New refrigerant nears mass production

Cadillac XTS will be the first U.S. car with an R-1234yf air-conditioning system.

The Cadillac XTS model comes out in late spring, with the ATS to follow in mid-summer with the new R-1234yf A/C refrigerant. Behind the scenes, regulatory paperwork issues have delayed production from a DuPont-Honeywell joint venture plant in China, and an SAE committee chairman has asked the EPA to expedite approvals for service equipment.

We're "almost" ready for R-1234yf, the new low global warming auto A/C refrigerant that is being used in place of R-134a to meet European regulations and gain U.S. **EPA** fuel economy credits. "Almost" applies despite the fact that R-1234yf already has been installed in a small number of cars in Europe since last winter and is coming to **Cadillac** dealers in a matter of a few months.

The major problem is R-1234yf supply. A large plant in China, a joint venture between **DuPont** and **Honeywell**, reportedly is ready to go, but Chinese government requirements for additional documentation apparently have delayed the needed approval for production to start. So the only supply of R-1234yf is from a pilot plant operated by Honeywell, as the company holds patents covering applications for the refrigerant. Although overturning these patents is the object of lawsuits and complaints with regulatory agencies by potential competitors in Europe and the U.S., at this time the refrigerant is single-source.

Honeywell has focused on delivering most of the available R-1234yf to Europe, where a European Community regulation mandates a low global warming refrigerant for all new platform vehicles since Jan. 1, 2011. Car companies have juggled production and introduction schedules to conform to the regulation and deal with the supply problem. However, Honeywell has a supply contract with **General Motors** and, despite the shortage, will provide enough refrigerant for the new Cadillac XTS, the larger-than-CTS luxury sedan coming in late spring, and then also for the ATS, the smaller-than-CTS sports sedan to be introduced in mid-summer. GM will earn fuel economy-related carbon dioxide emissions credits for the change.

The switch to R-1234yf will be seamless for passengers of the new XTS, though new equipment and training are needed for Cadillac dealerships' service personnel.

These Robinair and Bosch/RTI recovery/recycle/recharge machines for R-1234yf were exhibited at the 2012 Mobile Air Conditioning Society (MACS) Worldwide convention and trade show.

EPA approvals awaited

The issues go beyond the refrigerant supply into what seems like incredibly small items that remain but still are legally required. U.S. EPA regulates auto A/C refrigerants under the Clean Air Act, prohibiting venting and requiring they be recovered and recycled and, if needed, recharged (RRR) into vehicle systems. For R-134a, EPA has referenced an applicable **SAE** standard, J2788.

Although R-1234yf itself, some new parts, and service equipment have the EPA's OK, the agency still has to accept the SAE-specified fitting on the refrigerant tanks for the R-1234yf service equipment, and while there's no objection, the mandatory approval process is not fast. Ward Atkinson, chairman of the SAE Interior Climate Control Standards Committee (ICCC), has asked EPA for expedited review so equipment and tanks already engineered can be used.

A related issue, a barrier in the sense of a shop's bankroll, is the size of the refrigerant tank. The cost of R-1234yf—estimated at about $70/lb ($154/kg) to the professional installer—would represent a $2000 investment to fill the standard 30-lb (13.6-kg) tank. A $2000 expenditure would be a large amount for a refrigerant supply that with one or two exceptions (primarily for accidental damage to the A/C) might not even be tapped for years to come. So EPA has been asked to approve a smaller size, perhaps one with a 10- to 15-lb (4.5- to 6.8-kg) capacity.

And the expense for refrigerant would be in addition to perhaps $7000 or more for the R-1234yf service equipment. Per the forthcoming EPA regulations, which will be tied to the Clean Air Act, R-1234yf will have to be serviced with new RRR machines that meet SAE J2843 (or the refrigerant recovery-only J2851). This is equivalent to the currently used R-134a and J2788 (and J2810, refrigerant recovery-only standard).

Refrigerant identifiers important

R-1234yf is mildly flammable, so R-1234yf standards require service equipment and evaporators with safety features to cover this factor, and with J2843 machines also the integration of new refrigerant identifiers. Because R-1234yf is perhaps 10 to 12 times the price of R-134a, there is concern that R-1234yf systems will be charged with R-134a if they leak, or even just topped up with this less-expensive refrigerant. Performance would be about the same with a full charge of either one in an R-1234yf system, but global warming reduction benefits would be lost. There also would be a problem with a 50:50 mixture of R-1234yf and R-134a, which would produce refrigerant pressures 8% higher than normal.

So all SAE J2843-compliant machines must have a built-in identifier or a USB port for a valid R-1234yf signal from a handheld identifier before they will allow refrigerant recovery. And

Handheld refrigerant identifiers for R-1234yf also identify R-134a and other refrigerants. They will have USB output to new recovery/recycle/recharge machines, which will operate only if the identifier sample from a vehicle system is R-1234yf, to prevent machine contamination.

these identifiers are covered by two SAE standards: J2912 for handhelds and J2927 for built-ins. Current identifiers cannot even identify R-1234yf without modification, and in any case would not have the software and USB port to provide the signal to the RRR machine.

The new identifiers also will be able to determine if the tank or system contains R-40 (methyl chloride), a highly toxic, flammable, and dangerously reactive (to aluminum) refrigerant that has been found in systems and counterfeit R-134a tanks overseas and, in one case, in several containers that got to the U.S. Current-generation premium identifiers with digital displays can tell a technician only if a virgin R-134a tank actually contains nothing else, including 0% air/noncondensable gasses. The identifiers may interpret R-40 as air/noncondensables and therefore display a separate number indicating significant air/noncondensables content, so a technician who believes he bought virgin R-134a should be suspicious.

Although all RRR machine manufacturers have prototype SAE J2843-compliant equipment developed, the limited market potential makes it likely only car dealers will be customers for the present. **SPX Service Solutions' Robinair** Division and **Bosch** Automotive Aftermarket Division's **RTI Group** showed R-1234yf machines at the recent trade show of the **Mobile Air Conditioning Society Worldwide**. But just a few days after the show, Bosch announced it was acquiring Service Solutions, so some consolidation of the Robinair and RTI brands' equipment lines can be expected.

J2911 postings to appear on website

All the new R-1234yf service equipment and some components (such as hoses and evaporators) must be certified to their applicable standards and to SAE J2911, a new, overarching standard that covers certification to 11 SAE standards at this point. J2911 was written to deal with an issue that had been raised sotto voce in the equipment industry's competitive atmosphere: does a particular machine, tester, or part really pass the applicable SAE standard? In theory, certification is voluntary, only applying if the manufacturer advertises or claims in labeling that equipment meets a particular standard.

Standards-related Lab Data Available at Special Mobile A/C Database Website (MACDB.sae.org)	
J2064	Refrigerant (R-134a, R-1234yf) Automotive Air Conditioning Hose
J2788	R-134a Recovery/Recycle/Recharging Equipment for Mobile A/C Systems
J2791	R-134a Refrigerant Electronic Leak Detectors, Minimum Performance Criteria
J2810	R-134a Refrigerant Recovery Equipment for Mobile A/C Systems
J2842	R-1234yf and R-744 Design Criteria and Certification for OEM Mobile A/C Evaporator and Service Replacements
J2843	R-1234yf Recovery/Recycle/Recharge Equipment for Flammable Refrigerants in Mobile A/C Systems
J2845	R-1234yf and R-744 Technician Training for Service and Containment of Refrigerants Used in Mobile A/C Systems
J2851	R-1234yf Refrigerant Recovery Equipment for Mobile A/C Systems
J2912	Performance Requirements for R-134a and R-1234yf Refrigerant Diagnostic Identifiers for Use with Mobile A/C Systems
J2913	R-1234yf Refrigerant Electronic Leak Detectors, Minimum Performance Criteria
J2927	R-1234yf Refrigerant Identifier Installed in Recovery and Recycling Equipment for Use with Mobile A/C Systems
J2911	Certification Requirements for Mobile A/C System Components, Service Equipment, and Service Technicians to Meet SAE J Standards

However, "voluntary" doesn't mean much with the regulatory requirements of EPA when it comes to RRR machines, and now the identifiers that work with them, and also the A/C evaporator for R-1234yf systems.

In addition, OEMs require that all A/C service equipment and parts approved for their dealers meet the applicable SAE standards for the dealers to obtain warranty reimbursement. So for all practical purposes, SAE standards set the rules.

As *AEI* has noted, all the key laboratory results for certification testing to one of the standards must be provided in tabular form to SAE, for posting on the special mobile A/C database website (MACDB.sae.org). Results will appear over the dated signature of the manufacturer's CEO or equivalent. Website access is open to anyone—government agencies, competitors, etc.—and if anyone wishes to publicly question the numbers, he is free to pursue the subject in any applicable way, including with regulatory agencies. Because this format is so new, companies have been given added time to comply.

When the website is populated, it initially will provide data for many SAE standards (see table). Although J2842 and J2845 also reference R-744 (carbon dioxide as a refrigerant) A/C systems, there are no mass production systems in planned OE use at this time and therefore no actual certifications of same to the standards. Since 2007, R-134a equipment has been eligible for certification to SAE J2788 and J2810, later to J2791, all prior to publication of J2911. Whether or not to provide "grandfathering" exemptions for continuing production models, use original laboratory data for the new J2911 website listings, or set a time limit for a new series of lab tests is still to be decided. At the same time, ICCC is considering the addition of existing and work-in-progress standards for J2911 certification, including those for A/C ultraviolet trace dyes. AEI