

# ISO 13579-1:2013-01 (E)

## Industrial furnaces and associated processing equipment - Method of measuring energy balance and calculating efficiency - Part 1: General methodology

<b>Contents</b>		<b>Page</b>
<b>Foreword</b>	.....	<b>v</b>
<b>Introduction</b>	.....	<b>vi</b>
<b>1 Scope</b>	.....	<b>1</b>
<b>2 Normative references</b>	.....	<b>1</b>
<b>3 Terms and definitions</b>	.....	<b>1</b>
<b>5 Basic principles</b>	.....	<b>10</b>
<b>5.1 General</b>	.....	<b>10</b>
<b>5.2 Energy flow diagram</b>	.....	<b>13</b>
<b>5.3 Process Heating Assessment Survey Tool</b>	.....	<b>13</b>
<b>6 Basic conditions of measurement and calculation</b>	.....	<b>14</b>
<b>6.1 State of furnace</b>	.....	<b>14</b>
<b>6.2 Duration of measurement</b>	.....	<b>14</b>
<b>6.3 Unit of specific energy consumption</b>	.....	<b>14</b>
<b>6.4 Reference conditions</b>	.....	<b>14</b>
<b>6.5 Unit of amount of gas</b>	.....	<b>14</b>
<b>6.6 Fuel</b>	.....	<b>14</b>
<b>7.1 General</b>	.....	<b>15</b>
<b>7.2 Energy balance</b>	.....	<b>15</b>
<b>7.3 Thermal energy balance</b>	.....	<b>17</b>
<b>7.4 Energy balance of electrical generation</b>	.....	<b>18</b>
<b>7.5 Recycled energy</b>	.....	<b>18</b>
<b>8 Measurement method</b>	.....	<b>18</b>
<b>8.1 General</b>	.....	<b>18</b>
<b>8.2 Fuel</b>	.....	<b>19</b>
<b>8.3 Atomization agent</b>	.....	<b>19</b>
<b>8.4 Combustion air and exhaust gas</b>	.....	<b>20</b>
<b>8.5 Controlled atmospheric gas</b>	.....	<b>24</b>
<b>8.6 Products and jigs/fixtures for product handling</b>	.....	<b>25</b>
<b>8.7 Temperature of furnace surface</b>	.....	<b>25</b>
<b>8.8 Furnace inner wall temperature</b>	.....	<b>25</b>
<b>8.9 Inner furnace pressure</b>	.....	<b>26</b>
<b>8.10 Cooling water</b>	.....	<b>26</b>
<b>8.11 Electrical auxiliary equipment</b>	.....	<b>26</b>
<b>8.12 Generation of utilities</b>	.....	<b>26</b>
<b>8.13 Recycled energy</b>	.....	<b>26</b>
<b>9 Calculation</b>	.....	<b>26</b>
<b>9.1 General provisions</b>	.....	<b>26</b>
<b>9.2 Total energy input</b>	.....	<b>27</b>
<b>9.3 Total energy output</b>	.....	<b>30</b>
<b>9.4 Total energy efficiency</b>	.....	<b>35</b>
<b>10 Energy balance evaluation report</b>	.....	<b>36</b>

<b>Annex A (informative) Assessment of uncertainty of the total energy efficiency .....</b>	<b>37</b>
<b>Annex B (informative) Measurement method concerning regenerative burners .....</b>	<b>39</b>
<b>Annex C (informative) Reference data .....</b>	<b>40</b>
<b>Annex D (informative) Calculation of moisture content of fuel and air .....</b>	<b>49</b>
<b>Annex E (informative) Calculations of heat storage of furnace wall, furnace wall temperature profile and heat loss by furnace wall in serial batch-type furnace process .....</b>	<b>50</b>
<b>Annex F (informative) Calculation of wall loss and heat loss of discharged blowout from furnace opening .....</b>	<b>56</b>
<b>Annex G (informative) Calculation of energy for fluid transfer .....</b>	<b>60</b>
<b>Annex H (informative) Example of energy balance sheet .....</b>	<b>63</b>
<b>Bibliography .....</b>	<b>65</b>