TEST REPORT

MESILLA VALLEY TRANSPORTATION SOLUTIONS
CERTIFIED
Fuel Economy Experts

MVT SOLUTIONS CERTIFIED™ FUEL ECONOMY TEST

EX-GUARD LT 300 SERIES

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1.0: INTRODUCTION

Mesilla Valley Transportation Solutions (MVTS) certifies the fuel savings from this product are as described in this report.

Note that this report was designed for carriers and providing information relevant to their needs. Therefore, the format varies from the traditional fuel economy and technical reports.

The report Summary provides the reader a quick synopsis of the product's 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) 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.

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 grill 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. Ex-Guard LT 325 grill guard showed a negligible effect on fuel economy, measuring **0.01 gal/1000 miles and 0.01%** which can be considered zero, since it was within the margin of error of the test. Ex-Guard LT 350 (shown on cover page) showed a fuel loss of -**0.53 gal/1000 miles and 0.51%** on the same truck and trailer. Results can be found in Table 1 below.

Table 1: Fuel Economy Test Results

	Fuel Economy Improvement		
	gal/1000 miles	MPG	Percent
LT 325	**0.01**	0.00	0.01%
LT 350	**-0.53**	-0.05	-0.51%

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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 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.

Figure 1: Test Vehicles During Baseline Run without Ex-Guard installed

3.1: TEST VEHICLES

Test vehicles were 2019 International LT with Cummins X15 15 Liter engines and Eaton 10-Speed Automated Manual Transmissions (AMT). Trailers were 53' Great Dane dry vans. Gross Vehicle Weight (GVW) was 45,000 lbs. Trailers had Michelin Energy Guard aerodynamic system installed, which included trailer skirts. Trucks and trailers used Wide-Based-Single (WBS) tires. Vehicle and tire details can be found in the Appendix.

Tire pressures were set at 110 psi in the morning prior to incurring any effect of daytime heat.

Vehicles were thoroughly inspected and received regular maintenance prior to testing. It should also be noted, for the reader's piece of mind, Mesilla Valley Transportation (MVT) and MVT Solutions are 100% confident in the reliable condition of the test vehicles. MVT fleet uses the same vehicle data and test procedures for their own internal purchase decisions.

Figure 2: Test Vehicles and Ex-Guard LT 350 (right)

3.2: 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 3: Aerodynamic Sensors (air speed/direction/temperature)

Figure 4: Data Acquisition System

Figure 5: Fuel Flow Meter

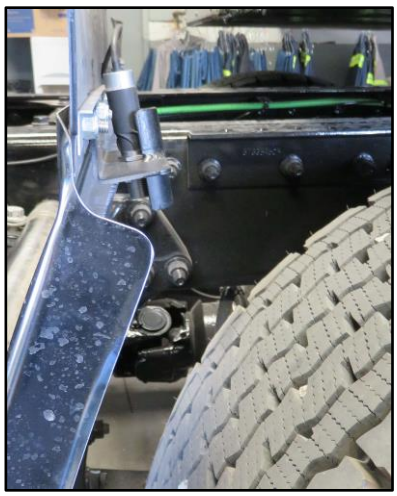


Figure 6: Tire Temp. Sensor

4.0: TEST RESULTS

As listed in the Summary, the Ex-Guard LT 325 had a negligible effect on fuel economy, measuring 0.01 gal/1000 miles, which was within the margin of error and can be considered zero. The Ex-Guard LT 350 had a fuel economy loss of -0.53 gal/1000 miles as shown below in Figure 7. The results are also shown below in Table 2 and include test accuracy and baseline fuel economy values.

Figure 7: Fuel Savings (gal/1000 miles)

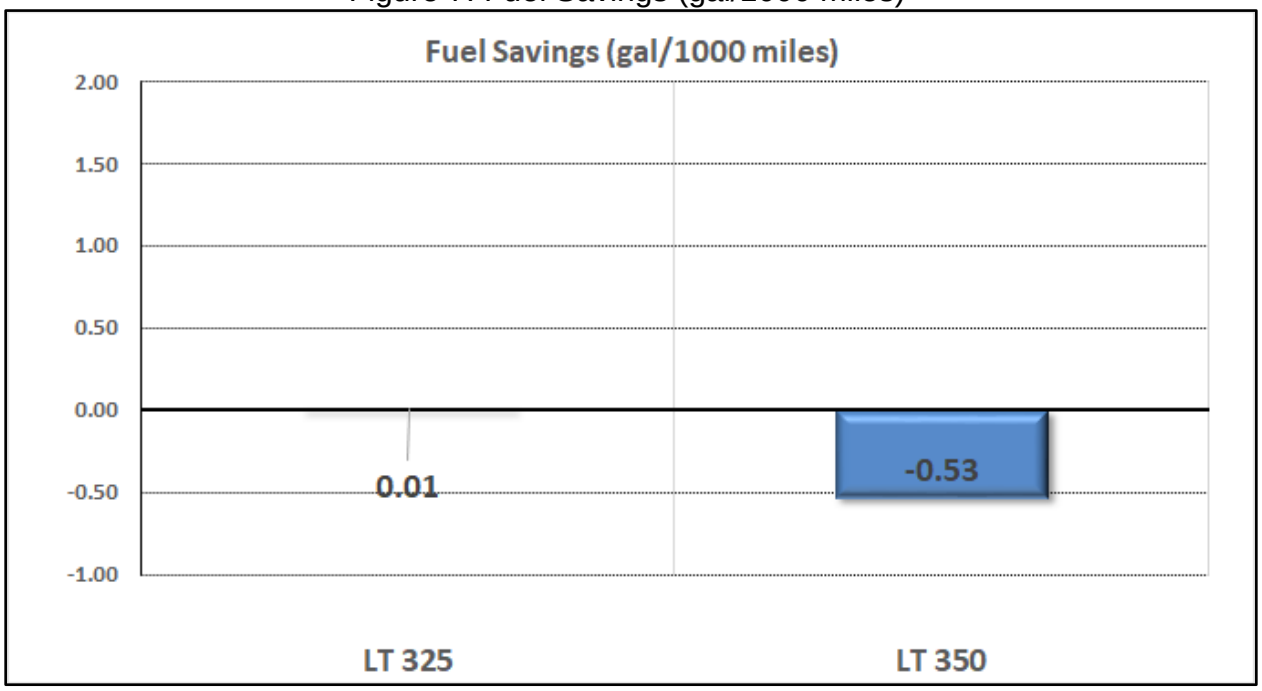


Table 2: Fuel Economy Test Results with Accuracy

	FUEL ECON. IMPROVEMENT		
	Gal/1000 miles	MPG	Percent
LT 325	**0.01**	0.00	0.01%
Accuracy	**+/- 0.35**	+/- 0.03	+/- 0.34%
Baseline	**103.09**	9.70	9.70 mpg
	Gal/1000 miles	MPG	Percent
LT 350	**-0.53**	-0.05	-0.51%
Accuracy	**+/- 0.33**	+/- 0.03	+/- 0.32%
Baseline	**103.09**	9.70	9.70 mpg

Figure 8: LT 325

Figure 9: Test Vehicle with LT 325

Figure 10: LT 350

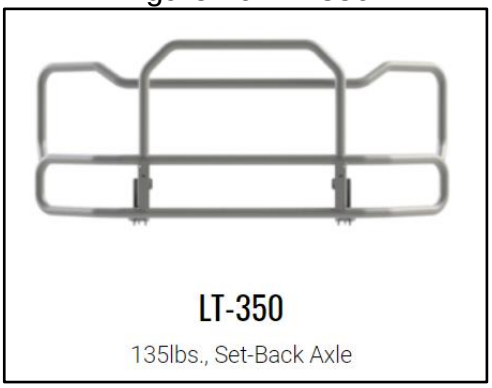
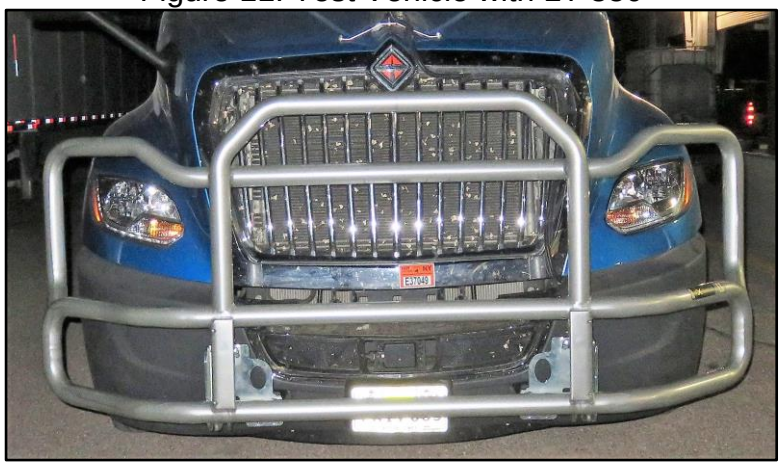


Figure 11: Test Vehicle with LT 350



4.1a: WHY EX-GUARDS HAD ONLY A SMALL EFFECT ON FUEL ECONOMY

The reader may be surprised by the Ex-Guard's minimal affect on fuel economy and therefore the topic is worth further discussion. Typically, interfering with the air flow on a vehicle can impact fuel economy significantly; however, the Ex-Guard products have some advantages that minimize this. First, air flow at the front of the truck is relatively slow due to the blunt face of the vehicle, which causes the air flow speed to decrease considerably. Aerodynamicists refer to this as a "high-pressure area". This situation results in less air flowing past the Ex-Guard system and therefore its effect on aerodynamic drag being reduced. Secondly, the Ex-Guard is mounted several inches away from the front of the vehicle, allowing the air that does impact the front of the vehicle to continue flowing as needed (*i.e.* left, right, up, down). Lastly, the round tubing used by Ex-Guard has a relatively low effect on drag; therefore, further reducing the negative impact on fuel economy. Overall, the combination of the Ex-Guard's design and the low air speed at the front of the vehicle enable Ex-Guard LT 325 and LT 350 to have near zero, or only minor effect, on fuel economy respectively. **Note** that other brands of grill guards may not perform as well with fuel economy as the Ex-Guard systems. This will be especially true of larger and more bluntly shaped grill guards. Grill guards that mount closer to the front of the vehicle, use more bluntly shaped materials, or block air flow with bracing or vertical risers will all perform worse with fuel economy.

4.2: 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.

4.3: THE VALUE OF EX-GUARD

The value provided by the Ex-Guard system is not in fuel economy, it is in preventing or reducing front end damage to the truck, which can be extremely costly in repairs and down time. This damage can occur by animal strikes or contact with other vehicles or stationary objects.

Costs Occurring from Front End Strikes

- Damages
  - Bumpers
  - Head lights
  - Radar for collision avoidance systems
  - Hoods and fenders
  - Heat exchangers such as radiator, A/C condenser, charge air cooler

- Additional Expenses
  - Vehicle tows (when truck is stopped due to damage)
  - Late load penalties
  - Replacement/rental vehicle costs
  - Vehicle downtime

4.3a: ADDITIONAL FEATURES THE MVT FLEET FOUND VALUABLE

In addition to the Ex-Guard's minimal effect on fuel economy, and ability to reduce front end damage, the MVT fleet leaders found several other features impressive.

Protective Layer

The steel tubes have 1/8-inch layer of PVC. Tubes are not simply painted, or corrosion protected, they are covered with a thick, strong protective layer. MVT was impressed with this since it will 'hold up' for a long time, not only physically but aesthetically, by avoiding chipping and corrosion.

Hood Remains Easy to Open

The Ex-Guard opens with one hand, simply folding forward. This avoids issues opening the truck hood.

Fast and Easy Install

Installation on the International LT required approximately 15 minutes with two people. The Ex-Guard mounts were inserted into the tow hook receptacles on the truck and the grill guard itself was then fastened to those mounts.

Transferable to New/Different Trucks

The Ex-Guard grill is universal and can be transferred to new trucks, or different model/brands. In the latter case, new mounts may be required. In the case of MVT and its Navistar brand the same Ex-Guard system can be transferred from an older ProStar model to the LT. The ability to transfer between vehicles becomes more important when the durability and longevity of the Ex-Guard system is realized.

4.4: CALCULATING TOTAL SAVINGS OR COST WITH EX-GUARD

Total savings or cost with an Ex-Guard system can now be calculated to include its effect on fuel economy.

LT 325

No effect on fuel economy, therefore zero cost in fuel.

LT 350

Full calculations are provided in the Appendix. At 125,000 miles travelled annually, the fuel used would be 66 gallons. Using the average retail cost of diesel fuel in the U.S. in 2018 at $3.178 /gal, this amounts to $210 annually in fuel per truck.

The reader can now input their own costs for front end damages, such as those described above, the cost to purchase and install the Ex-Guard system, and the effect on fuel economy.

4.5: WEATHER CONDITIONS SUMMARY

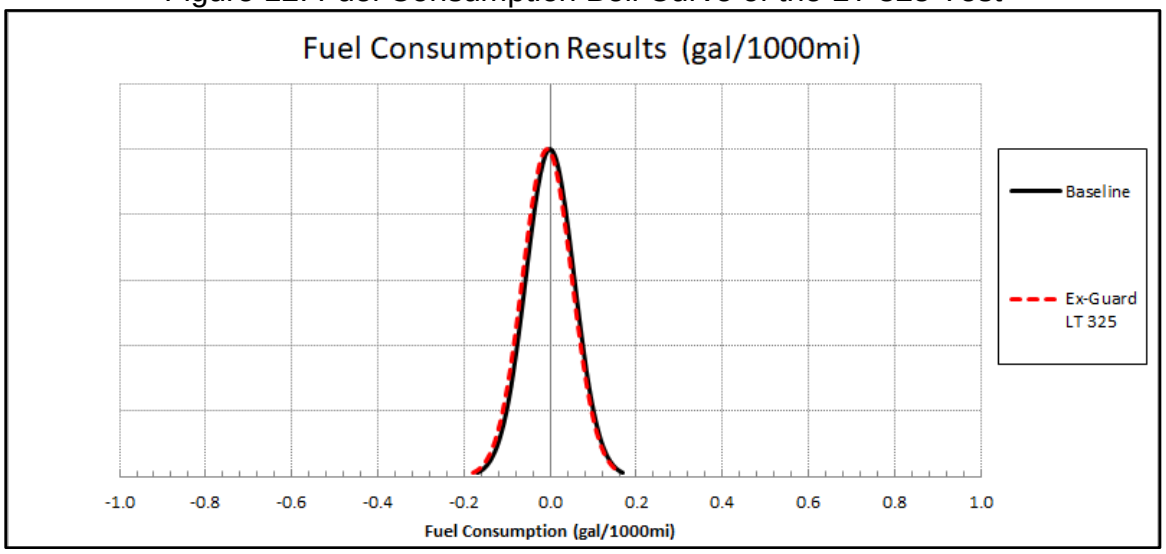
Weather during testing was cool with moderate winds. Temperatures ranged from 56.0°F to 73.0°F. Winds ranged from 0 mph to 13 mph. It should be noted that the MVTS test methods account for these variables and their effects on fuel savings. Therefore, the range in climate conditions did not impede the test results shown in this report. Complete weather data can be found in the Appendix.

4.6: MEASUREMENT ACCURACY

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.

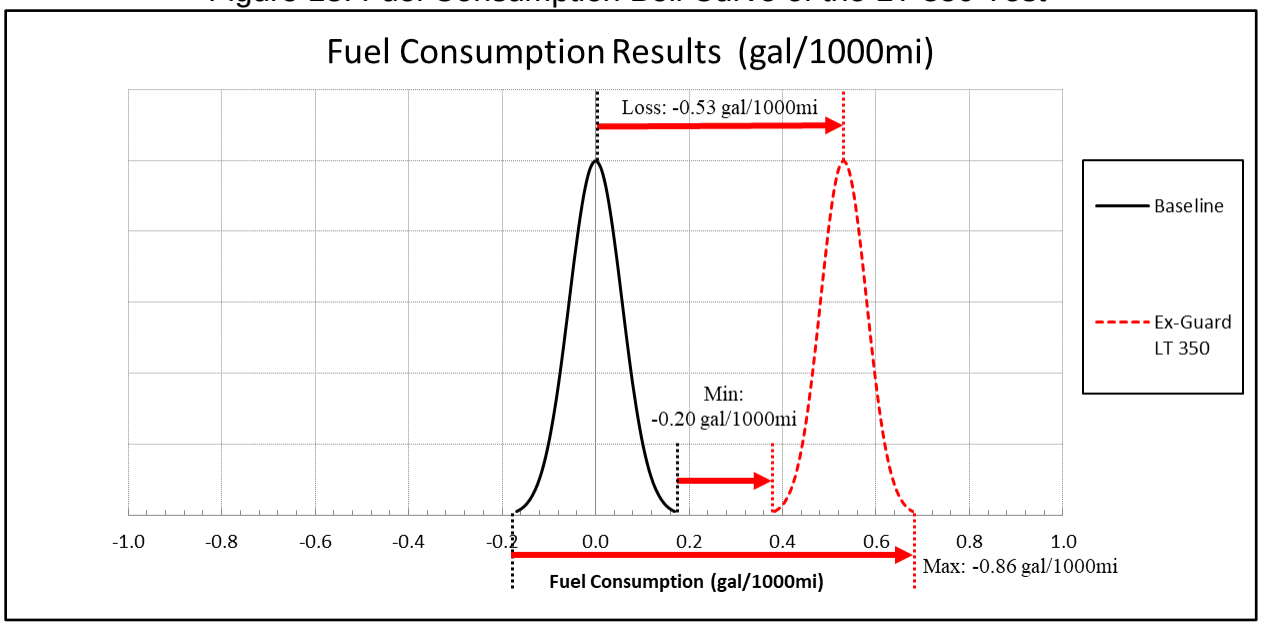
Theoretical accuracy is calculated with statistics and shown in Table 2 as a +/- value. Minimum and maximum values are calculated as the test result plus or minus the accuracy value (0.01 gal/1000mi +/- 0.35 gal/1000mi), which was 0.36 and -0.34 gal/1000mi. Figure 12 below shows the statistical bell curves of the Ex-Guard LT 325 grill guard test. The Baseline run and Ex-Guard LT 325 Test run bell curves overlap each other, which is a result of near-zero fuel savings result. A greater savings value would result in the peaks of the bell curves having a distance separating them. Although the accuracy range exceeds the magnitude of the test result, the results can still be considered conclusive through experienced manual data analysis which MVTS engineers conducted and confirmed.

Figure 12: Fuel Consumption Bell Curve of the LT 325 Test



Accuracy for the tests was calculated using a 95% confidence interval, a common standard for testing measurement. 95% confidence interval indicates that if the test was 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). Figure 13 below illustrates the statistical bell curve for the Ex-Guard LT 350. Unlike the previous graph, this test shows two separate bell curves illustrating a clear difference in fuel economy. The distance between the peaks of the bell curves is the test result average value, which in this test was a loss of -0.53 gal/1000 miles. Note that the Ex-Guard LT 350 is on the right of the graph, illustrating more fuel used and thereby a loss as indicated by the arrow on the graph. Minimum and maximum values were calculated as the test result plus or minus the accuracy value (-0.53 +/- 0.33), which were -0.20 and -0.86 gal/1000 miles.

Figure 13: Fuel Consumption Bell Curve of the LT 350 Test



5.0: CONCLUSION

Testing proved the impact of the Ex-Guard LT 325 and LT 350 models on fuel economy with answers that were clear and precise. The Ex-Guard LT model 325 had a near-zero effect on fuel economy with a value of 0.01 gal/1000 miles. The Ex-Guard LT 350, with greater front-end vehicle coverage, only resulted in a fuel economy loss of -0.53 gal/1000 miles.

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 affect on fuel economy, the Ex-Guard LT grill guards should provide fleets confidence to pursue the products based on operational costs as opposed to fuel economy losses.

6.0: APPENDIX

6.1: COMPARE TRUCK/TRAILER VEHICLE DETAILS

Figure 14: Vehicle Info, Compare Vehicle

Date	February 15, 2019				
Company	Mesilla Valley Transportation				
Location	Pecos, Texas				
Test Route	Pecos 9-mile Test Track				
TRUCK ID:	**2519P**				
Brand	International				
Year	2019				
Model	LT				
Engine	Cummins X15				
VIN	3HSKZAPR0KN391080				
Mileage (miles):	120,747				
Transmission	10-Speed Eaton AMT				
Rear Gear	2.31				
Fuel Load	Full at T/A Las Cruces prior to On-Road test				
Fuel Type & Batch	No. 2 diesel				
Axle Weights	12,000		16,740		16,220
Total weight	44,960				
Wheel covers off, solid mud flaps					
Photo/Video/Audio folder name:					
TRAILER ID:	**7224**				
Model	Great Dane				
VIN	3H3V532C4KT922005				
Year	2019				
Size	53' Dry Van				
Trailer Gap (inches)					
Add-ons					
	Michelin Energy Guard System				

Figure 15: Tire Info, Compare Vehicle

TIRES		
	Truck 2519P	
LF:	**Front Axle Tires**	RF: Same
Michelin X Line Energy	Type	Michelin X Line Energy
275/80R22.5	Size	275/80R22.5
11/32	Tread Depth (32nds)	11/32
110	Pressure (psi)	110
LF Drive:	**Drive Axle Tires**	RF Drive: Same
Michelin X One XDN2	Type	Michelin X One XDN2
445/50R22.5	Size	445/50R22.5
14/32	Tread Depth (32nds)	11/32
110	Pressure (psi)	110
LF Drive:	**Rear Axle Tires**	RF Drive: Same
Michelin X One Line Energy	Type	Michelin X One Line Energy
445/50R22.5	Size	445/50R22.5
10/32	Tread Depth (32nds)	9/32
110	Pressure (psi)	110
	Trailer 7224	
LF	**Tandem Front**	RF
Michelin X One Line Energy	Type	Michelin X One Line Energy
445/50R22.5	Size	445/50R22.5
13/32	Tread Depth (32nds)	13/32
110	Pressure (psi)	110
LR	**Tandem Rear**	RR
Michelin X One Line Energy	Type	Michelin X One Line Energy
445/50R22.5	Size	445/50R22.5
13/32	Tread Depth (32nds)	13/32
110	Pressure (psi)	110

6.2: MODIFIED TRUCK/TRAILER VEHICLE DETAILS

Figure 16: Vehicle Info, Modified Vehicle

Date	February 15, 2019				
Company	Mesilla Valley Transportation				
Location	Pecos, Texas				
Test Route	Pecos 9-mile Test Track				
TRUCK ID:	**2493P**				
Brand	International				
Year	2019				
Model	LT				
Engine	Cummins X15				
VIN	3HSKZAPRXKN391071				
Mileage (miles):	109,470				
Transmission	10-Speed Eaton AMT				
Rear Gear	2.31				
Fuel Load	Full at T/A Las Cruces prior to On-Road test				
Fuel Type & Batch	No. 2 diesel				
Axle Weights	11,900		17,060		16,080
Total weight	45,040				
Wheel covers off, solid mud flaps.					
Photo/Video/Audio folder name:					
TRAILER ID:	**7233**				
Model	Great Dane				
VIN	3H3V532C5KT922014				
Year	2019				
Size	53' Dry Van				
Trailer Gap (inches)					
Add-ons	Michelin Energy Guard System				

Figure 17: Tire Info, Modified Vehicle

TIRES		
	Truck 2493P	
LF:	**Front Axle Tires**	RF: Same
Michelin X Line Energy	Type	Michelin X Line Energy
275/80R22.5	Size	275/80R22.5
13/32	Tread Depth (32nds)	12/32
110	Pressure (psi)	110
LF Drive:	**Drive Axle Tires**	RF Drive: Same
Michelin X One XDN2	Type	Michelin X One XDN2
445/50R22.5	Size	445/50R22.5
16/32	Tread Depth (32nds)	14/32
110	Pressure (psi)	110
LF Drive:	**Rear Axle Tires**	RF Drive: Same
Michelin X One Line Energy	Type	Michelin X One Line Energy
445/50R22.5	Size	445/50R22.5
7/32	Tread Depth (32nds)	10/32
110	Pressure (psi)	110
	Trailer 7233	
LF	**Tandem Front**	RF
Michelin X One Line Energy	Type	Michelin X One Line Energy
445/50R22.5	Size	445/50R22.5
12/32	Tread Depth (32nds)	13/32
110	Pressure (psi)	110
LR	**Tandem Rear**	RR
Michelin X One Line Energy	Type	Michelin X One Line Energy
445/50R22.5	Size	445/50R22.5
13/32	Tread Depth (32nds)	13/32
110	Pressure (psi)	110

6.3: TEST ROUTE

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

Figure 18: Pecos Test Track

6.4: 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.

6.4a: Fuel Loss Explanation

In some product cases the benefit is not in the fuel savings but in other savings (i.e. operational costs). In these cases, quantifying the fuel loss is used to determine overall savings or ROI.

6.4b: Fuel Savings/Loss Calculations

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

Test result (gal/1000 miles) x Thousands of miles travelled per year, per vehicle

Example: Ex-Guard LT 350 fuel loss = -0.53 gal/1000 miles. If a vehicle travels 125,000 miles per year, fuel savings are:

-0.53 x 125 = -66 gallons lost annually

6.4c: FINANCIAL SAVINGS CALCULATIONS

Financial calculations can be made by multiplying the fuel saved by the fuel price. Using the U.S. average retail price of diesel fuel in 2018, $3.178 /gal:

-66 gallons/year x $3.178 /gal = $210 /year in fuel lost

To continue calculating the net financial savings requires input of the product investment, fleet trailer-to-truck ratio and other pertinent variables unique to each carrier. Contact MVTS for assistance if required.

6.4d: TECHNOLOGY PAYBACK AND RETURN-ON-INVESTMENT

Buyers of fuel economy technologies are most interested in saving money. For a technology supplier to be successful, their technology must save their potential customers money.

a) Fuel savings (per year) = (gal/1000 miles) x (vehicle miles per year) / 1000

b) Dollar savings (per year) = (Fuel savings (per year)) x (Price of fuel per gallon)

c) Payback (months) = (Product cost) / (Dollar savings per month)

6.5: WEATHER CONDITIONS

Weather during testing was relatively cool for Texas, with moderate winds. 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.

Figure 19: Test Run Times

	Begin	End
Baseline Run	6:56 P.M.	8:45 P.M.
Test Run (i.e. LT 350 installed)	9:10 P.M.	10:58 P.M.
Test Run (i.e. LT 325 installed)	11:21 P.M.	1:10 A.M.

Table 3: Weather Data, Feb. 15

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Precip Accum	Condition
12:15 AM	63 F	31 F	30 %	WSW	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
12:35 AM	64 F	31 F	30 %	SW	10 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
12:55 AM	63 F	32 F	31 %	SW	10 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
1:15 AM	62 F	32 F	33 %	SW	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
1:35 AM	60 F	32 F	35 %	WSW	9 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
1:55 AM	58 F	31 F	36 %	WSW	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
2:15 AM	58 F	32 F	37 %	WSW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
2:35 AM	56 F	32 F	39 %	SW	6 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
2:55 AM	57 F	32 F	39 %	SW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
3:15 AM	55 F	32 F	42 %	SW	5 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
3:35 AM	53 F	32 F	44 %	SW	6 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
3:55 AM	53 F	32 F	46 %	WSW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
4:15 AM	52 F	31 F	46 %	WNW	6 mph	0 mph	27.1 in	0.0 in	0.0 in	Partly Cloudy
4:35 AM	55 F	32 F	41 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
4:55 AM	58 F	33 F	38 %	WNW	3 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
5:15 AM	63 F	35 F	35 %	WSW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
5:35 AM	64 F	36 F	35 %	SW	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
5:55 AM	61 F	35 F	38 %	WSW	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
6:15 AM	60 F	36 F	41 %	WSW	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
6:35 AM	63 F	37 F	38 %	WSW	10 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
6:55 AM	61 F	37 F	41 %	WSW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
7:15 AM	57 F	37 F	47 %	NNW	3 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
7:35 AM	58 F	37 F	44 %	WNW	3 mph	0 mph	27.1 in	0.0 in	0.0 in	Partly Cloudy
7:55 AM	58 F	37 F	46 %	SW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Mostly Cloudy
8:15 AM	62 F	38 F	42 %	SW	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Partly Cloudy
8:35 AM	62 F	39 F	42 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
8:55 AM	65 F	40 F	39 %	CALM	0 mph	0 mph	27.2 in	0.0 in	0.0 in	Cloudy
9:15 AM	68 F	40 F	36 %	WSW	9 mph	0 mph	27.2 in	0.0 in	0.0 in	Cloudy
9:35 AM	70 F	41 F	35 %	WSW	21 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy / Windy
9:55 AM	72 F	43 F	36 %	WSW	37 mph	43 mph	27.1 in	0.0 in	0.0 in	Cloudy / Windy
10:15 AM	73 F	44 F	36 %	WSW	17 mph	25 mph	27.2 in	0.0 in	0.0 in	Cloudy
10:35 AM	73 F	44 F	35 %	W	21 mph	25 mph	27.2 in	0.0 in	0.0 in	Fair / Windy
10:55 AM	75 F	45 F	34 %	W	22 mph	0 mph	27.2 in	0.0 in	0.0 in	Fair / Windy
11:15 AM	77 F	45 F	32 %	W	31 mph	38 mph	27.2 in	0.0 in	0.0 in	Fair / Windy
11:35 AM	76 F	45 F	33 %	WSW	39 mph	44 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
11:55 AM	77 F	45 F	32 %	WSW	39 mph	47 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
12:15 PM	77 F	45 F	32 %	W	32 mph	45 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
12:35 PM	77 F	45 F	31 %	W	30 mph	39 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
12:55 PM	78 F	45 F	30 %	W	31 mph	37 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
1:15 PM	79 F	43 F	28 %	WSW	36 mph	44 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
1:35 PM	79 F	43 F	28 %	WSW	33 mph	44 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
1:55 PM	78 F	43 F	28 %	W	31 mph	40 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
2:15 PM	79 F	42 F	27 %	W	33 mph	37 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
2:35 PM	80 F	41 F	25 %	W	33 mph	41 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
2:55 PM	78 F	41 F	26 %	W	29 mph	37 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
3:15 PM	79 F	41 F	26 %	W	25 mph	38 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
3:35 PM	79 F	40 F	25 %	WSW	28 mph	39 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
3:55 PM	79 F	39 F	24 %	WSW	23 mph	35 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
4:15 PM	80 F	39 F	23 %	W	23 mph	29 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
4:35 PM	80 F	39 F	23 %	W	25 mph	32 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
4:55 PM	79 F	39 F	24 %	W	22 mph	30 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
5:15 PM	79 F	40 F	24 %	W	22 mph	25 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
5:35 PM	78 F	39 F	25 %	W	21 mph	25 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
5:55 PM	77 F	39 F	25 %	W	21 mph	28 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
6:15 PM	76 F	38 F	26 %	W	20 mph	23 mph	27.1 in	0.0 in	0.0 in	Fair
6:35 PM	74 F	38 F	27 %	W	15 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
6:55 PM	73 F	38 F	28 %	W	13 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
7:15 PM	72 F	38 F	29 %	W	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
7:35 PM	71 F	38 F	30 %	W	9 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
7:55 PM	69 F	38 F	31 %	W	10 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
8:15 PM	69 F	38 F	32 %	W	9 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
8:35 PM	67 F	38 F	34 %	W	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
8:55 PM	69 F	38 F	32 %	W	10 mph	0 mph	27.2 in	0.0 in	0.0 in	Fair
9:15 PM	67 F	38 F	35 %	WNW	8 mph	0 mph	27.2 in	0.0 in	0.0 in	Fair
9:35 PM	66 F	38 F	35 %	NW	9 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
9:55 PM	67 F	38 F	35 %	WNW	9 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
10:15 PM	63 F	37 F	39 %	W	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
10:35 PM	63 F	38 F	40 %	W	6 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
10:55 PM	61 F	37 F	41 %	W	7 mph	0 mph	27.2 in	0.0 in	0.0 in	Fair
11:15 PM	61 F	38 F	42 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
11:35 PM	60 F	38 F	44 %	SSW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
11:55 PM	59 F	38 F	46 %	WSW	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy

Source: https://www.wunderground.com/history/daily/us/tx/pecos/KPEQ/date/2019-2-15

Table 4: Weather Data, Feb. 16

Time	Temperature	Dew Point	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Precip.	Precip Accum	Condition
12:15 AM	58 F	38 F	47 %	W	3 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
12:35 AM	58 F	37 F	47 %	S	3 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
12:55 AM	56 F	36 F	47 %	WSW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
1:15 AM	58 F	37 F	44 %	WSW	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
1:35 AM	58 F	37 F	44 %	WSW	10 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
1:55 AM	56 F	36 F	47 %	SW	10 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
2:15 AM	56 F	36 F	47 %	SSW	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
2:35 AM	57 F	36 F	45 %	SW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
2:55 AM	55 F	36 F	49 %	SW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
3:15 AM	54 F	36 F	50 %	WSW	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
3:35 AM	53 F	36 F	51 %	SW	6 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
3:55 AM	52 F	36 F	53 %	SSW	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
4:15 AM	52 F	35 F	53 %	SW	5 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
4:35 AM	52 F	35 F	53 %	S	6 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
4:55 AM	51 F	35 F	55 %	SSW	6 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
5:15 AM	51 F	35 F	55 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
5:35 AM	50 F	35 F	56 %	S	5 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
5:55 AM	50 F	35 F	55 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
6:15 AM	50 F	37 F	59 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
6:35 AM	46 F	34 F	62 %	E	5 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
6:55 AM	48 F	35 F	60 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
7:15 AM	46 F	35 F	64 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
7:35 AM	45 F	35 F	67 %	E	5 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
7:55 AM	44 F	35 F	70 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
8:15 AM	44 F	35 F	71 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
8:35 AM	45 F	36 F	69 %	CALM	0 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
8:55 AM	47 F	36 F	66 %	SE	3 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
9:15 AM	49 F	37 F	62 %	SSE	5 mph	0 mph	27.1 in	0.0 in	0.0 in	Cloudy
9:35 AM	53 F	37 F	56 %	SSW	5 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
9:55 AM	56 F	39 F	52 %	W	7 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
10:15 AM	65 F	40 F	40 %	W	8 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
10:35 AM	69 F	40 F	36 %	WSW	9 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
10:55 AM	70 F	40 F	34 %	WSW	14 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
11:15 AM	72 F	40 F	32 %	WSW	14 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
11:35 AM	73 F	39 F	29 %	SW	17 mph	24 mph	27.1 in	0.0 in	0.0 in	Fair
11:55 AM	75 F	38 F	26 %	WSW	23 mph	30 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
12:15 PM	76 F	30 F	18 %	WSW	23 mph	32 mph	27.1 in	0.0 in	0.0 in	Fair / Windy
12:35 PM	77 F	25 F	15 %	WSW	30 mph	35 mph	27.0 in	0.0 in	0.0 in	Fair / Windy
12:55 PM	78 F	28 F	16 %	WSW	25 mph	33 mph	27.0 in	0.0 in	0.0 in	Fair / Windy
1:15 PM	77 F	28 F	16 %	SW	24 mph	32 mph	27.0 in	0.0 in	0.0 in	Fair / Windy
1:35 PM	78 F	28 F	16 %	WSW	22 mph	32 mph	27.0 in	0.0 in	0.0 in	Fair / Windy
1:55 PM	78 F	30 F	17 %	WSW	15 mph	29 mph	27.0 in	0.0 in	0.0 in	Fair
2:15 PM	79 F	30 F	17 %	SW	20 mph	29 mph	27.0 in	0.0 in	0.0 in	Fair
2:35 PM	79 F	27 F	15 %	WSW	24 mph	36 mph	27.0 in	0.0 in	0.0 in	Fair / Windy
2:55 PM	79 F	25 F	14 %	SW	22 mph	26 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
3:15 PM	80 F	22 F	12 %	WSW	24 mph	36 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
3:35 PM	80 F	22 F	12 %	WSW	21 mph	30 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
3:55 PM	81 F	16 F	9 %	WSW	29 mph	37 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
4:15 PM	80 F	14 F	8 %	WSW	28 mph	39 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
4:35 PM	80 F	13 F	8 %	WSW	31 mph	44 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
4:55 PM	80 F	11 F	8 %	WSW	28 mph	38 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
5:15 PM	79 F	10 F	7 %	W	29 mph	37 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
5:35 PM	79 F	10 F	7 %	W	24 mph	33 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
5:55 PM	78 F	9 F	7 %	W	20 mph	31 mph	26.9 in	0.0 in	0.0 in	Fair
6:15 PM	77 F	4 F	6 %	WSW	22 mph	33 mph	26.9 in	0.0 in	0.0 in	Fair / Windy
6:35 PM	74 F	8 F	8 %	W	14 mph	0 mph	26.9 in	0.0 in	0.0 in	Fair
6:55 PM	71 F	9 F	9 %	W	10 mph	0 mph	26.9 in	0.0 in	0.0 in	Fair
7:15 PM	67 F	8 F	10 %	W	9 mph	0 mph	26.9 in	0.0 in	0.0 in	Fair
7:35 PM	64 F	8 F	11 %	WNW	8 mph	0 mph	26.9 in	0.0 in	0.0 in	Fair
7:55 PM	66 F	8 F	10 %	WNW	12 mph	0 mph	27.0 in	0.0 in	0.0 in	Fair
8:15 PM	66 F	7 F	10 %	WNW	13 mph	0 mph	27.0 in	0.0 in	0.0 in	Fair
8:35 PM	66 F	12 F	12 %	W	16 mph	24 mph	27.0 in	0.0 in	0.0 in	Fair
8:55 PM	65 F	15 F	15 %	W	12 mph	20 mph	27.0 in	0.0 in	0.0 in	Fair
9:15 PM	62 F	16 F	17 %	WNW	9 mph	0 mph	27.0 in	0.0 in	0.0 in	Fair
9:35 PM	60 F	19 F	21 %	WNW	9 mph	0 mph	27.0 in	0.0 in	0.0 in	Fair
9:55 PM	61 F	22 F	23 %	WNW	13 mph	0 mph	27.0 in	0.0 in	0.0 in	Fair
10:15 PM	60 F	22 F	23 %	WNW	13 mph	0 mph	27.0 in	0.0 in	0.0 in	Fair
10:35 PM	59 F	21 F	23 %	WNW	13 mph	0 mph	27.0 in	0.0 in	0.0 in	Fair
10:55 PM	58 F	21 F	24 %	W	13 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
11:15 PM	57 F	21 F	25 %	W	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
11:35 PM	57 F	21 F	25 %	WNW	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair
11:55 PM	55 F	21 F	26 %	W	12 mph	0 mph	27.1 in	0.0 in	0.0 in	Fair

Source: https://www.wunderground.com/history/daily/us/tx/pecos/KPEQ/date/2019-2-16

6.6: PRODUCT DETAILS

Product Company Contact: sales@ex-guard.com
2515 Dean Ave., DSM, IA 50317
888.902.2777
https://ex-guard.com/

Test Products:

- LT 325
- LT 350

6.7: TEST PERSONNEL

6.7a: MVT & MVT SOLUTIONS

- Allan Dahringer, Director of Maintenance, MVT
- Seth Knight, Shop Supervisor, MVT
- Carlos Aragon, Driver, MVT
- Jack Burchell, Driver, MVT
- Ron Knowles, Driver, MVT
- Daryl Bear, Lead Engineer, MVT Solutions
- Drew Cassidy, Engineer, MVT Solutions

6.7b: DRIVERS

- Allan Dahringer
- Carlos Aragon
- Jack Burchell
- Ron Knowles

6.8: MVT SOLUTIONS CONTACT INFO

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