Firm Quotation

GEA Spray Dryer MOBILE MINOR™ Closed Cycle – MM-CC

Company	PolyPeptide Laboratories, Inc.
Attn.	Christelle Bobier
Project name	MOBILE MINOR™ Closed Cycle
Scope of supply	GEA Spray Dryer MOBILE MINOR™ Closed Cycle – MM-CC
GEA legal entity	GEA Systems North America, LLC
Quotation / CRM no.	30291833
Revision	1
Date	November 5, 2020

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Revision History

Rev. 0	10/1/20	Initial proposal
Rev. 1	11/5/20	Updated proposal to reflect desired scope

1 Contact List

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2 Executive Summary

The legal entity, GEA Systems North America, LLC, is hereinafter referred to as GEA.

This proposal is subject to the terms and conditions set forth in Section 7.2.

Our understanding of your requirements:

The client is working with products (solvents) and is looking at the opportunity to purchase a MOBILE MINOR™ spray dryer for research and development work.

Proposed solution:

The MOBILE MINOR™ is the perfect choice for carrying out test work and exploring the possibilities of spray drying. It meets the demand for a safe, sanitary, flexible, modern and easy-to-handle laboratory spray dryer. In the MOBILE MINOR™, small quantities of solutions, suspensions or emulsions can be dried into representative powder samples, and the process data required for scale-up to industrial production can be retrieved.

Why GEA?

- Ever since its introduction, the MOBILE MINOR™ Spray Dryer has enjoyed a unique reputation as the perfect choice lab-scale spray dryer to explore the possibilities of spray drying and produce small-volume powder samples.
- With more than 3,000 references for spray drying plants for R&D and small production units, GEA has unmatched expertise within small-scale spray drying technology. Which means that we have the know-how to help you choose exactly the right process and equipment.
- It is a flexible and easy-to-handle spray dryer which has become standard equipment in the R&D departments of many leading manufacturers, independent research institutes and universities worldwide.

3 Commercial Conditions

3.1 Price summary

3.1.1 Scope of supply

Item / description	Quantity	Price (USD)
Base System		
MOBILE MINOR™ Closed Cycle (MM-CC)	1	included
One set of typical spares	1	(included)
Atomization Devices (Refer to Section 6.1)		
Two-fluid nozzle atomization system, co-current mode	1	included
Additional Equipment (Refer to Section 6.2)		
Peristaltic feed pump, hazardous area installation, auto speed control	1	included
High pressure feed pump, nozzle and atomization system	1	included
Coriolis meter mass flow measurement	1	included
Powder collection container, 316 SS, 1000 mL	1	included
3-way valve for condenser control	2	included
Chamber extension (long)	1	included
Pneumatic hammer system	1	included
Low velocity gas disperser kit	1	included
Additional Condenser	1	included
Bag filter	1	included
HEPA filter for inlet hot process gas	1	included
HEPA police filter for outlet process gas: Bag-In Bag-Out (BIBO)	1	included
Equipment wetting device	1	included

SAT / IQ /OQ documentation package	1	included
Material traceability certificates	1	included

Service		
Consulting engineer – 5 days*		
Installation, automation and controls checkout Process commissioning On-site training	1	included
Travel and living expenses	1	included

Shipping		
DDP shipment	1	included

Subtotal	$
Customer Relationship Discount	
Total Sales Price	

* A day of service is defined as one person up to 8 hours per day, counting both arrival and departure travel time and all time spent on site (i.e. meaning active work plus standby). Unless otherwise specified, assignments shall not exceed 11 consecutive days on site. Minimum charge per day is 8 hours. Please provide GEA three weeks' notice prior to on-site services. Additional services are available anytime, if desired, at the GEA standard field service rates.

Delivery shall be DDP point(s) of manufacturer in accordance with Incoterms® 2010.

3.2 Validity

The quotation is valid for a period of 30 days, from date of this quotation.

3.3 Terms of payment

The following payment milestone schedule is contingent upon customer's credit rating approval by GEA:

- 40% due upon receipt of PO
- 20% due by December 15, 2020
- 30% due upon completion of equipment FAT
- 10% due upon completion of site services

Please make all payments within 30 days of GEA's invoice dates (net 30).

3.4 Time of delivery

The equipment will be ready for shipment within 6 to 7 months from the date of GEA's order confirmation, provided payments are received as stipulated under Section 3.3 - Terms of payment.

After GEA acceptance of purchase order, the estimated current delivery time is a sum of the following:

Description	Duration (months)
Basic engineering documents (GA, PFD, P&ID) to be ready for submittal	1
Equipment manufacturing	5
Equipment assembly, testing and packaging	1 - 2
Total ready to ship duration	**6 - 7 months**

3.5 Covid-19 special considerations

Due to current developments and measures taken globally, nationally and locally in connection with the World Health Organization's declared public health emergency in respect of the COVID-19 pandemic, GEA's offered goods and/or services can be negatively affected. Although GEA is taking actions to mitigate potential supply impacts, please be advised that our choice of suppliers / subcontractors, delivery lead-times, engineering and/or site services, quoted prices, etc. may be impacted due to the COVID-19 pandemic.

Such adverse effects may, in particular, be caused by or occur in response to actions taken by a government or public authority (including the imposition of embargoes or import or export restrictions, quarantine orders, travel restrictions or any other restrictions or prohibitions and the compliance by GEA or any of its sub-suppliers of any tier with corresponding laws or governmental orders, rules, regulations, directions, recommendations or precautions). The coronavirus pandemic and these effects may inter alia result in excessive illness rates of personnel, difficulties or increased costs in obtaining workers or goods, inability to transport goods or persons across borders, other travel restrictions or mobility impairments, personnel and/or material shortages, delays or other adverse circumstances affecting the supply of goods or services.

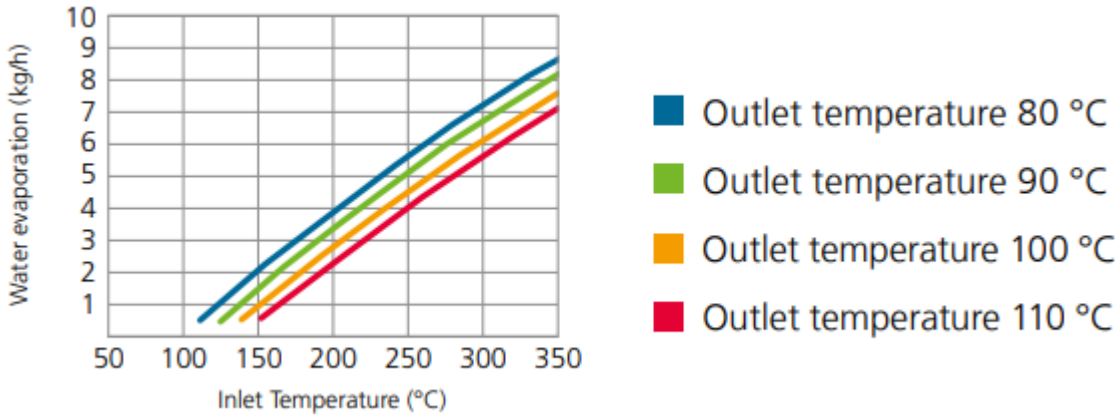
Accordingly, GEA will have an entitlement to an extension of any stated time schedule and/or to charge extra reasonable costs in the event GEA's time schedule is adversely impacted and/or GEA incurs additional costs due to any of the foregoing.

4 Technical Data

Unless otherwise agreed upon, the installation is designed for operation with non-hazardous products. The plant is suited for operation with a wide range of organic solvents such as acetone, methanol and ethanol. For other organic solvents, please consult with GEA.

4.1 Evaporation capacity

- the nominal evaporation capacity depends on the inlet and outlet temperatures of the drying chamber, and operation conditions. Please refer to the below capacity diagram.



Key Figures	MOBILE MINOR™
Nominal main process gas flow (kg/hr)	100 @ 200°C
Water evaporation capacity (kg/hr)	0.5 - 8
Typical mean particle size (µm)	5 - 80

4.2 Temperature

- maximum inlet temperature: 200 °C
- maximum outlet temperature acceptable for parts downstream: 120 °C

4.3 Atomizing equipment

- capability of operation with a two-fluid nozzle in co-current mode

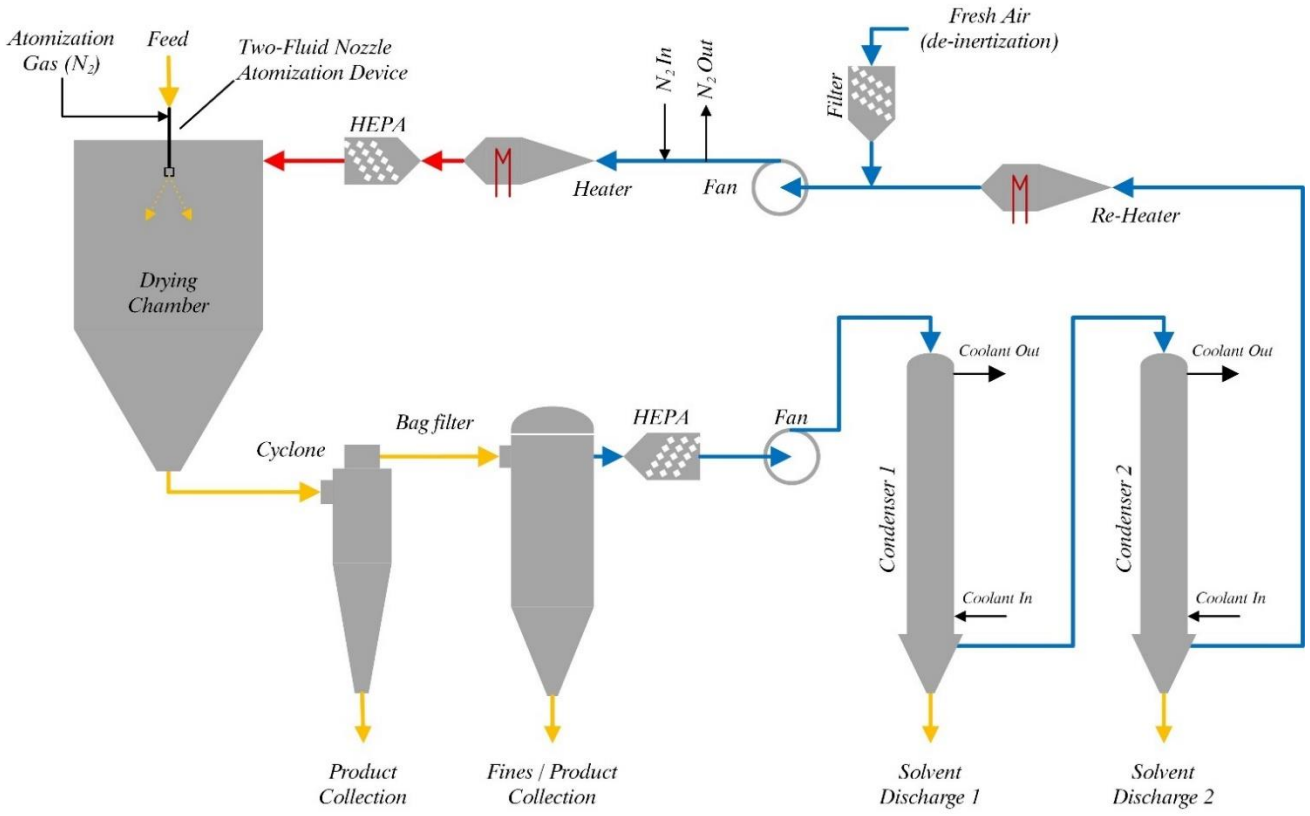
4.4 Heating system

- electrical heater

4.5 Exhaust gas cleaning

- capability of operation with a bag filter

4.6 Process block diagram



Example: process block with co-current two fluid nozzle

4.7 Process description

Spray drying in a MOBILE MINOR™ plant transforms a feed liquid into a dry powder in a continuous one step operation. The drying operation includes three stages:

a) Atomization of the feed liquid into a spray by use of a two-fluid nozzle (or alternative atomization device).
b) Contact of the atomized droplets with hot gas to promote evaporation. The hot gas enters the chamber through a proprietary ceiling gas disperser.
c) Separation of dried product from the gas in a cyclone and/or exhaust filter.

Proper feed liquid atomization into a fine spray results in a high droplet surface area. This is important because it allows evaporation to be completed rapidly and decreases the drying chamber size. The small droplets are most often produced by a two-fluid nozzle where compressed nitrogen creates the atomization, or alternatively by a rotary atomizer or single-fluid high pressure nozzle. During the evaporation stage there is an accompanying cooling effect on the droplets and the drying gas, and with a limited duration of the product in the chamber, heat damage of

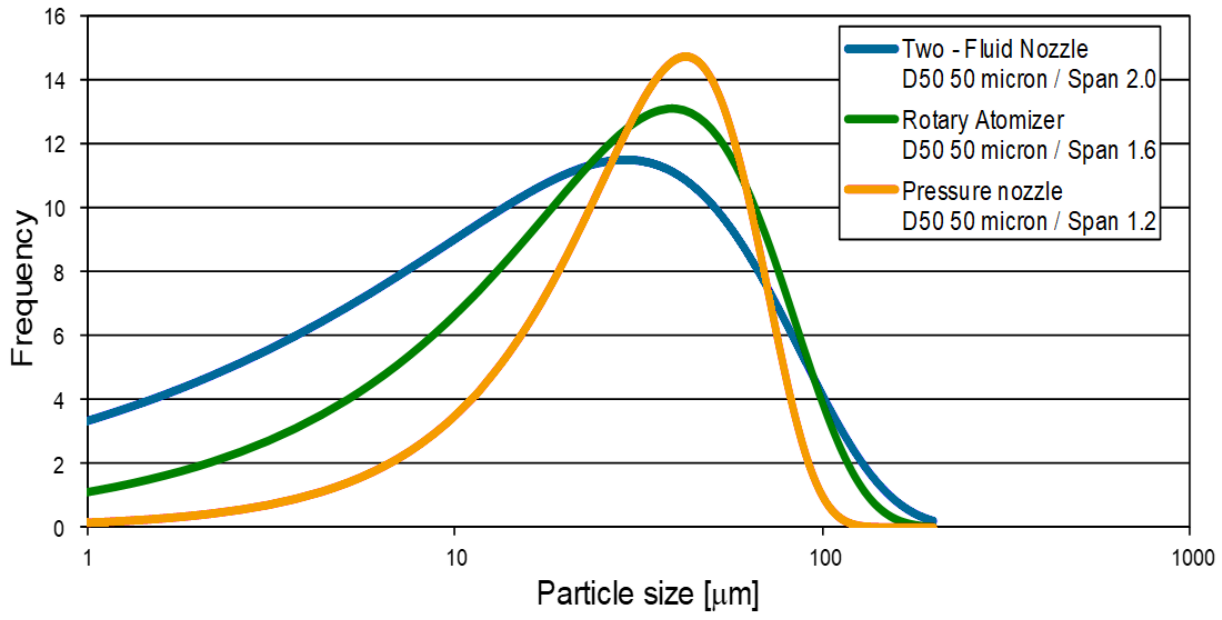
the product is prevented. The product is then conveyed to a cyclone for main product collection and the fines further conveyed to an exhaust filter. Exhaust gas is recycled, flowing through an outlet HEPA, solvent recovery stages, heating systems, and an inlet HEPA before re-entering the chamber and starting the evaporation process again. As slight variations in system pressure can occur, for example due to transient temperature fluctuations and instrument purges, nitrogen is added or removed from the process continuously to keep the overall system pressure balanced. *Note: some equipment mentioned in process description is optional*

Atomization Method Comparison

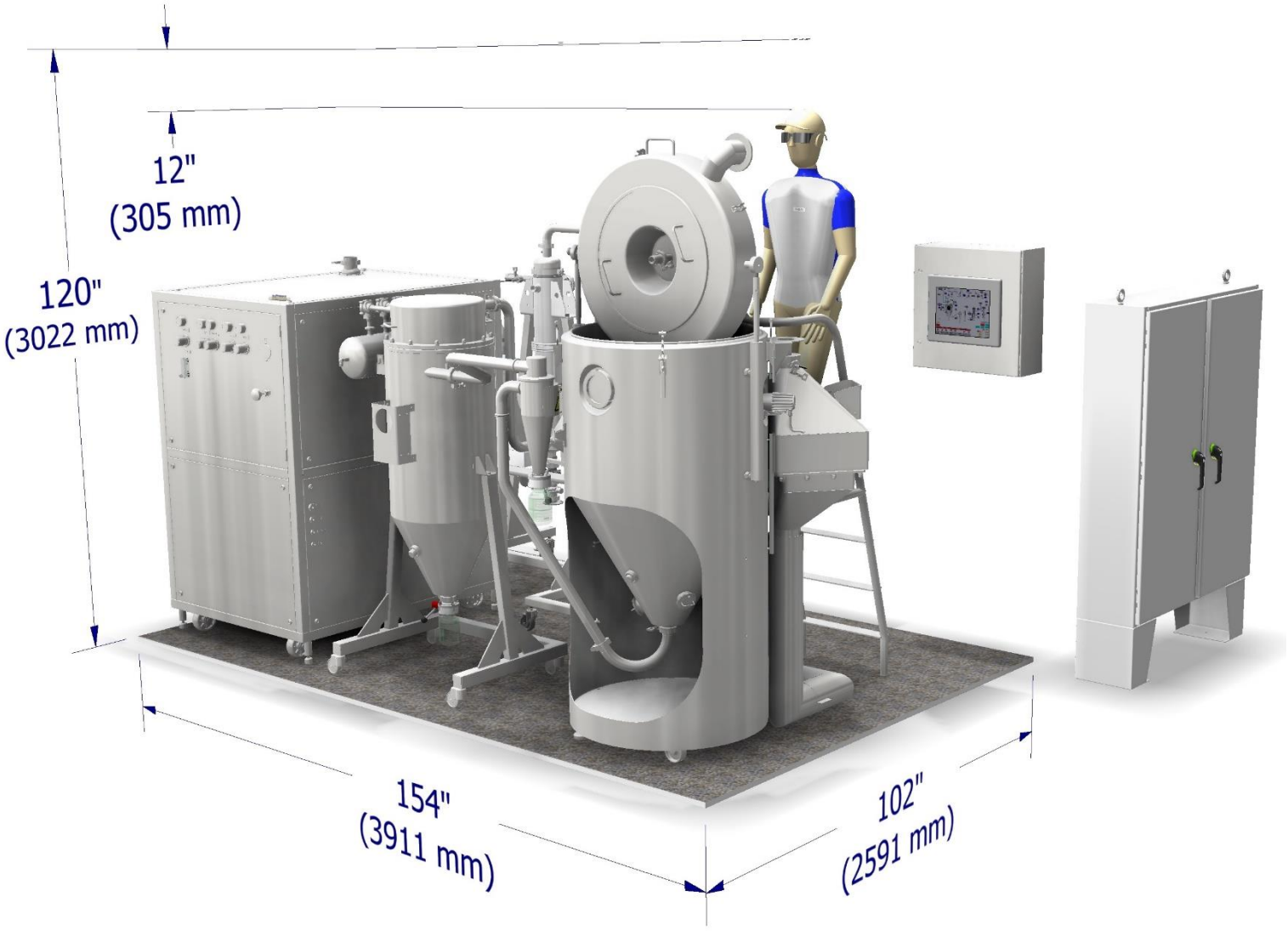
Method	Particle Size (typical)	Adjustment	Particle
Two-fluid nozzle (co-current)	3 – 80 µm	adjust gas flow/pressure	broad particle size distribution
Rotary Atomizer	20 – 80 µm	adjust rotation speed	medium particle size distribution
Two-fluid nozzle (counter-current)	3 – 80 µm	adjust gas flow/pressure	broad particle size distribution
Pressure nozzle *	20 – 80 µm	mechanical adjustment	narrow particle size distribution

* for pressure nozzle atomization, please consult with GEA

Particle Size Distribution Comparison



4.8 Plant general arrangement



Typical MM-CC equipment footprint dimensions (optional inlet HEPA shown)

4.9 General design standards

4.9.1 Materials of construction

4.9.1.1 Metallurgy

Except where specifically described in section 5, the construction material will be in accordance with the following:

- AISI 304 for stainless steel parts not in contact with product
- AISI 316 or AISI 316L for steel parts in contact with product

Components like motors, exterior of valves, and interior of valves that are not in product contact are typically made in other materials and possibly painted.

4.9.1.2 Elastomers

The proposed plant will be provided with silicone and PTFE elastomers where applicable (FDA compliant).

4.9.2 Surface treatment

- interiors of drying chamber, chamber extensions and bag filter subject to powder contact: Cold rolled 2B with welding zones ground to Ra ≤ 0,8 µm.
- interior of cyclone: ground to Ra ≤ 0,8 µm
- exteriors of drying chamber and cyclone: ground or brushed
- exteriors of bag filter: glass blasted

4.9.3 Electrical

Control panel(s) are UL 508A listed. Due to hazardous area location, all interconnecting cabling and pneumatic tubing between system components is by others.

4.9.4 Area classification, gas and dust

The proposed plant is designed for installation in hazardous space classified as Class 1 Division 2.

4.10 Utility requirements

Electrical Service Requirements	Amps	Volts	Phases	Hertz
PLC and Power Panel	40	480*	3	60

Main Compressed Air**	Flow		Pressure	
	scfm	Nm³/hr	psig	bar
Clean dry compressed air (panel)	0.1	0.17	87	6
Pneumatic hammer, chamber (option)	0.02	0.03	43.5	max 3
Chamber roof	0.03	0.05	0 - 58	0 - 4

Nitrogen Supply	Flow		Pressure	
	scfm	Nm³/hr	psig	bar
N2 drying gas	47	80	87 (min.)	6 (min.)
Two fluid nozzle. co-current, (option)	4.7 – 8.8	8 - 15 (at 2bar)	0 – 87	0 – 6
Bag filter	0.3 – 1.2	0.5 - 2	43.5 - 87	3 - 6

Cooling Medium	Temperature		Flow		Pressure	
	°F	°C	scfm	Nm³/hr	psig	bar
Condenser, cooling side, cooling medium	-20	-28.9	TBD	TBD	87	6

Note: Process figures are based on T inlet 200°C and T outlet 90°C. Baseline only, additional features and options will change utility requirements. Condenser cooling medium temperature varies with solvent types
** voltage must be within ±10 % of nominal value, frequency within ±1 %*
***compressed air must be clean, oil and water free.*

5 Scope of Supply

5.1 Quality, health, safety and environment

GEA is one of the world's largest suppliers of process technology and equipment for a wide range of industries. As an international technology group, GEA focuses on sophisticated production processes.

We conduct business activities by following our GEA Group Values and ethical principles laid down in a Global Business Conduct Policy and a Codes of Conduct policy which define our social responsibility principles.

GEA is committed to:

- Meeting or exceeding the satisfaction of customers
- Enhancing the well-being of GEA employees
- Identifying, analyzing, and effectively managing Quality, Health, Safety & Environment (QHSE) risks arising from all our business activities
- Creating an accident and incident free workplace and preventing occupational illnesses
- Complying with legal requirements, applicable codes and national standards
- Preventing environmental pollution, reducing energy consumption, waste generation and emissions as well as the creation and securing of the corresponding processes in accordance with relevant regulations and in consideration of the interested parties
- Taking precautions to prevent major accidents and to managing emergencies, incidents and impacts appropriately
- Assigning clear roles and responsibilities and conducting training to ensure necessary competence in all areas of QHSE
- Providing and maintaining appropriate systems of technology, work, tools and procedures that support the fulfillment of our objectives
- Continually monitoring and improving our QHSE systems, by reviewing our objectives and performance, implementing appropriate corrective and sustainable measures
- Integrating QHSE into business strategies and daily processes

These commitments, which are communicated, distributed, and posted throughout GEA facilities, are for individuals working for or on behalf of GEA to be actively involved in applying.

5.2 Equipment supply

5.2.1 Feed system

5.2.1.1 Feed System (not included)

- By customer or optional device, see section 6.2.1

5.2.2 Process gas supply system

5.2.2.1 Supply fan

For transportation of process gas through the plant (placed in closed cycle cabinet)

- gas tight design
- nitrogen-purged shaft sealing. Sealing rings made of a teflon / carbon-graphite compound
- TEFC motor, Class 1 Division 2
- speed regulation by VFD

5.2.2.2 System pressure safety relief burst disk

For overpressure safety

- burst disk plate
- burst disk support and mounting assembly
- integrated burst sensor indication to HMI

5.2.2.3 System airflow measurement with transmitter (high accuracy)

- venturi airflow measurement device
- estimated uncertainty in measured mass flowrate of gas: +/- 0.25%
- differential pressure transmitter for airflow indication to HMI
- transmitter mounting bracket

5.2.2.4 Process gas supply duct

From closed cycle cabinet to process gas heater

- assembled by clamps, easy disassembling

5.2.2.5 Process gas heater, electrical

- maximum consumption: 8 kW, infinitely variable
- maximum obtainable process gas temperature: 200 °C
- maximum allowable sheath temperature 292°C

- safety temperature sensor mounted on heating element, signal to control system
- electrical enclosure: Class I, Division 1 and 2, Groups B, C, D
- double wall cladding

MM-100 Chamber

5.2.3 Spray drying chamber system

5.2.3.1 MM-100 drying chamber

- cylinder size: diameter = 0.8m, height = 0.65m; cone: 60°
- sanitary design
- pneumatically operated chamber roof for easy cleaning
- process gas disperser in chamber roof
- light source and observation pane
- rapping stud for manual removal of possible deposits
- ports in chamber cone for optional fountain nozzle and exhaust process gas duct, plugged when not in use
- chamber insulated with mineral wool covered by fully welded stainless-steel cladding

5.2.3.2 Ladder with platform

- for access to chamber roof for inspection and cleaning
- mounted on brackets on drying chamber wall

5.2.4 Outlet process gas and powder collection system

5.2.4.1 Exhaust gas duct

From chamber bottom outlet to cyclone

- assembled by clamps
- chamber outlet temperature measurement port
- not insulated

5.2.4.2 Cyclone

- type CHE, size ø = 140 mm
- highly effective separation of powder and process gas
- assembled by clamp for easy dismantling for cleaning
- not insulated

CHE-140 Cyclone

5.2.4.3 Single point powder collection - cyclone

For powder collection under cyclone only

- powder discharge through a manual butterfly valve permitting replacement of the glass without interrupting the drying process
- powder collecting glass, 1000 mL

5.2.4.4 Cyclone gas exhaust duct

From cyclone to exhaust filter

- assembled by clamps, easy disassembling
- not insulated

5.2.4.5 Cartridge filter

For exhaust process gas

- a bag filter will be purchased in lieu of the standard cartridge filter, see section 6.2.5.1

5.2.4.6 Exhaust gas duct

From filter to condenser

- assembled by clamps, easy disassembling
- not insulated

5.2.4.7 Condenser

- shell and tube type, for cooling water or ethylene glycol depending on application
- vertical tubes for the passing of the process gas
- the process gas is cooled by the cooling medium passing counter current through the shell guided by multiple baffle plates ensuring effective cooling
- designed for use with a coolant inlet temperature of -28°C or higher
- not insulated
- manual shut off valve supplied for the coolant outlet
- pressure safety valve
- discharge of condensed solvent through an automated butterfly valve

Notes: The customer will supply cooling medium inclusive of chiller w/pump and all piping. GEA recommends optional three-way coolant control valve for proper process control. Type, consumption and temperature of cooling medium depend on type of solvent to be condensed. For lower coolant inlet temperature usage, please consult with GEA.

Condenser

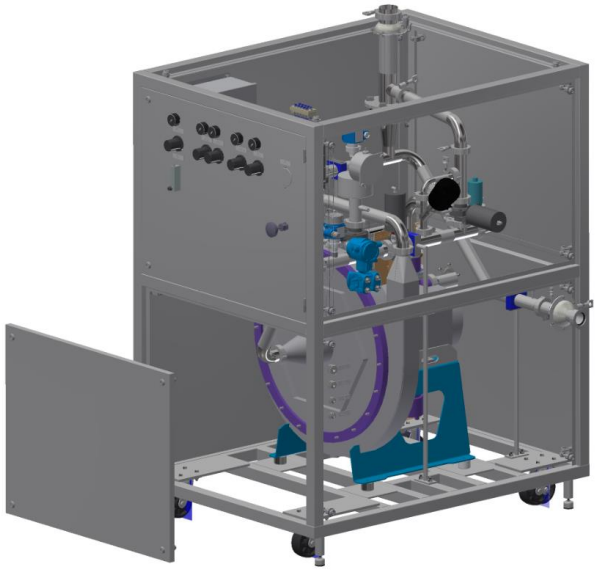
5.2.4.8 Exhaust gas duct

From condenser to process gas re-heater

- assembled by clamps, easy disassembling
- not insulated

5.2.4.9 Process gas re-heater, electrical

- maximum consumption: 2 kW
- maximum obtainable process gas temperature: 20 °C
- maximum allowable sheath temperature 292°C
- safety temperature sensor mounted on heating element, signal to control system
- electrical enclosure: Class I, Division 1 and 2, Groups B, C, D
- double wall cladding



Closed cycle cabinet w/side panels removed

5.2.4.10 Closed-cycle loop with nitrogen purging & balancing system

Assembled in a dedicated Closed Cycle Cabinet also including the supply fan

- duct system from re-heater to supply fan
- oxygen analyzer
- fittings and valves for supply and venting of plant
- fresh air filter housing and element: fiberglass felt media, 2 micron retention
- closed cycle cabinet with removable side panels for maintenance access
- ductwork assembled by clamps for easy disassembly

Note: The balancing system maintains a system pressure and oxygen content at necessary level for safe operation.

5.2.5 System spare parts

5.2.5.1 Essential spare parts

- four (4) powder collection containers (glass), 1000 mL each
- one (1) roof to chamber gasket
- one (1) cyclone gasket
- one (1) inlet duct to roof gasket
- one (1) atomizer/nozzle mounting gasket
- one (3) bag filter elements
- one (1) inlet air filter element
- set of sanitary ductwork gaskets
- set of RTD grommets

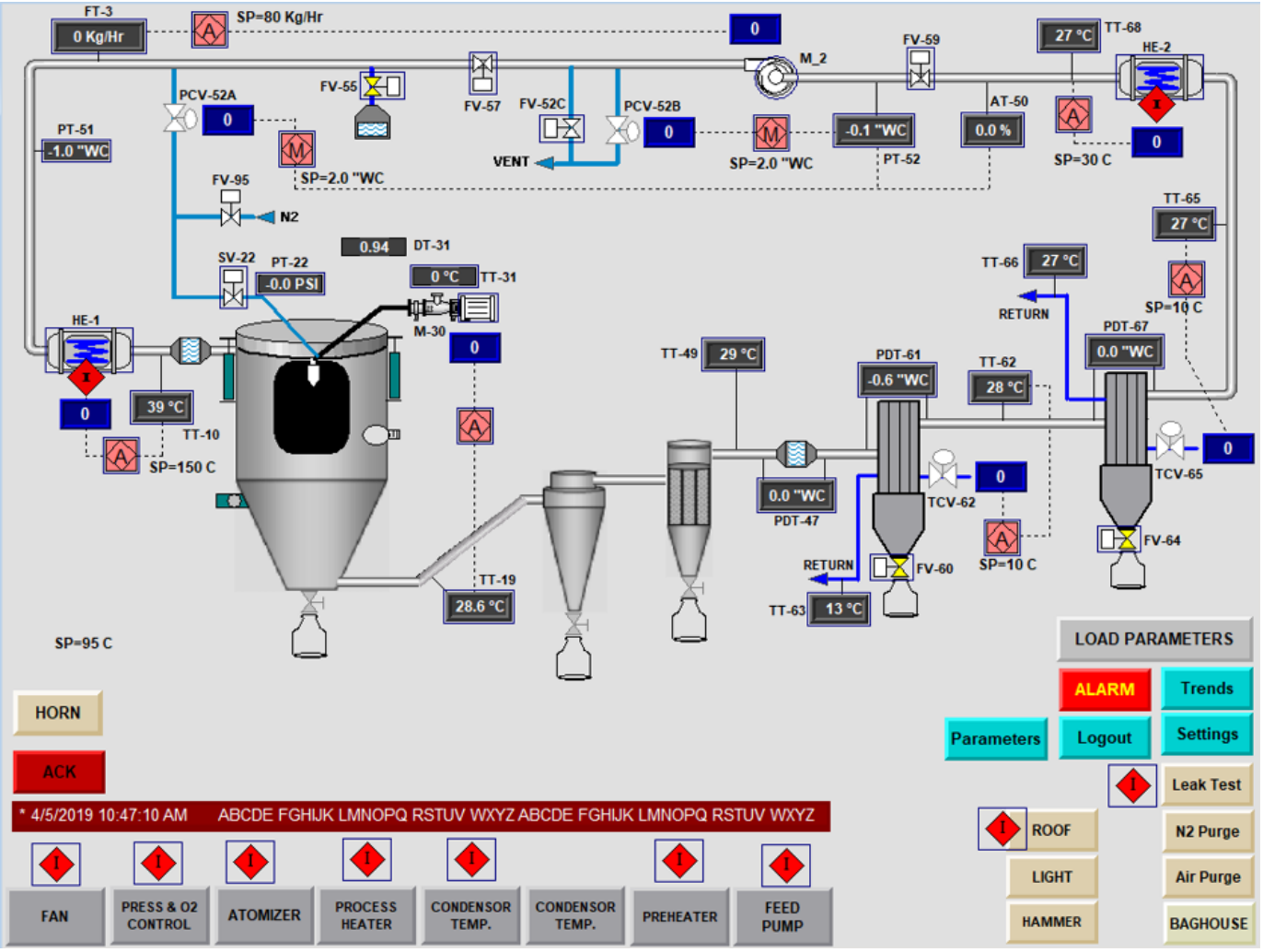
5.2.6 Automation hardware and software

5.2.6.1 HMI panel

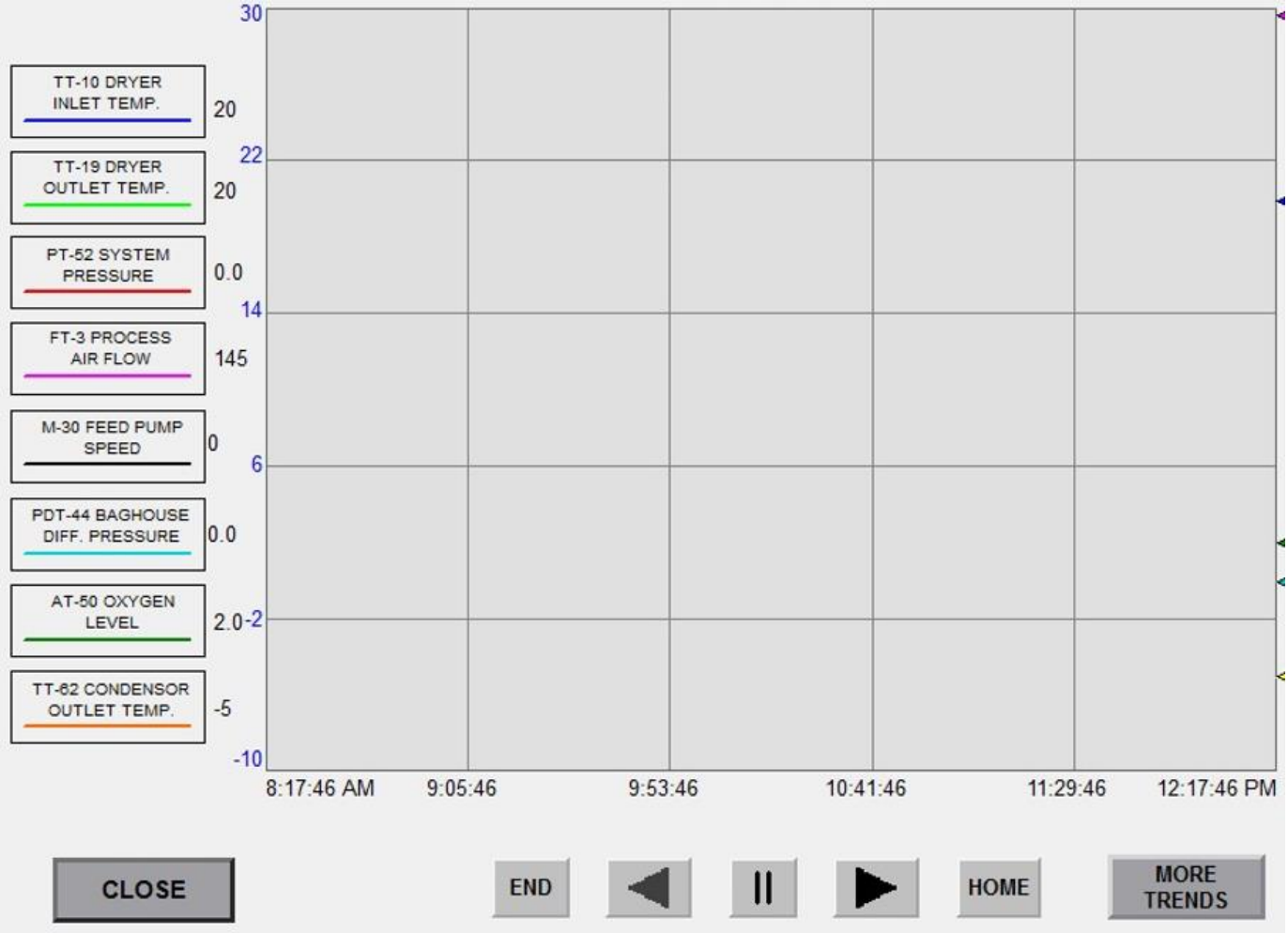
Suitable for wall mounting with integrated HMI. The panel is 304 SS NEMA 4X construction. The panel will be UL 508A listed and suitable for installation in a Class 1, Division 2 hazardous area.

Exterior: Interface make Allen-Bradley Panelview Plus 15" color/touch screen.

Interior: Terminals for electrical connections.



Example: typical HMI screen

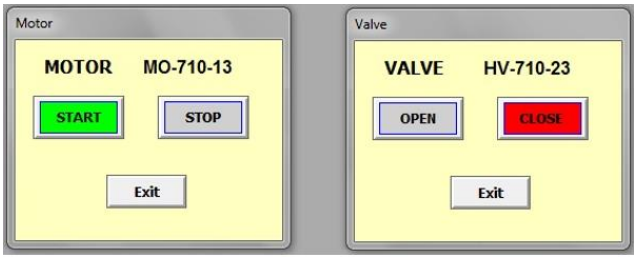


Example: typical trend screen

The display has animated flow diagrams to cover the following functions:

- Process circulation fan on/off and speed control with automatic speed adjustment based on a process gas mass flow (mass gas flow PID control)
- Feed pump on/off and speed control with automatic speed adjustment based on process gas outlet temperature (outlet temperature PID control). Automatic speed control not available for pressure nozzle option.
- on/off control for process heater and preheater alone with automatic temperature controllers for dryer inlet and preheater outlet temperatures
- automatic system pressure control/oxygen level control to monitor and control introduction of nitrogen gas into the closed cycle system

- on/off control for chamber light and atomizing gas
- buttons for pneumatic lifting of chamber roof
- alarms and safety interlocks
- indication of rotary atomizer speed, when optional rotary atomizer is included
- condenser outlet temperature control (PID control)
- automated nitrogen and air purge control



Example: typical motor and valve control

5.2.6.2 Electrical control panel

For installation in a non-classified, non-hazardous area. The panel is made of painted mild steel and is NEMA 1. The panel will be UL 508A listed.

Exterior: Main power disconnect, power ON status light, emergency stop pushbutton, heater element and temperature limit switch.

Interior: Allen-Bradley CompactLogix PLC, contactors, circuit breakers, Variable frequency drive, heater power controller, 24 VDC- power supply, terminals and other necessary devices.

Installation: All interconnecting wiring and pneumatics to be supplied and installed by others

5.2.6.3 Field equipment

- temperature sensors (RTD) for process gas temperature in chamber inlet, chamber outlet, after re-heater and condenser outlet
- local instrument for differential pressure across bag filter
- temperature sensor (RTD) for local indication of gas temperature of condenser outlet
- differential pressure transmitter to monitor pressure drop across condenser
- condenser level switch

Additionally, the following instruments and devices are located in the closed cycle cabinet:

- nitrogen pressure and flow gages and controllers for:
  - two fluid nozzle gas supply system
  - fan shaft sealing gas supply
  - filter cleaning gas supply
- oxygen transmitter to monitor drying system oxygen level
- pressure transmitters to monitor system pressure
- process valves equipped with position sensors

5.2.6.4 Chamber box

Mounted on back of drying chamber

- for electrical tie points
- NEMA 4X construction

5.3 Project services

5.3.1 Project engineering, design and documentation

GEA will provide process, mechanical and control systems engineering required to design, specify, fabricate and commission the proposed system.

All documentation will be in English. GEA will submit the following deliverables which will be done in GEA's standard format and issued in the Turnover Package (one electronic copy-PDF):

- Process flow diagram (PFD)
- Detailed process and instrumentation diagram (P&ID)
- GA layout drawings with overall dimensions (2D and 3D)
- Equipment and instrument OME documentation
- Control system functional specification
- Control panel electrical schematic drawings with BOM and layout
- Electrical schematic drawings
- Spare parts list
- Operating procedures

5.3.2 Project management

GEA utilizes clear business processes that are designed to harmonize our project management approach based on decades of experience and best practices from the Project Management Institute. Our project lifecycle processes are managed by our Project & Functional Excellence team and implemented worldwide as the basis for project management at GEA, including phase gate reviews to ensure top level quality throughout the project. Proactive risk and QHSE management are also integral parts of our approach.

Your GEA project manager will be responsible for:

- Organizing, leading, and following-up on project work within stipulated time, cost and contract conditions
- Communicating information to customer regarding progress of project work and about necessary changes, additions and adjustments
- Managing time and activity plans for the project, revising as required
- Preparing and coordinating technical documentation
- Preparing delivery schedules so that material, machinery, documentation, etc., are delivered on time according to the schedule
- Planning and arranging shipment, transportation, and insurance matters (if prepay and add)
- Invoicing
- Revising and updating contract documentation as necessary

5.4 Site services

5.4.1 Commissioning services

The services below are combined into one visit to the client site.

5.4.1.1 Installation, Automation and Controls Checkout

- 2 day of onsite service

GEA will support inspecting the plant for mechanical completion, motor rotation, control system operation, etc. The allowance for commissioning of the automation and controls is based on the active participation of customer's technical and engineering staff, or their representative(s). GEA has an advisory role only.

5.4.1.2 Process Commissioning

- 1 day of onsite service

Upon customer request, GEA will support testing the system on air/water or product to optimize system operation. The process commissioning is based on the active participation of customer's operations and engineering staff, or their representative(s). This is usually a major part of customer training. GEA has an advisory role only.

5.4.2 Training

5.4.2.1 On-site training

- 1 day of onsite service

GEA will perform training suited for the installed equipment using a standard agenda which will include training for maintenance and operators in field setting. The allowance for training is based on the active participation of customer's operations and engineering staff, or their representative(s).

6 Additional Equipment and Documents

6.1 Atomization Options

6.1.1 Two-fluid nozzle atomization system, co-current mode

- nozzle assembly, installed through chamber roof, consisting of two coaxial pipes, one for compressed gas and one for liquid to be atomized with orifice
- supporting plate for mounting in chamber roof opening
- compressed air / needle valve combination and flow meter for pressure regulation

6.2 Equipment Options

6.2.1 Atomizing pump and devices

Due to closed cycle interlocking and safety, it is recommended that the client purchase one of the feed pump options, in section 18.1, for the appropriate atomization type selected. If the client wishes to provide their own feed pump for the system, it will need to be integrated into the GEA control panel which may incur additional costs.

6.2.1.1 Peristaltic feed pump, hazardous area installation

- peristaltic type with silicone feed tubing
- twin tubes, 'low pulse' pump head
- close coupled TEFC motor, Class 1 Division 2 group C&D
- speed controlled by VFD via outlet temperature or manually in HMI
- maximum flow rate: 437 mL/min.

6.2.1.2 High pressure feed pump, pressure nozzle and atomization system

(Can only be used if Low velocity gas disperser kit and chamber extension pieces are installed)

- diaphragm pump, max pressure 700psi
- motor Class 1 Div 2
- speed controlled by VFD via outlet pressure or manually in HMI
- piping and hose from pump to nozzle lance
- pressure nozzle lance
- provided with three nozzle orifices
- arrangement mounted on stainless steel mobile cart

6.2.1.3 Coriolis mass flow measurement

- coriolis meter with transmitter for mass flow measurement (suitable for installation in Class 1 Division 2)
- alternative to loss-in-weight mass flow measurement
- indication of measurement displayed on the HMI

6.2.2 Powder collection

6.2.2.1 Stainless-steel powder collection container, 1000 mL

For use in lieu of the standard 1000 mL glass container

- powder collection container,1000 mL, with 4” sanitary adapter for use at product collection points

6.2.3 Controls

6.2.3.1 3-way valve for condenser control

- 3-way valve for condenser outlet gas temperature control
- interconnecting piping not included

Note: one (1) 3-way valve is required for each condenser. It is recommended that this option is purchased for proper condenser control when the client utility lacks appropriate coolant temperature control at point of use.

6.2.4 Equipment

6.2.4.1 Chamber extension section (long)

For creating a larger volume and thereby longer residence time, and in addition establishing of a longer distance from atomization device to drying chamber cone

- size: diameter = 0.8m, height = 0.5m
- easy mounting directly on top of the chamber cylinder
- insulated with mineral wool covered by fully welded stainless-steel cladding
- extended inlet duct from heater to chamber inlet
- extended lift cylinder rods
- extended chamber clamps

Note: Simultaneous use with extension section (long, short or combination) is not possible

6.2.4.2 Pneumatic hammer system

- one hammer mounted on the chamber cone to ensure a regular powder discharge
- the hammer consists of a steel pipe with a Delrin ball, which is blown periodically against a knocking plate on the chamber wall by means of compressed air
- inclusive of solenoid valve, compressed air tubes, and fittings

6.2.4.3 Low velocity gas disperser kit

To be used with a high pressure nozzle and extension

- top cover of gas disperser with pipe for fixation of nozzle rod
- guide vanes for low velocity

6.2.4.4 Additional Condenser

To be used if additional condensing is required.

- shell and tube type, for cooling water or ethylene glycol depending on application
- vertical tubes for the passing of the process gas
- the process gas is cooled by the cooling medium passing counter current through the shell guided by a number of baffle plates ensuring effective cooling
- designed for use with a coolant inlet temperature of -28°C or higher
- not insulated
- manual shut off valve supplied for the coolant outlet
- pressure safety valve
- discharge of condensed solvent through a butterfly valve

Notes: The customer will supply cooling medium inclusive of pump and all piping. GEA recommends optional three-way coolant control valve for proper process control (one valve required for each condenser). Type, consumption and temperature of cooling medium depend on type of solvent to be condensed. For lower coolant inlet temperature usage, please consult with GEA.

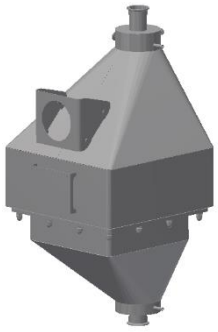
6.2.5 Exhaust bag filter

For use in lieu of the cartridge filter

6.2.5.1 Bag filter

- filter housing, diameter = 0.45m, conical bottom
- powder discharge through a manual butterfly valve permitting replacement of the glass without interrupting the drying process
- powder collecting glass, 1000 mL
- filter housing insulated with mineral wool covered by fully welded stainless-steel cladding
- removable top for access to filter bags and their cleaning system
- 3 PTFE filter bags for separation of very fine particles from exhaust gasses.
- 3 extra filter bags (= 1 set)
- individual blow back cleaning of each filter bag by means of compressed gas distributed through 3 pulsing valves. Control system with adjustable frequency in main panel
- compressed gas reservoir for cleaning of bags
- rapping stud for manual removal of possible powder deposits on the inner surface
- local pressure drop indication

Bag filter

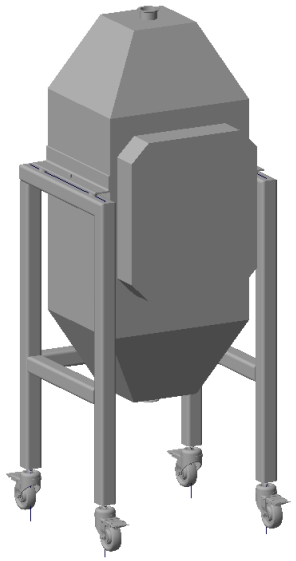


Inlet HEPA
(front loaded)

6.2.6 HEPA filters for inlet and outlet process gas

6.2.6.1 HEPA filter for inlet hot process gas

- 99.97% HEPA filter element
- heat resistant to 350 °C
- front loaded
- HEPA filter housing insulated with mineral wool covered by fully welded stainless-steel cladding
- cladding fully welded
- material of housing: AISI 316 internally, AISI 304 externally
- local pressure drop indication



BIBO HEPA filter
(inlet/outlet typical)

6.2.6.2 HEPA police filter for outlet process gas: Bag-In Bag-Out (BIBO) ready

- 99.97% high temp HEPA filter element
- filter housing and associated components heat resistant to 260 °C
- silicone door gaskets
- bagging ring for future bag in bag out application
- side loaded
- connecting ducts
- insulation with mineral wool covered by fully welded stainless-steel cladding
- local pressure drop indication
- support frame included

Note: bag-in bag-out components and accessories are available separately and are not included.

6.2.7 Miscellaneous

6.2.7.1 Equipment wetting device

- lance with integrated rotary spray head replaces the atomizing device in the drying chamber and is used for wetting the spray drying chamber
- 360° spray coverage
- 1-4 barg working pressure; flow rate 15 – 33.3 lpm
- sanitary clamp connections for customer supplied hoses

Note: Ducts and other parts must be cleaned manually.

Chamber wetting device

6.2.8 Documentation

6.2.8.1 SAT / IQ /OQ Documentation Package

All documentation written in accordance to GEA standard protocols

Documentation for customer's Site Acceptance Test (SAT)

- SAT Protocol and sub protocol templates for customer to complete on the controls specific parts
- test acceptance sheets

Note: Protocols are GEA templates only and are to be client executed. Customization of the template, if required, is by client. No site service is included with this option. Site service is available at the rates stipulated in Appendix A

Documentation for customer's Installation Qualification (IQ)

- IQ Protocol and sub protocol templates (where applicable)
- test acceptance sheets

Note: Protocols are GEA templates only and are to be client executed. Customization of the template, if required, is by client. No site service is included with this option. Site service is available at the rates stipulated in Appendix A

Documentation for customer's Operation Qualification (OQ)

- OQ Protocol and sub protocol templates for customer to complete on the controls specific parts
- test acceptance sheets

Note: Protocols are GEA templates only and are to be client executed. Customization of the template, if required, is by client. No site service is included with this option. Site service is available at the rates stipulated in Appendix A

6.2.8.2 Material Traceability Certificates

Material traceability certificates are included for all stainless-steel surfaces with product contact from drying chamber inlet to powder recovery component outlet (exhaust filter). All product contact elastomers will include a general certificate of conformity.

Clarifications to Scope Split

Item	Task	Description	GEA Scope	Not in GEA Scope	Not Applicable
1	Permission by Authorities	Permission to build the plant		X	
2		Permission to import the equipment		X	
3		Permission to install the equipment		X	
4		Tax for foreign work force		X	
5		Permission for personnel to enter the country on site		X	
6	Building and Civil Work	All building and architectural work, foundations, wall or floor penetrations, structural steel, site preparation & excavation, flashing and counter-flashing, stair towers, supporting structures, monorails, hoists, lighting, heating, ventilation systems, hub drains, hose stations, heating and ventilation and fire protection connections, grouting of floors etc. except where specified in the technical section		X	
7		Design and structural drawings		X	
8		Supply and connection/disposal of water, electricity and sewage		X	
9	Transportation & Positioning	Freight, (pre-paid and invoiced at cost)		X	
10		Sea-worth packaging		X	
11		Offloading, positioning, and re-assembly of pre-assembled components		X	
12		Local transport of equipment on site		X	
13		Forklifts, cherry pickers, scissor lifts and other lifting devices for installation		X	
14		Material used for covering and protecting equipment during installation work		X	
15		Cranage for tanks, skids etc. and truck unloading		X	
16	Access Platforms	Access platforms, stairways, handrails, etc. except for those listed specifically in this proposal.		X	
17	Installation	All building and architectural work, foundations, wall or floor penetrations, structural steel, flashing and counter-flashing, stair towers, supporting structures, monorails, hoists, lighting, heating, ventilation systems, hub drains, hose stations, heating and ventilation and fire protection connections, etc. except where specified in this document.		X	
18		Mechanical and electrical installation of loose GEA-supplied equipment (valves, pumps, etc.)		X	
19		All passivation, polishing, pickling, anti-rust treatment, painting, priming and other surface treatments		X	
20		Installation of instrumentation		X	
21		Installation of insulation unless noted otherwise		X	
22		Manufacture or installation of support structures and pipe routes to and from GEA provided equipment		X	
23		Permits for installation of the equipment.		X	
24		Additional labor during installation, commissioning, performance tests, etc.		X	
25	Drainage	Collection and drainage of leakage and flush-out liquids to drain		X	
26	Cleaning (CIP)	CIP skid or kitchen		X	
27		CIP piping from CIP skid to equipment		X	
28		CIP equipment if not stated in the technical section		X	
29	CIP Chemicals	CIP Chemical storage		X	
30		CIP chemical dosing pumps		X	
31		Piping/tubing between chemical dosing pumps and dosing point		X	
32	Utilities	Utility piping and tubing		X	
33		Condensate collection and distribution piping		X	
34		Chilled water, glycol, or ammonia generation system and distribution piping		X	
35		Instrument air compressor to supply dry, oil-free air		X	
36		Instrument air piping to a mutually agreed point		X	

Item	Task	Description	GEA Scope	Not in GEA Scope	Not Applicable
37		Shutoff, reducing and control valves for utility supplies (unless specifically listed in proposal)		X	
38	Control Wiring & Pneumatics	Main Control Panels (MCP)	X		
39		Wiring between skid components and same-skid mounted panels/junction boxes	X		
40	Electrical & Power	Electrical distribution equipment (main supply and local distribution)		X	
41		Connection of distribution panels to main power supply		X	
42		Motor Controls Center (MCC)	X		
43		Power to MCC		X	
44		Instruments and controls wiring		X	
45		Emergency power and UPS system		X	
46		Provisions for grounding		X	
47	Insulation	Insulation of GEA-provided piping, as specified in proposal		X	
48		Insulation of GEA-provided equipment, as specified in proposal		X	
49		Noise Insulation and abatement if required		X	
50	Upstream equipment	Any Mixing or feed preparation / storage equipment		X	
51		Evaporation or filtration equipment		X	
52		Feed tank or feed pump if not specified in the proposal		X	
53	Exhaust and downstream equipment	Exhaust stack		X	
54		Emissions, odor, noise, or other Pollution control		X	
55		Powder packing / handling or similar equipment		X	
56	Factory Testing	Factory setup and assembly of equipment	X		
57	Site Acceptance Testing	Site Acceptance Testing (SAT) on equipment		X	
58		Installation Qualification Testing (IQ) on equipment and/or software		X	
59	Qualification Testing	Operational Qualification Testing (OQ) on equipment and/or software		X	
60	Documentation	Material certifications or certificates of conformity, other than stated		X	
61		Qualification documentation, if not purchased as an option		X	
62	Miscellaneous	State or local taxes		X	
63		Spare parts (unless specifically listed in proposal)		X	
64		Items not detailed in this proposal.		X	

7 Appendices

7.1 GEA standard field service rates

7.2 GEA terms and conditions

gea.com