Case Number: S1117000002 Rev A

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Discussion: Air Suspension System Diagnosis

WK Air Suspension System Diagnostic Procedure

1. When a vehicle comes in with an Air Suspension Issue
If a vehicle comes in due to an air suspension issue perform the following tests:
Generate a vehicle scan-log with environmental conditions using WiTech
Perform the system Air Mass routine to get the amount of air in the system.
Verify that all sensor linkages are properly orientated and connected.
Verify that there are no other disabling conditions present (like no power to the ECU Fuse M2, or no power to the compressor 40-Amp Fuse J1).
Read out the DTCs – but do not start diagnosing based on these DTCs at this point. Gather all this information prior to fixing the vehicle as this will provide a complete picture of what the issue is.

1.1 Generate vehicle scan-log with environmental conditions
Switch units over to metric before doing so. This will provide finer resolution of the ride height sensor readings.

1.2 Check the System Air Mass
Run the Air Mass routine to get the system air mass. The acceptable amount of air is between 165 and 221 Bar-Liters (2392.5 to 3204.5 psi-liters). Anything below 165 Bar-Liters indicates that there is a leak in the system or the on-board air makeup system

(compressor & intake hose) is not functioning properly.

1.3 Inspect all ride height sensors and linkages for proper installation and orientation. The front sensor linkages can only be installed the proper way. However the rear sensor linkages can be placed in two possible orientations. Proper installation is as follows: looking from the rear of the vehicle the sensor arm and linkage will be orientated so that the “elbow” point towards the outboard side of the vehicle.

1.4 Verify that there are no other conditions which can disable the system
The following are conditions which disables the air suspension system:
System voltage out of normal range (normal operating voltage 9 to 16 voltages).
A door or the liftgate is open. The system will not lower if any of the doors or liftgate is open (normal operation). Doors and liftgate status are ignored when in the diagnostic in-plant mode.

The 40 Amp air compressor fuse is blown (J1) – If it is blown the system cannot re-level. A blown fuse can indicate a restriction in the system (partially pinched air-line) or that there is a leak in the system which requires additional running of the compressor to compensate. It can also indicate a failed air compressor.

ASCM 20 amp fuse is blown (M2) – If this is blown this test will not work as the ASCM will have no power to operate.

Battery voltage is too low (below 7 volts) – below this voltage the ASCM cannot operate. Either start the vehicle or put a charger on the vehicle to bring the voltage between 11.5 and 15 volts.

IOD fuse is out (UP) – The air suspension system has restricted functionality when the IOD is out and odometer is less than 60 miles. Verify that it is pushed down all the way.

One Ride Height Sensor Linkage not connected – The air suspension system will stop moving the vehicle if it detects at least one sensor reading being stuck.

1.5 Read out the DTCs from the ASCM
Fix all active electrical circuit faults before running any routines as most will not work if the system is not electrically intact.
Electrical faults refer to such conditions as open circuits, short to ground, or short to battery. In addition repair all CAN communication faults (such as “loss of communication” with module X, or implausible data received from module X.
Overuse faults are not considered electrical faults (ie compressor over-temperature, valves on too long). These faults indicate a problem with the pneumatic part of the system.
Possible causes:
an air leak in a line or the air-spring itself
a pinched air-line, or pinched air compressor intake hose On board air make-up not functioning

The overuse faults are:
C155E-92 – Ambience Valve on too long
C1562-92 - Compressor on too long
C1562-98 – Compressor over-temperature
C1566-92 – Left Rear air-spring valve on too long C1567-92 - Right Rear air-spring valve on too long C1568-92 – Left Front air-spring valve on too long C1569-92 – Right Front air-spring valve on too long C159F-92 – Compressor Reverse Valve 1 on too long
C15A0-92 – Compressor Reverse Valve 2 on too long C15C0-98 – Component or System over temperature
The setting of any of these faults will immediately stop vehicle leveling and cause the following fault to set: C15A1-00 - Unable to achieve desired ride height. The service manual’s definition for each of the above DTCs is correct (what it is,

Contact STAR Center, or your Technical Assistance Center Via TechCONNECT or eCONTACT ticket if no solution is found

how it sets) however do not use the diagnostic procedures, they are not correct. The updated service diagnostics for these DTCs will refer back to this section instead.

2. Defective Conditions

Look up the defect condition on Table-1 and follow the corrective action procedures to repair (Last page)

3. Corrective Action Procedures

3.1 On-Board Air Makeup Test Procedure

A properly functioning system will make up for small leaks. This is normal. The system does so as follows:

Air mass is measured by the ASCM. If it is low then the compressor is turned on to pull in outside air through a drier and into the reservoir. It does so at a rate of 10 liters every 2 minutes. Then right after that 5 liters of air are released back through the drier and out through the exhaust hose. This is done to regenerate the drier. Air mass makeup only occurs while in the normal operation mode (out of In-Plant mode).

So when the air mass is low perform the following test:

Read and record the initial air mass value

Inspect the air compressor intake hose. Verify that it is clear and has not kinks in it. Also verify that there is no water present in the hose or the filter.

Start and run the engine

Put the system into normal operation (out of In-Plant mode).

Listen for compressor to run. It should run for at least 15 seconds.

Then the compressor will stop running and you should hear about 7 seconds of air being exhausted. This compressor cycling will continue.

Wait for at least 3 of these cycles to complete then run air mass again.

Air mass should have increased. If it did then place the system back into normal operation and allow the system to refill.

If the compressor never came on at all then go Compressor Diagnostic Test Procedure.

If the air mass decreased then it is either a leak in the reservoir circuit (see Air Leak Procedure) or there is a partial obstruction (crush) in the air line between the compressor and the reservoir. Inspect the air line for this crush. It has typically been located near the B pillar area. Note: Symptom of a partial crush is that the compressor runs for a short time (5 seconds) then it exhausts for much longer (15 seconds).
To test for a partial crush. Turn off the engine. Move the vehicle to its lowest ride height if possible (maximum air in reservoir). Temporarily remove the reservoir air-line at the compressor and listen to the amount of air rushing out (one second of exhausting). Now reconnect it back up. Temporarily remove the air¬line at the reservoir and listen to the amount of air rushing out, If there is a noticeable difference of air rush then there is a restriction in this air-line. Locate and fix the affected air-line.

Note: The compressor over-temp fault can occur during air makeup. This is normal if the system is really low in air mass. When the fault goes stored the system continues to makeup air until it gets into the normal range.

3.2 Compressor Diagnostic Test Procedure

The purpose of this test is to verify that the compressor can run when the ASCM closes its relay. If at any time you hear the air compressor start to come on then this test is considered passed and is complete.
If the vehicle has the proper amount of air-mass then perform the following:
Using WiTECH diagnostically command the vehicle to the next higher level. There will be a short delay then the compressor should begin running and vehicle would move up to the next level. If the compressor does not run then go to the next step.
Check the 40 Amp J1 fuse to see that it is still intact. If it is then pull the compressor relay. Verify that Pin 30 has battery voltage. If it does then temporarily short pin 87 to pin 30 for about 1 second. Use a paperclip and hold it with pliers as 35 amps will be going through it and it will get hot. If you hear the compressor begin to run then this test has been successfully completed. If it does not run then check that power ground circuit to the compressor motor is intact. If it is not then fix the circuit. If it is then replace the compressor.

3.3 Air Leak Test Procedure

The purpose of this test is to identify if there is an air leak present and where it is located. Some leaks are large enough that you can hear them while others are so small that you will have to rely on ride height sensor readings and/or pressure measurements to identify where it is located. Perform this test in a controlled temperature environment as changes in temperature changes the pressure readings

NOTE: Do not use special tool 8404B EELD to diagnosis air leaks.

NOTE: The below process is for 2011 to 2013. 2014 to current- use the automated WiTECH leak routine under ASCM, System Tests

If air mass is low then fill the system with nitrogen until the air mass is in the acceptable range (between 165 and 221 bar-liters).
Using WiTECH change the units to metric and then diagnostically command the vehicle to Off-Road 2. Perform the complete component pressure measurement routine. Record all five pressure readings. Place the vehicle into In-Plant mode. Read out and record all four ride height sensor readings.
Now remove WiTECH, turn off the ignition and let the vehicle sit for at least a couple of hours.
Turn on the ignition, connect up WiTECH and read out the ride height sensor values. Compare these readings to the original. A sensor reading decrease of more than 5 millimeters relative to the others will indicate that the corresponding air-spring circuit has a leak in it. This can also be confirmed by retaking the complete component measurements values and comparing them.
Compare the reservoir before and after pressure readings. A decrease in pressure will indicate that there is an air leak in the reservoir circuit.

Note: The reason for putting the vehicle in Off-Road 2 is that some leaks can occur at the base of the air-spring and these can seal when the material folds back on itself when in Off-Road 1 and lower. Placing it in Off-Road 2 fully expands the air-spring such the material is fully expanded.

4. Run the Sensor Ride Height Routine to verify Fix

Once the vehicle is repaired and filled run the sensor ride height routine as a final check. Passing this test verifies compressor functionality, proper air mass, proper sensor orientation, and linkage orientation.

5. Miscellaneous Information

5.1 Placing the system into and out of In-Plant Mode

When running WiTECH routines the ASCM is placed in In-Plant mode. While in this mode the following occurs:

DTC C2212-00 ECU In-Plant Mode is active.

All 4 LEDs on the Up and Down buttons are blinking.

When the ASCM is in this mode normal leveling is disabled. Most of the above procedures require that the ASCM stay in the In-Plant mode. In order to do this the technician will need to select the CANCEL button at the completion of the particular routine rather than CONTINUE button. Pressing CONTINUE button at the end of a routine automatically takes the ASCM out of In-Plant mode and into normal operation. In addition it also clears all DTCs.

5.2 Check for proper airline plumbing

Use the filing and deflating to reservoir routines to individually move an air-spring up and down. Record the ride height sensor values before and after this test to determine which air spring actually moved. The one that moved the most is one that the ECU is controlling. This will check for proper air line connectivity.

5.3 Check for a restriction (kink in an air line)

Restriction in Air Tank circuit – Air-springs will not move up or down (strained movement). The restriction will make the compressor work harder when attempting to move to a different ride height. The compressor's 40-amp fuse typically blows due to the increased current needed to run the compressor in this state. The air-springs will

move down if deflated through the ambience valve. Kink in an airspring line – The affected airspring will not move up or down (strained movement). Use the appropriate actuator routine to check each airspring by individually raising and lowering it.

5.4 Checking the User Interface (Terrain Switch)

The air suspension user interface (terrain switches) can be monitored using WiTECH. Monitor the Up and Down buttons, LED output and the Terrain Switch Knob. Verify that these are functioning properly.

5.5 System Status

The status of the system can be determined by looking at the LEDs and Cluster Messages

At least one LED on – normal operation mode. The LEDs will be on in a stacked arrangement.

All 4 LEDs blinking indicates the ASCM is in the In-plant or Service Mode. When the ASCM is in service mode normal leveling is disabled.

All 4 LEDs off indicate Transport Mode - These vehicles are shipped from the assembly plant to the dealerships in Transport Mode. This is where the vehicle is at the Park Level and the system is disabled so that no leveling is allowed. When in this mode all 4 LEDs are off and the cluster displays “Air Suspension system temporarily disabled for Tire/Jack Mode”. Push in the IOD fuse to get out of this mode. The vehicle will go to the Park mode (Park LED will be ON) and the cluster message will go away.

OR2 and Park LEDs on - indicates the system is in Tire/Jack disable mode

5.6 WiTECH Write Ride Height Calibration Work Around Procedure

1. Place the vehicle on a flat level surface.
2. Verify that the air suspension system has enough air mass.
3. Start the “Write Suspension Height Values Routine” (under Misc Functions Tab). This will clear out original ride height values.
4. Cancel out of this routine when prompted to write the first ride height measurement.

5. Change the units on WiTECH to metric units and monitor the ride height sensor values using Data Display.
6. Individually adjust each corner of the vehicle until all four corners are between -15 mm and +15 mm. The raising of each corner can be done using the Fill Spring From Reservoir routine. The Lowering of each corner can be done using the Deflate Spring To Reservoir routine.
7. Now run the Height Sensor Check Routine (under Misc Functions Tab). This routine will move the vehicle to normal ride height (+/- 7 mm).
8. Determine the vehicle's current ride height by manually measuring each corner (the difference between centerline of wheel to ground minus bolt on the chassis to ground)
9. Now start the "Write Suspension Height Values Routine" once more. Input each of the four measured ride heights when prompted.
10. Complete the process as prompted.

6 Routines
Air Mass Estimation – Measures the amount of air in the system

WiTECH – MEASURING SYSTEM AIRMASS
Complete Component Pressure Measurement – get pressure readings for all 5 components. WiTECH – COMPLETE COMPONENT PRESSURE MEASUREMENT
Ride Height Sensor Routine – checks for proper sensor articulations WiTECH – HEIGHT SENSOR CHECK
Actuating an Air-spring – Can move each air-spring up or down WiTECH – ACTUATOR TEST
Filling an air-spring from the Air Tank WiTECH – AIR FILLING VIA RESERVIOR
Deflating an airspring to the Air Tank
WiTECH – DEFLATING AIRSPRING INTO RESERVIOR
Deflating a Component to Ambience
WiTECH – DEFLATING COMPONENT INTO AMBIENCE

Move the vehicle to a Set Level - Moves the vehicle to any of the defined ride heights.
WiTech – LEVEL TO SET LEVEL
ASCM reinitialization – Used when replacing the ASCM with a used ASCM
This routine allows current VIN to be learned, and at the same time clears all ride height calibrations. WiTECH – ECU REINITIALIZATION

Defect Condition	Possible Cause	Corrective Action
Low Air Mass	On-board air makeup not working properly	Perform On-board air makeup procedure
	Compressor can not run	Perform Compressor diagnostic procedure
	Air Leak is present	Perform Air Leak Procedure
Vehicle does not level	In plant mode	Take out of in plant mode
	Ride height not calibrated	Calibrate vehicle using WiTech workaround procedure
	Compressor does not run	Perform Compressor diagnostic procedure
	Linkage off	Reconnect linkage
Vehicle axle moves up/down by itself in wet driving conditions	Water intrusion into ride height sensor	Look at vehicle scan report to determine which sensor is affected Replace affected sensor - use liquid tap to seal back of connector
Vehicle raises/lowers by itself	Up or Down Button Stuck	Verify by appropriate active DTC, if still active replace Terrain switch
	Defective Compressor valve block	Put in In-Plant mode - move to Park then to OR2
		Command to Normal Ride Height while in the in-plant mode
		Perform Ride Height Sensor routine
		Take out of In-Plant mode - if vehicle immediately raises then change compressor assembly
Cannot calibrate ride height sensors	Low air mass	See Low air mass corrective action
	WiTech routine not working properly	Perform WiTech workaround procedure

TABLE-1: Air Suspension Defects and Corrective Action