



Calculation formulae, fuels and
parameters |
*Berechnungsformeln, Brenn-
stoffe und Parameter*

Testo Flue gas analyzers |
Testo Abgasanalysegeräte

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Errors and omissions excepted | *Angaben ohne Gewähr*

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| 10.15 | Netherlands <i>Niederlande</i> | 90 |
| 10.16 | Poland <i>Polen</i> | 91 |
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| 10.18 | Republic of Corea <i>Korea</i> | 92 |
| 10.19 | Romania <i>Rumänien</i> | 92 |
| 10.20 | Spain <i>Spanien</i> | 93 |
| 10.21 | Sweden <i>Schweden</i> | 93 |
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| 10.24 | USA <i>USA</i> | 95 |
| 10.25 | Vietnam <i>Vietnam</i> | 96 |

1 Calculation formulae testo 310 | Berechnungsformeln testo 310

1.1 Calculation basis area version 1 | Berechnungsgrundlage Gebietsversion 1

1.1.1 Carbon dioxide | *Kohlendioxid*

$$\text{CO}_2 = \frac{\text{CO}_{2\text{max}} \times (\text{O}_{2\text{ref}} - \text{O}_2)}{\text{O}_{2\text{ref}}}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

1.1.2 Efficiency | *Wirkungsgrad*

$$\eta = 100 - \left((FT - AT) \times \left(\frac{A2}{\text{O}_{2\text{ref}} - \text{O}_2} + B \right) - K_k \right)$$

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

A2 / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

K_k: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *Berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

1.1.3 Air ratio | Luftverhältniszahl

$$\lambda = \left(\frac{O_2 - \frac{CO}{2}}{0.26582 \cdot (100 - O_2 - CO_2 - CO) - (O_2 - \frac{CO}{2})} \right) \cdot 100$$

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

1.1.4 Excess Air | Luftüberschuss

$$ExAir = \left(\frac{21\%}{21\% - O_2} - 1 \right) \times 100$$

21%: O₂ level of air | *O₂-Gehalt von Luft*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

1.1.5 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$uCO = CO \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ: Calculated air ratio | *Berechnete Luftverhältniszahl*

1.2 Calculation basis area version 2 | Berechnungsgrundlage Gebietsversion 2

1.2.1 Carbon dioxide | Kohlendioxid

$$CO_2 = \frac{CO_{2max} \times (O_{2ref} - O_2)}{O_{2ref}}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

1.2.2 Effizienz | Wirkungsgrad

Calorific value range taken into account: | *Mit Berücksichtigung Brennwertbereich:*

$$EffG = 100 - \left(\left(\frac{K_{gr} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (2488 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{gr} \cdot 1000} \right) + \left(\frac{K1 \cdot CO}{CO_2 + CO} \right) \right)$$

Calorific value range not taken into account: | *Ohne Berücksichtigung Brennwertbereich:*

$$EffN = 100 - \left(\left(\frac{K_{net} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (210 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{net} \cdot 1000} \right) + \left(\frac{K1 \cdot Q_{gr} \cdot CO}{Q_{net} \cdot (CO_2 + CO)} \right) \right)$$

Kgr / Knet / Qgr / Qnet / K1 / MH₂O / H:

Fuel-specific factors | *Brennstoff-spezifische Faktoren*

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

1.2.3 Air ratio | Luftverhältniszahl

$$\lambda = \frac{CO_{2max}}{CO_2}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

1.2.4 Poison index | Giftindex

$$\text{ratio} = \frac{CO}{CO_2 \cdot 10000}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

1.2.5 Excess Air | Luftüberschuss

$$ExAir = \left(\frac{21\%}{21\% - O_2} - 1 \right) \times 100$$

21%: O₂ level of air | *O₂-Gehalt von Luft*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

1.2.6 Carbon monoxide undiluted | *Kohlenmonoxid unverdünnt*

$$u_{CO} = CO \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ : Calculated air ratio | *Berechnete Luftverhältniszahl*

1.3 Calculation basis area version 3, 4, 5 | *Berechnungsgrundlage Gebietsversion 3, 4, 5*

1.3.1 Carbon dioxide | *Kohlendioxid*

$$CO_2 = \frac{CO_{2max} \times (O_{2ref} - O_2)}{O_{2ref}}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

1.3.2 Flue gas loss | *Abgasverlust*

$$q_A = \left((FT - AT) \times \left(\frac{A_2}{O_{2ref} - O_2} + B \right) \right) - K_k$$

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

A₂ / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

K_k: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

1.3.3 Efficiency | *Wirkungsgrad*

$$\eta = 100 - q_A$$

q_A: Calculated flue gas loss | *berechneter Abgasverlust*

1.3.4 Heat of condensation (Specific area version 5 | Kondensationswärme (Speziell zur Gebietsversion 5)

$$ET [\%] = \eta^+ - [100 - qA]$$

qA: Calculated flue gas loss | *berechneter Abgasverlust*

1.3.5 Air ratio | Luftverhältniszahl

$$\lambda = \frac{CO_{2max}}{CO_2}$$

CO_{2max}: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

1.3.6 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$uCO = CO \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ: Calculated air ratio | *Berechnete Luftverhältniszahl*

1.3.7 Poison index (Specific area version 3) | Giftindex (Speziell zur Landesversion 3)

$$GI = \frac{CO}{CO_2 \cdot 100}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

2 Fuels and parameters testo 310 | Brennstoffe und Parameter testo 310

2.1 Area version 1 | Gebietsversion 1

| Brennstoff | A2 | B | CO _{2max} [Vol. %] | V _{AG trmin} | V _{Lmin} |
|-------------|--------|--------|-----------------------------|-----------------------|-------------------|
| Natural Gas | 0,5924 | 0,0010 | 11,7 | 7,91 | 8,70 |
| Propane | 0,5978 | 0,0013 | 13,8 | 22,31 | 24,37 |
| Fueloil #2 | 0,6385 | 0,0017 | 15,7 | 10,40 | 11,10 |
| Bioheat | 0,6000 | 0,0061 | 15,4 | 10,48 | 11,19 |
| Wood 20% M | 0,6194 | 0,0024 | 20,0 | 3,64 | 3,66 |

2.2 Area version 2 | Gebietsversion 2

| Fuel | CO _{2MAX} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| Natural Gas | 11,90 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| LPG | 13,80 | 0,42 | 0,45 | 47,00 | 17,90 | 0,00 | 49,93 | 46,04 |
| Butane | 14,10 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| Propane | 13,80 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| Light Oil | 15,50 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| Kerosene | 15,40 | 0,47 | 0,51 | 52,36 | 13,60 | 0,00 | 46,56 | 43,12 |
| Heavy Oil | 15,80 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| Wood Pellets | 20,70 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |

2.3 Area version 3 | Gebietsversion 3

| Brennstoff | A2 | B | CO _{2max} [Vol. %] | V _{AG trmin} | V _{Lmin} |
|-----------------------------|--------|--------|-----------------------------|-----------------------|-------------------|
| Natural gas Hb ¹ | 0,6230 | 0,0080 | 11,7 | 7,71 | 8,43 |
| Natural gas Ho ² | 0,6910 | 0,0090 | 11,7 | 7,71 | 8,43 |
| Propane Hb ¹ | 0,6190 | 0,0066 | 13,7 | 22,30 | 24,40 |
| Propane Ho ² | 0,6730 | 0,0070 | 13,7 | 22,30 | 24,40 |
| Butane Ho ² | 0,6660 | 0,0100 | 14,0 | 30,07 | 32,40 |
| LPG Ho ² | 0,6580 | 0,0073 | 13,8 | 25,23 | 27,51 |
| Light oil | 0,6800 | 0,0070 | 15,5 | 10,52 | 11,30 |
| Wood pellets | 0,6200 | 0,0081 | 20,0 | 4,07 | 4,13 |

¹ based on calorific value | *bezogen auf Brennwert*

² based on heat value | *bezogen auf Heizwert*

2.4 Area version 4 | Gebietsversion 4

| Brennstoff | A2 | B | CO ₂ max [Vol.-%] | V _{AG trmin} | H ₂ O max [Vol.-%] |
|---------------|--------|--------|------------------------------|-----------------------|-------------------------------|
| Natural Gas | 0,6600 | 0,0090 | 11,9 | 8,36 | 21,98 |
| Propane | 0,5826 | 0,0097 | 13,7 | 22,31 | 17,62 |
| Butane | 0,6660 | 0,0100 | 14,0 | 30,07 | 17,24 |
| Coke oven gas | 0,6000 | 0,0110 | 10,3 | 3,86 | 28,76 |
| Town gas | 0,6300 | 0,0110 | 13,6 | 3,61 | 26,04 |
| Light oil | 0,6800 | 0,0070 | 15,4 | 10,53 | 14,15 |
| Heavy oil | 0,8060 | 0,0000 | 15,9 | 10,09 | 12,88 |
| Gas oil A | 0,6710 | 0,0069 | 15,0 | 10,53 | 14,15 |
| Wood 15% w | 0,6860 | 0,0096 | 20,3 | 3,87 | 19,59 |

2.5 Area version 5 | Gebietsversion 5

| Brennstoff | A2 | B | CO ₂ max [Vol.-%] | V _{AG trmin} | V _{Lmin} |
|--------------|--------|--------|------------------------------|-----------------------|-------------------|
| Natural Gas | 0,6600 | 0,0100 | 11,7 | 8,52 | 9,52 |
| Propane | 0,6300 | 0,0080 | 13,9 | 23,80 | 25,90 |
| Butane | 0,6300 | 0,0080 | 13,9 | 28,15 | 30,95 |
| Light oil | 0,6800 | 0,0070 | 15,1 | 10,40 | 11,20 |
| Heavy oil | 0,6800 | 0,0070 | 15,7 | 10,09 | 10,73 |
| Wood pellets | 0,6200 | 0,0081 | 20,0 | 4,07 | 4,13 |
| Wood 15% w | 0,6860 | 0,0096 | 20,0 | 3,87 | 3,93 |

3 Calculation formulae testo 320 | Berechnungsformeln testo 320

3.1 Calculation basis Germany | *Berechnungsgrundlage Deutschland*

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

Austria | *Österreich*, Belgium | *Belgien*, Bulgaria | *Bulgarien*, Croatia | *Kroatien*, Czech Republic | *Tschechische Republik*, Denmark | *Dänemark*, France | *Frankreich*, Germany | *Deutschland*, Greece | *Griechenland*, Hungary | *Ungarn*, Italy | *Italien*, Japan | *Japan*, Netherlands | *Niederlande*, Poland | *Polen*, Portugal | *Portugal*, Romania | *Rumänien*, Russia | *Russland*, Slovenia | *Slowenien*, Spain | *Spanien*, Sweden | *Schweden*, Turkey | *Türkei*

3.1.1 Carbon dioxide | *Kohlendioxid*

$$\text{CO}_2 = \frac{\text{CO}_{2\text{max}} \times (\text{O}_{2\text{ref}} - \text{O}_2)}{\text{O}_{2\text{ref}}}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

3.1.2 Flue gas loss | *Abgasverlust*

3.1.2.1 All country-specific versions (except Austria, Japan) | *Alle Landesversionen (ausgenommen Österreich, Japan)*

$$q_A = \left((FT - AT) \times \left(\frac{A_2}{\text{O}_{2\text{ref}} - \text{O}_2} + B \right) \right) - K_k$$

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

A₂ / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

K_k: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

3.1.2.2 Country-specific versions (Austria, Japan) | Landesversionen (Österreich, Japan)

$$qA = \left((FT - AT) \times \left(\frac{A2}{O_{2ref} - O_2} + B \right) \right)$$

| | |
|---------|--|
| FT: | Flue gas temperature <i>Abgastemperatur</i> |
| AT: | Ambient air temperature <i>Umgebungslufttemperatur</i> |
| A2 / B: | Fuel-specific parameters <i>Brennstoff-spezifische Parameter</i> |
| O2ref: | O2 Reference value <i>O2-Referenzwert</i> |
| O2: | Measured oxygen content as % <i>Gemessener Sauerstoffgehalt in %</i> |

3.1.3 Efficiency | Wirkungsgrad

$$\eta = 100 - qA$$

qA: Calculated flue gas loss | *berechneter Abgasverlust*

3.1.4 Heat of condensation (Country-specific version Italy) | Kondensationswärme (Landesversion Italien)

$$ET [\%] = \eta^+ - [100 - qA]$$

qA: Calculated flue gas loss | *berechneter Abgasverlust*

3.1.5 Air ratio | Luftverhältniszahl

$$\lambda = 1 + \frac{V_{AGtrMin}}{V_{LMin}} \cdot \frac{O_2 - \frac{CO}{2}}{O_{2ref} - O_2 + \frac{CO}{2}}$$

VAGtrMin: Dry flue gas volume with stoichiometric combustion | *Trockene Abgasmenge bei stöchiometrischer Verbrennung*

VLMin: Air requirement for stoichiometric combustion of the fuel | *Luftbedarf bei stöchiometrischer Verbrennung des Brennstoffs*

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

3.1.6 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$uCO = CO \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ : Calculated air ratio | *Berechnete Luftverhältniszahl*

3.1.7 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$T_{p_{AG}} = \text{MIN} \left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT$$

F_{H_2O} : Flue gas-specific water vapour content as vol.% |
Abgasspezifischer Wasserdampfgehalt in Vol.%

P_{Abs} : Absolute pressure in mbar/hPa | Absolutdruck in mbar/hPa

3.1.8 Poison index (Country-specific version Netherlands) | Gifindex (Landesversion Niederlande)

$$GI = \frac{CO}{CO_2 \cdot 100}$$

CO: Measured carbon monoxide content | Gemessener Kohlenmonoxidgehalt

CO₂: Calculated carbon dioxide value in % | Berechneter Kohlendioxidwert in %

3.1.9 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. | Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³.

3.1.9.1 All country-specific versions (except Japan) | Alle Landesversionen (ausgenommen Japan)

$$CO \left[\text{mg/m}^3 \right] = \frac{O_{2ref} - O_{2base}}{O_{2ref} - O_2} \times CO \left[\text{ppm} \right] \times 1,25$$

O_{2ref}: O₂ Reference value | O₂-Referenzwert

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

O_{2base}: Fuel-specific oxygen base value as % | brennstoffspezifischer Sauerstoff-Bezugswert in %

3.1.9.2 Country-specific version Japan | Landesversion Japan

$$CO \left[\text{mg/m}^3 \right] = CO \left[\text{ppm} \right] \times 1,25$$

3.1.10 Efficiency related to calorific value (Country-specific version Belgium) | Wirkungsgrad bezogen auf Brennwert (Landesversion Belgien)

$$\eta_{Hs} = 100 - (q_A + CWD) * \frac{100}{(100 + CWD)}$$

$$\eta_{+Hs} = 100 - (q_A^+ + CWD) * \frac{100}{(100 + CWD)}$$

$$CO_{Hs} \left[\frac{g}{Gf} \right] = CO \left[\frac{g}{Gf} \right] * \frac{100}{(100 + CWD)}$$

$$NOx_{Hs} \left[\frac{g}{Gf} \right] = NOx \left[\frac{g}{Gf} \right] * \frac{100}{(100 + CWD)}$$

3.2 Calculation basis Great Britain | Berechnungsgrundlage Großbritannien

Formulae are valid for country-specific versions: | Formeln sind gültig für die Landesversionen:

Great Britain | Großbritannien, China | China, Korea | Korea, Thailand | Thailand

3.2.1 Carbon dioxide | Kohlendioxid

$$CO_2 = \frac{CO_{2max} \times (O_{2ref} - O_2)}{O_{2ref}}$$

CO2max: Fuel-specific carbon dioxide value | Brennstoffspezifischer Kohlendioxidwert

O2ref: O2 Reference value | O2-Referenzwert

O2: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

3.2.2 Efficiency | Wirkungsgrad

Calorific value range taken into account: | Mit Berücksichtigung Brennwertbereich:

$$EffG = 100 - \left(\left(\frac{K_{gr} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (2488 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{gr} \cdot 1000} \right) + \left(\frac{K1 \cdot CO}{CO_2 + CO} \right) \right)$$

Calorific value range not taken into account: | Ohne Berücksichtigung Brennwertbereich:

$$EffN = 100 - \left(\left(\frac{K_{net} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (210 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{net} \cdot 1000} \right) + \left(\frac{K1 \cdot Q_{gr} \cdot CO}{Q_{net} \cdot (CO_2 + CO)} \right) \right)$$

Kgr / Knet / Qgr / Qnet / K1 / MH2O / H:

Fuel-specific factors | Brennstoff-spezifische Faktoren

FT: Flue gas temperature | Abgastemperatur

AT: Ambient air temperature | Umgebungslufttemperatur

CO: Measured carbon monoxide content | Gemessener Kohlenmonoxidgehalt

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

3.2.3 Air ratio | *Luftverhältniszahl*

$$\lambda = \frac{CO_{2max}}{CO_2}$$

CO_{2max}: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

3.2.4 Poison index | *Giftindex*

$$\text{ratio} = \frac{CO}{CO_2 \cdot 10000}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

3.2.5 Excess Air | *Luftüberschuss*

$$\text{ExAir} = \left(\frac{21\%}{21\% - O_2} - 1 \right) \times 100$$

21%: O₂ level of air | *O₂-Gehalt von Luft*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

3.2.6 Carbon monoxide undiluted | *Kohlenmonoxid unverdünnt*

$$uCO = CO \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ: Calculated air ratio | *Berechnete Luftverhältniszahl*

3.2.7 Flue gas dew point temperature | *Abgastaupunkt-Temperatur*

$$T_{pAG} = \text{MIN} \left[\left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H₂O}: Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol.%*

P_{Abs}: Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

3.2.8 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³.*

$$\text{CO} \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{CO} \left[\text{ppm} \right] \times 1,25$$

O_{2ref}: O₂ Reference value | O₂-Referenzwert

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

O_{2base}: Fuel-specific oxygen base value as % | brennstoffspezifischer Sauerstoff-Bezugswert in %

3.3 Calculation basis USA | Berechnungsgrundlage USA

Formulae are valid for country-specific versions: | Formeln sind gültig für die Landesversionen:

USA |USA, Mexico |Mexico

3.3.1 Carbon dioxide | Kohlendioxid

$$\text{CO}_2 = \frac{\text{CO}_{2\text{max}} \times (O_{2\text{ref}} - O_2)}{O_{2\text{ref}}}$$

CO_{2max}: Fuel-specific carbon dioxide value | Brennstoffspezifischer Kohlendioxidwert

O_{2ref}: O₂ Reference value | O₂-Referenzwert

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

3.3.2 Efficiency | Wirkungsgrad

$$\eta = 100 - \left(\left((FT - AT) \times \left(\frac{A2}{O_{2\text{ref}} - O_2} + B \right) \right) - K_k \right)$$

FT: Flue gas temperature | Abgastemperatur

AT: Ambient air temperature | Umgebungslufttemperatur

A2 / B: Fuel-specific parameters | Brennstoff-spezifische Parameter

O_{2ref}: O₂ Reference value | O₂-Referenzwert

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

K_k: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)

3.3.3 Air ratio | Luftverhältniszahl

$$\lambda = \left(\frac{O_2 - \frac{CO}{2}}{0.26582 \cdot (100 - O_2 - CO_2 - CO) - (O_2 - \frac{CO}{2})} \right) \cdot 100$$

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

3.3.4 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$uCO = CO \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ : Calculated air ratio | *Berechnete Luftverhältniszahl*

3.3.5 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$Tp_{AG} = MIN \left[\left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H₂O}: Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol. %*

P_{Abs}: Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

3.3.6 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³.*

$$CO \left[\text{mg/m}^3 \right] = \frac{O_{2ref} - O_{2base}}{O_{2ref} - O_2} \times CO \left[\text{ppm} \right] \times 1,25$$

O_{2ref}: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

O_{2base}: Fuel-specific oxygen base value as % | *brennstoffspezifischer Sauerstoff-Bezugswert in %*

4 Fuels and parameters testo 320 | Brennstoffe und Parameter testo 320

4.1 Austria | Österreich

| Brennstoff | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------------|------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Heizöl HEL | 15,4 | 3,0 | 10,54 | 11,30 | 0,6642 | 0,0086 |
| Heizöl HL | 15,8 | 3,0 | 10,35 | 11,40 | 0,6655 | 0,0082 |
| Heizöl HM | 16,0 | 3,0 | 10,03 | 11,60 | 0,6687 | 0,0079 |
| Heizöl HS1L | 16,4 | 3,0 | 10,03 | 11,60 | 0,6736 | 0,0076 |
| Flüssig biogen | 15,2 | 3,0 | 9,03 | 9,74 | 0,6553 | 0,0080 |
| Erdgas | 11,7 | 3,0 | 8,49 | 9,40 | 0,6440 | 0,0111 |
| Holzpellets | 20,3 | 11,0 | 4,01 | 4,07 | 0,6753 | 0,0116 |
| Hackgut trocken | 20,3 | 11,0 | 3,34 | 3,39 | 0,6921 | 0,0137 |
| Hackgut feucht | 20,3 | 11,0 | 2,67 | 2,71 | 0,7290 | 0,0183 |
| Scheitholz | 20,3 | 11,0 | 3,79 | 3,84 | 0,6753 | 0,0116 |
| Biomasse | 20,3 | 11,0 | 3,79 | 3,84 | 0,6824 | 0,0125 |
| Gerste/Triticale | 20,3 | 11,0 | 3,79 | 3,84 | 0,6753 | 0,0116 |
| Propan | 13,9 | 3,0 | 22,30 | 24,36 | 0,6335 | 0,0092 |
| Butan | 13,9 | 3,0 | 30,07 | 32,40 | 0,6247 | 0,0089 |
| FAME | 15,75 | 3,0 | 9,03 | 9,74 | 0,6553 | 0,0080 |
| Steinkohle | 18,7 | 6,0 | 7,92 | 8,11 | 0,6932 | 0,0057 |

4.2 Belgium | Belgien

| Brandstof | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------|------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Stookolie L | 15,20 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| StookolieZ | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Propaan | 13,70 | 3,00 | 22,30 | 24,36 | 0,6300 | 0,0080 |
| Cokes | 20,30 | 13,0 | 7,64 | 7,66 | 0,7655 | 0,0000 |
| Houtpellets | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Briket | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Bruinkool | 19,80 | 8,00 | 5,61 | 5,69 | 0,9550 | 0,0000 |
| Steenkool | 20,50 | 8,00 | 7,64 | 7,66 | 0,7580 | 0,0000 |
| Cokesgas | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadsgas | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Aardgas H (G20) | 11,90 | 3,00 | 8,56 | 9,56 | 0,6900 | 0,0095 |
| Aardgas L (G25) | 11,80 | 3,00 | 7,50 | 8,22 | 0,7030 | 0,0095 |
| Butan (G30) | 14,00 | 3,00 | 29,67 | 32,09 | 0,6970 | 0,0078 |

4.3 Bulgaria | Bulgarien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Нафта | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Прир.газ | 11,90 | 3,00 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Втечен газ | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Брикети | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Лигнит | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Каменни въглища | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Коксов газ | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Градски газ | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Дърва 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Дървесни пелети | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Еталонен газ | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |

4.4 China | China

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| 天然气 | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| 轻油 | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| 重油 | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| 煤 | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| 无烟煤 | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| 焦炭 | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| 丙烷 | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| 丁烷 | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| 测试气体 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| LPG | 13,80 | 3,00 | 0,42 | 0,45 | 47,00 | 17,90 | 0,00 | 49,93 | 46,04 |
| 木材 | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |

4.5 CIS | GUS

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Диз.топливо | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Темн. дизтопл. | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Природн. газ | 11,90 | 3,00 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Бурый уголь | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Коксовый газ | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,1100 |
| Бытовой газ | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Калибр.газ | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Каменный уголь | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Сжж газ | 13,70 | 3,00 | 23,8 | 25,95 | 0,6300 | 0,0080 |
| Древесные брикеты | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Древесина 15%вл | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |

4.6 Croatia | Kroatien

| Brennstoff | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|----------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Zemni plin | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Lako ulje EL | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Ukapljeni plin | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Drvo 15%v | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Drvene pelete | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Test plin | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Briket | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Lignit | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Antracit | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Koksni plin | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Gradski plin | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

4.7 Czech Republic | Tschechien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| LTO | 15,40 | 3,00 | 10,53 | 11,26 | 0,6600 | 0,0090 |
| Mazut | 15,90 | 3,00 | 10,09 | 10,73 | 0,6800 | 0,0070 |
| Zemni plyn H | 12,00 | 3,00 | 8,76 | 9,58 | 0,6300 | 0,0080 |
| Propan | 13,70 | 3,00 | 23,8 | 25,95 | 0,686 | 0,0096 |
| Brikety | 18,90 | 8,00 | 5,08 | 5,20 | 0,6200 | 0,0081 |
| Hnedé uhli | 19,80 | 8,00 | 4,01 | 4,09 | 0,0000 | 0,0000 |
| Cerne uhli | 20,50 | 8,00 | 7,81 | 7,82 | 0,8330 | 0,0000 |
| Koks. plyn | 10,30 | 3,00 | 3,86 | 4,28 | 0,9550 | 0,0000 |
| Městský plyn | 13,60 | 3,00 | 3,61 | 3,90 | 0,7580 | 0,0000 |
| TTO | 15,90 | 3,00 | 10,90 | 10,73 | 0,6000 | 0,0110 |
| dřevo 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,6300 | 0,0110 |

4.8 Denmark | Dänemark

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Letolie | 15,3 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Sværolie | 16,0 | 3,0 | 10,09 | 10,73 | 0,700 | 0,0070 |
| Koks-gas | 13,8 | 13,0 | 3,86 | 4,28 | 0,62 | 0,0110 |
| Naturgas | 12,0 | 13,0 | 8,76 | 9,57 | 0,6600 | 0,0100 |
| Flaskegas | 13,8 | 3,0 | 22,3 | 24,36 | 0,6600 | 0,0080 |
| Koks | 20,00 | 8,0 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| Briket | 19,3 | 8,0 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Brunkul | 19,2 | 8,0 | 4,01 | 4,09 | 0,9844 | 0,0000 |
| Kul | 18,5 | 8,0 | 7,9 | 8,13 | 0,6811 | 0,0000 |

4.9 Germany | Deutschland

| Brennstoff | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Erdgas | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Heizöl EL | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Flüssiggas | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Holz 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Holzpellets | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Prüfgas | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Brikett | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Braunkohle | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Steinkohle | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Kokereigas | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadtgas | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

4.10 Great Britain | Großbritannien

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| Natural Gas | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| Butane | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| Propane | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| Light Oil | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| Kerosene | 15,40 | 3,00 | 0,47 | 0,51 | 52,36 | 13,60 | 0,00 | 46,56 | 43,12 |
| Heavy Oil | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| Wood Pellets | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |
| Coal | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| Anthracite | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| Coke | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| Test Gas | 0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

4.11 Greece | Griechenland

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|---------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Φυσικό αέριο | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Πετρέλαιο θέρμανσης | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Υγραέριο | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Ξύλο 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Pellets ξύλου | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Αέριο δοκιμής | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Μπρικήτα | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Λιγνίτης | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Λιθάνθρακας | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Αέριο Κοκ | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Αέριο Πόλης | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

4.12 Hungary | Ungarn

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Földgáz | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Fűtőolaj könnyű | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| LPG | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Fa 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Fa pellet | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Tesztgáz | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Brikett | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Barnaszén | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Kőszén | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Kokszgáz | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Városigáz | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

4.13 Italy | Italien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gas Nat. | 11,70 | 3,00 | 8,52 | 9,52 | 0,6600 | 0,0100 |
| GPL (misto) | 13,90 | 3,00 | 23,80 | 25,90 | 0,6300 | 0,0080 |
| Gasolio | 15,10 | 3,00 | 10,40 | 11,20 | 0,6800 | 0,0070 |
| Olio combustibile | 15,70 | 3,00 | 10,09 | 10,73 | 0,6800 | 0,0070 |
| Metano | 11,70 | 3,00 | 8,52 | 9,52 | 0,6600 | 0,0100 |
| GPL (butano) | 13,90 | 3,00 | 28,15 | 30,95 | 0,6300 | 0,0080 |
| GPL (propano) | 11,70 | 3,00 | 21,81 | 23,81 | 0,6300 | 0,0080 |
| Gas Coker | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Gas città | 11,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Coke | 20,00 | 8,00 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| Lignite | 19,20 | 8,00 | 5,26 | 5,40 | 0,9844 | 0,0000 |
| Mattonella di lignite | 19,30 | 8,00 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Antracite | 18,50 | 8,00 | 7,90 | 8,13 | 0,6811 | 0,0000 |
| Legno/pellet | 20,00 | 8,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |

4.14 Japan | Japan

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| 13A | 12,20 | 5,0 | 9,96 | 10,95 | 0,7634 | 0,0036 |
| 6C | 13,10 | 5,0 | 3,92 | 4,06 | 0,6947 | 0,0068 |
| 7° ㏍㏍ | 13,80 | 5,0 | 22,13 | 23,9 | 0,7411 | 0,003 |
| ㏍㏍ | 15,10 | 5,0 | 10,49 | 11,37 | 0,7455 | 0,0024 |
| ㏍㏍㏍ | 15,80 | 5,0 | 10,05 | 10,68 | 0,7285 | 0,0022 |
| C㏍㏍㏍ | 16,00 | 5,0 | 9,65 | 10,25 | 0,7285 | 0,0021 |
| ㏍㏍ | 15,40 | 5,0 | 10,45 | 11,31 | 0,7686 | 0,0021 |
| ㏍㏍㏍㏍㏍ | 0,00 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |

4.15 Netherlands | *Niederlande*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Aardgas Hb | 11,70 | 3,00 | 7,71 | 8,43 | 0,6230 | 0,0080 |
| Aardgas Ho | 11,70 | 3,00 | 7,71 | 8,43 | 0,6910 | 0,0090 |
| Propangas Hb | 13,70 | 3,00 | 22,30 | 24,40 | 0,6190 | 0,0066 |
| Propangas Ho | 13,70 | 3,00 | 22,30 | 24,40 | 0,6730 | 0,0070 |
| Hout 15%w | 20,00 | 6,00 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Cokes | 20,00 | 6,00 | 7,64 | 7,70 | 0,7770 | 0,0000 |
| Anthraciet | 18,50 | 6,00 | 7,90 | 8,10 | 0,7490 | 0,0000 |
| Bruinkool | 19,20 | 6,00 | 5,26 | 5,40 | 0,9840 | 0,0000 |
| G20 | 11,70 | 3,00 | 8,55 | 9,56 | 0,654 | 0,0089 |
| G25 | 11,50 | 3,00 | 7,50 | 8,22 | 0,7030 | 0,0094 |
| G30 | 14,00 | 3,00 | 29,46 | 32,07 | 0,696 | 0,0076 |
| Stookolie EL | 15,5 | 3,00 | 10,52 | 11,30 | 0,6800 | 0,0070 |

4.16 France | *Frankreich*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Fioul dom | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Fioul lourd | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Gaz naturel | 11,90 | 3,00 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Gaz liquéfié | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Butane | 14,00 | 3,00 | 30,07 | 32,40 | 0,6660 | 0,0100 |
| Pellets | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Copeau | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Bois 15%eau | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Bois 30%eau | 20,30 | 13,00 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Bois 45%eau | 20,30 | 13,00 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Bois 60%eau | 20,30 | 13,00 | 1,82 | 1,85 | 0,5860 | 0,0199 |
| Briquelette | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Lignite | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Houille | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |

4.17 Poland | *Polen*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| OLEj op.EL | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| OLEj op.S | 15,90 | 3,00 | 10,09 | 10,73 | 0,8057 | 0,0000 |
| Gaz GZ 50 | 11,80 | 3,00 | 8,47 | 9,44 | 0,6600 | 0,0110 |
| Gaz GZ41.5 | 11,50 | 3,00 | 7,24 | 7,89 | 0,6700 | 0,0110 |
| Gaz GZ 35 | 11,30 | 3,00 | 6,47 | 6,90 | 0,6800 | 0,0110 |
| Gaz plynny | 13,70 | 3,00 | 22,30 | 24,40 | 0,6300 | 0,0080 |
| DrewnoKoks | 20,30 | 13,00 | 7,64 | 7,66 | 0,7660 | 0,0000 |
| Brykiety | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| W.brunatny | 19,80 | 8,00 | 5,61 | 5,69 | 0,9545 | 0,0000 |
| W.kamienny | 20,50 | 8,00 | 7,64 | 7,66 | 0,7580 | 0,0000 |
| Gaz koksow | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| GazMiejski | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |

4.18 Portugal | *Portugal*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gasoleo A | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| Gasoleo C | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| F-Oleo n1 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| F-Oleo n2 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| Gas Nat. | 11,90 | 3,00 | 9,63 | 10,61 | 0,6688 | 0,0097 |
| Propano | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Butano | 14,00 | 3,00 | 29,55 | 32,17 | 0,5685 | 0,0097 |
| Madeira | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| GPL | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Pellets | 20,70 | 8,00 | 3,84 | 3,90 | 0,6750 | 0,0095 |
| Biomassa 20% | 20,30 | 11,00 | 3,79 | 3,84 | 0,6824 | 0,0125 |
| Hulha | 18,50 | 8,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Gas de coque | 10,30 | 3,00 | 3,86 | 4,28 | 1,0194 | 0,0000 |
| Gas Ciudad | 12,10 | 3,00 | 3,61 | 3,90 | 0,8678 | 0,0000 |
| Biodiesel 5 | 15,40 | 3,00 | 10,48 | 11,19 | 0,6400 | 0,0065 |

4.19 Republic of Korea | Korea

| Fuel | CO ₂ MAX [Vol.%] | O ₂ base [Vol.%] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|-------|--------------------------------|--------------------------------|--------------------------|---------------------------|--------|--------------------|------------------------------------|----------------------------|-----------------------------|
| 천연가스 | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| 경유 | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| 중유 | 15,80 | 3,00 | 0,50 | 0,5 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| 석탄 | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| 무연탄 | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| 코크스 | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| 프로판 | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| 부탄 | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| 테스트가스 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

4.20 Romania | Rumänien

| Fuel | CO ₂ max [Vol.%] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------------|-----------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Gaz natural | 11,70 | 3,00 | 8,57 | 9,56 | 0,6540 | 0,0086 |
| Motorină | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Păcură | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Cărbune | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Antracit | 18,50 | 8,00 | 8,37 | 8,55 | 0,7719 | 0,0000 |
| GPL (amestec) | 13,7 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Propan | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Butan | 14,00 | 3,00 | 30,07 | 32,40 | 0,6660 | 0,0100 |
| Kerosen | 15,40 | 3,00 | 10,44 | 11,30 | 0,6640 | 0,0069 |
| Peleți | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Huilă | 18,50 | 7,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Lignit | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Cocs | 20,30 | 13,00 | 7,64 | 7,66 | 0,7650 | 0,0000 |
| Lemn 15%w | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Brichete | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |

4.21 Slovakia | Slowakei

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| zemeljski plin | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| kurilno olje EL | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| tekoči plin | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| drva 15 % vode | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| lesni peleti | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Prüfgas | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| briketi | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| rjavi premog | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| premog | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| koksarniški plin | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| mestni plin | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

4.22 Spain | Spanien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gasoleo A | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| Gasoleo C | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| F-Oleo n1 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| F-Oleo n2 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| Gas Nat. | 11,90 | 3,00 | 9,63 | 10,61 | 0,6688 | 0,0097 |
| Propano | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Butano | 14,00 | 3,00 | 29,55 | 32,17 | 0,5685 | 0,0097 |
| Coque | 20,00 | 13,00 | 7,64 | 7,66 | 0,5985 | 0,0000 |
| Briquitita | 19,30 | 8,00 | 5,09 | 5,17 | 0,6202 | 0,0000 |
| Lignito | 19,20 | 8,00 | 4,01 | 4,09 | 0,6234 | 0,0000 |
| Antracita | 18,50 | 8,00 | 8,37 | 8,55 | 0,7719 | 0,0000 |
| Carbòn | 18,50 | 8,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Gas de coque | 10,30 | 3,00 | 3,86 | 4,28 | 1,0194 | 0,0000 |
| Gas Ciudad | 12,10 | 3,00 | 3,61 | 3,90 | 0,8678 | 0,0000 |
| Made/Coque | 20,70 | 8,00 | 3,84 | 3,90 | 0,6750 | 0,0095 |

4.23 Sweden | Schweden

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Eldn.olja1 | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Eldn.olja3 | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Träpellets | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Naturgas | 12,00 | 3,00 | 8,76 | 9,58 | 0,6650 | 0,0090 |
| Gasol | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Kol | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Brunkol | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Stadsgas | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Briketter | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Koksgas | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |

4.24 Thailand | Thailand

| Fuel | CO ₂ MAX [Vol. %] | O ₂ base [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------------|------------------------------|------------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| ก๊าซธรรมชาติ | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| ดีเซล | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| น้ำมันเตา | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| ถ่านหิน | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| แกลบ | 22,40 | 7,00 | 0,72 | 0,77 | 76,21 | 3,00 | 9,80 | 12,98 | 12,21 |
| ไม้ | 19,90 | 7,00 | 0,62 | 0,73 | 67,58 | 3,80 | 40,00 | 11,30 | 9,63 |
| LPG | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| ก๊าซทดสอบ | 0,0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0 | 0 |
| ขาน้อย | 20,77 | 7,00 | 0,57 | 0,61 | 70,60 | 2,90 | 51,00 | 10,11 | 9,46 |

4.25 Turkey | Türkei

| Fuel | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Hafif Yag | 15,40 | 3,00 | 10,53 | 11,26 | 0,680 | 0,0070 |
| Agir Yag | 15,90 | 3,00 | 10,09 | 10,73 | 0,806 | 0,0000 |
| Dogal Gaz | 12,00 | 3,00 | 8,76 | 9,58 | 0,665 | 0,0090 |
| Tas Kömürü | 20,50 | 8,00 | 7,81 | 7,82 | 0,758 | 0,0000 |
| Linyit | 19,80 | 8,00 | 4,01 | 4,09 | 0,955 | 0,0000 |
| Kok gazi | 10,30 | 3,00 | 3,86 | 4,28 | 0,600 | 0,0110 |
| Havagazi | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Briket | 18,90 | 8,00 | 5,08 | 5,20 | 0,833 | 0,0000 |
| Propan Lpg | 13,70 | 3,00 | 23,8 | 25,95 | 0,630 | 0,0080 |
| Odun 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,686 | 0,0096 |

4.26 USA | USA

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|---------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Natur.gas | 11.70 | 3.00 | 7.91 | 8.70 | 0.5924 | 0.0010 |
| Propangas | 13.80 | 3.00 | 22,31 | 24,37 | 0.5978 | 0.0013 |
| Butan | 14.10 | 3.00 | 29.55 | 32.17 | 0.6000 | 0.0013 |
| Fuel oil #2 | 15.70 | 3.00 | 10.40 | 11.10 | 0.6385 | 0.0017 |
| Fueloil #5 | 16.30 | 3.00 | 10.14 | 10.70 | 0.6275 | 0.0018 |
| Fueloil #6 | 16.70 | 3.00 | 9.84 | 10.30 | 0.6375 | 0.0019 |
| Kerosene | 15.10 | 3.00 | 10.47 | 11.20 | 0.6159 | 0.0016 |
| Bioheat 5 | 15.40 | 3.00 | 10.48 | 11.19 | 0.600 | 0.0061 |
| Anthracite | 19.90 | 7.00 | 8.37 | 8.60 | 0.6964 | 0.0027 |
| Bituminous | 18.50 | 7.00 | 5.30 | 5.40 | 0.6729 | 0.0024 |
| Distillate #1 | 15.40 | 3.00 | 10.50 | 11.25 | 0.6312 | 0.0017 |
| Wood 10% M. | 20.00 | 7.00 | 4.09 | 4.10 | 0.6194 | 0.0024 |
| Wood 20% M. | 20.00 | 7.00 | 3.64 | 3.66 | 0.6194 | 0.0024 |
| Wood 30% M. | 20.00 | 7.00 | 3.18 | 3.20 | 0.6194 | 0.0024 |
| Wood 40% M. | 20.00 | 7.00 | 2.73 | 2.75 | 0.6194 | 0.0024 |
| Bark 15% M. | 20.00 | 7.00 | 3.87 | 3.90 | 0.6669 | 0.0026 |
| Bark 30% M. | 20.00 | 7.00 | 3.18 | 3.20 | 0.6669 | 0.0026 |
| Bark 45% M. | 20.00 | 7.00 | 2.50 | 2.52 | 0.6669 | 0.0026 |
| Bark 60% M. | 20.00 | 7.00 | 1.82 | 1.83 | 0.6669 | 0.0026 |
| Bagasse | 20.30 | 7.00 | 2.03 | 2.06 | 0.5897 | 0.0023 |

5 Calculation formulae testo 330 | Berechnungsformeln testo 330

5.1 Calculation basis Germany | Berechnungsgrundlage Deutschland

Formulae are valid for country-specific versions: | Formeln sind gültig für die Landesversionen:

Austria | *Österreich*, Belgium | *Belgien*, Bulgaria | *Bulgarien*, Croatia | *Kroatien*, Czech Republic | *Tschechische Republik*, Denmark | *Dänemark*, France | *Frankreich*, Germany | *Deutschland*, Greece | *Griechenland*, Hungary | *Ungarn*, Italy | *Italien*, Japan | *Japan*, Netherlands | *Niederlande*, Poland | *Polen*, Portugal | *Portugal*, Romania | *Rumänien*, Russia | *Russland*, Slovenia | *Slowenien*, Spain | *Spanien*, Sweden | *Schweden*, Switzerland | *Schweiz*, Turkey | *Türkei*.

5.1.1 Carbon dioxide | Kohlendioxid

$$\text{CO}_2 = \frac{\text{CO}_{2\text{max}} \times (\text{O}_{2\text{ref}} - \text{O}_2)}{\text{O}_{2\text{ref}}}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

5.1.2 Flue gas loss | Abgasverlust

5.1.2.1 All country-specific versions (except Austria, Japan) | Alle Landesversionen (ausgenommen Österreich, Japan)

$$q_A = \left((FT - AT) \times \left(\frac{A_2}{\text{O}_{2\text{ref}} - \text{O}_2} + B \right) \right) - K_k$$

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

A₂ / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

K_k: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

5.1.2.2 Country-specific versions (Austria, Japan) | Landesversionen (Österreich, Japan)

$$qA = \left((FT - AT) \times \left(\frac{A2}{O_{2ref} - O_2} + B \right) \right)$$

| | |
|---------|--|
| FT: | Flue gas temperature <i>Abgastemperatur</i> |
| AT: | Ambient air temperature <i>Umgebungslufttemperatur</i> |
| A2 / B: | Fuel-specific parameters <i>Brennstoff-spezifische Parameter</i> |
| O2ref: | O2 Reference value <i>O2-Referenzwert</i> |
| O2: | Measured oxygen content as % <i>Gemessener Sauerstoffgehalt in %</i> |

5.1.3 Efficiency | Wirkungsgrad

$$\eta = 100 - qA$$

qA: Calculated flue gas loss | *berechneter Abgasverlust*

5.1.4 Heat of condensation (Country-specific version Italy) Kondensationswärme | (Landesversion Italien)

$$ET [\%] = \eta + [100 - qA]$$

qA: Calculated flue gas loss | *berechneter Abgasverlust*

5.1.5 Air ratio | Luftverhältniszahl

$$\lambda = 1 + \frac{V_{AGtrMin}}{V_{LMin}} \cdot \frac{O_2 - \frac{CO}{2}}{O_{2ref} - O_2 + \frac{CO}{2}}$$

VAGtrMin: Dry flue gas volume with stoichiometric combustion | *Trockene Abgasmenge bei stöchiometrischer Verbrennung*

VLMin: Air requirement for stoichiometric combustion of the fuel | *Luftbedarf bei stöchiometrischer Verbrennung des Brennstoffs*

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

5.1.6 Nitrogen oxide | Stickstoffoxide

$$NO_x = NO + (NO_{2add} \times NO)$$

NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*

NO2add: Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

5.1.7 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$u_{CO} = CO \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ : Calculated air ratio | *Berechnete Luftverhältniszahl*

5.1.8 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$T_{p_{AG}} = MIN \left[\left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H_2O} : Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol.%*

P_{Abs} : Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

5.1.9 Poison index (Country-specific version Netherlands) | Giftindex (Landesversion Niederlande)

$$GI = \frac{CO}{CO_2 \cdot 100}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

5.1.10 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten:*

for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | *für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

5.1.10.1 All country-specific versions (except Japan) | Alle Landesversionen (ausgenommen Japan)

$$\text{CO} \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{CO} \left[\text{ppm} \right] \times 1,25$$

$$\text{NOx} \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{NOx} \left[\text{ppm} \right] \times 2,05$$

O2ref: O2 Reference value | O2-Referenzwert

O2: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

O2base: Fuel-specific oxygen base value as % | brennstoffspezifischer Sauerstoff-Bezugswert in %

5.1.10.2 Country-specific version Japan | Landesversion Japan

$$\text{CO} \left[\text{mg/m}^3 \right] = \text{CO} \left[\text{ppm} \right] \times 1,25$$

$$\text{NOx} \left[\text{mg/m}^3 \right] = \text{NOx} \left[\text{ppm} \right] \times 2,05$$

5.1.11 Efficiency related to calorific value (Country-specific version Belgium) | Wirkungsgrad bezogen auf Brennwert (Landesversion Belgien)

$$\eta_{\text{Hs}} = 100 - (q_A + \text{CWD}) * \frac{100}{(100 + \text{CWD})}$$

$$\eta_{\text{Hs}} = 100 - (q_A^{\ddagger} + \text{CWD}) * \frac{100}{(100 + \text{CWD})}$$

$$\text{CO}_{\text{Hs}} \left[\frac{\text{g}}{\text{GJ}} \right] = \text{CO} \left[\frac{\text{g}}{\text{GJ}} \right] * \frac{100}{(100 + \text{CWD})}$$

$$\text{NOx}_{\text{Hs}} \left[\frac{\text{g}}{\text{GJ}} \right] = \text{NOx} \left[\frac{\text{g}}{\text{GJ}} \right] * \frac{100}{(100 + \text{CWD})}$$

5.2 Calculation basis Great Britain | Berechnungsgrundlage Großbritannien

Formulae are valid for country-specific versions: | Formeln sind gültig für die Landesversionen:

Great Britain | Großbritannien, China | China, Korea | Korea, Thailand | Thailand

5.2.1 Carbon dioxide | Kohlendioxid

$$\text{CO}_2 = \frac{\text{CO}_{2\text{max}} \times (O_{2\text{ref}} - O_2)}{O_{2\text{ref}}}$$

CO2max: Fuel-specific carbon dioxide value | Brennstoffspezifischer Kohlendioxidwert

O2ref: O2 Reference value | O2-Referenzwert

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

5.2.2 Efficiency | Wirkungsgrad

Calorific value range taken into account: | *Mit Berücksichtigung Brennwertbereich:*

$$EffG = 100 - \left(\left(\frac{K_{gr} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (2488 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{gr} \cdot 1000} \right) + \left(\frac{K1 \cdot CO}{CO_2 + CO} \right) \right)$$

Calorific value range not taken into account: | *Ohne Berücksichtigung Brennwertbereich:*

$$EffN = 100 - \left(\left(\frac{K_{net} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (210 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{net} \cdot 1000} \right) + \left(\frac{K1 \cdot Q_{gr} \cdot CO}{Q_{net} \cdot (CO_2 + CO)} \right) \right)$$

Kgr / Knet / Qgr / Qnet / K1 / MH2O / H:

Fuel-specific factors | *Brennstoff-spezifische Faktoren*

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

5.2.3 Air ratio | Luftverhältniszahl

$$\lambda = \frac{CO_{2max}}{CO_2}$$

CO2max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

5.2.4 Poison index | Giftindex

$$\text{ratio} = \frac{CO}{CO_2 \cdot 10000}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

5.2.5 Excess Air | Luftüberschuss

$$ExAir = \left(\frac{21\%}{21\% - O_2} - 1 \right) \times 100$$

21%: O2 level of air | *O2-Gehalt von Luft*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

5.2.6 Nitrogen oxide | Stickstoffoxide

$$\text{NO}_x = \text{NO} + (\text{NO}_{2\text{add}} \times \text{NO})$$

NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*

NO_{2add}: Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

5.2.7 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$u\text{CO} = \text{CO} \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ : Calculated air ratio | *Berechnete Luftverhältniszahl*

5.2.8 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$T_{p_{AG}} = \text{MIN} \left[\frac{\left[\ln \left(\frac{F_{\text{H}_2\text{O}} \times P_{\text{Abs}}}{610,78} \right) \times 234,175 \right]}{\left[\ln \left(\frac{F_{\text{H}_2\text{O}} \times P_{\text{Abs}}}{610,78} \right) - 17,08085 \right]}, FT \right]$$

$F_{\text{H}_2\text{O}}$: Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol. %*

P_{Abs} : Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

5.2.9 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten:*

for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | *für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

$$\text{CO} \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{CO} \left[\text{ppm} \right] \times 1,25$$

$$\text{NO}_x \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{NO}_x \left[\text{ppm} \right] \times 2,05$$

O_{2ref}: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

O_{2base}: Fuel-specific oxygen base value as % | *brennstoffspezifischer Sauerstoff-Bezugswert in %*

5.3 Calculation basis USA | *Berechnungsgrundlage USA*

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

USA | *USA*, Mexico | *Mexico*

5.3.1 Carbon dioxide | *Kohlendioxid*

$$\text{CO}_2 = \frac{\text{CO}_{2\text{max}} \times (\text{O}_{2\text{ref}} - \text{O}_2)}{\text{O}_{2\text{ref}}}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

5.3.2 Efficiency | *Wirkungsgrad*

$$\eta = 100 - \left(\left((\text{FT} - \text{AT}) \times \left(\frac{\text{A2}}{\text{O}_{2\text{ref}} - \text{O}_2} + \text{B} \right) \right) - \text{Kk} \right)$$

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

A2 / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

Kk: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

5.3.3 Air ratio | *Luftverhältniszahl*

$$\lambda = \left(\frac{\text{O}_2 - \frac{\text{CO}}{2}}{0.26582 \cdot (100 - \text{O}_2 - \text{CO}_2 - \text{CO}) - (\text{O}_2 - \frac{\text{CO}}{2})} \right) \cdot 100$$

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

5.3.4 Nitrogen oxide | Stickstoffoxide

$$\text{NO}_x = \text{NO} + (\text{NO}_{2\text{add}} \times \text{NO})$$

NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*

NO_{2add}: Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

5.3.5 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$u\text{CO} = \text{CO} \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ : Calculated air ratio | *Berechnete Luftverhältniszahl*

5.3.6 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$T_{p_{AG}} = \text{MIN} \left[\frac{\left[\text{In} \left(\frac{F_{\text{H}_2\text{O}} \times P_{\text{Abs}}}{610,78} \right) \times 234,175 \right]}{\left[\text{In} \left(\frac{F_{\text{H}_2\text{O}} \times P_{\text{Abs}}}{610,78} \right) - 17,08085 \right]}, FT \right]$$

$F_{\text{H}_2\text{O}}$: Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol. %*

P_{Abs} : Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

5.3.7 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten:*

for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | *für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

$$\text{CO} \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{CO} \left[\text{ppm} \right] \times 1,25$$

$$\text{NO}_x \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{NO}_x \left[\text{ppm} \right] \times 2,05$$

O_{2ref}: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

O_{2base}: Fuel-specific oxygen base value as % | *brennstoffspezifischer Sauerstoff-Bezugswert in %*

6 Fuels and parameters testo 330 | Brennstoffe und Parameter testo 330

6.1 Austria | Österreich

| Brennstoff | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------------|------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Heizöl HEL | 15,4 | 3,0 | 10,54 | 11,30 | 0,6642 | 0,0086 |
| Heizöl HL | 15,8 | 3,0 | 10,35 | 11,40 | 0,6655 | 0,0082 |
| Heizöl HM | 16,0 | 3,0 | 10,03 | 11,60 | 0,6687 | 0,0079 |
| Heizöl HS1L | 16,4 | 3,0 | 10,03 | 11,60 | 0,6736 | 0,0076 |
| Flüssig biogen | 15,2 | 3,0 | 9,03 | 9,74 | 0,6553 | 0,0080 |
| Erdgas | 11,7 | 3,0 | 8,49 | 9,40 | 0,6440 | 0,0111 |
| Holzpellets | 20,3 | 11,0 | 4,01 | 4,07 | 0,6753 | 0,0116 |
| Hackgut trocken | 20,3 | 11,0 | 3,34 | 3,39 | 0,6921 | 0,0137 |
| Hackgut feucht | 20,3 | 11,0 | 2,67 | 2,71 | 0,7290 | 0,0183 |
| Scheitholz | 20,3 | 11,0 | 3,79 | 3,84 | 0,6753 | 0,0116 |
| Biomasse | 20,3 | 11,0 | 3,79 | 3,84 | 0,6824 | 0,0125 |
| Gerste/Triticale | 20,3 | 11,0 | 3,79 | 3,84 | 0,6753 | 0,0116 |
| Propan | 13,9 | 3,0 | 22,30 | 24,36 | 0,6335 | 0,0092 |
| Butan | 13,9 | 3,0 | 30,07 | 32,40 | 0,6247 | 0,0089 |
| FAME | 15,75 | 3,0 | 9,03 | 9,74 | 0,6553 | 0,0080 |
| Steinkohle | 18,7 | 6,0 | 7,92 | 8,11 | 0,6932 | 0,0057 |

6.2 Belgium | Belgien

| Brandstof | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------|------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Stookolie L | 15,20 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| StookolieZ | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Propaan | 13,70 | 3,00 | 22,30 | 24,36 | 0,6300 | 0,0080 |
| Cokes | 20,30 | 13,0 | 7,64 | 7,66 | 0,7655 | 0,0000 |
| Houtpellets | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Briket | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Bruinkool | 19,80 | 8,00 | 5,61 | 5,69 | 0,9550 | 0,0000 |
| Steenkool | 20,50 | 8,00 | 7,64 | 7,66 | 0,7580 | 0,0000 |
| Cokesgas | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadsgas | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Aardgas H (G20) | 11,90 | 3,00 | 8,56 | 9,56 | 0,6900 | 0,0095 |
| Aardgas L (G25) | 11,80 | 3,00 | 7,50 | 8,22 | 0,7030 | 0,0095 |
| Butan (G30) | 14,00 | 3,00 | 29,67 | 32,09 | 0,6970 | 0,0078 |

6.3 Bulgaria | Bulgarien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Нафта | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Прир.газ | 11,90 | 3,00 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Втечен газ | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Брикети | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Лигнит | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Каменни въглища | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Коксов газ | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Градски газ | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Дърва 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Дървесни пелети | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Еталонен газ | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |

6.4 China | China

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| 天然气 | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| 轻油 | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| 重油 | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| 煤 | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| 无烟煤 | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| 焦炭 | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| 丙烷 | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| 丁烷 | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| 测试气体 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| LPG | 13,80 | 3,00 | 0,42 | 0,45 | 47,00 | 17,90 | 0,00 | 49,93 | 46,04 |
| 木材 | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |

6.5 CIS | GUS

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Диз.топливо | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Темн. дизтопл. | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Природн. газ | 11,90 | 3,00 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Бурый уголь | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Коксовый газ | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,1100 |
| Бытовой газ | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Калибр.газ | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Каменный уголь | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Сжж газ | 13,70 | 3,00 | 23,8 | 25,95 | 0,6300 | 0,0080 |
| Древесные брикеты | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Древесина 15%вл | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |

6.6 Croatia | Kroatien

| Brennstoff | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|----------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Zemni plin | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Lako ulje EL | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Ukapljeni plin | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Drvo 15%v | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Drvene pelete | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Test plin | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Briket | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Lignit | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Antracit | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Koksni plin | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Gradski plin | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

6.7 Czech Republic | Tschechien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| LTO | 15,40 | 3,00 | 10,53 | 11,26 | 0,6600 | 0,0090 |
| Mazut | 15,90 | 3,00 | 10,09 | 10,73 | 0,6800 | 0,0070 |
| Zemni plyn H | 12,00 | 3,00 | 8,76 | 9,58 | 0,6300 | 0,0080 |
| Propan | 13,70 | 3,00 | 23,8 | 25,95 | 0,686 | 0,0096 |
| Brikety | 18,90 | 8,00 | 5,08 | 5,20 | 0,6200 | 0,0081 |
| Hnede uhli | 19,80 | 8,00 | 4,01 | 4,09 | 0,0000 | 0,0000 |
| Cerne uhli | 20,50 | 8,00 | 7,81 | 7,82 | 0,8330 | 0,0000 |
| Koks. plyn | 10,30 | 3,00 | 3,86 | 4,28 | 0,9550 | 0,0000 |
| Městský plyn | 13,60 | 3,00 | 3,61 | 3,90 | 0,7580 | 0,0000 |
| TTO | 15,90 | 3,00 | 10,90 | 10,73 | 0,6000 | 0,0110 |
| dřevo 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,6300 | 0,0110 |

6.8 Denmark | Dänemark

| Fuel | CO ₂ max [Vol.%] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------|-----------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Letolie | 15,3 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Sværolie | 16,0 | 3,0 | 10,09 | 10,73 | 0,700 | 0,0070 |
| Koks-gas | 13,8 | 13,0 | 3,86 | 4,28 | 0,62 | 0,0110 |
| Naturgas | 12,0 | 13,0 | 8,76 | 9,57 | 0,6600 | 0,0100 |
| Flaskegas | 13,8 | 3,0 | 22,3 | 24,36 | 0,6600 | 0,0080 |
| Koks | 20,00 | 8,0 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| Briket | 19,3 | 8,0 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Brunkul | 19,2 | 8,0 | 4,01 | 4,09 | 0,9844 | 0,0000 |
| Kul | 18,5 | 8,0 | 7,9 | 8,13 | 0,6811 | 0,0000 |

6.9 Germany | Deutschland

| Brennstoff | CO ₂ max [Vol.%] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-------------|-----------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Erdgas | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Heizöl EL | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Flüssiggas | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Holz 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Holzpellets | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Prüfgas | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Brikett | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Braunkohle | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Steinkohle | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Kokereigas | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadtgas | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

6.10 Great Britain | Großbritannien

| Fuel | CO ₂ MAX [Vol.%] | O ₂ base [Vol.%] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| Natural Gas | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| Butane | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| Propane | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| Light Oil | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| Kerosene | 15,40 | 3,00 | 0,47 | 0,51 | 52,36 | 13,60 | 0,00 | 46,56 | 43,12 |
| Heavy Oil | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| Wood Pellets | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |
| Coal | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| Anthracite | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| Coke | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| Test Gas | 0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

6.11 Greece | Griechenland

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Φυσικό αέριο | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Πετρέλαιο θέρμανσης | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Υγραέριο | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Ξύλο 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Pellets ξύλου | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Αέριο δοκιμής | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Μπρικέτα | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Λιγνίτης | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Λιθάνθρακας | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Αέριο Κοκ | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Αέριο Πόλης | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

6.12 Hungary | Ungarn

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Földgáz | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Fűtőolaj könnyű | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| LPG | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Fa 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Fa pellet | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Tesztgáz | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Brikett | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Barnaszén | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Kőszén | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Kokszgáz | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Városigáz | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

6.13 Italy | *Italia*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gas Nat. | 11,70 | 3,00 | 8,52 | 9,52 | 0,6600 | 0,0100 |
| GPL (misto) | 13,90 | 3,00 | 23,80 | 25,90 | 0,6300 | 0,0080 |
| Gasolio | 15,10 | 3,00 | 10,40 | 11,20 | 0,6800 | 0,0070 |
| Olio combustibile | 15,70 | 3,00 | 10,09 | 10,73 | 0,6800 | 0,0070 |
| Metano | 11,70 | 3,00 | 8,52 | 9,52 | 0,6600 | 0,0100 |
| GPL (butano) | 13,90 | 3,00 | 28,15 | 30,95 | 0,6300 | 0,0080 |
| GPL (propano) | 11,70 | 3,00 | 21,81 | 23,81 | 0,6300 | 0,0080 |
| Gas Coker | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Gas città | 11,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Coke | 20,00 | 8,00 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| Lignite | 19,20 | 8,00 | 5,26 | 5,40 | 0,9844 | 0,0000 |
| Mattonella di lignite | 19,30 | 8,00 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Antracite | 18,50 | 8,00 | 7,90 | 8,13 | 0,6811 | 0,0000 |
| Legno/pellet | 20,00 | 8,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |

6.14 Japan | *Japan*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| 13A | 12,20 | 5,0 | 9,96 | 10,95 | 0,7634 | 0,0036 |
| 6C | 13,10 | 5,0 | 3,92 | 4,06 | 0,6947 | 0,0068 |
| ガソリン | 13,80 | 5,0 | 22,13 | 23,9 | 0,7411 | 0,003 |
| 灯油 | 15,10 | 5,0 | 10,49 | 11,37 | 0,7455 | 0,0024 |
| シタリン | 15,80 | 5,0 | 10,05 | 10,68 | 0,7285 | 0,0022 |
| シタリン | 16,00 | 5,0 | 9,65 | 10,25 | 0,7285 | 0,0021 |
| ケイ | 15,40 | 5,0 | 10,45 | 11,31 | 0,7686 | 0,0021 |
| アセチレン | 0,00 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |

6.15 Netherlands | *Niederlande*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Aardgas Hb | 11,70 | 3,00 | 7,71 | 8,43 | 0,6230 | 0,0080 |
| Aardgas Ho | 11,70 | 3,00 | 7,71 | 8,43 | 0,6910 | 0,0090 |
| Propangas Hb | 13,70 | 3,00 | 22,30 | 24,40 | 0,6190 | 0,0066 |
| Propangas Ho | 13,70 | 3,00 | 22,30 | 24,40 | 0,6730 | 0,0070 |
| Hout 15%w | 20,00 | 6,00 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Cokes | 20,00 | 6,00 | 7,64 | 7,70 | 0,7770 | 0,0000 |
| Anthraciet | 18,50 | 6,00 | 7,90 | 8,10 | 0,7490 | 0,0000 |
| Bruinkool | 19,20 | 6,00 | 5,26 | 5,40 | 0,9840 | 0,0000 |
| G20 | 11,70 | 3,00 | 8,55 | 9,56 | 0,654 | 0,0089 |
| G25 | 11,50 | 3,00 | 7,50 | 8,22 | 0,7030 | 0,0094 |
| G30 | 14,00 | 3,00 | 29,46 | 32,07 | 0,696 | 0,0076 |
| Stookolie EL | 15,5 | 3,00 | 10,52 | 11,30 | 0,6800 | 0,0070 |

6.16 France | *Frankreich*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Fioul dom | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Fioul lourd | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Gaz naturel | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Gaz liquéfié | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Butane | 14,0 | 3,0 | 30,07 | 32,40 | 0,6660 | 0,0100 |
| Pellets | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Bois 15%eau | 20,3 | 13,0 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Bois 30%eau | 20,3 | 13,0 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Bois 45%eau | 20,3 | 13,0 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Bois 60%eau | 20,3 | 13,0 | 1,82 | 1,85 | 0,5860 | 0,0199 |
| Briquelette | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Lignite | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Houille | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |

6.17 Poland | *Polen*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| OLej op.EL | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| OLej op.S | 15,90 | 3,00 | 10,09 | 10,73 | 0,8057 | 0,0000 |
| Gaz GZ 50 | 11,80 | 3,00 | 8,47 | 9,44 | 0,6600 | 0,0110 |
| Gaz GZ41.5 | 11,50 | 3,00 | 7,24 | 7,89 | 0,6700 | 0,0110 |
| Gaz GZ 35 | 11,30 | 3,00 | 6,47 | 6,90 | 0,6800 | 0,0110 |
| Gaz plynny | 13,70 | 3,00 | 22,30 | 24,40 | 0,6300 | 0,0080 |
| DrewnoKoks | 20,30 | 13,00 | 7,64 | 7,66 | 0,7660 | 0,0000 |
| Brykiety | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| W.brunatny | 19,80 | 8,00 | 5,61 | 5,69 | 0,9545 | 0,0000 |
| W.kamienny | 20,50 | 8,00 | 7,64 | 7,66 | 0,7580 | 0,0000 |
| Gaz koksow | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| GazMiejski | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |

6.18 Portugal | Portugal

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG tmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|----------------------|-------------------|--------|--------|
| Gasoleo A | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| Gasoleo C | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| F-Oleo n1 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| F-Oleo n2 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| Gas Nat. | 11,90 | 3,00 | 9,63 | 10,61 | 0,6688 | 0,0097 |
| Propano | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Butano | 14,00 | 3,00 | 29,55 | 32,17 | 0,5685 | 0,0097 |
| Madeira | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| GPL | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Pellets | 20,70 | 8,00 | 3,84 | 3,90 | 0,6750 | 0,0095 |
| Biomassa 20% | 20,30 | 11,00 | 3,79 | 3,84 | 0,6824 | 0,0125 |
| Hulha | 18,50 | 8,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Gas de coque | 10,30 | 3,00 | 3,86 | 4,28 | 1,0194 | 0,0000 |
| Gas Ciudad | 12,10 | 3,00 | 3,61 | 3,90 | 0,8678 | 0,0000 |
| Biodiesel 5 | 15,40 | 3,00 | 10,48 | 11,19 | 0,6400 | 0,0065 |

6.19 Republic of Korea | Korea

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|-------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| 천연가스 | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| 경유 | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| 중유 | 15,80 | 3,00 | 0,50 | 0,5 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| 석탄 | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| 무연탄 | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| 코크스 | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| 프로판 | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| 부탄 | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| 테스트가스 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

6.20 Romania | Rumänien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gaz natural | 11,70 | 3,00 | 8,57 | 9,56 | 0,6540 | 0,0086 |
| Motorină | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Păcură | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Cărbune | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Antracit | 18,50 | 8,00 | 8,37 | 8,55 | 0,7719 | 0,0000 |
| GPL (amestec) | 13,7 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Propan | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Butan | 14,00 | 3,00 | 30,07 | 32,40 | 0,6660 | 0,0100 |
| Kerosen | 15,40 | 3,00 | 10,44 | 11,30 | 0,6640 | 0,0069 |
| Peleți | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Huilă | 18,50 | 7,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Lignit | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Cocs | 20,30 | 13,00 | 7,64 | 7,66 | 0,7650 | 0,0000 |
| Lemn 15%w | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Brichete | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |

6.21 Slovakia | Slowakei

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|---------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| zemeljski plin | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| kurilno olje EL | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| tekoči plin | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| drva 15 % vode | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| lesni peleti | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Prüfgas | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| briketi | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| rjavi premog | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| premog | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| koksarniški plin | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| mestni plin | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |

6.22 Spain | Spanien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gasoleo A | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| Gasoleo C | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| F-Oleo n1 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| F-Oleo n2 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| Gas Nat. | 11,90 | 3,00 | 9,63 | 10,61 | 0,6688 | 0,0097 |
| Propano | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Butano | 14,00 | 3,00 | 29,55 | 32,17 | 0,5685 | 0,0097 |
| Coque | 20,00 | 13,00 | 7,64 | 7,66 | 0,5985 | 0,0000 |
| Briquita | 19,30 | 8,00 | 5,09 | 5,17 | 0,6202 | 0,0000 |
| Lignito | 19,20 | 8,00 | 4,01 | 4,09 | 0,6234 | 0,0000 |
| Antracita | 18,50 | 8,00 | 8,37 | 8,55 | 0,7719 | 0,0000 |
| Carbòn | 18,50 | 8,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Gas de coque | 10,30 | 3,00 | 3,86 | 4,28 | 1,0194 | 0,0000 |
| Gas Ciudad | 12,10 | 3,00 | 3,61 | 3,90 | 0,8678 | 0,0000 |
| Made/Coque | 20,70 | 8,00 | 3,84 | 3,90 | 0,6750 | 0,0095 |

6.23 Sweden | Schweden

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Eldn.olja1 | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Eldn.olja3 | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Träpellets | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Naturgas | 12,00 | 3,00 | 8,76 | 9,58 | 0,6650 | 0,0090 |
| Gasol | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Kol | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Brunkol | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Stadsgas | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Briketter | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Koksgas | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |

6.24 Swiss | Schweiz

| Brennstoff | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Heizöl EL | 15,5 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Heizöl S | 15,9 | 3,0 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Erdgas H | 12,0 | 3,0 | 8,76 | 9,57 | 0,6600 | 0,0080 |
| Butan | 13,9 | 3,0 | 29,55 | 32,17 | 0,6300 | 0,0080 |
| Koks | 20,0 | 13,0 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| Holz 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Holzpellets | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Brikett | 19,3 | 8,0 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Braunkohle | 19,2 | 8,0 | 4,01 | 4,09 | 0,9844 | 0,0000 |
| Fettkohle | 18,5 | 8,0 | 7,90 | 8,13 | 0,8400 | 0,0000 |
| Kokereigas | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadtgas | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Prüfgas | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |

6.25 Thailand | Thailand

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| ก๊าซธรรมชาติ | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| ดีเซล | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| น้ำมันเตา | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| ถ่านหิน | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| แกลบ | 22,40 | 7,00 | 0,72 | 0,77 | 76,21 | 3,00 | 9,80 | 12,98 | 12,21 |
| ไม้ | 19,90 | 7,00 | 0,62 | 0,73 | 67,58 | 3,80 | 40,00 | 11,30 | 9,63 |
| LPG | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| ก๊าซทดสอบ | 0,0 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0 | 0 |
| ชานอ้อย | 20,77 | 7,00 | 0,57 | 0,61 | 70,60 | 2,90 | 51,00 | 10,11 | 9,46 |

6.26 Turkey | Türkei

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Hafif Yag | 15,40 | 3,00 | 10,53 | 11,26 | 0,680 | 0,0070 |
| Agir Yag | 15,90 | 3,00 | 10,09 | 10,73 | 0,806 | 0,0000 |
| Dogal Gaz | 12,00 | 3,00 | 8,76 | 9,58 | 0,665 | 0,0090 |
| Tas Kömürü | 20,50 | 8,00 | 7,81 | 7,82 | 0,758 | 0,0000 |
| Linyit | 19,80 | 8,00 | 4,01 | 4,09 | 0,955 | 0,0000 |
| Kok gazi | 10,30 | 3,00 | 3,86 | 4,28 | 0,600 | 0,0110 |
| Havagazi | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Briket | 18,90 | 8,00 | 5,08 | 5,20 | 0,833 | 0,0000 |
| Propan Lpg | 13,70 | 3,00 | 23,8 | 25,95 | 0,630 | 0,0080 |
| Odun 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,686 | 0,0096 |

6.27 USA | USA

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|---------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Natur.gas | 11.70 | 3.00 | 7.91 | 8.70 | 0.5924 | 0.0010 |
| Propangas | 13.80 | 3.00 | 22,31 | 24,37 | 0.5978 | 0.0013 |
| Butan | 14.10 | 3.00 | 29.55 | 32.17 | 0.6000 | 0.0013 |
| Fuel oil #2 | 15.70 | 3.00 | 10.40 | 11.10 | 0.6385 | 0.0017 |
| Fueloil #5 | 16.30 | 3.00 | 10.14 | 10.70 | 0.6275 | 0.0018 |
| Fueloil #6 | 16.70 | 3.00 | 9.84 | 10.30 | 0.6375 | 0.0019 |
| Kerosene | 15.10 | 3.00 | 10.47 | 11.20 | 0.6159 | 0.0016 |
| Bioheat 5 | 15.40 | 3.00 | 10.48 | 11.19 | 0.600 | 0.0061 |
| Anthracite | 19.90 | 7.00 | 8.37 | 8.60 | 0.6964 | 0.0027 |
| Bituminous | 18.50 | 7.00 | 5.30 | 5.40 | 0.6729 | 0.0024 |
| Distillate #1 | 15.40 | 3.00 | 10.50 | 11.25 | 0.6312 | 0.0017 |
| Wood 10% M. | 20.00 | 7.00 | 4.09 | 4.10 | 0.6194 | 0.0024 |
| Wood 20% M. | 20.00 | 7.00 | 3.64 | 3.66 | 0.6194 | 0.0024 |
| Wood 30% M. | 20.00 | 7.00 | 3.18 | 3.20 | 0.6194 | 0.0024 |
| Wood 40% M. | 20.00 | 7.00 | 2.73 | 2.75 | 0.6194 | 0.0024 |
| Bark 15% M. | 20.00 | 7.00 | 3.87 | 3.90 | 0.6669 | 0.0026 |
| Bark 30% M. | 20.00 | 7.00 | 3.18 | 3.20 | 0.6669 | 0.0026 |
| Bark 45% M. | 20.00 | 7.00 | 2.50 | 2.52 | 0.6669 | 0.0026 |
| Bark 60% M. | 20.00 | 7.00 | 1.82 | 1.83 | 0.6669 | 0.0026 |
| Bagasse | 20.30 | 7.00 | 2.03 | 2.06 | 0,5897 | 0.0023 |

7 Calculation formulae testo 340 | Berechnungsformeln testo 340

7.1 Calculation basis Germany | *Berechnungsgrundlage Deutschland*

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

Austria | *Österreich*, Belgium | *Belgien*, Bulgaria | *Bulgarien*, Czech Republic | *Tschechische Republik*, Finland | *Finnland*, France | *Frankreich*, Germany | *Deutschland*, Hungary | *Ungarn*, Italy | *Italien*, Japan | *Japan*, Netherlands | *Niederlande*, Poland | *Polen*, Romania | *Rumänien*, Russia | *Rusland*, Spain | *Spanien*, Sweden | *Schweden*, Turkey | *Türkei*

7.1.1 Carbon dioxide | *Kohlendioxid*

$$\text{CO}_2 = \frac{\text{CO}_{2\text{max}} \times (\text{O}_{2\text{ref}} - \text{O}_2)}{\text{O}_{2\text{ref}}}$$

CO2max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

7.1.2 Flue gas loss | *Abgasverlust*

7.1.2.1 All country-specific versions (except Austria, Belgium, Japan) | *Alle Landesversionen (ausgenommen Österreich, Belgien, Japan)*

$$q_A = \left((FT - AT) \times \left(\frac{A_2}{\text{O}_{2\text{ref}} - \text{O}_2} + B \right) \right) - K_k$$

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

A2 / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

Kk: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

7.1.2.2 Country-specific versions (Austria, Belgium, Japan) | Landesversionen (Österreich, Belgien, Japan)

$$qA = \left((FT - AT) \times \left(\frac{A2}{O_{2ref} - O_2} + B \right) \right)$$

- FT: Flue gas temperature | *Abgastemperatur*
 AT: Ambient air temperature | *Umgebungslufttemperatur*
 A2 / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*
 O2ref: O2 Reference value | *O2-Referenzwert*
 O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

7.1.3 Efficiency | Wirkungsgrad

$$\eta = 100 - qA$$

- qA: Calculated flue gas loss | *berechneter Abgasverlust*

7.1.4 Air ratio | Luftverhältniszahl

$$\lambda = 1 + \frac{V_{AGtrMin}}{V_{LMin}} \cdot \frac{O_2 - \frac{CO}{2}}{O_{2ref} - O_2 + \frac{CO}{2}}$$

- VAGtrMin: Dry flue gas volume with stoichiometric combustion | *Trockene Abgasmenge bei stöchiometrischer Verbrennung*
 VLMin: Air requirement for stoichiometric combustion of the fuel | *Luftbedarf bei stöchiometrischer Verbrennung des Brennstoffs*
 O2ref: O2 Reference value | *O2-Referenzwert*
 O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

7.1.5 Poison index (country-specific Netherlands | Giftindex (Landesversion Niederlande)

$$\text{ratio} = \frac{CO}{100}$$

- CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

7.1.6 Nitrogen oxide | Stickstoffoxide

No NO₂ sensor plugged: | *kein No2-Sensor gesteckt:*

$$\text{NO}_x = \text{NO} + (\text{NO}_{2\text{add}} \times \text{NO})$$

NO₂ sensor plugged: | *NO2-Sensor gesteckt:*

$$\text{NO}_x = \text{NO} + (\text{NO}_2)$$

NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*

NO_{2add}: Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

7.1.7 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$u\text{CO} = \text{CO} \times \lambda$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

λ : Calculated air ratio | *Berechnete Luftverhältniszahl*

7.1.8 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$T_{p_{AG}} = \text{MIN} \left[\left[\frac{\ln \left(\frac{F_{\text{H}_2\text{O}} \times P_{\text{Abs}}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{\text{H}_2\text{O}} \times P_{\text{Abs}}}{610,78} \right) - 17,08085} \right], FT \right]$$

$F_{\text{H}_2\text{O}}$: Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol. %*

P_{Abs} : Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

7.1.9 Flow speed | Strömungsgeschwindigkeit

$$V = \sqrt{\frac{575 \times \Delta P \times (FT + 273,15)}{P_{\text{Abs}}}} \times \alpha$$

P_{Abs} : Absolute pressure | *Strömungsgeschwindigkeit*

ΔP : Differential pressure | *Differenzdruck*

FT: Flue gas temperature | *Abgastemperatur*

α : Pitot tube factor | *Stauohrfaktor*

7.1.10 Air flow | Volumenstrom

$$V = v \times a$$

v: Flow speed | *Strömungsgeschwindigkeit*

a: Cross-section area | *Querschnittsfläche*

7.1.11 Mass flow | Massenstrom

$$MCO = CO \text{ [kg/h] [ppm]} \times F_{\text{Gas}} \times 1,25 \text{ [kg/m}^3\text{]} \times Z$$

$$MNO_x = NO_x \text{ [kg/h] [ppm]} \times F_{\text{Gas}} \times 2,05 \text{ [kg/m}^3\text{]} \times Z$$

$$MSO_2 = SO_2 \text{ [kg/h] [ppm]} \times F_{\text{Gas}} \times 2,86 \text{ [kg/m}^3\text{]} \times Z$$

Fgas: Fuel-specific humidity value | *Brennstoff-spezifischer Feuchtigkeitswert*

Z: Calculation term: | *Berechnungsterm:*

$$Z = \frac{273.15 \times P_{\text{abs}} \text{ [mbar]}}{273.15 + FT \text{ [}^\circ\text{C]}} \times V \text{ [m}^3\text{/s]} \times 10^{-6} \text{ [1/ppm]} \times 3600$$

7.1.12 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten: for SO2, standard density values in the range from 2.86 to 2.93 are stated in literature (difference between ideal and real gas behaviour for SO2) | für SO2 werden in der Literatur Normdichte-Werte im Bereich von 2,86 bis 2,93 angegeben (Unterschied zwischen idealem und realem Gasverhalten bei SO2)*

for NOx the standard density of NO2 (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO2) | *für NOx wird mit 2,05 die Normdichte von NO2 verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO2)*

7.1.12.1 All country-specific versions (except Japan) | Alle Landesversionen (ausgenommen Japan)

$$CO \text{ [mg/m}^3\text{]} = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times CO \text{ [ppm]} \times 1,25$$

$$NO_x \text{ [mg/m}^3\text{]} = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times NO_x \text{ [ppm]} \times 2,05$$

$$SO_2 \text{ [mg/m}^3\text{]} = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times SO_2 \text{ [ppm]} \times 2,86$$

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

O2base: Fuel-specific oxygen base value as % | *brennstoffspezifischer Sauerstoff-Bezugswert in %*

7.1.12.2 Country-specific version Japan | Landesversion Japan

$$\text{CO} \left[\text{mg}/\text{m}^3 \right] = \text{CO} \left[\text{ppm} \right] \times 1,25$$

$$\text{NO}_x \left[\text{mg}/\text{m}^3 \right] = \text{NO}_x \left[\text{ppm} \right] \times 2,05$$

$$\text{SO}_2 \left[\text{mg}/\text{m}^3 \right] = \text{SO}_2 \left[\text{ppm} \right] \times 2,86$$

7.1.12.3 Country-specific version China | Landesversion China

Calculation/Berechnung:

$$\text{NO}_{2\text{calc}} = \text{NO}_{2\text{add}} \times \text{NO}$$

NO: Measured nitrogen monoxide value/gemessener Stickstoffmonoxidwert

NO_{2add}: Nitrogen dioxide addition factor/Stickstoffdioxid-Zuschlagsfaktor

Units like NO/Einheiten wie NO

Default Unit/Standard-Einheit: PPM

7.1.12.4 Country-specific version Greece | Landesversion Griechenland

$$A_{\text{VZ}} \text{CO} = \text{CO} * \left[\frac{(21\% - O_{2\text{ref}})}{(21\% - O_2)} \right]$$

$$A_{\text{VZ}} \text{NO} = \text{NO} * \left[\frac{(21\% - O_{2\text{ref}})}{(21\% - O_2)} \right]$$

$$A_{\text{VZ}} \text{NO}_x = \text{NO}_x * \left[\frac{(21\% - O_{2\text{ref}})}{(21\% - O_2)} \right]$$

7.1.13 Efficiency related to calorific value (Country-specific version Belgium) | Wirkungsgrad bezogen auf Brennwert (Landesversion Belgien)

$$\eta_{\text{HS}} = 100 - (q_A + \text{CWD}) * \frac{100}{(100 + \text{CWD})}$$

$$\eta_{+\text{HS}} = 100 - (q_A^+ + \text{CWD}) * \frac{100}{(100 + \text{CWD})}$$

$$\text{CO}_{\text{HS}} \left[\frac{\text{g}}{\text{GJ}} \right] = \text{CO} \left[\frac{\text{g}}{\text{GJ}} \right] * \frac{100}{(100 + \text{CWD})}$$

$$\text{NO}_{x\text{HS}} \left[\frac{\text{g}}{\text{GJ}} \right] = \text{NO}_x \left[\frac{\text{g}}{\text{GJ}} \right] * \frac{100}{(100 + \text{CWD})}$$

7.2 Calculation basis Great Britain | *Berechnungsgrundlage Großbritannien*

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

Great Britain | *Großbritannien*, China | *China*, Korea | *Korea*, Thailand | *Thailand*, Latin America | *Lateinamerika*

7.2.1 Carbon dioxide | *Kohlendioxid*

$$CO_2 = \frac{CO_{2max} \times (O_{2ref} - O_2)}{O_{2ref}}$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

7.2.2 Efficiency | *Wirkungsgrad*

Calorific value range taken into account: | *Mit Berücksichtigung Brennwertbereich:*

$$EffG = 100 - \left(\left(\frac{K_{gr} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (2488 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{gr} \cdot 1000} \right) + \left(\frac{K1 \cdot CO}{CO_2 + CO} \right) \right) \text{Calo}$$

Calorific value range not taken into account: | *Ohne Berücksichtigung Brennwertbereich:*

$$EffN = 100 - \left(\left(\frac{K_{net} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (210 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{net} \cdot 1000} \right) + \left(\frac{K1 \cdot Q_{gr} \cdot CO}{Q_{net} \cdot (CO_2 + CO)} \right) \right)$$

K_{gr} / K_{net} / Q_{gr} / Q_{net} / K1 / MH₂O / H:

Fuel-specific factors | *Brennstoff-spezifische Faktoren*

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

7.2.3 Air ratio | *Luftverhältniszahl*

$$\text{ratio} = \frac{CO}{CO_2 \cdot 10000}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

7.2.4 Excess Air | Luftüberschuss

$$Ex_{Air} = \left(\frac{21\%}{21\% - O_2} - 1 \right) \times 100$$

21%: O₂ level of air | O₂-Gehalt von Luft

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

7.2.5 Nitrogen oxide | Stickstoffoxide

No NO₂ sensor plugged: | kein NO₂-Sensor gesteckt:

$$NO_x = NO + (NO_{2add} \times NO)$$

NO₂ sensor plugged: | NO₂-Sensor gesteckt:

$$NO_x = NO + (NO_2)$$

NO: Measured nitrogen monoxide value | gemessener Stickstoffmonoxidwert

NO_{2add}: Nitrogen dioxide addition factor | Stickstoffdioxid-Zuschlagsfaktor

7.2.6 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$u_{CO} = CO \times \lambda$$

CO: Measured carbon monoxide content | Gemessener Kohlenmonoxidgehalt

λ: Calculated air ratio | Berechnete Luftverhältniszahl

7.2.7 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$T_{p_{AG}} = MIN \left[\left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H₂O}: Flue gas-specific water vapour content as vol.% | Abgasspezifischer Wasserdampfgehalt in Vol.%

P_{Abs}: Absolute pressure in mbar/hPa | Absolutdruck in mbar/hPa

7.2.8 Flow speed | Strömungsgeschwindigkeit

$$V = \sqrt{\frac{575 \times \Delta P \times (FT + 273,15)}{P_{Abs}}} \times \alpha$$

P_{abs}: Absolute pressure | Strömungsgeschwindigkeit

ΔP: Differential pressure | Differenzdruck

FT: Flue gas temperature | Abgastemperatur

α: Pitot tube factor | Staurohrfaktor

7.2.9 Air flow | Volumenstrom

$$V = v \times a$$

v: Flow speed | *Strömungsgeschwindigkeit*

a: Cross-section area | *Querschnittsfläche*

7.2.10 Mass flow | Massenstrom

$$MCO = CO \text{ [kg/h] [ppm]} \times F_{\text{Gas}} \times 1,25 \text{ [kg/m}^3\text{]} \times Z$$

$$MNO_x = NO_x \text{ [kg/h] [ppm]} \times F_{\text{Gas}} \times 2,05 \text{ [kg/m}^3\text{]} \times Z$$

$$MSO_2 = SO_2 \text{ [kg/h] [ppm]} \times F_{\text{Gas}} \times 2,86 \text{ [kg/m}^3\text{]} \times Z$$

Fgas: Fuel-specific humidity value | *Brennstoff-spezifischer Feuchtigkeitswert*

Z: Calculation term: | *Berechnungsterm:*

$$Z = \frac{273.15 \times P_{\text{abs}} \text{ [mbar]}}{273.15 + FT \text{ [}^\circ\text{C]}} \times V \text{ [m}^3\text{/s]} \times 10^{-6} \text{ [1/ppm]} \times 3600$$

7.2.11 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten: for SO₂, standard density values in the range from 2.86 to 2.93 are stated in literature (difference between ideal and real gas behaviour for SO₂) | für SO₂ werden in der Literatur Normdichte-Werte im Bereich von 2,86 bis 2,93 angegeben (Unterschied zwischen idealem und realem Gasverhalten bei SO₂)*

for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | *für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

$$CO \text{ [mg/m}^3\text{]} = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times CO \text{ [ppm]} \times 1,25$$

$$NO_x \text{ [mg/m}^3\text{]} = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times NO_x \text{ [ppm]} \times 2,05$$

$$SO_2 \text{ [mg/m}^3\text{]} = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times SO_2 \text{ [ppm]} \times 2,86$$

O_{2ref}: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

O2base: Fuel-specific oxygen base value as % | *brennstoffspezifischer Sauerstoff-Bezugswert in %*
Conversion from ppm to mg/m³ |
Umrechnung von ppm in mg/m³

7.2.12 Country-specific version China / Landesversion China

$$CO^* \left[\frac{mg}{m^3} \right] = CO[ppm] \times 1,25$$

$$NO_x^* \left[\frac{mg}{m^3} \right] = NO_x[ppm] \times 2,86$$

$$SO_2^* \left[\frac{mg}{m^3} \right] = SO_2[ppm] \times 2,86$$

$$NO \left[\frac{mg}{m^3} \right] = NO[ppm] \times 1,34$$

$$NO_x \left[\frac{mg}{m^3} \right] = NO_x[ppm] \times 2,05$$

$$H_2S \left[\frac{mg}{m^3} \right] = H_2S[ppm] \times 1,54$$

7.3 Calculation basis USA | Berechnungsgrundlage USA

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

USA | *USA*, Mexico | *Mexico*

7.3.1 Carbon dioxide | Kohlendioxid

$$CO_2 = \frac{CO_{2max} \times (O_{2ref} - O_2)}{O_{2ref}}$$

CO2max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

7.3.2 Effizienz | Wirkungsgrad

$$\eta = 100 - \left(\left((FT - AT) \times \left(\frac{A2}{O_{2ref} - O_2} + B \right) \right) - K_k \right)$$

- FT: Flue gas temperature | *Abgastemperatur*
 AT: Ambient air temperature | *Umgebungslufttemperatur*
 A2 / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*
 O2ref: O2 Reference value | *O2-Referenzwert*
 O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*
 Kk: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

7.3.3 Air ratio | Luftverhältniszahl

$$ExAir = \left(\frac{O_2 - \frac{CO}{2}}{0.26582 \cdot (100 - O_2 - CO_2 - CO) - (O_2 - \frac{CO}{2})} \right) \cdot 100$$

- O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*
 CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*
 CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

7.3.4 Nitrogen oxide | Stickstoffoxide

No NO2 sensor plugged: | *kein No2-Sensor gesteckt:*

$$NO_x = NO + (NO_{2add} \times NO)$$

NO2 sensor plugged: | *NO2-Sensor gesteckt:*

$$NO_x = NO + (NO_2)$$

- NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*
 NO2add : Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

7.3.5 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$uCO = CO \times \lambda$$

- CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*
 λ: Calculated air ratio | *Berechnete Luftverhältniszahl*

7.3.6 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$T_{p_{AG}} = \text{MIN} \left[\left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H_2O} : Flue gas-specific water vapour content as vol.% |
Abgasspezifischer Wasserdampfgehalt in Vol. %

P_{Abs} : Absolute pressure in mbar/hPa | Absolutdruck in mbar/hPa

7.3.7 Flow speed | Strömungsgeschwindigkeit

$$V = \sqrt{\frac{575 \times \Delta P \times (FT + 273,15)}{P_{Abs}}} \times \alpha$$

P_{Abs} : Absolute pressure | Strömungsgeschwindigkeit

ΔP : Differential pressure | Differenzdruck

FT : Flue gas temperature | Abgastemperatur

α : Pitot tube factor | Staurohrfaktor

7.3.8 Air flow | Volumenstrom

$$V = v \times a$$

v : Flow speed | Strömungsgeschwindigkeit

a : Cross-section area | Querschnittsfläche

7.3.9 Mass flow

$$MCO = CO \text{ [kg/h [ppm]]} \times F_{Gas} \times 1,25 \text{ [kg/m}^3\text{]} \times Z$$

$$MNO_x = NO_x \text{ [kg/h [ppm]]} \times F_{Gas} \times 2,05 \text{ [kg/m}^3\text{]} \times Z$$

$$MSO_2 = SO_2 \text{ [kg/h [ppm]]} \times F_{Gas} \times 2,86 \text{ [kg/m}^3\text{]} \times Z$$

F_{gas} : Fuel-specific humidity value | Brennstoff-spezifischer Feuchtigkeitswert

Z : Calculation term: | Berechnungsterm:

$$Z = \frac{273,15 \times P_{abs} \text{ [mbar]}}{273,15 + FT \text{ [}^\circ\text{C]}} \times V \text{ [m}^3\text{/s]} \times 10^{-6} \text{ [1/ppm]} \times 3600$$

7.3.10 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten: for SO₂, standard density values in the range from 2.86 to 2.93 are stated in literature (difference between ideal and real gas behaviour for SO₂) | für SO₂ werden in der Literatur Normdichte-Werte im Bereich von 2,86 bis 2,93 angegeben (Unterschied zwischen idealem und realem Gasverhalten bei SO₂) for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

$$\text{CO} \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{CO} \left[\text{ppm} \right] \times 1,25$$

$$\text{NO}_x \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{NO}_x \left[\text{ppm} \right] \times 2,05$$

$$\text{SO}_2 \left[\text{mg/m}^3 \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{SO}_2 \left[\text{ppm} \right] \times 2,86$$

O₂ref: O₂ Reference value | O₂-Referenzwert

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

O₂base: Fuel-specific oxygen base value as % | brennstoffspezifischer Sauerstoff-Bezugswert in %

8 Fuels and parameters testo 340 | Brennstoffe und Parameter testo 340

8.1 Austria | Österreich

| Brennstoff | A2 | B | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} |
|-----------------|--------|--------|------------------------------|-------------------------|-----------------------|-------------------|
| Heizöl HEL | 0,6830 | 0,0071 | 15,30 | 3,00 | 10,54 | 11,30 |
| Heizöl HL | 0,6850 | 0,0067 | 15,80 | 3,00 | 10,35 | 11,40 |
| Heizöl HM | 0,6850 | 0,0068 | 16,00 | 3,00 | 10,21 | 10,84 |
| Heizöl HS1 | 0,6900 | 0,0065 | 16,40 | 3,00 | 10,03 | 10,60 |
| Erdgas | 0,6590 | 0,0098 | 11,80 | 3,00 | 8,49 | 9,40 |
| Flüssiggas | 0,6430 | 0,0088 | 13,70 | 3,00 | 22,49 | 24,20 |
| Stückholz | 0,6753 | 0,0116 | 20,30 | 11,00 | 3,79 | 3,84 |
| Pellets | 0,6682 | 0,0107 | 20,30 | 11,00 | 4,01 | 4,07 |
| Hackgut trocken | 0,6921 | 0,0137 | 20,30 | 11,00 | 3,34 | 3,39 |
| Braunkohle | 0,6936 | 0,0097 | 19,80 | 6,00 | 5,04 | 5,19 |
| Steinkohle | 0,6967 | 0,0061 | 19,60 | 6,00 | 7,24 | 7,49 |
| Hackgut feucht | 0,7290 | 0,0183 | 20,30 | 11,00 | 2,67 | 2,71 |

8.2 Belgium | Belgien

| Brandstof | A2 | B | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} |
|------------|--------|--------|------------------------------|-------------------------|-----------------------|-------------------|
| Stookolie | 0,6800 | 0,0070 | 15,20 | 3,00 | 10,53 | 11,26 |
| StookolieZ | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Aardgas | 0,6600 | 0,0090 | 11,90 | 3,00 | 8,76 | 9,57 |
| Propaan | 0,6300 | 0,0080 | 13,70 | 3,00 | 22,30 | 24,36 |
| Briket | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Bruinkool | 0,9550 | 0,0000 | 19,80 | 8,00 | 5,61 | 5,69 |
| Steenkool | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,64 | 7,66 |
| Cokesgas | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Stadsgas | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| G20 | 0,6900 | 0,0095 | 11,70 | 3,00 | 8,56 | 9,56 |
| G25 | 0,7030 | 0,0095 | 11,50 | 3,00 | 7,50 | 8,22 |
| G30 | 0,6970 | 0,0078 | 14,00 | 3,00 | 29,67 | 32,09 |
| Cokes | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Hout 15% | 0,6860 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| Hout 30% | 0,6640 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| Hout 45% | 0,6340 | 0,0150 | 20,30 | 13,00 | 2,50 | 2,54 |
| Hout 60% | 0,5860 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |

8.3 Bulgaria | Bulgarien

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|-------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Нафта | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Прир.газ | 0,6600 | 0,0090 | 11,90 | 3,00 | 8,36 | 9,12 |
| Антрацит | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Каф.въглища | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Коксов газ | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Градски газ | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Брикети | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Пропан | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,8 | 25,95 |
| Талаш | 0,6200 | 0,0081 | 20,30 | 13,00 | 4,07 | 4,13 |
| Етал.газ | 0,0000 | 0,0000 | 0,00 | 0,00 | 0,00 | 0,00 |
| Соке | 0.7650 | 0.0000 | 20.30 | 13,00 | 7.64 | 7.66 |
| Дърва 15% | 0.6860 | 0.0096 | 20.30 | 13,00 | 3.87 | 3.93 |
| Дърва 30% | 0.6640 | 0.0118 | 20.30 | 13,00 | 3.19 | 3.24 |
| Дърва 45% | 0.6340 | 0.0150 | 20.30 | 13,00 | 2.50 | 2.54 |
| Дърва 60% | 0.5860 | 0.0199 | 20.30 | 13,00 | 1.82 | 1.85 |

8.4 China | China

| Fuel | CO _{2max} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| 天然气 | 11, 90 | 3, 00 | 0, 35 | 0, 39 | 40, 00 | 24, 40 | 0, 00 | 53, 42 | 48, 16 |
| 轻油 | 15, 50 | 3, 00 | 0, 48 | 0, 51 | 53, 00 | 13, 00 | 0, 00 | 45, 60 | 42, 80 |
| 重油 | 15, 80 | 3, 00 | 0, 51 | 0, 54 | 54, 00 | 11, 50 | 0, 20 | 42, 90 | 40, 50 |
| 煤 | 18, 40 | 7, 00 | 0, 62 | 0, 65 | 63, 00 | 4, 00 | 13, 00 | 26, 75 | 25, 50 |
| 无烟煤 | 19, 10 | 7, 00 | 0, 67 | 0, 69 | 65, 00 | 3, 00 | 12, 00 | 29, 65 | 28, 95 |
| 焦炭 | 20, 60 | 7, 00 | 0, 75 | 0, 76 | 70, 00 | 0, 40 | 10, 00 | 27, 90 | 27, 45 |
| 丙烷 | 13, 80 | 3, 00 | 0, 42 | 0, 45 | 48, 00 | 18, 20 | 0, 00 | 50, 00 | 46, 30 |
| 丁烷 | 14, 10 | 3, 00 | 0, 43 | 0, 46 | 48, 00 | 17, 20 | 0, 00 | 49, 30 | 45, 80 |
| 测试气体 | 0, 00 | 0, 00 | 0, 00 | 0, 00 | 0, 00 | 0, 00 | 0, 00 | 0, 00 | 0, 00 |
| 柴油 | 15, 60 | 3, 00 | 0, 43 | 0, 53 | 53, 00 | 12, 90 | 0, 00 | 44, 62 | 41, 80 |
| 汽油 | 15, 10 | 3, 00 | 0, 46 | 0, 49 | 51, 00 | 14, 20 | 0, 00 | 45, 10 | 42, 02 |

8.5 CIS | GUS

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|----------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Диз.Топл | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Мазут | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Природн. газ | 0,6600 | 0,0090 | 11,90 | 3,00 | 8,36 | 9,12 |
| Битум | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Каменноуг.газ | 0,6000 | 0,1100 | 10,30 | 3,00 | 3,86 | 4,28 |
| Бытовой газ | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,86 | 4,28 |
| Повер.газ | 0,0000 | 0,0000 | 0,00 | 0,00 | 0,00 | 0,00 |
| Брикеты | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Сжиж.нефт. газ | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,8 | 25,95 |
| Дерево/Кокс | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Гранулят | 0,6200 | 0,0081 | 20,30 | 13,00 | 4,07 | 4,13 |
| Бурый уголь | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Лигнит | 0,6234 | 0,0000 | 19,20 | 8,00 | 4,01 | 4,09 |
| Антрацит | 0,7580 | 0,0000 | 20,50 | 8,00 | 4,01 | 4,09 |
| Кокс | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Дрова 15% | 0,6860 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| Дрова 30% | 0,6640 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| Дрова 45% | 0,6340 | 0,0150 | 20,30 | 13,00 | 2,50 | 2,54 |
| Дрова 60% | 0,5860 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |

8.6 Czech Republic | Tschechien

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| LTO | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Mazut | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Zemni plyn | 0,6650 | 0,0090 | 12,00 | 3,00 | 8,76 | 9,58 |
| Propan | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,8 | 25,95 |
| Brikety | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Hnede uhli | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Cerne uhli | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Koks. plyn | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Bioplyn | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Koks | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| dřevo 15% | 0,6860 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| dřevo 30% | 0,6640 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| dřevo 45% | 0,6340 | 0,0150 | 20,30 | 13,00 | 2,5 | 2,54 |
| dřevo 60% | 0,5860 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |

8.7 Finland | *Finnland*

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|-----------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Kevytöljy | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Raskasöljy | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Nestekaasu | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,8 | 25,95 |
| Maakaasu | 0,6650 | 0,0090 | 12,00 | 3,00 | 8,76 | 9,58 |
| Kivihiihi | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Ruskohiili | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Häkäkaasu | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Kaupunkikaasu | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Antrasiitti | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Diesel | 0,6790 | 0,0069 | 15,50 | 3,00 | 10,35 | 11,17 |
| Pelletti | 0,6200 | 0,0081 | 20,30 | 13,00 | 4,07 | 4,13 |
| Hake | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Turve | 0,6790 | 0,0098 | 20,14 | 8,00 | 3,38 | 3,43 |
| Maakaasu Venäjä | 0,6540 | 0,0086 | 11,70 | 3,00 | 8,57 | 9,56 |
| Koksi | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Puu / Hake 15% | 0,6860 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| Puu / Hake 30% | 0,6640 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| Puu / Hake 45% | 0,6340 | 0,0150 | 20,30 | 13,00 | 2,50 | 2,54 |
| Puu / Hake 60% | 0,5860 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |

8.8 France | *Frankreich*

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|----------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Fuel-Domes | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Fuel-Lourd | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Gaz-Naturel | 0,6600 | 0,0090 | 11,9 | 3,0 | 8,36 | 9,12 |
| Propane | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,8 | 25,95 |
| Briquelette | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Lignite | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Houille | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Gaz de cokerie | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Gaz ville | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Coke | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Bois 15% | 0,6860 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| Bois 30% | 0,6640 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| Bois 45% | 0,6340 | 0,0150 | 20,30 | 13,00 | 2,50 | 2,54 |
| Bois 60% | 0,5860 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |

8.9 Germany | Deutschland

| Brennstoff | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Erdgas | 0,6600 | 0,0090 | 11,90 | 3,00 | 8,36 | 9,12 |
| Heizöl EL | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Heizöl S | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Flüssiggas | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,80 | 25,95 |
| Koks | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Pellets | 0,6200 | 0,0081 | 20,30 | 13,00 | 4,07 | 4,13 |
| Brikett | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Braunkohle | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Steinkohle | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Kokereigas | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Stadtgas | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Diesel | 0,6790 | 0,0069 | 15,50 | 3,00 | 10,35 | 11,17 |
| Benzin | 0,6530 | 0,0072 | 15,00 | 3,00 | 9,99 | 10,86 |
| Prüfgas | 0,0000 | 0,0000 | 0,00 | 0,00 | 0,00 | 0,00 |
| Holz 15% | 0,6860 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| Holz 30% | 0,6640 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| Holz 45% | 0,6340 | 0,0150 | 20,30 | 13,00 | 2,50 | 2,54 |
| Holz 60% | 0,5860 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |

8.10 Great Britain | Großbritannien

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|-------------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| Natural Gas | 11.90 | 3.00 | 0.35 | 0.39 | 40.00 | 24.40 | 0.00 | 53.42 | 48.16 |
| Light Oil | 15.50 | 3.00 | 0.48 | 0.51 | 53.00 | 13.00 | 0.00 | 45.60 | 42.80 |
| Heavy Oil | 15.80 | 3.00 | 0.51 | 0.51 | 54.00 | 11.50 | 0.20 | 42.90 | 40.50 |
| Coal | 18.40 | 7.00 | 0.62 | 0.65 | 63.00 | 4.00 | 13.00 | 26.75 | 25.50 |
| Anthracit | 19.10 | 7.00 | 0.67 | 0.69 | 65.00 | 3.00 | 12.00 | 29.65 | 28.95 |
| Coke | 20.60 | 7.00 | 0.75 | 0.76 | 70.00 | 0.40 | 10.00 | 27.90 | 27.45 |
| Propane | 13.80 | 3.00 | 0.42 | 0.45 | 48.00 | 18.20 | 0.00 | 50.00 | 46.30 |
| Butan | 4.10 | 3.00 | 0.43 | 0.46 | 48.00 | 17.20 | 0.00 | 49.30 | 45.80 |
| Test gas | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Diesel | 15.60 | 3.00 | 0.49 | 0.53 | 53.00 | 12.90 | 0.00 | 44.62 | 41.80 |
| Petrol | 15,10 | 3,00 | 0,46 | 0,49 | 51,00 | 14,2 | 0 | 45,1 | 42,02 |

8.11 Hungary | Ungarn

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|-----------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Fűtőolaj könnyű | 0,6800 | 0,0070 | 15,4 | 3,00 | 10,53 | 11,26 |
| Fűtőolaj nehéz | 0,8060 | 0,0000 | 15,9 | 3,00 | 10,09 | 10,73 |
| Földgáz | 0,6650 | 0,0090 | 12,00 | 3,00 | 8,76 | 9,58 |
| PB gáz | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,80 | 25,95 |
| Fa 15% | 0,6860 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| Fa 30% | 0,6640 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| Fa 45% | 0,6340 | 0,0150 | 20,30 | 13,00 | 2,50 | 2,54 |
| Fa 60% | 0,5860 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |
| Brikett | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Barnaszén | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Kőszén | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Kohógáz | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Városi gáz | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Koksz | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |

8.12 Italy | Italien

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|--------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| GAS NAT. | 0,6600 | 0,0100 | 11,70 | 3,00 | 8,52 | 9,52 |
| GPL | 0,6300 | 0,0080 | 13,90 | 3,00 | 23,80 | 25,90 |
| GASOLIO | 0,6800 | 0,0070 | 15,10 | 3,00 | 10,40 | 11,20 |
| OLIO COMB. | 0,6800 | 0,0070 | 15,70 | 3,00 | 10,09 | 10,73 |
| METANO | 0,6600 | 0,0100 | 11,70 | 3,00 | 8,52 | 9,52 |
| Gas liquido | 0,6300 | 0,0080 | 13,90 | 3,00 | 28,15 | 30,95 |
| Gas coker | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Gas città | 0,6300 | 0,0110 | 11,60 | 3,00 | 3,61 | 3,90 |
| Legno/Coke | 0,7770 | 0,0000 | 20,00 | 8,00 | 7,64 | 7,66 |
| Lignite | 0,9840 | 0,0000 | 19,20 | 8,00 | 5,26 | 5,40 |
| Tav. carbone | 0,8161 | 0,0000 | 19,30 | 8,00 | 5,09 | 5,17 |
| Antracite | 0,6811 | 0,0000 | 18,50 | 8,00 | 7,90 | 8,13 |

8.13 Japan | Japan

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| LPG (プロパン) | 0,7411 | 0,0030 | 13,80 | 5,00 | 22,13 | 23,90 |
| トウモロコシ | 0,7450 | 0,0024 | 15,10 | 5,00 | 10,49 | 11,37 |
| A ジェット | 0,7285 | 0,0022 | 15,80 | 5,00 | 10,05 | 10,68 |
| C ジェット | 0,7285 | 0,0021 | 16,00 | 5,00 | 9,65 | 10,25 |
| ケイソウ | 0,7690 | 0,0021 | 15,40 | 5,00 | 10,45 | 11,31 |
| セキタン | 0,7180 | 0,0028 | 20,90 | 8,00 | 7,73 | 7,81 |
| ウッドチップ | 0,6750 | 0,0095 | 20,70 | 8,00 | 3,84 | 3,90 |
| ブタン | 0,6600 | 0,0097 | 14,00 | 5,00 | 29,77 | 32,40 |
| テストガス | 0,0000 | 0,0000 | 0,00 | 0,00 | 0,00 | 0,00 |

8.14 Latin America | Latein-Amerika

| Fuel | CO ₂ MAX [Vol. %] | O ₂ base [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------------|------------------------------|------------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| GasNatural | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| GLP | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| gas de coque | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| F-Oleo n1BIA | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| Gasoleo A | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| Fa 15% | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |
| Fa 30% | 20,30 | 7,00 | 0,63 | 0,68 | 69,86 | 4,20 | 30,00 | 14,08 | 13,16 |
| Fa 45% | 20,30 | 7,00 | 0,61 | 0,65 | 69,86 | 3,30 | 45,00 | 11,57 | 10,84 |
| Fa 60% | 20,30 | 7,00 | 0,56 | 0,60 | 69,86 | 2,40 | 60,00 | 9,05 | 8,52 |
| Carbón | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| Bagasse | 20,80 | 7,00 | 0,30 | 0,61 | 70,61 | 2,90 | 51,00 | 19,42 | 9,46 |
| Pellets | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |
| Test gas | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

8.15 Mexico | Mexiko

| Fuel | A2 | B | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} |
|--------------|--------|--------|------------------------------|-------------------------|-----------------------|-------------------|
| Combustoleo | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Diesel | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Gasoil | 0,6800 | 0,0106 | 15,50 | 3,00 | 10,31 | 10,98 |
| LPG | 0,6300 | 0,0080 | 13,60 | 3,00 | 23,80 | 25,95 |
| Gas Natural | 0,6600 | 0,0090 | 11,90 | 3,00 | 8,36 | 9,12 |
| gas de coque | 0,6729 | 0,0024 | 18,50 | 7,00 | 5,30 | 5,40 |
| Made/Coque | 0,7650 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Antracita | 0,6964 | 0,0027 | 19,90 | 7,00 | 8,37 | 8,60 |
| Butano | 0,6000 | 0,0013 | 14,10 | 3,00 | 29,55 | 32,17 |
| Gas patrón | 0,0000 | 0,0000 | 0,00 | 0,00 | 0,00 | 0,00 |

8.16 Netherlands | Niederlande

| Fuel | A2 | B | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} |
|--------------|--------|--------|------------------------------|-------------------------|-----------------------|-------------------|
| Aardgas Hb | 0,6230 | 0,0080 | 11,70 | 3,00 | 7,71 | 8,43 |
| Aardgas Ho | 0,6910 | 0,0090 | 11,70 | 3,00 | 7,71 | 8,43 |
| Propangas Hb | 0,6190 | 0,0066 | 13,70 | 3,00 | 22,30 | 24,40 |
| Propangas Ho | 0,6730 | 0,0070 | 13,70 | 3,00 | 22,30 | 24,40 |
| Olie HBO | 0,6800 | 0,0070 | 15,50 | 3,00 | 10,52 | 11,30 |
| Hout/Cokes | 0,7770 | 0,0000 | 20,00 | 6,00 | 7,64 | 7,70 |
| Anthraciet | 0,7490 | 0,0000 | 18,50 | 6,00 | 7,90 | 8,10 |
| Bruinkool | 0,9840 | 0,0000 | 19,20 | 6,00 | 5,26 | 5,40 |
| Diesel | 0,6790 | 0,0069 | 15,60 | 3,00 | 10,35 | 11,17 |
| Pellets | 0,6200 | 0,0081 | 20,30 | 13,00 | 4,07 | 4,13 |
| Benzine | 0,6530 | 0,0072 | 15,10 | 3,00 | 9,99 | 10,86 |
| Stookolie | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |

8.17 Poland | Polen

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|---------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| OLej op.EL | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| OLej op.S | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Gaz GZ 50 | 0,6600 | 0,0110 | 11,80 | 3,00 | 8,47 | 9,44 |
| Gaz GZ41.5 | 0,6700 | 0,0110 | 11,50 | 3,00 | 7,24 | 7,89 |
| Gaz GZ 35 | 0,6800 | 0,0110 | 11,30 | 3,00 | 6,47 | 6,90 |
| Gaz plynny | 0,6300 | 0,0080 | 13,70 | 3,00 | 22,30 | 24,40 |
| DrewnoKoks | 0,7660 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| W.brunatny | 0,9550 | 0,0000 | 19,80 | 8,00 | 5,61 | 5,69 |
| W.kamienny | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,64 | 7,66 |
| Gaz koksow | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| GazMiejski | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Pelet drzewny | 0,6200 | 0,0081 | 20,30 | 13,00 | 4,07 | 4,13 |

8.18 Romania | Rumänien

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|-------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Gaz natural | 0,6540 | 0,0086 | 11,70 | 3,00 | 8,57 | 9,56 |
| Motorină | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Păcură | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Cărbune | 0,7719 | 0,0000 | 18,50 | 8,00 | 7,90 | 8,13 |
| Antracit | 0,7719 | 0,0000 | 18,50 | 8,00 | 8,37 | 8,55 |
| Butelie | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Propan | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,80 | 25,95 |
| Butan | 0,6660 | 0,0100 | 14,00 | 3,00 | 30,07 | 32,40 |
| Gaz de test | 0,0000 | 0,0000 | 0,00 | 0,00 | 0,00 | 0,00 |
| Diesel | 0,6790 | 0,0069 | 15,50 | 3,00 | 10,35 | 11,17 |
| Benzină | 0,6530 | 0,0072 | 15,00 | 3,00 | 9,99 | 10,86 |

8.19 Republic of Korea | Korea

| Fuel | CO _{2max} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | H ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------|--------------------------------|--------------------------------|--------------------------|---------------------------|--------|--------------------|-----------------------------------|----------------------------|-----------------------------|
| 천연가스 | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| 경유 | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| 중유 | 15,80 | 3,00 | 0,50 | 0,5 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| 석탄 | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| 무연탄 | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| 코크스 | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| 프로판 | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| 부탄 | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| 테스트가스 | 0,000 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |
| 디젤 | 15,60 | 3,00 | 0,49 | 0,53 | 53,00 | 12,90 | 0,00 | 44,62 | 41,80 |
| Petrol | 15,10 | 3,00 | 46,0 | 49,0 | 51,00 | 14,20 | 0,00 | 45,10 | 42,02 |

8.20 Spain | Spanien

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|--------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Gasoleo A | 0,6710 | 0,0069 | 15,50 | 3,00 | 10,53 | 11,26 |
| Gasoleo C | 0,6710 | 0,0069 | 15,50 | 3,00 | 10,53 | 11,26 |
| F-Oleo n1BIA | 0,6815 | 0,0067 | 15,90 | 3,00 | 10,09 | 10,73 |
| F-Oleo n2BIA | 0,6815 | 0,0067 | 15,90 | 3,00 | 10,09 | 10,73 |
| GasNatural | 0,6688 | 0,0097 | 11,90 | 3,00 | 9,63 | 10,61 |
| Propano | 0,5826 | 0,0097 | 13,70 | 3,00 | 22,30 | 24,36 |
| Butano | 0,5685 | 0,0097 | 14,00 | 3,00 | 29,55 | 32,17 |
| Made/Coque | 0,5985 | 0,0000 | 20,00 | 13,00 | 7,64 | 7,66 |
| Briquita | 0,6202 | 0,0000 | 19,30 | 8,00 | 5,09 | 5,17 |
| Lignito | 0,6234 | 0,0000 | 19,20 | 8,00 | 4,01 | 4,09 |
| Antracita | 0,7719 | 0,0000 | 18,50 | 8,00 | 8,37 | 8,55 |
| Hulla | 0,7719 | 0,0000 | 18,50 | 8,00 | 7,90 | 8,13 |
| GasdeCoque | 1,0194 | 0,0000 | 10,30 | 3,00 | 3,86 | 4,28 |
| Gas ciudad | 0,8678 | 0,0000 | 12,10 | 3,00 | 3,60 | 3,90 |
| Pellets | 0,6750 | 0,0095 | 20,70 | 8,00 | 3,84 | 3,90 |

8.21 Sweden | Schweden

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|--------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Eldn.olja1 | 0,6800 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Eldn.olja3 | 0,8060 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Trä/Pellets | 0,6200 | 0,0081 | 20,30 | 13,00 | 4,07 | 4,13 |
| Naturgas | 0,6650 | 0,0090 | 12,00 | 3,00 | 8,76 | 9,58 |
| Gasol | 0,6300 | 0,0080 | 13,70 | 3,00 | 23,80 | 25,95 |
| Stenkol | 0,7580 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Brunkol | 0,9550 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Stadsgas | 0,6300 | 0,0110 | 13,60 | 3,00 | 3,61 | 3,90 |
| Kolbriketter | 0,8330 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Gengas | 0,6000 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |

8.22 Thailand | Thailand

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|--------------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| ก๊าซธรรมชาติ | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| ดีเซล | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| น้ำมันเตา | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| ถ่านหิน | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| แก๊ส | 22,40 | 7,00 | 0,72 | 0,77 | 76,21 | 3,00 | 9,80 | 12,98 | 12,21 |
| ไม้ | 19,90 | 7,00 | 0,62 | 0,73 | 67,58 | 3,80 | 40,00 | 11,30 | 9,63 |
| LPG | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| ก๊าซทดสอบ | 0,000 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0 | 0 |
| ขาน้อย | 20,77 | 7,00 | 0,57 | 0,61 | 70,60 | 2,90 | 51,00 | 10,11 | 9,46 |

8.23 Turkey | Türkiye

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|------------|-------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Hafif Yag | 0,680 | 0,0070 | 15,40 | 3,00 | 10,53 | 11,26 |
| Agir Yag | 0,806 | 0,0000 | 15,90 | 3,00 | 10,09 | 10,73 |
| Dogal Gaz | 0,665 | 0,0090 | 12,00 | 3,00 | 8,76 | 9,58 |
| Tas Komur | 0,758 | 0,0000 | 20,50 | 8,00 | 7,81 | 7,82 |
| Linyit | 0,955 | 0,0000 | 19,80 | 8,00 | 4,01 | 4,09 |
| Komur Lpg | 0,600 | 0,0110 | 10,30 | 3,00 | 3,86 | 4,28 |
| Butan | 0,666 | 0,0100 | 14,00 | 3,00 | 30,07 | 32,40 |
| Briket | 0,833 | 0,0000 | 18,90 | 8,00 | 5,08 | 5,20 |
| Propan Lpg | 0,630 | 0,0080 | 13,70 | 3,00 | 23,8 | 25,95 |
| Odun Komur | 0,765 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Komur | 0,765 | 0,0000 | 20,30 | 13,00 | 7,64 | 7,66 |
| Odun 15% | 0,686 | 0,0096 | 20,30 | 13,00 | 3,87 | 3,93 |
| Odun 30% | 0,664 | 0,0118 | 20,30 | 13,00 | 3,19 | 3,24 |
| Odun 45% | 0,634 | 0,0150 | 20,30 | 13,00 | 2,5 | 2,54 |
| Odun 60% | 0,586 | 0,0199 | 20,30 | 13,00 | 1,82 | 1,85 |

8.24 USA | USA

| Fuel | A2 | B | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} |
|---------------|--------|--------|-----------------------------|------------------------|-----------------------|-------------------|
| Natur.gas | 0.5924 | 0.0010 | 11.70 | 3.00 | 7.91 | 8.70 |
| Propangas | 0.5978 | 0.0013 | 13.80 | 3.00 | 20.33 | 21.90 |
| Butan | 0.6000 | 0.0013 | 14.10 | 3.00 | 29.55 | 32.17 |
| Fuel oil #2 | 0.6385 | 0.0017 | 15.70 | 3.00 | 10.40 | 11.10 |
| Fueloil #5 | 0.6275 | 0.0018 | 16.30 | 3.00 | 10.14 | 10.70 |
| Fueloil #6 | 0.6375 | 0.0019 | 17.70 | 3.00 | 9.84 | 10.30 |
| Kerosene | 0.6159 | 0.0016 | 15.10 | 3.00 | 10.47 | 11.20 |
| Anthr. coal | 0.6964 | 0.0027 | 19.90 | 7.00 | 8.37 | 8.60 |
| Bitum coal | 0.6729 | 0.0024 | 18.50 | 7.00 | 5.30 | 5.40 |
| Distillate #1 | 0.6312 | 0.0017 | 15.40 | 3.00 | 10.50 | 11.25 |
| Wood 10% M. | 0.6194 | 0.0024 | 20.00 | 7.00 | 4.09 | 4.10 |
| Wood 20% M. | 0.6194 | 0.0024 | 20.00 | 7.00 | 3.64 | 3.66 |
| Wood 30% M. | 0.6194 | 0.0024 | 20.00 | 7.00 | 3.18 | 3.20 |
| Wood 40% M. | 0.6194 | 0.0024 | 20.00 | 7.00 | 2.73 | 2.75 |
| Bark 15% M. | 0.6669 | 0.0026 | 20.00 | 7.00 | 3.87 | 3.90 |
| Bark 30% M. | 0.6669 | 0.0026 | 20.00 | 7.00 | 3.18 | 3.20 |
| Bark 45% M. | 0.6669 | 0.0026 | 20.00 | 7.00 | 2.50 | 2.52 |
| Bark 60% M. | 0.6669 | 0.0026 | 20.00 | 7.00 | 1.82 | 1.83 |
| Diesel | 0.6360 | 0.0064 | 15.60 | 3.00 | 10.35 | 11.17 |

9 Calculation formulae testo 350 | Berechnungsformeln testo 350

9.1 Calculation basis Germany | *Berechnungsgrundlage Deutschland*

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

Austria | *Österreich*, Belgium | *Belgien*, Bulgaria | *Bulgarien*, CIS | *GUS*, Czech Republic | *Tschechische Republik*, Denmark | *Dänemark*, France | *Frankreich*, Germany | *Deutschland*, Hungary | *Ungarn*, Italy | *Italien*, Japan | *Japan*, Netherlands | *Niederlande*, Poland | *Polen*, Portugal | *Portugal*, Romania | *Rumänien*, Spain | *Spanien*, Sweden | *Schweden*, Swiss | *Schweiz*, Turkey | *Türkei*,

9.1.1 Carbon dioxide | *Kohlendioxid*

$$\text{CO}_2 [\%] = \text{CO}_{2\text{max}} \cdot \frac{\text{O}_{2\text{ref}} - \text{O}_2}{\text{O}_{2\text{ref}}} - \text{CO} \cdot (1 - 0.01881 \cdot \text{CO}_{2\text{max}})$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

9.1.2 Flue gas loss | *Abgasverlust*

9.1.2.1 Country-specific versions Germany, Swiss | *Landesversionen Deutschland, Schweiz*

$$q_{A+} = \left((FT - AT) \times \left(\frac{A_2}{\text{O}_{2\text{ref}} - \text{O}_2} + B \right) \right) - K_k$$

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

A₂ / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

K_k: Calculated value taking into account the recovered condensation heat when the dew point is undershot (for fuel value systems) | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung (für Brennwertanlagen)*

9.1.2.2 Country-specific version (expect Great Britain, China, Corea, Latin America, Vietnam) | Landesversion (außer Großbritannien, China, Korea, Lateinamerika, Vietnam)

$$qA = \left((FT - AT) \times \left(\frac{A2}{O_{2ref} - O_2} + B \right) \right)$$

- FT: Flue gas temperature | *Abgastemperatur*
 AT: Ambient air temperature | *Umgebungslufttemperatur*
 A2 / B: Fuel-specific parameters | *Brennstoff-spezifische Parameter*
 O2ref: O2 Reference value | *O2-Referenzwert*
 O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

9.1.3 Efficiency | Wirkungsgrad

9.1.3.1 Country-specific versions Germany, Swiss | Landesversionen Deutschland, Schweiz

$$\eta^+ = 100 - qA^+$$

- qA+: Calculated flue gas loss taking into account the recovered condensation heat | *berechneter Abgasverlust mit Berücksichtigung der rückgewonnenen Kondensationswärme*

9.1.3.2 Country-specific versions (expect Great Britain, China, Corea, Latin America, Vietnam) | Landesversion (außer Großbritannien, China, Korea, Lateinamerika, Vietnam)

$$\eta = 100 - qA$$

- qA: Calculated flue gas loss | *berechneter Abgasverlust*

9.1.4 Heat of condensation (Country-specific version Italy | Kondensationswärme (Landesversion Italien)

$$ET [\%] = \eta^+ - [100 - qA]$$

- qA: Calculated flue gas loss | *berechneter Abgasverlust*

9.1.5 Air ratio | Luftverhältniszahl

$$\lambda = 1 + \frac{V_{AGtrMin}}{V_{LMin}} \cdot \frac{O_2 - \frac{CO}{2}}{O_{2ref} - O_2 + \frac{CO}{2}}$$

- VAGtrMin: Dry flue gas volume with stoichiometric combustion | *Trockene Abgasmenge bei stöchiometrischer Verbrennung*
 VLMin: Air requirement for stoichiometric combustion of the fuel | *Luftbedarf bei stöchiometrischer Verbrennung des Brennstoffs*
 O2ref: O2 Reference value | *O2-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

9.1.6 Nitrogen oxide | *Stickstoffoxide*

No NO₂ sensor plugged: | *kein No₂-Sensor gesteckt:*

$$\text{NO}_x[\text{ppm}] = \text{NO}[\text{ppm}] \times \left[1 + \frac{\text{NO}_2\text{add} [\%]}{100 [\%]} \right]$$

NO₂ sensor plugged: | *NO₂-Sensor gesteckt:*

$$\text{NO}_x = \text{NO} + (\text{NO}_2)$$

NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*

NO₂add : Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

9.1.7 Carbon monoxide undiluted | *Kohlenmonoxid unverdünnt*

$$u\text{CO} = \text{CO} \cdot \frac{O_{2\text{ref}}}{O_{2\text{ref}} - O_2}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

9.1.8 Flue gas dew point temperature | *Abgastaupunkt-Temperatur*

$$T_{p_{AG}} = \text{MIN} \left[\left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H₂O}: Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol. %*

P_{Abs}: Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

9.1.9 Flow speed | *Strömungsgeschwindigkeit*

$$v \left[\frac{m}{s} \right] = \sqrt{\frac{200 \cdot 1013,25 \cdot \Delta p [\text{mbar}] \cdot (AT [^\circ\text{C}] + 273,15)}{273,15 \cdot \rho \cdot p_{Ort} [\text{mbar}]} \cdot \alpha}$$

P_{abs}: Absolute pressure | *Strömungsgeschwindigkeit*

ΔP: Differential pressure | *Differenzdruck*

FT: Flue gas temperature | *Abgastemperatur*

α: Pitot tube factor | *Stauohrfaktor*

Port: Local pressure in mbar or hPa | Ortsdruck in mbar bzw. hPa
 ρ : Standard density of the flowing medium, default value 1.29 for air as input value or from flue gas measurement for set fuel | Normdichte des strömenden Mediums, Default-Wert 1.29 für Luft als Eingabewert oder aus Abgasmessung für eingestellten Brennstoff

9.1.10 Air flow | Volumenstrom

$$\dot{V} \left[\frac{m^3}{s} \right] = v \left[\frac{m}{s} \right] \cdot A [cm^2] \cdot \frac{[m^2]}{10000 \cdot [cm^2]}$$

v: Flow speed | *Strömungsgeschwindigkeit*

A: Cross-section area | *Querschnittsfläche*

9.1.11 Mass flow | Massenstrom

$$MCO = CO [kg/h] [ppm] \times F_{Gas} \times 1,25 [kg/m^3] \times Z$$

$$MNO_x = NO_x [kg/h] [ppm] \times F_{Gas} \times 2,05 [kg/m^3] \times Z$$

$$MSO_2 = SO_2 [kg/h] [ppm] \times F_{Gas} \times 2,86 [kg/m^3] \times Z$$

$$MCO_2 = CO_2 [kg/h] [ppm] \times F_{Gas} \times 1,97 [kg/m^3] \times Z$$

$$MH_2S = H_2S [kg/h] [ppm] \times F_{Gas} \times 1,54 [kg/m^3] \times Z$$

F_{Gas} : Fuel-specific humidity value | *Brennstoff-spezifischer Feuchtigkeitswert*

Z: Calculation term: | *Berechnungsterm:*

$$Z = \frac{273.15 \times P_{abs} [mbar]}{273.15 + FT [^{\circ}C] \times 1013} \times V [m^3 / s] \times 10^{-6} [1 / ppm] \times 3600$$

Pabs: Absolute pressure | *Strömungsgeschwindigkeit*

9.1.12 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten: for SO₂, standard density values in the range from 2.86 to 2.93 are stated in literature (difference between ideal and real gas behaviour for SO₂) | für SO₂ werden in der Literatur Normdichte-Werte im Bereich von 2,86 bis 2,93 angegeben (Unterschied zwischen idealem und realem Gasverhalten bei SO₂)*

for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | *für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

9.1.12.1 All country-specific versions (except Japan) | Alle Landesversionen (ausgenommen Japan)

$$\text{CO} \left[\frac{\text{mg}}{\text{m}^3} \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{CO} [\text{ppm}] \times 1,25$$

$$\text{NOx} \left[\frac{\text{mg}}{\text{m}^3} \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{NOx} [\text{ppm}] \times 2,05$$

$$\text{SO}_2 \left[\frac{\text{mg}}{\text{m}^3} \right] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{SO}_2 [\text{ppm}] \times 2,86$$

O2ref: O2 Reference value | O2-Referenzwert

O2: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

O2base: Fuel-specific oxygen base value as % | brennstoffspezifischer Sauerstoff-Bezugswert in %

9.1.12.2 Country-specific version Japan and China | Landesversion Japan and China

$$\text{CO}^* \left[\frac{\text{mg}}{\text{m}^3} \right] = \text{CO} [\text{ppm}] \times 1,25$$

$$\text{NO}_x^* \left[\frac{\text{mg}}{\text{m}^3} \right] = \text{NO}_x [\text{ppm}] \times 2,86$$

$$\text{SO}_2^* \left[\frac{\text{mg}}{\text{m}^3} \right] = \text{SO}_2 [\text{ppm}] \times 2,86$$

$$\text{NO} \left[\frac{\text{mg}}{\text{m}^3} \right] = \text{NO} [\text{ppm}] \times 1,34$$

$$\text{NO}_2 \left[\frac{\text{mg}}{\text{m}^3} \right] = \text{NO}_2 [\text{ppm}] \times 2,05$$

$$\text{H}_2\text{S} \left[\frac{\text{mg}}{\text{m}^3} \right] = \text{H}_2\text{S} [\text{ppm}] \times 1,54$$

Reduced parameters | Reduzierte Messgrößen

rCO, rNOx, rNO, rSO2:

$$x [\text{ppm}_b] = x [\text{ppm}] \cdot \frac{O_{2\text{ref}} - O_{2\text{Bezug}}}{O_{2\text{ref}} - O_2}$$

O2ref: O2 Reference value | O2-Referenzwert

O2: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

9.1.13 Conversion from ppm to g/GJ | Umrechnung von ppm in g/GJ

$$x \left[\frac{\text{g}}{\text{GJ}} \right] = x[\text{ppm}] \cdot \rho_{\text{Gas}} \cdot \frac{O_{2\text{einst}}}{O_{2\text{einst}} - O_2} \cdot \frac{V_{\text{AG}}}{Hu}$$

Hu: Fuel-specific factor | *brennstoffspezifischer Faktor*

VAG: Fuel-specific factor | *brennstoffspezifischer Faktor*

For conversion purposes, the combustion gases are based on 15 °C | *Für die Umrechnung beziehen sich die Brenngase auf +15 °C*

9.1.14 O2 Nass-Wert | O2 Nass-Wert**9.1.14.1 Country-specific version Netherlands | Landesversion Niederlande**

$$O_{2N}[\%] = O_2 \cdot \left(1 - \frac{H_2O_{ag}}{100} \right)$$

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

H2Oag Steam content in humid flue gas at probe inlet | *Wasserdampfgehalt im feuchten Abgas am Sondeneingang*

9.1.15 Giftindex | Giftindex**9.1.15.1 Country-specific version Netherlands | Landesversion Niederlande**

$$GI = \frac{CO[\text{ppm}]}{CO_2[\%] \cdot 100}$$

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

9.2 Calculation basis Great Britain | Berechnungsgrundlage Großbritannien

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

Great Britain | *Großbritannien*, China | *China*, Republic of Korea | *Korea*, Latin America | *Latein-Amerika*, Vietnam | *Vietnam*

9.2.1 Carbon dioxide | Kohlendioxid

$$CO_2[\%] = CO_{2\text{max}} \cdot \frac{O_{2\text{ref}} - O_2}{O_{2\text{ref}}} - CO \cdot (1 - 0.01881 \cdot CO_{2\text{max}})$$

CO2max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

9.2.2 Effizienz | Wirkungsgrad

9.2.2.1 Country-specific version Great Britain | Landesversion Großbritannien

Calorific value range taken into account: | *Mit Berücksichtigung Brennwertbereich:*

$$EffG = 100 - \left(\left(\frac{K_{gr} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (2488 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{gr} \cdot 1000} \right) + \left(\frac{K1 \cdot CO}{CO_2 + CO} \right) \right)$$

Calorific value range not taken into account: | *Ohne Berücksichtigung Brennwertbereich:*

$$EffN = 100 - \left(\left(\frac{K_{net} \cdot (FT - AT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (210 + 2.1 \cdot FT - 4.2 \cdot AT)}{Q_{net} \cdot 1000} \right) + \left(\frac{K1 \cdot Q_{gr} \cdot CO}{Q_{net} \cdot (CO_2 + CO)} \right) \right)$$

Kgr / Knet / Qgr / Qnet / K1 / MH2O / H:

Fuel-specific factors | *Brennstoff-spezifische Faktoren*

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

9.2.2.2 Country-specific version China | Landesversion China

Calorific value range taken into account: | *Mit Berücksichtigung Brennwertbereich:*

$$EffG[\%] = 100 + X_k \cdot \frac{Q_{net}}{Q_{gr}} - \left(\left(\frac{K_{gr} \cdot (AT - VT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (2488 + 2.1 \cdot AT - 4.2 \cdot VT)}{Q_{gr} \cdot 1000} \right) + \left(\frac{K1 \cdot CO[\%]}{CO_2 + CO[\%]} \right) \right)$$

Calorific value range not taken into account: | *Ohne Berücksichtigung Brennwertbereich:*

$$EffN[\%] = 100 + X_k - \left(\left(\frac{K_{net} \cdot (AT - VT)}{CO_2} \right) + \left(\frac{(MH_2O + 9 \cdot H) \cdot (210 + 2.1 \cdot AT - 4.2 \cdot VT)}{Q_{net} \cdot 1000} \right) + \left(\frac{K1 \cdot Q_{gr} \cdot CO[\%]}{Q_{net} \cdot (CO_2 + CO[\%])} \right) \right)$$

Kgr / Knet / Qgr / Qnet / K1 / MH2O / H:

Fuel-specific factors | *Brennstoff-spezifische Faktoren*

FT: Flue gas temperature | *Abgastemperatur*

AT: Ambient air temperature | *Umgebungslufttemperatur*

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

Xt: calculated value for considering the recovered condensation heat when falling short of the dewpoint temperature | *berechneter Wert zur Berücksichtigung der rückgewonnenen Kondensationswärme bei Taupunktunterschreitung*

9.2.3 Air ratio | Luftverhältniszahl

$$\lambda = 1 + \frac{V_{AGrMin}}{V_{LMin}} \cdot \frac{O_2 - \frac{CO}{2}}{O_{2ref} - O_2 + \frac{CO}{2}}$$

VAGrMin: Dry flue gas volume with stoichiometric combustion | *Trockene Abgasmenge bei stöchiometrischer Verbrennung*

VLMin: Air requirement for stoichiometric combustion of the fuel | *Luftbedarf bei stöchiometrischer Verbrennung des Brennstoffs*

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

9.2.4 Poison index | Giftindex

$$\text{ratio} = \frac{CO}{CO_2 \cdot 10000}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

9.2.5 Excess Air | Luftüberschuss

$$ExAir[\%] = \left(\frac{O_{2ref}}{O_{2ref} - O_2} - 1 \right) \cdot 100 = \left(\frac{CO_{2max}}{CO_2} - 1 \right) \cdot 100$$

O2ref: O2 Reference value | *O2-Referenzwert*

O2: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

CO2: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

CO2max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

9.2.6 Nitrogen oxide | Stickstoffoxide

No NO2 sensor plugged: | *kein No2-Sensor gesteckt:*

$$NO_x[\text{ppm}] = NO[\text{ppm}] \times \left[1 + \frac{NO2add[\%]}{100[\%]} \right]$$

NO2 sensor plugged: | *NO2-Sensor gesteckt:*

$$NO_x = NO + (NO_2)$$

NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*

NO2add: Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

9.2.7 Carbon monoxide undiluted | Kohlenmonoxid unverdünnt

$$u_{CO} = CO \cdot \frac{O_{2ref}}{O_{2ref} - O_2}$$

CO: Measured carbon monoxide content | Gemessener Kohlenmonoxidgehalt

O2ref: O2 Reference value | O2-Referenzwert

9.2.8 Flue gas dew point temperature | Abgastaupunkt-Temperatur

$$Tp_{AG} = MIN \left[\left[\frac{\ln \left(\frac{F_{H2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H2O}: Flue gas-specific water vapour content as vol.% | Abgasspezifischer Wasserdampfgehalt in Vol. %

P_{Abs}: Absolute pressure in mbar/hPa | Absolutdruck in mbar/hPa

9.2.9 Flow speed | Strömungsgeschwindigkeit

$$v \left[\frac{m}{s} \right] = \sqrt{\frac{200 \cdot 1013,25 \cdot \Delta p [mbar] \cdot (AT [^{\circ}C] + 273,15)}{273,15 \cdot \rho \cdot p_{ort} [mbar]}} \cdot \alpha$$

P_{abs}: Absolute pressure | Strömungsgeschwindigkeit

ΔP: Differential pressure | Differenzdruck

FT: Flue gas temperature | Abgastemperatur

α: Pitot tube factor | Staurohrfaktor

Port: Umgebungsluftdruck in mbar bzw. hPa | Ortsdruck in mbar bzw. hPa

ρ: Normdichte des strömenden Mediums, Default-Wert 1.29 für Luft als Eingabewert oder aus Abgasmessung für eingestellten Brennstoff | Normdichte des strömenden Mediums, Default-Wert 1.29 für Luft als Eingabewert oder aus Abgasmessung für eingestellten Brennstoff

9.2.10 Air flow | Volumenstrom

$$\dot{V} \left[\frac{m^3}{s} \right] = v \left[\frac{m}{s} \right] \cdot A [cm^2] \cdot \frac{[m^2]}{10000 \cdot [cm^2]}$$

v: Flow speed | Strömungsgeschwindigkeit

A: cross-section area | Querschnittsfläche

9.2.11 Mass flow | Massenstrom

$$MCO = CO \text{ [kg/h [ppm]]} \times F_{\text{Gas}} \times 1,25 \text{ [kg/m}^3\text{]} \times Z$$

$$MNO_x = NO_x \text{ [kg/h [ppm]]} \times F_{\text{Gas}} \times 2,05 \text{ [kg/m}^3\text{]} \times Z$$

$$MSO_2 = SO_2 \text{ [kg/h [ppm]]} \times F_{\text{Gas}} \times 2,86 \text{ [kg/m}^3\text{]} \times Z$$

$$MCO_2 = CO_2 \text{ [kg/h [ppm]]} \times F_{\text{Gas}} \times 1,97 \text{ [kg/m}^3\text{]} \times Z$$

$$MH_2S = H_2S \text{ [kg/h [ppm]]} \times F_{\text{Gas}} \times 1,54 \text{ [kg/m}^3\text{]} \times Z$$

F_{Gas} : Fuel-specific humidity value | *Brennstoff-spezifischer Feuchtigkeitswert*

Z: Calculation term: | *Berechnungsterm:*

$$Z = \frac{273.15 \times P_{\text{abs}} \text{ [mbar]}}{273.15 + FT \text{ [}^\circ\text{C]} \times 1013} \times V \text{ [m}^3/\text{s]} \times 10^{-6} \text{ [1/ppm]} \times 3600$$

Pabs: Absolute pressure | *Strömungsgeschwindigkeit*

9.2.12 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³**9.2.12.1 Country-specific version Great Britain | Landesversion Großbritannien**

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten:*

for SO₂, standard density values in the range from 2.86 to 2.93 are stated in literature (difference between ideal and real gas behaviour for SO₂) | *für SO₂ werden in der Literatur Normdichte-Werte im Bereich von 2,86 bis 2,93 angegeben (Unterschied zwischen idealem und realem Gasverhalten bei SO₂)*

for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | *für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

for NO the standard density of 1,34 is used, for NO₂ the standard density 2,05. NO in mg/m³ und NO₂ in mg/m³ may not be added separately, to calculate NO_x | *für NO wird die Normdichte von 1,34 verwendet, für NO₂ die Normdichte 2,05. NO in mg/m³ und NO₂ in mg/m³ dürfen nicht separat addiert werden, um NO_x zu berechnen.*

$$CO \text{ [mg/m}^3\text{]} = CO \text{ [ppm]} \times 1,25$$

$$NO_x \text{ [mg/m}^3\text{]} = NO_x \text{ [ppm]} \times 2,05$$

$$SO_2 \text{ [mg/m}^3\text{]} = SO_2 \text{ [ppm]} \times 2,86$$

9.2.12.2 Country-specific version China | Landesversion China

$$\text{CO} [\text{mg}/\text{m}^3] = \text{CO} [\text{ppm}] \times 1,25 \times \frac{21}{21 - \text{O}_2} \times \frac{1}{K}$$

$$\text{NO}_x [\text{mg}/\text{m}^3] = \text{NO}_x [\text{ppm}] \times 2,05 \times \frac{21}{21 - \text{O}_2} \times \frac{1}{K}$$

$$\text{SO}_2 [\text{mg}/\text{m}^3] = \text{SO}_2 [\text{ppm}] \times 2,86 \times \frac{21}{21 - \text{O}_2} \times \frac{1}{K}$$

K: Fuel-specific factor | *Brennstoff-spezifischer Faktor*
 Power Plant: K = 1.4 | *Kraftwerk: K = 1.4*
 Normal industrial boiler: K = 1.8 | *Normaler großtechnischer Kessel: K = 1.8*
 Industrial boiler before commissioning: K = 1.7 | *Großtechnischer Kessel vor Inbetriebnahme: K = 1.7*
 Oil, gas burner: K = 1.2 | *Öl-, Gas-Brenner: K = 1.2*
 Turbine: K = 3.5 | *Turbine: K = 3.5*

9.3 Calculation basis USA | Berechnungsgrundlage USA

Formulae are valid for country-specific versions: | *Formeln sind gültig für die Landesversionen:*

USA | USA

9.3.1 Carbon dioxide | Kohlendioxid

$$\text{CO}_2 [\%] = \text{CO}_{2\text{max}} \cdot \frac{\text{O}_{2\text{ref}} - \text{O}_2}{\text{O}_{2\text{ref}}} - \text{CO} \cdot (1 - 0.01881 \cdot \text{CO}_{2\text{max}})$$

CO₂max: Fuel-specific carbon dioxide value | *Brennstoffspezifischer Kohlendioxidwert*

O₂ref: O₂ Reference value | *O₂-Referenzwert*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

9.3.2 Efficiency | Wirkungsgrad

$$\eta = 100 - q_A$$

q_A: Calculated flue gas loss | *berechneter Abgasverlust*

9.3.3 Excess Air | Luftüberschuss

$$\text{ExAir} [\%] = \left(\frac{\text{O}_2 - \frac{\text{CO}}{2}}{0.26582 \cdot (100 - \text{O}_2 - \text{CO}_2 - \text{CO}) - (\text{O}_2 - \frac{\text{CO}}{2})} \right) \cdot 100$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

CO₂: Calculated carbon dioxide value in % | *Berechneter Kohlendioxidwert in %*

9.3.4 Nitrogen oxide | *Stickstoffoxide*

No NO₂ sensor plugged: | *kein No2-Sensor gesteckt:*

$$\text{NO}_x[\text{ppm}] = \text{NO}[\text{ppm}] \times \left[1 + \frac{\text{NO}_2\text{add} [\%]}{100 [\%]} \right]$$

NO₂ sensor plugged: | *NO2-Sensor gesteckt:*

$$\text{NO}_x = \text{NO} + (\text{NO}_2)$$

NO: Measured nitrogen monoxide value | *gemessener Stickstoffmonoxidwert*

NO₂add : Nitrogen dioxide addition factor | *Stickstoffdioxid-Zuschlagsfaktor*

9.3.5 Carbon monoxide undiluted | *Kohlenmonoxid unverdünnt*

$$u\text{CO} = \text{CO} \cdot \frac{O_{ref}}{O_{ref} - O_2}$$

CO: Measured carbon monoxide content | *Gemessener Kohlenmonoxidgehalt*

O₂: Measured oxygen content as % | *Gemessener Sauerstoffgehalt in %*

O₂ref: O₂ Reference value | *O2-Referenzwert*

9.3.6 Flue gas dew point temperature | *Abgastaupunkt-Temperatur*

$$T_{p_{AG}} = \text{MIN} \left[\left[\frac{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) \times 234,175}{\ln \left(\frac{F_{H_2O} \times P_{Abs}}{610,78} \right) - 17,08085} \right], FT \right]$$

F_{H₂O}: Flue gas-specific water vapour content as vol.% | *Abgasspezifischer Wasserdampfgehalt in Vol. %*

P_{Abs}: Absolute pressure in mbar/hPa | *Absolutdruck in mbar/hPa*

9.3.7 Flow speed | *Strömungsgeschwindigkeit*

$$v \left[\frac{m}{s} \right] = \sqrt{\frac{200 \cdot 1013,25 \cdot \Delta p [\text{mbar}] \cdot (AT [^\circ\text{C}] + 273,15)}{273,15 \cdot \rho \cdot p_{Ort} [\text{mbar}]} \cdot \alpha}$$

P_{abs}: Absolute pressure | *Strömungsgeschwindigkeit*

ΔP: Differential pressure | *Differenzdruck*

FT: Flue gas temperature | *Abgastemperatur*

α: Pitot tube factor | *Stauohrfaktor*

Port: Ortsdruck in mbar bzw. hPa | *Ortsdruck in mbar bzw. hPa*

ρ : Normdichte des strömenden Mediums, Default-Wert 1.29 für Luft als Eingabewert oder aus Abgasmessung für eingestellten Brennstoff | Normdichte des strömenden Mediums, Default-Wert 1.29 für Luft als Eingabewert oder aus Abgasmessung für eingestellten Brennstoff

9.3.8 Air flow | Volumenstrom

$$\dot{V} \left[\frac{m^3}{s} \right] = v \left[\frac{m}{s} \right] \cdot A [cm^2] \cdot \frac{[m^2]}{10000 \cdot [cm^2]}$$

v: Flow speed | *Strömungsgeschwindigkeit*

A: Cross-section area | *Querschnittsfläche*

9.3.9 Mass flow

$$MCO = CO \left[\frac{kg}{h} \right] [ppm] \times F_{Gas} \times 1,25 \left[\frac{kg}{m^3} \right] \times Z$$

$$MNO_x = NO_x \left[\frac{kg}{h} \right] [ppm] \times F_{Gas} \times 2,05 \left[\frac{kg}{m^3} \right] \times Z$$

$$MSO_2 = SO_2 \left[\frac{kg}{h} \right] [ppm] \times F_{Gas} \times 2,86 \left[\frac{kg}{m^3} \right] \times Z$$

$$MCO_2 = CO_2 \left[\frac{kg}{h} \right] [ppm] \times F_{Gas} \times 1,97 \left[\frac{kg}{m^3} \right] \times Z$$

$$MH_2S = H_2S \left[\frac{kg}{h} \right] [ppm] \times F_{Gas} \times 1,54 \left[\frac{kg}{m^3} \right] \times Z$$

F_{gas}: Fuel-specific humidity value | *Brennstoff-spezifischer Feuchtigkeitswert*

Z: Calculation term: | *Berechnungsterm*:

$$Z = \frac{273.15 \times P_{abs} [mbar]}{273.15 + FT [^{\circ}C] \times 1013} \times V [m^3/s] \times 10^{-6} [1/ppm] \times 3600$$

P_{abs}: Absolute pressure | *Strömungsgeschwindigkeit*

9.3.10 Conversion from ppm to mg/m³ | Umrechnung von ppm in mg/m³

The numerical factor used in the formula (e. g. 1.25 for CO) corresponds to the standard density of the respective gas in mg/m³. Note: | *Der in den Formeln verwendete Zahlenfaktor (bspw. 1,25 bei CO) entspricht der Normdichte des jeweiligen Gases in mg/m³. Dabei ist zu beachten: for SO₂, standard density values in the range from 2.86 to 2.93 are stated in literature (difference between ideal and real gas behaviour for SO₂) | für SO₂ werden in der Literatur Normdichte-Werte im Bereich von 2,86 bis 2,93 angegeben (Unterschied zwischen idealem und realem Gasverhalten bei SO₂) for NO_x the standard density of NO₂ (2.05), is used, as only this compound is stable (NO combines very quickly after its creation with oxygen to form NO₂) | für NO_x wird mit 2,05 die Normdichte von NO₂ verwendet, da nur diese Verbindung stabil ist (NO verbindet sich sehr schnell nach seiner Entstehung mit Sauerstoff zu NO₂)*

for NO the standard density of 1,34 is used, for NO₂ the standard density 2,05. NO in mg/m³ und NO₂ in mg/m³ may not be added separately, to calculate NO_x | für NO wird die Normdichte von 1,34 verwendet, für NO₂ die

Normdichte 2,05. NO in mg/m³ und NO₂ in mg/m³ dürfen nicht separat addiert werden, um NO_x zu berechnen.

$$\text{CO [mg/m}^3] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{CO [ppm]} \times 1,25$$

$$\text{NO}_x \text{ [mg/m}^3] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{NO}_x \text{ [ppm]} \times 2,05$$

$$\text{SO}_2 \text{ [mg/m}^3] = \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2} \times \text{SO}_2 \text{ [ppm]} \times 2,86$$

Corrected parameters | Korrigierte Messgrößen
cCO, cNO_x, cNO, cSO₂:

$$x[\text{ppm}_D] = x[\text{ppm}] \cdot \frac{O_{2\text{ref}} - O_{2\text{base}}}{O_{2\text{ref}} - O_2}$$

O_{2ref}: O₂ Reference value | O₂-Referenzwert

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

O_{2base}: Fuel-specific oxygen base value as % | brennstoffspezifischer Sauerstoff-Bezugswert in %

9.3.11 Conversion from ppm to lbs/mBTU | Umrechnung von ppm in lbs/mBTU

$$x \left[\frac{\text{lbs}}{\text{mBTU}} \right] = x[\text{ppm}] \cdot \rho_{\text{Gas}} \cdot \frac{O_{2\text{ref}}}{O_{2\text{ref}} - O_2} \cdot \frac{F_D}{430.0269}$$

F_D: Fuel-specific factor | brennstoffspezifischer Faktor

ρ_{Gas}: Standard density of the gas in [kg/m³] CO: 1.25, NO_x: 2.05, SO₂: 2.86 | Normdichte des Gases in [kg/m³] CO: 1.25, NO_x: 2.05, SO₂: 2.86

O_{2ref}: O₂ Reference value | O₂-Referenzwert

O₂: Measured oxygen content as % | Gemessener Sauerstoffgehalt in %

10 Fuels and parameters testo 350 | Brennstoffe und Parameter testo 350

10.1 Austria | Österreich

| Brennstoff | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG tmin} | V _{Lmin} | A2 | B |
|------------------|-----------------------------|------------------------|----------------------|-------------------|--------|--------|
| Erdgas | 11,8 | 3,0 | 8,49 | 9,40 | 0,6440 | 0,0111 |
| Heizöl HEL | 15,3 | 3,0 | 10,54 | 11,30 | 0,6642 | 0,0086 |
| Heizöl HL | 15,8 | 3,0 | 10,35 | 11,40 | 0,6655 | 0,0082 |
| Heizöl HM | 16,0 | 3,0 | 10,21 | 10,84 | 0,6687 | 0,0079 |
| Heizöl HS | 16,4 | 3,0 | 10,03 | 10,60 | 0,6736 | 0,0076 |
| Holzpellets | 20,3 | 11,0 | 4,01 | 4,07 | 0,6660 | 0,0102 |
| Hackgut trocken | 20,3 | 11,0 | 3,34 | 3,39 | 0,6921 | 0,0137 |
| Hackgut feucht | 20,3 | 11,0 | 2,67 | 2,71 | 0,7290 | 0,0183 |
| Scheitholz | 20,3 | 11,0 | 3,79 | 3,84 | 0,6753 | 0,0116 |
| Biomasse | 20,3 | 11,0 | 3,79 | 3,84 | 0,6824 | 0,0125 |
| Gerste/Triticale | 20,3 | 11,0 | 3,79 | 3,84 | 0,6753 | 0,0116 |
| Propan | 13,68 | 3,0 | 22,30 | 24,36 | 0,6335 | 0,0092 |
| Butan | 13,7 | 3,0 | 30,07 | 32,40 | 0,6247 | 0,0089 |
| FAME | 15,75 | 3,0 | 9,03 | 9,74 | 0,6553 | 0,0080 |
| Diesel | 15,6 | 3,0 | 10,35 | 11,17 | 0,6790 | 0,0069 |
| Biodiesel | 15,34 | 3,0 | 10,54 | 11,30 | 0,6642 | 0,0086 |
| Eurosuper 95 | 15,51 | 3,0 | 9,99 | 10,86 | 0,6642 | 0,0086 |
| Braunkohle | 19,80 | 6,0 | 5,04 | 5,19 | 0,6936 | 0,0097 |
| Steinkohle | 18,7 | 6,0 | 7,92 | 8,11 | 0,6932 | 0,0057 |

10.2 Belgium | *Belgien*

| Brandstof | CO ₂ max [Vol. %] | O ₂ base [%] | VAG trmin | VLmin | A2 | B |
|-----------------|------------------------------|-------------------------|-----------|-------|--------|--------|
| Aardgas H | 11,90 | 3,00 | 8,76 | 9,57 | 0,6600 | 0,0090 |
| Cokesgas | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadsgas | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Propaan | 13,70 | 3,00 | 22,30 | 24,36 | 0,6300 | 0,0080 |
| Stookolie L | 15,20 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| StookolieZ | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Briket | 18,90 | 8,00 | 5,08 | 5,20 | 0,8333 | 0,0000 |
| Bruinkool | 19,80 | 8,00 | 5,61 | 5,69 | 0,9550 | 0,0000 |
| Houtpellets | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Cokes | 20,30 | 13,00 | 7,64 | 7,66 | 0,7655 | 0,0000 |
| Cokes | 20,30 | 8,00 | 7,64 | 7,66 | 0,7580 | 0,0000 |
| Hout | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Hout 30%M. | 20,30 | 13,00 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Hout 45%M. | 20,30 | 13,00 | 2,50 | 2,54 | 0,634 | 0,0150 |
| Hout 60%M. | 20,30 | 13,00 | 1,82 | 1,85 | 0,5860 | 0,0199 |
| Aardgas H (G20) | 11,70 | 3,00 | 8,56 | 9,56 | 0,6900 | 0,0095 |
| Aardgas L (G25) | 11,80 | 3,00 | 7,50 | 8,22 | 0,7030 | 0,0095 |
| Butan (G30) | 14,00 | 3,00 | 29,67 | 32,09 | 0,6970 | 0,0078 |

10.3 Bulgaria | *Bulgarien*

| Fuel | CO ₂ max [Vol. %] | O ₂ base [%] | VAG trmin | VLmin | A2 | B |
|-----------------|------------------------------|-------------------------|-----------|-------|--------|--------|
| Брикети | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Дървесни пелети | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Дървесина 15%w | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Каменни въглища | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Кокс | 20,30 | 13,00 | 7,64 | 7,66 | 0,7650 | 0,0000 |
| Природен газ | 11,90 | 3,00 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Нафта | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Мазут | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Лигнит | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Втечен газ | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Коксов газ | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Градски газ | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Еталонен газ | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |

10.4 CIS | GUS

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|----------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Природный Газ | 12,00 | 3,00 | 8,76 | 9,58 | 0,6650 | 0,0090 |
| Коксовый газ | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Городской Газ | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Диз.топливо | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Темн. дизтопл. | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Сжж газ | 13,70 | 3,00 | 23,8 | 25,95 | 0,6300 | 0,0080 |
| Бурый уголь | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Брикеты | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Древесина 15%вл | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Каменный уголь | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Древесина 30%вл | 20,30 | 13,00 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Древесина 45%вл | 20,30 | 13,00 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Древесина 60%вл | 20,30 | 13,00 | 1,82 | 1,85 | 0,586 | 0,0199 |
| Древесные брикеты | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |

10.5 China | China

| Fuel | CO _{2MAX} [Vol. %] | O _{2base} [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH _{2O} [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|------|-----------------------------|-----------------------------|-----------------------|------------------------|--------|-----------------|--------------------------------|-------------------------|--------------------------|
| 天然气 | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| 丁烷 | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| 丙烷 | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| 汽油 | 15,10 | 3,00 | 0,46 | 0,49 | 51,00 | 14,20 | 0,00 | 45,10 | 42,02 |
| 柴油 | 15,60 | 3,00 | 0,49 | 0,53 | 53,00 | 12,90 | 0,00 | 44,62 | 41,80 |
| 轻油 | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| 重油 | 15,80 | 3,00 | 0,51 | 0,54 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| 无烟煤 | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| 煤 | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| 木粒 | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |
| LPG | 13,80 | 3,00 | 0,42 | 0,45 | 47,00 | 17,90 | 0,00 | 49,93 | 46,04 |
| 城市煤气 | 13,10 | 3,00 | 0,37 | 0,41 | 44,58 | 14,50 | 0,00 | 31,49 | 28,33 |
| 测试气体 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 | 0,00 |

10.6 Czech Republic | Tschechien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Zemní plyn H | 12,00 | 3,00 | 8,76 | 9,58 | 0,6300 | 0,0080 |
| Koksárenský plyn | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| LTO | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| TTO | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Propan | 13,70 | 3,00 | 23,8 | 25,95 | 0,6300 | 0,0080 |
| Hnědé uhlí | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Brikety | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Dřevěné pelety | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Černé uhlí | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| dřevo 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |

10.7 Denmark | Dänemark

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Naturgas | 12,00 | 13,00 | 8,76 | 9,57 | 0,6600 | 0,0100 |
| Koks-gas | 13,80 | 13,00 | 3,86 | 4,28 | 0,62 | 0,0110 |
| Koks | 20,00 | 8,00 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| Flaskegas | 13,80 | 3,00 | 22,3 | 24,36 | 0,6600 | 0,0080 |
| Letolie | 15,30 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Sværolie | 16,00 | 3,00 | 10,09 | 10,73 | 0,700 | 0,0070 |
| Brunkul | 19,20 | 8,00 | 4,01 | 4,09 | 0,9844 | 0,0000 |
| Briket | 19,30 | 8,00 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Kul | 18,50 | 8,00 | 7,90 | 8,13 | 0,6811 | 0,0000 |
| Træbriketter | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Træ 15%w | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |

10.8 France | *Frankreich*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|----------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gaz naturel H | 12,00 | 3,00 | 8,76 | 9,58 | 0,6650 | 0,0090 |
| Gaz de cokerie | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Gaz naturel | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Gaz de ville | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Fioul dom | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Fioul lourd | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Gaz liquéfié | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Lignite | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Bois 15%eau | 20,3 | 13,0 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Bois 30%eau | 20,3 | 13,0 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Bois 45%eau | 20,3 | 13,0 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Bois 60%eau | 20,3 | 13,0 | 1,82 | 1,85 | 0,5860 | 0,0199 |
| Pellets | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Houille | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |

10.9 Germany | *Deutschland*

| Brennstoff | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Heizöl EL | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Diesel | 15,50 | 3,00 | 10,35 | 11,17 | 0,6790 | 0,0069 |
| Heizöl S | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Erdgas | 11,90 | 3,00 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Flüssiggas | 13,70 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Koks | 20,30 | 13,00 | 7,64 | 7,66 | 0,7650 | 0,0000 |
| Brikett | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Braunkohle | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Steinkohle | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Kokereigas | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadtgas | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Holz 15% | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Holz 30% | 20,30 | 13,00 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Holz 45% | 20,30 | 13,00 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Holz 60% | 20,30 | 13,00 | 1,82 | 1,85 | 0,5860 | 0,0199 |
| Pellets | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Prüfgas | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |

10.10 Great Britain | Großbritannien

| Fuel | CO ₂ MAX [Vol. %] | O ₂ base [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|-------------|------------------------------|------------------------------|-----------------------|------------------------|--------|-----------------|---------------------------------|-------------------------|--------------------------|
| Natural Gas | 11.90 | 3.00 | 0.35 | 0.39 | 40.00 | 24.40 | 0.00 | 53.42 | 48.16 |
| Butan | 4.10 | 3.00 | 0.43 | 0.46 | 48.00 | 17.20 | 0.00 | 49.30 | 45.80 |
| Propane | 13.80 | 3.00 | 0.42 | 0.45 | 48.00 | 18.20 | 0.00 | 50.00 | 46.30 |
| Light Oil | 15.50 | 3.00 | 0.48 | 0.51 | 53.00 | 13.00 | 0.00 | 45.60 | 42.80 |
| Heavy Oil | 15.80 | 3.00 | 0.51 | 0.51 | 54.00 | 11.50 | 0.20 | 42.90 | 40.50 |
| Anthracit | 19.10 | 7.00 | 0.67 | 0.69 | 65.00 | 3.00 | 12.00 | 29.65 | 28.95 |
| Bagasse | 20.80 | 7.00 | 0.30 | 0.61 | 70.61 | 2.90 | 51.00 | 19.42 | 9.46 |
| Coke | 20.60 | 7.00 | 0.75 | 0.76 | 70.00 | 0.40 | 10.00 | 27.90 | 27.45 |
| Wood | 20.70 | 7.00 | 0.63 | 0.69 | 70.20 | 5.10 | 15.00 | 17.12 | 15.60 |
| Kerosene | 15.40 | 3.00 | 0.47 | 0.51 | 52.36 | 13.60 | 0.00 | 46.56 | 43.12 |
| Diesel | 15.60 | 3.00 | 0.49 | 0.53 | 53.00 | 12.90 | 0.00 | 44.62 | 41.80 |
| Coal | 18.40 | 7.00 | 0.62 | 0.65 | 63.00 | 4.00 | 13.00 | 26.75 | 25.50 |
| Test gas | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

10.11 Hungary | Ungarn

| Fuel | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------|------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Földgáz | 11,9 | 3,0 | 8,36 | 9,12 | 0,6600 | 0,0090 |
| Kokszgáz | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Városigáz | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Fűtőolaj könnyű | 15,4 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Dízel | 15,5 | 3,00 | 10,35 | 11,17 | 0,6790 | 0,0069 |
| LPG | 13,7 | 3,0 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Barnaszén | 19,8 | 8,0 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Brikett | 18,9 | 8,0 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Fa 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Kőszén | 20,5 | 8,0 | 7,81 | 7,82 | 0,7580 | 0,0000 |
| Fa pellet | 20,3 | 13,0 | 4,07 | 4,13 | 0,6200 | 0,0081 |

10.12 Italy | Italien

| Fuel | CO _{2max} [Vol.%] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|-----------------------|----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gas Nat. | 11,70 | 3,00 | 8,52 | 9,52 | 0,6600 | 0,0100 |
| GPL (misto) | 13,90 | 3,00 | 23,80 | 25,90 | 0,6300 | 0,0080 |
| Gasolio | 15,10 | 3,00 | 10,40 | 11,20 | 0,6800 | 0,0070 |
| Olio combustibile | 15,70 | 3,00 | 10,09 | 10,73 | 0,6800 | 0,0070 |
| Gas Cokeria | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Gas città | 11,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Coke | 20,00 | 8,00 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| GPL (butano) | 13,90 | 3,00 | 28,15 | 30,95 | 0,6300 | 0,0080 |
| Metano | 11,70 | 3,00 | 8,52 | 9,52 | 0,6600 | 0,0100 |
| GPL (propano) | 11,70 | 3,00 | 21,81 | 23,81 | 0,6300 | 0,0080 |
| Lignite | 19,20 | 8,00 | 5,26 | 5,40 | 0,9844 | 0,0000 |
| Mattonella di lignite | 19,30 | 8,00 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Antracite | 18,50 | 8,00 | 7,90 | 8,13 | 0,6811 | 0,0000 |
| Legno 15%w | 20,00 | 8,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Legno 30%w | 20,30 | 13,00 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Legno 45%w | 20,30 | 13,00 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Legno/Pellets | 20,00 | 8,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Trucioli Legno | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Biomassa 30% | 20,30 | 11,00 | 3,79 | 3,84 | 0,7017 | 0,0149 |

10.13 Japan | Japan

| Fuel | CO _{2max} [Vol.%] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|----------|----------------------------|------------------------|-----------------------|-------------------|---------|--------|
| 13A | 12,20 | 5,00 | 9,96 | 10,95 | 0,7634 | 0,0036 |
| 6C | 13,10 | 5,00 | 3,92 | 4,06 | 0,6947 | 0,0068 |
| 7° ⅡΛ° Ⅰ | 13,80 | 5,00 | 22,13 | 23,9 | 0,7411 | 0,003 |
| ⅠⅠⅠ | 15,10 | 5,00 | 10,49 | 11,37 | 0,7455 | 0,0024 |
| ⅠⅠⅠⅠ | 15,80 | 5,00 | 10,05 | 10,68 | 0,7285 | 0,0022 |
| CⅠⅠⅠⅠ | 16,00 | 5,00 | 9,65 | 10,25 | 0,7285 | 0,0021 |
| 7° ⅡΛ° Ⅰ | 13,70 | 5,00 | 22,31 | 24,37 | 0,36570 | 0,0074 |
| ⅠⅠⅠⅠⅠⅠⅠ | 0,00 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |

10.14 Latin America | Latein-Amerika

| Fuel | CO ₂ MAX [Vol. %] | O ₂ base [Vol. %] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|-----------------------|---------------------------------|---------------------------------|--------------------------|---------------------------|--------|--------------------|------------------------------------|----------------------------|--------------------------|
| Gas Nat. | 11.90 | 3.00 | 0.35 | 0.39 | 40.00 | 24.40 | 0.00 | 53.42 | 48.16 |
| Propane | 13.80 | 3.00 | 0.42 | 0.45 | 48.00 | 18.20 | 0.00 | 50.00 | 46.30 |
| Coque | 20.60 | 7.00 | 0.75 | 0.76 | 70.00 | 0.40 | 10.00 | 27.90 | 27.45 |
| Combustible pesado | 15.80 | 3.00 | 0.51 | 0.51 | 54.00 | 11.50 | 0.20 | 42.90 | 40.50 |
| Combustible ligero | 15.50 | 3.00 | 0.48 | 0.51 | 53.00 | 13.00 | 0.00 | 45.60 | 42.80 |
| Diesel | 15.60 | 3.00 | 0.49 | 0.53 | 53.00 | 12.90 | 0.00 | 44.62 | 41.80 |
| Madera | 20.70 | 7.00 | 0.63 | 0.69 | 70.20 | 5.10 | 15.00 | 17.12 | 15.60 |
| Madera 30% | 20,30 | 7,00 | 0,63 | 0,68 | 69,86 | 4,20 | 30,00 | 14,08 | 13,16 |
| Madera 45% | 20,30 | 7,00 | 0,61 | 0,65 | 69,86 | 3,30 | 45,00 | 11,57 | 10,84 |
| Madera 60% | 20,30 | 7,00 | 0,56 | 0,60 | 69,86 | 2,40 | 60,00 | 9,05 | 8,52 |
| Carbón | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |
| Bagazo | 20.80 | 7.00 | 0.30 | 0.61 | 70.61 | 2.90 | 51.00 | 19.42 | 9.46 |
| Pellets | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |

10.15 Netherlands | Niederlande

| Fuel | CO ₂ max [Vol. %] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Aardgas Hb | 11,70 | 3,00 | 7,71 | 8,43 | 0,6230 | 0,0080 |
| Aardgas Ho | 11,70 | 3,00 | 7,71 | 8,43 | 0,6910 | 0,0090 |
| Propaan Hb | 13,70 | 3,00 | 22,30 | 24,40 | 0,6190 | 0,0066 |
| Propaan Ho | 13,70 | 3,00 | 22,30 | 24,40 | 0,6730 | 0,0070 |
| Stookolie EL | 15,50 | 3,00 | 10,52 | 11,30 | 0,6800 | 0,0070 |
| Cokes | 20,00 | 6,00 | 7,64 | 7,70 | 0,7770 | 0,0000 |
| Bruinkool | 19,20 | 6,00 | 5,26 | 5,40 | 0,9840 | 0,0000 |
| Antraciet | 18,50 | 6,00 | 7,90 | 8,10 | 0,7490 | 0,0000 |
| Hout 15%w | 20,00 | 6,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Diesel | 15,60 | 3,00 | 10,35 | 11,17 | 0,6790 | 0,0069 |
| G20 | 11,70 | 3,00 | 8,55 | 9,56 | 0,6540 | 0,0089 |
| G25 | 11,50 | 3,00 | 7,50 | 8,22 | 0,7030 | 0,0094 |
| G30 | 14,00 | 3,00 | 29,46 | 32,07 | 0,6960 | 0,0076 |
| Testgas | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |

10.16 Poland | *Polen*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|----------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gaz koksow | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| DrewnoKoks | 20,30 | 13,00 | 7,64 | 7,66 | 0,7655 | 0,0000 |
| W.kamienny | 20,50 | 8,00 | 7,64 | 7,66 | 0,7580 | 0,0000 |
| Gaz GZ 50 | 11,80 | 3,00 | 8,47 | 9,44 | 0,6600 | 0,0110 |
| Gaz GZ41.5 | 11,50 | 3,00 | 7,24 | 7,89 | 0,6700 | 0,0110 |
| Gaz GZ 35 | 11,30 | 3,00 | 6,47 | 6,90 | 0,6800 | 0,0110 |
| GazMiejski | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Gaz plynny | 13,70 | 3,00 | 22,30 | 24,40 | 0,6300 | 0,0080 |
| Olej op. lekki | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Olej op.S | 15,90 | 3,00 | 10,09 | 10,73 | 0,8057 | 0,0000 |
| Brykiety | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| W.brunatny | 19,80 | 8,00 | 5,61 | 5,69 | 0,9545 | 0,0000 |
| Drewno 15%w | 20,30 | 13,00 | 3,87 | 3,93 | 0,686 | 0,0096 |
| Pellets | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |

10.17 Portugal | *Portugal*

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Gas Nat. | 11,90 | 3,00 | 9,63 | 10,61 | 0,6688 | 0,0097 |
| Gas de coque | 10,30 | 3,00 | 3,86 | 4,28 | 1,0194 | 0,0000 |
| Coque | 20,00 | 13,00 | 7,64 | 7,66 | 0,5985 | 0,0000 |
| Gas Cidade | 12,10 | 3,00 | 3,61 | 3,90 | 0,8678 | 0,0000 |
| Butano | 14,00 | 3,00 | 29,55 | 32,17 | 0,5685 | 0,0097 |
| Propano | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Gasoleo A | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| Gasoleo C | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| F-Oleo n1 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| F-Oleo n2 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| Antracite | 18,50 | 8,00 | 8,37 | 8,55 | 0,7719 | 0,0000 |
| Bagaço | 15,90 | 8,00 | 5,31 | 5,72 | 0,8250 | 0,0133 |
| LinHITE | 19,20 | 8,00 | 4,01 | 4,09 | 0,6234 | 0,0000 |
| Briquete | 19,30 | 8,00 | 5,09 | 5,17 | 0,6202 | 0,0000 |
| Hulha | 18,50 | 8,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Madeira | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Gás padrão | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Etanol | 14,40 | 3,00 | 6,79 | 7,44 | 0,692 | 0,0105 |
| Metanol | 15,20 | 3,00 | 4,65 | 5,05 | 0,654 | 0,0122 |
| Biodiesel 5 | 15,40 | 3,00 | 10,48 | 11,19 | 0,6400 | 0,0065 |
| Pellets | 20,70 | 8,00 | 3,84 | 3,90 | 0,6750 | 0,0095 |

10.18 Republic of Korea | Korea

| Fuel | CO ₂ MAX [Vol.%] | O ₂ base [Vol.%] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|------|--------------------------------|--------------------------------|-----------------------|---------------------------|--------|--------------------|------------------------------------|-------------------------|-----------------------------|
| 천연가스 | 11,90 | 3,00 | 0,35 | 0,39 | 40,00 | 24,40 | 0,00 | 53,42 | 48,16 |
| 부탄 | 14,10 | 3,00 | 0,43 | 0,46 | 48,00 | 17,20 | 0,00 | 49,30 | 45,80 |
| 프로판 | 13,80 | 3,00 | 0,42 | 0,45 | 48,00 | 18,20 | 0,00 | 50,00 | 46,30 |
| 경유 | 15,50 | 3,00 | 0,48 | 0,51 | 53,00 | 13,00 | 0,00 | 45,60 | 42,80 |
| 중유 | 15,80 | 3,00 | 0,50 | 0,5 | 54,00 | 11,50 | 0,20 | 42,90 | 40,50 |
| 무연탄 | 19,10 | 7,00 | 0,67 | 0,69 | 65,00 | 3,00 | 12,00 | 29,65 | 28,95 |
| 바가스 | 20,80 | 7,00 | 0,30 | 0,61 | 70,61 | 2,90 | 51,00 | 19,42 | 9,46 |
| 코크스 | 20,60 | 7,00 | 0,75 | 0,76 | 70,00 | 0,40 | 10,00 | 27,90 | 27,45 |
| 나무 | 20,70 | 7,00 | 0,63 | 0,69 | 70,20 | 5,10 | 15,00 | 17,12 | 15,60 |
| 등유 | 15,40 | 3,00 | 0,47 | 0,51 | 52,36 | 13,630 | 0,00 | 46,66 | 43,12 |
| 디젤 | 15,60 | 3,00 | 0,49 | 0,53 | 53,00 | 12,90 | 0,00 | 44,62 | 41,80 |
| 석탄 | 18,40 | 7,00 | 0,62 | 0,65 | 63,00 | 4,00 | 13,00 | 26,75 | 25,50 |

10.19 Romania | Rumänien

| Fuel | CO ₂ max [Vol.%] | O ₂ base [%] | VAG trmin | V _L min | A2 | B |
|--------------------|-----------------------------|-------------------------|-----------|--------------------|--------|--------|
| Gaz natural H | 12,00 | 3,00 | 8,76 | 9,58 | 0,665 | 0,0090 |
| Gaz de cocserie | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Gaz oraş | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Motorină | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Păcură | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| GPL (amestec) | 13,7 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Lignit | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Brichete | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Peleţi | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Lemn 15%w | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Cărbune | 20,50 | 8,00 | 7,81 | 7,82 | 07580 | 0,0000 |

10.20 Spain | Spanien

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|--------------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| GasNatural | 11,90 | 3,00 | 9,63 | 10,61 | 0,6866 | 0,0097 |
| GasdeCoque | 10,30 | 3,00 | 3,86 | 4,28 | 1,0194 | 0,0000 |
| Coque | 20,00 | 13,00 | 7,64 | 7,66 | 0,5985 | 0,0000 |
| Gas ciudad | 12,10 | 3,00 | 3,61 | 3,90 | 0,8678 | 0,0000 |
| Butano | 14,00 | 3,00 | 29,55 | 32,17 | 0,5826 | 0,0097 |
| Propano | 13,70 | 3,00 | 22,30 | 24,36 | 0,6688 | 0,0097 |
| Gasoleo A | 15,50 | 3,00 | 10,53 | 11,26 | | |
| Gasoleo C | 15,50 | 3,00 | 10,53 | 11,26 | 0,6710 | 0,0069 |
| F-Oleo n1 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6710 | 0,0069 |
| F-Oleo n2 | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| Combustible pesado | 15,90 | 3,00 | 10,09 | 10,73 | 0,6815 | 0,0067 |
| Antracita | 18,50 | 8,00 | 8,37 | 8,55 | 0,6234 | 0,0000 |
| Bagazo | 15,90 | 8,00 | 5,31 | 5,72 | 0,6815 | 0,0067 |
| Lignito | 19,20 | 8,00 | 4,01 | 4,09 | 0,6202 | 0,0000 |
| Briquita | 19,30 | 8,00 | 5,09 | 5,17 | 0,5985 | 0,0000 |
| Carbón | 18,50 | 8,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Madera | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Gas patrón | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |
| Etanol | 14,40 | 3,00 | 6,79 | 7,44 | 0,6860 | 0,0096 |
| Metanol | 15,20 | 3,00 | 4,65 | 5,05 | 0,6920 | 0,0105 |
| Biomasa 5 | 15,40 | 3,00 | 10,48 | 11,19 | 0,6540 | 0,0122 |

10.21 Sweden | Schweden

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|------------|-----------------------------|------------------------|-----------------------|-------------------|--------|--------|
| Naturgas | 12,00 | 3,00 | 8,76 | 9,58 | 0,6650 | 0,0090 |
| Koksgas | 10,30 | 3,00 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Stadsgas | 13,60 | 3,00 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Eldn.olja1 | 15,40 | 3,00 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Eldn.olja3 | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| LPG | 13070 | 3,00 | 23,80 | 25,95 | 0,6300 | 0,0080 |
| Brunkol | 19,80 | 8,00 | 4,01 | 4,09 | 0,9550 | 0,0000 |
| Briketter | 18,90 | 8,00 | 5,08 | 5,20 | 0,8330 | 0,0000 |
| Träpellets | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Trä 15%w | 20,30 | 13,00 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Trä 30%w | 20,30 | 13,00 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Trä 45%w | 20,30 | 13,00 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Trä 60%w | 20,30 | 13,00 | 1,82 | 1,85 | 0,586 | 0,0199 |
| Kol | 20,50 | 8,00 | 7,81 | 7,82 | 0,7580 | 0,0000 |

10.22 Swiss | Schweiz

| Brennstoff | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG tmin} | V _{Lmin} | A2 | B |
|-------------|-----------------------------|------------------------|----------------------|-------------------|--------|--------|
| Heizöl EL | 15,5 | 3,0 | 10,53 | 11,26 | 0,6800 | 0,0070 |
| Erdgas H | 12,0 | 3,0 | 8,76 | 9,57 | 0,6600 | 0,0080 |
| Butan | 13,9 | 3,0 | 29,55 | 32,17 | 0,6300 | 0,0080 |
| Holzpellets | 20,3 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| Holz 15%w | 20,3 | 13,0 | 3,87 | 3,93 | 0,6860 | 0,0096 |
| Holz 30%w | 20,3 | 13,0 | 3,19 | 3,24 | 0,6640 | 0,0118 |
| Holz 45%w | 20,3 | 13,0 | 2,50 | 2,54 | 0,6340 | 0,0150 |
| Holz 60%w | 20,3 | 13,0 | 1,82 | 1,85 | 0,5860 | 0,0199 |
| Heizöl S | 15,90 | 3,00 | 10,09 | 10,73 | 0,8060 | 0,0000 |
| Stadtgas | 13,6 | 3,0 | 3,61 | 3,90 | 0,6300 | 0,0110 |
| Kokereigas | 10,3 | 3,0 | 3,86 | 4,28 | 0,6000 | 0,0110 |
| Koks | 20,0 | 13,0 | 7,64 | 7,66 | 0,7770 | 0,0000 |
| Brikett | 19,3 | 8,0 | 5,09 | 5,17 | 0,8161 | 0,0000 |
| Braunkohle | 19,2 | 8,0 | 4,01 | 4,09 | 0,9844 | 0,0000 |
| Fettkohle | 18,5 | 8,0 | 7,90 | 8,13 | 0,8400 | 0,0000 |
| Prüfgas | 0,0 | 0,0 | 0,00 | 0,00 | 0,0000 | 0,0000 |

10.23 Turkey | Türkiye

| Fuel | CO _{2max} [Vol. %] | O _{2base} [%] | V _{AG tmin} | V _{Lmin} | A2 | B |
|----------------|-----------------------------|------------------------|----------------------|-------------------|--------|--------|
| Dogal Gaz | 12,00 | 3,00 | 8,76 | 9,58 | 0,665 | 0,0090 |
| Bütan | 14,00 | 3,00 | 30,07 | 32,40 | 0,666 | 0,0100 |
| Propan | 13,70 | 3,00 | 22,30 | 24,36 | 0,5826 | 0,0097 |
| Kok Kömürü | 20,30 | 13,00 | 7,64 | 7,66 | 0,765 | 0,0000 |
| Hafif Yağ | 15,40 | 3,00 | 10,53 | 11,26 | 0,680 | 0,0070 |
| Ağır yağ | 15,90 | 3,00 | 10,09 | 10,73 | 0,806 | 0,0000 |
| Taş kömürü | 18,50 | 7,00 | 8,37 | 8,55 | 0,7719 | 0,0000 |
| Bagasse | 15,90 | 7,00 | 5,31 | 5,72 | 0,8250 | 0,0133 |
| Kömür | 18,50 | 7,00 | 7,90 | 8,13 | 0,7719 | 0,0000 |
| Odun topakları | 20,30 | 13,00 | 4,07 | 4,13 | 0,6200 | 0,0081 |
| TestGazı | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |

10.24 USA | USA

| Fuel | CO ₂ max [Vol.%] | O ₂ base [%] | V _{AG trmin} | V _{Lmin} | A2 | B |
|---------------|--------------------------------|-------------------------|-----------------------|-------------------|--------|--------|
| Natur_gas | 11,70 | 3,00 | 7,91 | 8,7 | 0,5924 | 0,0010 |
| Butane | 14,10 | 3,00 | 29,55 | 32,17 | 0,6000 | 0,0013 |
| Propane | 13,80 | 3,00 | 22,31 | 24,37 | 0,5978 | 0,0013 |
| Diesel | 15,60 | 3,00 | 10,35 | 11,17 | 0,6360 | 0,0064 |
| Fueloil #5 | 16,30 | 3,00 | 10,14 | 10,70 | 0,6275 | 0,0018 |
| Fueloil #6 | 16,70 | 3,00 | 9,84 | 10,30 | 0,6375 | 0,0019 |
| Kerosene | 15,10 | 3,00 | 10,47 | 11,20 | 0,6159 | 0,0016 |
| Anthracite | 19,90 | 7,00 | 8,37 | 8,60 | 0,6964 | 0,0027 |
| Bituminous | 18,50 | 7,00 | 5,30 | 5,40 | 0,6729 | 0,0024 |
| Distillate #1 | 15,40 | 3,00 | 10,50 | 11,25 | 0,6312 | 0,0017 |
| Wood 10%M. | 20,00 | 7,00 | 4,09 | 4,10 | 0,6194 | 0,0024 |
| Wood 20%M. | 20,00 | 7,00 | 3,64 | 3,66 | 0,6194 | 0,0024 |
| Wood 30%M. | 20,00 | 7,00 | 3,18 | 3,20 | 0,6194 | 0,0024 |
| Wood 40%M. | 20,00 | 7,00 | 2,73 | 2,75 | 0,6194 | 0,0024 |
| Bark 15%M. | 20,00 | 7,00 | 3,87 | 3,90 | 0,6669 | 0,0026 |
| Bark 30%M. | 20,00 | 7,00 | 3,18 | 3,20 | 0,6669 | 0,0026 |
| Bark 45%M. | 20,00 | 7,00 | 2,50 | 2,52 | 0,6669 | 0,0026 |
| Bark 60%M. | 20,00 | 7,00 | 1,82 | 1,83 | 0,6669 | 0,0026 |
| Bioheat 5 | 15,40 | 3,00 | 10,48 | 11,19 | 0,6000 | 0,0061 |
| Bioheat 12 | 15,40 | 3,00 | 10,38 | 11,07 | 0,6000 | 0,0061 |
| Bioheat 20 | 15,40 | 3,00 | 10,26 | 10,94 | 0,5900 | 0,0061 |
| Test gas | 0,00 | 0,00 | 0,00 | 0,00 | 0,0000 | 0,0000 |

10.25 Vietnam | Vietnam

| Fuel | CO ₂ MAX [Vol.%] | O ₂ base [Vol.%] | K _{gr} [1/K] | K _{net} [1/K] | K1 [-] | H [% by weight] | MH ₂ O [% by weight] | Q _{gr} [MJ/kg] | Q _{net} [MJ/kg] |
|-------------|--------------------------------|--------------------------------|--------------------------|---------------------------|--------|--------------------|------------------------------------|----------------------------|--------------------------|
| Natural Gas | 11.90 | 3.00 | 0.35 | 0.39 | 40.00 | 24.40 | 0.00 | 53.42 | 48.16 |
| Butan | 4.10 | 3.00 | 0.43 | 0.46 | 48.00 | 17.20 | 0.00 | 49.30 | 45.80 |
| Propane | 13.80 | 3.00 | 0.42 | 0.45 | 48.00 | 18.20 | 0.00 | 50.00 | 46.30 |
| Light Oil | 15.50 | 3.00 | 0.48 | 0.51 | 53.00 | 13.00 | 0.00 | 45.60 | 42.80 |
| Heavy Oil | 15.80 | 3.00 | 0.51 | 0.51 | 54.00 | 11.50 | 0.20 | 42.90 | 40.50 |
| Anthracit | 19.10 | 7.00 | 0.67 | 0.69 | 65.00 | 3.00 | 12.00 | 29.65 | 28.95 |
| Bagasse | 20.80 | 7.00 | 0.30 | 0.61 | 70.61 | 2.90 | 51.00 | 19.42 | 9.46 |
| Coke | 20.60 | 7.00 | 0.75 | 0.76 | 70.00 | 0.40 | 10.00 | 27.90 | 27.45 |
| Wood | 20.70 | 7.00 | 0.63 | 0.69 | 70.20 | 5.10 | 15.00 | 17.12 | 15.60 |
| Kerosene | 15.40 | 3.00 | 0.47 | 0.51 | 52.36 | 13.60 | 0.00 | 46.56 | 43.12 |
| Diesel | 15.60 | 3.00 | 0.49 | 0.53 | 53.00 | 12.90 | 0.00 | 44.62 | 41.80 |
| Coal | 18.40 | 7.00 | 0.62 | 0.65 | 63.00 | 4.00 | 13.00 | 26.75 | 25.50 |
| Test gas | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Rice husk | 22.40 | 7.0 | 0.72 | 0.77 | 76.00 | 3.00 | 9.80 | 12.98 | 12.21 |