
SECTION 7C

MANUAL CONTROL HEATING, VENTILATION AND AIR CONDITIONING SYSTEM

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DESCRIPTION AND OPERATION

SYSTEM COMPONENTS- FUNCTIONAL

Compressor

All compressors are belt-driven from the engine crankshaft through the compressor clutch pulley. The compressor pulley rotates without driving the compressor shaft until an electromagnetic clutch coil is energized. When voltage is applied to energize the clutch coil, the clutch plate and hub assembly is drawn rearward toward the pulley. The magnetic force locks the clutch plate and pulley together as one unit to drive the compressor shaft.

As the compressor shaft driven, it compresses the low pressure refrigerant vapor from evaporator into high pressure, high temperature vapor. The refrigerant oil that is used to lubricate the compressor is carried with the refrigerant.

Magnetic Clutch

The magnetic clutch is assembled in front of the compressor and controls to stop or operate the compressor.

The center piece is inserted to the compressor crankshaft and rotate the only the pulley when it doesn't operate the compressor. When the A/C switch is turned ON, the current flows into the wrapped coil of the stator and the stator is converted to the powerful electromagnet. Therefore, the compressor can rotate with the pulley together because the stator can pull the center piece tightly.

V-5 Compressor-General

Description

Vehicle using the V5 compressor may have differences between installations in the mounting brackets, the drive system, the pulleys, the connections and the system capacities. Basic overhaul procedures are similar between the compressors used on different vehicles.

When serving the compressor, keep dirt and foreign material from getting on or into the compressor parts and the system. Clean tools and a clean work area are important for proper service. The compressor connections and outside of the compressor should be cleaned before performance of any on-vehicle repairs and before removal of the compressor. The parts must be kept clean at all times and any parts that are to be reassembled should be cleaned with trichloroethane, naphtha, stoddard solvent, kerosene or equivalent solvents and dried with dry air. Use only lint-free cloths to wipe the parts.

The operations described are based on bench overhaul with the compressor removed from the vehicle, except as noted. They have been prepared in the order of accessibility of the components. When a compressor is removed from the vehicle for servicing, the amount of oil remaining the compressor should be drained, measured and recorded. This should then be discarded and new polyalkaline glycol (PAG) refrigerant oil added to the compressor.

Important: The oil drain plug must be removed and the oil drained through the plug opening to insure complete draining of oil from the compressor.

V-5 Compressor-Operation

The V5 is a variable displacement compressor that can match the automotive air conditioning demand under all conditions without cycling. The basic compressor mechanism is a variable angle wobble-plate with seven axially oriented cylinders. The center of the control of the compressor displacement is a billows-actuated control valve located in the rear head of the compressor that senses compressor suction pressure.

The wobble-plate angle and the compressor displacement are controlled by the crankcase suction pressure differential. When the A/C capacity demand is high, the suction pressure will be above the control point. The valve will maintain a bleed from crankcase to suction. With no crankcase suction pressure differential, the compressor will have maximum displacement.

When the A/C capacity demand is lower and the suction pressure reaches the control point, the valve will bleed discharge gas in the crankcase and close off a passage from the crankcase to suction plenum. The angle of the wobble-plate is controlled by a force balance of seven pistons. A slight elevation of the crankcase suction pressure differential creates total force on the piston resulting in a movement about the wobble-plate pivot pin that reduces the plate angle.

The compressor has a unique lubrication system. The crankcase suction bleed is routed through the rotating wobble-plate for lubrication of wobble-plate bearing.

The rotation acts as an oil separator that removes some of the oil from the crankcase where it can lubricate the compressor mechanism.

Condenser Core

The condenser assembly in front of the radiator consists of coils, which carry the refrigerant and cooling fins that provide the rapid transfer of heat. The air passing through the condenser cools the high-pressure refrigerant vapor and causes it to condense it to condense into a liquid.

Receiver-Drier

The sealed receiver-drier assembly is connected between the condenser and evaporator. It acts as a refrigerant storing container, receiving liquid and some vapor and refrigerant oil from the condenser.

At the bottom of the receiver-drier is the desiccant, which acts as drying agent for the moisture that may have entered the system. An oil bleed hole is located near the bottom of the receiver-drier outlet pipe to provide an oil return path to the compressor. The receiver drier is serviceable as an assembly.

Expansion Valve

The expansion valve can fall in three different positions: open, closed or restricted.

An expansion valve that fails in open position will result in a noisy A/C compressor or no cooling. The cause can be a broken spring, a broken ball or excessive moisture in the A/C system. If the spring or the ball are found to be defective, replace the expansion valve. If excessive moisture is found in the A/C system recycle the refrigerant.

A restricted expansion valve will result in low suction pressure and no cooling. This may be caused by debris in the refrigerant system. If debris is believed to be the cause, recycle the refrigerant, replace the expansion valve and replace the receiver-drier.

Evaporator

The evaporator is a device which cools and dehumidifies the air before it enters the vehicle. High pressure liquid refrigerant flows through the expansion tube (orifice) and becomes a low pressure gas in the evaporator. The heat in the air passing through the evaporator core is transferred to the cooler surface or the core, which cools the air.

As the process of heat transfer from the air the evaporator core surface is taking place, any moisture (humidity) in the air condenses on the outside surface of the evaporator core and is drained off as water.

Pressure Relief Valve

The compressor is equipped with a pressure relief valve which is placed in the system as a safety factor. Under certain conditions, the refrigerant on the discharge side may exceed the designed operating pressure at approximately at 3,171 to 4,137 kPa (460 to 600 psi) in an R-134a system. Conditions that might cause this valve to open, such as a defective pressure transducer, an inoperative cooling fan, etc., should be corrected. The refrigerant oil and the refrigerant should be replaced as necessary.

Controller

The operation of the A/C system is controlled by the switches and knob on the control head. This console-mounted controller contains following control knobs.

Rotary Temperature Control Knob

- Actuates by cable.
- Raise the temperature of the air entering the vehicle by sliding to the right or the red portion of the knob.
- Varies the mix of the fresh air from outside the vehicle with the heated air from inside the vehicle to suit individual performance.

Rotary Mode Control Knob

- Actuates by cable.
- Regulates the air distribution between the windshield, the instrument panel and the floor vents.

Rotary Blower Control Knob

- Turn on to operate the blower motor at four speeds.
- Turn OFF to stop the blower.
- Operates completely independently from both the mode control knob and temperature control knob.
- Changes the fan speed in any mode and at any speed.

SPECIFICATIONS

Component			Description	
Compressor		Type	Variable Displacement	
		Model	Single	V-5 Compressor
			Dual	V-7 Compressor
			Gasoline	10PAIRC
		Displacement	Single	9.8 - 151 cc/rev
			Dual	179 cc/rev
			Gasoline	170.5 cc/rev
Max. RPM		6,000 - 7,500 rpm		
Refrigerant		Type	R-134a	
		Capacity	Single	850 ± 50 g
			Dual	1200 ± 50 g
Oil		Type	Synthetic PAG Oil	
		Capacity	260 cc	
Receiver-Drier		Material	Aluminum	
		Capacity	260 cc	
A/C Condenser		Max. Capacity	11,400 Kcal/h	
Evaporator		Size	263.0 x 228.6 x 88.9 mm	
		Capacity	6,500 Kcal/h	
A/C Pressure Sensor	High Pressure	A/C ON/OFF	305/425 psi	
	Low Pressure	A/C ON/OFF	39/30 psi	
A/C Cutoff Pressure		High Pressure	32 Kg/cm²	
		Low Pressure	4 Kg/cm²	

DIAGNOSTIC INFORMATION AND PROCEDURES

INSUFFICIENT COOLING DIAGNOSIS

Step	Action	Yes	No
1	1. Check the A/C fuse. 2. Check the operation of the blower motor and cooling fan. 3. Check the accessory belt. 4. Check the A/C condenser for restricted air flow. 5. Check the engagement of the compressor clutch. 6. Check the discharge air temperature with the A/C turned ON. Are all above the operations normal?	System OK	Go to Step 2
2	1. Turn the ignition to LOCK. 2. Connect the high/low pressure gauges. Are both pressures within the specified value?	Go to Step 4	Go to Step 3
3	1. If it's above the specified value, discharge the refrigerant. 2. If it's below the specified value, add 0.45kg (1 pound) of the refrigerant and repair any leaks as needed. 3. Recover, evacuate and recharge the A/C system. Is the repair complete?	System OK	-
4	1. Start the engine and allow it to run at idle. 2. Turn the A/C switch to ON. 3. Set the blower motor switch to 4th. 4. Set the temperature control lever to full cold. Does the A/C compressor clutch engage?	Go to Step 8	Go to Step 5
5	1. Turn the ignition to LOCK. 2. Check the open or short in the compressor wiring. Is there any open or short in the wiring?	Go to Step 6	Go to Step 7
6	Repair the faulty wiring as needed. Is the repair complete?	System OK	-
7	Replace the compressor clutch coil. Is the replacement complete?	System OK	-
8	Check for a knocking noise from the A/C compressor. Cycle the A/C compressor ON and OFF in order to verify the source of the noise. Do you hear a loud knocking noise?	Go to Step 9	Go to Step 10
9	1. Recover the A/C system refrigerant. 2. Replace the A/C compressor. 3. Evacuate and recharge the A/C system. 4. Check the A/C system for leaks. Is the compressor running normally?	System OK	-
10	1. Close all of the windows and doors. 2. Set the A/C switch to ON position. 3. Set the intake air control switch to "Fresh Air". 4. Set the blower motor switch to 4th. 5. Set the temperature control switch to full cold. 6. Keep it to run at idle for 5 minutes. 7. Check the temperature at the inlet/outlet of the evaporator. Is there a noticeable difference in the temperature of the evaporator inlet/outlet pipes?	Go to Step 11	Go to Step 13

Insufficient Cooling Diagnosis (Cont'd)

Step	Action	Yes	No
11	1. Recover the A/C system refrigerant. 2. Replace the expansion valve as needed. 3. Evacuate and recharge the A/C system. 4. Check the A/C system for leaks. 5. Operate the A/C system. Is the discharge temperature normal?	Go to Step 13	Go to Step 12
12	1. Recover the refrigerant of the A/C system. 2. Evacuate and recharge the A/C system. 3. Check the A/C system for leaks. Does the A/C system operate normally?	System OK	-
13	Feel the liquid pipe between the condenser and the expansion valve. Is the pipe cold?	Go to Step 15	Go to Step 14
14	1. Repair any restriction in high pressure side. 2. Check the A/C system for leaks. Does the A/C system operate normally?	System OK	-
15	1. Run the engine at 3,000 rpm. 2. Close all of the windows and doors. 3. Set the A/C switch to ON. 4. Set the blower motor switch to 4th. 5. Set the temperature control switch to full cold. 6. Turn the A/C switch ON and OFF every 20 seconds for 3 minutes. 7. Measure the compressor high and low pressure. Are both pressures within the specified value?	Go to Step 17	Go to Step 16
16	Add the specified amount of the refrigerant to the A/C system. Is the amount within the specified value?	System OK	-
17	1. Turn the ignition to LOCK. 2. Set the A/C switch to OFF position. Can you turn the compressor clutch freely by hand?	Go to Step 18	Go to Step 19
18	1. Check the A/C system for leaks. 2. Repair any leaks as needed. 3. Evacuate and recharge the A/C system. Does the A/C system operate normally?	System OK	-
19	1. Recover the refrigerant of the A/C system. 2. Evacuate and recharge the A/C system. 3. Check the A/C system for leaks. 4. Replace the compressor as needed. Is the repair complete?	System OK	-

ABNORMAL REFRIGERANT PRESSURE

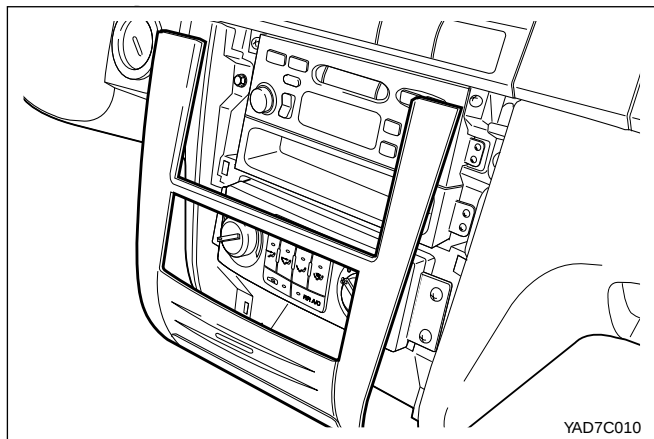
Step	Action	Yes	No
1	1. Verify whether airflow and excessive refrigerant. 2. Check any restriction at the condenser or radiator. 3. Check the condenser or cooling fan for proper operation. 4. Check any restriction of the refrigerant lines. Is the high-side refrigerant pressure high abnormally?	Go to Step 2	Go to Step 3
2	1. Recover, evacuate and recharge the A/C system according to the specified value. 2. Clean the condenser or radiator core. 3. Check the voltage, rpm, direction of the cooling fan. 4. Repair or replace the appropriate parts as needed. Is the high-side pressure within the specified value?	System OK	-
3	1. Check the amount of the refrigerant. 2. Check the internal faulty of the compressor. 3. Check the faulty of the expansion valve. 4. Check the moisture mix into the system. Is the high-side refrigerant pressure low abnormally?	Go to Step 4	Go to Step 5
4	1. Replace the compressor and the expansion valve as needed. 2. Recover, evacuate and recharge the A/C system according to the specified value. 3. Repair any leaks as needed. Is the repair complete?	System OK	-
5	1. Check the freezing/clogging of the expansion valve. 2. Check the clogging of the receiver-drier. 3. Check the amount of the refrigerant. Is the low-side refrigerant pressure low abnormally?	Go to Step 6	Go to Step 7
6	1. Clean the expansion valve and replace it as needed. 2. Replace the receiver-drier as needed. Is the repair complete?	System OK	-
7	1. Check the expansion valve and the compressor for any faulty. 2. Check the excessive amount of the refrigerant. Is the low-side refrigerant pressure high abnormally?	Go to Step 8	Go to Step 9
8	1. Replace the expansion valve and the compressor as needed. 2. Add the specified amount of the refrigerant. Is the repair complete?	System OK	-
9	1. Check the tightening condition of the refrigerant line coupling and bolts. 2. Check the faulty O-ring. 3. Check the faulty gasket or seal of the compressor. Is there any refrigerant leak?	Go to Step 10	System OK
10	1. Tighten the bolts. 2. Replace the faulty O-ring. 3. Replace the faulty compressor. Is the repair complete?	System OK	-

REPAIR INSTRUCTIONS

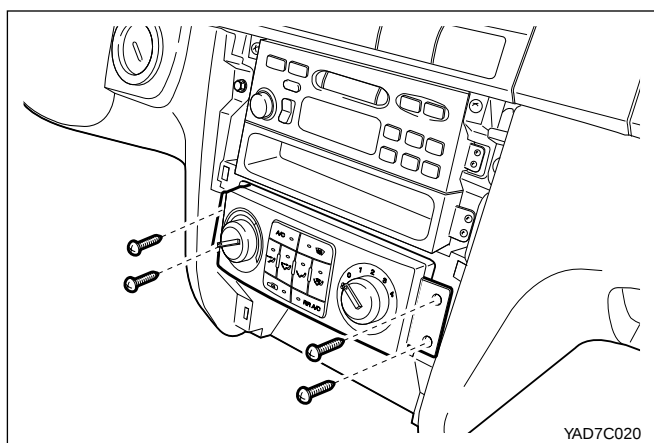
ON-VEHICLE SERVICE

CONTROL SWITCH ASSEMBLY

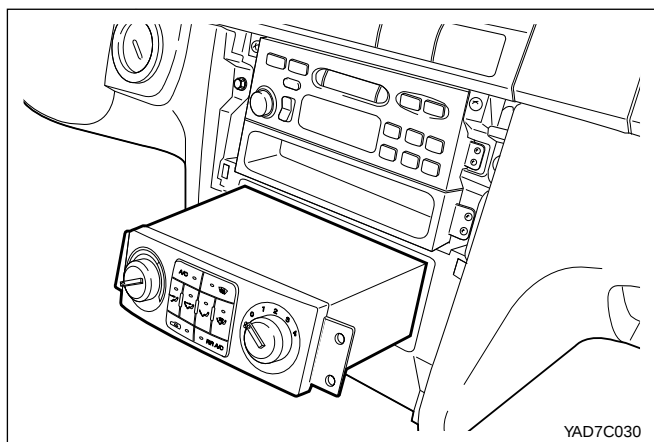
1. Remove the center instrument panel.

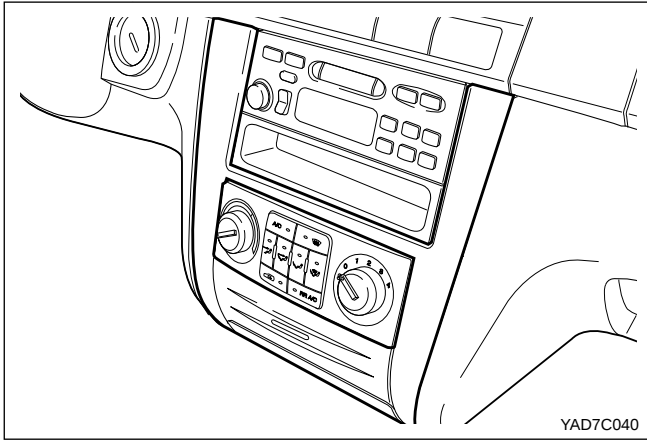


2. Remove four screws securing the A/C control switch assembly.



3. Remove the A/C control switch assembly from the instrument panel.





4. Installation should follow the removal procedure in the reverse order.

Notice: Insert connector to the switch and then assembly the