

MELiSSA Pilot Plant



Universitat Autònoma de Barcelona

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C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 1 / 275



TECHNICAL NOTE 87.2.17

C2 Detailed Engineering Datapackage

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1. OBJECT

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1. OBJECT

The Universitat Autònoma de Barcelona, from now UAB, participate in the Project MELISSA (Micro-Ecological Life Support System Alternative), together with the European Space Agency (ESA), related to study how to establish the life conditions into the space during long time missions.

In the UAB facilities, there is installed a Pilot Plant consisting in several modules to study the different stages and processes of recycling and recovering of food, water and oxygen from wastes, i.e. CO_2 and organic wastes, using the light as a source of energy.

The UAB required to De Dietrich Equipos Químicos SL, from now DDEQ, to study the design and assembling of one of these modules, specifically the one defined as COMPARTMENT II.

DDEQ submitted to the UAB, one quotation, ref DDE-K 1764-SI, dated on Sept 23 2008, defined as: "Budget proposal for detail engineering works related with the design of a photo-bioreactor and ancillary equipment", in order to develop the design, engineering and economical investment cost for the design of that module.

The documentation of reference is basically:

- "Technical Note: 62.2 Preliminary design of the Compartment II Pilot Photobioreactor", and other documents from UAB.
- Information defined in different meetings held with MELiSSA people.
- Standards of design taken from the previous design of module Compartment IVa.



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The UAB placed an order to DDEQ, reference: "contracte 2995/2008 d'enginyería del mòdul II per al projecte MELiSSA", dated on 12.01.09, for the execution of the works according conditions established in the scope of the quotation of DDEQ indicated.

With the present Project submitted to the UAB, DDEQ understands that it fulfil with the scope contemplated in the order of reference.





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2. FUNCTIONAL SPECIFICATION

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2. FUNCTIONAL SPECIFICATION

1 INTRODUCTION: The MELiSSA project

MELISSA is the acronym for Micro-Ecological Life Support System Alternative. This system consists of a loop of interconnected compartments envisaged to work as a complete unit. The driving element of MELISSA is the recovery of food, water and oxygen from organic waste, carbon dioxide and minerals. Based on the principle of an aquatic ecosystem, MELISSA is comprised of 5 compartments, colonized respectively by:

- thermophilic anoxygenic bacteria
- photo heterotrophic bacteria
- nitrifying bacteria
- photosynthetic bacteria and higher plants
- the last one being the crew

Such a system would be a key element to provide life support in any long term extraterrestrial manned activity as it would allow relieving the need for a constant food supply and waste disposal. A Moon or Mars planetary base or a permanent orbital station can be given as examples. Each compartment has a given objective within the complete biotransformation loop.



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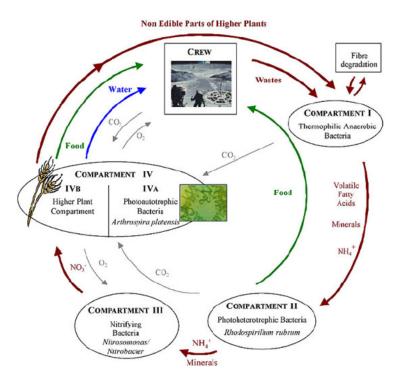


Figure 1: MELiSSA Advanced Loop Concept

1.1 Compartment II description:

The Compartment II of the MELiSSA Loop is the photo-heterotrophic compartment, which function is to consume the carbon sources that are not oxidized by the First Compartment. These carbon sources are mainly volatile fatty acids of low molecular weight.

The strain *Rhodospirillum rubrum* is grown in this compartment as it is capable to utilize all these carbon sources.

Due to the great degree of control that is needed in the operation of all the MELiSSA Compartments (particularly C-II), and for safety reasons, two main drivers have to be taken into account when designing and building this bio-reactor:

- the axenity of the bioreactor has to be ensured
- high standard of quality control has to be followed



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1.2 **Functional specification document:**

This document claims to do a general description of all the plant control loops, control elements, output/input signals, alarms and lock out.

IMPORTANT NOTE: The alarms and lock outs described in this document are only a reference because there can be more alarms concerning the process which are not defined in this document.

The documents of reference for this section are:

- P&ID DD-8550-Z1-100-02 rev. F (P&ID: control loops)
- Instruments list rev. A
- Instruments specifications rev. A
- Digital/Analogical signals list rev. A

OBSERVATION:

The control loops list has been prepared by MPP and SHERPA. All the elements of the P&ID have been tagged according the UAB/MPP "Tag's and labeling" document and control loops list.



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Compartment II loops list is the next:

DOCUMENT SECTION	LOOP NUMBER	DESCRIPTION	
2	2000	Influent General	
3	2001	Influent liquid Flow Control	
4	2002	Feeding Tank Level Control	
5	2003	Feeding Tank Temperature Control	
6	2004	Feeding Tank Pressure Control	
7	2005	Bioreactor General	
8	2006	Bioreactor Lightning Control	
9	2007	Bioreactor Temperature Control	
10	2008	Bioreactor pH Control	
11	2009	Bioreactor Pressure Control	
12	2010	Bioreactor Level Control	
13	2011	Bioreactor Biomass Production Control	
14	2012	Gas Loop Control	
15	2013	Bioreactor Outlet Gas Composition	
16	2014	Effluent General	
17	2015	Effluent Liquid Flow Control	
18	2016	Harvest Level Control	
19	2017	Harvesting Tank Temperature Control	
20	2018	Harvesting Tank Pressure Control	
21	2019	Helium Tank Control	
22	2020	Antifoam Control	
23	2021	Feeding Tank Sterilization	
24	2022	Bioreactor Sterilization	
25	2023	Harvesting Tank Sterilization	



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2 Loop 2000: Influent General

This loop includes the agitator, and all the instruments linked to another loop. At the moment, this loop only includes the agitation system of the feeding vessel VS 2000 01.

2.1 <u>Control elements:</u>

• <u>GP 4001 03 speed regulator</u>: Magnetic agitator. Feeding vessel agitation.

2.2 PLC output signals:

Equipment	Description		Signal Type
GP 2000 01	Start/Stop feeding tank agitator converter	DO	0/1
GP 2000 01	Feeding tank agitator speed set-point	AO	4-20 mA

2.3 PLC input signals:

Equipment	Description	I/O	Signal Type
GP 2000 01	Feeding tank agitator thermal protection	DI	0/1

2.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	GP 2000 01	Thermal protection	Err	To notify alarm to supervision	



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3 Loop 2001: Influent Liquid Flow Control

This loop regulates the reactor inlet liquid flow. Liquid input media is provided from two pumps (GP 2001 01 and GP 2001 02), working alternatively depending on the pre-filters blockage or pump maintenance.

Flow rate set point is provided by the supervision.

3.1 <u>Control elements:</u>

- <u>PS 2001 01/02</u>: Pressure switch. Pump membrane breakage detection.
- <u>PS 2001 03/04:</u> Pressure switch. Lines over-pressure detection.
- <u>DPT 2001 01:</u> Differential pressure transmitter. Differential pressure measurement for inlet liquid pre-filters (LF 2001 01/02) blockage control.
- FT 2001 01: Liquid mass flow meter. Reactor inlet liquid flow measurement.
- <u>DPT 2001 02</u>: Differential pressure transmitter. . Differential pressure measurement for inlet liquid filters (LF 2001 03/04) blockage control.
- <u>GP 2001 01/02 speed regulator</u>: Feeding pumps. Bioreactor inlet liquid flow regulation.

3.2 PLC output signals:

Equipment	Description		Signal Type
GP 2001 01/02	Start/Stop inlet pumps converter	DO	0/1
GP 2001 01	Start/Stop inlet pump GP 2001 01	DO	0/1
GP 2001 02	Start/Stop inlet pump GP 2001 02	DO	0/1
GP 2001 01/02	Flow set-point (inlet pumps)	AO	4-20 mA



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3.3 PLC input signals:

Equipment	Description		Signal Type
GP 2001 01/02	Inlet pumps thermal protection	DI	4-20 mA
PS 2001 01	Pressure switch (GP 2001 01)	DI	0/1
PS 2001 02	Pressure switch (GP 2001 02)	DI	0/1
PS 2001 03	Pressure switch		0/1
PS 2001 04	Pressure switch		0/1
FT 2001 01	Total liquid inlet flow to reactor	AI	4-20 mA
DPT 2001 01	Differential pressure measurement (pre-filters)		4-20 mA
DPT 2001 02	Differential pressure measurement (filters)	AI	4-20 mA

3.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	PS 2001 01/02	Pressure	Н	To notify alarm to supervision	
2	PS 2001 03/04	Pressure	Н	To notify alarm to supervision	GP 2001 01/02
3	DPT 2001 01	Differential pressure	Н	To notify alarm to supervision	
4	DPT 2001 01	Differential pressure	НН	To notify alarm to supervision	GP 2001 01/02
5	DPT 2001 02	Differential pressure	Н	To notify alarm to supervision	
6	DPT 2001 02	Differential pressure	НН	To notify alarm to supervision	GP 2001 01/02



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3.4.1 Alarms and warnings description:

 $1 \rightarrow$ ALARM: The membrane of the feeding pump has broken.

The pump works with a sandwich membrane which permits a quickly damage detection. If work membrane is broken, the process product is conducted through the control membrane to the pressure switch. When the sensors alarm is activated, the pump can continue with working by means of a fourth membrane during a <u>maximum time of 24h.</u>

 $2 \rightarrow$ ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop feeding pumps.

3 / 5 \rightarrow WARNING: The differential pressure (inlet/outlet of filter) has rise to -----bar. (Preventive maintenance)

4/6 \rightarrow ALARM: The differential pressure (inlet/outlet of filter) has rise to 2.5-3 bar. Stop feeding pumps.

It should be noted that the number of times the temperature is cycled from ambient to the sterilization temperature rather than the time at temperature determines the lifetime of the cartridge in steam.

To maximize the life of the cartridge, the differential pressure across the cartridge should not exceed 0.30 bar (4.4 psi) at 142°C (288°F).



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4 Loop 2002: Feeding Tank Level Control

This loop controls the liquid level of the feeding tank. The level is measured with a guided microwave level transmitter.

The level measure is sent to the supervision.

4.1 <u>Control elements:</u>

• <u>LT 2002 01</u>: Level transmitter. Feeding tank (VS 2000 01) level measurement.

4.2 PLC output signals:

There is not any signal sent by the PLC in this loop.

4.3 PLC input signals:

Equipment	Description	I/O	Signal Type
LT 2002 01	Feeding tank level measurement	AI	4-20 mA

4.4 Alarms and warnings:

Nr.	Tag	Variable	Alarm	Action	Lock out
1	LT 2002 01	Level	Н	To notify alarm to supervision	
2	LT 2002 01	Level	L	To notify alarm to supervision	GP 2000 01
3	LT 2002 01	Level	LL	To notify alarm to supervision	GP 2001 01/02



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4.4.1 Alarms and warnings description:

- $1 \rightarrow$ WARNING: Feeding vessel level is at -----% or upper.
- $2 \rightarrow$ ALARM: Feeding vessel level is at -----% or lower. Stop the tank agitator (GP 2000 01)
- $3 \rightarrow$ ALARM: VS 2000 01 is empty. Stop feeding pump (GP 2001 01 or GP 2001 02)

5 Loop 2003: Feeding Tank Temperature Control

This loop regulates the temperature of the feeding tank medium. The temperature is measured with a temperature transmitter installed in the tank hoop.

The temperature is regulated by means of cool water flowing through the tank jacket. This flow is controlled with an on/off automatic valve installed in the jacket outlet.

5.1 <u>Control elements:</u>

- TT 2003 01: Temperature transmitter. Tank VS 2000 01 temperature measurement.
- <u>SV 2003 01</u>: Control valve. Feeding tank VS 2000 01 jacket cooling water outlet valve.

5.2 PLC output signals:

Equipment	Description	I/O	Signal Type
SV 2003 01	Open/Close cooling water outlet valve	DO	0/1

5.3 PLC input signals:

Equipment	Description		Signal Type
SV 2003 01	Cooling water inlet valve feedback	DI	0/1
TT 2003 01	Feeding tank temperature measurement	AI	4-20 mA



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5.4 Alarms and warnings:

Nr.	Tag	Variable	Alarm	Action	Lock out
1	TT 2003 01	Temperature	Н	To notify alarm to supervision	
2	SV 2003 01		Err	To notify alarm to supervision	

5.4.1 Alarms and warnings description:

- 1 \rightarrow ALARM: Temperature is upper than ----°C.
- $\mathbf{2} \rightarrow$ ALARM: The automatic valve is not working.



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6 Loop 2004: Feeding Tank Pressure Control

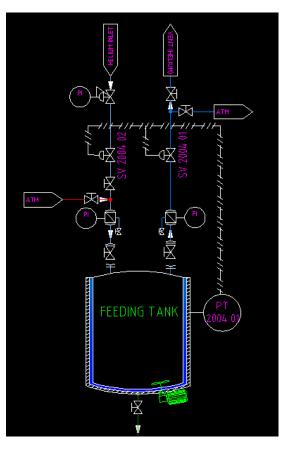
The feeding tank should be maintained, as all the plant, in anaerobic conditions.

The designed system has a way of allowing the inert gas (helium) into the tank, and a way to vent the gas when the pressure gets too high.

The helium is stored in a buffer tank of 40 I, which is used for the inertization of feeding and harvesting tank. This buffer tank operates at higher pressure than the feeding tank and for the vented gas storage is needed a gas compressor.

The system should operate at a slightly higher pressure than atmospheric.

A pressure transmitter measures the tank pressure and actuates over both automatic valves. When the pressure is lower than the set-point, the helium inlet is opened and when is higher, the helium is vented to the buffer tank.



6.1 <u>Control elements:</u>

- PT 2004 01: Pressure transmitter. Feeding tank VS 2000 01 pressure measurement.
- <u>SV 2004 01</u>: Control valve. Feeding tank VS 2000 01 vent pipe valve.
- <u>SV 2004 02</u>: Control valve. Feeding tank VS 2000 01 helium inlet pipe valve.
- SV 2004 03: Control valve. Compressor recycling valve.
- <u>PS 2004 01</u>: Pressure switch. Switch for compressor recycling control.



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6.2 PLC output signals:

Equipment	Description	I/O	Signal Type
BLWR 2004 01	Start/Stop the compressor D		0/1
SV 2004 03	Open/Close compressor (BLWR 2004 01) bypass valve		0/1
SV 2004 01	Open/Close feeding tank vent valve		0/1
SV 2004 02	Open/Close helium inlet valve	DO	0/1

6.3 PLC input signals:

Equipment	Description	I/O	Signal Type
PS 2004 01	Pressure switch for compressor recycling		0/1
SV 2004 01	Feeding tank vent valve feedback		0/1
SV 2004 02	Helium inlet valve feedback		0/1
SV 2004 03	Compressor (BLWR 2004 01) bypass valve feedback		0/1
PT 2004 01	Feeding tank pressure measurement		4-20 mA



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6.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	PS 2004 01	Pressure	Н		
2	SV 2004 01		Err	To notify alarm to supervision	
3	SV 2004 02		Err	To notify alarm to supervision	
4	SV 2004 03		Err	To notify alarm to supervision	
5	PT 2004 01	Pressure	Н	To notify alarm to supervision	
6	PT 2004 01	Pressure	L	To notify alarm to supervision	



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7 Loop 2005: Bioreactor General

This loop regulates the bioreactor agitation. The speed of agitation is variable by means of a converter. Agitation speed set point is provided by the supervision.

7.1 Control elements:

• <u>GP 2005 01 speed regulator</u>: Bioreactor agitation. Bioreactor agitation rate regulation.

7.2 PLC output signals:

Equipment	Description		Signal Type
GP 2005 01	Start/Stop bioreactor agitator converter	DO	0/1
GP 2005 01	Bioreactor agitator speed set-point	AO	4-20 mA

7.3 PLC input signals:

Equipment	Description	I/O	Signal Type
GP 2005 01	Bioreactor agitator thermal protection	DI	0/1

7.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	GP 2005 01	Thermal protection	Err	To notify alarm to supervision	



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IMPORTANT NOTE:

The <u>red ox sensor</u> is not included in any loop. The description of the function of this sensor is pending to be defined. The signals related to the sensor are the next:

Equipment	Description		Signal Type
AT 2005 01	Redox measurement	AI	4-20 mA
TT 2005 01	Temperature measurement (AT 2005 01)	AI	4-20 mA

8 Loop 2006: Bioreactor Lightning Control

This loop regulates the light intensity. The intensity is controlled by the PLC and is not possible to do it locally.

The light intensity can be regulated depending on the feedback of real intensity measures.

8.1 Control elements:

• IRC 2006 01: Light supply system. Light intensity regulation.

8.2 PLC output signals:

Equipment	Description	I/O	Signal Type
IRC 2006 01	Light intensity set-point	AO	4-20 mA



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8.3 PLC input signals:

Equipment	Description		Signal Type
IRC 2006 01	Light Power Phase 1	AI	4-20 mA
IRC 2006 01	Light Power Phase 2	AI	4-20 mA
IRC 2006 01	Light Power Phase 3	AI	4-20 mA

8.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	A)	Temperature	н	To notify alarm to supervision	
2	A)	Temperature	НН	To notify alarm to supervision	Light intensity (safety value)

A) The temperature value used to set these alarms will be defined in the control software depending on the type of data processing because the PLC receive five temperatures values from the reactor instrumentation:

Equipment	Description		Signal Type
TT 2007 01	Reactor temperature measurement	AI	4/20 mA
TT 2008 01	Temperature measurement (AT 2008 01)	AI	4/20 mA
TT 2008 02	Temperature measurement (AT 2008 02)	AI	4/20 mA
TT 2005 01	Temperature measurement (AT 2005 01)	AI	4/20 mA
TT 2013 02	Temperature measurement (AT 2013 03)	AI	4/20 mA

8.4.1 Alarms and warnings description:

1 \rightarrow WARNING: The PBR temperature has rise to -----°C.

2 \rightarrow ALARM: The PBR temperature has rise to -----°C (maximum process admissible temperature). Set light intensity to safety value (--- %)



From hardware point of view, the permissible operating temperature is <u>200°C</u>, provided that there is no sudden temperature shock.



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9 Loop 2007: Bioreactor Temperature Control

This loop measures and regulates the bioreactor temperature and provides this information to the control system. The temperature is regulated by two different systems: refrigerating with cool water through reactor jacket and refrigerating with air through lights system jacket.

9.1 <u>Control elements:</u>

- <u>TT 2007 01</u>: Temperature transmitter. Bioreactor temperature measurement.
- <u>TT 2008 01</u>: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- <u>TT 2008 02</u>: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- <u>TT 2005 01</u>: Temperature transmitter. Bioreactor temperature measurement (from redox sensor).
- <u>TT 2013 02</u>: Temperature transmitter. Bioreactor temperature measurement (from O₂/dO₂ sensor).
- <u>BLWR 2007 01</u>: Air Extractor. Air circulation in bioreactor refrigeration system by air.
- <u>SV 2007 01</u>: Control valve. Cooling water outlet valve.
- <u>HX 2007 02</u>: Electrical resistance. Electrical resistance for water heating.

9.2 PLC output signals:

Equipment	Description		Signal Type
HX 2007 02	Start/Stop electrical resistance		0/1
BLWR 2007 01	Start/Stop air extractor		0/1
SV 2007 01	Open/Close cooling water outlet valve		0/1
PP 2007 01	Start/Stop the pump		0/1
BLWR 2007 01	Air extractor set-point	AO	4-20 mA



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9.3 PLC input signals:

Equipment	Description		Signal Type
BLWR 2007 01	Air extractor thermal protection	DI	0/1
SV 2007 01	Cooling water inlet valve feedback	DI	0/1
TT 2007 01	Reactor temperature measurement	AI	4-20 mA
TT 2008 01	Temperature measurement (AT 2008 01)	AI	4-20 mA
TT 2008 02	Temperature measurement (AT 2008 02)	AI	4-20 mA
TT 2005 01	Temperature measurement (AT 2005 01)		4-20 mA
TT 2013 02	Temperature measurement (AT 2013 03)	AI	4-20 mA

9.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	A)	Temperature	Н	To notify alarm to supervision	
2	A)	Temperature	HH	To notify alarm to supervision	Light intensity (safety value)
3	BLWR 2007 01	Thermal protection	Err	To notify alarm to supervision	
4	SV 2007 01		Err	To notify alarm to supervision	

A) The temperature value to set these alarms will be defined in the control software depending on the type of data processing. There are five measured values of the reactor temperature.

Equipment	Equipment Description		Signal Type
TT 2007 01	Reactor temperature measurement	AI	4/20 mA
TT 2008 01	Temperature measurement (AT 2008 01)	AI	4/20 mA
TT 2008 02	Temperature measurement (AT 2008 02)	AI	4/20 mA
TT 2005 01	Temperature measurement (AT 2005 01)	AI	4/20 mA
TT 2013 02	Temperature measurement (AT 2013 03)	AI	4/20 mA



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9.4.1 Alarms and warnings description:

1 \rightarrow WARNING: The PBR temperature has rise to -----°C.

 $2 \rightarrow$ ALARM: The PBR temperature has rise to -----°C (maximum process admissible temperature). Set light intensity to safety value (--- %)



From hardware point of view, the permissible operating temperature is <u>200°C</u>, provided that there is no sudden temperature shock.

- $\mathbf{3}$ \rightarrow ALARM: Alarm from the blower thermal protection.
- 4 \rightarrow ALARM: The automatic valve is not working. Notify failure to the supervision.



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10 Loop 2008: Bioreactor pH Control

This loop measures and regulates the bioreactor pH and provides this information to the control system. The pH is

10.1 <u>Control elements:</u>

- <u>AT 2008 01</u>: pH sensor/transmitter. Bioreactor pH measurement. (BPR lower part)
- <u>AT 2008 02</u>: pH sensor/transmitter. Bioreactor pH measurement. (Installed in BPR outlet liquid pipe)
- <u>SV 2008 01</u>: Control valve. Acid addition regulation.
- <u>SV 2008 02</u>: Control valve. Base addition regulation.
- <u>WT 2008 01</u>: Scale. Acid bottle weight measurement for level control.
- <u>WT 2008 02</u>: Scale. Base bottle weight measurement for level control.

10.2 PLC output signals:

Equipment	Description		Signal Type
SV 2008 01	Open/Close PBR acid inlet valve	DO	0/1
SV 2008 02	Open/Close PBR base inlet valve	DO	0/1
PP 2008 01	Start/Stop the acid pump	DO	0/1
PP 2008 02	Start/Stop the base pump	DO	0/1



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10.3 PLC input signals:

Equipment	Description	I/O	Signal Type
SV 2008 01	PBR acid inlet valve feedback	DI	0/1
SV 2008 02	PBR base inlet valve feedback	DI	0/1
WT 2008 01	Weight (level) measurement	Eth	Ethernet
WT 2008 02	Weight (level) measurement		Ethernet
AT 2008 01	pH measurement		4-20 mA
TT 2008 01	Temperature measurement (AT 2008 01)		4-20 mA
AT 2008 02	pH measurement		4-20 mA
TT 2008 02	Temperature measurement (AT 2008 02)	AI	4-20 mA

10.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	AT 2008 01/02	рН <i>*</i>)	Н	To notify alarm to supervision	
2	AT 2008 01/02	рН <i>*</i>)	L	To notify alarm to supervision	Light intensity (safety value)
3	WT 2008 01	Weight (Level)	L	To notify alarm to supervision	
4	WT 2008 01	Weight (Level)	LL	To notify alarm to supervision	PP 2008 01
5	WT 2008 02	Weight (Level)	L	To notify alarm to supervision	
6	WT 2008 02	Weight (Level)	LL	To notify alarm to supervision	PP 2008 02
7	SV 2008 01		Err	To notify alarm to supervision	
8	SV 2008 02		Err	To notify alarm to supervision	

*) The pH value to set these alarms will be defined in the control software depending on the type of data processing.



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10.4.1 Alarms and warnings description:

- 1 \rightarrow ALARM: The PBR pH has risen to -----.
- $\mathbf{2} \rightarrow$ ALARM: The PBR pH has fallen to -----.
- $\mathbf{3} \rightarrow$ WARNING: Acid vessel level is at -----% or lower.
- 4 \rightarrow ALARM: VS 4006 01 is empty. Lock out stop PP 4006 01.
- $\mathbf{5} \rightarrow$ WARNING: Base vessel level is at -----% or lower.
- 6 → ALARM: VS 4006 02 is empty. Lock out stop PP 4006 02.
- 7 \rightarrow ALARM: The automatic valve is not working. Notify failure to supervision.
- $8 \rightarrow$ ALARM: The automatic valve is not working. Notify failure to supervision.



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11 Loop 2009: Bioreactor Pressure Control

This loop measures and controls the bioreactor pressure and provides this information to the control system.

11.1 Control elements:

- <u>PT 2009 01</u>: Pressure transmitter. PBR pressure measurement.
- PT 2009 02: Pressure transmitter. Bioreactor pressure measurement.
- <u>SCV 2012 01</u>: Control valve. Outlet gas flow control.
- <u>FT 2012 01</u>: Flow meter. Outlet gas flow measure.

11.2 PLC output signals:

Equipment	Description	I/O	Signal Type
SCV 2012 01	PBR outlet gas flow set-point	AO	4-20 mA

11.3 PLC input signals:

Equipment	Description	I/O	Signal Type
PT 2009 01	Bioreactor pressure measurement	AI	4-20 mA
PT 2009 02	Bioreactor pressure measurement	AI	4-20 mA
FT 2012 01	PBR outlet gas flow measurement	AI	4-20 mA



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11.4 Alarms and warnings:

Nr.	Tag	Variable	Alarm	Action	Lock out
1	PT 2009 01/02	Pressure	н	To notify alarm to supervision	
2	PT 2009 01/02	Pressure	нн	To notify alarm to supervision	FQRC 2012 04 (0 NI/min)

11.4.1 Alarms and warnings description:

- 1 \rightarrow WARNING: The PBR pressure has rise to -----bar.
- 4 \rightarrow ALARM: The PBR pressure has rise to ----bar. Close FQRC 2012 04 (PBR gas inlet)



From hardware point of view, the permissible operating pressure for the jacketed section pipe (DN200) is from -1 bar_g to 1 bar_g ,

12 Loop 2010: Bioreactor Level Control

This loop measures and controls the bioreactor pressure and provides this information to the control system.

12.1 Control elements:

- <u>WT 2010 01</u>: Weight cells. PBR weight measure for level controlling.
- <u>PS 2015 01/02</u>: Pressure switch. Pump membrane breakage detection.
- <u>PS 2015 03/04:</u> Pressure switch. Lines over-pressure detection.
- <u>GP 2015 01/02 speed regulator</u>: Feed pumps. Reactor outlet liquid pumping.



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12.2 PLC output signals:

Equipment	Description		Signal Type
GP 2015 01/02	Start/Stop outlet pumps converter		0/1
GP 2015 01	Start/Stop outlet pump GP 2015 01		0/1
GP 2015 02	Start/Stop outlet pump GP 2015 02		0/1
GP 2015 01/02	Flow set-point (outlet pumps)		4-20 mA

12.3 PLC input signals:

Equipment	Description		Signal Type
GP 2015 01/02	Outlet pumps thermal protection		4-20 mA
PS 2015 01	Pressure switch (GP 2015 01)		0/1
PS 2015 02	Pressure switch (GP 2015 02)		0/1
PS 2015 03	Pressure switch		0/1
PS 2015 04	Pressure switch		0/1
WT 2010 01	Bioreactor weight (level) measurement		4-20 mA

12.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	WT 2010 01	Weight (Level)	HH	To notify alarm to supervision	GP 2001 01/02
2	WT 2010 01	Weight (Level)	Н	To notify alarm to supervision	
3	WT 2010 01	Weight (Level)	L	To notify alarm to supervision	
4	WT 2010 01	Weight (Level)	LL	To notify alarm to supervision	GP 2015 01/02
5	PS 2015 01/02	Pressure	Н	To notify alarm to supervision	GP 2015 01/02
6	PS 2015 03/01	Pressure	Н	To notify alarm to supervision	GP 2015 01/02



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12.4.1 Alarms and warnings description:

- $1 \rightarrow$ ALARM: PBR level is upper than ----- L. Stop feeding pump.
- $2 \rightarrow$ WARNING: PBR level is at -----L or upper.
- $\mathbf{3} \rightarrow \mathsf{WARNING}$: PBR level is at -----L or lower.
- $4 \rightarrow$ ALARM: PBR level is lower than ----- L. Stop harvesting pump.
- $\mathbf{5} \rightarrow$ ALARM: The membrane of the harvesting pump has broken.

The pump works with a sandwich membrane which permits a quickly damage detection. If work membrane is broken, the process product is conducted through the control membrane to the pressure switch. When the sensors alarm is activated, the pump can continue with working by means of a fourth membrane during a maximum time of 24h.

 $6 \rightarrow$ ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop harvesting pumps.



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13 Loop 2011: Bioreactor Biomass Production Control

The biomass production control is still pending to be defined. The control elements and the signals directly related to this loop are:

13.1 Control elements:

- <u>AT 4011 01</u>: biomass sensor/transmitter. Bioreactor biomass measurement.
- <u>AT 4011 02</u>: biomass sensor/transmitter. Bioreactor biomass measurement.

13.2 PLC output signals:

At the moment, there is not any defined signal sent by the PLC.

13.3 PLC input signals:

Equipment	Description		Signal Type
AT 2011 01	Biomass measurement	AI	4-20 mA
AT 2011 01	Biomass sensor failure		22 mA
AT 2011 02	Biomass measurement	AI	4-20 mA
AT 2011 02	Biomass sensor failure		22 mA



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14 Loop 2012: Gas Loop Control

This loop includes inlet and outlet gas instrument excepting gas composition. The loop needs to be defined.

14.1 Control elements:

- <u>FQRC 2012 01</u>: Control valve/Flow meter. C. I gas flow measure and control.
- FQRC 2012 02: Control valve/Flow meter. CO₂ flow measure and control.
- FQRC 2012 03: Control valve/Flow meter. Helium flow measure and control
- FQRC 2012 04: Control valve/Flow meter. Total inlet gas flow measure and control
- FQRC 2012 05: Control valve/Flow meter. Circulated gas flow measure and control
- FQRC 2012 06: Control valve/Flow meter. C. II outlet gas flow measure and control.
- <u>FQRC 2012 07</u>: Control valve/Flow meter. Atmosphere outlet gas flow measure and control
- <u>SV 2012 0</u>1 Control valve. Gas inlet to analyzer.
- <u>SV 2012 02</u> Control valve. Compressor bypass valve.
- <u>SV 2012 03</u> Control valve. Helium inlet valve to outlet gases buffer.
- <u>SCV 2012 01</u> Control valve. Outlet gas flow control.
- FT 2012 01 Flow meter. Outlet gas flow measure.
- <u>PT 2012 01</u>: Pressure transmitter. Discharge vessel pressure measurement.
- <u>PS 2012 01</u>: Pressure switch. Pressure alarm for compressor bypass.



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14.2 PLC output signals:

Equipment	Description	I/O	Signal Type
BLWR 2012 01	Start/Stop the compressor	DO	0/1
SV 2012 02	Open/Close compressor (BLWR 2012 01) bypass valve	DO	0/1
SV 2012 01	Open/Close analyzer inlet valve	DO	0/1
HX 4012 02	Start/Stop post-condenser	DO	0/1
SV 2012 03	Open/Close helium inlet valve	DO	0/1
FQRC 2012 01	Inlet process gas flow set-point	AO	4-20 mA
FQRC 2012 02	Inlet CO2 flow set-point	AO	4-20 mA
FQRC 2012 03	Inlet helium flow set-point	AO	4-20 mA
FQRC 2012 04	Total inlet gas flow set-point	AO	4-20 mA
FQRC 2012 05	Circulated gas flow set-point	AO	4-20 mA
FQRC 2012 06	C. II outlet gas flow set-point (to C.III)		4-20 mA
FQRC 2012 07	Atm outlet gas flow set-point (to atm)		4-20 mA
SCV 2012 01	PBR outlet gas flow set-point	AO	4-20 mA



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14.3 PLC input signals:

Equipment	Description	I/O	Signal Type
SV 2012 02	Compressor (BLWR 2012 01) bypass valve feedback	DI	0/1
PS 2012 01	Pressure switch for compressor recycling	DI	0/1
SV 2012 01	Gas analyzer inlet valve feedback	DI	0/1
SV 2012 03	Helium inlet valve feedback	DI	0/1
FQRC 2012 01	Inlet process gas flow measurement	AI	4-20 mA
FQRC 2012 02	Inlet CO2 flow measurement	AI	4-20 mA
FQRC 2012 03	Inlet helium flow measurement	AI	4-20 mA
FQRC 2012 04	Total inlet gas flow measurement		4-20 mA
FQRC 2012 05	Circulated gas flow measurement	AI	4-20 mA
FQRC 2012 06	C. II outlet gas flow measurement (to C.III)	AI	4-20 mA
FQRC 2012 07	C. Il outlet gas flow measurement (to atm)	AI	4-20 mA
PT 2012 02	Discharge vessel pressure measurement		4-20 mA
FT 2012 01	PBR outlet gas flow measurement		4-20 mA
DPT 2012 01	Differential pressure measurement (filters)	AI	4-20 mA



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15 Loop 2013: Bioreactor Outlet Gas Composition Control

The outlet gas composition control loop is not implemented. The gas is analyzed and the information is sent to the control system.

15.1 <u>Control elements:</u>

- <u>FT 2012 01</u>: Flow meter. Outlet gas flow measurement.
- <u>TT 2013 01</u>: Temperature sensor/transmitter. Outlet gas temperature measurement.
- <u>PT 2013 01</u>: Pressure sensor/transmitter. Outlet gas pressure measurement.
- <u>AT 2013 01/02</u>: Outlet gas composition measurement.
- <u>AT 2013 03</u>: Dissolved O₂ Analyzer. PBR O₂ composition measurement.
- <u>SV 2013 0</u>1 Control valve. Analyzer gas inlet valve.

15.2 PLC output signals:

Equipment	Description		Signal Type
SV 2013 01	Open/Close gas analyzer inlet valve	DO	0/1



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15.3 PLC input signals:

Equipment	Description		Signal Type
SV 2013 01	Gas analyzer inlet valve feedback	DI	0/1
FT 2012 01	PBR outlet gas flow measurement	AI	4-20 mA
AT 2013 01	Outlet gas analyzer	AI	4-20 mA
AT 2013 02	Outlet gas analyzer		4-20 mA
AT 2013 03	Dissolved O2 analyzer		4-20 mA
TT 2013 02	Temperature measurement (AT 2013 03)		4-20 mA
PT 2013 01	Outlet gas pressure measurement		4-20 mA
TT 2013 01	Outlet gas temperature measurement	AI	4-20 mA

15.4 Alarms and warnings:

Nr.	Tag	Variable	Alarm	Action	Lock out
1	PT 2013 01	Pressure	Н	To notify alarm to supervision	
2	TT 2013 02	Temperature	Н	To notify alarm to supervision	
3	SV 2013 01		Err	To notify alarm to supervision	

15.4.1 Alarms and warnings description:

1 / 2 \rightarrow ALARM: pressure/temperature is out of analyzer operating range conditions. (see instrument manual)

 $3 \rightarrow$ ALARM: The automatic valve is not working. Notify failure to supervision.



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16 Loop 2014: Effluent General

This loop includes the agitator, and all the instruments linked to another loop. At the moment, this loop only includes the agitation system of the feeding vessel VS 2000 01.

16.1 <u>Control elements:</u>

• <u>GP 2014 01</u>: Agitator speed regulator. Harvesting tank agitation.

16.2 PLC output signals:

Equipment	Description		Signal Type
GP 2014 01	Start/Stop harvesting tank agitator converter	DO	0/1
GP 2014 01	Harvesting tank agitator speed set-point	AO	4-20 mA

16.3 PLC input signals:

Equipment	Description		Signal Type
GP 2014 01	Harvesting tank agitator thermal protection	DI	0/1

16.4 Alarms and warnings:

Nr.	Tag	Variable	Alarm	Action	Lock out
1	GP 2014 01		Err	To notify alarm to supervision	



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17 Loop 2015: Effluent Liquid Flow Control

This loop regulates the reactor outlet liquid flow. Output flow rate is controlled by two pumps (GP 4002 01 and GP 4002 02), working alternatively depending on the pumps maintenance. The flow rate is fixed with a set-point send from the supervision.

17.1 Control elements:

- <u>PS 2015 01/02</u>: Pressure switch. Pump membrane breakage detection.
- <u>PS 2015 03/04:</u> Pressure switch. Lines over-pressure detection.
- GP 4015 01/02 speed regulator: Feed pumps. Reactor outlet liquid pumping to harvest vessel.

17.2 PLC output signals:

Equipment	Description		Signal Type
GP 2015 01/02	Start/Stop outlet pumps converter		0/1
GP 2015 01	Start/Stop outlet pump GP 2015 01		0/1
GP 2015 02	Start/Stop outlet pump GP 2015 02		0/1
GP 2015 01/02	Flow set-point (outlet pumps)	AO	4-20 mA

17.3 PLC input signals:

Equipment	Description		Signal Type
GP 2015 01/02	Outlet pumps thermal protection		4-20 mA
PS 2015 01	Pressure switch (GP 2015 01)		0/1
PS 2015 02	Pressure switch (GP 2015 02)		0/1
PS 2015 03	Pressure switch		0/1
PS 2015 04	Pressure switch		0/1



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17.4 Alarms and warnings:

Nr.	Tag	Variable	Alarm	Action	Lock out
1	GP 2015 01/02		Err	To notify alarm to supervision	
2	PS 2015 01/02	Pressure	Н	To notify alarm to supervision	GP 2015 01/02
3	GP 2015 01/02	Pressure	Н	To notify alarm to supervision	GP 2015 01/02

17.4.1 Alarms and warnings description:

 $1 \rightarrow$ ALARM: Harvesting pump is not working. Notify failure to supervision.

 $2 \rightarrow$ ALARM: The membrane of the harvesting pump has broken.

The pump works with a sandwich membrane which permits a quickly damage detection. If work membrane is broken, the process product is conducted through the control membrane to the pressure switch. When the sensors alarm is activated, the pump can continue with working by means of a fourth membrane during a maximum time of 24h.

 $3 \rightarrow$ ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop harvesting pumps.



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18 Loop 2016: Harvest Level Control

18.1 Control elements:

• <u>WT 2016 01:</u> Weight measurement. Harvesting tank (VS 2014 01) weight measurement for tank level control.

18.2 PLC output signals:

There is not any output signal for this loop.

18.3 PLC input signals:

Equipment	Description	I/O	Signal Type
WT 2016 01	Harvesting tank weight (level) measurement	AI	4-20 mA

18.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	WT 2016 01	Weight (level)	нн	To notify alarm to supervision	GP 2015 01/02
2	WT 2016 01	Weight (level)	Н	To notify alarm to supervision	
3	WT 2016 01	Weight (level)	L	To notify alarm to supervision	GP 2014 01

18.4.1 Alarms and warnings description:

- $1 \rightarrow$ ALARM: VS 4002 01 is full. Stop harvesting pumps.
- $\mathbf{2} \rightarrow$ WARNING: Harvesting vessel level is at -----% or upper.
- $3 \rightarrow$ WARNING: Harvesting vessel level is at -----% or lower. Stop the vessel agitator.



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19 Loop 2017: Harvesting Tank Temperature Control

This loop regulates the temperature of the harvesting tank. The temperature is measured with a temperature transmitter installed in the tank hoop.

The temperature is regulated by means of cool water flowing through the tank jacket. This flow is controlled with an on/off automatic valve installed in the jacket outlet.

19.1 Control elements:

- <u>TT 2017 01:</u> Temperature transmitter. Tank VS 2014 01 temperature measurement.
- <u>SV 2017 01</u>: Control valve. Feeding tank VS 2014 01 jacket cooling water outlet valve.

19.2 PLC output signals:

Equipment	Description	I/O	Signal Type
SV 2017 01	Open/Close cooling water inlet valve	DO	0/1

19.3 PLC input signals:

Equipment	Description	I/O	Signal Type
SV 2017 01	Cooling water inlet valve feedback		0/1
TT 2017 01	Harvesting tank temperature measurement		4-20 mA

19.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	TT 2017 01	Temperature	Н	To notify alarm to supervision	
2	SV 2017 01		Err	To notify alarm to supervision	



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20 Loop 2018: Harvesting Tank Pressure Control

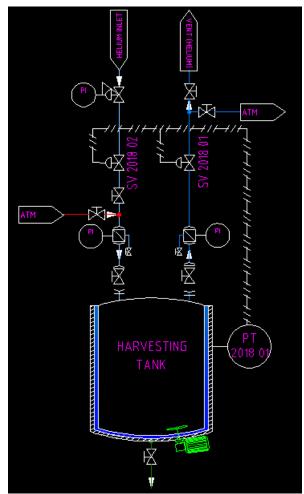
The harvesting tank should be maintained, as all the plant, in anaerobic conditions.

The designed system has a way of allowing the inert gas (helium) into the tank, and a way to vent the gas when the pressure gets to high.

The helium is stored in a buffer tank of 40 I, which is used for the inertization of feeding and harvesting tank. This buffer tank operates in higher pressure than the feeding tank and for the vented gas storage is needed a gas compressor.

The system should operate at a slightly higher than atmospheric.

A pressure transmitter measures the tank pressure and actuates over both automatic valves. When the pressure is lower than the set-point, the helium inlet is opened and when is higher, the helium is vented to the buffer tank.



20.1 Control elements:

- <u>PT 2018 01</u>: Pressure transmitter. Harvesting tank VS 2014 01 pressure measurement.
- <u>SV 2018 01</u>: Control valve. Harvesting tank VS 2014 01 vent pipe valve.
- <u>SV 2018 02</u>: Control valve. Harvesting tank VS 2014 01 helium inlet pipe valve.
- <u>SV 2004 03</u>: Control valve. Compressor recycling valve.
- <u>PS 2004 01</u>: Pressure switch. Switch for compressor recycling control.



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20.2 PLC output signals:

Equipment	Description	I/O	Signal Type
BLWR 2004 01	Start/Stop the compressor		0/1
SV 2004 03	Open/Close compressor (BLWR 2004 01) bypass valve		0/1
SV 2018 01	Open/Close feeding tank vent valve		0/1
SV 2018 02	Open/Close helium inlet valve	DO	0/1

20.3 PLC input signals:

Equipment	Description	I/O	Signal Type
PS 2004 01	Pressure switch for compressor recycling		0/1
SV 2018 01	Feeding tank vent valve feedback		0/1
SV 2018 02	Helium inlet valve feedback		0/1
SV 2004 03	Compressor (BLWR 2004 01) bypass valve feedback		0/1
PT 2018 01	Harvesting tank pressure measurement		4-20 mA

20.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	PS 2004 01	Pressure	Н		
2	SV 2018 01		Err	To notify alarm to supervision	
3	SV 2018 02		Err	To notify alarm to supervision	
4	SV 2004 03		Err	To notify alarm to supervision	
6	PT 2018 01	Pressure	Н	To notify alarm to supervision	
7	PT 2018 01	Pressure	L	To notify alarm to supervision	



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21 Loop 2019: Helium Tank Control

The helium tank is a buffer tank of 40 l, which is used for the inertization of feeding and harvesting tanks. This buffer tank operates in higher pressure than the feeding tank and for the vented gas storage is needed a gas compressor.

A pressure transmitter measures the tank pressure and actuates over both automatic valves. When the pressure is lower than the set-point, the helium inlet is opened and when is higher, the helium is vented to the atmosphere.

21.1 Control elements:

- <u>SV 2019 01</u>: Control valve. Helium tank VS 2019 01 helium inlet pipe valve.
- <u>SV 2019 02</u>: Control valve. Helium tank VS 2019 01 vent pipe valve.
- PT 2019 01: Pressure transmitter. Helium tank VS 2019 01 pressure measurement.

21.2 PLC output signals:

Equipment	Description	I/O	Signal Type
SV 2019 01	Open/Close helium inlet valve		0/1
SV 2019 02	Open/Close atm. vent valve		0/1

21.3 PLC input signals:

Equipment	Description		Signal Type
SV 2019 01	Helium inlet valve feedback		0/1
SV 2019 02	Vent valve feedback		0/1
PT 2019 01	Helium tank pressure measurement		4-20 mA



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21.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	SV 2019 01		Err	To notify alarm to supervision	
2	SV 2019 02		Err	To notify alarm to supervision	
3	PT 2019 01	Pressure	Н	To notify alarm to supervision	
4	PT 2019 01	Pressure	L	To notify alarm to supervision	

22 Loop 2020: Antifoam Control

The reactor antifoam system description is still pending.

A foam detector is foreseen. The switch emits an alarm when foam is detected.

Equipment	Description	I/O	Signal Type
LS 2020 01	Bioreactor foam detection	DI	0/1



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23 Loop 2021: Helium Tank Control

23.1 Control elements:

- <u>TT 2003 01:</u> Temperature sensor/transmitter. VS 2000 01 temperature measurement.
- <u>SV 2021 01</u>: Control valve. Steam inlet to VS 2000 01.
- <u>PT 2004 01</u>: Pressure transmitter. VS 2000 01 pressure measurement.

23.2 PLC output signals:

Equipment	Description		Signal Type
SV 2021 01	Open/Close steam inlet valve		0/1

23.3 PLC input signals:

Equipment	Description		Signal Type
SV 2021 01	Steam inlet valve feedback	DI	0/1
TT 2003 01	Feeding tank temperature measurement		4-20 mA
PT 2004 01	Feeding tank pressure measurement	AI	4-20 mA

23.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	TT 2003 01	Temperature	Н	To notify alarm to supervision	
2	TT 2003 01	Temperature	L	To notify alarm to supervision	
3	PT 2004 01	Pressure	Н	To notify alarm to supervision	
4	PT 2004 01	Pressure	L	To notify alarm to supervision	
5	SV 2021 01	Limit switch	Err	To notify alarm to supervision	



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24 Loop 2022: Bioreactor sterilization

24.1 <u>Control elements:</u>

- <u>TT 2005 01:</u> Temperature sensor/transmitter. Bioreactor temperature measurement.
- <u>TT 2007 01:</u> Temperature sensor/transmitter. Bioreactor temperature measurement.
- <u>TT 2008 01:</u> Temperature sensor/transmitter. Bioreactor temperature measurement.
- <u>TT 2013 02:</u> Temperature sensor/transmitter. Bioreactor temperature measurement.
- <u>SV 2022 01</u>: Control valve. Steam inlet to Bioreactor.
- PT 2009 01: Pressure transmitter. Bioreactor pressure measurement.
- <u>PT 2009 02</u>: Pressure transmitter. Bioreactor pressure measurement.

24.2 PLC output signals:

Equipment	Description		Signal Type
SV 2022 01	Open/Close steam inlet valve	DO	0/1

24.3 PLC input signals:

Equipment	Description		Signal Type
TT 2005 01	Temperature measurement (AT 2008 03)	AI	4-20 mA
TT 2007 01	Reactor temperature measurement	AI	4-20 mA
TT 2008 01	Temperature measurement (AT 2008 02)		4-20 mA
TT 2013 02	Temperature measurement (AT 2013 03)		4-20 mA
SV 2022 01	Steam inlet valve feedback		0/1
PT 2009 01	Bioreactor pressure measurement		4-20 mA
PT 2009 02	Bioreactor pressure measurement		4-20 mA



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24.4 Alarms and warnings:

Nr.	Тад	Variable	Alarm	Action	Lock out
1	*)	Temperature	Н	To notify alarm to supervision	
2	*)	Temperature	L	To notify alarm to supervision	
3	*2)	Pressure	Н	To notify alarm to supervision	
4	*2)	Pressure	L	To notify alarm to supervision	
5	SV 2022 01	Limit switch	Err	To notify alarm to supervision	

*) The temperature value to set these alarms will be defined in the control software depending on the type of data processing. There are four values of the reactor temperature measured: TT 2005 01, TT 2007 01, TT 2008 01 and TT 2013 02.

*²) The pressure value to set these alarms will be defined in the control software depending on the type of data processing. (PT 2009 01 and PT 2009 02)



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25 Loop 2023: Harvesting Tank Sterilization

25.1 <u>Control elements:</u>

- <u>TT 2017 01:</u> Temperature sensor/transmitter. VS 2014 01 temperature measurement.
- <u>SV 2023 01</u>: Control valve. Steam inlet to VS 2014 01.
- <u>PT 2018 01</u>: Pressure transmitter. VS 2014 01 pressure measurement.

25.2 PLC output signals:

Equipment	Description		Signal Type
SV 2023 01	Open/Close steam inlet valve	DO	0/1

25.3 PLC input signals:

Equipment	Description		Signal Type
SV 2023 01	Steam inlet valve feedback	DI	0/1
TT 2017 01	Harvesting tank temperature measurement	AI	4-20 mA
PT 2018 01	Harvesting tank pressure measurement	AI	4-20 mA

25.4 Alarms and warnings:

Nr.	Tag	Variable	Alarm	Action	Lock out
1	TT 2017 01	Temperature	H To notify alarm to supervision		
2	TT 2017 01	Temperature	L To notify alarm to supervision		
3	PT 2018 01	Pressure	н	To notify alarm to supervision	
4	PT 2018 01	Pressure	L To notify alarm to supervision		
5	SV 2023 01	Limit switch	Err	To notify alarm to supervision	





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3. CALCULATIONS

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3. CALCULATIONS

BIOREACTOR COOLING WATER SYSTEM

1. Bioreactor Cooling Water System

1.1. Design Parameters

Energy from lights:

Lamps to be installed	N _{LAMPS}	=	200 lamps
Lights power	Р	=	20 W/lamp
Lights heat	Q_1	=	3,6 <i>KW</i>

Assuming lighting system at 100% capacity and that 90% of power is converted as heating, the heat coming from the lighting system is:

$$Q = 200 \ lamps \cdot 20 \ \frac{W}{lamp} \cdot 0.9 = 3600 \ W = 3.6 \ KW$$

• Cooling Water circuit:

Density		=	$1000 \ Kg/m^3$
Specific heat	C_p	=	$1 K cal/Kg \cdot {}^{\circ}C$
	C_p	=	$4,18 \text{ KJ}/\text{Kg} \cdot ^{\circ}\text{C}$
Assumed differential temperature	ΔT	=	2°C

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1.2. Cooling Water Circuit

• <u>Heat to be removed during steady operation:</u>

Heat evolved by lighting	Q_1	=	3,6 <i>KW</i>
Heat evolved by agitator	Q_2	=	2,2 <i>KW</i>
Heat evolved by reaction	Q_3	=	Not considered
Total Heat	Q	=	5,8 <i>KW</i>

Observation: To make a worst case scenario calculation, the 100% of the agitator power is assumed as heating power.

$$Q = Q_1 + Q_2 + Q_3 = 3,6 \ KW + 2,2 \ KW = 5,8 \ KW$$

Required water flow:

 $Q = m \cdot C_P \cdot \Delta T$

$$m = \frac{Q}{C_P \cdot \Delta T} = \frac{5.8 \ KW \cdot 860}{\frac{1 \ Kcal}{Kg} \cdot \circ C} = 2494 \ \frac{Kg}{h} \approx 2.5 \ \frac{m^3}{h}$$

Design flow	Q_L	=	$3,0 m^3/h$
-------------	-------	---	-------------

2. <u>Heating Water for Bioreactor Start up</u>

2.1. Design parameters

Bioreactor volume (total calculated volume)	V	=	53 L
Assumed inlet temperature of media to reactor	T_1	=	15 °C
Assumed working temperature of reactor	T_2	=	30 ° C
Heating time required	t	=	30 min

2.2. Heating evolved

Observation: In this calculation, the heat coming from the agitator power is not considered (safety parameter).

$$Q = \frac{V \cdot C_p \cdot \Delta T}{t}$$

$$Q = \frac{\frac{53 l \cdot \frac{1 Kg}{1 l} \cdot 1 Kcal}{Kg \cdot C} \cdot (30 \circ C - 15 \circ C)}{30 \min \cdot \frac{1 h}{60 \min}} = 1590 Kcal_{h}$$

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2.3. Required water flow

Required water flow (see section 1.2)	Q_{L}	=	$2,5 m^3/h$
Heat evolved	Q	=	1590 Kcal/h

$$\Delta T = \frac{Q}{m \cdot C_p} = \frac{-1590 \ Kcal/h}{2.5 \ m^3/h} \cdot \frac{10^3 \ Kg}{1 \ m^3} \cdot 1 \ Kcal/Kg \cdot \circ C} = -0.64 \ \circ C$$

3. Heating Transfer through Reactor Jacket

3.1. Cooling (Steady operation)

3.1.1.Parameters

Transfer Area (D = 0,2 m / L = 1,4 m)	A	=	$0,88 m^2$
Water Flow	$Q_{\scriptscriptstyle L}$	=	$2,5 m^3/h$
Working temperature	Т	=	30 ° C
Requested heat transfer	Q	=	5,8 <i>KW</i>
		=	5000 Kcal/h

3.1.2. Maximum heat transfer through the reactor jacket

Water temperature in	$T_{W,IN}$	=	10 ° <i>C</i>
Water temperature out	$T_{W,OUT}$	=	11 °C
Reactor working temperature	Т	=	30 ° C
Logarithmic delta temperature	ΔTML	=	18,8 ° <i>C</i>
Transferred heat (through reactor jacket)	Q	=	2500 Kcal/h

3.1.3. Heat to be removed by the air system

Total heat to be removed	Q_T	=	5000 Kcal/h
Transferred heat (bioreactor jacket)	Q	=	2500 Kcal/h

Assuming the calculated available transfer of heat through the reactor jacket, the air system must be in operation during the reactor operation and must be able to remove a minimum heat of 2500 Kcal/h (at 100% of light intensity)

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4. Bioreactor Cooling/Heating System: Equipment Design

4.1. Electrical Heater (item: HX 2007 02)

Required Power (see section 2.2)		=	1590 Kcal/h
		=	1,85 <i>KW</i>
Design Power	Р	=	2 <i>KW</i>

4.2. Plate Heat Exchanger (item: HX 2007 01)

Total heat to be removed (see section 1.2)	=	5000 Kcal/h
	=	5,8 <i>KW</i>
Heat to be removed through reactor jacket	=	2500 Kcal/h
Design heat evolved (Safety factor of 20%)	=	3000 Kcal/h

4.2.1. Design Parameters

Calculated Water Flow	=	$2,5 m^3/h$
Temperature water in	=	12 ° <i>C</i>
Temperature water out	=	10 ° <i>C</i>

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Calculated Glycol Flow	=	$1,49 m^3/h$
Design Glycol Flow (Safety factor of 20%)	=	$1,8 m^3/h$
Temperature glycol in	=	4 ° C
Temperature glycol out	=	6 ° C

4.2.2. <u>Required Area</u>

Logarithmic delta temperature	ΔTML	=	6 ° C
Transfer Coefficient	U	=	$1500 \ Kcal/^{\circ}C \cdot m^2 \cdot h$

$$A = \frac{Q}{\Delta TML \cdot U}$$

$$A = \frac{\frac{3000 \ Kcal}{h}}{6 \ ^{\circ}C \cdot 1500 \ Kcal} = 0,33 \ m^{2}$$

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4.3. Circulating pump (item: PP 2007 01)

Operating Flow	=	$2,5 m^3/h$
Design Flow	=	$4 m^3/h$
Design Delta Height	=	20 mcw

5. Hydraulic conditions for Cooling/Heating system

5.1. Reactor jacket

Free Area	Α	=	0,011 m ²
Water Flow	Q_L	=	$2,5 m^3/h$
Water velocity	v	=	0,06 <i>m</i> / _s
Flow type			Laminar

5.2. Piping: water circuit

Inner diameter (DN1")	D	=	22,10 mm
Section	S	=	$0,038 \ dm^2$
Water velocity	V	=	1,8 <i>m</i> / _s
Flow type			Turbulent

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6. General conclusions from the calculations

To achieve the maximum transference level through the reactor jacket, the water flow should be as highest as possible (turbulent flow).

- ✓ The circulating pump of the water circuit should be able to pump the sufficient water flow (≅ 4 m^3/h)
- ✓ The diameter of pipes in the water circuit to the reactor should be increase to 1", in order to increase the turbulence in the reactor jacket.
- ✓ It is really important to check the real flow of cool water (glycol) available in the plant because of can be the limiting factor.

AIR REFRIGERATION FOR LIGHTING SYSTEM

1. Heat generation

Energy from lights:

Lamps to be installed	N _{LAMPS}	=	200 lamps
Lights power	Р	=	20 W/lamp
Lights heat	Q_1	=	3,6 <i>KW</i>

Assuming lighting system at 100% capacity and that 90% of power is converted as heating, the heat coming from the lighting system is:

$$Q = 200 \ lamps \cdot 20 \ \frac{W}{lamp} \cdot 0.9 = 3600 \ W = 3.6 \ KW$$

2. Required air flow

OBSERVATION: Considered at worse conditions, that means to eliminate 100% of the heat generated.

Delta temperature	ΔT	=	10 ° <i>C</i>
Air density	ρ	=	1,29 Kg/m^2
Specific heat	C _P	=	$0,2 \ Kcal/Kg.^{\circ}C$

$Q = m \cdot C_P \cdot \Delta T$

$$m = \frac{Q}{C_P \cdot \Delta T} = \frac{3.6 \ KW \cdot 860 \ Kcal}{\frac{KW}{0.2 \ Kcal}} = 1548 \ \frac{Kg}{h} = 1200 \ \frac{m^3}{h}$$

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Design flow	Q_L	=	$1500 m^3/h$
	$\boldsymbol{\sim}_L$		

3. <u>Required section in reactor lighting system</u>

3.1. Design Parameters

Out Diameter of reactor jacket	D_1	=	270 mm
In diameter of air conduct (PVC jacket)	D_2	=	390 mm
Free section assumed (lights and supports)		=	70 %

3.2. Circulation area

• Total area:

$$A = \frac{\pi}{4} \cdot \left(D_2^2 - D_1^2 \right)$$

$$A = \frac{\pi}{4} \cdot \left(0,380^2 - 0,270^2\right) = 0,062 \ m^2$$

• Free area:

 $A_{FREE} = A \cdot (Free \operatorname{sec} tion)$

$$A_{FREE} = 0,062 \ m^2 \cdot 0,7 = 0,044 \ m^2$$

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• <u>Air velocity:</u>

$$\langle v \rangle = \frac{Q_L}{A_{FREE}} = 9.5 \ m/s$$

$$\langle v \rangle = \frac{1500 \, m^3 / h \cdot \frac{1 \, h}{3600 \, s}}{0.044 \, m^2} = 9.5 \, m/s$$

4. Blower (item BLWR 2007 01)

Working flow		=	$1200 m^3/h$
Design flow	Q_L	=	$1500 m^3/h$
Delta pressure	ΔP	=	150 mbar

5. Air ducts section

Ducts diameter (DN200)	D	=	200 mm
Section	A	=	$0,125 m^2$
Air velocity	$\langle v \rangle$	=	3,3 m/s

$$\langle v \rangle = \frac{1500 \, m^3 / h \cdot \frac{1 \, h}{3600 \, s}}{0.125 \, m^2} = 3.3 \, m/s$$

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6. General conclusions from the calculations

The air blower should be able to transport $1500 m^3/h$ or more and to have sufficient delta pressure.

The blower should be installed as near as possible of the reactor in order to avoid big delta pressures in the aspiration.

BIOREACTOR OUTLET GAS CONDENSER (ITEM HX 2012 01)

1. Data design

Working parameters considered are the next:

- Outlet gas flow: 120 l/h

- At working temperature, it is assumed that no direct liquid evaporation will be produced.

- It will be considered a flow of evaporated liquid to condenser because of the stripping of the liquid in the reactor by the gas flow.

- Assumed: 10% of liquid evaporated in relation to gas flow \Rightarrow $V = 120 \cdot 0.10 = 12 l/h$

2. Condenser calculation

Evaporation heat *)	λ	=	100 Kcal/Kg
Density *)	ρ	=	$0,8 \ kg/dm^3$
Evaporated liquid	V	=	12 <i>l/h</i>
Logarithmic delta temperature	ΔTML	=	70 ° <i>C</i>

*)OBSERVATION: Assuming organics of boiling point at 80 °C

$$Q = m \cdot \lambda = V \cdot \rho \cdot \lambda$$

$$Q = 12 \frac{dm^{3}}{h} \cdot \frac{0.8 Kg}{dm^{3}} \cdot 100 \frac{Kcal}{Kg} = 960 Kcal / h$$

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$$A = \frac{Q}{U \cdot \Delta TML}$$

$$A = \frac{\frac{960 \ Kcal}{h}}{\frac{50 \ Kcal}{m^2 \cdot h^{\circ} C} \cdot 70^{\circ} C} = 0,27 \ m^2$$

The glass condenser is considered of $0.3 \ m^2$

3. Inlet pipe section to condenser

- Calculation of the pipe diameter from the reactor to the condenser.

Gas flow	$Q_{\scriptscriptstyle L}$	=	120 <i>l/h</i>
Assuming pipe diameter (3/4")	ID	=	15,75 mm
Section	A	=	$0,019 \ dm^2$
Gas velocity	$\langle v \rangle$	=	0,17 <i>m/s</i>
Flow type		=	laminar

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DROP PRESSURE: PROCESS GAS INSIDE BIOREACTOR

1. Design parameters

Height of liquid	h	=	1,7 <i>m</i>
Density of media	ρ	=	$1000 \ Kg/m^3$

2. Calculation

Pressure at reactor bottom = $h \cdot \rho$

 $\Delta P = 1.7 \ m \cdot 1000 \ Kg/m^3 = 1700 \ Kg/m^2 = 0.17 \ bar$



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4. UTILITIES: DESCRIPTION AND CONSUMPTIONS

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4. UTILITIES: DESCRIPTIONS AND CONSUMPTIONS

The pilot plant where to install the MELIiSSA COMPARTMENT II must have the following available services:

- Water
- Cool water
- Low pressure steam
- Compressed air
- Technical gases lines: air, CO₂ and Helium/Argon
- Electrical supply

Document of reference: The estimated dates present in this document are derived from the section 2: "Calculations".



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1. Water

The temperature control of the bioreactor is provided by a water flow through the reactor jacket. The circulated water is heated/cooled by an electrical resistance/plate heat exchanger. The design value of water flow during the steady operation is:

- Max. metric flow = $2,5 3 \text{ m}^3/\text{h}^*$
- Max. velocity = 2 m/s

*) NOTE: The water circuit is a closed pressurized circuit so, during steady operation, it has no water consumption except the purge losses.

2. Cool water (glycol)

Cooling water is used in three different plant equipments:

- In the plate heat exchanger (HX 2007 01) for the cooling of circulated water. The calculated flow of cool water is:

• Max. metric flow = $1.8 \text{ m}^3/\text{h}$

- In the condenser (HX 2012 01). This condenser will be installed in the head section of the PBR in order to condense the VFA of the outlet gas and part of the humidity. The condensate will return to the culture. The calculated flow of cool water in this case is:

• Max. metric flow = $0.5 \text{ m}^3/\text{h}$



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- In the feeding/harvesting vessel jacket for temperature controlling. The cooling water flow is controlled by a control valve installed in the cooling water outlet pipe. The calculated flow of cool water for each tank is:

• Max. metric flow = $0.5 \text{ m}^3/\text{h}$

NOTE: The available flow of cool water (glycol) in the pilot plant for Compartment II must be $3,3 \text{ m}^3/\text{h}$, being it the maximum consumption during the steady operation.

3. Low pressure steam

Steam is normally used to sterilize the plant or a part of it. It can be used too in the feed/harvest tanks jackets if it's necessary to heat the content of its. The maximum values of steam needed during the plant operation are:

• Max. mass flow = 20 Kg/h

NOTE: The steam consumption may vary remarkably depending on the sterilization operations frequency.

4. Compressed air

Compressed air is used for control valves actuators and for feeding and harvesting tanks jacket emptying.

NOTE: The consumption of compressed air is occasional and in any case is not continuous.



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5. Technical gases lines: air, CO2 and Helium/Argon

5.1 <u>Air</u>

Air circulation is required to refrigerate the bioreactor which is heated by the lighting system. The design value of the required air flow is:

• Max. metric flow = $1500 \text{ m}^3/\text{h}^*$)

*) This fan aspirates the air from the outside, and forces it to pass through the reactor air refrigeration system. The hot air is thrown out again to the outside of the pilot plant.

NOTE: This system has no air consumption. The air used is not service air.

5.2 CO2 and Helium/Argon

The compartment II will operate under anaerobic conditions so any air inlet will be completely avoided. Argon and/or CO_2 gas inlets will be provided.

NOTE: The consumption of its gases will be defined by the process.



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6. Electrical supply

Compartment II electrical components are listed next:

- Feed/Harvesting pumps (GP 2001 01/02, GP 2015 01/02): These pumps allow the reactor media input and output.
- Acid/base feeding pumps (PP 2008 01/02): Reactor pH control is done actuating over these pumps.
- **Centrifuge air fan (BLWR 2007 01):** This fan aspirates the air from the outside, and forces it to pass through the reactor air refrigeration system. The hot air is thrown out again to the outside of the pilot plant.
- **Compressor (BLWR 2012 01):** This compressor is used to introduce the bioreactor outlet gases to the discharge vessel.
- **Compressor (BLWR 2004 01):** This compressor is used to introduce the helium to the helium buffer tank.
- **Reactor water circuit pump (PP 2007 01):** This pump allows the cooling water flow through the bioreactor glass jacket.
- Feeding tank magnetic agitator (VS 2000 01): This equipment provides the necessary agitation to the feed vessel.
- Harvesting tank magnetic agitator (VS 2014 01): This equipment provides the necessary agitation to the harvesting vessel.
- Electrical heater (HX 2007 02): This electrical resistance heats the reactor water circuit (jacket water) if necessary.
- **Sample gas cooler (HX 2012 02):** This equipment is used to post-condensate the residual humidity of the reactor outlet gas before entering the gas analyzer.
- Reactor lighting system (IRC 2006 01): The illumination system consists of 200 halogen lamps distributed homogenously around the glass part of the bioreactor. A voltage regulator allows having different light intensities.
- **Reactor agitation group (GP 2005 01):** The medium inside the reactor is agitated with a mechanical stirrer with the motor installed in the upper part of the reactor.



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The characteristics and operating parameters of the electrical equipment are the next:

Item	Description	Power (KW)	Estimated operating load	Estimated consumption (KW·h/h)
GP 2001 01	Diaphragm pump	0,37	1,0	0,37
GP 2001 02	Diaphragm pump	0,37	0,0	0,00
GP 2015 01	Diaphragm pump	0,37	1,0	0,37
GP 2015 02	Diaphragm pump	0,37	0,0	0,00
PP 2008 01	Peristaltic pump	0,10	0,1	0,01
PP 2008 02	Peristaltic pump	0,10	0,1	0,01
BLWR 2007 01	Centrifuge air fan	0,14	1,0	0,14
BLWR 2012 01	Compressor	0,06	1	0,06
BLWR 2004 01	Compressor	0,06	1	0,06
PP 2007 01	Centrifuge pump	1,30	1,0	1,30
GP 2000 01	Magnetic agitator	0,20	1,0	0,20
GP 2014 01	Magnetic agitator	0,20	1,0	0,20
HX 2007 02	Electrical heater	2,00	0,05	0,10
HX 2012 02	Sample gas cooler	0,18	1,0	0,18
IRC 2006 01	Reactor lighting system	3,60	1,0	3,60
GP 2005 01	Reactor agitation group	2,20	1.0	2,20
	Total	11,62	0,7	8,17





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5. INVESTMENT

Member of			
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5. INVESTMENT

In the ANNEX III of the Project, there is included the quotation with the investment value of DDEQ, for the supply of the Melissa Pilot Plant Compartment II.

In that quotation there are detailed the investment costs for the construction and delivery of the indicated Compartment II, including:

- ✓ detail engineering pending works
- ✓ equipment supply
- ✓ piping, valves and accessories
- ✓ electric and control elements
- ✓ plant assembling
- ✓ commissioning

In the document, there is explained the scope of supply for each of the concepts considered.

The Annex of the document includes a complete part lists with the cost for each position.

A general planning for the development of the whole project is also included.





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6. ANNEX I: LISTINGS

- 6.1. Equipment List
- 6.2. Piping List
- 6.3. Instrument List
- 6.4. Materials List
- 6.5. Electrical & Control signals List
- 6.6. Motors List

		EQUIPMENT LIST		
	uipos Químicos, S.L. sturies 43-45, 1r-5a ELONA Member of De Dietrich	EQUIPMENT		
CUSTOMER:	Universitat Autònoma	de Barcelona / MPP		
PROJECT:	MELISSA COMPART	MENT II DATE:	19/01/2010	PREPARED: J.GUBERN
DRAWING:	DD-8550-Z1-100-01	REV:	A	CHECKED: J. MESTRE
TAG	DENOMINATION	DESCRIPTION	SUPPLIER	OBSERVATIONS
R 2005 01 GP 2005 01	Photobioreactor	Bioreactor with mechanical agitation. Material: AISI 316L / jacketed glass	DDEQ	
IRC 2006 01	Lighting system	PBR Lighting system	DDEQ	
HX 2012 01	Condenser	Condenser for reactor outlet gases. Material: glass borosilicate 3.3	DDPS	Transfer area: 0,3 m ²
BLWR 2007 01	Extractor	Fan for PBR air cooling system	SODECA	Required air flow: 1500 m ³ /h
GF 2007 01	Air filter	Air filter for PBR air cooling system		
VS 2000 01 GP 2000 01	Feeding tank	Agitated tank in AISI 316L, provided with jacket for heating - cooling. Designed to operate at positive pressure. Magnetic driver		V=250 L
GP 2001 01 GP 2001 02	Feed pumps to reactor	Mettering pump in AISI 316 and PTFE membrane. Controlled by an electronic variator. Sterilizable.	LEWA	Required flow: 10 l/h P=20 bar
VS 2008 01	Acid vessel	Borosilicate glass vessel for acid addition	Fisher	V=5 L
VS 2008 02	Alkali vessel	Borosilicate glass vessel for alkali addition	Fisher	V=5 L
PP 2008 01	Acid pump	Peristaltic pump for acid dosing (pH control).	Watson Marlow	
PP 2008 02	Alkali pump	Peristaltic pump for alkali dosing (pH control).	Watson Marlow	
VS 2014 01 GP 2014 01	Harvesting tank	Agitated tank in AISI 316L, provided with jacket for heating - cooling. Designed to operate at positive pressure. Magnetic driver		V=250 L
GP 2015 01/02	Harvest pumps to reactor	Mettering pump in AISI 316 and PTFE membrane. Controlled by an electronic variator. Sterilizable.	LEWA	Required flow: 10 l/h P=20 bar

		EQUIPMENT LIST		
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	De Dietrich			
CUSTOMER:	Universitat Autònoma d	de Barcelona / MPP		
PROJECT:	MELISSA COMPARTM		19/01/2010	PREPARED: J.GUBERN
	DD-8550-Z1-100-01	REV:	A	CHECKED: J. MESTRE
TAG	DENOMINATION	DESCRIPTION	SUPPLIER	OBSERVATIONS
VS 2012 01	Discharge vessel	Buffer tank in AISI 316L for process gas acumulation		V=200 L
BLWR 2012 01	Compressor	Membrane compressor in AISI 316 / PTFE for outlet gas flow		
VS 2019 01	Helium buffer	Buffer tank in AISI 316L for helium recycling		V=40 L
BLWR 2004 01	Compressor	Membrane compressor in AISI 316 / PTFE for helium flow		
HX 2007 01	Heat exchanger	Plate heat exchanger for water cooling with cool water (glycol)		Transfer area: 0,35 m ²
HX 2007 02	Water heater	Electrical resistance (heater)		Required Power: 2 KW
PP 2007 01	Circulation pump	Centrifugal pump for water loop (PBR temperature control)		Required flow: 3 m ³ /h
VS 2007 01	Expansion vessel	Expansion vessel for water circuit. Material AISI 316.	Olaer	V=10 L
HX 2012 02	Post-cooler	Sample gas cooler for sampling conditioning	Sick-Maihack	
VS XXXX XX	Media preparation tank	Athmospheric agitated tank in AISI 316L.		V=300 L
GP XXXX XX	Media inlet pump	Sanitary centrifugal pump		



	PROCESS SYSTEMS				
USTOMER:	Universitat Autònoma de Ba	arcelona / MPP			
ROJECT:	MELISSA COMPARTMENT II		DATE: 18/01/2010	CHECKED:	J.MESTRE
RAWING:	DD-8550-Z1-100-01		REV: A	PREPARED:	J. GUBERN
		PROCESS			
	PIPE NUMBER	FROM	ТО	OBS	CLASS
	PL-1/2"-SS2-001	COMPARTMENT LIQUID INLET	VS 2000 01		SS-2
	PL-1/2"-SS2-002	VS 2000 01	PL-1/2"-SS2-003		SS-2
	PL-1/2"-SS2-003	GP 2001 01	PL-1/2"-SS2-006		SS-2
	PL-1/2"-SS2-004	GP 2001 02	PL-1/2"-SS2-003		SS-2
	PL-1/2"-SS2-005	PL-1/2"-SS2-003	PL-1/2"-SS2-006		SS-2
	PL-1/2"-SS2-006	PL-1/2"-SS2-003	PL-1/2"-SS2-007		SS-2
	PL-1/2"-SS2-007	PL-1/2"-SS2-006	PL-1/2"-SS2-009		SS-2
	PL-1/2"-SS2-008	PL-1/2"-SS2-007	PL-1/2"-SS2-009		SS-2
	PL-1/2"-SS2-009	R 2005 01	PL-1/2"-SS2-007		SS-2
	PL-1/2"-SS2-010	R 2005 01	PL-1/2"-SS2-011		SS-2
	PL-1/2"-SS2-011	GP 2015 01	PL-1/2"-SS2-013		SS-2
	PL-1/2"-SS2-012	GP 2015 02	PL-1/2"-SS2-013		SS-2
	PL-1/2"-SS2-013	PL-1/2"-SS2-011	VS 2014 01		SS-2
	PL-1/2"-SS2-014	VS 2014 01	COMPARTMENT LIQUID OUTLET		SS-2

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DRAWING:	DD-8550-Z1-100-01		REV: A	PREPARED: J. GUBER		
		PROC	ESS GAS			
	PIPE NUMBER	FROM	ТО	OBS	CLASS	
F	PG-1/4"-SS2-001	C.I. GAS INLET	PG-1/2"-SS2-002		SS-2	
F	PG-1/2"-SS2-002	PRC 2012 04	PG-1/2"-SS2-003		SS-2	
F	PG-1/2"-SS2-003	PG-1/2"-SS2-002	R 2005 01		SS-2	
	PG-1/2"-SS2-004	R 2005 01	HX 2012 01		SS-2	
		HX 2012 01	HX 2012 02		SS-2	
PG-1/2"-SS2-005 PG-1/2"-SS2-006		PG-1/2"-SS2-005	PG-1/2"-SS2-005		SS-2	
F	PG-1/2"-SS2-007	HX 2012 02	BLWR 2012 01		SS-2	
F	PG-1/2"-SS2-008	BLWR 2012 01	VS 2012 01		SS-2	
F	PG-1/4"-SS2-009	VS 2012 01	PG-1/2"-SS2-002		SS-2	
F	PG-1/2"-SS2-010	PG-1/2"-SS2-007	PG-1/2"-SS2-002		SS-2	
F	PG-1/4"-SS2-011	VS 2012 01	COMPARTMENT GAS OUTLET		SS-2	

De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA Member of De Dietrich process systems		PIPING LIST		
CUSTOMER: Universitat Autònoma de Bar	celona / MPP			
PROJECT: MELISSA COMPARTMENT II		DATE: 18/01/2010	CHECKED:	J.MESTRE
DRAWING: DD-8550-Z1-100-01		REV: A	PREPARED:	J. GUBERN
	AIR and	d CO ₂		
PIPE NUMBER	FROM	ТО	OBS	CLASS
AI-1/4"-SS1-001	HV 2003 06	GLY-3/4"-SS1-004		SS-1
Al-1/4"-SS1-002	HV 2003 06	GLY-3/4"-SS1-007		SS-1
AI-200-PVC-001	GF 2007 01	R 2005 01		PVC
AI-200-PVC-002	R 2005 01	BLWR 2007 01		PVC
AI-200-PVC-003	BLWR 2007 01	AIR OUTLET		PVC
CO2-1/4"-SS2-001	CO ₂ INLET	PG-1/2"-SS2-002		SS-2

De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA **PIPING LIST** Member of De Dietrich CUSTOMER: Universitat Autònoma de Barcelona / MPP PROJECT: DATE: 18/01/2010 CHECKED: J.MESTRE MELISSA COMPARTMENT II **REV:** DRAWING: Α PREPARED: J. GUBERN DD-8550-Z1-100-01 ACID/ALKALI (for PBR pH control) PIPE NUMBER FROM то OBS CLASS PAC-1/2"-PP-001 PAC-1/2"-SS2-002 VS 2008 01 PP ----PAC-1/2"-PP-001 PAC-1/2"-SS2-002 R 2005 01 SS-2 ---PBA-1/2"-PP-001 PBA-1/2"-SS2-002 VS 2008 02 PP ----PBA-1/2"-SS2-002 PBA-1/2"-PP-001 R 2005 01 SS-2 ---

	Equipos Químicos, S.L. 'Asturies 43-45, 1r-5a RCELONA Member of De Dietrich PROCESS SYSTEMS		PIPING LIST		
CUSTOMER:	Universitat Autònoma de Ba	rcelona / MPP			
PROJECT:	MELISSA COMPARTMENT II		DATE: 18/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01		REV: A	PREPARED:	J. GUBERN
		COOL WAT	ER (GLYCOL)		
I	PIPE NUMBER	FROM	ТО	OBS	CLASS
GLY-1"-SS1-001		GLYCOL INLET	MISCELLANEOUS		SS-1
(GLY-1"-SS1-002	MISCELLANEOUS	GLYCOL OUTLET		SS-1
G	GLY-3/4"-SS1-003	GLY-3/4"-SS1-001	VS 2000 01		SS-1
G	GLY-3/4"-SS1-004	VS 2000 01	GLY-3/4"-SS1-002		SS-1
	GLY-3/4"-SS1-005	GLY-3/4·-SS1-003	GLY-3/4"-SS1-002		SS-1
	GLY-3/4"-SS1-006	GLY-3/4"-SS1-001	VS 2014 01		SS-1
	GLY-3/4"-SS1-007	VS 2014 01	GLY-3/4"-SS1-002		SS-1
G	GLY-3/4"-SS1-008	GLY-3/4"-SS1-006	GLY-3/4"-SS1-002		SS-1
	GLY-3/4"-PP-009	GLY-3/4"-SS1-001	HX 2012 01		PP
	GLY-3/4"-PP-010	HX 2012 01	GLY-3/4"-SS1-002		PP
	GLY-1"-SS1-011	GLY-3/4"-SS1-001	HX 2007 01		SS-1
(GLY-1"-SS1-012	HX 2007 01	GLY-3/4"-SS1-002		SS-1

De Dietrich Av. Príncep o E-08012 BAf	Equipos Químicos, S.L. d'Asturies 43-45, 1r-5a RCELONA Member of De Dietrich PROCESS SYSTEMS		PIPING LIST		
CUSTOMER:	Universitat Autònoma de Bar	celona / MPP			
PROJECT:	MELISSA COMPARTMENT II		DATE: 18/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01		REV: A	PREPARED:	J. GUBERN
		INOCULUM /	ANTIFOAM		
	PIPE NUMBER	FROM	ТО	OBS	CLASS
	IN-1/2"-SS2-001	INOCOULUM INLET	ST-1/2"-SS1-025		SS-2

Av. Príncep o E-08012 BAI	Member of De Dietrich PROCESS SYSTEMS		PIPING LIST		
CUSTOMER:	Universitat Autònoma de Bar	celona / MPP			
PROJECT:	MELISSA COMPARTMENT II		DATE: 18/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01		REV: A	PREPARED:	J. GUBERN
		HELIUM (IN			
	PIPE NUMBER	FROM	ТО	OBS	CLASS
	HE-1/4"-SS2-001	HELIUM INLET	PG-1/2"-SS2-002		SS-2
	HE-1/4"-SS2-002	HELIUM INLET	VS 2019 01		SS-2
	HE-1/4"-SS2-003	HELIUM INLET	VS 2012 01		SS-2



	PROCESS SYSTEMS				
CUSTOMER:	Universitat Autònoma de Bar	celona / MPP			
PROJECT:	MELISSA COMPARTMENT II		DATE: 18/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01		REV: A	PREPARED:	J. GUBERN
		VENT	FPIPES		
	PIPE NUMBER	FROM	ТО	OBS	CLASS
	VT-1/2"-SS2-001	VS 2019 01	VS 2000 01	HELIUM	SS-2
,	VT-1/2"-SS2-002	VS 2000 01	VT-1/2"-SS2-003	HELIUM	SS-2
	VT-1/2"-SS2-003	BLWR 2004 01	VT-1/2"-SS2-002	HELIUM	SS-2
	VT-1/2"-SS2-004	VS 2019 01	BLWR 2004 01	HELIUM	
		VS 2019 01	VS 2014 01	HELIUM	SS-2
VT-1/2"-SS2-005 VT-1/2"-SS2-006 VT-1/2"-SS2-007		VS 2014 01	VT-1/2"-SS2-003	HELIUM	SS-2
	VT-1/2"-SS2-007	VS 2019 01		HELIUM	SS-2
	VT-1/4"-SS2-008	PG-1/4"-SS2-011		HELIUM	SS-2 SS-2
	VT-1/4"-PP-009	VS 2008 02	VENTING	ALKALI BOTTLE	
	VT-1/2"-PP-010	VS 2008 01	VENTING	ACID BOTTLE	PP

De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA **PIPING LIST** Member of De Dietrich CUSTOMER: Universitat Autònoma de Barcelona / MPP PROJECT: DATE: 18/01/2010 CHECKED: J.MESTRE MELISSA COMPARTMENT II **REV:** Α DRAWING: PREPARED: J. GUBERN DD-8550-Z1-100-01 WATER PIPE NUMBER FROM то OBS CLASS WT-1"-SS1-001 WATER INLET WT-1"-SS1-002 SS-1 ----WT-1"-SS1-002 WT-1"-SS1-001 R 2005 01 SS-1 ---



CUSTOMER: PROJECT:	Universitat Autònoma de MELISSA COMPARTMEN		DATE: 18/01/2010	CHECKED:	J.MESTRE
		1 11			
DRAWING:	DD-8550-Z1-100-01			PREPARED:	J. GUBERN
		STE	EAM		
	PIPE NUMBER	FROM	ТО	OBS	CLASS
Ş	ST-3/4"-SS1-001	HV 2021 01			SS-1
0	ST-3/4"-SS1-001	HV 2021 01			SS-1
	ST-3/8"-SS1-002	ST-3/4"-SS1-001	PL-1/2"-SS2-001		SS-1
	ST-1/2"-SS1-003	ST-3/4"-SS1-001	GLY-3/4"-SS1-004		SS-1
Ş	ST-3/8"-SS1-004	ST-3/4"-SS1-001	HV 2001 01		SS-1
	ST-1/2"-SS1-005	ST-3/4"-SS1-001	VT-1/2"-SS2-001		SS-1
	ST-3/8"-SS1-006	ST-3/4"-SS1-001	HV 2004 03		SS-1
	ST-1/2"-SS1-007	HV 2021 06 / HV 2021 07	CONDENSATE MANIFOLD		SS-1
ę	ST-3/8"-SS1-008	ST-3/4"-SS1-001	VS 2000 01		SS-1
	ST-3/8"-SS1-009	ST-3/4"-SS1-001	HV 2001 02		SS-1
	ST-3/8"-SS1-010	ST-3/4"-SS1-001	HV 2001 04		SS-1
	ST-3/8"-SS1-011	ST-3/4"-SS1-001	HV 2001 09		SS-1
	ST-3/8"-SS1-012	ST-3/4"-SS1-001	HV 2001 14		SS-1
ę	ST-3/8"-SS1-013	ST-3/4"-SS1-001	HV 2001 15		SS-1
	ST-3/8"-SS1-014	ST-3/4"-SS1-001	PG-1/2"-SS2-003		SS-1
	ST-3/8"-SS1-015	HV 2012 05	CONDENSATE MANIFOLD		SS-1
Ş	ST-3/8"-SS1-016	ST-3/8"-SS1-018	PAC-1/2"-SS2-002		SS-1
Ş	ST-3/8"-SS1-017	ST-3/8"-SS1-018	PBA-1/2"-SS2-002		SS-1
	ST-3/8"-SS1-018	ST-3/4"-SS1-001	HV 2022 19		SS-1
S	ST-3/8"-SS1-019	HV 2022 22 / HV 2022 23	CONDENSATE MANIFOLD		SS-1
	ST-3/8"-SS1-020	ST-1/2"-SS1-025	HV 2012 07		SS-1
	ST-3/8"-SS1-021	ST-1/2"-SS1-025	HV 2012 07		SS-1



CUSTOMER:	Universitat Autònoma de E				
PROJECT:	MELISSA COMPARTMENT	11	DATE: 18/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01		REV: A	PREPARED:	J. GUBERN
		STI	EAM		
	PIPE NUMBER	FROM	ТО	OBS	CLASS
	ST-3/8"-SS1-022	ST-1/2"-SS1-025	HV 2012 08		SS-1
ST-3/8"-SS1-023		ST-1/2"-SS1-025	HV 2012 08		SS-1
	ST-3/8"-SS1-024	HV 2022 28 / HV 2022 29	CONDENSATE MANIFOLD		SS-1
(ST-3/4"-SS1-025	ST-3/4"-SS1-001	HV 2022 30		SS-1
	ST-3/8"-SS1-026	HV 2012 06 / HV 2022 30	CONDENSATE MANIFOLD		SS-1
(ST-1/2"-SS1-027	ST-3/4"-SS1-001	GLY-3/4"-SS1-002		SS-1
ST-3/8"-SS1-027		ST-3/4"-SS1-001	HV 2018 03		SS-1
ļ	ST-3/8"-SS1-029	ST-3/8"-SS1-034	VS 2014 01		SS-1
ļ	ST-3/8"-SS1-030	ST-3/8"-SS1-034	VS 2014 01		SS-1
ļ	ST-1/2"-SS1-031	ST-3/8"-SS1-034	VT-1/2"-SS2-005		SS-1
	ST-3/8"-SS1-032	ST-3/8"-SS1-034	HV 2023 02		SS-1
(ST-3/8"-SS1-033	ST-3/8"-SS1-034	HV 2023 03		SS-1
(ST-3/8"-SS1-034	ST-3/4"-SS1-001	HV 2015 01		SS-1
ļ	ST-3/8"-SS1-035	HV 2015 08	ST-1/2"-SS1-037		SS-1
	ST-3/8"-SS1-036	HV 2015 09	ST-1/2"-SS1-037		SS-1
	ST-1/2"-SS1-037	ST-3/8"-SS1-035 / 036	ST-1/2"-SS1-037		SS-1
	ST-3/8"-SS1-038	HV 2018 06 / HV 2023 12	CONDENSATE MANIFOLD		SS-1
	ST-1/2"-SS1-039		CONDENSATE MANIFOLD		SS-1
	ST-1/2"-SS1-040		CONDENSATE MANIFOLD		SS-1
	ST-1/2"-SS1-041		CONDENSATE MANIFOLD		SS-1

De Dietrich Eq	uipos Químicos, S.L.				Instrum	ients list						
Av. Príncep d'A E-08012 BARC	sturies 43-45, 1r-5a				CONTRO	OL VALVE						
CUSTOMER:	Universitat Autònoma	de Barce	elona / MELiS	SA								
PROJECT:	MELISSA COMPART	MENT II		DATE:	19/01/2010	CHECKED:	J. MESTRE					
DRAWING:	DD-8550-Z1-100-01			REV:	А	PREPARED:	J. GUBERN					
TAG Nº	SITUATION	Inch		SERVICE	REFERENCE	MATERIAL	MANUFACTURER	ТΡ	AC	F/E	Ν	E
FQRC 2012 01	PG-1/4"-SS2-001	1/4"	PROC	CESS GAS C.I. INLET								
FQRC 2012 02	CO2-1/4"-SS2-001	1/4"		CO2 INLET								
FQRC2012 03	HE-1/4"-SS2-001	1/4"		HELIUM INLET								
FQRC 2012 04	PG-1/2"-SS2-003	1/4"		PROCESS GAS								
FQRC 2012 05	PG-1/4"-SS2-009	1/4"		PROCESS GAS								
FQRC 2012 06	PG-1/2"-SS2-011	1/4"		PROCESS GAS								
FQRC 2012 07	VT-1/4"-SS2-008	1/4"	HELIU	M VENTING OUTLET								
SCV 2012 01	PG-1/2"-SS2-007	1/2"		PROCESS GAS								
SV 2003 01	GLY-3/4"-SS1-004	3/4"	G	LYCOL OUTLET				1	Α	Х	1	Х
SV 2004 01	VT-1/2"-SS2-002	1/2"	HELIU	M VENTING OUTLET				1	Α	Х	1	Х
SV 2004 02	VT-1/2"-SS2-001	1/2"	HELIU	M VENTING RETURN				1	Α	Х	1	Х
SV 2004 03	VT-1/2"-SS2-003	1/2"	HELIU	M VENTING OUTLET				1	Α	Х	1	Х
SV 2007 01	GLY-3/4"-SS1-012	3/4"	G	LYCOL OUTLET				1	Α	Х	1	Х
SV 2008 01	PAC-1/2"-SS2-002	1/2"		ACID INLET				1	А	Х	1	Х
SV 2008 02	PBA-1/2"-SS2-002	1/2"		BASE INLET				1	A	Х	1	Х
	TYPE 1: ON/OFF			IEUMATIC (SIMPLE EFFEC	,		F/E = LIMIT SWIT			<u> </u>	<u> </u>	<u> </u>
	PE 2: PROPORTIONAL			EUMATIC (DOUBLE EFFE	,	N =	NUMBER OF LIMIT SW		ES: 1	, 2		
TP = TYP	PE 3: ELECTROVALVE		AC = C : PN	IEUMATIC (PROPORTION	AL) OPERATION		E = ELECTROVA	LVE				

	quipos Químicos, S.L.			Instrum	nents list						
E-08012 BARC	Asturies 43-45, 1r-5a CELONA mber of e Dietrich			CONTRO	OL VALVE						
CUSTOMER:	Universitat Autònoma	de Barce	elona / MELiSSA								
PROJECT:	MELISSA COMPARTI	MENT II	DATE	19/01/2010	CHECKED:	J. MESTRE					
DRAWING:	DD-8550-Z1-100-01		REV:	А	PREPARED:	J. GUBERN					
TAG Nº	SITUATION	Inch	SERVICE	REFERENCE	MATERIAL	MANUFACTURER	ТΡ	AC	F/E	Ν	E
SV 2012 01	PG-1/2"-SS2-010	1/2"	PROCESS GAS				1	А	Х	1	Х
SV 2012 02	PG-1/2"-SS2-008	1/2"	PROCESS GAS				1	А	Х	1	Х
SV 2012 03	HE-1/4"-SS2-003	1/4"	HELIUM INLET				1	А	Х	1	Х
SV 2013 01	PG-1/2"-SS2-007	1/2"	PROCESS GAS				1	Α	Х	1	Х
SV 2017 01	GLY-3/4"-SS1-007	3/4"	GLYCOL OUTLET				1	Α	Х	1	Х
SV 2018 01	VT-1/2"-SS2-006	1/2"	HELIUM VENTING OUTLET				1	А	Х	1	Х
SV 2018 02	VT-1/2"-SS2-005	1/2"	HELIUM VENTING RETURN				1	Α	Х	1	Х
SV 2019 01	HE-1/4"-SS2-002	1/4"	HELIUM INLET				1	Α	Х	1	Х
SV 2019 02	VT-1/2"-SS2-007	1/2"	HELIUM VENTING OUTLET				1	Α	Х	1	Х
SV 2021 01	ST-1/2"-SS1-005	1/2"	STEAM				1	Α	Х	1	Х
SV 2022 01	ST-1/2"-SS1-025	1/2"	STEAM				1	Α	Х	1	Х
SV 2023 01	ST-1/2"-SS1-031	1/2"	STEAM				1	Α	Х	1	Х
								<u> </u>	<u> </u>	<u> </u>	<u> </u>
								<u> </u>		<u> </u>	┢
							\perp	\vdash	\square		\bot
								<u> </u>	<u> </u>		+
P = TYPE 1 : ON			AC = A: PNEUMATIC (SIMPLE EFFE			F/E = LIMIT SWI	ГСН				
P = TYPE 2 : PR			AC = B : PNEUMATIC (DOUBLE EFFE		N =	NUMBER OF LIMIT SV		ES: 1	, 2		
P = TYPE 3 : El	LECTROVALVE		AC = C: PNEUMATIC (PROPORTION	IAL) OPERATION		E = ELECTROVA	'TAE				

De Dietrich Equipos Químicos, S.L.		Instruments list									
	d'Asturies 43-45, 1r-5a	3	ANALYZER								
CUSTOMER:	Universitat Autonom	na de Ba	arcelona / MELiSSA								
PROJECT:	MELISSA COMPAR	RTMENT		DATE:	19/01/2010	CHECKED:		J. MESTRE			
DRAWING:	DD-8550-Z1-100-01			REV:	А	PREPARED:		J. GUBERN			
TAG Nº	SITUATION	Inch	DESCRIPTION	CONFIG	URATED RANGE	MODEL	MAT.	MANUFACTURER			
AT 2005 01	R 2005 01	1"	REDOX MEASUREMENT								
AT 2008 01	R 2005 01	1"	pH MEASUREMENT								
AT 2008 02	PL-1/2"-SS2-010	1"	pH MEASUREMENT								
AT 2011 01	R 2005 01	1"	BIOMASS MEASUREMENT								
AT 2011 02	PL-1/2"-SS2-010	1"	BIOMASS MEASUREMENT								
AT 2013 01	PG-1/2"-SS2-007	1"	GAS ANALYZER								
AT 2013 02	PG-1/2"-SS2-007	1"	GAS ANALYZER								
AT 2013 03	R 2005 01	1"	pO2 MEASUREMENT								
		1									
		1									
		1									

De Dietrich Equipos Químicos, S.L.			Instruments list									
Av. Príncep d E-08012 BAR	Asturies 43-45, 1r-5 CELONA Member of De Dietrich Process systems	a	FLOW									
			Barcelona / MELiSSA									
	MELISSA COMPAR		NT II		19/01/2010	CHECKED:		MESTRE				
	DD-8550-Z1-100-01			REV:	A	PREPARED:		GUBERN				
TAG №	SITUATION	DN	DESCRIPTION	RANGE	SERVICE	MODEL	MATERIAL	MANUFACTURER				
FT 2001 01	PL-1/2"-SS2-006	1/2"	INLET LIQUID FLOW MEASUREMENT		LIQUID							
FT 2012 01	PG-1/2"-SS2-007	1/2"	OUTLET GAS FLOW MEASUREMENT		GAS							
								I				

De Dietrich	Equipos Químicos, S.L.	_	Instruments list										
Av. Princep E-08012 BA	d'Asturies 43-45, 1r-5a		LEVEL										
CUSTOMER:	Universitat Autònoma de	Barce											
PROJECT:	MELISSA COMPARTME	INT II		DATE:	19/01/2010	PREPARED:	J. GUBERN						
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE						
TAG Nº	SITUATION		SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER						
LT 2002 01	VS 2000 01	1"	LEVEL MEASUREMENT	LEVEL TRANSMITTER									
LS 2020 01	R 2005 01	1"	FOAM MEASUREMENT	LEVEL SWITCH									
		<u> </u>											
		1											

De Dietrich Equipos Químicos, S.L.		Instruments list											
Av. Príncep d'As E-08012 BARCE	sturies 43-45, 1r-5a ELONA		WEIGHT										
CUSTOMER:	Universitat Autòno	ma de Barcelona / MELiSSA	Barcelona / MELiSSA										
PROJECT:	MELISSA COMP		DATE:	19/01/2010	PREPARED:	J.GUBERN							
DRAWING:	DD-8550-Z1-100-0		REV.:	A	CHECKED:	J.MESTRE							
TAG №	SITUATION	SERVICE	DESCRIPTION	MODEL	CONF. RANGE	MANUFACTURER							
WT 2008 01	VS 2008 01	ACID BOTTLE WEIGHT (LEVEL) MEASURE	Weight Balance										
WT 2008 02	VS 2008 02	ALKALI BOTTLE WEIGHT (LEVEL) MEASURE	Weight Balance										
WT 2010 01	R 2005 01	REACTOR WEIGHT (LEVEL) MEASURE	Weight Cells										
WT 2016 01	VS 2014 01	HARVESTING TANK WEIGHT (LEVEL) MEASURE	Weight Balance										

De Dietrich B	De Dietrich Equipos Químicos, S.L.		Instruments list										
	l'Asturies 43-45, 1r-5a												
	Member of			_		_							
	De Dietrich	PRESSURE											
CUSTOMER:	Universitat Autònoma de Barce	lona / ME											
PROJECT:	MELISSA COMPARTMENT II			DATE:	19/01/2010	CHECKED:		J.MESTRE					
DRAWING:	DD-8550-Z1-100-01			REV:	A	PREPARED:		J. GUBERN					
TAG Nº	SITUATION	Inch	SERVICE	RAN	NGE	MODEL	MATERIAL	MANUFACTURER					
PI 2003 01	PRC 2003 01	1 1/2"	SERVICE AIR INLET										
PI 2004 01	VT-1/2"-SS2-002	1 1/2"	HELIUM VENTING OUTLET										
PI 2004 02	VT-1/2"-SS2-001	1 1/2"	HELIUM VENTING RETURN										
PI 2004 03	VT-1/2"-SS2-001	1 1/2"	HELIUM VENTING RETURN										
PI 2007 01	WT-3/4"-SS1-002	1 1/2"	WATER										
PI 2012 01	PRC 2012 01	1 1/2"	PROCESS GAS C.I. INLET										
PI 2012 02	PRC 2012 02	1 1/2"	CO ₂ INLET										
PI 2012 03	PRC 2012 02	1 1/2"	HELIUM INLET										
PI 2012 04	PRC 2012 04	1 1/2"	PROCESS GAS										
PI 2012 05	PRC 2012 05	1 1/2"	PROCESS GAS										
PI 2012 06	PG-1/2"-SS2-003	1 1/2"	PROCESS GAS										
PI 2012 07	PG-1/2"-SS2-003	1 1/2"	PROCESS GAS										
PI 2012 08	PG-1/2"-SS2-005	1 1/2"	PROCESS GAS										
PI 2012 09	PG-1/2"-SS2-006	1 1/2"	PROCESS GAS										
PI 2012 10	PRC 2016 06	1 1/2"	PROCESS GAS										
PI 2012 11	HE-1/4"-SS2-003	1 1/2"	HELIUM INLET										
PI 2017 01	AI-1/4"-SS1-002	1 1/2"	SERVICE AIR INLET										
PI 2018 01	VT-1/2"-SS2-006	1 1/2"	HELIUM VENTING OUTLET										
PI 2018 02	VT-1/2"-SS2-005	1 1/2"	HELIUM VENTING RETURN										
PI 2018 03	VT-1/2"-SS2-005	1 1/2"	HELIUM VENTING RETURN										
PI 2019 01	HE-1/4"-SS2-002	1 1/2"	HELIUM INLET										
PS 2001 01	GP 2001 01	1 1/2"	MEMBRANE PROTECTION										
PS 2001 02	GP 2001 02	1 1/2"	MEMBRANE PROTECTION										

De Dietrich E	De Dietrich Equipos Químicos, S.L.		Instruments list									
Av. Príncep d' E-08012 BAR	Asturies 43-45, 1r-5a CELONA											
	Member of			_		~-						
	De Dietrich	PRESSURE										
CUSTOMER:	Universitat Autònoma de Barcel	lona / ME	LiSSA									
PROJECT:	MELISSA COMPARTMENT II			DATE:	19/01/2010	CHECKED:		J.MESTRE				
DRAWING:	DD-8550-Z1-100-01			REV:	Α	PREPARED:		J. GUBERN				
TAG Nº	SITUATION	Inch	SERVICE	RAI	NGE	MODEL	MATERIAL	MANUFACTURER				
PS 2001 03	PL-1/2"-SS2-003	1 1/2"	LIQUID									
PS 2001 04	PL-1/2"-SS2-004	1 1/2"	LIQUID									
PS 2004 01	VT-1/2"-SS2-004	1 1/2"	HELIUM VENTING OUTLET									
PS 2012 01	PG-1/2"-SS2-008	1 1/2"	PROCESS GAS									
PS 2015 01	GP 2015 01	1 1/2"	MEMBRANE PROTECTION									
PS 2015 02	GP 2015 02	1 1/2"	MEMBRANE PROTECTION									
PS 2015 03	PL-1/2"-SS2-011	1 1/2"	LIQUID									
PS 2015 04	PL-1/2"-SS2-012	1 1/2"	LIQUID									
PS	MEDIA PREPARATION TANK	1 1/2"	LIQUID									
PT 2004 01	VS 2000 01	1 1/2"	FEEDING TANK									
PT 2009 01	R 2005 01	1 1/2"	BIOREACTOR									
PT 2009 02	R 2005 01	1 1/2"	BIOREACTOR									
PT 2012 01	VS 2012 01	1 1/2"	DISCHARGE BUFFER									
PT 2013 01	PG-1/2"-SS2-007	1 1/2"	PROCESS GAS									
PT 2018 01	VS 2014 01	1 1/2"	HARVESTING TANK									
PT 2019 01	VS 2019 01	1 1/2"	HELIUM BUFFER									
DPT 2001 01	PL-1/2"-SS2-003	1 1/2"	LIQUID									
DPT 2001 02	PL-1/2"-SS2-006	1 1/2"	LIQUID									
DPT 2012 01	PG-1/2"-SS2-005	1 1/2"	PROCESS GAS									

De Dietrich Eo	quipos Químicos, S.L.	Instruments list									
Av. Príncep d'A E-08012 BARC	Asturies 43-45, 1r-5a CELONA										
	Member of De Dietrich PROCESS SYSTEMS	Temperature									
CUSTOMER:	Universitat Autònoma de l		a / MELiSSA	1		T					
	MELISSA COMPARTMEN	ΤII		DATE:	19/01/2010	CHECKED:		.MESTRE			
	DD-8550-Z1-100-01			REV:	A	PREPARED:		GUBERN			
TAG №	SITUATION	Inch	DESCRIPTION	RAP	NGE	MODEL	MATERIAL	MANUFACTURER			
TT 2003 01	VS 2000 01		TEMP. MEASURE								
TT 2005 01	R 2005 01	1 "	REDOX ANALYZER								
TT 2007 01	R 2005 01		TEMP. MEASURE								
TT 2008 01	R 2005 01	1 "	pH ANALYZER								
TT 2008 02	R 2005 01	1 "	pH ANALYZER								
TT 2013 01	PG-1/2"-SS2-007		PROCESS GAS								
TT 2013 02	R 2005 01	1 "	pO ₂ ANALYZER								
TT 2017 01	VS 2014 01		TEMP. MEASURE								

De Dietrich Equipos Químicos, S.L.		MATERIAL LIST							
Av. Prínce	Member of Process system		MANUAL VALVES						
CUSTOMER:	Universitat Autònoma de	Barcelona /	MPP						
PROJECT:	MELISSA COMPARTMEN	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN		
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE		
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER		
HV 2000 01	ST-3/8"-SS1-008	3/8"	STEAM	Manual Valve					
HV 2000 01	PL-1/2"-SS2-001	1/2"	LIQUID	Manual Valve					
HV 2000 02	PL-1/2"-SS2-002	1/2"	LIQUID	Manual Valve					
HV 2000 03	PL-1/2"-SS2-001	1/2"	DRAIN	Manual Valve					
HV 2001 01	PL-1/2"-SS2-002	1/2"	LIQUID	Manual Valve					
HV 2001 02	PL-1/2"-SS2-003	1/2"	LIQUID	Manual Valve					
HV 2001 03	PL-1/2"-SS2-002	1/2"	DRAIN	Manual Valve					
HV 2001 04	PL-1/2"-SS2-004	1/2"	LIQUID	Manual Valve					
HV 2001 05	PL-1/2"-SS2-003	1/2"	DRAIN	Manual Valve					
HV 2001 06	PL-1/2"-SS2-004	1/2"	DRAIN	Manual Valve					
HV 2001 07	PL-1/2"-SS2-003	1/2"	LIQUID	Manual Valve					
HV 2001 08	PL-1/2"-SS2-004	1/2"	LIQUID	Manual Valve					
HV 2001 09	PL-1/2"-SS2-006	1/2"	LIQUID	Manual Valve					
HV 2001 10	PL-1/2"-SS2-005	1/2"	LIQUID	Manual Valve					
HV 2001 11	PL-1/2"-SS2-006	1/2"	LIQUID	Manual Valve					
HV 2001 12	PL-1/2"-SS2-005	1/2"	LIQUID	Manual Valve					
HV 2001 13	PL-1/2"-SS2-006	1/2"	DRAIN	Manual Valve					
HV 2001 14	PL-1/2"-SS2-008	1/2"	LIQUID	Manual Valve					
HV 2001 15	PL-1/2"-SS2-007	1/2"	LIQUID	Manual Valve					

De Dietrich Equipos Químicos, S.L.		MATERIAL LIST								
Av. Prínce	Member of Process syst		MANUAL VALVES							
CUSTOMER:	Universitat Autònoma de E	Barcelona /	MPP							
PROJECT:	MELISSA COMPARTMEN	IT II		DATE:	19/01/2010	PREPARED:	J. GUBERN			
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE			
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER			
HV 2001 16	PL-1/2"-SS2-008	1/2"	LIQUID	Manual Valve						
HV 2001 17	PL-1/2"-SS2-007	1/2"	LIQUID	Manual Valve						
HV 2001 18	PL-1/2"-SS2-009	1/2"	LIQUID	Manual Valve						
HV 2003 01	GLY-3/4"-SS1-001	3/4"	GLYCOL INLET	Manual Valve						
HV 2003 01	GLY-3/4"-SS1-001	3/4"	GLYCOL INLET	Manual Valve						
HV 2003 01	GLY-3/4"-SS1-001	3/4"	GLYCOL INLET	Manual Valve						
HV 2003 02	GLY-3/4"-SS1-001	3/4"	GLYCOL INLET	Manual Valve						
HV 2003 03	GLY-3/4"-SS1-003	3/4"	CONDENSATE	Manual Valve						
HV 2003 04	GLY-3/4"-SS1-004	3/4"	GLYCOL OUTLET	Manual Valve						
HV 2003 05	GLY-3/4"-SS1-002	3/4"	GLYCOL OUTLET	Manual Valve						
HV 2003 05	GLY-3/4"-SS1-002	3/4"	GLYCOL OUTLET	Manual Valve						
HV 2003 05	GLY-3/4"-SS1-002	3/4"	GLYCOL OUTLET	Manual Valve						
HV 2003 06	AI-1/4"-SS1-001	1/4"	SERVICE AIR INLET	Manual Valve						
HV 2003 06	AI-1/4"-SS1-002	1/4"	SERVICE AIR INLET	Manual Valve						
HV 2003 07	AI-1/4"-SS1-001	1/4"	SERVICE AIR INLET	Manual Valve						
HV 2003 08	GLY-3/4"-SS1-005	3/4"	GLYCOL OUTLET	Manual Valve						
HV 2004 01	VT-1/2"-SS2-002	1/2"	HELIUM VENTING OUTLET	Manual Valve						
HV 2004 02	VT-1/2"-SS2-002	1/2"	HELIUM VENTING OUTLET	Manual Valve						
HV 2004 03	VT-1/2"-SS2-002	1/2"	HELIUM VENTING OUTLET	Manual Valve						

De Dietrich Equipos Químicos, S.L.		MATERIAL LIST								
Av. Prínce	Member of PROCESS SYST		MANUAL VALVES							
CUSTOMER:	Universitat Autònoma de E	Barcelona / I	MPP							
PROJECT:	MELISSA COMPARTMEN	IT II		DATE:	19/01/2010	PREPARED:	J. GUBERN			
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE			
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER			
HV 2004 04	VT-1/2"-SS2-004	1/2"	HELIUM VENTING OUTLET	Manual Valve						
HV 2004 05	VT-1/2"-SS2-001	1/2"	HELIUM VENTING RETURN	Manual Valve						
HV 2004 06	VT-1/2"-SS2-001	1/2"	HELIUM VENTING RETURN	Manual Valve						
HV 2004 07	VT-1/2"-SS2-001	1/2"	HELIUM VENTING RETURN	Manual Valve						
HV 2005 01	ST-3/8"-SS1-018	3/8"	STEAM	Manual Valve						
HV 2005 02	R 2005 01	1/2"	DRAIN	Manual Valve						
HV 2007 01	GLY-3/4"-SS1-011	3/4"	GLYCOL INLET	Manual Valve						
HV 2007 02	GLY-3/4"-SS1-011	3/4"	DRAIN	Manual Valve						
HV 2007 03	GLY-3/4"-SS1-012	3/4"	GLYCOL OUTLET	Manual Valve						
HV 2007 04	WT-3/4"-SS1-001	3/4"	WATER	Manual Valve						
HV 2007 05	WT-3/4"-SS1-002	3/4"	DRAIN	Manual Valve						
HV 2007 06	WT-3/4"-SS1-002	3/4"	WATER	Manual Valve						
HV 2007 07	WT-3/4"-SS1-002	3/4"	HCL OUTLET	Manual Valve						
HV 2007 08	WT-3/4"-SS1-002	3/4"	HCL INLET	Manual Valve						
HV 2007 09	WT-3/4"-SS1-002	3/4"	WATER	Manual Valve						
HV 2007 10	WT-3/4"-SS1-002	3/4"	WATER	Manual Valve						
HV 2007 11	WT-3/4"-SS1-002	3/4"	WATER	Manual Valve						
HV 2008 01	PAC-1/2"-SS2-002	1/2"	ACID INLET	Manual Valve						
HV 2008 02	PBA-1/2"-SS2-002	1/2"	BASE INLET	Manual Valve						

De Dietric	h Equipos Químicos, S		MATERIAL LIST						
Av. Prínce	Member of Process System		MANUAL VALVES						
CUSTOMER:	Universitat Autònoma de I	Barcelona /	MPP						
PROJECT:	MELISSA COMPARTMEN	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN		
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE		
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER		
HV 2008 03	PAC-1/2"-SS2-002	1/2"	ACID INLET	Manual Valve					
HV 2008 04	PBA-1/2"-SS2-002	1/2"	BASE INLET	Manual Valve					
HV 2012 01	PG-1/4"-SS2-001	1/4"	PROCESS GAS C.I. INLET	Manual Valve					
HV 2012 02	CO2-1/4"-SS2-001	1/4"	CO2 INLET	Manual Valve					
HV 2012 03	HE-1/4"-SS2-001	1/4"	HELIUM INLET	Manual Valve					
HV 2012 04	PG-1/2"-SS2-003	1/2"	PROCESS GAS	Manual Valve					
HV 2012 05	PG-1/2"-SS2-003	1/2"	PROCESS GAS	Manual Valve					
HV 2012 06	PG-1/2"-SS2-004	1/2"	PROCESS GAS	Manual Valve					
HV 2012 07	PG-1/2"-SS2-006	1/2"	PROCESS GAS	Manual Valve					
HV 2012 08	PG-1/2"-SS2-005	1/2"	PROCESS GAS	Manual Valve					
HV 2012 09	PG-1/2"-SS2-006	1/2"	PROCESS GAS	Manual Valve					
HV 2012 10	PG-1/2"-SS2-005	1/2"	PROCESS GAS	Manual Valve					
HV 2012 11	PG-1/2"-SS2-008	1/2"	PROCESS GAS	Manual Valve					
HV 2012 12	PG-1/4"-SS2-009	1/4"	PROCESS GAS	Manual Valve					
HV 2012 13	PG-1/4"-SS2-011	1/4"	PROCESS GAS	Manual Valve					
HV 2012 14	HE-1/4"-SS2-003	1/4"	HELIUM INLET	Manual Valve					
HV 2012 15	GLY-3/4"-SS1-001	3/4"	GLYCOL INLET	Manual Valve					
HV 2012 15	VS 2012 01	1 1/2"	DRAIN	Manual Valve					
HV 2012 16	GLY-3/4"-SS1-002	3/4"	GLYCOL OUTLET	Manual Valve					

De Dietric	ch Equipos Químicos, S		MATERIAL LIST						
Av. Prínce	Member of Process system		MANUAL VALVES						
CUSTOMER:	Universitat Autònoma de l	Barcelona /	MPP						
PROJECT:	MELISSA COMPARTMEN	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN		
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE		
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER		
HV 2012 17	GLY-3/4"-SS1-001	1/2"	DRAIN	Manual Valve					
HV 2013 01	PG-1/2"-SS2-007	1/2"	PROCESS GAS	Manual Valve					
HV 2014 01	ST-3/8"-SS1-030	3/8"	STEAM	Manual Valve					
HV 2014 02	PL-1/2"-SS2-014	1/2"	LIQUID	Manual Valve					
HV 2014 03	PL-1/2"-SS2-014	1/2"	LIQUID	Manual Valve					
HV 2015 01	PL-1/2"-SS2-010	1/2"	LIQUID	Manual Valve					
HV 2015 02	PL-1/2"-SS2-010	1/2"	DRAIN	Manual Valve					
HV 2015 03	PL-1/2"-SS2-011	1/2"	LIQUID	Manual Valve					
HV 2015 04	PL-1/2"-SS2-012	1/2"	LIQUID	Manual Valve					
HV 2015 05	PL-1/2"-SS2-011	1/2"	DRAIN	Manual Valve					
HV 2015 06	PL-1/2"-SS2-012	1/2"	DRAIN	Manual Valve					
HV 2015 07	PL-1/2"-SS2-012	1/2"	LIQUID	Manual Valve					
HV 2015 08	PL-1/2"-SS2-011	1/2"	LIQUID	Manual Valve					
HV 2015 09	PL-1/2"-SS2-013	1/2"	LIQUID	Manual Valve					
HV 2017 01	GLY-3/4"-SS1-001	3/4"	GLYCOL INLET	Manual Valve					
HV 2017 02	GLY-3/4"-SS1-006	3/4"	CONDENSATE	Manual Valve					
HV 2017 03	GLY-3/4"-SS1-007	3/4"	GLYCOL OUTLET	Manual Valve					
HV 2017 04	AI-1/4"-SS1-002	1/4"	SERVICE AIR INLET	Manual Valve					
HV 2017 04	AI-1/4"-SS1-002	1/4"	SERVICE AIR INLET	Manual Valve					

De Dietric	ch Equipos Químicos, S		MATERIAL LIST						
Av. Prínce	Member of Process system		MANUAL VALVES						
CUSTOMER:	Universitat Autònoma de	Barcelona / N	MPP						
PROJECT:	MELISSA COMPARTMEN	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN		
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE		
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER		
HV 2017 05	GLY-3/4"-SS1-008	3/4"	GLYCOL OUTLET	Manual Valve					
HV 2018 01	VT-1/2"-SS2-006	1/2"	HELIUM VENTING OUTLET	Manual Valve					
HV 2018 02	VT-1/2"-SS2-006	1/2"	HELIUM VENTING OUTLET	Manual Valve					
HV 2018 03	VT-1/2"-SS2-006	1/2"	HELIUM VENTING OUTLET	Manual Valve					
HV 2018 04	VT-1/2"-SS2-005	1/2"	HELIUM VENTING RETURN	Manual Valve					
HV 2018 05	VT-1/2"-SS2-005	1/2"	HELIUM VENTING RETURN	Manual Valve					
HV 2018 06	VT-1/2"-SS2-005	1/2"	HELIUM VENTING RETURN	Manual Valve					
HV 2019 01	HE-1/4"-SS2-002	1/4"	HELIUM INLET	Manual Valve					
HV 2019 02	VT-1/2"-SS2-007	1/2"	HELIUM VENTING OUTLET	Manual Valve					
HV 2019 03	VS 2019 01	1 1/2"	DRAIN	Manual Valve					
HV 2020 01	IN-1/2"-SS2-001	1/2"	INOCULUM / ANTIFOAM	Manual Valve					
HV 2021 01	ST-3/4"-SS1-001	3/4"	STEAM	Manual Valve					
HV 2021 01	ST-3/4"-SS1-001	3/4"	STEAM	Manual Valve					
HV 2021 02	ST-3/8"-SS1-002	3/8"	STEAM	Manual Valve					
HV 2021 03	ST-3/8"-SS1-003	1/2"	STEAM	Manual Valve					
HV 2021 04	ST-1/2"-SS1-005	1/2"	STEAM	Manual Valve					
HV 2021 05	ST-3/8"-SS1-006	3/8"	STEAM	Manual Valve					
HV 2021 06	ST-1/2"-SS1-007	1/2"	CONDENSATE	Manual Valve					
HV 2021 07	ST-1/2"-SS1-007	1/2"	CONDENSATE	Manual Valve					

De Dietric	ch Equipos Químicos, S	. 1	MATERIAL LIST MANUAL VALVES					
Av. Prínce	Member of Process system							
CUSTOMER:	Universitat Autònoma de	Barcelona /	MPP					
PROJECT:	MELISSA COMPARTMEN	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN	
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE	
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER	
HV 2021 08	HV 2000 02	3/8"	CONDENSATE	Manual Valve				
HV 2021 09	ST-3/8"-SS1-008	3/8"	STEAM	Manual Valve				
HV 2022 01	ST-3/8"-SS1-004	3/8"	STEAM	Manual Valve				
HV 2022 02	ST-3/8"-SS1-009	3/8"	STEAM	Manual Valve				
HV 2022 03	PL-1/2"-SS2-003	1/2"	INERT GAS INLET	Manual Valve				
HV 2022 04	ST-3/8"-SS1-010	3/8"	STEAM	Manual Valve				
HV 2022 05	PL-1/2"-SS2-004	1/2"	INERT GAS INLET	Manual Valve				
HV 2022 06	HV 2001 07	3/8"	CONDENSATE	Manual Valve				
HV 2022 07	HV 2001 08	3/8"	CONDENSATE	Manual Valve				
HV 2022 08	ST-3/8"-SS1-011	3/8"	STEAM	Manual Valve				
HV 2022 09	HV 2001 11	3/8"	CONDENSATE	Manual Valve				
HV 2022 10	ST-3/8"-SS1-012	3/8"	STEAM	Manual Valve				
HV 2022 11	ST-3/8"-SS1-013	3/8"	STEAM	Manual Valve				
HV 2022 12	PL-1/2"-SS2-008	1/2"	INERT GAS INLET	Manual Valve				
HV 2022 13	PL-1/2"-SS2-007	1/2"	INERT GAS INLET	Manual Valve				
HV 2022 14	HV 2001 16	3/8"	CONDENSATE	Manual Valve				
HV 2022 15	HV 2001 17	3/8"	CONDENSATE	Manual Valve				
HV 2022 16	HV 2001 18	3/8"	CONDENSATE	Manual Valve				
HV 2022 17	ST-3/8"-SS1-014	3/8"	STEAM	Manual Valve				

De Dietric	ch Equipos Químicos, S		MATERIAL LIST MANUAL VALVES					
Av. Prínce	Member of Process system							
CUSTOMER:	Universitat Autònoma de	Barcelona /	MPP					
PROJECT:	MELISSA COMPARTMEN	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN	
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE	
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER	
HV 2022 18	ST-3/8"-SS1-015	3/8"	CONDENSATE	Manual Valve				
HV 2022 19	ST-3/8"-SS1-018	3/8"	STEAM	Manual Valve				
HV 2022 20	ST-3/8"-SS1-016	3/8"	STEAM	Manual Valve				
HV 2022 21	ST-3/8"-SS1-017	3/8"	STEAM	Manual Valve				
HV 2022 22	ST-3/8"-SS1-019	3/8"	CONDENSATE	Manual Valve				
HV 2022 23	ST-3/8"-SS1-019	3/8"	CONDENSATE	Manual Valve				
HV 2022 24	ST-3/8"-SS1-020	3/8"	STEAM	Manual Valve				
HV 2022 25	ST-3/8"-SS1-021	3/8"	STEAM	Manual Valve				
HV 2022 26	ST-3/8"-SS1-022	3/8"	STEAM	Manual Valve				
HV 2022 27	ST-3/8"-SS1-023	3/8"	STEAM	Manual Valve				
HV 2022 28	ST-3/8"-SS1-024	3/8"	CONDENSATE	Manual Valve				
HV 2022 29	ST-3/8"-SS1-024	3/8"	CONDENSATE	Manual Valve				
HV 2022 30	ST-1/2"-SS1-025	1/2"	STEAM	Manual Valve				
HV 2022 31	ST-3/8"-SS1-026	3/8"	CONDENSATE	Manual Valve				
HV 2022 32	ST-3/8"-SS1-026	3/8"	CONDENSATE	Manual Valve				
HV 2022 33	ST-3/8"-SS1-026	3/8"	CONDENSATE	Manual Valve				
HV 2022 34	ST-3/8"-SS1-026	3/8"	CONDENSATE	Manual Valve				
HV 2022 35	ST-1/2"-SS1-039	1/2"	CONDENSATE	Manual Valve				
HV 2022 36	ST-1/2"-SS1-039	1/2"	CONDENSATE	Manual Valve				

De Dietri	ch Equipos Químicos, S		MATERIAL LIST						
Av. Prínce	p d'Asturies 43-45, 1r-5a BARCELONA Member of	turies 43-45, 1r-5a ILONA MANUAL VALVES							
CUSTOMER:	Universitat Autònoma de	Barcelona /	MPP						
PROJECT:	MELISSA COMPARTME	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN		
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE		
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER		
HV 2022 37	ST-1/2"-SS1-041	1/2"	CONDENSATE	Manual Valve					
HV 2022 38	ST-1/2"-SS1-041	1/2"	CONDENSATE	Manual Valve					
HV 2023 01	ST-3/8"-SS1-034	3/8"	STEAM	Manual Valve					
HV 2023 02	ST-3/8"-SS1-032	3/8"	STEAM	Manual Valve					
HV 2023 03	ST-3/8"-SS1-033	3/8"	STEAM	Manual Valve					
HV 2023 04	PL-1/2"-SS2-012	1/2"	INERT GAS INLET	Manual Valve					
HV 2023 05	PL-1/2"-SS2-011	1/2"	INERT GAS INLET	Manual Valve					
HV 2023 06	ST-3/8"-SS1-035	3/8"	CONDENSATE	Manual Valve					
HV 2023 07	ST-3/8"-SS1-035	3/8"	CONDENSATE	Manual Valve					
HV 2023 08	ST-3/8"-SS1-036	3/8"	CONDENSATE	Manual Valve					
HV 2023 09	ST-1/2"-SS1-031	1/2"	STEAM	Manual Valve					
HV 2023 10	ST-1/2"-SS1-028	3/8"	STEAM	Manual Valve					
HV 2023 11	ST-3/8"-SS1-038	3/8"	CONDENSATE	Manual Valve					
HV 2023 12	ST-3/8"-SS1-038	3/8"	CONDENSATE	Manual Valve					
HV 2023 13	ST-3/8"-SS1-030	3/8"	STEAM	Manual Valve					
HV 2023 14	HV 2014 03	3/8"	CONDENSATE	Manual Valve					
HV 2023 15	ST-1/2"-SS1-037	1/2"	CONDENSATE	Manual Valve					
HV 2023 16	ST-1/2"-SS1-037	1/2"	CONDENSATE	Manual Valve					
HV 2023 17	ST-1/2"-SS1-027	1/2"	STEAM	Manual Valve					

De Dietric	h Equipos Químicos, S	.L.		MATERI	AL LIST		
Av. Prínce	p d'Asturies 43-45, 1r-5a BARCELONA Member of De Dietri Process syst			MANUAL	VALVES		
CUSTOMER:	Universitat Autònoma de	Barcelona / M	IPP				
PROJECT:	MELISSA COMPARTMEN	NT II		DATE:	19/01/2010	PREPARED:	J. GUBERN
DRAWING:	DD-8550-Z1-100-01			REV:	А	CHECKED:	J.MESTRE
TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER
HV 2023 18	ST-1/2"-SS1-039	1/2"	CONDENSATE	Manual Valve			
HV 2023 19	ST-1/2"-SS1-039	1/2"	CONDENSATE	Manual Valve			
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Member of



MATERIAL LIST

ACCESSORIES

CUSTOMER:	Universitat Autònoma d	e Barcel	ona / MPP				
PROJECT:	MELISSA COMPARTM	ENT II		DATE:	19/01/2010	PREPARED:	J.GUBERN
DRAWING:	DD-8558-Z1-100-01			REV:	А	CHECKED:	J.MESTRE
TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
NRV 2001 01	PL-1/2"-SS2-009	1/2"	LIQUID	Check Valve			
NRV 2008 01	PAC-1/2"-PP-001	1/2"	ACID INLET	Check Valve			
NRV 2008 02	PBA-1/2"-PP-001	1/2"	BASE INLET	Check Valve			
NRV 2012 01	PG-1/4"-SS2-001	1/4"	PROCESS GAS C.I. INLET	Check Valve			
NRV 2012 02	CO2-1/4"-SS2-001	1/4"	CO2 INLET	Check Valve			
NRV 2012 03	HE-1/4"-SS2-001	1/4"	HELIUM INLET	Check Valve			
NRV 2012 04	PG-1/2"-SS2-003	1/2"	PROCESS GAS	Check Valve			
NRV 2012 05	PG-1/2"-SS2-003	1/2"	PROCESS GAS	Check Valve			
NRV 2012 06	PG-1/2"-SS2-008	1/2"	PROCESS GAS	Check Valve			
NRV 2012 07	PG-1/4"-SS2-009	1/4"	PROCESS GAS	Check Valve			
NRV 2012 08	PG-1/4"-SS2-011	1/4"	PROCESS GAS	Check Valve			
NRV 2012 09	VT-1/4"-SS2-008	1/4"	HELIUM VENTING OUTLET	Check Valve			
NRV 2015 01	PL-1/2"-SS2-013	1/2"	LIQUID	Check Valve			
PRC 2003 01	AI-1/4"-SS1-001	1/4"	SERVICE AIR INLET	Pressure regulator			
PRC 2004 01	VT-1/2"-SS2-001	1/4"	HELIUM VENTING RETURN	Pressure regulator			
PRC 2012 01	PG-1/4"-SS2-001	1/4"	PROCESS GAS C.I. INLET	Pressure regulator			
PRC 2012 02	CO2-1/4"-SS2-001	1/4"	CO2 INLET	Pressure regulator			
PRC 2012 03	HE-1/4"-SS2-001	1/4"	HELIUM INLET	Pressure regulator			
PRC 2012 04	PG-1/2"-SS2-002	1/4"	PROCESS GAS	Pressure regulator			
PRC 2012 05	PG-1/2"-SS2-003	1/4"	PROCESS GAS	Pressure regulator			
PRC 2012 06	PG-1/4"-SS2-009	1/4"	PROCESS GAS	Pressure regulator			
PRC 2012 07	HE-1/4"-SS2-003	1/4"	HELIUM INLET	Pressure regulator			
PRC 2018 01	VT-1/2"-SS2-005	1/4"	HELIUM VENTING RETURN	Pressure regulator			
PRC 2019 01	HE-1/4"-SS2-002	1/4"	HELIUM INLET	Pressure regulator			
RV 2003 01	GLY-3/4"-SS1-004	3/4"	GLYCOL OUTLET Page 11	Relief Valve			



MATERIAL LIST

ACCESSORIES

P	ROCESS SYSTEMS						
CUSTOMER:	Universitat Autònoma de	Barcel	ona / MPP				
PROJECT:	MELISSA COMPARTME	NT II		DATE:	19/01/2010	PREPARED:	J.GUBERN
DRAWING:	DD-8558-Z1-100-01			REV:	А	CHECKED:	J.MESTRE
TAG №	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
RV 2004 02	VT-1/2"-SS2-003	1/2"	HELIUM VENTING OUTLET	Relief Valve			
RV 2004 01	VS 2000 01		BLOW UP	Relief Valve			
RV 2005 01	R 2005 01	1/2"	BLOW UP	Relief Valve			
RV 2007 01	GLY-1"-SS1-012	1"	GLYCOL OUTLET	Relief Valve			
RV 2007 02	WT-1"-SS1-002	1"	WATER	Relief Valve			
RV 2007 03	WT-1"-SS1-002	1"	WATER	Relief Valve			
RV 2012 01	PG-1/2"-SS2-005	1/2"	PROCESS GAS	Relief Valve			
RV 2012 02	GLY-1"-SS1-001	1"	GLYCOL INLET	Relief Valve			
RV 2012 03	PG-1/2"-SS2-008	1/2"	PROCESS GAS	Relief Valve			
RV 2012 04	VS 2012 01		BLOW UP	Relief Valve			
RV 2017 01	GLY-3/4"-SS1-007	3/4"	GLYCOL OUTLET	Relief Valve			
RV 2018 01	VS 2014 01		BLOW UP	Relief Valve			
RV 2019 01	VS 2019 01		BLOW UP	Relief Valve			
SF 2021 01	ST-1/2"-SS1-007	1/2"	CONDENSATE	Steam Trap			
SF 2022 01	ST-3/8"-SS1-015	3/8"	CONDENSATE	Steam Trap			
SF 2022 02	ST-3/8"-SS1-024	3/8"	CONDENSATE	Steam Trap			
SF 2022 03	ST-3/8"-SS1-026	3/8"	CONDENSATE	Steam Trap			
SF 2022 04	ST-1/2"-SS1-039	1/2"	CONDENSATE	Steam Trap			
SF 2022 05	ST-1/2"-SS1-041	1/2"	CONDENSATE	Steam Trap			
SF 2023 01	ST-3/8"-SS1-038	3/8"	CONDENSATE	Steam Trap			
SF 2023 02	ST-1/2"-SS1-037	1/2"	CONDENSATE	Steam Trap			
SF 2023 03	ST-1/2"-SS1-040	1/2"	CONDENSATE	Steam Trap			

De Dietrich	Equipos Químicos,	S I		Ν	IATERIAL LIST				
	d'Asturies 43-45, 1r-5	a	FILTERS						
CUSTOMER:	Universitat Autònor	ma de E	Barcelona / MPP						
PROJECT:	MELISSA COMPA	RTMEN	IT II	DATE:	19/01/2010	PREPARED:	J. GUBERN		
DRAWING:	DD-8558-Z1-100-0	1		REV:	А	CHECKED:	J. MESTRE		
TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER		
LF 2000 01	PL-1/2"-SS2-001	1/2"	PROCESS LIQUID	Liquid filter					
LF 2001 01	PL-1/2"-SS2-003	1/2"	PROCESS LIQUID	Liquid filter					
LF 2001 02	PL-1/2"-SS2-004	1/2"	PROCESS LIQUID	Liquid filter					
LF 2001 03	PL-1/2"-SS2-008	1/2"	PROCESS LIQUID	Liquid filter					
LF 2001 04	PL-1/2"-SS2-009	1/2"	PROCESS LIQUID	Liquid filter					
LF 2008 01	PAC-1/2"-SS2-002	1/2"	ACID INLET	Liquid filter					
LF 2008 02	PBA-1/2"-SS2-002	1/2"	BASE INLET	Liquid filter					
GF 2004 01	VT-1/2"-SS2-002	1/2"	HELIUM VENTING OUTLET	Gas filter					
GF 2004 02	VT-1/2"-SS2-001	1/2"	HELIUM VENTING RETURN	Gas filter					
GF 2008 01	VT-1/2"-PP-010	1/2"	ACID INLET	Gas filter					
GF 2008 02	VT-1/4"-PP-009	1/4"	BASE INLET	Gas filter					
GF 2012 01	PG-1/4"-SS2-001	1/4"	PROCESS GAS C.I. INLET	Gas filter					
GF 2012 02	CO2-1/4"-SS2-001	1/4"	CO ₂ INLET	Gas filter					
GF 2012 03	HE-1/4"-SS2-001	1/4"	HELIUM INLET	Gas filter					
GF 2012 04	PG-1/2"-SS2-003	1/2"	PROCESS GAS	Gas filter					
GF 2012 05	PG-1/2"-SS2-003	1/2"	PROCESS GAS	Gas filter					
GF 2012 06	PG-1/2"-SS2-005	1/2"	PROCESS GAS	Gas filter					
GF 2012 07	PG-1/2"-SS2-006	1/2"	PROCESS GAS	Gas filter					
GF 2012 08	PG-1/2"-SS2-007	1/2"	PROCESS GAS	Gas filter					
GF 2012 09	PG-1/4"-SS2-009	1/4"	PROCESS GAS	Gas filter					
GF 2012 10	PG-1/4"-SS2-011	1/4"	PROCESS GAS	Gas filter					
GF 2012 11	VT-1/4"-SS2-008	1/4"	HELIUM VENTING OUTLET	Gas filter					
GF 2018 01	VT-1/2"-SS2-006	1/2"	HELIUM VENTING OUTLET	Gas filter					

	Equipos Químicos, d'Asturies 43-45, 1r-5 RCELONA Member of De Dietrich Process systems	a		N	FILTERS		
CUSTOMER:	Universitat Autònor	na de E	Barcelona / MPP				
PROJECT:	MELISSA COMPA	RTMEN	IT II	DATE:	19/01/2010	PREPARED:	J. GUBERN
DRAWING:	DD-8558-Z1-100-0	1		REV:	А	CHECKED:	J. MESTRE
GF 2018 02	VT-1/2"-SS2-005	1/2"	HELIUM VENTING RETURN	Gas filter			

Av. Príncep d'A	quipos Químicos, S.L. Asturies 43-45, 1r-5a CELONA Member of De Dietrich Constant Process systems	ELECTRICAL AND CONTROL SIGNALS						
CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA	N I I I I I I I I I I I I I I I I I I I						
PROJECT:	MELISSA COMPARTMENT II	DATE:	20/01/2010	CHECKED:	J.MESTRE			
DRAWING:	DD-8550-Z1-100-01	REV:	А	PREPARED:	J. GUBERN			
CONTROL LOOP	EQUIPMENT PLC	ADRESS	DESCRIPTION	1/0	SIGNAL TYPE			
2000	GP 2000 01		Start/Stop feeding tank agitator converter	DO	0/1			
2000	GP 2000 01		Feeding tank agitator thermal protection	DI	0/1			
2000	GP 2000 01		Feeding tank agitator speed set-point	AO	4-20 mA			
2001	FT 2001 01		Total liquid inlet flow to reactor	AI	4-20 mA			
2001	DPT 2001 01		Differential pressure measurement (pre-filters)	AI	4-20 mA			
2001	DPT 2001 02		Differential pressure measurement (filters)	AI	4-20 mA			
2001	GP 2001 01/02		Start/Stop inlet pumps converter	DO	0/1			
2001	GP 2001 01		Start/Stop inlet pump GP 2001 01	DO	0/1			
2001	GP 2001 02		Start/Stop inlet pump GP 2001 02	DO	0/1			
2001	GP 2001 01/02		Inlet pumps thermal protection	DI	0/1			
2001	GP 2001 01/02		Flow set-point (inlet pumps)	AO	4-20 mA			
2001	PS 2001 01		Pressure switch (GP 2001 01)	DI	0/1			
2001	PS 2001 02		Pressure switch (GP 2001 02)	DI	0/1			
2001	PS 2001 03		Pressure switch	DI	0/1			
2001	PS 2001 04		Pressure switch	DI	0/1			
2002	LT 2002 01		Feeding tank level measurement	AI	4-20 mA			
2003	TT 2003 01		Feeding tank temperature measurement	AI	4-20 mA			
2003	SV 2003 01		Open/Close cooling water inlet valve	DO	0/1			
2003	SV 2003 01		Cooling water inlet valve feedback	DI	0/1			
2004	BLWR 2004 01		Start/Stop the compressor	DO	0/1			

Av. Príncep d'A	Dietrich Equipos Químicos, S.L. Príncep d'Asturies 43-45, 1r-5a D8012 BARCELONA Member of DE Dietrich PROCESS SYSTEMS				
CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA				
PROJECT:	MELISSA COMPARTMENT II	DATE:	20/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01	REV:	А	PREPARED:	J. GUBERN
CONTROL LOOP	EQUIPMENT PI	LC ADRESS	DESCRIPTION	1/0	SIGNAL TYPE
2004	SV 2004 03		Open/Close compressor (BLWR 2004 01) bypass valve	DO	0/1
2004	SV 2004 03		Compressor (BLWR 2004 01) bypass valve feedback	DI	0/1
2004	PS 2004 01		Pressure switch for compressor recycling	DI	0/1
2004	PT 2004 01		Feeding tank pressure measurement	AI	4-20 mA
2004	SV 2004 01		Open/Close feeding tank vent valve	DO	0/1
2004	SV 2004 01		Feeding tank vent valve feedback	DI	0/1
2004	SV 2004 02		Open/Close helium inlet valve	DO	0/1
2004	SV 2004 02		Helium inlet valve feedback	DI	0/1
2005	GP 2005 01		Start/Stop bioreactor agitator converter	DO	0/1
2005	GP 2005 01		Bioreactor agitator thermal protection	DI	0/1
2005	GP 2005 01		Bioreactor agitator speed set-point	AO	4-20 mA
2005	AT 2005 01		Redox measurement	AI	4-20 mA
2005	TT 2005 01		Temperature measurement (AT 2005 01)	AI	4-20 mA
2006	IRC 2006 01		Light Power Phase 1	AI	4-20 mA
2006	IRC 2006 01		Light Power Phase 2	AI	4-20 mA
2006	IRC 2006 01		Light Power Phase 3	AI	4-20 mA
2006	IRC 2006 01		Light intensity set-point	AO	4-20 mA
2007	TT 2007 01		Reactor temperature measurement	AI	4-20 mA
2007	HX 2007 02		Start/Stop electrical resistance	DO	0/1
2007	BLWR 2007 01		Start/Stop air extractor	DO	0/1

Av. Príncep d'A	uipos Químicos, S.L. sturies 43-45, 1r-5a ELONA Member of De Dietrich Process systems				
CUSTOMER:	Universitat Autònoma de Barcelona / MELi	SSA			
PROJECT:	MELISSA COMPARTMENT II	DATE:	20/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01	REV:	A	PREPARED:	J. GUBERN
CONTROL LOOP	EQUIPMENT	PLC ADRESS	DESCRIPTION	IVO	SIGNAL TYPE
2007	BLWR 2007 01	tereterterterterterterterterterterterter	Air extractor thermal protection	DI	0/1
2007	BLWR 2007 01		Air extractor set-point	AO	4-20 mA
2007	SV 2007 01		Open/Close cooling water inlet valve	DO	0/1
2007	SV 2007 01		Cooling water inlet valve feedback	DI	0/1
2007	PP 2007 01		Start/Stop the pump	DO	0/1
2008	AT 2008 01		pH measurement	AI	4-20 mA
2008	TT 2008 01		Temperature measurement (AT 2008 01)	AI	4-20 mA
2008	AT 2008 02		pH measurement	AI	4-20 mA
2008	TT 2008 02		Temperature measurement (AT 2008 02)	AI	4-20 mA
2008	SV 2008 01		Open/Close PBR acid inlet valve	DO	0/1
2008	SV 2008 01		PBR acid inlet valve feedback	DI	0/1
2008	SV 2008 02		Open/Close PBR base inlet valve	DO	0/1
2008	SV 2008 02		PBR base inlet valve feedback	DI	0/1
2008	PP 2008 01		Start/Stop the acid pump	DO	0/1
2008	PP 2008 02		Start/Stop the base pump	DO	0/1
2008	WT 2008 01		Weight (level) measurement		Ethernet
2008	WT 2008 02		Weight (level) measurement		Ethernet
2009	PT 2009 01		Bioreactor pressure measurement	AI	4-20 mA
2009	PT 2009 02		Bioreactor pressure measurement	AI	4-20 mA
2010	WT 2010 01		Bioreactor weight (level) measurement	AI	4-20 mA

Av. Príncep d'A	Auipos Químicos, S.L. Asturies 43-45, 1r-5a CELONA Member of De Dietrich Process systems		ELECTRICAL AND CONTRO	DL SIGNALS	
CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA				
PROJECT:	MELISSA COMPARTMENT II	DATE:	20/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01	REV:	A	PREPARED:	J. GUBERN
CONTROL LOOP	EQUIPMENT PLC AD	DRESS	DESCRIPTION	I/O	SIGNAL TYPE
2011	AT 2011 01		Biomass measurement	AI	4-20 mA
2011	AT 2011 01		Biomass sensor failure	AI	22 mA
2011	AT 2011 02		Biomass measurement	AI	4-20 mA
2011	AT 2011 02		Biomass sensor failure	AI	22 mA
2012	FQRC 2012 01		Inlet process gas flow measurement	AI	4-20 mA
2012	FQRC 2012 01		Inlet process gas flow set-point	AO	4-20 mA
2012	FQRC 2012 02		Inlet CO ₂ flow measurement	AI	4-20 mA
2012	FQRC 2012 02		Inlet CO ₂ flow set-point	AO	4-20 mA
2012	FQRC 2012 03		Inlet helium flow measurement	AI	4-20 mA
2012	FQRC 2012 03		Inlet helium flow set-point	AO	4-20 mA
2012	FQRC 2012 04		Total inlet gas flow measurement	AI	4-20 mA
2012	FQRC 2012 04		Total inlet gas flow set-point	AO	4-20 mA
2012	FQRC 2012 05		Circulated gas flow measurement	AI	4-20 mA
2012	FQRC 2012 05		Circulated gas flow set-point	AO	4-20 mA
2012	FQRC 2012 06		C. II outlet gas flow measurement (to C.III)	AI	4-20 mA
2012	FQRC 2012 06		C. II outlet gas flow set-point (to C.III)	AO	4-20 mA
2012	FQRC 2012 07		C. II outlet gas flow measurement (to atm)	AI	4-20 mA
2012	FQRC 2012 07		C. II outlet gas flow set-point (to atm)	AO	4-20 mA
2012	BLWR 2012 01		Start/Stop the compressor	DO	0/1
2012	SV 2012 02		Open/Close compressor (BLWR 2012 01) bypass valve	DO	0/1

Av. Príncep d'A	uipos Químicos, S.L. sturies 43-45, 1r-5a ELONA Member of De Dietrich C PROCESS SYSTEMS	ELECTRICAL AND CONTRO	DL SIGNALS	
CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA			
PROJECT:	MELISSA COMPARTMENT II DA	TE: 20/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01 RE	EV: A	PREPARED:	J. GUBERN
CONTROL LOOP	EQUIPMENT PLC ADRESS	DESCRIPTION	ŊO	SIGNAL TYPE
2012	SV 2012 02	Compressor (BLWR 2012 01) bypass valve feedback	DI	0/1
2012	PS 2012 01	Pressure switch for compressor recycling	DI	0/1
2012	PT 2012 01	Discharge vessel pressure measurement	AI	4-20 mA
2012	FT 2012 01	PBR outlet gas flow measurement	AI	4-20 mA
2012	DPT 2012 01	Differential pressure measurement (filters)	AI	4-20 mA
2012	SCV 2012 01	PBR outlet gas flow set-point	AO	4-20 mA
2012	SV 2012 01	Open/Close analyzer inlet valve	DO	0/1
2012	SV 2012 01	Gas analyzer inlet valve feedback	DI	0/1
2012	HX 4012 02	Start/Stop post-condenser	DO	0/1
2012	SV 2012 03	Open/Close helium inlet valve	DO	0/1
2012	SV 2012 03	Helium inlet valve feedback	DI	0/1
2013	AT 2013 01	Outlet gas analyzer	AI	4-20 mA
2013	AT 2013 02	Outlet gas analyzer	AI	4-20 mA
2013	SV 2013 01	Open/Close gas analyzer inlet valve	DO	0/1
2013	SV 2013 01	Gas analyzer inlet valve feedback	DI	0/1
2013	AT 2013 03	Dissolved O ₂ analyzer	AI	4-20 mA
2013	TT 2013 02	Temperature measurement (AT 2013 03)	AI	4-20 mA
2013	PT 2013 01	Outlet gas pressure measurement	AI	4-20 mA
2013	TT 2013 01	Outlet gas temperature measurement	AI	4-20 mA
2014	GP 2014 01	Start/Stop harvesting tank agitator converter	DO	0/1

Av. Príncep d'A	uipos Químicos, S.L. sturies 43-45, 1r-5a EELONA Member of De Dietrich Process systems		ELECTRICAL AND CONTRO	DL SIGNALS	
CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA				
PROJECT:	MELISSA COMPARTMENT II	DATE:	20/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01	REV:	А	PREPARED:	J. GUBERN
CONTROL LOOP	EQUIPMENT PLC	ADRESS	DESCRIPTION	1/O	SIGNAL TYPE
2014	GP 2014 01		Harvesting tank agitator thermal protection	DI	0/1
2014	GP 2014 01		Harvesting tank agitator speed set-point	AO	4-20 mA
2015	GP 2015 01/02		Start/Stop outlet pumps converter	DO	0/1
2015	GP 2015 01		Start/Stop outlet pump GP 2015 01	DO	0/1
2015	GP 2015 02		Start/Stop outlet pump GP 2015 02	DO	0/1
2015	GP 2015 01/02		Outlet pumps thermal protection	DI	4-20 mA
2015	GP 2015 01/02		Flow set-point (outlet pumps)	AO	4-20 mA
2015	PS 2015 01		Pressure switch (GP 2015 01)	DI	0/1
2015	PS 2015 02		Pressure switch (GP 2015 02)	DI	0/1
2015	PS 2015 03		Pressure switch	DI	0/1
2015	PS 2015 04		Pressure switch	DI	0/1
2016	WT 2016 01		Harvesting tank weight (level) measurement	AI	4-20 mA
2017	TT 2017 01		Harvesting tank temperature measurement	AI	4-20 mA
2017	SV 2017 01		Open/Close cooling water inlet valve	DO	0/1
2017	SV 2017 01		Cooling water inlet valve feedback	DI	0/1
2018	PT 2018 01		Harvesting tank pressure measurement	AI	4-20 mA
2018	SV 2018 01		Open/Close feeding tank vent valve	DO	0/1
2018	SV 2018 01		Feeding tank vent valve feedback	DI	0/1
2018	SV 2018 02		Open/Close helium inlet valve	DO	0/1
2018	SV 2018 02		Helium inlet valve feedback	DI	0/1

Av. Príncep d'A	Auipos Químicos, S.L. Asturies 43-45, 1r-5a CELONA Member of De Dietrich Process systems		ELECTRICAL AND CONTRO	DL SIGNALS	
CUSTOMER:	Universitat Autònoma de Barcelona / MELiSS	SA			
PROJECT:	MELISSA COMPARTMENT II	DATE:	20/01/2010	CHECKED:	J.MESTRE
DRAWING:	DD-8550-Z1-100-01	REV:	A	PREPARED:	J. GUBERN
CONTROL LOOP	EQUIPMENT PL	C ADRESS	DESCRIPTION	Vo	SIGNAL TYPE
2019	PT 2019 01		Helium tank pressure measurement	AI	4-20 mA
2019	SV 2019 01		Open/Close helium inlet valve	DO	0/1
2019	SV 2019 01		Helium inlet valve feedback	DI	0/1
2019	SV 2019 02		Open/Close atm. vent valve	DO	0/1
2019	SV 2019 02		Vent valve feedback	DI	0/1
2020	LS 2020 01		Bioreactor foam detection	DI	0/1
2021	SV 2021 01		Open/Close steam inlet valve	DO	0/1
2021	SV 2021 01		Steam inlet valve feedback	DI	0/1
2022	SV 2022 01		Open/Close steam inlet valve	DO	0/1
2022	SV 2022 01		Steam inlet valve feedback	DI	0/1
2023	SV 2023 01		Open/Close steam inlet valve	DO	0/1
2023	SV 2023 01		Steam inlet valve feedback	DI	0/1
	E-stops		Emergency buttons (any button pressed)	DI	0/1
	E-stops		Emergency released	DI	0/1
	E-stops		Electrical enclosure RED led	DO	0/1
	E-stops		Electrical enclosure GREEN led	DO	0/1

				POWER	LIST		
	Member of			Moto	ors		
	De Dietrich						
CUSTOMER:	Universitat Autònoma de Barcelona	/ MPP					
PROJECT:	MELISSA COMPARTMENT II	DATE:	20/01/2010			PREPARED:	J. GUBERN
DRAWING:	DD-8550-Z1-100-Z1	REV:	A			CHECKED:	J. MESTRE
ITEM	DESCRIPTION	POWER (Kw)	CHARACTERISTICS V / Hz / rpm	TYPE	PROTECTION	CLASIFICATION	OBSERVATIONS
GP 2001 01	SANITARY DIAPHRAGM PUMP	0,37	400/500 V - 50 Hz - 1400 rpm	Electric	IP55		Feed pump
GP 2001 02	SANITARY DIAPHRAGM PUMP	0,37	400/500 V - 50 Hz - 1400 rpm	Electric	IP55		Feed pump
GP 2015 01	SANITARY DIAPHRAGM PUMP	0,37	400/500 V - 50 Hz - 1400 rpm	Electric	IP55		Harvest pump
GP 2015 02	SANITARY DIAPHRAGM PUMP	0,37	400/500 V - 50 Hz - 1400 rpm	Electric	IP55		Harvest pump
PP 2008 01	PERISTALTIC PUMP	0,1	220-240 V - 50/60 Hz	Electric	IP31		Acid addition pump
PP 2008 02	PERISTALTIC PUMP	0,1	220-240 V - 50/60 Hz	Electric	IP31		Alkali addition pump
BLWR 2007 01	CENTRIFUGAL AIR FAN	1,3	230 V - 50/60 Hz	Electric	IP 54		Air refrigeration
BLWR 2012 01	COMPRESSOR	0,06	230 V - 50 Hz	Electric	IP 20		Gas outlet
BLWR 2004 01	COMPRESSOR	0,06	230 V - 50 Hz	Electric	IP 20		Helium
PP 2007 01	CENTRIFUGAL PUMP	1,3	230 V - 50 Hz - 2780 rpm	Electric	IP 68		Water cirulation
GP 2000 01	MAGNETIC AGITATOR	0,2	220 V - 50 Hz - 3000 rpm	Electric	IP 65		VS 2000 01
GP 2014 01	MAGNETIC AGITATOR	0,2	220 V - 50 Hz - 3000 rpm	Electric	IP 65		VS 2014 01
GP 2005 01	MECHANICAL AGITATOR	2,2	230/400 V - 50 Hz	Electric			R 2005 01
HX 2007 02	ELECTRICAL HEATER	2	230 V - 50 Hz	Electric			Water heating
HX 2012 02	SAMPLE GAS COOLER	0,18	230 V - 50/60 Hz	Electric	IP 20		Sample conditioning
IRC 2006 01	REACTOR LIGHTING SYSTEM	3,6	220 V - 50 Hz	Electric			



MELISSA Pilot Plant



de Barcelona

Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 128 / 275

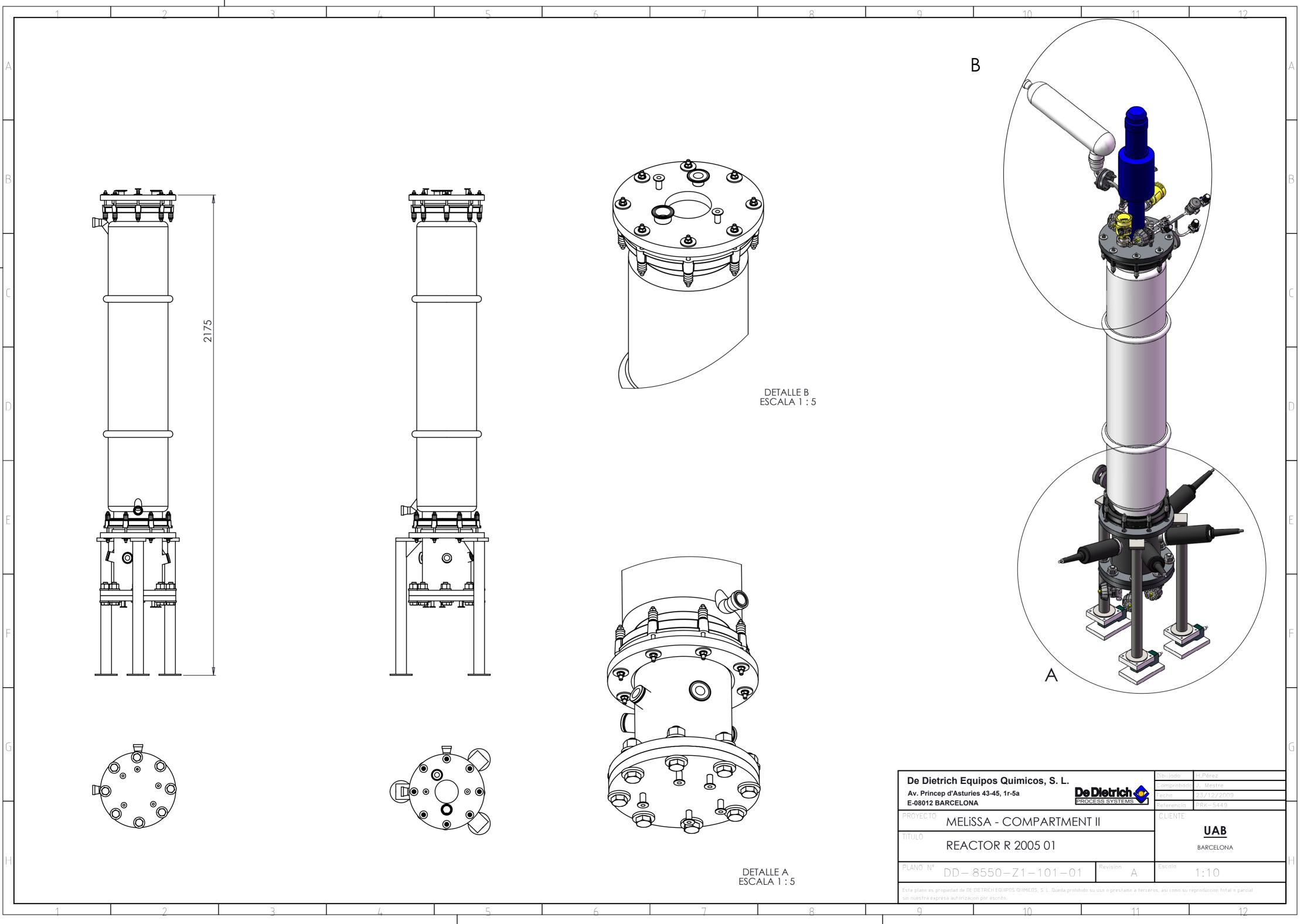
7. ANNEX II: SPECIFICATIONS

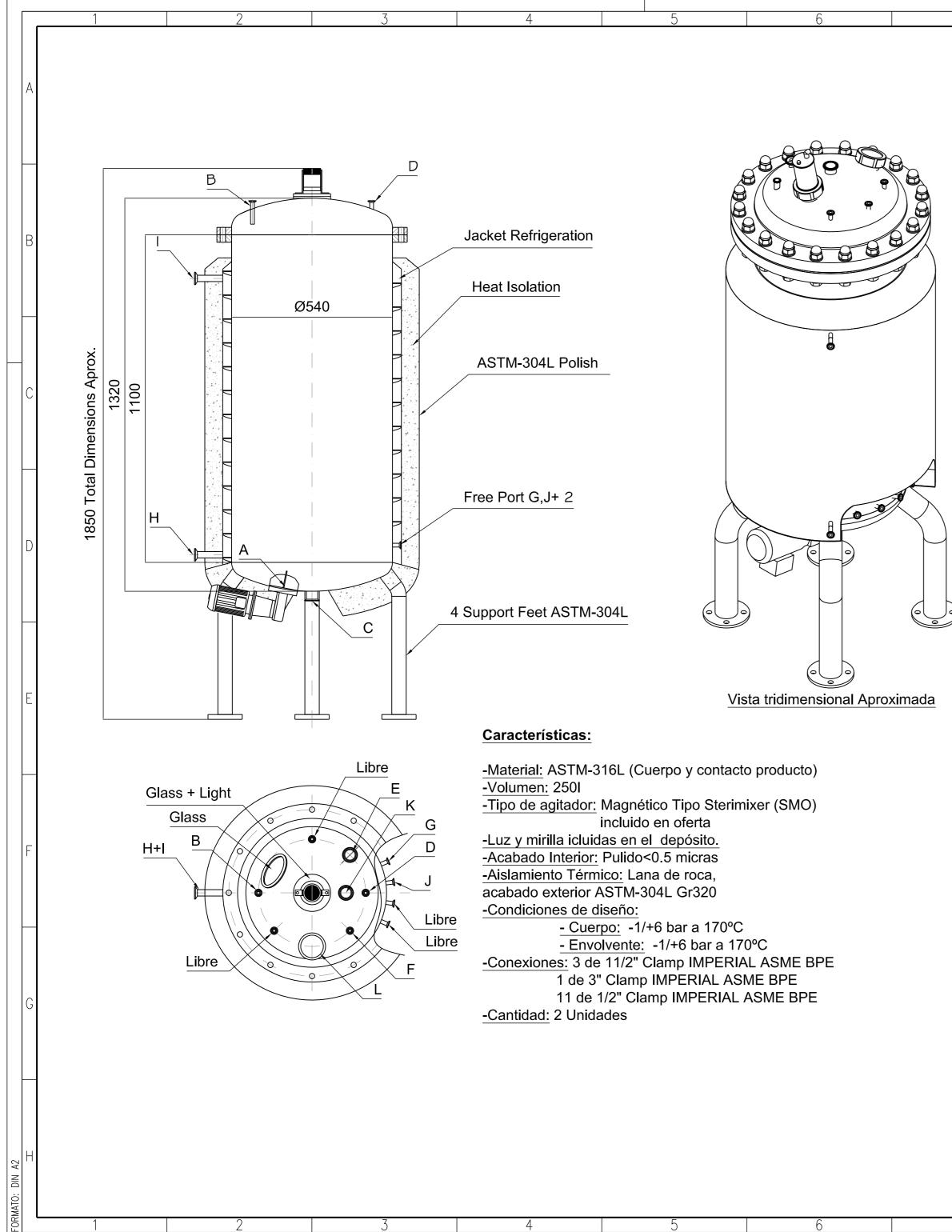
7.1. Equipment specifications

- Reactor
- Auxiliary tanks
- Gas buffer
- Media preparation vessel
- Glass part
- Heat exchanger
- Condenser

7.2. Instrument specifications

- 7.3. Electrical cabinet specifications
- 7.4. Accessories specifications





7	8	9		10	11		12	
		Rev.	Nota de	revisión		Fecha	Dib.	Verif.

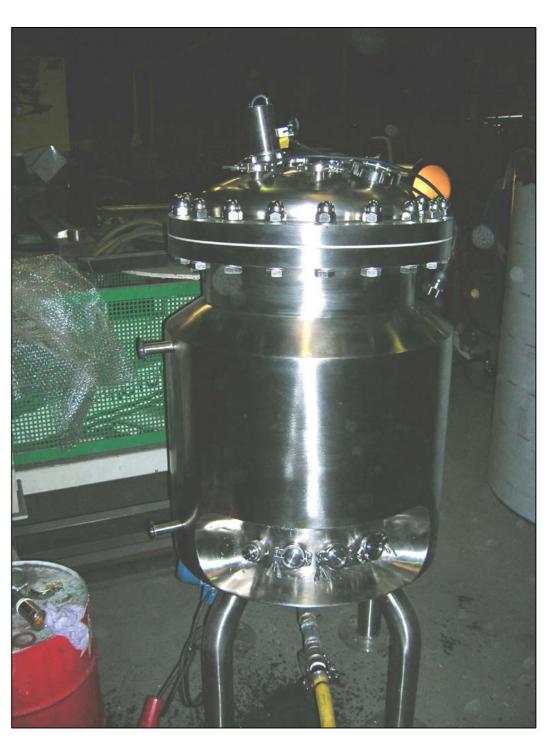
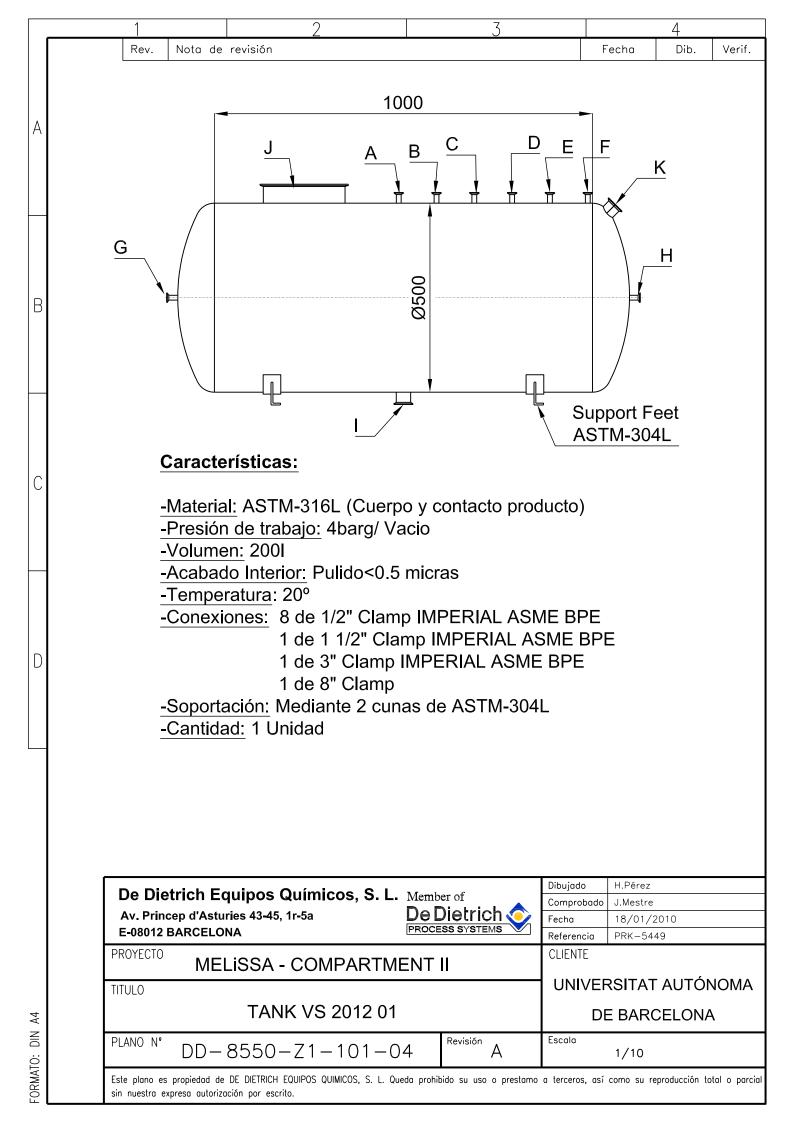
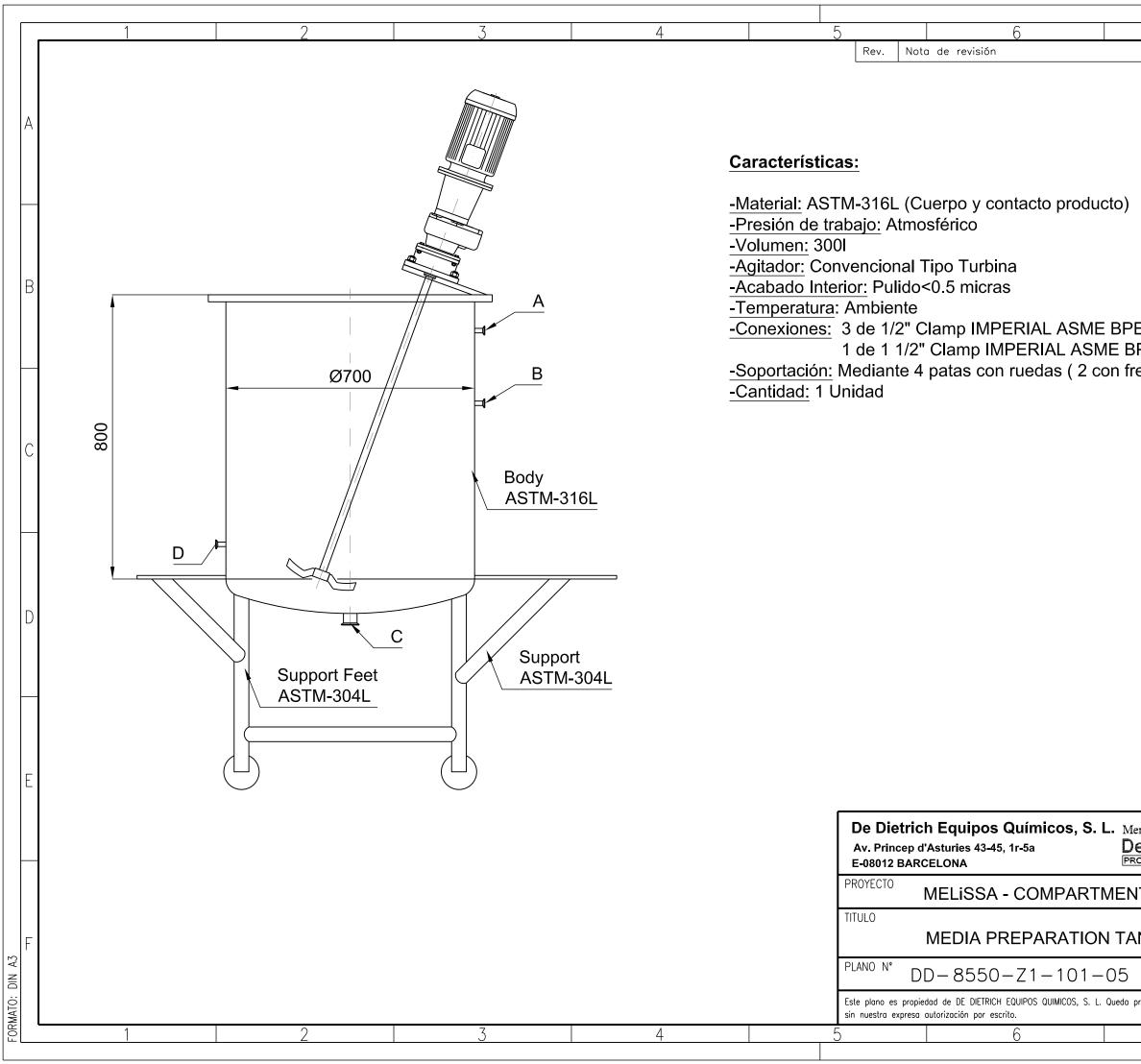


Imagen para idea general y tipo de acabados

			G
De Dietrich Equipos Químicos, S. L. Member of	Dibujado	H.Pérez	
Av. Princep d'Asturies 43-45, 1r-5a De Dietrich 📀	Comprobado	J.Mestre	
E-08012 BARCELONA	Fecha Referencia	18/01/2010 PRK-5449	
PROYECTO MELISSA - COMPARTMENT II	CLIENTE		
TITULO	UNIVEF	RSITAT AUTÓNOMA	l
TANKS VS 2000 01 & VS 2014 01	DE	E BARCELONA	Н
PLANO N° DD-8550-Z1-101-02 Revisión A	Escolo	1/10	
Este plano es propiedad de DE DIETRICH EQUIPOS QUIMICOS, S. L. Queda prohibido su uso o prestamo o sin nuestra expresa autorización por escrito.	a terceros, así	como su reproducción total o parcial	
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В]		
-	ASTM-304L				
	Correctoriations				
	Características:				
	-Material: ASTM-316L (Cuerpo y contacto producto)				
	<u>-Presión de trabajo:</u> 3barg/ Vacio				
	-Volumen: 40l				
С	-Acabado Interior: Pulido<0.5 micras				
	-Temperatura: 20°				
	-Conexiones: 8 de 1/2" Clamp IMPERIAL ASME BPI	=			
	1 de 1 1/2" Clamp IMPERIAL ASME B				
	1 de 3" Clamp IMPERIAL ASME BPE				
	1 de 8" Clamp				
	-Soportación: Mediante 2 cunas de ASTM-304L				
	<u>-Cantidad:</u> 1 Unidad				
D					
	Dibuj	ado li	H.Pérez		
	De Dietrich Equipos Químicos, S. L. Member of		J.Mestre		
	Av. Princep d'Asturies 43-45, 1r-5a De Dietrich 📀 Fech		18/01/2010		
	E-08012 BARCELONA	encia F	PRK-5449		
		NTE			
			SITAT AU	ΤŃΝ	
	molo				
A4	TANK VS 2019 01	DE	BARCEL	ONA	
	PLANO N° DD OFFO 71 101 07 Revisión Escal	a			
0:	DD - 8550 - Z1 - 101 - 03	1	1/10		
ORMATO: DIN	Este plano es propiedad de DE DIETRICH EQUIPOS QUIMICOS, S. L. Queda prohibido su uso o prestamo a terce sin nuestra expresa autorización por escrito.	ros, así co	omo su reproduc	ción to	al o parcial.





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reno)						С
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ember of e Dietrich ROCESS SYSTEMS	Dibujad Compro Fecha Referen	obado ncia	H.Pérez J.Mestre 18/01/2 PRK-54			
IT II	CLIEN			·		
NK				AUTÓN CELONA		F
^{Revisión} A	Escala		1/10			
prohibido su uso o prestamo	a tercero	s, así	como su re	producción to	tal o parcial	
7				8		

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EQUIPMENT SPECIFICATIONS

HEAT EXCHANGER

	Member of De Die Process s	· · · · · ·		ł	IEAT EX	CHANGE	R	
CUSTOMER:	Universitat Au	tònoma de Ba	rcelona					
PROJECT:	MELiSSA CO	MPARTMENT	- 11	ITEM:	HX 2007 01		CHA:	20/01/2010
DRAWING:	DD-8550-Z1			REV:	А	PREPA	RADO:	J. GUBERN
TIPO	Pla	ate heat exchan	ger	NO	RMA			
MODELO				SER	VICE		Water cooling	
Nº UNITS		1		SITU	ATION		WT-1"-SS1-00	2
	-		RE	QUIREMENTS	3	•		
	CONC	EPT		UNITS	PROCE: INLET	SS PART OUTLET	SERVIO INLET	CE PART OUTLET
	LIQUID	TYPE			W	ater	GI	ycol
	CONCENT	RATION		%	1	00		
	FLO	N		m³/h	2	,5	-	1,8
	LIQUID TEMP	ERATURE		°C	12	10	4	6
	DELTA PRE	ESSURE		mca				
	SPECIFIC \	VEIGHT		kg/m ³	1000		1000	
	VISCOS	SITY		ср				
	SPECIFIC	HEAT		kcal/ kg ℃				
	THERMAL CON			kcal/ h m ℃	1		1	
MAXI	UM OPERATIO		JRE	°C				
				bar				1
	EXCHANHE			Kw	5,8			
				IEAT EXCHA		l 		
	DESIGN PR	ESSLIBE		bar		<u></u> 4	<u></u>	4
	TESTS PRE			bar		+		4
	DESIGN TEMP			∪ai ℃	E	50		10
					j	-		10
C/	REAL TRANS			m ²		0,33		
				m ²	7			
	DESIGN EXCHA			kW	1			
	CAPAC		L					
			-	%		2	20	
	LCULATED DEL		E	mca				
	TOTAL NUMBER	R OF PLATES						
	·····	· · · · · · · · · · · · · · · · · · ·		TRUCTION DA				·····
	Description		Quantity	Lenght	Wehdt	Thickness	Material	Observations
	PLATES						AISI 316L	
	BODY						AISI 316L	
			C	ONNECTIONS				
POSITION DESCRIPTION SIZING	WATEF	I1 R INLET	WATER	I2 OUTLET	GLYCC	O1 DL INLET		D2 _ OUTLET
NORMA								
CORROSION OV			mm					
PART	TYPE	MATI	ERIAL					
JOINTS			DM	($\gamma)(\alpha)$		┥┟┰┰┰┪┞┚──	
SCREWS			OX		\mathcal{I}		4	
FLANGE			OX	T	1 01			
SUPPORTS		IN	OX					
	CONNEC	TION						
MATE	RIAL	IN	OX		2 02			
DIAME	TER							
STANDARD	CONEXIÓN	ASM	E-BPE		γ		-	
	WEIG	HT			シハマル		┥╞╧╧╝┝╴╴	
FULL OF	LIQUID	k	ξġ		<u> </u>	!		
EMF			(g					
					-		-	-
				,	-1	-		1
C		1						

EQUIPMENT SPECIFICATIONS

HEAT EXCHANGER

E-06012 BAP	Member of		ŀ		CHANGE	R	
	De Dietrich O						
CUSTOMER:	Universitat Autònoma de Ba			•			
PROJECT:	MELISSA COMPARTMENT	ГІІ	ITEM:	HX 2012 01		CHA:	20/01/2010
DRAWING:	DD-8550-Z1		REV:	A	PREPA	RADO:	J. GUBERN
TIPO MODELO	Condenser			RMA VICE		Gas condens	
				ATION	F	Gas condens PG-1/2"-SS2-	
		RE	QUIREMENTS				
		<u></u>			SS PART	SER	/ICE PART
	CONCEPT		UNITS	INLET	OUTLET	INLET	OUTLET
	FLUID TYPE			Proce	ess gas	(Glycol
	CONCENTRATION		%				
	FLOW		L/h		20		
	FLUID TEMPERATURE		°C	80	80		
	DELTA PRESSURE		mca		1		
	SPECIFIC WEIGHT VISCOSITY		kg/m ³				
	SPECIFIC HEAT		cp kcal/ kg ℃				
	THERMAL CONDUCTIVITY		kcal/ kg °C				
MAXIN	IUM OPERATION TEMPERAT	URE	°€				
	KIMUM OPERATION PRESSUF		bar				
	EXCHANGHE POWER		Kw				
		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ONDENSER	I	 	l	
	DESIGN PRESSURE	U	bar	1	,5	·····	3
	TESTS PRESSURE		bar	1	,5		3
	DESIGN TEMPERATURE		02	1	50		-10
CA	LCULATED TRANSFER AREA	١	 m²			27	
	REAL TRANSFER AREA		m²	0,3			
[	DESIGN EXCHANHE POWER		kW	1,5			
	CAPACITY		L	· · · · · ·		0,3	
	OVERSIZING FACTOR	_	%	25			
	LCULATED DELTA PRESSUR	E	mca				
			TRUCTION DA		1	line in the second s	
	Description JACKET	Quantity	Lenght	Diameter	Volume		laterial
	COIL	1	555 mm	90 mm	2,5 L 0,3 L		cate glass 3.3 cate glass 3.3
	OOIL	1			0,3 L	DOIOSIII	Jale glass 0.0
· · · · · · ·	· · · · · · · · · · · · · · · · · · ·						
BOOLTION			ONNECTIONS		N 14		DNM
POSITION	 GAS INLET		N2 )UTLET		N1 DL INLET		DN1 OL OUTLET
DESCRIPTION	50		25		5	GLIO	15
NORMA			UN		NN N		DIN
CORROSION OV		mm	-				
PART		ERIAL			_	2	
JOINTS			]	- mill	ATTITITITITI A	2-6	
SCREWS				Call	11111111111	T	
FLANGE				1-91111	MMMMM		
SUPPORTS				J'r			
	CONNECTION		4		100°		
MATE			1				
DIAME			1	(Date)		DNI	
STANDARD			1				
	WEIGHT				,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	14	
FULL OF	LIQUID I	kg	1	· · · · · · · · · · · · · · · · · · ·			1
EMP		kg					8
	1		1	577 S	-	-	

Do Districk	De Dietrich Equipos Químicos, S.L.								
Av. Príncep d'Asturies 43-45, 1r-5a		INSTRUMENTS SPECIFICATIONS							
				FLOW					
CUSTOMER:	Universitat A	utònoma de Barcelona			PREPARED BY:	J. GUBERN			
PROJECT:		ompartment II			CHECKED BY:	J. MESTRE			
DRAWING:	DD-8550-Z1				REV:	A			
DATE:	20/01/2010				PAGE:	1			
	ITEM		F	T 2001 01	FT 2012 01	•			
	PRODU	ст		ater solution	Process gas				
	TRODU	IN	~~~		100000 gas				
PRESSUR	E (bar)	OUT							
		MINIMUM		0.05	0				
FLOW (L	/h)			0,25					
	TEMPER 47.			10	120				
	TEMPERATU			7	10				
-	SITUATI			1/2"-SS2-006	PG-1/2-SS2-007				
	ROCES CONI			i-Clamp 1/2"	1/4" O.D.				
		T WITH PRODUCT		AISI 316L	AISI 316L / Kalrez				
PROC		ION MATERIAL		AISI 316L	AISI 316L				
	PIPE SIZ		1/2"		1/2"				
	MESURE R	ANGE	020 kg/h		3150 NL/h				
SENSOR TYPE		Coriolis							
TRANSMITTER TYPE		(	COMPACT						
ACCURACY		0,1	% / 2 g/cm ²	± 0,5 mm					
OUTLET SIGNAL		420 mA		420 mA / RS232					
ELEC	ELECTRICAL CLASIFICACTION ATEX		No		No				
	PROTECT		IP67						
El	LECTRICAL COI	NNECTION	8	5-260 VAC	+15 24 Vcc				
	OBSERVAT		Cofficie	ne Defeuttiouid	Magura an tuka				
	UBSERVAI			re: Default liquid	Mesure on tube				
			Mesure on tube		Not Sterilizable				
				ito-drainable	Filter required				
				Sterilizable					
	0	TV		1					
	QUANTI		ENDO						
	SUPPLIE			ESS&HAUSER	IBERFLUID				
	MANUFACT			ESS&HAUSER	BRONKHÖRST				
	MODE	L	+	PROMASS					
				CERTIFICATES					
				CERTIFICATES	2				
			Vaa	NIa					
			Yes	No					
	ATERIALS CEI		$\langle \rangle$						
CAL	IBRATION CE		$\succ$						
					>				
ATEX CERTIFICATE PED 97/23/EC CERTIFICATE			1						

#### INSTRUMENTS SPECIFICATIONS

#### LEVEL

				LEVEL			
USTOMER:	Universitat Autònoma de Bar	rcelona		PREPARED BY:	J. GUBERN		
ROJECT:	MELiSSA Compartment II			CHECKED BY:	J. MESTRE		
RAWING:	DD-8550-Z1			REV:	A		
ATE:	20/01/2010			PAGE:	1		
	ITEM	LT 2002 01	LS 2020 01				
	SITUATION	VS 2000 01	R 2005 01				
	TYPE	Microwave	Level switch				
C	DUTLET SIGNAL	420 mA	0/1				
TY	PE OF SENSOR	Guided microwave					
MATERIAL IN	CONTACT WITH PRODUCT	AISI 316L	AISI 316L				
CAL	IBRATION RANGE	0100 %	N/A				
PROC	ESS CONNECTION	Tri-clamp 1 1/2"	Tri-clamp 1/2"				
PROCESS	CONNECTION MATERIAL	AISI 316L	AISI 316L				
SE	NSOR LENGHT	1000 mm					
	NSOR MATERIAL	AISI 316L					
	NSOR DIAMETER	6 mm					
P	OWER SUPPLY						
l	PROTECTION	IP66 / IP67	IP66				
ELECTRIC/	AL CLASIFICACTION ATEX	No	No				
	ACCURACY	± 0,5 mm	N/A				
DIGITAL I	NDICATION (LCD METER)	No	No				
ELECT	RICAL CONNECTION						
	FLUID TYPE	Water solution	Water solution				
	FLUID STATE						
	VISCOSITY	Liquid 1 cP aprox.	Liquid				
	TION PRESSURE (barg)						
	UM PRESSURE (barg)						
		-	25				
	ON TEMPERATURE (°C)	5	35				
WAXIWC	IN TEMPERATURE ("C)						
	QUANTITY	1	1				
	SUPPLIER	VEGA					
Μ	ANUFACTURER	VEGA					
	MODEL	VEGAFLEX61					
			OBSERVATION	S			
		Yes	No				
MATE	RIALS CERTIFICATE	$\geq$					
CALIBR	ATION CERTIFICATE	$>\!\!\!<$					
ATE	X CERTIFICATE		$>\!\!<$				
PED 97	/23/EC CERTIFICATE		$\sim$	7			

ACCESSORIES SPECIFICATIONS

## WEIGHT

	Member of De Dietrich PROCESS SYSTEMS	WEIGHT			
CUSTOMER: Universitat Autònoma de Ba		celona	PREPARED BY:	J. GUBERN	
PROJECT:	MELiSSA Compartment II		CHECKED BY:	J. MESTRE	
RAWING:	DD-8550-Z1		REV:	A	
DATE:	20/01/2010		PAGE:	1	
	ITEM	WT 2008 01	WT 20	008 02	
	PRODUCT	Acid solution	Base s	solution	
PRODU	ICT DENSITY (kg/m ³ )	1000	10	00	
OPERAT	ION PRESSURE (bar)	atm	at	m	
TEN	/IPERATURE (°C)	atm	at	m	
	SITUATION	VS 2008 01	VS 20	008 01	
	TYPE	platform scale	platform	m scale	
NUI	MBER OF CELLS	1		1	
Т	RANSMITTER	Compact	Corr	pact	
	MATERIAL	INOX	IN	XC	
O	UTLET SIGNAL	Ethernet	Ethe	ernet	
ELECTRICA	AL CLASIFICACTION ATEX	No	N	0	
PROTECTION		IP43	IP	43	
MESURE WEIGHT RANGE		06 kg	0	6 kg	
	ACCURACY	1 g	1	g	
OI	BSERVATIONS				
	ITEM	WT 2010 01	WT 20	016 01	
	PRODUCT	Water solution	Waters	solution	
PRODU	ICT DENSITY (kg/m ³ )	1000	10	00	
	TION PRESSURE (bar)	0,2 bar	0,2	bar	
	/PERATURE (°C)	30 °C	5		
	SITUATION	R 2005 01	VS 20	014 01	
	TYPE	Weight cells		m scale	
NUI	MBER OF CELLS	3		3	
	RANSMITTER	M300		800	
-	MATERIAL	INOX			
O	UTLET SIGNAL	420 mA		0 mA	
	AL CLASIFICACTION ATEX	No		0	
	PROTECTION	IP65		65	
	RE WEIGHT RANGE				
	ACCURACY		20	0 g	
OI	BSERVATIONS			~ 3	

#### INSTRUMENTS SPECIFICATIONS

#### PRESSURE

				PRESSURE		
CUSTOMER:	Universitat Autònoma de B	arcelona		PREPARED BY:		J. GUBERN
ROJECT:	MELiSSA Compartment II			CHECKED BY:		J. MESTRE
RAWING:	DD-8550-Z1			REV:		А
ATE:	20/01/2010			PAGE:		1
	ITEM	PT 2004 01	PT 2009 01	PT 2009 02	PT 2012 01	PT 2013 01
	SITUATION	VS 2000 01	R 2005 01	R 2005 01	VS 2012 01	PG-1/2"-SS2-00
TYPE (ab:	solut/gauge/differentiall)	abs	abs	abs	abs	abs
0	OUTLET SIGNAL	420 mA	420 mA	420 mA	420 mA	420 mA
TY	PE OF SENSOR	VEGABAR	VEGABAR	VEGABAR	VEGABAR	VEGABAR
MATERIAL IN (	CONTACT WITH PRODUCT	AISI 316L	AISI 316L	AISI 316L	AISI 316L	AISI 316L
	IBRATION RANGE	-15 bar	-12 bar	-12 bar	05 bar	02 bar
PROCE	ESS CONNECTION	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"
PROCESS	CONNECTION MATERIAL	AISI 316L	AISI 316L	AISI 316L	AISI 316L	AISI 316L
	CAPILAR	N/A	N/A	N/A	N/A	N/A
CAF	PILAR MATERIAL	N/A	N/A	N/A	N/A	N/A
	MEMBRANE	CERTEC	CERTEC	CERTEC	CERTEC	CERTEC
MEM	BRANE MATERIAL	Ceramic	Ceramic	Ceramic	Ceramic	Ceramic
	AR FILLING FLUID	KN.59	KN.59	KN.59	KN.59	KN.59
PC	OWER SUPPLY					
F	PROTECTION	IP66 / IP67	IP66 / IP67	IP66 / IP67	IP66 / IP67	IP66 / IP67
ELECTRICA	AL CLASIFICACTION ATEX	No	No	No	No	No
ACCURACY		0,10%	0,10%	0,10%	0,10%	0,10%
DIGITAL IN	DICATION (LCD METER)	PLISCOM	PLISCOM	PLISCOM	PLISCOM	PLISCOM
ELECTR	RICAL CONNECTION					
	FLUID TYPE	Water solution/helium	Water/process gas	Process gas	Process gas	Process gas
	FLUID STATE			5	<u> </u>	5
	VISCOSITY					
OPERAT	ION PRESSURE (barg)					
	UM PRESSURE (barg)					
	ON TEMPERATURE (°C)	5	35	35	20	10
t	IM TEMPERATURE (°C)					
	QUANTITY	1	1	1	1	1
	SUPPLIER	VEGA	VEGA	VEGA	VEGA	VEGA
M	ANUFACTURER	VEGA VEGA/WIKA	VEGA/WIKA	VEGA/WIKA	VEGA VEGA/WIKA	VEGA VEGA/WIKA
	MODEL	VEGAMIKA VEGABAR52			VEGABAR52	VEGAWIKA VEGABAR52
	MODEL	VEGABARSZ	VEGABAR52 OBSERVATION	VEGABAR52	VEGABARJZ	VEGABARGZ

De Dietrich

#### INSTRUMENTS SPECIFICATIONS

#### PRESSURE

USTOMER:	Universitat Autònoma de B	arcelona		PREPARED BY:		J. GUBERN
ROJECT:	MELiSSA Compartment II			CHECKED BY:		J. MESTRE
RAWING:	DD-8550-Z1			REV:		A
ATE:	20/01/2010			PAGE:		2
	ITEM	PT 2018 01	PT 2019 01	DPT 2001 01	DPT 2001 02	DPT 2012 01
;	SITUATION	VS 2014 01	VS 2019 01	PL-1/2"-SS2-003	PL-1/2"-SS2-006	PG-1/2"-SS2-00
TYPE (abs	olut/gauge/differentiall)	abs	abs	diff	diff	diff
OL	JTLET SIGNAL	420 mA	420 mA	420 mA	420 mA	420 mA
TYP	PE OF SENSOR	VEGABAR	VEGABAR	VEGADIF	VEGADIF	VEGADIF
IATERIAL IN C	CONTACT WITH PRODUCT	AISI 316L	AISI 316L	AISI 316L	AISI 316L	AISI 316L
CALIE	BRATION RANGE	-15 bar	05 bar	0/3 bar	0/3 bar	0/3 bar
PROCE	SS CONNECTION	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"
PROCESS C	CONNECTION MATERIAL	AISI 316L	AISI 316L	AISI 316L	AISI 316L	AISI 316L
	CAPILAR	N/A	N/A	Yes	Yes	Yes
CAF	PILAR LENGHT	N/A	N/A	1 m	1 m	1 m
N	MEMBRANE	CERTEC	CERTEC			
MEMB	BRANE MATERIAL	Ceramic	Ceramic	AISI 316L	AISI 316L	AISI 316L
CAPILA	AR FILLING FLUID	KN.59	KN.59	KN.59	KN.59	KN.59
_						
	ROTECTION	IP66 / IP67	IP66 / IP67	IP66 / IP67	IP66 / IP67	IP66 / IP67
	L CLASIFICACTION ATEX	No	No	No	No	No
	ACCURACY	0,10%	0,10%			
		PLISCOM	PLISCOM	LCD	LCD	LCD
ELECTR						
I	FLUID TYPE	Water solution/helium	Helium	Water solution	Water solution	Process gas
F	LUID STATE		Gas	Liquid	Liquid	Gas
	VISCOSITY					
OPERATIO	ON PRESSURE (barg)					
MAXIMU	IM PRESSURE (barg)					
OPERATIO	ON TEMPERATURE (°C)					
MAXIMUN	I TEMPERATURE (⁰C)					
	QUANTITY	1	1	1	1	1
	SUPPLIER	VEGA	VEGA	VEGA	VEGA	VEGA
MA	NUFACTURER	VEGA/WIKA	VEGA/WIKA	VEGA/WIKA	VEGA/WIKA	VEGA/WIKA
	MODEL	VEGABAR52	VEGABAR52	VEGADIF55	VEGADIF55	VEGADIF55
			OBSERVATION	IS		

INSTRUMENTS SPECIFICATIONS

#### TEMPERATURE

	De Dietrich &		
MER:	Universitat Autònoma de Barcelona		PREPARED BY:
CT:	MELiSSA Compartment II		CHECKED BY:
IG:	DD-8550-Z1		REV:
	20/01/2010		PAGE:
	ITEM	TT 2003 01	TT 2005 0
	TYPE	Pt-100	Pt-100
	SITUATION	VS 2000 01	R 2005 01
	OUTLET SIGNAL	420 mA	420 mA
	SENSIBLE ELEMENT		
	POD MATERIAL	AISI 316L	AISI 316L
	SENSOR DIAMETER		

	PHOCESS SYSTEMS					
CUSTOMER: Universitat Autònoma de Barcelona		3	PREPARED BY:	J. GUI	BERN	
ROJECT:	MELiSSA Compartment II		CHECKED BY:	J. MESTRE A		
RAWING:	DD-8550-Z1		REV:			
ATE:	20/01/2010		PAGE:	1		
	ITEM	TT 2003 01	TT 2005 01	TT 2017 01	TT 2008 02	
	TYPE	Pt-100	Pt-100	Pt-100	Pt-100	
	SITUATION	VS 2000 01	R 2005 01	VS 2014 01	VS 2014 01	
	OUTLET SIGNAL	420 mA	420 mA	420 mA	420 mA	
	SENSIBLE ELEMENT					
	POD MATERIAL	AISI 316L	AISI 316L	AISI 316L	AISI 316L	
	SENSOR DIAMETER					
TOTAI	_ IMMERSION LENGHT (mm)	100	50	100	100	
PROCE	SS CONNECTION MATERIAL	Tri-Clamp 1"	Tri-Clamp 1/2"	Tri-Clamp 1"	Tri-Clamp 1"	
С	ONNECTION MATERIAL	AISI 316L	AISI 316L	AISI 316L	AISI 316L	
	CALIBRATION RANGE	0200 °C	0200 °C	0200 °C	0…100 ⁰C	
	TRANSMITTER	Analogical	Analogical	Analogical	Analogical	
ELECT	RICAL CLASIFICACTION ATEX	No	No	No	No	
	PROTECTION					
	POWER SUPPLY					
ELECTRICAL CONNECTION		M20 x 1,5	M20 x 1,5	M20 x 1,5	M20 x 1,5	
DIGITAL INDICATION (LCD METER)		No	No	No	No	
ACCURACY		± 0,1 °C	± 0,1 °C	± 0,1 °C	± 0,1 °C	
DIGITAL COMMUNICATION						
	FLUID TYPE	Water solution	Water solution	Water solution	Process gas	
	FLUID STATE	Liquid	Liquid	Liquid	Gas	
	VISCOSITY					
OPE	RATION PRESSURE (barg)					
MA	XIMUM PRESSURE (barg)					
OPER	ATION TEMPERATURE (°C)	5	35		10	
MAX	IMUM TEMPERATURE (°C)	200	200	200	200	
	QUANTITY	1	1	1	1	
	SUPPLIER					
	MANUFACTURER					
	MODEL					
		OBSE	RVATIONS			
		Yes	No			
MAT	FERIALS CERTIFICATE	$>\!\!\!>\!\!\!<$		1		
CALII	BRATION CERTIFICATE	>		1		
	ATEX CERTIFICATE		$\searrow$	1		
	97/23/EC CERTIFICATE			-		

De Dietrich 📀	CODE PROJECT: DD-	8550-Z1	Rev. A		
PROCESS SYSTEMS	CUSTOMER: UAB				
De Dietrich Equipos Químicos, S.L.	PROJECT: MELISSA COMPARTMENT II				
Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA	<b>DATE:</b> 15/12/2009	PREPARED: J. C	BUBERN		
	PAGE 1 of 6	Ref. PRK-005449			

# **ELECTRICAL CABINET DESCRIPTION**

This document tries to do a description of the power and control system that is foreseen for the for the compartment II of MELiSSA Pilot Plant.

Documents of reference:

- P&ID (DD-8550-Z1-100-02 rev. F)
- Electrical and control signals list rev. A
- Room Lay-Out (DD-8550-Z1-102-02 rev. 0)

## 1 SITUATION OF THE ELECTRICAL CABINET

In previous meetings has been discussed with MELiSSA people the situation and dimensions of the compartment II and its electrical cabinet, which is foreseen out of the skid:

"The electrical cupboards are foreseen by DDEQ out of the skid in order to save space in the same considering the room constraints" (01.10.2009) "MPP mentioned that the CI PLC cabinet could be moved to the corner near the GC in order to have more space for the C.II skid (to be confirmed by NTE)" (01.10.2009)

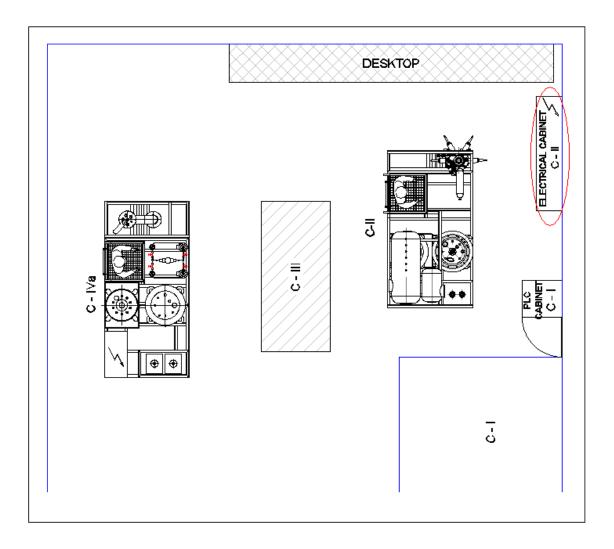
The designed electrical cabinet is 1800x2400x400 and it is conceptually divided in two different parts: power and control.

It can be physically divided too in order to be able to go through the pilot plant door.



De Dietrich 📀	CODE PROJECT: DD-	•8550-Z1 <b>Rev.</b> A			
PROCESS SYSTEMS	CUSTOMER: UAB				
De Dietrich Equipos Químicos, S.L.	PROJECT: MELiSSA	COMPARTMENT II			
Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA	<b>DATE:</b> 15/12/2009	PREPARED: J. GUBERN			
	PAGE 2 of 6	Ref. PRK-005449			

The situation in the plant of the electrical cabinet is the next:



<u>NOTE:</u> For further details about dimensions refer to Room Lay-Out (DD-8550-Z1-102-02 rev. 0) included in the ANNEX II of this dossier.



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De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA	CUSTOMER: UAB		
	PROJECT: MELiSSA C	COMPARTMENT II	
	<b>DATE:</b> 15/12/2009	PREPARED: J. GU	JBERN
	PAGE 3 of 6	Ref. PRK-005449	

# 2 SCOPE OF SUPPLY

## 2.1 Power and control panel

Supply of power and control panel, dimensions 1800 height, 2400 width and 400 depth, mechanized, mounted, connected and with the following elements and devices:

- $1 \rightarrow$  Base panel and accessories
- $1 \rightarrow$  Mounting board
- $1 \rightarrow$  Cooper bar and accessories
- 1→ Overvoltage protection Class D IEC 1024-1
- 1→ Light switch "On service"
- $1 \rightarrow$  General switch
- $1 \rightarrow$  Main ground-fault protection and thermal-magnetic circuit breaker
- $1 \rightarrow$  Emergency stop push button
- $1 \rightarrow$  "Emergency stop activated" indicator (red led)
- $1 \rightarrow$  White light indicator "Voltage in"
- $1 \rightarrow$  Acknowledge push button
- $1 \rightarrow$  Security check push button
- $1 \rightarrow$  Safety relay PREVENTA
- $2 \rightarrow$  Power supply 24Vdc/10 A
- $1 \rightarrow$  Single ground-fault protection for all frequency converters
- $1 \rightarrow$  General ground-fault protection for all the instrumentation
- $1 \rightarrow$  DIMMER 3-phase to control lightning columns
- $1 \rightarrow$  Transformer 3-phase 5KVA
- $1 \rightarrow$  Single thermal-magnetic protection for 7 lightning columns
- $1 \rightarrow$  Current metering and 4-20mA conversion
- $1 \rightarrow$  DIMMER protection security circuit against low load in the output
- $1 \rightarrow RS232/Ethernet converter$



De Dietrich 🔷	CODE PROJECT: DD-	8550-Z1	Rev. A
PROCESS SYSTEMS	CUSTOMER: UAB		
De Dietrich Equipos Químicos, S.L.	PROJECT: MELiSSA C	COMPARTMENT I	I
Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA	<b>DATE:</b> 15/12/2009	PREPARED: J. C	BUBERN
	PAGE 4 of 6	Ref. PRK-005449	

- $1 \rightarrow$  Wiring of the following control signals:
  - 38 Digital inputs
  - 43 Analogical inputs
  - 38 Digital outputs
  - 15 Analogical outputs
- $1 \rightarrow$  Set of galvanic isolators
- $1 \rightarrow$  Set of thermal-magnetic circuit breakers
- $7 \rightarrow$  Single-phase frequency converters 1,5KW
- $8 \rightarrow$  Contactors
- $1 \rightarrow$  Heater starter
- $1 \rightarrow$  Set of circuit breaker auxiliary switch
- $1 \rightarrow$  Set of connection strips
- $1 \rightarrow$  Elements and devices mounted and connected according CE directive
- $1 \rightarrow$  Design, technical managing and documentation

#### **IMPORTANT NOTES:**

- > It is not foreseen the connection to the plant power/pneumatic supply.
- The material included in these lists is the necessary for the electrical and control signals foreseen at the moment. (See "electrical and control signals list" included in ANNEX II of this dossier)



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De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA	CUSTOMER: UAB		
	PROJECT: MELiSSA (	COMPARTMENT I	I
	<b>DATE:</b> 15/12/2009	PREPARED: J. C	BUBERN
	PAGE 5 of 6	Ref. PRK-005449	

## 2.2 Electrical mounting and setting-up in MELiSSA Pilot Plant

The materials which are required for this action are:

- 20 m galvanized cable tray 60x60 mm (without cover).
- 20 m galvanized cable tray 300x60 mm (without cover).
- Trays mounting accessories.
- 60 m shielded cable 4x0,5 mm²
- 20 m blue shielded cable 8x0,5 mm²
- 150 m cable 4x0,5 mm²
- 100 m shielded cable 4x1,5 mm²
- 200 m shielded cable 3x1,5 mm²
- 250 m flexible conduit.
- 10 m heat-shrinkable tubing.
- Other connection and mounting accessories.
- Cable signalling.
- 60 m pneumatic tubing.
- 3 emergency stop pushbuttons.
- Other pneumatic accessories.

NOTE: It is foreseen that the setting up of the plant will last approximately 2 weeks.



De Dietrich 📀	CODE PROJECT: DD-	8550-Z1	Rev. A
PROCESS SYSTEMS	CUSTOMER: UAB		
<b>De Dietrich Equipos Químicos, S.L.</b> Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA	PROJECT: MELiSSA (	COMPARTMENT I	I
	<b>DATE:</b> 15/12/2009	PREPARED: J. C	JUBERN
	PAGE 6 of 6	Ref. PRK-005449	

## 2.3 Photo-bioreactor Lighting system

The illumination system consists of 200 halogen lamps which surround the glass jacketed pipe section (DN200, L=1500m).

The type of lamps used will be the specified in the technical note 62.2 and are: OSRAM 12V,  $20W BAB 38^{\circ}$ .

#### 2.3.1 Lighting system structure

The lights will be set-up on a portable structure made of stainless-steel with 10 columns of 20 halogen lamps of 20W 12V.

It will include 2 or 3 connection boxes sited on the half height of the structure.

These boxes will receive the cables from the lamps to link in 2 o 3 cables all the power to the main electric panel.

## 2.4 Phoenix material (NTE supplied formerly)

Set of Phoenix materials.

- Interface modules VARIOFACE FLKM50/MOFI-TSX/Q.
- Connectors PLC-V8/FLK14/OUT.
- Connectors PLC-V8/FLK14/IN.
- Relay PLC_RSP-24UC/21AU (24VDC).
- Plug-in bridges FBST 500-PLC BU
- Separating plates PLC-ATP BK.



Av. Príncep	d'Asturies 43-45, 1r-5a ARCELONA		ACCE	SSORIES SPECIFICA	TIONS	
CUSTOMER: PROJECT:	De Dietrich &			J. GUBERN J. MESTRE		
DRAWING: DATE:	DD-8550-Z1 20/01/2010			REV: PAGE:		A
DATE:	ITEM	RV 2003 01	RV 2004 01	RV 2004 02	RV 2005 01	1 RV 2007 01
	PRODUCT	Glycol	Helium/water solution	Helium	Helium/water solution	Glycol
	SITUATION	GLY-3/4"-SS1-004	VS 2000 01	VT-1/2"-SS2-003	R 2005 01	GLY-1"-SS1-012
		3/8"	1"		1"	3/8"
00	TLET DIAMETER TYPE	3/8"	1" Sanitary		1" Sanitary	3/8"
	FLOW		Sanitary		Sannary	****
TA	RE PRESSURE	4 bar	3 bar		1 bar	4 bar
SERVI	CE TEMPERATURE	7 ºC	5 ºC	20 ºC	5 ℃	7 ºC
	DDY MATERIAL	INOX	INOX	INOX	INOX	INOX
INTERN	AL PARTS MATERIAL	INOX	INOX	INOX	INOX	INOX
	QUANTITY	1 005 DN25	1	1	1	1 005 DN25
	MODEL SUPPLIER	095 PN25 GRM	74700 INOXPA		74700 INOXPA	095 PN25 GRM
MA		VYC	INOXPA		INOXPA	VYC
		10				10
OI	BSERVATIONS	Sterilizable with steam EPDM joint	Sterilizable with steam EPDM joint		Sterilizable with steam EPDM joint	
	ITEM	RV 2007 02	RV 2007 03	RV 2012 01	RV 2012 02	RV 2012 03
	PRODUCT	Water	Water	Process gas	Glycol	Process gas
INI	SITUATION	WT-1"-SS1-002	WT-1"-SS1-002	Process gas PG-1/2"-SS2-005	GLY-1"-SS1-012	PG-1/2"-SS2-008
	SITUATION LET DIAMETER	WT-1"-SS1-002 1"	WT-1"-SS1-002 1"	Process gas PG-1/2"-SS2-005 1"	GLY-1"-SS1-012 3/8"	PG-1/2"-SS2-008 3/8"
	SITUATION	WT-1"-SS1-002	WT-1"-SS1-002	Process gas PG-1/2"-SS2-005	GLY-1"-SS1-012	PG-1/2"-SS2-008
	SITUATION LET DIAMETER TLET DIAMETER	WT-1"-SS1-002 1"	WT-1"-SS1-002 1"	Process gas PG-1/2"-SS2-005 1"	GLY-1"-SS1-012 3/8"	PG-1/2"-SS2-008 3/8"
OU	SITUATION LET DIAMETER TLET DIAMETER TYPE	WT-1"-SS1-002 1"	WT-1"-SS1-002 1"	Process gas PG-1/2"-SS2-005 1"	GLY-1"-SS1-012 3/8"	PG-1/2"-SS2-008 3/8"
OU ⁻ TA SERVIO	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C	Process gas PG-1/2"-SS2-005 1" 1" 1" 1 bar 30 °C	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C	PG-1/2"-SS2-008 3/8" 3/8" 10 °C
OU" TA SERVII BC	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX	Process gas PG-1/2"-SS2-005 1" 1" 1" 1 bar 30 °C INOX	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX
OU" TA SERVII BC	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX	Process gas PG-1/2"-SS2-005 1" 1" 1" 1 bar 30 °C INOX INOX	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX
OU" TA SERVII BC	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1	Process gas PG-1/2"-SS2-005 1" 1" 1" 1 bar 30 °C INOX INOX 1	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1
OU" TA SERVII BC	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25	Process gas PG-1/2"-SS2-005 1" 1" 1" 1 bar 30 °C INOX INOX 1 74700	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25
OU" TA SERVII BC INTERN	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1	Process gas PG-1/2"-SS2-005 1" 1" 1" 1 bar 30 °C INOX INOX INOX	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1
OU" TA SERVIN BC INTERN/ MA	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU TA SERVII BC INTERN	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU TA SERVII BC INTERN	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA Sterilizable with steam	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC Sterilizable with steam	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU" TA SERVIN BC INTERN/ MA	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU" TA SERVIN BC INTERN/ MA	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA Sterilizable with steam	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC Sterilizable with steam	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU" TA SERVIN BC INTERN/ MA	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA Sterilizable with steam	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC Sterilizable with steam	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU TA SERVII BC INTERN	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA Sterilizable with steam	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC Sterilizable with steam	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU TA SERVII BC INTERN	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA Sterilizable with steam	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC Sterilizable with steam	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM
OU TA SERVII BC INTERN	SITUATION LET DIAMETER TLET DIAMETER TYPE FLOW RE PRESSURE CE TEMPERATURE DDY MATERIAL AL PARTS MATERIAL QUANTITY MODEL SUPPLIER ANUFACTURER	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	WT-1"-SS1-002 1" 1" 0,5 bar 12 °C INOX INOX 1 095 PN25 GRM	Process gas PG-1/2"-SS2-005 1" 1" 1 bar 30 °C INOX INOX 1 74700 INOXPA INOXPA Sterilizable with steam	GLY-1"-SS1-012 3/8" 3/8" 3 bar 7 °C INOX INOX 1 095 PN25 GRM VYC Sterilizable with steam	PG-1/2"-SS2-008 3/8" 3/8" 10 °C INOX INOX 1 095 PN25 GRM

De Dietrich	Equipos Químicos, S.L.		ACCE	SSORIES SPECIFICA	TIONS		
Av. Princep E-08012 BA	d'Asturies 43-45, 1r-5a ARCELONA	SAFETY					
CUSTOMER: PROJECT: DRAWING:	Universitat Autònoma de B MELiSSA Compartment II DD-8550-Z1	Barcelona		PREPARED BY: CHECKED BY: REV:		J. GUBERN J. MESTRE A	
DATE:	20/01/2010			PAGE:		2	
	ITEM PRODUCT	RV 2012 04	RV 2017 01	RV 2018 01 Helium/water solution	RV 2019 01 Helium		
	SITUATION	Process gas VS 2012 01	Glycol GLY-3/4"-SS1-007	VS 2014 01	VT-1/2"-SS2-003		
IN	LET DIAMETER	3/8"	3/8"	1"	V1-1/2 -332-003		
	TLET DIAMETER	3/8"	3/8"	1"			
	TYPE			Sanitary			
	FLOW						
TA	RE PRESSURE		4 bar	3 bar			
SERVI	CE TEMPERATURE	10 ºC	7 °C	5 °C	20 ℃		
BC	DDY MATERIAL	INOX	INOX	INOX	INOX		
INTERN	AL PARTS MATERIAL	INOX	INOX	INOX	INOX		
	QUANTITY	1	1	1	1		
	MODEL	095 PN25	095 PN25	74700			
	SUPPLIER	GRM	GRM	INOXPA			
MA	NUFACTURER	VYC	VYC	INOXPA			
O	BSERVATIONS		Otenilian his with stars.	Ota allia a bila suith a ta ana			
			Sterilizable with steam	Sterilizable with steam			
			EPDM joint	EPDM joint			
	ITEM						
	PRODUCT						
	SITUATION						
IN	LET DIAMETER						
OU	TLET DIAMETER						
	TYPE						
	FLOW						
	RE PRESSURE						
INTERN	AL PARTS MATERIAL						
	QUANTITY MODEL						
	SUPPLIER						
N4 /	NUFACTURER						
1717							
01	BSERVATIONS						
						1	



# MELiSSA Pilot Plant



Universitat Autònoma de Barcelona

Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 151 / 275

# 8. ANNEX III: EQUIPMENT DATASHEETS

8.1. Feed and harvest pumps8.2. Acid and base dosing pumps



# **BOMBAS DOSIFICADORAS**

# **DESCRIPCIÓN TÉCNICA Y OFERTA**

**LEWA Ecodos Sanitary** 

Para Ref. LEWA Ref. Cliente Fecha Páginas Anexos

DeDietrich - Sra. Júlia Gubert 104-B-02041-40

23/09/08

( )

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Lewa Hispania, S.L. Vía Trajana, 50 - 56; Nave 49 - 08020 Barcelona Oficinas comerciales en Barcelona y Madrid

www.lewa.es info@lewa.es

#### Pág. 23/09/2008 2/6

# **INTRODUCCIÓN**

# **Características generales**

Las bombas Ecodos son bombas dosificadoras con cabezal dosificador de membrana, actuado mecánicamente. La membrana tiene un diseño patentado, y esta formada por cuatro capas individuales de PTFE macizo, lo que le confiere una gran fiabilidad y resistencia.

#### Principales características de las bombas LEWA ECODOS:

- El diseño de cuádruple membrana permite que la bomba pueda seguir operando en caso de que se produzca una rotura de la misma. La rotura de membrana es señalizada a través de un dispositivo instalado en el cabezal dosificador.
- ✓ Vida útil de la membrana superior a 16.000 horas de operación en régimen continuo.
- ✓ Garantía de dos años para la membrana
- ✓ Herméticamente estancas
- Ninguna junta deslizante o empaquetaduras
- A prueba de funcionamiento sin engrase
- Fácil desmontaje y montaje de la cámara de dosificación
- Posibilidad de combinaciones de bombas múltiples
- Diseño compacto para ahorrar espacio
- Admiten periodos de operación prolongados
- ✓ Alta precisión de dosificación, desviación de ± 1%
- ✓ Piezas en contacto con el fluido pulidas Ra ≤ 0.8  $\mu$ m

# Comentarios

Bomba para 10 l/h máx y 0.25 l/h min de un producto de características similares al agua en cuanto a densidad y viscosidad.

Presión de descarga igual o inferior a 20 bar. Temperatura ambiente.

Bomba para 900 l/h máx de un producto de características similares al agua en cuanto a densidad y viscosidad.

Presión de descarga igual o inferior a 5 bar. Temperatura ambiente.

Ambos equipos pueden ser esterilizados con vapor durante periodos de tiempo de 20 minutos.

Lewa Hispania, S.L. Vía Trajana, 50 - 56; Nave 49 – 08020 Barcelona Oficinas comerciales en Barcelona y Madrid

www.lewa.es info@lewa.es

# **ALCANCE DEL SUMINISTRO**

# **Bombas dosificadoras**

#### Pos. DESCRIPCIÓN

1. BOMBA DOSIFICADORA LEWA TIPO ECODOS SANITARY 6S1 Datos de proceso y ubicación

Fluido	No declarado
Temperatura de Proceso [°C]	<25
Densidad[Sg]	No declarada
Viscosidad [mPas]	3
Presión de vapor[bar abs]	
Concentración de sólidos/tamaño [%]/[mm]	/
Caudal necesario (Min./Máx.)[l/h][l/h]	10 l/h
Presión en línea de impulsión[bar]	No declarada, suponemos < 5bar
Presión en línea de aspiración	0
Condiciones ambientales (temperatura, clima etc.)	Ubicación interior o exterior protegida de fenómenos atmosférico
Zona explosiva	
Alimentación eléctrica	400V, 50 Hz, 3F Protección motor IP55
	Potencia 0.37 Kw, 4 polos
	Para trabajar con VdF. A 50Hz, 6l/h

#### Datos de diseño

Caja d	le eng	jranaj	es
--------	--------	--------	----

Reducción	[I]
Cadencia nominal	[min ⁻¹ ]
Ajuste de carrera	

....

# Cabezal1 x CaCaudal a presión de impulsión[l/h]Presión máxima de la bomba[bar]Precisión20 barPrecisiónMejor dSeñalización de rotura de membranasManónVálvulas en aspiración[Tipo/Ø]Bola/5Válvulas en impulsiónConexiones en aspiraciónTri-claiConexiones en impulsiónTri-claiConexiones para la camisa de calefacción-

#### 17 80

A 100Hz Q=12l/h

Manual, a máquina parada o en marcha. Por variador de frecuencia. (no incluido)

1 x Cabezal 6 l/h a 50Hz 20 bar Mejor del 1% en el rango de caudal 1:5 Manómetro Bola/5 Bola/5 Tri-clamp ¼" Tri-clamp ¼"

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Materiales (en contacto con el fluido)

Cabezal	Acero inox 1.4571
Membrana	PTFE puro
Cuerpo de la válvula	Acero inox 1.4571
Elemento de cierre de la válvula	Oxido cerámico/Nylon
Motor de accionamiento	Motor Asíncrono
Potencia nominal	0.37Kw 4 polos
RPM[1/min]	1.400

RPW[1/minj	1.400
Ex – Protección	-
Protección	IP55
Voltios/Frecuencia[V]/[Hz]	400/500V, 50 Hz, 3F

#### Pos. DESCRIPCIÓN

#### 2. BOMBA DOSIFICADORA LEWA TIPO ECODOS SANITARY 1100S1 Datos de proceso y ubicación

Fluido	No declarado
Temperatura de Proceso [°C]	<25
Densidad [Sg]	No declarada
Viscosidad [mPas]	3
Presión de vapor [bar abs]	
Concentración de sólidos/tamaño [%]/[mm]	/
Caudal necesario (Min./Máx.)[l/h]	900 l/h
Presión en línea de impulsión[bar]	No declarada, suponemos < 5bar
Presión en línea de aspiración [bar]	0
Condiciones ambientales (temperatura, clima etc.)	Ubicación interior o exterior protegida de fenómenos atmosférico
Zona explosiva	
Alimentación eléctrica	400V, 50 Hz, 3F Protección motor IP55
	Potencia 1.5 Kw, 4 polos

#### Datos de diseño

Caja de engranajes		
Reducción	[i]	8.33
Cadencia nominal	[min ⁻¹ ]	170
Ajuste de carrera		Manu

Cabezal	
Caudal a presión de impulsión	[l/h]

#### <u>Lewa</u> Hispania, S.L.

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Manual, a máquina parada o en marcha.

1 x Cabezal 1100 l/h a 50Hz a longitud máx de carrera

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Ref. Lewa	104-B-02041-40	Bombas Dosificadoras Eco	DOS	23/09/2008	Pág. 5/6
Prec Seña Válv Válv Con Con Con	sisión alización de rotura de r ulas en aspiración ulas en impulsión exiones en aspiración. exiones en impulsión exiones para la camisa	iba [bar] nembranas [Tipo/Ø] [Tipo/Ø] i de calefacción		rango de cauda	I 1:5
Mo Pot RPI Ex Pro	Membrana Cuerpo de la válvula Elemento de cierre o tor de accionamiento encia nominal M – Protección	n el fluido) le la válvula [kW] [1/min] [V]/[Hz]	Acero inox 1.4571 PTFE puro Acero inox 1.4571 Oxido cerámico/Nyl Motor Asíncrono 1.5 Kw 4 polos 1.400 - IP55 400/500V, 50 Hz, 3		

# Opciones

)

# **Certificados y Pruebas**

## Documentación y pruebas estándar

- · Manuales de funcionamiento y puesta en marcha
- · Dibujos seccionales con lista de despiece para una identificación de todos los repuestos
- Dibujos dimensionales
- Identificación CE
- Certificación PTB (si procede)

Proceso de pintado según estándar de LEWA RAL 5015 azul





Improving your PERFORMANCE

# 323S/D and 323S/4D High-performance manual control variable speed pumps

# Technical information and features

- High performance microprocessor controlled pumps .
- Up to 2000 ml/min from three-roller 323S/D
- Up to 1600 ml/min from four-roller, lower pulsation 323S/4D
- Precision digital speed control 1rpm steps from 3 to 400rpm, 133:1 control ratio
- High visibility digital display and keypad lock .
- Compact design, chemical resistant case, contemporary styling
- Zero maintenance, quiet brushless DC motor .
- Rapid and simple tube loading flip-top pumphead .
- Snap fit extension pumpheads up to 6 channels of flow
- MemoDose facility for accurate single shot dosing
- Auto-restart for mains failure recovery and timer control
- Alternative pumpheads .
  - 314DW four roller pumphead for lower pulsation, 1.6mm wall thickness tube

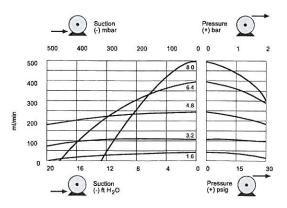
313DW2 three roller pumphead, 2.4mm wall tube for higher suction and delivery pressure 314DW2 four roller pumphead, 2.4mm wall tube for higher suction and delivery pressure

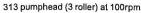
313X three roller and 314X four roller extension pumpheads for 1.6mm wall tube

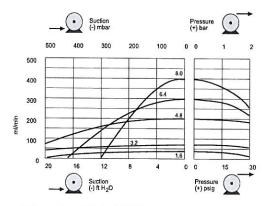


Flow rate ranges (ml/min)

	Tube bore and flow rates (ml/min)								
	Speed rpm	0.5mm	0.8mm	1.6mm	3.2mm	4.8mm	6.4mm	8.0mm	
323S/D (3 roller pumphead)	3.0 - 400	0.09-12	0.21-28	0.81-110	3.0-400	6.6-880	11-1400	15-2000	
323S/4D (4 roller pumphead)	3.0 - 400	0.09-12	0.18-24	0.75-100	2.6-340	5.7-760	9.0-1200	12-1600	

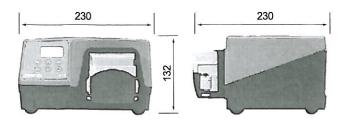






314 pumphead (4 roller) at 100rpm





# 323S/D and 323S/4D High-performance manual control variable speed pumps

323S/D 3-400rpm	drive, bayonet mounting plate + 3 roller pumphead for 1.6mm wall tube	030.3134.4D0*
323S 3-400rpm	drive only	036.3134.000*
313DW	3 roller pumphead for 1.6mm wall tube	033.3451.000
313X	3 roller extension pumphead for 1.6mm wall tube (maximum five)	033.3431.000
313DW2	3 roller pumphead for 2.4mm wall tube (maximum one)	033.3551.000
314DW	4 roller pumphead for 1.6mm wall tube	033.4451.000
314X	4 roller extension pumphead for 1.6mm wall tube (maximum five)	033.4431.000
314DW2	4 roller pumphead for 2.4mm wall tube (maximum one)	033.4551.000

*Replace last 0 with A, E or U for American, European or UK mains supply (American 110V 1ph 60Hz) If required for use with STA-PURE and Chem-Sure tubing, please contact Watson-Marlow Bredel technical support for drive and pumphead selection.

	1			
Bore/wall (mm)	Bioprene	Marprene	Platinum Silicone	PVC
0.5 / 1.6	903.0005.016	902.0005.016	913.A005.016	
0.8 / 1.6	903.0008.016	902.0008.016	913.A008.016	
1.6 / 1.6	903.0016.016	902.0016.016	913.A016.016	950.0016.016
3.2/1.6	903.0032.016	902.0032.016	913.A032.016	950.0032.016
4.8/1.6	903.0048.016	902.0048.016	913.A048.016	950.0048.016
6.4 / 1.6	903.0064.016	902.0064.016	913.A064.016	950.0064.016
8.0 / 1.6	903.0080.016	902.0080.016	913.A080.016	950.0080.016
1.6/2.4	903.0016.024	902.0016.024	913.A016.024	
3.2/2.4	903.0032.024	902.0032.024	913.A032.024	
4.8/2.4	903.0048.024	902.0048.024	913.A048.024	
6.4/2.4	903.0064.024	902.0064.024	913.A064.024	
Bore/wall (mm)	Neoprene	STA-PURE ®	Chem-Sure ®	Fluorel ®
0.8 / 1.6	920.0008.016			970.0008.016
1.6 / 1.6	920.0016.016	960.0016.016	965.0016.016	970.0016.016
3.2/ 1.6	920.0032.016	960.0032.016	965.0032.016	970.0032.016
4.8 / 1.6	920.0048.016	960.0048.016	965.0048.016	970.0048.016
6.4 / 1.6	920.0064.016	960.0064.016	965.0064.016	970.0064.016
8.0 / 1.6	920.0080.016	960.0080.016	965.0080.016	970.0080.016
1.6 / 2.4		960.0016.024	965.0016.024	
3.2/2.4		960.0032.024	965.0032.024	
4.8/2.4		960.0048.024	965.0048.024	
6.4/2.4		960.0064.024	965.0064.024	

* Fluorel is a registered trademark of Dyneon LLC, a 3-M Hoechst Enterprise

[®] STA-PURE and Chem-Sure are registered trademarks of W.L Gore & Associates Inc. Please state the product code when ordering pumps and tubing.

#### Specification

Weight	4.7kg
Operational temperature range	4°C to 40°C
Noise	<70dBA at 1m
Control ratio	133:1
Standards	CE, IEC335-1, EN60529 (IP31)
Supply	1ph, 100-120V, 220-240V 50/60Hz, 100VA

#### Materials of construction

Drive	
Drive base	Powder coated aluminium casting
Drive top	Self-coloured ABS plastic
Pumphead	
Body rear	Glass filled polypropylene
Body front, body front extension	IXEF
Mounting plate, track and lever	IXEF
Rotor, tube clamp	Glass filled Nylon
Mounting plate locking tab	Glass filled Nylon
Rollers	MoS2 filled Nylon 6 (Nylatron)
Spindles	Electroless nickel plated, hardened steel
Fixings	Stainless steel
Bearings	Carbon steel - main shaft Sintered bronze - rollers



Watson-Marlow-Bredel Pumps Falmouth Cornwall England TR11 4RU Tel: +44 (0) 1326 370370 Fax: +44 (0) 1326 376009 www.watson-marlow.com *Email support4gb@watson-marlow.co.uk* 



# MELiSSA Pilot Plant

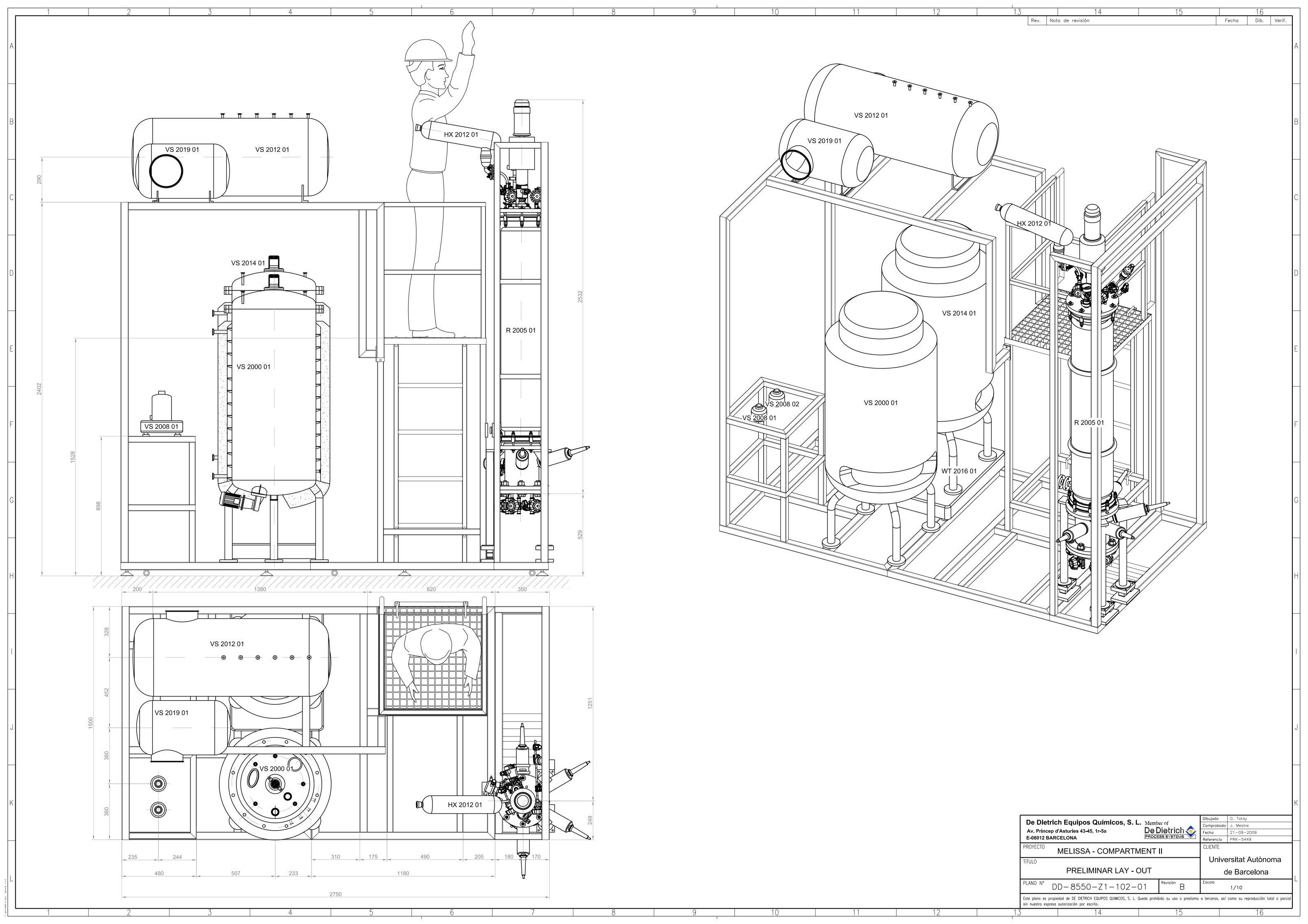


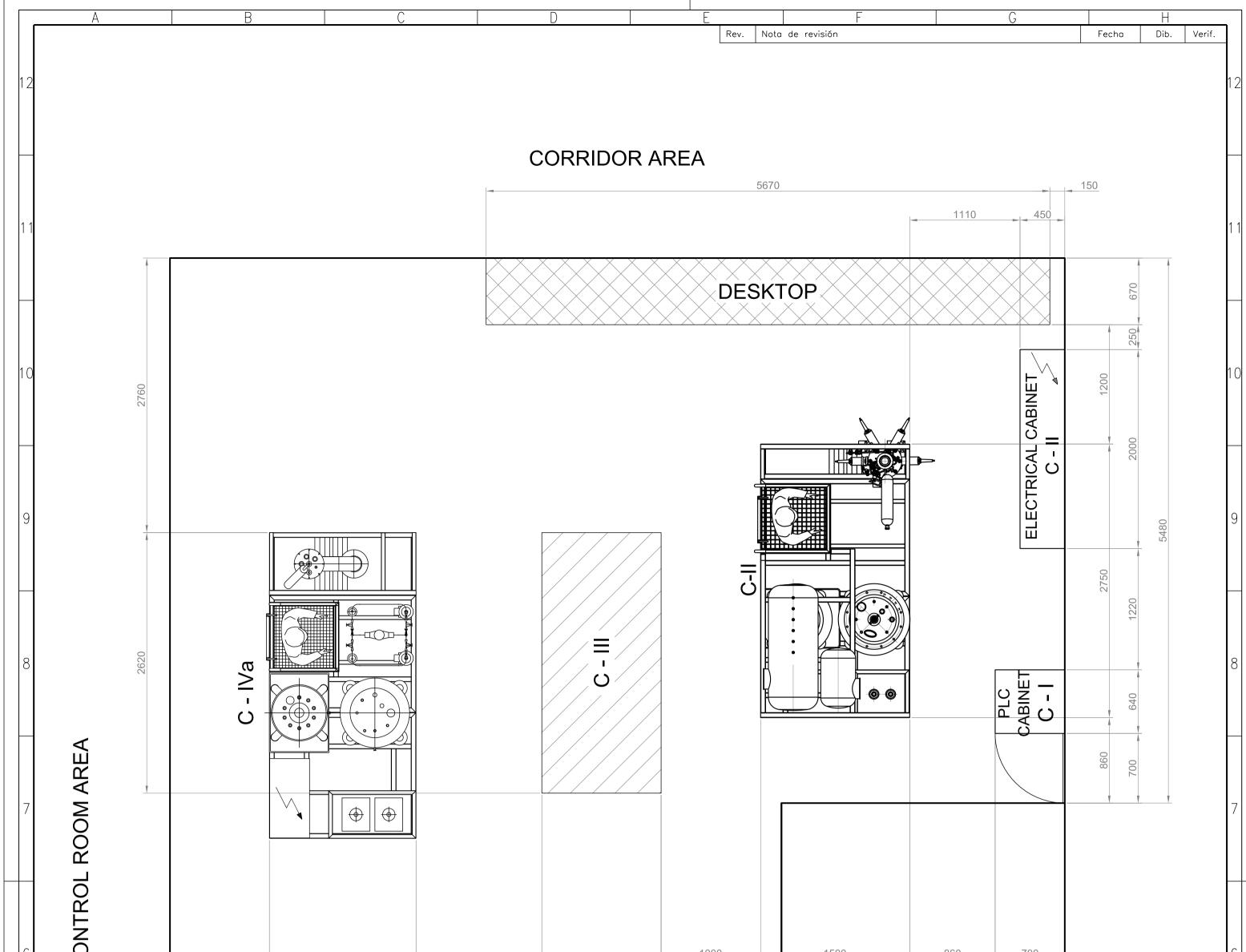
Universitat Autònoma de Barcelona

Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 159 / 275

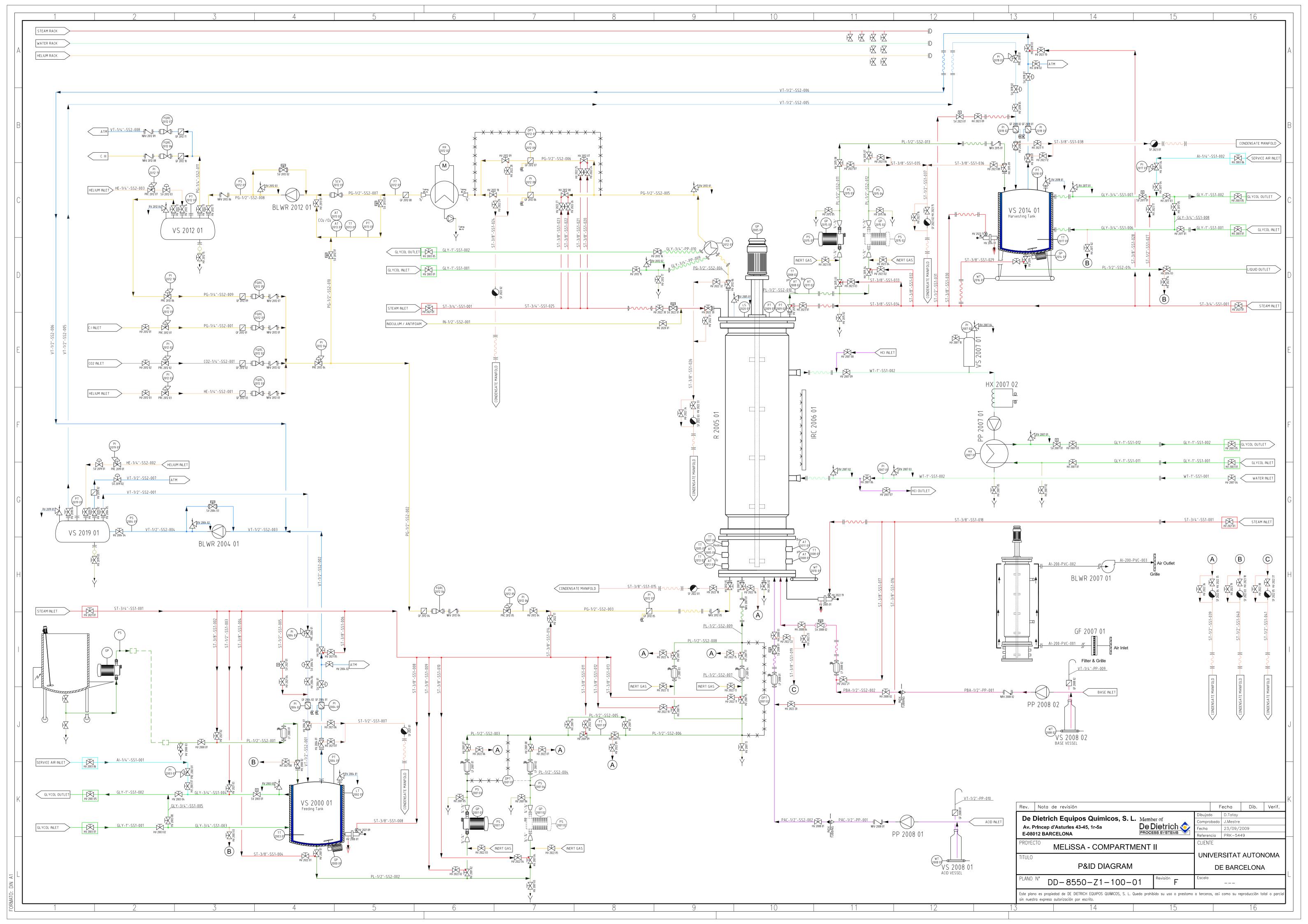
# 9. ANNEX IV: DRAWINGS

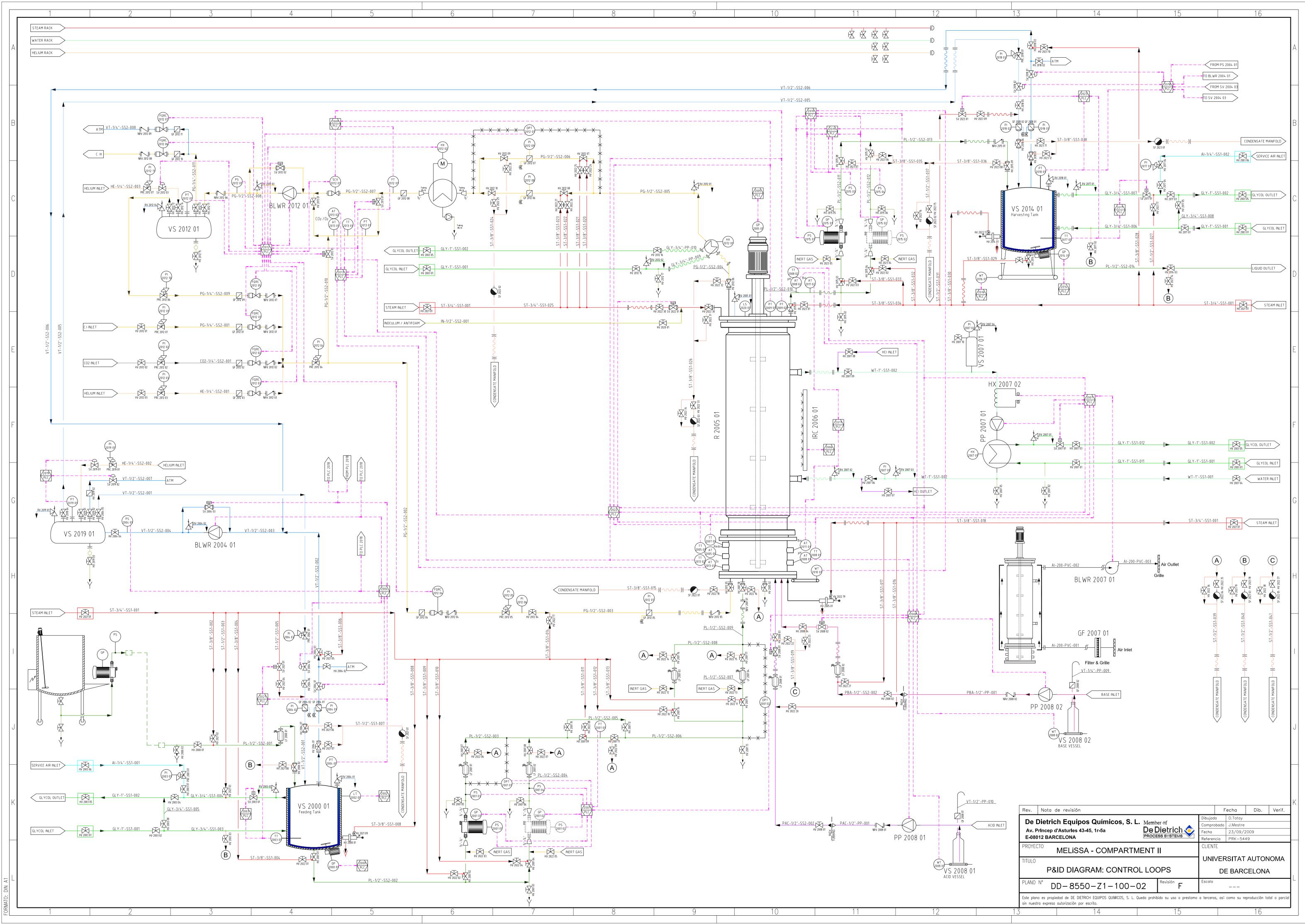
- 9.1. General layout (rev.
- 9.2. Layout (rev.
- 9.3. P&ID Diagram
- 9.4. P&ID Diagram (Control loops)





6	CON					1000	1500 860	700	-
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						TITULO	ROOM LAY - OUT		de Barcelona
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# MELiSSA Pilot Plant



Universitat Autònoma de Barcelona

Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 164 / 275

# **10. QUOTATION**

This document is confidential property of the MELiSSA partners and shall not be used, duplicated, modified or transmitted without their authorization Memorandum of Understanding 19071/05/NL/CP







**De Dietrich Equipos Quimicos, S.L.** Príncep d'Asturies 43-45, 1r-5a E-08012 Barcelona

Telf: +34 932 920 520 Fax: +34 932 184 709 www.dedietrich.es comercial@dedietrich.es

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# **1.- SUBJECT AND ANTECEDENTS**

The Universitat Autònoma de Barcelona, hereafter UAB, takes part in the MELiSSA Project of the European Space Agency (ESA) and the European Space Research and Technology Centre (ESTEC). The Project objective is to study and define parameters to achieve life conditions in the space during long journeys.

Included in this research project there is a pilot plant installed in the Departament d'Enginyeria Química de l'Escola Tècnica Superior d'Enginyeria (ETSE) of the UAB. This pilot plant is based in several compartments linked together in a close loop to process and recycle the ambient air, water, food and feces.

**De Dietrich Equipos Químicos**, hereafter **DDEQ**, was commissioned by the UAB for the basic designing of compartment C-II of the pilot plant, according to DDEQ quotation DDE-K1764-SI.

The present proposal **EXS-M0127 Rev. 1** for the construction and delivery of the skid corresponding to compartment C-II, is based in the documentation and designs generated during this basic engineering project development.

The proposal includes the following concepts:

- Carry out the required detailed and constructive engineering works to build up the plant
- Delivery of all the materials, equipments and goods.
- Carry out the assembly (mechanical and cabling) of the plant
- Commissioning and start-up of the plant
- Delivery of operation manual and technical dossier of the plant

## 2.- QUOTATION BASIS

To make this proposal the following documents (Data package) coming from the basic designing works of MELISSA – Compartment II Pilot Reactor, have been used:

P&ID Diagram DD-8550-Z1-100-01 Rev. F

Control Loops Diagram DD-8550-Z1-100-02 Rev. F

Main Equipments list Rev. A

Valves, filters and accessories list Rev. A

Piping list Rev. A

Instruments list Rev. A

Motor list Rev. A

Main Equipments Technical Specification Rev. A

Instruments Specification Rev. A

Electrical & Control Signals List Rev. A

At this stage it is mandatory that MPP and DDEQ establish a protocol to verify that the basic design elaborated fulfills the Technical Requirements (MPP/TN/2005/01 Version 1) and the Technical Note 62.2 edition 1. It has to be understood that a Prototype Pilot Plant might have some uncertainties that will not be clarified until the start up of the unit, and agreed changes might be required at that stage.

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A document with the conclusion of this verification will be released and added to this quotation basis. In case that after the verification improvements or changes over the design should be implemented with relevant impact on the budget of the plant, a new revision of this quotation will be prepared.

# 3.- SCOPE OF SUPPLY

# **3.1.-** Constructive Detail Engineering Contents

The Investment Budget has been calculated considering a Constructive Detail Engineering packet of 780h to execute the following works:

- 1. Definition and Execution of Final P&I'd.
- 2. Definition of utilities required and estimated consumptions.
- 3. Definition and Execution of Final Control Loops Diagram.
- 4. Final Lay-out drawing.
- 5. Final list of: Sensors, valves, lines and components.
- 6. Datasheets of sensors, valves and main equipments.
- 7. Constructive drawings of:
  - Liquid storage tanks and accessory vessels
  - Reactor
  - Frame, supports and skid
- 8. Sufficient drawings for the pipe assembly, including isometric drawing of process lines.
- 9. Final detailed control functional description.

Once this first Data package is ready it will be sent to MPP for revision and approval. Once the approval is received the rest of the Detail Engineering will be carried out and the purchases orders to suppliers will star to be released.

At this stage MPP will deliver the detailed control functional description plus the sensor and motor list with their datasheets to the control supplier (Sherpa) to star working on the PLC definition and program, as well as the scada control screens.

A *"kick off meeting"* with the MPP's control contractor will be held at the UAB in order to clarify all the information provided by DDEQ to this contractor in the Data Package with points 1 to 9 (sensor list, motor list, automatic valves list, data sheets, control loops definitions, and final detailed control functional description).

- 10. HAZOP Analysis over final lay-out and P&ID
- 11. Prepare the "Test Protocols" for DDEQ Test and Commissioning as per stated in point 3.5
- 12. Electrical diagrams for the electrical cabinet. CE marking and legalization of the new cabinet.
- 13. CE marking and legalization of the liquid storage tanks.
- 14. Machines and Equipment Security Evaluation, made by ICICT, S.A. (TÜV Rheinland Group), for a Pilot Plant module installed at the UAB facilities in Cerdanyola del Vallès.

Like for the C-IVa module the notified body will do a Study over Machines and Equipment security based on:

- R.D. 1215/97 about Minimum Security and Health Measures for the use of equipments.
- R.D. 1495/86 about Security in Machines
- UNE-EN norms of application

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The notified body will execute the following works:

- Hazards identification
- Risk analysis according the hazards detected
- Consensus about safety technical solutions based on UNE-EN norms

Final conclusions report and Machinery Conformity / Non Conformity Certificate emission.

To assure the traceability and control over the design, DDEQ will implement a "Design Changes Record". The objectives of this record are:

- a. Assure traceability over design changes: date, problem detected, reason, decision, final change introduced, possible delays, cost.
- b. Assure approval from both MPP and DDEQ.
- c. Decision about who will take the cost of the change.

## 3.2.- Mechanical Turn-key supply of the compartment C-II

Mechanical turn-key supply of the mechanical and electrical equipment corresponding to the Compartment C-II of the Melissa Pilot Plant. The supply will be done in accordance to the "Quotation basis" shown in point 2 and the Detail Engineering to be carried out according to point 3.1.

Previously to any purchase DDEQ will inform UAB which is the selected supplier or contractor. Should the UAB has any inconvenience regarding a supplier or contractor DDEQ will change to another one, unless this might have an economic impact on the project or cause a delay in the schedule.

Mechanical Erection and installation of the unit at DDEQ warehouse and UAB laboratories at Cerdanyola del Vallés

2 Copies of the final dossier

## 3.3.- Electrical supply for the compartment C-II

Following we provide a description of the power and control system that is foreseen for the for the compartment II of MELiSSA Pilot Plant.

Documents of reference:

- Control Loops P&ID (DD-8550-Z1-100-02 rev. F)
- Electrical and control signals list rev. A
- Room Lay-Out (DD-8550-Z1-102-02 rev. 0)

## 3.3.1.- Situation of the electrical cabinet

In previous **meetings** has been discussed with MPP staff the situation and dimensions of the compartment II and its electrical cabinet, which is foreseen out of the skid:

"The electrical cupboards are foreseen by DDEQ out of the skid in order to save space in it and considering the room constraints" (01.10.2009)

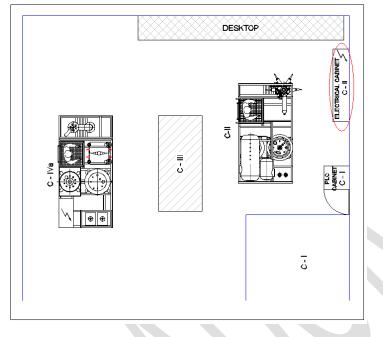
*"MPP mentioned that the C-I PLC cabinet could be moved to the corner near the GC in order to have more space for the C.II skid (to be confirmed by NTE)"* (01.10.2009)

The designed electrical cabinet is **1800x2400x400** and it is conceptually divided in two different parts: power and control. By control we mean concentrate all the control signals from site instruments to the cabinet, to communicate with the main PLC and supervisor (delivered and programmed by others).

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It can be physically divided too in order to be able to go through the pilot plant door.

The situation in the plant of the electrical cabinet is the next:



<u>NOTE:</u> For further details about dimensions refer to Room Lay-Out (DD-8550-Z1-102-02 rev. 0) included in the ANNEX II of the Engineering dossier.

## 3.3.2.- Power and control panel

Supply of **power** and control panel, dimensions 1800 height, 2400 width and 400 depth, mechanized, mounted, connected and with the following elements and devices:

- 1 Base panel and accessories
- 1 Mounting board
- 1 Cooper bar and accessories
- 1 Overvoltage protection Class D IEC 1024-1
- 1 Light switch "On service"
- 1 General switch
- 1 Main ground-fault protection and thermal-magnetic circuit breaker
- 1 Emergency stop push button
- 1 "Emergency stop activated" indicator (red led)
- 1 White light indicator "Voltage in"
- 1 Acknowledge push button
- 1 Security check push button
- 1 Safety relay PREVENTA
- 2 Power supply 24Vdc/10 A
- 1 Single ground-fault protection for all frequency converters
- 1 General ground-fault protection for all the instrumentation
- 1 DIMMER 3-phase to control lightning columns
- 1 Transformer 3-phase 5KVA

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Título:	Module C-II supply
Cliente:	UAB / MPP

Fecha:	19/05/2010
Autor:	Roberto de Miguel
Archivo:	EXS-M0127 Rev 1.docx

De Dietrich PROCESS SYSTEMS DE DIETRICH EQUIPOS QUÍMICOS S.L.

- 1 Single thermal-magnetic protection for 7 lightning columns
- 1 Current metering and 4-20mA conversion
- 1 DIMMER protection security circuit against low load in the output
- 1 RS232/Ethernet converter
- $1 \rightarrow$  Wiring of the following control signals:
  - 38 Digital inputs
  - 43 Analogical inputs
  - 38 Digital outputs
  - 15 Analogical outputs
- $1 \rightarrow$  Set of galvanic isolators
- $1 \rightarrow$  Set of thermal-magnetic circuit breakers
- $7 \rightarrow$  Single-phase frequency converters 1,5KW
- $8 \rightarrow$  Contactors
- $1 \rightarrow$  Heater starter
- $1 \rightarrow$  Set of circuit breaker auxiliary switch
- $1 \rightarrow$  Set of connection strips
- $1 \rightarrow$  Elements and devices mounted and connected according CE directive
- $1 \rightarrow$  Design, technical managing and documentation

#### **IMPORTANT NOTES:**

- > It is not foreseen the connection to the plant power/pneumatic supply.
- The material included in these lists is the necessary for the electrical and control signals according to the Basic Engineering Design.

## 3.3.3.- Electrical erection and commissioning of compartment C-II

The materials which are required for this action are:

- 20 m galvanized cable tray 60x60 mm (without cover).
- 20 m galvanized cable tray 300x60 mm (without cover).
- Trays mounting accessories.
- 60 m shielded cable 4x0,5 mm²
- 20 m blue shielded cable 8x0,5 mm²
- 150 m cable 4x0,5 mm²
- 100 m shielded cable 4x1,5 mm²
- 200 m shielded cable 3x1,5 mm²
- 250 m flexible conduit.
- 10 m heat-shrinkable tubing.
- Other connection and mounting accessories.

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- Cable signalling.
- 60 m pneumatic tubing.
- 3 emergency stop pushbuttons.
- Other pneumatic accessories.

#### 3.3.4.- Photo-bioreactor Lighting system

The illumination system consists of 200 halogen lamps which surround the glass jacketed pipe section (DN200, L=1500m).

The type of lamps used will be the specified in the technical note 62.2 and are: OSRAM 12V, 20W BAB 38°.

#### **3.3.5.- Lighting system structure**

The lights will be set-up on a portable structure made of stainless-steel with 10 columns of 20 halogen lamps of 20W 12V each.

It will include 2 or 3 connection boxes sited on the half height of the structure.

These boxes will receive the cables from the lamps to link in 2 o 3 cables all the power to the main electric panel.

#### 3.3.6.- Phoenix material

Set of Phoenix materials. In module C-IV these elements were supplied by NTE but in C-II will be in our scope,

- Interface modules VARIOFACE FLKM50/MOFI-TSX/Q.
- Connectors PLC-V8/FLK14/OUT.
- Connectors PLC-V8/FLK14/IN.
- Relay PLC_RSP-24UC/21AU (24VDC).
- Plug-in bridges FBST 500-PLC BU
- Separating plates PLC-ATP BK.

# 3.4.- Manuals:

The manuals will be issued in English once points 1 to 9 of the Detail Engineering are approved by the MPP and while the module skid is pre-assembly in DDEQ's warehouse. The manuals should be delivered to MPP at the same time the pilot skid is installed in the UAB's laboratories.

#### 3.4.1.- Operation Manual:

The Operation Manual will contain:

- System description.
- Components description.
- Detailed Operation Sequences:
  - Plant Start-up.
    - o Liquid feeding

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- o Reactor start-up
- Reactor jacket fill up and temperature control
- o Liquid harvesting
- o pH control reactive addition
- o Gas feeding
- o Gas outlet regulation
- Temperature regulation in the jacketed equipment.
- o Inert loading to the buffers
- Plant Stop. Description by homogeneous conjunctions:
  - o Gas feeding stop
  - o Gas outlet stop
  - Liquid feeding stop
  - o Liquid harvesting stop
  - Reactor stop
  - o Reactor jacket emptying
  - o Jackets Heating/cooling systems stop
  - o pH control reactive addition stop
  - o Buffers emptying
- Microorganism inoculation sequence
- Pumps and filters installed in Stand-by change sequence.
- Sterilization:
  - o Tanks sterilization
  - o Reactor sterilization
  - o Pumps sterilization
  - Filters sterilization
- Safety advices
- Service on hardware
- Calibrations advices
- Cleaning
- Control Loops Description and Initial Settings configuration of process parameters supplied by MPP to the control supplier. The optimization and fine adjustment of the settings will be responsibility of the MPP. If during the optimization and adjustment of the settings problems might arise due to the equipment supply, DDEQ will provide assistance to the MPP team.
- Alarms Description and Initial Set Points. The alarm management protocol will be responsibility of the MPP.

#### 3.4.2.- Technical Dossier

- Check list of standard controls (routine maintenance and service on hardware) to be executed by the plant operator
- Compilation of operation, maintenance manuals and technical documents provided by the different suppliers of the equipment installed in the plant. Whenever it is possible this information will be supplied in electronic format as well.
- Spare part list for two years operation

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# 3.5.- Test and commissioning of the Pilot Unit

## 3.5.1.- FAT by DDEQ

#### 3.5.1.1.- Mechanical

Once the skid is pre-assembled at DDEQ's warehouse and before the shipment to UAB's laboratories MPP will assist to FAT verification consisting in:

- Verify that final approved P&I'd diagram has been observed in the assembly
- Verify that the sensors, valves and equipments used are the specified ones according the project datasheets.
- Verify supports robustness.

<u>NOTE:</u> A mechanical FAT record will be signed both by MPP and DDEQ and the shipment date to UAB's laboratories will be agreed. The duration of this FAT test will be 2 or 3 working days.

No test with fluids will be included in the mechanical FAT as there are not such services at DDEQ's warehouse.

#### 3.5.1.2.- Electrical

The cabling of the C-II module will be executed at UAB premises. Therefore the Electrical FAT will focus only in the power and control cabinets delivered by DDEQ. This FAT will take place at DDEQ's electrical contractor premises.

The Electrical FAT will consist in:

- Verify that all the sensors, automatic valves and equipments included in the P&I'd appears in the electrical diagrams.
- Verify that the electrical diagrams have been observed during the manufacturing of the cabinets.
- Test the power and control cabinets simulating the signals.
- Test the lighting system for the photo bio-reactor

<u>NOTE:</u> An electrical FAT record will be signed both by MPP and DDEQ and the shipment date to UAB's laboratories will be agreed. The duration of this FAT test will be 2 working days.

## 3.5.2.- SAT by DDEQ

#### 3.5.2.1.- Mechanical

The following tests have been considered for the plant commissioning based on a scheduled commissioning of fifteen (15) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Erection Manager (DDEQ)
- Mechanic official (DDEQ Contractor)
- MPP (permanent dedication of plant operator and technical staff)

The works to be done are:

- Pressure test with water for the liquid tanks and lines, as well as the reactor.
- Pressure test with compress air of the Gas lines and buffers.

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- Pressure test with steam of the steam and condensate lines. After that a resume of sterilization sequences will be done. Resume means:
  - Not waiting all the sterilization time required until the temperature is reached
  - Not probing all the sterilization sequences but: tanks and complete sections between reactor and tanks. Sequences of individual equipment will not be checked.
- Pressure test with water of the heating / cooling circuits of the jacketed equipment.
- Test certificates and protocols filled up with the results

<u>NOTE</u>: For the mechanical SAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1. At the end of the mechanical SAT a record will be signed both by MPP and DDEQ.

## 3.5.2.2.- <u>Electrical</u>

The following tests have been considered for the plant commissioning based on a scheduled commissioning of ten (10) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Erection Manager (DDEQ)
- Electrical official (DDEQ Contractor)
- MPP (permanent dedication of plant operator and technical staff)

The works to be done are:

- Check of the spin direction of motors.
- Check the power supply to all the instruments.
- Check the output signals from the instruments to the cabinet.
- Check alarms contacts in the cabinet and signals to be sent to the PLC.
- Simulate PLC input signals from the cabinet to instruments and control valves.
- Test of the lighting system of the reactor and the air cooling equipment.
- Initial configuration (settings) of instruments and sensors.
- Test certificates and protocols filled up with the results.

<u>NOTE</u>: For the electrical SAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1. At the end of the mechanical SAT a record will be signed both by MPP and DDEQ.

## 3.5.2.3.- <u>Control</u>

The control commissioning will not be started until the mechanical and electrical commissioning (as per indicated in points 3.5.2.1 and 3.5.2.2) is finished.

To perform this part of the commissioning it is mandatory that both the PLC cabinet and PLC/supervision programs are finished, verified and implemented, and all the interconnecting cabling between DDEQ's cabinet and the PLC cabinet (supplied by others) is done. The interconnecting cabling is also out from DDEQ's scope.

The following tests have been considered for the plant commissioning based on a scheduled commissioning of ten (10) working days. The foreseen test team is:

• Project Engineer (DDEQ)

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- Project Engineer (Sherpa)
- MPP (permanent dedication of plant operator and technical staff)
- Electrical official (DDEQ Contractor + Sherpa Contractor) If required because of problems

The works to be done are:

- Verify the arrival of the inputs signal from DDEQ's cabinet to the PLC cabinet
- Verify the arrival of PLC commands to DDEQ's cabinet
- Verify consistency in the measurements in the onsite instruments with the supervisor lectures.

# We do not include any verification about the control loops program stability or performance, which is fully responsibility of the control supplier.

For further assistance or more extensive test and checks DDEQ will provide in point 5 "Price and Payment conditions" a daily net rate for engineers and technicians.

# 4.- EXCLUSIONS

The following services and works have not been taken into account in the present quotation and, therefore, are explicitly exclude of the scope of supply:

- Mechanical connections to UAB utilities nets (steam, air, CO₂, water,...)
- Gas analyzers are not defined yet by MPP. Therefore DDEQ has foreseen an estimation for its installation. Once MPP defines the gas analyzers desired for module C-II, DDEQ will evaluate the technical requirements. If necessary DDEQ will implement a Design change in the "Design Changes Record" as indicated in point 3.1.
- Electrical interconnecting cabling from DDEQ's electrical cabinet for compartment C-II and the PLC cabinet, and from the PLC cabinet to the control room computer. Neither the main power supply from UAB's general line to DDEQ's cabinet is included.
- Carrying out the communication test between the electrical cabinet of new supply for the compartment C-II and the PLC cabinet, and from the PLC cabinet to the control room computer is responsibility of the control supplier. DDEQ will attend these test as stated in point 3.5.2.3
- Commissioning of the PLC program and the supervisor system implemented in the control room computer. Neither the operation manual of these elements is included.
- Plant star-up with process fluids.
- Plant validation and/or qualification.
- Further engineering works, out of what is clearly stated in the present proposal, as per example:

<u>Note:</u> If any or the following works/tasks (or other not listed here) is required by the UAB, they will be invoiced separately accordingly to the "Daily rates" shown in point 5.2

- o Isometric drawings of the pipes but the process ones.
- Engineering works to accommodate UAB facilities or utilities to the requirements of the unit (connections, modifications in services nets,...)
- Drawings "as built" of the equipment showing the changes implemented over the approved detail constructive project.

<u>Note</u>: A revised version of the P&I'd drawing will be released free of charge, including all the changes, modifications and extension works implemented during the erection or

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commissioning of the equipment. In the same way, addendums over the manuals will be released to show **important changes** over the approved detail constructive project.

- Assistance and coordination with the Control Engineering involved in the project. The responsibility of control implementation is out of DDEQ's scope. A kick off meeting with the MPP's control contractor will be held at the UAB in order to clarify all the information provided by DDEQ to this contractor in the Data Package with points 1 to 9 as shown in point 3.1 (sensor list, motor list, automatic valves list, data sheets, control loops definitions, and final detailed control functional description).
- o Engineering works to assure the right integration of the different modules of the Melissa loop.
- Environmental engineering concerning liquid or gaseous effluents
- o Edition of Plant Operation Protocols for the field Operator
- Edition of Operational Emergencies and Alarms Management Protocol
- Edition of Sensor and Instrument Calibration Protocol
- Any legalization or CE marking of the pilot unit exceeding the Study over Machines and Equipment security edited by ICICT, S.A. (TÜV Rheinland Group)
- External sub-supplier management outside the scope of supply of the unit described in this proposal
- Official or legal projects, if necessary or required, as per example: Pressure Equipment Installation Project, Low Voltage Project, ....
- Further assistance services, out of what is clearly stated in the present proposal, as per example:
  - o Check over the operational sequences, one by one.
  - o Commissioning of the equipment with real process fluids.
  - o Validation of the sterilization of the plant prior to its start-up in production
  - o Once the commissioning phase is finished:
    - Optimization of the initial Control Settings and Alarm Set Points
    - Optimization of the Maintenance sequences and Cleaning instructions
  - o Others

# **5.- PRICE AND PAYMENT CONDITIONS**

# 5.1.- Price of the plant

The price of the Pilot Unit corresponding to Compartment C-II of the Melissa Pilot Plant according to the base equipment described in the Budget Rev. 0 included as Attachment 1 is:

#### NET PRICE (VAT excluded): -.669.301€.-

<u>Note</u>: The above price is a "fix price" according to "2.- Quotation Basis", that will allow the UAB/MPP to place an order to DDEQ in order to fulfill the required delivery schedule. If during the constructive detail engineering the relevant changes in the design appear they will be reflected in the "Design Changes Record" and the economic impact must be agreed between both parties.

# 5.2.- Daily rates for special assistance or test

Any further assistance, out of what is clearly stated in points 3.1 and 3.5 of this quotation, required by the MPP both, during the detail engineering (coordination with control engineering, other

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suppliers,...) or during the commissioning of the plant, will be invoiced according to the following daily rates:

Senior Engineer (mechanical or electrical/control):		40 €/day
Assembling coordinator:	56	50 €/day
Mechanic:	48	35 €/day
Electrician:	48	35 €/day
Travel expenses:	According to de	estination

# 5.3.- Orders and Payment conditions

DDEQ proposes the following payment conditions:

- 20% down payment at order placement, payment at 90 days after invoicing
- 30% at delivery of points 1 to 9 of the Detail Engineering as stated in point 3.1, payment at 90 days after invoicing
- 20% at conclusion of mechanical FAT test as stated in point 3.5.1.1, payment at 90 days after invoicing
- 10% at conclusion of electrical FAT test as stated in point 3.5.1.2, payment at 90 days after invoicing
- 5% at delivery of manuals as stated in point 3.4, payment at 90 days after invoicing.
- 5% at conclusion of the equipment installation at the UAB facilities at Cerdanyola del Vallès, payment at 90 days after invoicing
- 5% at the conclusion of the commissioning as stated in point 3.5, payment at 90 days after invoicing.

# 6.- PROPOSAL VALIDITY

This proposal is valid for a period of two natural months.

# 7.- PROJECT PLANNING

In practice the development of the Project will be mainly influenced by UAB/MPP final decisions about different design alternatives and the administrative delays in order to place the order and contract writting. Also delays in intermediate approvals will cause a longer delivery time for the skid.

Assuming an optimal schedule in the development of the project, the schedule would be as shown in the annex.

# 8.- GUARANTEE

DE DIETRICH EQUIPOS QUÍMICOS S.L., guarantees for one (1) operation year, against manufacturing defects or material failures, all the equipment supply and the erection and assembly works executed by its contractors. The guarantee applies only to the repair or the reposition of the defect element or equipment, once the defect is verified, checked and accepted as guarantee issue.

Elements subjected to wear and/or ageing are not covered by the present guarantee. For example (but not limited) mechanical seals, measurement probes, joints,...Neither is covered negligence in the operation of the equipment and normal maintenance or cleaning operations over the equipment, as well as, accidental failures of the unit.

As mentioned before, the guarantee covers only the repair / replacement of the damaged/defect equipment. No other service or compensation is covered. For third party components or equipments, if any, the guarantee will be provided by the manufacturer.

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# 9.- GENERAL PROJECT CONDITIONS AND LIABILITY LIMITATION

- The works covered under this proposal will be considered finished as soon as the commissioning tests stated in point 3.5 are finished satisfactorily.
- Design will be implemented under the guidelines and process requirements provided by the UAB, and according to the good engineering practices known by DDEQ. Before the order is placed to DDEQ it is mandatory that MPP and DDEQ establish a protocol to verify that the basic design elaborated fulfills the Technical Requirements (MPP/TN/2005/01 Version 1) and the Technical Note 62.2 edition 1. It has to be understood that a Prototype Pilot Plant might have some uncertainties that will not be clarified until the start up of the unit, and agreed changes might be required at that stage.
- The engineering works executed by DDEQ, and consequently equipment supply, do not mean that DDEQ has any liability in case the throughout put of the unit is less or different from the foreseen one. Process responsibility is charge of the MPP.
- DDEQ will not accept any liability for direct or indirect damages causes without the intention to harm as per example: production looses, third part claims, prestige looses, overall project delays,... DDEQ will not be responsible either for defects or damages arising from wrong or incomplete information delivered by the UAB/MPP.
- The MPP will designate a main interlocutor to evacuate through all the correspondence, question, doubts,..The same person will concentrate all the information and questions from the MPP to DDEQ.

# **10.- CONFIDENTIALITY**

All documents, data and information of the Project shared between MPP and DDEQ will be considered as confidential unless it is explicitly agree between both parts, is of public domain at the date of signing the contract or its use is necessary for the normal development of the project (inquiries or contracts to suppliers or contractors).

# 11.- ANNEX

Investment Budget Rev.0

Project planning

Barcelona, May 19th 2010 DE DIETRICH Equipos Químicos,S.L

> Fdo. Roberto de Miguel Managing Director

Fdo. Josep Mestre Technical manager

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# MELiSSA Pilot Plant



Universitat Autònoma de Barcelona

Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 180 / 275

# 11. PROPOSAL UPDATE (JUNE 2010)

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Av. Príncep d'Asturies 43-45, 1r-5a		CUSTOMER: UAB / MELiSSA		
E-08012 BARCELONA		PROJECT: MELISSA COMPARTMENT II		Ι
	De Dietrich	DATE: 01/06/2010	PREPARED: J. C	UBERN
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#### **PROPOSAL OF CHANGES IN PLANT DESIGN**

## 1. Object:

After the last meetings, some new requirements for the design have appeared. This document describes the proposed changes in the design of the plant regarding the Basic Engineering.

Documents of reference:	P&ID: DD-8550-Z1-100-01 rev. G		
	Influent/effluent tanks specifications: DD-8550-Z1-101-02 rev. B		
	Process gas buffer specifications: DD-8550-Z1-101-03 rev. B		
	Helium buffer specifications: DD-8550-Z1-101-04 rev. B		
	Reactor lighting system: DD-8550-Z1-101-06 rev. A		

**NOTE:** All the modifications on the P&ID have been indicated with a mark on the drawing.

# 2. Compartment II Gas system

There are two independent gas loops in the plant: venting system for influent/effluent tanks and process gas circuit. Each loop has been studied independently.

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## 2.1. Venting system for tanks: influent and effluent

member of **De Dietrich** 

#### 2.1.1 Introduction

The influent/effluent tanks should be maintained, as all the plant, in anaerobic conditions.

The designed system has a way of allowing the inert gas (helium) into the tank, and a way to vent the gas when the pressure gets too high.

The helium is stored in a buffer tank, which is used for the inertization of influent and effluent tanks. This buffer must operate at a higher pressure than the process tanks so, for vented gas storage a gas compressor is needed.

A transmitter measures the influent/effluent tanks pressure and actuates over both automatic valves (helium inlet/helium vent).

#### 2.1.1 Helium buffer design: volume and characteristics

The buffer volume is defined from the volume of gas to storage and the compressor compression factor.

In order to define the volume of this buffer, it is important to take into consideration the process requirements. In view of the compressor required, there are two different situations: filling/emptying of tanks and steady operation.

During steady operation, the flow of helium vent coming from the effluent tank will be 0.5 - 9 l/h of gas (according to *MPP/TN/2005/01)*.

During the influent tank filling, the flow of helium will be higher. It will be defined from the time of the filling operation duration (flow of liquid).

# 2.1.1.1 Steady operation:

Vent flow: 0.5 - 9 l/h

The compressor defined (GC 2004 01) is a double diaphragm pump and its technical data are:

- Flow: 5 l/min
- Inlet pressure: 200 mbarg
- Outlet pressure: 2 barg
- Maximum permissible pressure: 3.5 barg
- Motor: 230V/50Hz/IP44

The compressor operation flow, 5 l/min (300 l/h), is given from the compressor high outlet pressure required. To achieve this flow in the compressor inlet, a recirculation around the compressor has been planned, in order to maintain 200 mbarg on the compressor inlet.

# A recirculation around the compressor requires: a new pressure transmitter and a new solenoid valve.

The gas compressor is always ON. The pressure transmitter (set-point: 200 mbar₉) modulate the solenoid valve permitting the gas recirculation to the compressor inlet in order to maintain 200 mbar₉. The recirculation rate would be high in order to maintain the compressor inlet flow in 5 l/min.

The high rate of circulated gas across the compressor can cause the gas warm-up as a consequence of the compression.

An exterior cooling coil is proposed for the helium buffer, operated manually depending on the temperature measured in the new thermometer installed on the tank.

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## 2.1.1.2 Filling/emptying of tanks

# After studding the compressors availability, a second compressor for the influent tank filling operation is required.

During the influent tank filling, helium vent flow will be higher than 5 l/min so, the compressor (GC 2004 01) will not be capable to compress this gas flow.

Before starting filling operation, vent flow should be manually diverted to the new compressor (GC 2004 02) which will be a double diaphragm pump and its technical data are:

- Flow: 15 l/min
- Inlet pressure: 200 mbarg
- Outlet pressure: 2 barg
- Maximum permissible pressure: 3.5 barg
- Motor: 230V/50Hz/IP44

**IMPORTANT NOTE:** In order to avoid the vacuum formation in tank, influent tank pressure control loop should be activated.

For the study of the buffer volume, starting points for the calculations are:

- This buffer should be <u>always</u> capable of maintaining the influent/effluent vessels pressure controlled in order to ensure the axenity of the plant.
- The gas will be a mixture of gases. Because of its composition, pure helium can be assumed (Ideal gas case)
- The minimum pressure of the buffer (during the effluent tank emptying) is 750 mbarg approximately.
- During nominal operation the buffer will work at 2 barg (compressor outlet pressure).

The resultant volume for the helium buffer is 240 L.

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## 2.1.2 Tanks venting system operational sequences.

The outlet pressure given by the compressors is 2 barg, work pressure of the helium buffer.

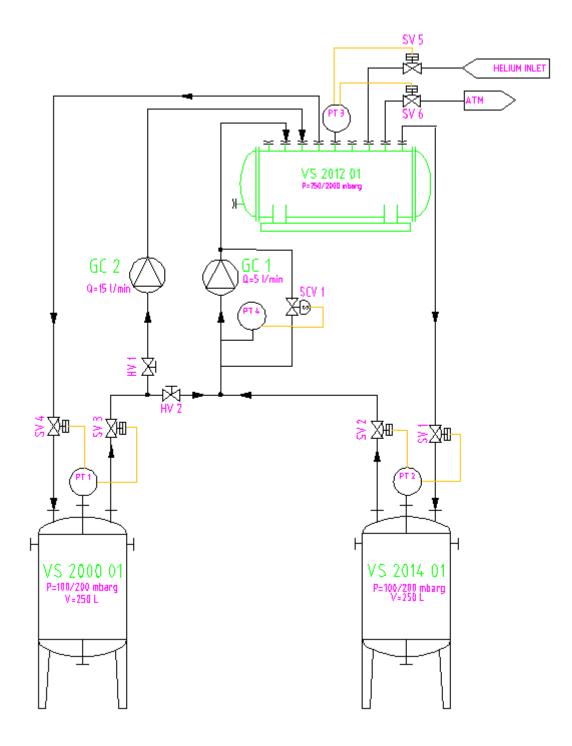
During the start-up of the plant, the helium buffer pressure should be lower than 2 barg in order to accept the 250 L of helium moved during the tank filling. As seen while doing the calculations, the buffer starting pressure (for plant starting-up) should be 750 mbarg approximately.

During nominal operation, the buffer will be pressurized (2 barg) and consequently, the emptying/filling of tanks sequence should be clearly defined.

**IMPORTANT NOTE:** It will be necessary to empty the effluent tank before filling the influent tank. While emptying the effluent tank, the buffer pressure will fall around the 750 mbarg. With buffer working at 750 mbarg is possible to continue operating with the foreseen pressure control loops of influent/effluent tanks and, when necessary, to fill the influent tank.

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A schematic view of the influent/effluent tanks venting system is:



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#### 2.1.2.1 Alarms and set-points value definition

It is important to define these values for a better understanding of the system operational.

**IMPORTANT NOTE:** All the values foreseen need to be better defined and adjusted during control SAT tests depending on the system stability.

a) Influent tank pressure transmitter (PT1):

- HH	: 250 mbarg	$\rightarrow$	open SV3
- H:	200 mbarg	$\rightarrow$	close SV3
- L:	100 mbarg	$\rightarrow$	close SV4
- LL:	50 mbarg	$\rightarrow$	open SV4
b) Effluent tank pres	sure transmitter	(PT2):	
- HH	: 250 mbarg	$\rightarrow$	open SV2
- H:	200 mbarg	$\rightarrow$	close SV2

- L: 100 mbarg  $\rightarrow$  close SV1

- LL:	50 mbarg	$\rightarrow$	open SV1

c) Buffer pressure transmitter (PT3):

- HH:	2200 mbarg	$\rightarrow$	open SV6
- H:	2000 mbarg	$\rightarrow$	close SV6
- L:	600 mbarg	$\rightarrow$	close SV5
- LL:	400 mbarg	$\rightarrow$	open SV5

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E-08012 BARCELONA		PROJECT: MELISSA (	COMPARTMENT I	Ι
	member of <b>De Dietrich ()</b>	DATE: 01/06/2010	PREPARED: J. G	JUBERN
	PROCESS SYSTEMS	PAGE 8 of 13	Ref. PRK-005449	

# 2.1.2.1 Tanks emptying/filling sequences description

- 2.1.2.1.1 Nominal operation:
- A. Effluent tank emptying:
  - Start emptying the tank
  - When: effluent tank pressure < 50 mbarg (LL alarm)  $\rightarrow$  open the valve SV1. The helium is entering into the tank.
  - When the emptying is finished, the pressure of the tank will start increasing till tank pressure = [100-200] mbarg → close the valve SV1.

In this moment, 250 liters of helium have been moved to the effluent tank and the buffer pressure has fallen to 750 mbarg.

**IMPORTANT NOTE:** In this situation (Buffer pressure = 750 mbarg) is possible to continue with nominal operation or/and start the influent tank filling.

#### B. Influent tank filling:

- Close the manual valve HV1
- Open the manual valve HV2
- Start the compressor GC2
- Start filling the tank
- When: influent tank pressure > 250 mbarg (HH alarm)  $\rightarrow$  open the valve SV3. The helium of the tank is compressed by GC2 and sent to the buffer tank.
- When the filling is finished, the pressure of the tank will start decreasing till tank pressure = [100-200] mbarg  $\rightarrow$  close the valve SV3.

In this case, 250 liters of helium have been moved from the influent tank to the buffer and its pressure has rise to 2000 mbarg.

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2.1.2.1.1 Plant start-up:

When the plant is totally filled-up with helium:

- Influent/Effluent tank pressure = [100-200] mbarg.
- Buffer pressure = 750 mbarg.
- Influent tank filling:
  - o Close the manual valve HV1
  - Open the manual valve HV2
  - o Start the compressor GC2
  - Start filling the tank
  - When: influent tank pressure > 250 mbarg (HH alarm) → open the valve SV3. The helium of the tank is compressed by GC2 and sent to the buffer tank.
  - When the filling is finished, the pressure of the tank will start decreasing till tank pressure = [100-200] mbarg → close the valve SV3.

In this case, 250 liters of helium have been moved from the influent tank to the buffer and its pressure has rise to 2000 mbarg.

The system is prepared for starting with nominal operation:

- Influent/Effluent tank pressure = [100-200] mbarg.
- Buffer pressure = 2000 mbarg.

# 2.2 Process circuit gas

#### 2.2.1 Introduction

The reactor gas outlet is compressed and sent to a buffer which is designed in order to increase the compressor stability as in this compartment, gas loop is a critical point for maintaining the axenity of the entire plant.

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# 2.2.2 Bioreactor outlet gas buffer design: volume and characteristics

The compressor foreseen for the bioreactor gas outlet (the same as GC 2004 01) is a double diaphragm pump and its technical data are:

- Flow: 5 l/min
- Inlet pressure: 200 mbarg
- Outlet pressure: 2 barg
- Maximum permissible pressure: 3.5 barg
- Motor: 230V/50Hz/IP44

According to the document MPP/TN/2005/01, the bioreactor outlet flow will be 0 - 2 l/min so, a recirculation for the compressor is foreseen too.

A recirculation around the compressor requires: a new pressure transmitter and a new solenoid valve.

# 3. Bioreactor design: Illumination system

# 3.1. Introduction

After internal discussions, MPP has changed the illumination system requirements. The new number of lamps to install is from 190 (minimum number of lamps) to 270 (ideal) lamps.

Studying the feasibility of the mechanical installation of 270 lamps surrounding the glass cylinder, it has been seen that is possible. Another thing for taking into account is the thermal balance for refrigerating air system design.

# 3.2 Reactor thermal balance

- Number of lamps = 270
- Design flow of air =  $1700 \text{ m}^3/\text{h}$
- Illumination column diameter = 430 mm

# **NOTE:** The lamps are foreseen to install at 10 mm of the reactor glass jacket outlet wall.

- Air ducts diameter = 260 mm

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	member of <b>De Dietrich</b>	DATE: 01/06/2010	PREPARED: J. G	UBERN
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**IMPORTANT NOTE:** If the air refrigeration system should be capable to <u>maintain</u> the reactor temperature in case of refrigeration water system failure, the system should be designed as calculated in "EMERGENCY OPERATION"

NUMBER OF LAMPS		270	250	230	210	190
Lamp power	W			20		
Lamps power	W	5400,00	5000,00	4600,00	4200,00	3800,00
(Assumed) Power converted into heating	%			90		
Lamps heat	W	4860,00	4500,00	4140,00	3780,00	3420,00
(Assumed) Agitation heat	W	2200,00	2200,00	2200,00	2200,00	2200,00
(Assumed) Reaction heat	W	0	0	0	0	0
STEADY OPERATION						
Total heat to remove	W	7060,00	6700,00	6340,00	5980,00	5620,00
Heat removed by bioreactor jacket	W			2900,00		
Heat to be removed by the refrigeration air	W	4160,00	3800,00	3440,00	3080,00	2720,00
Required air flow	m ³ /h	1386,67	1266,67	1146,67	1026,67	906,67
Design flow for blower selection	m³/h	1664,00	1520,00	1376,00	1232,00	1088,00
PVC JACKET						
Desired air velocity	m/s			9		
(Assumed) Free section: lamps and supports	%			70		
Required pass section	m ²	0,07	0,07	0,06	0,05	0,05
Inside diameter (Wall of reactor glass jacket)	m			0,27		
Calculated outside diameter	m	0,41	0,40	0,39	0,38	0,37
Minimum required diameter (mechanical restrictions)	m			0,43		
Minimum section	m²	0,09	0,09	0,09	0,09	0,09
Real air velocity	m	5,25	4,80	4,35	3,89	3,44
AIR DUCTS						
Desired air velocity	m/s	9,00	9,00	9,00	9,00	9,00
Calculated pass section	m²	0,05	0,05	0,04	0,04	0,03
Ducts diameter	m	0,26	0,24	0,23	0,22	0,21
EMERGENCY OPERATION						
Total heat to remove	W	7060,00	6700,00	6340,00	5980,00	5620,00
Heat removed by bioreactor jacket	W			0		
Heat to be removed by the refrigeration air	W	7060,00	6700,00	6340,00	5980,00	5620,00
Required air flow	m³/h	2353,33	2233,33	2113,33	1993,33	1873,33
Design flow for blower selection	m³/h	2824,00	2680,00	2536,00	2392,00	2248,00

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E-08012 BARCELONA		PROJECT: MELiSSA C	COMPARTMENT I	[
	member of <b>De Dietrich</b>	DATE: 01/06/2010	PREPARED: J. G	UBERN
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#### PVC JACKET

Desired air velocity	m/s			9		
(Assumed) Free section: lamps and supports	%			70		
Required pass section	m²	0,12	0,12	0,11	0,11	0,10
Inside diameter	m	0,27	0,27	0,27	0,27	0,27
Outside diameter	m	0,48	0,47	0,46	0,46	0,45
Air velocity during steady operation	m/s	3,71	3,57	3,42	3,24	3,05
AIR DUCTS						
Desired air velocity	m/s			9		
Calculated pass section	m²	0,09	0,08	0,08	0,07	0,07
Ducts diameter	m	0,33	0,32	0,32	0,31	0,30

## 4. Plant inertization system for plant starting-up



# For the inertization of the plant during start-up, a vacuum system is foreseen: vacuum pump, manual valve and manometer.

It will be necessary to connect the pump to the plant and do vacuum (10/20 mbar) followed of an inert gas inlet (900/100 mbar). This cycle should be repeated 2/3 times in order to guarantee the plant axenity.

Before disconnecting the horse of the system, it should be vented through the manual valve. If is necessary to take some gas sample, it is possible by means of the same valve.

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$\checkmark$	PAGE 13 of 13	Ref. PRK-005449	

#### 5. Other design changes

#### 5.1 Plate heat exchanger for bioreactor jacket heating

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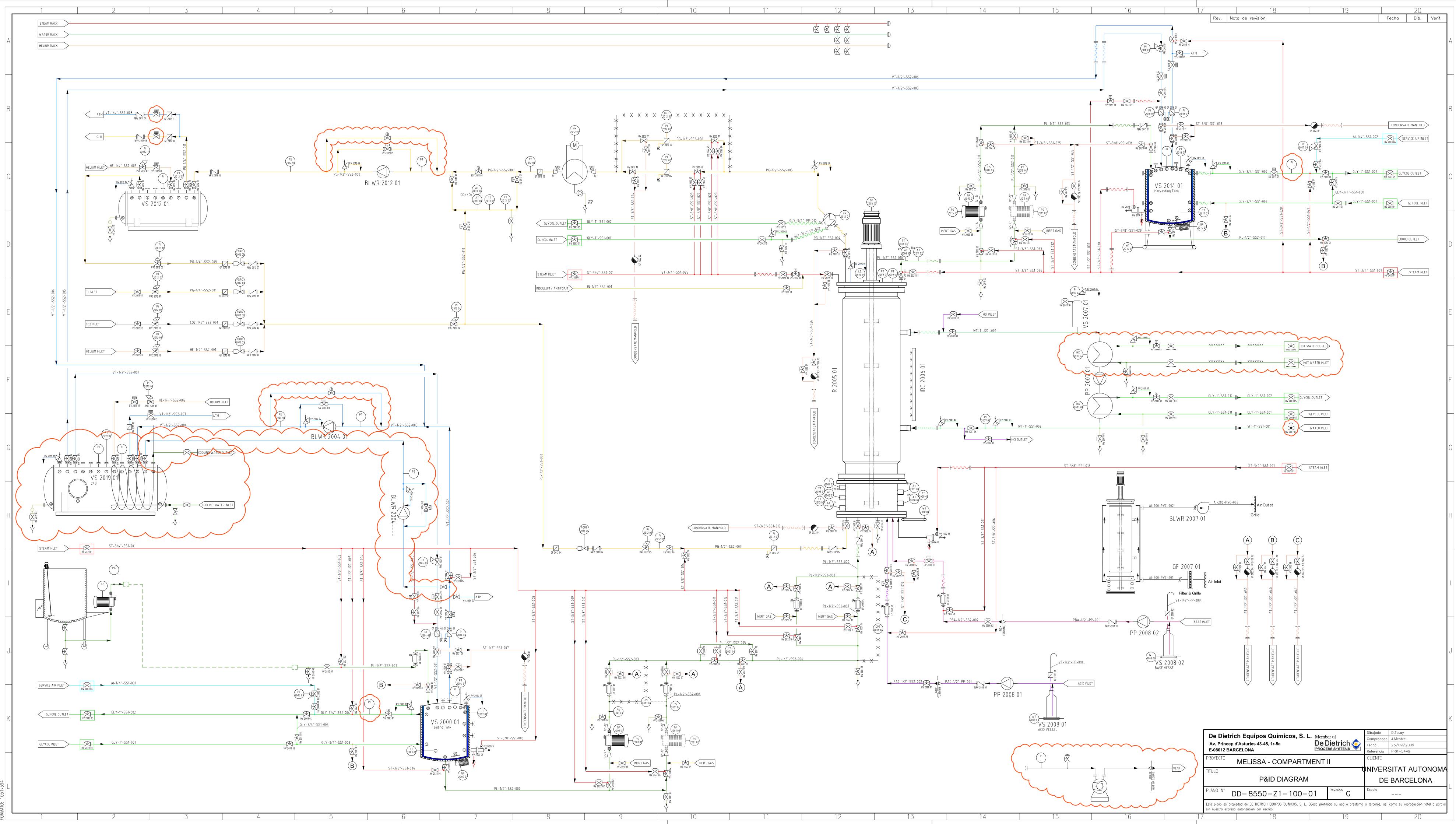
The electrical resistance that was previously foreseen has been replaced with a plate heat exchanger operating with hot water at 49 °C (available in MPP).

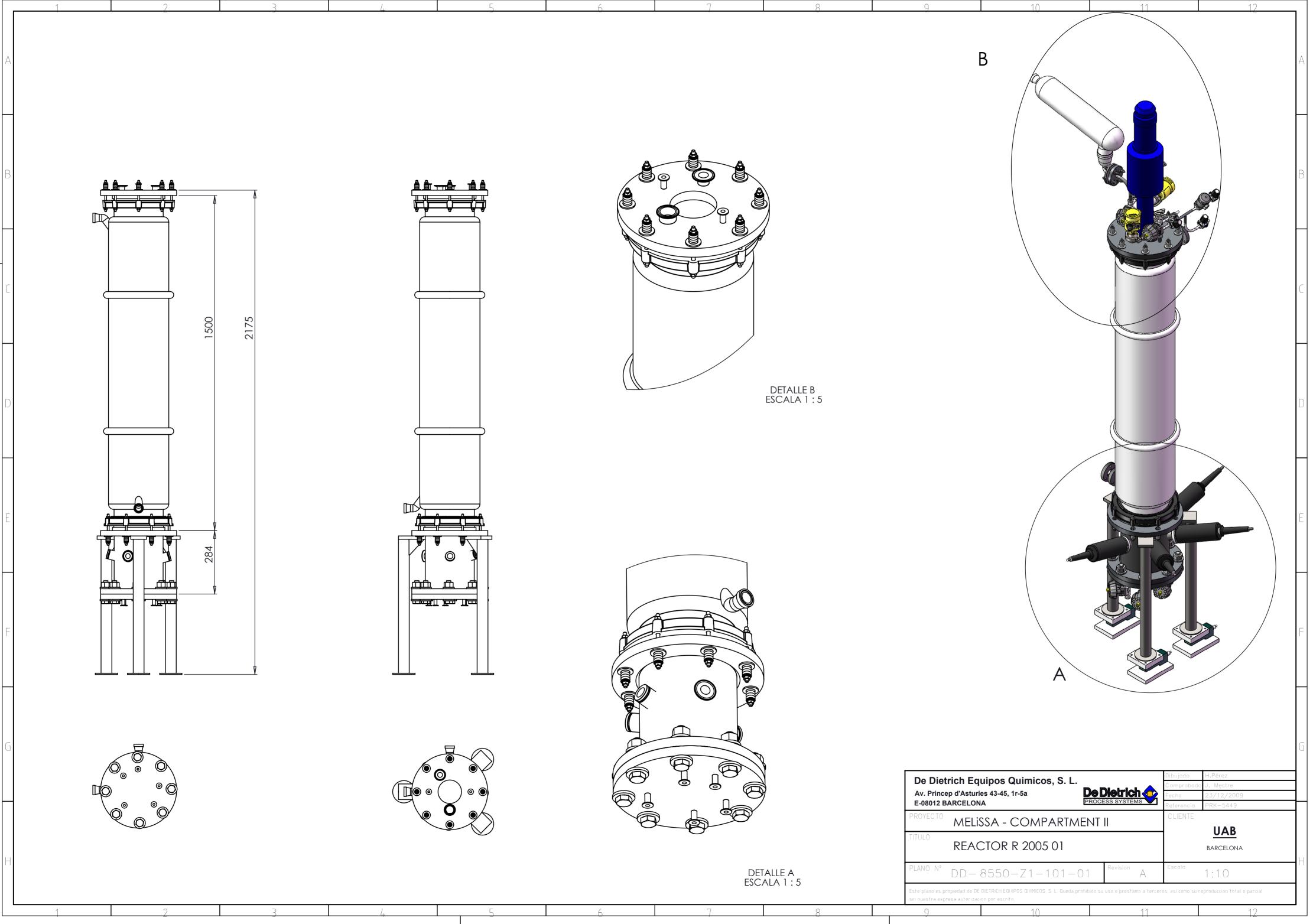
#### 5.2 Automatic valves for compartment produced gas outlet

Two automatic valves will be installed in the gas outlet instead of the gas flow meters/controllers that were previously foreseen. The reason for this change is that the way to interconnect the different MELiSSA compartments is still not decided by MPP people.

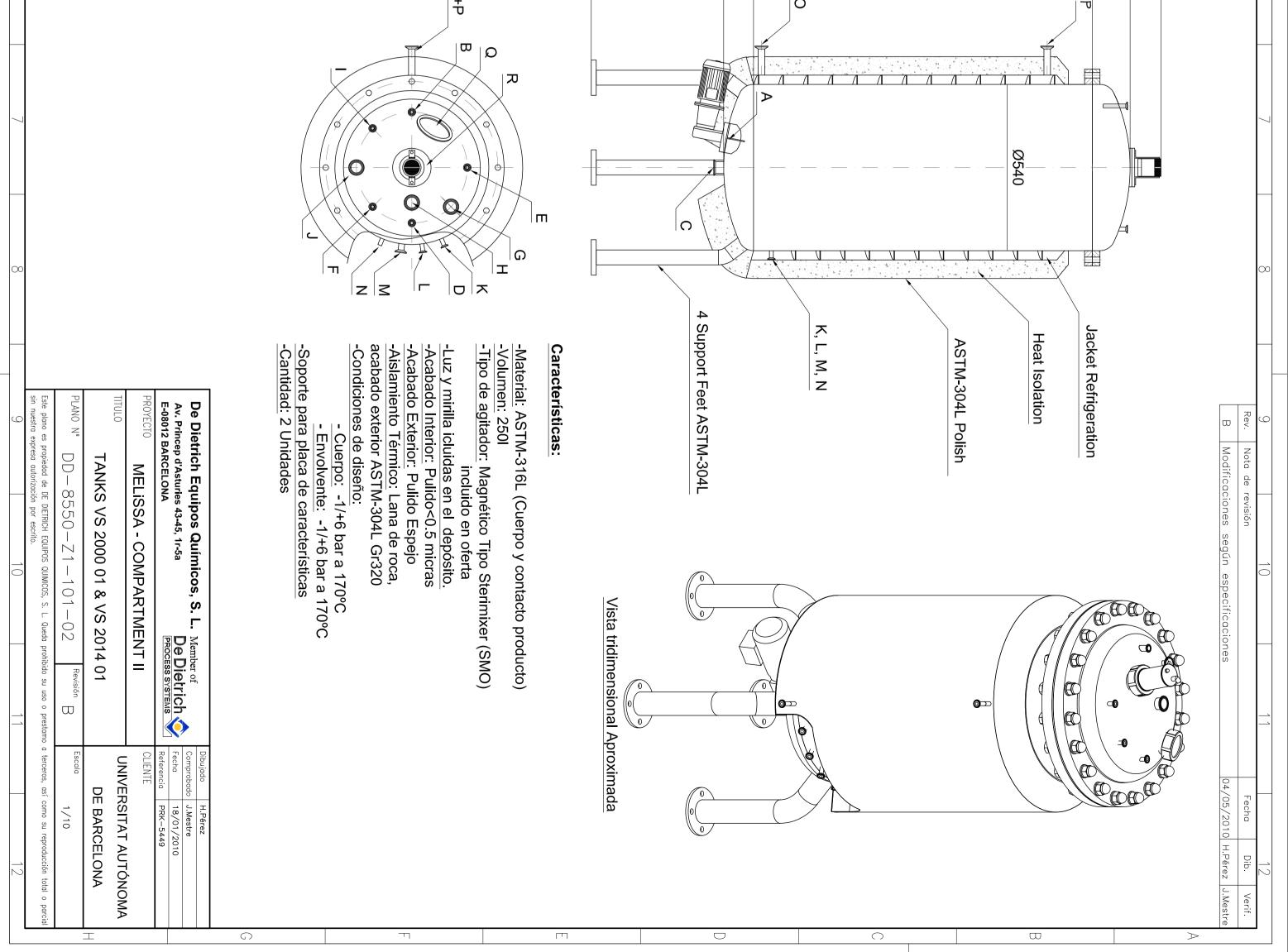
# 5.3 <u>Manometers in liquid storage tanks, gas buffers and influent/effluent refrigeration</u> jackets circuits

The installation of manometers was not scheduled because there is a pressure transmitter in each equipment, but thinking of the plant operation DDEQ things that is necessary to have a pressure local lecture.





IDBULADURASRefDescripciónTamañoAAgitador MagnéticoStermixer SMOBEntrada Líquido1" ClampCSalida Líquido1" ClampDSalida Gas (venteo)1" ClampFVálvula de Seguridad1" ClampGTransmisor de Presión1½" ClampHTransmisor de Nivel o Libre1½" ClampJLibre1½" ClampJLibre1½" ClampLToma Muestras1" ClampNLibre1½" ClampQMirilla Servicio1" ClampQMirilla + proyectorNWGS		T							G																		
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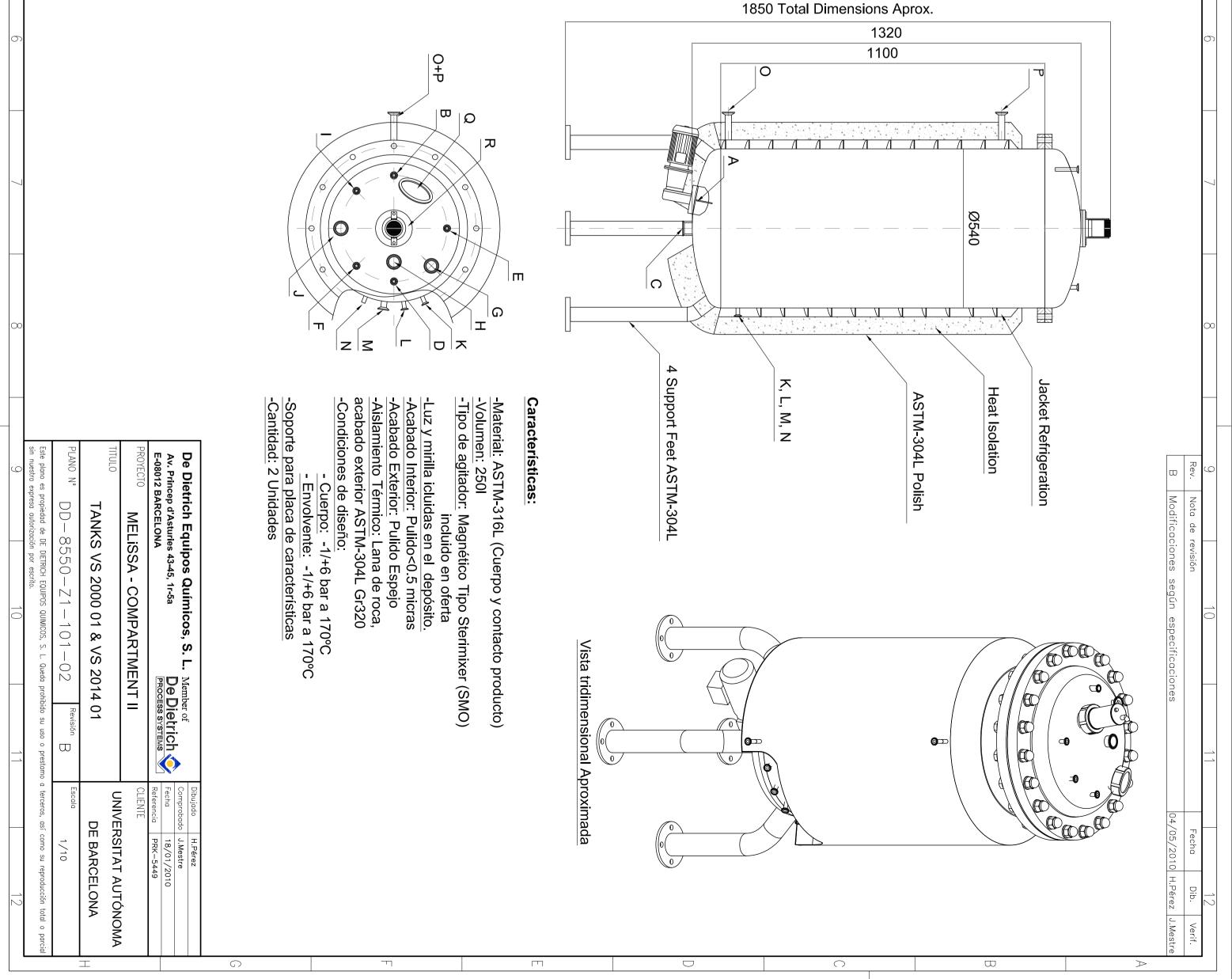


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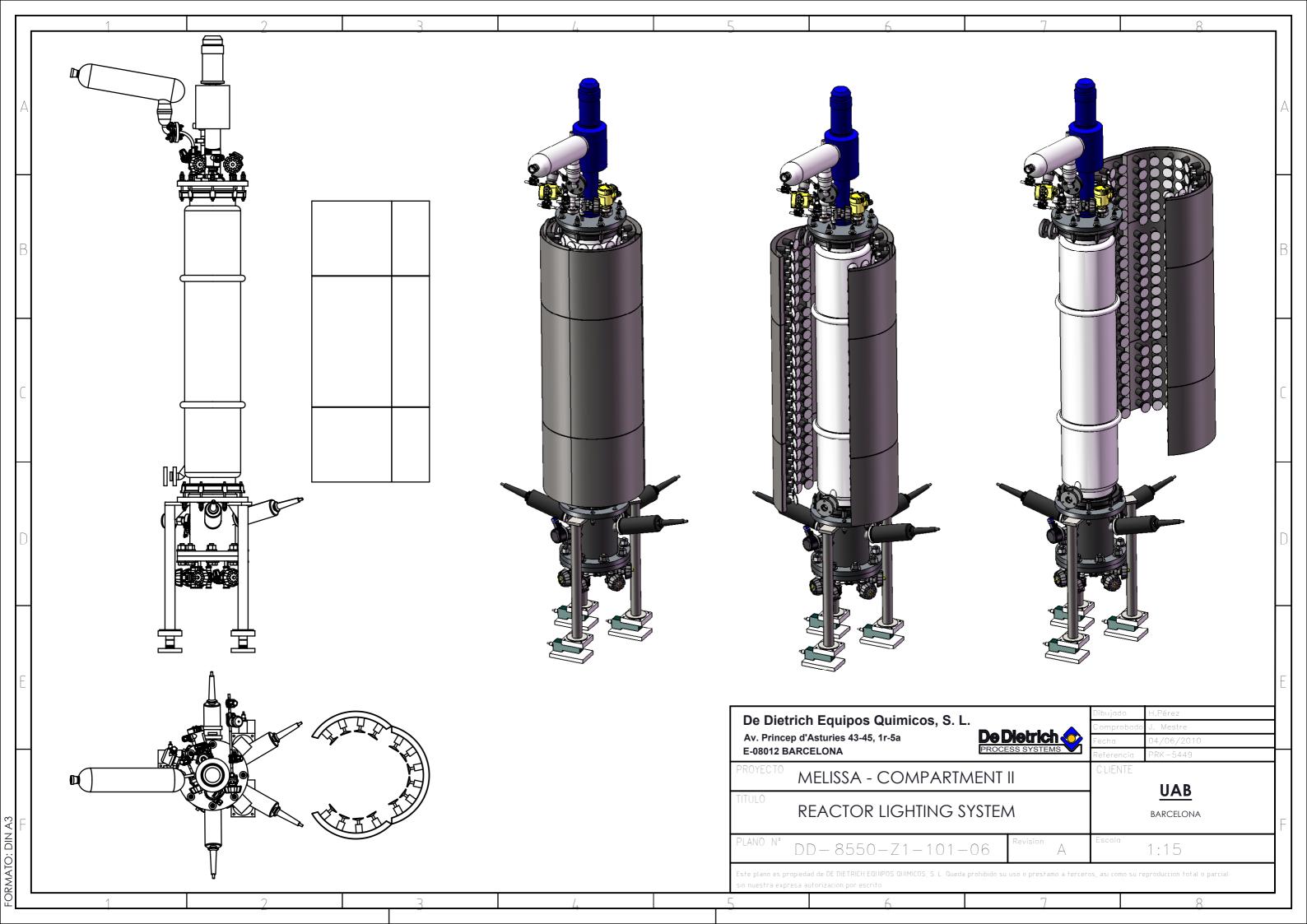
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7	Revisión B prohibido su uso o prestamo o		ber of Dietrich 🕎		Support ASTM-304L	Body ASTM-316L		7
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# MELiSSA Pilot Plant



Universitat Autònoma de Barcelona

Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 201 / 275

# 12. PROPOSAL UPDATE (AUGUST 2010)

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		EQUIPMENT LIST		
De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA		EQUIPMENT		
0110701155	PROCESS SYSTEMS			
CUSTOMER:			0.4/00/00.40	
PROJECT:	MELISSA COMPART		04/08/2010	PREPARED: J.GUBERN CHECKED: J. MESTRE
DRAWING:	DD-8550-Z1-100-01 re		В	
TAG	DENOMINATION	DESCRIPTION	SUPPLIER	OBSERVATIONS
R 2005 01 GP 2005 01	Photobioreactor	Bioreactor with mechanical agitation. Material: AISI 316L / jacketed glass	DDEQ	
IRC 2006 01	Lighting system	Bioreactor Lighting system. Portable structure of SS with 270 lamps.	DDEQ	
HX 2012 01	Condenser	Condenser for reactor outlet gases. Material: glass borosilicate 3.3	DDPS	Transfer area: 0,3 m ²
VS 2000 01 GP 2000 01	Feeding tank	Agitated tank in AISI 316L, provided with jacket for heating - cooling. Designed to operate at positive pressure. Magnetic driver		V=250 L
GP 2001 01 GP 2001 02	Feed pumps to reactor	Mettering pump in AISI 316 and PTFE membrane. Controlled by an electronic variator. Sterilizable.	LEWA	Required flow: 10 l/h P=20 bar
VS 2008 01	Acid vessel	Borosilicate glass vessel for acid addition	Fisher	V = 5 L
VS 2008 02	Alkali vessel	Borosilicate glass vessel for alkali addition	Fisher	V = 5 L
PP 2008 01	Acid pump	Peristaltic pump for acid dosing (pH control).	Watson Marlow	
PP 2008 02	Alkali pump	Peristaltic pump for alkali dosing (pH control).	Watson Marlow	
VS 2014 01 GP 2014 01	Harvesting tank	Agitated tank in AISI 316L, provided with jacket for heating - cooling. Designed to operate at positive pressure. Magnetic driver		V=250 L
GP 2015 01/02	Harvest pumps to reactor	Mettering pump in AISI 316 and PTFE membrane. Controlled by an electronic variator. Sterilizable.	LEWA	Required flow: 10 l/h P=20 bar
VS 2012 01	Discharge buffer	Buffer tank in AISI 316L for process gas		V=50 L
BLWR 2012 01	Compressor	Double membrane compressor in AISI 316 / PTFE for outlet gas flow compression	KNF	

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De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA		EQUIPMENT			
CUSTOMER:	Universitat Autònoma o	de Barcelona / MPP			
PROJECT:	MELISSA COMPARTM	IENT II DATE:	04/08/2010	PREPARED: J.GUBERN	
DRAWING:	DD-8550-Z1-100-01 re	v. I REV:	В	CHECKED: J. MESTRE	
TAG	DENOMINATION	DESCRIPTION	SUPPLIER	OBSERVATIONS	
HX 2007 01	Heat exchanger	Plate heat exchanger for water cooling with cool water (glycol)		Transfer area: 0,35 m ²	
HX 2007 02	Heat exchanger	Plate heat exchanger for water cooling with hot water		Transfer area: 0,35 m ²	
PP 2007 01	Circulation pump	Centrifugal pump for water loop (PBR temperature control)		Required flow: 3 m ³ /h	
VS 2007 01	Expansion vessel	Expansion vessel for water circuit. Material AISI 316.		V=10 L	
HX 2012 02	Post-cooler	Sample gas cooler for sampling conditioning	Sick-Maihack		

	BARCELONA		
JSTOMER	UAB	DATE	03/08/2010
ROJECT:	MELISSA - COMPARTMENT II	REF.	
RAWING:	DD-8550-Z1	PREPARED	RdM
TAG	REF. DESCRIPTION	QUANT.	COST
	EQUIPMENT		
	New Foto-Bioreactor		69.604,88
	Agitation group:       Electrical motor 0, 18 kW, nominal speed 250 (variable), shaft length: 1750 mm, double         mechanical seal, 10 stages of axial turbines (impeller type) with 4 blades.       **Note: The agitator has been designed for being modificated if necessary. Modifications on the design are not included in this quotation.	7 1	
	Jacketed pipe section DN200 L=1500 mm	1	
	Reactor bottom/top in AISI 316 with required nozzles	1	
	Lighting system and cabling (power cabinet included in supply and electrical assembling section)	1	
	Ingold connection and caps for required nozzles	1	
	Gas sparger	1	
	Others	1	
	Pre-assembly, package and transport	1	
	FAT's tests (tightness and agitation tests with water only)	1	3.466,6
	Spare part: Jacketed pipe section DN200 L=1500 mm	1	4.856,2
	Main gas condenser for the reactor 0,7 m ² in borosilicate (M-HECH 80/7)	1	3.230,7
	Stainless steel tank 250 I with jacket, isolation and magnetic agitator	2	90.300,6
	Process gas buffer (50 I) in stainless steel	1	7.847,4
	Feeding and Harvesting pumps of liquid. Mod. Ecodos 0,55kW - Sanitary. Manufacturer: Lewa	3	10.237,5
	Acid and base pumps - Mod. 521Vi/R2C with freq. Variator. Manufacturer: Watson Marlow	2	3.525,0
	Gas compressor to discharge tank - Manufacturer: KNF (Double diaphragm)	1	4.656,2
	Vacuum pump for plant inertization (pump/filter/oil/others)	1	1.808,6
	Post cooler for gas analysis - Manufacturer: Sick Maihak	1	6.043,7
	Expansion vessel of reactor temperature control circuit	1	1.666,6
	Plate heat exchanger for heating/cooling reactor	2	6.622,5
	Circulation pump for reactor temperature control circuit	1	384,6
	Glass vessels 2 I capacity (acid and base)	2	270,0
	Exterior jacket for reactor refrigeration with air	1	2.533,3
	Transport and inspection of equipments	1	3.875,0
	TOTAL COST (EQ		220.930
	SUPPLY AND MECHANICAL ASSEMBLING		
	Assembling of equipments. Construction and assembling of pipes and accessories/fittings	1	62.571,4
	Materials for pipes construction and accessories. Metalic support structure AISI 304.	1	41.600,0
	Platform . Structure in AISI304.	1	5.625,0
	Small modifications at assembling	1	4.375,0
	Orbital welding works	1	1.764,7
	Sterilizable gas filters - Manufacturer: Dominick Hunter	9	11.769,2
	Sterilizable liquid filters - Manufacturer: Dominick Hunter	7	7.107,6
	Filters for acid/base vents - Manufacturer: Dominick Hunter	2	350,7
	Filters (flow meters) - Manufacturer: HOKE	7	1.088,7
	Valves	47	40,400,6
	Diaphragm valve 1/2"	47	10.480,3
	Diaphragm valves for argon inlet, steam inlet or condensate outlet	33	6.820,0
		29	16.715,6
	Diaphragm valves 1/2" with steam inlet or condensate outlet valve	· ·	1.729,2
	Diaphragm valves 1/2" with double steam inlet valves	2	0 700 6
	Diaphragm valves 1/2" with double steam inlet valves       Diaphragm valves 1" with condensate outlet valve	6	
	Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1" with condensate outlet valve         Diaphragm valves 1 " with steam inlet valve (feed/harvest tanks outlet)	6 2	1.413,3
	Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1" with condensate outlet valve         Diaphragm valves 1 " with steam inlet valve (feed/harvest tanks outlet)         Ball valves 1/2"	6 2 22	1.413,3 6.776,0
	Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1" with condensate outlet valve         Diaphragm valves 1 1/2" with steam inlet valve (feed/harvest tanks outlet)         Ball valves 1/2"         Ball valves 3/4"	6 2 22 6	1.413,3 6.776,0 1.973,3
	Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1" with condensate outlet valve         Diaphragm valves 1 1/2" with steam inlet valve (feed/harvest tanks outlet)         Ball valves 1/2"         Ball valves 3/4"         Ball valves 1"	6 2 22 6 12	3.729,2 1.413,3 6.776,0 1.973,3 4.720,0
	Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1" with condensate outlet valve         Diaphragm valves 1 1/2" with steam inlet valve (feed/harvest tanks outlet)         Ball valves 1/2"         Ball valves 3/4"	6 2 22 6	1.413, 6.776, 1.973,

E-080121	ep d'Asturies 43-45, 1 BARCELONA	r-5a		
CUSTOMER	UAB		DATE	03/08/2010
PROJECT:		- COMPARTMENT II	REF.	
DRAWING:	DD-8550-	<u>Z1</u>	PREPARED	RdM
TAG	REF.	DESCRIPTION	QUANT.	COST
		Diaphragm valve 1/4" (liquid filters purgue)	7	728,00 €
		Sampling valve	3	5.413,60 €
		Check valves for liquids	2	1.006,00 €
		Check valves in PP (acid/base)	2	446,45 €
		Sanitary check valves for gases - FLUIVAL	2	392,80 €
		Check valves for gases (HOKE)	11	790,24 €
		Pressure reducing for gases with pressure indicator	8	384,00 €
		Safety Valves - Sanitary design	4	2.240,00 \$
		Safety Valves	10	1.840,00 €
		Steam traps - Manufacturer: SARCO	9	1.944,00 €
		Other valves	1	1.933,33 €
		Certificates of materials 3.1B, FDA	1	1.062,50 *
		Partial dismantle and re-assembling in MPP	1	3.529,41 €
		Coordination of assembling works at field		
		Assembling coordinator	1	9.222,00 €
		Engineer supervision	1	3.125,00 €
		Diets and other expenses TOTAL COST ( SUPPLY AND MECHANIC)	1 AL ASSEMBLING)	777,78 <del>•</del> 227.313,91 •
		SUPPLY AND ELECTRICAL ASSEMBLIES		
		1-Electrical works		44.005.00
		a) Power and control cabinet: See detail description in point 3.3 of quotation EXS-M0072 rev. 1	1	44.985,33 €
		b) Installation and electrical connection.		27.363,75 €
		c) Phoenix materials		8.550,00 €
		TOTAL COST ( SUPPLY AND ELECTRIC/		80.899,08 €
		INSTRUMENTS / FIELD CONTROL EQUIPMENTS		
		Level detector for feeding tank. Guided microwave type. Manufacturer: Vega	1	1.552,94 €
		Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo	2	1.588,24 €
		Differential pressure system for reactor level control (2 x presure transmitters and special connection)	1	2.401,53 €
		Scale for harvesting tank. Manufacturer: Mettler Toledo	1	3.880,00 €
		Foam detection system. Manufacturer: Charis	1	*excluded
		Biomass Analyzer, model InPro 8200 from Mettler Toledo	2	15.176,47 4
		Solved Oxygen analyzer. Manufacturer: Mettler Toledo	1	3.564,71 4
		pH Analyzer. Manufacturer: Mettler Toledo	2	10.176,47 €
		Redox Analyzer. Manufacturer: Mettler Toledo	1	3.518,82 €
		Outlet gas analyzer	1	*excluded
		Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H	1	5.764,71
		Gas flowmeter/regulation (3 x inlet gases, 2 x reactor total inlet gas, 1 x circulated gas)	6	10.588,24
		Gas flowmeter for the reactor outlet gases	1	1.342,35 -
		Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)	6	5.261,79
		Differential Pressure transmitter for filters blockage detection	3	5.279,22
		Pressure switches with LCD indication	6	2.645,29 -
	1	Pressure switch for pump's membrane breakage detection	3	765,88
			22	4.506,12
		Pressure gauge (lines, filters)		
		Pressure gauge (lines, filters) Temperature transmitter for influent/effluent tanks, gas analyzer and condensate manifold	5	945,41
			5	
		Temperature transmitter for influent/effluent tanks, gas analyzer and condensate manifold		396,47
		Temperature transmitter for influent/effluent tanks, gas analyzer and condensate manifold         Temperature sensor (PT-100) + transmitter for PBR	1	396,47 235,29
		Temperature transmitter for influent/effluent tanks, gas analyzer and condensate manifold         Temperature sensor (PT-100) + transmitter for PBR         Pod stainless steel for the temperature transmitters         Proportional valve for PBR pressure control and compressor bypass	1	945,41 396,47 235,29 729,41 5.723,29
		Temperature transmitter for influent/effluent tanks, gas analyzer and condensate manifold         Temperature sensor (PT-100) + transmitter for PBR         Pod stainless steel for the temperature transmitters	1 1 2	396,47 235,29 729,41

	Β	DATE	03/08/2010
	LISSA - COMPARTMENT II	REF.	
RAWING: DD	-8550-Z1	PREPARED	RdM
TAG	REF. DESCRIPTION	QUANT.	COST
	Certificates of materials 3.1B, FDA	1	1.352,94
	Transport / inspection	1	1.171,76
	TOTAL (INSTRUMENTS /EQUPMENT OF CONTROL	_ IN FIELD)	93.101 €
	OTHER CONCEPTS		
	GENERAL REVISION AFTER ASSEMBLING	1	2.266,6
	INSULATION (PIPES OF STEAM, CONDENSATE AND GLYCOL)	1	3.733,3
		COST	6.000€
	DETAIL ENGINEERING + COMMISSIONING		
	DETAIL ENGINEERING (P&I ´d definition, Lay-out, Detail drawings)		
	Technical designer	320	14.080,0
	Engineer	340	18.610,7
	Technical Manager	60	5.235,0
	Technical meetings with MPP for project advance control Paper work	40	2.250,0
	MANUAL AND FINAL DOSSIER		1.730,0
	Technical designer	40	1.760,0
	Engineer	210	11.494,8
	Technical Manager	15	1.308,7
	Partial "As built"		
	Technical designer	60	2.640,0
	Engineer COMMISSIONING	40	2.189,5
	(3.5.1.1) Mechanical FATs		
	Assembling coordinator	24	1.479,0
	Engineer	24	1.313,7
	(3.5.1.2) Electrical FATs		
	Engineer	24	1.313,7
	Electrical technician	40	1.750,0
	(3.5.2.1) Mechanical SATs		7.005
	Assembling coordinator	120	7.395,
	Engineer Mechanic official	120 120	6.568,9
	(3.5.2.2) Electrical SATs	120	4.000,0
	Assembling coordinator	80	4.930,
	Engineer	80	4.379,
	Electrical technician	80	3.500,
	(3.5.2.3) Communication comissioning		0.400
	Engineer	40	2.189,
	Electrical technician (4) Run test	40	1.750,
	Engineer	40	2.189,
	Diets and other expenses	1	3.706,2
	CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS	1	6.250,
	TOTAL COST (ENG		114.533 €
	TOTAL COST OF TH		742.777 €
	OPTIONAL:		
	MEDIA PREPARATION TANK:	+	
	Atmospheric stainless steel tank: 300 I with agitator	1	13.618,
	Centrifugal pump to fill up feeding tank - Sanitary pump	1	1.666,
	Electrical cabinet	1	3.312,

	<b>Equipos Químico</b> d'Asturies 43-45, 1 RCELONA			
CUSTOMER:	UAB		DATE	03/08/2010
PROJECT:	MELiSSA	- COMPARTMENT II	REF.	
DRAWING:	DD-8550-	Z1	PREPARED	RdM
TAG	REF.	DESCRIPTION	QUANT.	COST
		Pressure switch with LCD indication	1	440,88 €
		Required manual valves	2	573,39 €
		Assembling works	1	971,43 €
		TOTAL COST (MEDIA PF	REPARATION SYSTEM)	20.584 €

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**De Dietrich Equipos Quimicos, S.L.** Príncep d'Asturies 43-45, 1r-5a E-08012 Barcelona

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# **1.- SUBJECT AND ANTECEDENTS**

The Universitat Autònoma de Barcelona, hereafter UAB, takes part in the MELiSSA Project of the European Space Agency (ESA) and the European Space Research and Technology Centre (ESTEC). The Project objective is to study and define parameters to achieve life conditions in the space during long journeys.

Included in this research project there is a pilot plant installed in the Departament d'Enginyeria Química de l'Escola Tècnica Superior d'Enginyeria (ETSE) of the UAB. This pilot plant is based in several compartments linked together in a close loop to process and recycle the ambient air, water, food and feces.

**De Dietrich Equipos Químicos**, hereafter **DDEQ**, was commissioned by the UAB for the basic designing of compartment C-II of the pilot plant, according to DDEQ quotation DDE-K1764-SI.

The present proposal **EXS-M0127 Rev. 1** for the construction and delivery of the skid corresponding to compartment C-II, is based in the documentation and designs generated during this basic engineering project development, the Design Review conclusions during June 2.010 and MPP/ESA subsequent decisions.

The proposal includes the following concepts:

- Carry out the required detailed and constructive engineering works to build up the plant
- Delivery of all the materials, equipments and goods.
- Carry out the assembly (mechanical and cabling) of the plant
- Commissioning of the plant (DDEQ scope)
- Delivery of operation manual and technical dossier of the plant

# 2.- QUOTATION BASIS

To make this proposal the following documents (Data package) coming from the basic designing works of MELISSA – Compartment II Pilot Reactor, have been used:

P&ID Diagram DD-8550-Z1-100-01 **Rev. I** modified as per Basic Design Review conclusions based on meeting hold on June 7th, telecom hold on June 8th and mail from E. Peiro dated June 28th.

Control Loops Diagram DD-8550-Z1-100-02 Rev. F (not up-dated until constructive engineering)

Main Equipments list Rev. B

Valves, filters and accessories list Rev. A (not up-dated until constructive engineering)

Piping list Rev. A (not up-dated until constructive engineering)

Instruments list Rev. A (not up-dated until constructive engineering)

Motor list Rev. A (not up-dated until constructive engineering)

Main Equipments Technical Specification Rev. B

Instruments Specification Rev. A (not up-dated until constructive engineering)

Electrical & Control Signals List Rev. A (not up-dated until constructive engineering)

Nevertheless, it has to be understood that a Prototype Pilot Plant might have some uncertainties that will not be clarified until the start up of the unit, and agreed changes might be required at that stage.

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# 3.- SCOPE OF SUPPLY

# **3.1.-** Constructive Detail Engineering Contents

The Investment Budget has been calculated considering a Constructive Detail Engineering packet of 780h to execute the following works:

- 1. Definition and Execution of Final P&I'd.
- 2. Definition of utilities required and estimated consumptions.
- 3. Definition and Execution of Final Control Loops Diagram.
- 4. Final Lay-out drawing.
- 5. Final list of: Sensors, valves, lines and components.
- 6. Datasheets of sensors, valves and main equipments.
- 7. Constructive drawings of:
  - Liquid storage tanks and accessory vessels
  - Reactor
  - Lighting arrangement and supports
  - Frame, supports and skid
- 8. Sufficient drawings for the pipe assembly, including isometric drawing of process lines.
- 9. Final detailed control functional description.

As soon as this first Data package is ready it will be sent to MPP for revision and approval. Once the approval is received, the rest of the Detail Engineering will be carried out and the purchases orders to suppliers will star to be released.

At this stage MPP will deliver the detailed control functional description plus the sensor and motor list with their datasheets to the control supplier (Sherpa) to star working on the PLC definition and program, as well as the scada control screens.

A "kick off meeting" with the MPP's control contractor will be held at the UAB in order to clarify all the information provided by DDEQ to this contractor in the Data Package with points 1 to 9 (sensor list, motor list, automatic valves list, data sheets, control loops definitions, and final detailed control functional description). The estimated duration of this meeting is about one day and will be held with project engineers involved in the project.

- 10. HAZOP Analysis over final lay-out and P&ID
- 11. Prepare the "Test Protocols" for DDEQ Test and Commissioning as per stated in point 3.5. The protocols will be agreed with MPP.
- 12. Electrical diagrams for the electrical cabinet. CE marking and legalization of the new cabinet.
- 13. CE marking and legalization of liquid storage tanks and buffer.
- 14. Machines and Equipment Security Evaluation, made by ICICT, S.A. (TÜV Rheinland Group), for a Pilot Plant module installed at the UAB facilities in Cerdanyola del Vallès.

Like for the C-IVa module the notified body will do a Study over Machines and Equipment security based on:

R.D. 1215/97 about Minimum Security and Health Measures for the use of equipments.

R.D. 1495/86 about Safety in Machines

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- UNE-EN norms of application

The notified body will execute the following works:

- Hazards identification
- Risk analysis according the hazards detected
- Consensus about safety technical solutions based on UNE-EN norms

Final conclusions report and Machinery Conformity / Non Conformity Certificate emission.

# NOTE: The delivery of points 10-14 will be according the attached planning.

To assure the traceability and control over the design, DDEQ will implement a "Design Changes Record". The objectives of this record are:

- a. Assure traceability over design changes: date, problem detected, reason, decision, final change introduced, possible delays, cost.
- b. Assure approval from both MPP and DDEQ.
- c. Decision about who will take the cost of the change.

NOTE: This document will be prepared by DDEQ and shared with MPP for approval.

# 3.2.- Mechanical Turn-key supply of the compartment C-II

Mechanical turn-key supply of the mechanical and electrical equipment corresponding to the Compartment C-II of the Melissa Pilot Plant in accordance with the "Quotation basis" shown in point 2 and the Detail Engineering to be carried out according to point 3.1.

Previously to any purchase DDEQ will inform UAB which is the selected supplier or contractor. Should the UAB has any inconvenience regarding a supplier or contractor DDEQ will change to another one, unless this might have an economic impact on the project or cause a delay in the schedule.

Mechanical Erection and installation of the unit at DDEQ warehouse and UAB laboratories at Cerdanyola del Vallés

2 Copies of the final dossier

# **3.3.- Electrical supply for the compartment C-II**

Following we provide a description of the power and control system that is foreseen for the for the compartment II of MELiSSA Pilot Plant.

Documents of reference:

- Control Loops P&ID (DD-8550-Z1-100-02 rev. F) (not up-dated until constructive engineering)
- Electrical and control signals list rev. A (not up-dated until constructive engineering)
- Room Lay-Out (DD-8550-Z1-102-02 rev. 0) (not up-dated until constructive engineering)

# **3.3.1.-** Situation of the electrical cabinet

The electrical cupboards are foreseen by DDEQ out of the skid in order to save space in it and considering the room constraints.

MPP mentioned that the C-I PLC cabinet could be moved to the corner near the GC in order to have more space for the C.II skid (to be confirmed by NTE).

04/08/2010

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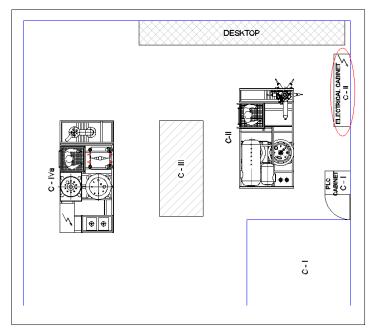
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The designed electrical cabinet is 1800x2600x400 (height, width, depth) and it is conceptually divided in two different parts: power and control. By control we mean concentrate all the control signals from site instruments to the cabinet, to communicate with the main PLC and supervisor (delivered and programmed by others).

It can be physically divided too in order to be able to go through the pilot plant door.

The situation in the plant of the electrical cabinet is the next:



<u>NOTE:</u> For further details about dimensions refer to Room Lay-Out (DD-8550-Z1-102-02 rev. 0) included in the ANNEX II of the Engineering dossier.

# 3.3.2.- Power and control panel

Supply of **power** and control panel, dimensions 1800 height, 2600 width and 400 depth, mechanized, mounted, connected and with the following elements and devices:

- 1 Base panel and accessories
- 1 Mounting board
- 1 Cooper bar and accessories
- 1 Overvoltage protection Class D IEC 1024-1
- 1 Light switch "On service"
- 1 General switch
- 1 Main ground-fault protection and thermal-magnetic circuit breaker
- 1 Emergency stop push button
- 1 "Emergency stop activated" indicator (red led)
- 1 White light indicator "Voltage in"
- 1 Acknowledge push button
- 1 Security check push button
- 1 Safety relay PREVENTA
- 2 Power supply 24Vdc/10 A
- 1 Single ground-fault protection for all frequency converters

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De Dietrich PROCESS SYSTEMS DE DIETRICH EQUIPOS QUÍMICOS S.L.

- 1 General ground-fault protection for all the instrumentation
- 1 DIMMER 3-phase to control lightning columns
- 1 Transformer 3-phase 5KVA
- 1 Single thermal-magnetic protection for 10 lightning columns
- 1 Current metering and 4-20mA conversion
- 1 DIMMER protection security circuit against low load in the output
- 1 RS232/Ethernet converter
- $1 \rightarrow$  Wiring of the following control signals:
  - 71 Digital inputs
  - 52 Analogical inputs
  - 49 Digital outputs
  - 19 Analogical outputs
- 6 Galvanic isolators
- $1 \rightarrow$  Set of thermal-magnetic circuit breakers
- $6 \rightarrow$  Single-phase frequency converters 1,5KW
- 1 Set of Contactors
- $1 \rightarrow$  Fan and filter
- $1 \rightarrow$  Set of circuit breaker auxiliary switch
- $1 \rightarrow$  Set of connection strips
- $1 \rightarrow$  Elements and devices mounted and connected according CE directive
- $1 \rightarrow$  Design, technical managing and documentation

# **IMPORTANT NOTES:**

- > It is not foreseen the connection to the plant main power/pneumatic supply.
- > All consumers will be equipped with ground-fault protection and thermal-magnetic circuit breaker.
- > The material included in these lists is the necessary for the electrical and control signals according to the Basic Engineering Design and conclusions arose from the Design review done in June.

# 3.3.3.- Electrical erection and commissioning of compartment C-II

The estimated materials which are required are:

- 20 m galvanized cable tray 60x60 mm (without cover).
- 20 m galvanized cable tray 300x60 mm (without cover).
- Trays mounting accessories.
- 160 m shielded cable 4x0,5 mm²
- 20 m blue shielded cable 8x0,5 mm²
- 250 m cable 4x0,5 mm²
- 200 m shielded cable 4x1,5 mm²
- 300 m shielded cable 3x1,5 mm²

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- 250 m flexible conduit.
- 10 m heat-shrinkable tubing.
- Other connection and mounting accessories.
- Cable signalling.
- 100 m pneumatic tubing.
- 3 emergency stop pushbuttons.
- Other pneumatic accessories.

# IMPORTANT NOTES:

If it is physically possible the power cables will be installed as separated as possible from the signal ones.

# 3.3.4.- Photo-bioreactor Lighting system

The illumination system consists of 250-270 halogen lamps which surround the glass jacketed pipe section (DN200, L=1500m).

The type of lamps used will be the specified in the technical note 62.2 and are: OSRAM 12V, 20W BAB 38°.

# **3.3.5.- Lighting system structure**

The lights will be set-up on a portable structure made of stainless-steel with 270 lamps of 20W 12V each, surrounded by a hybrid stainless steel – transparent plastic fairing, through which the cooling air can circulate.

It will include 2 or 3 connection boxes sited on the half height of the structure.

These boxes will receive the cables from the lamps to link in 2 o 3 cables all the power to the main electric panel.

# 3.3.6.- Phoenix material

Set of Phoenix materials:

- Analogical cable FLK 50/EX-DR/800
- Digital cable FLK 50/4X14/EZ-DR/800
- Interface modules VARIOFACE FLKM50/MOFI-TSX.
- Connectors PLC-V8/FLK14/OUT.
- Connectors PLC-V8/FLK14/IN.
- Relay PLC_RSP-24UC/21AU (24VDC).
- Plug-in bridges FBST 500-PLC BU
- Separating plates PLC-ATP-BK.

# **IMPORTANT NOTES:**

➢ We have included Phoenix Contact cables of 8 m. These cables will have in both sizes de connectors for flat cable BUT WILL NOT INCLUDE THE ADAPTERS TO CONNECT TO THE QUANTUM MODULES. These adapters must be supplied by the PLC cabinet manufacturer.

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# 3.4.- Manuals:

The manuals will be issued in English once points 1 to 9 of the Detail Engineering are approved by the MPP and while the module skid is pre-assembly in DDEQ's warehouse. The Operation Manuals should be delivered to MPP the latest at the same time the pilot skid is installed in the UAB's laboratories and the Technical Dossier no later than two months after the skid is installed.

# 3.4.1.- Operation Manual:

The Operation Manual will contain:

- 1. INTRODUCTION SYSTEM DESCRIPTION
- 2. COMPONENT DESCRIPTION
- 3. PLANT CONTROL DESCRIPTION
- 4. PLANT SAFETY
- 5. GENERAL PROCEDURES
- 6. INSTALLATION START UP
- 7. INSTALLATION SHUT DOWN
- 8. NOMINAL OPERATION
- 9. SIP (STERILIZATION SEQUENCES)
- 10. SERVICE ON HARDWARE
- 11. PROCESS FOLLOW UP
- 12. CALIBRATIONS

# 3.4.2.- Technical Dossier

The Technical Dossier will contain

- Final P&I'd.
- Final Control Loops Diagram.
- Final Lay-out drawing.
- Constructive drawings of:
  - Liquid storage tanks and accessory vessels
  - Reactor
  - Lighting arrangement and supports
  - Frame, supports and skid
- Sufficient drawings for the pipe assembly, including isometric drawing of process lines.
- Final list of: Sensors, valves, lines and main equipments, and the corresponding Datasheets
- Final detailed control functional description.
- Electrical diagrams for the electrical cabinet. CE marking and legalization of the cabinet.

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- CE marking and legalization of the liquid storage tanks.
- Welding controls and welding certificates for the storage tanks.
- Certificate issued by ICICT, S.A. (TÜV Rheinland Group) after the "Machines and Equipment Security Evaluation" for the Pilot Plant module installed at the UAB facilities in Cerdanyola del Vallès.
- Compilation of operation, maintenance manuals and technical documents provided by the different suppliers of the equipment installed in the plant. Whenever it is possible this information will be supplied in electronic format as well.
- Spare part list for two years operation

# **3.5.-** Test and commissioning of the Pilot Unit

#### 3.5.1.- FAT by DDEQ

#### 3.5.1.1.- <u>Mechanical</u>

Once the skid is pre-assembled at DDEQ's warehouse and before the shipment to UAB's laboratories MPP will assist to FAT verification consisting in:

- Verify that final approved P&I'd diagram has been observed in the assembly
- Verify that the sensors, valves and equipments used are the specified ones according the project datasheets.
- Verify supports robustness.
- Test certificates and protocols filled up with the results.

<u>NOTE</u>: For the mechanical FAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1. At the end of mechanical FAT a record will be signed both by MPP and DDEQ and the shipment date to UAB's laboratories will be agreed. The duration of this FAT test will be 2 or 3 working days.

No test with fluids will be included in the mechanical FAT as there are not such services at DDEQ's warehouse.

#### 3.5.1.2.- <u>Electrical</u>

The cabling of the C-II module will be executed at UAB premises. Therefore the Electrical FAT will focus only in the power and control cabinets delivered by DDEQ. This FAT will take place at DDEQ's electrical contractor premises.

The Electrical FAT will consist in:

- Verify that all the sensors, automatic valves and equipments included in the P&I'd appears in the electrical diagrams.
- Verify that the electrical diagrams have been observed during the manufacturing of the cabinets.
- Test the power and control cabinets simulating the signals.
- Test the lighting system for the photo bio-reactor
- Test certificates and protocols filled up with the results.

<u>NOTE:</u> For the electrical FAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1, and tests will be done by DDEQ and electric

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supplier. An electrical FAT record will be signed both by MPP and DDEQ and the shipment date to UAB's laboratories will be agreed. The duration of this FAT test will be 3 working days.

#### 3.5.2.- SAT by DDEQ

#### 3.5.2.1.- <u>Mechanical</u>

The following tests have been considered for the plant commissioning based on a scheduled commissioning of fifteen (15) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Erection Manager (DDEQ)
- Mechanic official (DDEQ Contractor)
- MPP (permanent dedication of plant operator and technical staff)

The works to be done are:

- Pressure test with water for the liquid tanks and lines, as well as the reactor.
- Pressure test with compressed air of the Gas lines and buffers.
- Pressure test with steam of the steam and condensate lines. After that a resume of sterilization sequences will be done. Resume means:
  - Not waiting all the sterilization time required until the temperature is reached
  - Reactor, tanks and complete sections between reactor and tanks will be tested with steam during the accorded and defined time. Sequences for individual equipment will not be checked.
- Pressure test with water of the heating / cooling circuits of the jacketed equipment.
- Test certificates and protocols filled up with the results

<u>NOTE</u>: For the mechanical SAT commissioning of the pilot unit DDEQ will perform the tests using its own protocols, elaborated as per point 11 in paragraph 3.1. At the end of the mechanical SAT a record will be signed both by MPP and DDEQ.

#### 3.5.2.2.- <u>Electrical</u>

The following tests have been considered for the plant commissioning based on a scheduled commissioning of ten (10) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Erection Manager (DDEQ)
- Electrical official (DDEQ Contractor)
- MPP (permanent dedication of plant operator and technical staff)

The works to be done are:

- Check of the spin direction of motors.
- Check the power supply to all the instruments.
- Check the output signals from the instruments to the cabinet.
- Check alarms contacts in the cabinet and signals to be sent to the PLC.
- Simulate PLC input signals from the cabinet to instruments and control valves.

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- Test of the lighting system of the reactor and the air cooling equipment.
- Initial configuration (settings and range definition) of instruments and sensors with process parameters supplied by MPP to the control supplier. The optimization and fine adjustment of the settings will be responsibility of the MPP and therefore its implementation over the equipments on site.
- Test certificates and protocols filled up with the results.

<u>NOTE</u>: For the electrical SAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1 and tests will be done by DDEQ and electrical supplier. At the end of the mechanical SAT a record will be signed both by MPP and DDEQ.

#### 3.5.2.3.- Communication commissioning

The communication commissioning will not be started until the mechanical and electrical commissioning (as per indicated in points 3.5.2.1 and 3.5.2.2) is finished and all the interconnecting cabling between DDEQ's cabinet and the PLC cabinet (supplied by others) is done. The interconnecting cabling is also out from DDEQ's scope.

The following tests have been considered for the plant commissioning based on a scheduled commissioning of five (5) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Project Engineer (Sherpa)
- MPP (permanent dedication of plant operator and technical staff)
- Electrical official (DDEQ Contractor + Sherpa Contractor)

The works to be done are:

- Verify the arrival of the inputs signal from DDEQ's cabinet to the PLC cabinet
- Verify the arrival of PLC commands to DDEQ's cabinet
- Verify consistency in the measurements in the onsite instruments with the PLC lectures.

We do not include any verification about the control loops program stability or performance, which is fully responsibility of the control supplier.

<u>NOTE</u>: For the electrical communication commissioning of the pilot unit DDEQ will use Sherpa's protocols. At the end of the electrical communication commissioning a record will be signed by MPP, SHERPA and DDEQ

At the conclusion of all the Test and Commissioning process as stated in points 3.5.1 and 3.5.2 a "Pilot Unit Acceptance Document" will be signed between MPP and DDEQ. From that moment, the risk and responsibility of the unit will be transferred to MPP, being then authorized to operate the plant alone or with other suppliers. At the same time, the guarantee period of twelve (12) months will start.

For further assistance or more extensive test and checks DDEQ will provide in point 6 "Price and Payment conditions" a daily net rate for engineers and technicians.

# 4.- RUN TEST OF THE MODULE

As an additional service to MPP, DDEQ is ready to assist to a complete run test of the pilot module when the control supplier has finalized the delivery and test of its scope of supply.

We have considered the assistance during five (5) working days of our Project Engineer to help MPP staff during the integration under operation of the control with the hardware.

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Leadership and execution of the Run Test is MPP responsibility and our task is to resolve doubts and give advices during the Trials. We will also take care of failures of the hardware but not accept any responsibility because of misuse, (in manual or automatic operation), of the hardware.

If additional presence over the five (5) foreseen days is required DDEQ will charge MPP according the rates indicated in point 6 "Price and Payment conditions".

# 5.- EXCLUSIONS

The following services and works have not been taken into account in the present quotation and, therefore, are explicitly exclude of the scope of supply:

- Mechanical connections to UAB utilities nets (steam, air, CO₂, water,...)
- Fan, filter and coolant battery for the lighting cooling system. Its installation (air tubes to the side of the C-II skid) and electrical connection (cabling to our cabinet) is not included. The electrical maneuver will be in our cabinet and the control ins Sherpa's scope.
- Gas analyzer connection different of what was implemented in Module C-IVa. If additional requirements are demanded by MPP DDEQ will implement a Design change in the *"Design Changes Record"* as indicated in point 3.1.
- Electrical interconnecting cabling from DDEQ's electrical cabinet for compartment C-II and the PLC cabinet, and from the PLC cabinet to the control room computer. Neither the main power supply from UAB's general line to DDEQ's cabinet is included.
- Carrying out the control commissioning neither commissioning of the PLC program and the supervisor system implemented in the control room computer. The operation manual of these elements is also out of our scope.
- Changes over design as per MPP Hazop analisys. If additional requirements are demanded by MPP DDEQ will implement a Design change in the *"Design Changes Record"* as indicated in point 3.1.
- Plant star-up with process fluids.
- Plant validation and/or qualification.
- Further engineering works, out of what is clearly stated in the present proposal, as per example:

<u>Note</u>: If any or the following works/tasks (or other not listed here) is required by the UAB, they will be invoiced separately accordingly to the "Daily rates" shown in point 5.2

- o Isometric drawings of the pipes but the process ones.
- Engineering works to accommodate UAB facilities or utilities to the requirements of the unit (connections, modifications in services nets,...)
- Drawings "as built" of the equipment showing the changes implemented over the approved detail constructive project.

<u>Note</u>: A revised version of the P&I'd drawing will be released free of charge, including all the changes, modifications and extension works implemented during the erection or commissioning of the equipment. In the same way, addendums over the manuals will be released to show **important changes** over the approved detail constructive project.

- o Control Commissioning of the plant.
- Engineering works to assure the right integration of the different modules of the Melissa loop.
- Environmental engineering concerning liquid or gaseous effluents

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- o Edition of Plant Operation Protocols for the field Operator
- o Edition of Operational Emergencies and Alarms Management Protocol
- o Edition of Sensor and Instrument Calibration Protocol
- Any legalization or CE marking of the pilot unit exceeding the Study over Machines and Equipment security edited by ICICT, S.A. (TÜV Rheinland Group)
- External sub-supplier management outside the scope of supply of the unit described in this proposal
- Official or legal projects, if necessary or required, as per example: Pressure Equipment Installation Project, Low Voltage Project, ....
- Further assistance services, out of what is clearly stated in the present proposal, as per example:
  - o Commissioning of the equipment with real process fluids.
  - o Validation of the unit
  - Once the commissioning phase is finished:
    - Optimization of the initial Control Settings and Alarm Set Points
    - Optimization of the Maintenance sequences and Cleaning instructions
  - o Others

# **6.- PRICE AND PAYMENT CONDITIONS**

## 6.1.- Price of the plant

The price of the Pilot Unit corresponding to Compartment C-II of the Melissa Pilot Plant according to the base equipment described in the Budget Rev. 2 included as Attachment 1 is:

#### NET PRICE (VAT excluded): -.742.777€.-

The tank for media preparation and its electrical cabinet, pump, required instrumentation and manual valves as well as the assembling of this set has been quoted separately. The price for this system, according to the base equipment described in the Budget Rev. 2 included as Attachment 1 is:

NET PRICE (VAT excluded): -.20.584€.-

<u>Note</u>: The above price is a "fix price" according to "2.- Quotation Basis", that will allow the UAB/MPP to place an order to DDEQ in order to fulfill the required delivery schedule. If during the constructive detail engineering the relevant changes in the design appear they will be reflected in the "Design Changes Record" and the economic impact must be agreed between both parties.

#### 6.2.- Daily rates for special assistance or test

Any further assistance, out of what is clearly stated in points 3.1 and 3.5 of this quotation, required by the MPP both, during the detail engineering (coordination with control engineering, other suppliers,...) or during the commissioning of the plant, will be invoiced according to the following daily rates:

Project E	ngineer (mechanical or electrical/	control):	740 €/day
Assembli	ng coordinator:		560 €/day
Mechani	с:		485 €/day
Electricia	n:	485 €/day	
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Travel expenses:

According to destination

# 6.3.- Order and Payment conditions

DDEQ proposes the following payment conditions:

- 20% down payment with the order, payment at 90 days after invoicing
- 30% at delivery of points 1 to 9 of the Detail Engineering as stated in point 3.1, payment at 90 days after invoicing
- 25% at conclusion of mechanical FAT test as stated in point 3.5.1.1, payment at 90 days after invoicing
- 10% at conclusion of electrical FAT test as stated in point 3.5.1.2, payment at 90 days after invoicing
- 5% at delivery of manuals as stated in point 3.4.1, payment at 90 days after invoicing.
- 5% at conclusion of the equipment installation at the UAB facilities at Cerdanyola del Vallès, payment at 90 days after invoicing
- 5% at the conclusion of the SAT commissioning as stated in point 3.5.2, payment at 90 days after invoicing.

# 7.- PROPOSAL VALIDITY

This proposal is valid for a period of two natural months.

# 8.- PROJECT PLANNING

In practice the development of the Project will be mainly influenced by UAB/MPP final purchasing decision and the administrative delays in order to place the order and contract writing. Also delays in intermediate approvals will cause a longer delivery time for the skid.

Assuming an optimal schedule in the development of the project, the schedule would be as shown in the annex.

# 9.- GUARANTEE

DE DIETRICH EQUIPOS QUÍMICOS S.L., guarantees for one (1) operation year, against manufacturing defects or material failures, all the equipment supply and the erection and assembly works executed by its contractors. The guarantee applies only to the repair or the reposition of the defect element or equipment, once the defect is verified, checked and accepted as guarantee issue.

Elements subjected to wear and/or ageing are not covered by the present guarantee. For example (but not limited) mechanical seals, measurement probes, joints,...Neither is covered negligence in the operation of the equipment and normal maintenance or cleaning operations over the equipment, as well as, accidental failures of the unit.

As mentioned before, the guarantee covers only the repair / replacement of the damaged/defect equipment. No other service or compensation is covered. For third party components or equipments, if any, the guarantee will be provided by the manufacturer.

# **10.- GENERAL PROJECT CONDITIONS AND LIABILITY LIMITATION**

• The works covered under this proposal will be considered finished as soon as the commissioning tests stated in point 3.5 are finished satisfactorily and the "Pilot Unit Acceptance Document" is signed between MPP and DDEQ.

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- Design will be implemented under the guidelines and process requirements provided by the UAB, and according to the good engineering practices known by DDEQ.
- A design review was conducted in June 2.010 to verify that the basic design elaborated fulfills the Technical Requirements (MPP/TN/2005/01 Version 1) and the Technical Note 62.2 edition 1. Some changes emerged from that review agreed between MPP and DDEQ and a new P&I'd version has been released, being the main basis for the current proposal. Again, it has to be understood that a Prototype Pilot Plant might have some uncertainties that will not be clarified until the real start up of the unit, and agreed changes might be required at that stage.
- The engineering works executed by DDEQ, and consequently equipment supply, do not mean that DDEQ has any liability in case the throughout put of the unit is less or different from the foreseen one. Process responsibility is charge of the MPP.
- DDEQ will not accept any liability for direct or indirect damages causes without the intention to harm as per example: production looses, third part claims, prestige looses, overall project delays,... DDEQ will not be responsible either for defects or damages arising from wrong or incomplete information delivered by the UAB/MPP.
- The MPP will designate a main interlocutor to evacuate through all the correspondence, question, doubts,..The same person will concentrate all the information and questions from the MPP to DDEQ.

# 11.- CONFIDENTIALITY

All documents, data and information of the Project shared between MPP and DDEQ will be considered as confidential unless it is explicitly agree between both parts, is of public domain at the date of signing the contract or its use is necessary for the normal development of the project (inquiries or contracts to suppliers or contractors).

# 12.- ANNEX

Investment Budget Rev.1

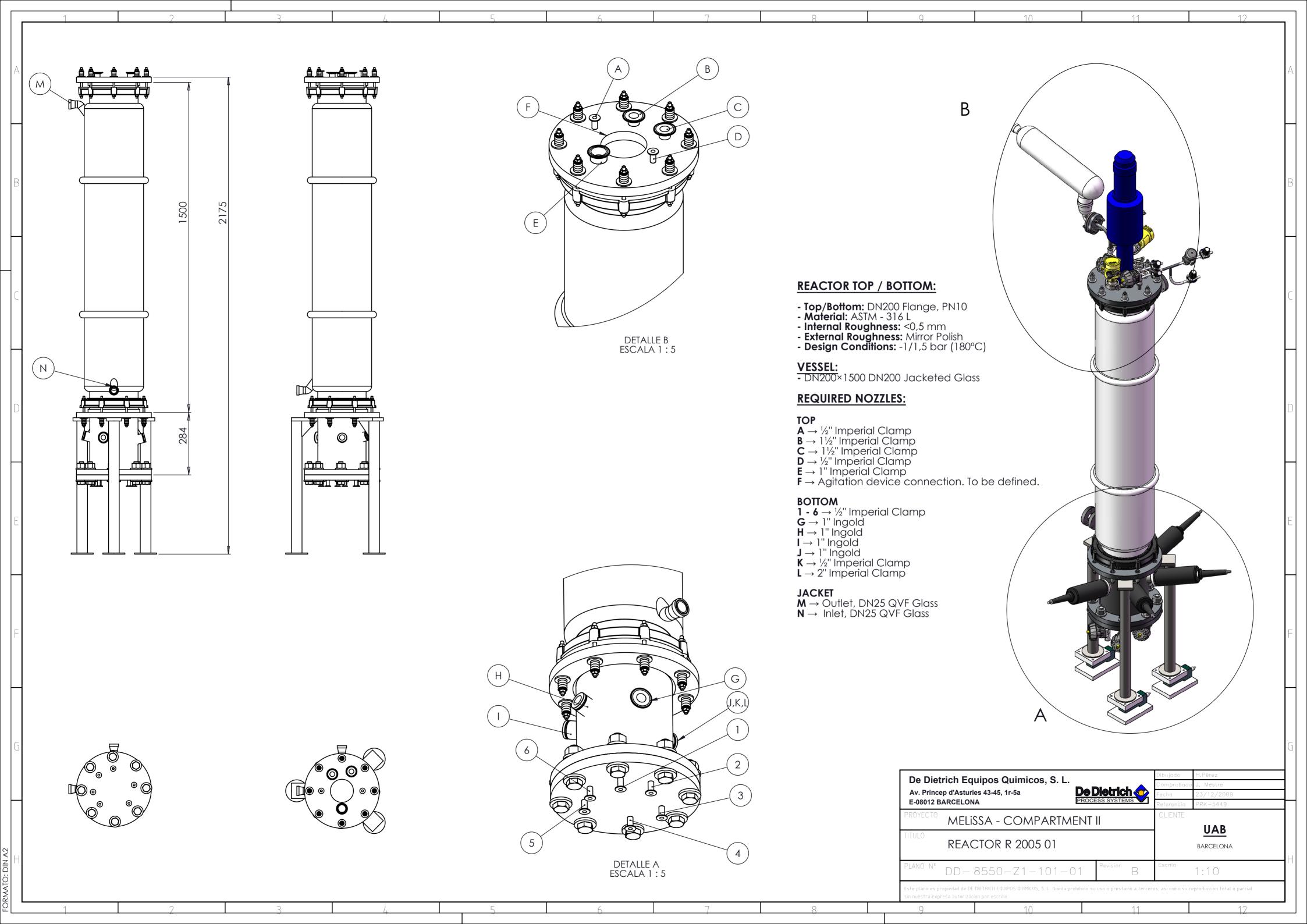
Project planning

Barcelona, July 29th 2010 DE DIETRICH Equipos Químicos, S.L

> Fdo. Roberto de Miguel Managing Director

Fdo. Josep Mestre Technical manager

Number	Task	Start	End	Duration	Q3 - 2010		Q4 - 2010			Q1 - 2011	L		Q2 - 201	1		Q3 - 201	1		Q4 - 2011	Q4 - 2011		
					September	October	November	December	January	February	March	April	Мау	June	July	August	September	October	November	December		
1	Order	15/9/2010	15/9/2010	1	•																	
2	Constructive Detail Design (CDD): Points 1 to 9	15/9/2010	3/12/2010	58				]														
3	Approval Final P&Id	15/10/2010	15/10/2010	1		٠																
	Approval Data package of CDD: Points 1 to 9	15/12/2010	15/12/2010	1				•														
5	Kick off meeting with SHERPA	20/12/2010	20/12/2010	1				•														
	Constructive Detail Design (CDD): Points 10 to 13	16/12/2010	15/2/2011	44																		
	Approval Data package of CDD: Points 10 to 13	28/2/2011	28/2/2011	1																		
	Instruments & Equipments purchases and reception	1/11/2010	28/2/2011	86																		
	Mechanical assembly at DDEQ warehouse	1/2/2011	30/4/2011	64																		
10	Manuals delivery	30/5/2011	30/5/2011	1									•									
	Mechanical FAT test	1/5/2011	4/5/2011	3																		
12	Electrical cabinets manufacturing	1/3/2011	15/5/2011	54																		
13	Electrical FAT test	20/5/2011	24/5/2011	3																		
	Delivery of mechanical and electrical equipment to UAB laboratory	27/5/2011	31/5/2011	3																		
15	Complete assembly and cabling of the skid	1/6/2011	24/6/2011	18																		
16	Interconnecting cabling to PLC byUAB	1/7/2011	19/7/2011	13																		
17	Utilities connection by UAB	20/6/2011	1/7/2011	10																		
18	Mechanical SAT test	1/7/2011	20/7/2011	14																		
19	Electrical SAT test	5/9/2011	16/9/2011	10																		
20	Communication commissioning	19/9/2011	23/9/2011	5																		
21	Pilot Unit Acceptance Document	30/9/2011	30/9/2011	1																		
22	Call out to TÜV to execute CCD Point 14	27/6/2011	27/6/2011	1										•								
23	RUN TEST OF THE MODULE	4/10/2011	10/10/2011	5																		



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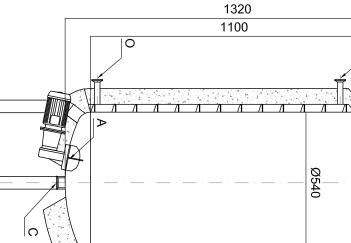
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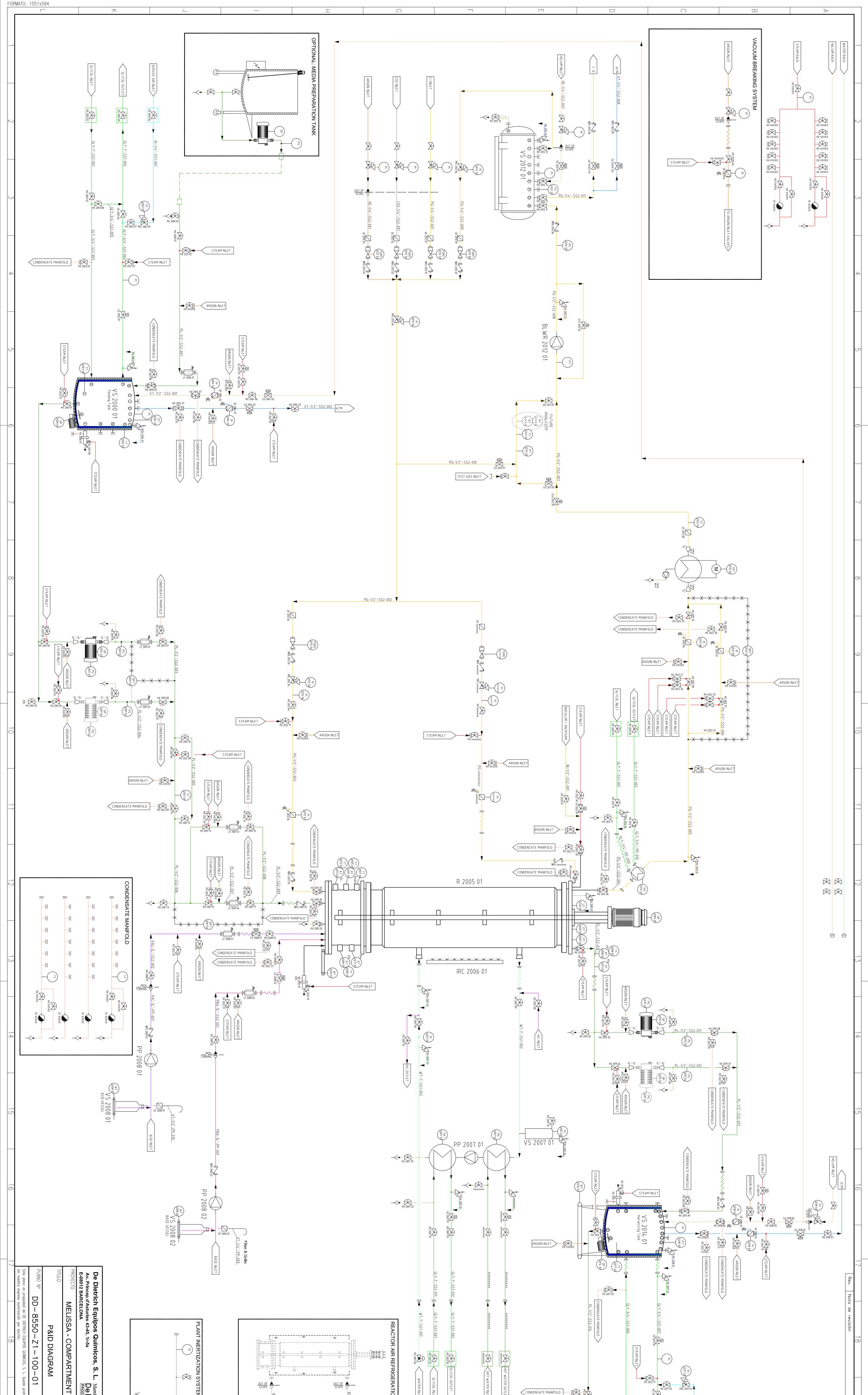
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# MELiSSA Pilot Plant



Universitat Autònoma de Barcelona

Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 229 / 275

# 13. PROPOSAL UPDATE (OCTOBER 2010)

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	quipos Químicos, S.L. Asturies 43-45, 1r-5a CELONA			
	UAB		DATE	30/09/2010
PROJECT:	MELiSSA	- COMPARTMENT C II	REF.	
DRAWING:	DD-8550-2	1-100-02	PREPARED	RdM
TAG	REF.	DESCRIPTION	QUANT.	COST
		EQUIPMENT		
		New Foto-Bioreactor		69.604,88
		Agitation group: Electrical motor 0, 18 kW, nominal speed 250 (variable), shaft length: 1750 mm, double mechanical seal, 10 stages of axial turbines (impeller type) with 4 blades. <i>**Note: The agitator has been designed for being modificated if necessary. Modifications on the design are not included in this quotation.</i>	1	00.004,00
		Jacketed pipe section DN200 L=1500 mm	1	
		Reactor bottom/top in AISI 316 with required nozzles	1	
		Lighting system and cabling (power cabinet included in supply and electrical assembling section)	1	
		Ingold connection and caps for required nozzles	1	
		Gas sparger	1	
		Others	1	
			1	
		Pre-assembly, package and transport		2 400 07
		FAT's tests (tightness and agitation tests with water only)	1	3.466,67
		Spare part: Jacketed pipe section DN200 L=1500 mm	1	4.856,25
		Main gas condenser for the reactor 0,7 m ² in borosilicate (M-HECH 80/7)	1	3.230,77
		Stainless steel tank 250 I with jacket, isolation and magnetic agitator	2	90.300,62
		Process gas buffer (50 l) in stainless steel	1	7.847,41
		Feeding and Harvesting pumps of liquid. Mod. Ecodos 0,55kW - Sanitary. Manufacturer: Lewa	3	10.237,50
		Acid and base pumps - Mod. 521Vi/R2C with freq. Variator. Manufacturer: Watson Marlow	2	3.525,00
		Gas compressor to discharge tank - Manufacturer: KNF (Double diaphragm)	1	4.656,25
		Vacuum pump for plant inertization (pump/filter/oil/others)	1	1.808,61
		Post cooler for gas analysis - Manufacturer: Sick Maihak	1	6.043,75
		Expansion vessel of reactor temperature control circuit	1	1.666,67
		Plate heat exchanger for heating/cooling reactor	2	6.622,52
		Circulation pump for reactor temperature control circuit	1	384,62 €
		Glass vessels 2 I capacity (acid and base)	2	270,00 (
		Exterior jacket for reactor refrigeration with air	1	2.533,33
		Transport and inspection of equipments	1	3.875,00
		TOTAL COST EQU	UIPMENTS	220.930 €
		SUPPLY AND MECHANICAL ASSEMBLING		
				00.440.00
		Assembling of equipments. Construction and assembling of pipes and accessories/fittings	1	62.142,86
				41.600,00
		Materials for pipes construction and accessories. Metalic support structure AISI 304.	1	
		Platform . Structure in AISI304.	1	5.625,00
		Platform . Structure in AISI304. Small modifications at assembling	1	5.625,00 4.375,00
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works	1 1 1 1	5.625,00 4.375,00 1.764,71
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter	1 1 1 9	5.625,00 4.375,00 1.764,71 11.769,23
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter	1 1 1 9 7	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter	1 1 1 9	5.625,00 4.375,00 1.764,71 11.769,23
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter	1 1 1 9 7	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter	1 1 1 9 7 2	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: HOKE	1 1 1 9 7 2	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: HOKE         Valves	1 1 1 9 7 2 6	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: HOKE         Valves         Diaphragm valve 1/2"	1 1 1 9 7 2 6 47	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: Dominick Hunter         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet	1 1 1 9 7 2 6 47 33	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: Dominick Hunter         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve	1 1 1 9 7 2 6 47 33 29	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: Dominick Hunter         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve         Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1/2" with double steam inlet valves	1 1 1 9 7 2 6 47 33 29 2	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: Dominick Hunter         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve         Diaphragm valves 1/2" with double steam inlet valves	1 1 1 9 7 2 6 47 33 29 2 6	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: HOKE         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve         Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1/2" with steam inlet valve         Diaphragm valves 1/2" with steam inlet valve         Diaphragm valves 1/2" with steam inlet valve         Diaphragm valves 1/2" with steam inlet valve	1         1         1         9         7         2         6         47         33         29         2         6         2         6         2         6         29         2         6         2         2         2         33         29         2         2         2         2         2         33         29         2         2         33         29         2         2         33         29         2         3         2         2         3         2         3         2         3         2         3         2         3         3         3         3         3 <t< td=""><td>5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00</td></t<>	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: HOKE         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve         Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1/2" with steam inlet valve         Ball valves 1/2"	1         1         1         9         7         2         6         47         33         29         2         6         2         6         2         6         2         6         2         6         2         6         2         6         2         6         2         6         2         6         2         6         2         6         2         6	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00 1.973,36
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: Dominick Hunter         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve         Diaphragm valves 1/2" with steam inlet valves         Diaphragm valves 3/4"         Ball valves 3/4"         Ball valves 1/2"	1         1         1         9         7         2         6         47         33         29         2         6         2         6         22         6         2         6         2         6         2         6         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         2         1         1         1         1         1         1         1         1         1         1         1         1         1         1 <tr< td=""><td>5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00 1.973,36 4.720,00</td></tr<>	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00 1.973,36 4.720,00
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: Dominick Hunter         Valves         Diaphragm valves 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve         Diaphragm valves 1/2" with double steam inlet valves         Diaphragm valves 1/2" with steam inlet valve         Diaphragm valves 1/2" with steam inlet valve         Ball valves 1/2" with steam inlet valve         Ball valves 1/2"         Ball valves 1/2"	1         1         1         9         7         2         6         47         33         29         2         6         22         6         23         26         1         1         1         33         29         2         6         2         6         2         6         12         2	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00 1.973,36 4.720,00 214,80
		Platform . Structure in AISI304.         Small modifications at assembling         Orbital welding works         Sterilizable gas filters - Manufacturer: Dominick Hunter         Sterilizable liquid filters - Manufacturer: Dominick Hunter         Filters for acid/base vents - Manufacturer: Dominick Hunter         Filters (flow meters) - Manufacturer: Dominick Hunter         Valves         Diaphragm valve 1/2"         Diaphragm valves for argon inlet, steam inlet or condensate outlet         Diaphragm valves 1/2" with steam inlet or condensate outlet valve         Diaphragm valves 1/2" with steam inlet valves         Diaphragm valves 3/4"         Ball valves 3/4"         Ball valves 1/2"	1         1         1         9         7         2         6         47         33         29         2         6         2         6         22         6         2         6         2         6         2         6         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         2         1         1         1         1         1         1         1         1         1         1         1         1         1         1 <tr< td=""><td>5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00 1.973,36 4.720,00</td></tr<>	5.625,00 4.375,00 1.764,71 11.769,23 7.107,69 350,77 933,23 10.480,37 6.820,00 16.715,60 1.729,20 3.729,20 1.413,33 6.776,00 1.973,36 4.720,00

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Manufacturer: Mettler Toledo<br>pH Analyzer. Manufacturer: Mettler Toledo<br>Qutlet gas analyzer<br>Coriolis mass flowmeter for reactor liquid inlet. 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Manufacturer: Mettler Toledo<br>pH Analyzer. Manufacturer: Mettler Toledo<br>Qutlet gas analyzer<br>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H<br>Gas flowmeter/regulation (3 x inlet gases, 1 x reactor total inlet gas, 1 x circulated gas)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         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Guided microwave type. Manufacturer: Vega<br/>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo<br/>Differential pressure system for reactor level control (2 x presure transmitters and special connection)<br/>Scale for harvesting tank. Manufacturer: Mettler Toledo<br/>Foam detection system. Manufacturer: Charis<br/>Biomass Analyzer, model InPro 8200 from Mettler Toledo<br/>Solved Oxygen analyzer. Manufacturer: Mettler Toledo<br/>pH Analyzer. Manufacturer: Mettler Toledo<br/>Qutlet gas analyzer<br/>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H<br/>Gas flowmeter/regulation (3 x inlet gases, 1 x reactor total inlet gas, 1 x circulated gas)<br/>Gas flowmeter for the reactor outlet gases</td><td>1         1         LASSEMBLING)         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I      <tr< td=""><td>27.363,75<br/>8.550,00<br/><b>80.899,08</b><br/>1.552,94<br/>1.588,24<br/>2.401,53<br/>3.880,00<br/>*exclude<br/>15.176,47<br/>3.564,71<br/>10.176,47<br/>3.518,82<br/>*exclude<br/>5.764,71<br/>8.823,53<br/>1.342,35</td></tr<></td></tr> <tr><td></td><td></td><td>b) Installation and electrical connection.<br/>c) Phoenix materials<br/>TOTAL COST ( SUPPLY AND ELECTRICAL<br/>INSTRUMENTS / FIELD CONTROL EQUIPMENTS<br/>Level detector for feeding tank. 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      1         1         5         1         6</td><td>27.363,75<br/>8.550,00<br/>80.899,08<br/>1.552,94<br/>1.588,24<br/>2.401,53<br/>3.880,00<br/>*exclude<br/>15.176,47<br/>3.564,71<br/>10.176,47<br/>3.518,82<br/>*exclude<br/>5.764,71<br/>8.823,53<br/>1.342,35<br/>5.261,79<br/>5.279,22</td></tr> <tr><td></td><td></td><td>b) Installation and electrical connection.<br/>c) Phoenix materials<br/>TOTAL COST ( SUPPLY AND ELECTRICAL<br/>INSTRUMENTS / FIELD CONTROL EQUIPMENTS<br/>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega<br/>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo<br/>Differential pressure system for reactor level control (2 x presure transmitters and special connection)<br/>Scale for harvesting tank. Manufacturer: Mettler Toledo<br/>Foam detection system. Manufacturer: Charis<br/>Biomass Analyzer, model InPro 8200 from Mettler Toledo<br/>Solved Oxygen analyzer. Manufacturer: Mettler Toledo<br/>PH Analyzer. 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(PT-100) + transmitter for PBR</li> </ul></td><td>1         1         ASSEMBLING)         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I      <tr <="" td=""><td>27.363,75<br/>8.550,00<br/>80.899,08<br/>1.552,94<br/>1.588,24<br/>2.401,53<br/>3.880,00<br/>*exclude<br/>15.176,47<br/>3.564,71<br/>10.176,47<br/>3.564,71<br/>10.176,47<br/>3.518,82<br/>*exclude<br/>5.764,71<br/>8.823,53<br/>1.342,35<br/>5.261,79<br/>5.279,22<br/>2.645,29<br/>765,88<br/>4.506,12<br/>1.323,58<br/>396,47</td></tr><tr><td></td><td></td><td><ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. 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Manufacturer: E&H<br>Gas flowmeter/regulation (3 x inlet gases, 1 x reactor total inlet gas, 1 x circulated gas)<br>Gas flowmeter for the reactor outlet gases                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1         1         LASSEMBLING)         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I <tr< td=""><td>27.363,75<br/>8.550,00<br/><b>80.899,08</b><br/>1.552,94<br/>1.588,24<br/>2.401,53<br/>3.880,00<br/>*exclude<br/>15.176,47<br/>3.564,71<br/>10.176,47<br/>3.518,82<br/>*exclude<br/>5.764,71<br/>8.823,53<br/>1.342,35</td></tr<>                                                                                                                                    | 27.363,75<br>8.550,00<br><b>80.899,08</b><br>1.552,94<br>1.588,24<br>2.401,53<br>3.880,00<br>*exclude<br>15.176,47<br>3.564,71<br>10.176,47<br>3.518,82<br>*exclude<br>5.764,71<br>8.823,53<br>1.342,35                                                                                                                       |  |  | b) Installation and electrical connection.<br>c) Phoenix materials<br>TOTAL COST ( SUPPLY AND ELECTRICAL<br>INSTRUMENTS / FIELD CONTROL EQUIPMENTS<br>Level detector for feeding tank. 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Manufacturer: Mettler Toledo<br>pH Analyzer. Manufacturer: Mettler Toledo<br>Qutlet gas analyzer<br>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H<br>Gas flowmeter/regulation (3 x inlet gases, 1 x reactor total inlet gas, 1 x circulated gas)<br>Gas flowmeter for the reactor outlet gases                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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Manufacturer: Mettler Toledo<br>pH Analyzer. Manufacturer: Mettler Toledo<br>Quttet gas analyzer<br>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H<br>Gas flowmeter for the reactor outlet gases<br>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               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|                                                                                                                                                                                                                                                                                                                                           |                                                       | b) Installation and electrical connection.<br>c) Phoenix materials<br>TOTAL COST ( SUPPLY AND ELECTRICAL<br>INSTRUMENTS / FIELD CONTROL EQUIPMENTS<br>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega<br>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo<br>Differential pressure system for reactor level control (2 x presure transmitters and special connection)<br>Scale for harvesting tank. Manufacturer: Mettler Toledo<br>Foam detection system. Manufacturer: Charis<br>Biomass Analyzer, model InPro 8200 from Mettler Toledo<br>Solved Oxygen analyzer. Manufacturer: Mettler Toledo<br>PH Analyzer. Manufacturer: Mettler Toledo<br>Qutlet gas analyzer<br>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H<br>Gas flowmeter for the reactor ulquid inlet. Manufacturer: E&H<br>Gas flowmeter for the reactor outlet gases<br>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)<br>Differential Pressure transmitter for filters blockage detection<br>Pressure switches with LCD indication                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>pH Analyzer. Manufacturer: Mettler Toledo</li> <li>Quitet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. 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Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>pH Analyzer. Manufacturer: Mettler Toledo</li> <li>Quttet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. 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Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Quete Qaygen analyzer. Manufacturer: Mettler Toledo</li> <li>Quete Qaygen analyzer. Manufacturer: Mettler Toledo</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure gauge (lines, filters)</li> <li>Temperature transmitter for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature sensor (PT-100) + transmitter for PBR</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Coriolis mass flowmeter for reactor lequid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor outlet gases</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure suit furs)</li> <li>Temperature transmitter for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature sensor (PT-100) + transmitter for PBR</li> <li>Pod stainless steel for the temperature transmitters</li> </ul></td><td>1         1         LASSEMBLING)         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I      <tr< td=""><td>27.363,75<br/>8.550,00<br/>80.899,08<br/>1.552,94<br/>1.588,24<br/>2.401,53<br/>3.880,00<br/>*exclude<br/>15.176,47<br/>3.564,71<br/>10.176,47<br/>3.564,71<br/>10.176,47<br/>3.518,82<br/>*exclude<br/>5.764,71<br/>8.823,53<br/>1.342,35<br/>5.261,79<br/>5.279,22<br/>2.645,29<br/>765,88<br/>4.506,12<br/>1.323,58<br/>396,47<br/>235,29</td></tr<></td></tr> <tr><td></td><td></td><td><ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. 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<li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Redox Analyzer. Manufacturer: Mettler Toledo</li> <li>Quitlet gas analyzer. Manufacturer: Mettler Toledo</li> <li>Outlet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. 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Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Redox Analyzer. Manufacturer: Mettler Toledo</li> <li>Quitlet gas analyzer. Manufacturer: Mettler Toledo</li> <li>Outlet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor outlet gases.</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure suitch for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature transmitter for PBR</li> <li>Pod stainless steel for the temperature transmitters</li> <li>Proportional valve for PBR pressure control and compressor bypass</li> </ul> | 1         1         ASSEMBLING)         I         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         3         2         7         1         1         1         1         1         1         1         1         1         1         1         1         1 <tr <="" td=""><td>27.363,75<br/>8.550,00<br/>80.899,08<br/>1.552,94<br/>1.588,24<br/>2.401,53<br/>3.880,00<br/>*exclude<br/>15.176,47<br/>3.564,71<br/>10.176,47<br/>3.564,71<br/>10.176,47<br/>3.518,82<br/>*exclude<br/>5.764,71<br/>8.823,53<br/>1.342,35<br/>5.261,79<br/>5.279,22<br/>2.645,29<br/>765,88<br/>4.506,12<br/>1.323,58<br/>396,47<br/>235,29<br/>729,41</td></tr> | 27.363,75<br>8.550,00<br>80.899,08<br>1.552,94<br>1.588,24<br>2.401,53<br>3.880,00<br>*exclude<br>15.176,47<br>3.564,71<br>10.176,47<br>3.564,71<br>10.176,47<br>3.518,82<br>*exclude<br>5.764,71<br>8.823,53<br>1.342,35<br>5.261,79<br>5.279,22<br>2.645,29<br>765,88<br>4.506,12<br>1.323,58<br>396,47<br>235,29<br>729,41 |  |  |      
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Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Coriolis mass flowmeter for reactor lequid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor outlet gases</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure suit furs)</li> <li>Temperature transmitter for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature sensor (PT-100) + transmitter for PBR</li> <li>Pod stainless steel for the temperature transmitters</li> </ul>                                                                                                                                                                                                                                                                                                                                                                  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|                                                                                                                                                                                                                                                                                                                                           |                                                       | <ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Redox Analyzer. Manufacturer: Mettler Toledo</li> <li>Quitlet gas analyzer. Manufacturer: Mettler Toledo</li> <li>Outlet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor outlet gases.</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure suitch for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature transmitter for PBR</li> <li>Pod stainless steel for the temperature transmitters</li> <li>Proportional valve for PBR pressure control and compressor bypass</li> </ul>                                                                                                                                                                                                                                                                             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Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Quitet gas analyzer. Manufacturer: Mettler Toledo</li> <li>Coriolis mass flowmeter for reactor level control (2 x presure tassmitters)</li> <li>Gas flowmeter for the reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor outlet gases</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure sansifter for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature transmitter for PBR</li> <li>Pod stainless steel for the temperature transmitters</li> <li>Proportional valve for PBR pressure control and compressor bypass</li> <li>Automatic diaphragm valves 1/2"</li> <td>1         1         ASSEMBLING)         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I      <tr <="" td=""><td>27.363,75<br/>8.550,00<br/>80.899,08<br/>1.552,94<br/>1.588,24<br/>2.401,53<br/>3.880,00<br/>*exclude<br/>15.176,47<br/>3.564,71<br/>10.176,47<br/>3.564,71<br/>10.176,47<br/>3.518,82<br/>*exclude<br/>5.764,71<br/>8.823,53<br/>1.342,35<br/>5.261,79<br/>5.279,22<br/>2.645,29<br/>765,88<br/>4.506,12<br/>1.323,58<br/>396,47<br/>235,29<br/>729,41<br/>5.723,29</td></tr><tr><td></td><td></td><td><ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. 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|                                                                                                                                                                                                                                                                                                                                           |                                                       | <ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo</li> <li>Redox Analyzer. Manufacturer: Mettler Toledo</li> <li>Quitlet gas analyzer. Manufacturer: Mettler Toledo</li> <li>Outlet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor outlet gases.</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure suitch for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature transmitter for PBR</li> <li>Pod stainless steel for the temperature transmitters</li> <li>Proportional valve for PBR pressure control and compressor bypass</li> </ul>                                                                                                                                                                                                                                                                             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| 27.363,75<br>8.550,00<br>80.899,08<br>1.552,94<br>1.588,24<br>2.401,53<br>3.880,00<br>*exclude<br>15.176,47<br>3.564,71<br>10.176,47<br>3.564,71<br>10.176,47<br>3.518,82<br>*exclude<br>5.764,71<br>8.823,53<br>1.342,35<br>5.261,79<br>5.279,22<br>2.645,29<br>765,88<br>4.506,12<br>1.323,58<br>396,47<br>235,29<br>729,41             |                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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	uipos Químicos, S.L. sturies 43-45, 1r-5a FLONA			
-00012 DANGI				
USTOMER:	UAB		DATE	30/09/2010
PROJECT:		- COMPARTMENT C II	REF.	
DRAWING:	DD-8550-2	21-100-02	PREPARED	RdM
TAG	REF.	DESCRIPTION	QUANT.	COST
		Transport / inspection	1	1.171,76
		TOTAL INSTRUMENTS /EQUPMENT OF C	ONTROL IN FIELD	91.714 €
		OTHER CONCEPTS		
		GENERAL REVISION AFTER ASSEMBLING	1	2.266,67
		INSULATION (PIPES OF STEAM, CONDENSATE AND GLYCOL)	1 COST	3.733,33 <b>6.000 €</b>
		DETAIL ENGINEERING + COMMISSIONING		
		DETAIL ENGINEERING (P&I'd definition, Lay-out, Detail drawings) Technical designer	320	14.080,00 €
		Engineer	320	14.080,00 €
		Technical Manager	60	5.235,00 €
		Technical meetings with MPP for project advance control	40	2.250,00 €
		Paper work	1	1.750,00 €
		MANUAL AND FINAL DOSSIER		
		Technical designer	40	1.760,00€
		Engineer	210	11.494,88 €
		Technical Manager	15	1.308,75€
		Partial "As built"		
		Technical designer	60	2.640,00€
		Engineer	40	2.189,50 €
		COMMISSIONING		
		(3.5.1.1) Mechanical FATs		
		Assembling coordinator	24	1.479,00 €
		Engineer	24	1.313,70 €
		(3.5.1.2) Electrical FATs		
		Engineer	24	1.313,70 €
		Electrical technician	40	1.750,00 €
		(3.5.2.1) Mechanical SATs	120	7 005 00 0
		Assembling coordinator	120	7.395,00 € 6.568,50 €
		Engineer Mechanic official	120 120	4.500,00 €
		(3.5.2.2) Electrical SATs	120	4.500,00 E
		Assembling coordinator	80	4.930,00€
		Engineer	80	4.379,00 €
		Electrical technician	80	3.500,00 €
		(3.5.2.3) Communication comissioning		
		Engineer	40	2.189,50 €
		Electrical technician	40	1.750,00 €
		(4) Run test		
		Engineer	40	2.189,50 €
		Diets and other expenses	1	3.706,25€
		CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS	1	6.250,00€
		C		114.533 €
		TOTAL COST	OF THE PROJECT	740.086 €
		OPTIONAL:		
		MEDIA PREPARATION TANK:		
		Atmospheric stainless steel tank: 300 I with agitator	1	13.618,9
		Centrifugal pump to fill up feeding tank - Sanitary pump	1	1.666,6
		Electrical cabinet		
		Pressure switch with LCD indication	1	3.312,8
			1 4	440.0

<b>De Dietrich Equ</b> Av. Príncep d'Asi E-08012 BARCE	 <b>tipos Químicos, S.L.</b> turies 43-45, 1r-5a ELONA 			
CUSTOMER: PROJECT:		- COMPARTMENT C II	DATE REF.	30/09/2010
DRAWING:	DD-8550-Z	1-100-02	PREPARED	RdM
TAG	REF.	DESCRIPTION	QUANT.	COST
		Assembling works	1	971,43€
			TOTAL COST	20.584 €

USTOMER	UAB		DATE	18/10/2010
PROJECT:	MELiSSA	- COMPARTMENT C II	REF.	
DRAWING:	DD-8550-2	Z1-100-02	PREPARED	RdM
TAG	REF.	DESCRIPTION	QUANT.	COST
		EQUIPMENT		
		New Foto-Bioreactor		69.604,88
				,
		<i>Agitation group:</i> Electrical motor 0, 18 kW, nominal speed 250 (variable), shaft length: 1750 mm, double mechanical seal, 10 stages of axial turbines (impeller type) with 4 blades. <i>**Note: The agitator has been designed for being modificated if necessary. Modifications on the design are not included in this quotation.</i>	1	
		Jacketed pipe section DN200 L=1500 mm	1	
		Reactor bottom/top in AISI 316 with required nozzles	1	
		Lighting system and cabling (power cabinet included in supply and electrical assembling section)	1	
		Ingold connection and caps for required nozzles	1	
		Gas sparger	1	
		Others	1	
		Pre-assembly, package and transport	1	
		FAT's tests (tightness and agitation tests with water only)	1	3.466,67
		Spare part: Jacketed pipe section DN200 L=1500 mm	1	4.856,25
				3.230,77
		Main gas condenser for the reactor 0,7 m ² in borosilicate (M-HECH 80/7)	2	83.312,67
		Stainless steel tank 250 I with jacket, isolation and magnetic agitator	_	
		Process gas buffer (50 I) in stainless steel	1	7.281,71
		Feeding and Harvesting pumps of liquid. Mod. Ecodos 0,55kW - Sanitary. Manufacturer: Lewa	3	10.237,50
		Acid and base pumps - Mod. 521Vi/R2C with freq. Variator. Manufacturer: Watson Marlow	2	3.525,00
		Gas compressor to discharge tank - Manufacturer: KNF (Double diaphragm)	1	4.656,25
		Vacuum pump for plant inertization (pump/filter/oil/others)	1	1.808,61
		Post cooler for gas analysis - Manufacturer: Sick Maihak	1	6.043,75
		Expansion vessel of reactor temperature control circuit	1	1.666,67
		Plate heat exchanger for heating/cooling reactor	2	6.622,52
		Circulation pump for reactor temperature control circuit	1	384,62
		Glass vessels 2 I capacity (acid and base)	2	270,00
		Exterior jacket for reactor refrigeration with air	1	2.533,33
		Transport and inspection of equipments	1	3.875,00
		TOTAL COST EQ	UIPMENTS	213.376 €
		SUPPLY AND MECHANICAL ASSEMBLING		
			1	60 4 40 00
		Assembling of equipments. Construction and assembling of pipes and accessories/fittings		62.142,86
		Materials for pipes construction and accessories. Metalic support structure AISI 304.	1	41.600,00
		Platform . Structure in AISI304.		5.625,00
		Small modifications at assembling	1	4.375,00
		Orbital welding works	1	1.764,71
		Sterilizable gas filters - Manufacturer: Dominick Hunter	9	11.769,23
		Sterilizable liquid filters - Manufacturer: Dominick Hunter	7	7.107,69
		Filters for acid/base vents - Manufacturer: Dominick Hunter	2	350,77
		Filters (flow meters) - Manufacturer: HOKE	6	933,23
		Valves		
		Diaphragm valve 1/2"	47	10.480,37
		Diaphragm valves for argon inlet, steam inlet or condensate outlet	33	6.820,00
		Diaphragm valves 1/2" with steam inlet or condensate outlet valve	29	16.715,60
		Diaphragm valves 1/2" with double steam inlet valves	2	1.729,20
		Diaphragm valves 1" with condensate outlet valve	6	3.729,20
		Diaphragm valves 1 1/2" with steam inlet valve (feed/harvest tanks outlet)	2	1.413,33
		Ball valves 1/2"	22	6.776,00
		Ball valves 3/4"	6	1.973,30
		Ball valves 1"	12	4.720,00
		Ball valves 1/2" in PP	2	214,80
		Ball valves 1/2" in PP	2 2	214,8 270,1

	<b>juipos Químicos, S.L.</b> Isturies 43-45, 1r-5a CELONA																		
CUSTOMER			DATE	18/10/2010															
PROJECT:		- COMPARTMENT C II	REF.																
DRAWING:	DD-8550-Z	1-100-02	PREPARED	RdM															
TAG	REF.	DESCRIPTION	QUANT.	COST															
		Sampling valve	3	5.413,60 €															
		Check valves for liquids	2	1.006,00 €															
		Check valves in PP (acid/base)	2	446,45 €															
		Sanitary check valves for gases - FLUIVAL	2	392,80															
		Check valves for gases (HOKE)	10	718,40 (															
		Pressure reducing for gases with pressure indicator	8	384,00 4															
		Safety Valves - Sanitary design	4	2.240,00															
		Safety Valves	10	1.840,00															
		Steam traps - Manufacturer: SARCO	6	1.296,00 (															
		Other valves	1	1.933,33 (															
		Certificates of materials 3.1B, FDA	1	1.062,50 €															
		Partial dismantle and re-assembling in MPP	1	3.529,41 €															
				5.529,411															
		Coordination of assembling works at field		0.000.00															
		Assembling coordinator	1	9.222,00 €															
		Engineer supervision	1	3.125,00 €															
		Diets and other expenses	1	777,78 €															
		TOTAL COST ( SUPPLY AND MECHANICA	L ASSEMBLING)	226.009,96															
		SUPPLY AND ELECTRICAL ASSEMBLIES           1-Electrical works																	
		<ul><li>a) Power and control cabinet: See detail description in point 3.3 of quotation EXS-M0072 rev. 1</li><li>b) Installation and electrical connection.</li></ul>	1 1																
				44.985,33 ( 27.363,75 ( 8.550,00 (															
		b) Installation and electrical connection.	1	27.363,75															
		b) Installation and electrical connection. c) Phoenix materials	1	27.363,75 € 8.550,00 €															
		b) Installation and electrical connection. c) Phoenix materials	1	27.363,75 8.550,00															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL	1	27.363,75 8.550,00 80.899,08															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS	1 1 L ASSEMBLING)	27.363,75 8.550,00 80.899,08 1.552,94															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega	1 1 L ASSEMBLING)	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> </ul>	1 1 L ASSEMBLING) 1 1 2	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> </ul>	1 1 1 LASSEMBLING) 1 1 2 1 1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> </ul>	1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> </ul>	1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo</li> </ul>	1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       2	27.363,75 = 8.550,00 = 80.899,08 = 1.552,94 = 1.588,24 = 2.401,53 = 3.880,00 = *exclude 4.592,80 = 1.352,94 =															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer. Manufacturer: Mettler Toledo-Transmitter for pH sensor</li> </ul>	1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1	27.363,75 4 8.550,00 4 80.899,08 4 1.552,94 4 1.588,24 4 2.401,53 4 3.880,00 4 *excluded 4.592,80 4 1.352,94 4 2.705,88 4															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer. Manufacturer: Mettler Toledo-Transmitter for pH sensor</li> <li>Redox Analyzer. Manufacturer: Mettler Toledo-Transmitter for redox sensor</li> </ul>	1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2          1          2          2	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer. Manufacturer: Mettler Toledo-Transmitter for pH sensor</li> <li>Redox Analyzer. Manufacturer: Mettler Toledo-Transmitter for redox sensor</li> <li>Outlet gas analyzer</li> </ul>	1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo Differential pressure system for reactor level control (2 x presure transmitters and special connection) Scale for harvesting tank. Manufacturer: Mettler Toledo Foam detection system. Manufacturer: Charis Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH Analyzer. Manufacturer: Mettler Toledo Transmitter for pH sensor Redox Analyzer. Manufacturer: Mettler Toledo Transmitter for redox sensor Outlet gas analyzer Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H	1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo Differential pressure system for reactor level control (2 x presure transmitters and special connection) Scale for harvesting tank. Manufacturer: Mettler Toledo Foam detection system. Manufacturer: Charis Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH Analyzer. Manufacturer: Mettler Toledo Transmitter for pH sensor Redox Analyzer. Manufacturer: Mettler Toledo Transmitter for redox sensor Outlet gas analyzer Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H Gas flowmeter/regulation (3 x inlet gases, 1 x reactor total inlet gas, 1 x circulated gas)	1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         1         5	27.363,75 = 8.550,00 = 80.899,08 = 1.552,94 = 1.588,24 = 2.401,53 = 3.880,00 = *exclude 4.592,80 = 1.352,94 = 2.705,88 = 1.235,29 = *exclude 5.764,71 = 8.823,53 =															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo Differential pressure system for reactor level control (2 x presure transmitters and special connection) Scale for harvesting tank. Manufacturer: Mettler Toledo Foam detection system. Manufacturer: Charis Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH Analyzer. Manufacturer: Mettler Toledo Transmitter for pH sensor Redox Analyzer. Manufacturer: Mettler Toledo Transmitter for redox sensor Outlet gas analyzer Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H Gas flowmeter/regulation (3 x inlet gases, 1 x reactor total inlet gas, 1 x circulated gas) Gas flowmeter for the reactor outlet gases	1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         5         1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo Differential pressure system for reactor level control (2 x presure transmitters and special connection) Scale for harvesting tank. Manufacturer: Mettler Toledo Foam detection system. Manufacturer: Charis Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH Analyzer. Manufacturer: Mettler Toledo Transmitter for pH sensor Redox Analyzer. Manufacturer: Mettler Toledo Transmitter for redox sensor Outlet gas analyzer Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H Gas flowmeter for the reactor outlet gases Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)	1         1         1         1         ASSEMBLING)         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         5         1         6	27.363,75 * 8.550,00 * 80.899,08 * 1.552,94 * 1.588,24 * 2.401,53 * 3.880,00 * *exclude 4.592,80 * 1.352,94 * 2.705,88 * 1.235,29 * *exclude 5.764,71 * 8.823,53 * 1.342,35 * 5.261,79 *															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer, Manufacturer: Mettler Toledo Transmitter for pH sensor</li> <li>Redox Analyzer, Manufacturer: Mettler Toledo Transmitter for redox sensor</li> <li>Outlet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor ulter gases</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> </ul>	1         1         1         1         ASSEMBLING)         I         I         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         5         1         6         3	27.363,75 * 8.550,00 * 80.899,08 * 1.552,94 * 1.588,24 * 2.401,53 * 3.880,00 * *exclude 4.592,80 * 1.352,94 * 2.705,88 * 1.235,29 * *exclude 5.764,71 * 8.823,53 * 1.342,35 * 5.261,79 *															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo Differential pressure system for reactor level control (2 x presure transmitters and special connection) Scale for harvesting tank. Manufacturer: Mettler Toledo Foam detection system. Manufacturer: Charis Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor Solved Oxygen analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH Analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH Analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor Outlet gas analyzer Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H Gas flowmeter for the reactor ulquid inlet. Manufacturer: E&H Gas flowmeter for the reactor outlet gases Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor) Differential Pressure transmitter for filters blockage detection Pressure switches with LCD indication	1         1         1         1         ASSEMBLING)         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         5         1         6         3         6         3         6	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo Differential pressure system for reactor level control (2 x presure transmitters and special connection) Scale for harvesting tank. Manufacturer: Mettler Toledo Foam detection system. Manufacturer: Charis Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor Solved Oxygen analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH - Analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pU - Stale for reactor liquid inlet. Manufacturer: E&H Gas flowmeter for reactor liquid inlet. Manufacturer: E&H Gas flowmeter for the reactor outlet gases Pressure transmitter for the reactor, influent, effluent, buffer, gas analyzer, compresor) Differential Pressure transmitter for filters blockage detection Pressure switches with LCD indication Pressure switch for pump's membrane breakage detection	1         1         1         ASSEMBLING)         I         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         5         1         6         3         6         3	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29 765,88															
		b) Installation and electrical connection. c) Phoenix materials TOTAL COST ( SUPPLY AND ELECTRICAL INSTRUMENTS / FIELD CONTROL EQUIPMENTS Level detector for feeding tank. Guided microwave type. Manufacturer: Vega Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo Differential pressure system for reactor level control (2 x presure transmitters and special connection) Scale for harvesting tank. Manufacturer: Mettler Toledo Foam detection system. Manufacturer: Charis Biomass Analyzer, model InPro 8200 from Mettler Toledo Transmitter for biomass sensor Solved Oxygen analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH - Analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor pH - Analyzer. Manufacturer: Mettler Toledo Transmitter for pI sensor Redox Analyzer. Manufacturer: Mettler Toledo Transmitter for redox sensor Outlet gas analyzer Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&H Gas flowmeter for the reactor outlet gases Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor) Differential Pressure transmitter for filters blockage detection Pressure switches with LCD indication Pressure switch for pump's membrane breakage detection Pressure gauge (lines, filters)	1         1         1         ASSEMBLING)         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I         I	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29 765,88 4.506,12															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. RS232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer, model InPro 8200 from Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer. Manufacturer: Mettler Toledo Transmitter for redox sensor</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor uliquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor liquid inlet. Manufacturer: gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure gauge (lines, filters)</li> <li>Temperature transmitter for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> </ul>	1         1         1         1         ASSEMBLING)         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29 765,88 4.506,12 1.323,58															
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer. Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer. Manufacturer: Mettler Toledo Transmitter for pH sensor</li> <li>Redox Analyzer. Manufacturer: Mettler Toledo Transmitter for redox sensor</li> <li>Outlet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor uiquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switches with LCD indication</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure gauge (lines, filters)</li> <li>Temperature transmitter for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature sensor (PT-100) + transmitter for PBR</li> </ul>	1         1         1         1         ASSEMBLING)         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         5         1         6         3         6         3         22         7         1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29 765,88 4.506,12 1.323,58 396,47															
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27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29 765,88 4.506,12 1.323,58 396,47 235,29																			
		<ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. Guided microwave type. Manufacturer: Vega</li> <li>Scales for acid/base vessels. R5232 Signal. Manufacturer: Mettler Toledo</li> <li>Differential pressure system for reactor level control (2 x presure transmitters and special connection)</li> <li>Scale for harvesting tank. Manufacturer: Mettler Toledo</li> <li>Foam detection system. Manufacturer: Charis</li> <li>Biomass - Analyzer, Manufacturer: Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH Analyzer, Manufacturer: Mettler Toledo-Transmitter for pH sensor</li> <li>Redox Analyzer, Manufacturer: Mettler Toledo-Transmitter for redox sensor</li> <li>Outlet gas analyzer</li> <li>Coriolis mass flowmeter for reactor liquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter for the reactor ulquid inlet. Manufacturer: E&amp;H</li> <li>Gas flowmeter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure suiter for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature transmitter for PBR</li> <li>Pod stainless steel for the temperature transmitters</li> </ul>	1         1         1         ASSEMBLING)         I         1         1         1         1         1         1         1         1         1         1         1         1         1         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         2         1         1         5         1         6         3         22         7         1         1         1         1         1         1         1         1         1          1          1	27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29 765,88															
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Manufacturer: Charis</li> <li>Biomass - Malyzer, Manufacturer: Mettler Toledo Transmitter for biomass sensor</li> <li>Solved Oxygen analyzer, Manufacturer: Mettler Toledo Transmitter for solved oxygen sensor</li> <li>pH - Analyzer, Manufacturer: Mettler Toledo-Transmitter for pH sensor</li> <li>Redox Analyzer, Manufacturer: Mettler Toledo-Transmitter for reactor level cortrol in gass. 1 x reactor total inlet gas, 1 x circulated gas)</li> <li>Gas flowmeter for the reactor outlet gases</li> <li>Pressure transmitter (1 x reactor, influent, effluent, buffer, gas analyzer, compresor)</li> <li>Differential Pressure transmitter for filters blockage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for pump's membrane breakage detection</li> <li>Pressure switch for influent/effluent tanks, gas analyzer, water circuit and condensate manifold</li> <li>Temperature transmitter for rBR</li> <li>Pod stainless steel for the temperature transmitters</li> </ul>	1         1         1         ASSEMBLING)         I         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1         3         1         1         1         1         1         1         1         1         1         1         1         1         1         1         1 <tr <="" td=""><td>27.363,75 8.550,00 80.899,08 1.552,94 1.588,24 2.401,53 3.880,00 *exclude 4.592,80 1.352,94 2.705,88 1.235,29 *exclude 5.764,71 8.823,53 1.342,35 5.261,79 5.279,22 2.645,29 765,88 4.506,12 1.323,58 396,47 235,29</td></tr> <tr><td></td><td></td><td><ul> <li>b) Installation and electrical connection.</li> <li>c) Phoenix materials</li> <li>TOTAL COST ( SUPPLY AND ELECTRICAL</li> <li>INSTRUMENTS / FIELD CONTROL EQUIPMENTS</li> <li>Level detector for feeding tank. 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De Dietrich Equ Av. Príncep d'As E-08012 BARCE	l <b>uipos Químicos, S.L.</b> sturies 43-45, 1r-5a ELONA			
CUSTOMER:	UΔB		DATE	18/10/2010
		COMPARTMENT C II	REF.	10/10/2010
	DD-8550-Z		PREPARED	RdM
TAG	REF.	DESCRIPTION Transport / inspection	QUANT.	<u>COST</u> 1.171,76
		TOTAL INSTRUMENTS /EQUPMENT OF CONTRO		68.576 €
		OTHER CONCEPTS		
		GENERAL REVISION AFTER ASSEMBLING	1	2.266,67
			COST	2.267 €
		DETAIL ENGINEERING + COMMISSIONING		
		DETAIL ENGINEERING (P&I 'd definition, Lay-out, Detail drawings)		
		Technical designer	320	14.080,00 €
		Engineer	340	18.610,75 €
		Technical Manager	60	5.235,00€
		Technical meetings with MPP for project advance control	40	2.250,00€
		Paper work	1	1.750,00€
		MANUAL AND FINAL DOSSIER		
		Technical designer	40	1.760,00 €
		Engineer	210	11.494,88 €
		Technical Manager	15	1.308,75€
		Partial "As built"	60	2.640,00€
		Technical designer Engineer	60 40	2.840,00 €
		COMMISSIONING	40	2.109,50 €
		(3.5.1.1) Mechanical FATs		
		Assembling coordinator	24	1.479,00€
		Engineer	24	1.313,70 €
		(3.5.1.2) Electrical FATs		
		Engineer	24	1.313,70 €
		Electrical technician	40	1.750,00€
		COSTE IN	NGENIERIA	67.175€
		TOTAL COST OF THE	PROJECT	658.304 €

	<b>quipos Químicos, S.L.</b> Asturies 43-45, 1r-5a CELONA			
USTOMER:			DATE	18/10/2010
PROJECT:			REF.	
DRAWING:	DD-8550-2	Z1-100-02	PREPARED	RdM
TAG	REF.	DESCRIPTION	QUANT.	COST
OPTION	IAL 1: 2nd	STAGE OF THE PROJECT.		
		SUPPLY AND ELECTRICAL ASSEMBLIES		
		1-Electrical works		
		Electrical assembling works pending (sensors to transmitter)	1	1.062,50
		TOTAL COST (ELECTRICAL ASS	SEMBLING)	1.062,50
		INSTRUMENTS / FIELD CONTROL EQUIPMENTS		
		Biomass analyzer (transmitter excluded)	2	10.583,67
		Solved Oxygen analyzer (transmitter excluded)	1	3.139,85
		pH analyzer (transmitter excluded)	2	7.470,59
		Redox sensor + cable + InTrac777	1	2.460,00
		Configuration and start-up for instruments that need it	1	529,41
		Certificates of materials 3.1B, FDA	1	235,29
		Transport / inspection	1	147,06
		TOTAL INSTRUMENTS /EQUPMENT OF CONTRO		24.566 €
		<u>OTHER CONCEPTS</u>		
		INSULATION (PIPES OF STEAM, CONDENSATE AND GLYCOL)	1	3.733,33
			COST	3.733€
		COMMISSIONING		
		(3.5.2.1) Mechanical SATs	120	7.395.00€
			120 120	7.395,00 € 6.568,50 €
		(3.5.2.1) Mechanical SATs Assembling coordinator		
		(3.5.2.1) Mechanical SATs Assembling coordinator Engineer Mechanic official (3.5.2.2) Electrical SATs	120 120	6.568,50 € 4.500,00 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator	120 120 80	6.568,50 € 4.500,00 € 4.930,00 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical SATs         Assembling coordinator         Engineer	120           120           80           80	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Engineer         Engineer         Electrical technician	120 120 80	6.568,50 € 4.500,00 € 4.930,00 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical SATs         Assembling coordinator         Engineer	120           120           80           80	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Engineer         Electrical technician         (3.5.2.3) Communication comissioning	120           120           80           80           80	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical technician         (3.5.2.3) Communication comissioning         Engineer         Electrical technician         (4) Run test	120 120 80 80 80 40 40	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical technician         (3.5.2.3) Communication comissioning         Engineer         Electrical technician         (4) Run test         Engineer	120         120         80         80         80         40         40         40         40	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 € 2.189,50 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical SATs         Image: Second Seco	120 120 80 80 80 40 40 40 40 1	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 € 2.189,50 € 3.706,25 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical technician         (3.5.2.3) Communication comissioning         Engineer         Electrical technician         (4) Run test         Engineer	120         120         80         80         80         40         40         40         40	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 € 2.189,50 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical SATs         Assembling coordinator         Engineer         Electrical technician         (3.5.2.3) Communication comissioning         Engineer         Electrical technician         (4) Run test         Engineer         Diets and other expenses         CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS	120 120 80 80 80 40 40 40 40 1	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 € 2.189,50 € 3.706,25 €
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical SATs         Assembling coordinator         Engineer         Electrical technician         (3.5.2.3) Communication comissioning         Engineer         Electrical technician         (4) Run test         Engineer         Diets and other expenses         CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS	120         120         80         80         80         40         40         1         1	$6.568,50 \in$ $4.500,00 \in$ $4.930,00 \in$ $4.379,00 \in$ $3.500,00 \in$ $2.189,50 \in$ $1.750,00 \in$ $2.189,50 \in$ $3.706,25 \in$ $6.250,00 \in$
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical SATs         Assembling coordinator         Engineer         Electrical technician         (3.5.2.3) Communication comissioning         Engineer         Electrical technician         (4) Run test         Engineer         Diets and other expenses         CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS	120 120 80 80 80 40 40 40 1 1 1 NGENIERIA	$6.568,50 \in$ $4.500,00 \in$ $4.930,00 \in$ $4.379,00 \in$ $3.500,00 \in$ $2.189,50 \in$ $1.750,00 \in$ $2.189,50 \in$ $3.706,25 \in$ $6.250,00 \in$
		(3.5.2.1) Mechanical SATs         Assembling coordinator         Engineer         Mechanic official         (3.5.2.2) Electrical SATs         Assembling coordinator         Engineer         Electrical technician         (3.5.2.3) Communication comissioning         Engineer         Electrical technician         (4) Run test         Engineer         Diets and other expenses         CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS	120 120 80 80 80 40 40 40 1 1 1 NGENIERIA	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 € 2.189,50 € 3.706,25 € 6.250,00 € 47.358 €
		(3.5.2.1) Mechanical SATs Assembling coordinator Engineer Mechanic official (3.5.2.2) Electrical SATs Assembling coordinator Engineer Electrical technician (3.5.2.3) Communication comissioning Engineer Electrical technician (4) Run test Engineer Diets and other expenses CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS COSTE I TOTAL COST OF THE PROJECT (2) IA PREPARATION TANK	120 120 80 80 80 40 40 40 1 1 INGENIERIA 2nd STAGE)	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 € 2.189,50 € 3.706,25 € 6.250,00 € 47.358 € 76.719 €
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		(3.5.2.1) Mechanical SATs Assembling coordinator Engineer Mechanic official (3.5.2.2) Electrical SATs Assembling coordinator Engineer Electrical technician (3.5.2.3) Communication comissioning Engineer Electrical technician (4) Run test Engineer Diets and other expenses CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS COSTE I COSTE I TOTAL COST OF THE PROJECT (2 DIA PREPARATION TANK Atmospheric stainless steel tank: 300 I with agitator	120 120 80 80 80 40 40 40 1 1 NGENIERIA 2nd STAGE) 1 1	6.568,50 € 4.500,00 € 4.930,00 € 4.379,00 € 3.500,00 € 2.189,50 € 1.750,00 € 2.189,50 € 3.706,25 € 6.250,00 € 47.358 € 76.719 € 12.938,00
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# **1.- SUBJECT AND ANTECEDENTS**

The Universitat Autònoma de Barcelona, hereafter UAB, takes part in the MELiSSA Project of the European Space Agency (ESA) and the European Space Research and Technology Centre (ESTEC). The Project objective is to study and define parameters to achieve life conditions in the space during long journeys.

Included in this research project there is a pilot plant installed in the Departament d'Enginyeria Química de l'Escola Tècnica Superior d'Enginyeria (ETSE) of the UAB. This pilot plant is based in several compartments linked together in a close loop to process and recycle the ambient air, water, food and feces.

**De Dietrich Equipos Químicos**, hereafter **DDEQ**, was commissioned by the UAB for the basic designing of compartment C-II of the pilot plant, according to DDEQ quotation DDE-K1764-SI.

The present proposal **EXS-M0127 Rev. 1** for the construction and delivery of the skid corresponding to compartment C-II, is based in the documentation and designs generated during this basic engineering project development, the Design Review conclusions during June 2.010 and MPP/ESA subsequent decisions.

The proposal includes the following concepts:

- Carry out the required detailed and constructive engineering works to build up the plant
- Delivery of all the materials, equipments and goods.
- Carry out the assembly (mechanical and cabling) of the plant
- Commissioning of the plant (DDEQ scope)
- Delivery of operation manual and technical dossier of the plant

## 2.- QUOTATION BASIS

To make this proposal the following documents (Data package) coming from the basic designing works of MELISSA – Compartment II Pilot Reactor, have been used:

P&ID Diagram DD-8550-Z1-100-01 **Rev. J** modified as per Basic Design Review conclusions based on meeting hold on June 7th, telecom hold on June 8th, mail from E. Peiro dated June 28th and last changes included in telecom hold on September 30th

Control Loops Diagram DD-8550-Z1-100-02 Rev. F (not up-dated until constructive engineering)

Main Equipments list Rev. B

Valves, filters and accessories list Rev. A (not up-dated until constructive engineering)

Piping list Rev. A (not up-dated until constructive engineering)

Instruments list Rev. A (not up-dated until constructive engineering)

Motor list Rev. A (not up-dated until constructive engineering)

Main Equipments Technical Specification Rev. B

Instruments Specification Rev. A (not up-dated until constructive engineering)

Electrical & Control Signals List Rev. A (not up-dated until constructive engineering)

Nevertheless, it has to be understood that a Prototype Pilot Plant might have some uncertainties that will not be clarified until the start up of the unit, and agreed changes might be required at that stage.

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# 3.- SCOPE OF SUPPLY

# **3.1.-** Constructive Detail Engineering Contents

The Investment Budget has been calculated considering a Constructive Detail Engineering packet of 780h to execute the following works:

- 1. Definition and Execution of Final P&I'd.
- 2. Definition of utilities required and estimated consumptions.
- 3. Definition and Execution of Final Control Loops Diagram.
- 4. Final Lay-out drawing.
- 5. Final list of: Sensors, valves, lines and components.
- 6. Datasheets of sensors, valves and main equipments.
- 7. Constructive drawings of:
  - Liquid storage tanks and accessory vessels
  - Reactor
  - Lighting arrangement and supports
  - Frame, supports and skid
- 8. Sufficient drawings for the pipe assembly, including isometric drawing of process lines.
- 9. Final detailed control functional description.

As soon as this first Data package is ready it will be sent to MPP for revision and approval. Once the approval is received, the rest of the Detail Engineering will be carried out and the purchases orders to suppliers will star to be released.

At this stage MPP will deliver the detailed control functional description plus the sensor and motor list with their datasheets to the control supplier (Sherpa) to star working on the PLC definition and program, as well as the scada control screens.

A *"kick off meeting"* with the MPP's control contractor will be held at the UAB in order to clarify all the information provided by DDEQ to this contractor in the Data Package with points 1 to 9 (sensor list, motor list, automatic valves list, data sheets, control loops definitions, and final detailed control functional description). The estimated duration of this meeting is about one day and will be held with project engineers involved in the project.

- 10. HAZOP Analysis over final lay-out and P&ID
- 11. Prepare the "Test Protocols" for DDEQ Test and Commissioning as per stated in point 3.5. The protocols will be agreed with MPP.
- 12. Electrical diagrams for the electrical cabinet. CE marking and legalization of the new cabinet.
- 13. CE marking and legalization of liquid storage tanks and buffer.
- 14. Machines and Equipment Safety Evaluation, made by ICICT, S.A. (TÜV Rheinland Group), for a Pilot Plant module installed at the UAB facilities in Cerdanyola del Vallès.

Like for the C-IVa module the notified body will do a Study over Machines and Equipment security based on:

- R.D. 1215/97 about Minimum Security and Health Measures for the use of equipments.
- R.D. 1644/2008 about Safety in Machines, transposition of directive 2006/42/EC

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- UNE-EN norms of application

The notified body will execute the following works:

- Hazards identification
- Risk analysis according the hazards detected
- Consensus about safety technical solutions based on UNE-EN norms

Final conclusions report and Machinery Conformity / Non Conformity Certificate emission.

#### NOTE: The delivery of points 10-14 will be according the attached planning.

To assure the traceability and control over the design, DDEQ will implement a "Design Changes Record". The objectives of this record are:

- a. Assure traceability over design changes: date, problem detected, reason, decision, final change introduced, possible delays, cost.
- b. Assure approval from both MPP and DDEQ.
- c. Decision about who will take the cost of the change.

NOTE: This document will be prepared by DDEQ and shared with MPP for approval.

# 3.2.- Mechanical Turn-key supply of the compartment C-II

It is included the mechanical turn-key supply of the mechanical and electrical equipment corresponding to the Compartment C-II of the Melissa Pilot Plant in accordance with the "Quotation basis" shown in point 2 and the Detail Engineering to be carried out according to point 3.1.

Previously to any purchase DDEQ will inform UAB which is the selected supplier or contractor. Should the UAB has any inconvenience regarding a supplier or contractor DDEQ will change to another one, unless this might have an economic impact on the project or cause a delay in the schedule.

Mechanical Erection and installation of the unit at DDEQ warehouse and UAB laboratories at Cerdanyola del Vallés

2 Copies of the final dossier

# **3.3.- Electrical supply for the compartment C-II**

Following we provide a description of the power and control system that is foreseen for the for the compartment II of MELiSSA Pilot Plant.

Documents of reference:

- Control Loops P&ID (DD-8550-Z1-100-02 rev. F) (not up-dated until constructive engineering)
- Electrical and control signals list rev. A (not up-dated until constructive engineering)
- Room Lay-Out (DD-8550-Z1-102-02 rev. 0) (not up-dated until constructive engineering)

#### **3.3.1.-** Situation of the electrical cabinet

The electrical cupboards are foreseen by DDEQ out of the skid in order to save space in it and considering the room constraints.

MPP mentioned that the C-I PLC cabinet could be moved to the corner near the GC in order to have more space for the C.II skid (to be confirmed by NTE).

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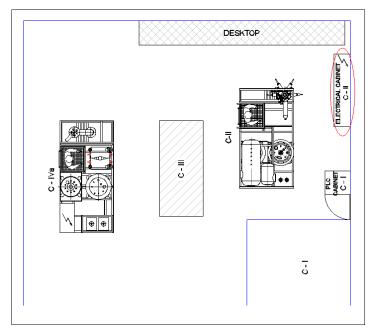
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The designed electrical cabinet is 1800x2600x400 (height, width, depth) and it is conceptually divided in two different parts: power and control. By control we mean concentrate all the control signals from site instruments to the cabinet, to communicate with the main PLC and supervisor (delivered and programmed by others).

It can be physically divided too in order to be able to go through the pilot plant door.

The situation in the plant of the electrical cabinet is the next:



<u>NOTE:</u> For further details about dimensions refer to Room Lay-Out (DD-8550-Z1-102-02 rev. 0) included in the ANNEX II of the Engineering dossier.

#### 3.3.2.- Power and control panel

Supply of **power** and control panel, dimensions 1800 height, 2600 width and 400 depth, mechanized, mounted, connected and with the following elements and devices:

- 1 Base panel and accessories
- 1 Mounting board
- 1 Cooper bar and accessories
- 1 Overvoltage protection Class D IEC 1024-1
- 1 Light switch "On service"
- 1 General switch
- 1 Main ground-fault protection and thermal-magnetic circuit breaker
- 1 Emergency stop push button
- 1 "Emergency stop activated" indicator (red led)
- 1 White light indicator "Voltage in"
- 1 Acknowledge push button
- 1 Security check push button
- 1 Safety relay PREVENTA
- 2 Power supply 24Vdc/10 A
- 1 Single ground-fault protection for all frequency converters

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- 1 General ground-fault protection for all the instrumentation
- 1 DIMMER 3-phase to control lightning columns
- 1 Transformer 3-phase 5KVA
- 1 Single thermal-magnetic protection for 10 lightning columns
- 1 Current metering and 4-20mA conversion
- 1 DIMMER protection security circuit against low load in the output
- 1 RS232/Ethernet converter
- $1 \rightarrow$  Wiring of the following control signals:
  - 71 Digital inputs
  - 52 Analogical inputs
  - 49 Digital outputs
  - 19 Analogical outputs
- 6 Galvanic isolators
- $1 \rightarrow$  Set of thermal-magnetic circuit breakers
- $6 \rightarrow$  Single-phase frequency converters 1,5KW
- 1 Set of Contactors
- $1 \rightarrow$  Fan and filter
- $1 \rightarrow$  Set of circuit breaker auxiliary switch
- $1 \rightarrow$  Set of connection strips
- $1 \rightarrow$  Elements and devices mounted and connected according CE directive
- $1 \rightarrow$  Design, technical managing and documentation

#### **IMPORTANT NOTES:**

- > It is not foreseen the connection to the plant main power/pneumatic supply.
- > All consumers will be equipped with ground-fault protection and thermal-magnetic circuit breaker.
- > The material included in these lists is the necessary for the electrical and control signals according to the Basic Engineering Design and conclusions arose from the Design review done in June.

#### 3.3.3.- Electrical erection and commissioning of compartment C-II

The estimated materials which are required are:

- 20 m galvanized cable tray 60x60 mm (without cover).
- 20 m galvanized cable tray 300x60 mm (without cover).
- Trays mounting accessories.
- 160 m shielded cable 4x0,5 mm²
- 20 m blue shielded cable 8x0,5 mm²
- 250 m cable 4x0,5 mm²
- 200 m shielded cable 4x1,5 mm²
- 300 m shielded cable 3x1,5 mm²

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- 250 m flexible conduit.
- 10 m heat-shrinkable tubing.
- Other connection and mounting accessories.
- Cable signalling.
- 100 m pneumatic tubing.
- 3 emergency stop pushbuttons.
- Other pneumatic accessories.

#### IMPORTANT NOTES:

If it is physically possible the power cables will be installed as separated as possible from the signal ones.

#### 3.3.4.- Photo-bioreactor Lighting system

The illumination system consists of 250-270 halogen lamps which surround the glass jacketed pipe section (DN200, L=1500m).

The type of lamps used will be the specified in the technical note 62.2 and are: OSRAM 12V, 20W BAB 38°.

#### **3.3.5.- Lighting system structure**

The lights will be set-up on a portable structure made of stainless-steel with 270 lamps of 20W 12V each, surrounded by a hybrid stainless steel – transparent plastic fairing, through which the cooling air can circulate.

It will include 2 or 3 connection boxes sited on the half height of the structure.

These boxes will receive the cables from the lamps to link in 2 o 3 cables all the power to the main electric panel.

#### 3.3.6.- Phoenix material

Set of Phoenix materials:

- Analogical cable FLK 50/EX-DR/800
- Digital cable FLK 50/4X14/EZ-DR/800
- Interface modules VARIOFACE FLKM50/MOFI-TSX.
- Connectors PLC-V8/FLK14/OUT.
- Connectors PLC-V8/FLK14/IN.
- Relay PLC_RSP-24UC/21AU (24VDC).
- Plug-in bridges FBST 500-PLC BU
- Separating plates PLC-ATP-BK.

#### **IMPORTANT NOTES:**

➢ We have included Phoenix Contact cables of 8 m. These cables will have in both sizes de connectors for flat cable BUT WILL NOT INCLUDE THE ADAPTERS TO CONNECT TO THE QUANTUM MODULES. These adapters must be supplied by the PLC cabinet manufacturer.

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# 3.4.- Manuals:

The manuals will be issued in English once points 1 to 9 of the Detail Engineering are approved by the MPP and while the module skid is pre-assembly in DDEQ's warehouse. The Operation Manuals should be delivered to MPP the latest at the same time the pilot skid is installed in the UAB's laboratories and the Technical Dossier no later than two months after the skid is installed.

#### 3.4.1.- Operation Manual:

The Operation Manual will contain:

- 1. INTRODUCTION SYSTEM DESCRIPTION
- 2. COMPONENT DESCRIPTION
- 3. PLANT CONTROL DESCRIPTION
- 4. PLANT SAFETY
- 5. GENERAL PROCEDURES
- 6. INSTALLATION START UP
- 7. INSTALLATION SHUT DOWN
- 8. NOMINAL OPERATION
- 9. SIP (STERILIZATION SEQUENCES)
- 10. SERVICE ON HARDWARE
- 11. PROCESS FOLLOW UP
- 12. CALIBRATIONS

#### 3.4.2.- Technical Dossier

The Technical Dossier will contain

- Final P&I'd. ("as built" one)
- Final Control Loops Diagram.
- Final Lay-out drawing.
- Constructive drawings of:
  - Liquid storage tanks and accessory vessels
  - Reactor
  - Lighting arrangement and supports
  - Frame, supports and skid
- Sufficient drawings for the pipe assembly, including isometric drawing of process lines.
- Final list of: Sensors, valves, lines and main equipments, and the corresponding Datasheets
- Final detailed control functional description.
- Electrical diagrams for the electrical cabinet. CE marking and legalization of the cabinet.

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- CE marking and legalization of the liquid storage tanks.
- Welding controls and welding certificates for the storage tanks.
- Certificate issued by ICICT, S.A. (TÜV Rheinland Group) after the "Machines and Equipment Security Evaluation" for the Pilot Plant module installed at the UAB facilities in Cerdanyola del Vallès.
- Compilation of operation, maintenance manuals and technical documents provided by the different suppliers of the equipment installed in the plant. Whenever it is possible this information will be supplied in electronic format as well.
- Spare part list for two years operation

# 3.5.- Test and commissioning of the Pilot Unit

# 3.5.1.- FAT by DDEQ

#### 3.5.1.1.- <u>Mechanical</u>

Once the skid is pre-assembled at DDEQ's warehouse and before the shipment to UAB's laboratories MPP will assist to FAT verification consisting in:

- Verify that final approved P&I'd diagram has been observed in the assembly
- Verify that the sensors, valves and equipments used are the specified ones according the project datasheets.
- Verify supports robustness.
- Test certificates and protocols filled up with the results.

<u>NOTE</u>: For the mechanical FAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1. At the end of mechanical FAT a record will be signed both by MPP and DDEQ and the shipment date to UAB's laboratories will be agreed. The duration of this FAT test will be 2 or 3 working days.

No test with fluids will be included in the mechanical FAT as there are not such services at DDEQ's warehouse.

#### 3.5.1.2.- <u>Electrical</u>

The cabling of the C-II module will be executed at UAB premises. Therefore the Electrical FAT will focus only in the power and control cabinets delivered by DDEQ. This FAT will take place at DDEQ's electrical contractor premises.

The Electrical FAT will consist in:

- Verify that all the sensors, automatic valves and equipments included in the P&I'd appears in the electrical diagrams.
- Verify that the electrical diagrams have been observed during the manufacturing of the cabinets.
- Test the power and control cabinets simulating the signals.
- Test the lighting system for the photo bio-reactor
- Test certificates and protocols filled up with the results.

<u>NOTE:</u> For the electrical FAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1, and tests will be done by DDEQ and electric

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supplier. An electrical FAT record will be signed both by MPP and DDEQ and the shipment date to UAB's laboratories will be agreed. The duration of this FAT test will be 3 working days.

#### 3.5.2.- SAT by DDEQ

#### 3.5.2.1.- <u>Mechanical</u>

The following tests have been considered for the plant commissioning based on a scheduled commissioning of fifteen (15) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Erection Manager (DDEQ)
- Mechanic official (DDEQ Contractor)
- MPP (permanent dedication of plant operator and technical staff)

The works to be done are:

- Pressure test with water for the liquid tanks and lines, as well as the reactor.
- Pressure test with compressed air of the Gas lines and buffers.
- Pressure test with steam of the steam and condensate lines. After that a resume of sterilization sequences will be done. Resume means:
  - Not waiting all the sterilization time required until the temperature is reached
  - Reactor, tanks and complete sections between reactor and tanks will be tested with steam during the accorded and defined time. Sequences for individual equipment will not be checked.
- Pressure test with water of the heating / cooling circuits of the jacketed equipment.
- Test certificates and protocols filled up with the results

<u>NOTE</u>: For the mechanical SAT commissioning of the pilot unit DDEQ will perform the tests using its own protocols, elaborated as per point 11 in paragraph 3.1. At the end of the mechanical SAT a record will be signed both by MPP and DDEQ.

#### 3.5.2.2.- <u>Electrical</u>

The following tests have been considered for the plant commissioning based on a scheduled commissioning of ten (10) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Erection Manager (DDEQ)
- Electrical official (DDEQ Contractor)
- MPP (permanent dedication of plant operator and technical staff)

The works to be done are:

- Check of the spin direction of motors.
- Check the power supply to all the instruments.
- Check the output signals from the instruments to the cabinet.
- Check alarms contacts in the cabinet and signals to be sent to the PLC.
- Simulate PLC input signals from the cabinet to instruments and control valves.

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- Test of the lighting system of the reactor and the air cooling equipment.
- Initial configuration (settings and range definition) of instruments and sensors with process parameters supplied by MPP to the control supplier. The optimization and fine adjustment of the settings will be responsibility of the MPP and therefore its implementation over the equipments on site.
- Test certificates and protocols filled up with the results.

<u>NOTE</u>: For the electrical SAT commissioning of the pilot unit DDEQ will use its own protocols, elaborated as per point 11 in paragraph 3.1 and tests will be done by DDEQ and electrical supplier. At the end of the mechanical SAT a record will be signed both by MPP and DDEQ.

#### 3.5.2.3.- Communication commissioning

The communication commissioning will not be started until the mechanical and electrical commissioning (as per indicated in points 3.5.2.1 and 3.5.2.2) is finished and all the interconnecting cabling between DDEQ's cabinet and the PLC cabinet (supplied by others) is done. The interconnecting cabling is also out from DDEQ's scope.

The following tests have been considered for the plant commissioning based on a scheduled commissioning of five (5) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Project Engineer (Sherpa)
- MPP (permanent dedication of plant operator and technical staff)
- Electrical official (DDEQ Contractor + Sherpa Contractor)

The works to be done are:

- Verify the arrival of the inputs signal from DDEQ's cabinet to the PLC cabinet
- Verify the arrival of PLC commands to DDEQ's cabinet
- Verify consistency in the measurements in the onsite instruments with the PLC lectures.

We do not include any verification about the control loops program stability or performance, which is fully responsibility of the control supplier.

<u>NOTE</u>: For the electrical communication commissioning of the pilot unit DDEQ will use Sherpa's protocols. At the end of the electrical communication commissioning a record will be signed by MPP, SHERPA and DDEQ

At the conclusion of all the Test and Commissioning process as stated in points 3.5.1 and 3.5.2 a "Pilot Unit Acceptance Document" will be signed between MPP and DDEQ. From that moment, the risk and responsibility of the unit will be transferred to MPP, being then authorized to operate the plant alone or with other suppliers. At the same time, the guarantee period of twelve (12) months will start.

For further assistance or more extensive test and checks DDEQ will provide in point 6 "Price and Payment conditions" a daily net rate for engineers and technicians.

# 4.- RUN TEST OF THE MODULE

As an additional service to MPP, DDEQ is ready to assist to a complete run test of the pilot module when the control supplier has finalized the delivery and test of its scope of supply.

We have considered the assistance during five (5) working days of our Project Engineer to help MPP staff during the integration under operation of the control with the hardware.

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Título:	MELiSSA module C-II supply
Cliente:	UAB / MPP

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Autor:	Roberto de Miguel
Archivo:	EXS-M0127 Rev 3.docx



Leadership and execution of the Run Test is MPP responsibility and our task is to resolve doubts and give advices during the Trials. We will also take care of failures of the hardware but not accept any responsibility because of misuse, (in manual or automatic operation), of the hardware.

If additional presence over the five (5) foreseen days is required DDEQ will charge MPP according the rates indicated in point 6 "Price and Payment conditions".

# 5.- EXCLUSIONS

The following services and works have not been taken into account in the present quotation and, therefore, are explicitly exclude of the scope of supply:

- Mechanical connections to UAB utilities nets (steam, air, CO₂, water,...)
- Fan, filter and coolant battery for the lighting cooling system. Its installation (air tubes to the side of the C-II skid) and electrical connection (cabling to our cabinet) is not included. The electrical maneuver will be in our cabinet and the control ins Sherpa's scope.
- Gas analyzer connection different of what was implemented in Module C-IVa. If additional requirements are demanded by MPP DDEQ will implement a Design change in the *"Design Changes Record"* as indicated in point 3.1.
- Electrical interconnecting cabling from DDEQ's electrical cabinet for compartment C-II and the PLC cabinet, and from the PLC cabinet to the control room computer. Neither the main power supply from UAB's general line to DDEQ's cabinet is included.
- Carrying out the control commissioning neither commissioning of the PLC program and the supervisor system implemented in the control room computer. The operation manual of these elements is also out of our scope.
- Changes over design as per MPP Hazop analisys. If additional requirements are demanded by MPP DDEQ will implement a Design change in the *"Design Changes Record"* as indicated in point 3.1.
- Plant star-up with process fluids.
- Plant validation and/or qualification.
- Further engineering works, out of what is clearly stated in the present proposal, as per example:

<u>Note</u>: If any or the following works/tasks (or other not listed here) is required by the UAB, they will be invoiced separately accordingly to the "Daily rates" shown in point 5.2

- o Isometric drawings of the pipes but the process ones.
- Engineering works to accommodate UAB facilities or utilities to the requirements of the unit (connections, modifications in services nets,...)
- Drawings "as built" of the equipment showing the changes implemented over the approved detail constructive project but the P&ID.
- o Control Commissioning of the plant.
- o Engineering works to assure the right integration of the different modules of the Melissa loop.
- Environmental engineering concerning liquid or gaseous effluents
- o Edition of Plant Operation Protocols for the field Operator
- o Edition of Operational Emergencies and Alarms Management Protocol
- Edition of Sensor and Instrument Calibration Protocol

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- Any legalization or CE marking of the pilot unit exceeding the Study over Machines and Equipment security edited by ICICT, S.A. (TÜV Rheinland Group)
- External sub-supplier management outside the scope of supply of the unit described in this proposal
- Official or legal projects, if necessary or required, as per example: Pressure Equipment Installation Project, Low Voltage Project, ....
- Further assistance services, out of what is clearly stated in the present proposal, as per example:
  - o Commissioning of the equipment with real process fluids.
  - o Validation of the unit
  - o Once the commissioning phase is finished:
    - Optimization of the initial Control Settings and Alarm Set Points
    - Optimization of the Maintenance sequences and Cleaning instructions
  - o Others

# 6.- PRICE AND PAYMENT CONDITIONS

# 6.1.- Price of the plant

The price of the Pilot Unit corresponding to Compartment C-II of the Melissa Pilot Plant according to the base equipment described in the Budget Rev. 3 included as Attachment 1, and considering the tanks are manufactured by **BIOPROCESS/TECALSA**, is:

#### NET PRICE (VAT excluded): -.742.777€.-

The tank for media preparation and its electrical cabinet, pump, required instrumentation and manual valves as well as the assembling of this set has been quoted separately. The price for this system, according to the base equipment described in the Budget Rev. 2 included as Attachment 1 is:

#### NET PRICE (VAT excluded): -.20.584€.-

If the tanks are manufactured by TALLERES AJA the price is:

NET PRICE FOR THE PLANT (VAT excluded): -.735.637€.-

#### NET PRICE FOR MEDIA TANK (VAT excluded): -.18.885€.-

If the tanks are manufactured by **EQUINOX** the price is:

#### NET PRICE FOR THE PLANT (VAT excluded): -.721.205€.-

#### NET PRICE FOR MEDIA TANK (VAT excluded): -.18.195€.-

<u>Note:</u> The above price are a "fix price" according to "2.- Quotation Basis", that will allow the UAB/MPP to place an order to DDEQ in order to fulfill the required delivery schedule. If during the constructive detail engineering the relevant changes in the design appear they will be reflected in the "Design Changes Record" and the economic impact must be agreed between both parties.

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Cliente:	UAB / MPP



### 6.2.- Daily rates for special assistance or test

Any further assistance, out of what is clearly stated in points 3.1 and 3.5 of this quotation, required by the MPP both, during the detail engineering (supervision of control engineering, other suppliers,...) or during the commissioning of the plant, will be invoiced according to the following daily rates:

Project Engineer (mechanical or electri	cal/control): 740 €/day
Assembling coordinator:	560 €/day
Mechanic:	485 €/day
Electrician:	485 €/day
Travel expenses:	According to destination

#### 6.3.- Order and Payment conditions

DDEQ proposes the following payment conditions:

- 20% down payment with the order, payment at 60 days after invoicing
- 25% at delivery of points 1 to 9 of the Detail Engineering as stated in point 3.1, payment at 60 days after invoicing
- 5% at delivery of points 10 to 13 of the Detail Engineering as stated in point 3.1, payment at 60 days after invoicing
- 20% at conclusion of mechanical FAT test as stated in point 3.5.1.1, payment at 60 days after invoicing
- 10% at conclusion of electrical FAT test as stated in point 3.5.1.2, payment at 60 days after invoicing
- 10% at delivery of manuals as stated in point 3.4.1, payment at 60 days after invoicing.
- 10% at the conclusion of the SAT commissioning as stated in point 3.5.2, payment at 60 days after invoicing.

#### 7.- PROPOSAL VALIDITY

This proposal is valid for a period of two natural months.

#### 8.- PROJECT PLANNING

In practice the development of the Project will be mainly influenced by UAB/MPP final purchasing decision and the administrative delays in order to place the order and contract writing. Also delays in intermediate approvals will cause a longer delivery time for the skid.

Assuming an optimal schedule in the development of the project, the schedule would be as shown in the annex.

#### 9.- GUARANTEE

DE DIETRICH EQUIPOS QUÍMICOS S.L., guarantees for one (1) operation year, against manufacturing defects or material failures, all the equipment supply and the erection and assembly works executed by its contractors. The guarantee applies only to the repair or the reposition of the defect element or equipment, once the defect is verified, checked and accepted as guarantee issue.

Elements subjected to wear and/or ageing are not covered by the present guarantee. For example (but not limited) mechanical seals, measurement probes, joints,...Neither is covered negligence in the operation of the equipment and normal maintenance or cleaning operations over the equipment, as well as, accidental failures of the unit.

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As mentioned before, the guarantee covers only the repair / replacement of the damaged/defect equipment. No other service or compensation is covered. For third party components or equipments, if any, the guarantee will be provided by the manufacturer.

#### **10.- GENERAL PROJECT CONDITIONS AND LIABILITY LIMITATION**

- The works covered under this proposal will be considered finished as soon as the commissioning tests stated in point 3.5 are finished satisfactorily and the "Pilot Unit Acceptance Document" is signed between MPP and DDEQ.
- Design will be implemented under the guidelines and process requirements provided by the UAB, and according to the good engineering practices known by DDEQ.
- A design review was conducted in June 2.010 to verify that the basic design elaborated fulfills the Technical Requirements (MPP/TN/2005/01 Version 1) and the Technical Note 62.2 edition 1. Some changes emerged from that review agreed between MPP and DDEQ and a new P&I'd version has been released, being the main basis for the current proposal. Again, it has to be understood that a Prototype Pilot Plant might have some uncertainties that will not be clarified until the real start up of the unit, and agreed changes might be required at that stage.
- The engineering works executed by DDEQ, and consequently equipment supply, do not mean that DDEQ has any liability in case the throughout put of the unit is less or different from the foreseen one. Process responsibility is charge of the MPP.
- DDEQ will not accept any liability for direct or indirect damages causes without the intention to harm as per example: production looses, third part claims, prestige looses, overall project delays,... DDEQ will not be responsible either for defects or damages arising from wrong or incomplete information delivered by the UAB/MPP.
- The MPP will designate a main interlocutor to evacuate through all the correspondence, question, doubts,..The same person will concentrate all the information and questions from the MPP to DDEQ.

#### 11.- CONFIDENTIALITY

All documents, data and information of the Project shared between MPP and DDEQ will be considered as confidential unless it is explicitly agree between both parts, is of public domain at the date of signing the contract or its use is necessary for the normal development of the project (inquiries or contracts to suppliers or contractors).Nevertheless, main contractors with access to relevant information must sign the confidentiality agreement too.

#### 12.- ANNEX

Investment Budget Rev.3

Project planning

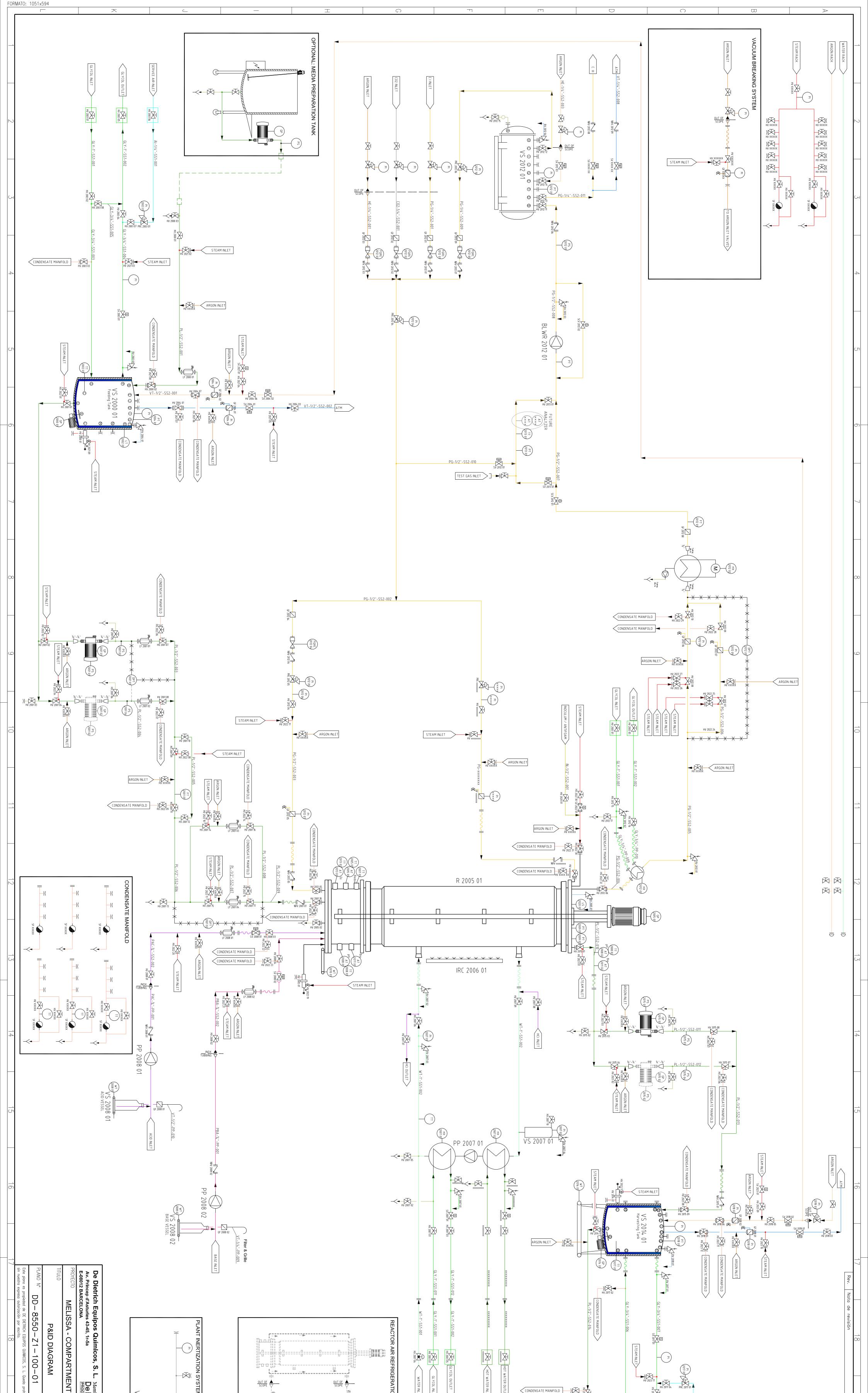
Barcelona, October 1st 2010 DE DIETRICH Equipos Químicos, S.L

> Fdo. Roberto de Miguel Managing Director

Oferta n°: EXS-M0127 Rev. 3 Título: MELiSSA module C-II supply Cliente: UAB / MPP Fdo. Josep Mestre Technical manager

Fecha: 01/10/2010 Autor: Roberto de Miguel Archivo: EXS-M0127 Rev 3.docx

Number	. Task	Start	End	Duration	Q4 - 2010		Q1 - 2011			Q2 - 201	1		Q3 - 201	1		Q4 - 201	1		Q1 - 2012	
Humber		Start	Lina	Jaration	December	January	February	March	April	Мау	June	July	August	Septembe r	October	November	December	January	February	March
1	Order	1/12/2010	1/12/2010	1	•															
2	Constructive Detail Design (CDD): Points 1 to 9	1/12/2010	1/3/2011	65				]												
3	Approval Final P&Id	10/1/2011	10/1/2011	1		•														
4	Approval Data package of CDD: Points 1 to 9	15/3/2011	15/3/2011	1				٠												
5	Kick off meeting with SHERPA	22/3/2011	22/3/2011	1				٠												
6	Constructive Detail Design (CDD): Points 10 to 13	10/3/2011	10/5/2011	44																
7	Approval Data package of CDD: Points 10 to 13	28/2/2011	28/2/2011	1			•	•												
8	Instruments & Equipments purchases and reception	1/2/2011	31/5/2011	86																
9	Mechanical assembly at DDEQ warehouse	15/4/2011	13/7/2011	64																
10	Manuals delivery	1/9/2011	1/9/2011	1									8	•						
11	Mechanical FAT test	25/7/2011	27/7/2011	3																
12	Electrical cabinets manufacturing	15/5/2011	28/7/2011	54																
13	Electrical FAT test	5/9/2011	7/9/2011	3																
14	Delivery of mechanical and electrical equipment to UAB laboratory	12/9/2011	14/9/2011	3																
15	Complete assembly and cabling of the skid	15/9/2011	10/10/2011	18																
16	Interconnecting cabling to PLC byUAB	10/10/2011	26/10/2011	13																
17	Utilities connection by UAB	10/10/2011	21/10/2011	10																
18	Mechanical SAT test	1/11/2011	18/11/2011	14																
19	Electrical SAT test	21/11/2011	2/12/2011	10																
20	Communication commissioning	12/12/2011	16/12/2011	5																
21	Pilot Unit Acceptance Document	16/12/2011	16/12/2011	1													•			
22	Call out to TÜV to execute CCD Point 14	12/10/2011	12/10/2011	1											•					
23	RUN TEST OF THE MODULE	19/12/2011	23/12/2011	5																



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Document Identification :	Туре	number	Issue	
C2 Detailed Engineering Datapackage	TN	87.2.17	(0)	Page : 257 / 275

### 14. MOM OF THE DESIGN REVIEW AND FINAL DECISIONS

14.1. Design Review MOM 14.2. Final Decisions





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Our reference: MPP-MOM-10-2002(0)-EP-20100608

Date : 08-Jun-10

Meeting place: DEDIETRICH, SHERPA and ESA by teleconference with MPP

#### **SUBJECT: Basic design review CII**

#### Attendees:

Company	MELiSSA Pilot Plant	MELiSSA Pilot Plant	MELiSSA Pilot Plant	DDEQ	SHERPA	ESA
Names	E. Peiro (EP)	A. Fossen (AF)	F. Godia (FG)	R. de Miguel (RM)	O. Gerbi ( OG)	B. Lamaze (BL)

#### Distribution list: the attendees and the following listed persons

Company	ESA	
Names	C. Lasseur	

#### Main conclusions:

- A requirements compliance matrix has been prepared describing DDEQ CII design proposal, that should be agreed upon for the contract signature, including verification tasks and scheduling.

- MPP/ESA will update the CII Technical specifications as basis for the design, incorporating the agreed modifications.

- The main critical points were discussed and comments incorporated in the compliance matrix; final decisions from MPP/ESA will be taken during week 25.

- DDEQ will update the proposal and corresponding quotation accordingly.

#### Approval by all attendees:

Company	MPP	MPP	MPP	DDEQ	SHERPA	ESA
Name	E.Peiro	A. Fossen	F. Godia	R. De Miguel	O. Gerbi	B. Lamaze
Visa	Approved by e-mail	Approved by e-mail	Approved by e-mail	Approved by e-mail	Approved by e-mail	Approved by e-mail





# **MINUTES OF MEETING**

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Our reference: MPP-MOM-10-2002(0)-EP-20100608

Item	Action #	Resp	Date
Agenda :			
1. Introduction			
2. Critical design points to be discussed			
3. Agreed actions			
Discussion :			
1. Introduction			
The purpose of the telecom was for MPP and DDEQ:			
1- to share with SHERPA and ESA:			
- the main points of the design where there is a main change from the			
preliminary proposal from DDEQ,			
- The main points where decisions have to be taken by MPP/ESA, giving			
the opportunity to raise questions to understand properly the proposed			
solutions			
2- check in detail the latest DDEQ proposal before a final decision is taken.			
Some general remarks were stated and agreed:			
- AF mentioned that the document Design acceptance_CII_V1.xls sent to			
the attendees ahead of the meeting including all the requirements			
described in the CII Technical Specifications doc. is in reality a			
compliance matrix (Annex 1) that should be agreed upon ahead of the			
contract and compiled along the manufacturing to demonstrate the			
compliance of the requirements.			
- The verification tasks should be clearly identified and scheduled in that			
matrix.			
2. Critical design points to be discussed			
EP explained that the main critical points refer to the following requirements			
(as they appear in the attached excel file, based on the CII Technical			
Specifications doc. numbering):			
- Req. 3 and 11: lighting system			





# **MINUTES OF MEETING**

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Our reference: MPP-MOM-10-2002(0)-EP-20100608			
- Req. 5: PBR gas loopgas and headspace inlet			
- Req. 7 and 16.6: gas analysers			
- Req. 9 and 25: agitator			
- Req. 13: control (tests)			
- Req. 14: redundancy of probes			
- Req. 16.3 and 16.3bis: level			
- Req. 18: sampling fee of cells			
- Req. 30: resistance of glass			
- Req. 34 and 35: aux. tanks gas loop management			
The comments and decisions on these points are included in the compliance matrix (Annex 1, highlighted in blue colour)			
3. Agreed actions			
- The requirements included in the Technical Specifications doc. will be updated by MPP/ESA in order to reflect the current status of the requirements on which CII manufacturing should be based.	1	MPP/ESA	
- A discussion on the main points will be held by MPP with UBP, in order to get their feedback	2	MPP	18.06
a) Need of an additional gas inlet direct to headspace vs. unique inlet to the bottom of the bioreactor			
b) CO2 and VFA analysis on-line			
c) Lack of redundancy of pH probe during batch phase (due to the availability of only one pH probe inside the PBR): criticity of this phase (duration, requirements)			
d) Alternative Gas loops management (PBR gas loop and auxiliary tanks gasloop)			
- MPP and ESA will decide next week on the above mentioned points, and beside these the illumination and level measurement issues, and will inform DDEQ in order that they can update and finalise the proposal.	3	MPP/ESA	18.06
- DDEQ will update the proposal accordingly.	4	DDEQ	30.06
- MPP will discuss with SHERPA about the points of the specification regarding control.	5	MPP	
SHERPA will prepare in the following weeks a proposal (joined with NTE) for			





# **MINUTES OF MEETING**

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SHERPA

# Our reference: MPP-MOM-10-2002(0)-EP-20100608the delivery of the control hardware and software for CII, to be harmonized6

with the manufacturing proposal of DDEQ.			
- MPP will check if the redox fitting cam welcome a pH probe, in redundant pH probe will be finally required in the bottom	case a		
	7	MPP	



## **MINUTES OF MEETING**

Our reference: MPP-MOM-10-2002(0)-EP-20100608



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SPECIFICATION	PRIORITY	VERIFICATION METHOD	VERIFICATION SCHLOPTION	DESCRIPTION	REMARKS	DECISION	COMPLIANCE
The C-II will produce around 60-70 g <i>R</i> . <i>rubrum</i> DW/day consuming the volatile fatty produced in C-I (around 50 g/day). As a result, the total working liquid volume of the photobioreactor will be around 40 L		Productivity to be demonstrated during PQ tests (MPP responsibility)			Cooling air need to be filtered to comply with MPP ambient conditions (HEPA filtration for the axenic compartments)		
		Volume: Bioreactor layout and glass drawing	-	Total Vol. 47L illuminated+9 non- illuminated (total 56L); working vol. 40L illuminated+9 non-illuminated			YES
The illuminated zone of the photobioreactor will have a diameter around 0.20 m and the height will be $1.0 \text{ m}$ i.e. at least $0.6 \text{ m}^2$ .		Diameter and height: Bioreactor layout and glass drawing		Height to be consistent with requirement nº1 and nº4		Requirement to be rephrased: height at least of	
							YES
 There will be a regulable illumination system that will provide a light intensity at the external walls of the bioreactor between 0- 300 W/m2 (around 200 lamps). Lamp active spectrum will be in the R. rubrum active photosynthetic range.		Lighting system: dedicated layout and facility layout Blower efficiency: calculations Coherence with calculations of lighting needs provided by the MPP	Lighting system layout Pending on discussion with architecture area	270 lamps available distributed as in CIVa 1 cm distance from the glass jacket, 1700 m3/h cooling airflow, diameter 260 mm; the cooling is only dedicated to the lamps cooling, NOT AS AN ALTERNATIVE FOR THE COOLING WATER LOOP. The cooling air needs to be refrigerated in order to reduce flow and pipe diameter and filtered, taking into account: - The ventilation supply is too hot in summer, it's OK in winter - The ventilation supply is too hot in summer, it's OK in winter - Filtration of the air needs to be also considered - Dedicated commercial systems are available	refrigerated in order to reduce flow and pipe diameter and filtered, taking into account: - The ventilation supply is too hot in winter, it's OK in summer - The exhaust cannot be used w/o affecting the current ventilation system for comfort	Lighting system: sheel material needs to be transparent (DDEQ to modify) Discussion with Architecture Area (Enric font) will be held in order to check the availability of the current cooling machines and layout in the facility for the ubication of conducts and blower and cooler if necessary	
 The non-illuminable volume of the bioreactor (i.e. the dark volume of the headspace or the "bottom" space) has to be minimum. Therefore, the design should maximize the volume fraction that can be illuminated. The photobioreactor walls in the illuminated section will be made of a transparent material for the active photosynthetic range mentioned above.		PBR manufacturing drawing Glass material datasheet		Percentage of illuminated/non-illuminated around 80% (see Req.1)			
							YES



## **MINUTES OF MEETING**

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5	There will be a gas circuit that will allow the	PID Compressor datasheet	Compressor: a second loop around the compressor is added (2 bar) to maintain	Headspace inlet: requirement to be reconsidered, as the supply in the BR top
	recirculation of a fraction of		pressure constant in the compressor inlet	could be not needed, if the supply for the
	the gas flow rate through the		in order to avoid vacuum considering the	bottom is guaranteed
	photobioreactor and the rest		gasflow is in a range quite wide (0-	
	through the headspace. This		120L/h); double-membrane; higher	To be discussed internally MPP/ESA
	fraction has to be variable. The gas of the		robustness,	
	photobioreactor will not be			
	exchanged with the			
	atmosphere. The impulse for			
	the gas flow will be provided			
	by means of a gastight			
	compressor			
				TBC
6	The volatile fatty acids	Equipment datasheet of the cooler	Condenser and post-cooler are included in Data on Vo	olatile compounds to be Calculations to be double-checked
ľ	should not escape from the	Design calculations based on 10% liquid		DEQ in order to validate
	compartment. The	evaporated and assuming organics		ncy on VFA condensation
	photobioreactor will have a	boiling point at 80°C		
	high efficiency gas			
	condenser in order to	Calculations to be revised including real data of VFA (to be supplied by MPP)		
	minimize the water vapour losses and condensation in	data of VFA (to be supplied by MPP)		
	the gas connecting devices.			
	3			
7	The compartment will have	PID	gas inlet and outlet lines are connected to	Decision on gas analysers to be taken by
	the necessary number of liquid and gas inlets and		the future gas analyser; "tees" will be needed if additional VFA analysis on line	MPP/ESA: - CO2
	outlets to operate both		will be incorporated	- VFA in gas phase
	connected to compartment I			- VFA in liquid phase
	and compartment III and			- need of liquid sampling in the harvesting
	consuming synthetic gas and			line?
	culture media. Special			
	attention should be given to liquid medium and gas			
	sampling nozzles.			
	Sumpling Hozzies.			
	The compartment II will	PID SAT sc	adula.	
8	operate under anaerobic	PID SAT sc Equipment datasheet	equie	
	conditions. Any air inlet will	SAT tests: tightness tests to be included		
	be completely avoided.			
	Argon and/or CO2 gas inlets			
	will be provided. All the			
	equipment of the gas loop			
	will be gastight.			YES
				YES



## **MINUTES OF MEETING**

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9	The photobioreactor will have good radial homogeneity (e.g. 5 rushton turbines of 2.5 or 2.3/4 inch).	Agitator datasheet and layout Agitator FAT (DDEQ workshop) SAT	FAT schedule SAT schedule	Proposal includes 3 Rushton + 3 axial turbines; this week proposal for CFD simulation in DeDietrich France To be manufactured by DD engineering	Previous manufacturer proposed (SOLARIS) has not the expertise on CFD simulation		твс
10	The radial gradients of temperature between the wall surface and the bulk liquid of the illuminated column should be minimized and will be less than 1°C. The photobioreactor will have the liquid temperature controlled and the maximum allowed temperature controlled between the culture temperature and its set point in any point of the photobioreactor will be 1 °C, knowing that the viscosity of liquid medium is in the order of magnitude of water viscosity (1 to 20 mPa.s)	Calculations by DeDietrich based on the agitation system when defined	,				
							TBC
11	There will be a system devoted to the removal of the hot air associated to the heat dissipation of the illumination system around compartment II. The total heat power to remove would reach 2 to 3 kW.	Lighting system: dedicated layout and facility layout Blower efficiency: calculations	Pending on discussion with architecture area	270 lamps available distributed as in CIVa 1 cm distance from the glass jacket, 1700 m3/h cooling airflow, diameter 260 mm; the cooling is only dedicated to the lamps cooling, NOT AS AN ALTERNATIVE FOR THE COOLING WATER LOOP. The cooling air needs to be refrigerated in order to reduce flow and pipe diameter and filtered, taking into account: - The ventilation supply is too hot in winter, it's OK in summer - The exhaust cannot be used w/o affecting the current ventilation system for comfort - Eitration of the air needs to be also	refrigerated in order to reduce flow and pipe diameter and filtered, taking into account: - The ventilation supply is too hot in winter, it's OK in summer - The exhaust cannot be used w/o affecting the current ventilation system for comfort	Requirement to be rephrased: 5,4 KW, 4,8 considered to be released as heat Discussion with Architecture Area (Enric font) will be held in order to check the availability of the current cooling machines and layout in the facility for the ubication of conducts and blower and cooler if necessary	YES
12	The photobioreactor liquid flow rate will be in the range of 0.25-10 L/h. The gas flow rate in the gas loop will be between 0-120 L/h.	Gas: compressor datasheet Liquid: pump datasheet			Flow requirement (low range) to be potentially reconsidered taking into account the characteristics of the available pump		
							YES



## **MINUTES OF MEETING**

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13	The control system for this bioreactor is done at different levels. At level 0, a number of variables will need to be controlled via a selected Programmable Logic Controller at the local bioreactor level. At levels 1 and 2 (not comprised in this ITT) the general set-points for the local controllers at level 0 will be established according to the general control laws for the Melissa loop.	Control SAT	For the gas loop SAT, DDEQ considers a requirement to have the PLC program completed; SAT could be divided in two parts if necessary	To be checked with SHERPA especially the Gas loop control	5
14.1	pH in the photobioreactor liquid	pH probe datasheet		Not redundant pH probe during batch phase (top probe located in the harvest line), considered enough if homogeneus mixing is provided. To check internally MPP/ESA the criticality of batch phase (pH evolution, duration)	
	Nominal value: 6.9 pH units Min/max operational values: Maximum deviation around Closed loop response time: Possible disturbances: the			SHERPA to check SHERPA to check	
14.2	Temp. Set point range: 20-40 °C Minimum/maximum Nominal value: 30°C Maximum deviation around Closed loop respone time: Possible disturbances: the Information about the disturbances: the heat generated by the lamps will depend on the number of lamps and their light intensity. The inlet of liquid flow-rate will vary around 0.25-10 L/h and the temperature of the liquid will be around 4 °C.	PT100 datasheet	requirements	Not redundant PT 100 (temp. Measurements of pH, DO and redox sensors is considered enough) SHERPA to check SHERPA to check	



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14.3	Gas pressure in the top of the PBR Set point: To be defined accurately as part of the proposed design and close to 100 kPa (normal operating relative pressure foreseen around 10 kPa).	P sensor datasheet		Redundant	Requirement to be updated (200 mBar foreseen)
	Maximum deviation around Closed loop response time at Possible disturbances: Information about the				SHERPA to check SHERPA to check
14.4	Gas mass flow rate in gas loop Set point: Depending on the test carried out. The working interval will be 0 - 120 L/h.	Flowmeter datasheet		2% precision is feasible except around zero flow	Requirement to be updated for new volume
	Maximum deviation around Closed loop response time Possible disturbances: Not Information about de				SHERPA to check SHERPA to check
14.5	Liquid mass flow rate in the PBR inlet Set point: Depending on the test carried out. The working interval will be 0.25-10 L/h. Maximum deviation around Closed loop response time	Flowmeter datasheet		2% precision is feasible	Requirement to be updated for new volume Careful layout needs to be provided (air purge) SHERPA to check
	Closed loop response time Possible disturbances: Not Information about				SHERPA to check
14.6	Gas mass flow rate in external gas inlet Set point: 10-20 L/h Maximum deviation around Closed loop response time: Possible disturbances: Not Information about the	Gas massflow datasheet	Foreseen 10-20L/h in all the inlets	Flow is not needed bigger to start the plant (not recirculating in the beginning)	Requirement to be updated for new volume SHERPA to check SHERPA to check



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14.7	Gas pressure drop in critic filters Set point: To be defined Maximum deviation around			Proposed DeltaP measurement as i		SHERPA to check	
	the set-point: 5 % of the set- point value in nominal conditions Closed loop response time of gas pressure drop control:				5	SHERPA to check	
	Jas pressure uno control. less than 5 sec. Possible disturbances: Sources of filter clogging Information about de disturbances: Foams						
	production and liquid outlet by the gas outlet line.						
14.8	Light flux Set point: Defined by level 2 control loop and varying between 0 and 300 Wm ⁻²	1				Requirement to be updated (0-300 W/m2 depending on nº of lamps)	
	Maximum deviation around the set-point: 5 % of the				\$	SHERPA to check	
	set-point value Closed loop response time: less than 10 sec (time to go to min/max light flux)				\$	SHERPA to check	
	Possible disturbances: Not available Information about de						
15	disturbances: Not available The architecture of this	Instrument datasheet				pH retractible	
5	control loops should be embedded in the general control architecture of the	instrument udtasheet				biomass: non retractible (not available)	
	Melissa pilot plant. To allow this, the sensors' and actuators' electrical				,	temperature: non retractible (non available)	
	connections should be compatible with those of the quantum Schneider PLC.						
						YES	
16	The following parameters should be measured:						
16.1	pO ₂ in the photobioreactor liquid	Instrument list Instrument datasheet PID				YES	
16.2	Redox potential in the photobioreactor liquid	Instrument list Instrument datasheet				VES	
16.3	Liquid level in the photobioreactor	PID CHARIS sensor to be tested	ahead of the manufacturing (TBD)			YES Potential inclusion of differential pressure measurement -new PT in the bottom, 2 inches port-, as alternative to the loadcells, and a redundant level measurement on the top part based on CHARIS sensor	
						To check influence of gas hubbling and foam	

on the level meas. by the CHARIS





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16.3bis 16.4 16.5 16.6	Optionally, the proposed design can consider the total weight of the reactor (shear gauges) which enables a Biomass concentration in the photobioreactor (0-4 g DW/L) Foam detection system Gas phase composition, at least CO ₂ partial pressure	Instrument list Instrument datasheet PID CHARIS sensor to be tested a	First approach: Loadcells (3) and BR foreseen standed on the floor, not on the skid, to reduce the disturbances Delta P as an alternative		Taking into account the experience in CIVa, an alternative option is proposed	N.A. YES
						ТВС
17	The pH, biomass concentration and culture temperature parameters will be redundant at the sensor level. All these probes (on line ones) will be retractile.	Instrument List Instrument datasheet Housing datasheet	PT100 non retractible; redundant with pH, O2 and redox probes		pH retractible biomass: non retractible (not available) temperature: non retractible (non available) probes in exhaust line non retractible (sterilised "in situ")	твс
			Probes in exhaust line non retractible (can be sterilised in situ)			
18	The photobioreactor will have installed a device to allow the automatic free-cell sampling. In addition, it will be		Not checked by DeDietrich (not previous info)	This device is not defined yet, so the requirement maybe not fullfilled	Needed fro VFA analysis? Needed automatic? To be confirmed by ESA/MPP Location?	NO
19	The gas loop will have two possible bypasses to allow the gas flow to an analyzing circuit. One located close to the output of the reactor and the other one at the point of	PID	 		To be maybe rephrased, although it's understood in the inlet, but after the buffer, anyway the highest pressure point	YES
20	The system will have reliable liquid and gas mass flow meters. As an example, electromagnetic flow meters or Coriolis flow meters could be used.	Flowmeters datasheet				YES
21	The system will minimize any liquid condensation in the non-sterile equipment, and it will include easy removal and potential recovery of the	Cooler + condensate removal filters datasheet	 		Add condensate filters in MELISSA gas loop inlet	
	condensates.					YES



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Ind nrond	osal should	Control loops definition SHE	ERPA to check
	the needs	SAT SAT	
	ed to the following	Detail Eng datapackage	
	n modes, all of them	HAZOP	
	formed under axeny		
:	tormed under axerty		TBC
			IBC
	state continuous		
	n (as a basis for the		
design)			
	eration mode		
	of the operation of		
the reacto			
	the operation of the		
reactor			
Changes	in operation set		
	and control of the		
reactor			
	nce of perturbations		
	otential accidents		
	tions of part of the		
	nt, power failure,		
etc.)			
_			
	y of the normal		
operation	n after a perturbation		
		Cool	ling: to include an external cleaning pipe
Interfaces	s between the		seen+1,5-2 inch (to be checked) port on
	nt and personnel in	the t	top of the tank
	of its operation, such		
	ess to the different		
	of the equipment,		
feeding c	operation, discharge		
of the liq	uid outlet, sampling		
	rtical control, on line		
maintena	ance and		
troublesh	nooting, cleaning,		
calibration	on, supervision, and		
general o	operation.		
Alarms m	nonitoring		
The steril	le parts have to be	Membrane datasheet	
able to be	e sterilized using		
water files	ered steam at 1.2		
water filte			
	or 45 minutes		
	for 45 minutes.		
	for 45 minutes.		YES
	for 45 minutes.	SS datasheet and certificates	YES
	for 45 minutes.	SS datasheet and certificates Sensors and instruments datasheet	YES
	for 45 minutes.	Sensors and instruments datasheet	YES
	for 45 minutes.	Sensors and instruments datasheet Pumps datasheet	YES
kg/cm ² fo		Sensors and instruments datasheet Pumps datasheet Filter datasheet	YES
kg/cm ² fo	ber of mechanical	Sensors and instruments datasheet Pumps datasheet	YES
kg/cm ² fo The numb devices s	ber of mechanical such as pumps and	Sensors and instruments datasheet Pumps datasheet Filter datasheet	YES
kg/cm ² fo The numt devices s compress	ber of mechanical such as pumps and sors that can	Sensors and instruments datasheet Pumps datasheet Filter datasheet	YES
kg/cm ² fo The num devices s compress comprom	ber of mechanical such as pumps and sors that can nise the sterility of	Sensors and instruments datasheet Pumps datasheet Filter datasheet	YES
kg/cm ² fo The num devices s compress comprom	ber of mechanical such as pumps and sors that can nise the sterility of m must be	Sensors and instruments datasheet Pumps datasheet Filter datasheet	YES
kg/cm ² fo The numt devices s compress comprom the syster	ber of mechanical such as pumps and sors that can nise the sterility of m must be	Sensors and instruments datasheet Pumps datasheet Filter datasheet	
kg/cm ² fo The numt devices s compress comprom the syster	ber of mechanical such as pumps and sors that can nise the sterility of m must be	Sensors and instruments datasheet Pumps datasheet Filter datasheet	YES

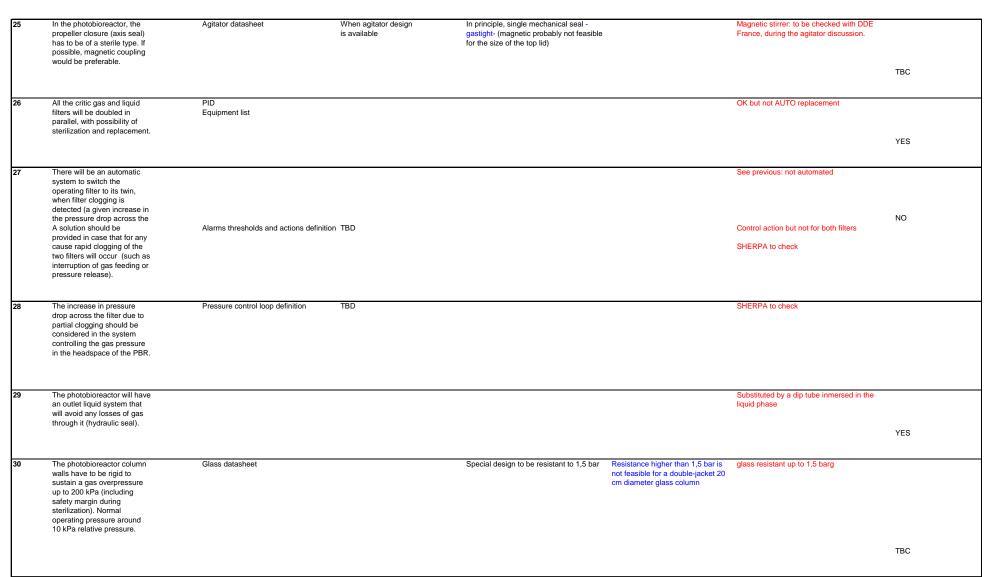




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There will be a feeding

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Equipment list and PID

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	vessel to store the liquid to feed the photobioreactor.						YES
32	There will be a discharge vessel to store the outlet liquid of the photobioreactor.	Equipment list and PID					YES
33	Characteristics of feeding and discharge vessels:	Equipment datasheet		250L working vol.	Mistake in RT calculation?	25h at max. Rate; 48h at medium flow	TBC
	33.2 Capacity to be sterilized 33.3 Mechanically stirred			Magnetic stirrer like in CIVa	Mistake in conversion of units?	Magnetc stirrer	
	33.4 The following parameters will be controlled via a PLC with Alarm monitoring:	PLC software description	TBD			SHERPA to check (all 33.4)	
	33.4.1 pressure					0-200 Kpa is considered enough for steril., overpres. Discharged to buffer	TBC
	33.4.2 Temp. 33.4.3 Liquid level Discharge vessel: 33.4.4 Pressure			Similar to CIVa: guided microwave	Level %: Configured by software	10°C for the moment	
	33.4.5 Temperature 33.4.6 Liquid level			Load cells		10°C for the moment	
34 35	The feeding vessel will have the capability to allow sterile external gas (argon) inlet or the photobioreactor gas inlet. The discharge vessel will	PID		Alternative loop including two compressors for two different operations: feeding (low flow) vs. filling feed tank and emptying harvest tank (high flow) Defined sequence during filling/emptying is needed See Req. 34		Requirement to be updated: two different loops, from ext. gas as well DDEQ to double-check the need of two different compressors, or a unique one of different characteristics (more than 2 bar), working potentially discontinuously Requirement to be updated: different loop, but	TBC
	have the capability to discharge the overpressure to the atmosphere or to the photobioreactor gas loop , for pressure					to atm. OK	
	compensation.						TBC
36	Power supply required will be either 220V 50 Hz or triphasic 360V 50 Hz	MPP Facilities description			380V, not 360V		YES
37	Control interface: - Analogical signals - Digital signals 24 V	instruments datasheet					YES



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38	Gas lines: compressed air,	MPP Facilities description	He to be included as alternative to Ar	He as an alternative to Ar	
	technical gas CO ₂ and Ar				
	at 4 bar.				TBC
39	Liquid cooling: cool water at	MPP facilities description	Not considered "500 W reacting		
	10 °C ; Flow rate to be	Calculations of cooling	volume", but agitator heat in stead	1	
	defined in order to remove	PID			
	heat from the process (up to	Equipment datasheet			
	500 W from the reacting	Pipelines list			YES
40	Waste discharge connection	Bottom valves datasheet			
10	to a waste vessel in 30	Bollom valves datasheet			
	minutes.				YES
41	Steam line: 7 bar	MPP facilities description		To be updated: 6 bar	TBC



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### 14.2 Final Decisions on the critical aspects of CII Design

During the Design Review of CII held on 08.06.10, the main critical points were discussed and comments incorporated in a dedicated compliance matrix, and it was agreed that final decisions from MPP/ESA would be taken during week 25, in order that DDEQ would update the proposal and corresponding quotation accordingly.

In the Progress meeting held in UAB between MPP and ESA on 17.06.10 (MPP-MOM-10-0001) a detailed analysis of C-II design was done, mainly to cover a short number of pending aspects to be finally defined to DDEQ, and therefore progress to a final proposal from their side. The main points discussed and decided where:

- the feeding of gas phase to the bioreactor will be maintained at two points: bottom and top of the reactor
- the gas loop to compensate gas phase changes when auxiliar tanks are filled or emptied has been discarded, and an auxiliar gas will be used instead. The use of N2 for this purpose was discarded (reasons: mass balance closure and potential uptake by *R.rubrum*)
- the on-line gas analysis line will not be defined at this point. A T connection will be installed, and initially only off-line analysis will be performed.
- It was confirmed the location of the pH probes, although in the start-up of the compartment (batch phase) this will not allow redundancy in the measurements.
- Level measurement will be finaly defined after the results of the tests on the load cells of Compartment IVa. If the tests are positive, load cells will be also considered for C-II. If the tests are negative, then the same alternative to load cells will be used in both reactors, such as differential pressure measurement, and an alternative system for measurement of both level and foam (CHARIS sensor) will be evaluated for redundancy.

After taking this decisions, MPP informed accordingly DDEQ, so that the final proposal would be prepared and submitted for approval (e-mail from E. Peiro on 28.06.10):



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"- Conclusions of the lighting issue: the proposed 250-270 lamps is considered enough, provided that the distribution is compatible with the minimum distance needed for adequate design and maintenance and with the required positioning of sensors, tubing, valves, etc. around the reactor.

- Additional gas inlet direct to headspace vs. only to the bottom: as it is still a issue to be confirmed during the characterisation of the bioreactor (impact on level management, complete utilisation of VFA vs. potential stripping of compounds, etc.), we prefer to maintain, on top of the bottom inlet, the option of recirculating a fraction of the gas flow rate through the photobioreactor and the rest through the headspace, fraction to be variable.

- CO2 and VFA analysis on-line: as we still don't have a clear picture of the need of online measurement (potentially CO2 and VFA), the conclusion is of course to provide the adequate drying of the exhaust gas (cooler) and instrumentation for flow calculation, and to provide a "t" for future analyser connection for both inlet and outlet gas streams, and the space for a gas analyser like the one in CIVa (CO2) in case it will be finally installed; for VFA it would be probably just a connection with the existing GC, so space for a new analyser would not be required.

- Lack of redundancy of pH probe during batch phase: in principle the impact on this phase is not considered critical; anyway the possibility of replacing redox sensor by the pH sensor in the bottom is considered enough if redundancy is required in future for the batch phase.

- Gas loop management:

a) Bioreactor gas loop: having into account that a new loop around the compressor has been included in order to guarantee a stable flow, with a new regulating solenoid valve, it could be that the previous "safety" loop through the valve SV-2012-02 to be removed, taking into account that the new loop is already providing this safety, not based on a threshold but in a continuous way.

b) Auxiliary tanks gas loop: having into account the complexity of the overall design of this loop, with two oversized compressors and a big buffer tank, with the need of refrigeration, the limitation in the sequence of filling and emptying tanks, etc., and considering as well that the assurance of anaerobiosis in other compartments is managed



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nowadays with external compressed gases (in the future closure of the MELiSSA loop could be different), we prefer to to the same in this case, so to provide the corresponding inert gas supply within the MPP Utilities frame for the hydraulic management of both the feeding and harvesting tank. We are requesting an offer for the installation of Argon bottles in the Department gas Station, and the corresponding pipelines up to the MPP. In that case, Argon in stead of helium would be used for both gasloops, in order to save costs.

- Level measurement: we need immediately a double feedback from METTLER: a) regarding the CIVa issue and b)from METTLER position, to propose or not the loadcell solution for CII. In case this is not existing or not clear, we'll install the differential pressure system and an alternative level instrument(CHARIS if tests are succesful, otherwise another system will be investigated and installed). If METTLER proposes the loadcells, the differential pressure system would be cancelled, and the loadcells would be installed provided that METTLER and DDEQ share with the MPP the risks of a potential failure of the system."