Coolant Concentration Facts and Terminology

Because words can have multiple meanings, we need to be sure we're using the same vocabulary and terminology. Here's a glossary of terms related to coolant concentrate, charging and maintaining your sump:

Coolant Concentrate

Coolant concentrate is undiluted water-soluble fluid straight from the pail or drum that will be mixed with water to make what's known as a working solution. All Master Fluid Solutions concentrates are sold at full, 100% strength and they do not contain any unnecessary ingredients. Concentrates are blended from chemicals, water and other liquids and surfactants, but every Master Fluid Solutions water-soluble fluid is distributed at 100% potency. So if your target working solution is 10%, you'll want to blend 90% water with 10% coolant concentrate to make the initial working solution for your sump.

Types of Coolant Concentrates

Master Fluid Solutions manufactures four types of coolant concentrates:

- Emulsions or Soluble Oils (40% or more oil content)
- Microemulsions or High Oil Semisynthetics (20% to 50% oil content)
- Low Oil Semisynthetics (0% to 20% mineral oil content)
- Synthetics (no mineral oil content) or (0% to 10% oil content)

Sump

The sump is the reservoir in the machine tool from which the working solution is circulated to the point of cut and where the returning fluid flushes chips and grinding swarf.

Working Solutions

Blending coolant concentrate with water forms the working solution. In general, the target working solution is between 5% and 10% coolant concentrate mixed with between 95% and 90% water.

Target Working Solution

The target working solution, also called coolant concentration, for any specific machine will depend on variables including the manufacturer's recommended working range, the materials being used, the operation being performed and the amount of lubrication and cooling needed. Working solutions are adjustable: if less lubricity is needed, a lower concentration may be appropriate; if more lubricity is needed, a higher concentration may be required. Once a target working solution is determined, it is important to monitor its fluid concentration level and make adjustments to keep it as close to target as possible. In order to check the concentration of your working solution after the initial sump fill, you use Brix factors and your refractometer reading.

A typical Master Fluid Solutions microemulsion concentrate is comprised of 18 ingredients and though it is clearly a very complex formula, it does not contain any unnecessary ingredients.

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A typical Master Fluid Solutions emulsion concentrate is comprised of 8 ingredients.

BRIX Factors and Refractive Readings

Every coolant concentrate has its own unique Brix factor (also known as its refractive index factor or RI factor) which is a multiplier utilised in conjunction with a digital or optical refractometer reading. Brix factors range from 0.9 for emulsions, to 3.4 for synthetics. A Brix factor is meaningful only as a multiplier; it does not indicate anything about a product's efficacy or water content. A refractometer reading is meaningful only as a number to be multiplied by the Brix factor, not as an indicator in itself.

Operators who have formerly employed only emulsions or soluble oils may not understand why they need to go through the computation of multiplying the working solution's Brix factor by its refractometer reading. This is because the Brix factor for many emulsions is 1.0...so what you read on the refractometer is the actual coolant concentration in the sump. However, as the table above demonstrates, when using microemulsions, semisynthetics and synthetics (which have Brix factors as high as 3.4) it is critical to make this calculation to determine the actual coolant concentration in the sump.

Makeup Coolant or Makeup Solution

Over time, sump levels decrease due to evaporation and use: some of the working solution will be carried out on parts and chips; some will be splashed outside the machine. Operators need to compensate by "topping off" the sump with makeup coolant: ie, adding a mixture of additional coolant concentrate and water to the sump. "Topping off" should be performed at the beginning of each shift and as needed.

To determine how much coolant concentrate and water are needed in the makeup solution, the operator needs to know the current and target working solution concentration and the current and full sump volume. Then the operator is able to calculate an accurately balanced makeup solution.

The easiest way to determine this is to use the Master Fluid Solutions online makeup calculator application at http:// apps.masterchemical.com/makeup/.

Calculating Coolant Concentration

Coolant Type	Typical Brix Factor	Coolant Concentration 5%	7.5%	10.0%
Emulsions/Soluble Oils	1.0 Brix	5 RR	7.5 RR	10 RR
High Oils/Semisynthetics/ Microemulsions	1.2 Brix	4.2 RR	4.2 RR	3.3 RR
Low Oils/Semisynthetics	1.8 Brix	2.8 RR	2.3 RR	5.6 RR
Semisynthetics	3.3 Brix	1.5 RR	6.3 RR	8.3 RR

Refractometer Reading (RR): 10.0, 9.5, 9.0, 8.5, 8.0, 7.5, 7.0, 6.5, 6.0, 5.5, 5.0, 4.5, 4.0, 3.5, 3.0, 2.5, 2.0, 1.5

Coolant Concentration = Refractometer Reading x Brix Factor

Proper Coolant Mixing Procedure (O-I-L)

To prepare your initial working solution or your makeup solution, always add water to the sump or mixing container first, followed by the determined amount of coolant concentrate while mixing or agitating. Never add water directly to coolant concentrate, which can form an inverse emulsion.

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