

UNITS OF MEASUREMENT USED IN DETERMINING BREATH ALCOHOL CONCENTRATIONS, AND HOW TO CONVERT THEM

CONVERTING BAC TO BrAC

The breath alcohol concentration (BrAC) is the concentration of ethanol (mass concentration in an **end-expiratory sample**) obtained from exhalation through the mouth.

The breath alcohol concentration is expressed in the unit [mg/l] (= mg of ethanol per litre of exhaled air at 34° C and 1013 mbar).

In the **elimination phase** (at a constant temperature) the **mass concentration of alcohol** in the breath is **2100** times below the **alcohol concentration in the blood**.

This factor can vary greatly in the **absorption phase** (1700 to 2800).

LIMIT VALUES IN LAW

In many countries, laws specify both breath and blood alcohol concentrations.

The relation between these limit values varies.

| Country | BAC | BrAC | Conversion factor |
|---------------|--------|--------------|-------------------|
| Germany | 0.5 ‰ | 0,25 mg/l | 2000 |
| Great Britain | 0.08 ‰ | 35 µg/100 ml | 2300 |
| Italy | 1.0 ‰ | - | 2300 |
| France | 0.8 ‰ | 0,4 mg/l | 2000 |
| Netherlands | 0.5 ‰ | 0,22 mg/l | 2300 |
| Portugal | 0.8 ‰ | 0,4 mg/l | 2000 |

UNITS OF MEASUREMENT IN USE

| | | |
|------------|-----|--|
| Per mille | ‰ | Used to state the concentration of a substance in a liquid [mass per volume] (blood alcohol concentration) |
| Percent | % | |
| Gram/litre | g/l | |

| | | |
|----------------------------|-----------|--|
| Milligram/litre | mg/l | Used to state the concentration of a gas in a gas [mass per volume] (breath alcohol concentration) |
| Microgram/litre | µg/l | |
| Microgram/100 milli litres | µg/100 ml | |
| Gram/210 litres | g/210 l | |

CONVERSION BAC TO BrAC

$$\text{Alcohol concentration in } \text{‰} = \frac{\text{g (ethanol)}}{\text{l (blood)}}$$

BAC values: $1 \text{ ‰} = 0,1 \text{ ‰}$

Equivalent BAC
and BrAC values
(conversion factor = 2100):

BAK **AAK**

$$1 \text{ ‰} = 0,476 \text{ mg/L}$$

$$1 \text{ ‰} = 476 \text{ } \mu\text{g/L}$$

$$1 \text{ ‰} = 47,6 \text{ } \mu\text{g}_{100 \text{ ml}}$$

$$1 \text{ ‰} = 0.1 \text{ g}_{210\text{L}}$$

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The following table is intended to illustrate the relation between the different units of measurement.

Each breath-alcohol value represents the same absolute concentration.

The corresponding blood alcohol values are stated taking the following three different breath-alcohol to blood-alcohol ratios into account

2000:1,

2100:1 and

2300:1.

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| Units of measurement for <i>breath</i> alcohol concentration | | |
|--|------------------------------------|------------------------------------|
| Microgram alcohol per 100 millilitres breath | Microgram alcohol per liter breath | Milligram alcohol per liter breath |
| $\mu\text{g}/100\text{ ml}; \mu\text{g} \%$ | $\mu\text{g}/\text{l}$ | mg/l |
| 35 | 350 | 0.35 |

* The specific weight of the total volume of blood is approx. 1.06

| Units of measurement for <i>blood</i> alcohol concentration | | | |
|---|--|--|--|
| Milligram alcohol per 100 millilitres blood | Per mille w/v [gram alcohol per liter blood] | Per mille w/w [gram alcohol per kilogram blood]* | Gram alcohol per 100 millilitres blood |
| $\text{mg}/100\text{ ml}; \text{mg} \%$ | $\text{‰} [\text{w/v}]$ | $\text{‰} [\text{w/w}]$ | $\text{g} \%; \text{g}/100\text{ ml}$ |
| 70 | 0.70 | 0.66 | 0.070 |
| 73 | 0.73 | 0.69 | 0.073 |
| 80 | 0.80 | 0.76 | 0.080 |

2000:1

2100:1

2300:1