

Section 3 Electrical system

Group 31 Battery

System voltage	12 V
Ground terminal	Negative pole

Battery capacity

Cold start current* CCA SAE	Capacity (DIN)	Reserve capacity** RC SAE	Recommended charge current
420 A	45 Ah	75	4.0 A
520 A	50 Ah	90	5.5 A
600 A	65 Ah	115	6.0 A

* **Cold start current (CCA, SAE)** is the discharge current which a battery can provide for 30 seconds, at a temperature of -18°C, without the voltage dropping below 7.2 V.

** **Reserve capacity (RC, SAE)** is the time taken at a temperature of +27°C, and a discharge current of 25 A, to reduce the voltage of a fully charged battery to 10.5 V.

Group 32 Generator / Charge regulator

Generators. electrical and mechanical data:

Generator type:	Bosch KC 14V 45/80 A	Nippon Denso 14 V 80 A
Volvo P/N.	91 62 684	91 62 468
Direction of rotation	clockwise	clockwise
Maximum current strength A	80	80
Maximum output W	1120	1120
Maximum speed r/s (rpm)	300 (18000)	300 (18000)
Carbon brushes, minimum length ... mm	5.0	5.5
Tightening torques:		
Mounting screws governor rear cover Nm	4.5 - 5.5	4.5
Nut for pulley fixed + freewheel Nm	60 - 70	115
Test values:		
Resistance, rotor winding Ω	2.6	2.9
Resistance, stator winding Ω	0.027*	0.03
Current strength at 13.5 V (minimum value) A at r/s (rpm)	45 at 30 (1.800) 80 at 100 (6000)	52 at 33.3 (2000) 80 at 83 (5000) 108 at 100 (6000)

* /phase. Use a low ohmmeter.

Generators

Generator type	Bosch NC 14V 55/100 A	Bosch NC 14V 65/115 A
Volvo P/N.	91 62 683	91 62 927
Direction of rotation	clockwise	clockwise
Maximum current strength A	100	115
Maximum output W	1400	1610
Maximum speed r/s (rpm)	300 (18000)	300 (18000)
Carbon brushes, minimum length mm	5.0	5.0
Tightening torques:		
Mounting screws governor rear cover Nm	4.5 - 5.5	4.5 - 5.5
Nut for pulley fixed + freewheel Nm	60 - 70	60 - 70
Test values:		
Resistance, rotor winding Ω	2.6	2.6
Resistance, stator winding Ω	0.020*	0.051*
Current strength at 13.5 V (minimum value) A at r/s (rpm)	55 at 30 (1,800) 100 at 100 (6000)	65 at 30 (1,800) 115 at 100 (6000)

Generators, electrical and mechanical data:

Generator type:	BOSCH KC 14 V 120 A
Volvo P/N.	94 59 038 94 59 077 94 45 741
Direction of rotation	counter-clockwise
Current strength at 13.5 V	120
Measured at 25 degrees C / 77 degrees F. A	Stabilised output voltage. Engine speed (RPM): 38.3 r/s / 2,300 rpm 70 Stabilised output voltage. Engine speed (RPM): 11.7 r/s / 700 rpm

Generator type:	BOSCH KC	
	14 V	
	120 A	
Nominal output	W	1680
Maximum speed	r/s (rpm)	113 (6800)
Carbon brushes, minimum length	mm	5.0
Tightening torques:		
Mounting screw for rear cover, use B+ terminal	Nm / ft lb.	35/26
Mounting screw for rear cover, do not use B+ terminal	Nm / ft lb.	12/9
Mounting screw for rear cover, fixing screw	Nm / ft lb.	4/3
Mounting screw for rear cover, ground screws	Nm / ft lb.	2/1.5
Mounting screw for regulator, phase connector	Nm / ft lb.	1/0.7
Nut with left-hand thread for fixed pulley	Nm / ft lb.	65/48
Nut with left-hand thread for freewheel pulley	Nm / ft lb.	65/48
Test values:		
Resistance, rotor winding	Ω	2.6
Resistance, stator winding		0.06
Measure using a low resistance voltmeter	Ω / phase	

Charge regulators, electrical and mechanical data:

Charge regulators, type	Bosch		Nippon Denso	
	In the car	On the test bench	In the car	On the test bench
Volvo P/N.	91 28 982		91 62 995	
Conditions:				
Battery charging	%	75	100	75
.....	°C	25	25	25
Temperature, regulator warm	°C	60 - 80	60 - 80	60 - 80
Test values:				
Generator (GEN) speed	r/s (rpm)	100 (6000)	100 (6000)	
Engine speed (RPM)	r/s (rpm)	50 (3000)	40 (2400)	
Generator (GEN) load	A	30 - 50*	30 - 50*	

Charge regulators, type	Bosch		Nippon Denso	
	In the car	On the test bench	In the car	On the test bench
Control voltage between B+ and D- on the generator V	13.4 - 14.2	13.7 - 14.5	13.8 - 14.6	14.1 - 14.9
Control tolerance: Load the generator (GEN) with 0.85 A rated output. Permitted voltage drop compared to previous reading V		0 - 0.3		0 - 0.3

* This load is reached when the engine is running.

Charge regulators

Charge regulators, type	Bosch	
	In the car	On the test bench
Volvo P/N.	91 62 929	
Conditions		
battery charging %	75	100
air temperature °C	25	25
temperature, regulator warm °C	60 - 80	60 - 80
Test values		
generator (GEN) speed r/s (rpm)	100 (6000)	
engine speed (RPM) r/s (rpm)	40 (2400)	
generator (GEN) load A	30 - 50*	
control voltage between B+ and D- on the generator V	13.4 - 14.2	13.7 - 14.5
Control tolerance: load the generator (GEN) with 0.85 A rated output. Permitted voltage drop compared to previous reading V		0 - 0.3

* This load is reached when the engine is running.

Charge regulators

Charge regulators, type	Bosch	
	In the car	On the test bench
Volvo P/N.	94 59 746 94 59 744	
Conditions:		
Battery charging %	75	100
Intake air temperature (IAT) °C/F°	25/77	25/77
Temperature, regulator warm °C/F°	60 - 80/140 - 176	60 - 80/140 - 176

Charge regulators, type	Bosch	
	In the car	On the test bench
Test values:		
Generator (GEN) speed r/s (rpm)	100 (6000)	
Engine speed (RPM) r/s (rpm)	38.3 (2300)	
Generator (GEN) load.	25 - 45	25 - 45
Vehicle basic load A		
Control voltage between the B+ connection and the generator housing.		
Do not measure the voltage until at least 10 seconds after starting the engine.		
Generator: 94 59 038 V	13.5 - 14.2	13.7 - 14.5
Generator: 94 59 093 V	13.7 - 14.6	14.1 - 14.9

Group 33 Starter motor

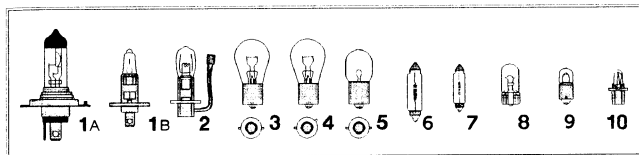
Electrical and technical data:

Starter motor, type	Bosch 12V 1.4 kW	Bosch DW 12V 1.7 kW
Volvo P/N.	13 63 451 91 28 421	13 63 912
Test values, starter motor unloaded:		
11.5 V and maximum 75 A, minimum rpm (r/s)	2900	
11.2 V and maximum 95 A, minimum rpm (r/s)		2800
Test value, starter motor locked:		
3.5 V and 0 rpm A	475 - 600	-
3.0 V and 0 rpm A	-	650 - 840
Lowest connection voltage V	7.3	7.3

Type	Bosch 12V 1.4 kW	Bosch 12V 1.4 kW
Volvo P/N.	91 62 617	91 62 618
Test value, starter motor unloaded:		
12.0 V and maximum 70 A, minimum rpm (r/s)	3000	2900
Test value, starter motor locked:		
4.0 V and 0 rpm A	650 - 750	650 - 750
Lowest connection voltage V	7.4	7.4

Type	Bosch EV 12V 2.2 kW	Bosch 12V 2.0 kW
Volvo P/N.	91 62 928	94 59 468
Test value, starter motor unloaded:		
12.0 V and maximum 70 A, minimum rpm (r/s)	6100	
12.0 V and maximum 85 A, minimum rpm (r/s)		4900
Test value, starter motor locked:		
4.0 V and 0 rpm A	1200 - 1300	700 - 1000
Lowest connection voltage V	7.0	8.0

Group 35 Lighting



A3500800

Bulbs, market dependent:

	Power (W)	Socket type	US/CAN	Fig. no.
Headlamp, early version	60/55	P 43t-38(H4)	9003/HB2	1A
Headlamp, later version	55	H7		1B
US/CAN, main	70		9005/HB3	
US/CAN, low	60		9006/HB4	
Fog lamps	55	PK 14.5 s	H3	2
Front parking lamps	5 (4cp)	BA 15 s	67	5
Tail lamp, 4-D	5 (4cp)	BA 15 s	67	5
Tail lamp, 5-D	21/4	BAZ 15 d		4
Parking lamps / Turn signal lamps, front, USA/CAN	24 / 2.2cp	BAY 15 d	1157 NA	3
Turn signal lamp, front	21/4	BAU 15 s		3
Turn signal lamp, rear	21 (32cp)	BAU 15 s	1156	3
Turn signal lamp, side marker	5	W 2.1 x 9.5 d yellow		8
Brake lamp, standard	21 (32cp)	BA 15 s	1156	3
High-mounted brake lamp	21 (32cp)	Special	1156	3
Spoiler, brake lamp	5	W 2.1 x 9.5 d		8
Fog tail lamp, 4-D	21 (32cp)	BA 15 s	1156	3
Fog tail lamp, 5-D	21/4	BAZ 15 d		4
Reversing lamps	21 (32cp)	BA 15 s	1156	3
Number plate lighting	5	W 2.1x9.5 d		8
Door open warning lamp	3	W 2.1x9.5 d		8
Courtesy lighting	5	W 2.1x9.5 d		8
Roof lighting	5	BA 9 s		9
Rear reading lamps	5	BA 9 s		9
Cargo compartment lighting	10	SV 8.5		6
Glove compartment lighting	2	BA 9 s		9

	Power (W)	Socket type	US/CAN	Fig. no.
Vanity mirror lighting	1.2	SV 5.5		7
Instrument lighting	3	W 2.1x9.5 d		8
Lighting control	1.2 + 1.5	Special		10
Warning / indicator lamps	1.2	W 2x4.6 d		10

Group 37 Fuses

11A/1-9, Main fuses in the integrated relay / fusebox in the engine compartment		
Fuse number	Function	A
1	Engine cooling fan (FC)	60
2	Fuses 11C/30-37 via overload relay X -98, Fuses 11C/26-29 via overload relay 15l 99-, Fuses 11C/25-29 via overload relay 15l	50
3	Starter motor (petrol), Coolant heating plugs (Diesel) -98, Pulsed secondary air injection system (PAIR) pump	50
4	ABS control module	50
5	Main lighting relay with bulb failure warning sensor	50
6	Fuses 11C/5-10. Starter motor (diesel)	60
7	Fuses 11C/11-17, 11C/39-40	50
8	Fuses 11B/1, 11B/2-5 via the main relay for the fuel injection system	60
9	Glow plugs 1-5, via glow plug relay (Diesel)	80

11B/1-5, Fuses in the integrated relay / fusebox in the engine compartment		
No.	Function	A
1	Ignition switch, Engine control module (ECM) -98, Control module AW50-42, Fuel injection system main relay (Motronic 4.3 / 4.4) 99-, Control module AW50-42*, Fuel injection system main relay**	10 15**
2	Engine control module (ECM), Injectors, Idle air control (IAC) valve, Fuel injection pump (Diesel), Injection timing valve (Diesel) -98, Mass air flow (MAF) sensor 99-, Accelerator pedal (AP) position sensor, A/C relay**, AW50-42 gearbox control module*, Electronic throttle module (ETM)	10 15**
3	Fuel pump (FP), Ignition discharge module (IDM) and ignition coil, Glow plug relay (Diesel), Coolant heating plugs (Diesel), turbocharger (TC) control valve (Diesel), EGR controller (Diesel), PTC resistor air pre-heating (Diesel) 99-, Mass air flow (MAF) sensor	15 20*

11B/1-5, Fuses in the integrated relay / fusebox in the engine compartment		
No.	Function	A
4	-98, AW50-42 gearbox control module (TCM)	10
	99-, AW50-42 Transmission control module Spark plugs with ignition coils	15**
5	Air conditioning (A/C) relay, Heated oxygen sensor (HO2S) front rear, Canister purge (CP) valve, EVAP canister shut-off valve, Turbocharger (TC) control valve, PTC resistor air pre-heating	10
	-98, Pulsed secondary air injection system (PAIR) solenoid valve, Pulsed secondary air injection system (PAIR) pump relay 99-, Relay A/C, Camshaft reset valve	20**

* Fenix 5.2, MSA 15.7

** ME7, DENSO, MSA 15.8

11C/1-40, Fuses, passenger compartment fusebox		
No.	Function	A
1	-	
2	-98, Control module central locking / Anti-theft alarm, Mode selector AW50-42, RTI	10
	99-, Fog tail lamp, indicator lamp for fog tail lamp	
3	-98, ABS control module	10
	99-, Control module central locking / Anti-theft alarm, Mode selector AW50-42, RTI control module	
4	Immobilizer	10
	99-, Engine control module (ECM)	
5	Climate control unit, Data link connector (DLC)	15
6	Control module central locking / Anti-theft alarm, Alarm siren, Alarm horn	20
	-99, Movement detectors	
7	Radio / Amplifier	15
8	Immobilizer, Light switch, Combined instrument panel	15
9	Heated rear seat	20
10	-98, Ignition switch	15
	99-, Remote control unit central locking / Anti-theft alarm, Alarm siren, Glass breakage sensor, Movement detectors	10
11	Stop (brake) lamps	10
12	Engine coolant heater (Diesel)	20
13	Turn signal lamps / Hazard warning signal flashers, High beam flash, Control module central locking / Anti-theft alarm	20
	-98, Remote control unit central locking / Anti-theft alarm, Glass breakage sensor	
14	Heated rear window, Heated door mirrors	30

11C/1-40, Fuses, passenger compartment fusebox		
No.	Function	A
15	Courtesy lighting, Glove compartment lighting, Footwell lighting, Door open warning lamps, Cargo compartment lighting, Seat belt reminder, RTI 99-, Vanity mirror lighting, passenger side	10
16	Power antenna, CD changer, Trailer socket, Accessories	30
17	Front fog lamps	20
18	Key warning	10
19	Left high beam, Accessory	15
20	Right high beam, High beam indicator lamp	15
21	Left low beam	15
22	Right low beam	15
23	Parking lamps, Tail lamps, Number plate lighting	10
24	Parking lamps, Tail lamps, Bulb failure warning sensor	10
25	-98, Fog tail lamp, Indicator lamp for the fog tail lamp 99-, ABS control module	10
26	Light switch	15
27	Back-up (reversing) lamps, Turn signal indicator	15
28	Heated seats, Heated rear seats	25
29	15l-rail (15/4): Heated rear window, Heated door mirrors, Seat belt reminder, Shift-Lock, Bulb failure warning sensor, Alarm siren, Cruise control, Engine coolant heater (Diesel) -98, Exhaust temperature sensor	10
30	Cigarette lighter / 12 V power outlet front, RTI 99-, Cigarette lighter / 12 V power outlet rear	15
31	Climate control	25
32	Radio / Amplifier 99-, ECC control module, Power sun roof, Retracting door mirrors, Instrument and control panel lighting, Ashtray lighting	10
33	X-rail (15/8): Headlamp height adjustment, Tailgate wiper / washer	15
34	Windscreen wiper / washer, Headlamp wiper / washer, Horn	25
35	Accessories -98, Instrument and control panel lighting, Ashtray lighting, Power sun roof 99-, Power seats, Remote garage door opener, Vanity mirror lighting driver's side, Roof lamp lighting buttons, RTI system	10
36	-98, Cigarette lighter / 12 V power outlet rear, Power seats 99-, SRS	15
37	Power windows, Power sun roof	.

11C/1-40, Fuses, passenger compartment fusebox		
No.	Function	A
38	-	*
39	Left side power seat	*
40	Right side power seat	*

* Automatic fuse

Relays in the integrated relay / fusebox, engine compartment	
Position	Function
1	Main relay fuel injection system (2/32)
2	-98, Pulsed secondary air injection system (PAIR) pump (2/53) or Automatic glow plug system (2/14) (Diesel). Electronic throttle module (ETM) relay (up to week 49 1998 inclusive)
3	Starter motor (2/35)
4	A/C (2/22)

Relays in the central electrical unit	
Position	Function
101-102	Control module, cruise control (4/3)
103	Fuel pump (FP) (2/23)
104	Main lighting relay with bulb failure warning sensor (2/1)
105	X-supply overload relay (2/30)
106	Overload relay 15l supply (2/6)
108	Main lighting relay with bulb failure warning sensor (2/1)
201	Fog lamps (2/2)
202	Alarm horn (2/77)
203	Windscreen wiper intermittent relay (2/4)
204	Tailgate wiper intermittent relay (2/16)
205	-
206	-
207	-98, Exhaust temperature sensor (2/15) This relay position is empty from model year 1999 inclusive.
208	Heated rear window / door mirrors (2/44)
212	Seat belt reminder / key reminder (2/5)
213	Bridge connector for the front fog lamps (34/13) up to model year 1998 inclusive. This relay position is empty from model year 1999 inclusive.

Other relays	
Position	Function
2/11	Engine cooling fan (FC)
2/43	Heated rear seat
2/54	Coolbox V70
2/74	Coolant heating plugs (Diesel)
7/1	Bulb failure warning sensor

Group 38 Instruments

Fuel level sensor	Volume litres	Resistance Ω
Empty fuel tank	0	325 \pm 2.5
Full fuel tank	73	10 \pm 2.5

Temperature sensor	Temperature $^{\circ}\text{C}$ ($^{\circ}\text{F}$)	Resistance Ω
Resistance at various temperatures	20 (68)	2800
	60 (140)	560
	90 (212)	206

Speedometer, resistance in sensor	Ω	1820 \pm 180
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