

# Service Manual

Section 3 (32)

Charging system

240, 260  
1975-19..

## Fault tracing

# VOLVO

**TP 30729/1**

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Printed in U.S.A.

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# Charging System Fault Tracing

240/260; 1975 - 19..

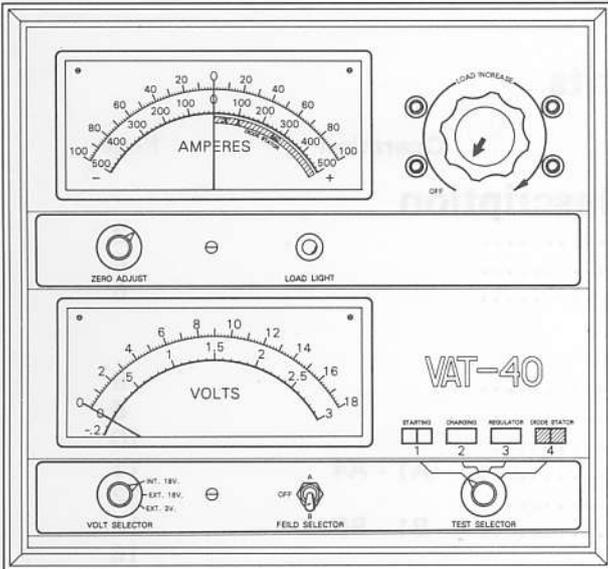
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Order number: TP 30729-1

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without prior notification.

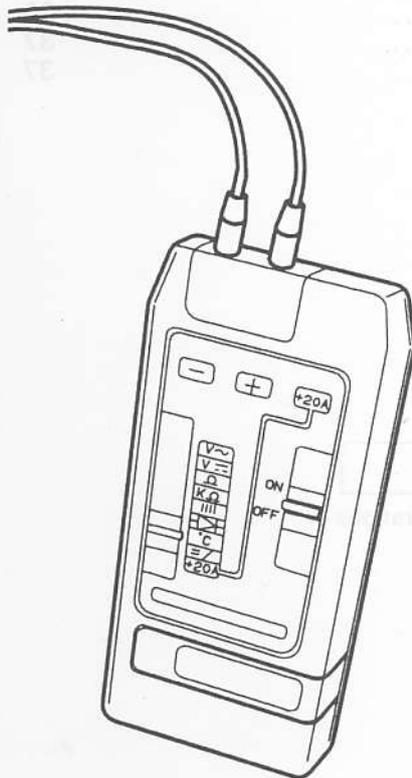
## Test equipment



### Marquette 42-130 volts ampere tester, Sun Vat-40 volts ampere tester (or equivalent)

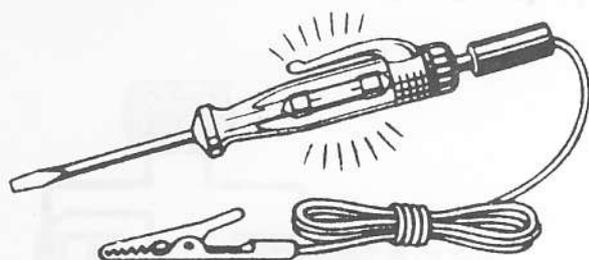
The unit contains a voltmeter, ammeter, built-in carbon pile resistor, and a diode/stator tester.

When using this equipment or similar equipment, follow the manufacturer's instructions.



### Digital multimeter (Volvo 9996525-3, Fluke 8022B or equivalent)

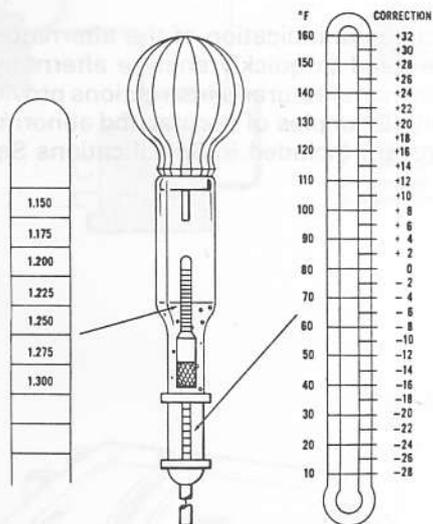
Used to measure current, voltage and resistance. Remember: To take resistance readings properly, the circuit being tested must be electrically disconnected from adjacent circuits and voltage should not be present.



**Test light**

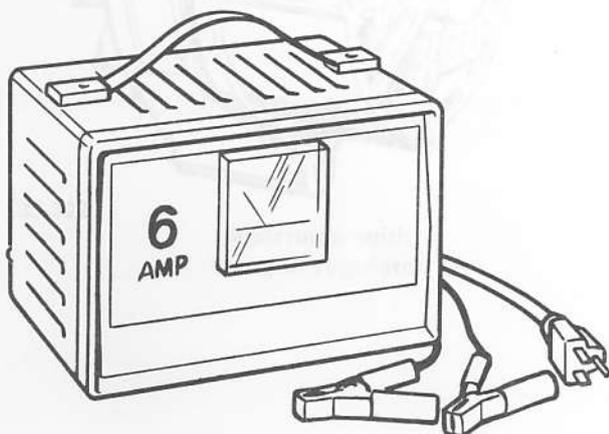
Used to check for current drain or to check for voltage present in a circuit. Test light glows when approximately 150 milliamperes flow through the light (the amount of current needed to illuminate the test light varies between test lights; 150 milliamperes is approximate.)

133 427



**Hydrometer with thermometer (Volvo 998-5011-7, Snap-On BB4A or equivalent)**

The hydrometer is used to measure the specific gravity of the electrolyte in battery cells. This measurement gives an indication of the battery's state of charge.

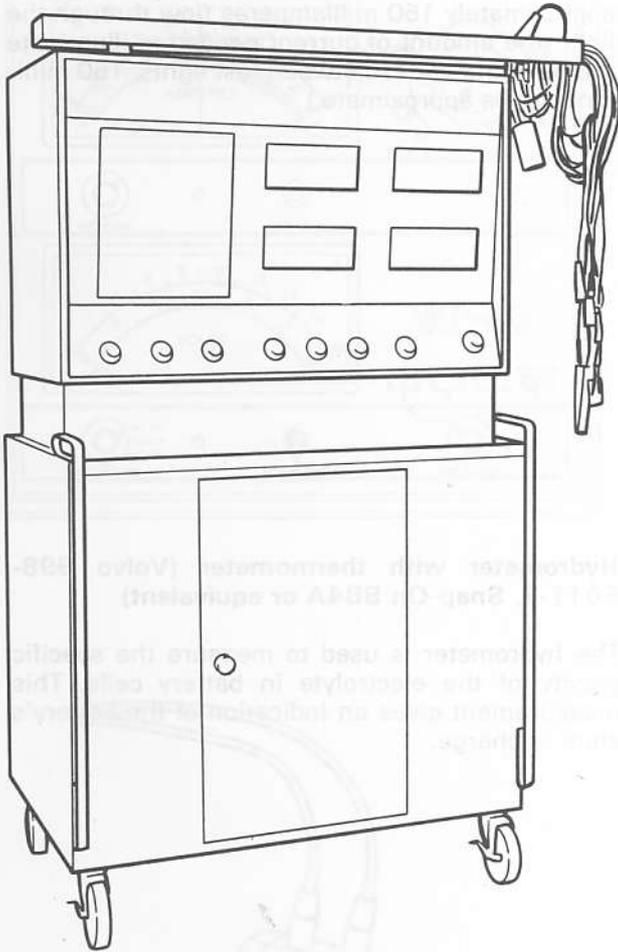


**Low-amperage charger (Marquette Model 30-136, Schumaker 43141 or equivalent)**

Recharges 6 and 12 volt batteries in 3 to 7 hours. Slow charge of 6 amps prevents battery damage caused by overheating.

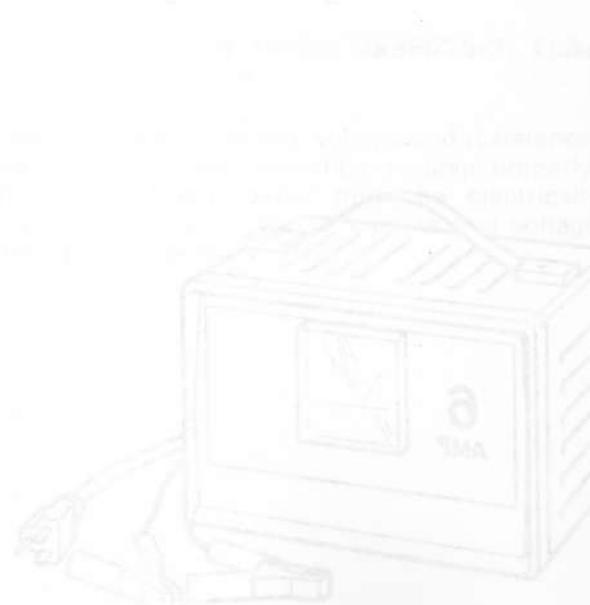
## Suggested equipment

This equipment is strongly recommended.

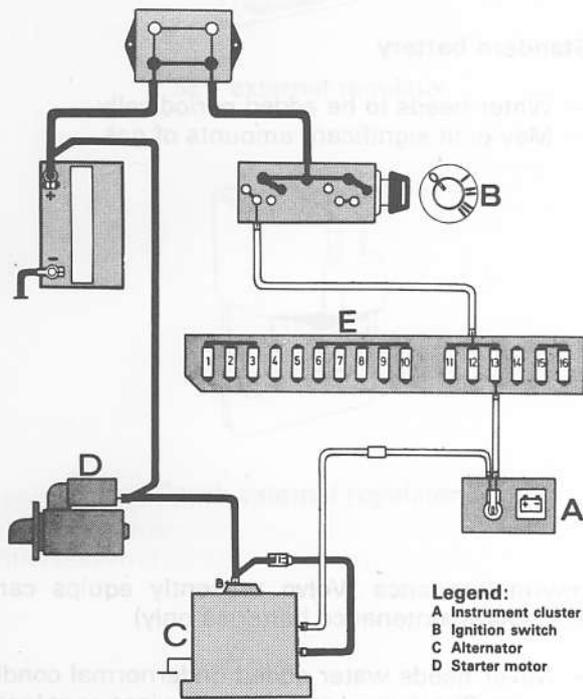


### Oscilloscope (automotive)

Gives a visual indication of the alternator output. Can be used to quickly analyze alternator faults. Refer to manufacturer's instructions provided with the unit. (Examples of normal and abnormal scope patterns are included in Specifications Section.)



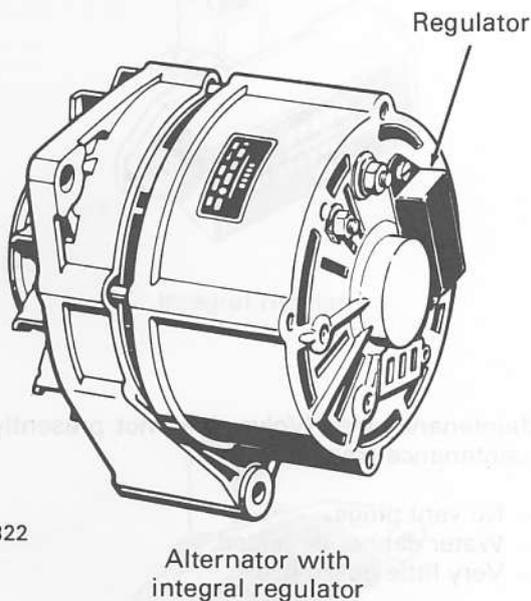
## Charging system, brief description



**Legend:**  
 A Instrument cluster  
 B Ignition switch  
 C Alternator  
 D Starter motor

**NOTE**

Drawing to the left is only representative of charging systems in general. Refer to specifications for specific wiring diagrams.



Alternator with integral regulator

133 322

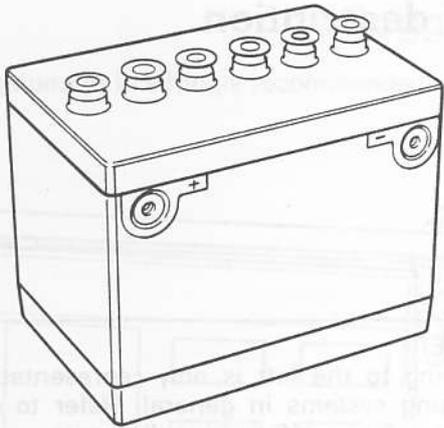
The charging system consists of three components, the alternator, battery, and voltage regulator.

**A) Alternator**

Converts the rotary motion of the engine into an electrical current. There are two general types of alternators used on Volvos. One type uses an external regulator and the other an integral (built-in) regulator. Shown is a representative drawing of an alternator with integral regulator.

**B) Battery**

Stores an electrical charge for starting the car. The battery also helps smooth out voltage fluctuations. There are three types of batteries, standard, low maintenance, and maintenance free.



**Standard battery**

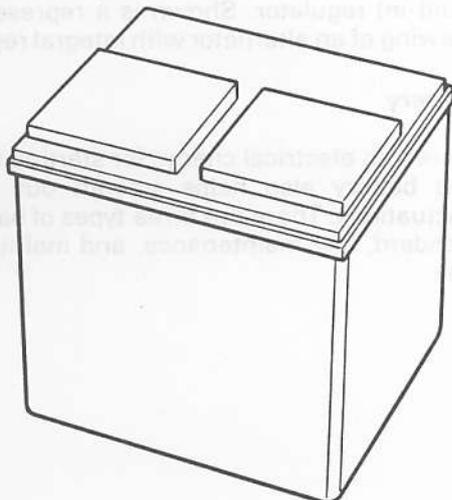
- Water needs to be added periodically.
- May emit significant amounts of gas.



**Low-maintenance (Volvo presently equips cars with low-maintenance batteries only)**

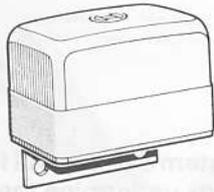
- Never needs water added under normal conditions. Check level at normal services or at least once a year.
- Reduced gassing.
- Low self-discharge.

127 522

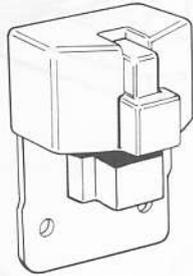


**Maintenance-free (Volvo does not presently use maintenance-free batteries)**

- No vent plugs.
- Water cannot be added.
- Very little gassing.



SEV external regulator

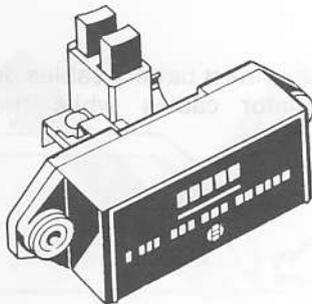


Bosch external regulator

### C) Voltage regulators

#### External transistor regulator

- Regulates by solid-state electronics.
- No moving parts.
- Relivable, can withstand vibration.
- Can be mounted on the alternator as an integral regulator.

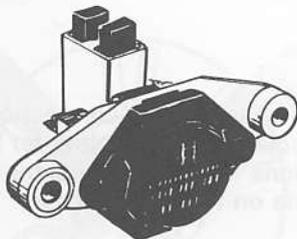


134 543

Integral regulator

#### Integral regulator

- Transistor-type regulator mounted on the alternator.
- Compact.



135 288

Integral regulator

#### NOTE

The regulated voltage varies with the temperature of the regulator. As the temperature of the regulator increases, the regulated voltage decreases. On some 1985 and later models, the regulator is connected to a temperature sensor located beneath the battery tray; thus, the regulated voltage is more precisely matched to the system's immediate requirements.

## Fault tracing

### General

This section explains the fault tracing method of correcting charging system defects. All fault tracing must be done in the sequence presented in this section. "Short-cut" methods undermine the efficiency of the fault tracing method.

#### FIRST

Troubleshooting Pre-checks

then

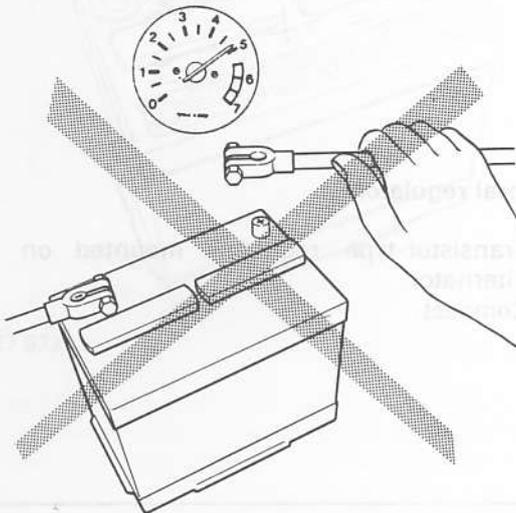
Battery Testing

then

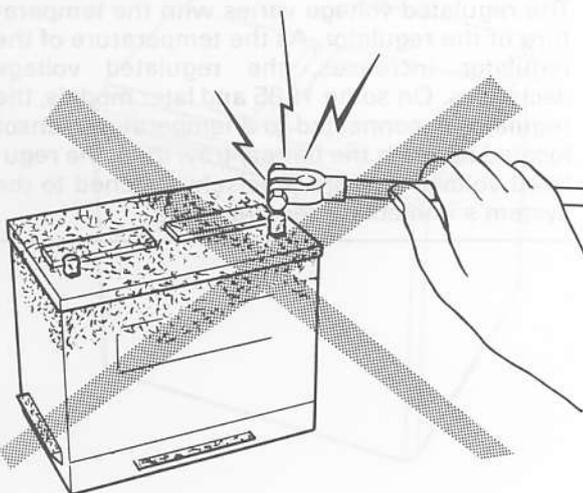
Charging System Fault Tracing

## The don'ts of fault tracing

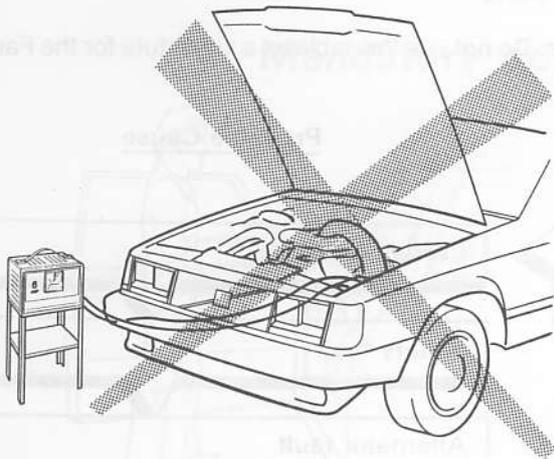
When testing or servicing an alternator, avoid damaging the unit and its regulator by carefully observing the following precautions:



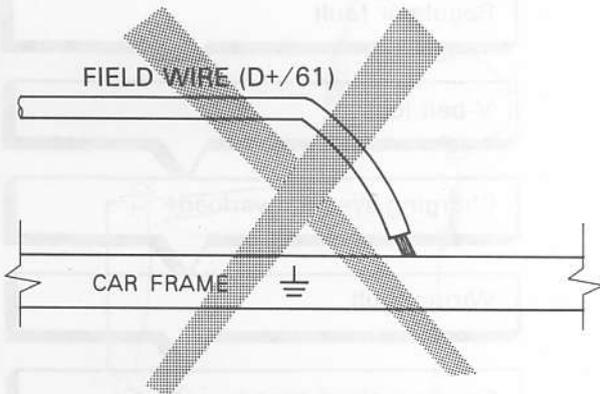
- A) Never disconnect battery cables or the wires to the regulator cables while the engine is running.



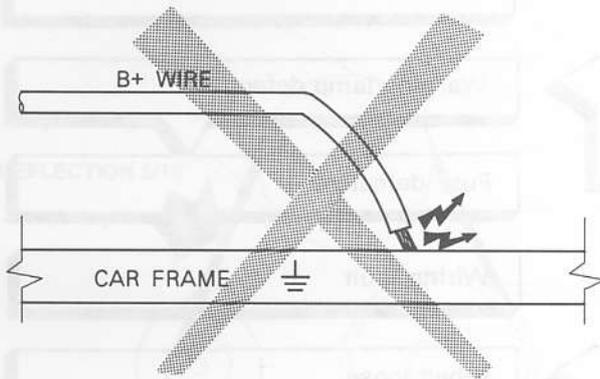
- B) Never reverse battery connections. Check the battery polarity with a voltmeter before making connections if the polarity signs "+" or "-" are not visible on the battery case.



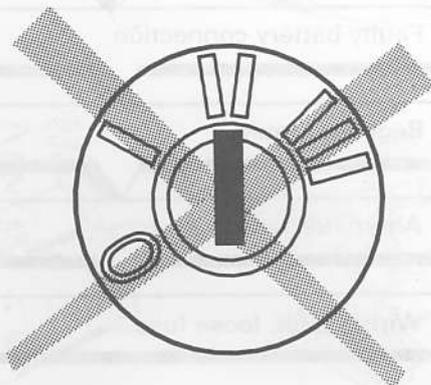
- C) Disconnect the battery cables before hooking up a fast charger. Never use a fast charger as a booster for starting the car. Do not charge battery with battery installed in car; gassing can damage the paint.



- D) Avoid grounding the field circuit (D+/61) between the alternator and the regulator. Grounding the field of either alternator or regulator may damage the regulator.



- E) Don't ground the alternator output terminal (B+) as this may damage the alternator, the circuit, or both. This precaution must be followed even when the system is not operating, because the output terminal on the alternator is "hot" at all times. Terminals must be covered with insulating boots or tape.



- F) Never leave the ignition switch "ON" when servicing the regulator.

### Quick check

Table to be used ONLY in conjunction with Fault Tracing Table: **Do not** use this table as a substitute for the Fault Tracing Table!

<u>Fault</u>	<u>Probable Cause</u>
Battery not being charged or not being sufficiently charged.	Current drain
	Battery fault
	Alternator fault
	Regulator fault
	V-belt loose
	Charging system overload
	Wiring fault
	Frequent short trips (see A1 on following page)
Alternator warning lamp not lit up with engine OFF and ignition switch in ON position.	Warning lamp defective
	Fuse defective
	Wiring fault
Alternator warning lamp glows dimly or flashes when engine is running.	V-belt loose
	Faulty battery connection
	Regulator fault
	Alternator fault
	Wiring fault, loose fuse

## A. Mandatory troubleshooting pre-checks

A1



### Vehicle operation

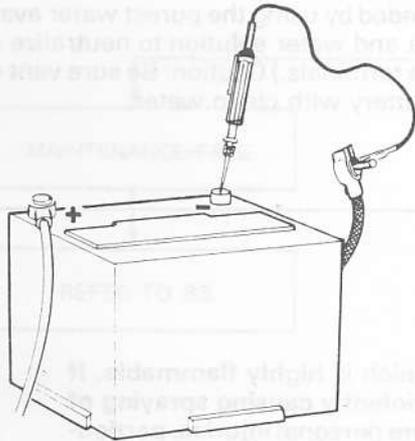
Analyze the operation of the vehicle. Some problems (e.g., partially-drained battery) may be the result of excessive strain on the charging system. Be aware that frequent trips of short duration constitute a severe driving condition. If this type of usage characterizes the vehicle's operation and charging system fault tracing procedures do not reveal any faults, then (on 1980 and earlier models) the installation of a "diode kit" (see last section of manual) may correct the problem.

A2

### Check for current drain

A short in the wiring or electrical equipment which remains on\* when the ignition is off, drains the battery. Open the circuit at the negative (-) battery post and connect a test light in series. Glowing of test light indicates a current drain. If there is a current drain, isolate the faulty circuit by removing fuses one at a time until the current drain stops. Then continue isolating the problem by disconnecting the wires attached to the affected fuse. After isolating the faulty circuit, trace the circuit wiring until the fault is found. Use appropriate wiring diagrams. Proceed to A3.

\*NOTE: Be aware that car's clock, or illuminated dome light, etc. may cause some test lights to glow.



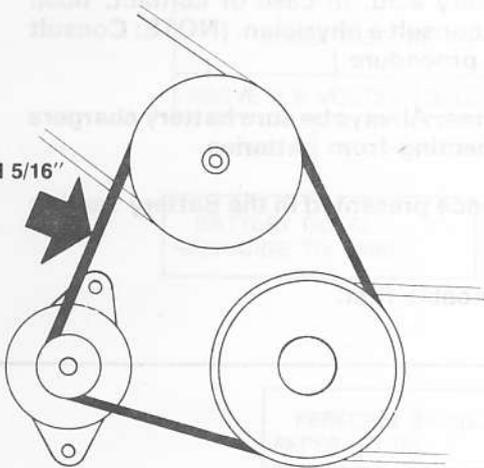
129 126

A3

### Check V-belt tension

The performance of the alternator, the life of the alternator bearings, and the life of the V-belt depends heavily on maintaining the correct belt tension. Measure the tension by firmly pressing down on the alternator belt midway between two pulleys as shown. The belt should move 5/16 in. (8 mm). Adjust as required. Proceed to A4.

DEFLECTION 5/16"



#### NOTE

Replace belts in sets (where applicable).

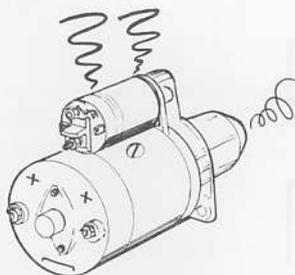
#### NOTE

Make sure that instrument panel **WARNING** light is on when key is in "ON" position (engine not running). If not, refer to C4.

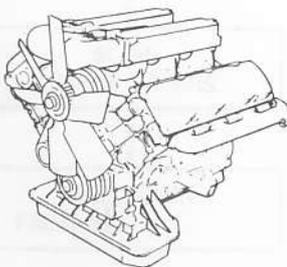
A4

### Check systems closely related to the charging system

Poor engine performance or a faulty starter may cause what appear to be charging system problems. Eliminate poor engine performance or starter faults as source(s) of the problem. Proceed to Battery Testing.



134 393



133 204

## Battery Testing

### General

Lack of electrolyte causes premature failure of batteries faster than anything else. Fill battery with distilled water; never with acid. Use only distilled water, battery life is extended by using the purest water available. A dirty battery should be removed and scrubbed with a baking soda and water solution to neutralize any acid present. (On a dirty battery there may be current drain between the terminals.) Caution: Be sure vent caps are tight so no solution gets into cells to neutralize the acid. Flush battery with clean water.

#### **WARNING**

**Wear safety glasses when working near batteries.**

**All automotive batteries generate hydrogen gas which is highly flammable. If ignited by a spark or flame, the gas may explode violently causing spraying of acid, fragmentation of the battery, and possible severe personal injuries, particularly to the eyes. Avoid contact with battery acid. In case of contact, flush affected area immediately with water, and consult a physician. (NOTE: Consult Owner's Manual for correct jump-starting procedure.)**

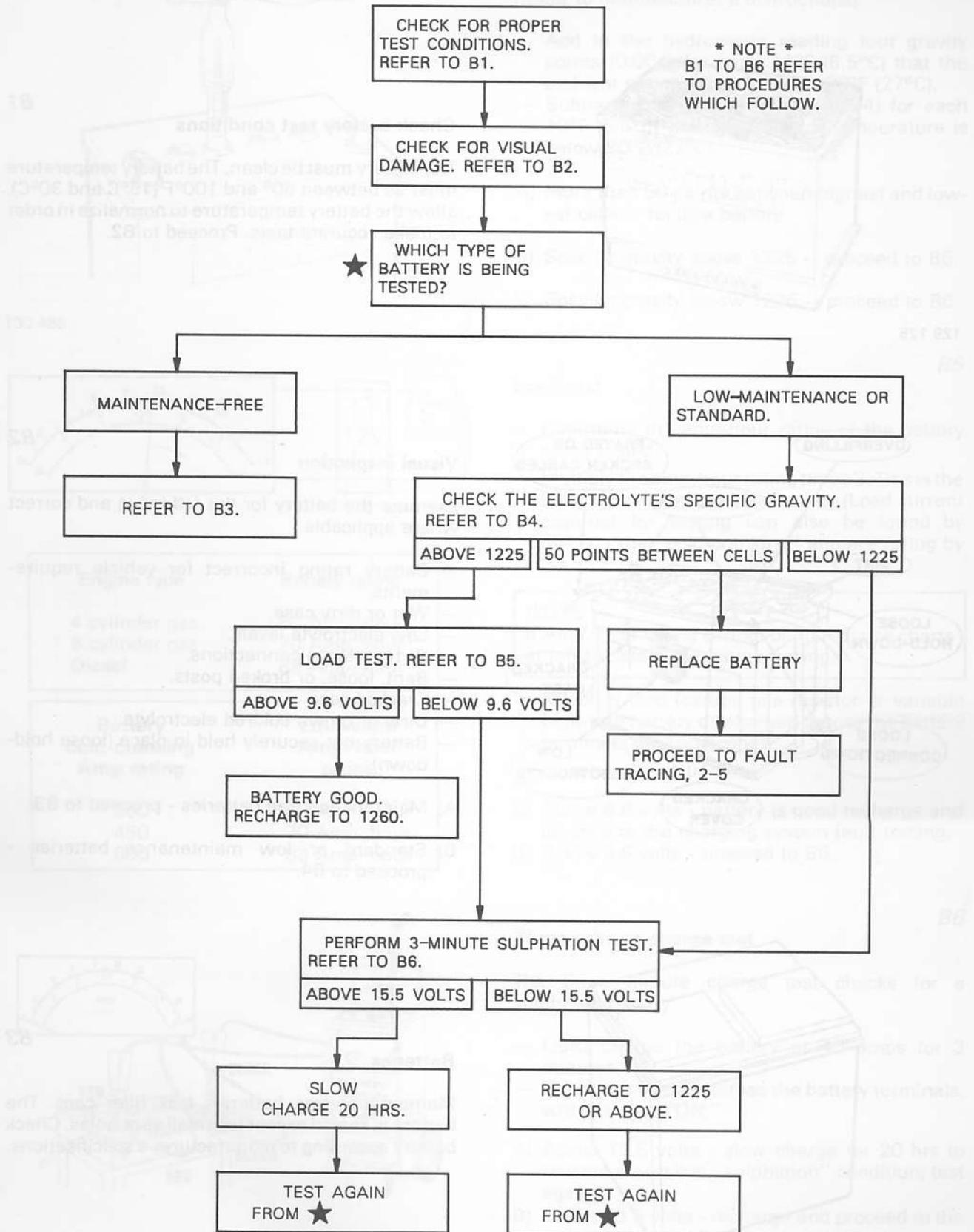
**Charge batteries only in a well-ventilated area. Always be sure battery chargers are "OFF" when connecting-to or disconnecting-from batteries.**

**All battery tests must be done in the sequence presented in the Battery Testing Chart (next page).**

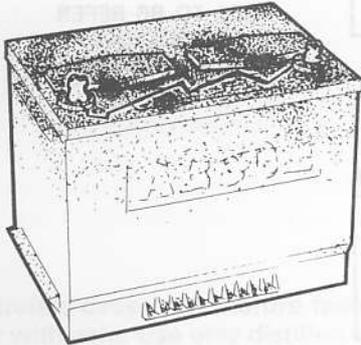
**Always disconnect the negative (-) battery cable first.**

# Battery testing chart

(APPLIES TO STANDARD, LOW-MAINTENANCE, AND MAINTENANCE-FREE BATTERIES)



## B. Battery testing procedures

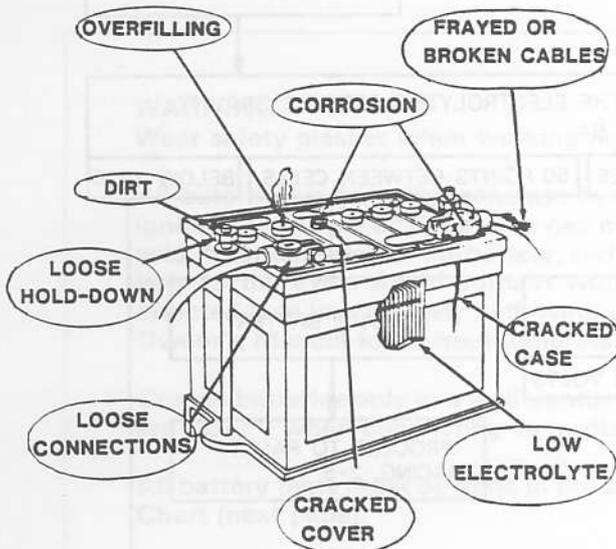


B1

### Check battery test conditions

The battery must be clean. The battery temperature must be between 60° and 100°F (15°C and 30°C), allow the battery temperature to normalize in order to make accurate tests. Proceed to B2.

129 125



B2

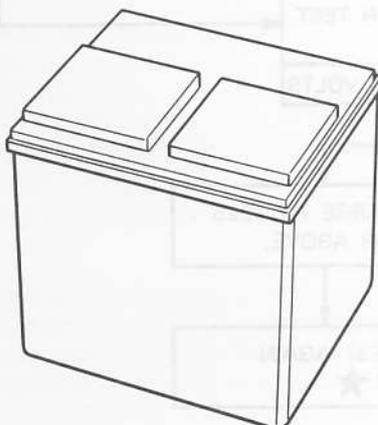
### Visual inspection

Examine the battery for the following and correct where applicable:

- Battery rating incorrect for vehicle requirements.
- Wet or dirty case.
- Low electrolyte levels.
- Dirty or loose connections.
- Bent, loose, or broken posts.
- Cracked case.
- Dirty or brown colored electrolyte.
- Battery not securely held in place (loose hold-down).

A) Maintenance free batteries - proceed to B3.

B) Standard or low maintenance batteries - proceed to B4.

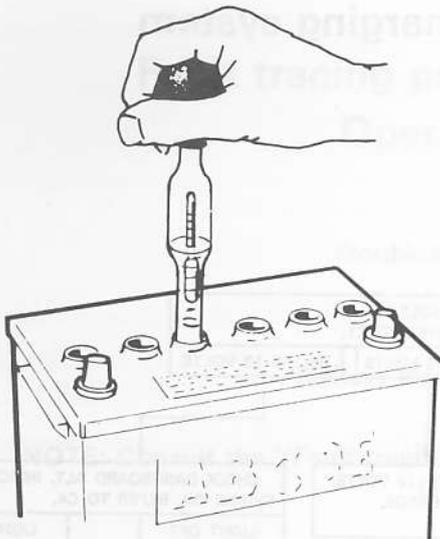


B3

### Batteries

Maintenance-free batteries lack filler caps. The battery is sealed except for small vent holes. Check battery according to manufacturer's specifications.

B4



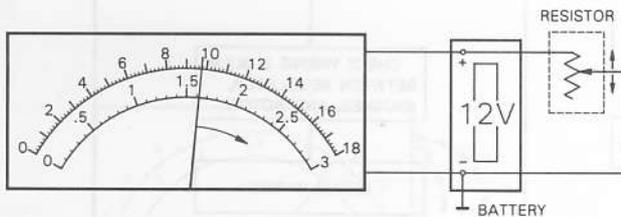
**Check the specific gravity**

Use a temperature compensating hydrometer (Refer to manufacturer's instructions).

- Add to the hydrometer reading four gravity points (0.004) for each 10°F (5.5°C) that the ambient temperature is above 80°F (27°C).
- Subtract four gravity points (0.004) for each 10°F (5.5°C) that the ambient temperature is below 80°F (27°C).

- A) More than 50 points between highest and low-est cells -- replace battery.
- B) Specific gravity above 1225 -- proceed to B5.
- C) Specific gravity below 1225 -- proceed to B6.

130 488



B5

**Load test**

- Determine the amp-hour rating of the battery being tested.
- Multiply the amp-hour rating times 3. This is the load current required for testing. (Load current required for testing can also be found by dividing the "cold-cranking" ampere rating by 2.)

Engine type	Battery rating
4 cylinder gas	60 Amp/hour
6 cylinder gas	70 Amp/hour
Diesel	88 Amp/hour

**NOTE**

If Amp/hour rating cannot be found, use charts at left to determine battery rating.

Battery cold-cranking Amp rating	Equivalent Amp/hour rating
360	60 Amp/hour
450	70 Amp/hour
600	88 Amp/hour

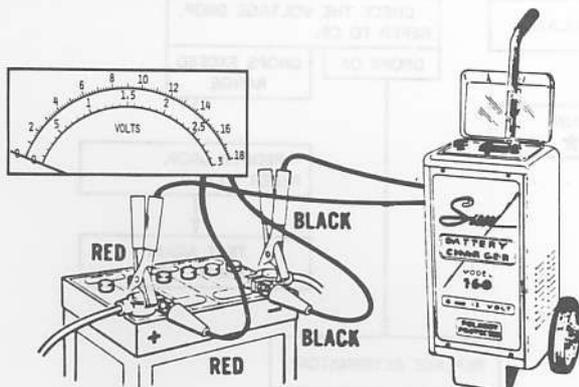
- Attach a load (carbon pile resistor or variable high-rate battery discharger) across the battery terminals for 15 seconds.
- Observe the voltmeter:

- A) Above 9.6 volts - battery is good recharge and proceed to the charging system fault tracing.
- B) Below 9.6 volts - proceed to B6.

B6

**Three-minute charge test**

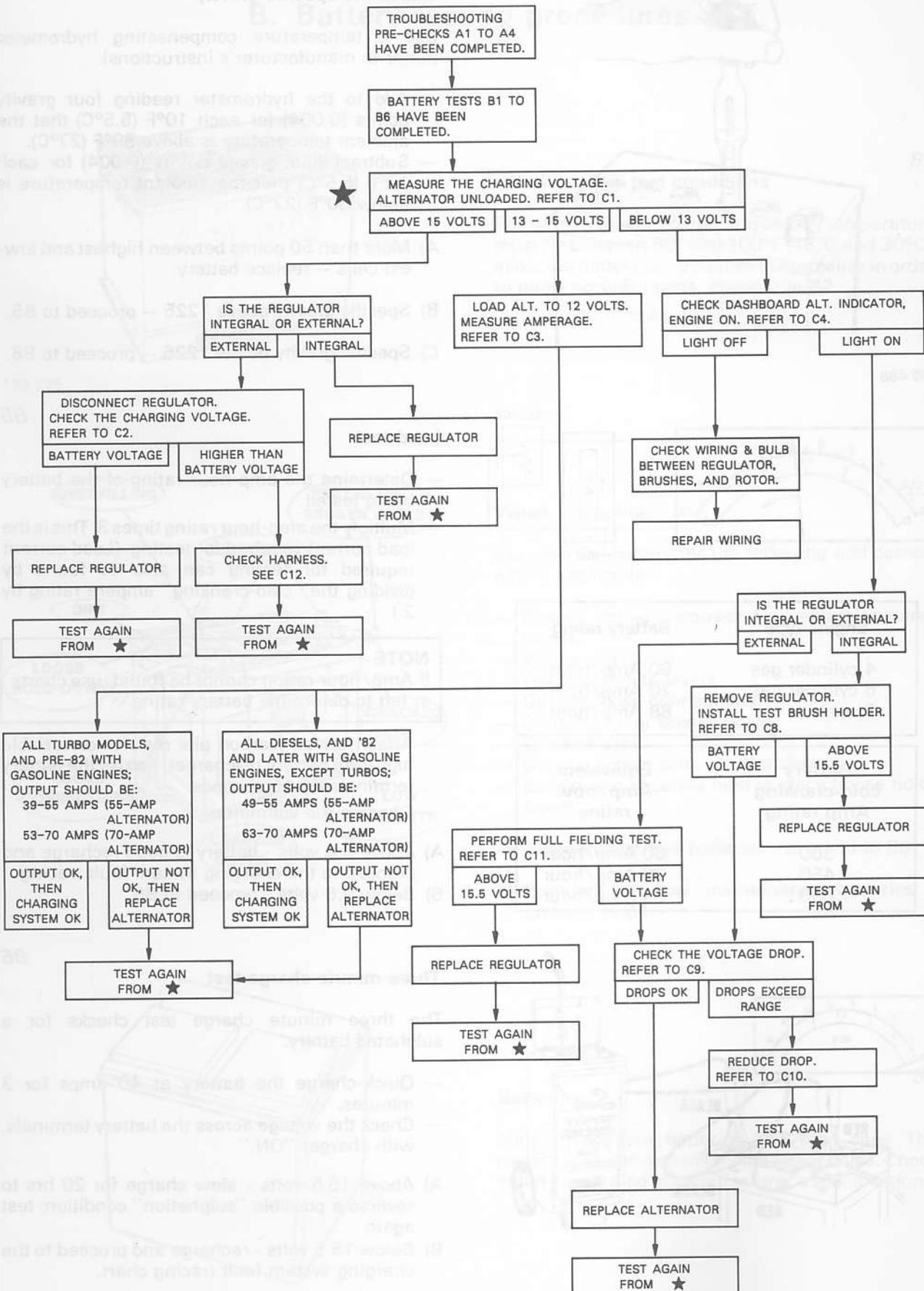
The three minute charge test checks for a sulphated battery.



- Quick-charge the battery at 40 amps for 3 minutes.
- Check the voltage across the battery terminals, with charger "ON."

- A) Above 15.5 volts - slow charge for 20 hrs to reverse a possible "sulphation" condition; test again.
- B) Below 15.5 volts - recharge and proceed to the charging system fault tracing chart.

## Fault tracing chart, charging system



## Fault tracing procedures, charging system Operations C1 to C12

Before testing

Troubleshooting prechecks A1 to A4

and

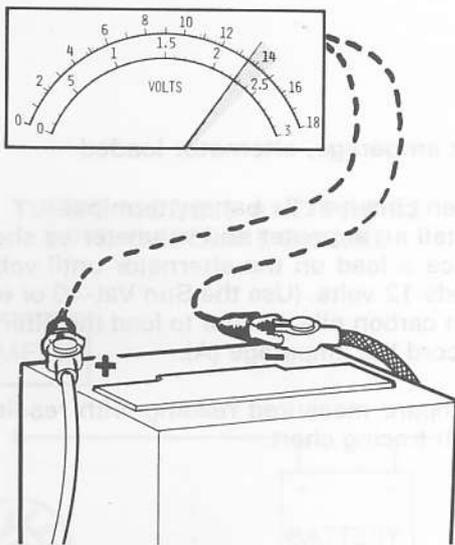
Battery tests B1 to B6 must be *completed*

**NOTE:** Consult the "Fault tracing chart" on the previous page prior to following the procedures listed here.

C1

Charging voltage, alternator unloaded

- Run engine at 2,000 rpm.
- No accessory electrical equipment on.
- Connect a voltmeter across the battery terminals as shown.
- Observe the voltage.



130 478

Higher than  
15.0 volts

— External regulator  
proceed to C2  
— Integral regulator  
Replace regulator  
Test again

13.0 to 15.0  
volts

Proceed to C3

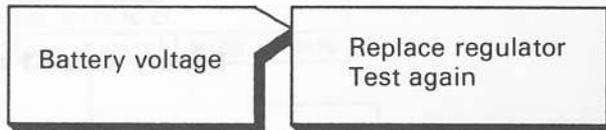
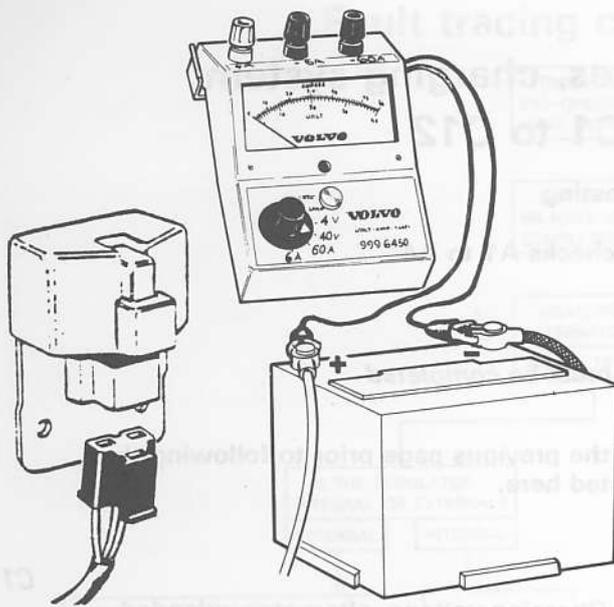
Lower than  
13.0 volts

Proceed to C4

C2

**Charging voltage, regulator disconnected**

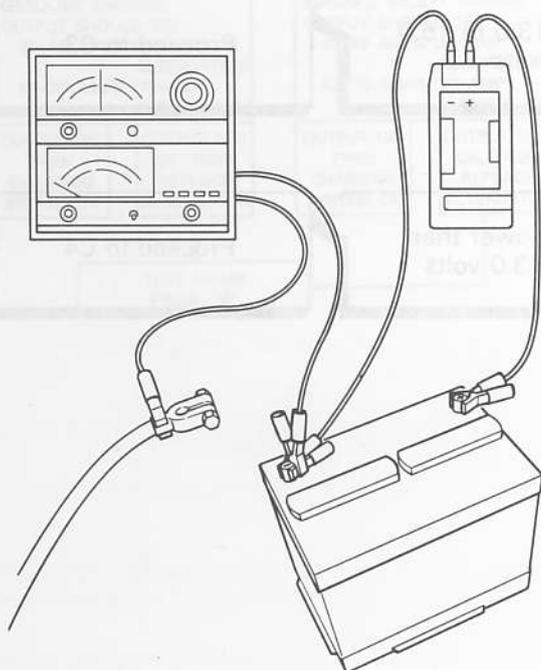
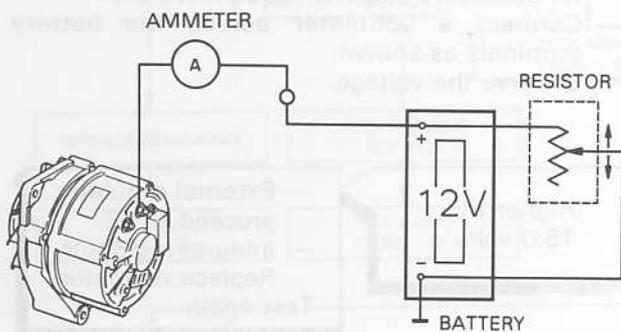
- Turn off ignition (key at position 0).
- Disconnect the harness at the regulator.
- Attach a voltmeter across the battery.
- With engine running at approximately 2000 rpm observe the voltage.



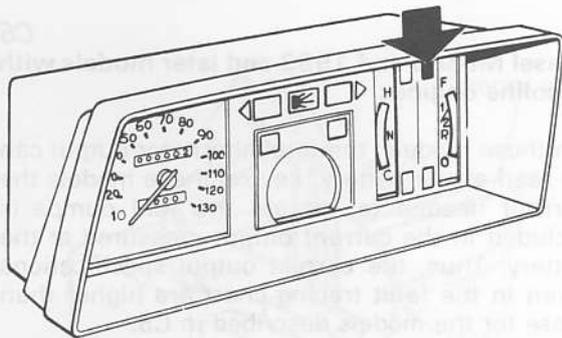
C3

**Check amperage, alternator loaded**

- Open circuit at B+ battery terminal.
- Install an ammeter and voltmeter as shown.
- Place a load on the alternator until voltmeter reads 12 volts. (Use the Sun Vat-40 or equivalent carbon pile resistor to load the alternator.)
- Record the amperage (A).
- Compare measured reading with readings on fault tracing chart.

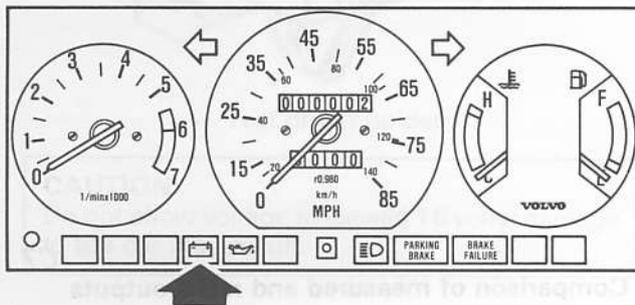


C4



**Check warning lights**

- Engine ON
- Observe the alternator warning lamp  
Note: Other warning lamps may be illuminated at the same time due to the design of the system.
- Is the alternator warning lamp on?



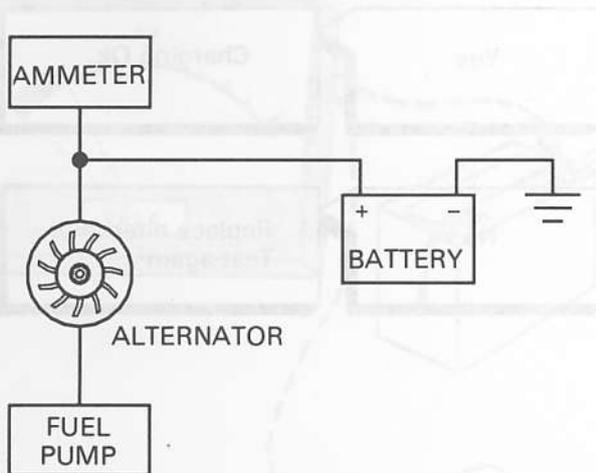
No

Check wiring between regulator, brushes and rotor.  
Check lamp.

Yes

- External Regulator Proceed to C11
- Integral Regulator Proceed to C8

**TURBO MODELS AND PRE-82 WITH GASOLINE ENGINE**



C5-C7 serve as an explanation of the methods used to determine correct charging system output (see Charging System Fault Tracing Chart).

C5

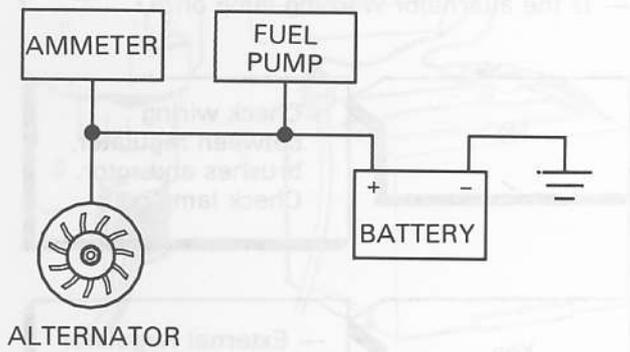
**All Turbo Models, and Pre-1982 Models with gasoline engines**

On these models the current used to operate the fuel pumps is drawn directly from the alternator. Thus, on these models, it is not possible to read total alternator output at the battery. The output measured at the battery, then, will reflect total alternator output minus the current necessary to operate the fuel pumps.

**NOTE**

The output specifications given in the fault tracing chart have been adjusted to reflect the above factors.

**DIESEL MODELS AND 1982 AND LATER WITH GASOLINE ENGINES**



**Diesel Models and 1982 and later models with gasoline engines**

On these models, the total alternator output can be read at the battery, i.e., on these models the current needed to operate the fuel pumps is included in the current output measured at the battery. Thus, the correct output specifications given in the fault tracing chart are higher than those for the models described in C5.

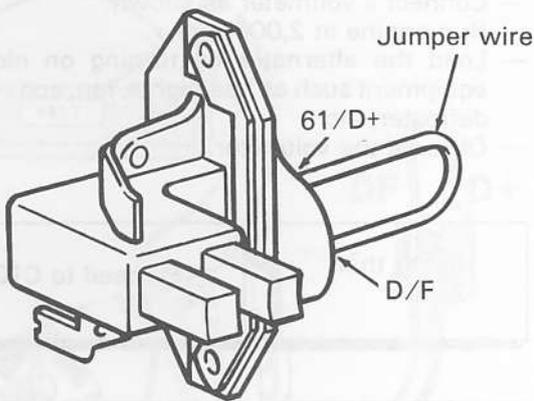


**Comparison of measured and rated outputs**

- Refer to the fault tracing chart and find the alternator's correct output (as measured at the battery).
- Is the measured output within the range given on the chart?

Yes → Charging Ok

No → Replace alternator  
Test again



Test brush holder

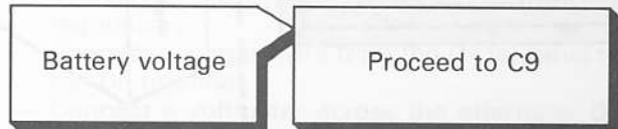
**CAUTION**

Do not allow voltage to exceed 16 volts; damage to the car may result.

C8

**Check alternator, using test brush holder**

- Connect a voltmeter across the battery.
- Remove regulator.
- Install test brush holder.

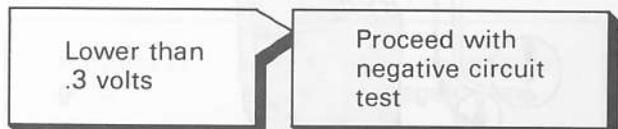
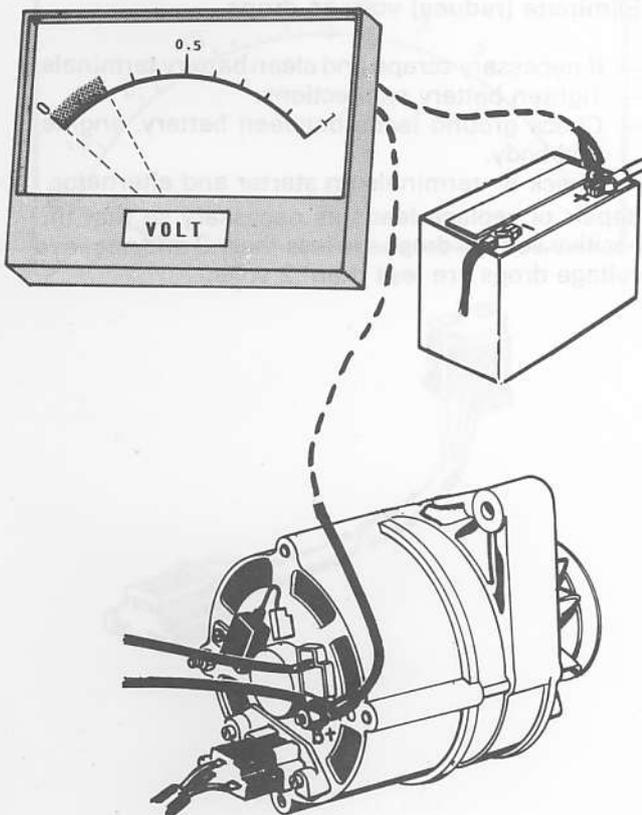


C9

**Check voltage drops**

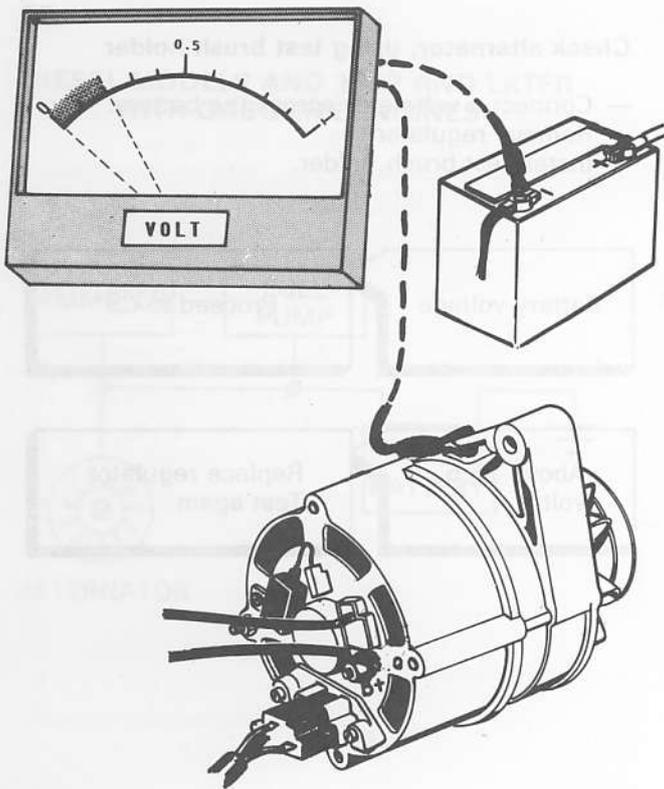
**Positive Circuit Test**

- Connect a voltmeter across the alternator B+ terminal and the battery's positive (+) terminal.
- Run engine at 2,000 rpm.
- Load the alternator by turning on electrical equipment such as headlights, fan, and window defroster, etc.
- Observe the voltmeter.



Group 32 Fault tracing

Fault tracing



Negative Circuit Test

- Connect a voltmeter as shown.
- Run engine at 2,000 rpm.
- Load the alternator by turning on electrical equipment such as headlights, fan, and window defroster, etc.
- Observe the voltmeter.

Higher than  
.2 volts

Proceed to C10

Lower than  
.2 volts

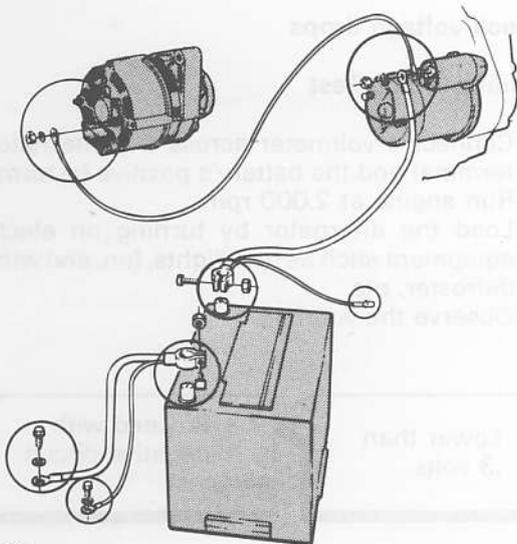
Drop OK  
Replace alternator

C10

Eliminate (reduce) voltage drops

- If necessary scrape and clean battery terminals.
- Tighten battery connections.
- Check ground leads between battery, engine, and body.
- Check B+ terminals on starter and alternator.

Repair or replace leads as necessary so that the positive voltage drops are less than .3 and negative voltage drops are less than .2 volts.



129 133

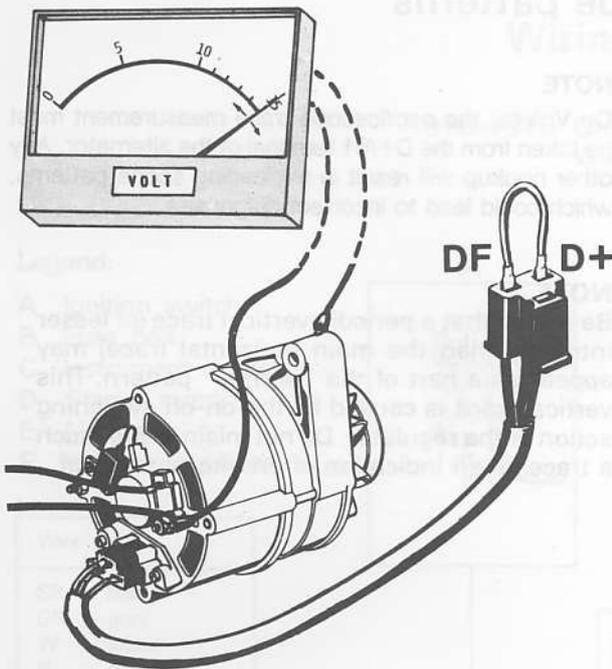
C11

**Full fielding test, external regulators**

NOTE: This test serves to distinguish between alternator faults and regulator faults.

Turn ignition OFF. (Key at position "0.")

- Disconnect the regulator wire harness from the regulator.
- Connect a jumper wire from the D+ terminal to the DF terminal.
- Connect a voltmeter across the alternator B+ terminal and ground.
- Start and run engine at 2,000 rpm.
- Observe the voltage.



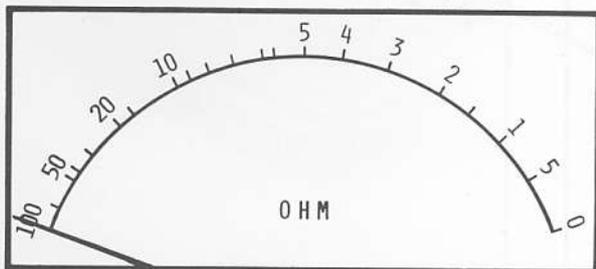
Above 15.5 volts → Replace regulator  
Test again

Battery voltage → Proceed to C9

C12

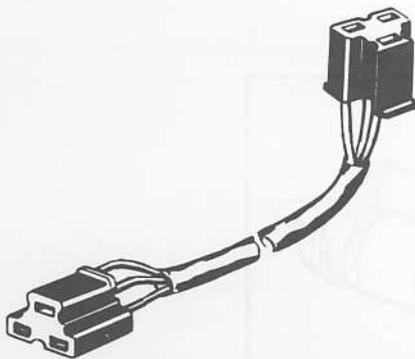
**Alternator wiring harness test (removable harness only)**

- Remove harness and check for shorts or opens with an ohmmeter.
- Clean connectors.

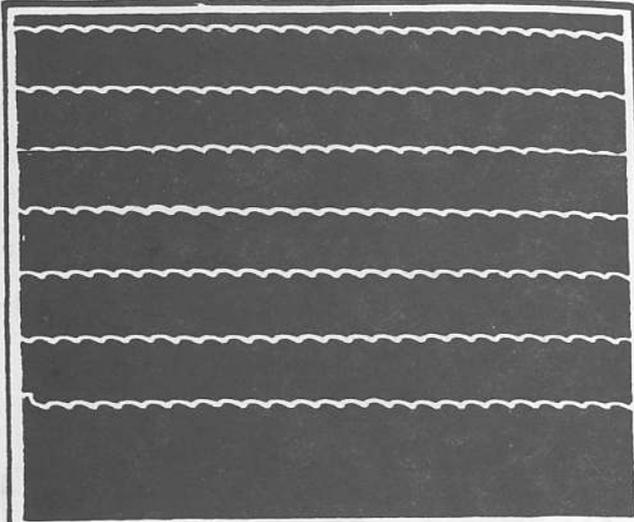


Harness open or shorted → Replace harness  
Test again

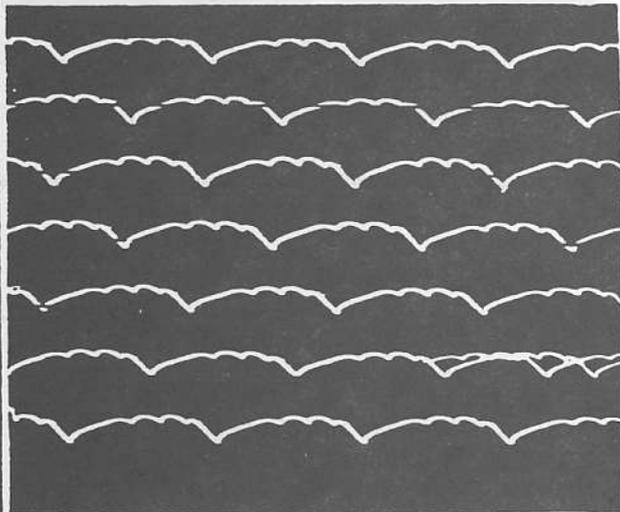
Harness is good → Replace regulator  
Test again



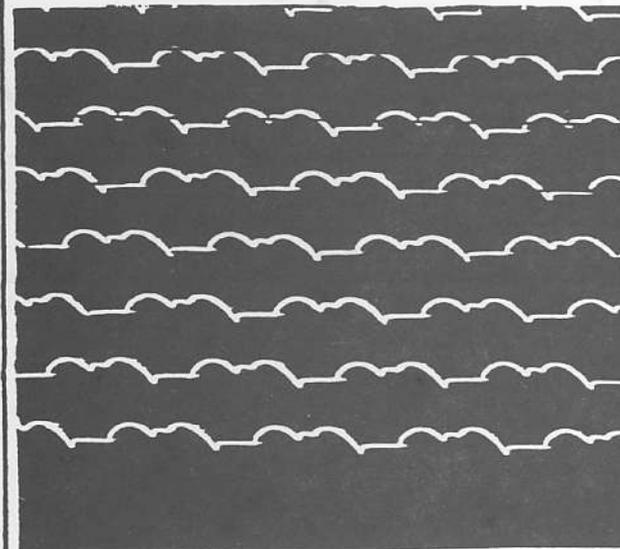
## Alternator scope patterns



Normal



Open diode



Shorted diode

### NOTE

On Volvos, the oscilloscope trace measurement must be taken from the D+/61 terminal of the alternator. Any other hookup will result in misleading scope patterns, which could lead to incorrect diagnoses.

### NOTE

Be aware that a periodic vertical trace (of lesser intensity than the main horizontal trace) may appear as a part of the "normal" pattern. This vertical trace is caused by the on-off switching action of the regulator. Do not misinterpret such a trace as an indication of an alternator fault.

# Wiring diagrams

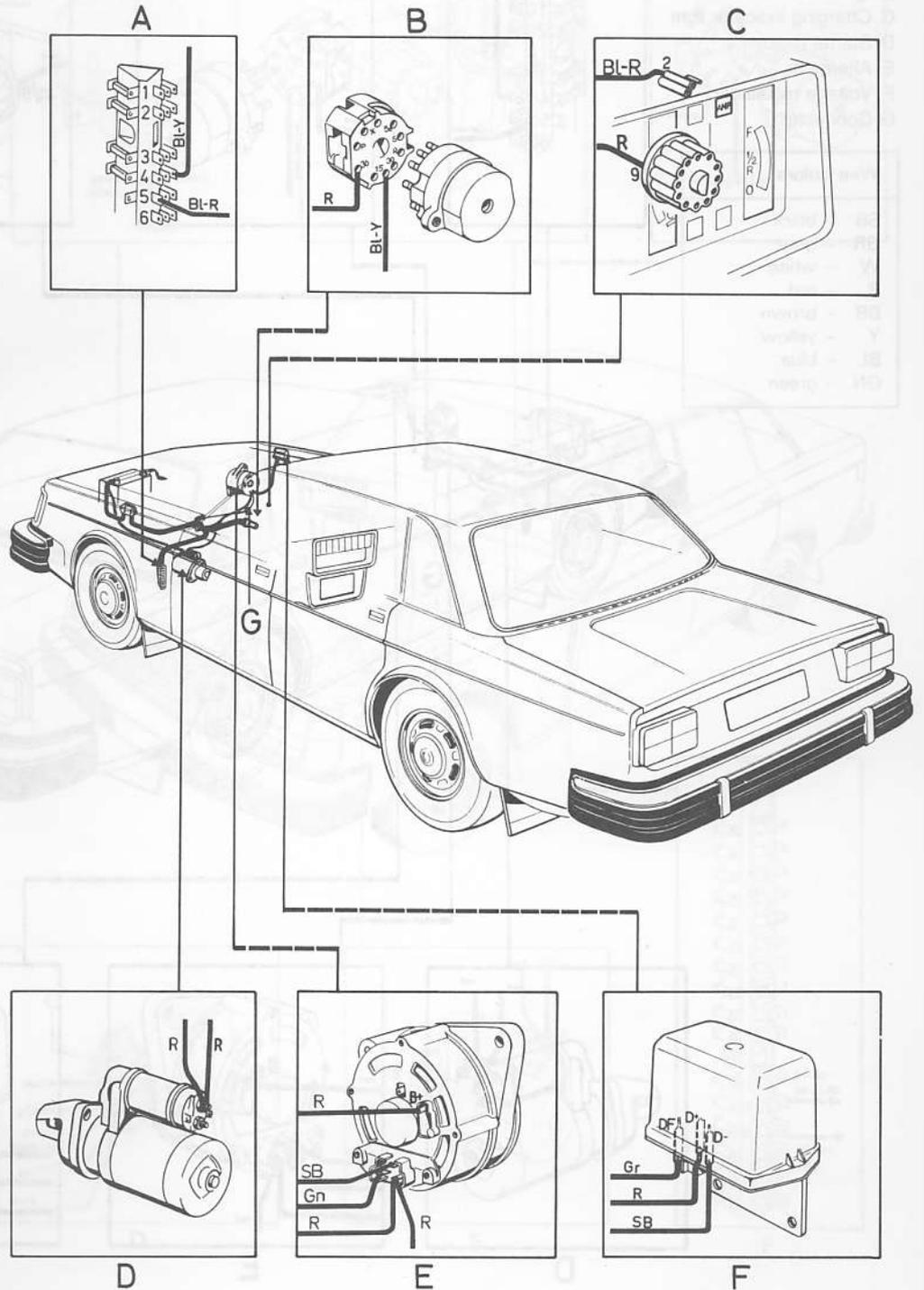
## 1975-1976 Group 32 Charging System Wiring Diagram 1975-1976

**Legend:**

- A Ignition switch
- B Fuse box
- C Instrument cluster
- D Starter motor
- E Alternator
- F Voltage regulator

**Wire colors:**

- SB - black
- GR - gray
- W - white
- R - red
- BR - brown
- Y - yellow
- BL - blue
- GN - green



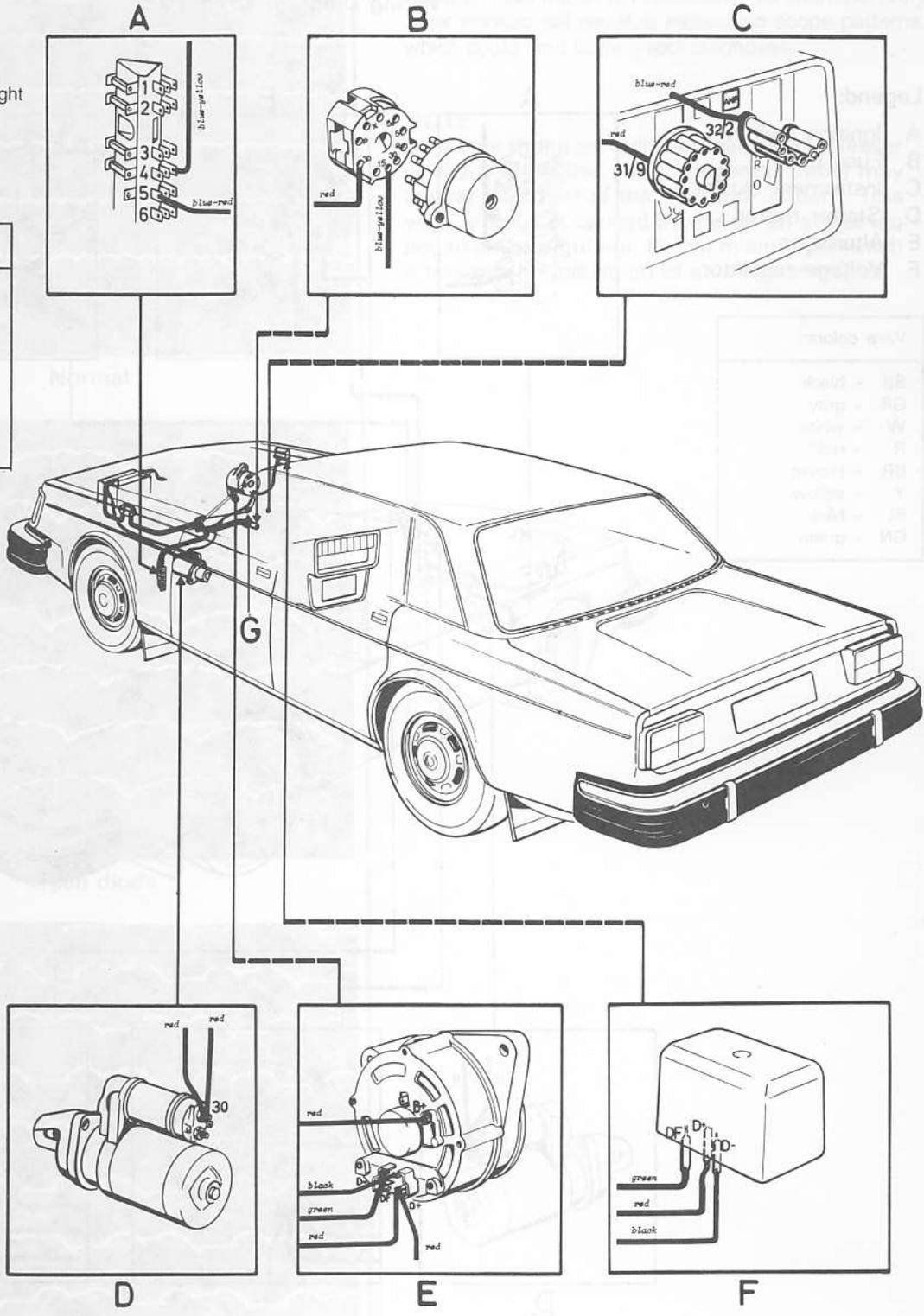
1977-1978 Group 32 Charging System  
Wiring Diagram 1977-1978

Legend:

- A Fuse box
- B Ignition lock
- C Charging indicator light
- D Starter motor
- E Alternator
- F Voltage regulator
- G Connector

Wire colors:

- SB - black
- GR - gray
- W - white
- R - red
- BR - brown
- Y - yellow
- BL - blue
- GN - green

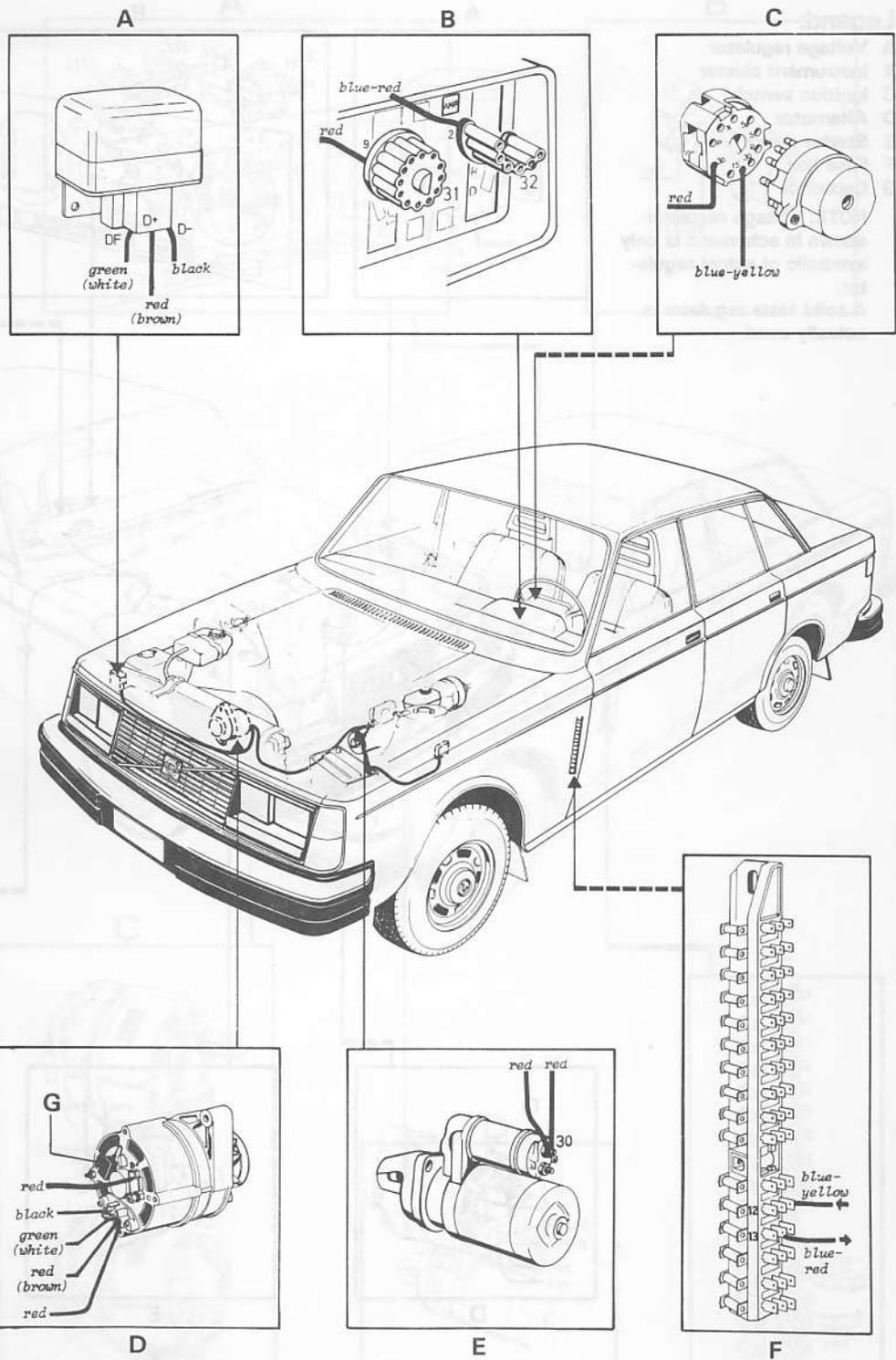


1979-1980 Group 32 Charging System  
Wiring Diagram 1979-1980

**Legend:**

- A Voltage regulator
- B Instrument cluster
- C Ignition switch
- D Alternator
- E Starter motor
- F Fuse box
- G Capacitor

**NOTE:** The voltage regulator shown in schematic is symbolic of and not the actual regulator. A solid state regulator is presently used.

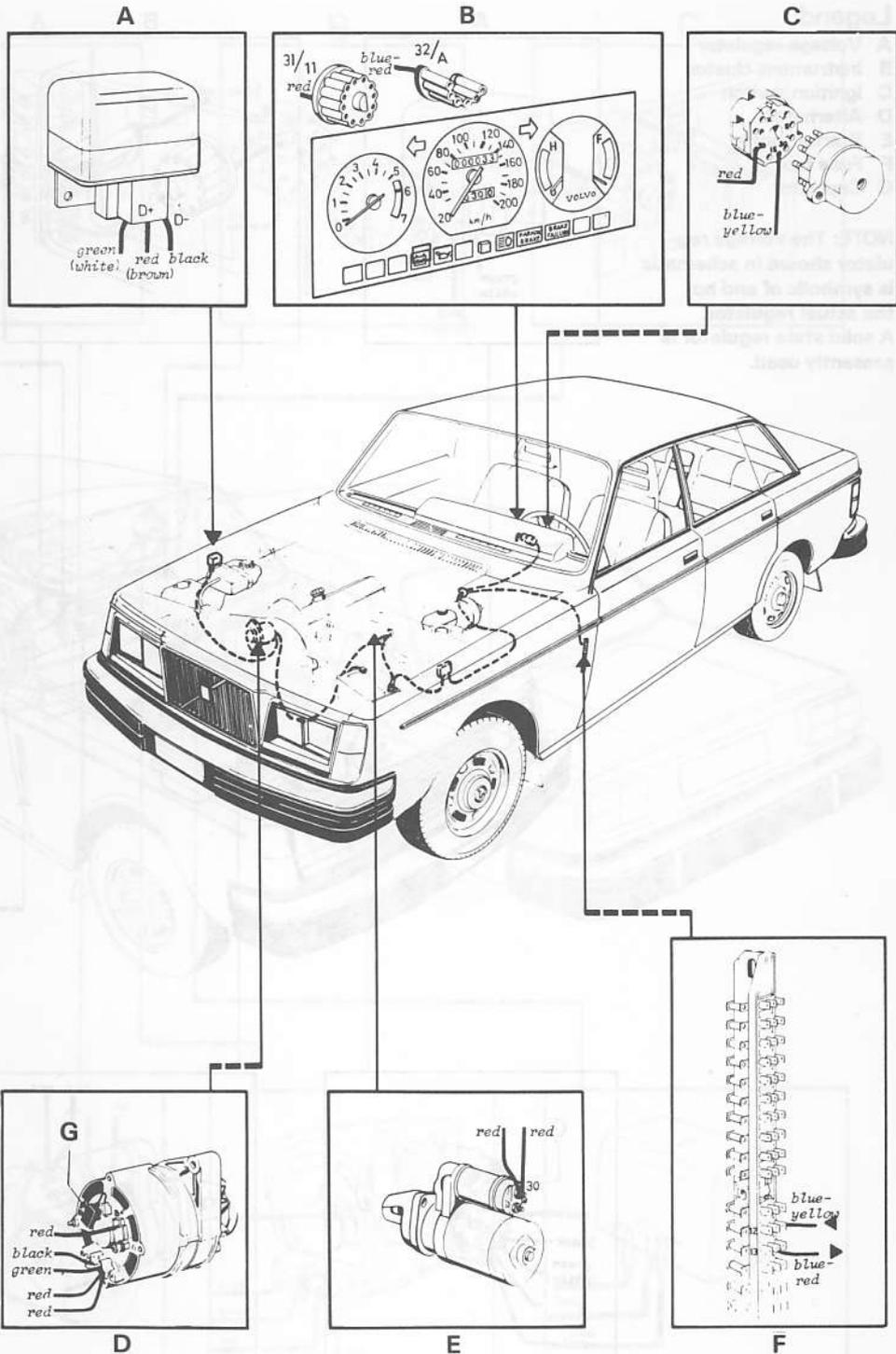


1981 Group 32 Charging System  
Wiring Diagram 1981

**Legend:**

- A Voltage regulator
- B Instrument cluster
- C Ignition switch
- D Alternator
- E Starter motor
- F Fuse box
- G Capacitor

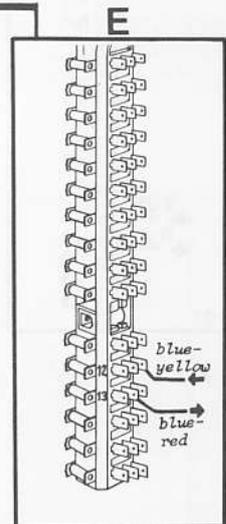
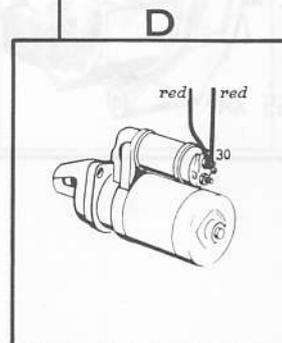
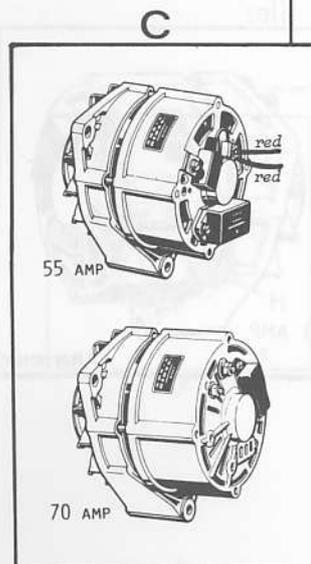
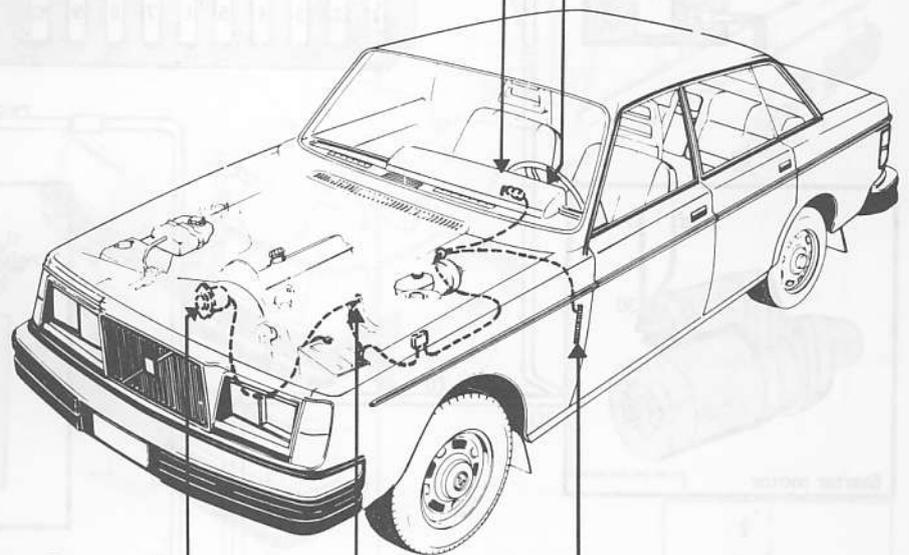
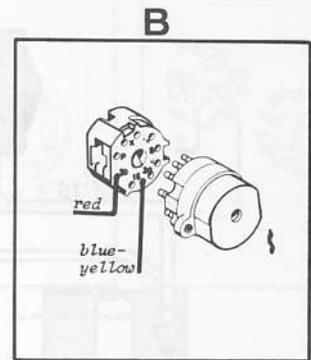
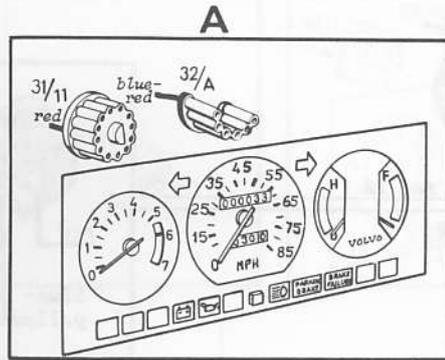
**NOTE:** Voltage regulator shown in schematic is only symbolic of actual regulator.  
A solid state regulator is actually used.



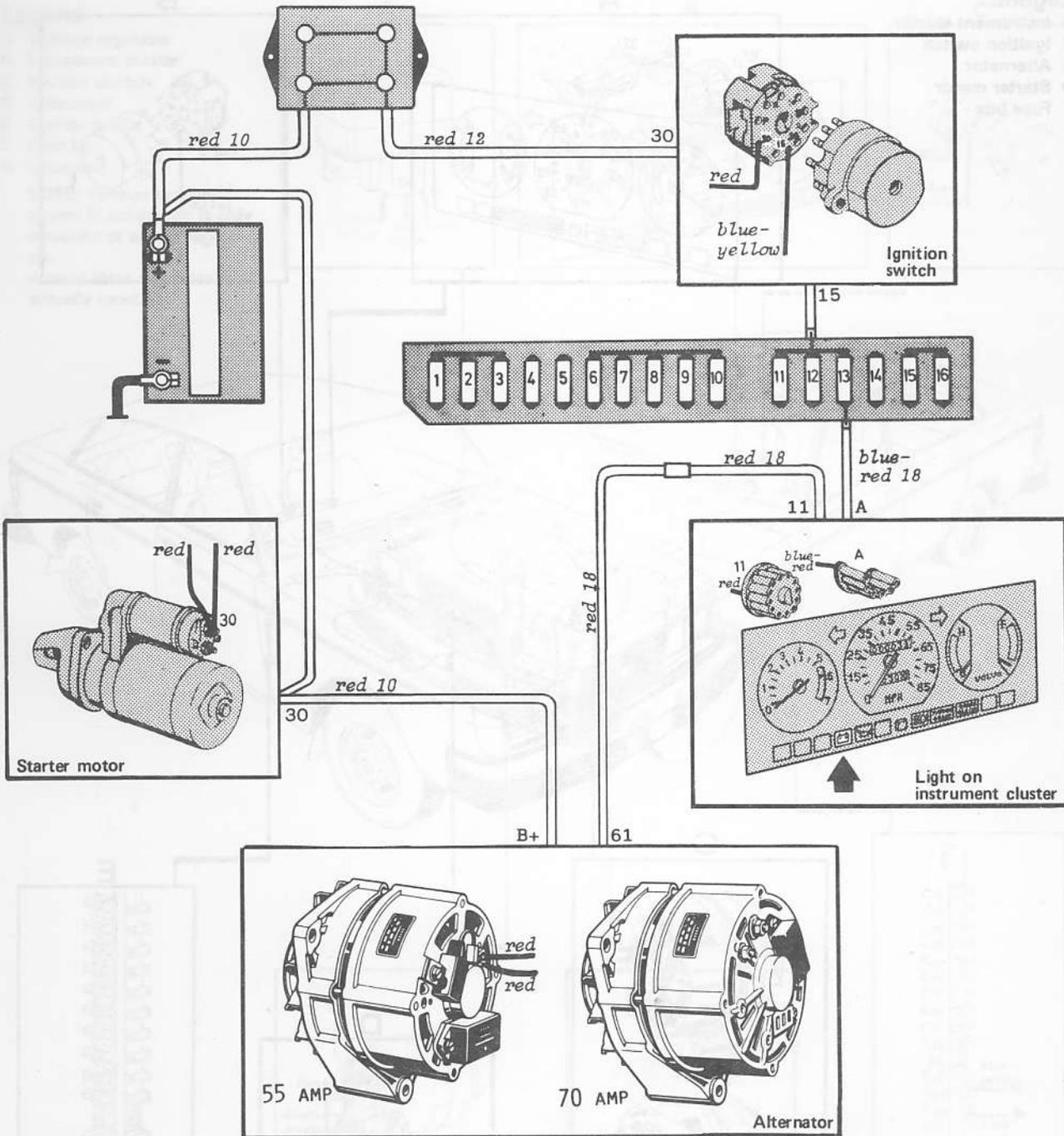
1982 Group 32 Charging System  
Wiring Diagram 1982

**Legend:**

- A Instrument cluster
- B Ignition switch
- C Alternator
- D Starter motor
- E Fuse box



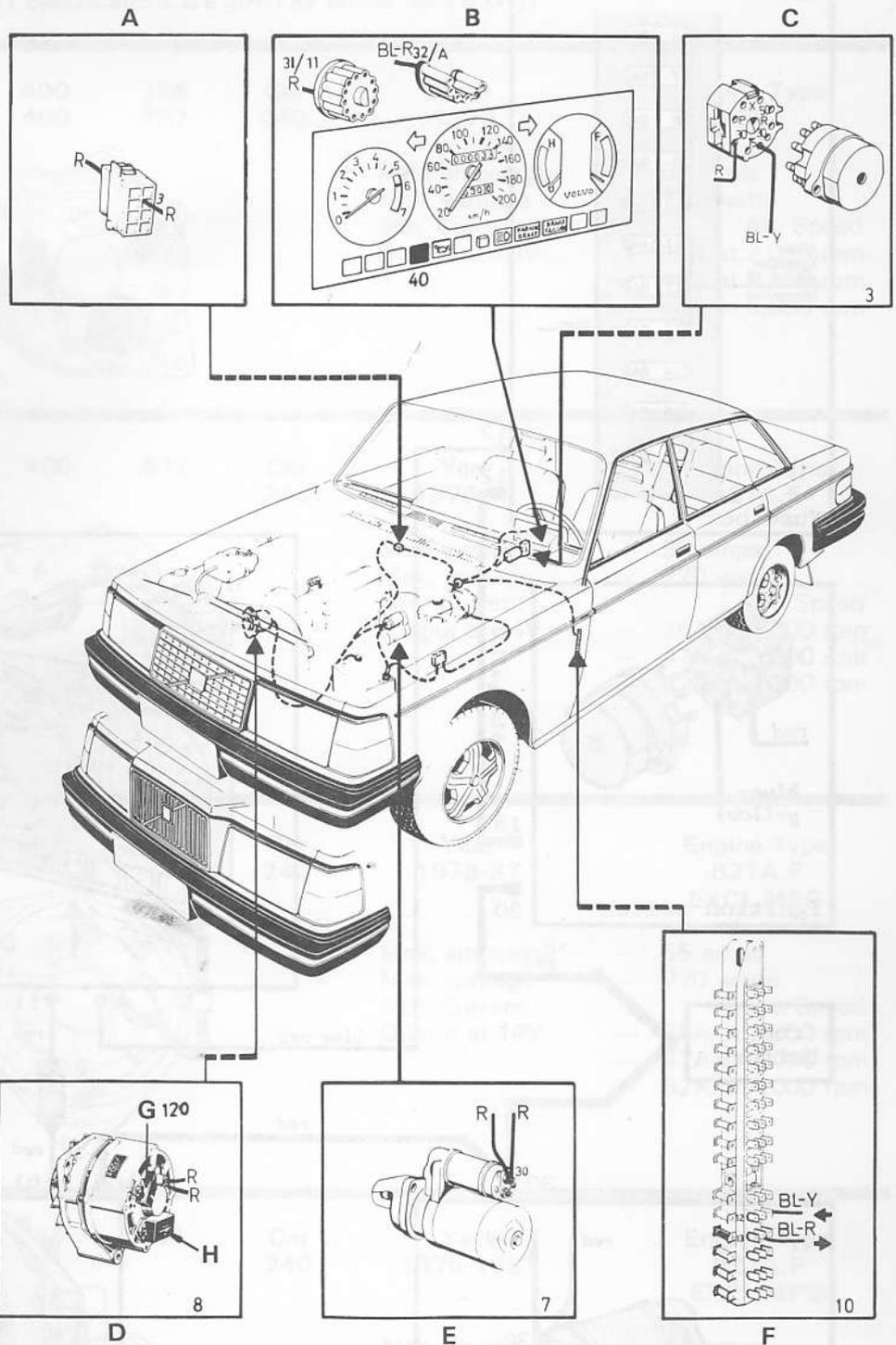
1983 Group 32 Charging System  
Wiring Diagram 1983



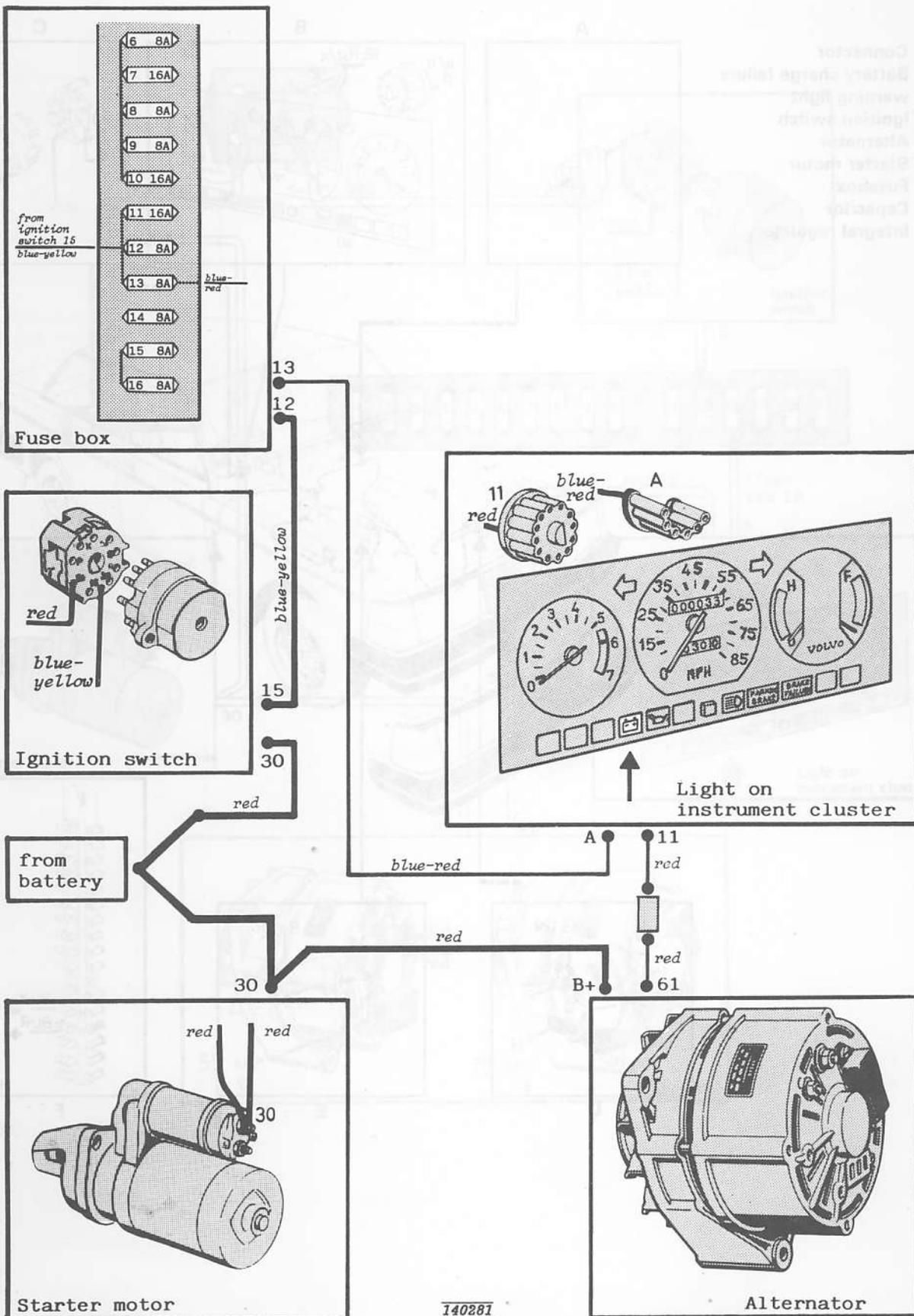
133 737

1984 Group 32 Charging System  
Wiring Diagram 1984

- A Connector
- B Battery charge failure warning light
- C Ignition switch
- D Alternator
- E Starter motor
- F Fusebox
- G Capacitor
- H Integral regulator



1985 Group 32 Charging System  
Wiring Diagram 1985

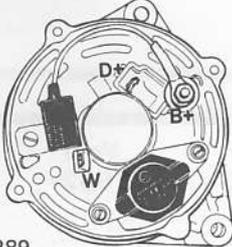
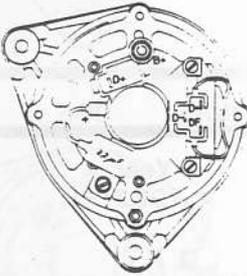
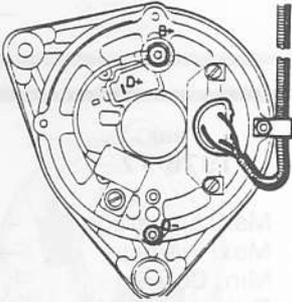
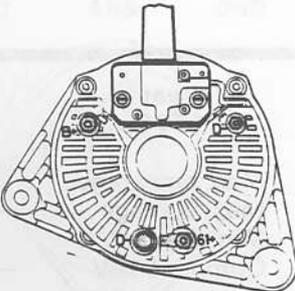


- A Connector
- B Battery charge label
- C Warning light
- D Ignition switch
- E Alternator
- F Starter motor
- G Fusebox
- H Ignition switch

140281

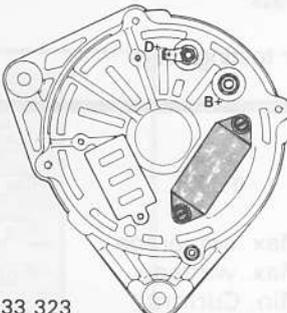
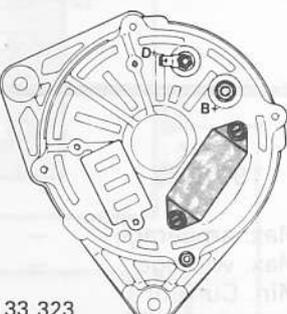
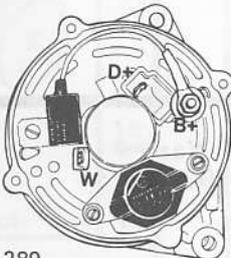
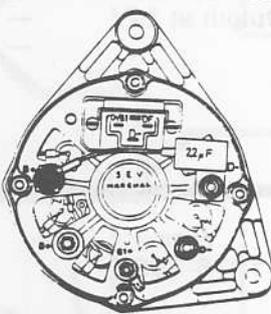
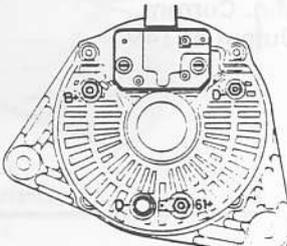
## Specifications

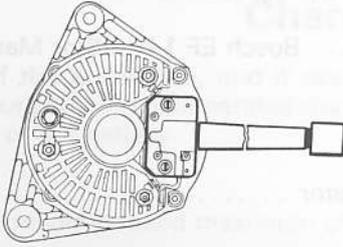
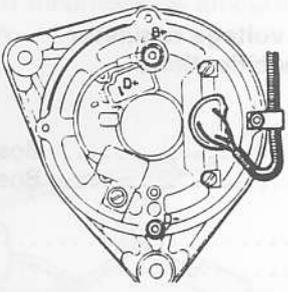
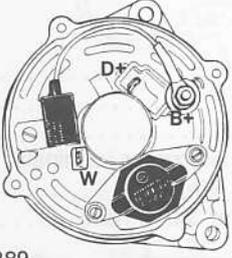
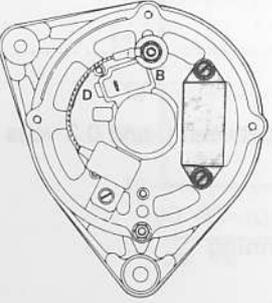
### 3-2 Alternator Specifications (\*Specifications are given for off-car testing only)

Bosch	0120	400	756	Car	Year	Engine Type
	0120	400	757	240	1975	B20F
				Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 36A at 2,000 rpm — 40A at 2,350 rpm — 55A at 6,000 rpm		
				135 289		
Bosch	0120	400	912	Car	Year	Engine Type
				240	1976-77	B21A,F
				Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 36A at 2,000 rpm — 47A at 3,000 rpm — 52A at 4,000 rpm		
Bosch	0120	400	932	Car	Year	Engine Type
				240	1978-81	B21A,F EXCL MPG
				Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 36A at 2,000 rpm — 47A at 3,000 rpm — 52A at 4,000 rpm		
S.E.V. Marchal	716	55	02	Car	Year	Engine Type
				240	1978-1981	B21A,F EXCL MPG
				Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 36A at 2,000 rpm — 48A at 3,000 rpm — 36A at 4,000 rpm		

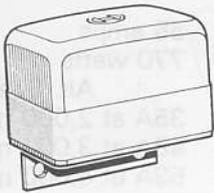
Group 32 Fault tracing

Specifications

Bosch	0120	450	008	Car 240	Year 1981-	Engine Type B21F, MPG	
						Max. amperage — 70 amps Max. wattage — 980 watts Min. Current — Alt. Speed Output at 14V — 30A at 1,500 rpm — 48A at 2,000 rpm — 67A at 6,000 rpm	
							
	133 323						
Bosch	0120	469	567	(B21F, B23F)	Car 240	Year 1982-	Engine Type B21F (Excl Turbo) B23F, B230F
	0120	469	670	(B230F)			Max. amperage — 70 amps Max. wattage — 980 watts Min. Current — Alt. Speed Output at 14V — 46A at 2,000 rpm — 58A at 3,000 rpm — 64A at 4,000 rpm
							
	133 323						
Bosch	0120	489	066	Car 240	Year 1982-	Engine Type B21A, B23E, B21F Turbo	
						Max. amperage — 55 amps Max. wattage — 770 watts Min. Current — Alt. Speed Output at 14V — 35A at 2,000 rpm — 48A at 3,000 rpm — 53A at 4,000 rpm	
							
	135 289						
S.E.V. Marchal	712	126	02	Car 260	Year 1976-77	Engine Type B27F	
						Max. amperage — 55 amps Max. wattage — 770 watts Min. Current — Alt. Speed Output at 14V — 35A at 2,000 rpm — 48A at 3,000 rpm — 53A at 4,000 rpm	
							
	135 289						
S.E.V. Marchal	716	551	02	Car 260	Year 1978	Engine Type B27F	
						Max. amperage — 55 amps Max. wattage — 770 watts Min. Current — Alt. Speed Output at 14V — 35A at 2,000 rpm — 48A at 3,000 rpm — 53A at 4,000 rpm	
							

S.E.V. Marchal	717	700	02	Car 260	Year 1979-1981	Engine Type B28F, B21F	Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 35A at 2,000 rpm — 48A at 3,000 rpm — 53A at 4,000 rpm
							
Bosch	0120	469	563	Car 260	Year 1982-	Engine Type B28F	Max. amperage — 70 amps Max. wattage — 980 watts Min. Current Alt. Speed Output at 14V — 46A at 2,000 rpm — 58A at 3,000 rpm — 64A at 4,000 rpm
							
133 323							
Bosch	0120	400	939	Car 260	Year 1980	Engine Type D24	Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 36A at 2,000 rpm — 47A at 3,000 rpm — 52A at 4,000 rpm
							
Bosch	0120	400	942	Car 260	Year 1981	Engine Type D24	Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 36A at 2,000 rpm — 40A at 2,350 rpm — 55A at 6,000 rpm
							
135 289							
Bosch	0120	489	069	Car 260	Year 1982-	Engine Type D24	Max. amperage — 55 amps Max. wattage — 770 watts Min. Current Alt. Speed Output at 14V — 36A at 2,000 rpm — 47A at 3,000 rpm — 52A at 4,000 rpm
							

**Transistor voltage regulator  
Specifications**



Type ..... Bosch EF 14V 3B or Marchal 723 171 02

Test conditions

Fully charged battery  
Temperature at voltage regulator ..... +25°C.

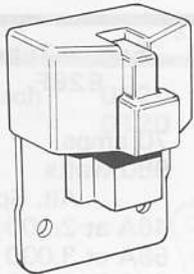
Test values

Alternator speed ..... 6,000 rpm  
Engine speed ..... approx. 3,000 rpm  
Alternator load ..... 5-10 A  
Voltage measured across terminals B+ and D- on alternator:  
Cold voltage regulator  
(reading within 1 min. after starting) ..... 13.7-14.5V  
Warm voltage regulator  
(reading after running for 30 min.) ..... 13.5-14.1V

Control tolerance

Load

55A alternator with 47A (rating x 0.85)  
70A alternator with 60A  
Control voltage should now be 0 to 0.3 volt lower than the previous reading.



**Integral voltage regulator  
Specifications**

Type

early type ..... Bosch 0 192 052 027  
late type ..... Bosch 1 197 311 008

Test conditions ..... In car  
State of battery charge ..... min 3/4  
Air temperature ..... +25°C (77°F)  
Temperature, warm regulator ..... +60-80°C (140-176°F)

Test values

Alternator speed ..... 6,000 rpm  
Engine speed ..... 3,000 rpm  
Alternator load ..... 30-50A\*  
Control voltage, between B+ and D- alternator terminals:  
Cold regulator (reading taken within 1 min) ..... 14.4-14.8V  
Warm regulator (run minimum 15 min at 3,000 rpm) ..... 13.8-14.3V

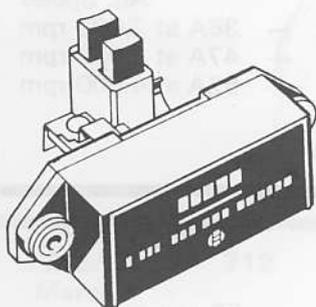
Control tolerance

Load

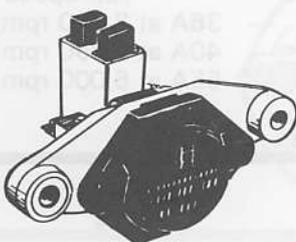
55A alternator to ..... 47A  
50A ..... 60A  
90A ..... 77A

The control voltage should now be between 0 and 0.3 volts lower than the previous reading.

\*Load achieved when engine running



134 543



135 288

## Charging a battery

Check the level of the electrolyte, and if necessary top-up with distilled water. Charge the battery for a minimum of 10 hours at the recommended charging current. The maximum recommended charging current is 0.1 x the capacity of the battery.

### EXAMPLE:

Capacity is 60 Ah, recommended maximum charging current is:  $0.1 \times 60 = 6A$ .

After charging the battery, measure the specific gravity of the electrolyte in all the cells. The maximum permissible deviation between the highest and lowest values measured is 0.03.

It is recommended to always slow-charge a battery. Fast-charging causes battery damage by overheating. The plates may warp and buckle which can cause separator damage and short circuit a cell.

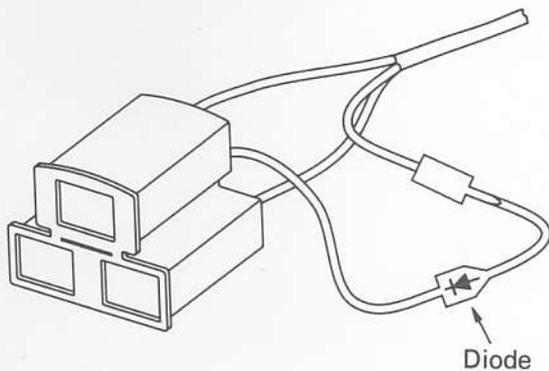
Violent bubbling and gassing of the electrolyte when fast-charging washes the active material from the plates; this reduces the battery capacity, and can cause internal shorts.

If sulphation is present, charge at a lower amperage rate (max. 3 AMPS) for a longer period of time, in order to remove any lead sulfate from the plates.

In no case may sulfated batteries be fast-charged at high current rate. Sulfated batteries gas excessively during initial charging period, therefore, observe safety precautions outlined in the battery check section (2-4).

A charging time of 10 hours at a low current level insures that the battery is not damaged by the charging process. If this is an inconvenient amount of time to have the car inoperable, a substitute battery may be installed temporarily.

## Diode kit

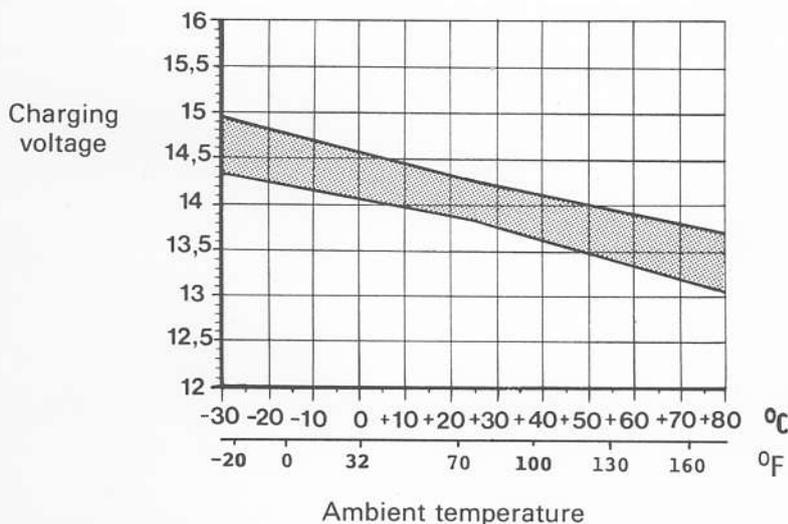


The Volvo diode kit P/N 75903-5 may be used to raise the charging rate.

### CAUTION

Do not use diode kit if charging voltage is above the shaded band in the graph.

- Install diode as shown.
- Check that system is not overcharging.



### Charging a battery

Check the level of the electrolyte and if necessary top-up with distilled water. Charge the battery for a minimum of 10 hours at the recommended charging current. The actual recommended charging current is 0.1 x the capacity of the battery.



**EXAMPLE**  
Capacity is 50 Ah, recommended maximum charging current is 0.1 x 50 = 5A.

After charging the battery, measure the specific gravity of the electrolyte in all the cells. The maximum permissible deviation between the highest and lowest values measured is 0.03.

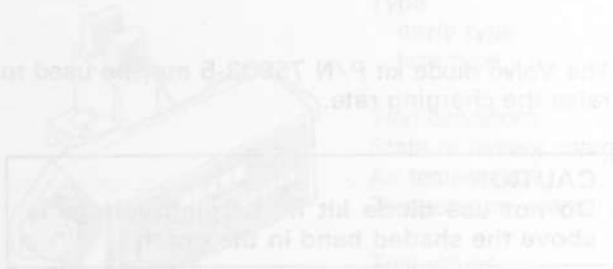


It is recommended to always slow-charge a battery. Fast-charging causes heavy damage by overheating. The plates may warp and bulge with the cell expansion. This causes the active material to fall from the plates. When topping and gassing of the electrolyte is stopped, the active material from the plates this reduces the battery capacity and causes internal gas pressure to build up. This may cause the battery to explode. If sulphation is present, charge at a lower or higher rate (max 3A/12V) for a longer period of time, in order to remove any lead sulfate from the plates.

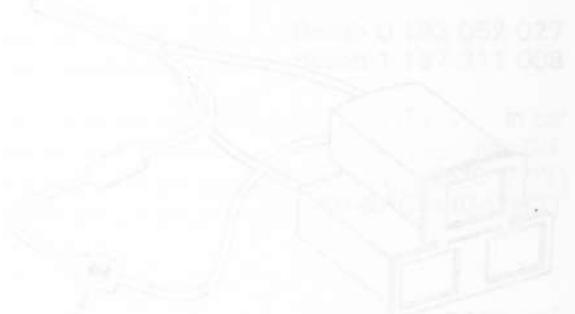
In no case may sulfated batteries be fast-charged at high current rate. Sulfated batteries gas excessively during initial charging period. Therefore, observe safety instructions in the battery check section (2-4).

A charging current of 10 hours will result in a low current level which will not damage the battery. It is not recommended to have an insufficient amount of time to have the car (tricycle), a substitute battery may be installed temporarily.

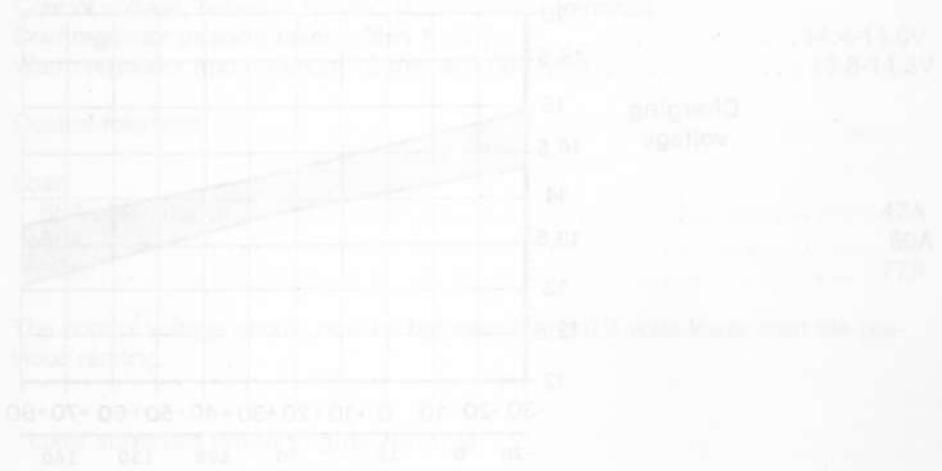
### Diode kit



**CAUTION**  
Do not use diode kit in the car. Above the shaded band in the car.



Check the system is not overcharging.





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HUMAN DEVELOPMENT

NOTES

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BY THE N.I.A.S.E.**

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*Your  
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special tool*

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