Test Report

EX-Guard XG-150G2

-0.58 gal/1000 miles	-0.05 MPG	-0.56% Percent

MESILLA VALLEY TRANSPORTATION SOLUTIONS
CERTIFIED
Fuel Economy Experts

MVT SOLUTIONS CERTIFIED™ FUEL ECONOMY TEST

August 2023

1.0: INTRODUCTION

Mesilla Valley Transportation Solutions ("MVTS" or "MVT Solutions") certifies the fuel savings described in this report. **Note:** this report was designed for carriers and providing information relevant to their needs. Therefore, the format varies from traditional fuel economy and technical reports. The Report Summary provides the reader a quick synopsis of the fuel savings. Following the Summary is the body of the report and further details on the subjects. This fuel economy test was performed using MVTS proprietary fuel economy test methods. These test methods were developed from race car engineering and advanced vehicle test methods, which the Mesilla Valley Transportation ("fleet" or "MVT") has relied on since 2012 to identify substantial fuel savings. The MVTS methods provide highly accurate and reliable answers on real-world fuel savings in comparison to other test methods, which enables carriers to make the best decisions for their company. Contact MVTS with any questions regarding the product or test. As part of an MVTS Certified™ test, MVTS supports product inquiries, which we encourage carriers to utilize.

Contact MVTS with any questions regarding the test.

Note: blue text indicates a link to the topic. Click to follow. Alt + ← returns the reader to the initial location.

2.0: TEST SUMMARY

Expecting a robust grille cover to result in a loss in fuel economy, the purpose of the Ex-Guard test was to quantify that loss and therefore enable fleets to make informed investment decisions with respect to fuel consumption versus vehicle front end damage.

The **Ex-Guard XG-150G2** showed a loss of -**0.58 gal/1000 miles (-0.56%)**, which can be considered very low when considering the magnitude of the system on the front of the vehicle.

Testing was conducted on a 9-mile test track at 65 mph, 46,000 lbs. Gross Vehicle Weight (GVW). Test results can be found below in Table 1.

Table 1: Results Summary

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Ex-Guard XG-150	**-0.58**	-0.05	-0.56%

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3.0: TEST PROCEDURE

The two (2) vehicles ran simultaneously at 65 mph on the 9-mile circle track near Pecos, Texas. The vehicles were 1-minute apart, avoiding any aerodynamic influence on either vehicle during testing. The vehicles were termed “Compare Vehicle” and “Test Vehicle”. The Compare Vehicle remained unchanged throughout testing; it was used solely for comparison. The Test Vehicle had modifications made during the test (*i.e.* Ex-Guard XG-150G2 installed).

The test procedure may appear similar to the SAE J1321 method traditionally used in the trucking industry; however, the MVTS methods are a much more advanced and precise form of on-road and track testing. The vehicles are equipped with sensors and data recording systems that collect data on fuel consumption, aerodynamics, rolling resistance, driver behavior and many other variables that affect fuel consumption. The data is analyzed using MVTS proprietary methods, which provide very accurate answers on fuel savings. Additionally, the test results can be scientifically translated to a carrier’s real-world daily operations and long-term savings, which is a feature unique to these methods. Overall, the MVTS test methods are a much more advanced and reliable tool for predicting fuel savings than the trucking industry has used previously.

3.1: TEST VEHICLES

Test vehicles were 2019 International LT 625 Sleeper Cabs with Cummins X15 15-Liter engines. Trailers were 53-ft dry van trailers. Gross Vehicle Weight (GVW) was approximately 46,000 lbs. GVW does not affect the fuel savings in units of gal/1000 miles. The Compare vehicle remained unchanged throughout all tests. The Test vehicle configuration was changed between test runs. Trucks and trailers used dual tires. Tire pressures were set at 100 psi in the morning, prior to incurring any effect of daytime heat. Vehicle info can be found in the Appendix.

Figure 1: “Test” Vehicle with Ex-Guard XG-150G2

Figure 2: “Compare” Vehicle and “Test” Vehicles During Test Run

Note: ‘Test’ vehicle did not include a grille guard during the Baseline run, which is explained further in the report.

Test runs were conducted in the order as shown in Table 2. Runs 1 through 3 were not applicable to the Ex-Guard XG-150G2 test and therefore were not included in the report.

Table 2: Test Run Sequence

Run	Test Name/Description	Start	End
4	Baseline	1:59 PM	3:38 PM
5	Ex-Guard XG-150	3:58 PM	5:37 PM

3.2: RUN 4: BASELINE WITHOUT EX-GUARD XG-150G2

Run 4 was the Baseline and the Test vehicle did not include a grille guard installed, as shown in (Figure 3). The mounting bracket was included, however, its effect on fuel economy can be considered negligible in the opinion of MVTS and therefore remained installed during the Baseline. The Compare vehicle included an Ex-Guard 325 for both the Baseline and Test runs and was therefore consistent between both runs and did not impact the test results of the XG-150G2.

Figure 3: Baseline without Grille Guard

3.3: RUN 5: TEST RUN WITH EX-GUARD XG-150G2

Run 5 consisted of installing the Ex-Guard XG-150G2 on the Test vehicle (Figure 4).

Figure 4: Test run with Ex-Guard XG-150G2

4.0: VEHICLE FUEL ECONOMY TEST EQUIPMENT

MVT Solutions fuel economy testing utilizes a data acquisition system and sensors specifically for this testing. This style of testing is derived from race car engineering where reliable sensor data is critical to understanding vehicle modifications.

MVTS test sensors include:

- Data acquisition system (records sensor data)
- Fuel flow meter (accurate to 0.2%)
- Fuel temperature sensor
- Tire temperature sensor (infrared, mounted on left-front drive tire)
- Ground/road temperature sensor (infrared, mounted ahead of left-front drive tire)
- Wind speed air pressure sensor (truck hood)
- Wind direction sensor (truck hood)
- Ambient air temperature sensor (truck hood)
- Ambient air pressure sensor (truck cab)
- High Precision GPS (latitude, longitude, altitude, time)

Click this link to see a video of MVTS sensors and testing: How We Test

Figure 5: Aerodynamic Sensors

Figure 6: Data Acquisition System

Figure 7: Fuel Flow Meter

Figure 8: Tire Temp. Sensor

5.0: TEST RESULTS

The EX-Guard XG-150G2 showed a loss in fuel economy of -0.58 gal/1000 miles (-0.56%) when compared to a Baseline run without a grille guard.

Table 3: Test Results with Accuracy

Product	Fuel Economy Improvement		
	Gal/1000 miles	MPG	Percent
Ex-Guard XG-150	**-0.58**	-0.05	-0.56%
Accuracy	**+/- 0.64**	+/- 0.06	+/- 0.62%

Figure 9: Test Results (gal/1000 miles)

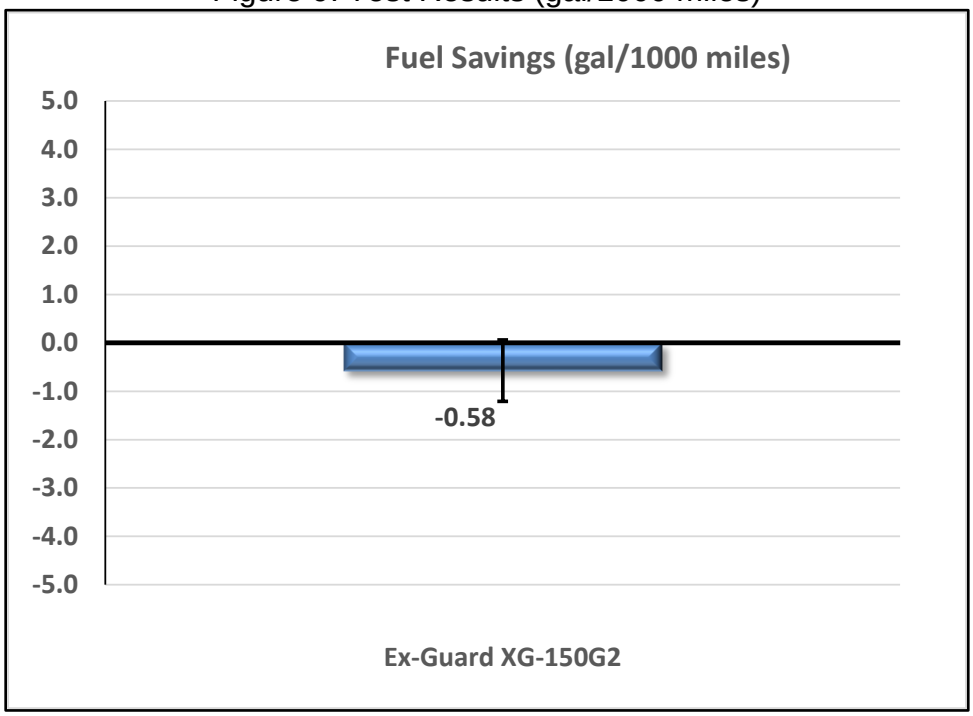
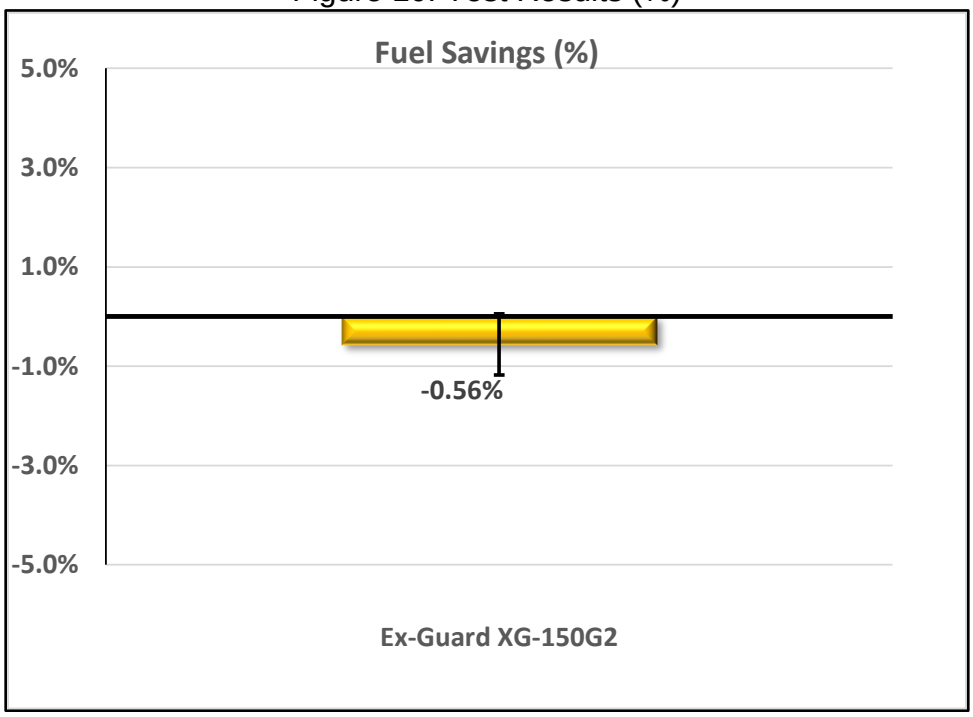


Figure 10: Test Results (%)



5.1: MEASUREMENT ACCURACY AND MARGIN OF ERROR

The accuracy of fuel economy measurements is critical in determining the trustworthiness of test results. Historically, this has been a major difficulty in the trucking industry with fuel economy testing, which has led to confusion and misleading results. The MVTS test methods overcome this issue by achieving better accuracy, which is one of the ways it provides more reliable test results.

Accuracy for all the tests was calculated using a 95% confidence interval, a common standard for testing measurement. 95% confidence interval indicates that if the test were repeated 100 times, values would fall within the range in 95 out of the 100 tests (*i.e.* the reader would be 95% confident the value would be within that range).

Accuracy (*i.e.* 'margin of error') is shown in multiple locations; tables of 'Test Results with Accuracy' and also as 'error bars' in the bar graphs. The error bars are the small solid lines at the top of each bar.

Test accuracy for the Ex-Guard XG-150G2 was +/- 0.64 gal/1000 miles (Table 3) and represented a large portion of the magnitude of the fuel savings/losses as shown by the Error Bar in Figure 9. Accuracy in percent values will not be discussed individually since it is linearly related to gal/1000 miles and follows a very similar pattern and conclusions. Although the margin of error is similar in magnitude to the test result, the result is considered reliable by MVTS due to experience with these tests and guards.

5.2: UNITS OF MEASUREMENT

The reader may not be familiar with units of gal/1000 miles (gallons per 1000 miles) since it is not traditionally used in the trucking industry. The following paragraphs briefly explain the reasons for these units and how they help carriers better calculate fuel savings.

Units of gal/1000 miles more reliably calculate fuel savings when compared to other units such as miles-per-gallon (MPG) and percent (%). Those units are prone to error from changing variables such as vehicle baseline fuel economy, load, driver behavior, and duty cycle. For example, gal/1000 miles values are not affected by load for an aerodynamic product. Any empty Class-8 unit at 34,000 lbs. will save the same fuel in gal/1000 miles as one loaded to 80,000 lbs. However, when viewed in percent (%) or MPG the values change with load. This causes a carrier to experience varied results in real-world operation and difficulty predicting the financial benefits of the product unless units of gal/1000 miles are used.

Units of gal/1000 miles are the most reliable units of measurement for aerodynamic fuel savings due to their scientific and mathematical relationship to fuel consumption. Further detail is beyond the scope of this report and the reader is encouraged to contact MVT Solutions if more information is desired.

5.3: WEATHER CONDITIONS SUMMARY

Ambient temperature during testing ranged from 86°F to 97°F with winds reported as 0 mph during the test run.

Weather data was acquired from a local Weather Underground weather station and complete data can be found in the Appendix.

The reader should be aware that MVTS methods include instantaneous and constant weather data acquisition on each vehicle, and this testing has minimal dependency on external weather data collection. MVTS test data accounts for changes in wind, temperature, and other pertinent variables instantaneously.

6.0: SAVINGS CALCULATIONS

Below is a brief outline of how to use the test results to calculate savings. For more detail or assistance contact MVT Solutions.

6.1: FUEL SAVINGS CALCULATIONS

Fuel savings resulting from this test can be calculated as follows:

$$Fuel\ Savings\ (gal/year) = (Test\ result)\ x\ \frac{(Thousands\ of\ miles\ travelled\ per\ year)}{1000}$$

Test result must be in units of gal/1000 miles (*i.e.* not percent or MPG)

Example: Ex-Guard XG-150G2 with fuel losses of -0.58 gal/1000 miles and 125,000 miles travelled annually:

$$Fuel\ Savings = (-0.58\ gal/1000\ miles)x\ \frac{(125{,}000\ miles/year)}{1000} = -73\ gal/year$$

Therefore, the Ex-Guard XG-150G2 would result in consumption of 73 gallons of fuel per year for this vehicle travelling 125,000 miles.

6.2: FINANCIAL SAVINGS CALCULATIONS

Financial calculations can be made by multiplying the fuel saved by the fuel price:

$$Savings\ (\$/year) = (Fuel\ Savings)\ x\ (Price\ of\ fuel)$$

Example: Using the example above and U.S. average retail price of diesel fuel in 2022, $4.989[1] /gal

$Savings\ (\$/year) = \left(-73\ \frac{gal}{year}\right)\ x\ \left(\frac{\$4.989}{gal}\right) = -\$364\ /year$ in fuel savings

Therefore, the Ex-Guard XG-150G2 would result in $364 per year in fuel usage for the vehicle travelling 125,000 miles.

[1] Source: https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2DXL0_PTE_NUS_DPG&f=W

7.0: CONCLUSION

MVTS testing proved the impact of the Ex-Guard XG-150G2 on fuel economy with answers that were clear and precise. The Ex-Guard XG-150G2 showed a fuel economy loss of -0.58 gal/1000 miles (-0.56%), which can be considered minimal for this magnitude of device.

Ex-guard is a product used to reduce front end damage and therefore reduce operational cost. Ex-guard is not a fuel savings product; however, these tests quantified the fuel consumption impact and can be used to determine a carrier's savings/loss in real-world operations. For further questions please contact MVTS.

Overall, having only a minor effect on fuel economy, the Ex-Guard grille guards should provide fleets confidence to pursue the products based on operational costs as opposed to fuel economy losses.

8.0: APPENDIX

8.1: TEST VEHICLE DETAILS

Figure 11: Vehicle Info, (Test) Vehicle

Date	August 15, 2023		
Company	Mesilla Valley Transportation Solutions		
Location	Pecos, Texas		
Test Route	Pecos 9-mile Test Track		
TRUCK ID:	**Veh. B**		
Brand	International		
Date of Manufacture (MY)	20-Sep-2018 (2019)		
Model	LT 625		
Engine	Cummins X15 (450 HP/1650 ft-lbs)		
VIN	3HSDZAPR3KN562087		
Starting Mileage (miles):	56,031		
Transmission	Eaton Endurant 12-speed AMT		
Front Drive Axle	Meritor MT-40-14X-3CFR		
Rear Drive Axle			
Rear Gear	2.79 : 1		
Fuel Load	Full		
Fuel Type & Batch	No. 2 Diesel		
Axle Weights (S,D,T) (lbs)	11,100	17,220	17,380
Total weight	45,700		
TRAILER ID:	**T-2**		
Model	Hyundai Translead (VC2530152-AJS)		
VIN	3H3V532C6LR282006		
Date of Manufacture (MY)	12/19 (2020)		
Type	Dry Van		
Size	53-ft		
King Pin Location	36-in		
Tandem Setting	40-ft 'California'		
Cab to Trailer Gap	57-in from cab extender to trailer (Adjustable 5th Wheel 41 to 65-in)		
Aero Trailer Gap	35-in from cab extender to trailer (Adjustable 5th Wheel 19 to 43-in)		
Add-ons	Trailer skirts		

Figure 12: Trailer Info, (Test) Vehicle

			Truck	**Veh. B**		
LF			**Front Axle**			RF
Michelin X Line Energy Z			Type			Michelin X Line Energy Z
275/80R22.5			Size			275/80R22.5
14			Tread Depth (32nds)			14
110			Pressure (psi)			110
Aluminum			Wheel Type			Aluminum
LF-Outer Drive	LF-Inner Drive		**Drive Axle**		RF-Inner Drive	RF-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +		Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
14	15		Tread Depth (32nds)		14	14
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel
LR-Outer Drive	LR-Inner Drive		**Drive Axle**		RR-Inner Drive	RR-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +		Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
14	13		Tread Depth (32nds)		14	13
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel
			Trailer	**T-2**		
LF-Outer Trailer	LF-Inner Trailer		**Tandem Front**		RF-Inner Trailer	RF-Outer Trailer
Michelin X Line Energy T2	Michelin X Line Energy T2		Type		Michelin X Line Energy T	Bridgestone R123 Ecopia
295/75R22.5	295/75R22.5		Size		295/75R22.5	295/75R22.5
11	11		Tread Depth (32nds)		10	8
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel
LR-Outer Trailer	LR-Inner Trailer		**Tandem Rear**		RR-Inner Trailer	RR-Outer Trailer
Bridgestone R123 Ecopia	Bridgestone R123 Ecopia		Type		Bridgestone R123 Ecopia	Bridgestone R123 Ecopia
295/75R22.5	295/75R22.5		Size		295/75R22.5	295/75R22.5
8	8		Tread Depth (32nds)		8	8
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel

8.2: COMPARE VEHICLE DETAILS

Figure 13: Vehicle Info, Compare Vehicle

Date	August 15, 2023		
Company	Mesilla Valley Transportation Solutions		
Location	Pecos, Texas		
Test Route	Pecos 9-mile Test Track		
TRUCK ID:	**Veh. A**		
Brand	International		
Date of Manufacture (MY)	20-Sep-2018 (2019)		
Model	LT 625		
Engine	Cummins X15 (450 HP/1650 ft-lbs)		
VIN	3HSDZAPR4KN562972		
Starting Mileage (miles):	56,636		
Transmission	Eaton Endurant 12-speed AMT		
Front Drive Axle	Meritor MT-40-14X-3CFR		
Rear Drive Axle			
Rear Gear	2.79 : 1		
Fuel Load	Full		
Fuel Type & Batch	No. 2 Diesel		
Axle Weights (S,D,T) (lbs)	11,220	17,000	17,600
Total weight	45,820		
TRAILER ID:	**T-1**		
Model	Hyundai Translead (VC2530152-AJS)		
VIN	3H3C532C6MR248009		
Date of Manufacture (MY)	12/19 (2020)		
Type	Dry Van		
Size	53-ft		
King Pin Location	36-in		
Tandem Setting	40-ft 'California'		
Cab to Trailer Gap	57-in from cab extender to trailer (Adjustable 5th Wheel 41 to 65-in)		
Aero Trailer Gap	35-in from cab extender to trailer (Adjustable 5th Wheel 19 to 43-in)		
Add-ons	Trailer skirts		

Figure 14: Trailer Info, Compare Vehicle

			Truck	**Veh. A**		
LF			**Front Axle**			RF
Michelin X Line Energy Z			Type			Michelin X Line Energy Z
275/80R22.5			Size			275/80R22.5
14			Tread Depth (32nds)			14
110			Pressure (psi)			110
Aluminum			Wheel Type			Aluminum
LF-Outer Drive	LF-Inner Drive		**Drive Axle**		RF-Inner Drive	RF-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +		Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
14	15		Tread Depth (32nds)		14	14
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel
LR-Outer Drive	LR-Inner Drive		**Drive Axle**		RR-Inner Drive	RR-Outer Drive
Michelin XDA Energy +	Michelin XDA Energy +		Type		Michelin XDA Energy +	Michelin XDA Energy +
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
13	14		Tread Depth (32nds)		13	13
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel
			Trailer	**T-1**		
LF-Outer Trailer	LF-Inner Trailer		**Tandem Front**		RF-Inner Trailer	RF-Outer Trailer
Michelin X Line Energy T	Michelin X Line Energy T		Type		Michelin X Line Energy T	Michelin X Line Energy T
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
9	9		Tread Depth (32nds)		9	9
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel
LR-Outer Trailer	LR-Inner Trailer		**Tandem Rear**		RR-Inner Trailer	RR-Outer Trailer
Michelin X Line Energy T	Michelin X Line Energy T		Type		Michelin X Line Energy T	Michelin X Line Energy T
275/80R22.5	275/80R22.5		Size		275/80R22.5	275/80R22.5
9	9		Tread Depth (32nds)		9	9
110	110		Pressure (psi)		110	110
Steel	Steel		Wheel Type		Steel	Steel

8.3: TEST ROUTE

Pecos, Texas 9-mile circle track. Clockwise direction, middle lane (of 3).

Figure 15: Pecos Test Track

8.4: WEATHER CONDITIONS

Weather during testing was Fair with winds at from 0 mph. Weather data was acquired from a local Weather Underground weather station. Source shown below.

The reader should be aware that MVTS methods include instantaneous and constant weather data acquisition on each vehicle, and this testing has minimal dependency on external weather data collection. MVTS test data accounts for changes in wind, temperature, and other pertinent variables instantaneously. **Note:** darkened rows pertain to test times.

Table 4: Weather Data, August 15, 2023

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Condition
12:10 AM	85 °F	58 °F	40 %	ENE	21 mph	24 mph	27.44 in	0.0 in	Fair / Windy
1:10 AM	83 °F	55 °F	39 %	ENE	16 mph	23 mph	27.45 in	0.0 in	Fair
2:10 AM	80 °F	54 °F	40 %	ENE	10 mph	17 mph	27.45 in	0.0 in	Fair
3:10 AM	79 °F	53 °F	41 %	ENE	13 mph	17 mph	27.45 in	0.0 in	Fair
4:10 AM	77 °F	52 °F	41 %	ENE	12 mph	0 mph	27.45 in	0.0 in	Fair
5:10 AM	76 °F	52 °F	43 %	CALM	0 mph	0 mph	27.46 in	0.0 in	Fair
6:10 AM	75 °F	51 °F	43 %	CALM	0 mph	0 mph	27.48 in	0.0 in	Fair
7:10 AM	73 °F	50 °F	45 %	CALM	0 mph	0 mph	27.51 in	0.0 in	Fair
8:10 AM	75 °F	49 °F	41 %	CALM	0 mph	0 mph	27.52 in	0.0 in	Fair
9:10 AM	77 °F	49 °F	37 %	NNE	3 mph	0 mph	27.54 in	0.0 in	Fair
10:10 AM	79 °F	50 °F	36 %	ENE	6 mph	0 mph	27.55 in	0.0 in	Fair
11:10 AM	81 °F	51 °F	35 %	CALM	0 mph	0 mph	27.55 in	0.0 in	Fair
12:10 PM	85 °F	53 °F	33 %	CALM	0 mph	0 mph	27.53 in	0.0 in	Fair
1:10 PM	86 °F	54 °F	34 %	CALM	0 mph	0 mph	27.51 in	0.0 in	Fair
2:10 PM	90 °F	56 °F	32 %	CALM	0 mph	0 mph	27.48 in	0.0 in	Fair
3:10 PM	93 °F	56 °F	29 %	CALM	0 mph	0 mph	27.45 in	0.0 in	Fair
4:10 PM	93 °F	55 °F	27 %	CALM	0 mph	0 mph	27.42 in	0.0 in	Fair
5:10 PM	95 °F	54 °F	25 %	CALM	0 mph	0 mph	27.38 in	0.0 in	Fair
6:10 PM	97 °F	54 °F	24 %	CALM	0 mph	0 mph	27.36 in	0.0 in	Fair
7:10 PM	96 °F	52 °F	23 %	CALM	0 mph	0 mph	27.35 in	0.0 in	Fair
8:10 PM	94 °F	52 °F	24 %	CALM	0 mph	0 mph	27.35 in	0.0 in	Fair
9:10 PM	90 °F	53 °F	28 %	CALM	0 mph	0 mph	27.36 in	0.0 in	Fair
10:10 PM	87 °F	53 °F	31 %	CALM	0 mph	0 mph	27.37 in	0.0 in	Fair
11:10 PM	86 °F	54 °F	33 %	CALM	0 mph	0 mph	27.38 in	0.0 in	Fair

Source: https://www.wunderground.com/history/daily/us/tx/pecos/KPEQ/date/2023-8-15

8.5: PRODUCT DETAILS

- Ex-Guard XG-150G2

8.6: TEST PERSONNEL (ON-SITE)

8.6a: MVT SOLUTIONS ENGINEERING

- Daryl Bear, Lead Engineer & COO
- Jacob Schwartz, Test Engineer
- Jonathan Ruppert, Test Engineer

8.6b: MVT SOLUTIONS DRIVERS & TECHNICIANS

- Allan Dahringer, Director of Maintenance
- Carlos Aragon, Driver
- Jack Burchell, Driver
- John Rintelen, Driver and Shop Technician
- Arturo Via, Shop Technician

8.6c: EX-GUARD INDUSTRIES

- Joel Wootten, Sales Manager

8.7: MVT SOLUTIONS CONTACT INFO

Daryl Bear, Lead Engineer & COO
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