



Functionality Test

VIGIA SYSTEM

PMR 5153

Issuer	CD71910, Omar Vargas ,+52 55 50903700, VIM
Date	2013-09-11
Est. date	2013-09-11
Version No	1
Saved and filed as	Document
Classification	Confidential
Status	OK



Type of document		Page
Test Report		2 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013
Issuer (dep No, name, phone, location)	Version No	Appendix
CD71910, Omar Vargas ,+52 55 50903700, VIM	1	N/A
Subject		
Functionality Test		

1 Introduction

1.1 Background

As a part of implementation process of PMR 5153 are tested two options of monitoring system tire, this is done due to current supplier is changed the current system by a newer technology system.

The two options consider for these tests are system 253 that is the analogical system and 343 that is the digital system, those systems will be tested in static way and dynamic way in which will be validated the proper operation of them as security system, both systems are placed in method unit and are tested at the same time to compare which one has better results.

2 Objectives

2.1 Purpose

Validate the proper operation of monitoring system tire (VIGIA) as security system.

2.2 Delimitations

N/A

2.3 Target

The system must maintain the calibration pressure under control in the tires.

2.4 Demand

The system must maintain the calibration pressure under control in the tires to avoid damage in them.

3 Testing

3.1 Method

Static Test

First the pressure in tires is measured to validate that they are calibrated.

Type of document		Page
Test Report		3 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013



Then the pressure in the 8 tires is lowered at 70 PSI to make the recovery test where is checked the time in which the tires are blown up at 100 PSI, this is done without load.



Next the test is carried out; the engine is ignited and in static way is accelerated at 1100 RPM, when finish to blown tires up the process is repeated in 1 tire, it is lowered at 70 PSI, the engine is ignited and in static way is accelerated at 1100 RPM.

After that the unit is loaded with 3200 kg.

Finally the test is carried out in 8 and 1 tire; the engine is ignited and in static way is accelerated at 1100 RPM and is checked the time in which the tires recover 100 PSI, when finish to blown tires up the process is repeated in 1 tire, it is lowered at 70 PSI, the engine is ignited and in static way is accelerated at 1100 RPM and is checked the time in which the tire recover 100 PSI.



Type of document		Page
Test Report		4 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013

Dynamic Test

In dynamic test is carried out the recovery test in 8, 6, 4, and 1 tire this is done to validate the proper operation of system and compare the results against the static test.

First to make this test the vehicle is loaded with 3 200 Kg in luggage.

Then is performed a test where the vigia system is not turned on, on this test is maintained cruise speed of 95 km/h in a route of 615 km this is done to get a parameter of fuel consumption for the next tests and know if the system affects the performance.

Next is made the recovery test in dynamic conditions in the same route of previous test, on this test is maintained cruise speed of 95 km/h, first the pressure is lowered in 8 tires at 70 PSI and is checked the time in which recover the pressure at 100 PSI according with the calibration next when is recover the pressure the process is repeated in 6 tires after in 4 and finally in 1 tire, and also during this process is checked the fuel consumption.

After that is made the test with vigia system in the same conditions of test where was not turned on the system.

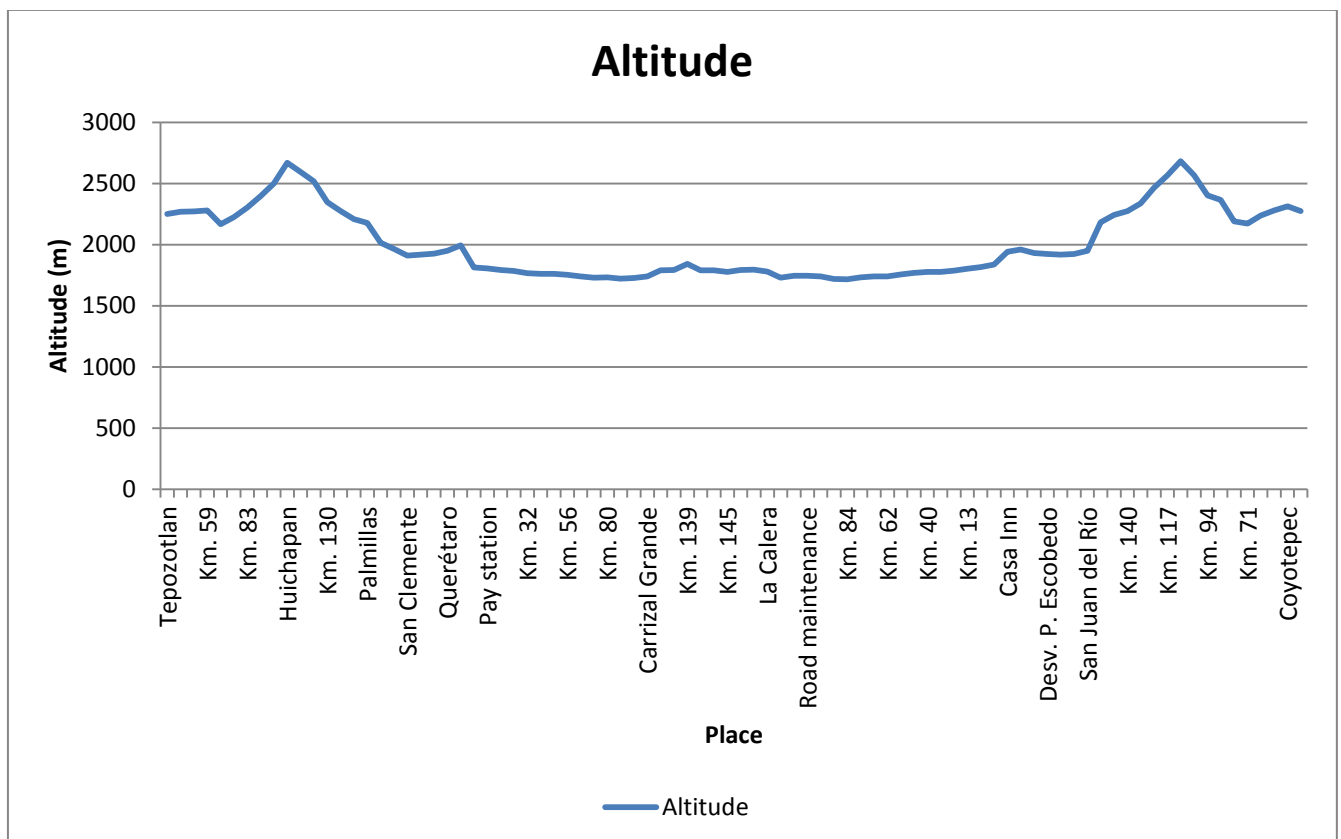
Finally is made the test in which the pressure in tires is calibrated at 90 PSI without turned on the vigia system in the same route and at the same conditions of tests with and without vigia system, that test is done to get the data of a hypothetical situation that what would happened if the tires are not calibrated properly.

3.2 Location

PD Workshop and the road tests are carried out from VIM to Silao where route offers 615 km of distance.



Type of document		Page
Test Report		5 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013





Type of document		Page
Test Report		6 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013

3.3 Personnel

Technician: Paulino Ursua

Driver: Carlos Ivan Ruiz / Leopoldo Torices

Product Engineer: Vanessa Cruz

Project Leader: Carlos Velazquez

Test Engineer: Omar Vargas / Ruben Sanchez

Supplier: Luis Rodriguez

3.4 External conditions

Sunny and raining with ambient temperatures from 12°C to 30°C

3.5 Object

System 253

System 343

3.6 Vehicle specification





Type of document		Page
Test Report		7 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013

Type: B13R 6X2
Build: VBM
Chassis: 161380
Body: 9700 with Eco: 2667
Engine: D13C460 EURO V
Fuel tank: 300 + 300.
Generator /Battery: 2X150 /2BATT35Ah/2BATT95Ah
Electrical system: EBS
Gearbox: AT2412D
Rear axle: 2:85:1
Brakes: Disc brake
Front axle: FWS-R
Wheel: 305/75 R24, 5"
Front axle load: 7 500 kg
Rear axle load: 11 500 kg
Auxiliary Axle load: 5 750 kg
Total Weight: 24 750 kg

3.7 Test

The tests consisted in validate the operation of monitoring system tire in two options provided by supplier.

These validations are carried out in static and dynamic way

During the static test the tires are lowered at 70 PSI and after the engine is ignited, the monitoring system tire is turned on and is checked the time in which the pressure reaches 100 PSI according with calibration, this is done without load and with load of 3200 kg.

In dynamic way are done 4 cycles, the cycles are carried out to compare the fuel consumption, the first one is made without monitoring system tire, the second one with monitoring system tire, the third one is done with a calibration pressure at 90 PSI, one of those four cycle tests is done to perform the recovery test in dynamic way.



Type of document	Page	
Test Report	8 (10)	
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013

4 Result

Static Test

To get that system works the tire must be blown up 10 PSI lower than the VIGIA calibration, this allow that the system make the pressure calibration.

So to make the test the system was calibrated at 100 PSI and the tires were lowered at 70 PSI and were done the static tests.

In static test were made the recovery test without loads and were obtained the following results:

Recovery Test Analogical System at 1 100 RPM			
8 Tires at 70 PSI	Start Time	End Time	Total Time
Front Axle	10:38	10:51	13.26 min
Driver Axle	10:38	10:54	16.57 min
Auxiliary Axle	10:38	10:54	16.15 min

Recovery time Analogical System at 1 100 RPM			
1 Tire at 70 PSI	Start Time	End Time	Total Time
Auxiliary Axle	11:03	11:07	4 min

In static test with load the following results were obtained:

Recovery Test Analogical System at 1 100 RPM			
8 Tires at 70 PSI	Start Time	End Time	Total Time
Front Axle	09:36	09:53	16.15
Driver Axle	09:36	09:56	19.32
Auxiliary Axle	09:36	09:53	16.15

Recovery time Analogical System at 1 100 RPM			
1 Tire at 70 PSI	Start Time	End Time	Total Time
Auxiliary Axle	10:14	10:20	5.26

As is observed in the results the time to blow tires up with load is increased in 17.89% in front axle, 14.23% in driver axle and it is the same time in auxiliary axle, when was made the test in one tire the time was increased in 23.95%.

Dynamic Test

During dynamic test were not found functionality problems in both systems in the tests the better results were obtained in digital system.

In digital system was found that has more sensibility to the pressure changes in tires, in one of the test days environmental conditions was with rain and



Type of document		Page
Test Report		9 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013

temperatures from 15°C to 22°C under these conditions the digital system detected a pressure drop of 2 PSI in driver axle below the calibration and in that moment the system was activated to recovered the pressure calibration while the analogical system didn't detect, this event was repeated thrice during journey the first event with a period of time of 3 minutes, the second one 5 minute and the third one 9 minutes.

With these was validated that system works in proper way as a security system to maintain the proper pressure in the tires.

With respect to recovering test the following data were obtained with analogical and digital systems:

Recovery time Analogical System (Parador San pedro)				Recovery Time Digital System (Parador San Pedro)			
8 Tires at 70 PSI	Start Time	End Time	Load Time	8 Tires at 70 PSI	Start Time	End Time	Load Time
Front Axle	11:52	12:05	13.17 min	Front Axle	11:52	12:05	13.17 min
Driver Axle	11:52	12:09	17.02 min	Driver Axle	11:52	12:17	24.17 min
Auxiliary Axle	11:52	12:05	13.17 min	Auxiliary Axle	11:52	12:05	13.17 min
Recovery time Analogical System (Caseta Queretaro)				Recovery Time Digital System (Caseta Queretaro)			
6 Tires at 70 PSI	Start Time	End Time	Load Time	6 Tires at 70 PSI	Start Time	End Time	Load Time
Driver Axle	13:08	13:23	15.01 min	Driver Axle	13:08	13:31	23.6 min
Auxiliary Axle	13:08	13:19	11.31 min	Auxiliary Axle	13:08	13:19	11.31 min
Recovery time Analogical System (Caseta Salamanca)				Recovery Time Digital System (Caseta Salamanca)			
4 Tires at 70 PSI	Start Time	End Time	Load Time	4 Tires at 70 PSI	Start Time	End Time	Load Time
Auxiliary Axle	14:18	14:29	11.39 min	Auxiliary Axle	14:18	14:41	23.16 min
Recovery time Analogical System				Recovery Time Digital System			
1 Tire at 70 PSI	Start Time	End Time	Load Time	1 Tire at 70 PSI	Start Time	End Time	Load Time
Driver Axle	15:56	16:00	4.55 min	Driver Axle	15:56	16:00	4.55 min

As is showing in the tables the digital system has more accurately than the analogical system, during the tests while analogical system indicated that the tires had recovered the pressure the digital system continued loaded the tires, also when digital system finishes to charge this makes an inspection to verify that the pressure in tires is ok and continuous monitoring the tires for a period of approximately 10 minutes.

When the data of recovering test are compared between data obtained in static way without load and in motion is found that in front axle the time is decreased in 1.96%, driver axle is increased in 2.64% and in auxiliary axle is decreased 18.45%, with respect to test in one tire the time is increased in 12.08%.

In the case of fuel consumption test was obtained that with monitoring system tire (Vigia) the consumption was increased 0.78% respect to test without vigia in a route of 615 km.

And when the test of recovering pressure was done the consumption was increased in 6.239 % in the route of 615 Km respect to first test without monitoring system tire.



Type of document		Page
Test Report		10 (10)
Name of document	Issue	Date
PMR 5153 VIGIA SYSTEM		sep 11, 2013

Finally were compared the data obtained during third test in which the pressure of tires was calibrated at 90 PSI, in this test was found that the consumption was increased in 4.311% respect to first test without monitoring system tire, respect to test with monitoring system tire was increased in 3.562% but the consumption is less than the recovery test in 2.05%.

During the consumption test was found that the pressure in tires that was calibrated at 90 PSI there was an increase of fuel consumption of 3.5% - 4.3% respect to tires that were calibrated at 100 PSI, this is due to the opposition of rolling tires due to the low pressure in them, the engine needs more torque and this includes the increased power required to the increased or maintain the velocity of the wheels.

In test the monitoring system tire worked in proper way, the system recovered the pressure established in the calibration when the pressure was lowered in 8 tires, 6 tires, 4 tires and 1 tire at 70 PSI but with those tests were found that there was an increase of fuel consumption of 6.23%, that is due to the compressor works more to supplying air to the accessories tank due to the air demand for recovering the pressure in tires and to maintain the pressure between 10.8 Bar and 9.1 Bar in the bus.

5 Recommendation

Make the fuel consumption test with a blowout tire to get the operation of vigia system under adverse conditions.

6 Conclusion

According with tests performed on Monitoring System Tire (VIGIA) this system meets with requirements as security system, this system maintained the proper pressure in tires, in static and dynamic tests were not detected problems during their operation, so the system as security system is approved.