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May 10, 2024
Mr. Paul Budge
Diversi-Tech Corp - IntegraRack
PO Box 910758
St. George, UT 84791

Subject: Simulated Wind Load on the IR-G Series Systems.

Dear Mr. Budge,

Please find included our test reports for the simulated wind load (tensile load) tests of the IR-G Series Systems performed on 3/20/2024 - 03/22/2024 in St. George, Utah.

The first simulated wind load test was performed on the IR-G Series BallastRack Frame installed with two large epoxy earth spikes. The load was applied to a single vertical upright post via the connected crossbar at an upward angle to simulate an uplift wind load. The load was applied via a skidsteer and reached a total of 1545 lbf which was the max load the skid steer could apply at that angle. The next test load was applied horizontally to the frame. The IR-G frame was monitored for movement as the simulated wind load tensile force was applied. Test loads were measured using a calibrated Dyna-Link 2 Dynamometer (SN 100326, Cal. Date 10/13/2023). Test run details are shown in the table below.

IR-G SERIES BALLASTRACK FRAME WITH EPOXY EARTH SPIEKS SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) INSPECTION DETAILS		
NO.	**MAX FORCE REACHED (lbf)**	**OBSERVATIONS**
1	1,545	Load reached the limit of the skidsteer capacity to pull.
2	1,040	Test force applied horizontally. A lower mounting bolt for the main pole to the square base tube failed and sheared (Photo 3). The main pole rotated in the direction of loading and the lower lip was able to rotate up and into the tube since there was minimal stickout, about 0.050 in., of the vertical tube through the base tube. The rotation caused stress to the mounting point bolt which eventually sheared the bolt. The sheared failed bolt was ungraded.
3	2,085	For the third test a grade 2 bolt was used in place of the ungraded bolt. The test was performed again and a total of 2085 lbf was reached with no failure. There was minimal deformation noted between the connection of the base tube and upright connection.

The next simulated wind load test was performed on the IR-G Modulus Ground Mount Solar Array that was installed with the IR EarthBallastMounting System. A total of 10 skid steer buckets of soil was utilized as ballast with an estimated total weight of 5000 lbf. The load was applied at an approximate 90 degree angle from the mounted angle of the solar panel support. The load reached 3755 lbf. The IR-G frame was monitored for movement as the simulated wind load tensile force was applied. Test loads were measured using a calibrated Dyna-Link 2 Dynamometer (SN 100326, Cal. Date 10/13/2023). Test run details are shown in the table below.

IR-G SERIES GROUND MOUNT SOLAR ARRAY AND EARTHBALLASTMOUNTING SYSTEM WITH SOIL BALLAST SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) INSPECTION DETAILS		
NO.	**MAX FORCE REACHED (lbf)**	**OBSERVATIONS**
1	3,755	Frame deflected under load. When load was removed the frame moved back into original position. No permanent deformation noted (Photo 3) and no movement of frame or earth ballast.

The first simulated wind load test was performed on the IR-G Series Base Frame that utilized the water ballast and ground spikes. The load was applied via a crossbar connected to the ground frame. The test was performed in three parts with the first part utilizing two ground spikes and applying the load at an approximate 45 degree angle, the second part the load was applied at a 60 degree angle, and the third part utilized four ground spikes and the load was applied at a 60 degree angle. The IR-G frame was monitored for movement as the simulated wind load tensile force was applied. Test loads were

measured using a calibrated Dyna-Link 2 Dynamometer (SN 100326, Cal. Date 10/13/2023). Test run details are shown in the table below.

IR-G SERIES FRAME WITH WATER BALLAST SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) INSPECTION DETAILS		
NO.	**MAX FORCE REACHED (lbf)**	**OBSERVATIONS**
1	1,460	Load was applied at an approximate 45 degree upward angle. The frame began to roll forward and lift off the ground at the back end at ~ 1460 lbf (Photo 1-2). No permanent damage was noted.
2	2,400	The load angle was adjusted to 60 degrees. The frame began to roll forward and lift off the ground at the back end at 2400 lbf (Photo 3). No permanent damage was noted.
3	2,550	Two additional ground spikes were installed into the frame prior to the test. The load angle was ~ 60 degrees. The rear ground spikes started to pull out of the ground at ~ 2100 lbf. The rear ground spikes came out of the ground at 2550 lbf and the frame began to lift off the ground. The front spikes were still in the ground and resisting the load (Photo 4).

Horizontal tensile pullout tests were run on two AP40 posts that were pounded 40 in. into the soil and cast-in-place with a concrete cap measuring 6 in. deep with a 21 in. diameter. The posts stood out 71 in. From the ground and were 113-3/4 in. On center. A horizontal pole was run between the posts to simulate the attachment method of solar panels. A load strap was run around the horizontal pole on the outside of the vertical poles. The posts were then loaded via the load strap and horizontal pole and the load and post reactions were monitored and recorded. The load reached a maximum of 2490 lbf. Upon load removal the poles moved back to initial position with minor permanent deformation noted. The concrete cap on one post cracked. For the second test, the load strap was run around a single post and load was again applied while load and post reactions were monitored recorded. The posts held 1695 lbf when the concrete cap shifted and the soil cracked. Test run details are shown in the table below.

HORIZONTAL TENSILE TEST INSPECTION DETAILS					
NO.	**TEST SETUP**	**POST ANGLE, BEFORE TEST**	**POST ANGLE, AFTER TEST**	**MAXIMUM LOAD (lbf)**	**OBSERVATIONS**
1	2 posts	0.1°	0.4°	2,490	The concrete cap cracked at one post (Photo 3) and the frame shifted forward. Posts deflected under load. Upon load removal they returned to their starting position but had experienced some permanent deformation due to bending in the load direction. The bolts that were used to tighten the post sleeve were deformed and started to deform the metal around it (Photo 7).
		0.2°	2.5°		
2	1 post	0.6°	2.4°	1,695	The concrete cap shifted and the soil around the post had a visible crack where the concrete shifted.

Test reports with additional details, photos, and data have been attached.

Respectfully submitted,
PHOENIX NATIONAL LABORATORIES, INC.

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INSPECTION AND TEST REPORT

PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 02
INSPECTION DATE 03/22/2024
IR-G Series Rack Frame: Simulated Wind Load

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	IR-G Series Rack Frame - Simulated Wind Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Simulated Wind Load (Upward and Horizontal Load) on IR-G Series Rack Frame		Weston A.

TEST DATA & EQUIPMENT INFORMATION

TEMPERATURE:	65 °F ± 10 °F	**HUMIDITY:**	30% ± 10%
LOAD TYPE:	Simulated Wind - Tensile / Uplift	**TEST LOAD:**	~2085 lbf
EQUIPMENT TYPE:	Dyna-Link 2 Dynamometer	**EQUIPMENT MODEL:**	MSI-7300RF (S/N 100326)

TEST SPECIMEN & COMPONENT INFORMATION

SPECIMEN COMPONENT 1:	IR-G Series 3 Module Solar Array	**SPECIMEN PART NO. 1:**	IR-G3M1303
BRACKET COMPONENT 2:	2 Square Base Tubes 2 Round Base Tubes	**BRACKET PART NO. 2:**	IR-GMBF6400 IR-GMBP6410
BRACKET COMPONENT 3:	Large Epoxy Earth Anchor	**BRACKET PART NO. 3:**	None

SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) TEST PROCEDURE/DESCRIPTION

The IR-G Series BallastRack Frame was installed with the large epoxy earth spikes. Simulated wind loads, tensile loads, were applied via a skid steer. The loads were applied at the top of the upright main pole, where solar panels would be mounted. Test loads were initially applied in a diagonal direction to mimic wind loads. After the diagonal test, a load was applied horizontally to the frame. Measurements were taken before and after the load was applied.

SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) INSPECTION DETAILS

NO.	MAX FORCE REACHED (lbf)	OBSERVATIONS
1	1,545	Load reached the limit of the skidsteer capacity to pull.
2	1,040	Test force applied horizontally. A lower mounting bolt for the main pole to the square base tube failed and sheared (Photo 3). The main pole rotated in the direction of loading and the lower lip was able to rotate up and into the tube since there was minimal stickout, about 0.050 in., of the vertical tube through the base tube. The rotation caused stress to the mounting point bolt which eventually sheared the bolt. The sheared failed bolt was ungraded.
3	2,085	For the third test a grade 2 bolt was used in place of the ungraded bolt. The test was performed again and a total of 2085 lbf was reached with no failure. There was minimal deformation noted between the connection of the base tube and upright connection.

TECHNICIAN Weston Allen

REVIEWED BY Kyle Flaig

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INSPECTION AND TEST REPORT

PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 02
INSPECTION DATE 03/22/2024
IR-G Series Rack Frame: Simulated Wind Load

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	IR-G Series Rack Frame - Simulated Wind Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Simulated Wind Load (Upward and Horizontal Load) on IR-G Series Rack Frame		Weston A.

PHOTOS

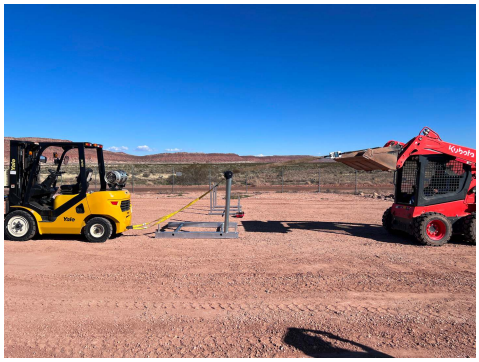

PHOTO 1: Test setup 1

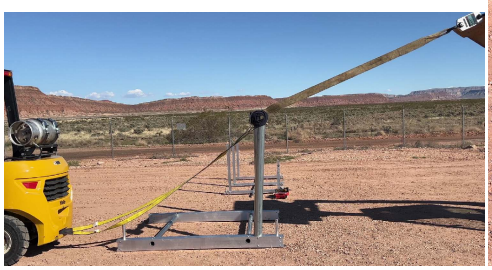

PHOTO 2: First test under load

PHOTO 3: Sheared bolt and minor aluminum tube deformation

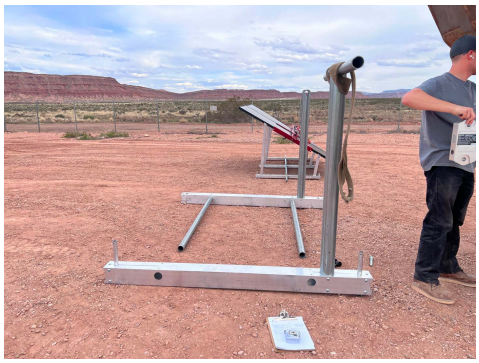

PHOTO 4: Test setup 3

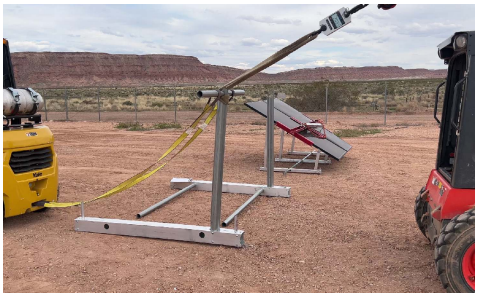

PHOTO 5: 3rd test under load

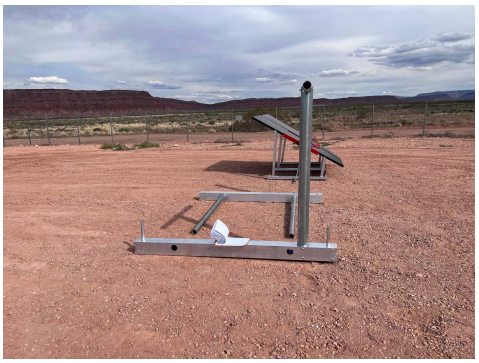

PHOTO 6: After third test

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INSPECTION AND TEST REPORT

PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 09
INSPECTION DATE 03/22/2024
IR-G Series EarthBallast: Simulated Wind Load

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	IR-G Series EarthBallast - Simulated Wind Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Simulated Wind Load Test on IR-G Series EarthBallast Frame		Weston A.

TEST DATA & EQUIPMENT INFORMATION

TEMPERATURE:	65 °F ± 10 °F	**HUMIDITY:**	30% ± 10%
LOAD TYPE:	Simulated Wind - Tensile / Uplift	**TEST LOAD:**	Record
EQUIPMENT TYPE:	Dyna-Link 2 Dynamometer	**EQUIPMENT MODEL:**	MSI-7300RF (S/N 100326)

TEST SPECIMEN & COMPONENT INFORMATION

SPECIMEN COMPONENT 1:	IR-G Series Solar Array	**SPECIMEN PART NO. 1:**	IR-G3M1303
BRACKET COMPONENT 2:	IR-G Series Horizontal Pipe	**BRACKET PART NO. 2:**	IRP-HPG30000-T
BRACKET COMPONENT 3:	IR-G Frame Upright	**BRACKET PART NO. 3:**	IRP-VPRF0461-T
BRACKET COMPONENT 4:	2 Square Base Tubes	**BRACKET PART NO. 4:**	IR-GMBF8000-T
BRACKET COMPONENT 5:	Earth Ballast Geotextile Mesh	**BRACKET PART NO. 5:**	IR EarthBallast System

SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) TEST PROCEDURE/DESCRIPTION

The IR-G Series Ground Mount Solar Array was installed with the IR EarthBallast Mounting System. Soil was loaded onto the frame as ballast. A total of 10 skid steer buckets were used. The total amount of soil was estimated as 5000 lbf. Simulated wind loads, tensile loads, were applied via a lifting strap wrapped around each of the upright poles and then attached to a forklift. The load was applied at an approximate 90 degree angle from the mounted orientation of the solar panel. The solar panel was mounted at a 45 degree angle.

SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) INSPECTION DETAILS

NO.	MAX FORCE REACHED (lbf)	OBSERVATIONS
1	3,755	Frame deflected under load. When load was removed the frame moved back into original position. No permanent deformation noted (Photo 3) and no movement of frame or earth ballast.

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INSPECTION AND TEST REPORT

PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 09
INSPECTION DATE 03/22/2024
IR-G Series EarthBallast: Simulated Wind Load

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	IR-G Series EarthBallast - Simulated Wind Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Simulated Wind Load Test on IR-G Series EarthBallast Frame		Weston A.

PHOTOS

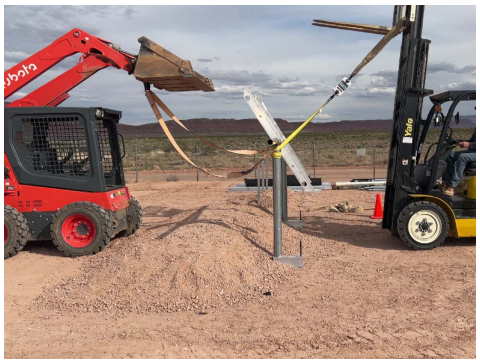

PHOTO 1: Test setup

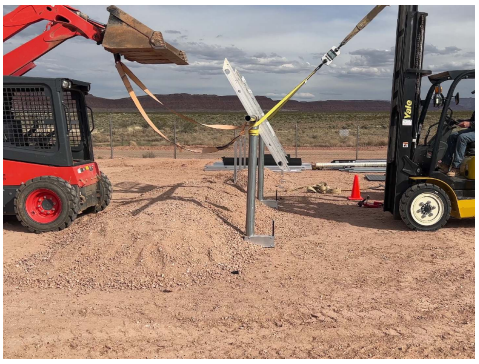

PHOTO 2: Frame under load

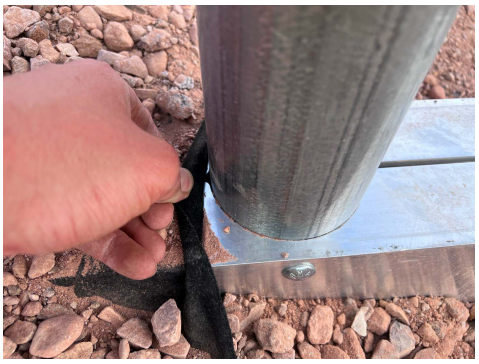

PHOTO 3: No signs of deformation observed after testing

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INSPECTION AND TEST REPORT

PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 10
INSPECTION DATE 03/22/2024
IR-G SeriesWater Ballast: Simulated Wind Load

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	IR-G Series EarthBallast - Simulated Wind Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Simulated Wind Load Test on IR-G Series Water Ballast Frame		Weston A.

TEST DATA & EQUIPMENT INFORMATION

TEMPERATURE:	65 °F ± 10 °F	**HUMIDITY:**	30% ± 10%
LOAD TYPE:	Simulated Wind - Tensile / Uplift	**TEST LOAD:**	Record
EQUIPMENT TYPE:	Dyna-Link 2 Dynamometer	**EQUIPMENT MODEL:**	MSI-7300RF (S/N 100326)

TEST SPECIMEN & COMPONENT INFORMATION

SPECIMEN COMPONENT 1:	IR-G Series Base Frame	**SPECIMEN PART NO. 1:**	IR-BFGS0306
BRACKET COMPONENT 2:	IR-G Series Horizontal Pipe	**BRACKET PART NO. 2:**	IRP-HPG30000-T
BRACKET COMPONENT 3:	IR-G Frame Upright	**BRACKET PART NO. 3:**	IRP-VPRF0461-T
BRACKET COMPONENT 4:	2 Square Base Tubes	**BRACKET PART NO. 4:**	IR-GMBF8000-T
BRACKET COMPONENT 5:	Steel Ground Spike	**BRACKET PART NO. 5:**	None

SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) TEST PROCEDURE/DESCRIPTION

The IR-G Series Ground Mount Solar Array was installed with the IR EarthBallast Mounting System and one 275 gallon water tote as ballast. The total weight was estimated as 2400 lbf. Simulated wind loads, tensile loads, were applied via a lifting strap wrapped around each of the upright poles and then attached to a forklift. The load was applied at an approximate 90 degree angle from the mounted orientation of the solar panel. The solar panel was mounted at a 45 degree angle. For the first two tests, only 2 ground spikes were installed at the front of the frame (Photo 1-3). For the third test, an additional 2 ground spikes were installed into the back of the frame (Photo 4).

SIMULATED WIND LOAD (TENSILE UPLIFT FORCE) INSPECTION DETAILS

NO.	MAX FORCE REACHED (lbf)	OBSERVATIONS
1	1,460	Load was applied at an approximate 45 degree upward angle. The frame began to roll forward and lift off the ground at the back end at ~ 1460 lbf (Photo 1-2). No permanent damage was noted.
2	2,400	The load angle was adjusted to 60 degrees. The frame began to roll forward and lift off the ground at the back end at 2400 lbf (Photo 3). No permanent damage was noted.
3	2,550	Two additional ground spikes were installed into the frame prior to the test. The load angle was ~ 60 degrees. The rear ground spikes started to pull out of the ground at ~ 2100 lbf. The rear ground spikes came out of the ground at 2550 lbf and the frame began to lift off the ground. The front spikes were still in the ground and resisting the load (Photo 4).

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INSPECTION AND TEST REPORT

PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 10
INSPECTION DATE 03/22/2024
IR-G SeriesWater Ballast: Simulated Wind Load

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	IR-G Series EarthBallast - Simulated Wind Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Simulated Wind Load Test on IR-G Series Water Ballast Frame		Weston A.

PHOTOS

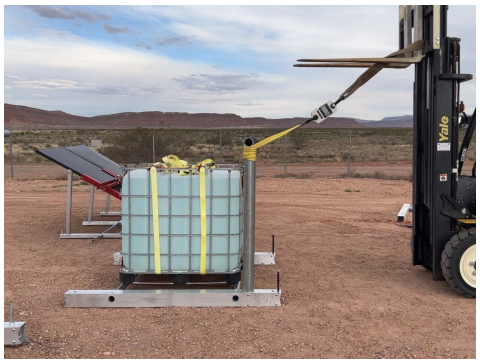

PHOTO 1: Test setup

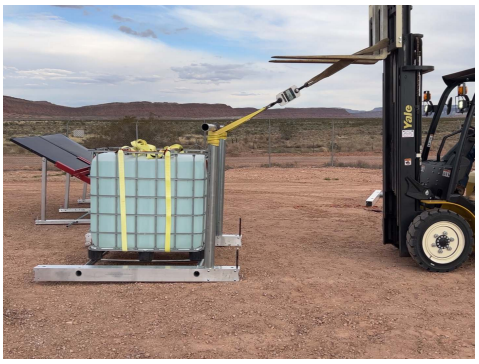

PHOTO 2: Load applied at ~ 45 degree angle

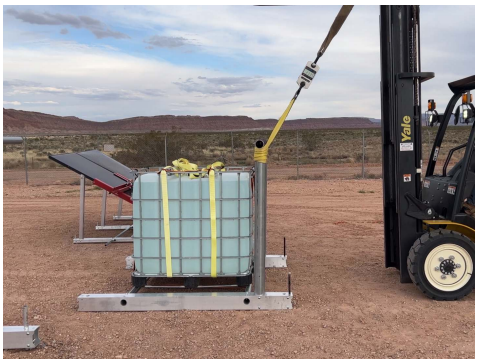

PHOTO 3: Load applied at ~ 60 degree angle.

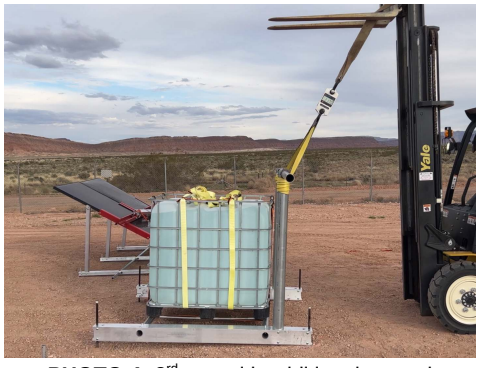

PHOTO 4: 3rd test with additional ground spikes installed at the back end of the frame.

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INSPECTION AND TEST REPORT

PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 07
INSPECTION DATE 03/20/2024

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	AP40 Pole - Horizontal Tensile Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Horizontal Tensile Load on Cast-in-place/post pounded AP40 Poles		Weston A.

TEST DATA & EQUIPMENT INFORMATION

TEMPERATURE:	65 °F ± 10 °F	**HUMIDITY:**	30% ± 10%
LOAD TYPE:	Tensile / Horizontal	**TEST LOAD:**	Record
EQUIPMENT TYPE:	Dyna-Link 2 Dynamometer	**EQUIPMENT MODEL:**	MSI-7300RF (S/N 100326)

TEST SPECIMEN & COMPONENT INFORMATION

SPECIMEN COMPONENT 1:	Vertical Pole	**SPECIMEN PART NO. 1:**	IRP-VPRF0461-T
BRACKET COMPONENT 2:	IR-G Series Horizontal Pipe	**BRACKET PART NO. 2:**	IRP-GMBF8600-T

HORIZONTAL TENSILE TEST PROCEDURE/DESCRIPTION

The AP40 posts were pounded 40 in. into the ground and concrete was poured in to anchor the post base. Client specified the concrete cap was 6 in. deep with a 21 in. diameter, with the post located in the middle. The posts stood out 71 in. from the ground. The two posts were 113-3/4 in. on center which was set to be the spacing used for the G8 frame. A horizontal pole was run between the posts to simulate the attachment method of installed solar panels. A load strap was run around the horizontal pole on the outside of the vertical poles. The posts were then loaded via the load strap and horizontal pole and the load and post reactions were monitored and recorded (See Photos 1-3). For the second test, the load strap was run around a single post and load was again applied while load and post reactions were monitored recorded (Photo 5-6). Test results are reported below.

HORIZONTAL TENSILE TEST INSPECTION DETAILS

NO.	TEST SETUP	POST ANGLE, BEFORE TEST	POST ANGLE, AFTER TEST	MAXIMUM LOAD (lbf)	OBSERVATIONS
1	2 posts	0.1°	0.4°	2,490	The concrete cap cracked at one post (Photo 3) and the frame shifted forward. Posts deflected under load. Upon load removal they returned to their starting position but had experienced some permanent deformation due to bending in the load direction. The bolts that were used to tighten the post sleeve were deformed and started to deform the metal around it (Photo 7).
		0.2°	2.5°		
2	1 post	0.6°	2.4°	1,695	The concrete cap shifted and the soil around the post had a visible crack where the concrete shifted.

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PNL REF. # 26-240383 **S.O. #** 001 **INDEX** 07
INSPECTION DATE 03/20/2024

CLIENT	CLIENT PROJECT REFERENCE	CLIENT ORDER NO.
IntegraRack	AP40 Pole - Horizontal Tensile Load	per S.A.
SAMPLE DESCRIPTION		TECHNICIANS
Horizontal Tensile Load on Cast-in-place/post pounded AP40 Poles		Weston A.

PHOTOS

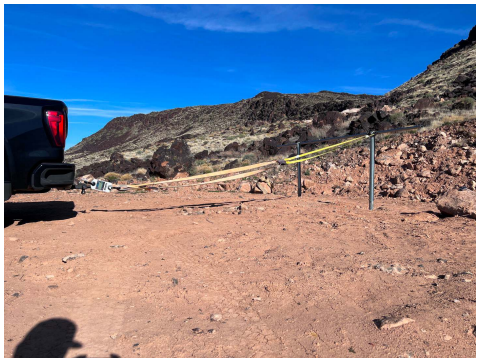

PHOTO 1: Dual post test setup

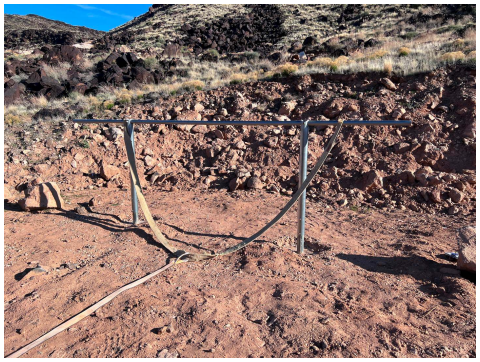

PHOTO 2: Dual post test setup

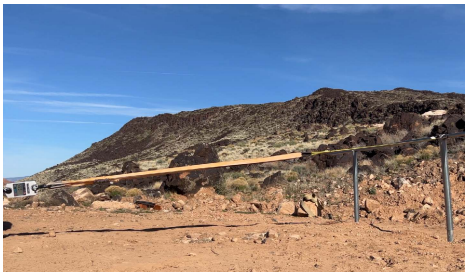

PHOTO 3: Dual post under load

PHOTO 4: Cracked concrete in base of post after dual post test

PHOTO 5: Single post test before load

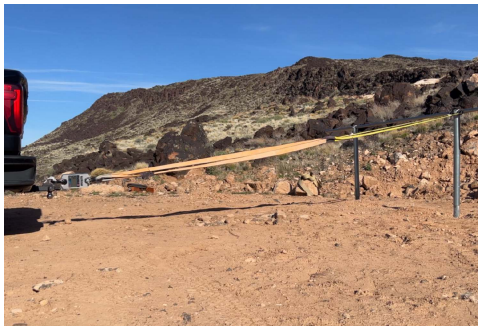

PHOTO 6: Single post test under load

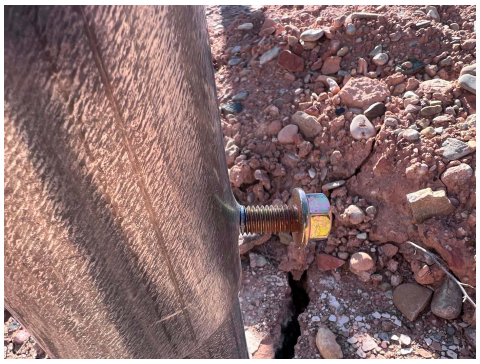

PHOTO 7: Typical post deformation around bolts