

**A** **A/C** – Air conditioning; a system which **dehumidifies** and removes heat from the air.

**A/C Inverter** – Electronic device in hybrid-powered vehicles. Used to convert DC voltage to AC to power the electric motor in the Electric Inverter Compressor.

**Ambient Temperature** – The temperature of the air around the outside of the vehicle.

**Ambient Temperature Sensor** – An NTC-type thermistor. Sends “temperature” signals to the A/C ECU by the resistance it produces when heated. Inputs actual outside temperature in front of vehicle for A/C ECU to factor in cooling output and controls outside temperature indicator on control panel. Works with vehicle speed sensor and temperature reading can only go down at stops and not increase until vehicle is in motion.

**Amplifier** – Sometimes referred to as the A/C ECU. A device that increases the strength of a signal; in an A/C system, the ECU controls compressor clutch operation based on various input signals. Also referred to as “A/C Control Assembly” and “A/C Amplifier.”

**ATC** (Automatic Temperature Control) – A system that automatically controls HVAC outlet temperature, distribution pattern and fan speed. Also called “climate control” or “automatic air conditioning.”

**Auto blow-up** – the delayed and gentle increase in blower speed upon initial operation. This reduces the “blast of hot air in the face” tendency when plastic ducts are still hot and the system is not yet cooling at maximum efficiency. Some models can use customizing and DATA LIST feature on Hand-held Tester to test or select this mode. See customization.

**B** **B+** – Battery voltage, typically controlled by the ignition switch; the positive terminal of a battery.

**Bar** – A metric unit for **barometric pressure**, 1 Bar = 1 kilogram per square centimeter = 14.5 psig.

**Barometric Pressure** – “Atmospheric pressure,” pressure exerted on all surfaces of an object as a result of gravity acting upon the mass of the atmosphere, typically 14.5 pounds per square inch of gauge pressure (psig).

**BEAN** (Body Electronics Area Network) – A multiplexing communications system where multiple signals for various body electrical accessories travel over a common electrical path.

**Blend** – A mixture of two or more refrigerant gases intended to replace some other refrigerant. (Not recommended)

**Blower controller** – Controls blower motor speed by limiting voltage to the motor by duty cycle or pulsing current.

**Blower resistor** – Controls blower motor speed by dropping voltage to blower motor by in-line resistance.

**BTU** (British Thermal Unit) – A British unit for measuring the heat energy of a process. One BTU = the heat energy which raises the temperature of one pound (one pint) of water by one degree **Fahrenheit**. One thousand calories = one KiloCalorie (Kcal).

**Bus** – A common conductor to which multiple circuits connect in an electrical system.

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## C

**Calorie** – A metric unit for measuring the heat energy of a process; a common unit for measuring energy (sugar content of food) which will raise the temperature of one kilogram (one liter) of water by one degree **centigrade**. One thousand calories = one KiloCalorie (Kcal).

**CAN** (Controller Area Network) – A high-speed data multiplex communication system linking control units and systems.

**Capillary Tube** – A small passage tube and **sensing bulb** contains a refrigerant that expands and contracts according to temperature. The tube carries the temperature “signal” to the **expansion valve**.

**Celsius** – The name of the scientist who devised the metric temperature scale, see also **Centigrade**.

**Centigrade** (° C) – A name for the metric scale of temperature measurement which is based on the properties of water. Water freezes at 0° C and boils at 100° C at sea level pressure (1 Bar).

**CFC** (Chlorine, Fluorine and Carbon) – A family of chemical compounds also called “chlorofluorocarbons” which are suspected of contributing to a decline in the **stratospheric zone**.

R-12 is a CFC. See dichlorodifluoromethane.

**Change of State** – The process where matter changes from a solid state to a liquid state or from a liquid state to a gas, usually caused by a great transfer of heat or a change in pressure.

**Charge** – The quantity of refrigerant necessary for efficient heat transfer by an air-conditioning system.

**Clutch** – A mechanical device for transmitting torque that allows for engaging and disengaging two shafts or rotating members.

**Compressor** – A pump that increases the pressure of a gas within a closed system.

**Compressor clutch cycling** – The compressor clutch normally cycles only when the system is switched ON or OFF or when evaporator temperatures sensed by the evaporator thermistor are below the freezing point. The thermistor signals the ECU/amplifier to disengage the compressor clutch. Non-cycling will cause evaporator icing. Overly frequent clutch cycling can be caused by insufficient refrigerant charge which drops evaporator temperatures.

**Condensation** – The process where a material changes state from a gas to a liquid following removal of heat or an increase of pressure.

**Condenser** – A heat exchanger through which a hot gas passes in order to remove heat from the gas and causing it to condense into a hot liquid.

**Cross-contamination** – Mixing of refrigerants or adding aftermarket replacement refrigerant other than HFC-134a. Refrigerant identifier should be used on every vehicle before recovering refrigerant from the A/C system to avoid cross-contamination of service equipment. Refrigerant must be 98-100% HFC-134a to recover and no more than 2% AIR in the system.

**Current** – A measure of the flow of electrons through an electrical circuit. The unit of measurement is the “Ampere” or “Amp.” See **Ohm’s Law**.

**Customization/DATA LIST** – Feature for some models where the Toyota Hand-held Tester can display all Auto AC system sensor inputs, air-mix door positions, actual temperature conditions and other data. Some Auto switching functions such as switching from RECIRC to FRESH can be selected or deactivated using the tester.

**Cycling** – The process of repeatedly turning a control device ON and OFF based on a prescribed pattern or input signal. See **Compressor Clutch Cycling**.

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## **D DATA LIST** – See Customization/DATA LIST

**Dehumidifying** – The process of removing water vapor (moisture) from the air; another result of removing heat from the air.

**Desiccant** – A chemical or structure that absorbs moisture by forming molecular bonds with water molecules. Located in the **receiver-drier** or **modulator** portion of a subcooling condenser. The moisture absorbed by the desiccant cannot be entirely removed during evacuation. Thus, the receiver-drier should be replaced whenever the A/C system is opened to the atmosphere. HFC-134a and CFC-12 types of receiver-driers must never be interchanged as they have different desiccant materials. Also see “receiver-drier.”

**Dichlorodifluoromethane** – CFC-12 or R-12; a nontoxic, nonflammable chemical compound of chlorine, fluorine and carbon; a colorless, odorless gas formerly used as a refrigerant. Replaced in vehicles by **HFC-134a** (R-134a).

**D.O.T.** (U.S. Department of Transportation) – Regulates interstate transportation of cylinders containing pressurized gas.

**DTC** (Diagnostic Trouble Code) – Fault codes generated by the ECU that indicate to service personnel the source of a system malfunction. A self-diagnosis feature that stores operation failures in memory. DTCs can be displayed by operating switches on the A/C control panel. DTCs remain in memory even when the ignition is OFF.

**Duct Air Temperature Sensor** – Works with solar sensor and ECU to set outlet temperature toward “face” a bit cooler than the “floor” outlet in bright sunlight.

**Duty cycle** – Method of controlling voltage to air mix servos or blower motors by using a pulsating voltage signal from inside the ECU or amplifier assembly. See solid state/transistorized.

**DVV** (Double Vacuum Valve) – Device used on vacuum-controlled ATC systems to regulate the pressure within the air mix servo-motor in order to control outlet air temperature.

**Dynamic Pressure** – The pressures measured from a **stabilized** and operating A/C system.

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## E

**Electric Inverter Compressor** – Scroll-type compressor found on hybrid vehicles. Uses a high voltage AC motor to rotate the compressor section to circulate refrigerant through the A/C system. Speed-controlled by an A/C ECU.

**Equalization of pressures** – When the A/C system cycles off, the low and high sides of the system balance in pressure. This increases the low side pressure while the high side pressure is reduced. The system does not balance or equalize immediately due to the restriction of the expansion valve before the evaporator and the sealing effectiveness of the reed valves in the compressor. Leak testing with a halogen leak detector is done with the A/C OFF and with pressures equalized.

**Evacuation** – The process of removing all gases from a closed system with a vacuum pump.

**Evaporator** – A heat exchanger that accepts a spray of hot liquid in order to absorb heat from air surrounding the evaporator. In this process, the liquid evaporates and changes into a gas. The ideal temperature of the evaporator core is near 32° F but not below. Freezing can occur. Evaporator temperature is controlled by the expansion valve metering the refrigerant and the thermistor signaling the amplifier (ECU) to switch the compressor clutch ON and OFF.

**Evaporator Temperature Sensor** – A thermistor that outputs an electrical signal according to temperature. This is an input to the A/C ECU, which controls the A/C compressor clutch in order to prevent evaporator icing and to regulate cooling temperature output.

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**F**    **Fahrenheit** – The name of the scientist who devised the British temperature scale in which water freezes at 32° F (0° C) and boils at 212° F (100° C) at sea level pressure.

**Fusible Plug** – A special bolt with a hollow center filled with a soft, low temperature solder. It is designed to melt under high pressure or high temperature to relieve pressure and protect the system from an explosion. This item is no longer used. A pressure switch now controls system pressure by de-energizing the compressor.

**Fuzzy Logic** – An attempt to duplicate the logic functions of a human being to automatically control the various functions of the HVAC system.

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**G**    **Gaseous** – The hottest state of matter in which the material is the least dense and is able to flow and expand or contract to fill an area. Heat is absorbed as a liquid changes to a gas.

**“Gateway” ECU** – A link between systems on a LAN. It connects the A/C ECU and the rear A/C controls over the AVC-LAN and the rear A/C amplifier over the BEAN (steering column bus).

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**H**    **Heat Energy** – The force that changes the measurable heat of an object; units for heat energy are the BTU and calorie.

**Heat Exchanger** – A device that allows heat to be transferred between two liquids or gases without the materials coming into direct contact with each other.

**Heat Load** – The total of all sources of energy acting to change the temperature of an object. Examples are sunlight, ambient temperature and passenger body temperature.

**Heater Core** – The heat exchanger that uses engine coolant to heat the air in the passenger compartment.

**High Pressure Side** – The section of the refrigerant system between the compressor and the expansion valve (including condenser and receiver-drier) where the refrigerant is under high pressure.

**Humidity Sensor** – Built into some interior air temperature sensors. The sensor monitors humidity using a resistance film that expands and contracts according to moisture in the air.

**HVAC** (Heating, Ventilation and Air Conditioning) system.

**Hydrochloric Acid** – A mild acid that can erode metal components. It forms inside an A/C system when hydrogen from water combines with chlorine from the CFC refrigerant.

**Hygroscopic** – A property of some liquids to absorb moisture from the air.

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**I**

**IDL (Idle)** – An input to the ECU when the throttle is at the idle position.

**IG (Ignition)** – An output signal from the ECU to the ignitor or coil in the ignition system

**Impermeable** – A barrier that cannot be penetrated. This refers to moisture-proof liners in flexible refrigerant hoses.

**Inches of Mercury (in. Hg)** – A measure of the strength of a vacuum. This refers to the ability of a vacuum to lift a column of mercury from a reservoir up a narrow tube.

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**L**

**LAN (Local Area Network)** – A multiplex path for serial data or a wiring path that carries more than one signal to a number of different components in an electrical circuit.

**Latent Heat** – The additional energy necessary to cause a material to change state. This is fundamental to efficient heat exchange processes.

**Liquid** – The middle state between a material being a solid or a gas. A liquid can flow to fill a space but cannot expand or be compressed.

**Lock sensor** – Sends compressor rotation signals to the A/C ECU which then compares compressor speed to engine speed to determine if compressor has “locked.” ECU then disengages the A/C clutch to prevent drive belt failure.

**Low Pressure Side** – The portion of the refrigerant circuit between the evaporator and the compressor where refrigerant is at a low pressure.

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**M**

**Magnetic Valve** – An electrically operated solenoid that controls cycling of evaporators and refrigerant flow in dual A/C systems.

**Manifold Gauge** – A set of two pressure gauges mounted on a common valve body. The manifold has two pressure paths that can be connected together for service operations.

**Microbes** – Single-cell living organisms (bacteria, mold).

**Molecular Sieve** – An open-cell structure designed to trap specific materials or compounds; used as a desiccant in A/C systems.

**Multiplex** – A method of sending and receiving digital signals through a single wire conductor. Often used to control satellite control units from a master ECU.

**N** **Ne** – An engine speed input signal to the ECU.

**Neural Network Control** – Control system capable of effecting complex control by artificially simulating the information processing method of the nervous system of living organisms in order to establish a complex input/output relationship that is similar to the human brain.

**Noncondensable Gas** – A gas that cannot be easily **condensed** into a liquid state at room temperature; typically refers to air.

**Normally Closed** – An electrical circuit or component where the path is connected under “normal” conditions (e.g. engine OFF, cold and stationary vehicle; a resistance of zero until activated).

**Normally Open** – An electrical circuit or component where the path is not connected (open) under “normal” conditions (e.g. engine OFF, cold and stationary vehicle; a resistance of infinity until activated).

**O** **O<sub>2</sub>** (Oxygen) – The naturally occurring molecule made up of two oxygen atoms, a clear, odorless gas that is crucial to respiration (breathing) of all animals.

**O<sub>3</sub>** (Ozone) – The molecule made up of three oxygen atoms, a poisonous, blue gas formed when oxygen is subjected to electrical energy or intense visible radiation (light).

**Oil Separator** – Used in scroll-type A/C compressors to prevent excess refrigerant oil from entering the scroll chambers. Excess oil can damage the compressor and/or lower the efficiency of the compressor.

**Ohm’s Law** – A rule which describes the relationship between voltage, current and resistance within electrical circuits, Voltage = Current X Resistance.

**One-Pass Machine** – A machine that **recycles** refrigerant as it is recovered from a vehicle A/C system. No additional process is necessary before returning the refrigerant to service. See also **Two-Pass Machine**.

**Overcharge** – Excess refrigerant added to the system beyond specifications reduces cooling efficiency, creates higher operating pressures and can damage components and sealing materials. Hot or humid days tend to increase system pressures. An overcharged system could fail on a hotter-than-usual day.

**Oxygen** – The most common element on Earth, present in most organisms and organic chemicals. Essential to life.

**P** **PAG** (Polyalkylene Glycol) – A synthetic lubricant oil (nonmineral-based) developed as a substitute for mineral oil for use with HFC refrigerant R-134a

**Performance Test** – System operation and cooling performance check. Uses a thermometer in center dash outlet register and conditions



specified in the Repair Manual (blower fan speed setting, doors open or closed, engine rpm setting) while checking and other procedures. Ambient temperature and humidity have a significant affect on performance test results.

**Phosgene** (Carbonyl Chloride) – A toxic gas also called “mustard gas” produced as a byproduct during combustion of CFC-12. Old, flame-type leak checker is not recommended due to this danger.

**Photo-Diode** – A single-pole semiconductor which normally blocks the flow of current in both directions; when subjected to light, it allows the current to pass in one direction.

**Plasmacluster™ Generator** – High voltage device takes water and oxygen molecules from the air and produces positive and negative ions which circulate and helps reduce airborne germs.

**Plenum** – A chamber common to several passages, as in the central distribution chamber of a heater blower case or the center passage of a manifold gauge set.

**Power transistor** – Controls blower motor speed by limiting the current to the motor using internal switching circuits to increase resistance and dissipates heat generated through the cooling fins on the case.

**Pressure Sensor** –

**Pressure Switch** – ON/OFF type switch installed in the A/C line monitors refrigerant pressure. Switch contacts close or open when a minimum threshold pressure is reached. For example: On or Off signal can de-energize compressor clutch if pressure too high or energize an electric cooling fan. On later vehicles, the pressure switch is able to monitor low, medium and high refrigerant pressure. This allows the A/C system to react automatically to different system conditions.

**PSI** (Pounds Per Square Inch) – A British unit of measure for fluid or gas pressure where zero psi is the absolute vacuum of outer space.

**PSIG** (Pounds Per Square Inch Gauge) – A measurement of fluid or gas pressure in which zero psi on the gauge is equal to **atmospheric pressure** or 14.5 pounds per square inch.

**PTC** (Positive Temperature Coefficient) – Describes the relationship between temperature and resistance of common metals.

**PTC Heater Core** – High efficiency heater core containing a Positive Temperature Coefficient (PTC) heating element. Used to create warm interior air before engine coolant is able to transfer heat to the heater core. Current passing through PTC element creates heat to warm air passing over it.



**R**    **R-12** – See **dichlorodifluoromethane**.

**R-134a** – See **tetrafluoroethane**.

**Radiator** – A water-to-air heat exchanger, the final stage cooler of an engine-cooling system.

**Receiver-Drier** – A combined accumulator and dehydrator in a refrigeration system. Filters impurities from the liquid refrigerant. Also see “desiccant.” HFC-134a and CFC-12 receiver-driers are not interchangeable

**Recharging** – Filling an A/C system following repair with a quantity of refrigerant necessary for efficient heat transfer.

**Recirculate** – Recooling of air in an enclosed space, providing increased cooling efficiency.

**Reclamation** – An off-site process of purifying recovered refrigerant to an “as-new” condition.

**Recovery** – Removal of refrigerant from an A/C system before repair or service.

**Recycling** – On-site purification of recovered refrigerant to a standard as defined by the **SAE**.

**Refrigerant** – A substance used in a heat exchange system to cool an area based on evaporation and condensation of the refrigerant.

**Relative Humidity** – A measure of the amount of water vapor in suspension in the atmosphere at a given temperature.

**Relief Valve** – A nonreusable valve that opens to relieve excessive pressure and thus protect the system from explosion without a total loss of refrigerant; replaces the **fusible plug** on newer A/C systems.

**Resistance** – A measure of an electrical circuit or a component to resist current flow. See **Ohm’s Law**.

**Retrofit** – Replacement A/C system components installed on a vehicle in service using non-CFC refrigerant. There are kits available to convert vehicles using R-12 refrigerant to HFC-134a. Usually consists of new HFC-134a fittings, receiver-drier and system identification decals.

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**S**    **SAE** (Society of Automotive Engineers) – A professional organization that drafts standards for vehicle systems.

**Saturated** – 100% relative humidity, air is saturated when it holds the maximum possible amount of water vapor in suspension, water will precipitate (condense into liquid and fall out of suspension) at this point.

**Sensing Bulb** – A small chamber filled with refrigerant and connected to the expansion valve by a thin **capillary tube**, controls expansion valve operation based on the surface temperature at the outlet of the evaporator.

**Series Resistance** – An electrical circuit where the current flows through the system components in a single path between power and ground.

See **Ohm's Law**.

**Sight glass** – Small glass viewing window near receiver-drier or pressure switch in the high-pressure side of the A/C system. Can be helpful for diagnosis if excessive bubbles or foreign material are seen circulating in the system. Actual charge amount must be determined using a refrigerant charging station that uses a scale to accurately measure the refrigerant amount. Using the sight glass to determine the charge is incorrect and will result in an improper charge amount and poor cooling.

**Sludging Valve** – Used in through-vane A/C compressors. This valve prevents damaging the through-vanes or the reed valve by allowing liquid oil to escape from the compression area into an oil chamber.

**Solar Sensor** – Detects sun load which is 60% of heat entering the vehicle and provides input information to the ECU.

**Solid** – The coldest of the three states of matter, a solid does not flow to fill a space and cannot be compressed or expanded.

**Solid state/transistorized** – Electronic components using transistors to control current flow to components such as the blower motor or servo-motors to control their operation.

**Speed Sensor** – An input sensor to the A/C ECU or amplifier to prevent ambient temperature sensor from giving false indications when not moving such as stopped at signal.

**SPD (Speed)** – A variable input signal to the ECU representing vehicle road speed. See **Speed Sensor**.

**STA (Start)** – An input signal to the ECU when the starter solenoid is energized.

**Stabilize** – The steady operating condition of an A/C system during heat exchange and pressures and temperatures are within normal operating range.

**Static Pressure** – The steady pressure within an A/C system that is not operating, units are in PSIG or kg/cm.<sup>2</sup>

**Step-less** – Variable blower fan speed control as opposed to 3 or 4 set fan speeds.

**Stratosphere** – A layer of the Earth's atmosphere 12-20 miles above the Earth.

**Stratospheric Ozone** – A layer of ozone gas (O<sub>3</sub>) surrounding the Earth in the stratosphere. Because ozone is blue in color, this layer reflects much of the ultraviolet light from the sun to protect the surface from the radiation.

**Systematic** – An approach to problem-solving based on a logical process.

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**T**

**TAM** – Ambient air temperature or outside air temperature measured in the front grille area.

**TAO** – Outlet air temperature sensor in Auto A/C sends signal to A/C ECU.

**Temperature** – A measure of the heat quantity present in a material, units are Fahrenheit (English system) or Centigrade (Metric system).

**Tetrafluoroethane** – HFC-134a or R-134a; a molecule of hydrogen, carbon and fluorine, a clear, odorless, nontoxic gas, a refrigerant for mobile air conditioning systems which has greatly reduced potential to deplete ozone and a low potential for contributing to global warming.

**THA** – a variable input signal to the ECU that represents air temperature in the air intake passage.

**Thermal Capacitance** – The ability of a material to resist sudden temperature changes, describes an insulating property.

**Thermistor** – A solid-state component that changes resistance with changes in temperature. Used as an electrical thermal sensor. A thermistor has a negative temperature coefficient.

**THW** – An input signal to the ECM/ECU that represents coolant temperature at the cylinder head outlet.

**TR** (Room Temperature Sensor) – Measures interior temperature.

**TSET** (Temperature Setting) or target temperature – Selected with Auto A/C systems input to A/C ECU.

**Two-Pass Machine** – Recovers refrigerant from a vehicle system without **recycling**. An additional process is necessary before the refrigerant can be returned to service. See also **One-Pass Machine**.

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**U**

**UL**<sup>®</sup> (Underwriters' Laboratory) – An independent organization that tests products to verify compliance with safety standards.

**Ultraviolet Radiation** – Intense blue light that consists of visible and invisible wavelengths. Excessive ultraviolet radiation may cause skin cancer, cataracts and other harm to living things.

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## V

**Vacuum** – An extremely low pressure, the absence of any measurable pressure.

**Vaporization** – A process where a liquid changes into a gas, either due to a drop in pressure or an increase in temperature.

**Voltage** – A measure of the electrical potential of a circuit, voltage drop within a circuit is defined by **Ohm's Law**. See also **Ohm's Law**.

**V<sup>TA</sup>** – A variable input signal to the ECM/ECU that corresponds to the angle of the throttle opening.

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## W

**Water Control Valve** – A water regulation control valve that controls coolant flow into the heater core. It is controlled by a cable or a servo-motor for outlet temperature control. Fully closed on MAX COLD setting but opens in incremental steps when selecting higher temperature settings. Controlled by cable manually on older models; by servo motor on newer models. If sticking open or closed, can cause reduced heating or cooling complaint.



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