Service Training

Self Study Program 890743

The 2015 e-Golf

Design and Function



Volkswagen Group of America, Inc.
Volkswagen Academy
Printed in U.S.A.
Printed 01/2015

Course Number SSP 890743

©2015 Volkswagen Group of America, Inc.

All rights reserved. All information contained in this manual is based on the latest information available at the time of printing and is subject to the copyright and other intellectual property rights of Volkswagen Group of America, Inc., its affiliated companies and its licensors. All rights are reserved to make changes at any time without notice. No part of this document may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, nor may these materials be modified or reposted to other sites without the prior expressed written permission of the publisher.

All requests for permission to copy and redistribute information should be referred to Volkswagen Group of America, Inc.

Always check Technical Bulletins and the latest electronic repair information for information that may supersede any information included in this booklet.

Trademarks: All brand names and product names used in this manual are trade names, service marks, trademarks, or registered trademarks; and are the property of their respective owners.

Contents

Introduction 1

Body 6

Occupant Protection 11

Transmission 12

Running Gear 14

Heating and Air Conditioning 28

High Voltage System 34

Electrical System 50

Infotainment 62

Car-Net 67

Knowledge Assessment 69

Note



Important!



This Self-Study Program provides information regarding the design and function of new models.
This Self-Study Program is not a Repair Manual. This information will not be updated.

For maintenance and repair procedures, always refer to the latest electronic service information.

Page intentionally left blank

The e-Golf

After over 30 million Golf vehicles have been produced, the first all-electric Golf is available. The e-Golf can be easily distinguished by its badging, arc-shaped LED daytime running lights and LED headlights.

The high voltage components, and the technologies of the remaining modules, make the e-Golf a safe and comfortable vehicle. The electric motor produces 116 hp (85 KW) and develops a maximum torque of 199 ft-lb (270 Nm) with a 0-60 mph time of 10.4 seconds. Improved aerodynamics and low rolling resistance of the tires contribute to a low 12.7 kWh/100 km consumption that can be compared to using (1.3 liters) of diesel fuel per 100 km or 62 mpg.

Depending upon additional load, distance and driving style the e-Golf has a range between 80 and 118 miles (130 and 190 kilometers) when using approximately 21.2 KW/H of energy from the lithium ion high voltage battery.

This Self-Study Program covers the new features and high voltage components of the e-Golf.



s530_001

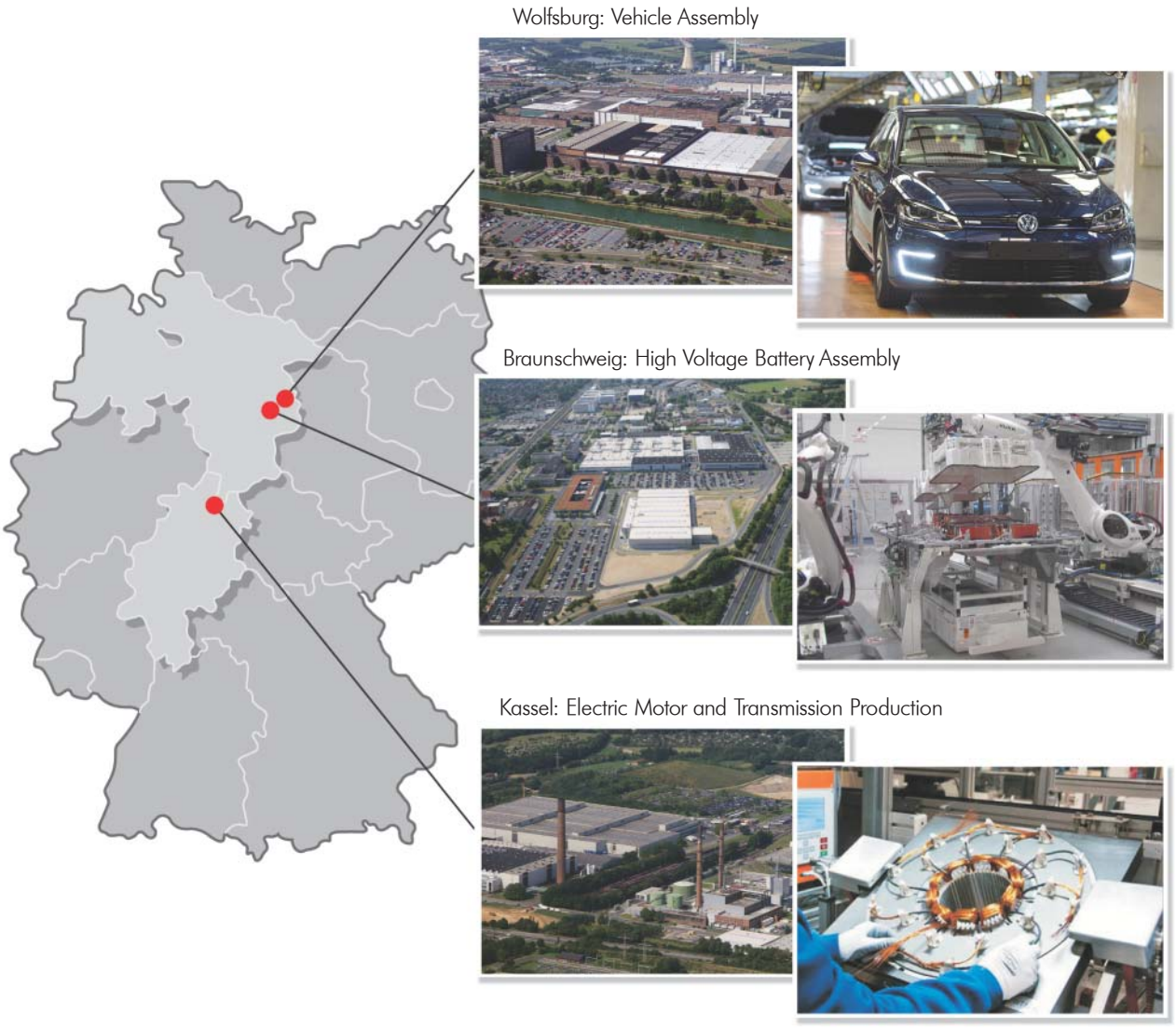
Introduction

Volkswagen Production Locations Wolfsburg, Kassel and Braunschweig

Due to its Modular Transverse Matrix (MQB) construction, the e-Golf can be manufactured on the same assembly line in the Wolfsburg factory alongside the other Golf models.

The drive system is made by Volkswagen, including the single speed transmission and electric motor combination and the lithium ion high voltage battery.

The drive system is made in Kassel. The lithium ion high voltage battery is made in Braunschweig.



Distinguishing Features of the e-Golf



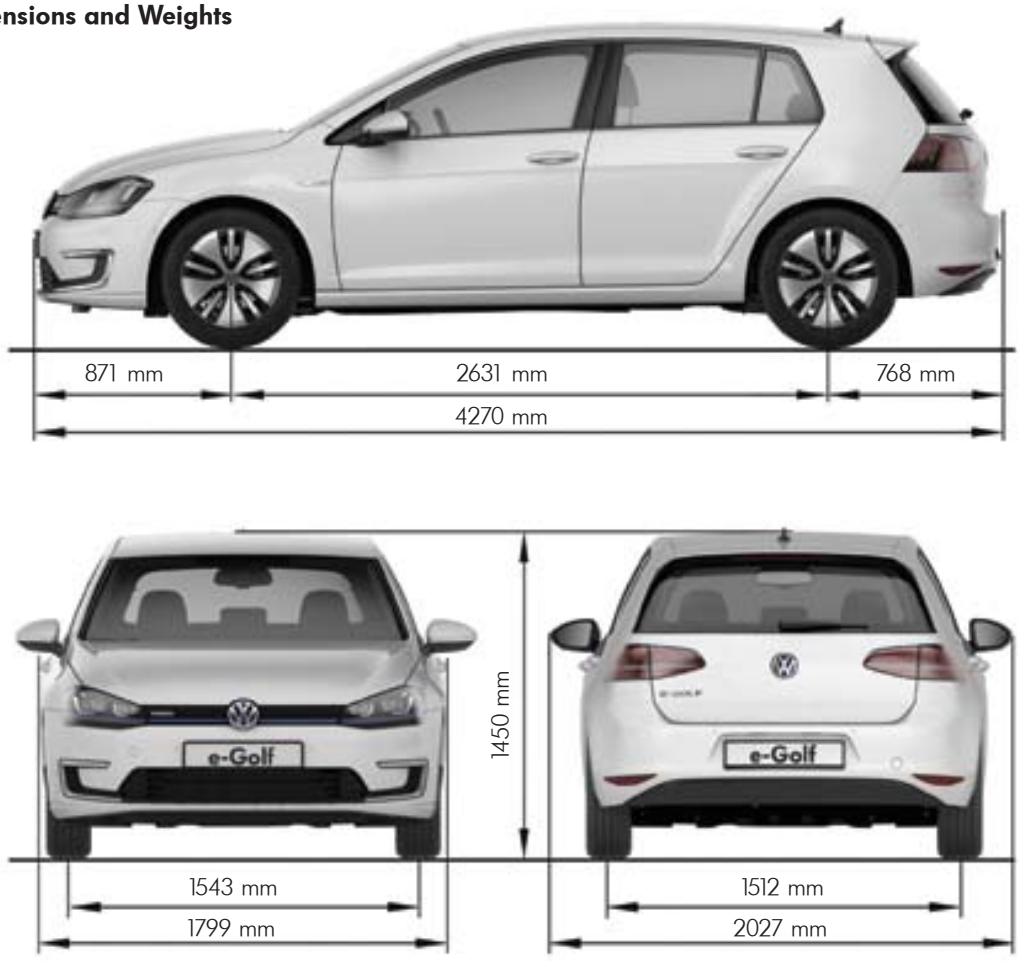
s530_005

Introduction

Technical Data

The data refers to a vehicle without driver.

Exterior Dimensions and Weights



s530_017

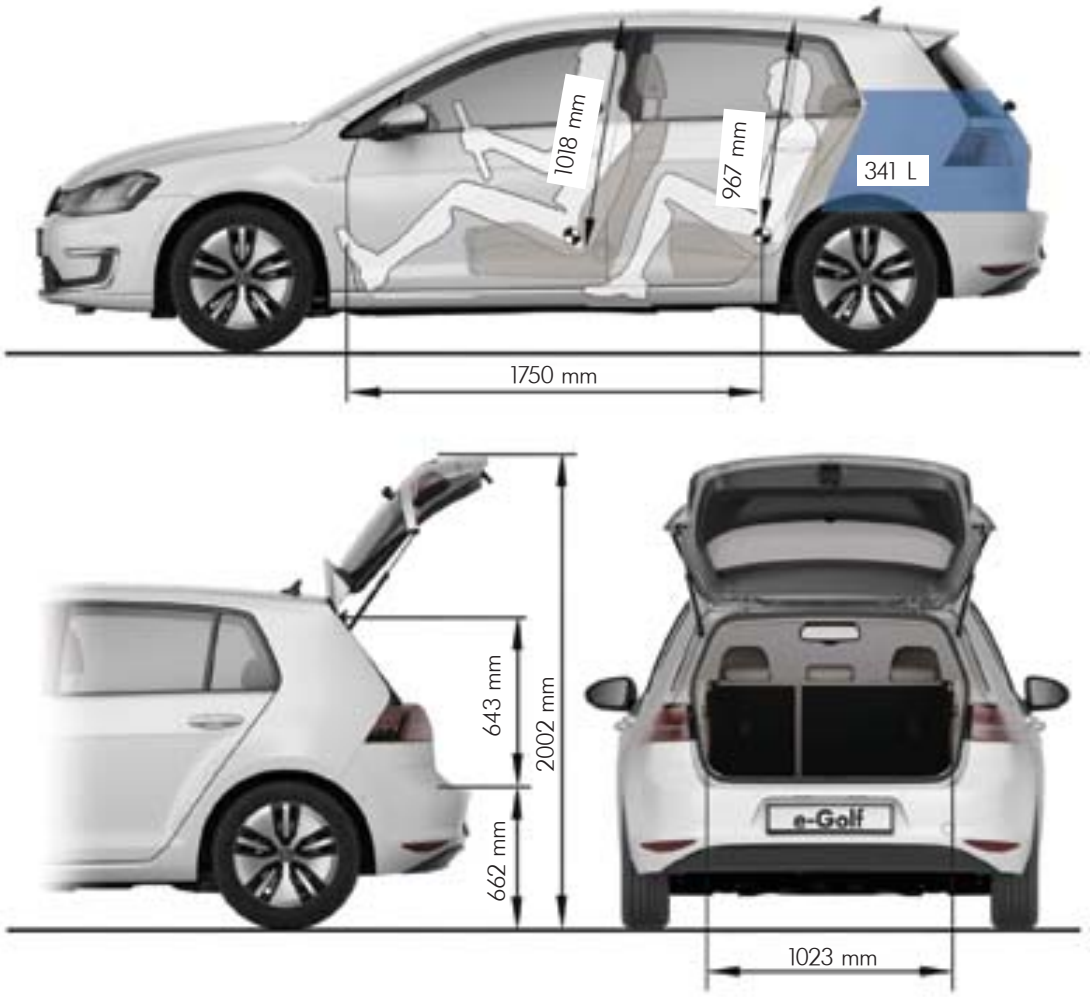
Exterior Dimensions

Length	4270 mm 168 in
Width	1799 mm 71 in
Height	1450 mm 57 in
Wheelbase	2631 mm 103.5 in
Track Width at Front	1543 mm 66.75 in
Track Width at Rear	1512 mm 59.5 in

Weights/Other Data

GVWR	1960 kg 4321 lb
Curb Weight	1510 kg 3329 lb
High voltage Battery Weight	310 kg 683 lb
Turning Radius	10.9 meters 35.8 feet
Noemal Energy	21.2 KW/H
Max. Performance/ Max. Torque	85 kW/270 Nm
Drag Coefficient	0.29cw

Interior Dimensions and Volumes



s530_019

Interior Dimensions and Volumes

Interior Vehicle Length	1750 mm 69 in
Luggage Compartment Volume	341 liters 12 ft³
Height of Tailgate	1305 liters 46.1 ft³
Height os Luggage Compartment Sil	662 mm 26 in
Height of Luggage Compartment Opening	643 mm 25 in

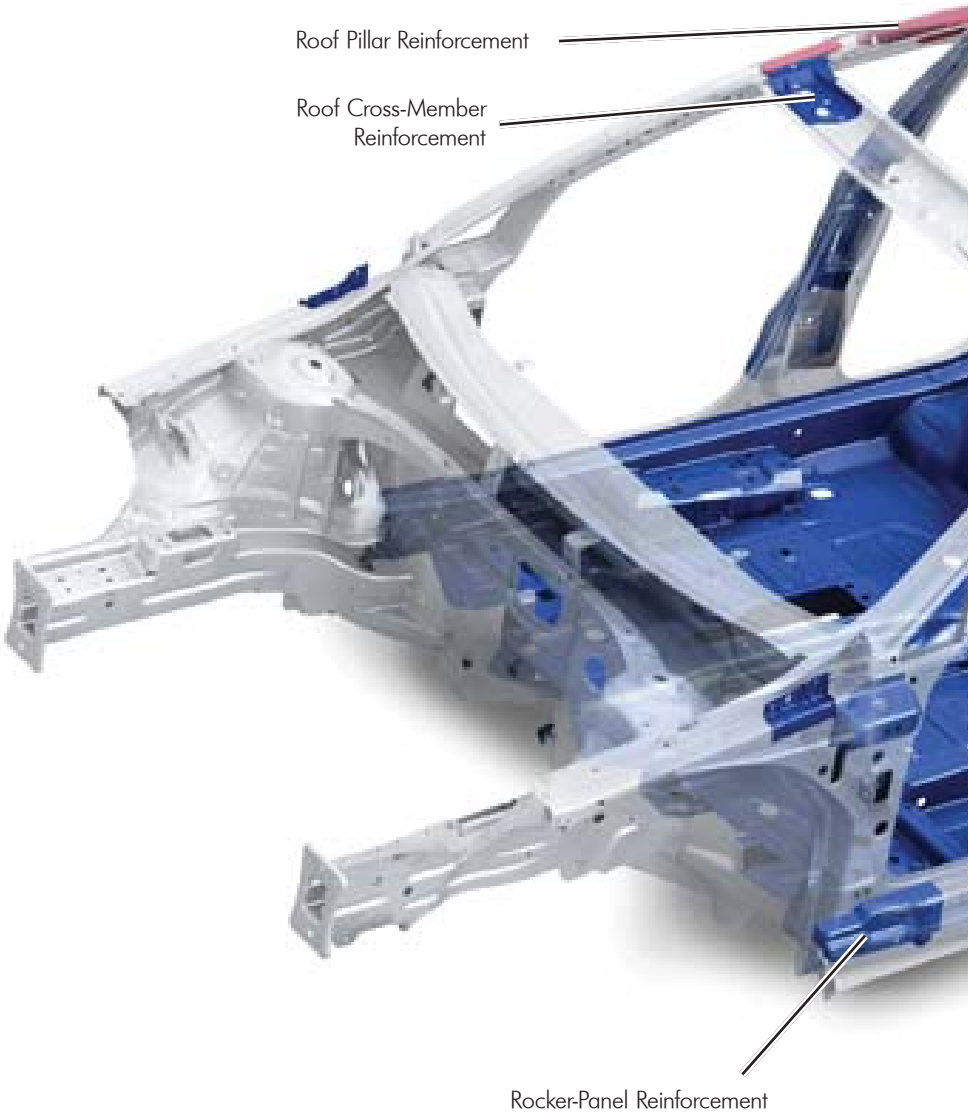
Through - Load Width Between Wheel Housings	1003 mm 39.5 in
Width of luggage Compartment Opening	1023 mm 40.2 in
Max. Front Headroom	1018 mm 40 in
Rear Headroom	967 mm 38 in

Body

Body Structure

The body structure of the e-Golf is based on the 2015 Golf four-door. Some components had to be strengthened or thickened for current crash test standards. The floor was also modified and strengthened to create space for the high voltage battery.

Additional reinforcements were added to the rear frame side rails, rear side panels and inner wheel housings. Rocker-panel reinforcements and rocker-panel bulk heads were installed for additional crash support. The NAR B-Pillar was installed to comply with crash test standards.



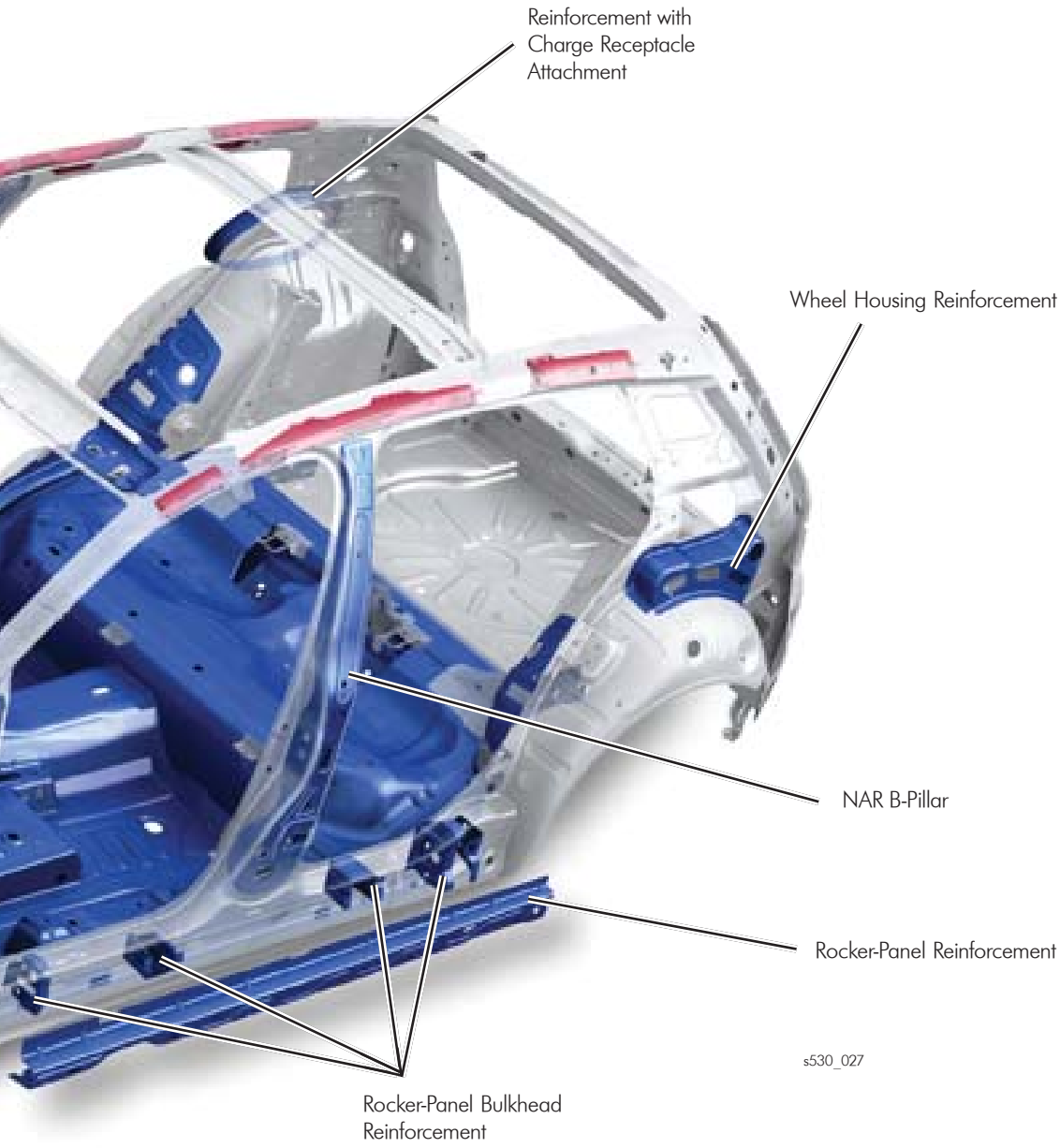
e-Golf-Specific Components

Roof Pillar Reinforcement

Body Components of the 2015 Golf

Roof Pillar Reinforcement

Three additional plastic roof pillar reinforcements are glued to the inside of each roof pillar to help absorb and distribute crash energy.

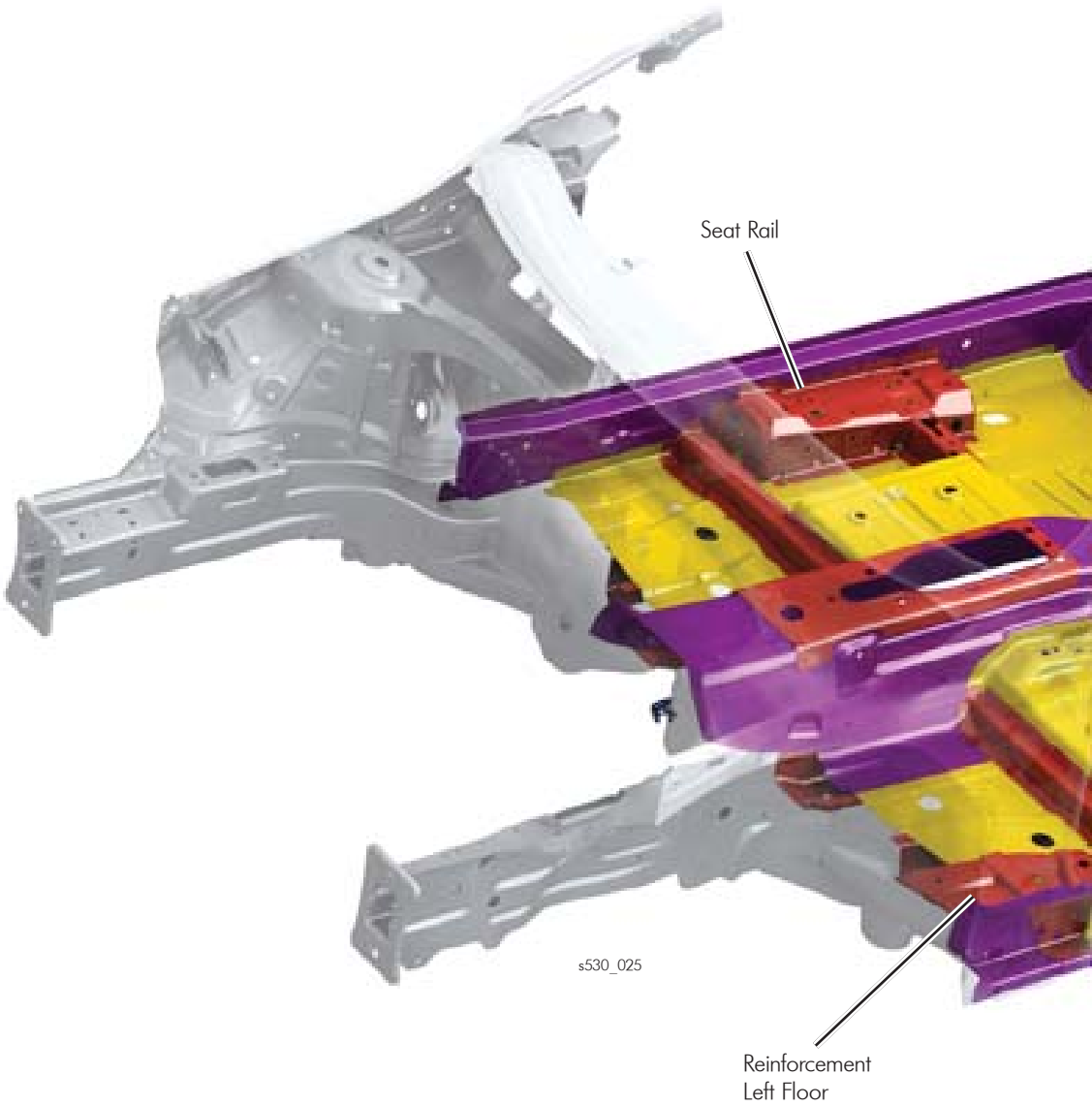


Body

Vehicle Underbody

The vehicle floor has been redesigned for the high voltage battery and for current crash standards.

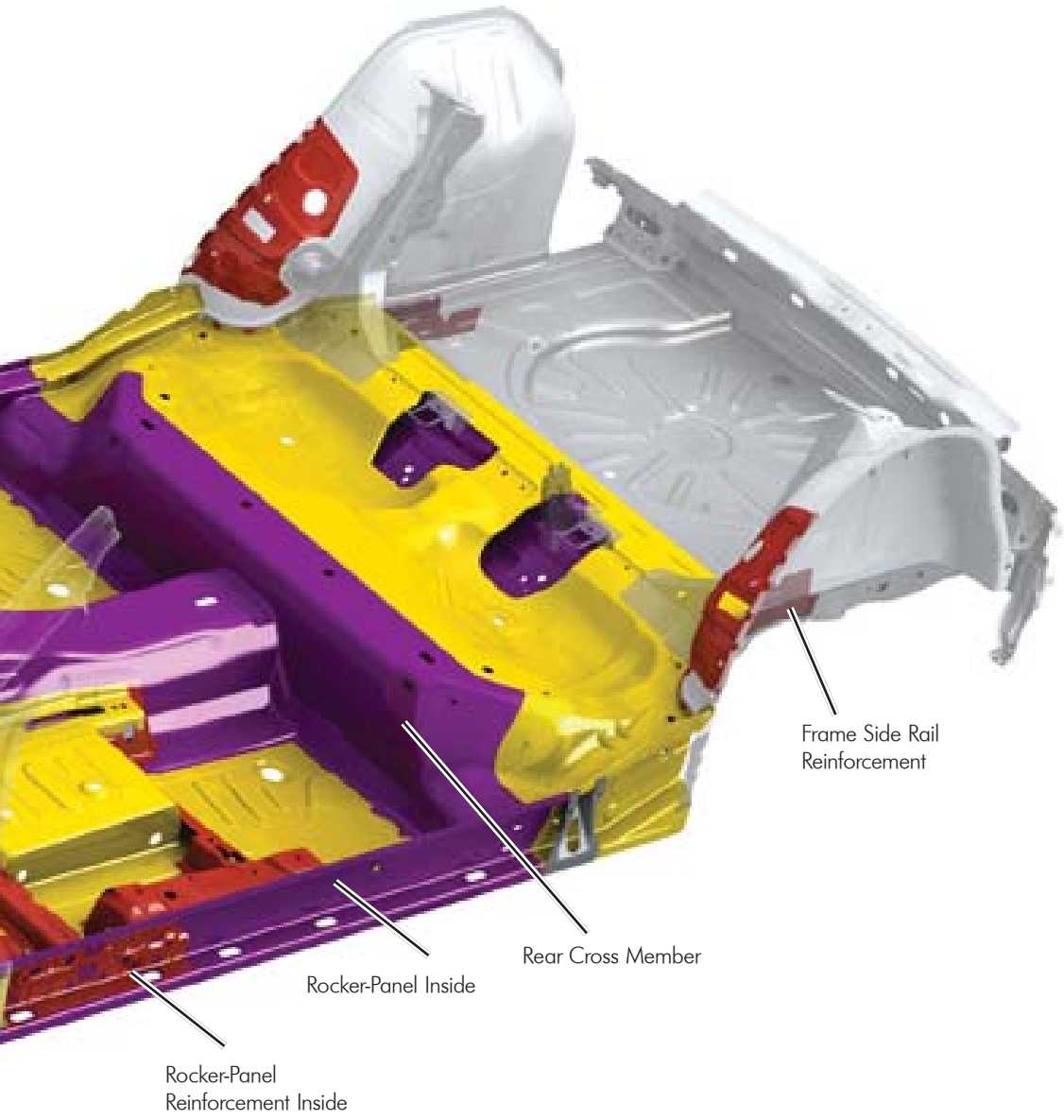
Additional reinforcements have been added to the rear frame side rails and each inner wheel housing. The rear floor has two multipart, high-strength hot-formed sheet metal cross beams.



Steel Strength

- < 420 MPa High-Strength Steel
- < 1000 MPa Highest-Strength Steel
- 1000 MPa High-Strength Hot-Formed Sheet Metal

The rocker-panel inside material thickness has been increased to 2mm. The left inner rocker-panel and floor also have reinforcements. These reinforcements required seat rail modification.

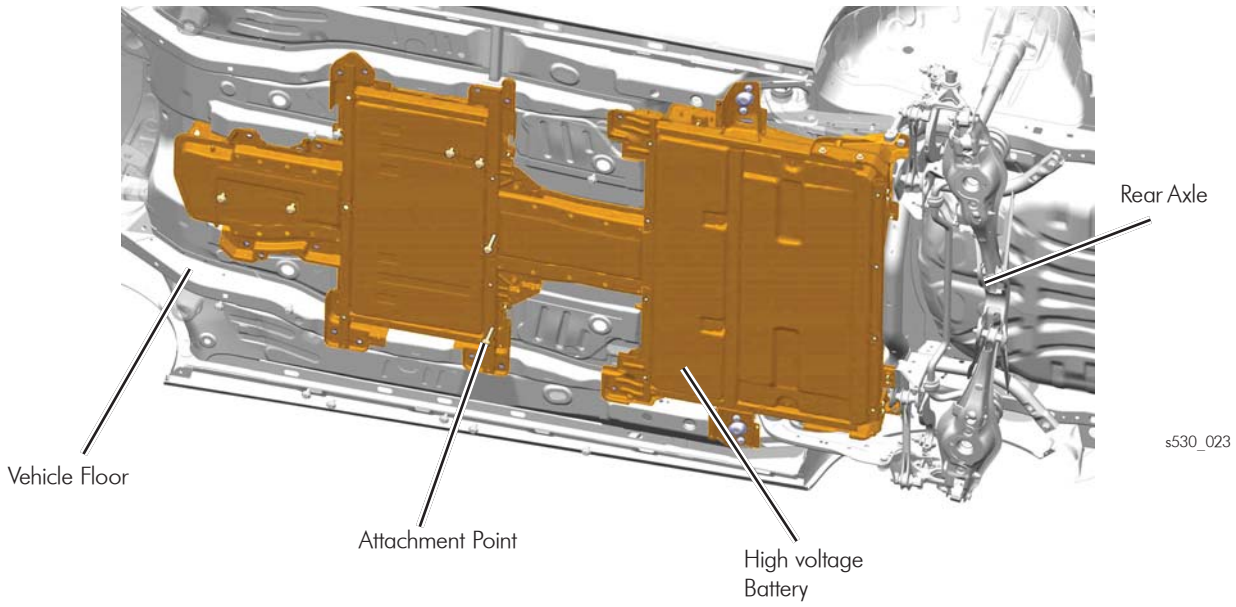


MQB Sections

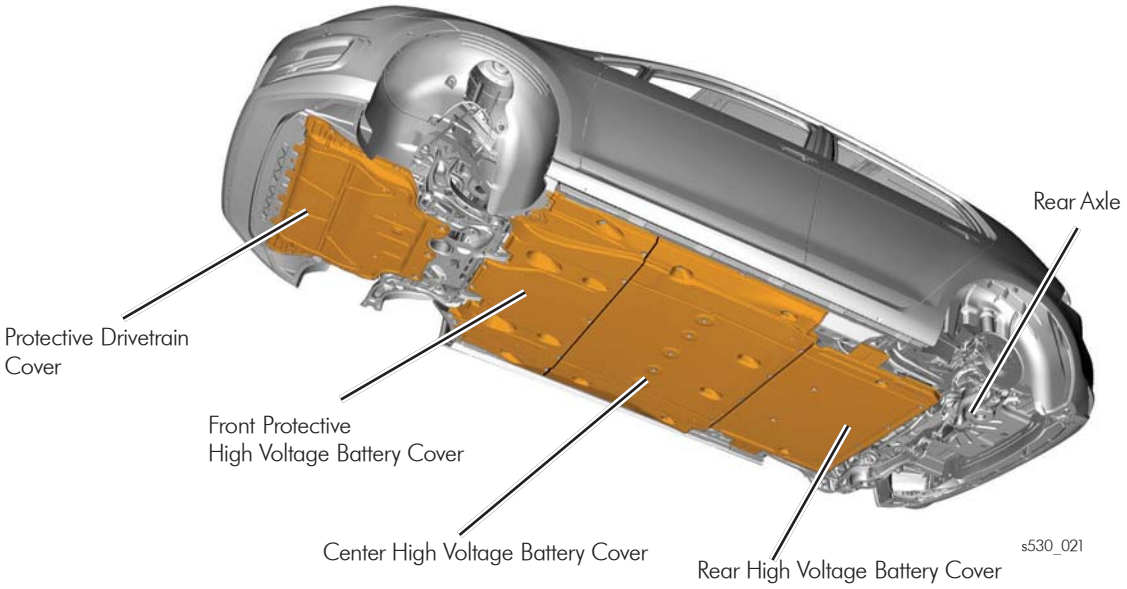
The front and the rear vehicle floor are MQB sections from the Golf R (4MOTION).

High Voltage Battery Protection

The high voltage battery is located under the vehicle. This required modification of the MQB floor pan.



To protect the high voltage battery and to improve the cw-value (drag coefficient), the vehicle underbody has four protective covers for the high voltage components. These are shown in the illustration below.



Safety Systems

The e-Golf, like the 2015 Golf, has the following standard safety systems:

- Single-stage driver and passenger airbags with front passenger seat Passenger Occupant Detection System (PODS)
- Curtain airbag system for front and rear passengers including front side airbags
- Three point automatic front seat belts with height adjustment and belt-tensioner
- Three point rear automatic seat belts
- Three adjustable rear head restraints to protect passengers against whiplash in rear end collisions



s530_055

Crash Sensors

The following crash sensors are:

- Up-front crash sensors
- Pressure sensors in the front doors
- Acceleration sensors at the C-pillars
- CISS (Crash Impact Sound Sensing) in the Airbag Control Module

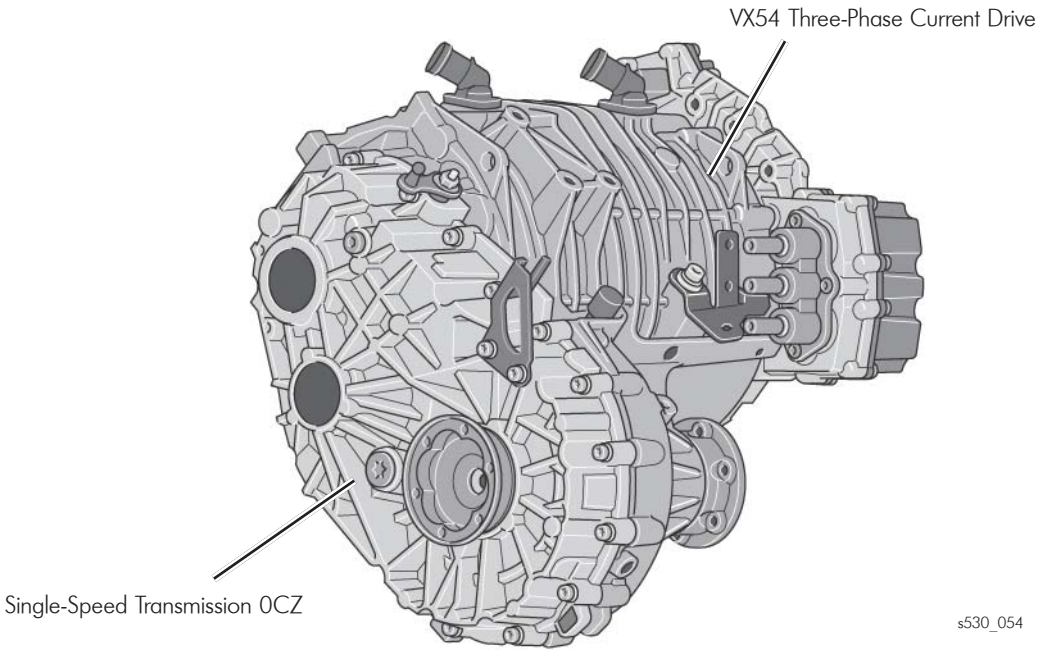


Additional information about the passenger protection system is in SSP 890643 “The 2015 Golf Body and Occupant Protection.”

Transmission

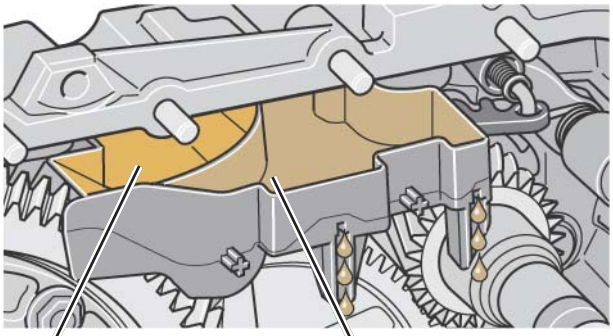
Single-Speed Transmission 0CZ

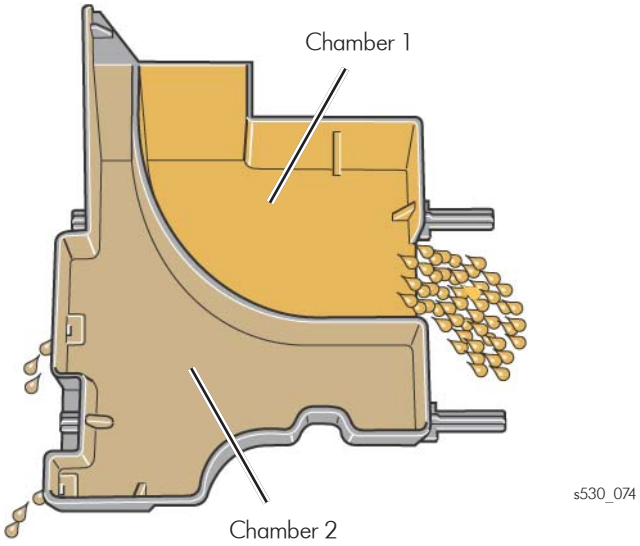
The single speed transmission of the e-Golf is attached directly to the e-machine. It has four internal gears that are meshed together to create a single output ratio. It is directly connected to the e-machine rotor. The e-machine rotor is turned in the reverse direction for the Reverse gear.



Transmission Designation	0CZ
Number of Gears/Speeds	1
Maximum Input Torque	199 ft-lb (270 Nm)
Maximum Input RPM	12,000 1/min
Weight (filled)	57 lb (25.75 kg)
Oil Volume	0.75L (Part number in ETKA)
Drive Shafts	Bolted Connection

Oil Catch Bowl





The oil catch bowl in the transmission has two chambers that are filled with oil from the final drive ring gear.

- Chamber 1 supplies the transmission case side with oil
- Chamber 2 supplies the three-phase alternating current drive side with oil

The oil flow rate of Chamber 1 is higher than Chamber 2 to provide more lubrication and to help with cooling.

The bearings in the electric motor housing are cooled by the cooling system of the three-phase alternating current drive.

Running Gear

Chassis and Driver Assistance Systems

Important chassis configurations and Driver Assistance Systems of the e-Golf are:

Chassis

- Chassis with:
  - Four-link rear axle
  - McPherson front struts
- Electromechanical Parking Brake (EMPB) with AutoHold
- Electromechanical Power Steering
- ABS/ESC Continental MK 100
- Electronic Differential Lock XDS
- Electromechanical Brake Booster (eBKV) with accumulator
- Low friction tires





s530_031

Driver Assistance Systems

- Automatic Post Collision Braking System
- Park Distance Control
- Tire Pressure Monitoring
- Cruise Control
- Rear Camera
- Hill Hold



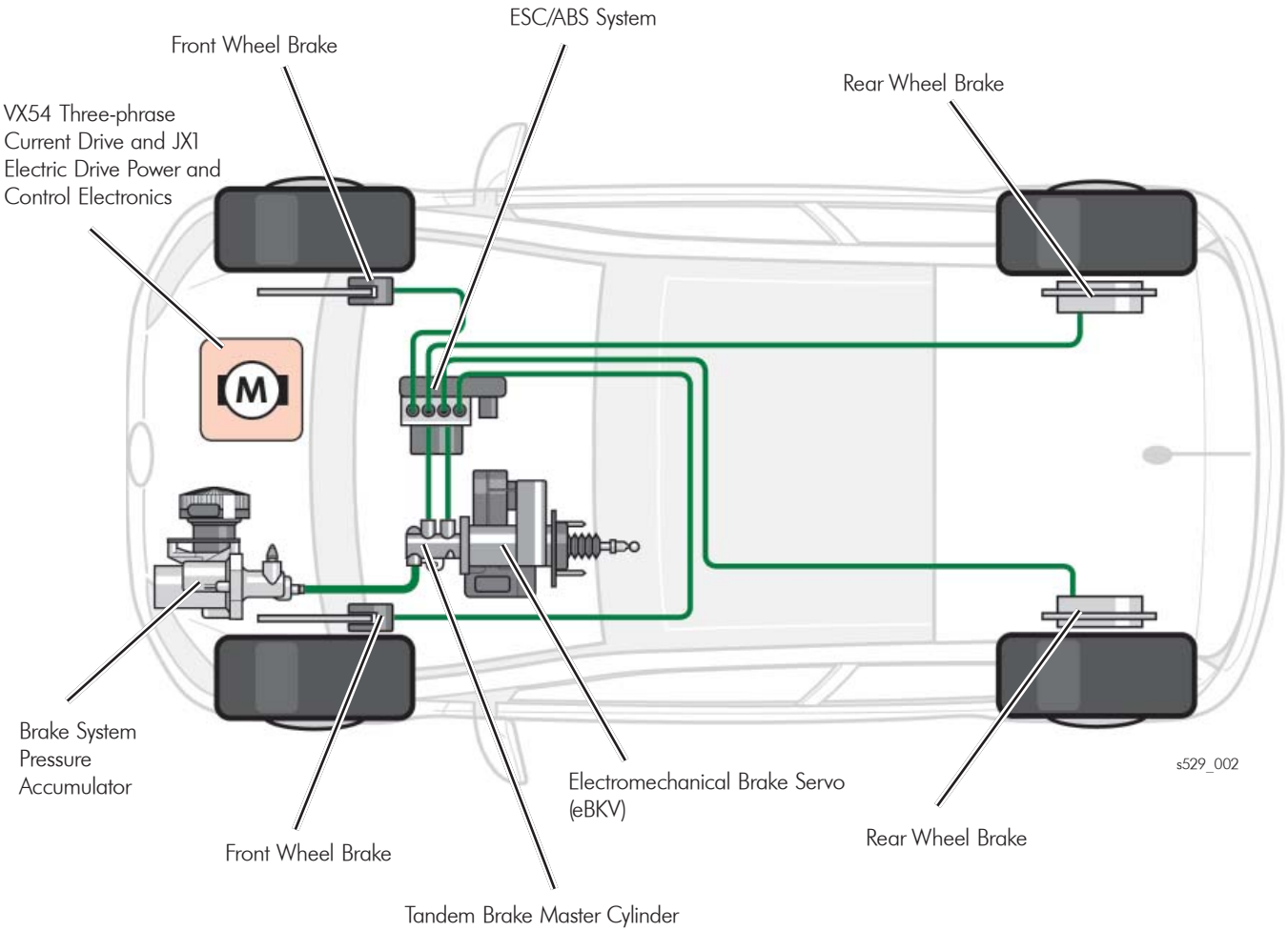
Additional information on Chassis and Drive Assist Systems is in SSP 890443 "The 2015 Golf Running Gear and Driver Assistance Systems."

The e-Golf Brake System

The e-Golf brake system consists of:

- Tandem brake master cylinder
- Hydraulic disc brakes
- Electromechanical brake servo
- ESC/ABS system
- Brake system pressure accumulator
- Three-phase current drive

The electromechanical brake servo increases the brake pedal force applied by the driver.



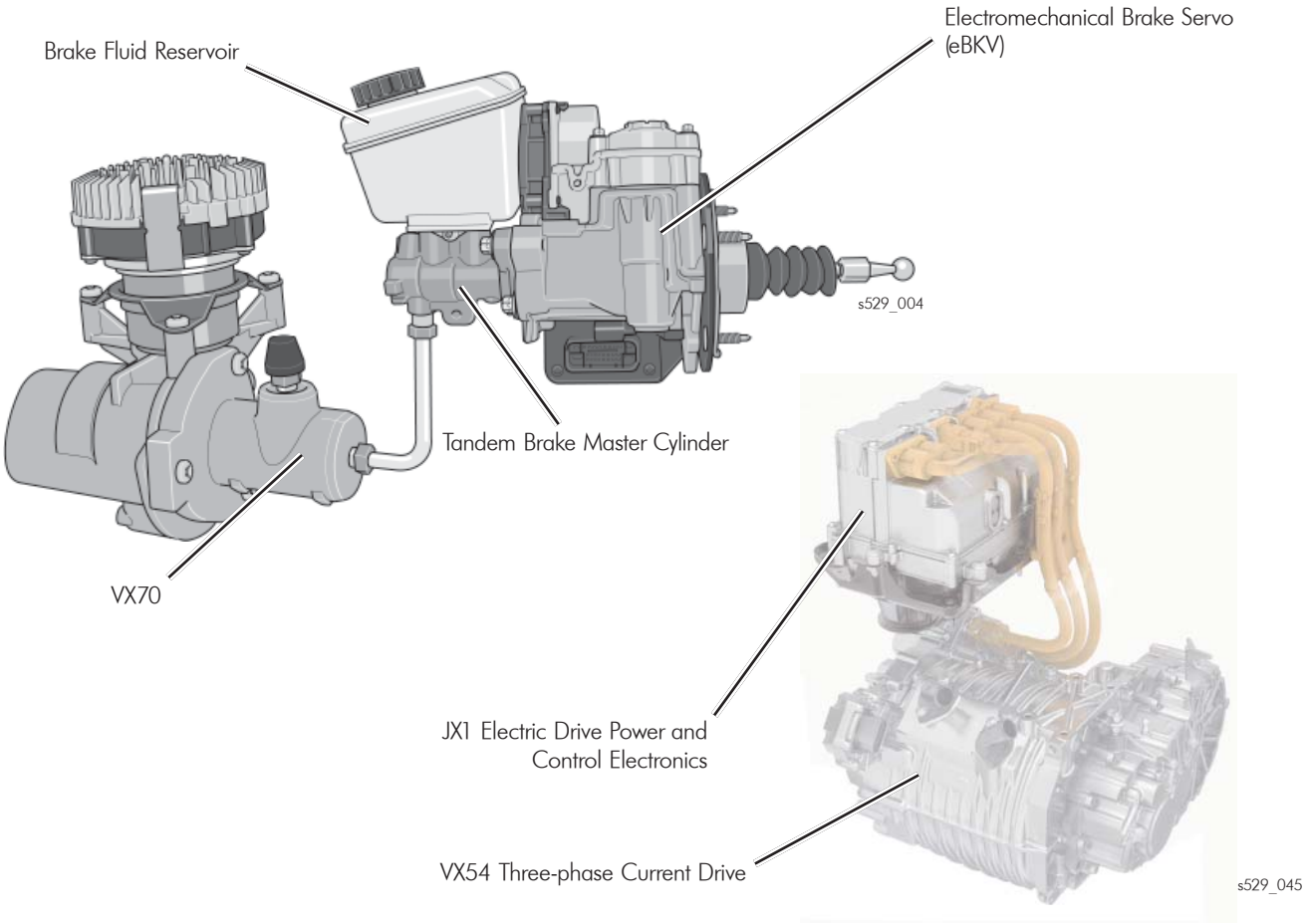
The Brake System with Recuperation

A recuperative brake system is used in the e-Golf. The VX54 Three-phase Current Drive (e-Machine) causes deceleration when in recuperation mode. The amount of deceleration depends on the vehicle speed, the temperature of the high-voltage battery and the charge level of the high-voltage battery. These variables can cause inconsistent deceleration. The hydraulic system is used to compensate for any inconsistent deceleration. The combination of recuperation and hydraulic braking is called brake blending.

When using VX54 for deceleration, regenerated electrical power is sent through the JX1 Electric Power Drive and Control Electronics to the battery to increase electric driving range.

The brake system with braking energy has:

- Electromechanical brake servo (eBKV)
- Tandem brake master cylinder
- VX70 Brake System Pressure Reservoir
- VX54 Three-phrase Current Drive
- JX1 Electric Drive Power and Control Electronics



Electromechanical Brake Servo (eBKV)

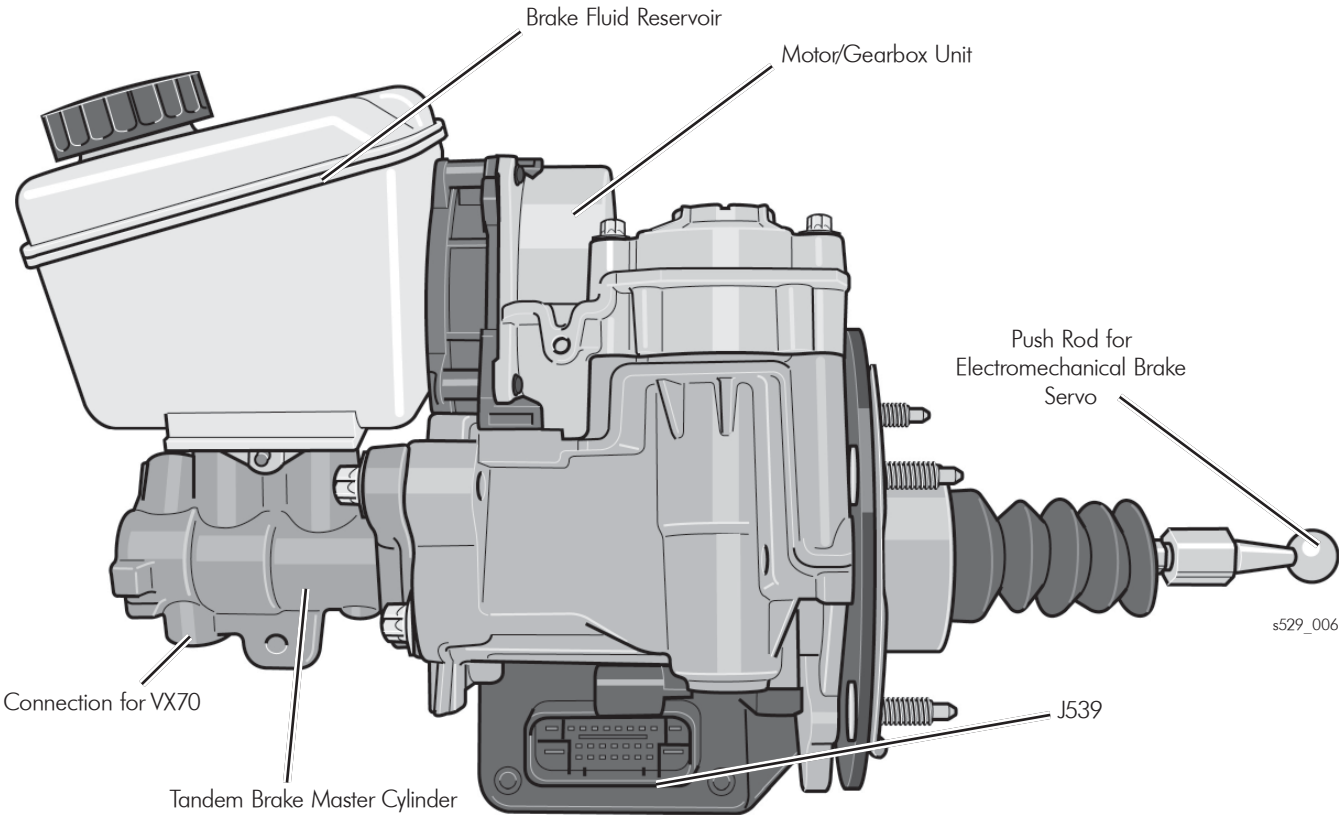
An electromechanical brake servo (eBKV) increases the brake force. The advantages of the electromechanical brake servo are:

- Vacuum-independent brake servo
- Brake blending function
- Rapid build-up in pressure
- High degree of accuracy in the setting of pressure
- Constant brake pedal characteristics/pedal power

Design

The electromechanical brake servo is located in the engine compartment. It is connected to the VX70 Brake System Pressure Reservoir and the ESC/ABS system. The electromechanical brake servo has:

- J539 Brake Booster Control Module
- Motor/gearbox unit
- Push rod for electromechanical brake servo
- Tandem brake master cylinder

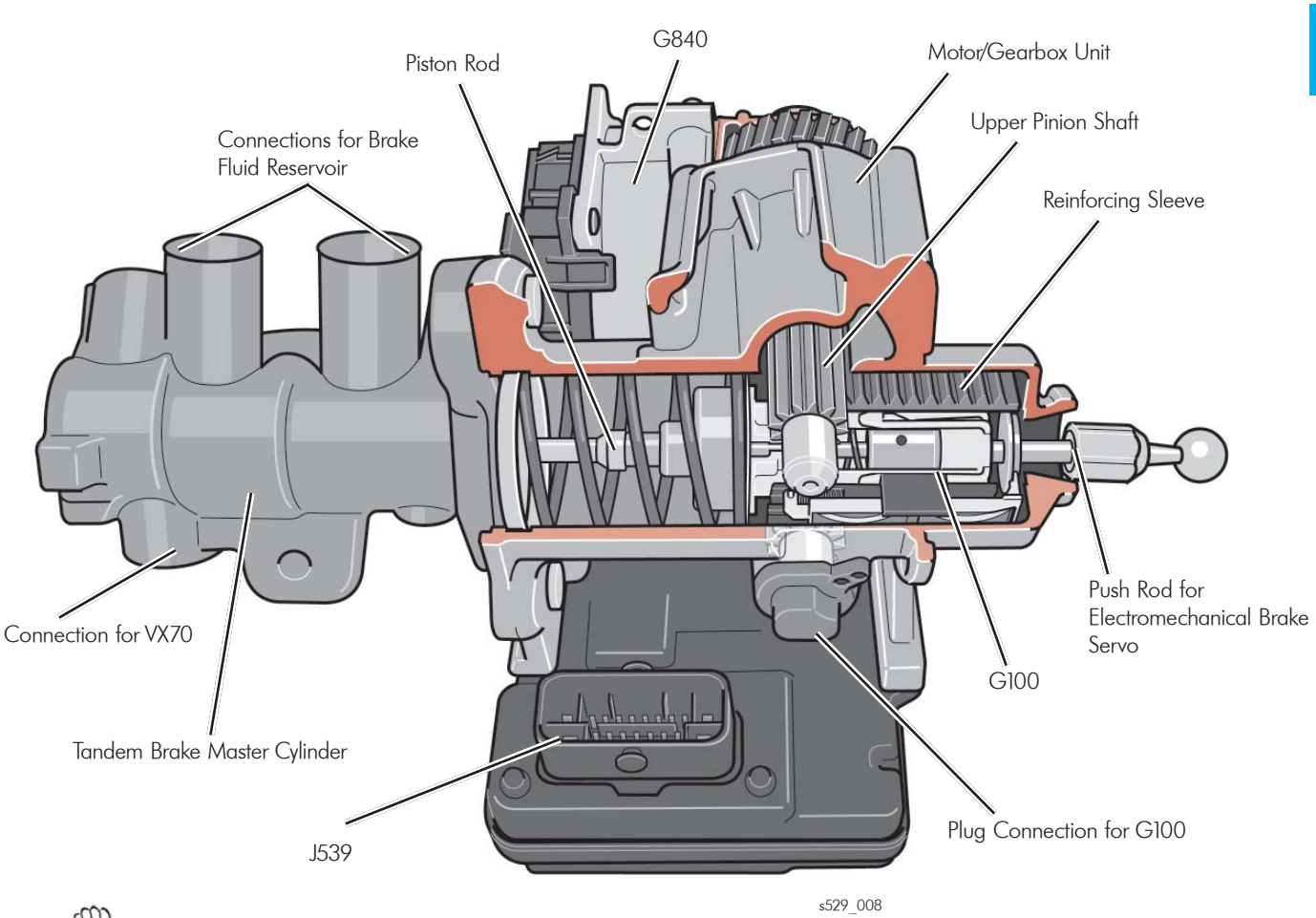


Function

The driver actuates the brake pedal. The push rod and piston rod transfer pedal force to the tandem brake master cylinder. The amount of push rod movement is measured and sent to J539 by the G100 Brake Pedal Position Sensor.

The electromechanical brake servo knows the motor position from the G840 Brake Booster Motor Position Sensor.

The J539 (in the electromechanical brake servo) calculates the necessary brake force increase by comparing the driver request to the motor position. The motor turns, moving the reinforcing sleeve for the pinion shaft to the left. This provides brake assist for the driver. The braking force is amplified 6 times by the electromechanical brake servo.





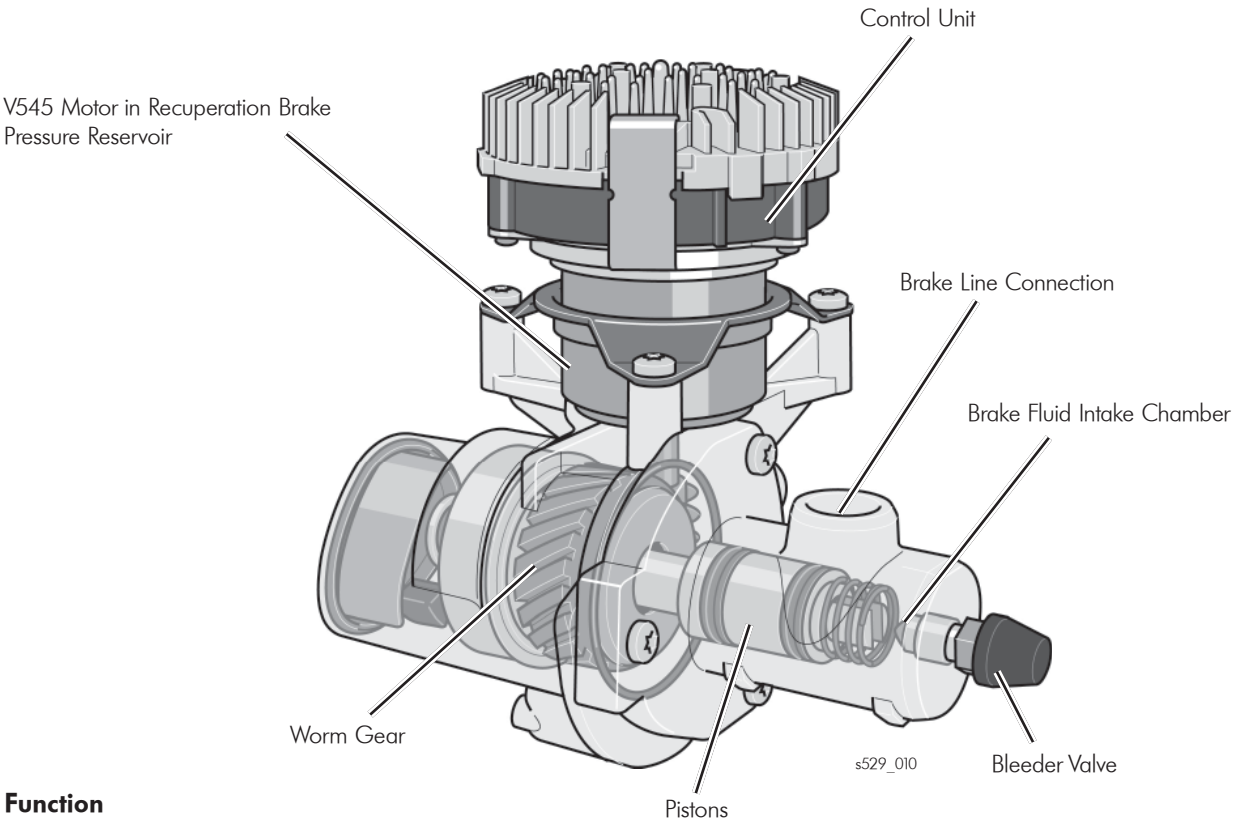
G100 in the electromechanical brake servo activates the brake light and the brake test signal.

VX70 Brake System Pressure Reservoir

The VX70 Brake System Pressure Reservoir stores brake fluid, then directs it back into the brake system when it is needed. The goal of this system is to control hydraulic braking pressure.

Design

The VX70 is directly connected to the tandem brake master cylinder. If the vehicle is decelerated using the e-Machine (recuperation), unused brake fluid is stored in the VX70.



Function

If the J539 Brake Booster Control Module recognizes that the recuperation deceleration is less than the braking request, brake fluid is sent into the hydraulic brake system using pressure from VX70. This information is sent from J539 to VX70.

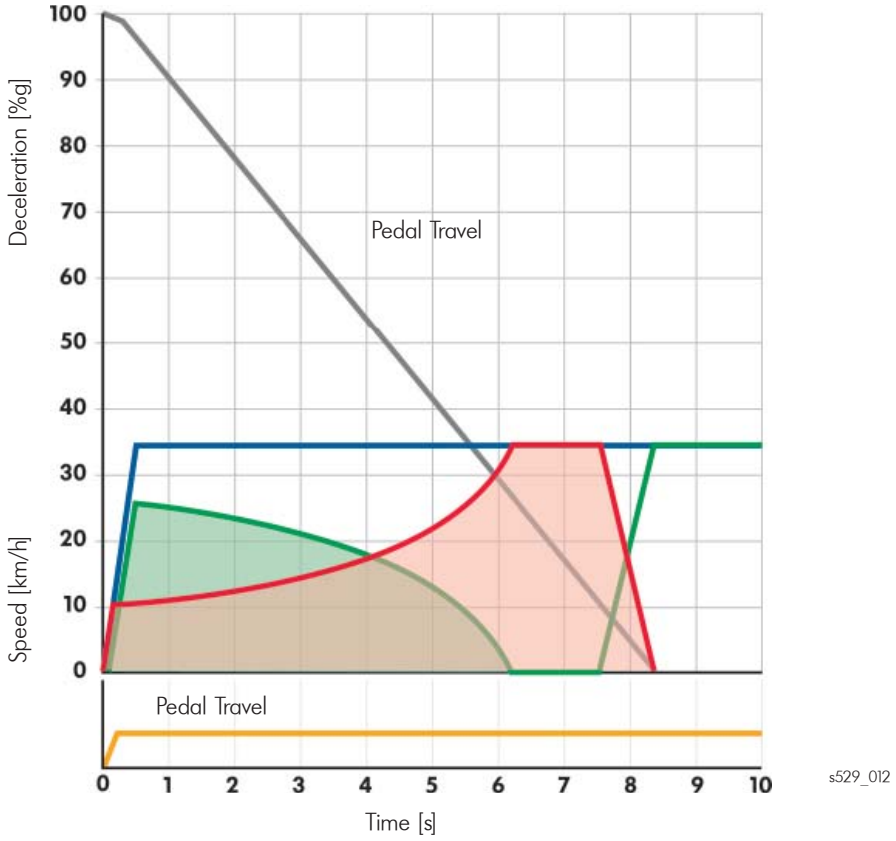
If enough recuperation deceleration is available, the hydraulic brake pressure on the wheel brakes is reduced. The Motor moves the worm gear, which moves the piston. This movement pulls brake fluid from the hydraulic system and reduces brake pressure.

Brake Blending

The use of electric vs. hydraulic deceleration is referred to as brake blending. The goal is for the braking force and pedal travel to remain constant. It does not matter whether the deceleration is electric (from the e-Machine) or hydraulic (from the wheel brakes).

The e-Machine can create braking torque during recuperation. This torque is dependent on the speed of the vehicle, the charge level and temperature of the high-voltage battery, and the speed and torque of the e-Machine itself. These variables can cause variable deceleration rates. Any variable deceleration is compensated using hydraulic braking. This compensation of electrical braking vs. wheel braking is performed automatically by the J539 Brake Booster Control Module.

Example of brake blending



Key

- Deceleration requirement from brake pedal actuation
- Friction deceleration: hydraulic braking torque
- Regenerative deceleration: alternator braking torque of the three-phase current drive
- Pedal travel: forces and paths at the brake pedal remain constant

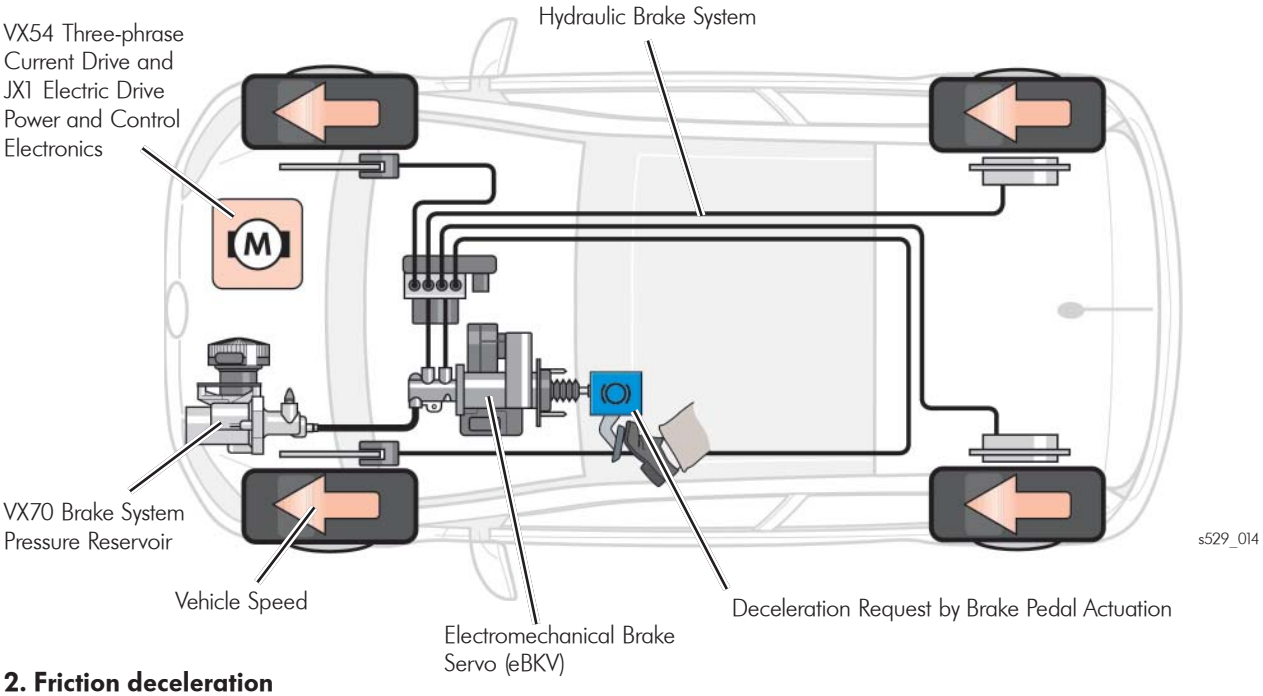


Friction + Regeneration = Total Deceleration.

Brake Blending

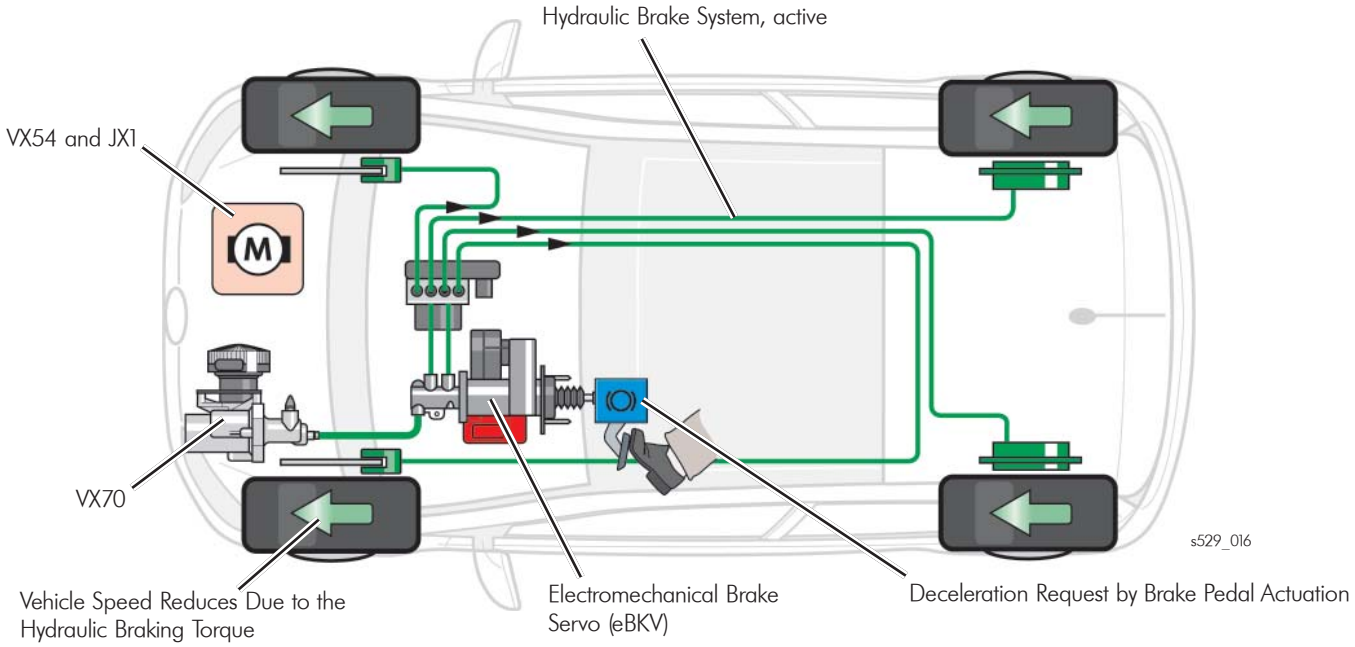
1. Deceleration request

The driver presses the brake pedal to decelerate the vehicle. The driver's braking request is communicated by the J539 Brake Booster Control Module using the brake pedal position.



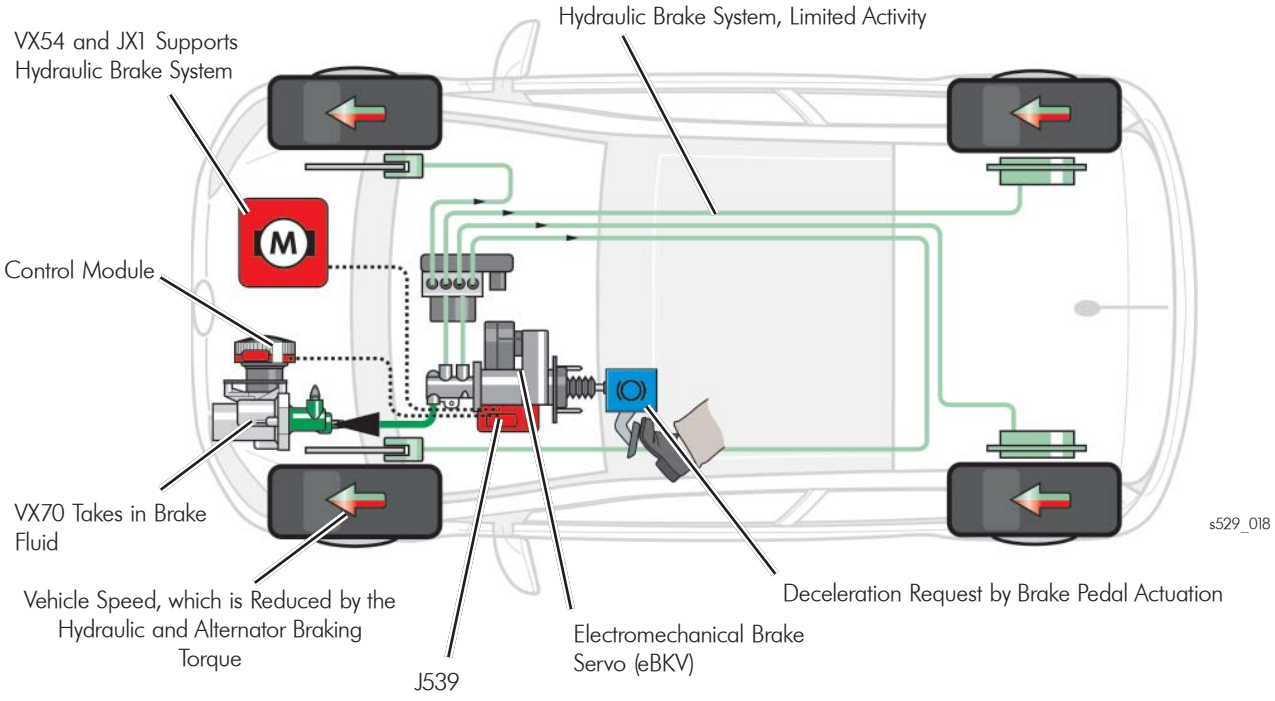
2. Friction deceleration

The driver's deceleration request increases pressure in the hydraulic brake system to reduce the speed of the vehicle.



3. Support from regenerative deceleration

JX1/VX54 sends regeneration information to J539 for hydraulic brake system support when the vehicle is travelling at high speed. Depending on the available alternator braking torque, the brake pressure is adjusted. As the speed decreases, the alternator braking torque increases. The brake pressure on the wheels can then be reduced because of the alternator braking torque available. To do this, VX70 takes in brake fluid to reduce brake pressure in the hydraulic brake system. This means it is possible for deceleration to take place only using the alternator braking torque for some periods of a braking event.



The influence of JX1 in relation to the hydraulic brake system depends on:

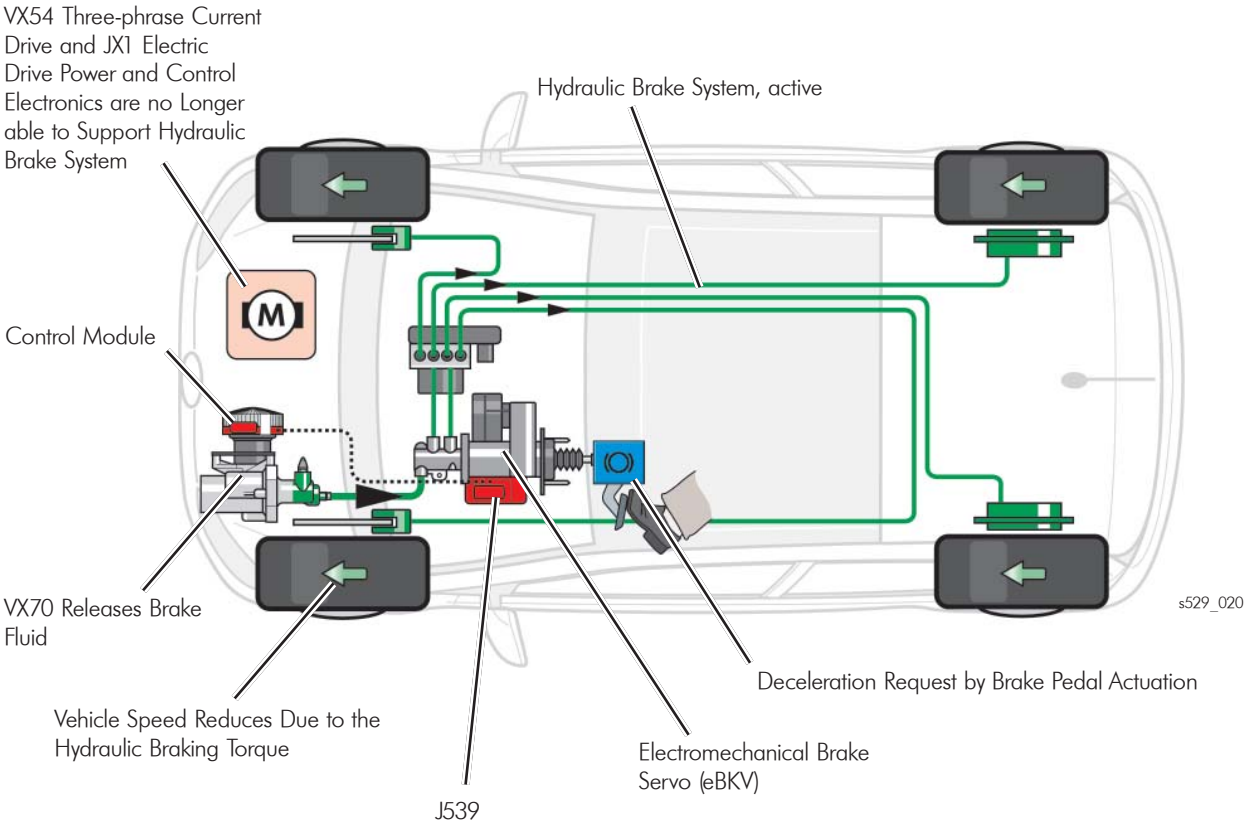


- Vehicle speed
- Charge level of the high-voltage battery (a fully charged high-voltage battery cannot store any more energy)
- Temperature of the high-voltage battery
- Speed of the three-phase current drive
- Torque of the three-phase current drive

4. Insufficient support from the three-phase current drive

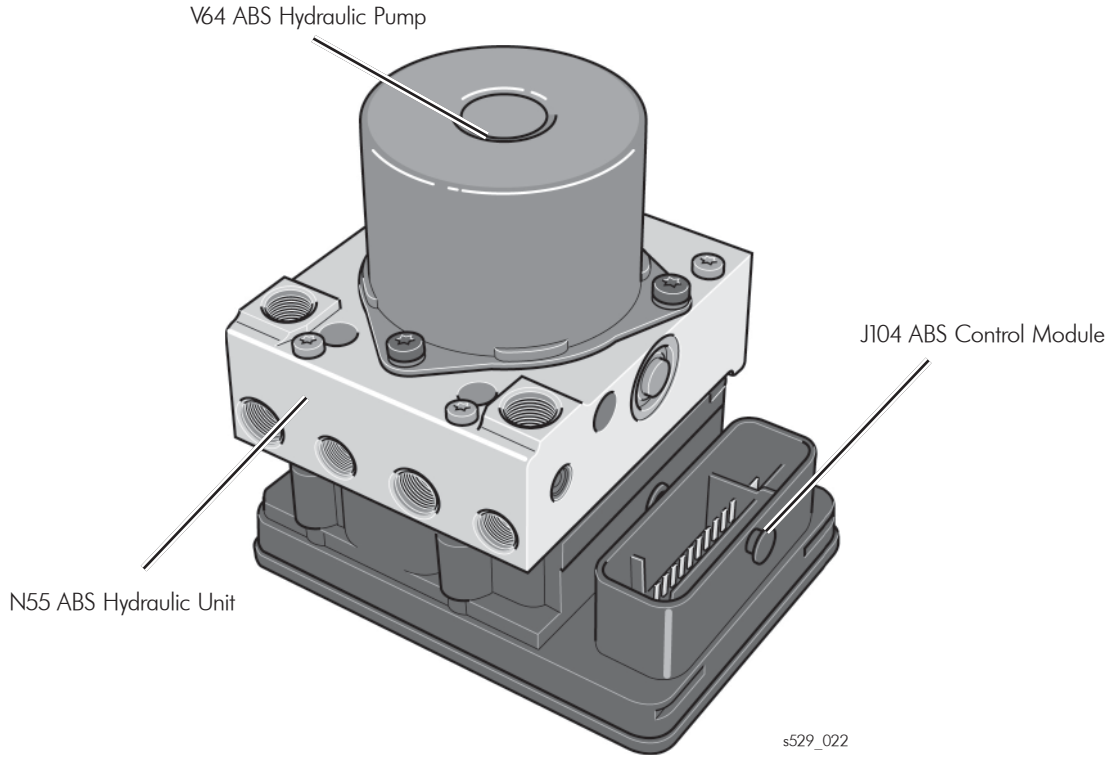
If the alternator braking torque decreases during deceleration, the J539 Brake Booster Control Module sends a signal to VX70, Brake System Pressure Reservoir. The pressure accumulator returns stored brake fluid into the brake system to increase pressure in the hydraulic brake system.

This frequently occurs when the vehicle is braked and brought to a standstill. At a vehicle speed of under 10 km/h, the alternator torque is reduced and hydraulic braking is increased.



The ESC/ABS System

The new ESC/ABS system made by TRW (Thompson Ramo Wooldridge, EBC 460) allows the brake pressure to be built up quickly and be sustained for a long time.



E-MSR

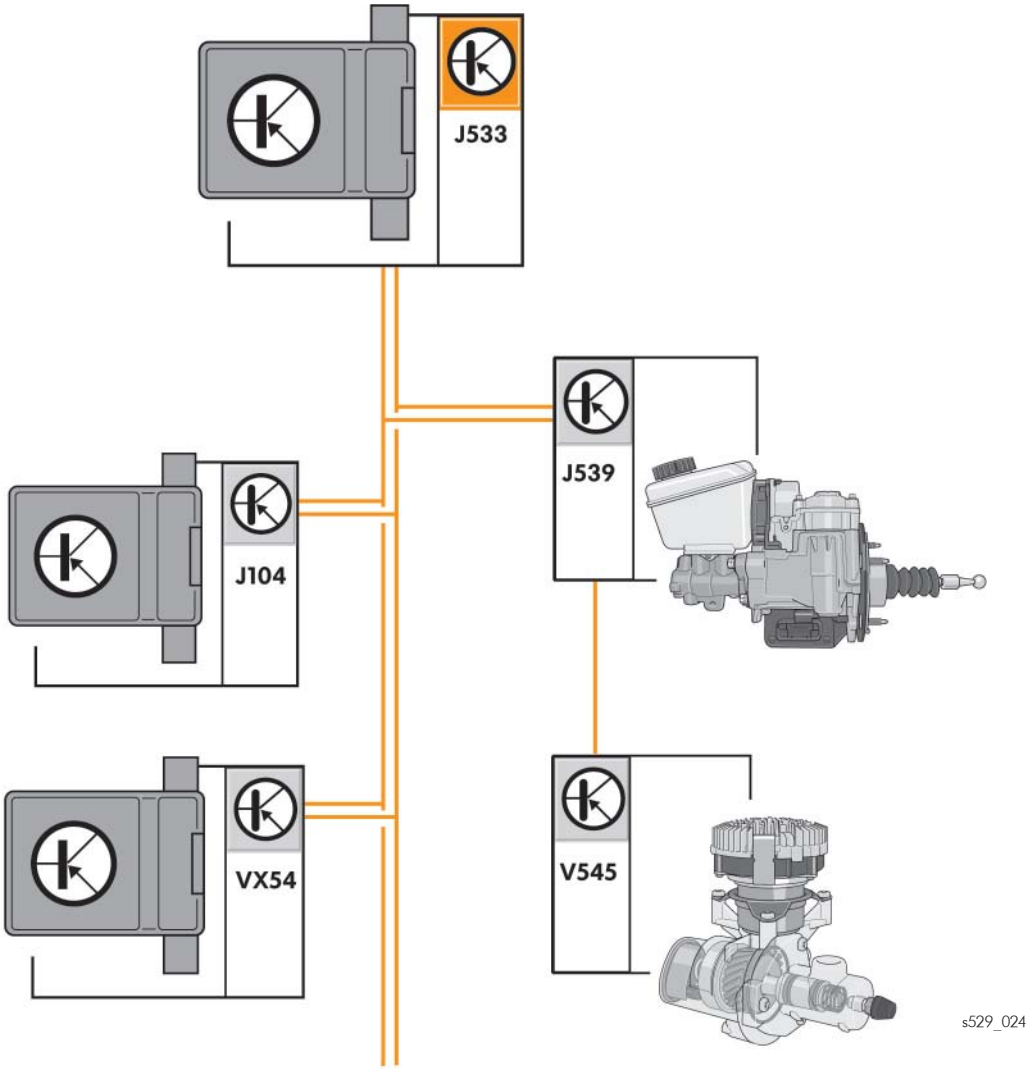
Electric motor braking control (E-MSR) identifies any slip created at the drive wheels due to the braking effect of the motor.

The energy recovery limit is an additional function of the electric motor braking control (E-MSR). It prevents the regeneration wheel drag from stopping the wheels in low traction situations. It can also increase energy recovery in situations where enough traction is present.

E-HBV

The electric-hydraulic brake servo (E-HBV) increases the brake force using the ESC control module if the electromechanical brake servo is unable to provide sufficient pressure.

Electrical Connections



Key

a	Private CAN-Bus
J104	ABS Control Module
J533	Data Bus on Board Diagnostic Interface
J539	Brake Booster Control Module
V545	Motor in Recuperation Brake Pressure Reservoir
VX54	Three-phase Current Drive
	Powertrain CAN-Bus
	Diagnostic CAN- Bus
	CAN-Bus wire

Page intentionally left blank

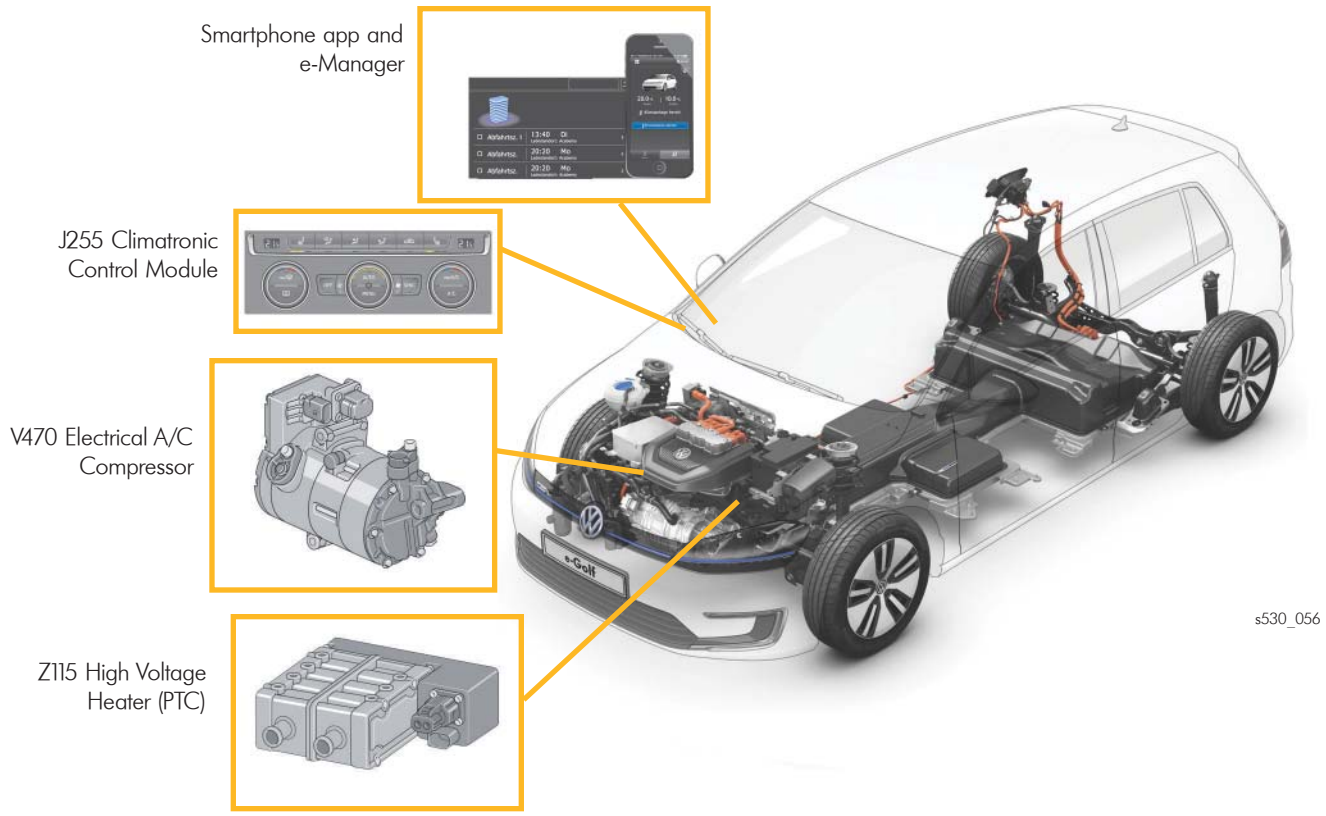
Heating and Air Conditioning

Overview

A 2-Zone-Climatronic system is standard. Although the refrigerant cycle is identical to that the 2015 Golf, the e-Golf uses an electric air-conditioning compressor.

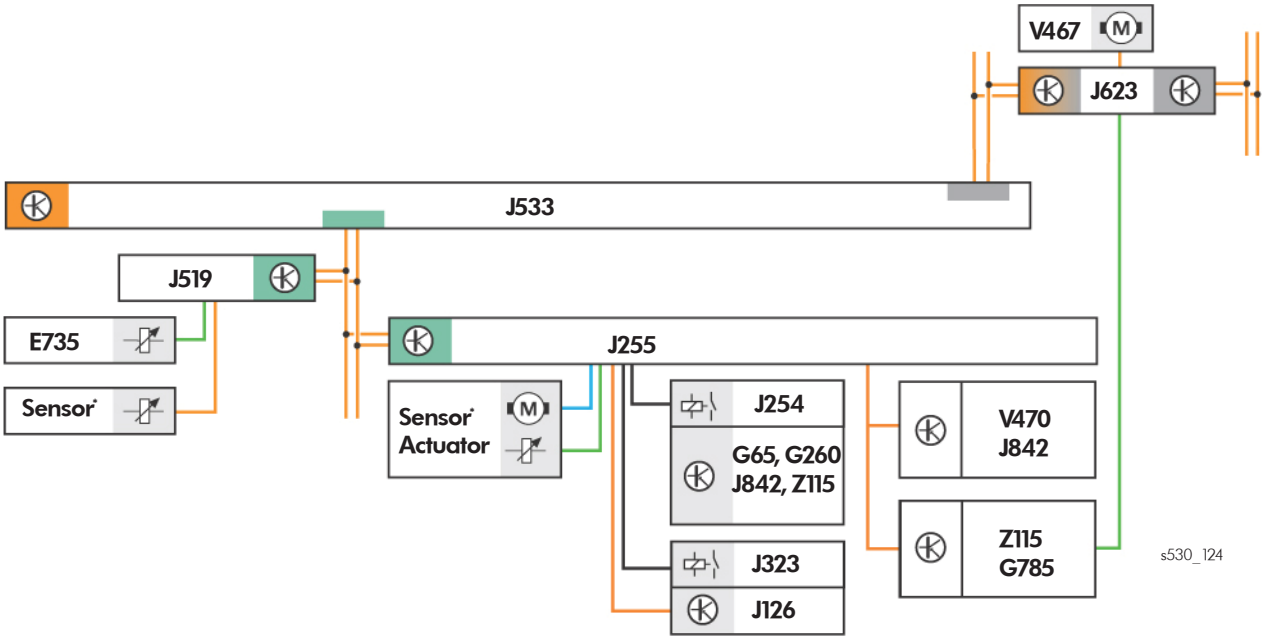
The air conditioning has a timer function that allows the driver to preset the vehicle interior to a certain temperature at a certain time (for example, 72° F at 7:00 am). Electricity from the grid can be used to cool the vehicle instead of battery power. An immediate temperature function can also be used to used to use grid power instead of battery power. Both of these can be controlled using a phone app.

Stationary air-conditioning (heating or cooling) departure times can be programmed through the e-Manager.



The performance of the Electrical Air-Conditioning Compressor V470 and the PTC Heater Z115 depend on the selected driving profile.

Air Conditioning Topology



Key

E735 Driving Profile Selection Button
G65 High Pressure Sensor
G260 A/C Humidity Sensor
J126 Fresh Air Blower Control Module
J254 Climatronic Relay
J255 Climatronic Control Module
J323 Fan Relay
J519 Vehicle Electrical System Control Module
J533 Data Bus on Board Diagnostic Interface
J623 Engine Control Module
J842 A/C Compressor Control Module
G785 Temperature Sensor in Front of High Voltage Heater (PTC)
V467 High Temperature Circuit Coolant Pump
V470 Electrical A/C Compressor
Z115 High Voltage Heater (PTC)

Powertrain CAN-Bus
Hybrid CAN-Bus
Diagnosis CAN-Bus
Comfort CAN-Bus
LIN-Bus
CAN-Bus
LIN-Bus
Actuator connection
Sensor connection
Electrical system voltage connection

* Sensors/Actuators of the Climatronic system, e.g. Potentiometers for temperature flaps, actuators or Temperature sensors, which are also used in conventional vehicles with a Two-Zone-Climatronic.

Heating and Air Conditioning

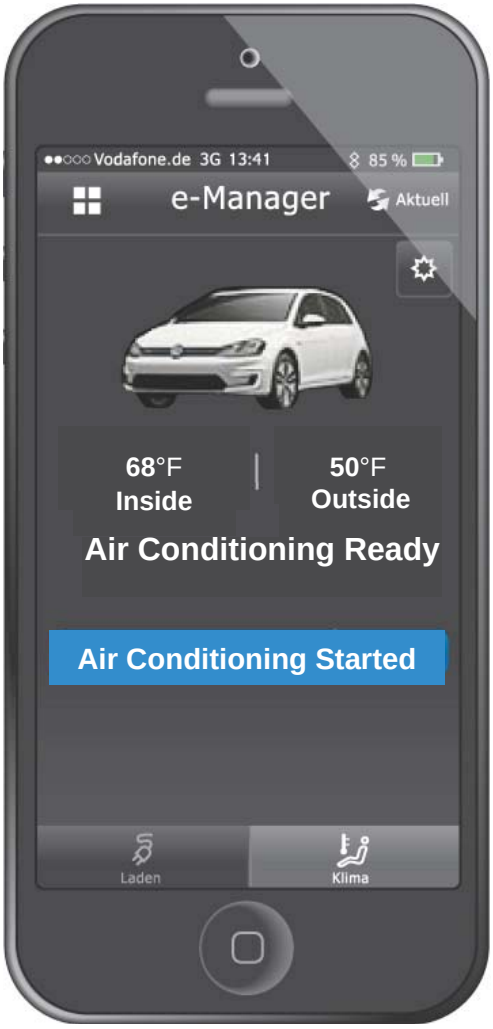
Immediate/Instant Climate Control

The immediate climate control function is activated over a smartphone app. This allows the desired interior temperature to be preselected by a smartphone app and the air conditioning begins immediately.

A desire temperature between 60°F and 84°F can be entered.

In "Low" and "High" modes the Climatronic Control Module J255 regulates the temperature in a range of Low = 59°F to High = 87°C. The maximum run time of the air conditioning during battery charging is 30 minutes. During high voltage battery operation it is a maximum of 10 minutes.

A 20% minimum high voltage battery capacity is necessary for immediate climate control when using battery power.



s530_118

Timer Programming

Stationary air conditioning timing is set through the e-Manager timer function. Approximately one hour before the preselected time, the High Voltage Battery Charger Control Module J1050 wakes the Climatronic Control Module J255 to evaluate the interior temperature. J255 computes the necessary air conditioning time and transmits this value to the J1050 High Voltage Battery Charger Control Module, J255 becomes inactive again.

At the proper time to begin climate control, J255 is activated and the stationary air conditioning cycle begins. The maximum. energy that can be used for stationary air conditioning is limited to 3.3 KW by the High Voltage Battery Charging Voltage Control Module J966.

If the stationary air conditioning was activated through the e-Manager, other stored timer entries are disregarded. Modifications through the e-Manager are not synchronized with the smartphone.



s530_009

Timer Programming During Charging

The stationary air conditioning can only be activated if the high voltage battery charge level is more than 20%. High voltage battery charging is reduced during stationary air conditioning operation.

When charging with AC current, either battery charging or air-conditioning can be performed, not both at the same time. When DC charging, air-conditioning can only take place during the charging procedure.

Stationary air conditioning is deactivated as soon as the vehicle is disconnected from the charging station.

Timer Programming During High Voltage Battery Operation

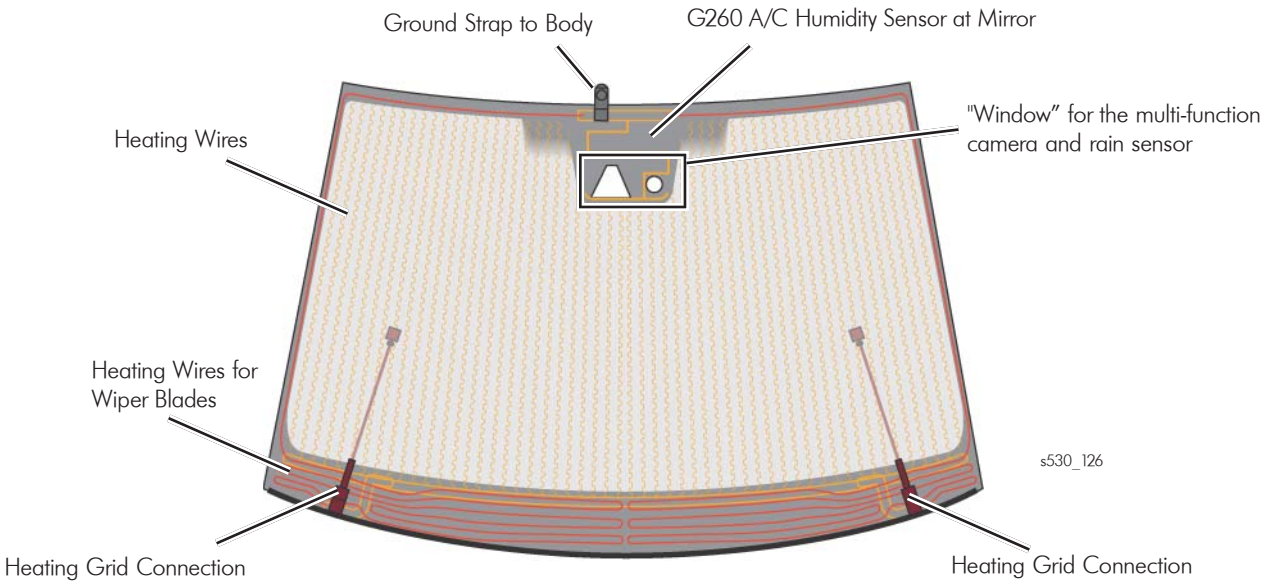
During high voltage battery operation, the air conditioning starts 10 minutes before the programmed departure time. Stationary air conditioning stops if the high voltage battery state of charge is less than 20%.

Heating and Air Conditioning

Heated Windshield Z2

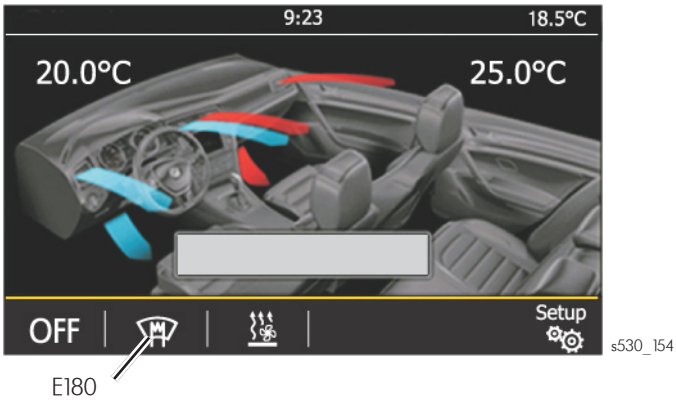
All e-Golfs are equipped with a heated windshield to reduce battery energy consumption. Small heating wires are imbedded in the windshield glass for heating. The windshield heating can be activated by a soft key in the Infotainment display, or automatically using the humidity sensor.

If the humidity sensor reaches a certain dew point, windshield heating is activated by the Climatronic Control Module J255. Up to 390 watts of power can be applied for windshield heating. If this amount of power is insufficient, the electrical A/C Compressor is turned on.



Manual Activation

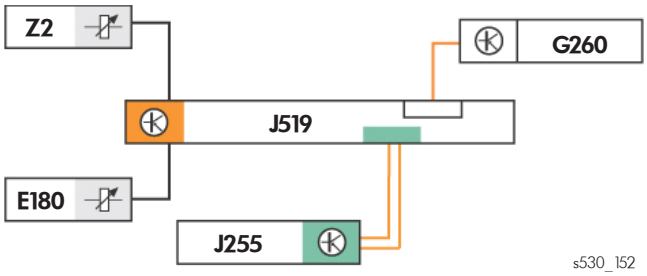
The button for the heated windshield is displayed as soft key in the Infotainment display. This allows for windshield heating to be manually activated or disabled.



Automatic Activation

The windshield heating can be automatically activated by the Climatronic Control Module J255 if the dew point exceeds a predetermined value. Dew point is the temperature at which humidity condenses and forms water droplets.

The A/C Humidity Sensor G260 detects temperature and humidity at the windshield. If necessary, the windshield heating is automatically turned on. This happens only in "AUTO" mode and can be more efficient than turning on the Electrical A/C Compressor V470. The function can be interrupted at any time by the Windshield Defogger Switch E180 (soft key).



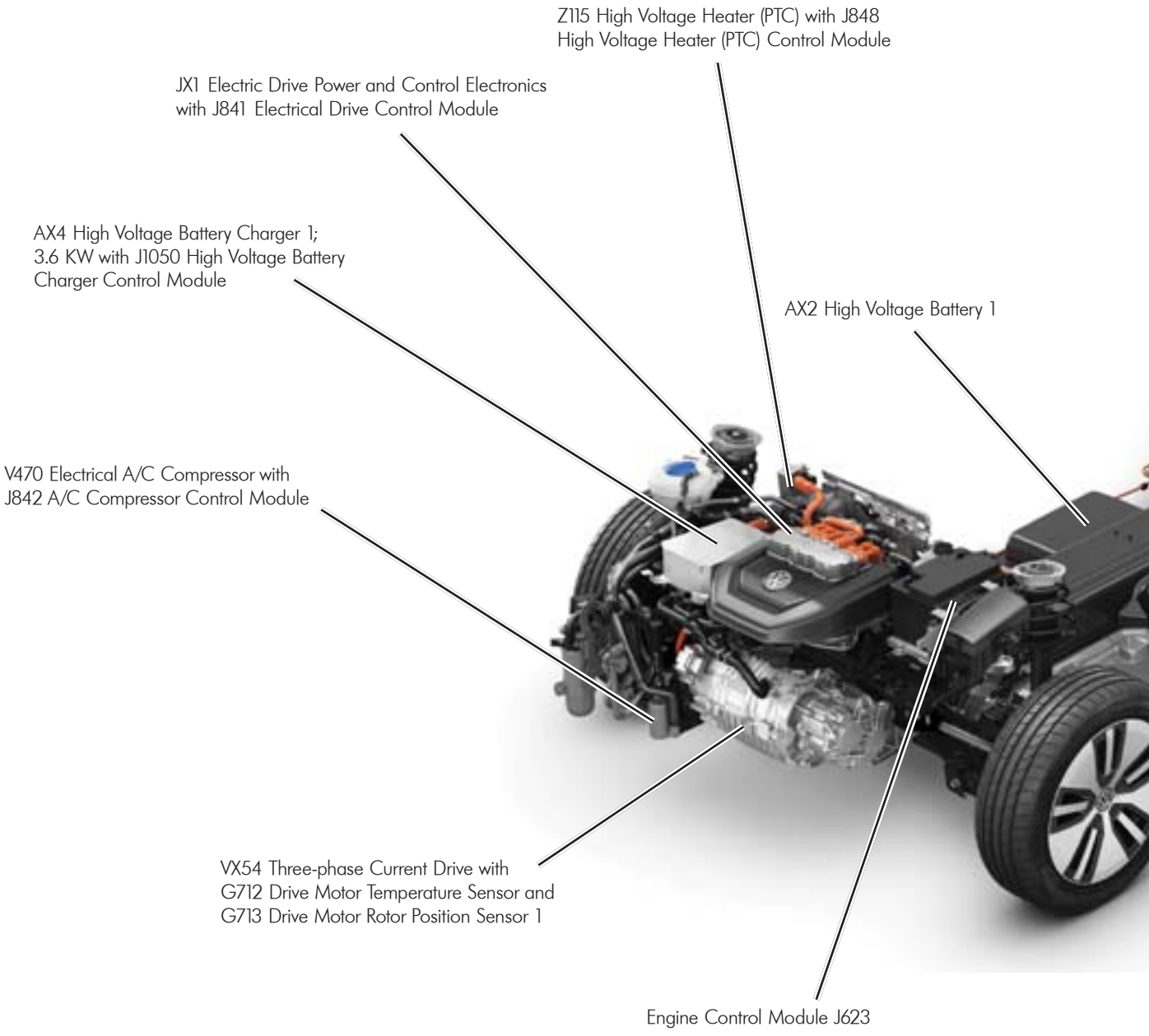
Key

E180 Windshield Defogger Switch
G260 A/C Humidity Sensor
J255 Climatronic Control Module
J519 Vehicle Electrical System Control Module
Z2 Windshield Defogger
Diagnosis CAN-Bus
Comfort CAN-Bus
LIN-Bus
CAN-Bus
LIN-Bus line
Electrical System Voltage

High Voltage System

Overview

Design and placement of the high voltage system components maximizes available room and supports functionality.







Note! Dangerous Electrical Voltage!

Service on the electric vehicles can only by performed by qualified employees. Inappropriate handling of the high voltage system can lead to life-threatening situations. Alternating current starting at 25V and direct current starting at 60V are dangerous for humans. Consult the safety information in the repair manual, the diagnostic tester and on the vehicle.

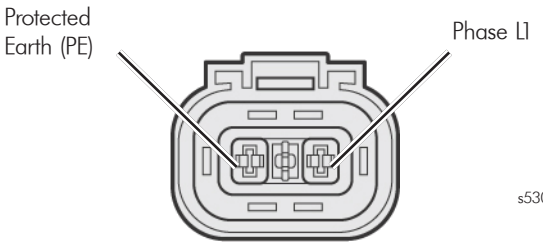
High Voltage System

High Voltage Connectors

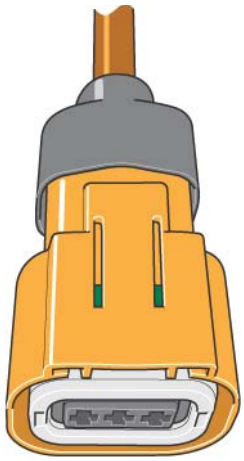
The e-Golf has five different types of high voltage connectors. The connectors for the JX1 Electric Drive Power and Control Electronics, the VX54 Three-Phase Current Drive and the V470 Electrical A/C Compressor are carryover from the Jetta Hybrid.

Additional High Voltage Connectors:

High voltage connector of UX4 High Voltage Battery Charging Socket 1 at AX4 High Voltage Battery Charger 1

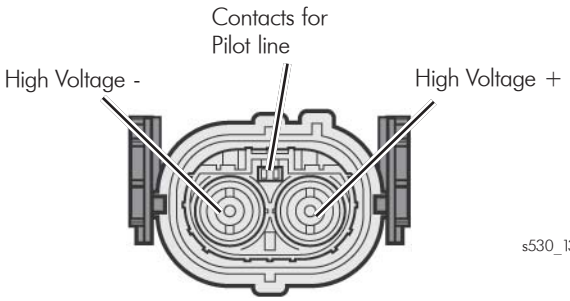


s530_130

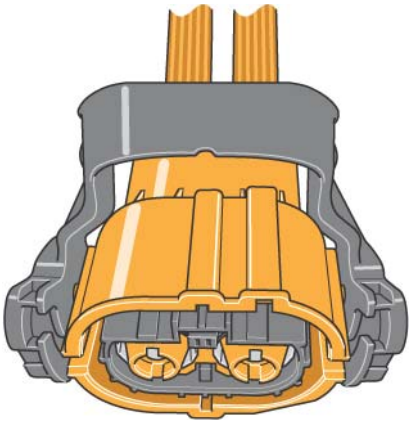


s530_090

High voltage connector at the AX2 High Voltage Battery 1 for JX1 Electric Drive Power and Control Electronics

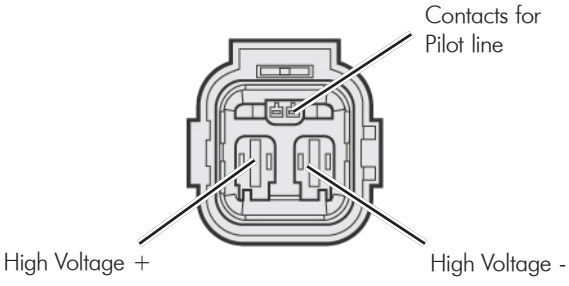


s530_132

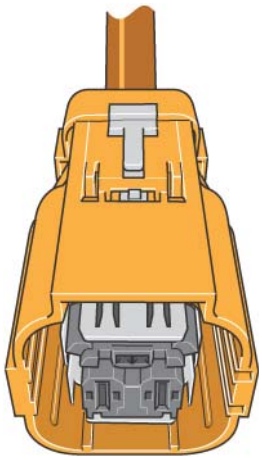


s530_092

High voltage connector from AX4 to JX1



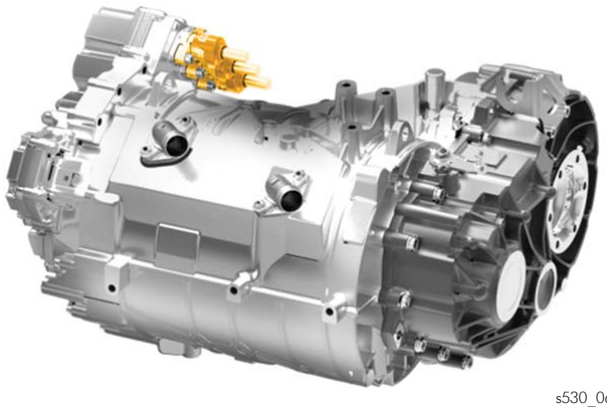
s530_128



s530_094

VX54 Three-Phase Current Drive

The basic design of VX54 is similar to other Volkswagen high voltage vehicles. Extending the rotor and stator provides higher performance.



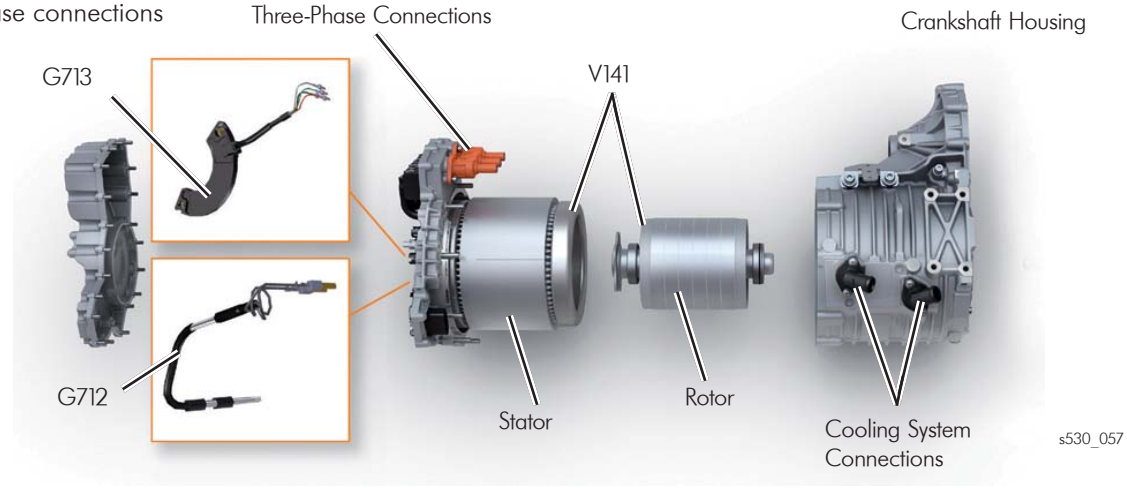
s530_063

V141 Rotor and Stator

Structure

The VX54 contains:

- V141 Electro-Drive Drive Motor
- G712 Drive Motor Temperature Sensor
- G713 Drive Motor Rotor Position Sensor 1
- Two cooling system connections
- Three, three-phase connections

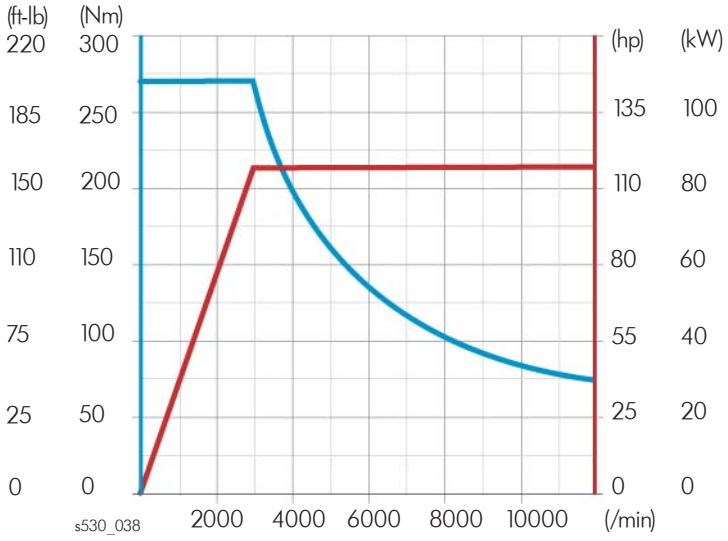


s530_057

Technical Data

Max Performance	85KW 115.5 HP
Max Torque	270 Nm 199 ft-lb
Max RPM	12,000 1/min[3]
Weight Including Transmssion	99.5 kg 219 lbs
Efficiency	up to 94%

Torque and Power Diagram



s530_038

High Voltage System

JX1 Electric Drive Power and Control Electronics

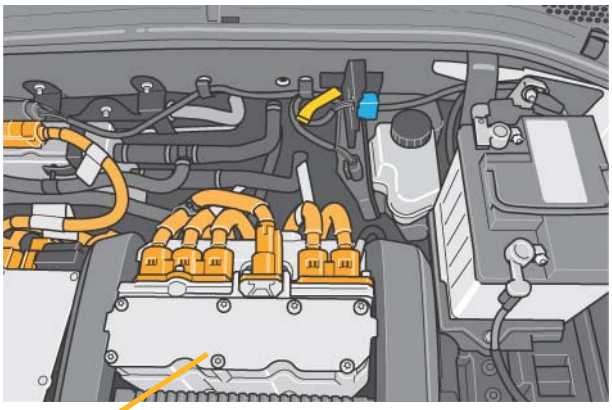
JX1 is located in the engine compartment. It controls the current flow from the AX2 High Voltage Battery 1 to the VX54 Three-Phase Current Drive. JX1 also maintains/ supplies the 12-Volt Electrical System using the integrated A19 Voltage Converter.

Technical Data

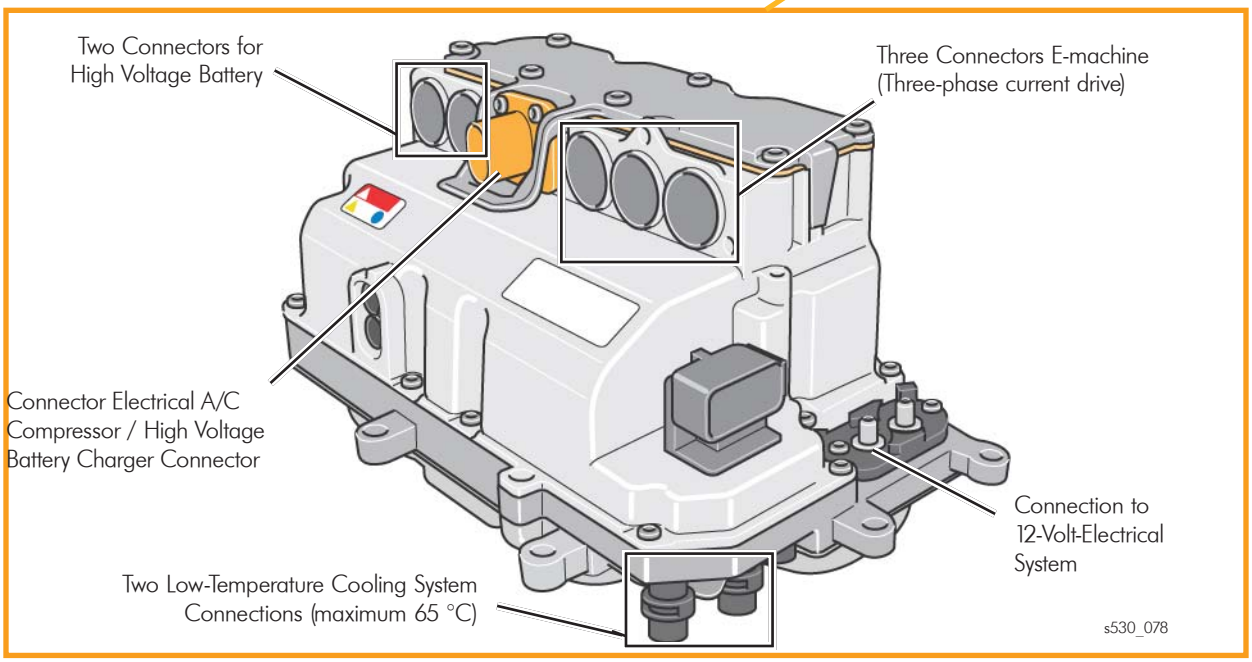
Voltage Range	230 - 430 V
Max Current	450 A
Charging Current 12V	120 A
Frequency	9-10 kHz
Weight	10.5 kg

Location

JX1 is located on the driver side in the engine compartment.



s530_098



s530_078

Construction/Configuration

The JX1 Electric Drive Power and Control Electronics is made up of several components. All components are controlled by the electrical drive control module. The following components are integrated into JX1:

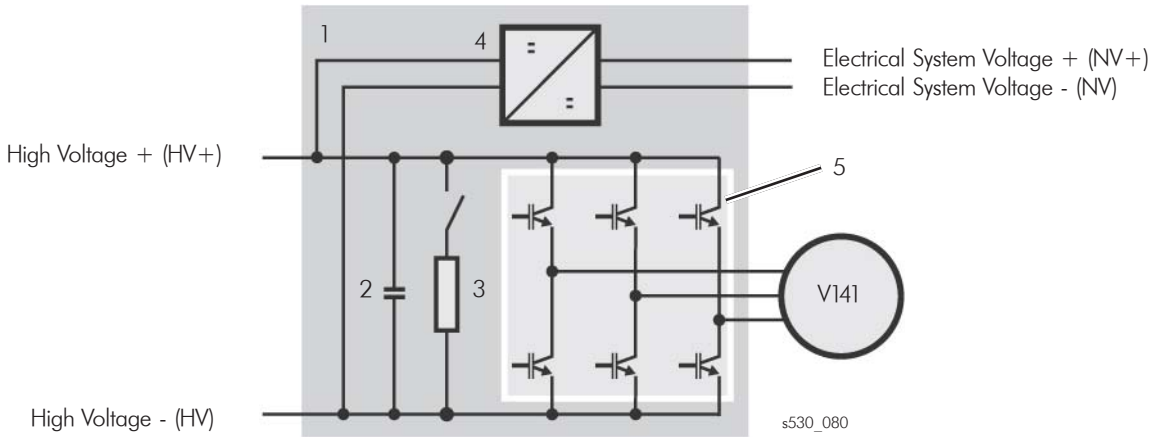
1 - J841 Electrical Drive Control Module

2 - C25 Intermediate Circuit Capacitor 1

3 - Discharging Resistor for Intermediate Circuit Condenser C25

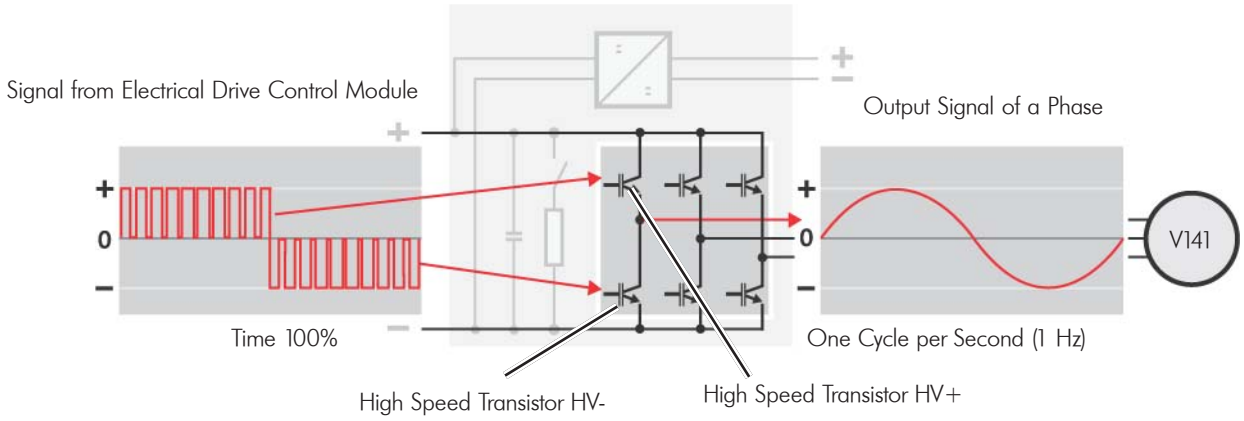
4 - A19 Voltage Converter

5 - A37 Drive Motor Inverter



A37 Function

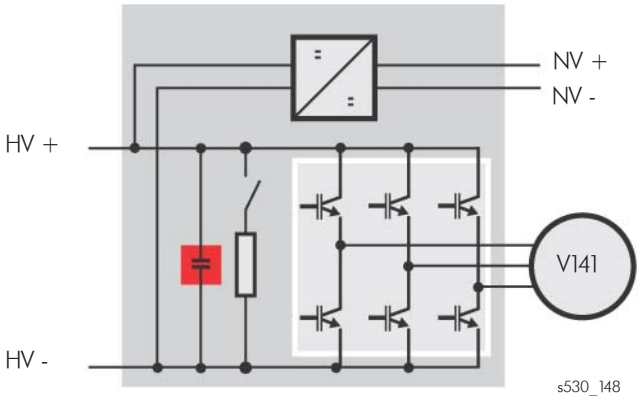
A37 converts direct current into alternating current (high speed transistors are Pulse-Width Modulated [PWM]). The PWM signal originates from J841. Each drive motor phase has two transistors. The phase is switched between high voltage positive and high voltage negative. The modulation of the transistors produces a sinusoidal alternating current that causes movement in the three-phase current drive.



High Voltage System

C25 Intermediate Circuit Capacitor 1

C25 keeps voltage constant and evens out voltage peaks. It is charged with terminal 15 ON and actively discharged with terminal 15 OFF. In case of an error or a crash signal, the condenser is passively discharged through resistors.



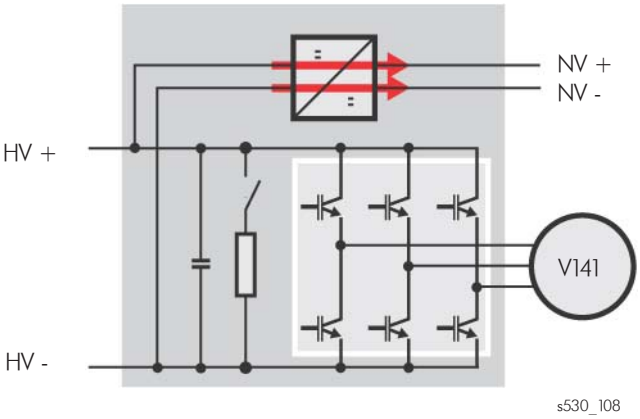
Active Discharge

Active discharging brings the high voltage to below 60 V within four seconds. This is done by pulsing the A19 Voltage Converter.

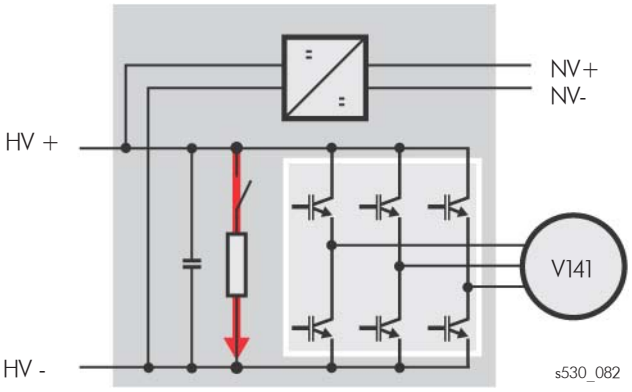
- Terminal 15 OFF
- In case of a crash signal (belt-tensioner or airbag deployed)
- Pilot line open

If A19 is defective, discharging through C25 takes place in approximately four seconds.

Active Discharge through the Voltage Converter



Emergency Discharging through C25



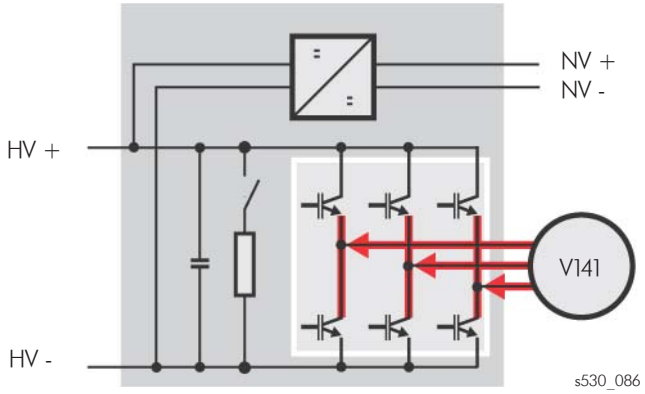
Passive Discharge

Various resistors inside of JX1 contribute to passive discharge. The passive discharge process between high voltage positive and high voltage negative takes place in approximately 120 seconds. It occurs continuously and cannot be manipulated.

Free-Wheel Function

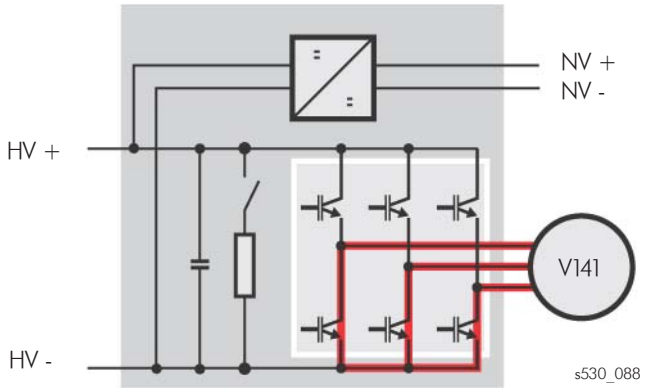
The transistors are opened during the free-wheel function.

- Terminal 15 OFF:
  - If terminal 15 is OFF, the vehicle can be moved (pushed)
- Terminal 15 ON:
  - Terminal 15 is ON and the selector lever is in the N position, the free-wheel function is operational up to approximately 50 km/h.



Active Short-Circuit

If the vehicle exceeds walking speed during terminal 15 OFF or it exceeds 50 km/h with terminal 15 ON during towing, the transistors for the three phase cables U, V and W are short-circuited. This causes a very high mechanical resistance.



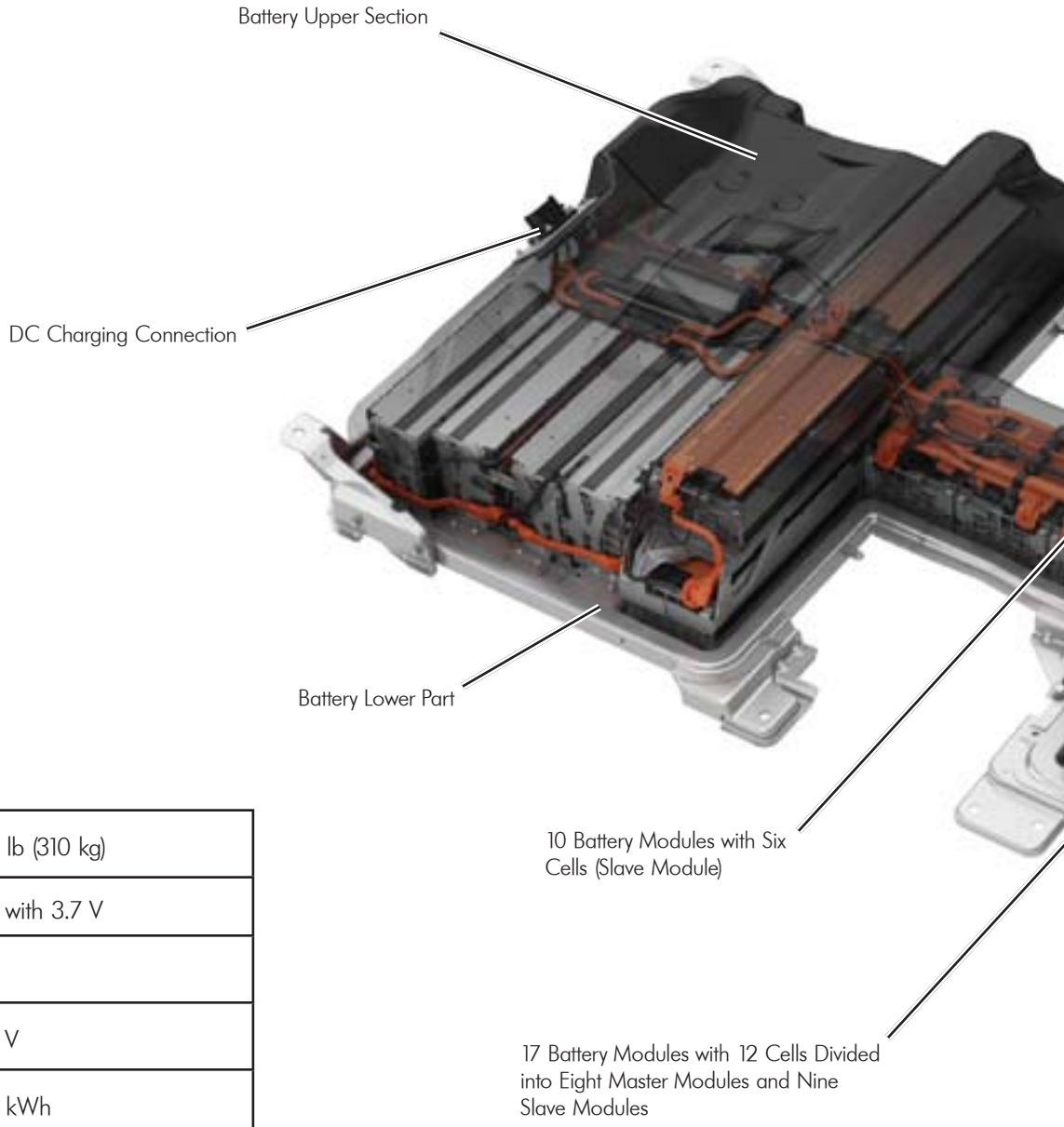


If the vehicle is towed for extended periods of time, the electric drive (e-Machine) can overheat!

High Voltage System

AX2 High Voltage Battery 1

The AX2 is located under the vehicle and provides the energy for driving, heating and cooling. Lithium-ion cells are used for energy storage.



Technical Data

Weight	683 lb (310 kg)
Number of Cells	264 with 3.7 V
Cell Modules	27
Rated Voltage	323 V
Nominal Energy	21.2 kWh
Capacity	75Ah
Temperature Range	-13° to + 131°F

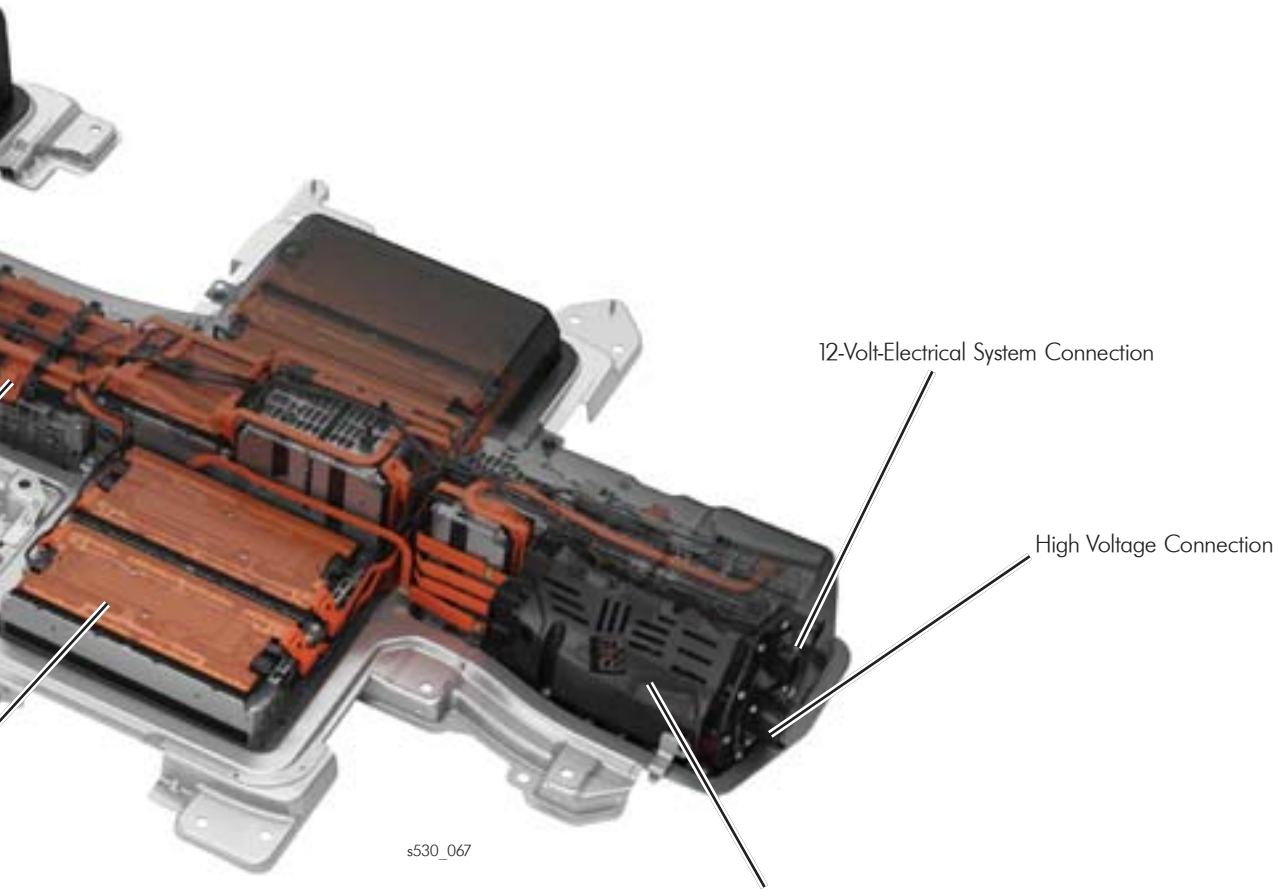
High Voltage System

The J840 Battery Regulation Control Module, integrated in the SX6 High Voltage Battery Switch Box, has the following functions:

- Pilot line monitoring
- Crash signal monitoring
- Master function for the J497 Battery Module Monitoring Control Module

The J497 has the following functions:

- Controlling the protective relays
- Charge regulation
- Isolation resistance monitoring
- Current measurements before and after the protective relays





Note! Dangerous electrical voltage!

Work on High Voltage Batteries can only by performed by a High Voltage Technician (HVT).

High Voltage System

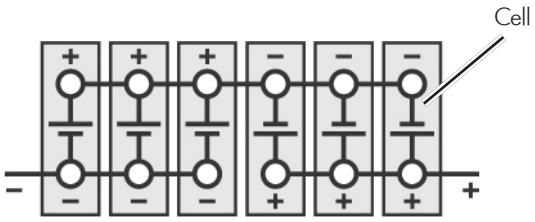
Battery Modules

The e-Golf has 27 battery modules connected in series.

- Eight Master Modules with twelve cells
- Nine Slave Modules with twelve cells
- Ten Slave Modules with six cells

The battery modules consist of battery cells. Three parallel connected battery cells are always connected in series.

Connection of Battery Cells (Module with six battery cells)

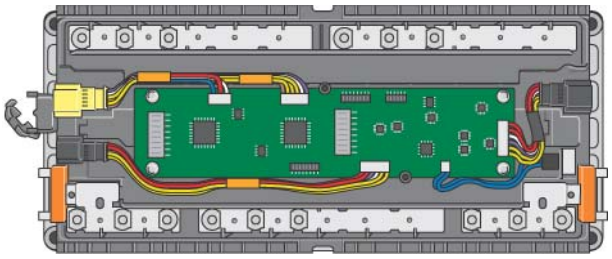


s530_134

Master Modules

Each Master Module can be connected to up to four Slave Modules. The Master Module controls the charge rate, monitors the module temperature and the cell voltage. The data is transmitted over a private CAN-Bus to the Battery Module Monitoring Control Module J497.

Master Module with 12 Battery Cells

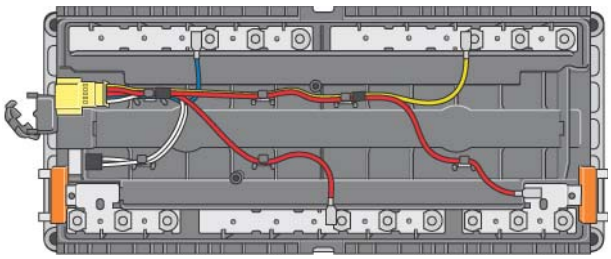


s530_142

Slave Module

The Slave Modules log cell voltage and temperature and send it to the Master Module.

Slave Module with 12 Battery Cells

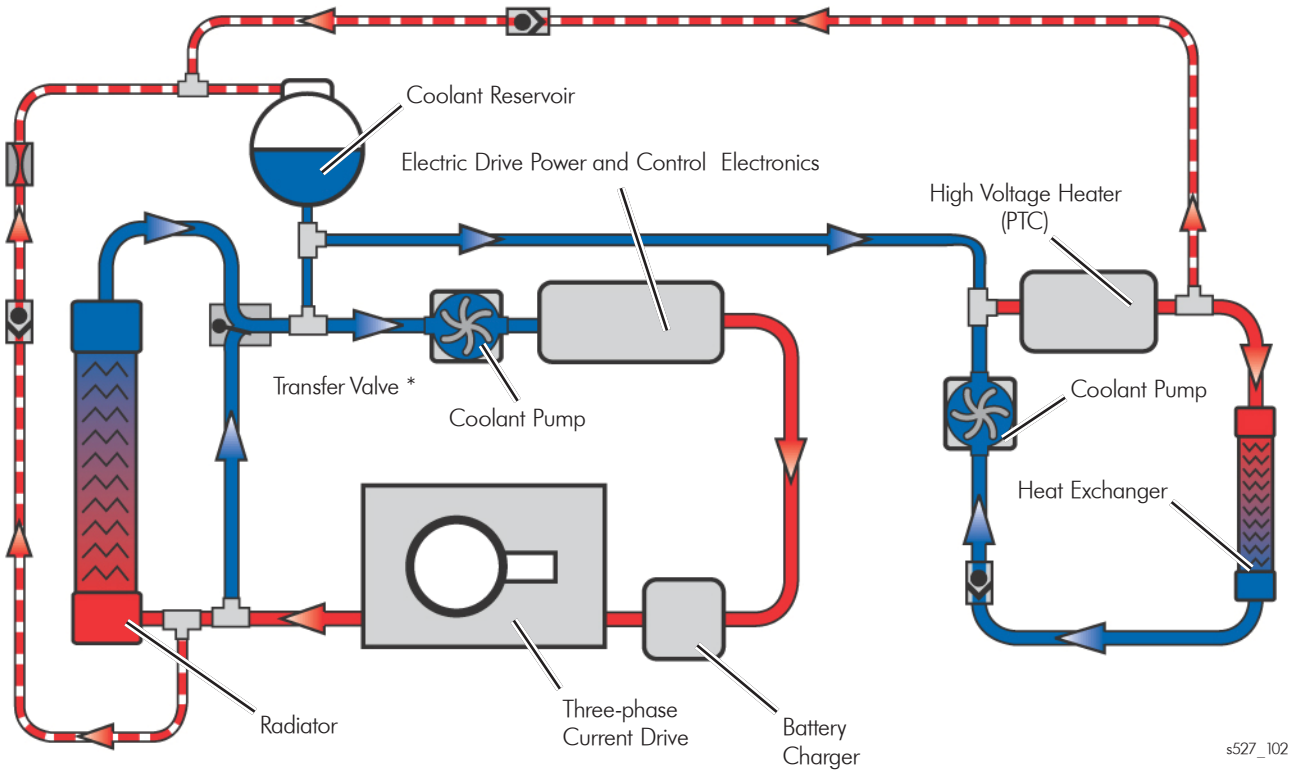


s530_146

Cooling System

The cooling system protects sensitive components from high temperatures. Coolant temperatures can reach up to 149°F (65°C) and are monitored electronically and regulated by the J623 Engine Control Module. The following components are cooled by the cooling system:

- VX54 Three-Phase Current Drive
- AX4 High Voltage Battery Charger 1
- JX1 Electric Drive Power and Control Electronics



Key

Cool Coolant

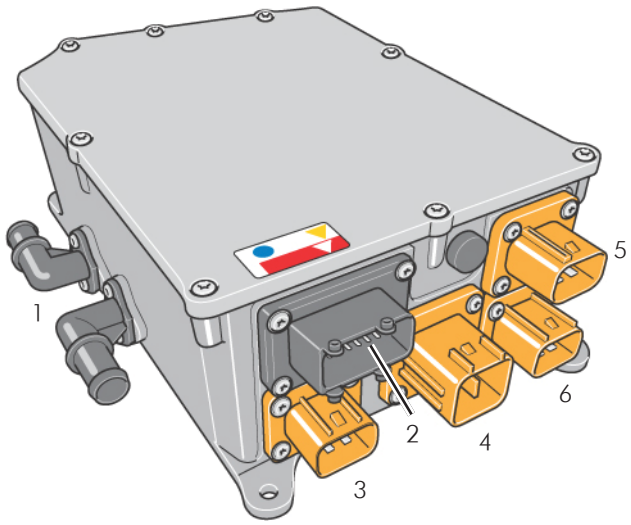
Warm Coolant

Coolant Pressure Balancing

* Currently, the Transfer Valve does not have a function.

High Voltage System

The High Voltage Battery Charger 1 AX4 converts alternating current to direct current to charge the high voltage battery. It also supplies power to the A/C compressor and the PTC heater. It is located in the engine compartment.



Structure

The High Voltage Battery Charger 1 AX4 has the following connections:

1 - Cooling system

2 – Vehicle electrical system connection for charger

3 - High voltage battery charging socket 1

4 - High voltage connection

5 - V470 Electrical A/C Compressor

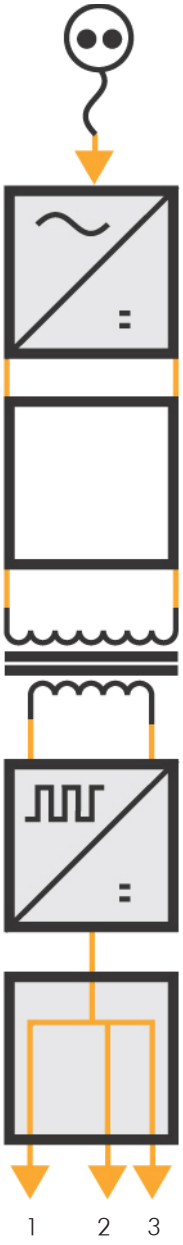
6 - Z115 High Voltage Heater (PTC)

Technical Data

	World-Wide	North America
Input Alternating Current	100-240 V, 16 A	100-240 V, 1x32 A/2x16 A
Output Direct Current	220-450 V, 12 A	220-450 V, 25 A
Efficiency	93%	94%
Weight	5.8 kg (12.79 lbs)	7.2 kg (15.87 lbs)

Function

The AX4 transforms alternating current into direct current, at approximately 400 V, to charge the high voltage battery.



The incoming alternating current is converted to direct current by the rectifier.

The J840 Battery Regulation Control Module adapts the direct current to the required amperage using a 100 kHz frequency.

The transformer adapts the voltage to the requested charge current from the J840.

The pulsed charging current is converted into direct current and sent through JX1 to the AX2 High Voltage Battery 1.

Outputs:

1 - JX1 Electric Drive Power and Control Electronics

2 - Z115 High Voltage Heater (PTC)

3 - V470 Electrical A/C Compressor



Charging performance is reduced during active air conditioning. All air conditioning power is supplied by the battery charger. Since the battery cannot charge and discharge at the same time, the charging duration is modified.

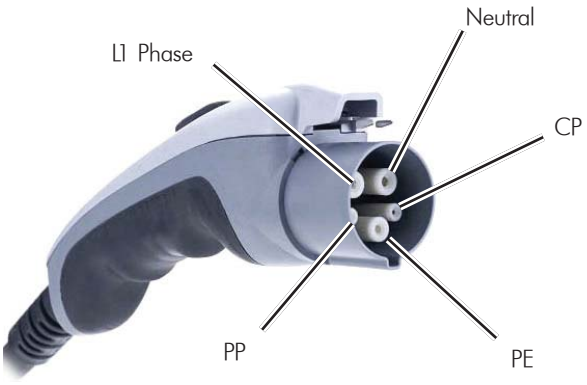
High Voltage System

Charge Connectors

The UX4/UX5 High Voltage Battery Charging Socket 1 and 2 are the connection points between vehicle and external power source. The charge connectors contain the following contacts:

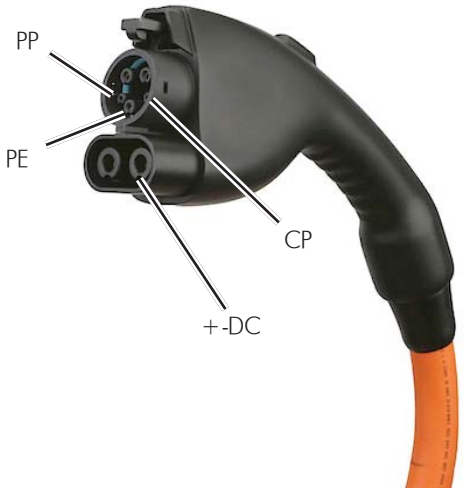
- PP - Proximity
  (maximum amperage/cross section)
- CP - Control Pilot
  (charge activation/termination by vehicle)
- PE - Protected Earth (Ground)
- L1 - Phase
- +-DC - Direct Current Connection

AC Connector



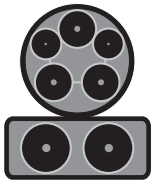
s530_158

DC Connector



s530_160

AC and DC Connectors

	AC	DC
USA Combination Charging System Type 1 Location: Right Rear of Vehicle		

High Voltage Cable Routing

1 - VX54 Three-Phase Current Drive

2 - JX1 Electric Drive Power and Control Electronics

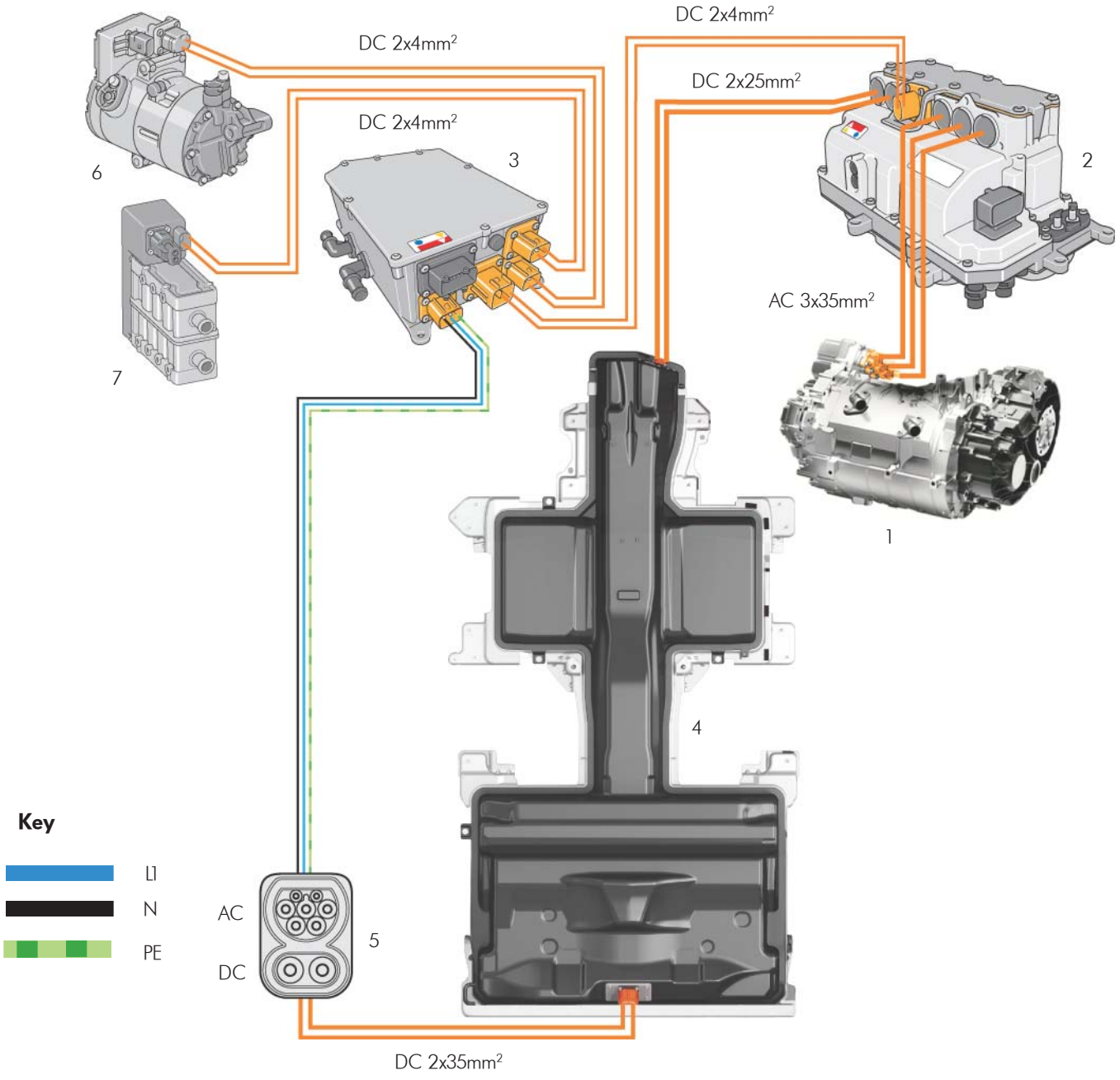
3 - AX4 High Voltage Battery Charger 1

4 - AX2 High Voltage Battery 1

5 - UX4/UX5 Connection

6 - V470 Electrical A/C Compressor

7 - Z115 High Voltage Heater (PTC)



Electrical System

12 Volt Vehicle Electrical System

High voltage is only used for drive components. The rest of the vehicle operates on 12V, just like the regular Golf. The JX1 converts high voltage into 12V for charging the 12V battery.

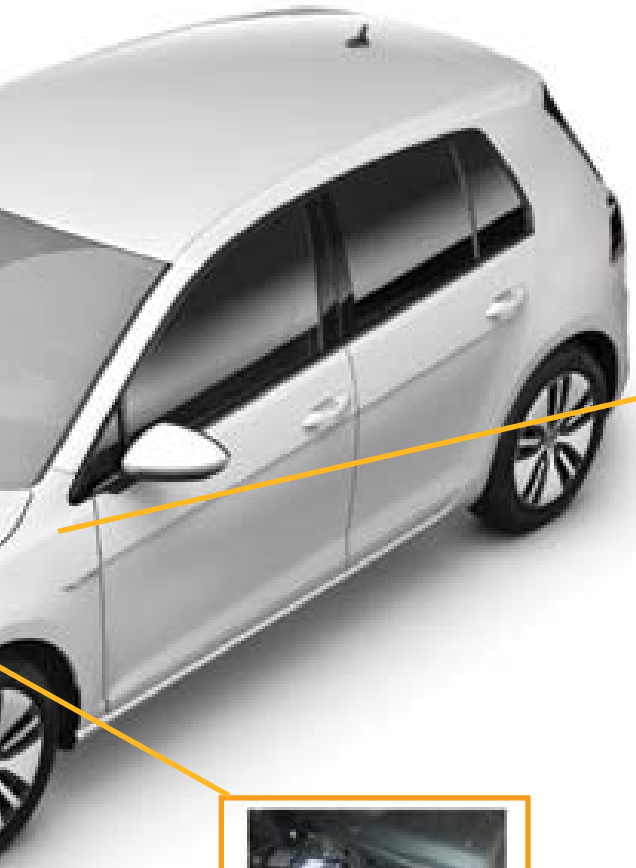


JX1 Electric Drive Power and Control Electronics

The JX1 provides the supply, support and charge for the e-Golf 12-Volt vehicle electrical system.



12 Volt Vehicle Electrical System Battery





Fuse box and J519 Vehicle Electrical System Control Module in passenger compartment on driver side.
The 10 A Fuse (marked by a tag) is a backup to interrupt current supply to terminal 30c and J840 Battery Regulation Control Module.

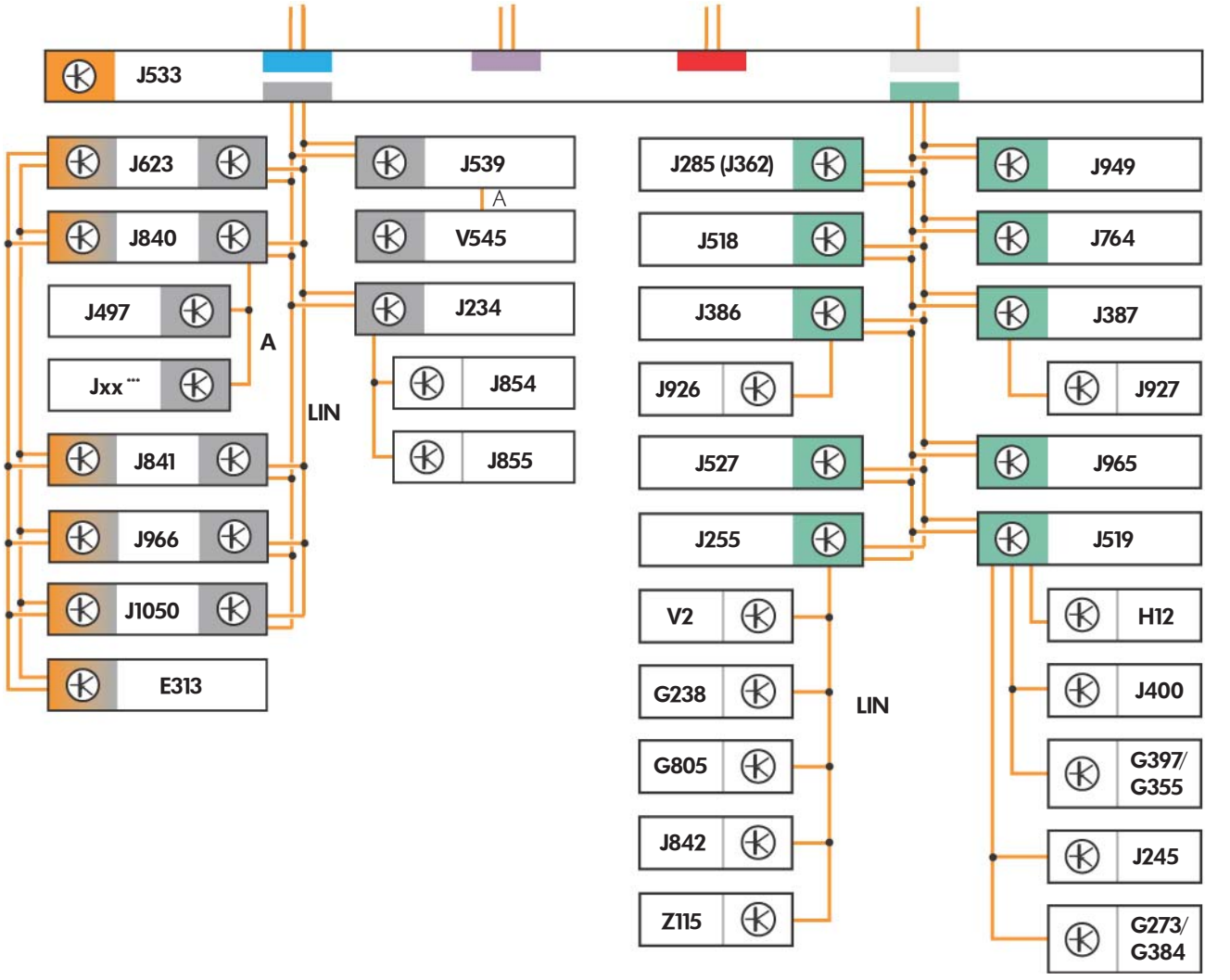


Fuse box with Multifuse in engine compartment next to 12 Volt Battery

s530_069

Networking Concept

A Hybrid CAN-Bus was developed to control additional modules. This is a sub-bus and does not have a connection to J533 Data Bus on Board Diagnostic Interface. It provides communication between the individual high voltage components.



s530_016



The Chassis CAN-Bus, Extended CAN-Bus and Infotainment CAN-Bus with the Most-Bus are identical to those in the 2015 Golf. Additional information is in SSPs 890343 The 2015 Golf Electrical System and 890543 The 2015 Golf Infotainment System.

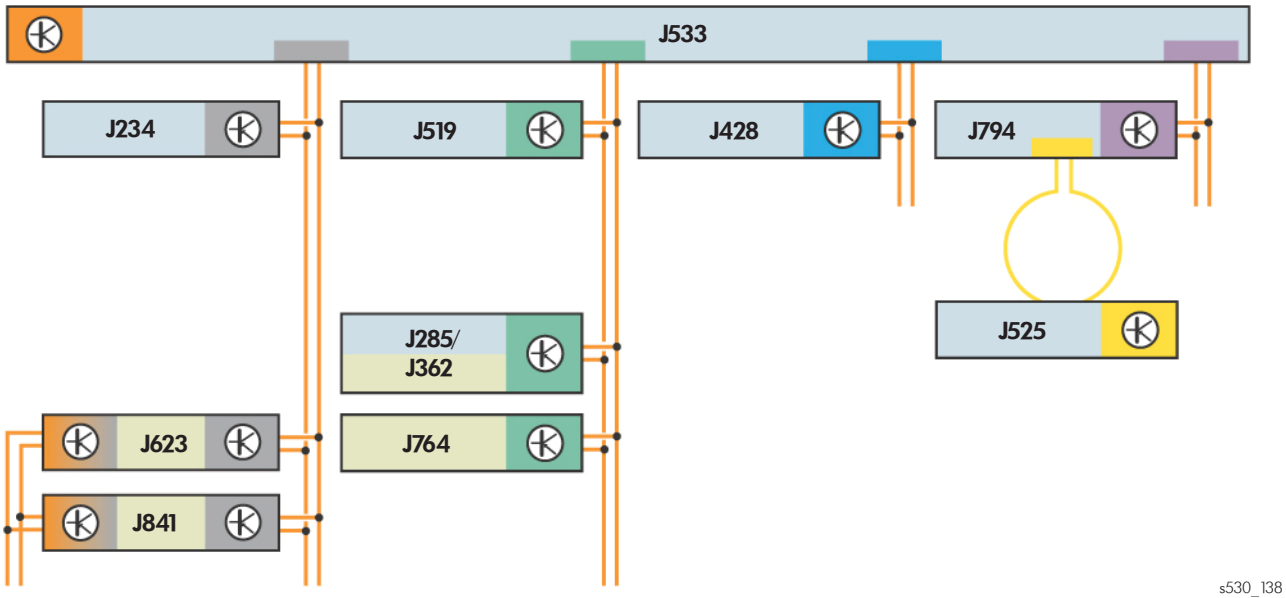
Key

A Private CAN-Bus
E313 Selector Lever
G238 Air Quality Sensor
G273 Interior Monitoring Sensor
G355 Humidity Sensor
G384 Vehicle Inclination Sensor
G397 Rain/Light Recognition Sensor
G805 Refrigerant Circuit Pressure Sensor
H12 Alarm Horn
J234 Airbag Control Module
J245 Power Sunroof Control Module
J255 Climatronic Control Module
J285 Instrument Cluster Control Module
J362 Anti-theft Immobilizer Control Module
J386 Driver Door Control Module
J387 Front Passenger Door Control Module
J400 Wiper Motor Control Module
J518 Access/Start Authorization Control Module
J519 Vehicle Electrical System Control Module
J527 Steering Column Electronics Control Module
J533 Data Bus on Board Diagnostic Interface
J539 Brake Booster Control Module
J623 Engine Control Module
J764 Electronic Steering Column Lock Control Module
J840 Battery Regulation Control Module
J841 Electrical Drive Control Module
J842 A/C Compressor Control Module
J854 Left Front Seat Belt Tensioner Control Module
J855 Right Front Seat Belt Tensioner Control Module
J926 Driver Side Rear Door Control Module
J927 Passenger Side Rear Door Control Module
J949 Control Module for Emergency Call Module and Communication Unit
J965 Access/Start System Interface
J966 High Voltage Battery Charging Voltage Control Module
J1050 High Voltage Battery Charger Control Module
Jxx *** Battery Modules 0-26: J991-J1002; J1068; J1077-J1085
J497 Battery Module Monitoring Control Module
V2 Fresh Air Blower
V545 Motor in Recuperation Brake Pressure Reservoir
Z115 High Voltage Heater (PTC)

Powertrain CAN-Bus
Hybrid CAN-Bus
Chassis CAN-Bus
Extended CAN-Bus
Comfort CAN-Bus
Infotainment CAN-Bus
LIN-Bus
CAN-Bus
LIN-Bus

Anti-Theft Immobilizer and Component Protection

The e-Golf has Generation V Immobilizer and component protection. The J841 Electrical Drive Control Module has also been added to the immobilizer system.



Key

J234 Airbag Control Module
J285 Instrument Cluster Control Module
J362 Anti-theft Immobilizer Control Module
J428 Distance Regulation Control Module
J519 Vehicle Electrical System Control Module
J525 Digital Sound System Control Module
J533 Data Bus on Board Diagnostic Interface
J623 Engine Control Module
J764 Electronic Steering Column Lock Control Module
J794 Information Electronics Control Module 1
J841 Electrical Drive Control Module

Immobilizer component protected component
Powertrain CAN-Bus
Hybrid CAN-Bus
Extended CAN-Bus
Comfort CAN-Bus
Infotainment CAN-Bus
MOST-Bus
CAN-Bus
MOST-Bus (fiber optics)



Additional information for the anti-theft immobilizer and component protection is in SSP 890343 The 2015 Golf Electrical System.

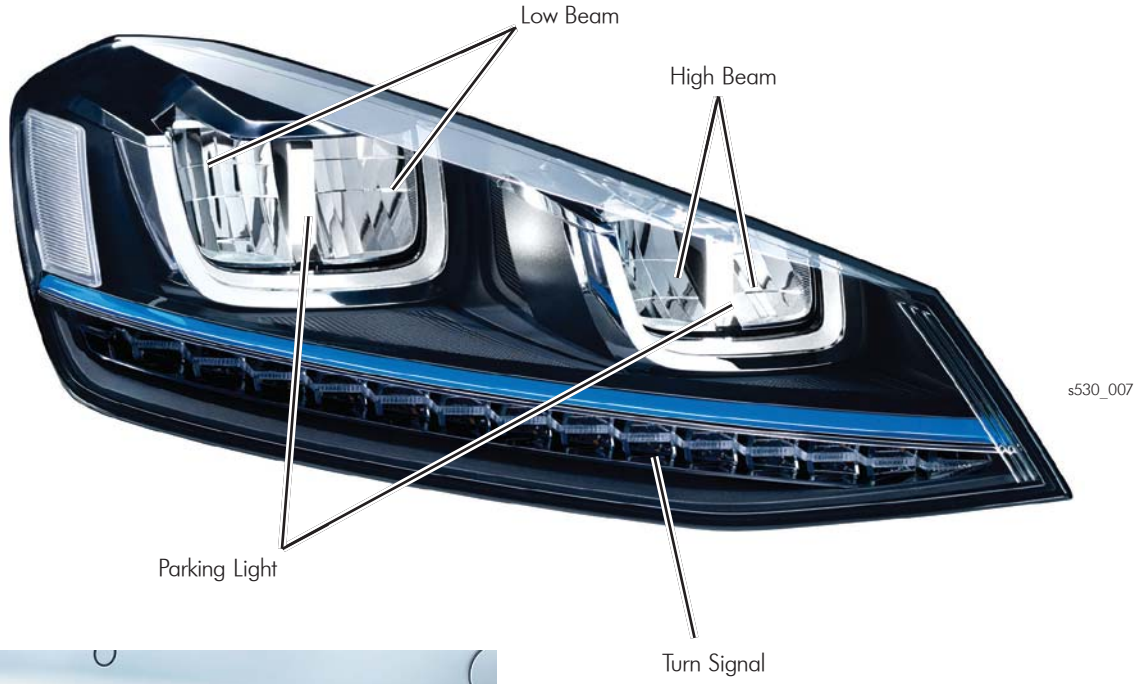
Lighting System

Front Lights

The e-Golf headlights are equipped with LED technology. Some of the LEDs are Multichip technology.

The headlight incorporates 20 LEDs:

- Parking light: Two LEDs distribute their light over vertically arranged fiber optics
- Low beam: Two LED modules (Multichip) 10W each light
- High beam: Two LED modules (Multichip) 5W each
- Turn signal: 14 LEDs 0.5W each



s530_007



Daytime Running Light - Four LEDs (3W each)

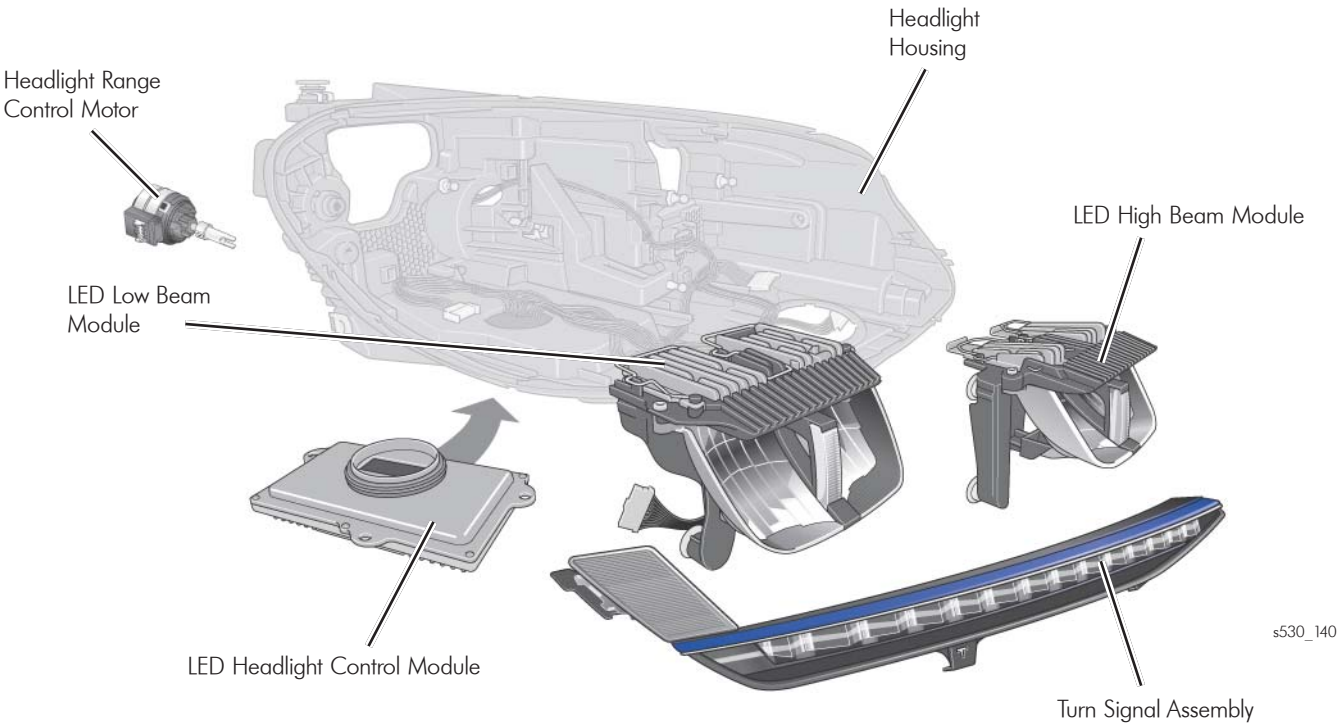
s530_011

The daytime running light module is C-shaped and located in the front bumper. The module has four LEDs, connected in series. The control module is integrated into the module for daytime running lights. Four LEDs receive a 100% PWM signal. When terminal 58 (parking light) is activated, the signal is dimmed/reduced to 10%.

LED Headlight

Structure

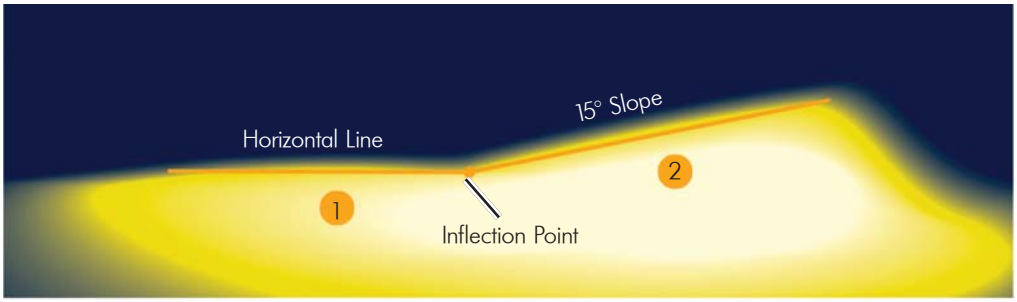
The following components are integrated in the LED headlight assembly:



Low Beam

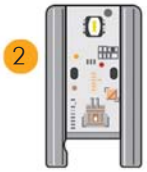
The LED low beam module produces a light cone that conforms to legal standards. LED module (1) generates the horizontal line and a second LED module (2) generates the 15° slope.

Variable arrangement of LED chips, reflector shapes and screens on the LED unit are used to create this shape.









s530_117

LED Headlight Control

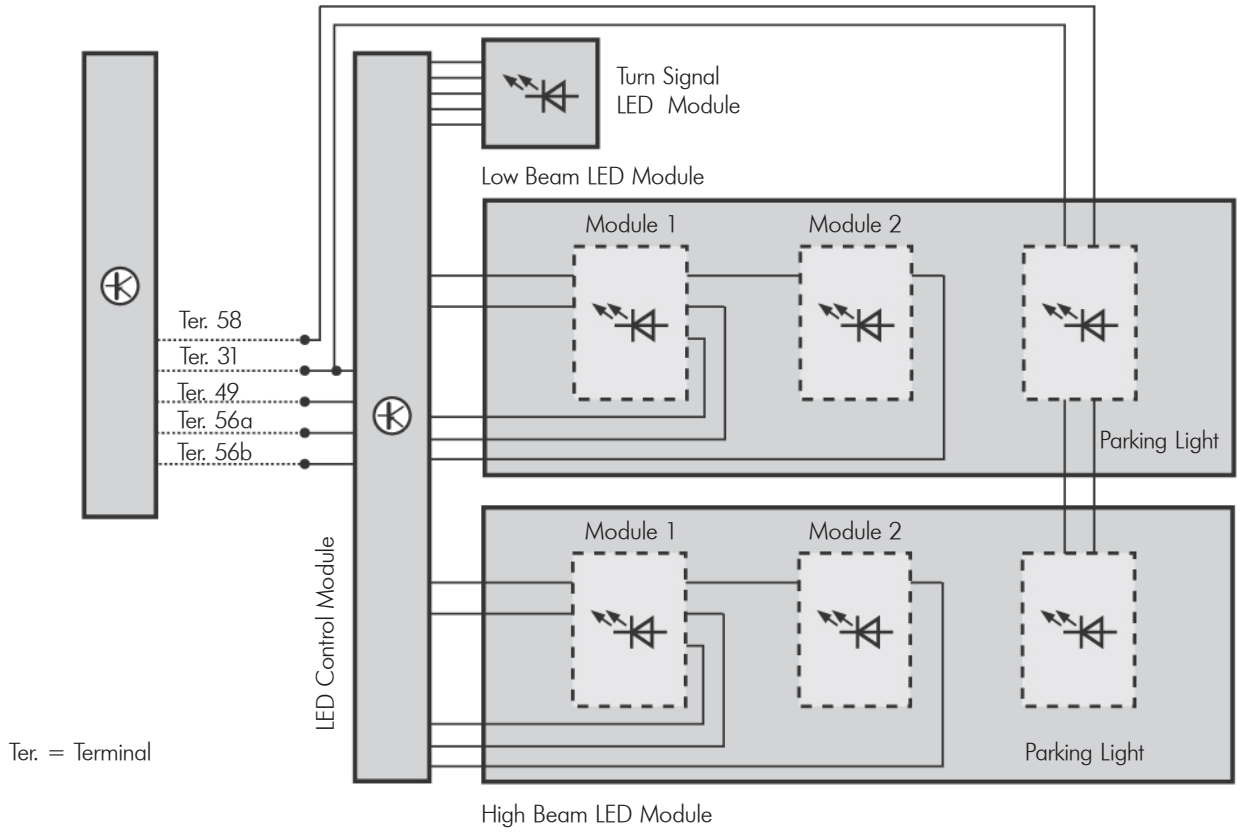
The LED headlights are activated by the J519 Vehicle Electrical System Control Module which communicates with the LED control module at each headlight. Headlamp range control is necessary for LED headlights and controlled by the J431 Headlamp Range Control Module. It receives a signal from the G76 Left Rear Level Control System Sensor.

The internal modules 1 and 2 for Low and High beam are connected in series. NTC resistors sense the temperature in each low and high beam LED module and report it to the LED control module. If the LEDs overheat, the LED control module reduces the amperage.

The parking light LED modules are directly connected to terminal 58. The parking light module in the Low beam LED carrier have a control module that also supplies and controls the second parking light LED in the High beam LED carrier.

There are 14 turn signal LEDs, connected series and activated by the headlight LED control module.

Vehicle Electrical System Control Module

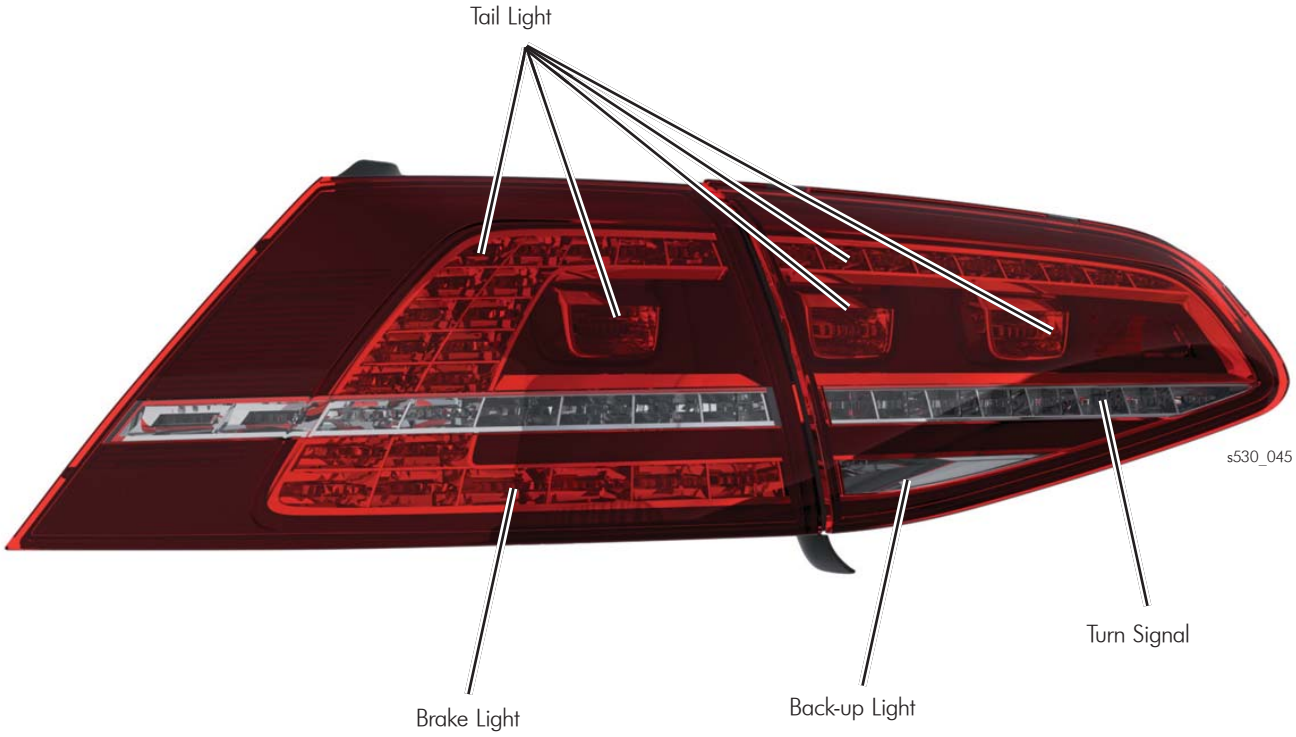




Refer to the Service Information or repair and adjustment of the LED headlight.

Tail Lights

The taillamp design reflects the styling cues of the e-Golf and uses halogen bulbs for lighting.



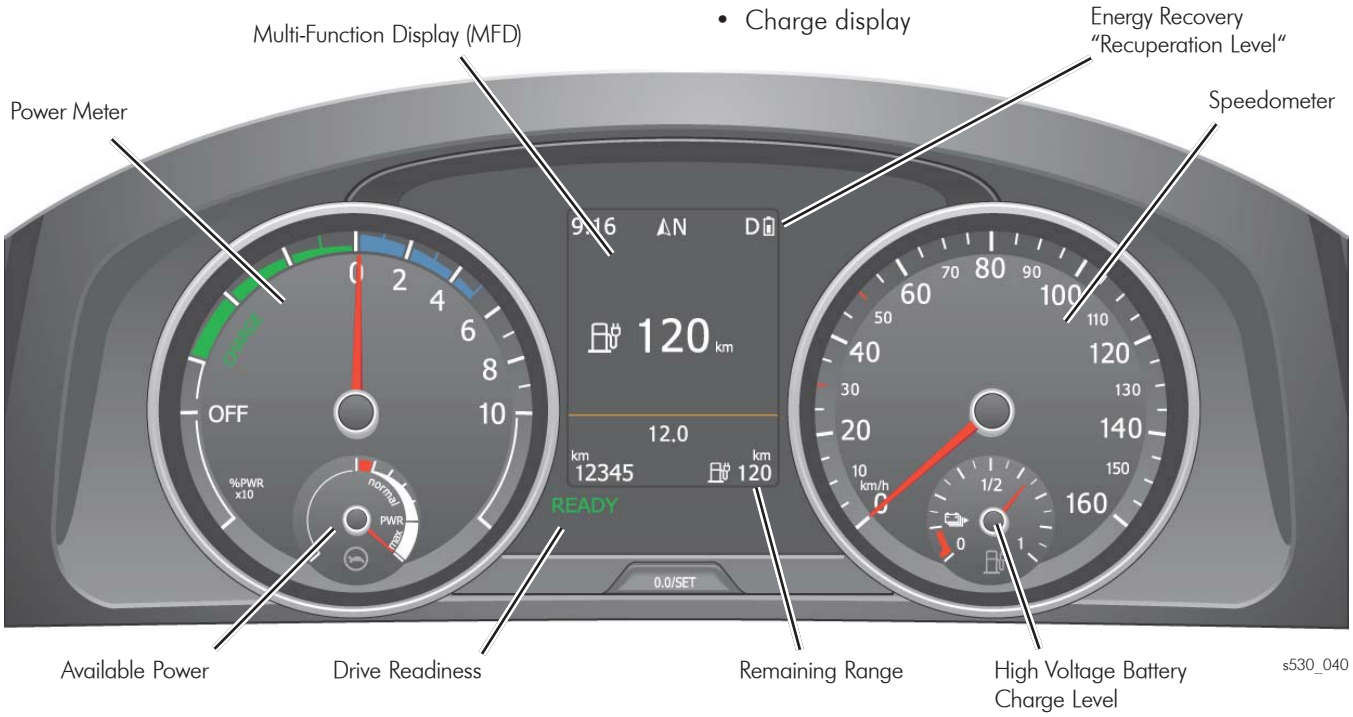
Instrument Panel

The instrument panel has the following e-specific displays:

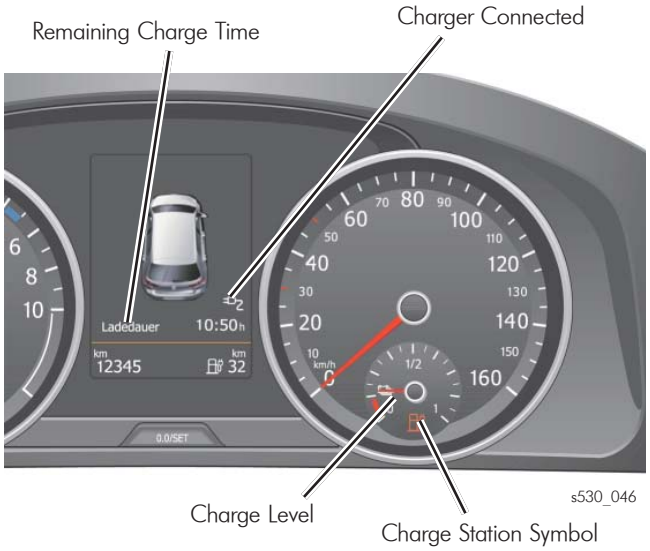
- Power Meter
- Available Power
- High Voltage Battery Charge Level

The modified multi-function display (MFA) can display the following additional information:

- Remaining range
- Drive readiness with “READY” display
- e-present consumption
- e-average consumption
- Charge display



Charge Display





If the driver door is opened during the charging process, the charge level of the HV battery is displayed and the “charger connected” symbol blinks/flashes.

Instrument Panel Left Side Display

The left side of the instrument panel displays:

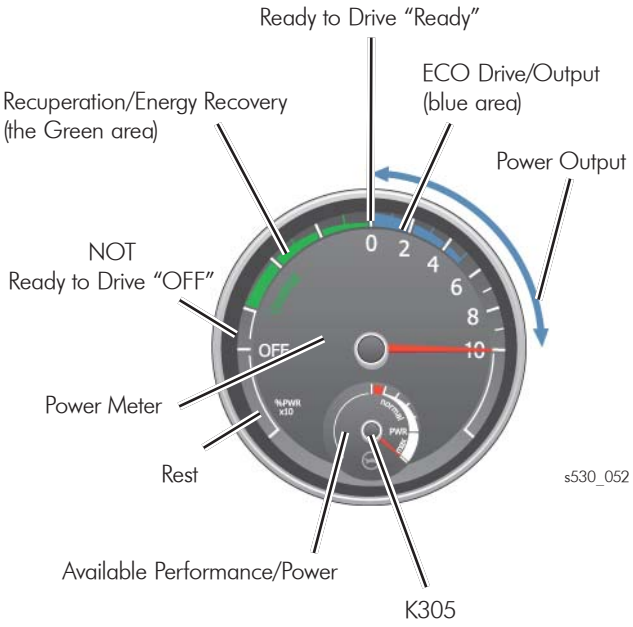
- Power meter
- Available power
- K305 Maximum Speed Restriction Indicator Lamp.

The power meter (displayed in percent) displays the requested performance/power. It is divided into six areas:

1. Power output
2. Eco drive/output
3. Ready to drive "Ready"
4. Recuperation/energy recovery
5. Not ready to drive OFF
6. Rest position

If the indicator needle is in the red, road performance and speed are drastically limited (maximum speed 50 mph [80 km/h]). The K305 (turtle) lights illuminates. If the vehicle is not re-charged, the performance and maximum speed are continually reduced.

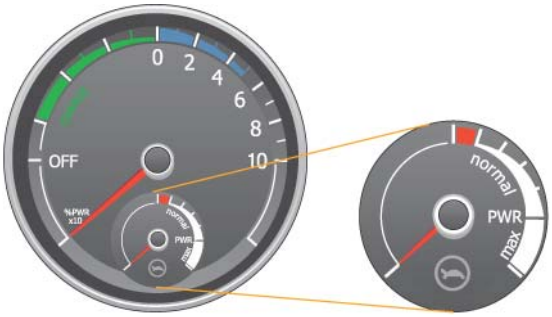
"Available Performance/Power "
Displays Available Power.



s530_052

Rest

In the resting state, both pointers of the left displays are at their lowest starting point of the scale.



s530_044

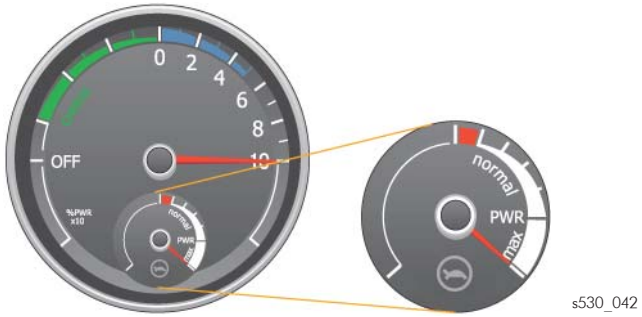
Ready to Drive "Ready"



s530_050

Ready to drive is displayed by the "READY" indicator light, the indicator needle in zero (0) position and a chime sounds. This happens when terminal 15 is switched on and terminal 50 has been disabled.

Availability of Maximum Performance/Power



s530_042

If the pointer is in the "max" area, maximum performance/power is available. The needle can fluctuate up to 10 (= 100%) during wide open throttle.

Driver input determines how fast the performance availability within the white area decreases.

Available Performance/Power



s530_048

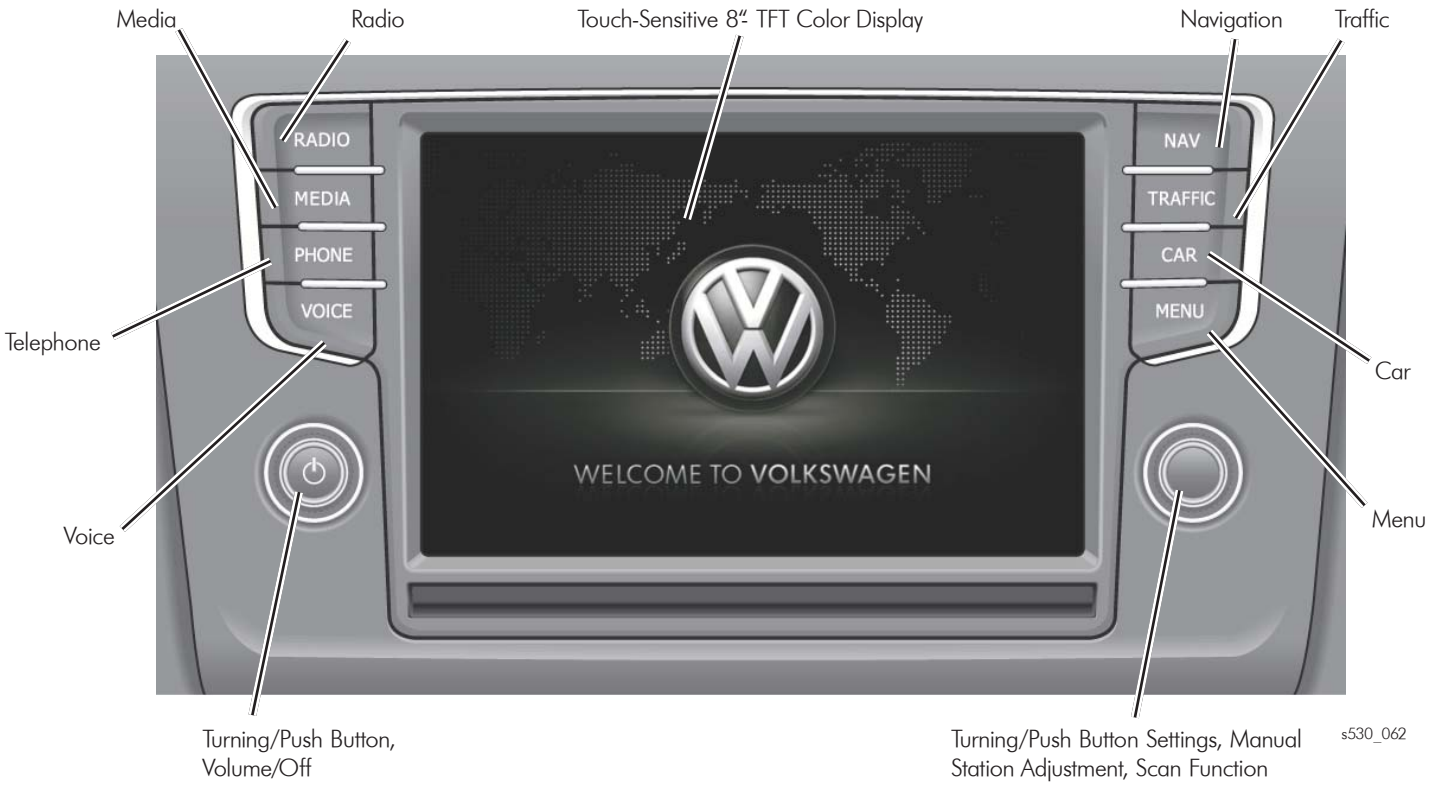
If the needle of the instrument for available performance/power is in the "normal" area, less than maximum performance is available.

The display of the power meter cannot go beyond the percentage of the available performance/power display.

Infotainment

Discover Pro

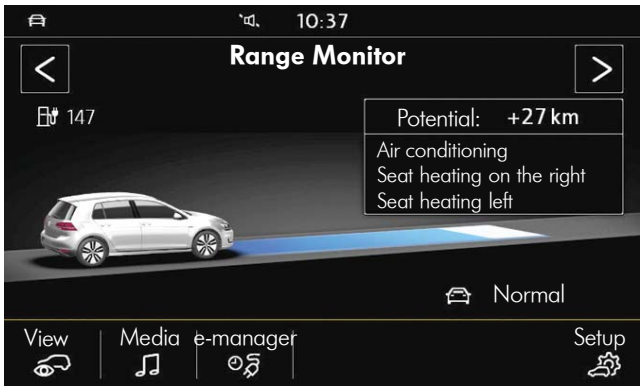
The Discover Pro is an optional radio. Discover Media is standard equipment. Both are based on the Modular Infotainment System platform.



The Discover Pro has been modified for the use in an electric vehicle. The following functions have been added:

- e-specific displays:
  - Range monitor
  - Energy flow display
  - Recuperation statistics
- e-Manager
- Navigation: 360° range
- Driving profile selection

e-Specific Displays

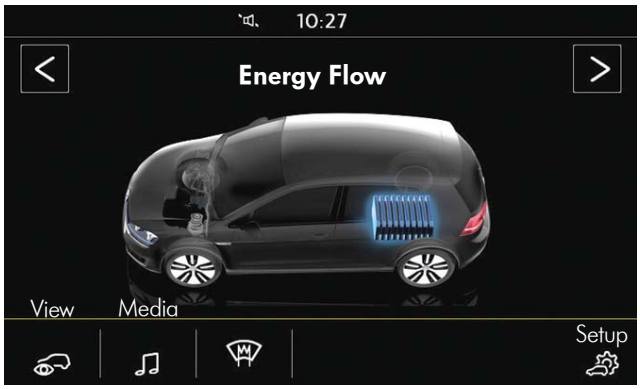


s530_087

Range Monitor

The range monitor displays the current range of the vehicle graphically. The "Potential" area displays the possible increased range if the listed comfort consumers are turned off.

This function is coordinated through the Data Bus On-Board Diagnostic Interface J533.

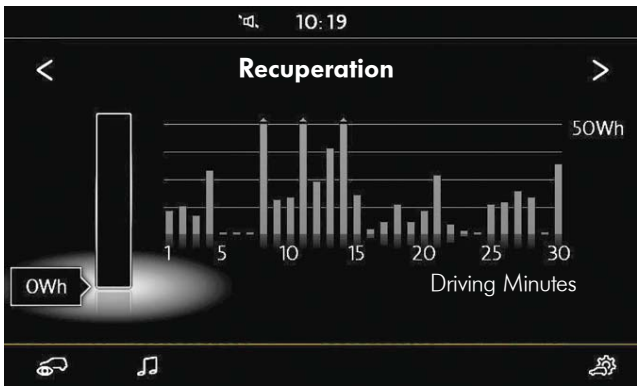


s530_089

Energy Flow Display

The energy flow display represents the energy flow between electrical motor and high voltage battery using animated graphics when accelerating or braking.

Current consumption is illustrated by blue arrows. Braking or recuperation is illustrated by green arrows in a reverse direction (charging of the high voltage battery). The high voltage battery displays the current charge level.



s530_091

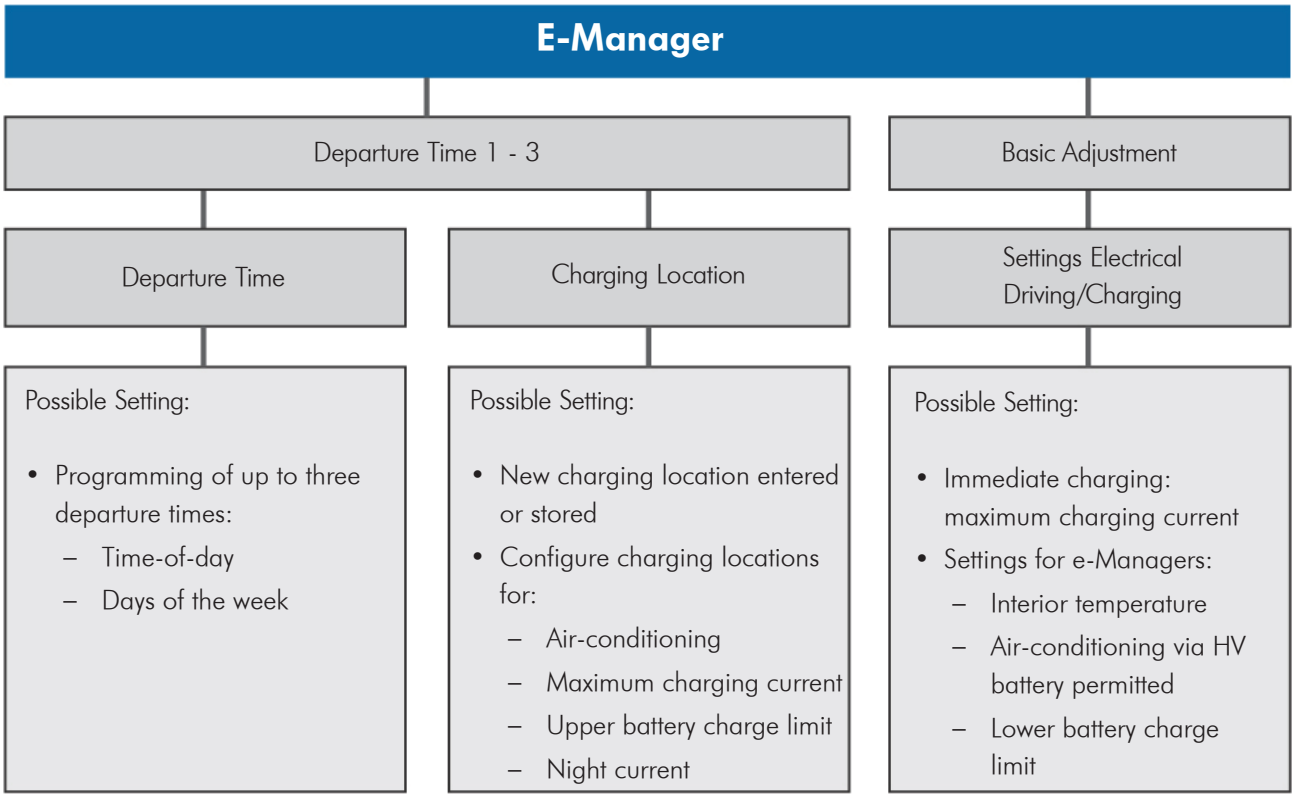
Recuperation Statistics

The recuperation statistics screen displays the amount of recovered energy since start of the trip. The recuperated energy is represented as a column in a graph over time (minutes).

Infotainment

e-Manager

The user can use the e-manager to program charging, air-conditioning, departure time and charging location. The following graphics provide an overview of the programming possibilities:



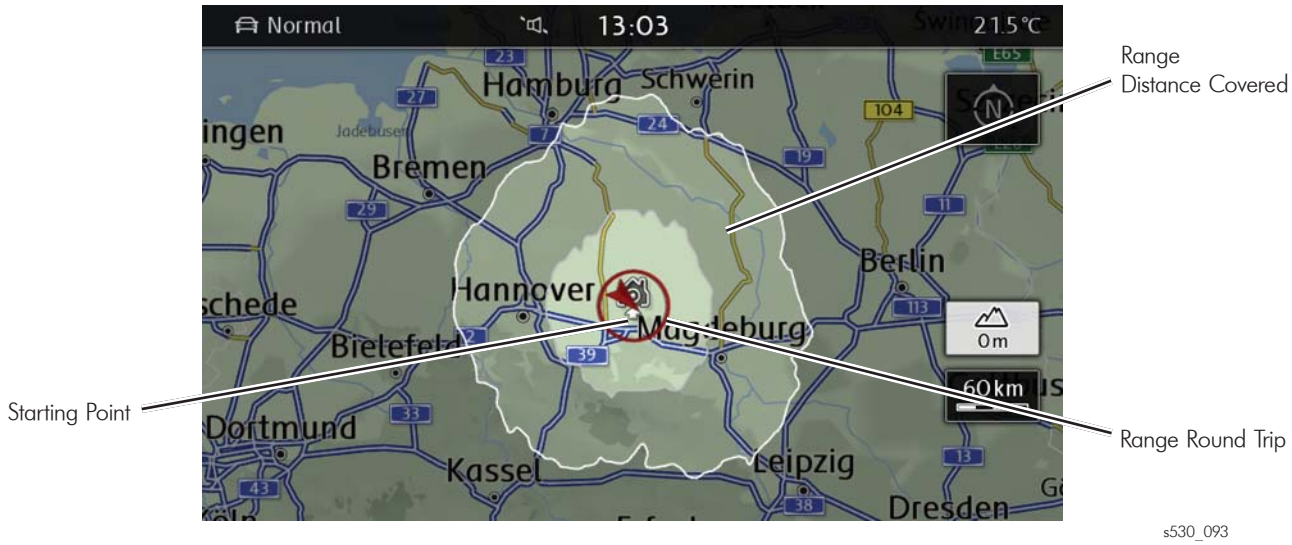
s530_106

Range Representation (Discover Pro)

The current range of the vehicle is represented by the 360°-Range view. The map displays

- The range in regard to the return trip, from the starting point (range internal area) as well as:
- The range in regard to distance covered (range outer area)

Charging stations within these areas can be displayed using the POI feature.



Driving Profile Selection

Three driving profiles are available for the e-Golf: "Normal," "Eco" and "Eco+."

Driving Profile	Normal	Eco	Eco+
Air Conditioning	Reduced	Considerably Reduced	Ventilation Only
Pedal Characteristics	Normal	Reduced	Flat
Maximum Starting Torque	199 ft-lb (270 Nm)	162 ft-lb (220 Nm) (overridable)	129 ft-lb (175 Nm) (overridable)
Mechanical Performance (peak)	116 HP (85 kW)	94 HP (70 kW)*	74 HP (55 kW)*
Maximum Speed (Combination)	87 mph (140 km/h)	75 mph (120 km/h)	60 mph (95 km/h)

* Can be overridden.

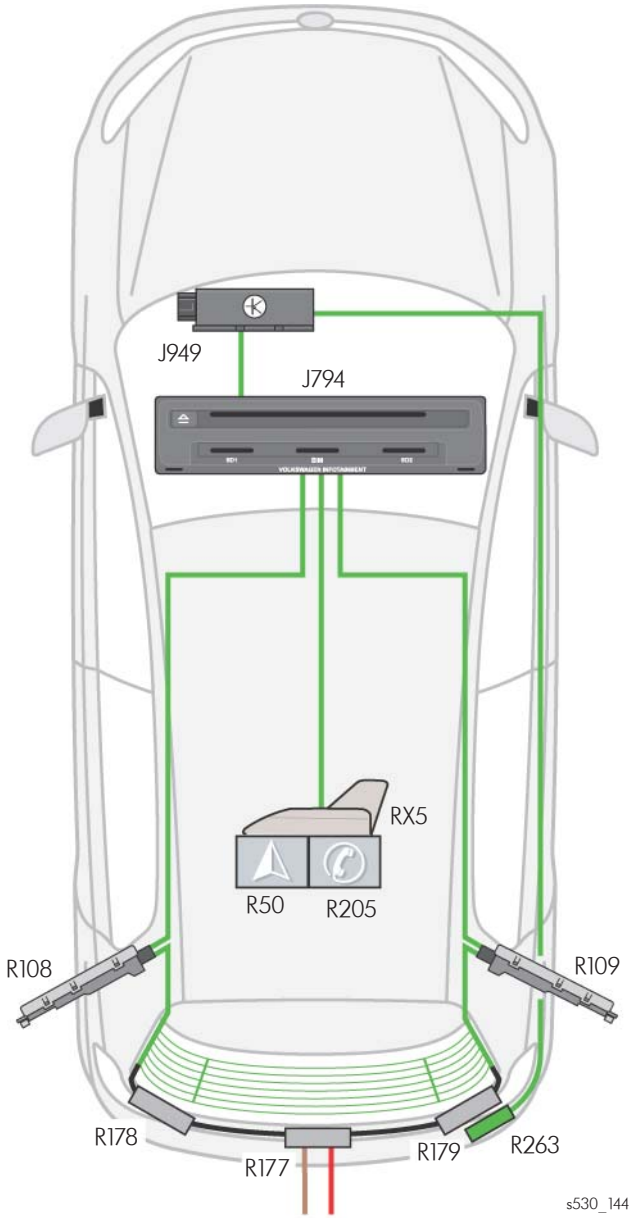
Infotainment

Antenna System

The antenna system of the e-Golf is identical to the 2015 Golf system with Discover Pro. A separate telephone antenna (Emergency Module Antenna R263) has been installed in the right rear bumper.

Key

J794	Information Electronics Control Module 1
J949	Control Module for Emergency Call Module and Communication Unit
R50	GPS Antenna
R108	Left Antenna Module(for FM2/DAB)
R109	Right Antenna Module (for AM/FM1)
R177	AM Frequency Filter (for amplitude modulation)
R178	FM Frequency Filter in Negative Wire (for frequency modulation in the negative conductor)
R179	FM Frequency Filter in Positive Wire (for frequency modulation in the plus wire)
R205	GSM Antenna
R263	Emergency Module Antenna
RX5	Roof Antenna

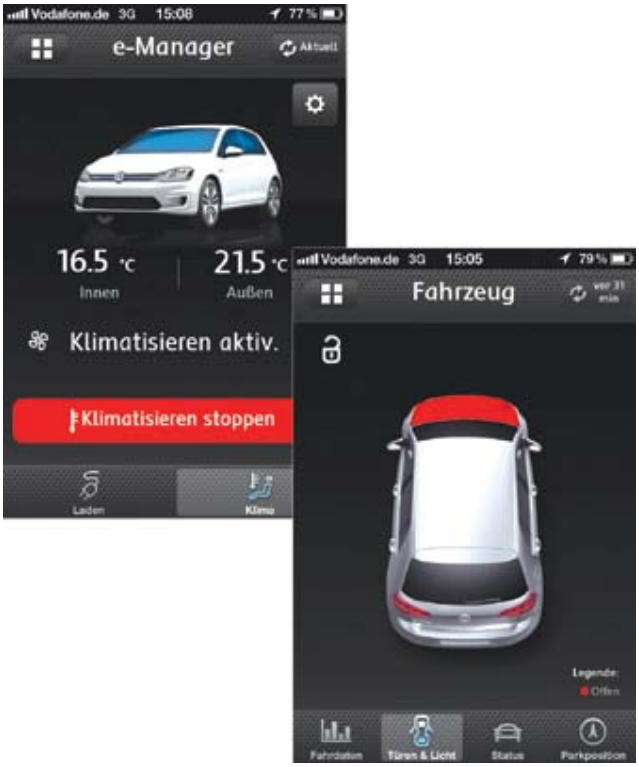




The graphics show a vehicle with maximum optional equipment. If the telephone “Premium” interface is not installed, the antenna for R263 is integrated in the RX5.

Mobile On-Line Services for the e-Golf

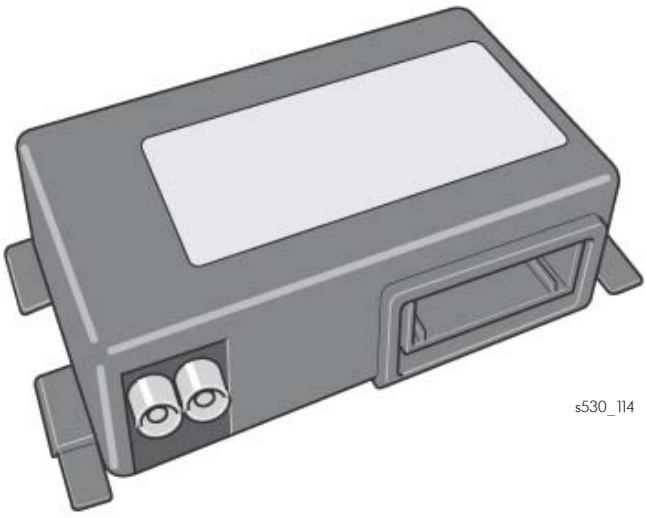
The e-Golf can be monitored over "the Car Net e-remote app" or the customer portal. Available services for the e-Golf are:



s530_095

- e-Manager:
  - Charging start and stop
  - Air-conditioning start and stop
- Vehicle:
  - Driving data
  - Doors and lights
  - Status
  - Parking locations

Control Module for Emergency Call Module and Communication Unit J949



s530_114

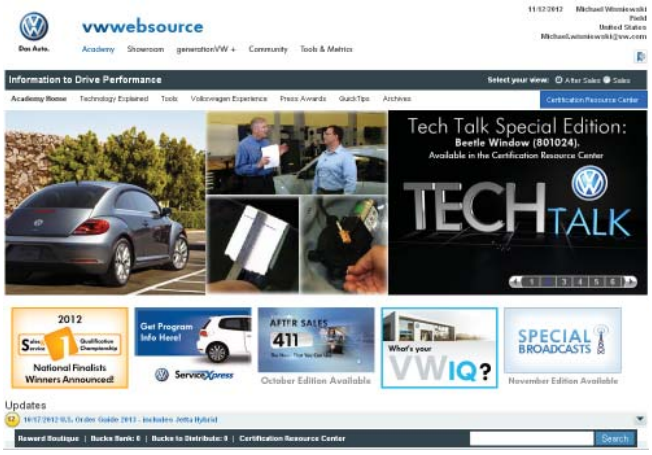
The J949 Control Module for Emergency Call Module and Communication Unit is standard equipment on the e-Golf. The unit is located behind the left side of the instrument cluster. It is used for Car-Net communication.

Only the antenna connection for the mobile telephone signal is used. The plug for the GPS antenna are not used. The GPS data is sent on the Comfort CAN-Bus from the radio navigation device.

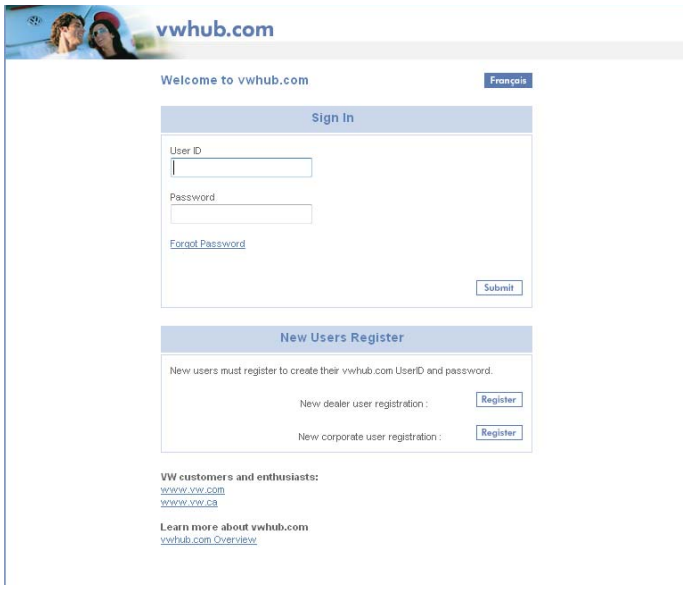
Important Links



https://www.datarunners.net/vw_crc/default.asp?pageid=home



www.vwwebsource.com



www.vwhub.com

Knowledge Assessment

An on-line Knowledge Assessment (exam) is available for this Self-Study Program.

The Knowledge Assessment may or may not be required for Certification.

You can find this Knowledge Assessment at:

www.vwwebsource.com

For Assistance, please call:

Volkswagen Academy

Certification Program Headquarters

1-877-791-4838

(8:00 a.m. to 8:00 p.m. EST)

Or, E-mail:

concierge@volkswagenacademy.com



Volkswagen Group of America
2200 Ferdinand Porsche Drive
Herndon, VA 20171
September 2015