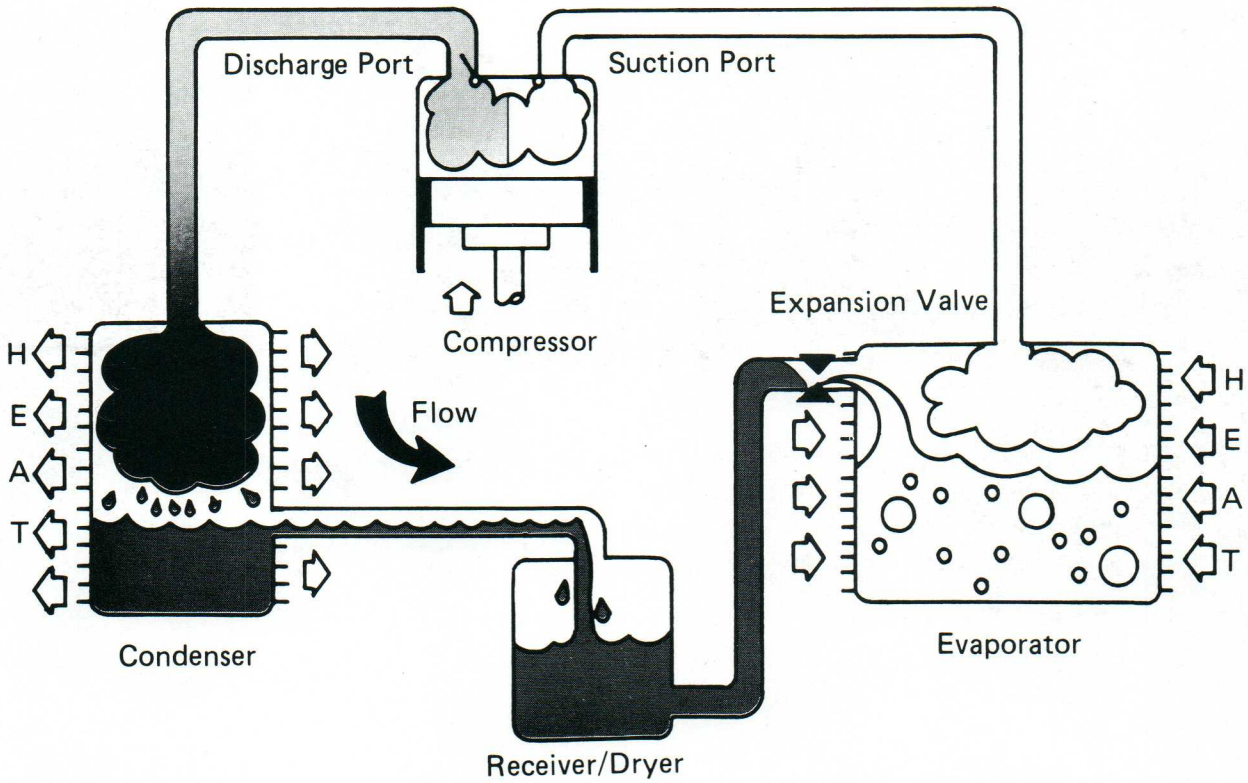
TOYOTA
SERVICE NEWS

Summer 1987 The Independents' Guide to Professional Toyota Service and Repair Bulletin 24

AIR CONDITIONING

SERVICE AND DIAGNOSIS



REFRIGERATION CYCLE

IN THIS ISSUE:

"The Toyota STAR Cabinet helped me solve my wait problem."

"Wait loss. That's what happens when your customer goes somewhere else because *you* don't have the part you need to fix his car. It happened to me, and believe me, it's painful.

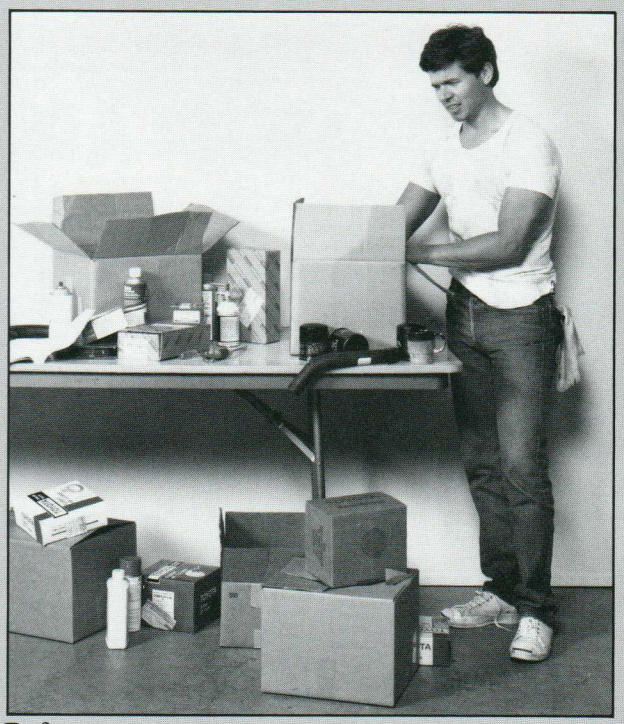
"Then my Toyota STAR Dealer showed me what the STAR Cabinet could do for my business. Now I can stock the fast-moving Toyota Genuine Parts my shop needs.

"The inventory is tailored to *my* business, and it's restocked regularly – with no delivery charge. That means parts are within reach, or a phone call away.

"The STAR Cabinet is attractive, too. It can hang on the wall or sit on the floor, and the shelves are adjustable. It even comes with a security lock.

"It's just one of many services my Toyota STAR dealer offers.

"Now my customers are satisfied. And so am I."



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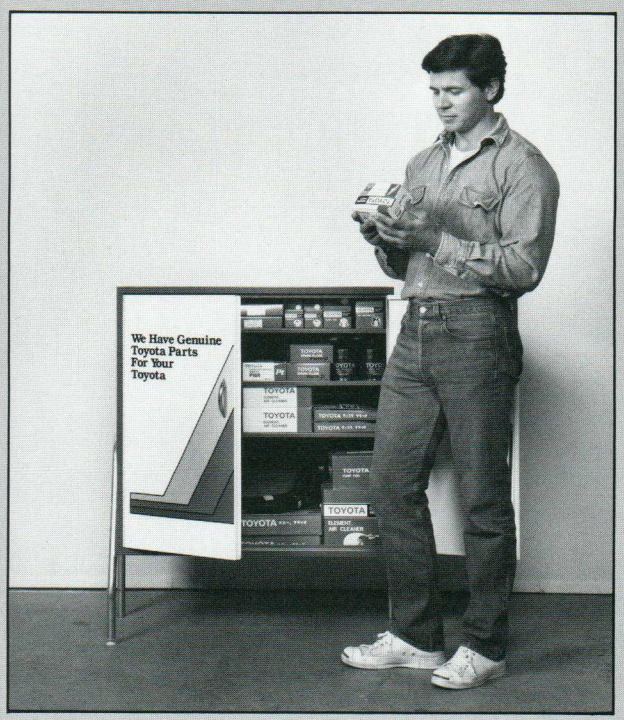

After

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THIS ISSUE

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BODY LANGUAGE

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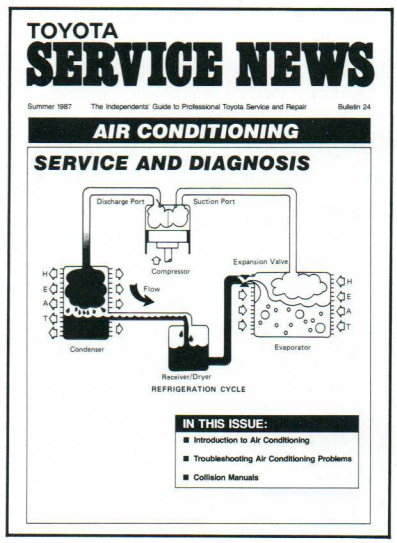

Summer's almost here — and what a perfect time to focus on air conditioning! This issue provides an introduction to air conditioning, along with basic service procedures and troubleshooting guides.

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Article No. 215

INTRODUCTION TO AIR CONDITIONING

Purpose

The purpose of air conditioning is to maintain a comfortable environment. Complete air conditioning involves:

1. Temperature control
2. Air circulation control
3. Humidity control
4. Air purification

Basic Operation of the Refrigeration Cycle

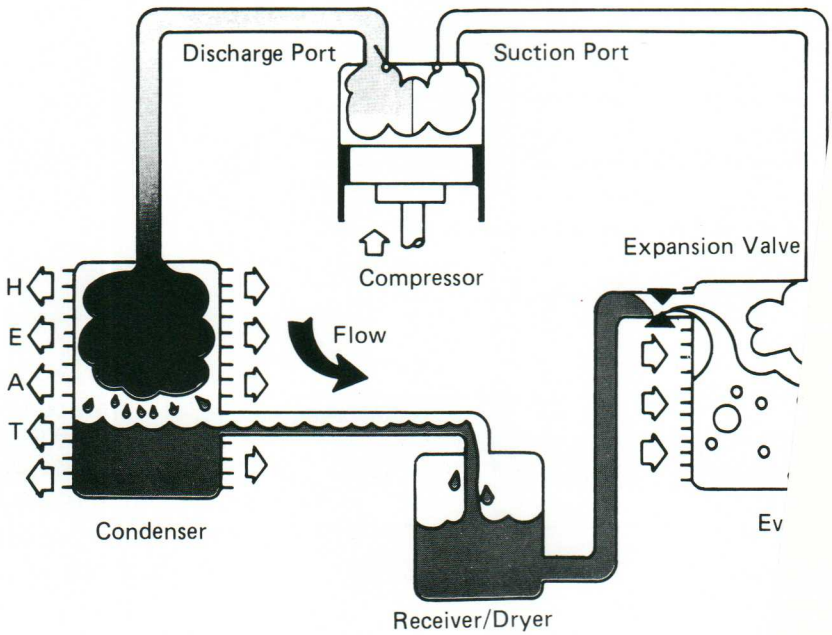


Figure 215-1

In Figure 215-1, the arrow indicates that the cycle runs counterclockwise. The compressor draws in freon gas through the suction port, squeezes it very tightly and discharges it as a hot high-pressure gas. It gets cooled slightly (still hot) into a liquid under pressure as it flows through the condenser, and is then stored by the receiver-dryer until needed. The expansion valve allows very small amounts of the hot liquid freon to spray through its tiny opening into the evaporator.

The freon is more of a foggy mist at this point, and begins to evaporate rapidly. When it evaporates, it absorbs heat.

The heat is taken from the air blowing across the evaporator fins and thus gives us the cold air used to cool the vehicle's passengers. In essence, the evaporating freon has "removed" the heat from inside the vehicle.

The freon, having fully evaporated, is once again a gas, ready to start the whole cycle over again.

That's a pretty basic view of the cycle, but it should give you a feel for how it works. Let's take a closer look at each key area.

INTRODUCTION (Continued)

Basic Components

Compressor (Figure 215-2): It's critical that only gas be drawn into the compressor. If liquid enters, it will cause a hydrostatic lock in the compressor and stall it. The gas drawn in is compressed to over 14.1 kg/cm2 (201 psi, 1,383 kPa), which causes it to get very hot.

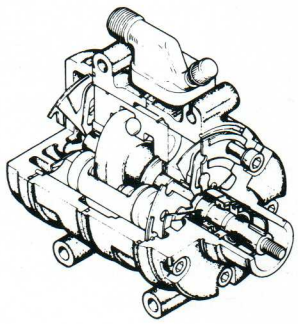


Figure 215-2

Condenser (Figure 215-3): The condenser mounted at the front of the car acts as a radiator, drawing off some of the heat of compression, and changes the high-temperature gas into a liquid under high pressure. When operating normally, the top of the condenser is full of hot liquid.

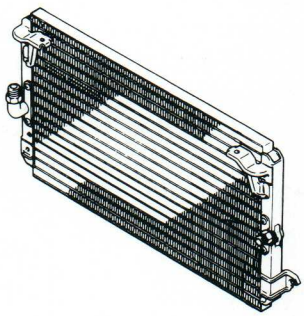


Figure 215-3

Receiver/dryer (Figure 215-4): This component acts as a storage device for liquid freon. It also contains a filter and a dessicant, which is a material that absorbs any water mixed with the freon. Usually, the receiver/dryer also contains a sight glass at the outlet which allows us to see the freon flowing out of it and to the expansion valve.

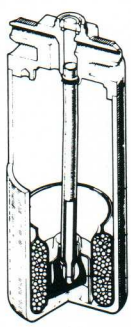


Figure 215-4

Expansion valve (Figure 215-5): This small valve controls the flow of freon into the evaporator. It is controlled by a temperature sensor at the evaporator outlet. If the outlet temperature is too high, it means not enough freon is flowing into the evaporator and poor passenger cooling will result.

If the outlet temperature is too cool, it means too much freon is flowing and the evaporator fins probably will load up with ice. In either case, the feedback temperature sensor opens or closes the expansion valve opening to achieve the correct flow rate and evaporator outlet temperature.

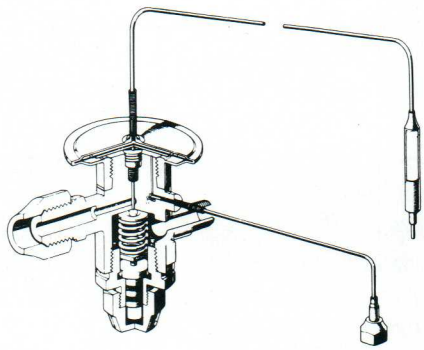


Figure 215-5

Evaporator (Figure 215-6): The last component in the cycle, and where we finally get around to cooling air. As the foggy mist of freon enters, the air passing over the evaporator fins gives up its heat to the evaporating freon. At the inlet the freon is warm liquid; at the outlet it has changed to a low-pressure gas.

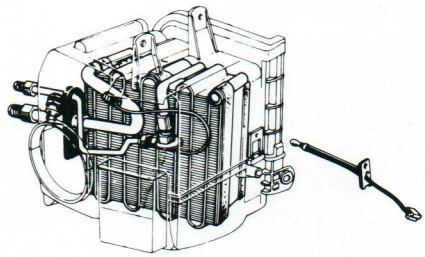


Figure 215-6

Article No. 216

AIR CONDITIONING SERVICE AND DIAGNOSIS

Fast and accurate diagnosis of air conditioning problems requires a systematic approach. This article is intended as a quick reference to basic air conditioner service. Technicians should refer to applicable Toyota Repair Manuals and wiring diagrams for specific related information.

Safety Precautions

Although R-12 Refrigerant is non-flammable and non-toxic, the following precautions must be observed for safe service work:

1. Always wear safety goggles. R-12 refrigerant is under pressure and should not contact your eyes or skin.
2. Never heat a can of R-12 above 125 degrees F, or leave it in the hot sun. Excessive heat may cause a drum to explode.
3. Never steam clean or weld near components or lines of an air conditioning system. The heat will cause excessive pressure buildup.
4. Never discharge R-12 in a closed area. It's heavier than air and can displace breathing air, causing asphyxiation.
5. Never smoke near R-12 or allow it to discharge near open flame. It produces poisonous phosgene gas in the presence of open flame.

Begin by Understanding the Complaint

To begin diagnosis, start up the engine and stabilize the A/C system:

- Blower setting: HI
- Temperature setting: maximum COOL
- Air control lever: RECIRC
- Engine: running at operating temperature, 1500 rpm

As the system is stabilizing, talk to the owner or look over the service writer's comments. Four questions should be asked:

1. Were windows and vents fully closed?
2. Was weather quite humid when cooling problems occurred? An air conditioner is not as effective in humid weather as in dry, because it must first remove heat from the water vapor before cooling the air. Some owners expect more cooling than the system can deliver.
3. Was frost or ice noticed at the evaporator? (This may indicate a faulty expansion valve or an incorrect combination of temperature and blower settings. Ice in the evaporator blocks airflow through the unit and reduces cooling.)
4. What blower and temperature settings were used when the problem occurred? The combination of a MAX COOL temperature setting and a LOW blower speed should be avoided in humid weather to prevent evaporator icing.

Asking these four questions will take care of many customer problems.

After the system is stabilized, check the evaporator's temperature to see whether a problem really exists. Insert a dial-type thermometer into the center vent where the temperature should be about 15 degrees F cooler than the air entering the evaporator. If the outcoming air is warmer than this, the system may need service.

SERVICE AND DIAGNOSIS (Continued)

Basic Approach to Determining the Cause

Although you may encounter various types of complaints, you'll find they usually fit into these five major categories:

1. Engine overheating
2. Noisy system operation
3. Insufficient cooling
4. Intermittent cooling
5. No cooling

Diagnosis in any of these five categories should always begin with a sight-sound-touch check. Frequently, this will be all that is required to determine the problem. Cooling problems sometimes require further diagnosis with a system pressure test, a leak inspection or an electrical circuit inspection.

Sight-Sound-Touch Checks

As the following troubleshooting charts indicate, the causes of many problems are located simply by looking, listening and touching various points of the system (Figure 216-1). For problems of engine overheating and noisy operation, this is the main method of diagnosis. For the three categories of cooling problems, a sight-sound-touch check is recommended to help you quickly zero in on the cause. The following procedure is suggested:

Inside the Car

- Check evaporator outlet temperature.
- Check blower speed at all switch positions.
- Listen for unusual noises.

Under the hood

- Make sure the compressor operates when engine speed is increased above specified engine rpm.
- Check refrigerant level in sightglass.
- Lightly touch compressor lines. Suction line should be cold; discharge, hot.
- Check condenser for obstruction from dirt, damage, bugs, etc.
- Lightly touch inlet and outlet to receiver-drier. Lines should both be warm.
- Check that fuse has not blown at receiver-drier.
- Check for kinks in refrigerant lines and loose wiring.
- Check for slipping belt or clutch.
- Check for any unusual noises.

Use the sight-sound-touch technique to get an overview of the air conditioner's operation. It should help you locate obvious problems and it should especially help you determine whether enough refrigerant is in the system. Frequently, this will be the only check needed to locate the cause of a cooling problem.

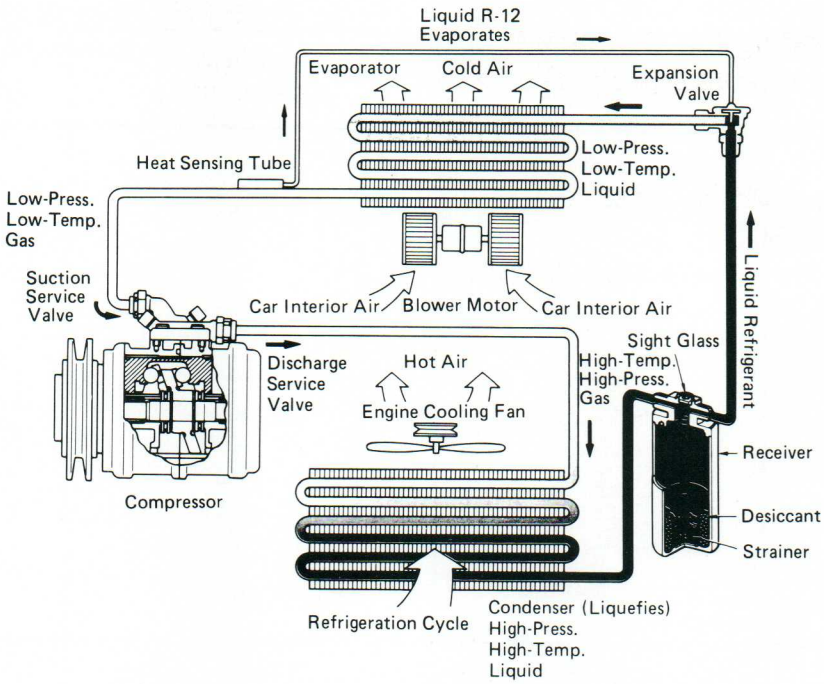


Figure 216-1

Article No. 217

THE SYSTEM PRESSURE CHECK

When the cause of a problem is not immediately apparent, or when you want to confirm your suspicion of a bad component or low refrigerant, a system pressure check is the next diagnosis step.

How to Connect the Manifold Gauge Set

1. Engine off.
2. Both hand valves on gauge set closed. (With valves closed, gauges will work, but refrigerant will not flow through hoses.)
3. Connect hose from low-pressure gauge to suction side of system (indicated by an "S" on the compressor).
4. Connect hose from high pressure gauge to discharge side of system (indicated by a "D" on the compressor).
5. If the service valves are located on the refrigerant lines, you can easily identify which is which. Simply remember that high-pressure lines are about ½ the diameter of low-pressure lines.
6. Turn air conditioner on and set at maximum cool. Start engine and run at approximately 1500 rpm for several minutes to stabilize system.

How to Use the Temperature-Pressure Chart

The purpose of the Temperature-Pressure Chart (Figure 217-1) is to show normal pressure readings for both sides of the system. Ranges of normal operation are indicated by a dotted line on the chart. Low-side pressure is related to evaporator core temperature. Normal low-side readings should be 14-30 psi in order to produce correct evaporator temperatures at the air outlets.

The high-side gauge reading is related to ambient, or outside, air temperature. As the system is stabilizing, measure this temperature with a thermometer just in front of the condenser. If the temperature is 90 F, for example, the normal high-side gauge reading should be 175-195 psi. The chart is useful in determining whether gauge readings are normal, high or low.

Pressure — Temperature Relationship

To perform this test:

1. Engine speed should be adjusted to 1500 RPM
2. System should be fully charged

LOW-PRESSURE GAUGE READING (psi)	EVAPORATOR TEMPERATURE F
10	2
12	6
14	10
16	14
18	18
20	20
22	22
24	24
26	27
28	29
30	32
35	36
40	42
45	48
50	53

AMBIENT TEMPERATURE F	HIGH-PRESSURE GAUGE READING (psi)
60	95-115
65	105-125
70	115-135
75	130-150
80	150-170
85	165-185
90	175-195
95	185-205
100	210-230
105	230-250
110	250-270
115	265-285
120	280-310

Normal operating ranges shown by dotted line boxes.

Figure 217-1

THE SYSTEM PRESSURE CHECK (Continued)

The gauge reading, in conjunction with the sight-sound-touch check, will usually help pinpoint the cause of an A/C cooling problem. Use the pressure diagnosis chart (Figure 217-2) to help you interpret the gauge readings.

Pressure Gauge Diagnosis

Low Side	High Side	Sight Glass	Cooling	Other Symptoms	Probable Cause
Slightly Low	Slightly Low	Bubbles	Slight		Level of R-12 is low. Leak check before recharging.
Very Low	Very Low	Few Bubbles or clear	None		R-12 very low. Check for large leak.
Low	Low	Clear	Slight	Heavy sweating or frost at expansion valve inlet	Expansion valve clogged or stuck closed.
Low	Low	Clear or bubbles	Slight	Liquid lines cool to touch: sweating or frost may be noticed	Restriction on high side. Check for clogged receiver-drier or kinked line.
Normal	Normal	Clear or bubbles	Slight		Air in system. Purge and recharge.
Normal or Vacuum	Normal or Low	Clear or cloudy	OK or Slight	Cooling OK when cool outside; not adequate when hot.	Moisture in system; Heat causes drier to release excess moisture, freezes and blocks against expansion valve. Gauge readings are OK until freezing occurs.
High	Low	Clear	Slight	Suction and discharge lines almost same temperature	Compressor malfunction — internal leak or wear.
High	Slightly High	Clear	Slight	Heavy sweating on suction hose and evaporator.	Expansion valve stuck open. Check for loose heat sensing tube.
High	High	Clear or bubbles	None	Engine overheating; very hot liquid lines.	Condenser airflow blocked, loose fan belt, cooling system malfunction, or refrigerant overcharge.

Figure 217-2

Leak Detection

More than 75 percent of all air conditioning problems are caused by leaks. If the system requires more than about ½ lb. of R-12 after a season of operation, leakage should be suspected.

If the system has lost most of its refrigerant, add about a pound so you can locate leaks. Several methods are used for leak detection as described below.

Electronic Leak Detector: An electronic detector is the best device for locating leaks. They are sensitive and easy to operate. Use according to manufacturer's instructions. Pass the probe slowly around and under all connections and components. A light or audible sound from the unit indicates the presence of R-12. Don't stop after only one leak is located; check the entire system. Caution: Some leak detectors can be damaged by a strong concentration of refrigerant. Caution: Don't intentionally stick the probe in a direct stream of R-12.

Halide Torch: Although not nearly as sensitive or easy to use as an electronic detector, a halide torch is sometimes used for locating leaks. It indicates a leak by the color of its flame: yellow indicates a moderate leak and greenish-purple indicates a large leak. A "sniffer tube" — or search hose — is attached so that air and refrigerant are drawn up and passed through the flame. Use the search hose like the probe of an electronic detector.

Dytel Colored Refrigerant: A chemical aid to leak detection is a colored refrigerant called Dytel, from DuPont. After a system is charged with a refrigerant containing Dytel, leaks are indicated by a red color at the point of leakage. After the leak is fixed, the color wipes off with a rag. Since Dytel adds little to the cost of refrigerant, it's a nice back-up to other leak detection methods.

Article No. 218

ELECTRICAL CIRCUIT INSPECTION

There are two basic circuits in an air conditioner:

- The blower circuit, which powers and controls the blower motor
- The temperature control circuit, which senses evaporator temperature and controls magnetic clutch operation

The blower circuit consists of the blower motor, speed-control resistor, and the control switch and resistor. If the blower works on only one or two speeds, check the switch and resistor. If it doesn't work at all, check the fuse and trace the wiring for a bad connection. If the fuse is blown, make sure you check, locate and fix the cause of it blowing before you replace it.

The temperature control circuit is a little more complex. It consists of the magnetic clutch, amplifier, low-pressure switch and thermistor.

If your sight-sound-touch checks indicate the clutch is not actuating, begin your electrical diagnosis there. Disconnect the lead from the clutch and touch it to the battery's positive terminal. If the clutch is actuated, it's OK, and the problem is upstream in the circuit.

Again, check the fuse. If it's blown, fix the cause before replacing it. Then check for a bad connection from the amplifier to the low-pressure switch, thermistor, or the clutch.

At the amplifier, check the idle speed cut-off adjustment. If it's set too high, it will keep the magnetic clutch from engaging until the engine's running relatively fast. If it's set too low, it may lead to engine overheating. The normal cut-off speed is 650 to 750 rpm.

If your inspection this far doesn't identify the problem, the A/C amplifier may have internal problems. If all other components and wiring have checked out OK, the amplifier should be replaced.

Evaporator Temperature Control Circuit

Now let's go through the A/C evaporator temperature control circuit. It functions to maintain the evaporator at an efficient cooling temperature, while at the same time, preventing evaporator ice-up. The system operates by *alternately* turning ON and OFF the magnetic clutch to engage the A/C compressor.

A cooling problem may be caused by:

- Blown A/C fuse
- Loose or poor connection
- Faulty:
  - — A/C switch
  - — Main heater relay
  - — A/C amplifier (or misadjusted)
  - — Thermistor
  - — Low pressure switch
  - — Electromagnetic clutch

Specific procedures for trouble-shooting this circuit are also found in your repair manual.

If your preliminary checks confirm that the blower operates properly but the magnetic clutch is not engaging, begin your diagnosis at the clutch.

- Turn off the engine.
- Remove the connector plug at the clutch stator.
- *Connect* a length of test wire between the stator lead and the battery's *positive* terminal.

If the clutch engages with a notable click, it's operating properly and the problem is farther upstream in the circuit.

Article No. 219

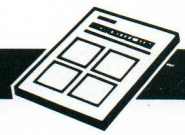
TROUBLESHOOTING: ENGINE OVERHEATING

Possible Causes	What to Check	Action to Take
1. Engine coolant low	Level of coolant in radiator.	Replenish coolant.
2. Excess rust or scale in cooling system	Inspect coolant in radiator.	Drain coolant; flush system; replenish coolant.
3. Slipping fan belt	Check tension and condition of belt.	Tighten. If worn or oil-soaked, replace.
4. Blocked radiator or A/C condenser	Look for dirt or bugs blocking airflow.	Clean radiator or A/C condenser with soft brush, water, and compressed air. DO NOT USE STEAM.
5. Incorrect rating or faulty pressure cap	Check with tester. Check against R/M specs.	Replace with new cap of correct rating.
6. Deteriorated or kinked coolant hoses	Check for kinks, cracks, and obvious weakness.	Replace with new hoses.
7. Incorrect ignition timing	Check ignition timing.	Adjust timing to correct specs.
8. Loss of oil from fan clutch	Look for oil leaks. Turn fan with hand. Should have some drag from oil.	Repair or replace.
9. Thermostat stuck	Remove and test operation.	Replace.
10. Water pump faulty	Loose driveshaft, noisy operation, leaks.	Replace.
11. Idle speed cut-out misadjusted (amplifier)	Confirm magnetic clutch engagement if engine speed drops below 650 rpm or exceeds 750 rpm.	Adjust "idle" knob on amplifier to obtain correct cut-out speed (if equipped).

Article No. 220

TROUBLESHOOTING: NOISY SYSTEM OPERATION

Possible Causes	What to Check	Action to Take
1. Loose or broken mounting brackets for compressor idler pulley	Shake components. Look for loose mounting bolts or broken bracket.	Tighten bolts. Replace broken bracket.
2. Refrigerant oil level low	Lightly touch bottom of compressor for excessive heat. Check oil level.	Check system for leaks. Replenish refrigerant oil recharge system.
3. Worn idler pulley (if equipped)	Listen for noise from pulley. Check for worn bearing and looseness.	Replace bearing.
4. Worn blower motor	Turn blower ON and OFF; listen for noise.	Replace motor.
5. Excess refrigerant charge	Listen for rumbling noise or vibration in high-pressure line; thumping noise in compressor. Gauge readings: Low side — HIGH High side — HIGH	Partially discharge system. Refill to proper level.
6. Low refrigerant charge	Sight glass will show bubbles or foam. Gauge readings: Low side — LOW High side — LOW	Locate and fix any leaks. Recharge system.
7. Moisture in system	May show cloudiness in sight glass.	Replace receiver-drier. Evacuate and recharge system.
8. Faulty or worn compressor	See items 1, 2, and 3 above.	If noise persists, replace compressor.
9. Noise from magnetic clutch	Worn or damaged bearing.	Replace bearing.
10. Noise from piping	Vibrating piping. Pulsating noise resonating into body.	Secure piping.
11. Noise from condenser	Condenser mounting stay resonating with body.	Secure by inserting rubber pad between stay and body.



Article No. 221

TROUBLESHOOTING: INSUFFICIENT COOLING

Possible Causes	What to Check	Action to Take
A. BLOWER NOT PRODUCING ENOUGH AIRFLOW:		
1. Intake cowl clogged	Check cowl at blower inlet	Remove debris, clean.
2. Airflow through evaporator restricted by ice buildup	Check for signs of ice in evaporator core. Check thermistor resistance.	Run system with blower on "HI" to melt ice. Instruct owner on correct settings. Replace thermistor.
3. Faulty or worn blower motor or fan bearings	Listen for noisy or obviously slow operation.	Repair or replace.
4. Faulty blower switch	Check that blower speed varies according to switch position.	Replace blower switch.
B. BLOWER IS PRODUCING ENOUGH AIRFLOW:		
1. Windows or vents open	Check position of controls. Discuss with owner if proper operation mode is used.	Close windows and vents; instruct owner on correct positions for maximum cooling.
2. Heating system ON	Check control position and heater mode adjustment. Check water valve.	Repair heater system or instruct owner on correct control settings.
3. Compressor drive belt slipping	Check for worn or misadjusted belt.	Tighten or replace.
4. Magnetic cluch slipping	Feel for heated clutch. Check for secure connections to power and ground.	Tighten connections. Replace if necessary.
5. Insufficient airflow through condenser	Check for dirt, bugs, license plates, spare tires, bug screens or anything restricting airflow through condenser. Outlet line from condenser typically be little or no cooler than inlet. Gauge readings: Low side — HIGH High side — HIGH	Clean condenser with soft brush, running water, and compressed air. DO NOT USE STEAM. Remove obstructions to air flow.

INSUFFICIENT COOLING (Continued)

Possible Causes	What to Check	Action to Take
6. Refrigerant LOW in system	Look for bubbles or foam in sightglass. Gauge readings: Low side — LOW High side — LOW	Locate and fix any leaks. Recharge system.
7. Restriction in receiver-drier or high-side line	Check for noticeable temperature drop (frost) at receiver-drier or kink in line. Gauge readings: Low side — LOW High side — LOW	Replace receiver-drier or kinked line.
9. Faulty expansion valve (allows too much flow)	Look for sweating in evaporator and on suction line. Gauge readings: Low side — HIGH High side — HIGH or NORMAL	Make sure heat sensing tube is securely fastened to evaporator. Replace valve, if necessary.
10. Incorrect idle-cut adjustment at amplifier (if equipped)	Compressor should turn on at engine speed between 650-750 rpm. If cut-in speed is significantly higher, insufficient cooling may result.	Adjust "idle" knob on stabilizer amplifier to obtain correct cut-in speed.
11. Faulty thermistor	Perform resistance check.	Replace if faulty.

Article No. 222

TROUBLESHOOTING: INTERMITTENT COOLING

Possible Causes	What to Check	Action to Take
1. Evaporator unit icing up in humid weather. Restricts airflow and cooling.	Ask owner about both temperature and blower settings. Max cooling/low blower speed should not be used in humid weather. Check thermistor for proper sensing of evaporator temperature (compressor cycles ON and OFF correctly).	Instruct owner on correct control settings. If necessary, replace thermistor.
2. Loose connection in electrical circuit or compressor ground	Check whether operation was affected by vehicle motion. With sight and touch, check for loose connections. If necessary, test continuity of circuit.	Fix loose connections.
3. Magnetic cluch slipping	Check for heated clutch. Check electrical connections.	If necessary, replace clutch.
4. Moisture in refrigerant freezes inside expansion valve	Look for cloudiness in sightglass (Figure 222-1). If moisture is not frozen in valve, gauges will read NORMAL, but once frozen, gauge readings will read: Low side — VACUUM High side — LOW	Replace receiver-drier. Evacuate system, recharge.

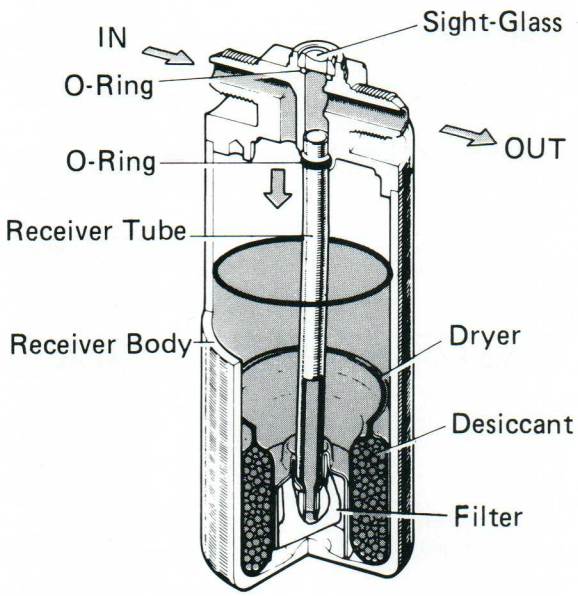
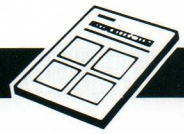


Figure 222-1

Article No. 223

TROUBLESHOOTING: LITTLE OR NO COOLING FROM SYSTEM

Possible Causes	What to Check	Action to Take
A. IF COMPRESSOR AND BLOWER ARE OPERATING:		
1. Excessively low refrigerant level	Check sight glass for bubbles. Cycle system ON and OFF, if no bubbles appear, system is empty. Gauge readings: Low side — LOW High side — LOW	Determine cause of refrigerant loss and repair. If system has lost all refrigerant, replace receiver-drier. Recharge system.
2. Compressor excessively worn	Inlet and outlet lines at near same temperature. Gauge readings: Low side — HIGH High side — LOW	Replace compressor
3. Expansion valve stuck open (evaporator flooded)	Suction line and evaporator may show heavy sweating. Gauge readings: Low side — HIGH High side — NORMAL or SLIGHTLY HIGH	Check that heat sensing tube is securely fastened to evaporator. If necessary, replace expansion valve.
4. Clogged receiver-drier	Outlet of receiver-drier much colder than inlet. Gauge readings: Low side — LOW High side — LOW	Replace receiver-drier.
B. IF NEITHER COMPRESSOR NOR BLOWER ARE OPERATING:		
1. Circuit breaker tripped	Check circuit breaker.	Determine cause of problem. Reset.
2. Blown fuse	Check for blown fuse.	Determine cause of problem. Replace fuse.
3. Faulty heater relay	Check relay.	Replace relay.
C. IF BLOWER IS NOT OPERATING:		
1. Circuit breaker tripped	Check circuit breaker.	Determine cause of problem. Reset.
2. Blown fuse	Check for blown fuse.	Determine cause of problem. Replace fuse with one of correct rating.
3. Faulty heater relay	Check relay.	Replace relay.



LITTLE OR NO COOLING FROM SYSTEM (Continued)

Possible Causes	What to Check	Action to Take
4. Worn or burned blower motor	Check voltage at motor connector with key switch ON and blower on HI. If power is present, motor should operate.	Replace blower motor.
5. Loose connection or broken wire in blower control circuit	Look for loose or broken connections and wires. If necessary, trace circuit with test light or volt meter.	Tighten connections. Replace or repair broken wires.
6. Faulty blower switch	Test power to and from switch.	Replace if necessary.
D. IF COMPRESSOR IS NOT OPERATING:		
1. Broken or excessively loose compressor drive belt	Inspect belt and belt tension.	Replace or tighten, as necessary.
2. Blown fuse	Check for blown fuse.	Determine cause of problem, then replace fuse with one of correct rating.
3. Faulty compressor	With A/C system ON and engine running at about 1500 rpm, touch positive lead from clutch to battery's positive terminal. If compressor operates, problem is elsewhere in electrical circuit.	Make sure clutch is grounded properly. If necessary, replace clutch or compressor.
4. Incorrect idle cut-out adjustment at amplifier	Compressor should turn ON at engine speed, between 650-750 rpm. Knob may be mis-adjusted.	Adjust "idle" knob on stabilizer amplifier to obtain correct cut-in speed.
5. Loose connection or broken wiring in temperature control circuit	Check wiring from amplifier to thermistor.	Tighten connection; repair broken wires.
6. Faulty thermistor	Inspect resistance.	Replace as necessary.
7. Faulty amplifier	If all other tests do not point out cause, amplifier may be faulty.	Replace and check system operation.

Article No. 224

RECOMMENDED SERVICE PRACTICES

1. Even a slight amount of moisture in a system will prevent proper operation; therefore, use extreme caution to keep air and moisture out.
2. When installing a system, keep A/C lines and components capped until ready to hook up. Use special caution with receiver-drier: Do not remove the plugs until the moment of final connection. (It becomes saturated if left unplugged for 10-15 minutes in humid weather!)
3. When opening a system, tightly cap lines and fittings to keep air from entering.
4. If the receiver-drier fuse is blown, or if system has been discharged for ANY reason, replace the receiver-drier and evacuate before recharging the system.

How to Discharge the System

All refrigerant must be discharged before the system can be opened for repair.

1. Engine should be off.
2. Hand valves on gauge manifold closed.
3. Connect gauge set: Low-pressure hose (blue) to suction side, high-pressure hose (red) to discharge side.
4. Place center hose so as to prevent R-12 from contaminating the area.
5. Open high-side valve to discharge refrigerant *slowly.* If discharged too fast, refrigerant will carry out compressor oil.
6. When high-side gauge reads less than 50 psi, low-side valve may be opened.
7. System is discharged when both gauges read zero. System may be opened for repair.

How to Evacuate the System

After repairs are completed, air and moisture must be evacuated from the system.

1. Engine OFF.
2. Gauge set connected, hand valves off.
3. Connect center hose to vacuum pump and turn on.
4. Open both hand valves and let pump run about 10 minutes.
5. Quick leak-check: After 10 minutes, vacuum gauge should read at least 24-27 inches of mercury. Close hand valves and turn pump off. If vacuum does not hold, a leak still exists. If system is OK, turn pump on, open hand valves and continue evacuating.
6. Evacuate down to 29.5 inches. It may take a while, but last few inches are most important for obtaining a good evacuation.
7. Hand valves CLOSED; vacuum pump OFF. Disconnect the center hose from pump. System is now ready for charging.

How to Charge the System

Refrigerant may be charged as a liquid, with the drum upside down, or as a vapor, with the drum right-side up. Liquid charging is faster, but sometimes vapor must be sucked into a system to complete a full charge. CAUTION: Carefully follow instructions for each type of charging to avoid damage or injury.

RECOMMENDED SERVICE PRACTICES (Continued)

Liquid Charge

1. Engine off. NEVER START THE ENGINE WHILE CHARGING LIQUID R-12.
2. System already evacuated; both hand valves still closed.
3. Connect center hose to can of refrigerant. Open valve on top of can.
4. Bleed air from center hose by loosening hose collar at gauge manifold. After a few seconds, when vapor can be seen, tighten collar.

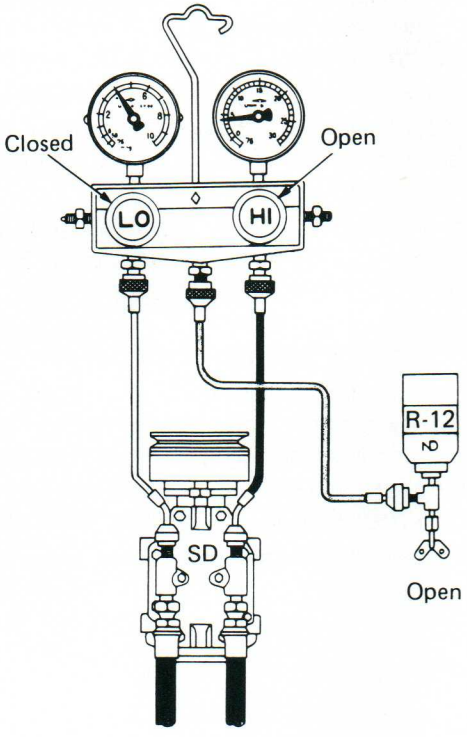


Figure 224-1

5. Open high-side hand valve, turn R-12 can upside-down (Figure 224-1). CAUTION: Keep low-side hand valve closed and DO NOT RUN ENGINE. (Compressor will force refrigerant back into drum and may cause it to explode.) System holds about 2 pounds, or two small cans.
6. To change 1-pound cans: Close high-side hand valve. Disconnect discharged can, connect new can with can valve closed. BLEED AIR FROM CENTER HOSE BY LOOSENING HOSE FITTING AT CAN CONNECTION. Open can valve. Open high-side hand-valve and continue charging.
7. If full capacity cannot be charged as liquid, use vapor charge method to top off system.

Vapor Charge

1. Make sure that at least 1 pound (one drum) of R-12 has been charged as a liquid.
2. Close high-side hand valve, and set R-12 drum right-side up.
3. Open low-side hand valve.

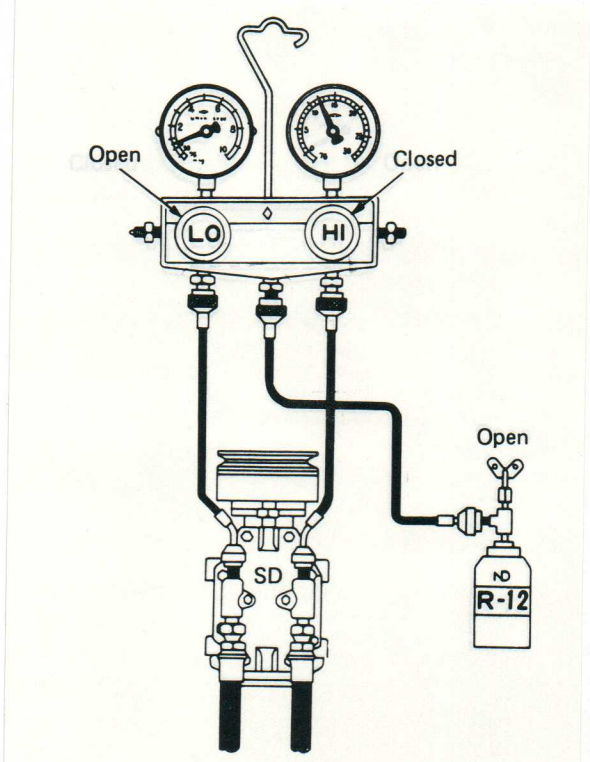


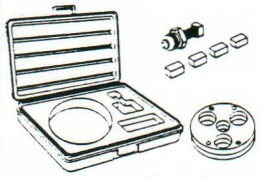
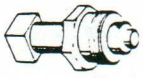
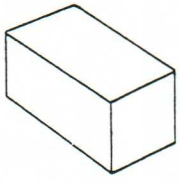
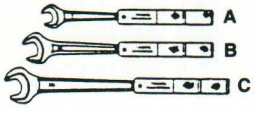
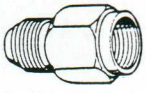
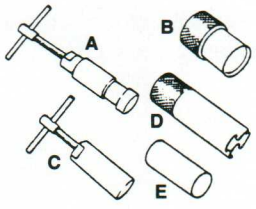
Figure 224-2 (REVISED 7/6/87)

4. Start engine, turn air conditioner to maximum cool, high blower, and run at about 1500 rpm. Compressor will draw vapor into system. DO NOT turn R-12 drum upside down (Figure 224-2). Liquid refrigerant will now damage compressor.
5. System is fully charged when all bubbles have disappeared from the sight glass and the gauges read normal.
6. When finished, stop engine, close can valve, and QUICKLY disconnect hoses from system.
7. Check for leaks.

Article No. 225

AIR CONDITIONING TOOLS

The following chart shows the tools (with Toyota tool numbers) you'll need for servicing air conditioning systems.

Illustration	Tool No.	Description	Application
	**00002-50280**	Air Conditioning Compressor Tools	RA, RN and RT *
	**00002-50281**	Pressure Plate Remover (Use in place of 07112-71010)	All Models
	**00002-50282**	Cylinder Assembler	RA, RN and RT
	**00002-50283-1**	Shoe Gauge (13.965mm)	RA, RN and RT
	00002-50283-2	Shoe Gauge (13.970mm)	RA, RN and RT
	00002-50283-3	Shoe Gauge (13.975mm)	RA, RN and RT
	00002-50283-4	Shoe Gauge (13.980mm)	RA, RN and RT
	**00002-50284-01 (Essential Tool)**	Torque Wrench Kit The following parts are available and may be ordered individually. A. 00002-51710-01 17mm B. 00002-52216-01 22mm C. 00002-52724-01 27mm	All Models
	**00002-50285-01**	Adapter	All Models (after 3-87)
	**211203**	Compressor Service Set The following replacement parts are available and may be ordered individually. A. 07112-15010-01 Shaft Plate Remover B. 07112-25010-01 Shaft Plate Installer C. 07112-45021-01 Shaft Key Remover D. 07114-15010-01 Seal Remover/Installer E. 07114-45010-01 Shaft Rotating Torque Adapter	All Late Model Air Conditioner Compressors

Toyota Service News #24 Reader Survey

How would you rate the air conditioning information included in this issue?

☐ Excellent ☐ Fair
☐ Good ☐ Poor

How would you rate the charts and illustrations in this issue?

☐ Extremely helpful ☐ Not very helpful
☐ Somewhat helpful ☐ Confusing

How did you receive this copy of Toyota Service News?

☐ From a Toyota Dealer ☐ It was passed on
☐ Sent in a coupon ☐ Other _____

How often do you refer back to Toyota Service News for technical information or repair assistance?

☐ At least once a month ☐ Never
☐ At lease once a year ☐ This is the first issue I've seen

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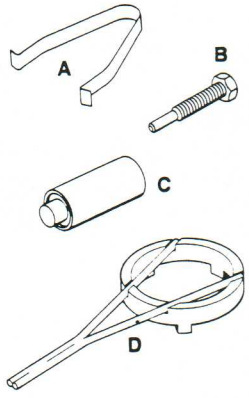
Illustration	Tool No.	Description	Application
	**213696**	Air Conditioning Tool Kit (TV-14 Seal Tools) The following replacement parts are available and may be ordered individually. A. 07112-15020 Seal Plate Remover B. 07112-66040 Pressure Plate Remover C. 07114-15020 Seal Plate Replacer D. 95047-10330 Seal Plate Replacer	Tercel
	**95780-05010-01 (Essential Tool)**	Air Conditioning Checking Resistor	MX*

* RA: Celica
* RN: Truck
* RT: Corona
* MX: Cressida

Article No. 226

COLLISION REPAIR MANUALS

Today's modern unibody vehicles are very complex in design, and body repairs can be made easier if the technician uses factory repair methods.

Factory-approved cutting and sectioning procedures save time and money by providing an alternative to the task of removing numerous welds, rewelding and trying to effectively reapply a rustproofing material to the various seams and weld joints.

Toyota's individual Collision Repair Manuals contain repair instructions for cutting and replacing many body and support member components, identification and location of plastic parts and high-strength steel components, as well as body seam sealing locations and handy factory body dimension drawings with easy-to-locate reference points and reference lenghts.

The Collision Repair Manuals supplied by Toyota are relatively inexpensive. To order manuals, contact your nearest Toyota dealer.

REPAIR MANUALS

Starlet	81-84	00400-36158
Tercel	80-82	00400-98367
Tercel	83-86	00400-36431E2WD
Tercel	83-86	00400-36432E4WD
Corolla	80-83	00400-36001
Corolla	84-87	00400-36434EFF/FR
Celica/Supra	82-85	00400-36182
Camry	83-86	00400-36443E
Cressida	81-84	00400-36118
Cressida	85-87	00400-36441E
Cressida Wagon	85-87	00400-36442E
MR2	85-87	00400-36440A
Van	84-87	00400-BRM003E
Celica	86-87	00400-BRM001E
Tercel	87	00400-BRM001E
Supra	86½-87	00400-BRM005E
Corolla FX	87	00400-BRM006E
MR2	87	00400-BRM008E
Camry	87	00400-BRM010E (available soon)

Miscellaneous

Toyota Fundamental Painting Procedures
#00400-36438E

This manual covers fundamentals, facilities, tools and equipment, repainting processes, problem areas, safety and cleanliness, and an explanation of refinishing terminology.

Toyota Fundamental Body Repair Procedure
#00400-BRM002E

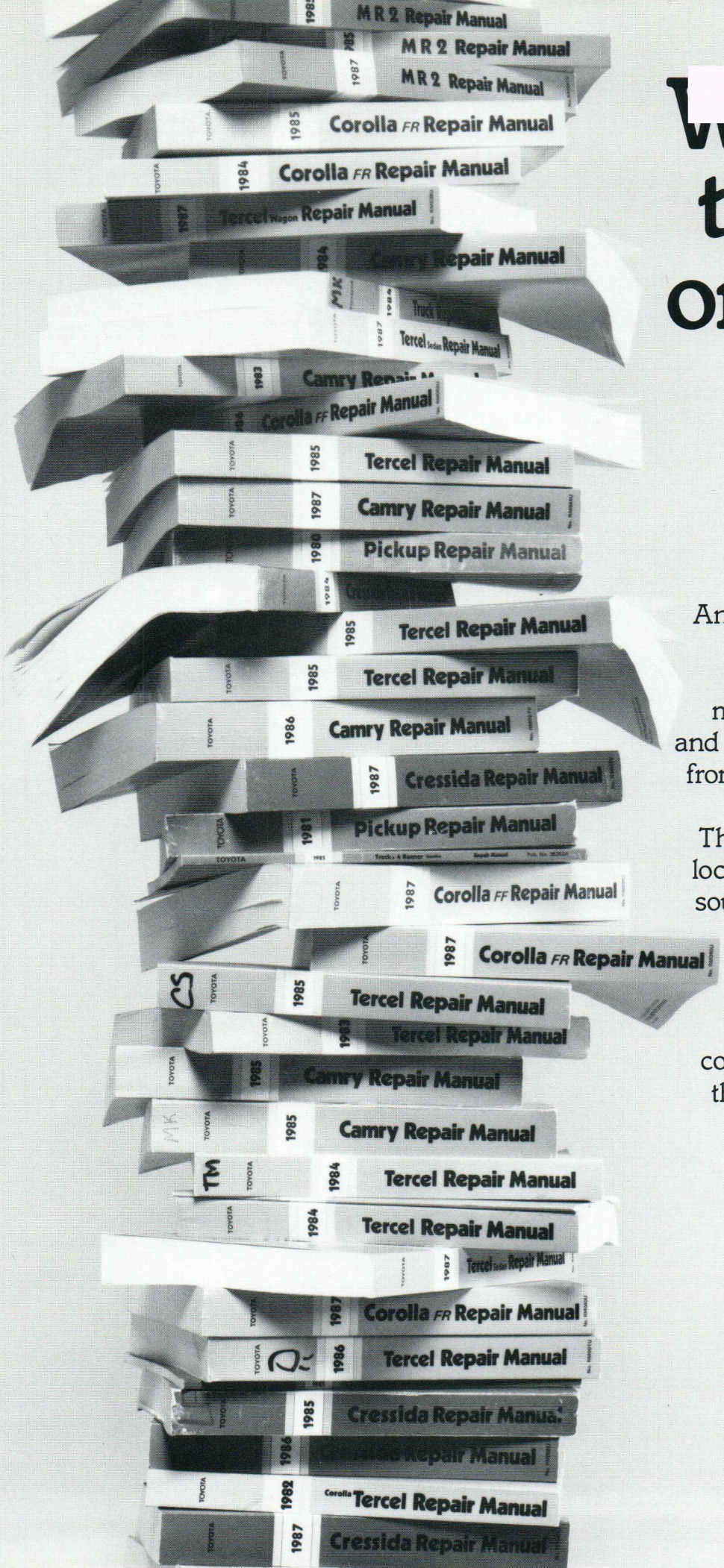
This manual covers body structure, body materials, body repairs, welding techniques and tools and equipment.

C.R.I.B. Binder (Collision Repair Information Bulletins)
#00400-36438E

This binder should be used to hold all of the present and future C.R.I.B. bulletins. All bulletins starting from #1 are included in the purchase of a C.R.I.B. binder.

Toyota Body Dimensions Guide
#00104-87861

This guide covers body dimensions for most Toyota models through the 1986 model year.



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Nobody knows Toyotas like we do. We build them.

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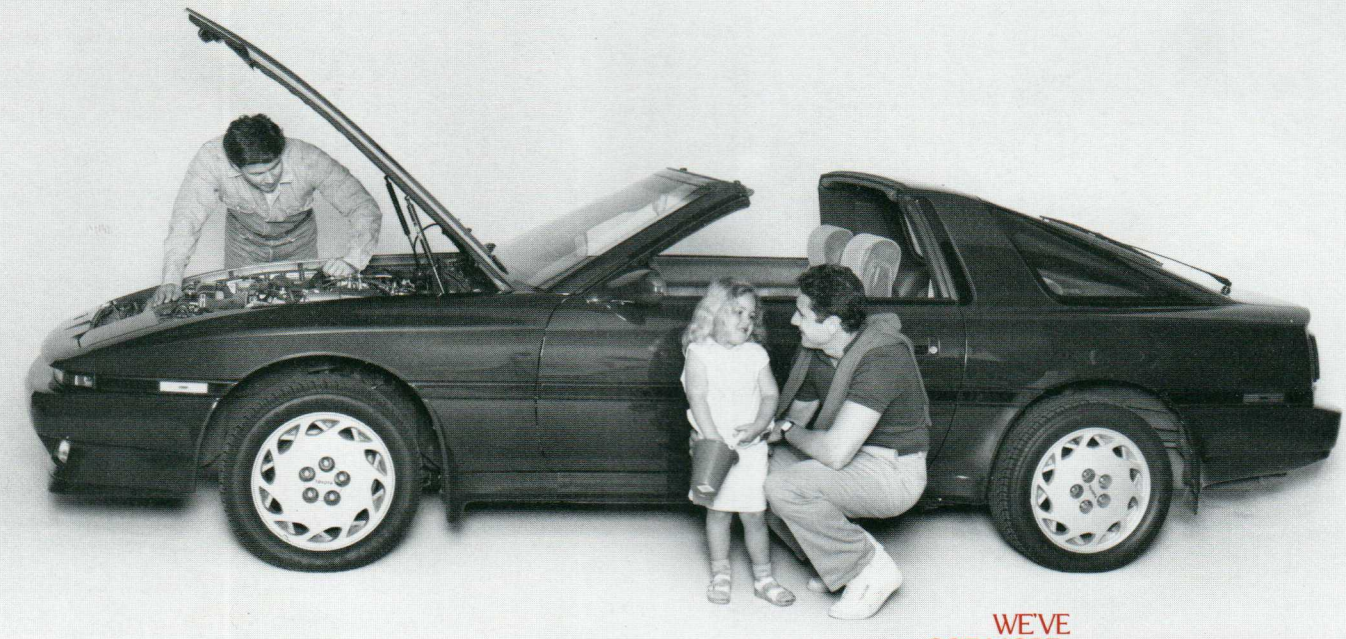
Give your customers a traveler's check

Before summer starts to simmer and your customers head for the highway, make sure their car's road ready.

This is the perfect time to see that their air conditioning is working properly. Before the temperature — and tempers — heat up.

Complete your summer send-off by inspecting the refrigerant level, V-belts, hoses and thermostat, replacing worn-out items with Toyota Genuine Parts.

Preventive maintenance is the best way to make sure your customers have a smooth, safe trip. It could be the most valuable traveler's check they've ever had.



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