REPORT NUMBER 138-STF-06-001

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 138 TIRE PRESSURE MONITORING SYSTEMS

VOLKSWAGEN AG GERMANY
2006 PASSAT 2.0T
FOUR-DOOR PASSENGER CAR
NHTSA NO. C65804

U.S. DOT SAN ANGELO TEST FACILITY
131 COMANCHE TRAIL, BUILDING 3527
GOODFELLOW AFB, TEXAS 76908

January 21, 2006

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, SW
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16. Abstract Compliance tests were conducted on the subject 2006 Volkswagen Passat 2.0T four-door passenger car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-138-02 for the determination of FMVSS 138 compliance. Test failures identified were as follows: NONE.		
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SECTION 1

INTRODUCTION

1.1 PURPOSE OF COMPLIANCE TEST

A 2006 Volkswagen Passat 2.0T four-door passenger car was tested to determine if the vehicle was in compliance with the requirements of the standard. All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure TP-138-02 dated September 14, 2005.

1.2 TEST VEHICLE

The test vehicle was a 2006 Volkswagen Passat 2.0T four-door passenger car. Nomenclatures applicable to the test vehicle are:

A. Vehicle Identification Number: WVWAK93CX6P098883

B. NHTSA No.: C65804

C. Manufacturer: Volkswagen AG Germany

D. Manufacture Date: 10/2005

1.3 TEST DATE

The test vehicle was tested during the time period April 24 through April 26, 2006.

SECTION 2

TEST PROCEDURE AND SUMMARY OF RESULTS

2.1 TEST PROCEDURE

Prior to test, the test vehicle was inspected for completeness, systems operability, and appropriate fuel and liquid levels, i.e. oil and coolant. The vehicle was then photographically documented as required by the DOT/NHTSA Test Procedure. Tire sidewall information was recorded. The owner's manual was reviewed, and pertinent tire and TPMS information was copied. Telltale symbols, colors, location, and lamp function were checked.

Subsequent events included weighing the vehicle to establish the unloaded vehicle weight (UVW) and the distribution of weight on the front and rear axles and each wheel position. The vehicle was then loaded to test weight and re-weighed. Test weight included the weights of driver, three passengers, and equipment, which was 320 kg (703 lbs).

The vehicle was instrumented with a Racelogic VBOX III 100 Hz GPS Data Logger to measure vehicle velocity, time, and distance during the on-road TPMS calibration and detection phases of the test. A stopwatch was also used to obtain approximate cumulative driving times during each test phase. Upon completion of each tire deflation test scenario, graphs were generated by VBOX software showing vehicle speed versus time for calibration and detection phase, as applicable. The cumulative driving time for each test phase was calculated by post processing the VBOX graph data and is reported in Section 3 (Test Data) as 'Total Driving Time'.

The tire deflation test consisted of four parts:

1. Calibration phase: Tires were set at vehicle placard cold inflation pressure and the vehicle was driven for at least twenty minutes of cumulative driving time between 50-100 km/h.
2. Detection phase: Immediately after calibration phase, the selected tires were deflated to seven kPa (one psi) below the Telltale Warning Activation Pressure. After one minute, the inflation pressure of only deflated tires were rechecked and adjusted if necessary. Vehicle was started and driven (if necessary) between 50 -100 km/h until low tire pressure telltale illuminated.
3. Cool down phase: Vehicle was parked in test facility garage. Tires were allowed to cool down for one hour, or until all tires excluding deflated tires were within seven kPa (one psi) of vehicle placard cold inflation pressure. After cool down, the vehicle was started and the low tire pressure telltale was checked for re-illumination.
4. Extinguishment phase: Tires were adjusted to vehicle placard cold inflation pressure. The vehicle was driven (if necessary) until the telltale extinguished.

Malfunction detection tests were not attempted. According to the manufacturer, the vehicle's voluntary malfunction indicator and owner's manual sections are not compliant with the April 2005 final rule.

2.2 SUMMARY OF RESULTS

Three tire deflation scenarios were run: 1. right rear tire deflated; 2. left front and right front tires deflated; 3. all four tires deflated. The data indicates compliance of the test vehicle's tire pressure monitoring system for those tire deflation scenarios tested.

SECTION 3

TEST DATA

FMVSS No. 138 – TEST DATA SUMMARY

TEST DATE: April 25, 2006 LAB: U. S. DOT San Angelo Test Facility

CONTRACT: N/A VEHICLE NHTSA NUMBER: C65804

VIN: WVWAK93CX6P098883 CERTIFICATION LABEL BUILD DATE: 10/2005

REQUIREMENTS	PASS/FAIL
LOW TIRE PRESSURE WARNING TELLTALE S138: S4.3.1 (a), (b); S4.3.3 (a), (b)	
Mounting	PASS
Symbol and color	PASS
Check of lamp function	PASS
MALFUNCTION TELLTALE S138: S4.4 (b) or (c)	
Mounting	SEE REMARKS
Symbol and color	SEE REMARKS
Check of lamp function	SEE REMARKS
LOW TIRE PRESSURE WARNING - OPERATIONAL PERFORMANCE S138: S4.2, S4.3.1 (c), S4.3.2	
Telltale illumination	PASS
MALFUNCTION INDICATOR - OPERATIONAL PERFORMANCE S138: S4.4 (a)	
Telltale illumination	SEE REMARKS
TPMS WRITTEN INSTRUCTIONS S138: S4.5	
Image of telltales	PASS
Verbatim Statements	N/A–Remarks page 22

REMARKS: Malfunction detection tests were not attempted. The FMVSS 138 malfunction performance requirements do not become effective until September 1, 2007. The test vehicle is equipped with a malfunction capability that would not correctly meet the future requirements.

DATA SHEET 1 (Sheet 1 of 3)
TEST PREPARATION INFORMATION

TEST DATE: April 24, 2006 LAB: U. S. DOT San Angelo Test Facility

CONTRACT: N/A VEHICLE NHTSA NUMBER: C65804

VIN: WVWAK93CX6P098883 CERTIFICATION LABEL BUILD DATE: 10/2005

MY/MAKE/MODEL/BODY STYLE: 2006 Volkswagen Passat 2.0T four-door passenger car

ENGINE: 2.0 L 121 CI

TIRE CONDITIONING:

(X) Tires used more than 100 km. Actual odometer reading : 108 km (67 mi)

VEHICLE ALIGNMENT AND WHEEL BALANCING:

Alignment checked: ( ) Front ( ) Rear (X) COTR waived

Wheels balanced: ( ) Front ( ) Rear (X) COTR waived

TPMS IDENTIFICATION:

TPMS MAKE/MODEL: Siemens VDO

TPMS TYPE: (X) Direct ( ) Indirect ( ) Other _____

TPMS MALFUNCTION INDICATOR TYPE:

( ) None ( ) Dedicated Telltale (X) Combination low tire pressure/malfunction telltale

Does TPMS require execution of a learning/calibration driving phase?

☐ YES ☑ NO

Does TPMS have a manual reset control?

☐ YES ☑ NO

DESIGNATED TIRE SIZE(S) FROM VEHICLE LABELING AND OWNER'S MANUAL:

Axle	Tire Size	Recommended Cold Inflation Pressure	Source
Front	215/55R16 97H XL	230 kPa (33 psi)	Vehicle Placard
Rear	215/55R16 97H XL	230 kPa (33 psi)	Vehicle Placard
Spare	215/55R16 XL	230 kPa (33 psi)	Vehicle Placard
Front	215/55R16 97H XL	230 kPa (33 psi)	Owner's Manual
Rear	215/55R16 97H XL	230 kPa (33 psi)	Owner's Manual

DATA SHEET 1 (Sheet 2 of 3)
TEST PREPARATION INFORMATION

INSTALLED TIRE DATA (Use diagrams as reference):

Diagram - Passenger Car Tire Labeling

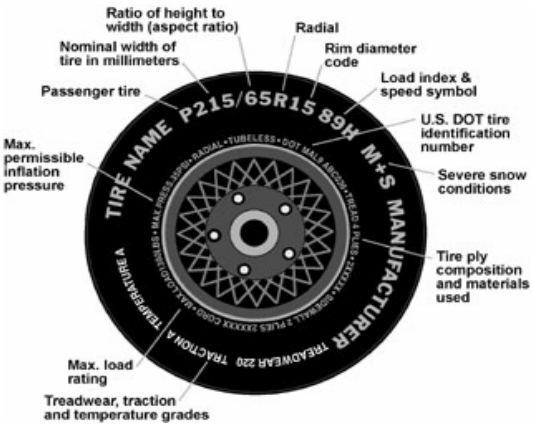
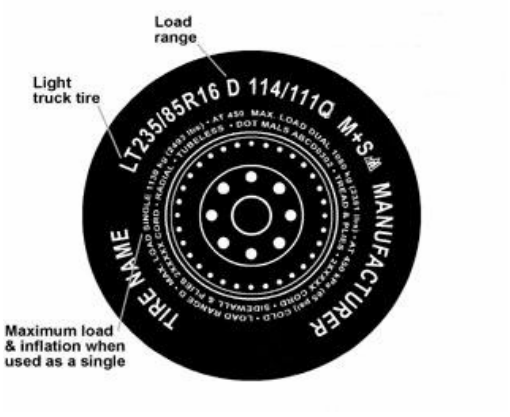


Diagram - Other Markings on Light Trucks



Front Axle

Tire Size (ex. P225/65R15 89H): 215/55R16 97H XL

Manufacturer/Tire Name: Goodyear Eagle LS2

Sidewall Max. Load Rating: 730 kg (1609 lbs)

Max Inflation Pressure: 340 kPa (50 psi)

Sidewall Construction (number of plies and ply material): 2 plies rayon

Tread Construction (number of plies and ply material): 5 plies – 2 rayon, 2 steel, 1 nylon

Rear Axle (if different than front axle)

Tire Size (ex. P225/65R15 89H): _____

Manufacturer/Tire Name: _____

Sidewall Max. Load Rating (kg): _____ Max. Inflation Press (kPa): _____

Sidewall Construction (number of plies and ply material): _____

Tread Construction (number of plies and ply material): _____

Do all installed tires have the same sidewall information?

☑ YES ☐ NO

Are all installed tires the same as designated by the vehicle manufacturer on the Vehicle Placard?

☑ YES ☐ NO

DATA SHEET 1 (Sheet 3 of 3)
TEST PREPARATION

Worksheet for Determining FMVSS No. 138 Telltale Warning Activation Pressure for Tires Installed on Vehicle		
Part	**Front Axle**	**Rear Axle**
(A) Recommended Inflation Pressure x .75	230.0 kPa x .75 = 172.5 kPa	230.0 kPa x .75 = 172.5 kPa
(B) Information from FMVSS 138 Table 1 below, Tire types are: Inflation pressure Minimum activation pressures from Table 1	( ) P-metric-Standard load (X) P-metric-Extra Load Load Range ( ) C, ( ) D, or ( ) E (X) Maximum or ( ) Rated 340 kPa (50 psi) 160 kPa (23 psi)	( ) P-metric-Standard load (X) P-metric-Extra Load Load Range ( ) C, ( ) D, or ( ) E (X) Maximum or ( ) Rated 340 kPa (50 psi) 160 kPa (23 psi)
(C) Telltale Warning Activation Pressure is the higher of Part (A) or (B)	172.5 kPa (25.0 psi)	172.5 kPa (25.0 psi)
(D) Pressure at which to deflate tire(s) = (C) – 7 kPa	165.5 kPa (24.0 psi)	165.5 kPa(24.0 psi)

FMVSS 138 Table 1 - Low Tire Pressure Warning Telltale - Minimum Activation Pressure

Tire Type	**Maximum or Rated Inflation Pressure**		**Minimum Activation Pressure**	
	(kPa)	**(psi)**	**(kPa)**	**(psi)**
P-metric – Standard Load	240, 300, or 350	35, 44, or 51	140 140 140	20 20 20
P-metric – Extra Load	280 or 340	41 or 49	160 160	23 23
Load Range C	350	51	200	29
Load Range D	450	65	240	35
Load Range E	550	80	240	35

REMARKS: None

RECORDED BY: David K. Banks DATE: April 24, 2006

APPROVED BY: Kenneth H. Yates

DATA SHEET 2 (Sheet 1 of 2)

LOW TIRE PRESSURE WARNING AND MALFUNCTION TELLTALE

TEST DATE: April 25, 2006 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C65804

TPMS Low Tire Pressure Warning Telltale

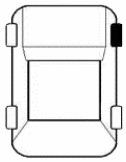
TPMS Low Tire Pressure Warning Telltale Location: Right side of tachometer, left side of instrument cluster

Telltale is mounted inside the occupant compartment in front of and in clear view of the driver?

☑ YES ☐ NO (fail)

Telltale is part of a reconfigurable display? ☐ YES ☑ NO

Identify Telltale Symbol Used (check box above figure).

[X]	[ ]	[ ]
		OTHER (fail) (describe below)

Note any words or additional symbols used.

Reconfigurable display provides additional low inflation pressure warnings to driver.

TPMS Malfunction Telltale

( ) None ( ) Dedicated stand-alone (X) Combined with low tire pressure telltale

DATA SHEET 2 (Sheet 2 of 2)
LOW TIRE PRESSURE WARNING AND MALFUNCTION TELLTALE

Check Telltale Lamp Functions:

LOW TIRE PRESSURE TELLTALE AND MALFUNCTION INDICATION, IF COMBINED

Identify position of ignition locking system when telltale illuminates.

☐ OFF/LOCK ☐ Between OFF/LOCK and ON/RUN

☒ ON/RUN ☐ Between ON/RUN and START

Is the telltale yellow in color? ☑ YES ☐ NO (fail)

Time telltale remains illuminated 1.65 seconds

Starter Interlocks:

Does vehicle have any starter, transmission or other interlocks that affect operation of the telltale lamp check function? ☐ YES ☑ NO

TEST RESULTS

Low Tire Pressure Warning Telltale (PASS/FAIL) **PASS**

REMARKS: None

RECORDED BY: David K. Banks DATE: April 25, 2006

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 1 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation

TEST DATE: April 25, 2006 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C65804

Time: Start: 8:00 am

Ambient Temperature: Start: 17.3°C (63.1°F)

Odometer Reading (km): Start: 107.8 km (67.0 mi)

Fuel Level: Start: Full

Outside Road Surface Temp: Start: 26.8°C (80.2°F)

Time vehicle has remained with engine off and tires shielded from direct sunlight (1 hour minimum): 12 hours (indoors, overnight)

PRE-TEST TIRE INFLATION PRESSURES AND TIRE TEMPERATURES:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
Pre-test cold measurements after ambient soak: Inflation Pressure	230.0 kPa (33.4 psi)	230.1 kPa (33.4 psi)	230.1 kPa (33.4 psi)	230.0 kPa (33.4 psi)
Tire Sidewall Temp	20.6°C (69.1°F)	19.8°C (67.6°F)	21.2°C (70.2°F)	20.6°C (69.1°F)
San Angelo Test Facility Shop Floor Temp	23.2°C (73.8°F)	23.0°C (73.4°F)	24.0°C (75.2°F)	24.4°C (75.9°F)
Adjusted pre-test inflation pressure to recommended cold pressure	230.0 kPa (33.4 psi)	230.1 kPa (33.4 psi)	230.1 kPa (33.4 psi)	230.0 kPa (33.4 psi)

DATA SHEET 3 (Sheet 2 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation

VEHICLE WEIGHT:

Vehicle Ratings from Certification Label:

GVWR: 2,040 kg (4,498 lbs) GAWR (front): 1,100 kg (2,426 lbs) GAWR (rear): 990 kg (2,183 lbs)

Vehicle Capacity Weight from Placard:

Vehicle Capacity Weight 440 kg (975 lbs)

Measured Unloaded Vehicle Weight:

LF	460 kg (1,015 lbs)	LR	318 kg (701 lbs)
RF	457 kg (1,008 lbs)	RR	318 kg (702 lbs)
Front Axle	917 kg (2,023lbs)	Rear Axle	636 kg (1,403 lbs)

Total Vehicle 1,553 kg (3,426 lbs)

Measured Test Weight: **( ) LLVW (+50, -0 kg) ( ) GVWR (+0, -50 kg) (X) UVW+VCW**

LF	528 kg (1,165 lbs)	LR	420 kg (925 lbs)
RF	513 kg (1,131 lbs)	RR	412 kg (908 lbs)
Front Axle	1,041 kg (2,296 lbs) (≤ GAWR)	Rear Axle	832 kg (1,833 lbs) (≤ GAWR)

Total Vehicle 1,873 kg (4,129 lbs) (not greater than UVW + VCW)

Note: This Total Vehicle Weight measures the vehicle loaded to 320 kg (703 lbs), which is 121 kg (272 lbs) less than the Vehicle Capacity Weight listed on the vehicle placard.

DATA SHEET 3 (Sheet 3 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation

TIRE INFLATION PRESSURES AND TIRE TEMPERATURES BEFORE CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
After loading vehicle for performance test and positioning vehicle at selected test start point, after vehicle cool down period. Ambient Temperature: 17.8°C (64.04°F) Vehicle cool down period: 60 minutes				
Re-adjusted Inflation Pressure	230.0 kPa (33.4 psi)	230.1 kPa (33.4 psi)	230.1 kPa (33.4 psi)	230.0 kPa (33.4 psi)
Tire Sidewall Temp	19.6°C (67.3°F)	19.4°C (66.9°F)	20.6°C (69.1°F)	20.2°C (68.4°F)
San Angelo Test Facility Shop Floor Temp	23.0°C (73.4°F)	23.2°C (73.8°F)	23.4°C (74.1°F)	23.6°C (74.5°F)

SYSTEM CALIBRATION/LEARNING PHASE:
(V-Box time - see Section 6 test plots)

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: south
Cumulative vehicle driving time (10 – 15 minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied.

9:56 minutes (stopwatch time) 14.5 km (9.0 mi) distance

Driving in opposite direction:

Starting point: Brodnax Road / Highway 87 Direction: north
Cumulative vehicle driving time (5 – 10minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied.

10:48 minutes (stopwatch time) 14.5 km (9.0 mi) distance

Max speed: 91.3 km/hr (56.7 mph)

Total Driving Time: 20:43 minutes (V-Box time – see test plots)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
Immediately, after vehicle is stopped, engine off; Inflation Pressure	244.5 kPa (35.5 psi)	248.3 kPa (36.0 psi)	244.6 kPa (35.5 psi)	244.7 kPa (35.5 psi)
Tire Sidewall Temp	30.0°C (86.0°F)	27.6°C (81.7°F)	30.9°C (87.6°F)	27.4°C (81.3°F)
San Angelo Test Facility Shop Floor Temp	23.6°C (74.5°F)	23.6°C (74.5°F)	24.2°C (75.6°F)	24.4°C (75.9°F)

DATA SHEET 3 (Sheet 4 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURE OF DEFLATED TIRE:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
Indicate Location of Tire(s) Deflated: ( )LF ( )LR ( )RF (X)RR Inflation Pressure	244.5 kPa (35.5 psi)	248.3 kPa (36.0 psi)	244.6 kPa (35.5 psi)	166.0 kPa (24.1 psi)

TELLTALE ILLUMINATION:

Did the telltale illuminate? ☑ YES ☐ NO

Instant illumination. No driving was required. 0 distance

TELLTALE ILLUMINATES WITHIN 20 MINUTES: ☑ YES ☐ NO (fail)

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
☐ YES ☑ NO

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? ☑ YES ☐ NO (fail)

DATA SHEET 3 (Sheet 5 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO A – Right Rear Tire Deflation

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? ☑ YES ☐ NO (fail)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
After vehicle cool down period: Ambient Temperature: 19.3°C (66.7°F) Vehicle cool down period: 124 minutes				
Inflation Pressure	231.4 kPa (33.6 psi)	232.9 kPa (33.8 psi)	232.1 kPa (33.7 psi)	156.9 kPa (22.8 psi)
Tire Sidewall Temp	22.4°C (72.3°F)	22.4°C (72.3°F)	22.4°C (72.3°F)	23.0°C (73.4°F)
San Angelo Test Facility Shop Floor Temp	23.8°C (74.8°F)	24.2°C (75.6°F)	23.6°C (74.5°F)	24.0°C (75.2°F)

After the cool down period of approximately one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? ☑ YES ☐ NO (fail)

TELLTALE EXTINGUISHMENT:

RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
After cool down period; Re-adjusted Inflation Pressure:	230.0 kPa (33.4 psi)	230.0 kPa (33.4 psi)	230.0 kPa (33.4 psi)	230.0 kPa (33.4 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ☐ YES ☑ NO

TEST RESULTS

TPMS Performance Test Results (PASS/FAIL) **PASS**
Right rear tire was deflated.

REMARKS: None

RECORDED BY: David K. Banks DATE: April 25, 2006

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 6 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO B – Left Front, Right Front Tire Deflation

TEST DATE: April 25, 2006 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C65804

Time:	Start:	1:37 pm
Ambient Temperature:	Start:	19.3°C (66.7°F)
Odometer Reading (km):	Start:	137 km (85 mi)
Fuel Level:	Start:	Full
Outside Road Surface Temp:	Start:	27.8°C (82.0°F)

Time vehicle has remained with engine off and tires shielded from direct sunlight (1 hour minimum): 2 hours, 39 minutes (in test facility shop, garage door open)

Note: See Data Sheet 3 (Sheet 2 of 11) for Test Weight. See Data Sheet 3 (Sheet 5 of 11) for Tire Inflation Pressures and Temperatures before Calibration Phase (Re-Adjusted Tire Inflation Pressures).

SYSTEM CALIBRATION/LEARNING PHASE:
(V-Box time - see Section 6 test plots)

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: south
Cumulative vehicle driving time (10 – 15 minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied.

9:45 minutes (stopwatch time) 14.5 km (9.0 mi) distance

Driving in opposite direction:

Starting point: Brodnax Road / Highway 87 Direction: north
Cumulative vehicle driving time (5 – 10minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied

10:47 minutes (stopwatch time) 14.5 km (9.0 mi) distance

Max speed: 86.6 km/hr (53.8 mph)

Total Driving Time: 20:58 minutes (V-Box time – see test plots)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
Immediately, after vehicle is stopped, engine off; Inflation Pressure	240.5 kPa (34.9 psi)	245.1 kPa (35.5 psi)	242.0 kPa (35.1 psi)	243.1 kPa (35.3 psi)
Tire Sidewall Temp	28.5°C (83.3°F)	26.8°C (80.2°F)	27.0°C (80.6°F)	29.9°C (85.8°F)
San Angelo Test Facility Shop Floor Temp	23.4°C (74.1°F)	23.6°C (74.5°F)	23.8°C (74.8°F)	23.6°C (74.5°F)

DATA SHEET 3 (Sheet 7 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO B – Left Front, Right Front Tire Deflation

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURES OF DEFLATED TIRES:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
Indicate Location of Tire(s) Deflated: (X)LF ( )LR (X)RF ( )RR Inflation Pressure	166.0 kPa (24.1 psi)	245.1 kPa (35.5 psi)	166.1 kPa (24.1 psi)	243.1 kPa (35.3 psi)

TELLTALE ILLUMINATION:

Did the telltale illuminate? ☑ YES ☐ NO

Instant illumination. No driving was required. 0 distance

TELLTALE ILLUMINATES WITHIN 20 MINUTES: ☑ YES ☐ NO (fail)

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
☐ YES ☑ NO

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? ☑ YES ☐ NO (fail)

DATA SHEET 3 (Sheet 8 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO B – Left Front, Right Front Tire Deflation

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? ☑ YES ☐ NO (fail)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
After vehicle cool down period: Ambient Temperature: 18.6°C (65.5°F)	Vehicle cool down period: 64 minutes			
Inflation Pressure	158.5 kPa (23.0 psi)	230.6 kPa (33.4 psi)	158.7 kPa (23.0 psi)	228.5 kPa (33.1 psi)
Tire Sidewall Temp	22.6°C (72.7°F)	22.6°C (72.7°F)	21.5°C (70.7°F)	21.6°C (70.9°F)
San Angelo Test Facility Shop Floor Temp	22.8°C (73.0°F)	23.4°C (74.1°F)	22.6°C (72.7°F)	23.2°C (73.8°F)

After the cool down period of approximately one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? ☑ YES ☐ NO (fail)

TELLTALE EXTINGUISHMENT:

RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
After cool down period; Re-adjusted Inflation Pressure:	230.4 kPa (33.4 psi)	230.6 kPa (33.4 psi)	230.2 kPa (33.4 psi)	230.3 kPa (33.4 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ☐ YES ☑ NO

TEST RESULTS

TPMS Performance Test Results (PASS/FAIL) **PASS**
Left front and right front tires were deflated.

REMARKS: None

RECORDED BY: David K. Banks DATE: April 25, 2006

APPROVED BY: Kenneth H. Yates

DATA SHEET 3 (Sheet 9 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Front, Left Rear, Right Front, Right Rear Tire Deflation

TEST DATE: April 26, 2006 LAB: U. S. DOT San Angelo Test Facility

VEHICLE NHTSA NUMBER: C65804

Time:	Start:	8:31 am
Ambient Temperature:	Start:	14.6°C (58.3°F)
Odometer Reading (km):	Start:	166 km (103 mi)
Fuel Level:	Start:	Full
Outside Road Surface Temp:	Start:	19.4°C (66.9°F)

Time vehicle has remained with engine off and tires shielded from direct sunlight (1 hour minimum): 18 hours, 21 minutes (indoors, overnight)

Note: See Data Sheet 3 (Sheet 2 of 11) for Test Weight.

SYSTEM CALIBRATION/LEARNING PHASE:
(V-Box time - see Section 6 test plots)

Driving in first direction:

Starting point: San Angelo Test Facility shop Direction: south
Cumulative vehicle driving time (10 – 15 minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied.

9:47 minutes (stopwatch time) 14.5 km (9.0 mi) distance

Driving in opposite direction:

Starting point: Brodnax Road / Highway 87 Direction: north
Cumulative vehicle driving time (5 – 10minutes) at a vehicle speed of 75± 25 km/h excluding time periods when brake pedal is applied

10:30 minutes (stopwatch time) 14.5 km (9.0 mi) distance

Max speed: 85.4 km/hr (53.1 mph)

Total Driving Time: 20:30 minutes (V-Box time – see test plots)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER CALIBRATION PHASE:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
Immediately, after vehicle is stopped, engine off; Inflation Pressure	244.2 kPa (35.4 psi)	245.9 kPa (35.7 psi)	243.3 kPa (35.3 psi)	245.3 kPa (35.6 psi)
Tire Sidewall Temp	24.0°C (75.2°F)	24.4°C (75.9°F)	27.4°C (81.3°F)	24.2°C (75.6°F)
San Angelo Test Facility Shop Floor Temp	21.4°C (70.5°F)	21.6°C (70.9°F)	22.0°C (71.6°F)	21.6°C (70.9°F)

DATA SHEET 3 (Sheet 10 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Front, Left Rear, Right Front, Right Rear Tire Deflation

SYSTEM DETECTION PHASE:

LOCATION AND PRESSURES OF DEFLATED TIRES:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
Indicate Location of Tire(s) Deflated: (X)LF (X)LR (X)RF (X)RR Inflation Pressure	166.0 kPa (24.1 psi)	166.4 kPa (24.1 psi)	166.2 kPa (24.1 psi)	166.0 kPa (24.1 psi)

TELLTALE ILLUMINATION:

Did the telltale illuminate? ☑ YES ☐ NO

Instant illumination. No driving was required. 0 distance

TELLTALE ILLUMINATES WITHIN 20 MINUTES: ☑ YES ☐ NO (fail)

Does the vehicle have a telltale that identifies which tire(s) is (are) under-inflated?
☐ YES ☑ NO

After 5 minutes with the ignition locking system in the “Off” or “Lock” position, does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the “On” or “Run” position? ☑ YES ☐ NO (fail)

DATA SHEET 3 (Sheet 11 of 11)
TPMS OPERATIONAL PERFORMANCE

SCENARIO C – Left Front, Left Rear, Right Front, Right Rear Tire Deflation

Deactivate the ignition locking system and then re-start the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? ☑ YES ☐ NO (fail)

TIRE INFLATION PRESSURES AND TEMPERATURES AFTER TELLTALE ILLUMINATION:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
After vehicle cool down period: Ambient Temperature: 16.3°C (61.3°F) Vehicle cool down period: 76 minutes				
Inflation Pressure	160.3 kPa (23.2 psi)	156.0 kPa (22.6 psi)	160.7 kPa (23.3 psi)	158.4 kPa (23.0 psi)
Tire Sidewall Temp	20.0°C (68.0°F)	19.2°C (66.6°F)	20.2°C (68.4°F)	19.6°C (67.3°F)
San Angelo Test Facility Shop Floor Temp	20.8°C (69.4°F)	20.0°C (68.0°F)	20.8°C (69.4°F)	20.4°C (68.7°F)

After the cool down period of approximately one hour, restart the vehicle engine. Does the telltale re-illuminate and stay illuminated when the ignition locking system is activated to the "On" or "Run" position? ☑ YES ☐ NO (fail)

TELLTALE EXTINGUISHMENT:

RE-ADJUSTED TIRE INFLATION PRESSURES:

Execution Procedure	LF Tire	LR Tire	RF Tire	RR Tire
After cool down period; Re-adjusted Inflation Pressure:	230.3 kPa (33.4 psi)	230.1 kPa (33.4 psi)	230.0 kPa (33.4 psi)	230.0 kPa (33.4 psi)

Is it necessary to drive the vehicle to extinguish the telltale? ☐ YES ☑ NO

TEST RESULTS

TPMS Performance Test Results (PASS/FAIL) **PASS**

Left front, left rear, right front, and right rear tires were deflated.

REMARKS: None

RECORDED BY: David K. Banks DATE: April 26, 2006

APPROVED BY: Kenneth H. Yates

DATA SHEET 4 (Sheet 1 of 1)
MALFUNCTION DETECTION TEST

Malfunction detection tests were not attempted. The FMVSS 138 malfunction performance requirements do not become effective until September 1, 2007.

DATA SHEET 5 (Sheet 1 of 2)
TPMS WRITTEN INSTRUCTIONS

TEST DATE: April 26, 2006 LAB: San Angelo Test Facility VEHICLE NHTSA NO: C65804

Does the Owner's Manual provide an image of the Low Tire Pressure Warning Telltale symbol (and an image of the TPMS Malfunction Telltale warning ("TPMS"), if a dedicated telltale is utilized for this function)? ☑ YES ☐ NO

The following statement, in the English language, is provided verbatim in the Owner's Manual. ☐ YES ☑ NO

"Each tire, including the spare (if provided), should be checked monthly when cold and inflated to the inflation pressure recommended by the vehicle manufacturer on the vehicle placard or tire inflation pressure label. (If your vehicle has tires of a different size than the size indicated on the vehicle placard or tire inflation pressure label, you should determine the proper tire inflation pressure for those tires.)

"As an added safety feature, your vehicle has been equipped with a tire pressure monitoring system (TPMS) that illuminates a low tire pressure telltale when one or more of your tires is significantly under-inflated. Accordingly, when the low tire pressure telltale illuminates, you should stop and check your tires as soon as possible, and inflate them to the proper pressure. Driving on a significantly under-inflated tire causes the tire to overheat and can lead to tire failure. Under-inflation also reduces fuel efficiency and tire tread life, and may affect the vehicle's handling and stopping ability.

"Please note that the TPMS is not a substitute for proper tire maintenance, and it is the driver's responsibility to maintain correct tire pressure, even if under-inflation has not reached the level to trigger illumination of the TPMS low tire pressure telltale.

REMARKS: The FMVSS 138 requirements for TPMS written instructions were not effective until September 1, 2006, therefore this vehicle was not subjected to these requirements. For first sentence of the second required paragraph, VW owner's manual is missing the text "As an added safety feature, your vehicle is equipped with a tire pressure monitoring system (TPMS)." The manual is also missing the third required paragraph.

DATA SHEET 5 (Sheet 2 of 2)
TPMS WRITTEN INSTRUCTIONS

The following statement, in the English language, is provided verbatim in the Owner's Manual. ☐ YES ☑ NO

[*The following paragraph is required for all vehicles certified to the standard starting on September 1, 2007 and for vehicles voluntarily equipped with a compliant TPMS MIL before that time.*] "Your vehicle has also been equipped with a TPMS malfunction indicator to indicate when the system is not operating properly. [*For vehicles with a dedicated MIL telltale, add the following statement:* The TPMS malfunction indicator is provided by a separate telltale, which displays the symbol "TPMS" when illuminated.] [*For vehicles with a combined low tire pressure/MIL telltale, add the following statement:* The TPMS malfunction indicator is combined with the low tire pressure telltale. When the system detects a malfunction, the telltale will flash for approximately one minute and then remain continuously illuminated. This sequence will continue upon subsequent vehicle start-ups as long as the malfunction exists.] When the malfunction indicator is illuminated, the system may not be able to detect or signal low tire pressure as intended. TPMS malfunctions may occur for a variety of reasons, including the installation of replacement or alternate tires or wheels on the vehicle that prevent the TPMS from functioning properly. Always check the TPMS malfunction telltale after replacing one or more tires or wheels on your vehicle to ensure that the replacement or alternate tires and wheels allow the TPMS to continue to function properly."

DATA INDICATES COMPLIANCE: PASS/FAIL PASS/FAIL: N/A

Does the Owner's Manual include the following (allowable) information?

☑ Significance of the low tire pressure warning telltale illuminating

☑ A description of corrective action to be undertaken

☑ Whether the tire pressure monitoring system functions with the vehicle's spare tire (if provided)

☐ How to use a reset button, if one is provided

☐ The time for the TPMS telltale(s) to extinguish once the low tire pressure condition or the malfunction is corrected

REMARKS: The FMVSS 138 malfunction performance requirements do not become effective until September 1, 2007. Because the test vehicle is equipped with a malfunction capability that would not correctly meet the future requirements, the owner's manual statements are not required to exactly match those above.

RECORDED BY: R.N. Gregg DATE: April 25, 2006

APPROVED BY: Kenneth H. Yates

SECTION 4

INSTRUMENTATION AND EQUIPMENT LIST

TABLE 1 - INSTRUMENTATION & EQUIPMENT LIST

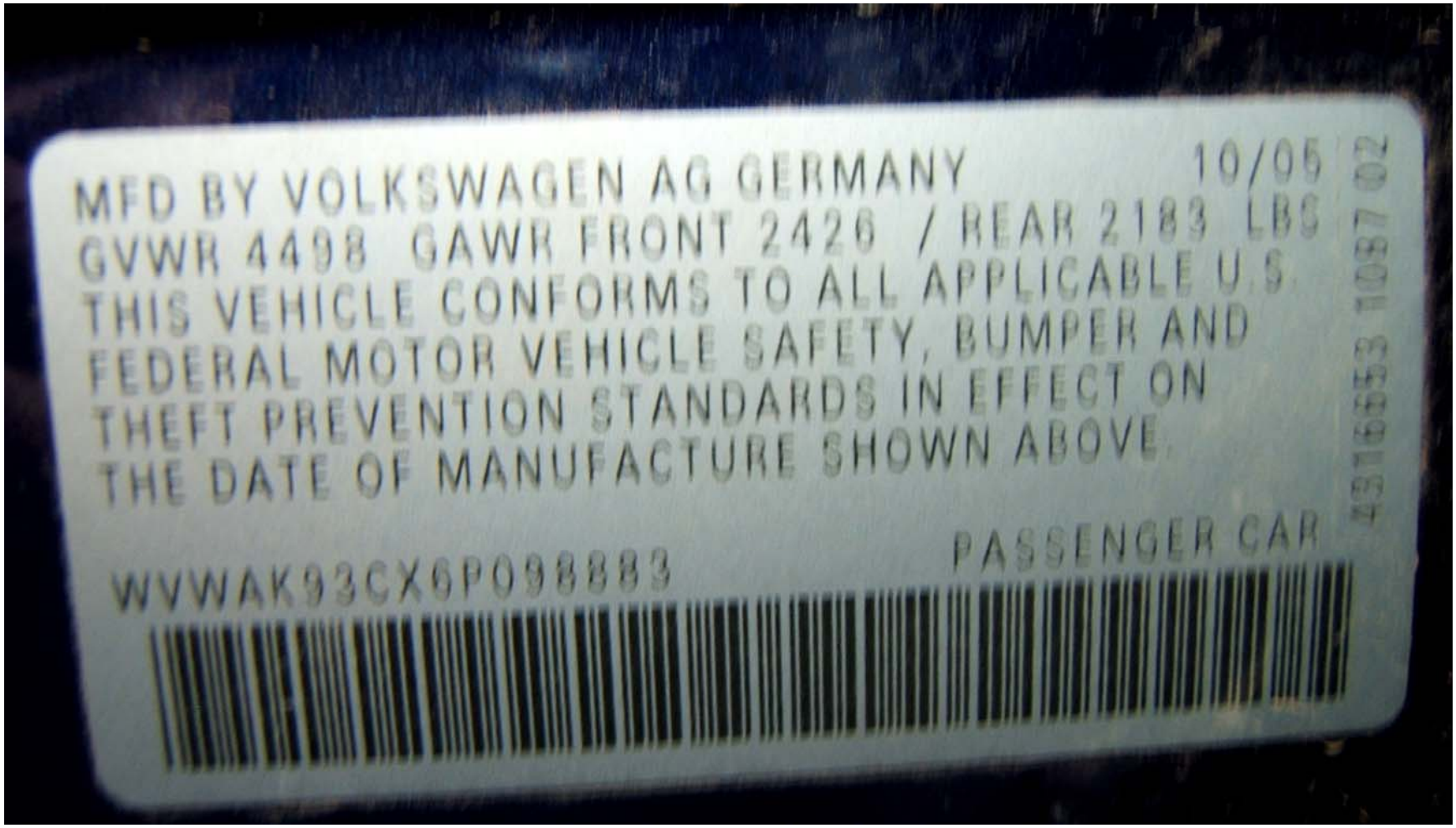
EQUIPMENT	**DESCRIPTION**	**MODEL/ SERIAL NO**	**CAL. DATE**	**NEXT CAL. DATE**
STOPWATCH	WESTCLOX QUARTZ STOPWATCH	NONE	N/A	
V-BOX RECORDING DEVICE	RACELOGIC V-BOX III	SERIAL #030209	2/23/2006	2/23/2007
TEMPERATURE GAUGE, AMBIENT	FLUKE 50D K/J THERMOMETER	SERIAL #80840101	7/7/2005	7/7/2006
TEMPERATURE GAUGE (LASER) - TIRES AND GROUND	RAYNGER ST20 PRO NON-CONTACT INFRARED THERMOMETER	SERIAL #2065640101-0014	9/14/2005	9/14/2006
AIR PRESSURE GAUGE	ASHCROFT GENERAL PURPOSE DIGITAL GAUGE	25C1005 PS02L100-B1 SERIAL #1003098	12/15/2005	12/15/2006
FLOOR SCALES (VEHICLE)	INTERCOMP SW DELUXE SCALES	SERIAL #27032382 PART #100156	9/13/2005	9/13/2006
ASHCROFT MASTER PRESSURE GAUGE	ASHCROFT (KILOPASCALS)	1082/40584	11/2/2005	11/2/2006

SECTION 5

PHOTOGRAPHS

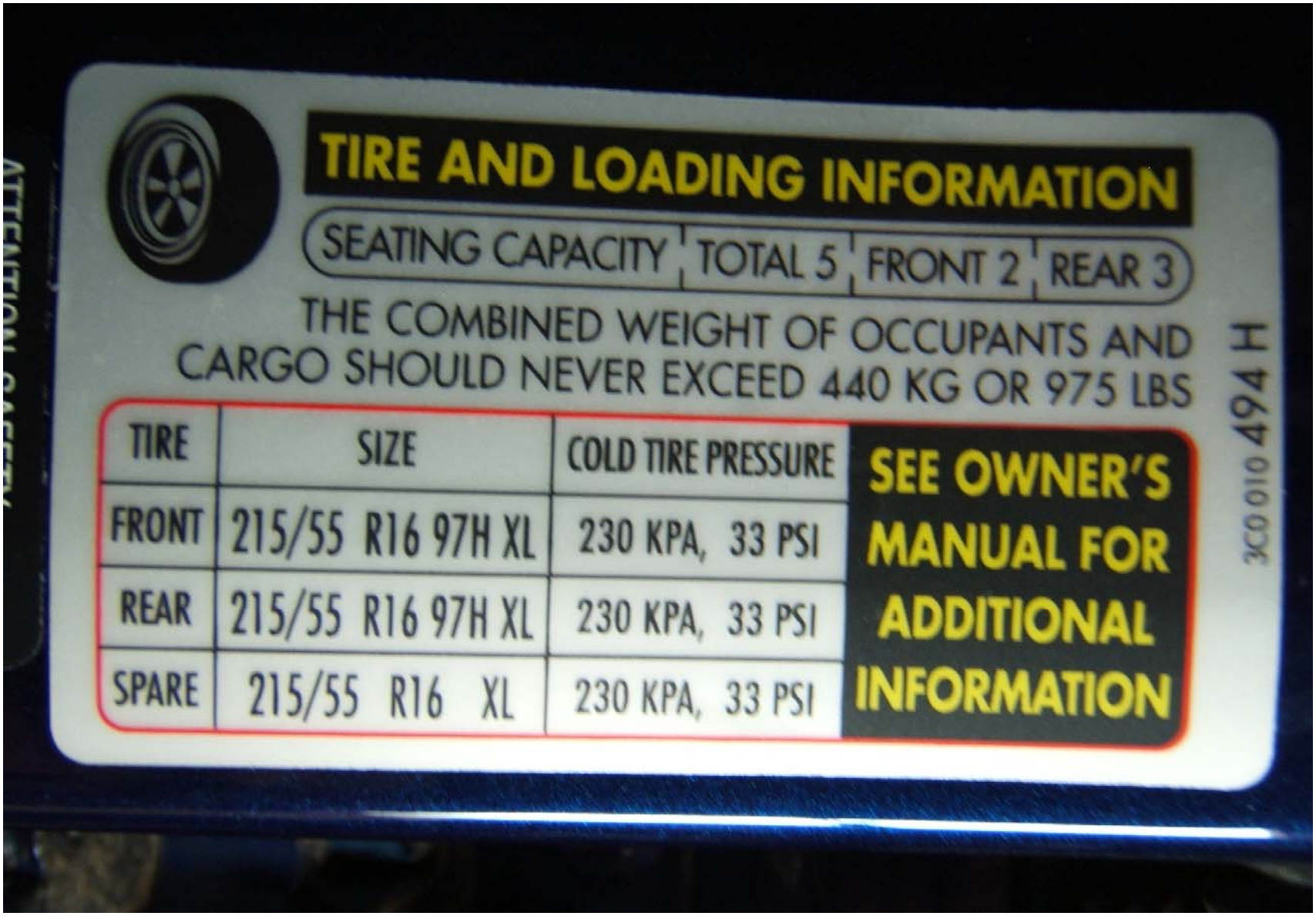
2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.1
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE



2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.2
VEHICLE CERTIFICATION LABEL



2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.3
VEHICLE PLACARD

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.4
TIRE SHOWING BRAND

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.5
TIRE SHOWING MODEL

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.6
TIRE SHOWING SIZE

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.7
TIRE SHOWING SERIAL NUMBER

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.8
TIRE SHOWING MAX LOAD RATING

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.9
TIRE SHOWING MAX COLD INFLATION PRESSURE

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.10
TIRE SHOWING SIDEWALL/TREAD CONSTRUCTION

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.11
RIM SHOWING VALVE STEM

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.12
INSTRUMENT PANEL SHOWING COMBINATION LOW TIRE PRESSURE WARNING AND MALFUNCTION TELLTALE WITH RE-CONFIGURABLE DISPLAY

2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.13
TEST INSTRUMENTATION MOUNTED ON VEHICLE

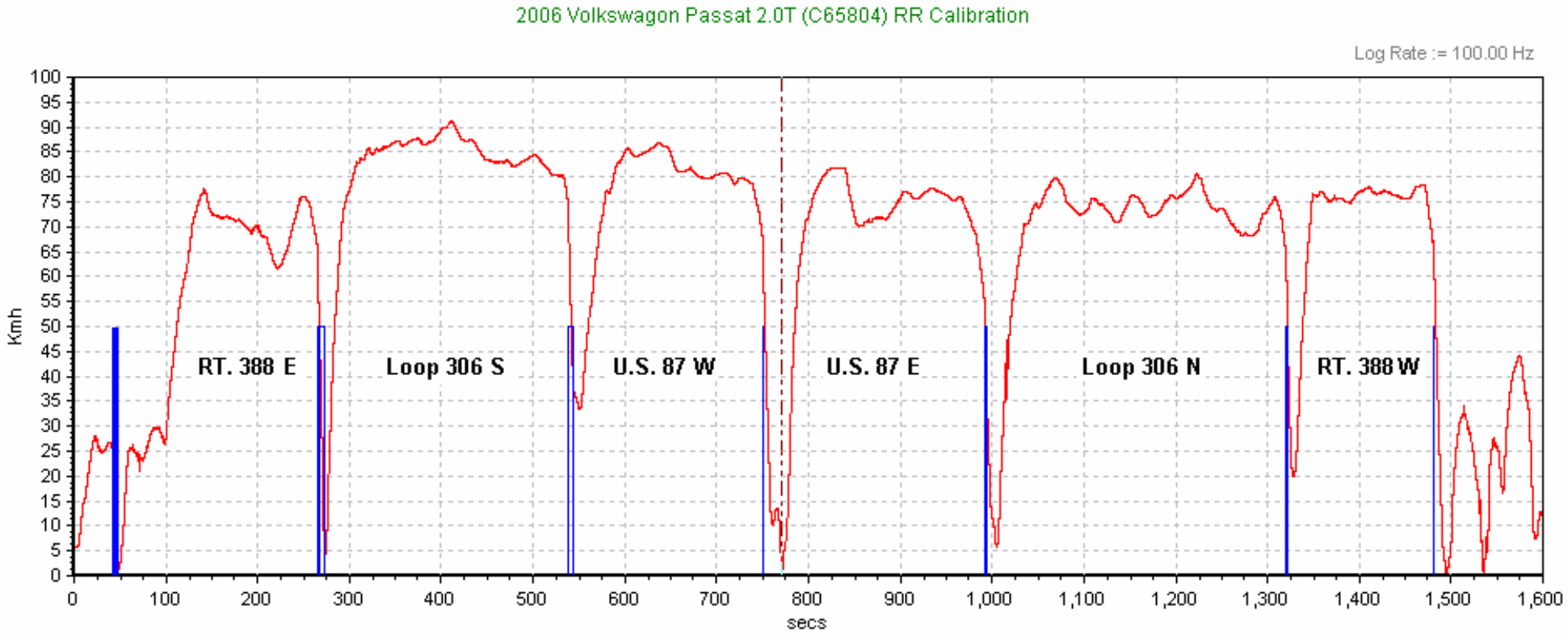
2006 VOLKSWAGEN PASSAT 2.0T
NHTSA NO. C65804
FMVSS NO. 138

FIGURE 5.14
VEHICLE ON WEIGHT SCALES

SECTION 6
TEST PLOTS

Scenario A:	Right Rear Tire
Test Date:	4/25/06
Data File Time:	26:41 minutes
Cumulative Driving Time:	20:43 minutes
Start Point:	San Angelo Test Facility shop

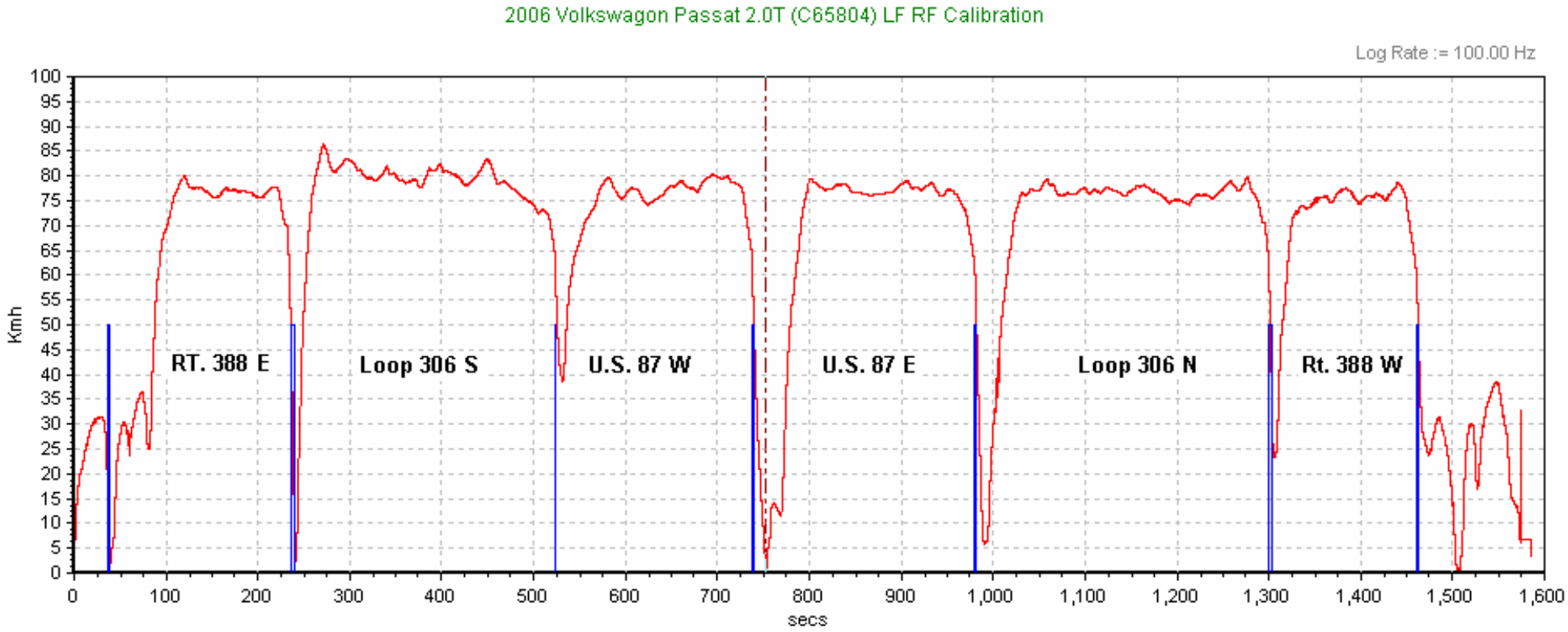
Calibration Phase



RR Detection Phase: Telltale illuminated upon vehicle start-up. Driving was not necessary.

Scenario B: Left Front, Right Front Tires
Test Date: 4/25/06
Data File Time: 26:23 minutes
Cumulative Driving Time: 20:58 minutes
Start Point: San Angelo Test Facility shop

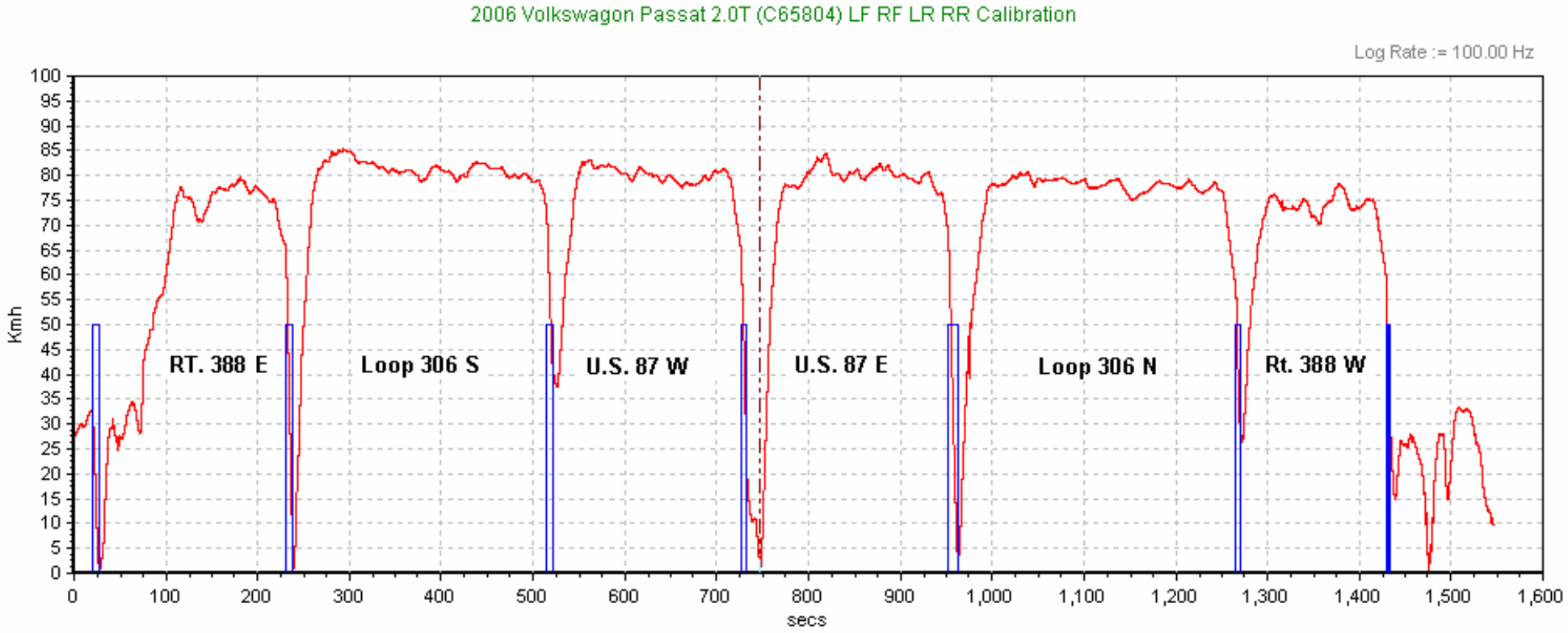
Calibration Phase



LF, RF Detection Phase: Telltale illuminated upon vehicle start-up. Driving was not necessary.

Scenario C: Left Front, Right Front, Left Rear, Right Rear Tires
Test Date: 4/26/06
Data File Time: 25:45 minutes
Cumulative Driving Time: 20:30 minutes
Start Point: San Angelo Test Facility shop

Calibration Phase



LF, RF, LR, RR Detection Phase: Telltale illuminated upon vehicle start-up. Driving was not necessary.