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CHEMISTRY AND CHEMICAL ENGINEERING DIVISION

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NSF-ISR
Registered to ISO 9001

DETERMINATION OF SAFE INSTALLATION STAND-OFF DISTANCES FOR A *QWIKHURRICANE® GENERATOR PAD™ (QWIKPAD™)* FOR USE WITH STANDBY GENERATORS THAT COMPLY WITH SECTION 4.1.4.1.2 OF NFPA 37, *STANDARD FOR THE INSTALLATION AND USE OF STATIONARY COMBUSTION ENGINES AND GAS TURBINES* (2018 EDITION)

FINAL REPORT
Consisting of 38 Pages

SwRI® Project No. 01.24919.01.304
Test Dates: May 26 and 27, 2020
Report Date: August 7, 2020

Prepared for:

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ABSTRACT

Full-scale testing of a multi-fuel power generator mounted on a generator support pad, identified as *QwikHurricane® Generator Pad™*, was conducted for compliance to NFPA 37 (2018 Edition), *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines*, Section 4.1.4.1.2 "Engines located Outdoors". Testing was performed on May 26 and 27, 2020, at Southwest Research Institute (SwRI), located in San Antonio, Texas for Mainstream Engineering Corporation, located in Rockledge, FL. The *QwikHurricane® Generator Pad™* and generator were provided by Mainstream Engineering Corporation. The objective of this program was to evaluate if using the *QwikHurricane® Generator Pad™* as a mounting pad with a generator affects the ability of the generator to comply with the requirement to not ignite combustible materials outside the enclosure when a fire occurs within the enclosure. This was performed by simulating a worst-case fire scenario from a power generator mounted on top of a *QwikHurricane® Generator Pad™*, and experimentally measuring the ignitability of items outside the engine enclosure at set distances (between 1½–3 ft from the pad, depending on the side) to determine allowable installation standoff distances between the pad-mounted generator and adjacent structures (such as a residence).

Based on the test results, it is unlikely that a fire in the generator enclosure mounted on the *QwikHurricane® Generator Pad™ (QwikPad™)* would pose an ignition risk to a nearby material or structure, at the tested standoff distances, and for nearby structures with materials having similar ignition and heat release rate properties as those tested in this project.

The model of pad tested under this project, *Universal Pad P/N QT8200*, is similar to other P/N (part numbers) manufactured by Mainstream Engineering Corporation. A summary of the various P/Ns is provided in Section 10. Because the *Universal Pad P/N QT8200* provided acceptable performance at the standoff distances tested, it is expected that the other similar P/N would too and do not need to be tested.

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1.0 INTRODUCTION

Full-scale testing of a multi-fuel power generator mounted on a generator support pad identified as *QwikHurricane® Generator Pad™* was conducted for compliance to NFPA 37 (2018 Edition), *Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines,* Section 4.1.4.1.2 "Engines located Outdoors". Testing was performed on May 26 and 27, 2020, at SwRI, located in San Antonio, Texas for Mainstream Engineering Corporation, located in Rockledge, Florida. The *QwikHurricane® Generator Pad™* and generator were provided by provided by Mainstream Engineering Corporation. Testing was conducted in accordance with SwRI Test Plan 01.24919.01.304, issued on April 30, 2020 with the following deviation:

- The standoff distance measurements were based on distance from the generator mounting pad and not the weatherproof enclosure.

The results presented in this report apply only to the materials tested, in the manner tested, and not to any similar materials or material combinations.

2.0 BACKGROUND AND OBJECTIVE

NFPA 37 describes guidelines for installation of power generators that utilize combustion engines. Section 4.1.4.1 specifically describes guidelines for installation of engines located outdoors.

The standard stipulates that engines installed outdoors shall be located at least 5 ft from openings in walls and structures having combustible walls. Further, a minimum separation shall not be required where the following conditions exist:

1. A clearance of less than 5 ft shall be permitted where all portions of structures that are closer than 5 ft from the engine enclosure have a fire resistance rating of at least 1 h.
2. A clearance less than 5 ft shall be permitted where it has been demonstrated through methods acceptable to the authority having jurisdiction that a fire within the enclosure will not ignite combustible structures.

Generator mounting pads are not explicitly discussed in NFPA 37. Therefore, the objective of this project was to evaluate if using the *QwikHurricane® Generator Pad™* as a mounting pad with a generator affects the ability of the generator to comply with the requirement to not ignite combustible materials outside the enclosure when a fire occurs within the enclosure. Testing was performed to specifically address the second point by simulating a worst-case fire scenario within the power generator mounted on the *QwikHurricane® Generator Pad™* and to experimentally measure the ignitability of items outside the engine enclosure at various distances (between 1½–3 ft from the pad) in order to determine allowable standoff distances between pad-mounted gas engine power generators installed outdoors adjacent to structures (such as a residence).

3.0 TEST SPECIMEN

Mainstream Engineering Corporation, provided a generator mounting pad identified as *QwikHurricane® Generator Pad™* for testing. The generator pad is sold with various part numbers, which reflect brand-specific threaded insert locations. The Universal Pad, P/N QT8200, has a total of 15 threaded inserts to cover all generator brands listed on the product data sheet which can be found in Appendix B. The generator pad is a rotationally molded LLDPE (linear low-density polyethylene) unit that has overall nominal dimensions of 56 × 38 × 5 in. (l × w × h) which does not vary between part numbers. For simplicity, only P/N QT8200 was evaluated, but the results will be applicable to all the P/N shown in Section 10 of this report. Two of the *QwikHurricane® Generator Pad™* (P/N QT8200) were received by SwRI on May 8, 2020. A model of the generator pad is shown in Figure 1. Additionally, Mainstream Engineering Corporation provided two generators for installation on the *QwikHurricane® Generator Pad™*. The generators provided were Generac Model No. G0070422, which is a 22-kW output multi-fuel generator. Client-provided drawings of the *QwikHurricane® Generator Pad™* are provided in Appendix A. Product data sheets are provided in Appendix B.

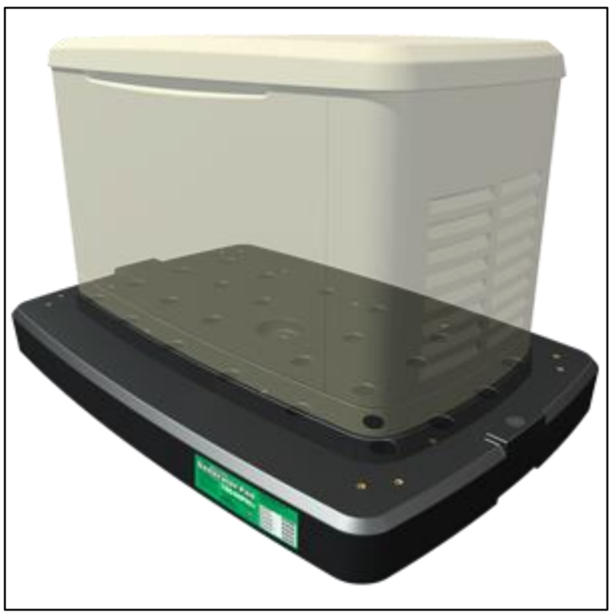


Figure 1. *QwikHurricane® Generator Pad™* Generator Pad.

4.0 FACILITY

Testing was performed in SwRI's calorimetry facility. The building is comprised of an air-conditioned 80 × 50 × 42-ft bay. The building has a 17 × 14-ft overhead door, centered in one of the 80-ft wide sides for ease in setting up large-scale test samples. Figure 2 provides a drawing of the test facility.

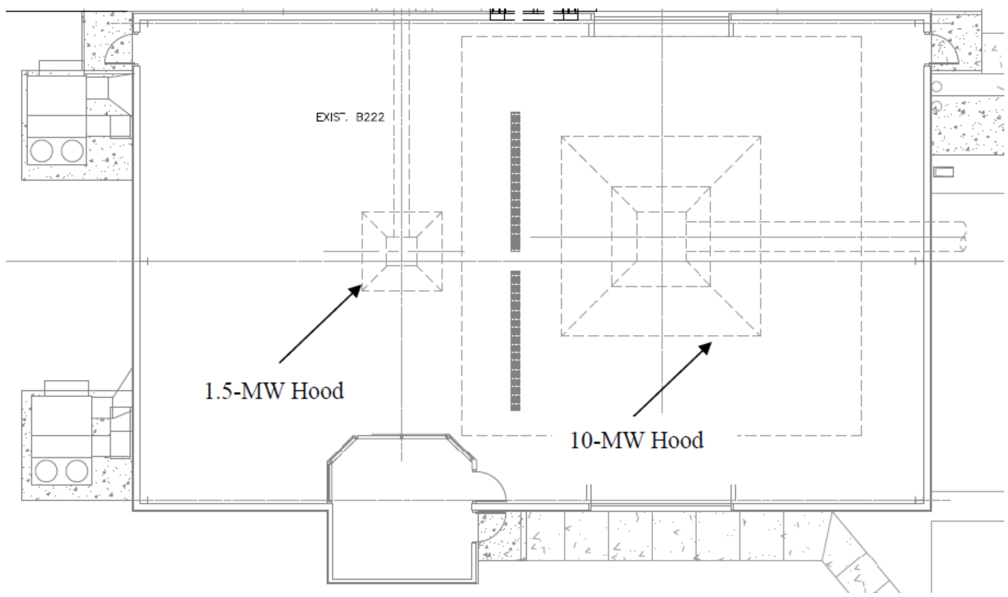


Figure 2. Plan View Schematic of SwRI's Calorimetry Test Facility.

5.0 TEST PROCEDURE

Testing was conducted in accordance with SwRI Test Plan 01.24919.01.304, issued April 30, 2020 with the following deviation:

- The standoff distance measurements were based on distance from the generator mounting pad and not the weatherproof enclosure.

In order to evaluate how the *QwikHurricane® Generator Pad™* performs, it must be tested with an operational generator installed. The *QwikHurricane® Generator Pad™* is designed to work with generator models from several manufacturers, including Briggs and Stratton, Kohler, and Generac/Honeywell, all with very similar enclosure footprints. Therefore, testing was conducted using the highest output model by a brand as this represents the worst-case scenario due to fuel consumption and combustible load. Lower-rated models would be considered approved without testing should the highest output model perform well. Additionally, testing was performed using a generator with aluminum enclosure as this represents the worst-case scenario. By testing aluminum enclosures, it can be assumed that steel enclosures would perform equal or better. The generator model to be used for testing was selected and provided by Mainstream Engineering Corporation.

Two main scenarios were evaluated; a small fuel leak in the main compartment and a high flow leak. The objective was to replicate both a slow burning fire resulting from a pinhole type leak that has ignited and a fast growth fire resulting from a catastrophic failure at the regulator or fuel hoses. The tests were performed with the unit running on natural gas, and propane was used as the leak fuel. Each ignition scenario was performed with the generator running and, if ignition was not achieved, with the generator off.

5.1 Small Leak Scenario

This test is meant to represent a small leak, with a nominal diameter of up to 2–3 mm, which is consistent with a cracked metal housing or pinhole leak in piping/tubing. The fuel gas was leaked at a nominal rate of 7 slpm (standard liter per minute) at nominal operating pressures (0.25–0.5 psig) through a ¼-in. dia. tube that was piped through the wall of the unit. This leak tube was located in the area with the highest fuel load as determined by visual inspection of the unit.

Two tests were performed for the small leak scenario; the first was with the generator running and the second was with the unit off, as ignition was not achieved with the unit running. The generator was preheated by running for a period of at least 15 min under load (supplied by a rental load bank) until the temperatures within the enclosure stabilized. To summarize, testing consisted of performing the following tests:

- Test 1: The test will be conducted with engine running, after the engine has run for at least 15 min to raise internal temperatures within the unit. The flow of propane is allowed to flow into the engine area for a 30-s leak duration with an electric spark plug on. If no ignition is observed during Test 1, Test 2 will be conducted. If sustained ignition is observed, Test 1 will be continued until the majority of the combustible material within the enclosure has been consumed, or ignition has occurred on one of the standoff walls, or a period of 1 h has elapsed and Test 2 will not be performed. If the majority of the combustibles are not consumed during Test 1, Test 2 will be conducted.
- Test 2: The test will be conducted with the engine off, but after the engine has run for at least 15 min to raise internal temperatures within the unit. The flow of propane is allowed to flow into the engine area for a 30-s leak duration with an electric spark plug on. If sustained ignition of the fuel leak is not observed within 1 min of the spark plug introduction, the location of the leak will be modified and the test repeated until sustained ignition occurs. Once sustained ignition occurs, the test will be continued until the majority of the combustible material within the enclosure has been consumed, or ignition has occurred on one of the standoff walls, or a period of 1 h has elapsed. The leak flow will remain on for the duration of the test or for 1 h, whichever is longer.

5.2 High Flow Leak Scenario

This test is meant to replicate a high flow (catastrophic) leak, representative of the fuel supply provided to the unit when operating under full load. The supply fuel gas was flowed at full load flow rate of 67 slpm (142 ft^3/h), as provided by generator literature, through a ½-in. pipe that is piped through the service panel of the unit in the vicinity of regulator.

Up to two tests could be performed for the high flow leak scenario; the first with the generator running and the second will be with the unit off. Because ignition was achieved during Test 3, Test 4 was not conducted. In all tests, the generator was preheated by running for a period of at least 15 min under load (supplied by a rental load bank) until the temperatures within the enclosure had stabilized. To summarize, testing consisted of performing the following tests:

- Test 3: The test will be conducted with engine running, after engine has run for at least 15 min to raise internal temperatures. The flow of propane is allowed to flow into the fuel inlet area with the electric spark plug on. If sustained ignition of the fuel leak is not observed within 30 s, Test 3 will be considered over. If sustained ignition is observed, the test will be continued until the majority of the combustible material within the enclosure has been consumed, or ignition has occurred on one of the standoff walls. The leak flow will remain on for the duration of the test or for 20 min, whichever period is shorter. The duration of 20 min was selected as this would be a reasonable amount of time for the fire to be noticed and for emergency response personnel to arrive and extinguish the fire.
- Test 4: The test will be conducted with the engine off, but after the engine has run for at least 15 min to raise internal temperatures. The flow of propane is allowed to flow into the fuel inlet area with the electric spark plug on. If sustained ignition of the fuel leak is not observed within 30 s of the spark plug introduction, the location of the leak will be modified and the test repeated until sustained ignition occurs. Once sustained ignition occurs, the test will be continued until the majority of the combustible material within the enclosure has been consumed, or ignition has occurred on one of the standoff walls. The leak flow will remain on for the duration of the test or for 20 min, whichever period is shorter.

Visual observations and instrumentation located within the unit were used to verify when the peak burning has occurred in order to determine when to end the test. The primary performance criterion was based on visual observation of ignition of the combustible materials adjacent to the generator. A successful test consists of a standoff distance that does not result in ignition of the combustible siding material, or overhead decking material. Secondary performance criteria are peak temperatures and heat fluxes in and around the generator enclosure.

6.0 TEST SETUP

Testing was performed adjacent to an "L" shaped assembly, such that the generator was placed a distance of 18 in. from the rear side of the enclosure and 36 in. from the right side of the generator enclosure. This would simulate the generator being close to the side(s) of a residence as well as another structure such as a shed. The walls were constructed using 2 × 4-in. dimensional lumber framing with 7/16-in. thick Oriented Strand Board (OSB) sheathing and a vinyl siding exterior. Figure 3 provides a schematic of the testing setup.

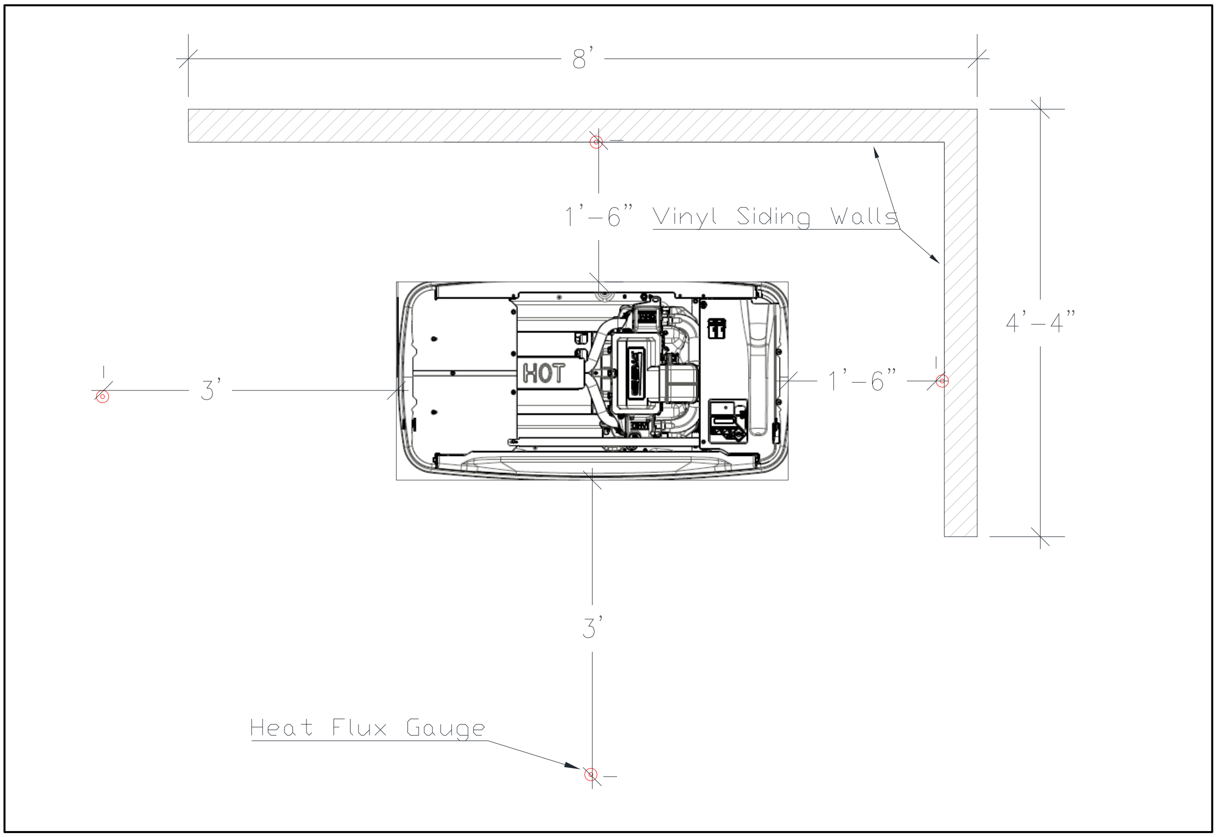


Figure 3. Plan View of Test Setup Stand-off Distances.

7.0 INSTRUMENTATION

Test measurements included temperatures, fuel flow rates, and heat fluxes. Data was logged on a dedicated PC-based data acquisition system at 1-s intervals. All equipment used for test measurements and data recording were calibrated as part of a calibration cycle in accordance with SwRI Quality Assurance Program.

Four heat flux gauges were used to measure the incident heat flux to targets approximately distanced 18 in. from the rear and right side of the generator pad, and 36 in. from other two sides of the generator pad. Temperature measurements were made with 20-ga exposed-bead (welded-junction) Type "K" TCs. This type of TC has an accuracy of approximately ± 2.2 °C and a 90% response time of 1 s in air. The location of the TCs and heat flux gauges are described in Table 1. Additionally, SwRI's thermal imaging camera was utilized during testing to track flame progression through the unit without having to open the panel and/or lid. High-definition video was taken of both the front of the unit and the rear of the unit.

Table 1. Thermocouple, Heat Flux Gauge, and Fuel Flow Locations.

Name	Location	Description
TC 1	AT HFG	Next to HFG-Front.
TC 2	AT HFG	Next to HFG-Left.
TC 3	AT HFG	Next to HFG-Rear.
TC 4	AT HFG	Next to HFG-Right.
TC 5	Battery	Top of the battery, held with foil tape.
TC 6	Fuel Inlet	In the fuel inlet area, near the regulator.
TC 7	Control Panel	Located on the top of the control panel user interface.
TC 8	Exhaust	2 in. below the exhaust, directly in airflow.
TC 9	Lid	Centered on the exterior of the lid.
HFG 1	HFG-Front	36 in. from unit, centered to front side.
HFG 2	HFG-Left	36 in. from unit, flush with vinyl siding, centered to left side.
HFG 3	HFG-Rear	18 in. from rear of unit, flush with vinyl siding, centered to back side.
HFG 4	HFG-Right	36 in. from unit, centered to right side.
Gas Supply	---	Natural Gas Supply to Unit.
Leak Flow	---	Propane Leak Flow.

8.0 RESULTS

Testing was conducted at SwRI's Fire Technology Department, located in San Antonio, Texas, on May 26 and 27, 2020. Graphical depiction of the test data can be found in Appendix C. Selected photographic documentation is provided in Appendix D. Full digital photographic and video documentation has been provided electronically to the Client. Tables 2, 3, and 4 provide the visual observations from the testing.

Table 2. Test 1: Visual Observations.

Data Time (min:s)	Visual Timer (min:s)	Observations
Test 1: Unit running. Small Leak Scenario.		
Generator was warmed up under load for 15 min.		
00:00	---	Data Started, Cameras started.
00:20	---	Spark ignitor turned on.
00:30	---	Leak flow of propane is initiated at 7 SLPM.
01:00	---	No sign of combustion. Leak flow is stopped. Spark igniter off. Load off. Unit turned off. Test ended. Begin Test 2.

Table 3. Test 2: Visual Observations.

Data Time (min:s)	Visual Timer (min:s)	Observations
Test 2: Unit off. Small Leak Scenario.		
00:00	---	Data acquisition started. Unit is still warm from Test 1.
00:20	---	Spark ignitor turned on.
00:30	00:00	Leak flow begins. Visual timer started.
00:35	00:05	Smoke visible from unit.
02:40	02:10	Visible smoke from lid on right side of unit.
04:35	04:05	Badge falls.
07:00	06:30	Smoke continues with no visible flames.
09:30	09:00	Discoloration of the lid and portions of the front of the unit.
11:03	10:37	Flames visible inside of battery compartment.
12:15	11:45	Flames licking out on the right exterior of the unit.
13:40	13:10	Smoke is darker in color.
14:00	13:30	Spark ignitor is turned off.
14:27	13:57	Flames on right exterior of unit.
15:16	14:46	Flaming droplets hit pad and self-extinguish.
16:00	15:30	Flaming material falls to pad and continues to burn.
17:30	17:00	Flames on back of unit.
18:00	17:30	Burning pad and fascia continue to burn.
20:00	19:30	Flaming drops in rear of unit self-extinguish on pad.
20:30	20:00	Area of pad burning on right continues.
22:45	22:15	Fascia along bottom of generator is consumed in area on right side.
24:00	23:30	Supply is leaking through the solenoid at a rate of 25 slpm.
26:00	25:30	Rate of fuel leaking through the solenoid is increasing.
27:00	26:30	Crater visible in pad on right side.
30:00	29:30	Solenoid has failed and fuel is flowing into unit at a rate of 130 slpm.
31:50	31:20	Right side of pad is burning and forming a pool fire on the lab floor.
33:00	32:30	Flames coming out of the vent in rear of unit.
34:30	34:00	Piece of siding falls from OSB.
36:00	35:30	Right side of mounting pad is burning on top.
37:00	36:30	Fascia slowly burns towards the front.
41:00	40:30	Generator is tipping to the right.
43:00	42:30	Small pool fire on right side of floor.
45:00	44:30	Increased tipping of the unit to the right side.
47:30	47:00	Rear of pad is consumed near inlet, fascia is separating.
50:00	49:30	Solenoid has failed and fuel is flowing into unit at a rate of 144 slpm.
52:00	51:30	Rear and right heat flux gauge are obstructed.
55:00	54:30	Fascia and pad continue to burn.
56:00	55:30	Increased sizzling noises.
60:00	59:30	Fuel flow off, unit extinguished, test ended.

Table 4. Test 3: Visual Observations.

Time (min:s)	Visual Timer (min:s)	Observations
Test 3: Unit running. High Flow Leak Scenario.		
Generator was warmed up under load for 15 min, cameras on before data started.		
00:00	---	Data acquisition started.
00:15	---	Spark ignitor turned on.
00:30	00:00	Leak flow begins, visual timer is started.
01:40	01:10	Spark ignitor turned off.
02:00	01:30	Flames are exiting the unit from the right side.
02:15	01:45	Smoke is exiting the unit from the lid.
02:30	02:00	Flaming droplets have ignited pad on right side of unit.
03:20	02:50	Dark smoke exiting from exhaust side of unit.
03:44	03:14	Left side of lid has opened.
04:22	03:52	Lid gasket falls onto pad and burns.
05:24	04:54	Flames exiting all around the lid.
06:15	05:45	Deformation of siding on walls.
06:35	06:05	Front of pad has self-extinguished.
08:30	08:00	Flames exiting out of the back vent of the unit.
09:00	08:30	Leak through solenoid has formed.
13:10	12:40	Right side of pad has extinguished.
17:00	16:30	Chunks of materials fall on right side of pad.
18:12	17:42	Right side of pad and fascia continues to burn.
20:00	19:30	Fuel flow off, unit extinguish, test ended.

9.0 CONCLUSIONS

Based on the test results, it is unlikely that a fire in this nominal generator mounted on the *QwikHurricane® Generator Pad™ (QwikPad™)* would pose an ignition risk to a nearby material or structure, at the tested standoff distances, and for nearby structures with materials having similar ignition and heat release rate properties as those tested in this project.

10.0 EQUIVALENT MODELS

10.1 Models

The model tested under this project, *Universal Pad P/N QT8200*, is sold with various part numbers, which reflect brand-specific threaded insert locations. The *QwikHurricane® Generator Pad™* has overall nominal dimensions of 56 × 38 × 5 in. (l × w × h) which does not vary between part numbers. For simplicity, only P/N QT8200 was evaluated, but the results will be applicable to all the P/N shown in Table 5.

Table 5. P/N and Description of Generator Models to be Mounted.

QwikHurricane® Generator Pad™ P/N	**Description of Generator Model to be Mounted.**
QT8200	**Universal Pad** *(includes hardware for Generac/Honeywell, Briggs & Stratton and Kohler)*
QT8210	For **Briggs and Stratton** 17/20-kW Steel Enclosure Generators *(hardware included)*
QT8220	For **Briggs and Stratton** 20-kW Aluminum Enclosure Generators *(hardware included)*
QT8230	For **Generac/Honeywell** 9-22-kW Generators *(hardware included)*
QT8240	For **Kohler** 14/20-kW Generators *(hardware included)*

SwRI analyzed the Part Numbers (P/N) shown in Table 5 and determined that the *Universal Pad P/N QT8200* was representative of the entire *QwikHurricane® Generator Pad™ (QwikPad™)* line. Therefore, because the *Universal Pad P/N QT8200* provided acceptable performance at the tested standoff distances, the other P/Ns listed in Table 5 should also be considered safe to install at the tested standoff distances.

APPENDIX A

QWIKHURRICANE® *GENERATOR PAD*™ – DWG. 5010950

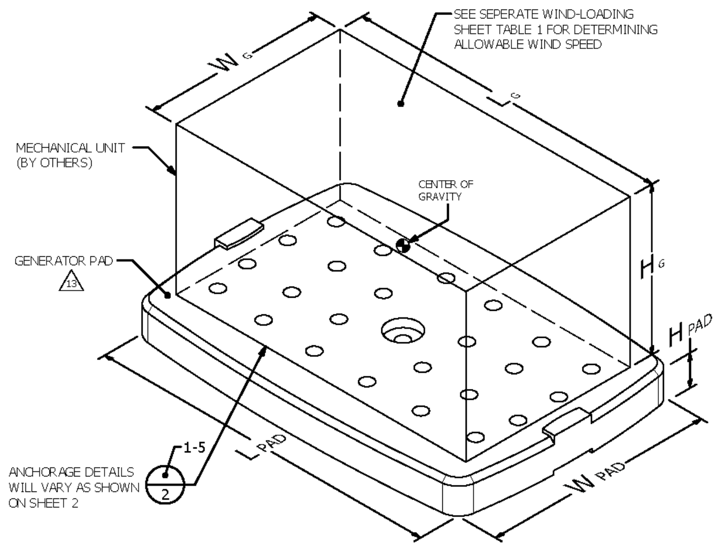
WIND LOADING AND TIE-DOWN SYSTEM INFORMATION

(CONSISTING OF 4 PAGES)

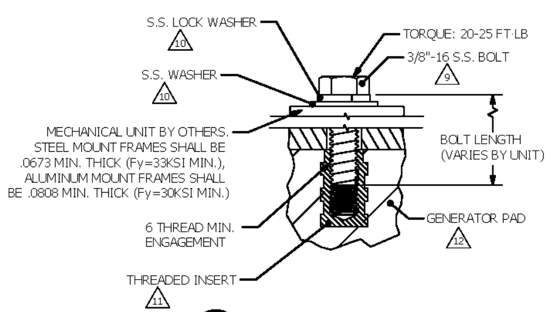
MAINSTREAM ENGINEERING CORP.

QWIKHURRICANE™ GENERATOR PAD

GENERATOR TIE-DOWN SYSTEM FOR HIGH-VELOCITY HURRICANE-ZONE (HVHZ)



1/1 GENERATOR TIE-DOWN SYSTEM — 1:18 SCALE — ISOMETRIC



2/1 ANCHOR DETAIL — 1:2 SCALE — SECTION VIEW

DESIGN NOTES:

1. THIS PRODUCT HAS BEEN DESIGNED IN ACCORDANCE WITH ASCE 7-10 AND THE FLORIDA BUILDING CODE - SIXTH EDITION (2017) FOR USE WITHIN AND OUTSIDE THE HIGH-VELOCITY HURRICANE ZONE (HVHZ).
2. DESIGN CONSIDERS ASCE 7-10 SECTION 29.5 DESIGN WIND LOADS - OTHER STRUCTURES. ALL OTHER DESIGN VARIABLES AND LOADING FACTORS ARE IN ACCORDANCE WITH ASCE 7-10 CHAPTERS 26 & 29 FOR EXPOSURE CATEGORY C.
3. PRODUCTS DETAILED HEREIN ARE INCLUDED WITH QWIKHURRICANE™ PAD (SERIES QT82XX) HIGH-VELOCITY HURRICANE ZONE GENERATOR MOUNTING PADS, UNLESS OTHERWISE SPECIFIED. APPROPRIATE PAD MODEL ASSUMED TO BE DETERMINED BY CONTRACTOR/ INSTALLER BASED ON GENERATOR MAKE/MODEL.
4. THIS INSTALLATION SPECIFICATION IS FOR INSTALLATION OF THE GIVEN GENERATOR MODELS ATOP ANY QWIKHURRICANE™ GENERATOR PAD (SERIES QT82XX), WITH THE PAD LEVELED AND LOCATED AT GRADE LEVEL ON COMPACTED GROUND OR ATOP EXISTING CONCRETE SLAB.
5. INSTALLATIONS ATOP EXISTING CONCRETE SLAB WHERE V_{ULT} WIND SPEEDS EXCEED DESIGN CHECK IN SEPERATE WIND-LOADING SHEET TABLE 2 REQUIRE (1) ANCHOR INSTALLED WITH S.S. FENDER WASHER THROUGH CENTER HOLE TO PREVENT SLIDING.
6. MODEL NUMBER LIST IN GENERATOR PAD SCHEDULE MAY NOT BE ALL INCLUSIVE. MODEL NUMBER VARIANTS MAY EXIST, OR MAY BE ADDED TO PRODUCT LINES, WHICH MEET WIND LOAD RATINGS. GENERATOR MODELS OTHER THAN THOSE LISTED HAVING EQUIVALENT, OR SMALLER, EXTERIOR DIMENSIONS (L_G, W_G, H_G), MATCHING ANCHORAGE PATTERNS, AND WEIGHT GREATER THAN OR EQUAL TO THOSE LISTED SHALL BE CONSIDERED TO MEET GIVEN V_{ULT} WIND SPEEDS. OTHERWISE, UNITS MUST BE CONSIDERED ON A CASE-BY-CASE BASIS.
7. GENERATOR MOUNT BOLTS TO BE INSTALLED INTO MAKE/MODEL SPECIFIC ACHORAGE POINTS PER THE DEPICTED CONFIGURATION VIEWS. PROPER BOLT LENGTH ASSUMED TO BE DETERMINED BY CONTRACTOR/INSTALLER BASED ON GENERATOR MAKE/MODEL AND MINIMUM THREAD ENGAGEMENT SPECIFIED HEREIN.
8. DESIGN IS BASED ON INSPECTED PRODUCTS AND MANUFACTURING DRAWINGS PRODUCED BY MAINSTREAM ENGINEERING CORP. NO SUBSTITUTIONS WITHOUT WRITTEN APPROVAL BY THIS ENGINEER SHALL BE PERMITTED.

- (9) BOLTS SHALL BE 18-8 STAINLESS STEEL PER ASTM F593 IN ACCORDANCE WITH ANSI B18.2.1 WITH UNC CLASS 2A THREADS (PER ASME B1.1).
- (10) WASHERS SHALL BE 18-8 STAINLESS STEEL.
- (11) THREADED INSERTS SHALL BE BRASS PER ASTM B16 WITH UNC CLASS 2B THREADS (PER ASME B1.1) AND SHALL HAVE A PULL-OUT STRENGTH GREATER THAN 250 LB.
- (12) GENERATOR PAD SHALL BE LOW-DENSITY POLYETHYLENE (LDPE) WITH YIELD STRENGTH = 1.675 KSI OR BETTER PER ASTM D638 AND NOMINAL WALL THICKNESS = .220 (.1875 MIN.).
- (13) GENERATOR PAD SHALL BE FILLED WITH WATER AT INSTALLATION SITE TO ACHIEVE INSTALLED WEIGHTS GIVEN IN THE GENERATOR PAD SCHEDULE. WEIGHT OF FILLED PAD IS 330 LB.

GENERAL NOTES:

1. NO 33-1/3% INCREASE IN ALLOWABLE STRESS HAS BEEN USED IN THE DESIGN OF THIS SYSTEM.
2. CENTER OF GRAVITY ASSUMED TO ACT AT GEOMETRIC CENTER OF UNIT.
3. THE CONTRACTOR SHALL BE RESPONSIBLE TO INSULATE ALL MEMBERS FROM DISSIMILAR METALS TO PREVENT ELECTROLYSIS.
4. ELECTRICAL GROUND, WHEN REQUIRED, SHALL BE DESIGNED AND INSTALLED BY OTHERS.
5. THE SYSTEM DETAILED HEREIN IS GENERIC AND DOES NOT PROVIDE INFORMATION FOR A SPECIFIC SITE. FOR SITE CONDITIONS DIFFERENT FROM THE CONDITIONS DETAILED HEREIN, A LICENSED ENGINEER SHALL PREPARE SITE SPECIFIC DOCUMENTS IN CONJUNCTION WITH THIS DOCUMENT.
6. FOR AN EXPLANATION OF RISK AND EXPOSURE CATEGORIES THAT ACCOMPANY THE V_{ULT} WIND SPEEDS USED IN THIS APPROVAL, SEE SECTIONS 1.5.1 AND 26.7.3, RESPECTIVELY, OF ASCE 7-10. V_{ULT} WIND SPEEDS FOR RISK CATEGORY II DETERMINED BY FIGURE 26.5-1A OF ASCE 7-10.
7. GENERATOR WEIGHTS AND DIMENSIONS PER MANUFACTURER DOCUMENTATION, TO BE VERIFIED BY OTHERS.
8. ALL DIMENSIONS SHOWN ARE REFERENCE AND IN INCHES, UNLESS OTHERWISE SPECIFIED.

PRODUCT APPROVAL NOTICE

This product has received **Florida Product Approval #27646** in accordance with the Florida Building Code - Sixth Edition (2017). The full product approval document can be accessed on the Florida Building Codes Information System (BCIS) (www.floridabuilding.org)

DR. ROBERT P. SCARINGE, P.E.
FL PE # 31527

ROBERT P. SCARINGE · LICENSE · No. 31527 · STATE OF FLORIDA · PROFESSIONAL ENGINEER

Solutions Through Advanced Technology®
MAINSTREAM ENGINEERING
200 YELLOW PLACE
ROCKLEDGE, FL 32955
PH: (321) 631-3550
WWW.MAINSTREAM-ENGR.COM

GENERATOR PAD EQUIPMENT TIE-DOWN SYSTEM

REMARKS	DRWN	CHKD	DATE
INITIAL RELEASE	ALC	RPS	12/7/2018

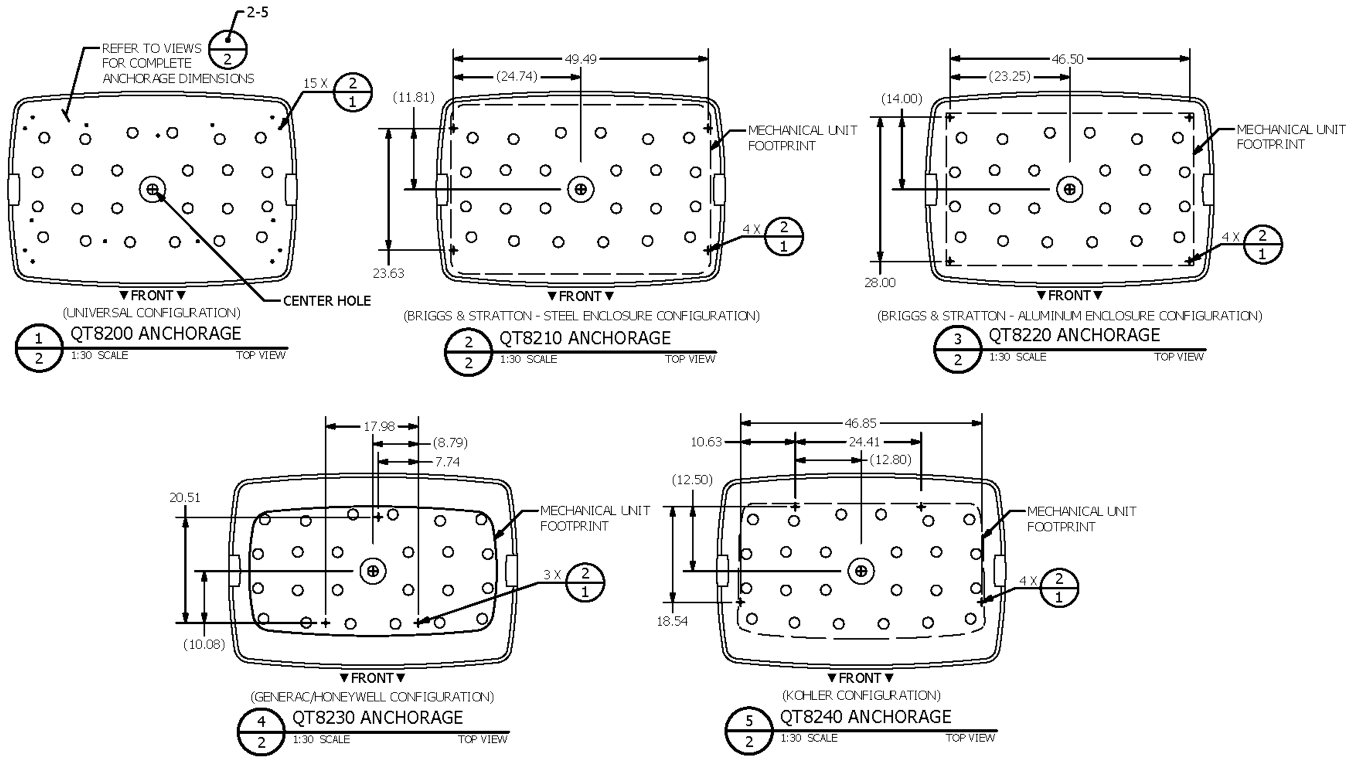
QT82XX

DWG NO. 5010950 **REV** A

SHEET 1 OF 2

GENERATOR PAD SCHEDULE:

QWIKHURRICANE™ GENERATOR PAD							GENERATOR						
PART NO.	INSTALLED PAD WEIGHT	L_{PAD}	W_{PAD}	H_{PAD}	RATED WIND SPEED	ULTIMATE PRESSURE	MAKE	NOMINAL RATING	SEE DESIGN NOTE 6 MODEL NO.	L_G	W_G	H_G	MIN. WEIGHT
-	*LB*	*IN*	*IN*	*IN*	*MPH*	*PSF*	-	-	-	*IN*	*IN*	*IN*	*LB*
QT8200	330	56	38	5	180	66.2	(UNIVERSAL)	-	ALL LISTED MAKES/MODELS	SEE DESIGN NOTE 6			
QT8210	330	56	38	5	180	66.2	BRIGGS & STRATTON	17 kW	040459	47	31	31	484
								20 kW	040336, 040547				500
QT8220	330	56	38	5	180	66.2		20 kW	040574, 040592, 040573	49.2	31.7	30.6	443
QT8230	330	56	38	5	180	66.2	GENERAC	9 kW	G007029, G007030	48	25.1	28.6	340
								11 k W	G007031, G007032, G007033				348
								16 kW	G007035, G007036, G007037				409
								20 kW	G007038, G007039				448
								22 kW	G007042, G007043				466
QT8230	330	56	38	5	180	66.2	HONEYWELL	16 kW	G007059	48	25.1	28.6	409
								20 kW	G007062				448
								22 kW	G007065				466
QT8240	330	56	38	5	180	66.2	KOHLER	14 kW	14RESA	48	26.2	29	420
								14 kW	14RESAL				467
								20 kW	20RESA, 20RESC				535
								20 kW	20RESAL, 20 RESCL				580



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GENERATOR PAD EQUIPMENT TIE-DOWN SYSTEM

REMARKS	DRWN	CHKD	DATE
INITIAL RELEASE	ALC	RPS	12/7/2018

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QT82XX

DWG NO. 5010950 REV A

SHEET 2 OF 2

MAINSTREAM ENGINEERING
Solutions Through Advanced Technology®

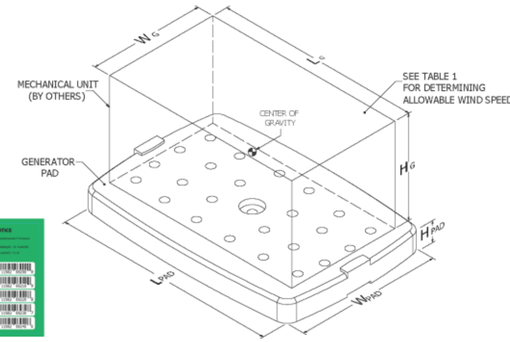
200 YELLOW PLACE
ROCKLEDGE, FLORIDA 32955

QT8200, QT8210, QT8220, QT8230, QT8240

QwikHurricane® Generator Pad:

HIGH-VELOCITY HURRICANE ZONE GENERATOR MOUNTING PAD

FLORIDA PRODUCT APPROVAL #FL27646



ROBERT P. SCARINGE. P.E.
FL #31527

OCTOBER 1, 2018

ROBERT P. SCARINGE LICENSE No. 31527 STATE OF FLORIDA PROFESSIONAL ENGINEER

WIND ANALYSIS OF HURRICANE PADS MAX. WIND SPEED = 180MPH

CODES: FLORIDA BUILDING CODE 2017
RISK CATEGORY II
ASCE 7-10

QT8200 GENERATOR PAD

WEIGHT:	330 LB
WIDTH:	38 IN
LENGTH:	56 IN
HEIGHT:	5 IN

$q_z = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2$ (Eq. 26.10-1)
$F = q_z \cdot G \cdot C_f \cdot A_f$ (Eq. 29.4-1)

$K_z = 0.85$ (Table 26.10-1)
$K_{zt} = 1.0$ (Sec. 26.8.2)
$K_d = 0.85$ (Table 26.6-1)
$K_e = 1.00$ (Table 26.9-1)

$G = 0.85$ (Sec. 26.11.1)
$C_f = 1.3$ (Fig. 29.4-1)

NOTES:

1. LOAD COMBINATION ASD PER 2.4.1 ASCE 7-10 (0.6 X DEAD + 0.6 X WIND)
2. DESIGN CONSIDERS ASCE 7-10 SECTION 29.5 DESIGN WIND LOADS - OTHER STRUCTURES. ALL OTHER DESIGN VARIABLES AND LOADING FACTORS ARE IN ACCORDANCE WITH ASCE 7-10 CHAPTERS 26 & 29 FOR EXPOSURE CATEGORY C.
3. TOTAL WIND FORCE BASED ON AREA OF UNIT AND PAD ($F_{WIND,TOT} = F_{WIND,UNIT} + F_{WIND,PAD}$).
TOTAL WIND MOMENT = $F_{WIND,UNIT}$ X ($H_{UNIT}/2+H_{PAD}$)+$F_{WIND,PAD}$ X $H_{PAD}/2$.
4. CENTER OF GRAVITY ASSUMED TO ACT AT GEOMETRIC CENTER OF UNIT.
5. PAD INSTALLED ON LEVEL GROUND PROVIDES 5" CLEARANCE ABOVE ADJOINING GRADE. DESIGN CONSIDERS 4" CLEARANCE ABOVE GRADE.
6. ORIGINAL EQUIPMENT INSTRUCTIONS SUPERSEDE THESE INSTRUCTIONS IF MORE STRINGENT.
7. IF UNIT IS TO BE INSTALLED ON EXISTING CONCRETE SLAB, REFER TO TABLE 2 FOR RATED WIND ZONES.
8. UNIT MUST BE SECURED TO PAD WITH HARDWARE PROVIDED. INCLUDED HARDWARE BASED ON PAD AND EQUIPMENT MODEL.
9. MODEL NUMBER LIST IN GENERATOR PAD SCHEDULE MAY NOT BE ALL INCLUSIVE. MODEL NUMBER VARIANTS MAY EXIST, OR MAY BE ADDED TO PRODUCT LINES, WHICH MEET WIND LOAD RATINGS. GENERATOR MODELS OTHER THAN THOSE LISTED HAVING EQUIVALENT, OR SMALLER, EXTERIOR DIMENSIONS (L_G, W_G, H_G), MATCHING ANCHORAGE PATTERNS, AND WEIGHT GREATER THAN OR EQUAL TO THOSE LISTED SHALL BE CONSIDERED TO MEET GIVEN V_{ULT} WIND SPEEDS. OTHERWISE, UNITS MUST BE CONSIDERED ON A CASE-BY-CASE BASIS.

GENERATOR PAD SCHEDULE:

QWIKHURRICANE™ GENERATOR PAD							GENERATOR						
PART NUMBER	INSTALLED PAD WEIGHT	L_{PAD}	W_{PAD}	H_{PAD}	RATED WIND SPEED	ULTIMATE PRESSURE	MAKE	NOMINAL RATING	SEE DESIGN NOTE 9 MODEL NUMBER	L_G	W_G	H_G	MINIMUM WEIGHT
	LB	IN	IN	IN	MPH	PSF	–	–	–	IN	IN	IN	LB
QT8200	330	56	38	5	180	66.2	UNIVERSAL	–	ALL LISTED MAKES/MODELS	SEE DESIGN NOTE 6			
QT8210	330	56	38	5	180	66.2	BRIGGS & STRATTON	17 kW	040459	47	31	31	484
								20 kW	040336, 040547				500
QT8220	330	56	38	5	180	66.2		20 kW	040573, 040574, 040592	49.2	31.7	30.6	443
QT8230	330	56	38	5	180	66.2	GENERAC	9 kW	G007029, G007030	48	25.1	28.6	340
								11 kW	G007031, G007032, G007033				348
								16 kW	G007035, G007036, G007037				409
								20 kW	G007038, G007039				448
								20 kW	G007042, G007043				466
QT8230	330	56	38	5	180	66.2	HONEYWELL	16 kW	G007059	48	25.1	28.6	409
								20 kW	G007062				448
								22 kW	G007065				466
QT8240	330	56	38	5	180	66.2	KOHLER	14 kW	14RESA	48	26.2	29	420
								14 kW	14RESAL				467
								20 kW	20RESA, 20RESC				535
								20 kW	20RESAL, 20 RESCL				580

5010916 REV-A / 1201890002

WIND LOAD CALCULATIONS FOR QT82XX SERIES GENERATOR PADS:
APPROPRIATE PAD MODEL DETERMINED USING PAD SCHEDULE ON SHEET 1

TABLE 1: WIND LOAD OVERTURN DESIGN CHECK FOR V_{ULT} = 180 MPH (EXPOSURE 'C') FOR QT82XX SERIES GENERATOR PADS FOR USE WITH RISK CATEGORY II STRUCTURE IN THE HVHZ.

MAKE	NOMINAL RATING	MODEL NUMBER	DIMENSIONS L_G	DIMENSIONS W_G	DIMENSIONS H_G	WEIGHT	.6 X DEAD LOAD (UNIT + PAD)	DEAD LOAD MOMENT	$F_{WIND, PAD}$	$F_{WIND, UNIT}$	$F_{WIND, TOT}$	.6 X WIND MOMENT	SF OVERTURN	DESIGN CHECK
							V_{ULT} = 180 MPH WIND SPEED (66.2 PSF ULTIMATE WIND PRESSURE)							
–	–	–	IN	IN	IN	LB	LB	FT-LB	LB	LB	LB	FT-LB	-	LB
BRIGGS & STRATTON	17 kW	040459	47	31	31	484	488.4	773.3	128.8	670.0	798.8	702.9	1.100	OK FOR 180 MPH
	20 kW	040336, 040547	47	31	31	500	498.0	788.5	128.8	670.0	798.8	702.9	1.122	OK FOR 180 MPH
	20 kW	040573, 040574, 040592	49.2	31.7	30.6	443	463.8	734.4	128.8	692.3	821.1	718.8	1.022	OK FOR 180 MPH
GENERAC	9 kW	G007029, G007030	48	25.1	28.6	340	402.0	636.5	128.8	631.3	760.1	625.3	1.018	OK FOR 180 MPH
	11 kW	G007031, G007032, G007033	48	25.1	28.6	348	406.8	644.1	128.8	631.3	760.1	625.3	1.030	OK FOR 180 MPH
	16 kW	G007035, G007036, G007037	48	25.1	28.6	409	443.4	702.1	128.8	631.3	760.1	625.3	1.123	OK FOR 180 MPH
	20 kW	G007038, G007039	48	25.1	28.6	448	466.8	739.1	128.8	631.3	760.1	625.3	1.182	OK FOR 180 MPH
	22 kW	G007042, G007043	48	25.1	28.6	466	477.6	756.2	128.8	631.3	760.1	625.3	1.209	OK FOR 180 MPH
HONEYWELL	16 kW	G007059	48	25.1	28.6	409	443.4	702.1	128.8	631.3	760.1	625.3	1.123	OK FOR 180 MPH
	20 kW	G007062	48	25.1	28.6	448	466.8	739.1	128.8	631.3	760.1	625.3	1.182	OK FOR 180 MPH
	22 kW	G007065	48	25.1	28.6	466	477.6	756.2	128.8	631.3	760.1	625.3	1.209	OK FOR 180 MPH
KOHLER	14 kW	14RESA	48	26.2	29	420	450.0	712.5	128.8	640.1	768.9	640.2	1.113	OK FOR 180 MPH
	14 kW	14RESAL	48	26.2	29	467	478.2	757.2	128.8	640.1	768.9	640.2	1.183	OK FOR 180 MPH
	20 kW	20RESA, 20RESC	48	26.2	29	535	519.0	821.8	128.8	640.1	768.9	640.2	1.284	OK FOR 180 MPH
	20 kW	20RESAL, 20 RESCL	48	26.2	29	580	546.0	864.5	128.8	640.1	768.9	640.2	1.350	OK FOR 180 MPH

TABLE 2. WIND LOAD SLIDING DESIGN CHECK FOR QT82XX SERIES GENERATOR PADS INSTALLED **ATOP EXISTING CONCRETE SLAB** FOR USE WITH RISK CATEGORY II STRUCTURE (EXPOSURE 'C') IN THE HVHZ.

MAKE	NOMINAL RATING	MODEL NUMBER	DIMENSIONS L_G	DIMENSIONS W_G	DIMENSIONS H_G	WEIGHT	NORMAL FORCE	STATIC FRICTION (μs = 0.6)	$F_{WIND, PAD}$	$F_{WIND, UNIT}$	$F_{WIND, TOT}$	ULTIMATE PRESSURE	WIND SPEED	DESIGN CHECK (NO ANCHORS)	DESIGN CHECK (1 ANCHOR) †
							V_{ULT} = 180 MPH WIND SPEED (66.2 PSF ULTIMATE WIND PRESSURE)								
–	–	–	IN	IN	IN	LB	LB	LB	LB	LB	LB	PSF	MPH	LB	LB
BRIGGS & STRATTON	17 kW	040459	47	31	31	484	814.0	488.4	78.7	409.7	488.4	40.49	140.75	UP TO 140 MPH	OK FOR 180 MPH
	20 kW	040336, 040547	47	31	31	500	830.0	498.0	80.3	417.7	498.0	41.28	142.13	UP TO 142 MPH	OK FOR 180 MPH
	20 kW	040573, 040574, 040592	49.2	31.7	30.6	443	773.0	463.8	72.7	391.1	463.8	37.40	135.28	UP TO 135 MPH	OK FOR 180 MPH
GENERAC	9 kW	G007029, G007030	48	25.1	28.6	340	670.0	402.0	68.1	333.9	402.0	35.02	130.91	UP TO 130 MPH	OK FOR 180 MPH
	11 kW	G007031, G007032, G007033	48	25.1	28.6	348	678.0	406.8	68.9	337.9	406.8	35.44	131.69	UP TO 131 MPH	OK FOR 180 MPH
	16 kW	G007035, G007036, G007037	48	25.1	28.6	409	739.0	443.4	75.1	368.3	443.4	38.63	137.48	UP TO 137 MPH	OK FOR 180 MPH
	20 kW	G007038, G007039	48	25.1	28.6	448	778.0	466.8	79.1	387.7	466.8	40.67	141.06	UP TO 141 MPH	OK FOR 180 MPH
	22 kW	G007042, G007043	48	25.1	28.6	466	796.0	477.6	80.9	396.7	477.6	41.61	142.69	UP TO 142 MPH	OK FOR 180 MPH
HONEYWELL	16 kW	G007059	48	25.1	28.6	409	739.0	443.4	75.1	368.3	443.4	38.63	137.48	UP TO 137 MPH	OK FOR 180 MPH
	20 kW	G007062	48	25.1	28.6	448	778.0	466.8	79.1	387.7	466.8	40.67	141.06	UP TO 141 MPH	OK FOR 180 MPH
	22 kW	G007065	48	25.1	28.6	466	796.0	477.6	80.9	396.7	477.6	41.61	142.69	UP TO 142 MPH	OK FOR 180 MPH
KOHLER	14 kW	14RESA	48	26.2	29	420	750.0	450.0	75.4	374.6	450.0	38.76	137.70	UP TO 137 MPH	OK FOR 180 MPH
	14 kW	14RESAL	48	26.2	29	467	797.0	478.2	80.1	398.1	478.2	41.18	141.95	UP TO 141 MPH	OK FOR 180 MPH
	20 kW	20RESA, 20RESC	48	26.2	29	535	865.0	519.0	86.9	432.1	519.0	44.70	147.89	UP TO 147 MPH	OK FOR 180 MPH
	20 kW	20RESAL, 20 RESCL	48	26.2	29	580	910.0	546.0	91.4	454.6	546.0	47.02	151.68	UP TO 151 MPH	OK FOR 180 MPH

† (1) Ø1/4" X 5" ITW CONCRETE SCREW (1.25" MIN. EMBEDMENT IN 3000 PSI MIN. CONCRETE AT 3.0" MIN. EDGE DISTANCE) INSTALLED WITH S.S. FENDER WASHER (13 GA MIN.) FOR V_{ULT} WIND SPEEDS ABOVE THE 'DESIGN CHECK (NO ANCHORS)' WIND SPEED REQUIRED TO PREVENT SLIDING ON CONCRETE FOR V_{ULT} WIND SPEEDS UP TO 180 MPH.

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APPENDIX B

QWIKHURRICANE® *GENERATOR PAD*™

PRODUCT DATA SHEET AND INSTALLATION INSTRUCTIONS

(CONSISTING OF 3 PAGES)

QwikProducts™
by Mainstream Engineering

QwikHurricane®
Generator Pad™
Hurricane-Secure Generator Pad

Fantastic!
a lightweight, easy-to-install generator pad that meets wind loading requirements of 180 MPH and Higher!

U.S. Patents Pending

QwikHurricane®
Generator Pad™

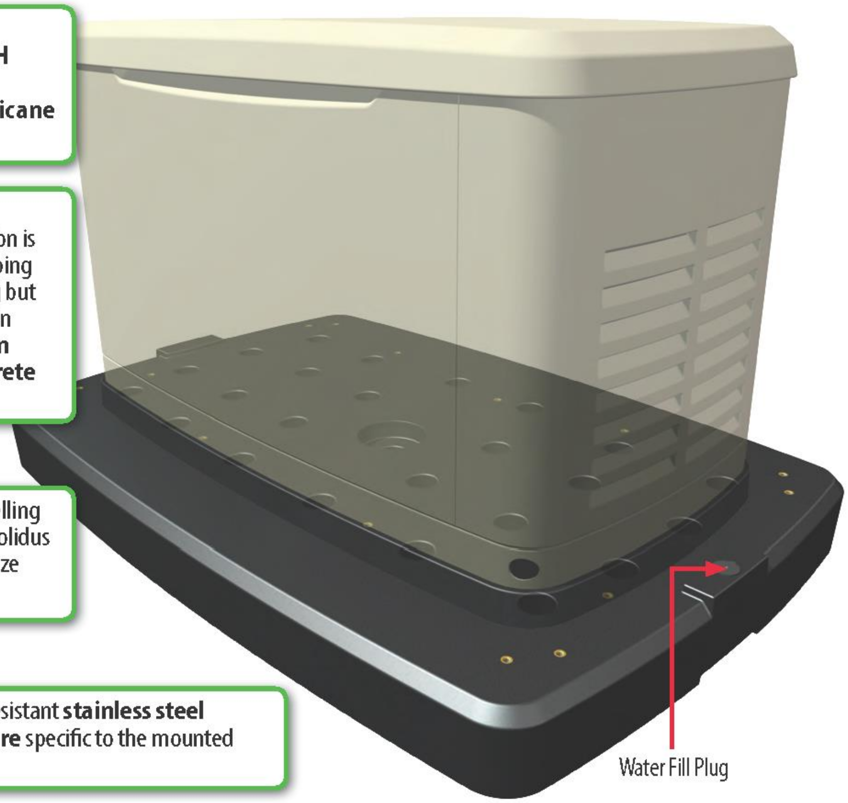
5 **Unfilled Weight**
42 lbs
Filled Weight
330 lbs

1 Rated for winds **in excess of 180 MPH** and **exceeds Miami-Dade hurricane requirements**.

2 UV-resistant, high-durability construction is lightweight for shipping and 1-man handling but once filled, more than **50 lbs heavier than competitor's concrete pads**.

3 Contains a unique gelling agent that forms a solidus gel and provides freeze protection.

4 Includes corrosion-resistant **stainless steel mounting hardware** specific to the mounted generator model.



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QwikProducts™ by Mainstream Engineering

QwikHurricane® Generator Pad™

Hurricane-Secure Generator Pad

QwikHurricane® Generator Pad™

The Florida Building Code compliant generator support pad is lightweight when purchased, but weighs enough to meet code requirements of **180 mph +** wind loading when filled with water and secured with stainless steel mounting bolts (supplied). Each pad includes a unique gelling agent that, once water is added, forms a solidus gel.

FLORIDA BUILDING CODE NOTICE

This product meets the following building code requirements:

1. **Mechanical Vol., Sect. 304.10 Clearances from Grade** – This product provides 5" of clearance above adjoining grade.
2. **Mechanical Vol., Sect. 301.15 Wind resistance** – Load combinations in accordance with the Florida Building Code, Building Vol. – Ch. 16 and ASCE 7 – Ch. 2.

Wind pressure calculations performed per Florida Building Code- Ch. 16 and ASCE 7 - Ch. 29. For the most up-to-date documentation, visit our website, **www.qwik.com/genpad** or call **1-800-866-3550**.

Florida Product Approval #FL27646

QwikHurricane® Generator Pad™ P/N	Description of Generator Model to be mounted
QT8200	**Universal Pad** *(includes hardware for Generac/Honeywell, Briggs & Stratton and Kohler)*
QT8210	For **Briggs and Stratton** 17/20 kW Steel Enclosure Generators *(hardware included)*
QT8220	For **Briggs and Stratton** 20 kW Aluminum Enclosure Generators *(hardware included)*
QT8230	For **Generac/Honeywell** 9-22 kW Generators *(hardware included)*
QT8240	For **Kohler** 14/20 kW Generators *(hardware included)*

For more details or information about the **QwikHurricane® Generator Pad™**
visit **www.qwik.com/genpad/** *or email* **info@qwik.com**

MADE IN THE USA

Solutions Through Advanced Technology® MAINSTREAM ENGINEERING

Mainstream Engineering Corporation®
1-800-866-3550
www.qwik.com

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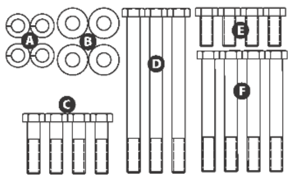
QwikProducts™ by Mainstream Engineering

QwikHurricane® Generator Pad

Installation Instructions

Generator anchoring methods should be chosen to meet wind loading requirements in your area. Visit **www.qwik.com** for the most up-to-date engineering documentation.

1 **Inspect Hardware Package Contents:**



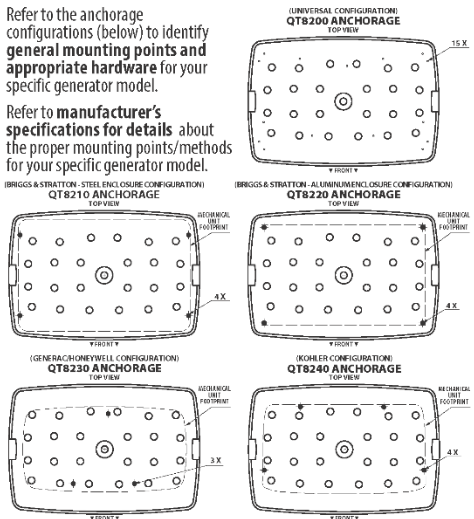
Hardware needs are specific to generator model. Hardware shown at the left is included with the Universal Pad model (QT8200).

See Model Specific Hardware chart at the bottom of this section.

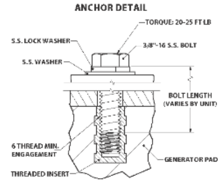
- A - (4) WASHERS, LOCK 3/8"
- B - (4) WASHERS, FLAT 3/8
- C - (4) BOLTS, HEX, 3/8-16 (1½")
- D - (3) BOLTS, HEX, 3/8-16 (4½")
- E - (4) BOLTS, HEX, 3/8-16 (7/8")
- F - (4) BOLTS, HEX, 3/8-16 (3¼")

Refer to the anchorage configurations (below) to identify **general mounting points and appropriate hardware** for your specific generator model.

Refer to **manufacturer's specifications for details** about the proper mounting points/methods for your specific generator model.



ANCHOR DETAIL



MODEL SPECIFIC HARDWARE REQUIREMENTS

MODEL	DESCRIPTION	QTY	BOLT LENGTH
QT8210	B&S, Steel	4	7/8"
QT8220	B&S, Aluminum	4	3¼"
QT8230	Generac/Honeywell	3	4½"
QT8240	Kohler	4	1½"

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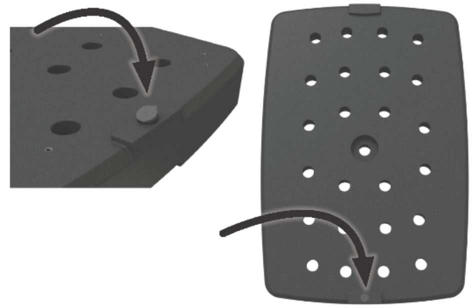
2 Locate the fill port cap (center of short side, nearest the product label), ensure it is securely pressed into pad, then tip the pad on the edge where the plug is located. This process should shift the powdered gelling agent contained inside the pad towards the fill port.

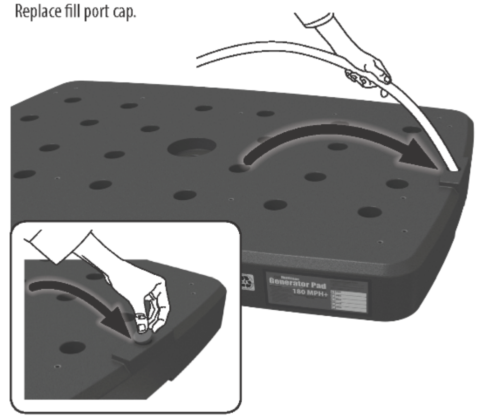


3 Place the Qwik**Hurricane**® **Generator Pad** on level, compacted ground where equipment is to be installed (or on top of existing, level concrete pad).

4 Remove fill port cap. Insert garden hose into fill port and fill Qwik**Hurricane**® **Generator Pad** to the top with tap water.

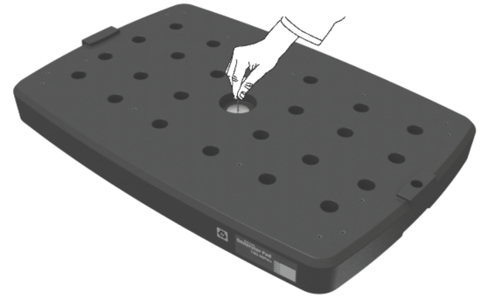
***Do not overfill** – Overfilling may result in loss of a portion of the gelling agent.*

Replace fill port cap.



5 *(Required for some installations)*

Install concrete anchor as determined by your wind loading requirements.



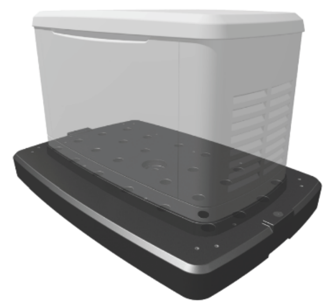
Concrete Anchor Installation:

- With pad in place, drill one (1) hole in concrete to 1.375" minimum depth, centrally located in the center anchor hole using 3/16" masonry bit (included in QT8381, sold separately).
- Secure pad using one (1) 1/4" x 5" concrete anchor with fender washer. (included in QT8381).

6 Place the equipment onto the Qwik**Hurricane**® **Generator Pad** and center.

Secure the generator to the pad using included stainless steel mounting bolts with lock and flat washers. Torque to 20-25 FT•LB.

Refer to table at the bottom of Step 1 for appropriate hardware.



NOTE: Mounting bolt placement is specific to generator model.

For more details or information about the
Qwik**Hurricane**® **Generator Pad** *visit* **www.qwik.com/genpad/**,
email **info@qwik.com** *or call* **1-321-631-3550**

MADE IN THE USA

APPENDIX C

GRAPHICAL DATA

(CONSISTING OF 6 PAGES)

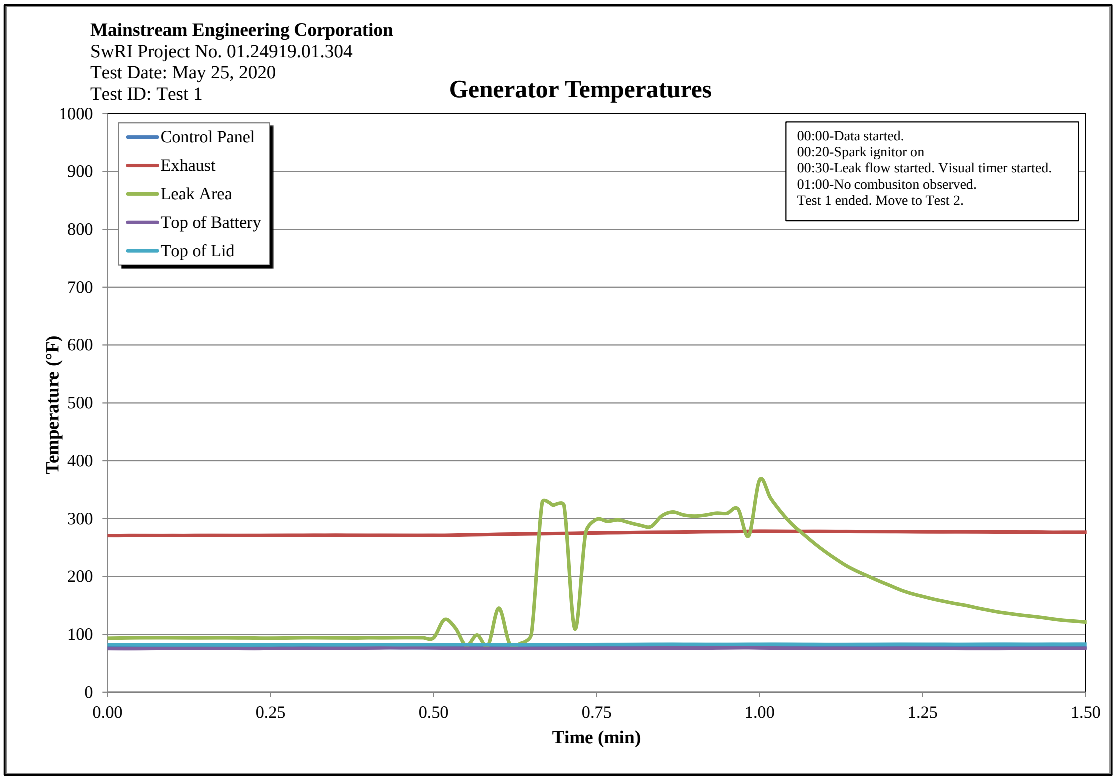


Figure C-1. Test 1: Generator Temperatures.

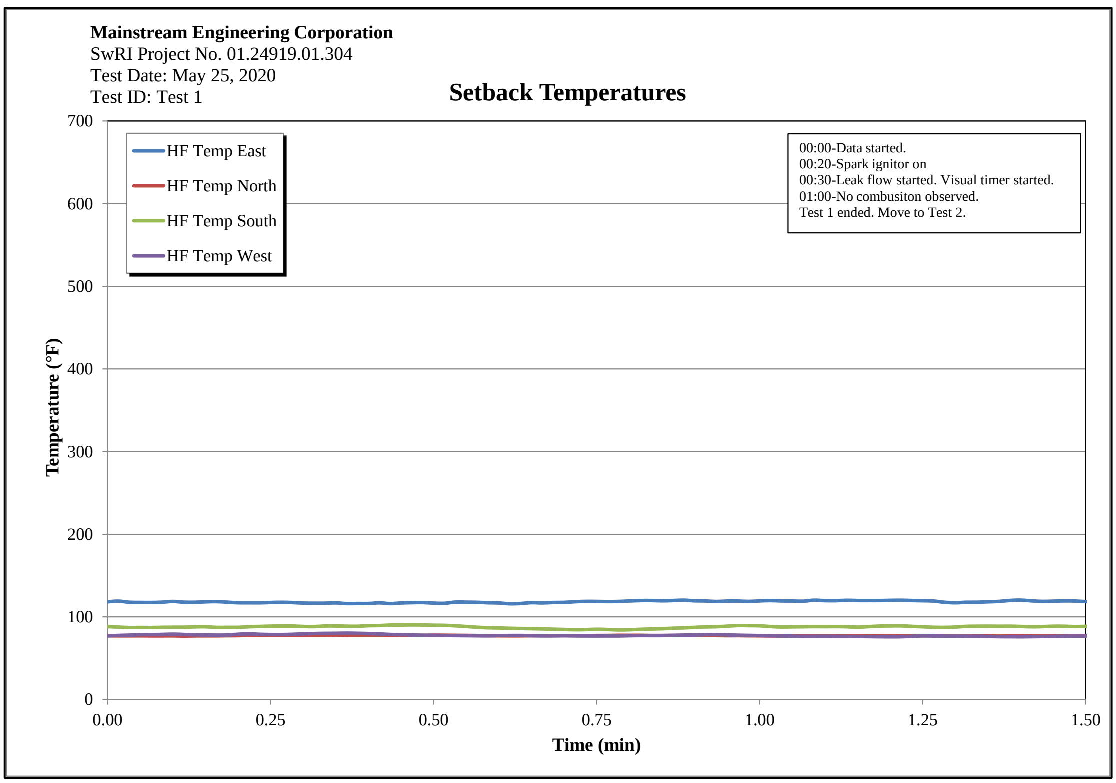


Figure C-2. Test 1: Setback Temperatures.

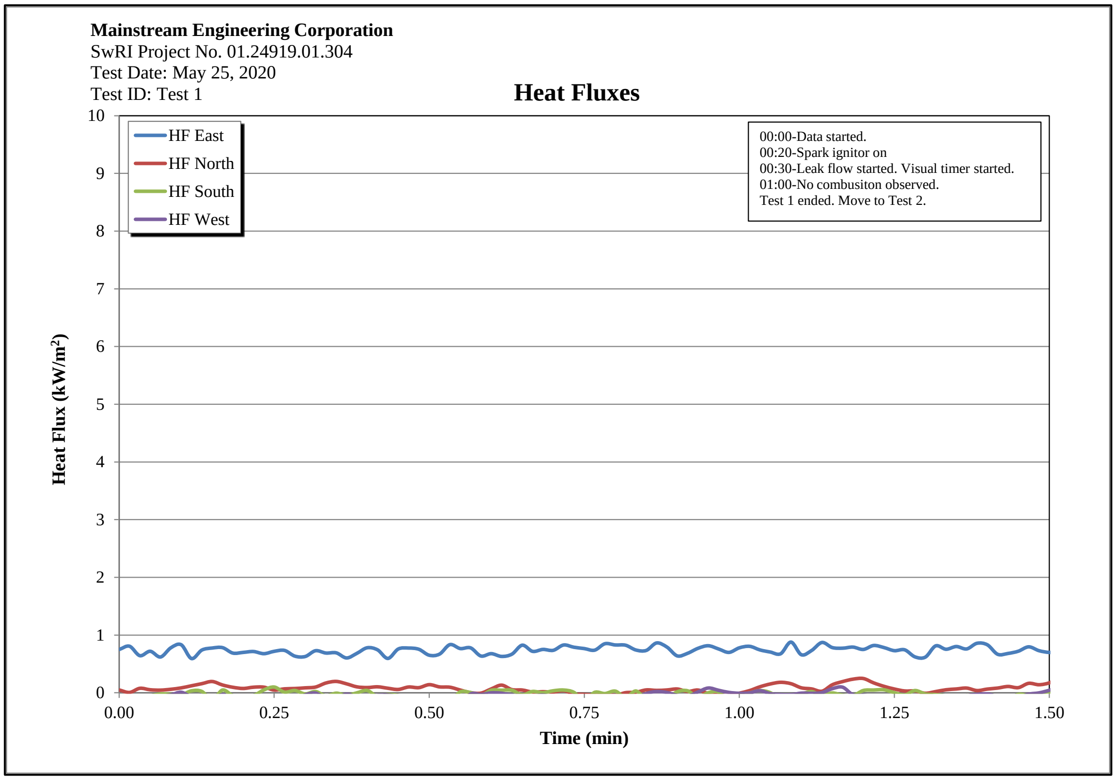


Figure C-3. Test 1: Heat Flux Measurements.

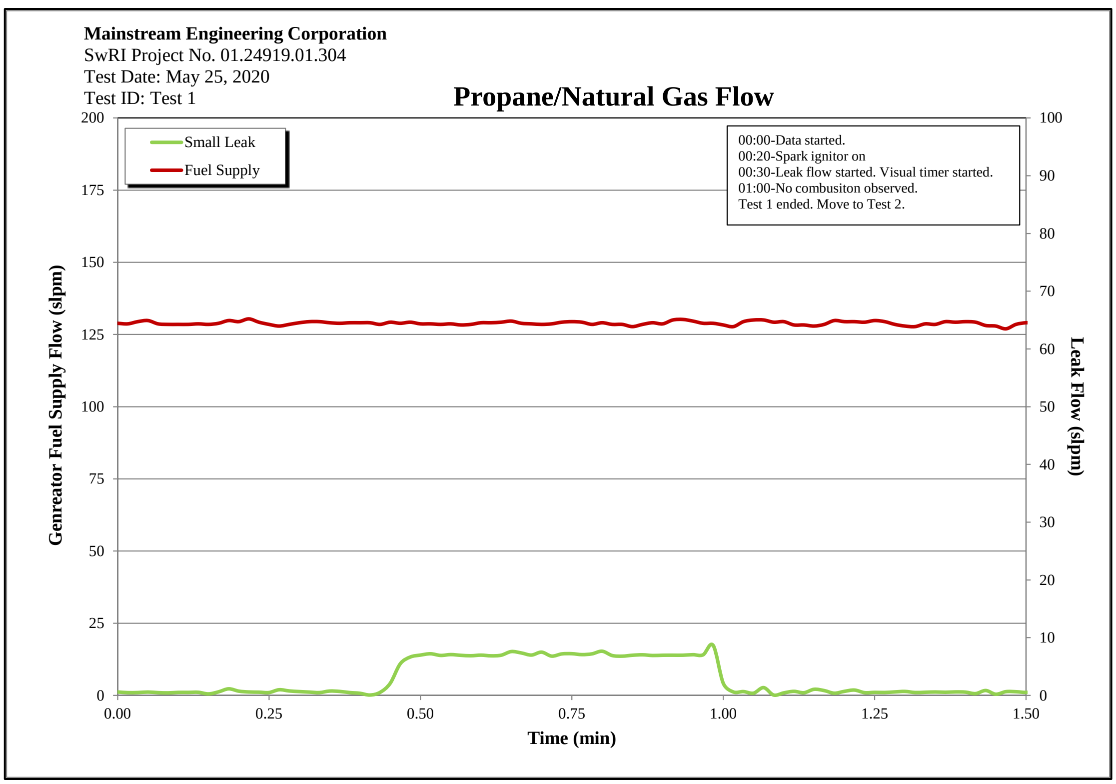


Figure C-4. Test 1: Gas Flow Rates.

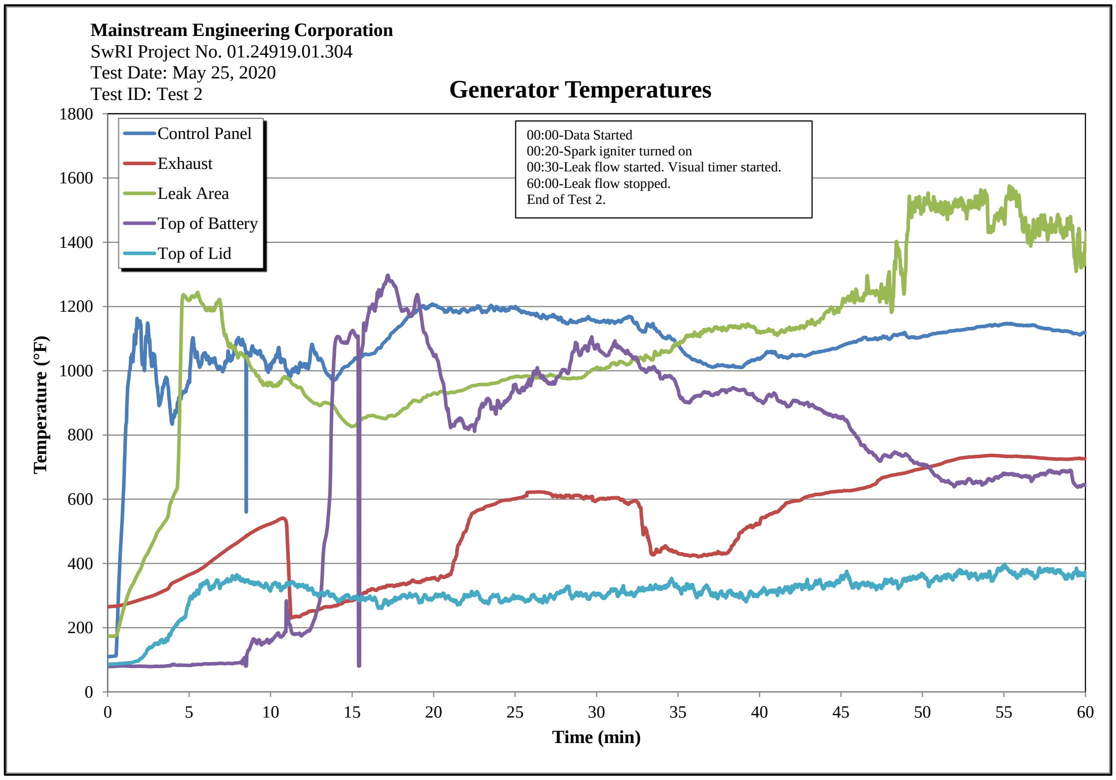


Figure C-5. Test 2: Generator Temperatures.

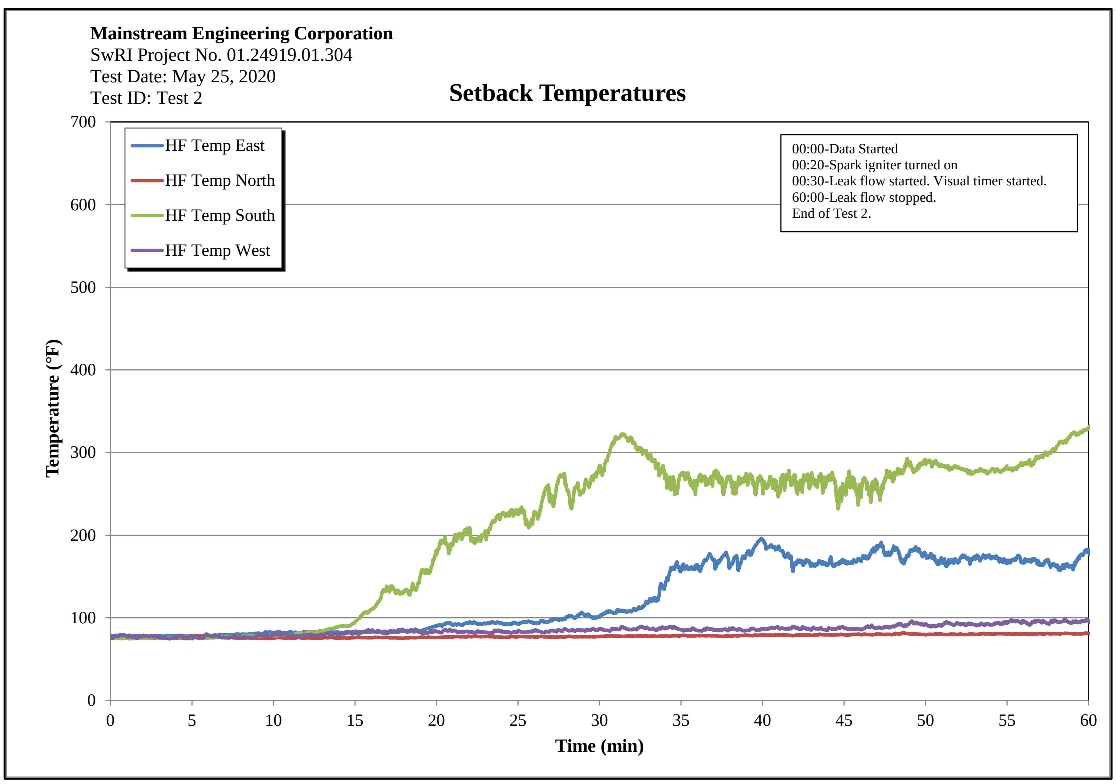


Figure C-6. Test 2: Setback Temperatures.

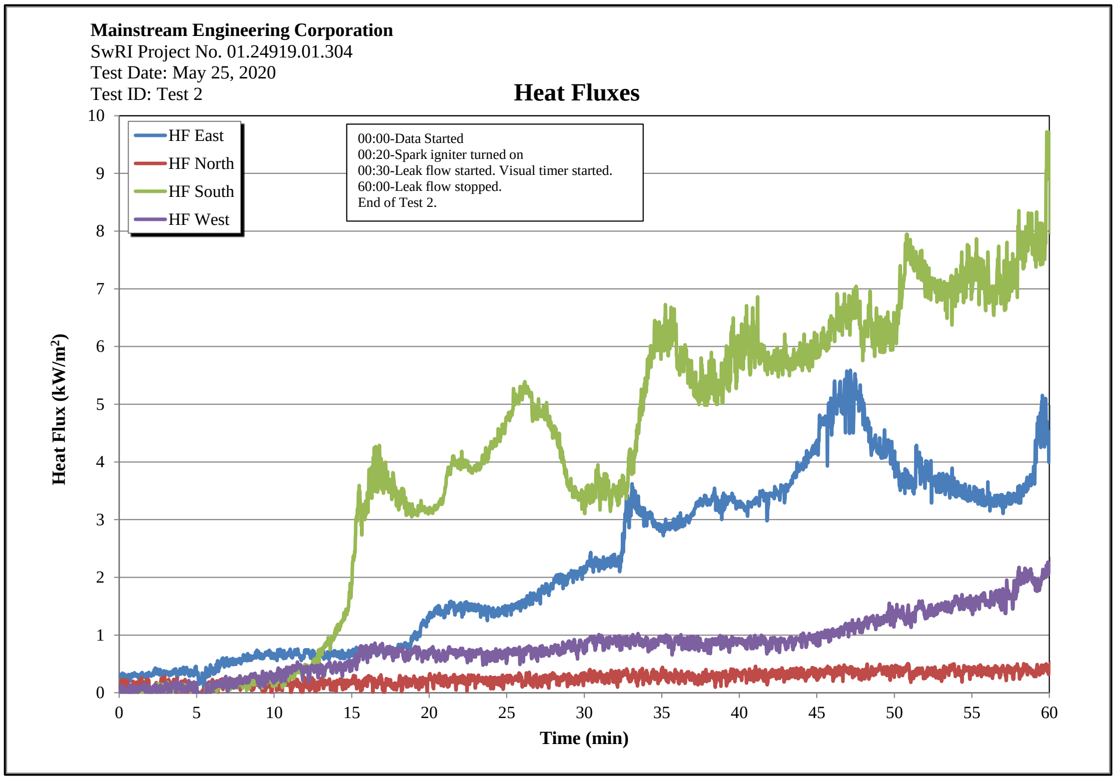


Figure C-7. Test 2: Heat Flux Measurements.

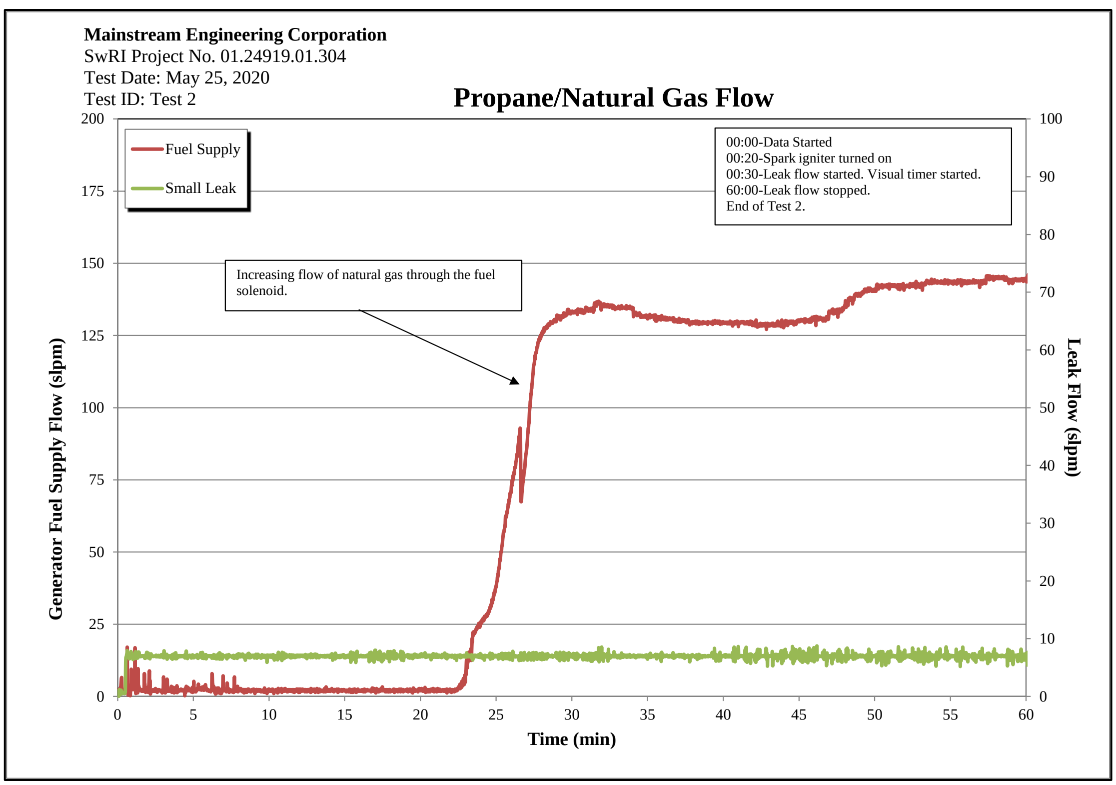


Figure C-8. Test 2: Gas Flow Rates.

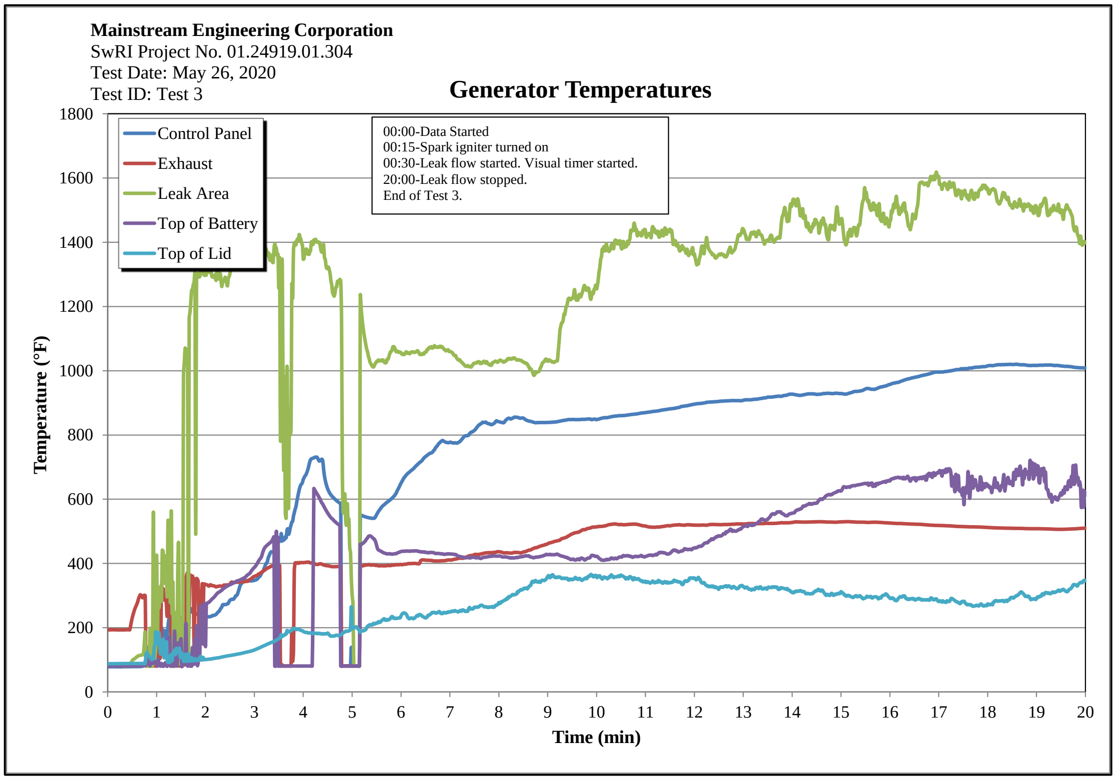


Figure C-9. Test 3: Generator Temperatures.

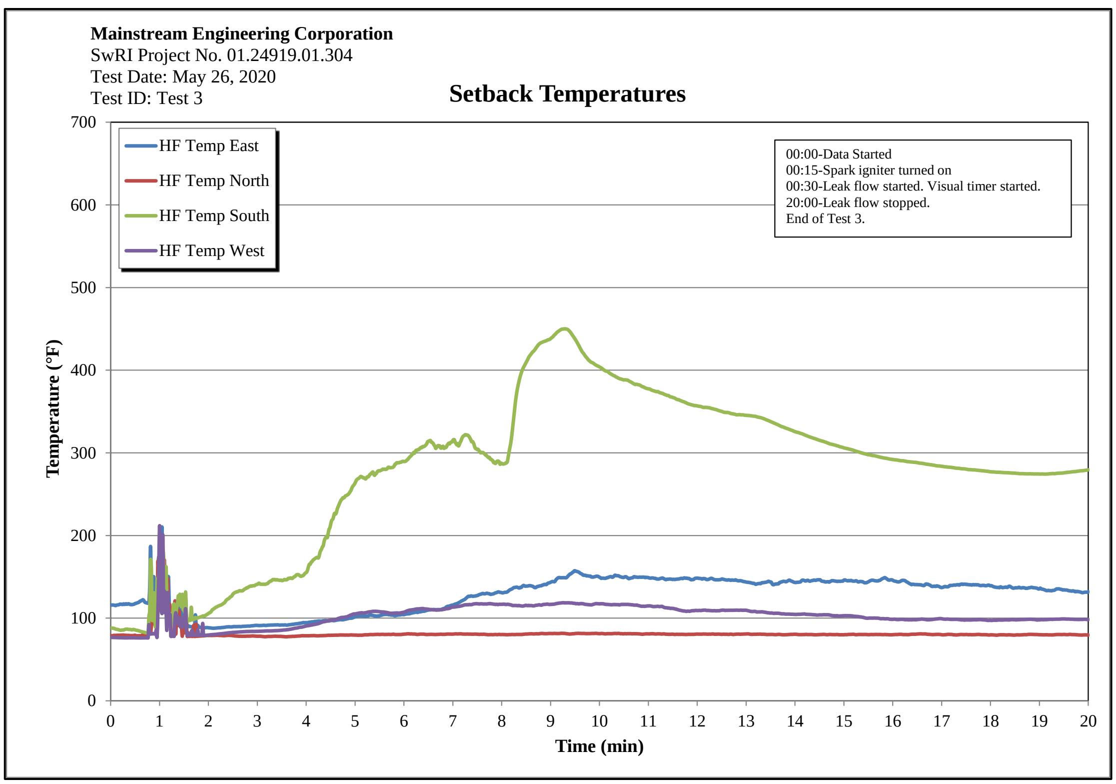


Figure C-10. Test 3: Setback Temperatures.

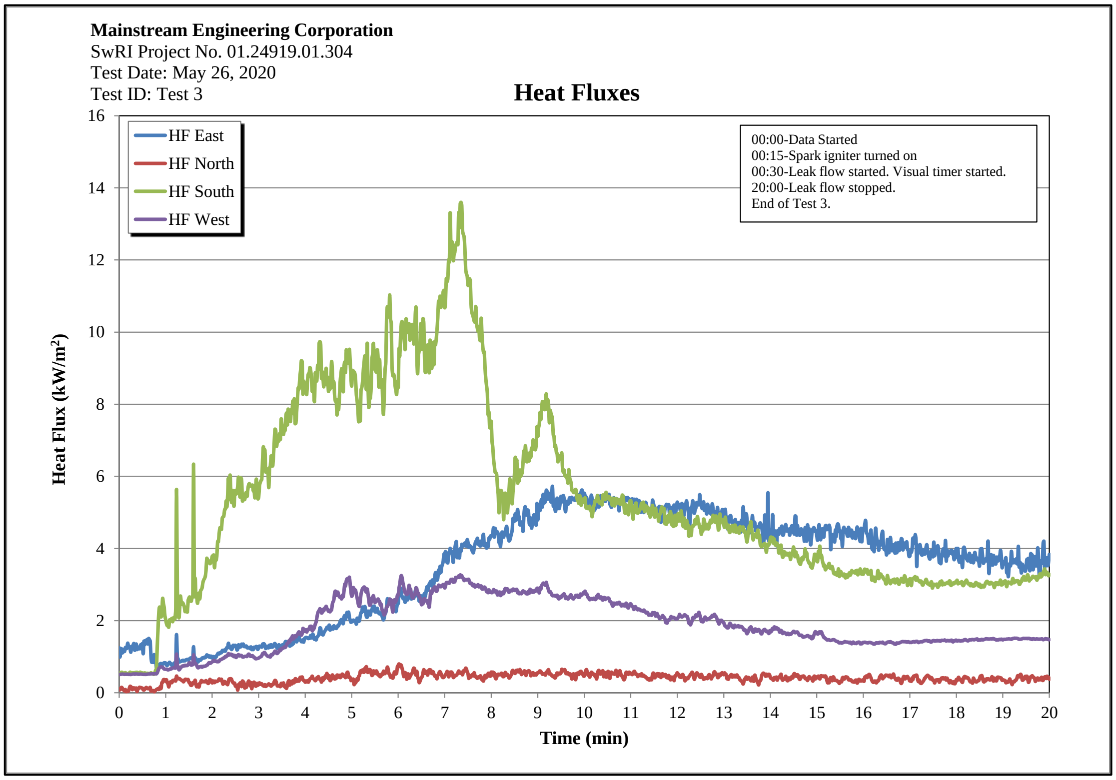


Figure C-11. Test 3: Heat Flux Measurements.

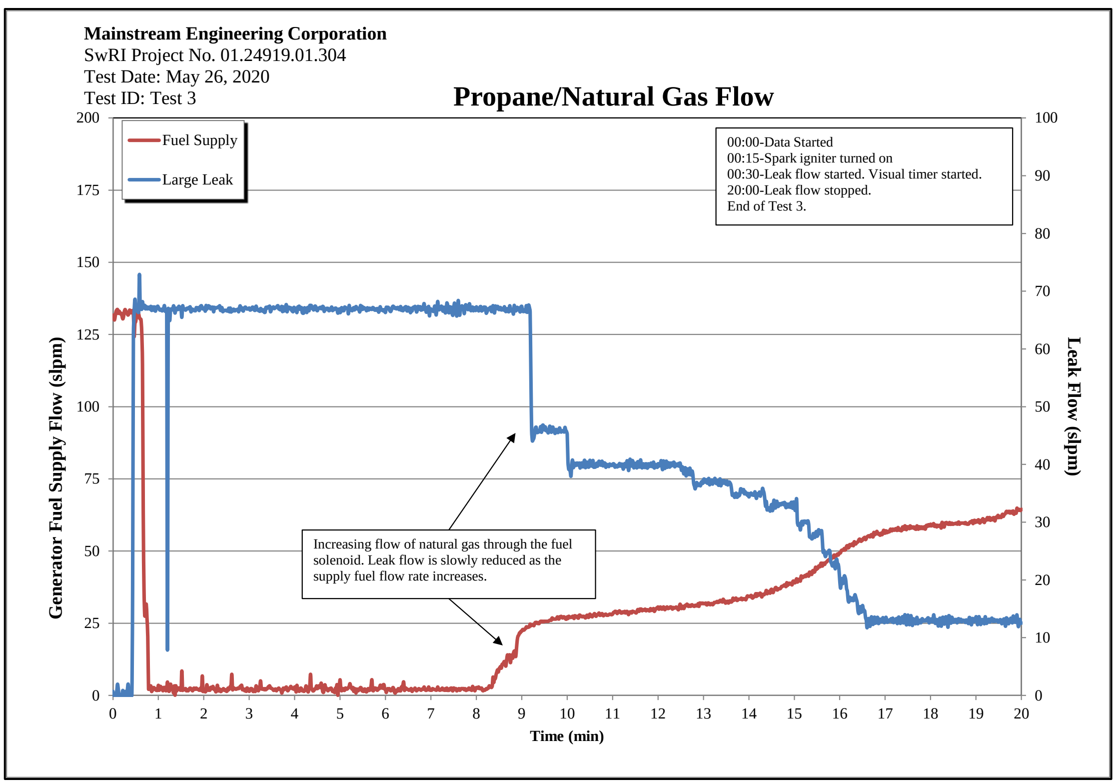


Figure C-12. Test 3: Gas Flow Rates.

APPENDIX D

PHOTOGRAPHIC DOCUMENTATION

(CONSISTING OF 8 PAGES)

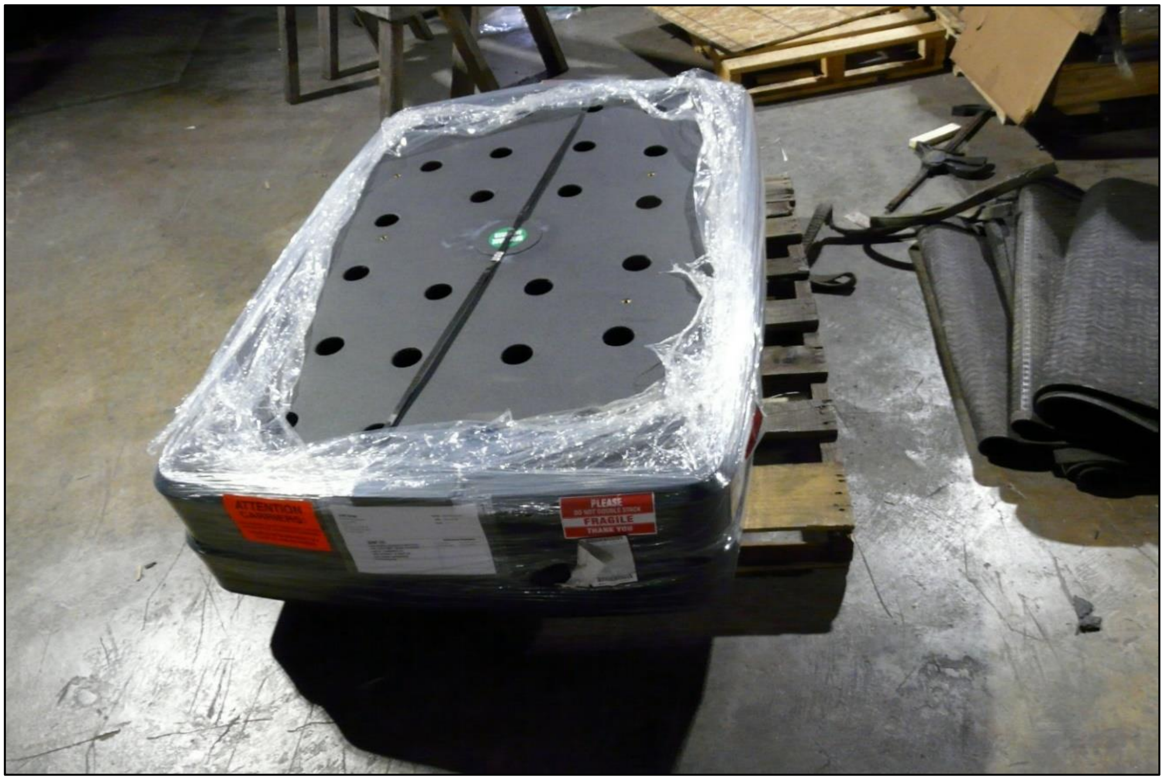


Figure D-1. View of *QwikHurricane® Generator Pad*™ as Received.

Figure D-2. View of Generator Provided by Client.

Figure D-3. View of *QwikHurricane®* *Generator Pad™* Filled Prior to Testing.

Figure D-4. Generator Bolted to the *QwikHurricane®* *Generator Pad™*.

Figure D-5. Electrical Load for Generator during Warmup Period.

Figure D-6. D-4. Test Setup.

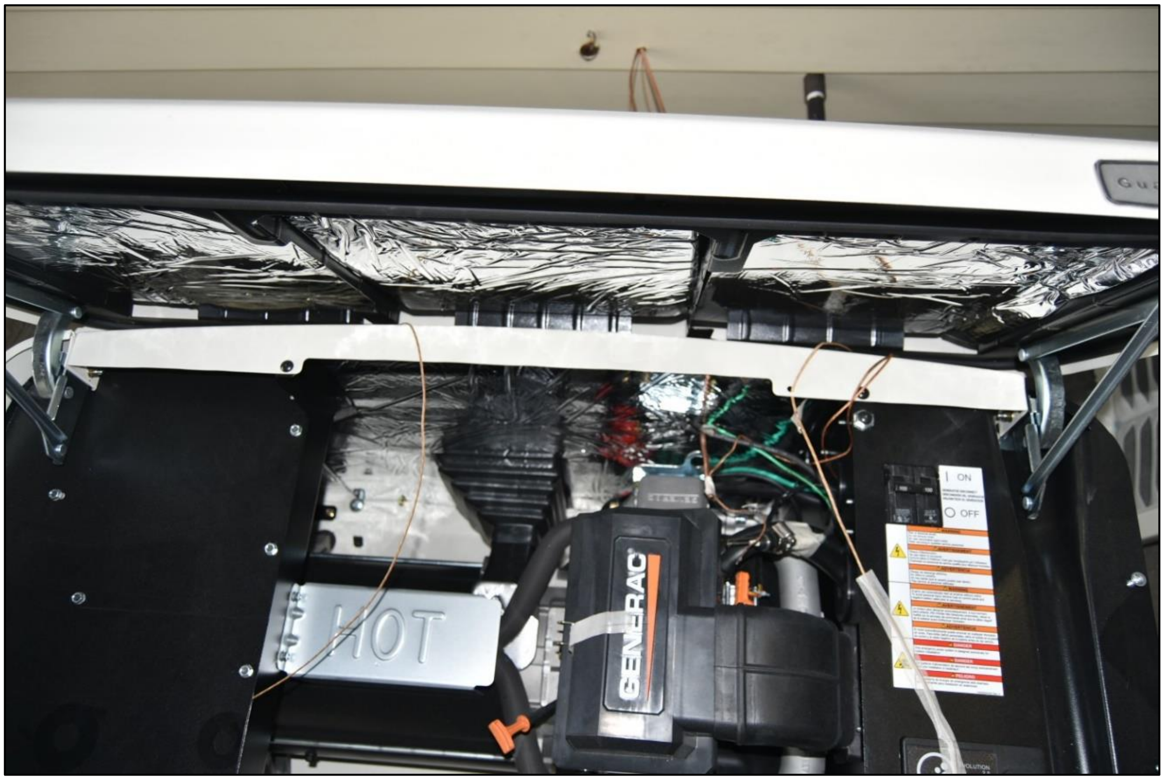


Figure D-7. View of Spark Igniter and Leak Tube for Tests 1 and 2.

Figure D-8. View of Test 2 in Progress.

Figure D-9. View of Test 2 in Progress.

Figure D-10. View of Generator and Pad after Test 2.

Figure D-11. View of Setback Walls after Test 2.

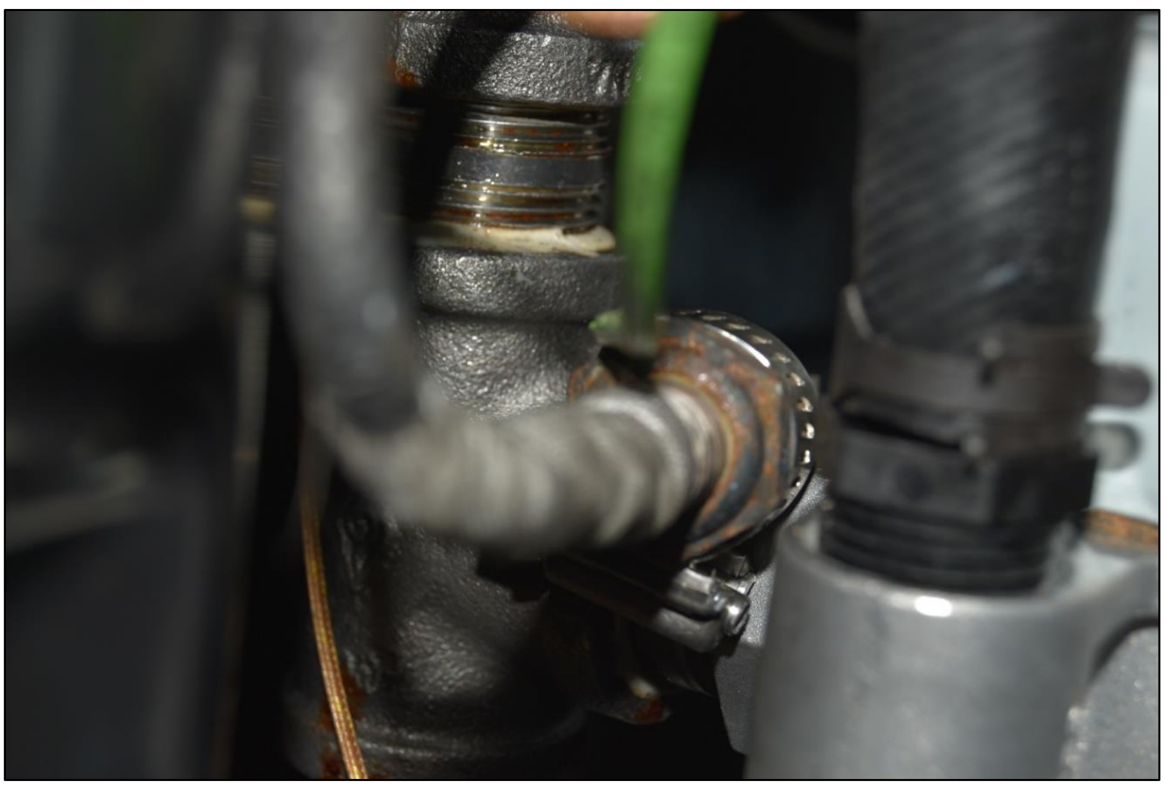


Figure D-12. View of Spark Igniter and Leak Location for Test 3.

Figure D-13. Test 3 in Progress.

Figure D-14. Test 3 in Progress.

Figure D-15. View of Generator and Pad after Test 3.

Figure D-16. View of Setback Walls after Test 3.