TOYOTA T-TEP
STEP 1

11. Karbantartás célja, karbantartási ütemterv, karbantartás lépései

Purpose of Periodic Maintenance
An automobile is constructed from a large number of parts, which can become worn down, weakened or corroded to lower the performance, depending on the conditions or the length of use. Constructed parts, which can be estimated that performance goes down, are needed to have a periodic maintenance, then adjust or replace to maintain the performance.

By carrying out periodic maintenance, the following results can be achieved, ensuring the customer's trust and peace-of-mind:

1. Much larger problems with the vehicle that may occur later can be avoided.
2. The vehicle can be maintained in a state which is in adherence to legal regulations.
3. The life of the vehicle can be extended.
4. The customer can enjoy an economic and safe driving experience.

Maintenance Schedule

- The items for servicing of the periodic maintenance and the service interval of the vehicle are stated in the maintenance schedule chart in the maintenance schedule booklet.The maintenance schedule is stipulated by these factors: model, age, usage conditions of the vehicle.

T, R, I, A, L stand for symbols of maintenance operation.
T=Tighten to specified torque
R=Replace or change
I=Inspect and correct or replace as necessary
A=Check and/or adjust as necessary
L=Lubricate

Maintenance Schedule
Service intervals
Because lubricants and some parts deteriorate even when the vehicle is not used, service intervals are decided according to the distance traveled as well as the period elapsed since the previous service, whichever comes first .

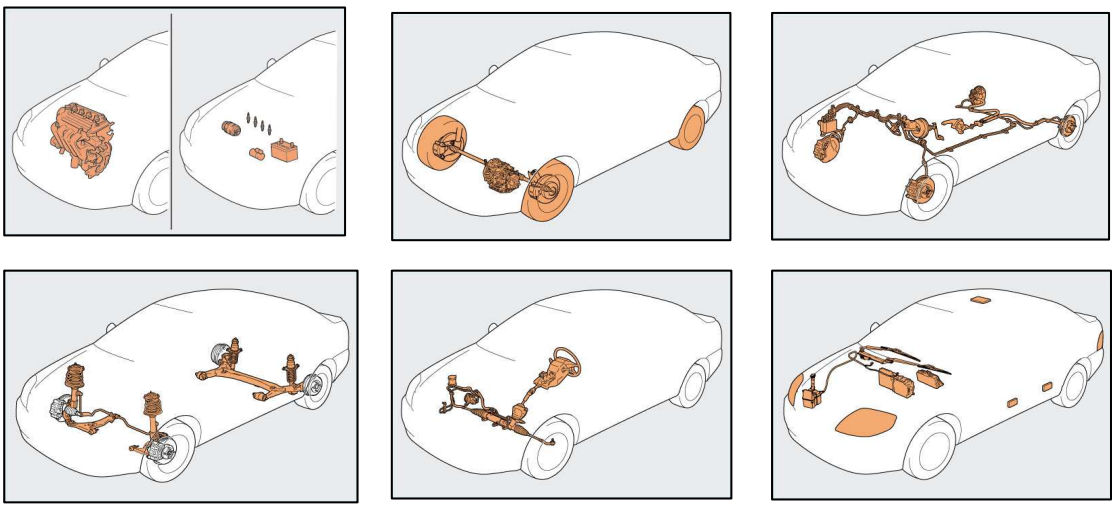
In average, vehicles are driven for 15.000 km a year. Customers who drive more will have to follow the odometer readings for correct service intervals. Less driving customers will have to follow the calendar.

Maintenance Schedule
If the vehicle is being used under severe conditions, more frequent maintenance will be necessary.
Severe conditions are:

- Door to door driving
- Exclusively city driving
- Towing trailers
- Sustained high speed driving (80% or more of the max. vehicle speed.
- Short distances in cold climate (less than 8 km at –5° C).
- Hot climates (frequently above 30° C).
- Cold climates (frequently below –15° C)
- Dusty atmosphere
- Low quality lubricants or fuel

During this presentation all aspects of periodic maintenance are handled in a structured way. Similar to other Toyota New Car Features, a vehicle is split up into different groups.

- Engine
- Drive train
- Brake system
- Suspension
- Steering
- Body electrical



Engine

Engine Oil
Importance of engine oil change
Engine oil deteriorates over time, even when the engine doesn't run.
Engine oil becomes dirty as it removes dirt and sludge inside the engine, and turns black.

If the engine oil is not changed
• The engine will be damaged due to poor lubrication, internal friction increases and engine performance drops.
• Continuing to add engine oil without performing an oil change leads to a decrease in oil performance shown in the left graph.

What is engine oil?
Engine oil has following functions:
1. Lubrication function
2. Cleaning function
3. Sealing function
4. Rust preventive function
5. Cooling function

• Refer to the maintenance schedule because the replacement interval varies by model and usage conditions of the vehicle.

Engine Oil

The reason why engine oil amount decreases

Engine oil decreases little by little even under normal conditions, as small fraction of oil burns with the fuel after lubricating. (oil consumption).
Engine oil enters the combustion chamber via the cylinder wall and valve stems.

Replacement interval

The replacement interval depends on the usage of the vehicle and the type of engine. Please refer to the maintenance schedule for details.

Because engine oil is differently treated in diesel engines as in gasoline engines, oil quality refers to different criteria based on its usage.

For gasoline engines, 3 organisations test the quality of oils and divide them in different categories.

The API (American Petroleum Institute) is the oldest institute to qualify fuels and oils. The API makes a difference in vehicles with a gasoline engine and a diesel engine. An indication starting with the character S for Service is given to oils for otto engines. The second digit indicates the category, where the latest category includes the performance of each earlier category.
On the API service label, the viscosity, quality (category) and e(nergy) c(onserving) spec. are indicated.
The "starburst" certification mark clearly indicates the usage of the oil

The Japanese -JAMA (Japanese Automobile Manufacturers Association)- and American -AAMA (American Automobile Manufacturers Association)- constructors have united in the ILSAC (International Lubricant Standardization and Approval Committee) since 1993. The aim is to classify fuel saving engine oils for gasoline engines. Energy conserving (low viscosity) engine oils are tested and given a certain grade, comparable with the API category.

The ACEA is a unity of European constructors since 1996, being: BMW AG, DAF Trucks NV, Daimler Chrysler AG, Fiat Auto Spa, Ford Of Europe Inc, General Motors Europe AG, MAN Nutzfahrzeuge AG, Dr. Ing. h.c.F. Porsche AG, PSA Peugeot Citroën, Renault SA, Scania AB, Volkswagen AG and AB Volvo.

Based on the ACEA laboratory and engine tests, a category is given on the tested oil. The higher the category, the higher the quality.
Since the test are different from the API and ILSAC, comparison between the categories is not possible.
A4 is a future oil category specially for direct injected gasoline engines.

For diesel engines, ILSAC has no standards, so only API and ACEA specifications are applicable.

The API uses "C" of commercial for the diesel engine oil quality. Since '94 with the introduction of the "F" quality, a separation was made between 2 and 4-stroke engines. For our Toyota diesel engines "CF" or "CF-4" oil can be used.

ACEA started testing engine oils for heavy duty diesel engines since 96, with the "E" indication. In '98 the light duty (passenger cars) diesel engines received some grading as well. Similar to gasoline categories, no comparison can be made with the API categories due to the different way of testing.
On most engine oil can labels, the year of implementation is **not** mentioned.

The society of American Engineers have set up a viscosity grading system for automotive use. In the graph the viscosity of an oil is expressed in relation to the oil temperature. A monograde oil will have a high viscosity at low temp. and a low viscosity at high temp. In Toyota engines, only multigrade oils are used.
This means that the oil will have the viscosity of a low viscosity monograde oil at low temp (-20° =W) and of a high viscosity monograde oil at high temp. (100°)
The lower the viscosity at low temp. the lower the internal engine resistance will be and faster lubrication after starting. At temp. above 100° C. a lower grade oil will have a higher viscosity, resulting in less wear and oil consumption .
Because of a lot of engine damages in the 80' s the CCMC/ACEA decided in 1985 to measure the HTHS (High Temperature High Shear) viscosity of the oil at 150°C instead of 100 °C. Besides, the ACEA let the oil flow through a special pump that imitates the temporarily viscosity loss. American and Japanese constructors want a fuel saving engine oil being an oil with a low viscosity especially under cold conditions, while a high viscosity oil helps reducing the oil consumption at high temps. Therefore the SAE uses lower HTHS-viscosity demands.

Engine Oil Filter
What is an engine oil filter?
This is the part that removes the carbon, sludge and metal particles in the engine oil.

If the engine oil filter is not replaced
If the filter is clogged, oil cannot flow through the filter. Then the relief valve opens and sends the dirty oil into the engine.

Replacement interval
• Replace the engine oil filter according to the distance driven or amount of time because it is impossible to judge the level of deterioration by looking. For details, please refer to the maintenance schedule of the specific vehicle

Cooling & Heater System
What is the cooling system?
This system keeps the temperature of the engine constant. Also, the warmed coolant warms the air to adjust the passenger compartment temperature.

If coolant leaks out
Not only does it cause overheating, but also it damages the engine itself.

Inspection interval
Please refer to the maintenance schedule

Radiator Cap
What is a radiator cap?
• It allows the coolant to stay at a constant pressure to keep the boiling point of the coolant above 100ºC. Also, it improves the cooling performance by making the temperature difference between the coolant and the air greater.

• The pressure valve opens at high pressure to deliver the coolant to the reservoir tank. On the other hand, the vacuum valve opens at decreased pressure to draw the coolant back in from the reservoir tank.

Importance of radiator cap inspection
If it does not function properly, it causes overheating.

Inspection interval
Please refer to the maintenance schedule for a specific vehicle

Engine Coolant
What is coolant?
It plays these roles.
• It prevents the coolant from freezing.
• It prevents oxidation in the cooling system.
• It prevents overheating. (The boiling point is higher than water.)

If the coolant is not changed
Its oxidation inhibiting property decreases, and the radiator, pipes, hoses, etc. become clogged and/or damaged.

Replacing interval
• Replace the engine coolant according to the distance driven or amount of time because it is difficult to judge the level of deterioration by looking.
• Refer to the maintenance schedule because it varies by model.

Types of coolant
Two types of LLC (Long Life Coolant): red and green. Both have almost the same ingredients.

Concentration
Use the coolant mixed with water however it freezes easily if it is not used in the appropriate concentration. Use the LLC concentration appropriate for each region. Refer to the Owner's Manual for the appropriate concentration of LLC.

Drive Belts
What is a drive belt?
Drive belt drives the auxiliary mechanisms such as the alternator, power steering pump, water pump or airco compressor.

If drive belt is damaged
Slippage can occur, increasing the wear of the belt.
• The alternator can stop operating, and the battery discharges.
• The water pump can stop operating, and it causes overheating.
  · The power steering pump can stop operating, and power steering assistance fails.

Inspection interval
According maintenance schedule

Air Cleaner Element
Roles of air cleaner element
Removes dust, sand, etc. to clean the intake air to the engine.

If air cleaner element becomes clogged
The engine power output falls and fuel economy becomes worse as the amount of air taken into the engine decreases.

Cleaning/Replacement interval
• Clean or replace the filter according to the distance driven and amount of time because it is difficult to judge the level of deterioration by looking.

Valve Clearance
What is valve clearance?
It makes the proper timing of valve opening and closing even if each parts expands by heat.

Excessive valve clearance
It causes the symptoms such as abnormal noise from the engine (tappet noise).

Insufficient valve clearance
It causes symptoms such as slight engine vibration. The closing time (cooling time) of the valves reduces and the temperature of the valves and seats can become too high.
Inspection/Adjustment interval and method
According maintenance interval

Timing Belt (Chain)
What is a timing belt?
It transfers the rotational movement of the crankshaft to the camshafts in order to properly operate the valves.
Importance of changing timing belt
It hardens due to the heat of the engine, and this can lead to cracking or causing the teeth to shear off because of the rubber material.

If timing belt breaks
The timing of the valve opening and closing is out of sync, and the engine stops operating. The piston can interfere with the valves, and the valves bend.

Replacement interval
• Replace it according to distance driven. Please refer to the maintenance schedule

Spark Plugs
What is a spark plug?
It sends sparks to ignite the air-fuel mixture which is compressed for burning.

Importance of replacement spark plug
• When the electrode wears, plug gap becomes greater.
• Dirt (carbon) sticks.

If the spark plugs are not replaced
The electrode gap increases and sparks will occur on unwanted locations between the electrodes. The fuel economy becomes worse, and the power output falls.

Inspection/Replacement interval
Please refer to the maintenance schedule because different types of spark plugs are use, thus effecting the replacement intervals.

Battery
What is a battery?
It plays these roles.
• It supplies electric power to start the engine.
• It supplies electric power to the electric devices.
• It stores electric power to start the engine again.

If battery is not inspected
• The electrolyte volume decreases, and battery cannot be sufficiently recharged.
• It deteriorates, discharges internally, and the charging capacity decreases.
If the gasket is damaged, gas evaporates into the air.
• If the vacuum valve breaks, air cannot be drawn into the tank to replace the fuel used. Then, a partial vacuum occurs in the tank causing an indentation.

Fuel Filter
What is a fuel filter?
It removes small impurities in the fuel.

If a fuel filter is not replaced?
When the filter is clogged, fuel volume decreases. At high engine loads, the engine performance will reduce.

Replacement interval
• Refer to the maintenance schedule because it varies by model

PCV (Positive Crankcase Ventilation) Valve
What is a PCV valve?
It is one of the control devices for the Emission Control, guiding the blow-by gasses back to the engine intake.

Importance of inspection of PCV valve
If the PCV valve is clogged, the blow-by gas is not taken into the intake manifold, and is released into the air.
It also mixes with the engine oil and deteriorates the oil.

REFERENCE:
Blow-by gas
This contains a large amount of unburned gas (HC), which blows from the gap between the piston ring and the cylinder wall out to the crankcase.

Charcoal Canister
What is a charcoal canister?
This device prevents evaporated gas from the fuel tank from escaping into the atmosphere.

Importance of inspection of charcoal canister
When the check valve sticks, it stops operating correctly. Then the evaporated gas is released into the atmosphere.

CHASSIS

Clutch Pedal
Importance of adjusting clutch pedal
•The appropriate stroke is required for the clutch to operate normally.
•The clutch unit fails to operate normally.
(Clutch becomes unable to disengage.)

Transmission Oil/Differential Oil
Importance of changing transmission oil/differential oil
Oil deteriorate during usage.

If oil is not changed
It causes the formation of oxidants which accelerates the wear of various parts.

Oil leakage
The transmission oil or the differential oil does not decrease in volume with mileage as does the engine oil. Any reduction in the oil volume is invariably caused by an oil leak.
Inspection/Changing interval
•Inspect/change according to the distance driven or amount of time because it is difficult to judge the level of deterioration by looking.
Transmission oil & differential oil:
•Refer to the maintenance schedule because it varies by model or usage condition.
Oil knowledge
•Gear oil is classified by API and SAE ratings.
•Fill with the prescribed amount of oil. If the prescribed amount of oil is not used, damage to the internal parts will occur. Refer to the Owner's manual for the correct oil to use.

Automatic Transmission Fluid
Importance of changing ATF
It deteriorates with use.

If ATF is not changed
•The shock becomes greater during shifting.
•The fuel economy gets worse.
•The transmission generates abnormal noise.

Fluid leakage
Inspect the ATF level, which should not decrease with mileage or the length of use. If the ATF level has decreased, it has invariably been caused by a fluid leak, which requires the replacement of the oil seals.

Reason for the inspection/replacement interval
•Inspection/Replacement according to the distance driven and amount of time because it is difficult to judge the level of deterioration by looking.

Inspection/Replacement interval
1. Wear
•Replace the tire when the tread depth of the tire wears below 3mm.
•If the depth of the tire tread reaches 1.6mm, the tire indicator appears on the tire surface and indicates the need for replacement. (It indicates the limit of tire wear.)

2. Air pressure
•It is possible to judge by looking.
•If pressure is incorrect, excessive tire wear will occur.
•Refer to the Owner's Manual for the prescribed air pressure.
•Check the spare tire at the same time as the tire inspection.

Condition of tire wear/uneven wear (Alignment)
When there is uneven wear such as both edge wear, center wear, feather wear, one side edge wear (inside or outside) or any other abnormal wear, it is a sign that there is a problem with the wheel alignment, not only with the air pressure.

1. Angular ball bearing
This type of ball bearing is made to support a radial load and one-directional thurst load and supports the axle with a combination of two bearings. It is tightened to the prescribed torque.

2. Tapered roller bearing
It can support the load for radial and thrust directions, and supports the axle with a combination of two bearings.
A preload adjustment is performed for the tapered roller bearing.
REFERENCE:
Preload adjustment
If the bearing is tightened hard, there is no gap and it cannot move. Therefore, tighten once and then loosen a little. After that, tighten to the prescribed torque.

Brake Pedal
Importance of adjusting brake pedal
• Correct brake pedal stroke is required to attain the proper braking force.

• Adjust brakes so that they are not "Dragging" or "Holding on" when pedal is not depressed.

Inspection items
1. Pedal condition
2. Pedal height
3. Pedal play
4. Pedal reserve distance
5. Function of brake booster

Disc Brake
Importance of replacing disc brake pads
When the disc brake pads wear, the disc rotor and the backing of pad touch directly, causing damage to the rotor.
Inspection interval
- It can be judged by looking.
- When the remaining thickness of the disc pads fall below 1.0mm, replace them.

Pad wear indicator
It is installed on the backing of the disc pad. When a pad wear indicator touches the rotor, the indicator makes a noise to inform the driver that disc pad wear has reached the limit.

Drum Brake
Importance of replacing the brake lining
- When the brake lining wears, braking performance drops as the gap between the shoe and the drum becomes greater.
- As the shoe touches the drum directly, it damages the drum.

Importance of applying grease at sliding portion
When the sliding portion rusts, the brake shoe does not operate smoothly.

Inspection/Replacement interval
- Inspect/replace according to the distance driven or amount of time.
- It can also be judged by looking.
- When the remaining thickness of lining falls below 1.0mm, replace it.

Brake Fluid

Importance of replacement of brake fluid
- Brake fluid is hydroscopic. This means brake fluid absorbs moisture from the air, and therefore its boiling point drops. When heat is generated during braking, the fluid boils creating air bubbles ("Vapor

locking"). When the air bubbles are created, they absorb the hydraulic braking force applied to the wheel cylinders, creating a loss of braking altogether.

- The moisture also creates rust to form in the wheel cylinders, which can cause the seals to leaks brake fluid.

Reasons for drop in fluid level

1. The brake pads and brake lining wear.
2. Fluid leaks out from the brake hydraulic system.

Brake Pipe & Hose

Importance of checking brake line

The brake hoses deteriorate and damage such as cracks and bulging.

If the brake line is not checked

The brake fluid leaks out, and the brakes do not work.

Inspection/Replacement interval

The brake hoses should be checked periodically. When any trouble is found, replace the hose immediately

Parking Brake Lever

Importance of adjusting parking brake lever

1. When the amount of parking brake lever is too large.

The parking brake has very little effect.

Due to brake lining wear or brake pad wear the parking brake stroke becomes too long.
Check the repair manual or SDS before checking a vehicle.

Check after adjusting carefully the parking brake stroke, because to short stroke will lead to overheating the brakes due to drag.

Ball Joint

Function of the ball joint

It supports the load in the vertical direction and the horizontal direction.

If ball joint play becomes too great

When the seat in the ball joint wears, play increases. This changes the wheel alignment, etc. because the ball joint cannot support the load.
During the inspection, if play is not excessive, check the boot on cracks and fixation. If grease can escape and dirt can enter the ball joint, wear will be accelerated.

Steering Wheel & Linkage

Irregularities in steering system

Check for these items: play of steering wheel, oil leakage from gear box, bending, breaking, cracking or looseness of steering linkage. If any trouble is found, it should be tightened or replaced.
A problem in the steering system can result in excessive tire wear on the front wheels, loss of power steering or unstable vehicle behavior.

Power steering fluid

Use ATF DEXRON®II or III

REFERENCE:

•Whiting, foam and fluid level gap

These occur when air is mixed with the fluid. This may be a sign that there are cracks or damage in pipes of the power steering system, and air has entered.

•Why is it important not to hold the steering wheel in a fully turned position?
Power steering fluid is always circulating in the power steering system. When turning the steering wheel, the power piston in the power cylinder is pushed, and supplies power to help turn the steering wheel. If the steering wheel is fully turned to one side, the fluid that is circulation cannot flow out. This creates a great load and heat generation on the system.

Grease change on some commercial vehicles
Importance of grease change
The grease deteriorates with use, as it is exposed to heat, or through the entry of water or dust. The deterioration of the grease creates rust, or creates looseness by wearing the bushing.

Grease with different properties such as heat resistance, water resistance, and mechanical stability are used at different locations. Therefore, make sure to use the specified type of grease.

BODY ELECTRICAL

Description
The electrical system makes the vehicle drive more safely and the interior more comfortable.
If it is broken, it may be dangerous to drive the vehicle. Therefore the maintenance is required
Theses are the maintenance items which are related to the electrical system.
•Light
•Warning light
•Wiper & Washer
•Air conditioner

Bulb replacement
•When one of a pair of light bulbs is blown, it is recommended to also replace the other at the same time because the other bulb is also approaching the end of its service life.
•Use the proper bulb because bulbs vary by power, voltage and by the place where they are used.

- **Always use a cloth when handling bulbs.**
  -bulbs become very hot during operation, finger tips could be burned.
  -the grease on human skin creates a heat insulation spot on the bulb glass. Internal temperature of the bulb will be too high which reduces the lifespan of the filament.

When replacing, check shape and specifications.

Warning Light
What is a warning light?
•It is a light that illuminates or flashes when there is trouble in a system, replenishment or replacement is required, or to help the driver drive safely.

•Light color is divided into red or orange by the level of emergency or importance.

Indication of trouble
1. Brake system warning light

- It illuminates when the parking brake lever is applied.
- It illuminates when the brake fluid level is low.
- It illuminates when the vacuum of the brake line for diesel engine is low.
- It illuminates when there is a malfunction in the EBD system.

2. Seat belt reminder light
It illuminates when a seat belt is not fastened.

3. Discharge warning light
It illuminates when there is a malfunction somewhere in the charging system.

4. Malfunction indicator lamp
It illuminates when there is a malfunction in the engine control system or transmission control system.

5. Low fuel level warning light
It illuminates when the fuel in the fuel tank is close to empty.

6. Low engine oil pressure warning light
It illuminates when the pressure of the engine oil drops. (The oil level is low.)

7. ABS warning light
It illuminates when there is a malfunction in the ABS system.

8. Open door warning light
It illuminates when a door is not closed.

9. SRS warning light
It illuminates or blinks when there is a malfunction in the SRS airbag system.

10. Timing belt replacement warning light
It illuminates when the distance driven reaches the replacement timing of the timing belt.

11. Fuel filter warning light
It illuminates when the water level in the fuel filter reaches the prescribed limt.

Wiper & Washer

Importance of inspection/replacement for wiper rubber
•The rubber inserts in the wipers scrape against the windshield to wipe the water off the surface and gradually wear over time.
•When scratches are created on the rubber inserts by the fine sand or dust particles that adhere to the windshield, they leave wiping lines on the windshield.

Freezing point of the fluid
If the fluid is only water, the washer fluid freezes when the air temperature reaches below 0° C
and the cleaning performance (insect removal) will be poor.
Therefore use the proper washer fluid and the proper concentration for each climate.