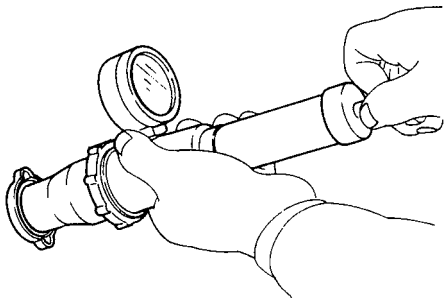
INCREASING THE PRESSURE OF THE SOLUTION

Increasing the pressure of the antifreeze solution will serve to raise the cooling system's boiling point, however it will do nothing for the lower end of the temperature range (the point at which the solution will freeze). If the solution will normally boil at 212°F (100°C), increasing the pressure on the solution will cause the boiling point to increase as well. This is one of the advantages of a closed pressurized system. An increase in pressure of 1 pound will increase the temperature 3 degrees. The radiator cap functions to maintain pressure in the cooling system. A defective radiator cap may cause low pressure. A pressure tester is a hand held pump with an attached gauge, which indicates applied pressure. It may be used to substantiate the integrity of the radiator cap as well as to pressure test the cooling system for small and internal leaks, which are not detected during visual inspection.



TLC017

OTHER METHODS TO DETECT INTERNAL LEAKS

Internal leaks may be detected in several manners.
Air leaks from the water pump or exhaust leaks from the cylinder head gasket may be detected using chemical combustion leak detectors. Exhaust leaks may also be detected using an after market leak tester or an exhaust gas analyzer.

You may check for exhaust leaks using an after market tester as described below:

- Run the engine to normal operating conditions
- **Use caution when removing the radiator cap**
- Install a scaling ring in the filler neck
- Attach the pressure tester to the radiator and open the relief valve.
- Close the relief valve and observe the gauge

Caution: Do not pressurize the system above maximum specifications

- Pressure increase indicates an exhaust leak into the system
- A steady gauge reading indicates that the system is OK
- Pressure decrease or a fluctuating gauge reading indicates an exhaust leak
- A decreased fluctuation will result when the leaking cylinder is shorted out

You may check for exhaust leaks using exhaust gas analyzer as described below:

Caution: Do not immerse the exhaust gas analyzer probe in the coolant

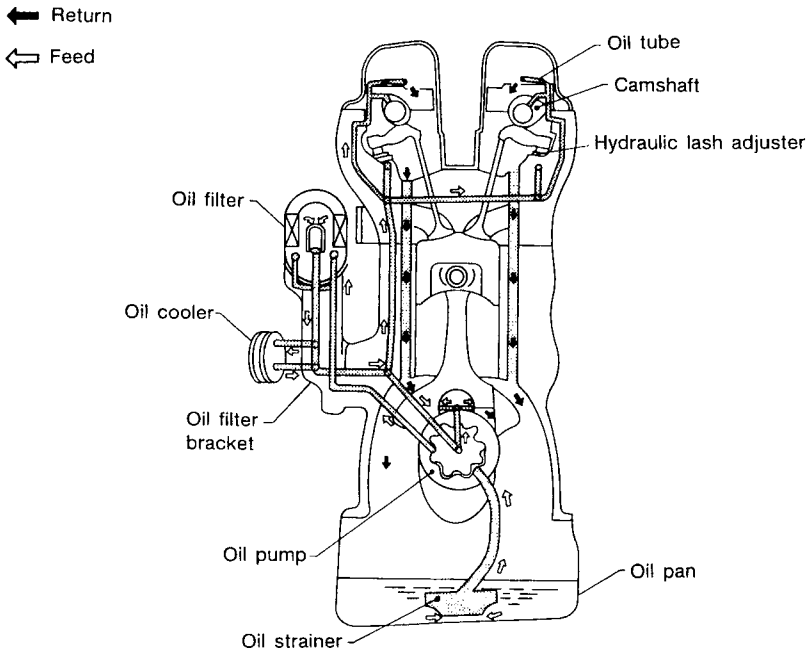
- Run the engine to normal operating conditions
- Carefully remove the radiator cap
- Hold the analyzer probe at the top of the filler neck (do not immerse the probe in the coolant)
- Accelerate to 2,000 rpm, then return to idle

Observe the analyzer for an increase in HC and CO

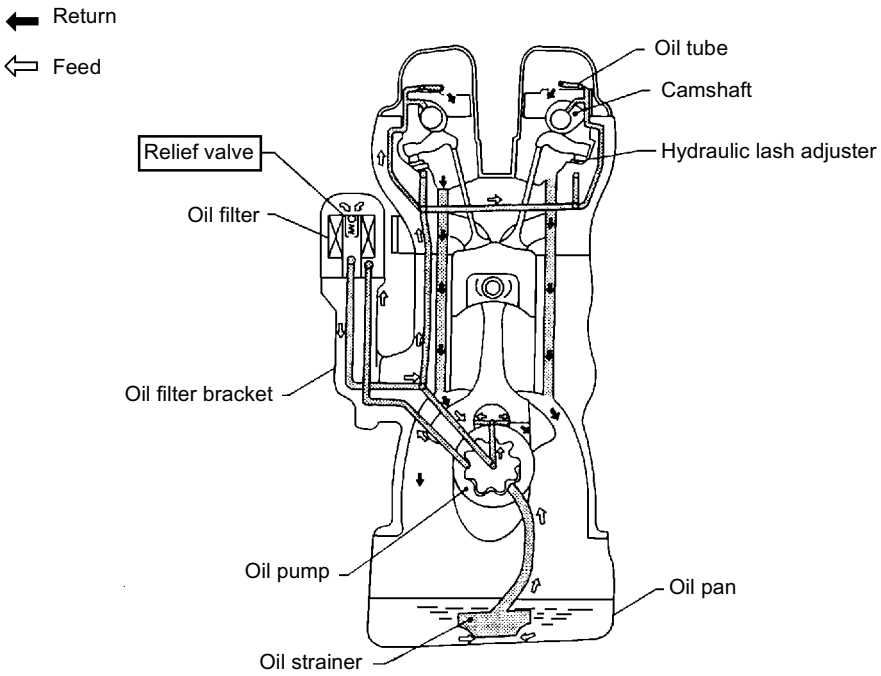
LUBRICATION SYSTEM

1. DESCRIPTION

There are many moving parts in an engine, and when two pieces of metal rub against each other, heat and scratches are produced by friction on the contact surfaces and eventually the metal seizes up. For this reason, a lubrication system is needed to form an oil film on the sliding surface of the metal.

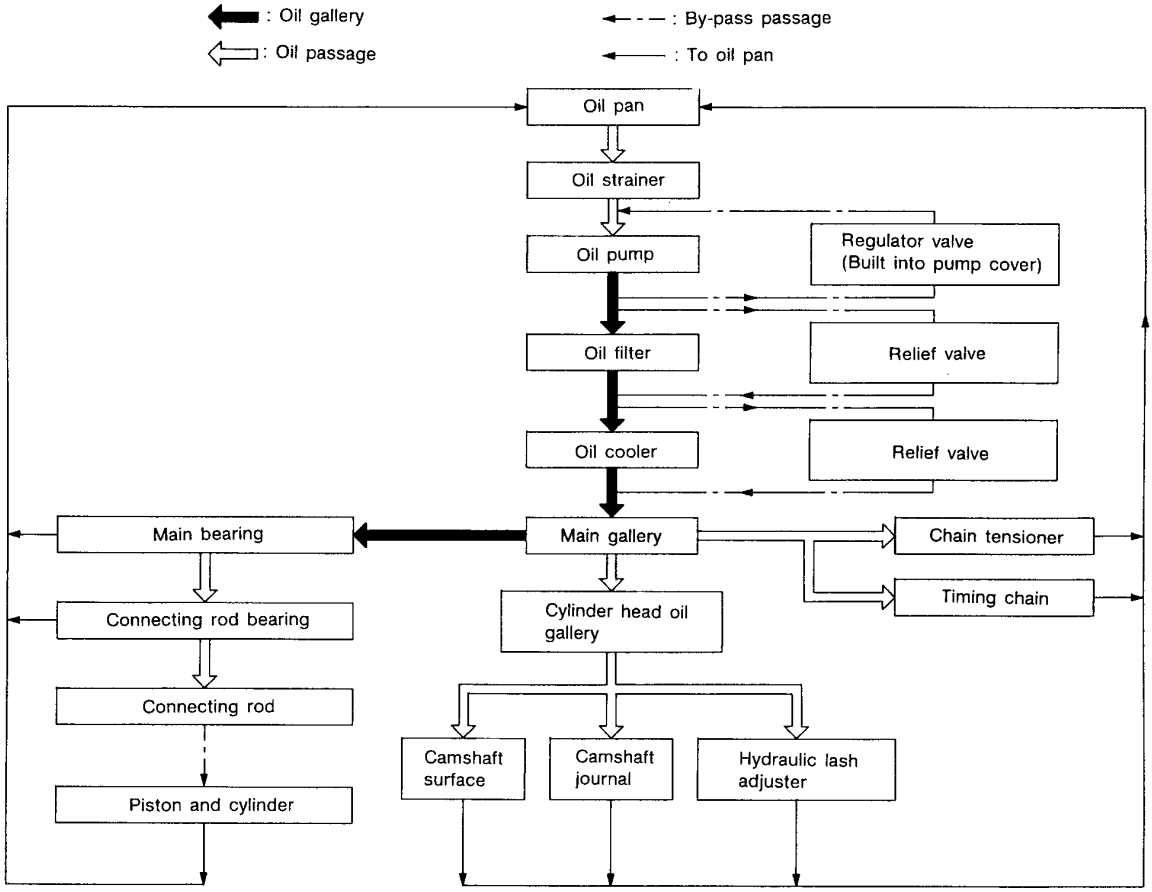


TLC018



TLC019

LUBRICATION SYSTEM (SR ENGINE)
[Relief valve built in type]



TLC020

LUBRICATION FLOW (SR ENGINE)

1-1. LUBRICATION CIRCUIT

There are several types of lubricating oil circulation and the full flow filtering pressure-feeding type is the most widely used.

The lubricating oil in the oil pan is drawn up by the oil pump (drive through the oil strainer to filter large-sized foreign particles and then through the oil cooler oil filter to filter small-sized foreign particles, and sent to the main bearings and valve mechanism passing through the oil gallery. The oil is sent to lubricate the main bearings then sent to the crank pin passing through the crankshaft to lubricate the connecting rods. The oil is injected from the oil jets located at the bottom of cylinder sleeve and squirts and blows against the of the pistons, piston pins and cylinder walls to lubricate and cool.

Oil sent from the oil gallery to the valve mechanism passes through the inside of the rocker shaft and camshaft and lubricates the bushings of the rocker arm, the cam shaft journal, the contact face of the cam and rocker arm, and then drops down into the oil pan. The gears are lubricated with oil injected from the oil jet from the oil gallery.

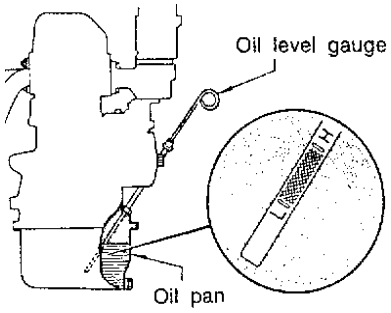
Generally, the oil gallery is equipped with an oil pressure switch or oil pressure sensor, and the oil pressure warning lamp and pressure gauge to inform the driver if oil pressure is indicating the specified value or not.

TLC021

OIL PRESSURE WARNING LAMP

2. OIL LEVEL GAUGE

The oil level gauge (attached to the side of the cylinder block) is a stick shaped gauge used to cheek the oil level in the oil pan. The gauge is marked with High (H) and lower (L) limits for optimal oil volume, the difference of which is approximately 1/ (1-1/8 US qt, 7/8 Imp qt).



TLC022

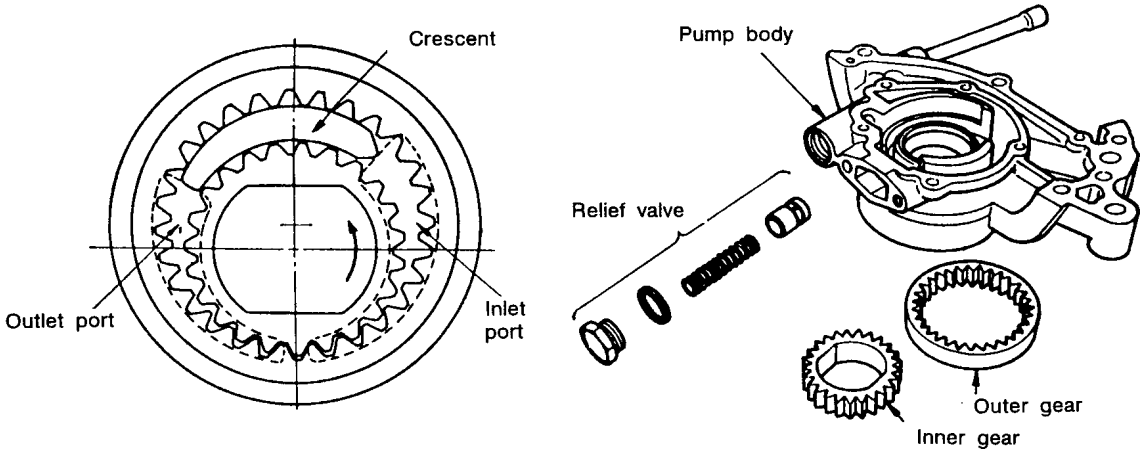
OIL LEVEL GAUGE

3. OIL PUMP

There are several types of oil pumps, with gear and trochoid types generally used,

3-1. INNER GEAR OIL PUMP

An inner gear and an outer gear are eccentrically assembled, and a crescent is placed in the space between these gears. When the inner gear is driven, it causes the outer gear to rotate and lubricating oil is drawn into the space between the outer gear, inner gear and crescent from the inlet port and forced out through the outlet port. The driving method of this pump is simple, and because the inner gear is directly driven by the crankshaft.
This type is used for the automatic transmission oil pump rather than the engine. (GA, SR, RB and VG series engines, etc.)

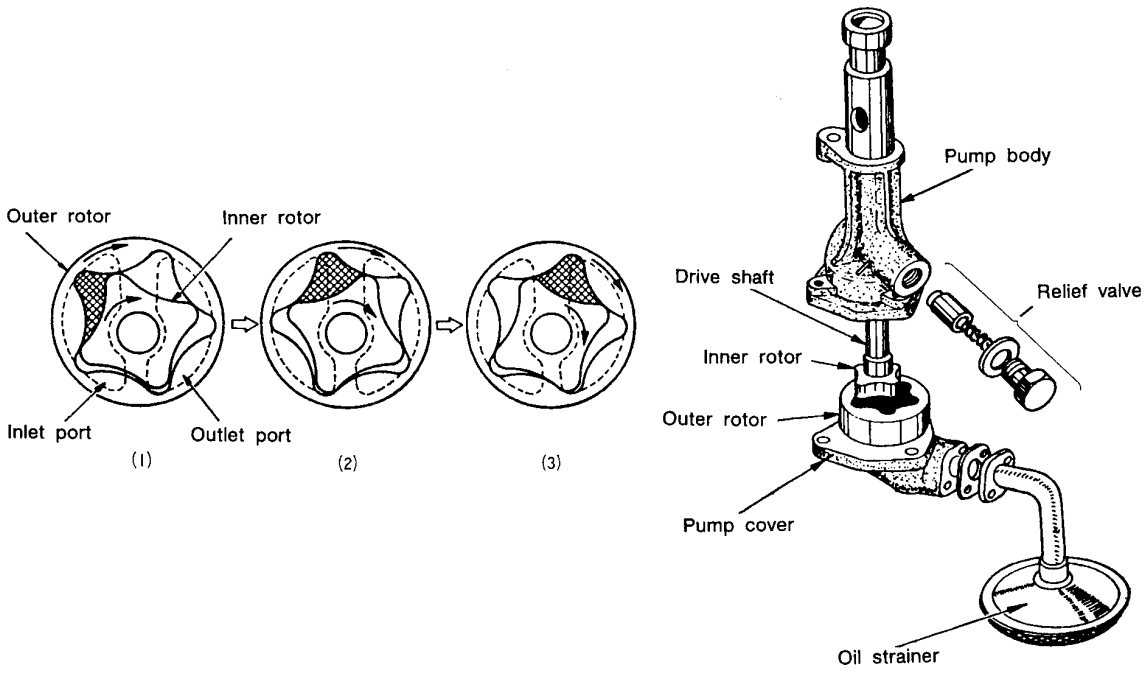


TLC023

3-2. TROCHOID TYPE OIL PUMP

This type is called a rotary type.

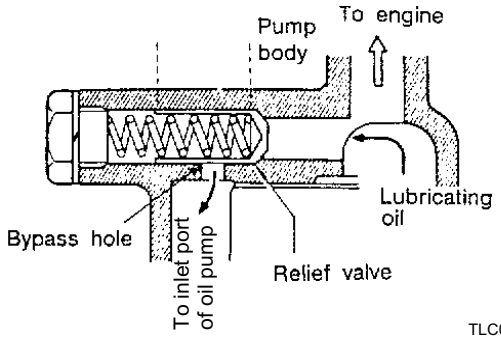
An inner rotor has four lobes, and is driven by the camshaft or crankshaft drive gear. An outer rotor has five dents to mesh with the inner rotor and is eccentrically assembled in the housing. When the inner rotor rotates, lubricating oil is drawn into the space between the inner and outer rotors and squeezed out through the outlet port. The trochoid type oil pump is widely used. (MA and E series engines, etc.)



TLC024

4. OIL PRESSURE REGULATOR

Lubricating oil is sent under pressure, and the higher the engine speed the higher the oil pressure. Each part to be lubricated is under high pressure, and requires a large quantity of oil. However, an excessive rise in oil pressure causes an excessive load on the pump and excessive oil consumption, which results in loss of engine power. For this reason, a pressure regulator is installed in the oil pump to properly adjust the oil pressure.

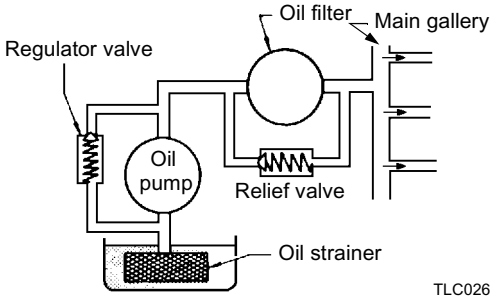


OIL PRESSURE REGULATOR

The figure shows the cross section view of an oil pressure regulator. If the oil pressure exceeds the spring force, the relief valve moves to open the bypass hole to allow some oil to return to the inlet port, thus adjusting the pressure.

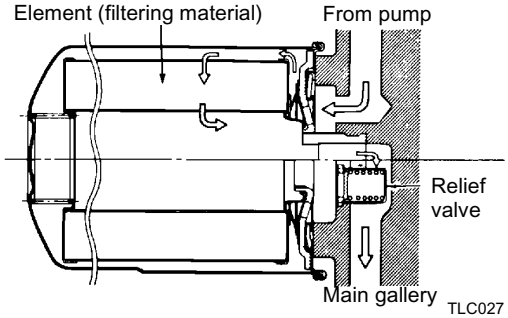
5. OIL FILTER

As the engine operates, dust and metal particles may contaminate the lubricating oil. To prevent seizure and excessive wear, these foreign particles must be completely removed. The oil filter is used for this purpose.

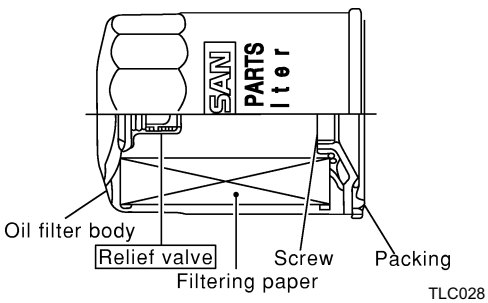


LUBRICATING OIL FLOW

Many types of filters are available, and recently cartridge type oil strainers are used on smaller diesel engines because of their easy maintenance. However, on bigger diesel engines a replaceable internal element is still used. The relief valve is designed to allow oil to pass when the element is clogged. When replacing the oil filter, be sure to use genuine Nissan Diesel parts. Some after market oil filters may be sold at a low price, but their element tends to be of low quality. They will cause malfunction.



OIL FILTER (CARTRIDGE TYPE)



OIL FILTER (CARTRIDGE TYPE)

6. ENGINE OIL SPECIFICATION

Engine oil is classified into three types: engine oil for gasoline engine, diesel engine, and two cycle engine. The type depends on the difference of additives in order to make good use of characteristics of each engine.
(Some oil makers use gasoline engine and diesel engine together.)

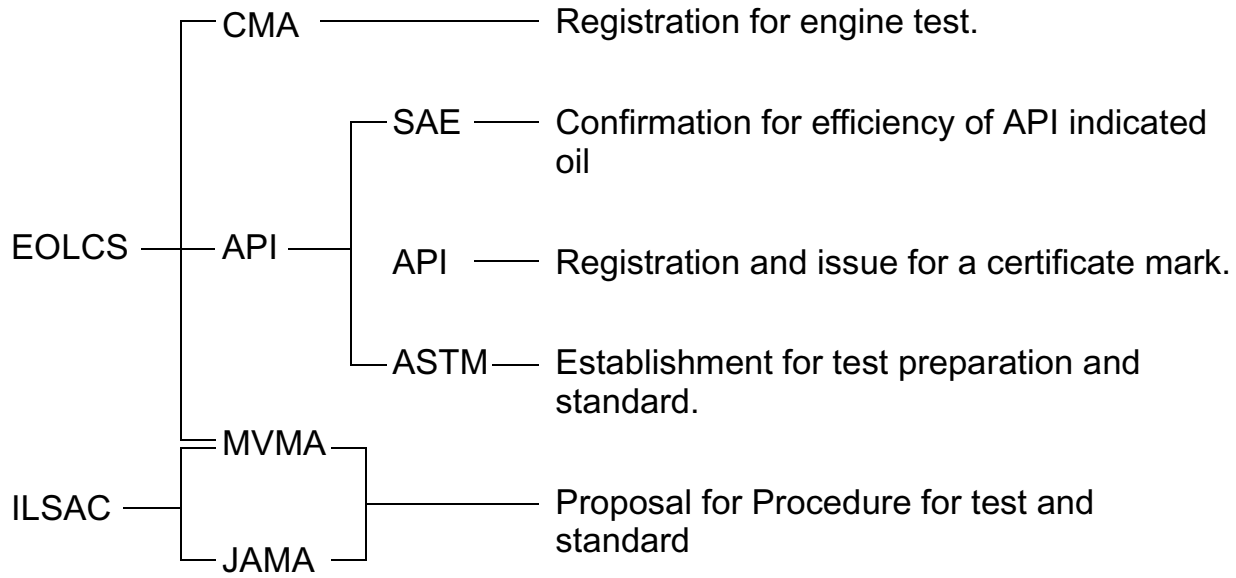
Engine oil base

Engine oil base is classified into four kinds: 100% chemical synthetic based oil, semi synthetic based oil, part synthetic oil, and mineral oil.
Each engine has differential response and durability, except for engine power.
Compared with mineral oil, 100% chemical sythetic based oil is much more expensive.

100% chemical synthetic based oil	Poly alpha olefin
Semi synthetic based oil.....	It is also called Semi synthetic
Part synthetic oil	20-30% chemical synthetic oil 70-80% mineral oil

Standard

The quality and grade are shared and established by the organization which prepares tests and establishes the standard.



ACEA ——— Europe standard which is an equivalent to API.

Classification

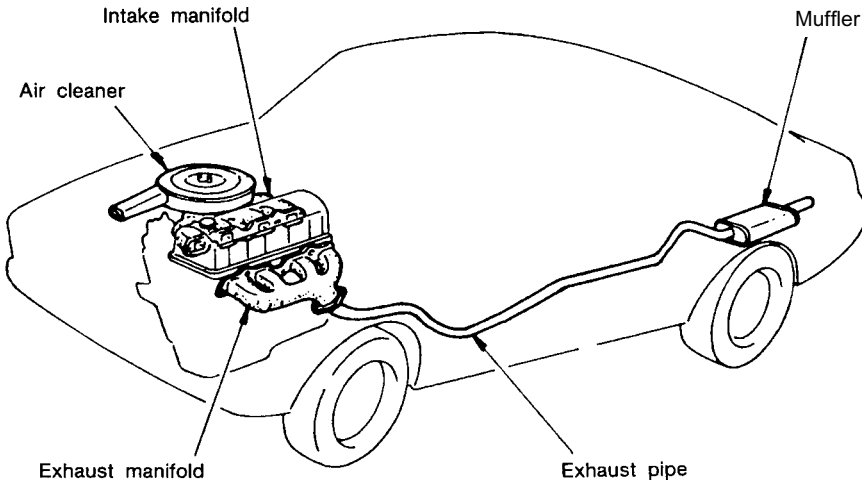
1. Viscosity (SAE standard)

Viscosity is classified into 11 kinds which range from SAE OW to SAE 60 according to SAE standard.
Example: OW, 5W, 20, 30
In the case of indicating the viscosity with only a number, it indicates the characteristic in high temperature. In the case of indicating the viscosity with number accompanied with “W”, it indicates characteristic in low temperature.
Engine oil for the use varies in districts and use conditions. For example, in a condition to drive with only low speed or middle speed at the outside temperature ranging from 0 degrees to 20 degrees (from 32 Fahrenheit to 68 Fahrenheit) the single grade, SAE 30 is used. In the case of indicating characteristics of low temperature to high temperature the multi-grade, 10 W - 30 is used to be easy to classify the viscosity. Regarding the temperature characteristic of oil, larger number indicates that the efficiency to keep oil film is high in high temperature (60,40,30...). On the other hands, smaller number preceding “W” indicates that the fluid of oil is high even if the temperature is low (0 W,5 W...).

Quality standard (API standard)
API standard establishes quality of applicable oil to engine increasing efficiency.
The quality is classified by deposit, oxidation stability, friction resisting, corrosion protection, consumption of oil, improvement in fuel mileage, etc.
Alphabet and number gives indication of classification.
Indication of S used in the first letter means gasoline. Indication of C used in the first letter means diesel gasoline.
example: Gasoline engine ..... SH, SJ
Diesel engine..... CD, CF, CF4
By the U.S. diesel engine emission control regulations to reduce PM, the temperature of the piston portion is required to increase. In order to cope with this circumstance, the specifications to increase the quantity of Dispersants and decrease the quantity of Detergents (or Ash) for engine oil are required. The change of the specifications may make it difficult for the oil filter to catch soot and sludge. The resistance of these oil types is weak to wear the valve mechanism.

INTAKE & EXHAUST SYSTEM

1. DESCRIPTION

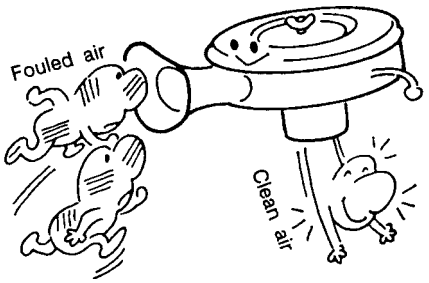


TFE001

The structure of intake and exhaust system is shown in illustration above. After dust is removed by the air cleaner, air enters the carburetor, mixed with gasoline, and is then sucked into the cylinder via the intake manifold. After combustion takes place in the cylinder, exhaust gas passes through the exhaust manifold and exhaust pipe and is discharged in the atmosphere after passing through the muffler.

2. AIR CLEANER

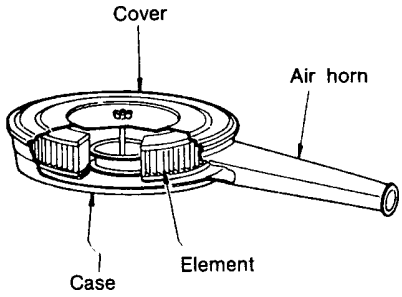
The air cleaner is attached to the air inlet of the carburetor. It removes dust and particles from air sucked into the engine.



TFE002

Dust suspended in the air contains substances which, if allowed to enter the cylinder, would cause wear to both the cylinder and piston rings. When mixed in with lubricating oil dust contributes to the wear of respective engine parts.

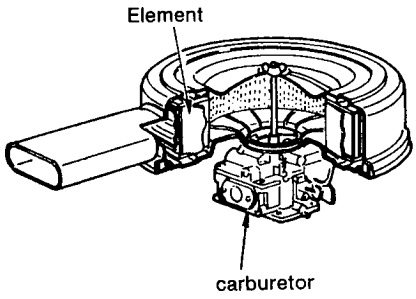
Foreign matter shortens engine life. Air cleaners which are currently used are classified according to filter elements of the air cleaner into paper (dry filter paper type) and viscous (wet filter paper type) types. The viscous type is most widely used.



TFE003

2-1. PAPER TYPE (DRY TYPE) AIR CLEANER

This type consists of an element (filter) and a body which contains the element. Foreign matter in the intake air is absorbed by the elements [dust is trapped or cannot pass through the element's minute holes (10 micron)].



TFE004

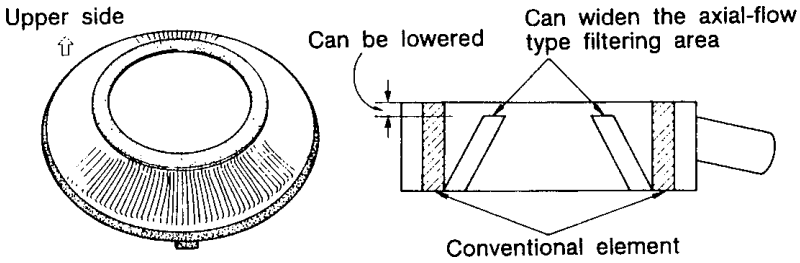
The element is made of filter paper containing various materials including cotton, rayon, etc., and is folded in a circular fashion and supported around a reinforcing plate. It requires periodic cleaning.

2-2. VISCOUS TYPE (WET TYPE) AIR CLEANER

This type is identical in structure to the paper type air cleaner, but the surface of the element is coated with special viscous oil that collects dust. Compared with the dry type, the drop in the engine performance is less because dusts are collected by virtue of an adhesion property of the special oil. Cleaning of this type filter is unnecessary, but it should be periodically replaced.

(1) AXIAL-FLOW TYPE AIR CLEANER ELEMENT

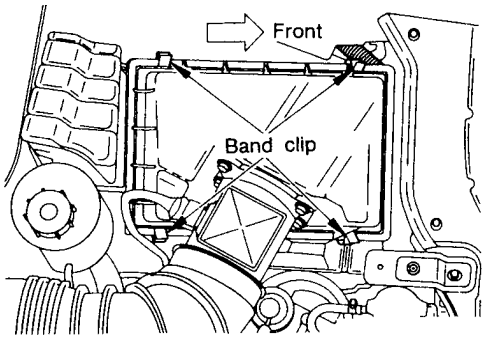
This air cleaner element is like an umbrella which allows its height to be lowered, thereby widening the filtering area.



TFE005

(2) SEPARATE TYPE AIR CLEANER ELEMENT

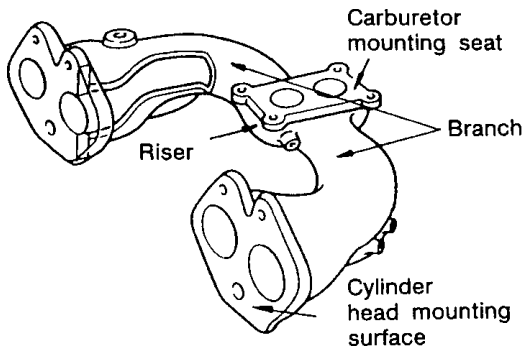
The element's shape is largely modified to incorporate the ECCS device. This type of cleaner element is attached to the hood ledge side. The element is square in shape. Recently, this type of element has been used with LPG vehicles. It contributes to easy maintenance.



TFE006

3. INTAKE MANIFOLD

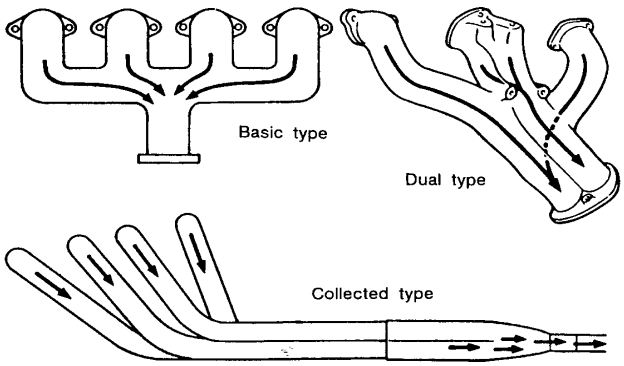
This is also called the suction manifold and is a set of branch tubes that branch from the carburetor uniformly carrying the air-fuel mixture to each engine cylinder.



TFE007

4. EXHAUST MANIFOLD

The exhaust manifold collects exhaust gases from each cylinder and passes them to the exhaust pipe with minimal resistance. The exhaust manifold needs be designed so that the exhaust gases from each cylinder do not interfere with one another.

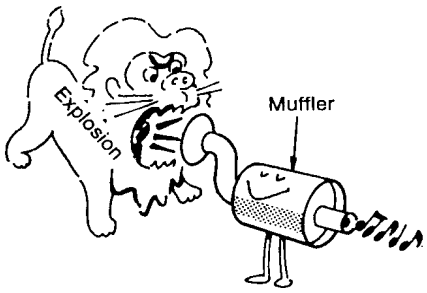


TFE008

Restricted exhaust gas flow causes combustion gas to remain in the cylinders resulting in insufficient air-fuel mixture intake for the following intake stroke, which results in reduction in power output.

5. EXHAUST TUBE, MUFFLER

If hot combustion gas under pressure were released directly from the cylinder into the air, it would rapidly expand causing a deep explosive sound. To prevent this, a muffler is installed so that it arrests noise by gradually allowing the gas to expand and cool down.



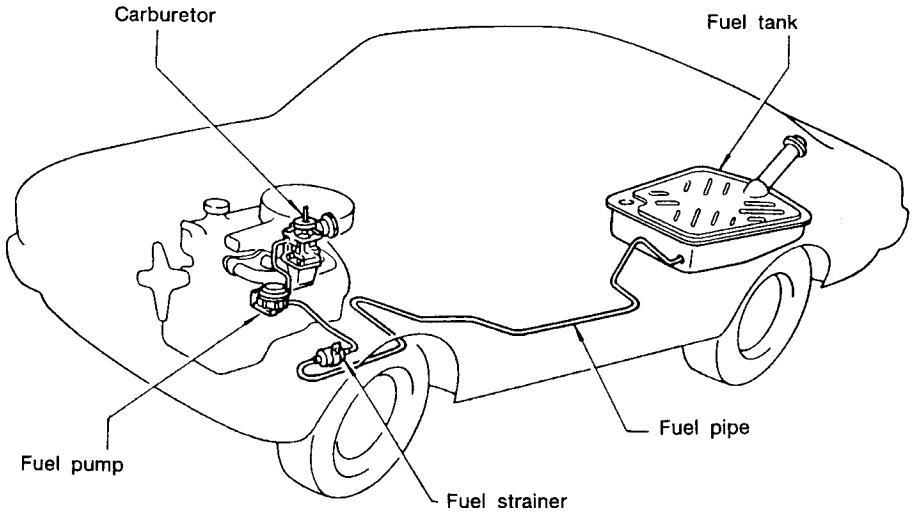
TFE009

A tube through which the combustion gases pass, from the exhaust manifold to the muffler and into the air is called the exhaust tube.

FUEL SYSTEM

1. DESCRIPTION

The fuel system is a series of systems to supply fuel to the engine. There are separate systems for carburetor, EGI (Electronic Gasoline Injection), LPG (Liquefied Petroleum Gas) and diesel fuel specifications.



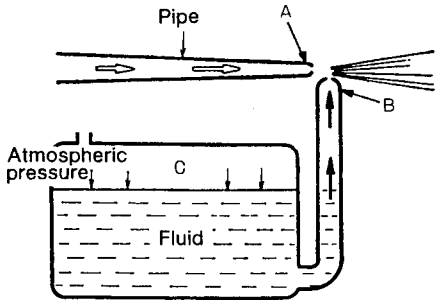
TFE010

2. CARBURETOR

The carburetor measures fuel corresponding to the air volume drawn into the engine and produces a mixture in the necessary air-fuel ratio for the respective operating condition. It controls the engine power output by adjusting the quantity of air-fuel mixture required in the cylinder.

2-1. PRINCIPLE

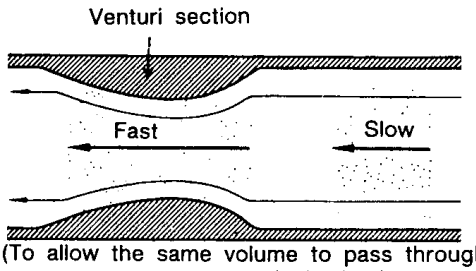
Many types of carburetors are available, but the basic principle is that fuel is converted into fine particles of fluid (in mist form) by applying a spraying principle.



TFE011

When air is blown from one end of the sprayer, the velocity of the blown air increases as it passes through the tapered pipe.

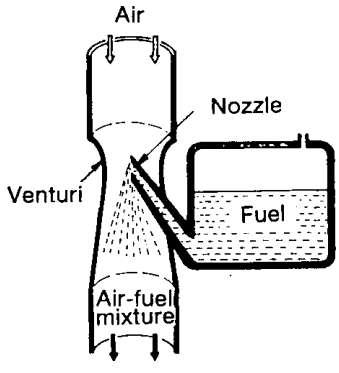
When the velocity of the air increases, the ambient pressure at the end of the pipe (point A) is reduced in proportion to the air velocity (vacuum pressure lower than the ambient pressure). Therefore, fluid is drawn from B due to the pressure difference between the ambient pressure in portion C and pressure in portion A, and the fluid is atomized by the stream of air.



(To allow the same volume to pass through in a certain time, the velocity in the narrow section increases.)

TFE012

When fluid (or air) flows in the narrow tube as shown in Fig. 104, the velocity of the fluid passing through the narrow section (venturi tube) is higher than that of the fluid passing through the wide section. Because fluid has the property that when its velocity increases the pressure decreases, the pressure at the venturi section becomes lower than other sections.
As shown below a pipe is provided in the narrow section, gasoline is drawn up and blown out in a mist, similar to the principle of a sprayer.



TFE013