



SURFACE VEHICLE RECOMMENDED PRACTICE

J3023™

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Superseding J3023 SEP2018

R134a and R1234yf Refrigerant Charge Determination Test Method

RATIONALE

This revision is to include R1234yf refrigerant and condenser with integrated receiver drier and change SAE J3023 from a standard to a recommended practice.

1. SCOPE

The purpose of this document is to establish guidelines for determining the critical R134a and R1234yf refrigerant charge for off-road, self-propelled work machines as defined in SAE J1116 and agricultural tractors as defined in ANSI/ASAE S390. It will develop a minimum to maximum refrigerant charge range in which the HVAC system can maintain proper operation. Operating conditions and characteristics of the equipment will influence the optimum charge. Since these conditions and characteristics vary greatly from one application to another, careful consideration should be taken to determine the optimum R134a and R1234yf refrigerant charge for the HVAC system.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 1-877-606-7323 (U.S. and Canada only) or 1-724-776-4970 (outside U.S. and Canada), www.sae.org.

SAE J1116 Categories of Off-Road Self-Propelled Work Machines

SAE J1503 Performance Test for Air-Conditioned, Heated, and Ventilated Off-Road, Self-Propelled Work Machines

Abraham, G., Ravikumar, A., and Shah, R., "Design Considerations for an Integral-Receiver Dryer Condenser," SAE 2006 World Congress & Exhibition, Detroit, Michigan, United States, April 3, 2006, <https://doi.org/10.4271/2006-01-0725>.

2.1.2 ANSI Publications

Copies of these documents are available online at <https://webstore.ansi.org>.

ANSI/ASAE S390 Tractors and machinery for agriculture and forestry - Basic types - Vocabulary

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2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 ASHRAE Publications

Available from ASHRAE, 180 Technology Parkway NW, Peachtree Corners, GA 30092, Tel: 800-527-4723 (U.S. and Canada only) or 404-636-8400, www.ashrae.org.

ASHRAE Handbook of Fundamentals

ASHRAE Temperature Measurement

3. DEFINITIONS

3.1 DRY BULB AIR TEMPERATURE

Air temperature in °C (°F) as read from a standard thermometer or other appropriate temperature measuring device and is shielded from radiation and moisture.

3.2 WET BULB TEMPERATURE

Air temperature in °C (°F) essentially equal to that read from a wet bulb thermometer or one whose sensing bulb is covered by a water-wetted wick located in the moving airstream.

3.3 RELATIVE HUMIDITY

Ratio of the amount of moisture content (in mol-fraction) in the air to the maximum amount the air can hold at the same temperature and pressure.

3.4 HUMIDITY RATIO

Ratio of the mass of water vapor to the mass of dry air in kg_w/kg_a (lb_w/lb_a).

3.5 EFFECTIVE TEMPERATURE

A human comfort index or scale takes into account the air temperature, moisture content, and air movement.

3.6 HVAC SYSTEM

Heating, ventilation, and air conditioning system which lowers, maintains, or elevates the effective temperature of the air within the operator enclosure.

3.7 REFRIGERANT

A substance used by the air conditioning system that has the needed characteristics to boil at a low temperature and is able to change its state readily from liquid to vapor and vice versa.

3.8 EVAPORATOR

An air to refrigerant heat exchanger that removes unwanted heat from the air within the operator enclosure to the refrigerant by the boiling of liquid refrigerant within the heat exchanger.

3.9 CONDENSER

A refrigerant to air heat exchanger that removes unwanted heat from the refrigerant to the ambient air by the condensing of vapor refrigerant within the heat exchanger.

3.9.1 CONDENSER WITH INTEGRATED RECEIVER DRIER (IRD)

Condenser with a receiver housing or tank mounted on a manifold or header of the heat exchanger with ports that direct refrigerant between the receiver tank and the header. It is also known for such units to include a desiccant material and/or a filter as inserts, or a combined insert, that is contained within the receiver housing and eliminate the need for an external receiver drier. The condenser has a sub-cool loop to help improve the performance of the refrigerant system.

3.10 COMPRESSOR

A mechanical device or pump that circulates the refrigerant and increases the pressure and temperature of the refrigerant through a closed loop plumbing system.

3.11 TXV OR TEV

Thermostatic expansion valve is a modulating device that meters or controls the flow of the liquid refrigerant into the evaporator. The metering device is a modulating restriction that creates a pressure drop which allows the refrigerant to evaporate inside the evaporator.

3.12 ORIFICE TUBE

A fixed orifice expansion device that restricts the flow of the liquid refrigerant into the evaporator. A small hole or orifice allows only a certain amount of refrigerant to pass through the device. This creates a pressure drop that allows the refrigerant to evaporate inside the evaporator.

3.13 ACCUMULATOR

A container for storing liquid refrigerant from the evaporator. The device contains desiccant material which absorbs small amounts of moisture from the refrigerant. This device is meant to prevent liquid refrigerant from flowing into the suction line before it vaporizes.

3.14 RECEIVER/DRIER

A container for storing liquid refrigerant from the condenser. The device contains desiccant which absorbs small amounts of moisture from the refrigerant.

3.15 SUB-COOLED VALUE

The liquid refrigerant temperature difference below its saturation temperature for a given pressure. Its value is calculated by subtracting the measured refrigerant temperature at the inlet of the metering device or condenser outlet from the determined saturation temperature for the refrigerant pressure at the same location (determined from refrigerant manufacturer's data sheets).

3.16 SUPERHEAT VALUE

The vapor refrigerant temperature difference above its saturation temperature for a given pressure. Its value is calculated by subtracting the refrigerant saturation temperature (determined from refrigerant manufacturer's data sheets) from the measured temperature at the same location.

3.17 MINIMUM CHARGE

The minimum refrigerant amount required to enable the refrigerant system to function properly under designed conditions.