Universitat Autònoma de Barcelona

TECHNICAL NOTE 87.2.11

CIVa refurbishment detailed design

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1. OBJECT

- OBJECT

The Universidad Autónoma 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 there is installed a pilot plant with several different modules to study the different processes of recycle and recovery of food, water and oxygen from wastes, i.e. CO_2 and organic wastes, using light as a source of energy.

The UAB required to De Dietrich Equipos Químicos, from now, DDEQ, to study the redesign and assembly of one of these modules, specifically the one defined as Compartment IVa.

DDEQ submitted to the UAB one quotation ref DDE- J 2025 SI, to develop the design, engineering and economical cost for the redesign of that module.
The documentation of reference is basically:

- "Technical Specifications for the Re-design of the Compartment IVa Pilot Reactor" from Melissa, and other documents also from Melissa and UAB.
- Information obtained from UAB during different meetings maintained together.

The UAB placed an order to DDEQ reference PD 155003061 dated on 28.02.2008 for the execution of the works included in the scope of the quotation of DDEQ indicated.

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

2. FUNCTIONAL SPECIFICATION

- FUNCTIONAL SPECIFICATION

1. COMPARMENT IVa

1.1- COMPARMENT IVa DESCRIPTION:

This compartment is base don a Photosynthetic reactor. Its inputs are the phase of the CIII compartment and the gas outputs of the other compartment via a buffer tank. This compartment's main function is to convert Nitrates and CO2 into edible Biomass and O2.

1.2- MAIN FUNCTIONS:

- Produce O2 from the liquid CIII output and the CII or gas output.
- Produce edible biomass from the liquid CII output and the CII or CI gas output.
- Allow for stable biomass production.
- Allow for phase separation of these outputs.
- Deliver gaseous O2 to CIII and CIV
- Deliver edible biomass to crew (CV)

1.3- INPUTS:

Compartment CIV is fed with nitrate in liquid phase and with air and CO2 in gas phase. The liquid phase input is delivered by two buffer tanks alternately supplying the bioreactor to allow its continuous stand alone operation.

1.4- STRAINS:

The process in this Compartment is carried out with Arthrospira platensis, a photoautotrophic microscopic algae. This compartment transforms mainly Nitrate and O2 into edible biomass and O2.

CIVa will meet the quality standards applicable to human metabolic consumables (including biosafety standards), be it for O2 or edible biomass (in particular low nitrite content).

1.5- OUTPUT:

The output of the process is in the form of O2 in gas phase and edible biomass in solid phase after harvesting of Arthorospira. O2 is then used by CV and non edible part of the solid phase is intended to be reinjected into CI, along with some CIV a liquid phase output.

1.6- MAIN EQUIPMENT:

- Photosynthetic Reactor:

Reactor consists of two cylindrical DN150 diameter sections and 1,5m height (material in glass), serving as riser and downcomer for the liquid circulation in the gas-lift reactor.

These columns are connected in the upper and lower parts by curved stainless-steel parts, supporting the instrumentation and external jackets for water circulation.

Total Volume 77 liter

Illuminated Total Volume 55 liter

- External Illumination System:

Illumination is provided by a total of 350 externally mounted halogen lamps. These halogens wrap the two tube glass (DN150 and 1.5m height).

Each halogen power supply is 12V 20W.

- Feeding Tank:

Tag nº is VS 401 01 (see P&ID)

Dimension of tank is Ø500x800mm (height) with agitator

Vessel material is AISI316L with jacket

These are different nozzles by instruments, entry and exit liquids.

Roughness surface Ra< 0.5µm

- Harvesting Tank:

  Tag nº is VS 402 01 (see P&ID)

  Dimension of tank is Ø500x800mm (height) with agitator

  Vessel material is AISI316L with jacket

  These are different nozzles by instruments, entry and exit liquids.

  Ruggedness surface Ra< 0.5µm

- Feeding pump:

  Tags nº: GP 401 01/02 (see P&ID).

  The pumps pumping from the tank of feed to the reactor. The pumps working alternatively depend of the clogging of prefilters or breakdown of the (own pumps or diaphragms).

  The pumps are working by pulse.

- Harvesting pump:

  Tags nº: GP 402 01/02 (see P&ID).

  The pumps pumping from the reactor to the tank harvesting. The pump works to keep constant the level of liquid of the reactor. Only one is active and the other one is in reservation.

  The pumps are working by pulse.

1.7- CONTROL:

1.7.1 Loops

1.7.1.1. Loop 400. Light Control

The intensity of the light inside the reactor is controlled directly by the PLC, it will not be possible to do it locally. No exist measures of intensity in the reactor.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
I_400_SP	CIV_SP_Ls	Light setpoint from supervision (Watt/m2)	4-20mA	0-500W/m2

Outputs

MPP Tag	NTE Tag	Description	Type	Range
I_400_MV	CIV_SMV_Ls	Regulator of light supply actuation in %	Real	0-100%

Alarms and warnings

MPP Tag	NTE Tag	Alarm condition	Action
T_405_A_01	CIV_ALM_T	Temperature alarm on	To set safety value to light regulator (10%) and to notify failure

1.7.1.2. Loop 401. Inlet Liquid Flow Control

This loop regulates the inlet liquid flow.

Flow rate setpoint is provided by the supervision. Liquid input media is provided from two pumps working alternatively, it depends of prefilter's clogging which are after the pumps. The change of the pumps is automatic or manual.

A balance measures the weight of tank and this allow the system to detect when a tank is empty.

When the tank's under the minimum volume input and output pumps are stopped. Also the pumps are stopped if each switch transmitter the each pump gives alarm of pressure.

Alarm pressure, sensor PT401 02(automatic)

Tag	Action
PT 401 02	Alarm high Pressure
GP 401 01	Stop pump
HV 401 06	Close valve
HV 401 04	Close valve
GP 401 02	Start pump
HV 401 07	Open valve
HV 401 05	Open valve

Alarm pressure, sensor PT401 03(automatic)

Tag	Action
PT 401 03	Alarm high Pressure
GP 401 02	Stop pump
HV 401 07	Close valve
HV 401 05	Close valve
GP 401 01	Start pump
HV 401 06	Open valve
HV 401 04	Open valve

Alarm empty VS401 01, sensor WT401 01(automatic)

Tag	Action
WT 401 01	Alarm empty VS 401 01
GP 401 01	Stop pump
GP 401 02	Stop pump
HV 401 04	Close valve
HV 401 06	Close valve
HV 401 07	Close valve
HV 401 05	Close valve

The items of L 401 are:

- Acquisition and conditioning of the inlet media tank weight translating weight units into volume units. The supervision fixes the conversion factor.
- To control the active inlet pump according to the clogging of prefilter. The value for switching is fixed by the manufacturer of the filter.
- When the tank's empty an alarm is generated and output pump is stopped.
- When switch transmitter is active an alarm is generated and stops the pump.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
F_401_SP1		Liquid pump input 01 setpoint from supervision	Real	
F_401_SP2		Liquid pump input 02 setpoint from supervision	Real	
WI 401 01	CIV_MLI_M1	Mass measurement	4/20mA	0-600kg
FT 401 01		Flow measurement to determine input flow	4/20mA	0-20l/h
PT 401 01		Differential Pressure measurement to change the filter (LF401 03 or LF401 04)	4/20mA	0/3 barg
PT 401 02		Pressure measurement to Stop the pump GP 401 01	0 – 1	3,5 barg
PT 401 03		Pressure measurement to stop the pump GP 401 02	0 – 1	3,5 barg
PT 401 04		Differential Pressure measurement to change the pumps GP 401 01/02	4/20mA	0/3 barg

Outputs

MPP Tag	NTE Tag	Description	Type	Range
F_401_MV1	CIV_SP_Li1	Liquid pump (GP401 01) input 01 setpoint	4/20mA	0-20l/h
F_401_MV2	CIV_SP_Li2	Liquid pump (GP401 02) input 02 setpoint	4/20mA	0-20l/h

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
F_401_A1	CIV_ALM_LiEmpty	Tank VS401 01 empty	To notify alarm to supervision (CIVa_RL_Lil and CIVa_RL_Li2) and to stop ouput pumps (GP 401 01/02).
F_401_A2	CIV_ALM_ CIV_ALM_LiEmpty_V 1Err	Scale 1 sensor failure	To set safety value and to notify failure to supervision
PT_401_03_A1	CIV_ALM_Pressure	Pressure alarm on	To notify alarm to supervision (CIVa_RL_Lil and CIVa_RL_Li2) and to stop output pump (GP 401 01).
PT_401_02_A1	CIV_ALM_Pressure	Pressure alarm on	To notify alarm to supervision (CIVa_RL_Lil and CIVa_RL_Li2) and to stop output pump (GP 401 02).
PT_401_04_A1	CIV_ALM_Pressure	Pressure alarm on	To notify alarm to supervision (CIVa_RL_Lil and CIVa_RL_Li2) and (change pumps "GP 401 01/02" automatic version).
T_405_A1	CIV_ALM_T	Temperature alarm on	To stop input pumps
PT_401_01_A1	CIV_ALM_Pressure	Pressure alarm on	To notify alarm to supervision

1.7.1.2. Loop 402. Outlet Liquid Flow Control

This loop regulates the outlet liquid flow.

Output flow rate is regulated maintaining by pump GP402 01 or GP402 02 and with the sensor of weight of the reactor (WT400 01).

The items of L 402 are:

- Acquisition and conditioning of the signal of the load cells (WT400 01) translating weight units into level units. The supervision fixes the conversion factor.
- To control the active outlet pump according to the level of the reactor.
- When the tank's full an alarm is generated and input/output pumps are stopped.
- When switch transmitter (pressure) give an alarm is generated and pump is stopped.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
F 402 SP1		Liquid pump input 01 setpoint from supervision	Real	
F 402 SP2		Liquid pump input 02 setpoint from supervision	Real	
WT 402 01	CIV_MLI_M1	Mass measurement	4/20mA	0-200kg
WI 402 01		Mass measurement	4/20mA	0-600kg
PT 402 01		Pressure measurement to Stopp the pump GP 401 01	0 – 1	3,5 barg
PT 402 02		Pressure measurement to stop the pump GP 401 02	0 – 1	3,5 barg

Outputs

MPP Tag	NTE Tag	Description	Type	Range
F_402_MV1	CIV_SP_Li1	Liquid pump (GP402 01) input 01	4/20mA	0-20l/h
F_402_MV2	CIV_SP_Li2	Liquid pump (GP402 02) input 02	4/20mA	0-20l/h

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
F_402_A1	CIV_ALM_Lifull	Tank VS402 01 full	To notify alarm to supervision (CIVa_RL_Lil and CIVa_RL_Li2) and to stop input/output pumps (GP 401-2 01/02).
F_402_A2	CIV_ALM_ CIV_ALM_LiEmpty_V1Err	Scale 1 sensor failure	To set safety value and to notify failure to supervision and to stop input/output pumps (GP 401-2 01/02).
PT_402_01_A1	CIV_ALM_Pressure	Pressure alarm on	To notify alarm to supervision (CIVa_RL_Lil and CIVa_RL_Li2) and to stop input/output pumps (GP 401-2 01/02).
PT_402_02_A1	CIV_ALM_Pressure	Pressure alarm on	To notify alarm to supervision (CIVa_RL_Lil and CIVa_RL_Li2) and to stop input/output pumps (GP 401-2 01/02).

1.7.1.3. Loop 403. Inlet Gas Flow Control

This loop control the inlet gas flow and the composition of CIVa

This loop measures the gas flow at compartment input and provides this information to the control system.

Three flows are currently controlled same time (air inlet, CO2 inlet and total gas inlet CIVa).

The items of loop L403 are:

- To allow manual setting of gas flow input (stop controlling action)
- To acquire gas flow rate at compartment input.
- To acquire inlet air gas flow rate.
- To acquire inlet CO2 flow rate.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
F 403 SP1		Inlet air gas flow setpoint from supervision	0-5 V	0 - 30nLm
F 403 SP2		Inlet CO2 flow setpoint from supervision	0-5 V	0 - 30nLm
F 403 SP3		Total gas flow setpoint from supervision	0-5 V	0 - 30nLm
F 403 01		Inlet air gas flow measurement		
F 403 02		Inlet CO2 flow measurement		
F 403 03		Total gas flow measurement		

Outputs

MPP Tag	NTE Tag	Description	Type	Range
F_403_MV1	CIV_SP_Fgex	Air inlet flow command	Real	
F_403_MV2		CO2 flow command	Real	
F_403_MV3	CIV_SP_Fgi	Total gas inlet flow command	Real	

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
F_403_A1	CIV_ALM_Gas	No Gas alarm	Stop liquid input pump set light to 10% and notify failure (CIVa_ALM_NoGas)

1.7.1.4. Loop 404. Outlet Gas Flow Control

This loop control the outlet gas flow of CIVa

This loop measures the gas flow (oxygen) and provides this information to the control system.

CO2 flow regulation is performed in the same PLC section as pH regulation.

The items of loop L404 are:

- To acquire total gas flow rate at compartment output.
- To allow to edit CO2 and O2 sensor scales.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
F 404 SP1	CIV_MGO_ FrGas	Gas flow at gas output from sensor		

1.7.1.5. Loop 405. Temperature Control

This loop measures the reactor's internal temperature and provides this information to the control system. Temperature control is in the PLC.

The items of loop L405 are:

- To acquire temperature sensor values.
- To acquire scale sensors.
- To acquire speed ventilator value (refrigeration system).

Inputs

MPP Tag	NTE Tag	Description	Type	Range
T_405	CIV_MV_T	Temperature measurement	4-20mA	0 – 150ºC
T_405_SP1	CIV_SSP_T	Temperature setpoint fixed by the supervision	Real	0 – 100ºC
BLWR_405	CIV_MV_T	Speed ventilator measurement	4-20 A	
BLWR_405_SP2	CIV_ _	Speed setpoint fixed by the supervision	Real	

Outputs

MPP Tag	NTE Tag	Description	Type	Range
T_405_MV1		Cooling valve command	Real	
T_405_MV2		Heat exchanger in on	Real	
BLWR_405_SP		Speed ventilator	4-20mA	rpm

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
T_405_A1	CIV_ALM_T	Temperature 5º over the setpoint value	To notify an alarm and to set light setpoint to safety value (10%)
T_405_A2	CIV_ALM_TErr	Temperature sensor failure	To set a safety value (temperature setpoint) and notify failure
BLWR_405_A1	CIV_ALM_TErr	Ventilator failure	To notify an alarm

1.7.1.5. Loop 406. pH Control

This loop control the pH within the reactor.

According to the measurement position in comparison to the pH setpoint the regulador actuates the acid solution or basic solution pumps.

A probe placed on the top of the engine provides the pH measurement for the control system.

There're three modes of regulation.

Mode	Description	CO2 Flow Rate	Base pump	Acid pump
1	Only CO2 used to regulate pH	Enabled	Disabled	Disabled
2	CO2 is fixed and a base medium is used to regulate pH	Enabled	Enabled	Disabled
3	CO2 is fixed and a base and addition acid medium is used to regulate pH	Disabled	Enabled	Enabled

PID output calculation is performed as follow (from Concept documentation):

1. dT = time differential between the current cycle and the previous cycle
2. TI = reset time
3. TD = Retaining time
4. YP = gain*Errnew
5. YInew = YIold+gain*(dT/TI)*(Errnew+Errold)/2
6. YDnew = YDold+TD*gain*(Errnew+Errold)dT
7. Y= YP+YI+YD

The items of loop L406 are:

- To acquire the pH value.
- To activate base pump and base ON indicator if base pump is enabled and in case of setpoint deviation is < 0,15 unit.
- To activate acid pump and acid ON indicator if acid pump is enabled and in case of setpoint deviation is > 0,15 unit.
- To control acid and base pumps
- If CO2 regulation is enabled, to regulate CO2 input flow to control the pH using a PID (Mode 1: Kp=5, Ki=1000, D=0 with PID output range 0-100%). Values can be modified from the supervision.
- To maintain a fix CO2 input flow rate (bias) value provided by the supervision.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
pH_406 01	CIV_MV_pH1	pH measurement	4-20mA	0 – 100%
pH_406 02	CIV_MV_pH2	pH measurement	4-20mA	0 – 100%
pH_406_SP	CIV_SSP_pH1	pH setpoint fixed by supervision		
WI_406 01		Weight measurement	RS232	0–3Kg
WI_406 02		Weight measurement	RS232	0–3Kg
WI_40601SP		Weight setpoint fixed by supervision		
WI_40602SP		Weight setpoint fixed by supervision		

Outputs

MPP Tag	NTE Tag	Description	Type	Range
pH_406_MV1	CIV_MAN_Ac	Manual acid pump setpoint	Real	0-100%
pH_406_MV2	CIV_MAN_Ba	Manual Base pump setpoint	Real	0-100%
pH_406_MV3	CIV_MAN_Ac	Open/Close valve SV-406_01		
pH_406_MV4	CIV_MAN_Ba	Open/Close valve SV-406_02		
CO2_406_SP	CIV_MAN_FrCO2	Manual CO2 flow regulation setpoint	Real	0-100%

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
pH_40601_A1	CIV_ALM_pH	pH out of the setpoint during 15 seconds	To notify an alarm to supervision
pH_40601_A2	CIV_ALM_pHErr	pH sensor failure	To set a safety value (nominal setpoint) and notify failure. Disable PID action (PID output = 0)
pH_406_A3	CIV_ALM_BapH	Base pump link error	To notify error to supervision
pH_406_A4	CIV_ALM_AcpH	Acid pump link error	To notify error to supervision
pH_40602_A5	CIV_ALM_pH	pH out of the setpoint during 15 seconds	To notify an alarm to supervision
pH_40602_A6	CIV_ALM_pHErr	pH sensor failure	To set a safety value (nominal setpoint) and notify failure. Disable PID action (PID output = 0)
WI_40601_A7		Empty VS406 01	To notify an alarm to supervision and stop pump PP406 01
WI_40601_A8		Empty VS406 02	To notify an alarm to supervision and stop pump PP406 02

1.7.1.7. Loop 407. Pressure Control

This loop measures the reactor's internal pressure and provides this information to the control system. Reactor internal pressure control is in the PLC.

The items of loop L407 are:

- To acquire the current pressure sensors values.
- To control pressure inside of reactor
  - Sensor(PT407 01 and/or PT407 02) to PLC "control" to FQRC 404 02 (automatic valve)

Inputs

MPP Tag	NTE Tag	Description	Type	Range
P_407_01	CIV_MV_P01	Pressure measurement	4-20mA	0 – 3barg
P_407_02	CIV_MV_P02	Pressure measurement	4-20mA	0 – 3barg
P_407_SP1		Pressure at output regulation from supervision	Real	

Outputs

MPP Tag	NTE Tag	Description	Type	Range
P_407_MV1		Pressure at output regulation	4-20mA	

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
P_407_01_A1	CIV_ALM_PHH	Alarm to notify pressure sensor high pressure inside of reacotr	Notify failure and to stop inlet gas
P_407_01_A2	CIV_ALM_PErr	Alarm to notify pressure sensor link error	Set safety value (nominal setpoint) and notify failure
P_407_02_A1	CIV_ALM_PHH	Alarm to notify pressure sensor high pressure inside of reacotr	Notify failure and to stop inlet gas
P_407_02_A2	CIV_ALM_PErr	Alarm to notify pressure sensor link error	Set safety value (nominal setpoint) and notify failure

1.7.1.8. Loop 408. Liquid level Control

This loop measures the reactor's liquid level and provides this information to the control system. Liquid level regulation is performed in the PLC with load cells.

The items of loop L408 are:

- To acquire sensor values (weight).
- To acquire scale sensors.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
L_408	CIV_MV_L	Liquid level reactor	4-20	0 -100%

Outputs

MPP Tag	NTE Tag	Description	Type	Range
L_408_MV1		Activate harvesting pump	4-20mA	
L_408_MV2		Stop feeding pump	0-1	
L_408_MV3		Stop feeding pump	0-1	

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
L_408_A1	CIV_ALM_PErr	Alarm to notify level sensor link error	To notify alarm to supervision and to stop input liquid.
L_408_A2		Alarm to notify high high level of reactor	To notify alarm to supervision and to stop input liquid.

1.7.1.9. Loop 409. Biomass Control

This loop measures the reactor's biomass concentration and provides this information to the control system.

Biomass production loop is controlled by an external program to the controller. It mixes the liquid flow control and the light intensity control.

Biomass concentration acquisition is performed in light attenuation units, to provide biomass concentration in dry weight units (g/l) a conditioning set of the value is performed.

In addition the section includes biomass sensor cleaning logic.

The items of loop F409 are:

- To acquire the biomass concentration (two sensors).
- To clean the biomass sensor a pulse is generated every 5 minutes during 5 seconds to open the compressed air valves.
- To maintain the biomass input value held since the valve is opened to 5 seconds after the valve is closed to avoid disturbances while the sensor is being cleaned.
- To calculate actual biomass production: Biomass production = liquid input flow * Biomass concentration (dw)
- To adjust inlet and outlet liquid flows

Inputs

MPP Tag	NTE Tag	Description	Type	Range
Bio_409_01	CIV_MV_CxAbs_01	Biomass concentration in absorvance unit	4-20mA	Configurable
Bio_409_02	CIV_MV_CxAbs_02	Biomass concentration in absorvance unit	4-20mA	Configurable
Bio_409_SP1		Biomass production setpoint		
Bio_409_SP2		Biomass production setpoint		

Outputs

MPP Tag	NTE Tag	Description	Type	Range
I_400_SP	CIV_SSP_LIBP	Light intensity setpoint	Real	0 –10g/h
F_401_SP1		Liquid pump input 01 setpoint from supervision	Real	
F_401_SP2		Liquid pump input 02 setpoint from supervision	Real	

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
Bio_409_A1	CIV_ALM_CxErr01	Biomass sensor failure	Set safety value (1,0) and notify failure
Bio_409_A2	CIV_ALM_CxErr02	Biomass sensor failure	Set safety value (1,0) and notify failure

1.7.1.10. Loop 410. Outlet Gas Composition Control

This loop composition gas control is not implemented.

1.7.1.11. Loop 441. Automatic sterilization

This control is not implemented.

1.7.1.12. Loop 412. Antifoam Control (Potential implementation)

This loop detects the presence of foam and provides this information to the control system.

Antifoam flow regulation is performed in the PLC with switch level sensor (vibronic).

The items of loop F412 are:

- To acquire the presence of foam (limit level of foam in reactor).

Inputs

MPP Tag	NTE Tag	Description	Type	Range
LVL_412_01		Detection of foam measurement	0/1	

Outputs

MPP Tag	NTE Tag	Description	Type	Range
LVL_412_SP		Active pump antifoam + open automatic valve inlet liquid of antifoam		

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
LVL_412_A1		Vibronic sensor failure	To notify alarm to supervision
LVL_412_A2		Antifoam pump link error	To notify error to supervision

1.7.1.13. Loop 432. Temperature Control inside of feeding tank

This loop measures the feeding tank's internal temperature and provides this information to the control system. Temperature control is in the PLC.

The items of loop L432 are:

- To acquire temperature sensor values.
- To acquire scale sensors.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
TT_401 01		Temperature measurement	4-20mA	0 – 150ºC
TT_432_SP1		Temperature setpoint fixed by the supervision	Real	0 – 150ºC

Outputs

MPP Tag	NTE Tag	Description	Type	Range
SV 432 01		Cooling valve command	Real	
SV 441 01		Heat valve command	Real	

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
TT_401_A1		Temperature sensor failure	To set a safety value (temperature setpoint) and notify failure
SV_441 01_A1		Automatic Valve failure	To notify failure
SV_432 01		Automatic Valve failure	To notify failure

1.7.1.13. Loop 434. Temperature Control inside of harvesting tank

This loop measures the harvesting tank's internal temperature and provides this information to the control system. Temperature control is in the PLC.

The items of loop L434 are:

- To acquire temperature sensor values.
- To acquire scale sensors.

Inputs

MPP Tag	NTE Tag	Description	Type	Range
TT_402 01		Temperature measurement	4-20mA	0 – 150ºC
TT_434_SP1		Temperature setpoint fixed by the supervision	Real	0 – 150ºC

Outputs

MPP Tag	NTE Tag	Description	Type	Range
SV 434 01		Cooling valve command	Real	
SV 441 02		Heat valve command	Real	

Alarms and warnings.

MPP Alarm Tag	NTE Alarm Tag	Alarm Condition	Action
TT_402_A1		Temperature sensor failure	To set a safety value (temperature setpoint) and notify failure
SV_441 02_A1		Automatic Valve failure	To notify failure
SV_432 02		Automatic Valve failure	To notify failure

3. CALCULATIONS

2008

Author: Francisco Mangas

Company: De Dietrich Equipos Químicos

Date: 28/07/2008

[CALCULATIONS]

DROP PRESSURE: LOOP OF REFRIGERATION OF BIOREACTOR

Parameters

Lengths of pipe including bioreactor "jacket": 5 meters.
Pipe DN15
Number of bend 90º = 10
Number of bend 45º = 5
Number through Tee = 4
Number of valves = 2

Flow cool water = 1 m3/h
Temperature = 15 ºC

The calculation has been realized using the following program "Pipe Flow Expert".

Results.

ΔP = 0.5 barg
Flow type: Turbulent

DROP PRESSURE: OUTLET GAS OF THE BIOREACTOR

Parameters

Lengths of pipe: 3 meters.
Pipe DN10
Number of bend 90º = 4
Number of bend 45º = 2
Number through Tee = 10
Number of valves = 6

Flow Air = 0.21 l/min
Temperature = 20 ºC

The calculation has been realized using the following program "Pipe Flow Expert".

Results.

ΔP = 0.0 barg
Flow type: laminar

DROP PRESSURE: PROCESS GAS INSIDE OF THE BIOREACTOR

Parameters

Height liquid inside of bioreactor = 2 meter
Density of medium = 1000 kg/m3

Equation:

Pressure bottom of bioreactor =Density x Height

Results.

$\Delta P = 0.2$ barg

AIR REFRIGERATION FOR THE LIGHTS

Parameters

Lights:

Number of halogens light = 350
Power = 12 V 20W

Air:

Density = 1.2 kg/m3
Cp = 1 KJ/KgºC
ΔT = 15ºC (inside and outside refrigeration system)

Pipe Size:

D_{out} = DN400
D_{inside} = DN150
Occupied area = 70% (structure and lights)

Estimate rate of heat vs power = 50%
Estimate loss heat = 20%
Coefficient Safety Air Flow = 20%

Equation and Results:

Total energetic consumption = 350 x 20 = 7kW

Heat contributed by lights = 7 kW * 50/100 * (100-20)/100 =
2.8kW → 10.080kJ/h

Air Flow = 10.080 / (1 * 10 *1,2) = **840 m3/h** * 1.2 (coef. Saf.) → **1000 m3/h**

Free Area = π (D_{out}^2/4 – D_{inside}^2/4) * (70/100)= 0.0324m2

Air velocity = 1000 / 0.0324 = 30864.2 m/h → **8.6 m/s**

COOLING WATER REFRIGERATION BIOREACTOR

Parameters

Lights:

Number of halogens light = 350
Power = 12 V 20W

Cool Water:

Density = 1.0 kg/m3
Cp = 4.18 KJ/KgºC
Flow = 1m3/h
$T_{cool\ water}$ = 15 ºC

Pipe Size:

Pipe DN15

BioReactor:

$U_{estimated}$= 400kcal/m2hºC
$Área_{bioreactor}$ = 0.3 m^2

Estimate rate of heat vs power = 50%
Estimate loss heat = 20%

Equation and Results:

Total energetic consumption = 350 x 20 = 7kW

Heat contributed by lights = 7 kW * 50/100 * (100-20)/100 =
2.8kW → 10.080kJ/h → 2409.18 kcal/h

$\Delta T_{cool\ water}$ = 10.080/(4,18 x 10^3) = 2.5 ºC

Transfer energy q= UAΔTm.

ΔTm= 2409.18/(400*0.3) = 20ºC

$ATm_{available}$ = ((35-15) – (35-20))/ln((35-15)/(35/20)) → 17ºC

Sterilization Time Heating

Nomenclature

V: Design criterion for sterilization.
N_0: Number of viable spores initially presents
N: Number of viable spores
T: Sterilization temperature
K: Specific reaction rate for thermal spore destruction.
h: Enthalpy of steam relative to raw medium temperature
s: Steam mass flow rate.
Cp: Heat Capacity of Bioreactor medium
U: Over-all heat transfer coefficient
A: Area of Bioreactor
Tco: Temperature of cooling water
Type spore: Bacillus Sterothermophilus

Parameter value:

N_0: 5.6×10^{12} spores
N: 10^{-6} spores
T: 120ºC

V: $\ln(5.6 \times 10^{12}/10^{-6}) =$ **43.17**

Cycle: Heating

Parameters

Empty Bioreactor (Air)

Alfa	
h (kJ/kg)	2250
S (kg/min)	0,33
M (kg)	80
Cp(kJ/Kg ºC)	1
To (K)	298
U(kcal/m2minºK)	400
Área (m2)	0,24
Tco (K)	288
T (K)	394

Time Vs Temperature		
time (minute)	Temperature	K
0	298	2,13446E-12
10	387,1	0,939496964
11	395,7	6,482456839

Time heating to arrived sterilization temperature = 10 minutes

Cycle: Heating

Parameters

Bioreactor witch Medium

Alfa	
h (kJ/kg)	2250
S (kg/min)	0,33
M (kg)	80
Cp(kJ/Kg ºC)	4,18
To (K)	298
U(kcal/m2hºK)	400
U(kJ/m2minºK)	28
Area (m2)	0,24
Tco (K)	20
T (K)	394
Flow cooling water kg/min	16,67

Time (min)	Temperature	K
0	298	2,13446E-12
10	319,3	5,08585E-09
20	339,0	2,80908E-06
30	357,3	0,000524251
40	374,2	4,28E-02
50	390,0	1,83E+00
51	391,6	2,59E+00
52	**394,1**	**3,63E+00**

Time heating to arrived sterilization temperature = **52 minutes**

Cycle: Heating constant temperature 120ºC (sterilization temperature)

Parameters

Bioreactor witch Medium

Alfa	
K (120ºC)s^{-1}	0.015

Time of Sterilization = **43.17/0.015 → 48 min**

Note: In the cycle of heating/cooling (20ºC to 120ºC/ 120 to 20ºC) there're sterilization but these values of sterilization are used how factor of safety.

Cycle: cooling of Bioreactor

Bioreactor witch medium

Nomenclature	**Values**
t1 initial medium temperature (K)	394
t2 final médium temperatura (K)	308
T1 Tº jacket (K)	270
Cp(kcal/Kg ºC)	1
U(Kcal/m2minºK)	7
M (kg)	80
Area (m2)	0,3

Time (min)	Temperature (K)
0	394
5	377,870815
10	364,602543
15	352,966288
20	342,76131
25	333,811559
30	325,962642
35	319,079153
40	313,042343
45	**307,74807**

Time cooling to arrived 120 to 30 ºC = **45 minutes**

Cycle: cooling of Bioreactor

Bioreactor witch air

Nomenclature	**Values**
t1 initial medium temperature (K)	394
t2 final médium temperatura (K)	308
T1 Tº jacket (K)	270
Cp air(kcal/Kg ºC)	0.237
U(Kcal/m2minºK)	0.05
Air (kg)	0.08
Area (m2)	0,3
Air Densityr (kg/m3)	0,6206

Time (min)	Temperature (K)
0	393
1	325,759
2	295,277
3	281,458
4	275,19
5	272,354
6	271,067
7	270,483
8	270,219
9	270,099
10	270,045

Time cooling to arrived 120 to 30 ºC = **10 minutes**

4. GENERAL DESCRIPTION: SEQUENCES

2008

Author: Francisco Mangas

Company: De Dietrich Equipos Químicos

Date: 21/05/2008

[GENERAL DESCRIPTION: SEQUENCES]

GENERAL DESCRIPTION SEQUENCES: LIST

1. Filling Sequences
    a. Filling feeding Tank Sequence
    b. Filling Harvesting Tank Sequence
    c. Filling Bioreactor Sequence
    d. Filling Vessel Acid
    e. Filling Vessel Basic
    f. Filling cooling water refrigeration Bioreactor Sequence

2. Empting Sequences
    a. Empting feeding Tank Sequence
    b. Empting Harvesting Tank Sequence
    c. Empting Bioreactor Sequence
    d. Empting Vessel Acid Sequence
    e. Empting Vessel Basic Sequence
    f. Empting cooling water refrigeration Bioreactor Sequence
    g. Empting process pipe Sequence

3. Start pumps Sequences
    a. Filling of the bioreactor
    b. Emptying of the bioreactor

4. Sterilization Sequences: list
    a. Empty feeding Tank Sterilization Sequence
    b. Empty harvesting Tank Sterilization Sequence
    c. Empty Sterilization Sequence of Liquid Inlet Filter F-401 01
    d. Empty Sterilization Sequence of Gas Vent Filter GF-442 01
    e. Empty Sterilization Sequence of Sample valve HV-401 17
    f. Empty Sterilization Sequence of Pump GP-401 01 and Liquid filter LF-401 05
    g. Empty Sterilization Sequence of Pump GP-401 02 and Liquid filter LF-401 06
    h. Empty Sterilization Sequence of Liquid Inlet Filter LF-401 03
    i. Empty Sterilization Sequence of Liquid Inlet Filter LF-401 04
    j. Empty Sterilization Sequence of Gas Inlet Filter GF-403 04
    k. Empty Sterilization Sequence of Sample valve HV-407 01
    l. Empty Sterilization Sequence of Liquid Inlet filter LF-406 03
    m. Empty Sterilization Sequence of Liquid Inlet filter LF-406 04
    n. Empty Sterilization Reactor Sequence
    o. Empty Sterilization Sequence of Gas Outlet filter GF-404 01

p. Empty Sterilization Sequence of Gas inlet filter GF-403 05
q. Empty Sterilization Sequence of Gas Outlet filter GF-404 02
r. Empty Sterilization Sequence of Pump GP-402 01
s. Empty Sterilization Sequence of Pump GP-402 02
t. Empty Sterilization Sequence of Sample valve HV-402 10
u. Empty Sterilization Sequence of Gas Vent Filter GF-442 02
v. Empty Sterilization Sequence of line pipe PL-10-SS-002/003
w. Empty Sterilization Sequence of line pipe PL-10-SS-004
x. Empty Sterilization Sequence of line pipe PL-10-SS-007
y. Empty Sterilization Sequence of line pipe PL-10-SS-012
z. Empty Sterilization Sequence of line pipe PL-10-SS-016
aa. Empty Sterilization Sequence of line pipe PL-10-SS-013
bb. Empty Sterilization Sequence of line pipe PG-10-SS-001
cc. Empty Sterilization Sequence of mass flowmeter FT 401 01
dd. Empty Sterilization Sequence of Biomass sensors OT 409 01 and OT 409 02
ee. Empty Sterilization Sequence of Temperature sensor TI 405 01
ff. Empty Sterilization Sequence of Pressure sensors PI 407 01 and PI 407 02
gg. Empty Sterilization Sequence of Level sensor LT 407 01
hh. Empty Sterilization Sequence of pH sensors AI 406 01 and AI 406 02
ii. Empty Sterilization Sequence of Dissolved Oxigen sensors AI 410 03
jj. Empty Sterilization Sequence of inoculums system
kk. Sequence "Fill feeding Tank with medio"
ll. Sequence "Fill Photo Bioreactor with media"
mm. Sequence "Fill Harvesting Tank with media"

1a.-General Description of Filling Sequence

The sequences of Filling are used when for process reasons they are needed.
The Filling and Empting are manuals sequences; Operator operates directly in the manual valves.

Steps of Sequence
The sequence is started by an operator. See below the steps:

Step 1: Vent Equipment

- To check correct utilities (Instrument)
- Open valves in the outlet air (vent pipe)

Step 2: Equipment

- To check that the valve of outlet liquid of the equipment is closed

Step 3: Inlet liquid of the Equipment

- To open the valves of inlet liquid

Step 4: Ending of the Sequence

- To close the valves of entry of the equipment

2.-General Description of Empty Sequence

The sequences of empty are used when for process reasons they are needed.
The Empting are manuals sequences; Operator operates directly in the manual valves.

Steps of Sequence
The sequence is started by operator. See below the steps:

Step 1: Vent Equipment

To check for correct utilities (Instrument)

- Open valves in the outlet air (vent pipe)

Step 2: Equipment

- To check that the valve of inlet liquid of the equipment is closed

Step 3: Inlet liquid of the Equipment

- To open the valves (drain valve) of inlet liquid

Step 4: Ending of the Sequence

- To close the valves of outlet of the equipment

3.- Start up pumps Sequence : General Description

The sequences of start up pumps are used when for process reasons they are needed. The start up pumps (Filling and Empting) to Bioreactor are automatic sequences; The operator defines a set point and the system of control takes charge supporting the above mentioned set point.

Steps of Sequence
The sequence is started by a operator. See below the steps:

Step 1: Check general of instalation

- To check correct utilities (Instrument)
- To check don't exist lack in the installation

Step 2: Manual operation by operator

- To check that the valve are in correct position.

Step 3: Start up the pumps

- To enable the loop of pumps system control by the operator.

4.General Description of Sterilization Sequence

The sequence is used to sterilize by direct steam injection into the pipe.
The sterilization is a manual sequence; Operator operates directly in the manual valves.

The sequence is controlled by a Timer, so that each step of the sequence has a fixed duration.

Steps of Sequence
The sequence is started by a operator, the steps as description below:

Step 1: Sterilization step

To check for correct utilities (Instrument and Clean Steam)

- Heat up 10 min. to sterilization temperature.
- Further heating 45 min. to sterilize.

If the sterilization is completed, Step 1 is finished.

Step 2: Cooling step
Cool down the filter and/or pump and pipes for 30 min.
Cool down by convection cooling.
Vacuum breaking via:

Inlet Process Air: Reactor, Harvesting Tank and line pipe outlet liquid and gas
Vent Air: Feeding Tank, line pipe inlet liquid to reactor, deposit acid and deposit base.

Step 2 is completed, if the timer of cooling step reaches 30 minutes. The state of valves returns to standard standby state.

5. INVESTMENT

- INVESTMENT

In the ANNEX IV of the Project, there is included the quotation of DDEQ for the supply of Melissa Project Compartment IVa. (Quotation DDEQ-K 1362- SI rev. 1).

In that quotation there are detailed the investment costs for the construction of Compartment IVa, including:

. detail engineering pending works
. equipment supply
. plant assembly
. commissioning

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

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

A planning for the development of the project is also included, with a total timing for the whole project of 7 months from the confirmation of an order from UAB.

6. ANNEX I: LISTINGS

6.1. Equipment List
6.2. Lines List
6.3. Instrument Lists
6.4. Material Lists
6.5. Control: Digital and Analogical signals

De Dietrich Equipos Químicos, S.L.
Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

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EQUIPMENT LIST

EQUIPMENT

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IVa	**DATE:**	25/08/2008	**PREPARED:** F.M.P.
DRAWING:	DD - 8506 - Z1 - 100 - 01	**REV:**	B	**CHECKED:** J.MESTRE

TAG	DENOMINATION	DESCRIPTION	SITUATION	SUPPLIER	OBSERVATIONS
RCIVa	Photobioreactor	Reactor "loop" , design natural convection. Material: AISI 316L, glass			
HX 407 01	Condenser	Reflux condenser for reactor. Material AISI 316L			Existing unit
BLWR 405 01	Fan	Air fan for cooling lightening of reactor			
VS 401 01	Feed tank	Agitated tank in AISI 316L, 170 l total capacity, provided with jacket for heating - cooling. Designed to operate at positive pressure. Magnetic driver			
GP 401 01 GP 401 02	Feed pumps to reactor	Mettering pump in stainless, membrane PTFE, flow 0 to 4 l/h. Control by electronic variator. Sterilizable			
VS 406 01	Acid addition	Vessel 5 l capacity in borosilicate glass for acid addition			
VS 406 02	Base addition	Vessel 5 l capacity in borosilicate glass for alcali addition			
PP 406 01	Acid pump	Mettering pump for acid dosing. Flow:			Existing unit
PP 406 02	Alcali pump	Mettering pump for alcali dosing. Flow:			Existing unit
VS 402 01	Harvest tank	Agitated tank in AISI 316L, 90 l capacity, provided with jacket for heating cooling. Designed to operate at positive pressure. Magnetic driver			Existing unit
GP 402 01		Mettering pump in stainless, membrane PTFE, flow 0 to 4 l/h. Control by electronic variator. Sterilizable			
BLWR 404 01	Compressor	Membrane compressor in AISI 316 / PTFE for outlet gas recirculation to reactor. Normal flow: 2,1 l/min			
HX 405 01	Glycol heater	Electrical heater			
HX 405 02	Glycol cooler	Plate heat exchanger for glycol cooling with cold glycol			Existing unit

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EQUIPMENT LIST

EQUIPMENT

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IVa	**DATE:**	25/08/2008	**PREPARED:** F.M.P.
DRAWING:	DD - 8506 - Z1 - 100 - 01	**REV:**	B	**CHECKED:** J.MESTRE

TAG	DENOMINATION	DESCRIPTION	SITUATION	SUPPLIER	OBSERVATIONS
PP 405 01	Recirculation pump	Centrifugal pump for glycol loop for control of reactor temperature			Existing unit
VS 405 01	Expansion vessel	Expansion vessel for glycol circuit. Material AISI 316. Volume: 10 l			
VS 411 01	Antifoam vessel	Vessel for antifoam addition			not in the scope of project
PP 411 01	Antifoam pump	Mettering pump for antifoam addition			not in the scope of project
HX 407 02	Cooler	Sample gas cooler			

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LINES LIST

LINES

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES — **FLOW: PROCESS LIQUID**

FLU	MAT	DN	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
PL	SS	10	001	LIQUID INLET	PL-10-SS-002	---	SS-1
PL	SS	10	002	PL-10-SS-001	PL-10-SS-003	---	SS-1
PL	SS	10	003	PL-10-SS-002	VS 401 01	---	SS-1
PL	SS	10	004	VS 401 01	PL-10-SS-006	---	SS-1
PL	SS	10	005	PL-10-SS-004	PL-10-SS-007	---	SS-1
PL	SS	10	006	PL-10-SS-004	PL-10-SS-007	---	SS-1
PL	SS	10	007	PL-10-SS-005	PL-10-SS-008	---	SS-1
PL	SS	10	008	PL-10-SS-007	PL-10-SS-010	---	SS-1
PL	SS	10	009	PL-10-SS-007	PL-10-SS-011	---	SS-1
PL	SS	10	010	PL-10-SS-008	PL-10-SS-012	---	SS-1
PL	SS	10	011	PL-10-SS-009	PL-10-SS-012	---	SS-1
PL	SS	10	012	PL-10-SS-010	REACTOR	---	SS-1
PL	SS	10	013	REACTOR	PL-10-SS-015	---	SS-1
PL	SS	10	014	PL-10-SS-013	PL-10-SS-016	---	SS-1
PL	SS	10	015	PL-10-SS-013	PL-10-SS-016	---	SS-1
PL	SS	10	016	PL-10-SS-014	VS 402 01	---	SS-1
PL	SS	10	017	VS 402 01	LIQUID OUTLET	---	SS-1

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LINES LIST

LINES

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: PROCESS GAS**

FLU	MAT	DN	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
PG	SS	10	001	HX 407 01	PG-10-SS-004	---	SS-1
PG	SS	10	002	PG-10-SS-001	PG-10-SS-003	---	SS-1
PG	SS	10	003	PG-10-SS-002	PG-10-SS-005	---	SS-1
PG	SS	10	004	PG-10-SS-001	PG-10-SS-005	---	SS-1
PG	SS	10	005	PG-10-SS-004	HX 407 02	---	SS-1
PG	SS	10	006	HX 407 02	PG-10-SS-008	---	SS-1
PG	PA	10	007	PG-10-SS-006	PG-10-SS-008	---	SS-1
PG	SS	10	008	PG-10-SS-006	GAS OUTLET	---	SS-1
PG	SS	10	009	HV 404 11	PAI-10-SS-002	---	SS-1

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LINES LIST

LINES

CUSTOMER:	UAB			
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DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW:PROCESS AIR**

FLU	MAT	DN	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
PAI	SS	10	001	PROCESS AIR INLET	PAI-10-SS-002	---	SS-2
PAI	SS	10	002	PAI-10-SS-001	CO2-10-SS-001	---	SS-2
PAI	SS	10	003	PAI-10-SS-001	REACTOR	---	SS-1

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LINES LIST

LINES

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: PROCESS $C0_2$**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
CO2	10	SS	001	PROCESS CO2 INLET	CO2-10-SS-002	---	SS-1
CO2	10	SS	002	CO2-10-SS-001	CO2-10-SS-003	---	SS-1
CO2	10	SS	003	CO2-10-SS-002	REACTOR	---	SS-1
CO2	10	SS	004	CO2-10-SS-002	PG-10-SS-007	---	SS-1

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LINES LIST

LINES

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: PROCESS ACID**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
PAC	10	PP	001	VS 406 01	PAC-10-SS-002	---	PP
PAC	10	SS	002	PAC-10-PP-001	PAC-10-SS-003	---	SS-1
PAC	10	SS	003	PAC-10-SS-002	REACTOR	---	SS-1

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Member of De Dietrich PROCESS SYSTEMS

LINES LIST

LINES

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: PROCESS BASIC**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
PBA	10	PP	001	VS 406 02	PBA-10-SS-002	---	PP
PBA	10	SS	002	PAC-10-PP-001	PAC-10-SS-003	---	SS-1

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LINES LIST

LINES

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: GLYCOL**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
GLY	15	SS	001	GLYCOL INLET	VS 401 01	---	SS-1
GLY	15	SS	002	VS 401 01	GLYCOL OUTLET	---	SS-1
GLY	15	SS	003	GLYCOL INLET	HX 405 02	---	SS-1
GLY	15	SS	004	HX 405 02	GLYCOL OUTLET	---	SS-1
GLY	15	SS	005	GLYCOL INLET	HX 407 01	---	SS-1
GLY	15	SS	006	HX 407 01	GLYCOL OUTLET	---	SS-1
GLY	15	SS	007	GLYCOL INLET	VS 402 01	---	SS-1
GLY	15	SS	008	VS 402 01	GLYCOL OUTLET	---	SS-1

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Av. Príncep d'Asturies 43-45, 1r-5a
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LINES LIST

LINES

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: AIR**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
AI	10	SS	001	AIR INLET	GLY-15-SS-002	---	SS-1
AI	10	SS	002	AIR INLET	GLY-15-SS-008	---	SS-1
AI	10	SS	003	AI-10-SS-001	GLY-15-SS-001	---	SS-1

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CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
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NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: INOCULUM**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
IN	15	SS	001	INOCULUM INLET	REACTOR	---	SS-1

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CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**CHECKED:**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: STEAM**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
ST	15	SS	001	STEAM INLET	SAMPLE VALVE REACTOR	---	SS-2
ST	15	SS	002	ST-15-SS-001	PL-10-SS-001	---	SS-2
ST	15	SS	003	ST-15-SS-001	GLY-15-SS-002	---	SS-2
ST	15	SS	004	ST-15-SS-001	VT-15-SS-001	---	SS-2
ST	15	SS	005	ST-15-SS-001	PL-10-SS-004	---	SS-2
ST	15	SS	006	ST-15-SS-005	VS 401 01	---	SS-2
ST	15	SS	007	ST-15-SS-005	PL-10-SS-005	---	SS-2
ST	15	SS	008	ST-15-SS-005	PL-10-SS-006	---	SS-2
ST	15	SS	009	ST-15-SS-005	SAMPLE VALVE (VS 401 07)	---	SS-2
ST	15	SS	010	ST-15-SS-001	CO2-10-SS-002	---	SS-2
ST	15	SS	011	STEAM INLET	IN-10-SS-001	---	SS-2
ST	15	SS	012	STEAM INLET	PG-10-SS-001	---	SS-2
ST	15	SS	013	ST-15-SS-012	PG-10-SS-004	---	SS-2
ST	15	SS	014	ST-15-SS-012	PG-10-SS-002	---	SS-2
ST	15	SS	015	STEAM INLET	PL-10-SS-013	---	SS-2
ST	15	SS	016	ST-15-SS-015	PL-10-SS-015	---	SS-2
ST	15	SS	017	ST-15-SS-063	ST-15-SS-063	---	SS-2
ST	15	SS	018	ST-15-SS-015	VT-15-SS-002	---	SS-2
ST	15	SS	019	ST-15-SS-015	GLY-15-SS-008	---	SS-2
ST	15	SS	020	ST-15-SS-015	VS 402 01	---	SS-2
ST	15	SS	021	PL-10-SS-003	ST-15-SS-022	---	SS-2
ST	15	SS	022	ST-15-SS-021	ST-15-SS-032	---	SS-2
ST	15	SS	023	GLY-15-SS-001	ST-15-SS-022	---	SS-2
ST	15	SS	024	INLET STEAM		---	SS-2
ST	15	SS	025	PL-10-SS-004	ST-15-SS-022	---	SS-2

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CUSTOMER:	UAB			
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DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: STEAM**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
ST	15	SS	026	PL-10-SS-011	ST-15-SS-022	---	SS-2
ST	15	SS	027	PL-10-SS-005	ST-15-SS-026	---	SS-2
ST	15	SS	028	PL-10-SS-006	ST-15-SS-026	---	SS-2
ST	15	SS	029	PL-10-SS-010	ST-15-SS-026	---	SS-2
ST	15	SS	030	ST-15-SS-001	PL-10-SS-009	---	SS-2
ST	15	SS	031	ST-15-SS-001	PL-10-SS-008	---	SS-2
ST	15	SS	032	ST-15-SS-034	ST-15-SS-022	---	SS-2
ST	15	SS	033	PBA-10-SS-002	ST-15-SS-032	---	SS-2
ST	15	SS	034	PL-10-SS-012	ST-15-SS-032	---	SS-2
ST	15	SS	035	PL-10-SS-004	OUT	---	SS-2
ST	15	SS	036	ST-15-SS-035	ST-15-SS-035	---	SS-2
ST	15	SS	037	CO2-10-SS-003	ST-15-SS-039	---	SS-2
ST	15	SS	038	REACTOR	ST-15-SS-039	---	SS-2
ST	15	SS	039	ST-15-SS-037	OUT	---	SS-2
ST	15	SS	040	ST-15-SS-039	OUT	---	SS-2
ST	15	SS	041	PG-10-SS-005	ST-15-SS-042	---	SS-2
ST	15	SS	042	ST-15-SS-041	OUT	---	SS-2
ST	15	SS	043	PG-10-SS-003	ST-15-SS-041	---	SS-2
ST	15	SS	044	ST-15-SS-042	ST-15-SS-042	---	SS-2
ST	15	SS	045	PL-10-SS-014	OUT	---	SS-2
ST	15	SS	046	PL-10-SS-015	ST-15-SS-045	---	SS-2
ST	15	SS	047	ST-15-SS-045	ST-15-SS-045	---	SS-2
ST	15	SS	048	IN-10-SS-010	ST-15-SS-049	---	SS-2
ST	15	SS	049	PAI-10-SS-003	ST-15-SS-037	---	SS-2
ST	15	SS	050	ST-15-SS-051	ST-15-SS-052	---	SS-2

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LINES LIST

LINES

CUSTOMER:	UAB			
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DRAWING:	DD - 8506-Z1	**REV.**: F	**PREPARED:**	F.MANGAS

NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: STEAM**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
ST	15	SS	051	PL-10-SS-016	ST-15-SS-050	---	SS-2
ST	15	SS	052	GLY-15-SS-007	ST-15-SS-050	---	SS-2
ST	15	SS	053	VT-15-SS-002	ST-15-SS-050	---	SS-2
ST	15	SS	054	PL-10-SS-017	ST-15-SS-050	---	SS-2
ST	15	SS	055	ST-15-SS-050	OUT	---	SS-2
ST	15	SS	056	ST-15-SS-055	ST-15-SS-055	---	SS-2
ST	15	SS	057	INLET STEAM	HV 402 01 (SAMPLE VALVE)	---	SS-2
ST	15	SS	058	INLET STEAM	ST-15-SS-059	---	SS-2
ST	15	SS	059	ST-15-SS-058	PBA-10-SS-002	---	SS-2
ST	15	SS	060	ST-15-SS-058	PAC-10-SS-002	---	SS-2
ST	15	SS	061	ST-15-SS-022	OUT	---	SS-2
ST	15	SS	062	ST-15-SS-061	ST-15-SS-061	---	SS-2
ST	15	SS	063	PL-10-SS-017	OUT	---	SS-2
ST	15	SS	064	PL-10-SS-007	ST-15-SS-026	---	SS-2
ST	15	SS	065	ST-15-SS-066	ST-15-SS-066	---	SS-2
ST	15	SS	066	REACTOR	OUT	---	SS-2
ST	15	SS	067	PAC-10-SS-003	ST-15-SS-034	---	SS-2
ST	15	SS	068	ST-15-SS-010	PAI-10-SS-003	---	SS-2

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NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: VENT**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
VT	15	SS	001	VS 401 01	ATM	---	SS-1
VT	15	SS	002	VS 402 01	ATM	---	SS-1
VT	15	PP	003	VS 406 02	ATM	---	SS-1
VT	15	PP	004	VS 406 01	ATM	---	SS-1

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NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: WATER**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
WT	15	SS	001	WATER INLET	WT-15-SS-02	---	SS-2
WT	15	SS	002	WT-15-SS-002	WT-15-SS-02	---	SS-2
WT	15	SS	003	COOLING WATER INLET		---	SS-2

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NOMENCLATURE LINES **FLOW: PROCESS LIQUID**

NOMENCLATURE LINES **FLOW: ANTIFOAM / GAS VACUMM BREACKING**

FLU.	DN	MAT.	NUM.	START LINE	END LINE	OBSERVATIONS	CLASS
AF	10	SS	001	ANTIFOAM INLET	REACTOR	(FUTURE)	SS-1
IR	15	SS	001	GAS VACUMM BREACKING INLET		---	SS-1

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INSTRUMENTS LIST

ANALYZER

CUSTOMER:	UAB				
PROJECT:	MELISSA COMPARTMENT IV	**DATE**	25/07/2008	**CHECKED**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV:**	F	**PREPARED:**	F.MANGAS

TAG Nº	SITUATION	DN	DESCRIPTION	SCALE	SERVICE	MODEL	MAT.	MANUFACTURER
OT 409 01	REACTOR	25	Biomass measurement	---	Analyzer	CT08 Dual Probe A01 0044	---	MONITEK
OT 409 02	REACTOR	25	Biomass measurement	---	Analyzer	InPro 8200, In Trac 799M	AISI316L	METTLER TOLEDO
AI 410 01/02	PG-10-SS-007	25	CO2/O2 gas analyzer	---	Analyzer	Multor 610	---	MAIHAK
AI 410 03	REACTOR	25	Dissolved Oxygen measurement	---	Analyzer	InPro6800+In Trac 777	AISI316L	METTLER TOLEDO
AI 406 01	REACTOR	25	Ph measurement	0/14	Analyzer	InPro 3253, In Trac777. Transmitter M300	AISI316L	METTLER TOLEDO
AI 406 02	REACTOR	25	Ph measurement	0/14	Analyzer	InPro 3253, In Trac777. Transmitter M300	AISI316L	METTLER TOLEDO

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FLOW

CUSTOMER:	UAB				
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DRAWING:	DD - 8506-Z1	**REV:**	F	**PREPARED:**	F.MANGAS

TAG Nº	SITUATION	DN	DESCRIPTION	RANGE	SERVICE	MODEL	MAT.	MANUFACTURER
FI 403 01	CO2-10-SS-002	---	Total gas inlet flowmeter	0-21l/min	---	art. 502654	Glass	BIOENGINEERING
FT 404 01	PG-10-SS-006	1/2	Total gas outlet flowmeter	0-120Nl/h	---	---	INOX	BRONKHORST
FT 401 01	PL-10-SS-007	1	Total liquid inlet to reactor	0-20l/h	---	Promass 8A01	AISI316L	E&H

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LEVEL

CUSTOMER:	UAB						
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DRAWING:	DD-8506-Z1			**REV:**	F	**PREPARADO:**	F.M.P.
TAG Nº	**SITUATION**	**DN**	**SERVICE**	**DESCRIPTION**	**MODEL**	**MAT.**	**MANUFACTURER**
LT 407 01	REACTOR	25	Foam measurement	Vibration Limit Switch	---	AISI316L	Bürkert
LT 401 01	VS 401 01	25	Level measurement	guided microwave	Vegaflex 61	AISI316L	VEGA

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WEIGHT

CUSTOMER:	UAB				
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DRAWING:	DD-8506-Z1	**REV:**	F	**PREPARADO:**	F.M.P.

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
WI 402 01	VS 402 01	---	Level VS 402	Weight Balance	IND560+PBA330-CC600	INOX	METTLER TOLEDO
WI 406 01	VS 406 01_acid	---	Level VS 406 01	Weight Balance	BBA 422-3SM	---	METTLER TOLEDO
WI 406 02	VS 406 02_Base	---	Level VS 406 02	Weight Balance	BBA 422-3SM	---	METTLER TOLEDO
WT 402 01	REACTOR	---	Level Reactor	Weight Cells	Ultramount 0972+IND110	---	METTLER TOLEDO

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PRESSURE

CUSTOMER:	UAB				
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DRAWING:	DD - 8506-Z1	**REV:**	F	**PREPARED:**	F.MANGAS

TAG Nº	SITUATION	DN	DESCRIPTION	RANGE	DIAM.	MODEL	MAT.	MANUFACTURER
PI 403 01	CO2-10-SS-002	1/4"	Inlet air pres. measurement	0/2,5barg	25	MSG18	316L	NUOVAFIMA
PI 403 02	CO2-10-SS-002	10	Inlet air pres. measurement	0/1barg	25	MSG18	316L	NUOVAFIMA
PI 405 01	WT-15-SS-002	1/2"	Temp. circuit pres. measurement	0/6barg	50	MSG18	316L	NUOVAFIMA
PI 407 01	REACTOR	50	Vessel pres. measurement	0/0,5barg	---	Cerabar S PMP75	316L	E&H
PI 407 02	REACTOR	50	Vessel pres. measurement	0/3barg	---	Cerabar S PMP75	316L	E&H
PT 401 01	PL-10-SS-007	10	Differential Pressure of filter	0/4barg	---	FMD78	316L	E&H
PT 401 02	PL-10-SS-005	10	Pressure switch transmitter	3 barg	---	Ceraphant T PTP35	316L	E&H
PT 401 03	PL-10-SS-006	10	Pressure switch transmitter	3 barg	---	Ceraphant T PTP35	316L	E&H
PT 401 04	PL-10-SS-005/006/007	10	Differential Pressure of filter	0/4barg	---	FMD78	316L	E&H
PI 401 01	VS 401 01	10	Pressure gauge vessel VS 401 01	0/3barg	50	MSG18	316L	NUOVAFIMA
PI 401 02	VS 401 01	25	Pressure gauge	0/3 barg	50	MSG18	316L	NUOVAFIMA
PT 402 01	PL-10-SS-014	10	Pressure switch transmitter	3 barg	---	Ceraphant T PTP35	316L	E&H
PT 402 02	PL-10-SS-015	10	Pressure switch transmitter	3 barg	---	Ceraphant T PTP35	316L	E&H
PI 402 01	VS 402 01	10	Pressure gauge vessel VS 402 01	0/3barg	50	MSG18	316L	NUOVAFIMA
PI 402 02	VS 402 01	10	Pressure gauge vessel VS 402 01	0/3barg	50	MSG18	316L	NUOVAFIMA
PI 436 01	AI-15-SS-002	10	Pressure gauge	0/6barg	50	MSG18	316L	NUOVAFIMA
PI 435 01	AI-10-SS-001	10	Pressure gauge	0/6barg	50	MSG18	316L	NUOVAFIMA
PI 405 02	VS 405 01	1/2	Pressure gauge	0/6barg	50	MSG18	316L	NUOVAFIMA
PT 407 03	PG-10-SS-001	10	Differential Pressure of filter	0/4barg	---	FMD78	316L	E&H
PT 404 01	PG-10-SS-008	50	pressure measurement	0/3barg	---	Cerabar S PMP75	316L	E&H

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INSTRUMENTS LIST

TEMPERATURE

CUSTOMER:	UAB				
PROJECT:	MELISSA COMPARTMENT IV	**DATE**	25/07/2008	**CHECKED**	J.MESTRE
DRAWING:	DD - 8506-Z1	**REV:**	F	**PREPARED:**	F.MANGAS

TAG Nº	SITUATION	DN	DESCRIPTION	RANGE	LONG.	MODEL	MAT.	MANUFACTURER
TI 405 02	REACTOR	25	Vessel temperature measurement	---	---	PT-100 + transmitter 4/20mA	INOX	BIOENGINEERING
TT 401 01	VS 401 01	25	Vessel temperature measurement	-10/60ºC	300	PT-100 + transmitter 4/20mA	INOX	E&H
TT 402 01	VS 402 01	25	Vessel temperature measurement	-10/60ºC	300	PT-100 + transmitter 4/20mA	INOX	E&H
TT 404 01	PG-10-SS-008	25	Temperature measurement	-10/60ºC	5	PT-100 + transmitter 4/20mA	INOX	E&H

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CONTROL VALVE

CUSTOMER:	UAB				
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DRAWING:	DD - 8506-Z1	**REV:**	F	**PREPARED:**	F.MANGAS

TAG Nº	SITUATION	DN	DESCRIPTION	REFERENCIA	MAT.	MANUFACTURER	T P	AC	F/E	N	E
FQRC 403 01	PAI-10-SS-001	10	Measurement of mass flow air inlet	F202D-FA-44-V	---	BRONKHORST	--	--	--	--	--
FQRC 403 02	CO2-10-SS-001	10	Measurement of mass flow CO2 inlet	F202D-FA-33-Z	---	BRONKHORST	--	--	--	--	--
FQRC 403 03	CO2-10-SS-001	10	Measurement of mass flow CO2 inlet	F202D-FA-44-V	---	BRONKHORST	--	--	--	--	--
FQRC 403 05	PG-10-SS-009	10	Measurement of mass flow CO2 inlet	F202D-FA-44-V	---	BRONKHORST	--	--	--	--	--
FQRC 404 02	PG-10-SS-001	10	Pressure Control to Reactor Air outlet valve	2031	PTFE	BÜRKERT	1	A	X	1	X
SV 405 01	GLY-15-SS-003	15	Cooling water outlet valve/BALL	F14D+PA00S	AISI316L	ISO	1	A	X	1	X
SV 432 01	GLY-15-SS-002	15	Cooling water outlet valve/BALL	F14D+PA00S	AISI316L	ISO	1	A	X	1	X
SV 441 01	ST-15-SS-006	15	Ball steam inlet valve	F14D+PA00S	AISI316L	ISO	1	A	X	1	X
SV 434 01	GLY-15-SS-008	15	Cooling water outlet valve/BALL	F14D+PA00S	AISI316L	ISO	1	A	X	1	X
SV 441 02	ST-15-SS-020	15	Ball steam inlet valve	F14D+PA00S	AISI316L	ISO	1	A	X	1	X
SV 406 01	PAC-10-SS-002	10	Acid inlet reactor	2031	PTFE	BÜRKERT	1	A	X	1	X
SV 406 02	PBA-10-SS-002	10	Basic inlet reactor	2031	PTFE	BÜRKERT	1	A	X	1	X
SV 404 01	PG-10-SS-007	10	Gas inlet Analyzer	2031	PTFE	BÜRKERT	1	A	X	1	X
SV 404 02	CO2-10-PA-004	10	Gas inlet Analyzer	2031	PTFE	BÜRKERT	1	A	X	1	X
SV 404 03	CO2-10-PA-004	10	Gas inlet Analyzer	2031	PTFE	BÜRKERT	1	A	X	1	X
SV 403 04	PAI-10-SS-003	10	Control pressure of reactor	2835	INOX	BÜRKERT	2	C	X	1	X

TP=TIPO ON/OFF(1)
TP=TIPO PROPORTIONAL(2)
TP=TIPO ELECTROVALVE(3)

AC=OPERATION PNEUMATIC SIMPLE EFFECT(A)
AC=OPERATION PNEUMATIC DOUBLE EFFECT(B)
AC=OPERATION PNEUMATIC PROPORTIONAL(C)

F/E=FINAL DE CARRERA
N=NºFINAL CARRERA: 1, 2
E=ELECTROVALVE

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MATERIAL LIST

FILTERS

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**PREPARED:**	F.M.P.
DRAWING:	DD - 8506-Z1	**REV: F**	**CHECKED**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
GF 403 01	PAI-10-SS-001	10	Inlet air filter	Filter	360 50 C	---	HEADLINE FILTER
GF 403 02	CO2-10-SS-001	10	Inlet CO2 filter	Filter	360 50 C	---	HEADLINE FILTER
GF 403 03	CO2-10-SS-002	10	Total inlet gas filter	Filter	360 50 C	---	HEADLINE FILTER
GF 403 04	CO2-10-SS-003	10	Inlet sterile gas filter	Filter (NEW)	VSACE-01A-BTB-T-E	316L/PTFE	DOMNICK HUNTER
GF 403 05	PAI-10-SS-003	10	Inlet sterile gas filter	Filter (NEW)	VSACE-01A-BTB-T-E	316L/PTFE	DOMNICK HUNTER
GF 404 01	PG-10-SS-002	10	Outlet sterile gas filter	Filter (NEW)	VSACE-01A-BTB-T-E	316L/PTFE	DOMNICK HUNTER
GF 404 02	PG-10-SS-006	10	Outlet sterile gas filter	Filter (EXIST)	360 50 C	---	HEADLINE FILTER
GF 404 03	PG-10-SS-004	10	Outlet sterile gas filter	Filter (NEW)	VSACE-01A-BTB-T-E	316L/PTFE	DOMNICK HUNTER
GF 442 01	VT-15-SS-001	10	Outlet gas filter	Vent Filter (NEW)	VSACE-01A-BTB-T-E	316L/PTFE	DOMNICK HUNTER
GF 442 02	VT-15-SS-002	10	Outlet gas filter	Vent Filter (NEW)	VSACE-01A-BTB-T-E	316L/PTFE	DOMNICK HUNTER
GF 442 03	VT-15-PP-003	10	Outlet gas filter	Vent Filter (NEW)	VSVTC-01C-BTB	316L/PTFE	DOMNICK HUNTER
GF 442 04	VT-15-PP-004	10	Outlet gas filter	Vent Filter (NEW)	VSVTC-01C-BTB	316L/PTFE	DOMNICK HUNTER
LF 401 01	PL-10-SS-001	10	Liquid inlet filter 01	Liquid Filter (NEW)	ZVDICE-01A-BTB-B-E	316L/PES	DOMNICK HUNTER
LF 401 03	PL-10-SS-009	10	Total liquid inlet filter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER
LF 401 04	PL-10-SS-008	10	Total liquid inlet filter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER
LF 401 05	PL-10-SS-005	10	Liquid inlet prefilter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER

De Dietrich Equipos Químicos, S.L.
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Member of De Dietrich PROCESS SYSTEMS

MATERIAL LIST

FILTERS

CUSTOMER:	UAB						
PROJECT:	MELISSA COMPARTMENT IV			**DATE:** 23/07/08	**PREPARED:**	F.M.P.	
DRAWING:	DD - 8506-Z1			**REV: F**	**CHECKED**	J.MESTRE	
LF 401 06	PL-10-SS-006	10	Liquid inlet prefilter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER
LF 406 01	VS 406 01	10	Acid inlet filter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER
LF 406 02	VS 406 02	10	Base inlet filter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER
LF 406 03	PAC-10-SS-002	10	Acid inlet filter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER
LF 406 04	PBA-10-SS-002	10	Base inlet filter	Liquid Filter (NEW)	ZVDICE-01B-BTB-B-E	316L/PES	DOMNICK HUNTER

De Dietrich Equipos Químicos, S.L.
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Member of De Dietrich PROCESS SYSTEMS

MATERIAL LIST

ACCESSORIES

CUSTOMER:	UAB						
PROJECT:	MELISSA COMPARTMENT IV			**DATE:** 23/07/08	**PREPARED:**	F.M.P.	
DRAWING:	DD - 8506-Z1			**REV: F**	**CHECKED**	J.MESTRE	
TAG Nº	**SITUATION**	**DN**	**SERVICE**	**DESCRIPTION**	**MODEL**	**MAT.**	**MANUFACTURER**
NRV 401 03	PL-10-SS-012	10	No return in total feeding inlet	Check Valve	---	AISI316	BÜRKERT
NRV 403 01	CO2-10-SS-003	10	No return air inlet valve	Check Valve	LR1/4-S-7-B	AISI316	FESTO
NRV 403 02	PAI-10-SS-003	10	No return air inlet valve	Check Valve	VERTIC	AISI316	FLUIVAL
NRV 406 01	PAC-10-PP-001	10	No return acid inlet valve	Check Valve	---	AISI316	BÜRKERT
NRV 406 02	PBA-10-PP-001	10	No return base inlet	Check Valve	---	AISI316	BÜRKERT
PRC 401 01	PL-10-SS-007	10	Liquid inlet pressure regulator system	Pressure reducing regulator self contained	12599106	INOX	JESCO
PRC 402 01	PL-10-SS-016	10	Liquid outlet pressure regulator system	Pressure reducing regulator self contained	12599106	INOX	JESCO
PRC 403 01	CO2-10-SS-002	10	Gas inlet pressure regulator system	Pressure reducing regulator self contained	EZRR 2/7 F20 PM/SM	INOX	WAICON
PRC 403 02	CO2-10-SS-002	10	Gas inlet pressure regulator system	Pressure reducing regulator self contained	EZRR 2/7 F20 PM/SM	INOX	WAICON
PRC 403 03	CO2-10-PA-004	10	Gas inlet pressure regulator system	Pressure reducing regulator self contained	EZRR 2/7 F20 PM/SM	INOX	WAICON
PRC 435 01	AI-10-SS-001	10	Air inlet pressure regulator system	Pressure reducing regulator self contained	EZRR 2/7 F20 PM/SM	INOX	WAICON
PRC 436 01	AI-10-SS-002	10	Air inlet pressure regulator system	Pressure reducing regulator self contained	EZRR 2/7 F20 PM/SM	INOX	WAICON
RV 401 01	VS 401 01	10	Pressure relief valve	Relief Valve	74700	AISI316l	INOXPA
RV 402 01	VS 402 01	10	Pressure relief valve	Relief Valve	74700	AISI316l	INOXPA
RV 403 01	PG-10-SS-009	10	Pressure relief valve	Relief Valve	74700	AISI316l	INOXPA

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MATERIAL LIST

ACCESSORIES

CUSTOMER:	UAB						
PROJECT:	MELISSA COMPARTMENT IV			**DATE:** 23/07/08	**PREPARED:**	F.M.P.	
DRAWING:	DD - 8506-Z1			**REV: F**	**CHECKED**	J.MESTRE	
RV 405 02	GLY-15-SS-004	10	Pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
RV 430 01	REACTOR		Pressure relief valve	Relief Valve	74700	AISI316l	INOXPA
RV 432 01	GLY-15-SS-006	10	Pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
RV 433 01	GLY-15-SS-002	10	Pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
RV 434 01	GLY-15-SS-008	10	Pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
SF 441 01	ST-15-SS-042	10	Steam trap in air outlet drain	Steam Trap	MST21	INOX	SARCO
SF 441 02	ST-15-SS-039	10	Steam trap in air inlet drain	Steam Trap	MST21	INOX	SARCO
SF 441 03	ST-15-SS-035	10	Steam trap in vessel drain	Steam Trap	MST21	INOX	SARCO
SF 441 04	ST-15-SS-055	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 06	ST-15-SS-045	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 07	ST-15-SS-066	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 08	ST-15-SS-017	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 09	ST-15-SS-061	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 04	ST-15-SS-055	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 06	ST-15-SS-045	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 07	ST-15-SS-066	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 08	ST-15-SS-017	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO
SF 441 09	ST-15-SS-061	10	Steam trap drain	Steam Trap	MST21	INOX	SARCO

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MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**PREPARED:**	F.M.P.
DRAWING:	DD - 8506-Z1	**REV: F**	**CHECKED**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
HV 401 01	REACTOR	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 02	PL-10-SS-001	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 03	PL-10-SS-003	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 04	PL-10-SS-005	10	liquid inlet pump (GP401 01) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 05	PL-10-SS-006	10	liquid inlet pump (GP401 02) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 06	PL-10-SS-005	10	liquid outlet pump (GP401 01) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 07	PL-10-SS-006	10	liquid outlet pump (GP401 02) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 08	PL-10-SS-008	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 09	PL-10-SS-009	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 10	PL-10-SS-011	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 11	PL-10-SS-010	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 12	VS 401 01	10	liquid outlet VS 401 01	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 13	PL-10-SS-004	10	Drain	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 14	PL-10-SS-004	10	Drain	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 15	PT-401 01	10	INSTRUMENT	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 16	PT-401 01	10	INSTRUMENT	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 17	VS 401 01	10	Sample valve	Sample Valve	Sample + tri-clamp	PTFE	BÜRKERT
HV 401 18	PL-10-SS-007	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 19	PL-10-SS-007	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 20	PL-10-SS-007	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 21	PL-10-SS-007	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 22	PT-401 04	10	INSTRUMENT	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 23	PT-401 04	10	INSTRUMENT	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT

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MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**PREPARED:**	F.M.P.
DRAWING:	DD - 8506-Z1	**REV: F**	**CHECKED**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
HV 401 24	PT-401 04	10	INSTRUMENT	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 25	PL-10-SS-09	10	inert gas inlet	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 401 26	PL-10-SS-08	10	inert gas inlet	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 01	PL-10-SS-013	10	liquid outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 02	PL-10-SS-014	10	liquid inlet pump3 (GP402 01) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 03	PL-10-SS-015	10	liquid inlet pump4 (GP402 02) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 04	PL-10-SS-014	10	liquid outlet pump3 (GP402 01) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 05	PL-10-SS-015	10	liquid outlet pump4 (GP402 02) valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 06	PL-10-SS-016	10	liquid inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 07	VS 402 01	10	outlet valve VS 402 01	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 08	VS 402 01	10	drain VS 402 01	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 09	PL-10-SS-017	10	liquid outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 10	VS 402 01	10	sample valve	Manual Valve	Sample + tri-clamp	PTFE	BÜRKERT
HV 402 11	PL-10-SS-014	10	inert gas inlet	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 402 12	PL-10-SS-015	10	inert gas inlet	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 403 01	CO2-10-SS-002	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 403 02	PAI-10-SS-001	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 403 03	CO2-10-SS-001	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 403 04	REACTOR	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 403 05	PAI-10-SS-003	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 403 06	PAI-10-SS-003	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 403 07	PG-10-SS-009	10	Gas inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT

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MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB						
PROJECT:	MELISSA COMPARTMENT IV			**DATE:** 23/07/08	**PREPARED:**	F.M.P.	
DRAWING:	DD - 8506-Z1			**REV: F**	**CHECKED**	J.MESTRE	
TAG Nº	**SITUATION**	**DN**	**SERVICE**	**DESCRIPTION**	**MODEL**	**MAT.**	**MANUFACTURER**
HV 404 01	PG-10-SS-004	10	Gas outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 02	PG-10-SS-002	10	Gas outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 03	PT-407 03	10	INSTRUMENT	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 04	PG-10-SS-003	10	Gas outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 05	PG-10-SS-005	10	Gas outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 06	PT-407 03	10	INSTRUMENT	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 07	ST-15-SS-043	15	Gas outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 09	PG-10-SS-007	10	Gas outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 10	PG-10-SS-008	10	Gas outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 404 11	PG-10-SS-009	10	Gas inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 405 01	GLY-15-SS-004	15	Glycol outlet valve	Manual Valve	ball + flanges	316L	ISO
HV 405 02	GLY-15-SS-003	15	Glycol inlet valve	Manual Valve	ball + flanges	316L	ISO
HV 405 03	WT-15-SS-001	15	Water inlet valve	Manual Valve	ball + flanges	316L	ISO
HV 405 04	PI-405 01	15	INSTRUMENT	Manual Valve	ball + flanges	316L	ISO
HV 405 05	WT-15-SS-02	15	Drain water	Manual Valve	ball + flanges	316L	ISO
HV 406 01	VS 406 02	10	liquid inlet valve vessel basic	Manual Valve	ball + flanges	PP	NEW
HV 406 02	VS 406 02	10	liquid outlet valve vessel basic	Manual Valve	ball + flanges	PP	NEW
HV 406 03	PAC-10-PP-001	10	liquid inlet acid valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 406 07	PAC-10-SS-003	10	liquid inlet acid valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 406 08	VS 406 01	10	liquid inlet valve vessel acid	Manual Valve	ball + flanges	316L	ISO
HV 406 09	VS 406 01	10	liquid outlet valve vessel acid	Manual Valve	ball + flanges	316L	ISO
HV 406 10	PBA-10-PP-001	10	drain	Manual Valve	ball + flanges	PP	NEW

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MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB						
PROJECT:	MELISSA COMPARTMENT IV			**DATE:** 23/07/08	**PREPARED:**	F.M.P.	
DRAWING:	DD - 8506-Z1			**REV: F**	**CHECKED**	J.MESTRE	
TAG Nº	**SITUATION**	**DN**	**SERVICE**	**DESCRIPTION**	**MODEL**	**MAT.**	**MANUFACTURER**
HV 406 11	PAC-10-PP-001	10	drain	Manual Valve	ball + flanges	PP	NEW
HV 406 12	PAC-10-PP-001	10	liquid inlet basic valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 406 13	PBA-10-SS-002	10	liquid inlet basic valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 407 01	REACTOR	10	Sample valve	Manual Valve	Sample + tri-clamp	PTFE	BÜRKERT
HV 411 02	AF-10-SS-001	10	Antifoam inlet valve to reactor	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 431 01	IN-10-SS-001	10	Inoculum inlet valve	Manual Valve	----	316L	NEW
HV 431 02	IN-10-SS-001	10	Inoculum inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 432 08	GLY-15-SS-006	10	Glycol valve to outlet gas condenser	Manual Valve	ball + flanges	316L	ISO
HV 432 09	GLY-15-SS-005	10	Glycol valve to inlet gas condenser	Manual Valve	ball + flanges	316L	ISO
HV 433 01	GLY-15-SS-002	15	Glycol valve to outlet VS 401 01	Manual Valve	ball + flanges	316L	ISO
HV 433 02	GLY-15-SS-001	15	Glycol water valve to inlet VS 401 01	Manual Valve	ball + flanges	316L	ISO
HV 434 01	GLY-15-SS-008	15	Glycol valve to outlet VS 402 01	Manual Valve	ball + flanges	316L	ISO
HV 434 02	GLY-15-SS-007	15	Glycol valve to inlet VS 402 01	Manual Valve	ball + flanges	316L	ISO
HV 435 01	AI-10-SS-001	10	Air inlet valve	Manual Valve	ball + flanges	316L	ISO
HV 435 02	AI-10-SS-001	10	Air inlet valve	Manual Valve	ball + flanges	316L	ISO
HV 436 01	AI-10-SS-002	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 436 02	AI-10-SS-002	10	Air inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 01	ST-15-SS-010	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 02	ST-15-SS-001	15	Steam valve to samplig port	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 03	ST-15-SS-037	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 04	ST-15-SS-041	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 05	ST-15-SS-012	15	Steam valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT

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Member of De Dietrich PROCESS SYSTEMS

MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**PREPARED:**	F.M.P.
DRAWING:	DD - 8506-Z1	**REV: F**	**CHECKED**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
HV 441 06	ST-15-SS-038	15	Drain valve in vessel	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 07	ST-15-SS-038	15	Drain valve in jacket	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 08	ST-15-SS-039	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 09	ST-15-SS-040	15	Drain valve - bypass	Manual Valve	ball + flanges	316L	ISO
HV 441 10	ST-15-SS-001	15	Steam inlet valve	Manual Valve	ball + flanges	316L	ISO
HV 441 11	ST-15-SS-002	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 12	ST-15-SS-003	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 13	ST-15-SS-004	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 14	ST-15-SS-005	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 15	ST-15-SS-021	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 16	ST-15-SS-021	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 17	ST-15-SS-006	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 18	ST-15-SS-009	15	Steam sample valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 19	ST-15-SS-005	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 20	ST-15-SS-031	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 21	ST-15-SS-057	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 22	ST-15-SS-023	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 23	ST-15-SS-061	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 24	ST-15-SS-062	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 25	ST-15-SS-027	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 26	ST-15-SS-028	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 27	ST-15-SS-025	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT

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Av. Príncep d'Asturies 43-45, 1r-5a
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MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IV	**DATE:** 23/07/08	**PREPARED:**	F.M.P.
DRAWING:	DD - 8506-Z1	**REV: F**	**CHECKED**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
HV 441 28	ST-15-SS-026	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 29	ST-15-SS-012	15	Steam inlet valve	Manual Valve	ball + flanges	316L	ISO
HV 441 30	ST-15-SS-034	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 31	ST-15-SS-001	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 32	ST-15-SS-029	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 33	ST-15-SS-013	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 34	ST-15-SS-014	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 36	ST-15-SS-042	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 37	ST-15-SS-044	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 38	ST-15-SS-030	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 39	ST-15-SS-059	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 40	ST-15-SS-060	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 41	ST-15-SS-033	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 42	PAC-10-SS-003	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 43	ST-15-SS-015	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 44	ST-15-SS-015	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 45	ST-15-SS-016	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 46	ST-15-SS-045	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 47	ST-15-SS-046	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 48	ST-15-SS-045	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 49	ST-15-SS-047	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 50	ST-15-SS-018	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT

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MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB					
PROJECT:	MELISSA COMPARTMENT IV		**DATE:** 23/07/08	**PREPARED:**	F.M.P.	
DRAWING:	DD - 8506-Z1		**REV: F**	**CHECKED**	J.MESTRE	
TAG Nº	**SITUATION**	**DN**	**SERVICE**	**DESCRIPTION**	**MODEL**	**MAT.**	**MANUFACTURER**
HV 441 51	ST-15-SS-020	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 52	ST-15-SS-020	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 53	ST-15-SS-019	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 54	ST-15-SS-051	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 55	ST-15-SS-053	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 56	ST-15-SS-054	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 57	ST-15-SS-052	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 58	ST-15-SS-055	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 59	ST-15-SS-056	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 60	ST-15-SS-008	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 61	ST-15-SS-007	15	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 63	ST-15-SS-015	15	Steam inlet valve	Manual Valve	ball + flanges	316L	ISO
HV 441 64	ST-15-SS-064	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 65	ST-15-SS-010	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 66	ST-15-SS-038	15	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 67	ST-15-SS-66	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 68	ST-15-SS-65	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 69	IN-10-SS-001	10	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 70	IN-10-SS-001	10	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 71	PAI-10-SS-003	10	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 72	PL-10-SS-007	10	Steam inlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 73	PL-10-SS-007	10	Drain valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT

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MATERIAL LIST

MANUAL VALVE

CUSTOMER:	UAB					
PROJECT:	MELISSA COMPARTMENT IV		**DATE:** 23/07/08	**PREPARED:**	F.M.P.	
DRAWING:	DD - 8506-Z1		**REV: F**	**CHECKED**	J.MESTRE	

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
HV 441 74	ST-15-SS-035	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 75	ST-15-SS-036	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 76	PL-10-SS-005	10	inert gas inlet	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 77	PL-10-SS-006	10	inert gas inlet	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 441 78	ST-15-SS-017	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 441 79	ST-15-SS-079	15	Drain valve	Manual Valve	ball + flanges	316L	ISO
HV 442 01	VT-15-SS-001	15	Vent outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 442 02	VT-15-SS-001	15	Vent outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 442 03	VT-15-SS-002	15	Vent outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 442 04	VT-15-SS-002	15	Vent outlet valve	Manual Valve	3233 + tri-clamp	PTFE	BÜRKERT
HV 442 05	VT-15-PP-003	15	Vent outlet valve	Manual Valve	ball + flanges	PP	NEW
HV 442 06	VT-15-PP-004	15	Vent outlet valve	Manual Valve	ball + flanges	PP	NEW

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DIGITAL

DIGITAL SIGNALS

CUSTOMER:	UAB				
PROJECT:	MELISSA COMPARTMENT IVa	**DATE:**	25/07/2008	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	B	**PREPARED:**	F.MANGAS

TAG Nº	DESCRIPTION	REFERENCIA	MANUFACTURER	SIGNAL	NUMBER
FQRC 403 01	Measurement of mass flow air inlet	F202D-FA-44-V	BRONKHORST	COMMUNICATION DIGITAL	1
FQRC 403 02	Measurement of mass flow CO2 inlet	F202D-FA-33-Z	BRONKHORST	COMMUNICATION DIGITAL	1
FQRC 403 03	Measurement of mass flow CO2 inlet	F202D-FA-44-V	BRONKHORST	COMMUNICATION DIGITAL	1
FQRC 404 01	Measurement of mass flow gas outlet	F202D-FA-44-V	BRONKHORST	COMMUNICATION DIGITAL	1
LT 401 01	Level control	Vegaflex61	VEGA	DIGITAL	
LT 407 01	Foam measurement	8111	Bürkert	DIGITAL	1
PT 401 02	Pressure switch transmitter	Ceraphant T PTP35	E&H	DIGITAL	1
PT 401 03	Pressure switch transmitter	Ceraphant T PTP35	E&H	DIGITAL	1
PT 402 01	Pressure switch transmitter	Ceraphant T PTP35	E&H	DIGITAL	1
PT 402 02	Pressure switch transmitter	Ceraphant T PTP35	E&H	DIGITAL	1
FQRC 403 04	Control pressure of reactor	F14D+PA00S	ISO	DIGITAL	1
FQRC 404 01	Measurement of mass flow gas outlet	F202D-FA-44-V	BRONKHORST	DIGITAL	1
FQRC 404 02	Pressure Control to Reactor Air outlet valve	2835	BÜRKERT	DIGITAL	1

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DIGITAL

DIGITAL SIGNALS

CUSTOMER:	UAB				
PROJECT:	MELISSA COMPARTMENT IVa	**DATE:**	25/07/2008	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	B	**PREPARED:**	F.MANGAS

TAG Nº	DESCRIPTION	REFERENCIA	MANUFACTURER	SIGNAL	NUMBER
SV 405 01	Cooling water outlet valve/BALL	F14D+PA00S	ISO	DIGITAL	1
SV 432 01	Cooling water outlet valve/BALL	F14D+PA00S	ISO	DIGITAL	1
SV 441 01	Ball steam inlet valve	F14D+PA00S	ISO	DIGITAL	1
SV 434 01	Cooling water outlet valve/BALL	F14D+PA00S	ISO	DIGITAL	1
SV 441 02	Ball steam inlet valve	F14D+PA00S	ISO	DIGITAL	1
SV 406 01	Acid inlet reactor	2031	BÜRKERT	DIGITAL	1
SV 406 02	Basic inlet reactor	2031	BÜRKERT	DIGITAL	1
SV 441 03	Gas inlet Analyzer	2031	BÜRKERT	DIGITAL	1
SV 404 01	Gas inlet Analyzer	2031	BÜRKERT	DIGITAL	1
SV 404 02	Gas inlet Analyzer	2031	BÜRKERT	DIGITAL	1

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Av. Príncep d'Asturies 43-45, 1r-5a
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DIGITAL

DIGITAL SIGNALS

CUSTOMER:	UAB				
PROJECT:	MELISSA COMPARTMENT IVa	**DATE:**	25/07/2008	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	B	**PREPARED:**	F.MANGAS

TAG Nº	DESCRIPTION	REFERENCIA	MANUFACTURER	SIGNAL	NUMBER

De Dietrich Equipos Químicos, S.L.
Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

Member of De Dietrich PROCESS SYSTEMS

ANALOGICAL

ANALOGICAL SIGNALS

CUSTOMER:	UAB				
PROJECT:	MELISSA COMPARTMENT IV	**DATE:**	25/07/2008	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	B	**PREPARED:**	F.MANGAS

TAG Nº	DESCRIPTION	REFERENCIA	MANUFACTURER	SIGNAL
OT 409 01	Biomass measurement	CT08 Dual Probe A01 0044	MONITEK	ANALOG.
OT 409 02	Biomass measurement	InPro 8200, In Trac 799M	METTLER TOLEDO	ANALOG.
AI 410 01/02	CO2/O2 gas analyzer	Multor 610	MAIHAK	ANALOG.
AI 410 03	Dissolved Oxygen measurement	InPro6800+In Trac 777	METTLER TOLEDO	ANALOG.
AI 406 01	Ph measurement	InPro 3253, In Trac777. Transmitter M300	CRISON Inst. Sa METTLER TOLEDO	ANALOG.
AI 406 02	Ph measurement	InPro 3253, In Trac777. Transmitter M300	METTLER TOLEDO	ANALOG.
FT 401 01	Total liquid inlet to reactor	Promass 8A01	E&H	ANALOG.
FQRC 404 02	Pressure Control to Reactor Air outlet valve	2835	BÜRKERT	ANALOG.
WI 402 01	Weight Balance	PFA574-DS600	METTLER TOLEDO	ANALOG.
WT 402 01	Weight Cells	Ultramount 0972+IND110	METTLER TOLEDO	ANALOG.
PI 407 01	Vessel pres. measurement	Cerabar S PMP75	E&H	ANALOG.
PI 407 02	Vessel pres. measurement	Cerabar S PMP75	E&H	ANALOG.
PT 404 01	Outlet gas pres. measurement	Cerabar S PMP75	E&H	ANALOG.

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Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

Member of De Dietrich PROCESS SYSTEMS

ANALOGICAL SIGNALS

CUSTOMER:	UAB				
PROJECT:	MELISSA COMPARTMENT IV	**DATE:**	25/07/2008	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	B	**PREPARED:**	F.MANGAS

TAG Nº	DESCRIPTION	REFERENCIA	MANUFACTURER	SIGNAL
PT 401 01	Differential Pressure of filter	FMD78	E&H	ANALOG.
PT 401 04	Differential Pressure of filter	FMD78	E&H	ANALOG.
PT 407 03	Differential Pressure of filter	FMD78	E&H	ANALOG.
TI 405 02	Vessel temperature measurement	PT-100 + transmitter 4/20mA	BIOENGINEERING	ANALOG.
TT 401 01	Vessel temperature measurement	PT-100 + transmitter 4/20mA	E&H	ANALOG.
TT 404 01	Vessel temperature measurement	PT-100 + transmitter 4/20mA	E&H	ANALOG.
TT 402 01	Vessel temperature measurement	PT-100 + transmitter 4/20mA	E&H	ANALOG.

7. ANNEX II: SPECIFICATIONS

7.1. Equipment specifications

7.2. Instrument specifications

EQUIPMENT ESPECIFICATIONS

De Dietrich Equipos Químicos, S.L.
Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

DOSING PUMP

CUSTOMER:	UAB			**DATE:**	25/07/2008
PROJECT:	MELISSA COMPARTMENT IVa	**ITEM:**	GP40101/02	**PREPARED:**	F.M.P.
DRAWING:	Attached files	**REV:**	C	**CHECKED:**	J.MESTRE

TYPE	**sanity**	NORM	**----**	GENERAL DIMENSIONS (mm)		
MODEL	**ECODOS**	SERVICE	**----**	425(L)	220 (A)	570 (H)
MANUFACT.	**LEWA**	SITUATION	**----**			

CONDITIONS OF WORK

CONCEPT	DESCRIPTION	UNITS	OPERATION	DESIGN
MEDIUM DATE				
PRODUCT	Water solution			
		UNITS	OPERATION	DESIGN
TEMPERATURE		°C	5	
DENSITY		kg/m³	1	
VISCOSITY		cst	1	
CONTENT OF SOLID		%peso	---	
SOLID SIZE		Ø mm	---	
OPERATING DATA				
TOTAL FLOW		l/h	0-4	
TOTAL HEAD		mcl	0,5	
STATIC HEAD		mcl	--	
INLET PRESSURE HEAD		mcl	--	
AVAILABLE NPSH		mcl	--	

MATERIALS / NOZZLES / CHARACTERISTICS

PART	MATERIAL	POSITION	SIZE	NORM	DESCRIPTION	
BODY	PTFE	SUCTION	25		SHAFT POWER	CV
IMPELLER	---	DISCHARGE	25		EFFICIENCY	%
SHAFT	---	SERVICE			NPSH VALUE	mcl
GASKET	PTFE				ELECTRICAL MOTOR	
		WEIGHT			TEST	
MEMBRANE	PTFE	PUMP	--	kg	FUNCTIONING	
VALVES	---	PLATE	--	kg	HYDROSTATICS	bar
BALL	PTFE	TOTAL	--	kg		

TIGHTNESS

TYPE	MECHANICAL SEAL	SINGLE	☐	DOUBLE	☐
MOUNTING				REF:	
MATERIALS					
QUENCH LIQUID				OTHER	

MOTOR

TYPE	
MANUFACTURER	----
SUPPLER	LEWA
SIZE	---
TYPE PROTECTION	IP55
ELECTRIC VOLTAGE	230V
PHASES	2
FREQUENCY	50Hz
RATED POWER	0,25 kW
SPEED	rpm
AIR PRESSURE	bar

EQUIPMENT ESPECIFICATIONS

De Dietrich Equipos Químicos, S.L.
Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

AGITATOR

CUSTOMER:	UAB			**DATE:**	25/07/2008
PROJECT:	MELISSA COMPARTMENT IV	**TAG:**	VS-401 01	**PREPARED:**	F.M.P.
DRAWING:	Attached sketch	**REV:**	C	**CHECKED**	J.MESTRE

TYPE	**---**	NORM	**---**	Nº UNITS	**1**
MODEL	**---**	SERVICE	**Vessel Agitator**	CONEC.	**---**
CONSTRU.	---	SITUATION	**VS-401 01**	DISPOSITION	**---**

VESSEL

MATERIAL:	ASTM-316L	DIAMETER	500mm	HEIGHT:	Virola:740mm
TEMPERATURE DESIGN:	150ºC	PRESSURE DESIGN:	6	VOLUME:	150l

OPERATION CONDITION

PRODUCT:	Water solution			
QUANTITY:				
WEIGHT ESPECIFIC:	kg/m³	kg/m³	kg/m³	
VISCOSITY	1 cp	cp	cp	
SOLIDS:	yes			

OBSERVATIONS

Sterilizable with Steam

PURPOSE AGITATION: Homogenization

TYPE OF AGITATION NEEDED: Soft

TYPE OPERATION

CONTINUOUS ☒ DISCONTINUOUS: ☐

VOLUME 150l

TOTAL: 150l

MINIMUM AGITATOR: 5l

AGITATION

FLANGES	---	
ASSEMBLY AGITATOR	---	
BAFFLES	NO	
TYPE	SMO 85/140	
DIMENSIONS	140mm	
MATERIAL	AISI316L	
DIAMETER SHAFT	--- mm	
LENGTH AXIS	--- mm	
SPEED MIN.	--- rpm	
SPEED NORMAL	98 rpm	
SPEED MAX.	--- rpm	
REDUCER	---	
VARIATOR SPEED	---	Electronic
WEIGHT INCLUDING MOTOR	---	

OBSERVATIONS

Sterilizable with Steam

SKETCH

OPERATION

TYPE		Electrical / Magnetic Seal
MANUFACTURER		---
SIZE/FORM		---
CLASIFICATION		---
PROTECTION		IP 55
VOLTAGE/PHASES/CYCLES		220/380/III/50
POWER	W	180
SPEED	rpm	98
PRESSURE AIR	bar	

OBSERVATIONS

WATERTIGHT

SYSTEM

MAGNETIC SEAL	☒
O-RING	☐
PACKING	☐

PRESSURIZATION:

MODEL

MATERIALS PTFE /Ceramics

OBSERVATIONS

EQUIPMENT ESPECIFICATIONS

De Dietrich Equipos Químicos, S.L.
Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

TANKS

CUSTOMER:	UAB			**DATE:**	25/07/2008
PROJECT:	DD-8506-Z1	**TAG:**	VS-401 01	**CHECKED:**	J.MESTRE
DRAWING:	Attached sketch	**REV:**	C	**PREPARED:**	F.M.P.

PROCESS DATE:	
EMPLACEMENT	MELISSA CIVa
SERVICE:	---
INSTRUMENTATION:	Temperature sensor
DEVICES SAFETY:	Safety Valves
OBSERVATIONS:	Sterilizable with Steam

CONDITIONS OF WORK			NORMAL OPERATION	DESIGN
USEFUL CAPACITY		m³	0,15	
FULL CAPACILY		m³	0,17	
DIAMETER		m	0,5	
PRESSURE		bar.	Atm / 4	6
TEMPERATURE		ºC	5	170
DENSITY		kg/m³	1000	1200
HEATING SURFACE		m²		
FLOWN HEATING / REFRIGERATION (JACKET)			Glycol / Steam	
	FLOWN	kg/h.		
	PRESSURE	bar.	4	6
	TEMPERATURE	ºC	Entry Exit	Entry Exit

DETAILS OF CONSTRUCTION

Type and norm	Vertical cylinder with Normalized Covers
Dimension:	Ø500×740mm(Cylindrical lenght)

Thick:	Top Head: 5 mm	Bottom Head: 5 mm	Corrosion mm	Cylindri 4mm

YES	NO	CONCEPT	TYPE	QUANTITY	OBSERVATIONS
X		SUPPORT	Legs	4	
	X	DESIGN FOR OUTSIDE			Speed Wind (km/h):
X		TYPE HEATING	Jacket		
X		DESIGN CODE			
		X RAYS	according to design code		
X		INSULATION	Mineral wool		Thick (mm): 50mm
X		INSULATION SUPPORT			
X		SURFACE FINISH INSIDE	Ra<0,5 micras		
X		SURFACE FINISH OUTSIDE	Ra<0,1micras		
	X	PAINTING			
X		LIFTING LUG			
X		BAFFLE			
X		AGITATOR (see attached file of especifications agitator)			

NOZZLES

POS.	QUANT.	DESCRIPTION	SIZE	DESIGN CODE
A	1	Agitator	Manufacturer	DIN 2576 PN10
B	1	Entry liquid	1"	Clamp Imperial
C	1	Nozzle outlet	1/2"	Clamp Imperial
D	1	Vent	1"	Clamp Imperial
E	1	Entry Steam + Safety relief valve	1/2"	Clamp Imperial
F	1	Pressure sensor	3/4"	Clamp Imperial
G	1	Temperature sensor	3/4"	Clamp Imperial
H	1	Entry Service	1/2"	Clamp Imperial
I	1	Exit Service	1/2"	Clamp Imperial
J	1	Nozzle sample	1/2"	Clamp Imperial

CONSTRUCTION MATERIAL

VESSEL	ASTM-316L
SUPPORT	ASTM-304
GASKET	PTFE
BOLT & NUTS	INOX . A4
NOZZLES	ASTM-316L
FLANGES NOZZLES	ASTM-316L

ESPECIFICACIONES EQUIPOS

De Dietrich Equipos Químicos, S.L.
Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

INTERCAMBIADOR DE PLACAS

CUSTOMER:					
PROJECT:	DD-8506	**ITEM:**	MX-405 02	**FECHA:**	18/02/2008
DRAWING:		**REV:**	0	**PREPARADO:**	

TIPO		NORMA		Nº UNIDADES	1
MODELO		SERVICIO		CONEC. EN	
CONSTRUC.		SITUACIÓN		DISPOSICIÓN	

REQUERIMIENTOS

CONCEPTO	UNIDADES	PRIMARIO		SECUNDARIO	
		ENTRADA	SALIDA	ENTRADA	SALIDA
FLUIDO		AGUA		GLICOL	
CONCENTRACIÓN DEL LÍQUIDO	%				
CAUDAL	l/h	1750		2350	
TEMPERATURA DE FLUIDO	°C	24	20	0	5
PÉRDIDA DE CARGA	M.C.A.		1		1
PESO ESPECÍFICO FLUIDO	kg/m³				
VISCOSIDAD DEL FLUIDO	cp				
VISCOSIDAD DE LA PARED	cp				
CALOR ESPECÍFICO FLUIDO	kcal/ kg °C	1		0,54	
CONDUCTIVIDAD TÉRMICA	kcal/ h m °C				
TEMPERATURA DE OPERACIÓN MÁXIMA	°C				
PRESIÓN DE OPERACIÓN MÁXIMA	bar	3		3	
FACTOR DE ENSUCIAMIENTO	m² h °C/kcal				
POTENCIA DE INTERCAMBIO					

INTERCAMBIADOR DE PLACAS

PRESIÓN DE DISEÑO	bar	4	4
PRESIÓN DE PRUEBA	bar		
TEMPERATURA DE DISEÑO	°C	50	-10
SUPERFICIE INTERCAMBIO (Calculada)	m²		
SUPERFICIE INTERCAMBIO (Real)	m²		
POTENCIA INTERCAMBIO	kcal/h	7000	
CAPACIDAD	l		
COEFICIENTE DE TRANSMISIÓN	kcal/m².°C.h	LIMPIO	EN SERVICIO
SOBREDIMENSIONAMIENTO	%		
PÉRDIDA DE CARGA CALCULADA	mca		
NÚMERO DE CANALES			
NÚMERO TOTAL DE PLACAS			

DATOS DE CONSTRUCCIÓN

Descripción	Cantidad	Longitud	Ancho	Espesor	Material	Observación
PLACAS					ASTM-316	
BASTIDOR						

TUBULADURAS

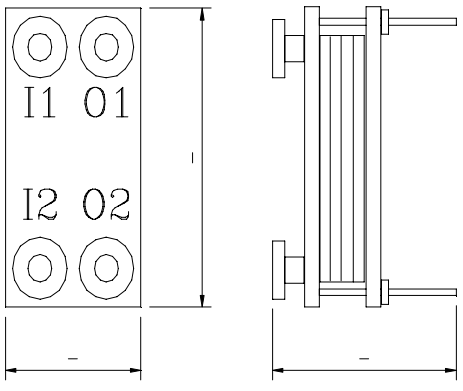
POSICION	I1	I2	O1	O2
DESCRIPCION	ENTRADA PRIMARIO	SALIDA PRIMARIO	ENTRADA SECUNDARIO	SALIDA SECUNDARIO
TAMAÑO				
NORMA				

SOBREESPESOR DE CORROSIÓN: ENVOLVENTE: mm TUBOS: mm

PARTE	TIPO	MATERIAL
JUNTAS		**S/PROCESO**
TORNILLERIA		**INOX A4**
BRIDAS		
SOPORTACIÓN		
PERNOS		

CONEXIÓN	
MATERIAL	
DIÁMETRO	
STANDARD CONEXIÓN	

PESO		
LLENO	kg	
VACIO	kg	
Posible diseño placas soldadas según proceso		



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Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

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ESPECIFICATIONS INSTRUMENTS

ANALYZER

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISSA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PAG.:**	1/2

TAG Nº	**OT 409 01 (biomass)**	**OT 409 02(biomass)**	**AI 410 03(dO2)**	**AI 406 02 (pH)**
TYPE	---	Optival, backscattered	Anode / Cathode	Electrodo pH
MODEL	CT08	InPro8200	InPro 6800/12/420	InPro3250
SITUATION	Reactor	Reactor	Reactor	Reactor
OUTPUT SIGN	4/20mA	4/20mA	---	4/20mA
PRECISION	---	---	1% o 4ppb	---
MATERIAL POD (CONTACT PRODUCT)	AISI316L	AISI316L	AISI316L	AISI316L
DIAMETER SENSOR	---	12mm	---	---
TOTAL LEGHT DOP (mm)	---	70	420	---
CONECTION PROCESS	Socket	Socket	Socket	Socket
MATERIAL CONECTION PROCESS	AISI316L	AISI316L	AISI316L	AISI316L
RANGE CALIBRATION	---	5-4000FTU o 0-30g/l	----	0/14
TRANSMITTER	---	TRB8300	4500 (EXIST)	M300
PROTECTION	---	IP65	IP65	IP65
POWER SUPPLY	---	100-240Vac	100/240Vca o 20/30Vcc	100/240Vca o 20/30Vcc
DIGITAL INDICATION (LCD METER)	---	yes	yes	yes
DIGITAL COMMUNICATION	---	RS232	---	USB
FLUID	Mixed	Mixed	Mixed	Mixed
STATE	Liquid	Liquid	Liquid	Liquid
VISCOSITY	aprox. 1 cp	aprox. 1 cp	aprox. 1 cp	aprox. 1 cp
OPERATION PRESSURE (barg)	atm	atm	atm	atm
PRESSURE MAX. (barg)	1 bar	5 bar	1 bar	4 bar
TEMPERATURE MAX. (ºC)	130	130	130	140
OPERATION TEMPERATURE (ºC)	36	36	36	36
QUANTITY	1	1	1	1
SUPPLIER	---	De Dietrich	De Dietrich	De Dietrich
MANUFACTURER	MONITEX	Mettler - Toledo	Mettler - Toledo	Mettler - Toledo
MODEL Retractable Housing	---	Intrac 779 M	InTrac777	InTrac777

OBSERVATION

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ESPECIFICATIONS INSTRUMENTS

ANALYZER

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISSA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PAG.:**	2/2

TAG Nº	**AI 406 01 (pH)**	**AI 410 01/02**		
TYPE	Electrodo pH	---		
MODEL	InPro3250	Multor 610		
SITUATION	Reactor	PG-10-SS-007		
OUTPUT SIGN	4/20mA	4/20mA		
PRECISION	---	---		
MATERIAL POD (CONTACT PRODUCT)	AISI316L	AISI316L		
DIAMETER SENSOR	---	---		
TOTAL LEGHT DOP (mm)	---	---		
CONECTION PROCESS	Socket	---		
MATERIAL CONECTION PROCESS	AISI316L	AISI316L		
RANGE CALIBRATION	0/14	---		
TRANSMITTER	M300	---		
PROTECTION	IP65	---		
POWER SUPPLY	100/240Vca o 20/30Vcc	---		
DIGITAL INDICATION (LCD METER)	yes	---		
DIGITAL COMMUNICATION	USB	---		
FLUID	Mixed	Mixed		
STATE	Liquid	Air		
VISCOSITY	aprox. 1 cp	---		
OPERATION PRESSURE (barg)	atm	atm		
PRESSURE MAX. (barg)	4 bar	1 bar		
TEMPERATURE MAX. (ºC)	140	120		
OPERATION TEMPERATURE (ºC)	36	30		
QUANTITY	1	1		
SUPPLIER	De Dietrich	---		
MANUFACTURER	Mettler - Toledo	Maihak		
MODEL Retractable Housing	InTrac777	---		

OBSERVATION

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E-08012 BARCELONA

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ESPECIFICATIONS INSTRUMENTS

SAFETY

CUSTOMER:	UAB			**DATE:**	25/07/2008
PROJECT:	MELISSA COMPARTMENT IV			**PREPARED:**	F.M.P.
DRAWING:	DD-8506-Z1	**REV:**	F	**CHECKED:**	J.MESTRE

TAG Nº	**RV 401 01**	**RV 402 01**	**RV 405 02**
PRODUCT	AIR	AIR	Glycol
SITUATION	VS 401 01	VS 402 01	GLY-15-SS-004
DIAMETER DN	25	25	25
TYPE	Pressure relief valve	Pressure relief valve	Pressure relief valve
MODEL	74700	74700	1216F
PRESSURE TARE	2 bar	2 bar	5 bar
TEMPERATURE	25 ºC	25 ºC	5ºC
MATERIAL VESSEL	AISI304	AISI304	AISI316L
MATERIAL PART INSIDE	AISI316l	AISI316L	AISI316L
MANUFACTURER	INOXPA	INOXPA	TOSACA
OBSERVATION	----	----	---

TAG Nº	**RV 430 01**	**RV 432 01**	**RV 433 01**
PRODUCT	AIR	Glycol	Glycol
SITUATION	REACTOR	GLY-15-SS-006	GLY-15-SS-002
DIAMETER DN	25	25	25
TYPE	Pressure relief valve	Pressure relief valve	Pressure relief valve
MODEL	74700	1216F	1216F
PRESSURE TARE	2 bar	5 bar	5 bar
TEMPERATURE SERVICE	27 ºC	5ºC	5ºC
MATERIAL VESSEL	AISI304	AISI316L	AISI316L
MATERIAL PART INSIDE	AISI316L	AISI316L	AISI316L
MANUFACTURER	INOXPA	TOSACA	TOSACA
OBSERVATION	---	---	---

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ESPECIFICATIONS INSTRUMENTS

SAFETY

CUSTOMER:	UAB			**DATE:**	25/07/2008
PROJECT:	MELISSA COMPARTMENT IV			**PREPARED:**	F.M.P.
DRAWING:	DD-8506-Z1	**REV:**	F	**CHECKED:**	J.MESTRE

TAG Nº	RV 434 01	RV 403 01	
PRODUCT	Glycol	MIXER (GAS)	
SITUATION	GLY-15-SS-008	PG-10-SS-009	
DIAMETER DN	25	25	
TYPE	Pressure relief valve	Pressure relief valve	
MODEL	1216F	74700	
PRESSURE TARE	5 bar	1	
TEMPERATURE SERVICE	5ºC	5 ºC	
MATERIAL VESSEL	AISI316L	AISI304	
MATERIAL PART INSIDE	AISI316L	AISI316L	
MANUFACTURER	TOSACA	INOXPA	
OBSERVATION	---	----	

TAG Nº			
PRODUCT			
SITUATION			
DIAMETER DN			
TYPE			
MODEL			
PRESSURE TARE			
TEMPERATURE SERVICE			
MATERIAL VESSEL			
MATERIAL PART INSIDE			
MANUFACTURER			
OBSERVATION			

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ESPECIFICATIONS INSTRUMENTS

FLOW

CUSTOMER:	UAB			**DATE:**	25/07/2008
PROJECT:	MELISSA COMPARTMENT IV			**PREPARED:**	F.M.P.
DRAWING:	DD-8506-Z1	**REV:**	F	**CHECKED:**	J.MESTRE

TAG Nº	**FI 403 01**	**FT 404 01**	**FT 401 01**
PRODUCT	MIX CO2/AIR	MIX CO2/AIR	WATER + SALTS
TYPE	Rotameter	Coriolis	Coriolis
MODEL	502654	---	Promass 8A01
PRESSURE (barg)	---	0,2	1
FLOW	0-21 l/min	0-120Nl/h	0-20l/h
TEMPERATURE (ºC)	atm	atm	atm
SITUATION	CO2-10-SS-002	PG-10-SS-006	PL-10-SS-007
MATERIAL	Glass	AISI316	AISI316L
SIZE LINE	10	10	10
RESOLUTION	---	---	---
OUTPUT SIGN	---	4/20mA	4/20mA
PROTECTION	---	IP67	IP67
POWER SUPPLY	---	---	85-260Vac
QUANTITY	1	1	1
SUPPLIER	BIOENGINEERING	De Dietrich	De Dietrich
MANUFACTURER	BIOENGINEERING	BRONKHORST	E&H
TAG Nº			
PRODUCT			
TYPE			
MODEL			
PRESSURE (barg)			
FLOW			
TEMPERATURE (ºC)			
SITUATION			
MATERIAL			
SIZE LINE			
RESOLUTION			
OUTPUT SIGN			
PROTECTION			
POWER SUPPLY			
QUANTITY			
SUPPLIER			
MANUFACTURER			

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ESPECIFICATIONS INSTRUMENTS

LEVEL

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISSSA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PAG.**	1/1

TAG Nº	**LT 407 01**	**LT 401 01**			
SITUATION	Reactor	VS 401 01			
TYPE (ultras/radar/p.diferencial/p.relativa	Vibronic	Microwave			
MODEL	8111	Vegaflex 61			
OUTPUT SIGN	0/1	4/20mA			
TYPE DE SENSOR	Vibronic	Microwave			
MATERIAL CONTACT PRODUCT	AISI316L	AISI316L			
CONECTION A PROCESS	40	25			
MATERIAL CONECTION PROCESS	AISI316L	AISI316L			
MATERIAL SENSOR	AISI316L	AISI316L			
DIAPHRAGM DIVIDER	---	---			
MATERIAL DIAPHRAGM	---	---			
FLUID RELLENO CAPILAR	---	---			
POWER SUPPLY	110/230 Vac	110/230Vac			
PROTECTION	IP67	IP66/67			
RESOLUTION	---	---			
DIGITAL INDICATION (LCD METER)	NO	YES			
FLUID	water + salts	water+ sals			
STATE	Liquid	Liquid			
VISCOSITY	1cp	1cp			
TEMPERATURE OPERATION (ºC)	36	5			
TEMPERATURE MAX. (ºC)	200	150			
PRESSURE MAX.	---	---			
PRESSURE OPERATION	0,5 Bar	atm			
QUANTITY	1	1			
SUPPLIER	De Dietrich	De Dietrich			
MANUFACTURER	E&H	E&H			

OBSERVATIONS

De Dietrich Equipos Químicos, S.L.
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ESPECIFICATIONS INSTRUMENTS

WEIGHT

CUSTOMER:	UAB			**DATE:**	24/07/2008
PROJECT:	MELISSA COMPARTMENT IV			**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F	**PREPARED**	F.M.P.

TAG Nº	**WI 402 01**	**WT 402 01**	**WI 406 01**
SITUATION	VESSEL VS 402 01	REACTOR RCIVa	VESSEL VS 406 01
TYPE	SCALE	LOAD CELL	SCALE
MODEL	IND560+PBA 330-CC600	IMD110+ULTRAMOUN	BBA 422-3SM
CELL NUMBER	---	4	---
TRANSMITTER	YES	YES	NO
MATERIAL	AISI304	INOX.	AISI304
OUTPUT SIGN	4/20mA	4/20mA	VISUAL
PROTECTION	IP65	IP20	---
TOTAL LOAD	600 KG	200	3 KG
RESOLUTION	200g	50g	0,5 / 1g
DIMENSION (mm)	600x800	74x100x57	240x350
OBSERVATION	---	---	RS232C
MANUFACTURER	Mettler Toledo	Mettler Toledo	Mettler Toledo

TAG Nº	**WI 406 02**		
SITUATION	VESSEL VS 406 01		
TYPE	SCALE		
MODEL	BBA 422-3SM		
CELL NUMBER	---		
TRANSMITTER	NO		
MATERIAL	AISI304		
OUTPUT SIGN	VISUAL		
PROTECTION	---		
TOTAL LOAD	3 KG		
RESOLUTION	0,5 / 1g		
DIMENSION (mm)	240x350		
COMMUNICATION	RS232C		
OBSERVATION	---		
MANUFACTURER	Mettler Toledo		

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ESPECIFICATIONS INSTRUMENTS

PRESSURE

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008		

TAG Nº	PI 435 01	PI 405 02	PI 401 02	PI 402 02	PT 404 01
SITUATION	AI-15-SS-001	VS 405 01	VS 401 01	VS 402 01	PL-10-SS-008
TYPE (absolute/relative/differential)	RELATIVE	RELATIVE	RELATIVE	RELATIVE	RELATIVE
OUTPUT SIGN	---	---	---	---	4/20mA
SENSOR TYPE	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE
CONTACT PRODUCT MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
RANGE CALIBRATION	0/1BARG	0/6 BARG	0/2,5 BARG	0/2,5 BARG	0/1 BARG
CONECTION A PROCESS	Socket	Socket	Socket	Socket	CLAMP
SIZE	10	1/2"	1/2"	1/2"	DN25
CONECTION PROCESS MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
CAPILLARY	---	---	---	---	---
CAPILLARY MATERIAL	---	---	---	---	---
DIAFRAGMA MATERIAL	---	---	---	---	AISI316L
FLUID CAPILAR	---	---	---	---	VEGETABLE OIL
POWER SUPPLY	---	---	---	---	24Vac
PROTECTION	IP65	IP65	IP65	IP65	IP66
DIGITAL INDICATION (LCD METER)	NO	NO	NO	NO	YES
FLUID	AIR	WATER	WATER	WATER	AIR
STATE	GAS	LIQUID	LIQUID	LIQUID	GAS
VISCOSITY	---	---	---	---	---
TEMPERATURE OPERATION (ºC)	20	20	20	20	atm
TEMPERATURE MAX. (ºC)	50	130	130	130	130
PRESSURE MAX.	6	6	6	6	3
PRESSURE OPERATION	2 barg	3 barg	0,2 barg	0,2 barg	0,2 barg
QUANTITY	1	1	1	1	1
SUPPLIER	De Dietrich	De Dietrich	De Dietrich	De Dietrich	De Dietrich
MANUFACTURER	NuovaFima	NuovaFima	NuovaFima	NuovaFima	E&H
MODEL	MSG18	MSG18	MSG18	MSG18	Cerabar S PMP75
OBSERVATIONS					

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ESPECIFICATIONS INSTRUMENTS

PRESSURE

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008		

TAG Nº	PI 403 02	PI 405 01	PI 401 01	PI 402 01	PI 436 01
SITUATION	CO2-10-SS-002	WT-15-SS-002	VS 401 01	VS 402 01	AI-15-SS-002
TYPE (absolute/relative/differential)	RELATIVE	RELATIVE	RELATIVE	RELATIVE	RELATIVE
OUTPUT SIGN	---	---	---	---	---
SENSOR TYPE	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE
CONTACT PRODUCT MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
RANGE CALIBRATION	0/1BARG	0/6 BARG	0/6 BARG	0/6 BARG	0/6 BARG
CONECTION A PROCESS	Socket	Socket	CLAMP	CLAMP	CLAMP
SIZE	1/2"	1/2"	10	10	10
CONECTION PROCESS MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
CAPILLARY	---	---	---	---	---
CAPILLARY MATERIAL	---	---	---	---	---
DIAFRAGMA MATERIAL	---	---	---	---	---
FLUID CAPILAR	---	---	---	---	---
POWER SUPPLY	---	---	---	---	---
PROTECTION	IP65	IP65	IP65	IP65	IP65
DIGITAL INDICATION (LCD METER)	NO	NO	NO	NO	NO
FLUID	CO2	WATER	MIXEX	MIXEX	AIR
STATE	GAS	LIQUID	GAS	GAS	GAS
VISCOSITY	---	---	---	---	---
TEMPERATURE OPERATION (ºC)	20	20	20	20	20
TEMPERATURE MAX. (ºC)	50	50	130	130	50
PRESSURE MAX.	6	6	6	6	6
PRESSURE OPERATION	0,5 barg	3 barg	atm	atm	2 barg
QUANTITY	1	1	1	1	1
SUPPLIER	De Dietrich	De Dietrich	De Dietrich	De Dietrich	De Dietrich
MANUFACTURER	NuovaFima	NuovaFima	NuovaFima	NuovaFima	NuovaFima
MODEL	MSG18	MSG18	MSG18	MSG18	MSG18
OBSERVATIONS					

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ESPECIFICATIONS INSTRUMENTS

PRESSURE

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008		

TAG Nº	PT 402 02	PT 401 01	PT 401 04	PT 407 03	PI 403 01
SITUATION	PL-10-SS-015	PL-10-SS-007	PL-10-SS-005/006/007	PG-10-SS-001	CO2-10-SS-002
TYPE (absolute/relative/differential)	RELATIVE	DIFFERENTIAL	DIFFERENTIAL	DIFFERENTIAL	RELATIVE
OUTPUT SIGN	0/1	4/20mA	4/20mA	4/20mA	---
SENSOR TYPE	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE
CONTACT PRODUCT MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
RANGE CALIBRATION	0/4 BARG	0/4 BARG	0/4 BARG	0/0,5 BARG	0/2,5BARG
CONECTION A PROCESS	CLAMP	CLAMP	CLAMP	CLAMP	Socket
SIZE	DN25	DN25	DN25	DN25	1/4"
CONECTION PROCESS MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
CAPILLARY	---	---	---	---	---
CAPILLARY MATERIAL	---	---	---	---	---
DIAFRAGMA MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	---
FLUID CAPILLARY	VEGETABLE OIL	VEGETABLE OIL	VEGETABLE OIL	VEGETABLE OIL	---
POWER SUPPLY	24Vac	24Vac	24Vac	24Vac	---
PROTECTION	IP66	IP66	IP66	IP66	IP65
DIGITAL INDICATION (LCD METER)	NO	NO	NO	NO	NO
FLUID	Mixed	Mixed	Mixed	Mixed	AIR
STATE	Liquid	Liquid	Liquid	Gas	GAS
VISCOSITY	aprox. 1 cp	aprox. 1 cp	aprox. 1 cp	----	---
TEMPERATURE OPERATION (ºC)	36	36	36	36	20
TEMPERATURE MAX. (ºC)	130	130	130	130	50
PRESSURE MAX.	3	3	3	3	6
PRESSURE OPERATION	0,2 barg	0,2 barg	0,2 barg	0,2 barg	2 barg
QUANTITY	1	1	1	1	1
SUPPLIER	De Dietrich	De Dietrich	De Dietrich	De Dietrich	De Dietrich
MANUFACTURER	E&H	E&H	E&H	E&H	NuovaFima
MODEL	Ceraphant T PTP35	FMD78	FMD78	FMD78	MSG18
OBSERVATIONS					

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ESPECIFICATIONS INSTRUMENTS

PRESSURE

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008		

TAG Nº	**PI 407 01**	**PI 407 02**	**PT 401 02**	**PT 401 03**	**PT 402 01**
SITUATION	REACTOR	REACTOR	PL-10-SS-005	PL-10-SS-006	PL-10-SS-014
TYPE (absolute/relative/differential)	RELATIVE	RELATIVE	RELATIVE	RELATIVE	RELATIVE
OUTPUT SIGN	4/20mA	4/20mA	0/1	0/1	0/1
SENSOR TYPE	PRESSURE	PRESSURE	PRESSURE	PRESSURE	PRESSURE
CONTACT PRODUCT MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
RANGE CALIBRATION	0/1 BARG	0/1 BARG	0/4 BARG	0/4 BARG	0/4 BARG
CONECTION A PROCESS	CLAMP	CLAMP	CLAMP	CLAMP	CLAMP
SIZE	1 1/2"	1 1/2"	DN25	DN25	DN25
CONECTION PROCESS MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
CAPILLARY	---	---	---	---	---
CAPILLARY MATERIAL	---	---	---	---	---
DIAPHARGM MATERIAL	AISI316L	AISI316L	AISI316L	AISI316L	AISI316L
FLUID CAPILAR	VEGETABLE OIL	VEGETABLE OIL	VEGETABLE OIL	VEGETABLE OIL	VEGETABLE OIL
POWER SUPPLY	24Vac	24Vac	24Vac	24Vac	24Vac
PROTECTION	IP66	IP66	IP66	IP66	IP66
DIGITAL INDICATION (LCD METER)	YES	YES	NO	NO	NO
FLUID	Mixed	Mixed	Mixed	Mixed	Mixed
STATE	Gas	Gas	Liquid	Liquid	Liquid
VISCOSITY	----	----	aprox. 1 cp	aprox. 1 cp	aprox. 1 cp
TEMPERATURE OPERATION (ºC)	36	36	36	36	36
TEMPERATURE MAX. (ºC)	130	130	130	130	130
PRESSURE MAX. (Barg)	3	3	3	3	3
PRESSURE OPERATION	0,2 bar	0,2 bar	0,2 bar	0,2 bar	0,2 bar
QUANTITY	1	1	1	1	1
SUPPLIER	De Dietrich	De Dietrich	De Dietrich	De Dietrich	De Dietrich
MANUFACTURER	E&H	E&H	E&H	E&H	E&H
MODEL	Cerabar S PMP75	Cerabar S PMP75	Ceraphant T PTP35	Ceraphant T PTP35	Ceraphant T PTP35
OBSERVATIONS					

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E-08012 BARCELONA

Member of De Dietrich PROCESS SYSTEMS

ESPECIFICATIONS INSTRUMENTS

TEMPERATURE

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PÁG.**	1

TAG Nº	**TI 405 02**	**TT 401 01**	**TT 402 01**	**TT 404 01**
TYPE	PT-100	PT-100	PT-100	PT-100
SITUATION	REACTOR	VS 401 01	VS 402 01	PG-10-SS-008
OUTPUT SIGN	4/20mA	4/20mA	4/20mA	4/20mA
CONTACT PRODUCT MATERIAL	---	AISI316L	AISI316L	AISI316L
DIAMETER SENSOR	---	9mm	9mm	9mm
TOTAL LENGHT DOP (mm)	---	200	200	20
CONECTION PROCESS	---	CLAMP	CLAMP	CLAMP
SIZE CONNECTION	---	DN25	DN25	DN25
MATERIAL CONECTION PROCESS	---	AISI316L	AISI316L	AISI316L
RANGE CALIBRATION	---	-10/150ºC	-10/150ºC	-10/150ºC
TRANSMITTER	---	TMT181	TMT181	TMT181
PROTECTION	---	IP66	IP66	IP66
POWER SUPPLY	---	24Vca	24Vca	24Vca
DIGITAL INDICATION (LCD METER)	---	---	---	---
DIGITAL COMMUNICATION	---	---	---	---
FLUID	Mixed	Mixed	Mixed	Mixed
STATE	Liquid	Liquid	Liquid	Liquid
VISCOSITY	aprox. 1 cp	aprox. 1 cp	aprox. 1 cp	aprox. 1 cp
OPERATION PRESSURE (barg)	atm	atm	atm	atm
PRESSURE MAX. (barg)	1 bar	1 bar	1 bar	1 bar
OPERATION TEMPERATURE (ºC)	36	4	4	4
QUANTITY	1	1	1	1
SUPPLIER	BIOENGINEERING	De Dietrich	De Dietrich	De Dietrich
MANUFACTURER	BIOENGINEERING	E&H	E&H	E&H
MODEL	----	TR45	TR45	TR45

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ESPECIFICATIONS INSTRUMENTS

PROPORTIONAL VALVES

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PÁG.**	1

TAG Nº	**FQRC 403 01**	**FQRC 403 02**	**FQRC 403 03**	**FQRC 403 05**	**FQRC 404 02**
SERVICE DATES					
PRODUCT	AIR	CO_2	CO_2	MIXER(gas)	AIR
SITUATION	PAI-10-SS-001	CO2-10-SS-001	CO2-10-SS-001	PG-10-SS-009	PG-10-SS-001
PRODUCT MATERIAL	---	---	---	---	INOX
DIAMETER SENSOR	---	---	---	---	2
TEMPERATURE	atm	atm	atm	atm	atm
PRESSURE	2 barg	2 barg	2 barg	0,1 barg	0,1
VISCOSITY (cst)	---	---	---	---	---
Kv (m^3/h) calculated	---	---	---	---	---
VALVE DATES					
TYPE	Mass	Mass	Mass	Mass	Bellow Seat
DN	10	10	10	10	10
MATERIAL	---	---	---	---	INOX
INPUT SIGN	---	---	---	---	4/20mA
OUTPOUT SIGN	---	---	---	---	4/20mA
QUANTITY	1	1	1	1	1
SUPPLIER	BIOENGINEERING	BIOENGINEERING	BIOENGINEERING	BIOENGINEERING	De Dietrich
MANUFACTURER	BRONKHORST	BRONKHORST	BRONKHORST	BRONKHORST	Bürkert
MODEL	F202D-FA-44-V	F202D-FA-33-Z	F202D-FA-44-V	F202D-FA-44-V	2031

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ESPECIFICATIONS INSTRUMENTS

VALVE ON/OFF

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PÁG.**	1

TAG Nº	FQRC 403 04	FQRC 404 02	SV 405 01	SV 432 01	SV 441 01
PROCESS DATES					
PRODUCT	AIR	MIXER (GAS)	GLY	GLY	STEAM
CONTACT PRODUCT MATERIAL	AISI316	PTFE	AISI316	AISI316	AISI316
PRESSURE	2 barg	0,1 barg	3 barg	3 barg	3 barg
TEMPERATURE	20ºC	20ºC	5 ºC	5 ºC	5 ºC
VISCOSITY (cps)	---	---	---	---	---
VALVE DATES					
SITUATION	PAI-10-SS-003	PG-10-SS-001	GLY-15-SS-003	GLY-15-SS-002	ST-15-SS-006
TYPE	Ball	Diaphragm	Ball	Ball	Ball
DIAMETER	10	10	15	15	15
MODEL	F14D	2031	F14D	F14D	F14D
MANUFACTURER	ISO	BÜRKERT	ISO	ISO	ISO
MATERIAL	AISI316	PTFE	AISI316	AISI316	AISI316
ACCIONAMIENTO-ACTUADOR					
TYPE	NEUMATIC	NEUMATIC	NEUMATIC	NEUMATIC	NEUMATIC
ACTION AIR	NC	NC	NC	NC	NC
MODEL	PA00S	PSS-A	PA00S	PA00S	PA00S
MANUFACTURER	PRISMA	---	PRISMA	PRISMA	PRISMA
FLUID	AIR	AIR	AIR	AIR	AIR
PRESSURE POWER SUPPLY	6	6	6	6	6
FINAL DE CARRERA					
TYPE	INDUCT.	INDUCT.	INDUCT.	INDUCT.	INDUCT.
QUANTITY	1	1	1	1	1
MODEL	NAMUR	NAMUR	NAMUR	NAMUR	NAMUR
MANUFACTURER	P&F	BÜRKERT	P&F	P&F	P&F
ELECTROVALVE					
POWER SUPPLY	24 Vcc	24 Vcc	24 Vcc	24 Vcc	24 Vcc
QUANTITY	1	1	1	1	1
MODEL	P00/P30	6012	P00/P30	P00/P30	P00/P30
MANUFACTURER	PRISMA	BÜRKERT	PRISMA	PRISMA	PRISMA

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ESPECIFICATIONS INSTRUMENTS

VALVE ON/OFF

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PÁG.**	1

TAG Nº	**SV 434 01**	**SV 441 02**	**SV 406 01**	**SV 406 02**	**SV 404 01**
PROCESS DATES					
PRODUCT	GLY	STEAM	ACID	BASIC	MIXER(GAS)
CONTACT PRODUCT MATERIAL	AISI316	AISI316	PTFE	PTFE	PTFE
PRESSURE	3 barg	3 barg	0,5 barg	0,5 barg	0,5 barg
TEMPERATURE	20 ºC	120 ºC	20ºC	20ºC	20ºC
VISCOSITY (cps)	---	---	---	---	---
VALVE DATES					
SITUATION	GLY-15-SS-008	ST-15-SS-020	PAC-10-SS-002	PBA-10-SS-002	PBA-10-SS-002
TYPE	Ball	Ball	Diaphragm	Diaphragm	Diaphragm
DIAMETER	15	15	10	10	10
MODEL	F14D	F14D	2031	2031	2031
MANUFACTURER	ISO	ISO	BÜRKERT	BÜRKERT	BÜRKERT
MATERIAL	AISI316	AISI316	PTFE	PTFE	PTFE
ACCIONAMIENTO-ACTUADOR					
TYPE	NEUMATIC	NEUMATIC	NEUMATIC	NEUMATIC	NEUMATIC
ACTION AIR	NC	NC	NC	NC	NC
MODEL	PA00S	PA00S	PSS-A	PSS-A	PSS-A
MANUFACTURER	PRISMA	PRISMA	BÜRKERT	BÜRKERT	BÜRKERT
FLUID	AIR	AIR	AIR	AIR	AIR
PRESSURE POWER SUPPLY	6	6	6	6	6
FINAL DE CARRERA					
TYPE	INDUCT.	INDUCT.	INDUCT.	INDUCT.	INDUCT.
QUANTITY	1	1	1	1	1
MODEL	NAMUR	NAMUR	NAMUR	NAMUR	NAMUR
MANUFACTURER	P&F	P&F	BÜRKERT	BÜRKERT	BÜRKERT
ELECTROVALVE					
POWER SUPPLY	24 Vcc	24 Vcc	24 Vcc	24 Vcc	24 Vcc
QUANTITY	1	1	1	1	1
MODEL	P00/P30	P00/P30	---	---	---
MANUFACTURER	PRISMA	PRISMA	BÜRKERT	BÜRKERT	BÜRKERT

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ESPECIFICATIONS INSTRUMENTS

VALVE ON/OFF

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PÁG.**	1

TAG Nº	**SV 404 02**	**SV 404 03**			
PROCESS DATES					
PRODUCT	GAS	GAS			
CONTACT PRODUCT MATERIAL	AISI316	AISI316			
PRESSURE	1 barg	1 barg			
TEMPERATURE	atmç	atm			
VISCOSITY (cps)	---	---			
VALVE DATES					
SITUATION	CO2-10-PA-004	CO2-10-PA-004			
TYPE	Diaphragm	bellow			
DIAMETER	10	10			
MODEL	2031	2835			
MANUFACTURER	BÜRKERT	Bürkert			
MATERIAL	PTFE	PTFE			
ACCIONAMIENTO-ACTUADOR					
TYPE	NEUMATIC	NEUMATIC			
ACTION AIR	NC	NC			
MODEL	PA00S	PA00S			
MANUFACTURER	PRISMA	PRISMA			
FLUID	AIR	AIR			
PRESSURE POWER SUPPLY	6	6			
FINAL DE CARRERA					
TYPE	INDUCT.	INDUCT.			
QUANTITY	1	1			
MODEL	NAMUR	NAMUR			
MANUFACTURER	P&F	P&F			
ELECTROVALVE					
POWER SUPPLY	24 Vcc	24 Vcc			
QUANTITY	1	1			
MODEL	P00/P30	P00/P30			
MANUFACTURER	PRISMA	PRISMA			

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ESPECIFICATIONS INSTRUMENTS

VALVE ON/OFF

CUSTOMER:	UAB	**PREPARED:**	F.M.P.
PROJECT:	MELISA COMPARTMENT IV	**CHECKED:**	J.MESTRE
DRAWING:	DD-8506-Z1	**REV:**	F
DATE:	25/07/2008	**PÁG.**	1

8. ANNEX III: HAZOP

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PROJECT: MELISSA	
CUSTOMER: UNIVERSITAT AUTÒNOMA DE BARC	
DESCRIPCION: COMPARTMENT IVa PILOT REACTOR	
REF. PROJECT: DD-8506-Z1	
PREPARED: J. MESTRE, F. MANGAS	
DATE: 16/05/08	Rev. 0

HAZARD AND OPERABILITY ANALYSIS-HAZOP

PROJECT:

MELISSA – COMPARTMENT IVa PILOT REACTOR

PREPARED: F. MANGAS	CHECKED: J.MESTRE
Ingeniero Químico. Téc. Especialista en Proceso	Ingeniero Industrial colegiado nº 4649

0. CONTENTS

1. INTRODUCTION

The development of a Hazard Analysis and Operability Study (HAZOP) has a dual purpose: on the one hand, rigorous and systematic identification of hazards, as an integral part of Risk Analysis of an industrial plant and, secondly, the analysis of operating problems that could jeopardize the fulfilment of the design goals. In both cases, this analysis makes it possible to define a series of corrective actions (short, medium and long term), appropriate to each case.
The objectives of any HAZOP study can be summarized as follows:

- Identifying areas, hazardous procedures or operations in the facility.
- Identification of Major Accidents. Definition of accident scenarios for subsequent calculation of consequences (only in facilities that require a Safety Report).
- Study of the design characteristics that could lead to dangerous incidents, and operability problems.
- Carrying out a systematic study of the different sections or nodes of a plant with potential risks. The survey is always done jointly by experts in different fields (design, process, instrumentation...), integrated into a multidisciplinary team.
- Proposal for corrective actions and protection systems needed.

The procedure or methodology for conducting such studies schematized in summary diagrams which are attached in ANNEX 1, complemented with a general guide word glossary (see Annex 2).

2. PLANNING AND ATTENDEES

The meeting took place at the offices of De Dietrich on Av. Princep d'Asturies No 43 1 No. 5 (08012) Barcelona.

The list of those attending the analysis session and the work done is provided in the table below.

SINGLE SITTING		
DATE	STARTING TIME	FINISH
13/05/2008	15:00	19:00
14/05/2008	8:00	14:00
ATTENDEES		
COMPANY	**NAME**	**CHARGE / DEPARTMENT**
DE DIETREICH	J. MESTRE	HEAD OF ENGINEERING AND PROCESS DEPARTMENT
DE DIETRICH	F.MANGAS	PROJECT ENGINEER, INSTRUMENTATION AND HAZOP MANAGER
DE DIETRICH	D. TATAY	MECHANICAL PROJECT DEVELOPMENT
DE DIETRICH	J. GARCIA	WORKS DEPARTMENT MANAGER
DE DIETRICH	J. SANS	SAFETY COORDINATOR
DE DIETRICH	T. MARQUES	PROJECT ENGINEER
NODES ANALIZED		
NODE	DESCRIPTION	
1	**VS 401 01** SUBSTRATE STORAGE TANK	
2	**RCIVa** REACTOR	
3	**VS 402 01** PRODUCT STORAGE TANK	

3. BRIEF DESCRIPTION OF THE FACILITIES SUBJECT TO STUDY

Compartment IV of the MELISSA cycle, comprises a photobioreactor project for the cultivation of the cyanobacteria *Spirulina platensis.*

The substrate of the bacteria is driven from the storage tank (VS 401 01), through a pumping system formed by two membrane pumps which feed it into the bioreactor (RCIVa), the bacteria in question is fed directly into the reactor, which also receives an air and CO_2 injection.

The resulting products are essentially a gas phase which leaves the reactor at the top after passing through a small exchanger to condense water vapour dregs, and a liquid phase that is pumped to a holding tank (VS 402 01) by a pumping unit formed by two other membrane pumps.

The energy needed for the transformation of the substrate, is given in the form of visible radiation produced by a set of lights arranged around the glass sections that make up the reactor. The heat generated by these lights is dissipated by a dual cooling system formed by a closed water circuit and the constant movement of air through the interior of the casing where the lights are found.

Given the need to work with all the equipment and pipes free of contamination, there are several steam inlets spread over different points of the system that allow the entire installation to be sterilised.

4. LIST OF DOCUMENTS CONSULTED

The analysis has been developed consulting the drawings which are listed below:

P & IDs:

- DD-8506-Z1-100-01 J Review

Documents:

- Technical Specifications for the Re-design of the Compartment IVa Pilot Reactor
- Technical note 37.2 Version 1

A true copy for all the original documents consulted is attached in ANNEX 4.

5. HAZOP DEVELOPMENT. NODES

The analysis concept of the facilities is based on the detailed breakdown of equipment, systems and operations to be performed in the facility. To conduct this detailed study specific parts of the plant called nodes have been identified.

During the NODES selection, we have taken into consideration the parts and operating conditions of the facility regarded as representative from an operation and safety viewpoint, maintaining a certain criterion of continuity for each of them, according to the running of the installation. The nodes selected in the facilities are as follows:

ANALIZED NODES
1. VS 401 01 SUBSTRATE STORAGE TANK 2. RCIVa REACTOR 3. VS402 02 PRODUCT STORAGE TANK

For each node the relevant parameters are analysed, applying to each one the guide words and deviations, allowing the possible causes and their consequences to be suggested.

The last column of the tables includes the overall improvement actions and comments, arising out of the meeting.

The tables reflecting the development of the HAZOP study are attached in ANNEX 3.

6. CONCLUSIONS

The development of a HAZOP type analysis on the Melissa project–*Compartment IVa Pilot Reactor*, has allowed the following considerations to be highlighted:

- The information provided has been sufficient for the proper development of analysis at this stage of the process, especially considering the direct input of the engineers in charge of the project.

- The HAZOP study has identified some important improvements to safety and the proper operation of the new facility, which are set out in Annex V. These improvements are mainly related to instrumentation and control of the operation, superfluous safeguards, and checks on the proper design of the facility.

ANNEX 1.
HAZOP PROCUDURE

The HAZOP procedure is based on the critical and systematic analysis of a process from the deviations that may occur in certain parameters of the same, identifying causes, possible consequences and detection mechanisms.

A multidisciplinary group of people, knowledgeable about the process, analyse these deviations led by a chairperson who systematises the analysis and maintains the pace of the meetings. One person acts as secretary and notes down for each deviation:

- The causes which lead to it.
- The possible consequences.
- The manner, in which such a deviation can be prevented, detected or is automatically controlled.

The selection of a person from outside the company to act as chairperson or secretary is often very useful for introducing different viewpoints.

The documentary basis of the analysis is a piping and instrumentation (P & ID) diagram, which applies the following methods:

- A NODE is selected. Generally this is some equipment or section of pipe, or a step in the process in the case of batch plants or semi-batch plants and the role of the node is indicated (INTENTION).

- A certain process PARAMETER is chosen (P, T, F, etc...), to which the previous GUIDE WORD is applied to obtain a certain deviation in the process. In order to be systematic and not forget any possibility, a checklist like the one presented in Annex 2 should be implemented.

- A GUIDE WORD is selected.

- For each deviation and in accordance with the table formats included in Annex 3, the following will be listed:

    - The causes that can produce it.
    - The consequences that can occur if the deviation spreads unchecked.
    - The indications and controls provided to prevent the deviation acquiring critical values.

ANNEX 2.
GUIDE WORD LIST

GUIDE WORDS	MEANING	PARAMETERS	DEVIATION
MORE (Knowlton) MORE THAN (Kletz) GREATER LESS (Knowlton) LESS THAN (Kletz) LESS	Quantitative Increase Quantitative Decrease	Process Variables: P (Pressure) T (Temperature) F (Flow) Q (quantity) L (Level) Properties: μ (viscosity) Y (humidity)	Greater / less pressure Higher / lower temperature More / less flow More / less quantity Higher/ lower level Higher / lower viscosity Higher/ lower humidity
NO (Knowlton) NO (Kletz)	Denial of design specifications	Process Variables: P (Pressure) F (Flow) Q (quantity) L (Level)	Empty No flow ... Empty
CONTRARY (Knowlton) LOSS OF DIRECTION	The contrary of the design purpose	Process Variables: F (Flow)	Reverse Flow
AS WELL AS (Knowlton) AS MUCH/MANY AS EXCESS OF (Kletz)	Qualitative Increase (Knowlton) More components present in the system than there should be	Composition Phase	Concentration increase Another specification impurities (air, water, acids, corrosion products) Contamination This additional phase or accumulation (liquid, vapour, solid)
PARTLY	Qualitative Decrease (Knowlton)	Composition	Concentration decrease

A PART OF (Knowlton / Kletz)	Any variance to what it should be (Kletz)		Change in the ratio of Components Component missing
DIFFERENT FROM OTHER TYPE (Knowlton / Kletz)	Complete replacement (Knowlton) Anything that can happen apart from the normal operation (Kletz)	Composition Substance Operation	Incorrect composition Another product Catalytic Change Start-up Stop Operation with excess Performance Operation with low Performance Alternative mode of operation Maintenance Inspection Weather

FAILURE IN	Unexpected general failure	Services	A.S. (air)
	In services	Operation	Steam
	Operation failure	Material	Power (electricity)
	material Failure		Nitrogen / inertization
			Water
			Stirring
			Chilling
			Filling
			Emptying
			Drainage
			Corrosion
			Erosion
			Voltage:
CONTAINMENT	Loss	Containment	Loss of containment

OPERATION	In addition (incidences at start-up)	Start-up	Incidents at start-up
		Stop	Incidents stopping
	In addition (incidences in Stopping)	Normal operations	Unauthorised operations
	Furthermore (operations not authorised)	Normal operations	Incidents due to Adverse weather
	Furthermore (adverse weather)	Normal operations	Affected by domino effect from nearby tank.
	Furthermore (domino effect)		

ANNEX 3.
HAZOP TABLES

DEDIETRICH **HAZARD AND OPERABILITY STUDY (*HAZOP*)**

Facility: MELISA PROJECT **PID. : DD-8506-Z1-100-01 rev J**

Node: 1. VS-401-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
LEVEL	MORE	• Scale failure • Human error manual loading • Excessive steam entering sterilisation	• Tank Overflow • Venting filter soiled	• Weigh scale alarm	• Installation of high level alarm locking feeding pump	1.1.
	LESS	• Scale failure • Human error control tank level • Manual valve failure on emptying tank	• Failure in feeding the liquid in the reactor. • Possible air inlet in reactor • Possible damage filters liquid inlet	• Alarm signal scale	• Configuration of minimum flow alarm on FT 401 01, locking supply pumps to reactor.	1.2

DEDIETRICH **HAZARD AND OPERABILITY STUDY (*HAZOP*)**

Facility: MELISA PROJECT **PID. : DD-8506-Z1-100-01 rev J**

Node: 1. VS-401-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
PRESSURE	MORE	• Vent closed during filling operation, human error • Steam inlet to casing venting closed • Clogged venting filter	• Over pressure in the tank (safety valve operation) • Possible entry of unfiltered air (via safety valve)	• Safety valve • Local Gauge PI40101	• Installation of pressure switch alarm • Direct safety valve discharge to a collecting area safe for people and facilities	2.1 2.2
	LESS	• Venting obstruction during feeding the reactor • Venting obstruction during tank cooling • Vent closed during emptying operation, human error.	• Failure to supply reactor due to pump running dry	• Tank designed for vacuum	• Installation of pressure switch alarm • Replacing local gauge PI 401 01 with vacuum gauge. • Configuration of minimum flow alarm on FT 401 01, locking supply pumps to reactor.	2.3 2.4 2.5

DEDIETRICH **HAZARD AND OPERABILITY STUDY (*HAZOP*)**

Facility: MELISA PROJECT **PID. : DD-8506-Z1-100-01 rev J**

Node: 1. VS-401-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	NO (vacuum)	• See less pressure	• See less pressure	• See less pressure	• See less pressure	2.6
TEMPERATURE	MORE	• Temperature loop failure • Glycol service failure • Human failure	• High supply temperature could affect process	• TT 401 01	• Installation of alarm point for high temperature in TT 401 01 • Installation pressure switch glycol circuit.	3.1 3.2
	LESS	• Temperature loop failure • Human failure	• Freezing of supply liquid • Lack of power to reactor less level	• TT 40101	• Installation low temperature alarm point on TT 401 01 • Seen in less level	3.3 3.4
FLOW	MORE	• See level	• See level	• See level	• See level	4.1
	LESS	• See level	• See level	• See level	• See level	4.2
	NO	• See level	• See level	• See level	• See level	4.3

DEDIETRICH **HAZARD AND OPERABILITY STUDY (*HAZOP*)**

Facility: MELISA PROJECT **PID. : DD-8506-Z1-100-01 rev J**

Node: 1. VS-401-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	OPPOSITE	• Cannot occur				4.4
HOMOGENEITY	OTHER	• Stirrer failure • entry of steam in production phase • Human failure	• Supply not uniform		• Alarm configuration stirrer failure	5.1
FAILURE IN	COMPRESSED AIR	• Failure compressed air system • Human failure	• No cooling of process liquid due to closing glycol valve service (see temperature)	• See temperature	• .Alarm configuration on automatic valve SV434 01 • Installation of pressure switch and configuration of low alarm.	5.2 5.3
	ELECTRICITY	• Power cut • Human failure	• Stirrer stops and deactivation control loops		• UPS facilities for control system	5.4
	STEAM	• Failure steam generation system • Human failure	• Sterilization impossible			

DEDIETRICH **HAZARD AND OPERABILITY STUDY (*HAZOP*)**

Facility: MELISA PROJECT **PID. : DD-8506-Z1-100-01 rev J**

Node: 1. VS-401-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	GLYCOL	• Failure Glycol system • Human failure	• See air system	• See temperature	• Installation of pressure switch and configuration of low alarm.	5.5

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
LEVEL	MORE	• Disconnection of weigh cell • Weigh cells measurement error • Loop failure on pump outlet	• Flooding of the reactor and the gas outlet.	• Weigh scale disconnection alarm	• Maximum level detector installation and configuration of high-level alarm	6.1

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
		• Output pump failure • Changes in bulk density of the liquid in the reactor • Human failure				
	LESS	• Disconnection of weigh cell • Error in measuring weigh cells. • Loop failure on pump outlet • Leak in the reactor • Changes in bulk density of the liquid in the reactor • Human failure	• Possible changes in the overall mass balance. • Potential air release by discharge pumps	• Weigh cells disconnection alarm		

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
PRESSURE	MORE	• Clogging of the output filters GF 404 01/03 • Pressure control loop failure • Excessive pressure on process gas input • Accidental entry of steam during the process • Human failure	• Overpressure in the equipment (rupture disc action) • Air entry (through the rupture disc)	• Rupture disc • Configuration of alarms on the 2 pressure transmitters (redundant) PI 407 01/02	• Incorporation of maximum switch PI 403 02 • Conduct discharge of rupture disc to safe collection area for people and facilities.	7.1 7.2
	LESS	• Gas output control loop failure • Human failure	• Without consequences			
	NO (vacuum)	• Formation of vacuum after sterilization • Human failure	• Entry of air through the output circuit, reactor pollution(reverse flow)		• Automatic valve setting FQRC 404 01/02	7.3

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
TEMPERATURE	MORE	• Loop failure casing cooling • recirculation pump failure • Glycol supply failure • Water circuit failure • Lighting cooling failure • Human failure	• Process collapse • Lights broken	• Intensity variators light supply.	• Fan speed variator • Incorporate minimum pressure switch on PI 405-01 and configuration of low pressure alarm. • Installation of pressure switch and configuration of low pressure alarm on the Glycol circuit.	8.1 8.2 8.3
	LESS	• Loop failure casing cooling • Too many lights blown • Excessive Airflow • Heating resistance failure • Human failure	• Decrease in process performance		• Low temperature alarm configuration	8.4

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
FLOW	MORE	• More flow liquid inlet due to counter pressure valve failure PRC 401 01 • Liquid inlet control loop failure • More liquid flow output due to counter pressure valve failure PRC 402 01 • Liquid output control loop failure • More gas supply flow due to pressure-reducing valve failure. • Failure of mass meter FQRC 403 03 • More gas outlet flow due to loop failure. • Human failure	• Excessive increase in level in the reactor • Excessive decrease in the reactor level • Excessive increase in reactor pressure • Decrease of reactor pressure	• See pressure and level	• Installation of back-pressure valve for each liquid inlet and outlet pump • Alarm configuration in flow meters.	9.1 9.2

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
		•				
	LESS	• Less flow inlet of liquid due to filter clogging • Liquid inlet control loop failure • Liquid output control loop	• Excessive increase • Reactor level • Excessive decrease in the reactor level • Excessive increase of	• See pressure and level • DPT configuration to detect clogging in filters PT401 01/04,	• Alarm configuration in flow meters.	9.3

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
		failure • Less flow of gas supply due to failure in pressure-reducing valves • Failure of mass flow meter FQRC 403 03 • Less gas outlet flow due to loop failure. • Less flow in gas outlet due to filter clogging • Less flow in gas inlet caused by filter clogging • Human failure	reactor pressure • Decrease of reactor pressure	PT 407 03		
	NO	• Less flow inlet of liquid due to filter clogging • Liquid inlet control loop failure • Liquid output control loop	• Excessive increase • Reactor level • Excessive decrease in the reactor level • Excessive increase of	• See pressure and level • DPT filter configuration to detect clogging in	• Alarm configuration in flow meters.	9.4

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
		failure • Less flow of gas supply due to failure in pressure-reducing valves • Failure of mass flow meter FQRC 403 03 • Less gas outlet flow due to loop failure. • Less flow in gas outlet due to filter clogging • Less flow in gas inlet caused by filter clogging • Human failure	reactor pressure • Decrease of reactor pressure	filters PT 401 01/04, PT 407 03		
	OPPOSITE	• Formation of vacuum after sterilization • Human failure	• Entry of air through the outlet circuit, reactor pollution(reverse flow)		• Automatic valve setting FQRC 404 01/02	9.5.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
COMPOSITION	OTHER	• Failure gas mixing loop • Failure liquid inlet loop • Failure gas inlet loop • Human failure	• Changes in apparent density of the mixture, error in measuring the level (load cells) • Loss of effectiveness of the process	• Mass flow meters in gas inlet FQRC 403 01/02/03, to control the mixture of gas and the inlet of these • Mass flow meter in liquid inlet FT 401 01	• Flow meter FT 401 01 liquid inlet, provides density • Setting up the system to treat the new liquid density signal.	10.1 10.2.
PH	MORE	• Base inlet loop failure • Acid inlet loop failure • CO_2inlet loop failure • Acid or base Inlet Pump failure PP 406 01/02 • Acid bottle empty • CO_2 Inlet failure • S filter clogging base or acid inlet LF 406 01/02 • Clogging Gas Inlet filters GF 403 02/03/04	• Failure of the process	• Instrumentation for controlling pH redundant (AI 406 01/02) • Locking of acid pumps and valves control loop to the pH control loop (PP 406 01/PP 406 02 SV406 01 / SV 406 02)	• Low flow alarm configuration FQRC 403 02	11.1.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
		• Human failure		• Error Alarm in pH sensors • Pump failure alarm • Alarm low level of acid or base in tanks		
	LESS	• Base input loop failure • Acid inlet loop failure • CO2inlet loop failure • Inlet Pump Failure acid or base DB 406 01/02 • Base bottle empty • CO2 Inlet failure • S filter clogging base or acid inlet LF 406 01/02 • Clogging Gas Inlet filters GF 403 02/03/04 • Human failure	• Failure of the process	• Instrumentation for controlling pH redundant (AI 406 01/02) • Locking of acid and base pumps and valves to the pH control loop (PP 406 01/PP 406 02 SV406 01 / SV 406 02) • Error Alarm in pH sensors • Pump failure alarm • Alarm low level of	• Configuration of high flow alarm FQRC 403 02	11.2.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
				acid or base in tanks		
FAILURE IN	Compressed air	• Failure compressed air system • Human failure	• No cooling of fluid process due to closing glycol valve service (see temperature) • Inability to add acid or base due to closure of service valve • Impossibility of cleaning instrumentation biomass analyzer OT 409 01 • Impossibility of outlet of gasses from the reactor • Process air inlet impossible.	• See temperature, pressure, flow, level, composition	• Configuration alarm on automatic valve SV 405 01 • Installation of pressure switch and alarm configuration for low pressure in service	12.1 12.2.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	ELECTRICITY	• Power cut • Human failure	• Pumps, lighting system, heating and cooling stopped • deactivation control loops • Overall process failure		• UPS installation for control system • Installation of generator	12.3 12.4
	STEAM	• Failure steam generation system • Human failure	• Sterilization impossible			
	GLYCOL	• Glycol failure supply • Valve failure SV 401 01 • Human failure	• Failure cooling system closed circuit reactor , Increased temperature in the reactor	• See temperature	• See temperature	12.5.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 2. RCIVa **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	WATER	• Water supply failure • Human failure	• Inability to fill the cooling system with water			
	Analysers	• Several causes leading to analysers malfunction.	• undesirable pH Conditions • Failure to control bacterial growth • Failure to control dissolved oxygen,	• Redundancy of biomass instruments and pH	• Quick availability of critical spare parts for the sensors.	12.6.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 3. VS-402-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
LEVEL	MORE	• Weigh scale failure • Human error manual loading • Excessive steam entering sterilisation	• Tank Overflow • Venting filter dirty	• Weigh scale alarm	• Installation of high level alarm locking feeding pump	13.1.
	LESS	• Scale failure • Human error control tank level • Manual valve on emptying tank				
PRESSURE	MORE	• Vent closed during filling operation • Steam inlet casing venting closed • Clogged venting filter • Human failure	• liquid output through safety valve • Possible entry of unfiltered air	• Safety valve • Local Gauge PI 402 01	• Installation of pressure switch alarm • Direct safety valve discharge to a collecting area safe for people and facilities	14.1. 14.2.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 3. VS-402-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	LESS	• Obstruction of venting during unloading tank • Obstruction of venting during tank cooling • Human failure	• Not considered hazards to people and facilities as tank is designed for a vacuum.	• Tank designed for vacuum	• Installation of pressure switch alarm • Replacing local gauge PI 402 01- with vacuum meter.	14.3 14.4.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 3. VS-402-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	NO (vacuum)	• See less pressure	• See less pressure	• See less pressure	• See less pressure	14.5.
TEMPERATURE	MORE	• Temperature loop failure • Glycol service failure • Human failure	• Biomass parameter variation	• TT 402 01	• Installation of high temperature alarm point in TT402 01 • Installation pressure switch glycol circuit.	15.1. 15.2.
	LESS	• Temperature loop failure • Human failure	• Freezing of supply liquid • Biomass parameter variation	• TT 402 01	• Installation of low temperature alarm point TT402 01	15.3.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 3. VS-402-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
FLOW	MORE	• Seen in level	• Seen in level	• Seen in level	• Seen in level	16.1
	LESS	• Seen in level	• Seen in level	• Seen in level	• Seen in level	16.2.
	OPPOSITE	• Not possible				
HOMOGENEITY	OTHER	• Stirrer failure • Entry of steam in production phase • Human failure	• Decanting solids • Destruction of bacteria		• Alarm configuration stirrer failure	17.1
FAILURE IN	Compressed air	• Failure compressed air system • Human failure	• Not cooling fluid process due to glycol valve closing service (see temperature)	• See temperature	• Alarm configuration on automatic valve SV434 01 • Installation of pressure switch and configuration of low alarm.	18.1 18.2.

DEDIETRICH **HAZARD AND OPERABILITY STUDY (HAZOP)**

Facility: MELISA PROJECT **PID. : DD-8506Z1-100-01**

Node: 3. VS-402-01 **Revision:** 0

Date: 13 / 05 /2008

Intention: System risks and operation study

Parameter	*Guide word and deviation*	*Causes*	*Consequences*	*Safeguards*	*Improvement actions/ comments*	*Ref.*
	ELECTRICITY	• Power cut • Human failure	• Stirrer stops and deactivation control loops		• UPS installation for control system	18.3
	STEAM	• Failure steam generation system • Human error	• Sterilization impossible			
	GLYCOL	• Glycol system failure • Human failure	• See air system	• See temperature	• Installation of pressure switch and configuration of low alarm.	18.4.

ANNEX 4 .
IMPROVEMENT PROPOSAL FOLLOW-UP TABLES

HAZARD AND OPERABILITY STUDY (HAZOP) IMPROVEMENT PROPOSAL FOLLOW-UP TABLES			
REF	**IMPROVEMENT PROPOSAL**	**Technical answer / clarifications**	**PERSON RESPONSIBLE**
1.1.	Installation of high level alarm locking feeding pump		
1.2.	Configuration of minimum flow alarm on FT 401 01, locking supply pumps to reactor		
2.1.	Installation of pressure switch alarm		
2.2.	Direct safety valve discharge to a collecting area safe for people and facilities		
2.3.	Installation of pressure switch alarm		
2.4.	Replacing local gauge PI 401 01-with vacuum gauge.		
2.5.	Configuration of minimum flow alarm on FT 401 01, locking of supply pumps to reactor		
3.1.	Installation of alarm point for high temperature in TT 401 01 Installation pressure switch on glycol circuit.		
3.2.	Installation pressure switch on glycol circuit.		
3.3.	Installation low temperature alarm point on TT 401 01		

REF	IMPROVEMENT PROPOSAL	Technical answer / clarifications	PERSON RESPONSIBLE
3.4.	Seen in less level		
5.1.	Alarm configuration stirrer failure		
5.2.	Alarm configuration in automatic valve SV434 01		
5.3.	Installation of pressure switch and configuration of low alarm.		
5.4.	UPS installation for control system		
5.5.	Installation of pressure switch and configuration of low alarm.		
6.1.	Maximum level detector installation and configuration of high-level alarm		
7.1.	Incorporation of maximum switch on PI 403 02		
7.2.	Conduct discharge of rupture disc to safe collection area for people and facilities.		
7.3.	Automatic valve setting FQRC 404 01/02		
8.1	Fan speed variator		

REF	IMPROVEMENT PROPOSAL	Technical answer / clarifications	PERSON RESPONSIBLE
8.2	Incorporate minimum pressure switch PI 405-01 and configuration of low pressure alarm.		
8.3	Installation of pressure switch and configuration of low pressure alarm on the Glycol circuit.		
8.4	Low temperature alarm configuration		
9.1.	Installation of back-pressure valve for each liquid inlet and outlet pump		
9.2.	Installation of back-pressure valve for each liquid inlet and outlet pump		
9.3.	Alarm configuration in flow meters.		
9.4.	Alarm configuration in flow meters.		
9.5.	Automatic valve setting FQRC 404 01/02		
10.1.	Flow meter FT 401 01 liquid inlet, provides density		

REF	IMPROVEMENT PROPOSAL	Technical answer / clarifications	PERSON RESPONSIBLE
10.2.	Setting up the system to treat the new liquid "density" signal .		
11.1.	Low flow alarm configuration on FQRC 403 02		
11.2.	Configuration of high flow alarm FQRC 403 02		
12.1.	Configuration alarm on automatic valve SV 405 01		
12.2.	Installation of pressure switch and alarm configuration for low pressure in service		
12.3.	UPS installation for control system		
12.4.	Installation of generator		
12.6.	Quick availability of critical spare parts for the sensors.		
13.1.	Installation of high level alarm for feeding pump locking		
14.1.	Installation of pressure switch alarm		
14.2.	Direct safety valve discharge to a collecting area safe for people and facilities		
14.3.	Installation of pressure switch alarm		

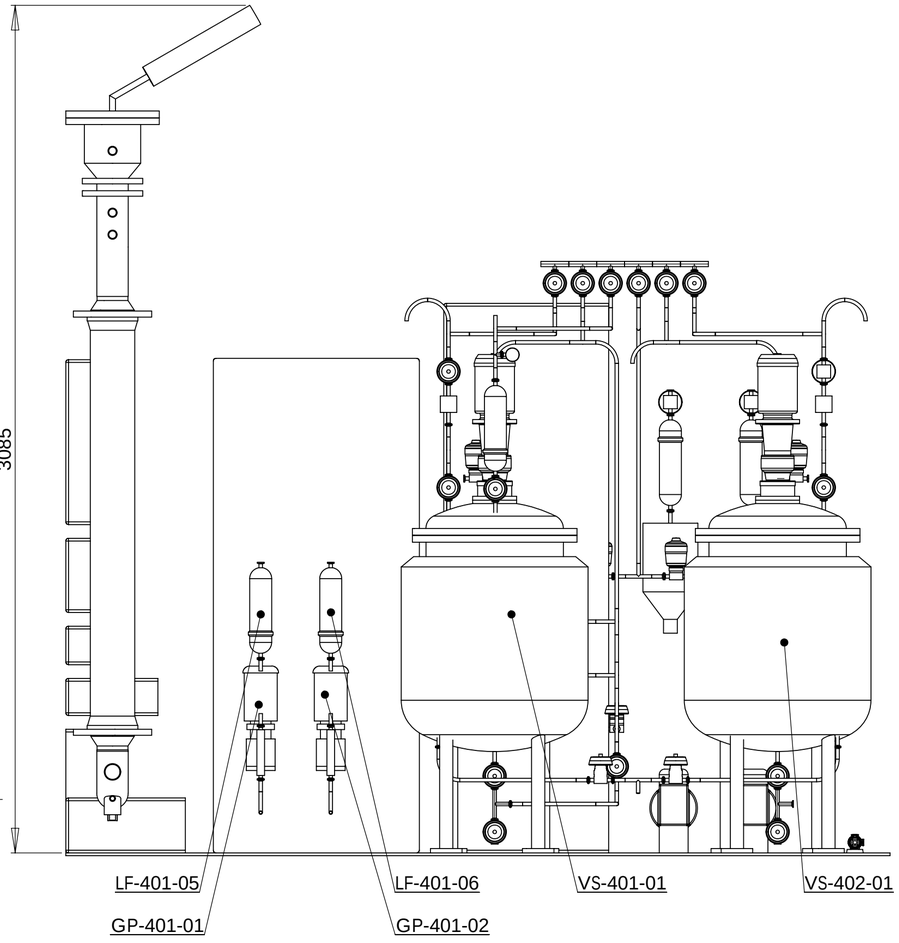
REF	IMPROVEMENT PROPOSAL	Technical answer / clarifications	PERSON RESPONSIBLE
14.4.	Replacing local gauge PI 402 01-vacuum meter.		
15.1.	Installation of high temperature alarm point in TT402 01		
15.2.	Installation pressure switch glycol circuit.		
15.3.	Installation of low temperature alarm point TT402 01		
17.1.	Alarm configuration stirrer failure		
17.2.	Alarm configuration in automatic valve SV434 01		
18.1	Installation of pressure switch and configuration of low alarm.		
18.2.	Installation of pressure switch and configuration of low alarm.		
18.3.	UPS installation for control system		
18.4.	Installation of pressure switch and configuration of low alarm.		

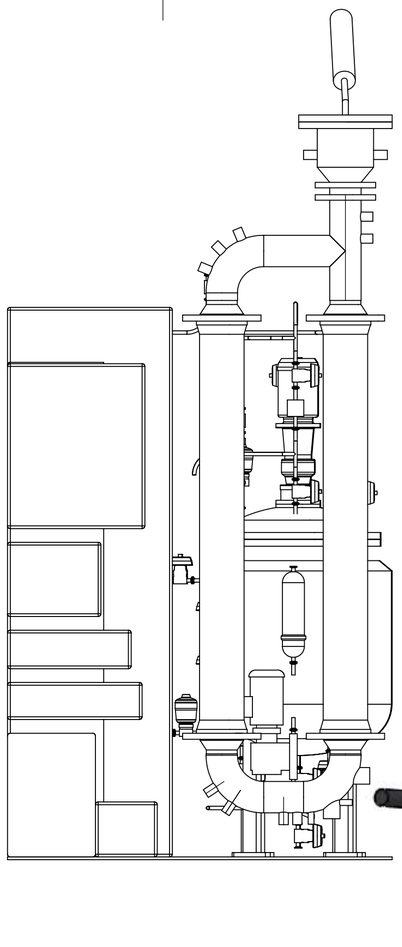
Annex 5

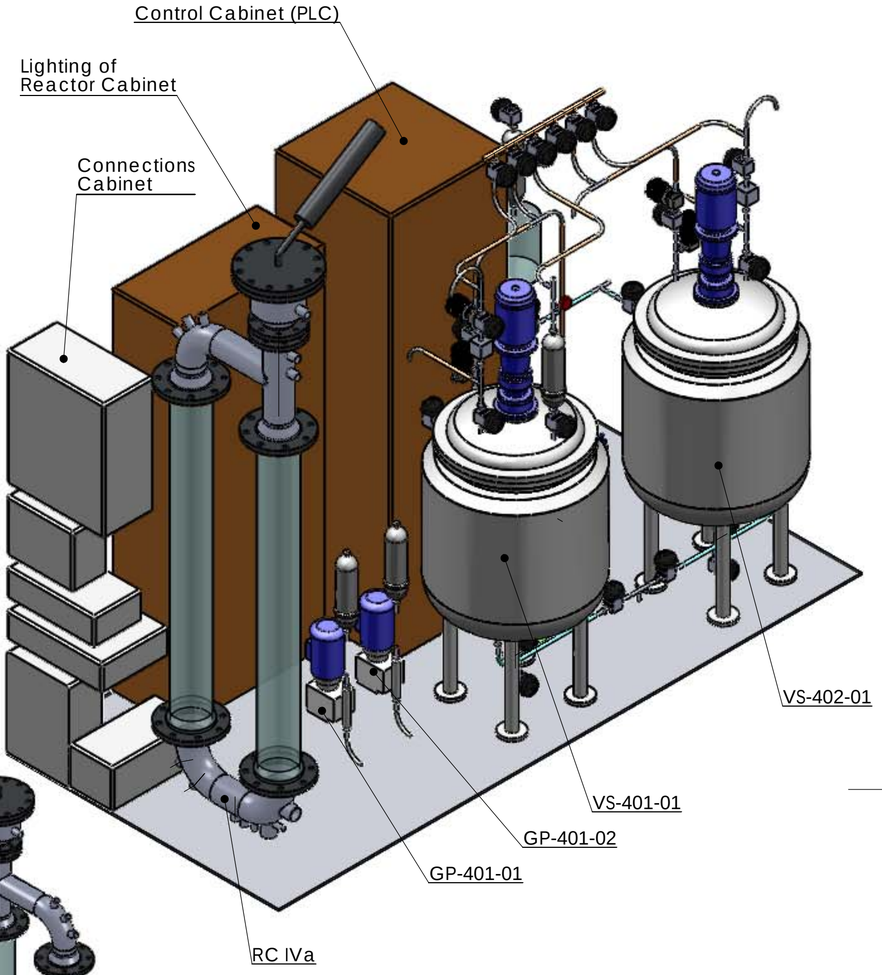
DOCUMENTS USED

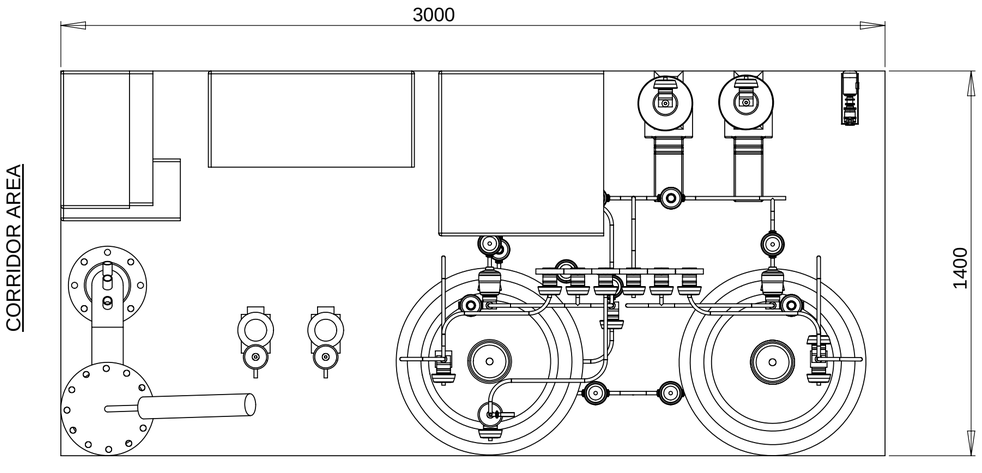
- **DIAGRAM DD-8506-Z1-100-01 rev.J**
- **TECHNICAL SPECIFICATIONS FOR THE RE-DESIGN OF THE Iva COMPARTMENT PILOT REACTOR**
- **TECHNICAL NOTE 37.2 VERSION 1**

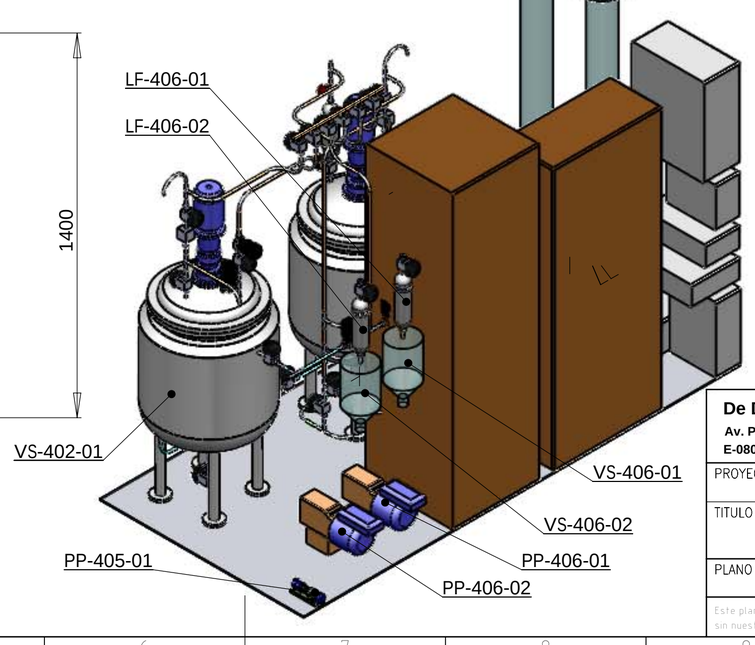
9. ANNEX IV: DRAWINGS











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De Dietrich PROCESS SYSTEMS

Dibujado	D.Tatay
Comprobado	J. Mestre / F. Mangas
Fecha	06/05/08
Referencia	PRK-5257

PROYECTO: Melissa - Compartment IVa -Pilot Reactor

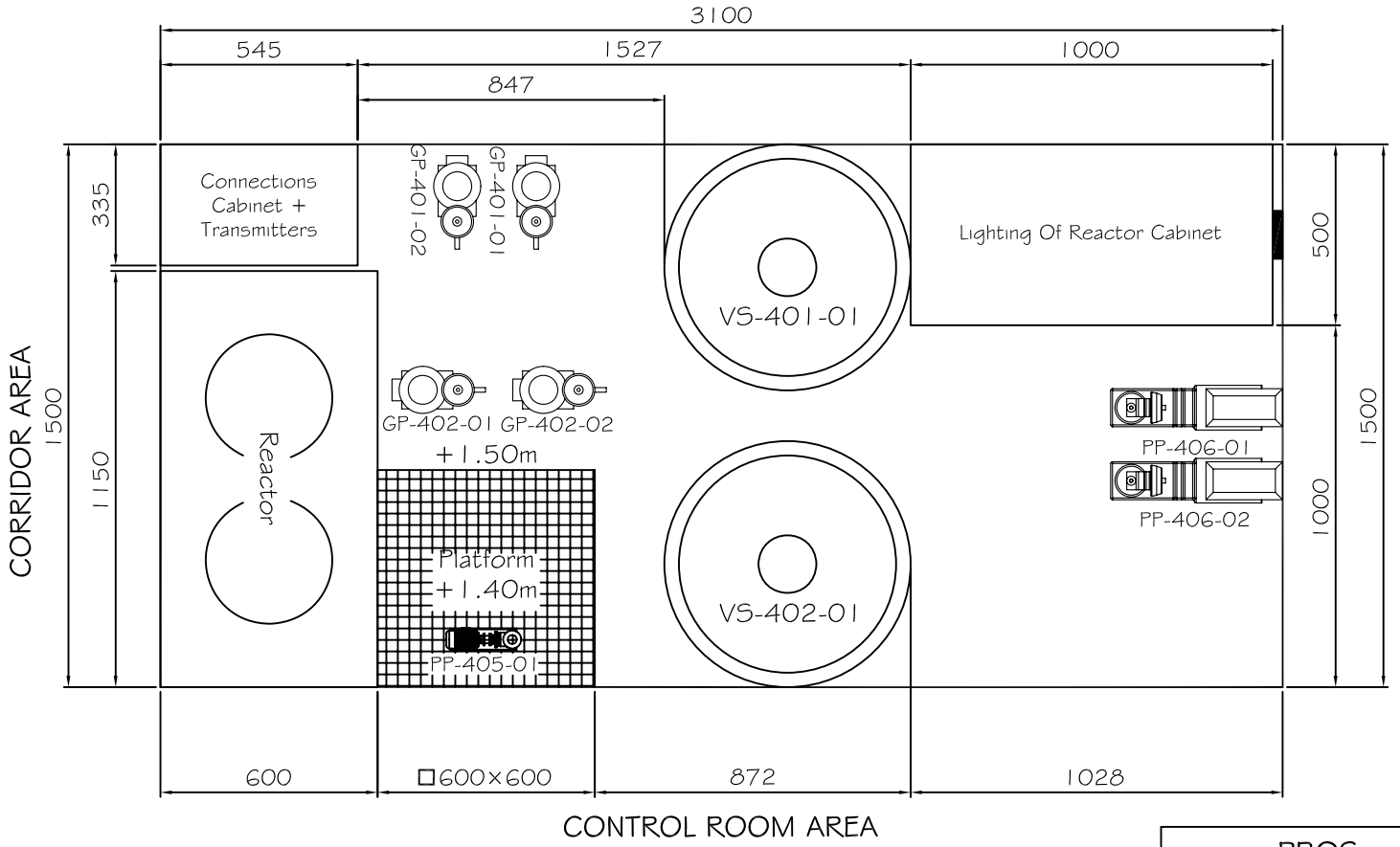
TITULO: General Lay - Out

CLIENTE: Universitat Autònoma de Barcelona

PLANO Nº: DD-8506-Z1-102-01

Revision: C

Escala: 1/15



PROS	CONS
- Integration of the whole unit	- Extra cost of wiring from reactor to lighting cabinet. - Total dimensions - Poor access to the rear face

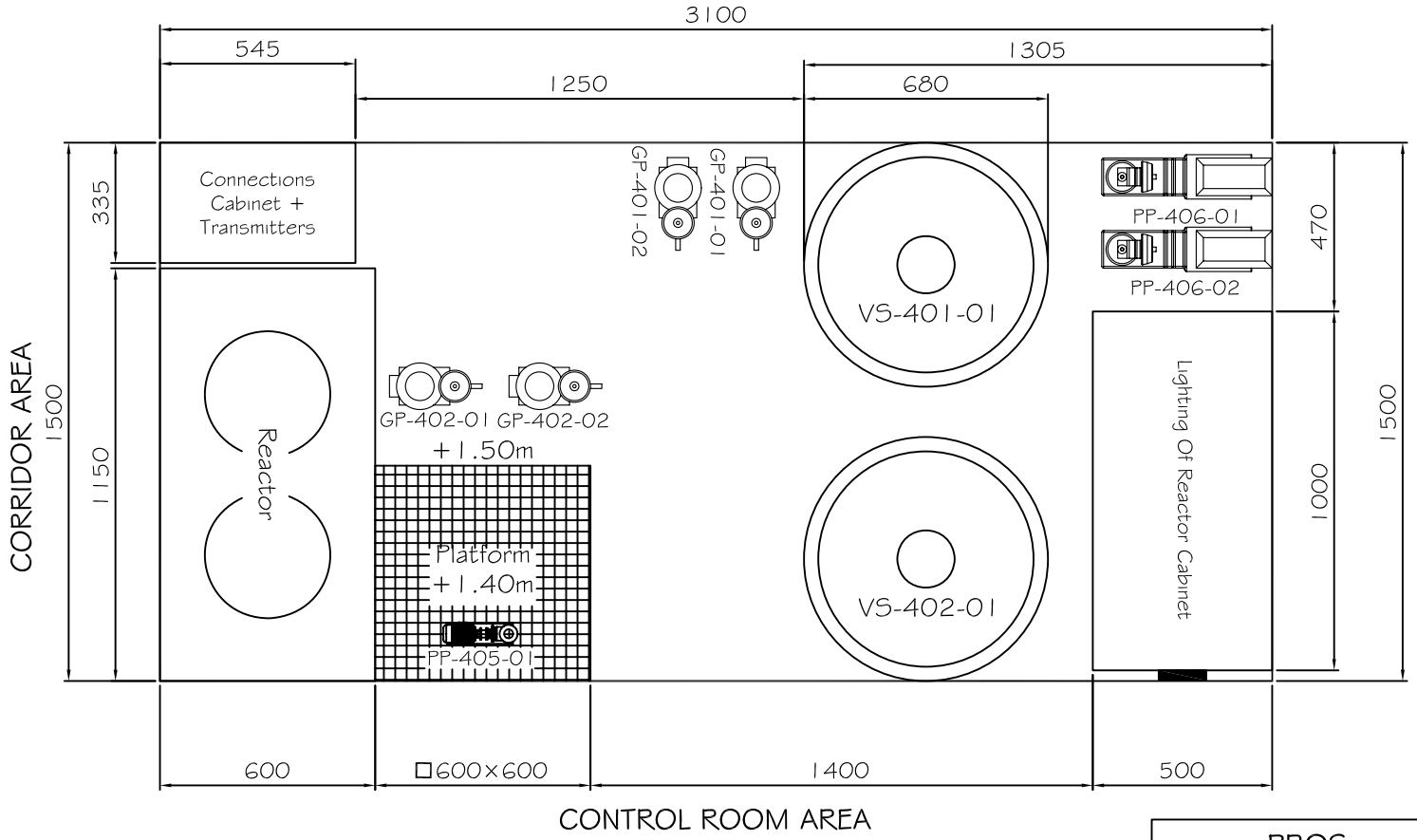
C-IVa // Option D

De Dietrich Equipos Quimicos, S. L.
Av. Princep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

Member of De Dietrich PROCESS SYSTEMS

22/05/2008

Real Lenght: To be Checked



PROS	CONS
- Integration of the whole unit - Pocess site	- Extra cost of wiring from reactor to lighting cabinet. - Total dimensions - Poor access to the rear face

C-IVa // Option E

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E-08012 BARCELONA

Member of De Dietrich PROCESS SYSTEMS

22/05/2008

Real Lenght: To be Checked

Others ◀▶ Project

Gas Outlet

Inlet Steam

Glycol Outlet

Glycol Inlet

Inlet Steam

Process Air Inlet

CO_2 Inlet

Steam

Cooling water

Gas vacuum breaking

Inlet Steam

Liquid Inlet

Service Air Inlet

Glycol Outlet

Glycol Inlet

Others ◀▶ Project

Inoculum Inlet

Bio

Ph

dO_2

RCIVa

Light Supply System

IRC 400 01

Resist Electrical

Inlet Steam

Base Inlet

Acid Inlet

Project ◀▶ Others

Antifoam

Inlet Steam

Service Air Inlet

Glycol Outlet

Inlet Steam

Glycol Inlet

Liquid Outlet

Project ◀▶ Others

Glycol Outlet

Glycol Inlet

Water Inlet

Project ◀▶ Others

AirOutlet

Air Inlet

Air Inlet

Vent

Inert Gas

Process

Drain

Asembly Standard for Filters

Inlet Steam

Sample Valve

Project ◀▶ Others

Drain

Asembly Standard for Sample valves

K	Insrte Gas Line / Folters assemby / Tank Drain	21/07/08	D.Tatay	F.Mangas
I	Change Steam inlet and purge	07/05/08	D.Tatay	F.Mangas
H	Insert Sample Valve Assembly / Sample Valve Symbol	09/04/08	D.Tatay	F.Mangas
E	Air Cooling System/Covering	07/04/08	D.Tatay	F.Mangas
D	Tags Changes	3/03/08	D.Tatay	F.Mangas
C	Steam Circuit–Service Air–Gas Recirculation–Symbol Change	14/02/08	D.Tatay	F.Mangas
B	Steam Circuit–Service Air–Gas Recirculation–Symbol Change	05/02/08	D.Tatay	J.Mestre

De Dietrich Equipos Quimicos, S. L.
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Member of De Dietrich PROCESS SYSTEMS

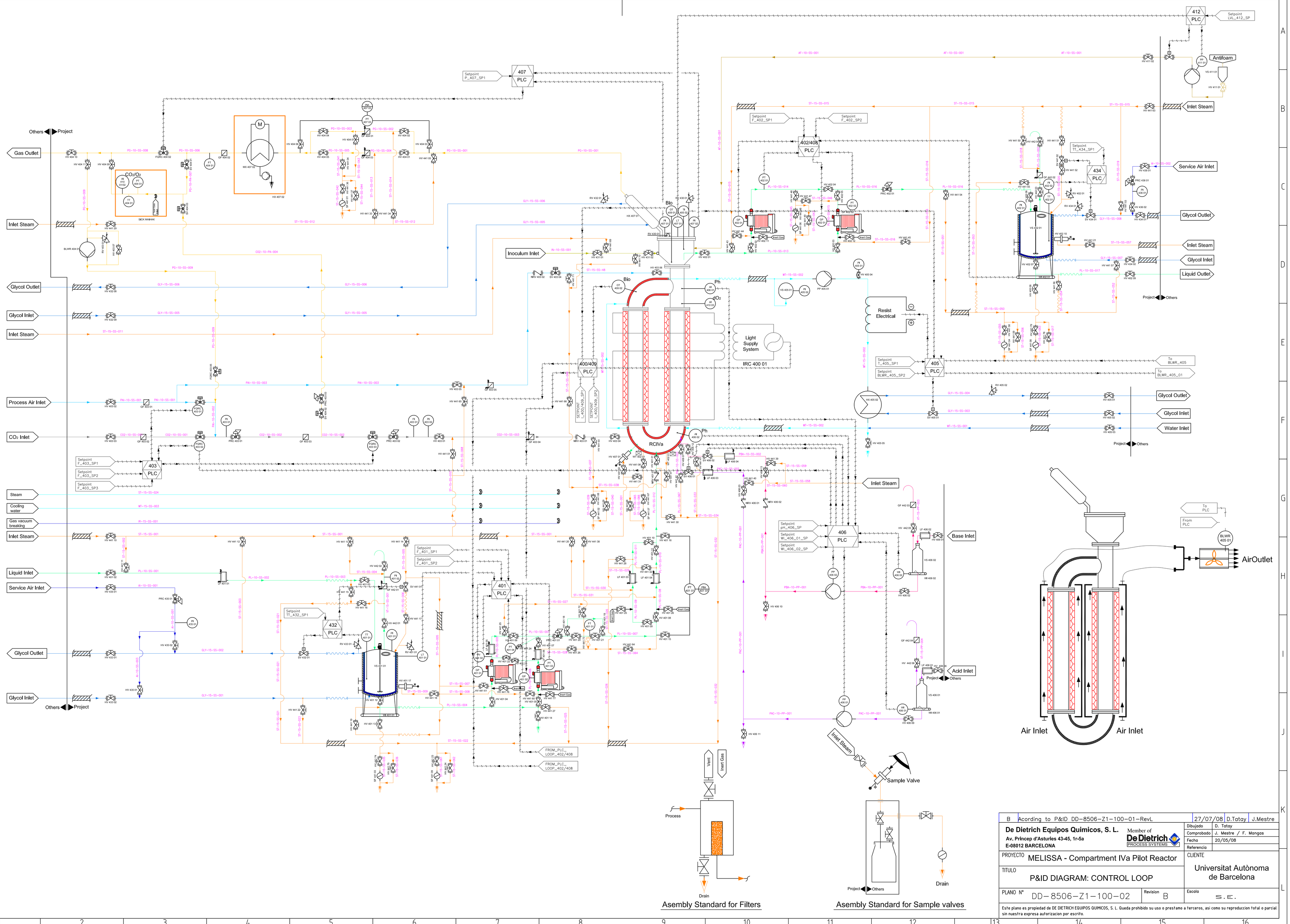
Dibujado	D. Tatay
Comprobado	J. Mestre / F. Mangas
Fecha	20/05/08
Referencia	

PROYECTO: MELISSA - Compartment IVa Pilot Reactor

CLIENTE: Universitat Autònoma de Barcelona

TITULO: P&ID DIAGRAM

PLANO Nº: DD–8506–Z1–100–01 | Revision: L | Escala: S.E.



B	Acording to P&ID DD-8506-Z1-100-01-RevL	27/07/08	D.Tatay J.Mestre

De Dietrich Equipos Quimicos, S. L.
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Member of De Dietrich PROCESS SYSTEMS

Dibujado	D. Tatay
Comprobado	J. Mestre / F. Mangas
Fecha	20/05/08
Referencia	

PROYECTO: MELISSA - Compartment IVa Pilot Reactor

TITULO: P&ID DIAGRAM: CONTROL LOOP

CLIENTE: Universitat Autònoma de Barcelona

PLANO Nº: DD-8506-Z1-100-02 | Revision: B | Escala: S.E.

Others ◀ ▶ Project

Gas Outlet

Inlet Steam

Glycol Outlet

Glycol Inlet

Inlet Steam

Process Air Inlet

CO_2 Inlet

Steam

Cooling water

Gas vacuum breaking

Inlet Steam

Liquid Inlet

Service Air Inlet

Glycol Outlet

Glycol Inlet

Others ◀ ▶ Project

Inoculum Inlet

Bio

Ph

O_2

RCIVa

Light Supply System

IRC 400 01

Resist Electrical

Inlet Steam

Base Inlet

Acid Inlet

Project ◀ ▶ Others

Antifoam

Inlet Steam

Service Air Inlet

Glycol Outlet

Inlet Steam

Glycol Inlet

Liquid Outlet

Project ◀ ▶ Others

Glycol Outlet

Glycol Inlet

Water Inlet

Project ◀ ▶ Others

AirOutlet

Air Inlet

Air Inlet

Vent

Inert Gas

Process

Drain

Asembly Standard for Filters

Inlet Steam

Sample Valve

Project ◀ ▶ Others

Drain

Asembly Standard for Sample valves

B	Acording to P&ID DD-8506-Z1-100-01-RevL	27/07/08	D.Tatay J.Mestre

De Dietrich Equipos Quimicos, S. L.
Av. Princep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

Member of De Dietrich PROCESS SYSTEMS

Dibujado	D. Tatay
Comprobado	J. Mestre / F. Mangas
Fecha	20/05/08
Referencia	

PROYECTO: MELISSA - Compartment IVa Pilot Reactor

TITULO: P&ID DIAGRAM: LINE PIPES STERILIZATION

CLIENTE: Universitat Autònoma de Barcelona

PLANO Nº: DD-8506-Z1-100-03 | Revision: B | Escala: S.E.

Others ◀ ▶ Project

Gas Outlet

Inlet Steam

Glycol Outlet

Glycol Inlet

Inlet Steam

Process Air Inlet

CO_2 Inlet

Steam

Cooling water

Gas vacuum breaking

Inlet Steam

Liquid Inlet

Service Air Inlet

Glycol Outlet

Glycol Inlet

Others ◀ ▶ Project

Inoculum Inlet

Bio

Ph

dO_2

RCIVa

Light Supply System

IRC 400 01

Resist Electrical

Inlet Steam

Base Inlet

Acid Inlet

Project ◀ ▶ Others

Antifoam

Inlet Steam

Service Air Inlet

Glycol Outlet

Inlet Steam

Glycol Inlet

Liquid Outlet

Project ◀ ▶ Others

Glycol Outlet

Glycol Inlet

Water Inlet

Project ◀ ▶ Others

Vent

Inert Gas

Process

Drain

Asembly Standard for Filters

Inlet Steam

Sample Valve

Project ◀ ▶ Others

Drain

Asembly Standard for Sample valves

AirOutlet

Air Inlet

Air Inlet

De Dietrich Equipos Quimicos, S. L.	Member of De Dietrich PROCESS SYSTEMS
Av. Princep d'Asturies 43-45, 1r-5a	
E-08012 BARCELONA	

Dibujado	D. Tatay
Comprobado	J. Mestre / F. Mangas
Fecha	28/07/08
Referencia	

PROYECTO: MELISSA - Compartment IVa Pilot Reactor

CLIENTE: Universitat Autònoma de Barcelona

TITULO: P&ID DIAGRAM: VACUM BREAKING

PLANO Nº: DD-8506-Z1-100-04

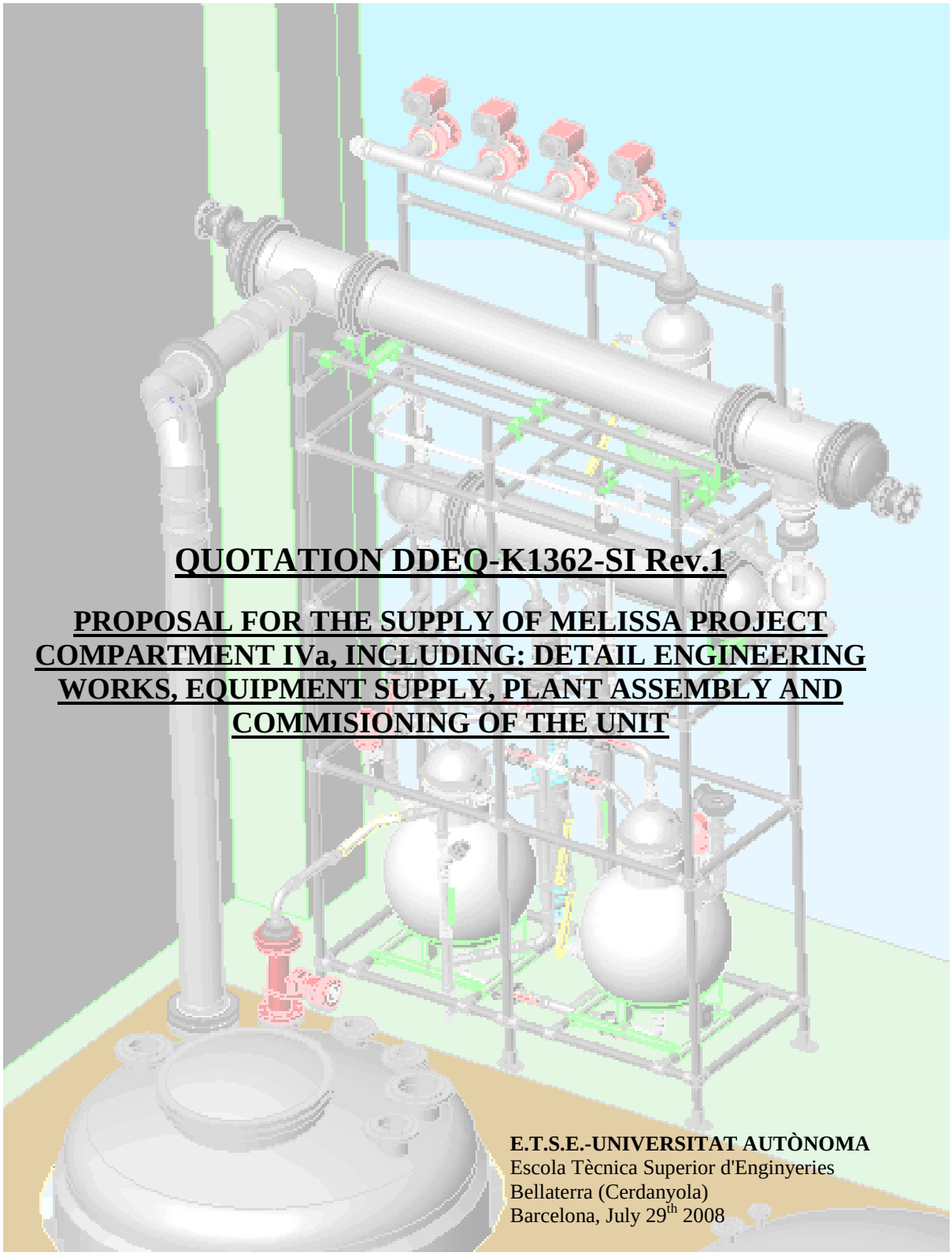
Revision: A

Escala: S.E.

10. QUOTATION

member of De Dietrich PROCESS SYSTEMS

DE DIETRICH EQUIPOS QUÍMICOS S.L.



QUOTATION DDEQ-K1362-SI Rev.1

PROPOSAL FOR THE SUPPLY OF MELISSA PROJECT COMPARTMENT IVa, INCLUDING: DETAIL ENGINEERING WORKS, EQUIPMENT SUPPLY, PLANT ASSEMBLY AND COMMISIONING OF THE UNIT

E.T.S.E.-UNIVERSITAT AUTÒNOMA
Escola Tècnica Superior d'Enginyeries
Bellaterra (Cerdanyola)
Barcelona, July 29th 2008

De Dietrich ROSENMUND QVF

INDEX

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.

- Involve in this research project a pilot plant is installed in the Departament d`Ènginyeria Química de l'Escola Tècnica Superior d`Ènginyeria (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.

- Some of the equipments of the pilot plant have been running in previous test in different countries and research centers. De Dietrich Equipos Químicos, hereafter DDEQ, was commissioned by the UAB for the re-designing and up-date of compartment IVa of the pilot plant, according to DDEQ quotation DDE-K1061-SI.

- The present proposal is based in the documentation and designs generated during this engineering works development.

- The proposal includes the following concepts:

- Carry out the required detailed 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 and maintenance manual, of the plant

2.- QUOTATION BASIS

To make this proposal the following documents coming from the re-designing works of MELISSA – Compartment IVa Pilot Reactor, have been used:

- P&ID Diagram DD-8506-Z1-100-01 Rev. L

- Main Equipments list Rev. B

- Valves, filters and accessories list Rev. F

- Lines list Rev. F
- Instruments list Rev. F
- Main Equipments Technical Specification Rev. C
- Instruments Specification Rev. F
- Digital and Analog signals Rev. B
- Investment Budget Rev. I

3.- SCOPE OF SUPPLY

3.1.- Detail Engineering Contents

The Investment Budget has been calculated considering a Detail Engineering pakect of 450h 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. Constructive drawings of:
    - Liquid storage tanks
    - Reactor
    - Frame, supports and skid
7. Sufficient drawings for the pipe assembly
8. Final detailed control functional description.
9. Prepare the "Test Protocols" for start up and commissioning
10. Electrical diagrams for the new electrical cabinet. CE marking and legalization of the new cabinet.
11. CE marking and legalization of the existing electrical cabinet for the reactor lighting
12. CE marking and legalization of the reactor and liquid storage tanks.
13. Machines and Equipment Security Evaluation, made by ICICT, S.A. (TÜV Rheinland Group), for a Pilot Plant installed at the UAB facilities in Cerdanyola del Vallès.

Note: A notified body was asked about the necessity of CE marking and legalization for the whole pilot unit. Their answer was uncertain but they do not think the machinery directive might have full application due to the fact that:

- It is an experimental pilot unit
- It is not a serial fabrication
- It is not a plant for commercialization

The notified body thinks that it would be enough to make 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

The notified body proposes 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.

3.2.- Manuals:

The manuals will be issued in English once points 1 to 8 of the Detail Engineering are approved by the UAB.

3.2.1.- Operation Manual:

The Operation Manual will contain:

- Detailed Operation Sequences:
  - Plant Start-up. Description by homogeneous conjunctions:
    - Liquid feeding
    - Reactor start-up
    - Liquid harvesting
    - pH control reactive addition
    - Gas feeding
    - Gas outlet regulation
    - Temperature regulation in the jacketed equipment.
  - Plant Stop. Description by homogeneous conjunctions:

  - Gas feeding stop
  - Gas outlet stop
  - Liquid feeding stop
  - Liquid harvesting stop
  - Reactor stop
  - Jackets Heating/cooling systems stop
  - pH control reactive addition stop
- Microorganism inoculation sequence
- Pumps and filters installed in Stand-by change sequence.
- Sterilization:
  - Tanks sterilization
  - Reactor sterilization
  - Pumps sterilization
  - Filters sterilization
- Equipment cleaning sequence

- Control Loops Description and Initial Settings of process parameters. The optimization and fine adjustment of the settings will be responsibility of the UAB. If during the optimization and adjustment of the settings problems might arise due to the equipment supply, DDEQ will provide assistance to the UAB team.

- Alarms Description and Initial Set Points. The alarm management protocol will be responsibility of the UAB.

3.2.2.- Maintenance Manual

- Check list of standard controls to be executed by the plant operator

- Compilation of operation and maintenance manuals and technical documents provided by the different suppliers of the equipment installed in the plant.

- Spare part list for two years operation

3.3.- Turn-key supply of the pilot unit

- Turn-key supply of the mechanical and electrical equipment corresponding to the Compartment IVa 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.

- Erection and installation of the unit at UAB laboratories at Cerdanyola del Vallés
- 2 Copies of the final dossier

3.4.- Test and commissioning of the Pilot Unit

The following tests have been considered for the plant start-up based on a scheduled commissioning of seven (7) working days. The foreseen test team is:

- Project Engineer (DDEQ)
- Erection Manager (DDEQ)
- Mechanic official (Contractor)
- Electrical official (Contractor)

The works to be done are:

- Hydrostatic test with water for the liquid tanks and lines as well as the reactor.
- Pressure test with compress air of the Gas lines and reactor.
- 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.
- Check of the spin direction of motors and correct power supply to the sensors.
- Test of the lighting system of the reactor and the new air cooling equipment.
- Initial configuration of instruments and sensors. Check alarm contacts and signals, up to the new electrical cabinet of our supply.
- Test certificates and protocols filled up with the results.

- 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, CO_2, water,…)
- Electrical connection of the electrical cabinet of new supply for the pilot unit of compartment Iva and the PLC cabinet, and from the PLC cabinet to the control room computer. Neither the main power supply from UAB general line to the new cabinet and the reactor lighting cabinet is included.
- Communication test between the electrical cabinet of new supply for the pilot unit of compartment IVa and the PLC cabinet, and from the PLC cabinet to the control room computer.
- Commissioning of the PLC program and the DCS system implemented in the control room computer. Neither the operation manual of these elements is included.
- Further engineering works, out of what is clearly stated in the present proposal, as per example:

  Note: 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

  - Isometric drawings of the pipes
  - 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.

    Note: If necessary and required, 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 inportant changes over the approved detail constructive project.

  - Assistance and coordination with the Control Engineering involve in the project. A kick off meeting with the control contractor selected by UAB will be held at

the UAB in order to clarify all the information provided by DDEQ to this contractor (sensor list, alarms, automatic valves list, control loops,…).

- Engineering works to assure the right integration of the different modules of the Melissa loop.
- Environmental engineering concerning liquid or gaseous effluents
- Edition of Plant Operation Protocols for the field Operator
- Edition of Operational Emergencies and Alarms Management Protocol
- Edition of Sensor and Instrument Calibration Protocol
- Further Risk Analysis over the HAZOP presented with the Basic Engineering and 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:
  - Check over the operational sequences, one by one.
  - Commissioning of the equipment with real process fluids.
  - Sterilization of the plant prior to its start-up in prodcution
  - Cost of start-up by the manufacturer of certain sophisticated instruments.
  - Once the commissioning phase is finished:
    - Optimization of the initial Control Settings and Alarm Set Points
    - Optimization of the Maintenance sequences and Cleaning instructions
  - Others

5.- PRICE AND PAYMENT CONDITIONS

5.1.- Price of the plant

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

NET PRICE (VAT excluded): -.402.931€.-

In the same Budget Rev. H included as Attachment 1 there are several alternatives thay will impact the final price, depending on the UAB final decision. Therefore, the above price is not fixed until the final supply is clarified by the UAB.

Note: The above price is a "base price" that will allow the UAB/Melissa to place an order to DDEQ in order to fulfill the required delivery schedule. This "base price" might go up or down slightly depending in minor changes during execution of the job. All the changes that might impact the "base price" must be agreed between DDEQ and the UAB/Melissa, in order to reach a monetary balance at the end of the project, in favor of whatever of the parts.

5.2.- Daily rates for special assistance or test

Any further assistance, out of what is clearly stated in this quotation, required by the UAB 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:

Senior Engineer (mechanical or electrical/control):	740 €/day
Mechanic:	485 €/day
Electrician:	485 €/day
Travel expenses:	According to destination

5.3.- Orders and Payment conditions

DDEQ proposes the following payment conditions:

25% down payment at order placement, payment no later than October 20th.

40% at delivery of points 1 to 8 of the Detail Engineering as stated in point 3.1, payment at 90 days after invoicing

30% at conclusion of the equipment installation at the UAB facilities at Cerdanyola del Vallès

5% at the conclusion of the commissioning as stated in point 3.4, payment at 90 days after invoicing.

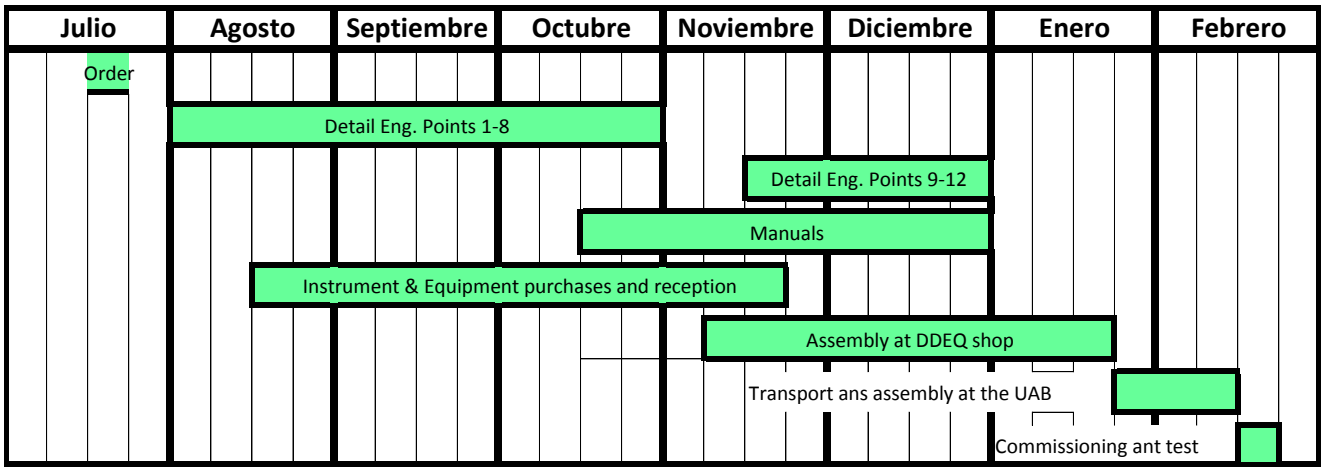
6.- PROPOSAL VALIDITY

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

7.- PLANNIG OF THE PROJECT

In practice the development of the Project will be mainly influenced by UAB/ESA final decisions about different design alternatives and the delays in deliveries due to vacation period during summer.

Assuming an optimal schedule in the development of the project, the schedule would be:



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 of 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 for 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.

All the components and equipment used in the plant will be at the state of the art, so spares and after sales services will be assured for at least 5 years.

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 3.4 are finished satisfactorily and the final dossier and manuals are delivered to the UAB.

- Design will be implemented under the guidelines and process requirements provided by the UAB, and according to the good engineering practices known by DDEQ. UAB assumes that might be slightly changes in the behavior of the unit due to changes over the existing design.

- 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 UAB.

- 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.

- The UAB 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 UAB to DDEQ.

10.- CONFIDENTIALITY

All documents, data and information of the Project shared between UAB 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).

Barcelona, July 29th 2008
DE DIETRICH Equipos Químicos,S.L

Fdo. Albert Pujol	Fdo. Roberto de Miguel	Josep Mestre
Dtor. General	Dtor. Comercial	Dtor, Técnico

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Barcelona, July 29th 2008
DE DIETRICH Equipos Químicos,S.L

Fdo. Albert Pujol	Fdo. Roberto de Miguel	Josep Mestre
Dtor. General	Dtor. Comercial	Dtor, Técnico

11.- ANNEX 1. INVESTMENT BUDGET

De Dietrich Equipos Químicos, S.L.
Av. Princep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

COST MATERIAL LIST

CUSTOMER:	**UAB**		DATE	06/05/2008
PROJECT:	**MELISSA - COMPARTMENT C IVa**		REF.	PRK-5257
DRAWING:	**DD-8506-Z1**	REV.: H	PREPARED	F.M.P.

TAG	REF.	DESCRIPTION	QUANT.	COST
		EQUIPMENT		
		Reactor in glass-stainless steel of 70 l capacity. Modification and adjustment of the existing one to the new requirements	1	12.800,00 €
		Stainless steel tank with jacket and agitator with magnetic seal. 150 lts.	1	36.769,23 €
		Feeding and Harvesting pumps of liquid. Mod. Ecodos 0,25kW - Sanitary. Manufacturer: Lewa	3	7.485,00 €
		Recirculation of gases compressor to reactor - Manufacturer: KNF	1	375,00 €
		Post-Cooler - Manufacturer: Sick Maihak	1	6.041,85 €
		Electrical heater of 5kW 230Vca for reactor temperature control	1	300,00 €
		Expansion vessel of reactor temperature control circuit	1	591,27 €
		Glass vessels 2 l capacity (acid and base)	2	384,00 €
		Air refrigeration system for reactor, including air fan.	1	6.716,42 €
		Transport and inspection of equipments	1	3.875,00 €
		TOTAL COST EQUIPMENTS		**75.338 €**
		SUPPLY AND MECHANICAL ASSEMBLING		
		1-Assembling of equipments. Construction and assembling of pipes and accessories/fittings	1	*51.553,33 €*
		2- Materials for pipes construction and accessories.Metalic support structure AISI304.	1	*22.566,67 €*
		2a- Platform . Structure in AISI304.	1	*8.266,67 €*
		3- Tests and small modifications at assembling	1	*4.666,67 €*
		4- Filters -Supplier: Dominick Hunter	1	*19.577,13 €*
		5- Valves		
		a) Diaphragm valves DN15 weld	64	*14.856,53 €*
		b) Diaphragm valves DN10 weld	76	*14.703,47 €*
		c) Ball valves + "Flanges" DN15	39	*4.888,00 €*
		d) Ball valves in PP, DN10	6	*320,00 €*
		e) Substitution of existing Bioengineering valves, DN15 (diaphragm valves DN15)	10	*1.975,60 €*
		f) Innoculum valve	1	*1.674,25 €*
		g) Sampling valve	3	*2.172,00 €*
		h) Inlet of steam to instruments + sampling valves	7	*280,00 €*
		i) Check valves	5	*2.213,20 €*
		j) Pressure reducing valves for liquids	2	*213,33 €*
		k) Pressure reducing for gases	4	*800,00 €*
		l) Bursting Disc	0	*0,00 €*
		m) Safety Valves - Sanitary design	4	*2.746,67 €*
		n) Safety Valves	4	*1.169,60 €*
		o) Steam trap type SARCO	7	*1.121,49 €*
		p) Counterpressure valve JESCO for mettering pumps	2	*402,67 €*

De Dietrich Equipos Químicos, S.L.
Av. Princep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA

COST MATERIAL LIST

CUSTOMER:	**UAB**		DATE	06/05/2008
PROJECT:	**MELISSA - COMPARTMENT C IVa**		REF.	PRK-5257
DRAWING:	**DD-8506-Z1**	REV.: H	PREPARED	F.M.P.
TAG	REF.	DESCRIPTION	QUANT.	COST
		q) Tray for liquid leakages collection	1	*s/c*
		s) Negative value for part utilization of existing support frame	1	*-1.250,00 €*
		TOTAL COST (SUPPLY AND MECHANICAL ASSEMBLING)		**151.488 €**
		SUPPLY AND ELECTRICAL ASSEMBLIES		
		1-Electrical works for adequacy of lighting system of the reactor		
		a) Supply and assembly, in light supports, of a whole of 14 profiles in S. steel, length 2200mm, for protection of the wired up current cables.	1	2.450,37 €
		b) Supply and assembly of protection cases for cables, from the outlet of the support frames on the top of them, to the connector type harting. (16 units).	1	1.973,33 €
		c) Supply and assembly of cases for protection of cables from the outlet of the electrical enclosure up to the last existing conectors harting to Electrical cabinet.	1	3.697,78 €
		d) Remodeling of the electrical cabinet including following actions and works: Substitution of transformer, substitution of ventilation and repair of exterior part of the cabinet	1	3.540,74 €
		d) Supply, assembly and protector's hookup of overvoltage and suppressing of transitory to fulfill the board(directive) of electromagnetic compatibility. Update of the electrical design in conformity with the board(directive) CE. Marked and declaration of conformity CE. (In fulfillment of the regulation of low tension, electromagnetic compatibility and safety of machines).	1	5.423,70 €
		2- Refrigeration device for the lighting system of the reactor		
		a) Supply of an electrical cabinet, dimensions about 600x500x250mm, to be mounted close to the reactor, mechanized, connection with the following elements and components: Plate of assembly, frequency variator for ventilator of 1,5kW, 2 frequency variators for vessel agitators, 0,37kW (in/out 4/20mA), electrical protections, general switch, stop emergency, 4 potentiometers for flow regulation of air and agitation speed, 2 automatic / manual selectors for agitators, connection points, small electrical devices and wiring, including electrical diagrams and mark according CE.	1	11.840,00 €
		b)Installation and electrical connection. Tests and commissioning.	1	6.925,93 €
		TOTAL COST (SUPPLY AND ELECTRICAL ASSEMBLING)		**35.852 €**
		INSTRUMENTS / FIELD CONTROL EQUIPMENTS		
		a) Scales for tanks. Accuracy: 200g.Manufacturer: Mettler Toledo	1	3.431,76 €
		a.1)Scales for acid/base vessels without 4/20mA outlet. Manufacturer: Mettler Toledo	2	668,24 €
		a.2)Level detector for tanks VS401 01 . Guided microwave type.Manufacturer: **Vega**	1	781,07 €
		b) Loading cells for reactor. Accuracy: 50g Manufacturer: Mettler Toledo	1	4.308,24 €
	OT 409 01, OT	c) Biomass Analyzer, model InPro 8200 from Mettler Toledo	1	7.588,24 €
	AI 410 03	e) Solved Oxygen analyzer. Manufacturer: Mettler Toledo	1	2.855,29 €
	AI 406 01 / 02	f) pH Analyzer. Manufacturer: Mettler Toledo	1	5.131,76 €
	FI 404 01	h) Total outlet massic gas, local flowmeter	1	1.176,47 €
	FT 401 01/ 02	i) Coriolis mass flowmeters for líquid inlet to reactor,model Promass83A01 Coriolis. Manufacturer: E&H	1	5.176,47 €
	LT 407 01	j) Switching Vibronic (foam detection) .Manufacturer: Vega	1	1.058,82 €
	PI405 02	k) Pressure gauge	1	105,88 €

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CUSTOMER:	**UAB**		DATE	06/05/2008
PROJECT:	**MELISSA - COMPARTMENT C IVa**		REF.	PRK-5257
DRAWING:	**DD-8506-Z1**	REV.: H	PREPARED	F.M.P.

TAG	REF.	DESCRIPTION	QUANT.	COST
	PI 407 01	l) Pressure transmitter in to the reactor	1	1.188,89 €
	PI 407 02	m) Pressure transmitter in to the reactor	1	1.188,89 €
	PI 404 01	m') Pressure transmitter in analyzer system (outlet gas)	1	1.188,89 €
	PT 407 03	n) Differential Pressure transmitter in the outlet gas filter from the reactor, model Deltabar from E+H	1	1.999,41 €
	PT 401 04	ñ) Differential Pressure transmitter for liquid prefilters to reactor, model Deltabar, from E+H	1	1.999,41 €
	PT 401 01	o) Differential Pressure transmitter for liquid filters to reactor, model Deltabar from E&H	1	1.999,41 €
	PT 401 02 / 03	p) Pressure transmitter at the outlet of feeding pumps of liquid to reactor.Model Ceraphant from E+H	2	941,18 €
	PT 402 01 / 02	q) Pressure transmitter at the outlet of feeding pumps of liquid to reactor.Model Ceraphant from E+H	2	941,18 €
	PI 401 01, 402 01, 435 01, 436 01	r) Pressure gauge	13	1.376,47 €
	TT 401 01, 402 01, 404 01	s) Temperature transmitter ,model TR 45 (PT-100) from E+H	3	1.411,76 €
		s1) Pod stainless steel for the temperature transmitter	3	705,88 €
	SV 405 01, 432 01, 434 01	t) Solenoid cooling wateroutlet ball valve	3	960,00 €
	SV 441 01, 441 02	u) Cooling water outlet valve ball	2	640,00 €
	SV 406 01, 406 02	v) acid/base inlet diaphragm valve	2	978,82 €
?	**FQRC 403 04**	w)Automatic ball valves	1	320,00 €
?	**SV 404 02, 404 01 404 03**	w) Automatic diaphragm valves	3	1.468,24 €
?	**FQRC 404 02**	w) Flow Controllers (Analyzer system)	1	1.680,24 €
		x) Transport / inspection	1	1.171,76 €
		TOTAL INSTRUMENTS /EQUPMENT OF CONTROL IN FIELD		**54.443 €**
		Note: Not included adicional cost of configuration and start up of those instruments that need it		
		OTHER CONCEPTS		
		PAINT + GENERAL REVISION	1	
		INSULATION (PIPES OF STEAM, CONDENSATE AND GLYCOL)	1	
			COST	**9.600 €**
		DETAIL ENGINEERING + COMMISSIONING		
		DETAIL ENGINEERING ACCORDING TO POINT 3.1 IN QOUTATION DDEQ-K1362-SI	1	**25.333 €**
		MANUAL ACCORDING TO POINT 3.2 IN QUOTATION DDEQ-K1362-SI AND FINAL DOSSIER	1	**14.400 €**
		PLAN SAFETY AND HEALTH IN WORK	1	**1.600 €**
		COORDINATION OF ASSEMBLING WORKS AT FIELD	1	**4.811 €**
		COMMISSIONING ACCORDING TO POINT 3.4 IN QUOTATION DDEQ-K1362-SI	1	**9.333 €**
				55.477 €
		EXTRA COS ING. BASIC ENGINEERING	1	**8.600 €**
		CE CERTIFICATE FOR THE REACTOR	1	**3.800 €**
		CERTIFICATE FOR THE WHOLE INSTALLATION ACCORDING TÜV SPECIFICATIONS	1	**8.333 €**

De Dietrich Equipos Químicos, S.L. Av. Princep d'Asturies 43-45, 1r-5a E-08012 BARCELONA		COST MATERIAL LIST		
CUSTOMER:	**UAB**		DATE	06/05/2008
PROJECT:	**MELISSA - COMPARTMENT C IVa**		REF.	PRK-5257
DRAWING:	**DD-8506-Z1**	REV.: H	PREPARED	F.M.P.
TAG	REF.	DESCRIPTION	QUANT.	COST
				20.733 €
		COSTE INGENIERIA		**76.211 €**
		TOTAL COST OF THE PROJECT		**402.931 €**
		EXCLUDED		
		* CONCEPTS NOT INCLUDED IN THE VALUATION (COST LIST)		