

ISO 13579-4:2013-01 (E)

Industrial furnaces and associated processing equipment - Method of measuring energy balance and calculating efficiency - Part 4: Furnaces with protective or reactive atmosphere

Contents		Page
Foreword		v
Introduction		vi
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
3.1	Terms relating to type of energy used in this part of ISO 13579	2
4	Symbols	5
5	Basic principles	7
5.1	General	7
5.2	Energy flow diagram	10
5.3	Process Heating Assessment Survey Tool	10
6	Basic conditions of measurement and calculation	10
6.1	State of furnace	10
6.2	Duration of measurement	10
6.3	Unit of specific energy intensity	10
6.4	Reference conditions	10
6.5	Unit of amount of gas	10
6.6	Fuel	10
7	Type of energy used in this part of ISO 13579	10
7.1	General	10
7.2	Energy balance	10
7.3	Thermal energy balance	12
7.4	Energy balance of electrical generation	13
7.5	Recycled energy	14
8	Measurement method	14
8.1	General	14
8.2	Fuel	14
8.3	Combustion air and exhaust gas	15
8.4	Controlled atmospheric gas	17
8.5	Products	17
8.6	Temperature of furnace surface	17
8.7	Furnace inner wall temperature	17
8.8	Inner furnace pressure	17
8.9	Cooling water	17
8.10	Electrical auxiliary equipment	18
8.11	Generation of utilities	18
8.12	Recycled energy	18
9	Calculations	18
9.1	General provisions	18

9.2	Total energy input	18
9.3	Total energy output	19
9.4	Total energy efficiency	21
10	Energy balance evaluation report	22
Annex A (informative) Reference data		23
Annex B (informative) Report of energy balance and efficiency of a continuous gas carburizing furnace (whole process) -- Example		25
ISO 13579-4:2013(E) Annex C (informative) Report of measurement of energy balance and calculation of efficiency of a continuous gas carburizing furnace -- Example		33
Annex D (informative) Assessment of uncertainty of total energy efficiency		42
Bibliography		45