Memorandum

To: Jag Tech Guy
Jag Customer Service

From: Mike Green

Date:

Subject: Seatback Cooling is not Functional

Re: Climate Controlled Seat System (CCS)
My 2011 XF (SAJWA0HE1BMR84330)
NP09-XF Body Systems Documentation (BSD)

# Issue:

On two occasions, at different dealerships, I have had the vehicle checked for proper operation of the CCS in the cooling mode. In each case it was reported to me that the system is operating nominally. In fact, in the cooling mode the CCS is not operating as it is intended. I have not examined the cooling mode operation of the driver seat or the passenger seat or passenger seatback. My examination is exclusively of the driver seatback operation.

After much examination, described below, my conclusion is that the cooling mode of the CCS respecting the driver seatback is not providing any noticeable cooling effect. Thus **the system is not operating nominally** which, as provided in the BSD on page 2-32 is “significantly improve the comfort level of the occupants by focusing the cooling directly on the passenger through the seat.” If the cooling is not noticeable it certainly cannot be a significant improvement in comfort.

# My Systematic Analysis:

# I have painstakingly examined the system. Initially I became aware the system was not functioning properly while cooling in seat and seatback mode. With the cooling on, I could sense some cooing in the seat but not any in the seatback. Thinking that there was a single blower, I then set to system to seatback only and there was no noticeable change in seatback cooling. There was no noticeable cooling in the seatback at all.

My assessment of cooling operations has been exclusively in a very low humidity environment. Icing of the thermoelectric device (TED) in the Peltier Cell Modules should not have been a significant factor during my examinations, certainly not an issue which would nearly instantly materialize.

The heating mode operation of the CCS seems to be satisfactory. The BSD suggests that seat heating is provided through the Peltier Cell Modules but these modules may only augment the heating provided by seat heater elements which are evidenced in the diagram on page 2-42 of the BSD.

After further review of documentations provided to me at my last visit for servicing, I have conducted a number of additional assessments. I now understand that the seat and seat back (squab) have separate blower – Peltier cell modules. While my initial assessment by setting to seat back only to enhance cooling was based a improper assumption of a single blower, my thought that this would enhance seat back cooling is correct (later I will discuss this further).

In a variety of environments I have activated the seat back cooling. I have never been able to notice any affect other that a slight indication of some air delivery through the seat back.

Most recently in a very careful environment I have twice done the following:

1. Establish a reasonably comfortable interior temperature in the vehicle with the vehicle at idle in the shade, outside air around 90 deg F.
2. Set the conditioning system to floor only --- this would cool the ambient air source to the seat intake. And maintain this for several minutes
3. Turn off the AC fan.
4. Activate the seat back cooling and listen for blower noise
5. Listen for blower noise changes.
6. Cycle AC on to provide cooling area to floor for a period of time and then back off.
7. Listen for blower noise changes.
8. Sense for seatback cooling.

Findings:

* No change to seatback blower fan operation throughout the assessment
* No sense of any effective cooling to the seatback

I performed an additional assessment. With the vehicle at idle in a shaded area, I set the AC system to floor only and initiated the driver seatback cooling system. After ten minutes I returned to the vehicle and hand checked the temperature of the driver seatback with the passenger seatback (seatback cooling off!). The driver seatback actually felt warmer. I did the same check five minutes later and had the same result. Note, I recognize that since I had been sitting in the driver seat, the seat should have initially been warmer that the passenger seat.

Conclusion: It is very evident that the seatback cooling is not operational or simply not effective. Quite possibly, this well intended design simply does not function to expectations. If the design simply does not function to expectations, then a note to me saying this is that case would be sufficient to address my concerns.

**However** if the design is indeed believed to be functional and as presented the documentation “significantly improve the comfort level of the occupants by focusing cooling directly on the passenger through the seat”, then there needs to be some demonstration to me that this is happening even though I cannot sense it.

Below I will discuss some of the CCS technology and offer some suggestions to verify proper operations and possible operational problems.

# Specific Discussions, BSD and Disoperations:

## BSD on Efficiency and Expectation

On page 2-32 the BSD discusses efficiencies and expectations. While it is not significant to my circumstances, I believe this discussion is technically incorrect in a couple of ways. The BSD suggests that conventional air conditioning has an efficiency of 40% but such efficiencies are typically an EER of >10. The documentation should be reexamined for a proper description of efficiencies.

Immediately below the discussion on efficiency there is an example. Taken with the discussion immediately above it, this leads one to conclude “when cooling is needed it is less or not at all available”! The discussion also relates to “ambient temperature inside the vehicle” and this is not an accurate reference. An accurate reference would be the temperature of the inlet air to the Peltier Cell Modules. Given there is a source of cooled air beneath the seat, this inlet air may have a substantially different (cooler) temperature than the ambient in the vehicle.

I would also suggest that except at extraordinarily high temperatures (say for example initial start-up of vehicle left in the sun) it is infeasible (except for a brief time) for the ambient (inlet) temperature to exceed the temperature of the heat rejection side of the Peltier Cell. Such a circumstance may be plausible but only for the short period of time required for the cooling system to begin providing cool air under the seat. Thus my suggestion it to reword the example to indicate something of the like that seat cool would not be instantaneously provided.

The BSD discussion on page 2-33 also refers to “ambient” air. To understand system operation, I believe it is essential to be aware that it is the below the seat air that is the driver and not the general ambient for the vehicle.

## BSD on CCS Source and Waste

The BSD provides that the seat cushion and the seatback air are sourced through a single filter. This filter is located on the underside of the seat to the front. The documentation that I have does not describe air ducting from this location to the seatback module.

The BSD also states (cooling mode) that the seatback blower air is split, part flowing over the cold side of the Peltier cell which absorbs heat and cools that air which is sourced as seatback cooling. The other part of the air flows over the warm side of the Peltier cell, absorbing heat that is then exhausted (waste air). My documentation does not show where this air is exhausted.

Suggested Assessments: Confirm that there is air flow to the seatback module. Determine that the waste air is exhausted, establish where this occurs and establish that this air is not looped into the seatback (this would negate cooling) . Verify that this waste air is warmed to confirm Peltier cell operation. This warming should be significant.

## BSD on CSS Blower Operation

The documentation provides, “The CCSM powers up the cells with minimum air flow to set the cell temperature, and then the module steps up blower speed to ensure the correct temperature is achieved quickly.” My assessments find that not such “step up” is happening. When the system is activated there is a specific level of blower noise and the lever of this noise does not change over time.

Suggested Assessment: Audibility, by air flow, and by electric measurement establish that proper blower step up is initiated according to design.

## BSD on Heat Mode Operation

This discussion is not really germane to my concerns but it with worthy of some consideration. The documentation indicates that the Peltier cells are utilized in the heating Mode. I note that the documentation also illustrates (page 2-42, Body Systems) that there are “heater elements” in the seat cushion and seat squab.

Questions: Why utilize 40% efficient Peltier cells for heating while 100% efficient resistance heating is provided? It seems silly to me to have the Peltier cells energized at all for heating if the seats have heating elements!

## BSD on Cool Mode Operation

This discussion provides that battery voltage is split between the seat and the seat back when cooling is functioning for both but when seat back only cooling is selected, the full voltage is provided to the seat back unit. Thus my instinct to select seatback only cooling to provide for enhanced cooling is validated, albeit for a reason different than I originally imagined.

The BSD also provides that “In order to preserve battery and electrical system functionality, the Battery Monitor System (BMS) communicates with the ECM to reduce or even disable system operation based on total vehicle loads.” It is evident from this discussion that the electrical draw by the CCSMs is significant and measureable.

Suggested Assessments: Verify CCSM activation as evidenced by design electrical load deltas. Note suggested assessment to verify for blower operation and modulation discussed above.

Ancillary Note: The system provides for the operator to select either of three blower fan settings. Given that the operator (I) cannot sense any system operation other than a small measure of fan noise, this seems functionally redundant.