Termomeccanica Industrial Process

Termomeccanica Group

EPCC OF ACID GAS OXIDIZER PROJECT AT GAS PROCESSING

AGO TECHNICAL PRESENTATION

Contents

I Company Introduction

Company Introduction

TM.I.P. Termomeccanica Industrial Process (hereinafter TMIP) together with its local partner PBH GROUP, offers more than 40 years of know-how and experience to those who are looking for solutions for Environmental, Energy and Process Technical projects. At our offices in La Spezia (Italy) the TMIP team consists of highly experienced process, mechanical, structural and instrumentation engineers, CAD draughtsmen, QA/QC managers, inspectors and administration staff. Each person is highly qualified in his own field of expertise, and collectively the TMIP team ensures a good and timely execution of complete turn-key projects, covering:

- Process design;
- Assistance at HAZOP reviews and SIL study;
- Engineering: process, mechanical, structural, electrical, instrumentation, automation;
- Calculations: thermal mass-balances, pressure drop, heat radiation, noise, dispersion, energy-recovery, CFD modelling etc.;
- Project management, planning;
- Procurement, expediting;
- Fabrication, inspection;
- Transportation, shipping;
- Erection, construction;
- Commissioning and start-up;
- Maintenance.

The TMIP commitment towards our clients does not stop when a project has been delivered. We believe that a long standing relationship with our clients throughout the life-cycle of an installation is a necessity in today's competitive environment.

Company Introduction - Location

TM.I.P. S.r.l. -
Via Fossamastra, 22
19126 La Spezia (Italia)

Company Introduction – Company Profile

Company Introduction – Company Profile

II Acid Gas Oxidizer

Acid Gas Oxidizer - Introduction

In order to comply with emission limits, Gas Processing Fields needs to replace the current with new Acid Gas Oxidiser (AGO) Project.

The Acid Gas Oxidiser is defined as a Package Unit, which shall treat continuously arising gaseous acid streams with high organic content as well as contents of H2S, HCs and Aromatics generated by the Acid Gas Removal Unit (AGRU). The Unit shall reduce the organic and H2S content of acid gas within emission limits by means of a fuel gas-fired Oxidiser (complete combustion).

The Combustion Air can be pre-heated in a gas-gas recuperator (Combustion Air Preheater) to reduce fuel gas consumption to LOW-NOx Burner. The Acid Gas is injected at proper distance from burner flame with advanced temperature control to minimize the presence of high temperature zones and thus the formation of thermal NOx. The internal gas-air mixing provisions also avoid the presence of low temperature areas, thus maximizing CO oxidation.

Then, the gas is vented out after passing through a Waste Heat Recovery Boiler, Acid Gas Preheater and/or Combustion Air Pre-heater via exhaust stack with the height in compliance of the local regulation.

Acid Gas Oxidizer – Design Requirements

1. Design Data

2.0 ACID GAS BATTERY LIMIT CONDITION				
2.1 Flowrate				
Maximum flowrate :	129,049 kg/hr[1]			
Normal flowrate :	60,000 to 90,000 kg/hr			
Minimum flowrate :	VTA			
Component	**Unit**	**Minimum hydrocarbon content[2]**	**Normal[2]**	**Maximum hydrocarbon content[2]**
H_2O	Mol.%	5.56[5]	Total hydrocarbon content of 1-3 mol% on dry basis	11.24[4]
CO_2	Mol.%	93.32		82.34
H_2S	PPM	-		125
C1	Mol.%	0.67		3.06
C2	Mol.%	0.11		0.56
C3	Mol.%	0.02		0.56
C4	Mol.%	-		0.09
i-C4	Mol.%	-		0.12
C5	Mol.%	-		-
C6+[3]	Mol.%	-		0.07
N_2	Mol.%	0.33		1.96
MDEA	Mol.%	-	-	-
Mol. Weight	MW	43.74	-	40.25
Temperature	ºC	35	40 - 50	55
Pressure	barA	1.002	1.02 – 1.03	1.4[6]

2. Emission Requirements

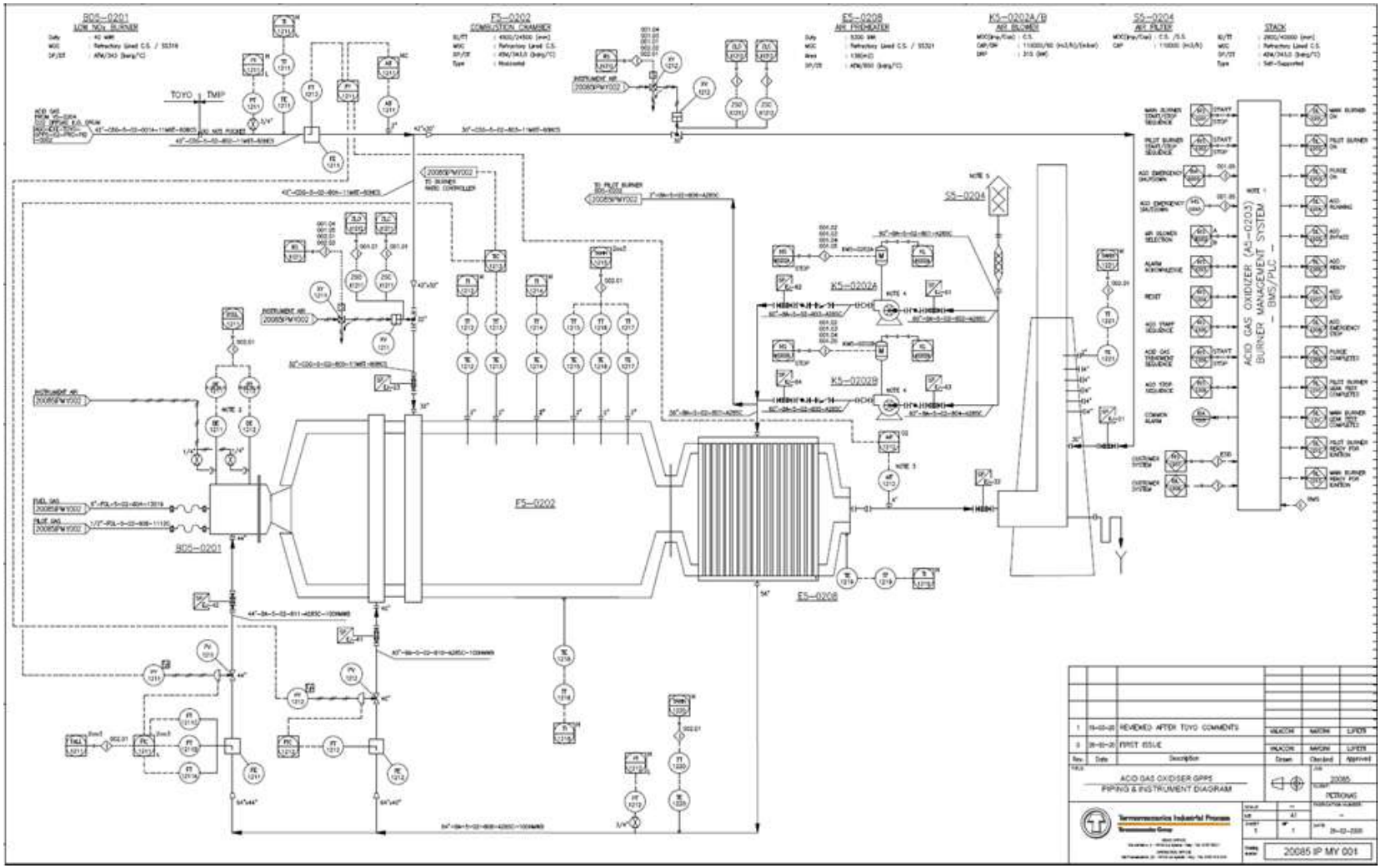
Pollutant	Value	Monitoring
Sum of NO and NO2 expressed as NO2	< 700 mg/Nm^3	intermittent
Carbon Monoxide (CO)	< 625 mg/Nm^3	intermittent
Sum of SO2 and SO3 expressed as SO2	< 600 mg/Nm^3	continuous
NMVOC as total organic carbon	< 150 mg/Nm^3	intermittent
Hydrogen Sulphide (H2S)*	< 7.6 mg/ Nm^3	intermittent

Acid Gas Oxidizer – Design Requirements

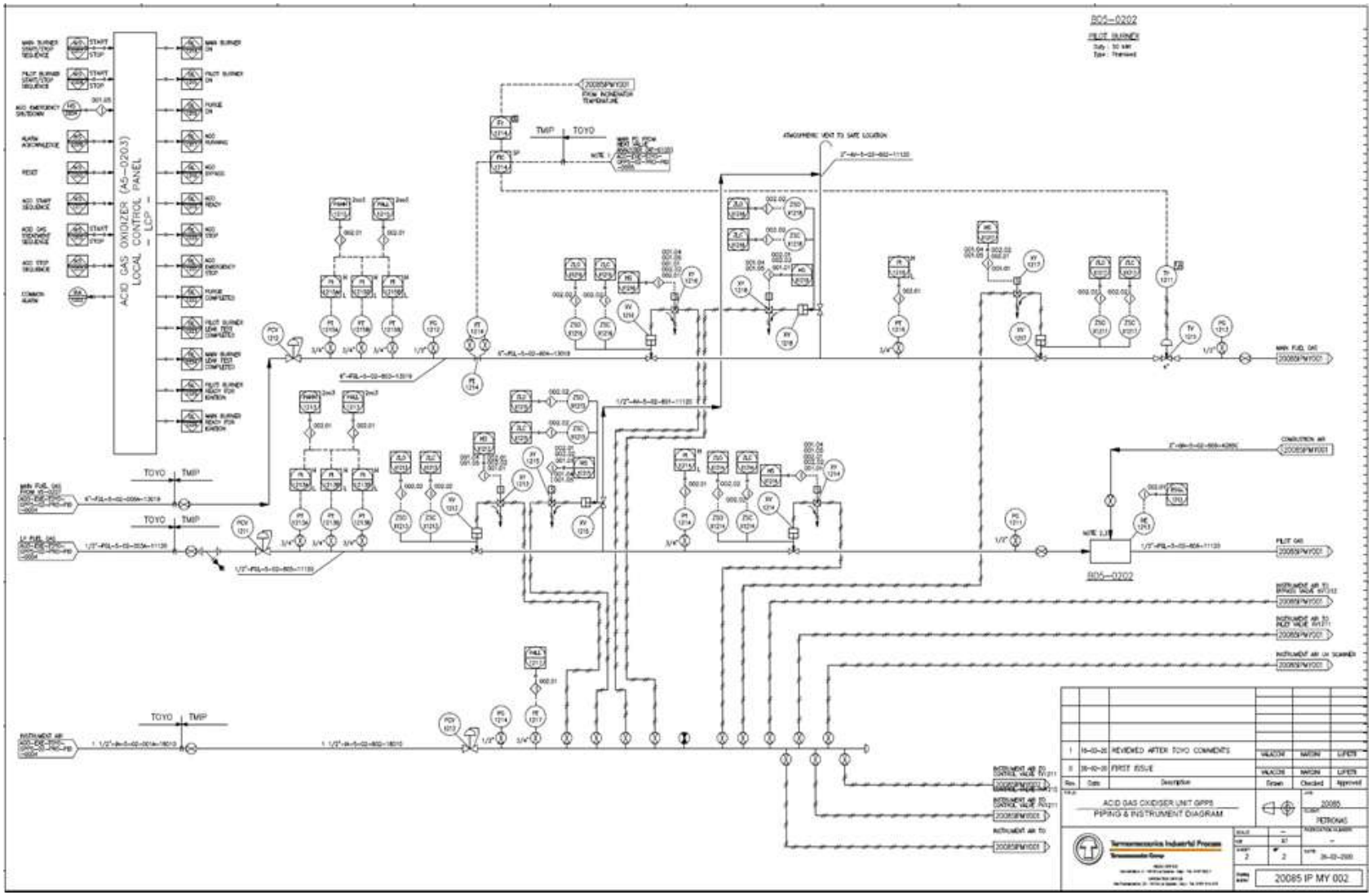
5. General Requirement

Number of AGO Unit	2
Design Flowrate per Unit	129,049 kg/h
Molecular Weight	≈ 40.25 – 43.74 kg/kmol
H2O Concentration	5.56 – 11.24 %mol
Hydrocarbon Concentration	0.8 – 4.39 (max. 5) % mol.
H_2S Concentration	125 ppmv
CO_2 Concentration	82.34 - 93.36 %mol
Inlet Temperature	35 – 55°C
Inlet Pressure	1.05 – 1.4 bar.a
Heat Duty Waste Gas	≈ 6 MWt at min. case
Heat Duty Fuel Gas	≈ 33 MWt at min. case
Heat Duty AGO	≈ 39 MWt at min. case
Heat Duty Waste Gas	≈ 44 MWt at max. case
Heat Duty Fuel Gas	≈ 5 MWt at max. case
Heat Duty AGO	≈ 49 MWt at max. case
Working range	16-100%
Service Life	20 years (proper maintenance of inner refractory lining)
Installation	outdoor
Hazardous area	Hazardous Area Zone 2 IIC T3 for outside of equipment.
Voltage for motors	400 V
Phases	3
Frequency	50 Hz

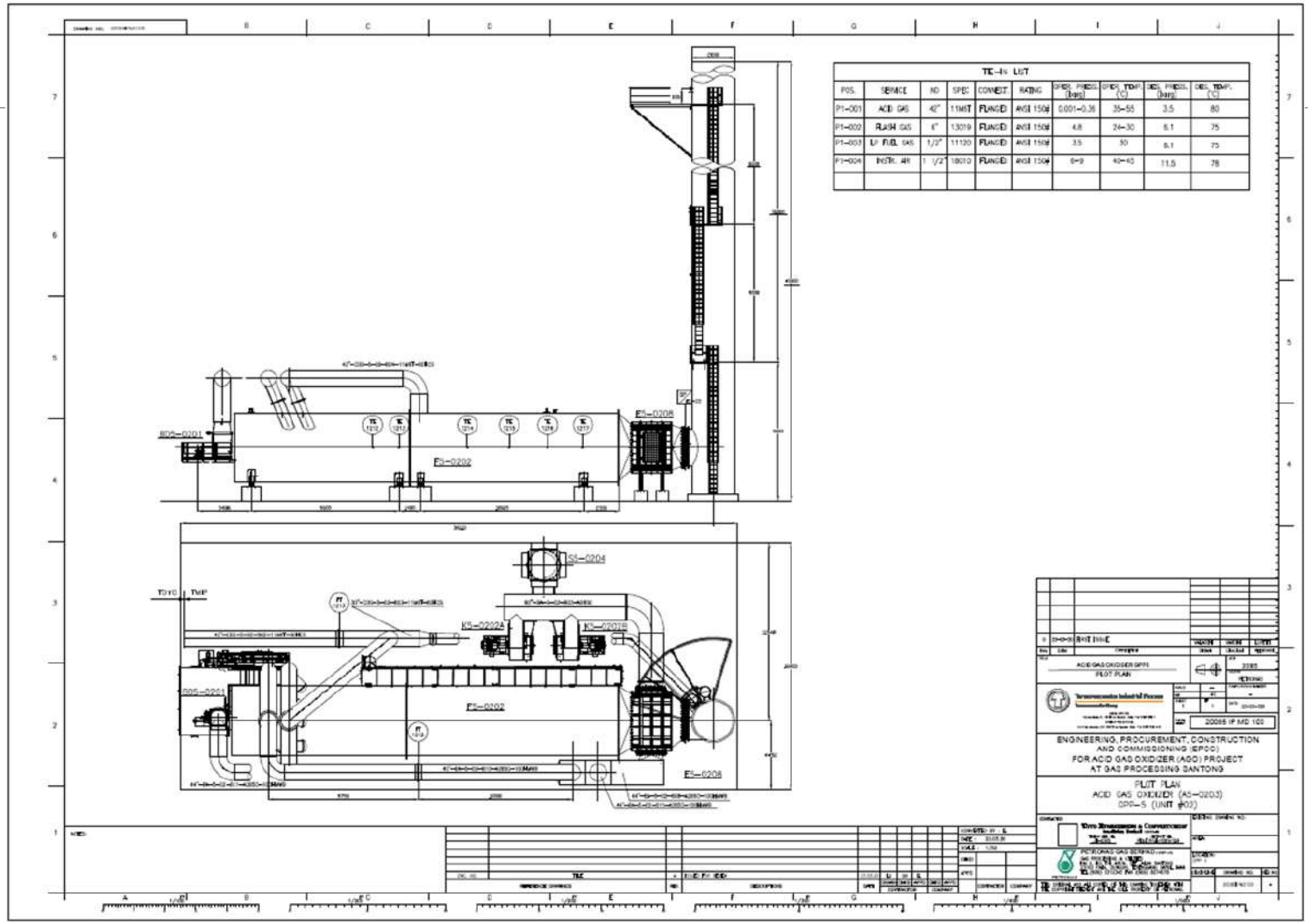
Acid Gas Oxidizer – P&ID



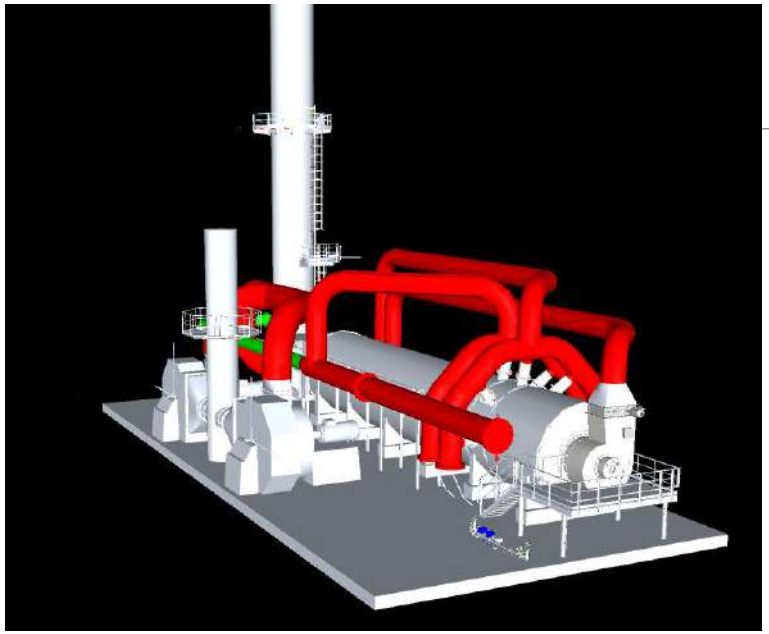
Acid Gas Oxidizer – P&ID

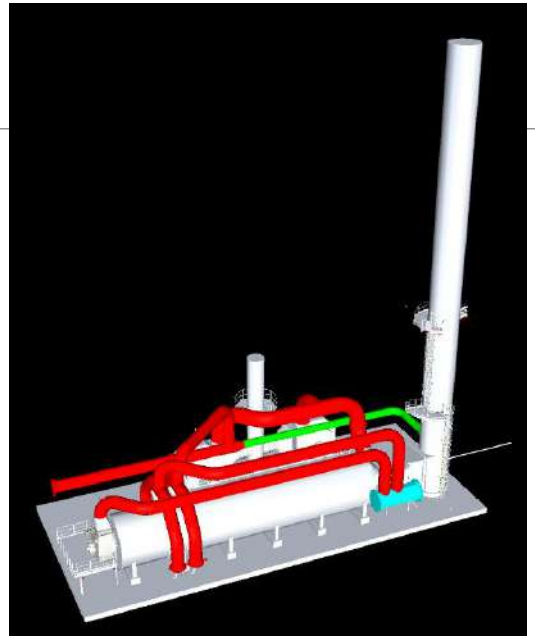


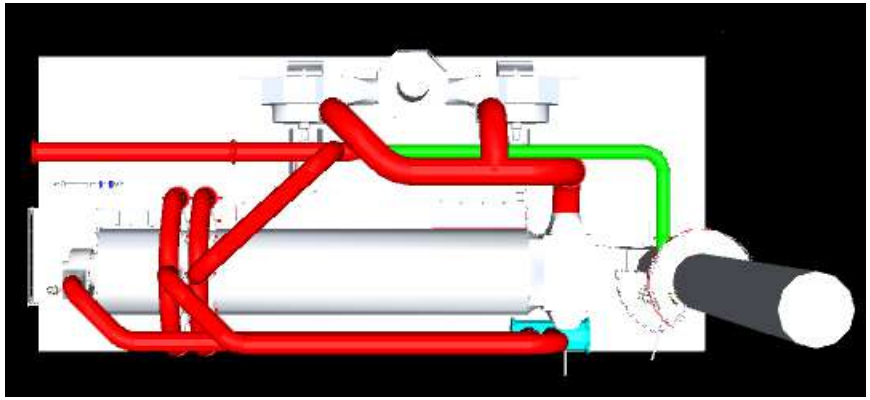
Acid Gas Oxidizer – Preliminary Layout



Acid Gas Oxidizer – 3D Model







III Process Description

Process Description

The main purpose of the Acid Gas Oxidizer is to oxidize CO, organic compounds and to convert to SO_2 all sulphur compounds present in the Sour Gas from the AGRU section. The conversion of all sulphur compounds to SO_2 is achieved with a thermal oxidation at high temperature with excess of oxygen; in all operating conditions of Thermal Oxidizer is necessary to support the combustion using Fuel gas.

The Thermal Oxidizer Burner will be forced draught type. The Combustion Air shall enter the Thermal Oxidizer Burner through a plenum provided with a flanged connection. The Combustion Air turbulence is maximized in order to ensure the gas mixing and thereby meet the requested limits as to the residual H_2S in the flue gas discharged to the atmosphere.

The Combustion Air flowrate is automatically controlled in ratio to the Fuel gas one; in addition, a dedicated trim valve actuated by an O_2 process analyzer on flue gas is provided to adjust concentration of oxygen.

The working temperature of the Acid Gas Oxidiser could ranges from 650 to 850°C by adjusting fuel gas massrate to burner. Hot gases after thermal oxidation go through the Waste Heat Recovery Section if required and vented to the stack.

Process Description – Advantages

The TMIP burner technology fulfils 3 basic T conditions to achieve the highest combustion efficiency and lowest emission level:

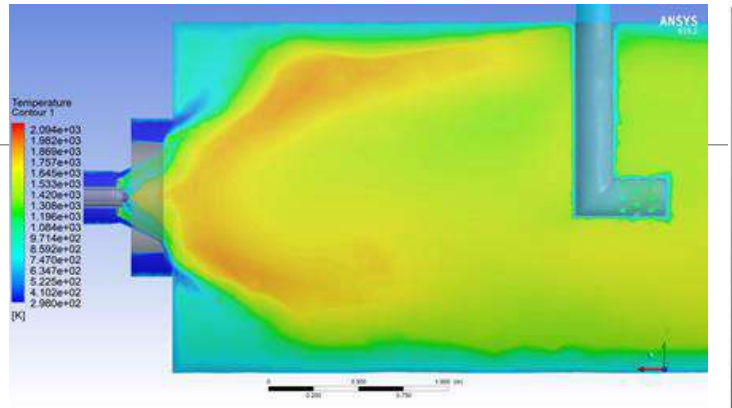
a) Temperature : the combustion temperature is optimised by the burner management system and the temperature controlled combustion.
b) Time : a min residence time is respected for the specified waste streams.
c) Turbulence : created by the LOW NOx Burner and the special designed air intake / waste gas injector.

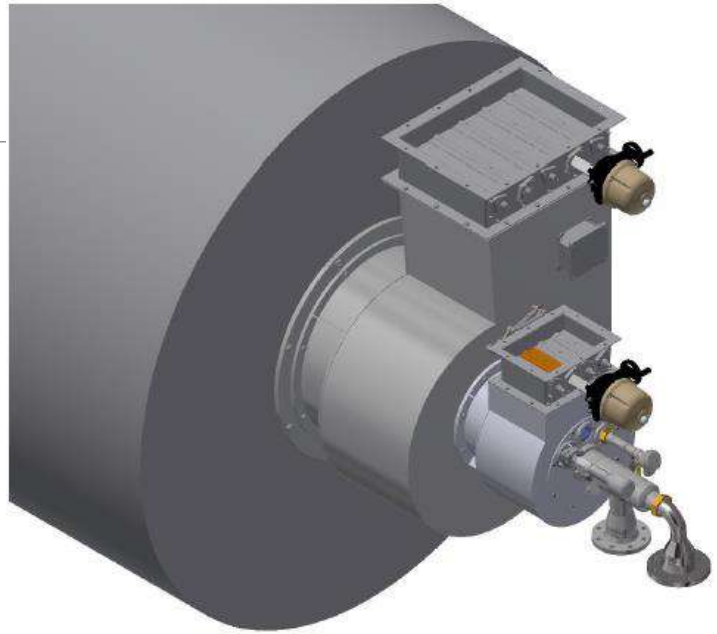
TMIP has selected a proprietary forced draft Low NOx Burner and furnace design for this application. This design consists of a horizontal fired combustion chamber with staged combustion and advanced temperature control to minimize the presence of high temperature zones and thus the formation of thermal NOx. The internal gas-air mixing provisions also avoid the presence of low temperature areas, thus maximizing CO oxidation.

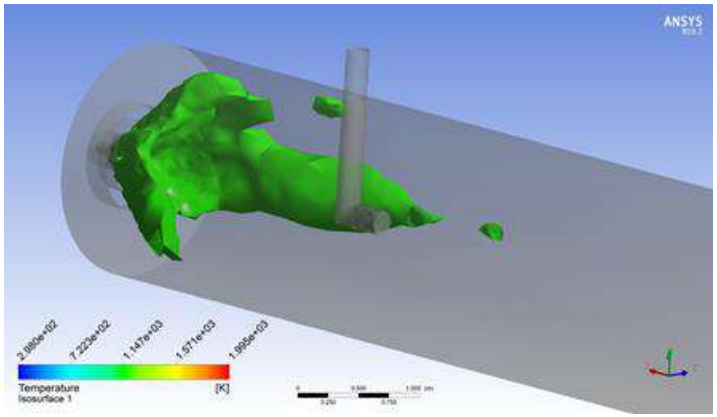
The design of the LOW NOx Burner is optimized by CFD modelling assuring the Intensive mixing of the fuel gas, liquids with the combustion air and quench air . And Intensive recirculation of the combustion gases with the flue gasses. The advantages of this Burner are:

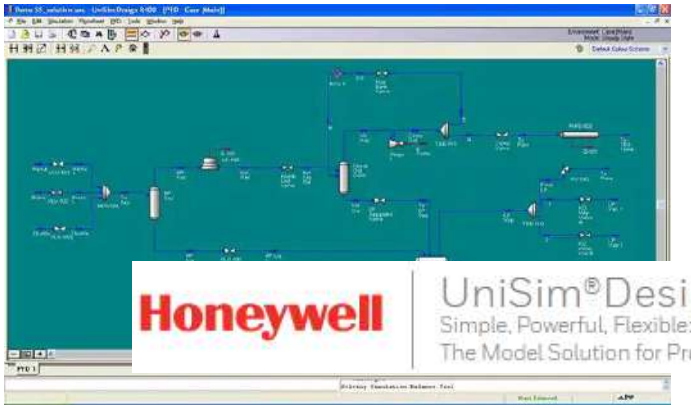
a) Clean combustion:
b) Complete burn out of the hydrocarbons
c) Efficiency > 99.9%
d) Minimizing the formation of CO
e) Homogenous temperature profile
f) Low reaction temperature
g) No hot spots in the flames
h) Minimizing the formation of NOx.

Process Description – Advantages









ANSYS® FLUENT®

Process Description – Advantages

The proposed TMIP technology has following distinct advantages:

- Simple, robust and reliable design proven by hundreds of references around the globe
- Perfect combustion resulting in CO and TOC values well below the most stringent regulations.
- Controlled combustion temperature to minimize thermal NOx formation resulting in ultra- low NOx emissions
- Robust design ensuring trouble free operation
- Low operating costs due to optimised design
- Flexible operation with high turn down ratio
- Proven technology with hundreds of units in operation world wide
- Modular fabrication and type-tested resulting in short installation and commissioning times
- High turn down ratio with fast ramping-up to 100% load.
- In accordance with the current International and EU-standards.
- Recommended operating hrs/year About 8400 h/y recommended but the unit can operate continuously for 8760 h/y.

Process Description – Others

1. Management and Control of AGO, during the fluctuation in acid gas pressure and hydrocarbon content in acid gas

   AGO system is static equipment properly designed to absorb pressure / flow fluctuations from inlet stream. The control system will manage the temperature and oxygen control to ensure the thermal oxidation of hydrocarbons and H2S contained in inlet acid gas due to flow / pressure fluctuations. The hydrocarbon content of the Acid gas will be monitored and If the hydrocarbon content in acid gas is lower the burner capacity will increase to maintain oxidation temperature set point. Oxygen concentration is controlled by increasing or decreasing the combustion/excess air flow rate.

thank you

Termomeccanica Industrial Process

Termomeccanica Group

TM.I.P. S.r.l. - Termomeccanica Industrial Process
Via Fossamastra 22- 19126
La Spezia – Italy
Tel. +39 0187 513.410 - Fax. +39 0187 515.352

www.tmip.termomeccanica.com

tmip@termomeccanica.com