laser displacement sensors behind the test panel
- A high-speed video camera behind the test panel
- Real-time video cameras behind the test panel and at a far distance in front of the test panel
- Reflected and free-field pressure sensors within set locations as described below

All instrumentation calibrations are documented in Appendix D. In addition to the above instrumentation and recordings, still photography was used for pre-test and post-test documentation of the specimens and framing assemblies.

Strain Gauges

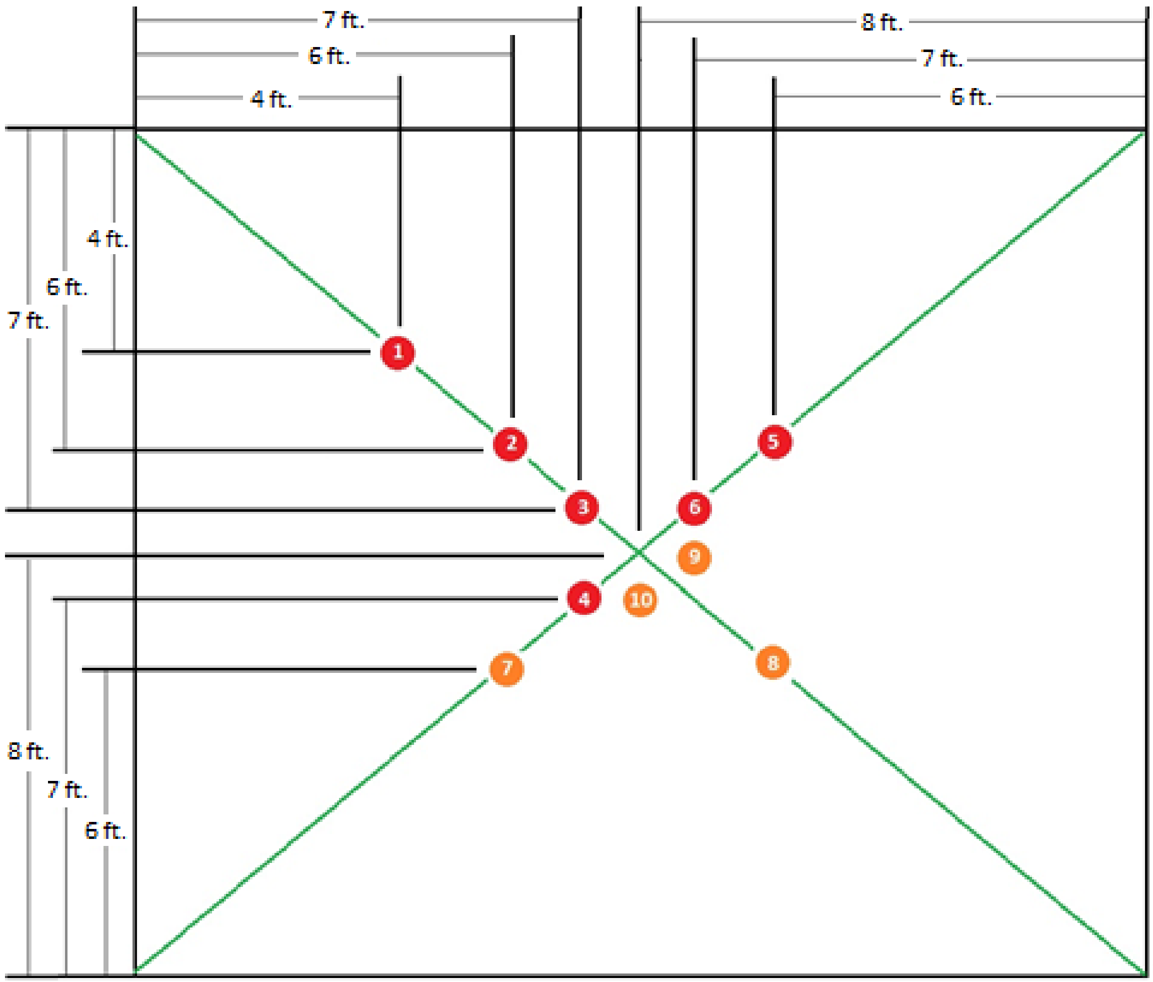
The strain gauges were mounted on the front and back mild steel rebar reinforcement within the test specimens to measure strain-time histories. The typical strain gauge in use is an Omega Model KFH-6-350-C1-11L1M2R. These were pre-wired and affixed onto the rebar. These met in a multi-pin connector on each sample, allowing each of the samples to plug in so that all of the bridge completion electronics was common throughout the testing. Examples of strain gauge attachment to rebar are shown in Figure 4-1.

Figure 4-1: Examples of Strain Gauge Attachment to Rebar



The strain gauge locations were laid out by the Client during the on-site slab construction inspection and were based on the diagonals (representing the plastic yield line formation) of the test samples. Strain gauges were placed on the rebar on both the front and back rebar mats inside the test specimens. The standard locations are shown in Figure 4-2.

Figure 4-2: Standard Strain Gauge Locations



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

Actual locations varied according to the rebar layout. Locations that would duplicate a reading on an already monitored rebar were moved to the nearest available location. In the case of Slab designs A and C, the gauges were moved 6 inches (152 mm) from the yield lines. For Slab designs B and D, the gauges were moved 4 inches (102 mm) from the yield lines. A layout based on the rebar count (starting from a zero datum point at the upper left corner of the slab specimen) for the four slab designs, as provided in Table 4-1, notes the bars that the sensors were mounted on. Most locations had two strain gauges mounted in it, one on the horizontal rebar and another on the vertical rebar. Each location corresponds to a channel on the data acquisition system.

The standard strain gauge layout schedule in Table 4-1 applies for all test slabs, except for Panel 1 and Panel 2, which were under construction prior to the on-site inspection and already had some of the strain gauges mounted. These samples have three strain gauges located on the centers of the 8th, 16th, and 24th bars in both the vertical and horizontal directions on the front rebar of the sample, while the remaining locations of strain gauges on the back face rebar for these two slabs match the standard layout.

Table 4-1: Standard Strain Gauge Location Schedule

Slab Designs A and C		
Rebar Location	X-bar	Y-bar
1	9	9
2	13	13
3	15	15
4	17	14
5	21	12
6	14	18
7	12	21
8	18	19
9	20	16
10	16	20

Slab Designs B and D		
Rebar Location	X-bar	Y-bar
1	13	13
2	19	19
3	22	22
4	28	21
5	32	16
6	23	26
7	18	31
8	23	26
9	28	24
10	24	28

The strain gauges were tested to determine their continuity. Table 4-2 summarizes the gauges among the eight panels that were determined to have an open or short circuit and, therefore, did not report strain information during testing. Position information on these strain gauges is provided in Table 4-3.

Table 4-2: Strain Gauges with Open or Short Circuits

Panel No.	Designation	Panel No.	Designation	Panel No.	Designation
1A	6-SG-3-F-V	5A	13-SG-1-R-H	6C	1-SG-1-F-H
	29-SG-9-R-H		14-SG-1-R-V		15-SG-2-R-H
2C	1-SG-1-F-H		15-SG-2-R-H	7B	1-SG-1-F-H
	6-SG-3-F-V		16-SG-2-R-V		15-SG-2-R-H
3B	1-SG-1-F-H		18-SG-3-R-V	8D	1-SG-1-F-H
	11-SG-6-F-H		19-SG-4-R-H		13-SG-1-R-H
	12-SG-6-F-V		21-SG-5-R-H		19-SG-4-R-H
4D	1-SG-1-F-H		22-SG-5-R-V		
	9-SG-5-F-H		23-SG-6-R-H		
	10-SG-5-F-V		24-SG-6-R-V		
	15-SG-2-R-H		26-SG-7-R-V		
	20-SG-4-R-V		27-SG-8-R-H		
	21-SG-5-R-H		28-SG-8-R-V		
	23-SG-6-R-H		29-SG-9-R-H		
			30-SG-10-R-V		

Table 4-3: Data Channels for Strain Gauges and Displacement Sensors

Channel	Instrument	Location	Rebar Layer	Orientation	Sensor Designation
1*	Strain Gauge	1	Front	Horizontal	1-SG-1-F-H
2*	Strain Gauge	1	Front	Vertical	2-SG-1-F-V
3*	Strain Gauge	2	Front	Horizontal	3-SG-2-F-H
4**	Strain Gauge	2	Front	Vertical	4-SG-2-F-V
5**	Strain Gauge	3	Front	Horizontal	5-SG-3-F-H
6**	Strain Gauge	3	Front	Vertical	6-SG-3-F-V
7***	Strain Gauge	4	Front	Horizontal	7-SG-4-F-H
8***	Strain Gauge	4	Front	Vertical	8-SG-4-F-V
9***	Strain Gauge	5	Front	Horizontal	9-SG-5-F-H
10***	Strain Gauge	5	Front	Vertical	10-SG-5-F-V
11***	Strain Gauge	6	Front	Horizontal	11-SG-6-F-H
12***	Strain Gauge	6	Front	Vertical	12-SG-6-F-V
13	Strain Gauge	1	Rear	Horizontal	13-SG-1-R-H
14	Strain Gauge	1	Rear	Vertical	14-SG-1-R-V
15	Strain Gauge	2	Rear	Horizontal	15-SG-2-R-H
16	Strain Gauge	2	Rear	Vertical	16-SG-2-R-V
17	Strain Gauge	3	Rear	Horizontal	17-SG-3-R-H
18	Strain Gauge	3	Rear	Vertical	18-SG-3-R-V
19	Strain Gauge	4	Rear	Horizontal	19-SG-4-R-H
20	Strain Gauge	4	Rear	Vertical	20-SG-4-R-V
21	Strain Gauge	5	Rear	Horizontal	21-SG-5-R-H
22	Strain Gauge	5	Rear	Vertical	22-SG-5-R-V
23	Strain Gauge	6	Rear	Horizontal	23-SG-6-R-H
24	Strain Gauge	6	Rear	Vertical	24-SG-6-R-V
25	Strain Gauge	7	Rear	Horizontal	25-SG-7-R-H
26	Strain Gauge	7	Rear	Vertical	26-SG-7-R-V
27	Strain Gauge	8	Rear	Horizontal	27-SG-8-R-H
28	Strain Gauge	8	Rear	Vertical	28-SG-8-R-V
29	Strain Gauge	9	Rear	Horizontal	29-SG-9-R-H
30	Strain Gauge	10	Rear	Vertical	30-SG-10-R-V
31	Laser Displacement	2" Left of Center	N/A	N/A	31-LD-C-1
32	Laser Displacement	2" Right of Center	N/A	N/A	32-LD-C-2

Notes: *(*) – For Panel 1 and Panel 2, strain gauges for these channels located on horizontal rebar.*
(**) – For Panel 1 and Panel 2, strain gauges for these channels located on vertical rebar.
(***) – For Panel 1 and Panel 2, strain gauges for these channels do not exist.

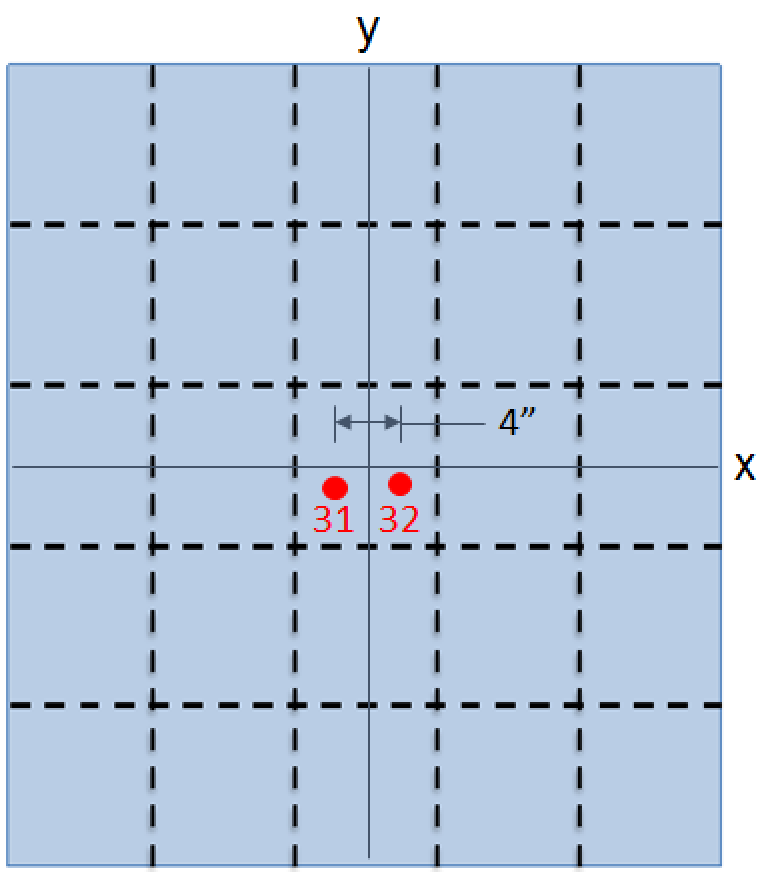
Laser Displacement Sensors

The laser displacement sensors to measure deflection-time histories were Keyence Model IL-2000 laser sensors. These were mounted in a protective box on the back wall of the target fixture, and independently measured the encroachment of the back face of the test sample. Each of the laser sensors monitored a different location to average out any localized events, such as cracking or fragmenting. The laser sensors were positioned to read displacement within the central grid area, 4 inches (102 mm) apart on either side of the vertical panel centerline, as depicted in Figure 4-3.

For Test 1, both sensors were set to measure displacement 13.5 inches (343 mm) below the horizontal panel centerline. For Test 2, Sensor 32 was moved up to 2.3 inches (57 mm) below the horizontal panel centerline. For the remaining tests, Sensor 31 and Sensor 32 were staggered approximately 2 inches (51 mm) vertically relative to one another, and generally located within 4 inches (102 mm) of the horizontal panel centerline. See Appendix E for specific test information.

The strain gauges and laser displacement sensors were both fed into a DTS TDAS G-5 data acquisition system with a vehicle docking station. The data channels for the laser displacement sensors are shown at the bottom of Table 4-3.

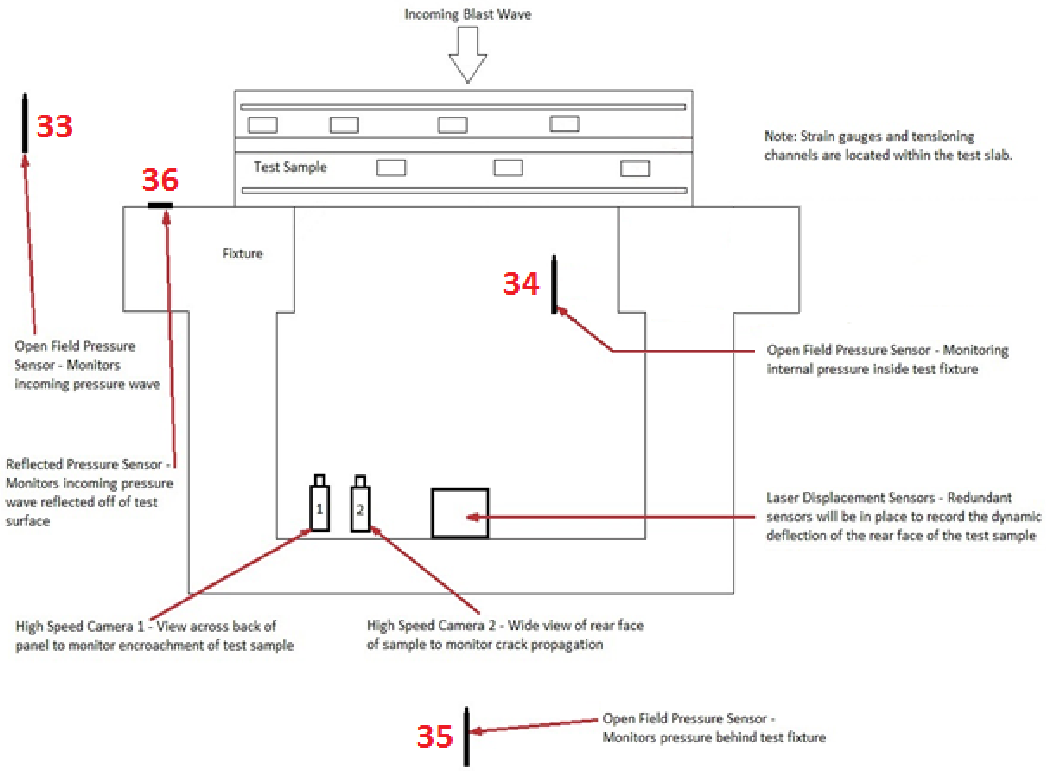
Figure 4-3: Pre-Test Laser Locations on Interior Slab Face



High-Speed & Real-Time Video Cameras

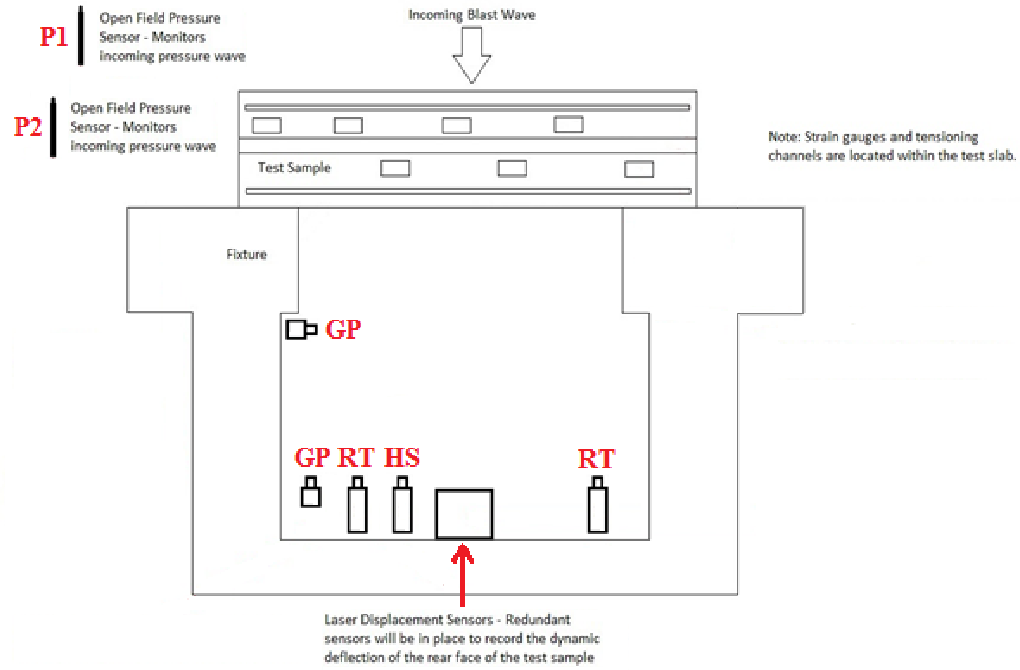
The cameras placed within the test fixture were generally used to watch a central area of the back face to monitor crack propagation. The high-speed cameras used, including a Vision Research Phantom 7.1 black and white camera, record at 10,000 frames per second. Following Test 2, a real-time GoPro camera was introduced in a side position, in addition to other real-time cameras along the rear wall of the test fixture focused on a central area of the test panel. The relative positions of the cameras used within the reaction structure for Test 1 and Test 2 are shown in Figure 4-4. The interior camera positions for the remaining tests are shown in Figure 4-5. An exterior real-time camera was used for all tests to record the detonation event.

Figure 4-4: Displacement and Pressure Sensor Locations for Test 1 and Test 2



Note: Pressure gauges 33, 34, and 35 were moved to positions with radial distances of 53 feet (16.2 m), 43 feet (13.3 m), and 40 feet (12.3 m), respectively, from the charge center for Test 2, irrespective of position with respect to the front panel face.

Figure 4-5: Displacement and Pressure Sensor Locations for Test 3 through Test 8

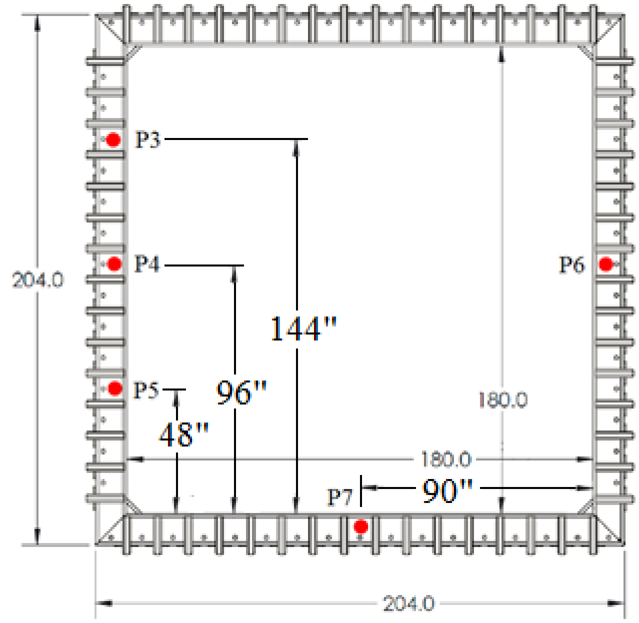


Pressure Sensors

Most of the pressure sensors used to gather pressure-time histories for Test 1 and Test 2 were PCB Model 137A22 Open Field Blast Probes, commonly referred to as pencil probes. These probes monitored the free-field (or "side-on") pressure of an incoming pressure wave, and for Test 1 were placed approximately 30 feet (9.1 m) away from the charge center, centered inside the fixture to monitor potential pressure increases within the test fixture, and 5 feet (1.5 m) behind the test fixture to monitor the remaining pressure behind the fixture as the wave moves over it. The final pressure sensor used was a PCB Model 113B24, mounted on the test fixture at the panel mid-height, to monitor the reflected pressure affecting the test sample. The locations of these sensors are shown in Figure 4-4, with modified locations for the free-field gauges for Test 2. The data acquisition system used was an HBM Genesis Gen 7T system with a four channel IEPE card that can capture one million points per second.

Additional reflected pressure gauges were used in the remaining tests to measure the pressure and impulse profile acting along the test specimen surface area. The positions of these gauges (P3 through P7) are shown in Figure 4-6. Two free-field pencil probes (P1 and P2), which were positioned to the side of the test specimen as shown in Figure 4-5, were typically located between 45 feet (13.7 m) and 55 feet (16.8 m) from the center of the explosive charge.

Figure 4-6: Reflected Pressure Sensor Locations for Test 3 through Test 8



4.2 Explosives and Test Matrix

The explosive used for the testing of the panels was ANFO (i.e., ammonium nitrate/fuel oil), a widely used bulk industrial explosive mixture. ANFO consists of 94% porous prilled ammonium nitrate (AN), which acts as the oxidizing agent and absorbent for the fuel, and 6% number 2 fuel oil (FO). The density of ANFO is approximately 57 lb/ft^3 (0.92 g/mL).

A singular lot of ANFO, manufactured by Dyno Nobel Co. – Salt Lake City, was procured by OBL from a distributor in Oregon. All tests were conducted using this same lot.

For Test 1 and Test 2, all ANFO material, originally in 50-lb (23 kg) bags, was poured and packed into a single container (i.e., a larger bag) per blast test. The container dimensions were kept as close to a 1 to 1 ratio as possible. The base of the container was elevated above the ground (approximately even with the base of the test panel) with use of light wood supports to minimize the extent of cratering (depth and diameter), and positioned such that the center of the container was 30 feet (9.1 m) in front of the test specimen. The charge size used for each of these tests, which was specified by the Client, is provided in the test matrix in Table 4-4.

For Test 3 through Test 8, stacked ANFO bags were placed on a wood table 4 feet (1.2 m) off the ground, such that the center of the ANFO mass was 45 feet (13.7 m) in front of the test specimen and located approximately 5.5 feet (1.7 m) off the ground. A blast mat (i.e., steel plate) was located beneath the charge mass to reduce cratering effects for select tests. The charge size used for each of these tests was specified by the Client following the prior test in the current program. The chosen charge sizes are provided in the test matrix in Table 4-4.

Two pentolite boosters weighing 1 lb (0.45 kg) each were used to detonate the ANFO material. Each pentolite booster was detonated by an electric, 0-second delay blasting cap. The pentolite boosters were positioned near the center of the ANFO material for detonation. An electric blasting machine was used to trigger and set off the electric caps.

Table 4-4: Test Matrix

Test Number	Panel Number	Explosive Standoff	ANFO Weight
1	5A	30 feet (9.1 m)	1300 lb (580 kg)
2	1A	30 feet (9.1 m)	1300 lb (590 kg)
3	2C	45 feet (13.7 m)	2300 lb (1040 kg)
4a	6C	45 feet (13.7 m)	1700 lb (770 kg)
4b	6C	45 feet (13.7 m)	2000 lb (910 kg)
5	7B	45 feet (13.7 m)	2300 lb (1040 kg)
6	3B	45 feet (13.7 m)	2000 lb (910 kg)
7	4D	45 feet (13.7 m)	2000 lb (910 kg)
8	8D	45 feet (13.7 m)	2300 lb (1040 kg)

4.3 Pre-Stressed Concrete Slab Response Limits

Flexural response limits for pre-stressed concrete slabs as defined in CSA S850-12 and ASCE 59-11 are provided in Table 4-5. These limits, which are derived from limits within PDC-TR 06-08 from the U.S. Army Corps of Engineers Protective Design Center for use in Single Degree of Freedom (SDOF) analyses, depend on the reinforcement index of the pre-stressed element, ω_p. Three ranges of reinforcement index, which is a function of the pre-stressed reinforcement ratio, the stress in the pre-stressing steel at the design load, and the concrete compressive strength, are provided in Table 4-5. The upper range ($\omega_p > 0.30$) denotes an over-reinforced member that could fail catastrophically due to concrete crushing prior to yielding of the pre-stressing steel. All slabs in this testing program were within or near this upper range. Meanwhile, the lower range ($\omega_p < 0.15$) denotes a shear limited condition. The given response limits for this lower range would only apply if adequate stirrups or shear ties are provided; otherwise, the middle range limits ($0.15 < \omega_p < 0.30$) would control. The damage levels noted in Table 4-5 are defined in Table 4-6 as per PDC-TR 06-08. Calculations for support rotation and reinforcement index are provided in Appendix A.

Table 4-5: Flexural Response Limits for Pre-Stressed Concrete Slabs

	Superficial Damage		Moderate Damage		Heavy Damage	
Reinforcement Index, ω_p	Ductility, μ	Support Rotation, θ	Ductility, μ	Support Rotation, θ	Ductility, μ	Support Rotation, θ
$\omega_p > 0.30$	0.7	--	0.8	--	0.9	--
$0.15 < \omega_p < 0.30$	0.8	--	$0.25/\omega_p$	1°	$0.29/\omega_p$	1.5°
$\omega_p < 0.15$*	1.0	--	--	1°	--	2°

Note: (*) – These limits only apply if adequate shear reinforcement is provided; otherwise, values in row above would apply.

Table 4-6: Damage Levels

Damage Level	Description
Superficial Damage	Component has no visible permanent damage.
Moderate Damage	Component has some permanent deflection. It is generally repairable, if necessary, although replacement may be more economical and aesthetic.
Heavy Damage	Component has not failed, but it has significant permanent deflections causing it to be unrepairable.
Hazardous Failure	Component has failed, and debris velocities range from insignificant to very significant.

The flexural response limits given in Table 4-5 for pre-stressed concrete slabs are generally lower than those for conventionally reinforced concrete slabs, where the Moderate Damage and Heavy Damage thresholds would be at minimum 2 degrees and 5 degrees, respectively, as per any of the referenced guidelines, even without shear reinforcement. The responses of the PT slabs tested in this program are classified in Section 5 according to both maximum deflection/support rotation and the descriptions provided in Table 4-6, generally as pertaining to the back face of the slab and through-thickness damage. Comparisons of the test results to the theoretical response limits for pre-stressed and conventionally reinforced concrete slabs are made in Section 6.

5 TEST RESULTS

This section discusses the results of the testing program. Table 5-1 provides an overall summary of these tests. Appendix E can be consulted for detailed gauge information for each test.

Table 5-1: Test Results Summary

Test Number	Panel Number	Maximum Deflection	Permanent Deflection	Test Rotation	ANFO Weight	Response Notes
1	5A	N/A	2.7 in (68 mm)	> 2.0 degrees	1300 lb* (590 kg)	Significant front face scabbing. Concrete crushing along panel edges. Through-thickness cracking. Frame damage sustained.
2	1A	5.8 in (148 mm)	4.6 in (117 mm)	4.4 degrees	1300 lb* (590 kg)	Significant front face scabbing. Concrete crushing along panel edges. Through-thickness cracking. Frame damage sustained.
3	2C	4.7 in (120 mm)	3.9 in (100 mm)	3.0 degrees	2300 lb** (1040 kg)	Significant front face scabbing. Through-thickness cracking: up to ½-inch (13 mm) above and below PT strands disengaged.
4a	6C	0.6 in (16 mm)	0 in (0 mm)	0.4 degrees	1700 lb** (770 kg)	Superficial slab damage to both faces.
4b	6C	4.3 in (109 mm)	3.5 in (90 mm)	2.7 degrees	2000 lb** (910 kg)	Front face scabbing along yield lines. Concrete crushing along panel edges. Through-thickness cracking.
5	7B	3.5 in (88 mm)	2.2 in (57 mm)	2.2 degrees	2300 lb** (1040 kg)	Front face scabbing along yield lines. Concrete crushing along panel edges. Through-thickness cracking.
6	3B	1.2 in (31 mm)	0.5 in (13 mm)	0.8 degrees	2000 lb** (910 kg)	Front face scabbing along yield lines. Moderate slab damage. Through-thickness cracking.
7	4D	0.8 in (21 mm)	0.1 in (2.5 mm)	0.5 degrees	2000 lb** (910 kg)	Isolated front face scabbing. Moderate slab damage. Through-thickness cracking.
8	8D	3.3 in (85 mm)	2.0 in (50 mm)	2.1 degrees	2300 lb** (1040 kg)	Significant front face scabbing. Through-thickness cracking: up to ½-inch (13 mm) along all the corner regions disengaged.

Notes: (*) – Charge at a standoff of 30 feet (9.1 m).
(**) – Charge at a standoff of 45 feet (13.7 m).

5.1 Test 1 (Panel 5A)

General Description

Panel 5 was constructed per Slab design A as described in Section 3, consisting of 725 psi (5 MPa) pre-stressing with 5.9 lb/ft^3 (95 kg/m^3) mild steel reinforcement. The frame design shown in Figure 3-5 was used. Figure 5-1 shows representative pre-test photos of the front and back sides of the panel. Four pressure gauges were placed, as indicated in Figure 4-3. The panel was subjected to an explosion of 1300 pounds (590 kg) of ANFO at a standoff of 30 feet (9.1 m).

Figure 5-1: Pre-Test Photos of Test 1

Post-Test Documentation

The blast load resulted in significant front face scabbing of the 3/4-inch (19mm) thick concrete cover with a recognizable pattern of cracking, as shown in Figure 5-2. On the back face, the test panel showed prominent cracking/crushing along the vertical supports and the bottom horizontal support. Horizontal cracks up to 1/4-inch (6mm) thick occurred near, but below the panel mid-height. Lighter cracking was visible over a wide region in the center of the panel. Back face panel damage is shown in Figure 5-3. Cracking through the thickness of the slab was also observed, as shown in Figure 5-4.

Figure 5-2: Front Face Slab Scabbing in Test 1

Figure 5-3: Back Face Slab Cracking in Test 1 (at Bottom Center)

Figure 5-4: Through-Thickness Slab Cracking in Test 1 (at Bottom Left)

Maximum panel deflection was not recorded due to an instrumentation malfunction. These issues were remedied for Test 2 as described in Section 5.2.

The maximum inbound permanent deflection recorded was 2.7 inches (68 mm) at a position 13.5 inches (343 mm) below the slab mid-height. This permanent deflection indicates that a support rotation of no less than 2.0 degrees occurred during testing. No rebound deflection was noted post-test. Individual gauge outputs of strain are provided on pages E-3 through E-6 of Appendix E.

Damage to the steel frame was observed after testing completed, particularly along the welds at the upper corners, as shown in Figure 5-5. Significant deformation of the steel pedestals was also visible.

Figure 5-5: Steel Frame Damage in Test 1 (at Upper Left and Upper Right Corners)

The slab sustained significant permanent deflections, including concrete crushing along the edges that was deemed unrepairable, but with no back face debris. The overall slab response for Test 1 most nearly corresponds to Heavy Damage, as defined in CSA S850-12 or ASCE 59-11.

5.2 Test 2 (Panel 1A)

General Description

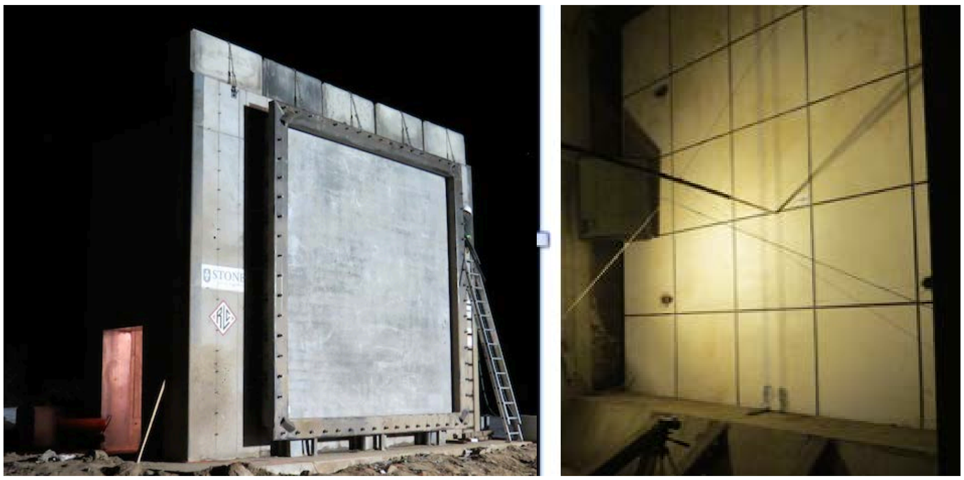
Panel 1 was constructed identically to Panel 5 used in Test 1. The frame design shown in Figure 3-5 was used with the following modifications. First, the welds at the corners were repaired, and steel hat sections were added at all four corners. Steel spacers were also introduced at the upper corners. Finally, the steel pedestals were stiffened and filled with sand for Test 2. Some of these frame modifications are shown in Figure 5-6.

Figure 5-6: Pre-Test Photos of Frame Modifications for Test 2

Redundancies in the set-up and operation of the instrumentation were made prior to Test 2. These mainly included improved lighting/power for the test fixture and instrumentation, as well as improved wiring for the data acquisition system. A manual displacement reader was also used.

Figure 5-7 shows representative pre-test photos of the front and back sides of the panel. Free-field pressure gauges were moved to three locations ranging between 40 feet (12.3 m) and 53 feet (16.2 m) from the charge center. Due to limited test data collected in Test 1, the Test 2 panel was also subjected to an explosion of 1300 pounds (590 kg) of ANFO at a standoff of 30 feet (9.1 m).

Figure 5-7: Pre-Test Photos of Test 2



Post-Test Documentation

The blast load again resulted in significant front face scabbing of the 3/4-inch (19mm) thick concrete cover with a recognizable pattern of cracking, as shown in Figure 5-8. On the back face, the test panel showed prominent cracking/crushing along the vertical supports. Horizontal cracks up to 1/4-inch (6mm) thick occurred near, but below the panel mid-height. Lighter cracking was visible over a wide region in the center of the panel. Back face panel damage is shown in Figure 5-9. Cracking through the thickness of the slab was also observed, as shown in Figure 5-10.

Figure 5-8: Front Face Slab Scabbing in Test 2

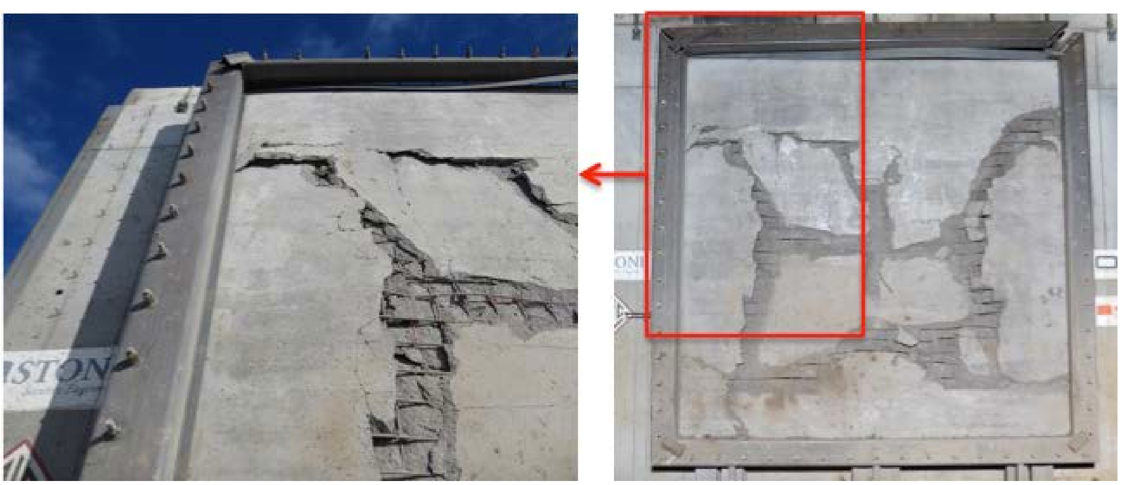


Figure 5-9: Back Face Slab Cracking in Test 2 (Overall and Along Left Edge)

Figure 5-10: Through-Thickness Slab Cracking in Test 2

The maximum deflection recorded with the laser sensors was 5.8 inches (148 mm) a few inches above a horizontal crack located 18 inches (457 mm) below the slab mid-height. This maximum deflection indicates that a support rotation of approximately 4.4 degrees occurred during testing. A maximum inbound permanent deflection of 4.6 inches (117 mm) was observed, while no rebound deflection was noted post-test. Individual gauge outputs and traces of strain and displacement are provided on pages E-13 through E-17 of Appendix E.

Damage to the steel frame was observed after testing completed, particularly along the welds at the upper corners, as shown in Figure 5-11. Visible, but less prominent damage occurred at the weld at the bottom left corner of the frame.

Figure 5-11: Steel Frame Damage in Test 2 (Along Upper Edge)

The slab sustained significant permanent deflections, including concrete crushing along the edges that was deemed unrepairable, but with no back face debris. Similar to Test 1, the overall slab response for Test 2 most nearly corresponds to Heavy Damage, as defined in CSA S850-12 or ASCE 59-11.

5.3 Test 3 (Panel 2C)

General Description

Panel 2 was constructed per Slab design C as described in Section 3, consisting of 1450 psi (10 MPa) pre-stressing with 5.9 lb/ft^3 (95 kg/m^3) mild steel reinforcement. The stiffened frame design shown in Figure 3-10 was used to support the panel. Figure 5-12 shows representative pre-test photos of the front and back sides of the panel. Five reflected pressure gauges were placed, as indicated in Figure 4-6, with two free-field pressure gauges placed to the side. The panel was subjected to an explosion of 2300 pounds (1040 kg) of ANFO at a standoff of 45 feet (13.7 m).

Figure 5-12: Pre-Test Photos of Test 3

Post-Test Documentation

The blast load resulted in significant front face scabbing of the 3/4-inch (19mm) thick concrete cover, as shown in Figure 5-13. On the back face, the test panel showed light cracking over the entire surface. The most pronounced cracking occurred near the middle of the slab (0.05-inch or 1.3mm wide) and along the bottom horizontal support (0.1-inch or 2.5mm wide), as highlighted in Figure 5-14. No damage was observed to the stiffened steel frame.

Figure 5-13: Post-Test Photos of Test 3

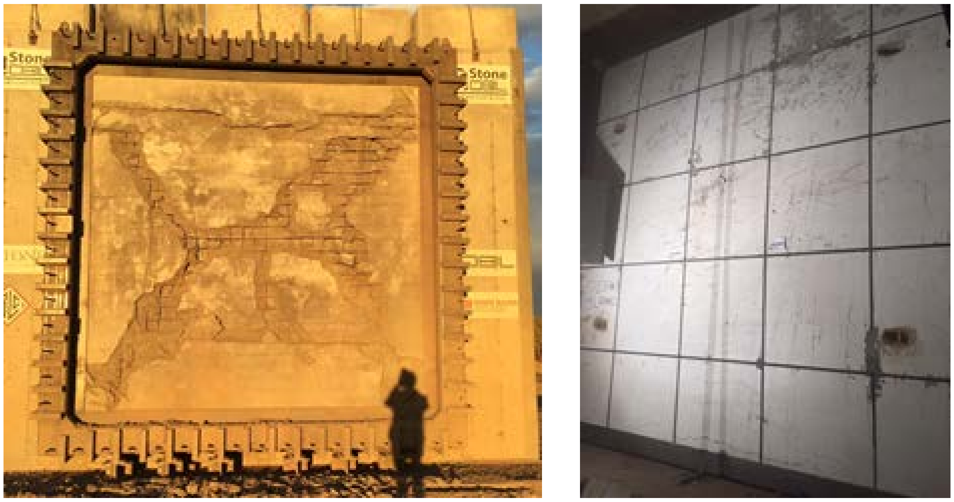


Figure 5-14: Highlighted Cracking Pattern on Back Face in Test 3

Peak pressure recorded ranged from 380 to 750 psi. Positive phase impulse recorded ranged from 400 to 670 psi-ms. The maximum deflection recorded with the laser sensors was 4.7 inches (120 mm) near the center of the slab. This maximum deflection indicates that a support rotation of approximately 3.0 degrees occurred during testing. The permanent set near the slab center point was approximately 3.9 inches (100 mm). Individual gauge outputs and traces of strain, displacement, and pressure are provided on pages E-23 through E-28 of Appendix E.

Upon removal of the panel from the test fixture, cracking through the slab thickness was observed along the edges, as shown in Figure 5-15. Moreover, disengagement of the concrete layers above and below the PT strands was recorded, as shown in Figure 5-16. This disengagement generally ranged from 3/8-inch (9.5 mm) to ½-inch (13 mm).

Figure 5-15: Through-Thickness Cracking along Top and Side Edges in Test 3

Figure 5-16: Disengagement of Concrete Layers in Test 3

The slab sustained significant permanent deflections with concrete disengagement at the PT tendons that was deemed unrepairable, but no back face debris. The overall slab response for Test 3 most nearly corresponds to Heavy Damage, as defined in CSA S850-12 or ASCE 59-11, though the level of disengagement observed through the slab thickness would indicate the likely onset of Hazardous Damage with even a small increase in blast load.

5.4 Test 4a (Panel 6C)

General Description

Panel 6 was constructed and framed identically to Panel 2 used in Test 3. Figure 5-17 shows representative pre-test photos of the front and back sides of the panel. Five reflected pressure gauges were placed, as indicated in Figure 4-6, with two free-field pressure gauges placed to the side. The panel was subjected to an explosion of 1700 pounds (770 kg) of ANFO at a standoff of 45 feet (13.7 m).

Figure 5-17: Pre-Test Photos of Test 4a

Post-Test Documentation

The blast load resulted in only minor damage to the front and back faces, as shown in Figure 5-18. No crushing or scabbing of concrete along the exterior surface was noticed. The interior surface of the concrete slab had minor hairline cracks from the edges that extend to hairline cracks along mid-span region. No through-thickness cracking of concrete nor damage to the steel frame was observed.

Figure 5-18: Post-Test Photos of Test 4a

Peak pressures recorded ranged from 240 to 430 psi. Peak impulse recorded was approximately 470 psi-ms. The maximum deflection recorded with the laser sensors was approximately 0.6 inch (16 mm), which translates to a 0.4-degree support rotation. No permanent set near the slab center point was observed. Individual gauge outputs and traces of strain, displacement, and pressure are provided on pages E-33 through E-39 of Appendix E.

The slab sustained no significant permanent deflections. The overall slab response for Test 4a most nearly corresponds to Superficial Damage, as defined in CSA S850-12 or ASCE 59-11.

5.5 Test 4b (Panel 6C)

General Description

Due to the small displacements achieved in Test 4a, Panel 6 was subjected to a second test shot—an explosion of 2000 pounds (910 kg) of ANFO at a standoff of 45 feet (13.7 m). Refer to Figure 5-18 for representative pre-test photos of the front and back sides of the panel.

Post-Test Documentation

The blast load resulted in heavy scabbing of the 3/4-inch (19mm) thick concrete cover on the front face of the panel, as shown in Figure 5-19. On the back face, cracking was observed along most of the slab surface, generally ranging from hairlines to cracks with widths of approximately 0.08 inches (2 mm). Major cracking, spalling, and bowing was noted along the left panel edge (when viewed from the interior), as shown in Figure 5-20. Cracks were also observed across the slab thickness, but to a lesser extent than the cracking and disengagement that was observed throughout the cross-section in Test 3. This through-thickness cracking is shown in Figure 5-21. No damage was observed to the stiffened steel frame.

Figure 5-19: Front Face Slab Scabbing in Test 4b

Figure 5-20: Highlighted Cracking Pattern on Back Face in Test 4b

Figure 5-21: Through-Thickness Cracking along Side Edge in Test 4b

Peak pressures recorded ranged from 340 to 550 psi. Peak impulse recorded was 570 psi-ms. The maximum deflection recorded with the laser sensors was 4.3 inches (109 mm), which translates to a 2.7-degree support rotation. The permanent set near the slab center point was approximately 3.5 inches (90 mm). Individual gauge outputs and traces of strain, displacement, and pressure are provided on pages E-44 through E-50 of Appendix E.

The slab sustained significant permanent deflections, including concrete crushing along the edges that was deemed unrepairable, but with no back face debris. The overall slab response for Test 4b most nearly corresponds to Heavy Damage, as defined in CSA S850-12 or ASCE 59-11.

5.6 Test 5 (Panel 7B)

General Description

Panel 7 was constructed per Slab design B as described in Section 3, consisting of 725 psi (5 MPa) pre-stressing with 13.7 lb/ft^3 (220 kg/m^3) mild steel reinforcement. The stiffened frame design shown in Figure 3-10 was used to support the panel. Figure 5-22 shows representative pre-test photos of the front and back sides of the panel. Five reflected pressure gauges were placed, as indicated in Figure 4-6, with two free-field pressure gauges placed to the side. The panel was subjected to an explosion of 2300 pounds (1040 kg) of ANFO at a standoff of 45 feet (13.7 m).

Figure 5-22: Pre-Test Photos of Test 5

Post-Test Documentation

The blast load resulted in horizontal, vertical, and diagonal cracks on the front face of the panel, along with some scabbing of the 3/4-inch (19mm) thick concrete cover, as shown in Figure 5-23. On the back face, cracking was observed along most of the slab surface, generally ranging from hairlines to cracks with widths of approximately 0.03 inch (0.8 mm). Significant cracking, spalling, and/or bowing was noted along the left and right panel edges, as shown in Figure 5-24. Cracks were also observed across the slab thickness, which were not chained between all end caps as in Test 3. This through-thickness cracking is shown in Figure 5-25. No damage was observed to the stiffened steel frame.

Figure 5-23: Front Face Slab Scabbing in Test 5

Figure 5-24: Highlighted Cracking Pattern on Back Face in Test 5

Figure 5-25: Through-Thickness Cracking along Side Edge in Test 5

Peak pressures recorded ranged from 470 to 750 psi. Positive phase impulse recorded ranged from 430 to 760 psi-ms. The maximum deflection recorded with the laser sensors was 3.5 inches (88 mm), which translates to a 2.2-degree support rotation. The permanent set near the slab center point was 2.2 inches (57 mm). Individual gauge outputs and traces of strain, displacement, and pressure are provided on pages E-55 through E-61 of Appendix E.

The slab sustained significant permanent deflections, including concrete crushing along the edges that was deemed unrepairable, but with no back face debris. The overall slab response for Test 5 most nearly corresponds to Heavy Damage, as defined in CSA S850-12 or ASCE 59-11.

5.7 Test 6 (Panel 3B)

General Description

Panel 3 was constructed and framed identically to Panel 7 used in Test 5. Figure 5-26 shows representative pre-test photos of the front and back sides of the panel. Five reflected pressure gauges were placed, as indicated in Figure 4-6, with two free-field pressure gauges placed to the side. The panel was subjected to an explosion of 2000 pounds (910 kg) of ANFO at a standoff of 45 feet (13.7 m).

Figure 5-26: Pre-Test Photos of Test 6

Post-Test Documentation

The blast load resulted in horizontal, vertical, and diagonal cracks on the front face of the panel, along with some concrete crushing/scabbing similar to that seen in Test 5. This front face damage is shown in Figure 5-27. On the back face, cracking was observed along most of the slab surface. Cracks were mostly hairlines in a yield line pattern similar to previous tests. The main cracks were a central horizontal vertical crack with a width of approximately 0.03 inch (0.8 mm), as well as more significant cracking up to 0.1 inch (2.5 mm) that was noted along the left and right panel edges. However, no crushing of the concrete was seen along the panel edges. This back face damage is shown in Figure 5-28. Some cracking was also observed across the slab thickness in a similar pattern but to a lesser extent than in Test 5. This through-thickness cracking is shown in Figure 5-29. No damage was observed to the stiffened steel frame.

Figure 5-27: Front Face Slab Scabbing in Test 6

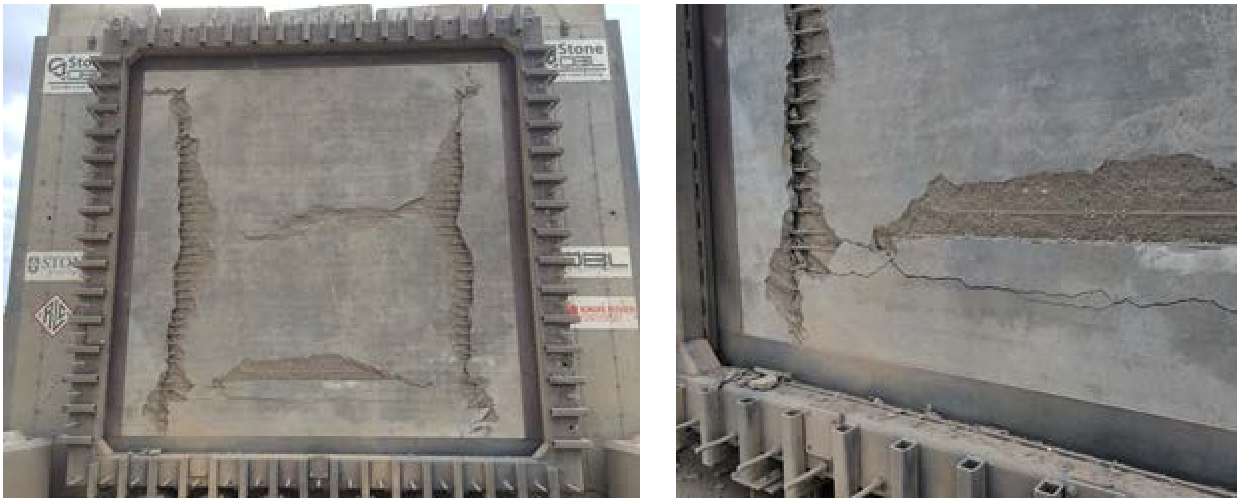


Figure 5-28: Cracking Pattern on Back Face in Test 6

Figure 5-29: Through-Thickness Cracking along Side Edge in Test 6

Peak pressures recorded along the vertical edges generally ranged from about 320 to 570 psi. Peak impulse recorded along these edges was 550 psi-ms. The maximum deflection recorded with the laser sensors was 1.2 inches (31 mm), which translates to a 0.8-degree support rotation. The permanent set near the slab center point was approximately 0.5 inch (13 mm). Individual gauge outputs and traces of strain, displacement, and pressure are provided on pages E-66 through E-72 of Appendix E.

The slab sustained permanent deflections, but without concrete crushing along the edges or concrete disengagement at the PT tendons. The overall slab response for Test 6 most nearly corresponds to Moderate Damage, as defined in CSA S850-12 or ASCE 59-11.

5.8 Test 7 (Panel 4D)

General Description

Panel 4 was constructed per Slab design D as described in Section 3, consisting of 1450 psi (10 MPa) pre-stressing with 13.7 lb/ft^3 (220 kg/m^3) mild steel reinforcement. The stiffened frame design shown in Figure 3-10 was used to support the panel. Figure 5-30 shows representative pre-test photos of the front and back sides of the panel. Five reflected pressure gauges were placed, as indicated in Figure 4-6, with two free-field pressure gauges placed to the side. The panel was subjected to an explosion of 2000 pounds (910 kg) of ANFO at a standoff of 45 feet (13.7 m).

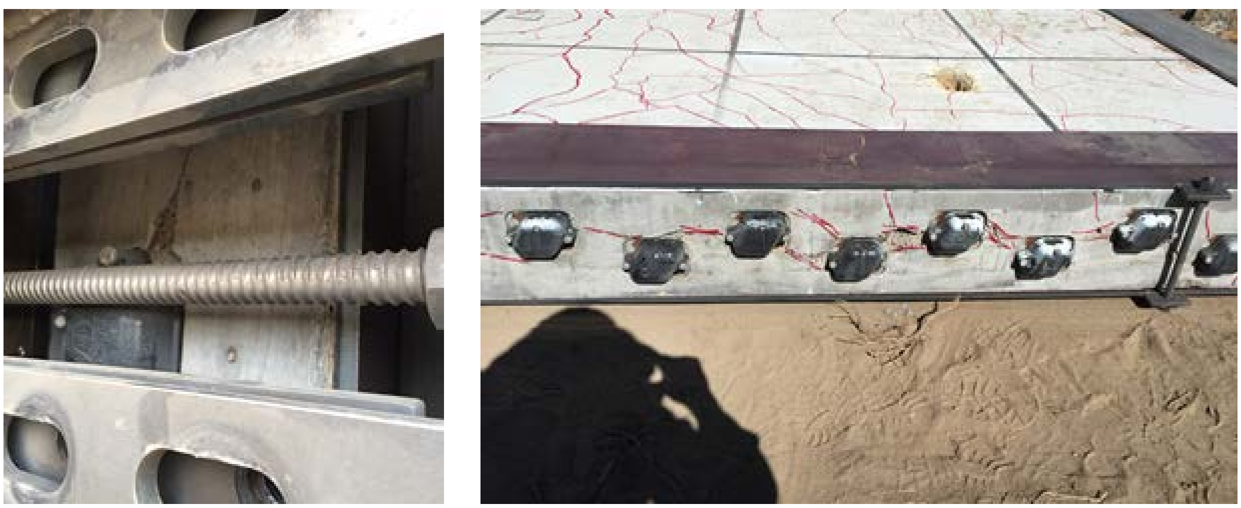
Figure 5-30: Pre-Test Photos of Test 7

Post-Test Documentation

Lesser cracks and concrete scabbing/crushing were observed on the front face of the panel in comparison with the previously tested slab designs exposed to the blast load from the same charge size and standoff. This front face damage is shown in Figure 5-31. On the back face, hairline cracking was observed on the slab surface. Cracks were mostly hairlines in a yield line pattern similar to previous tests. The main crack was a central horizontal crack pattern with a width of approximately 0.016 inch (0.41 mm), as shown in Figure 5-31. No crushing of the concrete was seen along the panel edges. Some cracking was also observed across the slab thickness, as shown in Figure 5-32. No damage was observed to the stiffened steel frame.

Figure 5-31: Post-Test Photos of Test 7

Figure 5-32: Through-Thickness Cracking along Side Edge in Test 7



Peak pressures recorded ranged from about 370 to 430 psi. Peak impulse recorded was 490 psi-ms. The maximum deflection recorded with the laser sensors was 0.8 inch (21 mm), which translates to a 0.5-degree support rotation. A small permanent set of roughly 0.1 inch (2.5 mm) was sustained near the slab center point. Individual gauge outputs and traces of strain, displacement, and pressure are provided on pages E-77 through E-83 of Appendix E.

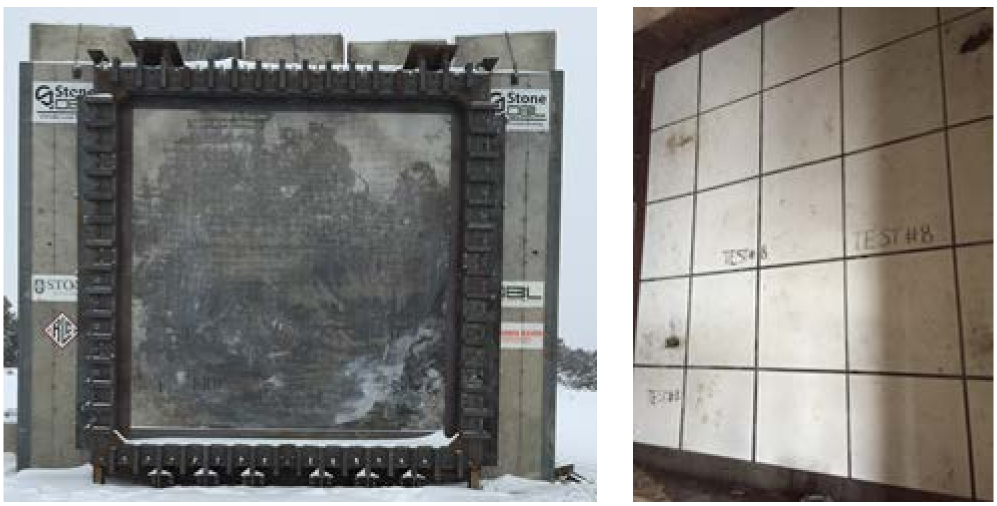
The slab sustained permanent deflections, but without concrete crushing along the edges or concrete disengagement at the PT tendons. The overall slab response for Test 7 most nearly corresponds to Moderate Damage, as defined in CSA S850-12 or ASCE 59-11.

5.9 Test 8 (Panel 8D)

General Description

Panel 8 was constructed and framed identically to Panel 4 used in Test 7. Figure 5-33 shows representative pre-test photos of the front and back sides of the panel. Five reflected pressure gauges were placed, as indicated in Figure 4-6, with two free-field pressure gauges placed to the side. The panel was subjected to an explosion of 2300 pounds (1040 kg) of ANFO at a standoff of 45 feet (13.7 m).

Figure 5-33: Pre-Test Photos of Test 8



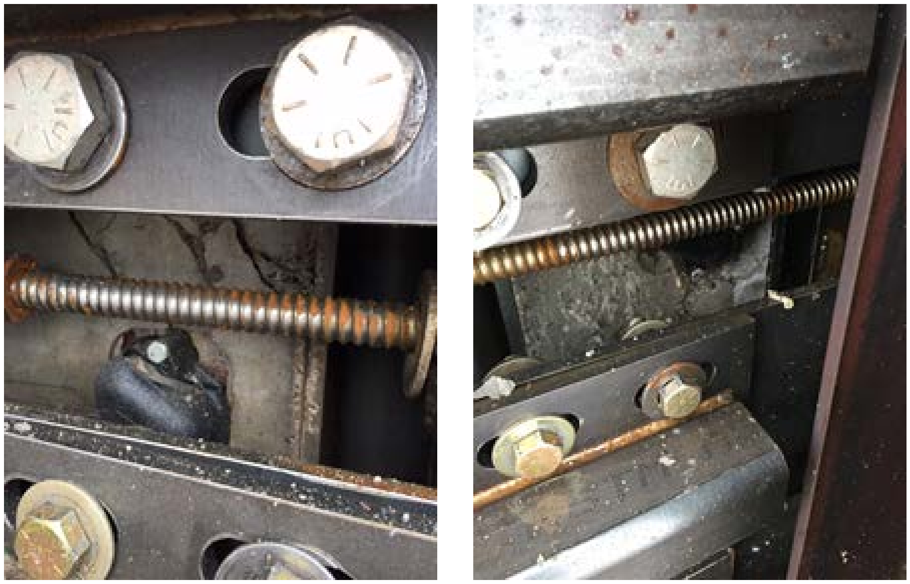
Post-Test Documentation

The blast load resulted in horizontal, vertical, and diagonal cracks on the front face of the panel, along with a concrete crushing/scabbing pattern similar to previous tests. This front face damage is shown in Figure 5-34. On the back face, cracking was observed along most of the slab surface, as shown in Figure 5-35. Cracks were mostly hairlines in a yield line pattern similar to previous tests. The main cracks on the interior face were central horizontal and vertical cracks with a width range of approximately 0.016 to 0.2 inch (0.41 to 0.5 mm). More significant cracking up to 0.1 inch (2.5 mm) and some minor spalling were noted along all edges of the panel. Heavier cracking was also observed across the slab thickness, as shown in Figure 5-36, which was in a similar pattern to previous tests. Moreover, disengagement of the concrete up to ½-inch (13 mm) along all the corner regions of the slab was recorded. No damage was observed to the stiffened steel frame.

Figure 5-34: Front Face Slab Scabbing in Test 8

Figure 5-35: Cracking Pattern on Back Face in Test 8

Figure 5-36: Through-Thickness Cracking along Side Edge in Test 8



Peak pressures recorded ranged from about 400 to 1100 psi. Peak impulse recorded was near 500 psi-ms. The maximum deflection recorded with the laser sensors was 3.3 inches (85 mm), which translates to a 2.1-degree support rotation. The permanent set near the slab center point was 2.0 inches (50 mm). Individual gauge outputs and traces of strain, displacement, and pressure are provided on pages E-88 through E-94 of Appendix E.

The slab sustained significant permanent deflections with concrete disengagement at the PT tendons that was deemed unrepairable, but no back face debris. The overall slab response for Test 8 most nearly corresponds to Heavy Damage, as defined in CSA S850-12 or ASCE 59-11.

6 CONCLUSIONS

The PT slabs in the main portion of the testing program achieved support rotations ranging from 0.4 degree (Test 4a, Slab Type C) to 3.0 degrees (Test 3, Slab Type C). The corresponding damage level for these tests would roughly range from Superficial Damage to Heavy Damage as defined in CSA S850-12 or ASCE 59-11. However, from the extent of concrete disengagement observed on the Type C slab following Test 3, it would appear a 3.0-degree rotation is approaching the PT slab's upper limit state for non-hazardous damage (i.e., near a transition from Heavy to Hazardous Damage). Other tests sustaining support rotations exceeding 2.0 degrees exhibited lesser, but observable through-cracking and/or concrete disengagement.

Comparing the results for Test 6 and Test 7 (each subject to a 2000-lb ANFO charge) and Test 5 and Test 8 (each subject to a 2300-lb ANFO charge), it appears that the increase of pre-stressing level from 725 psi (5 MPa) to 1450 psi (10 MPa) may only have a marginal effect on slab response for the slabs with the higher level of conventional reinforcement (i.e., Slab Types B and D).

Front face scabbing and through-thickness cracking were generally more pronounced for slabs with a lower concrete tensile strength. However, charge weight size (i.e., applied load) heavily influenced the overall response mechanisms.

The currently published CSA and ASCE response limits for PT slabs provide a 1-degree upper limit for Moderate Damage and a 2-degree upper limit for Heavy Damage for slabs with a low reinforcement index (i.e., $\omega_p < 0.15$) provided adequate shear reinforcement is included. The slabs in this testing program have relatively high reinforcement indices (i.e., ω_p near or above 0.30). These would usually be governed by ductility with a limit deflection for Heavy Damage below 1.0 inch (25 mm), which corresponds to a support rotation below 0.6 degree. In Test 4a (Slab Type A), the test panel sustained only Superficial Damage with a maximum displacement of 0.6 inch (16 mm), which corresponds to a support rotation of 0.4 degree. In Test 6 (Slab Type B) and Test 7 (Slab Type D), the test panels sustained Moderate Damage without concrete edge crushing or disengagement. The maximum support rotation for these two tests was 0.8 degree. Therefore, from the test results, it seems that the actual flexural response limits would fall between the currently published limits for pre-stressed concrete (i.e., upper limit for Moderate Damage of $\mu = 0.8$; upper limit for Heavy Damage of $\mu = 0.9$) and conventionally reinforced concrete (i.e., upper limit for Moderate Damage of $\theta = 2$ degrees; upper limit for Heavy Damage of $\theta = 5$ degrees) elements.

However, the designer should be cautious about using higher response limits due to potential brittle responses associated with PT concrete, wherein catastrophic concrete crushing or shear-controlled behavior could occur prior to PT tendon yielding. In any case, adequate supplemental steel (e.g., shear or bursting reinforcement) should be provided within PT slabs (particularly when the slabs are over-reinforced) in addition to PT tendons and conventional steel reinforcement that are designed exclusively for meeting flexural response demands. Additional testing and/or detailed analysis that can account for concrete disengagement, as well as shear and/or concrete-crushing controlled responses (e.g., finite element modeling), should be performed to justify any modification to the currently published response limits and further examine the effects of pre-stressing/post-tensioning in blast applications.

APPENDIX A. CALCULATIONS AND DRAWINGS

Stress Level Calculations

Slabs were post-tensioned using the VSL 6-4 strand Post-Tensioning System. Strands were placed in 72/21 flat ducts measuring 1.378 inches (35 mm) high × 3.386 inches (86 mm) wide. Four strands were located within each duct. The ducts were centered in the thickness of the slabs in one direction and staggered in the other direction to minimize the eccentricity of the applied force.

Slabs were post-tensioned with 0.6-inch, Grade 270 strands (15mm, Grade 1860) complying with ASTM A416. Lower level stress strands were pulled to approximately 60% of f_{pu}; higher level stress strands were pulled to 85% of f_{pu}. Each lower level stress strand was pulled 35.0 kips (156 kN); each higher level stress strand was pulled 49.6 kips (220 kN).

$$P_i(lower\ stress) = 0.6 f_{pu} A_{ps}$$
$$P_i(lower\ stress) = 0.6(270ksi)(0.217in^2) = 35.0\ kips$$
$$P_i(higher\ stress) = 0.85 f_{pu} A_{ps}$$
$$P_i(higher\ stress) = 0.85(270ksi)(0.217in^2) = 49.6\ kips$$

The length of the pre-stressed strands was 16 feet (4880 mm). Anticipated anchorage seating was ¼-inch (6.4 mm). With a strand seating loss, the anticipated force in the lower level stress strand was approximately 26.5 kips (118 kN); the anticipated force in the higher level stress strand was approximately 41 kips (182 kN).

The area of concrete in each direction is A_c = 2040 in^2 (33,430 cm^2).

Lower Level Stress

Slabs A and B were stressed to approximately 725 psi (5 MPa). These panels had 14 ducts in both directions. Each panel cross section had 56 strands.

$$P_e = (\#\ of\ strands)P_0 = (56)(26.5\ kips) = 1484\ kips$$

Compression stress in concrete:

$$f'_c = \frac{P_e}{A_c} = \frac{1484kips}{2040in^2} = 726\ psi$$

Higher Level Stress

Slabs C and D were stressed to approximately 1450 psi (10 MPa). These panels had 18 ducts in both directions. Each panel cross section had 72 strands.

$$P_e = (\#\ of\ strands)P_0 = (72)(41\ kips) = 2952\ kips$$

Compression stress in concrete:

$$f'_c = \frac{P_e}{A_c} = \frac{2952kips}{2040in^2} = 1446\ psi$$

Stress Checks

ACI 318-14 limits concrete compressive stress to the following values: 0.45*f'c* for pre-stress plus sustained load, and 0.60*f'c* for pre-stress plus total load.

When in a horizontal position, supported at its ends, the panel will see stresses due to a self-weight dead load moment.

$$M_d = wl^2/\,8 = 2125\frac{lb}{ft} \times (16\,ft)^2/\,8 = 68{,}000\,ft - lb$$
$$S_b = S_t = \frac{bh^2}{6} = \frac{(192in)(10.625in)^2}{6} = 3612.5\,in^3$$

Stresses in top of slab (at mid-span, higher stress level):

$f_t = \frac{P}{A} + \frac{M}{S} = (1446\,psi) + (68{,}000 ft - lb) \times \left(\frac{12in}{ft}\right) /\, 3612.5\,in^3$ = 1672 psi (compression)

Stresses in bottom of slab (at mid-span, higher stress level):

$f_b = \frac{P}{A} - \frac{M}{S} = (1446\,psi) - (68{,}000 ft - lb) \times \left(\frac{12in}{ft}\right) /\, 3612.5\,in^3$ = 1220 psi (compression)

These values do not exceed a value of 0.45*f'c* (2700 psi).

Support Rotation Calculations

Support rotation and ductility ratio are commonly used blast design metrics for comparing component response to allowance criteria. Support rotation is defined as the angle formed by the component deflection and the original unloaded component, assuming a straight-line deflection shape. Therefore, the calculated support rotation is not necessarily the actual rotation angle of the component at its support. For a component that achieves a maximum deflection at its mid-span, support rotation would be defined as:

$\theta = tan^{-1}[x_{max}/(L/2)]$.

As an example, for Test 8, the maximum deflection near the slab center point was 3.3 inches (85 mm). Therefore, for a span of 180 inches (4570 mm), the support rotation was calculated as:

$\theta = tan^{-1}[3.3\,in\,/\,90\,in]\ = 2.1°$.

For cases where the maximum deflection occurs away from the slab center (e.g., Test 1 and Test 2), the maximum deflection would be divided by a value less than 90 inches (2290 mm) in determining its support rotation.

For ductility limits, the maximum deflection is compared to the SDOF elastic deflection of the slab. For Slab Types A and C, the elastic deflection is approximately 0.8 inch (20 mm) for all cases. For Slab Types B and D, the elastic deflection is approximately 1.0 inch (25 mm) for all cases. Therefore, a ductility limit of μ = 0.7 (Superficial Damage upper limit) would translate to a maximum deflection of approximately 0.56 inch (14 mm) or 0.70 inch (18 mm) depending on the slab type. Analogous Heavy Damage limits (μ = 0.9) would be approximately 0.72 inch (18 mm) or 0.90 inch (23 mm) depending on the slab type. These Heavy Damage limit deflections correspond to support rotations of 0.5 degree and 0.6 degree, respectively.

Reinforcement Index Calculations

The reinforcement index of a pre-stressed concrete component is defined as:

$$\omega_p = A_{ps} \,/\, bd_p \,\times\, f_{ps} \,/\, f'_c,$$

where A_{ps} is the area of pre-stressed reinforcement in the tension zone, b is the pre-stressed reinforcement spacing, d_p is the depth to center of the pre-stressing steel, f'_c is the concrete compressive strength, and f_{ps} is the calculated stress in the pre-stressing steel at the design load.

As an example, for Panel 5A, the area of pre-stressed reinforcement was 0.868 in^2 (560 mm^2) spaced at 12 inches (305 mm) on center, roughly centered to the slab thickness. The estimated stress in the pre-stressing steel at the design load was calculated as 199 ksi (1370 MPa) using equations within Section 20.3.2 of ACI 318-14. Therefore, the reinforcement index was calculated as:

$$\omega_p = 0.868\,in^2 \,/\, 12\,in \,/\, 5.31\,in \,\times\, 199\,ksi \,/\, 9.43\,ksi = 0.29.$$

Reinforcement index values for all test slabs are summarized below.

Table A-1: Slab Reinforcement Index Summary

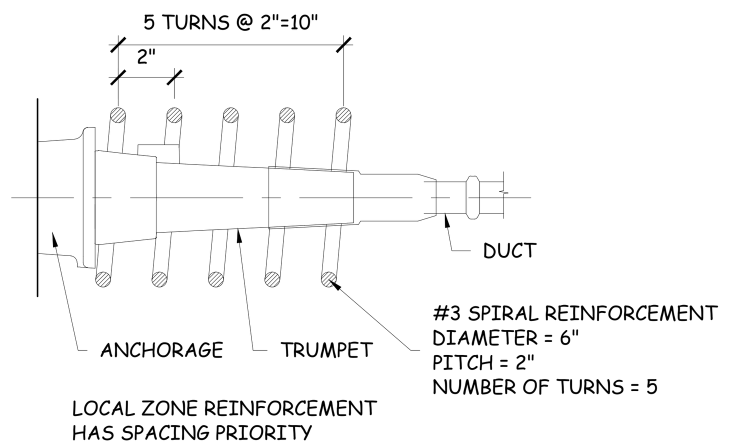
Test Number	Panel Number	Reinforcement Index, ω_p
1	5A	0.29
2	1A	0.32
3	2C	0.38
4a	6C	0.38
4b	6C	0.38
5	7B	0.29
6	3B	0.33
7	4D	0.33
8	8D	0.36

Tensile Strength Calculations

Concrete tensile strength values provided in Table 3-2 were calculated as 15% of the corresponding average concrete compressive strength values at 28 days attained from crushing tests.

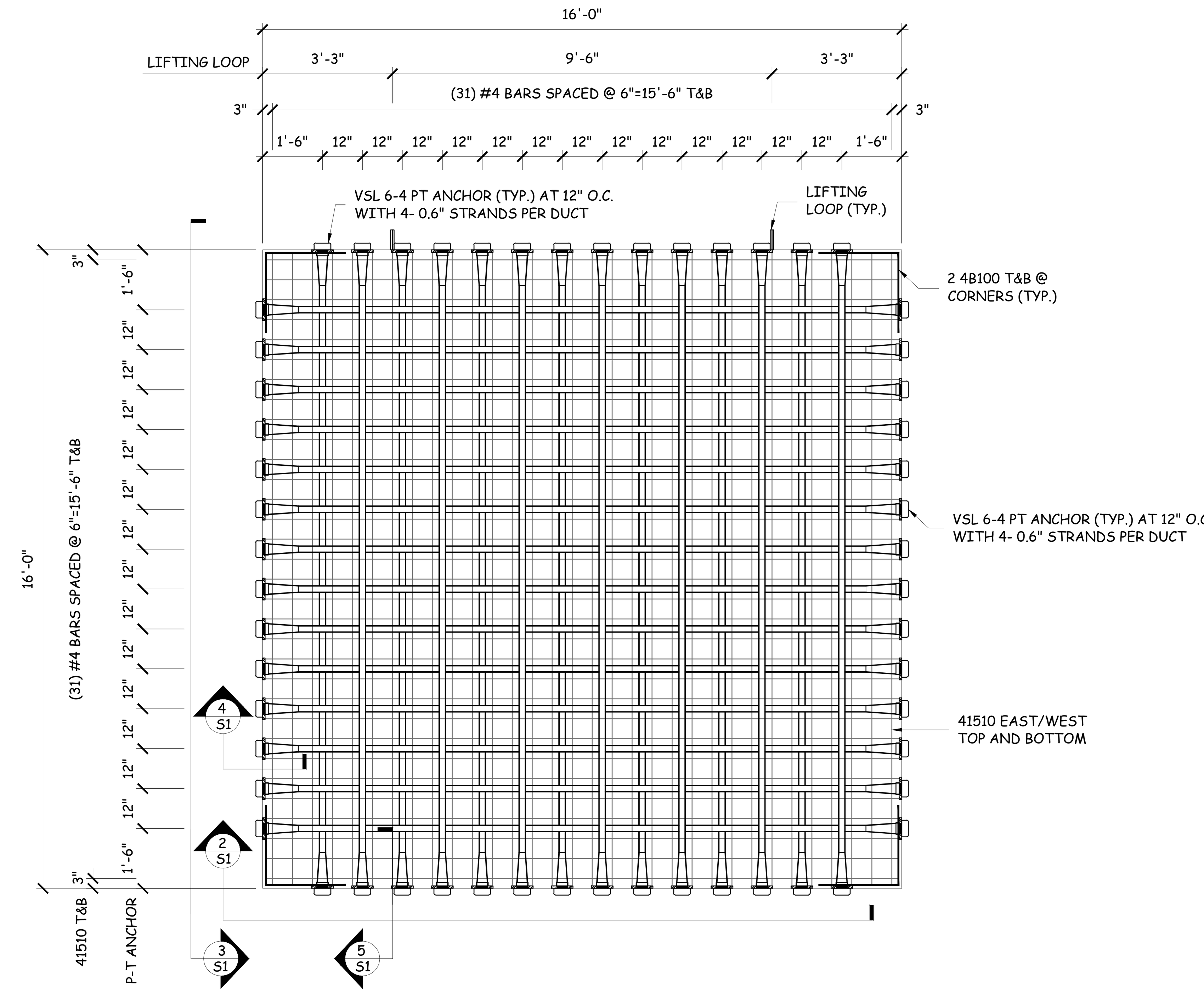
As an example, for Panel 1A, the average compressive strength at 28 days was determined to be 7830 psi (54.0 MPa) from testing. Therefore, the concrete tensile strength was estimated as:

$$f'_t = 0.15\,f'_c = 0.15 \times 7830\,psi\,(54.0\,MPa) = 1170\,psi\,(8.1\,MPa).$$

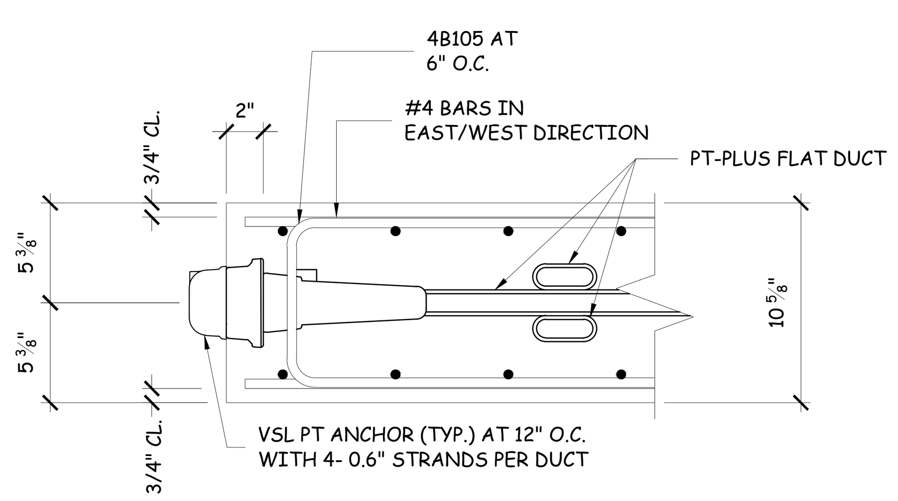


6/S1 LOCAL ZONE REINFORCEMENT

DESCRIPTION				QTY
41510	#4	15'-10"	A615	128
4B100	#4	2'-0" / 2'-0"	A615	8
4B104	#4	1'-9" / 7 1/2" / 1'-9"	A615	64
4B105	#4	1'-9" / 9" / 1'-9"	A615	64



1/S1 BLAST PANEL TYPE "A" - PT TENDON LAYOUT



4/S1 SECTION - END ANCHORAGE DETAIL
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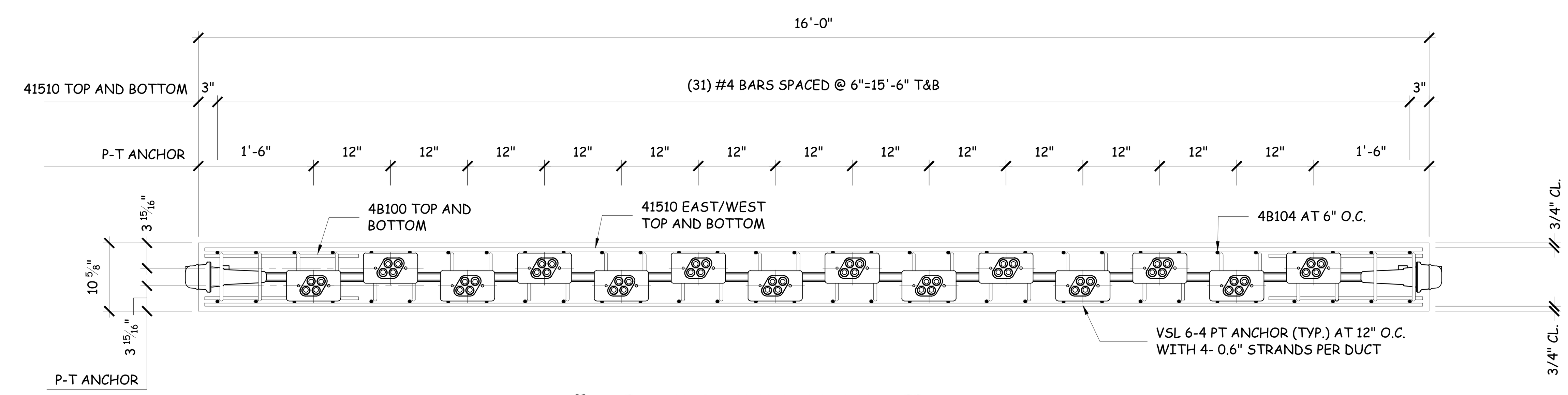
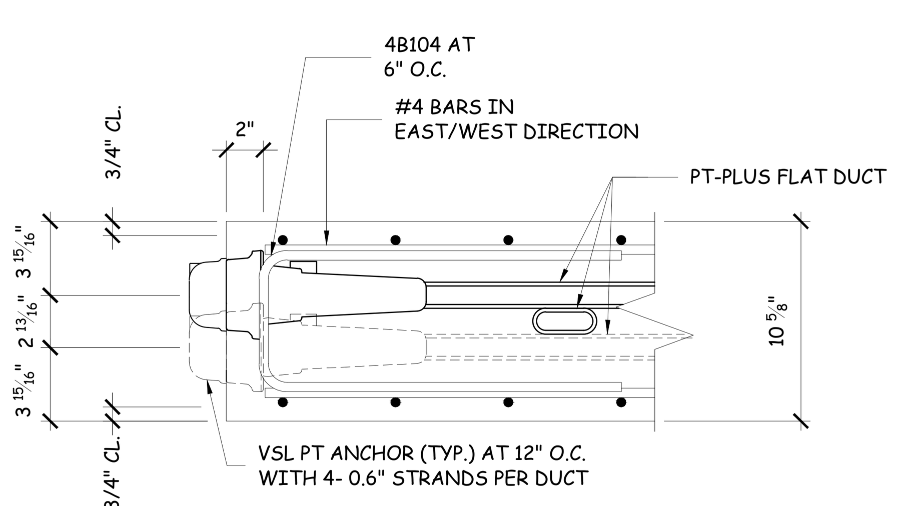
(SEE DETAIL 6/S1)



2/S1 SECTION - PT ANCHOR AND MILD STEEL LAYOUT



5/S1 SECTION - END ANCHORAGE DETAIL
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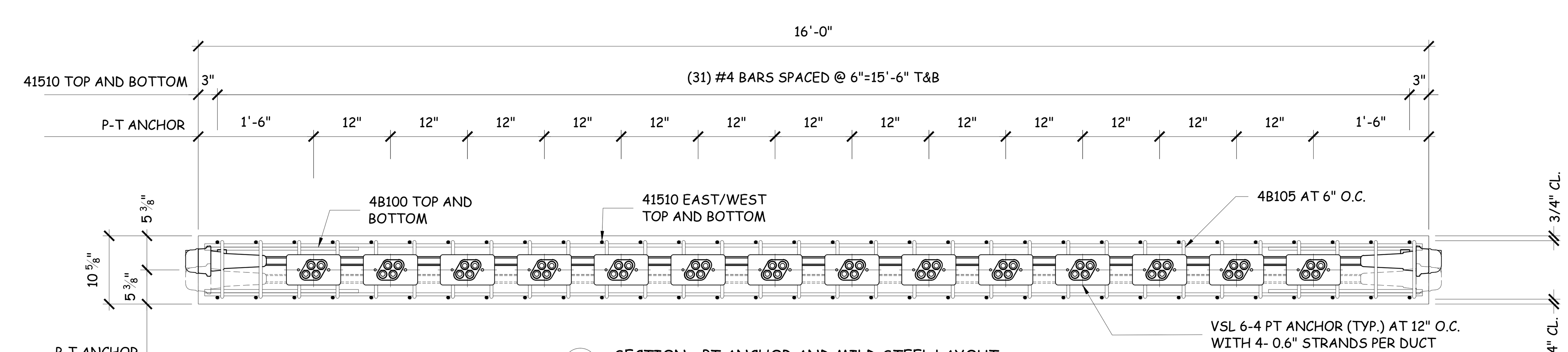

3/S1 SECTION - PT ANCHOR AND MILD STEEL LAYOUT

NO.	DATE	REVISION	BY
REV#			
REV#			
REV#			
REV#			

DES	NG	09/30/15
DRN	MHY	09/30/15
CHK	TA	09/30/15

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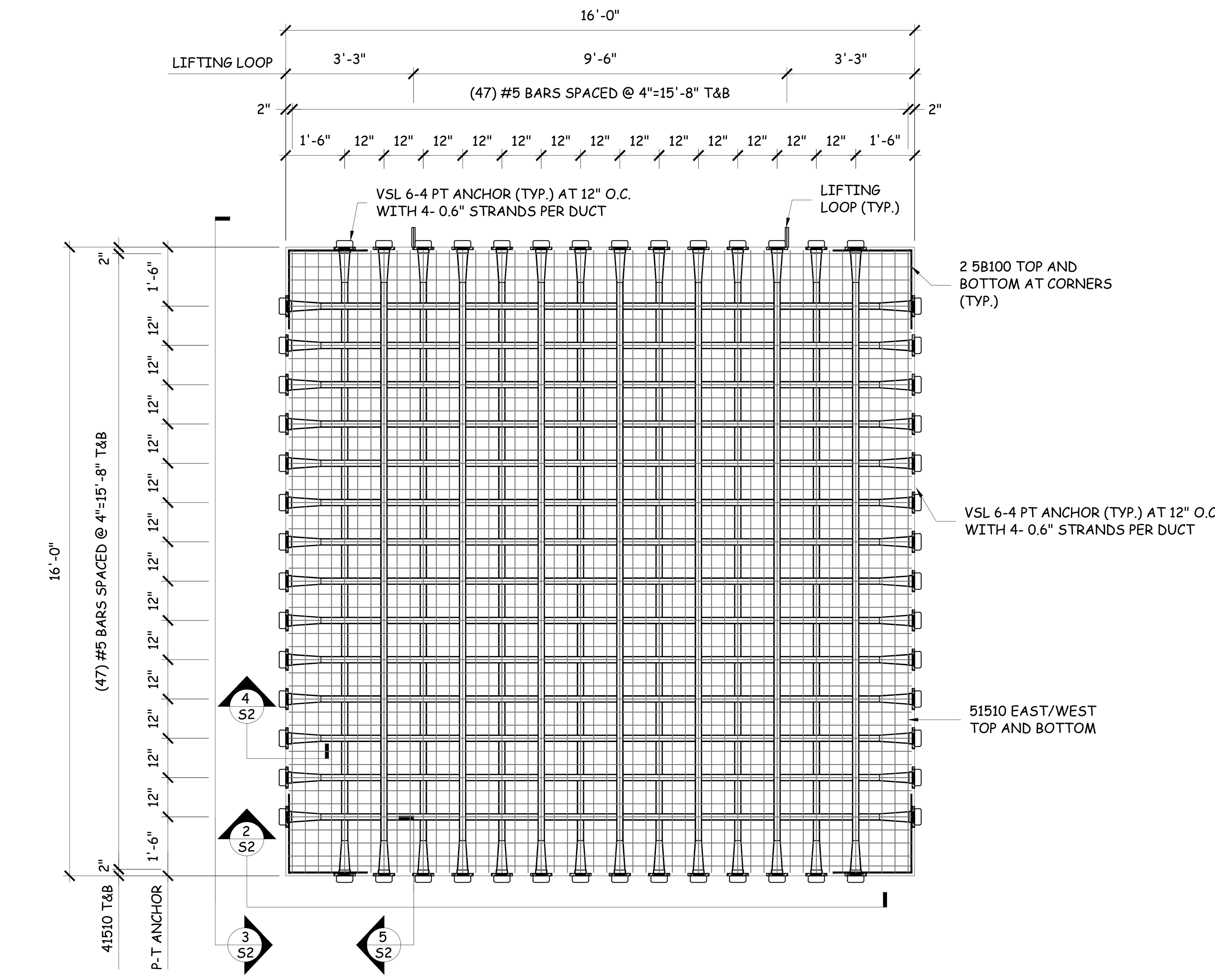
PROJECT STEX-0135
PRESTRESSED SLAB UNDER
BLAST LOADING

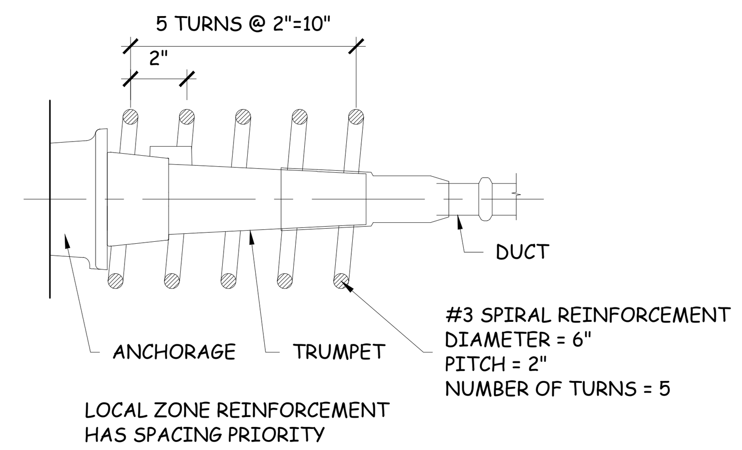
BLAST PANEL TYPE "A"
PLAN AND SECTION DETAILS

JOB NO:

SHEET: S1

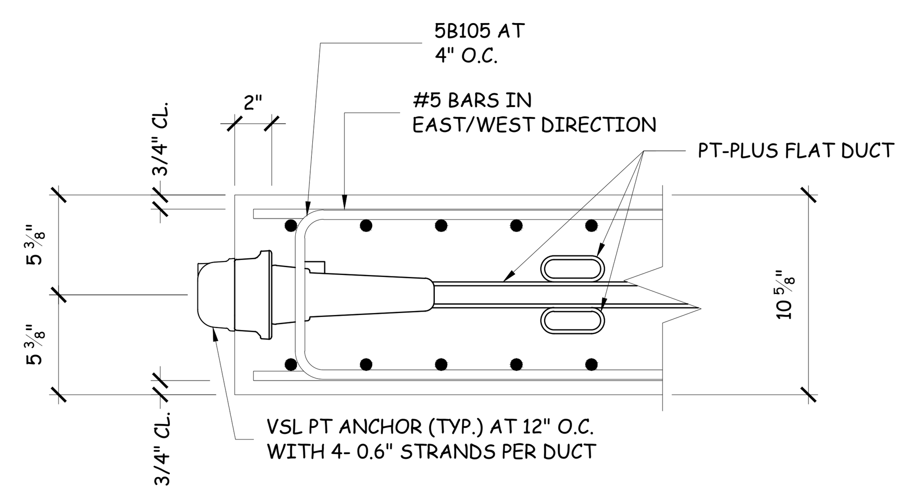


6 S2 LOCAL ZONE REINFORCEMENT



DESCRIPTION				QTY
51510	#5	15'-10"	A615	192
5B100	#5	2'-0" / 2'-0"	A615	8
5B104	#5	1'-9" / 7 1/2" / 1'-9"	A615	96
5B105	#5	1'-9" / 9" / 1'-9"	A615	96

1 S2 BLAST PANEL TYPE "B" - PT TENDON LAYOUT



4 S2 SECTION - END ANCHORAGE DETAIL
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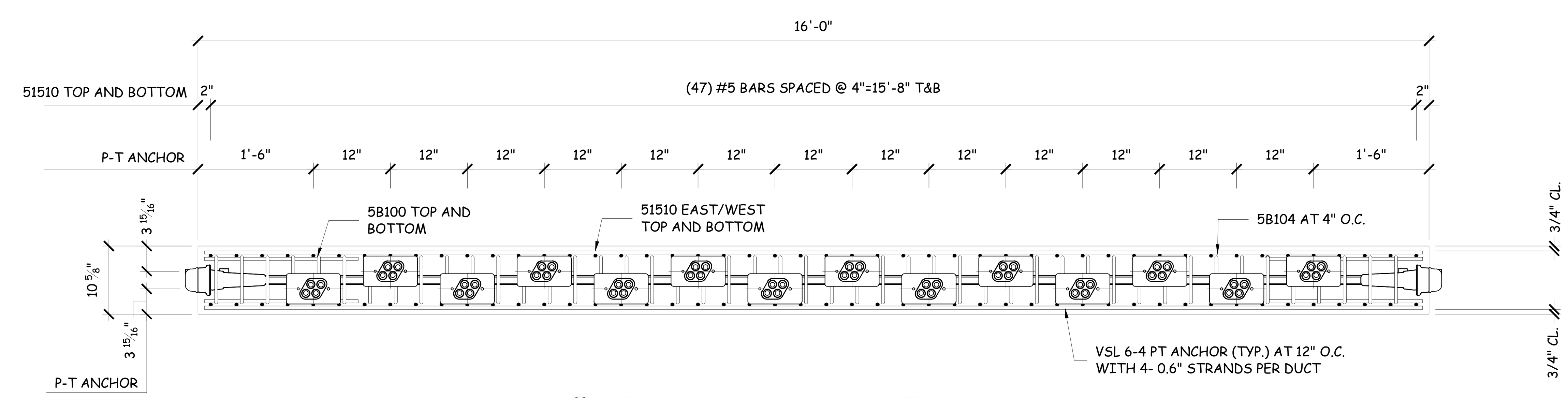
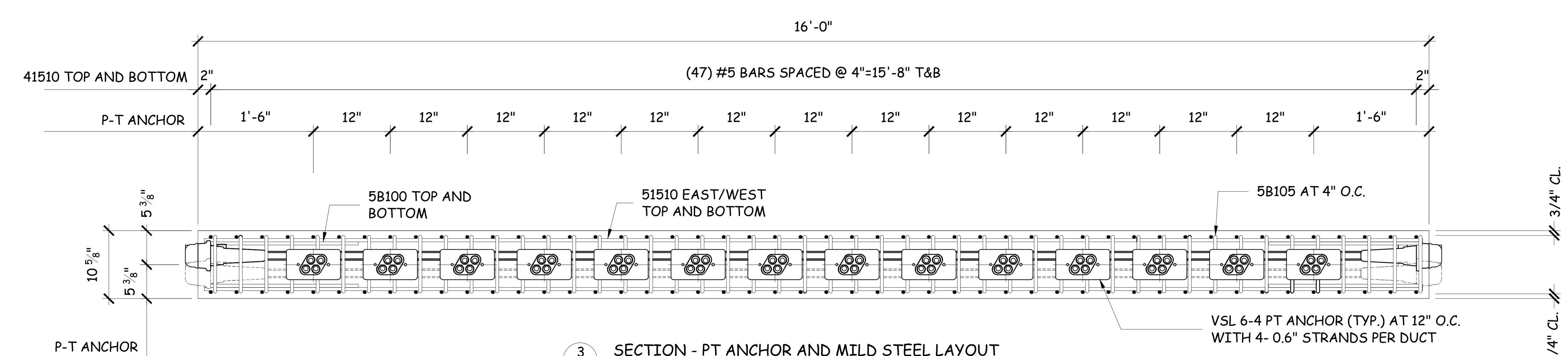
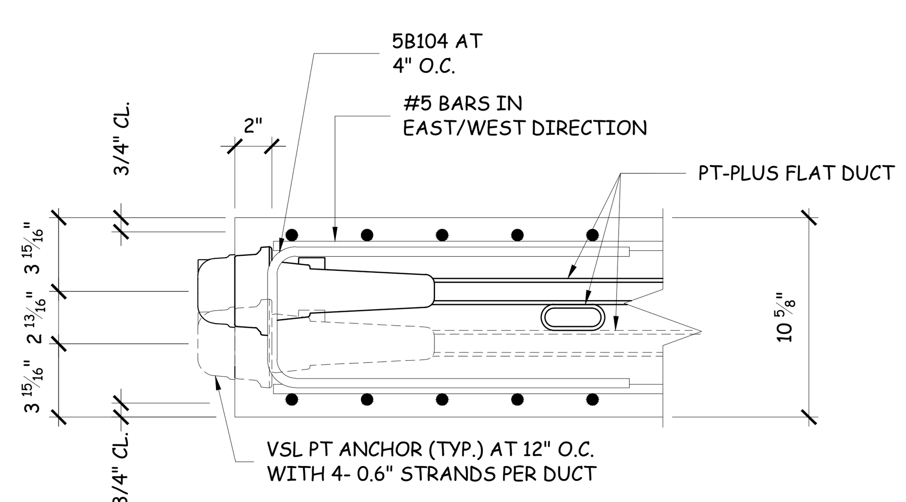


2 S2 SECTION - PT ANCHOR AND MILD STEEL LAYOUT



3 S2 SECTION - PT ANCHOR AND MILD STEEL LAYOUT



5 S2 SECTION - END ANCHORAGE DETAIL
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NO.	DATE	REVISION	BY
REV#			
REV#			
REV#			
REV#			

DES	NG	09/30/15
DRN	MHY	09/30/15
CHK	TA	09/30/15

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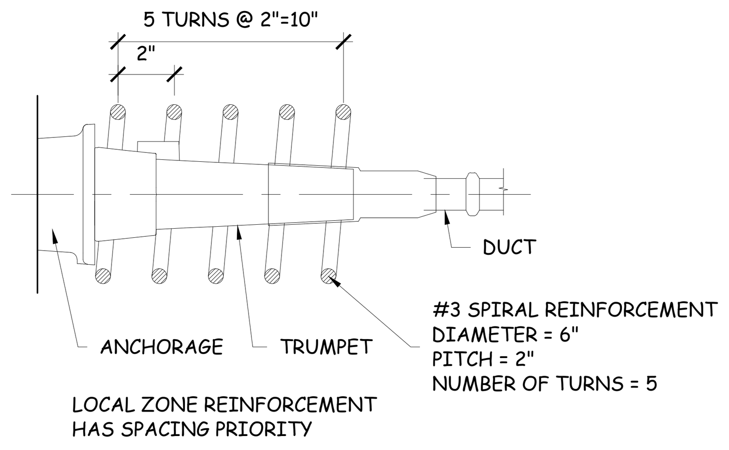
PROJECT STEX-0135
PRESTRESSED SLAB UNDER BLAST LOADING

BLAST PANEL TYPE "B"
PLAN AND SECTION DETAILS

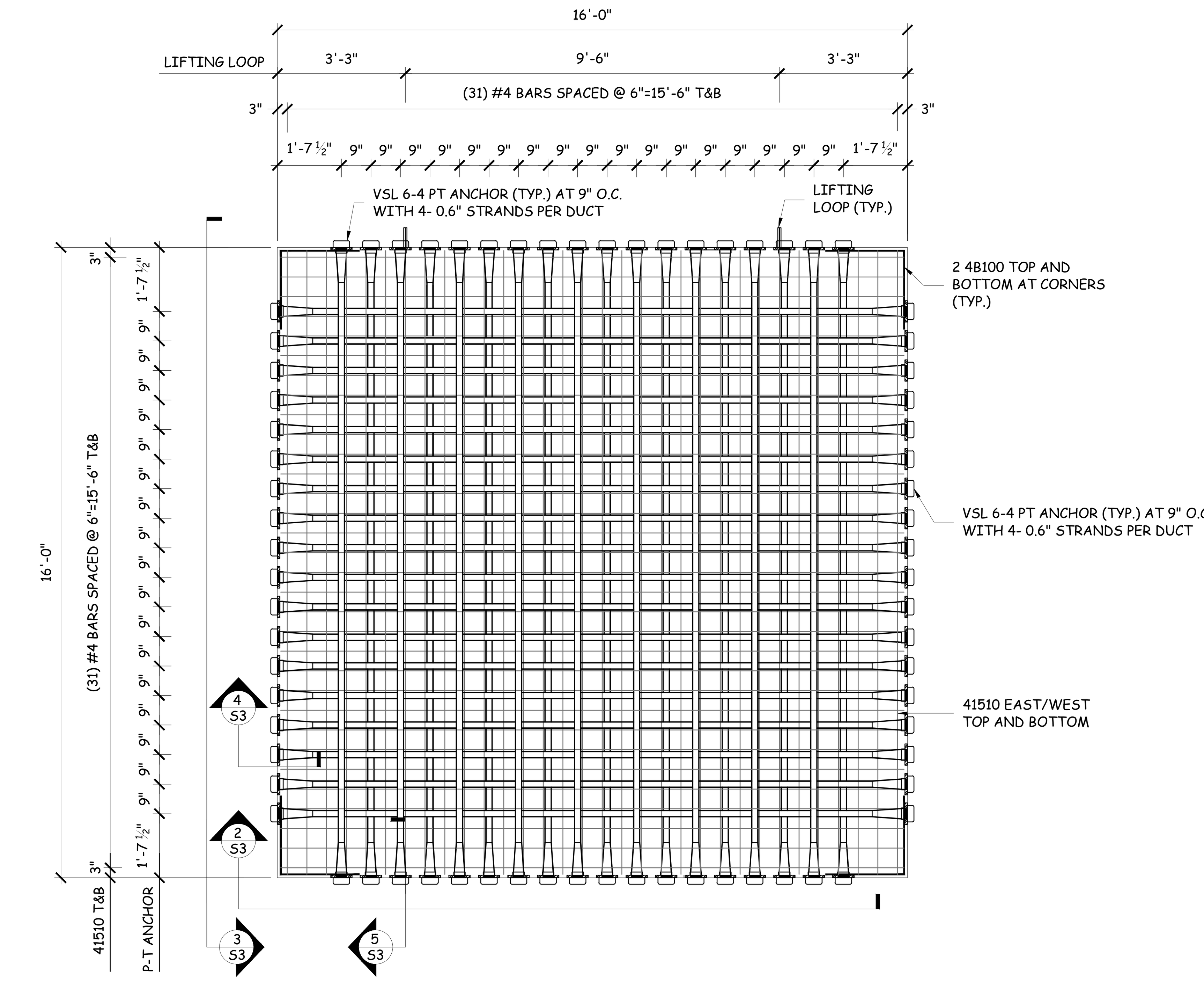
JOB NO:

SHEET: S2

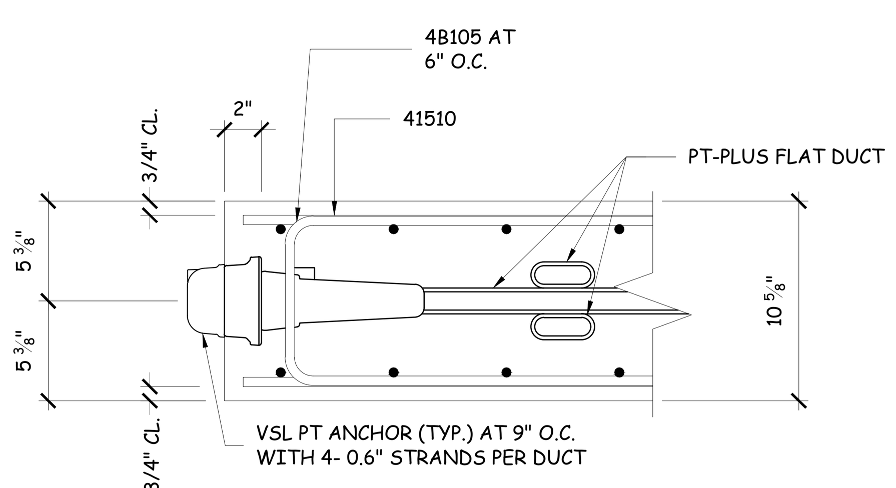


6/S3 LOCAL ZONE REINFORCEMENT

DESCRIPTION				QTY
41510	#4	15'-10"	A615	128
4B100	#4	2'-0" 2'-0"	A615	8
4B104	#4	1'-9" 7 1/2" 1'-9"	A615	64
4B105	#4	1'-9" 9" 1'-9"	A615	64



1/S3 BLAST PANEL TYPE "C" - PT TENDON LAYOUT



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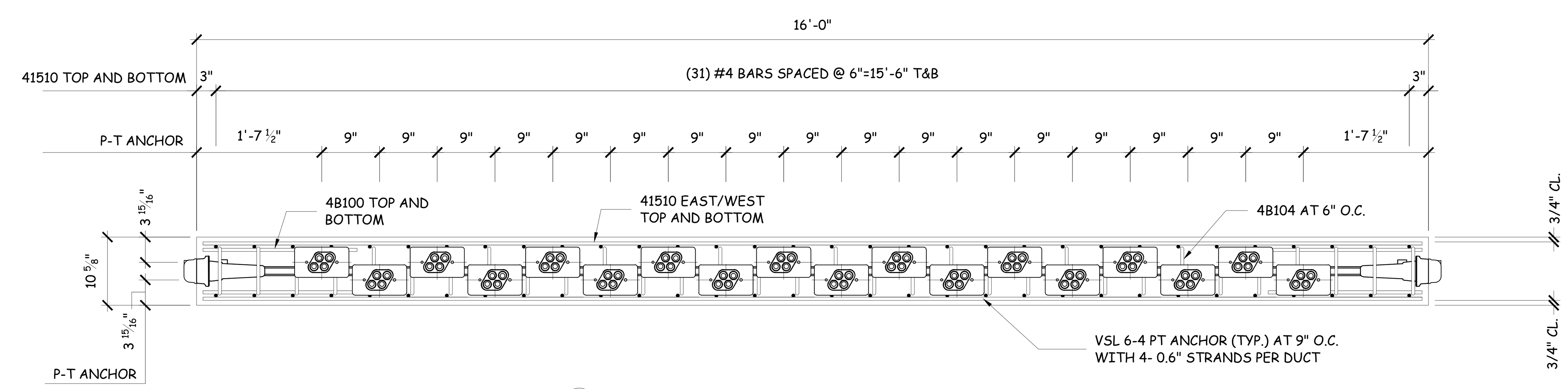
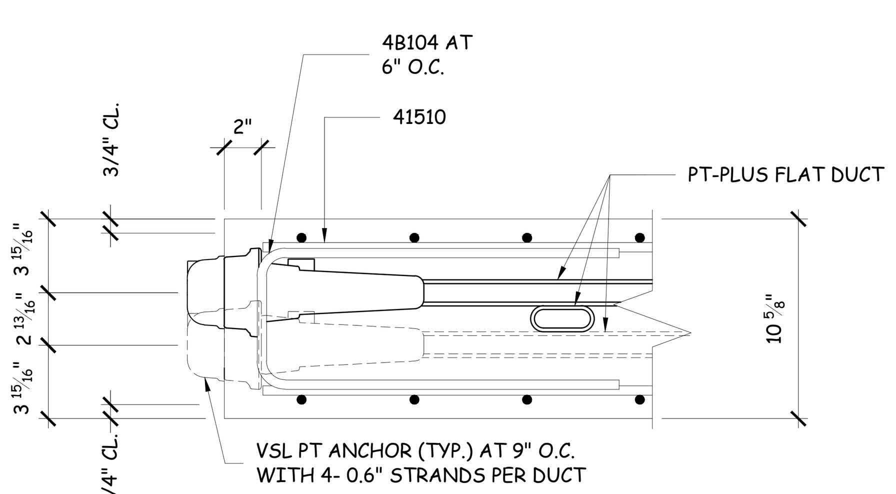


2/S3 SECTION - PT ANCHOR AND MILD STEEL LAYOUT



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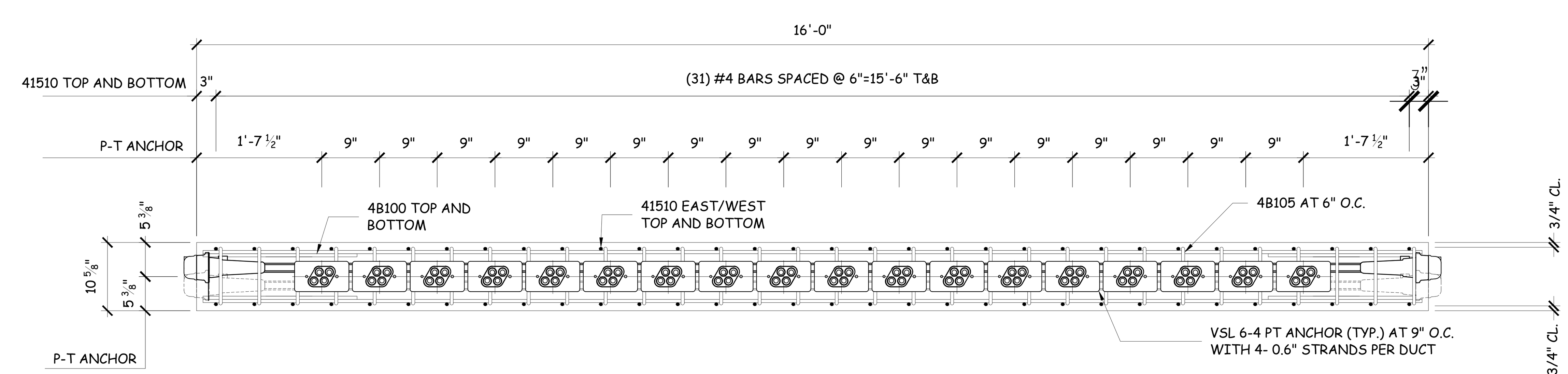

3/S3 SECTION - PT ANCHOR AND MILD STEEL LAYOUT

DES	NG	09/30/15	REV#	
DRN	MHY	09/30/15	REV#	
CHK	TA	09/30/15	REV#	
			REV#	
			NO. DATE	REVISION BY

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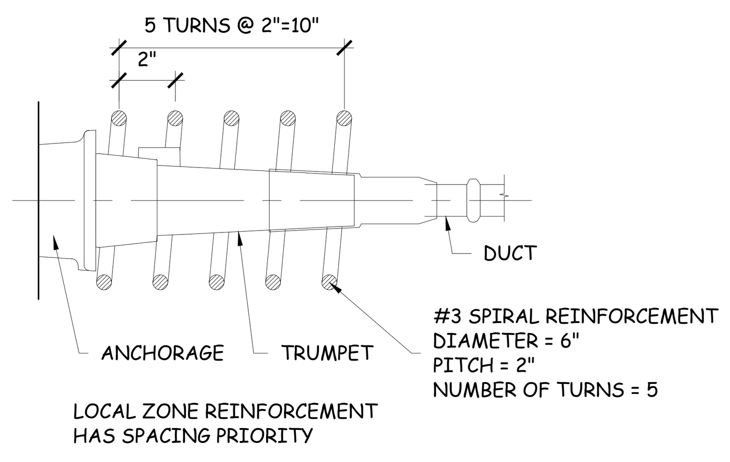
COLUMBIA, MD 21046 Fax: 410/850-4111

PROJECT STEX-0135
PRESTRESSED SLAB UNDER
BLAST LOADING

BLAST PANEL TYPE "C"
PLAN AND SECTION DETAILS

JOB NO:

SHEET: S3



6 S4 LOCAL ZONE REINFORCEMENT

DESCRIPTION				QTY
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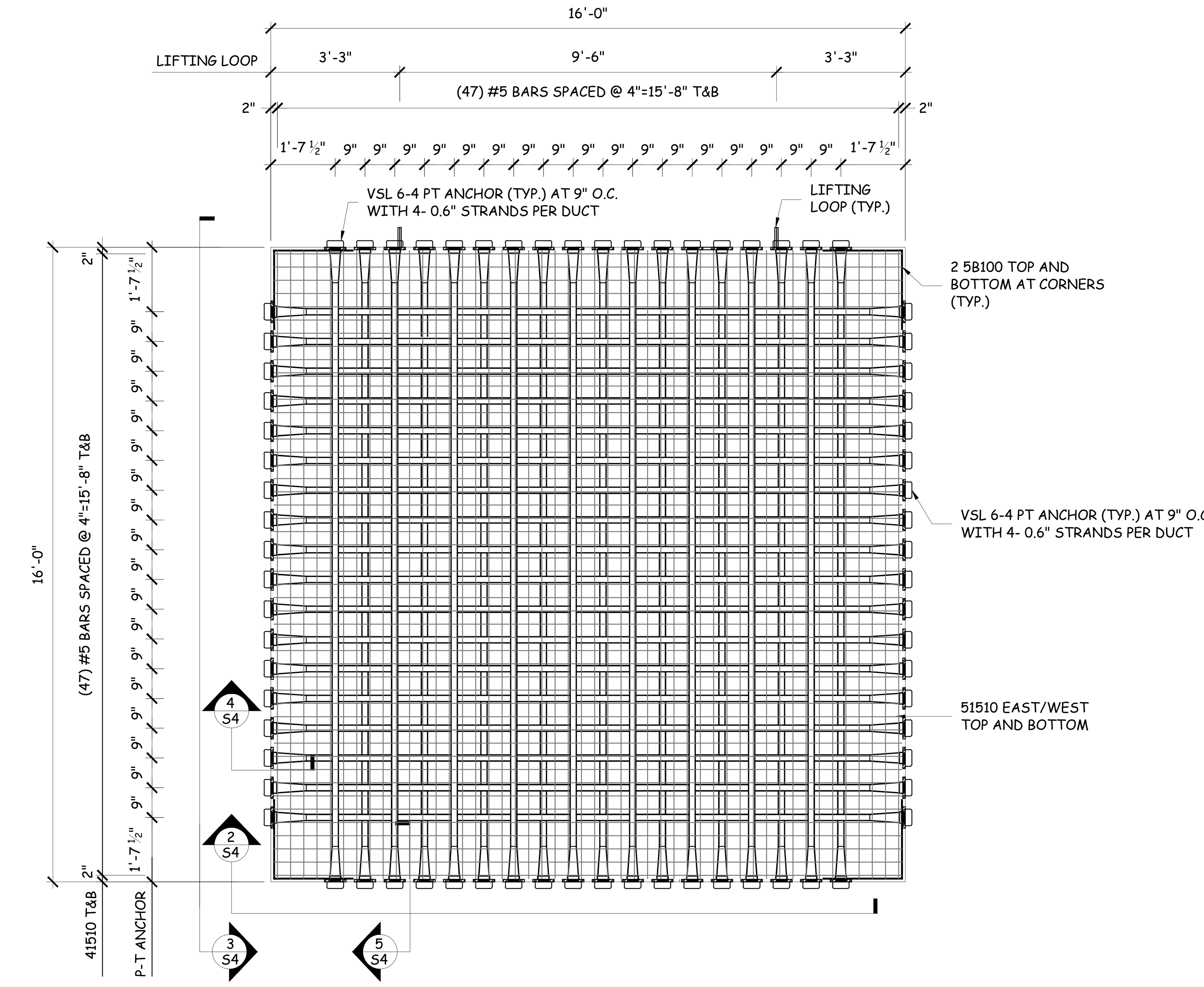
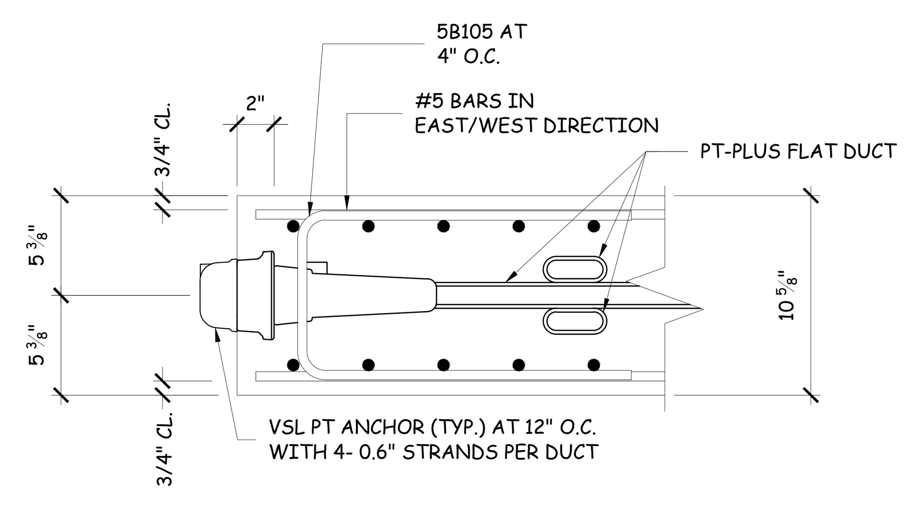
5B100 #5		2'-0" 2'-0"	A615	8
5B104 #5		1'-9" 7 1/2" 1'-9"	A615	96
5B105 #5		1'-9" 9" 1'-9"	A615	96



1 S4 BLAST PANEL TYPE "D" - PT TENDON LAYOUT



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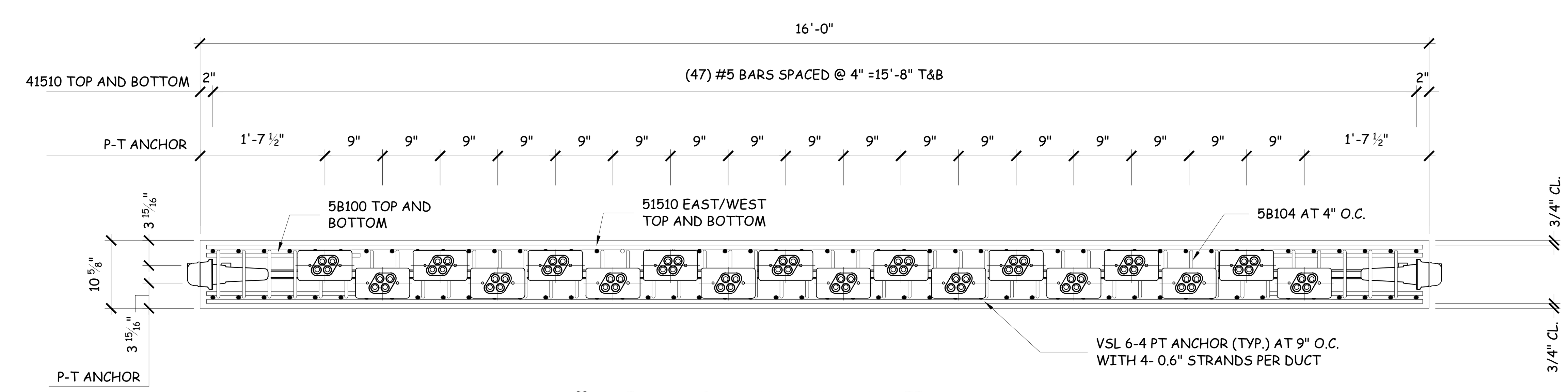
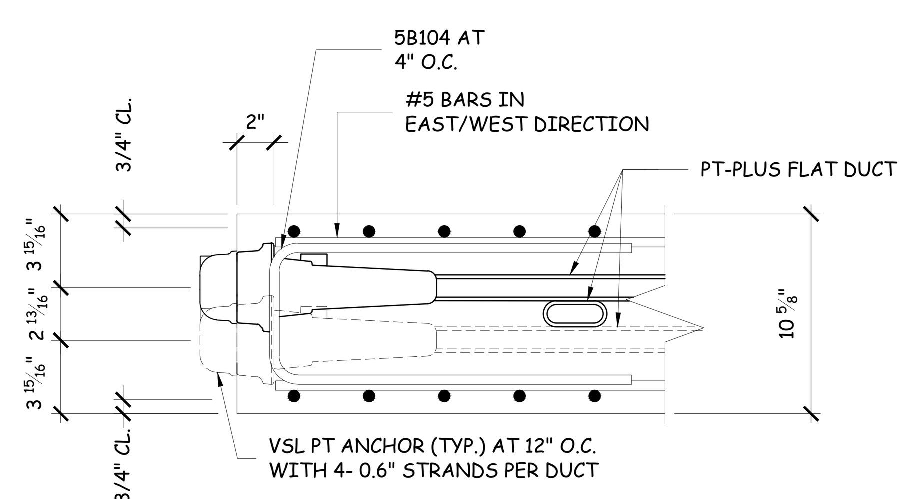
(SEE DETAIL 6/S4)



2 S4 SECTION - PT ANCHOR AND MILD STEEL LAYOUT



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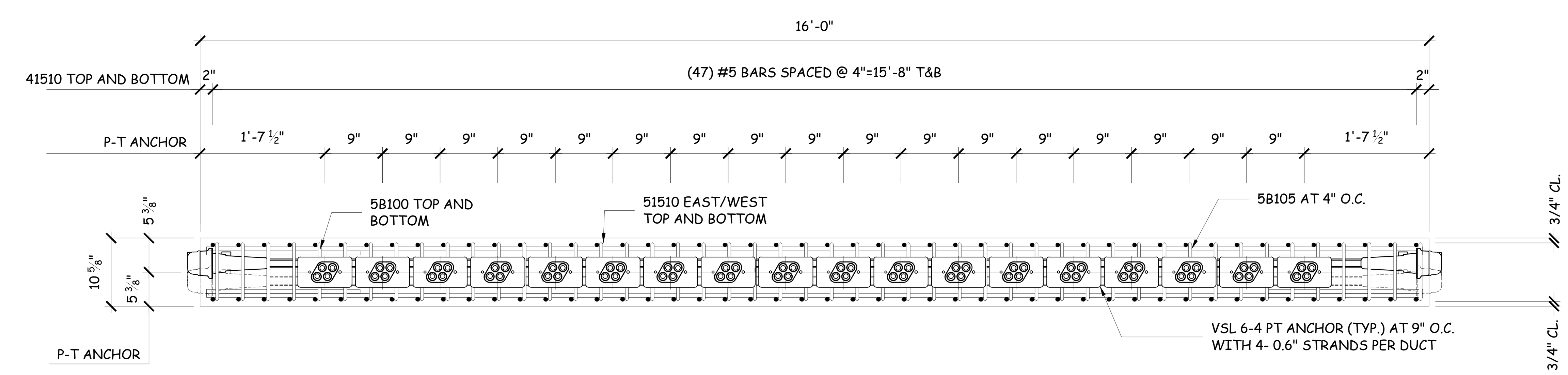

3 S4 SECTION - PT ANCHOR AND MILD STEEL LAYOUT

NO.	DATE	REVISION	BY

DES	NG	09/30/15 REV#
DRN	MHY	09/30/15 REV#
CHK	TA	09/30/15 REV#

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PROJECT STEX-0135
PRESTRESSED SLAB UNDER
BLAST LOADING

BLAST PANEL TYPE "D"
PLAN AND SECTION DETAILS

JOB NO:

SHEET: S4

APPENDIX B. VSL STRESSING PROTOCOLS, DATA, AND CERTIFICATION

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November 24, 2015

Khaled El-Domiaty
Stone Security Engineering
2011 Crystal Drive, Suite 400
Arlington, VA 22202

Re: P/T Stressing Certified Letter – OBL 466

Dear Khaled:

VSL, as the Post-Tensioning provider for the referenced project has reviewed the stressing records for all 8 panels of the referenced project and offer the following comments:

1. All tendon elongations were found to be within recommended tolerance of +/-7% plus ¼ in for extreme short tendons, such as the case for this project with tendon length being 16 ft. This is consistent with PTI/ASBI M50-12 “Guide Specification for Grouted Post-Tensioning” Section 12.6.

Based on the elongations recorded in the stressing report, VSL certifies that required post-tension forces shown on the construction drawings have been provided to the panels.

Our review of the stressing results and this certified letter are based strictly on the elongations recorded by VSL technicians on site between 11/17/2015 to 11/20/2015.

If you have any questions or comments, please contact the undersigned at VSL Dallas.

Sincerely,

Zuming Xia, Ph.D., P.E.
Senior Engineer

VStructural, LLC
15600 Trinity Boulevard, Suite 118 • Fort Worth, TX 76155 • Phone: 817-545-4807 • Fax: 817-545-4827
www.structuraltechnologies.com

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL - 466
LOCATION: Bond Oregon
SLAB #: 1
EDGE: E - W
GAUGE NO.: 6MR 053 A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MR 053
JACKING FORCE: 49.8
STRESSED BY: Emmanuel San Juan W; Omar Martinez R
VERIFIED BY: E Don Sear

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
1	A			-1/4	1 3/4	1 1/2	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/8	1 1/2	
2	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/2	-1/4	1 1/4	
3	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/4	1 1/4	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/8	1 1/4	
4	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/8	1 3/8	
5	A			-1/4	1 5/8	1 3/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/8	1 3/8	
6	A			-3/8	1 1/2	1 1/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 3/8	-1/8	1 1/4	
7	A			-3/8	1 1/4	1 1/8	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 3/8	-1/8	1 1/4	
8	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/4	1 1/4	
9	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 3/4	1 1/2	
	D			1 5/8	-1/4	1 3/8	
10	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1 1/4	1 5/8	1 3/8	
	D			1-1/2	-1/4	1 1/4	

OBL 466 Stressing Record
C:\Desktop\Prototype Panel\elongation\OBL 466 Stressing Record.docx 11/24/15

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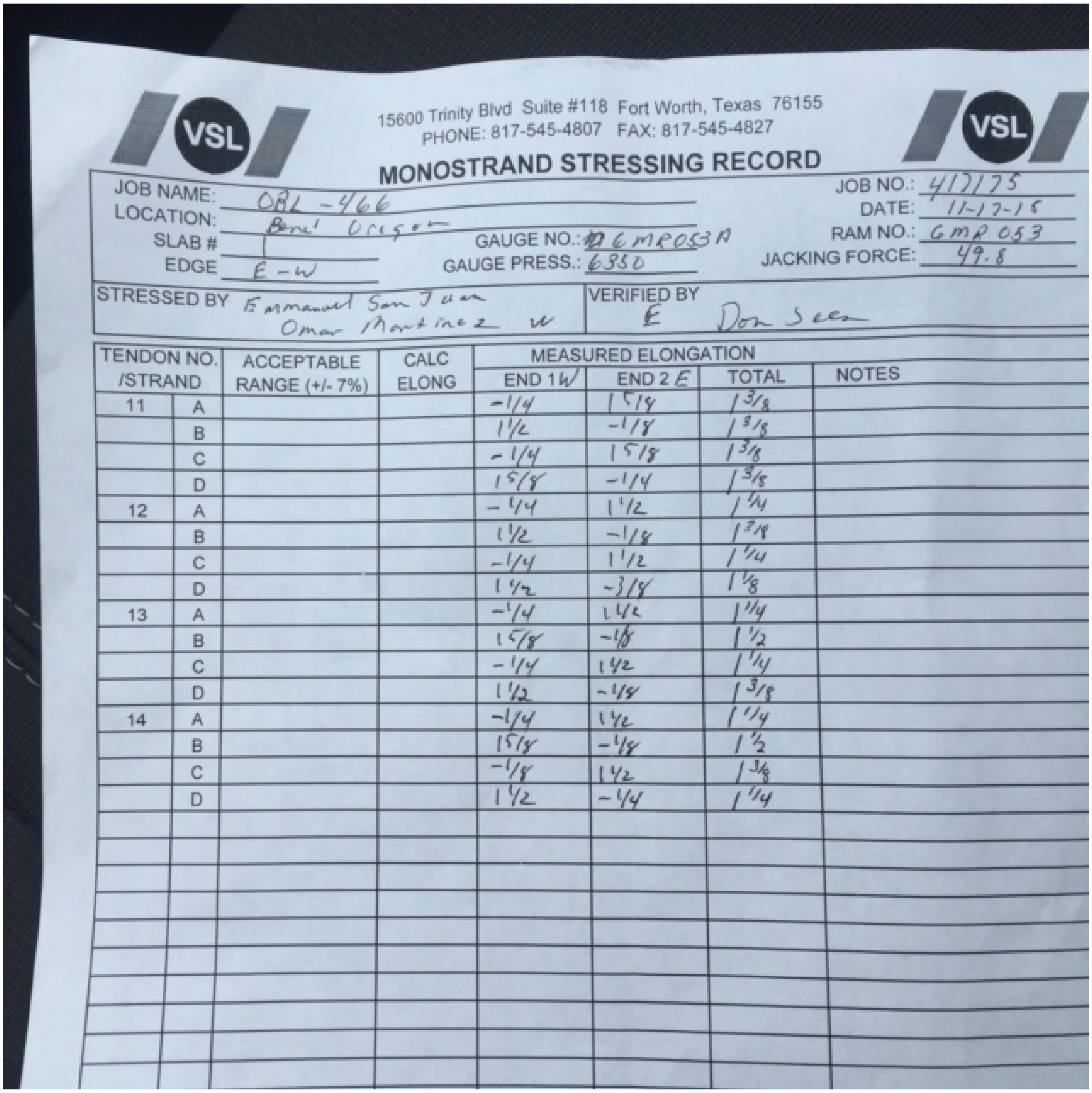

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL - 466
LOCATION: Bend Oregon
SLAB #: 1
EDGE: E - W
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MR 053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan W; Omar Martinez W
VERIFIED BY: E Don Sees

TENDON NO. /STRAND		ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	MEASURED ELONGATION END 2 E	MEASURED ELONGATION TOTAL	NOTES
11	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	
12	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/2	-3/8	1 1/8	
13	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/2	-1/8	1 3/8	
14	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/8	1 1/2	
	C			-1/8	1 1/2	1 3/8	
	D			1 1/2	-1/4	1 1/4	

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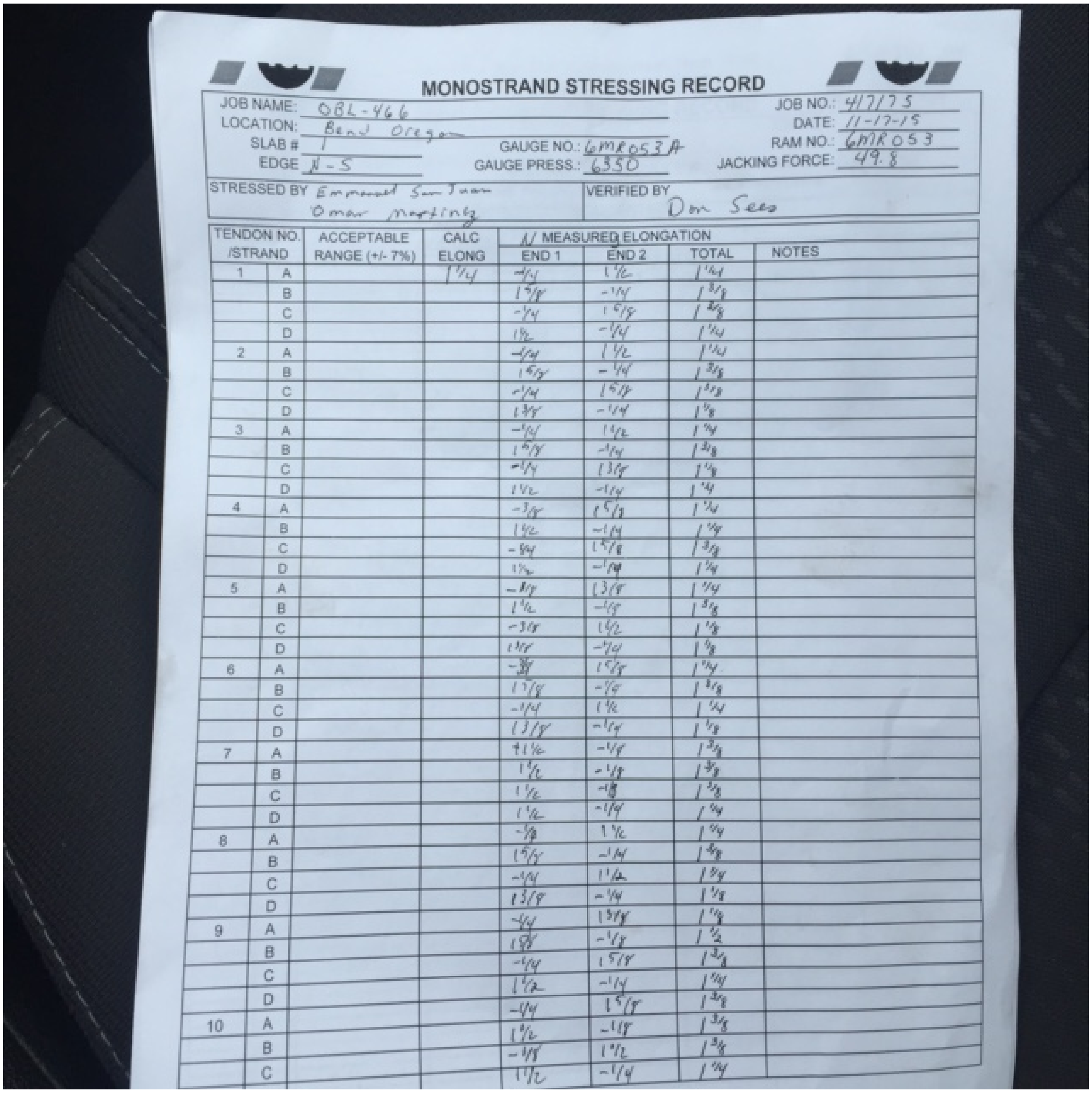

MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB # 1
EDGE N-S
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY Emmanuel San Juan
Omar Martinez
VERIFIED BY Don Sees

TENDON NO. /STRAND		ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1	END 2	TOTAL	NOTES
1	A		1 1/4	-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/4	1 1/4	
2	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 3/8	-1/4	1 1/8	
3	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/2	-1/4	1 1/4	
4	A			-3/8	1 5/8	1 1/4	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/4	1 1/4	
5	A			-1/8	1 3/8	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-3/8	1 1/2	1 1/8	
	D			1 3/8	-1/4	1 1/8	
6	A			-3/8	1 5/8	1 1/4	
	B			1 1/8	-1/8	1 3/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 3/8	-1/4	1 1/8	
7	A			+1 1/2	-1/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			1 1/2	-1/8	1 3/8	
	D			1 1/2	-1/4	1 1/4	
8	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 3/8	-1/4	1 1/8	
9	A			-1/4	1 3/8	1 1/8	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/4	1 1/4	
10	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/8	1 1/2	1 3/8	
				1 1/2	-1/4	1 1/4	

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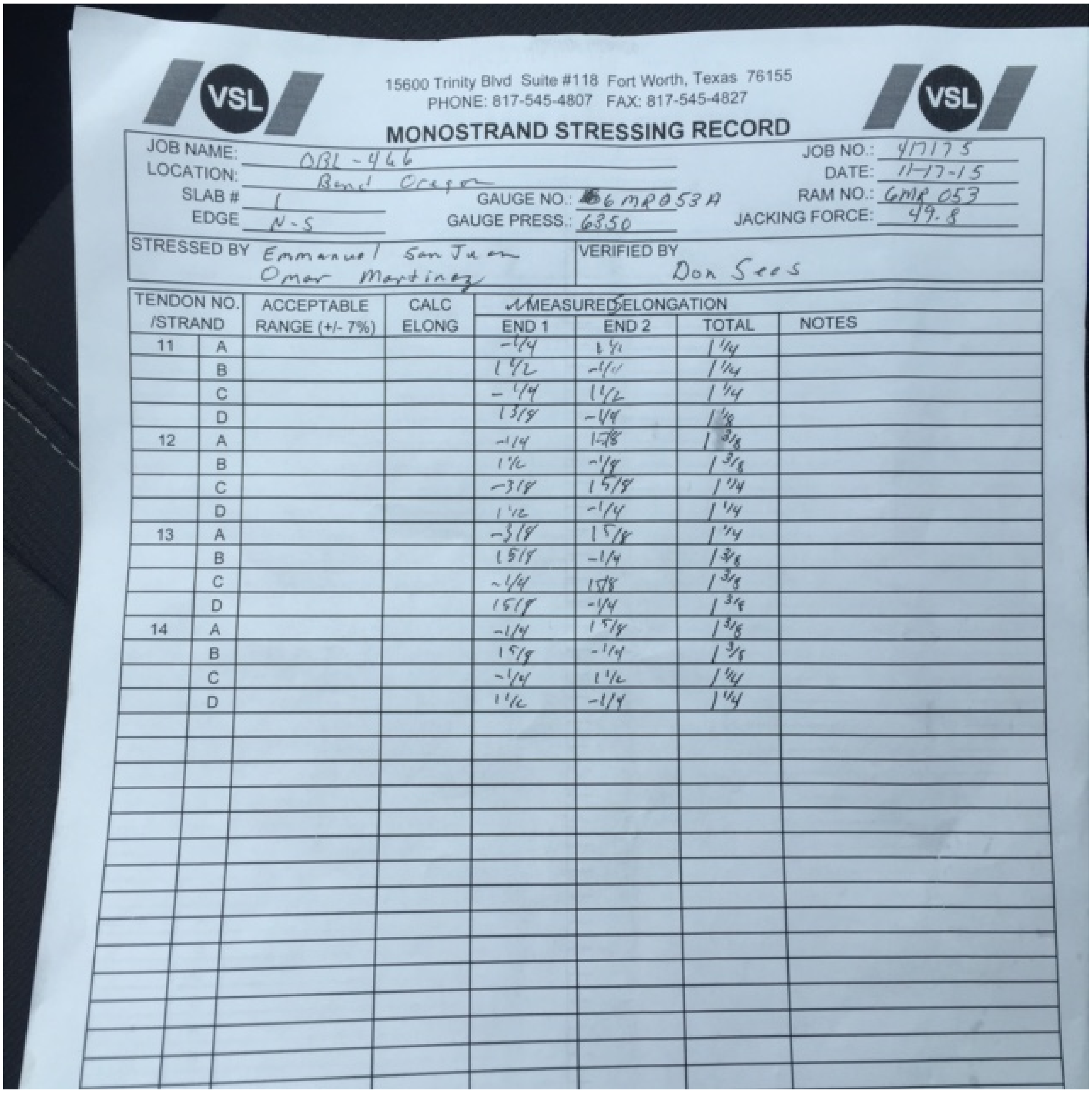

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL - 466
LOCATION: Bend Oregon
SLAB #: 1
EDGE: N-S
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: GMR 053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1	MEASURED ELONGATION END 2	MEASURED ELONGATION TOTAL	NOTES
11	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 1/2	1 1/4	
	D			1 3/8	-1/4	1 1/8	
12	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-3/8	1 5/8	1 1/4	
	D			1 1/2	-1/4	1 1/4	
13	A			-3/8	1 5/8	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	
14	A			-1/4	1 5/8	1 3/8	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/2	-1/4	1 1/4	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL - 466
LOCATION: Bend Oregon
SLAB #: 2
EDGE: E - W
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY

VERIFIED BY

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	END 2 E	TOTAL	NOTES
1	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-3/8	1 3/4	1 3/8	
	D			1 3/8	-1/4	1 1/8	
2	A			-3/8	1 1/2	1 1/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	
3	A			-3/8	1 5/8	1 1/4	
	B			1 3/8	-1/8	1 1/4	
	C			-1/4	1 3/4	1 1/2	
	D			1 1/2	-1/8	1 3/8	
4	A			-1/4	1 3/8	1 1/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 3/4	1 1/2	
	D			1 1/2	-1/8	1 3/8	
5	A			-3/8	1 5/8	1 1/4	
	B			1 3/8	-1/8	1 1/4	
	C			-1/4	1 3/4	1 1/2	
	D			1 1/2	-1/8	1 3/8	
6	A			-3/8	1 5/8	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 3/8	-1/8	1 1/4	
7	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 3/8	-1/4	1 1/8	
8	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 3/4	1 1/2	
	D			1 1/2	-1/8	1 3/8	
9	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 1/2	
	D			1 5/8	-1/4	1 1/2	
10	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/4	1 1/4	

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MONOSTRAND STRESSING RECORD

JOB NAME: DBL-466 JOB NO.: 417175
LOCATION: Bend Oregon DATE: 11-17-15
SLAB #: 2 GAUGE NO.: 6MR053A RAM NO.: 6MR053
EDGE: E-W GAUGE PRESS.: 6350 JACKING FORCE: 49.8 Kip

STRESSED BY | VERIFIED BY

TENDON NO. /STRAND		ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	END 2 E	TOTAL	NOTES
11	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/4	1 1/4	
12	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/4	1 1/4	
13	A			-1/4	1 5/8	1 3/8	
	B			1 5/8	-1/8	1 1/2	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/4	1 1/4	
14	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-3/8	1 1/4	
15	A			-1/4	1 1/8	1 1/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/8	1 3/8	
16	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/8	1 3/8	
17	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	
18	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 3/4	1 1/2	
	D			1 3/8	-1/8	1 1/4	

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JOB NAME: OBL - 466
LOCATION: Bend Oregon
SLAB #: 2
EDGE: N - S
GAUGE NO.: GMR 053
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: GMR 053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sea

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
1	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-3/8	1 3/4	1 3/8	
	D			1 1/2	-1/8	1 3/8	
2	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/8	1 3/8	
3	A			-3/8	1 3/4	1 3/8	
	B			1 1/2	-3/8	1 1/8	
	C			-1/4	1 3/4	1 1/2	
	D			1 1/2	-1/8	1 3/8	
4	A			-3/8	1 5/8	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/2	-1/8	1 3/8	
5	A			-3/8	1 3/4	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 3/8	-1/8	1 1/4	
6	A			-3/8	1 5/8	1 1/4	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/8	1 3/8	
7	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/8	1 3/8	
8	A			-1/4	1 5/8	1 3/8	
	B			1 5/8	-1/8	1 1/2	
	C			-3/8	1 3/4	1 3/8	
	D			1 1/2	-1/8	1 3/8	
9	A			-1/4	1 1/2	1 1/4	
	B			1 5/8	-1/4	1 3/8	
	C			-1/4	1 3/4	1 1/2	
	D			1 5/8	-1/4	1 3/8	
10	A			-1/8	1 1/2	1 3/8	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	

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Page 1/1

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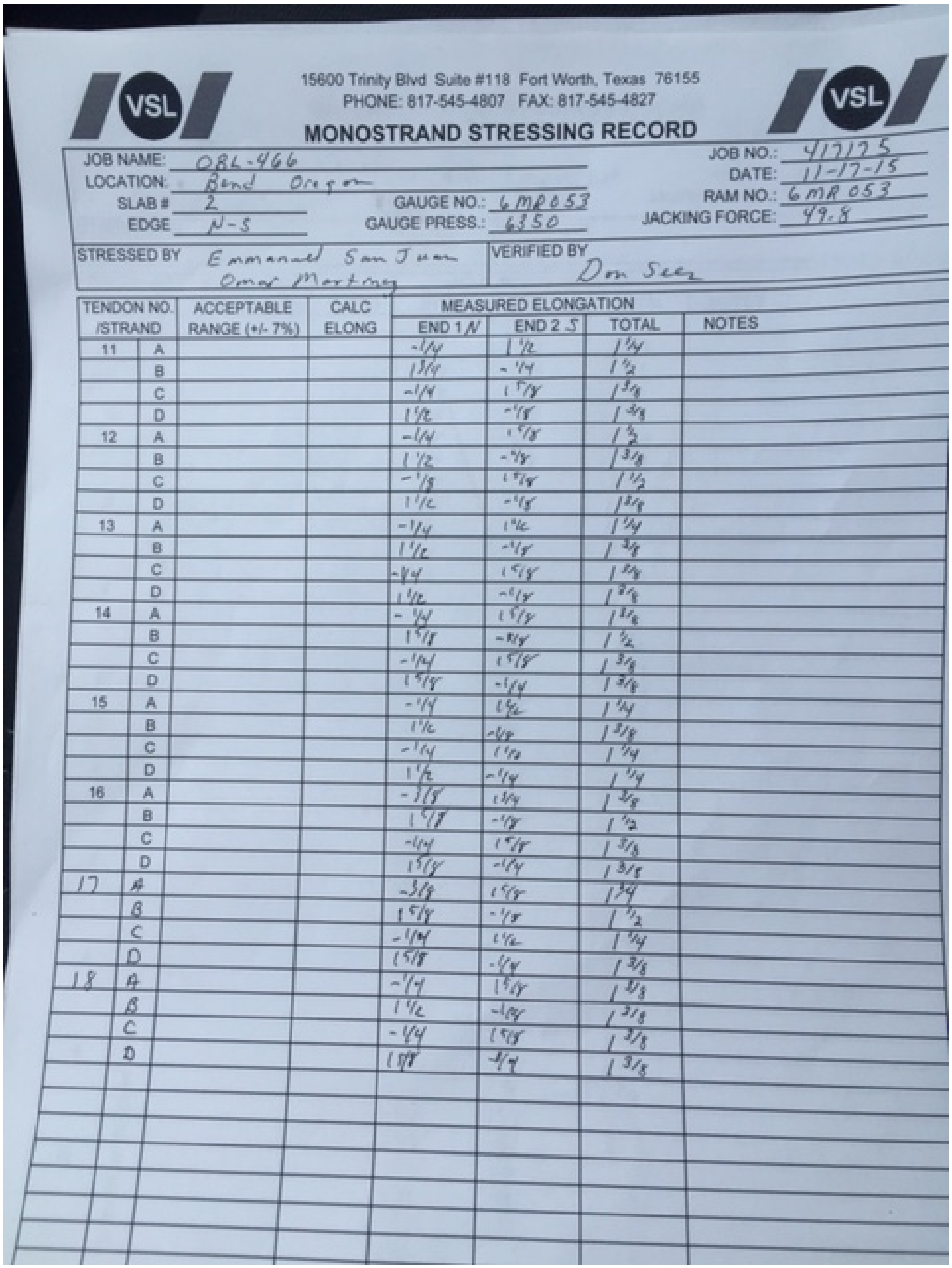
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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB # 2
EDGE N-S
GAUGE NO.: 6MP053
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Seez

TENDON NO. /STRAND		ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION			NOTES
				END 1 N	END 2 S	TOTAL	
11	A			-1/4	1 1/2	1 1/4	
	B			1 3/4	-1/4	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/8	1 3/8	
12	A			-1/4	1 5/8	1 1/2	
	B			1 1/2	-1/8	1 3/8	
	C			-1/8	1 5/8	1 1/2	
	D			1 1/2	-1/8	1 3/8	
13	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/2	-1/8	1 3/8	
14	A			-1/4	1 5/8	1 3/8	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	
15	A			-1/4	1 1/2	1 1/4	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/2	-1/4	1 1/4	
16	A			-3/8	1 3/4	1 3/8	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	
17	A			-3/8	1 5/8	1 1/4	
	B			1 5/8	-1/8	1 1/2	
	C			-1/4	1 1/2	1 1/4	
	D			1 5/8	-1/4	1 3/8	
18	A			-1/4	1 5/8	1 3/8	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 5/8	-1/4	1 3/8	

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MONOSTRAND STRESSING RE...

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 3
EDGE: E-W
GAUGE NO.: GMR076A
GAUGE PRESS.: 6330
JOB NO.: 971115
DATE: 11-17-15
RAM NO.: GMR076
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Seer

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION			NOTES
				END 1 W	END 2 E	TOTAL	
1	A			-1/4	1 1/2	1 1/4	
	B			1 1/4	-1/4	1	
	C			-1/8	1 3/8	1 1/4	
	D			1 1/4	-1/4	1	
2	A			-1/8	1 7/8	1 3/4	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 3/8	1 1/4	
	D			1 1/4	-1/4	1	
3	A			-1/8	1 1/2	1 3/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/2	1 3/8	
	D			1 1/4	-1/4	1	
4	A			-1/8	1 1/2	1 3/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/2	1 3/8	
	D			1 3/8	-1/4	1 1/8	
5	A			-1/8	1 5/8	1 3/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/2	1 3/8	
	D			1 3/8	-1/4	1 1/8	
6	A			-1/8	1 1/2	1 3/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/2	1 3/8	
	D			1 1/4	-1/4	1	
7	A			-1/8	1 1/2	1 3/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/2	1 3/8	
	D			1 1/4	-1/4	1	
8	A			-1/8	1 1/2	1 3/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 7/8	1 3/4	
	D			1 1/4	-1/4	1	
9	A			-1/4	1 1/2	1 1/4	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/4	-1/8	1 1/8	
10	A			-1/8	1 5/8	1 1/2	
	B			1 1/2	-1/4	1 1/4	
	C			-1/8	1 1/2	1 3/8	
	D			1 1/4	-1/4	1	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB # 3
EDGE E-W
GAUGE NO.: 6MP 076
GAUGE PRESS.: 6330
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MP 076
JACKING FORCE: 49.8

STRESSED BY Emmanuel San Juan, Omar Martinez
VERIFIED BY Don Sees

TENDON NO. /STRAND		ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	END 2 E	TOTAL	NOTES
11	A			-1/8	1 5/8	1 1/2	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 7/8	1 5/8	
	D			1 1/4	-1/8	1 1/8	
12	A			-1/4	1 3/8	1 1/4	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1 1/8	
13	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/2	1 3/8	
	D			1 1/8	-1/8	1	
14	A			-1/8	1 1/2	1 3/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/8	1	
	D			1 1/4	-1/4	1	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 3
EDGE: N-S
GAUGE NO.: 6MR076A
GAUGE PRESS.: 6330
JOB NO.: 417175
DATE: 11-17-18
RAM NO.: 6MR076R
JACKING FORCE: 49.8
STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1/N	END 2 S	TOTAL	NOTES
1	A			-1/8	1 3/8	1	
	B			1 1/2	-1/4	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
2	A			-1/4	1 1/2	1 1/4	
	B			1 1/8	-1/8	1	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/8	-1/8	1	
3	A			-1/4	1 1/2	1 1/4	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/8	-1/8	1	
4	A			-1/4	1 1/2	1 1/4	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 5/8	1 3/8	
	D			1 1/4	-1/8	1 1/8	
5	A			-1/4	1 1/2	1 1/4	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/4	
6	A			-1/4	1 1/4	1	
	B			1 1/8	-1/8	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	
7	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/8	-1/8	1	
8	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/8	1 1/8	
9	A			-1/4	1 3/8	1 1/8	
	B			1 1/8	-1/8	1	
	C			-1/4	1 1/4	1	
	D			1 1/8	-1/8	1	
10	A			-3/8	1 1/2	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/8	1 1/8	

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MONOSTRAND STRESSING RECORD

JOB NAME: ORL-466
LOCATION: Bend Oregon
SLAB #: #3
EDGE: N-S
GAUGE NO.: GMR 076 A
GAUGE PRESS.: 6330
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: GMR 076
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Saes

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
11	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/4	-1/8	1 1/8	
12	A			-3/8	1 3/8	1	
	B			1 1/4	-1/8	1 1/8	
	C		1	-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
13	A		#	-1/4	1 3/8	1 1/8	
	B			1 1/8	-1/8	1	
	C			-1/4	1 1/4	1	
	D			1 1/8	-1/8	1	
14	A			-1/4	1 3/8	1 1/4	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/8	-1/8	1	

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MONOSTRAND STRESSING RECORD

JOB NAME: ORL-466
LOCATION: Bend Oregon
SLAB #: 4
EDGE: E-W
GAUGE NO.: 6MR 053A
GAUGE PRESS.:
JOB NO.: 417125
DATE: 11-17-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel Sam Jean Omar Martinez
VERIFIED BY: Don Sears

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION W END 1	E END 2	TOTAL	NOTES
1	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
2	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/8	1 1/8	
3	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	1 3/8	1 1/8	
4	A			-1/4	-1/8	1 1/8	
	B			1 3/8	1 1/4	1 1/8	
	C			-1/8	-1/8	1 1/4	
	D			1 3/8	1 1/4	1 1/8	
5	A			-1/8	-1/8	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 5/8	1 1/4	
	D			1 1/4	-1/8	1 1/8	
6	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/8	1 1/8	
7	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/8	1 1/8	
8	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/8	1 1/8	
9	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/8	1 1/8	
10	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 4
EDGE: E-W
GAUGE NO.: GMR 053A
GAUGE PRESS.:
JOB NO.: 417175
DATE: 11-13-15
RAM NO.: GMR 053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION W END 1	E END 2	TOTAL	NOTES
11	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/8	1 1/8	
12	A			-1/8	1 1/8	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/8	1 1/8	
13	A			-1/8	1 1/8	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 3/8	1 1/4	
	D			1 1/4	-1/8	1 1/8	
14	A			-1/8	1 1/8	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/2	-1/8	1 3/8	
15	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/8	1	
	D			1 3/8	-1/4	1 1/8	
16	A			-1/4	1 1/4	1	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
				-1/4	1 1/4	1	
				1 3/8	-1/8	1 1/4	
				-1/8	1 1/4	1 1/8	
				1 1/2	-1/4	1 1/4	
				-1/4	1 1/4	1	
				1 1/2	-1/4	1 1/4	
				-1/8	1 1/4	1 1/8	
				1 3/8	-1/4	1 1/8	

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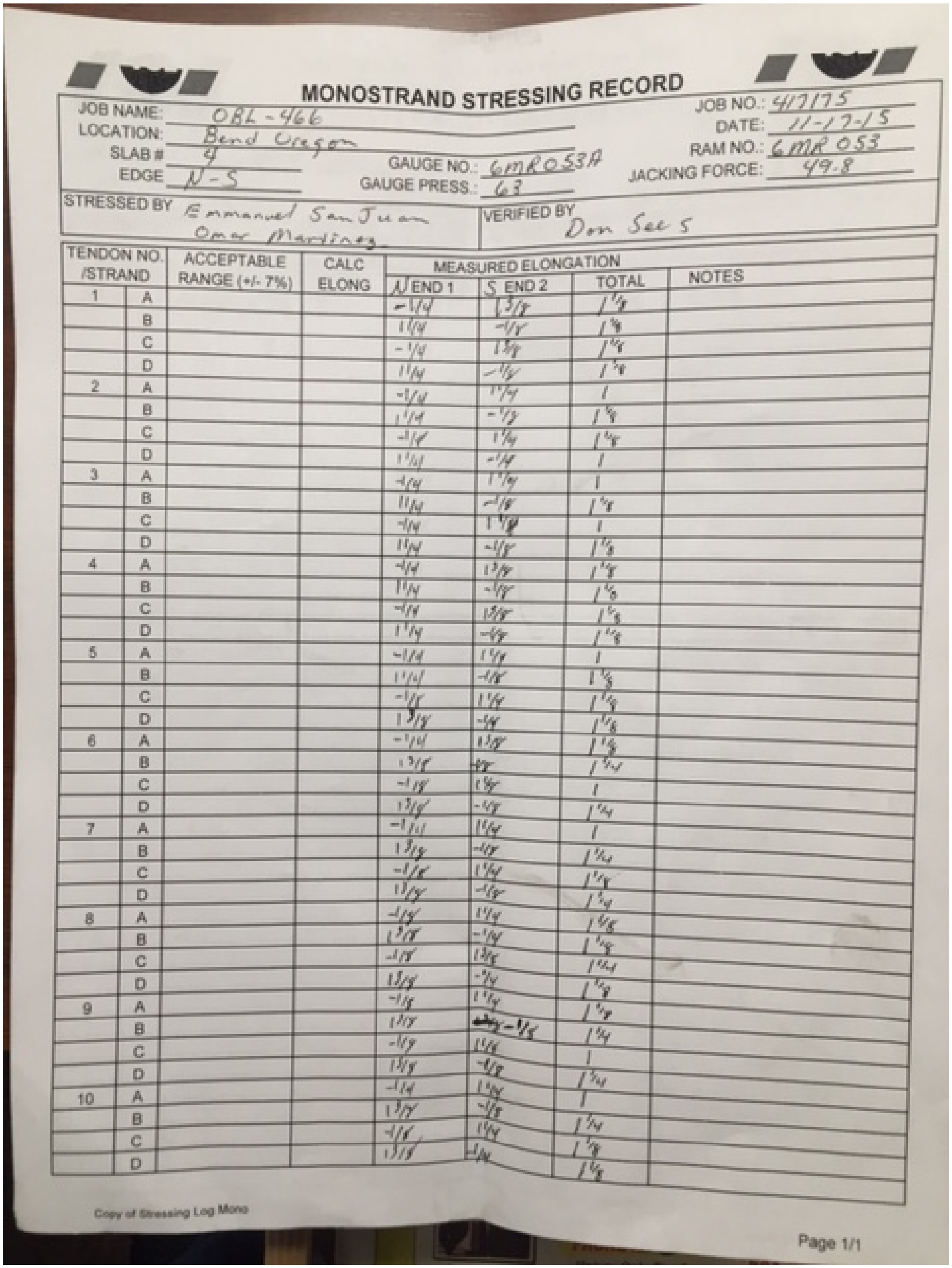

MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 9
EDGE: N-S
GAUGE NO.: 6MR053A
GAUGE PRESS.: 63
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MR053
JACKING FORCE: 49.8
STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION N END 1	S END 2	TOTAL	NOTES
1	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/8	1 1/8	
2	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
3	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	
4	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/8	1 1/8	
5	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
6	A			-1/4	1 3/8	1 1/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/8	1	
	D			1 3/8	-1/8	1 1/4	
7	A			-1/4	1 1/4	1	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/8	1 1/4	
8	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 3/8	1 1/4	
	D			1 3/8	-1/4	1 1/8	
9	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/8	1	
	D			1 3/8	-1/8	1 1/4	
10	A			-1/4	1 1/4	1	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL - 466
LOCATION: Bend Oregon
SLAB #: 4
EDGE: N - S
GAUGE NO.: 6MR053A
GAUGE PRESS.:
JOB NO.: 417175
DATE: 11-17-15
RAM NO.: 6MR053
JACKING FORCE: 49.8
STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sen

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION N END 1	S END 2	TOTAL	NOTES
11	A			-1/8	1 1/8	1	
	B			1 3/8	-1/8	1 1/4	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	
12	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/8	1 1/8	
13	A			-1/4	1 3/4	1 1/2	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/8	1 1/4	
14	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/8	1 1/4	
15	A			-1/4	-1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	
16	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
17	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
18	A			-1/8	1 1/8	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: #5
EDGE: E-W
GAUGE NO.: 6MR 053 A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	MEASURED ELONGATION END 2 E	MEASURED ELONGATION TOTAL	NOTES
1	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/8	1	
	D			1 3/8	-1/4	1 1/8	
2	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
3	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
4	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
5	A			-1/4	1 3/8	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
6	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
7	A			-1/8	1 3/8	1 1/4	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
8	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
9	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/2	1 1/4	
	D			1 1/4	-1/4	1	
10	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	

OBL-466 Stressing Log

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: #5
EDGE: E - W
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 (W)	END 2 (E)	TOTAL	NOTES
11	A			- 1/8	1 1/4	1 1/8	
	B			1 1/4	- 1/4	1	
	C			- 1/4	1 1/4	1	
	D			1 1/4	- 1/4	1	
12	A			- 1/4	1 1/4	1	
	B			1 3/8	- 1/4	1 1/8	
	C			- 1/4	1 1/4	1	
	D			1 1/4	- 1/4	1	
13	A			- 1/4	1 3/8	1 1/8	
	B			1 1/4	- 1/8	1 1/8	
	C			- 1/4	1 1/4	1	
	D			1 1/4	- 1/4	1	
14	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/4	1	
	C			- 1/4	1 1/4	1	
	D			1 1/4	- 1/4	1	

OBL-466 Stressing Log

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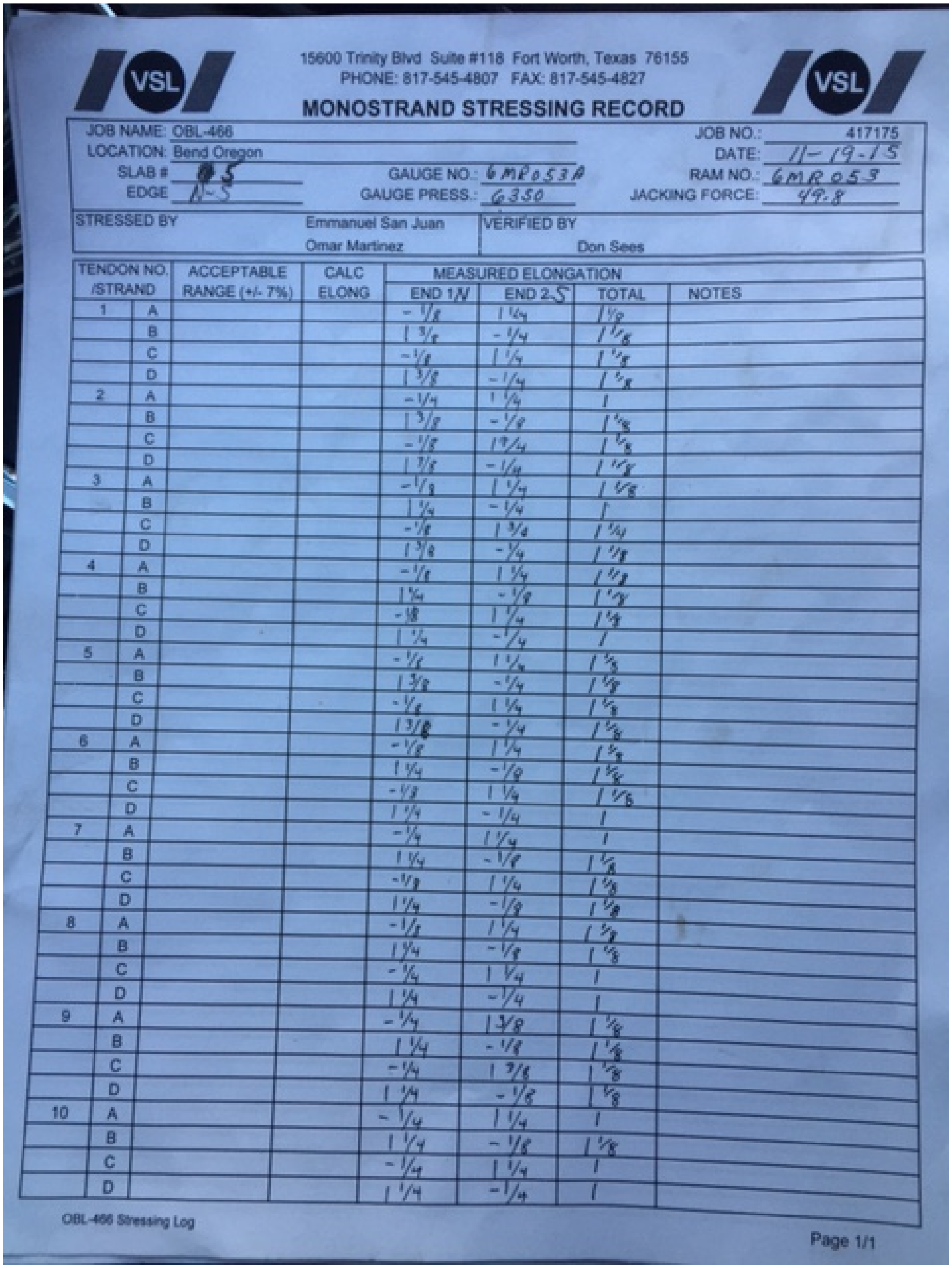

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466 | JOB NO.: 417175
LOCATION: Bend Oregon | DATE: 11-19-15
SLAB #: #5 | GAUGE NO.: 6MR053A | RAM NO.: 6MR053
EDGE: N-S | GAUGE PRESS.: 6350 | JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez | VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
1	A			- 1/8	1 1/4	1 1/8	
	B			1 3/8	- 1/4	1 1/8	
	C			- 1/8	1 1/4	1 1/8	
	D			1 3/8	- 1/4	1 1/8	
2	A			- 1/4	1 1/4	1	
	B			1 3/8	- 1/8	1 1/8	
	C			- 1/8	1 3/4	1 1/8	
	D			1 3/8	- 1/4	1 1/8	
3	A			- 1/8	1 1/4	1 1/8	
	B			1 1/4	- 1/4	1	
	C			- 1/8	1 3/4	1 1/4	
	D			1 3/8	- 1/4	1 1/8	
4	A			- 1/8	1 1/4	1 1/8	
	B			1 1/4	- 1/8	1 1/8	
	C			- 1/8	1 1/4	1 1/8	
	D			1 1/4	- 1/4	1	
5	A			- 1/8	1 1/4	1 1/8	
	B			1 3/8	- 1/4	1 1/8	
	C			- 1/8	1 1/4	1 1/8	
	D			1 3/8	- 1/4	1 1/8	
6	A			- 1/8	1 1/4	1 1/8	
	B			1 1/4	- 1/8	1 1/8	
	C			- 1/8	1 1/4	1 1/8	
	D			1 1/4	- 1/4	1	
7	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/8	1 1/8	
	C			- 1/8	1 1/4	1 1/8	
	D			1 1/4	- 1/8	1 1/8	
8	A			- 1/8	1 1/4	1 1/8	
	B			1 1/4	- 1/8	1 1/8	
	C			- 1/4	1 1/4	1	
	D			1 1/4	- 1/4	1	
9	A			- 1/4	1 3/8	1 1/8	
	B			1 1/4	- 1/8	1 1/8	
	C			- 1/4	1 3/8	1 1/8	
	D			1 1/4	- 1/8	1 1/8	
10	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/8	1 1/8	
	C			- 1/4	1 1/4	1	
	D			1 1/4	- 1/4	1	

OBL-466 Stressing Log

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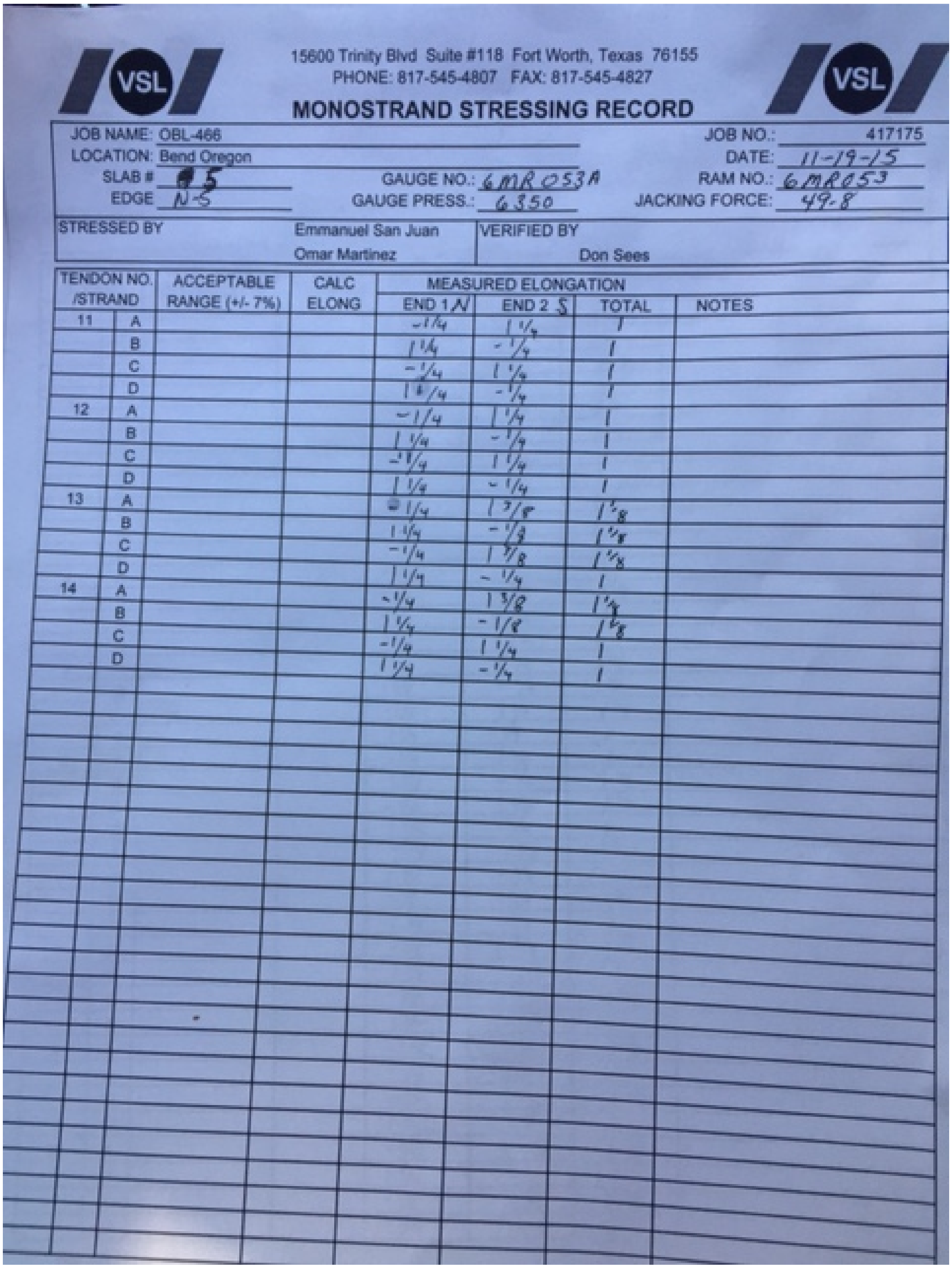

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
JOB NO.: 417175
LOCATION: Bend Oregon
DATE: 11-19-15
SLAB #: 5
GAUGE NO.: 6MR053A
RAM NO.: 6MR053
EDGE: N-S
GAUGE PRESS.: 6350
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
11	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
12	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
13	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
14	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 6
EDGE: E - W
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO. /STRAND		ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION			NOTES
				END 1 W	END 2 E	TOTAL	
1	A			- 1/4	1 1/4	1	
	B			1 3/8	- 1/4	1 1/8	
	C			- 1/4	1 3/8	1 1/8	
	D			1 3/8	- 1/4	1 1/8	
2	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/4	1	
	C			- 1/4	1 3/8	1 1/8	
	D			1 1/4	- 1/4	1	
3	A			- 1/4	1 1/4	1	
	B			1 3/8	- 1/4	1 1/8	
	C			- 1/4	1 1/4	1	
	D			1 1/4	- 1/4	1	
4	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/4	1	
	C			- 1/8	1 1/4	1 1/8	
	D			1 3/8	- 1/4	1 1/8	
5	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/4	1	
	C			- 1/8	1 1/4	1 1/8	
	D			1 1/4	- 1/8	1 1/8	
6	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/4	1	
	C			- 1/8	1 3/8	1 1/4	
	D			1 1/4	- 1/4	1	
7	A			- 1/8	1 1/4	1 1/8	
	B			1 3/8	- 1/4	1 1/8	
	C			- 1/8	1 1/4	1 1/8	
	D			1 1/4	- 1/4	1	
8	A			- 1/4	1 1/4	1	
	B			1 1/4	- 1/4	1	
	C			- 1/8	1 1/4	1 1/8	
	D			1 1/4	- 1/4	1	
9	A			- 1/8	1 3/8	1 1/4	
	B			1 3/8	- 1/8	1 1/4	
	C			- 1/8	1 1/4	1 1/8	
	D			1 3/8	- 1/4	1 1/8	
10	A			- 1/8	1 1/4	1 1/8	
	B			1 1/4	- 1/4	1	
	C			- 1/4	1 1/4	1	
	D			1 3/8	- 1/4	1 1/8	

OBL-466 Stressing Log

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB # 6
EDGE E-W
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	MEASURED ELONGATION END 2 E	MEASURED ELONGATION TOTAL	NOTES
11	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
12	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
13	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
14	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
15	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
16	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
17	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
18	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	

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MONOSTRAND STRESSING RECORD

JOB NAME:	OBL-466	JOB NO.:	417175
LOCATION:	Bend Oregon	DATE:	11-19-15
SLAB #	6	GAUGE NO.: 6MR-053	RAM NO.: 6MR-053
EDGE	N-S	GAUGE PRESS.: 6350	JACKING FORCE: 49.8
STRESSED BY	Emmanuel San Juan Omar Martinez	VERIFIED BY	Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
1	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
2	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
3	A			-1/4	1 1/4	1	
	B			1 1/2	-1/4	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
4	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
5	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
6	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/8	1 3/8	1 1/4	
	D			1 1/4	-1/4	1	
7	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
8	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
9	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
10	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	

OBL-466 Stressing Log

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 6
EDGE: N-S
GAUGE NO.: 6MR053
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO. /STRAND		ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
11	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
12	A			-1/8	1 3/8	1 1/4	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
13	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
14	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
15	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
16	A			-1/4	1 1/4	1	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
17	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	
18	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/8	1 1/4	
	C			-1/8	1 3/8	1 1/4	
	D			1 1/2	-1/4	1 1/4	

OBL-466 Stressing Log

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 7
EDGE: E-W
GAUGE NO.: GMR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-13
RAM NO.: GMR 053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	MEASURED ELONGATION END 2 E	MEASURED ELONGATION TOTAL	NOTES
1	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
2	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
3	A			-1/4	1 3/8	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
4	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
5	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
6	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/8	
7	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
8	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
9	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
10	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 7
EDGE: E-W
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-15
RAM NO.: 6MR053A
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	END 2 E	TOTAL	NOTES
11	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
12	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
13	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
14	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 7
EDGE: N-S
GAUGE NO.: 6MR053A
GAUGE PRESS.: 6350
JOB NO.: 417175
DATE: 11-19-15
RAM NO.: 6MR053
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
1	A			-1/4	1 1/4	1	
	B			1 5/8	-3/8	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/2	-1/4	1 1/4	
2	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
3	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
4	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
5	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
6	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
7	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
8	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
9	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
10	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	

OBL-466 Stressing Log

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466 JOB NO.: 417175
LOCATION: Bend Oregon DATE: 11-19-15
SLAB #: 7 GAUGE NO.: 6MR053A RAM NO.: 6MR053
EDGE: N-S GAUGE PRESS.: 6350 JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 N	END 2 S	TOTAL	NOTES
11	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
12	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
13	A			-1/4	1 1/4	1	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/8	1 1/64	
14	A			-1/8	1 3/8	1 1/64	
	B			1 1/4	-1/8	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	

OBL-466 Stressing Log

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
JOB NO.: 417175
LOCATION: Bend Oregon
DATE: 11-20-15
SLAB #: 8
GAUGE NO.: 6MR053A
RAM NO.: 6MR053
EDGE: E-W
GAUGE PRESS.: 6350
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END 1 W	MEASURED ELONGATION END 2 E	MEASURED ELONGATION TOTAL	NOTES
1	A			-1/4	1 1/4	1	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
2	A			-1/4	1 3/8	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
3	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/8	
4	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/8	
5	A			-1/4	1 1/4	1	
	B			1 3/8	-1/8	1 1/4	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	
6	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/8	1 1/4	
7	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/8	
8	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
9	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
10	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466 JOB NO.: 417175
LOCATION: Bend Oregon DATE: 11-20-15
SLAB #: 8 GAUGE NO.: 6MR053A RAM NO.: 6MR053
EDGE: E-W GAUGE PRESS.: 6350 JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION END W	END 2 E	TOTAL	NOTES
11	A			-1/4	1 3/8	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
12	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/8	
13	A			-1/4	1 3/8	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
14	A			-1/4	1 3/8	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
15	A			-1/8	1 1/4	1 1/8	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/8	
16	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 3/8	1 1/8	
	D			1 3/8	-1/4	1 1/8	
17	A			-1/4	1 3/8	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
18	A			-1/4	1 1/4	1	
	B			1 1/2	-1/8	1 3/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
LOCATION: Bend Oregon
SLAB #: 8
EDGE: N-S

GAUGE NO.: 6MR 053A
GAUGE PRESS.: 6350

JOB NO.: 41717
DATE: 11-20-15
RAM NO.: 6MR-05
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION N END 1	S END 2	TOTAL	NOTES
1	A			-1/8	1 1/4	1 1/8	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
2	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
3	A			-1/4	1 1/4	1	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/8	1 1/8	
4	A			-1/4	1 1/4	1	
	B			1 1/2	-1/4	1 1/4	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
5	A			-1/4	1 1/4	1	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
6	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/8	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
7	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
8	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
9	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
10	A			-1/4	1 1/4	1	
	B			1 1/2	-1/4	1 1/4	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	

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MONOSTRAND STRESSING RECORD

JOB NAME: OBL-466
JOB NO.: 417175
LOCATION: Bend Oregon
DATE: 11-20-15
SLAB #: 8
GAUGE NO.: 6MR 053A
RAM NO.: 6MR 053
EDGE: N-S
GAUGE PRESS.: 6350
JACKING FORCE: 49.8

STRESSED BY: Emmanuel San Juan, Omar Martinez
VERIFIED BY: Don Sees

TENDON NO.	/STRAND	ACCEPTABLE RANGE (+/- 7%)	CALC ELONG	MEASURED ELONGATION N END 1	S END 2	TOTAL	NOTES
11	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/8	1 1/4	1 1/8	
	D			1 3/8	-1/4	1 1/8	
12	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/4	-1/4	1	
13	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
14	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 3/8	-1/4	1 1/8	
15	A			-1/4	1 1/4	1	
	B			1 3/8	-1/4	1 1/8	
	C			-1/8	1 1/4	1 1/8	
	D			1 1/4	-1/4	1	
16	A			-1/4	1 1/4	1	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
17	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 1/4	1	
	D			1 1/4	-1/4	1	
18	A			-1/8	1 1/4	1 1/8	
	B			1 1/4	-1/4	1	
	C			-1/4	1 3/8	1 1/8	
	D			1 1/2	-1/4	1 1/4	

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OBL 466 ADDITIONAL SAFTY PROCEDURES ASSOCIATED WITH STRESSING OPERATION

STRESSING

1 THE STRESSING OPERATIONS MUST BE UNDER THE IMMEDIATE CONTROL OF A PERSON EXPERIENCED IN THIS TYPE OF WORK; HE SHALL MAINTAIN A CLOSE CHECK AND RIGID CONTROL OF ALL OPERATIONS. SAFETY IS THE TOP PRIORITY!

2 ADEQUATE ACCESS SCAFFOLDS, PLATFORMS, AND SAFETY DEVICES SHALL BE PROVIDED BY THE GENERAL CONTRACTOR AS REQUIRED BY GOVERNING JOBSITE STANDARDS, INSTALLATION, OR STRESSING PROCEDURES.

3 READ VSL MAINTENANCE MANUAL FOR FIELD SAFETY AND MAINTENANCE OPERATIONS. THE JOBSITE SAFETY PROGRAM SHALL INCLUDE STRUCTURAL TECHNOLOGIES / VSL SAFETY POLICIES AND PROCEDURES.

4 TAKE SAFETY PRECAUTIONS AS NECESSARY. DO NOT PERMIT ANYONE TO STAND BEHIND, ABOVE, OR BELOW RAMS, OR DEAD END AREA WHILE STRESSING. ONLY ESSENTIAL PERSONNEL SHALL BE IN THE AREA.

5 ALL TENDONS SHALL BE STRESSED BY MEANS OF STRUCTURAL TECHNOLOGIES / VSL HYDRAULIC RAMS, EQUIPPED WITH CALIBRATED HYDRAULIC PRESSURE GAUGES. A CALIBRATION CHART SHALL ACCOMPANY EACH GAUGE. NOTE: RAMS AND GAUGES ARE NOT TO BE INTERCHANGED.

6 THE STRANDS MAY BE FULLY STRESSED WHEN CONCRETE TEST CYLINDERS, CURED UNDER JOBSITE CONDITIONS, HAVE BEEN TESTED AND INDICATE THE CONCRETE HAS REACHED THE MINIMUM CYLINDER STRENGTH INDICATED ON THE POST TENSIONING DRAWINGS.

7 THE POST TENSIONING OPERATION SHALL BE SO CONDUCTED THAT ACCURATE ELONGATION OF THE TENDONS CAN BE RECORDED AND COMPARED WITH ELONGATIONS.

8 RECORDS OF ALL GAUGE PRESSURES AND ELONGATIONS SHALL BE SUBMITTED PROMPTLY TO THE ENGINEER FOR APPROVAL.

9 PROPER ALIGNMENT OF THE ANCHORAGE AND JACKING EQUIPMENT IS MANDATORY DURING ALL STRESSING OPERATIONS.

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www.structuraltechnologies.com

10 STRESSING PROCEDURE (VSLAB 6-4)

A) INSPECT RAM AND PUMP FOR LOOSE SCREWS, FITTINGS, ELECTRICAL, AND HOSE CONNECTIONS AND TIGHTEN IF NECESSARY. CHECK JACK GRIPPERS TO INSURE THEY ARE CLEAN AND ALIGNED PROPERLY.

B) INSTALL WEDGES INTO EACH WEDGE CAVITY (DO NOT REMOVE OILY FILM FROM WEDGES).

C) AS A REFERENCE FOR ELONGATIONS MEASUREMENTS, MARK BOTH ENDS WITH A QUICK DRY SPRAY PAINT, WHITEOUT OR OTHER MEANS TO ESTABLISH A REFERENCE POINT FOR ELONGATION MEASUREMENT.

D) STRESSING STRANDS IN A SYMMETRIC MANNER STARTING FROM THE CENTER OF THE SLAB USING 0.6” MONO RAM. ALWAYS STRES THE STRANDS ON THE ROW CLOSE TO THE MIDDLE OF THE SLAB FIRST, THEN GO TO THE ROW AWAY FROM THE MIDDLE OF SLAB. For THE ROW CLOSEST TO THE GROUND, RECOMMEND TO STRESS THE TENDON ON THE OTHER END OF THE SLAB SO THAT THE STRANDS CAN BE ON THE TOP ROW AWAY FROM THE GROUND. ONLY SINGLE-END STRESSING OPERATION IS NEEDED.

E) TO MEET THE DESIGN REQUIREMENT, ALL TENDONS WILL BE STRESSED TO 85% MUTS, WHICH EQUALS TO 49.8 KIPS. REFER TO THE CALIBRATION CHART OF STRESSING EQUIPMENT FOR GAUGE PRESSURE.

F) AFTER REMOVING THE JACK FROM THE TENDON TAIL, PLACE THE MARKING DEVICE AGAINST THE CONCRETE SURFACE, MEASURE THE DISTANCE FROM THE MARKING DEVICE TO THE REFERENCE MARK TO THE NEAREST 1/8 IN AND RECORD ON THE STRESSING RECORD FORM. SINCE THIS IS EXTREME SHORT TENDON (16 FT), THE MEASURED ELONGATION SHOULD COMPARE WITH ±7% OF CALCULATED ELONGATION ± ¼ IN AS SPECIFIED IN PTI / ASBI M50-12 “GUIDE SPECIFICATION FOR GROUTED POST-TENSIONING” SECTION 12.6. THE CALCULATED ELONGATION IS 1.25 IN SO THE ELONGATION MEASURED SHOULD BE BETWEEN 0.91 IN TO 1.5875 IN. OR MORE STRINGENTLY BETWEEN 1 IN TO 1-1/2 IN.

G) PROMPTLY SUBMIT STRESSING RECORDS TO THE ENGINEER. UPON APPROVAL OF THE ELONGATIONS, STRESSING TAILS MAY BE REMOVED USING AN APPROVED METHOD TO APPROXIMATELY 3/4" FROM FACE OF ANCHOR HEAD.

H) INSTALL GROUT FITTINGS AND PREPARE FOR GROUTING.

CONSTRUCTION TESTING SCIENCES

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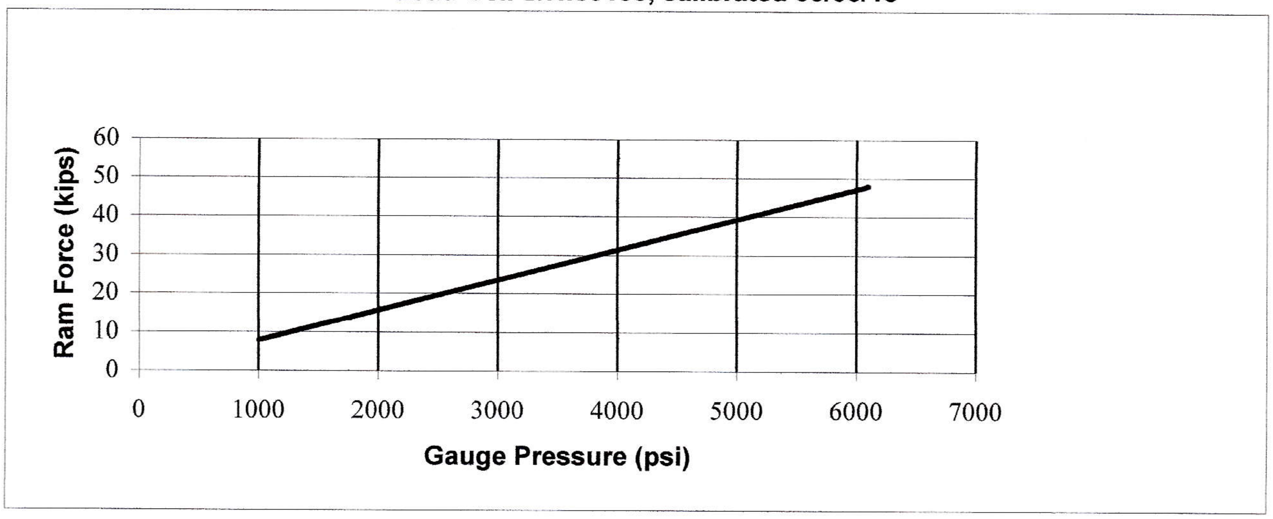
P.O. Box 824483, Dallas, TX 75382-4483
Phone: 214.703.8911
www.ctsciences.com

REPORT OF
RAM CALIBRATION

Client:	VSL	**Report No.:**	11384A
Ram S/N:	6MR 053	**Date of Calibration:**	11/04/15
Gauge:	**A**	**Client No.:**	101086
Load Cell S/N:	83103, calibrated 03/06/15		
Strain Ind. S/N:	SI-021		

Gauge Pressure (psi)	Machine Load (kips)			Average of Three Readings
	Reading #1	Reading #2	Reading #3	
1,000	7.87	7.88	7.62	7.79
2,000	15.75	15.79	15.78	15.77
3,000	23.53	23.58	23.65	23.59
4,000	31.47	31.34	31.40	31.40
5,000	39.35	39.11	39.26	39.24
6,000	47.10	46.67	47.01	46.93
6,100	47.84	47.52	47.67	47.68

Load Cell S/N:83103, calibrated 03/06/15



Gauge Pressure(psi) = (127.974 * Ram Force(kips)) -11.6

Technician: J. Gary

Jack Gary, General Manager

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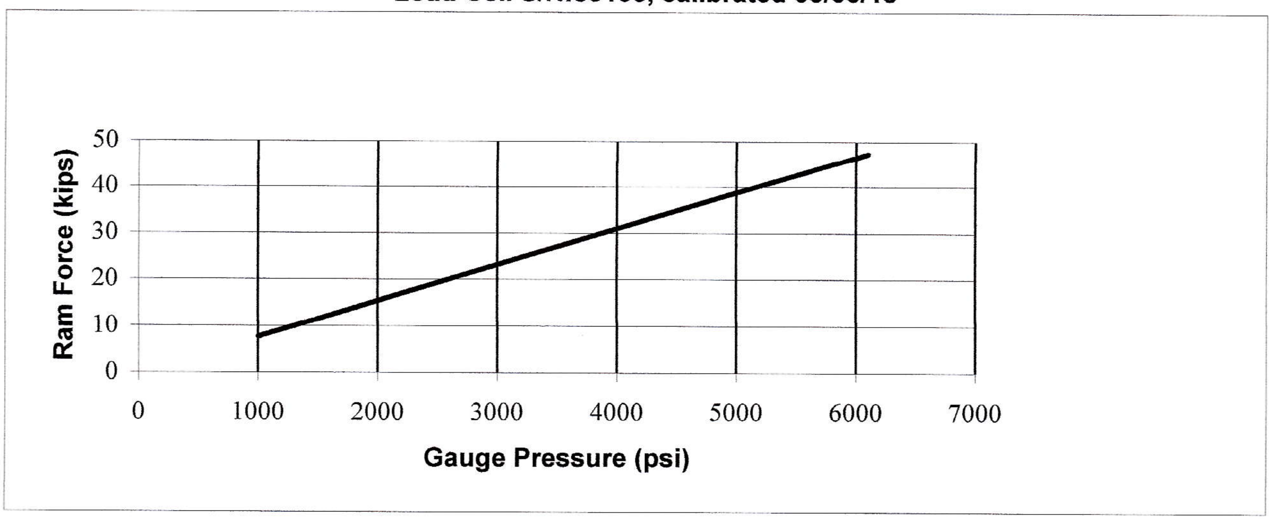
REPORT OF
RAM CALIBRATION

Client: VSL
Ram S/N: 6MR 053
Gauge: B
Load Cell S/N: 83103, calibrated 03/06/15
Strain Ind. S/N: SI-021

Report No.: 11384B
Date of Calibration: 11/04/15
Client No.: 101086

Gauge Pressure (psi)	Machine Load (kips)			Average of Three Readings
	Reading #1	Reading #2	Reading #3	
1,000	7.65	7.62	7.42	7.56
2,000	15.58	15.51	15.64	15.58
3,000	23.13	23.10	23.20	23.14
4,000	30.85	30.75	31.04	30.88
5,000	38.88	38.71	38.97	38.85
6,000	46.69	46.45	46.72	46.62
6,100	47.39	47.08	47.34	47.27

Load Cell S/N:83103, calibrated 03/06/15



Gauge Pressure(psi) = (128.436 * Ram Force(kips)) +20.07

Technician: J. Gary

Jack Gary, General Manager

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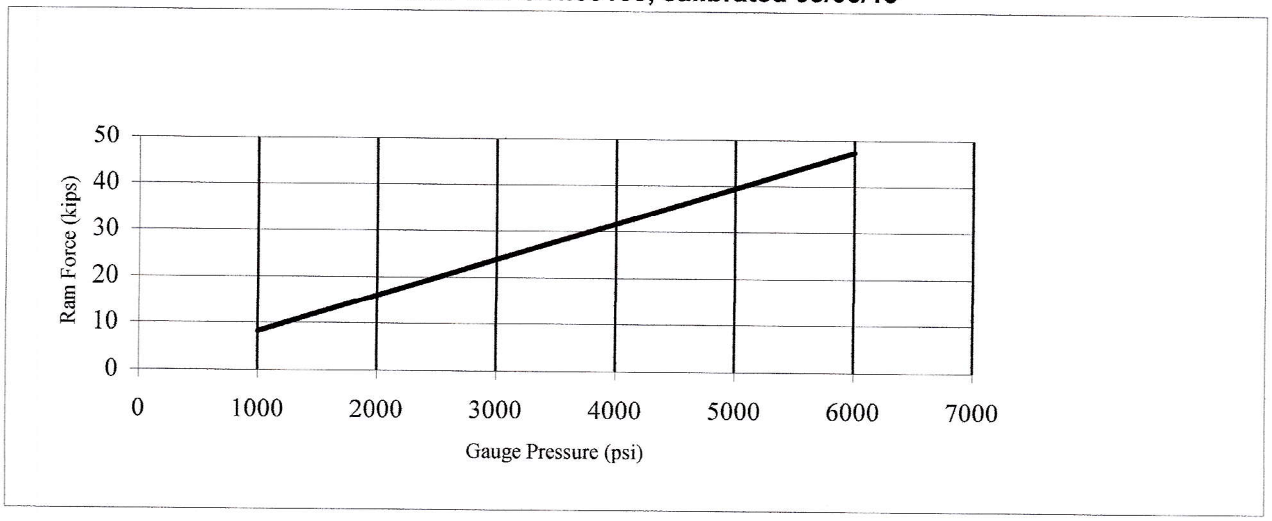
REPORT OF RAM CALIBRATION

Client: VSL
Ram S/N: **6MR-076**
Gauge: A
Load Cell S/N: 83103, calibrated 03/06/15
Strain Ind. S/N: SI-021

Report No.: 11385A
Client No.: 101086
Date of Calibration: 11/04/15

Gauge Pressure (psi)	Machine Load (kips)			Average of Three Readings
	Reading #1	Reading #2	Reading #3	
1,000	8.03	8.17	8.10	8.10
2,000	15.97	16.14	16.06	16.06
3,000	24.03	23.88	23.94	23.95
4,000	31.68	31.75	31.68	31.70
5,000	39.48	39.53	39.50	39.50
6,000	47.11	47.07	47.06	47.08

Load Cell S/N:83103, calibrated 03/06/15



Gauge Pressure(psi) = (128.2 * Ram Force(kips)) -55.28

Technician: J. Gary

Jack Gary, General Manager

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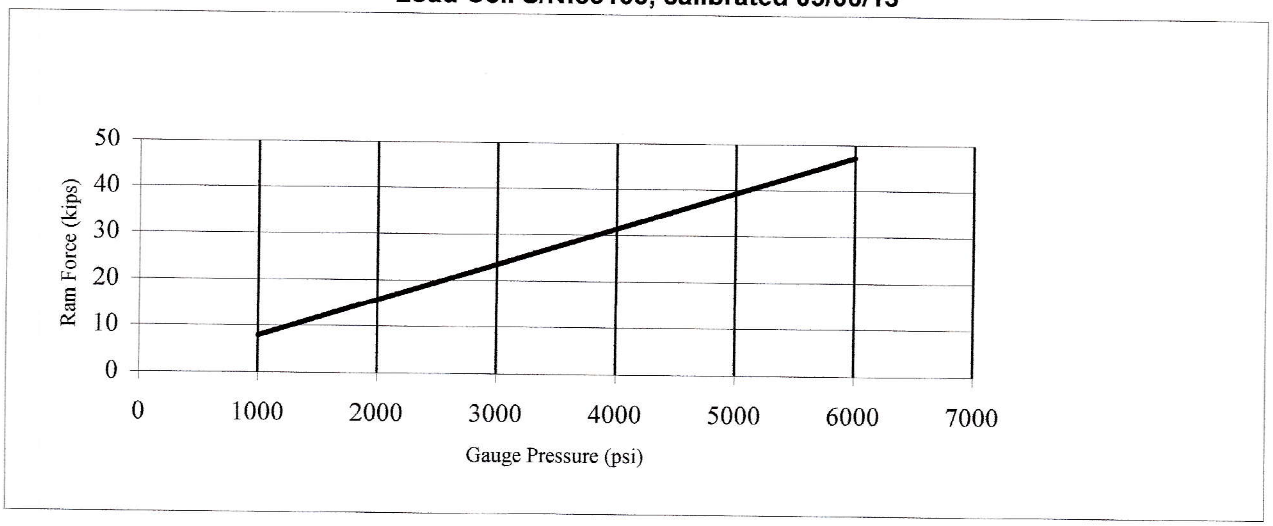
REPORT OF RAM CALIBRATION

Client:	VSL	**Report No.:**	11385B
Ram S/N:	**6MR-076**	**Client No.:**	101086
Gauge:	B	**Date of Calibration:**	11/04/15
Load Cell S/N:	83103, calibrated 03/06/15		
Strain Ind. S/N:	SI-021		

Gauge Pressure (psi)	Machine Load (kips) Reading #1	Machine Load (kips) Reading #2	Machine Load (kips) Reading #3	Average of Three Readings
1,000	7.99	7.81	7.62	7.81
2,000	15.73	15.72	15.69	15.71
3,000	23.50	23.42	23.62	23.51
4,000	31.41	31.48	31.47	31.45
5,000	39.14	39.34	39.32	39.27
6,000	46.98	46.99	46.95	46.97

Load Cell S/N:83103, calibrated 03/06/15



Gauge Pressure(psi) = (127.533 * Ram Force(kips)) -1.36

Technician: J. Gary

Jack Gary, General Manager

LIMITATIONS: The test results presented herein were prepared based upon the specific samples provided for testing. We assume no responsibility for variation in quality (composition, appearance, performance, etc.) or any other feature of similar subject matter provided by persons or conditions over which we have no control. Our letters and reports are for the exclusive use of the clients to whom they are addressed and shall not be reproduced except in full without the written approval of Construction Testing Sciences, LLC.

VSTRUCTURAL LLC
8006 Haute Court, Springfield, VA 22150
Friction and Elongation Calculations (version 4.4)

Project Name: **Prototype Panel**
Date: 11/18/2015
Engineer: **ZX**

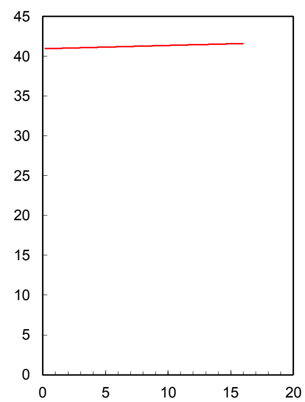
POST-TENSIONING SYSTEM

Coefficient of Friction: 0.14 /rad.
Coefficient of Wobble: 0.0010 /ft
PT is: ***V-Slab***

SPANS and PROFILES VSLAB6-4 REQD Fe = klf

Span Number	Span(ft.)	Type	Tendon Profile Left	Low pt.	Right	Total alpha (rad.)	Support Number	Force (kips)
1	16.00	1	5.38	5.38	5.38		1	41.0
2							2	41.6
3							3	
4							4	
5							5	
6							6	
7							7	
8							8	
9							9	
10							10	
11							11	
12							12	
13							13	
14							14	
15							15	
Total	16.00						16	

Note: Force is after seating and before long-term losses.



kips/strand vs position.

STRESSING ORDER

- (●) Near End Only (Support 1)
- ( ) Near End Then Far End
- ( ) Far End Only
- ( ) Far End Then Near End

STRAND PROPERTIES

Ultimate Stress, fpu: 270 ksi
Young's Modulus: 28500 ksi
Cross-Sectional Area: 0.217 sq. in.
Strand Type: Grade 270 Low Relaxation

OTHER INFO

% Jacking 85%
Jacking Force per Strand: 49.8 kips
Seating Loss: 0.250 in.

Beam or Slab ?
- ( ) Beam / Band
- (●) Slab

Slab Thickness: 10.6 in
Tendon Spacing 0.19 ft

LONG-TERM LOSSES Average Initial compression per strand at stressing: 40.43 kips (after seating)

P/A:	1691 psi			
Concrete Strength, Stressing:	6000 psi	Kes:	0.5	for post-tensioned members
Concrete Strength (28-day):	6000 psi	Kcr:	1.6	for post-tensioned members
Volume to Surface Ratio:	5.31 in.	Ksh:	0.85	for 3 days from moist cure to stress.
Moist Cure to Stressing:	3 days	Kre:	5	ksi for 270 grade low-lax strand
Force in This Strip:	kips	Jre:	0.04	for 270 grade low-lax strand
Relative Humidity:	80 %	Cre:	0.7	for low-lax strand at 69% Fu

Formulas used are based on Estimating Prestress Losses, Concrete International, June 1979.

			28-day	initial
Young's Modulus of Concrete:	Ec = 57000 (f'c)^1/2	=	4E+06	4.42E+06
Elastic Shortening:	ES = Kes (P/A) (E/Eci)	=	5.46	
Creep:	CR = Kcr (P/A) (E/Ec)	=	17.47	
Shrinkage:	SH = 8.2e-06 Ksh E(1-0.06(V/S)) (100-RH)	=	2.71	
Relaxation:	RE = (Kre - Jre (ES + CR + SH)) Cre	=	2.78	
Total Long-Term Losses:		=	28.41 ksi	
		=	6.17 kips	

SUMMARY

First Elongation:		1.28 in.	in/ft	0.0801
Second Elongation:		in.		
Pmax:	41.6 kips	0.71 fpu		
Pave:	36.5 kips	0.62 fpu		

Notes:
1. Pmax, Pmin and elongations include seating loss but not long-term losses.
2. Pave includes long-term losses.
3. The Deltas for the first and second pulls include the seating loss.

0.8 Δ **NA** in.
Δ2: **NA** in.

APPENDIX C. SLAB INSPECTION AND CONCRETE RESULTS

1ST POS.

A

KNIFE RIVER
AN MDU RESOURCES COMPANY

Pre-Pour

Pre Pour Inspection
Solid Slabs-Panels

Date:	10-23-15	Insp. Agency:	K.C.C
Job Number:	58590	Bed #:	
Piece Number:	A	Set up By:	
		Job Name:	O.B.L

	Design	Actual
Form Condition & Cleanliness		Good (Wood)
Length	16-0"	16'-0"
Width	16'-0"	16'-0"
Depth	10 5/8"	10 5/8 To 10 3/4" Some Low spot on slab.
Squareness/Diagonals		22'-7 1/4 x 22'-7 5/16
~~Skew~~ P.T Duct.	Lower 4" To ℄ off Bottom upper 6 1/2" To ℄ off Bottom	Pipe are not perfectly straight TJ come's in a role and it hard To get Perfect.
~~Return~~ Straight	5 1/4" To ℄ off Bottom	Height: Width: Length:
Reveals all P.T	Duct vary +- 1/4"	Do To Butt Pipe.
Chamfer U-Bars	4B105 North/South 4B104 east west	Top: Do To conflict Bottom: with Trumpets.
Plates		N.F. F.F. S.F. Qty.
Plates		N.F. F.F. S.F. Qty.
Plates		N.F. F.F. S.F. Qty.
Trumpets		
~~Blockout #1~~ east	1'-6" off side's 12" O.C	13 sp. 5 5/16 off B. & T ℄
~~Blockout #2~~ West	1'-6" off side's 12" O.C	13 sp. 5 5/16 off B. & T ℄
Hole #1 North	1'-6" off sides 12" O.C	13 sp 3 15/16 & 6 1/16 To ℄ off Bottom
Hole #2 South	1'-6" off sides 12" O.C	13 sp. 3 15/16 & 6 1/16 To ℄ off Bottom
Features		
Inserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.
Rebar Type	A615	A706 A615 A615
Bar Sizes	#4	
All Tied In		all Tied
Clearance	3/4" Top & Bottom	1" off all side's
Lifting	3 1/2 strand @ 3'-0 off sides	3 #4 @ 5'-0" at each pick point

9 ST Backs @ 4'-0 off ends 3'-0 off sides.

Performed By:

☐ Foreman:

☒ QC: Tom Walker

Time Checked:

Time Called:

Request Arrival Time:

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C #2nd pos.

KNIFE RIVER
AN MDU RESOURCES COMPANY

Bonded Pre-Stressed Concrete Slabs -- Open Air Blast Testing (Final Report)

Pre-Pour

Pre Pour Inspection
Solid Slabs-Panels

Date: 10-23-15
Job Number: 58580
Piece Number: C

Insp. Agency: K.R.C
Bed #:
Set up By:
Job Name: O.B.L

	Design	Actual
Form Condition & Cleanliness		Good (wood)
Length	16'-0"	16'-0
Width	16'-0"	16'-0"
Depth	10 5/8	10 5/8 To 10 11/16
Squareness/Diagonals		22'-7 5/16 22'-7 1/4
U Bars	4B105 ~~North~~ South side 4B104 ~~South~~ east ~~west~~ side	Do To conflict with Trumpets
Return		Height: Width: Length:
Reveals	5 5/16 To CL	
Chamfer	P.T DucT, EasT [illegible]	Top: Bottom:
Plates	WesT 5 5/16 To CL	N.F. F.F. S.F. Qty.
Plates	North 4 1/8" CL Lower 6 3/4" CL upper	N.F. F.F. S.F. Qty.
Plates	South 4" CL Lower 6 11/16 CL upper	N.F. F.F. S.F. Qty.
Trumpets	1'-7 1/2 - 9" O.C	17 sp.
Blockout #1 easT	5 5/16 CL	5 5/16 To CL of Trumpet
Blockout #2 WesT	5 5/16 CL	5 5/16 To CL
Hole #1 North	Lower 3 15/16 upper 6 11/16 CL	
Hole #2 South	Lower 3 5/16" upper 6 11/16" CL	
Features	all P.T DucT very + - 1/4"	Do To Bent Pipe, cone's in a rok.
Inserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.
Rebar Type		A706 A615 A615
Bar Sizes	6" on Center spacing	#4 on all rebar
All Tied In		Good
Clearance		
Lifting	3 1/2 strand @	3'-6" CL 3 #4 - 5'-0" @ each Pick point

4 Banks @ 4'-1" off ends 3'-0 off sides 8T.

Performed By:

☐ Foreman:

☒ QC: Tom Walker

Time Checked:
Time Called:
Request Arrival Time:

C-3

B Pos #3 11-4-15

KNIFE RIVER
AN MDU RESOURCES COMPANY

Pre-Pour

Pre Pour Inspection
Solid Slabs-Panels

Date: 11-3-15
Job Number: 58590
Piece Number: B Pos. 3

Insp. Agency: Knife river
Bed #:
Set up By:
Job Name: O.B.L

	Design	Actual
Form Condition & Cleanliness		Good
Length	16'-0"	16'-0"
Width	16'-0"	16'-0"
Depth	10 5/8	10 5/8
Squareness/Diagonals	23'-7 3/8	23'-7 3/8 - 23'-7 1/2
~~Skew~~ Trumpets	1'-6"-12" O.C	
Return		Height: Width: Length:
Reveals		
Chamfer		Top: Bottom:
Plates		N.F. F.F. S.F. Qty
Plates		N.F. F.F. S.F. Qty
Plates		N.F. F.F. S.F. Qty
P.T Duct	3 15/16 - 5 5/16 - 6 11/16	4" o.c 5 1/4 o.c 6 3/4 o.c
Blockout #1		
Blockout #2		
Hole #1		
Hole #2		
Features coils		
Inserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.
Rebar Type	#5 @ 4" o.c	A706 A615 4" o.c
Bar Sizes	#5	
All Tied In	Good	Yes
Clearance	3/4 off T. B.	1" off sides
Lifting 5 1/2 strand @ 3'-0" off sides with 5 #4 shear Bar @ 2" o.c.		

Performed By:
☐ Foreman: ______ Time Checked: ______
☐ QC: ______ Time Called: ______
Request Arrival Time: ______

C-4

D Pos #4

KNIFE RIVER
AN MDU RESOURCES COMPANY

Pre-Pour

're Pour Inspection
iolid Slabs-Panels

Date: 11-5-15
Job Number: 55590
Piece Number: D Pos. 4

Insp. Agency: Knife River
Bed #:
Set up By:
Job Name: D.B.L Blast Panel

	Design	Actual
'orm Condition & Cleanliness	Good	Good
ength	16'-0"	16'-0"
Vidth	16'-0"	16'-1/8"
)epth	10 5/8	10 5/8"
;quareness/Diagonals	23'-7 1/2	23'-7 1/2 - 23'-7 7/16"
Trumpets	1'-7 1/2 - 9" o.c 17 spaces	1'-7 1/2 (17) @ 9"
Return		Height: Width: Length:
P.T Ducts	3 15/16 - 5 5/16 - 6 11/16	4" 5 1/4 6 11/16
:hamfer		Top: Bottom:
'lates		N.F. F.F. S.F. Qty.
'lates		N.F. F.F. S.F. Qty.
'lates		N.F. F.F. S.F. Qty.
Grout Tube	3" - 4" - 6"	3 1/8" - 4 1/4" - 6 1/16"
3lockout #1		
3lockout #2		
Hole #1		
Hole #2		
'eatures		
nserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.
Rebar Type		A706 A615 #5
Bar Sizes		#5 @ 4" O.C
All Tied In		
Clearance	3/4 T.B 1" off	sides
Lifting	(3) 1/2 strand @ 2 Locations	3'-0" off sides To CL

Performed By:

☐ Foreman:

☒ QC: T. Walker

Time Checked:
Time Called:
Request Arrival Time:

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A2 Pos #5

KNIFE RIVER
AN MDU RESOURCES COMPANY

Bonded Pre-Stressed Concrete Slabs -- Open Air Blast Testing (Final Report)

Pre-Pour

Pre Pour Inspection
Solid Slabs-Panels

Date:	11-9-15	Insp. Agency:	Knife River
Job Number:	58590	Bed #:	Pos #5
Piece Number:	A2 Pos 5	Set up By:	
		Job Name:	C.O.B.L

	Design	Actual
Form Condition & Cleanliness	Wood	Good
Length	16'-0" ~~16'-0"~~	16'-0 1/4
Width	16'-0"	16'-0 1/4
Depth	10 5/8	10 5/8 - 10 11/16
Squareness/Diagonals	23'-7 1/2	23'-7 1/2 Burned 1'-0"
Skew Trumpets	1'-6 - 13 @ 12" o.c	1'-6 - 1'-6 1/4 - 13 @ 12'-0.C
Return		Height: Width: Length:
Reveals		
Chamfer		Top: Bottom:
Plates		N.F. F.F. S.F. Qty.
Plates		N.F. F.F. S.F. Qty.
Plates		N.F. F.F. S.F. Qty.
P.T Ducts	3 15/16 - 5 5/16 - 6 11/16	4" - 5 5/16" - 6 11/16" to 6 3/4"
Blockout #1		
Blockout #2		
Hole #1		
Hole #2 Burkes	3'-0 X 4'-0"	3'-0" X 4'-0" Good.
Features		
Inserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.
Rebar Type		A706 A615
Bar Sizes		#4 @ 6" O.C
All Tied In		Yes
Clearance	3/4" T.B. 1" on all sides	
Lifting 3	1/2 2 Locations 3'-0 off sides	

Performed By:

☐ Foreman: ______________

☒ QC: T. Walker

Time Checked: ______________

C-6 Time Called: ______________

Request Arrival Time: ______________

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C 2 Pos #6

KNIFE RIVER
AN MDU RESOURCES COMPANY

Bonded Pre-Stressed Concrete Slabs -- Open Air Blast Testing (Final Report)

Pre-Pour

Pre Pour Inspection
Solid Slabs-Panels

Date: 11-12-15
Job Number: 58590
Piece Number: C Pos #6

Insp. Agency: Knife river
Bed #:
Set up By:
Job Name: D. B. L

	Design	Actual	
Form Condition & Cleanliness	WooD OK	OK	
Length	~~16-0~~ X 16'-0"	~~16'-0"~~ X 16'-0 1/8"	
Width	16'-0	16'-0 1/8	
Depth	10 5/8	10 11/16	
Squareness/Diagonals	23'-7 1/2	23'-7 1/2	Burned 1'-0"
~~Item~~ Trumpet's	1'-7 1/2 (19) 9"	1'-7 1/2 (19) spaces @ 9"	
Return		Height: Width: Length:	
Reveals			
Chamfer		Top: Bottom:	
Plates		N.F. F.F. S.F. Qty.	
Plates		N.F. F.F. S.F. Qty.	
Plates		N.F. F.F. S.F. Qty.	
Grout TaBes	18 each side	18 each side.	
~~Blockout #1~~ P.T. Duct's	3 15/16 - 5 9/16 - 6 11/16	4" - 5 1/4 - 6 5/8 +-	
Blockout #2			
Hole #1			
Hole #2			
~~Features~~ Burk's	3'-0" X 4'-0"	2'-10" X 3'-6" conflic with P.T. Duct's	
Inserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.	
Rebar Type		A706 A615	
Bar Sizes	#4 32 each way	#4 64 Total each mat	
All Tied In		YeS	
Clearance	3/4" T.B 1" off Sides		
Lifting	3 1/2 strand @ 3'-6" off sides		

Performed By:

- ☐ Foreman: ____________
- ☐ QC: ____________

Time Checked: ____________
C-7 Time Called: ____________
Request Arrival Time: ____________

KNIFE RIVER
AN MDU RESOURCES COMPANY

Pre-Pour B 2 POS #7

're Pour Inspection
;olid Slabs-Panels

Date: 11-13-15
Job Number: 58590
Piece Number: B Pos #7

Insp. Agency: Knife river
Bed #:
Set up By:
Job Name: C.O.B. 2

	Design	Actual
orm Condition & Cleanliness	OK	OK
ength	16'-0"	16'-0 1/4"
Vidth	16'-0"	16'-0 1/4"
lepth	10 5/8"	10 11/16"
;quareness/Diagonals	23'-7 1/2	23'-7 1/2 Burned 1'0"
kew PT Ducts	3 15/16 - 5 5/16 - 6 11/16	4" - 5 5/16 - 6 5/8"
leturn		Height: Width: Length:
leveals Trumpets	1'-6 13 @ 12"	1'-6 - 1'-6 3/16 13 @ 12"
:hamfer		Top: Bottom:
'lates		N.F. F.F. S.F. Qty.
'lates		N.F. F.F. S.F. Qty.
'lates		N.F. F.F. S.F. Qty.
u Bars	48 9" each side	48 9" each side
3lockout #1 u-Bars	48 7 1/2" each end	48 7 1/2 each end
3lockout #2		
lole #1 L Bars	2 in each corner	2 T.B @ each corner
lole #2		
'eatures		
nserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.
Rebar Type	A615	A706 A615
3ar Sizes	#5 4" O.C	#5 4" O.C
All Tied In		Yes
Clearance	3/4" T.B 1" off sides	
.ifting	3 1/2 @ 3'-0" off sides	

Performed By:

☐ Foreman:

☑ QC: T. Walker

Time Checked:

C-8

Time Called:

Request Arrival Time:

D Pos #8

KNIFE RIVER
AN MDU RESOURCES COMPANY

Bonded Pre-Stressed Concrete Slabs -- Open Air Blast Testing (Final Report)

Pre-Pour

Pre Pour Inspection
Solid Slabs-Panels

Date: 11-14-15
Job Number:
Piece Number: D Pos #8

Insp. Agency: Knife river
Bed #:
Set up By:
Job Name: OBL

	Design	Actual
Form Condition & Cleanliness		OK Gaged 1/4" overall
Length	16'-0"	16'-0 3/16
Width	16'-0"	16'-0 1/4"
Depth	10 5/8	10 5/8 - 10 11/16
Squareness/Diagonals	23'-7 1/2"	23'-7 1/2 Burned 1'-0"
~~Item~~ Trumpet	1'-7 1/16 - (17) @ 9"	1'7 1/2 . 1'7 3/4 (17) @ 9" O.C
Return		Height: Width: Length:
~~Reveals~~ U Bars	48 each side	48 each side.
Chamfer		Top: Bottom:
Plates		N.F. F.F. S.F. Qty.
Plates		N.F. F.F. S.F. Qty.
Plates		N.F. F.F. S.F. Qty.
P.T. Ducts	3 15/16 - 5 5/16 - 6 11/16	4" - 5 1/4 - 6 3/4
Blockout #1		
Blockout #2		
Hole #1		
Hole #2		
Features Burks	3'-0" x 4'-0"	2'-8 x 4'-4"
Inserts-Coil or Ferrule		Qty: Size: N.F. F.F. S.F.
Rebar Type		A706 A615
Bar Sizes	#5, 4" O.C	#5 4" O.C +- moved for Lifting
All Tied In		Yes.
Clearance	3/4 T.B 1" off Sides	
Lifting	(3) 1/2 strand (2) Locations 3'-6" off Sides	

Performed By:

☐ Foreman:

☒ QC: T. Walker

Time Checked:

C-9 Time Called:

Request Arrival Time:

KR 117

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SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (E) or Metric (M)

Field	Value
* CON NO. & EA	
* DATA SHEET NUMBER	F - -
LABORATORY REPORT NUMBER	5245
PROJECT NAME (SECTION)	Oregon Ballistics Project
CONTRACT NUMBER	---
CONTRACTOR	Knife River / OBL
PROJECT MANAGER	---
BID ITEM NUMBER	---
CONCRETE SUPPLIER	Knife River Ready Mix
* SUBMITTED BY	Kevin McCaul
QUANTITY REPRESENTED	18 yd³
CONCRETE FOR USE IN (LOCATION OR PLACEMENT)	Precast Panel 1
BRIDGE NUMBER	---
* SPECIFIED STRENGTH	6000 #REF! 28 DAYS
REPRESENTED BY NO. OF CYLS.	12
SET NUMBER	1
* DATE CAST	11/2/15
DATE SHIPPED	11/3/15
CYLINDER SIZE	4x8
INVOICE NUMBER	1055245
* TEST SPECIMENS AT DAYS INDICATED	A. 3, B. 5, C. 7, D. 28, E. 28, F. 28, G. 65, H. 65
YIELD	9.14 yd³
* MIX DESIGN — * ODOT LAB / MIX DESIGN NUMBER	
* CONCRETE SUPPLIER MIX DESIGN NUMBER	268KN3H0S0
* DESIGN CEMENTITIOUS MATERIAL CONTENT	846 lb/yd³
* FREE (SURFACE) MOISTURE — * COARSE #1	1.34 %
* COARSE #2	3.02 %
* COARSE #3	%
* SAND	8.01 %
* AMBIENT TEMP.	44 °F
* CONCRETE TEMP	78 °F
* SLUMP	6.75 in
* AIR CONTENT	1.6 %
* UNIT WEIGHT	145.2 lb/ft³
* CEMENTITIOUS MAT. CONTENT	833 lb/yd³
* FIELD W/C RATIO	0.39 BY WT.
* ADDITIVES	2965 oz
* CEMENT	7617 lb
* FLYASH	lb
* SILICA	lb
* WATER BATCHED	1510 lb
* NET WEIGHT	36.28
* POT CALIBRATION	0.249810
* AGGREGATE #1	2480 lb
* AGGREGATE #2	11780 lb
* AGGREGATE #3	lb
* FINE AGG (SAND)	12280 lb
* WATER AT JOB	lb
* CURING	Tank
* CAPPING	
* PROJECT CONTACT PERSON	
* CONTACT PHONE NUMBER	
* TIME CYL CAST	1:30 PM
* LOW TEMP.	42 °F
* HIGH TEMP.	84 °F

FIELD REMARKS

[X] QUALITY CONTROL [ ] VERIFICATION [ ] INFO * PHONE No. FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/2/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/05/15	3	59204	12.56	4710	60	5	Lab Cure
B	11/07/15	5	70296	12.56	5600	60	2	Lab Cure
C	11/09/15	7	78740	12.56	6270	60	2	Lab Cure
D	11/30/15	28	98199	12.56	7820	60	2	Lab Cure
E	11/30/15	28	97310	12.56	7750	60	2	Lab Cure
F	11/30/15	28	99288	12.56	7910	60	2	Lab Cure
G	01/06/16	65	109829	12.56	8740	60	2	Partial Field Cure
H	01/06/16	65	112684	12.56	8970	60	4	Partial Field Cure

AVE 28 DAY 7830 ## [X] PASS [ ] FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders G and H were field cured on site until 11/15/2015 and then lab cured until broke.

[X] QUALITY CONTROL [ ] VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/30/2015

SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (E) or Metric (M)

* CON NO. & EA	* DATA SHEET NUMBER	LABORATORY REPORT NUMBER
	F - -	5251

PROJECT NAME (SECTION)	CONTRACT NUMBER
Oregon Ballistics Project	---

CONTRACTOR	PROJECT MANAGER	BID ITEM NUMBER
Knife River / OBL	---	---

CONCRETE SUPPLIER	* SUBMITTED BY	QUANTITY REPRESENTED
Knife River Ready Mix	Kevin McCaul	18 yd³

CONCRETE FOR USE IN (LOCATION OR PLACEMENT)	BRIDGE NUMBER	* SPECIFIED STRENGTH
Precast Panel 2	---	6000 #REF! 28 DAYS

REPRESENTED BY NO. OF CYLS.	SET NUMBER	* DATE CAST	DATE SHIPPED	CYLINDER SIZE	INVOICE NUMBER
12	2	11/2/15	11/3/15	4x8	1055251

* TEST SPECIMENS AT DAYS INDICATED

A.	B.	C.	D.	E.	F.	G.	H.	YIELD
7	28	28	28	65	65	H	H	9.14 yd³

* MIX DESIGN	* ODOT LAB / MIX DESIGN NUMBER	* CONCRETE SUPPLIER MIX DESIGN NUMBER	* DESIGN CEMENTITIOUS MATERIAL CONTENT	* FREE (SURFACE) MOISTURE * COARSE #1	* COARSE #2	* COARSE #3	* SAND
		268KN3H0S0	846 lb/yd³	1.34 %	3.02 %	%	6.63 %

* AMBIENT TEMP.	* CONCRETE TEMP	* SLUMP	* AIR CONTENT	* UNIT WEIGHT	* CEMENTITIOUS MAT. CONTENT	* FIELD W/C RATIO
44 °F	77 °F	7 in	1.8 %	144.4 lb/ft³	832 lb/yd³	0.40 BY WT.

* ADDITIVES	* CEMENT	* FLYASH	* SILICA	* WATER BATCHED	* NET WEIGHT	* POT CALIBRATION
2869 oz	7606 lb	lb	lb	1735 lb	36.07	0.249810

* AGGREGATE #1	* AGGREGATE #2	* AGGREGATE #3	* FINE AGG (SAND)	* WATER AT JOB	* CURING	* CAPPING
2260 lb	11740 lb	lb	12100 lb	lb	Tank	

* PROJECT CONTACT PERSON	* CONTACT PHONE NUMBER	* TIME CYL CAST	* LOW TEMP.	* HIGH TEMP.
		2:00 PM	42 °F	84 °F

FIELD REMARKS

X QUALITY CONTROL ☐ VERIFICATION ☐ INFO * PHONE No. FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/2/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/09/15	7	55365	12.56	4410	60	2	Lab Cure
B	11/30/15	28	94412	12.56	7520	60	3	Lab Cure
C	11/30/15	28	96750	12.56	7700	60	3	Lab Cure
D	11/30/15	28	96118	12.56	7650	60	2	Lab Cure
E	01/06/16	65	90658	12.56	7220	60	4	Partial Field Cure
F	01/06/16	65	109201	12.56	8690	60	2	Partial Field Cure
G	#VALUE!	H						
H	#VALUE!	H						

AVE 28 DAY 7620 ## X PASS ☐ FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders E and F were field cured on site until 11/15/2015 and then lab cured until broke.

X QUALITY CONTROL ☐ VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/30/2015

SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (**E**) or Metric (**M**)

* CON NO. & EA	* DATA SHEET NUMBER F - -	LABORATORY REPORT NUMBER **5311**	
PROJECT NAME (SECTION) Oregon Ballistics Project			CONTRACT NUMBER ---
CONTRACTOR Knife River / OBL	PROJECT MANAGER ---		BID ITEM NUMBER ---
CONCRETE SUPPLIER Knife River Ready Mix	* SUBMITTED BY Kevin McCaul		QUANTITY REPRESENTED 9 yd³
CONCRETE FOR USE IN (LOCATION OR PLACEMENT) Precast Panel 3	BRIDGE NUMBER ---	* SPECIFIED STRENGTH 6000 #REF! 28 DAYS	

REPRESENTED BY NO. OF CYLS.	SET NUMBER	* DATE CAST	DATE SHIPPED	CYLINDER SIZE	INVOICE NUMBER
12	1	11/4/15	11/5/15	4x8	1055311

* TEST SPECIMENS AT DAYS INDICATED

A.	B.	C.	D.	E.	F.	G.	H.	YIELD
7	28	28	28	65	65	H	H	9.11 yd³

* MIX DESIGN	* ODOT LAB / MIX DESIGN NUMBER	* CONCRETE SUPPLIER MIX DESIGN NUMBER	* DESIGN CEMENTITIOUS MATERIAL CONTENT	* FREE (SURFACE) MOISTURE * COARSE #1	* COARSE #2	* COARSE #3	* SAND
		268KN3H0S0	846 lb/yd³	1.34 %	3.02 %	%	6.97 %

* AMBIENT TEMP.	* CONCRETE TEMP	* SLUMP	* AIR CONTENT	* UNIT WEIGHT	* CEMENTITIOUS MAT. CONTENT	* FIELD W/C RATIO
42 °F	75 °F	6.25 in	1.6 %	144.3 lb/ft³	833 lb/yd³	0.39 BY WT.

* ADDITIVES	* CEMENT	* FLYASH	* SILICA	* WATER BATCHED	* NET WEIGHT	* POT CALIBRATION
2869 oz	7591 lb	lb	lb	1626 lb	36.05	0.249810

* AGGREGATE #1	* AGGREGATE #2	* AGGREGATE #3	* FINE AGG (SAND)	* WATER AT JOB	* CURING	* CAPPING
2260 lb	11600 lb	lb	12220 lb	lb	Tank	

* PROJECT CONTACT PERSON	* CONTACT PHONE NUMBER	* TIME CYL CAST	* LOW TEMP.	* HIGH TEMP.
		2:45 PM	53 °F	83 °F

FIELD REMARKS

X QUALITY CONTROL ☐ VERIFICATION ☐ INFO * **PHONE No.** FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/4/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/11/15	7	62138	12.56	4950	60	5	Lab Cure
B	12/02/15	28	89146	12.56	7100	60	3	Lab Cure
C	12/02/15	28	86552	12.56	6890	60	3	Lab Cure
D	12/02/15	28	87323	12.56	6950	60	2	Lab Cure
E	01/08/16	65	95631	12.56	7610	60	5	Partial Field Cure
F	01/08/16	65	102771	12.56	8180	60	2	Partial Field Cure
G	#VALUE!	H						
H	#VALUE!	H						

AVE 28 DAY 6980 ## X PASS ☐ FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders E and F were field cured on site until 11/15/2015 and then lab cured until broke.

X QUALITY CONTROL ☐ VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		12/2/2015

SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (E) or Metric (M)

* CON NO. & EA	* DATA SHEET NUMBER F - -	LABORATORY REPORT NUMBER 5339
PROJECT NAME (SECTION) Oregon Ballistics Project		CONTRACT NUMBER ---
CONTRACTOR Knife River / OBL	PROJECT MANAGER ---	BID ITEM NUMBER ---
CONCRETE SUPPLIER Knife River Ready Mix	* SUBMITTED BY Kevin McCaul	QUANTITY REPRESENTED 9 yd³

CONCRETE FOR USE IN (LOCATION OR PLACEMENT) Precast Panel 4	BRIDGE NUMBER ---	* SPECIFIED STRENGTH 6000 #REF! 28 DAYS

REPRESENTED BY NO. OF CYLS. 9	SET NUMBER 1	* DATE CAST 11/5/15	DATE SHIPPED 11/6/15	CYLINDER SIZE 4x8	INVOICE NUMBER 1055311

* TEST SPECIMENS AT DAYS INDICATED

A.	B.	C.	D.	E.	F.	G.	H.	YIELD
6	6	28	28	28	62	62	H	###### yd³

* MIX DESIGN	* ODOT LAB / MIX DESIGN NUMBER	* CONCRETE SUPPLIER MIX DESIGN NUMBER	* DESIGN CEMENTITIOUS MATERIAL CONTENT	* FREE (SURFACE) MOISTURE: * COARSE #1	* COARSE #2	* COARSE #3	* SAND
		268KN3H0S0	846 lb/yd³	1.34 %	3.02 %	%	6.71 %

* AMBIENT TEMP.	* CONCRETE TEMP	* SLUMP	* AIR CONTENT	* UNIT WEIGHT	* CEMENTITIOUS MAT. CONTENT	* FIELD W/C RATIO
46 °F	78 °F	n/a in	n/a %	###### lb/ft³	#VALUE! lb/yd³	0.40 BY WT.

* ADDITIVES	* CEMENT	* FLYASH	* SILICA	* WATER BATCHED	* NET WEIGHT	* POT CALIBRATION
2853 oz	7594 lb	lb	lb	1701 lb	#VALUE!	0.249810

* AGGREGATE #1	* AGGREGATE #2	* AGGREGATE #3	* FINE AGG (SAND)	* WATER AT JOB	* CURING	* CAPPING
2260 lb	11580 lb	lb	12160 lb	lb	Tank	

* PROJECT CONTACT PERSON	* CONTACT PHONE NUMBER	* TIME CYL CAST	* LOW TEMP.	* HIGH TEMP.
		1:00 PM	53 °F	83 °F

FIELD REMARKS

Slump not measured. Approximately a 28" spread due to the addition of 1466 on site for workability

[X] QUALITY CONTROL [ ] VERIFICATION [ ] INFO * PHONE No. FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River	[signature]	11/5/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/11/15	6	94697	12.56	7540	60	2	Field Cure
B	11/11/15	6	87788	12.56	6990	60	3	Field Cure
C	12/03/15	28	110213	12.56	8770	60	3	Lab Cure
D	12/03/15	28	113874	12.56	9070	60	2	Lab Cure
E	12/03/15	28	114644	12.56	9130	60	3	Lab Cure
F	01/06/16	62	120200	12.56	9570	60	5	Partial Field Cure
G	01/06/16	62	124044	12.56	9880	60	2	Partial Field Cure
H	#VALUE!	H						

AVE 28 DAY 8990 ## [X] PASS [ ] FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders F and G were field cured on site until 11/15/2015 and then lab cured until broke.

[X] QUALITY CONTROL [ ] VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River	[signature]	12/3/2015

SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (E) or Metric (M)

* CON NO. & EA	* DATA SHEET NUMBER F - -	LABORATORY REPORT NUMBER **5456**
PROJECT NAME (SECTION): Oregon Ballistics Project		CONTRACT NUMBER: ---
CONTRACTOR: Knife River / OBL	PROJECT MANAGER: ---	BID ITEM NUMBER: ---
CONCRETE SUPPLIER: Knife River Ready Mix	* SUBMITTED BY: Kevin McCaul	QUANTITY REPRESENTED: 9 yd³
CONCRETE FOR USE IN (LOCATION OR PLACEMENT): Precast Panel 5	BRIDGE NUMBER: ---	* SPECIFIED STRENGTH: 6000 #REF! 28 DAYS

REPRESENTED BY NO. OF CYLS.	SET NUMBER	* DATE CAST	DATE SHIPPED	CYLINDER SIZE	INVOICE NUMBER
9	1	11/10/15	11/12/15	4x8	1055456

* TEST SPECIMENS AT DAYS INDICATED

A.	B.	C.	D.	E.	F.	G.	H.	YIELD
7	28	28	28	57	57	H	H	####### yd³

* MIX DESIGN	* ODOT LAB / MIX DESIGN NUMBER	* CONCRETE SUPPLIER MIX DESIGN NUMBER	* DESIGN CEMENTITIOUS MATERIAL CONTENT	* FREE (SURFACE) MOISTURE: * COARSE #1	* COARSE #2	* COARSE #3	* SAND
		268KN3H0S0	846 lb/yd³	1.34 %	3.02 %	%	6.55 %

* AMBIENT TEMP.	* CONCRETE TEMP	* SLUMP	* AIR CONTENT	* UNIT WEIGHT	* CEMENTITIOUS MAT. CONTENT	* FIELD W/C RATIO
41 °F	76 °F	n/a in	n/a %	####### lb/ft³	#VALUE! lb/yd³	0.40 BY WT.

* ADDITIVES	* CEMENT	* FLYASH	* SILICA	* WATER BATCHED	* NET WEIGHT	* POT CALIBRATION
2857 oz	7627 lb	lb	lb	1726 lb	#VALUE!	0.249810

* AGGREGATE #1	* AGGREGATE #2	* AGGREGATE #3	* FINE AGG (SAND)	* WATER AT JOB	* CURING	* CAPPING
2340 lb	11840 lb	lb	12200 lb	lb	Tank	

* PROJECT CONTACT PERSON	* CONTACT PHONE NUMBER	* TIME CYL CAST	* LOW TEMP.	* HIGH TEMP.
		1:40 PM	50 °F	81 °F

FIELD REMARKS

Slump not measured. Approximately a 20" spread due to the addition of 1466 on site for workability

X QUALITY CONTROL ☐ VERIFICATION ☐ INFO * **PHONE No.** FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River	[signature]	11/10/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/17/15	7	97830	12.56	7790	60	2	Lab Cure
B	12/08/15	28	117832	12.56	9380	60	2	Lab Cure
C	12/08/15	28	119047	12.56	9480	60	2	Lab Cure
D	12/08/15	28	118446	12.56	9430	60	2	Lab Cure
E	01/06/16	57	108827	12.56	8660	60	4	Partial Field Cure
F	01/06/16	57	105879	12.56	8430	60	2	Partial Field Cure
G	#VALUE!	H						
H	#VALUE!	H						

AVE 28 DAY 9430 ## X PASS ☐ FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders E and F were field cured on site until 11/15/2015 and then lab cured until broke.

X QUALITY CONTROL ☐ VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River	[signature]	12/8/2015

SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (E) or Metric (M)

* CON NO. & EA	* DATA SHEET NUMBER	LABORATORY REPORT NUMBER
	F - -	5518

PROJECT NAME (SECTION)	CONTRACT NUMBER
Oregon Ballistics Project	---

CONTRACTOR	PROJECT MANAGER	BID ITEM NUMBER
Knife River / OBL	---	---

CONCRETE SUPPLIER	* SUBMITTED BY	QUANTITY REPRESENTED
Knife River Ready Mix	Kevin McCaul	9 yd³

CONCRETE FOR USE IN (LOCATION OR PLACEMENT)	BRIDGE NUMBER	* SPECIFIED STRENGTH
Precast Panel 6	---	6000 #REF! 28 DAYS

REPRESENTED BY NO. OF CYLS.	SET NUMBER	* DATE CAST	DATE SHIPPED	CYLINDER SIZE	INVOICE NUMBER
9	1	11/12/15	11/13/15	4x8	1055518

* TEST SPECIMENS AT DAYS INDICATED

A.	B.	C.	D.	E.	F.	G.	H.	YIELD
5	5	28	28	28	55	55	H	###### yd³

* MIX DESIGN	* ODOT LAB / MIX DESIGN NUMBER	* CONCRETE SUPPLIER MIX DESIGN NUMBER	* DESIGN CEMENTITIOUS MATERIAL CONTENT	* FREE (SURFACE) MOISTURE: * COARSE #1	* COARSE #2	* COARSE #3	* SAND
		268KN3H0S0	846 lb/yd³	1.34 %	3.02 %	%	5.85 %

* AMBIENT TEMP.	* CONCRETE TEMP	* SLUMP	* AIR CONTENT	* UNIT WEIGHT	* CEMENTITIOUS MAT. CONTENT	* FIELD W/C RATIO
47 °F	75 °F	n/a in	n/a %	###### lb/ft³	#VALUE! lb/yd³	0.38 BY WT.

* ADDITIVES	* CEMENT	* FLYASH	* SILICA	* WATER BATCHED	* NET WEIGHT	* POT CALIBRATION
2857 oz	7607 lb	lb	lb	1651 lb	#VALUE!	0.249810

* AGGREGATE #1	* AGGREGATE #2	* AGGREGATE #3	* FINE AGG (SAND)	* WATER AT JOB	* CURING	* CAPPING
2260 lb	11660 lb	lb	12140 lb	lb	Tank	

* PROJECT CONTACT PERSON	* CONTACT PHONE NUMBER	* TIME CYL CAST	* LOW TEMP.	* HIGH TEMP.
		1:40 PM	53 °F	82 °F

FIELD REMARKS

Slump not measured. Approximately a 22" spread due to the addition of 1466 on site for workability

[X] QUALITY CONTROL [ ] VERIFICATION [ ] INFO * **PHONE No.** FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/12/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/17/15	5	71415	12.56	5690	60	5	Field Cure
B	11/17/15	5	68127	12.56	5420	60	2	Field Cure
C	12/10/15	28	96116	12.56	7650	60	3	Lab Cure
D	12/10/15	28	94018	12.56	7490	60	3	Lab Cure
E	12/10/15	28	93235	12.56	7420	60	2	Lab Cure
F	01/06/16	55	98119	12.56	7810	60	2	Partial Field Cure
G	01/06/16	55	97892	12.56	7790	60	3	Partial Field Cure
H	#VALUE!	H						

AVE 28 DAY 7520 ## [X] PASS [ ] FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders F and G were field cured on site until 11/15/2015 and then lab cured until broke.

[X] QUALITY CONTROL [ ] VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		12/10/2015

SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (**E**) or Metric (**M**)

* CON NO. & EA	* DATA SHEET NUMBER F - -	LABORATORY REPORT NUMBER **5549**
PROJECT NAME (SECTION) Oregon Ballistics Project		CONTRACT NUMBER ---
CONTRACTOR Knife River / OBL	PROJECT MANAGER ---	BID ITEM NUMBER ---
CONCRETE SUPPLIER Knife River Ready Mix	* SUBMITTED BY Kevin McCaul	QUANTITY REPRESENTED 9 yd³
CONCRETE FOR USE IN (LOCATION OR PLACEMENT) Precast Panel 7	BRIDGE NUMBER ---	* SPECIFIED STRENGTH 6000 #REF! 28 DAYS

REPRESENTED BY NO. OF CYLS.	SET NUMBER	* DATE CAST	DATE SHIPPED	CYLINDER SIZE	INVOICE NUMBER
8	1	11/13/15	11/14/15	4x8	1055549

* TEST SPECIMENS AT DAYS INDICATED

A.	B.	C.	D.	E.	F.	G.	H.	YIELD
4	4	7	28	28	28	54	54	###### yd³

* MIX DESIGN	* ODOT LAB / MIX DESIGN NUMBER	* CONCRETE SUPPLIER MIX DESIGN NUMBER	* DESIGN CEMENTITIOUS MATERIAL CONTENT	* FREE (SURFACE) MOISTURE * COARSE #1	* COARSE #2	* COARSE #3	* SAND
		268KN3H0S0	846 lb/yd³	1.34 %	3.02 %	%	5.85 %

* AMBIENT TEMP	* CONCRETE TEMP	* SLUMP	* AIR CONTENT	* UNIT WEIGHT	* CEMENTITIOUS MAT. CONTENT	* FIELD W/C RATIO
50 °F	77 °F	n/a in	n/a %	###### lb/ft³	#VALUE! lb/yd³	0.40 BY WT.

* ADDITIVES	* CEMENT	* FLYASH	* SILICA	* WATER BATCHED	* NET WEIGHT	* POT CALIBRATION
2857 oz	7619 lb	lb	lb	1801 lb	#VALUE!	0.249810

* AGGREGATE #1	* AGGREGATE #2	* AGGREGATE #3	* FINE AGG (SAND)	* WATER AT JOB	* CURING	* CAPPING
2280 lb	11480 lb	lb	12020 lb	lb	Tank	

* PROJECT CONTACT PERSON	* CONTACT PHONE NUMBER	* TIME CYL CAST	* LOW TEMP.	* HIGH TEMP.
		11:00 AM	56 °F	84 °F

FIELD REMARKS

Slump not measured. Approximately a 20" spread due to the addition of 1466 on site for workability

[X] QUALITY CONTROL [ ] VERIFICATION [ ] INFO * **PHONE No.** FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/12/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/17/15	4	80202	12.56	6390	60	3	Field Cure
B	11/17/15	4	77323	12.56	6160	60	3	Field Cure
C	11/20/15	7	94525	12.56	7530	60	2	Lab Cure
D	12/11/15	28	103680	12.56	8250	60	2	Lab Cure
E	12/11/15	28	104022	12.56	8280	60	2	Lab Cure
F	12/11/15	28	104577	12.56	8330	60	2	Lab Cure
G	01/06/16	54	112344	12.56	8940	60	4	Partial Field Cure
H	01/06/16	54	108655	12.56	8650	60	2	Partial Field Cure

AVE 28 DAY 8290 ## [X] PASS [ ] FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders G and H were field cured on site until 11/15/2015 and then lab cured until broke.

[X] QUALITY CONTROL [ ] VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		12/11/2015

SAMPLE DATA SHEET FOR CONCRETE CYLINDERS

E English (E) or Metric (M)

* CON NO. & EA	* DATA SHEET NUMBER F - -	LABORATORY REPORT NUMBER **5573**
PROJECT NAME (SECTION) Oregon Ballistics Project		CONTRACT NUMBER ---
CONTRACTOR Knife River / OBL	PROJECT MANAGER ---	BID ITEM NUMBER ---
CONCRETE SUPPLIER Knife River Ready Mix	* SUBMITTED BY Kevin McCaul	QUANTITY REPRESENTED 9 yd³
CONCRETE FOR USE IN (LOCATION OR PLACEMENT) Precast Panel 8	BRIDGE NUMBER ---	* SPECIFIED STRENGTH 6000 #REF! 28 DAYS

REPRESENTED BY NO. OF CYLS.	SET NUMBER	* DATE CAST	DATE SHIPPED	CYLINDER SIZE	INVOICE NUMBER
8	1	11/14/15	11/16/15	4x8	1055573

* TEST SPECIMENS AT DAYS INDICATED

A.	B.	C.	D.	E.	F.	G.	H.	YIELD
3	3	5	28	28	28	53	53	###### yd³

* MIX DESIGN	* ODOT LAB / MIX DESIGN NUMBER	* CONCRETE SUPPLIER MIX DESIGN NUMBER	* DESIGN CEMENTITIOUS MATERIAL CONTENT	* COARSE #1	* COARSE #2	* COARSE #3	* SAND
		268KN3H0S0	846 lb/yd³	1.34 %	3.02 %	%	5.45 %

* FREE (SURFACE) MOISTURE applies to COARSE #1, #2, #3 and SAND.

* AMBIENT TEMP.	* CONCRETE TEMP	* SLUMP	* AIR CONTENT	* UNIT WEIGHT	* CEMENTITIOUS MAT. CONTENT	* FIELD W/C RATIO
36 °F	72 °F	n/a in	n/a %	###### lb/ft³	#VALUE! lb/yd³	0.39 BY WT.

* ADDITIVES	* CEMENT	* FLYASH	* SILICA	* WATER BATCHED	* NET WEIGHT	* POT CALIBRATION
2857 oz	7634 lb	lb	lb	1843 lb	#VALUE!	0.249810

* AGGREGATE #1	* AGGREGATE #2	* AGGREGATE #3	* FINE AGG (SAND)	* WATER AT JOB	* CURING	* CAPPING
2260 lb	11600 lb	lb	12060 lb	lb	Tank	

* PROJECT CONTACT PERSON	* CONTACT PHONE NUMBER	* TIME CYL CAST	* LOW TEMP.	* HIGH TEMP.
		10:15 AM	42 °F	84 °F

FIELD REMARKS

Slump not measured. Approximately a 20" spread due to the addition of 1466 on site for workability

X QUALITY CONTROL ☐ VERIFICATION ☐ INFO * **PHONE No.** FAX No.

T 23 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		11/12/15

LAB USE ONLY BELOW

CYLINDER ID	DATE OF BREAK	AGE DAYS	MAXIMUM LOAD	CYLINDER AREA	STRENGTH #REF!	COMPOUND TYPE / PAD DUROMETER	BREAK TYPE	REMARKS
A	11/17/15	3	53766	12.56	4280	60	2	Field Cure
B	11/17/15	3	52789	12.56	4200	60	2	Field Cure
C	11/19/15	5	75618	12.56	6020	60	2	Lab Cure
D	12/12/15	28	91589	12.56	7290	60	3	Lab Cure
E	12/12/15	28	91163	12.56	7260	60	2	Lab Cure
F	12/12/15	28	94792	12.56	7550	60	2	Lab Cure
G	01/06/16	53	103671	12.56	8250	60	5	Partial Field Cure
H	01/06/16	53	102364	12.56	8150	60	2	Partial Field Cure

AVE 28 DAY 7370 ## X PASS ☐ FAIL

COMMENTS (WHEN MATERIAL ,CYLINDERS OR DATA RECEIVED)

Cylinders G and H were field cured on site until 11/15/2015 and then lab cured until broke.

X QUALITY CONTROL ☐ VERIFICATION CYLINDERS REC'D DATA SHEET RECD

T 22 CERTIFIED TECHNICIAN (PLEASE PRINT) AND CARD NUMBER	COMPANY NAME	SIGNATURE	DATE
Kevin McCaul 44396	Knife River		12/12/2015

APPENDIX D. INSTRUMENTATION CALIBRATION CERTIFICATION

DTS
41204 Bridge Street, Novi, MI 48375-1301 USA
Phone: +1 248 427 0045 • Fax: +1 248 427 0630
www.dtsweb.com

ilac-MRA
ACCREDITED
Calibration CERT# 3007.01

Certificate of Calibration

Model #:	TDAS G5 Docking Station	Certificate #:	2015813G5DS0136
Serial #:	G5DS0136	Date Received:	12 August 2015
Procedure Name:	G5 VDS Calibration	Date Calibrated:	13 August 2015
Procedure Rev:	2.1	Next Calibration:	13 August 2016
Project Number:	RA29243	Item Received:	In Tolerance
Customer:	Oregon Ballistic Laboratories	Item Returned:	In Tolerance
	2873 22nd St. SE Ste C	Temperature:	77°F/24.7°C
	Salem, OR 97302	Humidity:	38 %

DTS has been audited by the American Association for Laboratory Accreditation (A2LA) and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the DTS Scope of Accreditation are indicated by the presence of the A2LA Logo and Certificate Number on this Certificate of Calibration.
DTS reference standards are processed and calibrated in accordance with the DTS Quality Assurance System, and traceable to the National Institute of Standards and Technology (NIST).
All calibrations have been performed using processes having a test uncertainty ratio of four or more times greater than the unit calibrated, unless otherwise noted on the report. Uncertainties have been estimated at a 95 percent confidence level (k=2). Calibration at a 4:1 TUR provides reasonable confidence that the instrument is within the manufacturer's published specifications.
The reported data is the raw recorded data and is not corrected for uncertainty or environmental effects. Any number of factors can cause a unit to drift out of tolerance at any time following its calibration.
This report only applies only to the item(s) identified above, and shall not be reproduced except in full, without the written approval of DTS. Limitations on the uses of this instrument are detailed in the manufacturer's operating instructions.

Remarks:

Standards Used

Serial #	Manufacturer	Model #	Description	Cal Date	Due Date
US34021614	HP	33120A	Function/Arbitrary Waveform Generator, 15 MHz	13-Feb-2015	13-Feb-2016
MY42002138	Agilent	34420A	Nano Volt, Micro-Ohm Meter, 7.5 Digit	28-May-2015	28-May-2016
CAL012	DTS	CALSTAT	TDAS Calibration Station	15-Nov-2014	15-Nov-2015

Results

Test Description	Test Result As Received	Test Result As Returned
Battery Changed	N/A	Yes
Visual Inspection	Pass	Pass
Basic Channel Functions	Pass	Pass
Power Management	Pass	Pass
Sensor Excitation Sources	Pass	Pass
Etherent Communications	Pass	Pass
Data Collection Function	Pass	Pass
T=0 Trigger Function	Pass	Pass

Calibrated By: Bob Colenso
Bob Colenso
Technical Support Engineer

Calibration Site: 25881 Meadowbrook Road
Novi, MI 48375

Test Description

2V Excitation Sources

		As Received					As Returned				
	Limit	Actual	Reported	Unc. (in Vdc)	Deviation (in %)	Pass/ Fail	Actual	Reported	Unc. (in Vdc)	Deviation (in %)	Pass/ Fail
Channel 1	0.1%	1.995 Vdc	1.995 Vdc	5.7E-03	0.01 %	Pass	1.995 Vdc	1.995 Vdc	5.7E-03	0.00 %	Pass
Channel 2	0.1%	1.996 Vdc	1.996 Vdc	8.1E-03	0.01 %	Pass	1.996 Vdc	1.996 Vdc	8.2E-03	0.00 %	Pass
Channel 3	0.1%	2.003 Vdc	2.003 Vdc	7.8E-03	0.02 %	Pass	2.003 Vdc	2.003 Vdc	7.8E-03	-0.01 %	Pass
Channel 4	0.1%	1.990 Vdc	1.990 Vdc	8.0E-03	0.01 %	Pass	1.990 Vdc	1.989 Vdc	8.0E-03	-0.01 %	Pass
Channel 5	0.1%	2.008 Vdc	2.008 Vdc	6.7E-03	0.01 %	Pass	2.008 Vdc	2.008 Vdc	6.7E-03	-0.01 %	Pass
Channel 6	0.1%	2.009 Vdc	2.009 Vdc	9.0E-03	0.00 %	Pass	2.009 Vdc	2.009 Vdc	9.0E-03	0.00 %	Pass
Channel 7	0.1%	1.993 Vdc	1.993 Vdc	3.1E-03	0.00 %	Pass	1.993 Vdc	1.993 Vdc	7.9E-03	0.00 %	Pass
Channel 8	0.1%	2.005 Vdc	2.005 Vdc	7.7E-03	0.01 %	Pass	2.005 Vdc	2.005 Vdc	7.7E-03	0.01 %	Pass
Channel 9	0.1%	1.994 Vdc	1.995 Vdc	8.0E-03	0.01 %	Pass	1.994 Vdc	1.994 Vdc	5.8E-03	-0.01 %	Pass
Channel 10	0.1%	1.996 Vdc	1.996 Vdc	7.5E-03	0.00 %	Pass	1.996 Vdc	1.996 Vdc	7.5E-03	0.00 %	Pass
Channel 11	0.1%	2.007 Vdc	2.007 Vdc	6.4E-03	0.00 %	Pass	2.007 Vdc	2.007 Vdc	6.4E-03	0.00 %	Pass
Channel 12	0.1%	2.008 Vdc	2.009 Vdc	6.1E-03	0.02 %	Pass	2.008 Vdc	2.008 Vdc	6.1E-03	-0.01 %	Pass
Channel 13	0.1%	1.995 Vdc	1.995 Vdc	7.4E-03	0.01 %	Pass	1.995 Vdc	1.995 Vdc	7.4E-03	0.00 %	Pass
Channel 14	0.1%	2.003 Vdc	2.003 Vdc	5.4E-03	0.01 %	Pass	2.003 Vdc	2.003 Vdc	5.4E-03	0.00 %	Pass
Channel 15	0.1%	1.997 Vdc	1.997 Vdc	6.3E-03	0.01 %	Pass	1.997 Vdc	1.997 Vdc	6.3E-03	0.01 %	Pass
Channel 16	0.1%	1.995 Vdc	1.995 Vdc	7.3E-03	0.01 %	Pass	1.995 Vdc	1.995 Vdc	7.3E-03	-0.01 %	Pass
Channel 17	0.1%	2.000 Vdc	2.000 Vdc	2.5E-03	0.00 %	Pass	2.001 Vdc	2.001 Vdc	2.5E-03	0.00 %	Pass
Channel 18	0.1%	2.005 Vdc	2.005 Vdc	6.4E-03	0.01 %	Pass	2.005 Vdc	2.005 Vdc	6.4E-03	-0.01 %	Pass
Channel 19	0.1%	1.994 Vdc	1.994 Vdc	5.5E-03	0.01 %	Pass	1.994 Vdc	1.994 Vdc	5.5E-03	0.00 %	Pass
Channel 20	0.1%	1.990 Vdc	1.990 Vdc	8.3E-03	0.01 %	Pass	1.990 Vdc	1.990 Vdc	8.3E-03	0.00 %	Pass
Channel 21	0.1%	1.993 Vdc	1.993 Vdc	7.4E-03	0.01 %	Pass	1.993 Vdc	1.992 Vdc	7.4E-03	-0.01 %	Pass
Channel 22	0.1%	2.008 Vdc	2.008 Vdc	8.1E-03	0.01 %	Pass	2.008 Vdc	2.008 Vdc	8.1E-03	-0.01 %	Pass
Channel 23	0.1%	1.999 Vdc	1.999 Vdc	6.0E-03	0.01 %	Pass	1.999 Vdc	1.999 Vdc	6.0E-03	0.00 %	Pass
Channel 24	0.1%	2.008 Vdc	2.008 Vdc	5.1E-03	0.01 %	Pass	2.008 Vdc	2.008 Vdc	5.1E-03	0.00 %	Pass
Channel 25	0.1%	2.006 Vdc	2.006 Vdc	6.9E-03	0.02 %	Pass	2.006 Vdc	2.006 Vdc	6.8E-03	0.00 %	Pass
Channel 26	0.1%	2.001 Vdc	2.001 Vdc	8.0E-03	0.01 %	Pass	2.001 Vdc	2.001 Vdc	8.0E-03	0.00 %	Pass
Channel 27	0.1%	1.992 Vdc	1.993 Vdc	8.6E-03	0.02 %	Pass	1.992 Vdc	1.992 Vdc	8.6E-03	0.00 %	Pass
Channel 28	0.1%	1.997 Vdc	1.997 Vdc	6.3E-03	0.01 %	Pass	1.997 Vdc	1.997 Vdc	6.2E-03	0.00 %	Pass
Channel 29	0.1%	2.009 Vdc	2.009 Vdc	5.5E-03	0.01 %	Pass	2.009 Vdc	2.009 Vdc	5.5E-03	0.00 %	Pass
Channel 30	0.1%	2.002 Vdc	2.002 Vdc	4.4E-03	0.01 %	Pass	2.002 Vdc	2.002 Vdc	4.4E-03	0.00 %	Pass
Channel 31	0.1%	1.996 Vdc	1.996 Vdc	5.7E-03	0.02 %	Pass	1.996 Vdc	1.996 Vdc	5.7E-03	-0.01 %	Pass
Channel 32	0.1%	2.006 Vdc	2.007 Vdc	6.0E-03	0.00 %	Pass	2.006 Vdc	2.007 Vdc	6.0E-03	0.01 %	Pass

Test Description

5V Excitation Sources

		As Received					As Returned				
	Limit	**Actual**	**Reported**	**Unc. (in Vdc)**	**Deviation (in %)**	**Pass/ Fail**	**Actual**	**Reported**	**Unc. (in Vdc)**	**Deviation (in %)**	**Pass/ Fail**
Channel 1	0.1%	4.970 Vdc	4.971 Vdc	8.5E-03	0.02 %	Pass	4.970 Vdc	4.970 Vdc	8.4E-03	0.00 %	Pass
Channel 2	0.1%	4.976 Vdc	4.976 Vdc	7.1E-03	0.00 %	Pass	4.976 Vdc	4.976 Vdc	8.3E-03	0.00 %	Pass
Channel 3	0.1%	4.976 Vdc	4.976 Vdc	8.9E-03	0.00 %	Pass	4.976 Vdc	4.976 Vdc	8.9E-03	0.00 %	Pass
Channel 4	0.1%	4.967 Vdc	4.969 Vdc	7.3E-03	0.03 %	Pass	4.967 Vdc	4.967 Vdc	8.0E-03	-0.01 %	Pass
Channel 5	0.1%	4.970 Vdc	4.971 Vdc	5.1E-03	0.01 %	Pass	4.971 Vdc	4.970 Vdc	5.1E-03	-0.01 %	Pass
Channel 6	0.1%	4.960 Vdc	4.961 Vdc	8.1E-03	0.01 %	Pass	4.960 Vdc	4.960 Vdc	9.0E-03	0.00 %	Pass
Channel 7	0.1%	4.955 Vdc	4.956 Vdc	1.1E-02	0.00 %	Pass	4.955 Vdc	4.955 Vdc	1.1E-02	0.00 %	Pass
Channel 8	0.1%	4.958 Vdc	4.959 Vdc	1.1E-02	0.02 %	Pass	4.958 Vdc	4.958 Vdc	1.1E-02	0.00 %	Pass
Channel 9	0.1%	4.973 Vdc	4.974 Vdc	7.1E-03	0.01 %	Pass	4.973 Vdc	4.973 Vdc	7.0E-03	0.00 %	Pass
Channel 10	0.1%	4.967 Vdc	4.967 Vdc	8.3E-03	0.00 %	Pass	4.967 Vdc	4.967 Vdc	7.4E-03	0.00 %	Pass
Channel 11	0.1%	4.957 Vdc	4.957 Vdc	1.1E-02	0.00 %	Pass	4.957 Vdc	4.957 Vdc	1.2E-02	0.00 %	Pass
Channel 12	0.1%	4.960 Vdc	4.960 Vdc	9.2E-03	0.01 %	Pass	4.960 Vdc	4.960 Vdc	9.3E-03	0.01 %	Pass
Channel 13	0.1%	4.967 Vdc	4.967 Vdc	7.1E-03	0.01 %	Pass	4.967 Vdc	4.967 Vdc	7.1E-03	0.00 %	Pass
Channel 14	0.1%	4.974 Vdc	4.974 Vdc	7.8E-03	0.01 %	Pass	4.974 Vdc	4.974 Vdc	8.6E-03	0.00 %	Pass
Channel 15	0.1%	4.949 Vdc	4.950 Vdc	1.0E-02	0.02 %	Pass	4.949 Vdc	4.949 Vdc	1.0E-02	0.00 %	Pass
Channel 16	0.1%	4.973 Vdc	4.974 Vdc	8.8E-03	0.02 %	Pass	4.973 Vdc	4.973 Vdc	8.7E-03	0.00 %	Pass
Channel 17	0.1%	4.968 Vdc	4.969 Vdc	6.8E-03	0.02 %	Pass	4.969 Vdc	4.968 Vdc	6.7E-03	-0.01 %	Pass
Channel 18	0.1%	4.982 Vdc	4.982 Vdc	7.6E-03	0.01 %	Pass	4.982 Vdc	4.982 Vdc	7.7E-03	0.00 %	Pass
Channel 19	0.1%	4.988 Vdc	4.988 Vdc	8.0E-03	0.02 %	Pass	4.988 Vdc	4.987 Vdc	8.0E-03	0.00 %	Pass
Channel 20	0.1%	4.963 Vdc	4.963 Vdc	8.5E-03	0.00 %	Pass	4.963 Vdc	4.963 Vdc	8.5E-03	0.01 %	Pass
Channel 21	0.1%	4.969 Vdc	4.970 Vdc	6.4E-03	0.02 %	Pass	4.969 Vdc	4.969 Vdc	6.4E-03	0.00 %	Pass
Channel 22	0.1%	4.969 Vdc	4.970 Vdc	2.4E-03	0.01 %	Pass	4.969 Vdc	4.969 Vdc	5.7E-03	0.00 %	Pass
Channel 23	0.1%	4.992 Vdc	4.993 Vdc	8.7E-03	0.01 %	Pass	4.992 Vdc	4.992 Vdc	8.7E-03	0.01 %	Pass
Channel 24	0.1%	4.968 Vdc	4.969 Vdc	8.7E-03	0.01 %	Pass	4.969 Vdc	4.969 Vdc	8.8E-03	0.00 %	Pass
Channel 25	0.1%	4.954 Vdc	4.955 Vdc	1.1E-02	0.02 %	Pass	4.954 Vdc	4.954 Vdc	9.8E-03	0.00 %	Pass
Channel 26	0.1%	4.967 Vdc	4.968 Vdc	7.6E-03	0.00 %	Pass	4.967 Vdc	4.968 Vdc	7.5E-03	0.00 %	Pass
Channel 27	0.1%	4.966 Vdc	4.967 Vdc	5.2E-03	0.00 %	Pass	4.966 Vdc	4.967 Vdc	5.2E-03	0.00 %	Pass
Channel 28	0.1%	4.955 Vdc	4.956 Vdc	9.3E-03	0.02 %	Pass	4.955 Vdc	4.955 Vdc	9.2E-03	0.00 %	Pass
Channel 29	0.1%	4.954 Vdc	4.955 Vdc	1.1E-02	0.02 %	Pass	4.954 Vdc	4.953 Vdc	1.1E-02	0.00 %	Pass
Channel 30	0.1%	4.965 Vdc	4.966 Vdc	9.2E-03	0.02 %	Pass	4.965 Vdc	4.965 Vdc	9.2E-03	0.00 %	Pass
Channel 31	0.1%	4.972 Vdc	4.973 Vdc	7.3E-03	0.01 %	Pass	4.972 Vdc	4.973 Vdc	7.4E-03	0.01 %	Pass
Channel 32	0.1%	4.972 Vdc	4.972 Vdc	8.3E-03	0.01 %	Pass	4.972 Vdc	4.972 Vdc	8.3E-03	0.00 %	Pass

*** End of Certificate***

DTS
41204 Bridge Street, Novi, MI 48375-1301 USA
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ilac-MRA ACCREDITED Calibration CERT# 3007.01

Certificate of Calibration

Model #:	G5 Data Acquisition Module	Certificate #:	201508135M0279
Serial #:	5M0279	Date Received:	12 August 2015
Firmware:	01U2	Date Calibrated:	13 August 2015
Procedure Name:	G5 Calibration Revision: 2.4	Next Calibration:	13 August 2016
Order Number:	RA29243	Item Received:	In Tolerance
Customer:	Oregon Ballistics Laboratories	Item Returned:	In Tolerance
	2873 22nd St SE Ste C	Temperature:	76°F/24.3°C
	Salem, OR 97302	Humidity:	45 %

DTS has been audited by the American Association for Laboratory Accreditation (A2LA) and found in compliance with ISO/IEC 17025:2005. Accredited calibrations performed within the DTS Scope of Accreditation are indicated by the presence of the A2LA Logo and Certificate Number on this Certificate of Calibration.
DTS reference standards are processed and calibrated in accordance with the DTS Quality Assurance System, and traceable to the National Institute of Standards and Technology (NIST).
All calibrations have been performed using processes having a test uncertainty ratio of four or more times greater than the unit calibrated, unless otherwise noted on the report. Uncertainties have been estimated at a 95 percent confidence level (k=2). Calibration at a 4:1 TUR provides reasonable confidence that the instrument is within the manufacturer's published specifications.
The reported data is the raw recorded data and is not corrected for uncertainty or environmental effects. Any number of factors can cause a unit to drift out of tolerance at any time following its calibration.
This report only applies only to the item(s) identified above, and shall not be reproduced except in full, without the written approval of DTS.
Limitations on the uses of this instrument are detailed in the manufacturer's operating instructions.

Remarks:

Standards Used

Serial #	Manufacturer	Model #	Description	Cal Date	Due Date
US34021614	HP	33120A	Function/Arbitrary Waveform Generator, 15 MHz	13-Feb-2015	13-Feb-2016
MY42002138	Agilent	34420A	Nano Volt, Micro-Ohm Meter, 7.5 Digit	28-May-2015	28-May-2016
CAL012	DTS	CALSTAT	TDAS Calibration Station	15-Nov-2014	15-Nov-2015

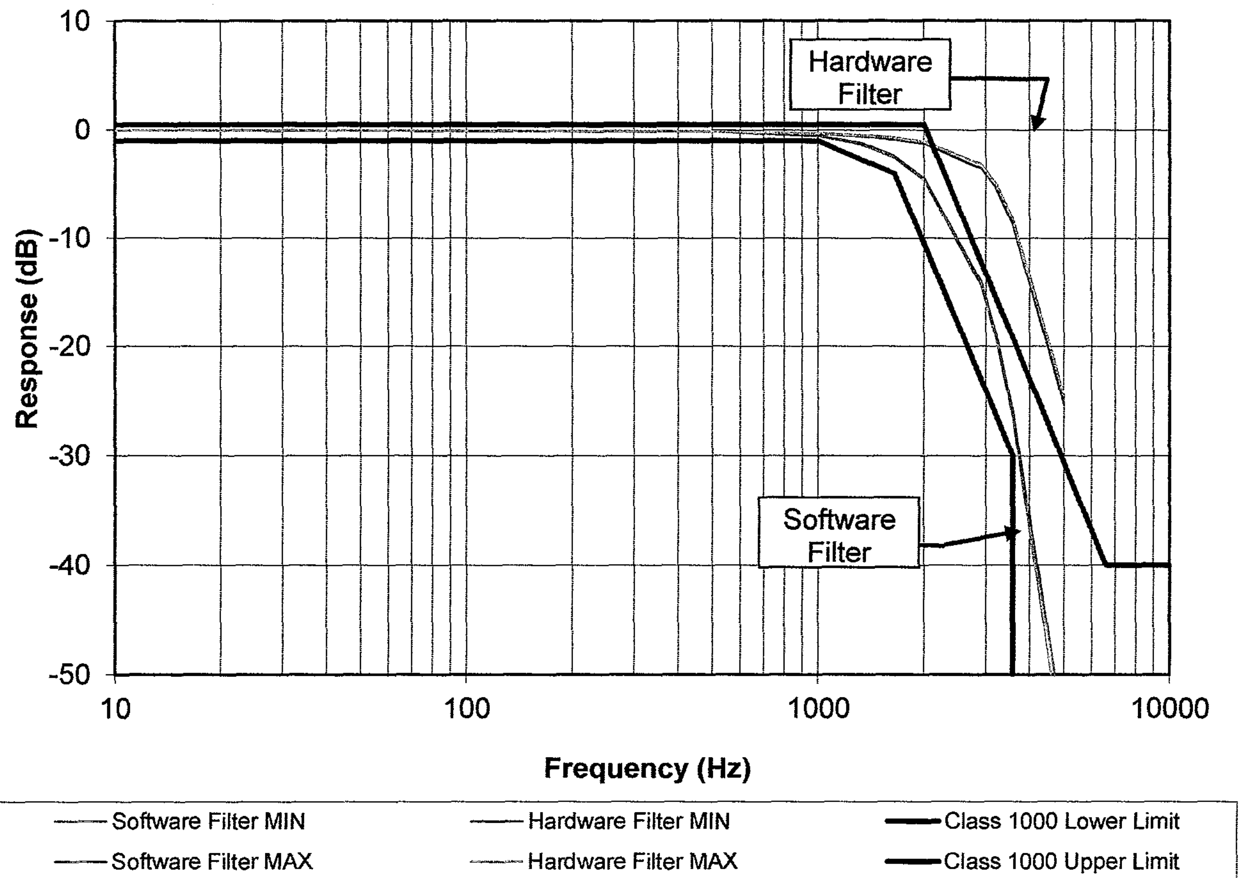
Results

Test Description	Test Result As Received	Test Result As Returned
Visual Inspection	Pass	Pass
Basic Channel Functions	Pass	Pass
Calibration DAC Accuracy	Pass	Pass
Excitation Sources	Pass	Pass
Gain Accuracy	Pass	Pass
Frequency Response	Pass	Pass
Timebase Accuracy	Pass	Pass
T=0 Trigger Function	Pass	Pass
Time Skew	Pass	Pass
Noise Level	Pass	Pass

Calibrated By: Bob Colenso
Bob Colenso
Technical Support Engineer

Calibration Site: 25881 Meadowbrook Road
Novi, MI 48375

Class 1000 System Response vs. SAE J211 (March 2014)
All 32 channels typically overlap due to very tight control of component tolerances.
Only the minimum and maximum response of the 32 channels are shown for clarity.



Test Description				**As Received**				**As Returned**		
Filter Response-Software			**Std**	**db**	**Uncertainty (mV)**	**Pass/ Fail**	**Std**	**db**	**Uncertainty (mV)**	**Pass/ Fail**
Channel 1	**Limit**									
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.108	0.002	Pass	0.652 mV	-0.116	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.545	0.002	Pass	0.621 mV	-0.544	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.231	0.003	Pass	0.573 mV	-1.231	0.003	Pass
1650Hz	0.5db	-4db	0.500 mV	-2.442	0.003	Pass	0.496 mV	-2.495	0.003	Pass
2000Hz	0.5db	-10.66db	0.392 mV	-4.547	0.002	Pass	0.391 mV	-4.548	0.002	Pass
2900Hz	-12.37db	-23.53db	0.128 mV	-14.251	0.002	Pass	0.128 mV	-14.252	0.002	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.078	0.001	Pass	0.073 mV	-19.081	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.416	0.001	Pass	0.032 mV	-26.391	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.649	0.000	Pass	0.001 mV	-57.308	0.000	Pass
Channel 2										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.108	0.002	Pass	0.652 mV	-0.115	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.544	0.002	Pass	0.621 mV	-0.542	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.229	0.003	Pass	0.574 mV	-1.229	0.003	Pass
1650Hz	0.5db	-4db	0.500 mV	-2.439	0.003	Pass	0.496 mV	-2.492	0.003	Pass
2000Hz	0.5db	-10.66db	0.393 mV	-4.540	0.004	Pass	0.392 mV	-4.541	0.004	Pass
2900Hz	-12.37db	-23.53db	0.129 mV	-14.223	0.003	Pass	0.129 mV	-14.221	0.003	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.041	0.002	Pass	0.074 mV	-19.043	0.002	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.379	0.001	Pass	0.032 mV	-26.350	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.696	0.000	Pass	0.001 mV	-57.512	0.000	Pass

Test Description			As Received				As Returned			
Filter Response-Software			Std	db	Uncertainty (mV)	Pass/ Fail	Std	db	Uncertainty (mV)	Pass/ Fail
Channel 3	Limit									
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.104	0.002	Pass	0.652 mV	-0.113	0.002	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.532	0.002	Pass	0.622 mV	-0.530	0.002	Pass
1325Hz	0.5db	-2.69db	0.576 mV	-1.209	0.002	Pass	0.575 mV	-1.210	0.002	Pass
1650Hz	0.5db	-4db	0.502 mV	-2.404	0.003	Pass	0.498 mV	-2.461	0.003	Pass
2000Hz	0.5db	-10.66db	0.395 mV	-4.495	0.003	Pass	0.394 mV	-4.494	0.003	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.118	0.002	Pass	0.130 mV	-14.118	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.902	0.001	Pass	0.075 mV	-18.901	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.182	0.001	Pass	0.033 mV	-26.150	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.260	0.000	Pass	0.001 mV	-56.589	0.000	Pass
Channel 4										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.110	0.002	Pass	0.652 mV	-0.118	0.002	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.554	0.002	Pass	0.620 mV	-0.552	0.002	Pass
1325Hz	0.5db	-2.69db	0.574 mV	-1.246	0.002	Pass	0.572 mV	-1.246	0.002	Pass
1650Hz	0.5db	-4db	0.499 mV	-2.463	0.002	Pass	0.495 mV	-2.517	0.002	Pass
2000Hz	0.5db	-10.66db	0.391 mV	-4.578	0.002	Pass	0.390 mV	-4.577	0.002	Pass
2900Hz	-12.37db	-23.53db	0.128 mV	-14.297	0.002	Pass	0.127 mV	-14.296	0.002	Pass
3200Hz	-15.77db	-26.93db	0.073 mV	-19.129	0.001	Pass	0.073 mV	-19.128	0.001	Pass
3575Hz	-19.61db	-999db	0.031 mV	-26.473	0.001	Pass	0.031 mV	-26.444	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.535	0.000	Pass	0.001 mV	-57.228	0.000	Pass
Channel 5										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.103	0.002	Pass	0.652 mV	-0.112	0.002	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.531	0.002	Pass	0.622 mV	-0.528	0.002	Pass
1325Hz	0.5db	-2.69db	0.576 mV	-1.207	0.002	Pass	0.575 mV	-1.206	0.002	Pass
1650Hz	0.5db	-4db	0.502 mV	-2.399	0.003	Pass	0.498 mV	-2.456	0.003	Pass
2000Hz	0.5db	-10.66db	0.395 mV	-4.488	0.003	Pass	0.394 mV	-4.487	0.003	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.120	0.002	Pass	0.130 mV	-14.118	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.914	0.001	Pass	0.075 mV	-18.912	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.207	0.001	Pass	0.032 mV	-26.175	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.082	0.000	Pass	0.001 mV	-57.129	0.000	Pass
Channel 6										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.107	0.002	Pass	0.652 mV	-0.116	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.544	0.002	Pass	0.621 mV	-0.542	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.229	0.003	Pass	0.574 mV	-1.230	0.003	Pass
1650Hz	0.5db	-4db	0.500 mV	-2.434	0.002	Pass	0.496 mV	-2.491	0.002	Pass
2000Hz	0.5db	-10.66db	0.393 mV	-4.538	0.002	Pass	0.392 mV	-4.536	0.002	Pass
2900Hz	-12.37db	-23.53db	0.129 mV	-14.204	0.001	Pass	0.129 mV	-14.204	0.001	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.008	0.001	Pass	0.074 mV	-19.006	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.309	0.001	Pass	0.032 mV	-26.278	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.092	0.000	Pass	0.001 mV	-57.014	0.000	Pass
Channel 7										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.103	0.002	Pass	0.652 mV	-0.111	0.002	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.528	0.002	Pass	0.622 mV	-0.526	0.002	Pass
1325Hz	0.5db	-2.69db	0.576 mV	-1.203	0.003	Pass	0.575 mV	-1.203	0.003	Pass
1650Hz	0.5db	-4db	0.503 mV	-2.393	0.003	Pass	0.498 mV	-2.451	0.003	Pass
2000Hz	0.5db	-10.66db	0.395 mV	-4.479	0.003	Pass	0.395 mV	-4.479	0.003	Pass
2900Hz	-12.37db	-23.53db	0.131 mV	-14.093	0.002	Pass	0.130 mV	-14.094	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.881	0.001	Pass	0.075 mV	-18.881	0.001	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.171	0.001	Pass	0.033 mV	-26.142	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-55.928	0.000	Pass	0.001 mV	-56.981	0.000	Pass

Test Description				**As Received**				**As Returned**		
Filter Response-Software			**Std**	**db**	**Uncertainty (mV)**	**Pass/ Fail**	**Std**	**db**	**Uncertainty (mV)**	**Pass/ Fail**
Channel 8	**Limit**									
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.101	0.002	Pass	0.652 mV	-0.110	0.002	Pass
1000Hz	0.5db	-1db	0.624 mV	-0.518	0.002	Pass	0.623 mV	-0.516	0.002	Pass
1325Hz	0.5db	-2.69db	0.578 mV	-1.185	0.002	Pass	0.576 mV	-1.185	0.002	Pass
1650Hz	0.5db	-4db	0.504 mV	-2.369	0.003	Pass	0.500 mV	-2.425	0.003	Pass
2000Hz	0.5db	-10.66db	0.397 mV	-4.446	0.003	Pass	0.396 mV	-4.447	0.003	Pass
2900Hz	-12.37db	-23.53db	0.131 mV	-14.055	0.002	Pass	0.131 mV	-14.054	0.002	Pass
3200Hz	-15.77db	-26.93db	0.076 mV	-18.849	0.001	Pass	0.075 mV	-18.851	0.001	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.156	0.001	Pass	0.033 mV	-26.129	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.371	0.000	Pass	0.001 mV	-56.975	0.000	Pass
Channel 9										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.106	0.002	Pass	0.654 mV	-0.090	0.002	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.531	0.002	Pass	0.621 mV	-0.537	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.235	0.002	Pass	0.574 mV	-1.219	0.002	Pass
1650Hz	0.5db	-4db	0.500 mV	-2.443	0.003	Pass	0.498 mV	-2.448	0.003	Pass
2000Hz	0.5db	-10.66db	0.394 mV	-4.515	0.003	Pass	0.392 mV	-4.533	0.003	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.123	0.002	Pass	0.130 mV	-14.087	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.946	0.001	Pass	0.075 mV	-18.935	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.213	0.001	Pass	0.032 mV	-26.193	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.114	0.000	Pass	0.001 mV	-57.204	0.000	Pass
Channel 10										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.107	0.003	Pass	0.654 mV	-0.090	0.003	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.532	0.002	Pass	0.621 mV	-0.538	0.002	Pass
1325Hz	0.5db	-2.69db	0.574 mV	-1.236	0.003	Pass	0.574 mV	-1.221	0.003	Pass
1650Hz	0.5db	-4db	0.500 mV	-2.445	0.003	Pass	0.498 mV	-2.451	0.003	Pass
2000Hz	0.5db	-10.66db	0.393 mV	-4.519	0.002	Pass	0.392 mV	-4.537	0.002	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.131	0.002	Pass	0.130 mV	-14.095	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.965	0.001	Pass	0.075 mV	-18.954	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.259	0.001	Pass	0.032 mV	-26.241	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.336	0.000	Pass	0.001 mV	-57.208	0.000	Pass
Channel 11										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.112	0.003	Pass	0.653 mV	-0.095	0.003	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.551	0.002	Pass	0.620 mV	-0.558	0.002	Pass
1325Hz	0.5db	-2.69db	0.572 mV	-1.270	0.002	Pass	0.572 mV	-1.255	0.002	Pass
1650Hz	0.5db	-4db	0.497 mV	-2.498	0.003	Pass	0.495 mV	-2.504	0.003	Pass
2000Hz	0.5db	-10.66db	0.390 mV	-4.596	0.002	Pass	0.388 mV	-4.615	0.002	Pass
2900Hz	-12.37db	-23.53db	0.128 mV	-14.295	0.001	Pass	0.128 mV	-14.257	0.001	Pass
3200Hz	-15.77db	-26.93db	0.073 mV	-19.153	0.001	Pass	0.073 mV	-19.144	0.001	Pass
3575Hz	-19.61db	-999db	0.031 mV	-26.469	0.001	Pass	0.031 mV	-26.450	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.607	0.000	Pass	0.001 mV	-57.711	0.000	Pass
Channel 12										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.108	0.002	Pass	0.654 mV	-0.092	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.537	0.002	Pass	0.620 mV	-0.544	0.002	Pass
1325Hz	0.5db	-2.69db	0.574 mV	-1.245	0.002	Pass	0.573 mV	-1.230	0.002	Pass
1650Hz	0.5db	-4db	0.499 mV	-2.459	0.002	Pass	0.497 mV	-2.466	0.002	Pass
2000Hz	0.5db	-10.66db	0.392 mV	-4.541	0.003	Pass	0.391 mV	-4.559	0.003	Pass
2900Hz	-12.37db	-23.53db	0.129 mV	-14.184	0.002	Pass	0.130 mV	-14.146	0.002	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.022	0.001	Pass	0.074 mV	-19.010	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.313	0.001	Pass	0.032 mV	-26.293	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.443	0.000	Pass	0.001 mV	-57.432	0.000	Pass

Test Description			As Received				As Returned			
Filter Response-Software			Std	db	Uncertainty (mV)	Pass/ Fail	Std	db	Uncertainty (mV)	Pass/ Fail
Channel 13	Limit									
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.660 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.104	0.002	Pass	0.654 mV	-0.088	0.002	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.521	0.002	Pass	0.622 mV	-0.528	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.219	0.002	Pass	0.575 mV	-1.202	0.002	Pass
1650Hz	0.5db	-4db	0.501 mV	-2.419	0.002	Pass	0.500 mV	-2.422	0.002	Pass
2000Hz	0.5db	-10.66db	0.395 mV	-4.481	0.002	Pass	0.393 mV	-4.499	0.002	Pass
2900Hz	-12.37db	-23.53db	0.131 mV	-14.060	0.001	Pass	0.131 mV	-14.026	0.001	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.876	0.001	Pass	0.075 mV	-18.867	0.001	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.133	0.001	Pass	0.033 mV	-26.117	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.089	0.000	Pass	0.001 mV	-57.350	0.000	Pass
Channel 14										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.111	0.003	Pass	0.653 mV	-0.094	0.003	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.547	0.002	Pass	0.620 mV	-0.554	0.002	Pass
1325Hz	0.5db	-2.69db	0.572 mV	-1.263	0.002	Pass	0.572 mV	-1.249	0.002	Pass
1650Hz	0.5db	-4db	0.497 mV	-2.487	0.003	Pass	0.496 mV	-2.495	0.003	Pass
2000Hz	0.5db	-10.66db	0.391 mV	-4.579	0.002	Pass	0.389 mV	-4.599	0.002	Pass
2900Hz	-12.37db	-23.53db	0.128 mV	-14.251	0.001	Pass	0.129 mV	-14.214	0.001	Pass
3200Hz	-15.77db	-26.93db	0.073 mV	-19.096	0.001	Pass	0.073 mV	-19.087	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.399	0.001	Pass	0.032 mV	-26.381	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.513	0.000	Pass	0.001 mV	-57.504	0.000	Pass
Channel 15										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.104	0.002	Pass	0.654 mV	-0.088	0.002	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.521	0.001	Pass	0.622 mV	-0.528	0.001	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.219	0.002	Pass	0.575 mV	-1.202	0.002	Pass
1650Hz	0.5db	-4db	0.501 mV	-2.419	0.002	Pass	0.500 mV	-2.422	0.002	Pass
2000Hz	0.5db	-10.66db	0.395 mV	-4.480	0.003	Pass	0.394 mV	-4.498	0.003	Pass
2900Hz	-12.37db	-23.53db	0.131 mV	-14.043	0.002	Pass	0.132 mV	-14.011	0.002	Pass
3200Hz	-15.77db	-26.93db	0.076 mV	-18.847	0.002	Pass	0.075 mV	-18.839	0.002	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.090	0.001	Pass	0.033 mV	-26.074	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.080	0.000	Pass	0.001 mV	-57.159	0.000	Pass
Channel 16										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.113	0.002	Pass	0.653 mV	-0.096	0.002	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.553	0.002	Pass	0.619 mV	-0.560	0.002	Pass
1325Hz	0.5db	-2.69db	0.572 mV	-1.273	0.002	Pass	0.571 mV	-1.259	0.002	Pass
1650Hz	0.5db	-4db	0.496 mV	-2.500	0.003	Pass	0.495 mV	-2.509	0.003	Pass
2000Hz	0.5db	-10.66db	0.390 mV	-4.599	0.002	Pass	0.388 mV	-4.618	0.002	Pass
2900Hz	-12.37db	-23.53db	0.128 mV	-14.285	0.002	Pass	0.128 mV	-14.246	0.002	Pass
3200Hz	-15.77db	-26.93db	0.073 mV	-19.139	0.001	Pass	0.073 mV	-19.128	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.452	0.001	Pass	0.031 mV	-26.433	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.471	0.000	Pass	0.001 mV	-57.607	0.000	Pass
Channel 17										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.091	0.002	Pass	0.653 mV	-0.099	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.540	0.002	Pass	0.621 mV	-0.534	0.002	Pass
1325Hz	0.5db	-2.69db	0.574 mV	-1.238	0.002	Pass	0.577 mV	-1.171	0.002	Pass
1650Hz	0.5db	-4db	0.499 mV	-2.454	0.002	Pass	0.502 mV	-2.384	0.002	Pass
2000Hz	0.5db	-10.66db	0.395 mV	-4.484	0.002	Pass	0.393 mV	-4.516	0.002	Pass
2900Hz	-12.37db	-23.53db	0.131 mV	-14.078	0.002	Pass	0.131 mV	-14.062	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.925	0.001	Pass	0.075 mV	-18.913	0.001	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.171	0.001	Pass	0.032 mV	-26.174	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.094	0.000	Pass	0.001 mV	-56.301	0.000	Pass

Test Description			As Received				As Returned			
Filter Response-Software			Std	db	Uncertainty (mV)	Pass/ Fail	Std	db	Uncertainty (mV)	Pass/ Fail
Channel 18	Limit									
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.096	0.002	Pass	0.653 mV	-0.103	0.002	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.559	0.002	Pass	0.620 mV	-0.552	0.002	Pass
1325Hz	0.5db	-2.69db	0.572 mV	-1.271	0.002	Pass	0.575 mV	-1.203	0.002	Pass
1650Hz	0.5db	-4db	0.497 mV	-2.502	0.002	Pass	0.499 mV	-2.434	0.002	Pass
2000Hz	0.5db	-10.66db	0.392 mV	-4.555	0.003	Pass	0.390 mV	-4.585	0.002	Pass
2900Hz	-12.37db	-23.53db	0.129 mV	-14.200	0.002	Pass	0.129 mV	-14.187	0.002	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.060	0.001	Pass	0.074 mV	-19.048	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.310	0.001	Pass	0.032 mV	-26.306	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.388	0.000	Pass	0.001 mV	-56.368	0.000	Pass
Channel 19										
10Hz	0.5db	-0.75db	0.663 mV	0.000	0.002	Pass	0.660 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.093	0.002	Pass	0.653 mV	-0.101	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.547	0.002	Pass	0.621 mV	-0.541	0.002	Pass
1325Hz	0.5db	-2.69db	0.574 mV	-1.251	0.002	Pass	0.576 mV	-1.184	0.002	Pass
1650Hz	0.5db	-4db	0.498 mV	-2.474	0.002	Pass	0.501 mV	-2.405	0.002	Pass
2000Hz	0.5db	-10.66db	0.394 mV	-4.514	0.003	Pass	0.391 mV	-4.544	0.003	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.131	0.002	Pass	0.130 mV	-14.116	0.002	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-18.986	0.001	Pass	0.074 mV	-18.970	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.237	0.001	Pass	0.032 mV	-26.237	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.181	0.000	Pass	0.001 mV	-56.148	0.000	Pass
Channel 20										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.656 mV	-0.088	0.002	Pass	0.653 mV	-0.095	0.002	Pass
1000Hz	0.5db	-1db	0.623 mV	-0.529	0.002	Pass	0.622 mV	-0.523	0.002	Pass
1325Hz	0.5db	-2.69db	0.576 mV	-1.220	0.002	Pass	0.579 mV	-1.152	0.002	Pass
1650Hz	0.5db	-4db	0.501 mV	-2.423	0.001	Pass	0.504 mV	-2.356	0.002	Pass
2000Hz	0.5db	-10.66db	0.397 mV	-4.442	0.002	Pass	0.395 mV	-4.471	0.002	Pass
2900Hz	-12.37db	-23.53db	0.132 mV	-13.980	0.002	Pass	0.132 mV	-13.969	0.002	Pass
3200Hz	-15.77db	-26.93db	0.076 mV	-18.807	0.001	Pass	0.076 mV	-18.794	0.001	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.019	0.001	Pass	0.033 mV	-26.016	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.882	0.000	Pass	0.001 mV	-55.706	0.000	Pass
Channel 21										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.094	0.002	Pass	0.653 mV	-0.101	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.552	0.002	Pass	0.620 mV	-0.546	0.002	Pass
1325Hz	0.5db	-2.69db	0.573 mV	-1.260	0.002	Pass	0.576 mV	-1.192	0.002	Pass
1650Hz	0.5db	-4db	0.497 mV	-2.487	0.002	Pass	0.500 mV	-2.417	0.002	Pass
2000Hz	0.5db	-10.66db	0.393 mV	-4.533	0.002	Pass	0.391 mV	-4.564	0.002	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.163	0.002	Pass	0.130 mV	-14.146	0.002	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.012	0.001	Pass	0.074 mV	-18.997	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.258	0.001	Pass	0.032 mV	-26.255	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.192	0.000	Pass	0.001 mV	-56.056	0.000	Pass
Channel 22										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.096	0.002	Pass	0.653 mV	-0.103	0.002	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.556	0.002	Pass	0.620 mV	-0.549	0.002	Pass
1325Hz	0.5db	-2.69db	0.573 mV	-1.265	0.002	Pass	0.576 mV	-1.197	0.002	Pass
1650Hz	0.5db	-4db	0.497 mV	-2.491	0.002	Pass	0.500 mV	-2.423	0.002	Pass
2000Hz	0.5db	-10.66db	0.393 mV	-4.536	0.002	Pass	0.390 mV	-4.567	0.002	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.156	0.001	Pass	0.130 mV	-14.142	0.001	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.009	0.002	Pass	0.074 mV	-18.996	0.002	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.256	0.000	Pass	0.032 mV	-26.253	0.000	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.301	0.000	Pass	0.001 mV	-56.181	0.000	Pass

Test Description			As Received				As Returned			
Filter Response-Software			Std	db	Uncertainty (mV)	Pass/ Fail	Std	db	Uncertainty (mV)	Pass/ Fail
Channel 23	Limit									
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.003	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.092	0.002	Pass	0.653 mV	-0.098	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.541	0.002	Pass	0.621 mV	-0.534	0.002	Pass
1325Hz	0.5db	-2.69db	0.574 mV	-1.240	0.002	Pass	0.577 mV	-1.171	0.002	Pass
1650Hz	0.5db	-4db	0.499 mV	-2.453	0.002	Pass	0.502 mV	-2.385	0.002	Pass
2000Hz	0.5db	-10.66db	0.395 mV	-4.485	0.002	Pass	0.393 mV	-4.513	0.002	Pass
2900Hz	-12.37db	-23.53db	0.131 mV	-14.052	0.002	Pass	0.131 mV	-14.041	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.879	0.001	Pass	0.075 mV	-18.864	0.001	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.087	0.001	Pass	0.033 mV	-26.086	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.074	0.000	Pass	0.001 mV	-55.901	0.000	Pass
Channel 24										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.655 mV	-0.098	0.002	Pass	0.653 mV	-0.106	0.002	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.567	0.002	Pass	0.619 mV	-0.561	0.002	Pass
1325Hz	0.5db	-2.69db	0.571 mV	-1.285	0.002	Pass	0.574 mV	-1.217	0.002	Pass
1650Hz	0.5db	-4db	0.495 mV	-2.525	0.002	Pass	0.498 mV	-2.455	0.001	Pass
2000Hz	0.5db	-10.66db	0.391 mV	-4.588	0.001	Pass	0.388 mV	-4.619	0.002	Pass
2900Hz	-12.37db	-23.53db	0.128 mV	-14.284	0.001	Pass	0.128 mV	-14.266	0.001	Pass
3200Hz	-15.77db	-26.93db	0.073 mV	-19.167	0.002	Pass	0.073 mV	-19.152	0.002	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.453	0.000	Pass	0.031 mV	-26.449	0.000	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.533	0.000	Pass	0.001 mV	-56.481	0.000	Pass
Channel 25										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.102	0.002	Pass	0.654 mV	-0.087	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.536	0.002	Pass	0.622 mV	-0.524	0.002	Pass
1325Hz	0.5db	-2.69db	0.578 mV	-1.179	0.003	Pass	0.575 mV	-1.213	0.003	Pass
1650Hz	0.5db	-4db	0.503 mV	-2.382	0.003	Pass	0.499 mV	-2.441	0.002	Pass
2000Hz	0.5db	-10.66db	0.394 mV	-4.511	0.003	Pass	0.394 mV	-4.497	0.003	Pass
2900Hz	-12.37db	-23.53db	0.132 mV	-14.031	0.002	Pass	0.132 mV	-13.992	0.002	Pass
3200Hz	-15.77db	-26.93db	0.076 mV	-18.844	0.001	Pass	0.076 mV	-18.822	0.001	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.080	0.001	Pass	0.033 mV	-26.065	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.708	0.000	Pass	0.001 mV	-55.272	0.000	Pass
Channel 26										
10Hz	0.5db	-0.75db	0.661 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.103	0.002	Pass	0.654 mV	-0.089	0.002	Pass
1000Hz	0.5db	-1db	0.622 mV	-0.540	0.002	Pass	0.622 mV	-0.529	0.002	Pass
1325Hz	0.5db	-2.69db	0.577 mV	-1.185	0.003	Pass	0.574 mV	-1.220	0.003	Pass
1650Hz	0.5db	-4db	0.502 mV	-2.391	0.002	Pass	0.498 mV	-2.452	0.002	Pass
2000Hz	0.5db	-10.66db	0.393 mV	-4.524	0.002	Pass	0.393 mV	-4.513	0.002	Pass
2900Hz	-12.37db	-23.53db	0.131 mV	-14.058	0.001	Pass	0.131 mV	-14.022	0.001	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.875	0.002	Pass	0.075 mV	-18.860	0.002	Pass
3575Hz	-19.61db	-999db	0.033 mV	-26.118	0.000	Pass	0.033 mV	-26.108	0.000	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.973	0.000	Pass	0.001 mV	-56.235	0.000	Pass
Channel 27										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.653 mV	-0.112	0.002	Pass	0.653 mV	-0.098	0.002	Pass
1000Hz	0.5db	-1db	0.619 mV	-0.575	0.002	Pass	0.619 mV	-0.564	0.002	Pass
1325Hz	0.5db	-2.69db	0.573 mV	-1.245	0.002	Pass	0.570 mV	-1.278	0.003	Pass
1650Hz	0.5db	-4db	0.497 mV	-2.485	0.002	Pass	0.493 mV	-2.545	0.002	Pass
2000Hz	0.5db	-10.66db	0.387 mV	-4.662	0.002	Pass	0.387 mV	-4.649	0.002	Pass
2900Hz	-12.37db	-23.53db	0.127 mV	-14.338	0.002	Pass	0.127 mV	-14.306	0.002	Pass
3200Hz	-15.77db	-26.93db	0.072 mV	-19.211	0.001	Pass	0.073 mV	-19.191	0.001	Pass
3575Hz	-19.61db	-999db	0.031 mV	-26.510	0.001	Pass	0.031 mV	-26.504	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.511	0.000	Pass	0.001 mV	-56.597	0.000	Pass

Test Description			As Received				As Returned			
Filter Response-Software	Limit		Std	db	Uncertainty (mV)	Pass/ Fail	Std	db	Uncertainty (mV)	Pass/ Fail
Channel 28										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.653 mV	-0.109	0.002	Pass	0.654 mV	-0.094	0.002	Pass
1000Hz	0.5db	-1db	0.620 mV	-0.561	0.002	Pass	0.620 mV	-0.550	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.223	0.002	Pass	0.572 mV	-1.256	0.002	Pass
1650Hz	0.5db	-4db	0.499 mV	-2.450	0.002	Pass	0.495 mV	-2.511	0.002	Pass
2000Hz	0.5db	-10.66db	0.389 mV	-4.613	0.002	Pass	0.389 mV	-4.600	0.002	Pass
2900Hz	-12.37db	-23.53db	0.128 mV	-14.250	0.002	Pass	0.129 mV	-14.218	0.002	Pass
3200Hz	-15.77db	-26.93db	0.073 mV	-19.112	0.001	Pass	0.073 mV	-19.094	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.400	0.001	Pass	0.032 mV	-26.393	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.339	0.000	Pass	0.001 mV	-56.707	0.000	Pass
Channel 29										
10Hz	0.5db	-0.75db	0.661 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.653 mV	-0.107	0.002	Pass	0.654 mV	-0.093	0.002	Pass
1000Hz	0.5db	-1db	0.620 mV	-0.556	0.002	Pass	0.621 mV	-0.545	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.212	0.002	Pass	0.572 mV	-1.246	0.002	Pass
1650Hz	0.5db	-4db	0.500 mV	-2.435	0.002	Pass	0.496 mV	-2.495	0.002	Pass
2000Hz	0.5db	-10.66db	0.390 mV	-4.590	0.002	Pass	0.390 mV	-4.576	0.002	Pass
2900Hz	-12.37db	-23.53db	0.129 mV	-14.206	0.001	Pass	0.129 mV	-14.173	0.001	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.059	0.001	Pass	0.074 mV	-19.040	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.336	0.001	Pass	0.032 mV	-26.325	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.404	0.000	Pass	0.001 mV	-56.203	0.000	Pass
Channel 30										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.653 mV	-0.109	0.002	Pass	0.654 mV	-0.094	0.002	Pass
1000Hz	0.5db	-1db	0.620 mV	-0.561	0.002	Pass	0.620 mV	-0.549	0.002	Pass
1325Hz	0.5db	-2.69db	0.575 mV	-1.220	0.002	Pass	0.572 mV	-1.253	0.002	Pass
1650Hz	0.5db	-4db	0.499 mV	-2.445	0.002	Pass	0.495 mV	-2.505	0.002	Pass
2000Hz	0.5db	-10.66db	0.389 mV	-4.601	0.002	Pass	0.390 mV	-4.586	0.002	Pass
2900Hz	-12.37db	-23.53db	0.129 mV	-14.209	0.002	Pass	0.129 mV	-14.173	0.002	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-19.062	0.001	Pass	0.074 mV	-19.042	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.348	0.001	Pass	0.032 mV	-26.337	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.377	0.000	Pass	0.001 mV	-56.584	0.000	Pass
Channel 31										
10Hz	0.5db	-0.75db	0.661 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.653 mV	-0.106	0.002	Pass	0.654 mV	-0.092	0.002	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.549	0.002	Pass	0.621 mV	-0.538	0.002	Pass
1325Hz	0.5db	-2.69db	0.576 mV	-1.200	0.003	Pass	0.573 mV	-1.234	0.003	Pass
1650Hz	0.5db	-4db	0.501 mV	-2.416	0.003	Pass	0.497 mV	-2.476	0.003	Pass
2000Hz	0.5db	-10.66db	0.391 mV	-4.561	0.003	Pass	0.391 mV	-4.548	0.003	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.143	0.002	Pass	0.130 mV	-14.109	0.002	Pass
3200Hz	-15.77db	-26.93db	0.074 mV	-18.986	0.002	Pass	0.074 mV	-18.965	0.002	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.253	0.001	Pass	0.032 mV	-26.240	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-56.292	0.000	Pass	0.001 mV	-55.337	0.000	Pass
Channel 32										
10Hz	0.5db	-0.75db	0.662 mV	0.000	0.002	Pass	0.661 mV	0.000	0.002	Pass
500Hz	0.5db	-0.96db	0.654 mV	-0.105	0.002	Pass	0.654 mV	-0.091	0.002	Pass
1000Hz	0.5db	-1db	0.621 mV	-0.549	0.002	Pass	0.621 mV	-0.538	0.002	Pass
1325Hz	0.5db	-2.69db	0.576 mV	-1.200	0.002	Pass	0.573 mV	-1.234	0.002	Pass
1650Hz	0.5db	-4db	0.501 mV	-2.415	0.002	Pass	0.497 mV	-2.476	0.002	Pass
2000Hz	0.5db	-10.66db	0.391 mV	-4.560	0.002	Pass	0.391 mV	-4.546	0.002	Pass
2900Hz	-12.37db	-23.53db	0.130 mV	-14.133	0.001	Pass	0.130 mV	-14.097	0.002	Pass
3200Hz	-15.77db	-26.93db	0.075 mV	-18.964	0.001	Pass	0.075 mV	-18.944	0.001	Pass
3575Hz	-19.61db	-999db	0.032 mV	-26.217	0.001	Pass	0.032 mV	-26.207	0.001	Pass
5000Hz	-31.23db	-999db	0.001 mV	-57.270	0.000	Pass	0.001 mV	-56.351	0.000	Pass

Test Description			As Received			As Returned		
Cal DAC	Lower Limit	Upper Limit	UUT	Uncertainty (Vdc)	Pass/ Fail	UUT	Uncertainty (Vdc)	Pass/ Fail
-2.4 Vdc	-2.4025 Vdc	-2.3975 Vdc	-2.3994 Vdc	0.0002	Pass	-2.4000 Vdc	0.0002	Pass
-1.2 Vdc	-1.2025 Vdc	-1.1975 Vdc	-1.1997 Vdc	0.0002	Pass	-1.2000 Vdc	0.0001	Pass
0.0 Vdc	-0.0005 Vdc	0.0005 Vdc	0.0000 Vdc	0.0001	Pass	0.0000 Vdc	0.0001	Pass

Test Description	Lower Limit	Upper Limit	As Received UUT	As Received Uncertainty (Vdc)	As Received Pass/ Fail	As Returned UUT	As Returned Uncertainty (Vdc)	As Returned Pass/ Fail
5V Excitation Short Circuit Recovery								
Channel 1	4.9 Vdc	N/A	4.962 Vdc	0.011	Pass	4.964 Vdc	0.010	Pass
Channel 2	4.9 Vdc	N/A	4.970 Vdc	0.010	Pass	4.971 Vdc	0.010	Pass
Channel 3	4.9 Vdc	N/A	4.972 Vdc	0.010	Pass	4.973 Vdc	0.010	Pass
Channel 4	4.9 Vdc	N/A	4.962 Vdc	0.010	Pass	4.964 Vdc	0.010	Pass
Channel 5	4.9 Vdc	N/A	4.966 Vdc	0.010	Pass	4.969 Vdc	0.010	Pass
Channel 6	4.9 Vdc	N/A	4.955 Vdc	0.010	Pass	4.956 Vdc	0.010	Pass
Channel 7	4.9 Vdc	N/A	4.951 Vdc	0.011	Pass	4.952 Vdc	0.011	Pass
Channel 8	4.9 Vdc	N/A	4.956 Vdc	0.011	Pass	4.958 Vdc	0.011	Pass
Channel 9	4.9 Vdc	N/A	4.973 Vdc	0.010	Pass	4.973 Vdc	0.010	Pass
Channel 10	4.9 Vdc	N/A	4.964 Vdc	0.010	Pass	4.964 Vdc	0.010	Pass
Channel 11	4.9 Vdc	N/A	4.957 Vdc	0.011	Pass	4.957 Vdc	0.011	Pass
Channel 12	4.9 Vdc	N/A	4.957 Vdc	0.010	Pass	4.957 Vdc	0.010	Pass
Channel 13	4.9 Vdc	N/A	4.959 Vdc	0.011	Pass	4.960 Vdc	0.011	Pass
Channel 14	4.9 Vdc	N/A	4.971 Vdc	0.010	Pass	4.972 Vdc	0.010	Pass
Channel 15	4.9 Vdc	N/A	4.942 Vdc	0.013	Pass	4.943 Vdc	0.013	Pass
Channel 16	4.9 Vdc	N/A	4.968 Vdc	0.010	Pass	4.968 Vdc	0.010	Pass
Channel 17	4.9 Vdc	N/A	4.964 Vdc	0.011	Pass	4.965 Vdc	0.011	Pass
Channel 18	4.9 Vdc	N/A	4.974 Vdc	0.010	Pass	4.974 Vdc	0.010	Pass
Channel 19	4.9 Vdc	N/A	4.984 Vdc	0.011	Pass	4.984 Vdc	0.011	Pass
Channel 20	4.9 Vdc	N/A	4.957 Vdc	0.011	Pass	4.957 Vdc	0.011	Pass
Channel 21	4.9 Vdc	N/A	4.967 Vdc	0.010	Pass	4.968 Vdc	0.010	Pass
Channel 22	4.9 Vdc	N/A	4.964 Vdc	0.010	Pass	4.964 Vdc	0.010	Pass
Channel 23	4.9 Vdc	N/A	4.988 Vdc	0.010	Pass	4.988 Vdc	0.011	Pass
Channel 24	4.9 Vdc	N/A	4.959 Vdc	0.011	Pass	4.959 Vdc	0.011	Pass
Channel 25	4.9 Vdc	N/A	4.949 Vdc	0.011	Pass	4.949 Vdc	0.011	Pass
Channel 26	4.9 Vdc	N/A	4.957 Vdc	0.011	Pass	4.957 Vdc	0.011	Pass
Channel 27	4.9 Vdc	N/A	4.960 Vdc	0.010	Pass	4.959 Vdc	0.010	Pass
Channel 28	4.9 Vdc	N/A	4.951 Vdc	0.011	Pass	4.951 Vdc	0.011	Pass
Channel 29	4.9 Vdc	N/A	4.951 Vdc	0.011	Pass	4.949 Vdc	0.011	Pass
Channel 30	4.9 Vdc	N/A	4.961 Vdc	0.010	Pass	4.961 Vdc	0.010	Pass
Channel 31	4.9 Vdc	N/A	4.970 Vdc	0.010	Pass	4.970 Vdc	0.010	Pass
Channel 32	4.9 Vdc	N/A	4.971 Vdc	0.010	Pass	4.970 Vdc	0.010	Pass
5V Excitation Source Output								
Channel 1	4.94 Vdc	5.05 Vdc	4.963 Vdc	0.010	Pass	4.964 Vdc	0.010	Pass
Channel 2	4.94 Vdc	5.05 Vdc	4.970 Vdc	0.013	Pass	4.972 Vdc	0.013	Pass
Channel 3	4.94 Vdc	5.05 Vdc	4.971 Vdc	0.011	Pass	4.973 Vdc	0.011	Pass
Channel 4	4.94 Vdc	5.05 Vdc	4.962 Vdc	0.012	Pass	4.963 Vdc	0.012	Pass
Channel 5	4.94 Vdc	5.05 Vdc	4.965 Vdc	0.013	Pass	4.968 Vdc	0.013	Pass
Channel 6	4.94 Vdc	5.05 Vdc	4.954 Vdc	0.011	Pass	4.956 Vdc	0.011	Pass
Channel 7	4.94 Vdc	5.05 Vdc	4.950 Vdc	0.014	Pass	4.952 Vdc	0.014	Pass
Channel 8	4.94 Vdc	5.05 Vdc	4.955 Vdc	0.015	Pass	4.957 Vdc	0.015	Pass
Channel 9	4.94 Vdc	5.05 Vdc	4.973 Vdc	0.011	Pass	4.973 Vdc	0.011	Pass
Channel 10	4.94 Vdc	5.05 Vdc	4.964 Vdc	0.011	Pass	4.964 Vdc	0.011	Pass
Channel 11	4.94 Vdc	5.05 Vdc	4.957 Vdc	0.012	Pass	4.957 Vdc	0.012	Pass
Channel 12	4.94 Vdc	5.05 Vdc	4.957 Vdc	0.017	Pass	4.957 Vdc	0.017	Pass
Channel 13	4.94 Vdc	5.05 Vdc	4.958 Vdc	0.010	Pass	4.958 Vdc	0.010	Pass
Channel 14	4.94 Vdc	5.05 Vdc	4.970 Vdc	0.013	Pass	4.970 Vdc	0.013	Pass
Channel 15	4.94 Vdc	5.05 Vdc	4.941 Vdc	0.010	Pass	4.942 Vdc	0.010	Pass
Channel 16	4.94 Vdc	5.05 Vdc	4.967 Vdc	0.015	Pass	4.967 Vdc	0.015	Pass
Channel 17	4.94 Vdc	5.05 Vdc	4.965 Vdc	0.007	Pass	4.966 Vdc	0.007	Pass
Channel 18	4.94 Vdc	5.05 Vdc	4.974 Vdc	0.006	Pass	4.974 Vdc	0.006	Pass
Channel 19	4.94 Vdc	5.05 Vdc	4.984 Vdc	0.008	Pass	4.984 Vdc	0.008	Pass
Channel 20	4.94 Vdc	5.05 Vdc	4.957 Vdc	0.010	Pass	4.957 Vdc	0.010	Pass
Channel 21	4.94 Vdc	5.05 Vdc	4.967 Vdc	0.010	Pass	4.967 Vdc	0.010	Pass
Channel 22	4.94 Vdc	5.05 Vdc	4.962 Vdc	0.011	Pass	4.963 Vdc	0.011	Pass
Channel 23	4.94 Vdc	5.05 Vdc	4.987 Vdc	0.006	Pass	4.987 Vdc	0.006	Pass
Channel 24	4.94 Vdc	5.05 Vdc	4.957 Vdc	0.007	Pass	4.958 Vdc	0.007	Pass
Channel 25	4.94 Vdc	5.05 Vdc	4.950 Vdc	0.013	Pass	4.949 Vdc	0.013	Pass

Test Description

5V Excitation Source Output

	Lower Limit	Upper Limit	As Received UUT	As Received Uncertainty (Vdc)	As Received Pass/ Fail	As Returned UUT	As Returned Uncertainty (Vdc)	As Returned Pass/ Fail
Channel 26	4.94 Vdc	5.05 Vdc	4.957 Vdc	0.016	Pass	4.957 Vdc	0.016	Pass
Channel 27	4.94 Vdc	5.05 Vdc	4.960 Vdc	0.010	Pass	4.959 Vdc	0.010	Pass
Channel 28	4.94 Vdc	5.05 Vdc	4.951 Vdc	0.010	Pass	4.950 Vdc	0.010	Pass
Channel 29	4.94 Vdc	5.05 Vdc	4.949 Vdc	0.013	Pass	4.948 Vdc	0.013	Pass
Channel 30	4.94 Vdc	5.05 Vdc	4.960 Vdc	0.009	Pass	4.960 Vdc	0.009	Pass
Channel 31	4.94 Vdc	5.05 Vdc	4.969 Vdc	0.014	Pass	4.969 Vdc	0.014	Pass
Channel 32	4.94 Vdc	5.05 Vdc	4.969 Vdc	0.013	Pass	4.968 Vdc	0.013	Pass

Excitation Reported by DAS for Data Scaling

	Limit	As Received Std (Vdc)	As Received DAS (Vdc)	As Received Deviation (%)	As Received Unc. (Vdc)	As Received Pass/ Fail	As Returned Std (Vdc)	As Returned DAS (Vdc)	As Returned Deviation (%)	As Returned Unc. (Vdc)	As Returned Pass/ Fail
Channel 1	+/-0.3%	4.963	4.966	0.066	0.010	Pass	4.964	4.964	-0.008	0.011	Pass
Channel 2	+/-0.3%	4.970	4.973	0.055	0.011	Pass	4.972	4.972	0.007	0.011	Pass
Channel 3	+/-0.3%	4.971	4.974	0.053	0.012	Pass	4.973	4.973	0.001	0.012	Pass
Channel 4	+/-0.3%	4.962	4.966	0.088	0.012	Pass	4.963	4.963	-0.004	0.012	Pass
Channel 5	+/-0.3%	4.965	4.969	0.074	0.012	Pass	4.968	4.968	0.010	0.012	Pass
Channel 6	+/-0.3%	4.954	4.957	0.052	0.011	Pass	4.956	4.956	0.008	0.011	Pass
Channel 7	+/-0.3%	4.950	4.952	0.037	0.015	Pass	4.952	4.952	0.010	0.015	Pass
Channel 8	+/-0.3%	4.955	4.958	0.053	0.015	Pass	4.957	4.957	0.000	0.015	Pass
Channel 9	+/-0.3%	4.973	4.979	0.117	0.012	Pass	4.973	4.973	-0.009	0.012	Pass
Channel 10	+/-0.3%	4.964	4.963	-0.013	0.011	Pass	4.964	4.964	-0.005	0.011	Pass
Channel 11	+/-0.3%	4.957	4.959	0.045	0.011	Pass	4.957	4.957	-0.003	0.011	Pass
Channel 12	+/-0.3%	4.957	4.957	0.009	0.017	Pass	4.957	4.957	-0.003	0.017	Pass
Channel 13	+/-0.3%	4.958	4.961	0.061	0.010	Pass	4.958	4.958	-0.009	0.010	Pass
Channel 14	+/-0.3%	4.970	4.972	0.049	0.013	Pass	4.970	4.970	-0.006	0.013	Pass
Channel 15	+/-0.3%	4.941	4.941	-0.009	0.010	Pass	4.942	4.942	0.001	0.010	Pass
Channel 16	+/-0.3%	4.967	4.969	0.039	0.014	Pass	4.967	4.967	-0.010	0.015	Pass
Channel 17	+/-0.3%	4.965	4.961	-0.086	0.008	Pass	4.966	4.966	0.007	0.008	Pass
Channel 18	+/-0.3%	4.974	4.971	-0.054	0.007	Pass	4.974	4.974	-0.004	0.007	Pass
Channel 19	+/-0.3%	4.984	4.982	-0.038	0.007	Pass	4.984	4.984	-0.002	0.007	Pass
Channel 20	+/-0.3%	4.957	4.954	-0.055	0.011	Pass	4.957	4.957	-0.004	0.010	Pass
Channel 21	+/-0.3%	4.967	4.964	-0.054	0.010	Pass	4.967	4.967	-0.001	0.010	Pass
Channel 22	+/-0.3%	4.962	4.959	-0.067	0.012	Pass	4.963	4.963	0.002	0.011	Pass
Channel 23	+/-0.3%	4.987	4.981	-0.113	0.006	Pass	4.987	4.987	-0.002	0.006	Pass
Channel 24	+/-0.3%	4.957	4.949	-0.169	0.009	Pass	4.958	4.958	-0.004	0.008	Pass
Channel 25	+/-0.3%	4.950	4.951	0.028	0.012	Pass	4.949	4.949	-0.002	0.012	Pass
Channel 26	+/-0.3%	4.957	4.959	0.035	0.015	Pass	4.957	4.957	0.007	0.015	Pass
Channel 27	+/-0.3%	4.960	4.960	0.006	0.011	Pass	4.959	4.959	0.000	0.011	Pass
Channel 28	+/-0.3%	4.951	4.952	0.022	0.009	Pass	4.950	4.950	-0.009	0.009	Pass
Channel 29	+/-0.3%	4.949	4.947	-0.036	0.013	Pass	4.948	4.948	0.002	0.013	Pass
Channel 30	+/-0.3%	4.960	4.959	-0.022	0.008	Pass	4.960	4.960	0.001	0.008	Pass
Channel 31	+/-0.3%	4.969	4.969	-0.001	0.013	Pass	4.969	4.969	0.006	0.013	Pass
Channel 32	+/-0.3%	4.969	4.970	0.012	0.013	Pass	4.968	4.968	-0.009	0.013	Pass

Excitation Reported by DAS for Diagnostic Check

Channel 1	+/-3%	4.963	4.967	0.076	0.016	Pass	4.964	4.968	0.073	0.016	Pass
Channel 2	+/-3%	4.970	4.965	-0.112	0.020	Pass	4.972	4.967	-0.092	0.020	Pass
Channel 3	+/-3%	4.971	4.965	-0.135	0.020	Pass	4.973	4.967	-0.114	0.020	Pass
Channel 4	+/-3%	4.962	4.956	-0.112	0.021	Pass	4.963	4.956	-0.149	0.021	Pass
Channel 5	+/-3%	4.965	4.966	0.010	0.008	Pass	4.968	4.965	-0.043	0.008	Pass
Channel 6	+/-3%	4.954	4.948	-0.123	0.023	Pass	4.956	4.949	-0.139	0.023	Pass
Channel 7	+/-3%	4.950	4.943	-0.143	0.023	Pass	4.952	4.943	-0.164	0.023	Pass
Channel 8	+/-3%	4.955	4.947	-0.171	0.023	Pass	4.957	4.952	-0.109	0.022	Pass
Channel 9	+/-3%	4.973	4.979	0.115	0.021	Pass	4.973	4.978	0.089	0.021	Pass
Channel 10	+/-3%	4.964	4.973	0.186	0.020	Pass	4.964	4.972	0.162	0.020	Pass
Channel 11	+/-3%	4.957	4.969	0.240	0.022	Pass	4.957	4.964	0.136	0.023	Pass
Channel 12	+/-3%	4.957	4.971	0.298	0.028	Pass	4.957	4.972	0.304	0.028	Pass
Channel 13	+/-3%	4.958	4.973	0.298	0.019	Pass	4.958	4.971	0.261	0.019	Pass

DTS

Serial #: 5M0279
Order #: RA29243
Date: 13 August 2015

Test Description
Excitation Reported by DAS for Diagnostic Check

	Limit	As Received Std (Vdc)	As Received DAS (Vdc)	As Received Deviation (%)	As Received Unc. (Vdc)	As Received Pass/ Fail	As Returned Std (Vdc)	As Returned DAS (Vdc)	As Returned Deviation (%)	As Returned Unc. (Vdc)	As Returned Pass/ Fail
Channel 14	+/-3%	4.970	4.978	0.168	0.022	Pass	4.970	4.978	0.146	0.022	Pass
Channel 15	+/-3%	4.941	4.949	0.157	0.016	Pass	4.942	4.951	0.173	0.015	Pass
Channel 16	+/-3%	4.967	4.975	0.166	0.024	Pass	4.967	4.976	0.173	0.024	Pass
Channel 17	+/-3%	4.965	4.964	-0.036	0.014	Pass	4.966	4.965	-0.005	0.014	Pass
Channel 18	+/-3%	4.974	4.980	0.125	0.014	Pass	4.974	4.980	0.111	0.014	Pass
Channel 19	+/-3%	4.984	4.989	0.101	0.016	Pass	4.984	4.991	0.140	0.016	Pass
Channel 20	+/-3%	4.957	4.962	0.114	0.016	Pass	4.957	4.963	0.121	0.016	Pass
Channel 21	+/-3%	4.967	4.974	0.149	0.015	Pass	4.967	4.973	0.125	0.015	Pass
Channel 22	+/-3%	4.962	4.969	0.129	0.018	Pass	4.963	4.972	0.173	0.018	Pass
Channel 23	+/-3%	4.987	4.988	0.031	0.015	Pass	4.987	4.988	0.026	0.015	Pass
Channel 24	+/-3%	4.957	4.962	0.087	0.017	Pass	4.958	4.961	0.059	0.017	Pass
Channel 25	+/-3%	4.950	4.952	0.057	0.021	Pass	4.949	4.952	0.050	0.021	Pass
Channel 26	+/-3%	4.957	4.964	0.142	0.022	Pass	4.957	4.961	0.078	0.023	Pass
Channel 27	+/-3%	4.960	4.965	0.111	0.017	Pass	4.959	4.962	0.064	0.017	Pass
Channel 28	+/-3%	4.951	4.958	0.151	0.018	Pass	4.950	4.955	0.098	0.018	Pass
Channel 29	+/-3%	4.949	4.954	0.103	0.014	Pass	4.948	4.949	0.014	0.014	Pass
Channel 30	+/-3%	4.960	4.964	0.074	0.015	Pass	4.960	4.959	-0.015	0.016	Pass
Channel 31	+/-3%	4.969	4.975	0.116	0.020	Pass	4.969	4.970	0.024	0.020	Pass
Channel 32	+/-3%	4.969	4.970	0.004	0.014	Pass	4.968	4.970	0.024	0.014	Pass

Gain Response
Gain of 4: 625mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 1											
-60 %	+/-0.5%	-369.220	-369.859	-0.102	0.891	Pass	-368.741	-369.371	-0.101	0.781	Pass
-30 %	+/-0.5%	-184.883	-185.302	-0.067	0.297	Pass	-184.638	-184.943	-0.049	0.485	Pass
30 %	+/-0.5%	185.326	185.569	0.039	0.241	Pass	185.149	185.191	0.007	0.097	Pass
60 %	+/-0.5%	370.161	370.889	0.116	0.470	Pass	369.836	370.381	0.087	0.462	Pass
Channel 2											
-60 %	+/-0.5%	-369.220	-369.837	-0.099	0.508	Pass	-368.741	-369.481	-0.118	0.634	Pass
-30 %	+/-0.5%	-184.883	-185.203	-0.051	0.363	Pass	-184.638	-184.987	-0.056	0.409	Pass
30 %	+/-0.5%	185.326	185.640	0.050	0.090	Pass	185.149	185.310	0.026	0.069	Pass
60 %	+/-0.5%	370.161	371.033	0.139	0.079	Pass	369.836	370.639	0.129	0.121	Pass
Channel 3											
-60 %	+/-0.5%	-369.220	-369.875	-0.105	0.513	Pass	-368.741	-369.332	-0.095	0.682	Pass
-30 %	+/-0.5%	-184.883	-185.253	-0.059	0.294	Pass	-184.638	-184.972	-0.053	0.397	Pass
30 %	+/-0.5%	185.326	185.616	0.046	0.144	Pass	185.149	185.258	0.018	0.068	Pass
60 %	+/-0.5%	370.161	370.869	0.113	0.094	Pass	369.836	370.383	0.088	0.198	Pass
Channel 4											
-60 %	+/-0.5%	-369.220	-369.971	-0.120	0.640	Pass	-368.741	-369.498	-0.121	0.750	Pass
-30 %	+/-0.5%	-184.883	-185.310	-0.068	0.397	Pass	-184.638	-184.997	-0.057	0.545	Pass
30 %	+/-0.5%	185.326	185.634	0.049	0.328	Pass	185.149	185.264	0.018	0.383	Pass
60 %	+/-0.5%	370.161	371.039	0.140	0.090	Pass	369.836	370.546	0.114	0.068	Pass
Channel 5											
-60 %	+/-0.5%	-369.220	-369.966	-0.119	0.605	Pass	-368.741	-369.456	-0.114	0.750	Pass
-30 %	+/-0.5%	-184.883	-185.250	-0.059	0.399	Pass	-184.638	-185.024	-0.062	0.478	Pass
30 %	+/-0.5%	185.326	185.690	0.058	0.176	Pass	185.149	185.329	0.029	0.112	Pass
60 %	+/-0.5%	370.161	371.112	0.152	0.072	Pass	369.836	370.487	0.104	0.175	Pass
Channel 6											
-60 %	+/-0.5%	-369.220	-370.030	-0.130	0.521	Pass	-368.741	-369.416	-0.108	0.698	Pass
-30 %	+/-0.5%	-184.883	-185.359	-0.076	0.368	Pass	-184.638	-185.042	-0.065	0.437	Pass
30 %	+/-0.5%	185.326	185.664	0.054	0.313	Pass	185.149	185.233	0.013	0.089	Pass
60 %	+/-0.5%	370.161	371.118	0.153	0.113	Pass	369.836	370.466	0.101	0.216	Pass
Channel 7											
-60 %	+/-0.5%	-369.220	-369.676	-0.073	0.666	Pass	-368.741	-369.218	-0.076	0.791	Pass
-30 %	+/-0.5%	-184.883	-185.180	-0.048	0.412	Pass	-184.638	-184.884	-0.039	0.489	Pass
30 %	+/-0.5%	185.326	185.523	0.031	0.227	Pass	185.149	185.170	0.003	0.191	Pass
60 %	+/-0.5%	370.161	370.817	0.105	0.114	Pass	369.836	370.301	0.074	0.092	Pass

Test Description
Gain Response
Gain of 4: 625mV

		As Received					As Returned				
	Limit	**Std (mV)**	**DAS (mV)**	**Deviation (%)**	**Unc. (mV)**	**Pass/ Fail**	**Std (mV)**	**DAS (mV)**	**Deviation (%)**	**Unc. (mV)**	**Pass/ Fail**
Channel 8											
-60 %	+/-0.5%	-369.220	-369.598	-0.061	0.603	Pass	-368.741	-369.107	-0.059	0.717	Pass
-30 %	+/-0.5%	-184.883	-185.113	-0.037	0.379	Pass	-184.638	-184.800	-0.026	0.407	Pass
30 %	+/-0.5%	185.326	185.531	0.033	0.152	Pass	185.149	185.104	-0.007	0.075	Pass
60 %	+/-0.5%	370.161	370.833	0.108	0.080	Pass	369.836	370.304	0.075	0.150	Pass
Channel 9											
-60 %	+/-0.5%	-369.127	-369.679	-0.088	0.935	Pass	-368.696	-369.256	-0.090	0.810	Pass
-30 %	+/-0.5%	-184.835	-185.174	-0.054	0.192	Pass	-184.612	-184.848	-0.038	0.732	Pass
30 %	+/-0.5%	185.318	185.575	0.041	0.207	Pass	185.125	185.306	0.029	0.069	Pass
60 %	+/-0.5%	370.155	370.826	0.107	0.233	Pass	369.793	370.192	0.064	0.103	Pass
Channel 10											
-60 %	+/-0.5%	-369.127	-369.711	-0.093	0.426	Pass	-368.696	-369.343	-0.104	0.511	Pass
-30 %	+/-0.5%	-184.835	-185.138	-0.048	0.234	Pass	-184.612	-184.851	-0.038	0.312	Pass
30 %	+/-0.5%	185.318	185.477	0.025	0.067	Pass	185.125	185.284	0.025	0.074	Pass
60 %	+/-0.5%	370.155	370.822	0.107	0.154	Pass	369.793	370.247	0.073	0.282	Pass
Channel 11											
-60 %	+/-0.5%	-369.127	-369.759	-0.101	0.649	Pass	-368.696	-369.304	-0.097	0.777	Pass
-30 %	+/-0.5%	-184.835	-185.193	-0.057	0.393	Pass	-184.612	-184.851	-0.038	0.459	Pass
30 %	+/-0.5%	185.318	185.517	0.032	0.185	Pass	185.125	185.289	0.026	0.257	Pass
60 %	+/-0.5%	370.155	370.862	0.113	0.070	Pass	369.793	370.217	0.068	0.091	Pass
Channel 12											
-60 %	+/-0.5%	-369.127	-369.501	-0.060	0.525	Pass	-368.696	-369.041	-0.055	0.640	Pass
-30 %	+/-0.5%	-184.835	-185.084	-0.040	0.274	Pass	-184.612	-184.769	-0.025	0.364	Pass
30 %	+/-0.5%	185.318	185.504	0.030	0.124	Pass	185.125	185.208	0.013	0.073	Pass
60 %	+/-0.5%	370.155	370.646	0.079	0.125	Pass	369.793	369.938	0.023	0.225	Pass
Channel 13											
-60 %	+/-0.5%	-369.127	-369.679	-0.088	0.810	Pass	-368.696	-369.289	-0.095	0.959	Pass
-30 %	+/-0.5%	-184.835	-185.119	-0.045	0.613	Pass	-184.612	-184.856	-0.039	0.746	Pass
30 %	+/-0.5%	185.318	185.505	0.030	0.361	Pass	185.125	185.242	0.019	0.340	Pass
60 %	+/-0.5%	370.155	370.778	0.100	0.215	Pass	369.793	370.213	0.067	0.142	Pass
Channel 14											
-60 %	+/-0.5%	-369.127	-369.628	-0.080	0.422	Pass	-368.696	-369.243	-0.088	0.582	Pass
-30 %	+/-0.5%	-184.835	-185.101	-0.042	0.271	Pass	-184.612	-184.813	-0.032	0.324	Pass
30 %	+/-0.5%	185.318	185.483	0.026	0.066	Pass	185.125	185.271	0.023	0.080	Pass
60 %	+/-0.5%	370.155	370.833	0.108	0.151	Pass	369.793	370.161	0.059	0.271	Pass
Channel 15											
-60 %	+/-0.5%	-369.127	-369.814	-0.110	0.528	Pass	-368.696	-369.373	-0.108	0.705	Pass
-30 %	+/-0.5%	-184.835	-185.153	-0.051	0.391	Pass	-184.612	-184.886	-0.044	0.458	Pass
30 %	+/-0.5%	185.318	185.608	0.046	0.172	Pass	185.125	185.341	0.035	0.135	Pass
60 %	+/-0.5%	370.155	370.951	0.127	0.078	Pass	369.793	370.340	0.088	0.094	Pass
Channel 16											
-60 %	+/-0.5%	-369.127	-369.543	-0.067	0.618	Pass	-368.696	-369.009	-0.050	0.769	Pass
-30 %	+/-0.5%	-184.835	-185.038	-0.032	0.401	Pass	-184.612	-184.761	-0.024	0.470	Pass
30 %	+/-0.5%	185.318	185.436	0.019	0.194	Pass	185.125	185.122	-0.001	0.108	Pass
60 %	+/-0.5%	370.155	370.645	0.078	0.077	Pass	369.793	369.959	0.026	0.081	Pass
Channel 17											
-60 %	+/-0.5%	-369.081	-370.000	-0.147	1.033	Pass	-368.698	-369.576	-0.140	0.842	Pass
-30 %	+/-0.5%	-184.810	-185.277	-0.075	0.317	Pass	-184.611	-184.960	-0.056	0.434	Pass
30 %	+/-0.5%	185.314	185.525	0.034	0.181	Pass	185.127	185.208	0.013	0.238	Pass
60 %	+/-0.5%	370.145	370.974	0.133	0.119	Pass	369.804	370.663	0.137	0.227	Pass
Channel 18											
-60 %	+/-0.5%	-369.081	-369.929	-0.136	0.254	Pass	-368.698	-369.430	-0.117	0.697	Pass
-30 %	+/-0.5%	-184.810	-185.299	-0.078	0.410	Pass	-184.611	-184.896	-0.046	0.450	Pass
30 %	+/-0.5%	185.314	185.662	0.056	0.179	Pass	185.127	185.316	0.030	0.118	Pass
60 %	+/-0.5%	370.145	370.922	0.124	0.085	Pass	369.804	370.614	0.130	0.109	Pass
Channel 19											
-60 %	+/-0.5%	-369.081	-369.845	-0.122	0.374	Pass	-368.698	-369.329	-0.101	0.497	Pass
-30 %	+/-0.5%	-184.810	-185.218	-0.065	0.193	Pass	-184.611	-184.807	-0.031	0.290	Pass
30 %	+/-0.5%	185.314	185.580	0.043	0.116	Pass	185.127	185.322	0.031	0.157	Pass
60 %	+/-0.5%	370.145	370.932	0.126	0.235	Pass	369.804	370.568	0.122	0.341	Pass

Test Description
Gain Response
Gain of 4: 625mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 20											
-60 %	+/-0.5%	-369.081	-369.833	-0.120	0.478	Pass	-368.698	-369.321	-0.100	0.610	Pass
-30 %	+/-0.5%	-184.810	-185.240	-0.069	0.265	Pass	-184.611	-184.860	-0.040	0.313	Pass
30 %	+/-0.5%	185.314	185.640	0.052	0.077	Pass	185.127	185.336	0.033	0.091	Pass
60 %	+/-0.5%	370.145	370.994	0.136	0.161	Pass	369.804	370.558	0.121	0.285	Pass
Channel 21											
-60 %	+/-0.5%	-369.081	-369.987	-0.145	0.437	Pass	-368.698	-369.511	-0.130	0.551	Pass
-30 %	+/-0.5%	-184.810	-185.307	-0.080	0.274	Pass	-184.611	-184.955	-0.055	0.315	Pass
30 %	+/-0.5%	185.314	185.688	0.060	0.069	Pass	185.127	185.355	0.036	0.112	Pass
60 %	+/-0.5%	370.145	371.109	0.154	0.110	Pass	369.804	370.710	0.145	0.271	Pass
Channel 22											
-60 %	+/-0.5%	-369.081	-370.058	-0.156	0.206	Pass	-368.698	-369.580	-0.141	0.310	Pass
-30 %	+/-0.5%	-184.810	-185.378	-0.091	0.069	Pass	-184.611	-184.969	-0.057	0.086	Pass
30 %	+/-0.5%	185.314	185.775	0.074	0.264	Pass	185.127	185.441	0.050	0.341	Pass
60 %	+/-0.5%	370.145	371.228	0.173	0.300	Pass	369.804	370.882	0.173	0.424	Pass
Channel 23											
-60 %	+/-0.5%	-369.081	-369.663	-0.093	0.404	Pass	-368.698	-369.221	-0.084	0.523	Pass
-30 %	+/-0.5%	-184.810	-185.182	-0.060	0.203	Pass	-184.611	-184.753	-0.023	0.300	Pass
30 %	+/-0.5%	185.314	185.543	0.037	0.100	Pass	185.127	185.246	0.019	0.147	Pass
60 %	+/-0.5%	370.145	370.839	0.111	0.225	Pass	369.804	370.511	0.113	0.330	Pass
Channel 24											
-60 %	+/-0.5%	-369.081	-369.505	-0.068	0.659	Pass	-368.698	-369.080	-0.061	0.802	Pass
-30 %	+/-0.5%	-184.810	-185.085	-0.044	0.430	Pass	-184.611	-184.692	-0.013	0.504	Pass
30 %	+/-0.5%	185.314	185.523	0.033	0.175	Pass	185.127	185.224	0.016	0.113	Pass
60 %	+/-0.5%	370.145	370.703	0.089	0.069	Pass	369.804	370.353	0.088	0.122	Pass
Channel 25											
-60 %	+/-0.5%	-368.699	-369.182	-0.077	0.686	Pass	-368.776	-369.193	-0.067	0.347	Pass
-30 %	+/-0.5%	-184.621	-185.022	-0.064	0.411	Pass	-184.655	-184.979	-0.052	0.214	Pass
30 %	+/-0.5%	185.129	185.098	-0.005	0.122	Pass	185.086	184.979	-0.017	0.080	Pass
60 %	+/-0.5%	369.784	370.273	0.078	0.126	Pass	369.698	370.093	0.063	0.364	Pass
Channel 26											
-60 %	+/-0.5%	-368.699	-369.074	-0.060	0.508	Pass	-368.776	-369.132	-0.057	0.534	Pass
-30 %	+/-0.5%	-184.621	-184.859	-0.038	0.251	Pass	-184.655	-184.879	-0.036	0.242	Pass
30 %	+/-0.5%	185.129	185.182	0.008	0.317	Pass	185.086	185.107	0.003	0.347	Pass
60 %	+/-0.5%	369.784	370.345	0.090	0.330	Pass	369.698	370.233	0.086	0.364	Pass
Channel 27											
-60 %	+/-0.5%	-368.699	-369.116	-0.067	0.469	Pass	-368.776	-369.162	-0.062	0.432	Pass
-30 %	+/-0.5%	-184.621	-184.910	-0.046	0.174	Pass	-184.655	-184.943	-0.046	0.192	Pass
30 %	+/-0.5%	185.129	185.177	0.008	0.199	Pass	185.086	185.114	0.005	0.238	Pass
60 %	+/-0.5%	369.784	370.373	0.094	0.385	Pass	369.698	370.266	0.091	0.432	Pass
Channel 28											
-60 %	+/-0.5%	-368.699	-369.377	-0.108	0.239	Pass	-368.776	-369.434	-0.105	0.239	Pass
-30 %	+/-0.5%	-184.621	-185.145	-0.084	0.066	Pass	-184.655	-185.135	-0.077	0.070	Pass
30 %	+/-0.5%	185.129	185.031	-0.016	0.306	Pass	185.086	185.002	-0.013	0.308	Pass
60 %	+/-0.5%	369.784	370.403	0.099	0.450	Pass	369.698	370.271	0.092	0.463	Pass
Channel 29											
-60 %	+/-0.5%	-368.699	-369.154	-0.073	0.514	Pass	-368.776	-369.123	-0.056	0.490	Pass
-30 %	+/-0.5%	-184.621	-184.940	-0.051	0.223	Pass	-184.655	-184.887	-0.037	0.243	Pass
30 %	+/-0.5%	185.129	185.170	0.006	0.156	Pass	185.086	185.135	0.008	0.197	Pass
60 %	+/-0.5%	369.784	370.378	0.095	0.351	Pass	369.698	370.194	0.079	0.416	Pass
Channel 30											
-60 %	+/-0.5%	-368.699	-369.074	-0.060	0.567	Pass	-368.776	-369.081	-0.049	0.592	Pass
-30 %	+/-0.5%	-184.621	-184.928	-0.049	0.323	Pass	-184.655	-184.875	-0.035	0.322	Pass
30 %	+/-0.5%	185.129	185.215	0.014	0.076	Pass	185.086	185.123	0.006	0.095	Pass
60 %	+/-0.5%	369.784	370.372	0.094	0.272	Pass	369.698	370.188	0.078	0.318	Pass
Channel 31											
-60 %	+/-0.5%	-368.699	-369.144	-0.071	0.459	Pass	-368.776	-369.282	-0.081	0.440	Pass
-30 %	+/-0.5%	-184.621	-184.942	-0.051	0.187	Pass	-184.655	-184.983	-0.052	0.233	Pass
30 %	+/-0.5%	185.129	185.170	0.006	0.140	Pass	185.086	185.191	0.017	0.168	Pass
60 %	+/-0.5%	369.784	370.511	0.116	0.335	Pass	369.698	370.497	0.128	0.351	Pass

Test Description

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Gain Response											
Gain of 4: 625mV											
Channel 32											
-60 %	+/-0.5%	-368.699	-369.120	-0.067	0.525	Pass	-368.776	-369.212	-0.070	0.487	Pass
-30 %	+/-0.5%	-184.621	-184.941	-0.051	0.237	Pass	-184.655	-184.958	-0.049	0.263	Pass
30 %	+/-0.5%	185.129	185.112	-0.003	0.157	Pass	185.086	185.072	-0.002	0.149	Pass
60 %	+/-0.5%	369.784	370.338	0.089	0.312	Pass	369.698	370.240	0.087	0.383	Pass
Gain Response											
Gain of 48: 52.083mV											
Channel 1											
-60 %	+/-0.5%	-30.832	-30.890	-0.112	0.177	Pass	-30.797	-30.845	-0.092	0.180	Pass
-30 %	+/-0.5%	-15.418	-15.460	-0.080	0.125	Pass	-15.401	-15.433	-0.062	0.140	Pass
30 %	+/-0.5%	15.421	15.442	0.040	0.136	Pass	15.404	15.427	0.044	0.139	Pass
60 %	+/-0.5%	30.846	30.903	0.110	0.116	Pass	30.811	30.866	0.107	0.116	Pass
Channel 2											
-60 %	+/-0.5%	-30.832	-30.901	-0.132	0.141	Pass	-30.797	-30.851	-0.104	0.144	Pass
-30 %	+/-0.5%	-15.418	-15.457	-0.074	0.090	Pass	-15.401	-15.426	-0.048	0.092	Pass
30 %	+/-0.5%	15.421	15.452	0.059	0.061	Pass	15.404	15.434	0.057	0.061	Pass
60 %	+/-0.5%	30.846	30.925	0.152	0.101	Pass	30.811	30.882	0.137	0.101	Pass
Channel 3											
-60 %	+/-0.5%	-30.832	-30.896	-0.124	0.115	Pass	-30.797	-30.857	-0.116	0.118	Pass
-30 %	+/-0.5%	-15.418	-15.460	-0.081	0.085	Pass	-15.401	-15.434	-0.065	0.087	Pass
30 %	+/-0.5%	15.421	15.447	0.050	0.090	Pass	15.404	15.434	0.059	0.090	Pass
60 %	+/-0.5%	30.846	30.898	0.100	0.083	Pass	30.811	30.875	0.124	0.084	Pass
Channel 4											
-60 %	+/-0.5%	-30.832	-30.909	-0.147	0.128	Pass	-30.797	-30.854	-0.110	0.132	Pass
-30 %	+/-0.5%	-15.418	-15.461	-0.082	0.086	Pass	-15.401	-15.441	-0.077	0.089	Pass
30 %	+/-0.5%	15.421	15.456	0.067	0.125	Pass	15.404	15.430	0.049	0.124	Pass
60 %	+/-0.5%	30.846	30.928	0.158	0.134	Pass	30.811	30.870	0.115	0.133	Pass
Channel 5											
-60 %	+/-0.5%	-30.832	-30.899	-0.129	0.107	Pass	-30.797	-30.862	-0.125	0.109	Pass
-30 %	+/-0.5%	-15.418	-15.458	-0.076	0.071	Pass	-15.401	-15.434	-0.065	0.072	Pass
30 %	+/-0.5%	15.421	15.453	0.061	0.107	Pass	15.404	15.443	0.074	0.107	Pass
60 %	+/-0.5%	30.846	30.920	0.143	0.120	Pass	30.811	30.887	0.146	0.121	Pass
Channel 6											
-60 %	+/-0.5%	-30.832	-30.901	-0.132	0.114	Pass	-30.797	-30.862	-0.125	0.117	Pass
-30 %	+/-0.5%	-15.418	-15.464	-0.088	0.091	Pass	-15.401	-15.439	-0.074	0.093	Pass
30 %	+/-0.5%	15.421	15.448	0.051	0.094	Pass	15.404	15.436	0.062	0.094	Pass
60 %	+/-0.5%	30.846	30.897	0.099	0.106	Pass	30.811	30.886	0.145	0.106	Pass
Channel 7											
-60 %	+/-0.5%	-30.832	-30.886	-0.105	0.106	Pass	-30.797	-30.829	-0.061	0.112	Pass
-30 %	+/-0.5%	-15.418	-15.455	-0.072	0.089	Pass	-15.401	-15.423	-0.043	0.092	Pass
30 %	+/-0.5%	15.421	15.444	0.044	0.067	Pass	15.404	15.423	0.038	0.067	Pass
60 %	+/-0.5%	30.846	30.908	0.118	0.102	Pass	30.811	30.852	0.078	0.102	Pass
Channel 8											
-60 %	+/-0.5%	-30.832	-30.872	-0.076	0.117	Pass	-30.797	-30.835	-0.073	0.120	Pass
-30 %	+/-0.5%	-15.418	-15.445	-0.051	0.078	Pass	-15.401	-15.424	-0.045	0.081	Pass
30 %	+/-0.5%	15.421	15.438	0.033	0.070	Pass	15.404	15.426	0.042	0.070	Pass
60 %	+/-0.5%	30.846	30.899	0.102	0.074	Pass	30.811	30.867	0.109	0.075	Pass
Channel 9											
-60 %	+/-0.5%	-30.828	-30.887	-0.114	0.191	Pass	-30.793	-30.837	-0.084	0.188	Pass
-30 %	+/-0.5%	-15.416	-15.445	-0.054	0.146	Pass	-15.399	-15.434	-0.067	0.141	Pass
30 %	+/-0.5%	15.419	15.446	0.052	0.123	Pass	15.402	15.411	0.018	0.123	Pass
60 %	+/-0.5%	30.841	30.894	0.101	0.143	Pass	30.807	30.851	0.085	0.143	Pass
Channel 10											
-60 %	+/-0.5%	-30.828	-30.890	-0.118	0.138	Pass	-30.793	-30.841	-0.091	0.140	Pass
-30 %	+/-0.5%	-15.416	-15.446	-0.057	0.125	Pass	-15.399	-15.427	-0.054	0.126	Pass
30 %	+/-0.5%	15.419	15.444	0.048	0.116	Pass	15.402	15.407	0.011	0.116	Pass
60 %	+/-0.5%	30.841	30.896	0.105	0.159	Pass	30.807	30.852	0.086	0.159	Pass

Test Description
Gain Response
Gain of 48: 52.083mV

		As Received					As Returned				
	Limit	Std (mV)	DAS (mV)	Deviation (%)	Unc. (mV)	Pass/ Fail	Std (mV)	DAS (mV)	Deviation (%)	Unc. (mV)	Pass/ Fail
Channel 11											
-60 %	+/-0.5%	-30.828	-30.893	-0.125	0.159	Pass	-30.793	-30.831	-0.074	0.163	Pass
-30 %	+/-0.5%	-15.416	-15.446	-0.057	0.128	Pass	-15.399	-15.429	-0.057	0.130	Pass
30 %	+/-0.5%	15.419	15.443	0.045	0.112	Pass	15.402	15.409	0.014	0.111	Pass
60 %	+/-0.5%	30.841	30.893	0.099	0.150	Pass	30.807	30.848	0.078	0.150	Pass
Channel 12											
-60 %	+/-0.5%	-30.828	-30.866	-0.074	0.136	Pass	-30.793	-30.823	-0.058	0.139	Pass
-30 %	+/-0.5%	-15.416	-15.438	-0.042	0.092	Pass	-15.399	-15.428	-0.056	0.093	Pass
30 %	+/-0.5%	15.419	15.440	0.040	0.050	Pass	15.402	15.407	0.009	0.050	Pass
60 %	+/-0.5%	30.841	30.878	0.070	0.072	Pass	30.807	30.839	0.062	0.073	Pass
Channel 13											
-60 %	+/-0.5%	-30.828	-30.887	-0.114	0.154	Pass	-30.793	-30.838	-0.087	0.165	Pass
-30 %	+/-0.5%	-15.416	-15.447	-0.059	0.133	Pass	-15.399	-15.423	-0.046	0.135	Pass
30 %	+/-0.5%	15.419	15.442	0.044	0.142	Pass	15.402	15.405	0.005	0.141	Pass
60 %	+/-0.5%	30.841	30.894	0.101	0.170	Pass	30.807	30.847	0.076	0.170	Pass
Channel 14											
-60 %	+/-0.5%	-30.828	-30.891	-0.120	0.127	Pass	-30.793	-30.839	-0.088	0.131	Pass
-30 %	+/-0.5%	-15.416	-15.444	-0.053	0.080	Pass	-15.399	-15.432	-0.063	0.081	Pass
30 %	+/-0.5%	15.419	15.444	0.047	0.059	Pass	15.402	15.407	0.011	0.059	Pass
60 %	+/-0.5%	30.841	30.900	0.113	0.116	Pass	30.807	30.854	0.090	0.117	Pass
Channel 15											
-60 %	+/-0.5%	-30.828	-30.905	-0.147	0.148	Pass	-30.793	-30.844	-0.099	0.155	Pass
-30 %	+/-0.5%	-15.416	-15.445	-0.056	0.126	Pass	-15.399	-15.425	-0.051	0.127	Pass
30 %	+/-0.5%	15.419	15.455	0.069	0.094	Pass	15.402	15.417	0.030	0.093	Pass
60 %	+/-0.5%	30.841	30.908	0.128	0.087	Pass	30.807	30.861	0.103	0.088	Pass
Channel 16											
-60 %	+/-0.5%	-30.828	-30.883	-0.106	0.152	Pass	-30.793	-30.825	-0.061	0.156	Pass
-30 %	+/-0.5%	-15.416	-15.440	-0.046	0.101	Pass	-15.399	-15.420	-0.040	0.102	Pass
30 %	+/-0.5%	15.419	15.442	0.043	0.070	Pass	15.402	15.400	-0.003	0.069	Pass
60 %	+/-0.5%	30.841	30.883	0.080	0.130	Pass	30.807	30.838	0.059	0.130	Pass
Channel 17											
-60 %	+/-0.5%	-30.826	-30.899	-0.140	0.164	Pass	-30.793	-30.872	-0.153	0.183	Pass
-30 %	+/-0.5%	-15.415	-15.460	-0.086	0.151	Pass	-15.399	-15.437	-0.074	0.151	Pass
30 %	+/-0.5%	15.418	15.434	0.031	0.143	Pass	15.401	15.419	0.034	0.146	Pass
60 %	+/-0.5%	30.839	30.909	0.133	0.112	Pass	30.806	30.880	0.142	0.113	Pass
Channel 18											
-60 %	+/-0.5%	-30.826	-30.899	-0.141	0.121	Pass	-30.793	-30.866	-0.140	0.124	Pass
-30 %	+/-0.5%	-15.415	-15.463	-0.091	0.100	Pass	-15.399	-15.444	-0.088	0.103	Pass
30 %	+/-0.5%	15.418	15.450	0.060	0.087	Pass	15.401	15.428	0.051	0.087	Pass
60 %	+/-0.5%	30.839	30.917	0.149	0.116	Pass	30.806	30.877	0.135	0.116	Pass
Channel 19											
-60 %	+/-0.5%	-30.826	-30.903	-0.149	0.125	Pass	-30.793	-30.859	-0.127	0.129	Pass
-30 %	+/-0.5%	-15.415	-15.458	-0.083	0.096	Pass	-15.399	-15.427	-0.055	0.098	Pass
30 %	+/-0.5%	15.418	15.447	0.055	0.090	Pass	15.401	15.427	0.049	0.091	Pass
60 %	+/-0.5%	30.839	30.918	0.151	0.119	Pass	30.806	30.872	0.126	0.126	Pass
Channel 20											
-60 %	+/-0.5%	-30.826	-30.897	-0.137	0.100	Pass	-30.793	-30.867	-0.142	0.103	Pass
-30 %	+/-0.5%	-15.415	-15.462	-0.091	0.065	Pass	-15.399	-15.430	-0.061	0.067	Pass
30 %	+/-0.5%	15.418	15.449	0.060	0.062	Pass	15.401	15.430	0.055	0.062	Pass
60 %	+/-0.5%	30.839	30.920	0.155	0.111	Pass	30.806	30.883	0.147	0.112	Pass
Channel 21											
-60 %	+/-0.5%	-30.826	-30.905	-0.152	0.123	Pass	-30.793	-30.877	-0.162	0.125	Pass
-30 %	+/-0.5%	-15.415	-15.462	-0.091	0.078	Pass	-15.399	-15.437	-0.074	0.080	Pass
30 %	+/-0.5%	15.418	15.453	0.066	0.056	Pass	15.401	15.432	0.059	0.056	Pass
60 %	+/-0.5%	30.839	30.929	0.173	0.094	Pass	30.806	30.897	0.173	0.095	Pass
Channel 22											
-60 %	+/-0.5%	-30.826	-30.912	-0.166	0.134	Pass	-30.793	-30.880	-0.167	0.136	Pass
-30 %	+/-0.5%	-15.415	-15.468	-0.102	0.075	Pass	-15.399	-15.439	-0.078	0.075	Pass
30 %	+/-0.5%	15.418	15.460	0.081	0.065	Pass	15.401	15.439	0.072	0.067	Pass
60 %	+/-0.5%	30.839	30.940	0.193	0.091	Pass	30.806	30.904	0.188	0.092	Pass

Test Description

Gain Response

Gain of 48: 52.083mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 23											
-60 %	+/-0.5%	-30.826	-30.883	-0.109	0.162	Pass	-30.793	-30.853	-0.115	0.164	Pass
-30 %	+/-0.5%	-15.415	-15.451	-0.069	0.146	Pass	-15.399	-15.428	-0.057	0.147	Pass
30 %	+/-0.5%	15.418	15.440	0.042	0.168	Pass	15.401	15.417	0.029	0.168	Pass
60 %	+/-0.5%	30.839	30.906	0.127	0.177	Pass	30.806	30.874	0.129	0.178	Pass
Channel 24											
-60 %	+/-0.5%	-30.826	-30.876	-0.096	0.126	Pass	-30.793	-30.826	-0.065	0.133	Pass
-30 %	+/-0.5%	-15.415	-15.447	-0.061	0.092	Pass	-15.399	-15.414	-0.030	0.092	Pass
30 %	+/-0.5%	15.418	15.442	0.046	0.061	Pass	15.401	15.414	0.024	0.060	Pass
60 %	+/-0.5%	30.839	30.902	0.119	0.081	Pass	30.806	30.851	0.085	0.081	Pass
Channel 25											
-60 %	+/-0.5%	-30.795	-30.856	-0.116	0.147	Pass	-30.792	-30.830	-0.072	0.153	Pass
-30 %	+/-0.5%	-15.400	-15.433	-0.063	0.135	Pass	-15.399	-15.425	-0.050	0.136	Pass
30 %	+/-0.5%	15.403	15.410	0.014	0.111	Pass	15.401	15.408	0.014	0.111	Pass
60 %	+/-0.5%	30.809	30.857	0.094	0.126	Pass	30.806	30.838	0.061	0.128	Pass
Channel 26											
-60 %	+/-0.5%	-30.795	-30.838	-0.082	0.142	Pass	-30.792	-30.817	-0.047	0.144	Pass
-30 %	+/-0.5%	-15.400	-15.417	-0.032	0.077	Pass	-15.399	-15.414	-0.030	0.076	Pass
30 %	+/-0.5%	15.403	15.408	0.011	0.063	Pass	15.401	15.406	0.009	0.063	Pass
60 %	+/-0.5%	30.809	30.859	0.097	0.097	Pass	30.806	30.843	0.069	0.099	Pass
Channel 27											
-60 %	+/-0.5%	-30.795	-30.833	-0.072	0.114	Pass	-30.792	-30.822	-0.056	0.115	Pass
-30 %	+/-0.5%	-15.400	-15.416	-0.030	0.070	Pass	-15.399	-15.416	-0.033	0.069	Pass
30 %	+/-0.5%	15.403	15.409	0.012	0.050	Pass	15.401	15.411	0.018	0.052	Pass
60 %	+/-0.5%	30.809	30.857	0.093	0.098	Pass	30.806	30.846	0.076	0.099	Pass
Channel 28											
-60 %	+/-0.5%	-30.795	-30.859	-0.123	0.137	Pass	-30.792	-30.849	-0.108	0.137	Pass
-30 %	+/-0.5%	-15.400	-15.431	-0.060	0.081	Pass	-15.399	-15.432	-0.065	0.081	Pass
30 %	+/-0.5%	15.403	15.400	-0.004	0.058	Pass	15.401	15.403	0.003	0.060	Pass
60 %	+/-0.5%	30.809	30.856	0.091	0.082	Pass	30.806	30.853	0.090	0.082	Pass
Channel 29											
-60 %	+/-0.5%	-30.795	-30.842	-0.091	0.114	Pass	-30.792	-30.834	-0.079	0.115	Pass
-30 %	+/-0.5%	-15.400	-15.417	-0.033	0.079	Pass	-15.399	-15.423	-0.048	0.078	Pass
30 %	+/-0.5%	15.403	15.409	0.012	0.150	Pass	15.401	15.417	0.030	0.150	Pass
60 %	+/-0.5%	30.809	30.860	0.099	0.110	Pass	30.806	30.858	0.099	0.110	Pass
Channel 30											
-60 %	+/-0.5%	-30.795	-30.842	-0.090	0.147	Pass	-30.792	-30.825	-0.062	0.148	Pass
-30 %	+/-0.5%	-15.400	-15.417	-0.033	0.091	Pass	-15.399	-15.414	-0.030	0.091	Pass
30 %	+/-0.5%	15.403	15.414	0.021	0.073	Pass	15.401	15.416	0.027	0.074	Pass
60 %	+/-0.5%	30.809	30.861	0.101	0.116	Pass	30.806	30.849	0.082	0.116	Pass
Channel 31											
-60 %	+/-0.5%	-30.795	-30.834	-0.075	0.139	Pass	-30.792	-30.820	-0.052	0.140	Pass
-30 %	+/-0.5%	-15.400	-15.415	-0.029	0.124	Pass	-15.399	-15.416	-0.034	0.124	Pass
30 %	+/-0.5%	15.403	15.410	0.014	0.149	Pass	15.401	15.415	0.026	0.149	Pass
60 %	+/-0.5%	30.809	30.867	0.111	0.148	Pass	30.806	30.857	0.097	0.147	Pass
Channel 32											
-60 %	+/-0.5%	-30.795	-30.849	-0.104	0.111	Pass	-30.792	-30.834	-0.079	0.112	Pass
-30 %	+/-0.5%	-15.400	-15.423	-0.045	0.116	Pass	-15.399	-15.430	-0.060	0.116	Pass
30 %	+/-0.5%	15.403	15.412	0.017	0.094	Pass	15.401	15.417	0.030	0.094	Pass
60 %	+/-0.5%	30.809	30.869	0.115	0.135	Pass	30.806	30.856	0.096	0.135	Pass

Gain Response

Gain of 128: 19.3125mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 1											
-60 %	+/-0.5%	-11.563	-11.589	-0.132	0.048	Pass	-11.550	-11.572	-0.113	0.055	Pass
-30 %	+/-0.5%	-5.781	-5.795	-0.075	0.059	Pass	-5.774	-5.790	-0.080	0.064	Pass
30 %	+/-0.5%	5.782	5.785	0.019	0.062	Pass	5.775	5.780	0.024	0.060	Pass
60 %	+/-0.5%	11.565	11.589	0.123	0.068	Pass	11.551	11.575	0.122	0.068	Pass

Test Description
Gain Response
Gain of 128: 19.3125mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 2											
-60 %	+/-0.5%	-11.563	-11.589	-0.129	0.047	Pass	-11.550	-11.571	-0.106	0.049	Pass
-30 %	+/-0.5%	-5.781	-5.792	-0.059	0.037	Pass	-5.774	-5.787	-0.066	0.037	Pass
30 %	+/-0.5%	5.782	5.789	0.037	0.028	Pass	5.775	5.781	0.029	0.028	Pass
60 %	+/-0.5%	11.565	11.594	0.150	0.039	Pass	11.551	11.582	0.156	0.040	Pass
Channel 3											
-60 %	+/-0.5%	-11.563	-11.591	-0.141	0.042	Pass	-11.550	-11.574	-0.120	0.043	Pass
-30 %	+/-0.5%	-5.781	-5.795	-0.071	0.026	Pass	-5.774	-5.790	-0.077	0.027	Pass
30 %	+/-0.5%	5.782	5.788	0.034	0.076	Pass	5.775	5.781	0.031	0.076	Pass
60 %	+/-0.5%	11.565	11.580	0.081	0.038	Pass	11.551	11.574	0.114	0.038	Pass
Channel 4											
-60 %	+/-0.5%	-11.563	-11.594	-0.157	0.052	Pass	-11.550	-11.572	-0.113	0.054	Pass
-30 %	+/-0.5%	-5.781	-5.796	-0.080	0.032	Pass	-5.774	-5.789	-0.074	0.033	Pass
30 %	+/-0.5%	5.782	5.789	0.036	0.033	Pass	5.775	5.780	0.028	0.032	Pass
60 %	+/-0.5%	11.565	11.595	0.154	0.062	Pass	11.551	11.576	0.128	0.062	Pass
Channel 5											
-60 %	+/-0.5%	-11.563	-11.596	-0.165	0.039	Pass	-11.550	-11.576	-0.133	0.041	Pass
-30 %	+/-0.5%	-5.781	-5.796	-0.077	0.028	Pass	-5.774	-5.790	-0.078	0.029	Pass
30 %	+/-0.5%	5.782	5.791	0.046	0.039	Pass	5.775	5.783	0.041	0.039	Pass
60 %	+/-0.5%	11.565	11.596	0.162	0.053	Pass	11.551	11.581	0.152	0.053	Pass
Channel 6											
-60 %	+/-0.5%	-11.563	-11.597	-0.172	0.046	Pass	-11.550	-11.574	-0.123	0.048	Pass
-30 %	+/-0.5%	-5.781	-5.800	-0.099	0.035	Pass	-5.774	-5.791	-0.083	0.035	Pass
30 %	+/-0.5%	5.782	5.789	0.037	0.026	Pass	5.775	5.782	0.034	0.026	Pass
60 %	+/-0.5%	11.565	11.597	0.165	0.051	Pass	11.551	11.580	0.148	0.052	Pass
Channel 7											
-60 %	+/-0.5%	-11.563	-11.587	-0.124	0.041	Pass	-11.550	-11.566	-0.079	0.043	Pass
-30 %	+/-0.5%	-5.781	-5.793	-0.061	0.025	Pass	-5.774	-5.785	-0.055	0.025	Pass
30 %	+/-0.5%	5.782	5.786	0.024	0.025	Pass	5.775	5.779	0.021	0.024	Pass
60 %	+/-0.5%	11.565	11.587	0.114	0.048	Pass	11.551	11.571	0.101	0.049	Pass
Channel 8											
-60 %	+/-0.5%	-11.563	-11.584	-0.108	0.046	Pass	-11.550	-11.563	-0.066	0.048	Pass
-30 %	+/-0.5%	-5.781	-5.791	-0.052	0.028	Pass	-5.774	-5.784	-0.047	0.030	Pass
30 %	+/-0.5%	5.782	5.783	0.009	0.021	Pass	5.775	5.777	0.010	0.021	Pass
60 %	+/-0.5%	11.565	11.589	0.123	0.035	Pass	11.551	11.571	0.099	0.035	Pass
Channel 9											
-60 %	+/-0.5%	-11.562	-11.580	-0.092	0.073	Pass	-11.549	-11.561	-0.065	0.078	Pass
-30 %	+/-0.5%	-5.780	-5.793	-0.067	0.050	Pass	-5.774	-5.781	-0.038	0.050	Pass
30 %	+/-0.5%	5.781	5.791	0.051	0.052	Pass	5.774	5.777	0.013	0.050	Pass
60 %	+/-0.5%	11.563	11.589	0.133	0.059	Pass	11.550	11.561	0.056	0.060	Pass
Channel 10											
-60 %	+/-0.5%	-11.562	-11.579	-0.089	0.056	Pass	-11.549	-11.559	-0.054	0.057	Pass
-30 %	+/-0.5%	-5.780	-5.792	-0.062	0.041	Pass	-5.774	-5.778	-0.022	0.042	Pass
30 %	+/-0.5%	5.781	5.788	0.034	0.045	Pass	5.774	5.775	0.003	0.045	Pass
60 %	+/-0.5%	11.563	11.588	0.127	0.060	Pass	11.550	11.562	0.060	0.060	Pass
Channel 11											
-60 %	+/-0.5%	-11.562	-11.580	-0.092	0.056	Pass	-11.549	-11.563	-0.072	0.058	Pass
-30 %	+/-0.5%	-5.780	-5.793	-0.067	0.042	Pass	-5.774	-5.781	-0.037	0.042	Pass
30 %	+/-0.5%	5.781	5.788	0.038	0.039	Pass	5.774	5.777	0.015	0.039	Pass
60 %	+/-0.5%	11.563	11.587	0.124	0.054	Pass	11.550	11.565	0.079	0.055	Pass
Channel 12											
-60 %	+/-0.5%	-11.562	-11.570	-0.042	0.055	Pass	-11.549	-11.555	-0.032	0.056	Pass
-30 %	+/-0.5%	-5.780	-5.789	-0.045	0.035	Pass	-5.774	-5.776	-0.014	0.037	Pass
30 %	+/-0.5%	5.781	5.787	0.029	0.017	Pass	5.774	5.776	0.007	0.017	Pass
60 %	+/-0.5%	11.563	11.580	0.087	0.035	Pass	11.550	11.559	0.044	0.035	Pass
Channel 13											
-60 %	+/-0.5%	-11.562	-11.582	-0.101	0.054	Pass	-11.549	-11.563	-0.073	0.056	Pass
-30 %	+/-0.5%	-5.780	-5.793	-0.067	0.043	Pass	-5.774	-5.781	-0.037	0.044	Pass
30 %	+/-0.5%	5.781	5.788	0.035	0.040	Pass	5.774	5.777	0.012	0.039	Pass
60 %	+/-0.5%	11.563	11.590	0.137	0.058	Pass	11.550	11.566	0.083	0.058	Pass

Test Description
Gain Response
Gain of 128: 19.3125mV

		As Received					As Returned				
	Limit	Std (mV)	DAS (mV)	Deviation (%)	Unc. (mV)	Pass/ Fail	Std (mV)	DAS (mV)	Deviation (%)	Unc. (mV)	Pass/ Fail
Channel 14											
-60 %	+/-0.5%	-11.562	-11.577	-0.075	0.050	Pass	-11.549	-11.561	-0.061	0.052	Pass
-30 %	+/-0.5%	-5.780	-5.792	-0.059	0.033	Pass	-5.774	-5.780	-0.031	0.034	Pass
30 %	+/-0.5%	5.781	5.788	0.036	0.026	Pass	5.774	5.777	0.012	0.027	Pass
60 %	+/-0.5%	11.563	11.587	0.126	0.051	Pass	11.550	11.565	0.077	0.051	Pass
Channel 15											
-60 %	+/-0.5%	-11.562	-11.581	-0.100	0.055	Pass	-11.549	-11.568	-0.097	0.057	Pass
-30 %	+/-0.5%	-5.780	-5.793	-0.065	0.039	Pass	-5.774	-5.782	-0.045	0.041	Pass
30 %	+/-0.5%	5.781	5.791	0.051	0.022	Pass	5.774	5.781	0.032	0.022	Pass
60 %	+/-0.5%	11.563	11.590	0.138	0.038	Pass	11.550	11.570	0.103	0.038	Pass
Channel 16											
-60 %	+/-0.5%	-11.562	-11.569	-0.035	0.059	Pass	-11.549	-11.556	-0.038	0.060	Pass
-30 %	+/-0.5%	-5.780	-5.788	-0.038	0.042	Pass	-5.774	-5.777	-0.017	0.043	Pass
30 %	+/-0.5%	5.781	5.783	0.010	0.027	Pass	5.774	5.774	-0.002	0.027	Pass
60 %	+/-0.5%	11.563	11.577	0.073	0.050	Pass	11.550	11.559	0.044	0.050	Pass
Channel 17											
-60 %	+/-0.5%	-11.561	-11.583	-0.110	0.046	Pass	-11.549	-11.577	-0.143	0.052	Pass
-30 %	+/-0.5%	-5.780	-5.789	-0.047	0.037	Pass	-5.774	-5.785	-0.060	0.039	Pass
30 %	+/-0.5%	5.781	5.781	0.005	0.045	Pass	5.774	5.776	0.010	0.045	Pass
60 %	+/-0.5%	11.562	11.580	0.089	0.064	Pass	11.550	11.573	0.119	0.065	Pass
Channel 18											
-60 %	+/-0.5%	-11.561	-11.580	-0.094	0.045	Pass	-11.549	-11.577	-0.146	0.046	Pass
-30 %	+/-0.5%	-5.780	-5.790	-0.053	0.032	Pass	-5.774	-5.786	-0.065	0.034	Pass
30 %	+/-0.5%	5.781	5.786	0.026	0.037	Pass	5.774	5.781	0.037	0.037	Pass
60 %	+/-0.5%	11.562	11.581	0.095	0.056	Pass	11.550	11.577	0.141	0.056	Pass
Channel 19											
-60 %	+/-0.5%	-11.561	-11.579	-0.092	0.053	Pass	-11.549	-11.575	-0.132	0.053	Pass
-30 %	+/-0.5%	-5.780	-5.788	-0.040	0.032	Pass	-5.774	-5.784	-0.054	0.032	Pass
30 %	+/-0.5%	5.781	5.786	0.028	0.031	Pass	5.774	5.781	0.034	0.032	Pass
60 %	+/-0.5%	11.562	11.579	0.086	0.046	Pass	11.550	11.570	0.105	0.046	Pass
Channel 20											
-60 %	+/-0.5%	-11.561	-11.579	-0.091	0.041	Pass	-11.549	-11.574	-0.132	0.042	Pass
-30 %	+/-0.5%	-5.780	-5.789	-0.045	0.023	Pass	-5.774	-5.786	-0.062	0.025	Pass
30 %	+/-0.5%	5.781	5.786	0.027	0.024	Pass	5.774	5.781	0.037	0.024	Pass
60 %	+/-0.5%	11.562	11.583	0.107	0.050	Pass	11.550	11.578	0.145	0.051	Pass
Channel 21											
-60 %	+/-0.5%	-11.561	-11.582	-0.108	0.050	Pass	-11.549	-11.579	-0.153	0.050	Pass
-30 %	+/-0.5%	-5.780	-5.790	-0.051	0.030	Pass	-5.774	-5.788	-0.073	0.030	Pass
30 %	+/-0.5%	5.781	5.786	0.030	0.025	Pass	5.774	5.782	0.041	0.025	Pass
60 %	+/-0.5%	11.562	11.585	0.118	0.045	Pass	11.550	11.580	0.153	0.045	Pass
Channel 22											
-60 %	+/-0.5%	-11.561	-11.586	-0.129	0.019	Pass	-11.549	-11.581	-0.168	0.019	Pass
-30 %	+/-0.5%	-5.780	-5.792	-0.061	0.040	Pass	-5.774	-5.790	-0.084	0.040	Pass
30 %	+/-0.5%	5.781	5.789	0.044	0.038	Pass	5.774	5.786	0.058	0.038	Pass
60 %	+/-0.5%	11.562	11.590	0.142	0.058	Pass	11.550	11.585	0.180	0.058	Pass
Channel 23											
-60 %	+/-0.5%	-11.561	-11.574	-0.063	0.072	Pass	-11.549	-11.568	-0.097	0.072	Pass
-30 %	+/-0.5%	-5.780	-5.787	-0.035	0.060	Pass	-5.774	-5.783	-0.048	0.060	Pass
30 %	+/-0.5%	5.781	5.784	0.017	0.055	Pass	5.774	5.778	0.020	0.055	Pass
60 %	+/-0.5%	11.562	11.575	0.064	0.066	Pass	11.550	11.565	0.076	0.066	Pass
Channel 24											
-60 %	+/-0.5%	-11.561	-11.566	-0.027	0.027	Pass	-11.549	-11.562	-0.066	0.026	Pass
-30 %	+/-0.5%	-5.780	-5.782	-0.009	0.032	Pass	-5.774	-5.779	-0.026	0.033	Pass
30 %	+/-0.5%	5.781	5.780	-0.003	0.020	Pass	5.774	5.776	0.007	0.020	Pass
60 %	+/-0.5%	11.562	11.570	0.040	0.031	Pass	11.550	11.566	0.082	0.031	Pass
Channel 25											
-60 %	+/-0.5%	-11.550	-11.561	-0.057	0.029	Pass	-11.549	-11.573	-0.125	0.023	Pass
-30 %	+/-0.5%	-5.774	-5.784	-0.050	0.046	Pass	-5.773	-5.788	-0.076	0.045	Pass
30 %	+/-0.5%	5.775	5.775	0.001	0.039	Pass	5.774	5.781	0.035	0.039	Pass
60 %	+/-0.5%	11.551	11.566	0.077	0.057	Pass	11.550	11.577	0.138	0.056	Pass

Test Description
Gain Response
Gain of 128: 19.3125mV

	Limit	As Received Std (mV)	DAS (mV)	Deviation (%)	Unc. (mV)	Pass/ Fail	As Returned Std (mV)	DAS (mV)	Deviation (%)	Unc. (mV)	Pass/ Fail
Channel 26											
-60 %	+/-0.5%	-11.550	-11.558	-0.040	0.056	Pass	-11.549	-11.556	-0.038	0.057	Pass
-30 %	+/-0.5%	-5.774	-5.781	-0.035	0.036	Pass	-5.773	-5.778	-0.024	0.036	Pass
30 %	+/-0.5%	5.775	5.776	0.005	0.022	Pass	5.774	5.776	0.010	0.023	Pass
60 %	+/-0.5%	11.551	11.569	0.094	0.037	Pass	11.550	11.565	0.079	0.038	Pass
Channel 27											
-60 %	+/-0.5%	-11.550	-11.561	-0.058	0.049	Pass	-11.549	-11.558	-0.047	0.049	Pass
-30 %	+/-0.5%	-5.774	-5.782	-0.039	0.028	Pass	-5.773	-5.780	-0.036	0.028	Pass
30 %	+/-0.5%	5.775	5.778	0.018	0.024	Pass	5.774	5.777	0.013	0.025	Pass
60 %	+/-0.5%	11.551	11.572	0.108	0.044	Pass	11.550	11.558	0.041	0.045	Pass
Channel 28											
-60 %	+/-0.5%	-11.550	-11.568	-0.094	0.047	Pass	-11.549	-11.566	-0.091	0.047	Pass
-30 %	+/-0.5%	-5.774	-5.788	-0.070	0.032	Pass	-5.773	-5.787	-0.067	0.032	Pass
30 %	+/-0.5%	5.775	5.774	-0.007	0.023	Pass	5.774	5.773	-0.005	0.023	Pass
60 %	+/-0.5%	11.551	11.569	0.095	0.037	Pass	11.550	11.567	0.088	0.036	Pass
Channel 29											
-60 %	+/-0.5%	-11.550	-11.558	-0.042	0.043	Pass	-11.549	-11.559	-0.051	0.042	Pass
-30 %	+/-0.5%	-5.774	-5.781	-0.033	0.031	Pass	-5.773	-5.781	-0.039	0.031	Pass
30 %	+/-0.5%	5.775	5.777	0.012	0.041	Pass	5.774	5.779	0.023	0.041	Pass
60 %	+/-0.5%	11.551	11.568	0.090	0.061	Pass	11.550	11.565	0.079	0.061	Pass
Channel 30											
-60 %	+/-0.5%	-11.550	-11.556	-0.031	0.053	Pass	-11.549	-11.556	-0.039	0.054	Pass
-30 %	+/-0.5%	-5.774	-5.780	-0.029	0.035	Pass	-5.773	-5.779	-0.030	0.035	Pass
30 %	+/-0.5%	5.775	5.778	0.014	0.024	Pass	5.774	5.777	0.013	0.024	Pass
60 %	+/-0.5%	11.551	11.567	0.085	0.048	Pass	11.550	11.562	0.064	0.048	Pass
Channel 31											
-60 %	+/-0.5%	-11.550	-11.562	-0.063	0.049	Pass	-11.549	-11.564	-0.080	0.049	Pass
-30 %	+/-0.5%	-5.774	-5.783	-0.045	0.037	Pass	-5.773	-5.783	-0.049	0.038	Pass
30 %	+/-0.5%	5.775	5.780	0.027	0.044	Pass	5.774	5.781	0.033	0.044	Pass
60 %	+/-0.5%	11.551	11.577	0.135	0.061	Pass	11.550	11.577	0.141	0.061	Pass
Channel 32											
-60 %	+/-0.5%	-11.550	-11.560	-0.054	0.043	Pass	-11.549	-11.558	-0.048	0.043	Pass
-30 %	+/-0.5%	-5.774	-5.783	-0.042	0.030	Pass	-5.773	-5.781	-0.038	0.030	Pass
30 %	+/-0.5%	5.775	5.777	0.012	0.038	Pass	5.774	5.775	0.006	0.039	Pass
60 %	+/-0.5%	11.551	11.572	0.108	0.056	Pass	11.550	11.565	0.079	0.055	Pass

Gain Response
Gain of 1024: 2.4414mV

Channel 1											
-60 %	+/-0.5%	-1.445	-1.448	-0.136	0.014	Pass	-1.443	-1.446	-0.113	0.014	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.058	0.011	Pass	-0.721	-0.722	-0.047	0.011	Pass
30 %	+/-0.5%	0.721	0.722	0.023	0.013	Pass	0.720	0.720	-0.016	0.013	Pass
60 %	+/-0.5%	1.444	1.446	0.076	0.012	Pass	1.442	1.444	0.097	0.013	Pass
Channel 2											
-60 %	+/-0.5%	-1.445	-1.449	-0.137	0.013	Pass	-1.443	-1.446	-0.118	0.013	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.043	0.011	Pass	-0.721	-0.722	-0.037	0.011	Pass
30 %	+/-0.5%	0.721	0.722	0.034	0.010	Pass	0.720	0.720	-0.004	0.010	Pass
60 %	+/-0.5%	1.444	1.446	0.108	0.011	Pass	1.442	1.445	0.123	0.011	Pass
Channel 3											
-60 %	+/-0.5%	-1.445	-1.448	-0.136	0.012	Pass	-1.443	-1.446	-0.115	0.013	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.048	0.011	Pass	-0.721	-0.722	-0.045	0.012	Pass
30 %	+/-0.5%	0.721	0.722	0.038	0.014	Pass	0.720	0.720	-0.011	0.014	Pass
60 %	+/-0.5%	1.444	1.446	0.071	0.015	Pass	1.442	1.444	0.097	0.015	Pass
Channel 4											
-60 %	+/-0.5%	-1.445	-1.448	-0.134	0.010	Pass	-1.443	-1.447	-0.141	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.042	0.008	Pass	-0.721	-0.722	-0.055	0.008	Pass
30 %	+/-0.5%	0.721	0.722	0.029	0.009	Pass	0.720	0.720	-0.007	0.009	Pass
60 %	+/-0.5%	1.444	1.446	0.081	0.011	Pass	1.442	1.445	0.125	0.011	Pass

Test Description
Gain Response
Gain of 1024: 2.4414mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 5											
-60 %	+/-0.5%	-1.445	-1.449	-0.163	0.010	Pass	-1.443	-1.447	-0.142	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.058	0.009	Pass	-0.721	-0.722	-0.052	0.009	Pass
30 %	+/-0.5%	0.721	0.723	0.061	0.011	Pass	0.720	0.720	0.005	0.011	Pass
60 %	+/-0.5%	1.444	1.447	0.114	0.012	Pass	1.442	1.445	0.123	0.012	Pass
Channel 6											
-60 %	+/-0.5%	-1.445	-1.449	-0.169	0.010	Pass	-1.443	-1.447	-0.146	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.062	0.008	Pass	-0.721	-0.722	-0.062	0.008	Pass
30 %	+/-0.5%	0.721	0.722	0.047	0.010	Pass	0.720	0.720	-0.013	0.010	Pass
60 %	+/-0.5%	1.444	1.447	0.116	0.012	Pass	1.442	1.445	0.127	0.012	Pass
Channel 7											
-60 %	+/-0.5%	-1.445	-1.448	-0.110	0.012	Pass	-1.443	-1.445	-0.082	0.012	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.034	0.010	Pass	-0.721	-0.722	-0.030	0.010	Pass
30 %	+/-0.5%	0.721	0.722	0.019	0.010	Pass	0.720	0.720	-0.020	0.010	Pass
60 %	+/-0.5%	1.444	1.446	0.072	0.011	Pass	1.442	1.444	0.075	0.011	Pass
Channel 8											
-60 %	+/-0.5%	-1.445	-1.448	-0.107	0.010	Pass	-1.443	-1.445	-0.073	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.039	0.009	Pass	-0.721	-0.721	-0.024	0.009	Pass
30 %	+/-0.5%	0.721	0.721	0.014	0.009	Pass	0.720	0.720	-0.026	0.009	Pass
60 %	+/-0.5%	1.444	1.446	0.075	0.010	Pass	1.442	1.444	0.073	0.010	Pass
Channel 9											
-60 %	+/-0.5%	-1.445	-1.447	-0.083	0.012	Pass	-1.443	-1.446	-0.111	0.012	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.058	0.010	Pass	-0.721	-0.722	-0.055	0.010	Pass
30 %	+/-0.5%	0.721	0.722	0.022	0.012	Pass	0.720	0.720	-0.007	0.012	Pass
60 %	+/-0.5%	1.444	1.446	0.117	0.013	Pass	1.442	1.446	0.152	0.013	Pass
Channel 10											
-60 %	+/-0.5%	-1.445	-1.447	-0.096	0.013	Pass	-1.443	-1.445	-0.080	0.013	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.051	0.010	Pass	-0.721	-0.721	-0.031	0.011	Pass
30 %	+/-0.5%	0.721	0.721	0.016	0.011	Pass	0.720	0.720	-0.024	0.011	Pass
60 %	+/-0.5%	1.444	1.446	0.108	0.012	Pass	1.442	1.445	0.108	0.012	Pass
Channel 11											
-60 %	+/-0.5%	-1.445	-1.447	-0.081	0.010	Pass	-1.443	-1.445	-0.082	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.051	0.009	Pass	-0.721	-0.722	-0.038	0.009	Pass
30 %	+/-0.5%	0.721	0.722	0.022	0.010	Pass	0.720	0.720	-0.011	0.010	Pass
60 %	+/-0.5%	1.444	1.446	0.099	0.012	Pass	1.442	1.445	0.107	0.012	Pass
Channel 12											
-60 %	+/-0.5%	-1.445	-1.446	-0.046	0.011	Pass	-1.443	-1.445	-0.047	0.011	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.038	0.008	Pass	-0.721	-0.722	-0.039	0.008	Pass
30 %	+/-0.5%	0.721	0.721	0.008	0.009	Pass	0.720	0.720	-0.023	0.009	Pass
60 %	+/-0.5%	1.444	1.445	0.057	0.011	Pass	1.442	1.444	0.075	0.012	Pass
Channel 13											
-60 %	+/-0.5%	-1.445	-1.447	-0.091	0.012	Pass	-1.443	-1.445	-0.087	0.012	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.056	0.010	Pass	-0.721	-0.721	-0.030	0.010	Pass
30 %	+/-0.5%	0.721	0.721	0.019	0.013	Pass	0.720	0.720	-0.022	0.013	Pass
60 %	+/-0.5%	1.444	1.446	0.111	0.014	Pass	1.442	1.445	0.140	0.014	Pass
Channel 14											
-60 %	+/-0.5%	-1.445	-1.447	-0.088	0.011	Pass	-1.443	-1.445	-0.084	0.011	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.058	0.009	Pass	-0.721	-0.722	-0.045	0.009	Pass
30 %	+/-0.5%	0.721	0.722	0.021	0.010	Pass	0.720	0.720	-0.017	0.010	Pass
60 %	+/-0.5%	1.444	1.446	0.112	0.011	Pass	1.442	1.445	0.122	0.011	Pass
Channel 15											
-60 %	+/-0.5%	-1.445	-1.447	-0.096	0.012	Pass	-1.443	-1.446	-0.115	0.011	Pass
-30 %	+/-0.5%	-0.722	-0.723	-0.060	0.010	Pass	-0.721	-0.722	-0.047	0.010	Pass
30 %	+/-0.5%	0.721	0.722	0.028	0.012	Pass	0.720	0.720	-0.002	0.013	Pass
60 %	+/-0.5%	1.444	1.447	0.132	0.012	Pass	1.442	1.445	0.144	0.013	Pass
Channel 16											
-60 %	+/-0.5%	-1.445	-1.446	-0.049	0.012	Pass	-1.443	-1.445	-0.062	0.012	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.035	0.009	Pass	-0.721	-0.721	-0.028	0.009	Pass
30 %	+/-0.5%	0.721	0.721	-0.003	0.009	Pass	0.720	0.720	-0.027	0.009	Pass
60 %	+/-0.5%	1.444	1.445	0.073	0.012	Pass	1.442	1.444	0.091	0.012	Pass

Test Description
Gain Response
Gain of 1024: 2.4414mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 17											
-60 %	+/-0.5%	-1.445	-1.447	-0.088	0.010	Pass	-1.443	-1.446	-0.104	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.021	0.010	Pass	-0.721	-0.722	-0.047	0.010	Pass
30 %	+/-0.5%	0.721	0.720	-0.038	0.010	Pass	0.720	0.721	0.027	0.011	Pass
60 %	+/-0.5%	1.443	1.445	0.047	0.007	Pass	1.442	1.444	0.098	0.008	Pass
Channel 18											
-60 %	+/-0.5%	-1.445	-1.447	-0.071	0.008	Pass	-1.443	-1.446	-0.099	0.008	Pass
-30 %	+/-0.5%	-0.722	-0.722	0.003	0.007	Pass	-0.721	-0.722	-0.047	0.007	Pass
30 %	+/-0.5%	0.721	0.720	-0.026	0.009	Pass	0.720	0.722	0.061	0.009	Pass
60 %	+/-0.5%	1.443	1.444	0.026	0.009	Pass	1.442	1.444	0.092	0.009	Pass
Channel 19											
-60 %	+/-0.5%	-1.445	-1.447	-0.074	0.010	Pass	-1.443	-1.445	-0.087	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.005	0.008	Pass	-0.721	-0.722	-0.038	0.008	Pass
30 %	+/-0.5%	0.721	0.720	-0.020	0.011	Pass	0.720	0.721	0.040	0.011	Pass
60 %	+/-0.5%	1.443	1.445	0.048	0.012	Pass	1.442	1.444	0.096	0.012	Pass
Channel 20											
-60 %	+/-0.5%	-1.445	-1.447	-0.074	0.005	Pass	-1.443	-1.445	-0.083	0.006	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.003	0.004	Pass	-0.721	-0.722	-0.061	0.004	Pass
30 %	+/-0.5%	0.721	0.720	-0.024	0.004	Pass	0.720	0.722	0.056	0.004	Pass
60 %	+/-0.5%	1.443	1.445	0.053	0.006	Pass	1.442	1.445	0.111	0.006	Pass
Channel 21											
-60 %	+/-0.5%	-1.445	-1.447	-0.094	0.009	Pass	-1.443	-1.446	-0.105	0.009	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.011	0.008	Pass	-0.721	-0.722	-0.052	0.008	Pass
30 %	+/-0.5%	0.721	0.721	-0.018	0.008	Pass	0.720	0.722	0.054	0.008	Pass
60 %	+/-0.5%	1.443	1.445	0.075	0.007	Pass	1.442	1.445	0.124	0.007	Pass
Channel 22											
-60 %	+/-0.5%	-1.445	-1.448	-0.120	0.010	Pass	-1.443	-1.447	-0.129	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.722	-0.016	0.008	Pass	-0.721	-0.722	-0.069	0.008	Pass
30 %	+/-0.5%	0.721	0.721	-0.006	0.009	Pass	0.720	0.722	0.077	0.009	Pass
60 %	+/-0.5%	1.443	1.446	0.110	0.011	Pass	1.442	1.446	0.160	0.011	Pass
Channel 23											
-60 %	+/-0.5%	-1.445	-1.446	-0.052	0.012	Pass	-1.443	-1.445	-0.050	0.012	Pass
-30 %	+/-0.5%	-0.722	-0.721	0.018	0.012	Pass	-0.721	-0.722	-0.042	0.012	Pass
30 %	+/-0.5%	0.721	0.720	-0.044	0.009	Pass	0.720	0.721	0.041	0.009	Pass
60 %	+/-0.5%	1.443	1.444	0.014	0.013	Pass	1.442	1.444	0.074	0.013	Pass
Channel 24											
-60 %	+/-0.5%	-1.445	-1.445	-0.008	0.010	Pass	-1.443	-1.444	-0.023	0.010	Pass
-30 %	+/-0.5%	-0.722	-0.721	0.031	0.009	Pass	-0.721	-0.721	-0.008	0.009	Pass
30 %	+/-0.5%	0.721	0.720	-0.047	0.009	Pass	0.720	0.721	0.022	0.009	Pass
60 %	+/-0.5%	1.443	1.443	-0.009	0.009	Pass	1.442	1.443	0.044	0.009	Pass
Channel 25											
-60 %	+/-0.5%	-1.443	-1.445	-0.050	0.012	Pass	-1.444	-1.444	-0.020	0.011	Pass
-30 %	+/-0.5%	-0.721	-0.722	-0.036	0.010	Pass	-0.721	-0.722	-0.043	0.010	Pass
30 %	+/-0.5%	0.720	0.720	-0.024	0.011	Pass	0.720	0.720	-0.019	0.012	Pass
60 %	+/-0.5%	1.442	1.443	0.030	0.011	Pass	1.442	1.443	0.043	0.011	Pass
Channel 26											
-60 %	+/-0.5%	-1.443	-1.444	-0.025	0.010	Pass	-1.444	-1.444	-0.028	0.010	Pass
-30 %	+/-0.5%	-0.721	-0.721	-0.011	0.008	Pass	-0.721	-0.721	-0.022	0.008	Pass
30 %	+/-0.5%	0.720	0.720	-0.017	0.009	Pass	0.720	0.720	-0.008	0.009	Pass
60 %	+/-0.5%	1.442	1.443	0.042	0.010	Pass	1.442	1.444	0.064	0.009	Pass
Channel 27											
-60 %	+/-0.5%	-1.443	-1.444	-0.026	0.010	Pass	-1.444	-1.444	-0.032	0.010	Pass
-30 %	+/-0.5%	-0.721	-0.721	-0.011	0.008	Pass	-0.721	-0.721	-0.024	0.008	Pass
30 %	+/-0.5%	0.720	0.720	-0.014	0.008	Pass	0.720	0.720	0.006	0.008	Pass
60 %	+/-0.5%	1.442	1.442	0.012	0.009	Pass	1.442	1.444	0.080	0.009	Pass
Channel 28											
-60 %	+/-0.5%	-1.443	-1.445	-0.073	0.010	Pass	-1.444	-1.445	-0.074	0.009	Pass
-30 %	+/-0.5%	-0.721	-0.722	-0.045	0.008	Pass	-0.721	-0.722	-0.056	0.008	Pass
30 %	+/-0.5%	0.720	0.720	-0.032	0.009	Pass	0.720	0.720	-0.021	0.009	Pass
60 %	+/-0.5%	1.442	1.443	0.040	0.011	Pass	1.442	1.444	0.082	0.011	Pass

Test Description

Gain Response

Gain of 1024: 2.4414mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/Fail
Channel 29											
-60 %	+/-0.5%	-1.443	-1.444	-0.018	0.009	Pass	-1.444	-1.445	-0.039	0.009	Pass
-30 %	+/-0.5%	-0.721	-0.721	-0.009	0.007	Pass	-0.721	-0.721	-0.026	0.007	Pass
30 %	+/-0.5%	0.720	0.720	-0.019	0.009	Pass	0.720	0.720	0.002	0.009	Pass
60 %	+/-0.5%	1.442	1.443	0.029	0.010	Pass	1.442	1.443	0.059	0.010	Pass
Channel 30											
-60 %	+/-0.5%	-1.443	-1.444	-0.032	0.010	Pass	-1.444	-1.444	-0.030	0.010	Pass
-30 %	+/-0.5%	-0.721	-0.721	-0.010	0.009	Pass	-0.721	-0.721	-0.025	0.009	Pass
30 %	+/-0.5%	0.720	0.720	-0.024	0.009	Pass	0.720	0.720	-0.005	0.009	Pass
60 %	+/-0.5%	1.442	1.443	0.027	0.009	Pass	1.442	1.444	0.066	0.009	Pass
Channel 31											
-60 %	+/-0.5%	-1.443	-1.445	-0.048	0.009	Pass	-1.444	-1.444	-0.032	0.009	Pass
-30 %	+/-0.5%	-0.721	-0.721	-0.023	0.008	Pass	-0.721	-0.721	-0.029	0.008	Pass
30 %	+/-0.5%	0.720	0.720	-0.014	0.009	Pass	0.720	0.720	0.005	0.009	Pass
60 %	+/-0.5%	1.442	1.444	0.077	0.010	Pass	1.442	1.445	0.105	0.010	Pass
Channel 32											
-60 %	+/-0.5%	-1.443	-1.445	-0.050	0.009	Pass	-1.444	-1.445	-0.046	0.009	Pass
-30 %	+/-0.5%	-0.721	-0.721	-0.016	0.011	Pass	-0.721	-0.721	-0.027	0.011	Pass
30 %	+/-0.5%	0.720	0.720	-0.021	0.012	Pass	0.720	0.720	-0.019	0.012	Pass
60 %	+/-0.5%	1.442	1.443	0.046	0.012	Pass	1.442	1.444	0.075	0.012	Pass

Gain Response

Gain of 2048: 1.2207mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/Fail
Channel 1											
-60 %	+/-0.5%	-0.722	-0.723	-0.133	0.005	Pass	-0.721	-0.722	-0.054	0.005	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.014	0.006	Pass	-0.360	-0.362	-0.108	0.006	Pass
30 %	+/-0.5%	0.360	0.360	0.030	0.005	Pass	0.360	0.360	0.058	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.086	0.007	Pass	0.720	0.722	0.121	0.007	Pass
Channel 2											
-60 %	+/-0.5%	-0.722	-0.723	-0.128	0.007	Pass	-0.721	-0.722	-0.065	0.007	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.011	0.008	Pass	-0.360	-0.361	-0.087	0.008	Pass
30 %	+/-0.5%	0.360	0.360	0.041	0.005	Pass	0.360	0.360	0.059	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.102	0.006	Pass	0.720	0.722	0.141	0.006	Pass
Channel 3											
-60 %	+/-0.5%	-0.722	-0.723	-0.126	0.007	Pass	-0.721	-0.722	-0.071	0.007	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.017	0.008	Pass	-0.360	-0.362	-0.115	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.043	0.006	Pass	0.360	0.360	0.062	0.006	Pass
60 %	+/-0.5%	0.721	0.722	0.079	0.007	Pass	0.720	0.722	0.129	0.007	Pass
Channel 4											
-60 %	+/-0.5%	-0.722	-0.723	-0.139	0.004	Pass	-0.721	-0.722	-0.084	0.004	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.016	0.007	Pass	-0.360	-0.362	-0.127	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.033	0.004	Pass	0.360	0.360	0.072	0.004	Pass
60 %	+/-0.5%	0.721	0.722	0.086	0.006	Pass	0.720	0.722	0.144	0.006	Pass
Channel 5											
-60 %	+/-0.5%	-0.722	-0.724	-0.154	0.006	Pass	-0.721	-0.722	-0.072	0.005	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.014	0.007	Pass	-0.360	-0.362	-0.108	0.007	Pass
30 %	+/-0.5%	0.360	0.361	0.052	0.005	Pass	0.360	0.361	0.080	0.005	Pass
60 %	+/-0.5%	0.721	0.723	0.116	0.006	Pass	0.720	0.722	0.148	0.006	Pass
Channel 6											
-60 %	+/-0.5%	-0.722	-0.724	-0.189	0.007	Pass	-0.721	-0.722	-0.080	0.007	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.019	0.008	Pass	-0.360	-0.362	-0.124	0.008	Pass
30 %	+/-0.5%	0.360	0.361	0.061	0.004	Pass	0.360	0.360	0.071	0.005	Pass
60 %	+/-0.5%	0.721	0.723	0.130	0.006	Pass	0.720	0.722	0.156	0.006	Pass
Channel 7											
-60 %	+/-0.5%	-0.722	-0.723	-0.107	0.005	Pass	-0.721	-0.721	-0.017	0.005	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.015	0.007	Pass	-0.360	-0.361	-0.083	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.038	0.005	Pass	0.360	0.360	0.043	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.081	0.007	Pass	0.720	0.721	0.081	0.007	Pass

Test Description
Gain Response
Gain of 2048: 1.2207mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
Channel 8											
-60 %	+/-0.5%	-0.722	-0.723	-0.105	0.006	Pass	-0.721	-0.721	-0.005	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.009	0.008	Pass	-0.360	-0.361	-0.080	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.023	0.005	Pass	0.360	0.360	0.040	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.074	0.007	Pass	0.720	0.722	0.103	0.007	Pass
Channel 9											
-60 %	+/-0.5%	-0.721	-0.723	-0.095	0.007	Pass	-0.721	-0.722	-0.075	0.007	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.059	0.009	Pass	-0.360	-0.362	-0.175	0.009	Pass
30 %	+/-0.5%	0.360	0.360	0.019	0.006	Pass	0.360	0.359	-0.044	0.006	Pass
60 %	+/-0.5%	0.721	0.722	0.065	0.008	Pass	0.720	0.721	0.057	0.008	Pass
Channel 10											
-60 %	+/-0.5%	-0.721	-0.723	-0.100	0.006	Pass	-0.721	-0.721	-0.056	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.019	0.008	Pass	-0.360	-0.362	-0.131	0.008	Pass
30 %	+/-0.5%	0.360	0.360	0.014	0.006	Pass	0.360	0.359	-0.049	0.006	Pass
60 %	+/-0.5%	0.721	0.722	0.082	0.007	Pass	0.720	0.721	0.045	0.007	Pass
Channel 11											
-60 %	+/-0.5%	-0.721	-0.723	-0.101	0.005	Pass	-0.721	-0.722	-0.072	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.011	0.008	Pass	-0.360	-0.362	-0.144	0.008	Pass
30 %	+/-0.5%	0.360	0.360	0.009	0.005	Pass	0.360	0.359	-0.034	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.083	0.006	Pass	0.720	0.721	0.048	0.006	Pass
Channel 12											
-60 %	+/-0.5%	-0.721	-0.722	-0.081	0.005	Pass	-0.721	-0.721	-0.013	0.004	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.040	0.007	Pass	-0.360	-0.362	-0.112	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.026	0.005	Pass	0.360	0.359	-0.051	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.063	0.007	Pass	0.720	0.721	0.024	0.007	Pass
Channel 13											
-60 %	+/-0.5%	-0.721	-0.723	-0.087	0.006	Pass	-0.721	-0.722	-0.076	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.028	0.007	Pass	-0.360	-0.362	-0.143	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.006	0.005	Pass	0.360	0.359	-0.041	0.006	Pass
60 %	+/-0.5%	0.721	0.722	0.080	0.007	Pass	0.720	0.721	0.058	0.007	Pass
Channel 14											
-60 %	+/-0.5%	-0.721	-0.722	-0.081	0.005	Pass	-0.721	-0.721	-0.063	0.005	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.031	0.007	Pass	-0.360	-0.362	-0.159	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.010	0.005	Pass	0.360	0.359	-0.027	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.075	0.008	Pass	0.720	0.721	0.048	0.008	Pass
Channel 15											
-60 %	+/-0.5%	-0.721	-0.723	-0.101	0.006	Pass	-0.721	-0.722	-0.086	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.029	0.008	Pass	-0.360	-0.362	-0.160	0.008	Pass
30 %	+/-0.5%	0.360	0.360	0.015	0.006	Pass	0.360	0.359	-0.026	0.006	Pass
60 %	+/-0.5%	0.721	0.722	0.086	0.008	Pass	0.720	0.721	0.075	0.008	Pass
Channel 16											
-60 %	+/-0.5%	-0.721	-0.722	-0.061	0.006	Pass	-0.721	-0.721	-0.036	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.057	0.007	Pass	-0.360	-0.362	-0.135	0.007	Pass
30 %	+/-0.5%	0.360	0.360	-0.012	0.005	Pass	0.360	0.359	-0.057	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.022	0.006	Pass	0.720	0.720	0.016	0.006	Pass
Channel 17											
-60 %	+/-0.5%	-0.722	-0.722	-0.073	0.006	Pass	-0.721	-0.721	-0.036	0.007	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.042	0.010	Pass	-0.360	-0.362	-0.141	0.010	Pass
30 %	+/-0.5%	0.360	0.360	0.009	0.005	Pass	0.359	0.358	-0.103	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.057	0.007	Pass	0.720	0.721	0.068	0.007	Pass
Channel 18											
-60 %	+/-0.5%	-0.722	-0.722	-0.042	0.005	Pass	-0.721	-0.721	-0.038	0.005	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.018	0.007	Pass	-0.360	-0.362	-0.139	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.041	0.005	Pass	0.359	0.359	-0.072	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.041	0.006	Pass	0.720	0.721	0.064	0.006	Pass
Channel 19											
-60 %	+/-0.5%	-0.722	-0.722	-0.045	0.005	Pass	-0.721	-0.721	-0.019	0.005	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.017	0.007	Pass	-0.360	-0.362	-0.144	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.037	0.006	Pass	0.359	0.358	-0.084	0.006	Pass
60 %	+/-0.5%	0.721	0.722	0.053	0.008	Pass	0.720	0.721	0.076	0.008	Pass

Test Description
Gain Response
Gain of 2048: 1.2207mV

	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/Fail
Channel 20											
-60 %	+/-0.5%	-0.722	-0.722	-0.072	0.006	Pass	-0.721	-0.721	0.002	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.027	0.009	Pass	-0.360	-0.362	-0.151	0.009	Pass
30 %	+/-0.5%	0.360	0.360	0.050	0.004	Pass	0.359	0.359	-0.078	0.004	Pass
60 %	+/-0.5%	0.721	0.722	0.077	0.007	Pass	0.720	0.721	0.076	0.007	Pass
Channel 21											
-60 %	+/-0.5%	-0.722	-0.722	-0.059	0.004	Pass	-0.721	-0.721	-0.020	0.004	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.016	0.009	Pass	-0.360	-0.362	-0.166	0.009	Pass
30 %	+/-0.5%	0.360	0.361	0.055	0.004	Pass	0.359	0.358	-0.096	0.004	Pass
60 %	+/-0.5%	0.721	0.722	0.068	0.005	Pass	0.720	0.721	0.086	0.005	Pass
Channel 22											
-60 %	+/-0.5%	-0.722	-0.723	-0.094	0.006	Pass	-0.721	-0.721	-0.034	0.006	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.032	0.009	Pass	-0.360	-0.362	-0.164	0.009	Pass
30 %	+/-0.5%	0.360	0.361	0.071	0.005	Pass	0.359	0.358	-0.082	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.115	0.009	Pass	0.720	0.721	0.088	0.009	Pass
Channel 23											
-60 %	+/-0.5%	-0.722	-0.722	-0.043	0.007	Pass	-0.721	-0.720	0.034	0.007	Pass
-30 %	+/-0.5%	-0.361	-0.361	-0.011	0.008	Pass	-0.360	-0.362	-0.156	0.008	Pass
30 %	+/-0.5%	0.360	0.360	0.034	0.005	Pass	0.359	0.358	-0.114	0.005	Pass
60 %	+/-0.5%	0.721	0.722	0.045	0.006	Pass	0.720	0.721	0.045	0.006	Pass
Channel 24											
-60 %	+/-0.5%	-0.722	-0.721	0.015	0.005	Pass	-0.721	-0.720	0.051	0.005	Pass
-30 %	+/-0.5%	-0.361	-0.360	0.016	0.007	Pass	-0.360	-0.361	-0.092	0.007	Pass
30 %	+/-0.5%	0.360	0.360	0.013	0.171	Pass	0.359	0.358	-0.092	0.171	Pass
60 %	+/-0.5%	0.721	0.721	-0.004	0.007	Pass	0.720	0.720	0.024	0.007	Pass
Channel 25											
-60 %	+/-0.5%	-0.721	-0.721	-0.018	0.006	Pass	-0.721	-0.721	-0.041	0.006	Pass
-30 %	+/-0.5%	-0.360	-0.362	-0.112	0.011	Pass	-0.360	-0.361	-0.058	0.011	Pass
30 %	+/-0.5%	0.359	0.358	-0.108	0.006	Pass	0.360	0.359	-0.008	0.006	Pass
60 %	+/-0.5%	0.720	0.721	0.033	0.009	Pass	0.720	0.721	0.046	0.009	Pass
Channel 26											
-60 %	+/-0.5%	-0.721	-0.721	-0.011	0.005	Pass	-0.721	-0.721	-0.031	0.005	Pass
-30 %	+/-0.5%	-0.360	-0.361	-0.080	0.068	Pass	-0.360	-0.360	-0.018	0.068	Pass
30 %	+/-0.5%	0.359	0.358	-0.096	0.005	Pass	0.360	0.360	0.008	0.005	Pass
60 %	+/-0.5%	0.720	0.721	0.044	0.007	Pass	0.720	0.721	0.052	0.007	Pass
Channel 27											
-60 %	+/-0.5%	-0.721	-0.721	-0.010	0.004	Pass	-0.721	-0.721	-0.036	0.004	Pass
-30 %	+/-0.5%	-0.360	-0.362	-0.089	0.007	Pass	-0.360	-0.360	-0.016	0.007	Pass
30 %	+/-0.5%	0.359	0.358	-0.096	0.004	Pass	0.360	0.360	0.008	0.004	Pass
60 %	+/-0.5%	0.720	0.721	0.050	0.006	Pass	0.720	0.721	0.066	0.006	Pass
Channel 28											
-60 %	+/-0.5%	-0.721	-0.721	-0.043	0.005	Pass	-0.721	-0.722	-0.083	0.005	Pass
-30 %	+/-0.5%	-0.360	-0.362	-0.120	0.007	Pass	-0.360	-0.361	-0.053	0.007	Pass
30 %	+/-0.5%	0.359	0.358	-0.122	0.005	Pass	0.360	0.360	-0.001	0.005	Pass
60 %	+/-0.5%	0.720	0.721	0.064	0.007	Pass	0.720	0.721	0.079	0.007	Pass
Channel 29											
-60 %	+/-0.5%	-0.721	-0.721	-0.010	0.006	Pass	-0.721	-0.721	-0.020	0.006	Pass
-30 %	+/-0.5%	-0.360	-0.361	-0.086	0.007	Pass	-0.360	-0.361	-0.031	0.007	Pass
30 %	+/-0.5%	0.359	0.358	-0.099	0.003	Pass	0.360	0.360	-0.001	0.003	Pass
60 %	+/-0.5%	0.720	0.721	0.053	0.008	Pass	0.720	0.721	0.060	0.008	Pass
Channel 30											
-60 %	+/-0.5%	-0.721	-0.721	0.002	0.004	Pass	-0.721	-0.721	-0.003	0.004	Pass
-30 %	+/-0.5%	-0.360	-0.362	-0.094	0.007	Pass	-0.360	-0.360	-0.009	0.007	Pass
30 %	+/-0.5%	0.359	0.358	-0.127	0.004	Pass	0.360	0.360	0.005	0.004	Pass
60 %	+/-0.5%	0.720	0.721	0.035	0.006	Pass	0.720	0.721	0.037	0.006	Pass
Channel 31											
-60 %	+/-0.5%	-0.721	-0.721	-0.039	0.005	Pass	-0.721	-0.721	-0.047	0.004	Pass
-30 %	+/-0.5%	-0.360	-0.362	-0.102	0.009	Pass	-0.360	-0.361	-0.042	0.009	Pass
30 %	+/-0.5%	0.359	0.358	-0.083	0.003	Pass	0.360	0.360	0.019	0.003	Pass
60 %	+/-0.5%	0.720	0.722	0.106	0.005	Pass	0.720	0.721	0.102	0.005	Pass

Test Description
Gain Response
Gain of 2048: 1.2207mV

Channel 32	Limit	As Received Std (mV)	As Received DAS (mV)	As Received Deviation (%)	As Received Unc. (mV)	As Received Pass/ Fail	As Returned Std (mV)	As Returned DAS (mV)	As Returned Deviation (%)	As Returned Unc. (mV)	As Returned Pass/ Fail
-60 %	+/-0.5%	-0.721	-0.721	-0.021	0.008	Pass	-0.721	-0.721	-0.021	0.008	Pass
-30 %	+/-0.5%	-0.360	-0.362	-0.121	0.009	Pass	-0.360	-0.360	-0.019	0.009	Pass
30 %	+/-0.5%	0.359	0.358	-0.129	0.006	Pass	0.360	0.360	0.000	0.006	Pass
60 %	+/-0.5%	0.720	0.721	0.061	0.006	Pass	0.720	0.721	0.073	0.006	Pass

End of Report

HBM

HBM Inc.
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Fax: +1-508-485-7480
www.hbm.com

Dear HBM Customer.

We are pleased to return your instrument to you. It has been calibrated or repaired as you requested, cleaned and fully tested to assure proper operation.
Our repairs are covered under a 90-day limited warranty, which includes parts, labor and return freight. If our repair is in any way unsatisfactory, please feel free to contact us 1-800-578-4260.

1-GN441-2
SN: IDV1101016
As found: Out of spec
As left: in spec (adjusted)

HBM Service & Technical Support

HBM

HBM Inc
19 Bartlett Street
Marlborough, MA 01752
Phone 1-800-578-4260

Genesis Module
Certificate of Calibration

Certificate No: 2017062

Customer: Oregon Ballistic Laboratories, LLC
Salem OR 97302

Model: Universal 1M 512 **Serial No:** IDV1101016

Calibration Type:		**As Found:**	**As Left:**
☐ Original	☑ Standard	☐ In Tolerance	☐ Left As Found
☐ Full B/W	☐ Military/ANSI	☑ Out Tolerance	☑ In Tolerance (adjusted)

HBM Inc does hereby certify that the above instrument has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology. The calibration system supporting these standards and instruments meets the requirements of MIL-STD-45662A and ANSI/NCSL Z540-1-1994.

Standard	Serial Number	Trace Number
Fluke 5700A	7685601	42450
Keysight	MY45050433	3458AMY450504

Cal Conditions: 24.8 **Degrees Centigrade** 37.2 **% R/H**

Jim Grassey	03-Dec-14	03-Dec-15
Technician:	Cal Date:	Cal Due:

J. Grassey 3-Dec-14
Technician

HBM

GEN series Calibration and Verification Software : V2.92

Post Calibration Verification results (Mil Standard)
Verification Date : Dec 03 , 2014
SPEC-File version : 2.92

Mainframe Interface Info
Serialnumber : IDJ0000001
Type : GEN16t
SW version : 6.16.11067

Recorder Info
Physical Name : Recorder B
Serialnumber : IDV1101016
Type : GEN series 1MS/s
SW version : 6.16.11067
No. channels : 4
Channel Type : Diff Amplifier

Board Test **PASSED**

Used Equipment for testing board:
DC reference : Fluke 5700A
Voltmeter : HP3458A
LF generator : Fluke 5700A
HF generator : Fluke 5820A
Generator (HV) : Fluke 5700A
PWG : Unspecified (manual)
Multimeter : HP3458A
Signal Switch : Unspecified (manual)

Filter: Wideband
Input: 1

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	0.682	-0.016	0.005	0.689	NA	NA	0.101	NA
0.04	0.352	0.006	0.007	0.357	NA	NA	0.050	NA
0.1	0.134	-0.002	0.007	0.139	NA	NA	0.021	NA
0.2	0.068	0.009	0.007	0.076	313.4	NA	0.012	NA
0.4	0.025	0.002	0.006	0.031	NA	NA	0.014	NA
1.0	0.003	0.004	0.006	0.008	NA	NA	0.007	NA
2.0	-0.002	0.008	0.007	0.012	528.6	NA	0.006	NA
4.0	-0.004	-0.007	0.006	0.014	504.2	NA	0.014	NA
10.0	-0.006	-0.005	0.007	0.014	NA	NA	0.007	NA
20.0	-0.005	-0.002	0.008	0.014	NA	NA	0.006	NA
40.0	-0.003	-0.004	0.007	0.012	503.5	NA	0.013	NA
100.0	-0.008	-0.002	0.006	0.014	NA	NA	0.007	NA
200.0	-0.006	0.005	0.006	0.013	NA	NA	0.006	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	NA	NA	NA	NA	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	-0.009	-0.022	0.007	0.025	NA	NA	0.046
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	24.407	0.314	0.022
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Wideband
Input: 2

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	0.238	0.004	0.014	0.247	NA	NA	0.089	NA
0.04	0.120	0.004	0.005	0.125	NA	NA	0.045	NA
0.1	0.045	-0.006	0.004	0.048	NA	NA	0.018	NA
0.2	0.026	0.002	0.006	0.032	311.1	NA	0.010	NA
0.4	0.014	0.005	0.003	0.016	NA	NA	0.013	NA
1.0	-0.007	0.003	0.005	0.013	NA	NA	0.007	NA
2.0	-0.003	0.009	0.006	0.012	532.6	NA	0.006	NA
4.0	-0.005	-0.001	0.004	0.008	504.9	NA	0.014	NA
10.0	-0.004	-0.007	0.004	0.011	NA	NA	0.007	NA
20.0	-0.006	-0.004	0.008	0.016	NA	NA	0.006	NA

40.0	-0.006	-0.006	0.007	0.014	504.1	NA	0.013	NA
100.0	-0.003	-0.008	0.003	0.010	NA	NA	0.007	NA
200.0	-0.002	-0.006	0.007	0.011	NA	NA	0.006	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	NA	NA	NA	NA	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	0.006	-0.001	0.004	0.010	NA	NA	0.058
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	24.358	0.368	0.025
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Wideband
Input: 3

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	-0.123	0.003	0.007	0.129	NA	NA	0.107	NA
0.04	-0.078	-0.016	0.010	0.095	NA	NA	0.052	NA
0.1	-0.037	-0.008	0.006	0.047	NA	NA	0.021	NA
0.2	-0.019	0.002	0.006	0.025	314.5	NA	0.012	NA
0.4	-0.021	-0.001	0.006	0.027	NA	NA	0.013	NA
1.0	-0.011	0.009	0.009	0.020	NA	NA	0.007	NA
2.0	-0.004	0.009	0.008	0.013	533.2	NA	0.005	NA
4.0	-0.005	0.000	0.004	0.009	507.0	NA	0.013	NA
10.0	-0.008	-0.010	0.010	0.020	NA	NA	0.007	NA
20.0	-0.007	-0.002	0.009	0.014	NA	NA	0.005	NA
40.0	-0.006	-0.006	0.006	0.015	506.8	NA	0.013	NA
100.0	-0.006	-0.004	0.007	0.014	NA	NA	0.007	NA
200.0	-0.003	0.002	0.009	0.011	NA	NA	0.005	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	NA	NA	NA	NA	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	0.010	-0.008	0.007	0.017	NA	NA	0.040
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	24.423	0.333	0.023

20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Wideband
Input: 4

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	-0.159	-0.015	0.004	0.170	NA	NA	0.094	NA
0.04	-0.088	0.008	0.010	0.095	NA	NA	0.047	NA
0.1	-0.036	-0.006	0.007	0.045	NA	NA	0.019	NA
0.2	-0.023	-0.004	0.007	0.031	311.1	NA	0.011	NA
0.4	-0.010	0.012	0.004	0.019	NA	NA	0.013	NA
1.0	-0.005	0.007	0.006	0.012	NA	NA	0.007	NA
2.0	-0.003	0.007	0.007	0.011	529.4	NA	0.005	NA
4.0	-0.004	0.002	0.006	0.010	502.3	NA	0.014	NA
10.0	-0.005	-0.004	0.004	0.010	NA	NA	0.007	NA
20.0	-0.006	0.003	0.007	0.013	NA	NA	0.006	NA
40.0	-0.002	0.015	0.003	0.009	502.9	NA	0.013	NA
100.0	-0.005	-0.003	0.005	0.012	NA	NA	0.007	NA
200.0	-0.004	0.002	0.008	0.011	NA	NA	0.005	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	NA	NA	NA	NA	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	0.012	0.022	0.005	0.021	NA	NA	0.033
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	24.518	0.931	0.017
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Bessel
Input: 1

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	-0.010	-0.006	0.006	0.016	NA	NA	0.065	NA
0.04	-0.010	0.003	0.007	0.016	NA	NA	0.033	NA
0.1	-0.005	-0.006	0.006	0.014	NA	NA	0.013	NA
0.2	-0.004	0.002	0.007	0.010	NA	NA	0.007	NA
0.4	-0.004	0.005	0.008	0.009	NA	NA	0.008	NA
1.0	-0.006	-0.006	0.004	0.013	NA	NA	0.004	NA
2.0	-0.007	0.003	0.004	0.011	NA	NA	0.003	NA
4.0	-0.005	-0.013	0.005	0.015	209.4	NA	0.010	NA
10.0	-0.007	-0.010	0.005	0.016	NA	NA	0.005	NA
20.0	-0.004	-0.005	0.006	0.012	NA	NA	0.004	NA
40.0	-0.004	-0.007	0.006	0.013	NA	NA	0.008	NA
100.0	-0.003	-0.001	0.005	0.008	NA	NA	0.004	NA
200.0	0.000	0.007	0.005	0.005	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	-0.004	-0.062	0.018	0.039	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	-0.003	-0.017	0.006	0.013	NA	NA	NA
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Bessel
Input: 2

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	-0.011	0.005	0.012	0.021	NA	NA	0.060	NA
0.04	0.009	-0.005	0.005	0.013	NA	NA	0.031	NA
0.1	-0.001	0.009	0.006	0.011	NA	NA	0.013	NA
0.2	-0.005	0.001	0.006	0.011	NA	NA	0.007	NA
0.4	0.001	0.009	0.005	0.009	NA	NA	0.008	NA
1.0	-0.007	0.004	0.005	0.014	NA	NA	0.004	NA
2.0	-0.001	0.002	0.008	0.007	NA	NA	0.004	NA
4.0	-0.002	-0.003	0.003	0.005	209.6	NA	0.011	NA
10.0	-0.005	-0.010	0.007	0.017	NA	NA	0.004	NA
20.0	-0.003	-0.009	0.007	0.014	NA	NA	0.004	NA

40.0	-0.003	-0.006	0.006	0.011	NA	NA	0.008	NA
100.0	-0.006	-0.014	0.005	0.018	NA	NA	0.004	NA
200.0	-0.008	-0.015	0.005	0.021	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	0.002	-0.039	0.011	0.022	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	-0.005	-0.004	0.006	0.012	NA	NA	NA
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Bessel
Input: 3

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	0.021	0.003	0.001	0.023	NA	NA	0.061	NA
0.04	0.011	-0.002	0.005	0.016	NA	NA	0.030	NA
0.1	-0.001	-0.006	0.008	0.011	NA	NA	0.013	NA
0.2	0.000	0.007	0.006	0.009	NA	NA	0.007	NA
0.4	-0.003	0.003	0.005	0.007	NA	NA	0.008	NA
1.0	-0.007	0.004	0.007	0.013	NA	NA	0.004	NA
2.0	-0.005	0.008	0.007	0.013	NA	NA	0.004	NA
4.0	-0.004	-0.006	0.006	0.013	209.5	NA	0.009	NA
10.0	-0.003	0.005	0.008	0.013	NA	NA	0.005	NA
20.0	-0.005	0.012	0.008	0.015	NA	NA	0.004	NA
40.0	-0.006	-0.003	0.004	0.010	NA	NA	0.008	NA
100.0	-0.005	0.001	0.005	0.009	NA	NA	0.004	NA
200.0	-0.005	0.004	0.008	0.011	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	-0.008	0.004	0.017	0.026	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	-0.003	-0.005	0.008	0.010	NA	NA	NA
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA

20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Bessel
Input: 4

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	0.006	-0.003	0.010	0.015	NA	NA	0.061	NA
0.04	-0.003	-0.013	0.006	0.014	NA	NA	0.030	NA
0.1	-0.003	-0.010	0.008	0.015	NA	NA	0.013	NA
0.2	-0.005	-0.009	0.005	0.013	NA	NA	0.007	NA
0.4	-0.003	0.006	0.003	0.009	NA	NA	0.008	NA
1.0	-0.002	-0.003	0.005	0.008	NA	NA	0.004	NA
2.0	-0.005	-0.004	0.005	0.012	NA	NA	0.004	NA
4.0	-0.002	0.002	0.004	0.005	207.6	NA	0.009	NA
10.0	-0.006	-0.009	0.006	0.016	NA	NA	0.005	NA
20.0	-0.004	-0.005	0.006	0.012	NA	NA	0.004	NA
40.0	-0.003	0.003	0.004	0.007	NA	NA	0.008	NA
100.0	-0.006	-0.004	0.005	0.012	NA	NA	0.004	NA
200.0	-0.005	-0.008	0.005	0.014	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	0.000	-0.029	0.023	0.025	NA	NA	NA
0.2	NA	NA	NA	NA	NA	NA	NA
0.4	NA	NA	NA	NA	NA	NA	NA
1.0	-0.003	0.011	0.006	0.013	NA	NA	NA
2.0	NA	NA	NA	NA	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Butterworth
Input: 1

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	-0.012	-0.006	0.005	0.019	NA	NA	0.079	NA
0.04	-0.011	-0.012	0.005	0.021	NA	NA	0.039	NA
0.1	-0.005	-0.003	0.008	0.013	NA	NA	0.016	NA
0.2	-0.004	0.004	0.006	0.012	NA	NA	0.009	NA
0.4	-0.002	-0.006	0.004	0.009	NA	-121.1	0.009	NA
1.0	-0.007	-0.009	0.005	0.016	NA	NA	0.005	NA
2.0	-0.006	-0.001	0.005	0.011	NA	NA	0.004	NA
4.0	-0.005	-0.014	0.004	0.015	355.9	-81.8	0.011	Passed
10.0	-0.004	-0.014	0.008	0.015	NA	NA	0.005	NA
20.0	-0.004	-0.015	0.006	0.017	NA	NA	0.004	NA
40.0	0.000	-0.007	0.004	0.007	NA	-79.8	0.009	NA
100.0	-0.007	-0.007	0.008	0.017	NA	NA	0.005	NA
200.0	-0.002	-0.004	0.007	0.011	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	-0.011	-0.068	0.018	0.039	NA	NA	NA
0.2	-0.006	-0.047	0.007	0.033	NA	NA	NA
0.4	-0.005	-0.025	0.008	0.016	NA	NA	NA
1.0	-0.002	-0.013	0.004	0.011	NA	NA	NA
2.0	-0.006	0.034	0.005	0.026	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Butterworth
Input: 2

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	-0.005	0.009	0.005	0.011	NA	NA	0.074	NA
0.04	-0.007	0.012	0.005	0.014	NA	NA	0.037	NA
0.1	0.002	0.006	0.006	0.009	NA	NA	0.015	NA
0.2	-0.003	0.005	0.006	0.010	NA	NA	0.008	NA
0.4	-0.007	0.009	0.005	0.013	NA	-134.8	0.009	NA
1.0	-0.004	0.002	0.006	0.009	NA	NA	0.005	NA
2.0	-0.006	-0.004	0.009	0.017	NA	NA	0.004	NA
4.0	-0.003	0.001	0.002	0.006	353.3	-84.2	0.010	Passed
10.0	-0.006	-0.007	0.006	0.015	NA	NA	0.005	NA
20.0	-0.003	-0.007	0.004	0.010	NA	NA	0.004	NA

40.0	-0.003	-0.002	0.002	0.005	NA	-81.4	0.009	NA
100.0	-0.010	-0.018	0.007	0.025	NA	NA	0.005	NA
200.0	-0.003	-0.014	0.006	0.016	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	0.011	-0.024	0.012	0.025	NA	NA	NA
0.2	0.008	-0.027	0.007	0.016	NA	NA	NA
0.4	-0.003	-0.018	0.007	0.012	NA	NA	NA
1.0	-0.006	-0.012	0.009	0.018	NA	NA	NA
2.0	-0.007	0.033	0.007	0.030	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Butterworth
Input: 3

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	0.018	-0.003	0.011	0.028	NA	NA	0.073	NA
0.04	0.003	-0.010	0.006	0.009	NA	NA	0.037	NA
0.1	0.004	-0.005	0.006	0.007	NA	NA	0.015	NA
0.2	-0.001	0.004	0.006	0.006	NA	NA	0.008	NA
0.4	-0.001	0.008	0.005	0.008	NA	-117.4	0.009	NA
1.0	-0.003	0.002	0.006	0.009	NA	NA	0.005	NA
2.0	-0.007	0.005	0.008	0.015	NA	NA	0.004	NA
4.0	-0.002	0.002	0.006	0.007	354.5	-85.2	0.010	Passed
10.0	-0.005	-0.001	0.007	0.012	NA	NA	0.005	NA
20.0	-0.006	-0.002	0.006	0.013	NA	NA	0.004	NA
40.0	-0.005	-0.003	0.007	0.014	NA	-82.0	0.009	NA
100.0	0.000	-0.006	0.007	0.009	NA	NA	0.005	NA
200.0	-0.001	0.003	0.007	0.008	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	-0.022	-0.021	0.015	0.035	NA	NA	NA
0.2	-0.008	-0.005	0.008	0.015	NA	NA	NA
0.4	0.002	-0.018	0.007	0.013	NA	NA	NA
1.0	-0.004	-0.009	0.006	0.011	NA	NA	NA
2.0	-0.004	0.026	0.005	0.020	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA

20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Filter: Analog Anti Alias Butterworth
Input: 4

Range (V)	Offset (%)	DCGain (%)	SINL (%)	MSE (%)	BWdth (kHz)	CMRR (dB)	Noise (%)	ACCpl
0.02	0.010	0.001	0.006	0.016	NA	NA	0.074	NA
0.04	0.007	0.009	0.003	0.011	NA	NA	0.037	NA
0.1	-0.004	-0.005	0.004	0.010	NA	NA	0.016	NA
0.2	-0.003	0.000	0.008	0.011	NA	NA	0.008	NA
0.4	-0.001	0.011	0.004	0.009	NA	-114.1	0.009	NA
1.0	-0.005	0.006	0.007	0.011	NA	NA	0.005	NA
2.0	0.001	0.015	0.006	0.010	NA	NA	0.004	NA
4.0	-0.005	0.010	0.005	0.012	356.3	-86.7	0.014	Passed
10.0	0.000	-0.003	0.007	0.007	NA	NA	0.005	NA
20.0	-0.006	0.004	0.006	0.012	NA	NA	0.004	NA
40.0	-0.006	0.011	0.006	0.012	NA	-83.9	0.009	NA
100.0	-0.002	0.003	0.006	0.009	NA	NA	0.005	NA
200.0	-0.005	0.002	0.005	0.009	NA	NA	0.004	NA

Range (V)	Offset_A (%)	dcGain_A (%)	SINL_A (%)	MSE_A (%)	IEPE Comp. (V)	IEPE Exc. (%)	IEPE Gain (%)
0.02	NA	NA	NA	NA	NA	NA	NA
0.04	NA	NA	NA	NA	NA	NA	NA
0.1	0.009	-0.022	0.018	0.029	NA	NA	NA
0.2	0.003	0.004	0.008	0.011	NA	NA	NA
0.4	-0.001	0.018	0.005	0.012	NA	NA	NA
1.0	-0.005	0.017	0.006	0.017	NA	NA	NA
2.0	-0.006	0.060	0.006	0.038	NA	NA	NA
4.0	NA	NA	NA	NA	NA	NA	NA
10.0	NA	NA	NA	NA	NA	NA	NA
20.0	NA	NA	NA	NA	NA	NA	NA
40.0	NA	NA	NA	NA	NA	NA	NA
100.0	NA	NA	NA	NA	NA	NA	NA
200.0	NA	NA	NA	NA	NA	NA	NA

Hottinger Baldwin Measurements, Inc.
19 Bartlett Street
Marlboro, MA 01752
Phone: 800-578-4260
Fax: 508-485-7480
www.mra@usa.hbm.com

F491 rev: 01

HBM

Analysis Report/Analyse Report

Issued on/Erstelldatum: 21-Nov-14
MRA number/Auftrag: 4907125

Customer Information/Daten des Auftraggebers:

Client/Auftraggeber: HBM-GMBH
Customer Number/Kunden-Nr.: U10160

Product/Produkt:

Part Number/Material-Nr.: Sigma 90-8
Serial Number/Serial-Nr.: IDM0300210

Original Customer Complaint/Fehlerbeschreibung des Kunden:

Calibration request.

Findings/Untersuchungsergebnisse:

N/A

Repair Actions/Reparaturschritte:

Calibration with data.

Hottinger Baldwin Measurements, Inc.
19 Bartlett Street
Marlboro, MA 01752
Phone: 800-578-4260
Fax: 508-485-7480
www.mra@usa.hbm.com

F49 Rev. 01

HBM

Analysis Report/Analyse Report

Issued on/Erstelldatum: 21-Nov-14
MRA number/Auftrag: 4907125

Customer Information/Daten des Auftraggebers:

Client/Auftraggeber: HBM-GMBH
Customer Number/Kunden-Nr.: U10160

Product/Produkt:

Part Number/Material-Nr.: Sigma 90-8
Serial Number/Serial-Nr.: IDM0300210

Original Customer Complaint/Fehlerbeschreibung des Kunden:

Calibration request.

Findings/Untersuchungsergebnisse:

N/A

Repair Actions/Reparaturschritte:

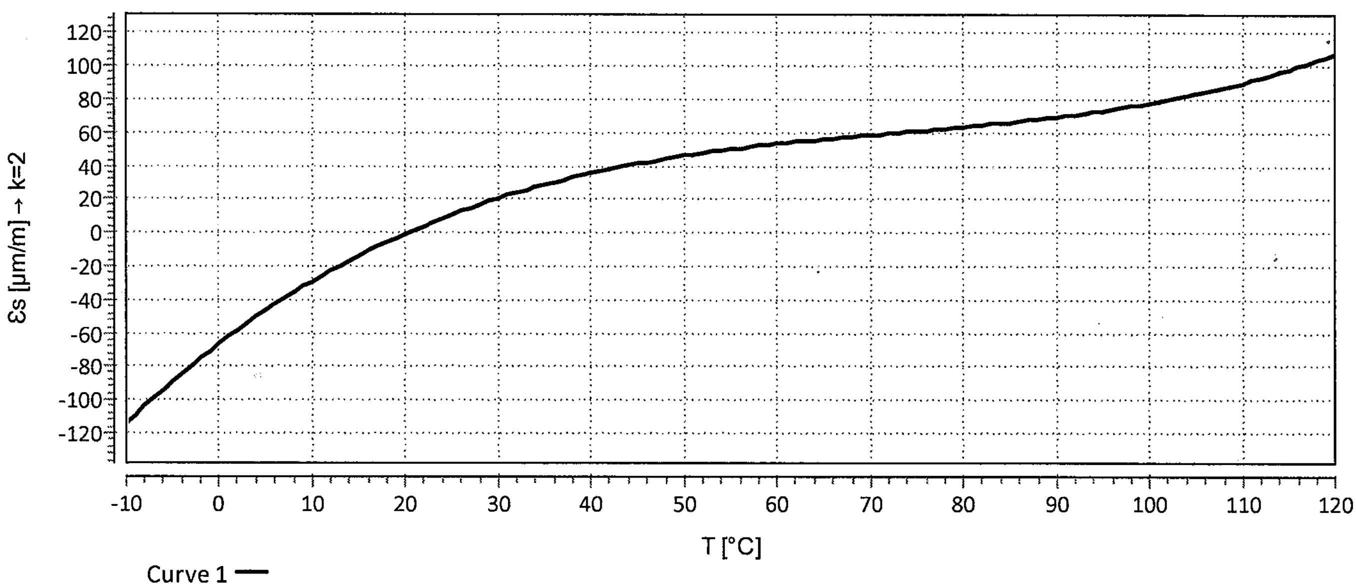
Calibration with data.

OMEGA®
The Latest Technological Innovations

Order No. Núm. de pedido 订货号	KFH-6-350-C1-11L1M2R
Contents Número de piezas 数量	10
Resistance Resistencia 电阻	350.4 Ω ±0.35 %
Gage factor Factor k k因数	2.04 ±1.0 %
Temperature coefficient of gage factor Coeficiente térmico del factor k k因数的温度系数	93 ±10 [10^{-6} / K] (-10°C ... +45°C)
Foil lot Lote de láminas 膜批号	A412/05
Transverse sensitivity Sensibilidad transversal 横向效应系数	-0.1 %
Production batch Lote de producción 生产批号	812069608

Data / Datos / 数据

Temperature compensation: steel with
Compensación térmica: Acero ferrita con
温度补偿： 铁素体钢和α值为 α = 10.8 [10^{-6} / K]



$$\varepsilon_S(T) = -14.32 + 1.63 * T - 5.14E{-}02 * T^2 + 2.35E{-}04 * T^3 \pm (T-20) * 0.30\ [\mu m/m] + 2.602 * (T-20)\ [\mu m/m]$$

All specifications in accordance with VDI/VDE 2635. In case of further inquiries please indicate order no. and production batch number

Todos los datos técnicos conforme a VDI/VDE 2635. En caso de cualquier duda, por favor incluya el número de pedido y lote de producción.

所有技术参数符合 VDI/VDE 2635 。有疑问并向我们联系时，请提供订货号码和生产批号。

Respuesta de temperatura de las bandas extensométricas en aplicaciones con coeficientes de dilatación térmica α indicados. Medido bajo continuo cambio de temperaturas.

Curva característica 1: banda extensométrica con cable de PVC.
T = Temperatura en °C
(adimensional)

The **temperature response** refers to strain gages bonded to materials with specified coefficients of thermal expansion α. Values are measured with continuous temperature variation.

Curve 1: Strain gages with PVC cable.
T = temperature in °C
(dimensionless)

应变片的温度漂移（用的贴装材料具有上述热膨胀系数α)。

特征线 1: 带有PVC线的应变片
T = 温度（°C ）
(不带单位)

Header / Datos de encabezamiento / 文件头

PCB PIEZOTRONICS

CERTIFICATION OF CONFORMANCE

Title Page of Calibration Certificate Documentation

CUSTOMER:

Oregon Ballistic Labs
2873 22nd Street Southeast
Salem, OR 97302
UNITED STATES

PURCHASE ORDER #: **H Bose-CC**

PCB ORDER #: **342014**

QTY	ITEM	DESCRIPTION
6	PCS-1	RECAL 137A22
	S/N 6403 6404 6405 7214 7215 7150	

Notes:

1. This document certifies that the subject item(s) have been manufactured, repaired (if applicable), tested, or inspected in accordance with referenced purchase order and conform(s) to applicable specifications per PCB Quality Policy Manual Rev. I 09/30/2014.
2. Equipment used in validation is traceable to NIST and appropriate records are on file.
3. Calibrations comply with ISO 17025 and ANSI/NCSL Z540-1-1994 except as noted on associated calibration certificate(s).
4. Calibrations are performed using processes having a test uncertainty ratio (TUR) of four or more times greater than the unit calibrated, unless otherwise noted on the calibration certificate. Calibration at 4:1 TUR provides reasonable confidence that the instrument is within product specifications.

Logistics Associate: ______________ **Date:** 11/17/15

- ISO 9001 Certified / ISO 17025 Accredited -
PCB Piezotronics, Inc.
3425 Walden Avenue Depew, New York, US 14043-2495
Phone: 716-684-0001 Fax: 716-684-0987

Packing List

PCB PIEZOTRONICS INC.

PCB PIEZOTRONICS

3425 WALDEN AVENUE
DEPEW, NY 14043
UNITED STATES

Order # 342014 **DO #** D000121883
Date 11/17/2015
PO# H Bose-CC

SHIP TO

Oregon Ballistic Labs
2873 22nd Street Southeast
Salem, OR 97302
UNITED STATES

Please check the material received against this listing, informing us promptly of discrepancies and referring to the order number above. Items not included have been back ordered as noted and will be shipped as soon as possible. Be sure to check carefully before reporting shortage. Any shortage of items as shown on Bill of Lading or damage should be called to the attention of the delivering agent who should acknowledge on the freight bill. Please contact us if we can answer any questions or if you would like to provide feedback of any type.

Contact: Justin Greeley

Customer PO # H Bose-CC **Pieces** 1 **Weight** 11.50 LB

Line	Release	Item Number	Item Description	Ordered	Shipped	Due
1	0	PCS-1	RECAL 137A22	6	6	0

S/N 6403 6404 6405 7214 7215 7150

Notes:

UPS / 3 Day Select / Collect /

Carrier: UNITED PARCEL SERVICE **Pro Bill Number**

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 6403
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 907 Dyn. Med. Press. #3 (Test Procedure AT601-11)

Sensitivity*: 9.204 mV/PSI
1335 mV/MPa

Temp: 72 deg F [22deg C]
Humidity: 56 %

Linearity*: 0.2% FS
Uncertainty:** +/- 1.3 %

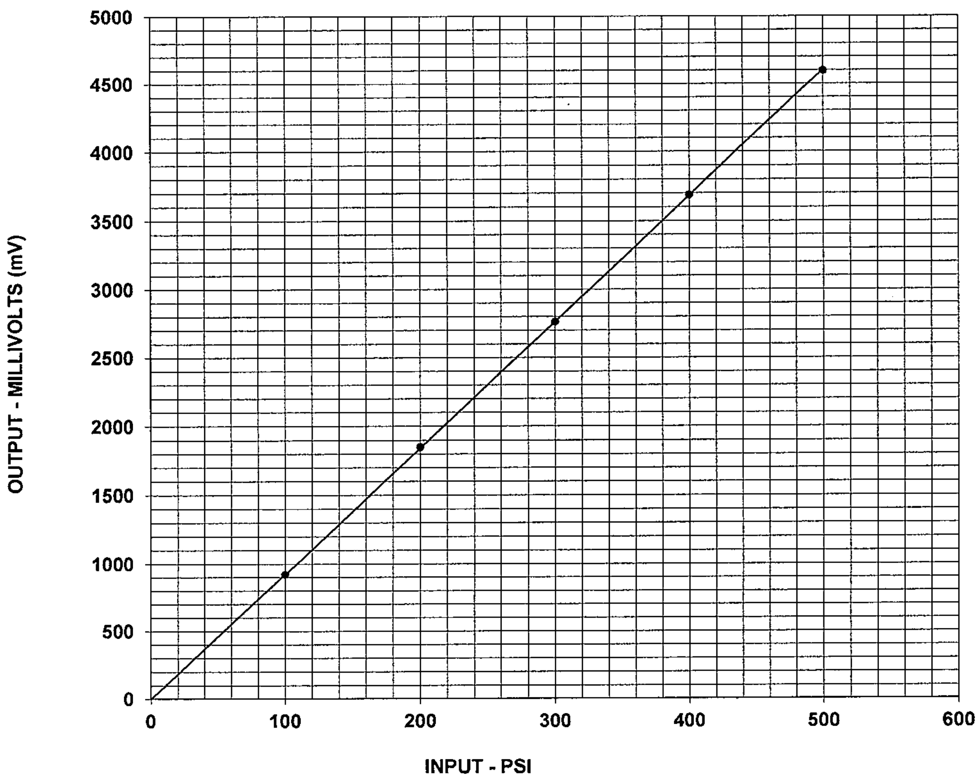
Cert #: 586712

Bias: 9.9 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
100	921
200	1849
300	2762
400	3684
500	4596

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA759.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 6404
Description: Pressure Sensor
Type: ICP

Sensitivity*: 9.462 mV/PSI
1372 mV/MPa

Linearity*: 0.2% FS
Uncertainty:** +/- 1.3 %

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 907 Dyn. Med. Press. #3 (Test Procedure AT601-11)

Temp: 73 deg F [23deg C]
Humidity: 54 %

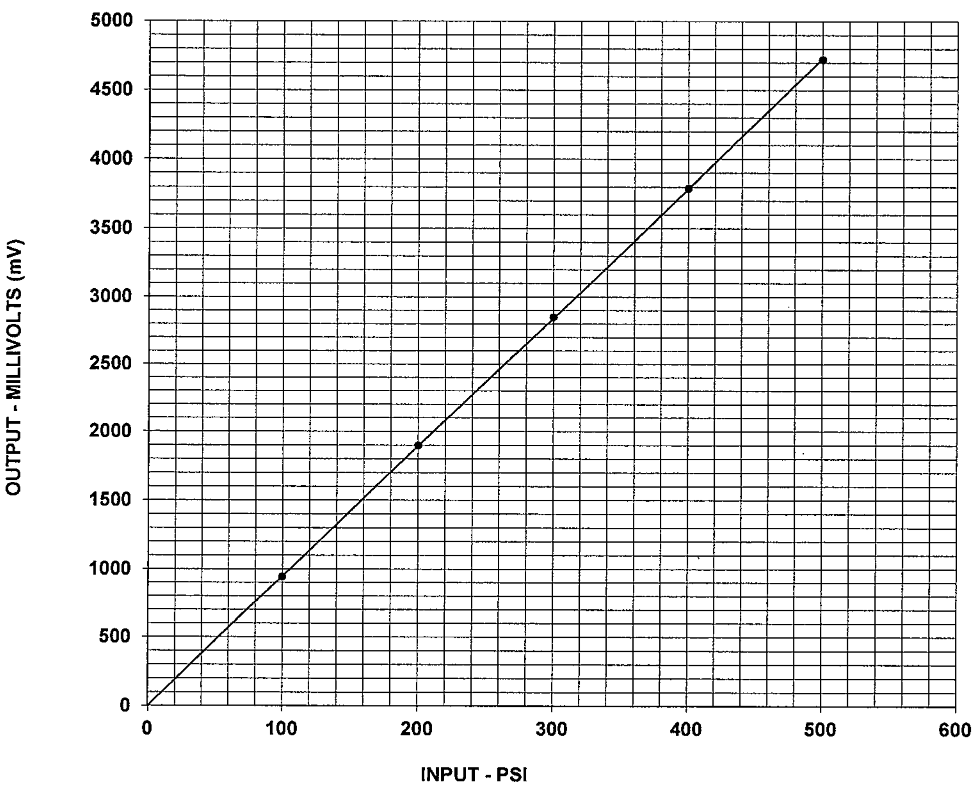
Cert #: 586713

Bias: 10.3 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
100	943
200	1896
300	2849
400	3789
500	4721

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA759.
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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 6405
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech
Station: 907 Dyn. Med. Press. #3 (Test Procedure AT601-11)

Sensitivity*: 9.221 mV/PSI
1337 mV/MPa

Temp: 73 deg F [23deg C]
Humidity: 54 %

Linearity*: 0.3% FS
Uncertainty:** +/- 1.3 %

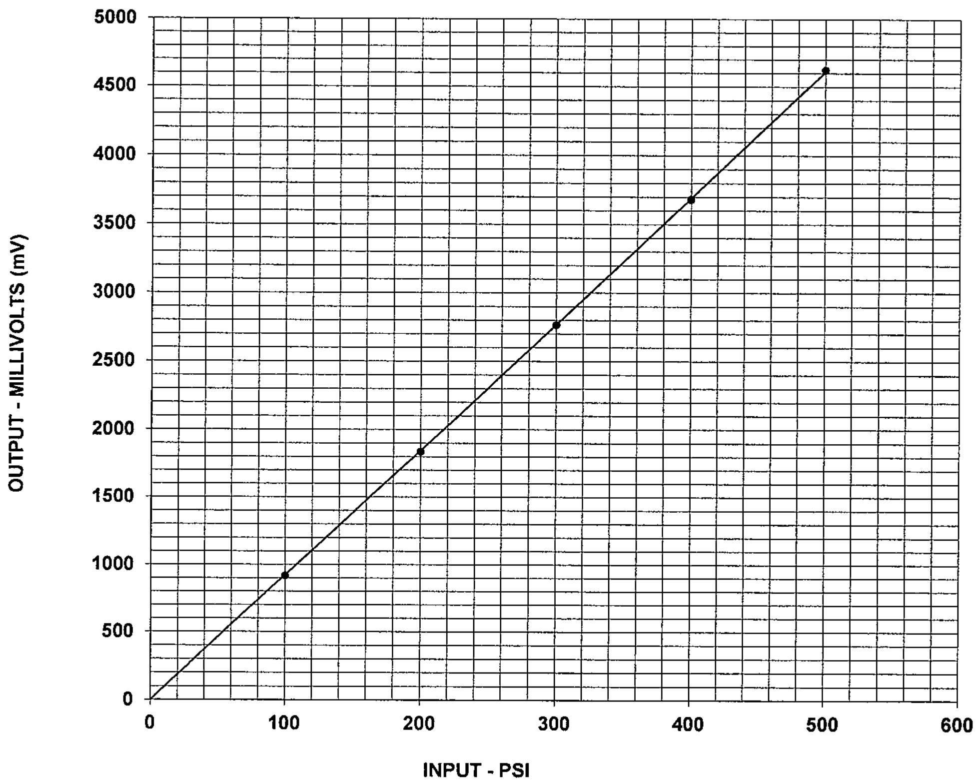
Cert #: 586716

Bias: 11.8 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
100	916
200	1834
300	2765
400	3680
500	4623

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA759.
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CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 7214
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 907 Dyn. Med. Press. #3 (Test Procedure AT601-11)

Sensitivity*: 10.08 mV/PSI
1463 mV/MPa

Temp: 73 deg F [23deg C]
Humidity: 54 %

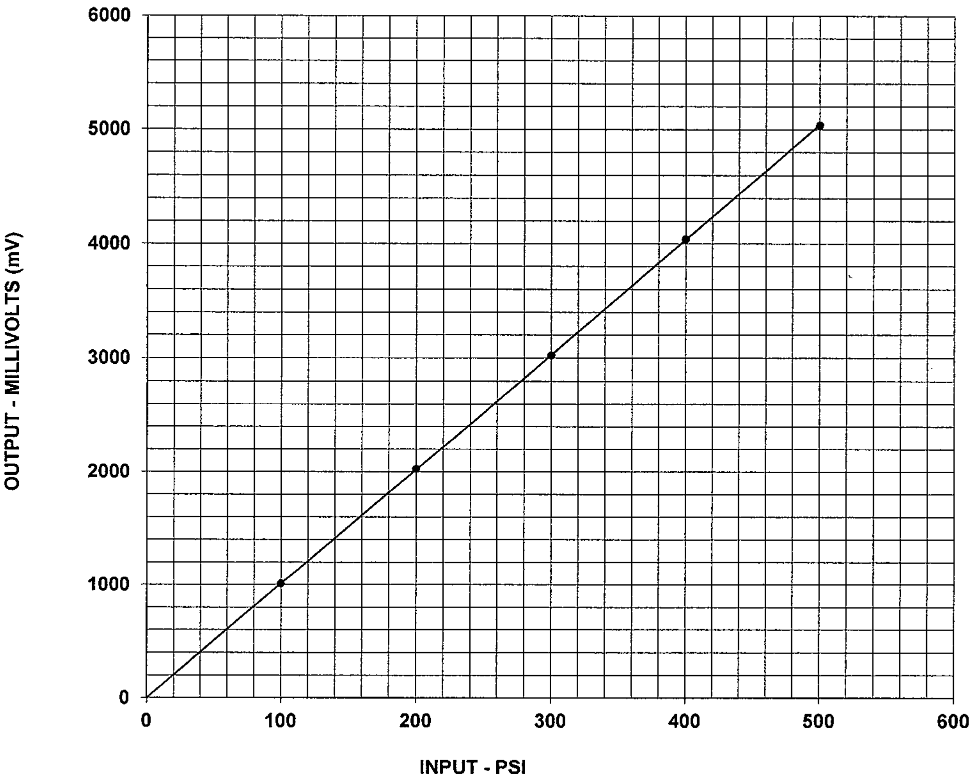
Linearity*: 0.2% FS
Uncertainty:** +/- 1.3 %

Cert #: 586721

Bias: 9.8 VDC

* Zero based, least-squares straight line.
** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
100	1008
200	2025
300	3023
400	4040
500	5035

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA759.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 7215
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 907 Dyn. Med. Press. #3 (Test Procedure AT601-11)

Sensitivity*: 10.35 mV/PSI
1501 mV/MPa

Temp: 73 deg F [23deg C]
Humidity: 54 %

Linearity*: 0.1% FS
Uncertainty:** +/- 1.3 %

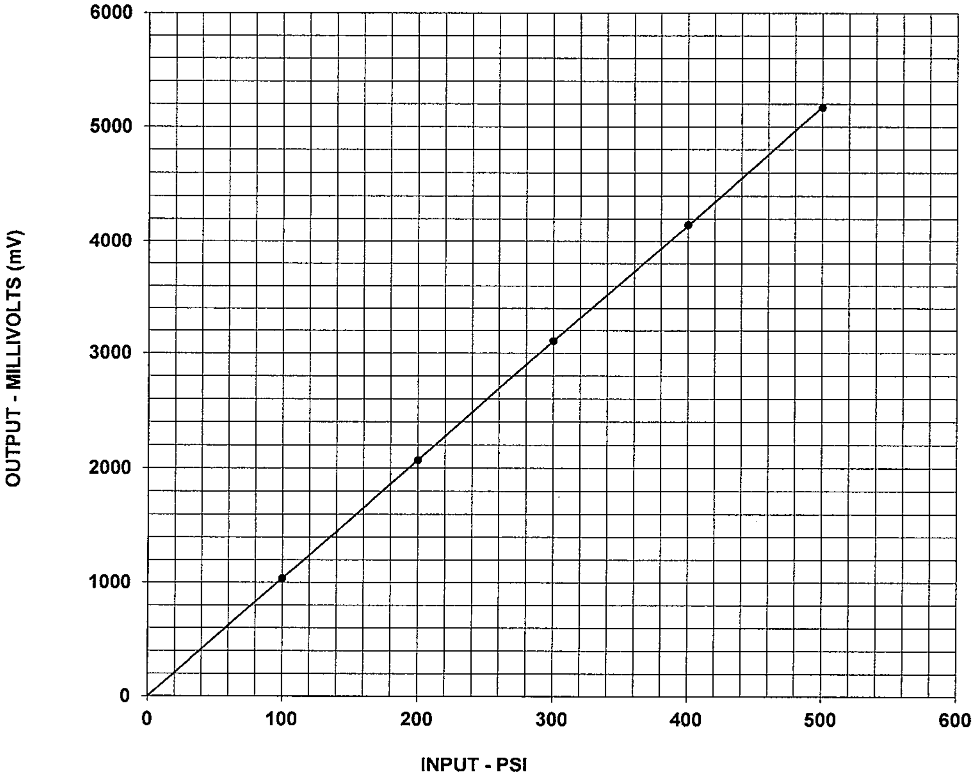
Cert #: 586725

Bias: 9.8 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
100	1034
200	2066
300	3106
400	4146
500	5169

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA759.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 7150
Description: Pressure Sensor
Type: ICP

Sensitivity*: 9.411 mV/PSI
1365 mV/MPa

Linearity*: 0.3% FS
Uncertainty:** +/- 1.3 %

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 907 Dyn. Med. Press. #3 (Test Procedure AT601-11)

Temp: 73 deg F [23deg C]
Humidity: 53 %

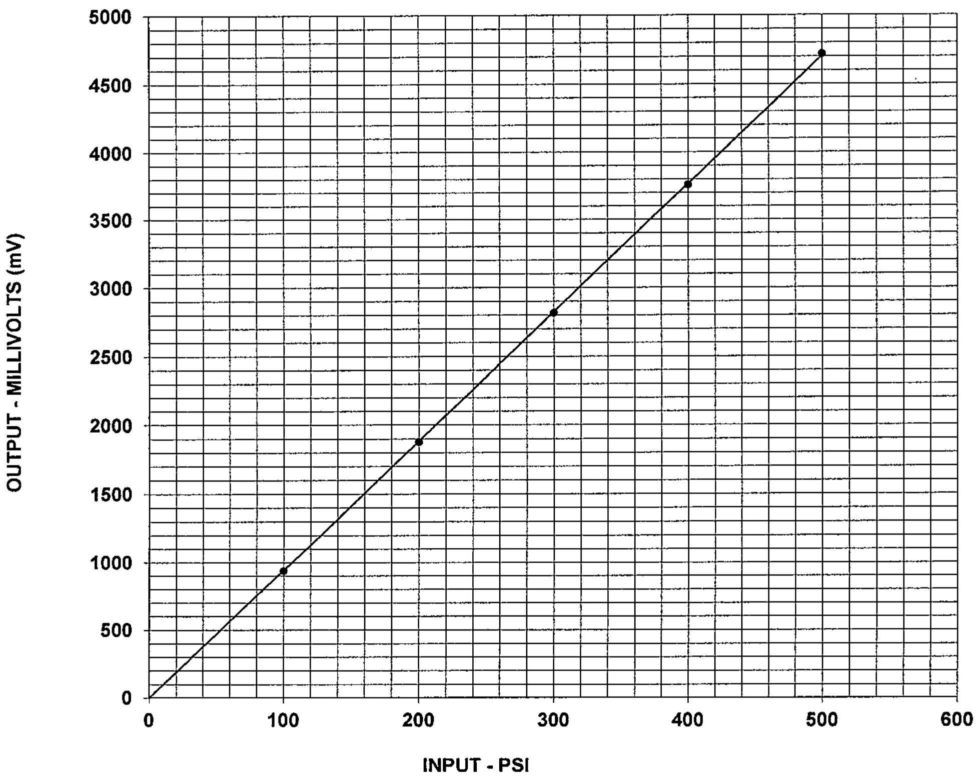
Cert #: 586726

Bias: 9.6 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
100	937
200	1876
300	2816
400	3757
500	4719

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA759.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 6403
Description: Pressure Sensor
Type: ICP

Sensitivity*: 9.424 mV/PSI
1.367 mV/kPa

Linearity*: 0.1% FS
Uncertainty:** +/- 1 %

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 903 Pulse #3 (Test procedure AT601-6)

Temp: 70 deg F [21deg C]
Humidity: 56 %

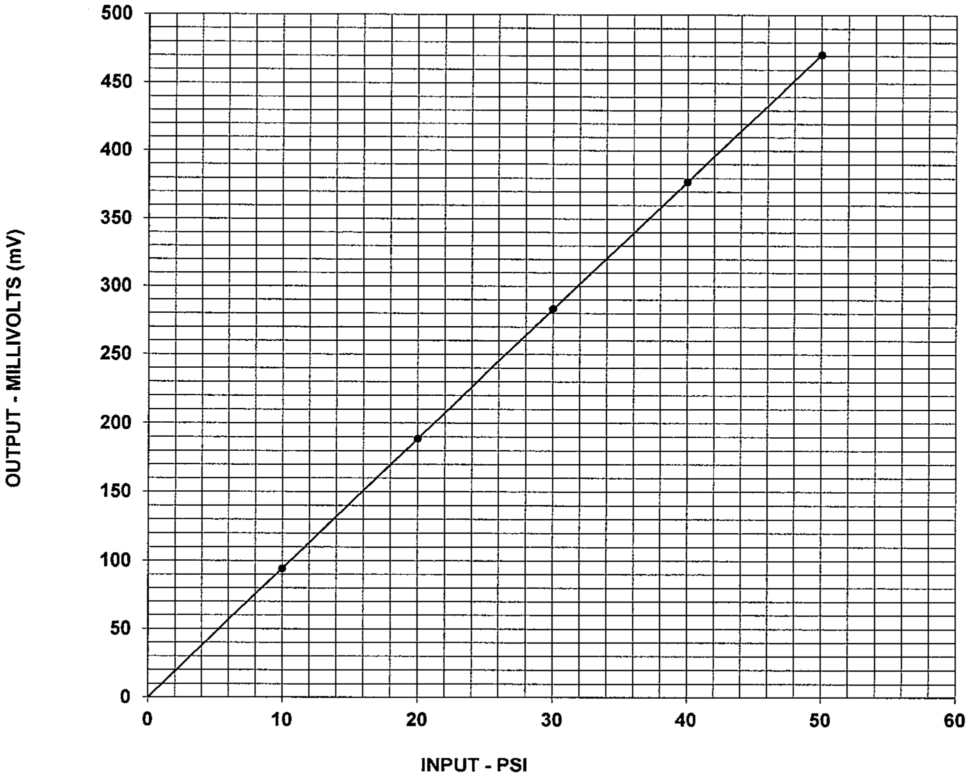
Cert #: 586819

Bias: 9.9 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
10.0	94.2
20.0	188.5
30.0	283.2
40.0	377.0
50.0	470.9

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA 1296.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 6404
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 903 Pulse #3 (Test procedure AT601-6)

Sensitivity*: 9.433 mV/PSI
1.368 mV/kPa

Temp: 70 deg F [21deg C]
Humidity: 56 %

Linearity*: 0.04% FS
Uncertainty:** +/- 1 %

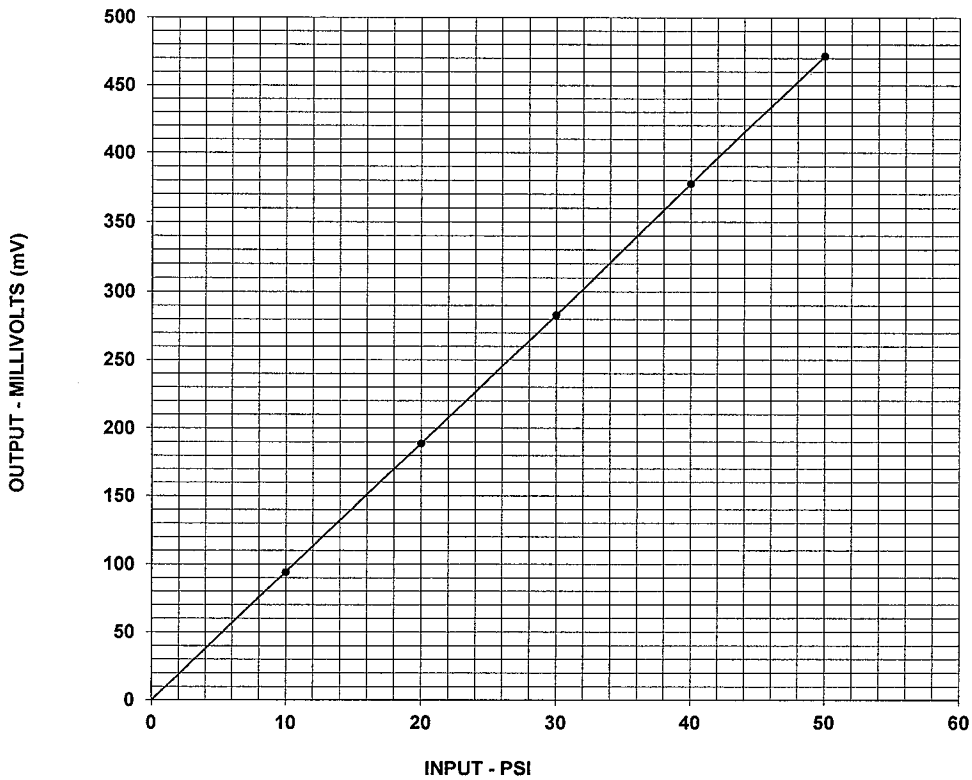
Cert #: 586824

Bias: 10.3 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
10.0	94.2
20.0	188.6
30.0	283.1
40.0	377.4
50.0	471.6

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 6405
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 903 Pulse #3 (Test procedure AT601-6)

Sensitivity*: 8.949 mV/PSI
1.298 mV/kPa

Temp: 70 deg F [21deg C]
Humidity: 56 %

Linearity*: 0.2% FS
Uncertainty:** +/- 1 %

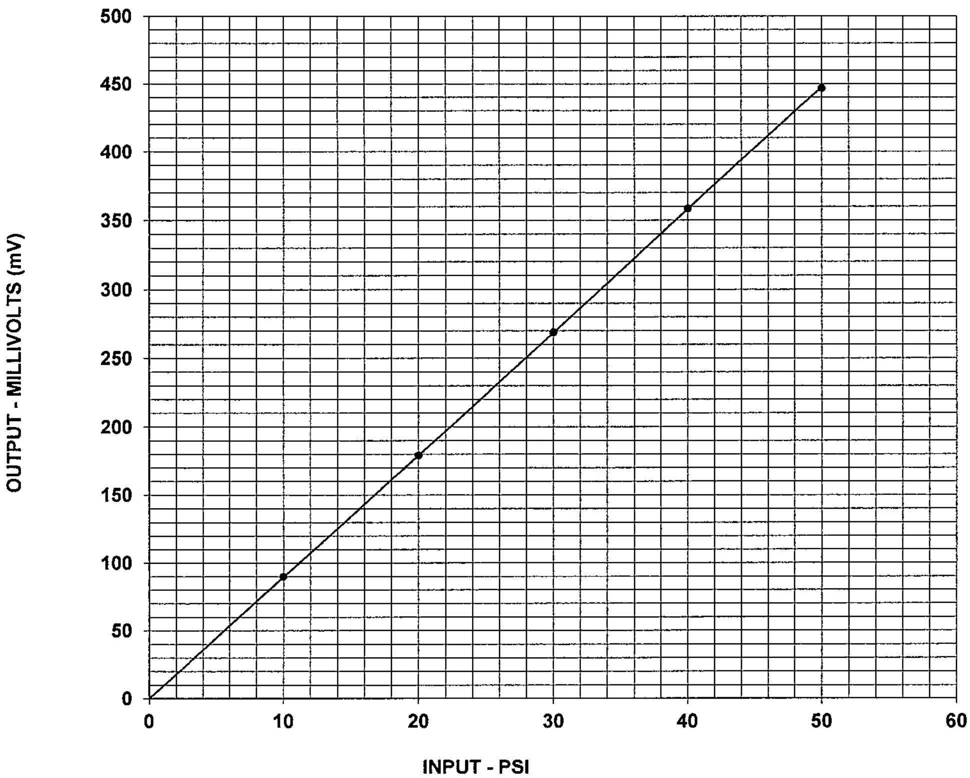
Cert #: 586826

Bias: 11.8 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
10.0	89.9
20.0	179.0
30.0	268.9
40.0	358.4
50.0	446.7

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA 1296.
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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 7214
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 903 Pulse #3 (Test procedure AT601-6)

Sensitivity*: 10.28 mV/PSI
1.491 mV/kPa

Temp: 72 deg F [22deg C]
Humidity: 53 %

Linearity*: 0.08% FS
Uncertainty:** +/- 1 %

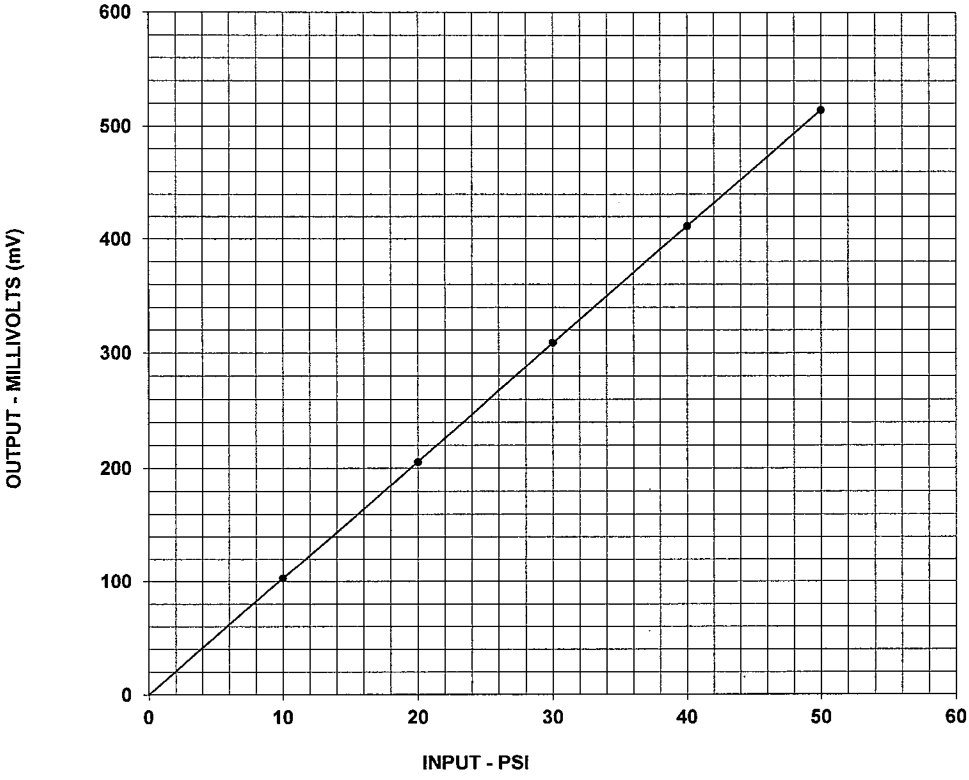
Cert #: 586833

Bias: 9.8 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
10.0	103
20.0	205
30.0	309
40.0	411
50.0	514

Notes:

1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA 1296.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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3425 Walden Avenue, Depew NY 14043

ISO 9001 CERTIFIED

Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 7215
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 903 Pulse #3 (Test procedure AT601-6)

Sensitivity*: 10.43 mV/PSI
1.513 mV/kPa

Temp: 72 deg F [22deg C]
Humidity: 53 %

Linearity*: 0.1% FS
Uncertainty:** +/- 1 %

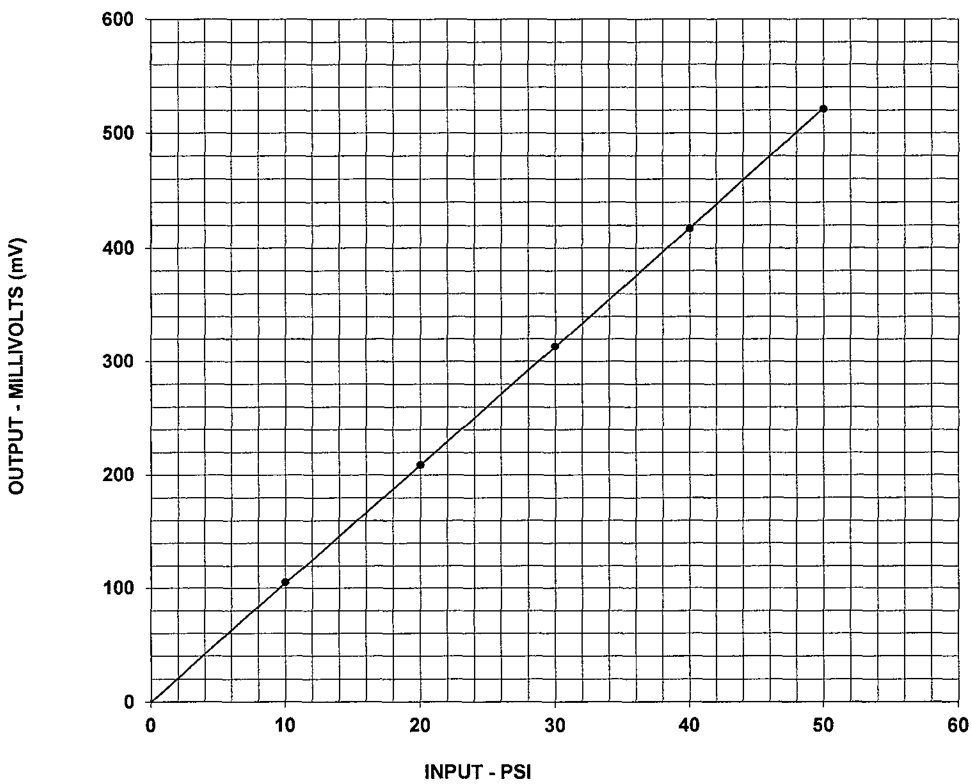
Cert #: 586835

Bias: 9.8 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
10.0	105
20.0	209
30.0	314
40.0	417
50.0	521

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA 1296.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

ACCREDITED
CALIBRATION CERT #1862.01

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Page 1 of 1

CALIBRATION CERTIFICATE

Model: 137A22
Serial #: 7150
Description: Pressure Sensor
Type: ICP

Date: 11/16/2015
By: Eric Kachermeyer, Cal. Tech.
Station: 903 Pulse #3 (Test procedure AT601-6)

Sensitivity*: 9.360 mV/PSI
1.358 mV/kPa

Temp: 71 deg F [22deg C]
Humidity: 54 %

Linearity*: 0.10% FS
Uncertainty:** +/- 1 %

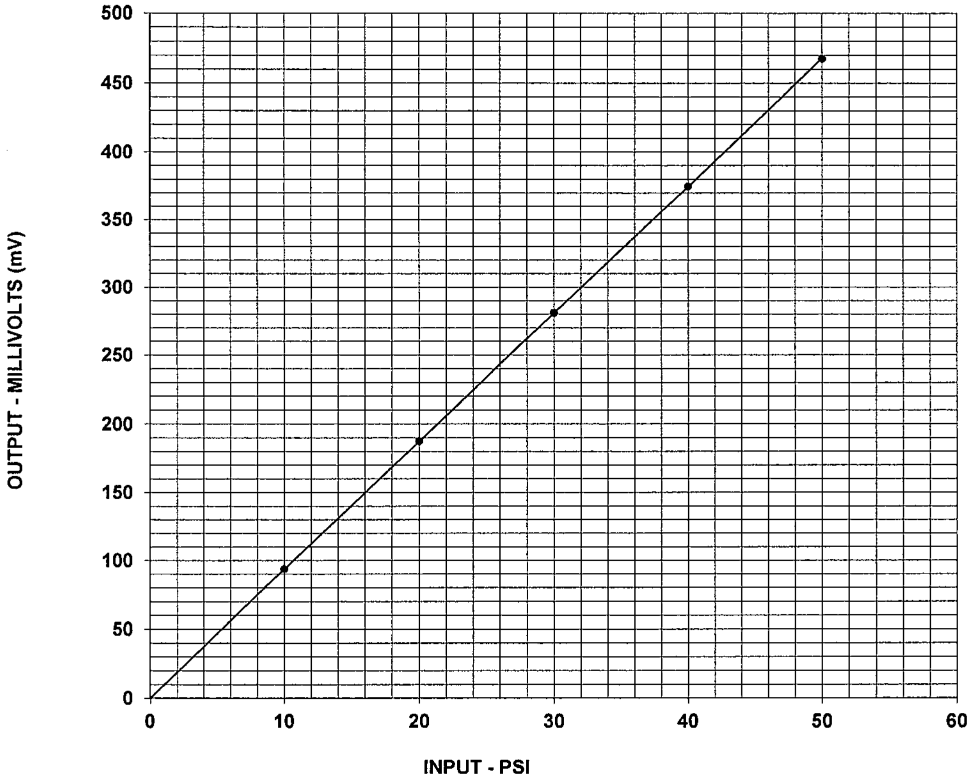
Cert #: 586836

Bias: 9.6 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: In tolerance
As Left: In tolerance



TEST DATA

INPUT (PSI)	OUTPUT (mV)
10.0	93.7
20.0	187.5
30.0	281.0
40.0	374.6
50.0	467.6

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA 1296.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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Page 1 of 1

PCB PIEZOTRONICS

CERTIFICATION OF CONFORMANCE

Title Page of Calibration Certificate Documentation

CUSTOMER:

APD LLC
Asymmetric Product Development
2725 19th Street SE
Salem, OR 97302
UNITED STATES

PURCHASE ORDER #: **Paul -Verbal**

PCB ORDER #: **312993**

QTY	ITEM	DESCRIPTION
1	106B	ICP MICROPHONE 00014985
1	061A13	B & K PISTON PHONE ADAPTOR
1	060A53	CLAMP NUT

Notes:

1. This document certifies that the subject item(s) have been manufactured, repaired (if applicable), tested, or inspected in accordance with referenced purchase order and conform(s) to applicable specifications per PCB Quality Policy Manual Rev. H 03/07/2012.
2. Equipment used in validation is traceable to NIST and appropriate records are on file.
3. Calibrations comply with ISO 17025 and ANSI/NCSL Z540-1-1994 except as noted on associated calibration certificate(s).
4. Calibrations are performed using processes having a test uncertainty ratio (TUR) of four or more times greater than the unit calibrated, unless otherwise noted on the calibration certificate. Calibration at 4:1 TUR provides reasonable confidence that the instrument is within product specifications.

Logistics Associate: ________ **Date:** 09/09/14

- ISO 9001 Certified / ISO 17025 Accredited -
PCB Piezotronics, Inc.
3425 Walden Avenue Depew, New York, US 14043-2495
Phone: 716-684-0001 Fax: 716-684-0987

Packing List

PCB PIEZOTRONICS INC.

Order # 312993 **DO #** D000075857

Date 9/9/2014

PCB PIEZOTRONICS

3425 WALDEN AVENUE
DEPEW, NY 14043
UNITED STATES

SHIP TO

APD LLC
Asymmetric Product Development
2725 19th Street SE
Salem, OR 97302
UNITED STATES

Please check the material received against this listing, informing us promptly of discrepancies and referring to the order number above. Items not included have been back ordered as noted and will be shipped as soon as possible. Be sure to check carefully before reporting shortage. Any shortage of items as shown on Bill of Lading or damage should be called to the attention of the delivering agent who should acknowledge on the freight bill. Please contact us if we can answer any questions or if you would like to provide feedback of any type.

Contact: Paul Cheney

Customer PO # Paul -Verbal **Pieces** 1 **Weight** 2.00 LB

Line	Release	Item Number	Item Description	Ordered	Shipped	Due
1	0	106B	ICP MICROPHONE	1	1	0
	Serials:	00014985				
2	0	061A13	B & K PISTON PHONE ADAPTOR	1	1	0
3	0	060A53	CLAMP NUT	1	1	0

Notes:

UPS / Ground / Prepaid and Charge /

Carrier: UNITED PARCEL SERVICE **Pro Bill Number**

CALIBRATION CERTIFICATE

Model: 106B
Serial #: 14985
Description: Pressure Sensor
Type: ICP
Time Constant: 1.5 sec

Date: 8/22/2014
By: Eric Kachermeyer, Cal. Tech.
Station: 903 Pulse #3 (Test procedure AT601-6)

Sensitivity*: 297.1 mV/PSI
43.09 mV/kPa

Temp: 72 deg F [22deg C]
Humidity: 55 %

Linearity*: 0.1% FS
Uncertainty:** +/- 1 %

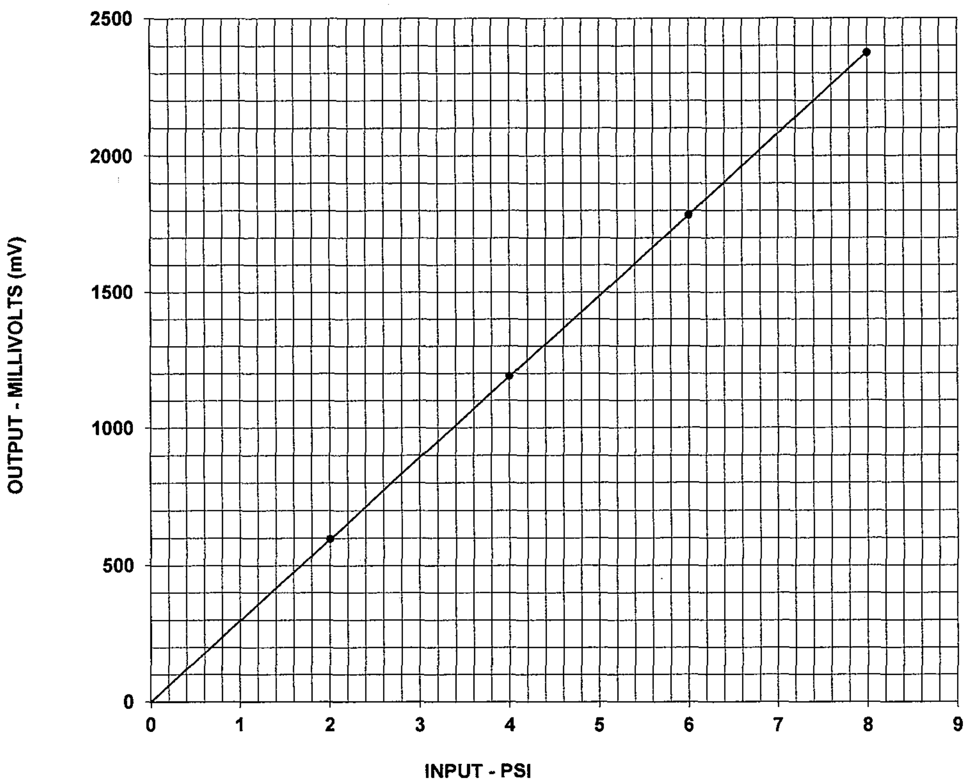
Cert #: 535513

Bias: 4.9 VDC

* Zero based, least-squares straight line.

** Measurement uncertainty represented using a coverage factor of k=2 which provides a level of confidence of approximately 95 %.

Condition of Unit:
As Found: Not applicable
As Left: In tolerance, new unit



TEST DATA

INPUT (PSI)	OUTPUT (mV)
2.00	597
4.00	1190
6.00	1783
8.00	2374

Notes:
1 STATION #17
2 Calibration is traceable to NIST and is accredited to ISO 17025 and ANSI/NCSL Z540.3.
3 NIST traceability through PCB control # CA1296A.
4 This certificate may not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.

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Page 1 of 1

~ Calibration Certificate ~

per ISA-S37.10

Model Number: 106B

Serial Number: 14985

Description: ICP® Microphone

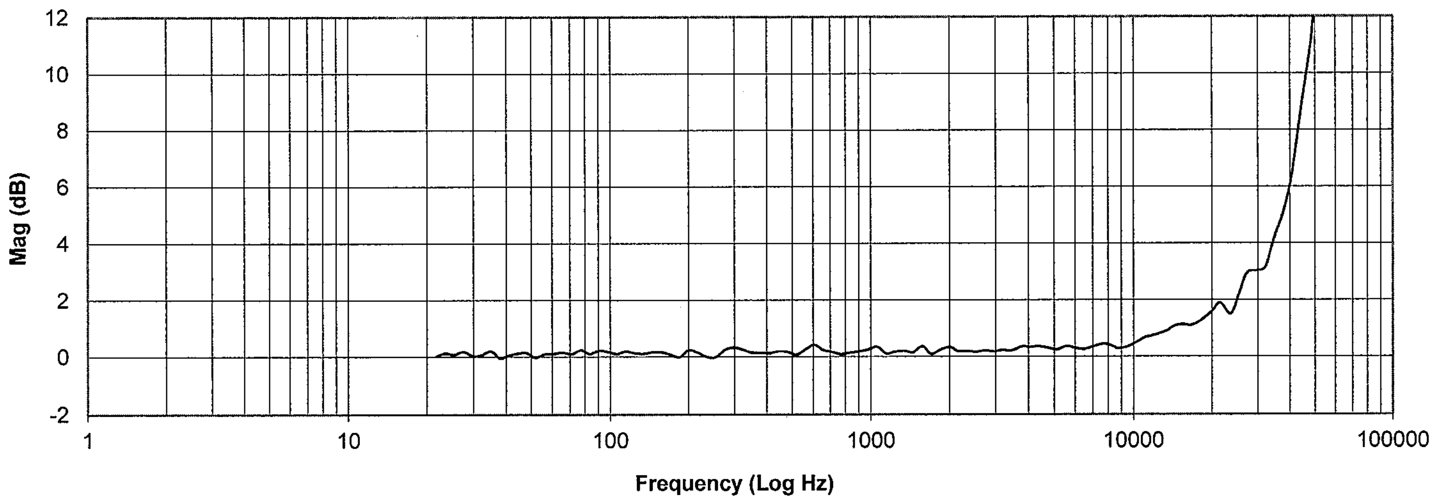
Manufacturer: PCB

Method: Sinusoidal Excitation (AT-601-1)

Calibration Data

Output @124 dB SPL	3.90	mV (pk/pk)			Reference Freq.:	250	Hz.
Sensitivity:	299.7	mV/psi	43.46	mV/kPa			
Acceleration Sens.:	0.0014	psi/g	0.0010	kPa/ms^{-2}	Dev. @ 10 kHz:	0.337	dB
Temperature:	71	°F	22	°C	Relative Humidity:	57	%

Electrostatic Frequency Response



Condition of Unit

As Found: n/a

As Left: New unit, in tolerance

Notes

1. Calibration is N.I.S.T. Traceable through Control No. CA322
2. Reference 0 dB = 20 μPa.
3. This certificate shall not be reproduced, except in full, without written approval from PCB Piezotronics, Inc.
4. Calibration is performed in compliance with ISO 9001, ISO 10012-1, ANSI/NCSL Z540-1-1994 and ISO 17025.
5. See Manufacturer's Specification Sheet for a detailed listing of performance specifications.
6. Measurement uncertainty (95% confidence level with coverage factor of 2) for reference frequency is +/-0.45 dB.

Technician: E. Kachermeyer

Date: 8/22/2014

ACCREDITED
CALIBRATION CERT # 1862.01

PCB PIEZOTRONICS INC.
PRESSURE DIVISION
3425 Walden Avenue
Depew, New York 14043
TEL: 888-684-0011 FAX: 716-686-9129 www.pcb.com

3491620234.13

PCB PIEZOTRONICS INC.

Model 106B

ICP® Pressure Sensor

Installation and Operating Manual

**For assistance with the operation of this product,
contact PCB Piezotronics, Inc.**

**Toll-free: 800-828-8840
24-hour SensorLine: 716-684-0001
Fax: 716-684-0987
E-mail: info@pcb.com
Web: www.pcb.com**

Total Customer Satisfaction
PCB PIEZOTRONICS

PCB PIEZOTRONICS INC.
A PCB GROUP COMPANY

Warranty, Service, Repair, and Return Policies and Instructions

The information contained in this document supersedes all similar information that may be found elsewhere in this manual.

Total Customer Satisfaction – PCB Piezotronics guarantees Total Customer Satisfaction. If, at any time, for any reason, you are not completely satisfied with any PCB product, PCB will repair, replace, or exchange it at no charge. You may also choose to have your purchase price refunded in lieu of the repair, replacement, or exchange of the product.

Service – Due to the sophisticated nature of the sensors and associated instrumentation provided by PCB Piezotronics, user servicing or repair is not recommended and, if attempted, may void the factory warranty. Routine maintenance, such as the cleaning of electrical connectors, housings, and mounting surfaces with solutions and techniques that will not harm the physical material of construction, is acceptable. Caution should be observed to insure that liquids are not permitted to migrate into devices that are not hermetically sealed. Such devices should only be wiped with a dampened cloth and never submerged or have liquids poured upon them.

Repair – In the event that equipment becomes damaged or ceases to operate, arrangements should be made to return the equipment to PCB Piezotronics for repair. User servicing or repair is not recommended and, if attempted, may void the factory warranty.

Calibration – Routine calibration of sensors and associated instrumentation is recommended as this helps build confidence in measurement accuracy and acquired data. Equipment calibration cycles are typically established by the users own quality regimen. When in doubt about a calibration cycle, a good "rule of thumb" is to recalibrate on an annual basis. It is also good practice to recalibrate after exposure to any severe temperature extreme, shock, load, or other environmental influence, or prior to any critical test.

PCB Piezotronics maintains an ISO-9001 certified metrology laboratory and offers calibration services, which are accredited by A2LA to ISO/IEC 17025, with full traceablility to N.I.S.T. In addition to the normally supplied calibration, special testing is also available, such as: sensitivity at elevated or cryogenic temperatures, phase response, extended high or low frequency response, extended range, leak testing, hydrostatic pressure testing, and others. For information on standard recalibration services or special testing, contact your local PCB Piezotronics distributor, sales representative, or factory customer service representative.

Returning Equipment – *Following these procedures will insure that your returned materials are handled in the most expedient manner.* Before returning any equipment to PCB Piezotronics, contact your local distributor, sales representative, or factory customer service representative to obtain a Return

Materials Authorization (RMA) Number. This RMA number should be clearly marked on the outside of all package(s) and on the packing list(s) accompanying the shipment. A detailed account of the nature of the problem(s) being experienced with the equipment should also be included inside the package(s) containing any returned materials.

A Purchase Order, included with the returned materials, will expedite the turn-around of serviced equipment. It is recommended to include authorization on the Purchase Order for PCB to proceed with any repairs, as long as they do not exceed 50% of the replacement cost of the returned item(s). PCB will provide a price quotation or replacement recommendation for any item whose repair costs would exceed 50% of replacement cost, or any item that is not economically feasible to repair. For routine calibration services, the Purchase Order should include authorization to proceed and return at current pricing, which can be obtained from a factory customer service representative.

Warranty – All equipment and repair services provided by PCB Piezotronics, Inc. are covered by a limited warranty against defective material and workmanship for a period of one year from date of original purchase. Contact PCB for a complete statement of our warranty. Expendable items, such as batteries and mounting hardware, are not covered by warranty. Mechanical damage to equipment due to improper use is not covered by warranty. Electronic circuitry failure caused by the introduction of unregulated or improper excitation power or electrostatic discharge is not covered by warranty.

Contact Information – International customers should direct all inquiries to their local distributor or sales office. A complete list of distributors and offices can be found at www.pcb.com. Customers within the United States may contact their local sales representative or a factory customer service representative. A complete list of sales representatives can be found at www.pcb.com. Toll-free telephone numbers for a factory customer service representative, in the division responsible for this product, can be found on the title page at the front of this manual. Our ship to address and general contact numbers are:

PCB Piezotronics, Inc.
3425 Walden Ave.
Depew, NY 14043 USA
Toll-free: (800) 828-8840
24-hour SensorLine^{SM}: (716) 684-0001
Website: www.pcb.com
E-mail: info@pcb.com

DOCUMENT NUMBER: 21354
DOCUMENT REVISION: B
ECN: 17900

OPERATION MANUAL FOR HIGH INTENSITY MICROPHONES MODELS 106B, 106B10, 106B50

1.0 INTRODUCTION

The Series 106B microphones feature high-sensitivity, acceleration-compensated quartz pressure elements coupled to built-in integrated circuit impedance converting amplifiers.

These very sensitive sensors are designed to measure pressure perturbations in air or in fluids in severe environments. They can also be used to measure very small pressure disturbances on a much higher static head, with certain precautions.

2.0 DESCRIPTION

The quartz elements in the 106B Series utilize a special cut in quartz to produce a proportionately higher output voltage than the standard X-cut compression crystals normally used.

A built-in seismic mass acting on another quartz crystal effectively cancels the spurious signal produced by the mass of the diaphragm and end piece acting upon the very sensitive crystals in the presence of axial vibration inputs.

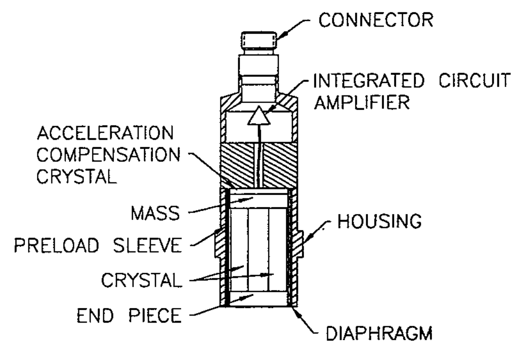
This design produces an extremely high level output signal with good resolution, relatively free from unwanted vibration effects.

As with all quartz sensors, the high rigidity results in negligible diaphragm motion producing excellent linearity from the threshold pressure to full-scale pressure. The high rigidity of quartz also results in sensors with high natural frequency, giving a very wide useful frequency range.

Although the same basic quartz element is used in both models, the sensitivity of the 106B50 is twice that of the 106B, the result of a larger diaphragm area in the B50.

The Model 106B10 consists of the Model 106B element in a customized package specifically designed for paper mill headbox measurements.
The built-in electronics consist of a low-noise MOSFET input source follower with unity gain. A single wire feeds constant current power to the source of the FET and also carries the dynamic signal, superimposed on the +3 to +5 bias.

See "Guide to ICP® Instrumentation, G-0001B" for a more complete treatment of the "Integrated Circuit Piezoelectric" (ICP®) concept.



Cross Section: Series 106B Microphone Element

3.0 POLARITY

Both models produce a positive-going output signal with increasing pressure at the diaphragm. Since the bias voltage of the low-noise electronics is rather low compared to other ICP® instruments, the output voltage capability is nonsymmetrical, i.e. the units can produce positive-going voltages to 12 or 13 volts with a +18 V battery supply, but the linear negative-going output voltage is limited to approximately 2.5 volts.

This is not a disadvantage because +2.5 volts provide an adequate output signal for most microphone applications and the higher positive-going voltage affords an ability to measure much higher positive-going pulses if desirable.

4.0 POWER UNITS

In general, it is advisable to use battery-powered signal conditioners (such as the 480C02) to power the Series 106 microphones because of their inherently low noise.

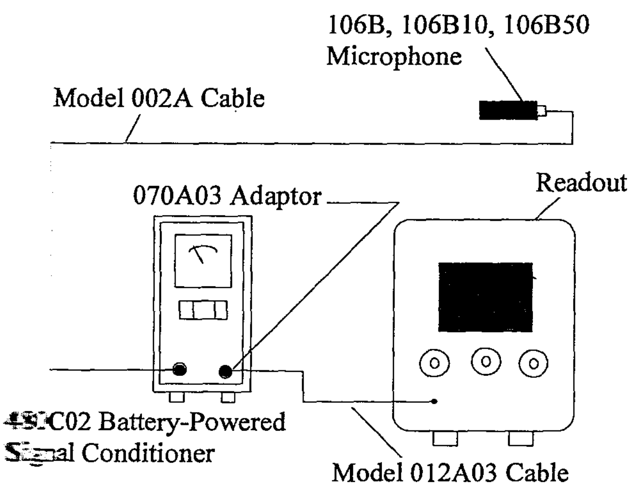
If line powering is desirable, consult the factory for help in selecting the best signal conditioner for the application.

Manual Number: 21083
Revision: A
ECR Number: 24751

These sensors must only be powered through constant-current diodes or other equivalent current-limiting circuitry, (2 to 20 mA) as contained in all PCB signal conditioners.

CAUTION: Never apply power directly to the center pin of the connector without the current-limiting protection (2 mA maximum), as to do so will destroy the built-in amplifier.

Connect the microphones to the power unit as shown in the figure below.



Typical Power Connection

The 106B, 106B10, and 106B50 differ from the standard ICP® sensors in that the low noise, built-in amplifiers have a +3 to +5 V bias or turn-on voltage instead of the usual +11 V bias. Consequently, the bias monitor voltmeter located on the front panel of most PCB signal conditioners will indicate approximately 20% full scale under normal operating conditions, rather than the mid-scale reading associated with normal operation for other ICP® instruments.

A full-scale reading on the bias monitor meter indicates an open circuit between the signal conditioner and sensor.

A zero reading indicates a short circuit in cable, connections, or sensor.

5.0 INSTALLATION

Consult the applicable installation drawing at the front of this manual for details on the preparation of mounting ports. For best high-frequency response, flush mounting of the diaphragm is desirable.

The standard type of mounting arrangement for these microphones is by use of the hollow clamp nut supplied (refer to installation drawing), but other methods of mounting the units are acceptable.

Non-metallic mounting adaptors for off-ground installations are available. Consult factory with your specific installation problem.

6.0 CALIBRATION

The 106B, 106B10, and 106B50 are calibrated by dynamic means over the full range by subjecting the unit to a series of calibrated pneumatic pressure steps. In addition, the units are given a 124 dB sound pressure level calibration at 250 Hz with a pistonphone. An electrostatic calibration is used to verify the sensor's frequency response.

Recalibration service is offered by PCB. Consult the factory for details.

7.0 MEASURING SMALL PRESSURE FLUCTUATIONS ON A HIGH STATIC HEAD

It is possible to measure small dynamic pressure variations superimposed upon a high static (pneumatic or hydraulic) head, but care must be exercised during application and removal of the static pressure to avoid destroying the input MOSFET amplifier.

The important point is to apply and release the static head slowly to allow the resistor across the quartz crystal to bleed off the charge and avoid a voltage build-up that can punch through the gate structure of the MOSFET, rendering it inoperative. (Approximately 100 V maximum rating.)

OPERATION MANUAL FOR HIGH INTENSITY MICROPHONES MODELS 106B, 106B10, 106B50

For the high sensitivity 106B50 (500 mV/psi), keep the rate of pressure application and removal below 200 psi/sec and do not exceed the maximum pressure rating of the unit. Remember that this rate must not be exceeded during removal of the static head as well as during application.

For the lower sensitivity 106B and 106B10, do not exceed a pressure application or removal rate of 300 psi/sec.

After the high static head is applied, allow time for all coupling capacitors in the readout circuit to fully charge (signified by an end to the apparent "drift" of the output signal), then proceed with the measurement.

8.0 MAINTENANCE

The sealed construction of the 106B Series precludes field maintenance and repair.

Should the time constant degrade or should an abnormality appear in the normal bias voltage, bake the unit in a +250 °F oven for 1 to 2 hours, then retest.

If this does not remove the problem, or should other problems occur, contact the factory for assistance in tracing the problem or for instructions on returning the unit for repair or replacement.

9.0 PRECAUTIONS

1. Do not apply voltage to the units without a current-limiting device (20 mA maximum) in the line, such as is incorporated in all PCB signal conditioners. To do so will destroy the built-in amplifier.

2. Do not subject these sensors to temperatures exceeding 250 °F.

3. Use caution when applying and releasing high static pressures (as outlined in Section 7.0 of this guide) to avoid destroying built-in amplifier.

4. Do not exceed maximum pressure rating.

Model Number 106B	ICP® PRESSURE SENSOR	Revision Y ECN #: 29620

ICP® PRESSURE SENSOR

Performance	ENGLISH	SI	
Measurement Range(for ±2.5V output)	8.3 psi	57.2 kPa	
Sensitivity(± 15 %)	300 mV/psi	43.5 mV/kPa	
Maximum Pressure(step)	200 psi	1379 kPa	
Maximum Pressure	2 kpsi	13,790 kPa	
Resolution	0.1 mpsi	0.00069 kPa	[1]
Resonant Frequency	≥ 60 kHz	≥ 60 kHz	
Rise Time	≤ 9 μ sec	≤ 9 μ sec	
Low Frequency Response(-5 %)	0.5 Hz	0.5 Hz	
Non-Linearity	≤ 1 % FS	≤ 1 % FS	[2]
Environmental			
Acceleration Sensitivity	≤ 0.002 psi/g	≤ 0.0014 kPa/(m/s²)	
Temperature Range(Operating)	-65 to +250 °F	-54 to +121 °C	
Temperature Coefficient of Sensitivity	≤ 0.05 %/°F	≤ 0.09 %/°C	
Maximum Flash Temperature	3000 °F	1649 °C	
Maximum Shock	2000 g pk	19,600 m/s² pk	
Electrical			
Output Polarity(Positive Pressure)	Positive	Positive	
Discharge Time Constant(at room temp)	≥ 1 sec	≥ 1 sec	
Excitation Voltage	12 to 30 VDC	12 to 30 VDC	
Constant Current Excitation	2 to 20 mA	2 to 20 mA	
Output Impedance	≤ 100 ohm	≤ 100 ohm	
Output Bias Voltage	3 to 8 VDC	3 to 8 VDC	
Physical			
Sensing Geometry	Compression	Compression	
Sensing Element	Quartz	Quartz	
Housing Material	304/304L Stainless Steel	304/304L Stainless Steel	
Diaphragm	316L Stainless Steel	316L Stainless Steel	
Sealing	Welded Hermetic	Welded Hermetic	
Electrical Connector	10-32 Coaxial Jack	10-32 Coaxial Jack	
Weight	0.63 oz	18.0 gm	

CE [3]

All specifications are at room temperature unless otherwise specified.
In the interest of constant product improvement, we reserve the right to change specifications without notice.

ICP® is a registered trademark of PCB Group, Inc.

OPTIONAL VERSIONS

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

E - Emralon coating

Coating	Emralon	Emralon
Electrical Isolation	10^8 ohm	10^8 ohm

Supplied Accessory : Model 065A47 Seal ring 0.497 OD x 0.437 ID x 0.025 thk Delrin (3)

J - Ground Isolated [4]

T - TEDS Capable of Digital Memory and Communication Compliant with IEEE P1451.4

Output Bias Voltage	3.7 to 8.7 VDC	3.7 to 8.7 VDC

W - Water Resistant Cable [5]
Supplied Accessory : Model 060A12 Clamp nut, 9/16-18-2A thd, 9/16" hex (1)

WM - Water Resistant Cable [5]
Supplied Accessory : Model 060A14 Metric clamp nut, M14 x 1.25-6g thd, 14 mm hex, stainless steel (1)

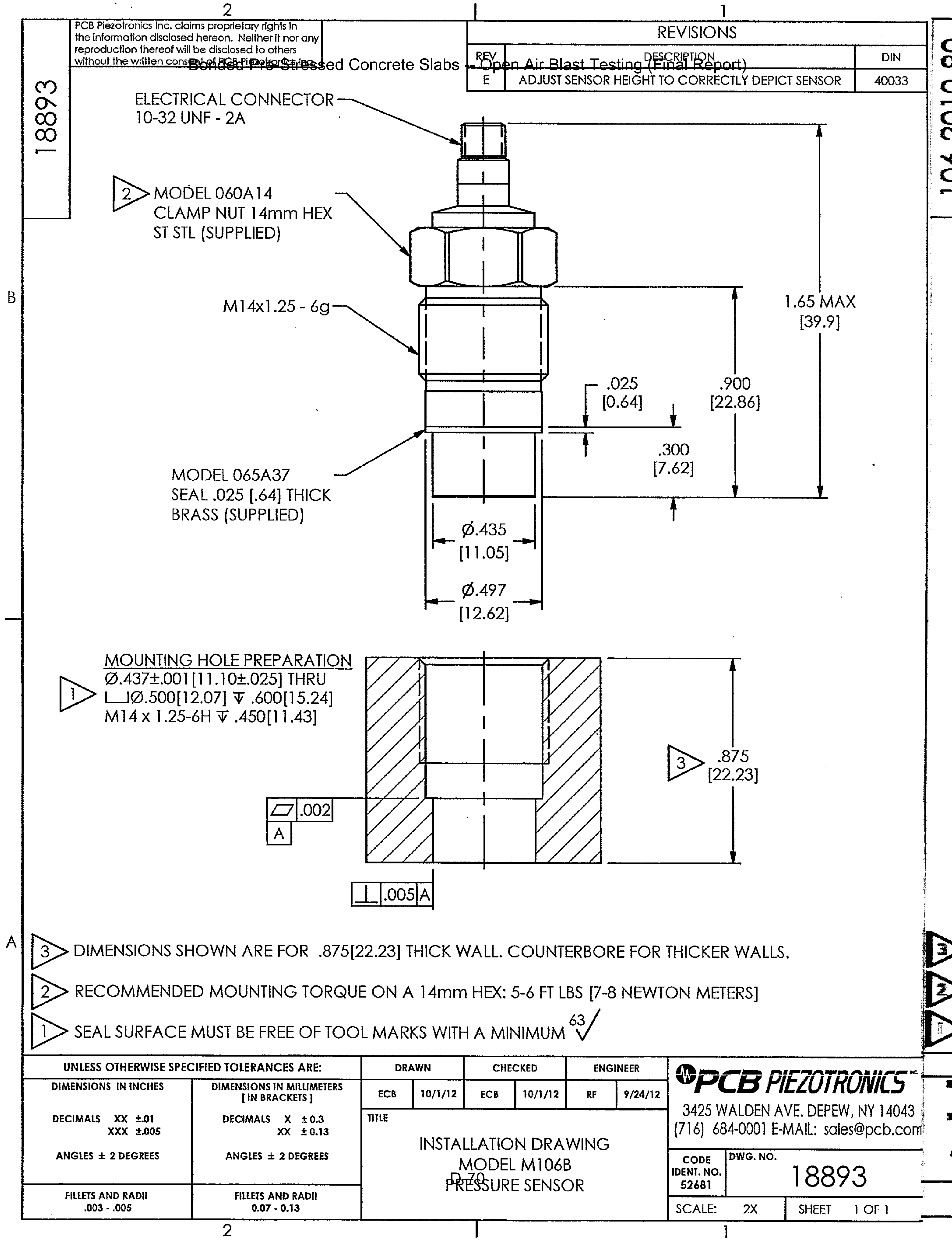
NOTES:
[1] Typical.
[2] Zero-based, least-squares, straight line method.
[3] See PCB Declaration of Conformance PS023 for details.
[4] Used with optional mounting adaptor.
[5] Clamp nut installed prior to cable attachment

SUPPLIED ACCESSORIES:
Model 060A12 Clamp nut, 9/16-18-2A thd, 9/16" hex (1)
Model 060A14 Metric clamp nut, M14 x 1.25-6g thd, 14 mm hex, stainless steel (1)
Model 065A37 Seal ring 0.497 OD x 0.437 ID x 0.025 thk Brass (3)

Entered: BLS	Engineer: NJL	Sales: RWH	Approved: RF	Spec Number:
Date: 10/17/08	Date: 10/2/08	Date: 10/3/08	Date: 10/2/08	106-2010-80

PCB PIEZOTRONICS™
PRESSURE DIVISION
3425 Walden Avenue, Depew, NY 14043

Phone: 716-684-0001
Fax: 716-686-9129
E-Mail: pressure@pcb.com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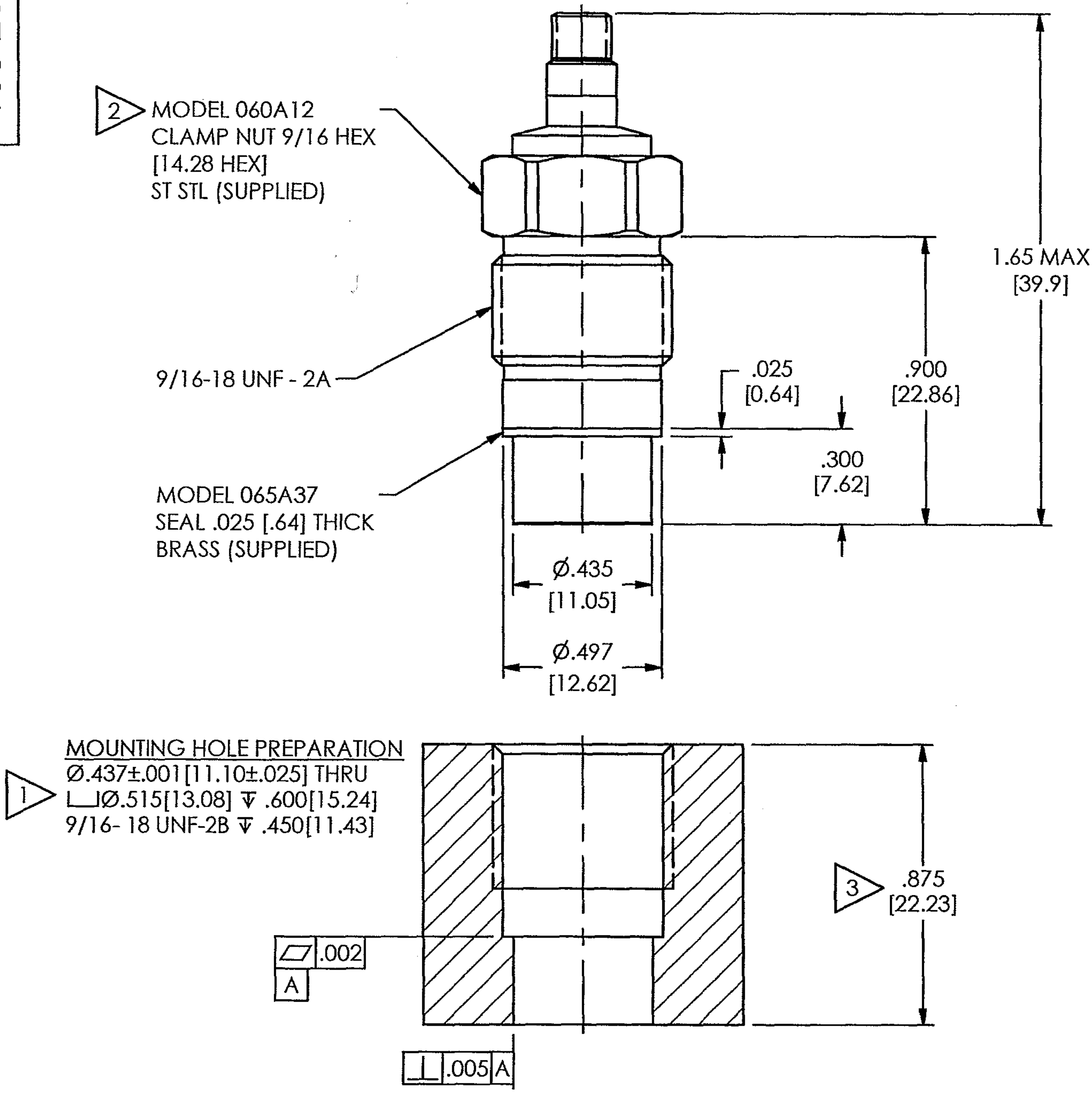
18893
REVISIONS
REV
DESCRIPTION
DIN
E
ADJUST SENSOR HEIGHT TO CORRECTLY DEPICT SENSOR
40033
ELECTRICAL CONNECTOR 10-32 UNF - 2A
2
MODEL 060A14 CLAMP NUT 14mm HEX ST STL (SUPPLIED)
M14x1.25 - 6g
1.65 MAX [39.9]
.025 [0.64]
.900 [22.86]
.300 [7.62]
MODEL 065A37 SEAL .025 [.64] THICK BRASS (SUPPLIED)
Ø.435 [11.05]
Ø.497 [12.62]
MOUNTING HOLE PREPARATION
1
Ø.437±.001[11.10±.025] THRU
⌴Ø.500[12.07] ↧ .600[15.24]
M14 x 1.25-6H ↧ .450[11.43]
3
.875 [22.23]
.002
A
⊥ .005 A
3 DIMENSIONS SHOWN ARE FOR .875[22.23] THICK WALL. COUNTERBORE FOR THICKER WALLS.
2 RECOMMENDED MOUNTING TORQUE ON A 14mm HEX: 5-6 FT LBS [7-8 NEWTON METERS]
1 SEAL SURFACE MUST BE FREE OF TOOL MARKS WITH A MINIMUM 63√
UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:
DIMENSIONS IN INCHES
DECIMALS XX ±.01 XXX ±.005
ANGLES ± 2 DEGREES
FILLETS AND RADII .003 - .005
DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS X ±0.3 XX ±0.13
ANGLES ± 2 DEGREES
FILLETS AND RADII 0.07 - 0.13
DRAWN ECB 10/1/12
CHECKED ECB 10/1/12
ENGINEER RF 9/24/12
TITLE
INSTALLATION DRAWING MODEL M106B PRESSURE SENSOR
PCB PIEZOTRONICS
3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 E-MAIL: sales@pcb.com
CODE IDENT. NO. 52681
DWG. NO. 18893
SCALE: 2X
SHEET 1 OF 1

106-2010-90

REVISIONS		
REV	DESCRIPTION	DIN
F	ADJUST SENSOR HEIGHT TO CORRECTLY DEPICT SENSOR	40033



3 DIMENSIONS SHOWN ARE FOR .875[22.23] THICK WALL. COUNTERBORE FOR THICKER WALLS.

2 RECOMMENDED MOUNTING TORQUE ON A 9/16 HEX: 5-6 FT LBS [.691 - .830 METER KILOGRAMS]

1 SEAL SURFACE MUST BE FREE OF TOOL MARKS WITH A MINIMUM 63√

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:		DRAWN		CHECKED		ENGINEER	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]	ECB	9/24/12	ECB	9/24/12	RF	9/24/12
DECIMALS XX ±.01, XXX ±.005; ANGLES ± 2 DEGREES	DECIMALS X ±0.3, XX ±0.13; ANGLES ± 2 DEGREES	TITLE: INSTALLATION DRAWING MODEL 106B PRESSURE SENSOR					
FILLETS AND RADII .003 - .005	FILLETS AND RADII 0.07 - 0.13						

PCB PIEZOTRONICS
3425 WALDEN AVE. DEPEW, NY 14043
(716) 684-0001 E-MAIL: sales@pcb.com

CODE IDENT. NO. 52681 | DWG. NO. 106-2010-90

SCALE: 2X | SHEET 1 OF 1

APPENDIX E. TEST RESULTS DOCUMENTATION

Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 1 - Panel 5

Test Date: January 7, 2016

Charge Material: ANFO

Charge Weight: 1300 lb

Charge Standoff: 30 ft to Center of Charge

Pre-Test Specimen Temperature: 36 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		725 psi (5 MPa)	5.9 lb/ft^3 (95 kg/m^3)	9430 psi (65.0 MPa)

Specimen Response

Description: The blast load resulted in significant front face scabbing of the concrete cover. On the back face, the test panel showed prominent cracking/crushing along the vertical supports and the bottom horizontal support. Horizontal cracks up to 1/4-inch (6mm) thick occurred near, but below the panel mid-height. Lighter cracking was visible over a wide region in the center of the panel. Cracking through the thickness of the slab was also observed.

The maximum inbound permanent deflection recorded was 2.7 inches (68 mm). No rebound deflection was noted post-test.

Damage to the steel frame was observed after testing completed, particularly along the welds at the upper corners. Significant deformation of the steel pedestals was also visible.

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 1 - Panel 5	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 7, 2016	

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	849	0.8818	
2	2-SG-1-F-V	-914	0.8782	Broken wire after 3.86 seconds
3	3-SG-2-F-H	3441	0.8885	Wire broken at 0.8886 seconds
4	4-SG-2-F-V	669	0.8891	
5	5-SG-3-F-H	N/A	N/A	Intermittent connection
6	6-SG-3-F-V	N/A	N/A	Intermittent connection and broken wire
7	7-SG-4-F-H	N/A	N/A	Intermittent connection
8	8-SG-4-F-V	N/A	N/A	Intermittent connection
9	9-SG-5-F-H	1190	0.8864	Broken wire at 0.9432 seconds
10	10-SG-5-F-V	11,056	0.8916	Broken wire at 0.8916 seconds
11	11-SG-6-F-H	614	0.8907	Intermittent connection from 0.935 to 1.74 s
12	12-SG-6-F-V	411	0.9172	Intermittent connection from 0.89 to 0.91 s
13	13-SG-1-R-H	N/A	N/A	No sensor response
14	14-SG-1-R-V	N/A	N/A	No sensor response
15	15-SG-2-R-H	N/A	N/A	No sensor response
16	16-SG-2-R-V	N/A	N/A	No sensor response
17	17-SG-3-R-H	-317	0.8779	
18	18-SG-3-R-V	N/A	N/A	No sensor response
19	19-SG-4-R-H	N/A	N/A	No sensor response
20	20-SG-4-R-V	-2316	0.8806	Wire broken at 0.8810 seconds
21	21-SG-5-R-H	N/A	N/A	No sensor response
22	22-SG-5-R-V	N/A	N/A	No sensor response
23	23-SG-6-R-H	N/A	N/A	No sensor response
24	24-SG-6-R-V	N/A	N/A	No sensor response
25	25-SG-7-R-H	-142	0.9071	
26	26-SG-7-R-V	N/A	N/A	No sensor response
27	27-SG-8-R-H	N/A	N/A	No sensor response
28	28-SG-8-R-V	N/A	N/A	No sensor response
29	29-SG-9-R-H	N/A	N/A	No sensor response
30	30-SG-10-R-V	N/A	N/A	No sensor response

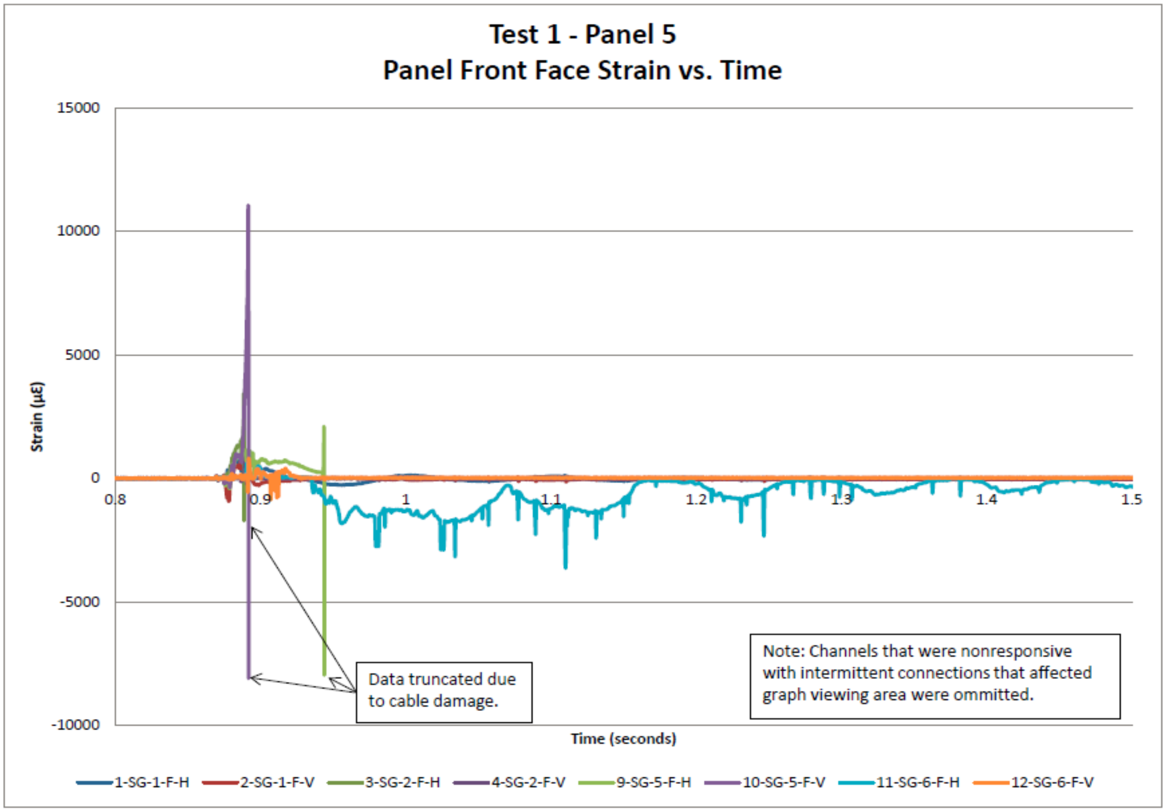
Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 1 - Panel 5
Test Date: January 7, 2016

Charge Material: ANFO
Charge Weight: 1300 lb
Charge Standoff: 30 ft to Center of Charge

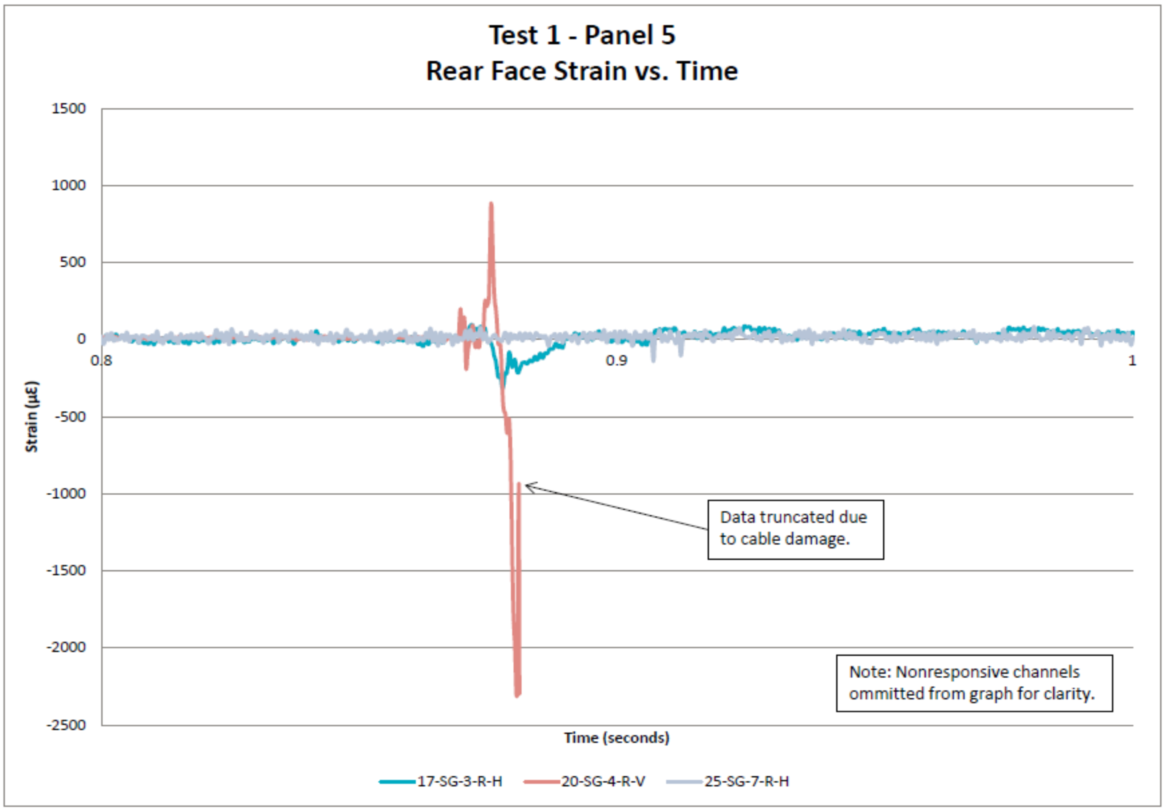


Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 1 - Panel 5	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 7, 2016	



Stone OBL

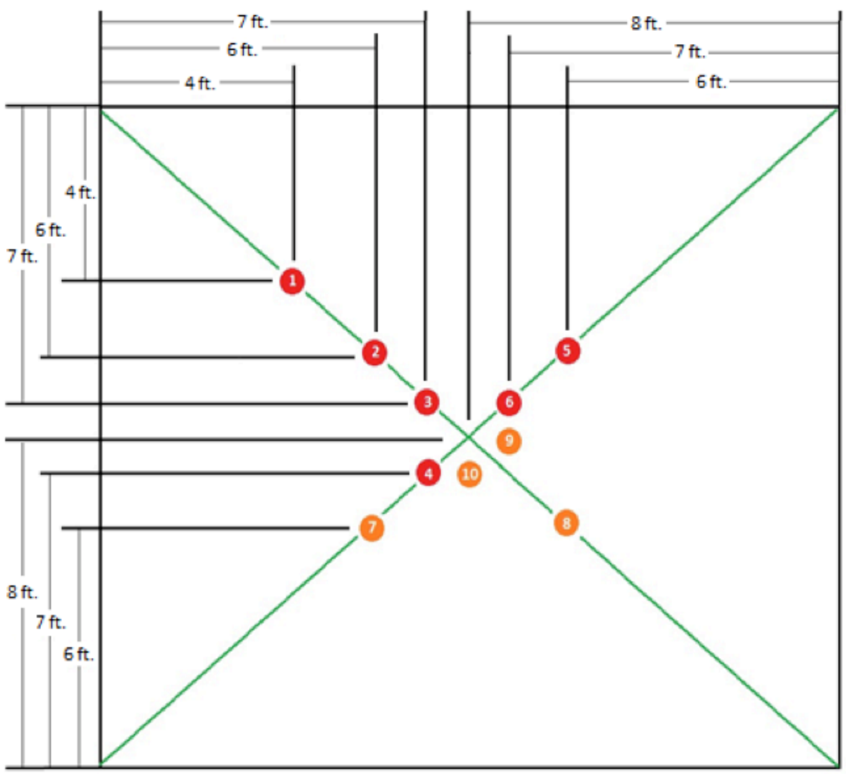
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 1 - Panel 5	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 7, 2016	

Strain Gauge Locations

Slab Design A		
Rebar Locat.	X-bar	Y-bar
1	9	9
2	13	13
3	15	15
4	17	14
5	21	12
6	14	18
7	12	21
8	18	19
9	20	16
10	16	20



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 1 - Panel 5
Test Date: January 7, 2016

Charge Material: ANFO
Charge Weight: 1300 lb
Charge Standoff: 30 ft to Center of Charge

Displacement Gauge Information
(see attached diagram for locations)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	N/A	N/A	67	Sensor functional, broken wire between amplifier and data acquisition system
32	N/A	N/A	68	Sensor functional, broken wire between amplifier and data acquisition system

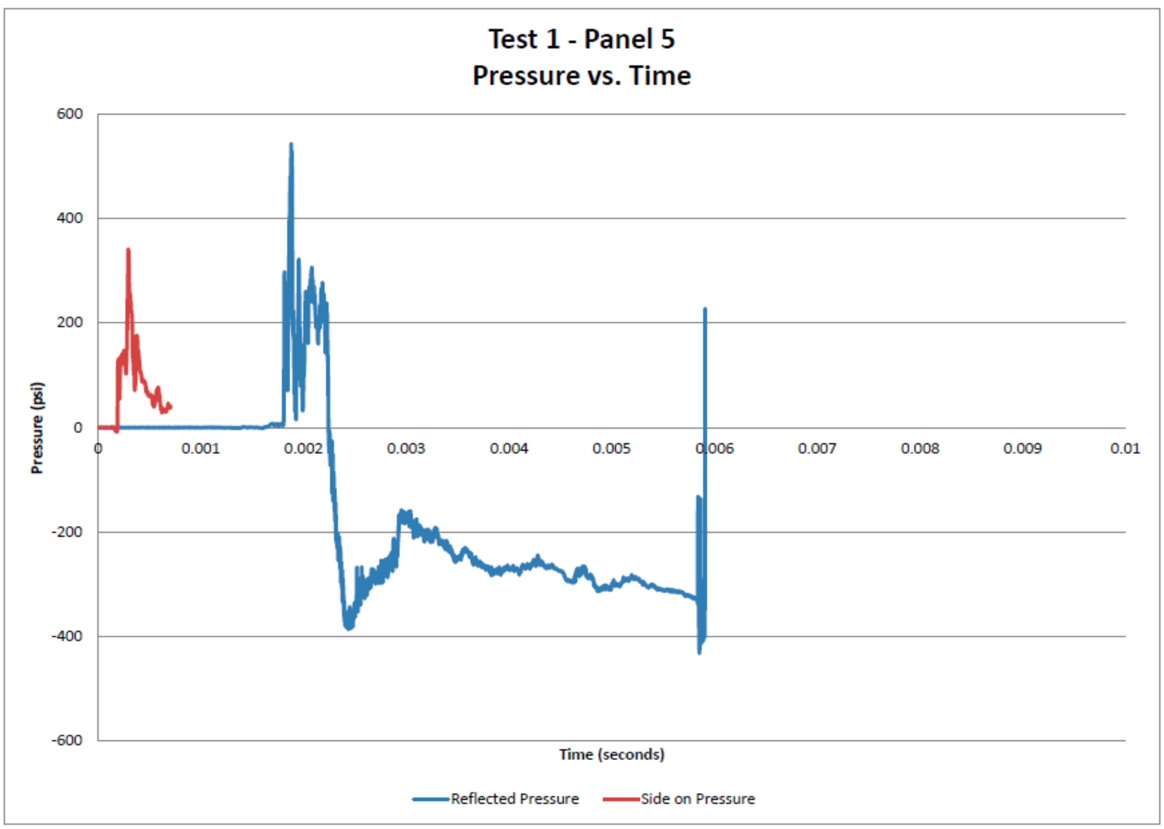
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 1 - Panel 5	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 7, 2016	

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
33	341	52.3	N/A	N/A	Wire broken after 0.000705 s
34	5.7	7.8	-5.7	N/A	Located inside test fixture
35	14.8	94.2	N/A	N/A	Located behind test fixture
36	542	92.4	-387	N/A	Signal becomes noisy after 0.0058 seconds

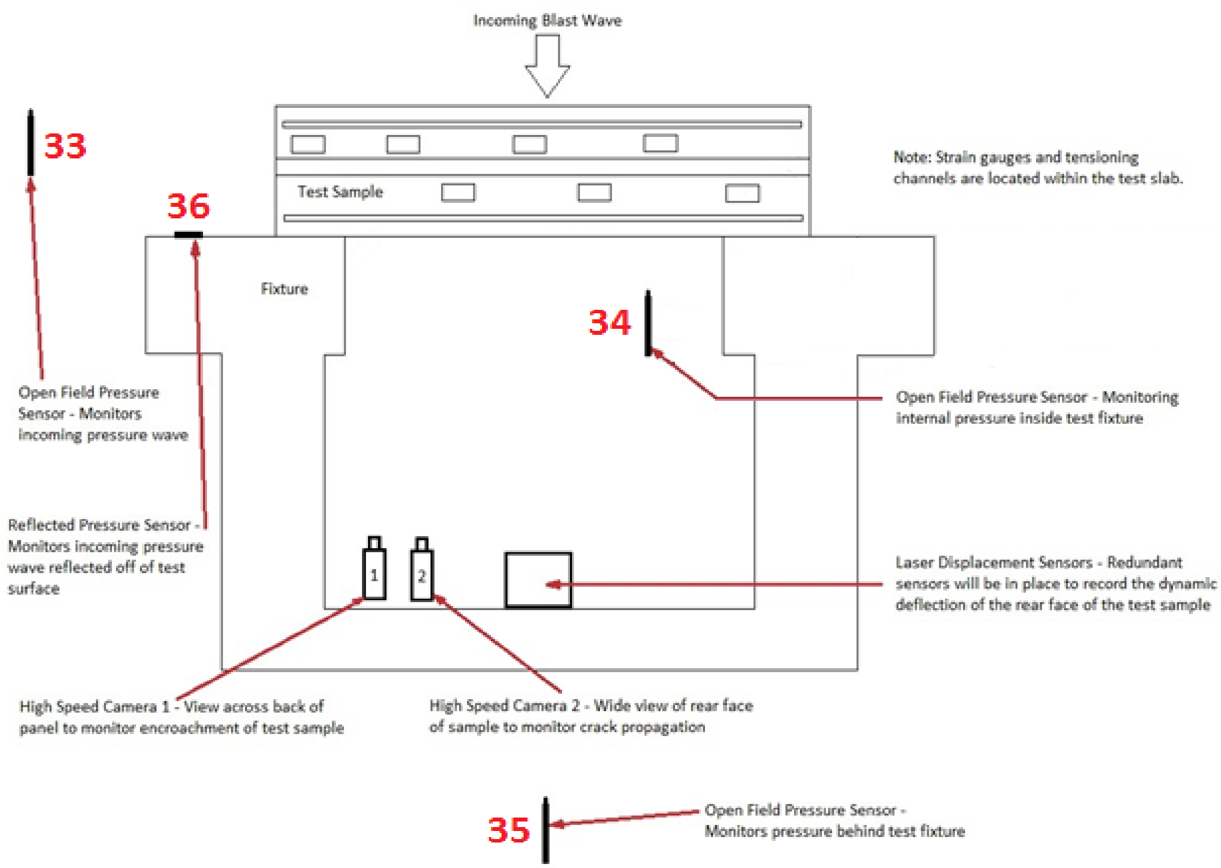


Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 1 - Panel 5	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 7, 2016	

Gauge Locations



StoneDBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 1 - Panel 5
Test Date: January 7, 2016

Charge Material: ANFO
Charge Weight: 1300 lb
Charge Standoff: 30 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (in)	Final Measurement (in)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2					
V2	H3					
V2	H4					
V2	H5					
V2	H6					
V3	H1					
V3	H2					
V3	H3					
V3	H4					
V3	H5					
V3	H6					
V4	H1	2.375	1.625		19.1	0.750
V4	H2	1.875				
V4	H3	1.75				
V4	H4	1.625				
V4	H5	1.625	0.875		19.1	0.750
V4	H6	2.25	1.75		12.7	0.500
V5	H1	2.375	2		9.5	0.375
V5	H2	1.8125	0.75		27.0	1.063
V5	H3	1.75				
V5	H4	1.6875				
V5	H5	1.625	1		15.9	0.625
V5	H6	2.25	1.75		12.7	0.500
V6	H1	2.375	2.5		-3.2	-0.125
V6	H2	2.25	1.625		15.9	0.625
V6	H3	2.25	1.375		22.2	0.875
V6	H4	2.25	1.25		25.4	1.000
V6	H5	2.125	1.25		22.2	0.875
V6	H6	2.25	2.25		0.0	0.000

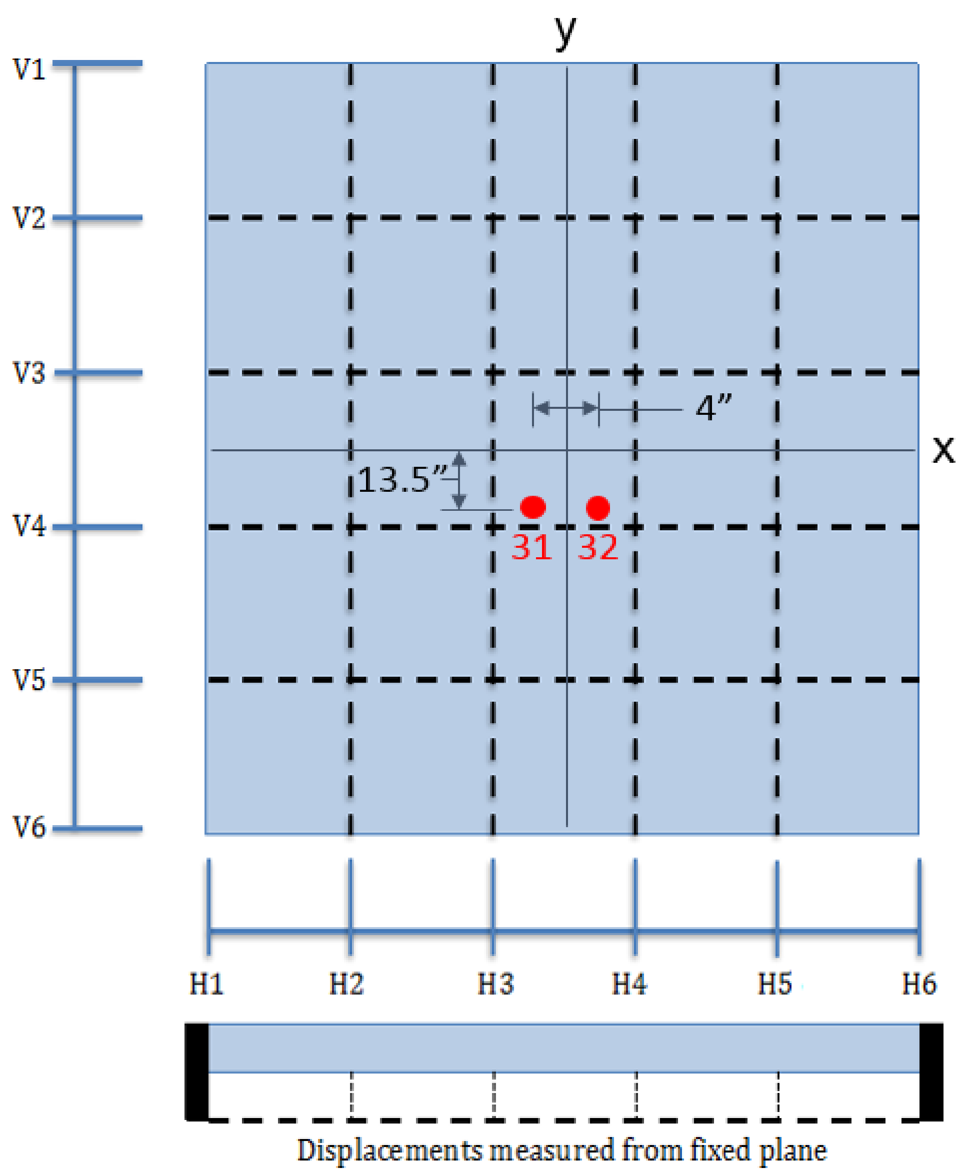
StoneOBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 1 - Panel 5	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 7, 2016	

Deflection Measurement Locations



Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 2 - Panel 1

Test Date: January 8, 2016

Charge Material: ANFO

Charge Weight: 1300 lb

Charge Standoff: 30 ft to Center of Charge

Pre-Test Specimen Temperature: 17 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		725 psi (5 MPa)	5.9 lb/ft^3 (95 kg/m^3)	7830 psi (54.0 MPa)

Specimen Response

Description: The blast load resulted in significant front face scabbing of the concrete cover. On the back face, the test panel showed prominent cracking/crushing along the vertical supports. Horizontal cracks up to 1/4-inch (6mm) thick occurred near, but below the panel mid-height. Lighter cracking was visible over a wide region in the center of the panel. Cracking through the thickness of the slab was also observed.

The maximum deflection recorded with the laser sensors was 5.8 inches (148 mm) a few inches above a horizontal crack located 18 inches (457 mm) below the slab mid-height. The manual displacement reader recorded a maximum deflection at this crack of 6.8 inches (171 mm). A maximum inbound permanent deflection of 4.6 inches (117 mm) was observed, while no rebound deflection was noted post-test.

Damage to the steel frame was observed after testing completed, particularly along the welds at the upper corners. Visible, but less prominent damage occurred at the weld at the bottom left corner of the frame.

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 2 - Panel 1	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 8, 2016	

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	3287	0.7898	4' down in center, Wire broken at 0.7900 s
2	2-SG-2-F-H	5911	0.7860	Center of panel, Wire broken at 0.7862 s
3	3-SG-3-F-H	1911	0.7800	12' down in center, Wire broken at 0.7801 s
4	4-SG-1-F-V	2679	0.7813	4' from left edge, Wire broken at 0.7815 s
5	5-SG-2-F-V	1221	0.7731	Center of panel, Wire broken at 0.7809 s
6	6-SG-3-F-V	N/A	N/A	12' from left edge, Sensor had no response
7	7-SG-4-F-H	N/A	N/A	No strain gauge installed
8	8-SG-4-F-V	N/A	N/A	No strain gauge installed
9	9-SG-5-F-H	N/A	N/A	No strain gauge installed
10	10-SG-5-F-V	N/A	N/A	No strain gauge installed
11	11-SG-6-F-H	N/A	N/A	No strain gauge installed
12	12-SG-6-F-V	N/A	N/A	No strain gauge installed
13	13-SG-1-R-H	465	0.7948	
14	14-SG-1-R-V	-4051	0.7843	
15	15-SG-2-R-H	-3013	0.7838	
16	16-SG-2-R-V	N/A	N/A	Noisy Connection
17	17-SG-3-R-H	-888	0.7798	Wire broken at 0.7804 s
18	18-SG-3-R-V	-13,134	0.7836	Permanent Strain: -8890 με
19	19-SG-4-R-H	7081	0.7819	Wire broken at 0.7894 s
20	20-SG-4-R-V	-14,152	0.7866	Permanent Strain: -6910 με
21	21-SG-5-R-H	-4093	0.7837	Permanent Strain: -1040 με
22	22-SG-5-R-V	-8654	0.7845	Permanent Strain: -4435 με
23	23-SG-6-R-H	209	0.7947	
24	24-SG-6-R-V	-12,791	0.7838	Permanent Strain: -1640 με
25	25-SG-7-R-H	-3707	0.7918	Permanent Strain: -1100 με
26	26-SG-7-R-V	-3535	0.7839	Permanent Strain: -800 με
27	27-SG-8-R-H	-5757	0.7865	Permanent Strain: -1100 με
28	28-SG-8-R-V	-3899	0.7881	Permanent Strain: -600 με
29	29-SG-9-R-H	N/A	N/A	Strain gauge had no response
30	30-SG-10-R-V	-5313	0.7868	Permanent Strain: -2400 με

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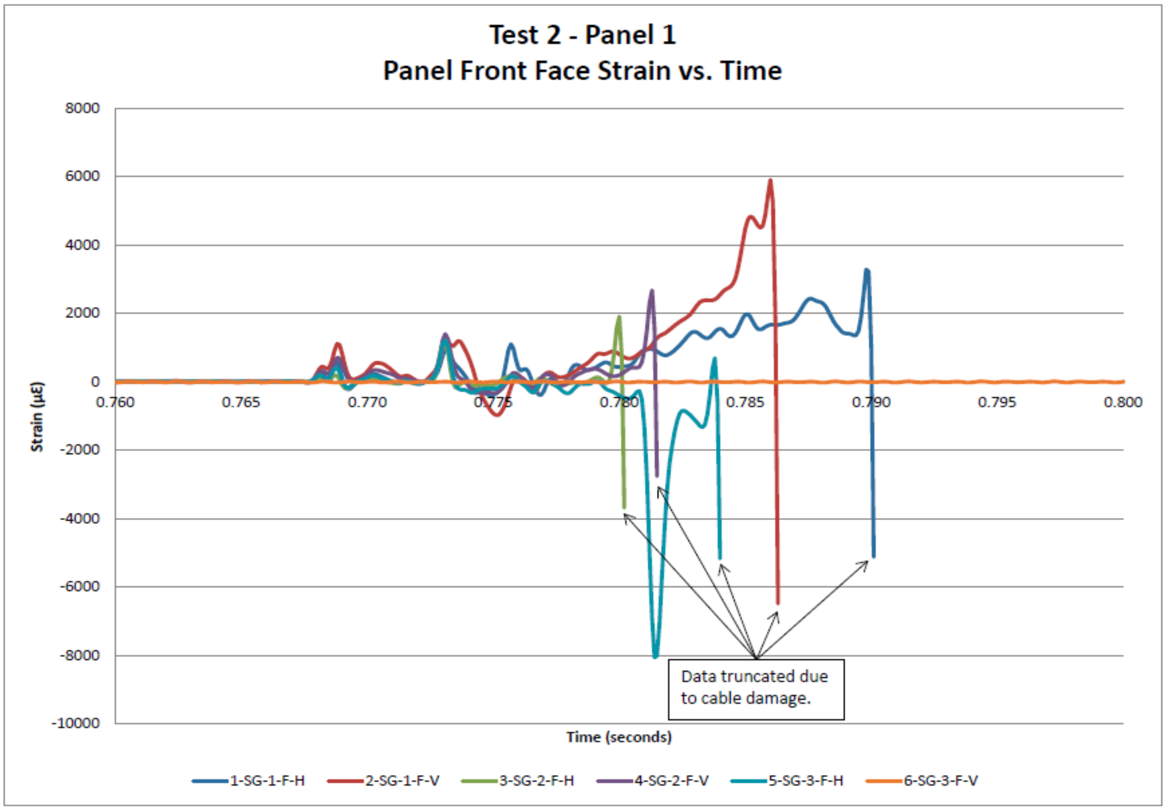
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 2 - Panel 1	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 8, 2016	



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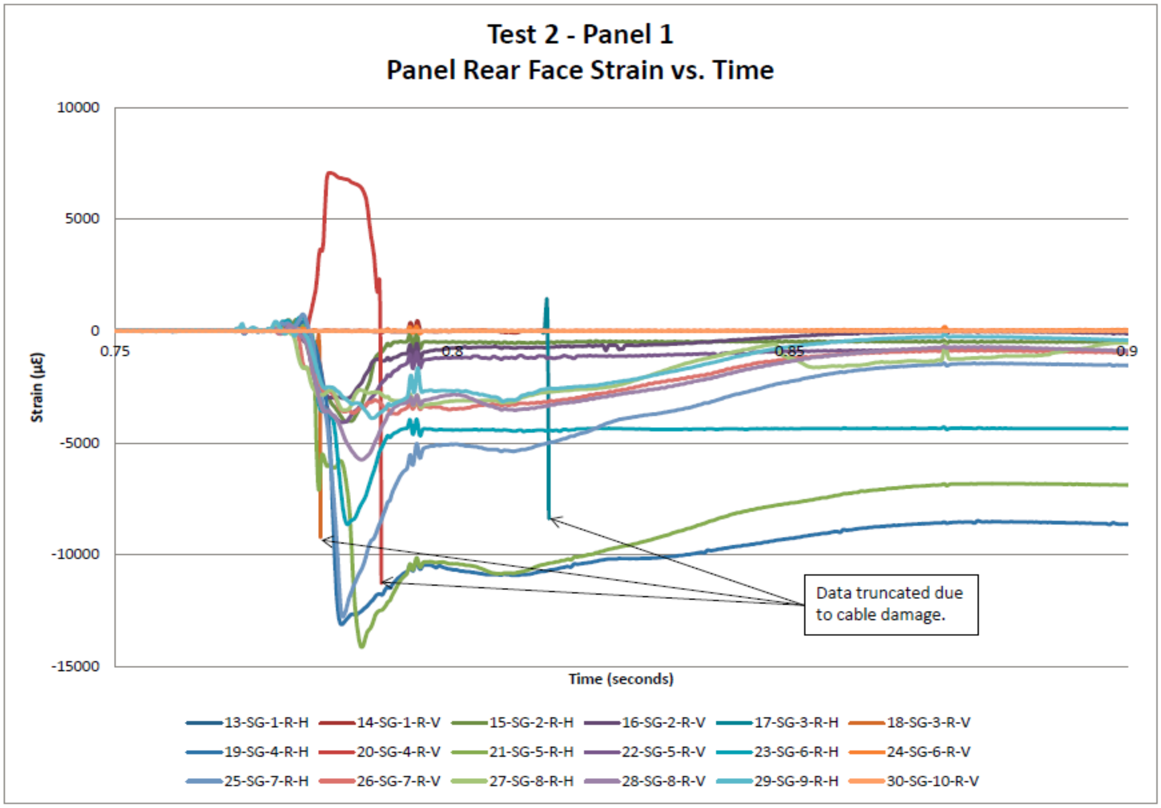
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 2 - Panel 1	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 8, 2016	



Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

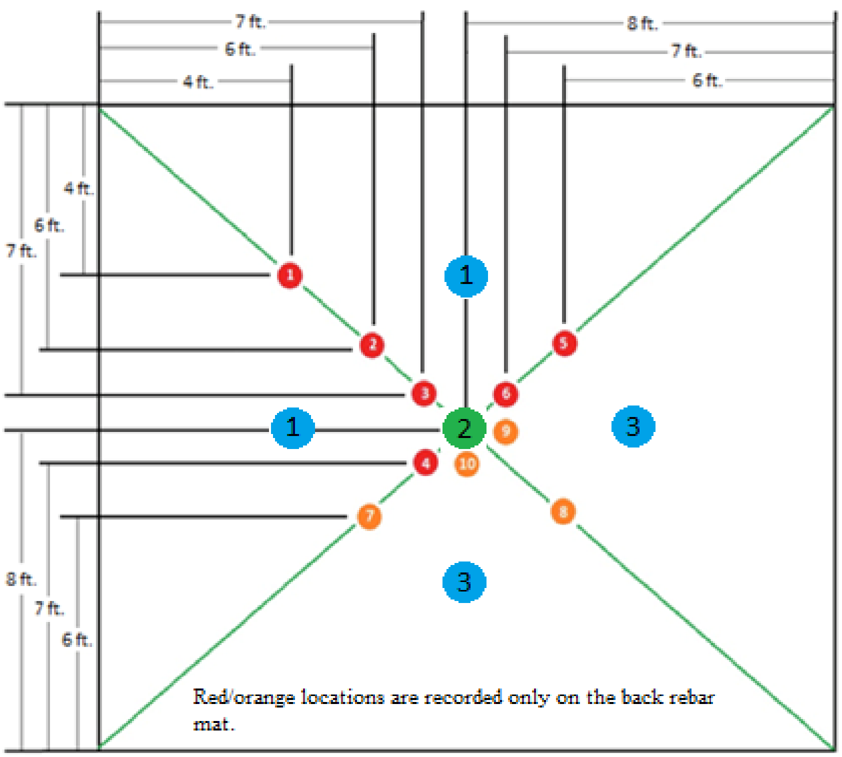
Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 2 - Panel 1
Test Date: January 8, 2016

Charge Material: ANFO
Charge Weight: 1300 lb
Charge Standoff: 30 ft to Center of Charge

Strain Gauge Locations

Slab Design A (Red/Orange)		
Rebar Locat.	X-bar	Y-bar
1	9	9
2	13	13
3	15	15
4	17	14
5	21	12
6	14	18
7	12	21
8	18	19
9	20	16
10	16	20

Slab Design A (Blue/Green)		
Rebar Locat.	X-bar	Y-bar
1	8	8
2	16	16
3	24	24



Red/orange locations are recorded only on the back rebar mat.
Blue locations are recorded only on the front rebar mat (horiz. or vert.)
Green locations are recorded only on the front rebar mat (horiz. and vert.)

Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 2 - Panel 1

Test Date: January 8, 2016

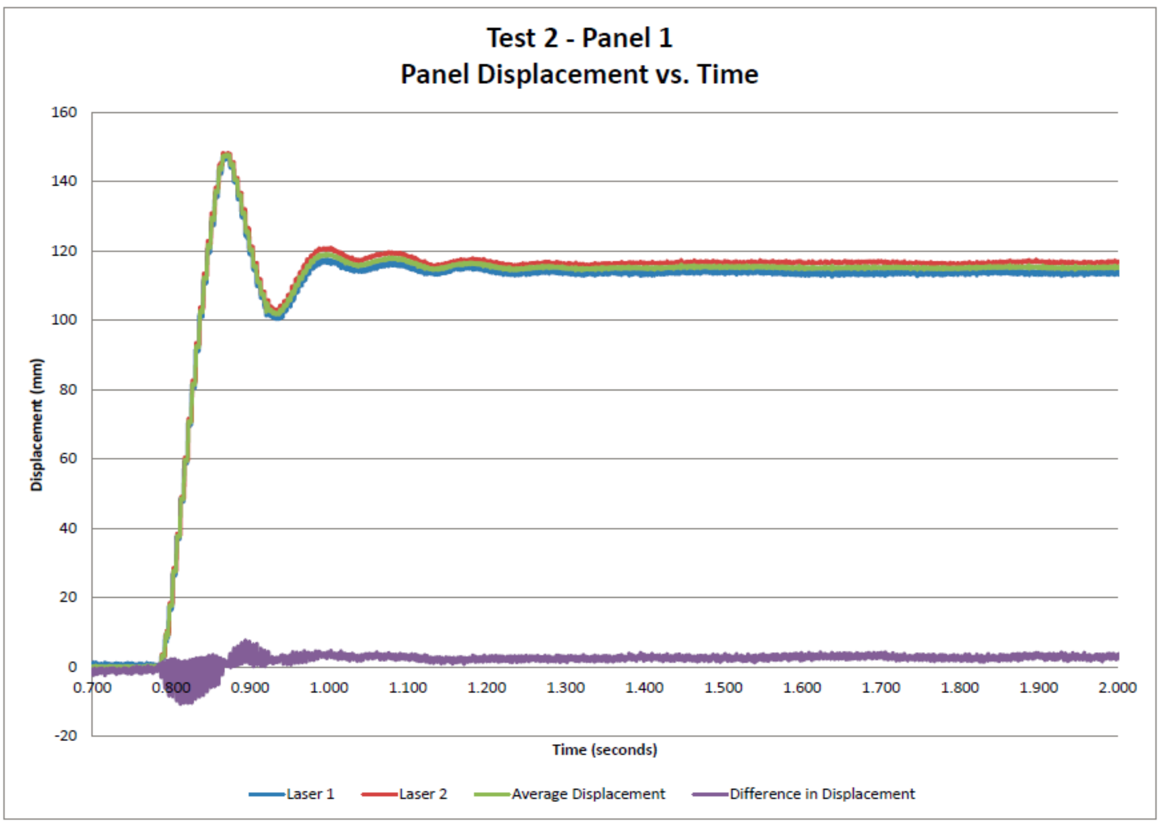
Charge Material: ANFO

Charge Weight: 1300 lb

Charge Standoff: 30 ft to Center of Charge

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	148	0.8715	113	Located 13.5 inches below slab centerline
32	148	0.8721	117	Located 2.3 inches below slab centerline



Stone OBL

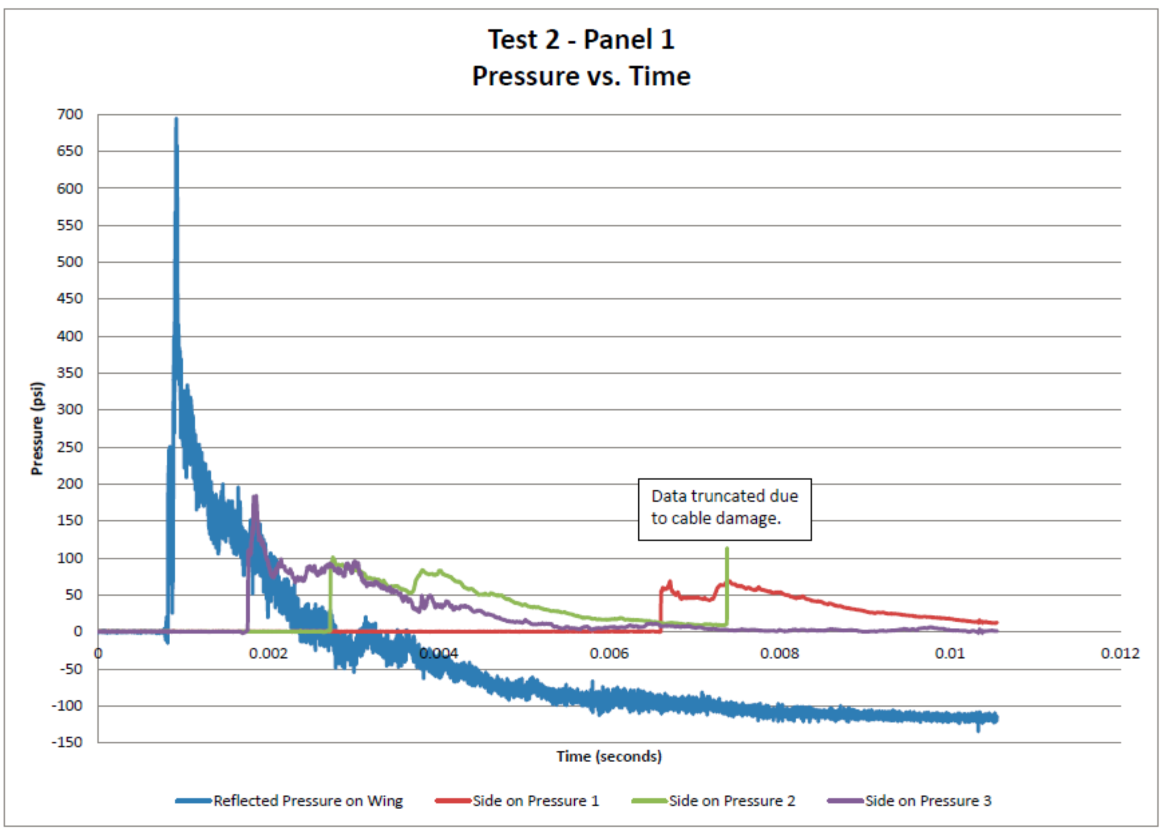
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 2 - Panel 1	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 8, 2016	

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
33	69.1	152	N/A	N/A	
34	101	195	N/A	N/A	
35	148	218	N/A	N/A	
36	695	239	-135	N/A	



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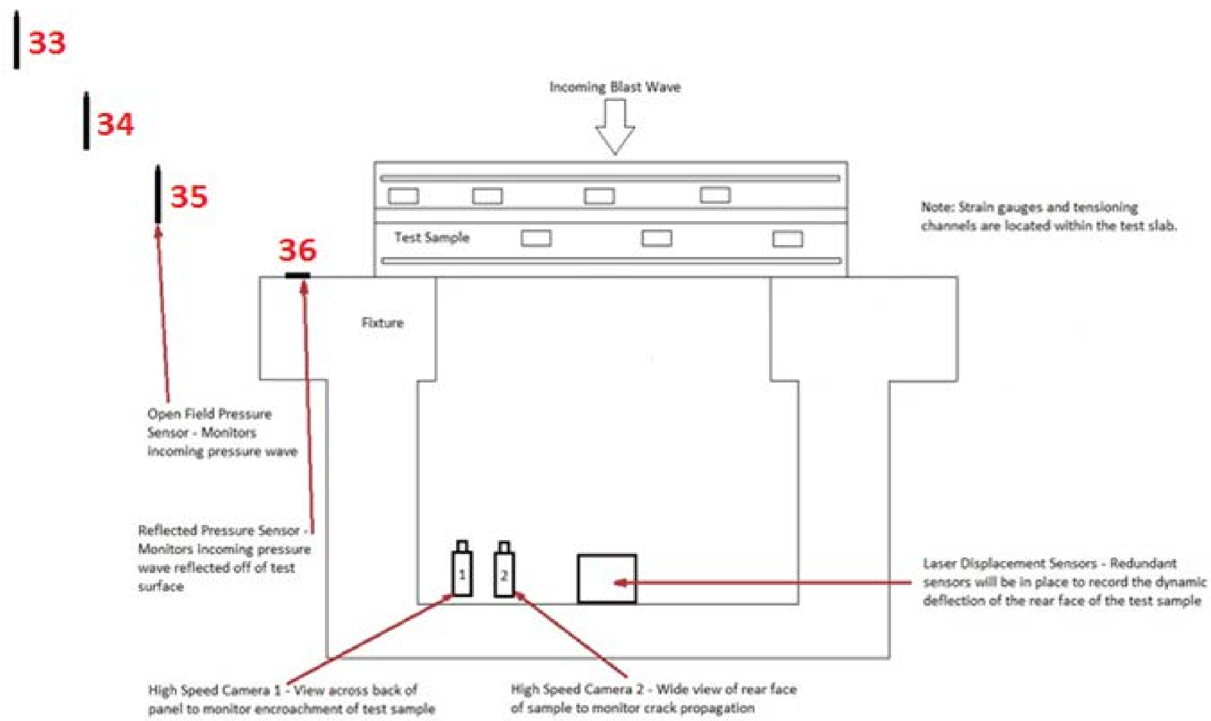
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 2 - Panel 1	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 8, 2016	

Gauge Locations



Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 2 - Panel 1
Test Date: January 8, 2016

Charge Material: ANFO
Charge Weight: 1300 lb
Charge Standoff: 30 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.17	12.02		45.7	1.800
V2	H3	12.18	11.98		61.0	2.400
V2	H4	12.19	11.8		118.9	4.680
V2	H5	12.18	11.99		57.9	2.280
V2	H6					
V3	H1					
V3	H2	12.18	11.95		70.1	2.760
V3	H3	12.18	11.89		88.4	3.480
V3	H4	12.18	11.87		94.5	3.720
V3	H5	12.17	11.88		88.4	3.480
V3	H6					
V4	H1					
V4	H2	12.2	11.88		97.5	3.840
V4	H3	12.2	11.82		115.8	4.560
V4	H4	12.18	11.79		118.9	4.680
V4	H5	12.15	11.87		85.3	3.360
V4	H6					
V5	H1					
V5	H2	12.24	12.2		12.2	0.480
V5	H3	12.21	11.94		82.3	3.240
V5	H4	12.19	11.92		82.3	3.240
V5	H5	12.17	11.94		70.1	2.760
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

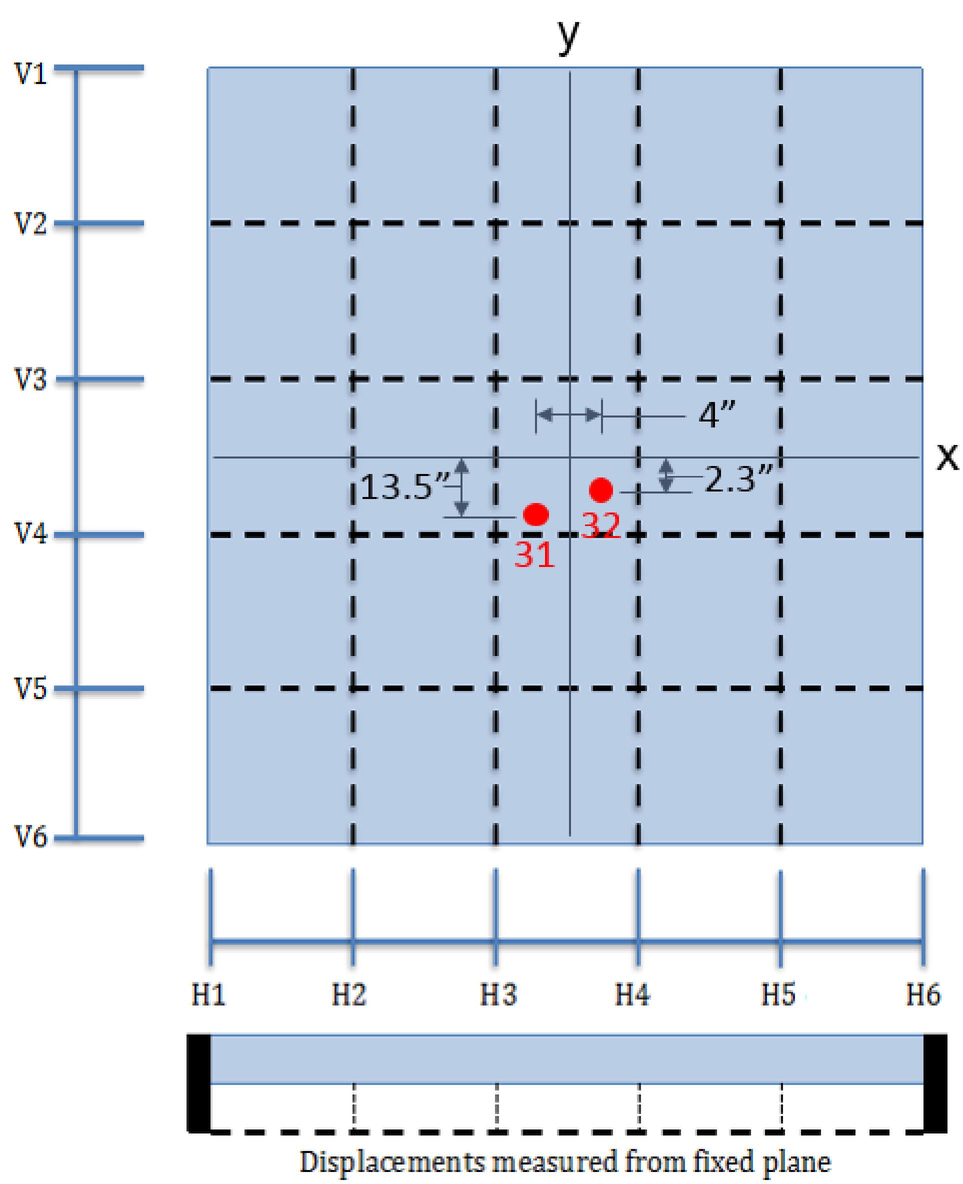
StoneOBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1300 lb
Test Number:	Test 2 - Panel 1	Charge Standoff: 30 ft to Center of Charge
Test Date:	January 8, 2016	

Deflection Measurement Locations



Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 3 - Panel 2	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 22, 2016	Pre-Test Specimen Temperature: 57 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		1450 psi (10 MPa)	5.9 lb/ft^3 (95 kg/m^3)	7620 psi (52.5 MPa)

Specimen Response

Description: The blast load resulted in significant front face scabbing of the concrete cover. On the back face, the test panel showed light cracking over the entire surface. The most pronounced cracking occurred near the middle of the slab (0.05 inch or 1.3 mm wide) and along the bottom horizontal support (0.1 inch or 2.5 mm). No damage was observed to the stiffened steel frame.

The maximum deflection recorded with the laser sensors was 4.7 inches (120 mm) near the center of the slab. The permanent set near the slab center point was approximately 3.9 inches (100 mm).

Upon removal of the panel from the test fixture, cracking through the slab thickness was observed along the edges. Disengagement of the concrete layers above and below the PT strands was recorded. This disengagement generally ranged from 3/8-inch (9.5 mm) to ½-inch (13 mm).

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 3 - Panel 2	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 22, 2016	

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	N/A	N/A	4' down in center, Sensor had no response
2	2-SG-2-F-H	2369	0.0130	Center of panel, Wire broken at 0.013 s
3	3-SG-3-F-H	13,662	0.0130	12' down in center, Wire broken at 0.013 s
4	4-SG-1-F-V	3004	0.0131	4' from left edge, Wire broken at 0.0131 s
5	5-SG-2-F-V	2231	0.0130	Center of panel, Wire broken at 0.013 s
6	6-SG-3-F-V	N/A	N/A	12' from left edge, Sensor had no response
7	7-SG-4-F-H	N/A	N/A	No strain gauge installed
8	8-SG-4-F-V	N/A	N/A	No strain gauge installed
9	9-SG-5-F-H	N/A	N/A	No strain gauge installed
10	10-SG-5-F-V	N/A	N/A	No strain gauge installed
11	11-SG-6-F-H	N/A	N/A	No strain gauge installed
12	12-SG-6-F-V	N/A	N/A	No strain gauge installed
13	13-SG-1-R-H	-2835	0.0181	Wire broken at 0.0185
14	14-SG-1-R-V	-3166	0.0184	Wire broken at 0.0232
15	15-SG-2-R-H	32,241	0.0156	Possible noisy connection
16	16-SG-2-R-V	13,599	0.0156	Possible noisy connection
17	17-SG-3-R-H	-3767	0.0143	Wire broken at 0.0143 s
18	18-SG-3-R-V	-13,134	0.7836	Wire broken at 0.024 s
19	19-SG-4-R-H	-18,538	0.0189	Wire broken at 0.0245 s
20	20-SG-4-R-V	-10,735	0.0191	Wire broken at 0.0245 s
21	21-SG-5-R-H	-3709	0.0188	Wire broken at 0.0251 s
22	22-SG-5-R-V	-3896	0.0148	Wire broken at 0.0256 s
23	23-SG-6-R-H	-4199	0.0159	Wire broken at 0.0259 s
24	24-SG-6-R-V	-23,783	0.0194	Wire broken at 0.0238 s
25	25-SG-7-R-H	-3967	0.0191	Wire broken at 0.0245 s
26	26-SG-7-R-V	-3206	0.0133	Wire broken at 0.0244 s
27	27-SG-8-R-H	-4964	0.0193	Wire broken at 0.0244 s
28	28-SG-8-R-V	-3871	0.0159	Wire broken at 0.0235 s
29	29-SG-9-R-H	-9105	0.0194	Wire broken at 0.0201 s
30	30-SG-10-R-V	-8669	0.0203	Wire broken at 0.021 s

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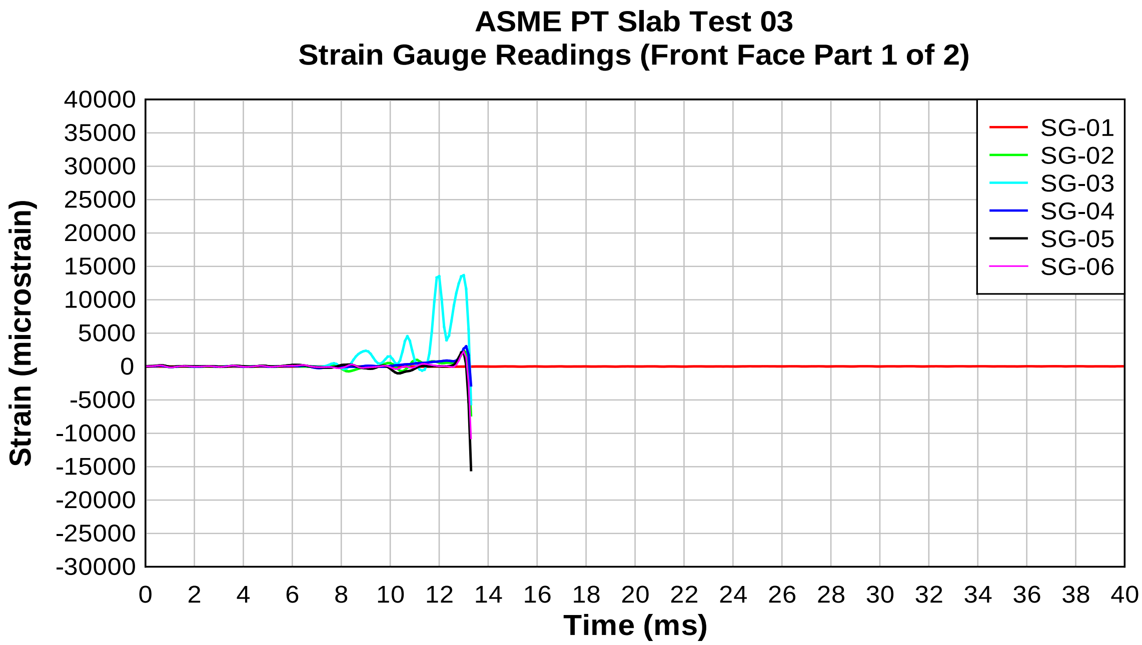
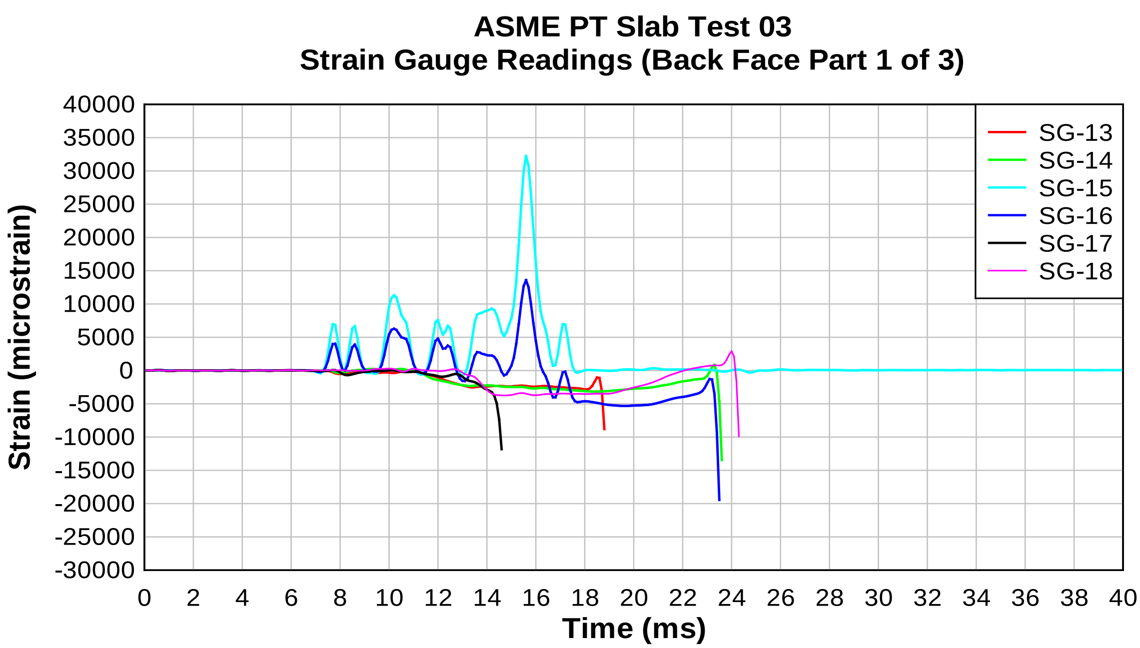
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 3 - Panel 2	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 22, 2016	





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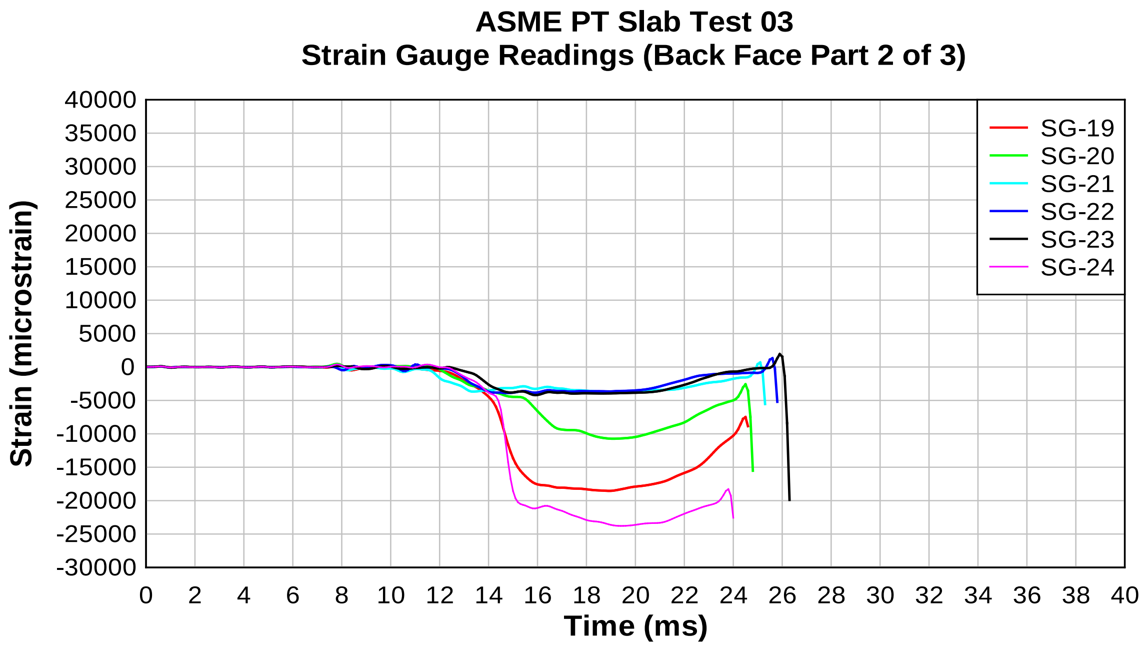
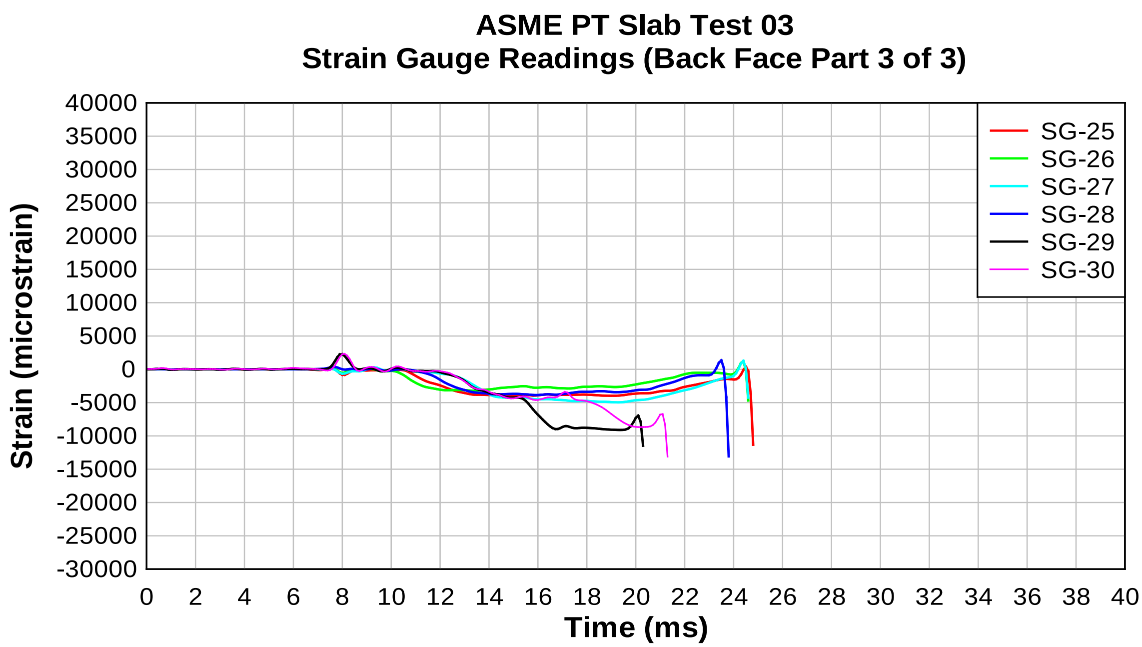
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 3 - Panel 2	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 22, 2016	





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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 3 - Panel 2

Test Date: September 22, 2016

Charge Material: ANFO

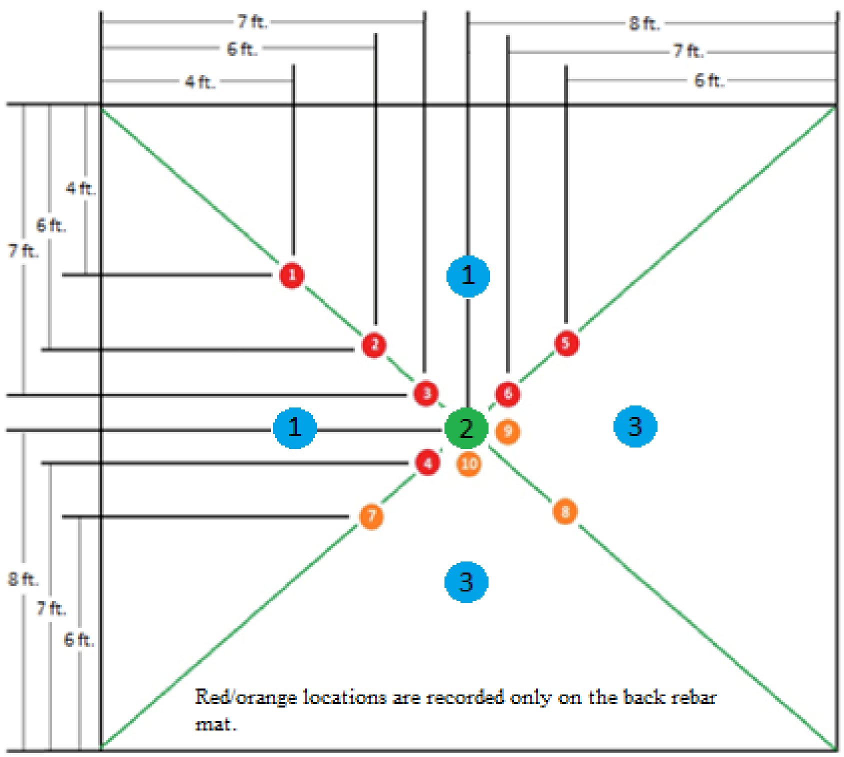
Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge

Strain Gauge Locations

Slab Design C (Red/Orange)		
Rebar Locat.	X-bar	Y-bar
1	9	9
2	13	13
3	15	15
4	17	14
5	21	12
6	14	18
7	12	21
8	18	19
9	20	16
10	16	20

Slab Design C (Blue/Green)		
Rebar Locat.	X-bar	Y-bar
1	8	8
2	16	16
3	24	24



Red/orange locations are recorded only on the back rebar mat.
Blue locations are recorded only on the front rebar mat (horiz. or vert.)
Green locations are recorded only on the front rebar mat (horiz. and vert.)

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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 3 - Panel 2

Test Date: September 22, 2016

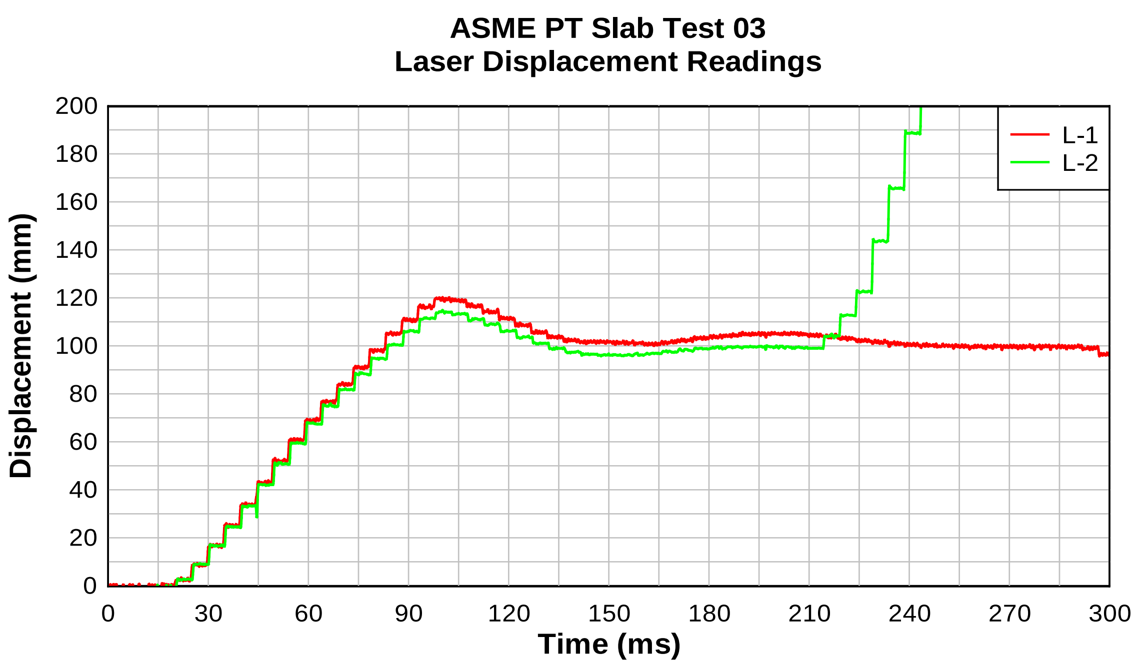
Charge Material: ANFO

Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	120	0.1002	104	
32	115	0.1002	100	



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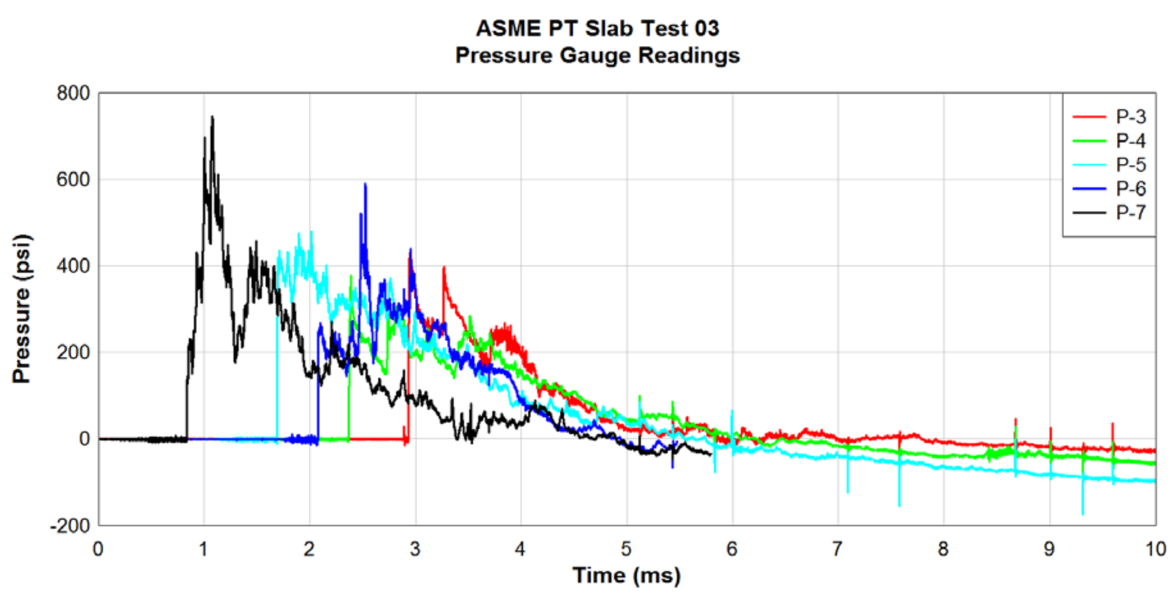
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 3 - Panel 2	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 22, 2016	

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
P1	N/A	N/A	N/A	N/A	Located 45 ft from charge; data read error
P2	155	416	N/A	N/A	Located 54 ft from charge
P3	431	398	-97.6	N/A	
P4	379	481	-122	N/A	
P5	479	667	-178	N/A	
P6	590	482	-64.6	N/A	
P7	747	616	-46.2	N/A	

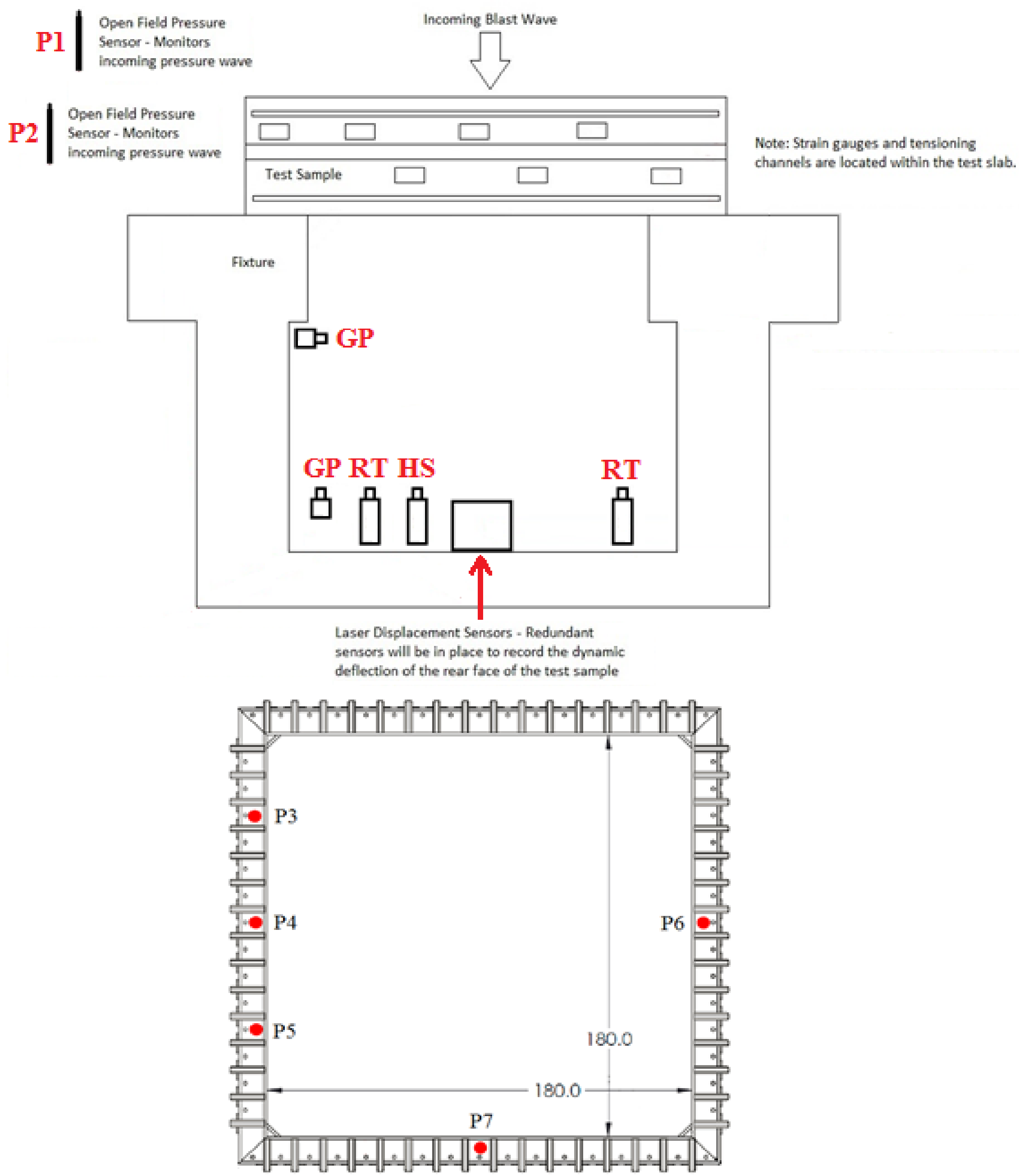


Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 3 - Panel 2	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 22, 2016	

Gauge Locations



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 3 - Panel 2
Test Date: September 22, 2016

Charge Material: ANFO
Charge Weight: 2300 lb
Charge Standoff: 45 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

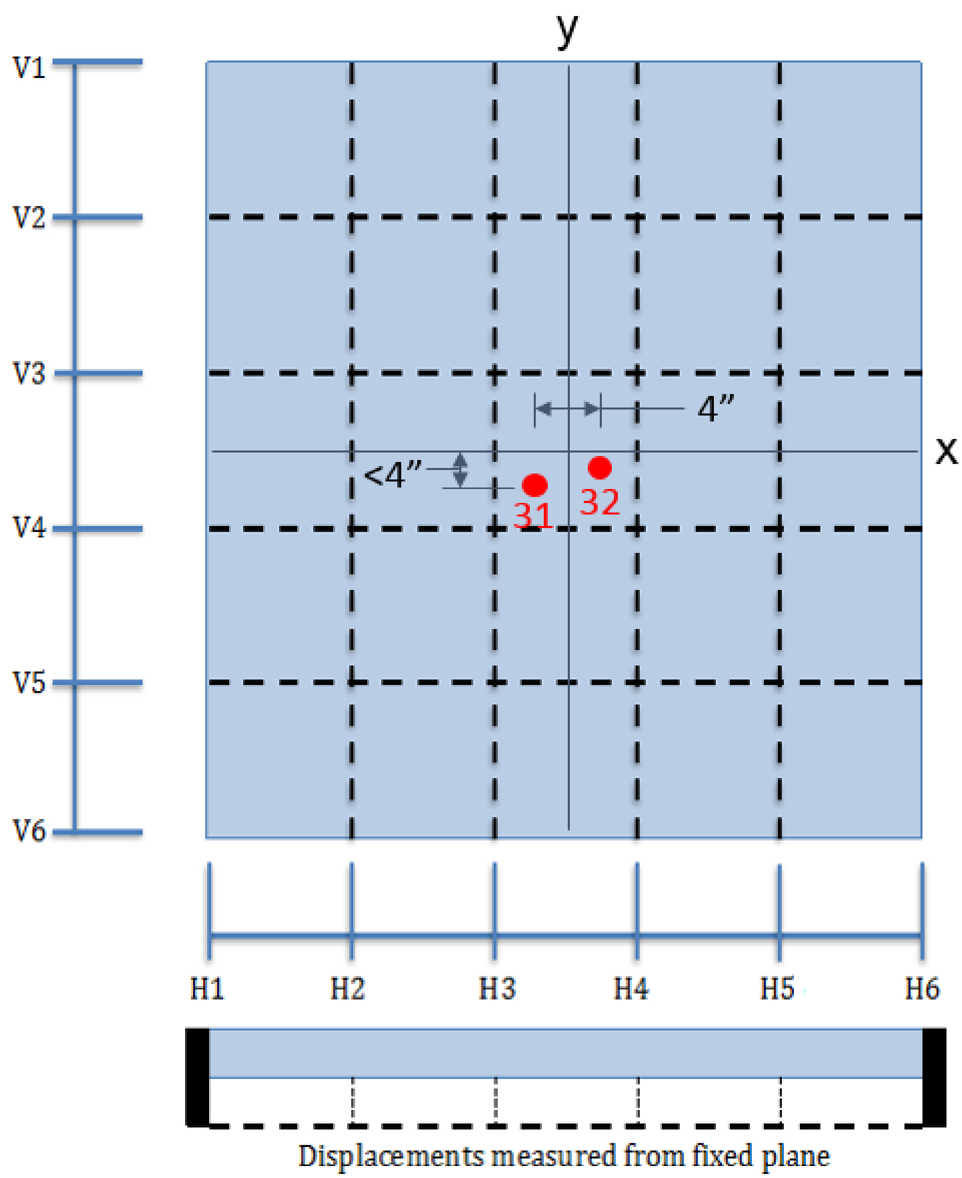
Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.33	12.17		48.8	1.920
V2	H3	12.33	12.08		76.2	3.000
V2	H4	12.33	12.08		76.2	3.000
V2	H5	12.33	12.08		76.2	3.000
V2	H6					
V3	H1					
V3	H2	12.33	12.08		76.2	3.000
V3	H3	12.33	12		100.6	3.960
V3	H4	12.33	12		100.6	3.960
V3	H5	12.33	12.08		76.2	3.000
V3	H6					
V4	H1					
V4	H2	12.33	12.08		76.2	3.000
V4	H3	12.33	12		100.6	3.960
V4	H4	12.33	12		100.6	3.960
V4	H5	12.33	12.08		76.2	3.000
V4	H6					
V5	H1					
V5	H2	12.33	12.17		48.8	1.920
V5	H3	12.33	12.17		48.8	1.920
V5	H4	12.33	12.08		76.2	3.000
V5	H5	12.25	12.17		24.4	0.960
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 3 - Panel 2	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 22, 2016	

Deflection Measurement Locations



Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 4a - Panel 6

Test Date: September 26, 2016

Charge Material: ANFO

Charge Weight: 1700 lb

Charge Standoff: 45 ft to Center of Charge

Pre-Test Specimen Temperature: 92 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		1450 psi (10 MPa)	5.9 lb/ft^3 (95 kg/m^3)	7520 psi (51.8 MPa)

Specimen Response

Description: The blast load resulted in only minor damage to the front and back faces. The interior surface of the concrete slab had minor hairline cracks from the edges that extend to hairline cracks along mid-span region. No crushing or scabbing of concrete along the exterior surface was noticed. No through-thickness disengagement of concrete was seen. No damage was observed to the stiffened steel frame.

The maximum deflection recorded with the laser sensors was approximately 0.6 inch (16 mm). No permanent deformation was observed near slab center point.

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

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Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1700 lb
Test Number:	Test 4a - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 26, 2016	

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	N/A	N/A	Sensor had no response
2	2-SG-1-F-V	-2085	0.0486	Permanent strain: -70 με
3	3-SG-2-F-H	-2960	0.0497	
4	4-SG-2-F-V	-3248	0.0487	Permanent strain: -118 με
5	5-SG-3-F-H	-3167	0.0469	Permanent strain: 224 με
6	6-SG-3-F-V	-4174	0.0480	Permanent strain: -152 με
7	7-SG-4-F-H	-3034	0.0482	Permanent strain: -52 με
8	8-SG-4-F-V	-3323	0.0473	Permanent strain: -154 με
9	9-SG-5-F-H	-3200	0.0475	
10	10-SG-5-F-V	-3319	0.0477	Permanent strain: -142 με
11	11-SG-6-F-H	-10,940	0.0480	Permanent strain: -1087 με
12	12-SG-6-F-V	-3495	0.0479	Permanent strain: 94 με
13	13-SG-1-R-H	-3156	0.0231	Permanent strain: -92 με
14	14-SG-1-R-V	-2813	0.0233	Permanent strain: -161 με
15	15-SG-2-R-H	N/A	N/A	Sensor had no response
16	16-SG-2-R-V	-3743	0.0168	Permanent strain: 150 με
17	17-SG-3-R-H	-4242	0.0169	Permanent strain: 295 με
18	18-SG-3-R-V	-3699	0.0172	Permanent strain: 518 με
19	19-SG-4-R-H	-4230	0.0169	Permanent strain: 444 με
20	20-SG-4-R-V	-3803	0.0188	
21	21-SG-5-R-H	-3810	0.0225	Permanent strain: -224 με
22	22-SG-5-R-V	-3191	0.0224	Permanent strain: -93 με
23	23-SG-6-R-H	-4518	0.0168	Permanent strain: 100 με
24	24-SG-6-R-V	-6106	0.0205	Permanent strain: -42 με
25	25-SG-7-R-H	-3135	0.0226	Permanent strain: -136 με
26	26-SG-7-R-V	-3659	0.0236	Permanent strain: -192 με
27	27-SG-8-R-H	-8932	0.0253	Permanent strain: -1686 με
28	28-SG-8-R-V	-3792	0.0175	Permanent strain: 64 με
29	29-SG-9-R-H	-4660	0.0244	Permanent strain: -86 με
30	30-SG-10-R-V	-3519	0.0173	Permanent strain: 131 με

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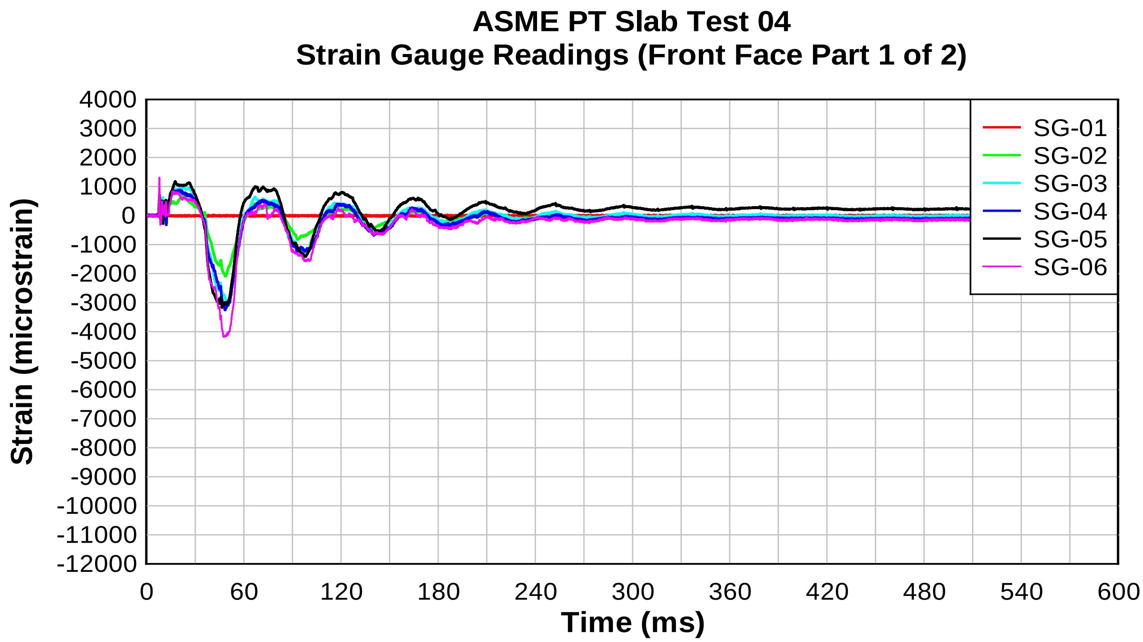
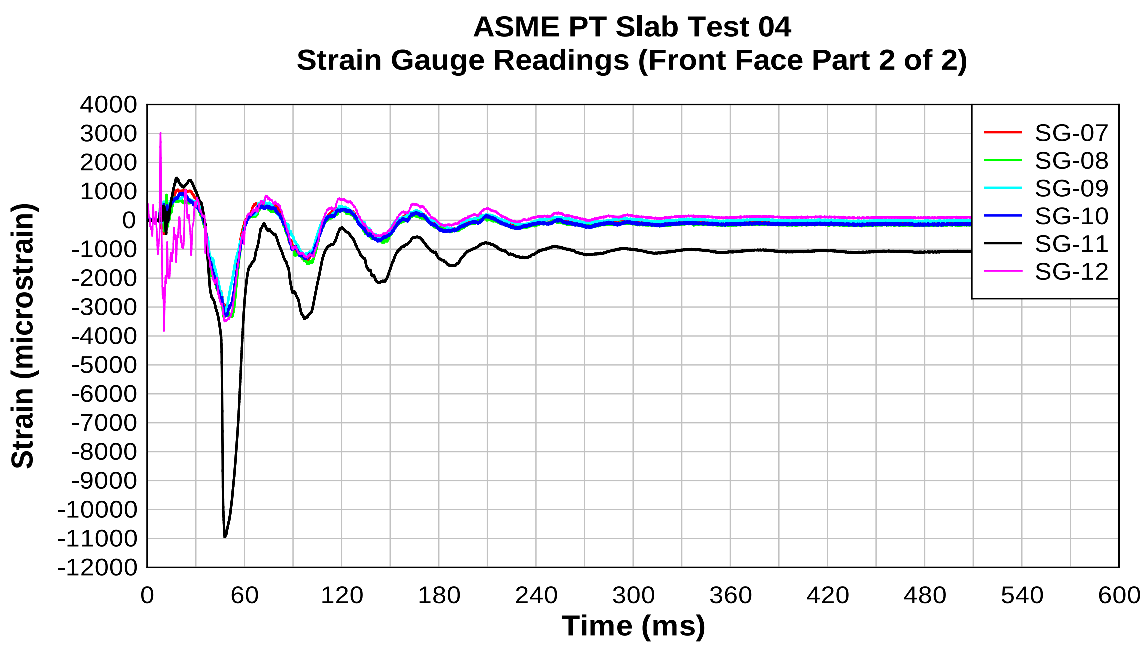
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1700 lb
Test Number:	Test 4a - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 26, 2016	



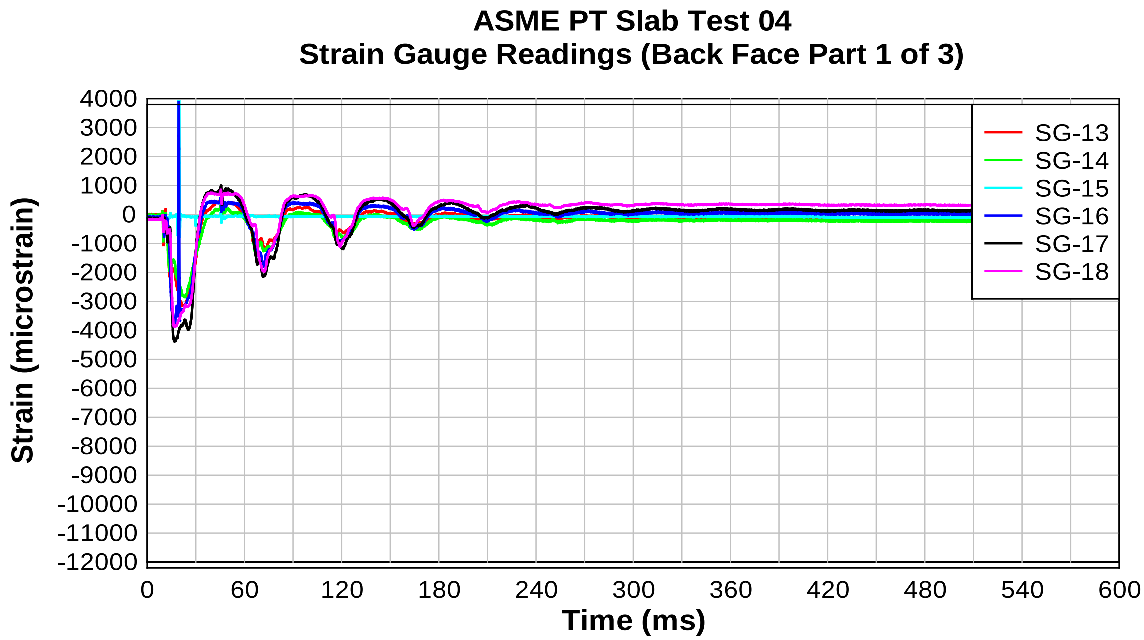


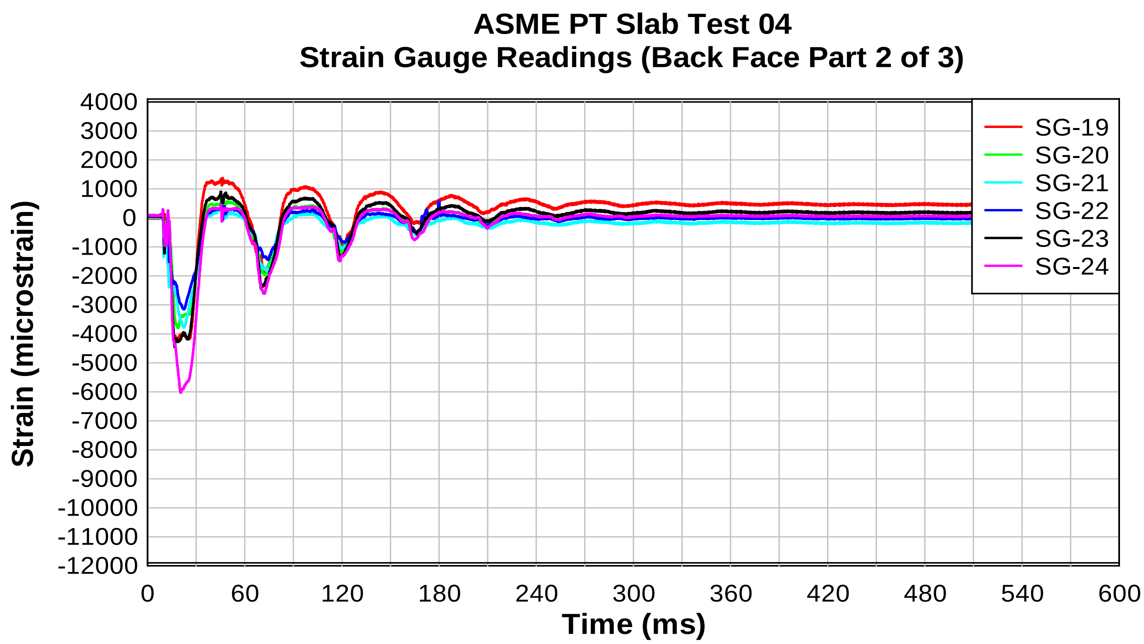
Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 4a - Panel 6
Test Date: September 26, 2016

Charge Material: ANFO
Charge Weight: 1700 lb
Charge Standoff: 45 ft to Center of Charge





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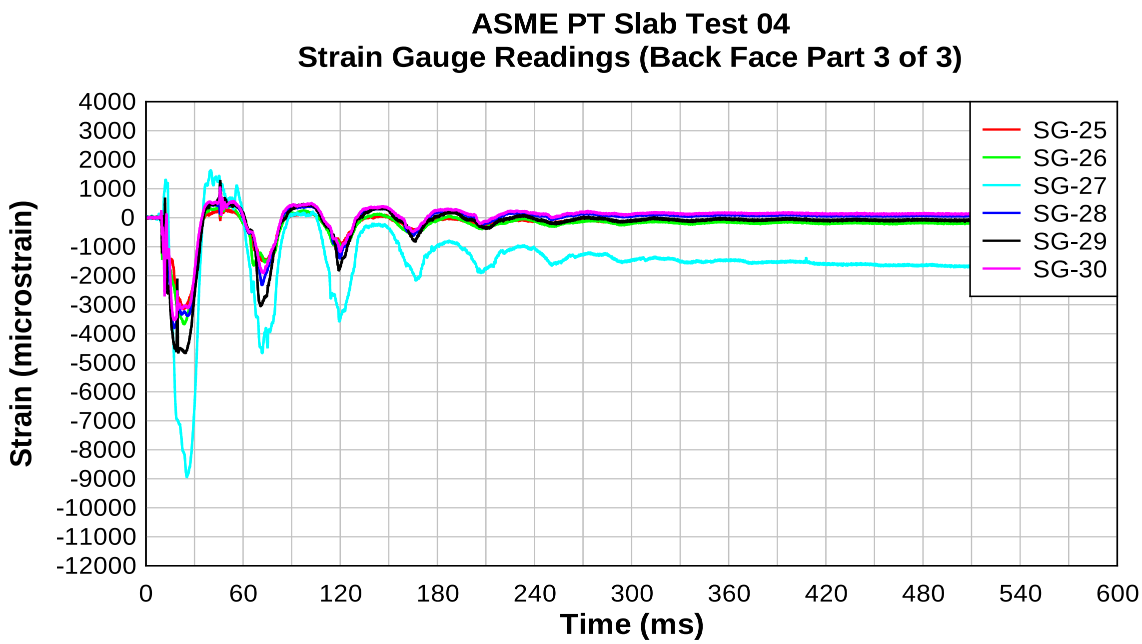
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1700 lb
Test Number:	Test 4a - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 26, 2016	



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Testing Data Sheet

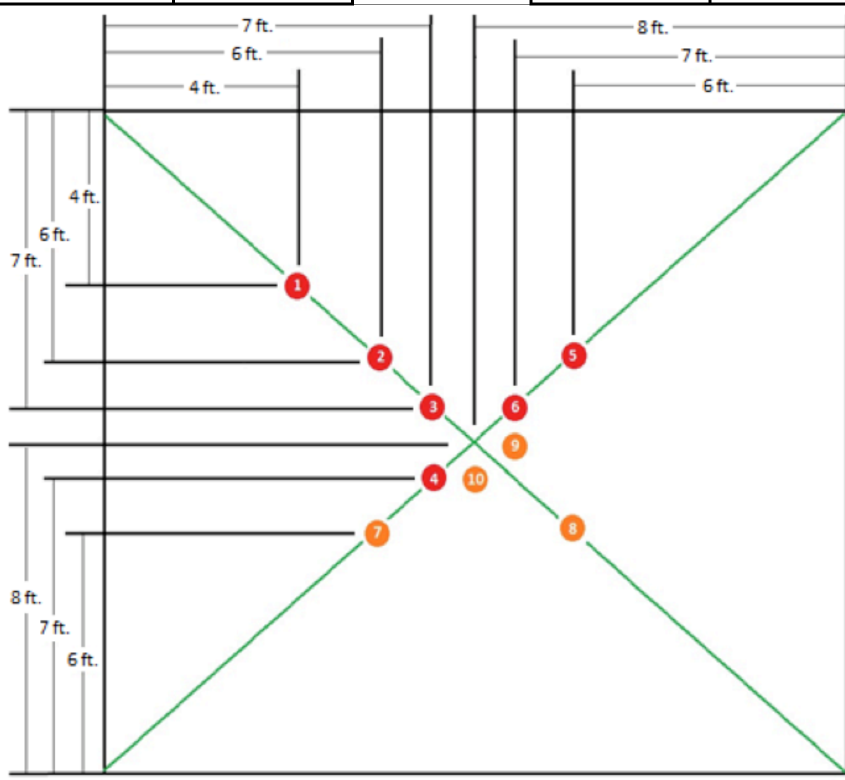
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 4a - Panel 6
Test Date: September 26, 2016

Charge Material: ANFO
Charge Weight: 1700 lb
Charge Standoff: 45 ft to Center of Charge

Strain Gauge Locations

Slab Design C		
Rebar Locat.	X-bar	Y-bar
1	9	9
2	13	13
3	15	15
4	17	14
5	21	12
6	14	18
7	12	21
8	18	19
9	20	16
10	16	20



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

Testing Data Sheet

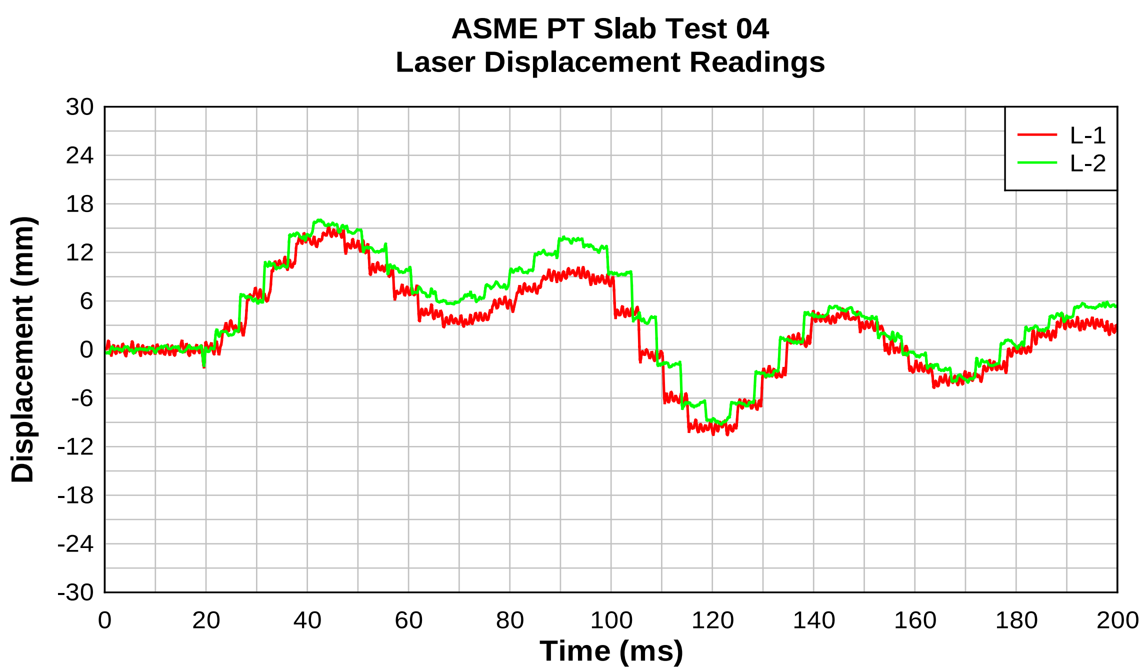
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 4a - Panel 6
Test Date: September 26, 2016

Charge Material: ANFO
Charge Weight: 1700 lb
Charge Standoff: 45 ft to Center of Charge

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	15.2	0.0442	0	
32	16.0	0.0426	0	



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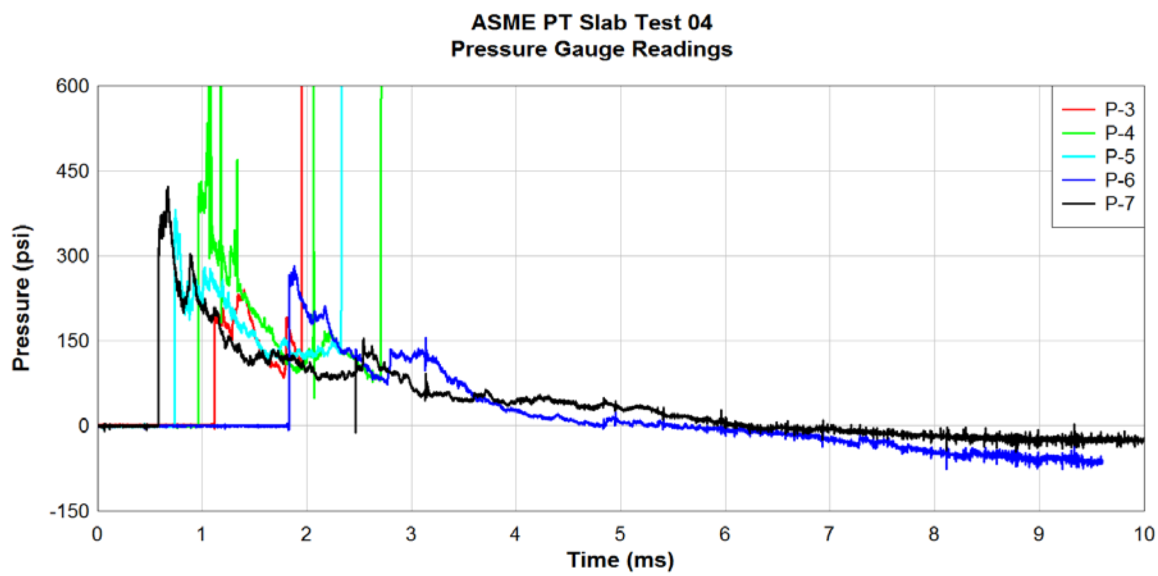
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1700 lb
Test Number:	Test 4a - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 26, 2016	

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
P1	99.5	174	N/A	N/A	Located 45 ft from charge; Impulse through 0.0077 s
P2	119	279	N/A	N/A	Located 53 ft from charge; Impulse through 0.0083 s
P3	242	132	N/A	N/A	Impulse through 0.0019 s
P4	431	332	N/A	N/A	Impulse through 0.0027 s
P5	382	285	N/A	N/A	Impulse through 0.0023 s
P6	283	266	-75.0	N/A	
P7	423	469	-43.8	N/A	



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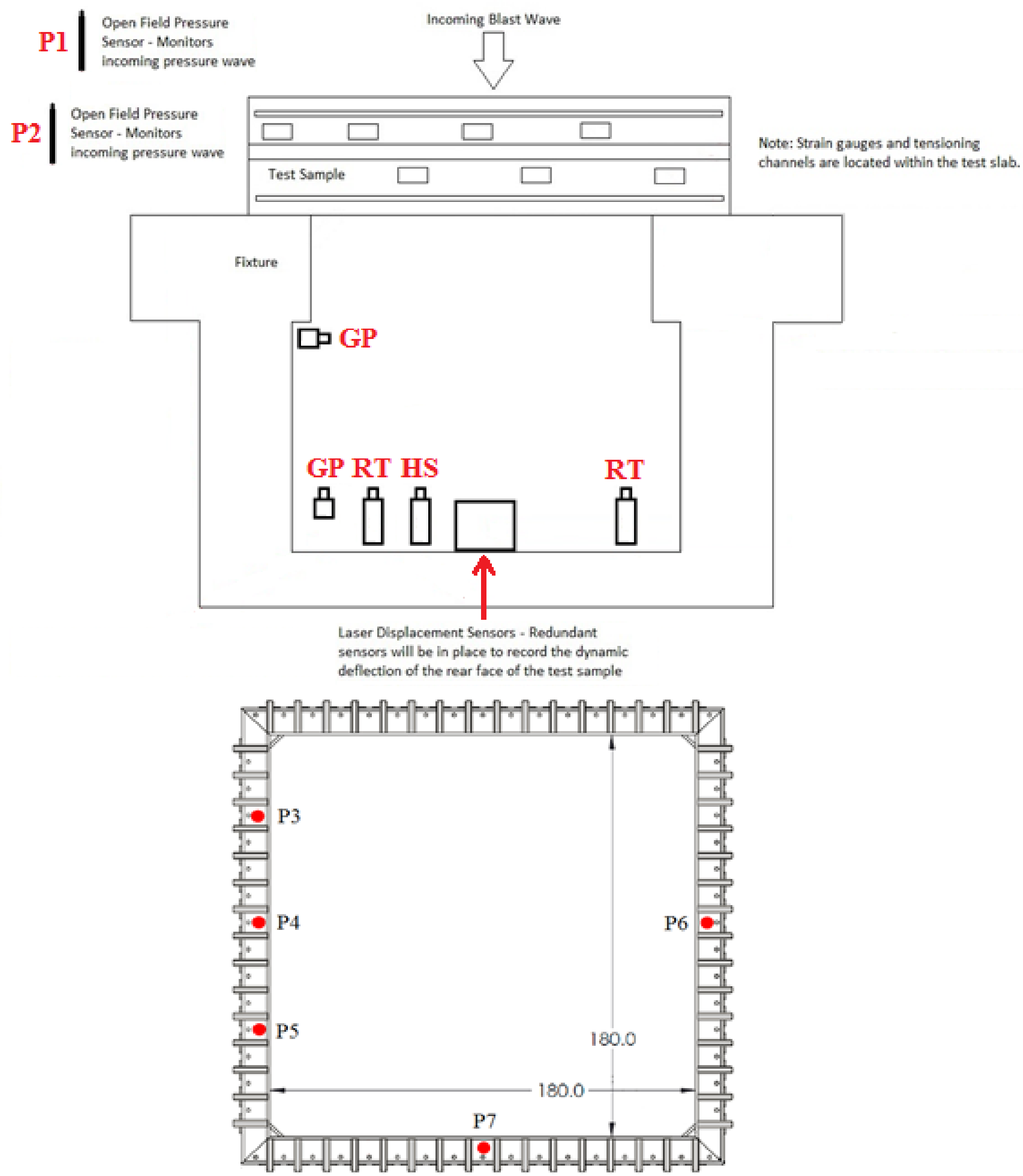
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1700 lb
Test Number:	Test 4a - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 26, 2016	

Gauge Locations



Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 4a - Panel 6
Test Date: September 26, 2016

Charge Material: ANFO
Charge Weight: 1700 lb
Charge Standoff: 45 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.32	12.32		0.8	0.031
V2	H3	12.34	12.33		1.6	0.063
V2	H4	12.35	12.35		0.8	0.031
V2	H5	12.35	12.34		1.6	0.063
V2	H6					
V3	H1					
V3	H2	12.38	12.38		0.0	0.000
V3	H3	12.39	12.39		0.8	0.031
V3	H4	12.38	12.38		1.6	0.063
V3	H5	12.39	12.39		0.0	0.000
V3	H6					
V4	H1					
V4	H2	12.40	12.40		0.8	0.031
V4	H3	12.40	12.40		0.0	0.000
V4	H4	12.39	12.39		2.4	0.094
V4	H5	12.34	12.33		1.6	0.063
V4	H6					
V5	H1					
V5	H2	12.41	12.41		0.0	0.000
V5	H3	12.40	12.40		0.0	0.000
V5	H4	12.38	12.37		0.8	0.031
V5	H5	12.34	12.33		1.6	0.062
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

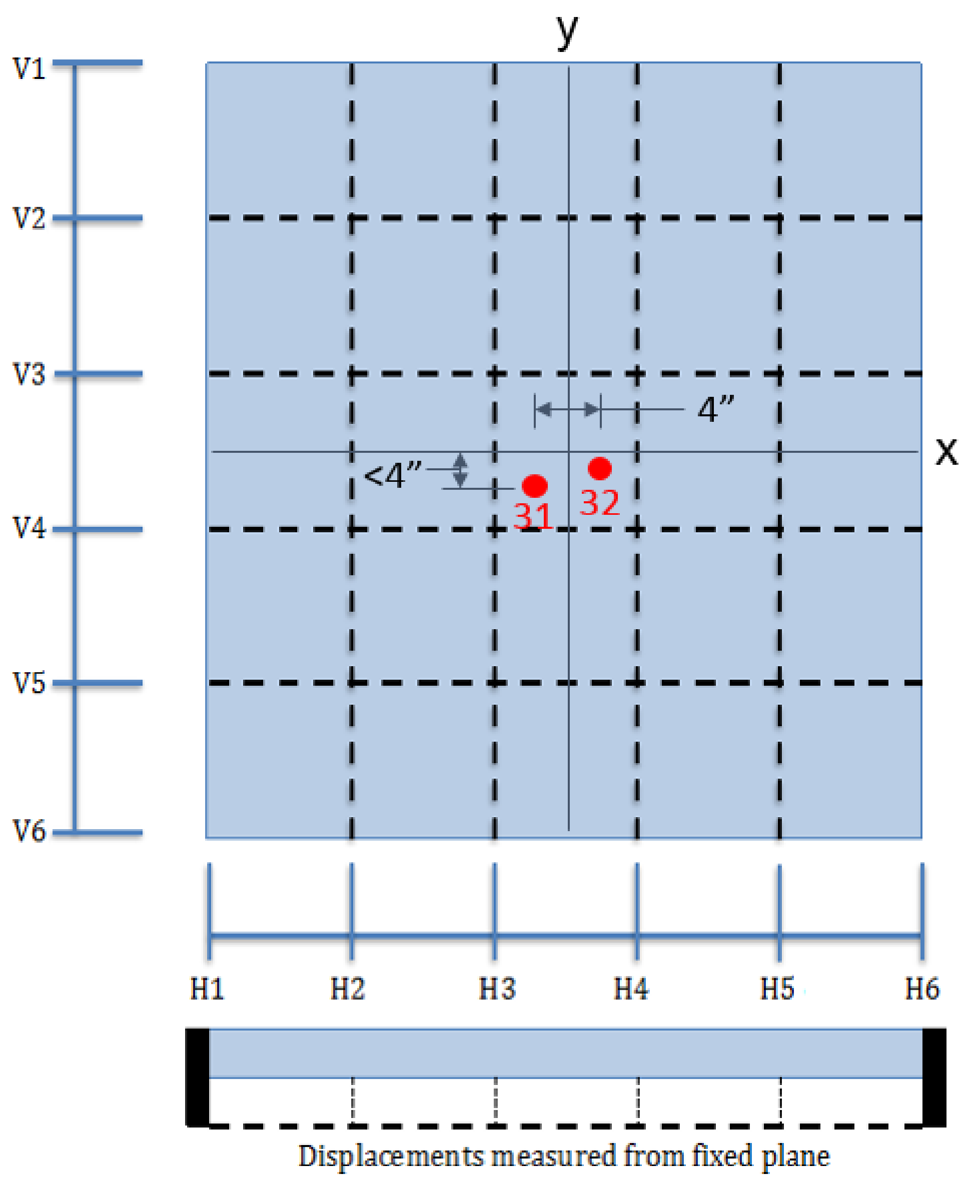
Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 1700 lb
Test Number:	Test 4a - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 26, 2016	

Deflection Measurement Locations



Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 4b - Panel 6
Test Date: September 27, 2016

Charge Material: ANFO
Charge Weight: 2000 lb
Charge Standoff: 45 ft to Center of Charge
Pre-Test Specimen Temperature: 80 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		1450 psi (10 MPa)	5.9 lb/ft^3 (95 kg/m^3)	7520 psi (51.8 MPa)

Specimen Response

Description: The blast load resulted in heavy scabbing on the front face of the panel. On the back face, cracking was observed along most of the slab surface, generally ranging from hairlines to cracks with widths of approximately 0.08 inches (2 mm). Major cracking, spalling, and bowing was noted along the left panel edge (when viewed from the interior). Cracks were also observed across the slab thickness, but to a lesser extent than the cracking and disengagement that was observed throughout the cross-section in Test 3. No damage was observed to the stiffened steel frame.

The maximum deflection recorded with the laser sensors was 4.3 inches (109 mm). The permanent set near the slab center point was approximately 3.5 inches (90 mm).

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 4b - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 27, 2016	

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	N/A	N/A	Sensor had no response
2	2-SG-1-F-V	N/A	N/A	Wire broken at 0.019 s
3	3-SG-2-F-H	N/A	N/A	Wire broken at 0.019 s
4	4-SG-2-F-V	N/A	N/A	Wire broken at 0.019 s
5	5-SG-3-F-H	N/A	N/A	Wire broken at 0.019 s
6	6-SG-3-F-V	N/A	N/A	Wire broken at 0.019 s
7	7-SG-4-F-H	N/A	N/A	Sensor had no response
8	8-SG-4-F-V	N/A	N/A	Wire broken at 0.019 s
9	9-SG-5-F-H	N/A	N/A	Wire broken at 0.019 s
10	10-SG-5-F-V	N/A	N/A	Wire broken at 0.019 s
11	11-SG-6-F-H	N/A	N/A	Wire broken at 0.019 s
12	12-SG-6-F-V	N/A	N/A	Wire broken at 0.019 s
13	13-SG-1-R-H	-4904	0.0178	Permanent strain: -882 με
14	14-SG-1-R-V	-4446	0.0178	Permanent strain: -319 με
15	15-SG-2-R-H	N/A	N/A	Noisy connection
16	16-SG-2-R-V	-10,815	0.0198	Noisy connection, Perm. strain: -2907 με
17	17-SG-3-R-H	-14,170	0.0179	Permanent strain: -2414 με
18	18-SG-3-R-V	-14,094	0.0179	Permanent strain: -3291 με
19	19-SG-4-R-H	-15,137	0.0179	Permanent strain: -3128 με
20	20-SG-4-R-V	-5134	0.0178	Permanent strain: 419 με
21	21-SG-5-R-H	-5592	0.0178	Permanent strain: -292 με
22	22-SG-5-R-V	-5141	0.0178	Permanent strain: -651 με
23	23-SG-6-R-H	-17,646	0.0178	Permanent strain: -5380 με
24	24-SG-6-R-V	-19,078	0.0178	Permanent strain: -6831 με
25	25-SG-7-R-H	-4503	0.0178	Permanent strain: 74 με
26	26-SG-7-R-V	-5369	0.0178	Permanent strain: -947 με
27	27-SG-8-R-H	-27,925	0.0186	Noisy connection, Wire broken at 0.0252 s
28	28-SG-8-R-V	-5369	0.0178	Permanent strain: 272 με
29	29-SG-9-R-H	-25,581	0.0179	Noisy connection, Perm. strain: -9699 με
30	30-SG-10-R-V	-12,393	0.0178	Noisy connection, Perm. strain: 2216 με

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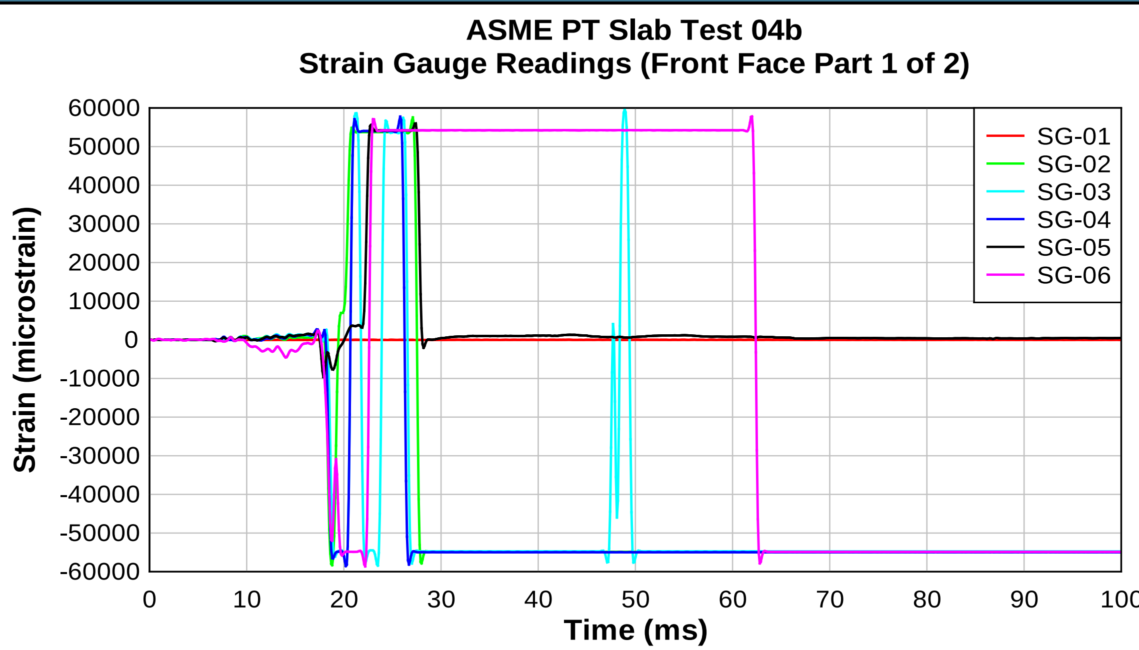
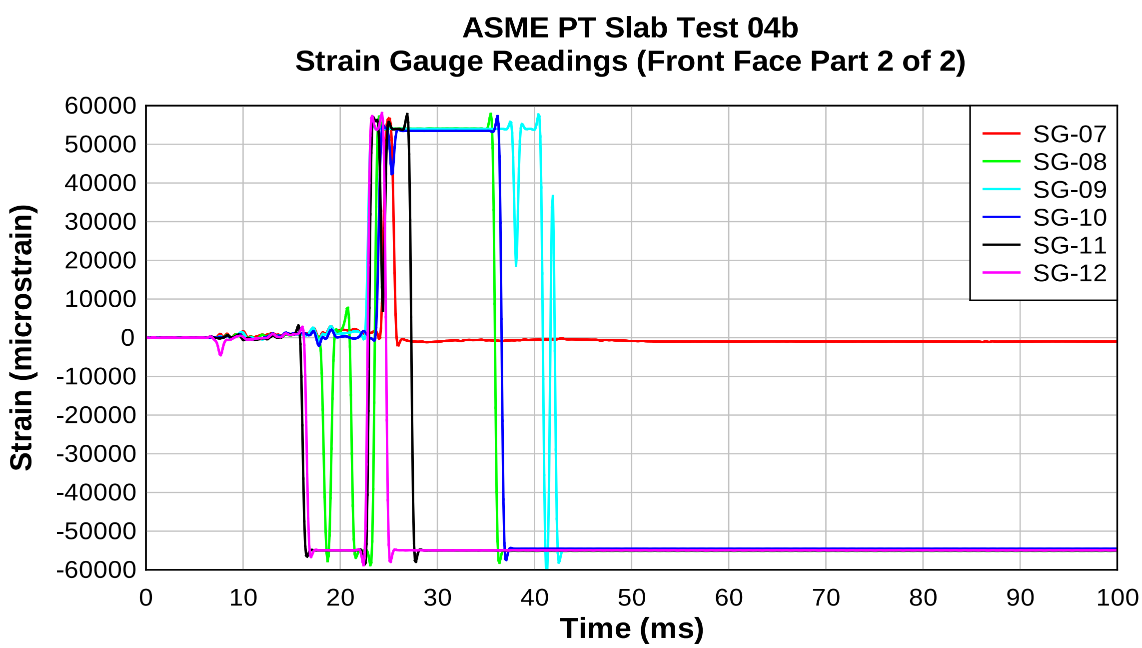
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 4b - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 27, 2016	





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Testing Data Sheet

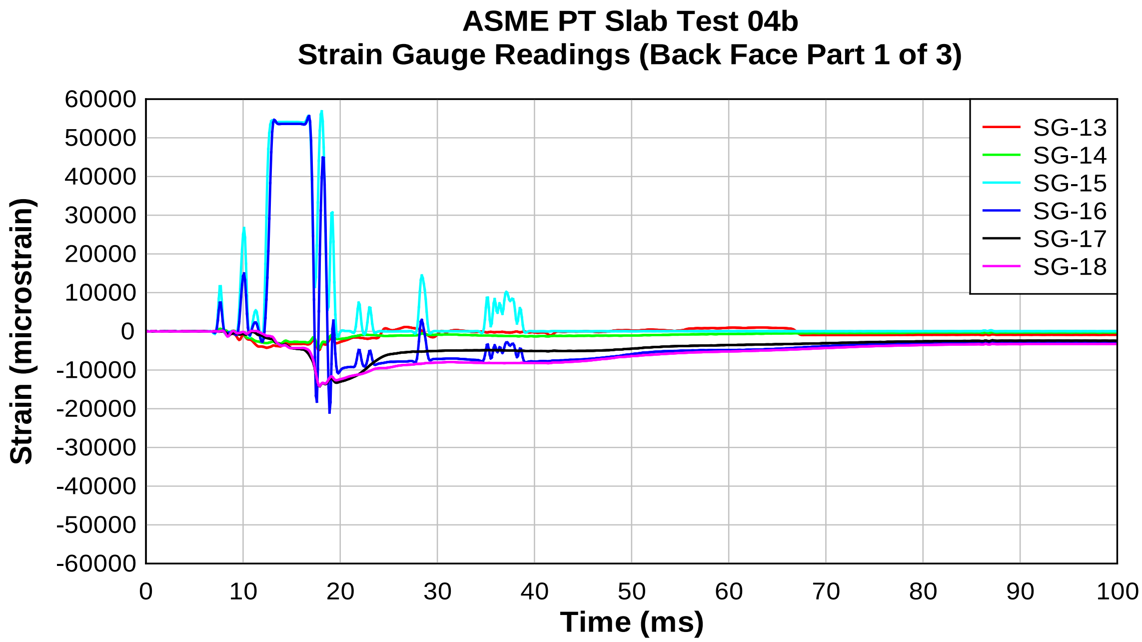
EXTREME LOAD TESTING

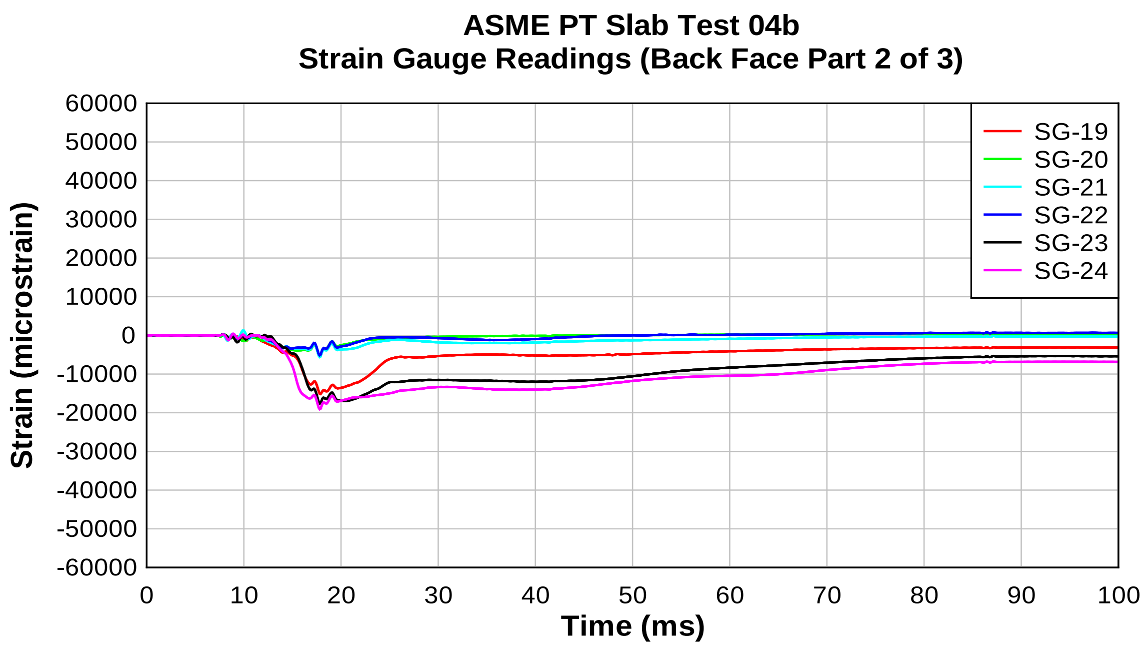
Project Name: ASME PT Slab Testing — Charge Material: ANFO

Project Number: 1507-11 — Charge Weight: 2000 lb

Test Number: Test 4b - Panel 6 — Charge Standoff: 45 ft to Center of Charge

Test Date: September 27, 2016





Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

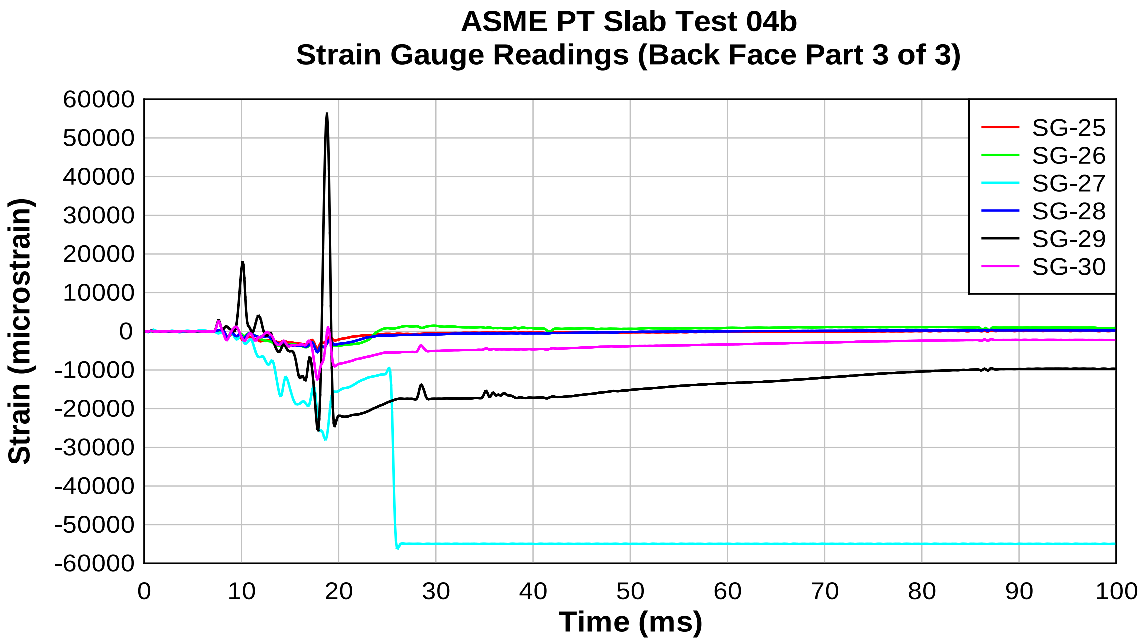
Test Number: Test 4b - Panel 6

Test Date: September 27, 2016

Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge



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Testing Data Sheet

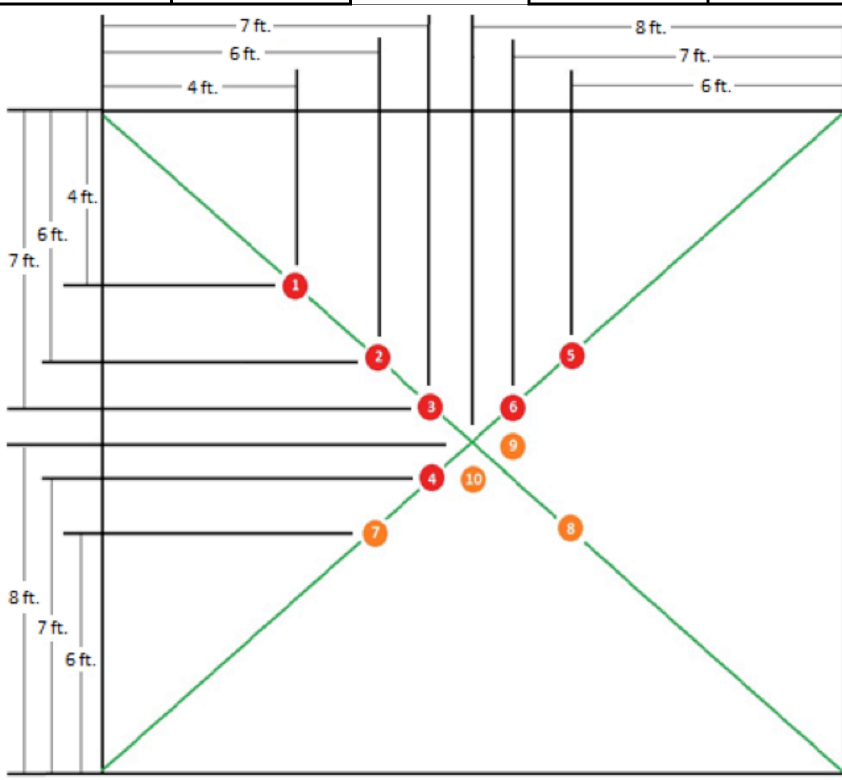
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 4b - Panel 6
Test Date: September 27, 2016

Charge Material: ANFO
Charge Weight: 2000 lb
Charge Standoff: 45 ft to Center of Charge

Strain Gauge Locations

Slab Design C		
Rebar Locat.	X-bar	Y-bar
1	9	9
2	13	13
3	15	15
4	17	14
5	21	12
6	14	18
7	12	21
8	18	19
9	20	16
10	16	20



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing — Charge Material: ANFO

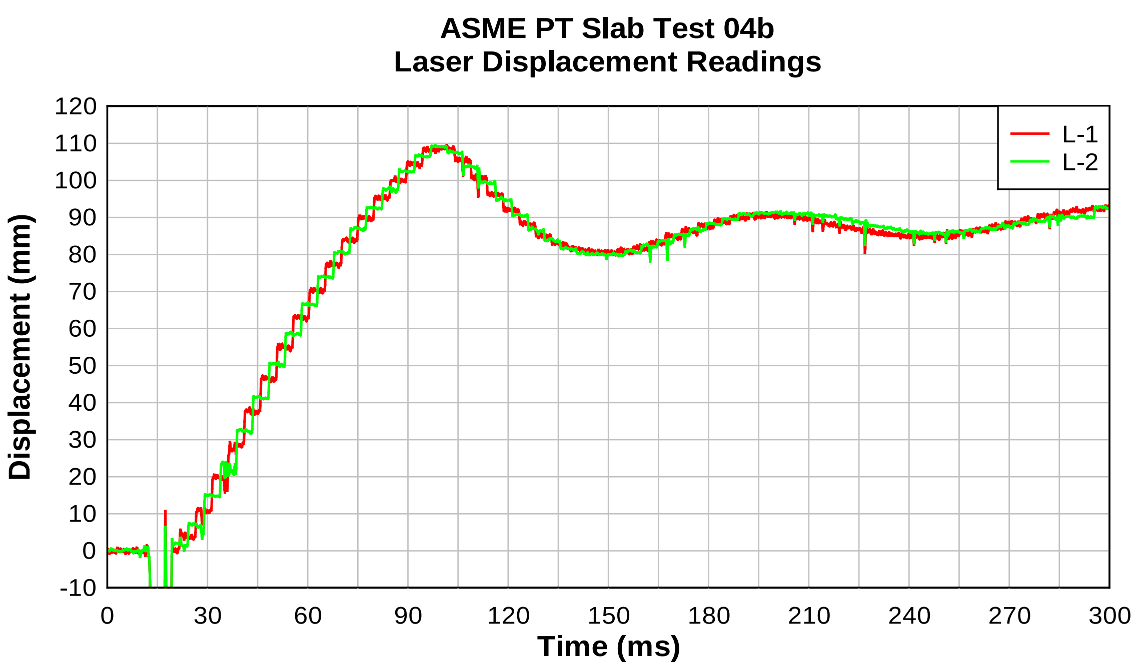
Project Number: 1507-11 — Charge Weight: 2000 lb

Test Number: Test 4b - Panel 6 — Charge Standoff: 45 ft to Center of Charge

Test Date: September 27, 2016

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	109	0.1014	90	
32	109	0.0982	91	



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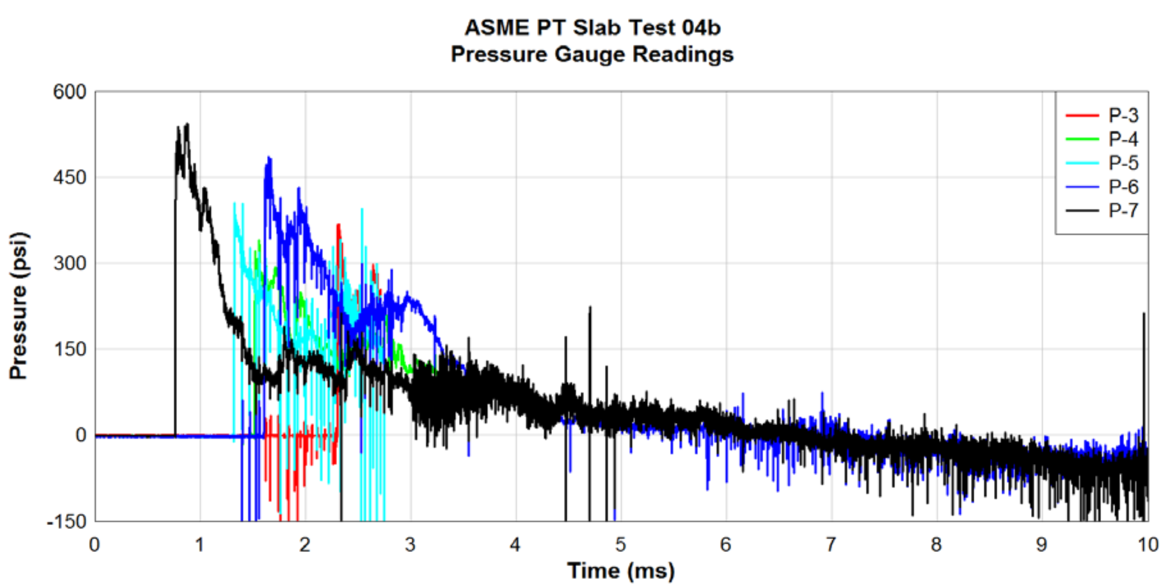
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 4b - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 27, 2016	

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
P1	91.9	189	N/A	N/A	Located 45 ft from charge
P2	144	484	N/A	N/A	Located 53 ft from charge; Impulse through 0.0094 s
P3	369	118	N/A	N/A	Impulse through 0.0028 s
P4	340	315	N/A	N/A	Impulse through 0.0034 s
P5	406	295	-296	N/A	Impulse through 0.00275 s
P6	487	570	-509	N/A	
P7	545	564	N/A	N/A	



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 4b - Panel 6

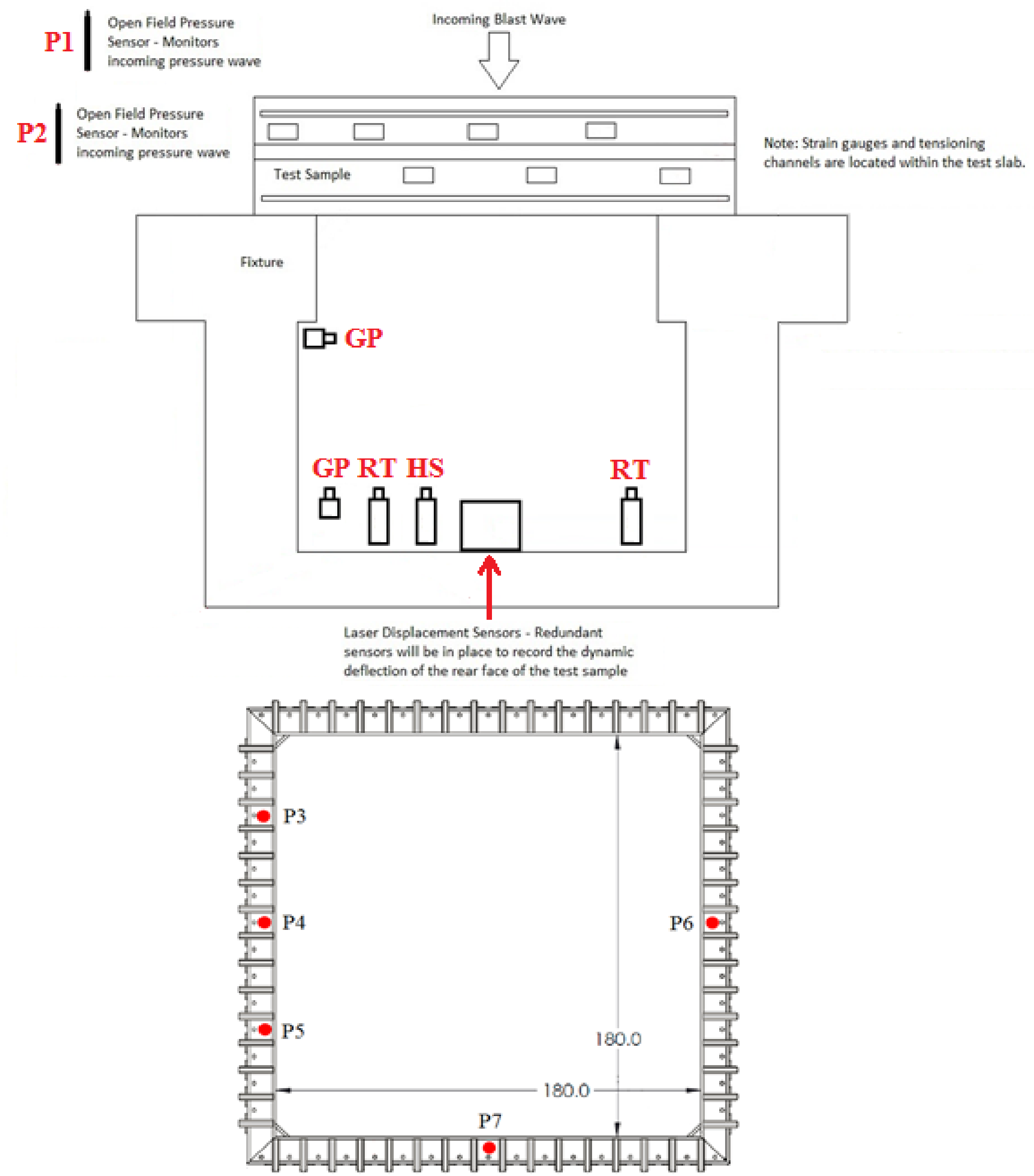
Test Date: September 27, 2016

Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge

Gauge Locations



Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 4b - Panel 6
Test Date: September 27, 2016

Charge Material: ANFO
Charge Weight: 2000 lb
Charge Standoff: 45 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.32	12.18		43.7	1.719
V2	H3	12.33	12.11		65.9	2.594
V2	H4	12.35	12.16		58.7	2.313
V2	H5	12.34	12.21		42.1	1.656
V2	H6					
V3	H1					
V3	H2	12.38	12.16		65.9	2.594
V3	H3	12.39	12.06		100.0	3.938
V3	H4	12.38	12.08		90.5	3.563
V3	H5	12.39	12.13		79.4	3.125
V3	H6					
V4	H1					
V4	H2	12.40	12.18		68.3	2.687
V4	H3	12.40	12.14		80.2	3.156
V4	H4	12.39	12.15		73.0	2.875
V4	H5	12.33	12.12		64.3	2.531
V4	H6					
V5	H1					
V5	H2	12.41	12.30		33.3	1.313
V5	H3	12.40	12.26		41.3	1.625
V5	H4	12.37	12.24		40.5	1.594
V5	H5	12.33	12.22		34.1	1.344
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

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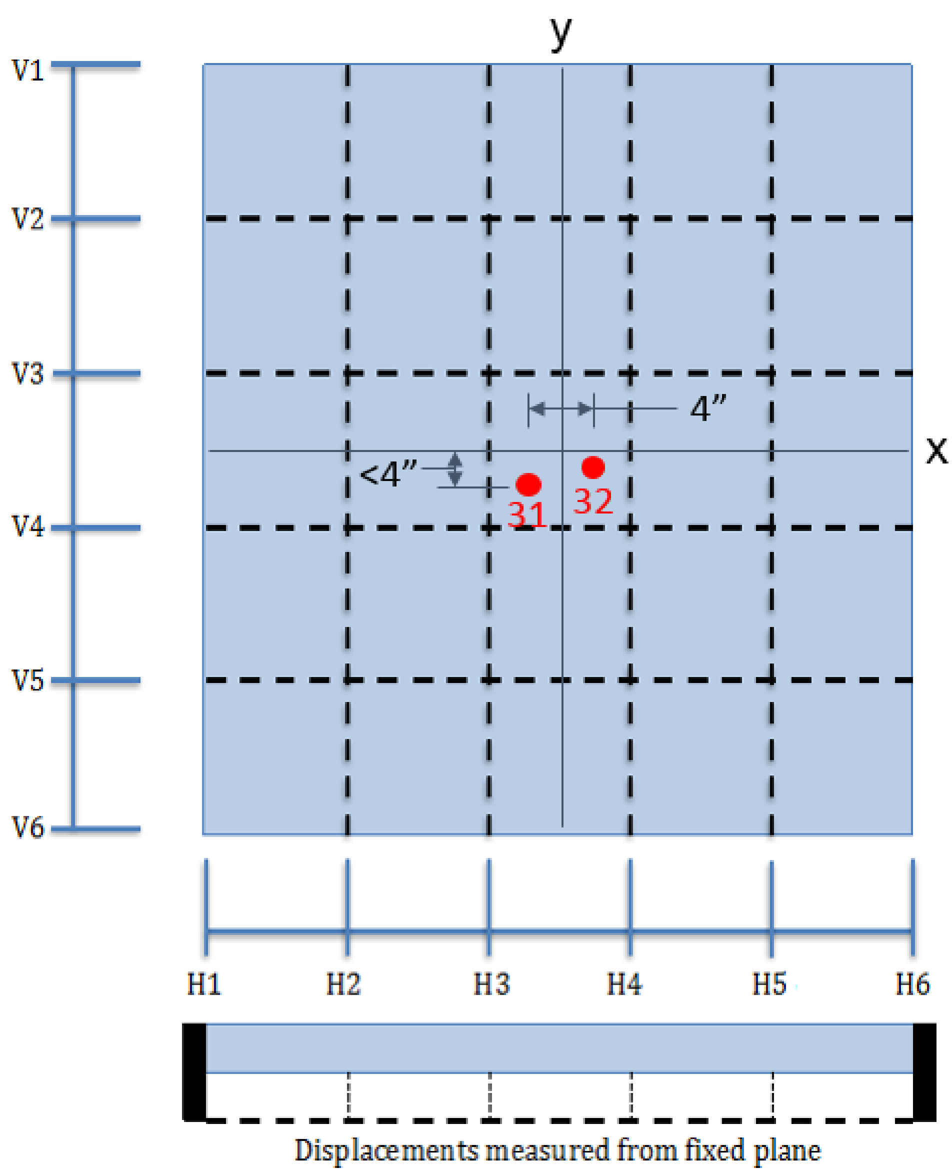
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 4b - Panel 6	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 27, 2016	

Deflection Measurement Locations



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 5 - Panel 7	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 29, 2016	Pre-Test Specimen Temperature: 73 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		725 psi (5 MPa)	13.7 lb/ft^3 (220 kg/m^3)	8290 psi (57.2 MPa)

Specimen Response

Description: The blast load resulted in horizontal, vertical, and diagonal cracks on the front face of the panel, along with some concrete scabbing. On the back face, cracking was observed along most of the slab surface, generally ranging from hairlines to cracks with widths of approximately 0.03 inch (0.8 mm). Significant cracking, spalling, and/or bowing was noted along the left and right panel edges. Cracks were also observed across the slab thickness. No damage was observed to the stiffened steel frame.

The maximum deflection recorded with the laser sensors was 3.5 inches (88 mm). The permanent set near the slab center point was 2.2 inches (57 mm).

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 5 - Panel 7
Test Date: September 29, 2016

Charge Material: ANFO
Charge Weight: 2300 lb
Charge Standoff: 45 ft to Center of Charge

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	N/A	N/A	Sensor had no response
2	2-SG-1-F-V	N/A	N/A	Wire broken at 0.0182 s
3	3-SG-2-F-H	1872	0.0186	Wire broken at 0.0245 s
4	4-SG-2-F-V	N/A	N/A	Wire broken at 0.0223 s
5	5-SG-3-F-H	1528	0.0204	Noisy connection, Permanent strain: 65 με
6	6-SG-3-F-V	1315	0.0188	Noisy connection, Permanent strain: -464 με
7	7-SG-4-F-H	1184	0.0132	Noisy connection, Permanent strain: -119 με
8	8-SG-4-F-V	26,826	0.0240	Noisy connection, Permanent strain: 2752 με
9	9-SG-5-F-H	N/A	N/A	Noisy connection
10	10-SG-5-F-V	N/A	N/A	Wire broken at 0.021 s
11	11-SG-6-F-H	N/A	N/A	Wire broken at 0.0183 s
12	12-SG-6-F-V	N/A	N/A	Wire broken at 0.0196 s
13	13-SG-1-R-H	-3582	0.0205	Wire broken at 0.0268 s
14	14-SG-1-R-V	-3616	0.0180	Wire broken at 0.0691 s
15	15-SG-2-R-H	N/A	N/A	Sensor had no response
16	16-SG-2-R-V	-11,683	0.0194	Permanent strain: -3599 με
17	17-SG-3-R-H	-13,185	0.0188	Permanent strain: -2983 με
18	18-SG-3-R-V	-14,928	0.0189	Permanent strain: -3822 με
19	19-SG-4-R-H	-19,231	0.0169	Permanent strain: -4944 με
20	20-SG-4-R-V	-16,616	0.0184	Permanent strain: -5190 με
21	21-SG-5-R-H	N/A	N/A	Noisy connection, Perm. strain: -4080 με
22	22-SG-5-R-V	-10,377	0.0185	Permanent strain: -1792 με
23	23-SG-6-R-H	-12,859	0.0199	Permanent strain: -1616 με
24	24-SG-6-R-V	-8771	0.0184	Permanent strain: -957 με
25	25-SG-7-R-H	-4607	0.0185	Permanent strain: -513 με
26	26-SG-7-R-V	-3639	0.0186	Permanent strain: -353 με
27	27-SG-8-R-H	-7503	0.0205	Permanent strain: -1627 με
28	28-SG-8-R-V	3277	0.0150	Permanent strain: -137 με
29	29-SG-9-R-H	-15,922	0.0195	Permanent strain: -2972 με
30	30-SG-10-R-V	-12,601	0.0183	Permanent strain: -3534 με

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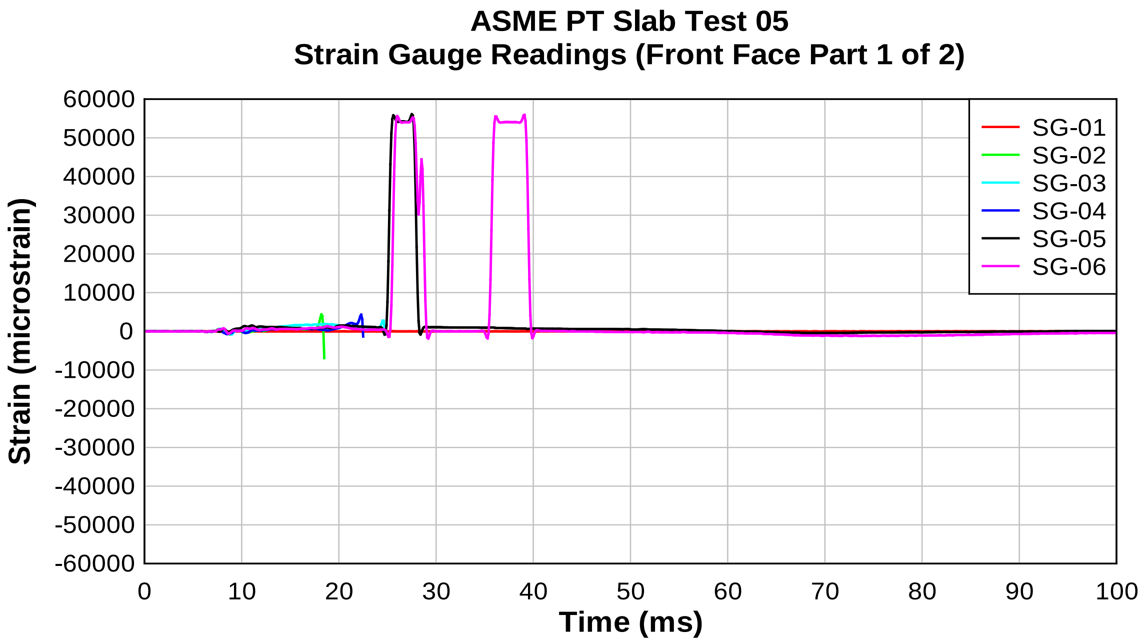
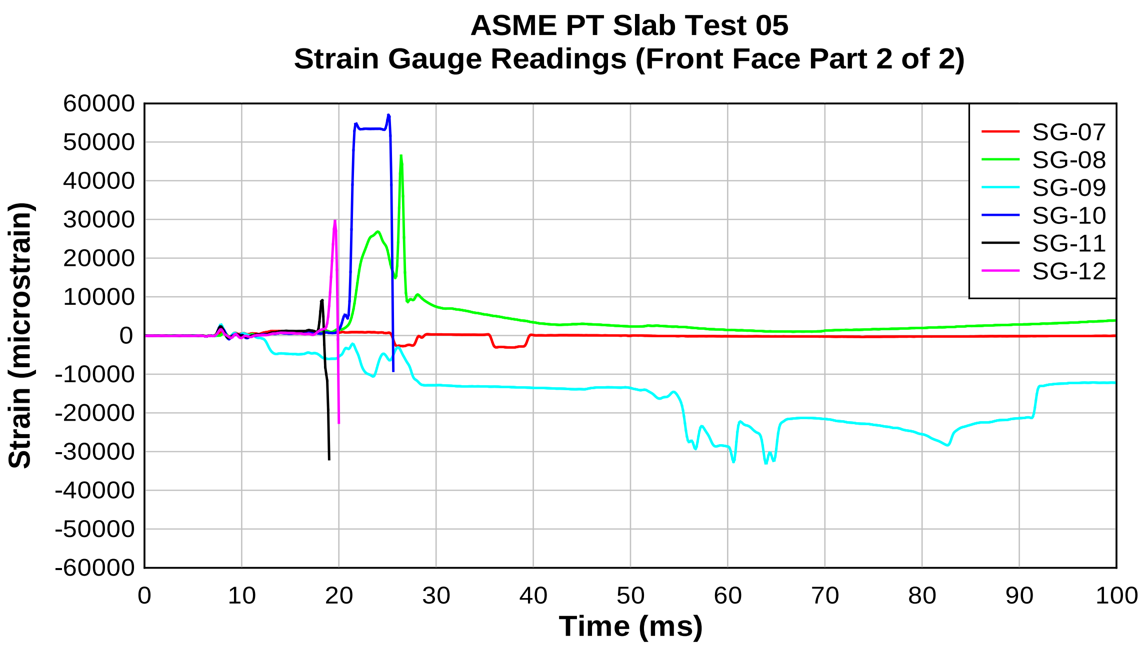
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 5 - Panel 7	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 29, 2016	

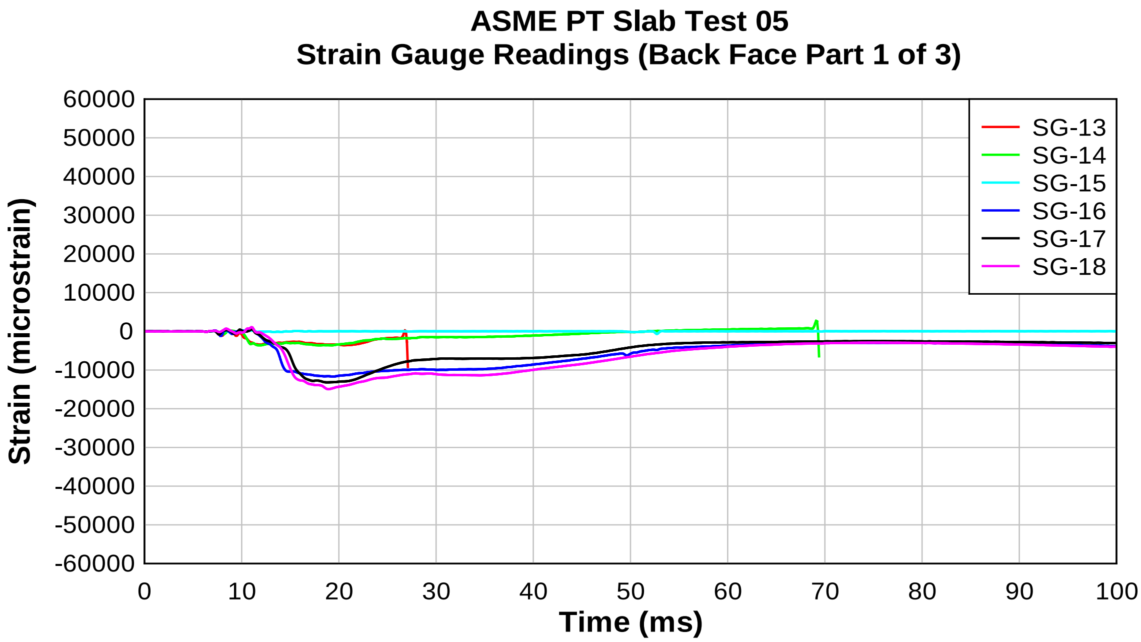


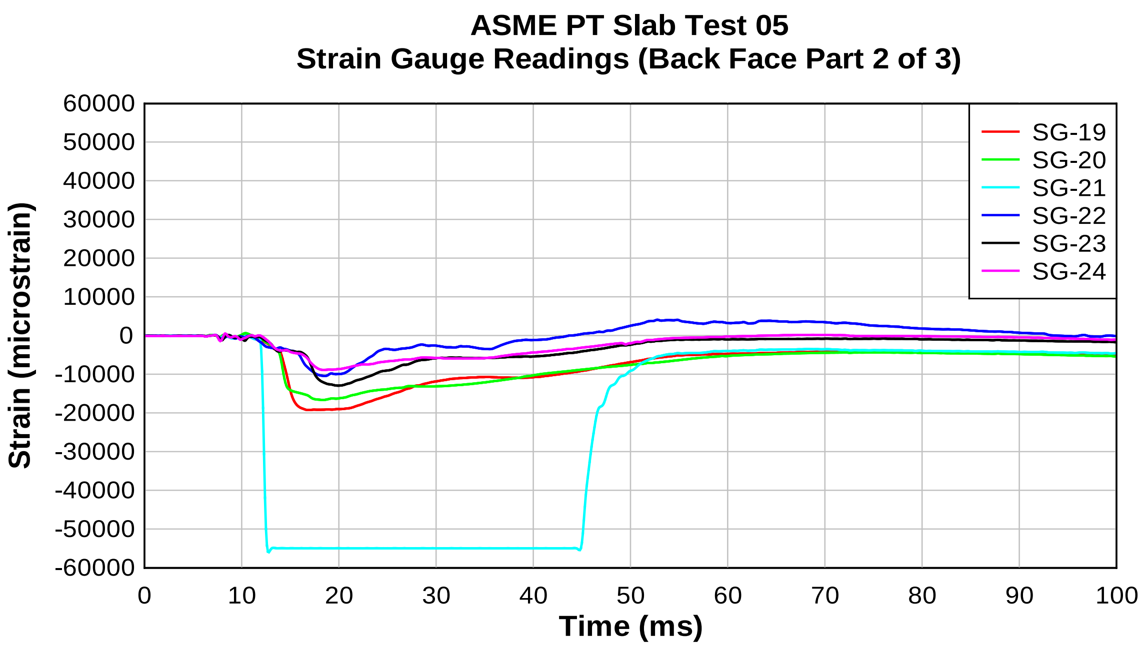


Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 5 - Panel 7	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 29, 2016	

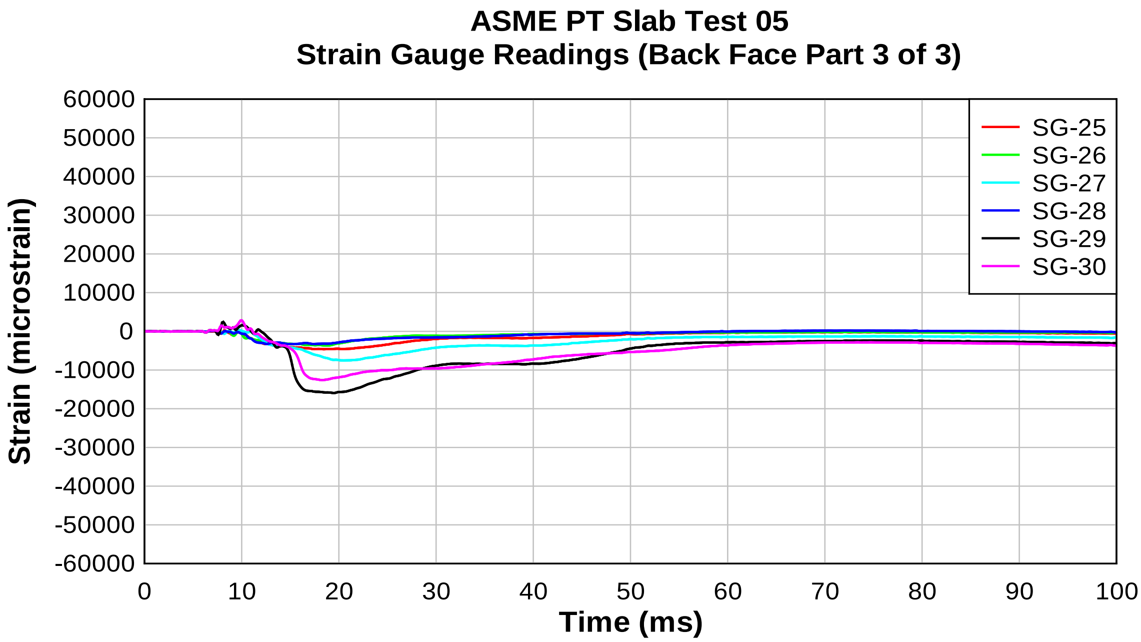




Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 5 - Panel 7	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 29, 2016	



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Testing Data Sheet

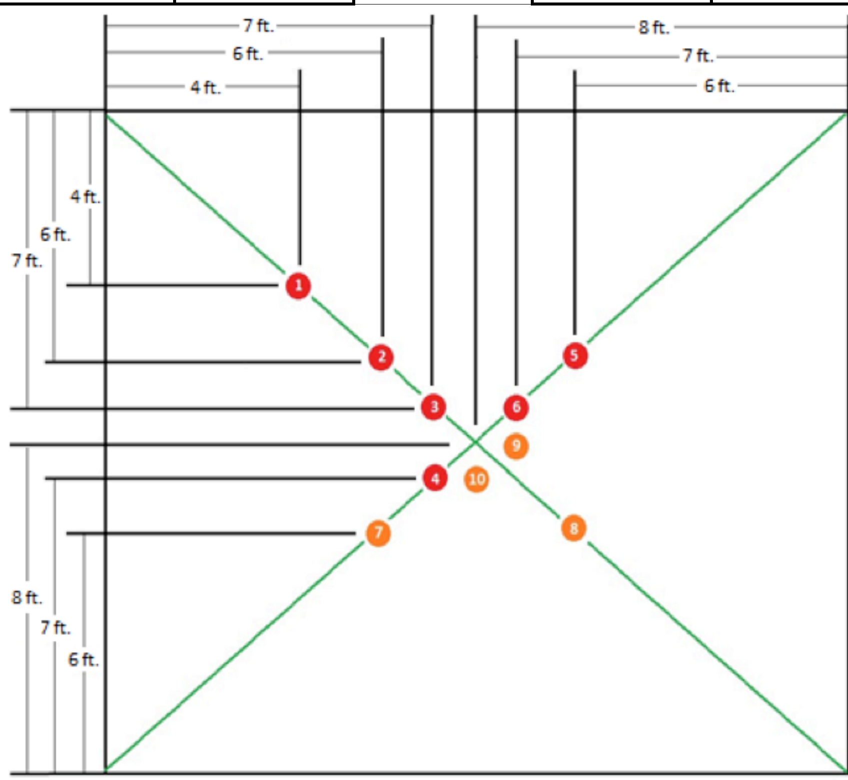
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 5 - Panel 7
Test Date: September 29, 2016

Charge Material: ANFO
Charge Weight: 2300 lb
Charge Standoff: 45 ft to Center of Charge

Strain Gauge Locations

Slab Design B		
Rebar Locat.	X-bar	Y-bar
1	13	13
2	19	19
3	22	22
4	28	21
5	32	16
6	23	26
7	18	31
8	23	26
9	28	24
10	24	28



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 5 - Panel 7

Test Date: September 29, 2016

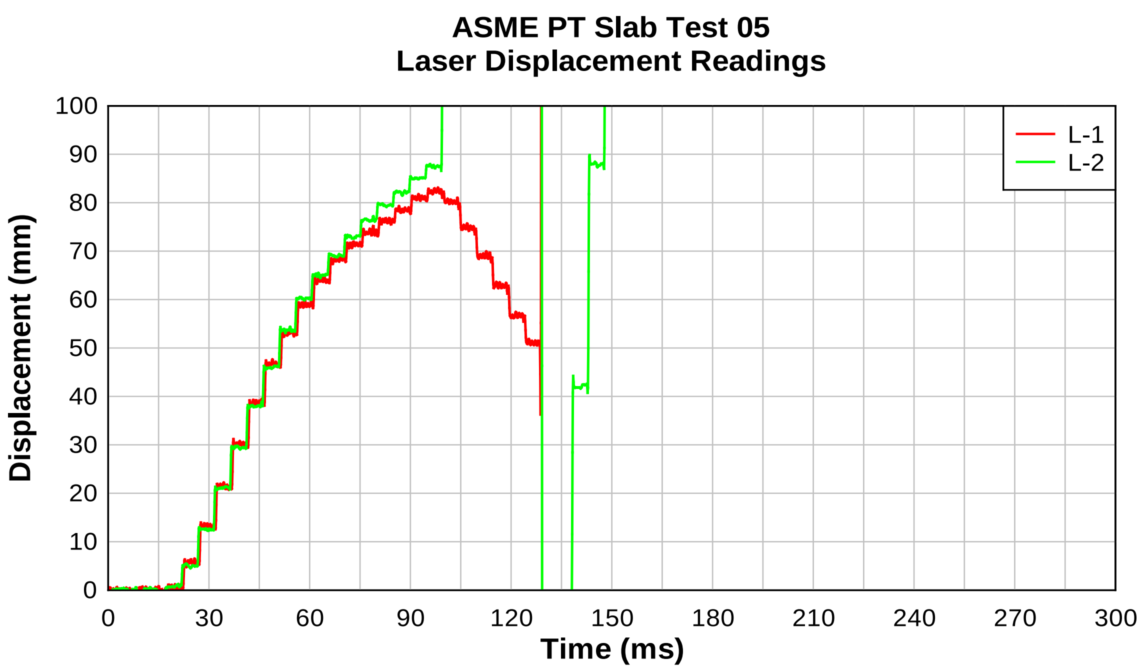
Charge Material: ANFO

Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	83	0.0982	59	
32	88	0.0959	57	



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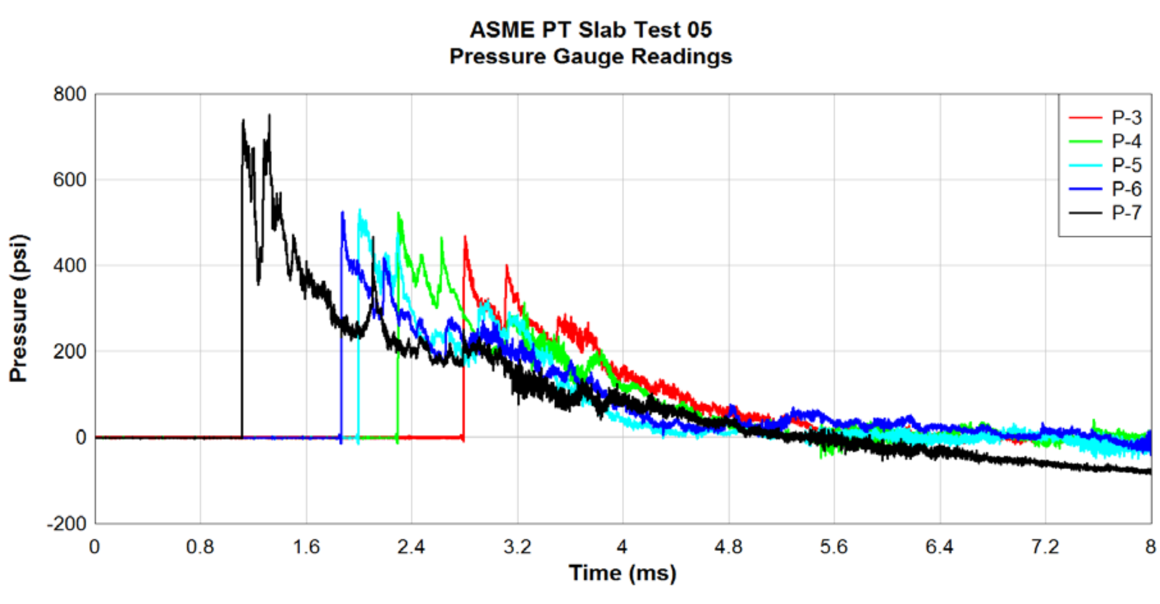
Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing — Charge Material: ANFO
Project Number: 1507-11 — Charge Weight: 2300 lb
Test Number: Test 5 - Panel 7 — Charge Standoff: 45 ft to Center of Charge
Test Date: September 29, 2016

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
P1	156	172	N/A	N/A	Located 53 ft from charge; Impulse through 0.008 s
P2	178	234	N/A	N/A	Located 46 ft from charge; Impulse through 0.0079 s
P3	470	434	-20.5	N/A	
P4	525	509	-46.4	N/A	Impulse through 0.008 s
P5	532	493	-47.4	N/A	
P6	527	580	-38.3	N/A	
P7	751	758	-86.5	N/A	

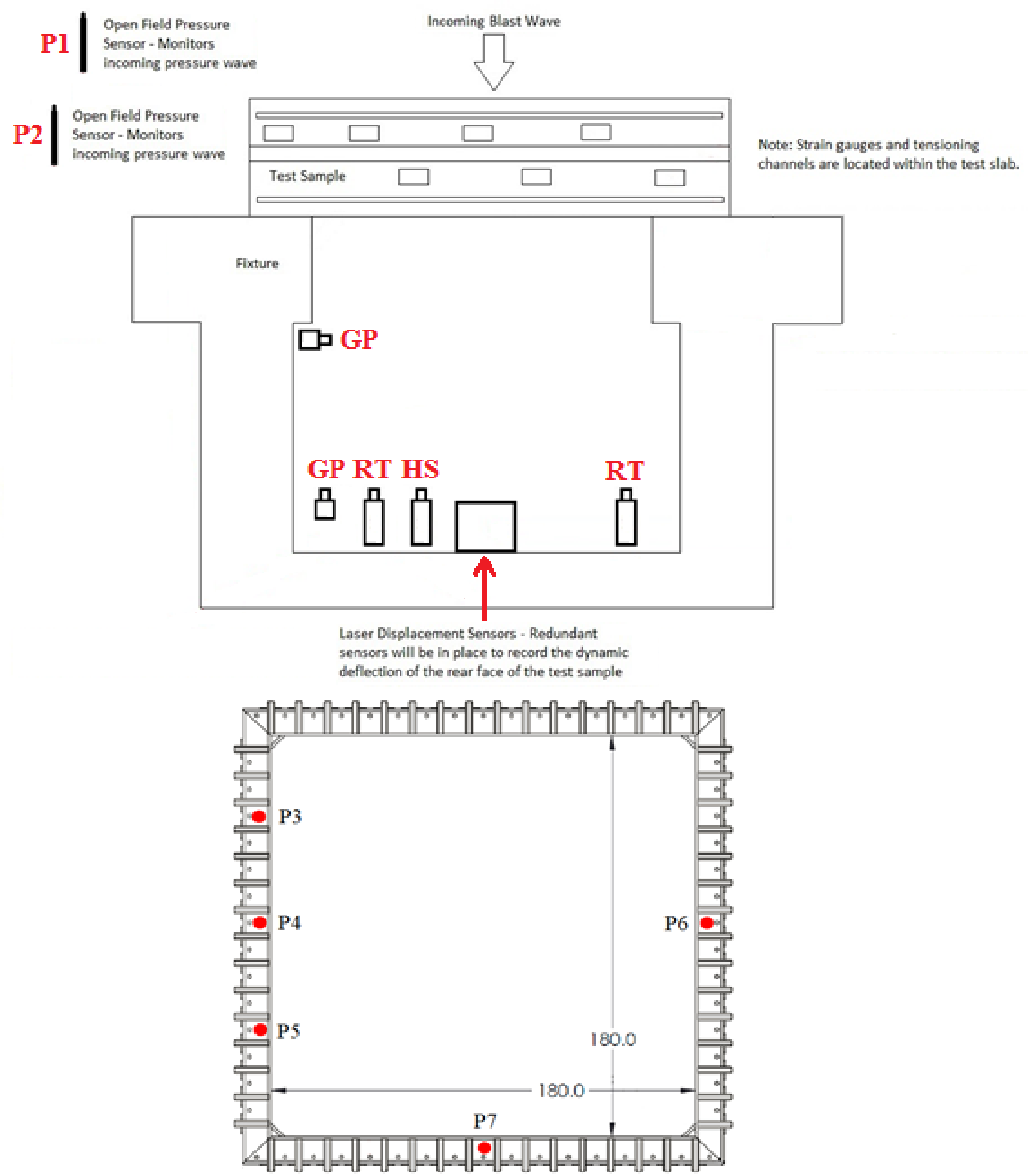


Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 5 - Panel 7	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 29, 2016	

Gauge Locations



Stone OBL

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 5 - Panel 7
Test Date: September 29, 2016

Charge Material: ANFO
Charge Weight: 2300 lb
Charge Standoff: 45 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.32	12.23		27.8	1.094
V2	H3	12.33	12.21		36.5	1.437
V2	H4	12.35	12.22		38.9	1.531
V2	H5	12.34	12.23		34.9	1.375
V2	H6					
V3	H1					
V3	H2	12.37	12.24		39.7	1.563
V3	H3	12.38	12.20		54.0	2.125
V3	H4	12.35	12.18		53.2	2.094
V3	H5	12.36	12.20		48.4	1.906
V3	H6					
V4	H1					
V4	H2	12.39	12.27		36.5	1.437
V4	H3	12.38	12.22		47.6	1.875
V4	H4	12.36	12.21		46.8	1.844
V4	H5	12.31	12.19		38.1	1.500
V4	H6					
V5	H1					
V5	H2	12.42	12.33		26.2	1.031
V5	H3	12.40	12.31		27.8	1.094
V5	H4	12.38	12.29		27.0	1.062
V5	H5	12.33	12.27		19.8	0.781
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

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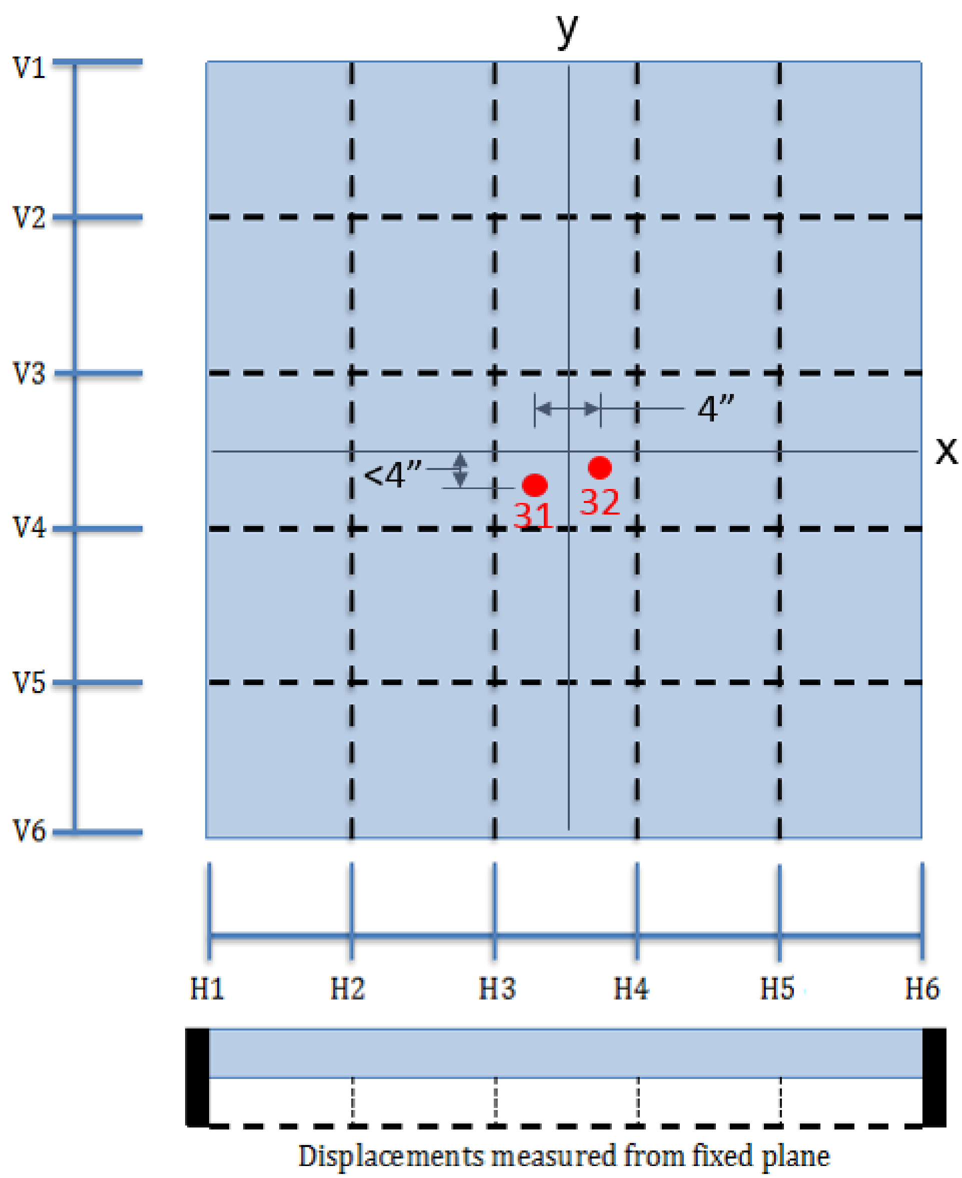
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 5 - Panel 7	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 29, 2016	

Deflection Measurement Locations



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 6 - Panel 3

Test Date: September 30, 2016

Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge

Pre-Test Specimen Temperature: 73 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		725 psi (5 MPa)	13.7 lb/ft^3 (220 kg/m^3)	6980 psi (48.1 MPa)

Specimen Response

Description: The blast load resulted in horizontal, vertical, and diagonal cracks on the front face of the panel, along with some concrete crushing/scabbing similar to that seen in Test 5. On the back face, cracking was observed along most of the slab surface. Cracks were mostly hairlines in a yield line pattern similar to previous tests. The main cracks were a central horizontal vertical crack with a width of approximately 0.03 inch (0.8 mm), as well as more significant cracking up to 0.1 inch (2.5 mm) that was noted along the left and right panel edges. Some cracking was also observed across the slab thickness in a similar pattern but to a lesser extent than in Test 5. No damage was observed to the stiffened steel frame.

The maximum deflection recorded with the laser sensors was 1.2 inches (31 mm). The permanent set near the slab center point was approximately 0.5 inch (13 mm).

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 6 - Panel 3	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 30, 2016	

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	N/A	N/A	Sensor had no response
2	2-SG-1-F-V	1258	0.0190	Permanent strain: 250 με
3	3-SG-2-F-H	-1810	0.0490	Permanent strain: -125 με
4	4-SG-2-F-V	-2163	0.0546	Permanent strain: -513 με
5	5-SG-3-F-H	6811	0.0271	Wire broken at 0.0462 s
6	6-SG-3-F-V	N/A	N/A	Noisy connection
7	7-SG-4-F-H	-2202	0.0488	Permanent strain: 87 με
8	8-SG-4-F-V	-1933	0.0546	Permanent strain: 123 με
9	9-SG-5-F-H	N/A	N/A	Noisy connection
10	10-SG-5-F-V	N/A	N/A	Noisy connection
11	11-SG-6-F-H	N/A	N/A	Sensor had no response
12	12-SG-6-F-V	N/A	N/A	Sensor had no response
13	13-SG-1-R-H	-3375	0.0211	Permanent strain: -321 με
14	14-SG-1-R-V	-3048	0.0212	Permanent strain: -154 με
15	15-SG-2-R-H	N/A	N/A	Noisy connection
16	16-SG-2-R-V	N/A	N/A	Noisy connection
17	17-SG-3-R-H	-11,154	0.0223	Permanent strain: -2133 με
18	18-SG-3-R-V	-15,242	0.0223	Permanent strain: -2203 με
19	19-SG-4-R-H	-5109	0.0214	Permanent strain: 787 με
20	20-SG-4-R-V	-13,707	0.0223	Permanent strain: -1850 με
21	21-SG-5-R-H	-3922	0.0198	Permanent strain: -248 με
22	22-SG-5-R-V	-3651	0.0223	Permanent strain: -385 με
23	23-SG-6-R-H	-14,968	0.0197	Permanent strain: -991 με
24	24-SG-6-R-V	-17,413	0.0194	Permanent strain: -4281 με
25	25-SG-7-R-H	-3715	0.0212	Permanent strain: -452 με
26	26-SG-7-R-V	-8215	0.0223	Permanent strain: -1576 με
27	27-SG-8-R-H	-9370	0.0168	Permanent strain: -180 με
28	28-SG-8-R-V	-11,918	0.0174	Permanent strain: -2731 με
29	29-SG-9-R-H	N/A	N/A	Noisy connection, Wire broken at 0.0235 s
30	30-SG-10-R-V	N/A	N/A	Noisy connection, Wire broken at 0.0233 s

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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

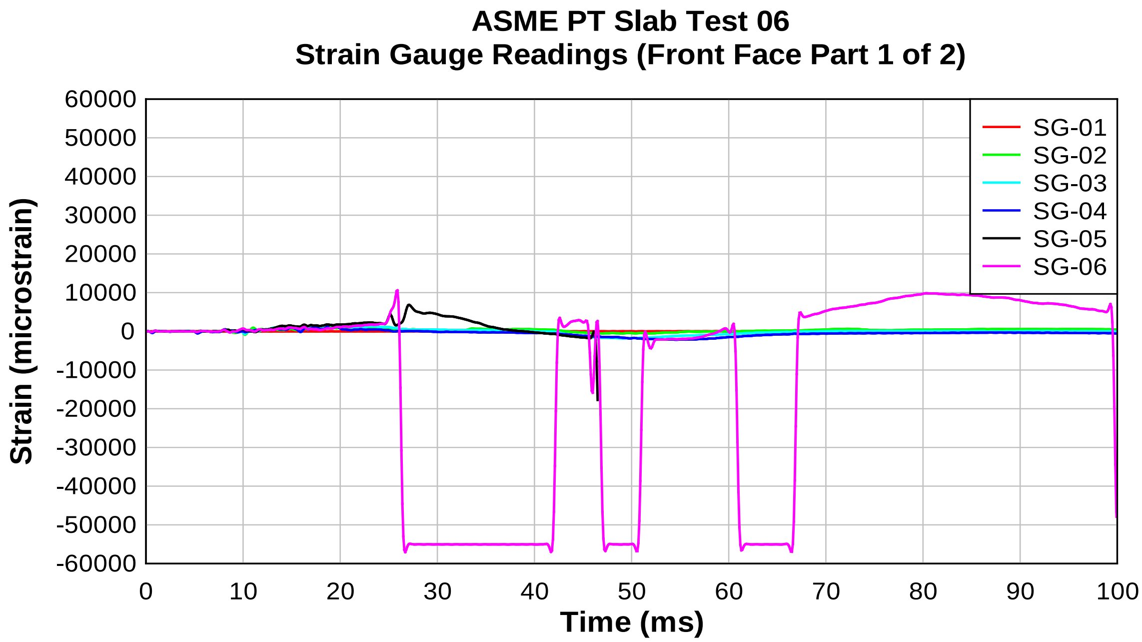
Test Number: Test 6 - Panel 3

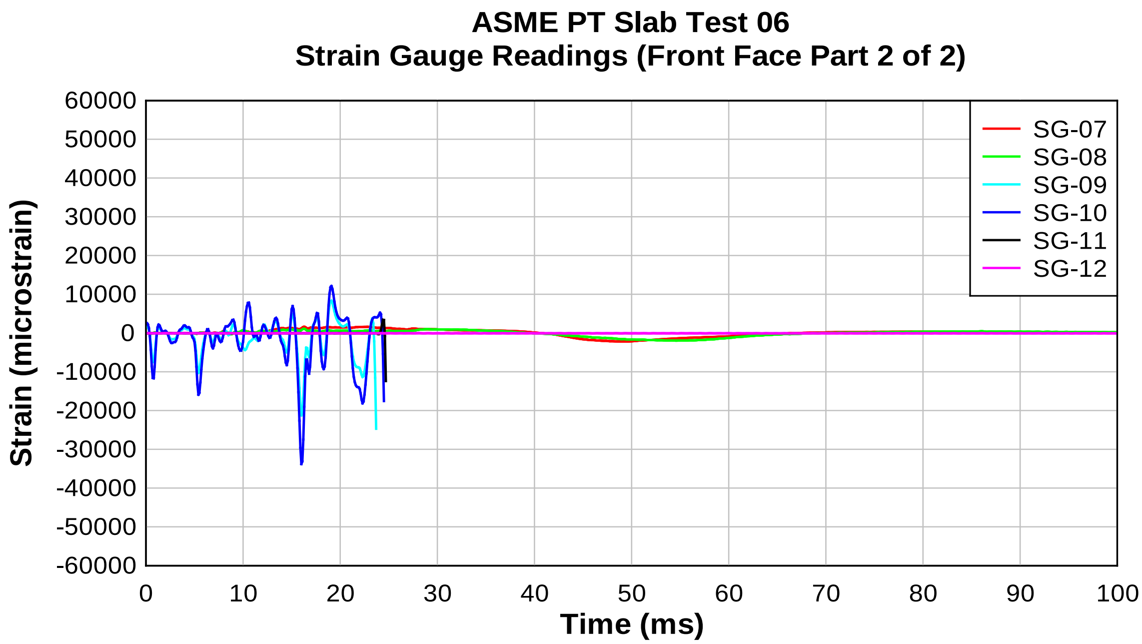
Test Date: September 30, 2016

Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge





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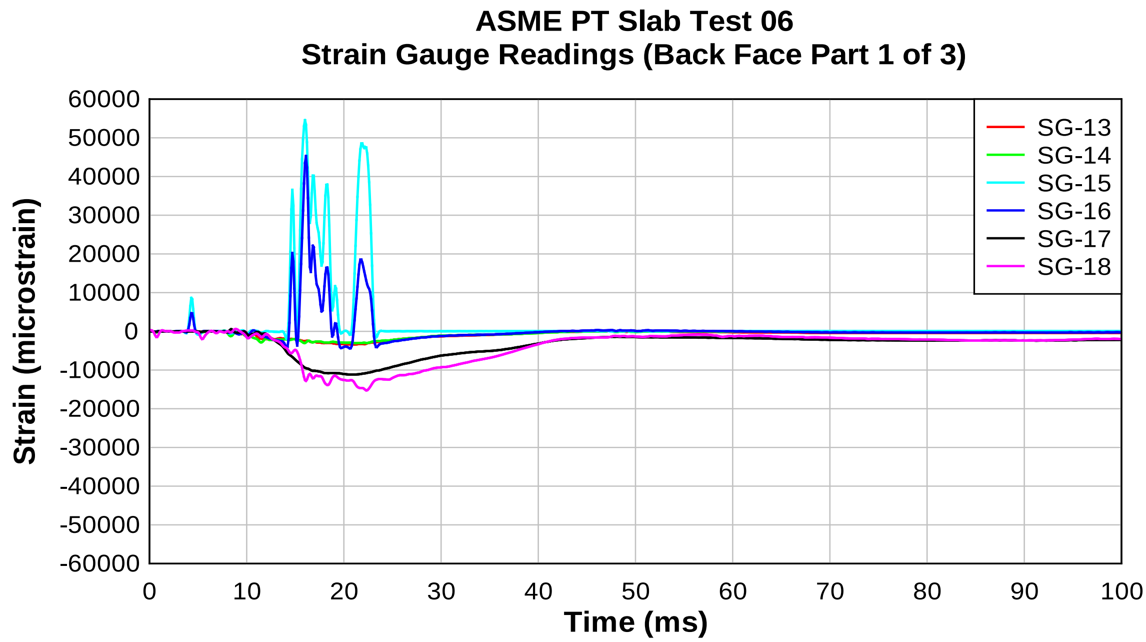
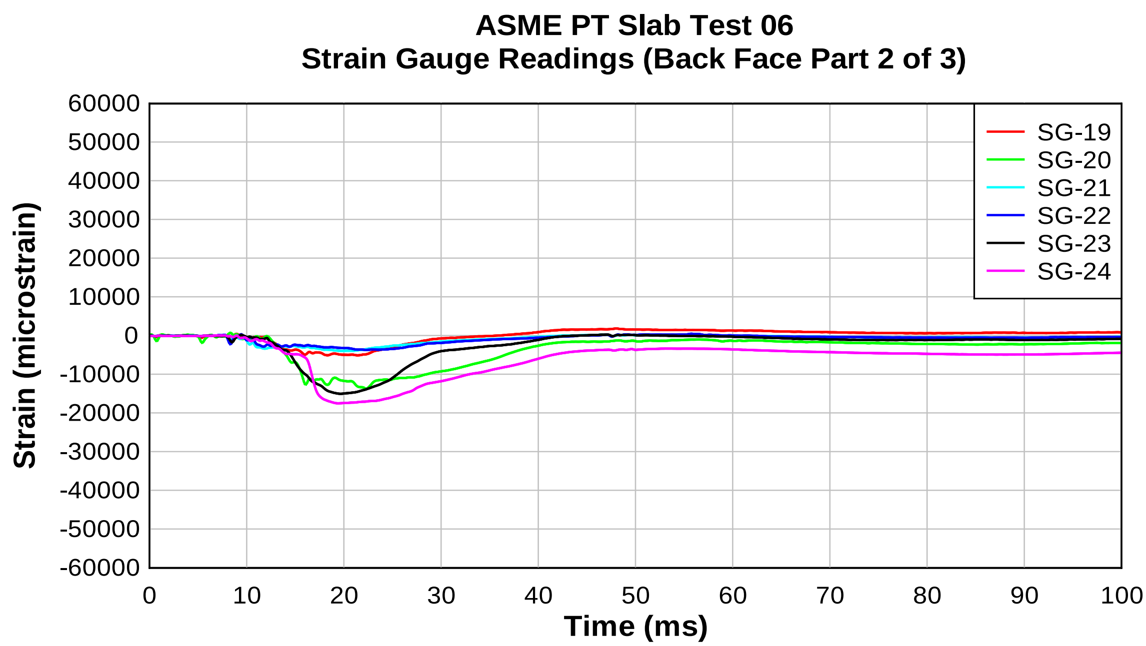
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 6 - Panel 3	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 30, 2016	





Testing Data Sheet

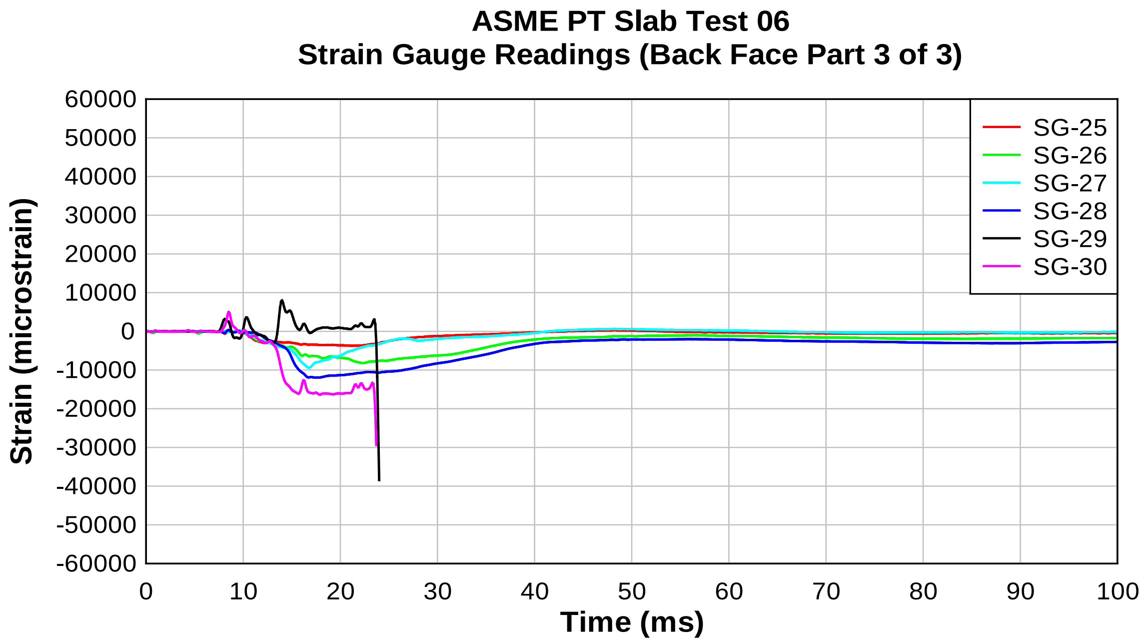
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing | Charge Material: ANFO

Project Number: 1507-11 | Charge Weight: 2000 lb

Test Number: Test 6 - Panel 3 | Charge Standoff: 45 ft to Center of Charge

Test Date: September 30, 2016



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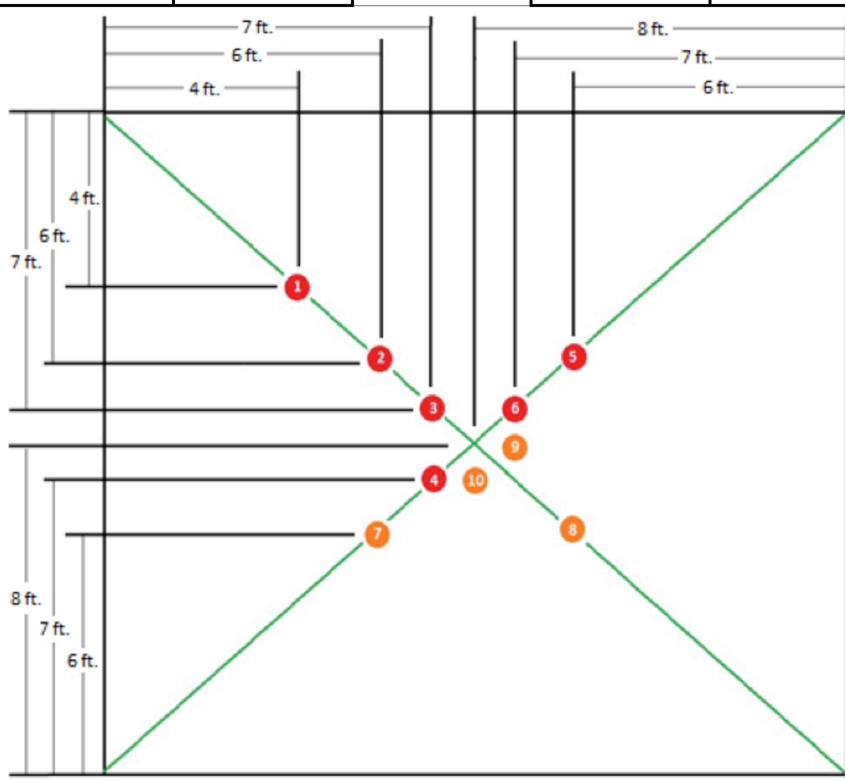
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 6 - Panel 3	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 30, 2016	

Strain Gauge Locations

Slab Design B		
Rebar Locat.	X-bar	Y-bar
1	13	13
2	19	19
3	22	22
4	28	21
5	32	16
6	23	26
7	18	31
8	23	26
9	28	24
10	24	28



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

Stone OBL

Testing Data Sheet

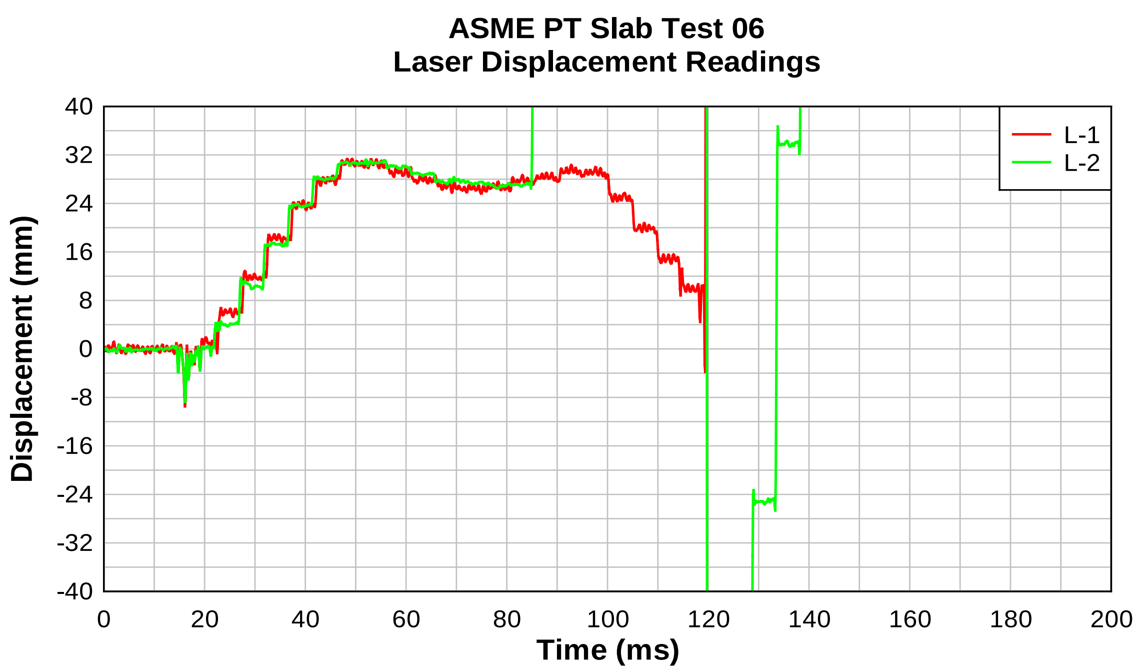
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 6 - Panel 3
Test Date: September 30, 2016

Charge Material: ANFO
Charge Weight: 2000 lb
Charge Standoff: 45 ft to Center of Charge

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	31	0.0483	12	
32	31	0.052	13	



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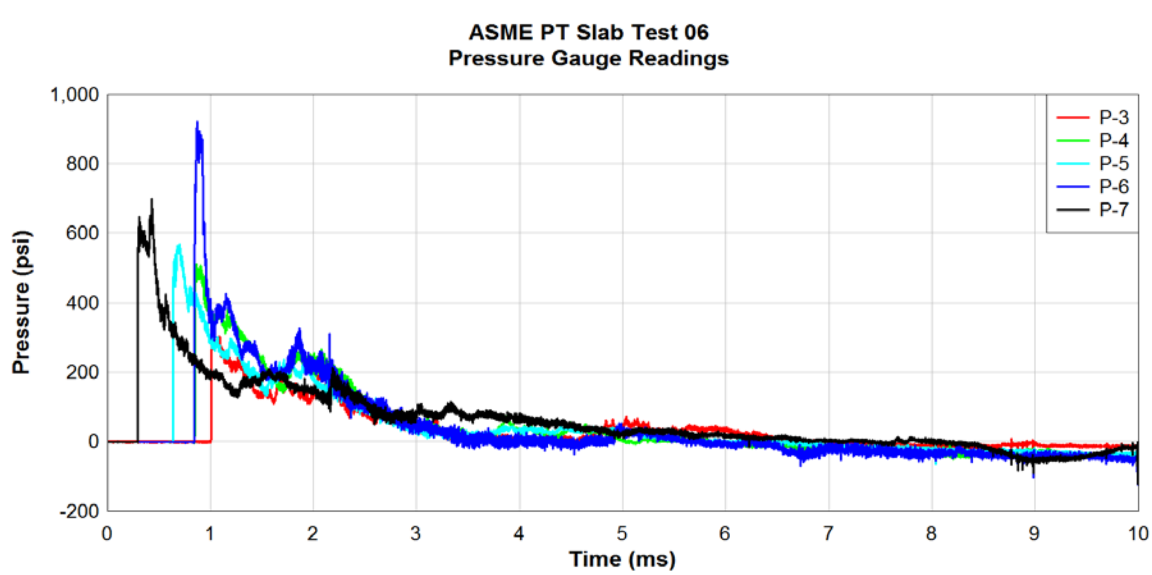
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 6 - Panel 3	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 30, 2016	

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
P1	95.1	211	N/A	N/A	Located 46 ft from charge; Impulse through 0.0121 s
P2	129	283	N/A	N/A	Located 55 ft from charge; Impulse through 0.0093 s
P3	318	362	-63.1	N/A	
P4	511	526	-62.3	N/A	
P5	568	547	-62.1	N/A	
P6	922	526	-101	N/A	
P7	701	702	-89.8	N/A	

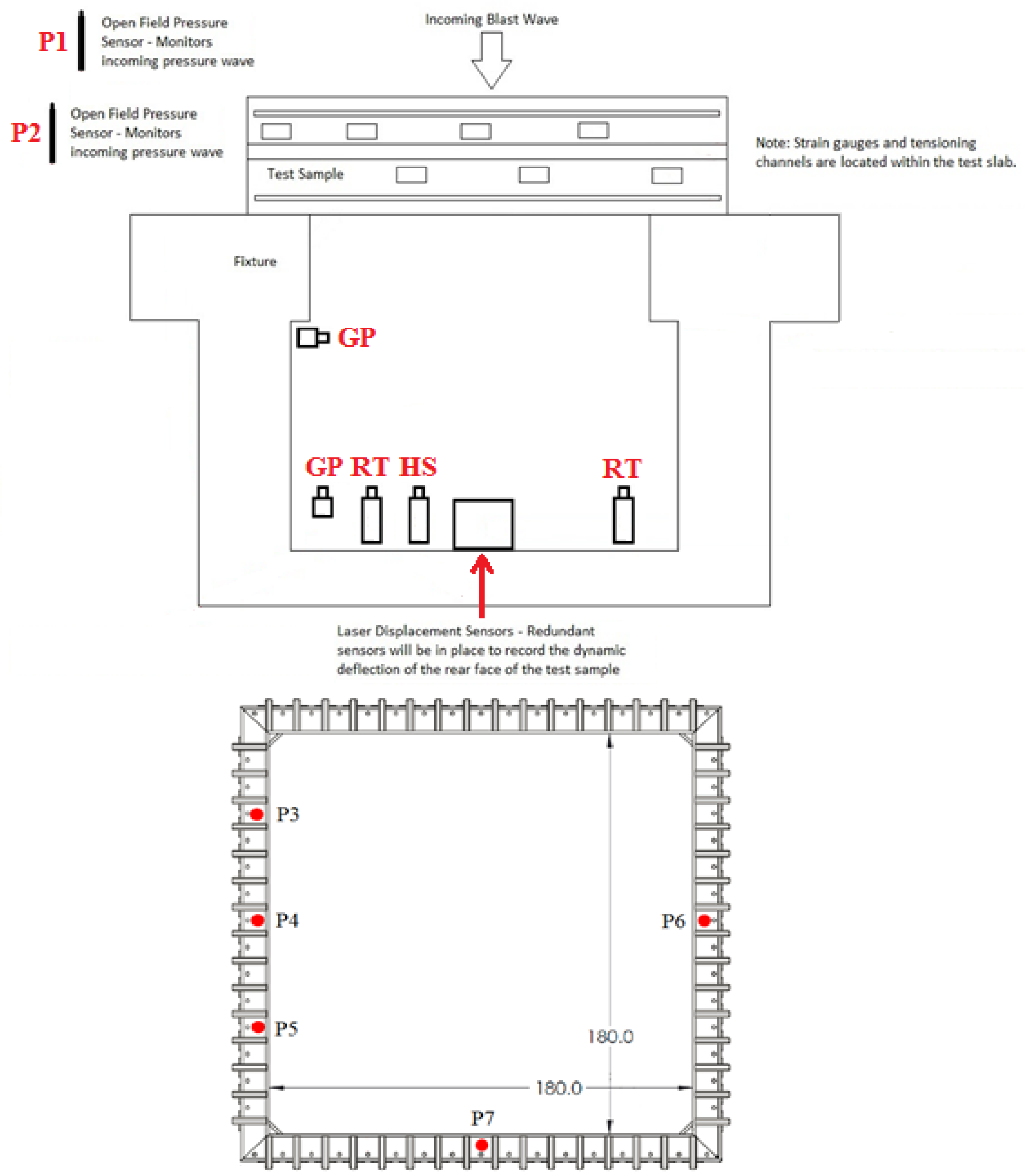


Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 6 - Panel 3	Charge Standoff: 45 ft to Center of Charge
Test Date:	September 30, 2016	

Gauge Locations



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 6 - Panel 3
Test Date: September 30, 2016

Charge Material: ANFO
Charge Weight: 2000 lb
Charge Standoff: 45 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.34	12.32		5.6	0.219
V2	H3	12.34	12.32		5.6	0.219
V2	H4	12.35	12.33		6.4	0.250
V2	H5	12.35	12.32		7.9	0.312
V2	H6					
V3	H1					
V3	H2	12.36	12.33		8.7	0.344
V3	H3	12.36	12.33		10.3	0.406
V3	H4	12.35	12.31		11.1	0.438
V3	H5	12.35	12.32		7.9	0.312
V3	H6					
V4	H1					
V4	H2	12.38	12.35		7.9	0.313
V4	H3	12.39	12.35		9.5	0.375
V4	H4	12.37	12.34		9.5	0.375
V4	H5	12.33	12.29		11.9	0.469
V4	H6					
V5	H1					
V5	H2	12.40	12.38		7.1	0.281
V5	H3	12.37	12.34		7.1	0.281
V5	H4	12.34	12.31		7.1	0.281
V5	H5	12.33	12.30		8.7	0.344
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 6 - Panel 3

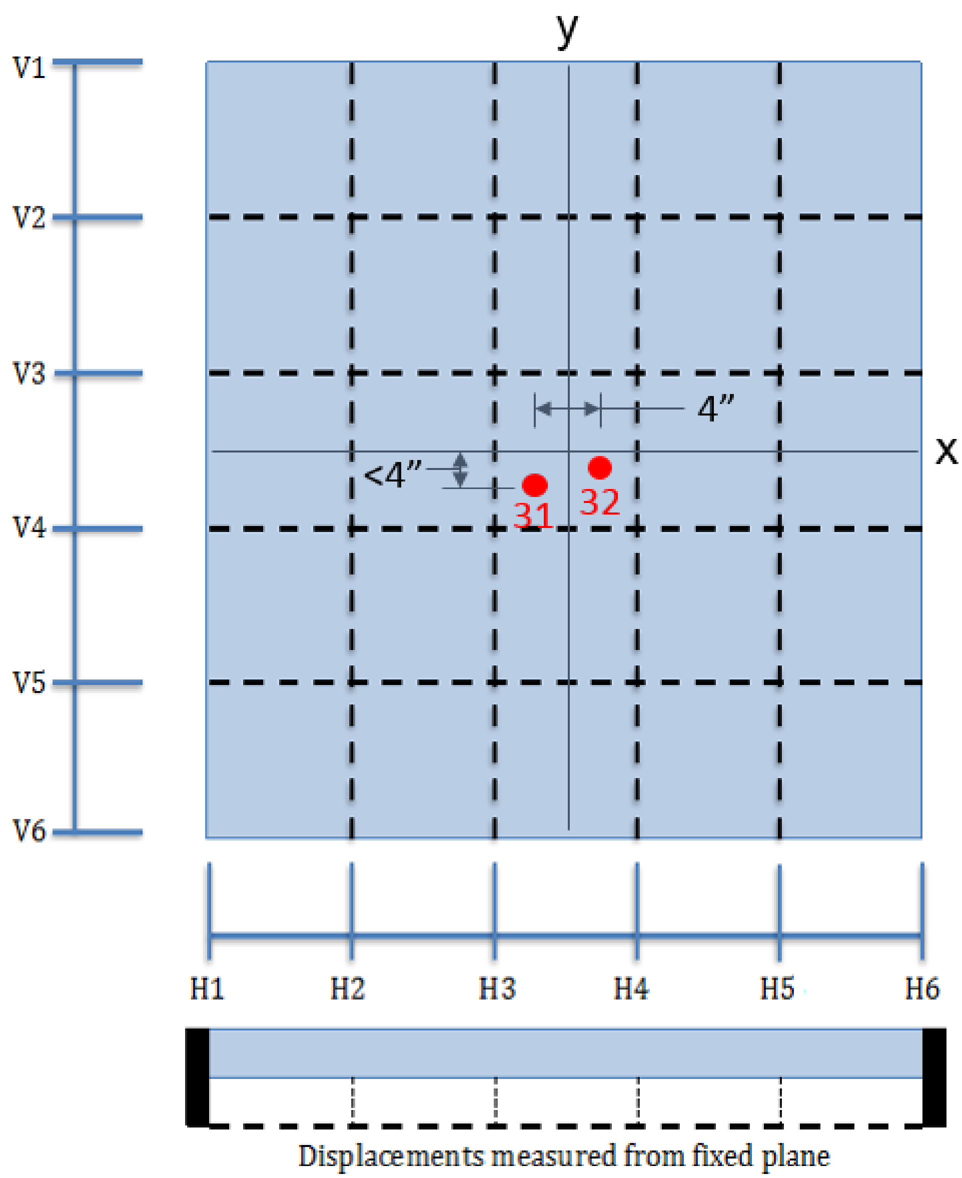
Test Date: September 30, 2016

Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge

Deflection Measurement Locations



Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 7 - Panel 4

Test Date: October 5, 2016

Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge

Pre-Test Specimen Temperature: 53 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		1450 psi (10 MPa)	13.7 lb/ft^3 (220 kg/m^3)	8990 psi (62.0 MPa)

Specimen Response

Description: Lesser cracks and concrete scabbing/crushing were observed on the front face of the panel in comparison with the previously tested slab designs. On the back face, hairline cracking was observed on the slab surface. Cracks were mostly hairlines in a yield line pattern similar to previous tests. The main crack was a central horizontal crack pattern with a width of approximately 0.016 inch (0.41 mm) Some cracking was also observed across the slab thickness. No damage was observed to the stiffened steel frame.

The maximum deflection recorded with the laser sensors was 0.8 inch (21 mm). A small permanent set of roughly 0.1 inch (2.5 mm) was sustained near the slab center point.

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing — Charge Material: ANFO
Project Number: 1507-11 — Charge Weight: 2000 lb
Test Number: Test 7 - Panel 4 — Charge Standoff: 45 ft to Center of Charge
Test Date: October 5, 2016

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	N/A	N/A	Sensor had no response
2	2-SG-1-F-V	1255	0.0217	
3	3-SG-2-F-H	1384	0.0222	Noisy connection, Permanent strain: 353 με
4	4-SG-2-F-V	1626	0.0230	
5	5-SG-3-F-H	1507	0.0211	Permanent strain: 216 με
6	6-SG-3-F-V	-1918	0.0174	Permanent strain: -57 με
7	7-SG-4-F-H	1511	0.0210	Noisy connection
8	8-SG-4-F-V	2326	0.0211	Permanent strain: -74 με
9	9-SG-5-F-H	N/A	N/A	Sensor had no response
10	10-SG-5-F-V	N/A	N/A	Sensor had no response
11	11-SG-6-F-H	-1535	0.0494	Permanent strain: -80 με
12	12-SG-6-F-V	-1940	0.0448	Permanent strain: -28 με
13	13-SG-1-R-H	-3346	0.0189	Permanent strain: -188 με
14	14-SG-1-R-V	-3166	0.0129	Permanent strain: -612 με
15	15-SG-2-R-H	N/A	N/A	Sensor had no response
16	16-SG-2-R-V	-4023	0.0190	Noisy connection
17	17-SG-3-R-H	-4866	0.0206	Permanent strain: -569 με
18	18-SG-3-R-V	-14,295	0.0168	Permanent strain: -3957 με
19	19-SG-4-R-H	-6206	0.0225	Permanent strain: -448 με
20	20-SG-4-R-V	N/A	N/A	Sensor had no response
21	21-SG-5-R-H	N/A	N/A	Sensor had no response
22	22-SG-5-R-V	-4234	0.0206	Permanent strain: -894 με
23	23-SG-6-R-H	N/A	N/A	Sensor had no response
24	24-SG-6-R-V	-13,423	0.0189	Permanent strain: -1916 με
25	25-SG-7-R-H	-8776	0.0218	Permanent strain: -1362 με
26	26-SG-7-R-V	-9754	0.0224	Permanent strain: -2811 με
27	27-SG-8-R-H	-3796	0.0217	Permanent strain: -329 με
28	28-SG-8-R-V	-3635	0.0225	Permanent strain: -308 με
29	29-SG-9-R-H	-10,224	0.0207	Noisy connection, Permanent strain: -54 με
30	30-SG-10-R-V	N/A	N/A	Noisy connection, Perm. strain: -2251 με

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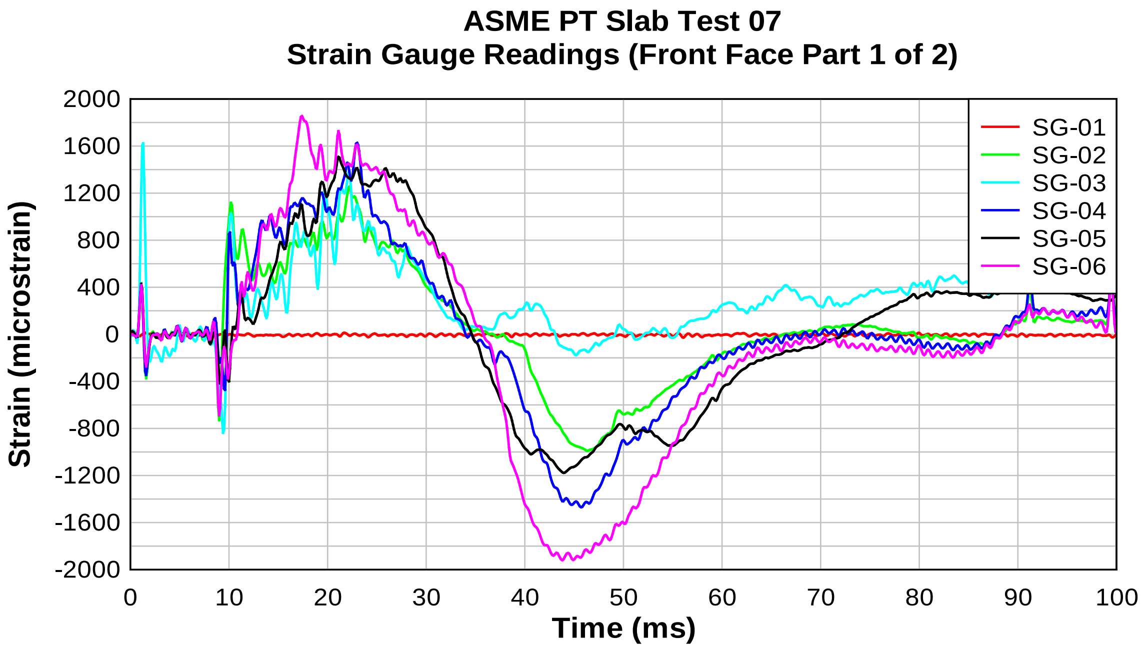
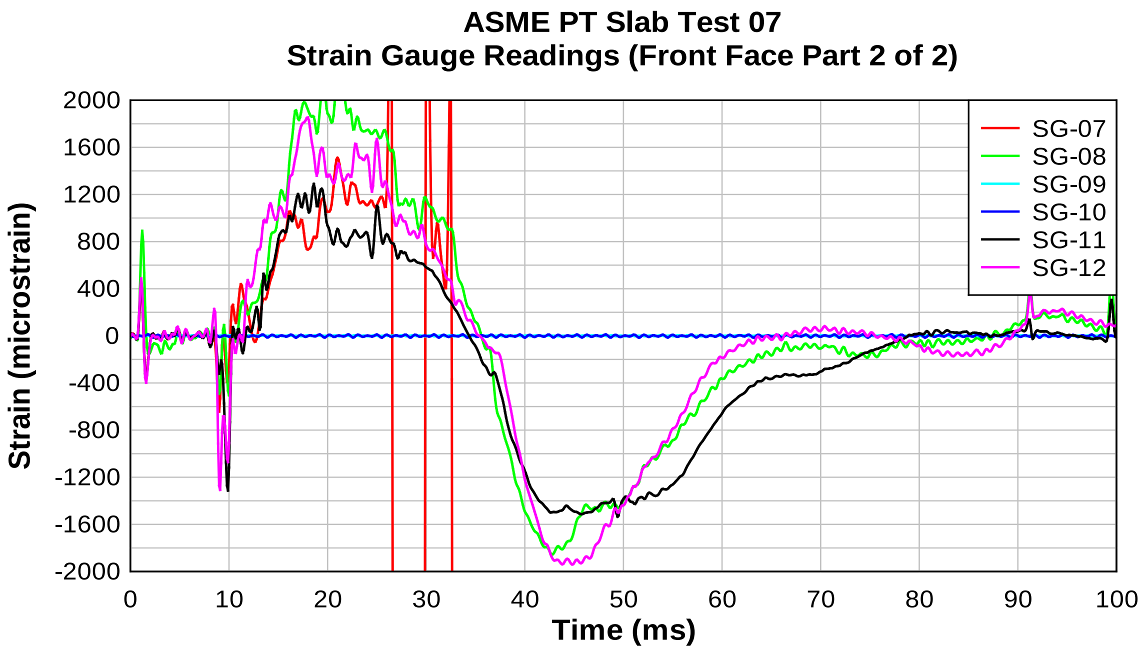
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 7 - Panel 4	Charge Standoff: 45 ft to Center of Charge
Test Date:	October 5, 2016	



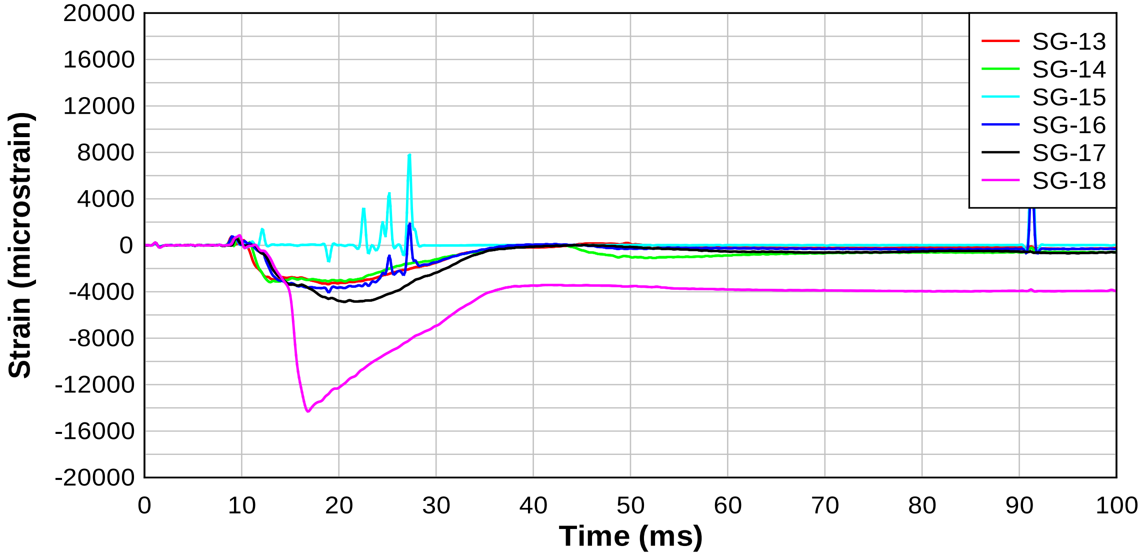


Testing Data Sheet

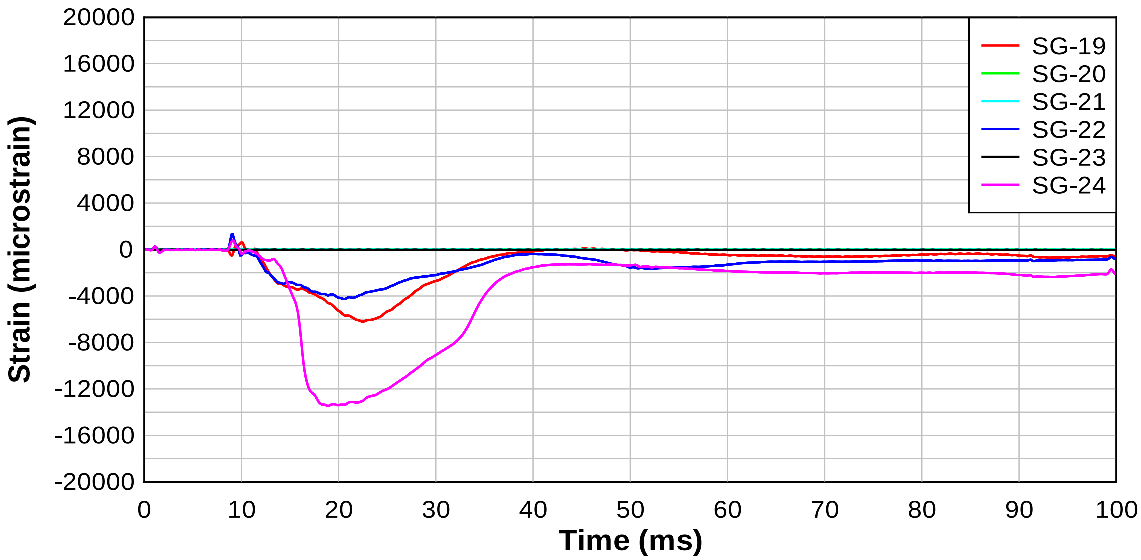
EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 7 - Panel 4	Charge Standoff: 45 ft to Center of Charge
Test Date:	October 5, 2016	

ASME PT Slab Test 07
Strain Gauge Readings (Back Face Part 1 of 3)



ASME PT Slab Test 07
Strain Gauge Readings (Back Face Part 2 of 3)



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

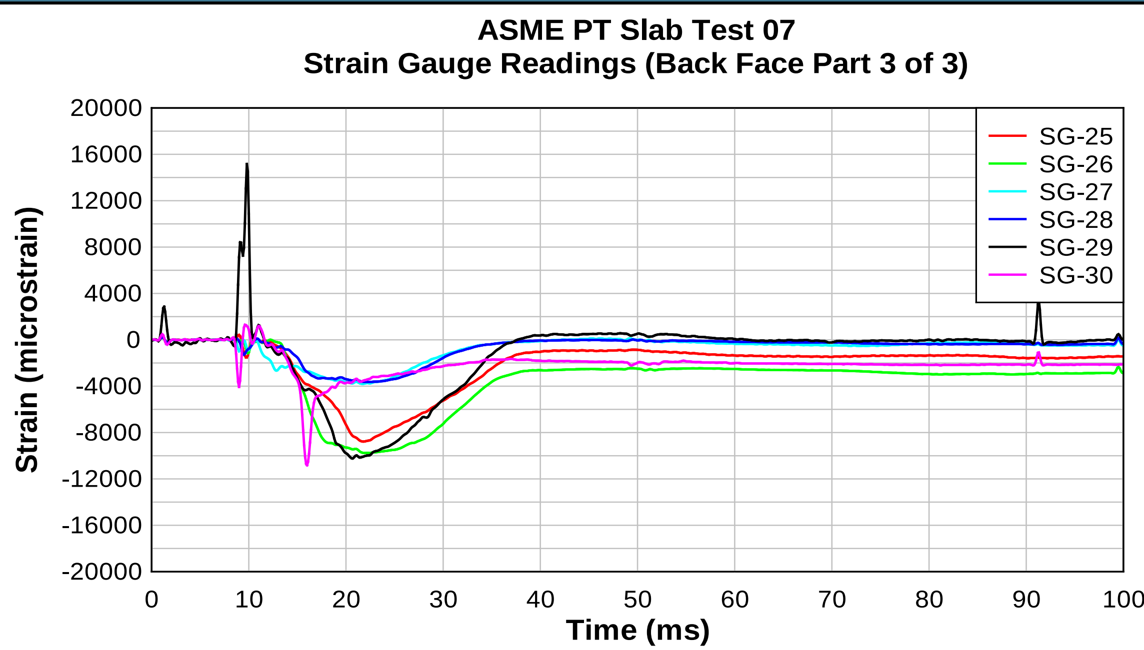
Test Number: Test 7 - Panel 4

Test Date: October 5, 2016

Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge



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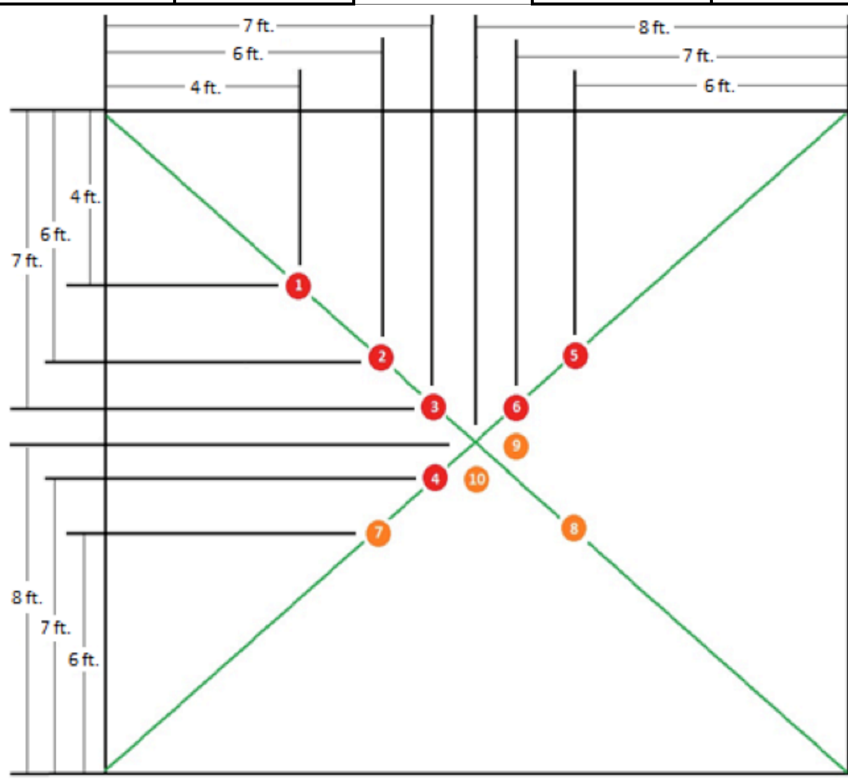
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 7 - Panel 4	Charge Standoff: 45 ft to Center of Charge
Test Date:	October 5, 2016	

Strain Gauge Locations

Slab Design D		
Rebar Locat.	X-bar	Y-bar
1	13	13
2	19	19
3	22	22
4	28	21
5	32	16
6	23	26
7	18	31
8	23	26
9	28	24
10	24	28



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

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Testing Data Sheet

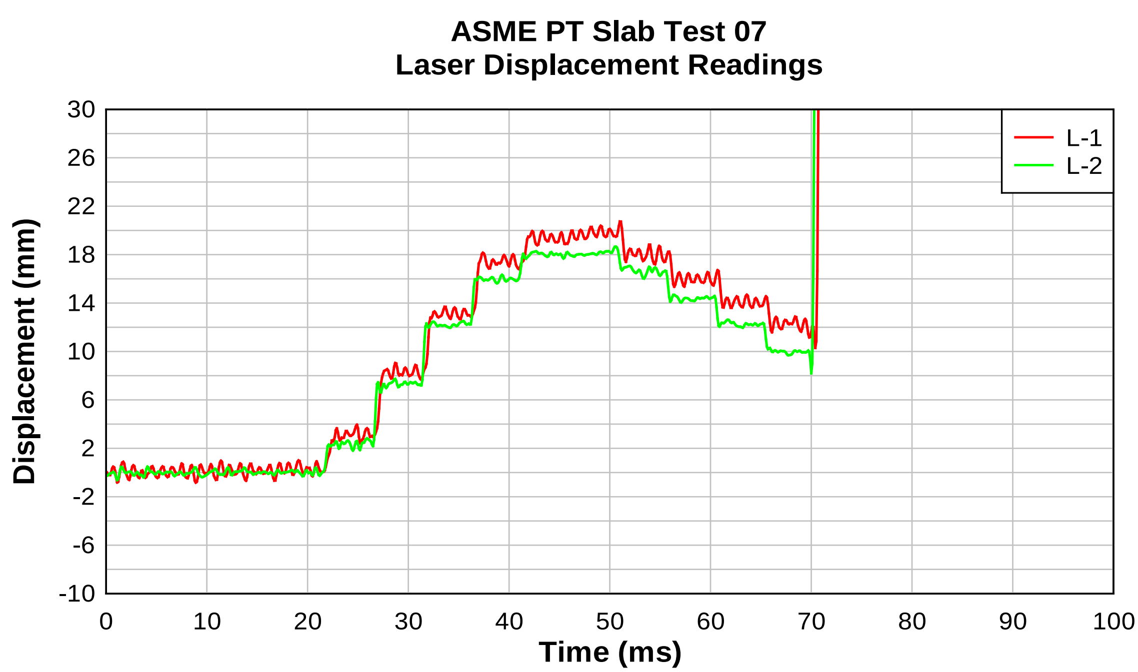
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 7 - Panel 4
Test Date: October 5, 2016

Charge Material: ANFO
Charge Weight: 2000 lb
Charge Standoff: 45 ft to Center of Charge

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	20.7	0.051	2.4	
32	19	0.0506	2.5	



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 7 - Panel 4

Test Date: October 5, 2016

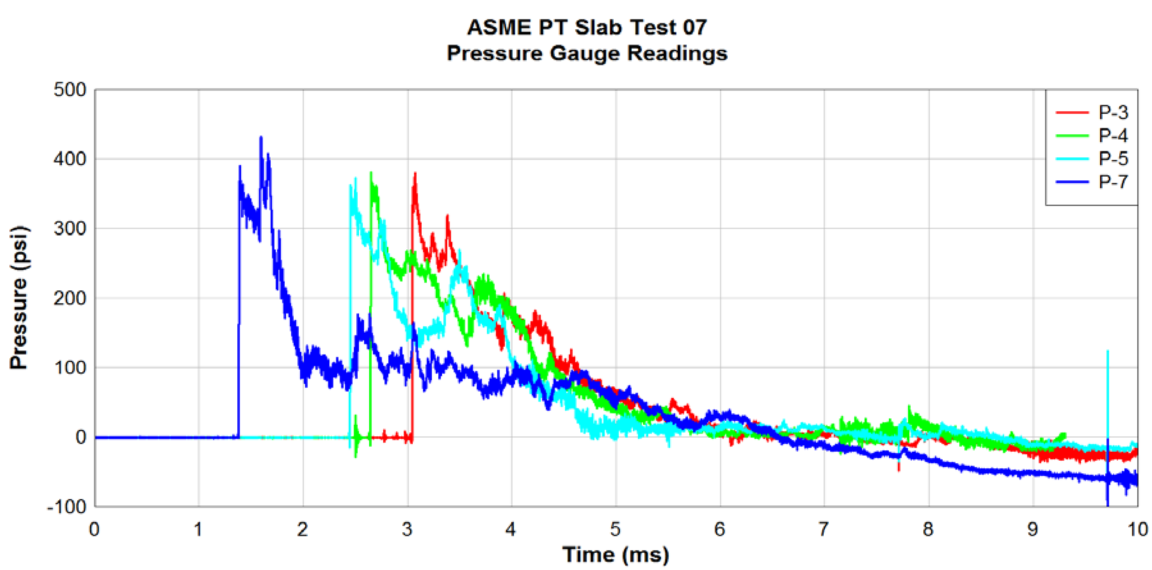
Charge Material: ANFO

Charge Weight: 2000 lb

Charge Standoff: 45 ft to Center of Charge

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
P1	70.1	352	N/A	N/A	Located 53 ft from charge
P2	114	217	N/A	N/A	Located 46 ft from charge; Impulse through 0.010 s
P3	380	381	-50	N/A	
P4	381	434	N/A	N/A	Impulse through 0.0093 s
P5	373	404	-43	N/A	
P6	N/A	N/A	N/A	N/A	Data read error
P7	432	490	-90	N/A	



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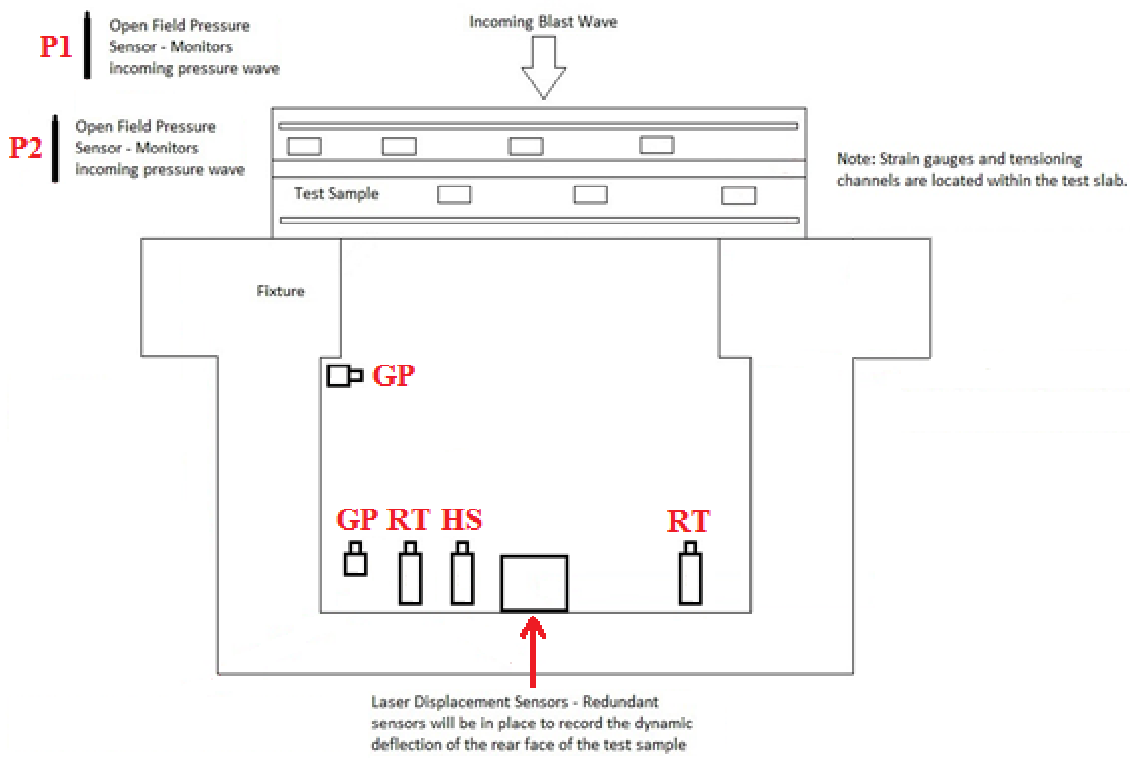
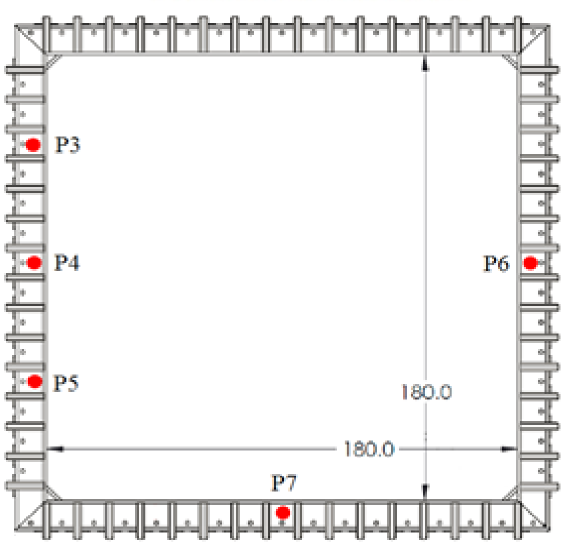
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 7 - Panel 4	Charge Standoff: 45 ft to Center of Charge
Test Date:	October 5, 2016	

Gauge Locations





Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing — Charge Material: ANFO
Project Number: 1507-11 — Charge Weight: 2000 lb
Test Number: Test 7 - Panel 4 — Charge Standoff: 45 ft to Center of Charge
Test Date: October 5, 2016

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.32	12.32		0.0	0.000
V2	H3	12.32	12.32		0.8	0.031
V2	H4	12.33	12.32		0.8	0.031
V2	H5	12.33	12.32		2.4	0.094
V2	H6					
V3	H1					
V3	H2	12.35	12.34		3.2	0.126
V3	H3	12.36	12.34		4.8	0.189
V3	H4	12.34	12.33		3.2	0.126
V3	H5	12.33	12.32		3.2	0.126
V3	H6					
V4	H1					
V4	H2	12.38	12.37		2.4	0.094
V4	H3	12.36	12.35		2.4	0.094
V4	H4	12.34	12.34		1.6	0.063
V4	H5	12.29	12.29		1.6	0.063
V4	H6					
V5	H1					
V5	H2	12.41	12.40		2.4	0.094
V5	H3	12.41	12.40		2.4	0.094
V5	H4	12.35	12.35		0.0	0.000
V5	H5	12.32	12.32		0.8	0.031
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

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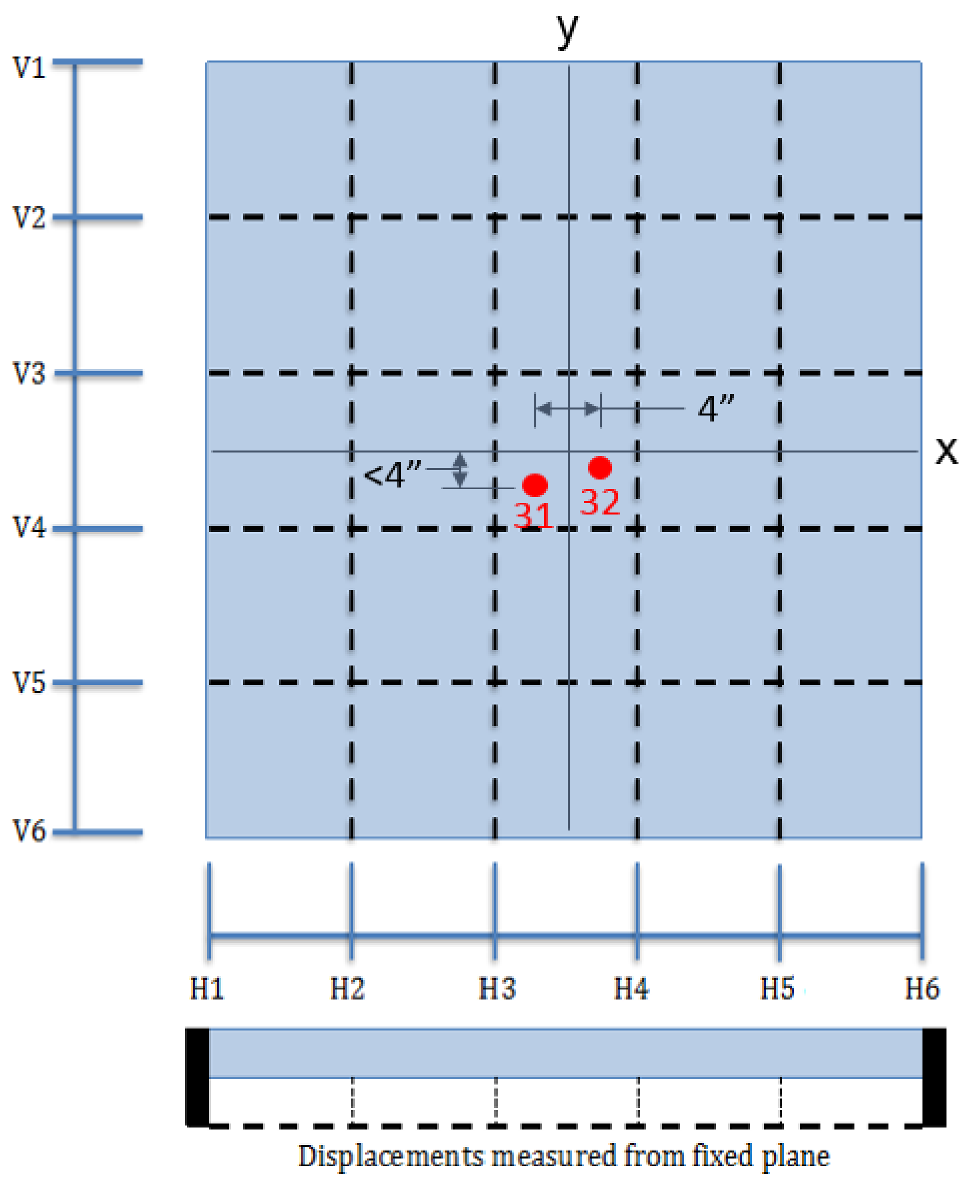
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2000 lb
Test Number:	Test 7 - Panel 4	Charge Standoff: 45 ft to Center of Charge
Test Date:	October 5, 2016	

Deflection Measurement Locations



Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 8 - Panel 8

Test Date: December 8, 2016

Charge Material: ANFO

Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge

Pre-Test Specimen Temperature: 18 °F

Specimen Description

Height	Width	Thickness		Prestress Level	Conventional Reinf. Level	Compressive Strength
16 ft (4.9 m)	16 ft (4.9 m)	10-5/8 in (270 mm)		1450 psi (10 MPa)	13.7 lb/ft^3 (220 kg/m^3)	7370 psi (50.8 MPa)

Specimen Response

Description: The blast load resulted in horizontal, vertical, and diagonal cracks on the front face of the panel, along with a concrete crushing/scabbing pattern similar to previous tests. On the back face, cracking was observed along most of the slab surface. Cracks were mostly hairlines in a yield line pattern similar to previous tests. The main cracks on the interior face were central horizontal and vertical cracks with a width range of approximately 0.016 to 0.2 inch (0.41 to 0.5 mm). More significant cracking up to 0.1 inch (2.5 mm) and some minor spalling were noted along all edges of the panel. Heavier cracking was also observed across the slab thickness, which was in a similar pattern to previous tests. Moreover, disengagement of the concrete up to ½-inch (13 mm) along all the corner regions of the slab was recorded. No damage was observed to the stiffened steel frame.

The maximum deflection recorded with the laser sensors was 3.3 inches (85 mm). The permanent set near the slab center point was approximately 2.0 inches (50 mm).

Strain Gauge Information (see attached gauge summary)

Displacement Gauge Information (see attached gauge summary)

Pressure Gauge Information (see attached gauge summary)

Permanent Deflection (see deflection measurement table)

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Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 8 - Panel 8	Charge Standoff: 45 ft to Center of Charge
Test Date:	December 8, 2016	

Strain Gauge Information
(see attached table for locations)
(see attached plot of strain time-history)

Channel	Sensor Designation	Maximum Strain (με)	Time of Maximum Strain (s)	Notes
1	1-SG-1-F-H	N/A	N/A	Sensor had no response
2	2-SG-1-F-V	-1202	0.1850	Permanent strain: -814 με
3	3-SG-2-F-H	-339	0.1811	Noisy connection, Permanent strain: -315 με
4	4-SG-2-F-V	-1021	0.1795	Permanent strain: -419 με
5	5-SG-3-F-H	-206	1812.0000	Permanent strain: -183 με
6	6-SG-3-F-V	-546	0.1824	Permanent strain: -175 με
7	7-SG-4-F-H	N/A	N/A	Wire broken at 0.1111 s
8	8-SG-4-F-V	3347	0.1137	Permanent strain: 1796 με
9	9-SG-5-F-H	N/A	N/A	Wire broken at 0.1099 s
10	10-SG-5-F-V	N/A	N/A	Wire broken at 0.1086 s
11	11-SG-6-F-H	N/A	N/A	Wire broken at 0.112 s
12	12-SG-6-F-V	N/A	N/A	Wire broken at 0.1086 s
13	13-SG-1-R-H	N/A	N/A	Sensor had no response
14	14-SG-1-R-V	-3216	0.1071	Permanent strain: -674 με
15	15-SG-2-R-H	-4505	0.1086	Permanent strain: -520 με
16	16-SG-2-R-V	-12,047	0.1080	Noisy connection, Perm. strain: -4885 με
17	17-SG-3-R-H	-3869	0.1080	Permanent strain: 381 με
18	18-SG-3-R-V	-14,072	0.1076	Permanent strain: -3972 με
19	19-SG-4-R-H	N/A	N/A	Sensor had no response
20	20-SG-4-R-V	-13,145	0.1089	Permanent strain: -6039 με
21	21-SG-5-R-H	-4318	0.1078	Permanent strain: -668 με
22	22-SG-5-R-V	N/A	N/A	Wire broken at 0.1087 s
23	23-SG-6-R-H	-12,645	0.1082	Noisy connection, Perm. strain: -3108 με
24	24-SG-6-R-V	N/A	N/A	Wire broken at 0.1064 s
25	25-SG-7-R-H	-3658	0.1090	Permanent strain: -658 με
26	26-SG-7-R-V	-3717	0.1070	Permanent strain: -445 με
27	27-SG-8-R-H	-4051	0.1094	Permanent strain: 85 με
28	28-SG-8-R-V	-3771	0.1086	Permanent strain: -768 με
29	29-SG-9-R-H	N/A	N/A	Wire broken at 0.1104 s
30	30-SG-10-R-V	-8974	0.1091	Permanent strain: -3775 με

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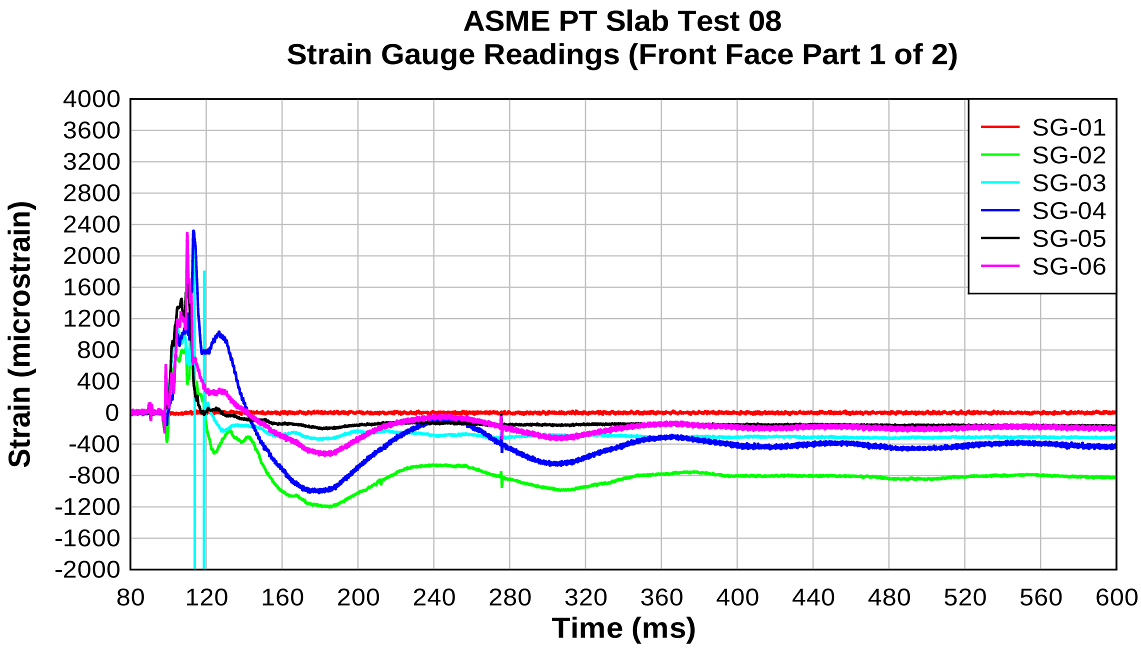
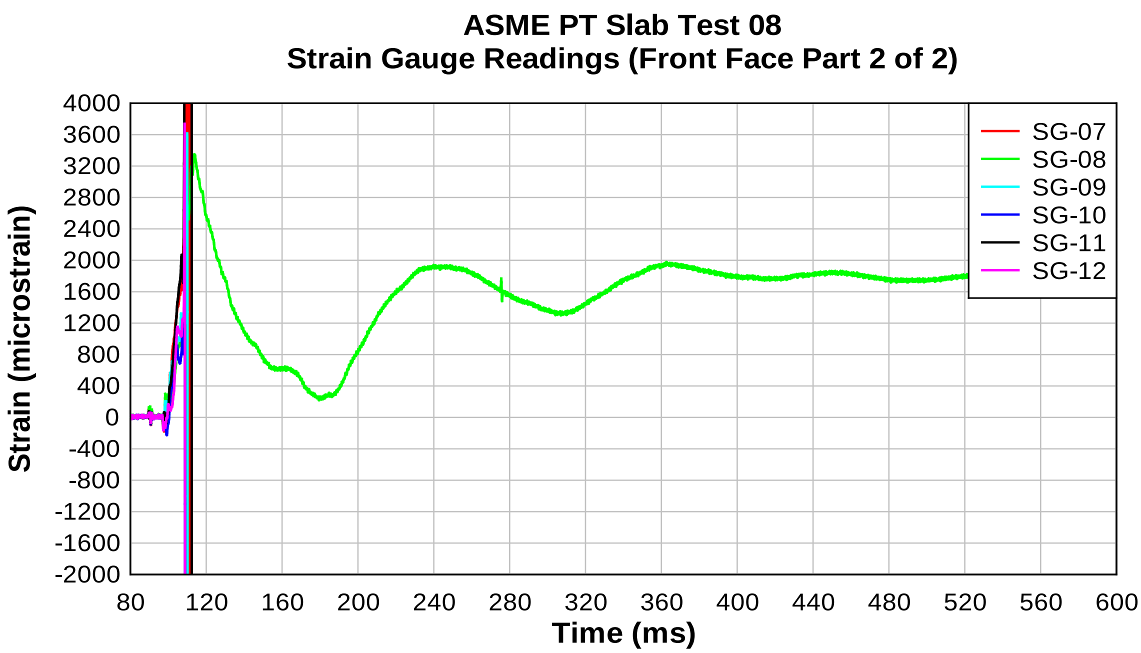
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 8 - Panel 8	Charge Standoff: 45 ft to Center of Charge
Test Date:	December 8, 2016	





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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

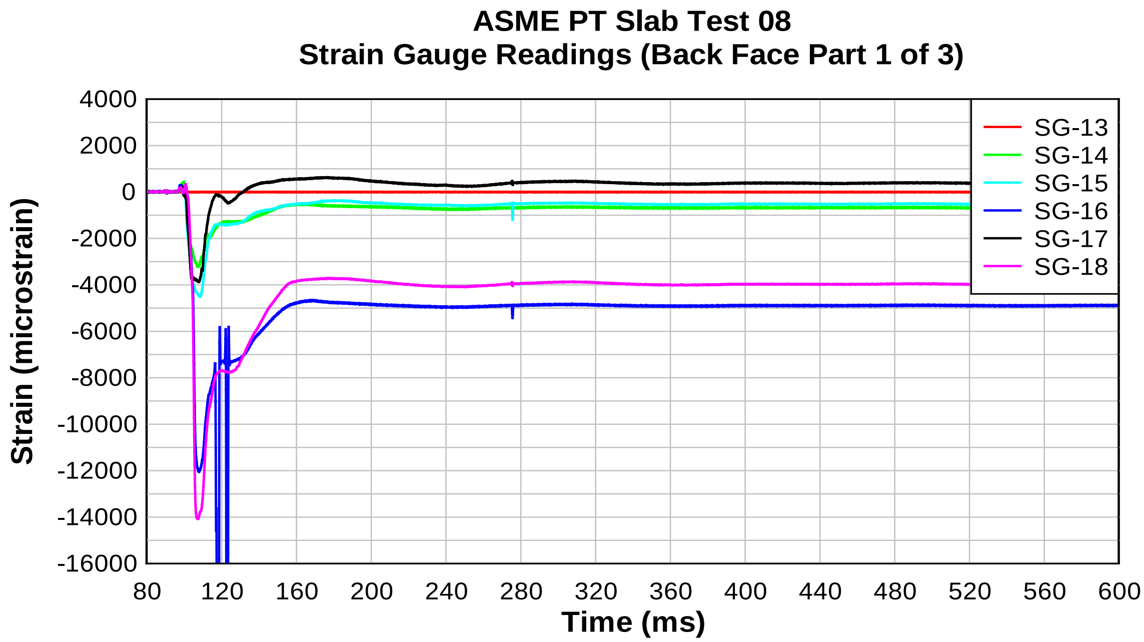
Test Number: Test 8 - Panel 8

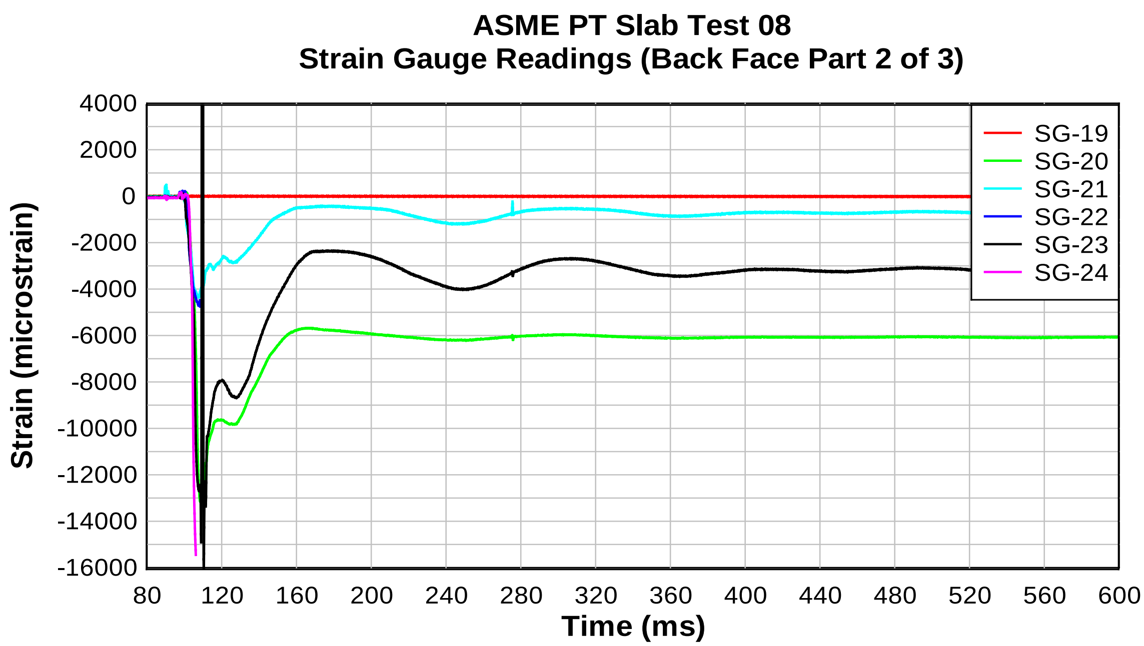
Test Date: December 8, 2016

Charge Material: ANFO

Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge





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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

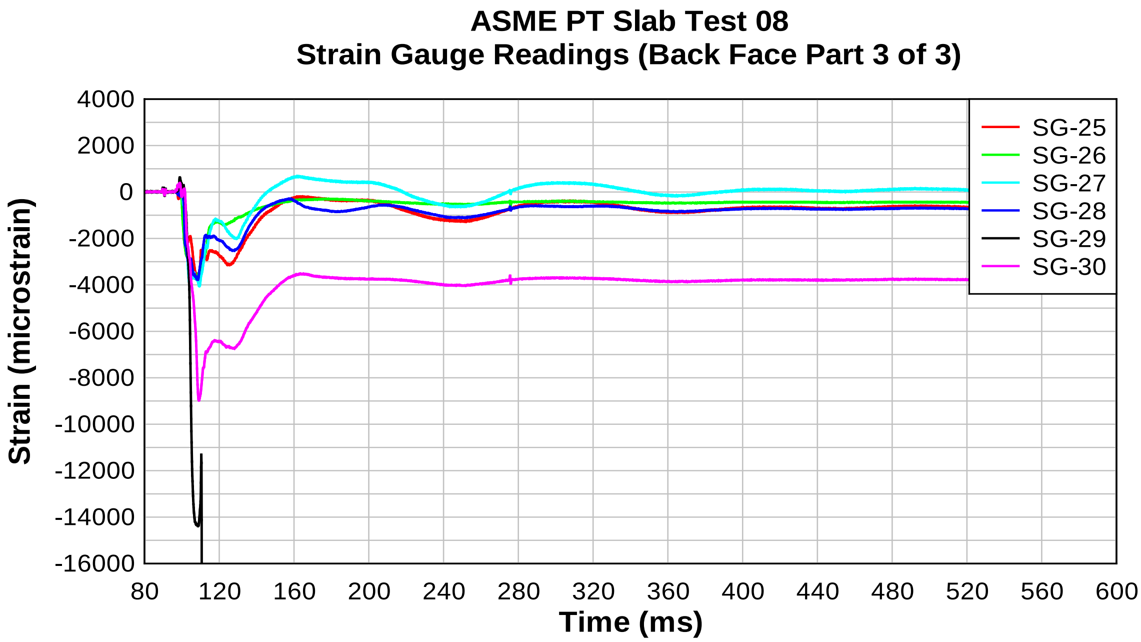
Test Number: Test 8 - Panel 8

Test Date: December 8, 2016

Charge Material: ANFO

Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge



Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 8 - Panel 8

Test Date: December 8, 2016

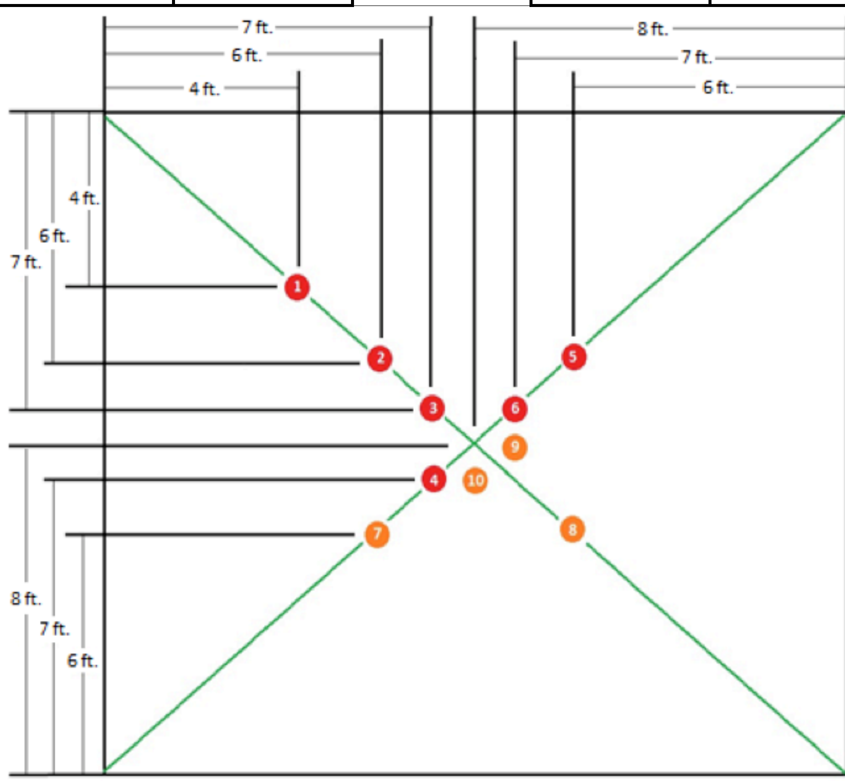
Charge Material: ANFO

Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge

Strain Gauge Locations

Slab Design D		
Rebar Locat.	X-bar	Y-bar
1	13	13
2	19	19
3	22	22
4	28	21
5	32	16
6	23	26
7	18	31
8	23	26
9	28	24
10	24	28



Red locations are recorded on both the front and back rebar mats.
Orange locations are recorded only on the back rebar mat.

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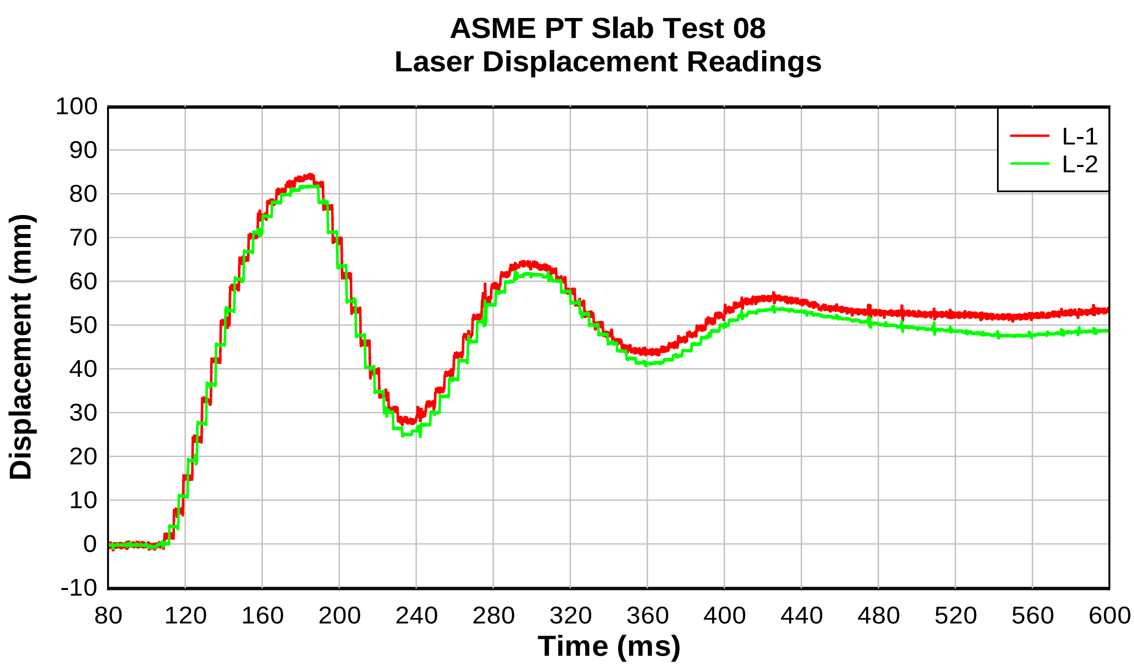
Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 8 - Panel 8	Charge Standoff: 45 ft to Center of Charge
Test Date:	December 8, 2016	

Displacement Gauge Information
(see attached diagram for locations)
(see attached plot of displacement time-history)

Gauge Number	Maximum Positve Displacement (mm)	Time of Maximum Positive Disp. (s)	Permanent Positive Displacement (mm)	Notes
31	85	0.1848	51	
32	82	0.189	48	



Testing Data Sheet

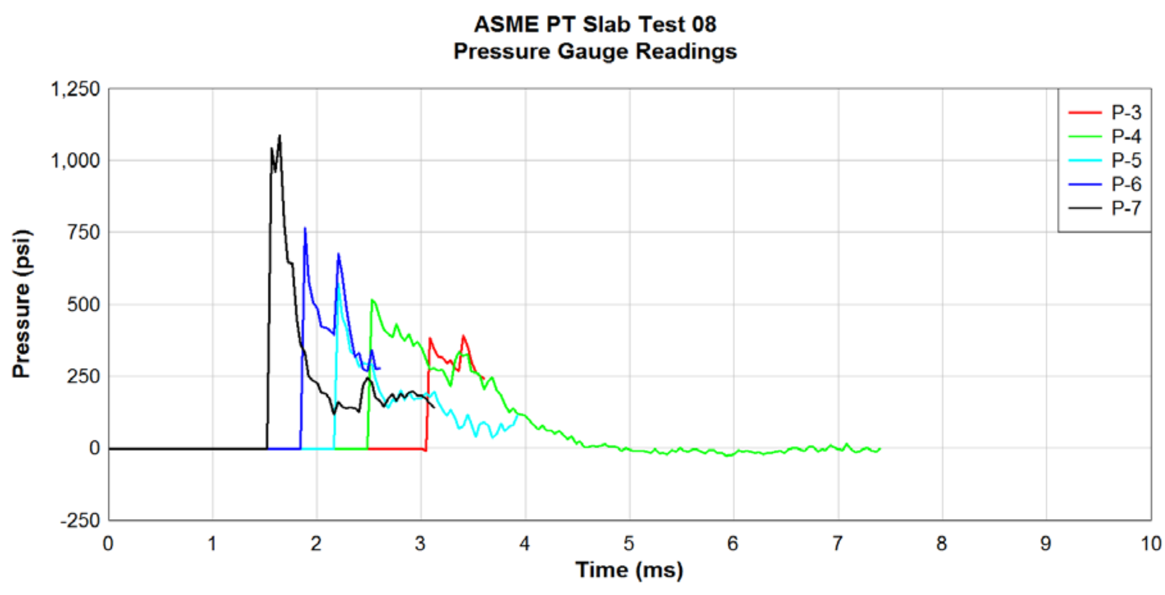
EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing
Project Number: 1507-11
Test Number: Test 8 - Panel 8
Test Date: December 8, 2016

Charge Material: ANFO
Charge Weight: 2300 lb
Charge Standoff: 45 ft to Center of Charge

Pressure Gauge Information
(see attached diagram for locations)
(see attached plot of pressure time-history)

Gauge Number	Peak Positive Pressure (psi)	Positive Impulse (psi-ms)	Peak Negative Pressure (psi)	Negative Impulse (psi-ms)	Notes
P1	90.4	203	N/A	N/A	Located 53 ft from charge; Impulse through 0.0102 s
P2	78.5	218	N/A	N/A	Located 45 ft from charge; Impulse through 0.0182 s
P3	391	166	N/A	N/A	Impulse through 0.0036 s
P4	519	474	N/A	N/A	
P5	572	309	N/A	N/A	Impulse through 0.004 s
P6	766	323	N/A	N/A	Impulse through 0.0026 s
P7	1088	470	N/A	N/A	Impulse through 0.0031 s

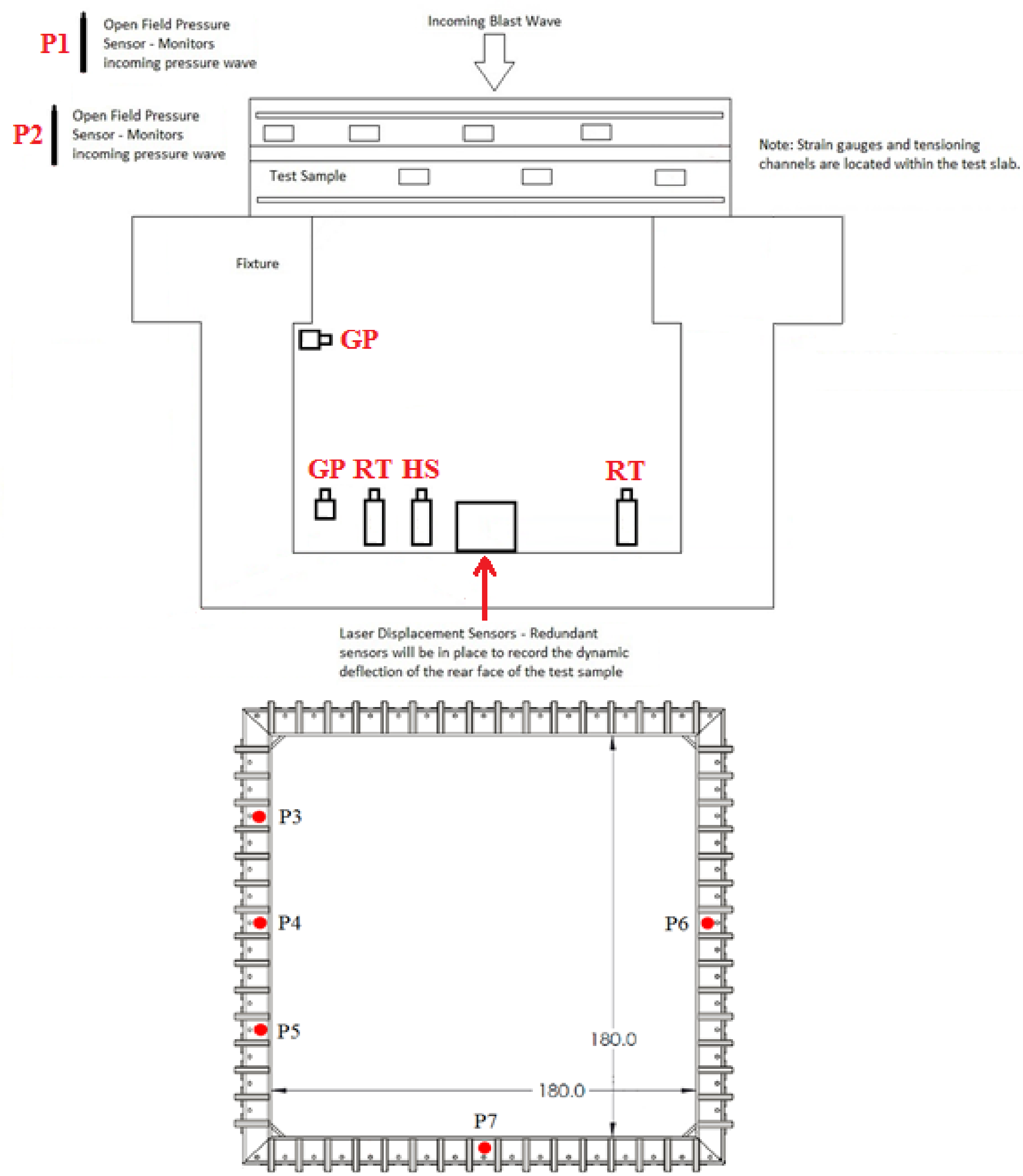


Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 8 - Panel 8	Charge Standoff: 45 ft to Center of Charge
Test Date:	December 8, 2016	

Gauge Locations



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Testing Data Sheet

EXTREME LOAD TESTING

Project Name: ASME PT Slab Testing

Project Number: 1507-11

Test Number: Test 8 - Panel 8

Test Date: December 8, 2016

Charge Material: ANFO

Charge Weight: 2300 lb

Charge Standoff: 45 ft to Center of Charge

Deflection Measurements - Interior Face of Specimen

Vertical Location	Horizontal Location	Initial Measurement (ft)	Final Measurement (ft)		Permanent Deflection (mm)	Permanent Deflection (in)
V1	H1					
V1	H2					
V1	H3					
V1	H4					
V1	H5					
V1	H6					
V2	H1					
V2	H2	12.38	12.26		36.5	1.438
V2	H3	12.38	12.26		36.5	1.438
V2	H4	12.38	12.23		42.9	1.688
V2	H5	12.41	12.23		52.4	2.063
V2	H6					
V3	H1					
V3	H2	12.40	12.24		46.0	1.813
V3	H3	12.40	12.26		41.3	1.625
V3	H4	12.38	12.23		42.9	1.688
V3	H5	12.41	12.23		52.4	2.063
V3	H6					
V4	H1					
V4	H2	12.41	12.25		49.2	1.938
V4	H3	12.40	12.23		49.2	1.938
V4	H4	12.38	12.23		44.5	1.750
V4	H5	12.34	12.23		33.3	1.313
V4	H6					
V5	H1					
V5	H2	12.42	12.29		39.7	1.563
V5	H3	12.41	12.27		42.9	1.688
V5	H4	12.39	12.26		41.3	1.625
V5	H5	12.35	12.26		28.6	1.125
V5	H6					
V6	H1					
V6	H2					
V6	H3					
V6	H4					
V6	H5					
V6	H6					

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Testing Data Sheet

EXTREME LOAD TESTING

Project Name:	ASME PT Slab Testing	Charge Material: ANFO
Project Number:	1507-11	Charge Weight: 2300 lb
Test Number:	Test 8 - Panel 8	Charge Standoff: 45 ft to Center of Charge
Test Date:	December 8, 2016	

Deflection Measurement Locations