StrikoWestofen Group

Customer
Furnace type MH II-T/N 4000/2000 G-eg
Bath temperature 760°C

14.07.2016

Fume quantities

Fuel		Natural gas		
Calorific value	kWh / m³ STP	10		
	kJ / m³ STP	36.000		
λ-value (air surplus)	-	1,1		
		Holding burner	**Melting burner**	**Total**
Number of burners		1	2	
Power of each burner	kW	450	600	
Totally installed power	kW	450	1.200	1.650
Gas-consumption	m³/h STP	45	120	165
Min. air need	m³/m³	9,61	9,61	9,61
Min fume quantity (λ=1,0)	m³/m³ wet	10,68	10,68	10,68
Fume quantity (λ=see above)	m³/h STP wet	**524**	**1.397**	**1.921**
		Holding mode	**Melting mode**	**Max.Power**
Activation period of holding burners	%	20	80	100
Activation period of melting burners	%	0	90	100
Fume quantity in stack				**Total**
λ-value (air surplus) in stack	-			3,5
Fume quantity	m³/h STP, wet			**6.045**
Mean fume temperature	°C			300
Fume quantity under operating condition	m³/h wet			**12.689**

Emissions as a result of combustion, at the stack

		Concentration	Load at max. power	
		[mg/m³] STP dry	[kg / h]	
Carbon monoxid (from combustion)	CO	50	0,29	(*1)
Nitrogen oxide (as NO2)	NOx	50	0,29	
Sulfur oxide (as SO2)	SOx	1	0,01	
Carbon dioxid	CO2 [Vol.% STP wet]	3,4%	408	
Water (vapour)	H2O [Vol.% STP wet]	5,0%	241	

λ=1,1 corresponds to approx. 2 % O2 STP: 101,3 kPa, 0°C
*1) please also read the textual emission prognosis section 2.2

Erstellt: RHL

Emission-prognosis on StrikoWestofen gas-fired melting and holding furnace units for aluminium (STRIKOMELTER®)

Customer:

Furnace type: MH II- T/N 4000/2000 G-eg

Project-number:

The operation of gas-heated melting furnaces (natural gas or LPG) leads to waste gas emissions. These emissions are divided into two groups: emission as a result of combustion and emissions as a result of the melting process.[1]

1 Emissions as a result of combustion

Emissions as a result of combustion originate in a false adjustment of the gas-air-mixture at the burner. Generally, these burners are adjusted by the specialised staff from the StrikoWestofen group (StrikoWestofen / StrikoDynarad / Striko UK) in a way that they are run at a near-stoichiometric range with a slight air surplus (λ-value). The target λ-value for gas-fired units is 1.05 – 1.15, corresponding to the oxygen content in the undiluted waste gas of 1 – 3 %.

1.1 Carbon monoxide CO

If the combustion is incomplete, or carried out without a sufficient supply of air (λ-value < 1), carbon monoxide is generated. If the burners are set correctly, the CO content in the fumes is less than 50 mg/m^3 STP. This content is far below the reference value of the BREF-document of the European Commission[2] (150 mg/m^3 STP).

1.2 Nitrogen oxides NO_X

The formation of nitrogen oxides is mainly influenced by the burning temperature in the flame as well as by the dwell time and the oxygen content in the high temperature range (> 1600°C). When using burners for external air pre-heat or recuperative, regenerative or oxygen burners, special measures have to be taken to avoid high NO_X -emissions. As StrikoWestofen burner units are run using cold air, the formation of nitrogen oxides is low.

Typical values of NOx (calculated as NO_2) for existing units with natural gas burners are below 50 mg/m^3 STP ([3]). This is far below the reference value of the BREF-document of the European Commission (120 mg/m^3 STP).

Remark: NO_X – formation can also be caused by pollution of nitrogen in the combustible (e.g. in some town gases). For natural gas and light fuel oil the pollution is usually very

[1] The unit of all concentrations given is mass of the emitted substance per dry waste gas, standard temperature and pressure (STP).
[2] European Commission: Integrated Pollution Prevention and Control, Reference Document on Best Available Techniques (BAT) in the Smitheries and Foundries Industry, July 2004.
[3] When using liquid gas (LPG, propane, butane), the NOx-emissions are approx. 25% higher than with natural gas.

low and not relevant for emission.

1.3 Sulphur oxides SO_X

Sulphur oxides are produced during combustion only if a percentage of sulphur is present, e.g. certain oil qualities and town gases. Natural and liquid gases are already de-sulphurrised, so that they undercut by far the SO_2 – reference value of the BREF-document of the European Commission (30 – 50 mg/m³ STP). For combustibles containing sulphur an analysis is necessary in order to estimate the SOx emission; the sulphur content should be supplied by the customer.

2 Emissions as a result of the melting process

Emissions caused by the melting process are especially the emissions of dust and carbon compounds C_{total}. These emissions are influenced by:

- Impurities in the return medium used,
- Use of cleaning fluxes or other metallic additives.

2.1 Dust

The following significantly influencing factors of the dust emission are existent:

- Impurities in the charged material, especially in the return medium used.

  Generally, impurities adherent to the returned material influence the dust emission. Dust sources in the material to be charged are also diminutive particles resulting from grating (flash), stamping or the mechanical processing of the cast part (chips, swarf, especially from sawing) or also general impurities from abrasion or sweepings which have been filled by mistake in the charging containers.

  Impurities in sand casting processes (or mould casting with sand cores) are especially mould-sand and sizing agents; in the pressure casting process especially the thin particles of moulding from the die-cast.

- Use of cleaning salts (flux)

  When cleaning fluxes are used, short-time peak-values of dust can appear. These can be minimised by:
  - Use of flux granulate instead of powder,
  - Use of non-exothermic salts,
  - Sparing and professional use as well as mechanical separation of metal and dross,
  - Stopping the burners when the fluxes are added.

The BREF-document of the European Commission gives a reference values for dust-emissions of 20 mg/m³ STP.

In most cases these values will not be exceeded, even without additional means. While melting only pure ingots, the dust concentration is below 4 mg/m³ STP.

2.2 Carbon compounds C_{total} and carbon-monoxide CO

Impurities adherent to the return material also influence the emission of carbon compounds and carbon-monoxide.

Separating agents are a main source of carbon compounds. With the use of water-soluble separating agents, which are common used today, exceeding the emission reference values of C_{total} are not known. Increased emission values are possible when separating agents on basis of organic solvents are applied.

Further sources are sizing agent as well as solid cooling lubricants from the machining and shape cutting of the cast part.

The BREF-document of the European Commission gives a reference values for C_{total} and CO- emissions, each with 150 mg/m³ STP. Operating the furnace professionally, these values will not be exceeded. When charging return material with strong adhesions of carbon compounds, attention has to be turned to the temperature control of the furnace in order to avoid exceeding the limit value for CO.

Based on the mentioned influencing factors of the melting process and the unit operation an emission concentration for the process-related impurities cannot be stated generally !

Typical waste gas emission values of a StrikoMelter®, measured in the chimney according to the German regulations (TA-Luft), European directives or other official orders are:

½ hour means	Dust	CO	C_{total}	NOx
	[mg/m³] STP dry	[mg/m³] STP dry	[mg/m³] STP dry	[mg/m³] STP dry
Mean value	4	30	15	25
Max.- value	10	150	50	50
Reference value of the BREF document of EU-Commission	20	150	150	120

3 Fume quantities

The StrikoMelter® of StrikoWestofen run in two different operating conditions, the holding mode, where the aluminium in the unit is kept at the required temperature, and the melting mode itself.

The furnace itself is procedurally separated from the fume hood which gathers the emitted gas by a drawing off device. The composition of the fumes changes toward the commonly known fresh air composition when fresh air is added between the hood and the furnace shaft. The quantity of fresh air added depends on the operating condition of the furnace (melting mode/ holding mode), the fill level of the melting shaft, the bulk density of the material in the shaft and the draught conditions in the chimney. On average, the fresh air proportion is 250% (2.5-times the fume quantity in the shaft). This results in fume temperatures of approx 200°C - 450°C (400 – 850°F) depending on the level in the furnace shaft. The average temperature is approx. 300°C (570°F). The fume quantity resulting from these conditions is given in table 1 (see attachment).

3.1 Holding mode

In holding mode, the holding burners are switched on and off as required (control of the set-temperature of the melt). The activation period of the holding burners is approximately 20% (see table 1, attached); the melting burners are not in operation.

In holding mode, emissions as a result of combustion may occur (see point 1), but no emissions as a result of the melting process are to be expected. An exception to this is cleaning the furnace, when the dross is removed from the melting bridge or the bath surface, possibly also by the use of fluxes.

3.2 Melting mode

In melting mode, the aluminium on the melting bridge is melted and the liquid metal flows into the holding chamber. The melting burners are switched on. The holding temperature of the aluminium bath (approx. 760°C) is always higher than the melting temperature (ca. 580 – 660°C, depending on the alloy). The holding burners must therefore increase the temperature of the melted aluminium. The activation period of the holding burners increases to approx. 80 %. The waste gases of the melting- and holding burners pre-heat the charged material in the shaft.

The fume quantities are given in table 1. In melting mode, emissions result from the combustion and from the melting process as described under point 1 and 2.

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Created: 14 July 2016