

# DIN EN 15316-4-1:2017-09 (E)

## Energy performance of buildings - Method for calculation of system energy requirements and system efficiencies - Part 4-1: Space heating and DHW generation systems, combustion systems (boilers, biomass), Module M3-8-1, M8-8-1

---

<b>Contents</b>		<b>Page</b>
European foreword .....		4
Introduction .....		5
<b>1</b>	<b>Scope .....</b>	<b>7</b>
<b>2</b>	<b>Normative references .....</b>	<b>9</b>
<b>3</b>	<b>Terms and definitions .....</b>	<b>9</b>
<b>4</b>	<b>Symbols and abbreviations .....</b>	<b>10</b>
4.1	Symbols .....	10
4.2	Abbreviations and indices .....	11
<b>5</b>	<b>Description of the method .....</b>	<b>11</b>
5.1	Output of the method .....	11
5.2	General description of the method .....	12
5.3	Input data .....	13
5.4	Boundaries between distribution and generation sub-system .....	15
5.5	Default values .....	16
5.5.1	Default values for generator efficiency at full load and intermediate load as a function of the generator power output .....	16
5.5.2	Default value for the stand-by heat losses $f_{gen;ls;P0}$ as a function of the generator power output .....	16
5.5.3	Auxiliary energy .....	16
5.6	Product values .....	17
5.7	Measured values .....	17
5.7.1	Boiler efficiencies from measured values .....	17
5.7.2	Measured total thermal losses, power input and calculated gains .....	17
5.7.3	Additional default data and calculation for condensing boilers .....	18
5.7.4	Thermal losses through the chimney with the burner on at full load $f_{ch;on}$ .....	19
5.7.5	Thermal losses through the generator envelope $f_{gen;env}$ .....	19
5.7.6	Thermal losses through the chimney with the burner off $f_{ch;off}$ .....	20
5.8	Boiler rated output .....	20
<b>6</b>	<b>Generation sub-system basic energy balance .....</b>	<b>20</b>
6.1	Heat balance .....	20
6.2	Expenditure factor .....	20
6.3	Equation fuel heat input .....	21
6.4	Generator auxiliary energy .....	21
6.5	Generator losses .....	21
6.5.1	Generator loss .....	21
6.5.2	Generator thermal loss at specific load ratio $H_{gen}$ and power output $P_x$ .....	21
6.5.3	Generator thermal loss calculation at full load .....	22
6.5.4	Generator thermal loss calculation at intermediate load .....	22
6.5.5	Generator thermal loss calculation at 0 % load .....	23
6.5.6	Correction factor by additional tests .....	23
6.6	Recoverable thermal losses .....	23
6.6.1	general .....	23

6.6.2	Generator thermal losses through the jacket (generator envelope) .....	23
6.6.3	Recoverable thermal losses out of auxiliary energy .....	23
6.7	Recovered auxiliary energy .....	24
6.8	Auxiliary energy .....	24
6.9	Generator thermal output .....	24
6.10	Heating time and load factor .....	25
6.11	Direct heated DHW heaters .....	25
6.11.1	Instantaneous electrical water heater .....	25
6.11.2	Gas-fired domestic storage water heaters .....	26
6.11.3	Boundary conditions for the default values .....	26
6.12	Method for domestic hot water appliance, tested with 24 h tapping cycles .....	27
Annex A (informative)	Additional formulas and default values for parametering the boiler efficiency method .....	29
A.1	Information on the method .....	29
A.1.1	Generator efficiencies and stand-by losses .....	29
A.1.2	Auxiliary energy .....	33
A.1.3	Recoverable generation thermal losses and boiler location .....	34
A.2	Conversion of the energy content of energy carriers .....	34
A.3	Deviation from default values .....	35
A.4	Fuel constants for flue gas measurement depending on Siegert constants .....	35
A.5	Default values for calculation of thermal losses through the chimney with the burner off .....	37
A.6	Additional default data and calculation for condensing boilers .....	38
A.7	Additional default data for generator output and losses .....	39
A.8	Additional default data and calculation for water heaters .....	39
Annex B (informative)	Additional formulas and default values for parametering the boiler efficiency method .....	40
B.1	Information on the method .....	40
B.1.1	Generator efficiencies and stand-by losses .....	40
B.1.2	Auxiliary energy .....	44
B.1.3	Recoverable generation thermal losses and boiler location .....	46
B.2	Conversion of the energy content of energy carriers .....	46
B.3	Deviation from default values .....	47
B.4	Fuel constants for flue gas measurement depending on Siegert constants .....	47
B.5	Default values for calculation of thermal losses through the chimney with the burner off .....	49
B.6	Additional default data and calculation for condensing boilers .....	50
B.7	Additional default data for generator output and losses .....	51
B.8	Additional default data and calculation for water heaters .....	51
Annex C (informative)	General part default values and information .....	53
Bibliography	.....	54