RTO/RCO 蓄热床设计说明

LANTEC 蓝太克

Date: March 4, 2016
Customer:
Project: MLM-180

Heat Recovery in Three-Canister RTO (with fixed burner air flow) — 3塔RTO蓄热床计算书

Design Basis

入口风量	Inlet Air Flow:	15,000 Nm³/h
吹扫风量	Average Purge Air Flow:	750 Nm³/h
助燃风量	Burner Air Flow:	150 Nm³/h
海平面高度	Elevation above Sea Level:	0 m
RTO出口静压	RTO Outlet Static Pressure:	0 mbar
入口CO2浓度	Inlet Air CO_2 Content:	0.04% v/v
入口含水量	Inlet Air H_2O Content:	8.5% v/v
入口气体相对湿度	Inlet Air Relative Humidity:	35.0%
入口气体温度	Inlet Air Temperature:	65 ℃
燃烧室温度	Combustion Temperature:	800 ℃
阀门切换时间	Valve Switch Time:	2.00 min
燃气用量	Lower Heating Value of Fuel Gas:	36 MJ/Nm³

Performance

Preheating Thermal Efficiency:	96.0%	蓄热材预热热效率
Thermal Energy Recovery:	95.0%	热回收效率
Inlet Gas Velocity:	1.25 Nm³/m²s	进口气体流速
Maximum Stack Gas Temperature:	139 ℃	最高排气温度
Average Stack Gas Temperature:	102 ℃	平均排气温度
Average Fuel Gas Consumption:	22.3 Nm³/h	平均燃料消耗
Average Burner Output:	227 kW	平均燃烧器功率
Pressure Gradient Across Media:	5.6 mbar/m	蓄热材压力梯度
Media Pressure Drop (across 2 beds):	18.4 mbar	蓄热床压力降（2床）
Total Pressure Drop:	18.4 mbar	总压力降
Fan Motor Efficiency:	80%	风机效率
Fan Power:	12.5 kW	风机功率

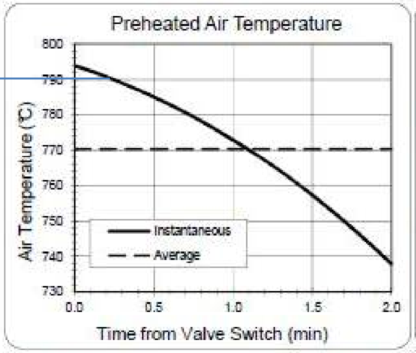
Canister Sizing

蓄热床长度（内径）	Canister Length (inside insulation):	1829 mm
蓄热床宽度（内径）	Canister Width (inside insulation):	1829 mm
蓄热床横截面积	Canister Cross Section:	3.345 m²
蓄热材填装高度	Depth of Media (per canister):	16.0 layers
	=	1626 mm
蓄热材型号推荐	Media Type:	MLM-180
蓄热材模块高度	Module Height:	102 mm
设计安全系数	Design Safety Factor:	5%
空塔压力降	ΔP_0 (without media):	0.00 mbar

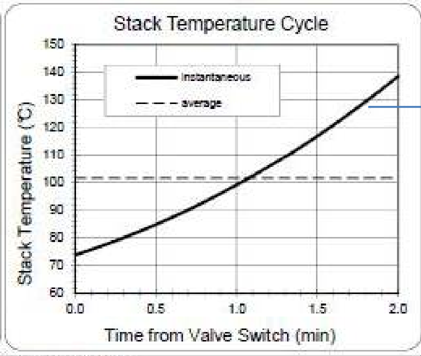
Heat-Transfer Parameters

Media Bulk Density:	937 kg/m³	蓄热材堆积密度
Media Heat Capacity:	863 kJ/m³·K	蓄热材热容
Media Heat-Transfer Coefficient:	1,338 kJ/min·m³·K	蓄热材导热系数
MW:	28.1 g/mol	蓄热材材质摩尔质量
$C_p/C_{p\ dry\ air}$:	1.04	进气与干空气的热容比
T_{in}:	338 K	入口温度
P^*_{H2O}:	0.247 atm	水压
$P_{atmospheric}$:	1.00 atm	大气压强
P_{in}:	1.02 atm	入口压强

预热气体温度变化曲线



出口气体温度变化曲线



The average purge air flow is the total volume of purge air divided by the valve switch time.
These calculations assume uniform "plug flow" of air through each media bed. Uneven air distribution can cause heat recovery to be less efficient than calculated.
Thermal energy recovery depends on the average stack temperature, which is not simply the average of the maximum and minimum thermocouple readings. It is calculated by integrating the stack temperature over the complete cycle. The true average temperature may be significantly lower than the average of extreme readings, especially if a thermocouple with long lag time cannot register the sudden decrease in air temperature right after the valves switch.

请注意：

风量及浓度单位中N与A代表了不同状态下的气体体积：

N—标态

A—时态