

## Section 3 Electrical system

## Group 31 Battery

System voltage, with ignition off: .....	12.5 - 12.7 V
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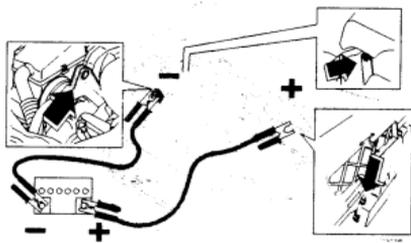
A newly charged battery may have a higher voltage.	
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**Battery capacity**

Cold start current* CCA SAE	Capacity	Reserve capacity** RC SAE	Recommended charge current
520 A	55 Ah	90 minutes	5.5 A
600 A	65 Ah	115 minutes	6 A
680 A	90 Ah	160 minutes	8 A
800 A	90 Ah	170 minutes	9 A

\* **Cold start current (CCA, SAE)** is the discharge current which a battery can provide for 30 seconds, at a temperature of  $-18^{\circ}\text{C}$  ( $0^{\circ}\text{F}$ ) without the voltage dropping below 7.2 V.

\*\* **Reserve capacity (RC, SAE)** is the time taken at a temperature of  $+27^{\circ}\text{C}$  ( $81^{\circ}\text{F}$ ), and a discharge current of 25 A, to reduce the voltage of a fully charged battery to 10.5 V.



M3100100

**Terminal for jump starting:**

The battery positive lead is routed to the terminal for jump starting located beside the engine compartment relay / fusebox.

**Battery discharge protection:**

To avoid involuntary battery discharge through the cargo compartment electrical outlet there is a control circuit in the rear electronic control module.

If the current in the circuit exceeds 60 mA the following occurs:

- 1) A text message is posted in the DIM when the key is turned from I to 0.
- 2) A short warning signal is heard when the ignition key is removed from the ignition switch.

## Group 32 Generator / Charge regulator

Generators, electrical and mechanical data:

<b>Generator (GEN)</b> Type:	BOSCH KC/ NCB1 14 V / 120 A BOSCH E140/8 14 V / 140 A
Petrol engine. Generator (GEN) without freewheel ..... 120A Volvo P/N	8111001
Generator 5 cylinders ..... 140A Volvo P/N	8602710
Generator 6 cylinders (S80) ..... 140A Volvo P/N	8602712
Petrol engine. Generator (GEN) with freewheel ..... 120 A Volvo P/N	8251071
Diesel engine D5252 T (S80/V70) ..... 120A Volvo P/N	8111122
Direction of rotation, Petrol engines, D5244T/T2 .....	Anticlockwise
Direction of rotation D5252T (S80/V70) .....	Clockwise
Current strength at 13.5 V: KC / NCB1 ..... E140/8 ..... Measured at a temperature of 25°C (77°F). Stabilised output voltage. Engine speed (RPM): 11.3 rps/680 rpm.	70 A 75 A
Current strength at 13.5 V: KC / NCB1 ..... E140/8 ..... Measured at a temperature of 25°C (77°F). Stabilised output voltage. Engine speed (RPM): 38.3 rps/2300 rpm.	120 A 140 A
Nominal output: ..... KC / NCB1 ..... E140/8 ..... Maximum speed ..... rps (rpm)	1680 W 1960 113 (6800)
Carbon brushes, minimum length .....	5.0 mm (0.197")
Tightening torques:	

<b>Generator (GEN)</b>		BOSCH KC/ NCB1
Type:		14 V / 120 A
Mounting screw for rear cover, use B+ terminal . . . . .	Nm / lbf ft.	30/22
Mounting screw for rear cover, do not use B+ terminal . . . . . / lbf ft.	Nm	12/9
Mounting screw for rear cover, fixing screw . . . . .	Nm / lbf ft.	4/3
E140/8 . . . . .	Nm/lbf ft.	2.6/1.9
Mounting screw for rear cover, ground screws . . . . .	Nm / lbf ft.	1.7/1.2
E140/8 . . . . .	Nm/lbf ft.	2.4/1.7
Mounting screw for regulator, phase connector . . . . .	Nm / lbf ft.	0.8/0.6
E140/8 . . . . .	Nm/lbf ft.	1.4/1.0
Nut with left-hand thread for fixed pulley . . . . .	Nm / lbf ft.	65/48
Nut with left-hand thread for freewheel pulley . . . . .	Nm / lbf ft.	80/60
Test values:		
Resistance, rotor winding . . . . .	$\Omega$	2.6
Resistance, stator winding . . . . .	$\Omega$ /phase	0.06
E140/8 . . . . .	$\Omega$ /phase	0.04
NOTE: Measured with a low ohm voltmeter		

**Charge regulators, electrical and mechanical data:**

<b>Charge regulator</b>		BOSCH	
Type:			
Volvo P/N Petrol . . . . .	120 A	94 59 741	
Volvo P/N Diesel . . . . .	120 A	94 59 744	
Volvo P/N . . . . .	140 A	86 37 851	
		Measured in the car	Measured at the test bench
Conditions:			
Battery charging . . . . .		75%	100%
Air temperature . . . . .	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	25 $^{\circ}$ (77 $^{\circ}$ )	25 $^{\circ}$ (77 $^{\circ}$ )
Temperature, regulator warm . . . . .	$^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	60 $^{\circ}$ - 80 $^{\circ}$ (140 $^{\circ}$ - 176 $^{\circ}$ )	60 $^{\circ}$ - 80 $^{\circ}$ (140 $^{\circ}$ - 176 $^{\circ}$ )
Test values:			
Generator (GEN) speed . . . . .	rps (rpm)	100 (6000)	—
Engine speed (RPM) . . . . .	rps (rpm)	38.3 (2300)	—
Generator (GEN) load . . . . .	A	25 - 45	25 - 45
Do not measure the control voltage between the B+ terminal and the generator (GEN) until at least 10 seconds after starting.			

*Group 32 Generator / Charge regulator*

<b>Charge regulator</b> Type:	<b>BOSCH</b>	
Generator: 8111001, 8602710, 8251071, 8111122 ..... V	13.7 - 14.6	14.1 - 14.9

V70

Group 33 Starter motor

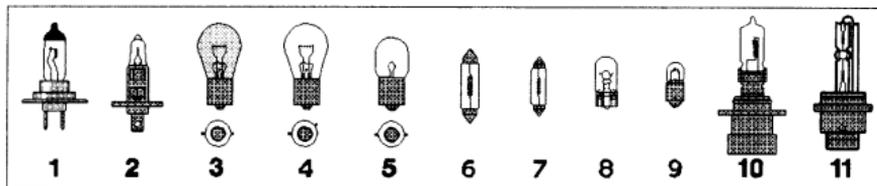
Group 33 Starter motor

P/N and test data:

<b>Starter motor</b> Type / Test data	Bosch 12 V		
1.4 kW Petrol .....	Volvo P/N.	81 11 302	
1.7kW Petrol 6 cyl. man .....	Volvo P/N	81 11 007	
1.7kW Petrol 6cyl. aut .....	Volvo P/N.	81 11 199	
2.0 kW Diesel VW (S80, V70) .....	Volvo P/N.	86 02 360	
2.2 kW Diesel new engine diesel .....	Volvo P/N.	86 02 355	
Control solenoid:			
Lowest connection voltage .....	V	7.4	

Starter motor, type	Bosch 12 V 1.4 kW	Bosch 12 V 2.0 kW	Bosch 12 V 2.2 kW
Direction of rotation .....	Clockwise	Clockwise	Clockwise
Test value, starter motor unloaded:			
11.3 V and maximum 70 A, min. ..... rpm (rps)	2900 (48.3)		
11.3 V and maximum 140 A, min. ..... rpm (rps)		4900 (81.6)	
11.4 V and maximum 125 A, min. ..... rpm (rps)			4535
Test value, starter motor locked:			
4.0 V and 0 rpm ..... A	650-750		
4.0 V and 0 rpm ..... A		700 - 1000	
5.3 V and 0 rpm ..... A			1440
Control solenoid:			
Lowest connection voltage .. V	7.4	7.0	7.4

## Group 35 Lighting



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**Bulbs (Market dependent)**

Location:	Power W	Lamp type	Figure number
Headlamp with Xenon bulb. <b>Warning: High voltage!</b>	35	D2R	11
Headlamps, high beam .....	60	HB3	10
Fog lamps .....	55	H1	2
Headlamps, low beam .....	55	H7	1
Parking lamps, front .....	5	W2.1x9.5d	8
Tail lamps: Upper .....	5	BA15s	7
Tail lamps: Lower .....	21/4	P 21/4 W	4
Indicator lamps:			
Front .....	21/5	PY21 W	3
Rear .....	21	PY 21 W	5
Page .....	5	W2.1x9.5d	10
Brake lamp, standard .....	21	BA15s	4
High-mounted brake lamp .....	4	LED	-
Rear fog lamps .....	21/4	P 21/4 W	6
Reversing lamps .....	21	BA15s	4
Number plate lighting .....	5	W2.1x9.5d	10
Courtesy lighting .....	5	SV8.5	8
Roof lighting .....	10	SV 8.5 / 6	8
Reading lamps, rear .....	5	W 5 W	10
Glove compartment lighting .....	3	BA 9 s	11
Vanity mirror lighting .....	1.2	SV 5.5	9
Instrument lighting .....	1.2/2/3	W 4.6 d	12
Lighting, control .....	0.9	Special	12
Hazard warning signal flasher .....	0.9	Special	12
LED lighting rear view mirror .....	11	W 11 W	8

## Group 37 Fuses

<b>11A</b>		
Main fuses in the engine compartment		
Fuse number:	Function	A
1	Glow plug	60
2	Fusing for 11C: 30-37	60
3	Fuse protection 11C: 1-4, 5-9, 12-19	60
4	Fusing for 11C: 21-29	60
5	-	
6	-	
7	-	
8	Engine cooling fan (FC)	60

<b>11B</b>		
Fuses in the engine compartment		
Fuse number:	Function	A
1	Additional heater	25
2	Accessories, auxiliary lamps	20
3	-	10
4	Engine management system (ECM), Heated oxygen sensor (HO2S), Solenoid valve Diesel, Bi-fuel	20
5	Evaporative emission system (EVAP) valve, EVAP canister shut-off valve, Solenoid variable valve, Camshaft reset valve, PTC resistor air preheating, turbocharger (TC) control valve, Fuel rail Bi-Fuel	10
6	Engine control module (ECM), Injectors, Mass air flow (MAF) sensor	15
6	Mass air flow (MAF) sensor Diesel	5
7	Electronic throttle body control module	10
8	Magnetic clutch A/C, accelerator pedal (AP) position sensor, Cooling fan for electronics box in engine compartment	10
9	Horn	15
10	Rear windscreen washer motor	10
11	Spark plugs with ignition coils, Exhaust gas recirculation (EGR) valve, Solenoid variable turbo geometry, Engine pad solenoid valve, Positive temperature coefficient (PTC) resistor air preheating, Climate control unit	20
12	Brake lamp switch	5
13	Windscreen wipers	25
14	Brake control module (BCM)	30
15	Petrol tank valve (Bi-fuel)	15

<b>11B</b> Fuses in the engine compartment		
Fuse number:	Function	A
16	Windscreen washer motor, headlight wipers	15
17	Low beam right, High beam Bi-Xenon	10
18	Low beam left, High beam left Bi-Xenon	10
19	Brake control module (BCM)	30
20	Left high beam	15
21	Right high beam	15
22	Starter motor	25
23	Engine control module (ECM)	5
24	-	-

<b>11C</b> Passenger compartment fuses		
Fuse number:	Function	A
1	Left low beam -2002	10
	Fusebox engine compartment 2002-	15
2	Right low beam -2002	10
	Fusebox engine compartment 2002-	20
3	Power driver's seat	15
4	Power passenger seat	20
5	Power steering, vacuum pump	15
6	Petrol tank valve	5
7	Heated seat left	15
8	Heated seat right	15
9	Brake control module (BCM), Steering angle sensor (SAS)	5
10	Daytime running lamps left	10
11	Daytime running lamps right	10
12	Headlamp wipers, Headlamp range adjustment	15
13	Power socket 12 V front and rear	20
14	Electric switch seat belt buckle, Power passenger seat Central electronic module (CEM)	5
15	Radio, RTI (option)	5
16	Audio	20
17	Amplifier	30
18	Front fog lamps	15

<b>11C</b>		
Passenger compartment fuses		
Fuse number:	Function	A
19	RTI display	10
20	–	
21	Gearbox control module (TCM), Fuel rail gas, Solenoid shift inhibitor, Fuel shut-off valve (DFCO), Gear selector module (GSM)	10
22	Central electronic module (CEM), Indicator lamp	5
23	Light switch module (LSM), Data link connector (DLC), Climate control module (CCM), Control stalks steering wheel module (SWM)	20
24	Electrical switch module Climate Control Module (CCM), combined instrument panel Driver Information Module (DIM), Driver's power seat module (PSM)	10
25	Ignition switch, Engine Control Module (ECM), SRS control module	10
26	Motor blower fan	30
27	Four-C	15
28	Interior lighting, Remote control module garage opening, Rain sensor	10
29	Carphone	10
30	Position / parking lamps left front and rear	10
31	Position / parking lamps right front and rear, number plate lighting	10
32	Central electronic module (CEM)	10
33	Fuel pump (FP), Demand controlled fuel pump	15
34	Sun roof	15
35	Lock unit front left door, heated door mirrors, power door mirrors, Motor power window left front	25
36	Lock unit front right door, heated door mirrors, power door mirrors, motor power window right front	25
37	Deadlocking, power window rear, Lighting rear door	30
38	Siren Control Module (SCM)	5

<b>11D</b>		
Fuses, cargo compartment		
Fuse number:	Function	A
1	Rear electronic module (REM)	10
2	Rear fog lamps	15
3	Stop (brake) lamps	15
4	Reversing lamps	10
5	Heated rear windscreen, relay 15l supply	5
6	Lock tailgate	10

<b>11D</b> Fuses, cargo compartment		
Fuse number:	Function	A
7	Electrical outlet cargo compartment	15
8	Central locking rear doors, fuel tank filler flap	20
9	Tow hitch wiring for trailer	15
10	Road Traffic Information Module (RTI)	10
11	Accessory electronic module (AEM)	15
12	Motor rear window wiper	15
13	Bass speakers cargo compartment. Petrol tank valve (Bi-fuel)	15 10
15	Tow hitch cabling	20
16	-	-
17	Electronically heated fuel filter, Differential Electronic Module (DEM)	5
18	Preheater fuel filter, Temperature switch fuel filter	15

<b>11E</b> Main fuses, cargo compartment		
Fuse number:	Function	A
1	Fusing for 11D: 15-18	40
2	Fusing for 11D: 12-14	40
3	Heated rear window	40
4	-	-
5	Fusing 11D 6-11	40
6	-	-
7	Fusing for 11D: 1-5	40

<b>Relays / Shunts</b>	
Located in engine compartment	
Position	Function
FMA1	Relay 1 coolant heater plug -2002
FMA2	Main relay engine management system
FMA3	Glow plug relay (diesels)
FMA4	Relay starter motor
FMA5	Relay 2 coolant heater plug -2002
FMI1	Air conditioning (A/C) relay
FMI2	Horn relay
FMI3	Relay washer motor front

V70

Group 37 Fuses

<b>Relays / Shunts</b>	
Located in engine compartment	
Position	Function
FMI4	Relay washer motor rear
FST1	Relay windscreen wiper
FST2	Relay fuel injection system
FST3	Relay windscreen wiper low / high speed

**Relays**

Located in the passenger compartment

Position	Function
CMA1	-
CMA2	Overload relay X-supply
CMA3	Overload relay
CMA4	-
CMI1	Relay power window up left rear
CMI2	Relay power window down left rear
CMI3	Relay power window child safety block rear door
CMI4	Relay high beam
CMI5	Relay position / parking lamps
CMI6	-
CMI7	Relay low beam
CMI8-10	-
CMI11	Relay fog lamps, front
CMI12	Relay fuel pump
CMI13	Relay Four-C
CMI14	Relay fuel leakage check
CMI21	Relay extended X/D2-supply automatic gearbox
CMI22	Relay extended X/D1-supply
CMI23	Relay power window down right rear
CMI24	Relay power window up right rear
CMI25	-
CSH1	Shunt left indicator lamp CEM
CSH2	Shunt right indicator lamp CEM
CSH3	-
CSH4	Shunt low beam CEM
CSH5-6	-
CST1	-

<b>Relays</b> Located in cargo compartment	
Position	Function
RMA1	Relay 15l-supply rear
RMA2	-
RMA3	Relay rear demister
RMA4	-
RMI1	Relay central locking locking left rear door
RMI2	Relay central locking unlocking left rear door
RMI3	Relay central locking deadlocking rear doors
RMI4	Relay reversing lamp
RMI5	Relay brake lamp
RMI6	Relay rear fog lamp
RMI7	Relay fog lamps trailer
RMI8	Relay fuel filter preheater
RMI11	Relay pager
RMI12	Relay pager
RMI13	Relay tailgate wiper
RMI14	Option: Relay foldable head restraint rear
RMI15	-
RMI16	Relay tailgate wiper
RMI17	Relay CNG/LPG
RMI19	Relay opening boot lid
RMI20	Relay opening boot lid
RMI21	Relay fuel tank filler cover unlocking
RMI22	Relay fuel tank filler cover locking
RMI23	Relay central locking unlocking right rear door
RMI24	Relay central locking locking right rear door
RMI25	-
RSH1	-
RSH2	Shunt fog lamps rear
RSH3	Shunt electrical socket cargo compartment
RSH4	Shunt position / parking lamps
RSH5	Shunt position / parking lamps / tail lamp
RSH6	Shunt brake lamp
RST1	-

<b>Other relays</b> Located by the rear door	
Position	Function
Left	Relay deadlocking left rear
Right	Relay deadlocking right rear

## Group 38 Instruments, sensors

<b>Fuel level sensor:</b>	<b>Fuel tank unit, left-hand side: Measured across the terminal pin 5 and 6. Resistance <math>\Omega</math></b>	<b>Fuel tank unit, right-hand side: Measured across the terminal pin 6 and 7. Resistance <math>\Omega</math></b>
Empty fuel tank .....	374	393
Half tank .....	133 - 136	129 - 133
Full fuel tank .....	12	12
<b>Note! During installation the left level sensor must have a resistance in excess of 125 <math>\Omega</math></b>		

<b>Engine coolant temperature (ECT) sensor:</b>						
Temperature: $^{\circ}\text{C}$ ( $^{\circ}\text{F}$ )	0 $^{\circ}$ (32 $^{\circ}$ )	10 $^{\circ}$ (50 $^{\circ}$ )	20 $^{\circ}$ (68 $^{\circ}$ )	40 $^{\circ}$ (104 $^{\circ}$ )	80 $^{\circ}$ (176 $^{\circ}$ )	100 $^{\circ}$ (212 $^{\circ}$ )
Resistance ..... $\Omega$	5740	3700	2450	1150	318	184
Voltage ..... Volt	2.65	2.10	1.62	0.92	0.29	0.17

**Speedometer**

Speedometer, resistance in sensor .....	Cannot be measured. Check using a VADIS station.
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