Table A-1.13-1  Lower Heating Value

<table>
<thead>
<tr>
<th>Component</th>
<th>Formula</th>
<th>Molar Fraction, $x_i$</th>
<th>Molecular Weight, $MW_i$</th>
<th>$x_i * MW_i$</th>
<th>Net Heating Value, $h_f$</th>
<th>$x_i * MW_i / h_f$</th>
<th>$\Sigma x_i * MW_i / h_f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>$\text{CH}_4$</td>
<td>82.78</td>
<td>16.043</td>
<td>13.280</td>
<td>21,511.9</td>
<td>285,687</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>$\text{C}_2\text{H}_6$</td>
<td>10.92</td>
<td>30.069</td>
<td>3.284</td>
<td>20,429.2</td>
<td>67,080</td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>$\text{C}_3\text{H}_8$</td>
<td>5.00</td>
<td>44.096</td>
<td>2.205</td>
<td>19,922.2</td>
<td>43,924</td>
<td></td>
</tr>
<tr>
<td>Isobutane</td>
<td>$\text{C}<em>4\text{H}</em>{10}$</td>
<td>0.50</td>
<td>58.122</td>
<td>0.291</td>
<td>19,589.8</td>
<td>5,693</td>
<td></td>
</tr>
<tr>
<td>n-Butane</td>
<td>$\text{C}<em>4\text{H}</em>{10}$</td>
<td>0.50</td>
<td>58.122</td>
<td>0.291</td>
<td>19,657.8</td>
<td>5,713</td>
<td></td>
</tr>
<tr>
<td>Isopentane</td>
<td>$\text{C}<em>5\text{H}</em>{12}$</td>
<td>0.10</td>
<td>72.149</td>
<td>0.072</td>
<td>19,655.9</td>
<td>1,404</td>
<td></td>
</tr>
<tr>
<td>n-Pentane</td>
<td>$\text{C}<em>5\text{H}</em>{12}$</td>
<td>0.20</td>
<td>72.149</td>
<td>0.144</td>
<td>19,497.2</td>
<td>2,813</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.00</td>
<td></td>
<td>19,567</td>
<td></td>
<td>412,314</td>
<td></td>
</tr>
</tbody>
</table>

Table A-1.14-1  Higher Heating Value

<table>
<thead>
<tr>
<th>Component</th>
<th>Formula</th>
<th>Molar Fraction, $x_i$, %</th>
<th>Molecular Weight, $MW_i$</th>
<th>$x_i * MW_i$</th>
<th>Gross Heating Value, $H_f$</th>
<th>$x_i * MW_i / H_f$</th>
<th>$\Sigma x_i * MW_i / H_f$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>$\text{CH}_4$</td>
<td>82.78</td>
<td>16.043</td>
<td>13.280</td>
<td>21,511.9</td>
<td>285,687</td>
<td></td>
</tr>
<tr>
<td>Ethane</td>
<td>$\text{C}_2\text{H}_6$</td>
<td>10.92</td>
<td>30.069</td>
<td>3.284</td>
<td>21,334.1</td>
<td>73,339</td>
<td></td>
</tr>
<tr>
<td>Propane</td>
<td>$\text{C}_3\text{H}_8$</td>
<td>5.00</td>
<td>44.096</td>
<td>2.205</td>
<td>21,654.1</td>
<td>47,743</td>
<td></td>
</tr>
<tr>
<td>Isobutane</td>
<td>$\text{C}<em>4\text{H}</em>{10}$</td>
<td>0.50</td>
<td>58.122</td>
<td>0.291</td>
<td>21,232.3</td>
<td>6,170</td>
<td></td>
</tr>
<tr>
<td>n-Butane</td>
<td>$\text{C}<em>4\text{H}</em>{10}$</td>
<td>0.50</td>
<td>58.122</td>
<td>0.291</td>
<td>21,300.2</td>
<td>6,190</td>
<td></td>
</tr>
<tr>
<td>Isopentane</td>
<td>$\text{C}<em>5\text{H}</em>{12}$</td>
<td>0.10</td>
<td>72.149</td>
<td>0.072</td>
<td>21,043.7</td>
<td>1,518</td>
<td></td>
</tr>
<tr>
<td>n-Pentane</td>
<td>$\text{C}<em>5\text{H}</em>{12}$</td>
<td>0.20</td>
<td>72.149</td>
<td>0.144</td>
<td>21,085.0</td>
<td>3,043</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>100.00</td>
<td></td>
<td>19,567</td>
<td></td>
<td>416,297</td>
<td></td>
</tr>
</tbody>
</table>

A-1.15 Sensible Heat

The heat rate for this sample calculation includes the consideration of sensible heat with an actual fuel temperature of 80°F, and a specified reference fuel temperature of 60°F. Equation (5-3.16) may be used. From that equation, $h_f = 11.4$ Btu/lb, and $h_{ref} = 0$ Btu/lb.

$SH = M(h_f - h_{ref}) = 54,545.4 \times (11.4 - 0) = 621,818$ Btu/hr

A-1.16 Total Heat Input (LHV)

$HI = LHV \cdot M_f + SH = 21,072 \times 54,545.4 + 621,818 = 1,150.0$ MMBtu/hr

A-2 Calculation of Electrical Output

This section provides a sample calculation of the test electrical output for a three-wattmeter method.

A-2.1 VT Test Data

For VT test data, see Table A-2.1-1.

A-2.2 VT Calibration Data

For VT calibration data, see Table A-2.2-1.

A-2.3 VT Voltage Drop

For VT voltage drop data, see Table A-2.3-1.

A-2.4 CT Corrections

For CT corrections, see Table A-2.4-1.

A-2.5 Gross Generation

For gross generation data, see Table A-2.5-1.

A-2.6 Corrected Secondary Watts

For corrected secondary watts data, see Table A-2.6-1.

A-3 Calculation of Corrected Performance

(Power, Heat Rate, Exhaust Temperature, and Exhaust Flow)

See Tables A-3-1 through A-3-5.

A-4 Calculation of Transformer Loss

The losses through a transformer are determined by

$\text{Loss}_{\text{TOTAL}} = \text{Loss}_{\text{NO-LOAD}} + \text{Loss}_{\text{LOAD}}$

where

$\text{Loss}_{\text{TOTAL}} = \text{total transformer losses in kW}$

$\text{Loss}_{\text{NO-LOAD}} = \text{transformer no-load losses in kW}$

$\text{Loss}_{\text{LOAD}} = \text{transformer load losses in kW}$