VAZ VEHICLES

VAZ-21213, VAZ-21214, VAZ-21214-20, VAZ-21215

REPAIR MANUAL

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Автомобили ВАЗ-21213, ВАЗ-21214, ВАЗ-21214-20, ВАЗ-21215
Руководство по ремонту автомобилей

Изд. № 0021311

About this manual

This Manual provides information on routine maintenance and servicing and is intended for engineers and mechanics of service outlets, garages and workshops.

The Manual covers the following models:

VAZ-21213 model - an off-road vehicle, three-door body of all-steel unitary construction, with 1.7 litre carburettor engine;

VAZ-21214 model - with 1.7 litre Central Fuel Injection Engine;

VAZ-21214-20 model - with 1.7 litre Sequential Fuel Injection Engine;

VAZ-21215 model - with Turbo Diesel Engine.

The chapters of the manual give full descriptions of VAZ-21213 vehicle units. For general description, service and repair procedures applicable to other models, refer to Section 9 where you can also find the information on additional and alternative equipment fitted to the vehicles.

The Manual provides a detailed description of service operations on the base of OEM parts, with helpful information on fault diagnosis, along with clear indications on removal and refitting, dismantling and reassembly, adjustment and repair of various vehicle units.

We recommend to use special tools and working facilities as listed in Attachment No 2. Tighten the thread connections to torques specified in Attachment No 1. Basic adjustments and inspection checks are outlined in Attachment No 3. Refer to Attachment 4 for recommended lubricants and fuels.

Due to the on-going process of vehicle improvement aimed to enhance the VAZ vehicle reliability and performance, the manufacturer can make alterations and design changes which may fail to enter this publication. Such changes and alterations will be incorporated into our manuals at the earliest opportunity.

The Manual describes the vehicle design as of October 1999.

Section 1. General Data

Table 1-1

TECHNICAL SPECIFICATION

Features	VAZ-21213	VAZ-21214	VAZ-21214-20	VAZ-21215
General				
Number of seats	5	5	5	5
Kerb weight, kg	1210	1210	1210	1240
Payload, kg	400	400	400	400
Overall dimensions		Fig.1-1		
Maximum braking distance at GVW and 80 km/h on horizontal dry flat asphalt road, not greater, meters:				
• with service braking system applied	40	40	40	40
• with emergency system applied (either of two service braking circuits)	90	90	90	90
Maximum speed* in top gear, km/h:				
• with driver and passenger	137	137	137	130
• at full load	135	135	135	128
Acceleration time*, 0 to 100 km/h through gear shifting, seconds:				
• with driver and passenger	19	19	19	22
• at full load	21	21	21	24
Engine				
Model	**21213**	**21214**	**21214-10**	**DHW (XUD-9SD)**
Type	Four-stroke, petrol, carburettor	Four-stroke, petrol, CFI	Four-stroke, petrol, sequential injection	Four-stroke, turbo diesel
No of cylinders	four in-line	four in-line	four in-line	four in-line
Bore x stroke, mm	82x80	82x80	82x80	83x88
Capacity, litre	1.69	1.69	1.69	1.905
Compression ratio	9.3:1	9.3:1	9.3:1	21.5:1
Maximum power:				
as per GOST 14846 (net), at least, κW (h.p.)	58 (78.9)	58 (78.9)	58.5 (79.6)	55 (74.8)
as per ISO 1585, κW	58	58	58.5	55
Maximum crankshaft speed at maximum power, rpm	5200	5400	5000	4600
Firing order	1-3-4-2	1-3-4-2	1-3-4-2	1-3-4-2

**** Measured using a special procedure***

Features	VAZ-21213	VAZ-21214	VAZ-21214-20	VAZ-21215
Power train				
Clutch	*single dry plate, diaphragm spring*			
Clutch release mechanism	hydraulic, servo spring			
Transmission	5-speed, synchro units on all forward gears			
Gear ratio:				
• first gear	3.67	3.67	3.67	3.67
• second gear	2.10	2.10	2.10	2.10
• third gear	1.36	1.36	1.36	1.36
• fourth gear	1.00	1.00	1.00	1.00
• fifth gear	0.82	0.82	0.82	0.82
• reverse gear	3.53	3.53	3.53	3.53
Transfer case	two-gear, lockup differential			
Gear ratio:				
• top gear	1.2	1.2	1.2	1.2
• bottom gear	2.135	2.135	2.135	2.135
Transfer case differential	bevel gears, two pinion gears			
Drive line:				
• from transmission to transfer case	flexible coupling and CV joints			
• from transfer case to front and rear axles	two universal joints on needle bearings with grease nipples and yokes			
• from front axle to wheels	open, with CV joints			
Final drive ratio, front and rear axles	bevel, hypoid			
• gear ratio	3.9	3.9	3.9	3.9
• differential	bevel, two pinion gears			

Suspension and wheels

Front suspension	independent, lower track control arms (wishbones), coil springs, hydraulic telescopic shock-absorbers, anti-roll bar
Rear suspension	rigid axle beam with Panhard rod and four trailing arms, coil springs/hydraulic telescopic shock-absorbers
Wheels	pressed-steel disc
• wheel rim	127J x 406 (5J x 16)
Tyres	tubed, cross-ply or radial ply
size:	
• cross-ply tyres	175 x 406 (6.95 x16),
• radial-ply tyres	175/80R16

Features	VAZ-21213	VAZ-21214	VAZ-21214-20	VAZ-21215

Steering

Steering mechanism	globoidal worm, double-crest roller, steering ratio 16.4
Steering linkage	three links, relay rod and two steering rods, drop arm, idler arm and swing arms

Braking system

Service braking system:	
• front brakes	disc-type, floating caliper, automatic disc-to-pad clearance adjustment
• rear brakes	drum-type, self-applying shoes and automatic shoe-to-drum clearance adjustment
• brake operation line	foot-type, hydraulic, dual circuit, split diagonally, vacuum servo unit and pressure regulator
Handbrake	cable-operated on rear wheels

Electrical system

Wiring diagram	single-wire, negative earth type
Voltage, volts	12
Battery	6CT-55A, 55 ampere-hour
Alternator	AC, integral diode plate and electronic voltage regulator
Starter motor	pre-engaged, solenoid switch and overrun clutch

Body

Type	all-steel unitary construction, monocoque, three-door, double-space

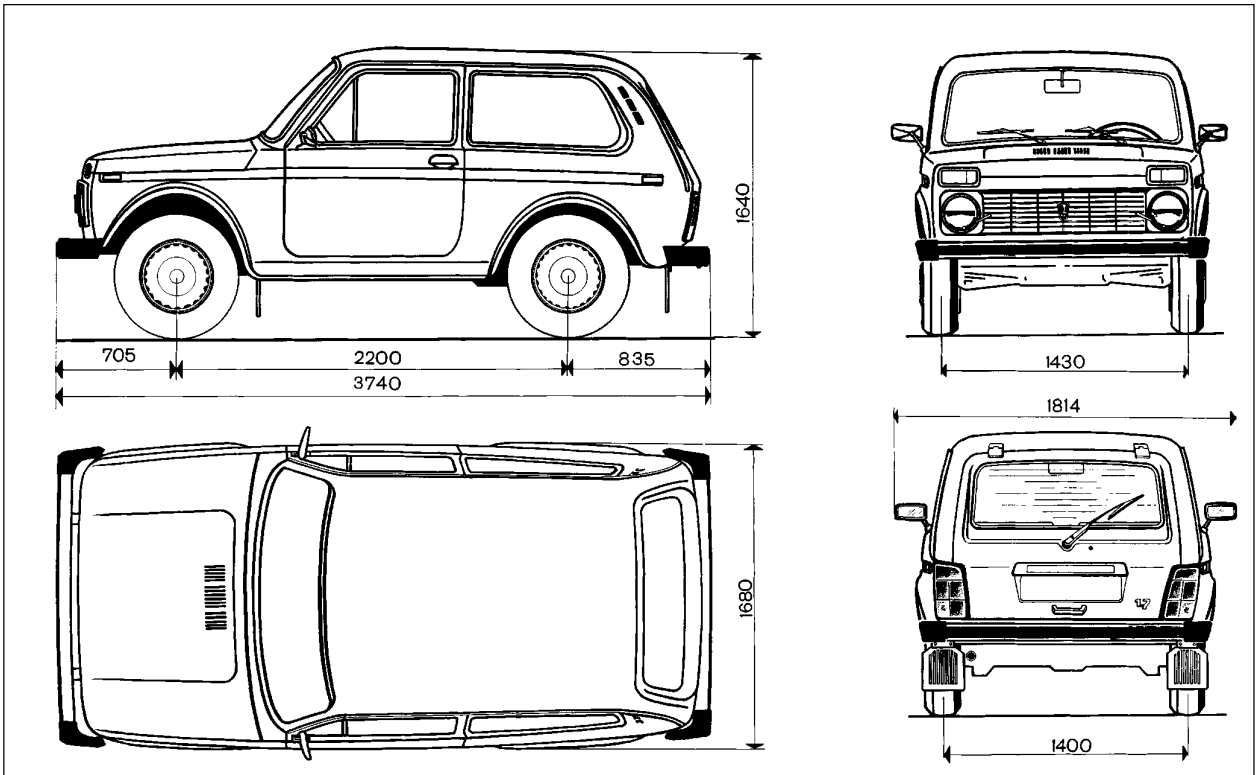

Fig.1-1. Basic overall dimensions of VAZ-21213 vehicle

Section 2. Engine

Refer to Fig.2-1 and Fig.2-2 for front and side sectional views of the engine.

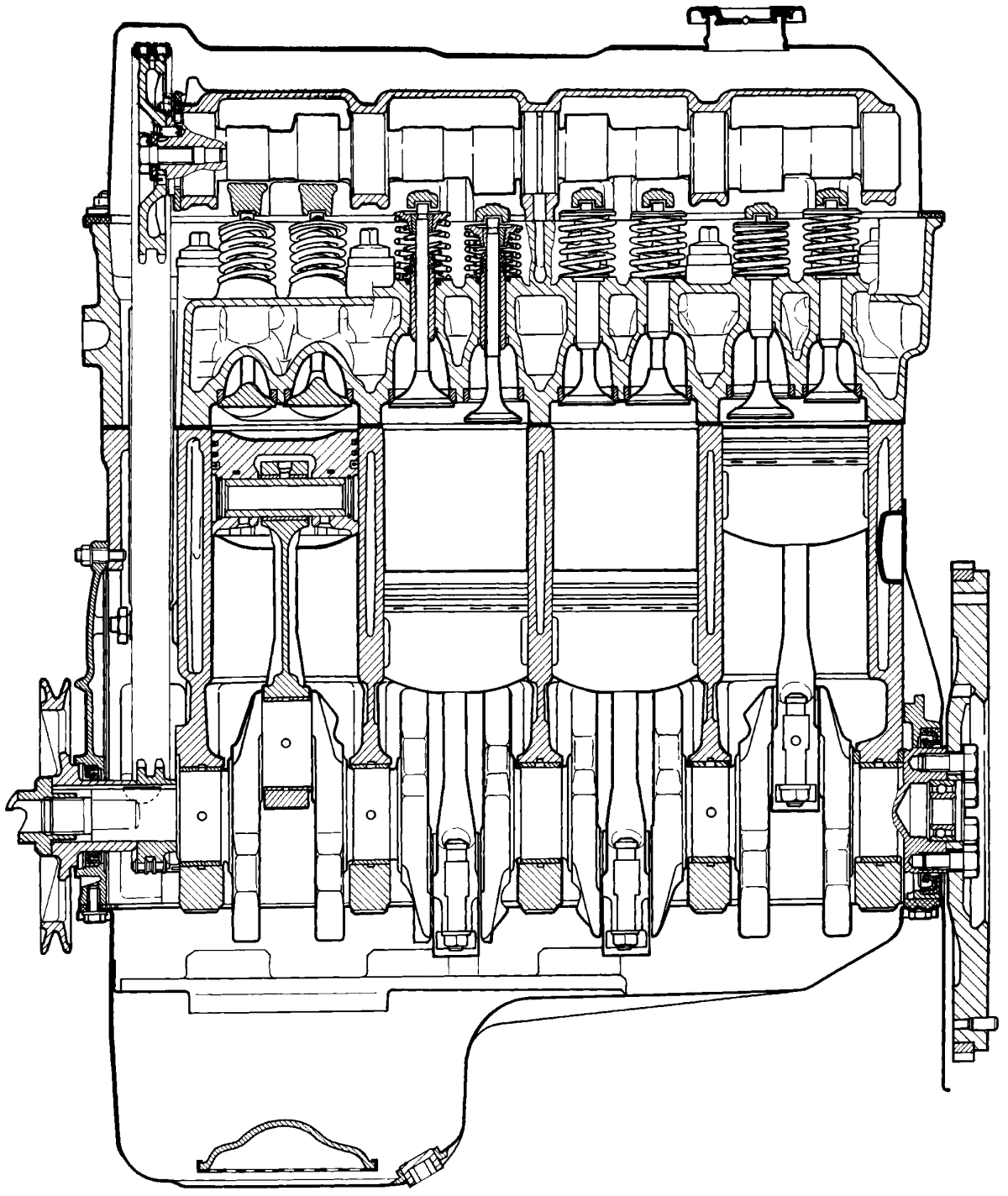

Fig.2-1. Side sectional view of the engine

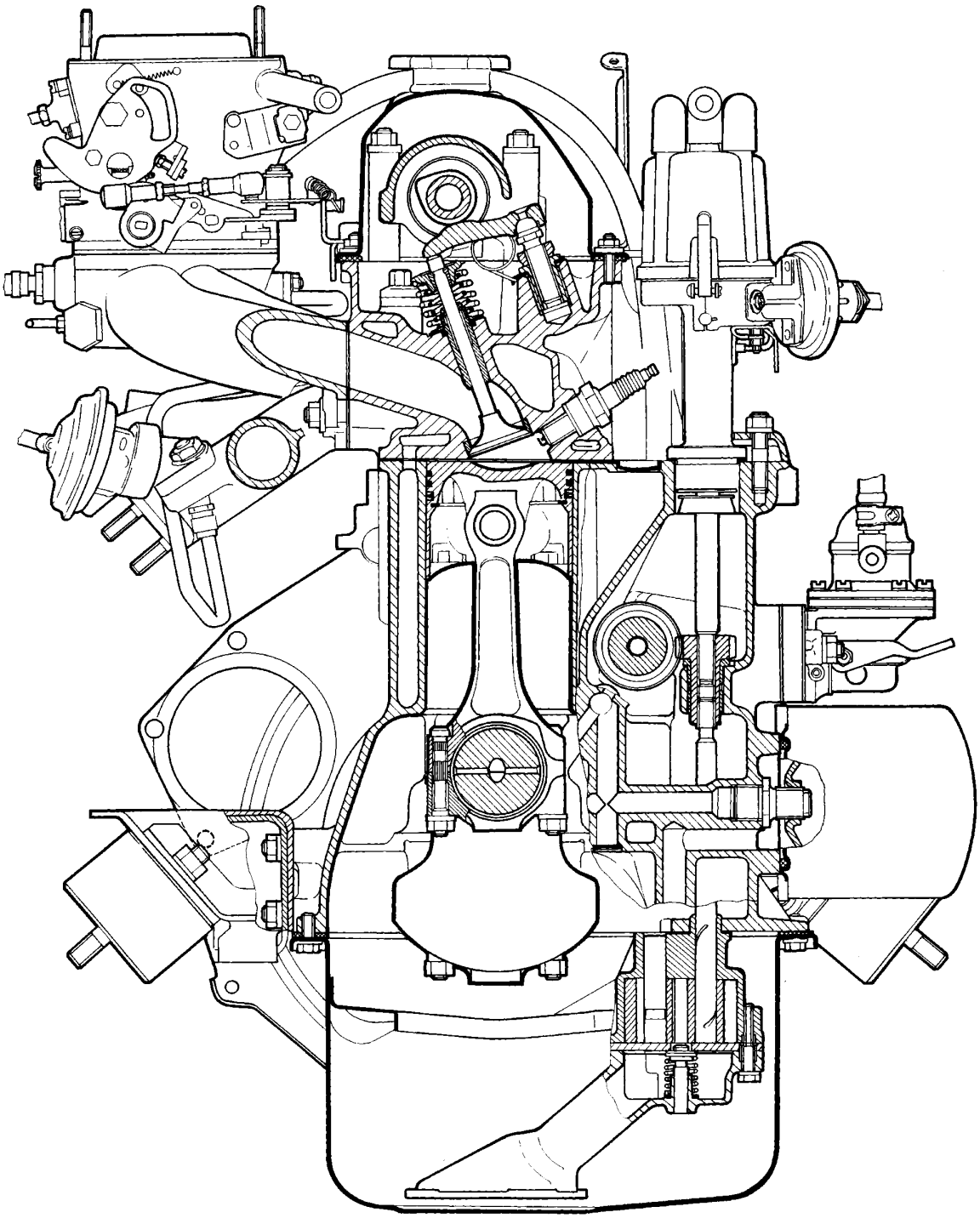

Fig.2-2. Front sectional view of the engine

Fault diagnosis

Symptom/fault	Remedy
Engine fails to start	
1. No fuel to carburettor:	1. Carry out the following operations:
- blocked fuel pipes or fuel filter;	- blow fuel pipes, clean fuel tank, renew fuel filter;
- clogged carburettor or fuel pump filters;	- clean filters;
- faulty fuel pump	- check pump operation and renew any damaged components
2. Ignition system fault	2. Refer to section «Ignition system»
3. Carburettor fuel cutoff solenoid fails to open at ignition switch-on:	3. Carry out the following:
- disconnected, loose or broken wiring to solenoid or solenoid control unit;	- check wiring and connections, renew damaged wires;
- faulty solenoid control unit;	- renew control unit;
- defective fuel cutoff solenoid	- replace solenoid with a new one
4. Carburettor choke not opening at first flashes in cylinders	4. Eliminate any leakage of choke pull-down unit
Engine idles erratically or stalls	
1. Incorrectly adjusted idle speed	1. Adjust idle speed
2. Defective carburettor solenoid control system	2. Refer to «Engine fails to start»
3. Faulty carburettor:	3. Carry out the following:
- blocked carburettor jets or internal passages;	- blow carburettor jets and internal passages;
- water in carburettor;	- remove water from carburettor, drain sludge from fuel tank;
- broken choke control diaphragm	- fit new diagram
4. Ignition system fault	4. Refer to section «Ignition system»
5. Vacuum leak through damaged hose between intake pipe and brake servo unit	5. Replace damaged hose
6. Air leak through gaskets at connections between intake pipe and carburettor/cylinder head	6. Tighten retaining nuts or renew gaskets; eliminate carburettor flange deformation or fit new carburettor
7. Leaking distributor vacuum pipe	7. Fit new pipe in place of damaged one
Engine lacks power and has poor acceleration	
1. Partly open throttle	1. Adjust throttle linkage
2. Choked air cleaner element	2. Change filter element
3. Ignition system fault	3. Refer to section «Ignition system»
4. Faulty fuel pump	4. Check pump operation and renew any damaged components
5. Faulty carburettor:	5. Carry out the following:
- faulty accelerator pump;	- check pump operation, renew damaged parts;
- blocked main jets;	- blow jets with compressed air;
- partly open choke;	- adjust choke operation;
- low fuel level in float chamber;	- adjust float;
- leaky throttle enrichment diaphragm	- replace diaphragm
6. Restricted fuel tank vent pipe	6. Blow pipe with compressed air
7. Incorrect valve clearances	7. Adjust valve clearances
8. Misaligned timing marks	8. Adjust timing belt accordingly, align timing marks
9. Insufficient cylinder compression - below 1 MPa (10 kgf/cm^2):	9. Carry out the following:
- broken or sticking piston rings;	- clean piston rings or grooves from carbon deposits, renew damaged components;
- poor valve-to-seat fitting;	- replace damaged valves, regrind valve seats;
- excessively worn cylinders or piston rings	- replace pistons, rebore and hone cylinders.

Main bearing knocking

Typical knocking or thumping noticeable at sudden throttle opening at idle which intensifies with higher crankshaft rate. Excessive endfloat of crankshaft causes sharper irregular knocking, especially noticeable during smooth increase or decrease in crankshaft speed.

1. Early ignition	1. Adjust ignition timing
2. Insufficient pressure oil	2. Refer to subsection «Insufficient oil pressure at idle»
3. Loose flywheel securing bolts	3. Tighten bolts to torque specified
4. Excessive main bearing running clearance	4. Grind journals and renew bearing shells
5. Excessive thrust washers-to-crankshaft clearance	5. Fit new thrust washers, check clearance

Big-end bearing knocking

Big-end bearing knocking is sharper than that of main bearings. It is noticeable during engine idle at sudden throttle opening. The origin of knocking can be easily identified through switching off spark plugs one at a time.

1. Insufficient oil pressure	1. Refer to «Insufficient oil pressure at idle»
2. Excessive big-end bearing running clearance	2. Fit new bearing shells and regrind journals

Piston slap

Thumping noise caused by piston «runout» in cylinder. Most noticeable at low crankshaft speed and under load.

1. Excessive piston-to-cylinder bore clearance	1. Renew pistons, rebore and hone cylinders
2. Excessive gudgeon pin-to-piston groove clearance	2. Fit new rings or new pistons with rings

Knocking of intake or exhaust valves

Excessive valve clearances cause typical regular noise; its frequency is lower than the frequency of any other engine noise, since the valves are operated by camshaft rotating at half the crankshaft speed.

1. Excessive valve clearances	1. Adjust clearances
2. Broken valve spring	2. Renew spring
3. Excessive valve-to-guide clearance	3. Replace worn parts
4. Worn camshaft lobes	4. Renew camshaft and levers
5. Loose locknut of adjuster bolt	5. Adjust clearance between lever and cam, tighten locknut

Excessive noise of camshaft operation line

Noise from camshaft operation line is caused by clearances between engagement elements and becomes noticeable in general engine noise at low crankshaft speed.

1. Loose chain caused by general wear	1. Tighten chain
2. Broken chain tensioner shoe or damper	2. Renew tensioner shoe or damper
3. Seized chain tensioner plunger rod	3. Eliminate seizure

Insufficient oil pressure at warm engine idle

1. Foreign particles entrapped under oil pump relief valve	1. Clean valve from foreign particles and flash, clean oil pump
2. Seized oil pressure relief valve	2. Renew valve
3. Worn oil pump gears	3. Repair oil pump
4. Excessive main bearing running clearance	4. Turn journals and renew bearing shells
5. Excessive camshaft bearing journal-to-bearing housing clearance	5. Renew camshaft or bearing housing
6. Incorrect oil grade or inappropriate oil quality	6. Change oil as recommended in Attachment 4

Excessive oil pressure on warm engine

1. Seized oil pressure relief valve	1. Renew valve
2. Excessively tough spring of oil pressure relief valve	2. Renew spring

Excessive oil consumption

1. Oil leaking through engine gaskets	1. Tighten fittings or replace gaskets and oil seals
2. Restricted crankcase ventilation system	2. Wash components of crankcase ventilation system
3. Worn piston rings	3. Rebore and renew pistons and rings
4. Broken piston rings	4. Renew rings
5. Foul windows of oil scraper rings or foul slots in piston grooves due to wrong oil	5. Clean windows and slots of carbon, change motor oil as recommended in Attachment 4
6. Worn or damaged valve oil caps	6. Renew oil caps
7. Badly worn valve stems or guides	7. Renew valves, repair cylinder head

Excessive fuel consumption

1. Choke not fully opened	1. Adjust choke linkage
2. Excessive resistance to vehicle motion	2. Check and adjust pressures in tyres, braking system, wheel alignment
3. Incorrect ignition timing	3. Adjust ignition timing
4. Defective distributor vacuum unit	4. Renew vacuum unit or ignition distributor
5. High fuel level in carburettor:	5. Carry out the following:
- leaking needle valve or its gasket;	- check for any foreign matter entrapped between needle and valve seat; renew valve or gasket as applicable;
- seizure or excessive friction hindering normal float operation	- check and when necessary replace floats
6. Choked carburettor air jets	6. Clean jets
7. Leaking part throttle enrichment diaphragm	7. Replace diaphragm
8. Carburettor solenoid failed to shut off fuel at overrun:	8. Following to be done:
- no earthing of idle switch sliding contact;	- clean solenoid contact surfaces;
- broken wire between control module and carburettor idle switch;	- check wiring and connections, renew damaged wire;
- faulty control module	- renew control unit

Engine overheating

Coolant temperature gauge needle is in the red sector. Start tracing the failure with checking coolant temperature gauge and its sender (Refer to section «Instrumentation»).

1. Slackened pump and alternator drive belt	1. Adjust drive belt tension
2. Insufficient coolant in system	2. Top up coolant to cooling system
3. Incorrect ignition timing	3. Adjust ignition timing
4. Dirty radiator outside	4. Clean radiator outside with water jet
5. Defective thermostat	5. Renew thermostat
6. Faulty radiator cap inlet valve (opening pressure is below 0.07 MPa (0.7 kgf/cm^2)	6. Renew cap
7. Defective coolant pump	7. Check pump operation, renew or repair pump

Sudden coolant drop in expansion tank

1. Damaged radiator	1. Repair or renew radiator
2. Damaged cooling hoses or pipe gaskets, loose clips	2. Renew damaged hoses or gaskets, tighten hose clips
3. Leaking heater tap or heater matrix	3. Renew tap or heater matrix
4. Leaking water pump seal	4. Renew seal
5. Damaged radiator cap or cap seal	5. Renew cap
6. Defective cylinder head gasket	6. Renew gasket
7. Leaks from fissures in cylinder block or cylinder head	7. Check cylinder block and cylinder head for leakage; renew damaged components in case of evident cracking
8. Leaks from fissures in water pump housing, water jacket return pipe, thermostat, expansion tank or intake pipe	8. Check for leaks; renew components in case of fissures; minor leaks can be cured by adding a radiator sealant such as НИИСС-1

Engine - removal and refitting

Put the vehicle on a lift or over an inspection pit and apply the handbrake. Take out the spare wheel and its supporting pipe. Disconnect the battery leads and withdraw the battery. Unbolt and remove the bonnet.

To remove the air cleaner, disconnect its hoses, remove the cover and filter element. Temporarily plug the carburettor.

Disconnect the throttle linkage and choke cable.

Disconnect the wires from the fuel cutoff solenoid, idle switch, oil pressure sensor, coolant temperature sensor, ignition distributor, alternator and starter motor.

Drain coolant from the radiator, cylinder head and heater unit. To do this, shift the heater tap control lever to the right, undo the caps on the cylinder block left side and radiator right-hand fluid cooler, screw instead the return hoses connectors, then undo the caps of the expansion tank and radiator.

Separate the fan cowl halves and remove the fan blower cowl. Disconnect the coolant supply and return hoses from the engine. Undo two bolts retaining the radiator to the body, release the top catch of the fan cowl, move the top radiator toward the engine and withdraw the radiator from the engine bay complete with the thermostat and associated hoses. Remove the fan cowl.

Undo the nuts holding the downpipe to exhaust manifold. Detach the downpipe from the bracket on the transmission and lower it down.

Slacken the clips, disconnect the hoses from the fuel pump and secure the pump in the position that excludes any fuel leakage. Detach the fuel return hose from the carburettor.

Release the clips and disconnect the hoses from the heater manifolds, detach the brake servo hose from the intake pipe.

Use socket spanner 02.7812.9500 to unbolt the starter motor from the clutch housing. Undo the bolts holding the clutch housing cover to the lower clutch. Using A.55035 undo the clutch bell-housing to the cylinder block.

Hoist the beam TCO-3/379 and secure the engine right side to the lifting yoke at the front exhaust manifold stud, while the left side shall be secured through the clutch housing mounting hole.

Slightly tension the hoist, undo the nuts that retain front engine mounting rubbers 3 (Fig.2-3) to the side brackets, undo the nut and bolt holding the front axle housing to the engine brackets. Disconnect the engine negative lead.

Lift out the engine, first raise its top in order to take the bolts of the mounting rubber out of the bracket holes, then move the engine forward in order to release the input shaft from the bearing in the crankshaft flange.

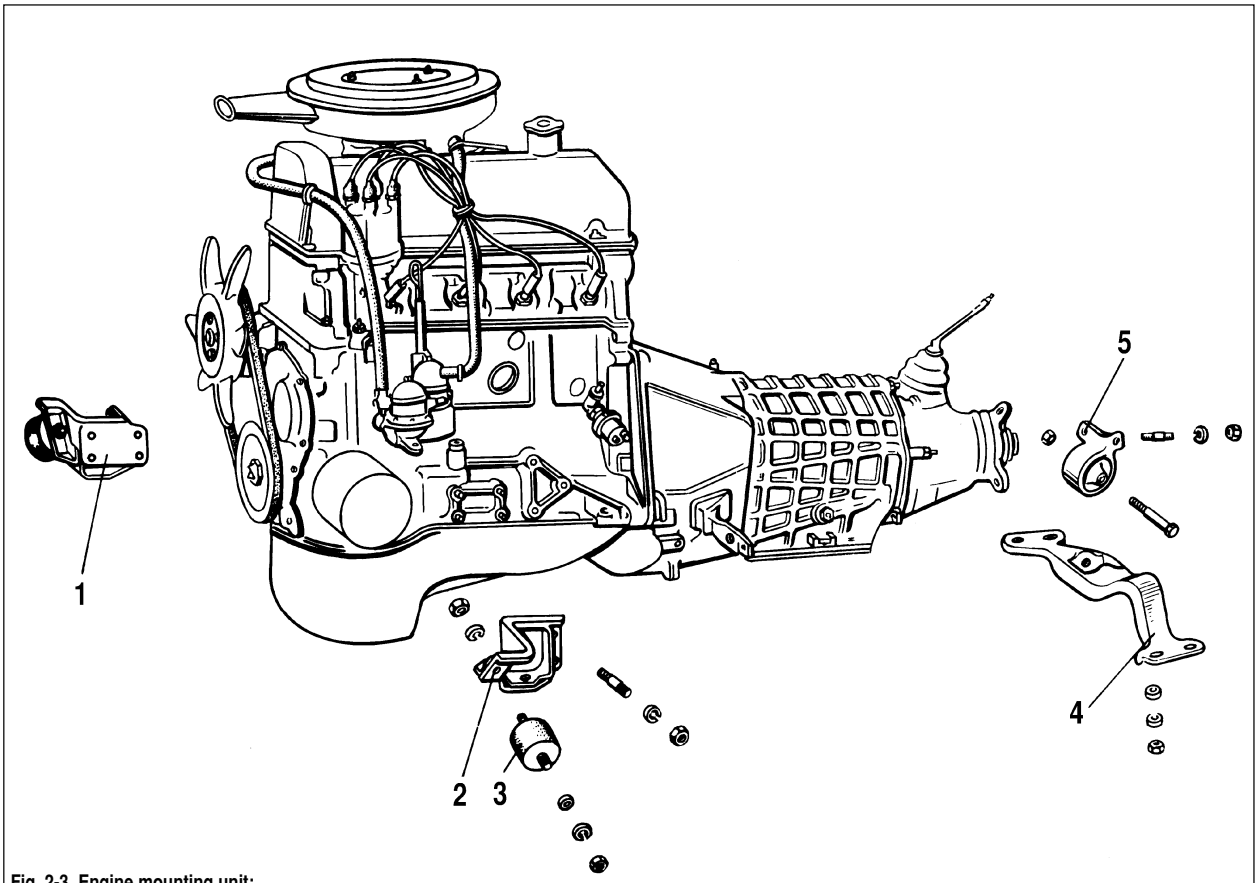

Fig. 2-3. Engine mounting unit:
1 - right-hand support bracket with rubber; 2 - left-hand support bracket; 3 - mounting rubber; 4 - cross-piece, rear mounting; 5 - bracket with rear mounting

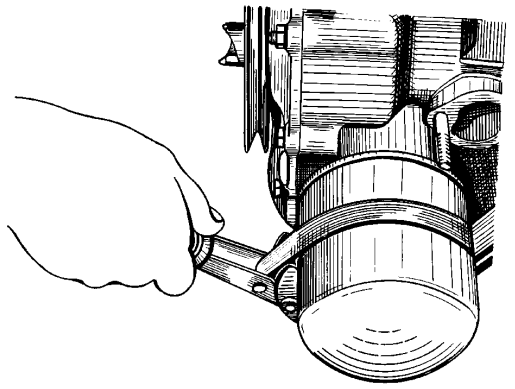

Fig.2-4. Removing the oil filter using tool A.60312

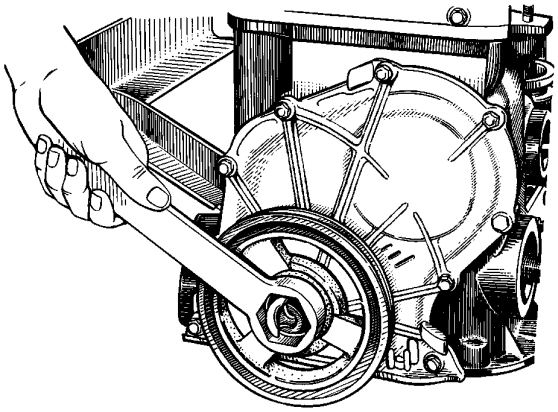

Fig.2-5. Releasing the crankshaft nut using tool A.50121

Remove the starter motor heat shield, followed by the starter motor, hot air intake complete with the supply hose. Remove from the cylinder head two side brackets together with the front engine mounting rubbers.

Unbolt the clutch and withdraw it.

Refitting is a reversal of the removal procedure. Draw special attention to the engine-to-transmission connection: the input shaft must precisely engage the clutch disc splines. Furthermore, for perfect engine/transfer box centering, the centering washers of the front engine mounting rubbers must be in the respective side brackets holes.

Engine - dismantling

Flush the engine, mount it on a stand for dismantling and drain the oil sump.

Remove the carburettor, for that disconnect the hoses and throttle operating rod.

Remove the fuel pump and ignition distributor. Use spanner 67.7812.9514 to unscrew the spark plugs and coolant temperature sensor.

Remove the alternator and water pump drivebelt. Remove the alternator and its retaining bracket.

On the pump and exhaust manifold disconnect the coolant supply pipe from the heater.

From the pump and exhaust manifold disconnect the coolant supply pipe from the heater.

Use tool A.60312 to undo the oil filter with seal, remove the oil filter and seal (Fig.2-4).

Unscrew the oil pressure warning lamp sender. Remove the crankcase vent breather cover, crankcase and oil pump. Remove the oil separator drain pipe catch and take out the oil separator.

To remove the crankshaft pulley, secure the flywheel using A.60330/R (Fig. 2-10) and undo the nut using tool A.5012 (Fig. 2-5). Withdraw the valve cover and timing cover. Unbolt the

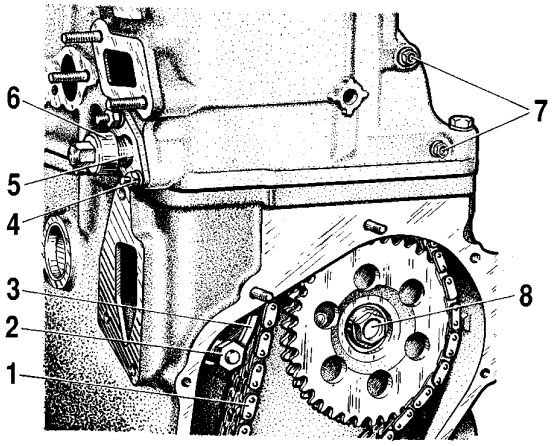

Fig.2-6. Removing the chain tensioner and damper:
1 - camshaft timing chain; 2 - shoe retaining bolt; 3 - tensioner chain; 4 - tensioner retainer nut; 5 - tensioner housing; 6 - tensioner cap nut; 7 - chain damper securing bolts; 8 - oil pump shaft sprocket retaining bolt

camshaft and oil pump drive shaft sprockets.

Slacken chain tensioner cap nut 6 (Fig.2-6), undo nut 4 holding it to the cylinder head, remove the tensioner; then unbolt and remove chain tensioner shoe 3.

Undo the chain stop pin, remove the oil pump and camshaft sprockets, then take off the chain.

Loosen studs 4 nuts (Fig. 2-7). Remove the camshaft bearing housing. Undo studs 4 nuts, remove thrust flange 1 and withdraw the camshaft exercising maximum care not to damage the camshaft bearing housing surface.

Unbolt the cylinder head and withdraw it complete with the exhaust manifold and intake pipe.

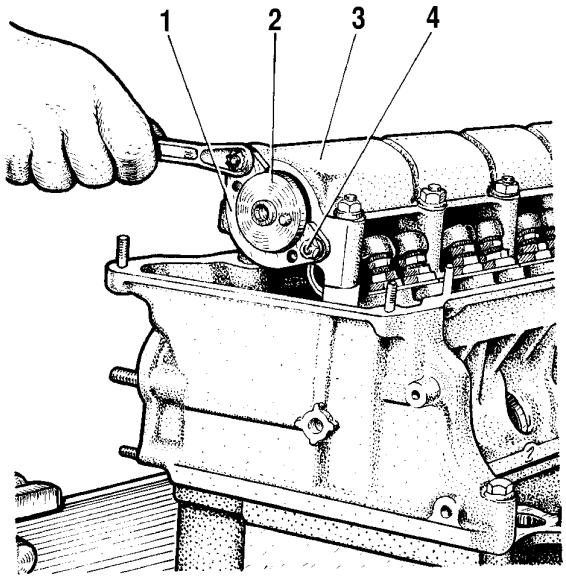

Fig.2-7. Removing the camshaft thrust flange:
1 - thrust flange; 2 - camshaft; 3 - bearing housing; 4 - thrust flange securing stud

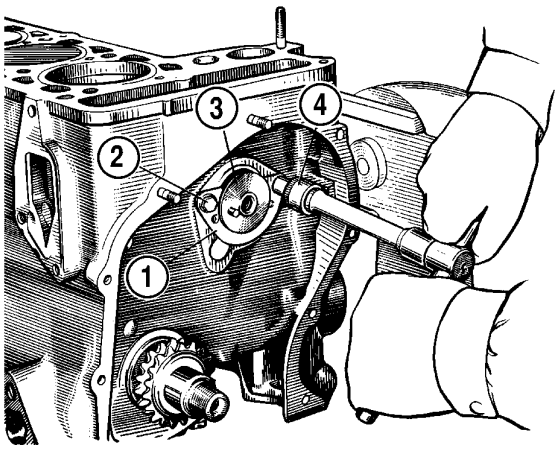

Fig.2-8. Removing the oil pump shaft:
1 - thrust flange; 2 - flange securing bolt; 3 - oil pump shaft; 4 - wrench

Remove thrust flange 1 (Fig.2-8) of the oil pump drive shaft and take the shaft out of the cylinder block.

Using picker A.40005/1/7 (kit A.40005) drive the sprocket off the crankshaft (Fig.2-9).

Undo the connecting rod bolts, remove the big end cap and carefully lift the pistons with the conrods through the cylinders. Mark the piston, connecting rod, main and big-end bearing shells for position to facilitate the reassembly.

WARNING. When removing the pistons and conrods, do not press out the connecting rod bolts.

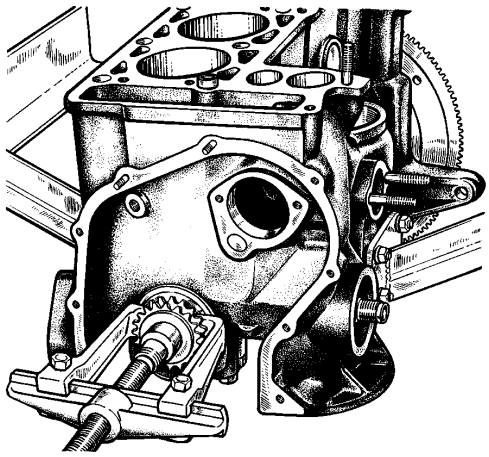

Fig. 2-9. Removing the crankshaft sprocket using a picker

Fit tool 5 (Fig.2-10), undo bolts 3, remove washer 4 and the flywheel from the crankshaft. Remove the front clutch housing cover.

Using tool A.40006, take the input shaft bearing out from the crankshaft (Fig.2-11).

Remove the crankshaft oil seal retainer.

Unbolt the main bearing cap bolts, remove them complete with the lower bearing shells, then lift out the crankshaft, top bearing shells and rear bearing thrust washers.

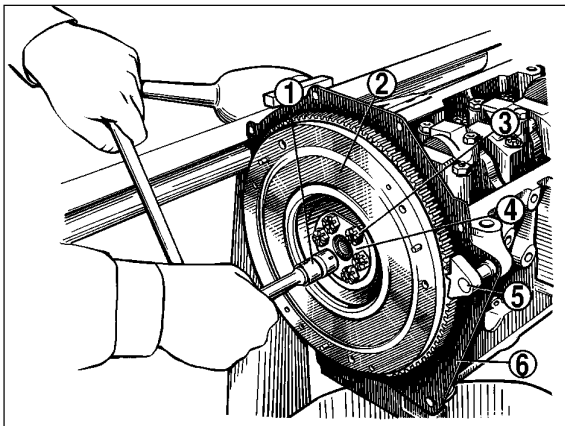

Fig.2-10. Removing the flywheel:
1 - wrench; 2 - flywheel; 3 - flywheel securing bolt; 4 - washer; 5 - tool A.60330/R to lock the flywheel stationary; 6 - front clutch housing cover

Engine - reassembly

Follow the engine reassembly procedure as below:

Locate a clean cylinder block and screw in any missing dowels. Oil the crankshaft bearing shells, thrust washers, pistons and oil seals. Always fit new crankshaft oil seals when reassembling the engine after overhaul.

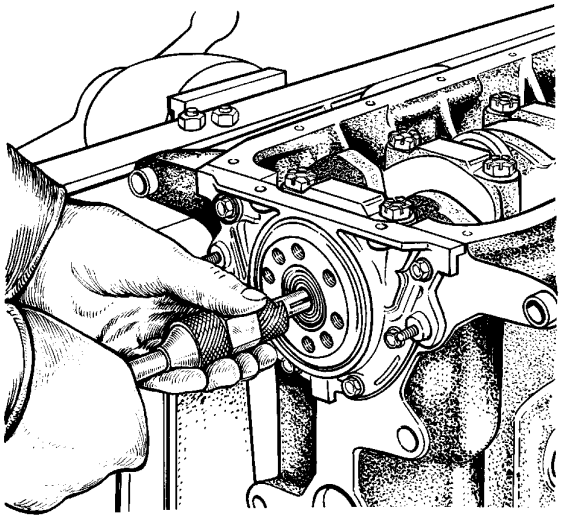

Fig.2-11. Pressing out the bearing from the crankshaft using tool A.40006

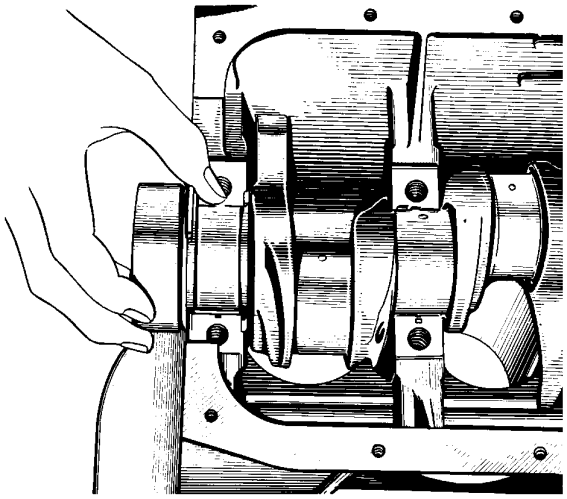

Fig. 2-12. Refitting the thrust washers to the rear mounting

Fit the centre main bearing shells without an oilway into the bearing recesses. Fit into other cylinder bores the bearing shells with an oilway, while into the relevant main bearing caps - the bearing shells without an oilway. Lower the crankshaft into position, then stick two thrust washers into the rear bearing recesses (Fig.2-12).

WARNING. The washers must be fitted so that their oilways face away from the bearings in the block and cap (anti-friction coat is applied on the washer surface). At the rear of the rear main bearing there fitted a sintered thrust washer (yellow), while at the front - a steel-aluminium thrust washer.

Locate the main bearing caps according to the marks on their outer surface (Fig.2-13). Tighten the cap securing bolts.

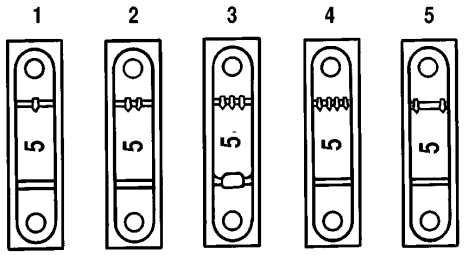

Fig.2-13. Marks on the main bearing caps (bearing are numbered from the engine front end)

Check the crankshaft endfloat. To do this, turn the cylinder block to have the rear side up and position the dial gauge foot against the crankshaft flange (Refer to Fig.2-14). Moving the crankshaft up and down (using screwdrivers, for instance), check the crankshaft endfloat to be within 0.06-0.26 мм. If not, adjust accordingly and replace the old thrust washers with new ones or fit thicker thrust washers.

Locate the rear oil seal housing gasket on the crankshaft flange, insert the front clutch housing cover bolts into the respective bores (Fig.2-15). Place the oil seal housing on tool 41.7853.4011 and slide it to on the crankshaft flange; next secure it to the cylinder block with the bolts.

Locate front clutch housing cover 6 (Fig.2-10) over two centering pins (Fig. 2-16). Secure the cover to the rear oil seal housing with nuts.

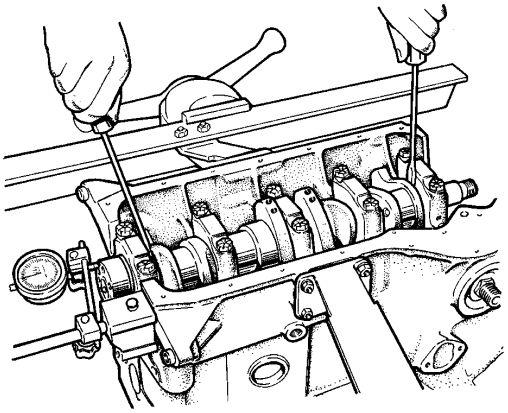

Fig.2-14. Checking the crankshaft endfloat

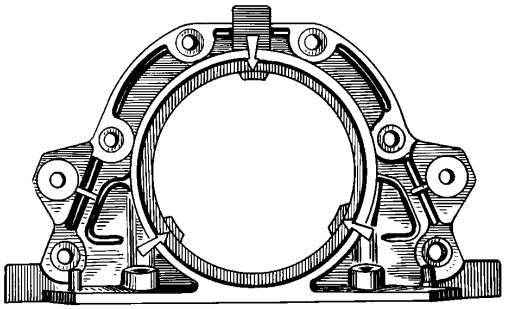

Fig.2-15. Crankshaft rear oil seal housing.
The lugs (arrowed) for centering the housing against the crankshaft flange

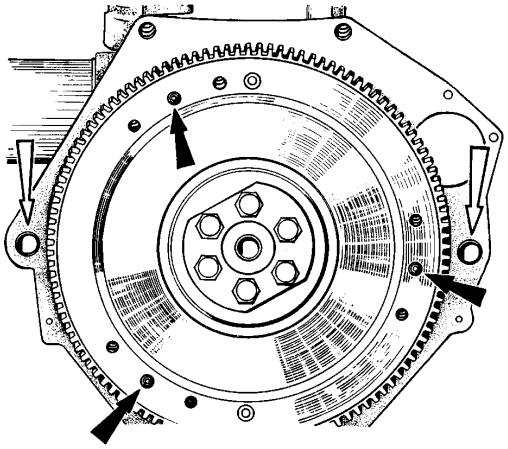

Fig.2-16. Clutch dowels (arrowed black) and clutch housing centering pins (arrowed white)

Locate the flywheel in position so that the marking (a cut-out) near the rim is against the No 4 cylinder crankpin axis. While holding the flywheel stationary with tool A.60330/R, bolt it to the crankshaft flange to the specified torque.

Using a ring compressor (tool 67.8125.9502), fit the pistons and connecting rods to the cylinders (Fig.2-17).

WARNING. The hole for gudgeon pin in the piston is 1.2 mm set off, so the arrows on the piston crown must face the timing belt end of the engine when inserting the pistons into the cylinders.

Press the big-end bearing shells into the connecting rods and caps. Guide the conrods and big-end caps onto the crankshaft journal, then tighten the connecting rod bolts. The big-end caps must be positioned so that the cylinder number on the cap is against the cylinder number on the connecting rod big-end.

Refit the crankshaft sprocket. Locate the oil pump shaft and secure it with the thrust flange.

Insert two centering pins into the cylinder block (Fig.2-17) and locate the cylinder head gasket over them.

WARNING. Always fit the new cylinder head gasket. Never re-use the old gasket.

Before refitting the gasket, remove any oil from the mating surfaces of the block and cylinder head. Make sure the gasket is perfectly clean and dry. Avoid any incidental oiling of the gasket.

Turn the crankshaft so that the pistons are midway in the cylinder bore.

Refit the cylinder head complete with the valves, exhaust manifold and intake pipe over the centering pins.

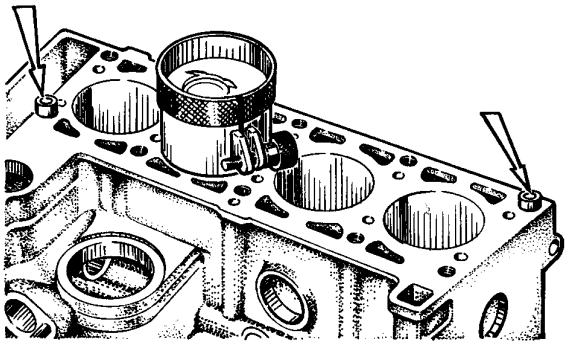

Fig.2-17. Fitting the pistons complete with piston rings using ring compressor; centering pins of the cylinder head (arrowed)

Tighten the cylinder head bolts in the established procedure (Fig.2-18) in four steps to ensure a reliable fit and exclude further tightening during vehicle servicing.

1st step	- tighten the bolts 1-10 to 20 N•m(2 kgf•m);
2nd step	- tighten the bolts 1-10 to 69.4-85.7 N•m (7.1-8.7 kgf•m), while the bolt 11 to 31.36 - 39.1 N•m (3.2-3.99 kgf•m);
3rd step	- turn the bolts 1-10 to 90°;
4th step	- turn again all bolts 1-10 to further 90°.

WARNING. The cylinder head bolts can be re-used only when their length is not in excess of 120 mm, otherwise renew the bolt.

Before reassembly, immerse the bolts, thread and head, into engine oil. Allow the excess oil drip for at least 30 minutes. Remove all entrapped oil from the bolt bores in the cylinder head.

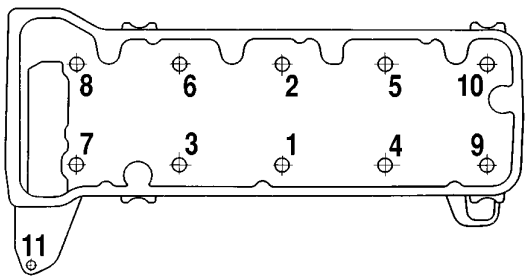

Fig. 2-18. Cylinder head bolt tightening sequence

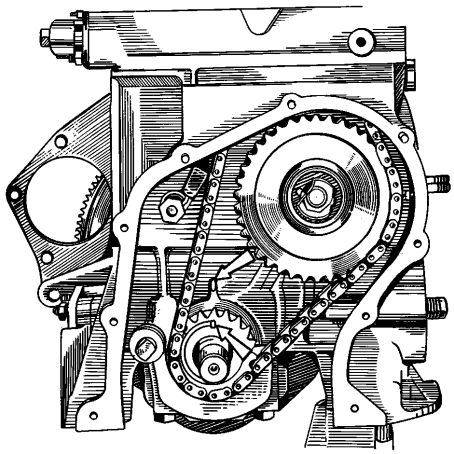

Fig. 2-19. Aligning the timing marks on the crankshaft sprocket and cylinder block

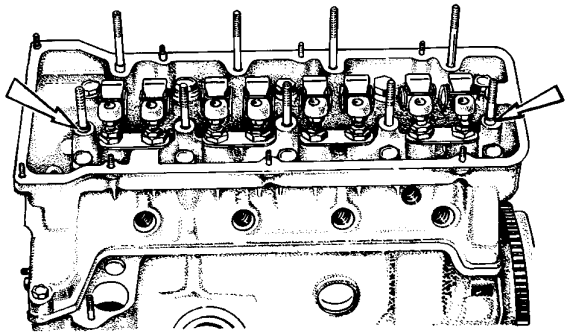

Fig.2-20. Centering pins for camshaft bearing housing

Turn the flywheel so that the mark on the crankshaft sprocket is against the cylinder block mark (Fig.2-19).

Check to see the camshaft bearing housing centering pins are in position (Fig.2-20). Refit the sprocket to the camshaft complete with the bearing housing and turn the camshaft so that the timing mark in the sprocket is aligned against the mark on the bearing housing (Fig.2-21). Remove the sprocket and without changing the camshaft position, refit the bearing housing to the cylinder head so that the centering pins are in the respective bores of the bearing housing. Secure the bearing housing, tightening the nuts in the sequence as shown in Fig.2-22.

Refit the chain vibration damper.

Refit the camshaft timing chain:

- fit the chain onto the camshaft sprocket and position the sprocket so its TDC mark is aligned with the respective mark on the bearing housing (Fig.2-21). Do not tighten the sprocket bolt fully;

- fit the sprocket to the oil pump shaft, but do not tighten the retaining bolt fully;

- fit the chain tensioner shoe and tensioner, but do not tighten the cap nut so that the tensioner spring can compress the shoe; screw the chain stop pin into the cylinder block;

- turn the crankshaft two turns forward to ensure the chain tension required; check the indentations in the sprockets are aligned with TDC marks in the cylinder block and bearing housing (Fig.2-19 and Fig.2-21);

- when the marks are aligned, hold the flywheel stationary with tool A.60330/R (Fig.2-10), then tighten the sprocket securing bolts and chain tensioner cap nut to the torques specified, bend the sprocket bolt lock washers; should the marks are not aligned, repeat the chain refitting procedure.

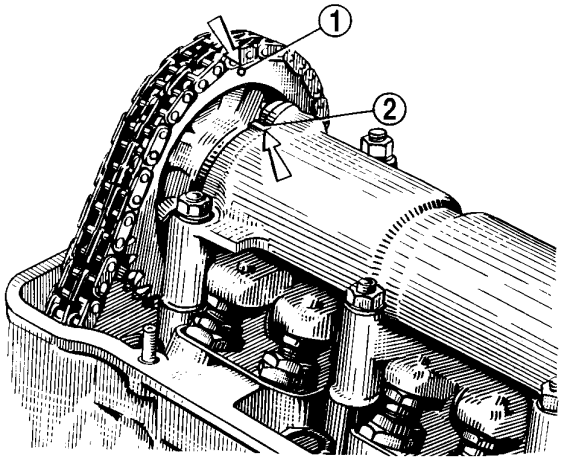

Fig.2-21. Aligning the timing mark on the camshaft sprocket against bearing housing mark:
1 - mark in sprocket; 2 - mark on bearing housing

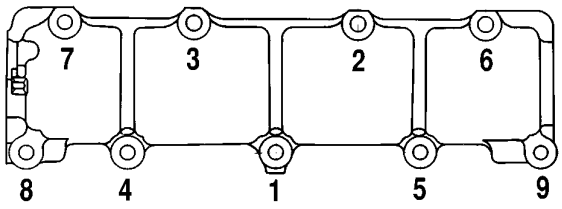

Fig.2-22. Camshaft bearing housing nuts tightening sequence

Adjust the clearance between the camshaft lobes and valve levers.

Refit the camshaft cover (Fig.2-23) complete with the gasket and oil seal to the cylinder block, do not tighten the retaining bolts and nuts fully. Using tool 41.7853.4010 centralize the cover against the crankshaft end, then tighten the retaining nuts and bolts to the torques specified.

Fit the alternator and oil pump pulley, then secure it with the nut.

Fit the oil filter complete with the gasket, manually screw it to the union on the cylinder block. Refit the crankcase vent oil separator, breather cover and secure the oil separator drain pipe with the clip.

Fit oil pump 1(Fig.2-24), then fit the oil sump with the gasket.

Fit the coolant pump, alternator bracket and alternator. Fit the belt around the pulleys and adjust the belt tension.

Fit the heater matrix supply pipe and cooling water jacket outlet pipe to the cylinder block. Secure the heater matrix drain pipe to the coolant pump and outlet pipe.

Fit the instrumentation sensors.

Fit the oil pump / distributor gear, followed by the ignition distributor. Insert the spark plugs, place spanner 67.7812.9515 on the spark plugs and tighten the spark plugs with a torque wrench to the torques specified.

Fit the fuel pump as outlined in section «Fuel system».

Fit the carburettor and reconnect the hoses. Cover the carburettor with a provisional cap.

WARNING. Never secure the carburettor (or tighten its retaining nuts) when it is warm.

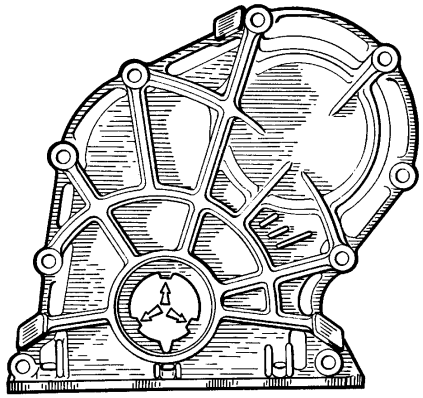

Fig.2-23. Timing cover
Projections (arrowed) for cover centering against crankshaft pulley hub

Fit the valve cover complete with the gasket and fuel piping bracket.

Fit the air cleaner, to do this secure the hoses to the air cleaner housing, fit the filter housing complete with the gasket to the carburettor, then fit the mounting plate and secure the housing with nuts. Locate the filter element and secure the air cleaner cover.

Reconnect the HT leads to the distributor and spark plugs.

Fill the engine with motor oil through the oil filler in the valve cover.

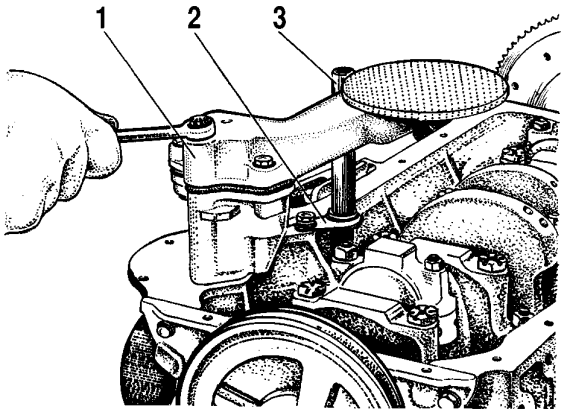

Fig.2-24. Refitting the oil pump:
1 - oil pump; 2 - drain pipe lock; 3 - oil separator drain pipe

Engine run-in after overhaul

After overhaul the engine is bench tested (run-in) at no loads under the following cycle:

750-800 rpm	2 minutes
1000 rpm	3 minutes
1500 rpm	4 minutes
2000 rpm	5 minutes

Locate the engine on the test bench, start the engine and make checks with respect to the following items:

- evidence of coolant or fuel leaks through mating components, pipe connections or gaskets;

- oil pressure and oil leaks through gaskets;

- ignition timing;

- idle speed;

- carburettor / intake pipe tightness;

- abnormal knock.

In case of any malfunctions or unknown rattle, stop the engine, eliminate the faults, then continue the tests.

In case of oil leaks through the gasket between the valve cover and cylinder head or through the gaskets between the oil sump, cylinder block and covers, tighten the securing bolts to the torque specified. If oil leaks persist, check the correct fitting of the gaskets and renew when applicable.

Since the overhauled engine is not fully bed-in and frictions between the working surfaces of renewed parts show significant resistance to the rotation, a certain run-in period is required.

This especially concerns those engines, where the pistons, main / big-end bearing shells have been renewed, or the crankshaft journals have been reground, or the cylinders - honed.

Therefore during run-in after the engine overhaul, never allow the engine to run at maximum loads. When in the vehicle, always run-in the engine at the speeds which are recommended for the run-in periods.

In-vehicle engine inspection after overhaul

Locate the engine in the vehicle, thoroughly check its correct mounting.

Run the engine for a while, then check for:

- coolant or fuel leaks through pipe connections, tighten when necessary;

- full throttle opening and closing by the carburettor cable, adjust accordingly, if necessary;

- alternator drivebelt tension, adjust, when applicable;

- reliable wiring connections and operation of the warning lamps in the instrument cluster.

WARNING. Never check the engine or vehicle on the roller stand without additional rollers for the front wheels.

Cylinder block

General description

The cylinder block basic sizes are shown in Fig.2-25.

The cylinder block is of a low-alloyed cast iron. The cylinder bores are of five classes in steps of 0.01 mm and are designated by the letters A, B, C, D, E. The cylinder class is engraved on the cylinder block bottom face. (Fig.2-26).

The cylinders can be rebored to accommodate the oversize pistons of 0.4 mm and 0.8 mm bigger diameters.

The main bearing caps are machined complete with the cylinder block; therefore they are not interchangeable and feature distinctive notches on the outside surface (Fig.2-13).

Inspection and repair

Inspection. Wash the cylinder block thoroughly and clear the oilways. Blow dry with compressed air and inspect the cylinder block visually. Make sure there are no cracks in the mountings or elsewhere in the cylinder block.

When cooling water is suspected in the crankcase, use a special test bench to examine the cylinder block for leaks. To do this, plug the cylinder block cooling water jacket ports, force in some room temperature water at 0.3 MPa (3 kgf/sq.cm). There should be no evidence of water leaks from the cylinder block within 2 minutes.

When coolant is found contaminated with oil, do not strip the engine completely, rather check the cylinder block for cracks in the area of the oilways. For that, drain the coolant from the cooling system, remove the cylinder head, refill the cylinder block water jacket with water and apply compressed air to the vertical oilway in the cylinder. If there are any bubbles in the water of the cooling water jacket, renew the cylinder block.

Examine the split face between the cylinder block and cylinder head using a straight-edge and feeler blades. Position the straight-edge diagonally and using a feeler gauge measure at the centre, both transversely and longitudinally. The flatness to be within 0.1 mm tolerance.

Cylinder repair. Check the cylinders for wear to be maximum 0.15 mm.

When available, use a dial inside gauge to measure the bore diameter (Fig.2-27) in four lands, both longitudinally and transversely (Fig.2-28). Use tool 67.8125.9502 to set the inside gauge to zero.

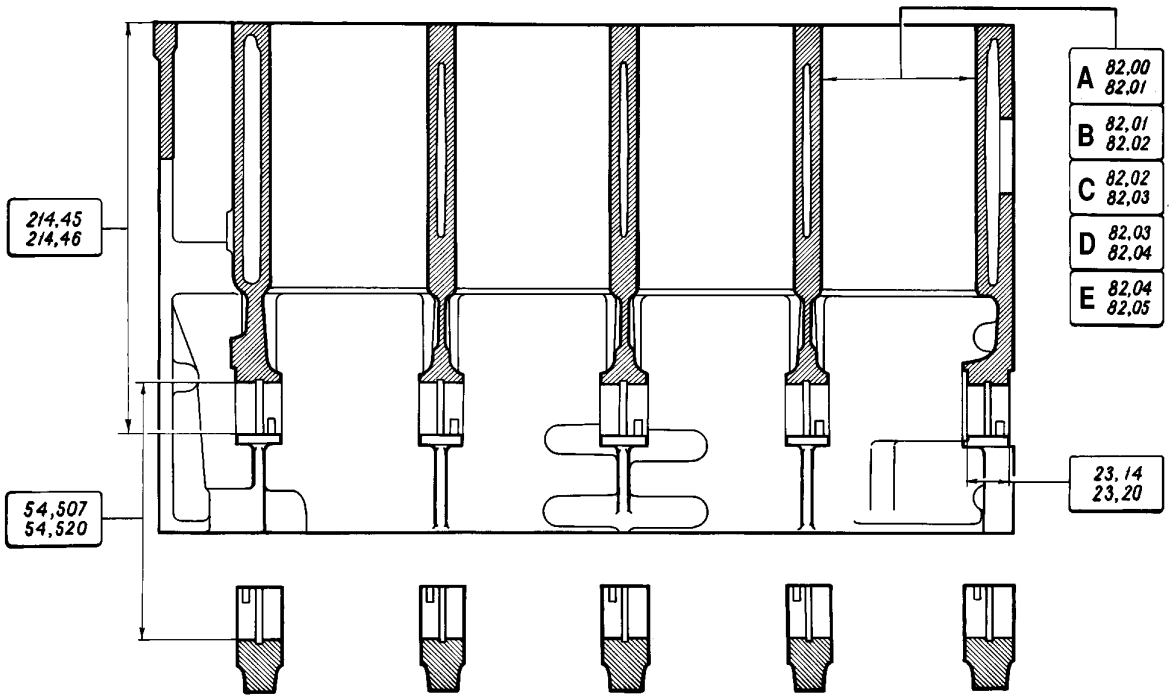

Fig.2-25. Basic sizes of the cylinder block

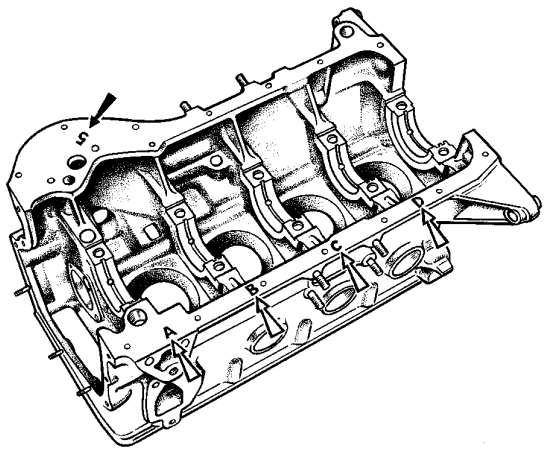

Fig.2-26. Cylinder size class engraved on the cylinder block

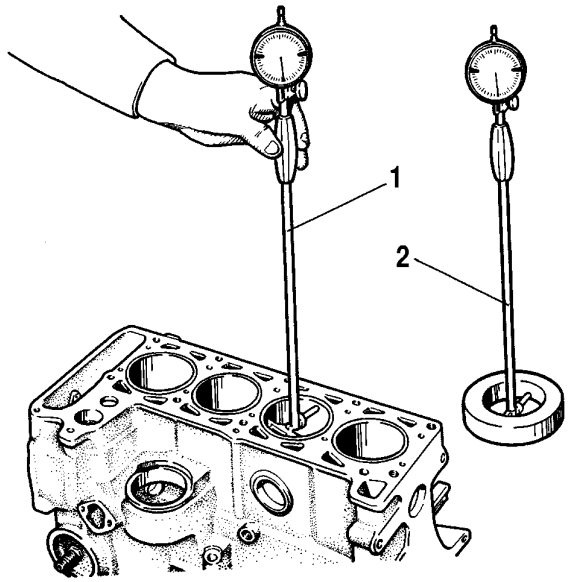

Fig.2-27. Measuring the cylinder bore with the inside dial gauge:
1 - inside dial gauge; 2 - setting to zero against reference gauge

There is practically no wear in the land 1 area of the cylinders. Compare the values measured on the first and other cylinder lands to see the amount of the cylinder wear.

When the maximum wear is over 0.15 mm, rebore the cylinders to the nearest oversize; provide 0.03 mm honing allowance on the diameter. Hone the cylinder walls so that the difference between the oversize piston diameter and cylinder bore is 0.025 - 0.045 mm.

Pistons and connecting rods

General Description

The basic sizes of the pistons and connecting rods are shown in Fig.2-29.

Piston is an aluminium casting. The piston weight is precisely maintained during the manufacturing process. Consequently, there is no need to select the matching piston of the same weight class during the engine assembly.

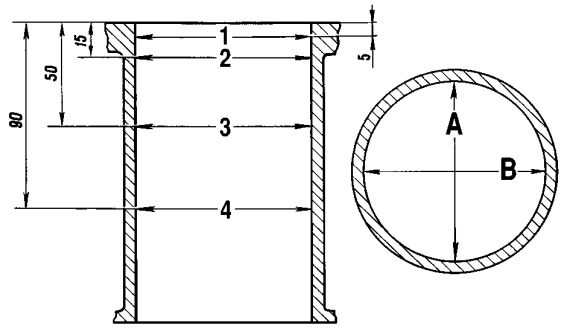

Fig.2-28. Measuring the cylinder bore:
A and B - direction of measurement; 1, 2, 3 and 4 - No of lands

There are five classes (A, B, C, D, E) of the piston according to their major diameter, in steps of 0.01 mm. The piston has a complex outside shape: tapered in height and oval in the cross-section area. Therefore, the piston diameter must be measured in the plane normal to the gudgeon pin at 55 mm from the piston crown.

There are three classes (1, 2, 3) of pistons, as to the hole for the gudgeon pin, in step of 0.004 mm. The classes of piston diameters and holes for the gudgeon pin are stamped on the piston crown (Fig.2-30).

The oversize piston major diameter is 0.4 or 0.8 mm bigger. The 0.4 step is marked in the form of a triangle, while the 0.8 mm step is marked as a square.

Use the arrow on the piston crown for correct piston orientation and fitting within the cylinder. The arrow of the piston must face the timing belt end of the engine.

Gudgeon pin is of steel, hollow, floating-type, i.e. freely operates in the piston bosses and connecting rod bush. The gudgeon pin is secured in the hole with two circlips.

As to the outside diameter the gudgeon pin are of three classes in step of 0.004 mm. The class is paint marked on the gudgeon pin face: 1st class - blue paint, 2nd class - green paint, 3rd class - red paint.

Piston rings are of cast iron. The top compression ring has a chromed barrel face. The bottom compression ring is of the scraper type. The oil control piston ring features chromed working edges and has a coil expander (spreader ring).

The oversize rings are marked as 40 or 80, which corresponds respectively to 0.4 or 0.8 mm step in the major diameter.

Connecting rod is of forged steel.The connecting rod is machined together with the big end cap, therefore they are interrelated. The cylinder number (6 in Fig.2-30) is stamped on the caps and connecting rods to prevent confusion when refitting into the cylinders. During reassembly the figures on the connecting rod and cap should face the same side.

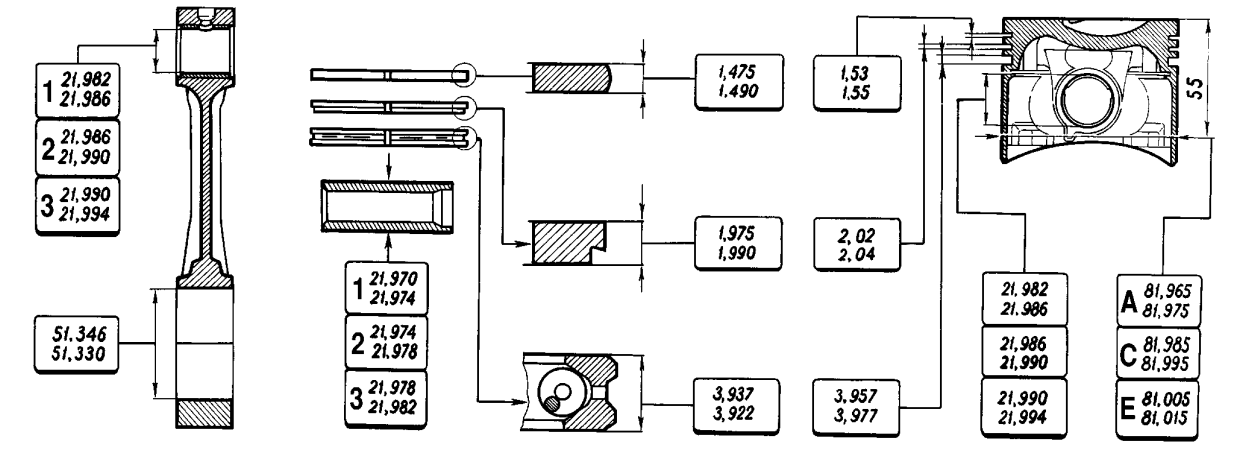

Fig.2-29. Basic dimensions of pistons and connecting rods

The connecting rod small-end features a pressed-in steel-bronze bush. As to the diameter of the bush, the connecting rods are divided into three classes in steps of 0.004 mm (similar to the pistons).

The class number (5 in Fig.2-30) is engraved on the big-end cap.

The connecting rod small-end and big-end are classified weight-wise (Table 2-1) and are paint marked on the connecting rod. The engine must always be fitted with the connecting rods of the same weight class. The connecting rod weight can be adjusted by removing excess metal from the bosses on the small-end or big-end up to the minimum size of 16.5 mm or 35.5 mm (Fig.2-31).

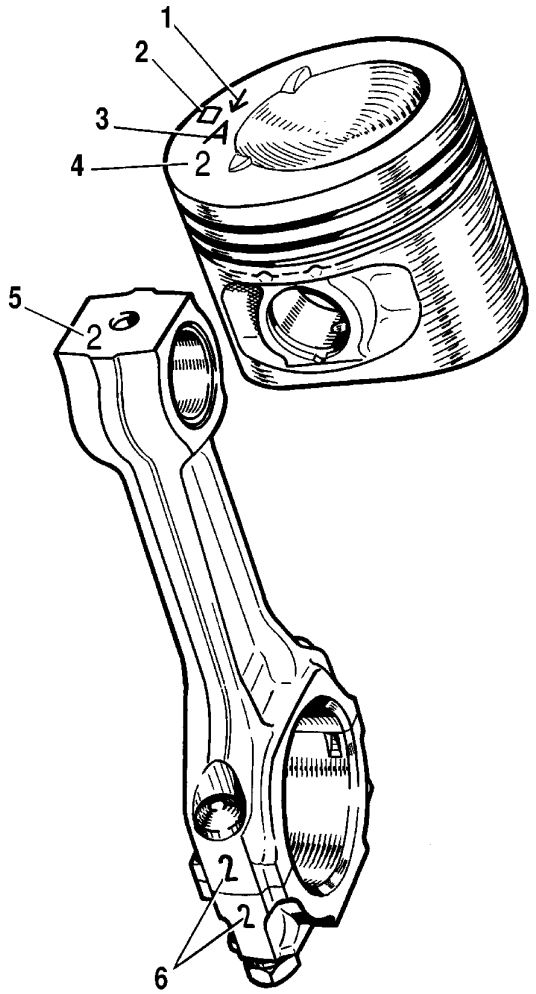

Fig.2-30. Marking on the piston and connecting rod:
1 - arrow on piston crown for orientation in cylinder; 2 - oversize; 3 - piston class; 4 - class of gudgeon pin hole; 5 - connecting rod class as to gudgeon pin hole; 6 - cylinder No

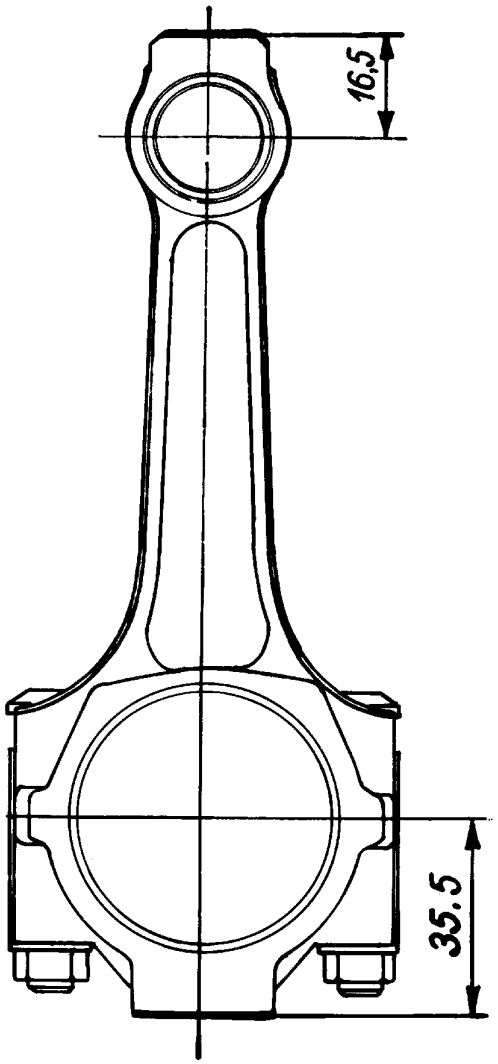

Fig.2-31. Locations of possible metal removal subject to adjusted connecting rod small-end and big-end weights

Table 2-1

Connecting rod classification as to small-end and big-end weights

Connecting rod weight, g		Class	Paint mark
small-end	big-end		
	519±3	A	white
186±2	525±3	B	blue
	531±3	C	red
	519±3	D	black
190±2	525±3	E	violet
	531±3	F	green
	519±3	G	yellow
194±2	525±3	H	brown
	531±3	I	orange

Selecting piston to cylinder

The design clearance between the piston and cylinder bore (for new parts) is 0.025 - 0.045. The condition must be ensured through prior measurements of the associated parts and fitting of the pistons which belong to the same class of cylinders. The maximum permissible gap (for worn parts) is 0.15 mm.

When the engine, in the course of operation, shows a clearance of over 0.15 mm, reselect the pistons to the cylinders to have the clearance as close to the design value as possible.

The pistons of classes A, C, E are intended for replacement. These classes can be selected to closely match any cylinder in the event of the engine overhaul, since the pistons and cylinders are classified with small overlapping in the sizes. It means, the piston of class C can match the cylinders of class B and D.

Dismantling and reassembly

Dismantling. Prise out the gudgeon pin circlips from the piston, press out the gudgeon pin and detach the connecting rod from the piston. Remove the piston rings.

The bolts are pressed into the connecting rod and must never be pressed out from the connecting rods during the engine or piston/connecting rod dismantling.

When some components of the piston or connecting rod are not damaged or show little wear, they can be re-used. Identify them accordingly during dismantling to facilitate further reassembly with the respective components and to the original cylinder.

Reassembly. Before reassembly, select the gudgeon pin to match the piston and connecting rod. For new components the class of the holes for the gudgeon pin in the connecting rod and pistons must be identical to the class of the gudgeon pin. In case of used components, for perfect mating, the gudgeon pin when oiled should fit the relevant piston hole by force of the hand thumb (Fig.2-32); it should not drop out while held as shown in Fig.2-33.

If the gudgeon pin drops, replace it with a new one of the next class. When the piston is fitted with the gudgeon pin of the third class, renew the piston, gudgeon pin and connecting rod.

The reassembly of the piston and connecting rod is a reversal of dismantling. After reassembly oil the gudgeon pin through the holes in the piston bosses. Refit the piston rings in the order as detailed below.

Oil the piston rings and grooves in the piston. Arrange the piston rings so that the gap of the first compression ring is at a 45° interval to the gudgeon pin; space the gap of the second compression ring at about 180° interval to the first compression gap, afterwards align the gap of the oil ring at about 90° interval to the first compression ring gap.

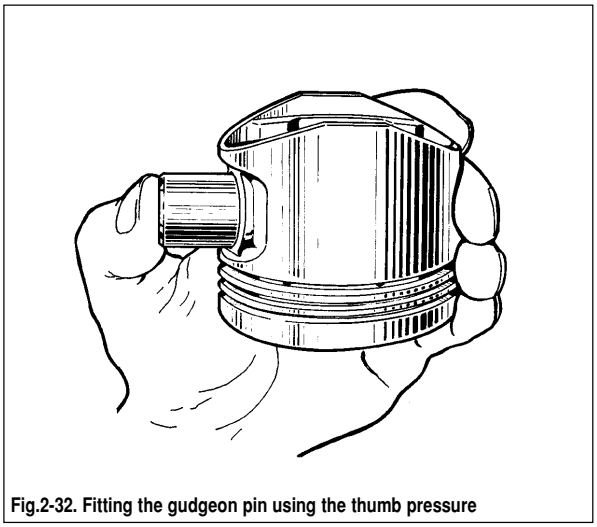

Fig.2-32. Fitting the gudgeon pin using the thumb pressure

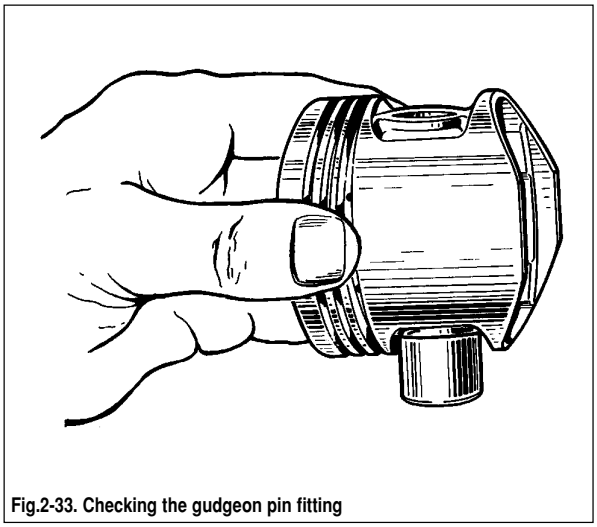

Fig.2-33. Checking the gudgeon pin fitting

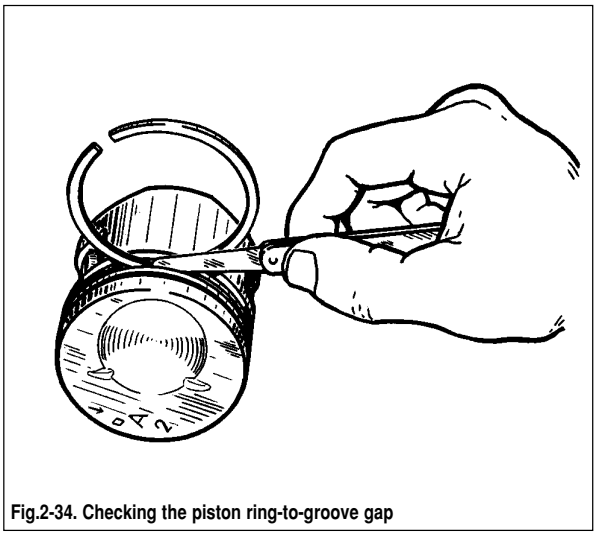

Fig.2-34. Checking the piston ring-to-groove gap

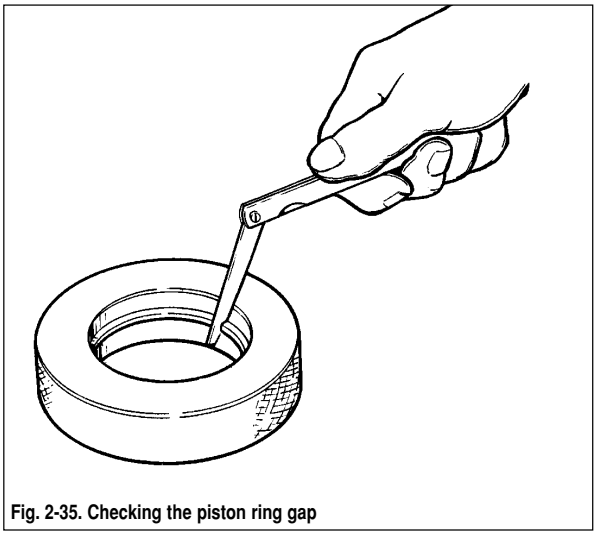

Fig. 2-35. Checking the piston ring gap

Make certain the second compression ring is positioned with the recess facing down (Fig.2-30), while the TOP (or BEPX) mark should face up (the piston crown).

Before refitting the oil ring, check to see the joint of the coil expander (spreader ring) is on the side opposite to the ring gap.

Inspection

Scrape away all traces of carbon from the piston and remove all carbon deposits from the piston/connecting rod oilways.

Thoroughly examine the components. Make sure there are no cracks of any sort on the piston, piston rings, gudgeon pin, connecting rod or big-end cap. Renew the bearing shell if there is obvious scoring or scuffing.

The piston-ring-to-groove wall clearance is checked using feeler blades as shown in Fig.2-34, fitting the ring into the respective groove. For new components the design clearance (rounded off to the nearest 0.01 mm) is 0.04-0.07 mm for the first compression ring; 0.03-0.06 mm for the second compression ring and 0.02-0.05 mm for the oil control ring. When worn, the tolerance must not exceed the specified maximum of 0.15 mm.

The piston ring gap should be checked with a feeler gauge via inserting the rings into the gauge (Fig.2-35), with the bore equal to the piston ring nominal diameter ±0.003 mm. Use gauge 67.8125.9502 for the normal 82 mm rings.

The gap for all new piston rings should be within 0.25 to 0.45 mm. The maximum permitted gap for worn rings is 1 mm.

Crankshaft and flywheel

Design description

Basic dimensions of the crankshaft are shown in Fig.2-36.

Crankshaft is cast-iron, of five bearings. The crankshaft journals can be reground during the engine overhaul when the diameter is reduced by 0.25 mm, 0.5 mm, 0.75 mm and 1mm.

The crankshaft endfloat is restricted by two thrust washers. The thrust washers are fitted on both sides of the rear main bearing: a sintered one (yellow) at the rear end and a steel-aluminium one at the front end. The thrust washers are of two sizes - standard and 0.127 mm thicker.

Crankshaft bearing shells are thin-walled, aluminium with steel backing. The upper bearing shells of No 1, 2, 4 и 5 bearings have inner oil grooves, whilst the lower bearing shells are plain shells. The upper and lower bearing shells of the centre bearing (No 3) are plain, without an oil groove. The big-end bearing shells (both upper and lower ones) are also plain.

The oversize bearing shells are thicker for the crankshaft journals reduced by 0.25 mm, 0.5 mm, 0.75 mm and 1 mm.

Flywheel is cast iron with the pressed-in steel starter ring. The flywheel centering is ensured by a front input shaft bearing which is pressed into the crankshaft.

A taper recess on the rear face of the flywheel near the ring gear is provided as a positioning mark. Adjust it against cylinder No 4 crankpin.

Inspection and overhaul

Crankshaft. Inspect the crankshaft. Make sure there are no cracks. Examine the faces which mate the oil seal working edges for evident cracking, scoring or scuffing.

Mount the crankshaft on two V-blocks as shown in Fig.2-37 and check the run-out with a dial gauge:

• main bearing journals - maximum 0.03 mm;

• mounting surfaces for the input shaft sprocket and bearing - maximum 0.04 mm;

• surface mating the oil seal - maximum 0.05 mm.

Measure the diameters of the main bearing journals and

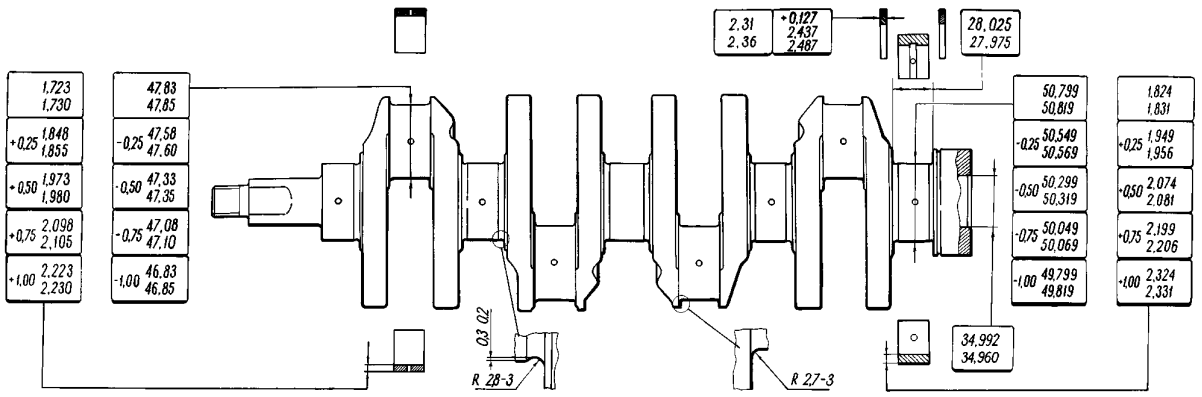

Fig.2-36. Basic crankshaft dimensions

crankpins. Regrind when the wear is in excess of 0.03 mm, ovality is over 0.03 mm, or when scoring and scuffing is obvious.

Regrind the journals and crankpins through reducing the diameter to the nearest undersize (Fig.2-36).

When regrinding, observe the sizes for the crankshaft fillet as shown in Fig.2-36 for the standard-size crankshaft.

The ovality and taper for the main bearing journals and big-end bearing journals after regrinding must not exceed 0.005 mm.

On a reground crankshaft, the vertical offset of the crankpins axes must be 0.35 mm (Fig.2-37). To check this, place the crankshaft on V-blocks and position the crankshaft so that No1 crankpin axis is in the horizontal plane passing through the main bearing journal axes. Using a dial gauge, check the vertical offset of crankpins No 2, No 3 and No 4 against crankpin No 1.

After regrinding the journals and crankpins, polish them using the diamond paste or special grinding pastes.

After regrinding and followed finishing, unplug the oilways, then machine the plug seats with the mill-cutter A.94016/10 and spindle A.94016. Thoroughly wash the crankshaft and oilways to flush abrasive residuals and blow dry with compressed air.

Use tool A.86010 to press in new plugs and punch each plug in three points with a centre-punch.

On crankshaft web No 1 mark the reduced amount (undersize) of the main bearing journals and big-end journals (eg. M 0.25; B 0.50).

Bearing shells. Remember that no adjustment on the bearing shells is allowed. Renew the shells when there are scratches, scoring or flaking.

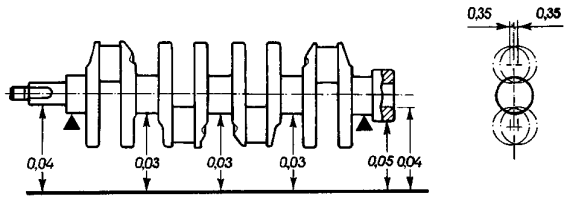

Fig.2-37. Permissible runouts for basic crankshaft surfaces

The main and big-end bearing running clearance is checked by measuring the components. It is convenient to check the clearance with the help of «Plastigage» (which consists of a fine thread of perfectly-round plastic, which is compressed between the bearing cap shell and the crankshaft journal) under the following procedure:

- ensure the journals and bearing shells are clean and dry, cut several pieces of the appropriate-size Plastigage (they should be slightly shorter than the width of the bearings) and place one piece on each crankshaft journal axis;

- with the bearing shells in position in the cages, fit the caps to their original locations (depending on the journal checked). Take care not to disturb the Plastigage. Then tighten the securing nuts and bolts to the specified torque. Tighten the connecting rod bolts to 51 Н•м (5.2 kgf•m), while the main bearing cap bolts to 80.4 Н•м (8.2 kgf•m);

- remove the bearing cap and check the running clearance by comparing the width of the crushed Plastigage on each journal with the scale printed on the card gauge to obtain the bearing running clearance (Fig.2-38).

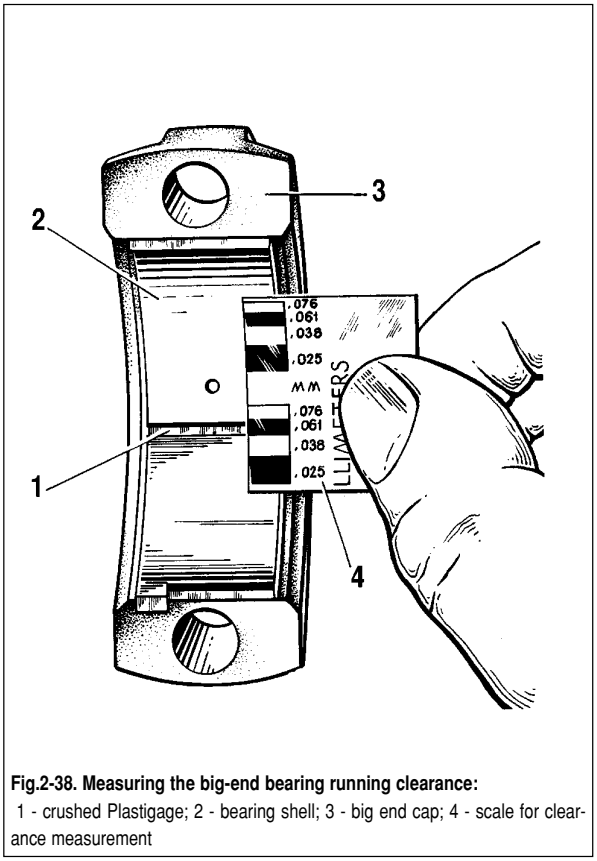

Fig.2-38. Measuring the big-end bearing running clearance:
1 - crushed Plastigage; 2 - bearing shell; 3 - big end cap; 4 - scale for clearance measurement

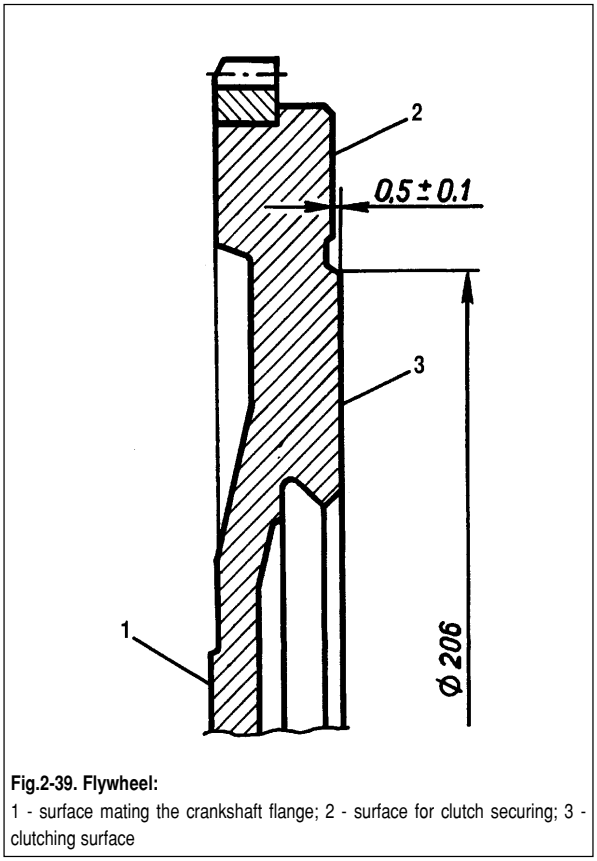

Fig.2-39. Flywheel:
1 - surface mating the crankshaft flange; 2 - surface for clutch securing; 3 - clutching surface

The nominal design clearance is 0.02-0.07 mm for the crankpins and 0.026-0.073 mm for the main bearing journal. When the running clearance is below the maximum value (0.1 mm for the big-end bearing journals and 0.15 mm for the main bearing journals), the bearing shells can be re-used.

When the running clearance exceeds the specified maximum, replace the respective bearing shells with new ones.

Where the crankshaft journals are worn and are reground to their undersize, change the bearing shells to those oversize.

Thrust washers. Similar to the bearing shells, no adjustments are possible on the thrust washers. Always renew the thrust washers when there is scoring, scuffing or flaking.

The thrust washers must be renewed when the crankshaft endfloat exceeds the specified limit of 0.35 mm. Select new thrust washers of the standard size or 0.127 mm thicker to have the endfloat within 0.06 - 0.26 mm.

The crankshaft endfloat is checked with the help of a dial gauge as outlined in Section «Engine reassembly» (Fig.2-14).

The crankshaft endfloat can be also checked on the engine in the vehicle. The axial shift of the crankshaft occurs at depressing and releasing the clutch pedal, the endfloat value is determined by the front crankshaft end displacement.

Flywheel. Inspect the teeth of the flywheel starter ring, should they are found deteriorated, renew the flywheel. If there are temper colours on flywheel face 3 (Fig.2-39), check the starter ring interference on the flywheel. The starter ring should not rotate when applying 590 Н•м (60 kgf•m).

Check to see there are no scratches or scores on flywheel face 1 mating the crankshaft flange or on surface 3 mating the clutch disc.

Remove by lathing all scratches or scores on face 3, provided the overall thickness is reduced maximum by 1 mm. Do not forget to lathe surface 2 maintaining the size (0.5±0.1) mm. Ensure surfaces 2 and 3 are parallel to surface 1. The out-of-parallelism tolerance is 0.1 mm.

Mount the flywheel on the tool, centralize is over the mounting bore against surface 1 and check the run-out of surfaces 2 and 3. The run-out values at the outboard points must not exceed 0.1 mm.

Cylinder head and valve gear

General description

Refer to Fig. 2-40 for basic sizes of the valves, guides and valve seats.

Cylinder head is an aluminium casting with the pressed-in iron valve seats and valve guides.

The top of the valve guides is sealed with metal-rubber oil caps 3 (Fig.2-41).

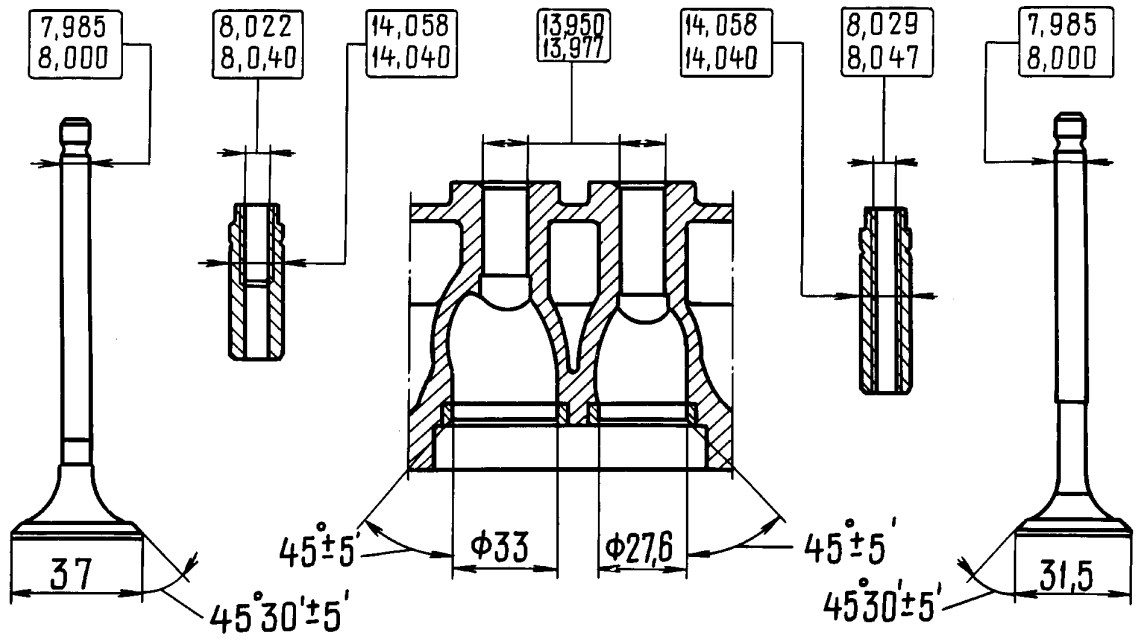

Fig.2-40. Basic dimensions of the valves, valve guides and valve seats

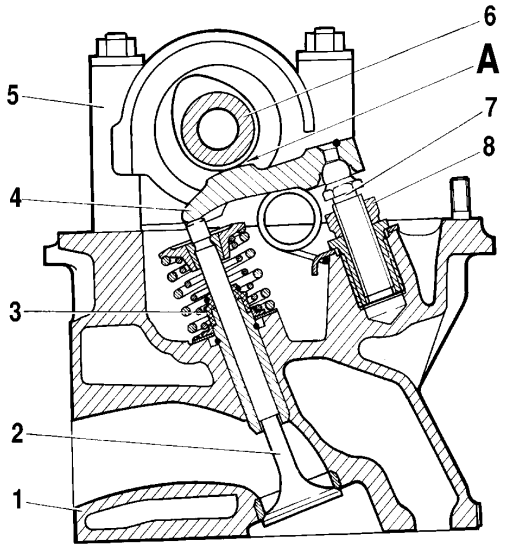

Fig.2-41. Cylinder head cross-sectional view showing the exhaust valve: 1 - cylinder head; 2 - valve; 3 - oil cap; 4 - lever; 5 - bearing housing; 6 - camshaft; 7 - adjuster bolt; 8 - lock nut; A - cam-to-lever clearance

The outer diameter of the replacement guides is 0.2 mm bigger. Bearing housing 5 with camshaft 6 is fitted to the cylinder head.

Valve train. Valves 2 are operated by the cams through levers 4. One end of the lever pushes the valve stem, while the other end rests on the spherical head of adjuster bolt 7 which adjusts the clearance A in the valve gear.

Valve clearance adjustment

The clearances are adjusted on the cold engine by means of the chain adequately tensioned. The adjustment should result is 0.15±0.02 mm clearance for the intake valves and 0.2±0.02 mm clearance for the exhaust valves.

While making adjustments, do not to twist the valve lever, since it may result in a bigger final clearance.

The clearance is adjusted as follows:

- turn the crankshaft clockwise to align the indentation in the camshaft sprocket with the mark on the bearing housing, which corresponds to the end of the compression stroke of the cylinder No4. Now in this position adjust the clearance at the cylinder No4 exhaust valve (No8 cam) and cylinder No3 intake valve (No6 cam);

- slacken the valve lever adjuster bolt nut;

- between the valve lever and cam place a flat feeler blade (A.95111) of 0.15 mm for the intake valve (0.2 mm for the exhaust valve) and using a spanner tighten or slacken the bolt with further

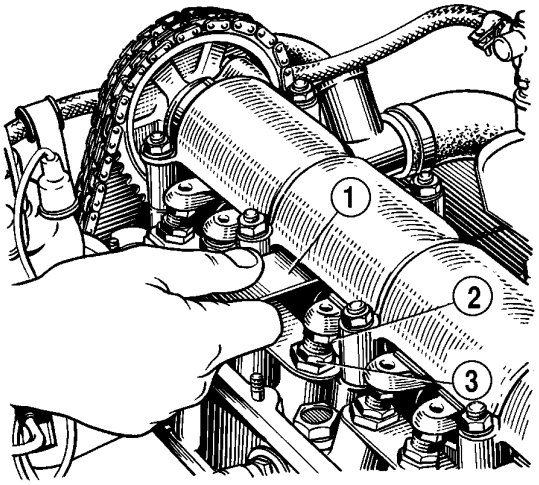

Fig.2-42. Checking the clearance between the rocker levers and cam lobes:
1 - feeler blade A.95111; 2 - adjuster bolt; 3 - lock nut

lock nut tightening, until the blade is a firm sliding fit when the lock nut is tightened (Fig.2-42);

- after the clearance is adjusted at the cylinder No4 exhaust valve and cylinder No3 intake valve, turn the crankshaft progressively to the 180° and adjust the clearances, observing the sequence as shown in Table 2-2.

Table 2-2

Valve clearance adjustment

Crankshaft angle, degrees	Cylinder No (end of compression stroke)	Valve (cam) No
0	4	8 & 6
180	2	4 & 7
360	1	1 & 3
540	3	5 & 2

Cylinder head - removal and refitting

The cylinder head is removed from the engine in the vehicle, when no complete stripping of the engine is required, or when carbon deposits should only be removed from the combustion chamber and valves. To remove the cylinder head, carry out the following operations.

Apply the handbrake, remove the spare wheel and disconnect the battery negative lead.

Remove the air cleaner and protect the carburettor with the provisional plug. Drain the coolant from the radiator and cylinder block.

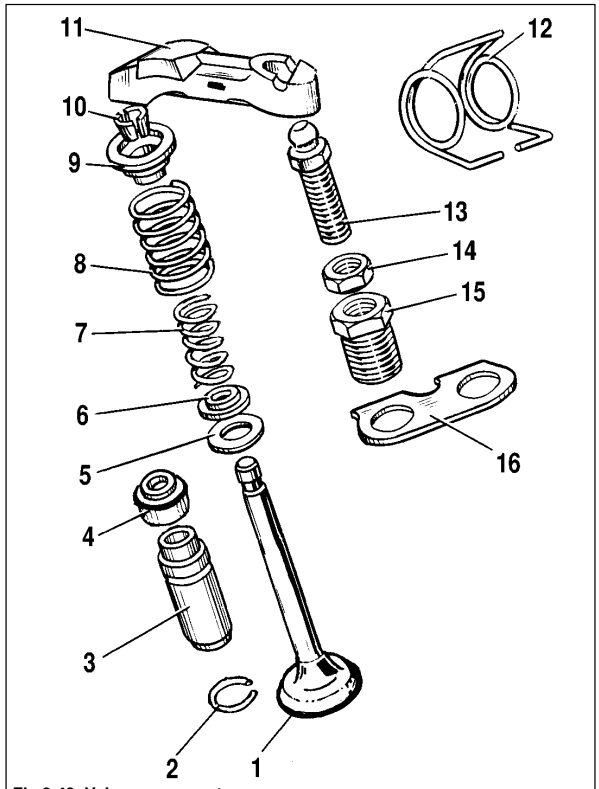

Fig.2-43. Valve components:
1 - valve; 2 - circlip; 3 - valve guide; 4 - oil cap; 5 - lower spring seat, outer spring; 6 - locking washer, inner spring; 7 - inner spring; 8 - outer spring; 9 - upper spring seat; 10 - collets; 11 - valve rocker lever; 12 - valve lever spring; 13 - adjuster bolt; 14 - lock nut, adjuster bolt; 15 - bush, adjuster bolt; 16 - locking plate, valve lever spring

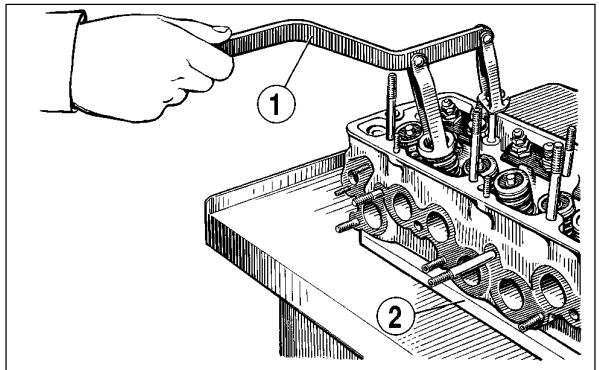

Fig.2-44. Removing the valve spring:
1 - tool A.60311/R; 2 - mounting base

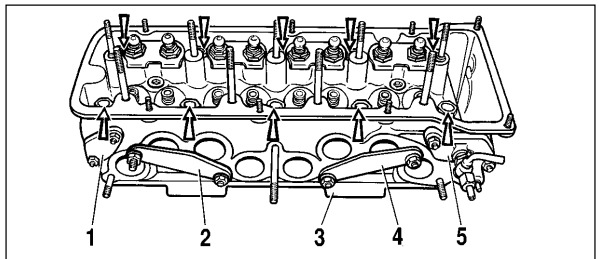

Fig. 2-45. Checking the leak-proofness of the cylinder head on tool A.60334:
1, 2, 4 - plugs; 3 - tool plate; 5 - flange with water supply connector

Disconnect the leads from the spark plugs and coolant temperature sender, from carburettor idle switch and fuel cutoff solenoid.

Disconnect the choke cable; disconnect the throttle linkage from the intermediate lever on the valve cover.

Loosen the clips and disconnect the carburettor supply / return fuel hoses. Secure the hoses in a manner to exclude possible fuel leaks. Detach the vacuum hose from the carburettor.

Disconnect the hoses from the intake pipe, from the outlet pipe of the cooling water jacket and from coolant delivery pipe to the heater. Remove the EGR valve.

Disconnect the starter motor shield from the exhaust manifold, downpipe and detach the bracket securing the coolant pipe (heater return line).

Remove the valve cover complete with the gasket and fuel piping securing bracket.

Turn the crankshaft to align the camshaft sprocket TDC mark against the bearing housing mark (Fig.2-22).

Unbolt the camshaft sprocket. Slacken the chain tensioner cap nut, release the tensioner rod and fix it in position with the cap nut. Remove the camshaft sprocket.

Undo the bolts securing the cylinder head to the cylinder block and remove the cylinder head complete with the gasket.

Refitting of the cylinder head is the reverse order of removal, refer to the procedure described in section «Engine reassembly». Never re-use the gasket between the cylinder head and cylinder block, always replace it with a new one.

While refitting the cylinder head, adjust the timing chain tension and valve clearances. Having refitted the cylinder head, adjust the carburettor linkage and ignition timing.

Cylinder head - dismantling and reassembly

Dismantling. When only a single part is required to be replaced, there is no need to completely dismantle the cylinder head; instead, remove only what is necessary.

Position the cylinder head on the stand, disconnect the hose from the hot air intake, undo the nuts and remove the carburettor complete with the gasket; next withdraw the inlet and exhaust manifolds (the hot air intake is withdrawn at the same time).

Remove the water jacket return pipe and coolant-to-heater return pipe. Unscrew the spark plugs and coolant temperature sender.

Undo the securing nuts and remove the bearing housing complete with the camshaft. Undo the nuts holding the thrust flange to the bearing housing. Remove the flange and lift out the camshaft from the bearing housing.

Release springs 12 and remove valve rocker levers 11 (Fig.2-43). Remove the rocker lever springs.

Slacken lock nuts 14, undo adjuster bolts 13 and bushes 15.

Position tool A.60311/R, as shown in Fig.2-44, compress the valve springs and release the collets. A stationary tool 02.7823.9505 can be used instead of tool A.60311/R.

Remove the valve springs together with lower and upper seats. Turn the cylinder head over and remove the valves from the underneath. Take off the outer caps from the valve guides.

Reassembly. Reassemble the cylinder head in the reverse order. Before assembly begins, always oil the outer caps and valves with engine oil.

Before refitting the camshaft bearing housing, check the centering pins are in the position (Fin.2-21). Tighten the bearing housing securing nuts in the sequence as shown in Fig.2-23. Ensure the centering pins are positioned in the bearing housing recesses without sheering.

The valve clearances are adjusted only after the cylinder head has been refitted to the engine.

Inspection and overhaul

Cylinder head. Thoroughly wash the cylinder head and clean the oilways. Scrape away all carbon from the combustion chambers and from the exhaust valve ports with a wire brush.

Examine the cylinder head. Look to see there is no cracking in the cylinder head. Check the cylinder head for leakage when suspicious as to possible oil contamination with coolant.

To do this, plug the cooling water jacket holes (using plugs from tool A.60334, Fig.2-45), then pump water into the cylinder head water jacket at 0.5 MPa (5 kgf/cm^2). No water leak should be evident within 2 minutes.

The cylinder head tightness can be checked with compressed air. Plug the water jacket holes (using the same plugs from tool A.60334), immerse the cylinder head into the bath with water of 60-80°C for 5 minutes. Next pump the compressed air into the cylinder head at 0.15-0.2 MPa (1.5-2 kgf/cm^2). No air bubbles must be seen from the cylinder head within 1-1.5 minutes.

Valve seats. The valve seat chamfer shape is shown in Fig.2-46 and Fig.2-47. Check the working chamfers of the valve seats (valve contact area) for pitting, corrosion or deterioration. Minor irregularities of the seats must be recut. Remove as little metal as possible. Both manual and machine grinding is permitted. Valve regrinding is carried out as follows.

Position the cylinder head on a mounting base. Insert centering tool A.94059 in the valve guide and clean the seat chamfers from carbon using tools A.94031 and A.94092 for the exhaust valves and A.94003 and A.94101 for the inlet valves. Use spindle A.94058 and centering tool A.94059. The centering tools differ in diameters, use tool A.94059/1 for the inlet valve guides and A.94059/2 for the exhaust valve guides.

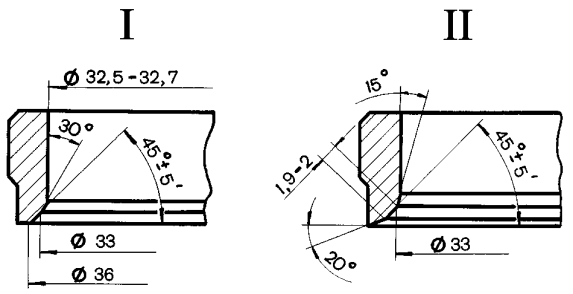

Fig. 2-46. Intake valve seat profile:
I - new seat; II - reconditioned seat

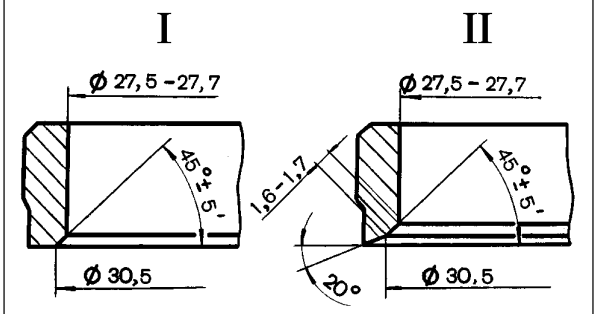

Fig. 2-47. Exhaust valve seat profile:
I - new seat; II - reconditioned seat

Put spring A.94069/5 on tool A.94059, fit tapered wheel A.94078 on spindle A.94069 for the exhaust valve seats or wheel A.94100 for the inlet valve seats, secure the spindle in a grinder and recut the valve seat (Fig.2-48).

The grinding wheel must be off at the moment the grinding wheel contacts the valve seat, otherwise vibration ensued will distort the chamfer. Frequent diamond dressing of the wheel is recommended.

The working chamfer width for the exhaust valve seats should be as shown in Fig.2-46 using tools A.94031 (20°) and A.94092 to remove the wear hardening on the minor diameter. The tools should be used with spindle A.94058 and are centered with tool A.94059.

The working chamfer width for the inlet valve seats should be as shown in Fig.2-47, first machine the inner chamfer with tool A.94003 (Fig.2-49) to get the diameter of 33 mm, then machine the 20° chamfer with tool A.94101 to achieve the working chamfer width of 1.9-2 mm.

Valves. Scrape away carbon from the valves.

Check the valve stem for deformation; check the valve disc for cracking. Always renew the damaged valve.

Examine the valve working chamfer. Reface the valve in case of minor damages, maintaining the chamfer angle at 45°30' ±5'. Note, that the distance between the bottom valve seat face and base diameter (36 and 30.5) must be as shown in Fig.2-50.

Valve guides. Check the valve guide - to - stem clearance by measuring the valve stem diameter and valve guide bore.

The clearance for new guides is 0.022 - 0.055 mm for the inlet valves and 0.029 - 0.062 mm for the exhaust valves; the maximum permissible clearance (in case of wear) is 0.3 mm provided no excessive noise is produced in the valve train.

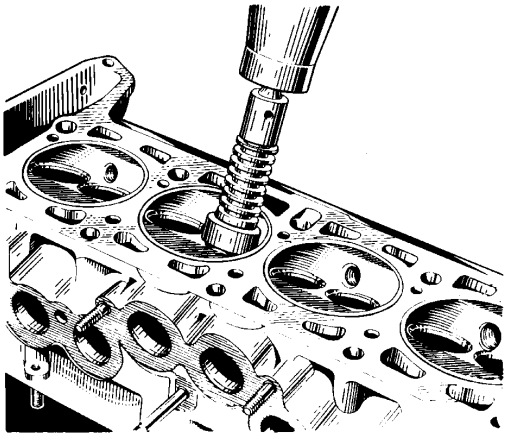

Fig. 2-48. Regrinding the valve seat working chamfer

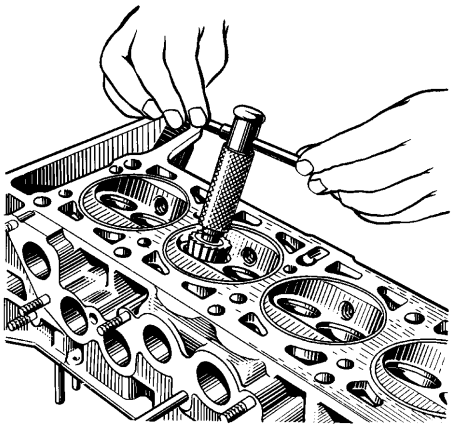

Fig. 2-49. Reducing the valve seat working chamfer using the cutting tool with spindle A.94058

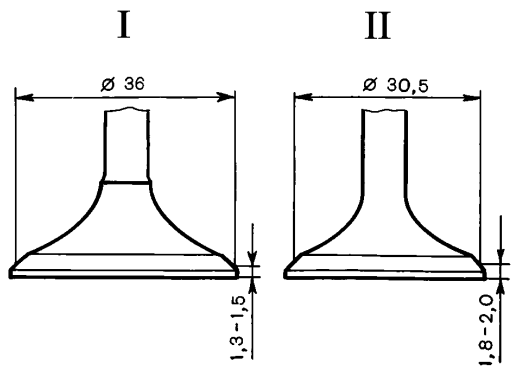

Fig.2-50. Limit sizes for valve chamfer regrinding:
I - inlet valve; II - outlet valve

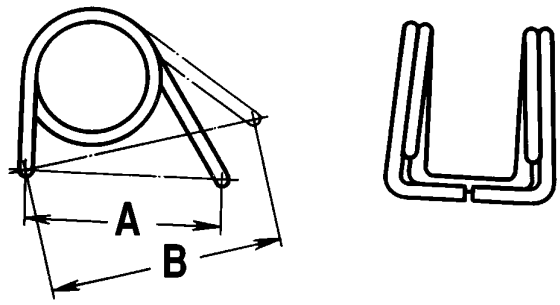

Fig.2-53. Valve spring checking diagram:
A - dimension in free state; B - dimension under load

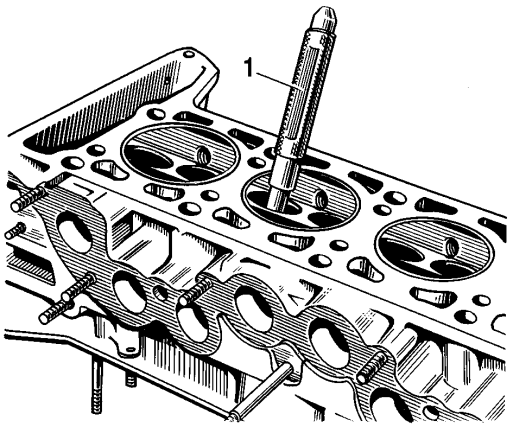

Fig.2-51. Pressing out the valve guides:
1- tool A.60153/R

When a new valve fails to take up clearance between the valve guide and the valve rim, renew the valve guides using tool A.60153/R (Fig.2-51).

Push in the valve guide complete with the circlip to the cylinder head to their stop.

After the valve is pressed into position, ream the valve guide bores using tool A.90310/1 (for the inlet valve guides) and tool A.90310/2 (for the exhaust valve guides).

Valve stem oil caps must always be renewed during the engine overhaul.

Any damaged oil caps are renewed on the cylinder head removed. Use special tool 41.7853.4016 to push the oil seals on the guide.

Springs. Check the springs are not cracked and are adequately tense; load test the springs to reveal any deformation (Fig.2-52).

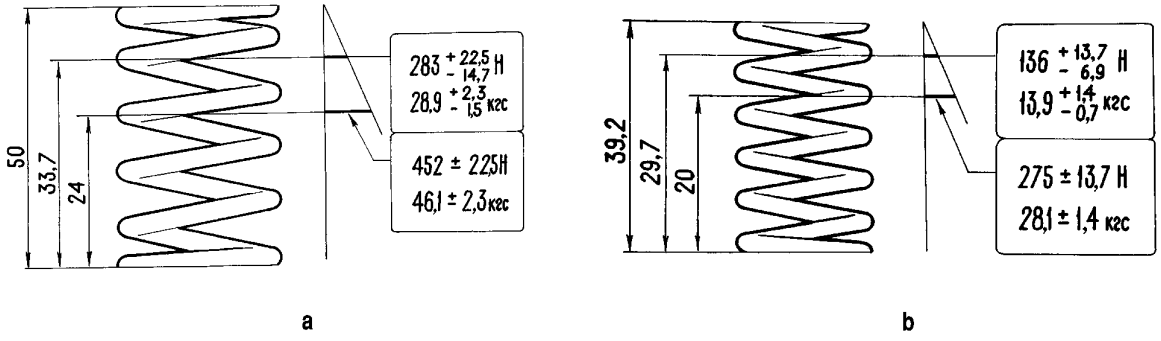

Fig.2-52. Basic lengths to check the valve outer (a) and inner (b) springs

For lever springs (Fig.2-53) the size A (spring unloaded) must be 35 mm, whereas the size B (spring loaded 51-73.5 N/ 5.2-7.5 kgf) must be 43 mm.

Cylinder head bolts. Multiple use of the cylinder head bolts results in the bolt elongation. Therefore, check the length of the bolt (L) to be 120 mm (less the bolt head length), otherwise renew the bolt.

When replacing the bolts take care not to fit similar bolts from other VAZ engines of the same type (2101, 21011, 2103, 2107, 2121), but made of different steel.

The 21213 engine bolts have the threaded area of 70 мм (30 mm for other engines); in addition, the 21213 engine bolts do not have a distinctive mark (a 7.5 mm diameter recess for wrench).

Valve rocker levers. Check the condition of the lever operating surfaces which mate the valve stem, cam lobe and adjuster bolt spherical end.

Always renew the rocker arm when its surfaces are chipped, scored or scuffed.

Renew the lever adjuster bolt bush or the bolt itself in case of any deformation or damages found.

Camshaft and timing gear

Design description

Camshaft is cast iron, of five bearings, operates in the aluminium bearing housing fitted to the cylinder head.

Basic dimensions of the camshaft and bearing housing are shown in Fig.2-54. The flanks of the cams are chilled for better wear resistance.

In order to eliminate the camshaft endfloat, the camshaft is supported by the thrust flange held in the front journal groove.

Camshaft is operated through crankshaft sprocket 5 (Fig. 2-55) and double-row roller chain 2. The chain also operates sprocket 4 of the oil pump shaft. The chain drive has semi-automatic tensioner 8 with shoe 7 and chain damper 3 with rubber covers.

In the cylinder bottom there is stop pin 6 to prevent the chain dropping into the crankcase when camshaft sprocket 1 is removed.

Chain tension adjustment

Loosen nut 1 (Fig.2-56) of the tensioner. This releases rod 3 and the chain is tightened by means of shoe 7 (Fig.2-55) which is loaded by spring 7 (Fig.2-56).

Turn the crankshaft 1-1.5 turns progressively. By doing that, the tensioner spring, operating the shoe, automatically adjusts the chain tension.

Tighten tensioner nut 1, this results in rod 3 clamped by collets 8; during engine operation plunger 6 is effected only by spring 4. The spring releases the plunger from rod 3 head, so that the clearance between them is filled with oil that acts as a damper when the chain strikes.

Chain renewal

Apply the handbrake, open the bonnet, remove the spare wheel with the supporting tube and withdraw the battery.

Remove the air cleaner and close the carburettor inlet filler with a provisional cap. Disconnect the throttle and choke cables from the carburettor.

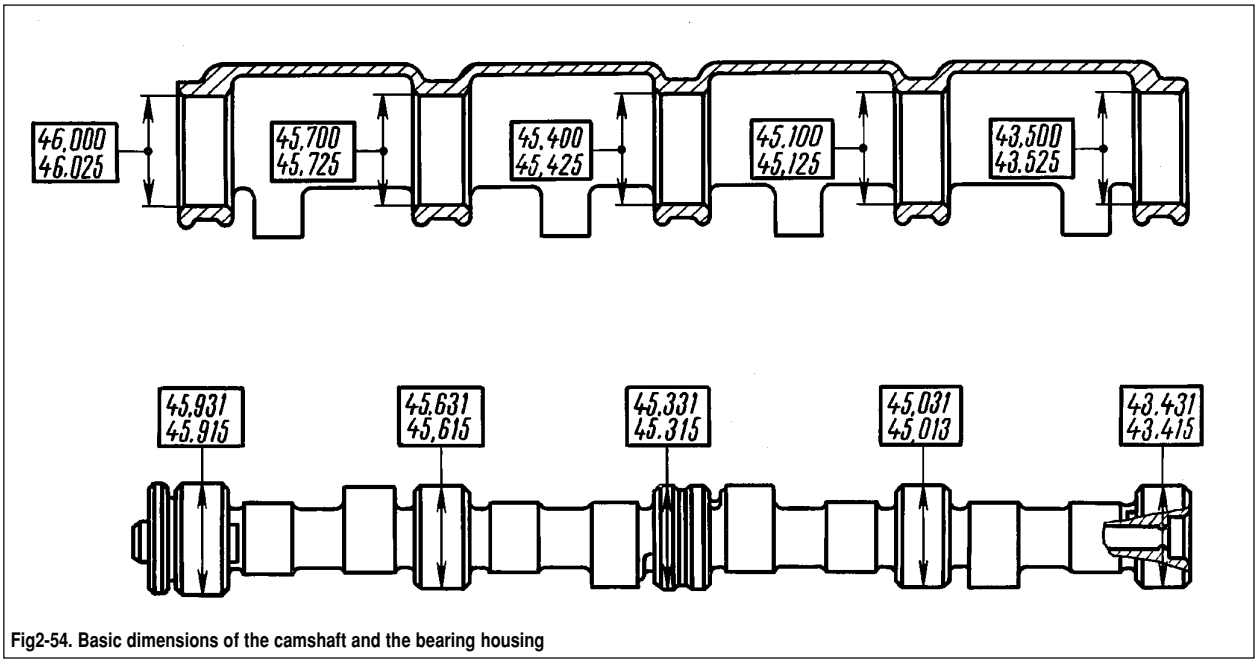

Fig2-54. Basic dimensions of the camshaft and the bearing housing

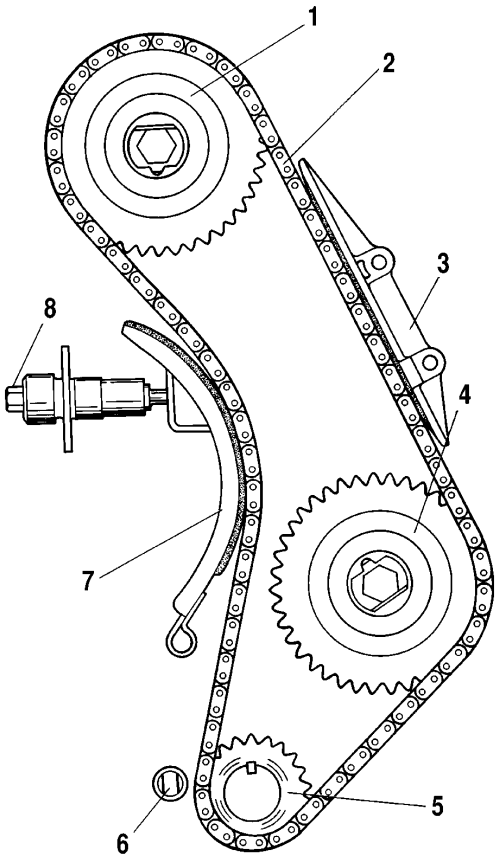

Fig.2-55. Camshaft and ancillaries drive:
1 - camshaft sprocket; 2 - chain; 3 - chain damper; 4 - oil pump shaft sprocket; 6 - stop pin; 7 - tensioner shoe; 8 - chain tensioner

Drain the cooling water from the radiator and cylinder block, remove the radiator complete with the hoses and thermostat. Undo the retaining nuts and remove the fan.

Remove the valve cover and turn the crankshaft to align the TDC mark in the camshaft sprocket against the timing mark in the bearing housing (Fig.2-21), while the alternator belt pulley marks are aligned against a long mark in the timing cover (Fig.7-18).

Undo the camshaft sprocket retaining bolt. Slacken the chain tensioner cap nut, release the tensioner rod and fix it in position using the cap nut. Remove the camshaft sprocket.

Slacken the alternator and remove the alternator drivebelt. Apply the 4th gear of the gearbox, undo the nut and withdraw the alternator drivebelt pulley from the crankshaft.

Remove the timing cover complete with the gasket. Undo the nuts holding the cover to the cylinder block; then undo the bolts retaining the oil sump to the cover.

Undo stop pin 6 (Fig.2-55) and withdraw the camshaft timing chain.

The refitting procedure is a reversal of removal, observing the recommendations outlined in section «Engine assembly».

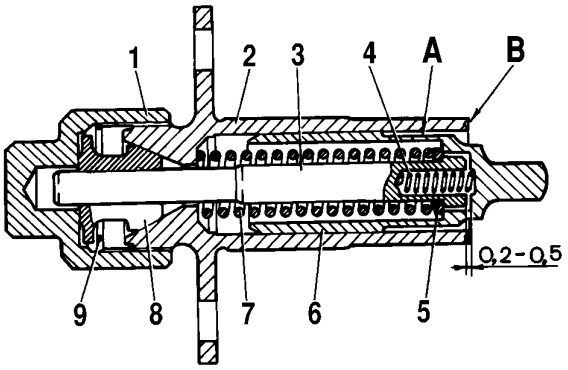

Fig.2-56. Sectional view of the chain tensioner:
1 - cap nut; 2 - tensioner housing; 3 - core; 4 - spring; 5 - washer; 6 - plunger; 7 - spring; 8 - collet; 9 - spring ring;
A - plunger surface; B - centre-punch points on housing face

Before refitting, smear the chain with engine oil. Always use new gaskets for the timing cover and valve cover.

The chain refitted, adjust the chain tension and alternator drivebelt tension, adjust the carburettor linkage and ignition timing.

Inspection

Camshaft. The camshaft journals must have no scores, scuffs, scratches or aluminium galling from the bearing housing. The maximum wear of the cam lobe surfaces is 0.5 mm, there should be no evident scoring or cut-type wear of the cams.

Mount the crankshaft on two V-blocks, located on the test plate and using a dial gauge, check the centre camshaft journal endfloat to be 0.04 mm maximum. If the endfloat exceeds the value specified, straighten the camshaft on the straightening press.

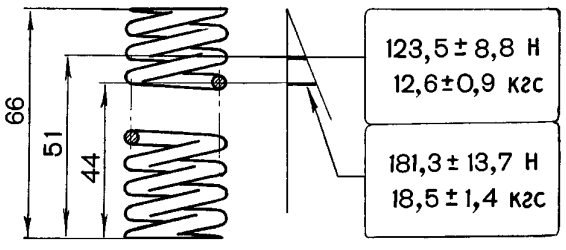

Fig.2-57. Basic data for checking the tensioner spring

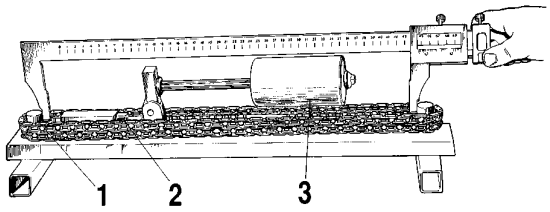

Fig. 2-58. Tool 67.7824.9521 for checking the chain wear (extension):
1 - roller; 2 - adjuster nut; 3 - counterweight

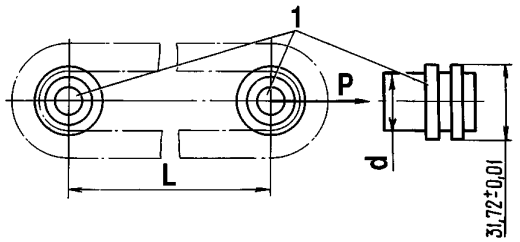

Fig.2-59. Checking the chain wear (extension):
1- pulleys

Camshaft bearing housing. Wash and clean the bearing housing, flush clean the oilways.

Check the diameters of the holes in the bearings. When the clearance between the camshaft journals and bearing surfaces exceeds 0.2 mm (wear limit), renew the bearing housing.

The inner bearing surfaces should be smooth, with no scores; renew the bearing housing in case of damages. Check the housing for cracks; if this is the case, renew the bearing housing.

Chain tensioner. When the tensioner plunger is seized in the housing, dismantle the chain tensioner. For that undo cap nut 1 (Fig.2-56), push plunger 6 full way, then tighten the cap nut. File the housing edges at the points B of centre-punching, withdraw plunger 6 with spring 4. Undo the cap nut and withdraw rod 3 complete with spring 7 and washer 5. Prise free spring ring 9 and take out clamping collet 8 from cap nut 1.

Check collet 8, core 3 and plunger 6 for scores, check the mating surfaces of the tensioner shoe and plunger for deep scores. Always renew any damaged components.

The spring tension should be within the range specified in Fig.2-57; otherwise renew the spring.

Check to see the shoe and chain damper do not have excess wear; renew them when applicable.

Refitting is a reversal of removal. Once the plunger is refitted, center-punch housing 2 at three points B. Make certain the projections caused by centre-punching do not contact the surface A during the plunger stroke.

Note: The spring ring is used in some vehicles instead of centre-punching.

Camshaft timing chain. Wash the chain in kerosine, examine the chain links. Check to see there are no scores, cracks or other damages.

In the course of the engine operation the chain lengthens. The chain deems operable as long as the tensioner ensures its proper tension, i.e. the chain length is maximum 4 mm longer.

Check the chain length with the help of tool 67.7824. 9521 (Fig.2-58), having 2 special-type wheels 1 on which the chain is located. Using counterweight 3 the chain is extended through applying force of 294 N (30 kgf) or 147 N (15 kgf). Use adjuster nut 2 to ensure the counterweight axis is parallel to the tool base.

Apply force 294 N (30 kgf) with the counterweight in the extreme right position, then decrease the force by 147 N (15 kgf) moving the counterweight fully to the left. Repeat both operations and determine the chain difference on the length **L** (Fig.2-59) between the axis of the wheels. Using vernier calipers, measure the distance between the wheels**,** then add the diameter **d** value to get the distance **L** between the wheels axes.

For a new chain the distance **L** between the wheels axes is 495.4-495.8 mm. Renew the chain, when its length is 499.5 mm.

Before refitting, smear the chain with engine oil.

Cooling system

Refer to the cooling system layout as shown in Fig.2-60.

Checking coolant level and density

Check to make certain the coolant level in the expansion tank is adequate. When the engine is cold (15-20°C), the coolant level within the expansion tank must be 3-4 cm above the «MIN» mark.

WARNING. Always check the coolant level on the cold engine, since its volume increases with rise in temperature; the coolant level can be significantly higher with the hot engine.

When necessary, use an areometer to check the coolant density to be 1.078-1.085 g/cu.cm for TOSOL A-40 which is used in VAZ vehicles.

When the level in the expansion tank is below the value specified, while its density is in excess of that required, top up distilled water.

When the density is as recommended, top up the correct coolant of the same grade as that in the cooling system.

When the coolant density is below the value specified, while the vehicle will be used in cold conditions, change the coolant.

Coolant change

Change coolant at the intervals recommended or after the engine overhaul. Fill the cooling system, as described below:

- undo the radiator and expansion tank caps, open the heater tap;

- disconnect the heater hose (top) from the union on the vehicle body;

- pour coolant (10.7 litre) to the radiator (up to the upper filler edge) until it starts flowing from the hose and heater union;

- reconnect the heater hose with the union and refit the radiator cap. Top up the remaining coolant into the expansion tank, refit and tighten the filler cap;

- to remove air pockets, start the engine, run it idle until the coolant temperature reaches the temperature of the thermostat opening (80±2)°C. Check to see the radiator inlet and return pipes are hot.

Leave the engine to cool and check the coolant level. When the level is below that required, while there are no evident system leaks, top up coolant as necessary.

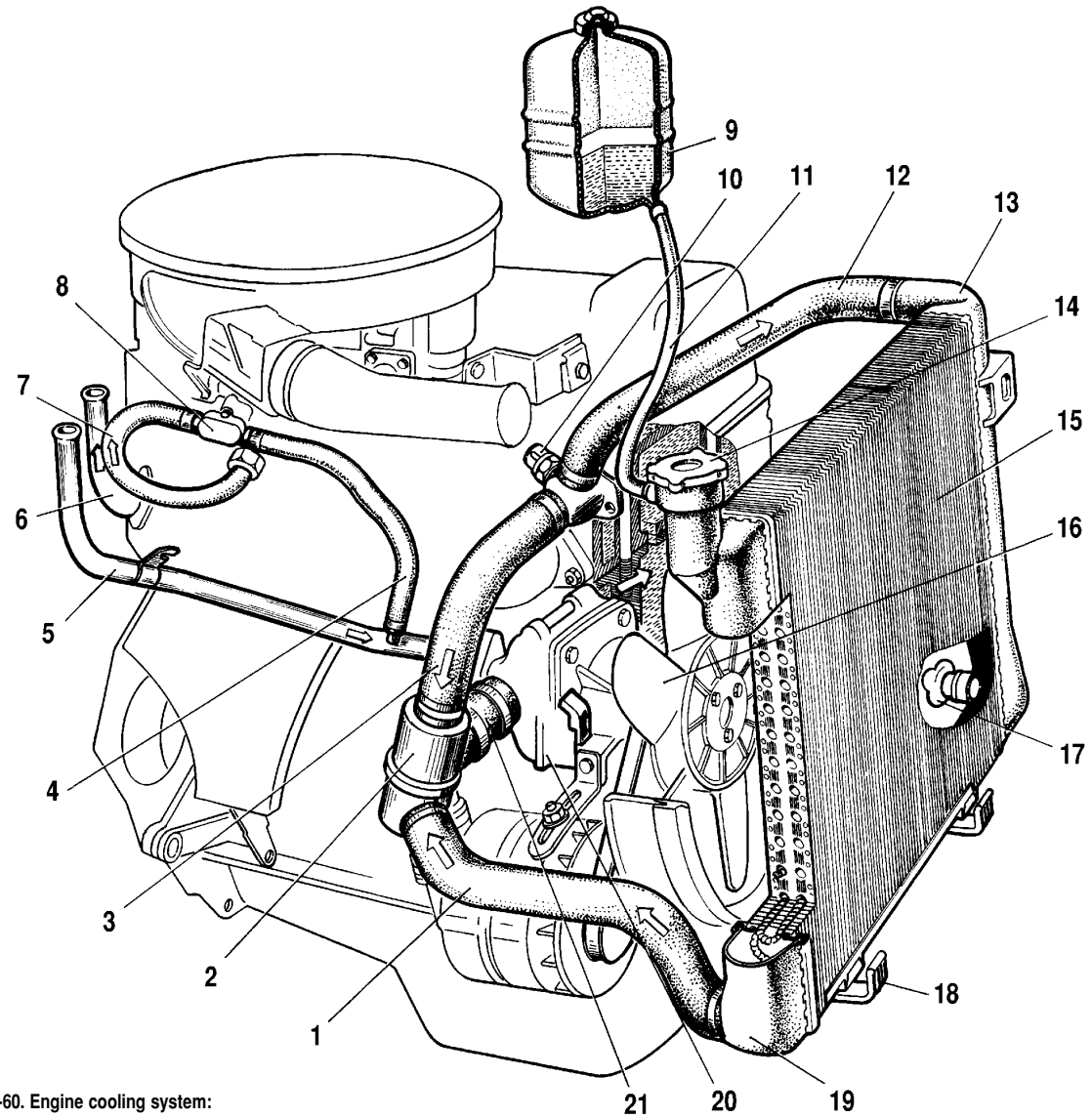

Fig.2-60. Engine cooling system:
1 - radiator return hose; 2 - thermostat; 3 - thermostat hose; 4 - return hose to pump; 5 - return pipe, heater radiator; 6 - delivery pipe, heater radiator; 7 - return hose from intake manifold preheater to part throttle channel heater; 8 - part throttle channel heater; 9 - expansion tank; 10 - coolant temperature sensor; 11 - hose between radiator and expansion tank; 12 - radiator feed hose; 13 - left-hand fluid cooler; 14 - radiator cap; 15 - radiator matrix; 16 - fan ring; 17 - radiator drain tap; 18 - radiator mounting rubber; 19 - right-hand fluid cooler; 20 - water pump; 21 - feed hose to pump

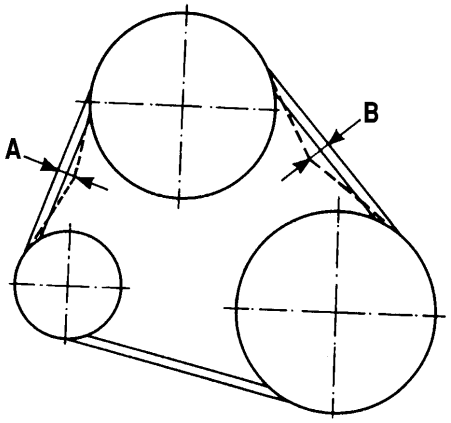

Fig.2-61. Checking the water pump belt tension

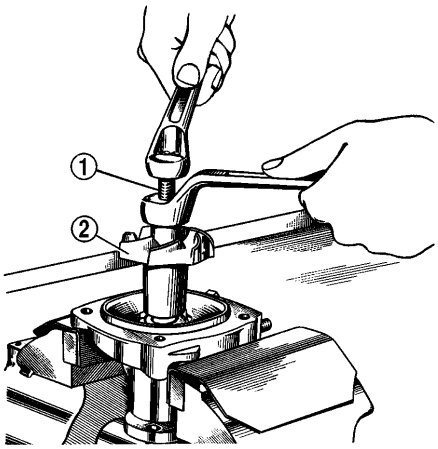

Fig.2-63. Removing the impeller:
1 - puller; 2 - impeller

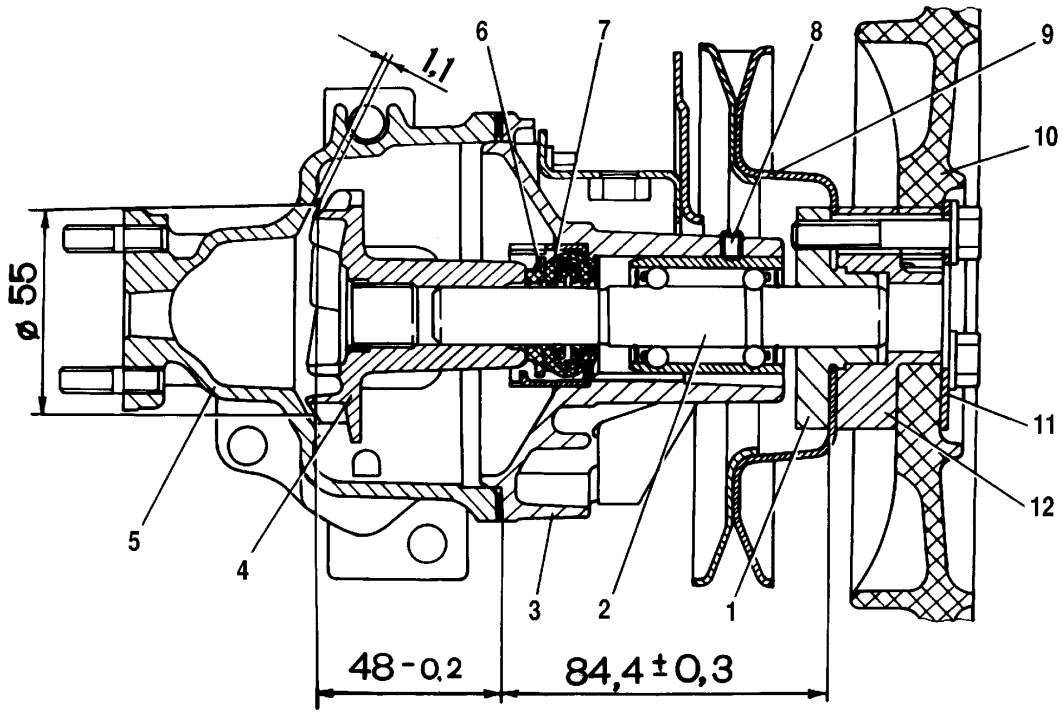

Fig.2-62. Sectional view of the coolant pump:
1 - pulley hub; 2 - shaft; 3 - cover; 4 - impeller; 5 - housing; 6 - thrust ring; 7 - oil seal; 8 - bearing stop screw; 9 - pulley; 10 - blower fan; 11 - cover plate; 12 - fan hub

Water pump drivebelt tension adjustment

The belt tension is checked by exerting a hand pressure on the chain between the alternator pulley and pump pulley or between the pump pulley and crankshaft pulley. With proper tension, slack A in the belt (Fig.2-61) at 98 N (10 kgf) must be 10-15 мм, while at the same pressure the deflection B must be within 12-17 mm.

To adjust the belt tension, slacken the alternator retaining nuts, move the alternator off the engine (to increase tension) or towards the engine (to decrease tension), then tighten the nuts. Turn the crankshaft two revolutions clockwise and check the belt tension.

No excess tension of the belt is allowed to prevent hazardous loads to the alternator bearings.

Coolant pump

Dismantling. Carry out the coolant pump dismantling as detailed below:

- disconnect pump housing 5 (Fig.2-62) from cover 3;

- place the cover in vice using protective pads; remove impeller 2 (Fig.2-63) from the shaft using picker A.40026;

- remove hub 2 (Fig.2-64) of the fan pulley from the shaft using puller A.40005/1/5;

- undo lock screw 8 (Fig.2-62) and force out the shaft with the bearing, applying force to the bearing race;

- withdraw oil seal 7 from housing cover 3.

Inspection. Check the bearing axial clearance. This operation is mandatory if the pump is noisy. The clearance must not exceed 0.13 mm at load of 49 N (5 kgf). Renew the bearing complete with the shaft when the clearance is bigger.

Always remember to renew the pump oil seal and pump-to-cylinder block gasket during overhaul.

Check the pump housing and cover for cracks or deformation, which are not permitted.

Reassembly. The assembly is carried out as follows:

- using the appropriate tool, fit the oil seal to the housing cover, look out not to skew;

- press in the bearing and shaft, applying the force to the bearing race so that the holes for the locking screw are matched;

- tighten the bearing lock screw and punch the seat over the contour to prevent its self-loosening;

- using tool A.60430 (Fig.2-65) press the pulley hub onto the shaft, maintaining a size of (84.4±0.3) mm. When the hub is of sintered quality, press in the new hub only.

- using tool A60430, press the impeller onto the shaft, maintaining a size of (48-0,2) mm, as shown in Fig.2-62. This ensures the required clearance between the impeller blades and pump housing;

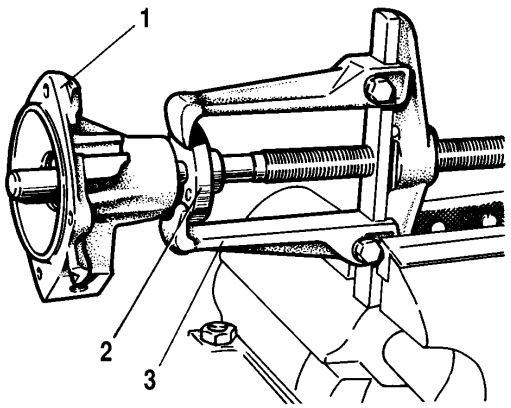

Fig.2-64. Removing the pulley hub:
1 - pump housing cover; 2 - pulley hub; 3 - tool A.40005/1/5

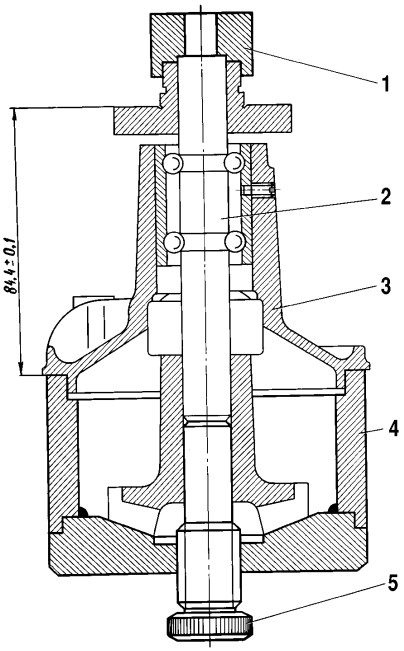

Fig.2-65. Fitting the impeller to the pump shaft using tool A.60430:
1 - base; 2 - pump shaft; 3 - pump housing cover; 4 - shell; 5 - set screw

- reassemble the pump housing with the cover, having placed the gasket in-between.

Thermostat

To test whether the unit is serviceable, check the temperature of the main valve opening and valve travel.

Using the test bench БС-106-000, suspend the thermostat with a piece of string in a container of water or coolant. Position the bracket arm of the gauge against main valve 9 (Fig.2-66).

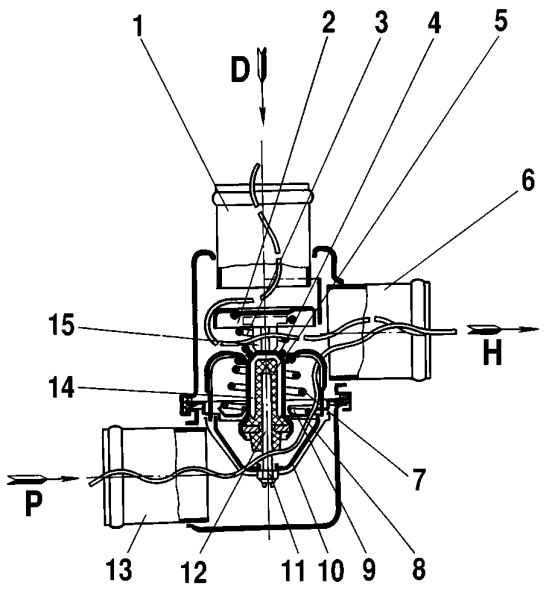

Fig.2-66. Thermostat:
1 - intake manifold (engine side); 2 - relief valve; 3 - relief valve spring; 4 - shell; 5 - rubber insert; 6 - exhaust manifold; 7 - main valve spring; 8 - main valve seat; 9 - main valve; 10 - retainer; 11 - adjuster nut; 12 - piston; 13 - sleeve; D - coolant inflow from engine; P - coolant inflow from radiator; H - coolant outflow to pump

Gradually heat the water from the starting 73-75°C in increments of approximately 1°C per minute, at constant agitation to ensure homogeneous heating within the container.

The value, when the valve travel is 0.1 mm, is deemed as the initial temperature of the main valve opening.

The main valve opening temperature is stated on the thermostat face side and is (80±2)°C or (83±2)°C. The thermostat is subject to renewal when its main valve opening temperature differs from the value stated on the thermostat face or when the main valve stroke is below 6.0 mm.

The easiest way to check the thermostat is serviceable, is to touch it directly in the vehicle. The thermostat is good when after the engine cold start, the lower radiator pipe gets warmer as soon as the coolant temperature reaches 80-85°C (the coolant temperature gauge needle is 3-4 mm from the red area of the scale).

Radiator

Removal. Withdraw the radiator from the vehicle in the following order:

- remove the spare wheel and its supporting tube;

- drain the fluid from the radiator and cylinder block through the respective caps in the left-hand fluid cooler and cylinder block; open the heater drain tap and remove the radiator filler cap;

- disconnect the hoses from the radiator;

- separate the fan cowl halves and withdraw the fan cowl;

- undo two bolts holding the radiator to the body, release the upper catch of the radiator cowling upwards, move the radiator top towards the engine and withdraw the radiator from the engine compartment;

- take out the radiator cowling.

Radiator leak test. The radiator tightness is checked in a container full of water.

Plug the radiator pipes, apply air at pressure of 0.2 MPa (2 kgf/cm^2) and immerse the radiator into the water for at least 30 seconds. The radiator should show no air bubbles.

Repair or renew the radiator when it is found leaky or damaged.

Radiator repair. In the event the aluminium tubes are damaged, dismantle the radiator, drill the defective tubes from both ends to a depth of 25-30 mm, using a drill of 8.5 mm diameter.

Fit the undersize tubes (flared at one end) of 7.3 mm diameter and 0.5 mm wall thickness into the defective tubes. Then on a special stand push the tubes all the length down using a steel core of 7.5±0.05 mm.

On the respective bench expand each tube from both ends simultaneously.

Assemble the radiator and check it for tightness.

Lubrication system

Refer to Fig.2-67.

Engine oil change

Change oil only when the engine is hot. Allow at least 10 minutes, after the drain plug is removed, for all the oil to drain.

Oil renewal should be accompanied by the oil filter removal; use tool A.60312 (Fig.2-4) to undo the filter. When refitting, screw the filter into position on the engine and tighten the filter by hand only - do not use any tools.

Change oil in the following order:

- stop the engine, drain the oil and without removing the oil filter, pour cleaner oil to the «MIN» mark of the oil dipstick (2.9 litre). Use oil equivalent to grades ВНИИНП-ФД, МСП-1 or МПТ-2М;

- start the engine and run it for 10 minutes at low rpm;

- completely drain the cleaner oil and discard the old oil filter;

- fit a new oil filter and pour oil of respective season grade.

Oil pump

The basic dimensions of the pump components and its linkage are shown in Fig.2-68.

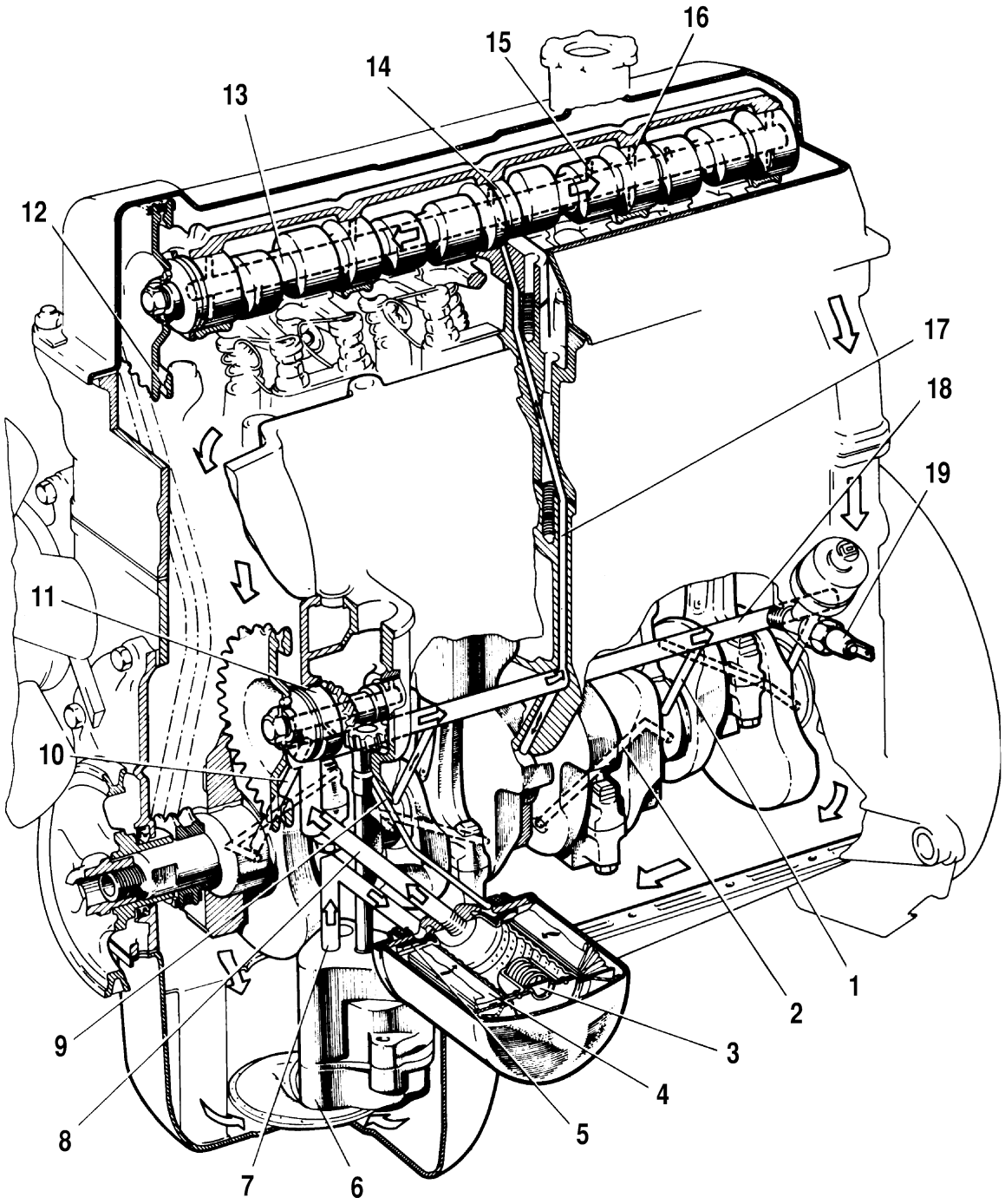

Fig.2-67. Lubrication system:

1 - oil passage to main bearing; 2 - main bearing-to-big-end bearing oil passage; 3 - oil filter relief valve; 4 - paper element; 5 - check valve; 6 - oil pump; 7 - oil pump-to-oil filter oil passage; 8 - oil passage from oil filter to main oil gallery; 9 - oil passage to oil pump gear and ignition distributor; 10 - oilway to oil pump shaft and ignition distributor; 11 - oil pump and ignition distributor shaft; 12 - oilway in outer gear to feed oil to chain; 13 - camshaft; 14 - oil recess, camshaft centre bearing journal; 15 - cam lobe oilway; 16 - oilway, camshaft bearing journal; 17 - cylinder head vertical oil passage to valve timing gear; 18 - oil gallery; 19 - oil pressure warning light sender

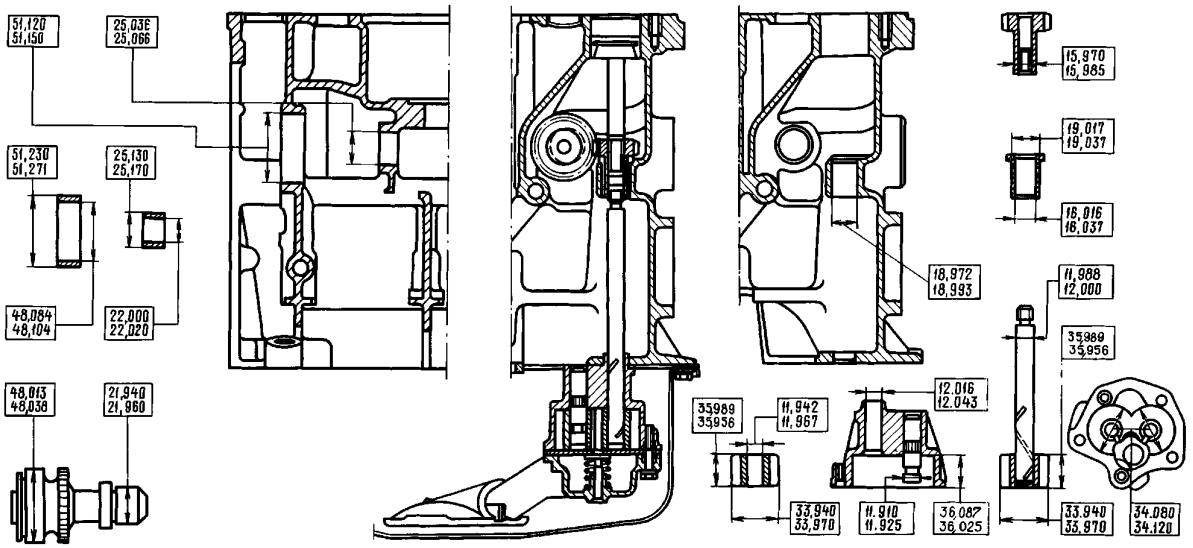

Fig.2-68. Basic dimensions of the oil pump components and associated parts

Removal and refitting. When only the oil pump requires reconditioning, remove it from the vehicle (Refer to section «Engine - removal and refitting»), place it on the turning stand, drain the oil from the sump, turn over the engine and remove the sump. Undo the oil pump bolts and remove the pump complete with the intake manifold assembly.

Refitting is the reversal order of removal.

Dismantling and reassembly. Position the oil pump in vice taking care not to damage the pump housing, then:

- undo the bolts and remove the intake manifold complete with the oil pressure relief valve;

- remove cover 3 (Fig.2-69) and withdraw the pump shaft complete with the inner and outer gears from the housing.

To reassemble the pump, position the pump in vice and carry out the following operations:

- refit the inner gear with the shaft, then the outer gear;

- refit the pump cover, pressure relief valve with the spring and bolt the intake manifold assembly to the pump body.

Note. *On completing the pump assembly, turn the inner gear by hand to check the gears are running smoothly, without jerks or seizures.*

Inspection. After dismantling, wash all components in kerosine or petrol, blow dry with compressed air, then check the pump housing and cover for cracks, renew when applicable.

Using feeler blades, check the backlash in the gears and the radial play (Fig.2-70) to be respectfully 0.15 mm (maximum permissible value is 0.25 mm) and 0.11-0.18 mm (maximum permissible value is 0.25 mm). If the tolerances are exceeded, then the gears or pump housing should be renewed.

Using a feeler gauge and a straight-edge (Fig. 2-71), check the axial clearance to be 0.066-0.161 mm (maximum permissible value is 0.20 mm). When the clearance is over 0.20 mm, renew the gears or pump housing whichever is worn out.

Having taken the measurements, determine the clearance between the outer gear and its axle to be 0.017-0.057 mm (maximum permissible value is 0.10 mm) and the clearance between the oil pump shaft and the housing bore to be 0.016-0.055 mm (maximum permissible value is 0.10 mm). Renew any worn parts when the tolerances exceed the values specified.

Checking the pressure relief valve. Always inspect the pressure relief valve during the oil pump repair. Draw special attention to the valve surfaces and bores in the intake manifold assembly, since possible contamination or sediments on the mating surfaces can result in the valve seizures.

The mating valve/pump cover surfaces should show no dents or flash to prevent a drop of oil pressure in the lubrication system.

Check the relief valve spring tension against the values as given in Fig.2-72.

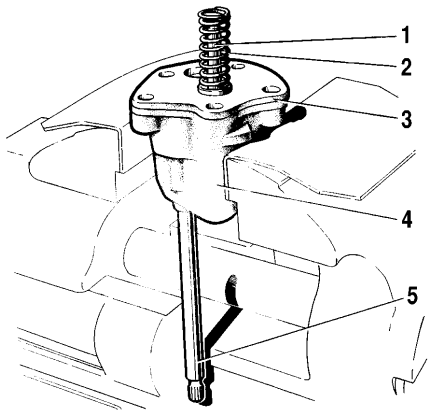

Fig.2-69. Dismantling the oil pump:
1 - relief valve; 2 - valve spring; 3 - cover; 4 - housing; 5 - shaft

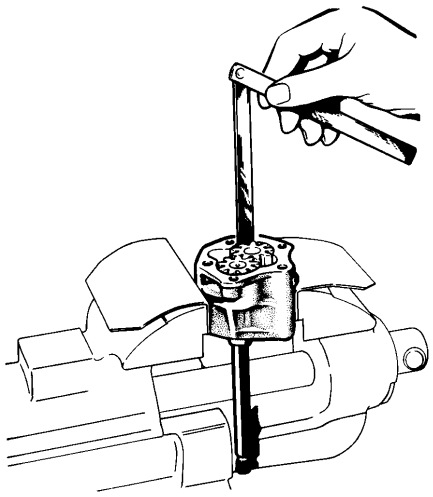

Fig. 2-70. Checking the oil pump radial play

Oil pump shaft and drive gears

Check to see there is no denting or scuffing of the shaft bearing journals or eccentric cam surfaces.

No pitting of the oil pump gears or ignition distributor is permitted, if this is the case, renew the gears and shaft.

Oil pump shaft bushes. Check the inner diameter of the bushes, their proper fitting, make certain the oil port in the front bush is aligned against the oilway in the cylinder block (bush turning). The inner surface must be smooth and without scuffs.

Measure the diameter of the shaft and bushes to determine the clearances between the bushes and shaft bearing surfaces. When the clearance is over 0.15 mm (limit wear value), or in case of damaged or loose bushes, renew the bushes.

For removal and refitting use tool A.60333/1/2 (Fig. 2-73), observing the following:

- the bushes must be pressed in place with the oil port in the front bush aligned against the oilway in the cylinder block;

- after pressing in, the bushes are machined to the final inner diameter (Refer to Fig.2-68 for the sizes). For optimum concentricity of the shaft bushes, use the finishing reamer A.90353 for concurrent machining of both bushes.

Oil pump inner gear bush. Check the bush is adequately pressed in. The inner surface should be smooth, with no scuffs, otherwise renew the bush.

Use tool A.60326/R for bush pressing-in or out (Fig.2-74).

After pressing-in, ream the bush to 16.016-16.037 mm.

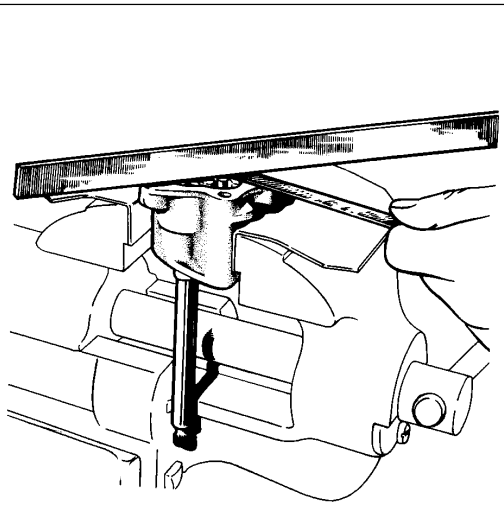

Fig. 2-71. Checking the oil pump endfloat

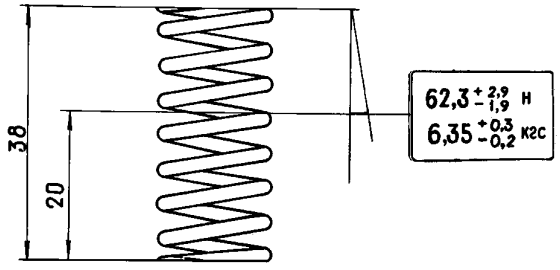

Fig.2-72. Basic data for checking the relief valve spring

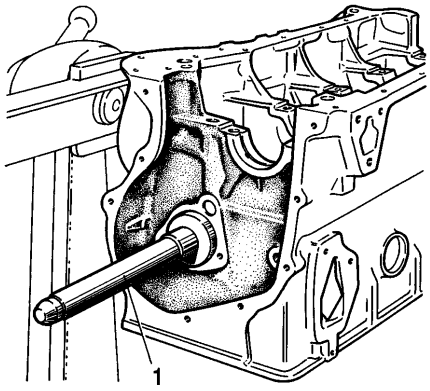

Fig.2-73. Removal and refitting of the oil pump / distributor shaft bush:
1 - tool A.60333/1/2

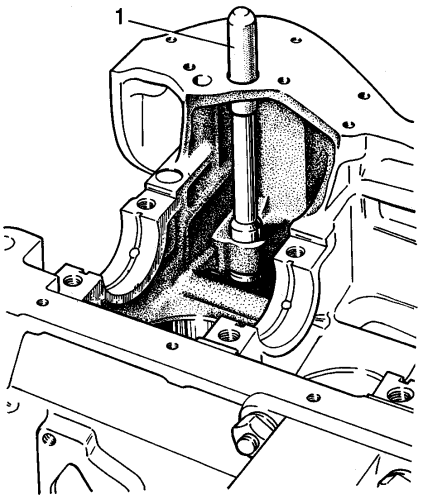

Fig.2-74. Pressing out the oil pump / distributor inner gear bush:
1 - tool A.60326/R

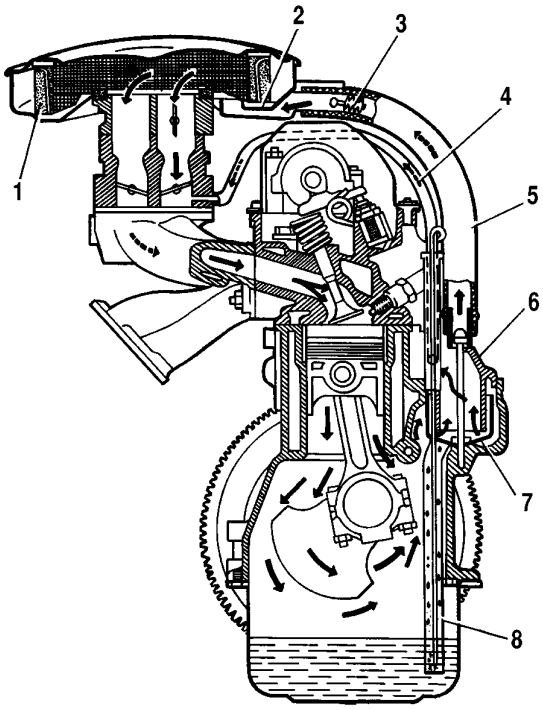

Fig.2-75. Crankcase ventilation diagram:
1 - filter element, air cleaner; 2 - exhaust manifold; 3 - flame arrester; 4 - hose to draw crankcase emission on throttle body; 5 - discharge hose; 6 - oil separator cover; 7 - oil separator; 8 - oil separator drain tube

Crankcase emission ventilation system

Flushing the system. For flushing disconnect vent hoses 4 and 5 (Fig. 2-75) from the manifolds, remove flame arrester 3 from discharge hose 5, remove cover 6 of oil separator 7 and wash them in petrol or kerosine.

Flush and blow dry with compressed air the carburettor manifold to draw crankcase emission on the throttle body (to the side of the air cleaner).

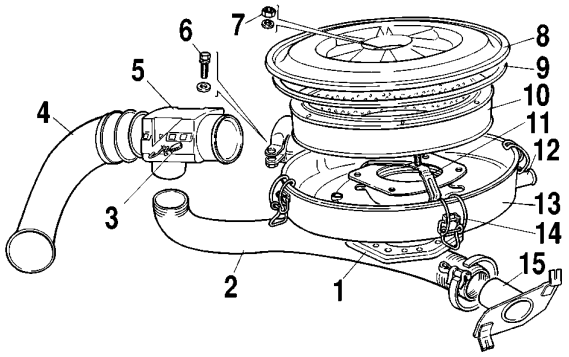

Fig.2-76. Air cleaner and temperature regulator:
1 - gasket; 2 - corrugated hose; 3 - air temperature control flap handle; 4 - cold air intake; 5 - temperature regulator; 6 - clamp bolt; 7 - air cleaner cover securing nut; 8 - air cleaner cover; 9 - air cleaner cover gasket; 10 - filter element; 11 - filter cover mounting bracket; 12 - emission discharge pipe; 13 - air filter housing; 14 - spring retainer; 15 - warm air intake from exhaust manifold

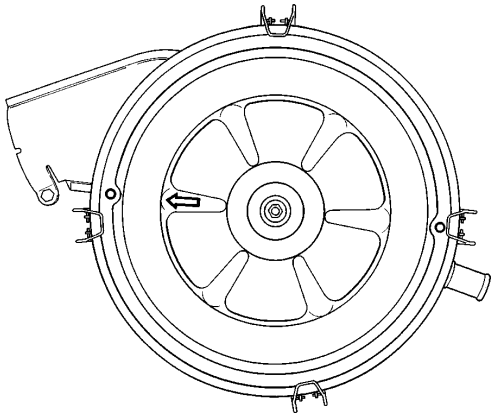

Fig.2-77. Refitting the air cleaner cover

Fuel system

Air cleaner and temperature regulator

Removal and refitting. To remove the air cleaner, release spring retainers 14 (Fig. 2-76) and undo nut 7 securing air cleaner cover 8. Remove the cover and lift out filter element 10.

Undo the nuts holding housing 13 to the carburettor. Disconnect hose 2, then remove the air cleaner and temperature regulator 5.

Loosen clamp bolt 6 and remove temperature regulator 5 complete with cold air intake 4.

When refitting the air cleaner, position the arrow on the filter cover as shown in Fig. 2-77 in order to reduce intake air noise.

Fuel tank

Removal and refitting. Before removing fuel tank 1 (Fig.2-78), disconnect the battery earth lead.

Undo cap 5 of filler pipe 4 and remove as much petrol as possible.

Remove the rear seat, undo screws holding the right-hand and left-hand wheel arch liner, remove the liners.

Unbolt and remove the cover in the floor to expose the fuel tank. Disconnect hoses 9 and wiring from fuel level sender 8, followed by hoses 2 from the fuel vapour separator.

Undo the retaining bolts and withdraw the petrol tank.

The fuel tank refitting is a reversal of removal.

Cleaning and inspection. Remove the fuel level sender. Clean the tank with petrol to remove any contaminants or sediments. Wash the tank with a jet of hot water and steam out any petrol residuals.

Thoroughly examine the fuel tank welding seam for leaks. If leakage is evident, solder the fuel tank.

WARNING. Before soldering, check to see the fuel tank is thoroughly cleaned and steam-treated and there are no fuel vapours which can ignite and explode during soldering.

Fuel pump

Refer to Fig.2-79.

Fuel pump inspection. Insufficient fuel flow to the carburettor can be caused by a faulty fuel pump, clogged or damaged fuel lines or fuel filter.

To find the cause of failure, disconnect the hose from supply manifold 1 and using fuel priming lever 8, check fuel delivery. If there is no fuel, disconnect the hose from intake manifold 4 and check the manifold for vacuum. In case of vacuum, the fuel lines are damaged, if not - the fuel pump is faulty.

The fuel pump can be tested on a stand. By rotating the drive shaft at 2000±40 rpm, check the fuel delivery by the pump to be at least 54 litre/hour at 20±5°C, while the supply pressure at «zero» fuel delivery must be 0.02-0.03 MPa (0.21-0.30 kg/cm^2). When found defective, dismantle the fuel pump and examine all its components.

Dismantling, cleaning and inspection. To dismantle, unbolt cover 5, remove the cover and fuel pump filter 2. Next undo the screws holding the housing to the lower cover, separate them, withdraw the diaphragm unit and spring. Wash all components in petrol and blow dry with compressed air.

Examine the state of components. The pump springs must be undamaged. Check the valves are not sticking. The diaphragms must have no fractures, cracks or hard spots.

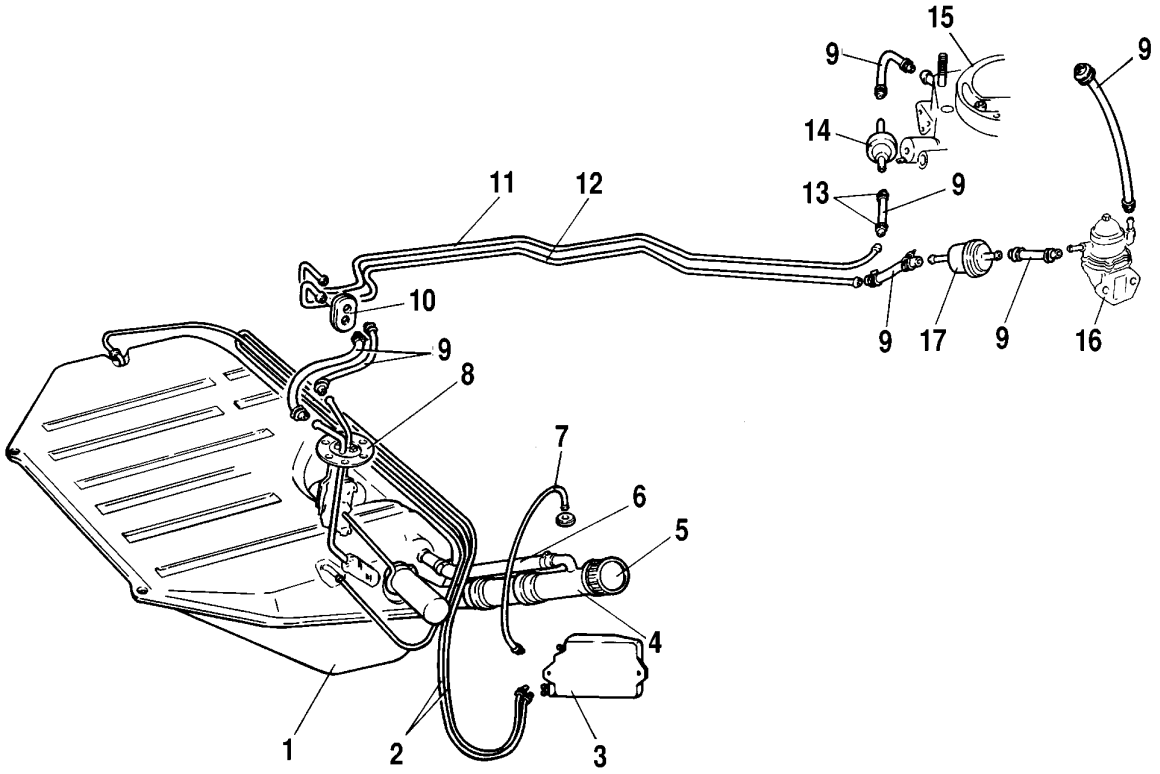

Fig.2-78. Fuel tank and fuel pipeline associated components

1 - fuel tank; 2 - hoses, fuel vapour separator and fuel tank; 3 - fuel vapour separator; 4 - filler pipe; 5 - cap; 6 - hose, fuel tank and filler pipe; 7 - hose, fuel vapour separator and fuel tank cover; 8 - fuel level sender; 9 - connection hoses; 10 - grommet; 11 - return flow line; 12 - fuel line; 13 - hose clips; 14 - non-return valve; 15 - carburettor; 16 - fuel pump; 17 - fine fuel filter

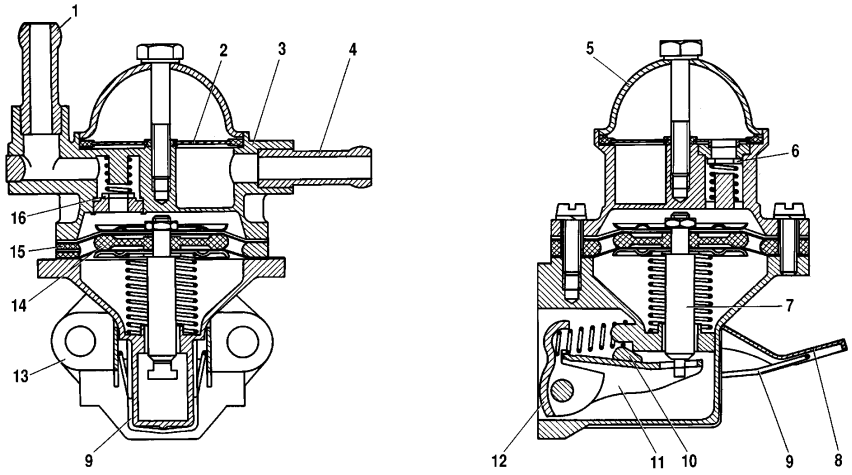

Fig.2-79. Fuel pump:

1 - delivery pipe; 2 - filter; 3 - housing; 4 - suction pipe; 5 - cover; 6 - suction valve; 7 - operating rod; 8 - hand priming lever; 9 - spring; 10 - eccentric; 11 - rocker; 12 - mechanical priming lever; 13 - lower cover; 14 - inner distance gasket; 15 - outer distance gasket; 16 - delivery valve

Check and renew any worn components. Always fit new pump gaskets, remember to lubricate the gaskets with a thin layer of grease before refitting them to the pump.

Refitting pump to engine. For correct fitting, use two out of three gaskets as stated below:

«A» gasket of 0.27-0.33 mm;

«B» gasket of 0.70-0.80 mm

«C» gasket of 1.10-1.30 mm.

Refit as shown in Fig.2-80 in the following sequence.

Locate the gasket **A**, then heat screen to the cylinder block, next place the gasket **B** on the face mating the pump. Using tool 67.7834.9506 measure the distance **«d»** (minimum rod protrusion to be set through slow crankshaft rotation). When the size **«d»** is within 0.8-1.3 mm, secure the fuel pump to the engine. When the size **«d»** is below 0.8 mm, replace the gasket **B** with the gasket **A.** When the size **«d»** is over 1.3 mm, replace the gasket **B** with the gasket **C**. Recheck the size **«d»** and secure the pump to the engine.

Make sure the gasket **A** is always fitted between the cylinder block and heat screen.

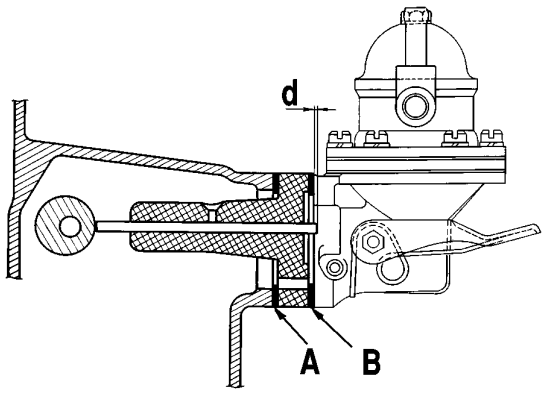

Fig.2-80. Checking and adjusting the fuel pump pushrod projection:
A - gasket of 0.27-0.33 mm; B - gasket of 0.70-0.80 mm;
d - pushrod projection

Carburettor

General description

The engine is fitted with the 21073-1107010 carburettor (Fig.2-81) of emulsion, twin progressive throttle type. The carburettor features a balanced float barrel, a system of drawing crankcase emission on the throttle body, a part throttle channel heater and secondary barrel locking.

The carburettor has two main fuel jet systems for the primary and secondary barrels, a primary barrel idling system with air correction, a secondary barrel air correction system, part throttle enrichment (economizer), full throttle enrichment (econostat), diaphragm-type accelerator pump, semi-automatic choke control unit.

On the overrun an idling overrun control unit is actuated.

Refer to Table 2-2 for carburettor data.

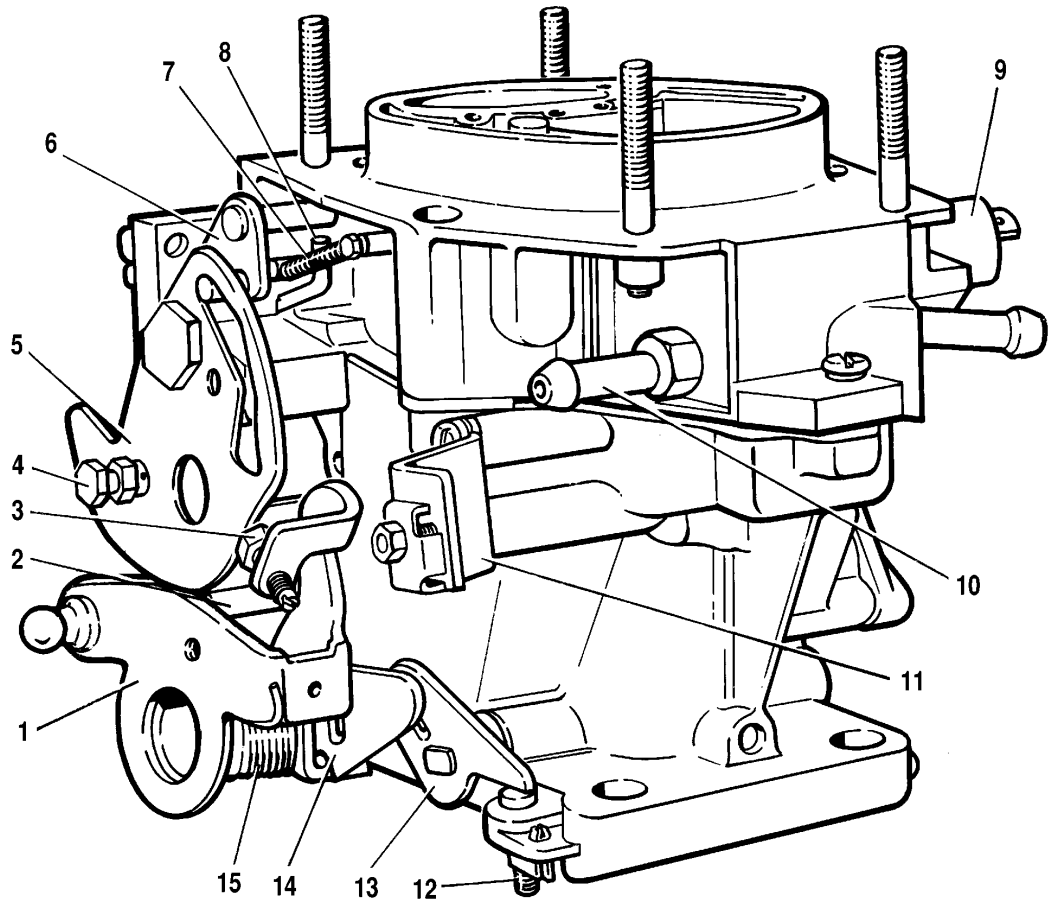

Fig.2-81. Carburettor 21073-1107010:
1 - throttle valve lever; 2 - secondary barrel lock lever pin; 3 - primary throttle valve opening adjustment screw; 4 - screw for choke valve cable end fitting; 5 - choke valve control lever; 6 - choke valve lever; 7 - choke valve return spring; 8 - diaphragm rod, pull-down unit; 9 - fuel shutoff solenoid; 10 - fuel supply manifold; 11 - bracket for choke outer cable end fitting; 12 - secondary barrel adjuster screw; 13 - secondary throttle valve lever; 14 - secondary throttle lever; 15 - primary throttle return spring

21073-1107010 CARBURETTOR

Parameters	Primary barrel	Secondary barrel
Barrel diameter, mm	32	32
Venturi diameter,mm	24	24
Main jet system:		
• fuel jet marking*	107.5	117.5
• air jet marking	150	135
Emulsion tube, type	ZD	ZC
Idling and air correction systems, primary barrel:		
• fuel jet marking	39	–
• conventional flow,** air jet	140	–
Air correction system, secondary barrel:		
• conventional flow, fuel jet	–	70
• conventional flow, air jet	–	140
Full throttle enrichment (econostat):		
• conventional flow, fuel jet	–	70
Part throttle enrichment (economizer):		
• fuel jet marking	40	–
• spring compression (9.5 mm length), N	14.5±15%	
Accelerator pump:		
• atomizer marking	45	–
• delivery (10 full strokes), cc	14	–
• cam marking	4	–
Starting clearances***:		
• choke valve (clearance B), mm	3.0	–
• throttle valve (clearance C), mm	1.1	–
Diameters,mm:		
• crankcase vent drilling	1.2	–
• vacuum advance unit orifice	1.2	
• needle valve bore	1.8	
• fuel return orifice to petrol tank	0.70	

**** Jet marking is flow-related. Flow rate is measured with a micrometer, calibrated against the reference jets.***

***** Conventional flow through the jet is determined against the reference jet under a special procedure; in operation no control is required.***

******Starting clearances are as shown in Fig.2-86***

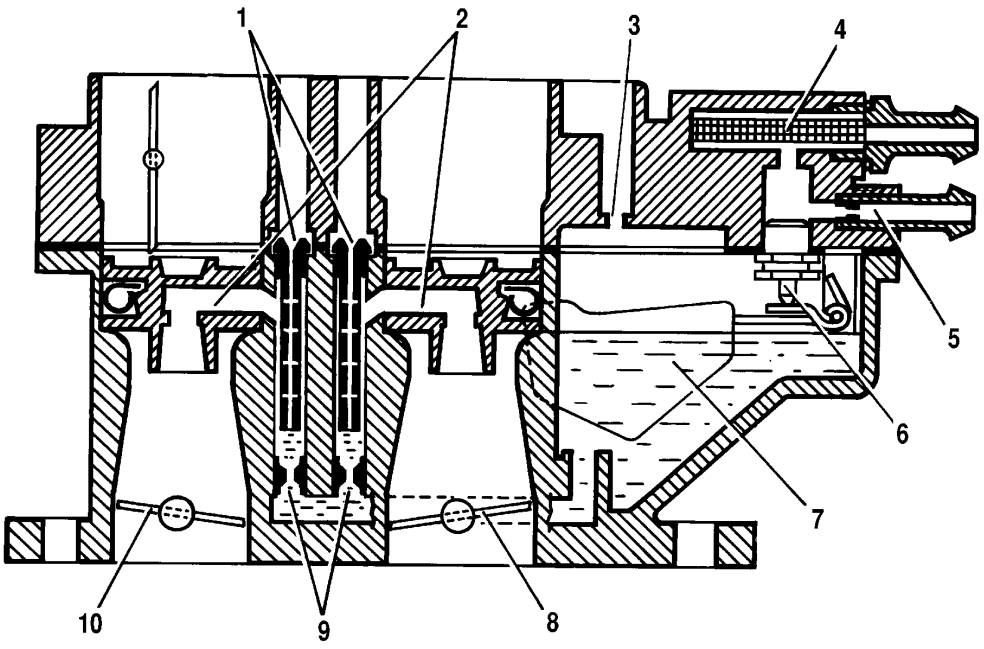

Fig.2-82. Main metering system:
1 - main air jets and emulsion tubes; 2 - atomizers, primary and secondary barrels; 3 - balance orifice; 4 - fuel filter; 5 - return pipe with calibrated orifice to petrol tank; 6 - needle valve; 7 - float; 8 - secondary throttle valve; 9 - main fuel jets; 10 - primary throttle valve

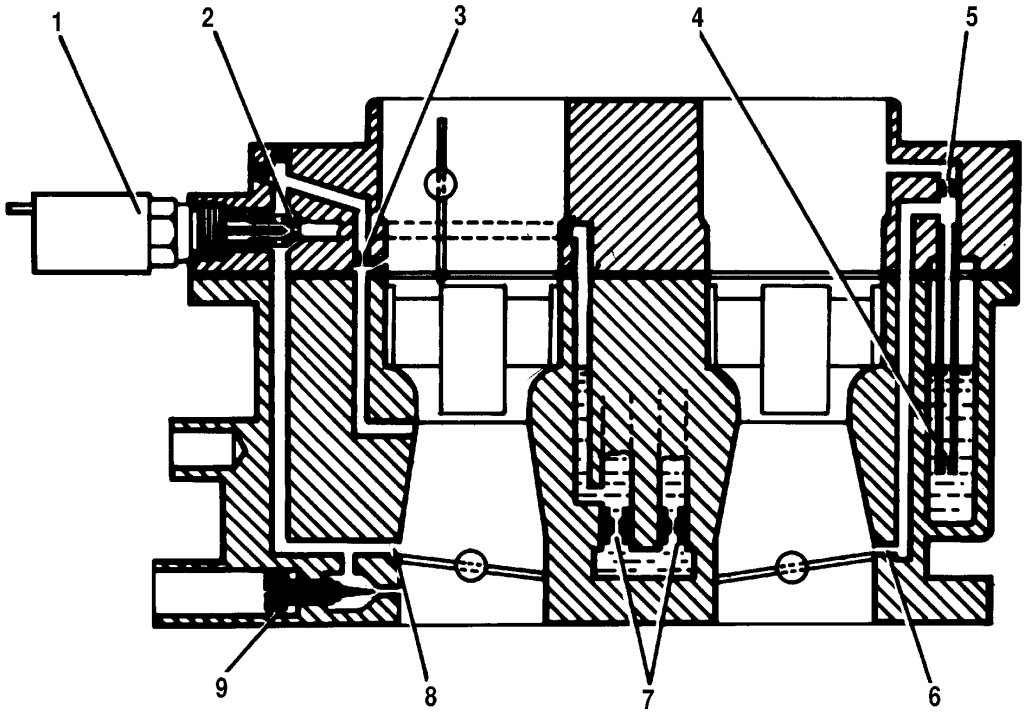

Fig.2-83. Idling and air correction systems:
1 - fuel cut-off solenoid; 2 - idling fuel jet; 3 - idling air jet; 4 - fuel jet and tube, secondary air correction system; 5 - air jet, secondary air correction system; 6 - outlet orifice, secondary air correction system; 7 - main fuel jets; 8 - primary air correction passage; 9 - idle mixture adjustment screw

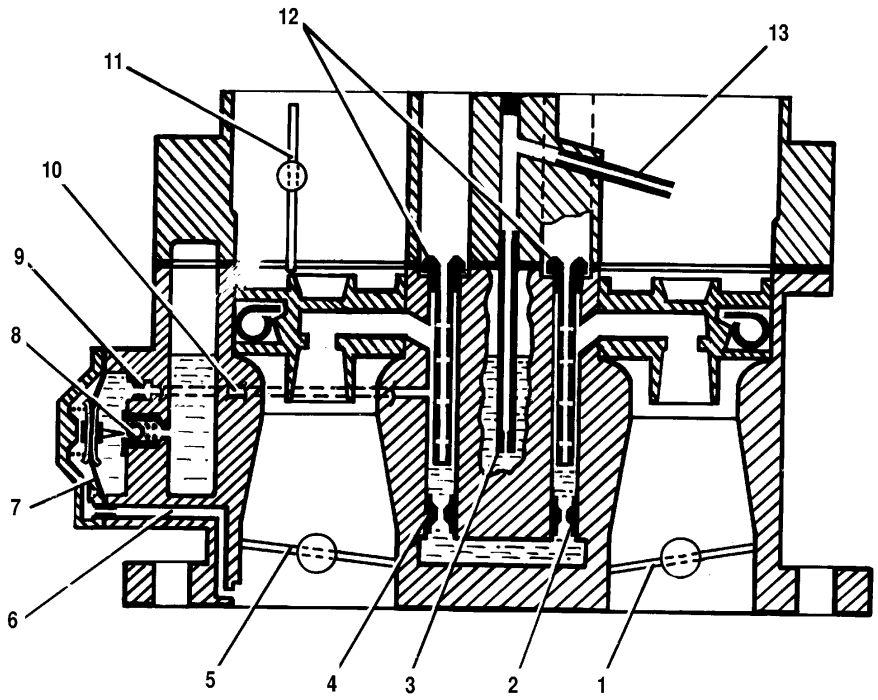

Fig.2-84. Part throttle and full throttle enrichment systems:
1 - secondary throttle valve; 2 - main fuel jet, secondary barrel; 3 - fuel jet and tube, full throttle enrichment; 4 - main fuel jet, primary barrel; 5 - primary throttle valve; 6 - vacuum port; 7 - part throttle diaphragm; 8 - ball valve; 9 - fuel jet, part throttle enrichment; 10 - fuel passage; 11 - choke; 12 - main air jets; 13 - injection tube, full throttle enrichment

Main metering system. Fuel through gauze filter 4 (Fig. 2-82) and needle valve 6 is fed to the float chamber. From the float chamber fuel flows through main fuel jets 9 to the emulsion wells to be mixed with air, escaping from emulsion tubes 1 which are built as one piece with the main air jets. Through atomizers 2 the air-fuel mixture flows to the primary and secondary venturi.

Throttle valves 8 and 10 are connected so that the secondary barrel starts opening when the primary one is 2/3 open.

Idling system runs on fuel from the emulsion well behind fuel jet 7 (Fig.2-83). Fuel is fed to fuel jet 2 which is fitted with fuel cut-off solenoid 1. At the jet outlet the fuel is mixed with the air coming from the port and from a flared part of the venturi (to ensure the carburettor smooth operation at idling). Emulsion goes under the throttle plate through the correcting orifice adjusted by idle mixture adjustment screw 9.

Air correction systems. Following the throttle opening but prior to activation of the main metering system, the air-fuel mixture enters:

- the primary barrel through idling fuel jet 2 and air correction system passage 8, located at the level of the closed throttle plate edge;

- the secondary barrel through outlet orifice 6 being slightly over the edge of the closed throttle plate. Fuel flows from jet 4 through the tube to be further mixed with air from air jet 5 flowing through the idling air passage.

Part throttle enrichment (economizer) operates when certain vacuum level is maintained on throttle body 5 (Fig. 2-84). Fuel is fed from the float chamber through ball valve 8. Valve 8 remains closed as long as the diaphragm is held retracted in the intake pipe by means of the vacuum. With wide open throttle, the vacuum decreases allowing diaphragm 7 spring to open the valve. Petrol which flows through part throttle enrichment jet 9 is added to fuel passing through main fuel jet 4, providing a richer mixture.

Full throttle enrichment (econostat) operates at full engine load, at high, close-to-maximum speeds and wide open throttles. Petrol from the float barrel through jet 3 (Fig.2-84) is delivered to the fuel pipe and further through injection tube 13 into the secondary barrel resulting in a richer mixture.

Accelerator pump is of diaphragm type, mechanically operated by cam 6 (Fig.2-85) on the primary throttle spindle. With the throttle valve closed, the spring retracts diaphragm 3 thus filling the pump with petrol through ball valve 8. As the throttle opens, the cam operates lever 5, whilst diaphragm 3 forces fuel through ball valve 2 and atomizer 1 into the barrels enriching the air-fuel mixture.

The pump capacity is invariable and is determined by the cam profile only.

Choke control unit. Choke lever 4 (Fig.2-86) has three profiles. Its outer edge 4.3 operates throttle lever 11 through adjuster screw 10 to start the engine when cold and to further rise the

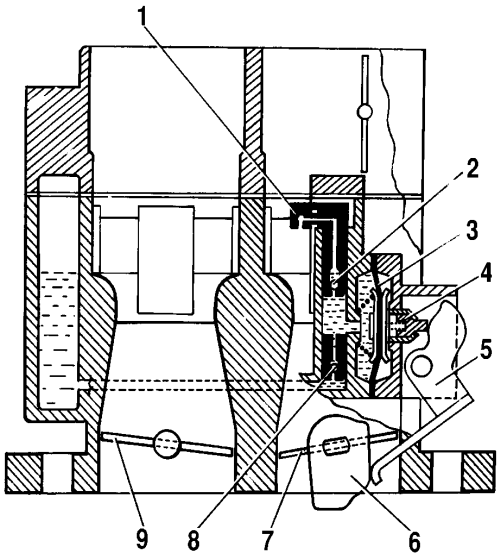

Fig.2-85. Accelerator pump:
1 - atomizer; 2 - fuel delivery ball valve; 3 - diaphragm; 4 - pushrod; 5 - operating lever; 6 - cam; 7 - primary throttle valve; 8 - non-return ball valve; 9 - secondary throttle valve

engine speed. Inner profiles 4.1 and 4.2 operate choke lever 6 allowing choke opening to a certain amount at intermediate positions of lever 4. Rotation of choke lever 4 anticlockwise causes the wider slot to release choke lever 6 stud; the choke is held in a fully closed position by return spring 7. At the same time the primary throttle is opened by means of lever 4 edge 4.3.

Choke 5 shaft is not centralized, therefore, after the engine is started, the choke is opened by force of air flow, extending spring 7 to result in a leaner air-fuel mixture.

Vacuum from the throttle body operates diaphragm 1 and opens the choke by means of rod 3. Adjuster screw 2 makes possible to control the degree of the choke opening.

The maximum choke opening rate at the engine start-up and warm-up depends on choke lever 4 positions or choke lever slot width.

Idling overrun control unit disables the idling system on the overrun (during engine deceleration, downhill movement or gear shifting) thus improving fuel economy and reducing CO emission to atmosphere.

On the overrun at over 2100 rpm and carburettor idle switch 7 shorted to «ground» (Fig.7-40) (throttle pedal released), fuel cutoff solenoid 4 is disactivated to shut off fuel supply. When the idle switch is not grounded, the solenoid will not be disabled.

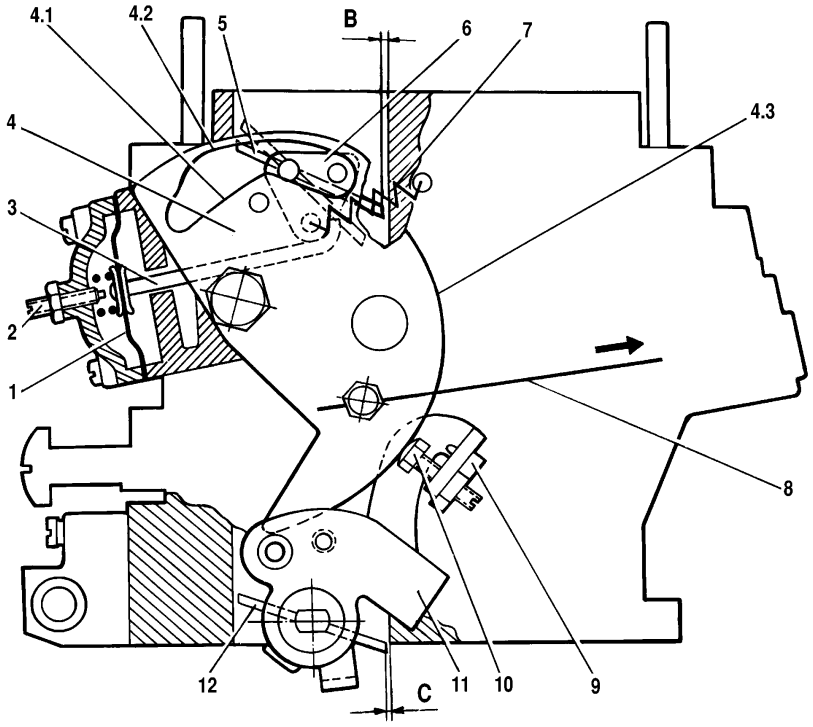

Fig.2-86. Choke pull-down unit:
1 - diaphragm; 2 - adjusting screw; 3 - diaphragm rod; 4 - choke control lever; 4.1 - lever 4 bottom profile to restrict maximum choke opening; 4.2 - top profile to ensure choke mechanical opening ; 4.3 - lever 4 edge to ensure primary throttle starting clearance; 5 - choke valve; 6 - choke lever; 7 - choke return spring; 8 - choke cable; 9 - adjuster screw stop; 10 - primary throttle opening adjuster screw; 11 - throttle lever; 12 - primary throttle; **B** - choke starting clearance; **C** - throttle starting clearance

When the crankshaft speed goes down as low as 1900 rpm on the overrun, the control unit re-triggers the fuel cutoff solenoid to feed fuel through the idle jet, and the engine gradually shifts to idling.

Secondary barrel locking. The secondary throttle can open only with the open choke when lever 5 edge (Fig.2-81) does not rest against pin 2 of the secondary barrel lock lever.

In this case during throttle opening the lock lever operates lever 13 through lever 14 to open the secondary throttle.

When the choke is closing, lever 5 outer edge operates lock lever pin 2 to disengage lever 14 and lock lever. Now the secondary throttle is locked out and cannot be opened.

Carburettor - removal and refitting

Carburettor removal and refitting is done on the cold engine only. Start with removing the air cleaner. Next disconnect operating rod 15 (Fig. 2-87) from the throttle lever, followed by operating rod 3 and choke outer operating rod. Undo the retaining screw and remove the part throttle channel heater.

Disconnect the idling overrun wiring from the shutoff solenoid and idle switch. Undo the carburettor retaining nuts, remove the carburettor and plug the intake pipe.

Refitting is a reversal of the removal procedure. Before refitting, examine the carburettor heat screen and intake pipe/carburettor mating surfaces. Tighten the carburettor nuts to the torques specified in Attachment 1.

WARNING. Never refit or tighten the retaining nuts on the hot carburettor.

After refitting, adjust the carburettor linkage and engine idle.

The carburettor linkage should operate without seizures.

Carburettor - dismantling

Undo the retaining screws and remove the carburettor cover, taking care not to damage the gasket, float and tubes of the full throttle enrichment and secondary air correction systems.

Dismantle the carburettor cover.

Using a tool, carefully push out spindle 1 (Fig.2-88) of floats 3, providing you do not damage the float tabs, remove the floats.

Remove gasket 4, needle valve 2 seat, fuel supply pipe 11 and fuel filter 13.

Remove the housing of the idling fuel jet with fuel cutoff solenoid 10 and remove jet 9.

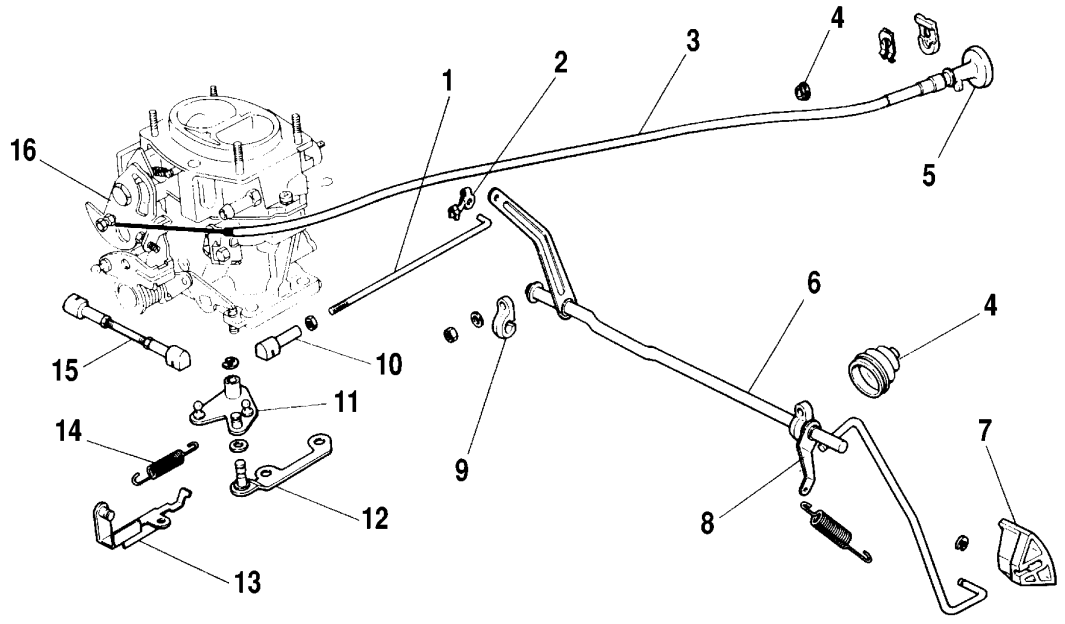

Fig.2-87. Carburettor linkage:
1 - longitudinal rod; 2 - rod securing clamp; 3 - choke cable; 4 - grommets; 5 - choke knob; 6 - shaft; 7 - throttle pedal; 8 - return spring lever; 9 - shaft support bracket; 10 - longitudinal rod end-piece; 11 - intermediate lever; 12 - bracket, intermediate lever; 13 - return valve bracket; 14 - return spring; 15 - transverse rod; 16 - carburettor

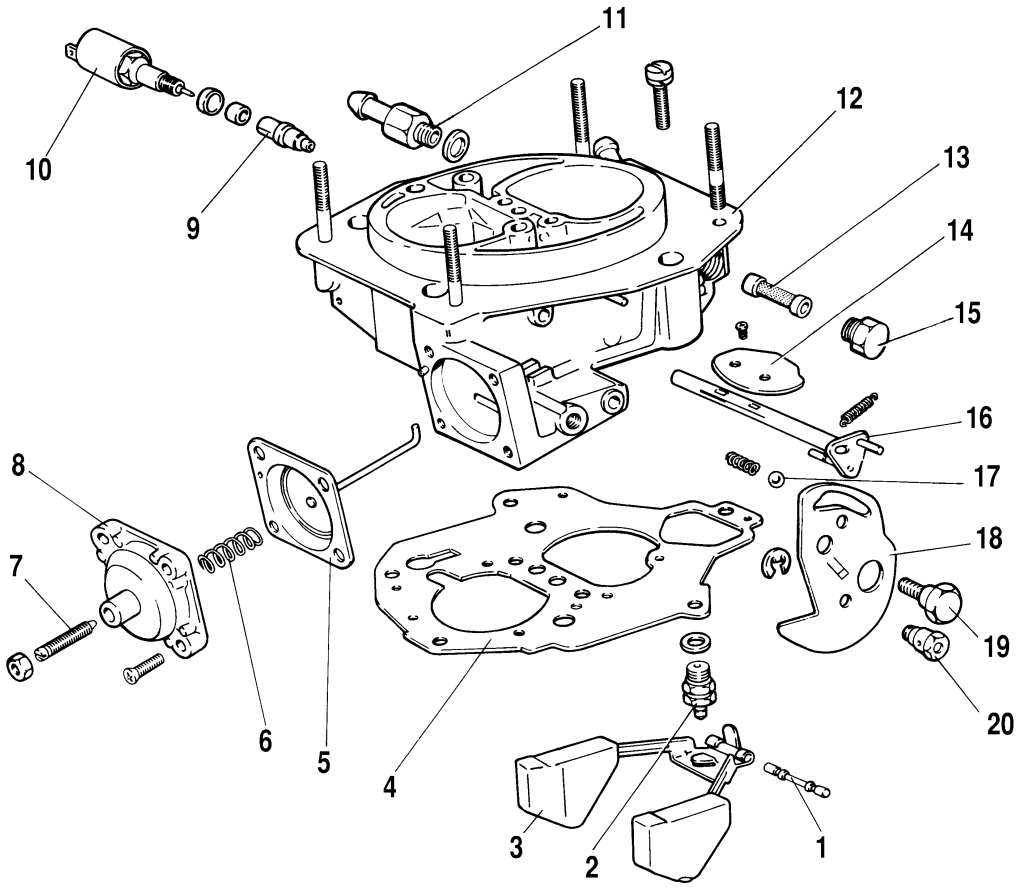

Fig.2-88. Carburettor cover components:
1 - float spindle; 2 - needle valve; 3 - float; 4 - gasket; 5 - diaphragm and rod, choke pull down unit; 6 - spring; 7 - adjusting screw; 8 - cover, choke pull down unit; 9 - idling fuel jet; 10 - fuel cut-off solenoid; 11 - fuel supply pipe; 12 - carburettor cover; 13 - fuel filter; 14 - choke valve; 15 - cap; 16 - spindle, choke valve and lever; 17 - choke control lever securing ball; 18 - choke control lever; 19 - lever spindle; 20 - bush for securing choke cable

Undo shaft 19, extract ball 17 with the spring, remove choke lever 18, detach the choke lever spring. When applicable, undo choke retaining screws, withdraw plate 14 and spindle 16.

Dismantle the diaphragm-type choke control unit, having removed cover 8 complete with adjusting screw 7. Lift out spring 6 and diaphragm 5 with the rod.

Dismantle the carburettor housing (Fig.2-89) as described below.

Remove accelerator pump cover 3 complete with lever 2 and diaphragm 1.

Using a screwdriver, remove accelerator pump atomizer 10, followed by atomizers 11 of the primary and secondary barrels. Grip the housing when removing atomizer 10.

Undo the nut of the primary throttle spindle, remove cam plate 4 of the accelerator pump linkage, then the washer.

Undo the retaining screw, remove wire 30 from throttle stop screw (CO adjustment screw) 29 and when applicable remove screw 29.

Remove plastic plug 25 and undo idle mixture adjusting screw 27.

Lift out part throttle enrichment cover 5, diaphragm 6 and spring.

Unscrew fuel jet 7 of the part throttle enrichment unit.

Undo main air jets 12 with the emulsion tubes and main fuel jets 13.

Carburettor components - cleaning and inspection

Fuel filter. Wash the filter and blow dry with compressed air. Examine the filter. When the filter or the fuel supply manifold are damaged, renew them.

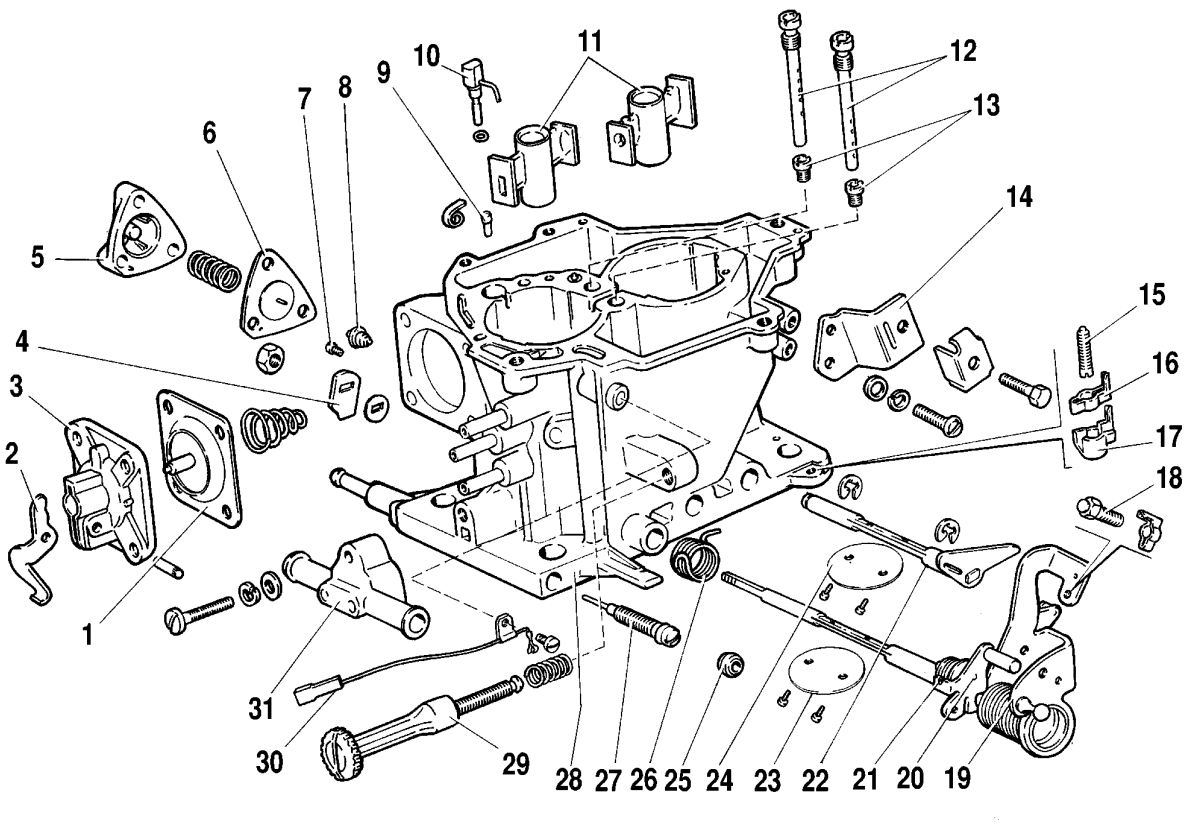

Fig.2-89. Carburettor housing components:
1 - accelerator pump diaphragm; 2 - operating lever, accelerator pump; 3 - cover; 4 - cam, accelerator pump linkage; 5 - cover, part throttle enrichment; 6 - diaphragm, part throttle enrichment; 7 - fuel jet, part throttle enrichment; 8 - valve, part throttle enrichment; 9 - return valve, accelerator pump; 10 - atomizer and fuel feed valve, accelerator pump;11 - main metering atomizers; 12 - main air jets with emulsion tubes; 13 - main fuel jets; 14 - bracket to secure choke outer cable end; 15 - adjusting screw, secondary barrel; 16 - stop, adjusting screw; 17 - cap, stop; 18 - primary throttle opening adjusting screw; 19 - primary throttle spindle and operating levers; 20 - secondary lock lever; 21 - lock lever spring; 22 - secondary throttle shaft and lever; 23 - primary throttle valve; 24 - secondary throttle valve; 25 - idle mixture adjustment screw cap; 26 - return spring, secondary throttle lever; 27 - idle mixture adjustment screw; 28 - carburettor body; 29 - throttle stop screw (CO adjustment); 30 - idle switch wire; 31 - part throttle channel heater

Float components. Wash the components in petrol and examine them. The floats must have no damages. Check to see there are no damages on the needle valve sealing face and seat which can result in the valve leakage. The valve must easily operate in its socket, the ball should not stick. The float weight should not exceed 6.23 gram. Renew any damaged components.

Carburettor cover. Clean any dirt or oil from the cover, clean all passages and holes. Wash the cover in acetone or petrol, blow dry with compressed air. Examine the cover sealing surfaces. Renew the cover in there are any damages.

Choke control unit. Wash in petrol and blow dry all choke control associated components. Inspect the parts and renew when applicable.

Jets and emulsion tubes. Clean out the jets and emulsion pipes from dirt, gummy substances, wash in acetone or petrol, then blow dry with compressed air.

Do not use any metal tool or wire for cleaning the jets; never wipe the jets or other carburettor components with cotton wool, cloths or rags, since lint can foul up the fuel-emulsion ducting. When excessively dirty, clear the jets with the help of a soft wooden needle soaked in acetone.

Carburettor housing. Clean the housing from dirt or oil. Wash the passages with acetone or petrol, blow dry with compressed air. Where applicable, use special tools for cleaning the ports and emulsion tubes. Examine the sealing surfaces of the housing; when found damaged or distorted, renew the housing with a new one.

Accelerator pump. Clean out the pump components, wash in petrol and blow dry with compressed air. Check to see the ball in the atomizers and moving parts (lever, diaphragm components) operate smoothly. There must be no seizures or sticking. The diaphragm should be intact and undamaged. Examine all sealing surfaces and gaskets. Always renew any damaged components.

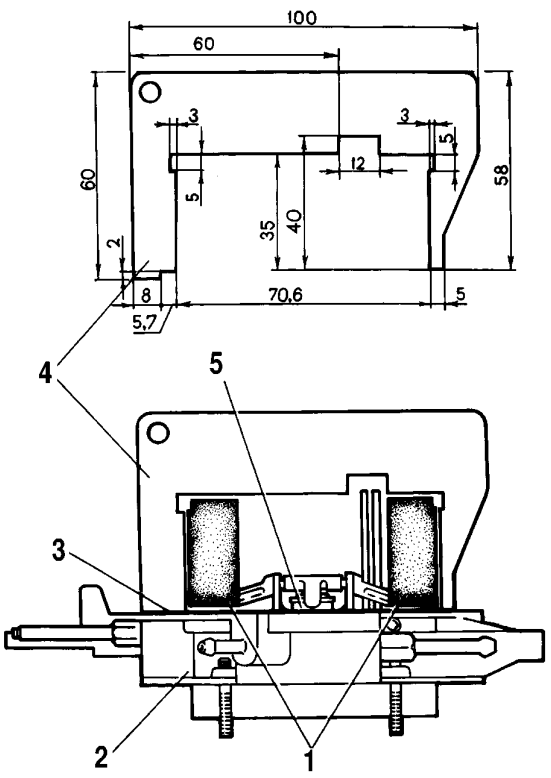

Fig.2-90. Setting the fuel level in float barrel:
1 - float; 2 - carburettor cover; 3 - gasket; 4 - gauge to check the float position; 5 - needle valve

Part throttle enrichment unit (economizer). The diaphragm must be integral and have no damages. Renew the diaphragm complete with the pushrod when the pushrod length (the head included) is less than 6.0 mm.

Carburettor - reassembly

Reassembly of the carburettor is a reverse of the dismantling procedure. Special attention should be drawn to the following.

The float must freely turn on its pivot pin, there should be no conflict with the barrel walls.

The needle valve must freely operate in its seating, without warping or seizure; the tightening torque for the needle valve seat is 14.7 N•m (1.5 kgf•m).

The tightening torque for the solenoid cutoff valve is 3.68 N•m (0.4 kgf•m).

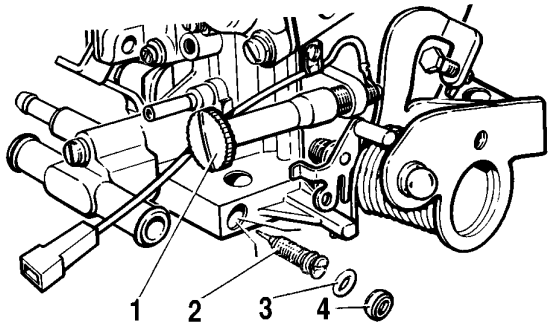

Fig. 2-91. Throttle stop screw:
1 - throttle stop screw; 2 - idle mixture adjustment screw; 3 - sealing ring; 4 - adjusting screw cap

Check the jet marking and consult Table 2-2 to prevent the jet confusion when refitting.

Before refitting pivot pit 19 (Fig.2-88), apply sealant УГ-9 on the pivot end and over 1-1.5 end turns of thread.

To reassemble the accelerator pump, first hand start the cover retaining screws, press the lever full way to stop, tighten the screws and release the lever.

Carburettor - adjustment and checks

Setting fuel level in float chamber. The adequate fuel level for proper carburettor operation is ensured by correct fitting of good cut-off valve components.

Correct fitting of float 1 (Fig.2-90) is checked with gauge 4. To do it, locate it normal to cover 2, which should be held horizontally with the floats up. The clearance between the gauge (over its contour) and floats must be 1 mm as a maximum.

When necessary, adjust by means of bending the float tab or levers. The locating tab face must be normal to needle valve 5 pivot and have no evident dents or cuts.

Choke control unit adjustment. When turning lever 4 (Fig. 2-86) of choke 5 control unit full way anticlockwise, choke must be completely closed by spring 7. If not, remedy the situation.

With the choke fully closed, press choke control rod 3 to its stop. This results in choke 5 opening to 3.0 mm (starting clearance **B**). Adjust the clearance using screw 2.

Primary throttle 12 with the choke fully closed, should be open to 1.1 mm (starting clearance **C**). Using screw 10, adjust the clearance as necessary.

Carburettor linkage adjustment. With fully depressed throttle pedal 7 (Fig.2-87) the primary throttle must be wide open and rod 15 must have no further travel. With pedal 7 released the

throttle must be fully closed. If not, adjust the pedal and throttle by means of end piece 10 at front rod 1 end.

Secure the end of throttle linkage cable 3 so that with knob 5 pulled, the choke is fully closed, while with knob 5 pushed in - fully open.

Engine idle adjustment. This is to be done via idle mixture adjustment screw 2 (Fig.2-91) and throttle stop screw 1. Cap 4 is provided for adjustment screw 2. Remove the cap to access the screw.

Idle adjustment is done on the warm engine (coolant to be at 85-90°C), after the valve gaps and ignition timing are correctly adjusted, the choke should be wide open.

Using throttle stop screw 1, set the crankshaft speed within 750-800 rpm.

Using idle mixture adjustment screw 2, set the content of carbon monoxide (CO) in exhaust emissions at maximum 1.5 % with throttle stop screw 1 at the preset position as above (CO level is for 20°C and 101.3 кPa (760 mm Hg).

Reset the crankshaft speed to 750-800 rpm by means of throttle stop screw 1.

When applicable, restore CO level to the maximum 1.5 %.

On completion, sharply depress and release the throttle pedal - check to see the engine speeds up without any gasps and does not stall at lower rpm. Should the engine stops, use throttle stop screw 1 to increase the engine speed to 750-800 rpm.

Refit new plastic cap 4 to idle mixture adjustment screw 2.

Checking the secondary barrel locking linkage. Turn the choke lever anticlockwise to fully close the choke. Next, turn spindle 19 lever (Fig.2-89) to wide open primary throttle 23; secondary throttle 24 must remain closed

Turn the choke lever fully clockwise, turn throttle lever 19 to wide open the throttle. If the secondary throttle fails to open, eliminate the fault. The fault can be caused by seized secondary lock lever 20 or disconnected lock lever spring 21.

Exhaust gas recirculation system

The vehicle is fitted with the exhaust gas recirculation (EGR) system which comprises thermo-vacuum switch 2 (Fig.2-92) and EGR valve 5 with the relevant port and recirculation tube 6 in intake pipe 3.

When coolant is over 40-48°C, the thermo-vacuum switch triggers to build-up vacuum in the EGR valve; the valve opens to reintroduce small amount of exhaust gas from exhaust manifold 4 into the intake pipe and inside the engine.

Checking EGR system operation. Depress the throttle lever and smoothly raise the engine speed to 2500-3000 rpm. At coolant temperature of 30-38°C EGR valve 5 must be closed, while at coolant temperature of 40-48°C it must be open, which can be evident through the EGR valve rod upward travel. If the

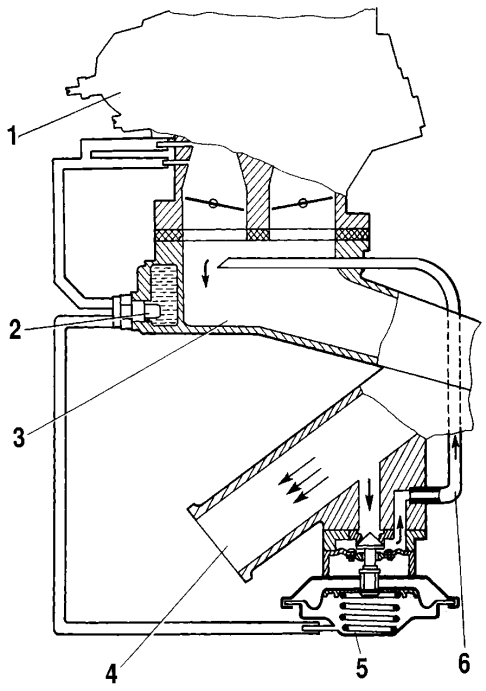

Fig.2-92. Exhaust gas recirculation:
1 - carburettor; 2 - thermo-vacuum switch of EGR valve; 3 - intake pipe; 4 - exhaust manifold; 5 - EGR valve; 6 - recirculation tube

EGR valve does not open, check the proper operation of the EGR valve and thermo-vacuum switch 2.

To check the EGR valve, disconnect the thermo-vacuum switch. Using manual vacuum pump, build up vacuum in the EGR valve diaphragm cavity. The EGR valve must be closed at 9.3 kPa (70-75 mm Hg). With vacuum level over 59.9 kPa (450-455 mm Hg) the EGR valve must be fully open, which is checked through a sharp vacuum removal - the EGR valve closes with a distinct click. In both cases no air leaks are allowed within 5 seconds.

To check thermo-vacuum switch 2, disconnect the hose and EGR valve 5. Using manual vacuum pump, build up vacuum of 13.3 kPa (100±5 mm Hg) to the thermo-vacuum switch. At coolant temperature maximum 30-38°C no vacuum leaks are allowed (thermo-vacuum switch is closed). At coolant temperature below 40-48°C there should be no vacuum (thermo-vacuum switch is open).

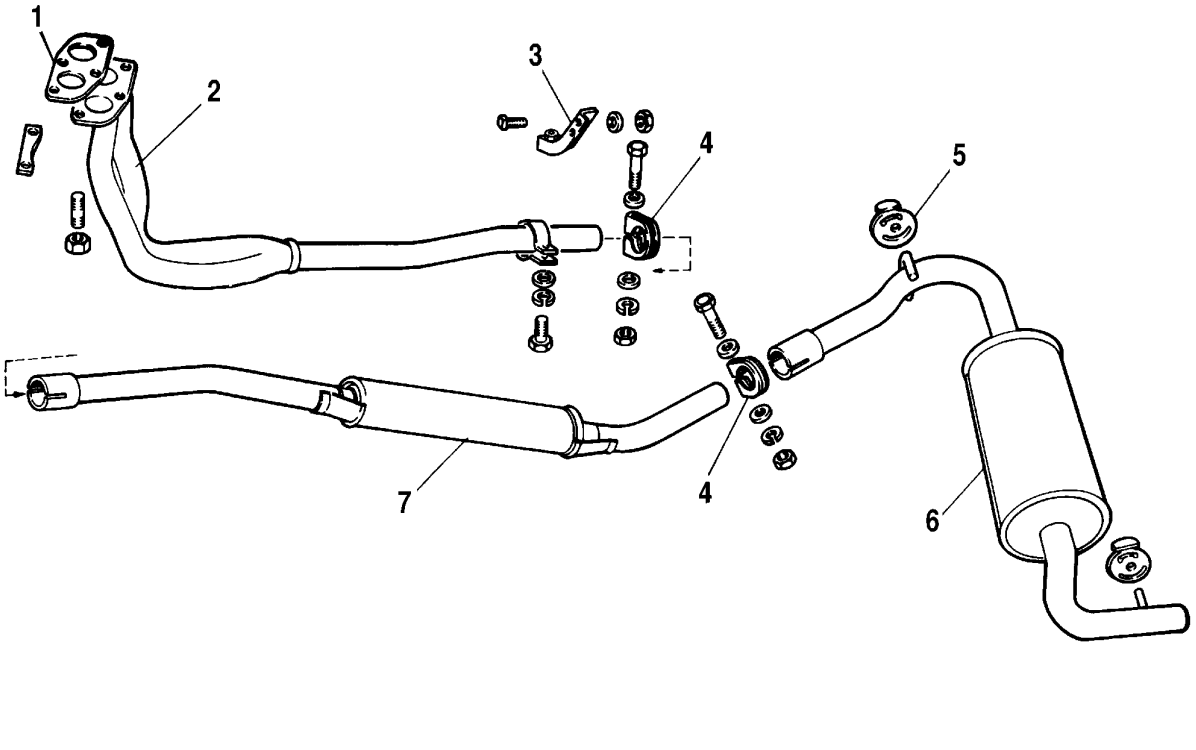

Fig.2-93. Exhaust system:
1 - sealing gasket; 2 - downpipe; 3 - bracket to secure downpipe to transmission; 4 - connection clasp; 5 - suspension ring, main silencer; 6 - main silencer; 7 - front silencer

Exhaust system

Exhaust gases escape from the engine through the exhaust manifold, front exhaust pipe (downpipe) 2 (Fig.2-93), centre (front) silencer 7 and main (rear) silencer 6.

Gasket 1 is fitted between the exhaust manifold and downpipe. The silencer pipes are connected through their flared ends by means of clasps 4 with taper rings.

Downpipe 2 is secured with nuts to the exhaust manifold studs and in addition to bracket 3 mounted on the gearbox cover. The lock plates are used under the manifold retaining nuts. The nuts and gasket 1 are of disposal type. Rear silencer 6 is secured to the underbody with the help of two suspension rings 5.

The silencers and associated pipes are made as a one-piece unit, so in the event of their failure they are renewed as a unit.