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'NP WSM 314/2020 (Re-Issue) - NEGOTIATED PROCEDURE FOR THE DESIGN, SUPPLY, DELIVERY, INSTALLATION AND COMMISSIONING OF AIR TREATMENT PLANT(S) AT THE THERMAL TREATMENT FACILITY IN MARSALA, MALTA' and CFT CA Unique ID 'WSM 314/2020 (Re-Issue)

CSO Group Reference Q6840A – 25/03/2021

RTO Technical data

CSO Group's technical partner for RTO contract is Airprotech and they will be responsible for the design, manufacture, supply, installation and commissioning of the RTO element of the project: -

airprotech is an Italian leader in the design and manufacture of combustion and air cleaning units for the oil&gas, refining, petrochemical, chemical, pharmaceutical and steel industries.

Located in Magenta, close to Milan Malpensa airport, **airprotech**'s facility includes the headquarter and two workshops, one for steelworks and one for plastic manufactures.

airprotech is able to design and manufacture the best available technology thanks to its own experiences acquired

- by means of research and development projects
- supplying many packages in Italy and abroad
- by assembling a team of engineers

Qualified technicians and engineers collaborate with **airprotech** to assure a continuative service to customers.

Several well known EPC Contractors and Companies have qualified **airprotech** as an approved vendor and invited us to quote for important projects.

At present **airprotech** is in bidding stage for the supply of combustion plants and Flares to Saipem, Tecnimont, Hyundai, Technip, Eni, Uhde, Polimeri Europa, Danieli, Pidec and others.

airprotech is able to comply with the most important international standards as: AISC, API, ASCE, ASME, ASTM, BS, DIN, EN, IEC, NEMA, UBC and others.

airprotech structure includes:

- administration

- commercial department
- research and development section
- process and engineering department
- workshops (steel manufactures and plastic manufactures)
- after sales service department

INTRODUCTION

2.1. General

This offer is relative to the equipment engineering supplying, the assembly for the realisation of the “**turn key plant**” as under mentioned.

In particular, our supply will include:

- process, basic and detail engineering
- equipment: all the necessary equipment for the plant realisation
- assembly
- commissioning and start-up activity

The supplying and the battery limits are described in the following sections.
The characteristics of the supply will be in accord to the normative in force and to the “Machine Directive”.

The supplying and the battery limit are following described.

Airprotech supplies the following after-sales services:

Free insurance policy:

Civil responsibility and damages to customer things and people

Coverage of the costs for the reparations/substitution in the period of guarantee (24 months with total coverage of the damages) independently from the cause of the damage to the plant (least franchise = 5.000 €);

Coverage of the costs in case of eventual last of performances of plant

Annual contracts of technical assistance at payment with periodic analysis of the parameters of process

2.2. Clarifications and deviations

1. **airprotech** is ISO 9001:2008 certified.
2. The plant object of the supplying has been projected for the application in zone defined in the following way according to the norm 94/9/CEE:

inside of the pipeline	not hazardous area.
Installation area	not hazardous area.

The classification has to be confirmed by customer.

3. The offered plant is the up to date solution of RTO referred to the energy cost saving. It has a very high efficiency of thermal recovery ($\geq 96\%$) given by the use of the best ceramic materials on the market and it is equipped with the **gi-tech system**. The gi-tech system allows you to shut off the burner when you are running at process conditions (since the burner is used only during the pre-heating phase) and consequently you switch off the air combustion fan needed by the burner once reached the working temperature in the combustion chamber.

4. Dimensions

The data for plant installation could be approx.

Dimensions 22.000 x 8.000 mm

Our offer refers to a standard airprotech layout. In any case, relating to the layout, we underline that the dimensions are preliminary and airprotech is the direct manufacturer of the plant; therefore, following the customer needs, we are available to study an alternative layout solution.

5. Design parameters

The oxidation chamber has been designed considering the followings parameters:

- residence time: **1 second**;
- Temperature max combustion chamber: **900°C**;
- Thermal recovery Efficiency: **>96.5%**
- Predisposition for periodical **burn out operations**.

6. Material choice

The choice of particular materials is defined in order to avoid any corrosion problems considering both the high water content and the possible presence of inorganics compounds.

In particular:

Plant piping	1.4404 (AISI 316 L)
Poppet valves and start-up valve on process air	1.4404 (AISI 316 L)
Grids for ceramics support	1.4404 (AISI 316 L)
Bottom part of RTO (plenum)	1.4404 (AISI 316 L)
Main stack	1.4404 (AISI 316 L)
Process fan	1.4404 (AISI 316 L)
Recovery chambers	CARBON STEEL
Combustion chamber	CARBON STEEL

7. Noise level

The value of SPL of the plant will be 85 dbA at 1,5 mt of distance.

8. Reference document

Your reference document NP WSM 314/2020

2.3. Supply list

Description	Included	Option	Exclusion
Process, basic and detail engineering	•		
Combustion unit	•		
Burner and gi-tech system	•		
Process air fan and inverter	•		
Combustion air fan	•		
Connection pipes and valves	•		
Burn-out	•		
Stack	•		
Insulation	•		
Painting	•		
Instruments	•		
Service structure	•		
Electrical board with PLC and Remote control	•		
Assembly in our workshop	•		
Works on site (electrical and mechanical)	•		
Transport	•		
Commissioning and start-up	•		
Preheating system			•
Cold plant by-pass			•
Lifting equipment as crane truck, platform, forklift etc, stairs and scaffolding			•
Intake line from production department			•
Civil engineering and relevant foundations : all civil work			•
Utility connections beyond the battery limits			•
Grounding ring and relative connections			•
Soundproofing and Plant lighting			•
Analysis			•
Spare parts			•
Insurance and custom duty			•

PROJECT DATA

3.1. Inlet conditions PLANT DESIGN

Project flow rate	95,000	m ³ /h
Inlet temperature	30	°C
Project flow rate in N.C.	85.600	Nm ³ /h
Relative humidity	abt. 70	%

Pollutants

Odour concentration	500.000	OU/m ³
Ammonia NH ₃	50	mg/Nm ³
Hydrogen Sulphide (H ₂ S)	70	mg/Nm ³
Total VOC	50	mg/Nm ³

Dust inlet concentration	absent
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3.2. Outlet conditions

Max flow rate	abt. 81.500	Nm ³ /h
Temperature max	70÷90	°C

ODOUR abatement efficiency	>95	%
T.O.C. concentration mgC/Nm ³	<20	

3.3. Utilities and consumption

Electric energy

Voltage \ phases \ frequency	400 V \ 3f + N \ 50 Hz	
Installed power ¹	337	kW
Absorbed power ²	176	kW

¹ Main fan designed with 100 mm w.c. at Your disposal for piping.

² Without 100 mm w.c. at Your disposal for piping.

Combustible (LPG)

Pressure	250	mbar
L.H.V.	72,9÷87.3	MJ/Nm ³
Value considered for consumption	20.800	kcal/Nm ³
Max flow:	abt.163	Nm ³ /h
	325	kg/h
Consumption:		
- Without V.O.C.	55 Nm ³ /h abt. 110	kg/h
- With V.O.C 50 mg/Nm ³	51 Nm ³ /h abt.102	kg/h

Compressed air

Pressure	6	bar
Dew point	-20	°C
Max flow	40	m ³ /h

PLANT OPERATING PRINCIPLE

◆ **Oxidation unit**

The plant is a **five chambers** system with regenerative thermal recovery on ceramic beds.

The ceramic packing accumulates the thermal energy of the purified air leaving the combustion chamber and uses it back during the following phase for heating the polluted air entering the plant.

The main oxidation chamber consists of a carbon steel main structure, lined ceramic fibre in order to grant the working temperature of 900°C.

The oxidation chamber has been designed to grant a minimum residence time of 1 second at the minimum operating temperature.

On the combustion chamber N°2 burners B-01A/B are installed. By using LPG as combustible, the burners heat the air temperature up to the operating temperature. This temperature is kept steady and even in the whole combustion chamber by means of the modulating valves placed on the fuel feed and controlled by temperature regulator.



At this temperature, the V.O.C. are oxidised to CO₂ and H₂O.

The chambers will operate as follows:

N°2 chambers : as **pre-heater** of the inlet air

N°2 chambers : as **heat recuperator** from the air leaving the combustion chamber

N°1 chamber : for **washing phase** with clean air

The switching between the different phases takes place about every 90÷120 sec by means of special valves placed near the combustion unit forming the body of the combustor.

**The whole plant is run by a control unit.
On this control unit all the temperature and pressure alarms are installed together with all the components required for the automatic and continuous operation of the plant.**

Operation cycle description

The polluted air coming from your departments is sucked by the centrifugal fan BL-01 and is conveyed into the combustion unit R.T.O. where, by the open valve goes to chambers A and B.

In chambers A and B, air is warmed.

After leaving the chamber, air passes through the combustion chamber whose temperature is kept steady by means of burners B-01A/B and regardless from the solvent concentration.

Then air leaves the combustion chamber and passes through chambers C and D in which it gives up some of its heat to the ceramic beds.

Cleaned air leaves chambers C and D.

In the meantime, the chamber E is undergoing the washing phase so that, during the following cycle, the cleaned air leaving the combustion chamber can pass through it without dragging not oxidised V.O.C. to the stack.

During this phase the air not completely oxidized exits from chamber E and it is conveyed to the process fan.

The total air volume leaving the combustion unit is sent to the stack.

The five chambers will alternate cyclically in the different phases allowing in this way the continuous operation of the plant.

Besides, the plant is equipped with the following safety devices:

- N.1 thermoelement TE-01 for measuring the process gas inlet temperature
- N.7 thermoelements TE-02A/B/C/D/E, TE-03A, TE-03B/C for measuring the temperatures inside the oxidizer, with thresholds of high and very high temperature
- N.1 regulation loop TIC-average for the regulation of the intake of the auxiliary fuel for the maintenance of the combustion temperature, with thresholds of high and very high temperature
- N.1 thermoelement TE-04 for measuring the process gas outlet temperature
- fuel feed ramp realised according to the EN 746-2.
- secondary fuel feeding ramp for natural gas (gi-tech)

All the temperatures needed (combustion chamber, inlet process air and outlet air) are continuously controlled and partly registered so that the safe running of the plant is always assured.

After the pre-heating phase, the working temperature in the combustion chamber is kept constant with a device that permits to feed the natural gas directly into the combustion chamber (**gi-tech**), avoiding the use of comburent air.

In case of a malfunction in the plant, which requires the plant shut down, the valve KV-101, installed upstream of the system, closes automatically and the

valve KV-102 fully opens to allow the inlet of ambient air for the purging of the plant.

The inlet gas flow rate can be regulated by the action of the control loop, which will increase or decrease the rotation speed of the process fan BL-01 (**inverter and pressure transmitter**).

Considering the high V.O.C. concentration, the plant will be completed with a hot by-pass automatic system of ceramic bed, in order to avoid very high temperatures in the combustion chamber. A modulating valve TCV-05 allows to divert a part of purified air from combustion chamber directly to the RTO outlet, by-passing ceramic bed.

The plant is equipped with all the devices in order to realize the operations of **burn-out**. The temperature of burn-out is abt. 400°C.
The RTO purge and start-up operations will be done with a fan BL-03 dedicated.

5.2. N°2 Burners B-01A/B and **gi-tech system, designed to reach and keep the temperature of the oxidation chamber and each one composed by:**

- combustion head with pilot burner
 - sight glass port
 - ignition road
 - refractory block and SS 310 external sleeve
 - flame detection with U.V. cell
 - ignition transformer
 - electrical board (waterproof), IP 54 with alarm circuit and emergency button
 - air/gas valve with electrical regulation actuator and positioner 4-20 mA
 - fuel feeding ramp made according to the NFPA 86
 - secondary fuel feeding ramp made according to the NFPA 86 (**gi-tech**)
- | | | |
|--------------------|-------------|--------|
| Max capacity total | 3.400.000 | kcal/h |
| Fuel | Natural gas | |

This burner type allows the operation at high temperature, where an elevated uniformity is necessary without located overheatings.

5.3. Process fan BL-01

Installed downstream before the stack

Max flow rate	89.900	Nm ³ /h
Static head ³	530	mm w.c.
Installed power	315	kW

Motor protection	IP 55
Regulation	by INVERTER

Material:	
Body	AISI 316L
Impeller	AISI 316L

Sound pressure level (SPL)	85 dB(A) at 1,5 m
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5.4. Combustion air fan BL-02

Max flow rate	abt. 4.500	Nm ³ /h
Static head	650	mm w.c.
Installed power	22	kW
Motor protection	IP 55	
Material:		

³ With 100 mm w.c. at Your disposal for piping.

Body	carbon steel
Impeller	carbon steel
Sound pressure level (SPL)	85 dB(A) at 1,5 m



5.5. **Piping and valves**

- N°2 start-up wafer butterfly valves KV-101 (AISI 316L) and KV-102, N°1 for combustion air KV-04
- N. 3 wafer butterfly valves for washing of chambers (AISI 316L).
- Ducting for connection complete with expiation joints
- Piping and manual valves will be supplied where they are necessary.

5.6. **Insulation**

The insulation of the plant will be furnished where it is necessary, by means of mineral wool and sheet aluminium to finish.

5.7. **Stack**

The supplying will be complete with a stack with sample intakes.

Type	Self-supporting
Diameter	1.750
mm	
Material	SS 316L insulated
Height (to be confirmed)	25.000
mm	

Service walkway for the access to the sample intakes, complete of ladder.

*The stack will be manufactured with **airprotech** standard execution.*



5.8. **Painting (standard airprotech)**

Combustor unit

- * degreasing and brushing cycle
- * polyurethane primer thickness 50 micron
- * polyurethane coating layer total thickness 60 micron

Service walkway and ladder

- * hot galvanized

Skid

* hot galvanized

5.9. Instrumentation

We will supply the whole instrumentation to work the order of plant, it includes:

- N°7 thermo elements
- N°1 pressure switch compressed air
- N°1 pressure switch combustion air
- N°1 pressure transmitter

5.10. Instrument/electric board and relative plant

The supply includes:

- a. Electric cabinet, automation with PLC and operator panel HMI
- b. Electric and instrument connections in our workshop
- c. Remote control

The software for the PLC and operator panel management will be done by airprotech

a. Electric cabinet:

The electric cabinet consists of N°1 modular cabinet, with forced ventilation through roof fan, protection min. IP 54. It is divided in two sections:

- POWER SECTION
- CONTROL SECTION

POWER SECTION:

- General panel switch with fuses
- Fuses for utilities protection
- 400/110 Vac phase-changing transformer for auxiliary circuits
- Power supply circuit for each utility
- Interconnection terminal board with field-utilities
- Inverter for the regulation of the fan BL-01 rpm
- Emergency stop push button (front panel)

CONTROL SECTION

- PLC **SIEMENS S7 1500**
- Operator panel **SIEMENS** (12" TOUCH)
- Alarm and signal lamps
- Manual start/stop selectors (front panel)
- Voltage alarm, general alarm and plant status (front panel)

The plant will be automatically controlled by means of:

- **PLC** installed on the electric board. It is programmable with the same Siemens operating system.

The PLC is composed of:

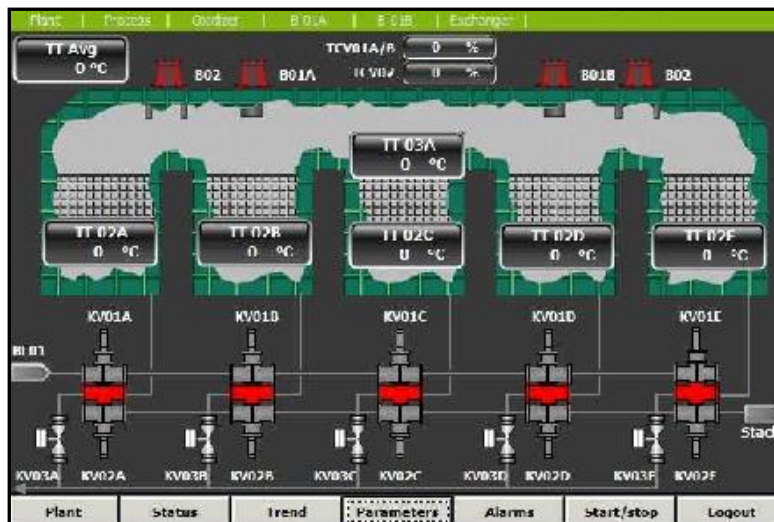
- * CPU
- * Digital I/O cards
- * Analogical I/O cards

- **N°1 Operator panel (HMI), with 12" touchscreen.**

The HMI application is the user interface with the entire system; it allows the real-time monitoring of the operating status, of all values, both analogical and digital and of subsequent analysis of trends and alarms. It allows to provide commands to cycles or to single users and to set all the parameters (such as thresholds, delay times, etc.) essential to the proper functioning of the plant.



In the panel, the graphic pages are organized for the setting of several parameters and for the plant operating conditions' control.



Data storage (CSV format)

The panel automatically creates each year/month, a directory in which, every day, a file is created including data sampled every minute. The file is in CSV format and contain the data of the historical information with date, time and value of recorded samples; each measure has its own column of samples. These files are stored in a USB flash drive included in the supply.

b. Installation of the electrical system:

Instrument/electric connections between the electric board and field-utilities and between electric board and field-instruments will be supplied:

- The **cables** will be FG7 type. All the cabling will be multi conductor that can be shielded, where required, and suitable for the expected ambient temperatures.
- Perforated **cable trays** will be supplied, complete with cover.
- The **pneumatic plant** will be realized with aluminium pipes, starting from the valve located at the geometrical limit of the plant, until the utilities.

c. Remote control

This system consists in the possibility, from airprotech, to have a remote access to the operator panel of the plant in order to be able to visualize the plant status, the operating parameters and, eventually, to modify these parameters.

The operator panel incorporates the platform Ubiquity for the remote control

An Ethernet/Internet connection, in the electric board, is required to the customer.

The electrical and control board will be installed close to plant at max distance of 10 meters.



5.11. Erection on site

All the equipment or main part of them, will be installed on the skid made of hot galvanized carbon steel to be placed on the ground.

The special RTO airprotech layout permits to speed-up the assembly time of the RTO in order to finish it in few days.

Airprotech will provide its own staff for the installation activities on site.

5.12. Burn out

The plant is designed for periodical burn out operations.

5.13. Transport

airprotech will supply the transport of equipment DDP – Marsa Malta.

DOCUMENTATION

The supplying will be in accordance with the section 5.

About the engineering of the plant, this will be carried out according to the criteria considered suitable and sufficient by airprotech on the basis of its own needs and experiences in similar plants.

At the plant start, the customer will receive an instruction handbook including:

- technical notes of the instrumentation and equipment lay-out
- lay-out
- P&I diagram

The language for the operation and maintenance manual will be **English**.

Battery limits:

Polluted air

- at the valve KV-101

LPG

- at the valve located on the fuel train

Compressed air

- from the valve located to the geometrical limit of the plant

Our supplying will include electrical-instruments connections between instrumentation and control and electrical cabinet located close to the plant (max 10 meters).

The feeding of the control cabinets will be at customer charge.

EXCLUSIONS

Our supply will not include the following items:

- Intake lines from production departments
- Grounding ring and relative connections
- Civil engineering and relevant foundations and estimates
- Utility connections beyond the battery limits
- Lifting equipment as crane truck, platform, forklift etc, stairs and scaffoldings
- All civil works
- Plant lighting
- Soundproofing
- Spare parts
- Analysis
- Insurances and custom duty
- Custom clearance
- Anything else which isn't expressly described in this offer

TESTING

Preliminary test and test run will be carried out by our skilled workers, unless differently specified in section 7.

8.1. Preliminary test

By "preliminary test" we mean the checking of the correct operation of the equipment, of all the instruments and all the valves that compose the plant and, in addition, the calibration of the instruments themselves.

This test will be carried out at your works in the presence of members of our staff.

The expected duration of the trial is **2** days. The maximum daily presence of one of our technicians is 10 working hours/day.

8.2. Test run

By "test run", we mean the checking, during operation of the plant, of the data included in section 3 or, if different, previously accepted by **airprotech**.

This test will have to be carried out soon after the positive issue of the preliminary test and it will last **2** days, meant as maximum daily presence of one of our technicians of 10 working hours/day, journey and displacement included. Our staff's services, as indicated above, are intended to be continuous. If a protracted presence of our staff were needed, owing to causes not depending on us, this extension would have to be paid to us according to ANIMA TARIFFS for foreign countries, with reimbursement of expenses on the base of our list.

If a report of the conformity established by a qualified organization is required, this is at customer charge.

GUARANTEE

9.1. Working guarantees

ODOUR abatement efficiency	>95	%
T.O.C. concentration mgC/Nm ³	<20	

9.2. Manufacturing guarantees

We guarantee every part of the plant against manufacturing defects for a period of **12 months as from the date of completion of commissioning (max 15 months from delivery)**.

The parts to be replaced or repaired in guarantee will be put at your disposal free at our works.

The guarantee doesn't cover the parts prone to usual wear and tear due to the plant operation. In order to obtain the guarantee of the values, it's essential that the working conditions of the plant be corresponding to the ones we indicated and the plant shouldn't be modified or tampered with.

In addition, we point out that the contents of this offer are merely indicative and that, consequently, **airprotech** reserves the right, in case of order, to introduce all the variations needed to make the plant operate according to the guarantees we give.