



ALFA ROMEO

MONTREAL

**characteristics, inspection
specifications and
overhaul directions**

C O N T E N T S

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S P E C I F I C A T I O N

Number and layout of cylinders	90 deg. vee 8
Bore	80 mm
Stroke	64.5 mm
Total cylinder capacity	2593 cc
Max. power at 6,500 rpm	{ HP DIN 200 HP SAE 230
Front track	
Rear track	1374 mm
Wheelbase	1340 mm
Minimum turning circle	2350 mm
Overall length	11,000 mm
Overall width	4220 mm
Overall height (unladen)	1672 mm
Kerb weight (full tank)	1205 mm
Number of seats	1270 Kgs
Fuel consumption for 100 Km (CUNA standard)	2 + 2
(for best engine performance, the use of premium grade fuel is advised)	13.7 lts
Tyres (195/70 x 14 VR)	{ MICHELIN X Radial

Warning for the first 3000 km

- Up to 1000 Km - max engine speed: 3500 rpm
- From 1000 to 3000 Km - max engine speed: 4500 rpm

Performance after running-in

With 41:10 final drive

Gear	Max speed Kph
1st	60
2nd	105
3rd	140
4th	185
5th	220
Rev.	50

Oil pressures with
hot engine

{ Min. pressure at idling speed .. .5 - 1 Kg/cm²
Min. pressure at top speed 3.5 Kg/cm²
Max. pressure at top speed 4.5 - 5 Kg/cm²

T Y R E S

Inflation pressure in Kg/cm² (cold)

195/70 - 14 VR MICHELIN X Radial
(under all conditions)

Front wheels	Rear wheels
2.2	2

N O T E: Use exclusively VR Rating Tyres.

FUEL, OIL AND COOLANT

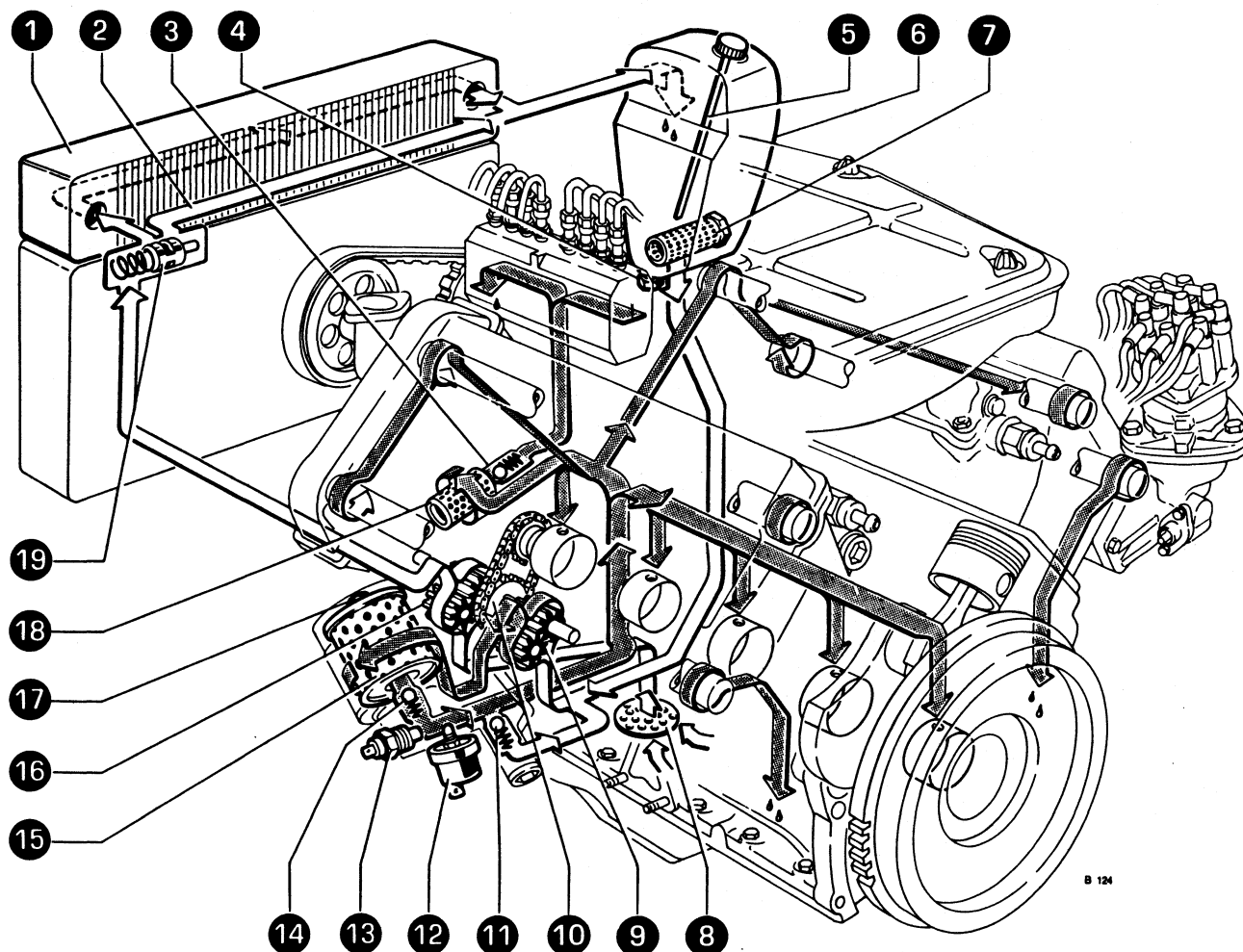
ALFA ROMEO antifreeze		12 lts	
Fuel (reserve 8 lts)		63 lts	
Oil {	Engine {	Reservoir and filter to max. level * . .	8.5 Kgs
		Total amount of oil in the circuit (reservoir, sump, filter, cooler and passages). .	11.000 Kgs
	Gearbox	1.600 Kgs	
	Differential	2.250 Kgs	
	Steering box	0.360 Kg	

* This quantity is that needed for regular changing.

FLUID AND LUBRICANTS

Refer to the directions given in the Instruction Book

LUBRICATING SYSTEM DIAGRAM



- | | |
|--|---|
| 1 Oil cooler | 11 Pressure relief valve |
| 2 Pipe connecting thermostatic bypass valve to reservoir | 12 Sender for oil pressure gauge |
| 3 Check valve | 13 Sender for oil thermometer |
| 4 Drain plug | 14 Check valve |
| 5 Filler cap with dipstick | 15 Oil filter |
| 6 Oil tank | 16 Recovery pump |
| 7 Oil filter in reservoir | 17 Clogged-element bypass valve |
| 8 Strainer in intake duct | 18 Additional oil filter for injection pump lubricating circuit |
| 9 Delivery pump | 19 Thermostatic bypass valve |
| 10 Drive sprocket | |

N.B. - The delivery pump circuit is that shown by shaded areas.

L U B R I C A T I O N

Description of lubricating circuit.

The lubricating system is of the dry sump type with separate oil tank.

The lubricating oil, from tank "6" flows through the filter "7" to the delivery pump "9" and, hence, through the filter "15" to the crankshaft; a pressure relief valve "11" downstream of the filter regulates the oil pressure.

The oil under pressure is delivered to the crankpin and main bearings and to the camshaft journals through suitable passages drilled into the camshaft themselves. Through the oil screen "18", where it is filtered further, the lubricating oil passes to the injection pump for the lubrication of pump moving parts: the check valve "3" prevents the oil from flowing back when the engine is stopped.

The valve "17" opens to bypass the filter if the filter element becomes clogged.

Pressure and temperature values of the circulating oil are transmitted to the instruments in the facia panel by the senders "12" and "13".

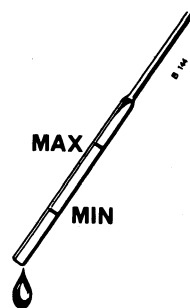
The check valve "14" prevents the oil from flowing from the tank to the sump when the engine is stopped.

After having lubricated the various moving parts, the oil returns to the sump and, drawn off by the recovery pump "16" through the strainer "8", is delivered to tank via either the cooler "1" or the pipe "2" by the thermostatic bypass valve "19" according to the oil temperature.

Checking the oil level

To check the oil level in the tank "6" screw all the way in the dipstick "5", run the engine a few minutes, then stop it and withdraw the dipstick.

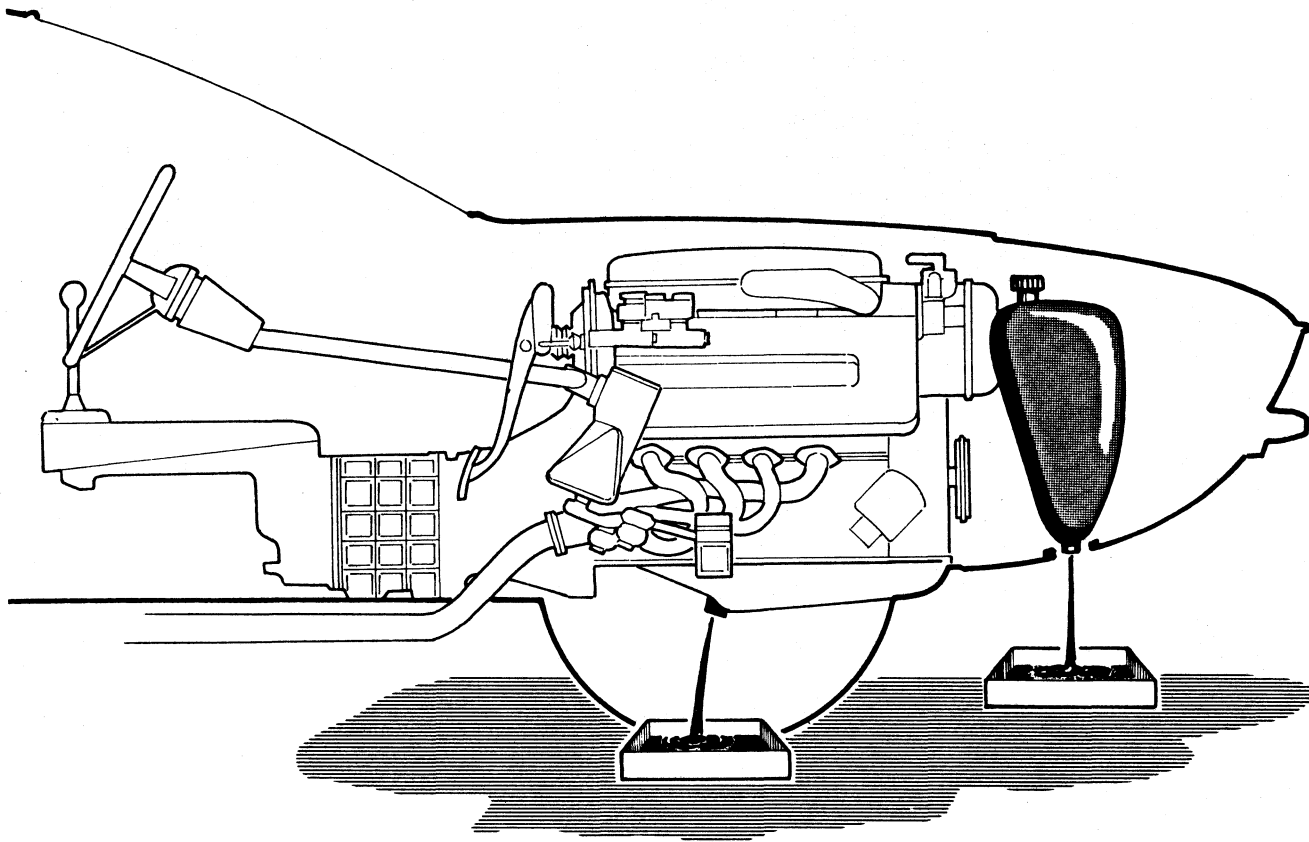
Never allow the oil level to fall below the minimum or, while topping up, to exceed the maximum mark.

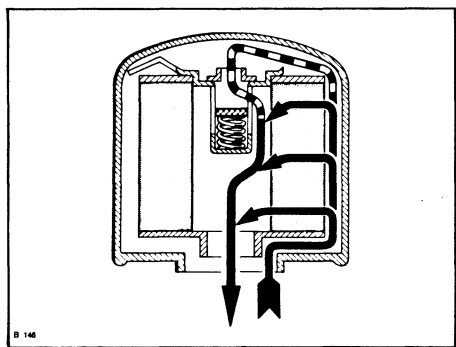


Oil change (engine warmed up)

With the engine stopped, thoroughly drain off old oil from tank and sump as follows:

- remove drain plug from the sump
- unscrew the drain plug from the tank. Gain access to the drain plug from the suitable port in the R.H. front underside of car.
- renew the filter element
- clean and refit the drain plugs
- refill the tank with new oil and run the engine at idle speed
- after a few minutes of idling in order to fill up properly the lubricating circuit, top up the tank with the prescribed quantity of oil.





- Oil flow with normal operation
- - - Oil flow in an emergency

Oil filter

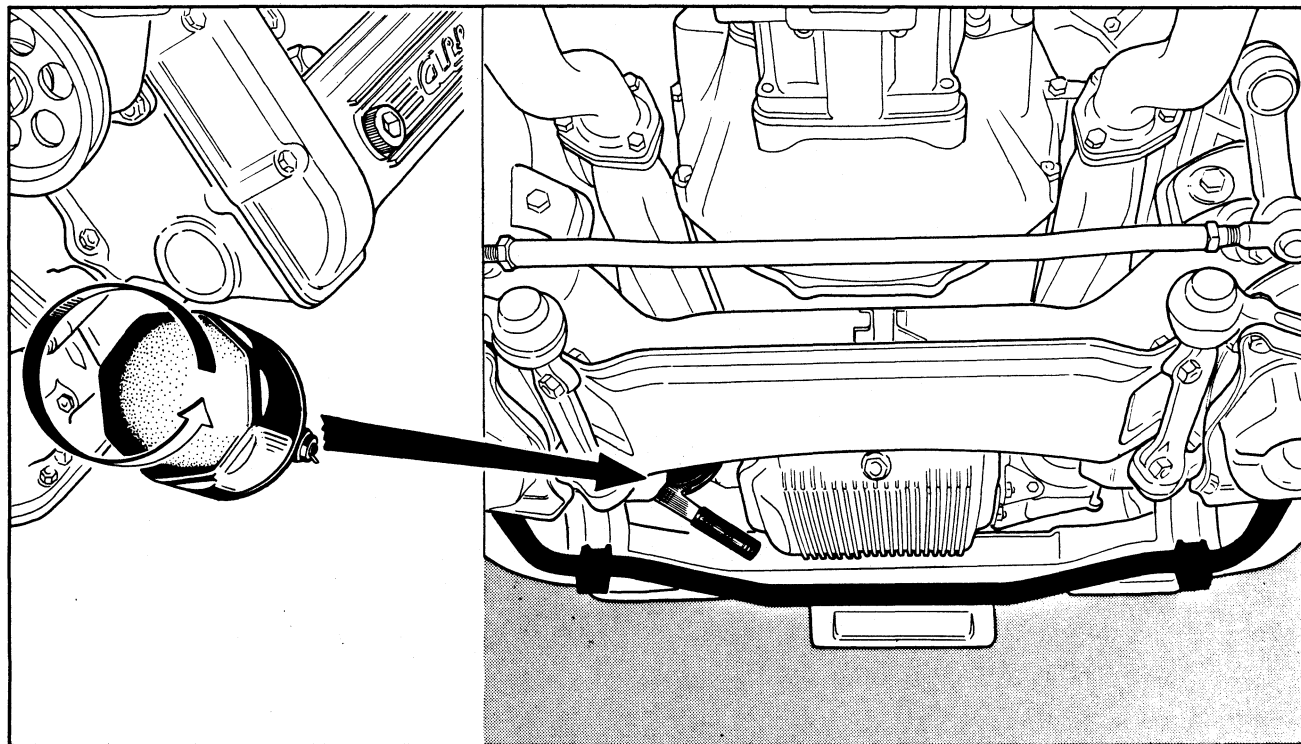
To remove impurities the engine oil is filtered by a full-flow filter.

The filter is fitted with a valve that bypasses the element if it should become clogged.

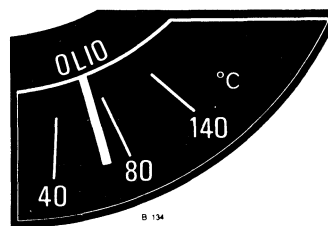
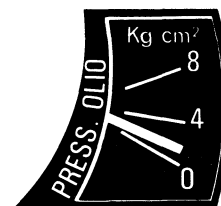
At the prescribed intervals change the filter element.

To remove the filter, detach the two brackets anchoring the stabilizer rod to the body, slacken the filter with the suitable spanner, then unscrew the filter by hand.

After refitting the filter to the engine, make sure that there are no oil leaks.



Oil pressures with hot engine	
Engine running fast	min. 3.5 Kg/cm ² max. 4.5 - 5 Kg/cm ²
Engine idling	min. 0.5 - 1 Kg/cm ²



Oil pressure

The oil pressure is regulated by a relief valve downstream of the pump (see 11, Lubricating system diagram).

If the pressure falls below the minimum values, inspect the system to trace and remedy the fault.

Oil Temperature

The oil temperature is regulated by the suitable thermostatic valve fitted into the circuit (see 19, Lubricating system diagram).

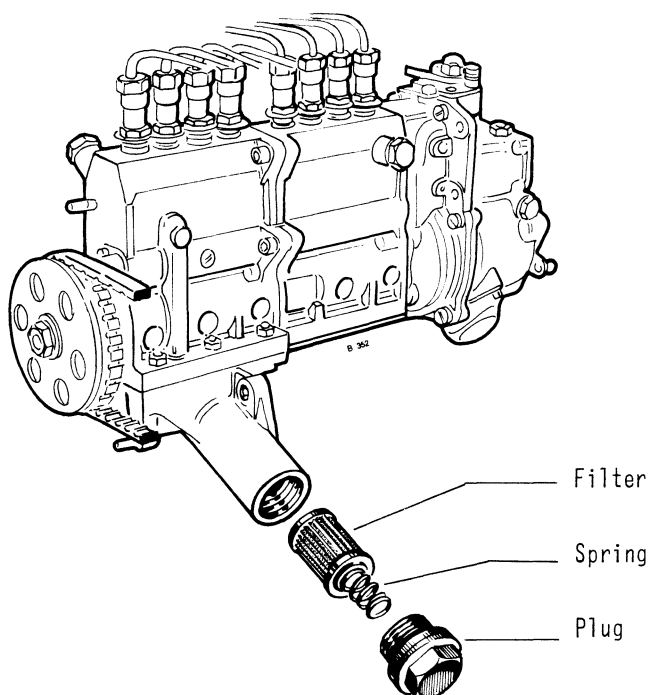
This valve should not open until the oil has reached a temperature of 82/85°C; at 95°C the valve should be fully opened. If excessive oil temperatures are experienced, this is probably due to a defective thermostatic valve.

Injection pump oil filter

At the prescribed intervals change the element of the oil filter in the injection pump lubricating circuit.

Clean very carefully the affected areas and parts to prevent any foreign matter from entering the filter housing and damaging the pump.

After the element has been renewed, add oil (of the same type as specified for the engine) to the injection pump control unit, if necessary, by removing the thermostatic actuator.



F U E L I N J E C T I O N

Description of fuel injection system

General

Fuel is supplied to the engine by injection into the intake port of each cylinder by means of eight pumping elements (one per cylinder) whose delivery is controlled by a "control unit"; such a metering device supplies fuels in quantities exactly metered in accordance with the opening of throttles and rpm range.

The control unit also includes compensating devices which give proper corrections for atmospheric pressure, engine and ambient temperature, cold starting and initial running and cut off fuel on deceleration.

The injection pump is also provided with a hand-operated device (see 19 on the operating diagram) that varies the carburation setting in accordance with the average seasonal temperature.

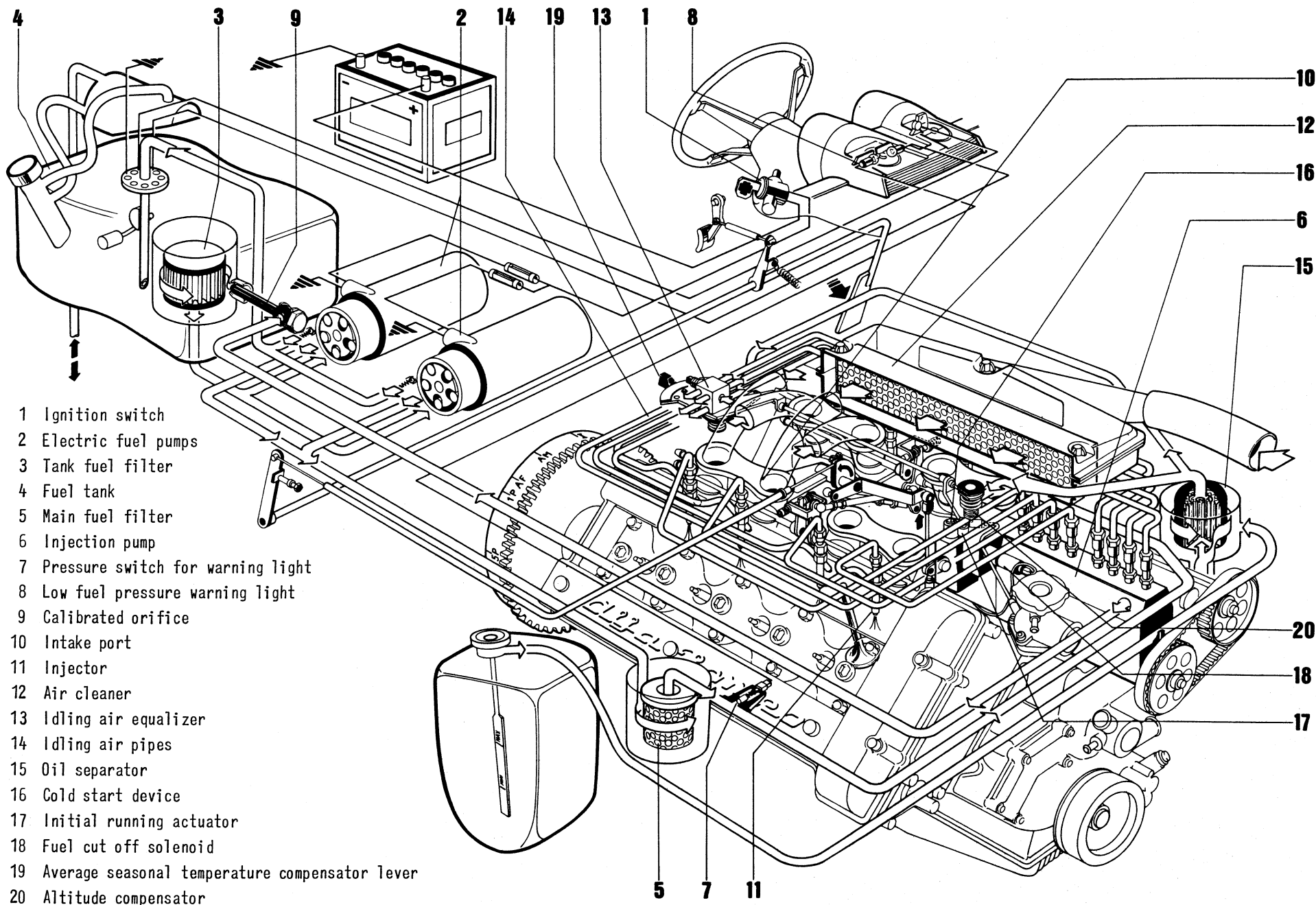
Fuel feed system (see operating diagram)

Inserting the key in the ignition switch "1" and rotating clockwise to MARCIA position will operate the electric pumps "2". The fuel flows from the tank "4" through tank filter "3" and main filter "5" and feeds the injection pump "6".

The excess fuel, acting also as a coolant for the injection pump, before returning to the tank, passes through a calibrated orifice "9" which regulates the fuel pressure within the injection pump. A pressure switch "7" inserted in the delivery pipe will switch on the warning light "8" on facia panel if a pressure drop occurs in fuel lines.

A pressure relief valve in each pump limits the fuel pump outlet pressure by passing fuel to the recovery pipe.

Fuel vapors emanating from fuel tank are collected in the liquid vapor separator; the condensate is then returned from the separator to the fuel tank.



- 1 Ignition switch
- 2 Electric fuel pumps
- 3 Tank fuel filter
- 4 Fuel tank
- 5 Main fuel filter
- 6 Injection pump
- 7 Pressure switch for warning light
- 8 Low fuel pressure warning light
- 9 Calibrated orifice
- 10 Intake port
- 11 Injector
- 12 Air cleaner
- 13 Idling air equalizer
- 14 Idling air pipes
- 15 Oil separator
- 16 Cold start device
- 17 Initial running actuator
- 18 Fuel cut off solenoid
- 19 Average seasonal temperature compensator lever
- 20 Altitude compensator

OPERATING DIAGRAM

Air induction system (refer to the operating diagram)

The filtered air enters the engine thru eight intake ports "10" each one with a throttle valve.

The idling air (throttles closed) is fed thru a separate circuit: from the cleaner "12" air passes to the idling air equalizer and thru eight small hoses "14" connecting the equalizer to the intake ports downstream of the throttles.

The accelerator pedal is mechanically linked via a relay crank to both the throttle lever and the control unit input lever. Therefore, any position of accelerator pedal corresponds to an exact position of throttle valve and control unit levers.

The air cleaner is connected with hoses to two ram intake ports at the car nose.

Crankcase ventilation system

The exhaust gases and the oil vapors developed from crankcase and oil tank during engine operation collect in the oil separator "15"; from here they are sucked in the combustion chambers and burned.

The crankcase ventilating system controls gases both at high engine RPMs and at idling speed when the throttles are closed.

When the throttles are fully opened the vapors flow to the oil separator "15" and into the manifold chamber communicating with the intake ports. (5)

When the throttles are partially closed, the secondary circuit comes into operation; such a circuit starts from the oil separator and conveys unburned gases and vapors directly into the intake ports downstream of the throttles by means of the equalizer "13" provided with calibrated orifices to which the hoses "14" are connected for proper distribution among cylinders. The oil collected in the separator returns to the pan and hence in circulation.

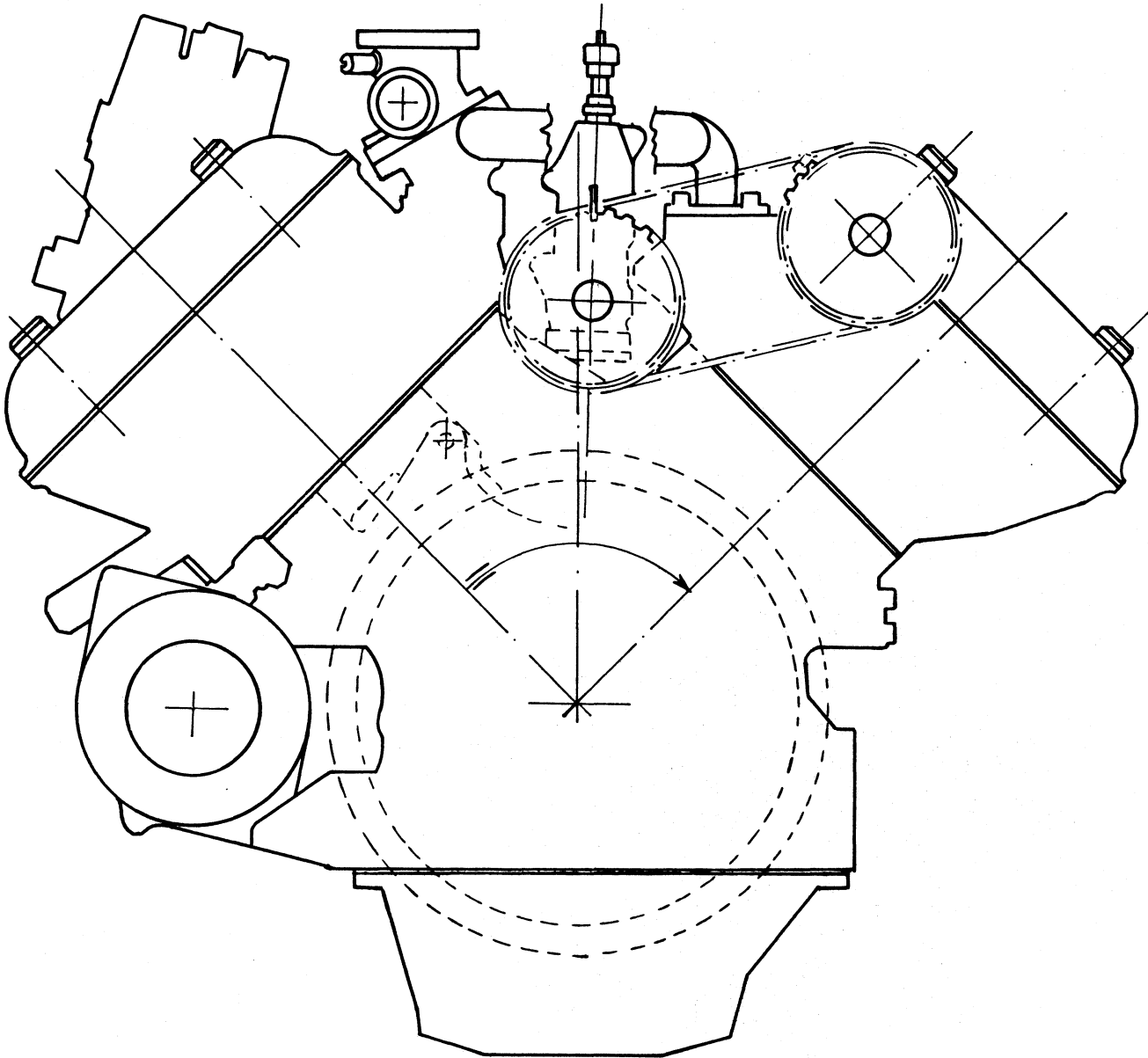
TIMING THE INJECTION PUMP

Bring the piston of cylinder no. 1 at 70 degrees before T.D.C. of the induction stroke by aligning the mark "I" on flywheel with the reference line on rear flange at crankcase right side.

Rotate the injection pump pulley to line up the marks on the pulley and the injection pump.

Refit the drive belt by rotating the pulley in either direction to engage the nearest spline.

With the belt fitted, the reference marks can be out of alignment within a tolerance of about ± 5 mm.

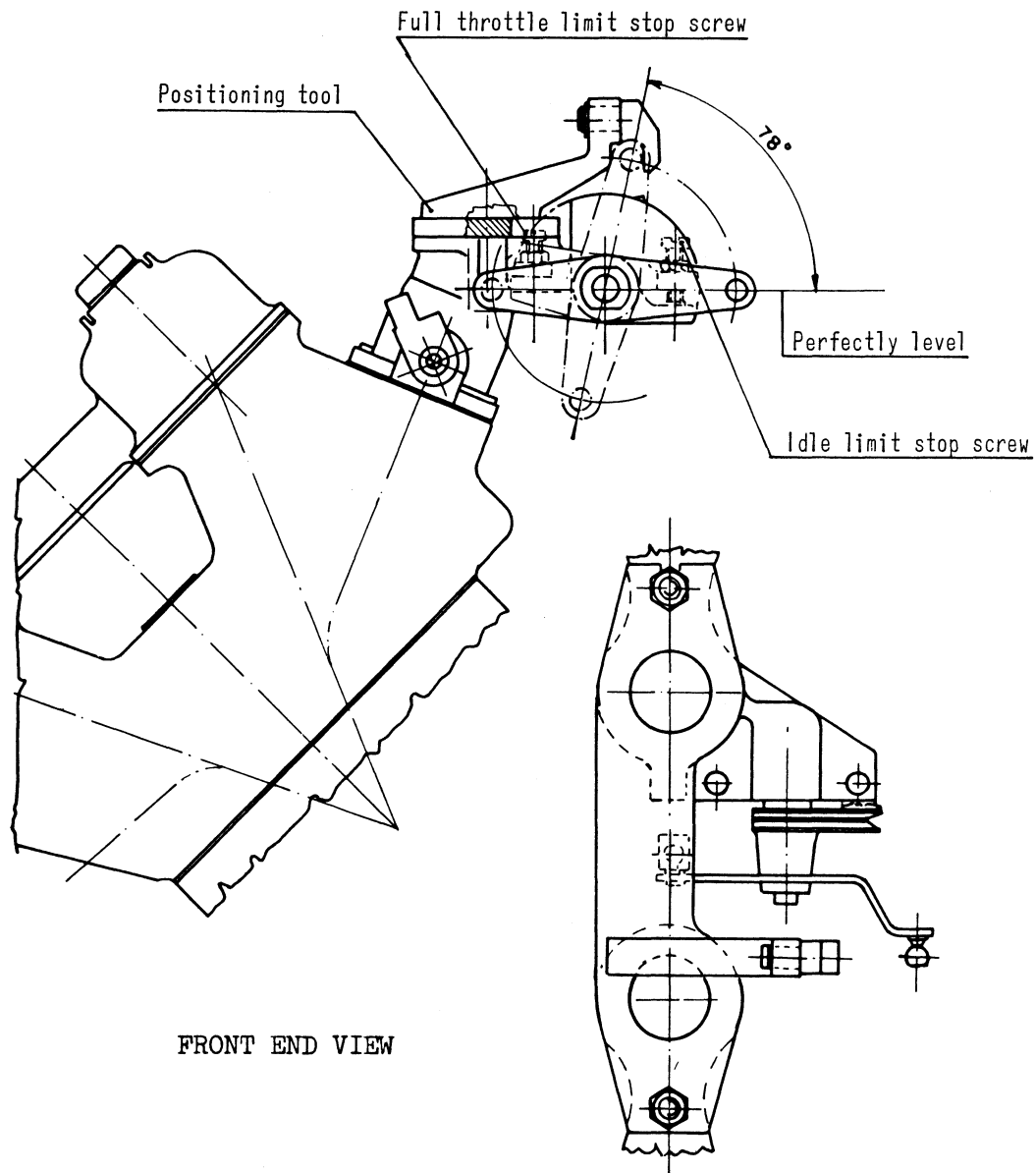


INSTALLING THE ACCELERATOR CONTROL

Install the throttle unit complete with relay crank on the right bank and screw in almost fully the coupling screw so that the rear throttles are set to an opening wider than the front throttles.

Install the complete throttle unit on the left bank and screw in almost fully the coupling screw so that the front throttles are set to an opening wider than the rear throttles.

Mount the heads on cylinder block.



With the special tool, position the crank at idle as shown keeping the ball of the crank as a reference; then adjust the idle limit stop screw and lock it in place. Rotate the crank by 78 degrees and, taking the other ball as reference, adjust the full throttle limit stop screw and lock it in place.

Fit the return spring and the rod connecting relay crank to left bank throttle unit lever set at the length specified on the installation drawing.

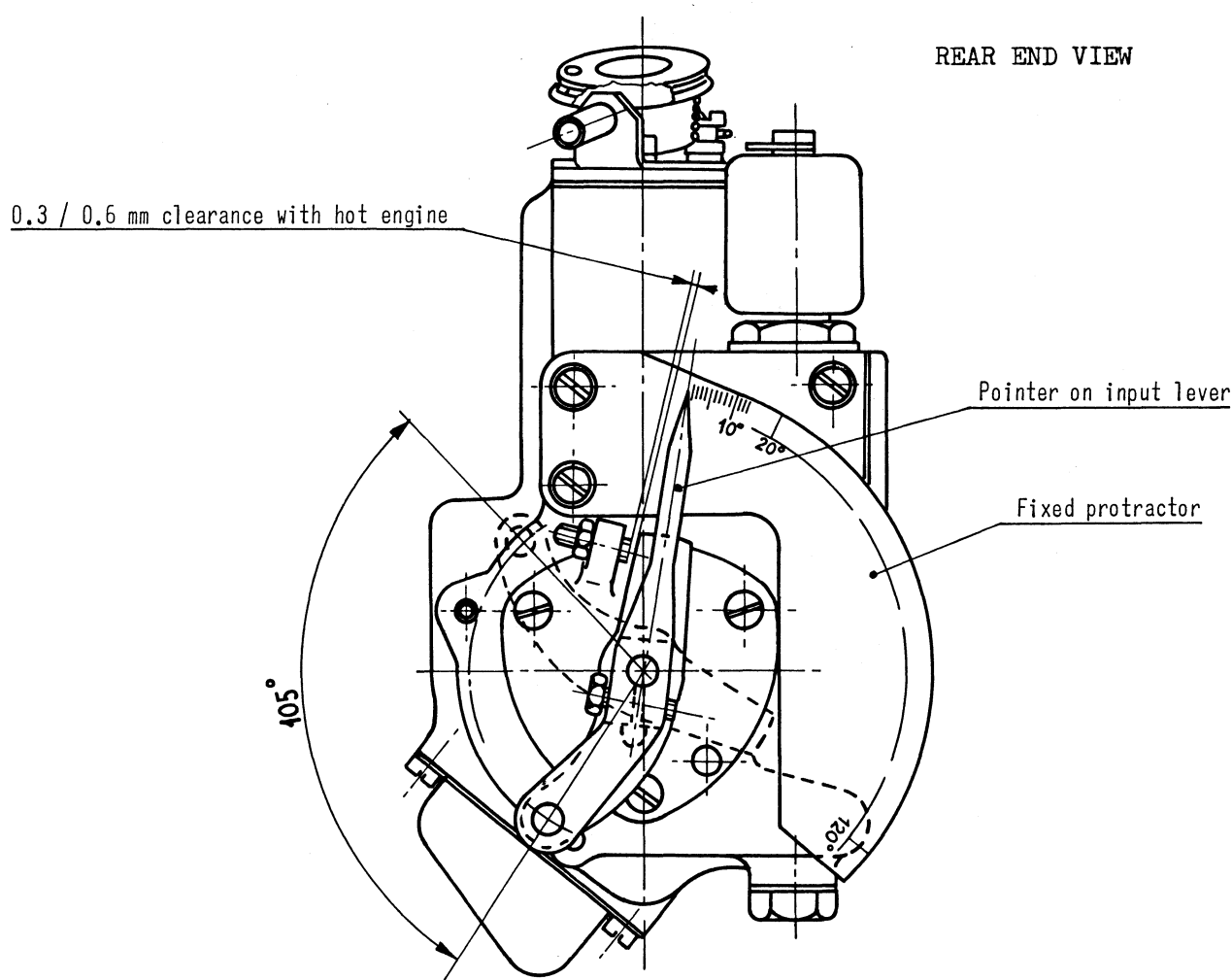
Checking the relationship between throttle
angles and control unit lever angles

This check must be performed after the injection pump has been installed onto the engine.

Fit the dummy actuator to the control unit.

Fit the relay crank-to-control unit rod set at the specified length. Check that clearance between the control unit input lever and its reference screw is 0.3/0.6 mm (the nearer to 0.5 the better) when the relay crank is resting against the idle limit stop: if not so, lengthen or shorten the rod by rotating one of the socket joints at the ends.

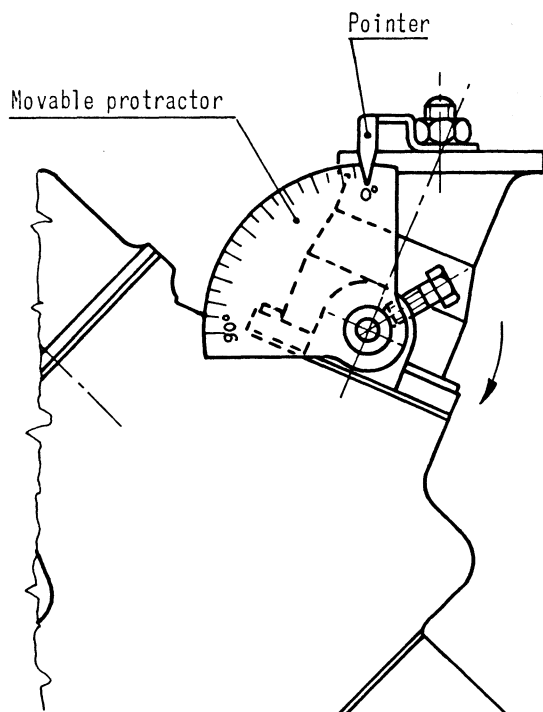
Fit the fixed protractor to the rear end of control unit and the pointer aligned with the zero on the scale.



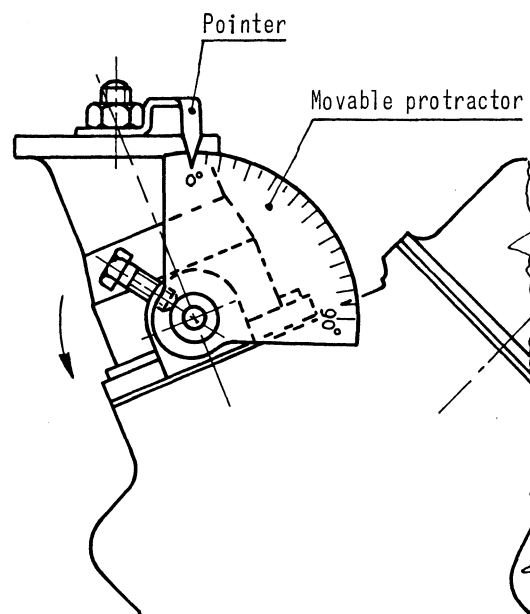
Place the movable protractors on the spindles of rear throttle units and set to zero the pointers when the relay crank is resting against the idle limit stop.

By acting on the special relay crank rotation adjuster, open the throttles to predetermined angles and read the corresponding rotations of control unit lever.

After having so checked the relationship, shorten the crank-to-control unit rod until there is a clearance of 0.90/1.30 mm or 1° to 1° 30'



REAR END VIEW



between the control unit lever and its reference screw, (throttles always closed) (the clearance of 0.3/0.6 mm shall again be checked with hot engine).

Warning

On reconnecting the injection pump solenoids, make sure that connections do not interfere with the air cleaner body.

Check the positioning and alignment of throttles.

To perform this check, the vacuum gauge, tool no. C.2.0014 and the "Synchrotest" flow indicator, tool no. C.2.0019, should be used.

The procedure is as follows:

- Connect the vacuum gauge to the four intake ports of centre cylinders.
- Adjust provisionally the throttles to a minimum opening of about 0.03 mm; then start the engine and, by turning in either direction the idle adjusting screw on the equalizer, keep the engine running even if not smoothly.
- Install the "Synchrotest" onto the no. 7 intake port of the second bank of cylinders and set the "Synchrotest" so that the small cup inside it remains hovering halfway of the column.

α	β	Tolerance on β
1°	5° 30'	$\pm 20'$
2°	10°	
3°	14° 10'	
4°	17° 40'	
5°	21°	
6°	24°	$\pm 1^\circ$
7°	26° 50'	
9°	32°	
12°	38° 30'	
16°	46°	
20°	52° 30'	$\pm 2^\circ$
25°	59° 40'	
32°	68° 10'	
40°	76° 20'	
50°	85° 10'	
65°	95° 30'	
82°	103° 10'	
α = throttle rotation angle β = input lever rotation angle		

- Rest the "Synchrotest" on the other intake ports of the same bank and, observing the positions of the cup, adjust the throttle alignment screw in such a way that the position of the cup is the same for all four ports (average of the first two ports equal to the average of the second two).
- Calibrate the "Synchrotest" at the no. 2 port, then repeat the procedure on the ports of the other bank.
- Make a better alignment of the two banks by placing the "Synchrotest" on each of the eight cylinders with such a calibration as to allow to adjust the throttle alignment by acting on the front rod interconnecting the throttles of the two banks so as to keep the flow indicator readings withing a tolerance of 10/15 mm.
- Adjust the length of rear rod so that the readings of vacuum gauge columns are all aligned at 125/135 mm.

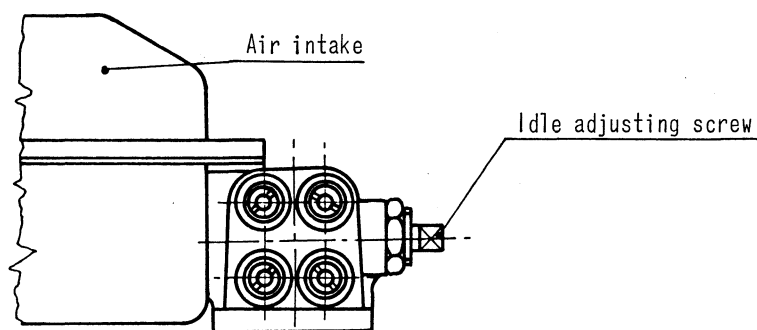
Idle adjustment on bench

Install the engine on the test bench and make connection with the air ducting.

The engine should be run in, at operating temperature (coolant exceeding 70°C) and under no load. With the accelerator fully released (crank against idle limit stop) check that the clearance between input lever and reference screw is 0.3/0.6 mm.; if not so, lengthen or shorten the rod by rotating one of the socket joints (a twisting within $\pm 30^\circ$ from the in - line - position of the sockets of the rod is allowed).

In-car idle adjustment

Disconnect the vacuum gauge and refit the hoses between idle equalizer and the adapters on throttle throats. Check whether the engine is idling smoothly, at not less than 750/800 rpm. If idle is faster but hunting takes place, gradually screw in the adjusting screw on idle equalizer until smooth idle is obtained provided that idle speed does not fall below 800 rpm. If idle speed is slower than specified, gradually unscrew the adjusting screw until the prescribed rpms are obtained.



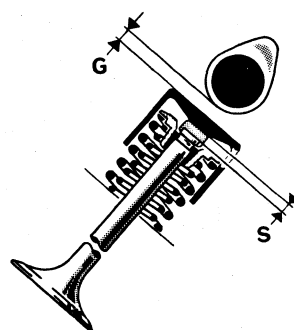
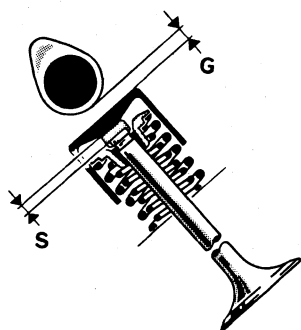
V A L V E G E A R

The V-mounted overhead valves are directly operated by four camshafts, two per bank, acting through oil bath cups.

I n - c a r t e s t s

Valve clearance adjustment

When the engine is cold carefully measure, with a feeler gauge the clearance "G" between the unlobed profile of cams and the valve cup ceiling.



Specified clearance	{	Intake	G = 0.475 to 0.500 mm
		Exhaust	G = 0.525 to 0.550 mm

If the clearance is not as specified, keep a record of the readings taken on the 16 valves. Remove the camshafts and the cups. Replace the adjusting pads of those valves whose clearance does not fall within the limits with new pads having such a thickness "S" as to bring the clearance "G" again within the specified limits.

To facilitate this adjustment the pads are made available in a series of thicknesses ranging from 1.3 to 3.5 mm in increments of .025 mm.

CHECKING OF VALVE OPENING AND CLOSING ANGLES

Clearance (with cold engine) between the unlobed profile of cams and the valve cup ceiling

intake	0.475 to 0.500 mm
exhaust	0.525 to 0.550 mm

Opening of intake valves

lift of cup	0.20 mm
corresponding to an angle, before TDC of .	$18^{\circ} 30' \pm 1^{\circ} 30'$

Closing of intake valves

lift of cup	0.20 mm
corresponding to an angle, after BDC of .	$42^{\circ} 30' \pm 1^{\circ} 30'$

Opening of exhaust valves

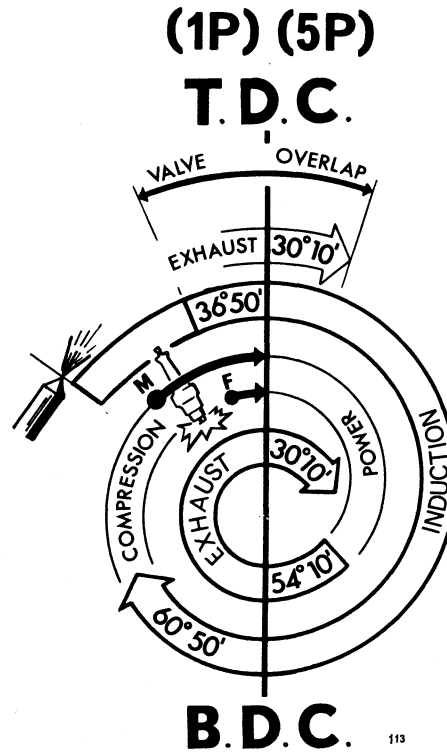
lift of cup	0.15 mm
corresponding to an angle, before BDC of .	$42^{\circ} 30' \pm 1^{\circ} 30'$

Closing of exhaust valves

lift of cup	0.15 mm
corresponding to an angle, after TDC of .	$18^{\circ} 30' \pm 1^{\circ} 30'$

ACTUAL DIAGRAM OF VALVE TIMING ANGLES WITH COLD ENGINE

(clockwise rotation direction of the crankshaft as seen from the front end)



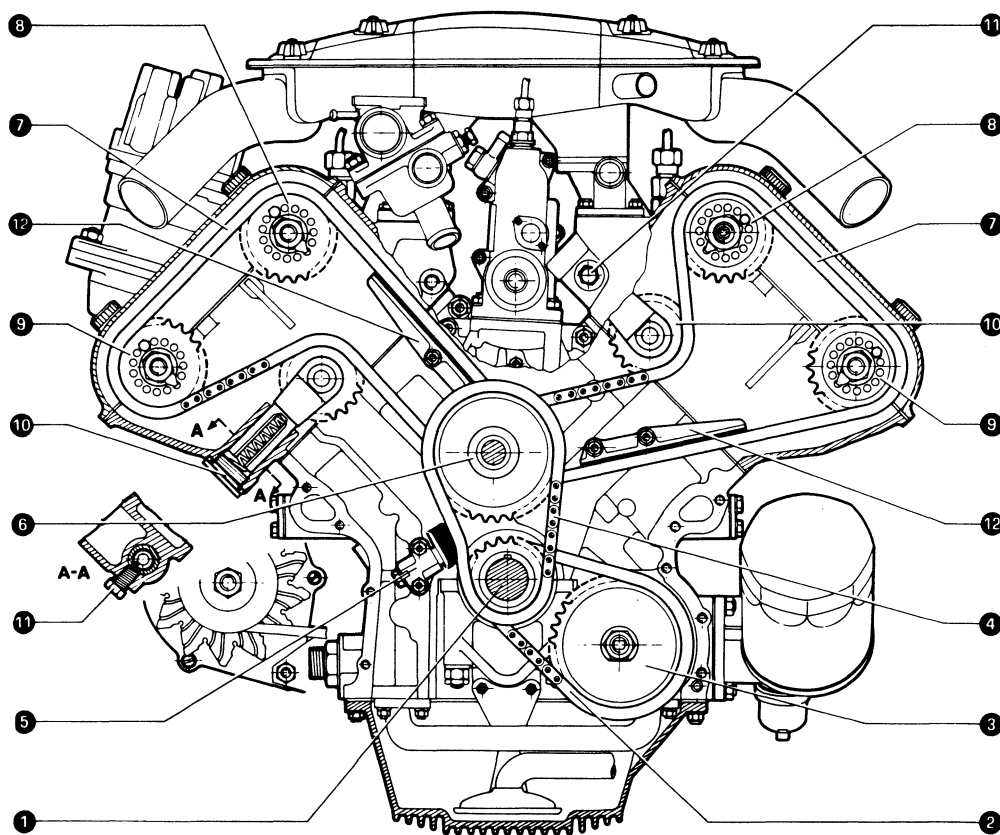
Opening of intake valves (before TDC)	36° 50'
Closing of intake valves (after BDC)	60° 50'
Opening of exhaust valves (before BDC)	54° 10'
Closing of exhaust valves (after TDC)	30° 10'
Induction stroke	277° 40'
Exhaust stroke	264° 20'

Chain tension adjustment

To adjust the tension of the valve timing chains (7) proceed as follows:

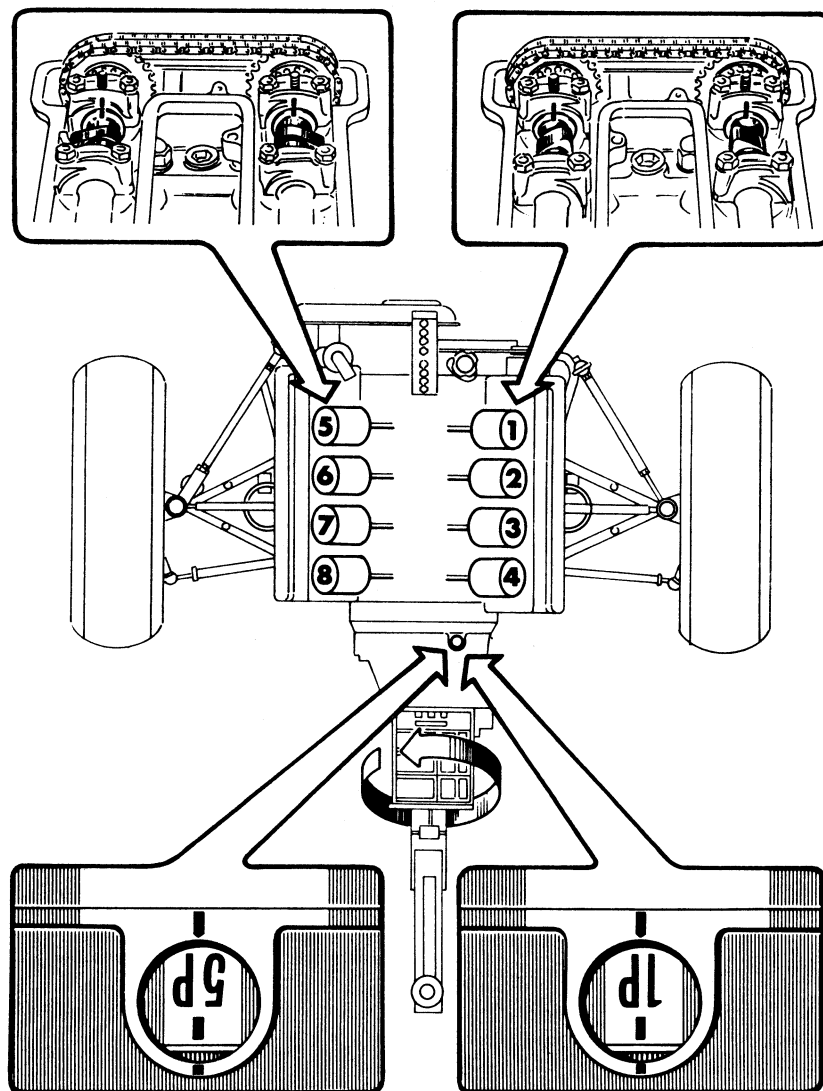
- run engine at idling speed (900/1000 rpm); while performing the following adjustment any revving up of the engine must be absolutely avoided;
- slacken off the setscrews (11) securing the chain tensioners (10); wait a few minutes to allow the tensioner to tighten the chain;
- lock the chain tensioner setscrews (11) firmly.

CAUTION: keep clear from the fan which might start spinning automatically.



- | | |
|--|------------------------------------|
| 1 Crankshaft and oil pump & camshaft driving sprockets | 7 Secondary chains |
| 2 Oil pump chain | 8 Intake valve camshaft sprockets |
| 3 Oil pump sprocket | 9 Exhaust valve camshaft sprockets |
| 4 Primary chain | 10 Chain tensioner |
| 5 Hydraulic tensioner of primary chain | 11 Tensioner setscrew |
| 6 Idle sprockets | 12 Guide |

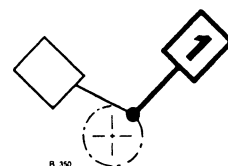
Checking the valve timing



The valve timing is correct when:

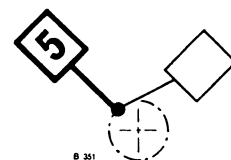
- a) no. 1 (R.H. front) cylinder on compression stroke, the timing mark 1 P cut on the crankshaft pulley is in line with the reference mark on R.H. side of clutch housing and when the timing marks cut in the camshaft front journals are in line with those on the journal bearings.

No.1 cylinder cams must be positioned as shown in the illustration, i.e. pointing inward.



- b) no. 5 (L.H. front) cylinder on compression stroke, the timing mark 5 P cut on the crankshaft pulley is in line with the reference mark on L.H. side of clutch housing and when the timing marks cut in the camshaft front journals are in line with those on the journal bearings.

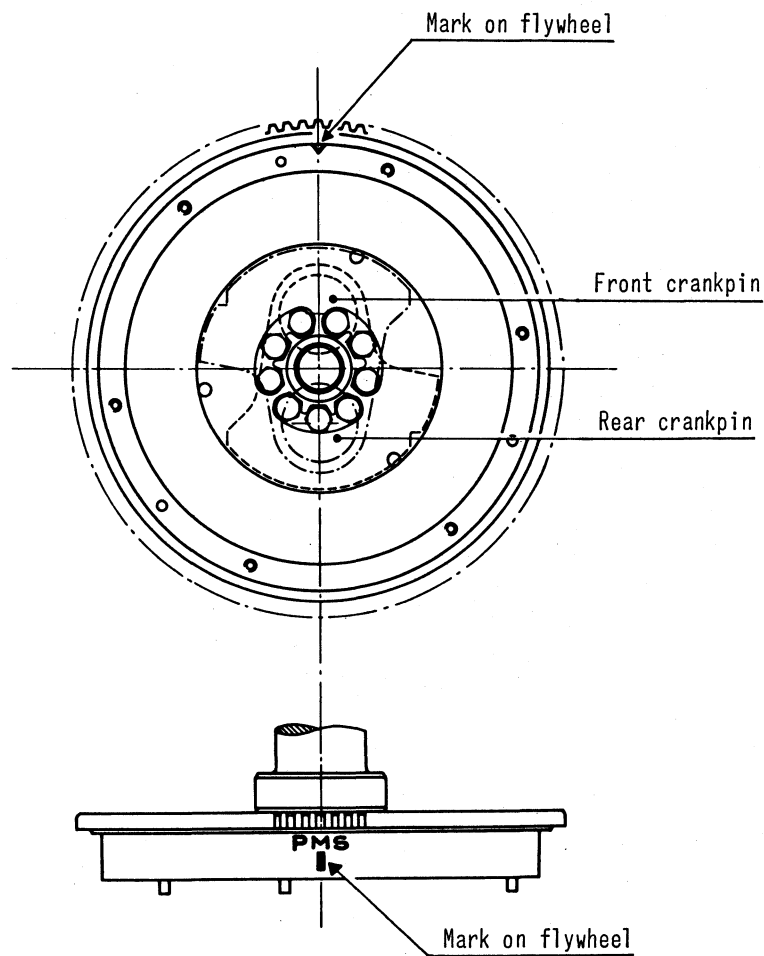
No.5 cylinder cams must be positioned as shown in the illustration, i.e. pointing outward.



B E N C H C H E C K S

Fitting the flywheel to the crankshaft

When fitting the flywheel to the crankshaft, the mark P.M.S. must be aligned with the front crankpin centreline.



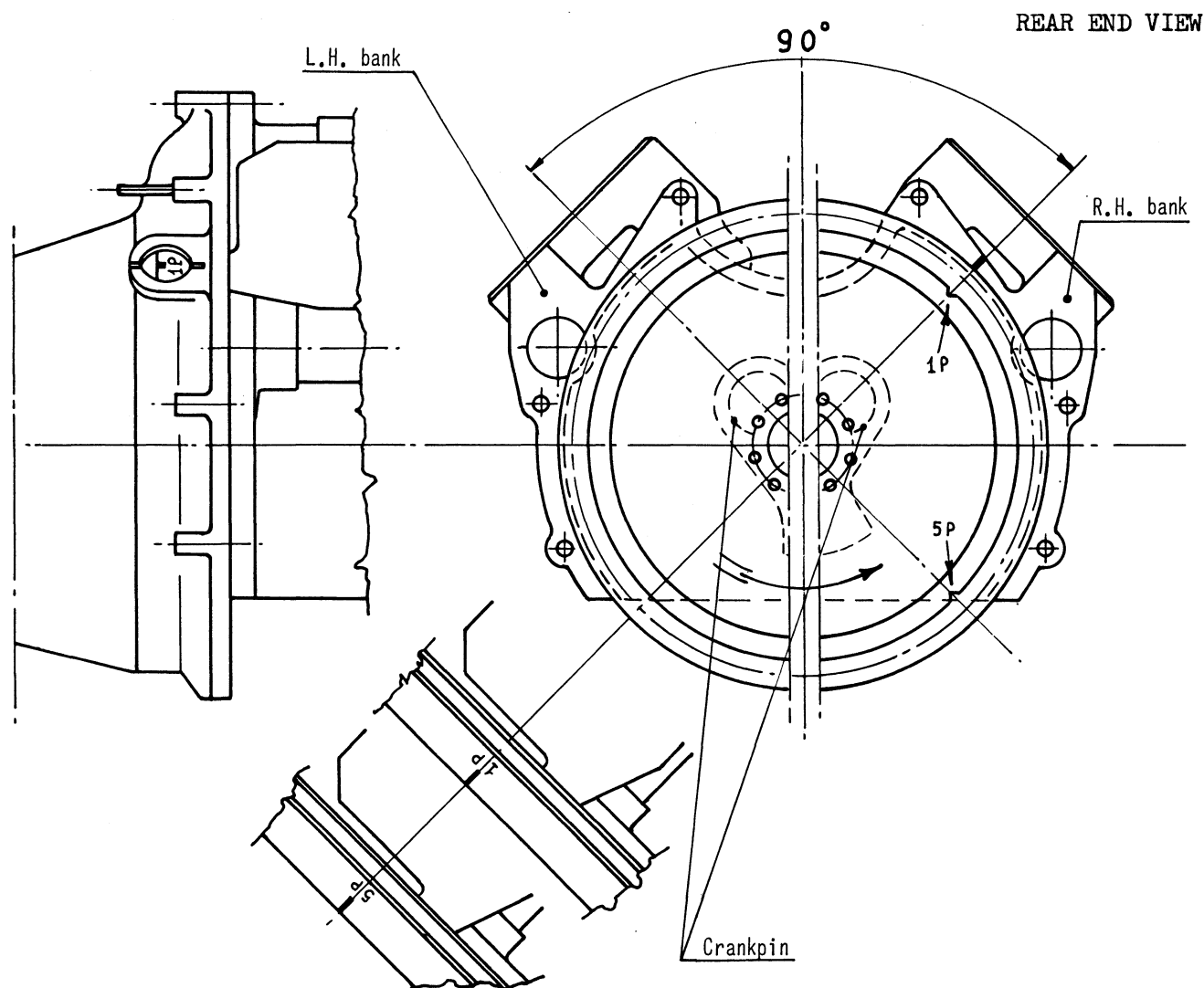
Determining the T.D.C. position of no.1 cylinder piston (front one of R.H. bank)

This position is determined by lining up the mark 1P on the flywheel with that cut in the rear flange on cylinder block R.H. side.

With the gearbox fitted, such a position is determined by aligning the mark 1P cut in the flywheel with that on the R.H. side of clutch housing.

Determining the T.D.C. position of no. 5 cylinder piston (front one L.H. bank)

This position is determined by lining up the mark 5P on the flywheel with that cut in the rear flange on cylinder block R.H. side.



Checking the valve opening and closing angles

Apply the suitable protractor to the cylinder block rear flange; mount with suitable adapters a pair of dial indicators in such a way that the sensing needles are resting on the top of intake and exhaust valves cups of cylinders no.1 and no.5; keeping the clearance between the valve cup and the unlobed profile of cam within the specified limits, take readings of the angles on protractor after the dial indicators have shown a valve lift of 0.20 mm at intake side and 0.15 mm at exhaust side. In this condition protractor readings should be the following:

Opening of intake valves (BTDC)	18° 30' \pm 1° 30'
Closing of exhaust valves (ATDC)	18° 30' \pm 1° 30'
Opening of exhaust valves (BBDC)	42° 30' \pm 1° 30'
Closing of intake valves (ABDC)	42° 30' \pm 1° 30'

Actual valve timing diagram with cold engine

Such a diagram is obtained by the checks carried out as directed above.

The arrow shows the rotation direction of the crankshaft as seen from the front end.

Angle values:

Induction stroke	277° 40'
Exhaust stroke	264° 20'
Opening of intake valve (before TDC)	36° 50'
Opening of exhaust valve (before BDC)	54° 10'
Closing of intake valve (after BDC)	60° 50'
Closing of exhaust valve (after TDC)	30° 10'

I G N I T I O N

The system is of the capacitor discharge, transistorized, breaker type, with a centrifugal advance governor.

Firing order: 1 - 5 - 4 - 2 - 6 - 3 - 7 - 8

The ignition system consists of two separate circuits "A" and "B"; each circuit, provided with separate coil and transistor control unit, connects to the relevant contact-breaker in the distributor.

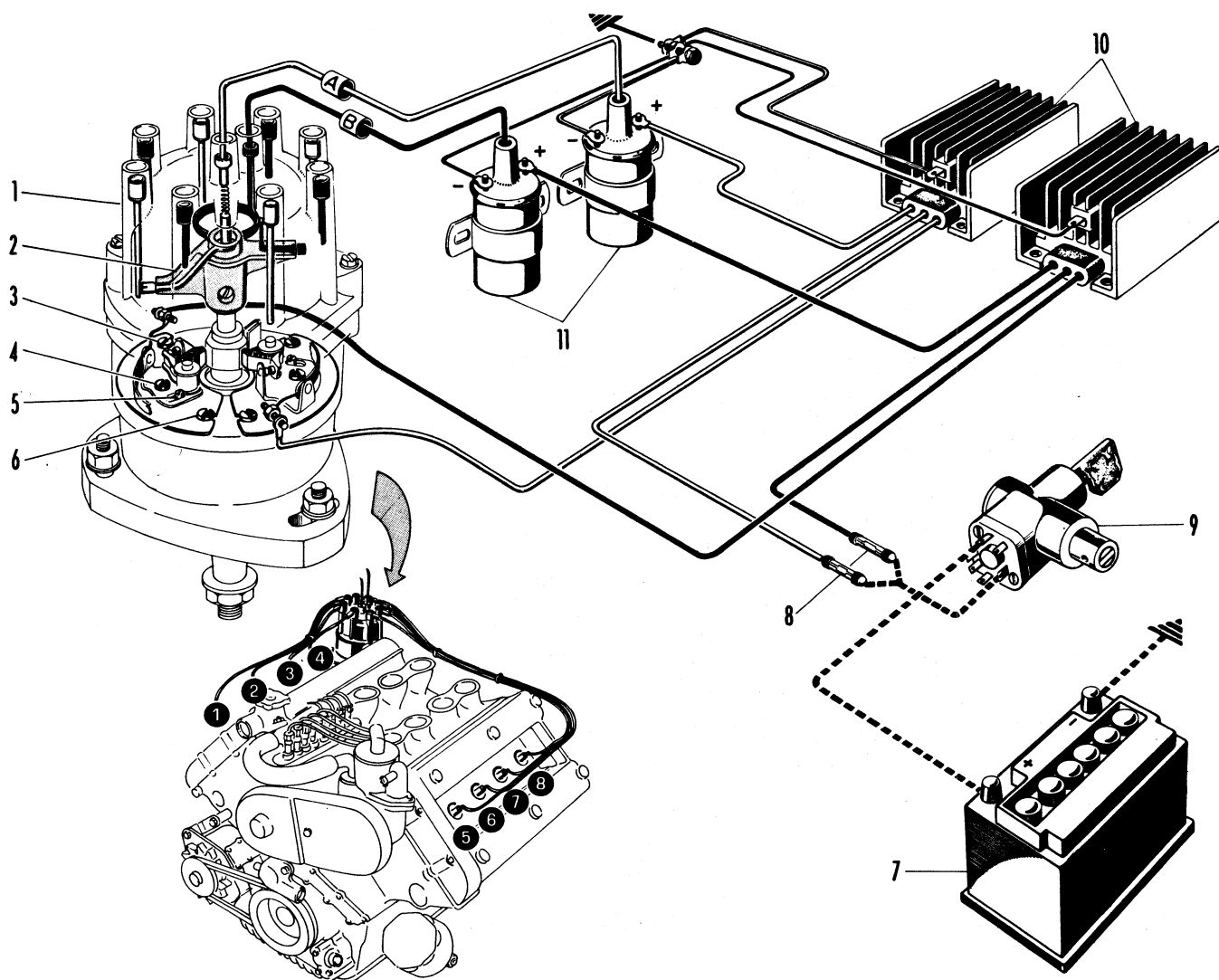
A single rotor, keyed to the distributor shaft, feeds with the lower arm the spark plugs of the "A" circuit (cylinders no. 1 - 4 - 6 - 7) and with the upper arm the spark plugs of the "B" circuit (yellow mark-cylinders no. 2 - 3 - 5 - 8).

WARNING - Because of its special characteristics, before performing any repair work on the ignition system the following should be kept in mind.

- Never connect condensers, radio interference suppressor, timing lights, etc., to the coil positive terminal.
- Make sure the protective cap is properly fitted to the positive terminal so that accidental contacts and grounds are prevented.
- The coil cannot be replaced with a standard coil nor be connected with the conventional hook up.
- Works such as disconnecting or connecting wires of the ignition system shall always be performed with the ignition circuit off.
- Before using a quick charger, disconnect the battery from the car's wiring harness.
- Never use a quick charger as a battery booster.
- When reconnecting the battery, check connections for proper polarity (negative terminal grounded)

Failure to comply with these directions will seriously damage or even destroy the transistor control units.

I G N I T I O N S Y S T E M



- | | | | |
|-----|--------------------------------|----|---------------------------|
| 1 | Coil | 7 | Battery |
| 2 | Rotor | 8 | Fuses |
| 3-6 | Breaker plate attaching screw | 9 | Ignition switch-antitheft |
| 4 | Stationary contact plate screw | 10 | Transistor control unit |
| 5 | Offset pin | 11 | Ignition coils |

D i s t r i b u t o r

Check that points gap of each contact-breaker is:

$$S = 0.32 \text{ to } 0.38 \text{ mm}$$

if necessary, adjust the gap as follows:

- slacken the screw "1";
- rotate the offset pin "2" until the specified gap is obtained; lock screw "1".

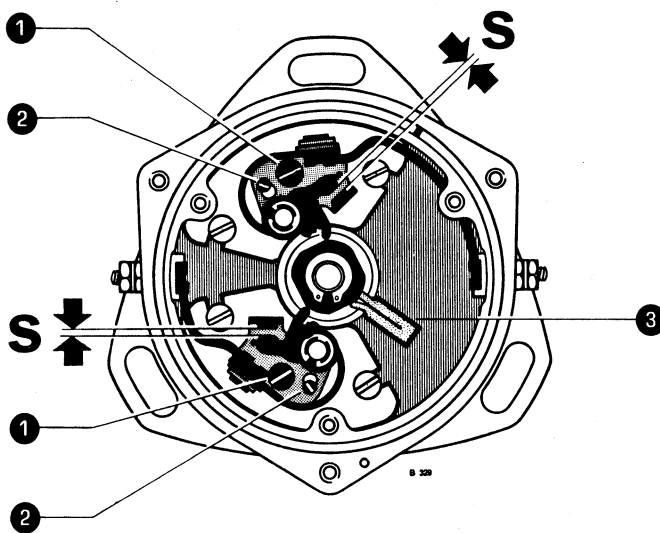
Soak the felt wick "3" with oil.

Check the inside of the distributor cap for any sign of moisture, carbon deposits or cracks. Check also the carbon brush for free movement in its housing and that the spring action is effective.

Check that the rotor is securely keyed to the shaft; if necessary, fix the keying bolt with a suitable cement.

Should this bolt be removed, mark the rotor and the shaft for proper positioning on reassembly.

When replacing the contact-breakers, it is better to remove the distributor from support, properly countermarked for reassembly; after the set of contact-breakers has been renewed the distributor must be tested on bench for proper timing of contact points.



CHECKING THE IGNITION TIMING

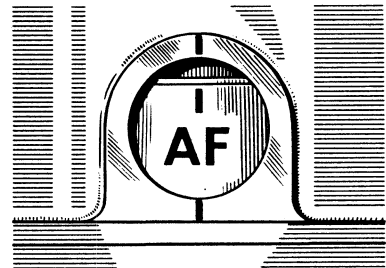
To check the ignition timing, proceed as follows:

- 1 - Rotate the crankshaft to bring no. 1 piston (R.H. front) into compression stroke, that is with both valves closed.
- 2 - By slightly rotating the crankshaft, bring the fixed advance mark AF cut in the flywheel into line with the reference mark on the inspection hole in the R.H. side of clutch housing.
- 3 - Remove the distributor cap and check that the points for cylinder no.1 (circuit "A") begin to open when the engine is cranked further in its normal direction of rotation.

A more accurate check can be made with a stroboscopic gun as follows:

connect

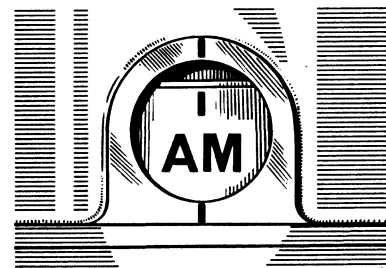
- the high voltage cable of stroboscopic gun to the spark plug of cylinder no. 1;
- the low voltage cable to one of fusebox terminals. Do not make connection with the coil positive terminal.



Static advance
 $5^{\circ} \pm 1^{\circ}$ BTDC

Run the engine at about 4,600 rpm and direct the light from the stroboscopic gun onto the inspection hole; if the timing is correct, the AM (maximum advance) stamped on the pulley will be seen in line with the reference mark on the inspection hole in the R.H. side of clutch housing.

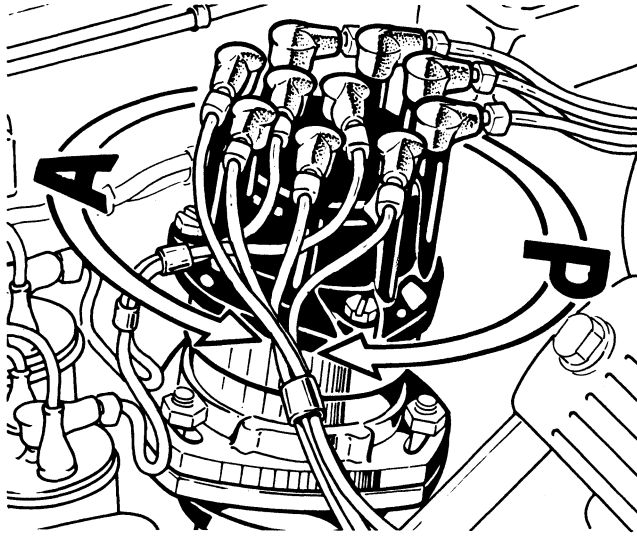
If it is found that the maximum advance is greater or less than the prescribed value, adjust the fixed advance accordingly, as it is better to have correct timing at high speeds.



Maximum advance
 $30^{\circ} + 0^{\circ}$
 $- 3^{\circ}$ at 4600 rpm

TIMING ADJUSTMENT

If the timing requires adjustment proceed as follows:



- unscrew the nuts securing distributor to support;
- rotate the distributor body anti-clockwise or clockwise according to whether it is necessary to advance "A" or retard "P" the ignition setting;
- retighten the nuts taking care not to move the distributor body.

On completion of the adjustment re-check timing as previously outlined.

Timing after removal of distributor from engine

Before removing the distributor, mark its position with respect to the support.

To re-set the timing after the distributor has been removed from the engine proceed as follows:

- rotate the crankshaft to bring no. 1 piston to the compression stroke, that is with both valves closed;
- by slightly rotating the crankshaft, bring the fixed advance mark AF into line with the reference mark on the inspection hole in the R.H. side of clutch housing;
- remove the distributor cap and rotate the drive shaft by hand to bring the lower rotor arm (circuit "A") in line with the reference mark on distributor body (contact for plug of no. 1 cylinder);
- make sure that in this position the contact-breaker points are about to open;
- then without disturbing the drive shaft, mount the distributor on its support according to the reference marks previously made and tighten the nuts to secure the distributor.

Check timing and adjust, if necessary, as previously directed.

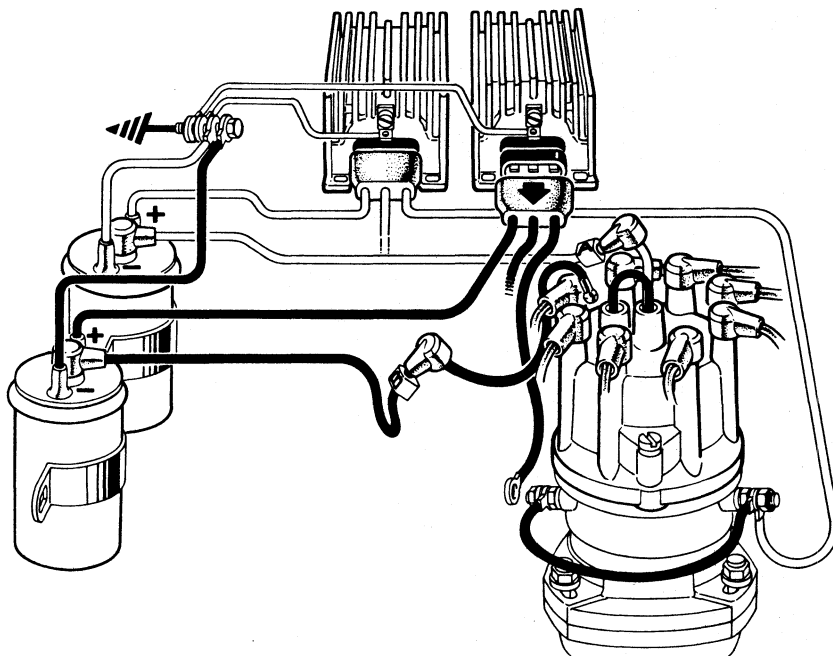
Emergency measures in the event a control unit fails to operate

Emergency connection

If either control unit (or even either coils) fails to operate and

replacement parts are not available, the engine may notwithstanding be set in motion by carrying out the following:

- trace the defective unit by disconnecting, with the ignition switch in off position, the connector from either of the control units then trying to start the engine;
- disconnect the connector of the control unit which proves faulty;
- remove from the distributor cap the wire coming from the coil of the defective control unit and connect a jumper as shown making certain it stays securely in place and works properly.



- connect a jumper across the terminals of the contact breakers as shown (in the diagram a fault in the control unit "B" is simulated and the hook up accordingly arranged is illustrated).

CAUTION

It is essential to limit the operation of the ignition system in this condition to the minimum, positively avoiding to exceed 5000 rpm. to prevent damaging the operating control unit.

SPARK PLUGS: LODGE 2 HL

The spark plugs are of the type with four points and a central electrode.

The only maintenance required is occasional cleaning with a brush of the central and earth electrodes.

No routine adjustment is necessary of the gap between the electrode and points.

For further details about the transistorized ignition system refer to the publication no. 1643.

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COOLING SYSTEM

The cooling circuit is of the sealed type with a compensating reservoir.

The coolant, kept in circulation by the pump 16, cools down the cylinder head and sleeves then flows, through return lines, to the thermostatic valve 5. Hence, according to the position of the valve spool, the coolant is sucked by the pump either from the thermostatic valve or the radiator outlet line.

The latter condition occurs when the thermostatic valve spool, according to the high temperature of coolant, moves to such a position as to allow the coolant to flow from engine to radiator through the upper outlet of thermostatic valve.

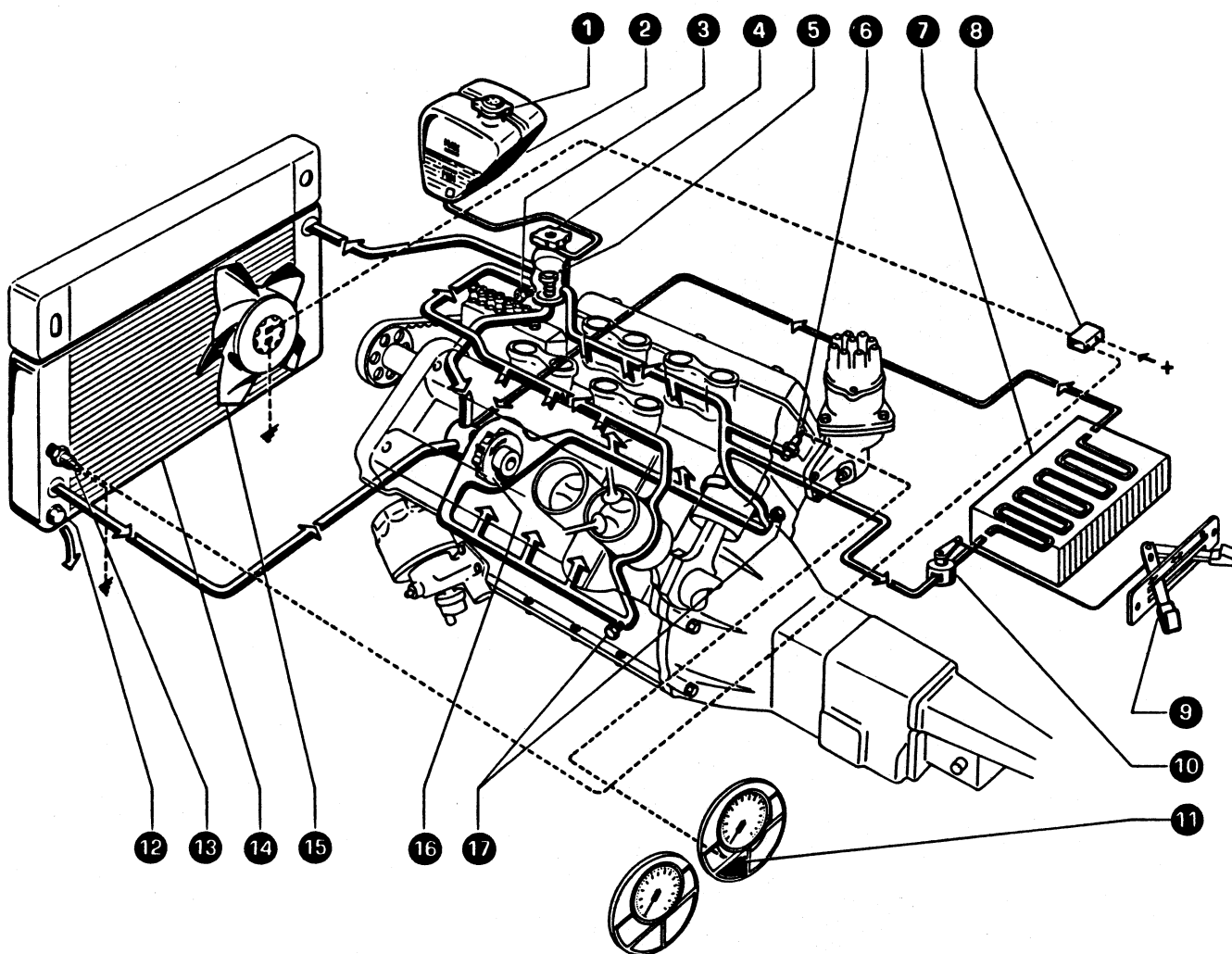
By gradually controlling the coolant flow, the thermostatic valve automatically regulates the engine temperature.

The electric fan, which automatically cuts in or out by means of the relay 8 in turn energized by the thermal switch 13, prevents engine overheating when ram ventilation of radiator is not enough for proper cooling.

Coolant temperature is indicated by the thermometer 11 via its sender 6.

The lever 9, by controlling the temperature of the heater core, enables to regulate as desired the temperature inside the car.

COOLING SYSTEM DIAGRAM



- | | |
|------------------------------------|--------------------------------|
| 1 Reservoir filler cap | 10 Heater valve |
| 2 Compensating reservoir | 11 Water thermometer |
| 3 Air bleed screw | 12 Radiator drain plug |
| 4 Filler cap on thermostatic valve | 13 Electric fan thermal switch |
| 5 Thermostatic valve | 14 Radiator |
| 6 Water thermometer sender | 15 Electric fan |
| 7 Heater | 16 Pump |
| 8 Electric fan relay | 17 Drain plug |
| 9 Temperature control lever | |

COOLING SYSTEM MAINTENANCE

To ensure the efficient operation of the cooling system, the following procedure should be observed.

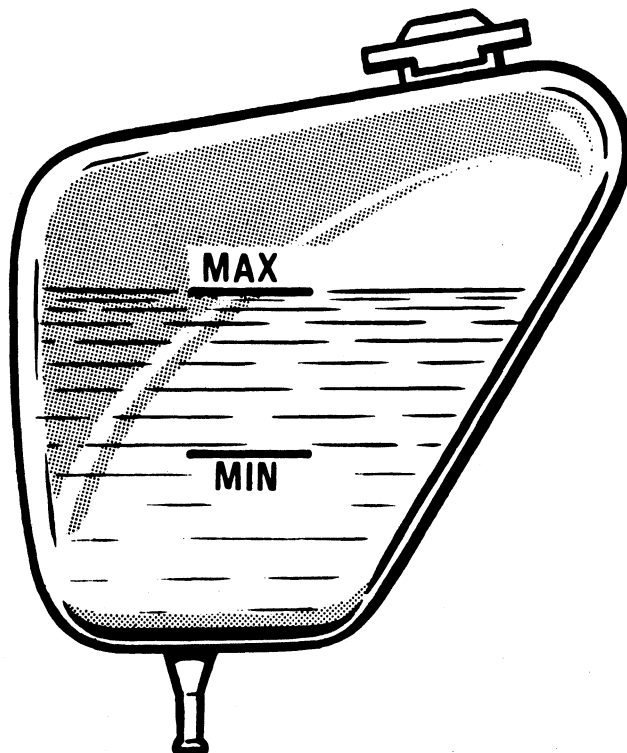
Occasionally, check level of coolant in the reservoir: this should be done exclusively with a cold engine as with a hot engine the level may increase remarkably, even after stopping the engine.

The level of mixture in the reservoir should never fall below the "Min" nor exceed the "Max".

To top up use Alfa Romeo Coolant Mixture, drawn from suitable containers available from Alfa Romeo Service Stations, to be added to the compensating reservoir only.

If too frequent a topping up is required, have the cooling system checked by an Authorized Workshop.

Should sudden and excessive leaks be experienced from the system, the use of fresh water is allowed provided that the specified mixture is restored and trouble remedied as soon as possible by an Authorized Workshop.



C O O L I N G C I R C U I T

Warning

Never remove radiator cap unless absolutely necessary; in any case, to avoid severe injuries, wait that the liquid is cooled down to outside temperature.

Changing the coolant mixture

Every 18,750 mi (30,000 Kms), or once a year whichever comes first, get the coolant mixture renewed by an Alfa Romeo Service Station after the circuit has been flushed with a suitable descaling compound.

Draining and replenishing the system

Proceed as follows: (refer to the illustration on page 32):

Draining:

- Remove filler cap. 4.
- Unscrew the radiator drain plug 12 and the air bleed screw 3.
- Turn on the heater valve 10.
- Remove the drain plugs 17 from crankcase; let liquid drain off and empty the reservoir 2 by detaching the pipe from the cap 4.

Reinstall drain plugs 17 and 12 and reconnect the pipe to the cap.

Replenishing:

- Remove filler caps and turn on the heater valve.
- Open the air bleed screw 3.
- Pour coolant mixture through filler port until coolant escapes from bleed screw 3.
- With the bleed screw 3 opened and no cap on filler port of thermostatic valve, start the engine and keep it running for a few seconds in order to bleed air completely.
- Close the bleed screw 3.
- Add mixture to thermostatic valve filler port until full.
- Add mixture also to reservoir until "Max" level is reached.
- Put caps on reservoir and thermostatic valve filler ports.

I M P O R T A N T N O T E

The Alfa Romeo Coolant Mixture gives full protection against freezing down to -20°C .

In places where the temperature falls below -20°C ., the antifreeze mixture can be made stronger by varying its concentration.

It is recommended that this operation should be entrusted to an authorized Service Station.

E L E C T R I C F A N

The electric fan starts operating automatically when the coolant reaches a temperature of $90-95^{\circ}\text{C}$.

In the event the temperature indicated by the thermometer 11 would exceed the above said values, have the cooling system checked by an Authorized Workshops: specifically, test the electric fan for proper cut-in temperature; if it is not correct, check for a faulty thermostatic valve 5.

ELECTRICAL EQUIPMENT

Voltage 12 V

Battery 64 Ah

	B O S C H
Alternator	K 1 - 14 V 55 A 20
Regulator	AD 1/14 V
Starter motor	GF - 12 V 1 PS
Coils	ZS 7/9 C 8
Transistor control units	BHKZ 12 V
Distributor MARELLI S 127 C	---
Windscreen wiper, two-speed	WS 4911 AR 2 A (O)

Bulb's wattage

High beams (inner headlights) 55 iodine

Low beams (outer headlights) 55 iodine

Reversing light 25

Tail direction indicators 25

Stop lights 21

Front parking lights and direction indicators 5/21

License plate light 5

Engine compartment light 5

Courtesy light on facia panel 5

Courtesy light in rearview mirror 5

Boot light 5

Tail parking light	5
Side direction indicator	4
Courtesy light (on pillars)	4
Control panel light	3
Courtesy light on doors	3
Instrument light	3
Tell tale for parking light	3
Tell tale for high beams	3
Tell tale for handbrake	3
Tell tale for fuel reserve	3
Tell tale for blower	3
Tell tale for low fuel pressure	3
Tell tale for dual brake system and brake fluid level . .	1.2
Tell tale for heated rear window	1.2
Tell tale for direction indicators	1.2

TIGHTENING TORQUE SPECIFICATIONS

ENGINE - GEARBOX UNIT

Cylinder head nuts *	Inspection	when cold
		when hot
	After repairing	when cold
		when hot
		when cold

Kgm.	Manner of tightening
7.7 to 7.9	Slacken, in proper sequence, the nuts by one turn and torque with lube between washer and nut. Before slackening the nuts, partially drain coolant to prevent it from creeping along the stud shank.
8.1 to 8.2	Warm up the engine and when hot retighten without unscrewing
7.7 to 7.9	Retighten with lube
8.1 to 8.2	Warm up the engine by actually driving the car and when hot retighten without unscrewing
7.7 to 7.9	After tested the car, slacken, when cold and in proper sequence, the nuts by one and one half turn and torque with lube between washer and nut

* WARNING: In case of any repair work involving the removal of cylinder head, the gasket must be renewed at all times.

	Kgm	Manner of tightening
Spark plugs	2.5 to 3.5	With graphite grease, when cold
Nuts of the camshaft caps	2 to 2.25	i n o i l
Nuts of the connecting rod caps	4 to 4.25	" "
Nuts of main bearing caps	6 to 6.25	" "
Screws of flywheel on crankshaft	5.25 to 5.5	" "
Oil drain plug on sump	4 to 4.5	" "
Nut of damper	14	" "
Nuts of injectors	2.8 to 3.2	" "
Nut of coolant pump impeller	4 to 4.5	" "
Nut of alternator	3.5 to 5	d r y
Nuts securing pedal bracket to brake servo until	1.2 to 1.5	"
Nut of gearbox mainshaft yoke	14 to 16	"
Nuts of gearbox half-casings	2 to 2.5	"
Nuts of gearbox front flange	2 to 2.5	"
Nuts of gearbox rear cover	2 to 2.5	"
Screws of gear lever swivel bracket	2 to 2.5	"
Screws of reverse gear cover	2 to 2.5	"
Screws of gearbox fork guides	0.8 to 1.2	"
Setscrews of reverse gear spindle	2 to 2.5	"
Bolts connecting sliding yoke to front prop. shaft yoke	4.85 to 5.35	"

FRONT FRAME

Bolts securing lower wishbone shaft to cross-member
(to tighten these nuts use tool A.5.0161 and torque to 5.2/5.5
Kgm).

Nut securing shock absorber to suspension arms

Screws securing upper wishbone front arm to body

Bolts securing upper wishbone front arm to rear arm

Bolt securing upper wishbone rear arm to body

Nuts securing steering arm to steering knuckle

Nut securing upper ball joint of rear arm to steering knuckle . .

Nuts securing lower ball joint to wishbone

Nut securing lower ball joint to steering knuckle

Screws securing calipers to steering knuckles

Nuts securing splash shields to steering knuckles

Nuts securing wheels and brake discs

Nut securing steering arm to box output shaft

Nut securing steering wheel to column

Screws securing steering box cover

Bolts securing steering box to body

Bolts securing crank bracket & steering lock to body

Nuts securing side and track rod ball joint

Kgm	Manner of tightening
5.6 to 5.9	d r y
8.2 to 9.2	"
2.2 to 2.75	"
4 to 4.5	"
11 to 13.65	"
4 to 4.5	"
7.5 to 8.5	"
8.2 to 9.2	"
7.5 to 8.5	"
7.5 to 8.5	"
0.8 to 1	"
6 to 8	"
12.5 to 14	"
5 to 5.5	"
2.3 to 2.5	"
5.12 to 5.45	"
4.4 to 5.45	"
4.8 to 5.5	"

REAR FRAME

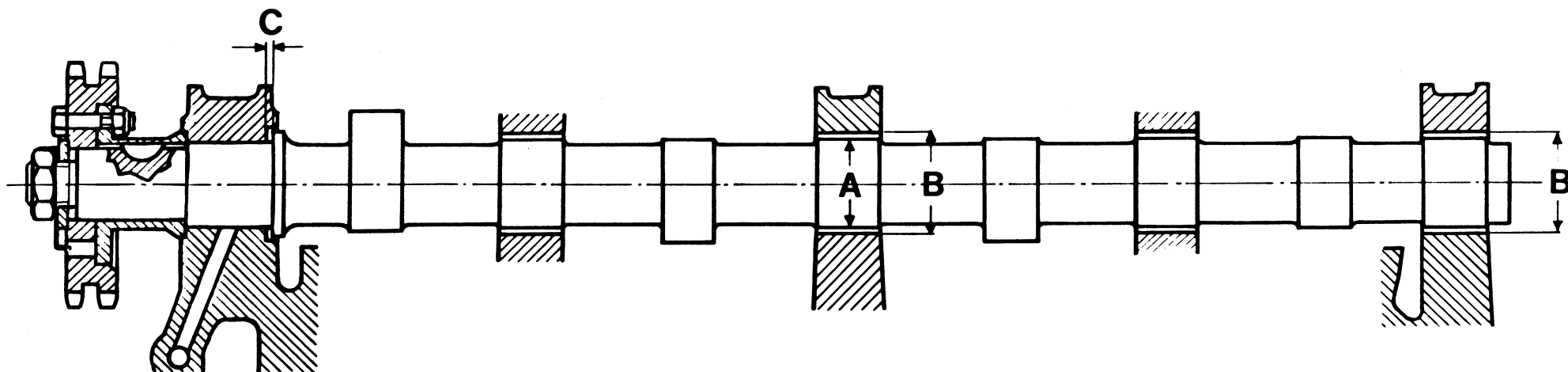
Screws securing ring gear to differential case	6.3 to 6.7	d r y
Ringnut securing yoke on final drive pinion shaft	15 to 16	"
Screw securing rear brake caliper to bracket	5.5 to 6.5	"
Nuts securing caliper bracket to bearing housing	4.8 to 5.5	"
Nuts securing axle tubes to differential	2.5 to 2.8	"
Ringnut securing axle shaft bearing	19 to 20	"
 <u>"A T E" BRAKES</u>		
Bleed screw	0.2 to 0.35	"
Caliper joining bolt	2.9 to 3.4	"
Inlet fitting to caliper	<div> <div>with gasket . . .</div> <div>without gasket .</div> </div>	<div>0.8 to 1.1</div> <div>1 to 1.5</div>

M A J O R I N S P E C T I O N S P E C I F I C A T I O N S

All dimensions, unless otherwise stated, are in millimeters

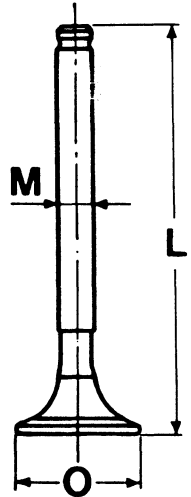
Camshafts

Diameter of journals	A = 26.959 to 26.980
Diameter of journal bearings	B = 27.000 to 27.033
Clearance between journals and bearings	B-A = 0.020 to 0.074
End play of camshaft in thrust bearing	C = 0.065 to 0.182



Valves and valve guides

VALVES		I N T A K E		E X H A U S T (sodium cooled)
		LIVIA H	ATE	ATE
	Diameter of valve poppet . O	36.85 to 37	36.85 to 37	32.35 to 32.5
	Diameter of valve stem . . M	8.872 to 8.987	8.972 to 8.987	8.935 to 8.960
	Total length L	104.85	104.85	107.57 to 107.82



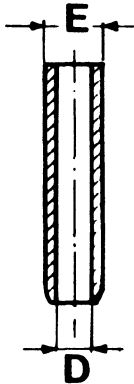
N.B.: ATE - LIVIA intake valves are alternative supply.

Valve guide	Outside diameter with guide removed E =	14.033 to 14.044
	Inside diameter with guide assembled in cylinder head D =	9.000 to 9.015

Projection of intake valve guides from their recesses in cylinder head 13.800 to 14.000

Projection of exhaust valve guides from their recesses in cylinder head 16.800 to 17.000

Clearance between guide assembled in cylinder head and valve stem	intake . . .	0.013 to 0.043
	exhaust . . .	0.040 to 0.080



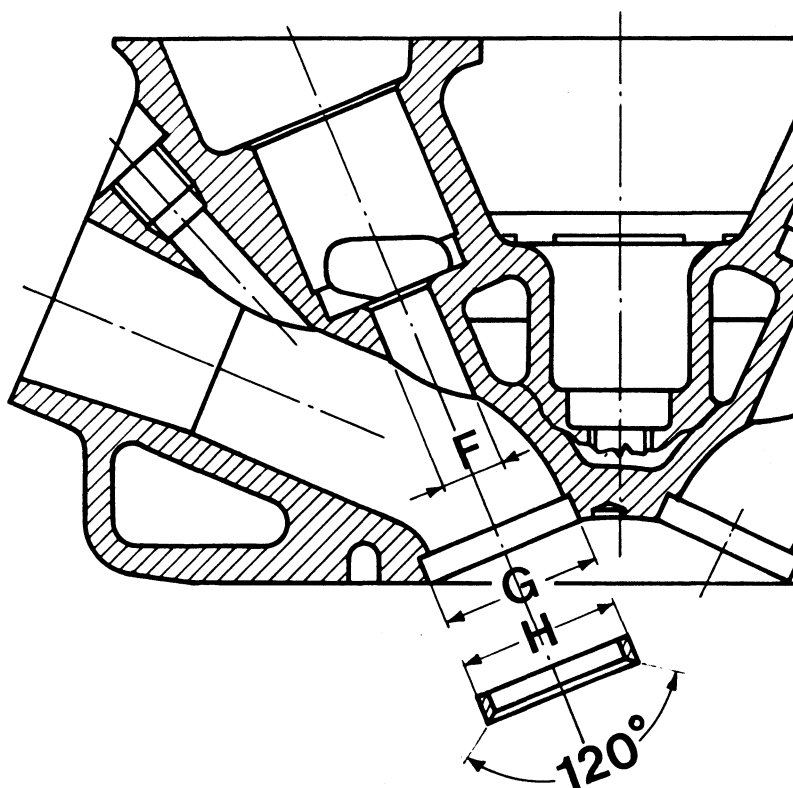
Valve seats

Diameter of valve guide seat in cylinder head . F = 13.990 to 14.018

Interference between seat and valve guide 0.054 to 0.015

	Intake	Exhaust
Outside diameter of the valve seat insert H =	37.565 to 37.600	33.065 to 33.100
Diameter of recesses in the cylinder head for valve seat insert G =	37.500 to 37.525	33.000 to 33.025

Interference between valve seat insert and recesses in cylinder head 0.040 to 0.100

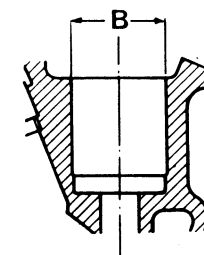
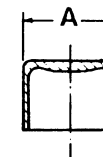


V a l v e c u p s

Diameter of cup A = { standard 34.973 to 34.989
oversized 35.173 to 35.189

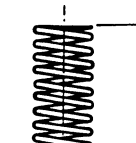
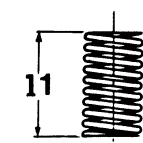
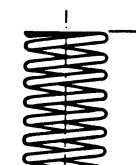
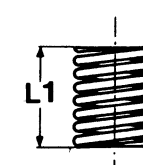
Diameter of cup seat in cylinder head B = { standard 35.000 to 35.025
oversized 35.200 to 35.225

Clearance between seat and cup 0.011 to 0.052



V a l v e s p r i n g s

L e n g t h		Test load
f r e e	under test load	
Inner spring l =	46.50 47.35 47.00 51.30 52.80 52.00	l1 = 26 L1 = 27.5
Outer spring L =		22.24 to 23.16 Kg. 35.67 to 37.13 Kg. 35.87 to 37.33 Kg.



Connecting rods

Length between ϕ of big end and ϕ of small end of connecting rod	D =	129.955 to 130.045
Inside diameter of the big end of connecting rod	E =	48.158 to 48.171
Inside diameter of bushing in the small end of rod	C =	22.005 to 22.015
Thickness of connecting rod bearings . .	F =	1.566 to 1.574
Radial clearance between crankpins and bearing for big end of connecting rod		0.025 to 0.063
Maximum out of parallelism between ϕ of big end hole and ϕ of small end hole		0.078

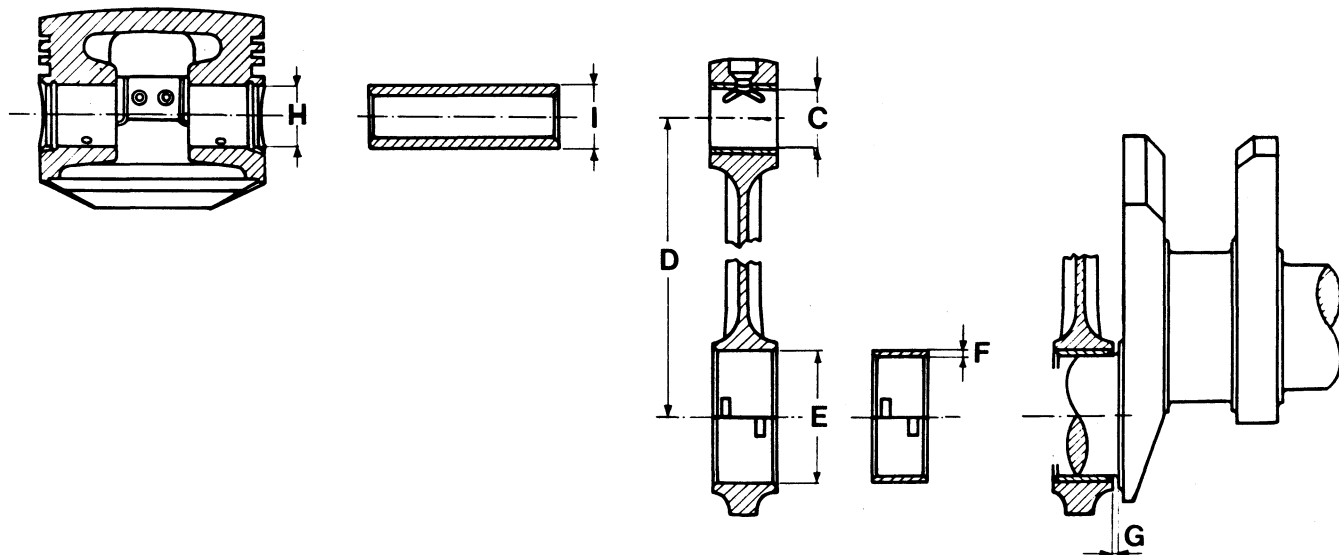
Piston pins

O.D. of pin I	Black color . . .	21.994 to 21.997
	White color . . .	21.997 to 22.000
Clearance between piston pin and small end hole	Black color . . .	0.008 to 0.021
	White color . . .	0.005 to 0.018

Piston pin hole

	Black mark	White mark
BORGHO piston H =	22.000 to 22.0025	22.003 to 22.005

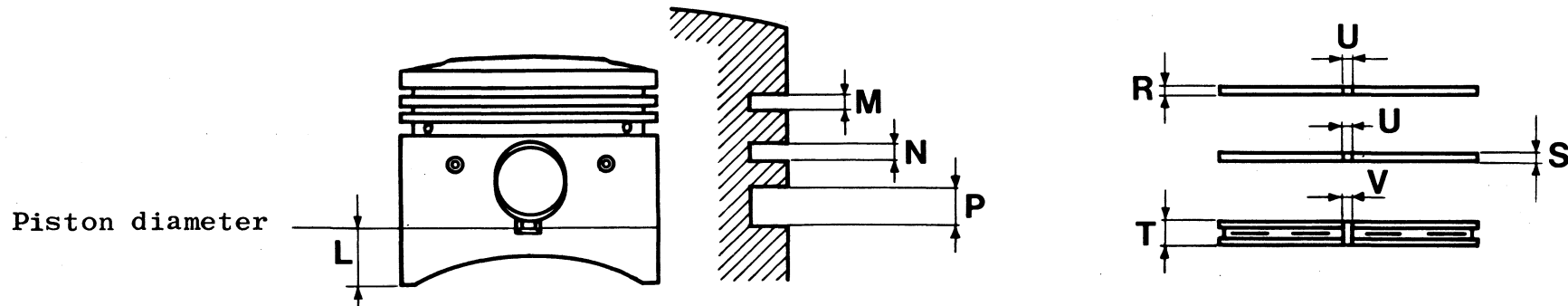
End play of the connecting rods on the crankpins . . G = 0.2 to 0.3



Pistons and piston rings

Diameter of pistons to be measured at right angle to the hole for piston pin and at a distance of $L = 15$ mm. from the lower border of skirt.

	Classe A (Blue)	Classe B (Pink)	Classe C (Green)
BORG0 piston	79.945 to 79.955	79.955 to 79.965	79.965 to 79.975

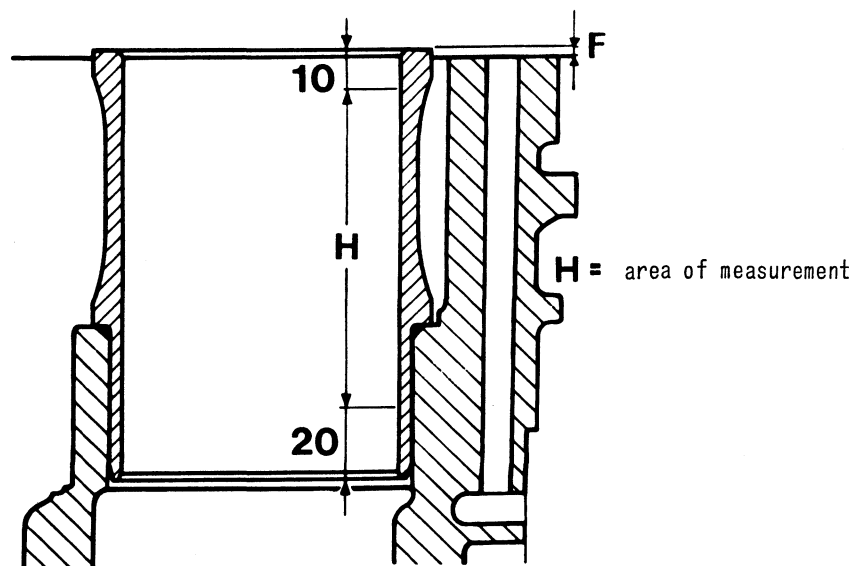


Height of grooves for piston rings	chromium-plated compression ring	M =	1.525 to 1.545
	oil scraper ring	N =	1.775 to 1.795
	oil control ring	P =	4.015 to 4.035
Thickness of rings	chromium-plated compression ring	R =	1.478 to 1.490
	oil scraper ring	S =	1.728 to 1.740
	oil control ring	T =	3.978 to 3.990
End play of rings in grooves	chromium-plated compression ring		0.035 to 0.067
	oil scraper ring		0.035 to 0.067
	oil control ring		0.025 to 0.057
Gap of compression ring and oil scraper ring (to be inspected in ring gauge or in cylinder sleeves)			
		U =	0.30 to 0.45
Gap of oil control ring (to be inspected in ring gauge or in cylinder sleeves). . .			
		V =	0.25 to 0.40

Cylinder sleeves

	B l u e	P i n k	G r e e n
Cylinder sleeve diameter	79.985 to 79.994	79.995 to 80.004	80.005 to 80.014

Clearance between cylinder sleeve and piston 0.030 to 0.049

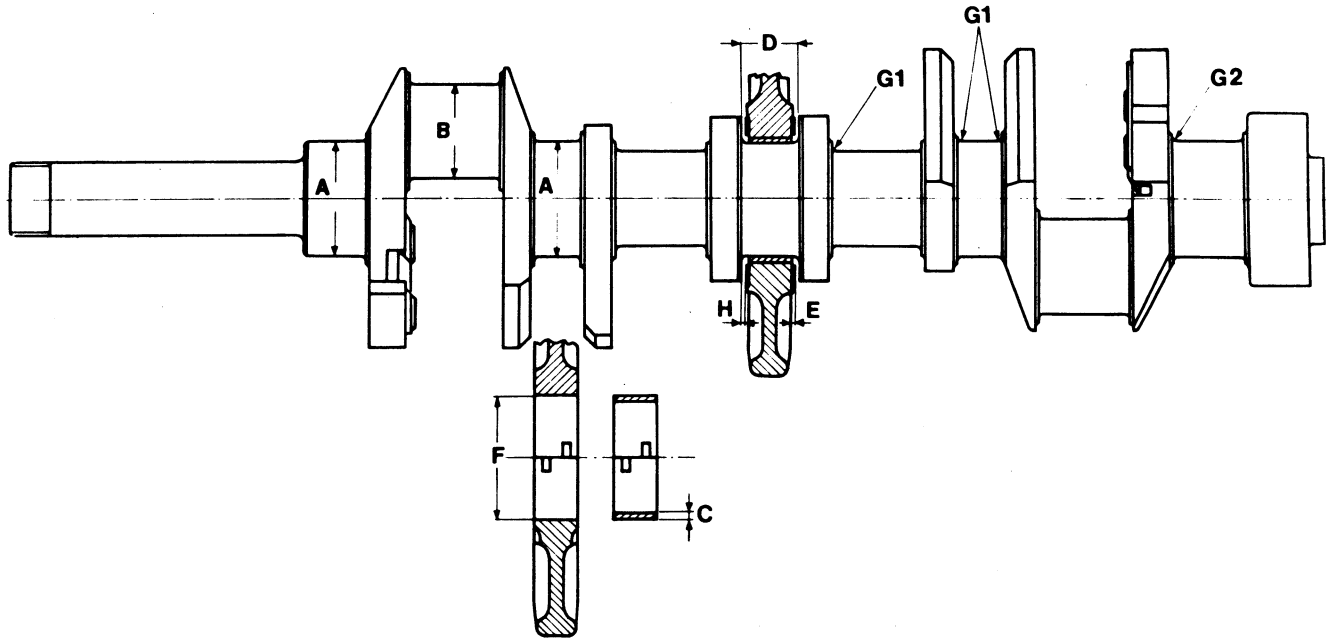


Projection of barrels from cylinder block F = 0 to 0.06

Surface roughness R = 0.5 to 1 μ

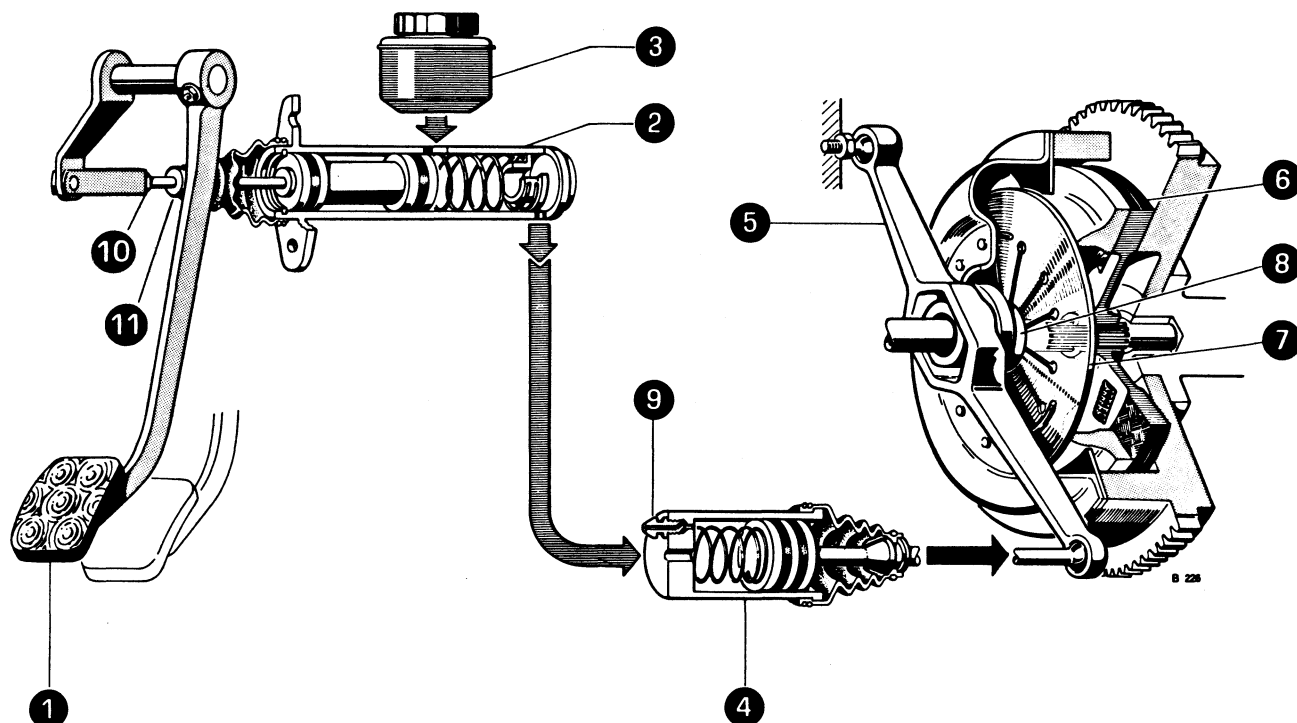
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CRANKSHAFT



Diameter of main journals	A =	54.988 to 54.999
Diameter of crankpins	B =	44.958 to 44.971
Thickness of main bearings	C =	1.829 to 1.835
Diameter of seat for main bearings in crankcase	F =	58.684 to 58.703
Length of central journal	D =	25.980 to 26.030
Thickness of thrust rings for central journal	E =	2.310 to 2.360
End play of crankshaft.	H =	0.076 to 0.263
Clearance between journals and main bearings (*) . .		0.014 to 0.058
(*) - Clearance = main bearing ID - (twice bearing thickness + journal OD)		
Fillet radii {	main journals and crankpins. .	G1 = 1.7 to 2.1
	pin on flywheel side	G2 = 2.7 to 3.1
Main journal & crankpins surface roughness. .	R =	0.16 μ
Maximum elongation of main journals and crankpins		0.007
Maximum taper of main journals and crankpins as measured on their full length		0.01
Maximum error of parallelism of main journals and crankpins as measured on their full length		0.015
Maximum misalignment allowed between main journals		0.01
Maximum misalignment between ϕ of the two pairs of crankpins and ϕ of main journals . . .		0.300

CLUTCH



- | | |
|--------------------------|--------------------|
| 1 Pedal | 7 Diaphragm spring |
| 2 Master cylinder | 8 Throwout bearing |
| 3 Clutch fluid reservoir | 9 Air bleed screw |
| 4 Operating cylinder | 10 Locknut |
| 5 Disengagement lever | 11 Push rod |
| 6 Driven plate | |

The clutch is of the automatic clearance take-up, hydraulically-operated single-plate dry type.

The clutch pedal acts on a master cylinder supplied by the fluid reservoir "3". When the clutch pedal is depressed, the fluid under pressure actuates the piston in the cylinder "4" connected to the clutch disengagement lever "5". The driven plate "6" is controlled by means of diaphragm spring "7".

This type of clutch has the throwout bearing constantly in contact with the diaphragm spring. Thus, no more clearance exists and the wear is automatically taken up.

No regular adjustment of the play is required.

If necessary, check that, when the clutch pedal is depressed fully the push rod of cylinder "4" moves through a total travel of 17 to 19 mm. If adjustment is needed, proceed as follows: slacken the locknut "10" on master cylinder push rod; screw in or unscrew the push rod "11" to increase or diminish its travel until the travel of the rod of cylinder "4" falls within the above specified limits. In this conditions, the travel of master cylinder rod shall not exceed 29 mm.

In the event that master cylinder rod travel is as specified but the travel of rod of cylinder "4" does not fall within the prescribed limits (17-19 mm.) check the circuit for proper air bleeding.

G E A R B O X

Transmission ratios	{	1st gear	2.99 : 1
		2nd gear	1.76 : 1
		3rd gear	1.30 : 1
		4th gear	1 : 1
		5th gear	0.87 : 1
		Reverse gear	3.64 : 1
Calibration of spring for striking rod balls	{	Free length	27.9
		Length under test load 8 ± 0.75 .Kg..	18
		Test load 105 ± 0.95 Kg.	15
Maximum end play (non adjustable) of the main shaft gears	{	1st speed gear	0.150 to 0.400
		2nd speed gear	0.100 to 0.250
		3rd speed gear	0.100 to 0.450
		5th speed gear	0.100 to 0.400
End play of layshaft bearings			0 to 0.05 mm
End play of 4th & 5th gear synchronizer hub			0.5 to 0.8 mm
Distance of centre boss of 4th and 5th gear synchronizer hub as fitted from the casing joining flange			53.5 ± 0.1 mm

REAR AXLE AND SUSPENSION

Transmission-axle overall ratios-with 41 : 10 final drive	1st gear	12.26 : 1
	2nd gear	7.22 : 1
	3rd gear	5.33 : 1
	4th gear	4.10 : 1
	5th gear	3.57 : 1
	Reverse gear	14.92 : 1

ZF-make limited slip differential

Nonslip percentage	25%
Clearance between clutch plates and case	0.1 to 0.2
Tightening torque of cover screws	2.3 Kgm
Maximum eccentricity of axle shafts	0.10
Backlash of final drive	0.05 to 0.10
Reference dimension on special tool for pinion-to-ring gear fitting	70 \pm 0.0025
Pre-load on pinion bearing	11.5 to 15.5 Kgcm
Total preload on bevel drive bearings	16.5 to 24.5 Kgcm
Max. end play between T-arm and attachment to body	max 1

With the differential fitted with no pre-load, the clutches should slip under a 1.5 Kgm max. torque when an axle shaft is locked and the other rotated.

Checking of shock absorbers on test bench

Calibration data (when cold)

	B I A N C H I	
	Extension	Compression
High speed	135 to 190 Kg	50 to 80 Kg
Low speed	19 to 55 kg	9 to 22 kg

Checking of suspension springs

Free length	467	Identification numbers 39-40-41 - 42
Length under test load	252	
Test load	349 to 371 Kg	

FRONT SUSPENSION

The front wheels are independently suspended and connected to the body by transverse arms.

Coil springs and double-acting hydraulic telescopic shock absorbers are located between the lower arms and the body.

The suspension system is completed by a transverse stabilizer rod which improves the stability of the vehicle when cornering.

Upward and downward movement of the arms is restricted by pads attached to the cross member.

Adjustment of clearance in wheel bearings

When performing regular servicing or whenever the removal of wheel hubs is required, adjust the bearing clearance as follows:

- Pre-load the bearings by applying a torque of 2 to 2.5 Kgm to the castellated nut; at the same time rotate the hub to set the bearings properly and to prevent the rollers from brinelling the races.
- Slacken the nut and tighten it again to 0.5 - 1 Kgm with a torque wrench.
- Back up the nut by a quarter turn and insert the split pin; if the slot in the castellated nut and the hole in the axle are not aligned, screw in the nut of the minimum required to line up the hole and the next slot.
Lightly tap on the stub axle end with a mallet.
- Make sure the bearing retainer plate is not blocked by inserting the tip of a screwdriver in the plate holes; the plate should be easily rotated.
- If the plate is blocked, unscrew the nut by one slot and tap slightly on the stub axle end with a mallet.

Wheel bearing lubricating instructions

The quantity of lubricating grease should be about 65 grammes ($2\frac{1}{2}$ ozs) for each hub; do not exceed such a quantity to avoid bearing overheating, grease leakage, etc.

The grease should be well distributed inside the bearings and into side recesses.

Subsequently, at the regular schedule, remove the hub cover and pack the outboard bearing.

Ball joints

End play of lower ball joint in its socket 1 mm

N o t e - Ball joints require no regular lubrication being provided with special grease seals which retain the grease packed in by factory on assembly.

Checking of off side suspension spring

Free length	355	} Identification no. 34-35-36-37-38
Length under test load	214	
Test load 970 to 1030 Kg		

Checking of near side suspension spring

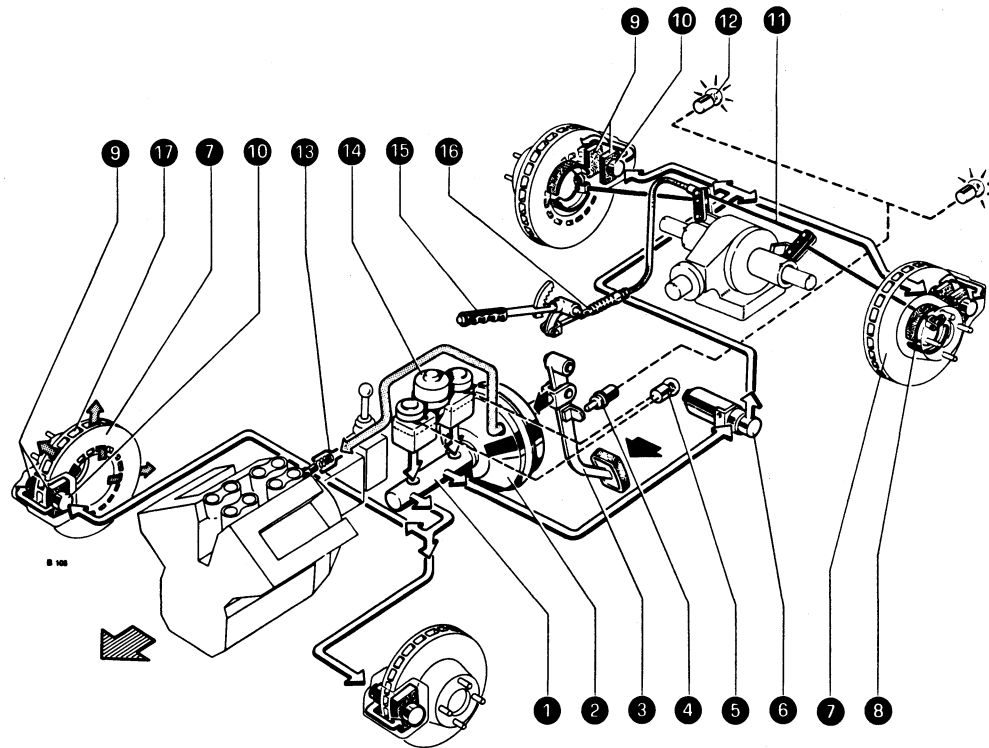
Free length	345	} Identification no. 29-30-31-32-33
Length under test load	214	
Test load 902 to 958 Kg		

Checking of shock absorbers on test bench

Calibration data (when cold)

	BIANCHI - ALLINQUANT	
	Extension	Compression
High speed	150 to 190 Kg	55 to 80 Kg
Low speed	25 to 55 Kg	9 to 22 Kg

DUAL BRAKE SYSTEM



- | | |
|-----------------------------|-------------------------------|
| 1 Tandem master cylinder | 10 Piston |
| 2 Vacuum servo | 11 Handbrake linkage |
| 3 Brake pedal | 12 Stop lights |
| 4 Stop light switch | 13 Check valve on vacuum port |
| 5 Tell tale for fluid level | 14 Fluid reservoir |
| 6 Pressure regulator | 15 Handbrake lever |
| 7 Ventilated disc | 16 Stretcher |
| 8 Handbrake shoes | 17 Ventilating slits |
| 9 Friction pads | |

The brake system consists of two separate circuits.

Each one of the circuits, front and rear, is assisted by the vacuum servo 2 and controlled by the tandem master cylinder 1 with one cylinder operating the front brakes and the other cylinder the rear brakes. The friction pads 9 of the front and rear brakes are directly actuated by the pistons 10 within cylinders integral with the calipers and are forced against the two sides of the ventilated discs; a very effective ventilation of the discs is obtained by means of the ventilating slits 17 even under the heaviest operating conditions.

A regulator, inserted in the rear brake circuit, regulates the pressure between front and rear brakes to provide balanced braking action. The pressure regulator must never be tampered with; specifically, do not attempt to act on the adjusting nut as it is factory sealed.

A tell tale, located in the facia panel, will alert the driver if the level of fluid in the reservoir falls below the minimum.

Check frequently the tell tale circuit, using the press-to-test feature built into the light.

Should the tell tale come on, the cause for the drop in level must be traced and remedied immediately.

To maintain the brakes in good operating condition, follow the servicing instructions given below:

Take care to prevent the minimum level of fluid in the reservoir from falling below the maximum level by more than a quarter; for renewal or topping up, it is absolutely essential to use only the specified fluids drawn from freshly opened sealed containers.

When adding fluid, leave the strainer in place so as to filter the fluid.

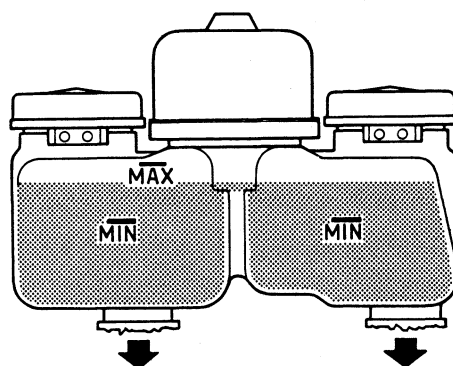
Renew the brake fluid at the prescribed periods. For effective and reliable operation of the brake system, the pipes must always be full of fluid and free of air bubbles.

Excessive and spongy brake pedal action is an indication of the presence of air bubbles in the system.

Compressed air must not be used for replenishing the system.

Should flushing of the brake circuit be required, use exclusively fluid of the specified type.

Compressed air or alcohol must on no account be used to dry a flushed system.



Brake discs

When a brake disc is replaced it is necessary to check it for run-out after installation:

- use a dial indicator and the special tool A.2.0151 which is mounted to the caliper by means of the pad retaining pins.

Maximum permissible run out as measured at the swept surface should not exceed 0.22 mm.

N o t e - Run-out readings can be misleading if bearing clearance is not as specified; therefore, check and adjust if necessary, according to factory instructions.

If the disc is scored, the grinding of the surfaces is allowed providing not to exceed an undersize of 1 mm, equalized on both faces, i.e. 0.5 mm each face; disc thickness wear limit: 21 mm front and 19 mm rear.

Inspection specifications after regrinding of disc surfaces:

- Max. out of parallelism with disc mounting plane: 0.05 mm;
- Max. out of flatness: 0.025 mm and max. difference in thickness: 0.038 mm as measured along any radial line;
- Max. out of flatness: 0.025 mm and max. difference in thickness: 0.015 mm as measured along any circular line;
- The surface should show no sign of scoring or porosity.

The surface roughness should be:

- 32 microinches as measured circularly;
- 50 microinches as measured radially.

F r i c t i o n p a d s

	F r o n t	R e a r
Thickness when new	15	
Wear limit	8	7

C a l i p e r s

On replacement of disc or caliper, measure the running clearance between caliper and disc on each side; the difference should not exceed 0.5 mm.

To centralize the caliper about the disc, insert shims between caliper and mounting flange as required.

H a n d b r a k e

It is mechanically operated and acts on the rear wheels through suitable shoes which spread apart against a drum machined in the disc casting.

For a brief description and repair and maintenance instructions refer to:

ATE DISC BRAKES (Publication no. 1202)

N o t e - When reassembling the operating levers, a slight quantity of grease AGIP F.1 Gr SM or SHELL Retinax AM is to be applied to the pivot pins and rubbing surfaces of levers.

Bleeding the brake system

The bleeding should be performed with the greatest care and following these instructions:

- Fill the reservoirs, if necessary, with the genuine fluid freshly drawn from sealed containers; during bleeding operations pay attention that fluid level does not drop below the min. mark.
- Push rubber pipes over the bleed screws of a front and a rear wheel the other ends will lead to glass containers half full of fluid.

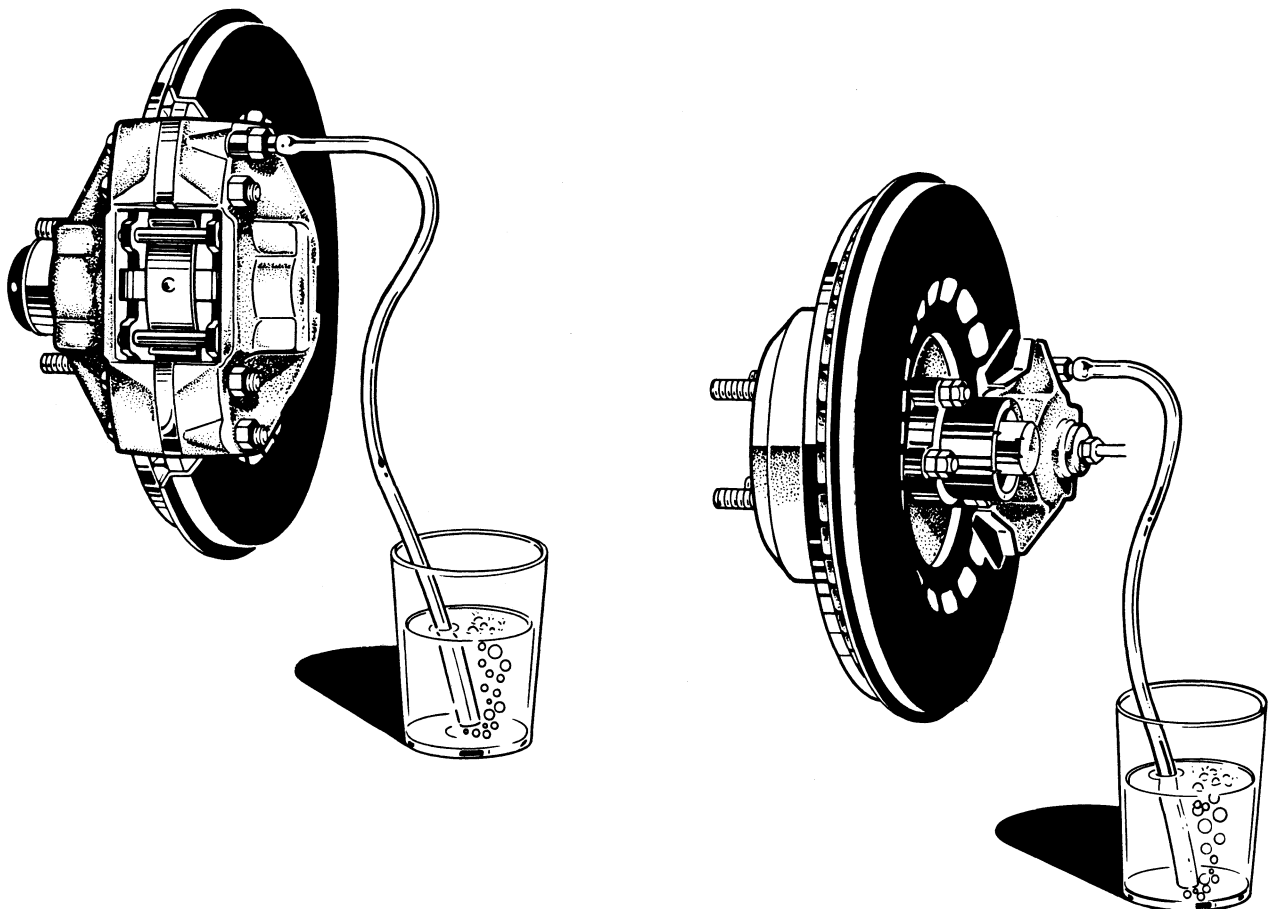
Loosen the bleed screws of front and rear wheel at the same time; depress the brake pedal several times allowing it to return slowly and waiting a few moment before depressing it again.

This sequence must be repeated until the pipes discharge fluid free from air bubbles.

Then, hold the pedal down, tighten the bleed screws and remove the pipes.

Proceed the same way for the other two wheels.

If the bleeding has been carefully performed, it will be found that, when brake pedal is depressed, direct action on the fluid can be felt, free of resilience, immediately at the end of the free travel. If not, repeat the procedure.



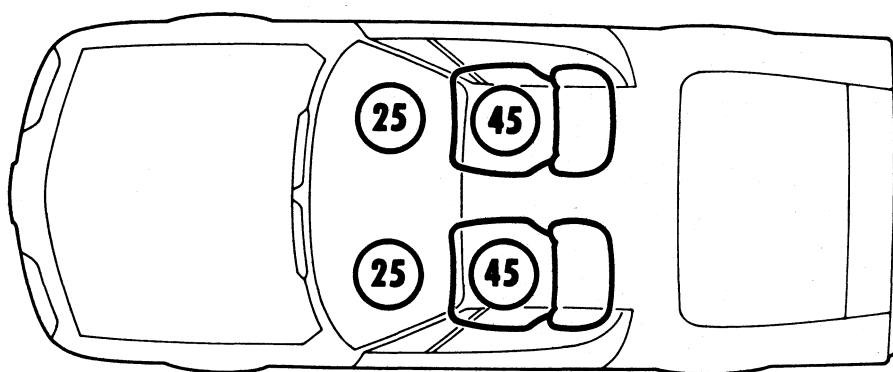
WHEEL ALIGNMENT

Checking of wheel angles and car trim under static load

Put the car under static load, with shock absorbers and stabilizer rods disconnected, with full tank or equivalent, with spare wheel, tool kit and the tires inflated as specified.

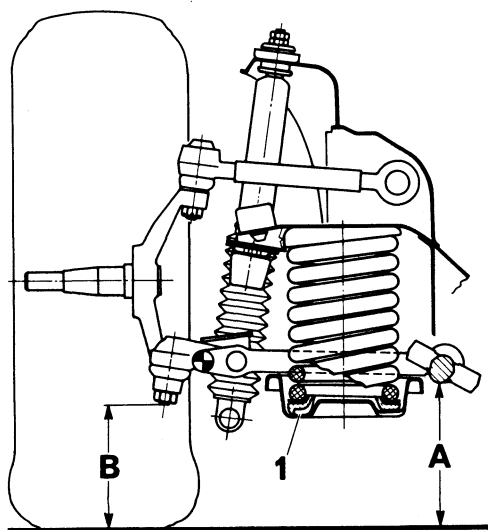
Before checking, slightly move the car up and down so as to settle the suspensions.

Static load { 1 weight of 45 Kgs on each seats
2 weights of 25 Kgs on flooring where feet rest



Front suspension height

$$A - B = 24 \pm 5 \text{ mm}$$



Dimension "A" must be measured in correspondence of the lower line of wishbone shaft as shown.

To adjust, add shims in "1".

Shims are available in the following thicknesses:

3.5 mm - 7 mm - 10.5 mm

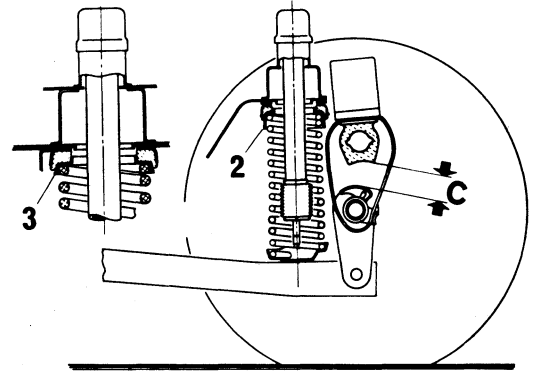
Distance of rear axle from rubber buffers

$$C = 41 \pm 5 \text{ mm}$$

N o t e - To adjust, remove the seat 3 and add shims in 2 as shown.

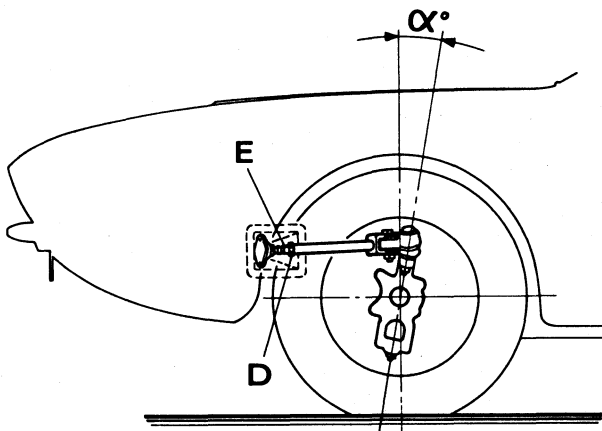
Shims are available in the following thicknesses:

6.5 mm	16.5 mm
11.5 mm	21.5 mm



In the condition as specified check the wheel angles.

Caster angle: $\alpha = 1^\circ 30' \pm 30'$



The difference in caster angle between R.H. and L.H. wheel must not exceed $0^\circ 20'$.

To adjust, loosen jam nut "D" and rotate rod "E".

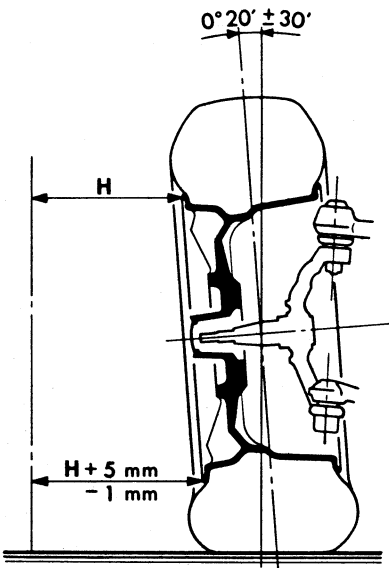
WARNING - Small adjustment of the caster angle allow to correct slight drift tendency of the car.

The caster angle should be checked under static load and alignment conditions as specified and with shock absorbers disconnected at one end.

N.B. - Before checking the caster angle shake the front end of car in order to allow the rubber bushing on the front slanting arm to set properly.

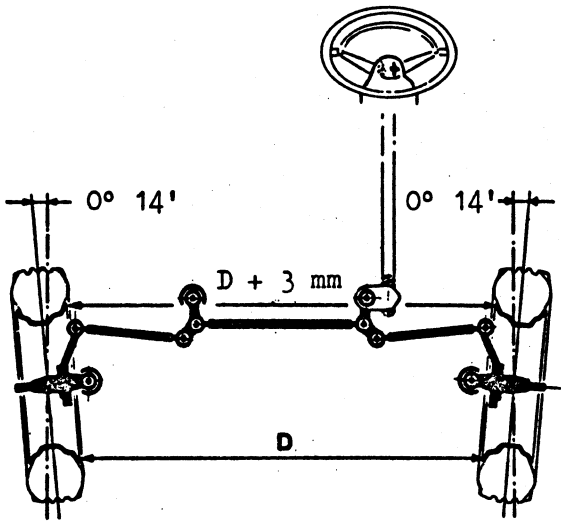
Front wheel camber

Difference in camber angle between R.H. and L.H. = $0^{\circ} 40'$



N o t e - Not adjustable. Check the chassis and suspension arms if necessary.

Front weel toe-in



Rod length:

side	256 to 272 mm
track	643 to 663 mm

With the toe-in as specified, the length of rods as measured between ball joint centers should fall within the limits shown. If these values cannot be restored, the cause will probably be attributable to distortion of the body resulting from a collision.

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