VOLVO S60 RECHARGE HYBRID ADAS FEATURES WITH RADAR SENSORS

Elliott Horner

I. GENERAL – VOLVO S60 RECHARGE RADAR UNITS

Reference:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/736e6ce0baa20978c0a8015161271996

- The radar units on a Volvo S60 Recharge Hybrid are located in the center of the vehicle's grille and the back left and right sides of the bumper. These radar units provide information to the vehicle's various safety systems which allows for a safer driving experience

II. PEDESTRIAN PROTECTION SYSTEM (PPS)

Reference:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/article/09a8fb9f4adcd8a5c0a801514180273f

- The Volvo S60 Recharge Hybrid uses sensors installed in the front of the vehicle to detect objects that look similar to a human leg. If the sensors correctly identify an object that fits this category, the car raises the rear section of the hood in order to minimize damage to the pedestrian and the vehicle, as well as sending an alarm. The car may also attempt to stop if the collision is avoidable using its other systems such as Automatic Emergency Braking (AEB).
- Note: This system only works at speeds at around 15-30 miles per hour, since the risk of death to the pedestrian is much higher within this range. Below 15 mph, the risk to the pedestrian is low, thus the system is not required to engage. Above 30 mph, the system will most likely not have enough time to avoid pedestrians due to the high speed of the situation.

III. REAR COLLISION WARNING (RCW)

Reference:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/eae979d0ba032d86c0a801510673af01

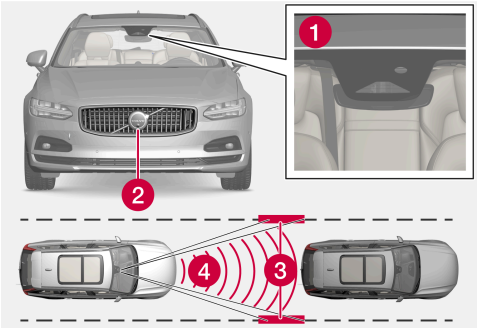
- The Volvo S60 Recharge Hybrid uses radar and detection sensors to detect the presence of other vehicles behind the vehicle. If the radar sensors detect that another vehicle is at risk of rear-ending the current vehicle, a warning to the driver is issued, and the vehicle tenses the seatbelts as well as activating other safety systems such as the Whiplash Protection System (WHIPS) in case the driver is not able to accelerate away from the

other vehicle. The system also applies the brakes to reduce the car's acceleration in case of a collision

- Note: This system only works at speeds below 20 mph. At higher speeds, the driver often does not have enough time to react to a warning from the system before a collision occurs, or the vehicle isn't detected in time in order to prevent a collision. Other safety systems are not as effective at mitigating damage at high speeds.

IV. PILOT ASSIST

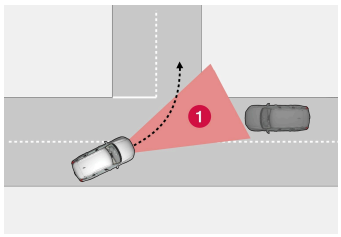
Referencet:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/468b6e20afa2c90ac0a8015164fa9740



- The Volvo S60 Recharge Hybrid's Pilot Assist is a combination of Adaptive Cruise Control (ACC) and Lane Keeping Assistance (LKA) systems. Pilot Assist uses a combination of radar and camera systems in order to measure the distance between other vehicles in front of the vehicle and measure the distance the vehicle is away from the lane lines. Pilot Assist uses ACC to maintain a safe distance between the vehicle and the vehicle in front of it by smoothly accelerating and decelerating the car when needed. Pilot Assist uses LKA technology to keep the vehicle exactly halfway between each of the lane markers. Pilot Assist takes the information gathered from both of these systems and uses it in combination with Steering Assist, where the vehicle's steering wheel is automatically turned in order to keep the vehicle inside the lane.
- Note: Pilot Assist is not a replacement for the driver. The driver must be attentive and keep their hands on the steering wheel at all times in order for Pilot Assist to remain active. If the driver is detected without their hands on the wheel, the car will warn the driver, progressively getting more aggressive with its warnings until bringing the car to a complete stop until the driver becomes attentive again.

V. ASSISTANCE AT RISK OF COLLISION

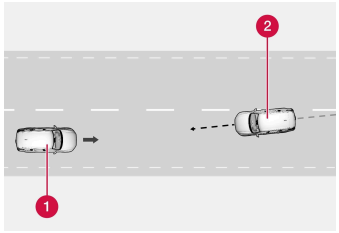
Reference:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/51f3ea24a992216cc0a801511b650320
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/cdb8c537c1e9edadc0a8015139737098
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/fb5c9552c1fc7d0cc0a8015164e12bb5



- (General) Assistance at risk of collision combines other safety systems in order to avoid collisions. This system will constantly check the distance between vehicles using onboard radar units and will assist the

driver in the event of a potential collision. This system uses a combination of auditory warnings, Steering Assistance, and Automatic Emergency Braking (AEB) in order to remove the risk of collision with another vehicle. The vehicle will slowly assist with braking, then brake on its own if the driver is not slowing down enough to avoid an accident, as well as steering the vehicle in the case of an accidental lane departure.

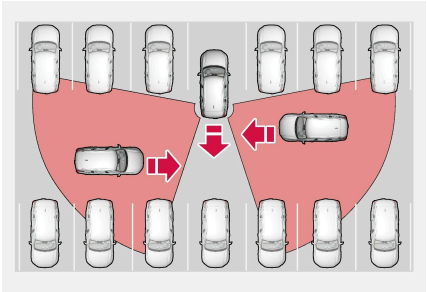
- (Cross Traffic) In cross traffic, the system will take similar steps but is limited by the ability of the vehicle to detect other vehicles at risk of collision before it is too late to avoid a collision. The system will only recognize cross traffic as a threat once the driver intends to turn or is in the process of turning.



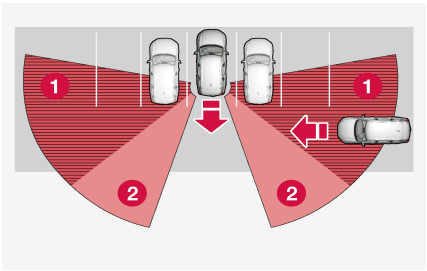
- (Oncoming Traffic) In the event of the driver accidentally drifting into oncoming traffic, the system will use the above process in order to steer the car back into the correct line. If another driver veers into the Volvo's lane, it is difficult to avoid a collision due to a large list of limitations, such as speed and the type of potential collision, among others (read above)

VI. WARNING AND AUTOBRAKE WHEN REVERSING

Reference:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/b88c5feec7224834c0a8015100c38220



- This system uses the Volvo's radar and camera units in order to detect oncoming vehicles when the vehicle is in reverse. If a vehicle is detected approaching, and the driver does not react to its presence, the system will automatically engage the brakes in order to avoid a collision. This system is designed for low speeds that are common in parking lots, where backing accidents are common.
- This system is limited when the radar units are blocked, most commonly by other vehicles, as the system is incapable of detecting oncoming vehicles through solid objects. This blindspot in the radar will remain until its line of sight is no longer blocked by any large objects.



VII. DISTANCE WARNING

Reference:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/b8747d40ba1348c2c0a8015140e470ca

- The distance warning system uses the radar in the front of the vehicle and other sensors in order to measure the time interval between the Volvo and the vehicle ahead of the Volvo. If this time interval is too small to safely avoid a collision in the event of a sudden stop,

the vehicle will warn the driver to slow down and give the other vehicle more space in case a situation arises where the other driver must suddenly and rapidly slow down.

VIII. PARKING ASSIST

Reference:
https://www.volvocars.com/lb/support/car/s60-recharge-plug-in-hybrid/23w17/article/0d56268eba76a4eac0a8015145a03bfd

- Parking Assist uses sensors to alert the driver of any nearby objects while they are attempting to park their vehicle. This alert comes in the form of a visual alert on the HUD and an acoustic tone.