Italian National Agency for New Technologies, Energy and Sustainable Economic Development

Energy Technologies Department and Renewable Sources

Bioenergy, Biorefinery and Grenn Chemistry Division

TERIN-BBC

ATTIVITÀ	SIGLA DI IDENTIFICAZIONE:	DISTRIBUZ.	COPIA nº	PAG.:
P.I.B.E. Piattaforma Integrata per la Bioeconomia	**PIBE_STF-3**	L	//	1 / 22

TECHNICAL SPECIFICATIONS FOR THE SUPPLING OF A THIN FILM EVAPORATOR PILOT PLANT

Trisaia Research Center

ROTONDELLA (MT)

October 2020

0	Prima emissione	20/03/2019	Ing. J. Canonaco	Ing. P. Garzone	Ing. G. Braccio
REV.	DESCRIZIONE	DATA	REDAZIONE	CONVALIDA	APPROVAZIONE

INDEX

1. Introduction

A new thin film evaporator unit will be installed in the ENEA research center in order to produce a new bio based polyalfaolefin (APAO) to be used as lubricant base. The scope of the thin film evaporator unit is to evaporate the unreacted monomers and light oligomers from the heavy product increasing its viscosity.

2. Description of the supply

The scope of this document is to provide all the technical information required for the preparation of a quotation for all hardware and related services, as mentioned in this specification, for the supply at the ENEA's premises in its research center of a skid mounted thin film evaporator unit and associated issues as laid down in this specification.

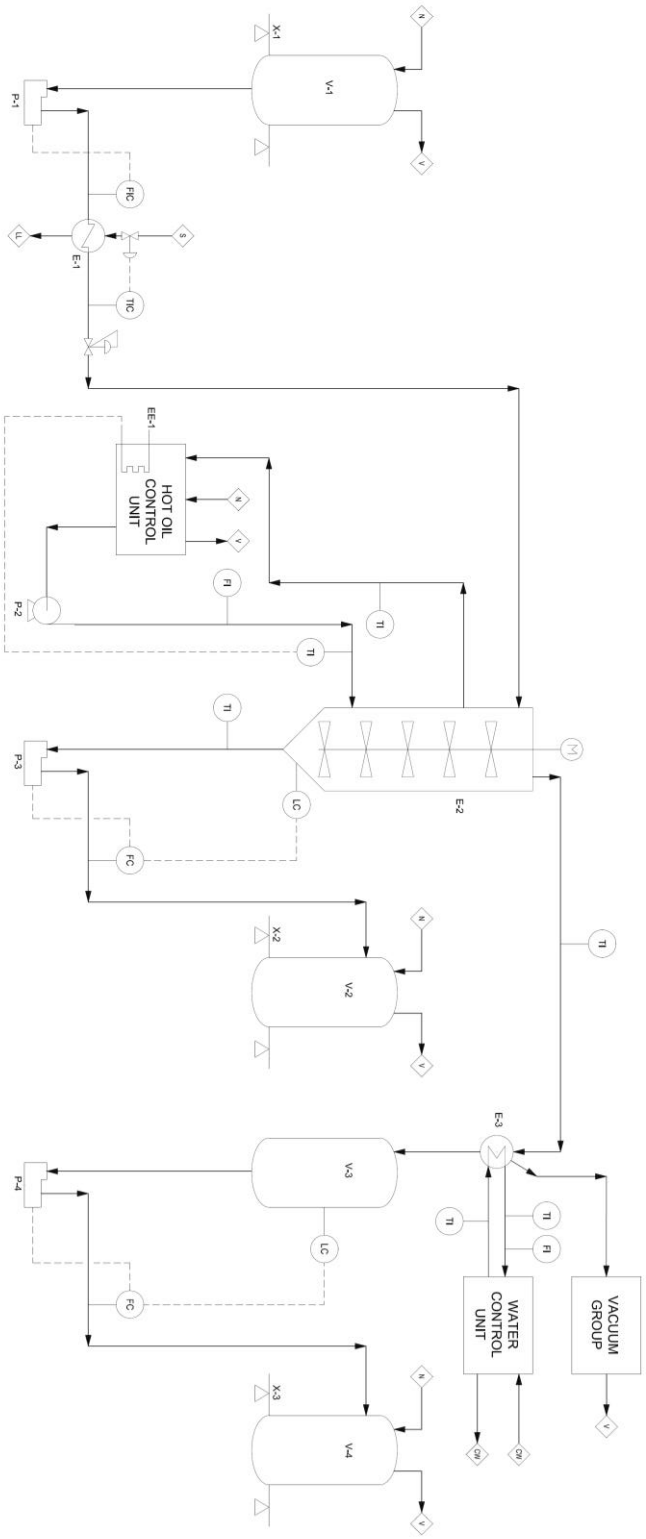
3. Techinacl details

3.1. Design basis

The pilot plant shall be designed for the following feed characteristics:

Temperature	Ambient
Physical state	Liquido
Typical composition of feed	~ 85 % poly-alphaolefins ~ 15 % monomers (decene and 9-DAME) and light oligomers
Mass flow-rate of the feed	20 kg/h
Feed density (kg/m^3)	870 at 40 °C 830 at 100 °C
Feed viscosity (cP)	10÷435 cP at 40 °C 1÷45 cP at 100 °C
Mass flow rate of the product	17 kg/h
Product Density (kg/m^3)	880 kg/m3 at 40 °C 840 kg/m3 at 100 °C
Product Viscosity (cP)	100÷880 cP a 40 °C 15÷100 cP a 100 °C

3.2. Process scheme



The pilot unit shall include:

- n.1 feed storage tank,

- n.1 product concentrate storage tank
- n.1 distillate storage tank

in order to feed continuously the pilot plant for at least 72 hours at max capacity.

The required operating conditions range is reported as follows:

- Exchanger Type: Thin Film Evaporator
- Operating pressure min/nom/max: 4/10/20 mbara;
- Operating temp. min/nom/max: 150/200/260 °C;
- % Evaporation min/nom/max: 10/15/20 %w

Heat exchangers, vacuum pumps, control units for hot oil and tanks have to be included in the supply.

3.3. Plant dimensions

The supplier has to indicate in the technical sheets the required space for plant installation and the weight.

4. Construction materials

The construction materials for all process components and lines shall be AISI 316L in accordance to the design temperature of the plant components.

Line sizes, materials and tubing/piping will be indicated on the P&Id according to Vendor's standard. For tubing and associated products metric sizes Swagelok will be applied in accordance with Swagelock guidelines.

Material certificates will be supplied as required from PED regulation.

5. Instrumentation and control

The pilot plant shall be equipped with all necessary instrumentation on all vital points in order to monitor or control where necessary.

For safety interlock purposes, separate instrumentation shall be installed.

Details on instrument installation to be places in hazardous area will be specified during finalization of the project.

The new hardware and software to be supplied by the Vendor is summarised as follows:

- PLC installed in feld

6. Process frame

Process components, piping and cabling will be mounted on a rigid carbon steel, box/H-beam structure, painted accordingly to the client coating spec (to be provided by Client).

The Vendor shall indicate a preliminary overall dimensions and weight of the frame layout of the DCR pilot plant (including the storage tanks and analyzers) with the technical proposal documentation in order to preliminary evaluate the installation area of the unit.

Main features of the frame design are: the optimal accessibility and operability of pilot plant, optimized to facilitate easy maintenance, service and training, minimal interconnections between process frames for effective assembly and disassembly of the unit.

7. Spare parts

An ample selection of spares and consumables shall be included in the scope of supply, e.g. seals, o-rings, gaskets, fuses and couplings. Moreover, wherever special tools are needed, they will be included as well.

All these parts shall be shipped together with the pilot plant and enable client to use these parts during installation and acceptance tests for replacement in case of damage or malfunctioning.

Furthermore, a detailed list of spare parts necessary during operation stage shall be provided by the Vendor.

8. Design and manufactoring codes and standards

All documentation, project communication and implementation shall be in the English language. Units will be in accordance with SI.

With respect to manufacturer operating manuals, Vendor will ask to suppliers to provide an Italian documentation.

The design, manufacturing and documentation will be in accordance with the European regulations, such as PED 97/23/CE and ATEX 94/9/CE.

A EC declaration of conformity shall be delivered and the related CE marking shall be installed on the pilot plant.

The Hazardous electrical area classification of the new pilot unit is the Zone 2 IIC T1.

9. Scope of the supply

The Vendor scope of supply shall be:

- Extended basic design engineering of the thin film evaporator unit, including as minimum:
  - Process and instrumentation diagram
  - Basic process frame lay-out
  - Equipment specifications and drawings
  - Battery limit and utility list
  - Instrumentation and signals list with identification of the battery limits between Vendor and client
  - Analysers specifications
  - Electrical diagrams and identification of the battery limits between Vendor and client
  - HAZOP/SIL analysis
  - Execution schedule
- Detailed engineering and procurement (to be carried out on the client's final approval on the extended basic design engineering documents)
- Construction and assembly of the thin film evaporator unit at Vendor's premises
- Documentation for the thin film evaporator unit operating and safety manual
- Documentation for the thin film evaporator unit laboratory manual
- Manufacturer manual and documentation for maintenance and installation of the equipment, instrumentation, analysers, GC and detectors.
- Transportation to client's premises
- Thin film evaporator unit re-assembling to client's premises
- Assistance for training, assistance to start-up and execution of acceptance test

The Vendor shall indicate together with the technical proposal the project methodology to be applied for the supply of thin film evaporator unit and a

project milestone time schedule starting from KOM up to plant start-up at client's premises

10. Utilities

The following utilities will be made available at pilot plant battery limits:

- Electric power
  - 50 Hz / 380 V for motor and heater
  - 50 Hz / 280 V for control and interlocking purposes
  - 24VDC for instrumentation
- Cooling water
  - inlet temp.: HOLD °C
  - max outlet temp.: HOLD °C
- Instrument air:
  - Min/Max pressure: HOLD °C
- Plant air
  - Min/Max pressure: HOLD °C
- Nitrogen
  - Min/Max pressure: HOLD °C
- Natural gas
  - Min/Max pressure: HOLD °C
- Demi water
  - Min/Max pressure: HOLD °C

The Vendor shall indicate with its technical proposal the requirement needed for each utilities at BL condition (norm/max flow-rate/consumption) of the new unit.

11. Assessment parameters of technical offer

The Technical Value of the offer will be assessed by taking into account the following aspects:

A) Technical details of the supply and quality of design documentation (score: max 40);

B) Turnover (score: max 10);

C) Experience (score: max 10);

D) Human resources (score: max 5);

E) Professional skills (score: max 5);

The technical score will be awarded on the basis of the following criteria:

A) Technical details of the supply and quality of design documentation (maximum score: 40)

The economic operator must provide a design documentation with at least the following information:

- General description of the supply;
- Process scheme with mass/heat balances;
- Process and instrument diagram;
- Equipment specifications and drawings;
- Battery limit and utility list;
- Electrical diagrams and identification of the battery limits
- List of instruments and electrical signals;

- List of suppliers of the main electrical, mechanical and control devices;
- Technical and improvement considerations;
- Construction materials;
- Control system;
- Execution schedule

B) Turnover (maximum score: 10)

The economic operator must declare the economic turnover (expressed in €) concerning executive designs/manufacture/fabbrication/commissioning of process plants (pilot and/or industrial scale) carried out in the 2015-2019 five years, by filling the following table:

Turnover of executive design (€)					
2015	*2016*	*2017*	*2018*	*2019*	*Total*

Calculation formula: (F/Fmax)*10

where:

F= turnover in the 2015-19 five year concerning process plants (pilot and/or industrial scale) of the economic operator;

Fmax= maximum turnover in the 2015-19 five year concerning process plants (pilot and/or industrial scale) among all the economic operators

participating to the procedure.

For instance:

Economic operator	*Turnover (€)*						*Score*
	2015	*2016*	*2017*	*2018*	*2019*	*Total*	
EO1	*100.000*	*200.000*	*5.000*	*300.000*	*15.000*	*620.000*	*1,6*
EO2	*800.000*	*60.000*	*100.000*	*1.000.000*	*20.000*	*1.980.000*	*5,0*
EO3	*200.000*	*50.000*	*700.000*	*50.000*	*100.000*	*1.100.000*	*2,8*

C) Experience (max score: 10)

C.1-Experience in executive design (max score: 5)

The economic operator must declare a list of executive design projects process plants (pilot and/or industrial scale) carried out in the 2015-2020. For each project, the scope, a technical description and the customer shall be indicated as reported below.

N.	***Project Overview***
1	*Scope: ……* *Description: …….* *Customer: ……*
2	*Scope: ……* *Description: …….* *Customer: ……*
…	

Calculation criterion:

- A score of 0.5 for each executive design projects of Thin Film Evaporator plants (pilot and/or industrial scale);
- A score of 0.25 for each other executive design projects

An example is reported below:

N.	***Project Overview***	***Assigned score***
1	***Scope**: Thin Film Evaporator pilot plant* ***Description**: fabrication and commissioning of a thin film evaporator pilot plant. Capacity: 20 kg/h of oligomers/monomers feed with an evaporation rate of 3 kg/h. Technical aspects: agitated thin layer evaporator; design pressure: 5-20 mbara; design temperature;…* ***Customer**: ENEA – Italy*	*0.5*
2	***Scope**: Hydrogenation pilot plant* ***Description**: executive design of a continuous hydrogenation pilot plant able to perform hydrogenation reaction of hydrocarbon oligomers contain double bonds in order to obtain a product with low iodine number. Capacity: 15 kg/h of liquid flow rate and 5 STDm3/h of hydrogen with sepration/recycling system for both liquid and gas phase; operating conditions: up to 300 °C and 60 barg; ; WHSV: 0.2-0.5 h-1, …* ***Customer**: ENEA – Italy*	*0.25*
…		

C.2 - Experience in engineering/manufacture/commissioning (max score: 5)

The economic operator must declare a list of

engineering/manufacture/fabrication/commissioning/testing projects of process plants (pilot and/or industrial scale) carried out in the 2015-2020. For each project, the scope, a technical description and the customer shall be indicated as reported below:

N.	***Project Overview***
1	*Scope: ……* *Description: …….* *Customer: ……*
2	*Scope: ……* *Description: …….* *Customer: ……*
…	

Calculation criterion:

- A score of 0.5 for engineering, manufacture, fabrication, commissioning of Thin Film Evaporator plants (pilot and/or industrial scale);

- A score of 0.25 for engineering, manufacture, fabrication, commissioning of other projects

An example is reported below:

N.	***Project Overview***	**Assigned score**
1	***Scope****: Thin Film Evaporator pilot plant* ***Description****: fabrication and commissioning of a thin film evaporator pilot plant. Capacity: 20 kg/h of oligomers/monomers feed with an evaporation rate of 3 kg/h. Technical aspects: agitated thin layer evaporator; design pressure: 5-20 mbara; design temperature;…* ***Customer****: ENEA – Italy*	0.5
2	***Scope****: Hydrogenation pilot plant* ***Description****: engineering and fabrication of a continuous hydrogenation pilot plant able to perform hydrogenation reaction of hydrocarbon*	0.25

	oligomers contain double bonds in order to obtain a product with low iodine number. Capacity: 15 kg/h of liquid flow rate and 5 STDm3/h of hydrogen with sepration/recycling system for both liquid and gas phase; operating conditions: up to 300 °C and 60 barg; WHSV: 0.2-0.5 h-1, … ***Customer**: ENEA – Italy*	
…		

D) Human resources (maximum score: 5)

Organization chart and number of permanent and not permanent employees (at the date of application) involved in the activities of design, engineering, manufacture, fabrication, assembly, and commissioning of process plants (pilot and/or industrial scale). An example is here reported:

Activity	*Permanent employees (no.)*	*Not permanent employees (no.)*
Design *Manufacture/Fabrication* *Assembly* *Commissioning*	……..	……

Calculation formula: (Nind+Ndet/2)/ (Nind+Ndet/2)max*5

where:

Nind: number of permanent employees

Ndet: number of not-permanent employees

(Nind+Ndet/2)max: maximum value among all the economic operators participating to the procedure.

For instance:

Economic operator	*Permanent employees (no.)*	*Not permanent employees (no.)*	*Assigned score*

EO1	*20*	*10*	*4.2*
EO2	*30*	*0*	*5.0*
EO3	*25*	*5*	*4.6*

E) Professional skills (maximum score: 5)

Permanent employees (at the date of application) with professional skills and experiences able to perform the contract with a suitable quality standard, as reported in the following table:

Professional resources	**Yes**	**No**
• Project manager, with master degree in engineering science and at least three years of experience in the management of projects with economic value higher or equals to the opening bid.		
• Project engineer with master degree in Chemical Engineering and with at least three years of experience in process engineering;		
• Structural engineer with master degree in mechanical or nuclear engineering or equivalent and with at least three years of experience in mechanical design of high-pressure equipments.		
• Process control engineer with master degree in Chemical Engineering or Electric/Electronic engineering or similar, with at least three years of experience in design and tuning of system controls.		
• Electronic or Mechanical Experts with at least three-years of experience in maintenance of electrical and mechanical devices		

Calculation criterion: A score of 1 for each professional resource available in the society.