TURBONutter

Lada Niva 4x4
Service Manual
Fuel Injection

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Chapter 7. Electrical system

Wiring and fuses

The electrical system is of the single-wire negative earth type. The vehicle basic wiring diagram is illustrated in Fig.7-1.

Most electrical circuits are powered when the ignition is switched on. Regardless the ignition switch position, the following functions are available: horn, stoplight, cigarette lighter, interior lamps, inspection lamp, hazard warning flashers, exterior lighting and main beam.

Most of the vehicle electrical circuits are protected by fuses, which are located beneath the facia, at the left-hand side of the steering column (Fig.7-2). There are no fuses for battery charging, ignition and engine start-up (starter and alternator) circuits, main/dipped beam relay. Extra fuses 11, 12, 14, 16 are provided in the additional fusebox to be used for alternative vehicle specifications.

Before renewing a blown fuse, isolate and remedy the cause. Before attempting to diagnose any electrical fault, refer to Table 7-1 to study the relevant wiring diagram protected by a failed fuse.

Table 7-1

Fuse-protected circuits

Fuse No	Circuit protected
1 (16 A)	Heater blower motor Headlight wiper relay (winding) and headlight wiper motors at all wiper positions, except initial Heated tailgate relay (winding) Tailgate wipe/wash motors Windscreen washer motor
2 (8 A)	Windscreen wiper relay and motor Direction indicators and indicators flasher relay (turn indication mode) Direction indicator warning light Tail lights (reversing lamp) Alternator winding (at engine start-up) and low battery warning light* Differential lockup warning light Relay and handbrake-on warning light Low brake fluid warning light Oil pressure warning light Coolant temperature gauge Low fuel gauge and fuel reserve warning light Tachometer
3 (8A)	Left-hand headlight (main beam) Main beam warning light
4 (8 A)	Right-hand headlight (main beam)
5 (8 A)	Left-hand headlight (dipped beam)
6 (8 A)	Right-hand headlight (main beam)
7 (8 A)	Left-hand front lamp (side marker light) Right-hand front lamp (side marker light) Number plate light Side marker warning light
8 (8A)	Right-hand rear lamp (side marker light) Left-hand rear lamp (side marker light) Instrument panel illumination Heater control illumination lamp Cigarette lighter illumination Switch illumination
9 (16A)	Direction indicators and indicators hazard relay (hazard flashers mode) Tailgate heating element and switch-on relay (contacts)
10 (16A)	Horn Inspection lamp socket Interior lamps Tail lights (stop lamp bulbs)
13 (8A)	Tail lights (fog lamps) Headlight wiper motors at start-up and when wiper arms pass initial position Headlight wiper relay (contacts) Headlight washer motor
15 (16A)	Cigarette lighter

** Pre-1996 vehicles were fitted with a voltmeter (protected by fuse No2) instead of the relevant warning light in the instrument cluster.*

In all wiring diagrams, covered by chapter «Electrical system», the letters are used to denote the respective colour code: the first letter stays for the wire colour code, while the second letter - for the tracer colour code (Table 7-2).

Table 7-2

Fuse colour codes

Letter	Colour
Б	*White*
Г	*Blue*
Ж	*Yellow*
З	*Green*
К	*Brown*
О	*Orange*
П	*Red*
Р	*Pink*
С	*Grey*
Ч	*Black*

WARNING. Always disconnect the battery negative lead when making repairs on the vehicles or its electrical system. When replacing fuses or checking wiring, never use fuses other than those specified for a particular vehicle model as it may damage current tracks in the fuse and relay box.

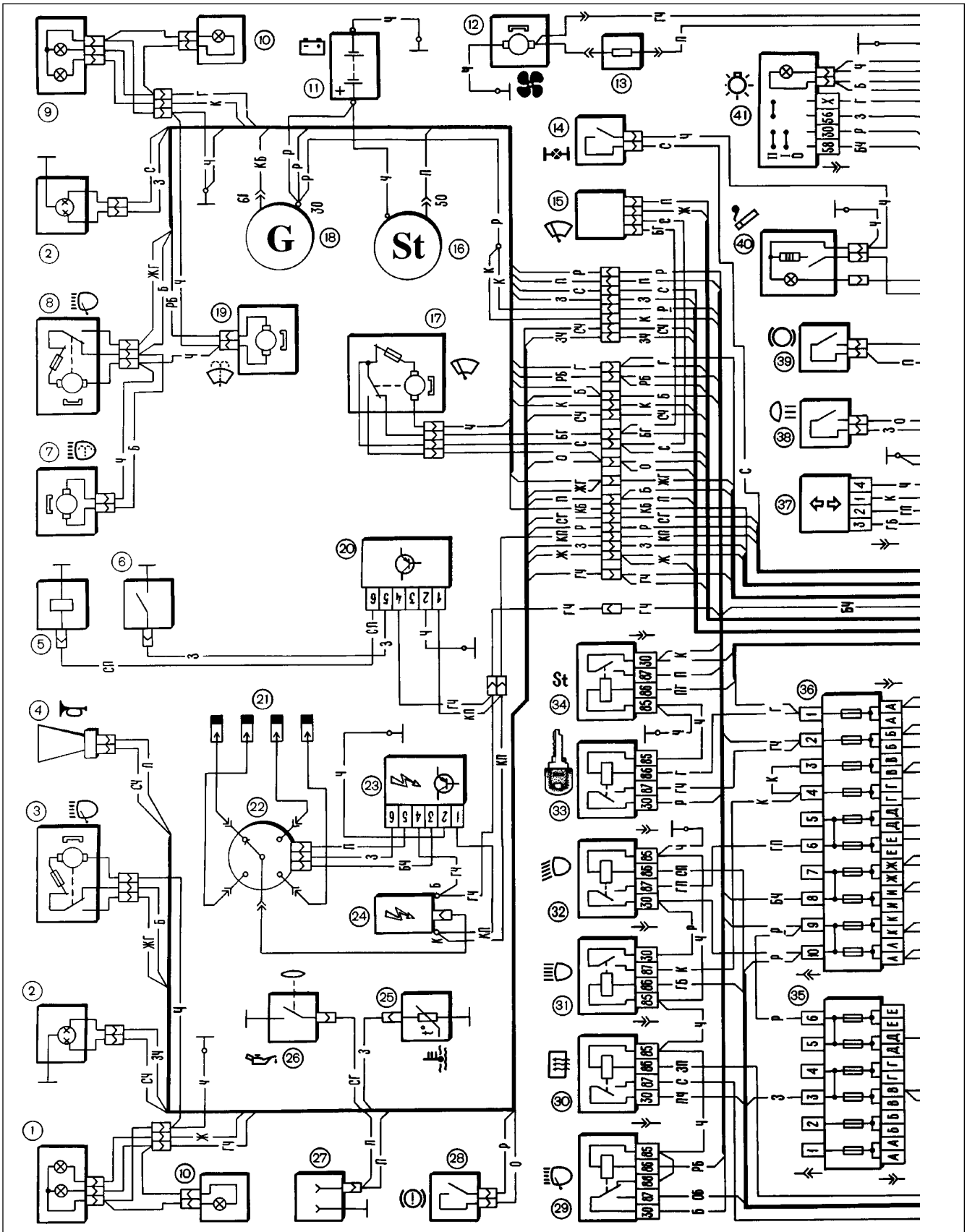
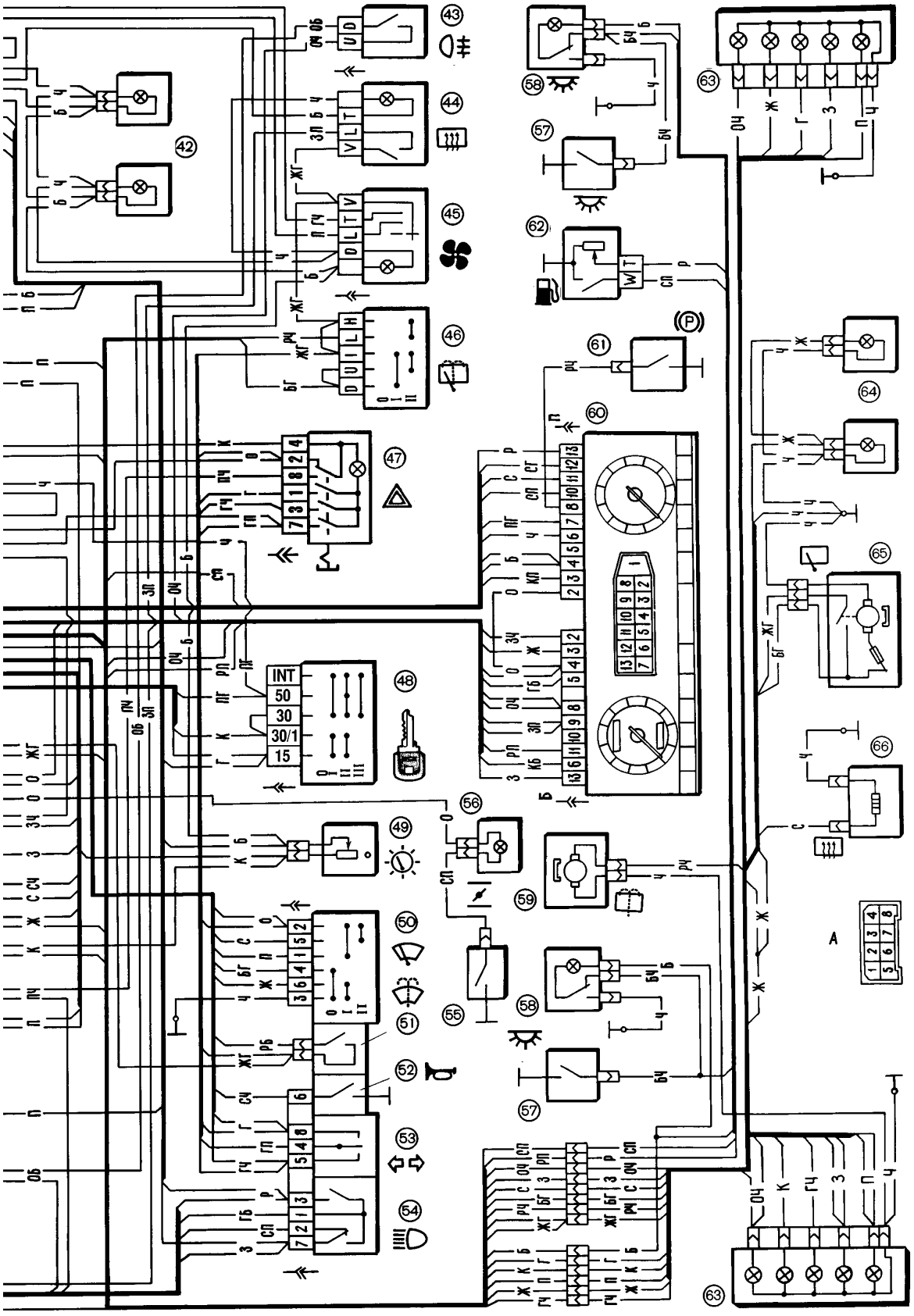


Fig.7-1. Electrical system of VAZ-21213 vehicle:

1 - left-hand front headlamp; 2 - headlights; 3 - left-hand headlamp wiper motor; 4 - horn; 5 - fuel cutoff solenoid; 6 - idle switch; 7 - headlight washer motor; 8 - right-hand headlight wiper motor; 9 - right-hand front headlamp; 10 - side repeaters; 11 - battery; 12 - heater motor; 13 - heater motor complimentary resistor; 14 - differential lockup warning light switch; 15 - windscreen wiper relay; 16 - starter motor; 17 - windscreen wiper motor; 18 - alternator; 19 - windscreen washer motor; 20 - fuel cutoff solenoid control unit; 21 - spark plugs; 22 - ignition distributor; 23 - spark control module; 24 - ignition coil; 25 - temperature gauge sender unit; 26 - oil pressure warning light sender; 27 - inspection lamp socket; 28 - brake fluid level warning light switch; 29 - headlight wipe/wash relay; 30 - rear window heating relay; 31 - main beam relay; 32 - dipped beam relay; 33 - ignition switch relay; 34 - starter motor relay; 35 - complimentary fuse box; 36 - main fuse box; 37 - indicators flasher relay; 38 - reversing light switch; 39



- stop light switch; 40 - cigarette lighter; 41 - exterior light switch; 42 - heater controls illumination; 43 - rear fog light switch; 44 - rear window heating switch; 45 - heater motor switch; 46 - rear window wipe/wash switch; 47 - hazard warning flasher switch; 48 - ignition switch; 49 - instrument lighting switch; 50 - windscreen wiper switch; 51 - switch, windscreen washer & headlamp wipe/wash; 52 - horn switch; 53 - direction indicator switch; 54 - headlight switch; 55 - choke warning light switch;
56 - choke warning light; 57 - door courtesy light switches; 58 - interior lights; 59 - rear window washer motor; 60 - instrument cluster; 61 - handbrake warning light switch; 62 - fuel level and fuel reserve gauge sender unit; 63 - rear lights; 64 - number plate light; 65 - rear window wiper motor; 66 - rear window heating element;
A - pin assignment in steering column combination switch connector

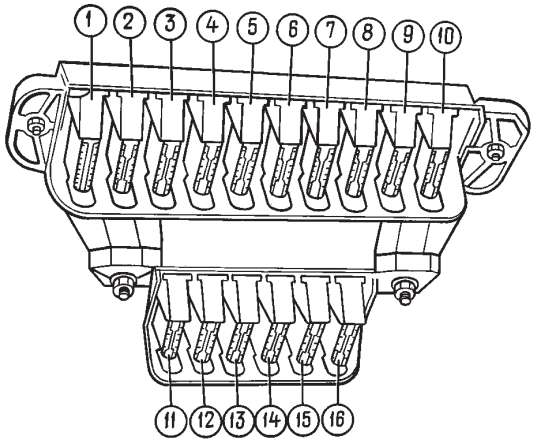


Fig.7-2. Fuses

Battery

Specification

Battery . . . . . 6CT-55A, maintenance-free
Maximum voltage,volt 12
Maximum capacity (at 20-hour discharge rate and initial electrolyte temperature of (27±2)°C, ampere-hour 55
20-hour discharge amps rate 2.75
Cold start amps rating (with running starter motor and electrolyte temperature of -18°C) 255

Fault diagnosis

Cause	Remedy
Battery discharge in operation	
1. Alternator drivebelt slipping	1. Adjust belt tension
2. Battery surface dirty	2. Clean battery surface
3. Damaged insulation in electrical equipment system (discharge rate exceeds 11 mA with loads disconnected)	3. Locate battery leak and remedy the situation
4. Too many accessories fitted by vehicle owner	4. Disconnect new electrical consumers
5. Alternator faulty	5. Check alternator
6. Electrolyte contaminated	6. Charge battery, drain electrolyte, flush, fill with new electrolyte and recharge battery
7. Short-circuits between plates	7. Renew battery
8. Electrolyte level below top plate edge	8. Restore electrolyte level
Electrolyte on battery cover	
1. Too high electrolyte level causing spillage	1. Replenish electrolyte as required
2. Electrolyte leaks through fractures in battery case	2. Replace battery
3. Electrolyte boiling due to excessive alternator voltage	3. Replace alternator
4. Electrolyte boiling through plate sulfation	4. Replace battery

Dry-storage battery - putting into operation

The vehicles are factory-fitted with ready-to-use batteries, i.e. batteries filled with electrolyte and fully charged.

Replacement batteries can be supplied dry, without electrolyte. In order to operate such battery, first remove any provisional plugs or masking tape. Then using a funnel (made of glass or acid-resistant plastic), slowly fill the battery with electrolyte (at 25°C) of 1.28 g/cm^3 for normal climates or 1.23 g/cm^3 for tropics. All procedures required to activate the battery should be performed at the ambient temperature of (25±10)°C.

Allow 20 minutes for the internal plates and separators to saturate well in electrolyte. Then check the battery voltage without loads.

The battery is ready for use when its voltage reading is at least 12.5 volts. At values below 12.5 volts but over 10.5 volts, the battery should be recharged to the output voltage which is specified by the manufacturer. The battery is rejected when the voltage is equal or below 10.5 volts.

The saturation of internal plates and separators normally results in a lower electrolyte level. Therefore, top up the battery with electrolyte of the original specific gravity before refitting it to the vehicle.

Always re-charge the battery after it is filled with electrolyte in the event:

- the battery will be initially operated in heavy duty conditions, in cold weather, at frequent engine starts, etc.;

- the battery has been stored for over 12 months from the date of manufacture.

Electrolyte level - checking

Electrolyte level in all battery cells must be maintained between the «MIN» «MAX» marks on the translucent battery case. Never try to use the battery with the electrolyte level below the «MIN» mark.

In the course of vehicle operation the electrolyte level gradually decreases due to water evaporation. Only distilled water should be used to top up the battery.

If spillage is suspected to be the cause for low electrolyte level, always add electrolyte of the same specific gravity as that remaining in the battery cell. When overfilled, remove excessive electrolyte using an ebony-tipped rubber bulb.

Battery charge level- checking

Always measure the battery charge with a hydrometer (areometer) during servicing or in the event of the battery failed in operation. At the same time measure the temperature in order to account for temperature correlation (Table 7-3) of hydrometer readings.

Table 7-3

Temperature correction values to hydrometer readings for measuring electrolyte density

Electrolyte temperature, °C	Correction value, g/cm^3
-40 to -26	-0.04
-25 to -11	-0.03
-10 to +4	-0.02
+5 to +19	-0.01
+20 to +30	0.00
+31 to +45	+0.01

With electrolyte temperatures over 30°C, the correction value is added to actual hydrometer readings. When electrolyte temperature is below 20°C, the correction value is subtracted. The correction value is not applied when electrolyte temperature is within 20 to 30°C.

Once you have measured the electrolyte specific gravity in each battery cell, determine the state of the battery charge using Table 7-4. Withdraw the battery from the vehicle for re-charging when it is discharged in excess of 25 percent in winter time or 50 percent in summer time.

When measuring electrolyte density, take care not to drip electrolyte on the battery cover, case, body or other parts. Electrolyte contains hazardous sulfuric acid which causes corrosion, current leaks, etc.

Do not measure the electrolyte specific gravity in the following cases to exclude wrong readings:

- when the electrolyte level is not as required;

- when electrolyte is too hot or too cold; the optimum temperature to measure electrolyte specific gravity is 15-27°C;

- immediately after the battery replenishment. Leave the battery for some time to let the electrolyte mix up; it may take up to several hours if the battery has been fully discharged;

- after a number of start-up attempts. It is advisable to wait until electrolyte in the battery cell is homogeneous in terms of density;

- when electrolyte is «boiling». Wait to see bubbles rising to the surface in the electrolyte, sampled with a hydrometer.

Battery charging

Remove the battery from the vehicle and clean it carefully, especially its top. Check the electrolyte level and replenish, if applicable.

The battery is recharged at a rate of 5.5 amperes with the caps undone. Charge the battery until intensive gas escape is observed and consistent voltage and electrolyte specific gravity is achieved within three hours. The electrolyte density of the charged battery at 25°C should be as shown in Table 7-4.

When recharging the battery, frequently check the electrolyte temperature to keep it below 40°C. When 40°C is reached, then either halve the charging current or stop recharging to cool the battery down to 27°C.

Stop charging the battery in case of intensive gas escape from the battery cells and when the last three measurements (taken hourly) show no changes in voltage and specific gravity.

If at the end of the recharging procedure the electrolyte specific gravity (after temperature correlation) differs from that specified, adjust it accordingly. In case of higher specific gravity, remove some electrolyte and top up distilled water, while in case of lower specific gravity - remove some amount of lower specific gravity electrolyte and add some higher specific gravity electrolyte (1.4 g/cm^3).

After the electrolyte specific gravity has been duly adjusted, continue to charge the battery further 30 minutes for better electrolyte mixing. Next disconnect the battery and after 30 minutes check the electrolyte level in all cells.

When electrolyte is below the level required, pour in electrolyte of the specific gravity which is recommended for that climate (Refer to Table 7-4). When electrolyte level is above that required, remove excessive amount using a rubber bulb.

Table 7-4

Electrolyte specific gravity at 25°C, g/cm^3

Climate (average January temperature, °C	Season	Fully discharged battery	Battery discharged	
			by 25%	by 50%
Very cold (from -50 to -30)	Winter	1.30	1.26	1.22
	Summer	1.28	1.24	1.20
Cold (from -30 to -15)	All seasons	1.28	1.24	1.20
Moderate (from -15 to -8)	All seasons	1.28	1.24	1.20
Warm and damp (from 0 to +4)	All seasons	1.23	1.19	1.15
Hot and dry (from -15 to +4)	All seasons	1.23	1.19	1.15

Alternator

Specification

Maximum current output (at 13 volts and 5000 rpm), amp . . 55
Adjustable voltage range, volts . . . . . 14.1±0.5
Maximum rotor speed, rpm 13,000
Engine-to-alternator ratio 1:2.04

General description

The alternator of 37.3701 model is of AC, three-phase, clockwise rotation (when viewed from the drive end), with integral diode plate and voltage regulator.

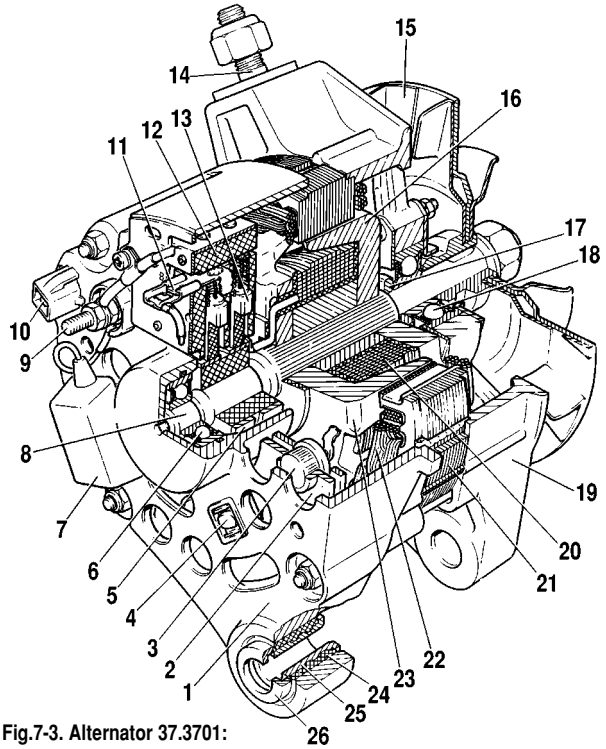


Fig.7-3. Alternator 37.3701:
1 - slip ring end housing; 2 - diode plate; 3 - diode; 4 - screw; 5 - slip ring; 6 - rear ballbearing; 7 - suppression condenser; 8 - rotor shaft; 9 - alternator terminal «30»; 10 - alternator terminal «61»; 11 - voltage regulator terminal «В»; 12 - voltage regulator; 13 - brush; 14 - alternator-to-belt tensioner lever securing pin; 15 - pulley and fan; 16 - rotor pole end; 17 - spacer; 18 - front ballbearing; 19 - drive-end housing; 20 - rotor winding; 21 - stator; 22 - stator winding; 23 - rotor pole end; 24 - buffer bush; 25 - bush; 26 - hold-down bush

Protective cover 4 is used for slip ring-end housing (Fig.7-11). The protective cover and air intake have several design alternatives.

Four bolts hold together stator 21 (Fig.7-3) and housings 1 and 19. Rotor shaft 8 runs in bearings 6 and 18 located in the housings. The rotor winding (field winding) is powered through the brushes and slip rings 5.

Three-phase alternative current, induced in the stator winding, is converted into direct current in diode plate 2 fitted to housing 1. Electronic voltage regulator 12 is integral with the brush holder and is also attached to housing 1.

The alternator wiring diagram is shown in Fig.7-4. When the ignition is switched on, the voltage for the alternator actuation is applied to the regulator terminal «В» (alternator terminal 61) via warning light 6 in instrument cluster 3. Once the engine is started, the current to the field winding is supplied from three supplementary diodes in the alternator diode plate.

The alternator operation is checked via warning light 6 in the instrument cluster. The light comes on when the ignition is switched on and goes out after the engine has been started, when the alternator is good. Bright or dim light of the warning lamp indicates faults.

Before 1995 an electronic voltmeter in the instrument cluster was used to control voltage in the vehicle electrical system. With correct voltage the voltmeter LED did not light up. In case of overvoltage the LED started flashing, while in case of undervoltage the LED stayed steadily.

Starting from 1996 an alternative voltage regulator and brush holder are used. Now the voltage regulator is located in the metal housing and is riveted to the brush holder (Fig.7-10, a), making a unit. The new voltage regulator has no terminal «Б», so voltage is supplied only to terminal «В». Both the earlier and new voltage regulators are similar and are interchangeable as a complete unit with the brush holder.

Some vehicles can be fitted with alternators made in Slovenia, Bulgaria or Germany. These alternators are interchangeable with the alternator of 37.3701 model as to specification and mounting sizes, though are slightly different in design. This chapter describes the alternator of 37.3701 model, preferably used in VAZ-21213 vehicles.

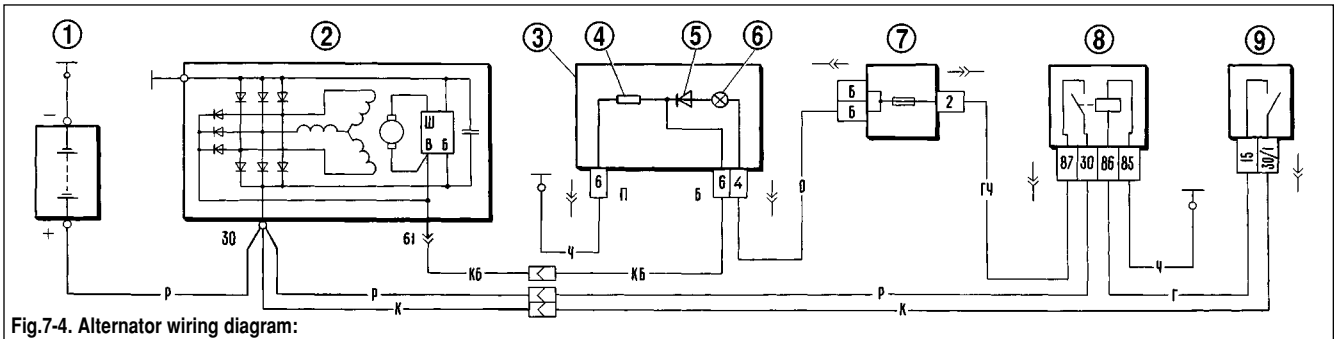


Fig.7-4. Alternator wiring diagram:
1 - battery; 2 - alternator; 3 - instrument cluster; 4 - resistor 51 Ohm, 5 W; 5 - diode; 6 - low battery charge warning light; 7 - fuse box; 8 - ignition relay; 9 - ignition switch

Fault diagnosis

Cause	Remedy
Warning light does not light up when ignition is switched on. Instruments inoperative	
1. Blown fuse 2 in fuse box	1. Renew fuse
2. Broken supply circuit in instrument cluster:	2. Carry out the following:
- no voltage between terminal «Б» of main fusebox and instrument cluster;	- check wire «О» and its connections between fuse boxes and instrument cluster;
- no voltage between ignition relay and fusebox unit	- check wire «ГЧ» and its connections between ignition relay and fusebox
3. Ignition switch or ignition relay faulty:	3. Carry out the following:
- faulty contact part or ignition relay;	- check and renew faulty contact part of ignition switch or ignition relay;
- no voltage between ignition switch and ignition relay;	- check wire «Г» and its connections between ignition switch and ignition relay;
- break or no contact in the ignition relay earth wire	- check wire «Ч» and its connections between ignition relay and earth
Warning light does not light up when ignition is switched on and does not stay on during engine operation. Instruments operate. Battery is discharged.	
1. Blown warning light bulb or loose holder-to-PCB contact	1. Renew failed bulb, bend holder contacts or replace bulb holder
2. Broken circuit between instrument cluster and alternator terminal 61	2. Check wire «КБ» and its connections between alternator and instrument cluster
3. Brushes worn or binding, slip ring oxidized	3. Renew brush holder with brushes, clean slip rings with fuel-moistened cloth
4. Voltage regulator damaged (break between «Ш» terminal and earth)	4. Renew voltage regulator
5. Lead from voltage regulator «В» terminal disconnected	5. Reconnect wire
6. Short-circuit in positive diodes	6. Renew diode plate
7. Field winding leads disconnected from slip rings	7. Solder pins or renew alternator rotor
8. No contact between voltage regulator terminals «В» and «Ш» and brush terminals (for pre-1996 alternators)	8. Clean voltage regulator terminals «В», «Ш» and brush output; bend voltage regulator pins
Warning light is bright or half bright with engine running. Battery is non-charged	
1. Alternator drivebelt slipping	1. Adjust belt tension
2. Voltage regulator damaged	2. Renew voltage regulator
3. Damaged diodes	3. Renew diode plate
4. Field winding diodes damaged	4. Renew diodes or diode plate
5. Stator winding broken, shorted or earthed	5. Replace alternator stator
Warning light is on with engine running. Battery is overcharged	
Voltage regulator damaged (short-circuit between terminal «Ш» and earth)	Renew voltage regulator
Alternator is noisy	
1. Loose alternator pulley nut	1. Tighten nut
2. Alternator bearings damaged	2. Renew rear bearing or front cover with bearing
3. Stator winding shorted internally or to housing (alternator howl)	3. Renew stator
4. Short-circuit in diode plate	4. Renew diode plate
5. Brush squeak	5. Clean brushes and slip rings with cotton cloth moistened in petrol

WARNING. Always earth the battery negative post to the bodyshell and connect the positive post to the alternator clip 30. If battery connections are erroneously reversed, the alternator diodes will be damaged by resulting high voltage.

Never operate the alternator with the battery disconnected since this causes overvoltage peaks at the alternator terminal 30 and can damage the voltage regulator or other electronic devices of the vehicle electrical system.

Never test the alternator for «spark» by earthing the alternator terminal 30 even for a short time. The diodes can be damaged by considerable current flow. Check the alternator operation using an ammeter or a voltmeter.

Never check the alternator diodes by applying voltage over 12 volts or using a megohmmeter, as its voltage is very high and can damage the diodes (by short-circuit).

Never check the vehicle wiring by a megohmmeter or a lamp powered in excess of 12 volts. If the check is really necessary, disconnect the leads from the alternator first.

Always use the test bench and disconnect the winding from the diodes when performing the high voltage check of alternator stator winding insulation resistance.

When welding the body units or components, remember to disconnect first the leads from all battery and alternator connectors.

Alternator - testing

Using tester

A tester helps determine whether the alternator is faulty or meets the specification. The carbon brushes of the unit tested should slide smoothly on the slip rings, which should always be clean.

Mount the alternator on the tester and connect as shown in Fig.7-5. Start the tester motor, using rheostat 4, set the alternator output voltage at 13 volts and raise the rotor speed to 5000 rpm. Run the alternator at this speed for at least 10 minutes and then measure the alternator output amperage. The reading for a sound alternator should not be below 55 amperes.

When the measured amperage is much lower, this is an indication of some fault in the stator or rotor windings or damaged diodes. If this is the case, very thorough diagnostics will have to be carried out in order to locate the fault.

The output voltage should be measured at rotor speed of 5000 rpm. Set rheostat 4 to test amperage of 15 amps and take the reading of the alternator output voltage to be within 14.1±0.5 volts at the ambient / alternator temperature of 25±10°C.

If the voltage reading falls outside the range specified, replace the complete voltage regulator with a new unit which is proved good. Then repeat the test procedure. Normal voltage indicates that the old regulator is faulty and must be renewed. If the fault persists, check the alternator windings and diodes.

Alternator - oscilloscope test

The oscilloscope offers an accurate and quick way to check the alternator and identify the fault through the output waveform.

To perform the check make the connections as shown in Fig.7-6. Disconnect the output lead common for three supplementary diodes from the voltage regulator terminal «B» and make sure the lead end does not touch the alternator housing. Connect the battery lead to the regulator terminal «B» via warning light 1. Now the field winding is only battery powered.

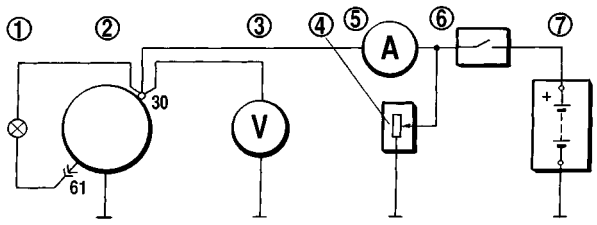


Fig.7-5. Wiring connections for diode plate test:
1 - warning light (12 v, 3 W); 2 - alternator; 3 - voltmeter; 4 - rheostat; 5 - amperemeter; 6 - switch; 7 - battery

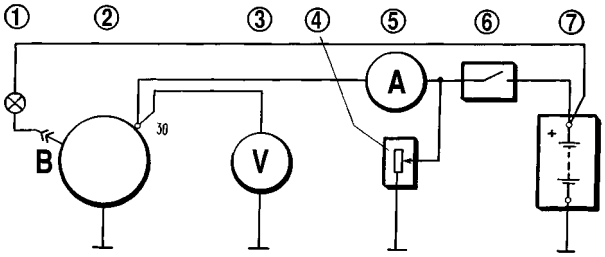


Fig.7-6. Alternator wiring connections for oscilloscope test:
1 - warning light (12 v, 3 W); 2 - alternator; 3 - voltmeter; 4 - rheostat; 5 - amperemeter; 6 - switch; 7 - battery

Start the tester motor and increase the rotor speed up to 1500-2000 rpm. Using switch 6, cut off the battery from the alternator terminal 30; while using rheostat 4, set the output current at 10 amperes.

Check the voltage across the alternator terminal 30. When the diodes and stator winding are sound, the output waveform is «saw-shaped» with uniform peaks (Refer to Fig.7-7, I). In case of a broken stator winding or shorted diodes, the waveform is quite different - the peaks are no longer uniform and there are very deep troughs (Fig.7-7, II и III).

Check to see the output waveform across the alternator terminal 30 is normal; next check voltage across the alternator terminal 61 or at the end of the lead disconnected from the voltage regulator terminal «B». These points are a common connection for three supplementary diodes (Fig.7-4), supplying current to the field winding during the alternator operation. The output waveform must have the same even saw-shaped pattern. An irregular waveform is an indication of damaged supplementary diodes.

Rotor field winding - testing

The field winding can be tested with the alternator in the vehicle. It is sufficient to remove the housing and voltage regulator/brush holder assembly.

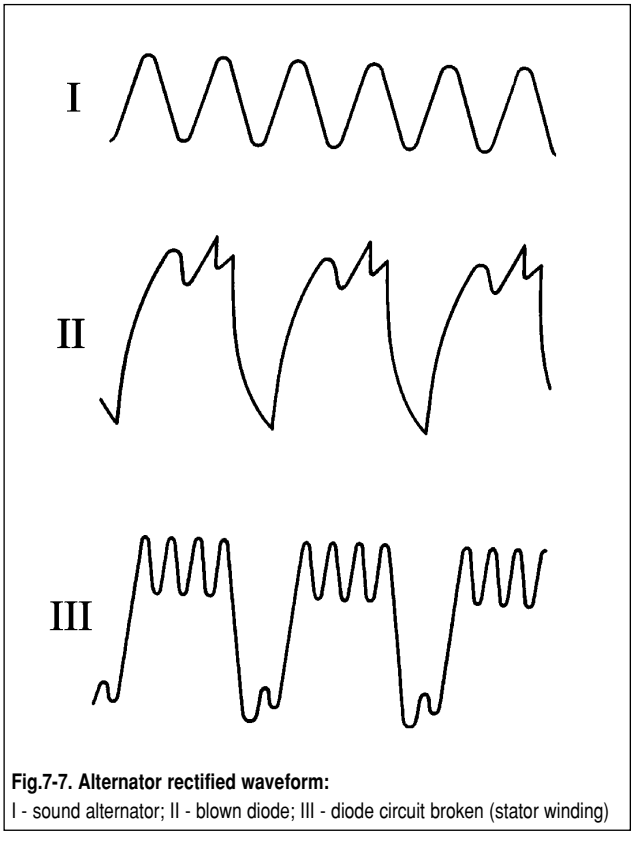


Fig.7-7. Alternator rectified waveform:
I - sound alternator; II - blown diode; III - diode circuit broken (stator winding)

When necessary, sand the slip rings with emery paper, then check the winding for continuity or earthing with an ohmmeter or a test bulb.

Stator - testing

The stator is tested separately after dismantling the alternator and disconnecting the winding from the diodes.

First test the stator winding for continuity or earthing using an ohmmeter or a test bulb and battery. The wire insulation should show no signs of overheating caused by short-circuit in the diode plate. Always renew the stator with a damaged winding.

Finally, using a special growler, check the stator winding for internal short-circuit.

Diodes - testing

A sound diode allows current only in one direction. A faulty diode can either prohibit the current flow (a broken circuit) or allow it in both directions (a short-circuit).

The complete diode plate must be renewed if any diode is found damaged.

The diode plate can be checked for a short-circuit with the alternator in the vehicle. For this disconnect leads from the battery and alternator and remove the slip ring end housing. Also the lead to the voltage regulator terminal «B» should be disconnected. In case of the alternator with an old voltage regulator do not forget to disconnect the voltage regulator terminal «Б» from the alternator terminal 30.

An ohmmeter or a test bulb (1-5 watt, 12 volts) and battery can be used as shown in Fig.7-8.

Note. *For easier diode fitting three diodes (marked red) make «positive» rectified voltage. These diodes are «plus» and are pressed within one diode plate connected to the alternator terminal 30. Three other diodes («minus», marked black) have «negative» rectified voltage to the housing. They are press-fitted to the other diode plate connected to earth.*

First make sure both positive and negative diodes are not shorted internally. For this connect the battery positive terminal through a test bulb to the alternator terminal 30, whilst the negative terminal - to the alternator housing (Fig.7-8, I). The illuminated bulb indicates shorted positive and negative diodes.

Short-circuit in the negative diodes can be detected by connecting the battery «plus» terminal through a test bulb to one of the diode plate securing bolts, while the «minus» to the alternator housing (Fig.7-8, II). The illuminated bulb is an indication of a short-circuit fault in one or more negative diodes. Note that in the latter case the bulb may come on as a result of stator winding being earthed to the alternator housing. However, this fault is much less frequent than short-circuits in the diodes.

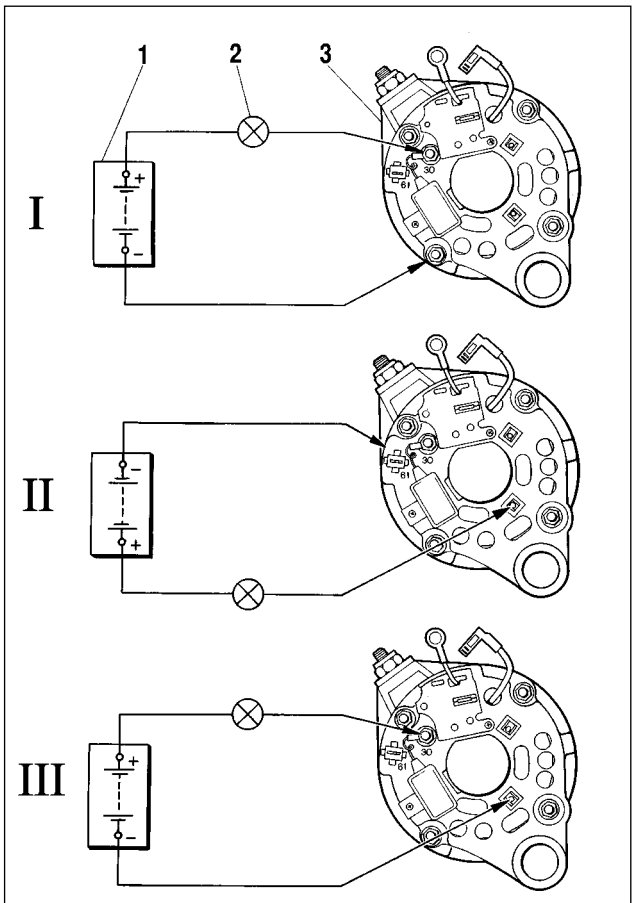


Fig.7-8. Diode check:
1 - battery; 2 - warning light; 3 - alternator; **I** - concurrent check of positive and negative diodes; **II** - check of negative diodes; **III** - check of positive diodes

Short-circuit in the positive diodes can be detected by connecting the battery «plus» terminal through a test bulb to the alternator terminal 30, while «minus» - to one of the diode plate securing bolts (Fig.7-8, III). The illuminated bulb advises about a short-circuit in one or more positive diodes.

Discontinuity in the diodes can be traced without dismantling the alternator either by means of an oscilloscope or a tester through a significant output current drop (20 to 30 percent) against the specification. If the alternator windings, supplementary diodes or voltage regulator are sound, whilst the diodes are not shorted, the cause of the output current drop is discontinuity in the diodes.

Supplementary diodes - testing

To check the supplementary diodes for short-circuit without removing and dismantling the alternator, make connections as shown in Fig.7-9. Similarly to the diode checking, disconnect the battery and alternator leads, remove the alternator housing, disconnect the lead to the voltage regulator terminal «B».

Connect the battery positive post through a test bulb (1-3 watt, 12 volts) to the alternator terminal 61, while the negative post - to one of the diode plate securing bolts.

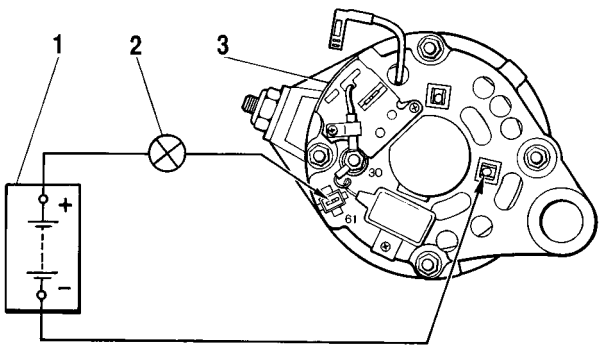


Fig.7-9. Checking the supplementary diodes:
1 - battery; 2 - warning light; 3 - alternator

An illuminated bulb advises about short-circuit in one or more supplementary diodes.

The damaged diode can be identified only after removing the diode plate and checking each diode.

Discontinuity in the supplementary diodes can be detected with an oscilloscope through distortions in the voltage waveform across terminal 61 and also by low voltage (below 14 volts) across terminal 61 at a medium rate of the alternator rotor.

Voltage regulator - testing

The function of the voltage regulator is to continuously adjust the field current flow to the alternator so that the alternator voltage is maintained within the preset range at various speed / load conditions of the alternator operation.

In-vehicle test. For this test you need a DC voltmeter with 15-30 volt scale and accuracy of at least 1.0 class.

Run the engine for 15 minutes at medium speeds with the headlights on, measure the voltage between the alternator terminal 30 and alternator earth. The reading should be within 13.6-14.6 volts.

When battery undercharge or overcharge becomes repetitive, while the adjustable voltage falls outside the specification, the voltage regulator must be renewed.

Off-vehicle test. For testing the voltage regulator, removed from the alternator, make the connections as shown in Fig.7-10. The pre-1996 voltage regulator should be tested complete with the brush holder (Fig.7-10, b), since at the same time you can detect a broken brush connection or a poor contact between the voltage regulator terminals and brush holder.

Connect a test lamp of 1-3 watt, 12 volts across the brush terminals. The terminals «В», «Б» (when available) and earth terminal should be connected first to the power supply of 12 volts and then to that of 15-16 volts.

With the sound voltage regulator, the lamp illuminates in the first case and goes out in the second case. If the lamp illuminates in both cases, there must be a break in the voltage regulator; when the bulb fails to light in both cases, the regulator circuit is broken or brush-to-regulator connection is loose (for pre-1996 alternators).

Capacitor - testing

The suppression capacitor is intended to protect the on-board electronic equipment against voltage surges in the ignition system along with suppression of radio interference.

A damaged capacitor or its loose fitting to the alternator (poor ground) is recognizable through increased radio interference with the engine running.

A simple way of testing the capacitor is to use a megohmmeter or a tester (scaled as 1-10 MOhm). In case of a sound capacitor, when its contacts are closed via the instrument, the needle should first deflect towards a lower resistance values and then gradually return to the initial position. The capacitance measured with a special device should be 2.2 microfarad ± 20%.

Alternator - overhaul

Alternatzor - dismantling

Clean the alternator and blow dry with compressed air. Release the clip to disconnect air intake 3 (Fig.7-11) from housing 4. Undo two screws 1 and nut from contact bolt extension 5,

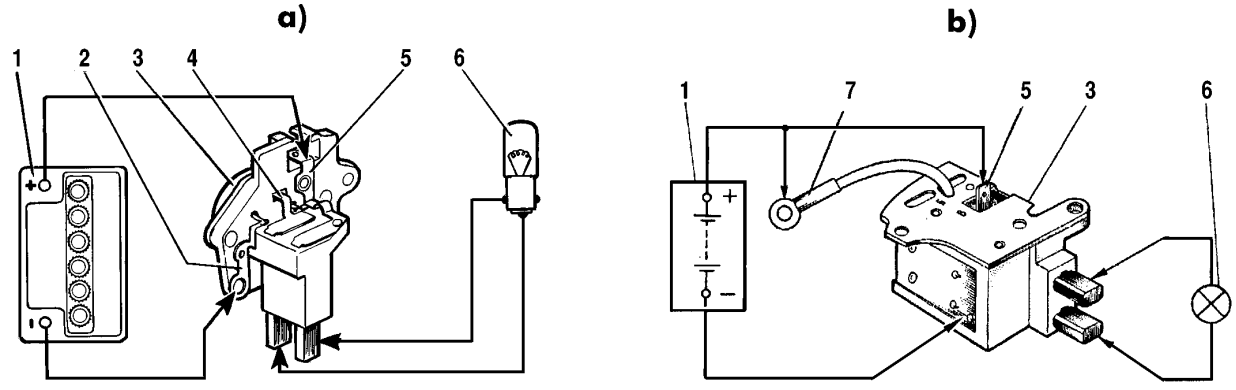


Fig.7-10. Checking the voltage regulator:
a - 1996-on voltage regulator; **b** - pre-1996 voltage regulator; 1 - battery; 2 - voltage regulator earth ; 3 - voltage regulator; 4 - voltage regulator terminal «Ш»; 5 - voltage regulator terminal «В»; 6 - warning light; 7 - voltage regulator terminal «Б»

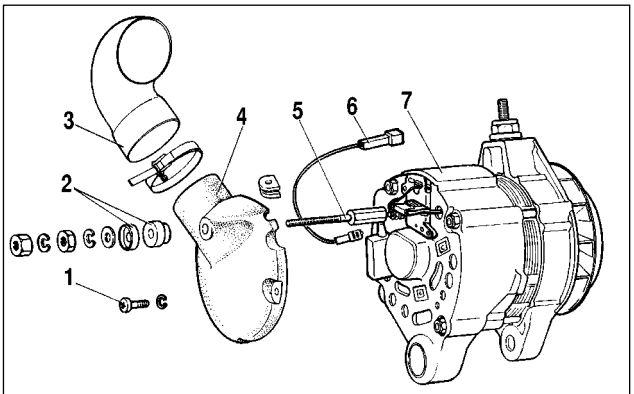


Fig.7-11. Removing the alternator protective case:
1 - securing screw; 2 - bushes; 3 - air intake; 4 - protective case; 5 - extension, alternator terminal 30; 6 - wire, alternator terminal 61; 7 - alternator

remove housing 4. Disconnect lead 6 from alternator terminal 61 and undo contact bolt extension 5.

Lock the alternator pulley with a tool from kit 67.7823.9504, undo the pulley retaining nut and press the pulley out using a puller.

Remove the pulley key and taper washer.

Tool kit 67.7823.9504 includes an ordinary picker and a grip. The grip consists of two steel half-rings, inserted into the pulley.

The half-rings are of the same cross-section area as the alternator drivebelt. At one end they are connected by means of the joint, at the other end they have levers to be compressed by hand when removing the pulley.

Disconnect the wire from the alternator terminal «B». Disconnect the voltage regulator and capacitor leads from alternator terminal 30, undo regulator 1 retaining screws (Fig.7-12) and withdraw it. In case of pre-1996 alternators to prevent damages to the brushes when removing the brush holder. Insert a screwdriver between regulator 2 housing and brush holder, then partly pull out the regulator from the alternator, leaving the brush holder in place. Next swing and withdraw the regulator complete with the brush holder from the alternator. Undo the retaining screw and remove suppression capacitor 20.

Undo clamp bolt 14 nuts, remove alternator housing 11 and rotor 8. Undo the bolt nuts, connecting diode ends to stator winding terminals, withdraw stator 7 from alternator housing 17.

Undo contact bolt 6 nut, disconnect the supplementary diode wire terminal from connector 3, remove diode plate 5.

Alternator - reassembly

The reassembly of the alternator is the reverse of the dismantling procedure.

In case of pre-1996 alternators (with detachable regulator / brush holder unit), in order to avoid damage to the brushes, before refitting the regulator complete with the brush holders, do not fully insert the brush holder into the regulator, it should be pushed in place only partly, then insert the assembly as such into the alternator. After the brush holder is refit into the alternator housing, press lightly the regulator into the alternator.

Out-of-concentricity for the holes in the alternator housings must not exceed 0.4 mm. Therefore during reassembly always insert a special gauge into these holes.

The taper spring washer of the pulley must be assembled with the convex side facing the nut. Tighten the pulley securing nut to a torque of 38.4-88 N•м (3.9-9.0 kgf•m)

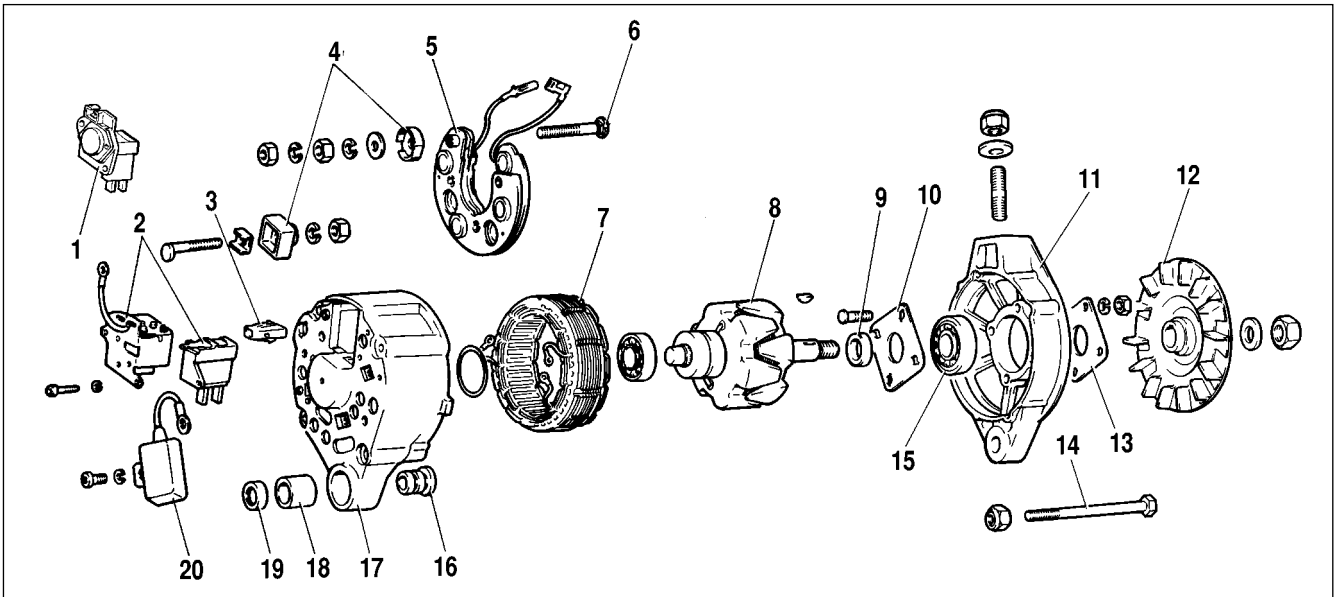


Fig.7-12. Alternator components:
1 - voltage regulator complete with brush holder, 1996-on alternators; 2 - voltage regulator and brush holder, pre-1996 alternators; 3 - supplementary diode connector; 4 - insulating bushes; 5 - diode plate; 6 - contact bolt; 7 - stator; 8 - rotor; 9 - spacer; 10 - inner washer for bearing attachment; 11 - drive end housing; 12 - pulley; 13 - outer washer for bearing attachment; 14 - clamp bolt; 15 - front rotor ball bearing; 16 - bush; 17 - slip ring end housing; 18 - buffer bush; 19 - hold-down bush; 20 - suppression capacitor

Brush holder - renewal

Always renew the complete unit if the regulator fails or brushes are worn or protrude from the holder to less than 5 mm.

In case of pre-1996 alternators, force the brush holder out of the voltage regulator housing by pressing the terminal «B». Avoid damaging the brushes, so remove and refit the regulator with the brush holder as described earlier in sections «Alternator - dismantling» and «Alternator - reassembly».

In case of 1996-on alternators with one-piece regulator/brush holder unit, renew the complete brush regulator/holder assembly.

Before refitting the voltage regulator with new brush holder, blow its locating place in the alternator clean from carbon dust and wipe off any oil contamination.

Rotor bearings - renewal

To remove a failed bearing from the drive-end housing, undo the nuts of screws holding the bearing retaining washers, remove the washers and screws, then press out the bearing on a hand press. Should the screw nuts fail to undo (the screw ends are bent-up), cut off the screw ends.

Refit the new bearing to the alternator housing only when the bore for the bearing is not deformed and its diameter is not over 42 mm. If the bore is bigger or deformed, renew the housing.

Using a press, drive in the bearing, then compress the bearing between two washers, held by the screws and nuts. Tighten the nuts and bend-up the screw ends. The slip ring rotor bearing is renewed together with the housing, since when the bearing is damaged, the recess in the housing is damaged too. The bearing is removed from the rotor using a puller; use a press tool to drive it into position.

Supplementary diodes - renewal

To replace a damaged diode, unsolder its pins, then carefully take the diode out from the plastic holder, taking care not to hit the diode plate. Clean the holder from epoxy, fit a new diode and solder it.

The colour-coded diode terminal must be re-soldered to the common output wire. After soldering, secure the diode to the holder with epoxy.

Starter motor

Specification

Maximum power, kW 1.3
Amperage at maximum power, not greater . . . . . .290±10
Amperage at 'brake-on', not greater 550
Amperage at idle without solenoid, not greater 60

General description

The starter motor is of pre-engaged type (35.3708 model), DC, with field coils, incorporating a double-winding solenoid.

Body 17 (Fig.7-13) houses four poles 18 with field windings, three of which are series and one is parallel. Covers 7 and 15 and starter housing 17 are held together by two bolts. The armature features a face-type commutator. The armature shaft runs in sintered shells 14, press fitted to cover 6 and 15.

The starter motor wiring diagram is shown in Fig.7-14. When the starter motor is switched on, the battery voltage is supplied through supplementary relay 4 (113.3747-10 model) to both solenoid windings (plunging winding II and holding winding I). The plunging winding shuts off when the solenoid contacts close.

Fault diagnosis

Cause	Remedy
At starter motor switch-on, armature fails to rotate, solenoid inoperative	
1. Battery defective or fully discharged	1. Charge or renew battery
2. Battery terminal posts and lead ends severely corroded; end loose	2. Clean battery posts and lead ends, tighten and apply a coat of petroleum jelly (Vaseline)
3. Solenoid faulty internally, earthed or broken	3. Renew solenoid
4. Starter motor relay defective	4. Clean relay contacts. Renew faulty relay
5. Starter relay winding power circuit open	5. Check wires and connections between ignition switch terminal 50 and relay terminal 86
6. Ignition switch contacts 30 and 50 fail to close	6. Renew ignition switch contact unit
7. Starter solenoid power leads broken	7. Check leads and connections: battery - starter cut-in relay - starter solenoid terminal 50
8. Stuck starter solenoid	8. Remove solenoid, check armature for smooth slide
No or slow armature rotation, solenoid inoperative	
1. Battery defective or fully discharged	1. Renew or charge battery
2. Battery posts and lead clamps severely corroded; ends loose	2. Clean battery posts and wire ends, tighten and apply a coat of petroleum jelly
3. Loose end of cable from power plant to body or between power plant to battery «minus» post	3. Tighten cable end fasteners
4. Solenoid terminal bolts oxidized or terminal bolt wire end retaining nuts loose	4. Clean terminal bolts, tighten lead retaining nuts
5. Commutator burnt, brushes sticking or worn	5. Clean commutator, renew brushes
6. Stator winding or armature broken or shorted	6. Renew stator or armature
7. Positive brush holder earthed	7. Eliminate shock-circuit or renew commutator end cover

Solenoid repetitive cutting in and out

1. Battery discharged	1. Recharge battery
2. Excessive voltage drop in solenoid power circuit caused by badly oxidized lead ends	2. Check leads and connections between battery and solenoid terminal 50
3. Solenoid holding winding broken or shorted	3. Renew solenoid

Starter motor armature rotates, flywheel inoperative

1. Overrun clutch slipping	1. Bench test starter motor, renew overrun clutch
2. Clutch operating lever broken or pivot shaft dropped	2. Renew lever or refit pivot shaft
3. One-way clutch guide ring or buffer spring broken	3. Renew clutch

Starter motor noisy

1. Starter motor retaining nuts loose or drive-end housing broken	1. Tighten retaining nuts or overhaul starter motor
2. Starter wrongly mounted	2. Check starter fitting
3. Bearing shells or armature shaft journals excessively worn	3. Renew starter motor
4. Stator pole loose (armature touches pole)	4. Tighten pole retaining screw
5. Pinion or ring gear teeth damaged	5. Renew drive or flywheel
6. Pinion fails to disengage ring gear:	6. Carry out the following:
- operating lever seized;	- renew operating lever;
- overrun clutch jams in mesh with armature shaft splines;	- clean and lubricate splines with motor oil;
- clutch or solenoid springs loose or broken;	- renew clutch or solenoid;
- clutch hub circlip lost;	- renew damaged components;
- solenoid armature sticking;	- renew solenoid or eliminate sticking
- ignition switch contact part faulty: pins 30 and 50 fail to open	- check correct contact closing at different key positions; renew faulty contact unit

Starter motor - bench testing

If the starter motor fails to operate effectively, check it using a tester. The wiring connections for the test are shown in Fig.7-15. The cross-sectional area of leads to power source, ammeter and starter solenoid terminal bolt should be at least 16 mm^2.

The starter motor test temperature should be (25±5)°C. The brushes must slide smoothly on the commutator.

Functional test. By closing switch 5 (Fig.7-15), operate the starter motor three times from a 12 volt source at different braking conditions, eg. at the braking moments of 2; 6 and 10 N•m (0.2; 0.6 and 1 kgf•m). The starter motor should be switched on for no longer than 5 seconds with minimum 5 second intervals in-between.

If the starter motor fails to turn the tester ring gear or produces unusual noise, dismantle the starter motor and examine its components.

Fully locked ring test. Lock the tester ring gear, operate the starter motor and measure the current, voltage and braking moment to be maximum 550 amps, 7.5 volts and at least 13.7 N•m (1.4 kgf•m) respectfully. Do not switch on the starter motor for over than 5 seconds.

When the braking moment is below, while the current is over the values specified, the likely reason is an internal short-circuit of the stator or armature winding or earthed winding.

When the braking moment and current are below the values specified, the possible cause is an oxidized or dirty commutator, severely worn brushes or weak springs, sticking brushes, loose stator winding terminals, eroded or burnt solenoid terminal bolts.

At fully locked condition, the starter armature must not turn; when otherwise the one-way clutch is faulty.

Dismantle the starter motor, replace or overhaul damaged components to remedy the situation.

No-load test. Disengage the tester ring gear from the starter motor pinion. Operate the starter motor, measure the current flow and armature shaft speed to be respectively maximum 60 amps and (5000±1000) rpm at 11.5-12 volts across the starter motor terminals.

If the amperage and drive shaft rpm readings differ from the values specified, the possible causes are likely to be the same as those for the test described above.

Solenoid test. Insert a shim of 12.8 mm between stop collar 21 (Fig.7-13) and pinion and operate the solenoid. The solenoid cut-in voltage, with the pinion resting against the shim, should not exceed 9 volts at ambient (20±5)°C. Any higher voltage indicates the solenoid or drive failure.

Starter motor relay. The relay cut-in voltage should not exceed 8 volts at (23±5)°C. When higher, it is an indication of a failed relay or drive.

Starter overhaul

Dismantling

Undo the nut on the lower solenoid terminal bolt and disconnect the stator winding lead. Undo the solenoid retaining nuts and remove the solenoid. Remove the end cap (Fig.7-16) from the pinion-end cover.

Unscrew and remove protective case 8. Recover lock ring 9, undo clamp bolts 12 and separate yoke 11 with housing 5 from housing 1 with armature 13.

Unscrew the brush holders from the stator winding leads, then separate the yoke from the commutator end housing. Extract springs 7 and brushes 6.

Undo the cotter pin and withdraw the lever and armature / actuator assembly, next disconnect the operating lever.

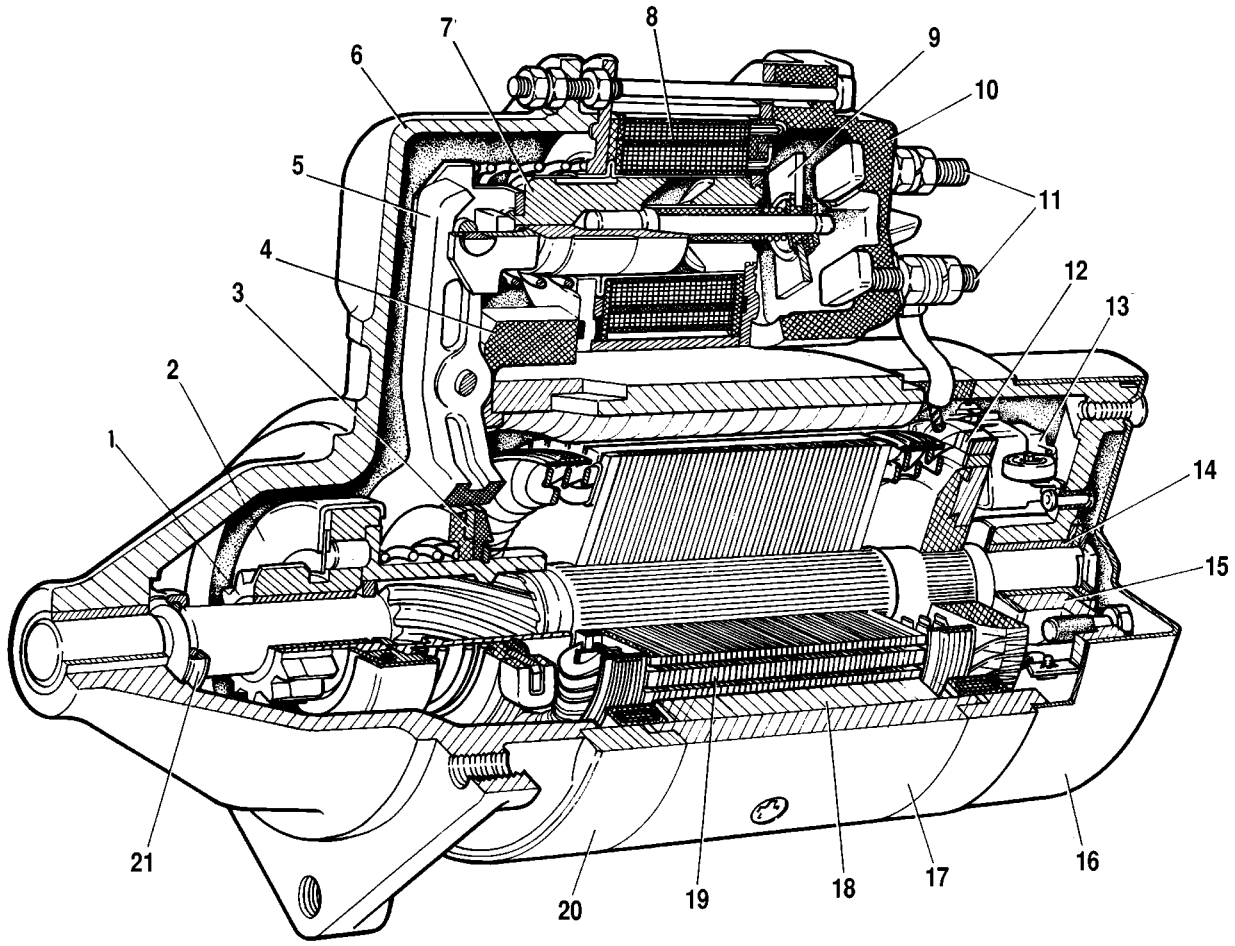


Fig.7-13. Starter motor (35.3708 model):
1 - pinion; 2 - overrun clutch; 3 - guide ring; 4 - rubber plug; 5 - operating lever; 6 - drive-end housing; 7 - relay armature; 8 - relay winding; 9 - contact plate; 10 - relay cover; 11 - terminal bolts; 12 - commutator; 13 - brush; 14 - armature shaft bush; 15 - commutator-end housing; 16 - end cover; 17 - housing; 18 - stator pole; 19 - armature; 20 - intermediate ring; 21 - stop collar

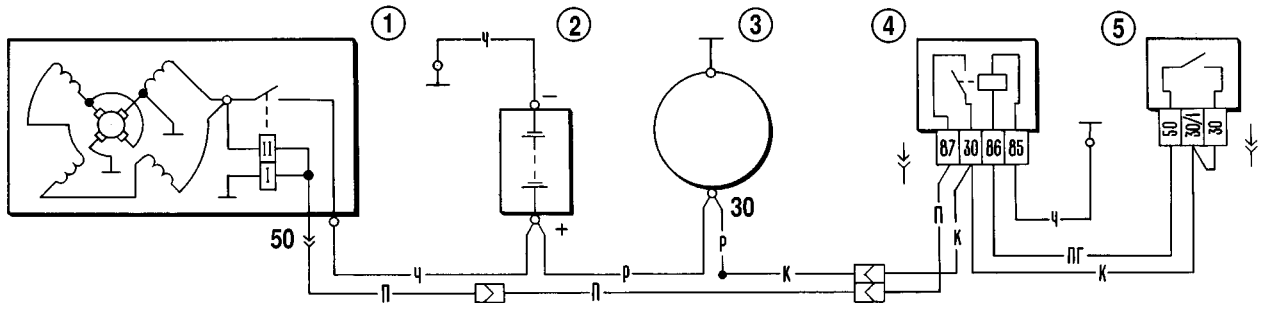


Fig.7-14. Starter wiring connections:
1 - starter motor; 2 - battery; 3 - alternator; 4 - starter cut-in relay; 5 - ignition switch

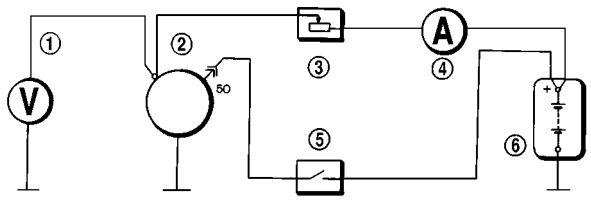


Fig.7-15. Wiring connections for starter motor testing:
1 - voltmeter with scale limit at least 15 v; 2 - starter motor; 3 - rheostat, 800 amps; 4 - amperemeter shunted to 1000 amps; 5 - switch; 6 - battery

To withdraw the actuator unit from the armature, retrieve the circlip from under stop collar 16. Dismantle the actuator unit after removing the lockwasher from the clutch hub.

To dismantle the solenoid, undo the clamp bolt nuts and unsolder the winding leads from terminal 50 and from the end which is secured at the bottom solenoid terminal bolt.

Once the starter motor has been dismantled, blow its parts with compressed air and wipe clean.

Components - inspection

Armature. Using a megohmmeter or a 220 v test lamp, check the armature for the earthed winding. The voltage through the test lamp is supplied to the commutator segments and armature core. An illuminated lamp is an indication of a commutator being shorted to earth. When using the megohmmeter, the reading should be at least 10 kOhms. Renew the earthed armature.

Using a specialized device, check for internal faults in the armature winding and commutator segments, check for loose connections where the winding wires are soldered to the commutator.

Inspect the commutator. When dirty or burnt, sand it with fine emery paper. Check the runout between the core and shaft journal. Renew the armature when the runout is over 0.08 mm.

Check the surfaces of splines and armature shaft journals. There should be no scuffs, scores or wear. In the event the shaft surface has yellow marks because of the pinion bush, remove the marks with the help of fine emery paper, since this can possibly cause a pinion jam in the shaft.

Actuator unit. The starter motor actuator unit should operate over the armature shaft smoothly, without jams. The pinion should turn on the armature shaft in the direction of the armature rotation at a maximum torque of 0.27 Н•м (2.8 kgf•cm).

The pinion is not supposed to turn in the reverse direction. If the teeth are scored, regrind them with a small-diameter fine abrasive disc.

When the drive-associated components are damaged or badly worn, renew the actuator assembly.

Stator. Using megohmmeter or a 220 v test lamp, check the stator winding is not earthed.

The test lamp voltage is supplied to the common winding terminal and starter housing. When the bulb is lit up or megohmmeter resistance reading is below 10 kOhm, or if the windings have evidence of overheating (blackened insulation), renew the housing complete with the windings.

Housings. Inspect the housings for cracks. If this is the case, replace the housings with new ones.

Examine the bushes. When they are worn, renew the complete housings or only the bushes. When the new bushes are pressed-in, ream them to 12.015+0.03 mm.

Make sure the brush holders are properly secured on the commutator end housing. The «positive» brush holders must not be earthed. The brushes should slide smoothly in the holder slots. Renew the brushes worn to 12 mm in height, but first run them in to the commutator.

Using the dynamometer, check the spring load at the brushes to be 9.8±0.98 N (1±0.1 kgf) for new brushes, renew the spring, when applicable.

Solenoid. Check the solenoid armature for smooth operation. Using ohmmeter, check the closing of the solenoid terminal bolts via a contact plate. When there is no contact, the solenoid should be dismantled and the terminal bolts to be sanded with fine emery paper or a superfine flat file.

You may turn the terminal bolts 180°C in case they are badly damaged at the contact point with the contact plate.

Reassembly

Assemble the starter motor in reversal of the dismantling procedure. Before reassembly lubricate the armature shaft splines and freewheel hub, pinion and housing bushes with motor oil. Lubricate drive guide ring with Litol-24 grease.

Protect the clamp bolt passing under the stator coils with an insulating plastic tube.

Select shim 10 thickness (Fig.7-16) to ensure maximum armature axial play of 0.5 mm. On reassembly, bench test the starter motor.

Ignition system

General description

The ignition system is breakerless. It comprises ignition distributor 5 (Fig.7-17), spark control module 3, ignition coils 4, spark plugs 6, ignition switch 1 with relay 2 (113.3747-10 model) and high-tension (HT) leads. The spark control module monitors the supply circuit of the ignition coil primary winding. Control pulses to the control module are generated by the Hall sensor housed in ignition distributor 6.

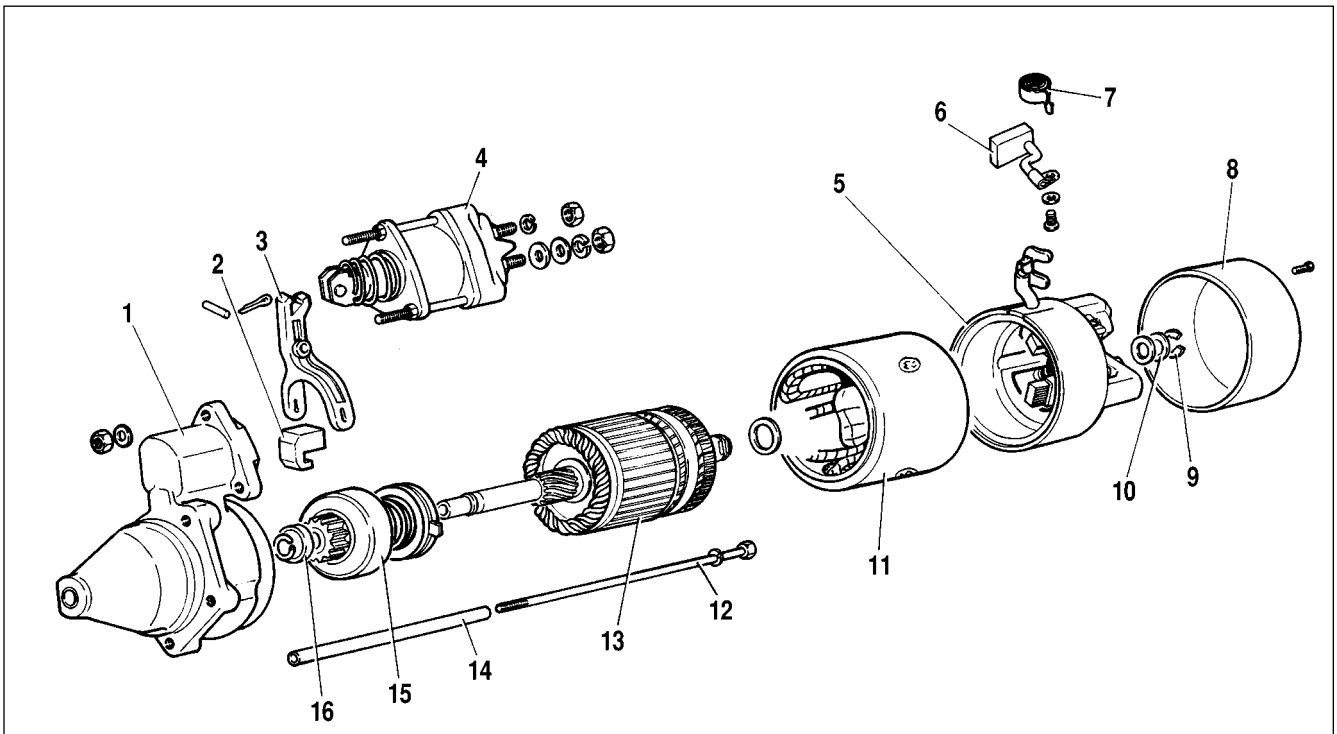


Fig.7-16. Exploded view of starter motor:
1 - drive end housing with intermediate ring; 2 - rubber plug; 3 - operating lever; 4 - solenoid; 5 - commutator end housing; 6 - brush; 7 - brush spring; 8 - protective case; 9 - stop ring; 10 - adjusting shim; 11 - yoke; 12 - clamp bolt; 13 - armature; 14 - insulating pipe; 15 - overrun clutch with pinion; 16 - stop collar

Ignition distributor is of 3810.3706 model, four-event sparking rate, non-shielded, with vacuum and centrifugal advance units, with built-in Hall sender.

Spark control module is of 3620.373 model, or 76.3734, or RT1903, or PZE4022, or K563.3747 model. The module processes the control output pulses from the Hall sender into current pulses for the ignition coil primary winding.

Ignition coil is of 8352.12, or 27.3705, or 027.3705, or 27.3705-01 model, oil-filled, sealed, open-loop magnetic circuit.

Spark plugs are of A17ДВРМ model, or A17ДВРМ1 model with suppressant chokes.

Ignition switch is of 2101-3704000-11 model, theft-deterrent.

Fault diagnosis

Cause	Remedy
Engine will not start	
1. Hall sender pulses fail to reach control module: - broken circuit between sender and control module; - Hall sensor faulty	1. Carry out the following: - check wiring and connections, renew damaged wires; - check Hall sensor using adapter and voltmeter; renew failed sensor
2. No pulses to primary winding: - broken circuit between control module and solenoid or control module and ignition coil; - control module faulty; - ignition switch or ignition relay failed	2. Carry out the following: - check wires and connections; renew damaged wires; - check control module with oscilloscope; renew faulty control module - check, renew faulty contact unit of ignition switch or ignition relay
3. No HT to spark plugs: - HT lead ends loose, broken off or oxidized; leads dirty or insulation damaged; - carbon brush worn or damaged, or has no contact with rotor arm; - tracking through cracks or burns in distributor cap or rotor, through damp or foul distributor cap inside; - distributor rotor resistor blown; - ignition coil damaged	3. Carry out the following: - check and restore connections, clean or renew leads; - check and when necessary renew carbon brush; - check, clean cap from moisture and carbon deposits, renew cap and rotor in case of cracks; - renew resistor; - renew ignition coil
4. Oily spark plugs or wrong electrode gap	4. Clean and regap spark plugs
5. Spark plug damaged (perished insulation)	5. Renew spark plugs
6. Wrong HT leads connection to distributor cap terminals	6. Reconnect leads as per firing order 1-3-4-2
7. Wrong ignition timing	7. Check and adjust ignition timing
Engine operates erratically or stalls at idle	
1. Ignition timing too advanced 2. Electrode gap excessive	1. Check, adjust ignition timing 2. Check, adjust electrode gap
Engine running unstable or irregular at high crankshaft speeds	
Weak weight springs in ignition distributor	Renew springs, run functional bench test of centrifugal unit

Engine gasps at all speeds

1. Ignition wires damaged, connections loose or lead ends oxidized	1. Examine leads and connections. Renew damaged leads
2. Electrodes worn or oily spark plugs, strong fouling; cracks in plug insulation	2. Examine plugs, regap spark plugs, renew damaged spark plugs
3. Carbon brush in ignition distributor worn or damaged	3. Renew carbon brush
4. Strong burning of central contact point on distributor rotor arm	4. Clean central contact
5. Cracks, fouling or burnings of rotor arm or distributor cap	5. Inspect, renew rotor or cap
6. Control module faulty - wrong waveform of ignition coil primary winding impulses	6. Check spark control module with oscilloscope, renew faulty control module

Engine lacking power or sluggish

1. Incorrect ignition timing	1. Check and adjust ignition timing
2. Jammed distributor weights, weak weight springs in ignition distributor	2. Examine and renew damaged parts
3. Spark control module faulty - wrong waveform of ignition coil primary winding pulses	3. Check spark control module with oscilloscope, renew faulty control module

WARNING. The vehicle is fitted with high energy transistorized ignition system with extended application of electronic components. Caution should be exercised to avoid personal injury or damage to electronics. Always observe the following rules.

Do not touch any ignition system parts (spark control module, coil or HT leads) when the engine is running.

Do not start the engine through a spark plug gap and do not check the ignition system through sparking between the ends of the spark plug leads and earth lead.

Do not route LT and HT ignition leads together within one wiring harness.

Always ensure the spark control unit is reliably earthed through the retaining dowels, or its trouble-free operation will be affected.

With ignition switched on, never disconnect the leads from the battery posts and never remove the connector from the spark control unit, since it may result in higher voltage to some components and damaged control module.

Ignition timing - adjustment

Refer to Attachment 3 for the advance angle BTDC at crankshaft speeds of 750-800 rpm.

To check the ignition timing there provided three marks - 1, 2 and 3 (Fig.7-18) on the timing cover and mark 4 in the crankshaft pulley, which corresponds to TDC of pistons No1 and No4 when aligned with mark 1 on the timing cover.

The ignition timing is best checked and adjusted by means of a stroboscopic timing light. Follow the procedure below:

- connect the timing light positive clamp to the battery positive post, earth terminal clamp to the battery negative post, connect the timing light terminal to No1 cylinder HT lead. Highlight in chalk timing mark 4 on the crankshaft pulley;

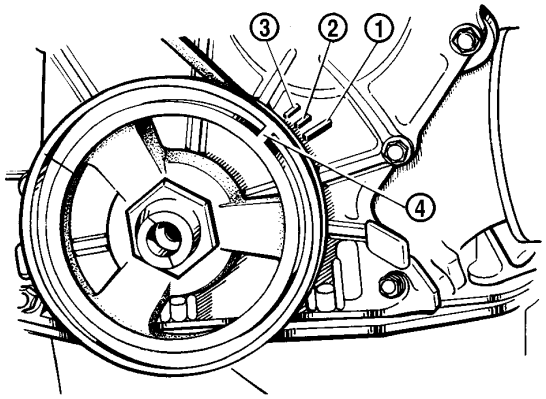


Fig.7-18. Ignition timing marks:
1 - TDC mark; 2 - 5°advance timing mark; 3 - 10° advance timing mark; 4 - TDC mark on crankshaft pulley

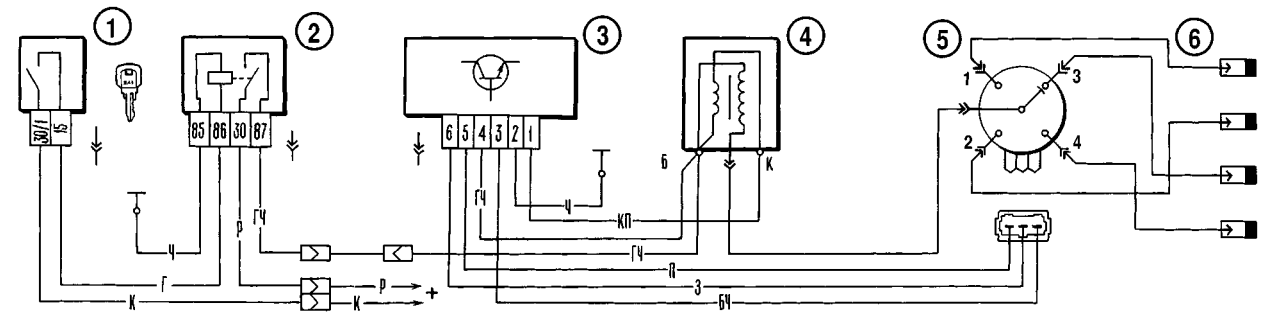


Fig.7 -17. Wiring diagram of ignition system:
1 - ignition switch; 2 - ignition solenoid; 3 - spark control unit; 4 - ignition coil; 5 - ignition distributor; 6 - spark plugs

- start the engine and point the flashing timing light at the timing mark on the pulley; when the ignition is correct, then at idling speed the TDC mark on the flywheel should be as outlined in Attachment 3.

To adjust the ignition timing, switch off the engine, slacken the nuts securing the ignition distributor and turn the latter to the angle desired (clockwise for advance and anticlockwise for retard when viewed from the distributor cap end). Tighten the nuts and recheck the ignition timing.

For easier ignition timing adjustment there provided the respective graduations and **(+)**/**(-)** marks on the distributor flange.

A graduation on the distributor flange corresponds to eight degrees (8°) of the crankshaft turn.

Another effective way for checking the ignition timing is to use an oscilloscope analyzer, when this tool is available.

Refit the distributor as following:

- turn the crankshaft to the position of compression beginning at No1 piston; then still turning the crankshaft, align mark 4 with mark 1;

- remove the distributor cap, turn the rotor arm so that its exterior contact faces the No1 piston contact on the distributor cap;

- holding the distributor driveshaft stationary, insert it to the cylinder block so that the axial line through the spring clamps is nearly parallel to the engine axial line;

- locate the distributor to the cylinder block, refit the distributor cap, reconnect the wiring, check and adjust timing ignition.

Ignition components - bench testing

Ignition distributor

The distributor of 3810.3706 model is shown in Fig.7-19.

Functional test. Mount the distributor on the tester intended for checking electrical devices. Connect it to a variable speed motor.

Connect the distributor terminals to the ignition coil, spark control module and battery of the tester similar to the wiring in the vehicle. Connect four terminals of the distributor cap to the spark box with adjustable gaps.

Set the spark gap to 5 mm, switch on the tester motor and operate the distributor driveshaft clockwise for some minutes at 2000 rpm. Increase the gap to 10 mm and check for internal discharges in the distributor. These can be recognized by specific sounds or weak or intermittent sparking in the tester spark box.

No noise should be produced by the ignition distributor at any driveshaft speed.

Automatic ignition advance control. Mount the ignition distributor on the tester and connect it to terminals 3, 5 and 6 of tester control module 1 (Fig.7-20). Connect control module terminal 4 to the tester «plus», while terminal 1 - to the tester «breaker» terminal. Set the spark gap to 7 mm.

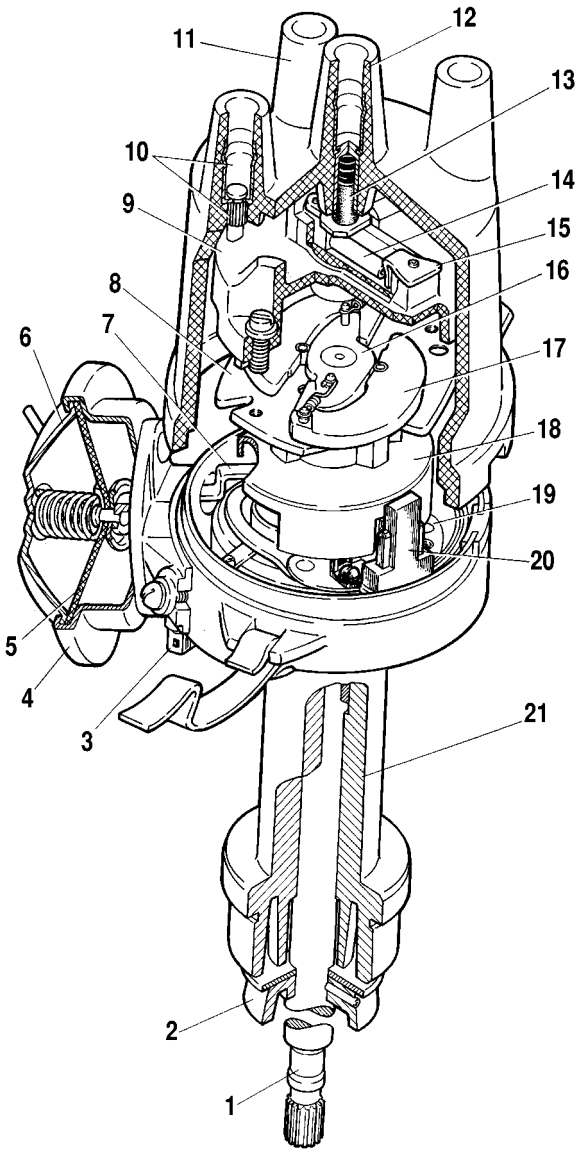


Fig.7-19. Ignition distributor (3810.3706 model):
1 - shaft; 2 - oil screen collar; 3 - connector; 4 - vacuum advance housing; 5 - diaphragm; 6 - vacuum advance cover; 7 - vacuum advance operating rod; 8 - bearing plate, centrifugal advance unit; 9 - ignition distributor rotor; 10 - side electrode and terminal; 11 - cover; 12 - centre electrode and terminal; 13 - centre electrode carbon brush; 14 - resistor; 15 - outside rotor contact breaker point; 16 - centrifugal advance unit plate; 17 - weight; 18 - screen; 19 - Hall sensor bearing plate; 20 - Hall sensor; 21 - ignition distributor body

Switch on the tester motor and operate the distributor shaft at 500-600 rpm. On the tester graduated disc note the angle at which one of the four sparkings occurs.

While increasing the speed in steps of 200-300 rpm and watching the disc, determine the advance angle with respect to the distributor shaft speed. Compare the resulting centrifugal advance pattern to that in Fig. 7-21.

When the pattern differs from that shown in Fig.7-21, it can be adjusted by bending the weight spring brackets of the centrifugal advance unit. Bend the thinner spring bracket for speeds

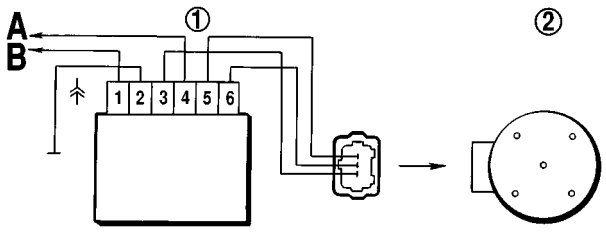


Fig.7-20. Checking the ignition distributor on the test bench:
1 - spark control module; 2 - ignition distributor; A - to test bench «plus» terminal; B - to test bench «breaker» terminal

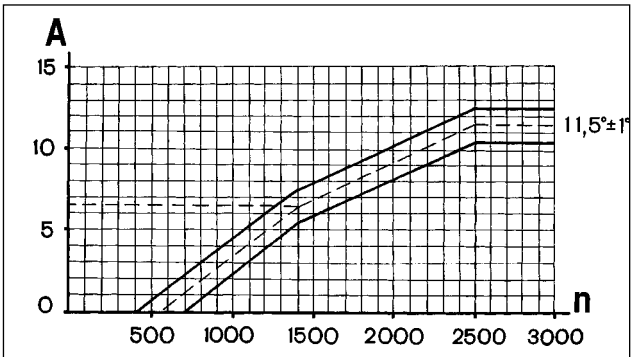


Fig.7-21. Centrifugal advance ignition distributor map:
A - advance timing, degrees; n - ignition distributor shaft speed, rpm

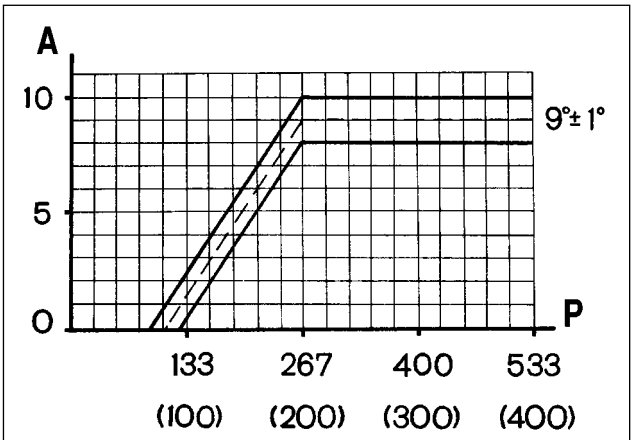


Fig.7-22. Ignition distributor vacuum advance map :
A - advance, degrees; P - vacuum gPa (mm Hg)

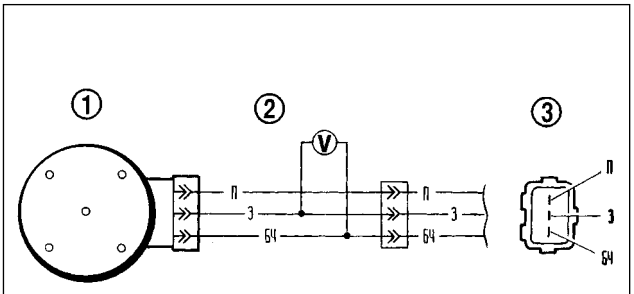


Fig.7-23. Wiring diagram for Hall sensor in-vehicle test:
1 - ignition distributor; 2 - adapter with voltmeter of at least 15 v scale and internal resistance of minimum 100 kOhm; 3 - view on ignition distributor connector

up to 1500 rpm or the thicker spring bracket for speeds over 1500 rpm. Increase the spring tension for a smaller angle (retard) or decrease the spring tension for a bigger angle (advance).

To obtain the vacuum advance pattern, connect the vacuum advance unit to the vacuum pump of the tester.

Operate the tester motor and run the distributor driveshaft at 1000 rpm. Watching the tester graduated disc, note the angle at which one of the four sparking events occurs.

Smoothly increase the vacuum through every 26.7 gPa (20 mm Hg) and make note of the advance angle with respect to the initial value. Compare the resulting advance pattern with that in Fig.7-22.

Note the Hall sensor mounting plate invariably returns to its original position after vacuum has been removed.

Hall sensor. The Hall sensor produces the output voltage if there is a steel vane in the air gap. The output is around zero volts when there is no vane in the gap.

With the distributor removed from the engine, the sensor can be tested as illustrated in Fig.7-24 at supply voltage of 8-14 volts.

While slowly rotating the distributor shaft, measure the output using a voltmeter. The voltage should change sharply between the low level (0.4 volt maximum) and the high level, which must be maximum 3 volts below the supply voltage.

The Hall sensor can be tested in the vehicle as shown in Fig.7-23. Adapter 2 and a voltmeter are connected across the distributor connector and wiring harness connector. Switch on the ignition and measure the sensor output with a voltmeter, while slowly rotating the crankshaft with a special tool. The output voltage readings should meet the specification.

Ignition coil

Check resistance of the winding and insulation.

For the ignition coil of 27.3705 model the resistance at 25°C should be 0.45±0.05 Ohm for the primary winding and 5±0.5 kOhm for the secondary winding. For the ignition coil of 8352.12 model the resistance of the primary winding is 0.42±0.05 Ohm, while that of the secondary winding is 5±1 kOhm.

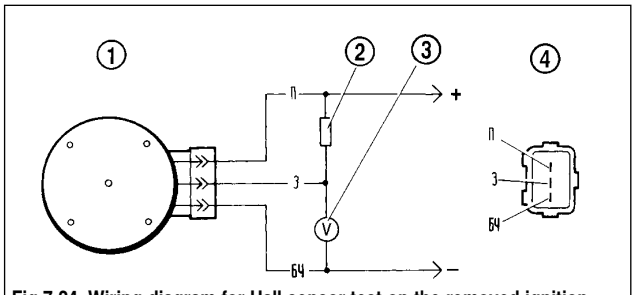


Fig.7-24. Wiring diagram for Hall sensor test on the removed ignition distributor:
1 - ignition distributor; 2 - 2kOhm resistor; 3 - voltmeter of minimum 15 v scale and minimum 100 kOhm internal resistance; 4 - view on the ignition distributor connector

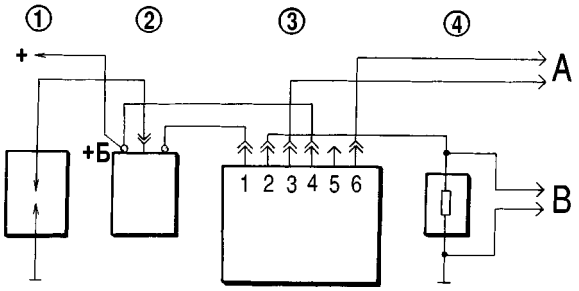


Fig.7-25. Checking the spark control module:
1 - spark gap; 2 - ignition coil; 3 - control module; 4 - 0.01 Ohm resistor (1%, at least 20 W); A - to square wave generator; B - to oscilloscope

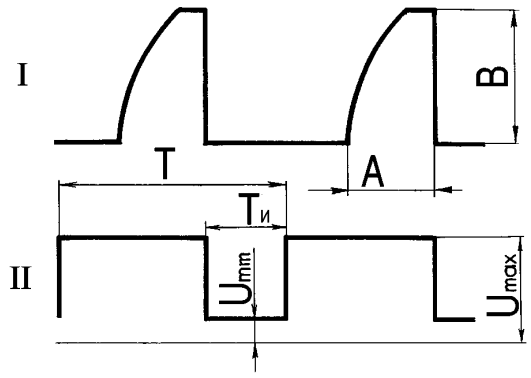


Fig.7-26. Displaying pulse waveform at the oscilloscope:
I - control module pulses; II - alternator pulses; A - dwell (current saturation time); B - maximum current; T - pulse period; Ти - pulse width

Resistance of the insulation to earth should be at least 50 MOhm.

Spark control module

The spark control module can be tested using an oscilloscope and square wave pulse generator connected as shown in Fig.7-25. The pulse generator resistance should be 100-500 Ohm. It is preferable to use a double-channel oscilloscope - the 1st channel is for the generator pulses, while the 2nd channel - for the control module pulses.

Square wave pulses, simulating those of the distributor sensor, are supplied to the module terminals 3 and 6. The pulse frequency should be within 3.33 - 233 Hz, while the duty cycle (period-to-pulse length ratio, T/Ти) should be set to 3. The maximum voltage (Umax) is 10 volts, the minimum voltage (Umin) should not exceed 0.4 volts (Fig.7-26, II). A sound control module should generate the pulses as shown in oscillogram I.

For 3620.3734 and 76.3734 modules at the supply voltage 13.5±0.5 volts, the current flow **(B)** should be from 7.5 to 8.5 amps. There is no standard dwell (current saturation) **(A)**.

For RT1903 module at the supply voltage of 13.5±0.2 volts and frequency of 25 Hz, the current flow is 7 to 8 amps, while the dwell is 5.5 to 11.5 milliseconds.

For PZE4022 module at the supply voltage of (14±0.3) volts and frequency 25 Hz, the current flow is 7.3-7.7 amps, while the dwell is not specified.

For K563.3747 module at the supply voltage of (13.5±0.5) volts and frequency 33.3 Hz, the current flow is 7.3-7.7 amps, while the dwell is not specified.

Any distortions in the pulse waveform can result in misfires or retarded ignition. The engine will tend to overheating and will not develop maximum power.

Spark plugs

If the spark plugs are foul or have deposits, then prior to testing clean them by means of a sand blasting machine and blow with compressed air. When the insulator nose is covered with light tan to greyish brown deposits, there is no need to clean them, as it is indicative that the mixture is correct and the engine is in good condition.

Once the plugs have been cleaned, examine them and set the correct spark gap. If the insulator is chipped, cracked or the side electrode weld is perished, renew the spark plug.

Check the spark plug gap (it is to be 0.7-0.8 mm) with a round wire feeler blade. It is not recommended to use a flat feeler blade since it is cannot account for erosion (cut-out) on the outer electrode which appears in course of operation. Bend, open or close, the outer (side) plug electrode only until the correct gap is achieved.

Leak test. Screw the plug into the seat on the tester and tighten it to a torque of 31.4-39.2 N•m (3.2-4 kgf•m). Build up the pressure of 2 MPa (20 kgf/cm^2) in the tester chamber.

Take an oil cup and place a few drops of oil or kerosine on the spark plug; the broken tightness is evident through the air bubbles between the insulator nose and metal plug body.

Electrical test. Insert the spark plug to the seat on the tester and tighten to the torque specified above. Adjust the gap between the spark box electrodes to 12 mm, which corresponds to 18 kvolts; afterwards, using a pump, build the pressure up to 0.6 MPa (6 kgf/cm^2).

Fit the end of the HT cable to the plug and apply HT pulses.

The spark plug is sound when a good spark is observed through the tester sight window. When sparking takes place between the spark box electrodes, decrease the pressure in the tester. Next recheck the pressure value when the spark jumps between the spark plug electrodes.

When sparking occurs at the pressure below 0.3 MPa (3 kgf/cm^2), the spark plug is defective.

Only a few sparks are allowed in the spark gap; when no sparking is observed either on the spark plug or in the spark gap, it is likely that the insulation is cracked and the central electrode arcs internally to earth. Always discard such spark plugs.

Ignition switch

Check the ignition switch contacts are closing properly at different key positions (Table 7-5) and theft-deterrent device is functional. The battery and alternator voltage is supplied to terminals 30 and 30/1. The vacant terminal «INT» is intended for radio/cassette player connection.

The steering lock pin moves out when the key is turned to position III «parking» and is then removed from the switch. The lock pin moves in after the ignition key is turned from position III «parking» to position 0 «ignition off». The key can only be removed from position III.

When inserting the contact part into the ignition switch housing, locate it so that terminals 15 and 30 are on the lock pin side (Fig.7-27), ensure the wider end of the contact part is well within the wider slot of the ignition switch housing.

Suppression components - testing

The following is used for interference suppression:

- 1 kOhm resistor in the distributor rotor arm;

- resistive HT cables of (2000±200) Ohm/m for red leads (ПВВП-8) or (2550±270) Ohm/m for blue leads (ПВППВ-40);

- 4-10 kOhm resistors in the spark plugs;

- 2.2 microfarad capacitor in the alternator.

The leads and resistors are checked with an ohmmeter. Refer to subsection «Alternator» for the capacitor checking procedure.

Lighting and signalling

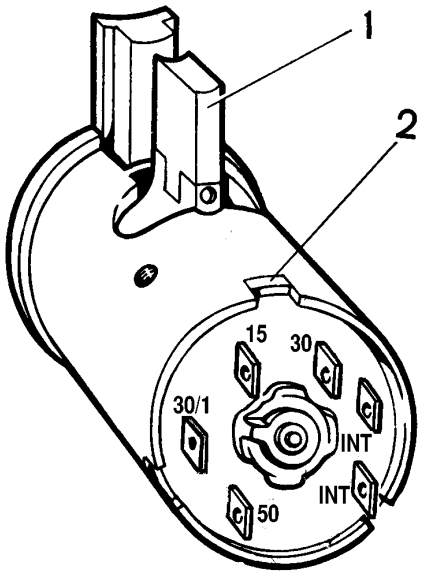


Fig.7-27. Ignition switch contact unit:
1 - lock pin; 2 - wider part of contact unit

Table 7-5

Circuits activated at different ignition switch positions

Position	Live contacts	Circuits activated
0 (Off)	**30 and 30/1**	–
I (Ignition)	**30-INT**	–
	30/1-15	Alternator field winding. Ignition system. Direction indicators. Instruments. Heater unit. Heated rear window. Wipers: windscreen, rear window, headlight .
II (Starter motor)	**30-INT**	–
	30/1-15	Refer to position **I**
	30-50	Starter motor
III (Parking)	**30-INT**	

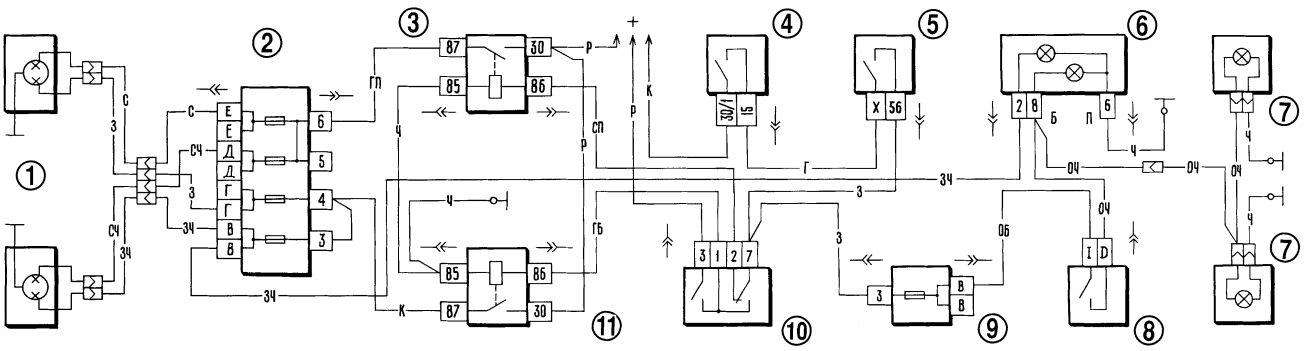


Fig.7-28. Wiring diagram for headlight and foglight:
1 - headlights; 2 - main fusebox; 3 - low beam relay; 4 - ignition switch; 5 - exterior light switch; 6 - warning lights: high beam (left) and fog lamp (right); 7 - rear fog light; 8 - fog light switch; 9 - complementary fusebox; 10 - headlight switch; 11 - high beam relay

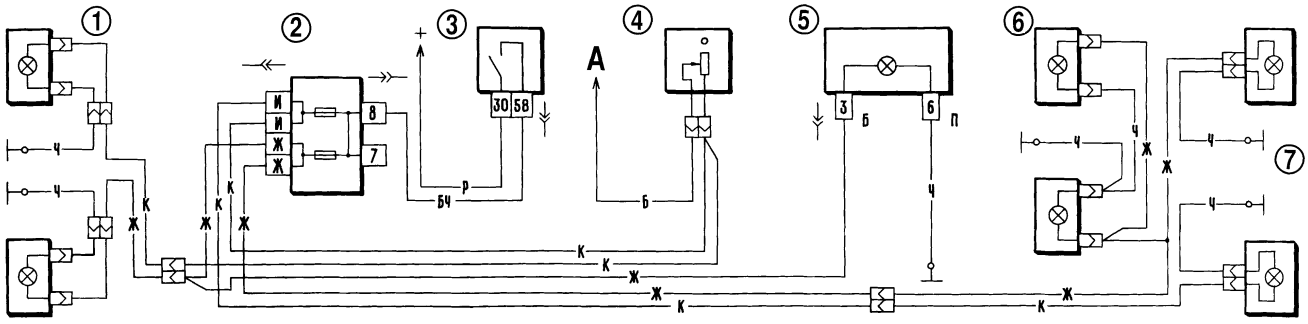


Fig.7-29. Wiring diagram for exterior lighting:
1 - sidelights in headlights; 2 - fusebox; 3 - exterior light switch; 4 - instrument illumination switch; 5 - exterior light warning lamp in instrument cluster; 6 - number plate lamp; 7 - sidelights in rear light units; A - to illumination lamps for instruments, switches and heater controls

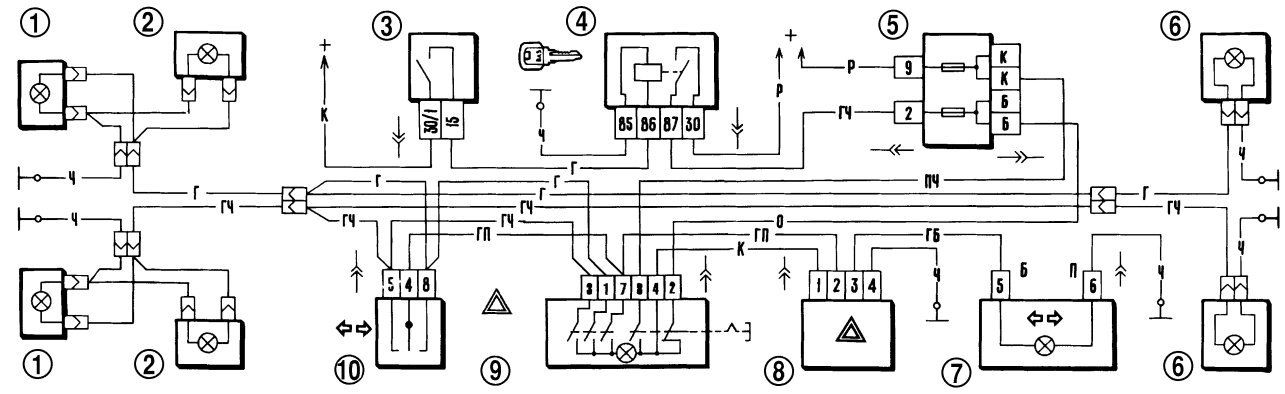


Fig.7-30. Wiring diagram for direction indicators and hazard flashers :
1 - direction indicators in headlights; 2 - side repeat indicators; 3 - ignition switch; 4 - ignition relay; 5 - fusebox; 6 - direction indicators in rear light cluster; 7 - direction indicators warning light in instrument cluster; 8 - indicators flasher relay; 9 - hazard warning flasher switch; 10 - direction indicators switch

General description

The headlight wiring diagram is shown in Fig.7-28.

High and low beam is operated through supplementary relays 3 and 11.

The control voltage to the relay winding is supplied from headlight combination switch 10 when external light push switch 5 is fully depressed.

Regardless the position of push switch 5, the high beam can be briefly switched on by pulling combination switch 10 for light signalling. By doing this, stalk switch 10 terminal is energized directly from the power source bypassing the ignition switch.

Some vehicles are fitted with the hydraulic headlight adjuster to align the headlight beam depending on the vehicle load.

The external light wiring diagram is shown in Fig.7-29.

The sidelights in the front and rear lights are operated by means of exterior light switch 3.

Number plate lamp 6, instruments and switch illumination lamps, sidelight warning lamp 5 are powered at the same time.

The wiring diagram for direction indicators/hazard warning flashers is shown in Fig.7-30.

The left-hand and right-hand direction indicators are operated with the help of steering column combination switch 10.

When operated, hazard flashing switch 9 activates all direction indicators.

Flashing is enabled by relay 8.Fault diagnosis

Cause	Remedy
Lights do not come on	
1. Fuses blown 2. Bulb filament blown 3. Switch or relay pins corroded 4. Damaged leads, corroded ends of leads, loose lead connections	1. Renew fuses 2. Renew bulbs 3. Clean contacts 4. Check, renew damaged leads, clean wire ends
Brake light inoperative	
Brake light switch inoperative	
Failure to switch between low and high beam	Check with a test lamp, renew faulty switch
1. Corroded pins of combination switch 2. High beam or low beam relay faulty	1. Renew 3- stalk switch 2. Check and renew relay
Steering column levers are inoperative	
1. Lever catch ball dropped 2. Lever catch recesses damaged	1. Renew 3-stalk switch 2. Detto
Turn signal self-canceling device inoperative	
1. Cancelling mechanism seized 2. Combination switch guide ring shoulders worn or broken	1. Renew 3-stalk switch 2. Detto
Steering column levers fail to switch between the positions	
1. Lever catch balls jammed 2. Self-cancelling device seized	1. Renew 3-stalk switch 2. Detto
Turn signal warning light inoperative	
1. Bulb filament blown 2. Indicators flasher relay faulty	1. Renew bulb 2. Renew relay
Direction indicator warning light flashes at higher rate	
1. Direction indicator bulb blown, front or rear 2. Indicators flasher relay faulty	1. Renew bulb 2. Renew indicators flasher relay

Headlight - adjustment

The headlight beams should be adjusted so that the area in front of the vehicle is properly illuminated and the drivers of the oncoming traffic are not dazzled with the dipped beam.

The headlights are adjusted by means of screws 1 and 7 (Fig.7-31) which allow to alter vertical and horizontal settings of the reflector unit.

Headlight beam alignment is best carried out using optical beam setting equipment. If it is not available, the adjustment can be done using a screen.

A fully laden and equipped vehicle with a load of 735 N (75 kgf) to represent a driver should be positioned on level ground facing a flat wall or screen (plywood board of approx. 2x1 m or similar) at a distance of 5 meters with the vehicle centre line being normal to the screen. Before marking-off the screen, make sure that the tyre pressures are correct; next swing the vehicle to settle the springs and shock absorbers.

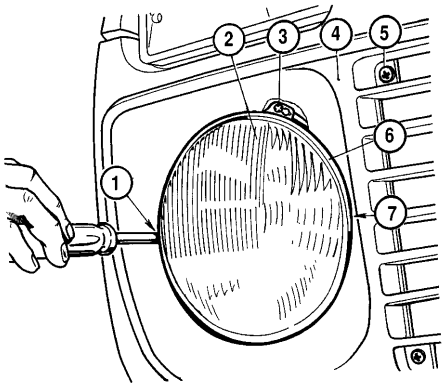


Fig.7-31. Headlight alignment:
1,7 - headlight beam adjustment screws; 2 - optical unit; 3 - retaining screw, optical unit rim; 4 - body front trim; 5 - trim retaining screw; 6 - optical unit rim

Three vertical lines should be drawn on the screen (Fig.7-32): centre line O and lines A and B through the reference points E corresponding to each headlamp center. These lines should run symmetrical to the centre line of the car. Draw line 1 at the height of 600 mm which is the distance to the centres from the ground and 75 mm below draw line 2 passing through the centres of the headlight beam patterns.

Make sure the facia-mounted switch of the headlamp aim adjustment system is in the position corresponding to the load of the driver only.

Switch on the lower beam. Using adjustment screws 1 and 7 (Fig.7-31), align the beams, first on the right-hand headlamp (while the other is covered with a piece of cardboard or dark cloth) and then on the left-hand headlamp (with the right-hand one screened).

To adjust the headlight beam in the vertical plane, turn screws 1 and 7 simultaneously in the same direction and to the same number of turns. The difference in turns between the screws (with the other screw intact) should not exceed 3 turns.

Horizontally the headlights are adjusted by means of screws 1 and 7, turned in opposite directions. If one screw is turned one turn clockwise, the other should be turned one turn anticlockwise.

Some vehicles can be fitted with the headlights without the hydraulic beam adjuster and have an alternatively mounted adjuster screws, when the horizontal adjuster screw is on the left, while that for vertical adjustment is fitted at the top.

If the headlights are correctly aligned, a cut-off at the top of the beam patterns must be at line 2 (Fig.7-32), while the intersection points of horizontal and angled lines should coincide with reference points E.

Bulb replacement

Headlight units. To replace a bulb:

- undo securing screws 5 and remove trim 4 (Fig.7-31);

- slacken screws 3 securing the headlight optical unit rim, turn the rim anti-clockwise to remove it;

- withdraw the headlight optical unit and renew a failed bulb;

- refit the optical unit so that the retaining lugs enter the recesses of the headlight inner rim.

Front lights. Undo two screws and remove the lens, then slightly depress the bulb and turn it anticlockwise to remove.

Direction indicator side repeater. To renew a failed bulb, first remove the holder complete with the bulb, working from the engine bay.

Interior lamp. To renew a blown bulb, gently pull the lens up. The lamp is held in the recess in the door centre pillar by two spring clips.

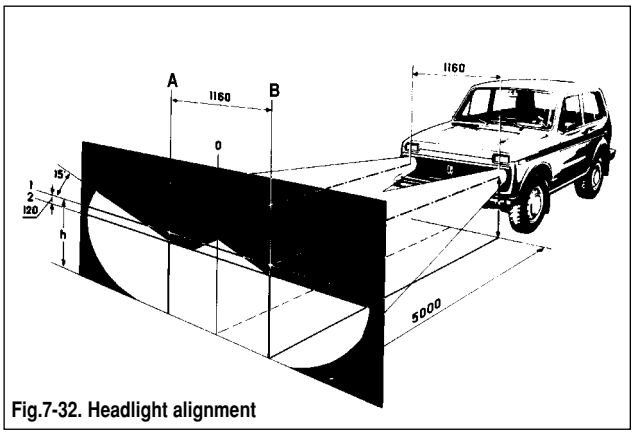


Fig.7-32. Headlight alignment

Rear light unit. To replace a failed bulb in the rear light unit, remove a plastic cap from the inside of the luggage compartment, disconnect the terminal connector, squeeze the retaining lugs and withdraw the base complete with the bulbs. Next depress the bulb, turn it anticlockwise and withdraw.

Number plate light. Undo the retaining screws, remove the light unit, detach the reflector lens and renew a blown bulb.

Hydraulic headlight adjuster

The hydraulic headlight adjuster system consists of the master cylinder, fitted to the instrument panel, working cylinders on the headlamps and connecting pipes. The cylinders and pipes are filled with non-freezing hydraulic fluid. The hydraulic adjuster is not serviceable and has to be renewed as a complete unit, together with the cylinders and pipes, in the event of a failure.

When the beam setting is disturbed and alignment by means of the adjustment screws on the headlight has failed, check the cylinders and pipes for leaks. Remove the working cylinders and check the rod travel to be (7±0.5) mm.

To replace a faulty headlamp adjuster, detach the pipe clips from the wiring clamps, remove the control knob from the master cylinder and undo the mounting nut. Detach the working cylinders from the headlight units and push them together with seals into the passenger compartment. Refit a new headlamp adjuster using the reversal of the removal procedure.

Steering column combination switch

The steering column switch is secured to the steering column support bracket with the help of the retaining strap.

Observe the following procedure when removing the steering column combination switch:

- remove the steering wheel;

- remove both steering column shrouds;

- remove the instrument cluster and disconnect the steering column switch wiring;

- release the retaining strap and withdraw the steering column switch.

Indicators flasher relay

Relay 8 (Fig.7-30) (231.3747 model) is intended for intermittent light signals both for direction indication and hazard flashing. It also allows to identify a failed bulb in the direction indicator. With good bulbs in the direction indication mode, the relay ensures flashing warning light 7. With a failed bulb in the direction indicators (blown bulb or broken bulb circuit), the direction indicator and relevant facia warning light start flashing faster.

The relay is secured under the facia by the bolt welded to the air intake wall. A faulty relay is not repairable and must be always replaced with a new relay.

The relay should ensure the direction indicators flashing at a rate of 90±30 cycles per minutes at 92 watt, ambient temperature of - 20 to +50°C and supply voltage between 10.8 and 15 volts.

Headlamp-on relay

The headlights are switched by means of relay 3 and 11 (Fig.7-28), model 113.3747-10, fitted below the instrument panel on the left. Similar relays are used to switch the rear window heating, headlight wipe/wash.

The relay cut-in voltage at (23±5)°C must not exceed 8 volts, the winding resistance should be (85±8.5) Ohms.

Horn

The vehicle is fitted with a horn of model 20.3721. The horn is located in the engine compartment behind the radiator grill.

The horn wiring diagram is shown in Fig.7-33.

When the volume is low or the horn emits harsh sound, adjust it using the adjustment screw on the horn body unit until a satisfactory sound is achieved.

In the event of the horn failure, inspect all connections and condition of the switch contacts.

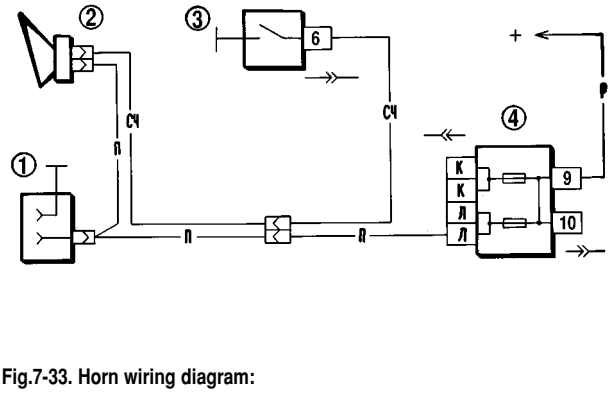


Fig.7-33. Horn wiring diagram:
1 - inspection lamp socket; 2 - horn; 3 - horn switch; 4 - fusebox

Windscreen wiper/washer

General description

The windscreen wipe/wash comprises motor, linkage and blades. The windscreen wipe/wash wiring diagram is shown in Fig.7-34.

There are two operating modes of the windscreen wiper: continuous operation and intermittent operation, ensured by a relay of PC-514 model.

A thermal bimetal fuse is provided to protect against the motor overheating in the event of the blades binding to the glass or resistance to sweep.

The washer pump is combined with the motor and is fitted to the washer fluid container in the engine compartment. The pump motor is operated by pulling up the right-hand lever of the steering column combination switch.

Fault diagnosis

Cause	Remedy
Inoperative wiper motor and bimetal fuse, non-blown fuse 2 in fuse and relay box	
1. Motor supply wires damaged, ends of wires in connectors corroded	1. Inspect and renew leads when found damaged. Clean wire ends
2. Wiper switch faulty	2. Renew 3-stalk switch
3. Motor brushes sticking, foul or burnt commutator	3. Inspect, eliminate wiper blades sticking or renew damaged components, clean commutator
4. Broken wires between motor brushes and connector	4. Check and when necessary solder wires
5. Bimetal thermal fuse damaged	5. Clean thermo-bimetal fuse contacts or renew it.
6. Motor armature winding lead broken	6. Renew armature or motor
Wiper motor inoperative, bimetal thermal fuse operative or fuse 2 in fuse box blown	
1. Wiper arms bent or conflict with bodywork	1. Examine, straighten wiper arms or renew windscreen wiper
2. Wiper blades stuck because of ice or snow	2. Detach blades from glass, taking care not to damage rubber
3. Foreign object in wiper mechanism	3. Check and remove foreign object if any
4. Short-circuit in motor armature winding	4. Renew motor or motor armature
Wiper motor fails to operate intermittently	
1. Wiper switch faulty	1. Renew 3-stalk switch
2. Wiper relay damaged:	2. Carry out the following:
- break in relay winding;	- renew relay;
- shorted wires in contact part;	- remedy short-circuit;
- clearance between relay breaker contacts	- eliminate clearance, renew relay when applicable

Continuous operation of wiper blades in intermittent mode

1. Wiper relay breaker winding blown	1. Renew wiper relay
2. Motor gear cam does not operate limit switch spring plate	2. Bend switch plate so cam can operate plate
3. Foul motor limit switch contacts	3. Clean limit switch contacts
4. Foul wiper relay breaker contacts	4. Clean breaker contacts or renew relay

Wiper stops in intermittent mode. Blades do not stop at park position

Motor limit switch contacts corroded or close incompletely	Clean switch contacts or bend limit switch plate

Blades inoperative with motor running

1. Motor gear teeth broken	1. Renew gear
2. Loose crank fitting to motor gear shaft	2. Check, tighten crank retaining nut in its end position

Windscreen wiper - removal and refitting

The repair of the wiper is basically restricted to straightening the deformed arms and rods or their renewal. A failed motor must be renewed. The overhaul of the motor is restricted to replacement of gears, cleaning of commutator and adjustment of limit switch. To remove the windscreen wiper:

- withdraw the blades complete with the arms, open the bonnet and disconnect the leads from the battery and wiper motor;

- undo the connector nuts and remove them together with washers and shims;

- undo the motor bracket retaining nut, withdraw the wiper.

When necessary, take the motor off the bracket and dismantle the linkage on the work bench.

Refitting is a reversal of the removal procedure.

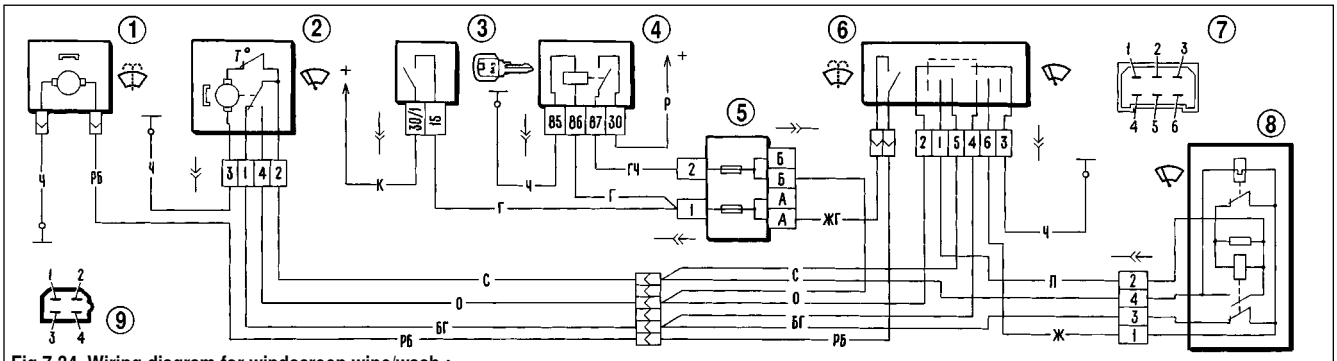


Fig.7-34. Wiring diagram for windscreen wipe/wash :

1 - windscreen washer motor; 2 - windscreen wiper motor; 3 - ignition switch; 4 - ignition relay; 5 - fusebox; 6 - windscreen wipe/wash switch; 7 - pin assignment of switch connector; 8 - windscreen wiper relay; 9 - pin assignment of wiper relay and motor connectors

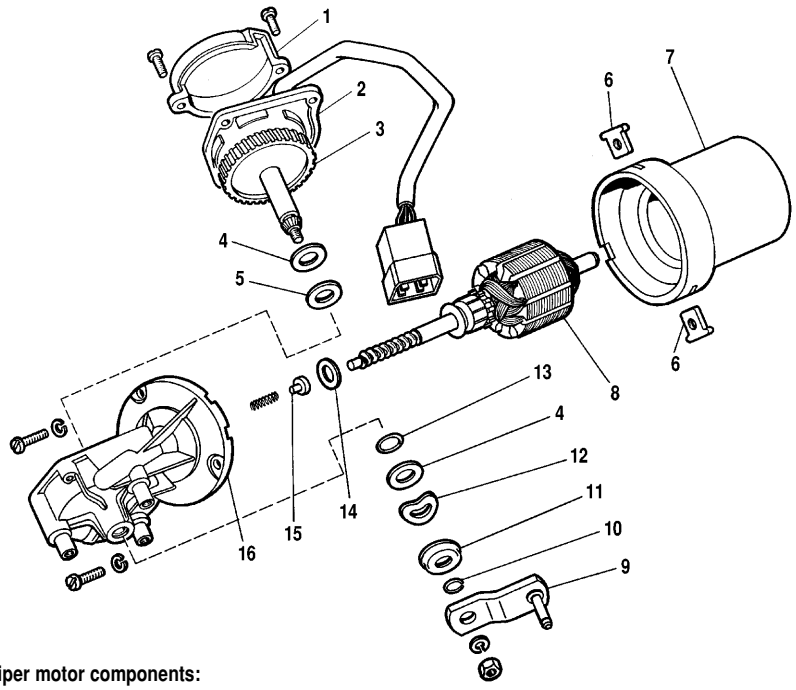


Fig.7-35. Windscreen wiper motor components:

1 - cover; 2 - panel; 3 - drive gear; 4 - steel washer; 5 - tekstolite washer; 6 - retainer; 7 - housing; 8 - armature; 9 - crank; 10 - circlip; 11 - protective cap; 12 - spring washer; 13 - sealing ring; 14 - shim; 15 - thrust washer; 16 - motor cover

Wiper motor - dismantling, reassembly and inspection

Commence to dismantle the motor by undoing cover 1 (Fig.7-35) retaining screws.

Remove the cover complete with plate 2. Next unscrew cover 16 from motor housing 7 and separate them. Extract armature 8 from the motor housing.

To remove motor gear 3, undo crank 9 retaining nut, retrieve the circlip from the spindle and withdraw the spindle complete with the gear and washers.

On completion blow the inside of the dismantled motor with compressed air to remove any carbon deposits; always inspect the brushes and commutator.

The brushes should slide freely without sticking in the brush holders, the springs should be good and sufficiently tense.

The commutator should be sanded with fine emery paper, then wiped with a cloth moistened in petroleum jelly.

If the commutator is badly burnt or worn, it is advisable to renew a complete motor.

Inspect the armature shaft ends for any traces of jamming. Sand them with fine emery paper, if applicable.

When reassembling, make sure the brushes are well clear off the commutator to prevent possible edge chipping or damage. Refit the armature into the motor housing with a particular care, avoiding hitting the magnets.

On completion, align the bearings by tapping the motor housing with a wooden mallet, then check the motor on the tester.

Wiper motor specification

Maximum operative drive spindle torque,* N•m (kgf•m) 2 (0.2)

*Consumption current **
at 1 N•m (0.1 kgf•m), not greater, amps 2.8
*Motor drive spindle speed**
at 1 N•m (0.1 kgf•m), at least, rpm 50

Starting torque of motor drive spindle,*
at least, N•m (kgf•m) 12 (1.2)

**** At 14 volts and ambient temperature of (25±10)°C, on a cold engine***

Windscreen wiper relay

The relay of PC-514 model is used for intermittent operation of the windscreen wiper. The relay is located beneath the instrument panel on the left-hand side and is attached to the body by means of two screws.

The relay must ensure 9 to 17 wiper cycles per minute at supply voltage of 10 volts and ambient temperatures of -20 to +50°C. The resistance of the electromagnet winding is (66±2) Ohm, while the breaker winding resistance is (23±1) Ohm.

When the wiper is activated for an intermittent operation (while the breaker bimetal plate is not warm enough), the wiper blades can make up to 4 continuous double sweeps.

Headlight wipe/wash

The headlight wipe/wash includes two (right-hand and left-hand) motors, arms and blades. The wiper arms and blades park at the bottom position. The motor unit is fitted with a thermal bimetal fuse for overload protection or 8 amps fuse in the motor yellow-black wire.

The headlight wipe motor unit is built as a complete unit, therefore it is not serviceable and is subject to renewal in case of failure.

The headlight washer pump motor is the same as that for the windscreen washer.

The wiring diagram for wipe/wash operation is shown in Fig.7-36. The headlight wipe/wash system is operated only with the headlights on by steering column lever 7, i.e. simultaneously with activation of the windscreen wipe/wash. Voltage is supplied to supplementary relay 3 winding, activating the relay. When the terminal «30» is powered through the exterior light switch (i.e. the headlights are on), voltage is supplied through the closed relay contacts to headlamp wipers 1 and to headlamp washer motor 2.

The headlamp wiper should operate at 45-60 rpm (double sweeps) at a load of 0.49 N•m (0.05 kgf•m), supply voltage of 12 volts, ambient temperature of (25±10)°C and maximum consumption current of 1.5 amperes.

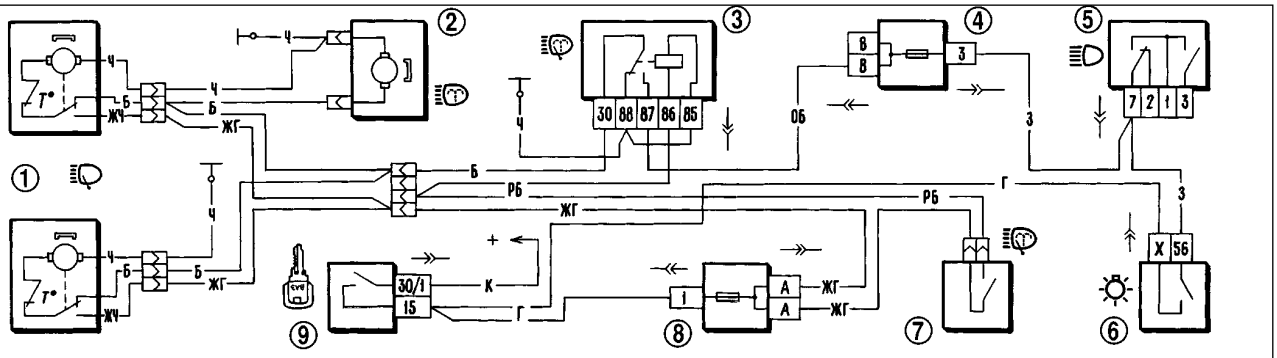


Fig.7-36. Wiring diagram for headlight wipe/wash:
1 - headlight wipers; 2 - headlight washer motor; 3 - headlight wipe/wash relay; 4 - complementary fusebox; 5 - headlight beam switch; 6 - external light switch; 7 - windscreen washer and headlight wipe/wash switch; 8 - fusebox; 9 - ignition switch

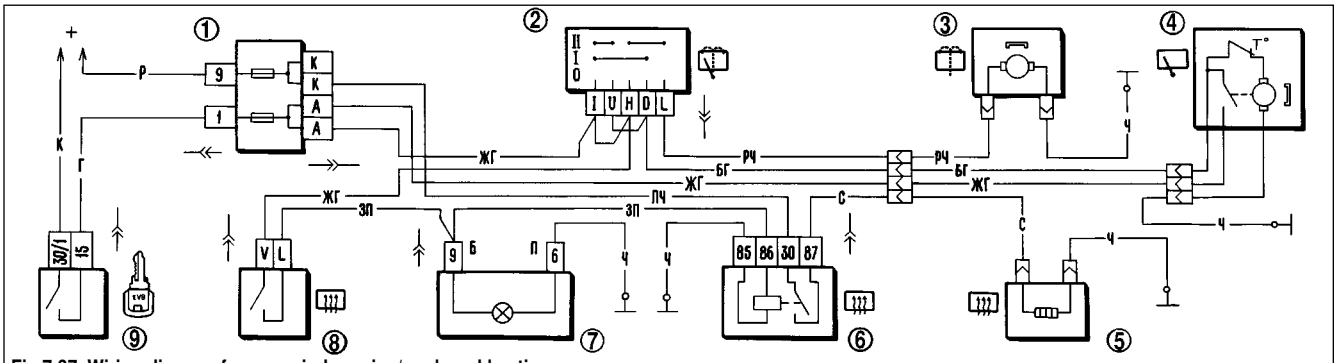


Fig.7-37. Wiring diagram for rear window wipe/wash and heating:
1 - fusebox; 2 - rear window wipe/wash switch; 3 - rear window washer motor; 4 - rear window wiper motor; 5 - rear window heating element; 6 - rear window heating relay; 7 -warning light of heated rear window; 8 - rear window heating switch; 9 - ignition switch

Rear window wipe/wash and heating, cigarette lighter

The rear window wiper includes a motor of 471.3730 model, arm and blade. The wiper arm and blade have a right-hand park position as viewed with the vehicle in forward motion. The motor has a thermal bimetal fuse for overload protection.

The washer motor integral with the pump is secured on the bracket to the left-hand bodyside panel.

The wiring diagram for rear window wipe/wash is shown in Fig.7-37. The wiper is activated by push-button 2 located at the left-hand side of the instrument panel. At the push-button middle position only the wiper is activated, while at a fully depressed push-button the rear window washer is operated too.

The motor design allows its dismantling to eliminate minor faults (commutator cleaning, etc.). Dismantling and reassembly methods are similar to those described earlier for the windscreen wiper motor.

The rear window wiper should operate at (50±5) rpm (double sweeps) at a load of 0.49 N•m (0.05 kgf•m), supply voltage of 14 volts, ambient temperature of (25±10)°C and maximum consumption current of 2 amperes.

The rear window heating is activated by switch 8 through supplementary relay 6 (113.3747-10 model), fitted at the left-hand side of the instrument panel. Refer to «Lighting and signalling» for details.

The cigarette lighter (11.3725 model) is provided with protection against extended operation (over 30 seconds) of the heating element by means of a fusible washer secured on the insulator at the rear of the cigarette lighter. When overheated the washer melts and closes the central lighter contact to earth. This results in a blown fuse No5 in the supplementary fuse box and disconnected cigarette lighter.

To restore the cigarette lighter operation, eliminate the cause of its lengthy operation, dismantle the cigarette lighter, remove the melted washer and fit a new safety washer.

Heater blower motor

It is a motor of МЭ-255 model, DC, on permanent magnets. The motor wiring diagram is shown in Fig.7-38.

For slower speeds there is supplemental resistor 4. The resistor is retained by two spring washers in the heater blower fan cowl. The resistance value is 1.5 Ohms at 20°C.

Always renew a faulty motor with a new one. The only repair possible is the commutator cleaning.

To dismantle the motor, undo the retaining screws to remove the cover. Then retrieve the lock washer from the armature shaft and withdraw the armature from the housing. The reassembly is carried out in the reverse order to the dismantling.

Inspect the motor in the way similar to that for the windscreen wiper motor.

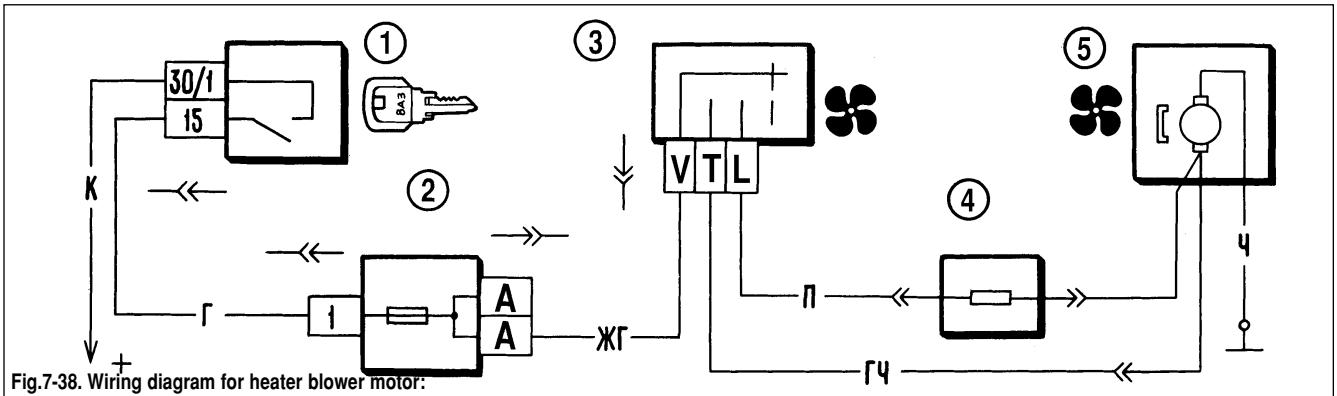


Fig.7-38. Wiring diagram for heater blower motor:
1 - ignition switch; 2 - fusebox; 3 - heater blower switch; 4 - supplemental resistor; 5 - heater blower motor

Blower motor specification

Shaft speed (with fan impeller load)

at 12 v and (25±10)°C, rpm . . . . . .3000±150

Consumption current at the load and

rpm as above, ampere, not greater 4.5

Fault diagnosis

Cause	Remedy
Motor does not operate	
1. Wires damaged or wire connections corroded	1. Check and restore connections. Renew damaged wiring
2. Blown fuse 1 (in fuse and relay box unit)	2. Renew blown fuse
3. Heater switch damaged - no voltage across switch terminals	3. Check switch, renew when applicable
4. Motor brushes stuck or worn, armature winding broken or commutator foul	4. Check motor, overhaul or renew as applicable
5. Armature winding shorted to earth - fuse blows at motor cut-in	5. Renew motor
Motor is restricted to one speed	
1. Wires damaged or wire connections corroded	1. Renew damaged wires, clean wire ends
2. Heater switch damaged	2. Renew switch
3. Supplemental resistor blown	3. Renew resistor
Slower motor armature rotation	
1. Dirty or corroded commutator, brushes worn	1. Clean commutator, renew brushes
2. Internal earthing in armature winding	2. Renew motor
3. Armature shaft seized in bearings	3. Dismantle motor, clean shaft journals

Instruments

General description

All gauges and warning lights are grouped within the instrument cluster. The instrument cluster includes a speedometer with trip counter, coolant temperature gauge, fuel gauge, tachometer, voltmeter with LED and 12 warning lights. In 1996 the voltmeter was replaced with the low battery warning light.

The instrument cluster is held to the dashboard by two nuts. The connections for instrument cluster are through the printed circuit board which is fitted to the back of the housing. The wiring diagram for the instrument cluster is shown in Fig.7-39 (pre-1996) and Fig.7-40 (1996-on).

The speedometer incorporates two trip recorders: total mileage odometer and trip counter. The trip counter can be reset to zero by pushing the reset knob in the instrument cluster. Reset the trip counter only on a stationary vehicle turning the knob clockwise.

WARNING. To avoid damage to the instrument cluster glass, never use solvents for its cleaning.

Fault diagnosis

Cause	Remedy
Temperature gauge or fuel gauge inoperative	
1. Gauge faulty	1. Renew gauge or instrument cluster
2. Sender unit faulty	2. Renew sender unit
3. Wires damaged or wire ends corroded	3. Check wiring, restore connections
Fuel gauge at zero with full tank	
Float stop set incorrectly (beyond resistor winding)	Bend stop 1-2 mm down
Fuel gauge needle moves erratically and frequently drops to zero	
1. Poor contact between sender resistance and current collector	1. Bend current collector
2. Sender resistor winding broken	2. Renew sender
Fuel reserve warning lamp stays on	
Sender lead earthed	Check, eliminate earthing
Warning light failure	
1. Bulb blown	1. Renew bulb
2. Warning light switch faulty	2. Renew switch
3. Wires broken, wire ends corroded	3. Renew damaged wires, clean wire ends
4. Poor bulb holder contact with PCB	4. Bend bulb holder contacts or renew bulb holder
Speedometer inoperative	
1. Loose speedometer cable ends retaining nuts	1. Check, tighten nuts
2. Cable broken	2. Renew cable
3. Speedometer mechanism damaged	3. Renew speedometer
Noise from speedometer cable	
1. Outer cable broken (dents, twists, etc.)	1. Renew cable
2. Cable routed with bending radius less than 100 mm	2. Route cable correctly

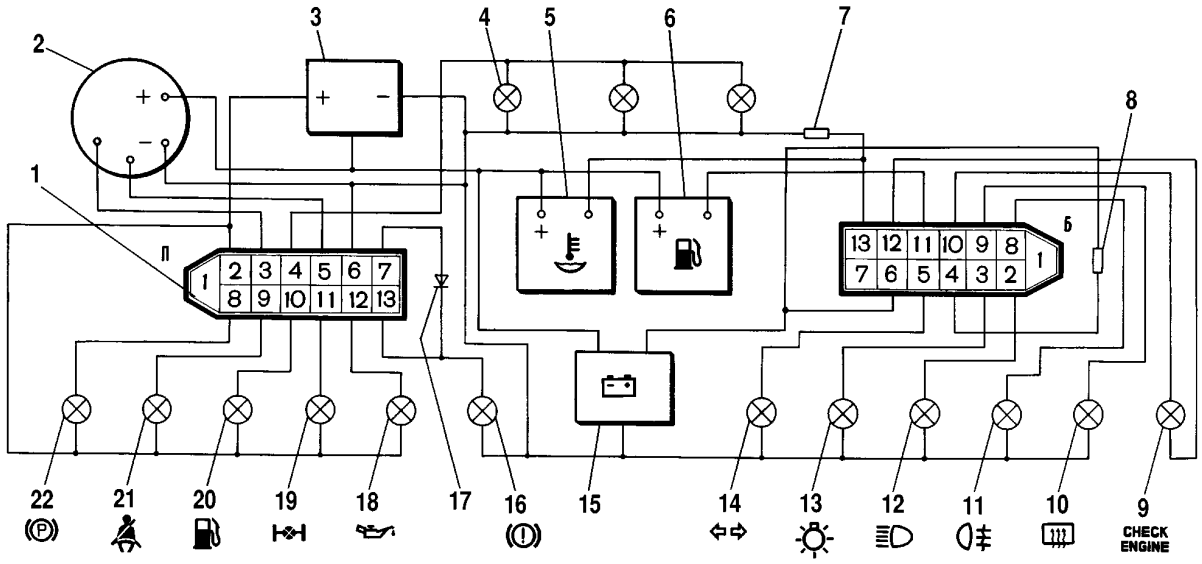


Fig.7-39. Wiring diagram for pre-1996 instrument cluster (rear view):
1 - wiring connector and pin assignment; 2 - tachometer; 3 - voltage stabilizer; 4 - instrument illumination lamp; 5 - coolant temperature gauge; 6 - fuel gauge; 7 - resistor, 470 Ohm, 0.25 W; 8 - resistor, 36 Ohm, 5 W; 9 - warning light, exhaust emission system; 10 - heated rear window warning light; 11 - foglamp warning light; 12 - high beam warning light; 13 - external light warning lamp; 14 - direction indicator warning light; 15 - voltmeter; 16 - low brake fluid warning light; 17 - diode IN4002; 18 - oil pressure warning light; 19 - differential lockup warning light; 20 - fuel reserve warning light; 21 - seat belt reminder; 22 - handbrake-on warning light

Instrument cluster - removal and refitting

The instrument cluster is removed as follows:

- disconnect the battery negative lead;

- undo the screws holding the facia, pull the bottom edge of the facia and release the top catches;

- undo the two securing nuts and withdraw the instrument cluster from the facia;

- disconnect the wiring and speedometer drive cable.

Refitting is the reversal of the removal procedure.

Take precautions not to loop or twist the cable which can result in the outer cable permanent set.

No sharp bends of the drive cable should be evident after refitting. The permitted drive cable bending radius is 100 mm as a maximum.

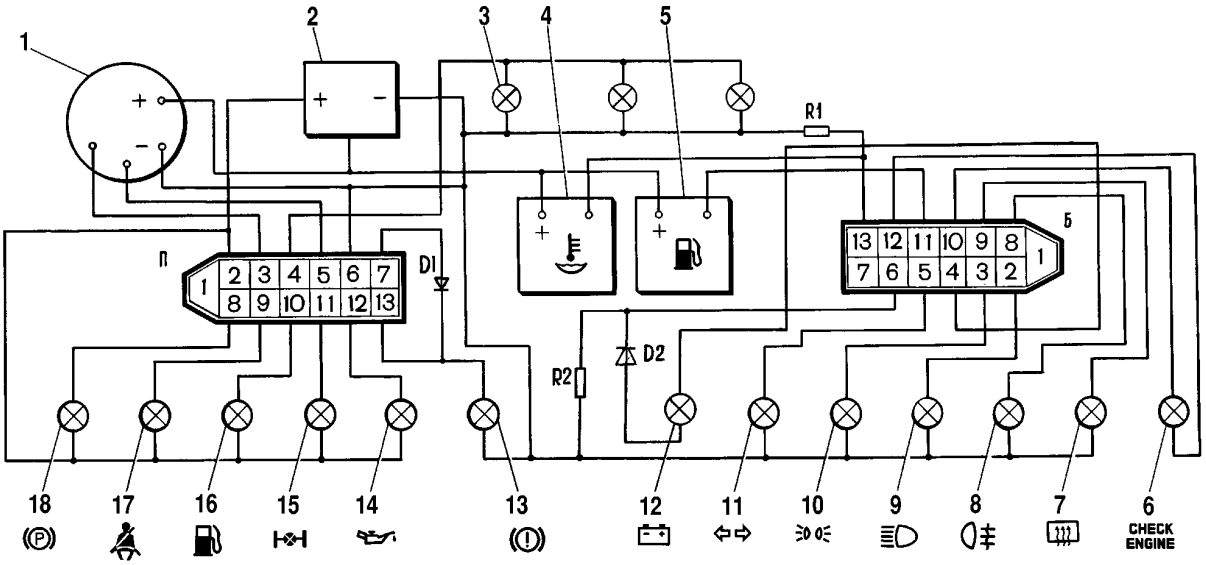


Fig.7-40. Wiring diagram for 1996-on instrument cluster (rear view):
1 - tachometer; 2 - voltage stabilizer; 3 - instrument illumination bulb; 4 - coolant temperature gauge; 5 - fuel gauge; 6 - warning light, exhaust emission system; 7 - heated rear window warning light; 8 - foglight warning lamp; 9 - high beam warning light; 10 - external light warning lamp; 11 - direction indicators warning light; 12 - voltmeter; 13 - low brake fluid warning light; 14 - low oil pressure warning light; 15 - differential lockup warning light; 16 - fuel reserve warning light; 17 - seat belt reminder; 18 - handbrake-on warning light; D1, D2 - diodes IN4002; R1 - resistor, 470 Ohm, 0.25 W; R2 - resistor, 51 Ohm, 5 W

Instrument cluster - dismantling and reassembly

Undo the trip counter knob by pulling it outward, then remove the surround and glass, having first released its bottom edge from the retaining spring wire. Undo the nuts holding the instruments to the PCB and withdraw the instruments.

Reassembly is the reverse of the dismantling procedure.

Instruments - fault diagnosis

Coolant temperature gauge

If the gauge needle constantly stays at the low end of scale, switch on the ignition, disconnect the lead from the gauge and connect its end to earth through a resistor of 20 - 50 Ohm.

If the needle swings, the gauge is faulty and must be renewed. If the needle does not move, remove the instrument cluster, and without disconnecting its wiring, pull out the red connector, then with the ignition switched on, earth terminal 13 (Fig.7-39) of the instrument cluster white connector through the 20-50 Ohm resistor. The needle swings if the gauge is sound but the wire between the sender and the instrument cluster is damaged. When the needle does not swing, renew the coolant temperature gauge or the complete instrument cluster.

When the needle stays in the red area, then with the ignition switched on, disconnect the sender wire. The sender is faulty if the needle returns to the low end of scale. If the needle remains in the red area, then either the lead is earthed or the gauge is damaged. The gauge can be checked through disconnecting the white terminal connector from the instrument cluster. With the ignition switched off, the needle should be at the low end of the scale.

Fuel gauge

The checking procedure for the fuel gauge is similar to the one described earlier.

If the needle stays at the low end of the scale and does not move when the pink wire is disconnected from the gauge and earthed, check the fuel gauge. To do this, remove the instrument cluster, disconnect the white wiring connector, then with the ignition switched on, earth terminal 11 of the instrument cluster white connector through a resistor of 20-50 Ohm. If the gauge is sound, the needle moves.

If the needle always stays at the high end of scale, check the gauge through disconnecting the instrument cluster white connector. If the gauge is sound, the needle returns to the low end of scale with the ignition switched on.

Instruments - checking

Coolant temperature gauge. The gauge is associated with a sender in the cylinder head. At 700 Ohm the needle should be at the low end of the scale, while at 77-89 Ohm it should stay at the beginning of the red area of scale.

Fuel gauge. The gauge is coupled with a sender in the fuel tank. The sender is used to operate the fuel reserve warning light when only 4 to 6 litres of petrol are left in the fuel tank.

The sender resistance of 238-262 Ohm corresponds to the «empty» reading, 59-71 Ohm - to the half filled tank reading (needle is in the middle of the scale), while 7-23 Ohm - to the «full» reading (mark 1).

Speedometer. Check the speedometer by rotating its drive shaft at various speeds. The speedometer specification is shown in Table 7-6.

Table 7-6

Speedometer checking data

Drive shaft speed, rpm	Speedometer reading, km/h
500	31-35
1000	62-66.5
1500	93-98
2000	124-130
2500	155-161.5

Tachometer. The tachometer measures the frequency of voltage pulses in the ignition primary circuit.

Check the speedometer on a tester unit which simulates the vehicle ignition system. Connect the tachometer to the tester circuitry as it done in the vehicle, set the primary circuit voltage to 14 volts and the spark gap in the tester to 7 mm. Turn the distributor shaft so that the tachometer needle reaches one of the main graduations of the scale. At this moment check the distributor shaft speed variation is within +250 to -70 rpm.

Voltmeter. The voltmeter was fitted to the vehicles before 1996, then it was replaced by the low battery warning light; refer to Fig.7-4 for the relevant wiring diagram.

Check the voltmeter by applying a known voltage. At voltage below (11.3±0.35) volts the voltmeter LED should light steadily. When the voltage is between (11.3±0.35) volts and (16±0.35) volts, the LED should not light. When the voltage is above (16±0.35) volts, the LED should flash. The voltmeter operates with a 5 second delay.

Switches and senders

Coolant temperature sender. The sender has an integrated thermal resistor which resistance alters depending on the coolant temperature. The sender specification is shown in Table 7-7.

Table 7-7

Coolant temperature sender specification

Temperature, °C	Supply voltage, volts	Resistance, Ohm
30	8	1350-1880
50	7.6	585-820
70	6.85	280-390
90	5.8	155-196
110	4.7	87-109

Low oil pressure warning light switch. The switch is fitted to the cylinder head. The switch contacts should close and open at 20-60 kPa (0.2-0.6 kgf/cm^2).

Fuel gauge sender. The sender unit is located in the fuel tank and is secured by nuts. The sender has an alternating Ni-Cr wire resistor. The resistor slide contact is operated by the float lever. Another slide contact, fitted to the shorter end of the lever, triggers the fuel reserve warning lamp, when only 4 to 4.6 litres of petrol are left in the tank.

The sender resistance should be (250±12) Ohm for an empty tank, (66±6) Ohm for a half filled tank and (20±3) Ohm for a full tank.

Handbrake-on warning lamp relay. The relay of PC-492 model is intended for intermittent light of the handbrake «on» warning lamp. It is fitted to the wires on the left-hand side beneath the instrument panel.

The number of the relay ons/offs per minute should be in the range of 60-120 at 10.8 to 15 volts within -40 to +40°C. The winding resistance is 26 Ohm.

The relay of PC-492 model is out of use starting from 1995, therefore when the handbrake is applied, the warning lamp lights steadily.

Carburettor solenoid - control Electronic control unit - testing

Sound electronic control unit 4 (Fig.7-41) should cut off solenoid 5 when the engine speed reaches 2100 rpm and operate it when the engine slows down to 1900 rpm, if the idle switch is earthed.

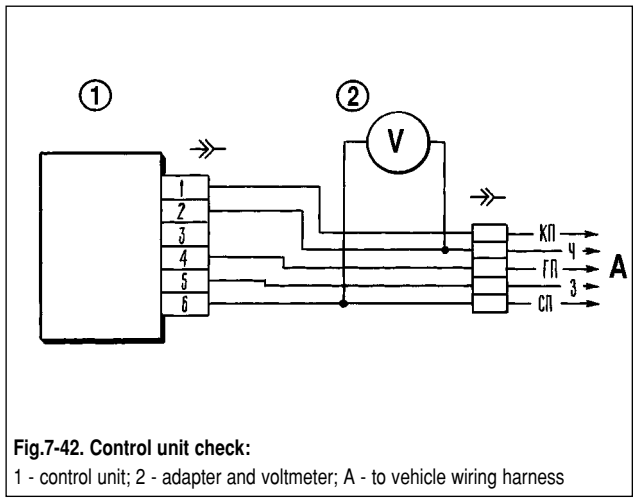


Fig.7-42. Control unit check:
1 - control unit; 2 - adapter and voltmeter; A - to vehicle wiring harness

Start testing the control unit with checking its correct wiring.

Check the control unit operation using a voltmeter (ranged 0-15 volts) in the following sequence:

- disconnect the green wire from the idle switch and earth the wire end;

- connect the voltmeter to the control unit using special connector 2 (Fig.7-42);

- start the engine and let it running, gradually increase the speed while observing the voltmeter readings: after start-up the voltmeter should read at least 10 volts with an instantaneous drop as low as 0.5 volts at the moment the solenoid shuts off;

- once the solenoid is shut off, gradually decrease the engine speed until the solenoid cuts in again - there should be an instant surge in voltage to 10 volts at least;

- run the engine at 2200-2300 rpm, disconnect the carburettor idle switch earth lead and then reconnect it. The solenoid should cut in when the earth wire is disconnected and cut off when the wire is reconnected to earth.

Note. *The control unit can be checked without a voltmeter by audible clicks the solenoid produces at cut-in or cut-off.*

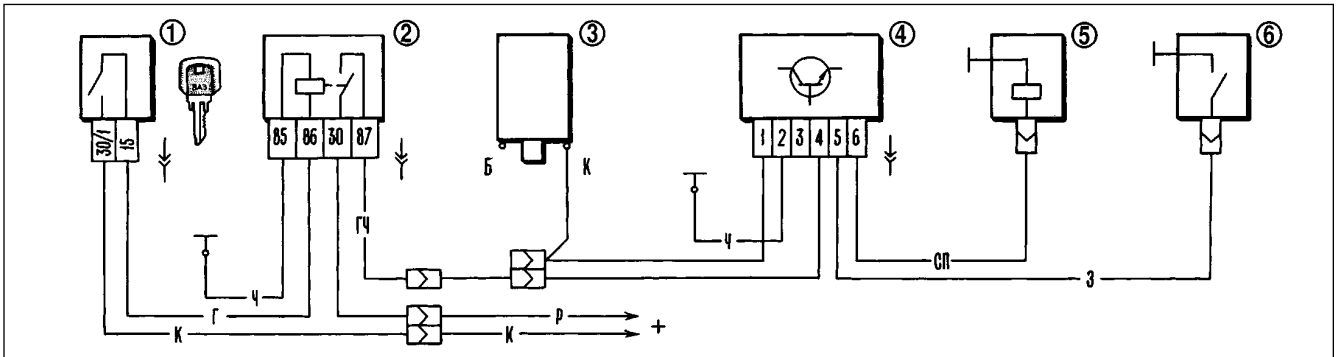


Fig.7-41. Fuel cutoff solenoid control system wiring diagram:
1 - ignition switch; 2 - ignition solenoid; 3 - ignition coil; 4 - control unit; 5 - fuel cutoff solenoid; 6 - idle switch

Chapter 8. Bodywork

Fault diagnosis

Cause	Remedy
Dark spots over bodywork	
1. Hot water was used for washing (above 80°C) 2. Leaded petrol or other aggressive agents were used for dewaxing	1. Remove minor blemishes through buffing, respray body in case of major deterioration 2. Respray body
Pink spots over light painted surfaces	
Deterioration by coolant	Polish affected areas
Lighter spots over dark painted surfaces	
Deterioration by moisture due to prolonged vehicle storage under an air-tight cover	Buff affected areas, respray body, if applicable
Dull shine	
1. Dry cloths were used for cleaning 2. Extended exposure to the sun 3. Aggressive cleaners were used for bodywork washing	1. Buff affected areas, respray body, if applicable 2. Buff affected areas, respray body, if applicable 3. Buff affected areas, respray body, if applicable
Water penetration into passenger compartment	
1. Excessive or irregular clearance over door aperture 2. Crumpled metal structure of door seal 3. Windscreen seal leaking 4. Heater air box drain valve is squeezed by vacuum servo unit hose	1. Centralize door and adjust door lock striker position, adjust door aperture flange 2. Renew seal 3. Put 51-Г-7 sealant under outer seal lug 4. Properly route servo unit hose
Excessive efforts to open door	
1. Door lock striker retainer pivot shaft bent 2. Striker retainer worn 3. Door position incorrect	1. Renew pivot 2. Renew retainer 3. Adjust door position
Failure to lock door by key or locking knob	
Top end of lock outer control lever butts against exterior handle shoulder	Bend lever top end away of handle shoulder to have 0.5-2.0 mm clearance
Failure to unlock door with exterior handle	
Excessive clearance between exterior handle shoulder and top end of lock exterior linkage	Bend lever top end to handle shoulder to have 0.5-2.0 mm clearance
Failure to lock door	
1. Broken or weak spring of lock central shaft or external control lever 2. Loose riveting of external operating lever shaft. On closing the lever lug fails to engage ratchet due to lever misalignment 3. Seized exterior control lever due to dust or grease coking	1. Renew lock 2. Remove lock and ensure reliable riveting 3. Remove lock, wash and lubricate friction parts with grease Litol 24
Failure to unlock door with interior handle	
Insufficient travel of inner control lever due to insufficient operating link travel	Adjust lock inner control lever
Failure to unlock bonnet from passenger compartment	
1. Lock operating link broken 2. Excessive operating link length	1. Renew operating link 2. Adjust operating link length through loop on lock hook

Cause	Remedy
Failure to lock bonnet	
1. Lock spring broken or loose	1. Renew spring
2. Shorter lock operating link	2. Adjust operating link length through loop on lock hook
3. Incorrect position of lock	3. Adjust lock position
Failure to secure sliding glass in position	
Spring brake of window lifter broken	Renew window lifter
Excessive efforts or failure to recline front seat back forward or rearward	
1. Excessive friction in seat reclining mechanism	1. Lubricate friction components of seat reclining mechanism and front seat rails with grease Фиол-1
2. Worn components of seat reclining mechanism	2. Renew worn components, lubricate new ones
3. Damaged welding joints of front seat frame components	3. Renew front seat frame
Failure to fix front seat back in reclined position	
1. Disconnected control cable of front seat rake adjuster	1. Secure control cable on seat recliner hook, check for proper operation
2. Broken control cable or fractured outer cable of seat back rake adjuster	2. Renew faulty recliner mechanism components, check for proper operation
Failure to adjust front seat back rake	
1. Faulty retainer of front seat back rake adjuster knob	1. Renew front seat back rake adjuster knob retainer, check operation of mechanism
2. Faulty front seat back rake adjuster	2. Renew front seat back frame
Front seat position is difficult to adjust	
1. Seized runners in tracks due to poor lubrication	1. Lubricate runners with grease Фиол-1
2. Misaligned front seat tracks and runners	2. Adjust front seat runner using adjusting shims under securing bolts
Hot air flow to interior compartment	
1. Faulty heater tap linkage	1. Check cable operation, secure outer cable, renew cable, if applicable
2. Heater tap fails to shut off water flow	2. Renew tap
Air to interior compartment is not heated	
1. Heater tap inoperative due to faulty tap cable drive	1. Check cable operation, secure outer cable, renew cable, if applicable
2. Faulty heater tap	2. Renew tap
Insufficient air inflow to interior	
Inoperative air intake cover cable drive (cover closed)	Check cable operation, secure outer cable, renew cable, when applicable

Bodywork - repair

Refer to Fig.8-1, Fig.8-2 and Fig.8-3 for body frame design and relevant cross-sections.

Bodywork damages - repair

Most repair on vehicles, especially after road accidents, falls on bodywork. In the large part repair involves geometry inspection of attachment points of diverse vehicle units and ancillaries. The main reference sizes for inspection are shown in Fig.8-4.

The bodywork damages can vary greatly thus demanding specific remedial actions in each particular case. Maximum use of panel ding and dent is recommended. Where applicable, avoid heat treatment of metal to preserve the factory welding and bodywork rustproof protection. The exposed body panel should be lifted off only when it is absolutely necessary in order to locate the damaged area, to straighten or align the bodywork.

In the event of major body damage it is advisable to remove all interior trim to facilitate measurement, examination or fitting of hydraulic and screw jacks to rectify any crosslays or damages.

All projections of exposed panels or detachable parts against the adjoining panels must be properly realigned and readjusted.

Deformed surfaces - repair

The repair of any damaged body parts is carried out by means of stretching, ding and dent, straightening, cutting out of irreparable areas, making of maintenance patches from the body rejects or metal sheets by shaping them into a suitable part.

Deformed panels are restored, as a rule, manually with the help of specialized tools (metal hammers, plastic or wooden mallets, various mandrels) and accessories.

Heating up is recommended to contract (settle down) heavily stretched panel surfaces. Heat up to 600-650°C (cherry-red colour) to prevent a sharp belling-out of the panel or degrading of physical properties. The heated area should not exceed 20 to 30 mm.

Contracting of surfaces is carried out as described below:

- using a carbon electrode of a semi-automatic welder or a gas burner, heat up the metal sheet starting from outside to centre of the damaged area and restore the original shape by hammering out the heated sections with a wooden mallet or a hammer and facilitating the job with a flat block and anvil;

- proceed with alternative heating and settling until you achieve the desired quality of the panel surface.

Panel irregularities can be rectified by means of polyester fillers, thermosetting plastics, cold set epoxy resins or soldering.

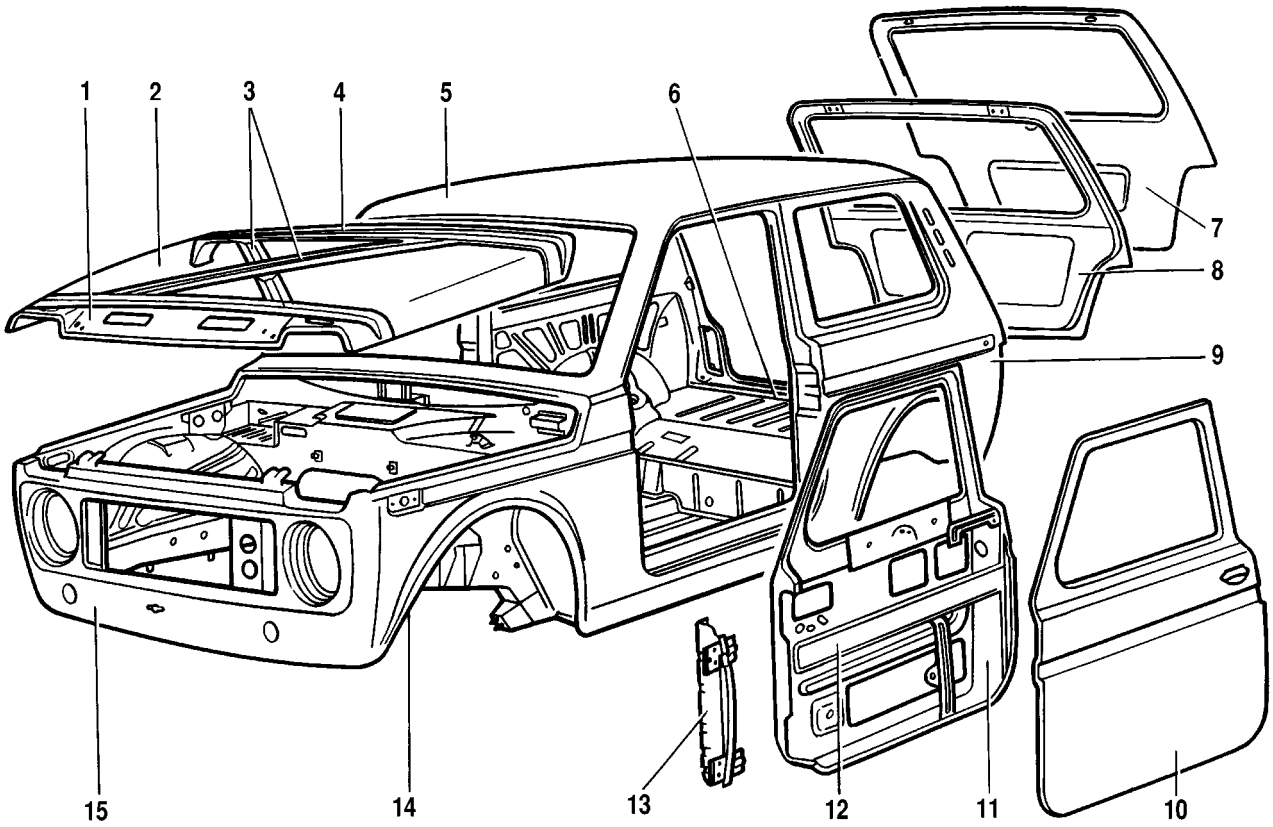


Fig.8-1. Bodywork:
1 - front bonnet reinforcement; 2 - bonnet panel; 3 - diagonal bonnet reinforcements; 4 - rear bonnet reinforcement; 5 - roof panel; 6 - rear end cross-member; 7 - outer tailgate panel; 8 - inner tailgate panel; 9 - side panel; 10 - outer front door panel; 11 - inner door panel; 12 - door bar; 13 - front door extension; 14 - front wing; 15 - front panel

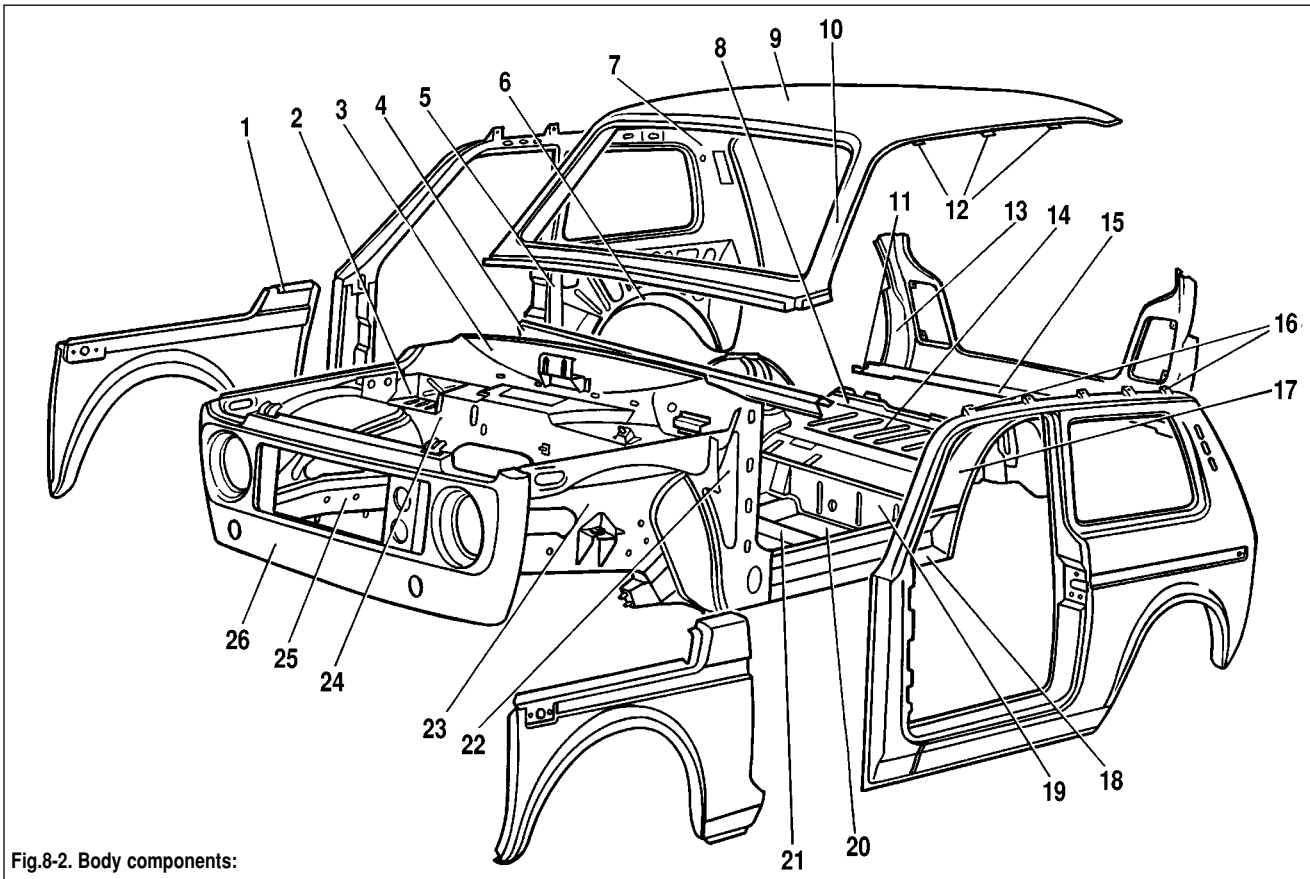


Fig.8-2. Body components:
1 - front wing; 2 - battery tray; 3 - top bulkhead reinforcement; 4 - instrument panel crossbar; 5 - centre pillar; 6 - outer rear wheel arch; 7 - inner bodyside panel; 8 - rear floor cross-member; 9 - roof panel; 10 - windscreen frame; 11 - bracket for wheel mudflap; 12 - roof reinforcements; 13 - rear pillar; 14 - rear floor panel; 15 - rear cross-piece; 16 - brackets of door trim bow; 17 - inner arch, rear wheel; 18 - floor-to-bodyside panel connection; 19 - floor cross-member under rear seat; 20 - floor front panel; 21 - floor cross-member under front seat; 22 - side panel, front end; 23 - splash guard, front wing; 24 - bulkhead; 25 - front chassis arm; 26 - front panel

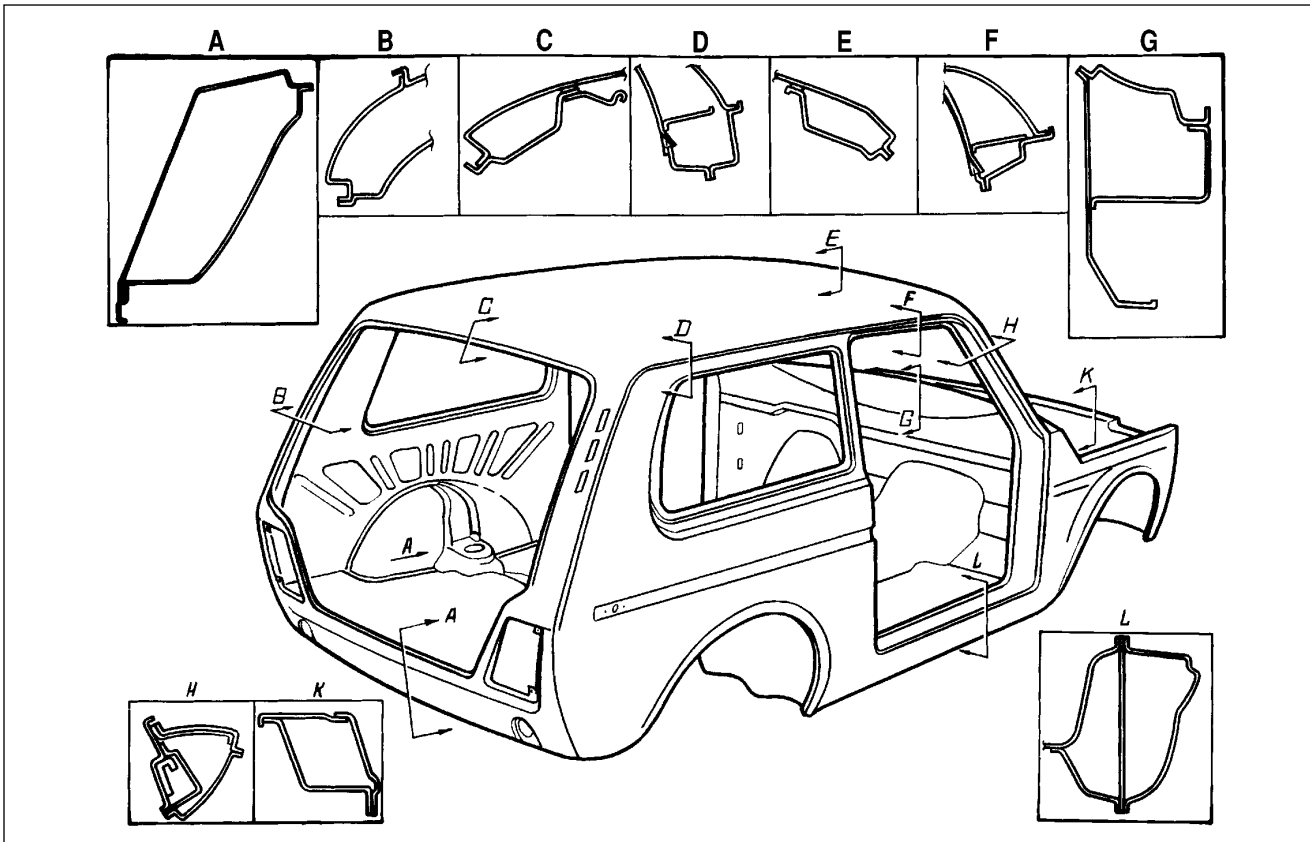


Fig.8-3. Main bodywork cross-sections

Polyester fillers of «Хемпропол-П» or ПЭ-0085 type offer a reliable adhesion with the panels stripped to the bare metal. They consists of two components: unsaturated polyester resin and a hardener serving as a fast curing catalyst. The ambient temperature in the workshop should not be below 18°C. The mixture of polyester filler must be used within ten minutes since it usually takes sixty minutes for the filler to harden well through. The thickness of the filler layer should be a maximum of 2 mm.

Thermosetting plastic is produced as a powder. Its elastic properties, required for application on a metal panel, develop at 150-160°C. The surface to be treated must be thoroughly cleaned of rust, scale, loose paint and other impurities. Thermoplastic adheres better to rough metal surfaces. Before applying thermoplastic, heat up the affected area to 170-180°C and apply a first layer of powder which is to be smoothed down by a metal roller. Then apply a second layer and further ones until all surface imperfections are fully covered. Each layer is rolled down to achieve a monolithic layer of plastic mass. Use your usual treating methods when the layer is hardened well through.

Use solders of ПОССу 18-2 type or ПОССу 25-2 type to straighten the areas which were earlier filled with solder, to build-up edges and to eliminate undesirable gaps.

Severely damaged panels are replaced with new ones using electric inert gas welding.

Front wing - removal and refitting

With minor damages (small dent, scratches, etc.), straighten and paint the wing without removing it from the vehicle. Inspect the condition of inner anti-corrosion coating, restore it when necessary.

Always renew the wing in case of major damages or splits.

Remove the bumper, bonnet and front door.

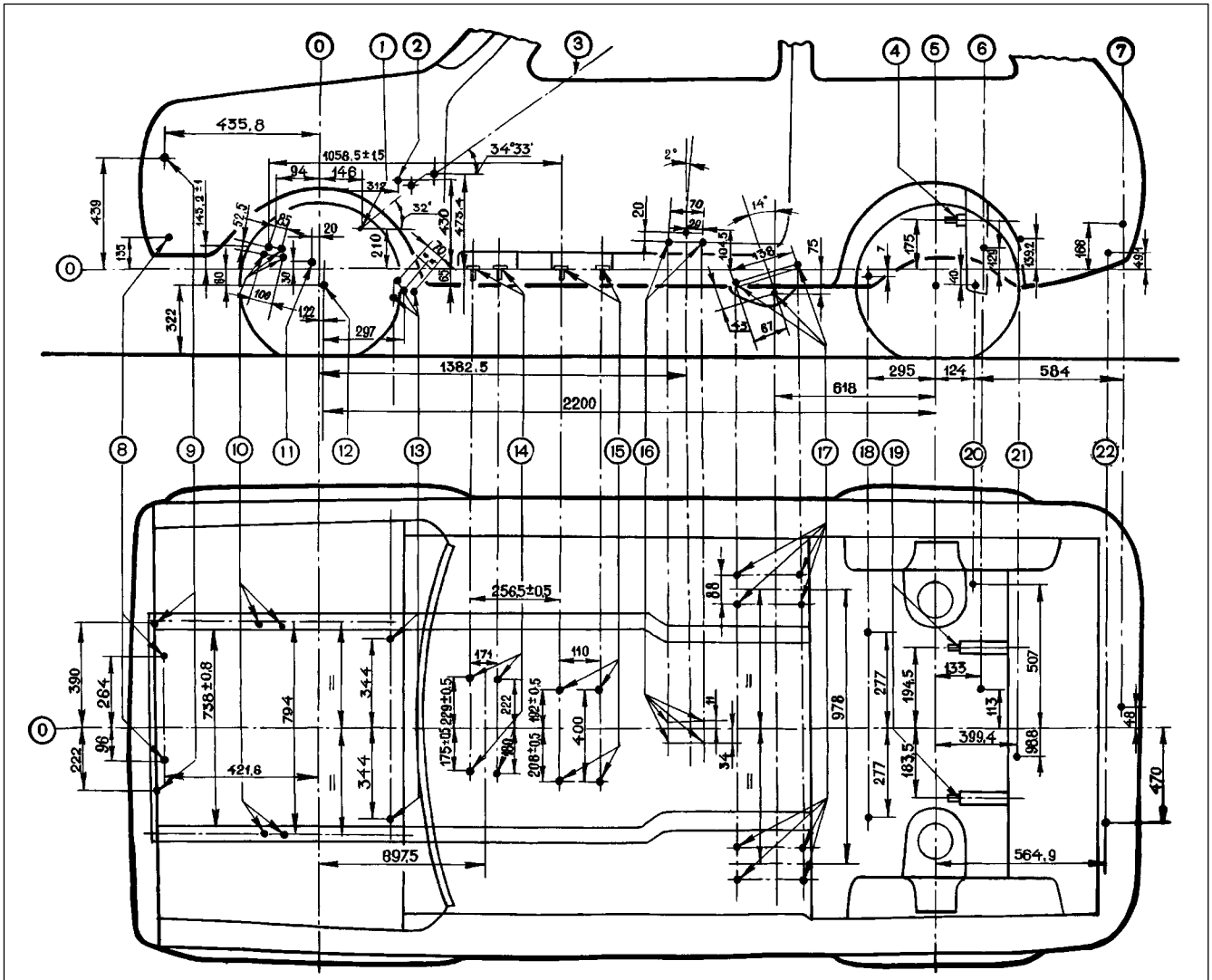


Fig.8-4. Anchorages of vehicle units and assemblies:

0 - datum lines; 1 - centre of steering mechanism; 2 - brake and clutch pedal axis; 3 - steering wheel shaft axis; 4 - attachment of rear suspension shock-absorbers; 5 - rear wheel axis; 6 - attachment of front pipe, main silencer; 7 - rear attachment of main silencer; 8 - bottom radiator attachment; 9 - top radiator attachment; 10 - front suspension cross-member attachment; 11 - differential centre; 12 - wheel centre; 13 - front anti-roll bar attachment; 14 - rear power unit mounting attachment; 15 - transfer case attachment; 16 - attachment of handbrake lever bracket; 17 - front attachment of rear suspension trailing arms; 18 - rear attachment of rear suspension trailing arms; 19 - rear suspension shock-absorber attachment; 20 - attachment of rear suspension trailing arms; 21 - front attachment of main silencer; 22 - attachment of exhaust pipe

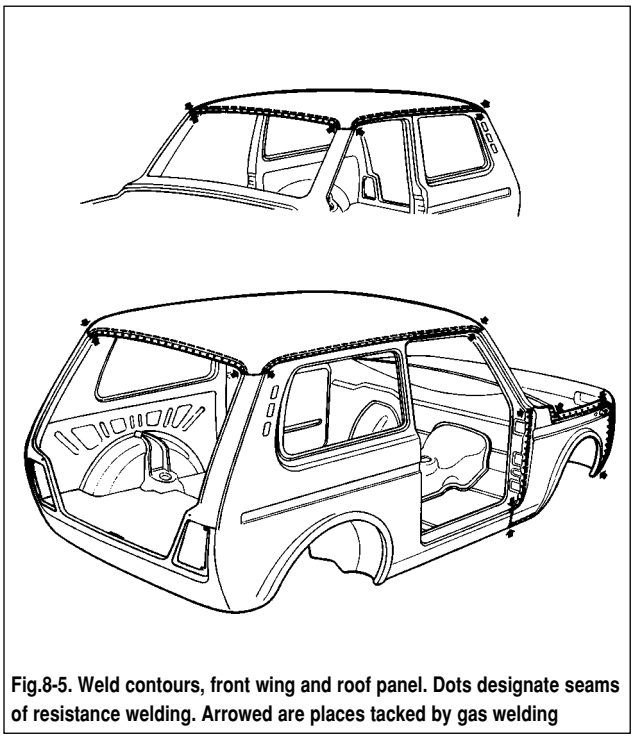


Fig.8-5. Weld contours, front wing and roof panel. Dots designate seams of resistance welding. Arrowed are places tacked by gas welding

Chip off the wing with a sharp thin chisel or cut with a grinding tool over the lines as shown in Fig.8-5.

Detach the wing, remove the remainders of the wing, straighten the deformed edges and smooth them with an electric or pneumatic grinding tool.

Refit the front door and new wing, secure the wing using quick detachable grips.

Weld the wing in the locations as arrowed in the figure by means of CO_2 arc welding. Soldering is allowed too. Use soldering bars of Л62, Л63 type (2-3 mm in diameter).

Refit the bonnet and check the wing position. A maximum 2 mm inward or outward misalignment of the wing against the door or bonnet is allowed; the wing clearances with the bonnet or door over the outer surface should be (5±2) mm.

Withdraw the bonnet and door.

Use resistance welding with step of 40-50 mm to weld the wing to the front bodyside panel pillar, splash guard and bulkhead. Gas welding with tin solder is possible or electric CO_2 arc welding with a broken seam of 7 to 10 mm with a 50-60 mm step. Use an electric semi-automatic welder and 0.8 mm dia. wire of св.08Г1С or св.08Г2С type.

Weld the wing to the front by melting the welding flange edges using a broken seam of 5 to 7 mm with a 40-70 mm step.

Roof - removal

In most cases a damaged roof requires renewal.

Remove the tailgate, waterchannel trim, windscreen, headliner and roof accessories. Make a layout and cut off the roof panel over the lines as shown in Fig.8-5.

Detach the roof panel, remove the panel remainder and straighten any areas deformed. Remove loose colour paint and base paint up to bare metal on the roof panel edges, windscreen frame, roof side panels and reinforcements.

Renew the gaskets on reinforcements.

Fit the roof panel, secure it with quick detachable grips, tack the panel by gas welding in the locations arrowed in Fig.8-5.

Weld the roof panel by resistance welding with a step of 40-50 mm and by electric CO_2 arc welding or gas welding with a step of 50-60 mm over the earlier drilled holes of 5-6 mm diameter. To avoid deformation, start welding from the middle of the seam rightward and leftward.

Finish the seams with an electric or pneumatic grinding tool.

Paintwork

Polishing

To preserve paintwork and maintain it as long as possible, select the polishers to suit the condition of the paintwork. Strictly adhere to recommendations for application.

The basic maintenance routine for the bodywork within the first two or three months is just regular washing with cold water. Over further three years move to non-abrasive polishers for new coatings to restore the brilliance of shine.

After three to five years of vehicle operation, use the automotive polishers intended for weather affected paintwork which contain a small amount of abrasive. After five years of intensive use, select the polishers for aged paintwork.

To prevent the polisher drying off, work on small areas buffing them manually with a clean flannel cloth.

To rectify minor paintwork defects, it is recommended to use polishing pastes of ПМА-1 or ПМА-2 type. Hand pads or power tools, with lambskin discs or flannel discs, can be used for polishing.

Prior to use, thoroughly mix the paste, dilute it with water when thick. After polishing, wipe the surface clean with flannel.

Respraying with acrylic paints

Using plenty of water and a putty knife or a brush, rub down any loose paint from the affected areas.

Use abrasive paper (68С 8-П or 55С 4-П) for wet sanding of the surfaces to be painted. In case of a thin coating and no evidence of mechanical damages, sand the repair area down to the factory primer layer. In the event of severe corrosion or earlier applied nitric paints, strip down the areas to the bare metal.

Wash the body with water, blow dry with compressed air.

Degrease the painted surfaces with white spirit or petrol-solvent (БР-1) and apply bodystopper paste like «Plastisol Д-4А»

over the weld seams and on the joints of the replaced parts. Remove the stopper surplus with a cleaning cloth moistened in white spirit.

Ensure the surrounding area is protected against overspray (use genuine masking tape or several thickness of newspaper).

With the aid of a spray gun, apply primer like ГФ-073 or ВЛ-023 over the areas rubbed down to the bare metal. Allow five minutes. The primer viscosity should be 22-24 cs at 20°C when measured with the viscosimeter ВЗ-4. Use ksylol for thinning.

Using a spray gun, apply primer (ЭП-0228) over the surfaces coated with the base coat (ГФ-073 or ВЛ-023) and over the renewed body parts. Dry off at 90°C within 60 minutes. Prior to spraying, to primer (ЭП-0228) add НФ-1-type siccative of 6-8 % or МТТ-75-type catalyst of 3-4 % of the primer weight. The ready mixture with catalyst should be consumed within 7 hours. The primer viscosity should be 23-25 cs by the viscosimeter ВЗ-4. Thin the primer with thinner РЭ-11В or ksylol.

Allow the bodywork cool down, proceed with wet sanding using the abrasive paper of 55С 4-П type, flush with water, blow with compressed air and allow to dry.

Any irregularities remained can now be filled carefully applying filler paste, dry the body and smooth down the areas with the abrasive paper of 55С 4-П type. Wash the body and blow dry with compressed air. Mask off the surrounding areas from overspray with thick paper and masking tape, then place the vehicle body into the paint booth. Degrease the surfaces to be painted with white spirit.

Using a spray gun, apply two coats of paint (МЛ-197 or МЛ-1195 type) at 7-10 minute interval on inner surfaces of the passenger compartment, door apertures, engine bay, luggage compartment.

Apply three colour paint coats on the outside body surfaces at 7 to 10 minute intervals.

Allow to dry at 90°C within an hour and cool down at ambient environment.

Before application, add 10% catalyst of ДГУ-70 type into the paint. For paints of МЛ-197 type it is permitted to use 20% maleic anhydride in ethylacetate. The paint viscosity should be 20 cs when measured by the viscosimeter ВЗ-4. It is advisable to thin paint with thinner of Р-197 type.

It is recommended to use СП-7-type paint remover. For old multilayer paint, apply it with brush two or three times depending on the paint thickness.

Usually, 30-40 minutes are required to soften the old paint which is then removed with a wire brush or putty knife.

Use white spirit to wipe off the remainder of the paint, rinse with water, allow to dry.

Respraying separate parts

Paint any separately replaced parts (wings, doors, bonnets, etc.) all over outer surfaces. The same recommendations are applied to the parts restored after ding and dent.

Before respraying the parts remember to sand and apply primer on the reassembled parts .

When performing the job, follow the methods adopted for body respraying.

Bodywork corrosion protection

Corrosion mostly attacks inner cavities of the body, floorpan, lower parts and struts along with anchorages and spot welding areas.

Hard-to-reach cavities and underbody parts are most susceptible to corrosion caused by moisture, mud, salts and acids.

All this necessitates further protection for body inner surfaces and box sections through application of specific rust inhibiting paints or sealants for joints. The products used to resist rust formation are shown in Table 8-1.

It is advisable to use corrosion inhibitors «Мовиль» or «Мовиль-2» for box sections. Box sections should be treated every 1 to 1.5 years. The corrosion inhibitor is also applicable for the surfaces earlier treated with nygrol or other oils as well as for rusty surfaces.

Protective grease of НГМ-МЛ type is used for inner cavities. New vehicles have all inner cavities already coated with it.

Use a protective skin of НГ-216Б type on the underbody.

Bitumen-type sound-proof sealant (БПМ-1) offers corrosion protection and noise reduction for the underbody. The thickness of the protective layer to be 1.0-1.5 mm.

Plastisol Д-11А helps protect the vehicle underbody against corrosion, abrasive wear and contributes to better sound-deadening. The layer thickness should be 1.0-1.2 mm. All new vehicles have the underbody coated with Д-11А-type plastisol.

Plastisol Д-4А is applied on weld seams. Use the wet-type sealant (51-Г-7) on body joints.

Both air and airless rust-inhibitor spraying is recommended for hard-to-reach or hollow cavities.

For air spray method you need compressed air supplied at 0.5-0.8 MPa (5-8 kgf/sq.cm) and a spray gun with a tank, hoses and extensions for the gun. The optimum coating is achieved with airless spraying at 4-12 MPa (40-120 kgf/cm^2), where higher viscosity paints can be successfully used.

Box sections - preparations and corrosion treatment

Inner cavities require specialist equipment. Entrust the job to the skilled personnel in workshops.

Follow the procedure below when treating inner cavities against corrosion:

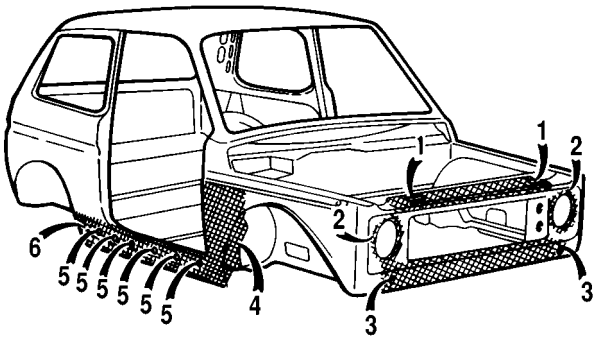


Fig.8-6. Front view of the body. Inner cavities of:
1 - top front cross-member; 2 - headlight casings; 3 - bottom front cross-member; 4 - under front wing; 5 - outer sill; 6 - inner sill

- position the vehicle on a lift, dismantle all relevant components and trims which may obstruct access to box sections;

- through provisional or drain holes flush inner cavities and the underbody with warm (40-50°C) water (Table 8-2) until the drained water is clean. Do not forget to fully close the windows;

- remove any water penetrated into the passenger or luggage compartments; blow dry with compressed air the areas where rust inhibitors are going to be applied;

- drive the vehicle into a corrosion treatment booth and position it on a lift; spray the relevant rust inhibitor onto the areas shown in Fig.8-6, Fig.8-7 and Fig.8-8;

- lower the vehicle, wipe off any dirt from the outside body surfaces with a cloth moistened in white spirit.

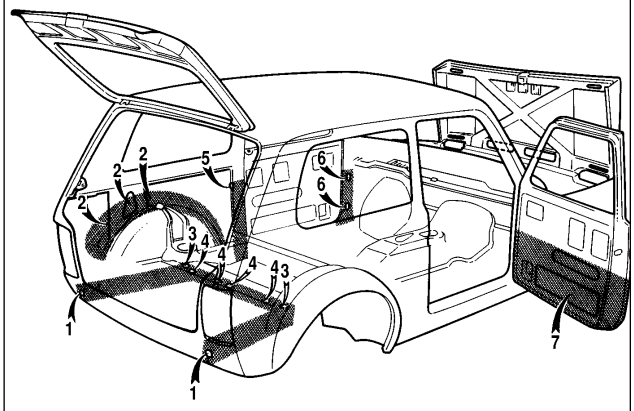


Fig.8-7. Rear view of the body. Inner cavities of:
1 - rear chassis arms; 2 - between rear wheel arches and body sides; 3 - rear chassis arms; 4 - rear floor cross-member; 5 - central pillars; 6 - front door pillars; 7 - door pocket

Restoring corrosion-proof and sound-proof coating on underbody and wheel arches

When in service, the vehicle underbody is deteriorated by loose gravel, sand salt and water.

As a result, undersealant and primer can be damaged and worn thus encouraging rust.

For the purposes of noise reduction, corrosion protection and wear resistance, the underbody and chassis arms are factory treated with PVC plasticate - Plastisol Д-11А»- of 1-1.5 mm thickness over epoxy ЭФ-083 primer.

Таблица 8-1

Corrosion inhibitors for bodywork protection

Description	Grade	Viscosity, sec at 20 °C as per B3-4	Solvent, thinner	Drying conditions	
				Temperature, °C	Time, min
Automotive sill rust inhibitor	Мовиль				
	Мовиль-2	15 - 40	white-spirit, petrol	20	20 - 30
Protective non-drying grease	НГМ-МЛ	45	white-spirit	20	15
Protective skin	НГ-216Б	18 - 22	white-spirit, petrol	20	20
Bitumen-type sound-proof sealant	БМП-1	high viscosity	ksylol, solvent	100-110	30
PVC plasticate	Plastisol Д-11A	Detto	–	130	30
Plasticate	Plastisol Д-4A	Detto	–	130	30
Non-drying sealant	51-Г-7	Detto	–	–	

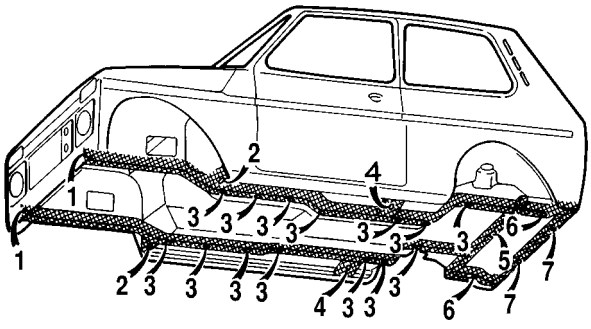


Fig.8-8. Underneath view of the body. Inner cavities of:
1 - front chassis arms; 2 - front chassis arms connections; 3 - middle chassis arms; 4 - middle chassis arms connectors; 5 - rear floor cross-member; 6 - rear chassis arms; 7 - rear end cross-member

When only the Д-11А plastisol coating is affected, while the primer is intact, scour any dirt from the relevant areas, then on a dry surface apply БПМ-1-type plastisol by means of a brush or airless spray (1.5 mm thick). Allow to dry at ambient temperature within a day or at 90°C within 30 minutes.

In the event of major damages of protective layers and damaged primer, clean of dirt and rust the area affected to the bare metal, then apply ГФ-073-type primer on a dry degreased surface. Using a brush, apply БПМ-1-type sealant on the areas prepared.

When the vehicle is in use no longer than 1-1.5 years, it is recommended to have a minimum overlapping of a new sealant over an old layer. In the event of a longer field service with this underbody protection, apply the sealant over the entire underbody and wheel arches surfaces.

In cold weather before use, store sealant paste in a warm room to warm it up to at least 20°C. When thick, thin sealant with ksylol to 3% as a maximum. Clean the paintwork of excessive sealant using a cleaning cloth moistened in white spirit.

Body - sealing and tightness

The body tightness is ensured by use of rubber seals (Fig.8-9), pastes, bodyfillers, sealants, rubber plugs in provisional holes and thorough levelling of adjoining parts.

When removing or refitting seals with metal reinforcement, take care not to crumple the metal frame or seal.

Weld seams do not offer an absolute tightness between the parts, so corrosion is encouraged when water or moisture gets in between the welded parts. Use Д-4А-type plastisol on weld seams to guard off moisture and dirt; apply the 51-Г-7 wet-type sealant (Fig.8-10 and Fig.8-11) on angle joints and clearances:

- between the sidesills and bulkhead (passenger compartment side);
- between the bulkhead and front pillar panel and battery tray;
- between the front chassis arms and radiator support / bulkhead;
- between the bulkhead and front cover plate;
- between the rear floor / rear floor extensions and rear wheel arches, bodysides and rear end cross-member.

Table 8-2

Box sections to be corrosion treated

Cavity	Injection location	Injection direction	Notes
Front top cross-member	Through two top holes	Rightward and leftward	Open bonnet
Headlight casings	Front (from outside)	Over entire surface	Remove headlights
Front bottom cross-member	Through two holes for bumper fitting	Rightward and leftward	Remove front bumper
Under front wings	Through shielded opening	All directions	Remove sealing shield
External door sills	Through six side holes	Forward and backwards	Remove moldings
Internal door sills	Through hole at the back of sill end	Along sills	
Front chassis arms	Through holes for bumper fitting	Along chassis arms	Remove front bumper
Front chassis arm connections	Through holes underneath body	Rightward and leftward	Lift vehicle by hoist
Middle and rear chassis arms	Through seven holes underneath body	Forward and backward	Lift vehicle by hoist
Middle chassis arms connections	Through holes underneath body	Rightward and leftward	Lift vehicle by hoist
Rear floor cross-member	Through holes in luggage compartment and underneath the body	Rightward and leftward	Remove trim in luggage compartment
Rear end cross-member	Through holes underneath the body	Rightward and leftward	Lift vehicle by hoist
Between rear wheel arches and body sides	Into cavity openings in luggage compartment	Over all surface	Remove trim in luggage compartment
Central pillars	Into hole behind pillar	Downward	Remove pillar trim
Front pillars	Through 2 holes from interior compartment side	Downward	Remove pillar trim
Door pockets	Through openings in inner door panel	Over all bottom inner surface	Remove pillar trim

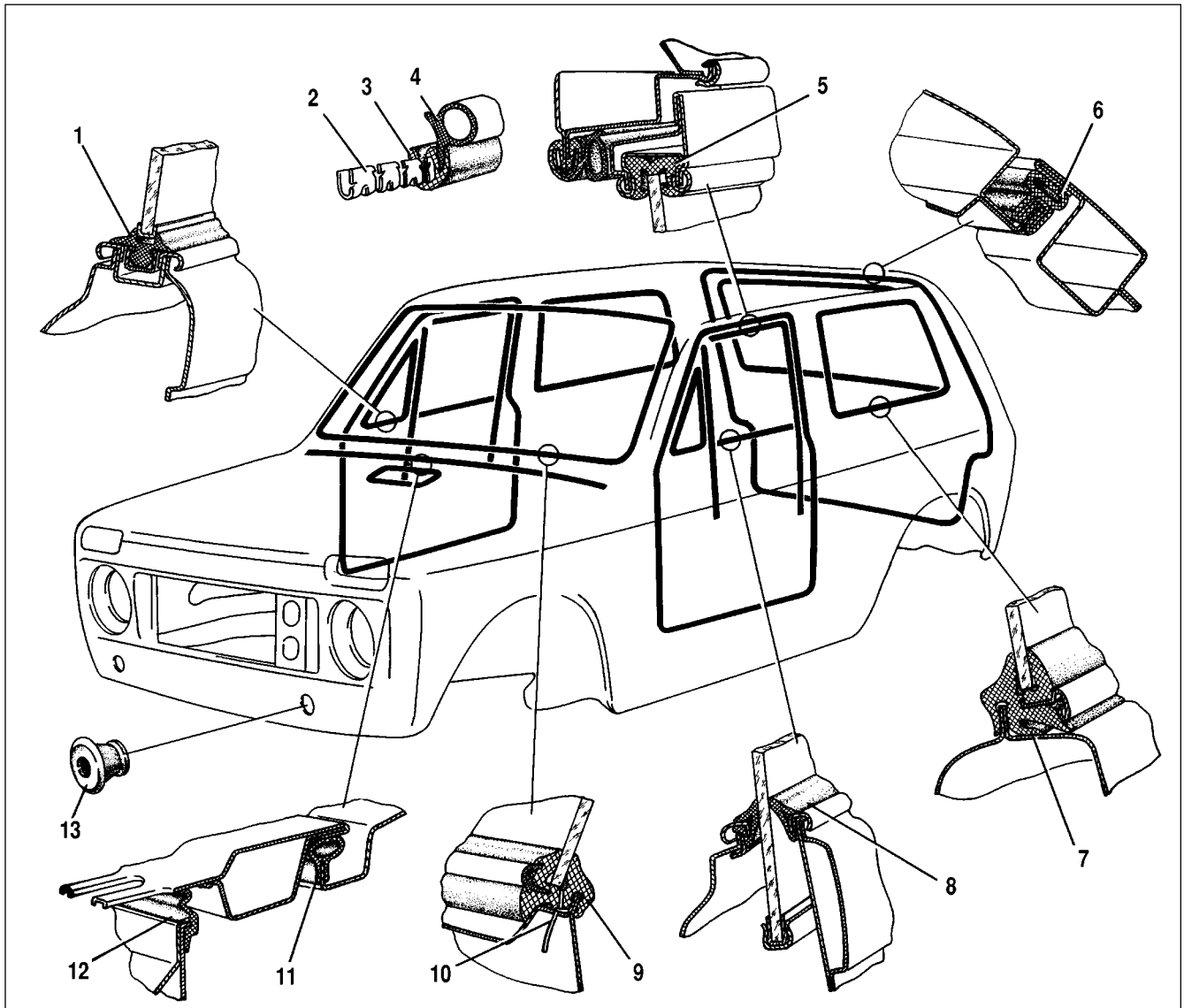


Fig.8-9. Rubber seals:
1 - of swivel glass; 2 - front door seal frame; 3 - seal molding; 4 - front door seal; 5 - of sliding glass; 6 - of tailgate aperture; 7 - of side window; 8 - lower seal of sliding window; 9 - of windscreen; 10 - drain pipe; 11 - bonnet seal; 12 - of air intake; 13 - of front bumper connection

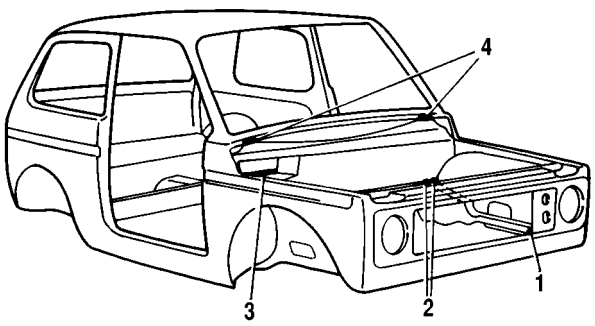


Fig.8-10. Locations for 51-Г-7-type sealant application (front body view):
1 - front chassis arm connection with bottom radiator support; 2 - front chassis arm-to-bulkhead joints; 3 - battery tray -to-bulkhead connection (from passenger compartment side); 4 - bulkhead-to-front cover abutting joints (from engine compartment side)

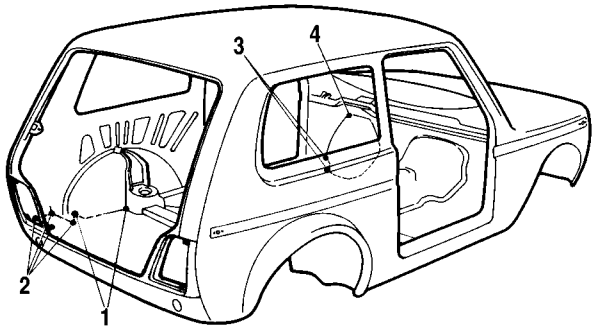


Fig.8-11. Locations for 51-Г-7-type sealant application (rear body view):
1 - rear floor-to-rear wheel arch joints; 2 - slots in angular joints of rear floor extensions with rear wheel arches, bodysides and rear end cross-member; 3 - bulkhead-to-floor sill angular joints; 4 - bulkhead-to-front bodyside pillar panel corner

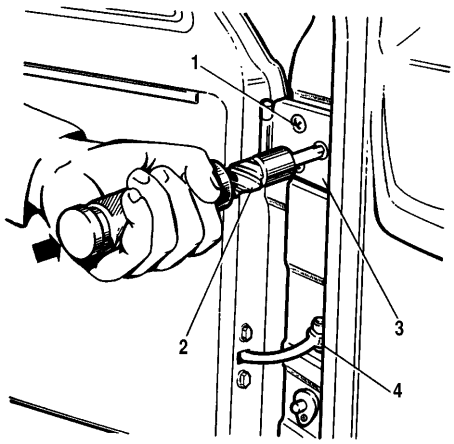


Fig.8-12. Removing the front door:
1 - hinge screw; 2 - impact screwdriver; 3 - hinge; 4 - check strap.
Arrowed is the direction to hit the impact screwdriver

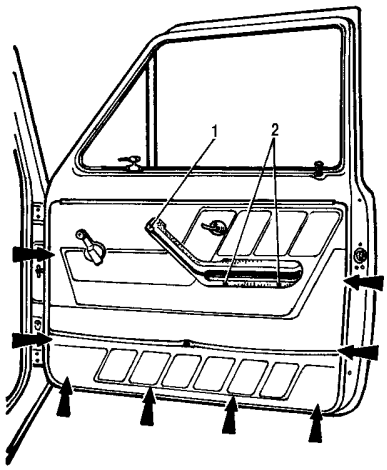


Fig.8-13. Front door inner view:
1 - top armrest screw clip; 2 - bottom armrest securing screws
Arrowed is the location for door trim securing clips

Door

Front door - removal and refitting

Fully open the door, push out the finger holding the check strap to the front pillar and disconnect the check strap.

Hold the door open and using impact screwdriver 2 (Fig.8-12), undo screws 1 securing the door hinges to the pillar. Withdraw the door.

Refitting is the reversal of removal. Prior to finally tighten screws 1, adequately line up the door with the aperture in the body.

Front door - dismantling and reassembly

Dismantle the door when you have to repair the door or renew its units and mechanisms.

Remove upper screw plastic clip 1 (Fig.8-13), undo the screws that secure the armrest door pull and remove the armrest door pull.

Prise out surround 20 (Fig.8-14), trim 1 and remove window lifter handle 2. Using a screwdriver, remove the trim of the inner door lock handle.

Remove the door trim overcoming the resistance of the spring-type plastic retaining clips (arrowed in Fig.8-13).

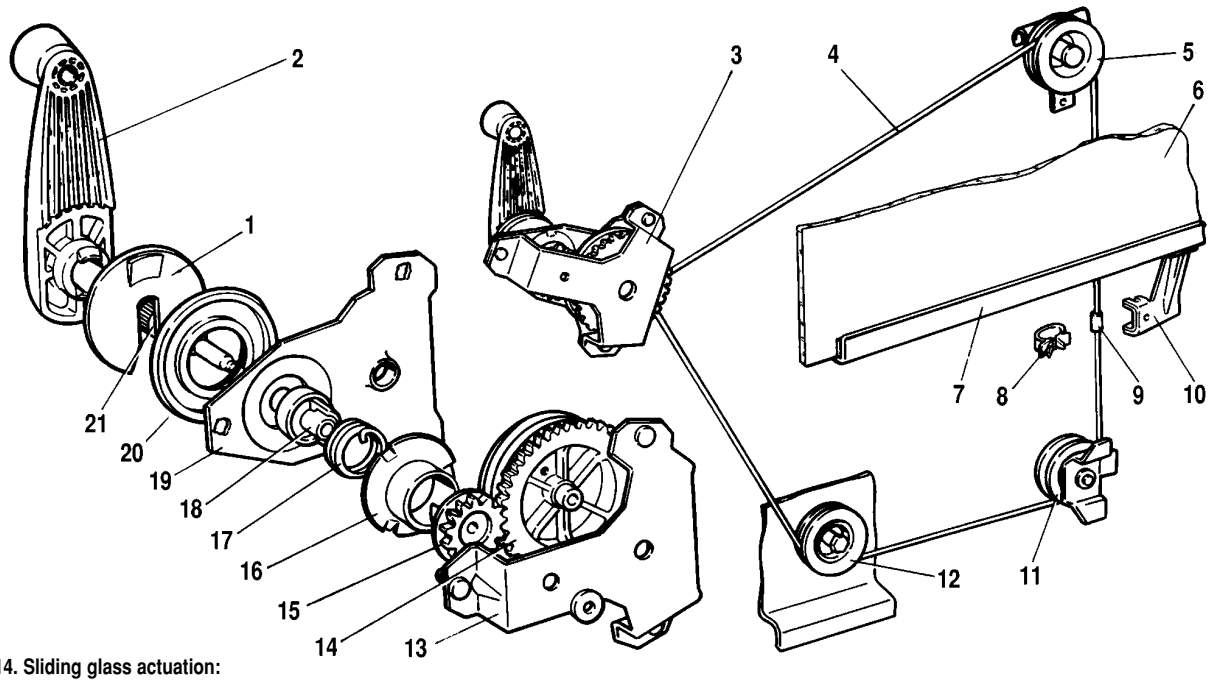


Fig. 8-14. Sliding glass actuation:
1 - escutcheon; 2 - window lifter handle; 3 - window lifter mechanism; 4 - cable; 5 - top roller; 6 - sliding glass; 7 - sliding glass holder; 8 - cable retainer; 9 - cable sleeve; 10 - glass holder bracket; 11 - bottom roller; 12 - tensioner; 13 - window lifter housing; 14 - barrel and driven gear; 15 - pinion; 16 - support; 17 - brake spring; 18 - spring brake drive link; 19 - housing cover; 20 - surround; 21 - shaft

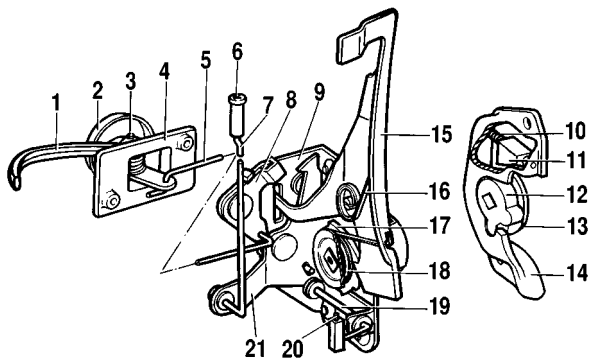


Fig.8-15. Front left door lock:
1 - inner door handle; 2 - escutcheon; 3 - pivot shaft; 4 - inner door bracket; 5 - inner door operating link; 6 - door locking knob; 7 - locking knob rod; 8 - inner control lever; 9 - lock body; 10 - spring; 11 - thrust block; 12 - rotor; 13 - central shaft support; 14 - striker housing; 15 - exterior drive lever; 16 - exterior drive lever spring; 17 - ratchet; 18 - ratchet spring; 19 - lock release shaft; 20 - lock release link; 21 - lock operating lever

With the sliding glass fully up, undo the retaining screws and remove the front and rear glass guide channel.

Slide the window down and slacken the window lifter tension roller. Detach the cable from the sliding glass holder and remove it from the rollers. Holding the cable taut, undo the retaining nuts and withdraw the window regulator. Clamp the cable at the barrel output with a wire clip. Withdraw the window glass through the lower door aperture.

Undo the retaining screws to remove the swivel glass complete with the sliding glass weatherstrips.

Undo door locking knob 6 (Fig.8-15), undo the screws that retain inner door handle 1 bracket 4. Undo lock securing screws 3 (Fig.8-16) and remove the lock complete with the links, having first detached lock release link 20 (Fig.8-15) from the lock driver.

Undo the two securing nuts and remove the external door handle.

Undo the two retaining bolts and remove the check strap.

Reassembly is a straightforward reversal of dismantling.

When refitting the window lifter, watch there is no overlapping of the cable on the drum. Adequately adjust the tension of cable 2 (Fig.8-17) and ensure smooth operation of the window lifter by means of the tension roller, having slackened nut 3.

Before refitting the door trim, inspect the plastic clips.

Front door - alignment

Start the alignment by marking the contours of hinges on the body pillar. Using impact screwdriver 2 (Fig.8-12), slacken hinge retaining screws 1.

Align the door with the aperture in the body to the clearances required, shifting the hinges within the contour marked. On completion, tighten the screws.

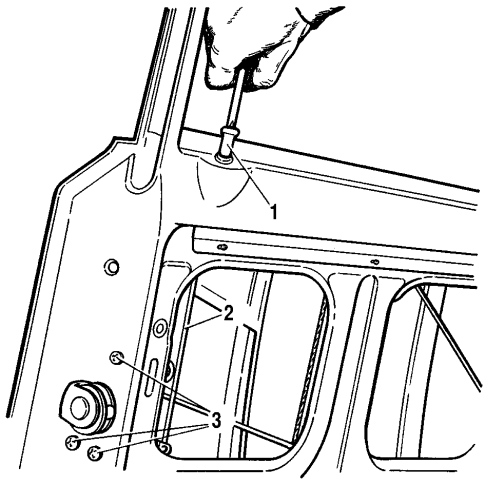


Fig.8-16. Front door lock attachment:
1 - door locking knob; 2 - locking knob rod; 3 - lock securing screws

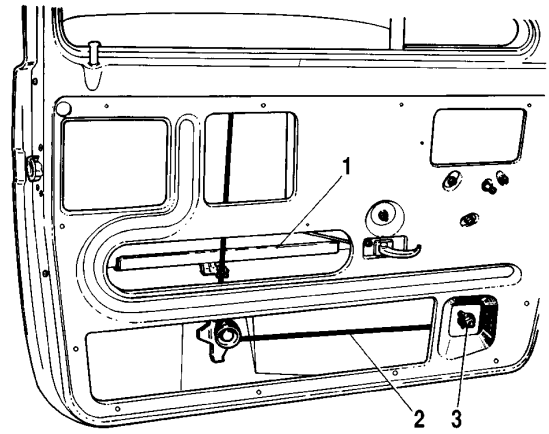


Fig.8-17. Adjusting the window lifter cable tension:
1 - sliding glass holder; 2 - cable; 3 - nut, tensioner bolt

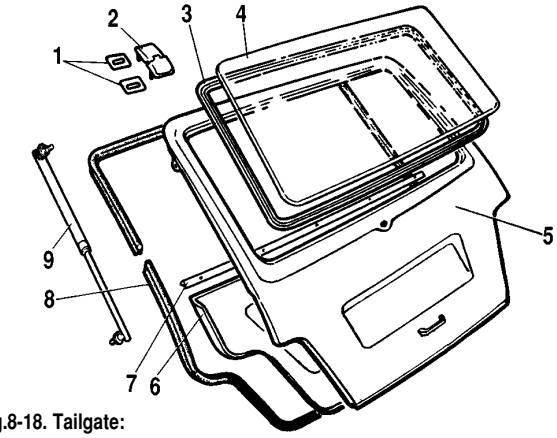


Fig.8-18. Tailgate:
1 - gaskets; 2 - hinge; 3 - window seal; 4 - glass; 5 - tailgate; 6 - door trim; 7 - cover; 8 - door aperture seal; 9 - gas-filled strut

Front door lock - adjustment

To ensure a trouble-free operation of the lock, slacken the securing bolts and align the position of door striker housing 14 (Fig.8-15).

It is a good practice to mark the door striker contour on the body pillar before making any alignments.

If the door fits too tight, slacken the door striker securing screws, move the striker outward and tighten the screws. If the door fails to close firmly, move the striker inward. Check to see the door is not seized and lines up within the body aperture.

Lower down the striker if the door goes up when closing (door sagging in the open position).

When the door is difficult to open with inner handle 1, adjust the handle position accordingly. To do this, slacken the securing screws and move the handle and bracket to the optimum position.

On completion, tighten the securing screws.

Tailgate - removal, refitting and alignment

The tailgate is hinged to the body (two hinges 2, Fig.8-18) and is locked. In the open the tailgate is held by two solid gas-filled struts 9.

Disconnect the struts from the door by removing the pins from the welded nuts.

Disconnect the wiper wiring and washer tube, undo the nuts holding the door to the hinges and withdraw the door.

When refitting the door make appropriate alignments within the body aperture via the oval holes for the hinge studs, then finally tighten the nuts.

When the door lock (Fig.8-19) is difficult in operation, adjust the lock by moving housing 4 or striker plate 5 as appropriate.

The gas-filled struts must be renewed if they fail to hold the door open.

Bonnet, bumpers

Bonnet - removal, refitting and adjustment

Open bonnet 3 (Fig.8-20), undo the pin from pivot 1 of bonnet stay 2 and detach the stay from the bonnet.

Holding the bonnet, undo bolts 4 of upper hinge 5 links to withdraw the bonnet.

Refitting is a reversal of removal. Align the bonnet as applicable via the slotted holes in the hinges.

Bonnet lock adjustment. Adjust the lock position when locking is not reliable or when unlocking requires excessive efforts (Fig.8-21).

Open the bonnet, mark the contour of lock housing 1, slacken the retaining nuts and move the lock housing as appropriate within the slotted hole.

Tighten the nuts and check the lock for satisfactory operation.

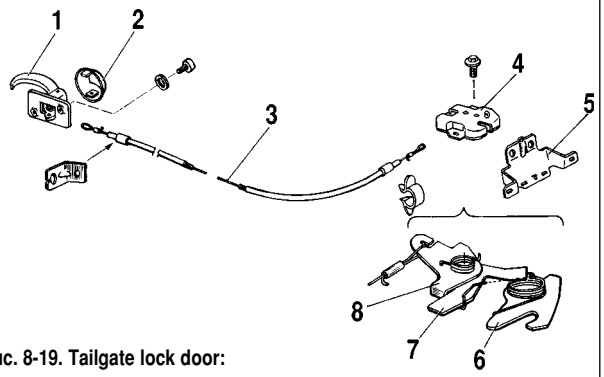


Рис. 8-19. Tailgate lock door:
1 - lock operating handle; 2 - handle escutcheon; 3 - operating link; 4 - lock housing; 5 - door striker; 6 - rotor; 7 - lever; 8 - return lever

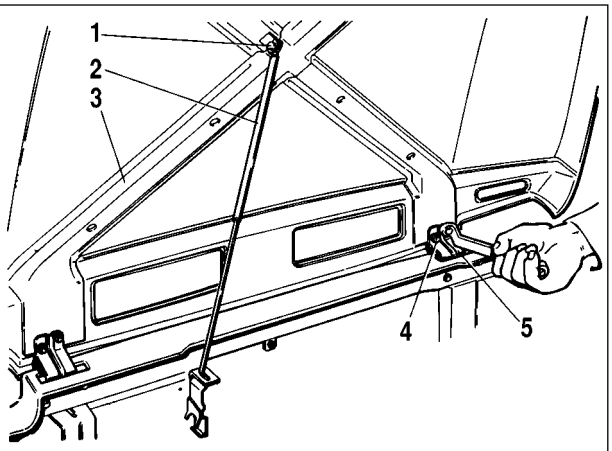


Fig.8-20. Removing the bonnet:
1 - pivot; 2 - stay; 3 - bonnet; 4 - bonnet securing bolt; 5 - hinge

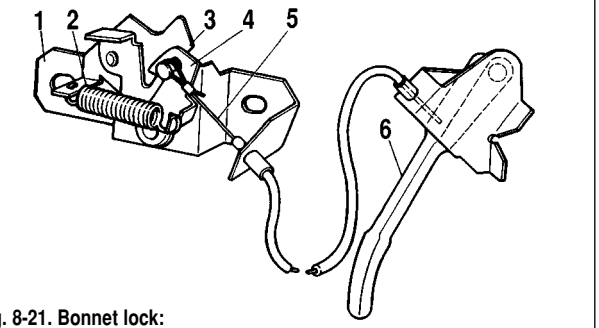


Fig. 8-21. Bonnet lock:
1 - lock body; 2 - spring; 3 - ejector; 4 - hook; 5 - release cable; 6 - handle

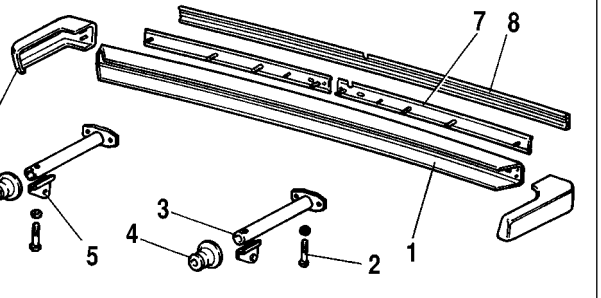


Fig.8-22. Front bumper:
1 - bumper; 2 - securing bolt; 3 - connecting piece; 4 - rubber seal; 5 - tow eye; 6 - plastic side cover; 7 - cover retainer; 8 - front cover

Bumpers - removal and refitting

The bumpers (Fig.8-22) are made from aluminium profile, with the face lined lengthwise with black rubber strip 8. The bumper ends are fitted with plastic black cover plates 6.

Both bumpers are secured to the body with two bolts to be undone when removing the bumpers.

Refitting is reversal to removal.

Bodywork glazing and windscreen washers

Windscreen - renewal

To replace a damaged windscreen, remove the windscreen wiper arms and moulding. Then applying pressure to the top windscreen corners, force the windscreen out. Ask your assistant to support the windscreen from the outside (Fig.8-23).

Remove the windscreen seal.

Refitting is carried out in the following sequence:

- rinse seal 9 grooves (Fig.8-9) with water, then blow dry with compressed air;

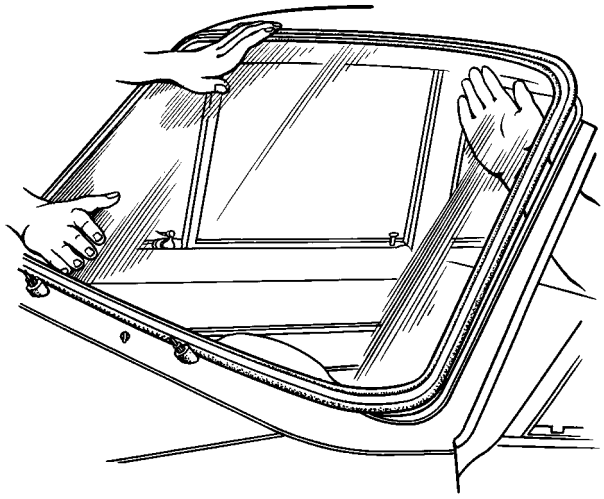


Fig.8-23. Removing the windscreen

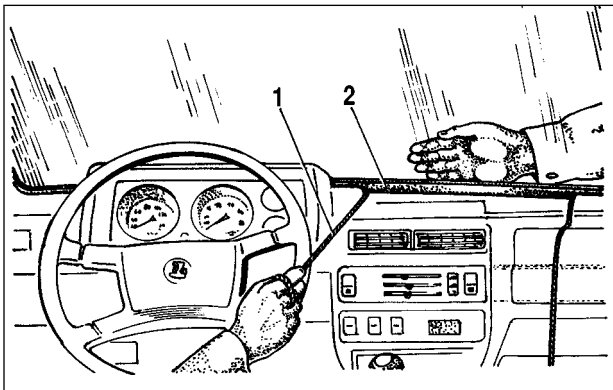


Fig.8-24. Fitting the windscreen:
1 - cord for windscreen fitting; 2 - seal

- refit the seal to the windscreen;

- using glycerine or soapy water, wet seal 2 groove (Fig.8-24) which is used for attaching it to the body flange;

- using a screwdriver, place cord 1 into the groove;

- refit the windscreen to the aperture, then tighten cord 1 ends inside the body to have the glass with seal 2 fitted snugly to place. Ask your assistant to stand outside and slightly press the windscreen inward. Should you experience any difficulties to fit it, check the aperture size, using the windscreen without the seal. Rectify any deviations in the aperture size as applicable.

Side and rear window glasses - replacement

To withdraw the glasses, remove the molding, then depress at the bottom glass corners and force the glass out. Ask your assistant to support the glass from falling outside.

Refitting of the side and rear window glasses is similar to that of the windscreen.

Washer system

The washer system is shown in Fig.8-25.

A separate washer container for the tailgate washer is provided in the luggage compartment.

Removal and refitting of windscreen / headlamp washer pump. Detach the wiring from motor 1 (Fig. 8-26) and remove the tube from the washer pump connection unit.

Turn cover 2 with motor anticlockwise and withdraw the pump from the fluid container.

Refitting is a reversal of the removal sequence.

Dismantling and reassembly of windscreen / headlamp washer pump. The pump and motor (Fig.8-26) are secured with the screws and nuts to cover 2.

To dismantle the pump, undo the screws, remove the motor and cover, detach pick-up tube 4. Pick rim 8 edge to prise it out

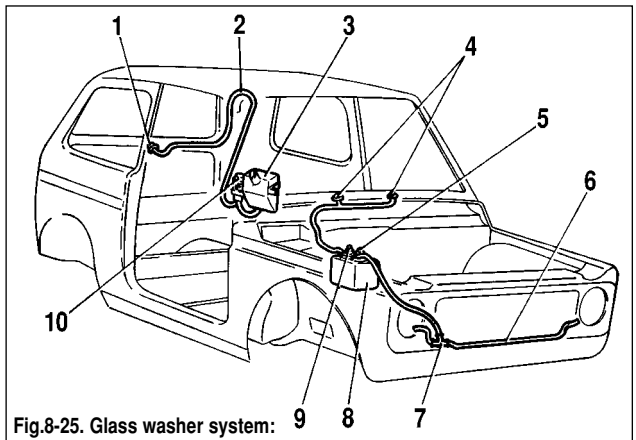


Fig.8-25. Glass washer system:
1 - tailgate washer jet; 2 - pump-to-jet hose; 3 - tailgate washer reservoir; 4 - windscreen washer jets; 5 - headlight washer pump; 6 - hose to headlight jet; 7 - T-piece; 8 - windscreen/headlight washer reservoir; 9 - windscreen washer pump; 10 - tailgate washer pump

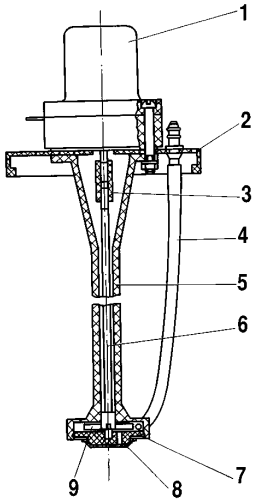


Fig.8-26. Washer pump:
1 - motor; 2 - reservoir cover; 3 - sleeve; 4 - pick-up tube; 5 - pump housing; 6 - rotor shaft; 7 - rotor shaft support; 8 - rim and filter gauze; 9 - rotor

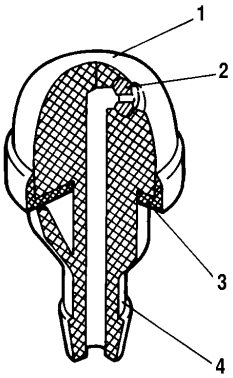


Fig.8-27. Windscreen and tailgate washer jets:
1 - jet housing; 2 - atomizer; 3 - gasket; 4 - pipe union

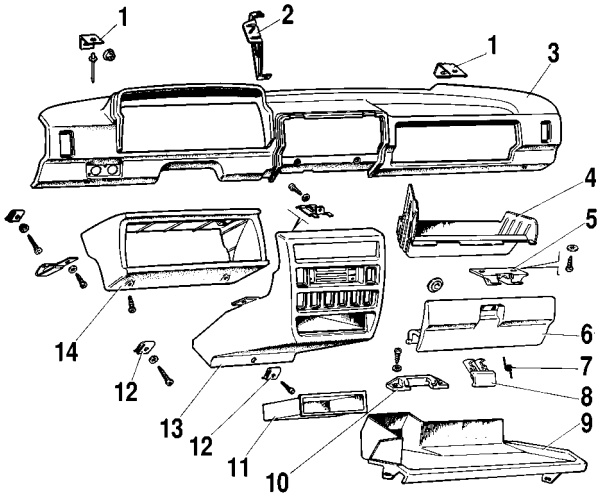


Fig.8-28. Instrument panel components:
1 - bracket; 2 - reinforcement; 3 - instrument panel; 4 - glovebox housing; 5 - lid catch; 6 - glovebox lid; 7 - spring; 8 - lid latch; 9 - shelf; 10 - lid hinge link; 11 - trinket tray; 12 - retaining clips; 13 - radio support panel; 14 - instrument panel surround

together with the filter gauze. Extract sleeve 3, then carefully tapping rotor 9 shaft 6, push support 7 out and withdraw the shaft and rotor.

Reassembly is a reversal of dismantling.

Removal and refitting of washer jets. Working from the engine bay, slightly squeeze the holders of plastic housing 1 (Fig.8-27), next pick its top with a screwdriver and force the jet complete with the atomizer. Detach the tube and blow atomizer 2 and housing with compressed air. Refit the jet pushing its housing strongly into the bore in the body.

Adjust the fluid jet through altering the atomizer position within the socket in the housing. For that insert a needle into the atomizer hole and carefully swivel the atomizer to direct the fluid jet where desired.

Instrument panel, seats

Instrument panel - removal and refitting

Disconnect the battery negative lead.

Remove the windscreen pillar trim, steering column shroud, instrument panel surround 14 (Fig.8-28), instrument cluster (Refer to section «Electrical equipment»), disconnect the wiring connectors and wiring plugs.

Remove the instrument lighting switch knob, undo the retaining nut and push the switch down, behind the instrument panel.

Undo the retaining screws, remove front parcel shelf 9 and radio support panel 13; disconnect the wiring from the radio, cigarette lighter, headlight wipe/wash switch, hazard warning flasher switch.

Undo the retaining screws and withdraw glovebox housing 4.

Remove the knobs of the heater control levers. To do this, at the knob / lever connection point prise out the lower part of the top knob with some flat and sharp tool, while for the middle and lower knobs - prise out the upper part.

Undo the four screws (arrowed in Fig.8-29) holding lower instrument panel 3 (Fig.8-28) to the front cross-member, then working through the apertures of the glovebox and instrument panel binnacle, undo four nuts holding the top panel to the front end, next remove the instrument panel.

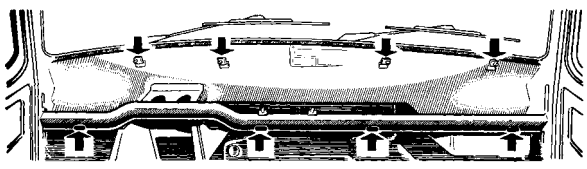
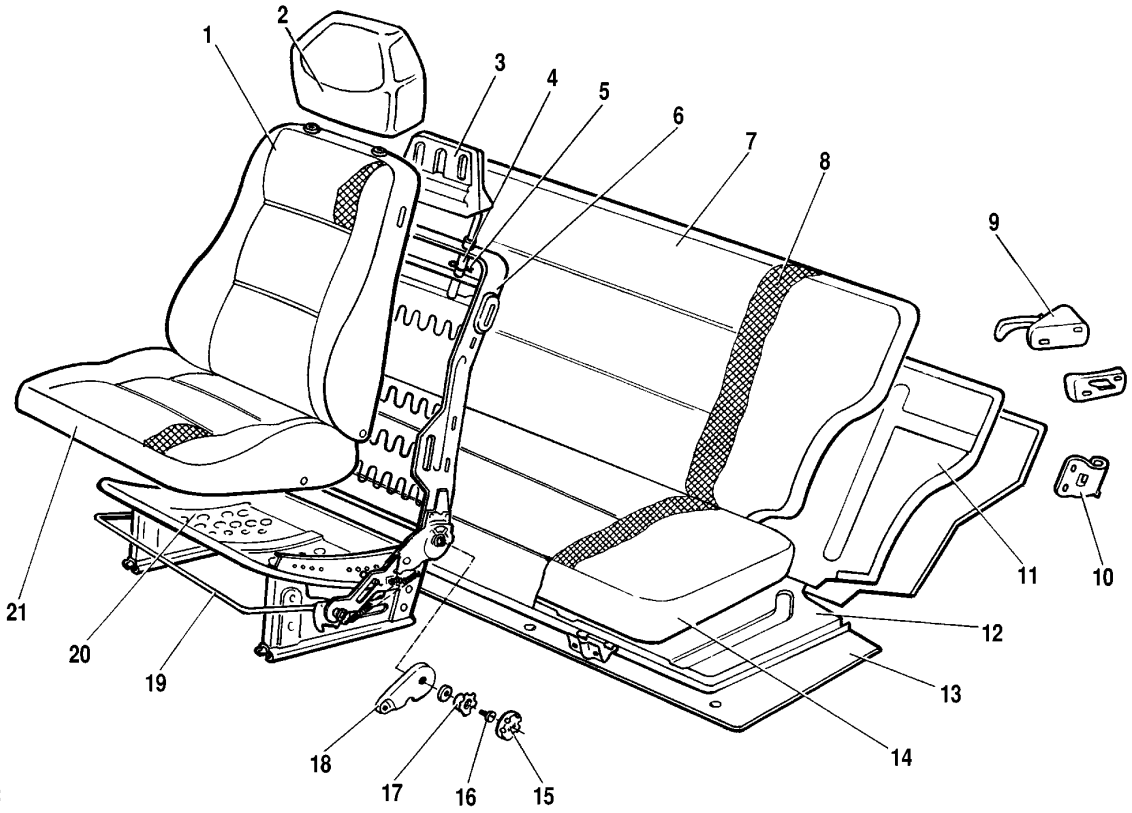


Fig.8-29. Instrument panel attachment points (arrowed).



8Fig.8-30. Seats:

1 - seat back; 2 - headrest; 3 - headrest frame; 4 - headrest guide; 5 - cotter pin; 6 - front seat back frame; 7 - rear seat back trim; 8 - trim backing; 9 - seat back catch; 10 - seat back clamp; 11 - seat back base; 12 - cushion base; 13 - carpet; 14 - rear seat cushion padding; 15 - seat back rake adjuster knob; 16 - retainer securing bolt; 17 - seat back reclining mechanism handle retainer; 18 - trim, seat back reclining mechanism; 19 - seat sliding mechanism grab handle; 20 - front seat cushion frame; 21 - front seat cushion

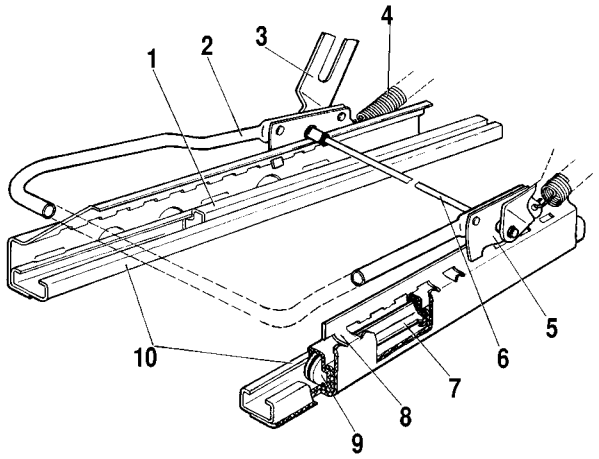


Fig.8-31. Front seat rails:

1 - slide; 2 - seat sliding mechanism handle; 3 - bottom seat back rake adjuster lever; 4 - seat sliding spring; 5 - locking catch; 6 - shaft; 7 - stop; 8 - catch; 9 - roller; 10 - tracks

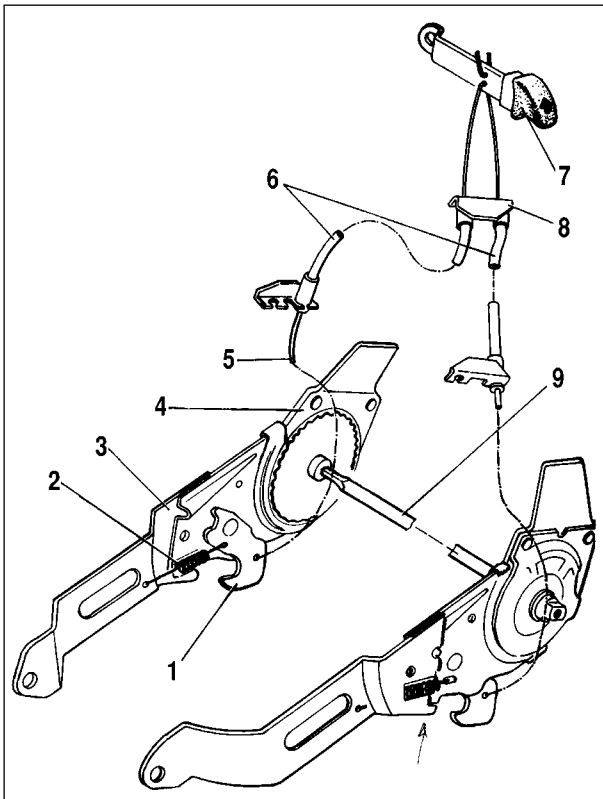


Fig.8-32. Front seat back reclining and tipping mechanisms:

1 - hook; 2 - spring; 3 - bottom seat back rake adjuster lever; 4 - top seat back rake adjuster; 5 - control cable, seat back tipping; 6 - outer cables; 7 - seat back tipping handle; 8 - bracket; 9 - synchronizer

When necessary, remove the centre facia and side facia vent nozzles together with the associated air ducts.

Refitting is a reversal of removal.

Seats - removal and refitting

The front seats design is shown in Fig.8-30, Fig.8-31 and Fig.8-32.

Front seats. To remove the seat, move it fully forward, undo the rear bolts securing the rails to the floor.

Move the seat fully rearward, undo the front bolts securing the rails and withdraw the seat complete with the adjuster mechanisms.

Refitting is a reversal of removal.

Rear seat. Release catches 9 (Fig.8-30) holding the seat back, undo the bolts securing the seat cushion straps to the floor cross-member, then withdraw the seat.

Refitting is a reversal of removal.

Front seat rails - dismantling and reassembly

For dismantling, remove the seats from the vehicle.

Raise handle 2 (Fig.8-31) up, move tracks 10 forward, remove the front rest on the tracks, move the tracks rearward until rollers 9 go out of end stop 7, withdraw the tracks.

To reassemble, relocate the rollers with the stop into the slider groove, force the track fully forward and restore the rests mechanically. Lower down handle 2 and и check the slides for smooth operation.

Heater unit

Removal and refitting

To remove the heater unit perform the following operations:

- fully shift rightward knob 6 (Fig.8-33) of heater tap 17 and drain coolant from the engine cooling system;

- disconnect the battery negative lead;

- undo the securing screws, remove the facia shelf and radio panel, disconnect the relevant wiring;

- slacken the clips and detach the rubber hoses from heater supply / return tubes 16;

- working from the engine bay side, undo the two retaining bolts and remove the heater radiator pipe grommet;

- loosen the bolt of tap outer cable retaining clamp, then remove the cable from the tap;

- remove the heater blower motor switch and disconnect its wiring;

- remove four spring holders and fan blower cowl 18 complete with the blower;

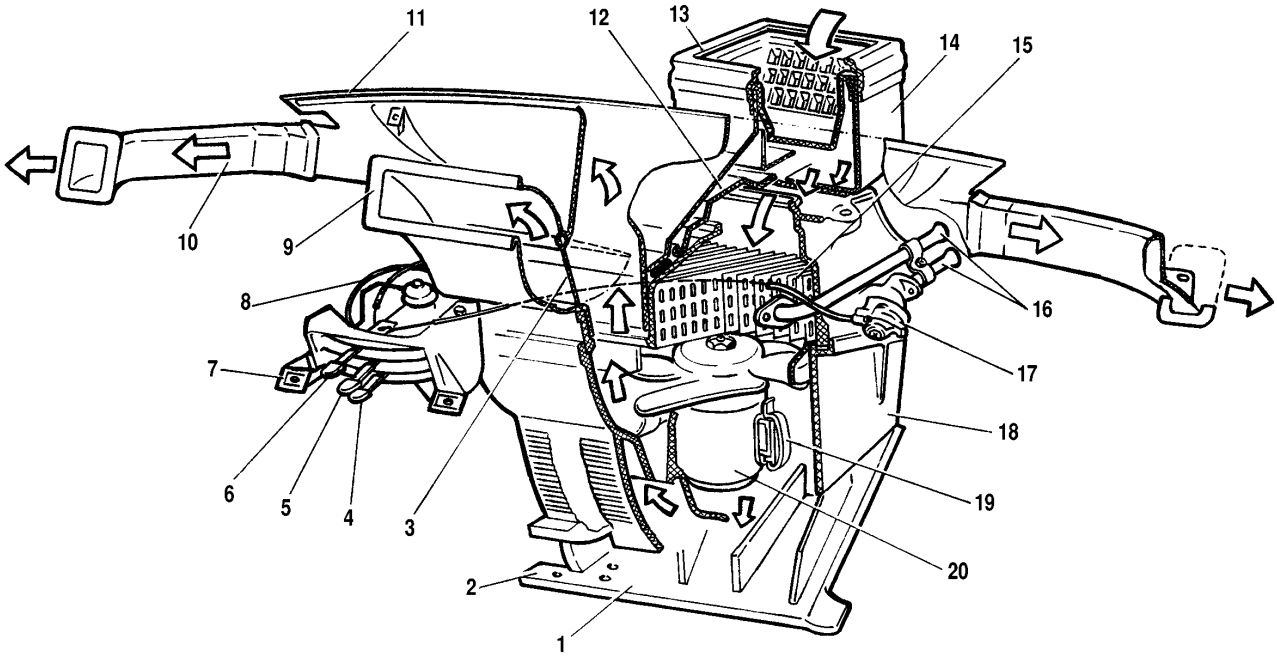


Fig.8-33. Heater unit:
1 - air distribution cover; 2 - lever; 3 - windscreen demister airduct flap; 4 - windscreen heating flap control knob; 5 - air intake cover control knob; 6 - tap control knob; 7 - control levers bracket; 8 - control cable; 9 - interior ventilation airduct; 10 - side demister airduct; 11 - windscreen demister airduct; 12 - air intake cover; 13 - air intake grommet; 14 - air intake; 15 - heater matrix; 16 - delivery and return pipes; 17 - tap; 18 - fan cowl; 19 - spring clip; 20 - fan motor

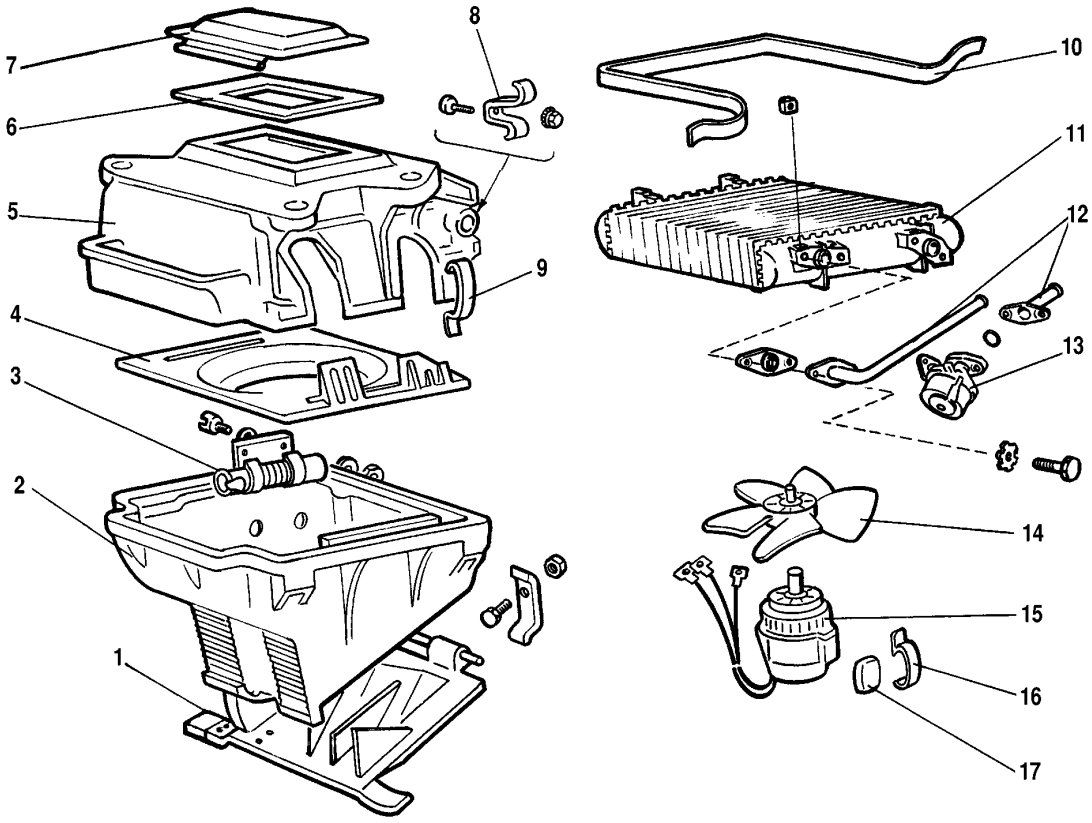


Fig.8-34. Heater components:
1 - air distribution cover; 2 - fan shroud; 3 - resistor; 4 - guide cowl; 5 - heater matrix housing; 6 - air intake cover gasket; 7 - air intake cover; 8 - spring clips, delivery and return pipes; 9 - spring clip; 10 - gasket; 11 - heater matrix; 12 - delivery and return pipes; 13 - heater tap; 14 - fan impeller; 15 - fan motor; 16 - spring clip; 17 - mounting pad

- remove the instrument panel surround, through this aperture, working on bracket 7, loosen the screws of air intake cover 12 cable clips and windscreen heating duct shutter 3. Remove the rods from the control levers;

- undo the nuts holding heater matrix 15 housing to air intake 14, disconnect the negative lead secured under one of the nuts, remove the housing and air intake unit.

Refitting of the heater is a reversal of removal.

Check the position of the sealing grommet between the radiator cowling and body, ensure the rubber hoses securing straps are reliably tightened.

After the hoses have been refitted and reconnected, fill the engine cooling system with coolant and check the connections for leaks.

Heater unit - dismantling and reassembly

To dismantle the heater unit, remove two spring clips 16 (Fig.8-34) and remove the electric blower fan from shroud 4. Undo impeller securing nut 14 and detach it from motor 15.

Undo clasp 8 nut holding the supply and return pipes, remove the clasp and detach heater matrix 11 from housing 5.

Undo the clip retaining nuts and lift off air intake cover 7.

Undo the clip retaining nuts and remove air distributor cover 1 of the blower shroud.

The reassembly is a reversal of removal.

Chapter 9. VAZ-21213 vehicle modifications, alternative and additional equipment

VAZ-21214 vehicle

The VAZ-21214 vehicle is fitted with 1.7-L engine, Central Fuel Injection (CFI). Instead of the carburettor, a single injector is used for injecting fuel into the central injection unit. Here fuel is mixed with air, the resulting combustion mixture is fed to the intake manifold and further to the engine cylinders.

The fuel injection system and catalytic converter in the exhaust system help reduce exhaust emission and improve vehicle performance.

This chapter provides a brief description of design features, operation and diagnostics of fuel injection system, removal and refitting procedures and methods for engine repair. Refer to Repair Manual for Central Fuel Injection System for a more detailed description of the system design, repair and diagnostics with the help of specialized tools and diagnostic charts.

Engine repair - description

Engine - removal and refitting

Before removing the engine, depressurize the fuel system. To do this, detach the fuel pump wiring plug from the injection wiring connector, start the engine, run it for a while, then stop the engine and operate the starter motor for 3 seconds to equalize the pressure in the line.

Disconnect the battery negative lead.

Slacken the nuts holding the air cleaner to the central injection unit and to the pin in the valve cover, detach the relevant hoses and remove the air cleaner. Detach the injector wiring; then temporarily plug the filler neck of the central injection unit.

Disconnect the fuel supply/return hoses from the pipes on the engine. Plug the open ends of the hoses and pipes to prevent dirt ingress or fuel leaking.

Disconnect the throttle cable from the central injection unit and from the bracket on the intake manifold.

On the central injection unit disconnect all vacuum hoses to the charcoal canister and MAP sensor, detach the crankcase vent hose. Disconnect the wiring from all injection-related units fitted to the engine.

Further steps for removing the engine are in accordance with the established procedure.

Refitting is the reverse order of removal. On completion adjust the accelerator cable and check the operation of fuel injection system, as recommended in Repair Manual for Central Fuel Injection.

Engine - dismantling and reassembly

Remove bracket 3 (Fig.9-1) with ignition module 4, then plug 2 with gasket and detent 1 with the sealing ring.

Disconnect and remove the supply/return pipes from the central injection unit and from the bracket on the valve cover.

Undo the retaining pins and remove the central injection unit, withdraw the gasket from the intake pipe surface.

Remove intake manifold 2 (Fig.9-2) with preheater 1. When applicable, on a work bench, detach the preheater complete with the gasket and sealing ring from the intake manifold.

Unscrew the crankshaft position sensor, mounted on the timing cover.

Further dismantling of the engine is carried out in the usual order as outlined in section 2.

Reassembly is the reversal of dismantling. There is a disposal gasket under the central injection unit, always remember to renew it during reassembly.

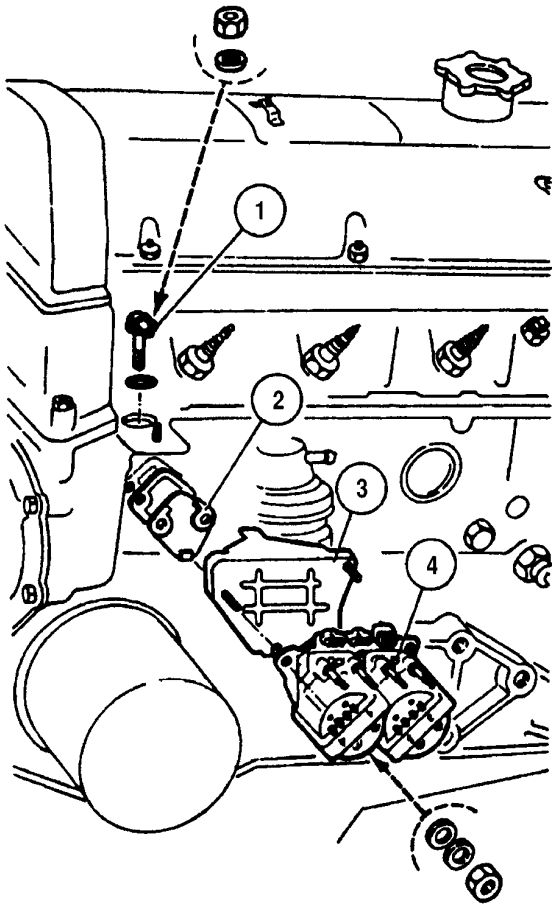


Fig.9-1. Removing the original components from the front left-hand side of the engine:
1 - detent; 2 - plug; 3 - bracket; 4 - ignition module

Central Injection Unit

Removal and refitting

Select the neutral position of the gearchange lever and apply the handbrake.

Since, after the engine is stalled, fuel remains under pressure, always depressurize the fuel system. To do this, disconnect the fuel pump wiring plug from the injection wiring harness. Start the engine and run it until it cuts off. Operate the starter motor for three seconds to equalize pressure in the pipework. Reconnect the fuel pump wiring plug to the injection wiring harness. Disconnect the battery negative lead.

Remove the air cleaner and disconnect the throttle cable from the central injection unit.

Detach the fuel pipes from the central injection unit and plug the pipe ends to prevent fuel leakage.

Disconnect the wiring plug (Fig.9-3) of throttle position sensor 4, injector 2 and idle air control valve 9.

On the central injection unit detach the vacuum hoses to the canister and MAP sender, along with the crankcase vent hose. Make certain everything is reconnected properly.

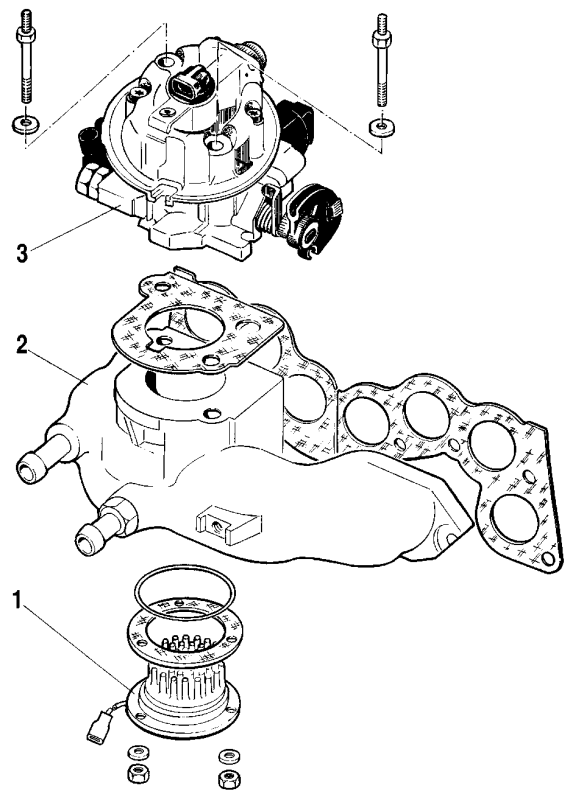


Fig.9-2. Removing the central injection unit and intake pipe:
1 - intake manifold preheater; 2 - intake manifold; 3 - central injection unit

Undo the retaining pins and remove the central injection unit from the intake pipe complete with the gasket. Plug the intake pipe end to prevent entry of extraneous matter.

Refitting is the reverse order of removing. Pay attention to the condition of the seals and gaskets, renew if applicable.

On completion, check the fuel pressure as described below.

WARNING. Never re-use the gasket mounted under the central injection unit and sealing rings of fuel pipes.

Dismantling and reassembly.

Undo the retaining screws and remove throttle position (TP) sensor 10 (Fig. 9-4), injector 6, fuel pressure regulator, vacuum hose manifold housing 13 and idle air control valve 14.

Undo two retaining screws and disconnect the fuel supply part from the throttle housing.

Reassembly is a reverse of dismantling. Examine the seals, renew if applicable. When refitting the TP sensor, align the throttle shaft flats with the TP sensor pickup lever.

Examination and repair

Injector is a one-piece unit. When removing the injector, take care not to damage the wiring plug or atomizer head.

WARNING. Never clean or wash the injector with petrol or other cleaners.

Renew the injector seals. In the event of deposits on the injector filters (the major diameter filter is a purge filter, while the minor diameter filter is an intake filter), blow the filters with compressed air, then flush the fuel tank and fuel pipes.

Apply sealant on the retainer screw thread when refitting the injector.

Fuel pressure regulator. Remember that the spring under the regulator cover is compressed, so exercise care when unscrewing the cover.

When the regulator is removed, examine the valve seats, use a magnifying glass if necessary. The seat must not show any pitting, dents or surface irregularities, otherwise renew the fuel supply housing of the central injection unit.

It is recommended to renew the valve diaphragm after each dismantling. Always smear the thread of the regulator cover securing screw with sealant.

WARNING. When refitting the fuel pressure regulator check to see the diaphragm sits correctly without skewing.

Fuel supply housing of central injection unit. During reassembly of the central injection unit always renew the gasket between the fuel supply housings and throttle plate. Cut-outs in the gasket should be aligned with the bores in the throttle plate.

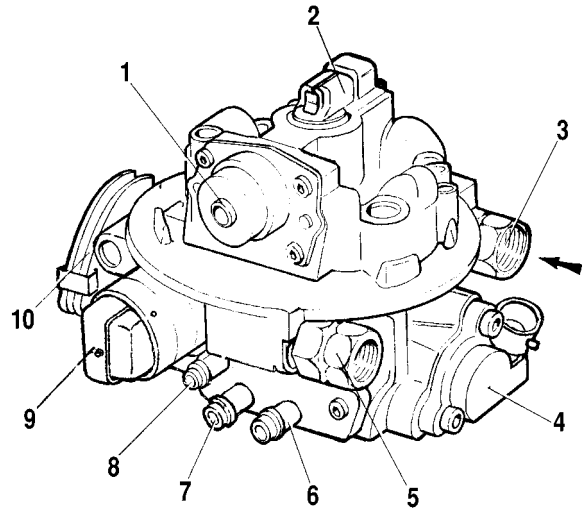


Fig.9-3. Central injection unit:
1 - fuel pressure gauge; 2 - injector; 3 - connection for fuel delivery pipe; 4 - throttle position sensor; 5 - connection for fuel return hose to tank; 6 - pipe union for canister purge hose; 7 - pipe union for crankcase vent hose; 8 - pipe union for MAP sensor hose; 9 - idle air control valve; 10 - quadrant for throttle actuation from pedal in the passenger compartment

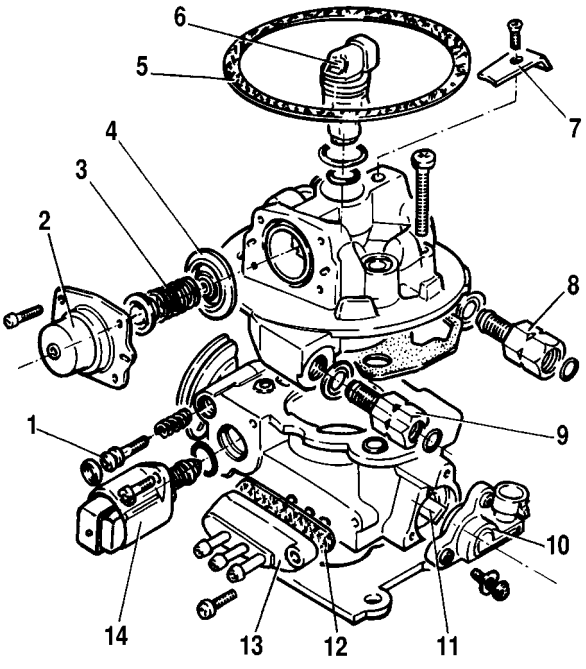


Fig.9-4. Components and assemblies of central injection unit:
1 - throttle stop screw (preset at the factory); 2 - fuel pressure regulator cover; 3 - spring; 4 - diaphragm; 5 - air cleaner gasket; 6 - injector; 7 - holder; 8 - fuel delivery pipe union; 9 - fuel return pipe union; 10 - throttle position sensor; 11 - throttle shaft; 12 - grommet; 13 - vacuum pipes housing; 14 - idle air control valve

Apply sealant on the thread of the housing securing screws.

Throttle position sensor. Before fitting the TP sensor, fully close the throttle, then turning the sensor anticlockwise, align the flats of the shaft with the sensor pickup lever.

Tighten the securing screws.

WARNING. Never clean or wash the TP sensor or idle air control valve with petrol or other cleaners.

Idle air control valve. Replace the sealing washers with new ones. The idle air control valve is of a taper shape, 10 mm diameter. Always replace it with a new valve of the respective model.

Before fitting the idle air control valve to the throttle housing, check the distance between the mounting flange and valve end. Remember, an excess protrusion of the valve can cause damages.

The distance should be less than 23 mm. When with a new idle air control valve it is in excess of 23 mm, sway the valve with your hand, pushing it in.

To avoid damage, do not hand push the valve which was in use. For this purpose it is recommended to use a diagnostic tool or specialized monitor.

After having refitted the idle air control valve and central injection unit, reconnect a diagnostic tool to the diagnostic plug and command the ECM to reset the parameters of the idle air control valve.

Throttle housing. When reassembling the central injection unit, it is a good practice to renew the sealing gasket of the fuel supply housing.

Scrape the gasket from the throttle housing and vacuum housing, fit a new gasket.

Fuel supply pressure - checking

Carry out the following checks: inspect the fuel delivery lines for leaks, check the fuel pressure regulator and electric fuel pump for satisfactory operation.

Relief the pressure in the fuel line, as described earlier for removal of the central injection unit.

Reconnect the wiring plug to the fuel pump.

Disconnect the fuel pipe from the fuel supply pipe union of the central injection unit, then using a T-piece connect a pressure gauge between the pipe union and fuel pipe.

Turn the ignition key to the position «Ignition».

Check the pressure gauge is functional, check its connection shows no leaks. The pressure should be within 190-210 kPa. When there is no pressure, listen to hear the fuel pump cuts in when the ignition key is turned to the position «Ignition» (the pump operation and its relay clicks can be distinctly heard in the passenger compartment).

Should the fuel pump fails to operate, check the pump circuit.

After two seconds of operation the fuel pump shuts off, as no

crankshaft position pulses are fed to the ECU when the engine is not running. To re-activate the fuel pump, switch off the ignition for ten seconds, then switch it on again.

After the fuel pump is shut off, the fuel pressure can slightly go down and then stabilizes; or it can go up, if the engine is warm. When the fuel pressure fails to stabilize and instead, goes down, operate the fuel pump and immediately after its stop, pinch the hose that supplies fuel to the central injection unit.

If no pressure drop is evident, check the fuel line for leaks between the fuel tank and central injection unit, check the gauze filter for tightness, then re-check pressure in the fuel delivery system.

A lower pressure (below 190 kPa) can be caused by a faulty fuel pressure regulator or by a restricted flow in the fuel delivery system.

The fuel delivery system capacity can be checked by return flow. When necessary, renew the gauze filter.

The fuel pressure regulator can be checked by a pressure gauge; for that disconnect the return hose and immerse it into a container. Operate the electric fuel pump, pinch the return hose and check the pump pressure by the pressure gauge. Release the hose. The pressure gauge reading is the pressure of the fuel pressure regulator valve actuation. Renew the fuel pressure regulator when applicable.

A higher pressure in the fuel supply system (in excess of 210 kPa) can be caused by a faulty fuel pressure regulator or a higher resistance to fuel return to the fuel tank. To check this, connect a pressure gauge to the system; then working in the engine bay, disconnect the return hose and immerse it to the container. Switch off the electric fuel pump and read the pressure gauge to check the pressure.

Should the pressure exceeds the normal value, renew the fuel pressure regulator, otherwise, identify and eliminate the cause of higher resistance to fuel return.

Electric fuel pump

Removal and refitting. Disconnect the wiring and depressurize the fuel delivery system as described in the procedure for removing the central injection unit.

Disconnect the fuel pipes from the fuel pump and undo the nuts holding it to the fuel tank. Withdraw the fuel pump unit from the fuel tank.

Refitting is a reversal of the removal procedure.

The electric pump cannot be dismantled or repaired. In case of failure, always replace it with a new one.

Evaporative emission control system

Examine the hoses and charcoal canister. If the housing is found cracked or damaged, renew the charcoal canister.

If leakage is evident, check the hose connections for tightness. Renew a leaking canister.

Electrical equipment

Refer to Fig.9-5 for electric wiring diagram that is complemented with the injection wiring harness routed between the injection electronic control unit (ECU) and various sensors and injection system actuators.

Through a separate connector, three wires of the injection wiring harness are linked to the low tension (LT) input of the tachometer in the instrument cluster, to the «CHECK ENGINE» lamp and terminal «15» of the ignition switch.

There are five fuses in the injection wiring harness.

Fuse 16 (50 amperes) is housed separately. It protects the intake manifold preheater. The remaining four fuses (15 amperes each) are located in a separate fusebox 17, on the left-hand side, under the facia console.

Refer to Table 9-1 for detailed information on the circuits fused.

Table 9-1

Injection system protective fuses

Fuse	Circuits protected
1-2	Fuel pump «on» relay (contacts) Electric fuel pump. Fuel injector.
3-4	Oxygen sensor. Vehicle speed sender. Canister valve. Intake manifold preheater relay (winding).
5-6	ECU. Ignition control module.
7-8	Reserve

In addition to fuses, there is «a fusible link» at the end of the red wire connected to the battery. This fusible link represents a length of black wire of 1mm^2 cross-section, whereas the main red wire is of 6 mm^2 cross-section.

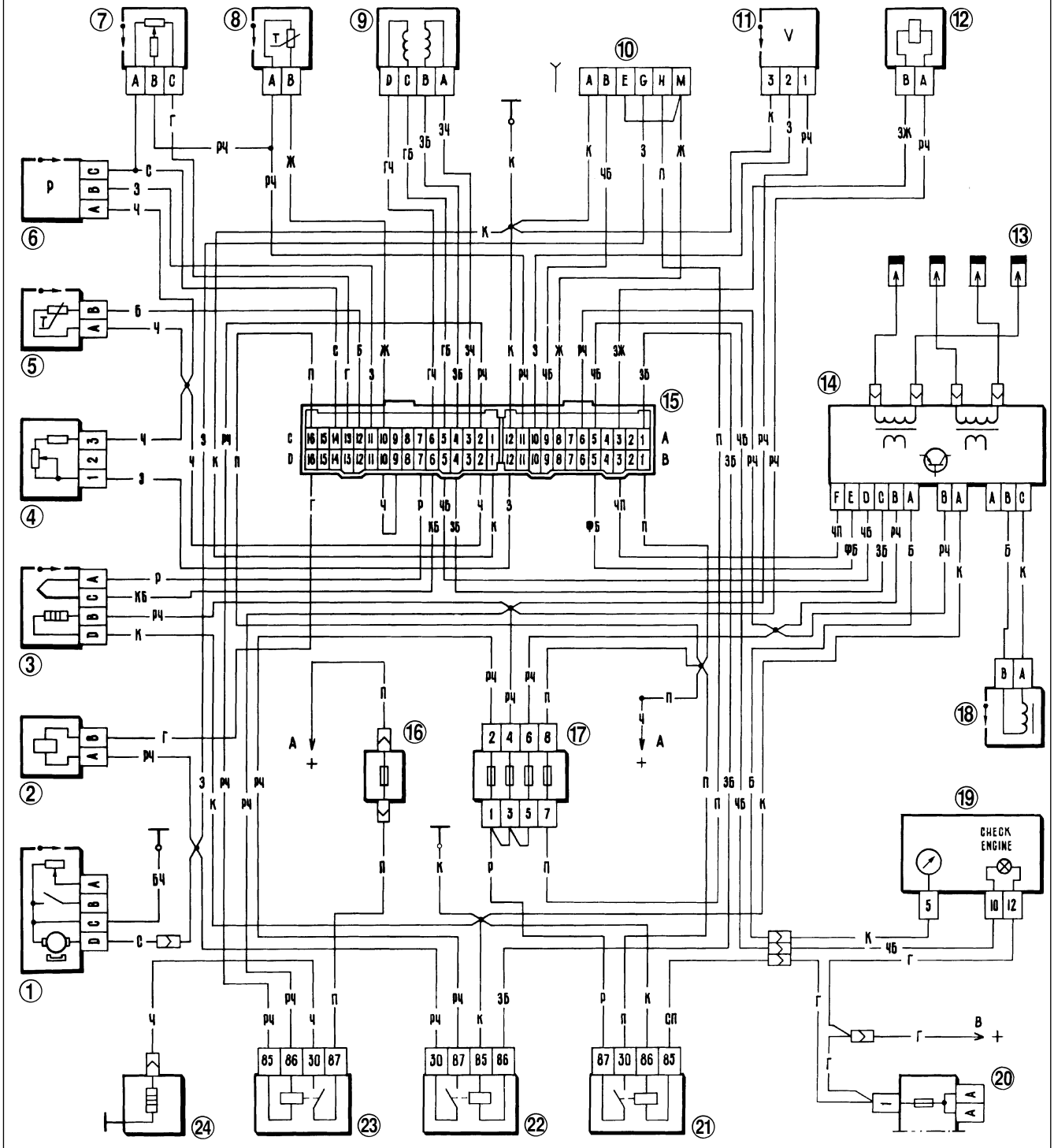


Fig.9-5. Wiring diagram for VAZ-21214 vehicle, CFI:

1 - electric fuel pump and fuel level sender; 2 - injector; 3 - oxygen sensor; 4 - octane potentiometer; 5 - air temperature sensor; 6 - MAP sensor; 7 - throttle position sensor; 8 - coolant temperature sensor; 9 - idle air control valve; 10 - diagnostic plug; 11- speed sender; 12 - canister purge valve; 13 - spark plugs; 14 - ignition module; 15 - electronic control unit plug; 16 - intake manifold preheater fuse; 17 - fusebox, injection system; 18 - crankshaft position sensor; 19 - instrument cluster with tachometer and «CHECK ENGINE» light; 20 - main fusebox; 21 - ignition relay; 22 - fuel pump cut-in relay; 23 - intake manifold preheater relay; 24 - intake manifold preheater;
A - to battery «+» terminal; B - to ignition switch terminal «15»

VAZ-21214-20 vehicle

The VAZ-21214-20 vehicle is fitted with a 1.7-L engine, Sequential Fuel Injection.

Engine 21214-10

The engine 21214-10 is four-stroke, four-cylinder, in-line, SOHC, with Sequential Fuel Injection System.

The 21214-10 engine is based on the 21213 engine. Both engines have similar housing components, piston / connection rod mechanism and power unit mounting. The differences include the sequential ignition system used instead of the carburettor, the hydraulic valve lifters and hydraulic chain tensioner in the valve timing gear. All this results in different engine dismantling and reassembly, with respect to removal and refitting of air supply units, fuel metering system and lubrication system.

Power unit - removal and refitting

Before removing the power unit, depressurize the fuel supply system. For that disconnect the fuel pump wiring plug from the injection wiring harness, operate the engine, let it run until it stops, then operate the starter for three seconds to equalize pressure in the fuel lines.

Disconnect the battery negative lead.

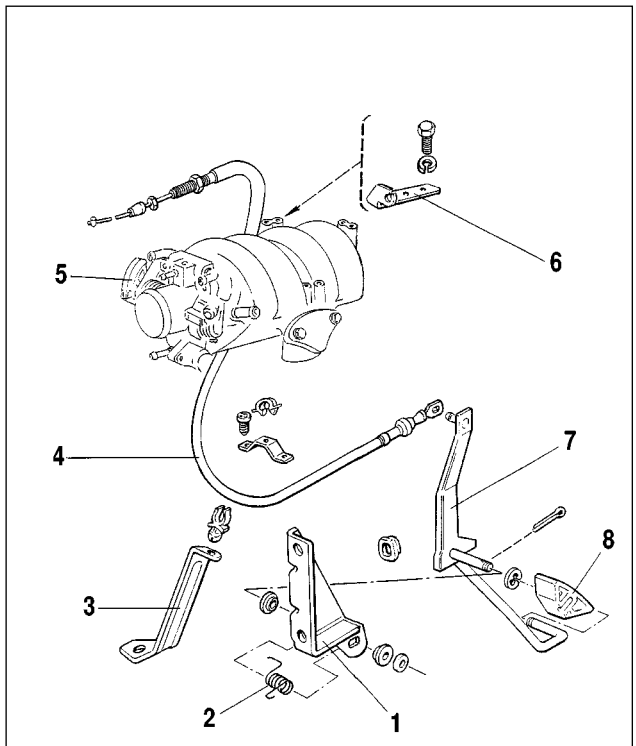


Fig.9-7. Removing the accelerator linkage:
1 - bracket; 2 - return spring; 3 - support bracket; 4 - throttle cable; 5 - sector with throttle lever; 6 - cable retaining bracket; 7 - throttle pedal; 8 - pedal pad.

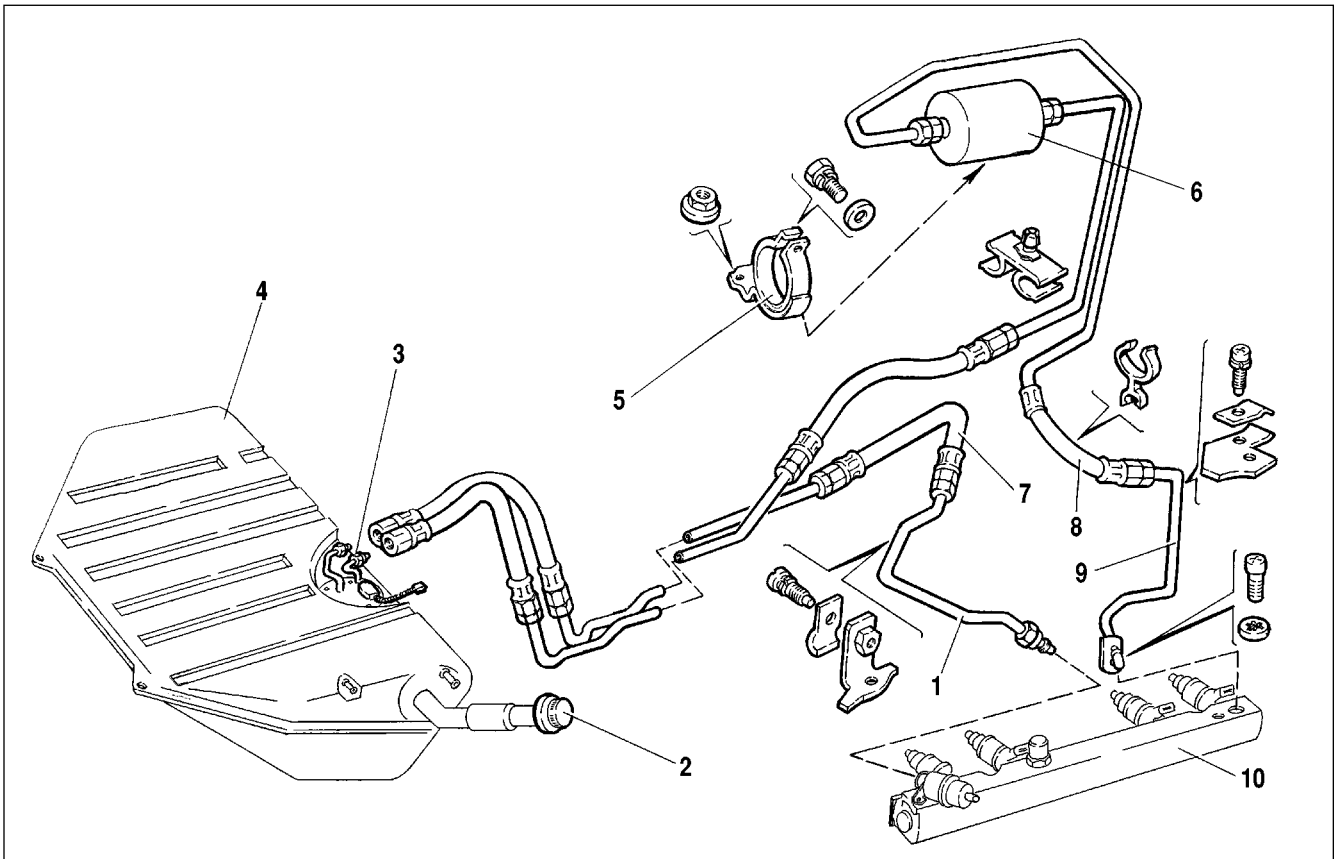


Fig.9-6. Fuel tank and fuel pipes:
1 - return pipe; 2 - cap; 3 - electric fuel pump; 4 - petrol tank; 5 - fuel filter strap; 6 - fuel filter; 7 - fuel return hose; 8 - fuel delivery hose; 9 - fuel delivery pipe; 10 - fuel rail

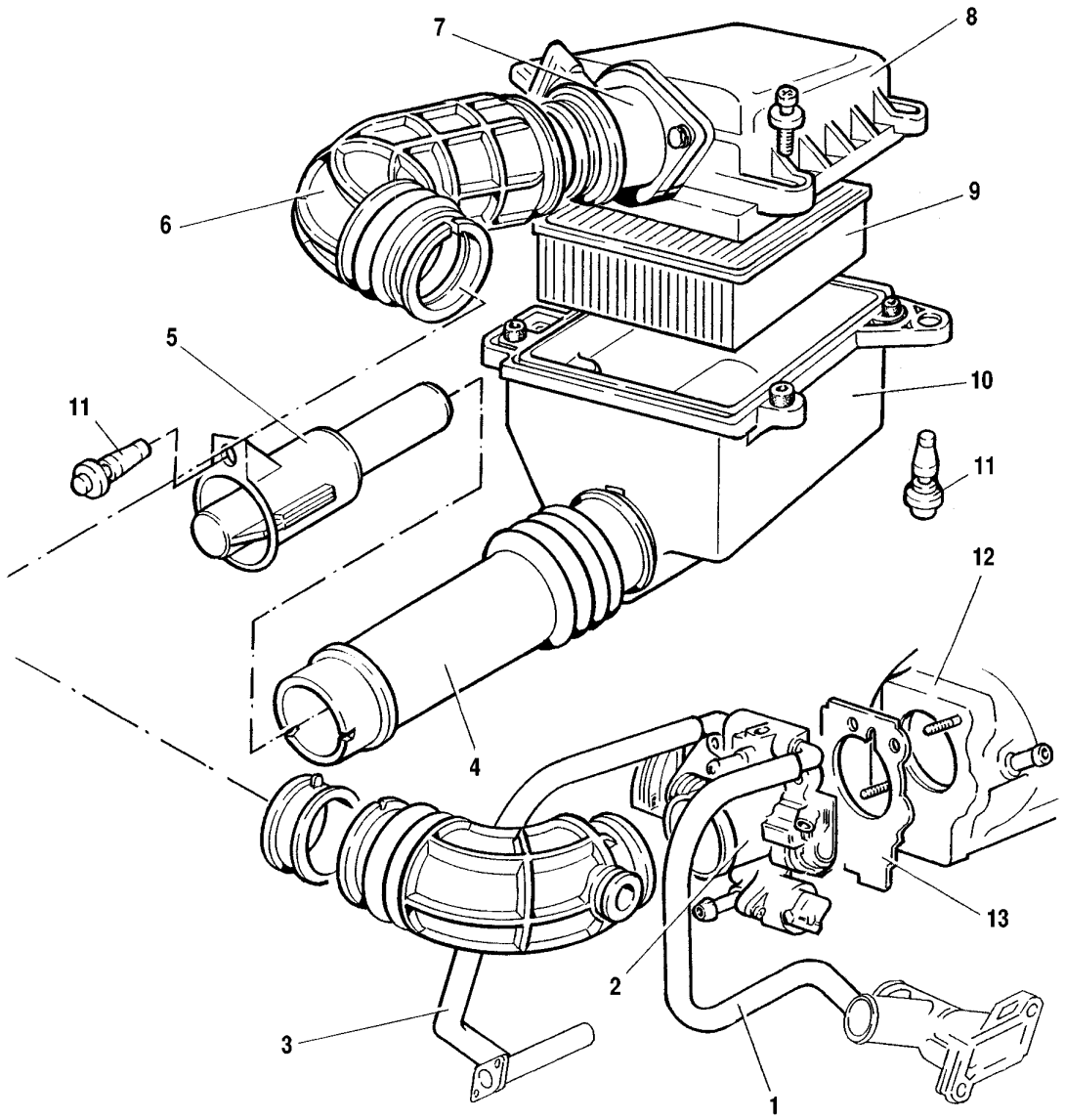


Fig.9-8. Removing the components and units of air intake system:
1 - part throttle channel heater hose; 2 - throttle body; 3 - return hose from throttle body; 4 - air intake; 5 - air intake end piece; 6 - intake manifold hose; 7 - MAF sensor; 8 - air cleaner cover; 9 - filtering element; 10 - air filter housing; 11 - filter mounting; 12 - receiver unit; 13 - gasket

Disconnect hoses 7 and 8 (supply and return) (Fig.9-6) from pipes 1 and 9. Plug the hose / pipe ends to prevent dirt ingress.

Disconnect accelerator cable 4 (Fig.9-7) from sector 6 on the throttle hosing, bracket 5 on the receiver unit and from bracket 3 on valve cover.

Disconnect the crankcase evap hose from hose 6 (Fig.9-8) connection, loosen two clips and remove hose 6 of the intake manifold. Cut off three rubber mountings 11 holding the air cleaner to the body and one mounting that retains the cold air intake end to the radiator, remove the air cleaner complete with mass air flow meter 7.

From the receiver unit disconnect the vacuum hose to the fuel pressure regulator and to the brake servo unit.

Disconnect the canister purge hose from the throttle housing (when the vehicle is fitted with the evaporative emission control system).

Disconnect the wiring from the throttle manifold, ignition module, injector wiring harness, all relevant sensors on the power unit and from reversing light switch on the transmission.

Next proceed with the usual removal procedure as described in chapter 2.

Refitting is the reverse order of removal. The rubber mountings of the air cleaner are disposal, so new mountings must be fitted when refitting the air cleaner.

After refitting the power unit, adjust the accelerator drive. At fully released accelerator pedal 7 (Fig. 9-7), the throttle should be fully closed. The cable should be taut. The cable deflection by hand force should be 10 mm as a maximum. When necessary, adjust the cable tension using the adjuster nuts at the cable end.

At fully depressed accelerator pedal, the throttle should be wide open, throttle sector 6 should have no further movement.

Check the injection system for satisfactory operation, as outlined in Repair Manual for Fuel Sequential Injection System.

Engine - dismantling and reassembly

The main differences on dismantling and reassembly are related to alternative design of the air supply system.

Mount the engine on the test bench, drain oil from the oil pan, dismantle the engine in the order described below.

Disconnect supply 1/return 3 coolant hoses (Fig.9-8) and idle crankcase vent hose from throttle manifold 2. Undo the nuts holding the throttle housing to receiver unit 12 and withdraw the throttle housing with gasket 13.

Disconnect and remove supply 9 /return 1 fuel pipes (Fig.9-6) from fuel rail 10, fuel pressure regulator and from the bracket on the receiver unit. Detach and remove vacuum hose 6 (Fig.9-9) from receiver unit 8 and fuel pressure regulator 5.

Undo five nuts holding the receiver unit to intake pipe 1 and withdraw the receiver unit complete with gasket 7.

Disconnect the wiring from the injectors, withdraw fuel rail 4 with pressure regulator 5, having undone two bolts 3 holding it to the intake pipe. Undo retaining nuts and bolts, withdraw the brackets, followed by the intake pipe with the shield. Detach the ignition module and knock sensor from the left-hand side of the engine.

Further engine dismantling is as described in chapter 2 of this Manual. The engine reassembly is reverse of the dismantling procedure. Before refitting the fuel rail, lubricate the injector sealing rings with motor oil.

Valve mechanism - design description

Valves 2 (Fig.9-10) are operated by the cams through rocker arms 3. One end of the lever presses down the valve, while the other end rests on the spherical head of the hydraulic lifter. The hydraulic lifters automatically eliminate the clearance in the valve train, so during technical service you do not need to check or adjust the valve clearances.

Lubricating oil through pipe 3 (Fig.9-11) flows to the tensioner cavity «E» (Fig. 9-12), through the bore «Д» and valve unit 2 into the working cavity «B» pushing down plunger 5. Tensioner housing 1 has a 1 mm bore to release air in the cavity «E».

The diameter clearance between housing 1 and plunger 5 should be 0.018-0.024 mm and is measured as a difference between the maximum measured diameter of plunger 5 and minimum measured diameter of housing 1.

The tensioner housing and plunger make a unit, where no replacement of either part is allowed once the clearance has been selected. Plunger 5 should easily stroke within housing 1 up to 16 mm.

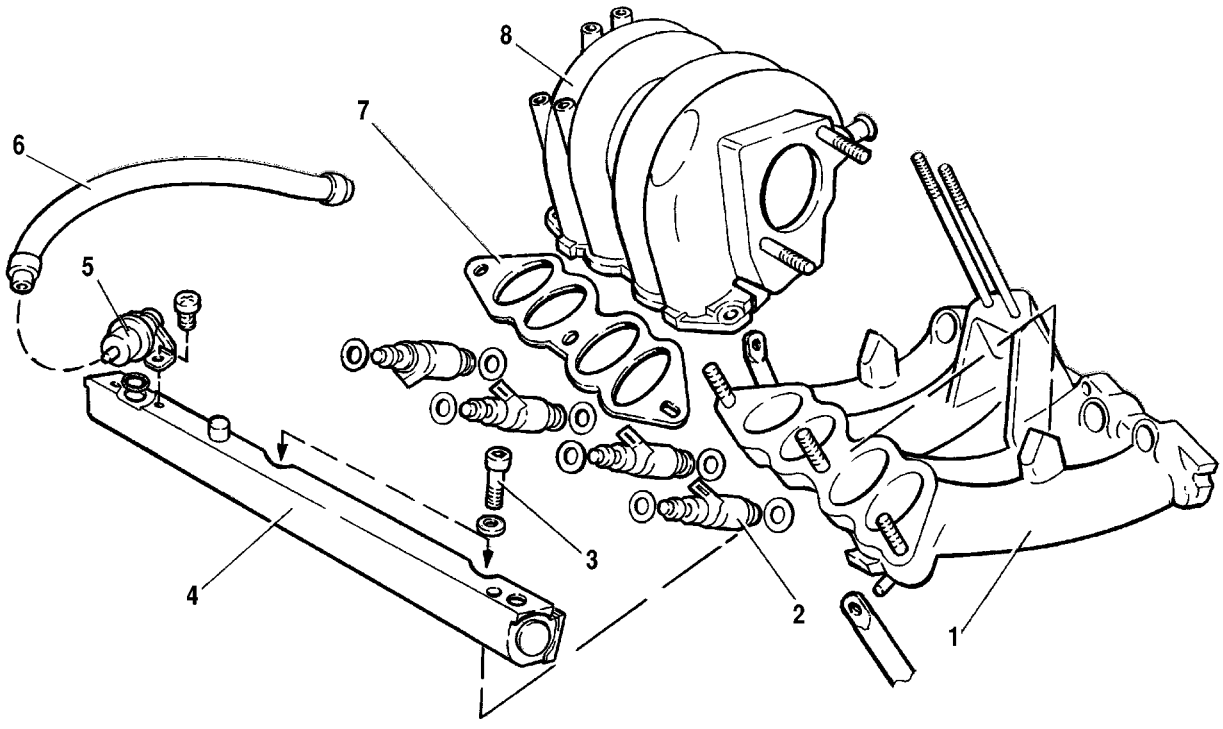


Fig.9-9. Removing the fuel system components:
1 - intake manifold; 2 - injector; 3 - bolt; 4 - fuel fail; 5 - fuel pressure regulator; 6 - vacuum hose; 7 - gasket; 8 - receiver unit

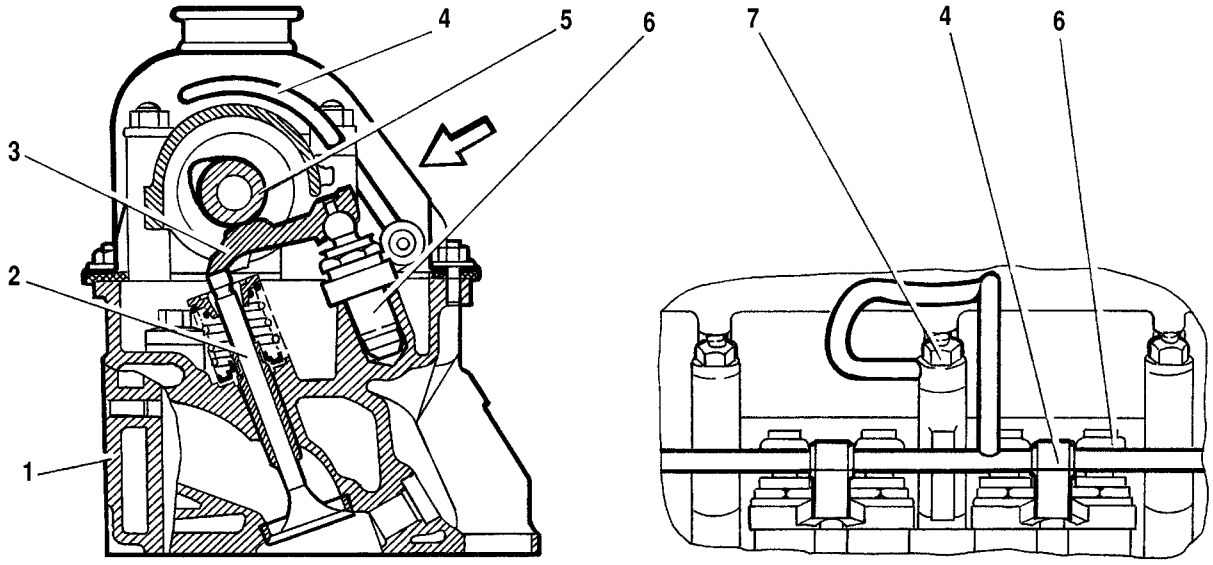


Fig.9-10. Valve actuation:
1 - cylinder head; 2 - valve; 3 - valve lever; 4 - rail, hydraulic valve lifter; 5 - camshaft; 6 - hydraulic valve lifter; 7 - nut

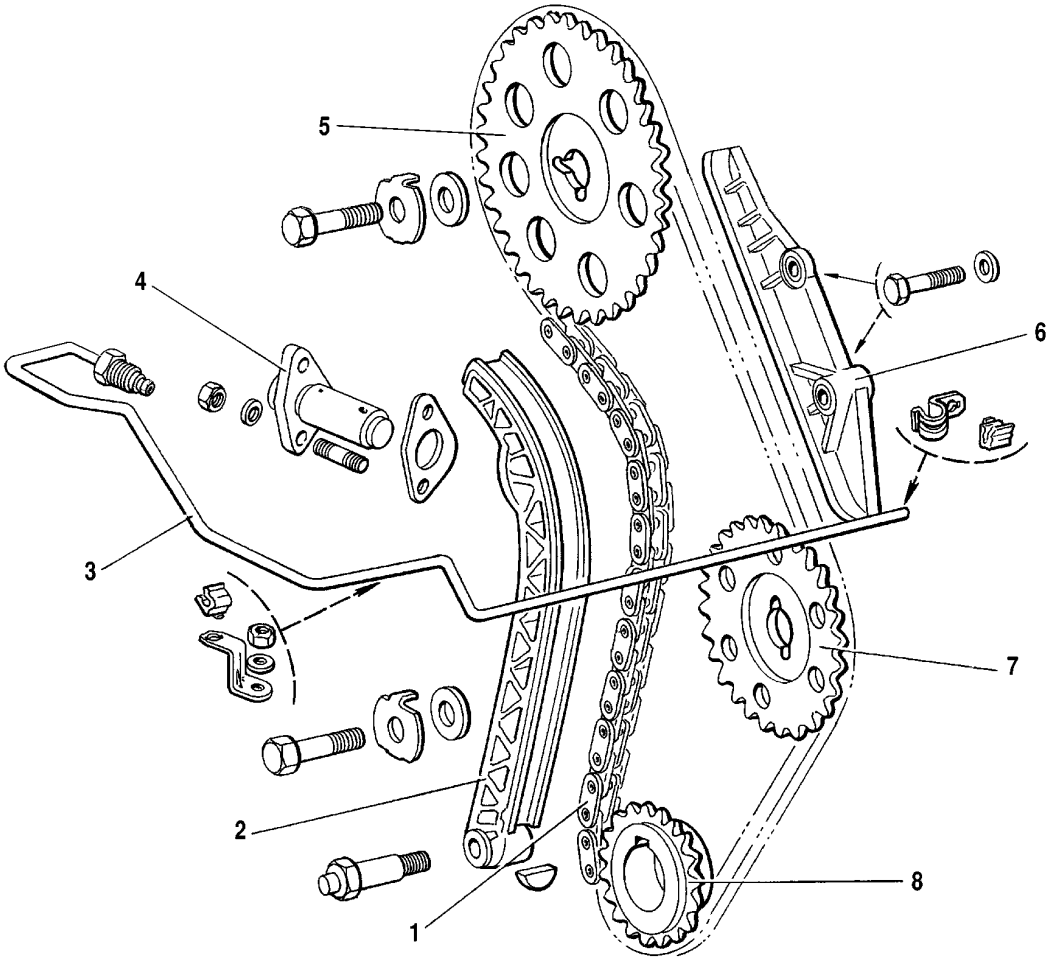


Fig.9-11. Exploded view of chain tensioner:
1 - chain; 2 - tensioner shoe; 3 - oil delivery pipe to tensioner; 4 - chain tensioner; 5 - camshaft sprocket; 6 - chain damper; 7 - oil pump shaft sprocket; 8 - crankshaft sprocket

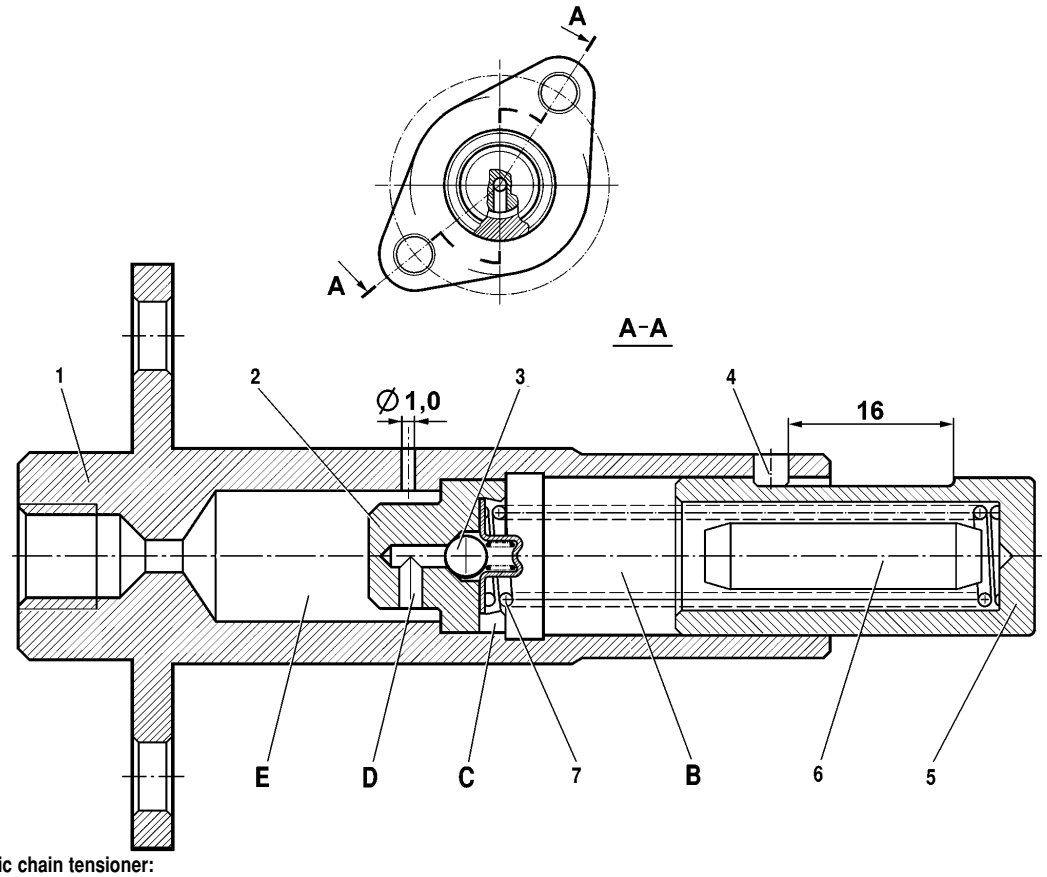


Fig.9-12. Hydraulic chain tensioner:

1 - tensioner housing; 2 - valve unit; 3 - ball, non-return valve; 4 - stop pin; 5 - plunger; 6 - volume restrictor; 7 - spring; B - working cavity; C - locating slot; Д - hole; E - reserve cavity

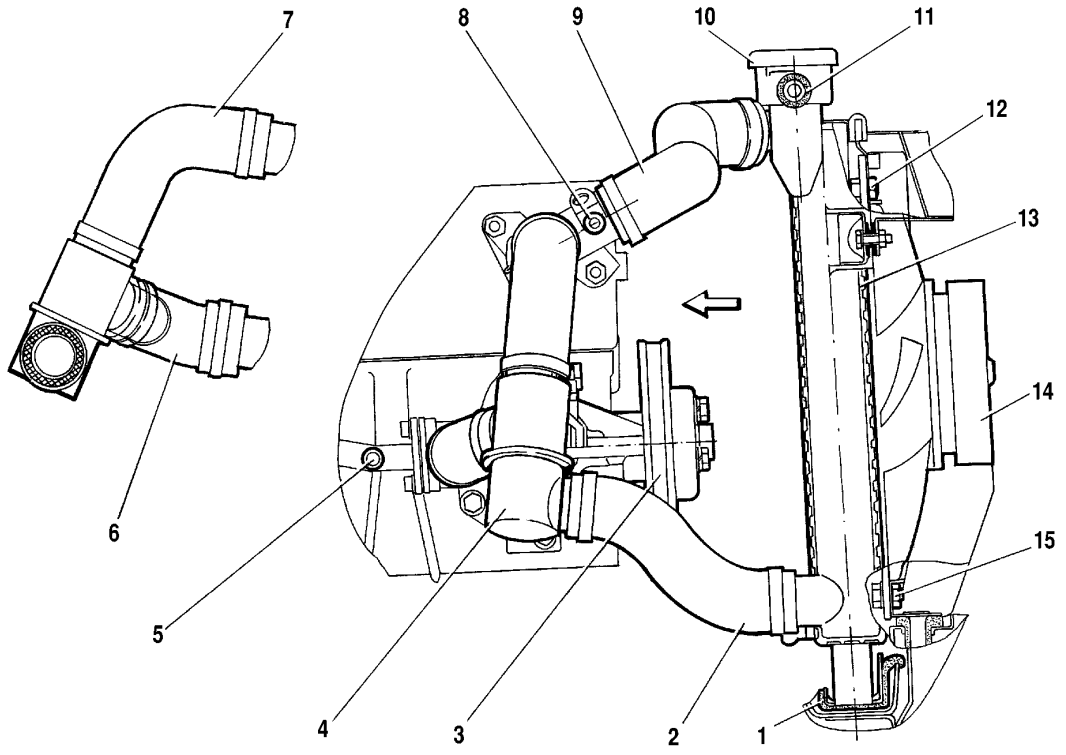


Fig.9-13. Cooling system:

1 - radiator pad; 2 - radiator return hose; 3 - water pump pulley; 4 - thermostat; 5 - drain pipe from throttle housing; 6 - coolant delivery hose to pump; 7 - transfer hose, thermostat; 8 - coolant delivery pipe for part throttle channel preheating; 9 - radiator delivery hose; 10 - radiator cap; 11 - hose between radiator and expansion tank; 12 - top fan cowl securing nut; 13 - radiator; 14 - electric fan; 15 - bottom fan cowl securing nut

When refitting to the engine, the tensioner should be free from oil, dowel 4 should not protrude from the housing.

Cooling system

The cooling system features two electric fans 14 (Fig.9-13). The fan cowl is mounted in front of the radiator and is held by two top 12 and two bottom 15 nuts.

The introduction of the throttle housing in the cooling system has necessitated its heating-up by delivery of coolant via hose 8 from the cylinder head return pipe. The coolant is returned through hose 5 which connects the throttle housing to the heater matrix return pipe.

The cooling fan motor is operated by the electronic control unit, so there is no fan blower «cut-in» sensor.

Fuel system

The fuel system is within the Engine Management System (EMS) which is described in detail in a separate Repair and Service Manual for EMS, Sequential Fuel Injection, therefore this section describes only removal, refitting and replacement of the air cleaner filter element.

The air filter is mounted at the front right-hand side of the engine bay on three rubber mountings 11 (Fig.9-8).

Fresh air through air intake 5 and pipe 4 is drawn into air cleaner housing 10. The air then flows through paper filter element 9, MAF sensor 7, hose 6 and throttle housing 2. From the throttle housing the warm air is directed to receiver unit 12 and intake pipe and further to the cylinder head and cylinders.

Filter element - renewal

1. Undo four retaining bolts, remove air cleaner cover 8 complete with MAF sensor 7 and intake pipe hose 6.

2. Renew filter element 9 so that its corrugation is parallel to the vehicle axial line.

3. Refit and secure the air cleaner cover.

Crankcase ventilation system

Draught ventilation is provided to expel crankcase gases and fuel vapours into the engine intake pipe.

Crankcase gases are drawn through hose 1 (Fig.9-14) into the intake pipe hose and further via the throttle housing and receiver unit into the intake pipe.

At low rpm and closed throttle, most of crankcase gases are drawn along hose 2 to the throttle housing.

Flushing. To flush the system disconnect vent hoses 1 and 2 from the intake pipe hose and throttle housing 3. Remove oil separator 8 cover 5 and wash both units with petrol or kerosine. Flush and blow with compressed air all hoses and connectors.

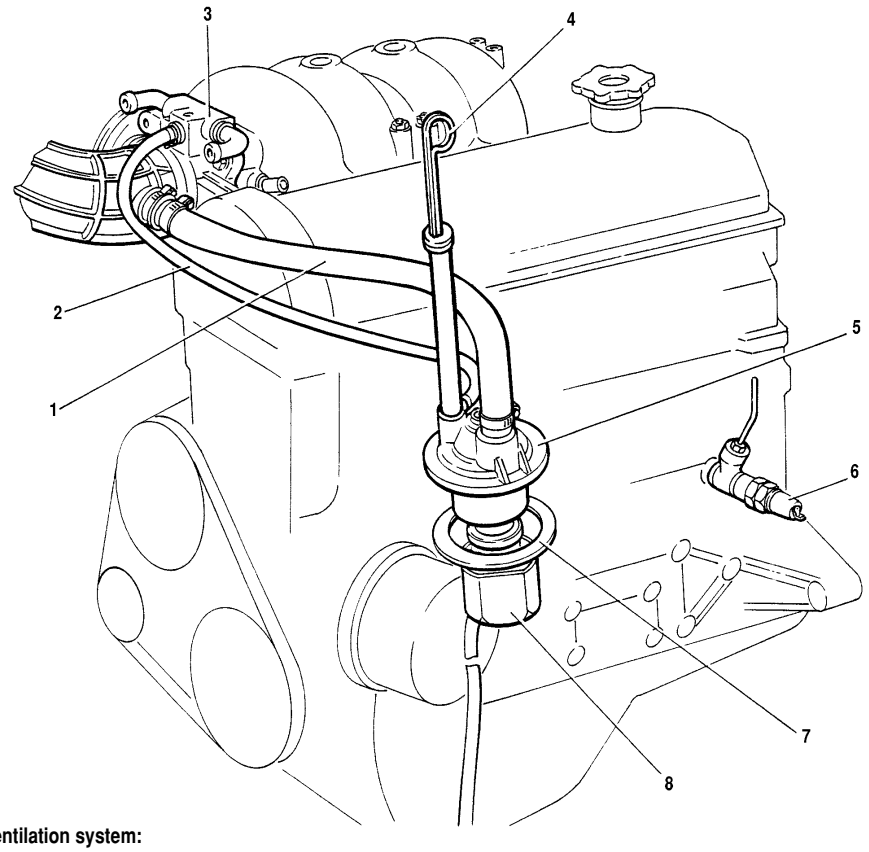


Fig.9-14. Crankcase ventilation system:
1 - discharge hose; 2 - vent hose; 3 - throttle housing; 4 - oil dipstick; 5 - oil separator cover; 6 - oil pressure gauge; 7 - gasket; 8 - oil separator

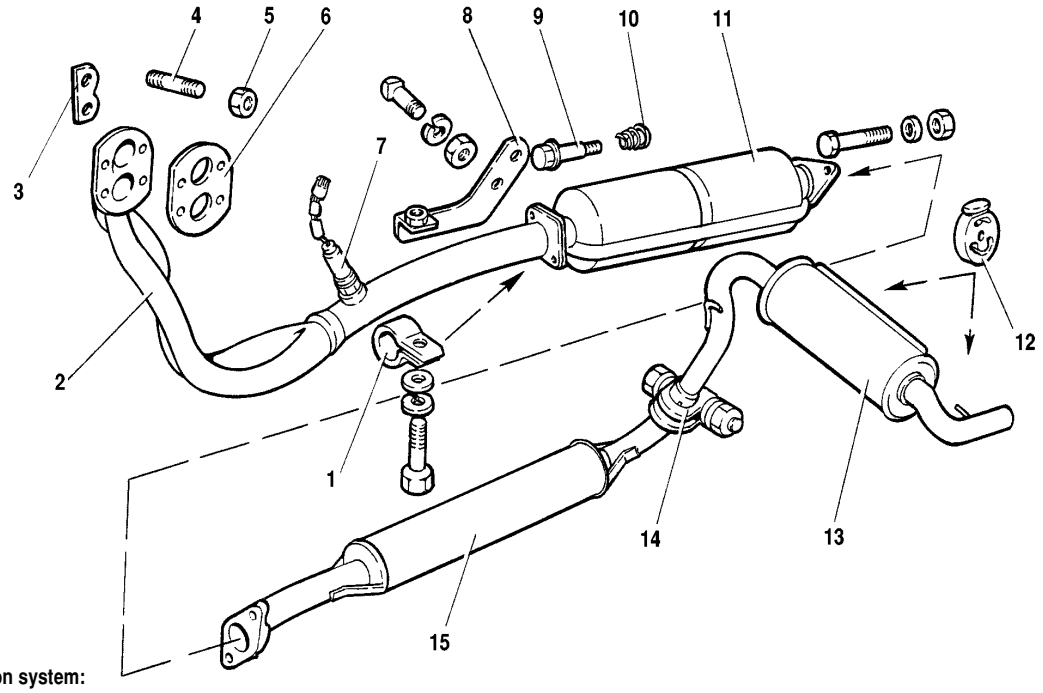


Fig.9-15. Exhaust emission system:
1 - clasp; 2 - front exhaust pipe; 3 - lock plate; 4 - pin; 5 - nut; 6 - gasket; 7 - oxygen sensor; 8 - bracket; 9 - bolt; 10 - conical string; 11 - catalytic converter; 12 - suspension loop; 13 - main silencer; 14 - clip; 15 - front silencer

Exhaust emission system

Exhaust gases are drawn from the engine through the exhaust manifold, front exhaust pipe 2 (Fig.9-15), catalytic converter 11, front silencer 15 and main silencer 13.

The downpipe is connected to the catalytic converter flange by means of a movable joint. Between the flanges there is a metallographite ring with a spherical surface.

Downpipe 2 is secured with nuts 5 onto exhaust manifold studs 4, gasket 6 is fitted between them. Lock plates 3 are placed under the nuts. The other end of the downpipe by means of clasp 1 is secured to bracket 8, fitted to the transmission cover.

Main silencer 13 is attached to the underbody by two suspension loops 12.

The silencers complete with pipes represent single units and should be renewed as such during repair.

Electrical system

An EMS wiring harness is added to the vehicle electrical system (Fig.9-16) to connect the ECU with EMS sensors and actuators. No headlamp wipe/wash is fitted to VAZ 21214-20 vehicle.

Three wires of the EMS wiring harness through a separate plug are connected to the tachometer LT input in the instrument cluster, to «CHECK ENGINE» lamp and to ignition switch terminal «15».

There are four fuses in the EMS wiring harness. They are located in a separate fusebox 26, underneath the left-hand end trim cover. Refer to Table 9-2 for details.

Table 9-2

Injection system fuses

Fuse	Circuits protected
1-2	Electric fuel pump relay (contacts). Electric fuel pump.
3-4	ECU.
5-6	Main relay (contacts). Oxygen sensor. Vehicle speed sender. Canister purge solenoid. Electric fuel pump relay (winding). Electrical fan blower relay (winding). ECM. MAF meter. Injection wiring harness.
7-8	Electric fan blower relay (contacts). Electric fans.

Besides the fuses there is «a fusible link» at the end of red wire, which is connected to the battery «+» terminal. The «fusible link» represents a length of black wire of 1 mm^2 cross-section, whereas the main red wire is 6 mm^2 cross-section.

Cooling fan motors. The cooling fans are operated by two dc motors (MP 8015 model) on permanent magnets.

The motors are triggered by EMS ECU via a relay. With the engine running the relay cuts in when the coolant temperature exceeds 105°C or cuts off when the coolant temperature goes below 101°C.

The motors are maintenance-free and must be renewed in case of failure.

Motor specification

Nominal shaft speed with impeller load, rpm . . . . . .2000 - 2200
Current consumption at speeds and loads
as specified, amperes, not greater 15

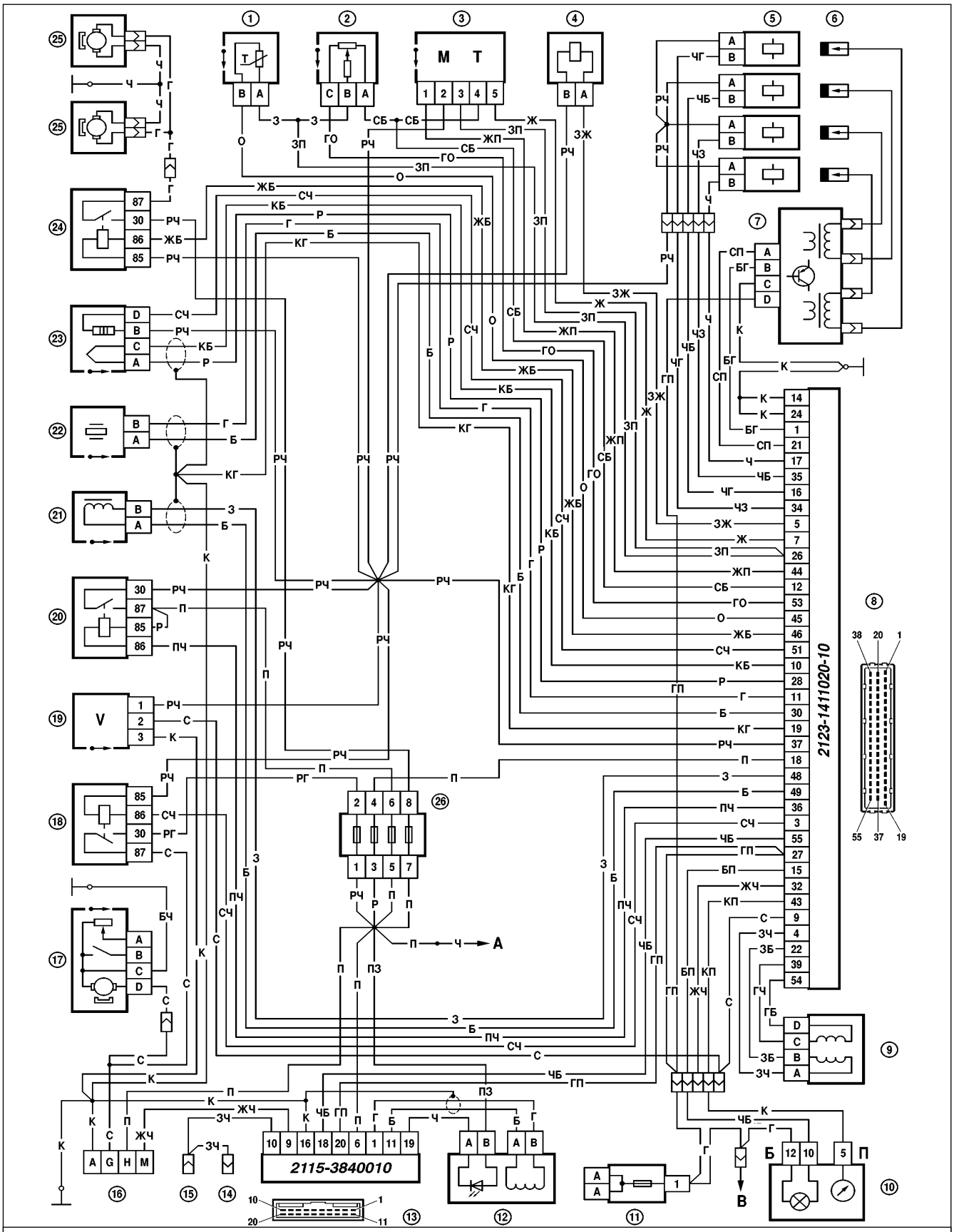


Fig.9-16. EMS wiring diagram (Sequential Fuel Injection), VAZ-21214-20 vehicle:

1 - coolant temperature sensor; 2 - throttle position sensor; 3 - mass airflow meter; 4 - canister purge solenoid; 5 - injectors; 6 - spark plugs; 7 - ignition module; 8 - electronic control unit; 9 - idle air control valve; 10 - instrument cluster with tachometer and CHECK ENGINE light; 11 - main fusebox; 12 - LED, antitheft system ; 13 - control module, antitheft system; 14 - to door courtesy light switch; 15 - to interior light switch; 16 - diagnostic plug; 17 - electric fuel pump and fuel level sender; 18 - fuel pump relay; 19 - speed sender; 20 - main relay; 21 - crankshaft position sender; 22 - knock sensor; 23 - oxygen sensor; 24 - fan relay; 25 - electric fans; 26 - injection system fusebox; **A** - to power supply

VAZ-21215-10 vehicle

The VAZ-21215-10 vehicle is fitted with the diesel engine DHW (XUD-9SD).

The section gives a brief description of diagnostic procedures for fuel and electrical systems, engine removal and refitting, repair procedures for engine systems.

For detailed design, repair and diagnostic procedures with respect to all engine systems using specialized tools and diagnostic charts, refer to PEUGEOT Repair Manual for Diesel Engine.

The diesel engine operation depends much on the sound fuel injection system, this is why this section focuses on the fuel supply units and components.

In the event the injection system has failed, do not blame the high pressure pump, first check the following:

– fuel tank and fuel level;

– delivery and return fuel lines;

– fuel filter;

– injectors;

– glow plugs;

– engine stop solenoid resistance.

Examine the engine, since higher flash-point temperature depends on compression, valve and piston ring condition.

Inspect the air cleaner, battery, starter motor, check the oil level.

Major faults and remedial actions

1. Engine does not start, emitting no smoke:

- check fuel level in fuel tank;
- set engine manual stop device to normal position;
- check fuel delivery pipes; in case of leaks, tighten connections or replace pipes;
- check engine stop solenoid for resistance, wiring conductivity and fuel inflow.

If engine still fails to start after all these checks and remedial actions, remove high pressure pump and test it using specialized equipment.

2. Engine does not start, emitting black smoke:

- when engine speed is below 150 rpm, check condition and fitting of battery terminals and starter motor, battery charge, oil grade and oil level;
- when engine speed is over 150 rpm, start engine without using air cleaner; when no smoke is evident, renew filter element, check proper mounting of air cleaner housing;
- check injection timing is correct, check fuel injectors are sound;
- check valve adjustment and compression in cylinders.

Should smoke persists despite all remedial actions, remove and test pump using specialized equipment.

3. Engine does not start, emitting white smoke (cold engine):

Check the following items:
- glow plugs;
- secondary warming-up system;
- cylinder head gasket;
- injection timing.

If smoke persists after repair work, remove pump for inspection.

4. Difficult cold engine start with black smoke:

Check the following items:
- glow plugs;
- fast idle thermostat;
- injection timing;
- injectors;
- hydraulic lifters and valve clearances;
- compression.

Should smoke persists after repair, remove and test pump using specialist equipment.

5. Engine starts and stalls:

Check the following items:
- idle adjustment;
- oil grade and oil level;
- ventilation system;
- fuel feed system;
- solenoid;
- secondary warming-up system;
- air cleaner;
- non-return valve on LUCAS pump.

Should engine stalls despite repair performed, remove fuel pump.

6. Unstable idle:

Check the following items:
- settings of engine stop prevention system and idle (for LUCAS);
- settings for idle and fuel remainder return (for BOSCH);
- accelerator lever spring;
- fuel feed system;
- injectors;
- valve clearances;
- cam belt tension.

In case of failure to adjust idle speed, remove and examine pump on a specialist test bench.

Engine - removal and refitting

Place the vehicle on the lift or over an inspection pit, chock the front wheels and raise the rear axle from one or both sides.

Withdraw the bonnet, disconnect wiring from the battery and electrical units fitted to the vehicle. Remove the battery and underbonnet lamp.

Drain fluid form the cooling system and heater; to do this unplug the expansion tank, undo the drain plugs on the radiator (underneath, left-hand side) and on the cylinder block (left-hand side).

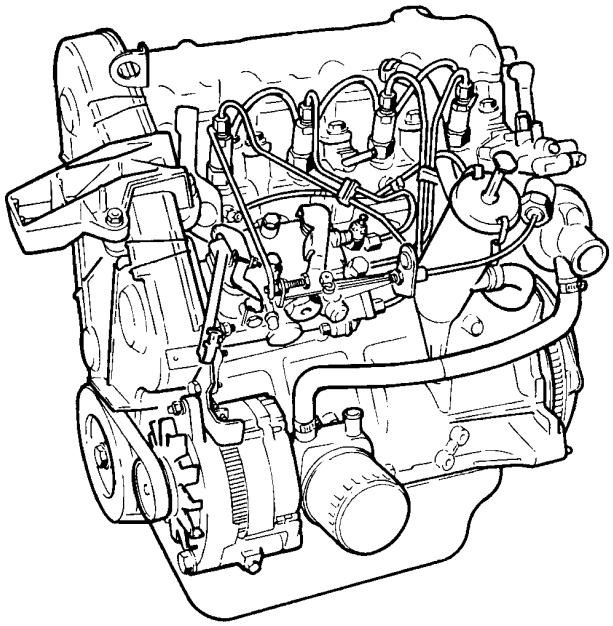


Fig.9-17. Engine - general view

From the engine (Fig.9-17) disconnect the coolant supply and return hoses, remove the radiator complete with the grille and fan cowl. Disconnect the cooling hoses from the thermostat. Disconnect the hoses between the engine and heater.

From the air cleaner (Fig.9-18) disconnect the crankcase vent hose, undo three securing nuts, remove the air cleaner cover complete with the gasket; extract the filter element. Undo four nuts which hold the air cleaner housing to the intake pipe and withdraw the air cleaner housing and gasket.

Disconnect the fuel delivery and return hoses from the high pressure fuel pump.

Using a box spanner, undo the nuts retaining the front exhaust pipe to the exhaust manifold.

Using a flat screwdriver, release the ball end and disconnect the fuel delivery operating cable from the high pressure pump.

Undo the retaining screw and release the end piece, then disconnect the cable from the timing advance lever.

Remove the transmission, working as described in section «Gearbox» in the Repair Manual.

Hoist the cross-piece TCO-3/379 and lock the engine on the right-hand side at the clamp, fitted to the front exhaust manifold securing stud, while on the left-hand side - at the hole for clutch housing fastening. Slightly tighten the hoist chain, undo the nuts securing engine mounting rubbers 2 (Fig.9-19) to the front suspension cross-member and lift the engine out.

Remove the heat shield of the starter motor and withdraw the starter motor. Undo the clutch retaining bolts and withdraw the clutch.

Refitting the engine is carried out as follows:

- refit the cooling hoses, connectors and clamps;
- check the radiator for deposits, leaks, damages;
- check the radiator cooling fan operation;
- check the radiator cap seal and valve;
- fit a new air cleaner and fuel filter elements;
- refill the engine with oil;
- adjust the controls;
- eliminate air pockets and refill the cooling system;
- start and warm-up the engine;
- adjust idle speed;
- check the lubricating and cooling systems for leaks.

Draw special attention to the engine / transmission connection: the input shaft must fully engage the splines of the clutch disc.

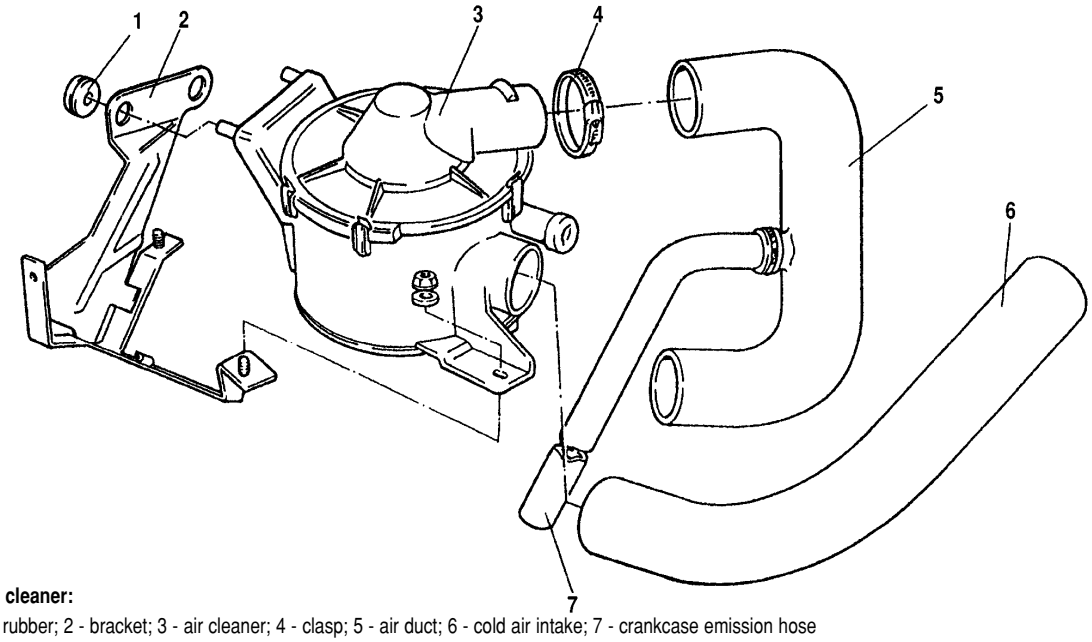


Fig.9-18. Air cleaner:
1 - mounting rubber; 2 - bracket; 3 - air cleaner; 4 - clasp; 5 - air duct; 6 - cold air intake; 7 - crankcase emission hose

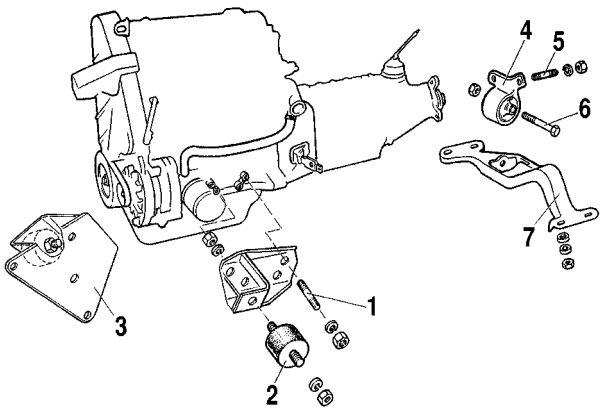


Fig.9-19. Engine support:
1 - left-hand bracket retaining pin; 2 - engine mounting rubber; 3 - right-hand bracket /rubber assembly; 4 - bracket with rear engine support mounting; 5 - pin; 6 - bolt; 7 - rear engine support cross-piece

Cooling system

Design description

The cooling system is of closed-, pressurized type, with expansion tank (Fig.9-20).

The coolant pump is of centrifugal type, driven by a V-belt from the crankshaft pulley.

The cooling system includes radiator 7 with expansion tank 5, thermostat 13, coolant temperature gauge, water jacket and connecting hoses.

During engine operation, water, warmed up in the water jacket, through the drain pipe flows to the radiator or thermostat, depending on the thermostat valve position. Then water is sucked by the pump and returned to the water jacket.

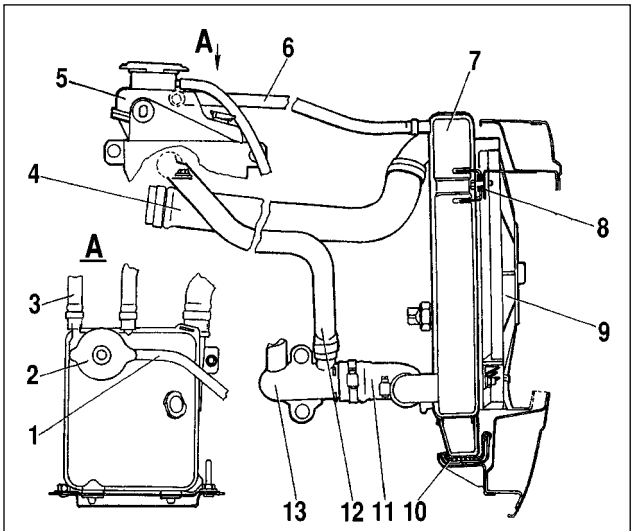


Fig.9-20. Cooling system:
1 - expansion tank vapour discharge pipe; 2 - expansion tank cap; 3 - engine vapour discharge hose; 4 - radiator delivery hose; 5 - expansion tank; 6 - radiator vapour discharge pipe; 7 - radiator; 8 - top radiator mounting rubber; 9 - electric fan blower; 10 - bottom mounting rubber; 11 - return hose; 12 - filler hose; 13 - thermostat

The cooling system is fitted with a built-in double-acting thermostat, the valve opening temperature is 83°C.

Coolant - level and density check

With the cold engine (15-20°C) the level of water in the expansion tank must be 25-30 mm above the «MIN» mark.

WARNING. It is recommended to check the water level on the cold engine, since on heating up water expands, so the fluid level can rise significantly on the warm engine.

When necessary, use areometer to check the coolant density to be 1.078-1.085 g/cm^3 for Tosol A-40.

When the level in the expansion tank is below the norm, while the density exceeds the value required, add distilled water. In case of normal density top up the coolant of the same grade as the coolant in the cooling system.

Coolant change

Observe the following procedure when changing coolant:

- set the heater controls in the position «heating»;

- undo the caps in the bottom radiator cooler and cylinder block, remove the expansion tank cap and drain coolant through two drain holes. Detach the expansion tank and lift it over the radiator, then remove the coolant remainder from the expansion tank;

- to flush the cooling system, fill the system with clean water, start the engine and run it until the radiator bottom cooler is warm. With engine idling, drain water through the drain holes, stop the engine and let it cool;

- repeat flushing steps as described above;

- after flushing refit the caps and fill the system with new coolant 25-30 mm above the «MIN» mark on the expansion tank;

Fill coolant through the filler neck of the expansion tank. Refit the cap, start the engine and allow it to idle for 1.5-2 minutes. Stop the engine and when necessary top up coolant.

Cambelt - removal and refitting

The cam removal procedure is as follows (Fig.9-21):

- remove covers 3, 5 и 6 of valve timing mechanism;

- fix the flywheel using tool OUT0000049;

- loosen the crankshaft pulley retaining bolts;

- remove the crankshaft pulley;

- fix the flywheel with tool OUT0000015;

- secure the camshaft and fuel pump pulleys with retaining bolts (the bolts should be hand tightened only);

- loosen nut 2 and bolt 4 (Fig.9-22);

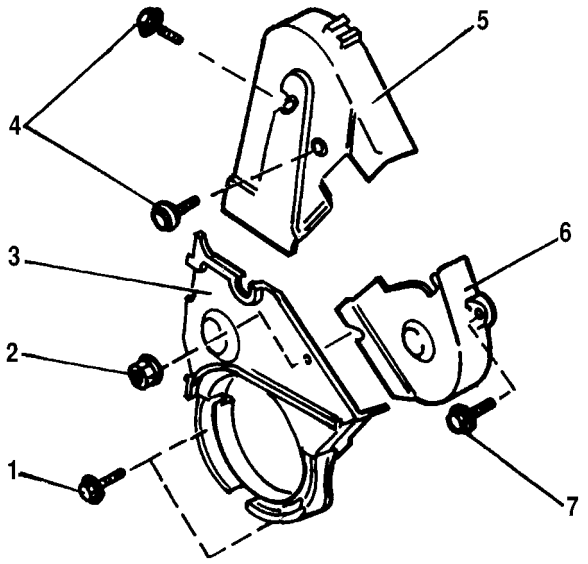


Fig.9-21. Removing and refitting the timing covers:
1 - securing bolts, bottom cover; 2 - nut; 3 - bottom cover; 4 - securing bolts, left-hand cover; 5 - left-hand cover; 6 - right-hand cover; 7 - bolt

- use special wrench (of 10 mm square size) for 5 mm square hole and turn the bracket clockwise to remove spring 6;

- tighten bolt 4;

- remove the cambelt.

Refitting is the reversal of the removal procedure:

- make sure the camshaft and fuel pump pulleys are in the position required and secured, idler pulley 7 (Fig.9-22) and tensioner 3 rotate freely, while plunger 1 and spring 6 are free within the tensioner housing;

- refit the belt providing it is taut;

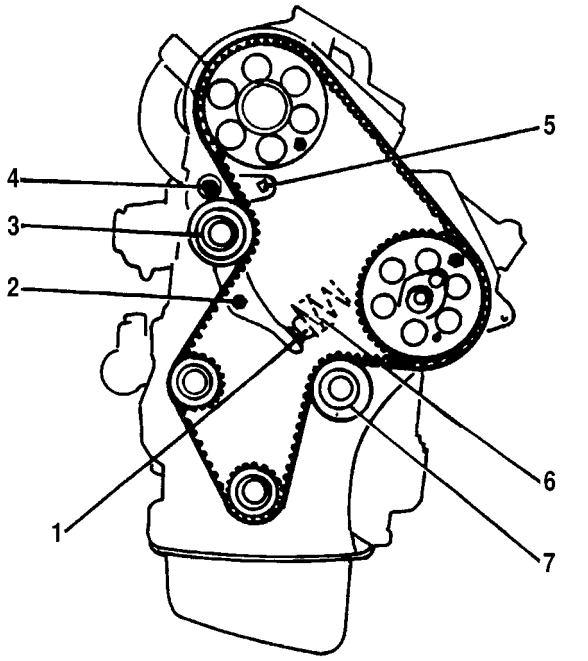


Fig.9-22. Removing and refitting the cambelt:
1 - plunger; 2 - nut; 3 - tensioner roller; 4 - bolt; 5 - square-type hole; 6 - spring; 7 - idler pulley

- refit the timing belt over the pulleys in the following order: crankshaft pulley, idler pulley 7, fuel pump pulley, camshaft pulley, tensioner pulley, water pump;

- slacken bolt 4 to release the tensioner;

- remove the retaining bolts and flywheel retainer;

- tighten bolt 4 and nut 2;

- rotate the crankshaft two turns clockwise.

Tension - checking:

- tighten the retaining bolts and refit the flywheel retainer;

- loosen bolt 4 and nut 2 to spread tension over the belt;

- tighten bolt 4 and nut 2 to 18 N•m;

- refit the crankshaft pulley;

- coat bolt 20 with Loctite 243;

- fix the flywheel with tool OUT0000049;

- refit the pulley retaining bolt, torque to 40 N•m, turn to further 60°;

- refit bottom cover 3 (Fig.9-21), tighten bolts 1 to 15 N•m;

- refit cover 5, tighten bolts 4 to 15 N•m;

- tighten right-hand cover 6 bolt 7 to 10 N•m.

Note. *When you fail to refit any securing bolt or a retainer, repeat the complete procedure for the cambelt refitting.*

Alternator - removal and refitting

Removal. Loosen tensioner 2 bolt and bolt 9 (Fig.9-23). Tighten bolt 8 until it comes against the limiter. Remove the belt.

CHECK *to see pulley 4 rotates easily without seizures.*

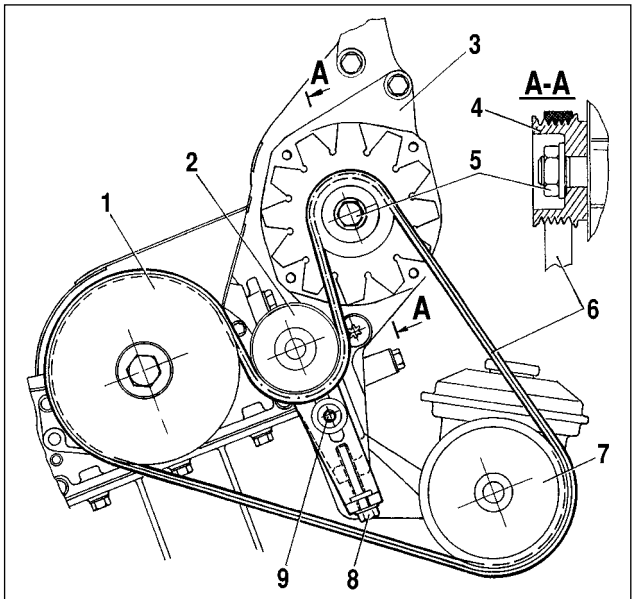


Fig.9-23. Removing and refitting the alternator drive belt:
1 - crankshaft pulley; 2 - tensioner pulley; 3 - alternator; 4 - alternator pulley; 5 - nut; 6 - alternator drivebelt; 7 - vacuum pump pulley; 8 - tensioner bolt; 9 - tensioner fixing bolt

Refitting. Refit the belt over the pulleys and ensure the belt is located properly within the groove of each pulley.

Belt tensioning is carried out in the following sequence:

- tighten the belt through loosening bolt 8;

- locate tool OUT0000016;

- use bolt 8 to tighten the belt until the tool reads 115±10 SEEM;

- remove the tool, tighten the tensioner bolt and bolt 9;

- turn the crankshaft clockwise four turns;

- locate tool OUT0000016, check the tension and adjust it as applicable;

- remove the tool, tighten bolts to 22 N•m.

Lubrication system

Design description

The lubrication system is of mixed type. The crankshaft and camshaft bearings, oil pump shaft and inner gear are pressure lubricated, while pistons, piston rings, gudgeon pins and cylinder walls are fling lubricated.

Oil change

Change oil on a warm engine only. Allow at least 10 minutes after opening the drain plug to completely drain oil.

Oil change should be accompanied by the oil filter renewal; use tool A.60312 to undo the filter. When refitting the filter into position, tighten the filter by hand only - do not use any tools.

Renew oil in the following sequence:

- stop the engine and drain oil; without removing the oil filter, pour in cleaning oil to the «MIN» mark of the oil dipstick. Use cleaning oils of ВНИИНП-ФД, МСП-1 or МПТ-2М type;

- start the engine and run it at low rpm for 10 minutes;

- fully drain the cleaning oil and discard the old oil filter;

- fit a new filter and pour oil of required season grade.

Fuel system

Design description

Fuel system consists of a fuel tank, a fuel filter, a high pressure fuel pump, injectors, an air cleaner, an intake pipe and high / low pressure fuel pipes.

High pressure fuel pump is maintenance-free. To exclude air leaks resulting in higher fuel consumption, remember to check the pipes are properly tightened.

Injectors. In case of difficult engine start or black smoke form the silencer, remove, check and if necessary, renew the injectors. When refitting the injectors always renew both copper and steel washers.

Fuel filter is one-stage with a replaceable filter element, a built-in water separator and a sludge discharge cap. Undo the central bolt, remove the housing and clean it in diesel fuel. Renew the filter element and oil seals.

Air cleaner has a replaceable filter element made of special cardboard and a gauge strainer from synthetic cotton.

WARNING. Fuel accessories (high pressure fuel pump, fuel injectors, fuel filter) must be repaired at specialist maker's workshops. This manual does not cover the relevant dismantling, repair and reassembly procedures.

Idle adjustment

No adjustments of maximum fuel supply and speed are possible. The adjustments can only be done by specialist dealers.

Idle speed can be adjusted. Any changes in adjustments can result in rapid engine wear and ensued loss of guarantee.

Fast idle - setting. With the cold engine , lever 10 (Fig.9-24) should touch limiter 9; when necessary, tighten cable 7 by tensioner 11. The cable movement should be more than 6 mm.

Accelerator - setting. Fully depress the accelerator pedal, lever 4 should touch limiter 5. Make sure that at idle lever 4 rests on limiter 9.

Warm up the engine, the electric fan blower must cut in.

Engine stall prevention system. Fit 4 mm gasket 8 between lever 4 and limiter. Depress stop lever 2.

Insert 3 mm pin 3 in lever 10. Set the crankshaft speed at 900 ±100 rpm by turning limiter 9.

Remove gasket 8 and locating pin 3.

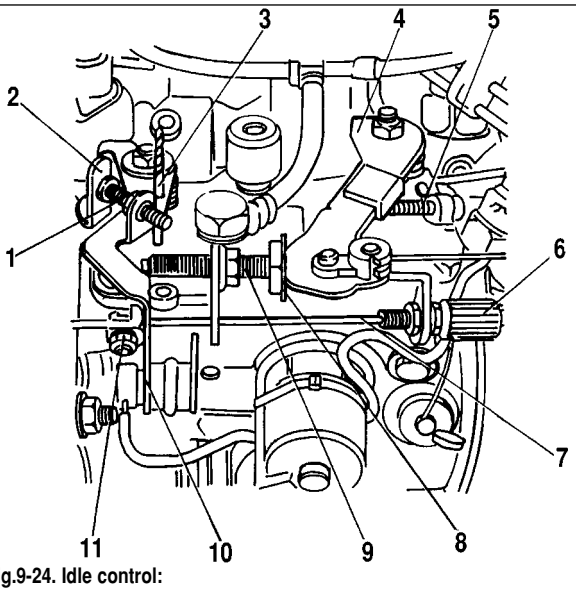


Fig.9-24. Idle control:
1 - throttle stop (CO adjustment) screw; 2 - stop lever; 3 - locating pin; 4 - load lever; 5 - limiter; 6 - outer cable tensioner; 7 - accelerator cable; 8 - gasket; 9 - limiter; 10 - fast idle lever; 11 - cable tensioner

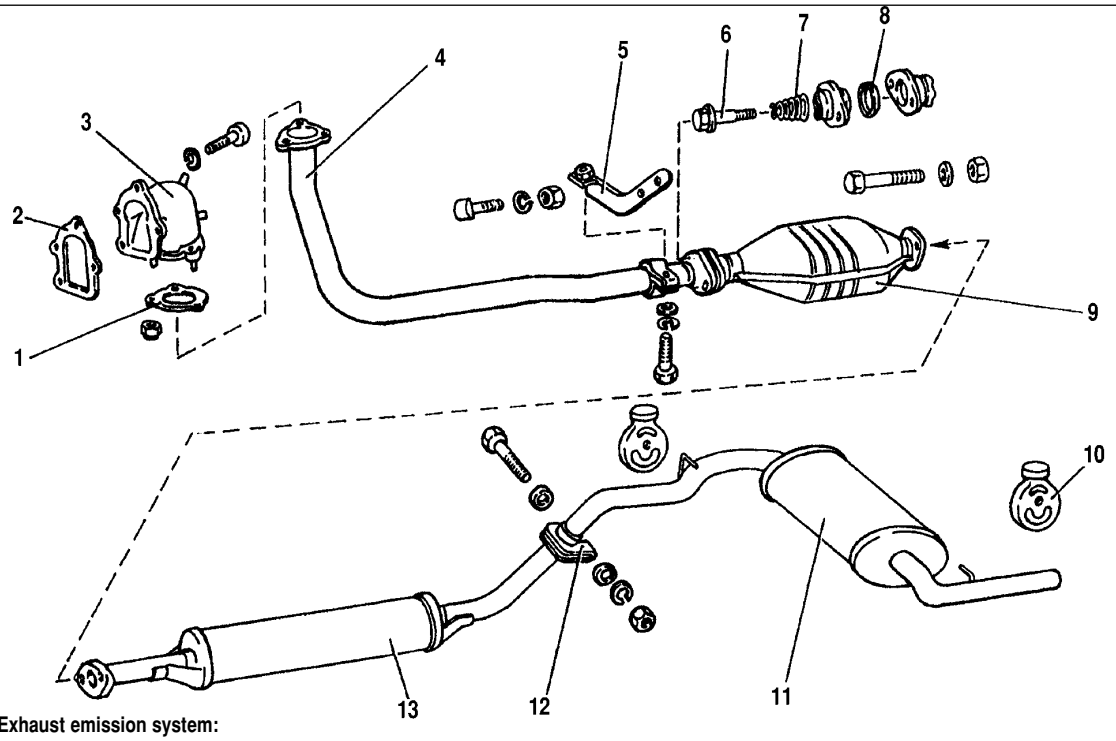


Fig.9-25. Exhaust emission system:
1 - exhaust gasket; 2 - gasket; 3 - exhaust manifold; 4 - downpipe; 5 - bracket, downpipe; 6 - bolt; 7 - helical spring; 8 - sealing ring; 9 - catalytic converter; 10 - suspension loop; 11 - main silencer; 12 - clasp; 13 - front silencer

Adjust idle with the help of screw 1. The idle speed should be 800-850 rpm.

Engine rundown - checking. Using load lever 4 set the engine speed at 3000 rpm. Release the load lever, the engine rundown should be 2.5 - 3.5 seconds.

After returning to idle, the speed difference should not exceed 50 rpm.

WARNING. The adjustment screws for maximum fuel feed and speed are sealed at the factory.

Exhaust emission system

Exhaust gases escape from the engine through exhaust manifold 3 (Fig.9-25), front exhaust pipe (downpipe) 4, catalytic converter 9, intermediate silencer 13 and front silencer 11.

There is a steel heat shield over the catalytic converter. Exhaust gasket 1 is fitted between the downpipe flange and exhaust manifold 1.

The downpipe is connected to the catalytic converter flange through a moving joint. Metal/graphite ring 8 with a spherical surface is placed between the flanges, an inner spherical surface is provided in the flange of the downpipe.

The silencer pipes are held together by means of clasp 12. Downpipe 4 is attached by three nuts to the exhaust manifold and in addition to bracket 5.

No dismantling or repair of the silencers or pipes is possible, have them always replaced with new ones.

Electrical system

Alternator. The Valeo alternator is supplied together with the engine. The wiring diagram for alternator is shown in Fig.9-26.

When the ignition is switched on, the alternator «B» terminal is powered through warning light 6. After the engine start current is not supplied through the warning light and it does not illuminate. The alternator «W» terminal is used for voltage supply to electronic tachometer 4.

Starter motor. The Valeo starter motor is supplied together with the engine. The wiring diagram for starter motor is shown in Fig.9-27.

Engine management system (EMS). The wiring diagram for the engine management system is shown in Fig.9-28.

The system design, operation and diagnostics are detailed in a separate «Peugeot» Manual for Diesel Engine Diagnostics.

Vehicle antitheft system. The vehicle VAZ-21215-10 is fitted with an antitheft system of relay type (АПС-2Р).

The antitheft system includes control module 1 (Fig.9-29), system state indication LED 2 and code key fobs 3. The theft-deterrent system represents an electronic control module, which allows in case of unauthorized use to inhibit the engine start through disconnecting the relevant electrical circuits.

Refer to Fig.9-30 for the wiring diagram of theft-deterrent system. The installation of the antitheft system brought alterations in operation of direction indicators and hazard flashers (Fig.9-31), windscreen wipe/wash (Fig.9-32), rear window wipe/wash and heating (Fig.9-33).

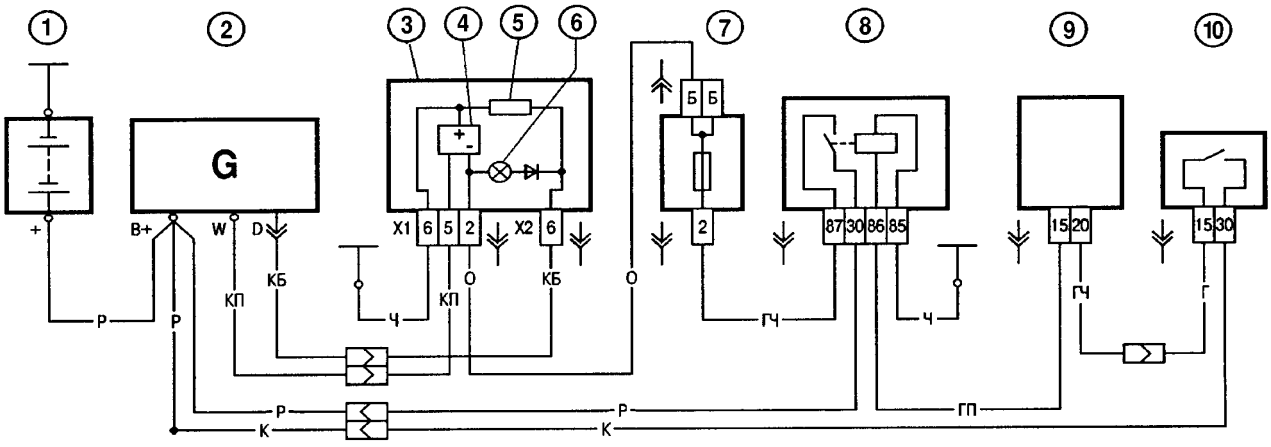


Fig.9-26. Wiring diagram for alternator:
1 - battery; 2 - alternator; 3 - instrument cluster; 4 - digital tachometer; 5 - resistor 50 Ohm, 5 W; 6 - low battery warning light; 7 - fusebox; 8 - ignition relay; 9 - control module, theft-deterrent system; 10 - ignition switch

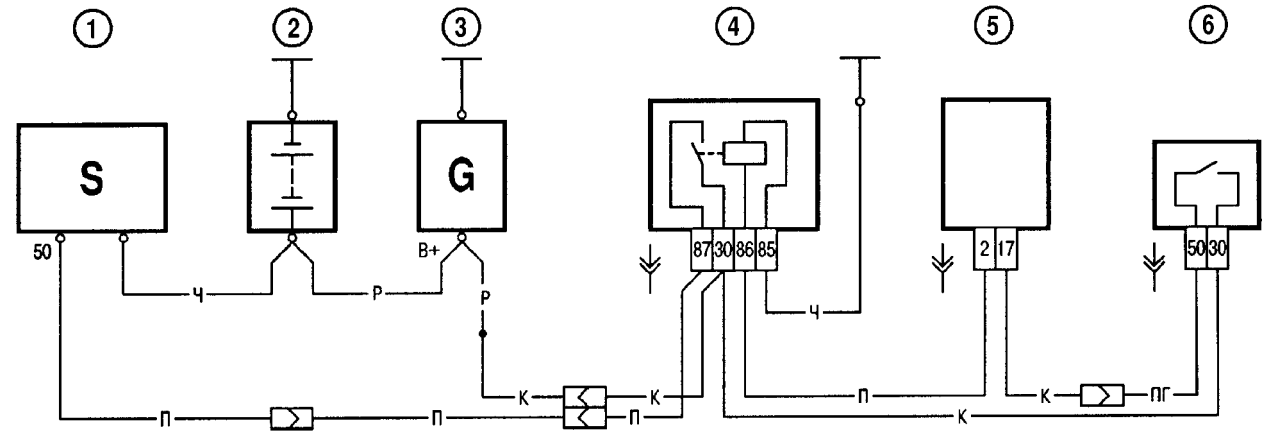


Fig.9-27. Wiring diagram for starter motor:
1 - starter motor; 2 - battery; 3 - alternator; 4 - ignition relay; 5 -control module, theft-deterrent system; 6 - ignition switch

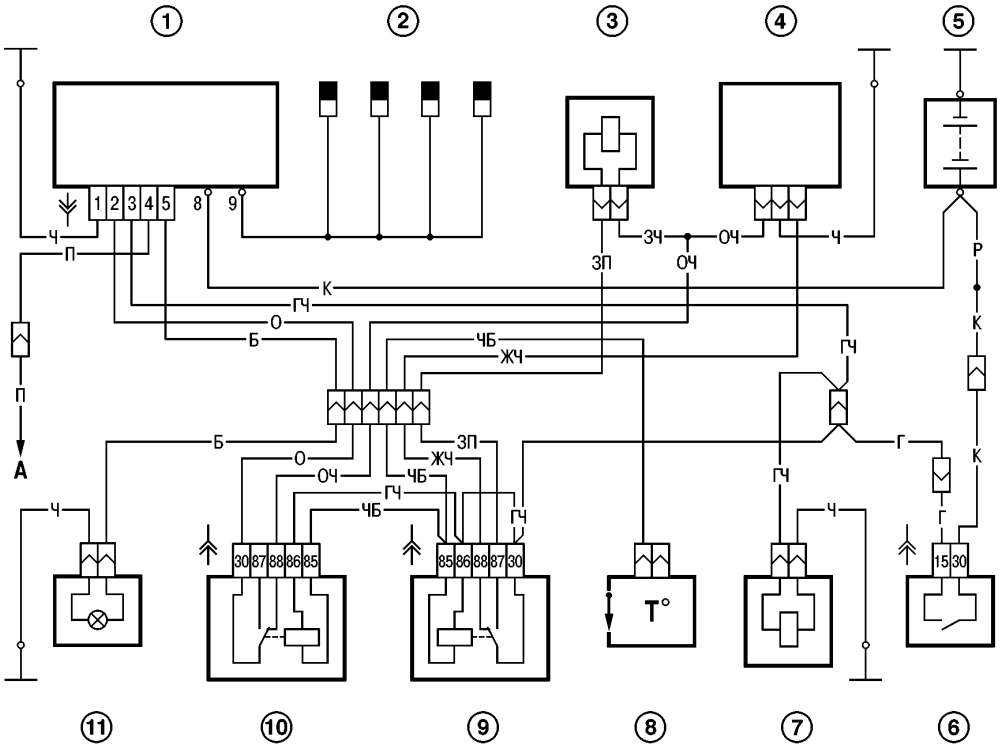


Fig.9-28. Wiring diagram for Engine Management System:
1 - glow plug control module; 2 - glow plugs; 3 - EGR valve; 4 - fuel pump; 5 - battery; 6 - ignition switch; 7 - breaker; 8 - thermoswitch; 9 - relay, EGR valve; 10 - relay, thermoswitch; 11 - glow plug warning light

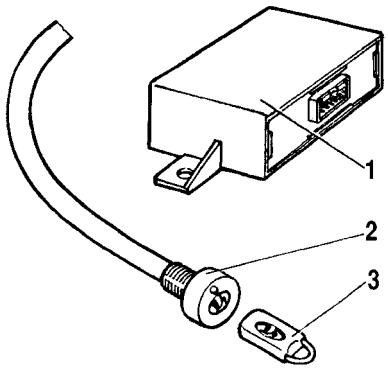


Fig.9-29. Automotive theft-deterrent system:
1 - control module; 2 - LED for system state indication; 3 - key fob

Headlight wipe/wash. The vehicle VAZ-21215-10 is not fitted with the headlight wipe/wash.

Cooling fan motor. Two dc motors powered from constant magnets of MP 8019/37 type are provided to operate the engine cooling fan blower. The wiring diagram for cooling fan motor is shown in Fig.9-34.

The motors are triggered by sensor 1 through complementary relay 3. The sensor is fitted to the right-hand radiator cooler. The sensor contacts close at (99±3)°C and open at (94±3)°C. The relay is housed in the engine bay and is bolted to the top bulkhead reinforcement.

The motors are maintenance-free and must always be renewed in case of failure.

Motor specification

Nominal motor shaft speed with impeller load, rpm 600-2800
Current consumption at speed and load as specified, ampere, not greater 14

Instrument cluster. The instrument cluster includes: speedometer with trip counter, coolant temperature gauge, fuel gauge, tachometer, 13 warning lights (Fig.9-35). The wiring diagram for instrument cluster is shown in Fig.9-36. The instrument panel pin assignment is shown in Table 9-3.

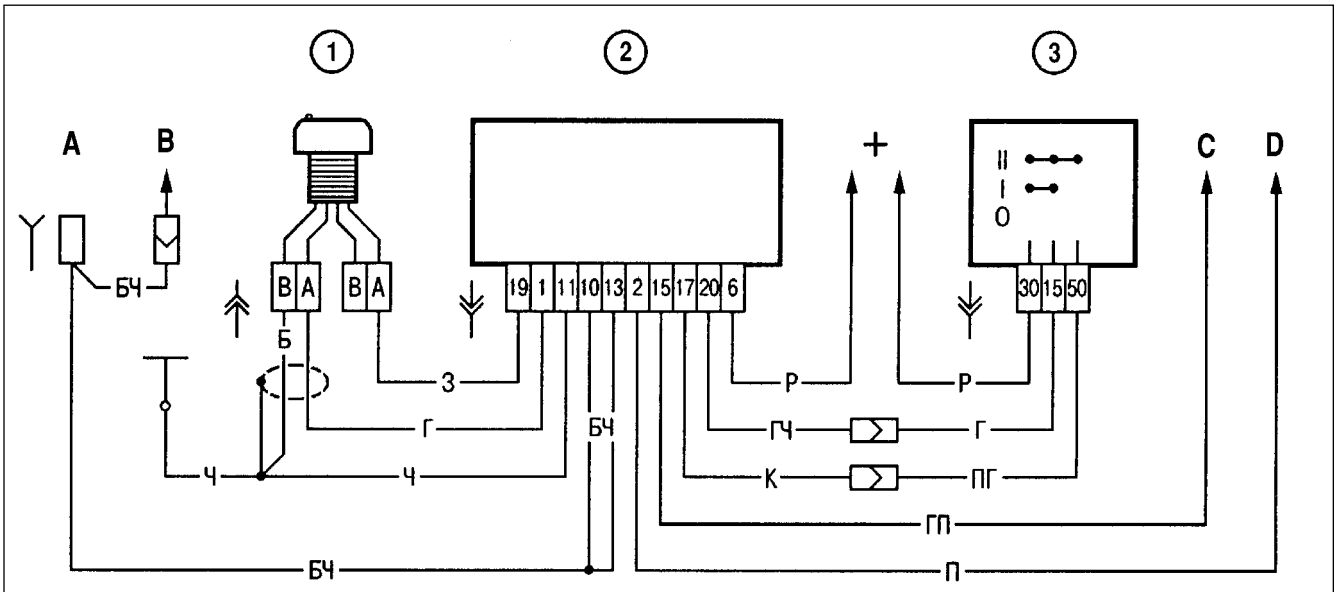


Fig.9-30. Wiring diagram for theft-deterrent system:

1 - LED for system state indication; 2 - control module; 3 - ignition switch;

A - to interior light switch; B - to interior light; C - to ignition relay terminal 86; D - to starter relay terminal 86

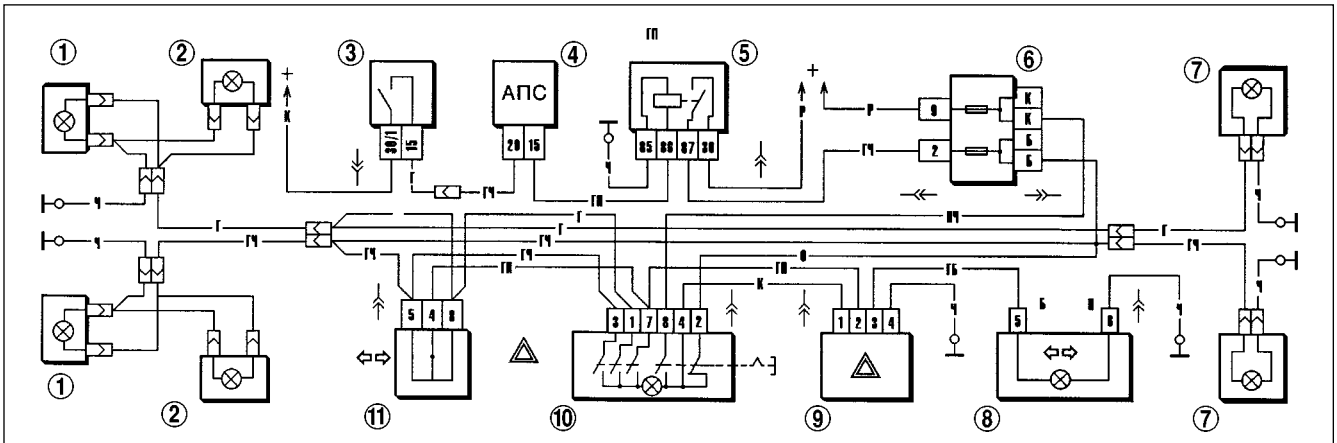


Fig.9-31. Wiring diagram for direction indicators and hazard warning flashers:

1 - direction indicators, front lights; 2 - side repeat indicators; 3 - ignition switch; 4 - control module, theft-deterrent system; 5 - ignition relay; 6 - fuse and relay box; 7 - direction indicators, rear lights; 8 - direction indicator warning light in instrument cluster; 9 - indicators flasher relay; 10 - hazard warning flasher switch; 11 - direction indicator switch

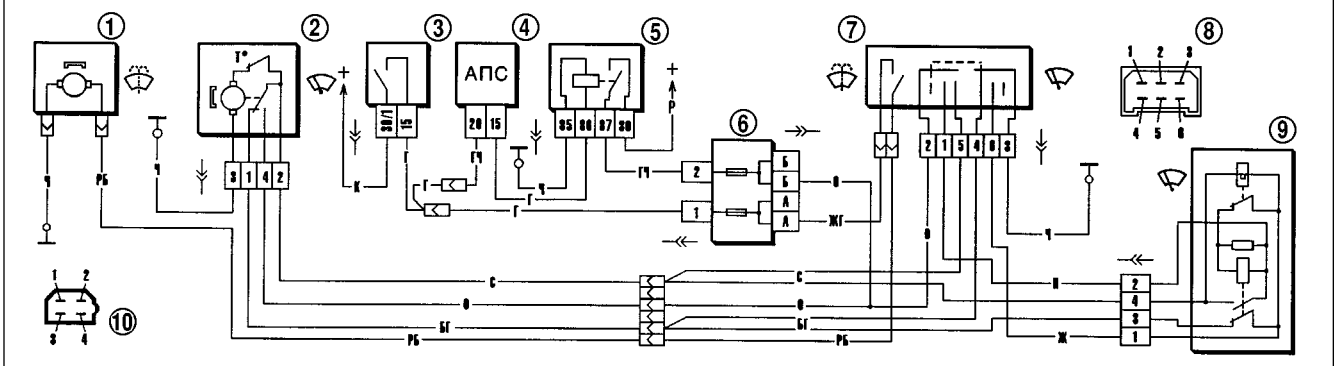


Fig.9-32. Wiring diagram for windscreen wipe/wash:

1 - windscreen washer motor; 2 - windscreen wiper motor; 3 - ignition switch; 4 - control module, anti-theft system; 5 - ignition relay; 6 - fusebox; 7 - windscreen wipe/wash switch; 8 - pin assignment in switch connector; 9 - windscreen wiper relay; 10 - pin assignment in windscreen wiper relay and motor connectors.

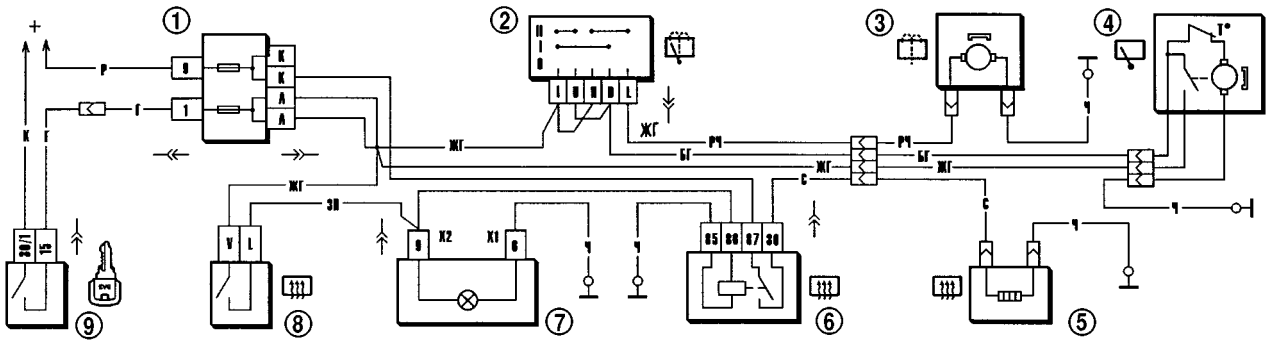


Fig.9-33. Wiring diagram for tailgate wipe/wash and heating element:
1 - fusebox; 2 - wipe/wash switch; 3 - rear window washer motor; 4 - rear window wiper motor; 5 - rear window heating element; 6 - heated rear window relay; 7 - heated rear window warning light; 8 - heated rear window switch; 9 - ignition switch

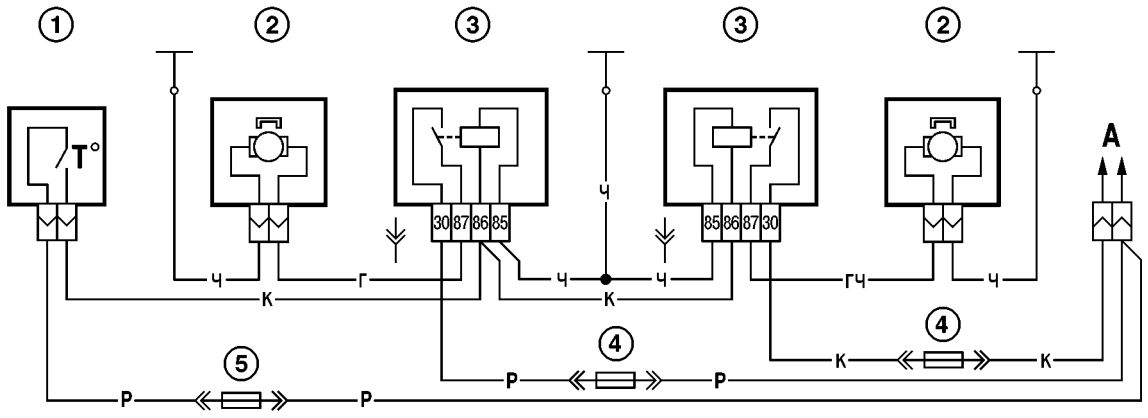


Fig.9-34. Wiring diagram for cooling fan motors:
1- motor-on sensor; 2 - fan blower motor; 3 - fan motor cut-in relay; 4 - fuse (8 ampers) 5 - fuse (16 amperes)

Table 9-3.

Instrument cluster pin assignment

Pin No	Pin assignment
	Connector X1 (red or amber)
1	-
2	To ignition switch terminal «15»
3	Spare
4	To instrument cluster lighting switch
5	To alternator terminal «W»
6	To housing
7	To ignition switch terminal «50»
8	To handbrake warning light switch
9	To seat belt relay
10	To fuel gauge terminal «W»
11	To differential lockup sensor
12	To low oil pressure sensor
13	To brake fluid level sensor

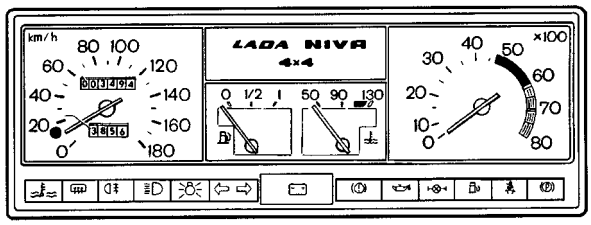


Fig.9-35. Instrument cluster

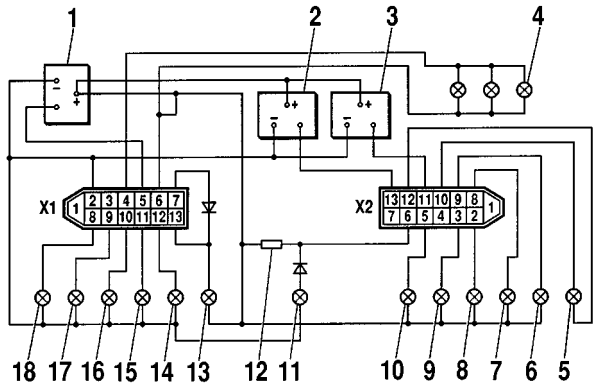


Fig.9-36. Wiring diagram for instrument cluster:
1 - digital tachometer; 2 - coolant temperature gauge; 3 - fuel level gauge; 4 - instrument illumination light; 5 - engine overheating warning light; 6 - heated rear window warning light; 7 - rear fog light warning light; 8 - high beam warning light; 9 - exterior lighting warning light; 10 - direction indicator warning light; 11 - low battery warning light; 12 - resistor, 50 Ohm, 5 W; 13 - brake failure warning light; 14 - low oil pressure warning light; 15 - differential lock-up warning light; 16 - fuel reserve warning light; 17 - seat belt reminder; 18 - handbrake-on warning light Connector «X1» is red or orange

Connector X2 (any colour, except red and amber)

1	-
2	To high beam relay
3	To exterior lighting switch
4	-
5	To indicators flasher relay
6	To alternator terminal «B»
7	-
8	To rear foglight switch
9	To heated rear window switch
10	To ignition switch terminal «15»
11	To fuel level sensor terminal «T»
12	To coolant temperature sender
13	To coolant temperature sender

Coolant temperature gauge - checking. The coolant temperature gauge is associated with the relevant sender in the cylinder head. At the sensor resistance of 640-1320 Ohm the needle should be at the low end of scale, at 77-89 Ohm it should rest at the front of the red area, at resistance of 40-50 Ohm the needle should go to the end of the red area.

Fuel level gauge - checking. The fuel gauge is associated with the relevant sensor in the petrol tank. The same sensor operates the fuel reserve warning light, when 4 to 6 litres are left in the petrol tank. At the sensor resistance of 200-238 Ohm the needle should at the low end of scale, at 59-71 Ohm - at the middle scale, while at 17-23 Ohm the needle should go to the high end of scale (mark 1).

Speedometer - checking. Check the speedometer turning its drive shaft at various speeds. The data required for checking is shown in Fig.9-4.

Table 9-4

Speedometer specification

Speedometer readings, km/h	Drive shaft speed, rpm
30	433 - 500
40	600 - 667
50	766 - 833
60	933 - 1000
80	1250 - 1333
100	1567 - 1667
120	1883 - 2000
140	2200 - 2333
160	2517 - 2667

Tachometer - checking. The tachometer operates on the principle of measuring the voltage pulse frequency in the alternator field winding.

The tachometer is checked on a test bench simulating the vehicle ignition system. Connect the tachometer as applicable, apply 14 volts to the primary circuit and set the spark gap at 7 mm. Turn the ignition distributor shaft at such a speed to bring the tachometer needle to one of main scale divisions. At this moment the ignition distributor shaft speed should be within the permissible limits (Refer to Table 9-5).

Table 9-5

Tachometer specification

Tachometer reading, rpm	Ignition distributor shaft speed, rpm
1000	900 - 1100
2000	1900 - 2250
3000	2950 - 3300
4000	3950 - 4300

Fuel level sender - checking. With an empty tank the sensor resistance should be (250±10) Ohm, with a half-filled tank - (66±6) Ohm, with a full tank - (20±2) Ohm.

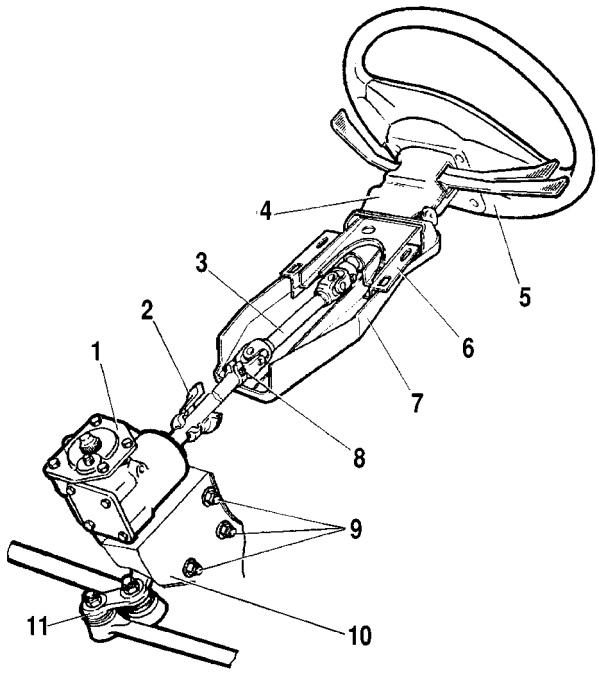


Fig.9-37. Steering components:
1 - steering mechanism; 2 - seal; 3 - middle shaft; 4 - upper steering column shroud; 5 - steering wheel; 6 - bracket; 7 - lower steering column shroud; 8 - clamp bolt, universal joint; 9 - securing bolts, steering mechanism; 10 -chassis arm; 11 - drop arm

Steering with *BREED «SRS-40»* driver's airbag in the steering wheel

Design description

The SRS-40 system is housed in the steering wheel, being an additional protection to the seat belt, the system is intended to prevent serious chest and head injuries to the driver.

The system is activated at the frontal impact and at 30° impact leftward and rightward to the vehicle centre line. The system is not activated during:

- impacts at more than 30° to the vehicle centre line;
- side impacts;
- rear impacts;
- rollover;
- minor frontal impacts.

The SRS-40 system consists of the following main components:

- gas generator (inflator) with a built-in impact sensor;
- airbag module;
- special steering wheel with fixtures.

The system is activated by inertial impact force via triggering a mechanical sensor (opposite to electrical pulse), which operates the gas generator, thus making redundant wiring and power supply. Since the system is mechanical, there is no need in the warning light or diagnostic unit. The system is always ready to operate, it is maintenance-free, though after seven years in field the gas generator is subject to mandatory replacement.

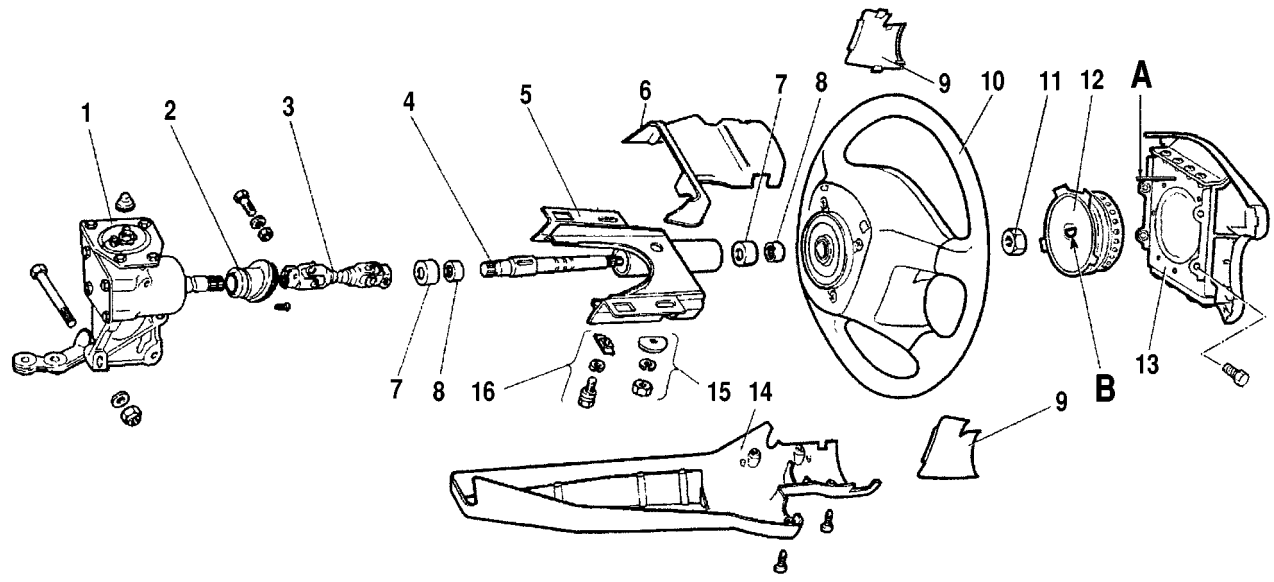


Fig.9-38. Steering components:
1 - steering mechanism; 2 - seal; 3 - middle shaft; 4 - upper shaft; 5 - bracket; 6 - upper shroud; 7 - ball bearing; 8 - race; 9 - cap; 10 - steering wheel; 11 - nut; 12 - inflator unit with integral impact sensor; 13 - airbag module; 14 - lower shroud; 15,16 - fixtures, steering shaft bracket; **A -** fixing pin; **B -** D-shaped outlet, ignitor unit

WARNING. Never fit the steering wheel SRS-40 to other vehicle models, since the impact sensor in the gas generator is tailored to parameters and characteristics of VAZ-21213 vehicle and its versions.

Due to variations in parameters and characteristics among vehicle models and within similar models of different production years, NEVER use the SRS-40 components for other vehicles. In the event the adjustments are lost or a component is damaged in an accident or during dismantling, do not reuse the SRS-40 components.

In case of an accident the impact sensor inside the inflator module receives an impact force pulse and at the preset pulse level activates the system, releasing gas (nitrogen) through the holes in the housing, filling the airbag that is folded inside the module. During the airbag filling, it breaks through the central seam on the steering wheel trim pad, which halves go open up and down respectively. The airbag of 40 litre capacity is deployed in front of the steering wheel.

The protective function of the steering wheel with the SRS-40 airbag is intended for one application only, therefore after the accident renew the steering wheel complete with the inflator, airbag module and other steering-related parts damaged.

The steering fitted with an airbag features a different, original steering wheel, which houses the gas generator and airbag module unit, there is also an original bracket to secure the steering column. Refer to chapter 5 for design description and repair instructions with respect to other steering-associated units and components.

Removal and refitting

WARNING

1. Always use eye protection and wear gloves when working with the gas generator or airbag module.

2. Always keep on the lateral side of the steering wheel when working with the gas generator or airbag module. Never place anything on the steering wheel or between the steering wheel and a worker.

3. Never use the gas generator unit when it happened to fall from over 1 meter height or has evident damages.

4. Do not store the gas generator at temperatures above 52°C.

5. When handling the gas generator, always keep the holes outward; on any surfaces position the holes upward; never put anything on the gas generator.

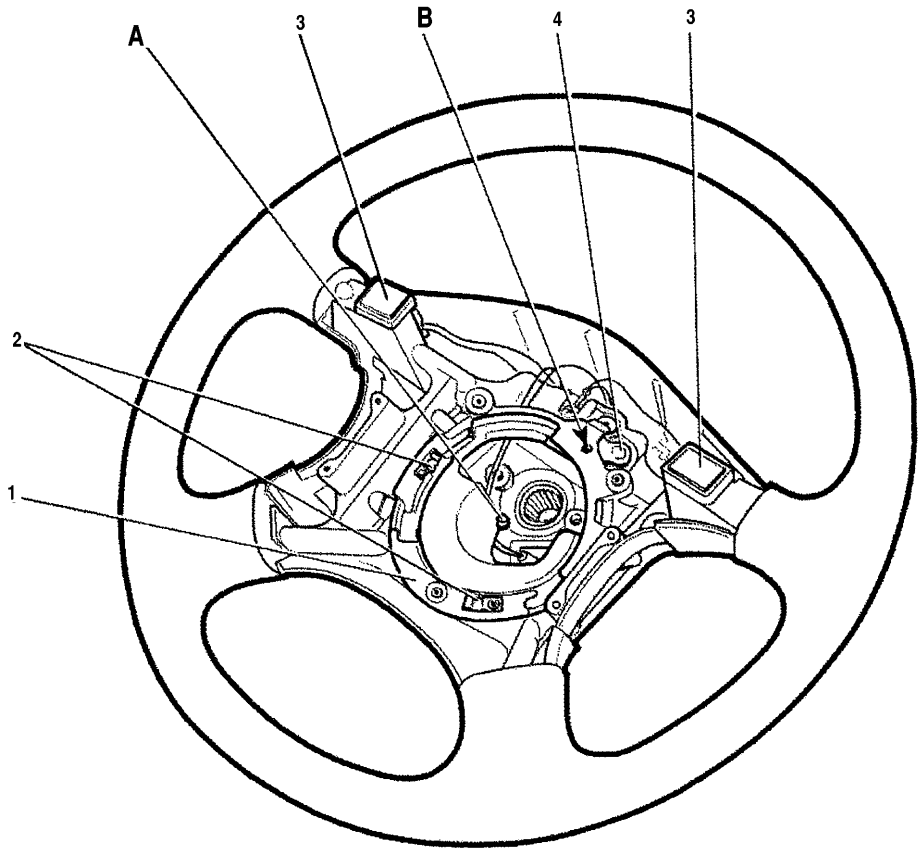


Fig.9-39. Steering wheel:
1 - adapter (for inflator unit fitting); 2 - lock spring; 3 - horn button; 4 - locking tab;
A - device for setting system to ready position - D-shaped lug; B - hole in adapter

6. Always check the steering wheel is reliably secured before fitting the gas generator, never pierce or rotate the ignitor unit through the D-shaped hole in the housing.

7. Store the gas generator in a box, while the airbag module in a plastic bag. Do not dismantle; protect the gas generator from damages, since inside its sealed housing there are solid chemicals being poisonous, inflammable and potentially health hazardous.

8. To exclude any misuse of the SRS-40 system, do not employ impact tools on steering elements.

Removal. Open the bonnet and disconnect the battery negative lead. Position the front wheels in the straight-ahead position so that steering wheel 5 top elements (Fig.9-37) are horizontal. Next carry out the following:

- remove two caps 9 (Fig.9-38) from the steering wheel side trim;

- working from the side of the steering wheel, unscrew four bolts securing airbag module 13; carefully withdraw the airbag module from the steering wheel;

- using a screwdriver, retract spring-type locking tab 4 (Fig.9-39), then turn inflator unit 12 (Fig.9-38) anticlockwise to align its base with recesses in steering wheel adapter 1 (Fig.9-39);

WARNING. Never apply excessive force to the inflator unit when dismantling. If the inflator unit doesn't turn, make certain the locking tab is fully retracted.

- exercise care and withdraw the gas generator from the steering wheel adapter;

- undo nut 11 (Fig.9-38) and remove the steering wheel. Refer to chapter 5 of Repair Manual for further dismantling of steering-associated parts and units.

Refitting of the steering is a reversal of the removal procedure observing the following:

- before refitting the steering wheel, make sure the unit «A» (Fig.9-39) for putting the system in the ready-to-work position (D-shaped projection in the centre of the steering wheel adapter) is not bent or broken, otherwise renew the steering wheel;

- refit the steering wheel to the steering shaft so that the top elements of the steering wheel are horizontal. Torque the steering wheel nut to 31.4-51 N•m (3.2-5.2 kgf•m) and bend it up at one point;

- before refitting the gas generator, make certain there are no knocks or sticking, check the steering wheel rotates smoothly lock-to-lock; swing the steering wheel to see there is no radial or axial steering wheel play; eliminate all defects found;

- fit the gas generator to the steering wheel adapter with your right hand. Position the gas generator in the adapter recesses and turn clockwise about 40° to the full lock. A click should be heard, the hole in locking tab 4 (Fig.9-39) should coincide with the hole «B» in the steering wheel adapter. In this position the gas generator is set to working order. During installation turn the gas generator by hand only. The gas generator should never be forced into the position;

- working from the outside of the vehicle, place the airbag module to the gas generator unit, while matching the «A» fixture (Fig.9-38) on the module with the hole «B» (Fig.9-39) in the steering wheel adapter;

- tighten airbag module 13 securing bolts (Fig.9-38) to 7-11 N•m;

- do not cut, drill or pierce any part of the SRS-40 system under any circumstances.

ATTACHMENTS

Attachment 1

TORQUE WRENCH SETTINGS *

Part	Thread	Tightening torque, N•m (kgf•m)
ENGINE		
Main bearing cap bolt	M10x1.25	68.31-84.38 (6.97-8.61)
Oil pump bolt	M6	5.10-8.20 (0.52-0.85)
Breather cover retaining stud	M8	12.7-20.6 (1.3-2.1)
Breather cover nut	M8	12.7-20.6 (1.3-2.1)
Cylinder head bolt	M12x1.25	Refer to chapter «Engine»
Cylinder head bolt	M8	31.36-39.1 (3.2-3.99)
Nut, inlet and exhaust pipe securing stud	M8	20.87-25.77 (2.13-2.63)
Nut, big end cap bolt	M9x1	43.32-53.51 (4.42-5.46)
Flywheel securing bolt	M10x1.25	60.96-87.42 (6.22-8.92)
Chain tensioner shoe bolt	M10x1.25	41.2-5.0 (4.2-5.2)
Valve cover bolt	M6	1.96-4.60 (0.20-0.47)
Camshaft bearing housing retaining nut	M8	18.33-22.64 (1.87-2.3)
Oil pump shaft sprocket bolt	M10x1.25	41.2-51.0 (4.2-5.2)
Camshaft sprocket bolt	M10x1.25	41.2-51.0 (4.2-5.2)
Nut, valve adjuster bolt	M12x1.25	43.3-53.5 (4.42-5.46)
Valve adjuster bolt sleeve	M18x.5	83.3-102.9 (8.5-10.5)
Spark plug	M14x1.25	30.67-39 (3.13-3.99)
Coolant pump retaining bolt	M8	21.66-26.75 (2.21-2.73)
Nut, water jacket exhaust manifold	M8	15.97-22.64 (1.63-2.31)
Crankshaft ratchet	M20x1.5	101.3-125.64 (10.34-12.8)
Alternator bracket bolt	M10x1.25	44.1-64.7 (4.5-6.6)
Nut, alternator mounting plate	M10x1.25	28.03-45.27 (2.86-4.62)
Nut, alternator-to-bracket securing bolt	M12x1.25	58.3-72.0 (5.95-7.35)
Mounting plate-to-alternator retaining nut	M10x1.25	28.03-45.27 (2.86-4.62)
Retaining nut, engine front mounting bracket	M8	10.4-24.2 (1.1-2.5)
Retaining nut, front mounting rubber-to-crosspiece bracket	M10x1.25	27.4-34.0 (2.8-3.46)
Retaining nut, rear engine mounting crosspiece	M8	15.0-18.6 (1.53-1.9)
Retaining nut, rear engine mounting / transmission	M8	28.3-28.8 (2.38-2.94)
Retaining nut, rear engine mounting / crosspiece	M8	15.9-25.7 (1.62-2.62)
CLUTCH		
Clutch securing bolt	M8	19.1-30.9 (1.95-3.15)
Nut, clutch / brake pedals bolt	M12x1.25	12.7-20.6 (1.3-2.1)
Retaining nut, clutch / brake master cylinders and pedal bracket	M8	9.8-15.7 (1.0-1.6)
Nut, clutch hydraulic drive connection pipes	M12	24.5-31.4 (2.5-3.2)
Nut, brake hydraulic drive connection pipes	M10	14.7-18.6 (1.5-1.9)

TRANSMISSION		
Reversing light switch	M14x1.5	28.4-45.1 (2.9-4.6)
Clutch housing-to-engine bolts	M12x1.25	53.9-87.2 (5.5-8.9)
Clutch housing-to-transmission retaining nut	M10x1.25	31.8-51.4 (3.25-5.25)
Clutch housing-to-transmission retaining nut	M8	15.7-25.5 (1.6-2.6)
Shift rod detent cover bolt	M8	15.7-25.5 (1.6-2.6)
End cover retaining nut	M8	15.7-25.5 (1.6-2.6)
Output shaft rear end nut	M20x1.0	66.6-82.3 (6.8-8.4)
Intermediate shaft bearing clamping washer bolt	M12x1.25	79.4-98 (8.1-10.0)
Fork-to-shift rod retaining bolt	M6	11.7-18.6 (1.2-1.9)
TRANSFER BOX		
Mounting bracket-to-rubber shaft retaining nut	M10x1.25	26.5-32.3 (2.7-3.3)
Mounting bracket-to-body retaining nut	M8	15.0-18.6 (1.53-1.9)
Nut holding covers of transfer box casing, front axle drive casing, speedometer drive unit housing, control lever bracket	M8	14.7-24.5 (1.5-2.5)
Differential lockup switch	M16x1.5	28.4-45 (2.9-4.6)
Fork-to-selector rod retaining bolt	M6	11.8-18.6 (1.2-1.9)
Fork-to-differential lockup rod retaining bolt	M12x1.25	11.7-18.6 (1.2-1.9)
Driven gear retaining bolt	M10x1.25	66.6-82.3 (6.8-8.4)
Retaining bolt, driving shaft rear bearing and intermediate shaft rear bearing	M18x1.5	96-117.6 (9.8-12.0)
Nut holding propeller shaft flange to driving shaft and to front / rear axle driveshafts	M16x1.5	96-117.6 (9.8-12.0)
DRIVE LINE		
Nut, bolts holding flexible coupling to gearbox and transfer box flanges	M12x1.25	57.8-71.5 (5.9-7.3)
Nut, bolt holding propeller shaft flange to flanges of front/rear axles reduction gear and transfer case	M8	27.4-34.3 (2.8-3.5)
FRONT AXLE		
Front axle-to-engine retaining bolt	M12x1.25	74.5-92 (7.6-9.4)
Front axle-to-engine retaining nut	M12	60.8-75 (6.2-7.66)
Front axle-to-engine retaining bolt	M10x1.25	42.1-52 (4.3-5.3)
Inner joint housing bearing cover retaining nut	M8x1.25	19.6-24.5 (2.0-2.5)
Differential bearing cover retaining nut	M12x1.25	62.7-75.4 (6.3-7.7)
Retaining bolt, lockplate-to-spring washer	M6x1	3.8-6.2 (0.39-0.63)
Driven gear securing bolt	M10x1.25	83.3-102.9 (8.5-10.5)
REAR AXLE		
Bolt holding reduction gear casing to rear axle beam	M8	35-43.2 (3.57-4.41)
Differential bearing cover bolt	M10x1.25	43.3-53,5 (4.42-5.46)
Driven gear bolt	M10x1.25	83.3-102.9 (8.5-10.5)
Flange-to-drive gear nut	M16x1.5	Refer to section «Rear axle»
Retaining nut, axleshaft bearing and rear brake	M10x1.25	41.6-51.4 (4.25-5.25)
FRONT SUSPENSION		
Nut, lower bolts holding cross-member to chassis arms	M12x1.25	66.6-82.3 (6.8-8.4)
Nut, upper bolts holding cross-member to chassis arms	M12x1.25	66.6-82.3 (6.8-8.4)

Nut, bolt holding recoil block bracket to cross-member	M8	15.1-18.6 (1.53-1.9)
Nut, upper control arm shaft bolt	M12x1.25	66.6-82.3 (6.8-8.4)
Shock-absorber upper end retaining nut	M10x1.25	27.4-34 (2.8-3.46)
Shock-absorber lower end retaining nut	M10x1.25	50-61.7 (5.1-6.3)
Nut, front wheel hub bearing	M18x1.5	Refer to «Running gear»
Brake caliper-to-steering knuckle retaining bolt	M10x1.25	29.1-36 (2.97-3.67)
Anti-roll bar retaining nut	M8	15-18.6 (1.53-1.9)
Balljoint-to-steering knuckle retaining nut	M14x1.5	83.3-102.9 (8.5-10.5)
Radius rod-to-suspension crosspiece nut	M12x1.25	66,6-82,3 (6.8-8.4)
Radius rod-to-body retaining nut	M16x1.5	104.9-169.5 (10.7-17.3)
Lower arm shaft-to-crosspiece connecting nut	M16x1.5	114.7-185.2 (11.7-18.9)
Balljoint-to-suspension arm retaining nut	M8	20.6-25.75 (2.1-2.63)
Nut, wheel retaining bolt	M12x1.25	62.4-77.1 (6.37-7.87)
Suspension upper arm shaft nut	M14x1.5	63.7-102.9 (6.5-10.5)
Nut, swing arm retaining bolt	M12x1.25	66.6-82.3 (6.8-8.4)
REAR SUSPENSION		
Shock-absorber retaining nut	M12x1.25	38.2-61.7 (3.9-6.3)
Nut, Panhard rod and trailing arms retaining bolts	M12x1.25	66.6-82.3 (6.8-8.4)
STEERING		
Nut, steering box retaining bolt	M10x1.25	33.3-41.2 (3.4-4.2)
Nut, idler arm bracket retaining bolt	M10x1.25	33.3-41.2 (3.4-4.2)
Nut, steering rod ballpin **	M14x1.5	42.1-53 (4.3-5.4)
Middle shaft-to-upper shaft and worm shaft retaining nut	M8	22.5-27.4 (2.3-2.8)
Steering wheel retaining nut	M16x1.5	31.4-51 (3.2-5.2)
Steering shaft bracket and ignition switch retaining nut	M8	15-18.6 (1.53-1.9)
Drop arm nut	M20x1.5	199.9-247 (20.4-25.2)
Idler arm shaft nut	M14x1.5	63.7-102.9 (6.5-10.5)

** It is allowed to round tightening torques for nuts and bolts to the tenth of kgf•m within the tolerance.*

*** With the nut recess mismatching the cotter pin hole, tighten to further torque (less than 60°) to ensure a reliable locking*

SPECIAL TOOLS FOR MAINTENANCE AND REPAIR *

Designation	Description
	ENGINE
A.40005	Universal pickers kit
A.40026	Removal tool, coolant pump impeller
A.50088	Spanner, intake / exhaust pipe nuts
A.50113	Allen key, crankcase oil drain plug
A.50121	Spanner, crankshaft pulley bolt
A.50126	Spanner for checking cylinder head bolt tightening torques (with camshaft in situ)
A.60153/R	Mandrel for pressing in/out inlet/exhaust valve guide
A.60311/R	Tool, removal / installation of engine valves
A.60312	Removal tool, oil filter
A.60326/R	Tool to press out ignition distributor / oil pump drive gear bush from the cylinder block
A.60330/R	Flywheel fixing arm for fitting flywheel to crankshaft
A.60333/1/2	Tool to press in/out oil pump drive shaft bushes
A.60334	Tool for checking cylinder head tightness
A.60430	Installation tool, coolant pump impeller
A.86010	Tool for pressing in crankshaft plugs
A.90310	Set of reamers, valve guide bore machining
A.90353	Reamer for bushes of oil pump drive shaft, ignition distributor and fuel pump
A.94003	Core drill (75°), inlet valve seat machining
A.94016	Core drill spindle, plug machining
A.94016/10	Core drill, crankshaft plug socket machining
A.94031	Core drill (20°), exhaust valve seat machining
A.94058	Core drill spindle, valve seat machining
A.94059	Set of guides, valve seat machining
A.94069	Grinding wheel spindle, valve seat machining
A.94078	Grinding wheel, exhaust valve seat machining
A.94092	Core drill, exhaust valve seat machining
A.94100	Grinding wheel, inlet valve seat machining
A.94101	Core drill (20°), inlet/exhaust valve seat machining
A.95111	Blade for checking camshaft valve lever/cam lobe clearance
02.7812.9500	Socket spanner (13 mm), removal and refitting of starter motor and downpipe
02.7823.9505	Tool, valve removal and installation (can be used in place of A.60311/R)
41.7816.4013	Socket spanner (21 mm) for tightening valve lever adjuster bolt guides
41.7853.4010	Installation tool, camshaft cover to engine
41.7853.4011	Installation tool, oil seal + retainer to crankshaft
41.7853.4016	Installation tool, valve guide oil caps
67.7812.9513	Dynamometer for checking fan blower belt tension
67.7812.9514	Spark plug spanner
67.7812.9515	Spanner for checking spark plug tightening torque
67.7812.9519	Socket, spark plug removal/installation
67.7824.9521	Tool for checking wear (extension) of camshaft drive chain
67.7834.9506	Tool for checking fuel pump pushrod protrusion
67.7854.9519	Adjuster bush for fitting normal and oversize pistons of 82 mm dia.
67.8125.9502	Ring gauge (82 mm dia.) for setting inside gauge to zero
67.8151.9505	Gauge for checking fuel level in carburettor
TCO-3/379	Crosspiece, engine removal and installation
EC-106	Thermostat inspection rig

CLUTCH

A.70017	Tool, clutch pedal spring removal and installation
A.70081	Mandrel, clutch disc centering
67.7813.9503	Tooling, clutch disc repair
67.7822.9517	Jig, clutch disc lining renewal
67.7851.9500	Mandrel, clutch disc lining rivetting

TRANSMISSION

A.40006	Puller, front input shaft bearing
A.55035	Jointed box spanner, gearbox removal and installation
41.7816.4068	Input shaft fixing arm
41.7816.4069	Tool for fitting (removing) circlip to (from) output shaft
41.7853.4028	Mandrel for fitting output shaft bearing
41.7853.4032	Mandrel, installation of intermediate shaft bearing
41.7853.4039	Mandrel, installation of output shaft oil seal
67.7853.9558	Mandrel for driving on transfer case differential bearing

DRIVE LINE

A.70025	Clasp, removal and installation of flexible coupling
41.8734.4092	Gauge for selection of propeller shaft universal joint bearing circlips
67.7823.9522	Cramp, renewal of universal joint spider
67.7853.9533	Tool for pressing in front wheel CV joint oil seal ring
67.7853.9537	Installation tool, front wheel CV joint rubber boot

DRIVE AXLES

A.45008	Removal tool, driving pinion rear bearing inner race
A.45028	Rest, removal of differential box bearing inner race
A.55085	Spanner, differential bearing nuts
A.70152	Tool for pressing rear bearing inner race to driving pinion
A.70157	Installation tool, axleshaft oil seal
A.70171	Tool for pressing in driving pinion rear bearing outer race
A.70172	Pair of flanges to be fitted to rear axle beam ends during its inspection (truing)
A.70184	Tool to determine shim thickness to adjust clearance in final drive gear meshing
A.70185	Tool for pressing in driving pinion front bearing outer race
A.70198	Tool for pressing out driving pinion bearing outer race
67.7823.9530	Installation tool, axleshaft lockring
67.7823.9529	Removal tool, lockring from axleshaft
A.95601/R	Tool for checking reliable pressing of lockring onto axleshaft
A.95688/R	Tool for adjusting clearance in drive gear/crown wheel meshing and differential bearing tightening
A.95690	Tool for selecting drive pinion shim thickness
A.95697/5	Socket, dynamometer 02.7812.9501
02.7812.9501	Dynamometer for checking rotational resistance moment of drive axle pinion and steering worm shaft
67.7812.9520	Spanner, front axle pinion adjustment
02.7834.9504	Measuring tool, free axial play of axleshaft
67.7823.9516	Removal tool for axleshaft, rear axle
67.7853.9559	Rest, differential bearing removal
67.8701.9508	Bracket with endpiece to tool A.95688/R for adjusting front axle pinion

FRONT SUSPENSION

A.47045	Tool for pressing out silent blocks of suspension upper arms
A.57034/R	Wrench, shock-absorber cartridge nut

A.57070	Spanner, front shock-absorber removal and installation
A.74177/1	Tool for fitting silent blocks to front suspension upper control arm (to be used with tool 67.7853.9519)
02.8701.9502	Tool for checking front suspension balljoints
67.7820.9514	Cross-member for engine lifting
67.7820.9520	Mandrel, nut reduction
67.7820.9521	Lever for moving front wheel hub to check clearance in bearings
67.7823.9514	Removal tool, wheel hub cap
67.7823.9515	Removal tool, lower control arm shaft
67.7823.9517	Tool for pressing out/in lower control arm silent blocks
67.7823.9526	Tool for pressing in/out lower control arm silent blocks on press
67.7823.9527	Tool for pressing out upper control arm silent block
67.7824.9513	Repair tool kit, shock absorber
67.7834.9507	Tool for measuring clearance in front wheel hub bearing
67.7853.9519	Tool for pressing in upper control arm silent block (to be used with tool A.74177/1)
67.7853.9528	Tool for fitting wheel hub cap
67.7853.9534	Washer for pressing out front wheel hub inner bearing outer race
67.7853.9535	Handle to washers for pressing out wheel hub inner bearing outer race
67.7853.9536	Tool for pressing in front wheel hub bearing outer race
67.7853.9540	Washer for pressing out wheel hub bearing inner race / oil seal
67.8732.9501	Tool for checking geometry of front suspension cross-member

REAR SUSPENSION

67.7820.9517	Tool kit, replacement of rear suspension rod silent blocks

STEERING

A.47035	Separator tool for pressing out steering joints from drop arm and idler arm
A.47043	Removal tool, drop arm
A.74076/1	Repair tool, steering box
A.74076/R	Bracket for securing steering box, to be attached to tool A.74076/1
A.74105	Tool for pressing in/out drop arm shaft bush
A.74186	Tool for pressing out worm shaft bearing outer race
A.90336	Reamer, steering box bushes
67.7813.9504	Wrench, steering rod coupling
67.7824.9516	Puller, steering link balljoints
67.7853.9541	Tool for pressing out/in worm upper bearing outer race
67.8720.9501	Tool for checking steering wheel free play

BRAKING SYSTEM

A.56124	Spanner, brake pressure regulator cover plug
67.7820.9519	Installation tool, rear brake pressure regulator
67.7823.9519	Puller, brake drum

ELECTRICAL SYSTEM

02.7823.9504	Removal tool, alternator pulley

BODYWORK

A.78034	Removal tool, window lifter handle locking clip

**** Tool kit to be supplied to the customer is defined separately***

Adjustment and checking DATA

Valve clearances, cold engine (18-20°C), mm:
- inlet valves 0.15
- exhaust valves 0.20

Coolant temperature, warm engine, at ambient air of 20-30°C, full load and 80 km/h, not greater, °C 95

Minimum idle rpm 750-800

Oil pressure in engine lubrication system, oil temperature of 85°C and crankshaft speed of 5400 rpm, MPa (kgf/cm^2) 0.35-0.45 (3.5-4.5)

Coolant level in expansion tank, cold engine . . . . . 3-4 cm above «MIN» mark

Alternator drivebelt deflection at 98 N (10 kgf), mm 10-15

Electrode gap, mm:
- carburettor engine 0.7-0.8
- injection engine 1.00-1.13

Initial ignition timing BTDC, degrees:
- 91 RON fuel . . . . . 1±1
- 93 RON, 95 RON fuel . . . . . 3±1

Clutch pedal free play, mm 25-35

Brake pedal free play, engine stalled, mm 3-5

Steering wheel play, vehicle in straight-ahead position, not greater, degrees (mm) 5 (18-20)

Front wheel toe-in, run-in vehicle, at 3140 N (320 kgf), mm 2-4

Front wheel camber, run-in wheel, at 3140 N (320 kgf), degrees (mm) . . . . . 0°30'±20' (1-5)

Castor, run-in vehicle, at 3140 N (320 kgf), degrees . . . . . 3°30'±30'

Tyre pressure, MPa (kgf/cm^2):
- front wheels 0.21 (2.1)
- rear wheels 0.19 (1.9)

Backlash, front wheel hub bearings, mm: 0.02-0.07
- field adjustment 0.02-0.15

Minimum permissible lining thickness, front pads and rear shoes, mm 1.5
Fluid level, brake /clutch fluid reservoirs . . . . . up to lower filler neck edge
Maximum gradient on dry hard ground where laden vehicle is retained unlimited time with handbrake applied, % 25

Handbrake lever travel, notch on the ratchet:
- adjustment . . . . . 4-5 (2-4)*
- operation . . . . . 4-7 (2-8)*

**** For vehicles with double tooth pawl***

Fuel, lubricants and fluids

Location	Capacity, litres	Description
Fuel tank, VAZ-21213, VAZ-21214, VAZ-21214-20 vehicles	42	Automotive petrol, at least 95 RON as per EN 228
Fuel tank, VAZ-21215-10 vehicle	45	Diesel fuel as per EN 590
Engine cooling system, including heating and ventilation system, VAZ-21213, VAZ-21214,VAZ-21214-20 vehicles	10.7	Ethylene glycol-based coolant meeting ASTM D 3306-86 b
Engine cooling system, including heating and ventilation system, VAZ-21215-10 vehicle	11	Coolants: «PROCOR 3000», «ACO 800», «NAPGEL C 2400», «REVCO CEL 107»
Engine lubrication system, including oil filter, VAZ-21213, VAZ-21214, VAZ-21214-20 vehicles	3.75	Motor oils: SAE: *5W-40 (-30 to +30°C)* *10W-40 (-25 to +35°C)* *15W-40 (-20 to +45°C)* *API: SG/SH/CD* *ACEA: A2-96*
Engine lubrication system, including oil filter, VAZ-21215-10 vehicle	6	Motor oils: SAE: *15W-40 (-12 to +40°C)* *10W-30 (-20 to +30°C)* *5W-30 (-25 to + 30°C)* *10W-40 (-20 to +40°C)* *API: SG/CF* *ACEA: B2 96 mini* *CCMC: PD2*
Gearbox Rear axle casing Steering box Transfer case Front axle casing	1.35 1.3 0.18 0.75 1.15	Transmission oils: *SAE: 75W-90(-40 to + 25°C* *80W-90 (-26 to + 35°C)* *85W-90 (-12 to + 45°C)* *API: GL5*
Clutch hydraulic release system Brake hydraulic system	0.2 0.66	Brake fluids: *FM VSS : 571 116 DOT 4* *SAE: J 1713*
Windscreen/headlight washer container Rear door washer reservoir	5.0 2.0	Any alcohol-based glass cleaners
Front wheel bearings Starter motor guide ring	–	Automotive multipurpose lithium grease: *NLGI:* class 2
Bearings, universal joints	–	Automotive multipurpose lithium grease: *NLGI:* class 2 c M0S2
Propeller shafts spline joint Seat rails Door locks	–	Automotive multipurpose lithium grease: *NLGI*: class 1
Front suspension ballpins, steering joints	–	KB-521 (*Fiat Lubrificanti*) grease
Front wheel CV joints	–	VN 2461C (*Molikot*) grease
Transmission / transfer case drive joint	–	Longtern-00 (*Dow Corning*) grease
Battery terminals and clamps Door key holes	–	Hydrocarbon grease: *NLGI: class* 1 or 2
Rear brake pressure regulator	–	*Castrol* S 058 grease

Автомобили ВАЗ-21213, ВАЗ-21214, ВАЗ-21214-20, ВАЗ-21215
Руководство по ремонту автомобилей

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