

RECO-COOL

TECHNICAL BULLETIN 0011/12

USE OF RECYCLED COOLANTS

Overview

There is increasing pressure from customers, local authorities, government bodies, and media to explore the wider use of re-cycled glycol in coolant, or to recycle used coolant product.

This paper explores the standards and specifications that exist which affect the use of re-cycled coolant products, and provides a technical summary on the benefits or detriments to quality and performance of such products.

Recycling of Used Coolants

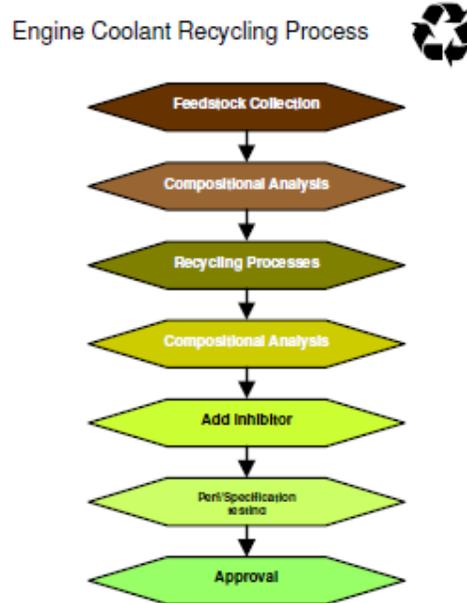
The proper recycling of used coolants to prepare new fluids which are appropriate for use involves a number of steps to (a) purify the glycol or glycol/water separations sufficiently to reformulate to antifreeze, and (b) reinhabit with appropriate quality inhibitor packages.

The recycler of coolants must address the problems associated with the used product:

- Glycol breaks down into acids as it degrades and ages, and these can esterify through excessive heat. All of these by-product materials will reduce the performance of a recycled coolant and significantly reduce the long-life performance of the recycled fluid.
- The inhibitor package depletes through the service life of the virgin fluid, and variable maintenance techniques will result in chemical imbalances in the collected fluids which are the recyclers feedstocks
- Many automotive cooling systems incorporate heavy metals which can leach over time into the coolant fluid. These must be stripped out during the recycling and purification process, and will carry HSSE consequences for the recycled fluid if this process is inadequate.



The process map for the recycling of coolants can be presented as follows:-



Recycling Processes

Multiple recovery technologies are required to best produce 'like new' coolants.

- a) Settling
Used coolant is left to settle in collection storage tanks. Solid particulate matter is removed from the bottom of the tank to be disposed of through authorized agencies. Fluid is pumped off from the top.
- b) Filtering
Settled coolant is filtered for any suspended matter and undissolved particulates. Proper filtration will extend the life of the chemical stripping process.
- c) Distillation/Dialysis/Exchange (Membrane/Ion) (Stripping)
The primary process to purify the water/glycol mixture from the remaining elemental components. Can be either vacuum distillation, membrane separation or ion exchange technologies. This process removes the total dissolved solids from the recycled fluid and produces a clear and bright intermediate fluid with minimal residual by-products, that is virtually colorless and odorless.
- d) Polishing
Removes the last remaining contaminants through secondary level ion exchange processes.



- e) Reformulating
Requires adjustment of the glycol percentage (rebalance to 50%), adjustment of pH, and rebalance with corrosion inhibition package and stabilizers.

Specifications

ASTM D 3306

– The basic specification for the performance of Coolant products in light duty and automobile applications. Until recently, this standard required the use of virgin glycol, and therefore recycled coolants were ineligible to meet this specific standard. This has changed recently so that as long as the technical requirements of ASTM E 1177 (standard quality specification for Ethylene Glycol) are met, ASTM D 3306 may be claimed on passing formulated coolants.

ASTM D 6210

– The basic specification for the performance of Coolant products for Heavy Duty engines. ASTM D 3306 is a pre-requirement for ASTM D 6210, so again, until recently, recycled coolants were ineligible to meet this specific performance standard. This has now again been modified so that recycled glycols which pass ASTM E 1177 may be formulated into inhibited coolants which can claim ASTM D 6210 if they pass all tests.

ASTM D 6471

– This is a standard which has been specifically devised for Recycled Pre-diluted Aqueous engine coolants. It is the primary standard for recycled ‘ready to use’ coolant fluids.

ASTM D 6472

– Specifically devised for concentrated Recycled engine coolants. A test method for the determination of glycol ester in recycled glycol is still under evaluation by the ASTM. The presence of glycol ester in coolants will diminish the performance of the product with respect to oxidation stability (and therefore reduce the coolant life considerably). The removal of glycol esters and glycolates during the recycling processes (distillation/dialysis/exchange) is extremely difficult.

Most automotive OEMs specifically refer to the performance standards ASTM D 3306 or ASTM D 6210 (or their own internal specification) when approving coolants for use. Rarely are the specific recycled coolant specifications mentioned in approval literature.

Summary

- 1) Use of recycled glycol in coolants is something becoming increasingly common. There are significant cost benefits of recycled glycol over virgin glycols



2) There are significant concerns with the ability of recycling methods to properly strip out the impurities in the used coolant. In particular, esterification of the glycol is highly likely due to the heat impact, and this will affect the performance of the recycled coolant in terms of its oxidation stability, and therefore will affect the coolant life. Furthermore, the presence of heavy metal elements from coolant systems are often found in used coolants which may have not been properly removed during stripping processes, and such heavy metals have significant HSSE impact.

3) Some modern recycling techniques, such as distillation or dialysis, may be quite useful in stripping out these heavy metal elements. There is however, no universally accepted test method to determine recycling efficiency.

4) The standard technical performance levels for coolant/antifreeze are the ASTM standards ASTM D 3306 (for light duty) and ASTM D 6210, both of which until very recently prohibited the use of recycled glycols. Now, it is possible to make these ASTM D 3306 and ASTM D 6210 claims on passing formulated coolants, blended with recycled glycol components, as long as the recycled ethylene glycol itself passes the quality test requirements as specified in ASTM E 1177. The ASTM has put in place some specific performance standards which apply only to re-cycled coolants. They are: ASTM D 6471 and 6472 for recycled pre-diluted coolants and recycled concentrated coolants respectively, although these particular specifications are rarely referred to in OEM approval literature.

5) The industry is generally working on evaluating the possibilities to use recycled coolants through enhanced R&D activity, and therefore the ability to properly strip used coolants and remove by-products such as glycol esters should improve.

