Index

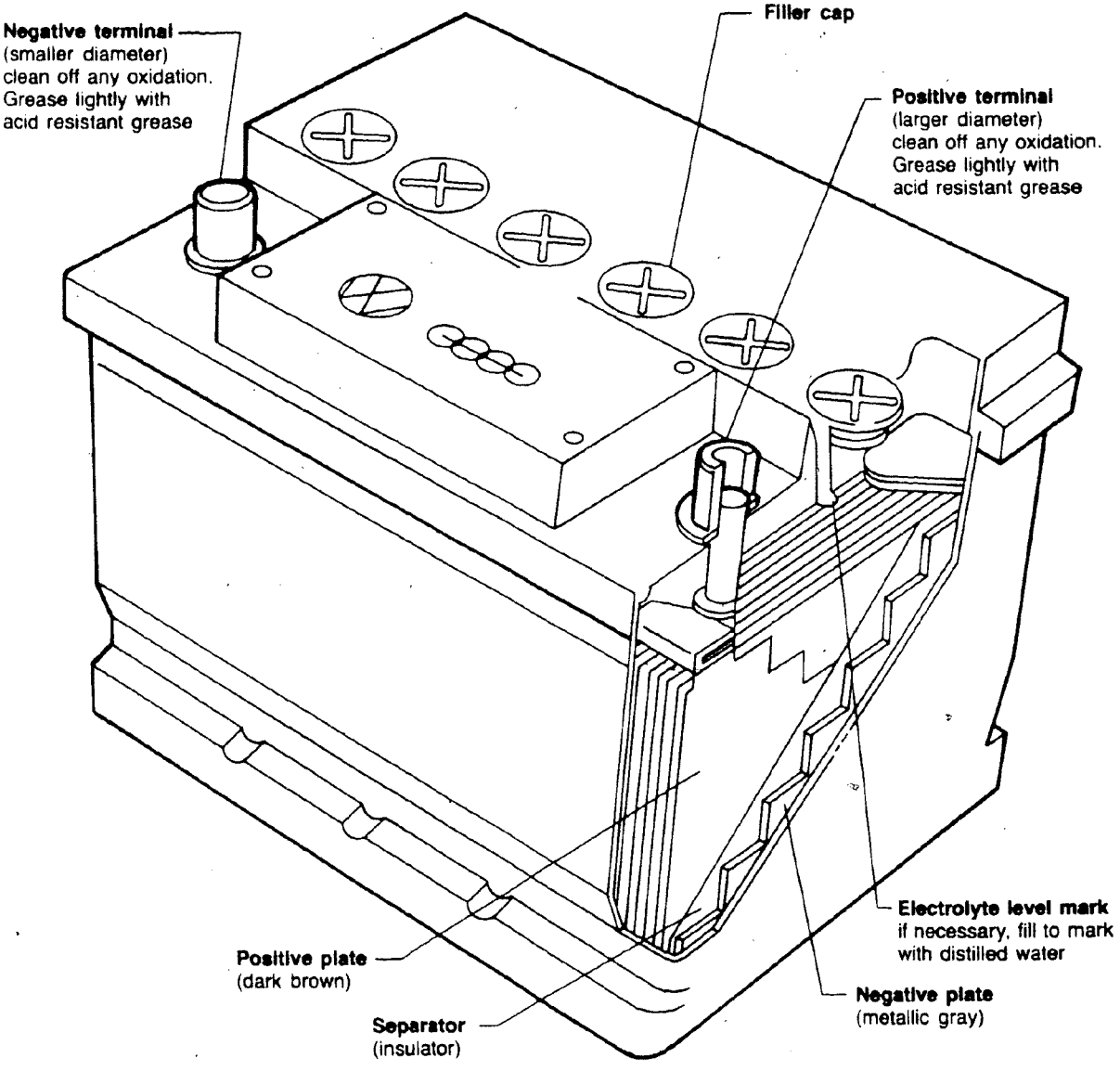
★ **NEW INFORMATION** since last filming

Battery

- specific gravity; checking, section 27.3
- voltage; checking, section 27.4
- charging, section 27.6
- troubleshooting guide, section 27.9

CAUTION

Before beginning repairs on the electrical system, disconnect battery negative cable.



Battery condition, checking

A weak battery can be caused by:

- alternator belt slipping (replace belt if glazed)
- ground straps corroded, loose or broken
- alternator or voltage regulator defective
- alternator warning light bulb burned out
- poor ground connection between warning light socket and circuit board

Battery and cable terminals should be cleaned and then coated with acid resistant grease to prevent corrosion.

Visual checks

- check for:
  - cracked or leaking case
  - loose or corroded terminals
  - low electrolyte level

Hydrometer test (specific gravity) (for batteries with removable caps)

> **CAUTION**
>
> Do not expose fully discharged battery to freezing temperature because battery will be damaged.

- test electrolyte in all cells
  - average specific gravity should be at least 1.225
- correct for electrolyte temperature if necessary
  - for every 10°F **above** 80°F **add** .004 to hydrometer reading
  - for every 10°F **below** 80°F **subtract** .004 from hydrometer reading

Specific gravity	% of charge
1.265	100%
1.225	75%
1.190	50%
1.155	25%
1.120	0%

If specific gravity is **above** 1.225

- load test battery

If specific gravity is **below** 1.225

- recharge battery

If specific gravity varies by more than .050 between cells

- replace battery

Battery voltage test – engine not running (for sealed and non-sealed batteries)

- turn headlights on high beam for 1 minute to remove surface charge
- disconnect battery ground strap
- check battery voltage using multimeter **US 1119**
  - 12.4 volts minimum

Voltage	% of charge
12.8 or more	100%
12.5	75%
12.2	50%
12.0	25%
11.7 or less	0%

If above minimum voltage

- load test battery

If below minimum voltage

- charge until 12.55 volts minimum

Load test

Note

Before load testing, battery must be at least 75% charged.

- connect load tester according to manufacturer's instructions
- load battery to 3 times amp/hour rating **or** 1/2 0°F cold cranking current rating
- wait 15 seconds and read voltage
  - battery voltage at room temperature should be9.6 volts minimum

If **NO**

- replace battery

Note

If battery is colder than room temperature, voltage under load will be **lower**.

If battery must be tested cold:

- use table

Approximate electrolyte temp. °F (°C)	Minimum acceptable voltage under load
60 (16)	9.5
50 (10)	9.4
40 (4)	9.3
30 (−1)	9.1
20 (−7)	8.9
10(−12)	8.7
0(−18)	8.5

Battery, charging

Note

Follow battery charger manufacturer's instructions. Before testing a battery that has been charged, load battery with 15 amps for 1 minute to remove surface charge.

WARNING

Gases given off during charging are explosive. Do **NOT** smoke or allow sparks or flame near a charging battery.

Battery charger **MUST** be turned off when connecting or disconnecting cables on battery.

"Boosting" a sulfated battery at a high charging rate can cause an explosion!

Battery with removable caps

If water is added, charge battery for 15 minutes at approximately 10% of battery capacity. Fast charge (60 amps max) **only** if a time constraint is present.

CAUTION

Do not allow battery charging voltage to exceed 15 volts.

If battery begins gassing (boiling) violently when charging, **REDUCE** charging rate.

Do **NOT** disconnect battery while engine is running.

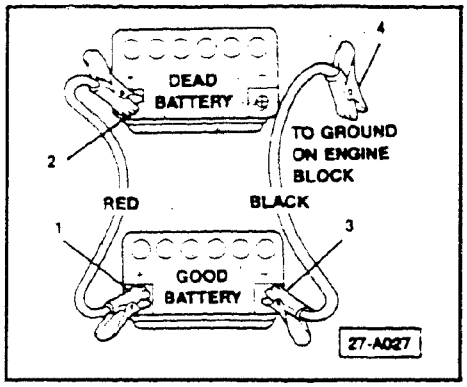
- charge battery according to following table:

Specific gravity	Fast charge up to
1.150 or less	1 hour
1.150 to 1.175	3/4 hour
1.175 to 1.200	1/2 hour
1.200 to 1.225	1/4 hour
above 1.225	slow charge **ONLY** to 1.250-1.280

Sealed batteries

Only **slow** charge sealed batteries. Sealed batteries, sometimes called "maintenance free," will not accept high rate of charge, making it necessary to charge it for up to twice as long as battery with removable caps. Also, voltage reading will **NOT** increase as rapidly as when charging battery with removable caps.

Battery, jump starting



CAUTION

Car with good battery must **NOT** be running when connecting jumper cables.

- connect jumper cables in following order:
  - 1 – one end of positive cable to + post of good battery
  - 2 – other end of positive cable to jump start terminal (in engine compartment)
  - 3 – one end of negative cable to - post of good battery
  - 4 – other end of negative cable to engine block of car with dead battery
- start car with good battery first
- next start car with dead battery
- disconnect jumper cables in reverse order

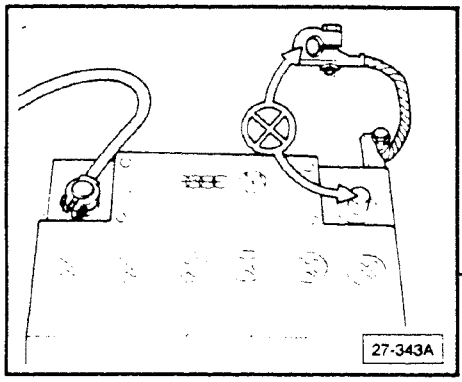
Battery discharges, troubleshooting

Current draw suspected

Check these first:
- fully charged battery

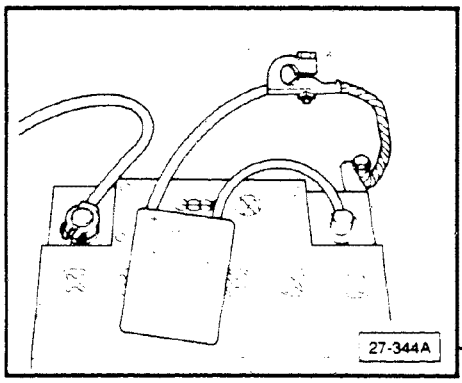
Battery discharges

Possible causes
- corroded terminals
- worn insulation
- internal short circuits in electrical equipment



- disconnect battery ground (–) strap
- connect test light between negative (–) battery terminal and ground strap
- turn off all electrical consumers
- close all doors

Test light lights up	Test light does not light up



- eliminate individual circuits by removing fuses
- if test light goes out in one of interrupted circuits, source of fault is to be found there

- in place of test light, connect ammeter (measuring range 0-200 mA) between negative (–) battery terminal and battery ground strap
- reduce measuring range until a clear reading is shown (1-3 mA is permissible)

- eliminate individual circuits by removing fuses
  if reading drops to zero in one of interrupted circuits, source of fault is to be found there

- if no faults are found in fused circuits, disconnect wiring connectors from nonfused components:
  alternator
  starter
  ignition system
  cluster instruments
  coolant fan and so on until defective circuit or component is discovered

- repair or replace as necessary

End

Alternator output, checking

Using the SUN VAT-40 (or VAT-60)

- connect black clamp to battery negative (–)
- connect red clamp to battery positive (–)
- connect green clamp (inductive pickup) to alternator **D+**: either at alternator or battery
- start engine
- raise engine speed and hold at 2000 RPM
- slowly adjust load control of **VAT-40** (or **VAT-60**) until highest possible reading is obtained
  - must be within 10% of manufacturers specifications

CAUTION

Test must be performed and completed within fifteen seconds to avoid overloading and damaging the electrical system.

Alternator exciter circuit, checking

Note

If the complaint "battery isn't being charged" is received even though the warning light comes on when the ignition is switched **ON** and goes out when the ignition is switched **OFF**; check the exciter circuit as follows:

- verify that battery voltage is approximately 12 volts minimum, charge as necessary
- disconnect blue wire from alternator terminal **61**
- switch multimeter **VAG 1526** (**US 1119**) to 200 mA range

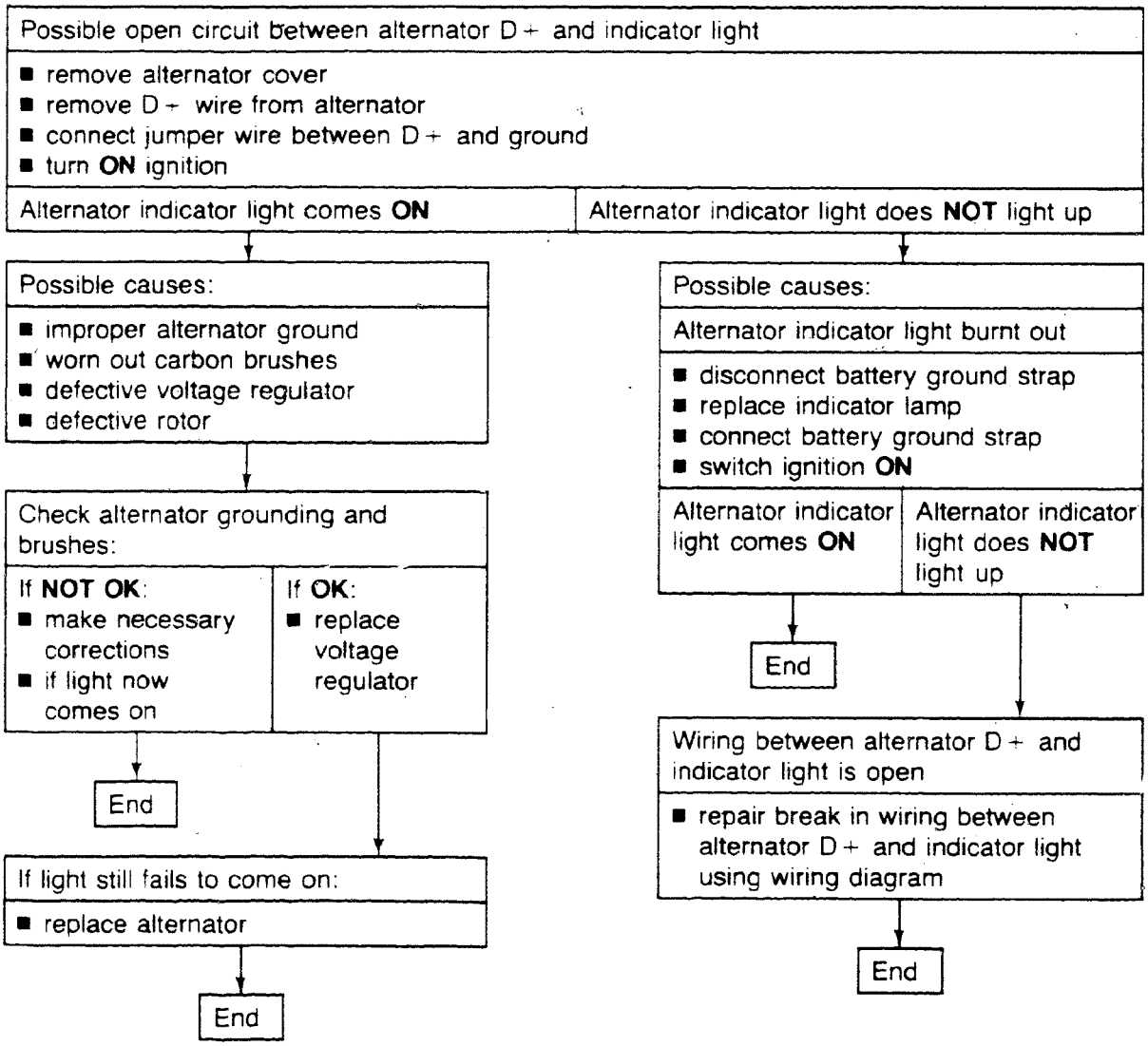
- connect multimeter between disconnected blue wire and alternator terminal **61**
- switch **ON** ignition
  - current must fall between 150 and 185 mA

If reading is lower than 150 mA

- check blue wire between alternator and instrument panel or replace printed circuit in instrument cluster

Alternator indicator light, troubleshooting

Does not illuminate with ignition ON (engine NOT started)



Light is on with ignition **OFF**
■ alternator diode(s) defective (rectifier bridge)
■ replace alternator

↓

End

Alternator indicator light does **NOT** go out when RPM increases
Possible causes:
■ slipping alternator belt, tighten if necessary ■ ground short between alternator D+ and indicator light (see next box) ■ defective alternator, replace

↓

End

Possible short to ground between alternator D+ and indicator light	
■ disconnect alternator wiring ■ turn **ON** ignition	
Alternator indicator light comes **on**	Alternator indicator light does **NOT** light up

↓

■ short to ground in wiring between alternator D+ and indicator light
■ repair short in wiring using wiring diagram

↓

End

↓

■ test alternator output
■ test voltage regulator

↓

■ replace defective component

↓

End

Alternator V-belt tension, checking (for engines without toothed rack on bracket)

Due to increased alternator output, V-belt tension checking is more important than before.

The following values apply for checking tension using the "thumb test."

V-belts up to 1000 mm long (39.4 in.) maximum deflection **a**:

- new V-belt — approximately 2 mm (0.079 in.)
- used V-belt — approximately 5 mm (0.197 in.)

V-belts over 1000 mm long (39.4 in.) maximum deflection **a**:

- new V-belt — approximately 10 mm (0.39 in.)
- used V-belt — approximately 15 mm (0.59 in.)

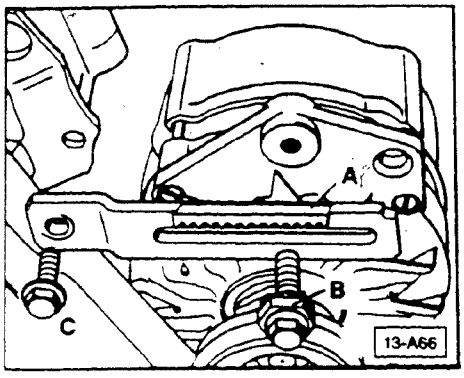
Note

The values given are retroactive for all vehicles currently manufactured.

Adjusting

- loosen bolts (**arrows**)
- push alternator outward until specification **a** is achieved
- tighten mounting bolts (**arrows**)

Alternator V-belt tension, adjusting



Vehicles with toothed mechanism

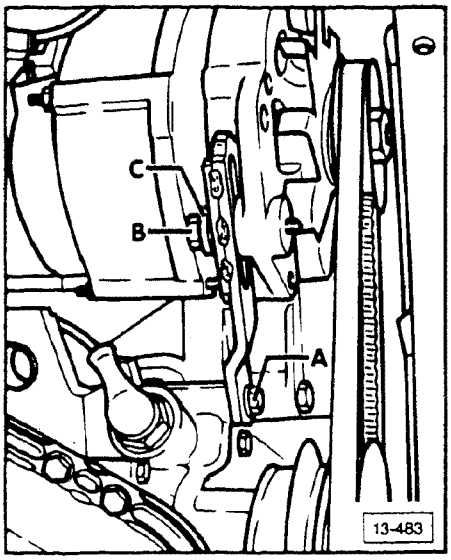
- loosen bolts **B**, **C**, and pivot bolt in cradle (not shown)

Note

The mounting bolts should be loose enough for the alternator to swing freely under its own weight.

- tension the V-belt by rotating tensioning gear **B** using a box wrench
- using your free hand check the belt deflection at point **a** (see illustration 10-826)
  - new V-belt: 8 mm (0.3 in.)
  - used V-belt: 4 mm (0.16 in.)
  tighten or loosen the tensioning gear as necessary to achieve specification **a**
- torque bolt **B**, while maintaining this wrench setting
  - 35 Nm (26 ft lb)
- torque bolt **C**
  - 20 Nm (15 ft lb)
- torque cradle bolt
  - 35 Nm (26 ft lb)

Alternator belt, adjusting



This procedure applies to vehicles with 5 cylinder engine and toothed rack style of adjustment.

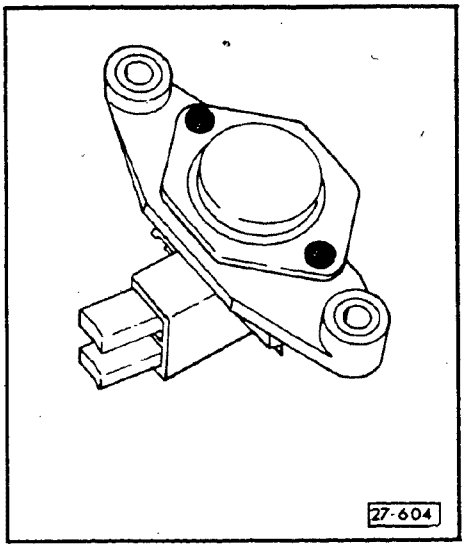
- loosen mounting bolts **A** and **B** (for toothed rack) **by one turn**
- loosen alternator pivot bolt in cradle (not shown)

Note

The mounting bolts should be loose enough for the alternator to swing freely under its own weight.

- rotate tensioning gear **C** until proper belt deflection is obtained (check deflection at center point of belt between pulleys, using free hand)
  - new belt 2.0 mm (5/64 in.) approximately
    used belt 5.0 mm (13/64 in.) approximately
- tighten bolt **B** while maintaining proper v-belt tension
  - 35 Nm (26 ft lb)
- tighten bolt **A**
  - 20 Nm (15 ft lb)
- tighten alternator pivot bolt (not shown)
  - 35 Nm (26 ft lb)

Alternator voltage regulator, checking



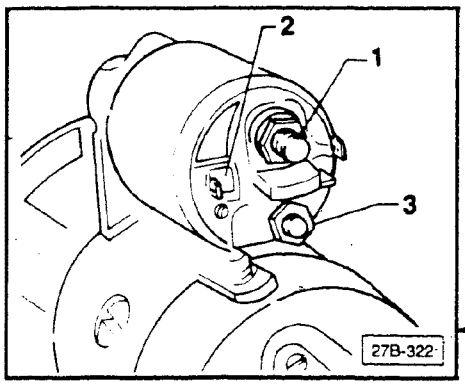
- measure length of carbon brushes
  - must be: new 12 mm

    wear limit: 5 mm

    tolerance ± 1 mm

Starter, troubleshooting

Does not turn engine when ignition/starter switch is operated



Terminal locations

1 — terminal **30** — from positive (+) battery terminal
2 — terminal **50** — from ignition/starter switch
3 — connection for armature

Note

See routing of wire **50** in wiring diagram.

Check these first:

- solenoid switch connections **OK**
- ground straps between engine and body tight and corrosion free
- battery fully charged
- use **SUN VAT-40** or **SUN VAT-60** for measurements

■ measure voltage at terminal **50** of solenoid switch while cranking
• 8 volts minimum

No voltage or less than 8 volts	Voltage **OK**

Note

This measurement assumes terminal **30** current at ignition switch.

■ measure voltage at terminal **50** of ignition/starter switch (min. 8 volts)

No voltage	Voltage **OK**

■ replace ignition/starter switch → End

■ check wiring between terminal **50** on ignition/starter switch and terminal **50** on starter solenoid and make necessary repairs → End

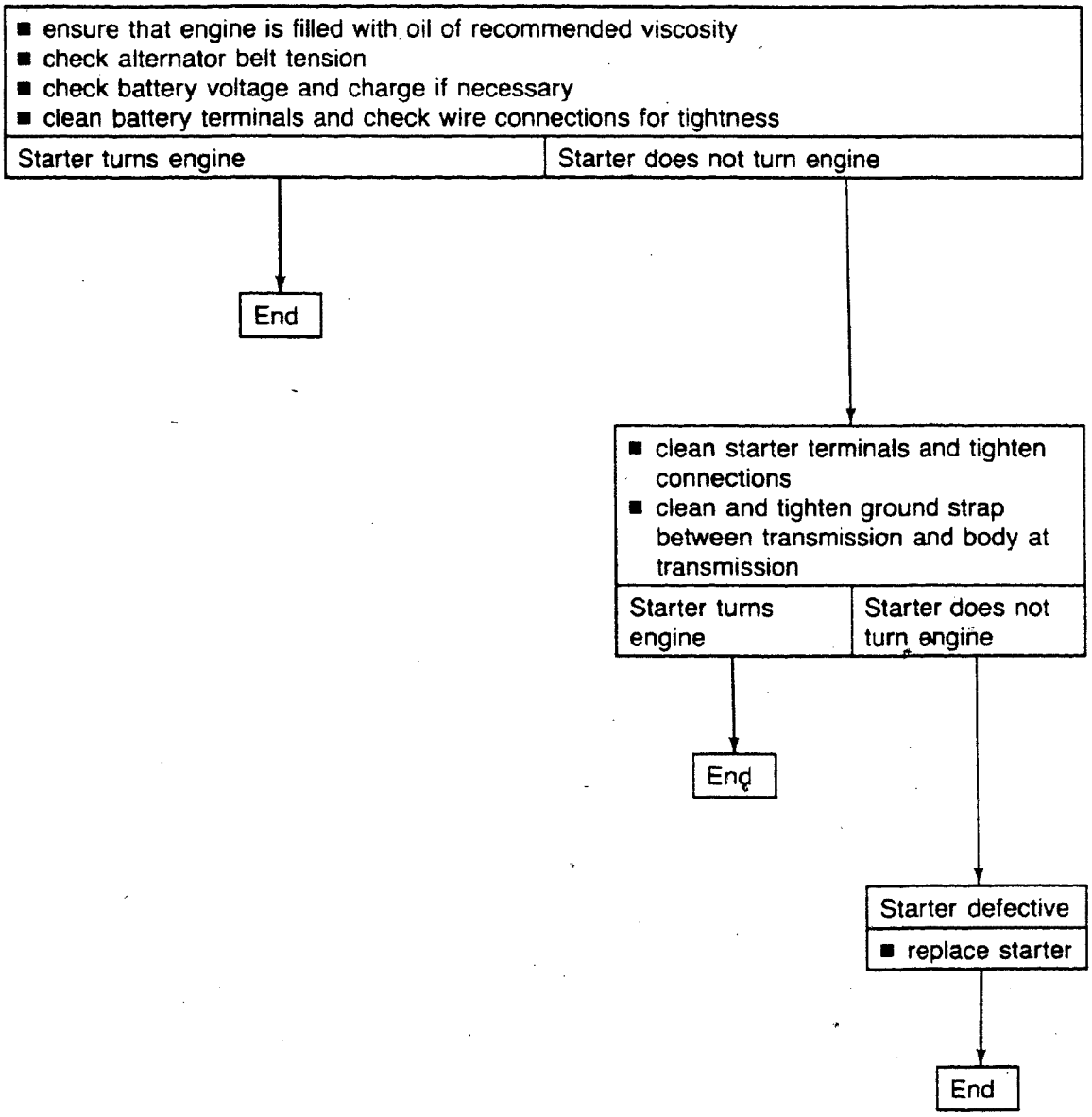
■ measure voltage at connection **3** for armature on solenoid switch
• 8 volts minimum

No voltage	Voltage **OK**

■ replace solenoid switch → End

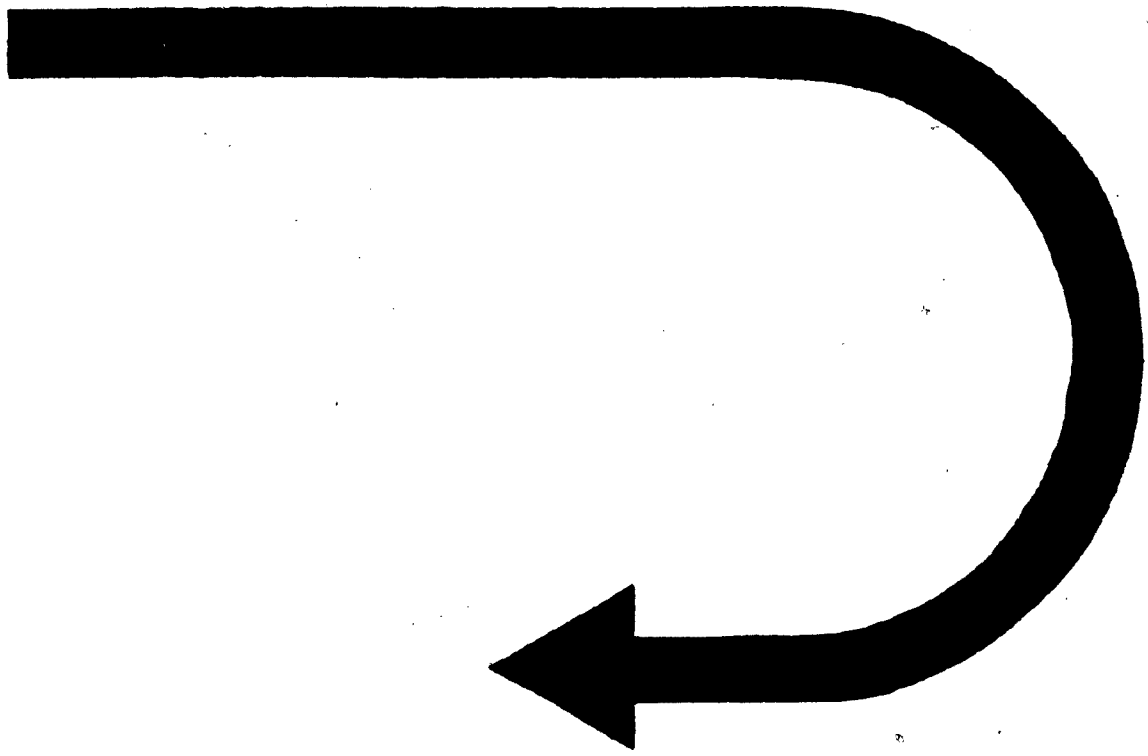
■ replace starter → End

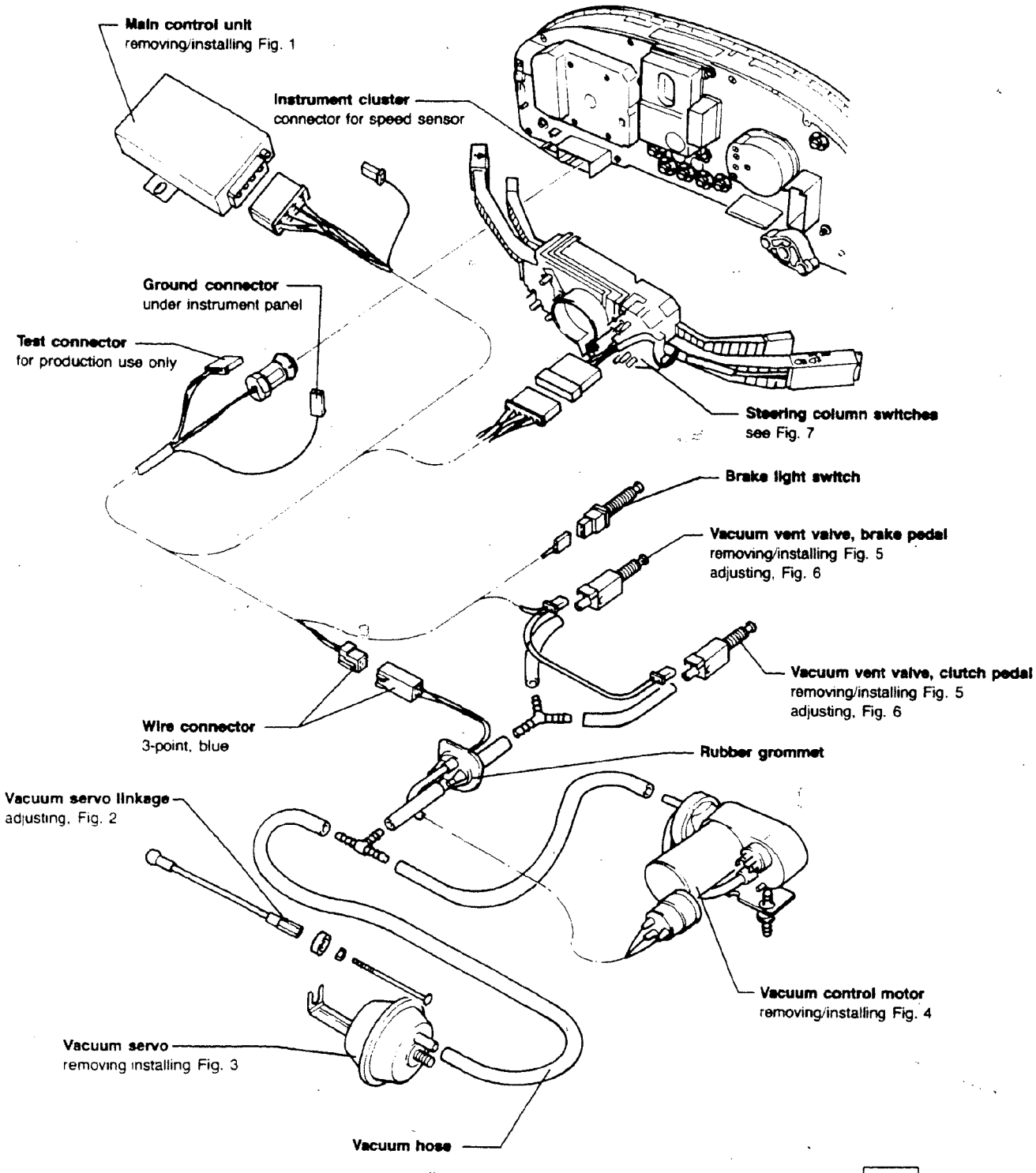
Turns engine too slowly or engages and will not turn engine

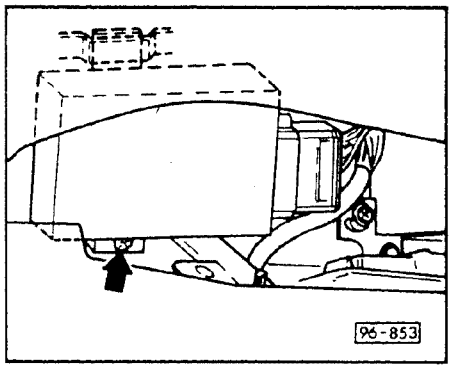


CONTINUED IN THE

BEGINNING OF NEXT ROW

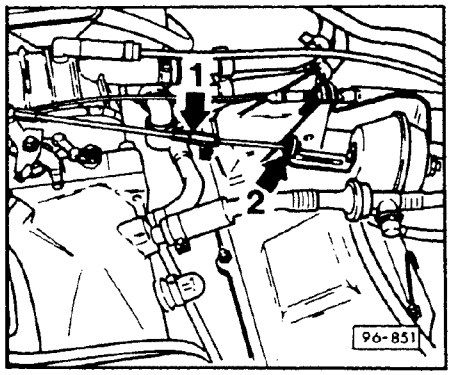



Main control unit
removing/installing Fig. 1
Instrument cluster
connector for speed sensor
Ground connector
under instrument panel
Test connector
for production use only
Steering column switches
see Fig. 7
Brake light switch
Vacuum vent valve, brake pedal
removing/installing Fig. 5
adjusting, Fig. 6
Vacuum vent valve, clutch pedal
removing/installing Fig. 5
adjusting, Fig. 6
Wire connector
3-point, blue
Rubber grommet
Vacuum servo linkage
adjusting, Fig. 2
Vacuum control motor
removing/installing Fig. 4
Vacuum servo
removing installing Fig. 3
Vacuum hose
96-855



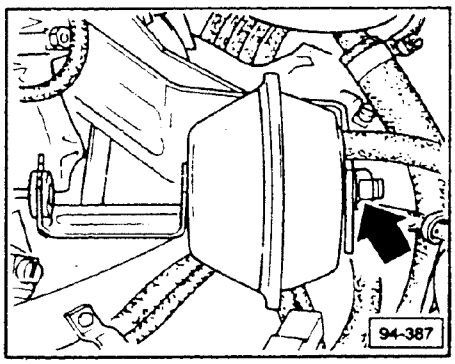
▶ Fig. 1 Main control unit, removing/installing

- remove glove compartment
- from rear side of instrument panel, remove Phillips head screw
- remove control unit from strap and disconnect electrical connector



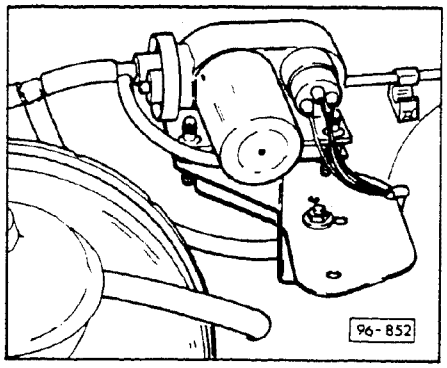
▶ Fig. 2 Vacuum servo linkage, adjusting

- make sure throttle is closed
- turn adjuster nut (**1**) so there is clearance between bushing and contact plate (**2**)
  - 0.1mm to 0.3mm



▶ Fig. 3 Vacuum servo, removing

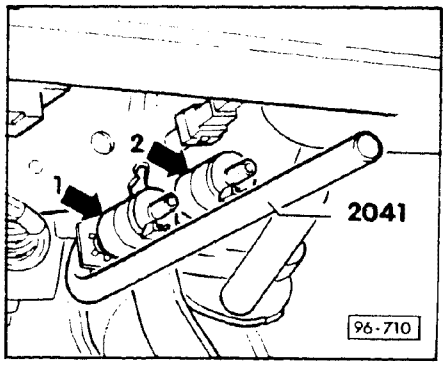
- unclip or unscrew linkage
- remove vacuum hose
- remove vacuum servo from bracket (**arrow**)
  - 25 Nm (18.4 ft lb)



▶ **Fig. 4 Vacuum control motor, removing/installing**

On vehicles with 4 cylinder motor
- remove complete pump with rubber grommets up and out from bracket

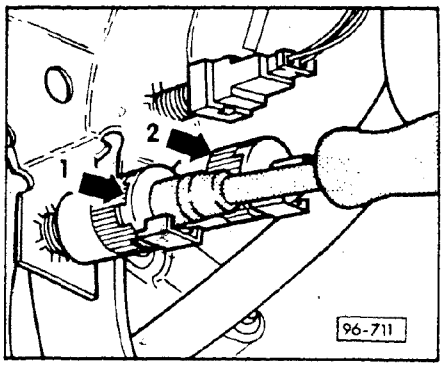
On vehicles with 5 cylinder motor
- remove pump down and out from bracket



▶ **Fig. 5 Vacuum vent valves, removing**

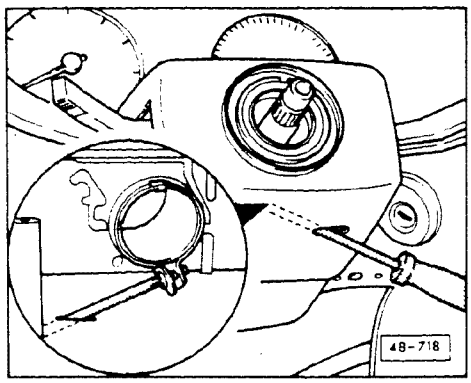
- remove cover from under left side of instrument panel
- remove electrical connector from vacuum vent valve

With "J" shaped tool,
- push vacuum vent valve out of bushing from behind



▶ **Fig. 6 Vacuum vent valves, installing**

- install valve loosely by hand
- push vent valve through bushing as far as possible using 10mm socket
- pull brake (clutch) pedal as far back as it will go
- release pedal slowly
- switch is now adjusted



▶ **Fig. 7 Steering column switches removing/installing**

- remove steering wheel
  - 40 Nm (29.5 ft lb)
- loosen clamp for steering column switch
- disconnect switch connectors
- pull off steering column switches

Vacuum system, checking

- remove vacuum hose from vacuum control pump
- push vacuum servo in until stop
- cover end of vacuum hose with finger
  - vacuum servo must not release

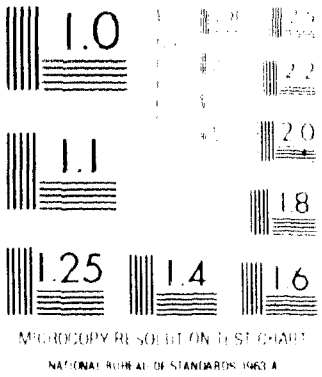
If vacuum servo releases to original position,
- the vacuum system is leaking

- check the following components for vacuum leaks:
  - vacuum vent valves
  - vacuum vent valves are properly installed
  - vacuum servo
  - vacuum hoses
- repair as necessary

Microfilm Service Information System

Quality Control Test Pattern

ORIGINAL 9 28 81
REVISED 11 17 81



POINT SIZE

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LINE WIDTH

5 mil.
8 mil.
10 mil.
13 mil.
15 mil.
20 mil.
30 mil.
50 mil.

Gray Scale

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

Gray Side . . . 18% Reflectance

White Side . . . 90% Reflectance