Understanding
The Refractometer Factor

Water miscible coolants

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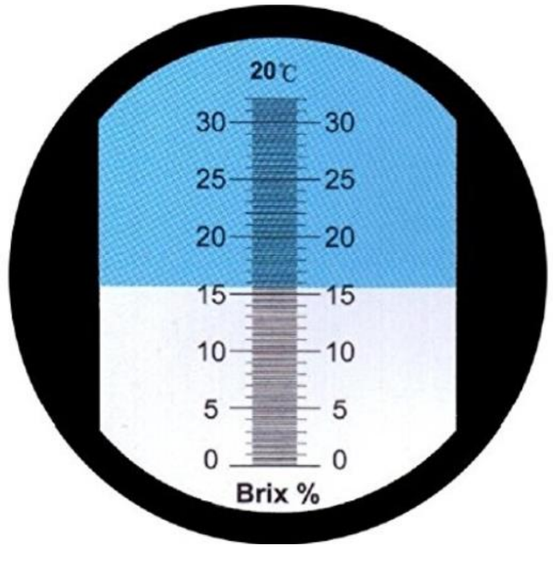
Definitions



Brix

The name of the scale used on a refractometer

Sometimes refered to as Brix % or Brix º (degrees) or visa-versa. % Brix

Brix or **Refractometer reading**

The numerical reading on the refractomer. In the example above right, 15.8*ish*

Refractometer <u>Factor</u> - ***note****: not necessarily linear*

Used to determine the concentration by volume of the mixed coolant.

The Brix reading x the Factor = Concentration

When the concentrate contains ingredients that either cannot be read by a refractomer or need to be compensated for.

<u>mainly water</u>

Assuming a factor of 1.5 in the example above right 15.8 x 1.5 = 23.7

Definitions continued

Concentration

The percentage (%) of concentrate by volume, in the mixed coolant

The Brix reading x the Factor = Concentration

Top-off, Top-up, Make-up

The concentration of mixed coolant used to replenish the sump. Normally a fraction of the target, sump concentration. - due to drag out and evaporation

The Brix reading x the Factor = Concentration

Ratio

Parts water to Parts concentrate. i.e. 9:1

Profital (prä-fət-ȯl)

An additive commonly used in water miscible metalworking fluids to reduce the price per unit (price per gallon, price per liter). aka *water*

Profital should not be confused with the amount of water necessary in the concentrate in order to introduce water soluble additives into the concentrate mixture.

Dug Notes: For the calculation examples

1. *Write down 1.7 as the refractometer factor*
2. *Write down $38 as the price per gallon*

Calculations

Price per gallon of mixed coolant

Factor x Brix reading x $ price per gallon = Price per gallon of mixed coolant

Assuming a factor of 1.7, a reading of 4.7 and a price of $38 per gallon of concentrate…

1.7 x 0.047 (as a decimal) x $38 = $3.036 per gallon

(1.7 x 0.047) = .08 x $38 = $3.04 per gallon. This is an example of the **cost to fill the sump**.

For top-off, assuming a factor of 1.7, a reading of 2.4 and a price of $38 per gallon

1.7 x 0.024 (as a decimal) x $38 = $1.55 per gallon

(1.7 x .024) = .04 x $38 = $1.55 per gallon

Number of gallons of concentrate to fill the sump

Sump in gallons x Concentration of the sump = Gallons of concentrate needed

From the example above, assuming 250 gallon sump

250 x .08 (as a decimal) = 20 gallons of concentrate

Calculations continued

Number of gallons of mixed coolant per 55 gallon drum

Container size ÷ top off concentration = number of gallons of mixed coolant

From the example previously for a top off brix reading of 2.4 (1.7 x .024 = .04)

55 ÷ .04 (as a decimal) = 1,375 mixed gallons of coolant for top off in a 55 gallon drum

Refractometer reading of a <u>concentration</u> that has a factor

Concentration ÷ Refractometer factor = Brix or Refractometer reading

Assuming a factor of 1.7, a concentration of 8%…

8.0 ÷ 1.7 = 4.7 Refractometer reading (Brix)

Assuming a factor of 1.7 and a concentration of 4%…

4.0 ÷ 1.7 = 2.4 Refractometer reading (Brix)

Ratio as a Percentage

Assuming 9:1 ratio, 1 part ÷ Total parts or 1 ÷ 10 = 10% or .10 (as a decimal)

Calculations continued

How much water is in the concentrate based on the Factor?

This example is for calculating a concentration of 1%

Assuming a factor of 1.7, *solve for "X"*

In other words, what number times 1.7 = 1?

"X" x 1.7 = 1

"X" = 1 ÷ 1.7

"X" = 0.59

0.59 x 1.7 = 1(%)

What does 0.59 represent?

Readable ingredients (Brix) x 1.7 = 1% by volume

1 – readable ingredients = water (non-readable ingredients)

1 – 0.59 = 0.41 water

In other words, 41% water

Refractometer Factor

Refractometer factor = Concentration by volume ÷ Refractometer reading

Determining the Refractometer Factor – On-site

Work with a known ratio of 9:1, or 10%

9 parts water (3 x 3ml)
1 part concentrate (1x1ml)

concentrate

water

empty

Set the plunger to the same location of the hash mark

Determining the Refractometer Factor – On-site

Work with a known ratio of 9:1, or 10%

Shake up the 9:1 ratio, or 10%

- What is the refractometer reading (**n**)?
- What is the known concentration by volume? **10%**
- Solve for ‘X’
- 10 ÷ **n** = ‘X’
- ‘X’ is the refractometer factor

Take Aways

- Concentration is % by volume
- Brix is the scale used on a refractometer. It can be refered to as percentage, i.e. % Brix or as degrees, i.e. º Brix
- The refractometer factor is not necessarily linear, so use a ratio of 9:1 or 10%. This is commonly within the in use working range.
- A ratio is Parts water to Parts concentrate.
- Convert a ratio to a percentage concentration:

  Divide 1 part by the Total parts. i.e. 1 ÷ 10
- Don’t forget to enter percentages as decimals when calculating.
- The concentration is how you can determine price per mixed unit.
- The concentration is used to calculate how much concentrate you need to fill.
- The top-off concentration determines how many gallons of mixed coolant you get per packaging unit. Drums, pails, totes
- You need to know the refractometer factor in order to calculate the concentration!

Q & A

What?!?