MELiSSA

TECHNICAL NOTE 87.2.11
Part II

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Part II: CIVa Final detailed engineering datapackage

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Reference/Réference	MELiSSA Pilot Plant Frame Contract 19445/05/NL/CP
Issue/Edition	0
Revision/Révision	0
Date of issue/Date d'édition	15/04/10
Status/Statut	Final

MELiSSA

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APPROVAL

Title *Titre*	**CIVa Final detailed engineering datapackage**	Issue Edition	0	Revision Révision	0

Prepared by *Auteur*	Gubern, J. and Mestre, J. (DeDietrich Equipos Químicos, S.L.) Peiro, E. (MELiSSA Pilot Plant)	Date *Date*	15/04/10

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Approved by *Approuvé par*	Gòdia, F.	Date *Date*	15/04/10

Approved by customer *Approuvé par le client*	Lamaze, B.	Date *Date*	15/04/10

CHANGE LOG

Issue/*Edition*	Revision/*Révision*	Status/*Statut*	Date/*Date*
0	0	final	15/04/10

Distribution List

Name/*Nom*	Company/*Société*	Quantity/*Quantité*
Brigitte LAMAZE	ESA	2 hardcopies + electronic version

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1. OPERATION MANUAL

1. INTRODUCTION – SYSTEM DESCRIPTION

1.1. The MELiSSA Project

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

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

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

Each compartment has a given objective within the complete biotransformation loop.

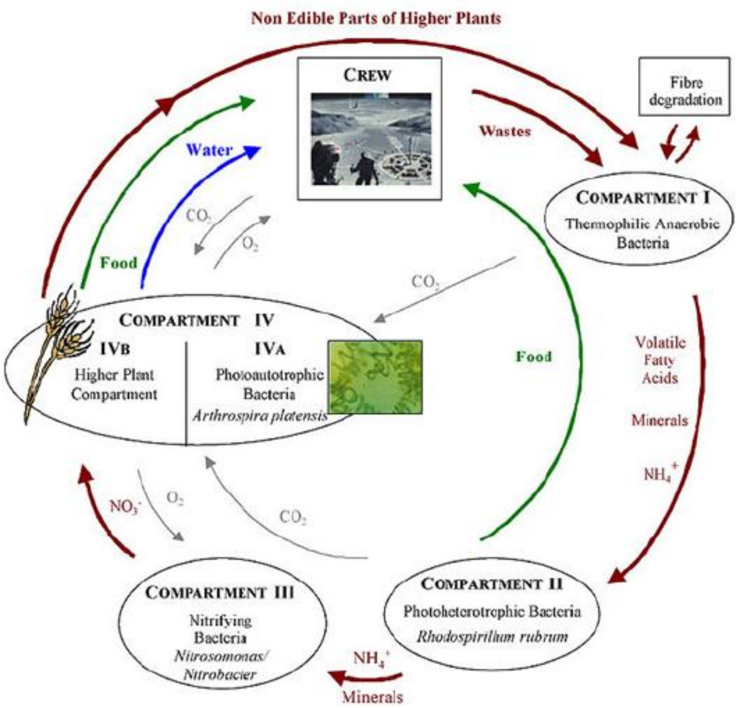


Figure 1: Melissa Advanced Loop Concept

1.2. Compartment IVa description

This compartment is based on a Photosynthetic reactor. Its inputs are the liquid phase of the CIII compartment and the gas outputs of the other compartments via a buffer tank. This compartment's main function is to convert Nitrates and CO_2 into edible Biomass and O_2.

1.2.1 Main functions:

- Produce O_2 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 O_2 to CIII and CIV
- Deliver edible biomass to crew (CV)

1.2.2 **Inputs:**

Compartment CIVa is fed with nitrate in liquid phase and with air and CO_2 in gas phase. The liquid phase input is delivered by two buffer tanks alternately supplying the bioreactor to allow its continuous stand alone operation.

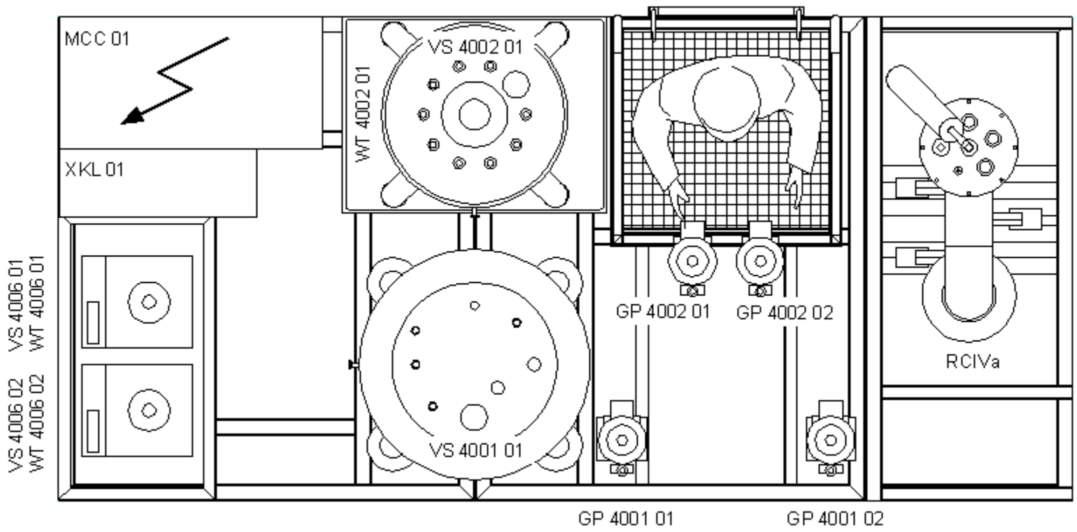
1.2.3 **Strains:**

The process in this Compartment is carried out with *Arthrospira platensis*, photoautotrophic microscopic algae. This compartment transforms mainly Nitrate and O_2 into edible biomass and O_2.
CIVa will meet the quality standards applicable to human metabolic consumables (including biosafety standards), be it for O_2 or edible biomass (in particular low nitrite content).

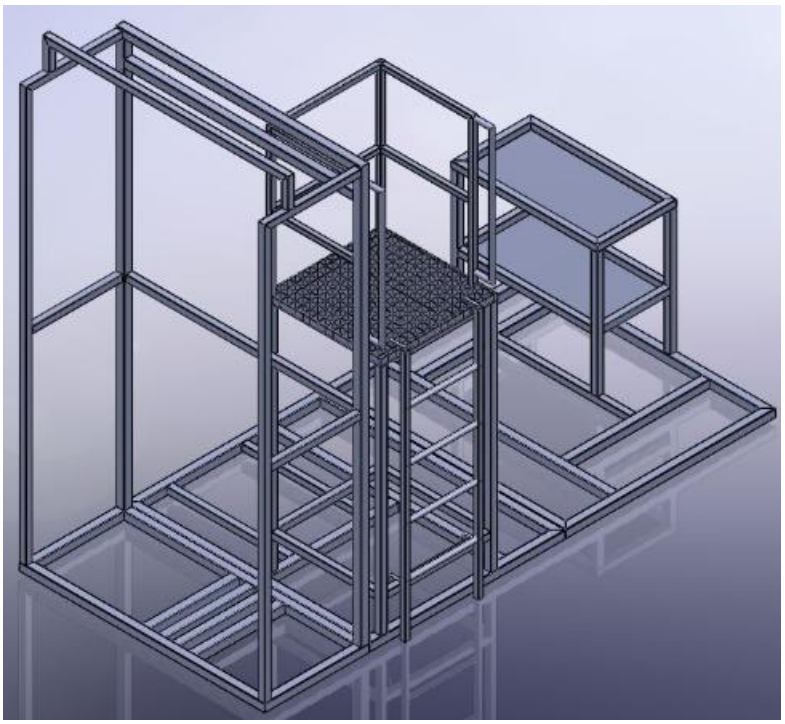
1.2.4 **Output:**

The output of the process is in the form of O_2 in gas phase and edible biomass in solid phase after harvesting of Arthrospira. O_2 is then used by CV and non edible part of the solid phase is intended to be reinjected into CI, along with some CIVa liquid phase output.

1.3. Compartment IVa Skid



The plant is mounted in a skid of 3075 x 1475 x 3265 mm that consists of three detachable parts. The reason for this fact is that is necessary for going through the MPP door.



2. COMPONENT DESCRIPTION

2.1 Feeding tank (VS 4001 01)

This tank consists of:

- a cylindrical and vertical hoop of external diameter 512 mm, 6 mm of thickness, and 725 mm length, manufactured in stainless steel 316L. On bottom, hoop is welded to a torispherical and on top hoop is welded to a flange of thickness 40 mm. There are different nozzles for steam inlet, liquid inlet and outlet, vent outlet, instruments, valves and others.

- a cylindrical and vertical jacket of external diameter 600 mm, with thickness of 4 mm and 531 mm of length with two connections for glycol/steam inlet and outlet.

- a cylindrical and vertical insulation hoop of external diameter 704 mm, with thickness of 2 mm and 640 mm of length. The material for the insulation is Rock Wool.

The design conditions of the tank are:

- ✓ Hoop Design pressure = -1/6 bar
- ✓ Jacket Design pressure = -1/6 bar
- ✓ Hoop Design temperature = 170 ºC
- ✓ Jacket Design temperature = 170 ºC

The tank has been designed according to ASME section VIII Division I code.

The internal volume of the reactor is 160L and the volume of the jacket, 37L. All parts in contact with the product are constructed in AISI 316L with a roughness lower than 0.5 µm.

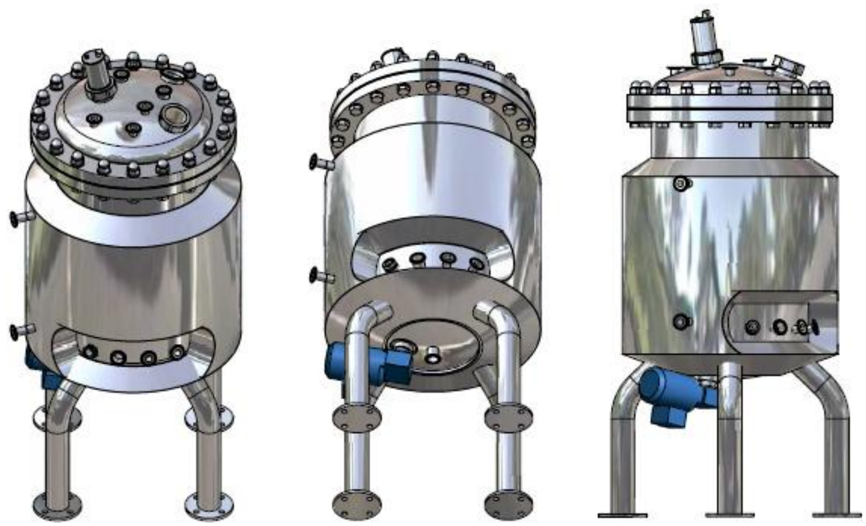
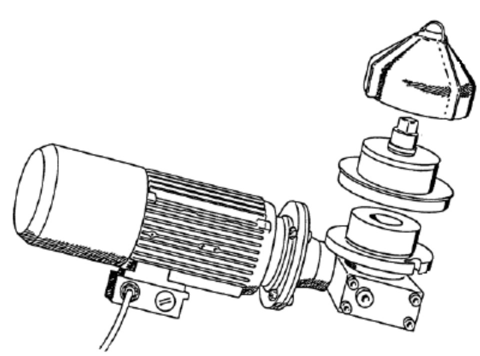
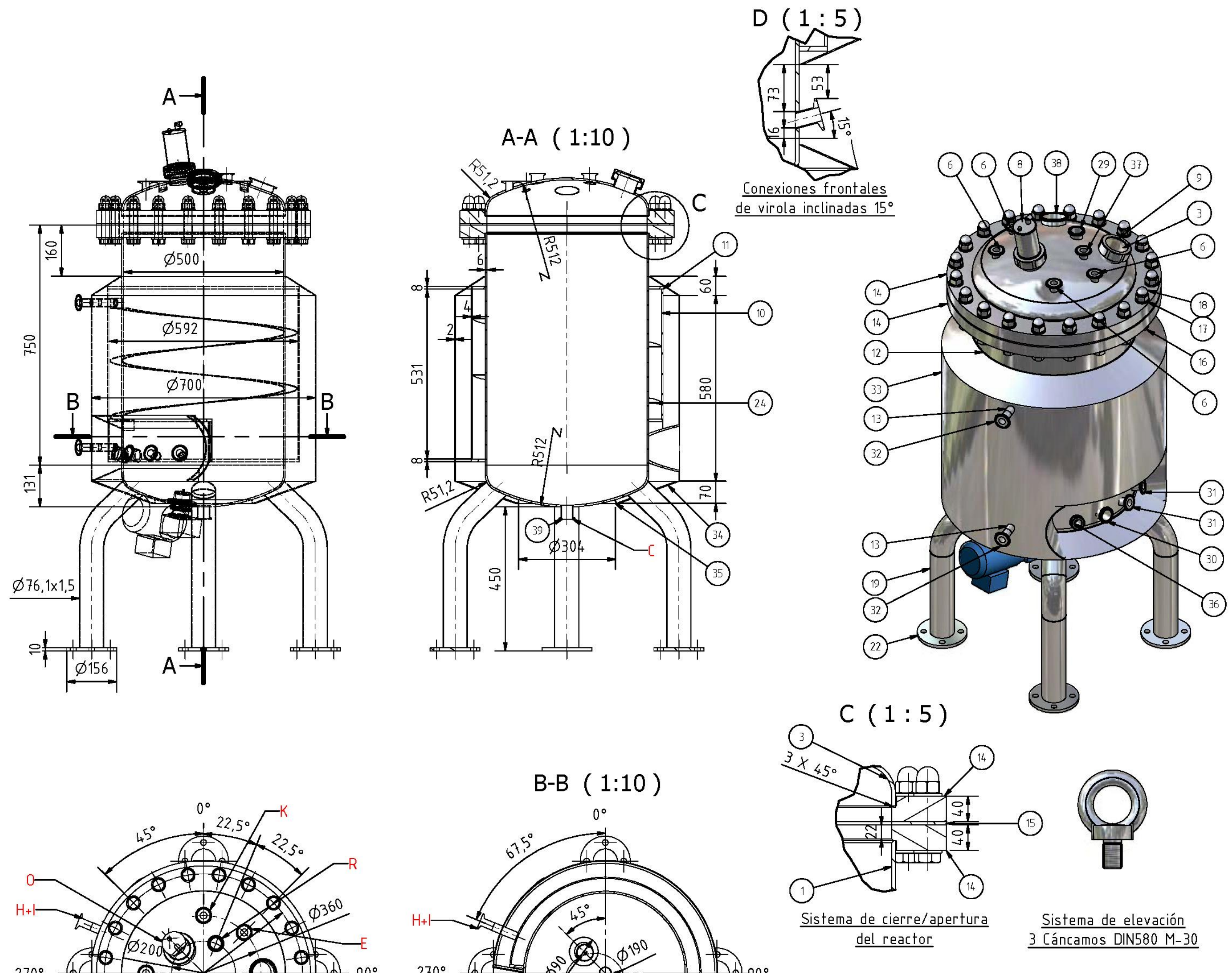


Figure 2: Feeding vessel 3D sight

The tank is agitated with a magnetic mixer (Sterimixer® SMO 85/140). The impeller is installed on the bottom Klopper head.





DATOS DE DISEÑO		
CÓDIGO DE DISEÑO	ASME Sección VIII División 1	ASME Sección VIII División 1
	CUERPO	CAMISA
Presión de diseño (bar)	-1/6	-1/6
Temperatura de diseño (°C)	170	170
Presión de prueba (bar)	9,9	9,9
Temperatura de prueba (°C)	Ambiente	Ambiente
Fluído	?	Glicol/Vapor
Tratamiento Térmico	No aplica	No aplica
Radiografiado (%)	No aplica	No aplica
Eficiencia de soladadura	0,7	0,7
Capacidad útil (m3)	0,16	0,037

Marca	Nº pieza	DENOMINACION	Despiece	Dimensiones	Material	Peso	Observaciones
39	1	Casquillo Clamp ASME BPE 1½in fondo	Ø	Ø38,1x1,65	AISI-316L	0,09 kg	Ra<0,5 micras
38	1	Casquillo Clamp ASME BPE 3in	Ø	Ø76,1x1,65	AISI-316L	0,15 kg	Ra<0,5 micras
37	1	Casquillo Clamp ASME BPE 1in	Ø	Ø25,4x1,65	AISI-316L	0,09 kg	Ra<0,5 micras
36	1	Conexión INGOL 1in	Ø	1"	AISI-316L	0,32 kg	
35	1	Aro inferior de cierre	ch.	e=3	AISI-304L	0,18 kg	Ra<0,8 micras
34	1	Cono inferior aislamiento	ch.	e=3	AISI-304L	7,73 kg	Ra<0,8 micras
33	1	Aislamiento	ch.	2205x580x2	AISI-304L	19,42 kg	Ra<0,8 micras
32	2	Casquillo Clamp ASME BPE 1in(camisa)	Ø	Ø25,4x1,65	AISI-316L	0,11 kg	Ra<0,5 micras
31	2	Casquillo Clamp ASME BPE 1in(virola)	Ø	Ø25,4x1,65	AISI-316L	0,1 kg	Ra<0,5 micras
30	1	Casquillo Clamp ASME BPE 1½in (virola)	Ø	Ø38,1x1,65	AISI-316L	0,08 kg	Ra<0,5 micras
29	2	Casquillo Clamp ASME BPE 1½in	Ø	Ø38,1x1,65	AISI-316L	0,07 kg	Ra<0,5 micras
28	2	Cierre frontal aislamiento	ch.	e=2	AISI-304L	0,72 kg	Ra<0,8 micras
27	1	Motor		180 W AC		3,09 kg	
26	1	Rotor	Ø		AISI-316L	0,26 kg	
25	1	Plato de soldadura	Ø	Ø90	AISI-316L	0,42 kg	Ra<0,5 micras
24	1	Guia espiral camisa calefacción	ch.	e=2	AISI-304L	2,15 kg	
23	2	Cierre lateral camisa	ch.	e=8	AISI-304L	0,04 kg	
22	4	Disco de apoyo	Ø	Ø156 e=10	AISI-304L	1,46 kg	
21	1	Aro frontal de camisa	ch.	e=8	AISI-304L	1,33 kg	
20	1	Aro inferior de camisa	ch.	e=8	AISI-304L	3,57 kg	
19	4	Pata Ø76,1x1.5	Ø	Ø76,1x1,5	AISI-304L	1,53 kg	Ra<0,8 micras
18	20	Tuerca DIN1587	Ø	M24	A4	0,2 kg	
17	40	Arandela DIN125	Ø	M24	A2	0,03 kg	
16	20	Tornillo DIN931	Ø	M24x120	A4	0,56 kg	
15	1	Junta plana	Ø	Ø670/500	Teflón	0,68 kg	
14	2	Brida de cierre	Ø	Ø670/500 e=40	AISI-316L	45,36 kg	Ra<0,8 micras
13	2	Carrete camisa ½in	Ø	Ø12,7x1,65 L=84	AISI-316L	0,08 kg	
12	1	Cierre aislamiento	ch.	e=2	AISI-304L	3,38 kg	Ra<0,8 micras
11	1	Aro cierre camisa	Ø	e=8	AISI-304L	4,94 kg	
10	1	Camisa de calefacción	ch.	1872x531x4	AISI-304L	29,82 kg	
9	1	Mirilla NW65 Inclinada	Ø	NW65	AISI-316L	1,21 kg	Ra<0,5 micras
8	1	Mirilla NW65 Central	Ø	NW65	AISI-316L	1,82 kg	Ra<0,5 micras
6	4	Casquillo Clamp ASME BPE 1in	Ø	Ø25,4x1,65	AISI-316L	0,09 kg	Ra<0,5 micras
3	1	Fondo Klopper superior	Ø	Øext512 e=6	AISI-316L	12,82 kg	Ra<0,5 micras
2	1	Fondo Klopper inferior	Ø	Øext512 e=6	AISI-316L	14,19 kg	Ra<0,5 micras
1	1	Virola	ch.	1587x725x6	AISI-316L	55,3 kg	Ra<0,5 micras

LISTA DE MATERIALES

DESCRIPCIÓN DE CONEXIONES		
REFERENCIA	DESCRIPCIÓN	TAMAÑO
A	Agitador magnético	Sterimixer SMO 85/140
B	Entrada de líquido	1"
C	Conexión de salida	1½"
D	Venteo	1"
E	Entrada de vapor + Válvula de seguridad	1"
F	Sensor de nivel	1½"
G	Sonda de Temperatura	1"
H	Entrada de servicio	1"
I	Salida de servicio	1"
J	Tomamuestras	1"
K	Sensor de Presión	1"
L	Reserva	1"
M	Reserva	1½"
N	Reserva	1" Ingold
O	Mirilla + Proyector	NW65
P	Mirilla	NW65
Q	?	1½"
R	?	3"

CLIENTE/Customer	DE DIETRICH EQUIPOS QUÍMICOS S.L.		
PROYECTO/Project			
PEDIDO No./Order No. CPK-004084		**FABRICACIÓN No.**/Manufacture No. 0-3259	
	FECHA/Date	**NOMBRE**/Name	TECALSA TECNICA Y CALDERERIA, S.A.L.
DIBUJADO Drawing by	10/10/2008	E. Muñoz	
COMPROBADO Checked by		G. Escobar	
ESCALA Scale 1:10	REACTOR DE 160L UAB	**PESO NETO** Net Weight 312 Kg	
		TAMAÑO Size A2	**PLANO No.** Drawing No. 3103 — **Rev.** 5

2.2 Photo bioreactor (RCIVa)

The reactor consists of two cylindrical glass sections of DN150 diameter and 1.5 m height. These two sections: riser and down comer, allow the liquid circulation throw the gas-lift reactor. The upper and lower parts of these glass columns are connected by stainless-steel parts provided with external jackets, which support all the valves and instrumentation. The reactor has a total volume of 86 litres and an illuminated volume of 53 litres.

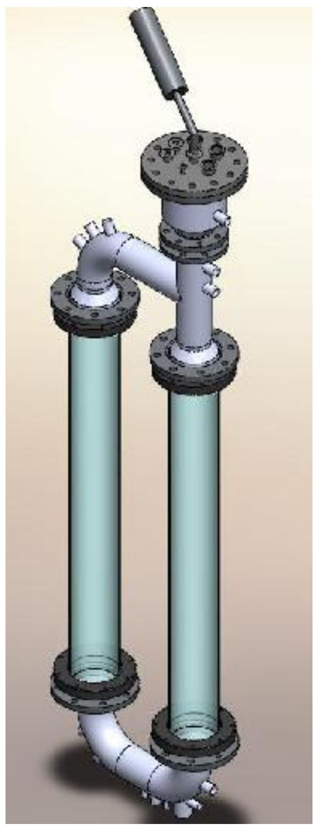
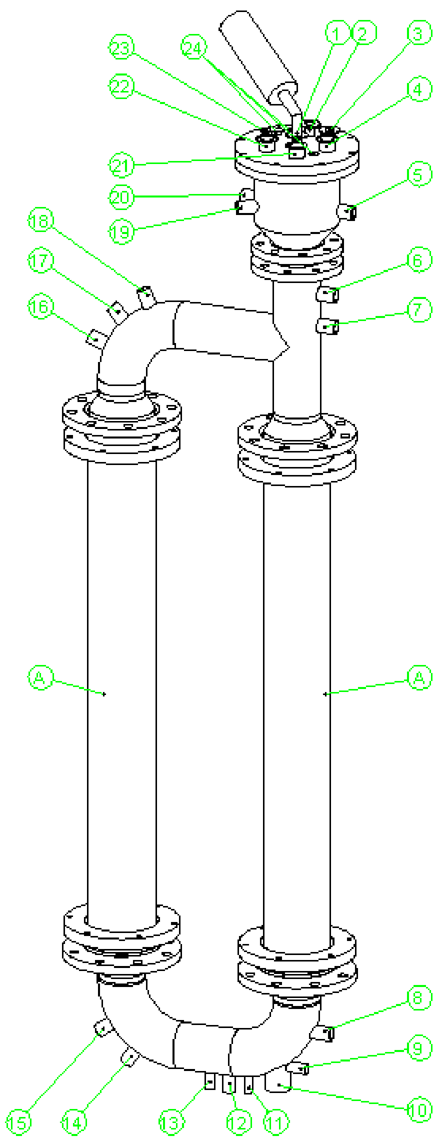


Figure 3: Bioreactor 3D sight

There is a condenser installed in the top of the reactor which is used to condense part of the humidity of the outlet gas in order to return it to the culture (construction characteristics of the equipment not available)

The parameters measured in the PBR are: pressure, temperature, pH, biomass, dissolved O_2. All this variables, excepting the dissolved O_2, are measure at for two different sensors, in order to have a redundant reading of the variables, given that are critical for the process.

The instrumentation and PBR inlets/outlets are distributed as stated bellow:

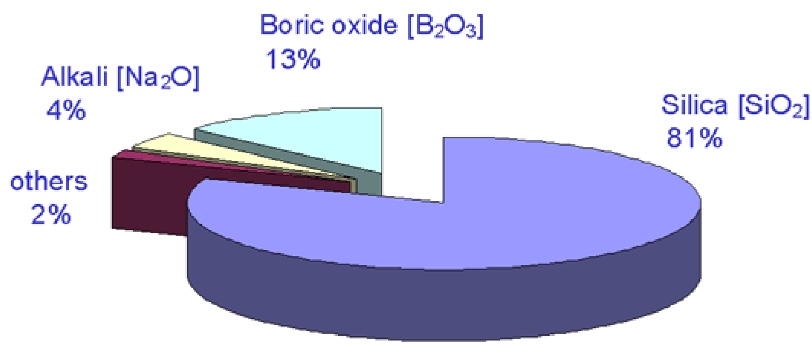


A	Pipe section according QVF	PS150/1500	QVF WPR 2002
24	Free	1"	Ingold
23	Liquid outlet	1/2"	Clamp Imperial ASME BPE
22	Safety valve	1"	Clamp Imperial ASME BPE
21	Pressure transmitter	1"	Clamp Imperial ASME BPE
20	Air inlet (Biomass sensor cleaning)	1"	Ingold
19	Biomass transmitter	1"	Ingold
18	Dissolved O2transmitter	1"	Ingold
17	Ph transmitter	1"	Ingold
16	Temperature sensor	1"	Ingold
15	Ph tansmitter	1"	Ingold
14	Free	1"	Ingold
13	Jacket purge	1/2"	BSP
12	Liquid inlet	1"	Ingold
11	Free	3/8"	BSP
10	Total gas inlet	2"	BSP
9	Acid - Base inlet	1/2"	BSP
8	Sampling valve	1"	Ingold
7	Biomass transmitter	1"	Ingold
6	Free	1"	Ingold
5	Inoculum / Antifoam / Steam inlet	1"	Ingold
4	Pressure transmitter	1"	Clamp Imperial ASME BPE
3	Free	1"	Clamp Imperial ASME BPE
2	Level transmitter (Future implementation)	1"	Clamp Imperial ASME BPE
1	Conderser / Gas outlet	1"	Clamp Imperial ASME BPE
Position	Description	Dimension	Standard

2.2.1 Borosilicate glass 3.3 technical information

2.2.1.1 Chemical composition of Borosilicate glass 3.3

The special properties – especially its high chemical resistance, its resistance to temperature and its low coefficient of linear expansion – of the borosilicate glass 3.3 exclusively used by QVF for the construction of glass plant and pipeline are achieved by strict adherence to its chemical composition, which is as follows:



2.2.1.2 Chemical resistance

Borosilicate glass 3.3 is resistant to chemical attack by almost all products, which makes its resistance much more comprehensive than that of other well-known materials. It is highly resistant to water, saline solutions, organic substances, halogens such as chlorine and bromine and also many acids. There are only a few chemicals which can cause noticeable corrosion of the glass surface namely hydrofluoric acid, concentrated phosphoric acid and strong caustic solutions at elevated temperatures. However, at ambient temperatures caustic solutions up to 30% concentration can be handled by borosilicate glass without difficulty.

Borosilicate glass 3.3 can be classified in accordance with the relevant test methods as follows (see also ISO 3585 and EN 1595):

Hydrolytic resistance at 98 ºC	Hydrolytic resistance grain class ISO 719-HGB 1
Hydrolytic resistance at 121 º	Hydrolytic resistance grain class ISO 720-HGA 1
Acid resistance	Deposit of Na2O < 100 mg/dm² to ISO 1776
Alkali resistance	Alkali resistance class ISO 695-A2

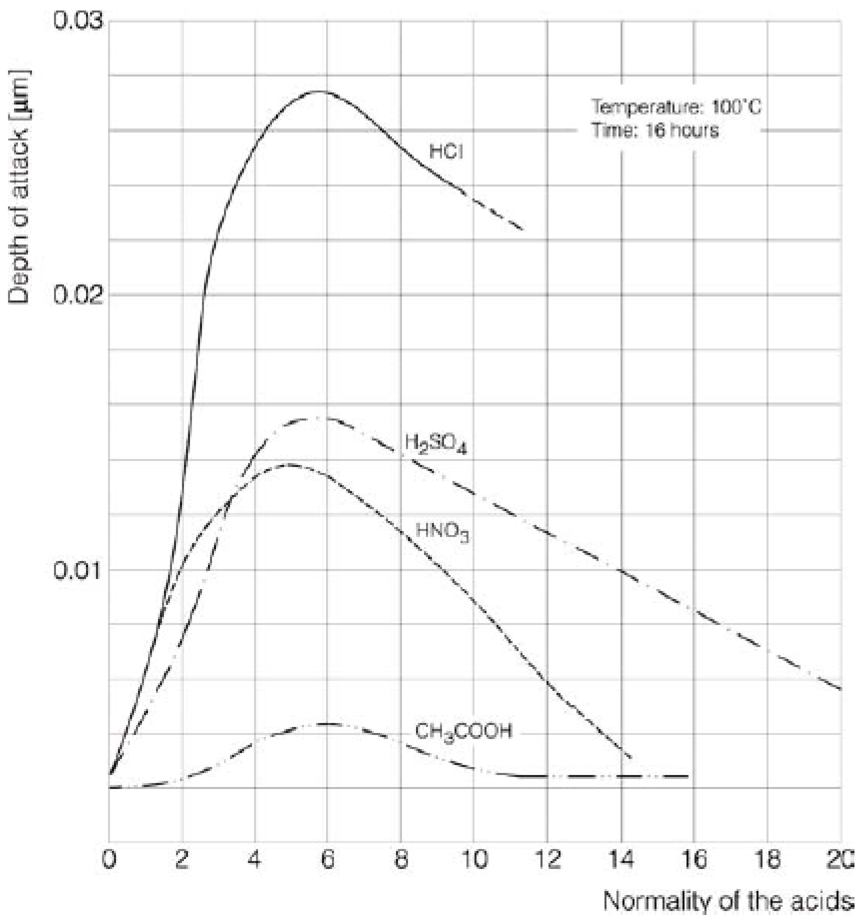


Fig. 1 Acid attack on borosilicate glass 3.3 as a function of concentration

Further information about acid and alkali attack can be obtained from the figures. The corrosion curves in fig.1 show a maximum for different acids in the concentration range between 4 and 7 N (HCl for example at the azeotrope with 20.2 wt %). Above that the reaction speed decreases markedly so that the eroded layer amounts to only a few thousandths of millimeter after some years. There is, therefore, justification for referring to borosilicate glass 3.3 as an acid-resistant material.

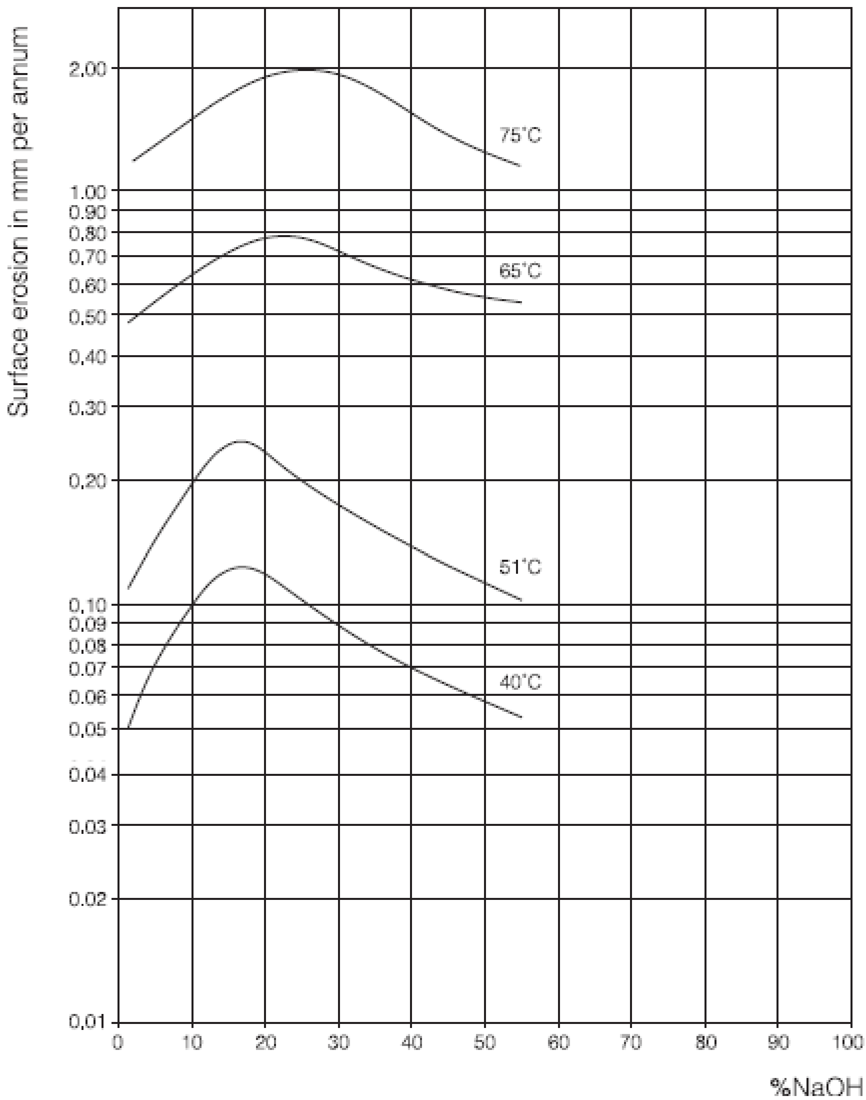


Fig. 2 Alkali attack on borosilicate glass 3.3 as a function of temperature

It can be seen from the corrosion curves in fig. 2 that the attack on the glass surface initially increases as the concentration of the caustic solution increases but after exceeding a maximum it assumes a virtually constant value. Rising temperatures increase the corrosion, while at low temperatures the reaction speed is so low that reduction of the wall thickness is hardly detectable over a number of years.

2.2.1.3 **Physical properties**

Borosilicate glass 3.3 differs from other materials of construction used for process plant not only because of its virtually universal resistance to corrosion (see above) but also because of its very low thermal expansion coefficient. There is, therefore, no need for expensive measures to compensate for thermal expansion resulting from changes in temperature. This becomes of particular significance in the layout of long runs of glass pipeline.

The most important physical properties for the construction of plant are listed below (see also ISO 3585 and EN 1595).

Mean linear thermal expansion coefficient	$a_{20/300}$	=	$(3{,}3 \pm 0{,}1) \times 10^{-6}\ K^{-1}$
Mean thermal conductivity between 20 and 200°C	$l_{20/200}$	=	$1{,}2\ W\ m^{-1}\ K^{-1}$
Mean specific heat capacity between 20 and 100°C	$Cp_{20/100}$	=	$0{,}8\ kJ\ kg^{-1}\ K^{-1}$
Mean specific heat capacity between 20 and 200°C	$Cp_{20/200}$	=	$0{,}9\ kJ\ kg^{-1}\ K^{-1}$
Density at 20°C	r	=	2,23 kg dm-^{3}

2.2.1.4 **Mechanical properties**

The permissible tensile strength of borosilicate glass 3.3 includes a safety factor which takes into account practical experience on the behavior of glass and, in particular, the fact that it is a non-ductile material. Unlike other materials of construction used for similar purposes, it is not able to equalize stresses occurring at local irregularities or flaws, as happens in the case of ductile materials such as metals. The safety factor also takes into account additional processing which components may have undergone (ground sealing surfaces), handling of the glass (minute surface damage) and permissible pressures and temperatures to which it may be subjected in use.

The design figures indicated in the table below and specified in EN 1595 therefore apply to the permissible tensile, bending and compressive stress to which glass components may be subjected taking into account the likely surface condition of the glass in service.

Strength parameters	Tensile and bending strength	K/S = 7 N mm-²
	Compressive strength	K/S = 100 N mm-²
Modulus of elasticity		E = 64 kN mm-²
Poisson's ratio (transverse contraction figure)		n = 0,2

2.2.1.5 **Operating permissible conditions**

The permissible values for operating temperature and pressure must always be seen in combination. The reason for this is the thermal stresses that result from temperature differences between the inner and outer surfaces of the glass component. These stresses are superimposed on the stresses resulting from the working pressure.

Higher thermal stresses therefore result in a reduction of the permissible working pressure. Thermal insulation reduces the thermal stresses and can, therefore, become a requirement of an installation.

- Permissible operating temperature

Borosilicate glass only deforms at temperatures which approach its transformation temperature (approximately 525 ºC) and up to this point it retains its mechanical strength. The permissible operating temperature is, however, considerably lower – normally around 200 °C – for glass components, provided that there is no sudden temperature shock and that the components are not specially marked.

At sub-zero temperatures tensile strength tends to increase. Borosilicate glass 3.3 can, therefore, be used safely at temperatures as low as -80 ºC.

These temperature limits should be regarded only as a guideline and must always be modified in accordance with the actual operating conditions of a given application. The individual operating conditions of some components in this catalogue must also be considered. Where such operating limits apply, they are detailed in the individual catalogue sections and component descriptions.

- Thermal shock

Rapid changes in temperature across the walls of glass components should be avoided during operation both indoors and outside. They result in increased thermal stress in the glass which, as described above, has an adverse effect on the permissible operating pressure of the plant components. Although it is not possible to give a definite figure applicable to all the operating conditions likely to be encountered in practice, a maximum permissible thermal shock of 120 K can be taken as a general guide.

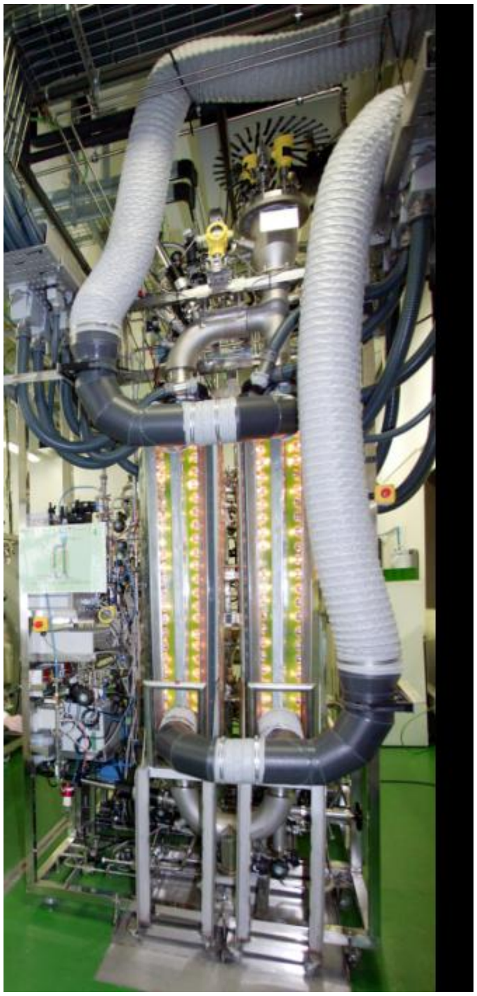
- Permissible operating pressure

Glass components in all nominal sizes that are basically cylindrical, domed and spherical can be used with full vacuum (-1 bar g), provided they are not specially marked otherwise. Likewise the maximum permissible operating pressures (Ps) shown in the tables apply to these glass components as a function of their principal nominal size DN or diameter D (in the case of spherical vessels) and the internal (product side) and external (ambient) temperature difference (DQ).

Depending on the shape and the particular working conditions, glass components can be used under certain circumstances at higher internal pressures. In these cases, the glass component is specially marked on in accordance with EN 1595.

		Main nominal size DN												
		15	25	40	50	80	100	**150**	200	300	450	600	800	1000
Glass cylinder	Ps (barg)	4	4	4	4	3	2	**2**	1	1	0,6	0,6	0,6	0,6

2.3 External Illumination System



The illumination system consists of 350 halogen lamps which surround the two glass cylinders (DN150 x 1.5 m).

The lamps used are: OSRAM 12V, 20W BAB 38°

The light regulation is performed by a set point from the supervision.

The lights are supported in two structures which wrap the PBR glass columns.

2.3.1 Lighting refrigeration system

The structures are rounded by a transparent PVC jacket that permits the air circulation throughout the lights in order to extract the maximum amount of heat produced by the lighting system.

The air system consists of a pre-filter (installed on the air inlet) type G-4, a piping circuit (AIRFIBRA Ø200 pipe) and an air extractor which is installed on the air outlet.

2.4 Harvesting tank (VS 4002 01)

This tank consists of:

- a cylindrical an vertical hoop of external diameter 408 mm, 4 mm of thickness, and 950 mm length, manufactured in stainless steel 316L. There are different nozzles for steam inlet, liquid inlet and outlet, vent outlet, instruments, valves and others.

- a cylindrical and vertical jacket of external diameter 475 mm, with thickness of 3 mm and 805 mm of length with two connections for glycol/steam inlet and outlet.

- a cylindrical and vertical insulation hoop of external diameter 543 mm, with thickness of 2 mm and 802 mm of length. The material for the insulation is Rock Wool.

The tank design conditions are:

- ✓ Hoop Design pressure = -1/3 bar
- ✓ Jacket Design pressure = -1/4 bar
- ✓ Hoop Design temperature = 150 ºC
- ✓ Jacket Design temperature = 150 ºC

The internal volume of the reactor is 120L and the volume of the jacket, 35.2L. All parts in contact with the product are constructed in AISI 316L with a roughness lower than 0.5 μm.

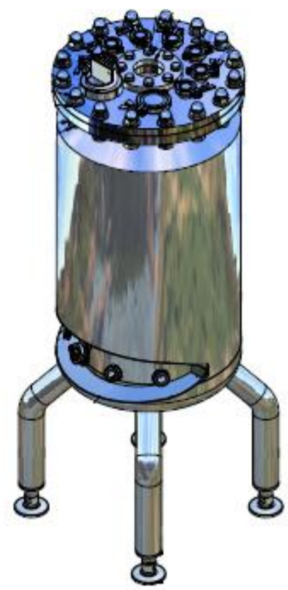
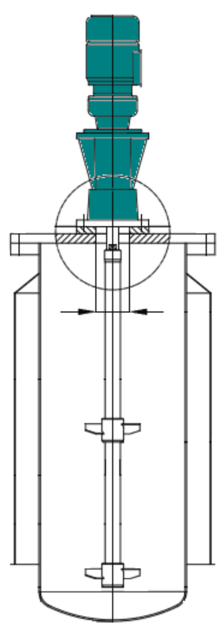
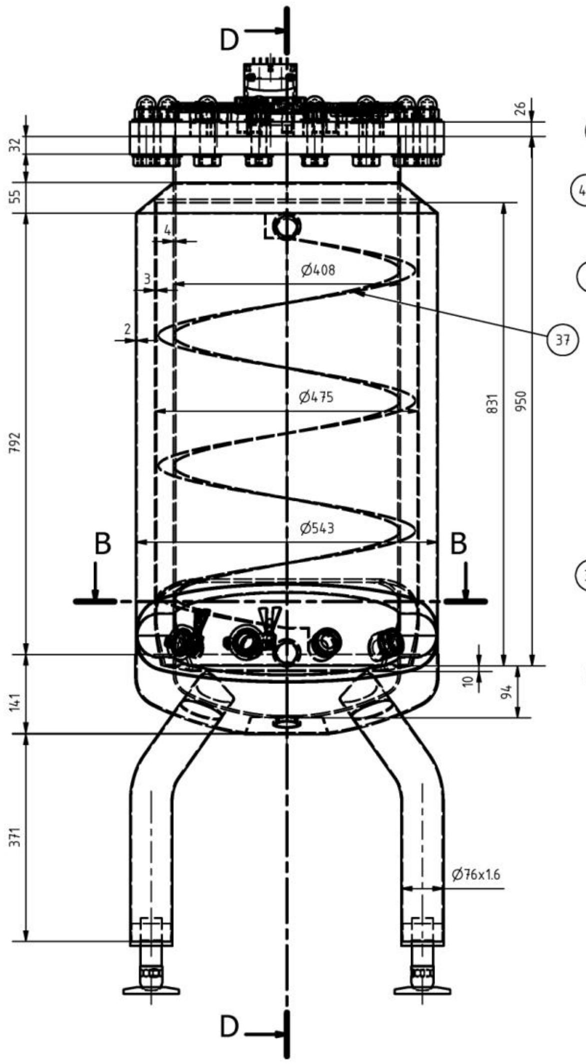


Figure 4: Harvesting vessel 3D sight

The agitator is installed on the harvesting tank upper flange. It is a mechanical mixer (VAK KIMSA M0.374) which consists in two TRIVAK blades of 150 mm.





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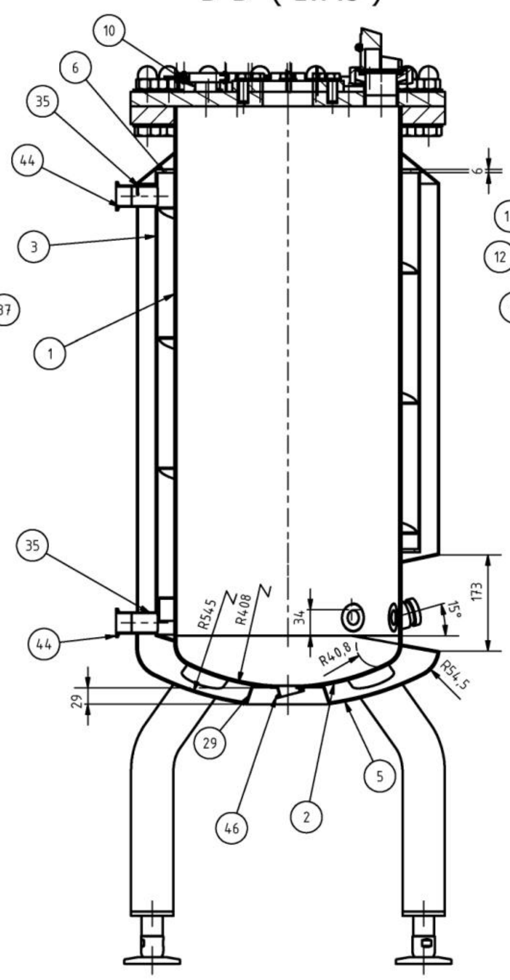

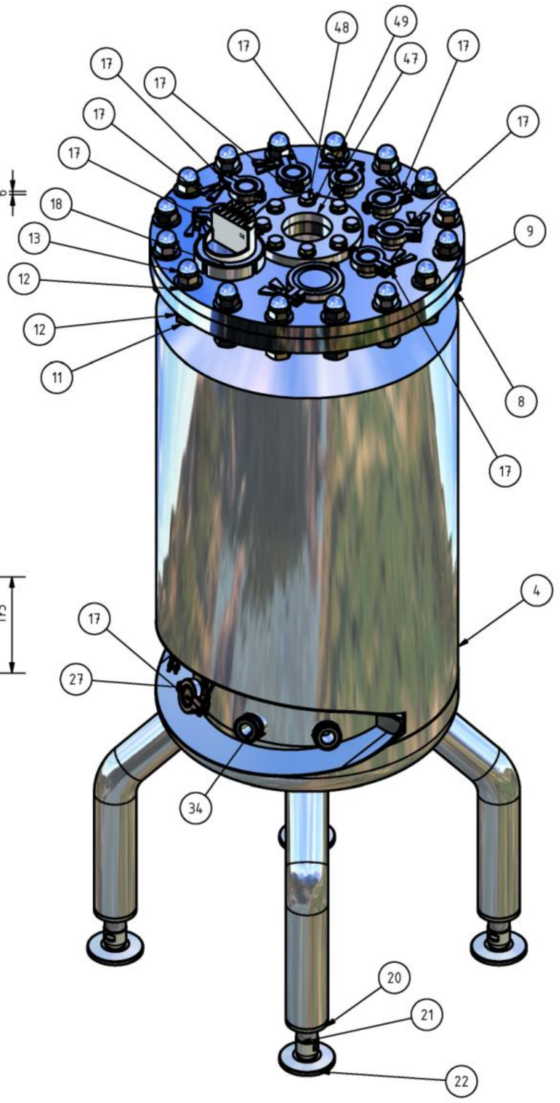

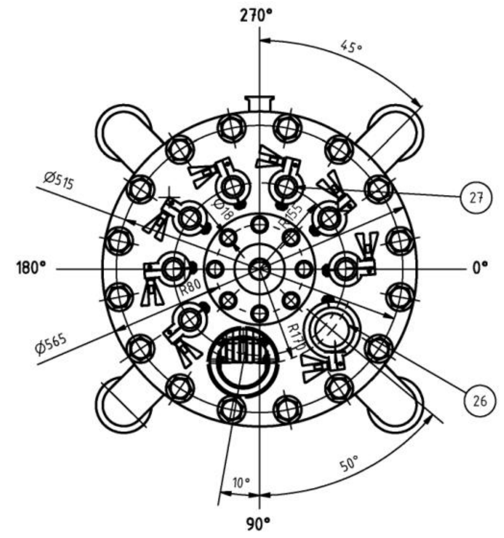

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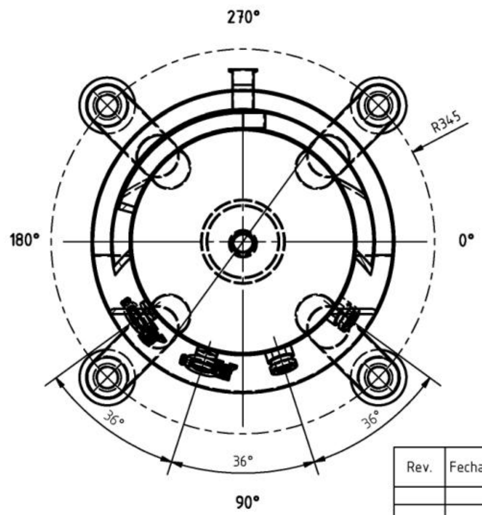
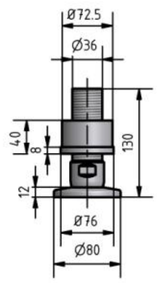




DETALLE PATA ROSCADA RETRÁCTIL

Marca	Nº pieza	DENOMINACION	Despiece	Dimensiones	Material	Peso	Observaciones
1	1	Virola Øint400	ch.	2000x1000x4	AISI-316	38,5 kg	
2	1	Fondo Klopper Virola	Ø	Ø408x4	AISI-316	5,73 kg	
3	1	Camisa de calefacción	ch.	2500x1000x3	AISI-304	27,2 kg	
4	1	Aislamiento	ch.	3000x1500x2	AISI-304	23,62 kg	
5	1	Fondo Klopper Aislamiento	Ø	Ø543x3	AISI-316	8,3 kg	
6	1	Aro de cierre superior de camisa	ch.	2000x1000x6	AISI-304	2,24 kg	
7	1	Chapa cierre camisa de calefacción	ch.	2500x1000x3	AISI-304	1,83 kg	
8	1	Brida DN400	Ø	Øext565 e=32	AISI-316	28,65 kg	
9	1	Brida ciega DN400	Ø	Ø565 e=26	AISI-316	45,11 kg	
10	8	Clamp 1.5in acoplado a tapa	Ø	Ø38x1.5 L=28	AISI-304	0,07 kg	
11	16	Tornillo DIN931 M27	Ø	M27 L=90	Acero dulce	0,6 kg	
12	32	Arandela DIN125 M27	Ø	M27	Acero dulce	0,04 kg	
13	16	Tuerca ciega DIN1587 M27	Ø	M27	Acero dulce	0,2 kg	
14	1	Macho Mirilla NW80	Ø	Ø84 L=35	AISI-316	0,62 kg	
15	1	Carrete Ø85x2	Ø	Ø85x2 L=20	AISI-316	0,08 kg	
16	1	Cristal Mirilla NW80.	Ø		Vidrio	0,04 kg	
17	9	Abrazadera 1.5in	Ø	Ø1½"	AISI-316	0,29 kg	
18	1	Tuerca Mirilla NW80	Ø		AISI-316	0,77 kg	
19	4	Pata Ø76x1.6	Ø	Ø76x1.6	AISI-316	1,92 kg	
20	4	Casquillo Pie Regulable_Ø76	Ø	Ø76 L=40	AISI-304	0,94 kg	
21	4	Pie regulable	Ø	Ø80 L=130	AISI-304	1,18 kg	
22	4	Placa apoyo	Ø	Ø80 L=12	AISI-304	0,61 kg	
23	7	Carrete Ø38.1.5	Ø	Ø38x1.65 L=23.5	AISI-316	0,03 kg	
24	1	Casquillo Clamp 3in	Ø	Ø76.1x1.5 L=28	AISI-316	0,13 kg	
25	1	Carrete Ø76.1x1.5	Ø	Ø76.1x1.5 L=23.5	AISI-316	0,07 kg	
26	1	Clamp ciego 3in	Ø	Ø76.1 L=10	AISI-316	0,3 kg	
27	9	Clamp ciego 1.5in	Ø	Ø38 L=10	AISI-316	0,09 kg	
17	1	Abrazadera 3in	Ø	Ø3"	AISI-316	0,44 kg	
29	1	Tapa cono inferior aislamiento	ch.	2000x1000x2	AISI-304	0,22 kg	
32	2	Carrete Ø38x1.5 (virola)	Ø	Ø38x1.5 L=20	AISI-316	0,02 kg	
33	2	Casquillo Clamp 1.5in virola	Ø	Ø38x1.5 L=28	AISI-316	0,07 kg	
34	2	Conexión INGOL	Ø		AISI-316	0,43 kg	
35	2	Carrete Ø38x1.5 (camisa)	Ø	Ø38x1.5 L=47	AISI-316	0,07 kg	
37	1	Guia espiral camisa calefacción	ch.	2000x1000x2	AISI-304	1,85 kg	
43	1	Cierre aislamiento	ch.	3000x1500x2	AISI-304	1,72 kg	
44	2	Casquillo Clamp 1.5in (camisa)	Ø	Ø38x1.5 L=28	AISI-316	0,07 kg	
46	1	Casquillo Clamp 1.5in (fondo)	Ø	Ø38x1.65 L=21.5	AISI-316	0,05 kg	
47	1	Brida DN80 DIN 2576	Ø	Øext200 Øint93.3 e=20	AISI-316	3,69 kg	
48	8	Tornillo DIN931 M16	Ø	Ø18 L=40	Acero dulce	0,13 kg	
49	8	Arandela DIN125 M16	Ø	Ø18	Acero dulce	0,01 kg	

LISTA DE MATERIALES

Rev.	Fecha/Date	Descripción/Description	Dibujado/Drawn by	Aprobado/Approved by

CLIENTE/Customer BIOPROCESS TECHNOLOGY

PROYECTO/Proyect

PEDIDO No./Order No. | **FABRICACIÓN No.**/Manufacture No. 0-2954

	FECHA/Date	**NOMBRE**/Name
DIBUJADO Drawing by	18/08/2007	E. Muñoz
COMPROBADO Checked by		G. Escobar

TECALSA
TECNICA Y CALDERERIA, S.A.L.

ESCALA Scale		**PESO NETO** Net Weight		
1:7.5	REACTOR 120L UAB	**TAMAÑO** Size: A2	**PLANO No.** Drawing No.	**Rev.** 1

2.5 Gas loop

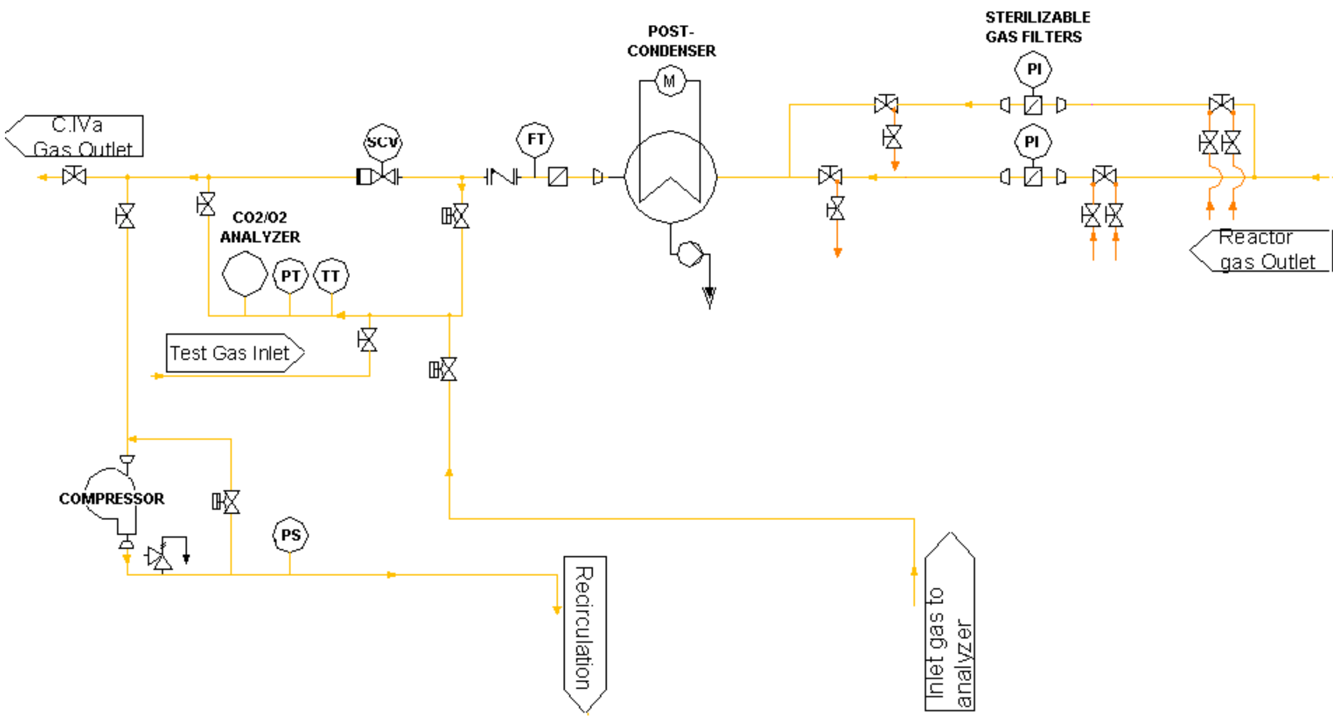


Figure 5: Gas loop process Diagram

2.5.1 Gas lines: from reactor to C.IVa outlet

The reactor gas outlet flow is filtered by a sterilizable filter (*GF 4004 01* or *GF 4004 02*) before arriving to a post-condenser (*HX 4010 01*). There are two filters mounted in two parallel lines in order to permit a continuous operation in case of filter maintenance. The finality of its post-condenser is to ensure that the air is exempt of humidity before passing through the mass flow meter (*FT 4004 01*) and the composition analyzer (*AT 4010 01/02*).

The outlet gas is sent to the analyzer through a control valve (*SV 4010 01*). The analysis of the outlet gas is an automatic operation and the pressure and the temperature of the gas are also measured.
After the flow measurement, the gas is taken to the C. IVa gas outlet. The compartment outlet gas flow, and consequently the reactor pressure, is controlled by a solenoid control valve (*SCV 4004 01*).

2.5.2 **Gas lines: Test Gas Inlet**

There is one line that is directly connected to the gas analyzer (*AT 4010 01/02*) which permits the analysis of any externally fed gas (for calibration purposes). The line finishes with a ½" clamp connection. This is a manual operation because to do this operation is needed to operate over the manual valves.

2.5.3 **Gas lines: Circulation**

This line allows the circulation of the reactor outlet gas to the reactor inlet gas lines by means of a compressor (*BLWR 4003 01*) that drives the gas flow. The circulated gas mass flow is controlled with a mass flow meter/controller (*FQRC 4003 03*).
The circulation of gas is an automatic operation.

2.5.4 **Gas lines: Inlet gas to analyzer**

This line permits the analysis of the total reactor inlet gas. The flow to analyzer is controlled by an automatic valve (*SV 4003 02*).

3. PLANT CONTROL DESCRIPTION

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

IMPORTANT NOTE: The alarms and lock outs described in this document are only the ones considered by the hardware point of view. There will be more alarms concerning the process which are not defined in this document.

The documents of reference for this section are:

- P&ID DD-8558-Z1-100-02 rev. 8 (P&ID and control diagram)
- Final instruments lists and specifications

LOOP NUMBER	DESCRIPTION
4000	Bioreactor lighting control
4001	Inlet liquid flow control
4002	Outlet liquid flow control
4003	Inlet gas flow control
4004	Outlet gas flow control
4005	Bioreactor temperature control
4006	Bioreactor pH control
4007	Bioreactor pressure control
4008	Bioreactor liquid level control
4009	Bioreactor biomass production control
4010	Bioreactor outlet gas composition control
4011	Feeding tank temperature control
4012	Harvesting tank temperature control
4013	Antifoam control
4014	Feeding tank sterilization
4015	Bioreactor sterilization
4016	Harvesting tank sterilization

3.1 Loop 4000. Bioreactor lighting control

This loop regulates the light intensity. The intensity is controlled by the PLC and is not possible to do it locally. This loop is a manual actuation (Reactor light intensity measures don't exist).

To actuate directly over the light intensity, the loop 4009 (Bioreactor biomass production control) should be deactivated.

IMPORTANT NOTE: The activation of loop 4009 means the deactivation of loop 4000.

3.1.1 Control elements

- IRC 4000 01: Light supply system

3.1.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
IRC 4000 01	IRC_4000_MV	400115	Light Intensity	AO	0...100 %	4/20 mA

3.1.3 PLC Input signals *(Future installation)*

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
IRC 4000 01	IT_4000_01	300145	Light Power Phase 1*)	AI		4/20 mA
IRC 4000 01	IT_4000_02	300146	Light Power Phase 2*)	AI		4/20 mA
IRC 4000 01	IT_4000_03	300147	Light Power Phase 3*)	AI		4/20 mA

*) *Note: These signals are not implemented yet in the plant. The signals are foreseen in phoenix connectors' cabinet and connected to PLC. The connection of these signals was checked during CIVa electrical tests done by DDEQ/NTE.*

3.1.4 Alarms and warnings

Tag	Variable	Alarm	Action	Lock out
1)	Temperature	H	To notify alarm to supervision	
1)	Temperature	HH	To notify alarm to supervision and set safety value to light power	light intensity (safety value)

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

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4005 01	TT_4005_01	300141	Reactor temperature measurement	AI	0…150 ºC	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI	0…140 ºC	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI	0…140 ºC	4/20 mA

⚠ **From hardware point of view and regarding glass constraints, the permissible operating temperature is 200ºC, provided that there is no sudden temperature shock.** (*See chapter 2.2.1.5: Operating permissible conditions* of the Operation Manual)

3.2 Loop 4001. Inlet liquid flow control

This loop regulates the reactor inlet liquid flow. Liquid input media is provided from two pumps (GP 4001 01 and GP 4001 02), working alternatively depending on the pre-filters blockage or pump maintenance. Flow rate set point is provided by the supervision.

3.2.1 Control elements

- LT 4001 01: Level transmitter. Feeding tank (VS 4001 01) level measurement.
- PS 4001 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4001 01/02: Pressure switch. Lines over-pressure detection.
- DPT 4001 02: Differential pressure transmitter. ΔP measurement for pre-filters (LF 4001 02/03) blockage control.
- FT 4001 01: Liquid mass flow meter. Reactor inlet liquid flow measurement.
- DPT 4001 01: Differential pressure transmitter. ΔP measurement for filters (LF 4001 04/05) blockage control.
- GP 4001 01/02 speed regulator: Feed pumps. Liquid pumping to the reactor liquid inlet.
- GP 4001 03 speed regulator: Magnetic agitator. Feeding vessel agitation.

3.2.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
GP 4001 03	GP_4001_03_MV2	400113	VS 4001 01 agitator speed set point	AO	50 Hz = 1400 rpm	4/20 mA
GP 4001 01/02	GP_4001_01_MV2	400109	Flow setpoint to the inlet pumps	AO		4/20 mA
GP 4001 03		000110	Start/Stop GP 4001 03 converter	DO	N/A	0/1
GP 4001 01	GP_4001_01_MV1	000091	Start/Stop of the pump	DO	N/A	0/1
GP 4001 02	GP_4001_02_MV1	000090	Start/Stop of the pump	DO	N/A	0/1
GP 4001 01/02		000111	Start/Stop GP 4001 01/02 converter	DO	N/A	0/1

3.2.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FT 4001 01	FT_4001_01	300130	Total liquid inlet flow to reactor	AI	0…20 kg/h	4/20 mA
LT 4001 01	LT_4001_01	300131	VS 4001 01 level	AI	0…100 %	4/20 mA
DPT 4001 01	DPT_4001_01	300138	Differential pressure measurement	AI	0…3 bar	4/20 mA
DPT 4001 02	DPT_4001_02	300139	Differential pressure measurement	AI	0…3 bar	4/20 mA
GP 4001 03	GP_4001_03_ERR	100104	Thermal protection of the agitator	DI	N/A	0/1
PS 4001 01	PS_4001_01	100082	Pressure switch	DI	N/A	0/1
PS 4001 02	PS_4001_02	100083	Pressure switch	DI	N/A	0/1
PS 4001 03	PS_4001_03	100106	Pressure switch (GP 4001 01)	DI	N/A	0/1
PS 4001 04	PS_4001_04	100107	Pressure switch (GP 4001 02)	DI	N/A	0/1
GP 4001 01/02	GP_4001_01_ERR	100099	Thermal protection of the inlet pumps	DI	N/A	0/1

3.2.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**LT 4001 01**	Level	L	To notify alarm to supervision	------
2	**LT 4001 01**	Level	LL	To notify alarm to supervision	GP 4001 01/02 and GP 4001 03
3	**PS 4001 03/04**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
4	**PS 4001 01/02**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
5	**DPT 4001 02**	Differential pressure	H	To notify alarm to supervision	------
6	**DPT 4001 02**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02
7	**DPT 4001 01**	Differential pressure	H	To notify alarm to supervision	------
8	**DPT 4001 01**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02

1 → WARNING: Feeding vessel level is at ------% or lower.

2 → ALARM: VS 4001 01 is empty. Stop feeding pumps and vessel agitator.

3 → ALARM: The membrane of the feeding pump has broken.

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

*(*See chapter *10.1: Maintenance of pumps* of the Operation Manual*)*

4 → ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop feeding pumps.

5 / 7 → WARNING: The differential pressure (inlet/outlet of filter) has rise to ------bar. (Preventive maintenance)

6 / 8 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 0.3 bar. Stop feeding pumps.

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

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

3.3 Loop 4002. Outlet liquid flow control

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

IMPORTANT NOTE: The activation of loop 4002 means the deactivation of loop 4008 which controls indirectly the outlet liquid flow by controlling the PBR level.

3.3.1 Control elements

- PS 4002 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4002 01/02: Pressure switch. Lines over-pressure detection.
- WT 4002 01: Weight measurement. Harvesting tank (VS 4002 01) weight measurement for controlling the tank level.
- GP 4002 01/02 speed regulator: Feed pumps. Reactor outlet liquid pumping to the harvesting vessel.
- GP 4001 03 speed regulator: Mechanic agitator. Harvesting vessel agitation.

3.3.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
GP 4002 01/02	GP_4002_01_MV2	400111	Flow set point to the outlet pumps	AO		4/20 mA
GP 4002 03	GP_4002_03_MV2	400114	VS 4001 01 agitator speed set point	AO		4/20 mA
GP 4002 01	GP_4002_01_MV1	000089	Start/Stop of the pump	DO	N/A	0/1
GP 4002 02	GP_4002_02_MV1	000104	Start/Stop of the pump	DO	N/A	0/1
GP 4002 01/02		000112	Start/Stop GP 4002 01/02 converter	DO	N/A	0/1
GP 4002 03		000109	Start/Stop GP 4002 03 converter	DO	N/A	0/1

3.3.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
WT 4002 01	WT_4002_01	300132	Weight Balance (VS 4002 01)	AI	0…500 Kg	4/20 mA
GP 4002 01/02	GP_4002_01_ERR	100101	Thermal protection of the outlet pumps	DI	N/A	0/1
GP 4002 03	GP_4001_03_ERR	100105	Thermal protection of the agitator	DI	N/A	0/1
PS 4002 01	PS_4002_01	100084	Pressure switch	DI	N/A	0/1
PS 4002 02	PS_4002_02	100085	Pressure switch	DI	N/A	0/1
PS 4002 03	PS_4002_03	100108	Pressure switch (GP 4002 01)	DI	N/A	0/1
PS 4002 04	PS_4002_04	100109	Pressure switch (GP 4002 02)	DI	N/A	0/1

3.3.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**PS 4002 03/04**	Pressure	H	To notify alarm to supervision	GP 4002 01/02
2	**PS 4002 01/02**	Pressure	H	To notify alarm to supervision	GP 4002 01/02
3	**WT 4002 01**	Weight (level)	H	To notify alarm to supervision	
4	**WT 4002 01**	Weight (level)	HH	To notify alarm to supervision	GP 4002 01/02
5	**WT 4002 01**	Weight (level)	L	To notify alarm to supervision	GP 4002 03

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

1 → ALARM: The membrane of the harvesting pump has broken.

2 → ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop harvesting pumps.

3 → WARNING: Harvesting vessel level is at ------% or upper.

4 → ALARM: VS 4002 01 is full. Stop harvesting pumps.

5 → WARNING: Harvesting vessel level is at ------% or lower. Stop the vessel agitator.

3.4 Loop 4003. Inlet gas flow control

This loop regulates the reactor inlet gas flow and its composition. To do this, there is one control valve/flow meter installed in each reactor inlet gas pipe which permits to control the total flow as well as its composition.

3.4.1 Control elements

- FQRC 4003 01: Control valve/Flow meter. CO_2 flow measure and control.
- FQRC 4003 02: Control valve/Flow meter. Process air flow measure and control.
- FQRC 4003 03: Control valve/Flow meter. Circulated gas flow measure and control
- FQRC 4003 04: Control valve/Flow meter. Total inlet gas flow measure and control
- SV 4003 01: Control valve. Open/close the total inlet gas line to analyzer.
- SV 4003 02: Control valve. Open/close the inlet gas line for biomass sensor cleaning.
- SV 4003 03: Control valve. Open/close the compressor recycles.
- PS 4003 04: Pressure switch. Controls the valve SV 4003 04 in case of over pressure

3.4.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FQRC 4003 01	FQRC_4003_01_SP	400100	Inlet CO_2 flow set point	AO		0-5 V
FQRC 4003 02	FQRC_4003_02_SP	400101	Inlet Air flow set point	AO		0-5 V
FQRC 4003 03	FQRC_4003_03_SP	400102	Circulated air flow set point	AO		0-5 V
FQRC 4003 04	FQRC_4003_04_SP	400103	Total Inlet gas flow set point	AO		0-5 V
SV 4003 01	SV_4003_01_MV	000093	Analyzer gas inlet valve (Open/Close)	DO	N/A	0/1
SV 4003 02	SV_4003_02_MV	000095	Reactor air inlet valve (Open/Close)	DO	N/A	0/1
SV 4003 03	SV_4003_03_MV	000096	Blower bypass valve (Open/Close)	DO	N/A	0/1
BLWR 4003 01	BLWR_4003_01_MV1	000103	Start/Stop of the blower	DO	N/A	0/1

3.4.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FQRC 4003 01	FQRC_4003_01	300109	Inlet CO_2 flow measurement	AI		0-5 V
FQRC 4003 02	FQRC_4003_02	300110	Inlet Air flow measurement	AI		0-5 V
FQRC 4003 03	FQRC_4003_03	300111	Circulated air flow measurement	AI		0-5 V
FQRC 4003 04	FQRC_4003_04	300112	Total Inlet gas flow measurement	AI		0-5 V
SV 4003 01	SV_4003_01_FB	100097	Analyzer gas inlet valve (Limit switch)	DI	N/A	0/1
SV 4003 02	SV_4003_02_FB	100095	Reactor air inlet valve (Limit switch)	DI	N/A	0/1
SV 4003 03	SV_4003_03_FB	100094	Blower bypass valve (Limit switch)	DI	N/A	0/1
PS 4003 01	PS_4003_01	100110	Pressure switch bypass for recycling	DI	N/A	0/1

3.4.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**PS 4003 01**	Pressure	H	To notify alarm to supervision and to open SV 4003 03	------
2	**SV 4003 01**	(Limit switch)	Err	To notify alarm to supervision	------
3	**SV 4003 02**	(Limit switch)	Err	To notify alarm to supervision	------
4	**SV 4003 03**	(Limit switch)	Err	To notify alarm to supervision	Stop blower BLWR 4003 01

1 → ALARM: The pressure of the pipe is higher than the maximum compressor operating pressure (2.2 bar). Open the compressor recycle valve.

2 → ALARM: The automatic valve is not working. To notify failure.

3 → ALARM: The automatic valve is not working. To notify failure.

4 → ALARM: The automatic valve is not working. To notify failure and stop the compressor.

3.5 Loop 4004. Outlet gas flow control

This loop regulates the C.IVa outlet gas flow and its composition. This loop measures the gas flow and its composition and provides this information to the control system.

IMPORTANT NOTE: The activation of loop 4004 means the deactivation of loop 4007 which controls indirectly the outlet gas flow by controlling the reactor pressure.

3.5.1 Control elements

- DPT 4004 01: Differential pressure transmitter. ΔP measurement for filters (GF 4004 01/02) blockage control.
- FT 4004 01: Flow meter. Outlet gas flow measure.
- SCV 4004 01: Control valve. Outlet gas flow control.

3.5.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SCV 4004 01	SCV_4004_01_MV	400108	Reactor outlet gas flow set point	AO	0...100 %	4/20 mA

3.5.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI	0…20 Nl/min	4/20 mA
DPT 4004 01	DPT_4004_01	300140	Differential pressure measurement	AI	0...3 bar	4/20 mA

3.5.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**DPT 4004 01**	Pressure	H	To notify alarm to supervision	
2	**DPT 4004 01**	Pressure	HH	To notify alarm to supervision	

1 → WARNING: The differential pressure (inlet/outlet of filter) has rise to ------bar. (Preventive maintenance)

2 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 0.3 bar.

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

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

3.6 Loop 4005. Bioreactor temperature control

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

3.6.1 Control elements

- TT 4005 01: Temperature transmitter. Bioreactor temperature measurement.
- TT 4006 01: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- TT 4006 02: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- BLWR 4005 01: Air Extractor. Air circulation in bioreactor refrigeration system by air.
- SV 4005 01: Control valve. Cooling water flow control.
- HX 4005 02: Electrical resistance. Electrical resistance for water heating.

3.6.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
BLWR 4005 01	BLWR_4005_01_MV2	400104	Air extractor setpoint (lightening refrig.)	AO	0…100 %	0-10 V
HX 4005 02	HX_4005_02_MV1	000100	Start/Stop electrical resistance	DO	N/A	0/1
BLWR 4005 01	BLWR_4005_01_MV1	000099	Start/Stop of the extractor	DO	N/A	0/1
SV 4005 01	SV_4005_01_MV	000088	Cooling water valve (Open/Close)	DO	N/A	0/1
PP 4005 01	PP_4005_01_MV1	000102	Start/Stop of the pump	DO	N/A	0/1

3.6.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4005 01	TT_4005_02	300141	Reactor temperature measurement	AI	0…150 ºC	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI	0…140 ºc	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI	0…140 ºc	4/20 mA
BLWR 4005 01	BLWR_4005_01_ERR	100103	Thermal protection of the extractor	DI	N/A	0/1
SV 4005 01	SV_4005_01_FB	100086	Cooling water valve (Limit switch)	DI	N/A	0/1

3.6.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	***)**	Temperature	H	To notify alarm to supervision	
2	***)**	Temperature	HH	To notify alarm to supervision	light intensity (safety value)
3	**BLWR 4005 01**		Thermal protection	To notify alarm to supervision	
4	**SV 4005 01**	Limit switch	Err	To notify alarm to supervision	

**)* The temperature value to set these alarms will be defined in the control software depending on the type of data processing. There are three values of the reactor temperature measured: TT 4005 01, TT 4006 01 and TT 4006 02.

1 → WARNING: The PBR temperature has rise to ------ºC.

2 → ALARM: The PBR temperature has rise to ------ºC (maximum process admissible temperature). Set light intensity to safety value (--- %)

⚠ **From hardware point of view, and regarding glass constraints, the permissible operating temperature is <u>200ºC</u>, provided that there is no sudden temperature shock.**

(*See chapter 2.2.1.5: Operating permissible conditions* of this manual)

3 → ALARM: Alarm from the blower thermal protection.

4 → ALARM: The automatic valve is not working. To notify failure.

3.7 Loop 4006. Bioreactor pH control

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

3.7.1 Control elements

- AT 4006 01: pH sensor/transmitter. Bioreactor pH measurement. (BPR upper part)
- AT 4006 02: pH sensor/transmitter. Bioreactor pH measurement. (BPR lower part)
- SV 4006 01: Control valve. Acid addition regulation.
- SV 4006 02: Control valve. Base addition regulation.
- WT 4006 01: Scale. Acid bottle weight measurement for level control.
- WT 4006 02: Scale. Base bottle weight measurement for level control.

3.7.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4006 01	SV_4006_01_MV	000083	Reactor acid inlet valve (Open/Close)	DO	N/A	0/1
SV 4006 02	SV_4006_02_MV	000082	Reactor base inlet valve (Open/Close)	DO	N/A	0/1
PP 4006 01	PP_4006_01_MV1	000098	Start/Stop of the pump	DO	N/A	0/1
PP 4006 02	PP_4006_02_MV1	000097	Start/Stop of the pump	DO	N/A	0/1

3.7.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
AT 4006 01	AT_4006_01	300125	Ph measurement	AI	0…12	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI	0…140 ºC	4/20 mA
AT 4006 02	AT_4006_02	300127	Ph measurement	AI	0…12	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI	0…140 ºC	4/20 mA
SV 4006 01	SV_4006_01_FB	100091	Reactor acid inlet valve (Limit switch)	DI	N/A	0/1
SV 4006 02	SV_4006_02_FB	100092	Reactor base inlet valve (Limit switch)	DI	N/A	0/1
WT 4006 01	WT_4006_01	-----	Acid balance	Eth	0…6 Kg	Ethernet
WT 4006 02	WT_4006_02	-----	Base balance	Eth	0…6 Kg	Ethernet

3.7.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	***)**	pH	H	To notify alarm to supervision	
2	***)**	pH	L	To notify alarm to supervision	
3	WT 4006 01	Weight (level)	L	To notify alarm to supervision	
4	WT 4006 01	Weight (level)	LL	To notify alarm to supervision	PP 4006 01
5	WT 4006 02	Weight (level)	L	To notify alarm to supervision	
6	WT 4006 02	Weight (level)	LL	To notify alarm to supervision	PP 4006 02
7	SV 4006 01	Limit switch	Err	To notify alarm to supervision	PP 4006 01
8	SV 4006 02	Limit switch	Err	To notify alarm to supervision	PP 4006 02

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

1 → ALARM: The PBR pH has risen to ------.

2 → ALARM: The PBR pH has fallen to ------.

3 → WARNING: Acid vessel level is at ------% or lower.

4 → ALARM: VS 4006 01 is empty. Stop PP 4006 01.

5 → WARNING: Base vessel level is at ------% or lower.

6 → ALARM: VS 4006 02 is empty. Stop PP 4006 02.

7 → ALARM: The automatic valve is not working. To notify failure.

8 → ALARM: The automatic valve is not working. To notify failure.

3.8 Loop 4007. Bioreactor pressure control

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

IMPORTANT NOTE: The activation of loop 4007 means the deactivation of loop 4004 which controls the outlet gas flow.

3.8.1 Control elements

- PT 4007 01: Pressure transmitter. Bioreactor pressure measurement.
- PT 4007 02: Pressure transmitter. Bioreactor pressure measurement.
- SCV 4004 01: Control valve. Outlet gas flow control.
- FT 4004 01: Flow meter. Outlet gas flow measure.
- DPT 4004 01: Differential pressure transmitter. ΔP measurement for filters (GF 4004 01/02) blockage control.

3.8.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SCV 4004 01	SCV_4004_01_MV	400108	Reactor outlet gas flow set point	AO	0 to 100 %	4/20 mA

3.8.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
PT 4007 01	PT_4007_01	300135	Reactor pressure measurement	AI	-1…1,5 bar	4/20 mA
PT 4007 02	PT_4007_02	300136	Reactor pressure measurement	AI	-1…5 bar	4/20 mA
FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI	0…20 Nl/min	4/20 mA
DPT 4004 01	DPT_4004_01	300140	Differential pressure measurement	AI	0...3 bar	4/20 mA

3.8.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	*)	Pressure	H	To notify alarm to supervision	
2	*)	Pressure	HH	To notify alarm to supervision	FQRC 4003 04 (0 l/min)
3	DPT 4004 01	Pressure	H	To notify alarm to supervision	
4	DPT 4004 01	Pressure	HH	To notify alarm to supervision	

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

1 → WARNING: The PBR pressure has rise to -----bar.

4 → ALARM: The PBR pressure has rise to ----bar. Close FQRC 4003 04 (PBR gas inlet)

⚠ **From hardware point of view, the permissible operating pressure for the glass DN150 cylinders is from -1 bar$_g$ to 2 bar$_g$,**

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

4 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 0.3 bar.

3.9 Loop 4008. Bioreactor liquid level control

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

IMPORTANT NOTE: The activation of loop 4008 means the deactivation of loop 4002 which controls the outlet liquid flow.

3.9.1 Control elements

- WT 4008 01: Weight cells. Bioreactor weight measurement for level controlling.
- PS 4002 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4002 01/02: Pressure switch. Lines over-pressure detection.
- WT 4002 01: Weight measurement. Harvesting tank (VS 4002 01) weight measurement for controlling the tank level.
- GP 4002 01/02 speed regulator: Feed pumps. Reactor outlet liquid pumping to the harvesting vessel.
- GP 4002 03 speed regulator: Mechanic agitator. Harvesting vessel agitation.

3.9.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
GP 4002 01/02	GP_4002_01_MV2	400111	Flow set point to the outlet pumps	AO		4/20 mA
GP 4002 03	GP_4002_03_MV2	400114	VS 4001 01 agitator speed set point	AO		4/20 mA
GP 4002 01	GP_4002_01_MV1	000089	Start/Stop of the pump	DO	N/A	0/1
GP 4002 02	GP_4002_02_MV1	000104	Start/Stop of the pump	DO	N/A	0/1
GP 4002 01/02		000112	Start/Stop GP 4002 01/02 converter	DO	N/A	0/1
GP 4002 03		000109	Start/Stop GP 4002 03 converter	DO	N/A	0/1

3.9.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
WT 4008 01	WT_4008_01	300133	Reactor weight cells	AI	0…100 Kg	4/20 mA
WT 4002 01	WT_4002_01	300132	Weight Balance (VS 4002 01)	AI	0…500 Kg	4/20 mA
GP 4002 01/02	GP_4002_01_ERR	100101	Thermal protection of the outlet pumps	DI	N/A	0/1
GP 4002 03	GP_4001_03_ERR	100105	Thermal protection of the agitator	DI	N/A	0/1
PS 4002 01	PS_4002_01	100084	Pressure switch	DI	N/A	0/1
PS 4002 02	PS_4002_02	100085	Pressure switch	DI	N/A	0/1
PS 4002 03	PS_4002_03	100108	Pressure switch (GP 4002 01)	DI	N/A	0/1
PS 4002 04	PS_4002_04	100109	Pressure switch (GP 4002 02)	DI	N/A	0/1

3.9.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	WT 4008 01	Weight (level)	H	To notify alarm to supervision	
2	WT 4008 01	Weight (level)	HH	To notify alarm to supervision	GP 4001 01/02
3	WT 4008 01	Weight (level)	L	To notify alarm to supervision	
4	WT 4008 01	Weight (level)	LL	To notify alarm to supervision	GP 4002 01/02
5	PS 4002 03/04	Pressure	H	To notify alarm to supervision	GP 4002 01/02
6	PS 4002 01/02	Pressure	H	To notify alarm to supervision	GP 4002 01/02
7	WT 4002 01	Weight (level)	H	To notify alarm to supervision	
8	WT 4002 01	Weight (level)	HH	To notify alarm to supervision	GP 4002 01/02
9	WT 4002 01	Weight (level)	L	To notify alarm to supervision	GP 4002 03

1 → WARNING: PBR level is at ------L or upper.

2 → ALARM: PBR level is upper than ----- L. Stop feeding pump.

3 → WARNING: PBR level is at ------L or lower.

4 → ALARM: PBR level is lower than ----- L. Stop harvesting pump.

5 → ALARM: The membrane of the harvesting pump has broken.

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

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

7 → WARNING: Harvesting vessel level is at ------% or upper.

8 → ALARM: VS 4002 01 is full. Stop harvesting pumps.

9 → WARNING: Harvesting vessel level is at ------% or lower. Stop the vessel agitator.

3.10 Loop 4009. Bioreactor biomass production control

This loop measures the PBR biomass concentration and provides this information to the control system. This loop is a mixture of the inlet liquid flow control and the PBR lighting control.
In addition, this section includes biomass sensor cleaning logic.

IMPORTANT NOTE: The activation of loop 4009 means the deactivation of loops 4000/4001 which control the PBR lighting and the inlet liquid flow.

3.10.1 Control elements

- AT 4009 01: biomass sensor/transmitter. Bioreactor biomass measurement.
- AT 4009 02: biomass sensor/transmitter. Bioreactor biomass measurement.
- IRC 4000 01: Light supply system.
- LT 4001 01: Level transmitter. Feeding tank (VS 4001 01) level measurement.
- PS 4001 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4001 01/02: Pressure switch. Lines over-pressure detection.
- DPT 4001 02: Differential pressure transmitter. ΔP measurement for pre-filters (LF 4001 02/03) blockage control.
- FT 4001 01: Liquid mass flow meter. Reactor inlet liquid flow measurement.
- DPT 4001 01: Differential pressure transmitter. ΔP measurement for filters (LF 4001 04/05) blockage control.
- GP 4001 01/02 speed regulator: Feed pumps. Liquid pumping to the reactor liquid inlet.
- GP 4001 03 speed regulator: Magnetic agitator. Feeding vessel agitation.
- SV 4003 02: Control valve. Air inlet for sensor cleaning.

3.10.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
IRC 4000 01	IRC_4000_MV	400115	Light Intensity	AO	0...100 %	4/20 mA
GP 4001 03	GP_4001_03_MV2	400113	VS 4001 01 agitator speed set point	AO	50 Hz = 1400 rpm	4/20 mA
GP 4001 01/02	GP_4001_01_MV2	400109	Flow set point to the inlet pumps	AO		4/20 mA
GP 4001 03		000110	Start/Stop GP 4001 03 converter	DO	N/A	0/1
GP 4001 01	GP_4001_01_MV1	000091	Start/Stop of the pump	DO	N/A	0/1
GP 4001 02	GP_4001_02_MV1	000090	Start/Stop of the pump	DO	N/A	0/1
GP 4001 01/02		000111	Start/Stop GP 4001 01/02 converter	DO	N/A	0/1
SV 4003 02	SV_4003_02_MV	000095	Reactor air inlet valve (Open/Close)	DO	N/A	0/1

3.10.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
AT 4009 01	AT_4009_01	300118	Biomass measurement	AI	0…2 g/l	4/20 mA
AT 4009 02	AT_4009_02	300119	Biomass measurement	AI	0…5 g/l	4/20 mA
AT 4009 02	AT_4009_FAILURE_IND	300120	Biomass sensor failure	AI	(22 mA)	4/20 mA
FT 4001 01	FT_4001_01	300130	Total liquid inlet flow to reactor	AI	0…20 kg/h	4/20 mA
LT 4001 01	LT_4001_01	300131	VS 4001 01 level	AI	0,,,100 %	4/20 mA
DPT 4001 01	DPT_4001_01	300138	Differential pressure measurement	AI	0,,,3 bar	4/20 mA
DPT 4001 02	DPT_4001_02	300139	Differential pressure measurement	AI	0,,,3 bar	4/20 mA
GP 4001 03	GP_4001_03_ERR	100104	Thermal protection of the agitator	DI	N/A	0/1
PS 4001 01	PS_4001_01	100082	Pressure switch	DI	N/A	0/1

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
PS 4001 02	PS_4001_02	100083	Pressure switch	DI	N/A	0/1
PS 4001 03	PS_4001_03	100106	Pressure switch (GP 4001 01)	DI	N/A	0/1
PS 4001 04	PS_4001_04	100107	Pressure switch (GP 4001 02)	DI	N/A	0/1
GP 4001 01/02	GP_4001_01_ERR	100099	Thermal protection of the inlet pumps	DI	N/A	0/1
SV 4003 02	SV_4003_02_FB	100095	Reactor air inlet valve (Limit switch)	DI	N/A	0/1

3.10.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**AT 4009 02**	Sensor failure	Err	To notify alarm to supervision	
2	**LT 4001 01**	Level	L	To notify alarm to supervision	------
3	**LT 4001 01**	Level	LL	To notify alarm to supervision	GP 4001 01/02 and GP 4001 03
4	**PS 4001 03/04**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
5	**PS 4001 01/02**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
6	**DPT 4001 02**	Differential pressure	H	To notify alarm to supervision	------
7	**DPT 4001 02**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02
8	**DPT 4001 01**	Differential pressure	H	To notify alarm to supervision	------
9	**DPT 4001 01**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02
10	**SV 4003 02**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: The biomass sensor (AT 4009 02) is not working. To notify failure.

2 → WARNING: Feeding vessel level is at ------% or lower.

3 → ALARM: VS 4001 01 is empty. Stop feeding pumps and vessel agitator.

4 → ALARM: The membrane of the feeding pump has broken.

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

5 → ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop feeding pumps.

6 / 8 → WARNING: The differential pressure (inlet/outlet of filter) has rise to ------bar. (Preventive maintenance)

7 / 9 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 2.5-3 bar. Stop feeding pumps.

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

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

10 → ALARM: The automatic valve is not working. To notify failure.

3.11 Loop 4010. Bioreactor outlet gas composition control

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

3.11.1 Control elements

- FT 4004 01: Flow meter. Outlet gas flow measure.
- TT 4010 01: Temperature sensor/transmitter. Outlet gas temperature measurement.
- PT 4010 01: Pressure sensor/transmitter. Outlet gas pressure measurement.
- AT 4010 01/02: CO_2/O_2 Analyzer. Outlet gas composition measurement.
- AT 4010 03: Dissolved O_2 Analyzer. PBR O_2 composition measurement.
- SV 4010 01 Control valve. Gas inlet to analyzer.

3.11.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4010 01	SV_4010_01_MV	000081	Analyzer gas inlet valve (Open/Close)	DO	N/A	0/1

3.11.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
AT 4010 01	AT_4010_01	300121	CO2/O2 analyzer	AI		4/20 mA
AT 4010 02	AT_4010_02	300122	CO2/O2 analyzer	AI		4/20 mA
AT 4010 03	AT_4010_03	300123	Dissolved O2 measurement	AI		4/20 mA
PT 4010 01	PT_4010_01	300137	Outlet gas pressure measurement	AI	-1...5 bar	4/20 mA
TT 4010 01	TT_4010_01	300143	Outlet gas temperature measurement	AI	0…150 ºC	4/20 mA
FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI	0…20 Nl/min	4/20 mA
SV 4010 01	SV_4010_01_FB	100093	Analyzer gas inlet valve (Limit switch)	DI	N/A	0/1

3.11.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**PT 4010 01**	Pressure	H	To notify alarm to supervision	SV 4010 01
2	**TT 4010 01**	Temperature	H	To notify alarm to supervision	------
3	**SV 4010 01**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: pressure is out of analyzer operating range conditions. Close inlet valve SV 4010 01.

2 → ALARM: temperature is out of analyzer operating range conditions.

3 → ALARM: The automatic valve is not working.

3.12 Loop 4011. Feeding tank temperature control

3.12.1 Control elements

- TT 4011 01: Temperature sensor/transmitter. VS 4001 01 temperature measurement.
- SV 4011 01: Control valve. Cooling water inlet to VS 4001 01 jacket.

3.12.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4011 01	SV_4011_01_MV	000087	Cooling water valve (Open/Close)	DO	N/A	0/1

3.12.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4011 01	TT_4011_01	300142	VS 4001 01 temp. measurement	AI	-10…150 ºC	4/20 mA
SV 4011 01	SV_4011_01_FB	100087	Cooling water valve (Limit switch)	DI	N/A	0/1

3.12.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4011 01**	Temperature	H	To notify alarm to supervision	
2	**TT 4011 01**	Temperature	Err	To notify alarm to supervision	
3	**SV 4011 01**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: Temperature is upper than ----ºC.

2 → ALARM: Temperature sensor is not working.

3 → ALARM: The automatic valve is not working. To notify failure.

⚠ **From hardware point of view, the permissible operating temperature is 170ºC, for vessel and jacket.**

3.13 Loop 4012. Harvesting tank temperature control

3.13.1 Control elements

- TT 4011 01: Temperature sensor/transmitter. VS 4001 01 temperature measurement.
- SV 4011 01: Control valve. Cooling water inlet to VS 4001 01 jacket.

3.13.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4012 01	SV_4012_01_MV	000085	Cooling water valve (Open/Close)	DO	N/A	0/1

3.13.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4012 01	TT_4012_01	300144	VS 4002 01 temp. measurement	AI	-50…250 ºC	4/20 mA
SV 4012 01	SV_4012_01_FB	100089	Cooling water valve (Limit switch)	DI	N/A	0/1

3.13.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4012 01**	Temperature	H	To notify alarm to supervision	
2	**SV 4012 01**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: Temperature is upper than ----ºC.

2 → ALARM: The automatic valve is not working. To notify failure.

⚠ **From hardware point of view, the permissible operating temperature is 150ºC, for vessel and jacket**

3.14 Loop 4013. Antifoam control

This loop is not implemented yet in the plant. There is wired and connected the signal from the sensor for foam detection which is the next:

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
LS 4013 01	LS_4013_01	100081	Foam measurement	DI	N/A	0/1

3.15 Loop 4014. Feeding tank sterilization

3.15.1 Control elements

- TT 4011 01: Temperature sensor/transmitter. VS 4001 01 temperature measurement.
- SV 4014 01: Control valve. Steam inlet to VS 4001 01.

3.15.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4014 01	SV_4014_01_MV	000086	Steam inlet valve (Open/Close)	DO	N/A	0/1

3.15.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4011 01	TT_4011_01	300142	VS 4001 01 temp. measurement	AI	-10…150 ºC	4/20 mA

3.15.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4011 01**	Temperature	L	To notify alarm to supervision	
2	**TT 4011 01**	Temperature	H	To notify alarm to supervision	

1 → ALARM: Temperature is lower than ----ºC (admissible temperature for sterilization).

2 → ALARM: Temperature is upper than ----ºC.

⚠ **From hardware point of view, the permissible operating temperature for the vessel is 170ºC.**

3.16 Loop 4015. PBR sterilization

3.16.1 Control elements

- TT 4005 01: Temperature transmitter. Bioreactor temperature measurement.
- TT 4006 01: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- TT 4006 02: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- SV 4015 01: Control valve. Steam inlet to PBR.

3.16.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4015 01	SV_4015_01_MV	000092	Reactor Steam inlet valve (Open/Close)	DO	N/A	0/1

3.16.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4005 01	TT_4005_02	300141	Reactor temperature measurement	AI	0…150 ºC	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement	AI	0…140 ºc	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement	AI	0…140 ºc	4/20 mA
SV 4015 01	SV_4015_01_FB	100098	Reactor Steam inlet valve (Limit switch)	DI	N/A	0/1
PT 4007 01	PT_4007_01	300135	Reactor pressure measurement	AI	-1…1,5 bar	4/20 mA
PT 4007 02	PT_4007_02	300136	Reactor pressure measurement	AI	-1…5 bar	4/20 mA

3.16.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	***)**	Temperature	L	To notify alarm to supervision	
2	***)**	Temperature	H	To notify alarm to supervision	
3	***²)**	Pressure	H	To notify alarm to supervision	
4	***²)**	Pressure	L	To notify alarm to supervision	
5	**SV 4015 01**	Limit switch	Err	To notify alarm to supervision	

*) The temperature value to set these alarms will be defined in the control software depending on the type of data processing. There are three values of the reactor temperature measured: TT 4005 02, TT 4006 01 and TT 4006 02.

***²)** The pressure value to set these alarms will be defined in the control software depending on the type of data processing. (PT 4007 01 and PT 4007 02)

1 → ALARM: Temperature is lower than ----ºC (admissible temperature for sterilization).

2 → ALARM: Temperature is upper than ----ºC.

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

3 → ALARM: Pressure has raised to ----bar

4 → ALARM: Pressure has fall to ----bar

⚠ **From hardware point of view, the permissible operating pressure for the glass DN150 cylinders is from -1 bar_g to 2 bar_g.**

5 → ALARM: The automatic valve is not working. To notify failure.

3.17 Loop 4016. Harvesting tank sterilization

3.17.1 Control elements

- TT 4012 01: Temperature sensor/transmitter. VS 4002 01 temperature measurement.
- SV 4016 07: Control valve. Steam inlet to VS 4002 01.

3.17.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4016 01	SV_4016_01_MV	000084	Steam inlet valve (Open/Close)	DO	N/A	0/1

3.17.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4012 01	TT_4012_01	300144	VS 4002 01 temp. measurement	AI	-50…250 ºC	4/20 mA

3.17.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4012 01**	Temperature	L	To notify alarm to supervision	
2	**TT 4012 01**	Temperature	H	To notify alarm to supervision	

1 → ALARM: Temperature is lower than ----ºC (admissible temperature for sterilization).

2 → ALARM: Temperature is upper than ----ºC.

⚠ **From hardware point of view, the permissible operating temperature for the vessel is 150ºC.**

3.18 General list of Digital/Analogical signals list

Loop	Equipment	Tag Variable	PLC ADDRESS	Description	I/O
4000	**IRC 4000 01**	IT_4000_01	300145	Light Power Phase 1 (NOT IMPLEMENTED)	AI
4000	**IRC 4000 01**	IT_4000_02	300146	Light Power Phase 2 (NOT IMPLEMENTED)	AI
4000	**IRC 4000 01**	IT_4000_03	300147	Light Power Phase 3 (NOT IMPLEMENTED)	AI
4000	**IRC 4000 01**	IRC_4000_MV	400115	Light Intensity	AO
4001	**FT 4001 01**	FT_4001_01	300130	Total liquid inlet flow to reactor	AI
4001	**LT 4001 01**	LT_4001_01	300131	VS 4001 01 level	AI
4001	**DPT 4001 01**	DPT_4001_01	300138	Differential pressure measurement	AI
4001	**DPT 4001 02**	DPT_4001_02	300139	Differential pressure measurement	AI
4001	**GP 4001 03**	GP_4001_03_MV2	400113	VS 4001 01 agitator speed set point	AO
4001	**GP 4001 03**		000110	Start/Stop GP 4001 03 converter	DO
4001	**GP 4001 03**	GP_4001_03_ERR	100104	Thermal protection of the agitator	DI
4001	**PS 4001 01**	PS_4001_01	100082	Pressure switch	DI
4001	**PS 4001 02**	PS_4001_02	100083	Pressure switch	DI
4001	**PS 4001 03**	PS_4001_03	100106	Pressure switch (GP 4001 01)	DI
4001	**PS 4001 04**	PS_4001_04	100107	Pressure switch (GP 4001 02)	DI
4001	**GP 4001 01**	GP_4001_01_MV1	000091	Start/Stop of the pump	DO
4001	**GP 4001 02**	GP_4001_02_MV1	000090	Start/Stop of the pump	DO
4001	**GP 4001 01/02**		000111	Start/Stop GP 4001 01/02 converter	DO
4001	**GP 4001 01/02**	GP_4001_01_ERR	100099	Thermal protection of the inlet pumps	DI
4001	**GP 4001 01/02**	GP_4001_01_MV2	400109	Flow setpoint to the inlet pumps	AO
4002	**WT 4002 01**	WT_4002_01	300132	Weight Balance (VS 4002 01)	AI
4002	**GP 4002 01**	GP_4002_01_MV1	000089	Start/Stop of the pump	DO
4002	**GP 4002 02**	GP_4002_02_MV1	000104	Start/Stop of the pump	DO
4002	**GP 4002 01/02**		000112	Start/Stop GP 4002 01/02 converter	DO
4002	**GP 4002 01/02**	GP_4002_01_ERR	100101	Thermal protection of the outlet pumps	DI
4002	**GP 4002 01/02**	GP_4002_01_MV2	400111	Flow setpoint to the outlet pumps	AO
4002	**GP 4002 03**	GP_4002_03_MV2	400114	VS 4001 01 agitator speed setpoint	AO
4002	**GP 4002 03**		000109	Start/Stop GP 4002 03 converter	DO
4002	**GP 4002 03**	GP_4001_03_ERR	100105	Thermal protection of the agitator	DI
4002	**PS 4002 01**	PS_4002_01	100084	Pressure switch	DI
4002	**PS 4002 02**	PS_4002_02	100085	Pressure switch	DI
4002	**PS 4002 03**	PS_4002_03	100108	Pressure switch (GP 4002 01)	DI
4002	**PS 4002 04**	PS_4002_04	100109	Pressure switch (GP 4002 02)	DI

Loop	Equipment	Tag Variable	PLC ADDRESS	Description	I/O
4003	FQRC 4003 01	FQRC_4003_01	300109	Inlet CO_2 flow measurement	AI
4003	FQRC 4003 01	FQRC_4003_01_SP	400100	Inlet CO_2 flow set point	AO
4003	FQRC 4003 02	FQRC_4003_02	300110	Inlet Air flow measurement	AI
4003	FQRC 4003 02	FQRC_4003_02_SP	400101	Inlet Air flow set point	AO
4003	FQRC 4003 03	FQRC_4003_03	300111	Circulated air flow measurement	AI
4003	FQRC 4003 03	FQRC_4003_03_SP	400102	Circulated air flow set point	AO
4003	FQRC 4003 04	FQRC_4003_04	300112	Total Inlet gas flow measurement	AI
4003	FQRC 4003 04	FQRC_4003_04_SP	400103	Total Inlet gas flow set point	AO
4003	SV 4003 01	SV_4003_01_MV	000093	Analyzer gas inlet valve (Open/Close)	DO
4003	SV 4003 01	SV_4003_01_FB	100097	Analyzer gas inlet valve (FEEDBACK)	DI
4003	SV 4003 02	SV_4003_02_MV	000095	Reactor air inlet valve(Open/Close)	DO
4003	SV 4003 02	SV_4003_02_FB	100095	Reactor air inlet valve (FEEDBACK)	DI
4003	SV 4003 03	SV_4003_03_MV	000096	Blower bypass valve(Open/Close)	DO
4003	SV 4003 03	SV_4003_03_FB	100094	Blower bypass valve (FEEDBACK)	DI
4003	PS 4003 01	PS_4003_01	100110	Pressure switch bypass for recycling	DI
4003	BLWR 4003 01	BLWR_4003_01_MV1	000103	Start/Stop of the blower	DO
4004	FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI
4004	DPT 4004 01	DPT_4004_01	300140	Differential pressure measurement	AI
4004	SCV 4004 01	SCV_4004_01_MV	400108	Reactor outlet gas flow set point	AO
4005	HX 4005 02	HX_4005_02_MV1	000100	Start/Stop electrical resistance	DO
4005	TT 4005 01	TT_4005_01	300141	Reactor temperature measurement	AI
4005	BLWR 4005 01	BLWR_4005_01_MV2	400104	Air extractor set point (lightening refrigeration)	AO
4005	BLWR 4005 01	BLWR_4005_01_MV1	000099	Start/Stop of the extractor	DO
4005	BLWR 4005 01	BLWR_4005_01_ERR	100103	Thermal protection of the extractor	DI
4005	SV 4005 01	SV_4005_01_MV	000088	Cooling water valve (Open/Close)	DO
4005	SV 4005 01	SV_4005_01_FB	100086	Cooling water valve (FEEDBACK)	DI
4005	PP 4005 01	PP_4005_01_MV1	000102	Start/Stop of the pump	DO
4006	AT 4006 01	AT_4006_01	300125	Ph measurement	AI
4006	TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI
4006	AT 4006 02	AT_4006_02	300127	Ph measurement	AI
4006	TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI
4006	SV 4006 01	SV_4006_01_FB	100091	Reactor acid inlet valve (Limit switch)	DI
4006	SV 4006 02	SV_4006_02_FB	100092	Reactor base inlet valve (Limit switch)	DI
4006	SV 4006 01	SV_4006_01_MV	000083	Reactor base inlet valve (Open/Close)	DO
4006	SV 4006 02	SV_4006_02_MV	000082	Reactor base inlet valve (Open/Close)	DO
4006	PP 4006 01	PP_4006_01_MV1	000098	Start/Stop of the pump	DO
4006	PP 4006 02	PP_4006_02_MV1	000097	Start/Stop of the pump	DO
4006	WT 4006 01	WT_4006_01	-----	Acid balance	Eth
4006	WT 4006 02	WT_4006_02	-----	Base balance	Eth
4007	PT 4007 01	PT_4007_01	300135	Reactor pressure measurement	AI
4007	PT 4007 02	PT_4007_02	300136	Reactor pressure measurement	AI

Loop	Equipment	Tag Variable	PLC ADDRESS	Description	I/O
4007	**PT 4007 01**	PT_4007_01	300135	Reactor pressure measurement	AI
4007	**PT 4007 02**	PT_4007_02	300136	Reactor pressure measurement	AI
4008	**WT 4008 01**	WT_4008_01	300133	Reactor weight cells	AI
4009	**AT 4009 01**	AT_4009_01	300118	Biomass measurement	AI
4009	**AT 4009 02**	AT_4009_02	300119	Biomass measurement	AI
4009	**AT 4009 02**		300120	Biomass sensor failure	AI
4010	**AT 4010 01**	AT_4010_01	300121	CO_2/O_2 analyser	AI
4010	**AT 4010 02**	AT_4010_02	300122	CO_2/O_2 analyser	AI
4010	**AT 4010 03**	AT_4010_03	300123	Dissolved O_2 measurement	AI
4010	**PT 4010 01**	PT_4010_01	300137	Outlet gas pressure measurement	AI
4010	**TT 4010 01**	TT_4010_01	300143	Outlet gas temperature measurement	AI
4010	**SV 4010 01**	SV_4010_01_MV	000081	Analyser gas inlet valve (Open/Close)	DO
4010	**SV 4010 01**	SV_4010_01_FB	100093	Analyser gas inlet valve (FEEDBACK)	DI
4010	**HX 4010 01**	HX_4010_01_MV1	000107	Start/Stop post condenser	DO
4011	**TT 4011 01**	TT_4011_01	300142	VS 4001 01 temp. measurement	AI
4011	**SV 4011 01**	SV_4011_01_MV	000087	Cooling water valve (Open/Close)	DO
4011	**SV 4011 01**	SV_4011_01_FB	100087	Cooling water valve (FEEDBACK)	DI
4012	**TT 4012 01**	TT_4012_01	300144	VS 4002 01 temp. measurement	AI
4012	**SV 4012 01**	SV_4012_01_MV	000085	Cooling water valve (Open/Close)	DO
4012	**SV 4012 01**	SV_4012_01_FB	100089	Cooling water valve (FEEDBACK)	DI
4013	**LS 4013 01**	LS_4013_01	100081	Foam measurement	DI
4014	**SV 4014 01**	SV_4014_01_MV	000086	Steam inlet valve (Open/Close)	DO
4015	**SV 4015 01**	SV_4015_01_MV	000092	Reactor Steam inlet valve (Open/Close)	DO
4015	**SV 4015 01**	SV_4015_01_FB	100098	Reactor Steam inlet valve (Feedback)	DI
4016	**SV 4016 01**	SV_4016_01_MV	000084	Steam inlet valve (Open/Close)	DO
	Emergency Buttons	Emergency_Button_01	100111	Emergency Buttons (any button pressed)	DI
	Emergency Buttons		000106	Electrical enclosure red LED	DO
	Emergency Buttons	Emergency_Button_02	100112	Emergency released	DI
	Emergency Buttons		000105	Electrical enclosure green LED	DO
			300148	SPARE (NOT USED)	AI
			400110	SPARE (NOT USED)	AO
			400112	SPARE (NOT USED)	AO
			100100	SPARE (NOT USED)	DI
			100102	SPARE (NOT USED)	DI
			000107	SPARE (NOT USED)	DO
			000101	SPARE (NOT USED)	DO
			000108	SPARE (NOT USED)	DO
			300124	CANCELLED (AT 4010 03 temp. meas.)	AI
			100088	CANCELLED (SV 4014 01 FEEDBACK)	DI
			100090	CANCELLED (SV 4016 01 FEEDBACK)	DI

4. PLANT SAFETY:

4.1 Emergency stop buttons (E-stops)

The digital/analogical signals associated to the emergency buttons are:

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
Emergency Buttons	Emergency_Button_01	100111	Emergency Buttons (any button pressed)	DI	N/A	0/1
Emergency Buttons		000106	Electrical enclosure red LED	DO	N/A	0/1
Emergency Buttons	Emergency_Button_02	100112	Emergency released	DI	N/A	0/1
Emergency Buttons		000105	Electrical enclosure green LED	DO	N/A	0/1

There are three emergency buttons installed in the skid of the plant:

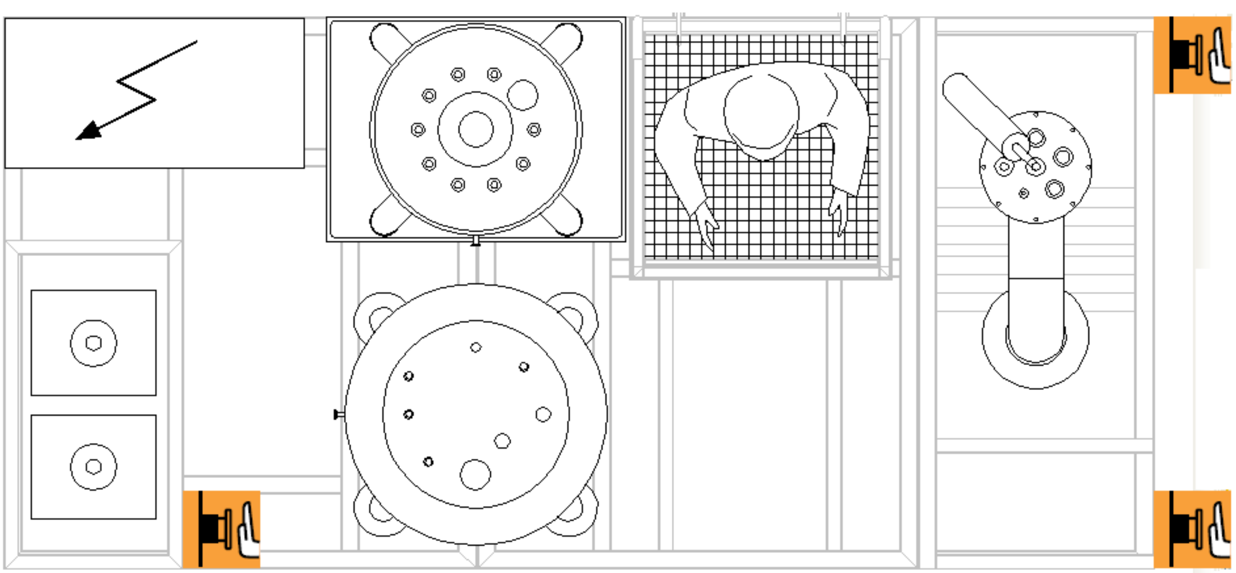


Fig. 1 Situation of C.IVa emergency buttons

An Emergency Stop Device is not considered a safeguarding device because it requires an overt action by an individual to stop machine motion.

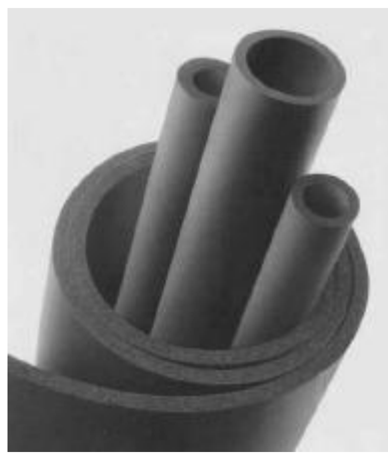
Because an individual must actuate the E-Stop button for it to function, these devices do not fit the definition of a safeguarding device.

The user is responsible for making sure that all machine operators, maintenance personnel, electricians, and supervisors are thoroughly familiar with and understand all instructions regarding the installation, maintenance, and use of this product, and with the machinery it controls.

4.2 Thermal insulation of equipment and piping

Reasons for the use of insulation generally fall into one of the following categories:

- To save Energy
- To help maintain process temperatures
- To protect site personnel against burns
- To prevent condensation forming
- To protect against frost
- To protect equipment from corrosion
- To provide fire protection
- To provide acoustic insulation



In C.IVa all the glycol/steam pipes have been insulated, basically to protect site personnel against burns and to prevent condensation formation.

The material used for the insulation is K FLEX ST (tubular insulator)

Technical data for K FLEX ST are:

Thermal conductivity at -20 ºC	$\lambda_{-20\ ºC}$	=	0,033 W m^{-1} K^{-1}
Thermal conductivity at 0 ºC	$\lambda_{0\ ºC}$	=	0,035 W m^{-1} K^{-1}
Thermal conductivity at 20 ºC	$\lambda_{20\ ºC}$	=	0,037 W m^{-1} K^{-1}
Temperatures range	T	=	[-45…155] ºC
Density	r	=	65 ± 10 kg m^{-3}

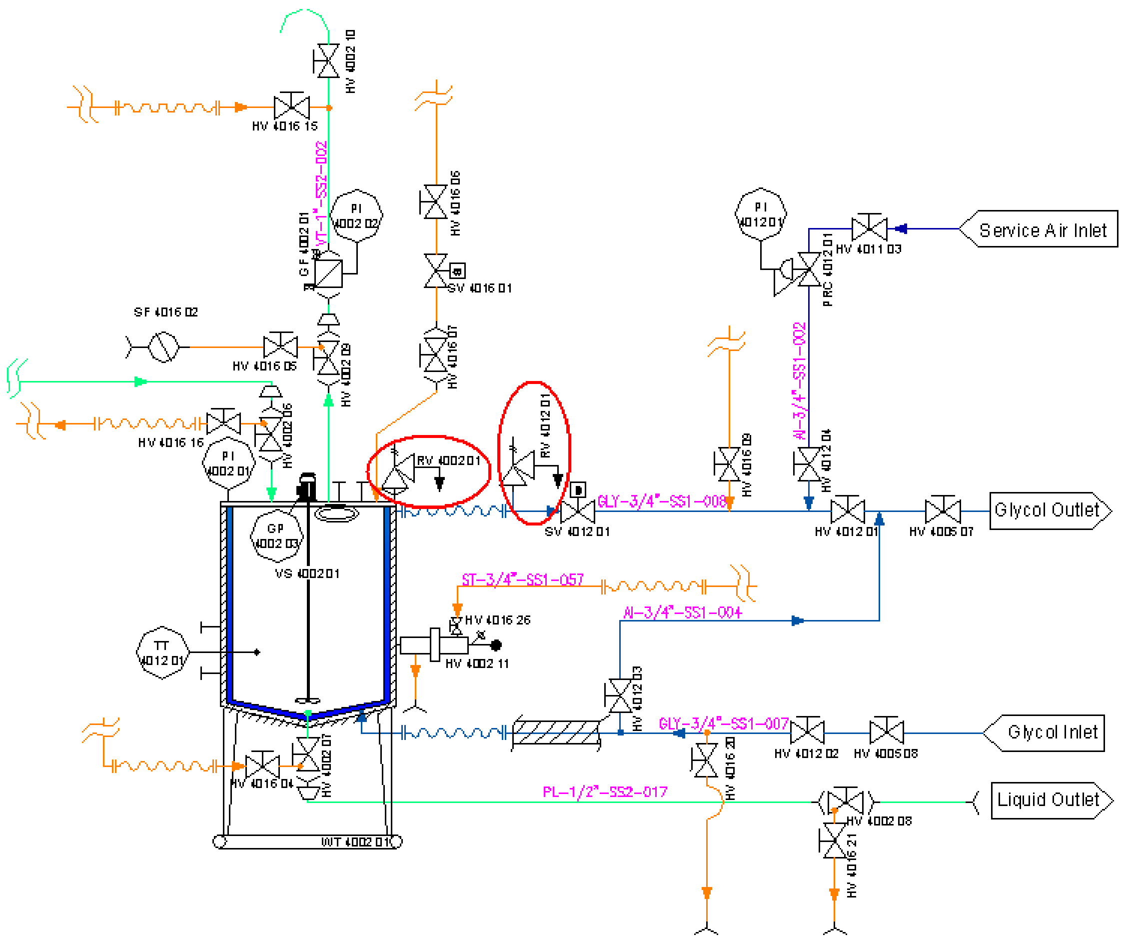
4.3 Relief valves

As a safety device for protection against excessive pressure there are installed relief valves. Relief valves are a type of valve used to control or limit the pressure in a system or vessel.

The pressure is relieved by allowing the pressurized fluid to flow from an auxiliary passage out of the system. As the fluid is diverted, the pressure inside the vessel will drop. Once it reaches the valve's reseating pressure, the valve will close.

The relief valve is designed or set to open at a predetermined set pressure to protect pressure vessels and other equipment from being subjected to pressures that exceed their design limits.

4.3.1 Feeding and harvesting vessels:

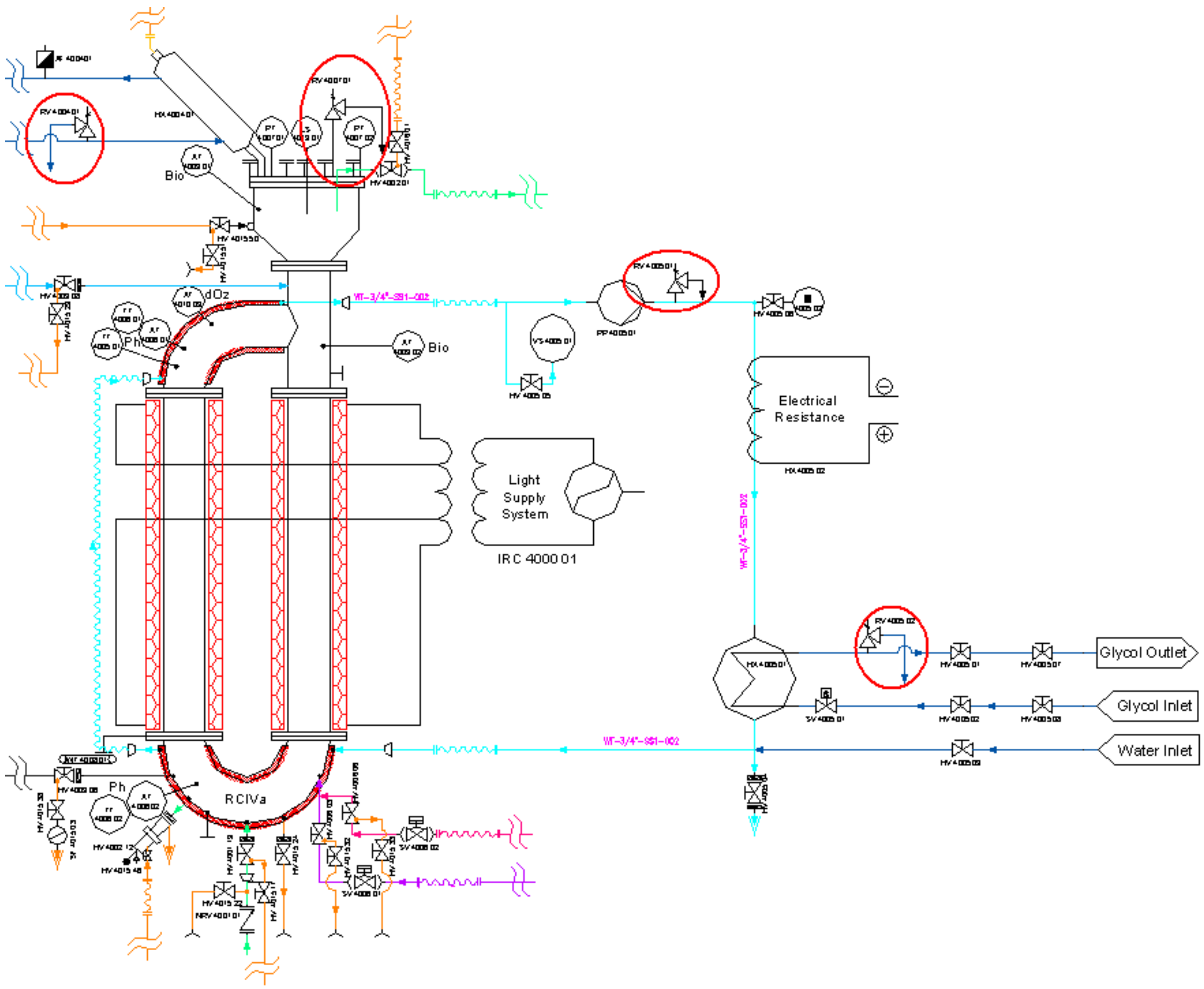


In feeding and harvesting vessels, there are installed two relief valves:

- RV 4001 01 / RV 4002 01: Sanitary relief valve installed on the vessel upper butt-end in order to protect the tank hoop.

- RV 4011 01 / RV 4012 01: Relief valve installed on VS 4001 01 / VS 4002 01 glycol outlet pipe GLY-3/4”-SS1-002/008 to protect the tank jacket.

4.3.2 PBR and outlet gases condenser (HX 4004 01)



- RV 4007 01: Sanitary relief valve installed on the upper flange of the PBR in order to protect the reactor vessel shell (AISI 316 parts and glass columns) and the process part of the condenser HX 4004 01.

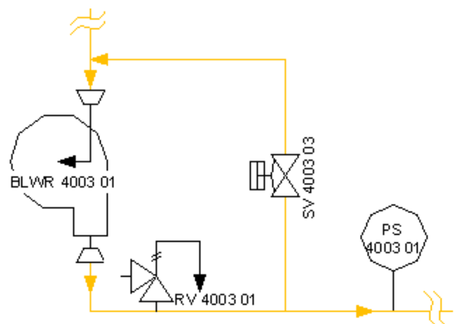
- RV 4004 01: Relief valve installed on the condenser HX 4004 01 glycol inlet pipe GLY-3/4”-SS1-004 in order to protect the service part of the condenser.

- RV 4005 01: Relief valve installed on the PBR cooling water circuit which protects the PBR jacket and the water flow part of the plate heat exchanger HX 4005 01.

NOTE: For the expanding water has been installed in the water circuit a bladder accumulator (VS 4005 01) constructed in stainless steel.

- RV 4005 02: Relief valve installed on the condenser HX 4005 01 glycol outlet pipe GLY-3/4"-SS1-004 in order to protect the service part of the heat exchanger.

4.3.3 **Compressor of circulated gas pipe (BLWR 4003 01)**



- RV 4003 01: Relief valve installed in the compressor BLWR 4003 01 outlet to protect the compressor in case of control system failure*).

*) A control valve commanded by a pressure switch is used to return all or part of the fluid discharged by the compressor back to the compressor inlet in order to protect the compressor from an excessive pressure.

4.3.4 Relief valves certificates

All the relief valves installed on the plant have a calibration certificated emitted by the supplier.

INOXPA SOURCE OF SOLUTIONS

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C. Telers, 54 Apt, 161
17820 BANYOLES .GIRONA (SPAIN)
Tel. (+34) 972 57 52 00 – Fax (+34) 972 57 55 02

Banyoles, 20/02/2009

CERTIFICADO DE TARAGE

INOXPA S.A declara que la válvula con código V7401 00218274FLU descripción: VÁLVULA DE SOBREPRESIÓN CL/CL DN 1' y con OF I053887 ha sido tarada a una presión de **2 bar**

Atentamente

Inoxpa, S.A
Dpt. de Calidad

INOXPA SOURCE OF SOLUTIONS

INOXPA, S.A
C. Telers, 54 Apt, 161
17820 BANYOLES .GIRONA (SPAIN)
Tel. (+34) 972 57 52 00 – Fax (+34) 972 57 55 02

Banyoles, 08/06/2009

CERTIFICADO DE TARAGE

INOXPA S.A declara que la válvula con código V7401 00205697FLU descripción: VÁLVULA DE SOBREPRESIÓN CL/CL DN 1' y con OF I053886 ha sido tarada a una presión de **2 bar**

Atentamente

Inoxpa, S.A
Dpt. de Calidad

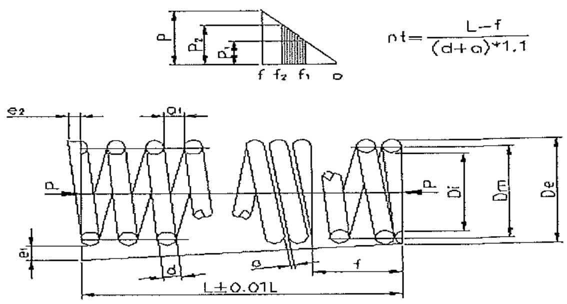
VYC	CERTIFICADO VÁLVULAS DE SEGURIDAD	CERTIFICADO N° 9702
		FECHA 05/06/2009

IDENTIFICACIÓN VÁLVULA

Orden de fabricación	93464	Diámetro nominal de la entrada en mm	(DN1) 3/8"	Fluido de trabajo	agua
Fabricante	`VYC	Diámetro nominal de la salida en mm	(DN2)3/8"	Localizacion / PSV..etc	
Modelo	095	Diámetro mínimo de paso de fluido en m	(d0) 10,20	Presión de disparo en frío	(Pe) 3,0 Bar
Código	200209563821	Coeficiente de descarga concedido	(αd)	Contrapresión	Atmosférica
Tipo (AIT/AN/AP)	AP	Elevación en mm	(h)	Atmosférica	Pa

IDENTIFICACIÓN MUELLE

Código		56026
Longitud en mm	(L)	42
Diámetro exterior en mm	(De)	12,6
Diámetro del hilo en mm	(d)	1,8
Flecha en mm	(f)	6,7
Diámetro interior en mm	(Di)	9
Diámetro medio en mm	(Dm)	10,8
Espiras totales	(nt)	12
Espiras efectivas	(ne)	10,5
Fuerza en Kp	(P)	5,52

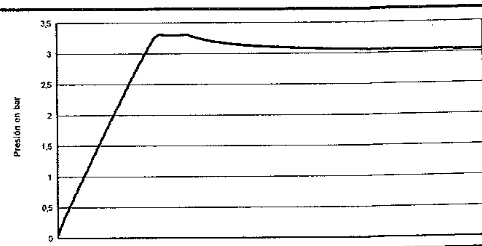


INSPECCIÓN VISUAL

Corrosión interior	Inexistente	Cierre	Excelente
Acabado	Excelente	Eje	Excelente
Conexiones	Excelente	Muelle	Excelente
Cuerpo	Excelente	Campana	Excelente
Asiento	Excelente	Caperuza	Excelente

TARADO

Presión de tarado	(Pe)	3,0 Bar
Presión de apertura	(Ps)	3,3 Bar
Presión de cierre	(Pc)	3,0 Bar
Resultado		Pasa
Fluido de prueba		Aire
Temperatura		20 °C
Longitud visible de rosca en mr		



Observaciones

25122

CERTIFICACIONES

Resultado	Pasa	Probado	
Fecha	05/06/2009	Firma	[signature]

VYC

CERTIFICADO VÁLVULAS DE SEGURIDAD

CERTIFICADO N° 8960

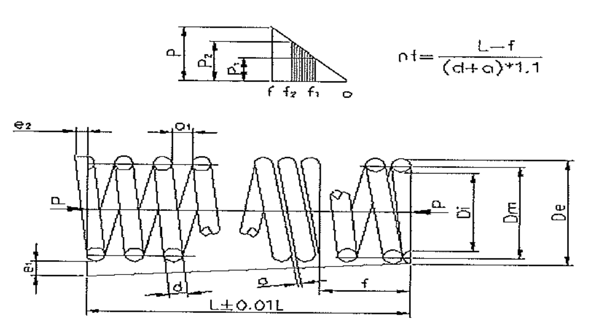
FECHA 29/04/2009

IDENTIFICACIÓN VÁLVULA

Orden de fabricación	92872	Diámetro nominal de la entrada en mm	(DN1) 3/8"	Fluido de trabajo	Agua
Fabricante	VYC	Diámetro nominal de la salida en mm	(DN2)3/8"	Localizacion / PSV..etc	
Modelo	095	Diámetro mínimo de paso de fluido en m	(d0) 10,20	Presión de disparo en frío	(Pe) 3,0 Bar
Código	200209563821	Coeficiente de descarga concedido	(αd)	Contrapresión	Atmosférica
Tipo (AIT/AN/AP)	AP	Elevación en mm	(h)	Atmosférica	Pa

IDENTIFICACIÓN MUELLE

Código		56026
Longitud en mm	(L)	42
Diámetro exterior en mm	(De)	12,6
Diámetro del hilo en mm	(d)	1,8
Flecha en mm	(f)	6,7
Diámetro interior en mm	(Di)	9
Diámetro medio en mm	(Dm)	10,8
Espiras totales	(nt)	12
Espiras efectivas	(ne)	10,5
Fuerza en Kp	(P)	5,52

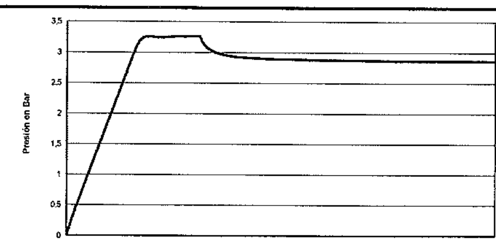


INSPECCIÓN VISUAL

Corrosión interior	Inexistente	Cierre	Excelente
Acabado	Excelente	Eje	Excelente
Conexiones	Excelente	Muelle	Excelente
Cuerpo	Excelente	Campana	Excelente
Asiento	Excelente	Caperuza	Excelente

TARADO

Presión de tarado	(Pe)	3,0 Bar
Presión de apertura	(Ps)	3,3 Bar
Presión de cierre	(Pc)	2,9 Bar
Resultado		Pasa
Fluido de prueba		Aire
Temperatura		20 °C
Longitud visible de rosca en mr		



Observaciones

25122

CERTIFICACIONES

Resultado	Pasa	Probado	
Fecha	29/04/2009	Firma	

CERTIFICADO VÁLVULAS DE SEGURIDAD

CERTIFICADO N° 8958

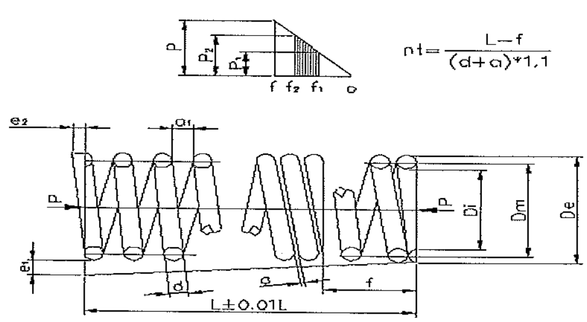
FECHA 29/04/2009

IDENTIFICACIÓN VÁLVULA

Orden de fabricación	92873/3	Diámetro nominal de la entrada en mm	(DN1) 3/8"	Fluido de trabajo	Agua
Fabricante	VYC	Diámetro nominal de la salida en mm	(DN2)3/8"	Localizacion / PSV..etc	
Modelo	095	Diámetro mínimo de paso de fluido en m	(d0) 10,20	Presión de disparo en frío	(Pe) 4,0 Bar
Código	200209563821	Coeficiente de descarga concedido	(αd)	Contrapresión	Atmosférica
Tipo (AIT/AN/AP)	AP	Elevación en mm	(h)	Atmosférica	Pa

IDENTIFICACIÓN MUELLE

Código		56027
Longitud en mm	(L)	42
Diámetro exterior en mm	(De)	13
Diámetro del hilo en mm	(d)	2
Flecha en mm	(f)	8,2
Diámetro interior en mm	(Di)	9
Diámetro medio en mm	(Dm)	11
Espiras totales	(nt)	9,5
Espiras efectivas	(ne)	8
Fuerza en Kp	(P)	11,04

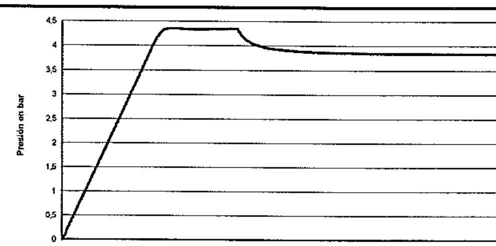


INSPECCIÓN VISUAL

Corrosión interior	Inexistente	Cierre	Excelente
Acabado	Excelente	Eje	Excelente
Conexiones	Excelente	Muelle	Excelente
Cuerpo	Excelente	Campana	Excelente
Asiento	Excelente	Caperuza	Excelente

TARADO

Presión de tarado	(Pe)	4,0 Bar
Presión de apertura	(Ps)	4,4 Bar
Presión de cierre	(Pc)	3,8 Bar
Resultado		Pasa
Fluido de prueba		Aire
Temperatura		20 °C
Longitud visible de rosca en mr		



Observaciones

25122

CERTIFICACIONES

Resultado	Pasa	Probado	
Fecha	29/04/2009	Firma	

VYC

CERTIFICADO VÁLVULAS DE SEGURIDAD

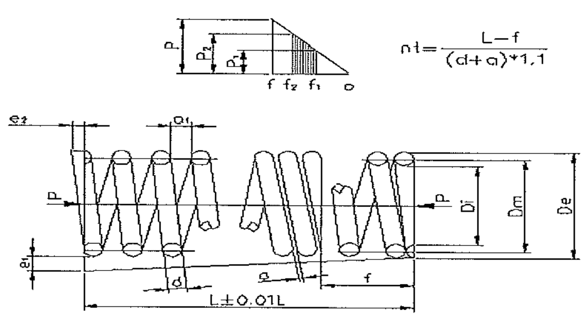
CERTIFICADO N°	8959
FECHA	29/04/2009

IDENTIFICACIÓN VÁLVULA

Orden de fabricación	92873/4	Diámetro nominal de la entrada en mm	(DN1) 3/8"	Fluido de trabajo	Agua
Fabricante	VYC	Diámetro nominal de la salida en mm	(DN2)3/8"	Localizacion / PSV..etc	
Modelo	095	Diámetro mínimo de paso de fluido en m (d0)	10,20	Presión de disparo en frío	(Pe) 4,0 Bar
Código	200209563821	Coeficiente de descarga concedido	(αd)	Contrapresión	Atmosférica
Tipo (AIT/AN/AP)	AP	Elevación en mm	(h)	Atmosférica	Pa

IDENTIFICACIÓN MUELLE

Código		56027
Longitud en mm	(L)	42
Diámetro exterior en mm	(De)	13
Diámetro del hilo en mm	(d)	2
Flecha en mm	(f)	8,2
Diámetro interior en mm	(Di)	9
Diámetro medio en mm	(Dm)	11
Espiras totales	(nt)	9,5
Espiras efectivas	(ne)	8
Fuerza en Kp	(P)	11,04

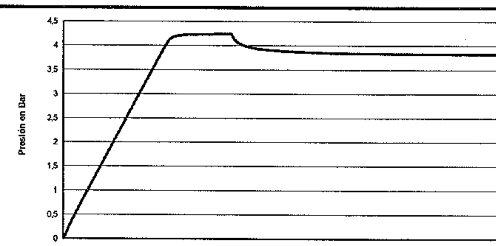


INSPECCIÓN VISUAL

Corrosión interior	Inexistente	Cierre	Excelente
Acabado	Excelente	Eje	Excelente
Conexiones	Excelente	Muelle	Excelente
Cuerpo	Excelente	Campana	Excelente
Asiento	Excelente	Caperuza	Excelente

TARADO

Presión de tarado	(Pe)	4,0 Bar
Presión de apertura	(Ps)	4,2 Bar
Presión de cierre	(Pc)	3,8 Bar
Resultado		Pasa
Fluido de prueba		Aire
Temperatura		20 °C
Longitud visible de rosca en mr		



Observaciones

25122

CERTIFICACIONES

Resultado	Pasa	Probado	
Fecha	29/04/2009	Firma	[signature]

CERTIFICADO VÁLVULAS DE SEGURIDAD

VYC

CERTIFICADO N° 8957

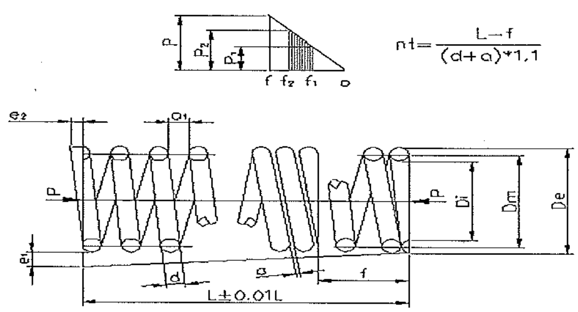
FECHA 29/04/2009

IDENTIFICACIÓN VÁLVULA

Orden de fabricación	92873/2	Diámetro nominal de la entrada en mm	(DN1) 3/8"	Fluido de trabajo	Agua	
Fabricante	VYC	Diámetro nominal de la salida en mm	(DN2)3/8"	Localizacion / PSV..etc		
Modelo	095	Diámetro mínimo de paso de fluido en m	(d0) 10,20	Presión de disparo en frío	(Pe) 4,0 Bar	
Código	200209563821	Coeficiente de descarga concedido	(αd)	Contrapresión	Atmosférica	
Tipo (AIT/AN/AP)	AP	Elevación en mm	(h)	Atmosférica	Pa	

IDENTIFICACIÓN MUELLE

Código		56027
Longitud en mm	(L)	42
Diámetro exterior en mm	(De)	13
Diámetro del hilo en mm	(d)	2
Flecha en mm	(f)	8,2
Diámetro interior en mm	(Di)	9
Diámetro medio en mm	(Dm)	11
Espiras totales	(nt)	9,5
Espiras efectivas	(ne)	8
Fuerza en Kp	(P)	11,04

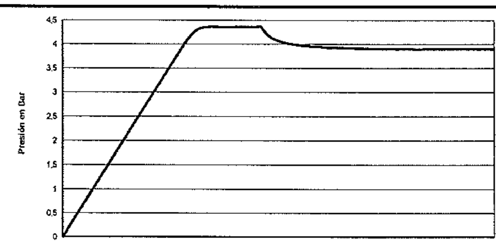


INSPECCIÓN VISUAL

Corrosión interior	Inexistente	Cierre	Excelente
Acabado	Excelente	Eje	Excelente
Conexiones	Excelente	Muelle	Excelente
Cuerpo	Excelente	Campana	Excelente
Asiento	Excelente	Caperuza	Excelente

TARADO

Presión de tarado	(Pe)	4,0 Bar
Presión de apertura	(Ps)	4,4 Bar
Presión de cierre	(Pc)	3,9 Bar
Resultado		Pasa
Fluido de prueba		Aire
Temperatura		20 °C
Longitud visible de rosca en mr		



Observaciones

25122

CERTIFICACIONES

Resultado	Pasa	Probado	
Fecha	29/04/2009	Firma	

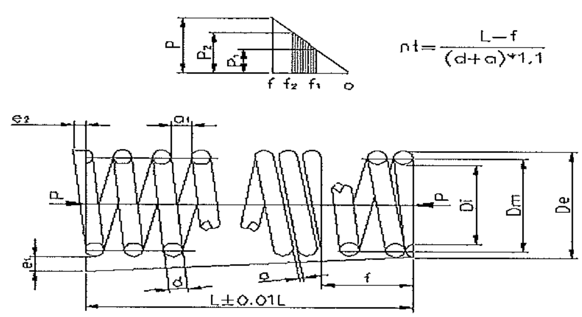
VYC	CERTIFICADO VÁLVULAS DE SEGURIDAD	CERTIFICADO N° 8956
		FECHA 29/04/2009

IDENTIFICACIÓN VÁLVULA

Orden de fabricación	92873/1	Diámetro nominal de la entrada en mm	(DN1) 3/8"	Fluido de trabajo	Agua	
Fabricante	VYC	Diámetro nominal de la salida en mm	(DN2)3/8"	Localizacion / PSV..etc		
Modelo	095	Diámetro mínimo de paso de fluido en m	(d0) 10,20	Presión de disparo en frío	(Pe) 4,0 Bar	
Código	200209563821	Coeficiente de descarga concedido	(αd)	Contrapresión	Atmosférica	
Tipo (AIT/AN/AP)	AP	Elevación en mm	(h)	Atmosférica	Pa	

IDENTIFICACIÓN MUELLE

Código		56027
Longitud en mm	(L)	42
Diámetro exterior en mm	(De)	13
Diámetro del hilo en mm	(d)	2
Flecha en mm	(f)	8,2
Diámetro interior en mm	(Di)	9
Diámetro medio en mm	(Dm)	11
Espiras totales	(nt)	9,5
Espiras efectivas	(ne)	8
Fuerza en Kp	(P)	11,04

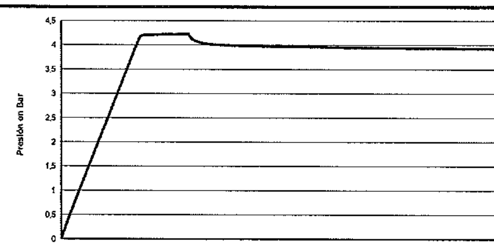


INSPECCIÓN VISUAL

Corrosión interior	Inexistente	Cierre	Excelente
Acabado	Excelente	Eje	Excelente
Conexiones	Excelente	Muelle	Excelente
Cuerpo	Excelente	Campana	Excelente
Asiento	Excelente	Caperuza	Excelente

TARADO

Presión de tarado	(Pe)	4,0 Bar
Presión de apertura	(Ps)	4,2 Bar
Presión de cierre	(Pc)	3,9 Bar
Resultado		Pasa
Fluido de prueba		Aire
Temperatura		20 °C
Longitud visible de rosca en mr		



Observaciones

25122

CERTIFICACIONES			
Resultado	Pasa	Probado	
Fecha	29/04/2009	Firma	

5. GENERAL PROCEDURES

5.1 Preparation of chemicals

5.1.1 Feeding media preparation

5.1.2 Preparation of acid for pH control in bioreactor

5.1.3 Preparation of base for pH control in Bioreactor

5.1.4 Preparation of base for pH control in Bioreactor

5.1.5 Preparation of cleaning agent for cleaning Bioreactor and auxiliary vessels

Observation: This section will be completed by MPP because all points are specific process procedures.

6. INSTALLATION START-UP

NOTE: *The next shortenings are used in this manual section in order to describe the state of the valves.*

1	This means that the valve is opened
0	This means that the valve is closed

⚠ **To follow the next procedure easily, it's necessary to follow the P&ID (rev. 13) diagram by the operator.**

6.1 Feeding tank filling sequence:

⚠ Before filling, the vessel and the inlet filter should be previously sterilised. (refer to sterilization sequences chapter).

This sequence should be carried out by the plant operator because it's a manual operation, and it's necessary to operate directly on the manual valves.

⚠ **Before the start-up, check to see that all the steam circuits' valves are closed.**

A) Check that all the vent pipe valves are opened:

ITEM	STATE
HV 4001 03	1
HV 4001 04	1

table 1

B) Check the state of the liquid outlet valve (this valve should be closed during all the filling sequence):

ITEM	STATE
HV 4001 05	0

table 2

C) Connect (½" clamp connection) the compartment inlet liquid pipe (PL-1/2"SS2-001) to the **media supply stream** and then open the required valves to permit the liquid get into the tank. The states of the valves that should be checked in this case are:

ITEM	STATE
HV 4001 01	1
HV 4001 02	1

table 3

D) When the tank is almost full, the temperature control loop should be activated. So, open the next valves in order to permit the glycol flow through the tank jacket.

ITEM	STATE
HV 4005 07	1
HV 4005 08	1
HV 4011 01	1
HV 4011 02	1

table 4

**__NOTE__: Once the circuit is opened, the __loop 4011__ can be activated. This loop controls the feeding tank inside temperature regulating the glycol flow by means of the control valve SV 4011 01.*

E) When the level tank goes up to its maximum (LT 4001 01), the inlet liquid valves should be closed:

ITEM	STATE
HV 4001 01	0
HV 4001 02	0

table 5

6.2 PBR filling sequence:

Before filling, the reactor should be previously sterilised. (Refer to sterilization sequences chapter).

A) In order to fill the reactor, the manual valves of the pipes that connect the feeding tank to the reactor should be opened. That means the opening of the next valves:

**OBSERVATION: Before proceeding with this sequence, two things should be known about the liquid line from VS 4001 01 to PBR:*

- *Which pump is installed at the moment of the start-up, and consequently the pre- filter LF 4001 02 or LF 4001 03) that is going to be used.*
- *Which liquid inlet filter (LF 4001 04 or LF 4001 05) is going to be used.*

ITEM	STATE	
HV 4001 19	1	
	***Using LF 4001 04**	***Using LF 4001 05**
HV 4001 18*	0	1
HV 4001 17*	1	0
HV 400116*	0	1
HV 4001 15*	1	0
HV 4001 14	00	
HV 4001 13	0	
HV 4001 12	1	
HV 4001 11	1	
	***Using GP 4001 01 (LF 4001 02)**	***Using GP 4001 02 (LF 4001 03)**
HV 4001 10*	0	1
HV 4001 09*	1	0
HV 4001 08*	0	0
HV 4001 07*	0	1
HV 4001 06*	1	0
HV 4001 05*	1	1

table 1

B) Before start filling the reactor, the gas outlet should be opened. (The liquid outlet and the gas circulation will remain closed during this sequence). To permit the gas outlet, open the next valves:

**NOTE: Before starting this procedure, the PBR outlet gas filter should be selected.*

ITEM	STATE	
HV 4004 03	1	
HV 4004 06	1	
	*Using GF 4004 01	* Using GF 4004 02
HV 4004 01*	1	0
HV 4004 02*	0	1
HV 4004 03*	1	0
HV 4004 04*	0	1
HV 4010 01	0	
HV 4003 04	0	
HV 4004 05	1	
SCV 4004 01	[MANUAL SET POINT - 100%]	
HV 4004 06 (Glycol to condenser)	1	
HV 4004 07 (Glycol to condenser)	1	

table 2

C) The liquid inlet and the gas outlet had been opened so, to fill the reactor, start manually the feeding pump (GP 4001 01 or GP 4001 02). [MANUAL SET POINT - 100%]

D) For the refrigeration water circuit filling and the glycol flow to the exchanger do the next:

- **Open** the valve **HV 4005 05** (bladder accumulator VS 4005 01)
- **Open** the valve **HV 4005 06** (pressure indicator PI 4005 02)
- <u>If the water circuit is empty</u>, **open** the valve **HV 4005 03** (water inlet)

There is not any pressure regulator before the compartment water inlet so, be careful with the circuit pressure while filling it.

- **Purge the existing air with the valve HV 4005 10** (valve installed on the upper jacket outlet pipe: highest point of the circuit)
- Check that the valves **HV 4005 07** and **HV 4005 08** are opened (glycol outlet/inlet)
- **Open** the valves **HV 4005 01** and **HV 4005 02** (entry and exit of glycol of the plate heat exchanger HX 4005 01).

Now it's already possible to activate the **loop 4005** (Reactor Temperature control). When activating this loop, the water circuit pump is activated.

E) When the reactor level it's almost the optimum, the feeding pumps should be manually stopped. [MANUAL SET POINT - 0%]

6.3 Acid/Base filling sequence (VS 4006 01/02):

Filling the vessels is a manual operation. The venting pipes of these vessels are always opened to the atmosphere. There is a filter installed in each vent pipe.

6.3.1 Preparing the entrance of acid and base into the reactor

Be sure about disposable pipes: connected and clamped by the peristaltic pump.

The actions that should be carried out are the next:

- **Open** the manual valve **HV 4006 02**. (acid inlet pipe)
- **Open** the manual valve **HV 4006 05**. (base inlet pipe)
- **Fill the line** manually until the pump is overcome (using the pump)
- Activate the control **loop 4006** (Reactor pH control). Both pumps (PP 4006 01 and PP 4006 02) should be started with the loop connection.
- Finally, the valves **HV 4006 03** and **HV 4006 06** could be opened.

***NOTE**: The last two valves opened in this sequence are the valves which permit the acid and base entries to the reactor.*

6.4 Light supply system (IRC 4000 01) activation:

At this stage, the external light system can be activated by means of the activation of loop 4000 (PBR lighting control). Simultaneously, the air refrigeration system (BLWR 4005 01) should be activated too.

6.5 Inoculums' inlet sequence:

***IMPORTANT NOTE:** The inoculum inlet should always be re-sterilized before its use. The sterilization sequence for this line is described in the nominal operation sterilization sequence section of its manual.

For inoculating, it is necessary to operate manually over two pumps, **HV 4013 01** and **HV 4015 50**.

6.6 Gas Loop:

6.6.1 PBR gas outlet

Activate **loop 4004** (Outlet gas flow control)

OBSERVATION: During the PBR filling, the gas outlet pipes have been opened but the outlet gas flow control (loop 4004) has not been activated.
The PBR pressure control loop can be activated in this step.

6.6.2 CO_2 and process air inlet:

Now, it's already possible to open the reactor gas inlet.

- **Open** the general CO_2 /air inlet valves (valves installed before the pressure reducers of the gas inlet to the compartment)
- Filters **GF 4003 08** and **GF 4003 09** should be previously sterilized. (Refer to sterilization sequences chapter).
- **Open** the valves **HV 4003 05, HV 4003 06, HV 4003 07, HV 4003 08.**

6.6.3 Circulated gas (PBR outlet gas) to reactor:

- Open the valve **HV 4003 04.**

- Activate **loop 4003** (inlet gas flow control).

Loop 4003 controls the PBR gases inlet and the gas circulation. The blower (BLWR 4003 01) is automatically started with the loop activation.

6.7 Opening of the PBR liquid outlet (harvesting tank filling):

In which moment the PBR liquid outlet must be opened, is a process decision.

The sequence to be followed in order to open the PBR liquid outlet is the next:

**NOTE: Before proceeding with this sequence should be known which pump is installed to impulse the liquid from the PBR to VS 4002 01:*

A) Check the state of the next valves:

ITEM	STATE	
HV 4002 01	1	
HV 4002 13	0	
HV 4016 14	0	
	*Using GP 4002 01	* Using GP 4002 02
HV 4002 02*	1	0
HV 4002 03*	0	1
HV 4002 04*	1	0
HV 4002 05*	0	1
HV 4016 27	0	0
HV 4016 28	0	0
HV 4002 06	1	

***table 1**

B) Activate the **loop 4008** (PBR liquid level control) or **loop 4002 (Outlet liquid flow control)** if a manual control of the liquid outlet flow is needed.

OBSERVATION: Both loops can not be activated simultaneously because are acting over the same variable (GP 4002 01/02 speed regulator).

C) When the harvest tank it's over its 10% of capacity (temperature probe is immersed in the liquid), **loop 4012** (Harvesting tank temperature control) can be activated. Before the activation, open the next valves:

- Check **HV 4005 07** and **HV 4005 08** are opened.
- Open HV **4012 01** and **HV 4012 02** (glycol inlet valves to VS 4002 01 jacket)

7. INSTALLATION SHUT-DOWN

NOTE: *The next shortenings are used in this manual section in order to describe the state of the valves.*

1	This means that the valve is opened
0	This means that the valve is closed

To follow the next procedure easily, it's necessary to follow the P&ID (rev. 12) diagram by the operator.

7.1 General stop of the plant:

A) All the PBR entrances (gas and liquid) should be closed. So, using a manual control:

- **Stop** feeding pump **GP 4001 01 or GP 4001 02** [MANUAL SET POINT - 100%]
- **Close** the manual valve **HV 4001 19** (PBR liquid inlet)
- **Close** the mass flow controllers **FQRC 4003 01/02/03/04** [MANUAL SET POINT – 0 ml/min]
- **Close** the manual valve **HV 4003 08**
- **Close** the manual valve **HV 4003 06** (PBR total gas inlet)

B) After this, the next valves can be closed (manual valves of the PBR gas/liquid inlet lines):

ITEM	STATE
HV 4003 05	0
HV 4003 07	0
HV 4001 05	0
HV 4001 06 or HV 4001 07	0
HV 4001 09 or HV 4001 10	0
HV 4001 11	0
HV 4001 12	0
HV 4001 15 or HV 4001 16	0
HV 4001 17 or HV 4001 18	0

***table 1**

C) To continue with the procedure, shut down the reactor lightening system (IRC 4000 01).

As the feeding pumps and the gassing have been stopped before, the level of the reactor will decrease, so the harvesting pumps will stop automatically.

In this moment, all the control loops shall be closed and all the manual valves of the plant should be closed except the reactor gas outlet and the tanks' vent pipes.

7.2 Plant emptying:

Before starting the vessels emptying sequences it's important to know where the emptied liquid shall be discharged and connect the emptied vessel liquid outlet to wherever is needed.

NOTE: All the manual valves are closed except the reactor gas outlet and the tanks' vent pipes.

7.2.1 Feeding tank (VS 4001 01) emptying sequence: Vessel and jacket

A) Check the state of the next valves (to discharge the vessel, vent pipe should be opened):

ITEM	STATE
HV 4001 03	1
HV 4001 04	1

table 1

B) Open the next valves in order to permit the liquid outlet and consequently, the emptying of the vessel:

ITEM	STATE
HV 4001 05	1
HV 4001 08	1

table 2

C) Once the vessel is totally emptied, the vent pipes valves and the valves in table number 2 can be closed:

ITEM	STATE
HV 4001 03	0
HV 4001 04	0
HV 4041 05	0
HV 4041 08	0

table 3

⚠ **Only if is necessary to empty out the tank jacket continue with point D instructions.**

D) To empty the jacket, check the state of the next valves in order to prepare the glycol circuit for its emptying:

ITEM	STATE
HV 4005 07	0
HV 4005 08	0
HV 4011 01	0
HV 4011 02	1
SV 4011 01	1
HV 4014 10 (purge)	1
HV 4011 05	1

E) Open the valves HV 4011 03 and HV 4011 04 (air inlet valves) to carry out the glycol of the circuit.

Once the circuit is empty, all the valves opened during this sequence should be closed.

7.2.2 Feeding pipes emptying (from VS 4001 01 to PBR)

If the emptying of the whole unit is necessary, all the lines to the reactor can be purged in this moment.

For purging the feeding lines, it is possible to open any of the next valves:

- HV 4001 08
- HV 4015 10
- HV 4015 03
- HV 4015 04
- HV 4015 47
- HV 4015 48
- Purge valves of the liquid filters LF 4001 02 / 03 / 04 / 05
- HV 4015 14
- HV 4015 22

7.2.3 PBR emptying sequence: Vessel and jacket

A) First of all, make sure that the reactor gas outlet valves are opened, so check the state of the manual valves listed next:

ITEM	STATE
HV 4004 01	1
HV 4004 03	1
SCV 4004 01	1
HV 4004 05	1

table 1

B) Open the next valves in order to permit the liquid outlet and consequently, the emptying of the vessel:

ITEM	STATE
HV 4001 19	1
HV 4015 22	1

table 2

C) Once the reactor is emptied, the valves listed in table 1 and 2 can be closed:

ITEM	STATE
HV 4001 19	0
HV 4015 22	0
HV 4004 01	0
HV 4004 03	0
SCV 4004 01	0
HV 4004 05	0

table 3

⚠ **Only if is necessary to empty out the PBR jacket continue with instructions of point D.**

D) For PBR jacket emptying, carry out the next actions:

- Open the air purge valve HV 4005 10 (installed in the highest point of the water circuit)
- Open the water purge valve HV 4005 04
- Once the circuit is totally empty, both valves can be closed.

7.2.4 Harvesting tank (VS 4002 01) emptying sequence: Vessel and jacket

A) First of all, make sure that the vessel vent pipe valves are opened, so check the state of the manual valves listed next:

ITEM	STATE
HV 4002 09	1
HV 4002 10	1

***table 1**

B) Open the next valves in order to permit the liquid outlet and consequently, the emptying of the vessel:

ITEM	STATE
HV 4002 07	1
HV 4002 08	1

***table 2**

C) Once the vessel is totally emptied, the vent pipes valves and the valves in table number 2 can be closed:

ITEM	STATE
HV 4002 07	0
HV 4002 08	0
HV 4002 09	0
HV 4002 10	0

***table 3**

Only if is necessary to empty out the tank jacket continue with point D instructions.

D) To empty the jacket, check the state of the next valves in order to prepare the glycol circuit for its emptying:

ITEM	STATE
HV 4005 07	0
HV 4005 08	0
HV 4012 02	0
HV 4012 01	1
HV 4016 20 (purge)	1
SV 4012 01	1
HV 4012 03	1

E) Open the valves HV 4011 03 and HV 4012 04 (air inlet valves) to carry out the glycol of the circuit.

Once the circuit is empty, all the valves opened during this sequence should be closed.

7.2.5 Harvest pipes emptying (from PBR to VS 4002 01)

If the emptying of the whole unit is necessary, all the lines from the reactor to VS 4002 01 can be purged in this moment.

For purging the harvesting lines, it is possible to open any of the next valves:

- HV 4002 13
- HV 4016 14
- HV 4016 27
- HV 4016 28

8. NOMINAL OPERATION

8.1 Influent tank

8.2 Acid and base tanks

8.3 Bioreactor

8.4 Gas loop

8.5 Harvesting

8.6 Light supply

9. SIP (STERILIZATION SEQUENCES)

9.1 Introduction

SIP is the acronym of Steam-In-Place: the use of steam to sanitize or sterilize a piece of equipment without the use of an autoclave.

A sterile environment is a very important fact in this process. Therefore, before the start-up of the plant it's important to guarantee that the whole plant had been sterilized previously (point 9.2). Once the plant is already working, if some maintenance operation over any equipment should be carried out, it's important to sterilize again the affected stretch. These types of sequences are described in point 9.3 of this section.

All the sterilization procedures shall be made according the following steps:

- Step 1: Heating up

In order to sterilize, pressurized steam is directly injected to the pipes and/or to the equipment. The minimum temperature that should be reached is 121ºC.

The inlet steam is opened and all the drainages are sent to a steam trap to drain condensatesso the result is a pressure increase. The pressure should be kept over 1.2 barg, equivalent to 121 ºC.

The heating process will last over 10/20 minutes, depending on the section value.

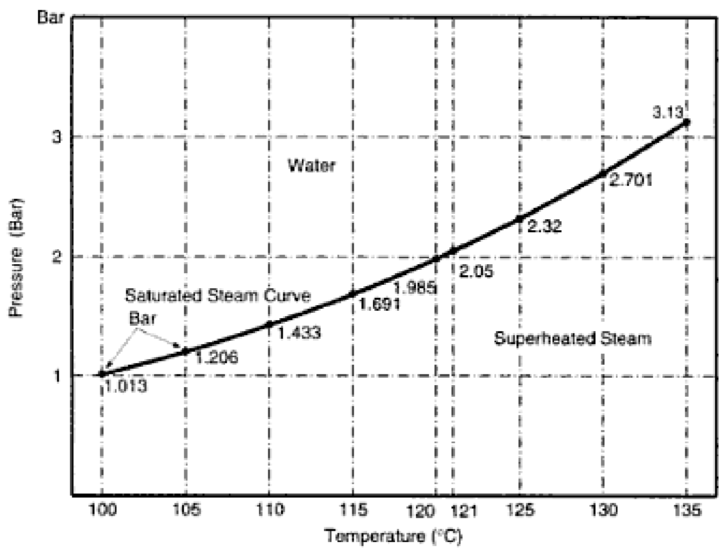


Figure 1: Saturated steam temperature versus absolute pressure diagram

NOTE: In the diagram (figure 1) is easy to see that at 2.2 bar (absolute pressure), the temperature of the saturated is 121 ºC.

⚠ **The maximum operation temperature permitted is 145 ºC. (for do not damage the valves membranes, filters and others)**

The need to heat larges masses of stainless steel from ambient temperature to 121 ºC and the loss of radiant heat to the surrounding room will result in the creation of large quantities of condensate especially during the start of the process.

- <u>Step 2: Sterilization</u>

After the heating up of the equipment, the sterilization will last over **20 minutes** to guarantee the correct sterilization of the piping and equipment.

⚠ **It is not good to increase the sterilization time or temperature because it reduces the working life of equipment. In case of hard contamination it is better to repeat, as many times as necessary, the described sterilization with intermediate cooling down.**

Once the sterilization step is completed, the valves should return to their standard standby state.

⚠ **All the manual/control valves should be closed at this moment (steam inlet valves).**

- Step 3: Cooling

After step 1 and step 2, the equipment should be cooled down by convection. This process is going to take up approximately **30 minutes.**

During the cooling process, a change in the steam/water density can cause vacuum formation. In order to break this vacuum, one line of vacuum breaking gas has been installed.

Depending on the case, the vacuum would be broken with inlet process gas, vent air or vacuum breaking gas. (pending to be defined with MPP).

NOTE: *The next shortenings are used in this section in order to describe the state of the valves.*

1	This means that the valve is opened
0	This means that the valve is closed

All the sterilization sequences should be carried out by the plant operator because it’s necessary to operate directly on the manual valves.

9.2 Plant Start-up sterilization procedures (empty plant)

⚠ **All the manual valves of the unit should be closed before starting any procedure.**

⚠ **To follow the next procedure easily, it's necessary to keep the P&ID (rev. 12) diagram by the operator.**

The sterilization of the whole plant will be carried out in four stretches to make this operation easier.

9.2.1 Inlet of feeding tank:

A) Check the state of the next valves:

ITEM	STATE
HV 4001 01	0
HV 4001 02	0

table 1

***NOTE:** These valves are closed to limit the sterilized area.*

B) To permit the steam outlet the next valves should be checked:

ITEM	STATE
HV 4014 08	1

table 2

***NOTE:** Remember that all the valves of the steam circuits, which are not mentioned in the previous list, should be closed during this operation.*

***NOTE:** Be sure to connect flexible pipe, if needed, to steam trap.*

C) The valves detailed next should be open to start the sterilization process (to permit the steam inlet):

ITEM	STATE
HV 4014 01	1
HV 4014 02	1

***table 3**

Before starting with the sterilization, all the air of the pipe should be moved out.

D) After the required time, the valves detailed before (table 3), should be closed to stop the steam inlet:

ITEM	STATE
HV 4014 01	0
HV 4014 02	0

***table 4**

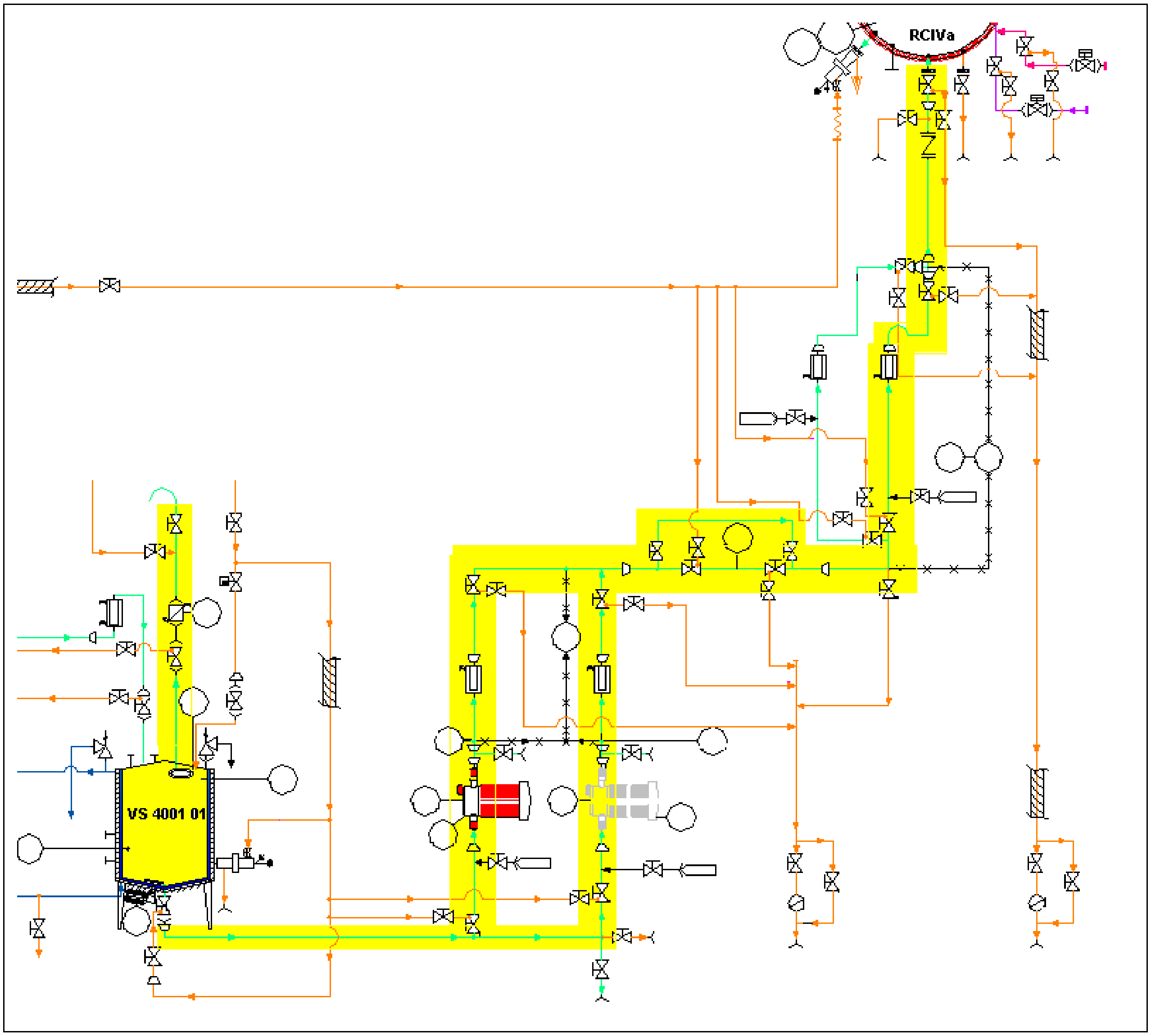
E) After closing the steam inlet, the outlet steam valves could be closed:

ITEM	STATE
HV 4014 08	0

***table 5**

F) Pending to be discussed with MPP (Cooling + vacuum breaking)

9.2.2 **Feeding tank and feeding line:**



**The lines/equipment underlined in yellow are the lines which will be sterilized in this stage.*

A) Check the state of the next valves (process pipes valves):

ITEM	STATE
HV 4001 03 (Vessel vent pipe)	0
HV 4001 04 (Vessel vent pipe)	0
HV 4001 02	0
HV 4001 05	1
HV 4001 06	0
HV 4001 07	0
HV 4001 08	0
HV 4001 09	1
HV 4001 10	1
HV 4001 11	1
HV 4001 12	1
HV 4001 13 (Flow meter bypass)	1
HV 4001 14 (Flow meter bypass)	1
HV 4001 15	1
HV 4001 16	1
HV 4001 17	1
HV 4001 18	1
HV 4001 19 (Reactor inlet valve)	0

table 1

Valves HV 4001 06/07 are closed to make independent the sterilization of the tank and the sterilization of the pipes and permit the automatic sterilization of the vessel (loop 4014).

The bypass of the flow meter should be open to sterilize because of the flow meter small pass area (1 mm). This area doesn't permit to maintain the pressure during the sterilization.

B) To permit the steam outlet the next valves should be checked:

ITEM	STATE
HV 4014 04	1
HV 4015 10[1)]	1
HV 4015 11	1
HV 4015 12	1
HV 4015 13	1
HV 4015 14	1
HV 4015 15	1
HV 4015 16	1
HV 4015 17	1

***table 2**

[1)] ***NOTE:*** *This valve should be connected with a hose to the steam trap system. All the others outlets are already connected to a steam trap.*

C) The valves detailed next should be open to start the sterilization process (to permit the steam inlet):

ITEM	STATE
HV 4014 01	1
HV 4014 09	1
HV 4014 05	1
HV 4014 06	1
SV 4014 01 (AUTO: Loop 4014)	1 / 0
HV 4014 07	0
HV 4015 01	1
HV 4015 02	1
HV 4015 09	1
HV 4015 05	1
HV 4015 06	1

***table 3**

**NOTE: The automatic valve is opened/closed automatically for the control system.*

⚠ **Before starting with the sterilization, all the air of the pipes should be moved out.**

D) After the required time, the valves detailed before (table 3), should be closed to stop the steam inlet:

ITEM	STATE
HV 4014 01	0
HV 4014 09	0
HV 4014 05	0
HV 4014 06	0
SV 4014 01 (AUTO: Loop 4014)	0
HV 4014 07	0
HV 4015 01	0
HV 4015 02	0
HV 4015 09	0
HV 4015 05	0
HV 4015 06	0

table 4

**NOTE: The automatic valve is opened/closed automatically for the control system.*

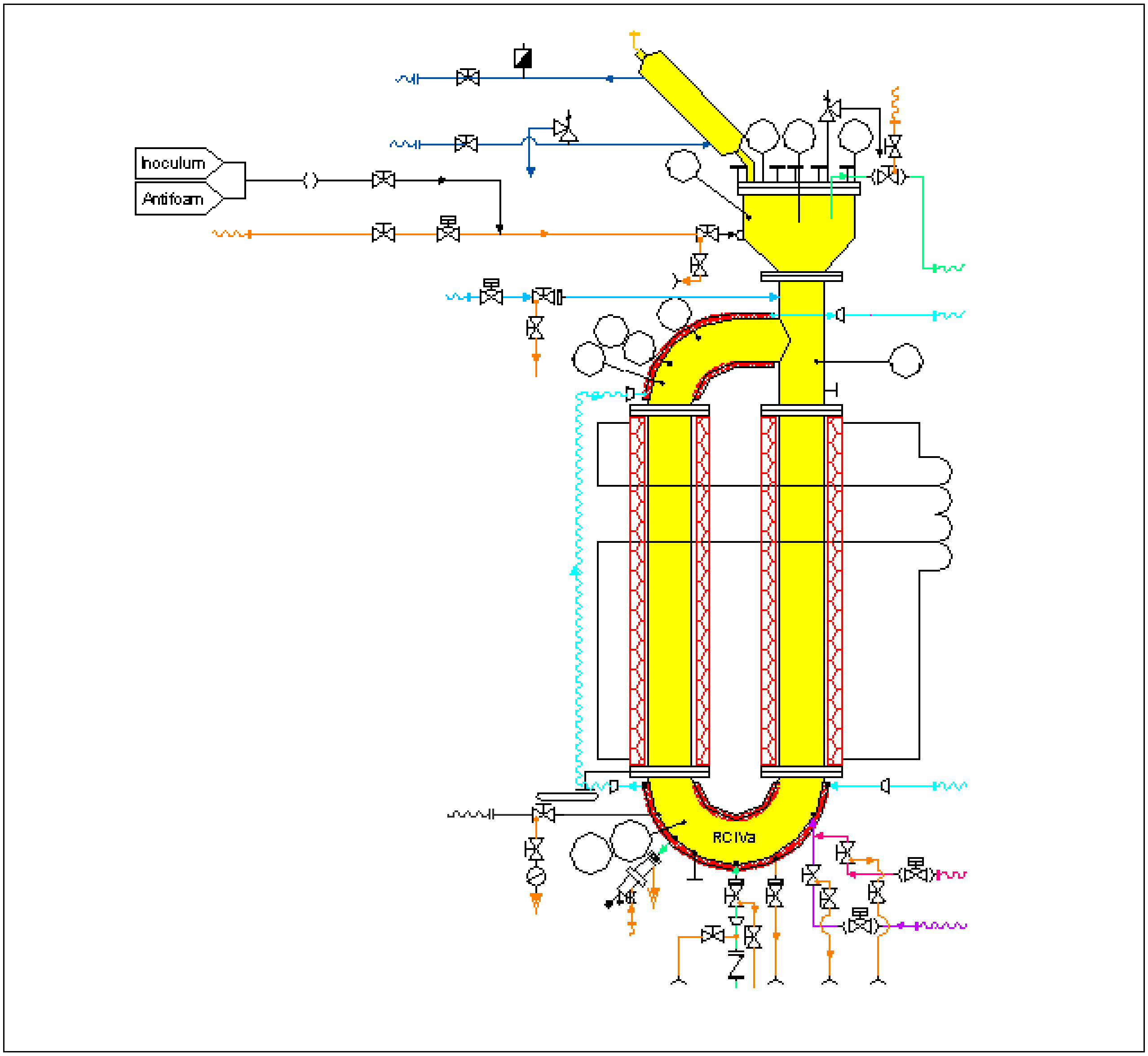
E) After closing the steam inlet, the outlet steam valves could be closed:

ITEM	STATE
HV 4014 04	0
HV 4015 10[1)]	0
HV 4015 11	0
HV 4015 12	0
HV 4015 13	0
HV 4015 14	0
HV 4015 15	0
HV 4015 16	0
HV 4015 17	0

table 5

F) Pending to be discussed with MPP (Cooling + vacuum breaking)

9.2.3 **PBR:**



**The lines/equipment underlined in yellow are the lines which will be sterilized in this stage.*

A) Open the PBR discharge valve **HV 4001 19**.

B) To permit the steam outlet open the next valves:

ITEM	STATE
HV 4015 17	1
HV 4015 22[1)]	1

table 1

[1)] ***NOTE:*** *This valve should be connected with a hose to the steam trap system.*

C) The valves detailed next should be open to start the sterilization process (to permit the steam inlet):

ITEM	STATE
HV 4014 01	1
HV 4015 36	1
HV 4015 37	1
HV 4015 50	1
SV 4015 01 (AUTO: Loop 4015)	1 / 0
HV 4015 49	1

table 2

**NOTE: The automatic valve is opened/closed automatically for the control system.*

⚠ **Before starting with the sterilization, all the air of the PBR should be moved out.**

D) After the required time, the valves detailed before (table 2), should be closed to stop the steam inlet:

ITEM	STATE
HV 4014 01	0
HV 4015 36	0
HV 4015 37	0
HV 4015 50	0
SV 4015 01 (AUTO: Loop 4015)	0
HV 4015 49	0

table 3

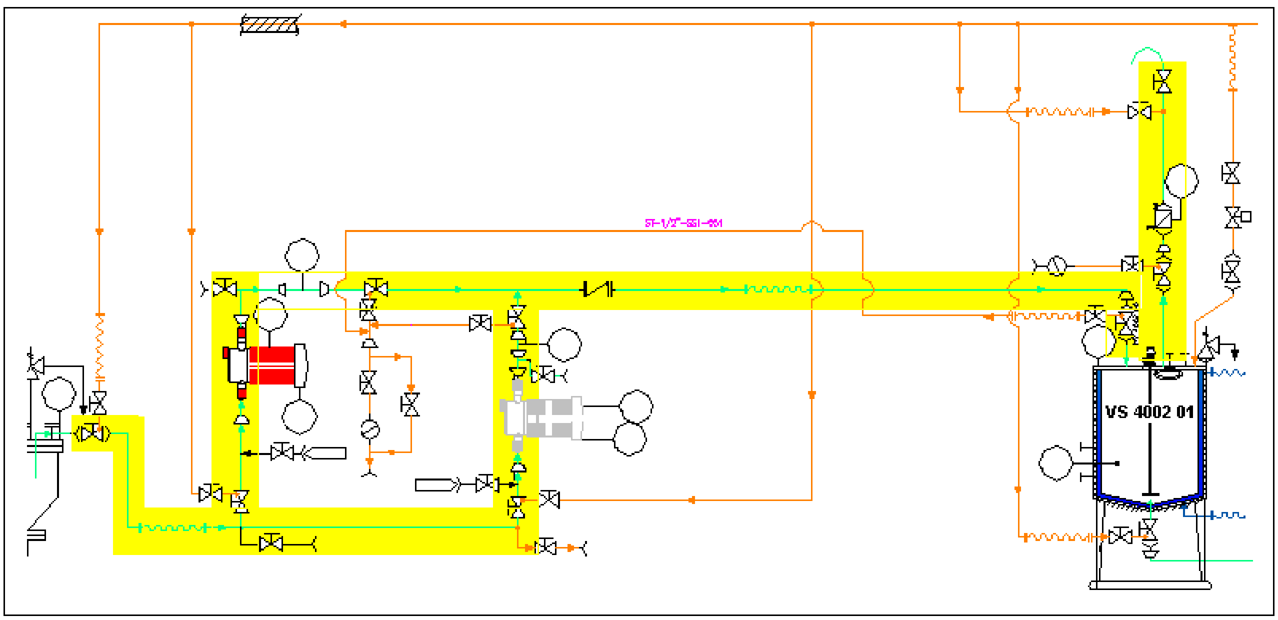
E) After closing the steam inlet, the outlet steam valves could be closed:

ITEM	STATE
HV 4015 17	1
HV 4015 22	1

table 5

F) Pending to be discussed with MPP (Cooling + vacuum breaking)

9.2.4 Harvesting line and harvesting tank:



**The lines/equipment underlined in yellow are the lines which will be sterilized in this stage.*

A) Check the state of the next valves (process pipes valves):

ITEM	STATE
HV 4002 01	0
HV 4002 02	1
HV 4002 03	1
HV 4002 04	1
HV 4002 05	1
HV 4002 06	0
HV 4002 09 (Vessel vent pipe)	0
HV 4002 10 (Vessel vent pipe)	0
HV 4002 07	1
HV 4002 08	0

table 1

Valve HV 4002 06 is closed to make independent the sterilization of the tank and the sterilization of the pipes and permit the automatic sterilization of the vessel (loop 4016).

B) To permit the steam outlet the next valves should be checked:

ITEM	STATE
HV 4016 14[1)]	1
HV 4016 16	1
HV 4016 25	1
HV 4016 21[1)]	1

table 2

[1)] ***NOTE:*** *These valves should be connected with a hose to the steam trap system. All the others outlets are already connected to a steam trap.*

C) The valves detailed next should be open to start the sterilization process (to permit the steam inlet):

ITEM	STATE
HV 4014 01	1
HV 4016 01	1
HV 4016 02	1
HV 4016 03	1
HV 4016 06	1
SV 4016 01 (AUTO: Loop 4016)	1 / 0
HV 4016 07	1

table 3

**NOTE: The automatic valve is opened/closed automatically for the control system.*

⚠ **Before starting with the sterilization, all the air of the pipes should be moved out.**

D) After the required time, the valves detailed before (table 3), should be closed to stop the steam inlet:

ITEM	STATE
HV 4014 01	0
HV 4016 01	0
HV 4016 02	0
HV 4016 03	0
HV 4016 06	0
SV 4016 01 (AUTO: Loop 4016)	0
HV 4016 07	0

table 4

E) After closing the steam inlet, the outlet steam valves could be closed:

ITEM	STATE
HV 4016 14[1)]	1
HV 4016 16	1
HV 4016 25	1
HV 4016 21[1)]	1

table 5

F) Pending to be discussed with MPP (Cooling + vacuum breaking)

9.2.5 Harvesting transfer line to other compartments:

⚠ This line has been already sterilized in the last point (9.2.4 Harvesting line and harvesting tank)

A) Check the state of the next valves:

ITEM	STATE
HV 4002 07	0
HV 4002 08	0

table 1

***NOTE:** These valves are closed to limit the sterilized area.*

B) To permit the steam outlet the next valves should be checked:

ITEM	STATE
HV 4016 21 1)	1

table 2

1) ***NOTE:** These valves should be connected with a hose to the steam trap system. All the others outlets are already connected to a steam trap.*

C) The valves detailed next should be open to start the sterilization process (to permit the steam inlet):

ITEM	STATE
HV 4014 01	1
HV 4016 04	1

table 3

⚠ **Before starting with the sterilization, all the air of the pipe should be moved out.**

D) After the required time, the valves detailed before (table 3), should be closed to stop the steam inlet:

ITEM	STATE
HV 4014 01	1
HV 4016 04	1

table 4

E) After closing the steam inlet, the outlet steam valves could be closed:

ITEM	STATE
HV 4016 21	0

table 5

F) Pending to be discussed with MPP (Cooling + vacuum breaking)

9.3 Nominal operation sterilization procedures

During the plant operation, after the substitution or manipulation of any specific unit, it could be necessary to sterilize some specific areas in order to be able to continue with the operation in a sterile environment. All the plant can be sterilized using pressurized steam.

Therefore, in this section will be studied the most repetitive sterilizations that will be in sampling valves, filters, pumps, and others.

There are some cases (filters and pumps) where two parallel units are installed in order to permit the operation over one of these without stopping the process.

⚠ **To follow the next procedure easily, it's necessary to keep the P&ID (rev. 12) diagram by the operator.**

9.3.1 Sampling valves:

Before taking a sample, the sampling valve should be sterilized.

The three valves installed, had a BBS-Systems port that allows through the chamber SIP flow between sampling, to ensure a truly representative sample every time.
The valves are flush mounted to the vessels without dead spaces.

All sampling valves had an inlet steam valve welded to the main valve, and these steam valves are connected to inlet steam pipes.

9.3.1.1 **Feeding tank sampling valve:**

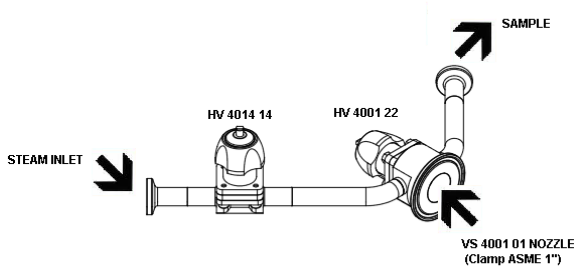


Figure1. Feeding vessel sampling valve diagram

Before taking any sample:

- Check that the main valve **HV 4001 22** is **closed.**
- **Open** the next valves: **HV 4014 01**, **HV 4014 05** and **HV 4014 14** to permit the steam inlet.
-

**Note: The valve HV 4014 14 is connected to the compartment inlet steam system.*

9.3.1.2 **Harvesting tank sampling valve:**

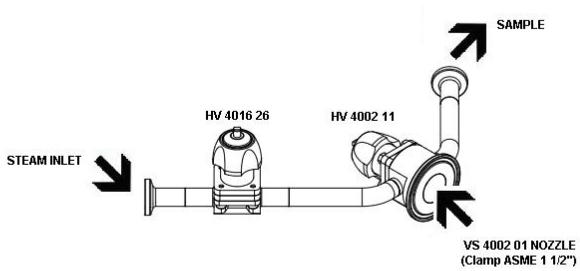


Figure2. Harvesting vessel sampling valve diagram

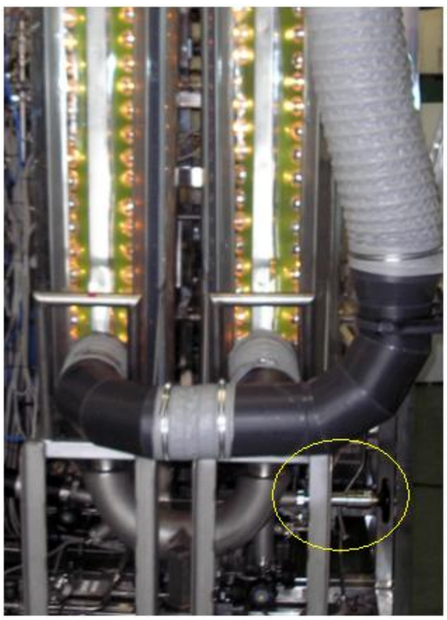
Before taking any sample:

- Check that the main valve **HV 4002 11** is **closed.**
- **Open** the general steam inlet valve **HV 4014 01** and **HV 4016 26** to permit the steam inlet.

**Note: The valve HV 4016 26 is connected to the compartment inlet steam system.*

9.3.1.3 **PBR sampling valve:**

In this case, the sampling valve HV 4002 12 is a piston type valve.



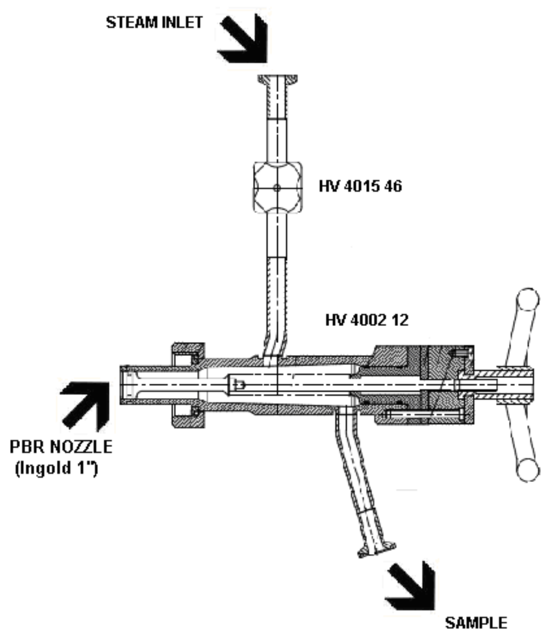


Figure3. PBR sampling valve diagram

Before taking any sample:

- Check that the main valve **HV 4002 12** is **closed.**
- **Open** the general steam inlet valve **HV 4014 01** and **HV 4015 46** to permit the steam inlet.

**Note: The valve HV 4015 46 is connected to the compartment inlet steam system.*

9.3.2 Inoculums' inlet pipe sterilization:

***IMPORTANT NOTE:** The inoculums' inlet should always be resterilized before use. In order to sterilize this pipe, the next actions should be carried out:

- **Close** the valve **HV 4015 50**.
- **Close** the valve **HV 4013 01**.
- **Connect** the clamp of the valve **HV 4015 51** with a flexible pipe to a steam trap**.**
- **Open** the valve **HV 4015 29** to permit the steam outlet.
- **Open** the valves **HV 4015 49** and **SV 4015 01** to permit the steam inlet.

- After 20 min close the steam inlet closing the valves **HV 4015 49** and **SV 4015 01**.
- Immediately, **close** the steam outlet closing the valve **HV 4015 29.**

⚠ **To inoculate, the pipe should be cold.**

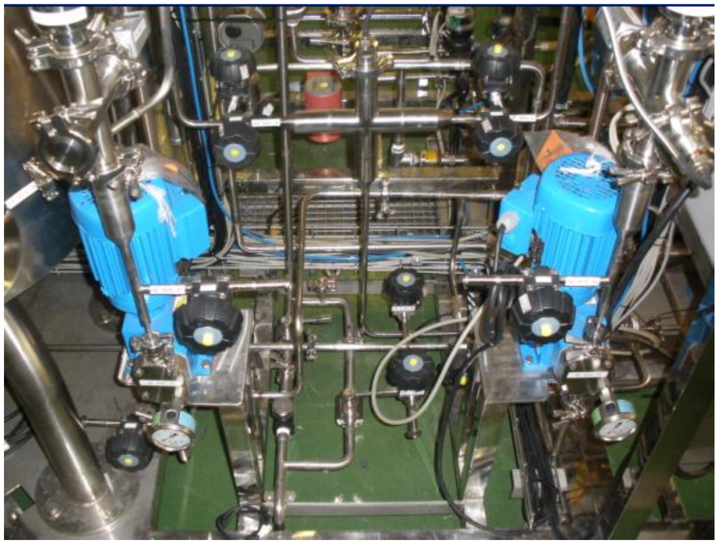
Now, it's already possible to add the inoculums' to the reactor.

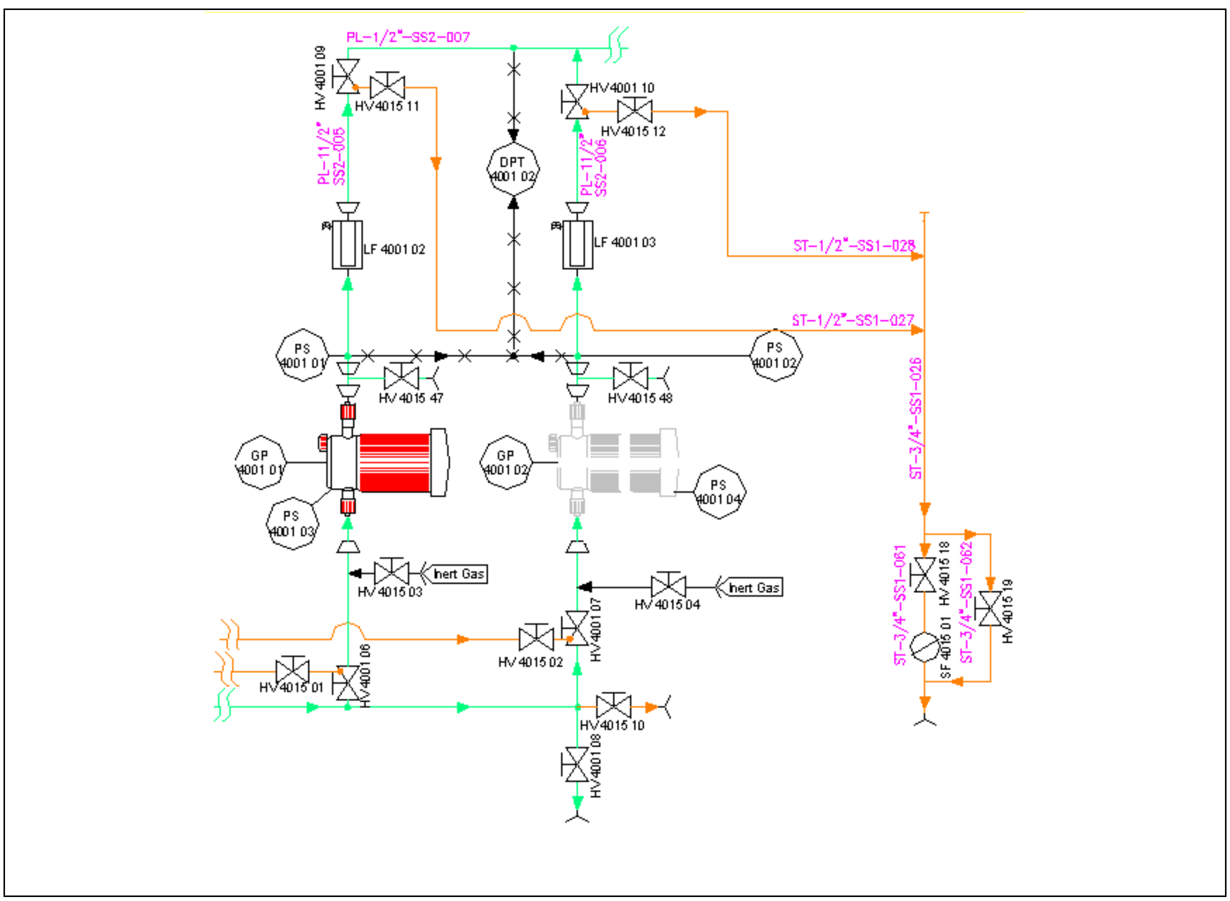
9.3.3 Pumps manipulation/sterilization:

⚠ **In a first stage, in the plant will be two pumps installed and one as spare. So, the manipulation of the pumps will be usual.**

The pumps in use should be generally changed for two reasons: the breakage of the pump/ filter or the blockage of the filter.
During the plant operation, it's possible to change one pump to another without stopping the process (if the change is not caused by an unexpected breakage of the pump). The new pump can be installed while the pump that is going to be trade is still working.

9.3.3.1 **Replacing GP 4001 01 with GP 4001 02 and vice versa (Feeding pumps)**





** Enlarged view of the working zone from the P&ID Diagram.*

The procedure that must be followed in order to sterilize the pump just installed before its use, is the one described next:

A) Check the state of the next valves:

GP 4001 01 to GP 4001 02		GP 4001 02 to GP 4001 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4001 07	0	HV 4001 06	0
HV 4001 10	0	HV 4001 09	0

***table 1**

**NOTE: Actually, the state of the valves listed before should be the natural state of the valves at the moment.*

B) To permit the steam outlet should be checked the state of the next valves:

GP 4001 01 to GP 4001 02		GP 4001 02 to GP 4001 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4015 12	1	HV 4015 11	1
HV 4015 18	1	HV 4015 18	1

***table 2**

***NOTE:** *Remember that all the valves of the steam circuits, which are not mentioned in the previous or the next lists, should be closed during this operation.*

C) The valves detailed next should be open to start the sterilization process (to permit the steam inlet):

GP 4001 01 to GP 4001 02		GP 4001 02 to GP 4001 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4014 01	1	HV 4014 01	1
HV 4014 05	1	HV 4014 05	1
HV 4015 02	1	HV 4015 01	1

***table 3**

To carry out and complete the sterilization process it's necessary to wait over 20-30 minutes while the steam is flowing.

D) After the required time, the valves detailed before (table 3), should be closed to stop the steam inlet:

GP 4001 01 to GP 4001 02		GP 4001 02 to GP 4001 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4014 01	0	HV 4014 01	0
HV 4014 05	0	HV 4014 05	0
HV 4015 02	0	HV 4015 01	0

table 4

E) After closing the inlet steam, the outlet steam valves could be closed:

GP 4001 01 to GP 4001 02		GP 4001 02 to GP 4001 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4015 12	0	HV 4015 11	0
HV 4015 18	0	HV 4015 18	0

table 5

Now starts the second step, the cooling.

F) After waiting the 30 minutes required for the cooling, it's necessary to break the vacuum formed on the sterilized pipes. (Pending to be defined with MPP)

After this action, sterilization process of the new pump installed is finished, and the process can be carried out with the new pump.

In order to change the pump in use, the actions that should be realized are the next:

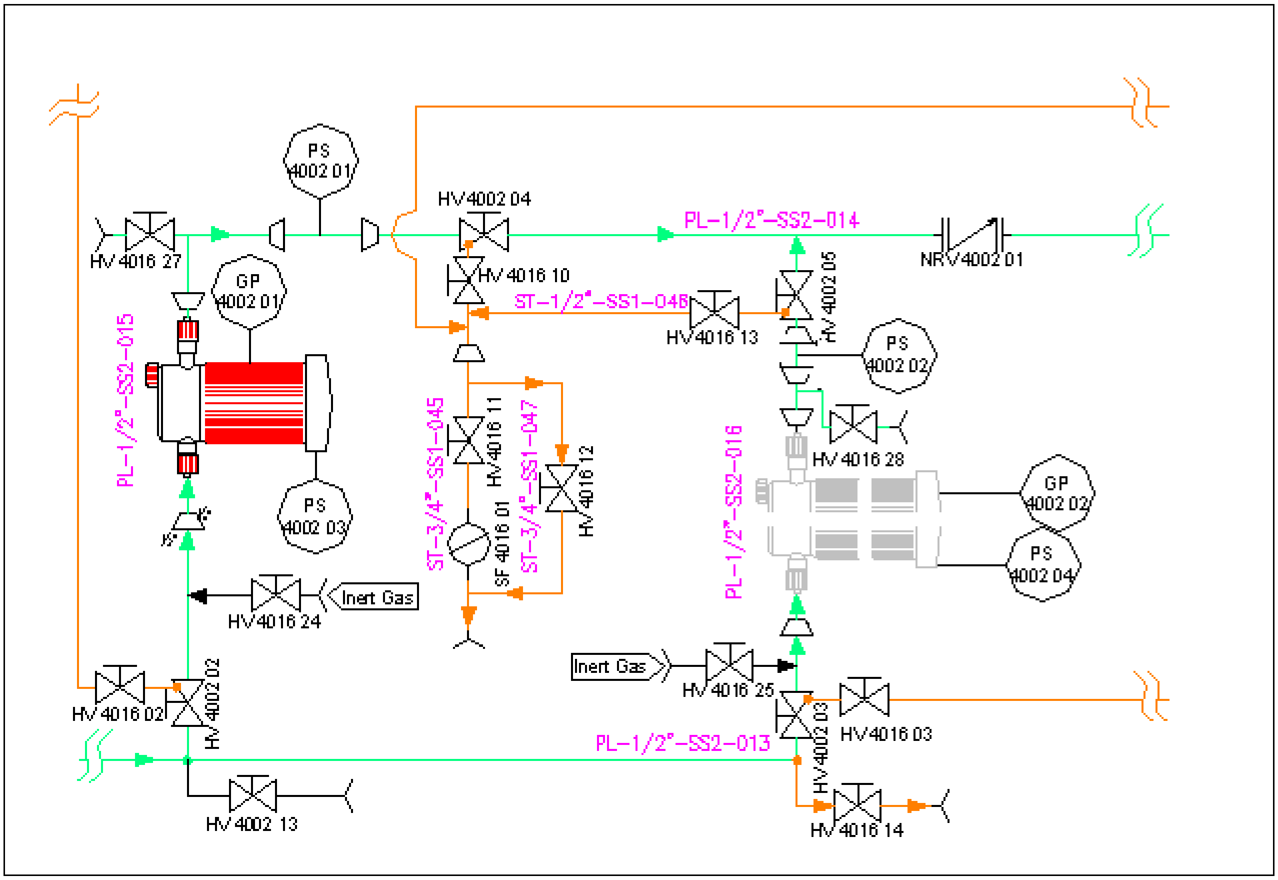
***GP 4001 01 to GP 4001 02:**

- **Open** the valves **HV 4001 07** and **HV 4001 10**
- **Close** the valve **HV 4001 06**
- **Switch off** the pump **GP 4001 01**
- **Close** the valve **HV 4001 09**
- **Switch on** the pump **GP 4001 02**

***GP 4001 02 to GP 4001 01:**

- **Open** the valves **HV 4001 06** and **HV 4001 09**
- **Close** the valve **HV 4001 07**
- **Switch off** the pump **GP 4001 02**
- **Close** the valve **HV 4001 10**
- **Switch on** the pump **GP 4001 01**

9.3.3.2 **Replacing GP 4002 01 for GP 4002 02 and vice versa (Harvesting pumps)**



** Enlarged view of the working zone from the P&ID Diagram.*

The procedure that must be followed in order to sterilize the pump just installed before its use, is the one described next:

A) Check the state of the next valves:

GP 4002 01 to GP 4002 02		GP 4002 02 to GP 4002 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4002 03	0	HV 4002 02	0
HV 4002 05	0	HV 4002 04	0

table 1

**NOTE: Actually, the state of the valves listed before should be the natural state of the valves at the moment.*

B) To permit the steam outlet should be checked the state of the next valves:

GP 4002 01 to GP 4002 02		GP 4002 02 to GP 4002 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4016 13	1	HV 4016 10	1
HV 4016 11	1	HV 4016 11	1

table 2

***NOTE:** *Remember that all the valves of the steam circuits, which are not mentioned in the previous or the next lists, should be closed during this operation.*

C) The valves detailed next should be open to start the sterilization process (to permit the steam inlet):

GP 4002 01 to GP 4002 02		GP 4002 02 to GP 4002 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4014 01	1	HV 4014 01	1
HV 4016 03	1	HV 4016 02	1

table 3

To carry out and complete the sterilization process it's necessary to wait over 20-30 minutes while the steam is flowing.

D) After the required time, the valves detailed before (table 3), should be closed to stop the steam inlet:

GP 4002 01 to GP 4002 02		GP 4002 02 to GP 4002 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4014 01	1	HV 4014 01	1
HV 4016 03	1	HV 4016 02	1

table 4

E) After closing the inlet steam, the outlet steam valves could be closed:

GP 4002 01 to GP 4002 02		GP 4002 02 to GP 4002 01	
ITEM	**STATE**	**ITEM**	**STATE**
HV 4016 13	0	HV 4016 10	0
HV 4016 11	0	HV 4016 11	0

table 5

Now starts the second step, the cooling.

F) After waiting the 30 minutes required for the cooling, it's necessary to break the vacuum formed on the sterilized pipes.

After this action, sterilization process of the new pump installed is finished, and the process can be carried out with the new pump.

In order to change the pump in use, the actions that should be realized are the next:

<u>*GP 4002 01 to GP 4002 02:</u>

- **Open** the valves **HV 4002 03** and **HV 4002 05**
- **Close** the valve **HV 4002 02**
- **Switch off** the pump **GP 4002 01**
- **Close** the valve **HV 4002 04**
- **Switch on** the pump **GP 4002 02**

<u>*GP 4002 02 to GP 4002 01:</u>

- **Open** the valves **HV 4002 02** and **HV 4002 04**
- **Close** the valve **HV 4002 03**
- **Switch off** the pump **GP 4002 02**
- **Close** the valve **HV 4002 05**
- **Switch on** the pump **GP 4002 01**

9.3.4 Filters manipulation/sterilization

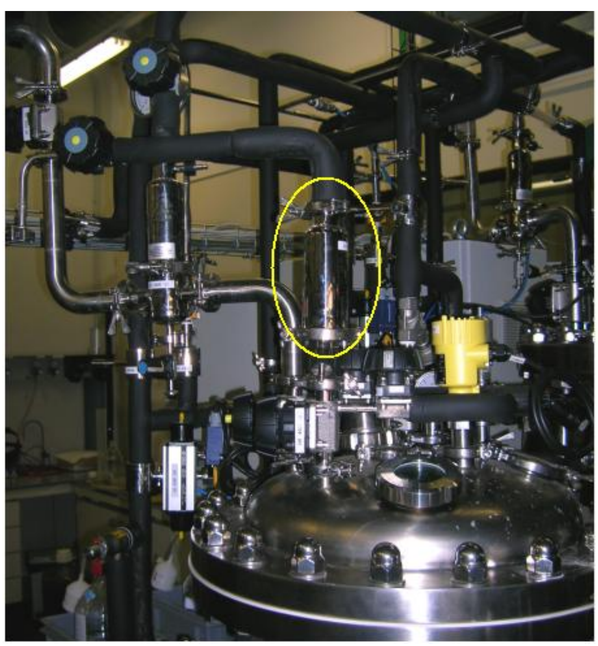
To follow the next procedure easily, it's necessary to keep the P&ID (rev. 12) diagram by the operator.

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

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

Gas filters permit sterilization against the normal flow direction but NOT liquid filters.

9.3.4.1 Feeding tank liquid inlet filter (LF 4001 01) sterilization



- Close HV 4001 01 and HV 4001 02
- [Filter manipulation: cartridge substitution, others]
- Open HV 4014 08 to permit the steam outlet
- Open HV 4014 01 and HV 4014 02 to permit the steam inlet
- After 20-30 minutes, valves HV 4014 01 and HV 4014 02 can be closed
- Close HV 4014 08

9.3.4.2 **PBR liquid inlet pre- filter (LF 4001 02 or LF 4001 03) sterilization**

To manipulate any of these filters, the flow mustn't be stopped. The liquid flow can be diverted to the other filter; because of they are installed in two parallel pipes.

The differential pressure transmitter measures the pressure drop over the filter. In this case, the differential pressure diaphragm position must change when the liquid flows for one pipe or another.

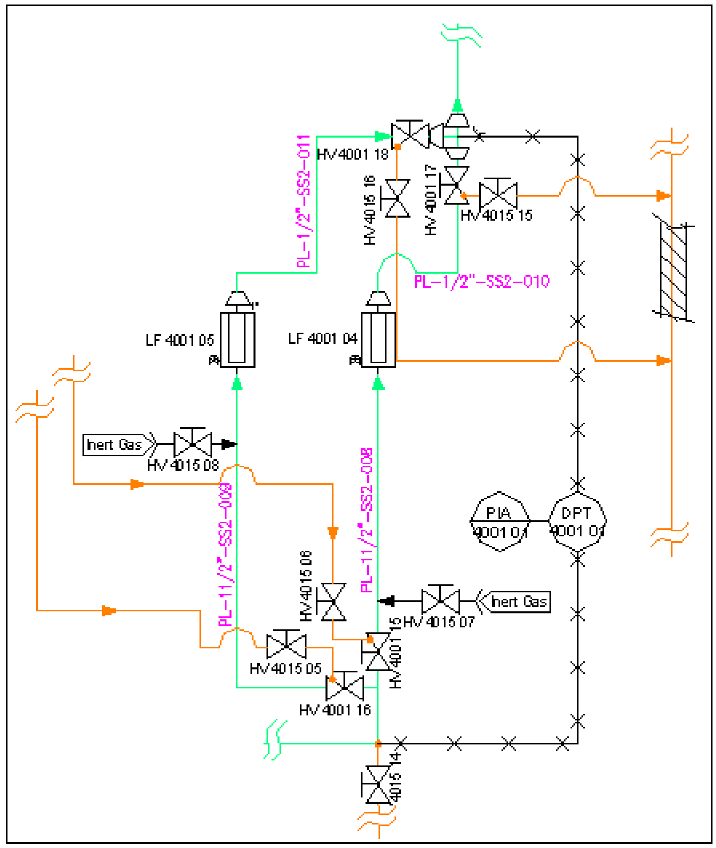
✓ **LF 4001 02**

- Close HV 4001 06 and HV 4001 09
- [Filter manipulation]
- Open HV 4015 11 and HV 4015 18 to permit the steam outlet
- Open HV 4014 01, HV 4014 05 and HV 4015 01 to permit the steam inlet
- After 20-30 minutes, valves HV 4014 01, HV 4014 05 and HV 4015 01can be closed
- Close HV 4015 11 and HV 4015 18

✓ **LF 4001 03**

- Close HV 4001 07 and HV 4001 10
- [Filter manipulation]
- Open HV 4015 12 and HV 4015 18 to permit the steam outlet
- Open HV 4014 01, HV 4014 05 and HV 4015 02 to permit the steam inlet
- After 20-30 minutes, valves HV 4014 01, HV 4014 05 and HV 4015 02 can be closed
- Close HV 4015 12 and HV 4015 18

9.3.4.2 **PBR liquid inlet filter (LF 4001 04 or LF 4001 05) sterilization**



**Enlarged view of the P&ID stretch.*

To manipulate any of these filters, the flow mustn't be stopped. The liquid flow can be diverted to the other filter; because of they are installed in two parallel pipes.

The differential pressure transmitter measures the pressure drop over the filter. In this case, the differential pressure diaphragm position does not change when the liquid flows for one pipe or another.

✓ **LF 4001 04 manipulation**

To manipulate LF 4001 04 the flow is diverted to PL-1/2"-SS2-008/010 (LF 4001 05):

- Close HV 4001 15 and HV 4001 17
- Open HV 4001 16 and HV 4001 18

Now it is possible to manipulate LF 4001 04.
Before a new use, this filter should be sterilized. To sterilize LF 4001 04, the actions are the next:

- Close HV 4001 15 and HV 4001 17 *(already closed)*
- Open HV 4015 15 and HV 4015 20 to permit the steam outlet
- Open HV 4014 01and HV 4015 06 to permit the steam inlet
- After 20-30 minutes, valves HV 4014 01and HV 4015 06 can be closed
- Close HV 4015 15 and HV 4015 20

✓ **LF 4001 05 manipulation**

To manipulate LF 4001 05 the flow is diverted to PL-1/2"-SS2-009/011 (LF 4001 04):

- Close HV 4001 16 and HV 4001 18
- Open HV 4001 15 and HV 4001 17

Now it is possible to manipulate LF 4001 05.

Before a new use, this filter should be sterilized. To sterilize LF 4001 05, the actions are the next:

- Close HV 4001 16 and HV 4001 18 *(already closed)*
- Open HV 4015 16 and HV 4015 20 to permit the steam outlet
- Open HV 4014 01and HV 4015 05 to permit the steam inlet
- After 20-30 minutes, valves HV 4014 01and HV 4015 05 can be closed
- Close HV 4015 16 and HV 4015 20

9.3.4.3 **Acid inlet filter (LF 4006 01) sterilization (Acid line sterilization)**

- Stop the loop 4006 (Reactor pH control)
- Close the valves HV 4006 03 and HV 4006 02.
- [Filter manipulation]

Before a new use of the filter that has been manipulated, it should be sterilized, so:

- Open the valve HV 4015 32 in order to permit the steam outlet (connect this with a hose to a steam trap)
- Open the automatic valve SV 4006 01 [Manual set point]
- Open the valves HV 4014 01 and HV 4015 35 to permit the steam inlet
- (After 20-30 minutes) Close the steam inlet closing the valves HV 4014 01 and HV 4015 35
- Close the steam outlet closing HV 4015 32

9.3.4.4 **Base inlet filter (LF 4006 02) sterilization (Base line sterilization)**

- Stop the loop 4006 (Reactor pH control)
- Close the valves HV 4006 05 and HV 4006 06.
- [Filter manipulation]

Before a new use of the filter that has been manipulated, it should be sterilized, so:

- Open the valve HV 4015 33 in order to permit the steam outlet (connect this with a hose to a steam trap)
- Open the automatic valve SV 4006 02 [Manual set point]
- Open the valves HV 4014 01 and HV 4015 34 to permit the steam inlet
- (After 20-30 minutes) Close the steam inlet closing the valves HV 4014 01 and HV 4015 34
- Close the steam outlet closing HV 4015 33

9.3.4.5 **Feeding tank vent pipe filter (GF 4001 01) sterilization**

- Close the valves HV 4001 03 and HV 4001 04
- [Filter manipulation]
- Open the valve: HV 4014 04 to permit the steam outlet
- Open the valves: HV 4014 01 and HV 4014 09 to permit the steam inlet.
- (After 20-30 minutes) Close the steam inlet closing the valves HV 4014 01 and HV 4014 09
- Close the steam outlet closing HV 4014 04
- After sterilization open the valves HV 4001 03 and HV 4001 04 in order to break the vacuum formed during the cooling.

After this, it's possible to continue with the normal operation.

9.3.4.6 **Harvesting tank vent pipe filter (GF 4002 01) sterilization**

- Close the valves HV 4002 09 and HV 4002 10
- [Filter manipulation]
- Open the valve: HV 4016 05 to permit the steam outlet
- Open the valves: HV 4014 01 and HV 4016 15 to permit the steam inlet.
- (After 20-30 minutes) Close the steam inlet closing the valves HV 4014 01 and HV 4014 09
- Close the steam outlet closing HV 4016 05
- After sterilization open the valves HV 4002 09 and HV 4002 10 in order to break the vacuum formed during the cooling.

After this, it's possible to continue with the normal operation.

9.3.4.7 **PBR total gas inlet filter (GF 4003 08) sterilization**

The gas flow should be stopped while the manipulation of this filter. In this case, the procedure to follow is the next one:

- Stop the loop 4003 (Inlet gas flow control)
- Close the valves HV 4003 05 and HV 4003 06.
- (Operate on the filter)
- Open the valve HV 4015 38 to permit the steam outlet.
- Open the valves: HV 4014 01 and HV 4015 25 to permit the steam inlet.
- (After 20-30 minutes) Close the steam inlet closing the HV 4014 01 and HV 4015 25.
- Close the steam outlet closing HV 4015 38

After this, it's possible to continue with the normal operation, so open the valves HV 4003 05 and HV 4003 06 to permit the gas flow and activate loop 4003.

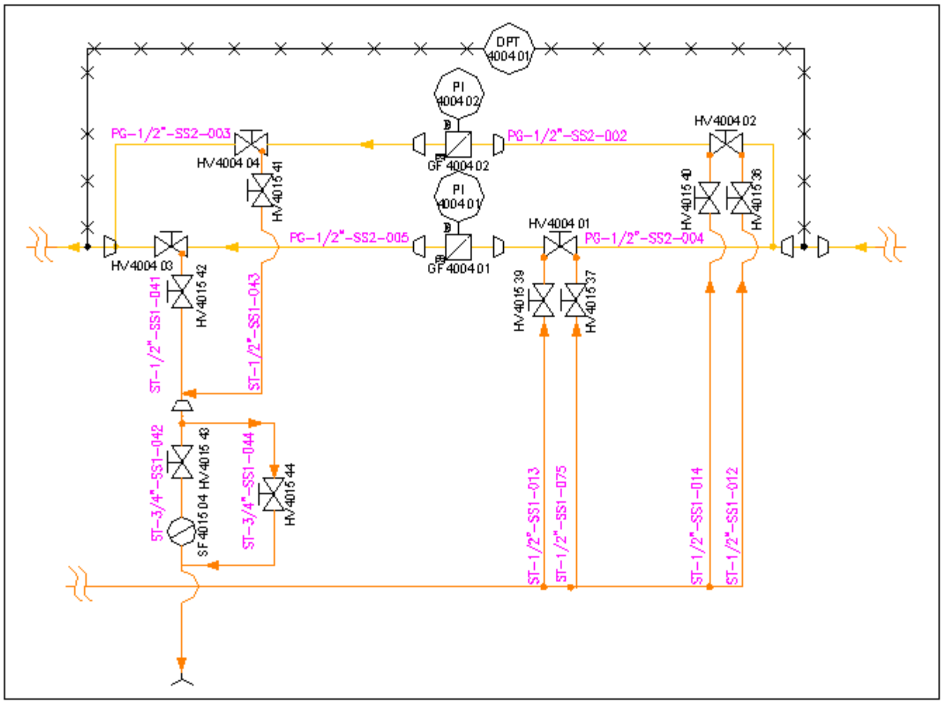
9.3.4.8 **PBR air inlet for biomass sensor cleaning filter (GF 4003 09) sterilization**

The gas flow should be stopped while the manipulation of this filter. In this case, the procedure to follow is the next one:

- Stop the loop 4003 (Inlet gas flow control)
- Close the valves HV 4003 07 and HV 4003 08.
- (Operate on the filter)
- Open the automatic valve SV 4003 02 (Manual set point)
- Open the valves HV 4015 29 and HV 4015 43 to permit the steam outlet.
- Open the valves: HV 4014 01 and HV 4015 26 to permit the steam inlet.
- (After 20-30 minutes) Close the steam inlet closing the HV 4014 01 and HV 4015 26.
- Close the steam outlet closing HV 4015 29 and HV 4015 43.

After this, it's possible to continue with the normal operation, so open the valves HV 4003 07 and HV 4003 08 to permit the gas flow and activate loop 4003.

9.3.4.9 **PBR outlet gases filter (GF 4004 01 or GF 4004 02) manipulation/sterilization**



Enlarged view of the P&ID stretch.

In this case, there are installed two parallel filters. Therefore, it's possible to manipulate one of both filters without closing the reactor gas outlet. So, in order to manipulate one of these filters, the procedure to be followed is described next.

✓ **Manipulation of the filter GF 4004 01:**

If it is being used the filter GF 4004 01 and should be manipulated, the gas flow must be diverted from PG-1/2"-SS2-04/05 to PG-1/2"-SS2-02/03. So the procedure is:

- Open the valves HV 4004 02 and HV 4004 04.
- Close the valves HV 4004 01 and HV 4004 03.

Now it is possible to manipulate GF 4004 01.

Before a new use of the filter that has been manipulated, it should be sterilized so:

- Check that the valves HV 4004 01 and HV 4004 03 are closed.
- Open the valves HV 4015 42 and HV 4015 43 in order to permit the steam outlet.
- Open the valves HV 4014 01 and HV 4015 39 to permit the steam inlet.
- (After 20-30 minutes) Close the steam inlet closing the valves HV 4014 01 and HV 4015 39.
- Close the steam outlet closing HV 4015 42 and HV 4015 43.

✓ **Manipulation of the filter GF 4004 02:**

In this case, if the filter that is being used is the GF 4004 02 and should be manipulated the flow must be diverted from PL-1/2”-SS2-02/03 to PL-1/2”-SS2-04/05. So the procedure is:

- Open the valves HV 4004 01 and HV 4004 03.
- Close the valves HV 4004 02 and HV 4004 04.

Now it is possible to manipulate GF 4004 02.
Before a new use of the filter that has been manipulated, it should be sterilized so:

- Check that the valves HV 4004 02 and HV 4004 04 are closed.
- Open the valves: HV 4015 41 and HV 4015 43 in order to permit the steam outlet.
- Open the valves: HV 4014 01 and HV 4015 40 to permit the steam inlet.
- Close the steam inlet closing the valves HV 4014 01 and HV 4015 40.
- Close the steam outlet closing HV 4015 41 and HV 4015 43.

10. SERVICE ON HARDWARE

IMPORTANT NOTE: All the information of this section (service on hardware) has been extracted from the technical documentation of each item. For further details please consult the supplier complete operating instructions included in the project technical documentation.

10.1. Maintenance of pumps

In a first stage, the plant will have two pumps installed (one for the feeding and one for the harvest) and one pump as spare.

Lewa Ecodos pumps use a 4-layer PTFE safety diaphragm for highest availability and operating safety

The patented 4-layer PTFE safety diaphragm consists of:

- 2 working diaphragms
- 1 monitoring diaphragm
- 1 pressure resistant (protection diaphragm)

Compared to other diaphragm systems in the low pressure range the LEWA safety diaphragm has two working diaphragms already. This alone provides double safety. If the first working diaphragm is worn the second working diaphragm takes over its work.

If the second working diaphragm is worn also this is immediately and reliably indicated by the monitoring diaphragm and the standard diaphragm monitoring system.

However interruption of the production process is not necessary. An also pressure stiff safety diaphragm takes over the task of the working diaphragms. The production process can be continued up to the next scheduled stop and the LEWA ecodos still remains hermetically tight.

For maintenance/service instructions, see LEWA operating manual on volume II of the project technical documentation.

10.2. Maintenance of filters (liquid and gas filters)

Fitting Filter Cartridges:

New vessel installations should be flushed out with clean water or air (dependant on the application) prior to installation of the cartridges. This will ensure that any installation debris is removed. Before flushing remove internal support plates/cage, springs and tie rods.

1. Close upstream and downstream isolation valves.

2. Depressurise vessel by cracking open the vent or drain connection.

3. Fully vent air vessels and fully drain liquid vessels

4. Remove filter bowl by releasing V band clamps, lock ring, bolts on flanges or unscrew bowl on plastic vessels.

Remove bowl and place on clean surface to protect seal face.

Note: if steam jackets or electrical heaters are fitted to air sterilisation vessels, they should have the steam or electricity supply switched off, be disconnected and allowed to cool before attempting work on bowl.

5. Remove support retaining nut/plate/cage and any springs or 'cup' seals if these were not removed for initial flushing. In this case leave tie rods in-situ.

6. Replace internal tie rods if removed for flushing.

7. Ensure bottom 'cup' seals in multi-cartridge industrial vessels are clean and not damaged.

8. Fit filter cartridges in accordance with instructions supplied (see Installation and Operating Instructions for Liquid &Gas Filter Cartridges Ref. 179500420). Pay careful attention to the condition of seals.

9. Refit top 'cup' seals and springs, in multi cartridge industrial vessels.

10. Refit support plate and retaining nut in sterile air vessels and retaining cage in sanitary liquid vessels. Ensure retaining nut is fully tightened on retaining plate types.

11. Check housing body seal, replace if any signs of wear or damage are evident

Note: multi sanitary liquid vessels have a removable distribution plate which has top and bottom body seals and two internal outlet seals. Ensure that this place is sealed properly before bowl is replaced.

12. Replace bowl by reversing actions carried out in step 4.

13. Ensure that filter bowl and fastenings are secured.

14. Ensure that drain, vent and pressure gauge connections are closed and secure.

15. Slowly open the upstream isolation valve and allow fluid to flow into vessel.

16. The vent valve at the top of the vessel should be 'cracked' open (two full turns on rotary valves is adequate, further turns will allow the valve to be removed completely). This allows air to vent from the vessel and ensure that it is full of liquid and that the entire cartridge is utilised. This is not necessary with air or gas installations.

17. Close vent when liquid emerges.

18. Slowly open the downstream isolation valve and allow the filtered liquid to flow.

19. Carefully check all seals, drains and vent and make good any leakage.

20. The filter vessel installation can now be run normally, within the operating parameters indicated for the vessel.

Cartridges should not be subjected to excessive hydraulic shock and should never be reverse pressurised from the downstream to upstream side inside to out through the cartridge).

Cartridges should be changed when they have completed their pre determined life, number of steam sterilization cycles or alternatively when the differential pressure and or flow through the filter vessel reach an unacceptable limit.

10.3. Maintenance of agitators

10.3.1. Feeding tank agitator (Sterimixer®)

The Sterimixer® requires a minimum of maintenance. Regular inspection of all parts and any consequent action is usually sufficient.

⚠ **Ensure the Sterimixer® is in a safe state before performing any service.**

Before performing maintenance and service ensure;
• The impeller and vessel are fully cleaned from any processed media and that any processed media cannot enter the vessel during maintenance.
• The vessel is fully vented from any possible gases.
• The vessel is depressurized.
• The main power is switched-off and cannot be accidentally switched on during maintenance.
• The vessel has been cooled to a temperature below 50°C (or a limit set by local regulations).

Mounting drive unit

Ensure the magnetic rotor is not damaged and properly aligned preventing physical contact with the weld plate upon installation and operation.
Be certain that you can handle the weight of the drive unit. Take a firm grip of the gearbox to balance the weight of the drive unit and to minimize the risk of damage caused by crushing when dismounting.

1. Lift the drive unit up and let the welding plate's screws pass through the slots in the drive unit flange.
2. Turn the drive unit counter clockwise into position.
3. Lock the drive unit in position by tightening the locking nuts.

Dismounting drive unit

Dismount the drive unit by following the mounting instructions in reverse order.
Be certain that you can handle the weight of the drive unit. Take a firm grip of the gearbox to balance the weight of the drive unit and to minimize the risk of damage caused by crushing when dismounting.

⚠ **Due to the strong magnetic forces generated by the magnets, the impeller must be mounted before the drive unit to avoid any damage on the bearings.**

The Sterimixer® magnetic rotor includes strong magnets thus personnel equipped with pacemaker shall not handle these components.

The Sterimixer® impeller and magnetic rotor includes strong magnets thus magnetic cards, e.g. credit cards, can be permanently damaged if being close to the components specified.

Ensure the power supply is disconnected and not possible to accidentally be connected.

The drive unit can be heavy.

⇒ **Routine maintenance during start up/running in:**

Following maintenance schedule should be performed at start up and/or running in of the Sterimixer®.

• Remove and check the impeller.

• If particles are stuck to the impeller they have to be removed.

• Due to the strong magnets inside the impeller all magnetic particles will get stuck inside the impeller. Therefore, check the inside of the impeller in particular.

• The impeller must not be scratched or in any way damaged. If it has been damaged, the impeller and bearing must be replaced. The impeller can be sent to Roplan for refurbishment.

• If a refurbished impeller is to be installed the bearing unit shall be replaced with a new.

⚠ **The Sterimixer® impeller includes strong magnets thus personnel equipped with pacemaker shall not handle these components.**

⇒ **At least once a year - interval dependent upon application**

Following maintenance schedule should be performed at least once a year. Do note that the interval will be highly dependant upon the application.

• Remove and check the bearing and the impeller for signs of surface damage and general wear of the bearings.
• Change the bearing and the impeller if the surface is coarse or uneven, scratched or if fragments have been knocked out from the bearing. The impeller can be sent to Roplan for refurbishment.
• Change the PTFE washer when dismounting the bearing.
• Make a general inspection of the motor, gearbox and other Sterimixer® parts. Make sure the gearbox is not leaking oil.

⚠ **The Sterimixer® impeller includes strong magnets thus personnel equipped with pacemaker shall not handle these components.**

NOTE: The male bearing and the female bearing must be of same material, TC or SiC. If a refurbished Impeller is installed, a new bearing unit shall be mounted as well.

10.3.2. Harvesting tank agitator (Vak kimsa)

NOTE: See the maintenance manual of Vak kimsa agitator (included in the volume I of the project technical documentation)

10.4. Maintenance of valves: membrane replacement/others

10.4.1. Hand-operated diaphragm valves (Bürkert, model 3233)

Dismantling of the valve:

⚠ **Before dismantling or opening the valve, turn-off the medium and depressurize the pipes.**

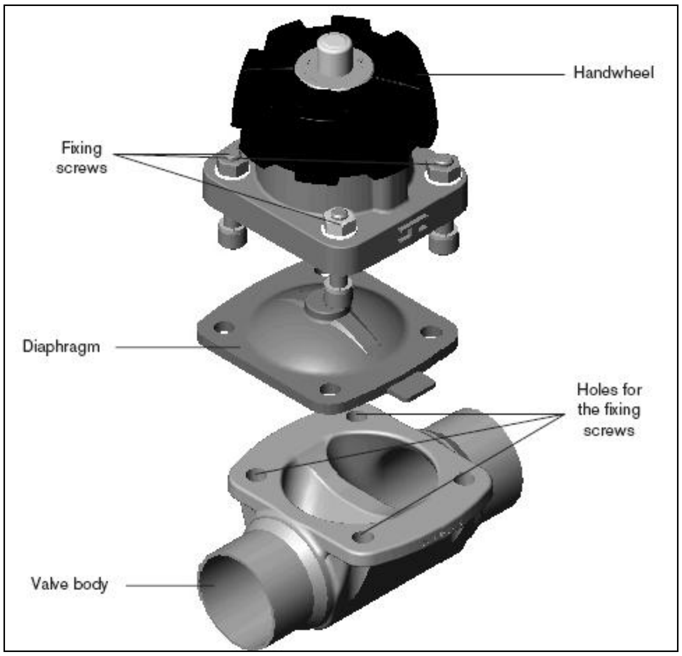


FIGURE1. Disassembled drawing of the manual diaphragm valve 3233

- Open the valve until the optical indicator (yellow) is completely let out (till blocking).

⚠ **Only turn the hand wheel by hand.**

- Remove the protection caps from the nuts, if necessary.
- Unscrew the 4 fixing screws in an alternating pattern and remove the hand wheel.
- Turn the hand wheel a few times so that the diaphragm separates from the body.
- Remove the diaphragm:
    - For DN15 and 20, remove the elastomeric diaphragm.
    - For DN > 20, unscrew the elastomeric diaphragm.
    - For a PTFE/EPDM diaphragm, turn a quarter turn to release the bayonet.
- Place back the new diaphragm so that the fixing holes are aligned with those of the diaphragm (screw home if necessary).
- Open the hand wheel again (turn until blocking).
- Place back the hand wheel and the screws.
- Screw in an alternating pattern until the hand wheel is in its proper place, without tightening.
- Close the valve entirely then open it again completely so that the diaphragm positions itself correctly.
- Tighten the screws in an alternating pattern to the torque rating (in Nm) specified below:

DN	Material of the diaphragm	
	Elastomer	PTFE/EPDM
8	2	2,5
15	3,5	4
20	4	4,5
25	5	6
40	8	10
50	12	15
80	30	55
100	40	50

For 3A approved products, please use only sterile food grade lubricant complying with CFR 21 arts 178.3570.

10.4.2. Hand-operated ball valves (Bürkert, model 2651)

The ball valves are maintenance-free when operated according to the instructions indicated in his manual.

NOTE: See the operating instructions in the project documentation.

10.4.3. Piston-operated diaphragm valves (Bürkert, model 2031)

Dismantling of the valve:

Before dismantling or opening the valve, turn-off the medium and control medium and depressurize the pipes.

Dismantling security: the cover can be unscrewed without any risk (the spring loses its tension progressively).

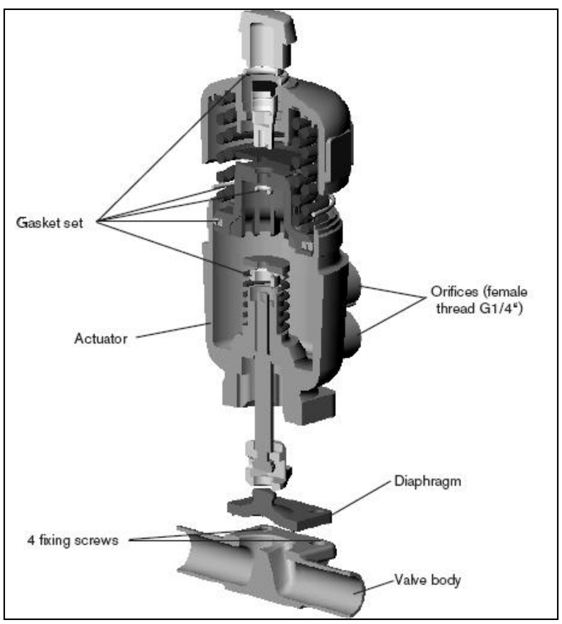


FIGURE2. Disassembled drawing of the automatic diaphragm valve 2031

- Apply the control pressure indicated on the label to the lower orifice of the valve: the diaphragm separates from the body.
- Unscrew the 4 fixing screws in an alternating pattern and remove the valve actuator.
- Remove the pressure.
- Remove the diaphragm:
    • For DN15 and 20, remove the elastomeric diaphragm.
    • For DN > 20, unscrew the elastomeric diaphragm.
    • For a PTFE/EPDM diaphragm, turn a quarter turn to release the bayonet.
- Place back the new diaphragm so that the fixing holes are aligned with those of the diaphragm (screw home if necessary).
- Apply the control pressure indicated on the label to the lower orifice of the valve.
- Place back the actuator and the screws.
- Screw in an alternating pattern until the actuator is in its proper place, without tightening.
- Actuate the valve twice so that the diaphragm positions itself correctly.
- Remove the pressure then tightens the screws in an alternating pattern to the torque rating (in Nm) specified below:

DN	Material of the diaphragm	
	Elastomer	PTFE/EPDM
8	2	2,5
15	3,5	4
20	4	4,5
25	5	6
40	8	10
50	12	15
80	30	55
100	40	50

- Apply again the control pressure indicated on the label to the lower orifice of the valve.
- Check the torque rating of the 4 screws. Tighten if necessary.

⚠ **For 3A approved products, please use only sterile food grade lubricant complying with CFR 21 Part 178.3570.**

10.4.4. Proportional valves with control electronics (2833)

Under normal conditions, operation of the valve is maintenance-free.

NOTE: See the operating instructions in the project documentation.

10.5. Maintenance of sensors

10.5.1. Maintenance of biomass sensor AT 4009 02

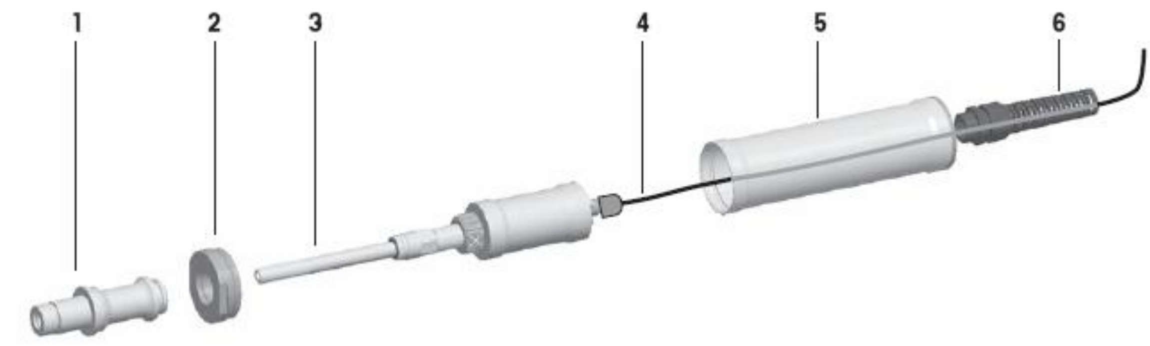
Dirty or contaminated sensors can deliver incorrect measurement values. If fouling is presumed, the sensor is to be removed and cleaned. Suitable cleaning solutions are mild detergents or strongly diluted acids (< 0.5 % by wt.) such as hydrochloric acid.

When handling acids, precautionary measures are to be taken at all times.

10.5.2. Maintenance of dissolved O_2 sensor AT 4010 03

Mounting/Dismounting InTrac777:

1. Guide sensor cable (4) through the sensor protection tube (5) and the screwed cable gland (6).
2. Mount flange adapter (2) on the existing InTrac housing (1).
3. Insert optical sensor (3) and screw in hand tight.
4. Mount sensor protection tube (5).
5. Tighten screwed cable gland (6).



Inspection of the sensor:

⇒ Visual inspection

To check your sensor, following procedure is recommended:

• The contacts of the connector must be dry. Moisture, corrosion and dirt in the connector can lead to false readings.
• Check the cable for buckling, brittle areas or ruptures.
• Before calibration always examine the membrane foil optically for signs of damage. The foil must be intact and clean. Dirty membranes should be wiped clean using a soft, moist tissue.
Note: An undulated membrane has no influence on the sensor performance, assuming the membrane is intact.
• The membrane body must be replaced if the sensor has too long a response time, the reading is unstable or subject to drift, and if the sensor cannot be calibrated or the membrane shows sign of mechanical damage.
• Check the cathode area for discoloration, contamination or cracks in the glass. If necessary rinse with demineralized water and clean with a clean soft brush or soft paper tissue.

⚠ **Do not use any cleaning agents containing alcohol. This could damage the sensor or lead to fault current. The glass body is fragile and sensitive to vibration.**

⇒ Testing the sensor via transmitter

A periodic zero current measurement (**no zero point calibration**) is recommended for verification of proper sensor function.

⚠ **At the time you carry out the zero current measurement, the sensor must be polarized.**

Zero current measurement can be done by using zeroing gel (order no. 34 100 1032) or nitrogen (N_2) or carbon dioxide (CO_2) calibration gases with a purity of at least 99.995 %, alternatively in a sample medium saturated with one of these gases.

After 2 minutes in an oxygen-free sample medium, the reading on the transmitter should drop to below 10 % of the reading in ambient air, and within 10 minutes the value should have dropped to below 1 %.

If the measured values are too high, this suggests a depleted electrolyte or a defective membrane. In the first instance replace the electrolyte, and in the second case exchange both the membrane body and the electrolyte accordingly.

If after such procedures the above mentioned values are still not reached, replace the interior body. If this doesn't solve the problem too send the sensor to your local METTLER TOLEDO representative for inspection.

Many sample media contain volatile substances which, even at very low concentrations, have a clearly perceptible smell. Similarly to oxygen, these substances are able to invade the electrolyte through the gas-permeable membrane. Accordingly, they become noticeable when changing the electrolyte. In most cases, such substances have absolutely no influence on the measuring properties of the sensor.

Slight discoloration of the electrolyte also has no effect on the measuring properties.

Changing the electrolyte, the membrane body or the interior body

If a sensor is to be stored for several months, the electrolyte should be replaced before use.
If the membrane exhibits signs of failure (long response time, increased current in an oxygen-free medium, mechanical damage, etc.) the membrane body has to be replaced.

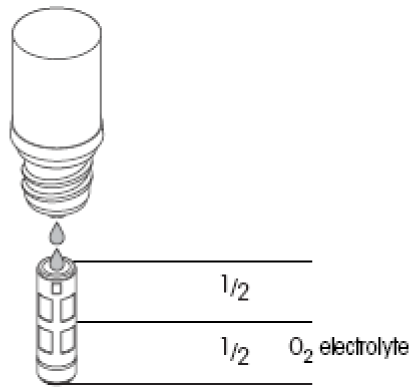
⚠ The O_2 electrolyte has an alkaline pH value of 13. Contact of electrolyte with mucous membrane or eyes is to be avoided. **Therefore protective gloves and safety glasses have to be worn for the following dismantling works.** If such contact occurs, the affected area should be well rinsed with water. In the case of accident, or should ever any adverse signs appear, get immediate medical attention.

When changing the electrolyte, the membrane body or the interior body, please observe the following instructions (see also the following illustration):

⚠ **Make sure that this maintenance step is carried out in clean place.**

1. Unscrew the cap sleeve from the sensor shaft and carefully pull it off the sensor.
2. Pull off the membrane body from the interior body. If it is tight-fitted, eject by pushing it with the flat finger tip. Before electrolyte is refilled, the membrane body must be removed from the cap sleeve.
3. Rinse the interior body with demineralized water and carefully dab it dry with a paper tissue.

Note: steps 4 to 7 may only be carried out when changing the interior body.
4. Unscrew the retainer nut of the interior body with an adjustable wrench or with a 3/8" wrench.
5. Remove the interior body by pulling it out of the sensor shaft. If necessary use a plier.
Do not twist the interior body. Otherwise the connection pins can be damaged.
6. Insert the new interior body in the sensor shaft. Turn the interior body in the shaft until the slit of the interior body is aligned with the pin placed in the shaft.
7. Press the body in the shaft and screw the new retainer nut in place.
8. Examine the O-rings visually for mechanical defects, and replace if necessary.
9. Half-fill the new membrane body with O_2 electrolyte and make sure that all bubbles are removed. Air bubbles can be removed by carefully tapping on the membrane body.

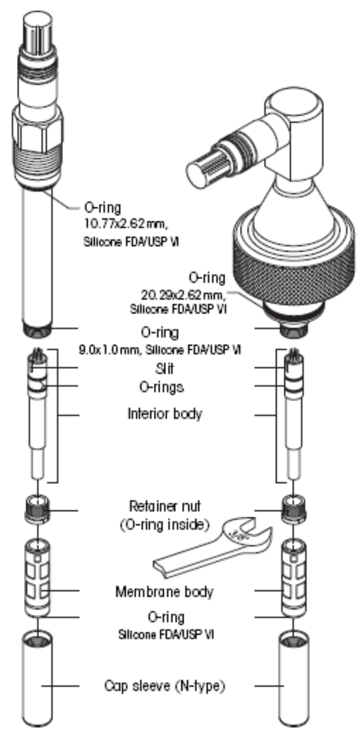


10. Slip the membrane body over the interior body while holding the sensor in a vertical position. The excess electrolyte will be displaced and have to be removed with a paper tissue.

⚠ **No electrolyte, sample media or contamination may be present between the membrane body and the cap sleeve. Please check carefully.**

11. Carefully slip the cap sleeve over the fitted membrane body, holding the sensor in a vertical position and screw it tight. The cap sleeve must be clean and dry.

12. After each exchange of electrolyte or membrane body, the sensor has to be repolarised and recalibrated.



10.5.3. **Maintenance of pH sensors AT 4006 01/02**

Mounting/Dismounting InTrac777:

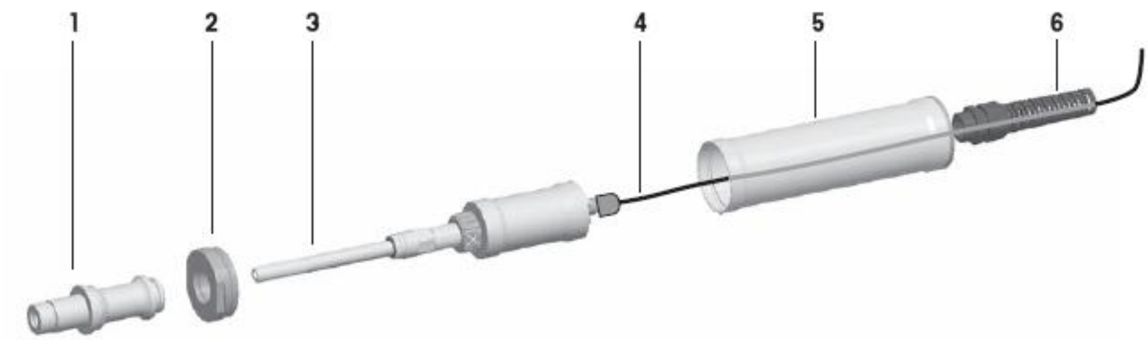
1. Guide sensor cable (4) through the sensor protection tube (5) and the screwed cable gland (6).

2. Mount flange adapter (2) on the existing InTrac housing (1).

3. Insert optical sensor (3) and screw in hand tight.

4. Mount sensor protection tube (5).

5. Tighten screwed cable gland (6).



1. After each working cycle the electrode tip and diaphragm(s) are to be carefully rinsed with deionised water. Any drying out of residues from the solution being measured on these parts must be avoided at all costs!

2. If the electrode is not in use it is stored with the electrode tip and the diaphragm immersed in a tank of electrolyte (9823/3M KCl or 9848 Friscolyt).

3. If the electrode is stored in its armature the rules described under Item 2 apply, although the electrolyte has to be slightly modified for storage purposes (2 parts of buffer solution pH 9.2 to 10 parts of electrolyte) in order to avoid any corrosion of the armature parts.

4. If an electrode is inadvertently stored in a dry condition for several days it must be rinsed for several hours in a standard storage electrolyte.

5. The plug-in head should occasionally be checked for possible traces of moisture. If necessary clean it thoroughly with deionised water or alcohol and then dry it off carefully.

With a soft toothbrush and water any residues can easily be removed from the electrode. Mild washing agents can also be used. Protein contaminations on the diaphragm can be most likely removed with the cleaning solution.

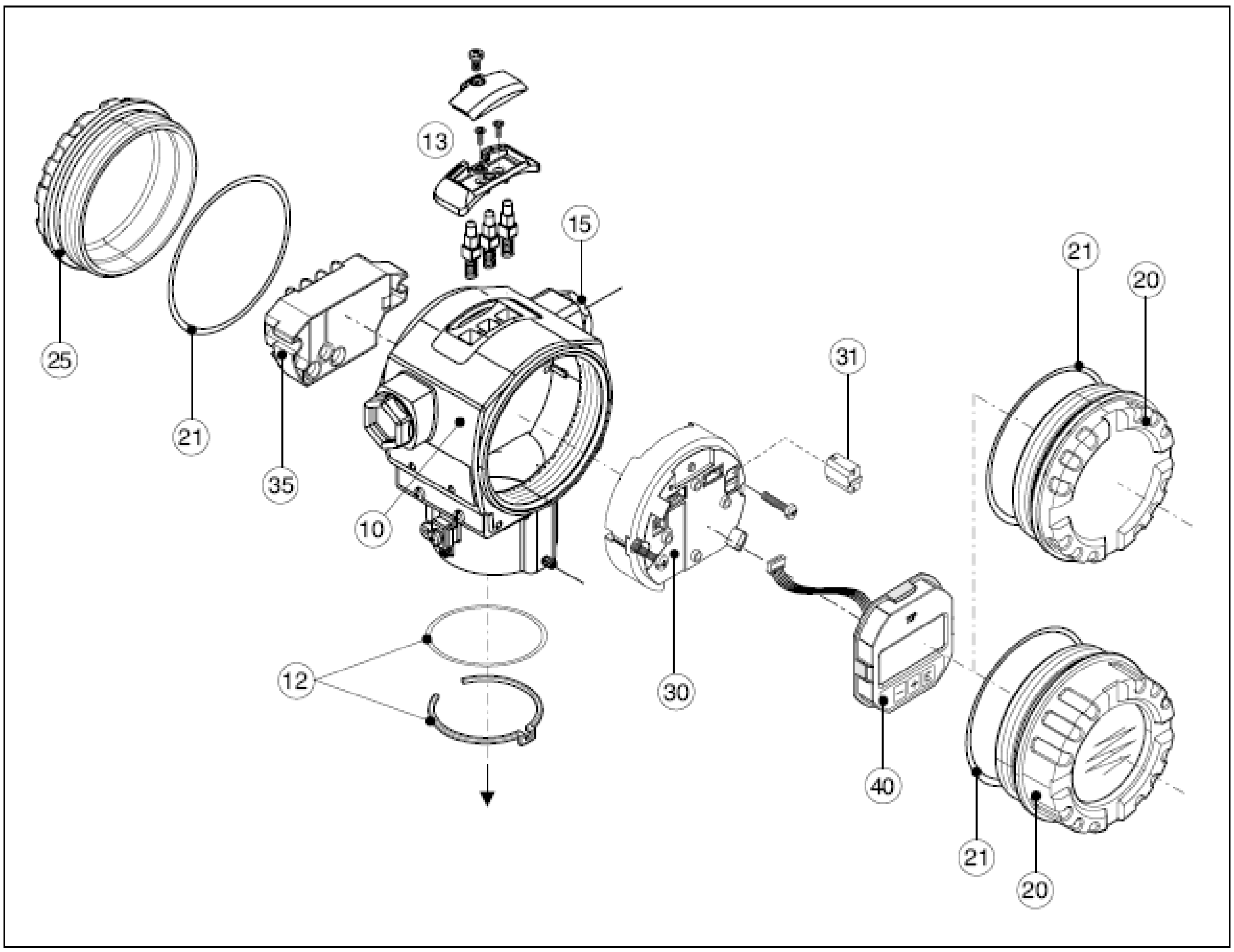
⚠ **Solutions containing hydrofluoric acid damage the pH sensitive part of the electrode.**

10.5.4. Maintenance of differential pressure sensors DPT 4001 01/02

Due to the modular construction of the instrument, some repairs can be carried out by the customer. All replacement parts are listed with order numbers which you can order for repair of the instrument. Where required, exchange instructions are provided with the replacement parts.

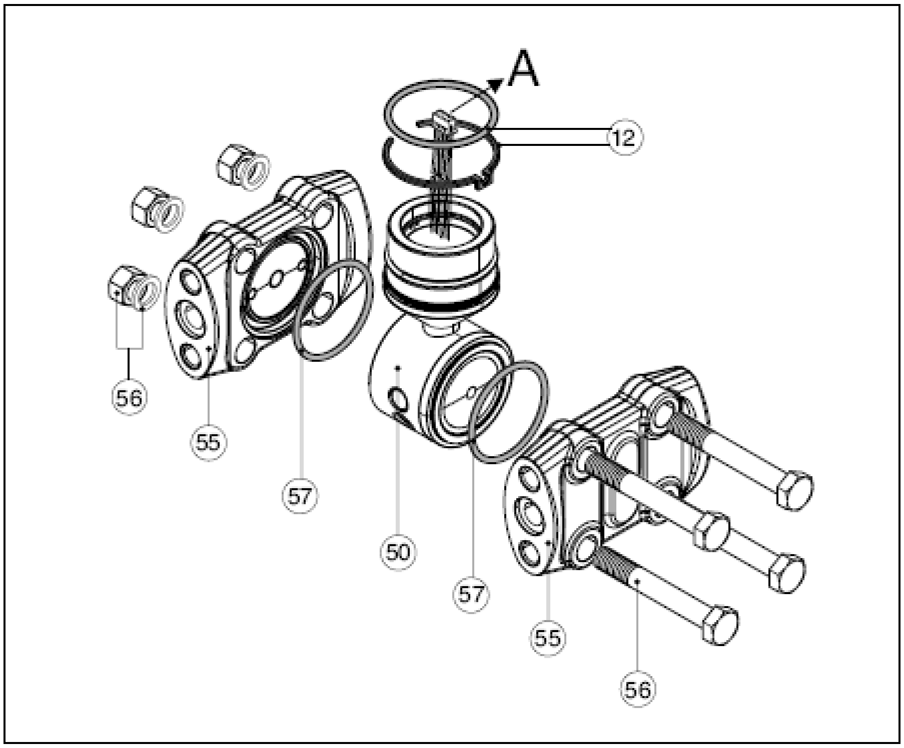
On the following pages you will find all replacement parts with order numbers which you can order from VEGA for repair of VEGADIF 55. In the replacement parts order always provide the serial number stated on the type label. The replacement part number is printed on each replacement part.

Replacement parts for electronic and housing:



Serial no.	Order no.	Description
10	52020430	Aluminium housing, M20 x 1,5; not for EEx-d/XP
10	52020488	Aluminium housing, M20 x 1,5; HART, with 3 keys for adjustment from outside, not for EEx-d/XP
10	52020489	Aluminium housing, M20 x 1,5; Profibus PA/Foundation Fieldbus, with key for adjustment from outside, not for EEx-d/XP
10	52020431	Aluminium housing, ½ NPT, not for EEx-d/XP
10	52020490	Aluminium housing, ½ NPT, HART, with 3 keys for adjustment from outside, not for EEx-d/XP
10	52020491	Aluminium housing, ½ NPT, Profibus PA/Foundation Fieldbus, with key for adjustment from outside, not for EEx-d/XP
12	52020440	Mounting set housing/sensor consisting of: 2 O-rings 45.69 x 2.62 EPDM + locking piston
13	52024110	Adjustment keys for adjustment from outside, consisting of: keys, covers and screws (version 2.0)
15	52020760	Cable gland M20 x 1.5; seal
15	52020761	Cable gland G½, seal, adapter
15	52020762	Plug 2/7-pole, Han7D, seal
15	52020763	Plug 3-pole, M12, seal
20	52020432	Cover for Aluminium housing incl. seal, not for EEx-d/XP
20	52020433	Cover for Aluminium housing incl. seal, for EEx-d/XP
20	52020494	Cover for Aluminium housing with inspection glass incl. seal, for Ex-free area
20	52020492	Cover for Aluminium housing with inspection glass incl. seal, not for EEx-d/XP
20	52020493	Cover for Aluminium housing with inspection glass incl. seal, for EEx-d/XP
21	52020429	Seal set EPDM for cover Aluminium housing (5 pcs.)
25	52020432	Cover for Aluminium housing incl. seal, not for EEx-d/XP
30	52024400	Electronics 4 … 20 mA, HART, Ex, version 2.0x, adjustment keys on electronics
30	52024111	Electronics 4 … 20 mA, HART, Ex, version 2.0x, adjustment keys on the housing
31	52027785	Data memory module
35	52020434	Terminal 3-pole, RFI filter 4 … 20 mA/HART
40	71002865	Indicating module with 3 adjustment keys, incl. holder

Replacement parts for process components:



Serial no.	Order no.	Description
55	52020667	Flange 1/4-18 NPT IEC 61518, fastening: 7/16-20 UNF, C22.8 (2 pcs.)
55	52020668	Flange 1/4-18 NPT IEC 61518, fastening: 7/16-20 UNF, 316L (2 pcs.)
55	52020669	Flange 1/4-18 NPT IEC 61518, fastening: 7/16-20 UNF, 316L (2 pcs.), with PTFE seal (2 pcs.)
55	52020670	Flange 1/4-18 NPT IEC 61518, fastening: 7/16-20 UNF, 316L, lateral ventilation (2 pcs.) incl. 4 closing screws, with PTFE seal (2 pcs.)
55	52020671	Flange 1/4-18 NPT, IEC 61518, fastening: 7/16-20 UNF, C22.8, lateral ventilation (2 pcs.) incl. 4 closing screws
55	52020672	Flange 1/4-18 NPT, IEC 61518, fastening: 7/16-20 UNF, 316L, lateral ventilation (2 pcs.) incl. 4 closing screws
55	52020673	Flange 1/4-18 NPT, PN 160, fastening: M10, 316L (2 pcs.), with PTFE seal (2 pcs.)
55	2020674	Flange 1/4-18 NPT, PN 160, fastening: M10, C22.8 (2 pcs.)

Serial no.	Order no.	Description
55	52020675	Flange 1/4-18 NPT, PN 160, fastening: M10, 316L (2 pcs.)
55	52020676	Flange 1/4-18 NPT, PN 420, fastening: M12, 316L (2 pcs.)
55	52020677	Flange 1/4-18 NPT, PN 420, fastening: M12, 316L (2 pcs.), with PTFE seal (2 pcs.)
55	52020678	Flange 1/4-18 NPT, PN 420, fastening: M12, C22.8 (2 pcs.)
55	52020679	Flange RC 1/4, fastening: 7/16-20 UNF, 316L (2 pcs.), with PTFE seal (2 pcs.)
55	52020680	Flange RC 1/4, fastening: 7/16-20 UNF, 316L (2 pcs.)
55	52020681	Flange RC 1/4, fastening: 7/16-20 UNF, 316L, lateral ventilation (2 pcs.) incl. 4 screws, with PTFE seal (2 pcs.)
55	52020682	Flange RC 1/4, fastening: 7/16-20 UNF, 316L, lateral ventilation (2 pcs.) incl. 4 closing screws
55	52020430	Aluminium housing, M20 x 1,5; not for EEx-d/XP
55	52020488	Aluminium housing, M20 x 1,5; HART, with 3 keys for adjustment from outside, not for EEx-d/XP
55	52020489	Aluminium housing, M20 x 1,5; Profibus PA/Foundation Fieldbus, with key for adjustment from outside, not for EEx-d/XP
55	52020431	Aluminium housing, ½ NPT, not for EEx-d/XP
55	52020430	Aluminium housing, M20 x 1,5; not for EEx-d/XP
55	52020488	Aluminium housing, M20 x 1,5; HART, with 3 keys for adjustment from outside, not for EEx-d/XP
55	52020489	Aluminium housing, M20 x 1,5; Profibus PA/Foundation Fieldbus, with key for adjustment from outside, not for EEx-d/XP
55	52020431	Aluminium housing, ½ NPT, not for EEx-d/XP
55	52020430	Aluminium housing, M20 x 1,5; not for EEx-d/XP
55	52020488	Aluminium housing, M20 x 1,5; HART, with 3 keys for adjustment from outside, not for EEx-d/XP

Serial no.	Order no.	Description
55	52020489	Aluminium housing, M20 x 1,5; Profibus PA/Foundation Fieldbus, with key for adjustment from outside, not for EEx-d/XP
55	52020431	Aluminium housing, ½ NPT, not for EEx-d/XP
12	52020440	Mounting set housing/sensor consisting of: 2 O-rings 45.69 x 2.62 EPDM + locking piston
13	52024110	Adjustment keys for adjustment from outside, consisting of: keys, covers and screws (version 2.0)
15	52020760	Cable gland M20 x 1.5; seal
15	52020761	Cable gland G½, seal, adapter
15	52020762	Plug 2/7-pole, Han7D, seal
15	52020763	Plug 3-pole, M12, seal
20	52020432	Cover for Aluminium housing incl. seal, not for EEx-d/XP
20	52020433	Cover for Aluminium housing incl. seal, fpr EEx-d/XP
20	52020494	Cover for Aluminium housing with inspection glass incl. seal, for Ex-free area
20	52020492	Cover for Aluminium housing with inspection glass incl. seal, not for EEx-d/XP
20	52020493	Cover for Aluminium housing with inspection glass incl. seal, for EEx-d/XP
21	52020429	Seal set EPDM for cover Aluminium housing (5 pcs.)
25	52020432	Cover for Aluminium housing incl. seal, not for EEx-d/XP
25	52020433	Cover for Aluminium housing incl. seal, for EEx-d/XP
30	52024400	Electronics 4 … 20 mA, HART, Ex, version 2.0x, adjustment keys on electronics
30	52024111	Electronics 4 … 20 mA, HART, Ex, version 2.0x, adjustment keys on the housing
31	52027785	Data memory module
35	52020434	Terminal 3-pole, RFI filter 4 … 20 mA/HART
40	71002865	Indicating module HART with 3 adjustment keys, incl. holder

10.5.5. Maintenance of pressure sensors PT 4007 01/02

When the instrument is used properly, no special maintenance is required in normal operation. Product build-up on the diaphragm can influence the measuring result. Take precautions to ensure that heavy build-up and especially a hardening thereof, is avoided.

Exchanging the electronics module

In case of a defect, the electronics module can be exchanged by the user against an identical type. If no electronics module is available on the plant, the module can be ordered from the VEGA agency serving you.

For further reparations is necessary to send the instrument to the supplier.

10.5.6. Maintenance of mass flowmeter FT 4001 01

In most applications, when correctly selected and installed, this instrument requires very little maintenance as it is designed without any moving mechanical parts.
Nevertheless, according to its criticality to the quality, the instrument needs to be inspected or/and calibrated periodically.

Periodic inspection to assure reliability of the application

After the flowmeter has been operating for a period of time, it is easy to think that just because the flowmeter signal is stable it is correct – but this might not be the case. Even an indicated flow that appears to be within acceptable limits may be inaccurate and may then affect the quality of the final product.

Pipeline inspections

Deposits in the pipe can cause a slow drift of measured values at meter output that is not detected and rectified. Anything that alters the shape or diameter of a pipeline upstream of the measurement point will cause errors in the readings.
Due to the effects of sedimentation or deposition, a periodical cleaning of the flowmeter pipe might be necessary.

Calibration

Intrinsically this flowmeter offers long-term stability and repeatability of the measurements. Nevertheless, periodic calibrations are recommendable for the measurement points which are critical to the process.

Inspection of seals and gaskets

In this particular process, operational needs the use of frequent cleaning or sterilization in place (CIP or SIP). The flowmeter seals and gaskets should then be frequently replaced to avoid risks of leakage, contamination and even process failure.

Routine maintenance

The need for routine maintenance is defined according to the importance of the flowmeter in the process. Flowmeters can be checked in a variety of ways: The most common maintenance seems to be the use of electrical devices for simple checking of the input and output function of the transmitter.

11. PROCESS FOLLOW UP

11.1. Sampling

11.1.1. Influent

11.1.2. Reactor content

11.1.3. Gas

11.1.4. Harvested broth

11.2. Follow-up

11.2.1. Influent tank

11.2.2. Bioreactor

11.2.3. Gas loop

11.2.4. Harvesting tank

11.3. Analysis

11.3.1. On-line measurements

11.3.2. Off-line measurements

12. CALIBRATIONS

12.1. Biomass sensor (AT 4009 02) calibration

If the turbidity measuring system is calibrated off-line, it is recommended to use the METTLER TOLEDO calibration tool, «CaliCap» (order no. 52 800 210), for fitting on the sensor shaft. If «CaliCap» is not used, a minimum distance of 10 cm (4") to the vessel walls has to be observed as well.
During calibration, the sample should be stirred in order to prevent the sedimentation of solid particles.

12.2. Dissolved O_2 sensor (AT 4010 03) calibration

Purpose of calibration

Each oxygen sensor has its own individual slope and own individual zero point. Both values are subject to change, for example, through electrolyte consumption or after exchange of electrolyte or membrane body. To ensure high measurement accuracy of the sensor, a calibration must be carried out after each change of electrolyte or membrane. Prior to calibration, the sensor has to be polarized for at least 6 hours.

Note: A zero point calibration is only advisable if very high accuracy is required at low oxygen concentrations.
Note: To check if your sensor needs a recalibration, you may dry it and take it in the air to check that the reading is close to 100%. If not, then the sensor needs a new calibration.

Calibration general remarks

– **For calibration in air, the sensor membrane must be dry**, since adhering water drops can falsify the measured oxygen value.

– Make sure that the **oxygen saturation index** of the calibration medium is **correct and remains constant** during calibration.

– In the event of calibration in water or sample medium, the **calibration medium must be in equilibrium with the air**. Oxygen exchange between water and air is only very slow. Therefore it takes quite long time until water is saturated with atmospheric oxygen.

– For correct calibration, a minimum flow rate of the calibration medium is necessary.

– **Calibration in a fermenter should be performed after sterilization** (as sterilization may alter the sensor slope), but prior to inoculation. If it is not possible to perform the calibration after sterilization, the use of an existing membrane body that has been pre-sterilized while mounted in the sensor is recommended. A slope alteration of some per cent can occur with new membrane bodies, particularly after a first sterilization, as the tension of the membrane may be altered by the sterilization process.

– Make sure that all other parameters, such as temperature and pressure, are constant.

– For continuous applications, **periodic recalibration is recommend in line with your requirements on accuracy, the type of process in operation and your own experience**. The frequency of the need for recalibration depends very much on the specific application, and therefore appropriate intervals cannot be exactly defined here.

Single point calibration

By carrying out a single point calibration, the factual slope of the sensor can be established. The calibration medium can be water with known oxygen saturation index (e.g. air-saturated water) or air with known water-vapor saturation (e.g. water-vapor saturated air).

After the sensor signal has stabilized, the complete measuring system can then be calibrated to the100 % value of the desired measurable variable, e.g.100 % air, 20.95 % O_2, or 8.26 ppm at 25 °C (77 °F) and normal pressure (see instruction manual for the transmitter).

Single point calibration should be sufficient for almost all process applications.

<u>Dual point calibration</u>

By carrying out a dual point calibration both slope and zero point of the sensor can be established.
Note: In case of a **dual point calibration, always start by the zero point calibration** before calibrating the slope.

Due to the very low zero current of METTLER TOLEDO sensors, dual point calibration is normally not necessary for standard applications. As a rule, the zero point should be adjusted to zero manually, or it is automatically performed by the transmitter (see instruction manual for the transmitter). A zero point calibration is only advisable if very high accuracy is required at low oxygen concentrations.

⚠ **Incorrect zero point calibration is a frequent source of measurement error. For correct calibration, is recommended the use of nitrogen gas or other oxygen-free medium with a level of purity of at least 99.995%.**

After the sensor signal has stabilized (after 20…30 minutes), the sensor can be calibrated through the relevant transmitter to the 100 % value of the desired measurable variable, e.g. 0 % air, 0.0 % O2, or 0.0 ppm (see instruction manual for the transmitter).

12.3. <u>pH sensors (AT 4006 01/02) calibration</u>

Before a calibration immerse the electrode for 10 minutes in a pH 7.00 or pH 4.01 buffer solution whilst connecting it to the transmitter. A 2-point calibration is recommended, e.g. pH 7.00 and pH 4.01 buffer solutions. For further details please consult the operating instructions for the pH transmitter.

2. FINAL P&ID

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. Totoy Comprobado: J. Mestre Fecha: 13/04/2010 Referencia	D.Totoy J.Mestre
PROYECTO	MELiSSA - Compartment IVa	CLIENTE	Universitat Autònoma de Barcelona
TITULO	P&ID DIAGRAM		
PLANO Nº	DD-8558-Z1-100-01	Revision 13	Escala S.E.

3. REQUIRED UTILITIES DEFINITION AND ESTIMATED CONSUMPTIONS

2008

Author: Francisco Mangas

Company: De Dietrich Equipos Químicos

Date: 10 / 02 / 2009

Rev. 3

2. DEFINITION OF UTILITIES REQUIRED AND ESTIMATED CONSUMPTIONS

1. ESTIMATED UTILITIES CONSUMPTIONS

Utilities required in Melissa Compartment IVa Pilot Plant are the ones described next:

– **Air:** Air circulation is required to refrigerate the reactor heated by the lighting system. The maximum values of air needed to maintain the optimum operating conditions are:

- Max. metric flow = 1000 m^3/h
- Max. mass flow = 1200 Kg/h
- Max. velocity = 8.6 m/s

– **Water:** Water is used in the reactor jacket. The water can be used as heating or cooling liquid depending in its temperature.

- If the reactor inlet temperature needs to be increased, the jacket water is heated with an electric resistance.

- If the reactor inlet temperature needs to be decreased, the jacket water is cooled with a plate exchanger using glycol.

The maximum values of water needed to maintain the optimum operating conditions are:

- Max. metric flow = 0 m^3/h[1)]
- Max. mass flow = 0 Kg/h[1)]
- Max. velocity = 1.4 m/s

[1)] NOTE: The water loop is a closed circuit so it has no consumption except the purge losses.

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

- Max. metric flow = 9.5 m^3/h
- Max. mass flow = 19.8 Kg/h
- Max. velocity = 13.6 m/s

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

– **Glycol:** Glycol is used in different plant equipments:

- To refrigerate the reactor water circuit through the plate exchanger HX 4005 02.

- Max. metric flow = 1 m^3/h
- Max. mass flow = 1000 Kg/h
- Max. velocity = 1.4 m/s

- To condense the reactor gas outlet in order to separate the liquid and gas parts with the condenser HX 4007 01 situated in the reactor upper part

- Max. metric flow = 0.3 m^3/h
- Max. mass flow = 300 Kg/h
- Max. velocity = 0.4 m/s

- To refrigerate the feed/harvest tanks.

- Max. metric flow = 1 m^3/h
- Max. mass flow = 1000 Kg/h
- Max. velocity = 1.4 m/s

- **Compressed air:** Compressed air is used for actuators.

- **Electricity:** The electrical consumption is calculated from all the plant electric components.

1.1 ESTIMATED ELECTRICITY CONSUMPTION

The compartment IVa electrical components are listed next:

- **Feed/Harvest pumps (GP 4001 01/02, GP 4002 01/02):** These pumps allow the reactor media input and output.

- **Acid/base feeding pumps (PP 4006 01/02):** Reactor pH control is done actuating over these pumps.

- **Centrifuge air fan (BLWR 4005 01):** This fan aspirates the air from the outside, and forces it to pass through the reactor air refrigeration system. The hot air is thrown out again to the outside of the pilot plant.

- **Compressor (BLWR 4004 01):** This compressor is used to recirculate the compartment outlet gases to the reactor inlet.

- **Reactor water circuit pump (PP 4005 01):** This pump allows cooling water flow through the external jacket of the reactor stainless-steel parts.

- **Feeding tank (VS 4001 01) magnetic agitator:** This equipment provides the necessary agitation to the feed vessel.

- **Harvesting tank (VS 4002 01) mechanic agitator:** This equipment provides the necessary agitation to the harvest vessel.

- **Electrical heater (HX 4005 01):** This electric resistance heats the reactor water circuit (jacket water) if necessary.

- **Sample gas cooler (HX 4007 02):** This equipment is used to condensate the reactor outlet gas before entering the gas analyzer.

- **Reactor lighting system:** The illumination system consists of 350 halogen lamps distributed homogenously around the glass cylinders. A voltage regulator allows for different light intensities to the bioreactor.

The characteristics and operating parameters of the electrical equipment are as follows:

Item	Description	Power (KW)	Estimated operating load	Estimated consumption (KW·h/h)
GP 4001 01	Diaphragm pump	0,37	1,0	0,37
GP 4001 02	Diaphragm pump	0,37	0,0	0,00
GP 4002 01	Diaphragm pump	0,37	1,0	0,37
GP 4002 02	Diaphragm pump	0,37	0,0	0,00
PP 4006 01	Peristaltic pump	0,10	0,1	0,01
PP 4006 02	Peristaltic pump	0,10	0,1	0,01
BLWR 4005 01	Centrifuge air fan	0,14	1,0	0,14
BLWR 4004 01	Compressor	0,07	0,7	0,05
PP 4005 01	Centrifuge pump	1,30	1,0	1,30
VS 4001 01	Magnetic agitator	0,20	1,0	0,20
VS 4002 01	Mechanic agitator	0,37	1,0	0,37
HX 4005 01	Electrical heater	5,00	0,1	0,50
HX 4007 02	Sample gas cooler	0,18	1,0	0,18
-----	Reactor lighting system	7,00	1,0	7,00
Total		**15,94**	0,6	**10,50**

**Table 1: Estimated electrical consumption*

To sum up, the utilities requirements are the next:

Service	Max. Metric flow (m^3/h)	Max. Mass flow (Kg/h)	Max. Velocity (m/s)
AIR			
Reactor air refrigeration system	**1000,0**	**1200,0**	**8,6**
WATER			
Reactor refrigeration system (jacket)	**0,0**	**0,0**	**1,4**
STEAM			
Sterilizing operations	**9,5**	**19,8**	**13,6**
GLYCOL			
Feeding tank (VS 4001 01) refrigeration system	1,0	1000,0	1,4
Harvesting tank (VS 4002 01) refrigeration system	1,0	1000,0	1,4
Reactor water circuit cooling system	1,0	1000,0	1,4
Condenser refrigerating	0,3	300,0	0,4
TOTAL	**3,3**	**3300,0**	**-----**

**Table 2. Utilities requirements*

- ✓ **As shown in *table 1*, the total estimated electrical consumption is 10,5 KW·h/h.**

*NOTE: The total consumption of each utility will change depending on the operating parameters.

Document of reference: All the data present in this document are derived from the "Annex I: Calculations".

4. FINAL CONTROL LOOPS DIAGRAM

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. Totoy
Comprobado	J. Mestre
Fecha	13/04/2010
Referencia	

D.Totoy | J.Mestre

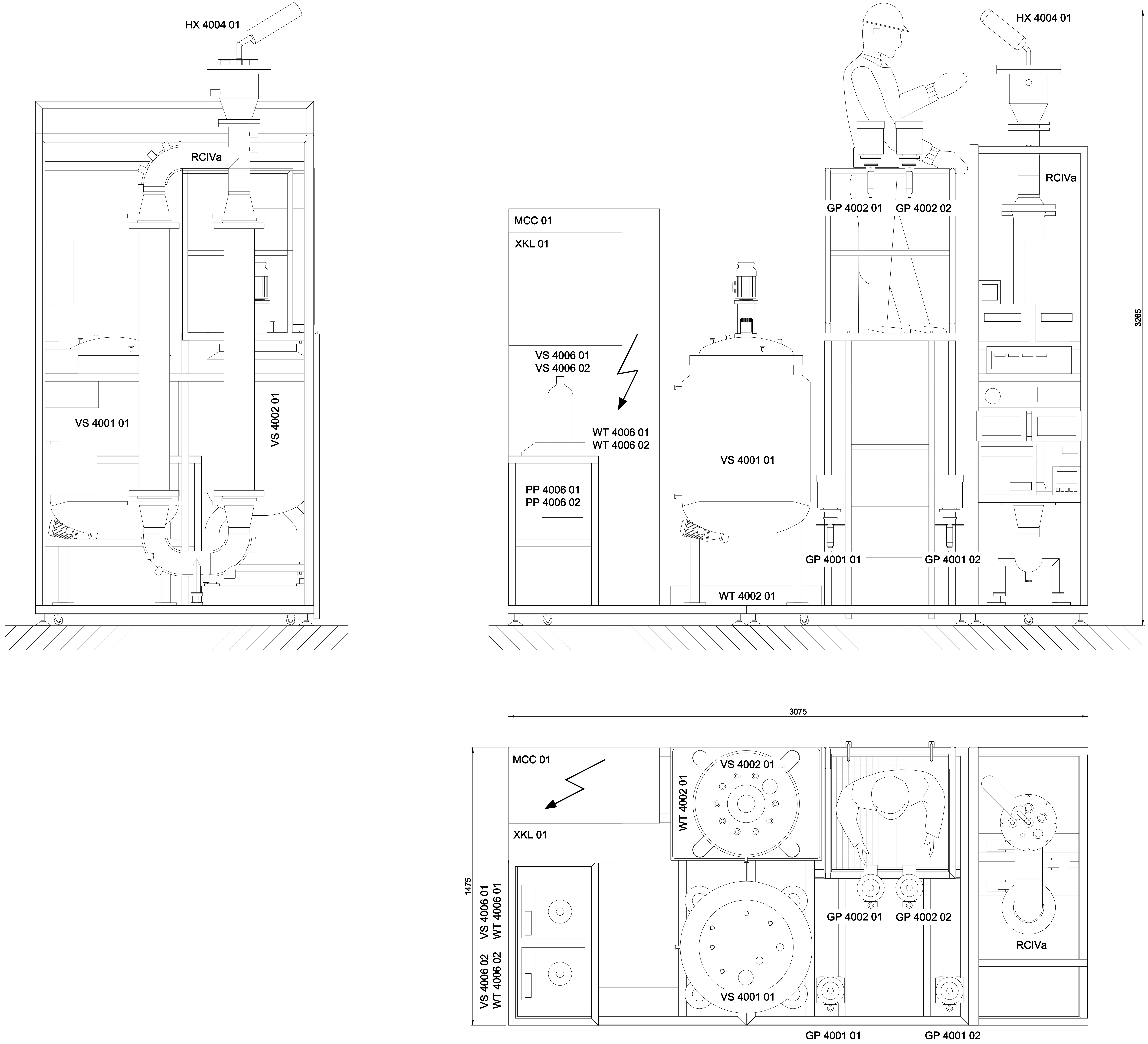
PROYECTO: MELiSSA - Compartment IVa

CLIENTE: Universitat Autònoma de Barcelona

TITULO: P&ID DIAGRAM & CONTROL

PLANO N°: DD-8558-Z1-100-02 — Revision: 9 — Escala: S.E.

5. FINAL LAYOUT DRAWING



De Dietrich Equipos Químicos, 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 Fecha: 21-10-2009 Referencia: PRK-5393
PROYECTO: MELiSSA - Compartment IVa	CLIENTE: **Universitat Autònoma de Barcelona**
TITULO: LAY - OUT	
PLANO Nº: DD-8558-Z1-102-01 — Revisión: 1	Escala: 1/10

6. FINAL LISTS

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

EQUIPMENT LIST

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

Member of De Dietrich PROCESS SYSTEMS

EQUIPMENT

CUSTOMER:	UAB			
PROJECT:	MELISSA COMPARTMENT IVa	**DATE:**	13/11/2009	**PREPARED:** J.GUBERN
DRAWING:	DD - 8558 - Z1	**REV:**	4	**CHECKED:** J. MESTRE

TAG	DENOMINATION	DESCRIPTION	SUPPLIER	OBSERVATIONS
RCIVa	Photobioreactor	Reactor "loop" , design natural convection. Material: AISI 316L, glass	DDPS / Bioengineering	Modification of the existing one
HX 4004 01	Condenser	Reflux condenser for reactor. Material AISI 316L	Bioengineering	Existing unit
BLWR 4005 01	Extractor	Air fan for cooling lightening of reactor	SODECA	Air refrigeration system
VS 4001 01	Feeding tank	Agitated tank in AISI 316L, 170 l total capacity, provided with jacket for heating - cooling. Designed to operate at positive pressure. Magnetic driver	TECALSA	
GP 4001 01 GP 4001 02	Feed pumps to reactor	Mettering pump in stainless, membrane PTFE, flow 0 to 4 l/h. Control by electronic variator. Sterilizable	LEWA	Flow: 4 l/h. P=20 bar. Tri-clamp 1/4". Motor IP55 0,25KW 2 polos
VS 4006 01	Acid vessel	Vessel (2L capacity) in borosilicate glass for acid addition	AFORA	
VS 4006 02	Base vessel	Vessel (2L capacity) in borosilicate glass for base addition	AFORA	
PP 4006 01	Acid pump	Mettering pump for acid dosing.	AFORA	Existing unit
PP 4006 02	Alcali pump	Mettering pump for alcali dosing.	AFORA	Existing unit
VS 4002 01	Harvesting tank	Agitated tank in AISI 316L, 90 l capacity, provided with jacket for heating cooling. Designed to operate at positive pressure. Magnetic driver	TECALSA	Existing unit
GP 4002 01	Harvest pumps to reactor	Mettering pump in stainless, membrane PTFE, flow 0 to 4 l/h. Control by electronic variator. Sterilizable	LEWA	Flow: 4 l/h. P=20 bar. Tri-clamp 1/4". Motor IP55 0,25KW 2 polos
BLWR 4003 01	Compressor	Membrane compressor in AISI 316 / PTFE for outlet gas recirculation to reactor. Normal flow: 2,1 l/min	KNF	
HX 4005 01	Glycol cooler	Plate heat exchanger for glycol cooling with cold glycol		Existing unit
HX 4005 02	Glycol heater	Electrical resistance (heater)	Tope	5 KW 230 Vca
PP 4005 01	Recirculation pump	Centrifugal pump for glycol loop for control of reactor temperature		Existing unit
VS 4005 01	Expansion vessel	Expansion vessel for glycol circuit. Material AISI 316. Volume: 10 l	Olaer	
VS 4011 01	Antifoam vessel	Vessel for antifoam addition		not in the scope of project
PP 4011 01	Antifoam pump	Mettering pump for antifoam addition		not in the scope of project
HX 4010 01	Cooler	Sample gas cooler	Sick-Maihack	Samplig conditioner

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

Member of De Dietrich PROCESS SYSTEMS

Instrument list

ANALYZER

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:**	04/11/2009	**CHECKED:**	J. MESTRE
DRAWING:	DD-8558-Z1-100-01			**REV:**	7	**PREPARED:**	J. GUBERN

TAG Nº	SITUATION	Inch	DESCRIPTION	CONFIGURATED RANGE	MODEL	MAT.	MANUFACTURER
AT 4009 01	REACTOR	1"	Biomass measurement	---	CT08 Dual Probe A01 0044	---	MONITEK
AT 4009 02	REACTOR	1"	Biomass measurement	0...5 g/l	InPro8200, In Trac799M	AISI316L	METTLER TOLEDO
AT 4010 01/02	PG-1/2"-SS2-007	1/2"	CO_2/O_2 gas analyzer	---	Multor 610	---	SICK MAIHAK
AT 4010 03	REACTOR	1"	Dissolved Oxygen measurement	0...100%	InPro6800+In Trac 777+VP6	AISI316L	METTLER TOLEDO
AT 4006 01	REACTOR	1"	Ph measurement	0…12	InPro3253+InTrac777+VP6+M300	AISI316L	METTLER TOLEDO
AT 4006 02	REACTOR	1"	Ph measurement	0…12	InPro3253+InTrac777+VP6+M300	AISI316L	METTLER TOLEDO

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

Instrument list

CONTROL VALVE

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA											
PROJECT:	MELiSSA COMPARTMENT IVa		**DATE:**	04/11/2009	**CHECKED:**	J. MESTRE						
DRAWING:	DD-8558-Z1-100-01		**REV:**	7	**PREPARED:**	J. GUBERN						
TAG Nº	**SITUATION**	**Inch**	**DESCRIPTION**	**REFERENCIA**	**MATERIAL**	**MANUFACTURER**	**T`P**	**AC**	**F/E**	**N**	**E**	
FQRC 4003 01	CO2-1/2"-SS2-001	1/2"	CO_2 inlet mass flow measurement	F202D-FA-44-V	---	BRONKHORST	--	--	--	--	--	
FQRC 4003 02	PAI-1/2"-SS2-001	1/2"	Process air inlet mass flow measurement	F202D-FA-33-Z	---	BRONKHORST	--	--	--	--	--	
FQRC 4003 03	PG-1/4"-SS2-009	1/2"	Circulated gas mass flow measurement	F202D-FA-44-V	---	BRONKHORST	--	--	--	--	--	
FQRC 4003 04	CO2-1/2"-SS2-002	1/2"	Total gas mass flow measurement	F202D-FA-44-V	---	BRONKHORST	--	--	--	--	--	
SCV 4004 01	PG-1/2"-SS2-006	1/2"	Outlet gas mass flow measurement	2833 + 8605	AISI316L	BÜRKERT	--	--	--	--	--	
SV 4003 01	CO2-1/2"-PP-004	1/2"	Inlet process gas to analyzer	2031 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4003 02	PAI-1/2"-SS2-003	1/2"	Inlet gas for biomass sensor cleaning	2031 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4003 03	PG-1/4"-SS2-009	1/2"	Blower BLWR 4003 01 gas recycling	2031 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4005 01	GLY-3/4"-SS1-003	3/4"	Glycol inlet to plate heat exchanger	2652 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4006 01	PAC-1/2"-SS2-001	1/2"	Acid addition to reactor for the pH control	2031 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4006 02	PBA-1/2"-SS2-001	1/2"	Base addition to reactor for the pH control	2031 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4011 01	GLY-3/4"-SS1-002	3/4"	Glycol outlet from VS 4001 01 jacket	2652 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4012 01	GLY-3/4"-SS1-008	3/4"	Glycol outlet from VS 4002 01 jacket	2652 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4014 01	ST-3/4"-SS1-006	3/4"	Steam inlet to VS 4001 01	----	AISI316L	SIEMENS	1	A	--	--	X	
SV 4015 01	ST-1/2"-SS1-077	1/2"	Steam inlet to reactor	2031 + 1062 + 6012	AISI316L	BÜRKERT	1	A	X	1	X	
SV 4016 01	ST-3/4"-SS1-020	3/4"	Steam inlet to VS 4002 01	----	AISI316L	SIEMENS	1	A	--	--	X	

TP = TYPE **1**: ON/OFF	AC = **A**: PNEUMATIC (SIMPLE EFFECT) OPERATION	**F/E** = LIMIT SWITCH
TP = TYPE **2**: PROPORTIONAL	AC = **B**: PNEUMATIC (DOUBLE EFFECT) OPERATION	**N** = NUMBER OF LIMIT SWITCHES: **1**, **2**
TP = TYPE **3**: ELECTROVALVE	AC = **C**: PNEUMATIC (PROPORTIONAL) OPERATION	**E** = ELECTROVALVE

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Instrument list

Temperature

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:** 15/03/2010	**CHECKED:**	J.MESTRE	
DRAWING:	DD-8558-Z1-100-01			**REV:** 8	**PREPARED:**	J. GUBERN	

TAG Nº	SITUATION	Inch	DESCRIPTION	RANGE	MODEL	MATERIAL	MANUFACTURER
TT 4010 01	VS 4001 01	1"	VS 4001 01 temperature measurement	0…150 ºC	PT-100 + transmitter 4/20mA	INOX	WIKA
TT 4011 01	PG-1/2"-SS2-007	1"	Temperature measurement	-10…150 ºC	PT-100 + transmitter 4/20mA	INOX	WIKA
TT 4012 01	VS 4002 01	1"	VS 4002 01 temperature measurement	-50…250 ºC	PT-100 + transmitter 4/20mA	INOX	WIKA
TT 4005 01	REACTOR	1"	Reactor temperature measurement	0…150ºC	PT-100 + transmitter 4/20mA	INOX	BIOENGINEERING
TT 4006 01	REACTOR	1"	Reactor tem. Meas. (pH sensor AT 4006 01)	0…140 ºC	InPro3253+InTrac777+VP6+M300	AISI316L	METTLER TOLEDO
TT 4006 02	REACTOR	1"	Reactor tem. Meas. (pH sensor AT 4006 02)	0…140 ºC	InPro3253+InTrac777+VP6+M300	AISI316L	METTLER TOLEDO

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LEVEL

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:**	04/11/2009	**PREPARED:**	J. GUBERN
DRAWING:	DD-8558-Z1-100-01			**REV:**	7	**CHECKED:**	J.MESTRE
TAG Nº	**SITUATION**		**SERVICE**	**DESCRIPTION**	**MODEL**	**MAT.**	**MANUFACTURER**
LT 4001 01	VS 4001 01	1 1/2"	Level measurement	Guided microwave	Vegaflex 63	AISI 316L	VEGA
LT 4007 01	REACTOR	1"	Foam measurement		(not defined)		(not defined)

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FLOW

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PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:**	04/11/2009	**CHECKED:**	J. MESTRE	
DRAWING:	DD-8558-Z1-100-01			**REV:**	7	**PREPARED:**	J. GUBERN	

TAG Nº	SITUATION	DN	DESCRIPTION	RANGE	SERVICE	MODEL	MATERIAL	MANUFACTURER
FI 4003 01	CO2-1/2"-SS2-002	1/2"	Total gas inlet flowmeter	0-21 l/min	---	art. 502654	Glass	BIOENGINEERING
FT 4004 01	PG-1/2"-SS2-006	1/2"	Total gas outlet flowmeter	0-20 l/min	---	---	INOX	BRONKHORST
FT 4001 01	PL-1/2"-SS2-007	1/2"	Total liquid inlet to reactor	0-20 Kg/h	---	Promass83 A	AISI 316L	Endress&Hauser

De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA Member of De Dietrich PROCESS SYSTEMS	Instrument list **PRESSURE**

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA		
PROJECT:	MELiSSA COMPARTMENT IVa	**DATE:** 04/11/2009	**CHECKED:** J.MESTRE
DRAWING:	DD-8558-Z1-100-01	**REV:** 7	**PREPARED:** J. GUBERN

TAG Nº	SITUATION	Inch	DESCRIPTION	RANGE	MODEL	MATERIAL	MANUFACTURER
PI 4001 01	VS 4001 01	1 1/2"	VS 4001 01 pressure measurement	-1…5 bar		316L	WIKA
PI 4001 02	VT-1"-SS2-001	1 1/2"	GF 4001 04 pressure measurement	-1…5 bar		316L	WIKA
PI 4002 01	VS 4002 01	1 1/2"	VS 4002 01 pressure measurement	-1…3 bar		316L	WIKA
PI 4001 02	VT-3/4"-SS2-001	1 1/2"	GF 4001 04 pressure measurement	-1…5 bar		316L	WIKA
PI 4003 01	PRC 4003 01	---	Pressure measurement	0…1,5 bar		PP	WAIRCOM
PI 4003 02	PRC 4003 02	---	Pressure measurement	0…1,5 bar		PP	WAIRCOM
PI 4003 03	CO2-1/2"-SS2-002	---	Pressure measurement	0…1,5 bar		PP	WAIRCOM
PI 4003 04	PRC 4003 04	---	Pressure measurement	0…1,5 bar		PP	WAIRCOM
PI 4003 05	GF 4003 08	1 1/2"	GF 4003 08 pressure measurement	-1…5 bar		316L	WIKA
PI 4003 06	GF 4003 09	1 1/2"	GF 4003 09 pressure measurement	-1…5 bar		316L	WIKA
PI 4004 01	GF 4004 01	1 1/2"	GF 4004 01 pressure measurement	-1…5 bar		316L	WIKA
PI 4004 02	GF 4004 02	1 1/2"	GF 4004 02 pressure measurement	-1…5 bar		316L	WIKA
PI 4005 02	WT-3/4"-SS2-002	1 1/2"	Water circuit pressure measurement	0…4 bar		316L	WIKA
PI 4011 01	PRC 4011 01	---	Pressure measurement	0…1,5 bar		PP	WAIRCOM
PI 4011 02	PRC 4012 01	---	Pressure measurement	0…1,5 bar		PP	WAIRCOM
PT 4007 01	REACTOR	1 1/2"	Reactor pressure measurement	-1…1,5 bar	VEGABAR 52	316L	VEGA
PT 4007 02	REACTOR	1 1/2"	Reactor pressure measurement	-1...5 bar	VEGABAR 52	316L	VEGA
PT 4010 01	PG-1/2"-SS2-007	1 1/2"	Analyzer line pressure measurement	-1...5 bar	VEGABAR 52	316L	VEGA
PS 4001 01	PL-1/2"-SS2-005	1 1/2"	Pressure switch transmitter	----	PSD10	316L	WIKA
PS 4001 02	PL-1/2"-SS2-007	1 1/2"	Pressure switch transmitter	----	PSD10	316L	WIKA
PS 4001 03	GP 4001 01	1/2"	Pressure switch transmitter	----	M700 IE4	316L	LEWA
PS 4001 04	GP 4001 02	1/2"	Pressure switch transmitter	----	M700 IE4	316L	LEWA
PS 4002 01	PL-1/2"-SS2-015	1 1/2"	Pressure switch transmitter	----	PSD10	316L	WIKA
PS 4002 02	PL-1/2"-SS2-013	1 1/2"	Pressure switch transmitter	----	PSD10	316L	WIKA
PS 4002 03	GP 4002 01	1/2"	Pressure switch transmitter	----	M700 IE4	316L	LEWA
PS 4002 04	GP 4002 02	1/2"	Pressure switch transmitter	(NOT INSTALLED)	M700 IE4	316L	LEWA
PS 4003 01	PG-1/4"-SS2-009	1 1/2"	Pressure switch transmitter	----	PSD10	316L	WIKA

DPT 4001 01	PL-1/2"-SS2-007	1 1/2"	Filter differential pressure measurement	0…3 bar	VEGADIF 55	316L	VEGA
DPT 4001 02	PL-1/2"-SS2-009	1 1/2"	Prefilter differential pressure measurement	0…3 bar	VEGADIF 55	316L	VEGA
DPT 4004 01	PG-1/2"-SS2-001	1 1/2"	Outlet gas diff. pressure measurement	0…3 bar	VEGADIF 55	316L	VEGA

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WEIGHT

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA					
PROJECT:	MELiSSA COMPARTMENT IVa		DATE:	15/03/2010	**PREPARED:**	J.GUBERN
DRAWING:	DD-8558-Z1-100-01		REV.:	8	**CHECKED:**	J.MESTRE
TAG Nº	**SITUATION**	**SERVICE**	**DESCRIPTION**	**MODEL**	**CONF. RANGE**	**MANUFACTURER**
WT 4002 01	VS 4002 01	VS 4002 01 Level measurement	Platform Balance	PBA330+IND560	0…200 Kg	METTLER TOLEDO
WT 4006 01	VS 4006 01	VS 4006 01 Level measurement	Weight Balance	BBA 422-3SM	0…6 Kg	METTLER TOLEDO
WT 4006 02	VS 4006 02	VS 4006 02 Level measurement	Weight Balance	BBA 422-3SM	0…6 Kg	METTLER TOLEDO
WT 4008 01	REACTOR	Reactor Level measurement	Weight Cells	Ultramount 0972+IND560	0…200 Kg	METTLER TOLEDO

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PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:** 05/11/2009		**CHECKED:**	J.MESTRE
DRAWING:	DD-8558-Z1-100-01			**REV:** 4		**PREPARED:**	J. GUBERN

LINE NOMENCLATURE				FLOW: PROCESS LIQUID			
FLUID	**MAT**	**SIZE**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
PL	SS2	1/2"	001	CIVa LIQUID INLET	VS 4001 01	---	SS-2
PL	SS2	1/2"	004	VS 4001 01	PL-1 1/2"-SS2-005/006	---	SS-2
PL	SS2	1 1/2"	005	PL-1/2"-SS2-004	PL-1/2"-SS2-007	---	SS-2
PL	SS2	1 1/2"	006	PL-1/2"-SS2-004	PL-1/2"-SS2-007	---	SS-2
PL	SS2	1/2"	007	PL-1 1/2"-SS2-005/006	PL-1 1/2"-SS2-008/009	---	SS-2
PL	SS2	1 1/2"	008	PL-1/2"-SS2-007	PL-1/2"-SS2-010	---	SS-2
PL	SS2	1 1/2"	009	PL-1/2"-SS2-007	PL-1/2"-SS2-011	---	SS-2
PL	SS2	1/2"	010	PL-1 1/2"-SS2-008	PL-1/2"-SS2-012	---	SS-2
PL	SS2	1/2"	011	PL-1 1/2"-SS2-009	PL-1/2"-SS2-012	---	SS-2
PL	SS2	1/2"	012	PL-1/2"-SS2-010/011	REACTOR	---	SS-2
PL	SS2	1/2"	013	REACTOR	PL-1/2"-SS2-015/016	---	SS-2
PL	SS2	1/2"	014	PL-1/2"-SS2-015/016	VS 4002 01	---	SS-2
PL	SS2	1/2"	015	PL-1/2"-SS2-013	PL-1/2"-SS2-014	---	SS-2
PL	SS2	1/2"	016	PL-1/2"-SS2-013	PL-1/2"-SS2-014	---	SS-2
PL	SS2	1/2"	017	VS 4002 01	CIVa LIQUID OUTLET	---	SS-2

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LINE NOMENCLATURE — **FLOW: PROCESS LIQUID**

LINE NOMENCLATURE — **FLOW: PROCESS GAS**

FLUID	MAT	SIZE	NUMBER	START LINE	END LINE	OBSERVATIONS	CLASS
PG	SS2	1/2"	001	HX 4004 01	PG-1/2"-SS2-002/004	---	SS-2
PG	SS2	1/2"	002	PG-1/2"-SS2-001	PG-1/2"-SS2-003	---	SS-2
PG	SS2	1/2"	003	PG-1/2"-SS2-002	PG-1/2"-SS2-006	---	SS-2
PG	SS2	1/2"	004	PG-1/2"-SS2-001	PG-1/2"-SS2-005	---	SS-2
PG	SS2	1/2"	005	PG-1/2"-SS2-004	HX 4010 01	---	SS-2
PG	SS2	1/2"	006	HX 4010 01	PG-1/2"-SS2-007/008	---	SS-2
PG	PP	1/2"	007	PG-1/2"-SS2-006	PG-1/2"-PP-008	---	PP
PG	PP	1/2"	008	PG-1/2"-SS2-006	CIVa GAS OUTLET	---	PP
PG	PP	1/2"	009	PG-1/2"-PP-008	BLWR 4003 01	---	PP
PG	SS2	1/2"	010	PG-1/2"-PP-009	PAI-1/2"-SS2-001	---	SS-2

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PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:** 05/11/2009		**CHECKED:**	J.MESTRE
DRAWING:	DD-8558-Z1-100-01			**REV:** 4		**PREPARED:**	J. GUBERN
LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: PROCESS AIR**			
FLUID	**MAT**	**SIZE**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
PAI	SS2	1/2"	001	CIVa PROCESS AIR INLET	PAI-1/2"-SS2-002/003	---	SS-2
PAI	SS2	1/2"	002	PAI-1/2"-SS2-001	CO2-1/2"-SS2-001	---	SS-2
PAI	SS2	1/2"	003	PAI-1/2"-SS2-001	REACTOR	---	SS-2

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LINE NOMENCLATURE				FLOW: PROCESS LIQUID			
LINE NOMENCLATURE				**FLOW: PROCESS CO_2**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
CO2	1/2"	SS2	001	CIVa CO_2 INLET	CO2-1/2"-SS2-002	---	SS-2
CO2	1/2"	SS2	002	CO2-1/2"-SS2-001	CO2-1/2"-SS2-003	---	SS-2
CO2	1/2"	SS2	003	CO2-1/2"-SS2-002	REACTOR	---	SS-2
CO2	1/2"	PP	004	CO2-1/2"-SS2-002	PG-1/2"-PP-007	---	SS-2

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DRAWING:	DD-8558-Z1-100-01	**REV:** 4	**PREPARED:** J. GUBERN

LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: ACID**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
PAC	1/2"	PP	001	VS 4006 01	PAC-1/2"-SS2-002	---	PP
PAC	1/2"	SS2	002	PAC-1/2"-PP-001	REACTOR	---	SS-2

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LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: BASE**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
PBA	1/2"	PP	001	VS 4006 02	PBA-1/2"-SS2-002	---	PP
PBA	1/2"	SS2	002	PBA-1/2"-PP-001	REACTOR	---	SS-2

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LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: GLYCOL**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
GLY	3/4"	SS1	001	GLYCOL INLET	VS 4001 01	---	SS-1
GLY	3/4"	SS1	002	VS 4001 01	GLYCOL OUTLET	---	SS-1
GLY	3/4"	SS1	003	GLYCOL INLET	HX 4005 01	---	SS-1
GLY	3/4"	SS1	004	HX 4005 01	GLYCOL OUTLET	---	SS-1
GLY	3/4"	SS1	005	GLYCOL INLET	HX 4004 01	---	SS-1
GLY	3/4"	SS1	006	HX 4004 01	GLYCOL OUTLET	---	SS-1
GLY	3/4"	SS1	007	GLYCOL INLET	VS 4002 01	---	SS-1
GLY	3/4"	SS1	008	VS 4002 01	GLYCOL OUTLET	---	SS-1

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DRAWING:	DD-8558-Z1-100-01			**REV:** 4		**PREPARED:**	J. GUBERN
LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: AIR**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
AI	3/4"	SS2	001	AIR INLET	GLY-3/4"-SS1-002	---	SS-2
AI	3/4"	SS2	002	AIR INLET	GLY-3/4"-SS1-008	---	SS-2
AI	3/4"	SS2	003	GLY-3/4"-SS1-001	GLY-3/4"-SS1-002	---	SS-2
AI	3/4"	SS3	004	GLY-3/4"-SS1-007	GLY-3/4"-SS1-008	---	SS-2

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DRAWING:	DD-8558-Z1-100-01			**REV:** 4		**PREPARED:**	J. GUBERN
LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: INOCULUM**			
FLUID	**SIZQ**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
IN	1/2"	SS2	001	INOCULUM INLET	ST-1/2"-SS1-077	---	SS-2

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CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:** 05/11/2009		**CHECKED:** J.MESTRE	
DRAWING:	DD-8558-Z1-100-01			**REV:** 4		**PREPARED:** J. GUBERN	
LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: STEAM**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
ST	3/4"	SS1	001	STEAM INLET	(General steam pipe)	---	SS-1
ST	1/2"	SS1	002	ST-3/4"-SS1-001	PL-1/2"-SS2-001	---	SS-1
ST	3/4"	SS1	003	ST-3/4"-SS1-001	GLY-3/4"-SS1-002	---	SS-1
ST	1/2"	SS1	004	HV 4015 29	ST-1/2"-SS1-041	---	SS-1
ST	3/4"	SS1	005	ST-3/4"-SS1-001	HV 4001 05 / ST-3/4"-SS1-006/009	---	SS-1
ST	3/4"	SS1	006	ST-3/4"-SS1-005	VS 4001 01	---	SS-1
ST	1/2"	SS1	007	ST-3/4"-SS1-005	HV 4015 01	---	SS-1
ST	1/2"	SS1	008	ST-3/4"-SS1-005	HV 4015 02	---	SS-1
ST	1/2"	SS1	009	ST-3/4"-SS1-005	HV 4014 14 (sampling valve)	---	SS-1
ST	1/2"	SS1	010	ST-3/4"-SS1-001	HV 4015 25	---	SS-1
ST	1/2"	SS1	011	HV 4015 14	ST-3/4"-SS1-026	---	SS-1
ST	1/2"	SS1	012	ST-3/4"-SS1-001	HV 4015 36	---	SS-1
ST	1/2"	SS1	013	ST-3/4"-SS1-001	HV 4015 39	---	SS-1
ST	1/2"	SS1	014	ST-3/4"-SS1-001	HV 4015 40	---	SS-1
ST	1/2"	SS1	015	ST-3/4"-SS1-001	HV 4016 01	---	SS-1
ST	1/2"	SS1	016	ST-3/4"-SS1-001	HV 4016 03	---	SS-1
ST	3/4"	SS1	019	ST-3/4"-SS1-001	HV 4016 09	---	SS-1
ST	3/4"	SS1	020	ST-3/4"-SS1-001	VS 4002 01	---	SS-1
ST	1/2"	SS1	021	ST-3/4"-SS1-001	VT-1"-SS2-001	---	SS-1
ST	3/4"	SS1	026	----	ST-3/4"-SS1-061/062	---	SS-1
ST	1/2"	SS1	027	HV 4015 11	ST-3/4"-SS1-026	---	SS-1
ST	1/2"	SS1	028	HV 4015 12	ST-3/4"-SS1-026	---	SS-1
ST	1/2"	SS1	029	HV 4001 19	ST-3/4"-SS1-063/64	---	SS-1
ST	1/2"	SS1	030	ST-3/4"-SS1-001	HV 4015 05	---	SS-1
ST	1/2"	SS1	031	ST-3/4"-SS1-001	HV 4015 06	---	SS-1

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CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:** 05/11/2009		**CHECKED:**	J.MESTRE
DRAWING:	DD-8558-Z1-100-01			**REV:** 4		**PREPARED:**	J. GUBERN
LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: STEAM**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
ST	1/2"	SS1	041	HV 4015 42	ST-3/4"-SS1-042/044	---	SS-1
ST	3/4"	SS1	042	ST-1/2"-SS1-041	OUT	---	SS-1
ST	1/2"	SS1	043	HV 4015 41	ST-1/2"-SS1-041	---	SS-1
ST	3/4"	SS1	044	ST-3/4"-SS1-041	ST-3/4"-SS1-042	---	SS-1
ST	3/4"	SS1	045	HV 4016 10	OUT	---	SS-1
ST	1/2"	SS1	046	HV 4016 13	ST-3/4"-SS1-045/047	---	SS-1
ST	3/4"	SS1	047	HV 4016 10	OUT	---	SS-1
ST	1/2"	SS1	051	HV 4016 16	ST-3/4"-SS1-045/047	---	SS-1
ST	3/4"	SS1	057	INLET STEAM	HV 4002 11 (sampling valve)	---	SS-1
ST	1/2"	SS1	059	ST-3/4"-SS1-001	HV 4015 34	---	SS-1
ST	1/2"	SS1	060	ST-3/4"-SS1-001	HV 4015 35	---	SS-1
ST	3/4"	SS1	061	ST-3/4"-SS1-026	OUT	---	SS-1
ST	3/4"	SS1	062	ST-3/4"-SS1-026	OUT	---	SS-1
ST	3/4"	SS1	063	ST-3/4"-SS1-029	OUT	---	SS-1
ST	1/2"	SS1	064	ST-3/4"-SS1-029	OUT	---	SS-1
ST	1/2"	SS1	068	ST-3/4"-SS1-001	HV 4015 26	---	SS-1
ST	1/2"	SS1	069	HV 4001 04/08	Steam trap	---	SS-1
ST	1/2"	SS1	070	HV 4015 13	ST-3/4"-SS1-026	---	SS-1
ST	1/2"	SS1	071	ST-3/4"-SS1-001	HV 4015 09	---	SS-1
ST	1/2"	SS1	072	ST-3/4"-SS1-001	HV 4016 02	---	SS-1
ST	1/2"	SS1	073	ST-3/4"-SS1-001	HV 4016 04	---	SS-1
ST	1/2"	SS1	074	ST-3/4"-SS-001	REACTOR	---	SS-1
ST	1/2"	SS1	075	ST-3/4"-SS-001	HV 4015 37	---	SS-1

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LINES

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA		
PROJECT:	MELiSSA COMPARTMENT IVa	**DATE:** 05/11/2009	**CHECKED:** J.MESTRE
DRAWING:	DD-8558-Z1-100-01	**REV:** 4	**PREPARED:** J. GUBERN

LINE NOMENCLATURE				FLOW: PROCESS LIQUID			
LINE NOMENCLATURE				**FLOW: VENT**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
VT	1"	SS2	001	VS 4001 01	ATM	---	SS-2
VT	1"	SS2	002	VS 4002 01	ATM	---	SS-2
VT	1/2"	PP	003	VS 4006 01	ATM	---	PP
VT	1/2"	PP	004	VS 4006 02	ATM	---	PP

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LINES

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:** 05/11/2009		**CHECKED:**	J.MESTRE
DRAWING:	DD-8558-Z1-100-01			**REV:** 4		**PREPARED:**	J. GUBERN
LINE NOMENCLATURE				**FLOW: PROCESS LIQUID**			
LINE NOMENCLATURE				**FLOW: WATER**			
FLUID	**SIZE**	**MAT**	**NUMBER**	**START LINE**	**END LINE**	**OBSERVATIONS**	**CLASS**
WT	3/4"	SS1	001	WATER INLET	WT-3/4"-SS1-002	---	SS-1
WT	3/4"	SS1	002	WT-3/4"-SS1-001	----	---	SS-1

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MATERIAL LIST

ACCESSORIES

CUSTOMER:	Universitat Autònoma de Barcelona						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:**	03/11/2009	**PREPARED:**	J.GUBERN
DRAWING:	DD - 8558 - Z1 - 100 - 01			**REV:**	9	**CHECKED:**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MAT.	MANUFACTURER
NRV 4001 01	PL-1/2"-SS2-012	1/2"	Reactor feed line no return valve	Check Valve	CV TC - Tri-Clamp 1/2"	AISI316	BÜRKERT
NRV 4002 01	PL-1/2"-SS2-014	1/2"	ΔP for the reactor outlet liquid pumps	Check Valve	CV TC - Tri-Clamp 1/2"	AISI316	BÜRKERT
NRV 4003 01	CO2-1/2"-SS2-001	1/2"	Control valve protection	Check Valve	6133G4Y	AISI316	HOKE
NRV 4003 02	PAI-1/2"-SS2-002	1/2"	Control valve protection	Check Valve	6133G4Y	AISI316	HOKE
NRV 4003 03	PG-1/2"-SS2-009	1/2"	Control valve protection	Check Valve	6133G4Y	AISI316	HOKE
NRV 4003 04	CO2-1/2"-SS2-002	1/2"	Control valve protection	Check Valve	6133G4Y	AISI316	HOKE
NRV 4003 05	CO2-1/2"-SS2-003	1"	Reactor air inlet no return valve	Check Valve	Sanitary valve 1"	AISI316	FLUIVAL
NRV 4003 06	PAI-1/2"-SS2-003	1"	Reactor total gas inlet no return valve	Check Valve	Sanitary valve 1"	AISI316	FLUIVAL
NRV 4004 01	PG-1/2"-SS2-006	1/2"	Control valve protection	Check Valve	6133G4Y	AISI316	HOKE
NRV 4006 01	PAC-1/2"-PP-001	1/2"	Reactor acid inlet no return valve	Check Valve	CV TC - Tri-Clamp 1/2"	AISI316	BÜRKERT
NRV 4006 02	PBA-1/2"-PP-001	1/2"	Reactor base inlet no return valve	Check Valve	CV TC - Tri-Clamp 1/2"	AISI316	BÜRKERT
PRC 4003 01	CO2-1/2"-SS2-002	1/2"	Gas inlet pressure regulator system	Pressure regulator valve	EZRR 2/7 F20 PM/SM	INOX	WAIRCOM
PRC 4003 02	CO2-1/2"-SS2-002	1/2"	Gas inlet pressure regulator system	Pressure regulator valve	EZRR 2/7 F20 PM/SM	INOX	WAIRCOM
PRC 4003 04	PAI-1/2"-SS2-003	1/2"	Gas inlet pressure regulator system	Pressure regulator valve	EZRR 2/7 F20 PM/SM	INOX	WAIRCOM
PRC 4011 01	AI-3/4"-SS1-001	1/2"	Air inlet pressure regulator system	Pressure regulator valve	EZRR 2/7 F20 PM/SM	INOX	WAIRCOM
PRC 4012 01	AI-3/4"-SS1-002	1/2"	Air inlet pressure regulator system	Pressure regulator valve	EZRR 2/7 F20 PM/SM	INOX	WAIRCOM
RV 4001 01	VS 4001 01	1"	VS 4001 01 safety valve	Relief Valve	74700	AISI316l	INOXPA
RV 4002 01	VS 4002 01	1-1/2"	VS 4002 01 safety valve	Relief Valve	74700	AISI316l	INOXPA
RV 4003 01	PG-1/4"-SS2-009	1/2"	Compresor outlet relief valve	Relief Valve	74700	AISI316l	INOXPA
RV 4004 01	GLY-3/4"-SS1-005	3/4"	Glycol inlet pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
RV 4005 01	WT-3/4"-SS1-002	3/4"	Water circuit pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
RV 4005 02	GLY-3/4"-SS1-004	3/4"	Glycol outlet pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
RV 4007 01	REACTOR	1"	Reactor safety valve	Relief Valve	74700	AISI316l	INOXPA
RV 4011 01	GLY-3/4"-SS1-002	3/4"	Glycol outlet pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
RV 4012 01	GLY-3/4"-SS1-008	3/4"	Glycol outlet pressure relief valve	Relief Valve	1216F	AISI316L	TOSACA
SF 4014 01	ST-1/2"-SS1-069	3/4"	Steam trap in air outlet drain	Steam Trap	MST21	INOX	SPIRAX SARCO
SF 4015 01	ST-3/4"-SS1-061	3/4"	Steam trap in air inlet drain	Steam Trap	TD42	INOX	SPIRAX SARCO
SF 4015 02	ST-3/4"-SS1-063	3/4"	Steam trap in vessel drain	Steam Trap	TD42	INOX	SPIRAX SARCO
SF 4015 03	HV 4015 38	3/4"	Steam trap in vessel drain	Steam Trap	TD42	INOX	SPIRAX SARCO
SF 4015 04	ST-3/4"-SS1-042	3/4"	Steam trap drain	Steam Trap	MST21	INOX	SPIRAX SARCO
SF 4016 01	ST-3/4"-SS1-045	3/4"	Steam trap drain	Steam Trap	MST21	INOX	SPIRAX SARCO
SF 4016 02	HV 4016 05	3/4"	Steam trap drain	Steam Trap	TD42	INOX	SPIRAX SARCO

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MATERIAL LIST

FILTERS

CUSTOMER:	Universitat Autònoma de Barcelona						
PROJECT:	MELiSSA COMPARTMENT IVa		**DATE:**	19/03/2010		**PREPARED:**	J. GUBERN
DRAWING:	DD - 8558 - Z1 - 100 - 01		**REV:**	10		**CHECKED:**	J. MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTIO	MODEL	MATERIAL	MANUFACTURER
LF 4001 01	PL-1/2"-SS2-001	1"	Liquid inlet sterile filter	Liquid Filter	ZVDICE-01A-BTB-B-E / ZCMSA-020Z-PS1	316L/PES	DOMNICK HUNTER
LF 4001 02	PL-1/2"-SS2-007	1"	Liquid inlet prefilter	Liquid Filter	ZVDICE-01B-BTB-B-E / PCPPB-96Z-PS	316L/PES	DOMNICK HUNTER
LF 4001 03	PL-1/2"-SS2-006	1"	Liquid inlet prefilter	Liquid Filter	ZVDICE-01B-BTB-B-E / PCPPB-96Z-PS	316L/PES	DOMNICK HUNTER
LF 4001 04	PL-1/2"-SS2-008	1"	Total liquid inlet filter	Liquid Filter	ZVDICE-01B-BTB-B-E / ZCMSB-020Z-PS1	316L/PES	DOMNICK HUNTER
LF 4001 05	PL-1/2"-SS2-009	1"	Total liquid inlet filter	Liquid Filter	ZVDICE-01B-BTB-B-E / ZCMSB-020Z-PS1	316L/PES	DOMNICK HUNTER
LF 4006 01	PAC-1/2"-SS2-002	1"	Acid inlet filter	Liquid Filter	ZVDICE-01B-BTB-B-E / ZCMSB-020Z-PS1	316L/PES	DOMNICK HUNTER
LF 4006 02	PBA-1/2"-SS2-002	1"	Base inlet filter	Liquid Filter	ZVDICE-01B-BTB-B-E / ZCMSB-020Z-PS1	316L/PES	DOMNICK HUNTER
GF 4001 01	VT-1"-SS2-001	1"	Outlet sterile gas filter	Vent Filter	VSACE-01A-BTB-T-E / ZHFT-AT	316L/PTFE	DOMNICK HUNTER
GF 4002 01	VT-1"-SS2-002	1"	Outlet sterile gas filter	Vent Filter	VSACE-01A-BTB-T-E / ZHFT-AT	316L/PTFE	DOMNICK HUNTER
GF 4003 03	CO2-1/2"-SS2-001	1/2"	Control valve filter	Filter	6323G4Y	---	HOKE
GF 4003 04	PAI-1/2"-SS2-001	1/2"	Control valve filter	Filter	6323G4Y	---	HOKE
GF 4003 05	PG-1/4"-SS2-009	1/2"	Control valve filter	Filter	360 50 C	---	HEADLINE FILTER
GF 4003 06	CO2-1/2"-SS2-002	1/2"	Control valve filter	Filter	360 50 C	---	HEADLINE FILTER
GF 4003 08	CO2-1/2"-SS2-003	1/2"	Total inlet gas sterile filter	Filter	VSACE-01A-BTB-T-E / ZHFT-AT	316L/PTFE	DOMNICK HUNTER
GF 4003 09	PAI-1/2"-SS2-003	1/2"	Inlet sterile gas filter	Gas Filter	VSACE-01A-BTB-T-E / ZHFT-AT	316L/PTFE	DOMNICK HUNTER
GF 4004 01	PG-1/2"-SS2-005	1/2"	Outlet sterile gas filter	Gas Filter	VSACE-01A-BTB-T-E / ZHFT-AT	316L/PTFE	DOMNICK HUNTER
GF 4004 02	PG-1/2"-SS2-002	1/2"	Outlet sterile gas filter	Gas Filter	VSACE-01A-BTB-T-E / ZHFT-AT	316L/PTFE	DOMNICK HUNTER
GF 4004 03	PG-1/2"-SS2-006	1/2"	Control valve filter	Filter	360 50 C	---	HEADLINE FILTER
GF 4006 01	VT-1/2"-PP-004	1/2"	Outlet gas filter	Vent Filter	ZEMTE-020GG-AN3	---	DOMNICK HUNTER
GF 4006 02	VT-1/2"-PP-003	1/2"	Outlet gas filter	Vent Filter	ZEMTE-020GG-AN3	---	DOMNICK HUNTER

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VALVES LIST

MANUAL VALVES

CUSTOMER:	Universitat Autònoma de Barcelona						
PROJECT:	MELiSSA COMPARTMENT IVa			DATE:	19/03/2010	PREPARED:	J. GUBERN
DRAWING:	DD - 8558 - Z1 - 100 - 01			REV:	10	CHECKED:	J.MESTRE
TAG Nº	**SITUATION**	**DN**	**SERVICE**	**DESCRIPTION**	**MODEL**	**MATERIAL**	**MANUFACTURER**
HV 4001 01	PL-1/2"-SS2-001	1/2"	CIVa liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 02	VS 4001 01	1/2"	VS 4001 01 liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 03	VS 4001 01	1/2"	VS 4001 01 vent outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 04	VS 4001 01	1/2"	VS 4001 01 vent outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 05	VS 4001 01	1-1/2"	VS 4001 01 liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 06	PL-1 1/2"-SS2-007	1/2"	Pump (GP 4001 01) liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 07	PL-1 1/2"-SS2-006	1/2"	Pump (GP 4001 02) liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 08	PL-1 1/2"-SS2-006	1/2"	Drain valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 09	PL-1 1/2"-SS2-007	1-1/2"	Filter (LF 4001 02) liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 10	PL-1 1/2"-SS2-007	1-1/2"	Filter (LF 4001 03) liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 11	PL-1 1/2"-SS2-007	1/2"	Flowmeter (FT 4001 01) liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 12	PL-1 1/2"-SS2-007	1/2"	Flowmeter (FT 4001 01) liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 13	PL-1 1/2"-SS2-007	1/2"	Flowmeter (FT 4001 01) bypass	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 14	PL-1 1/2"-SS2-007	1/2"	Flowmeter (FT 4001 01) bypass	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 15	PL-1 1/2"-SS2-008	1-1/2"	Process liquid valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 16	PL-1 1/2"-SS2-009	1-1/2"	Process liquid valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 17	PL-1 1/2"-SS2-010	1-1/2"	Filter (LF 4001 04) liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 18	PL-1 1/2"-SS2-011	1-1/2"	Filter (LF 4001 08) liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 19	REACTOR	1/2"	Reactor liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4001 22	VS 4001 01	1"	Feeding tank sampling valve	Manual Valve	----	AISI 316	BÜRKERT
HV 4002 01	REACTOR	1/2"	Reactor liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 02	PL-1/2"-SS2-015	1/2"	Pump (GP 4002 01) liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 03	PL-1/2"-SS2-013	1/2"	Pump (GP 4002 02) liquid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT

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VALVES LIST

MANUAL VALVES

CUSTOMER:	Universitat Autònoma de Barcelona						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:**	19/03/2010	**PREPARED:**	J. GUBERN
DRAWING:	DD - 8558 - Z1 - 100 - 01			**REV:**	10	**CHECKED:**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER
HV 4002 04	PL-1/2"-SS2-014	1/2"	Pump (GP 4002 01) liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 05	PL-1/2"-SS2-013	1/2"	Pump (GP 4002 02) liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 06	VS 4002 01	1-1/2"	VS 4002 01 liquid inlet	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 07	VS 4002 01	1-1/2"	VS 4002 01 liquid outlet	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 08	PL-1/2"-SS2-017	1/2"	CIVa liquid outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 09	VT-1"-SS2-002	1"	VS 4002 01 vent valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 10	VT-1"-SS2-003	1"	VS 4002 01 vent valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4002 11	VS 4002 02	1-1/2"	Harvesting tank sampling valve	Manual Valve	----	AISI 316	BÜRKERT
HV 4002 12	REACTOR	1"	Reactor sampling valve	Manual Valve	----	AISI 316	BÜRKERT
HV 4002 13	PL-1/2"-SS2-015	1/2"	Purge valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4003 04	PG-1/2"-PP-009	1/2"	Circulated gas valve	Manual Valve	----	PP	----
HV 4003 05	CO2-1/2"-SS2-003	1/2"	Process gas valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4003 06	REACTOR	1"	Reactor air inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4003 07	PAI-1/2"-SS2-003	1/2"	Process gas valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4003 08	REACTOR	1"	Reactor air inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4004 01	PG-1/2"-SS2-004	1/2"	Reactor gas outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4004 02	PG-1/2"-SS2-002	1/2"	Reactor gas outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4004 03	PG-1/2"-SS2-005	1/2"	Reactor gas outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4004 04	PG-1/2"-SS2-003	1/2"	Reactor gas outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4004 05	PG-1/2"-PP-008	1/2"	Compartment gas outlet valve	Manual Valve	----	PP	----
HV 4004 06	GLY-3/4"-SS1-006	3/4"	Condenser glycol outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4004 07	GLY-3/4"-SS1-005	3/4"	Condenser glycol inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 01	GLY-3/4"-SS1-004	3/4"	Heat-exchanger glycol outlet valve	Manual Valve	2651	AISI 316	BÜRKERT

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

MANUAL VALVES

CUSTOMER:	Universitat Autònoma de Barcelona						
PROJECT:	MELiSSA COMPARTMENT IVa			**DATE:**	19/03/2010	**PREPARED:**	J. GUBERN
DRAWING:	DD - 8558 - Z1 - 100 - 01			**REV:**	10	**CHECKED:**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER
HV 4005 02	GLY-3/4"-SS1-003	3/4"	Heat-exchanger glycol inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 03	WT-3/4"-SS1-001	3/4"	Water inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 04	WT-3/4"-SS1-002	3/4"	Water purge valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 05	WT-3/4"-SS1-002	3/4"	Water circuit valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 06	WT-3/4"-SS1-002	3/4"	Water circuit valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 07	GLY-3/4"-SS1-002/004/008	3/4"	General glycol outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 08	GLY-3/4"-SS1-001/003/007	3/4"	General glycol inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4005 09	WT-3/4"-SS1-002	3/4"	Air purge valve	Manual Valve	----	AISI 316	ISO
HV 4006 02	PAC-1/2"-SS2-002	1/2"	Acid line valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4006 03	PAC-1/2"-SS2-001	1/2"	Reactor acid inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4006 05	PBA-1/2"-SS2-002	1/2"	Base line valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4006 06	PBA-1/2"-SS2-001	1/2"	Reactor base inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4010 01	PG-1/2"-PP-007	1/2"	Analyzer gas outlet valve	Manual Valve	----	PP	----
HV 4010 02	PG-1/2"-PP-008	1/2"	Test gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4011 01	GLY-3/4-SS1-001	3/4"	Glycol valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4011 02	GLY-3/4-SS1-002	3/4"	Glycol valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4011 03	AI-3/4-SS1-001/002	3/4"	General air inlet valve	Manual Valve	----	AISI 316	ISO
HV 4011 04	AI-3/4-SS1-001	3/4"	Air inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4011 05	AI-3/4-SS1-003	3/4"	Air valve	Manual Valve	----	AISI 316	ISO
HV 4012 01	GLY-3/4"-SS1-008	3/4"	Glycol valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4012 02	GLY-3/4"-SS1-009	3/4"	Glycol valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4012 03	AI-3/4-SS1-004	3/4"	Air valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4012 04	AI-3/4-SS1-002	3/4"	Air inlet valve	Manual Valve	2651	AISI 316	BÜRKERT

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DRAWING:	DD - 8558 - Z1 - 100 - 01			**REV:**	10	**CHECKED:**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER
HV 4014 01	ST-3/4-SS1-001	3/4"	General steam inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4014 02	ST-3/4-SS1-002	3/4"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 03	ST-3/4-SS1-003	3/4"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 04	ST-3/4-SS1-069	3/4"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 05	ST-3/4-SS1-006	3/4"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 06	ST-3/4-SS1-006	3/4"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 07	ST-3/4-SS1-005	3/4"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 08	ST-3/4-SS1-069	3/4"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 09	ST-3/4-SS1-021	3/4"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 10	GLY-3/4-SS1-001	3/4"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4014 14	ST-1/2-SS1-009	1/2"	Steam inlet valve (sampling valve)	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 01	ST-1/2-SS1-007	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 02	ST-1/2-SS1-008	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 03	PL-1 1/2"-SS2-007	1/2"	Inert gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 04	PL-1 1/2"-SS2-006	1/2"	Inert gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 05	ST-1/2-SS1-030	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 06	ST-1/2-SS1-031	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 07	PL-1 1/2"-SS2-008	1/2"	Inert gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 08	PL-1 1/2"-SS2-009	1/2"	Inert gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 09	ST-1/2-SS1-071	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 10	PL-1 1/2"-SS2-006	1/2"	Inert gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 11	PL-1 1/2"-SS2-007	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 12	PL-1 1/2"-SS2-006	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT

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DRAWING:	DD - 8558 - Z1 - 100 - 01			**REV:**	10	**CHECKED:**	J.MESTRE

TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER
HV 4015 13	ST-1/2-SS1-070	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 14	ST-1/2-SS1-064	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 15	ST-1/2-SS1-029	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 16	ST-1/2-SS1-029	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 17	ST-1/2-SS1-029	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 18	ST-3/4-SS1-061	3/4"	Steam outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4015 19	ST-3/4-SS1-062	3/4"	Steam outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4015 20	ST-3/4-SS1-063	3/4"	Steam outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4015 21	ST-3/4-SS1-064	3/4"	Steam outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4015 22	PL-1/2-SS2-012	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 24	REACTOR	1/2"	Reactor jacket purge	Manual Valve	----	AISI 316	----
HV 4015 25	ST-1/2-SS1-010	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 26	ST-1/2-SS1-068	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 27	Drainage	3/4"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 28	Drainage	3/4"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 29	PAI-1/2-SS2-003	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 32	PAC-1/2"-SS2-001	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 33	PBA-1/2"-SS2-001	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 34	ST-1/2-SS1-059	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 35	ST-1/2-SS1-060	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 36	ST-1/2-SS1-012	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 37	ST-1/2-SS1-075	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 38	CO2-1/2-SS2-003	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 39	ST-1/2-SS1-013	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT

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TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER
HV 4015 40	ST-1/2-SS1-014	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 41	ST-1/2-SS1-043	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 42	ST-1/2-SS1-041	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 43	ST-1/2-SS1-042	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 44	ST-1/2-SS1-044	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 46	ST-3/4-SS1-001	1/2"	Steam inlet valve (sampling valve)	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 47	PL-1 1/2"-SS2-007	1/2"	Purge valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 48	PL-1 1/2"-SS2-006	1/2"	Purge valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 49	ST-1/2-SS1-077	1/2"	Steam inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4015 50	ST-1/2-SS1-077	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4015 51	ST-1/2-SS1-077	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 01	ST-1/2-SS1-015	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 02	ST-1/2-SS1-072	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 03	ST-1/2-SS1-016	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 04	ST-1/2-SS1-073	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 05	VT-1-SS2-002	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 06	ST-3/4-SS1-020	3/4"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 07	ST-3/4-SS1-021	1-1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 09	ST-3/4-SS1-019	3/4"	Steam inlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4016 10	PL-1/2"-SS2-014	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 11	ST-3/4-SS1-045	3/4"	Steam outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4016 12	ST-3/4-SS1-047	3/4"	Steam outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4016 13	ST-1/2-SS1-046	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 14	PL-1/2"-SS2-013	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT

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TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER
HV 4016 15	VT-1-SS2-002	1/2"	Steam inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 16	ST-1/2-SS1-051	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 20	GLY-3/4-SS1-007	1/2"	Steam outlet valve	Manual Valve	2651	AISI 316	BÜRKERT
HV 4016 21	PL-1/2-SS2-017	1/2"	Steam outlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 24	PL-1/2"-SS2-015	1/2"	Inert gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 25	PL-1/2"-SS2-013	1/2"	Inert gas inlet valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 26	ST-3/4-SS1-057	1/2"	Steam inlet valve (sampling valve)	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 27	PL-1/2"-SS2-015	1/2"	Purge valve	Manual Valve	3233	AISI 316	BÜRKERT
HV 4016 28	PL-1/2"-SS2-013	1/2"	Purge valve	Manual Valve	3233	AISI 316	BÜRKERT

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TAG Nº	SITUATION	DN	SERVICE	DESCRIPTION	MODEL	MATERIAL	MANUFACTURER

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DIGITAL / ANALOGICAL SIGNALS LIST

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA				
PROJECT:	MELiSSA COMPARTMENT IVa	**DATE:**	18/11/2009	**CHECKED:**	J.MESTRE
DRAWING:	DD-8558-Z1-100-01	**REV:**	11	**PREPARED:**	J. GUBERN

CONTROL LOOP	EQUIPMENT	PLC ADRESS	DESCRIPTION	I/O	SIGNAL TYPE
4000	IRC 4000 01	300145	Light Power Phase 1 (NOT IMPLEMENTED)	AI	4/20 mA
4000	IRC 4000 01	300146	Light Power Phase 2 (NOT IMPLEMENTED)	AI	4/20 mA
4000	IRC 4000 01	300147	Light Power Phase 3 (NOT IMPLEMENTED)	AI	4/20 mA
4000	IRC 4000 01	400115	Light Intensity	AO	4/20 mA
4001	FT 4001 01	300130	Total liquid inlet flow to reactor	AI	4/20 mA
4001	LT 4001 01	300131	VS 4001 01 level	AI	4/20 mA
4001	DPT 4001 01	300138	Differential pressure measurement	AI	4/20 mA
4001	DPT 4001 02	300139	Differential pressure measurement	AI	4/20 mA
4001	GP 4001 03	400113	VS 4001 01 agitator speed set point	AO	4/20 mA
4001	GP 4001 03	000110	Start/Stop GP 4001 03 converter	DO	0/1
4001	GP 4001 03	100104	Thermal protection of the agitator	DI	0/1
4001	PS 4001 01	100082	Pressure switch	DI	0/1
4001	PS 4001 02	100083	Pressure switch	DI	0/1
4001	PS 4001 03	100106	Pressure switch (GP 4001 01)	DI	0/1
4001	PS 4001 04	100107	Pressure switch (GP 4001 02)	DI	0/1
4001	GP 4001 01	000091	Start/Stop of the pump	DO	0/1
4001	GP 4001 02	000090	Start/Stop of the pump	DO	0/1
4001	GP 4001 01/02	000111	Start/Stop GP 4001 01/02 converter	DO	0/1
4001	GP 4001 01/02	100099	Thermal protection of the inlet pumps	DI	0/1
4001	GP 4001 01/02	400109	Flow setpoint to the inlet pumps	AO	4/20 mA
4002	WT 4002 01	300132	Weight Balance (VS 4002 01)	AI	4/20 mA
4002	GP 4002 01	000089	Start/Stop of the pump	DO	0/1
4002	GP 4002 02	000104	Start/Stop of the pump	DO	0/1
4002	GP 4002 01/02	000112	Start/Stop GP 4002 01/02 converter	DO	0/1

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CONTROL LOOP	EQUIPMENT	PLC ADRESS	DESCRIPTION	I/O	SIGNAL TYPE
4002	GP 4002 01/02	100101	Thermal protection of the outlet pumps	DI	0/1
4002	GP 4002 01/02	400111	Flow setpoint to the outlet pumps	AO	4/20 mA
4002	GP 4002 03	400114	VS 4001 01 agitator speed setpoint	AO	4/20 mA
4002	GP 4002 03	000109	Start/Stop GP 4002 03 converter	DO	
4002	GP 4002 03	100105	Thermal protection of the agitator	DI	0/1
4002	PS 4002 01	100084	Pressure switch	DI	0/1
4002	PS 4002 02	100085	Pressure switch	DI	0/1
4002	PS 4002 03	100108	Pressure switch (GP 4002 01)	DI	0/1
4002	PS 4002 04	100109	Pressure switch (GP 4002 02)	DI	0/1
4003	FQRC 4003 01	300109	Inlet CO2 flow measurement	AI	0-5 V
4003	FQRC 4003 01	400100	Inlet CO2 flow set point	AO	0-5 V
4003	FQRC 4003 02	300110	Inlet Air flow measurement	AI	0-5 V
4003	FQRC 4003 02	400101	Inlet Air flow set point	AO	0-5 V
4003	FQRC 4003 03	300111	Circulated air flow measurement	AI	0-5 V
4003	FQRC 4003 03	400102	Circulated air flow set point	AO	0-5 V
4003	FQRC 4003 04	300112	Total Inlet gas flow measurement	AI	0-5 V
4003	FQRC 4003 04	400103	Total Inlet gas flow set point	AO	0-5 V
4003	SV 4003 01	000093	Analyser gas inlet valve (Open/Close)	DO	0/1
4003	SV 4003 01	100097	Analyser gas inlet valve (FEEDBACK)	DI	0/1
4003	SV 4003 02	000095	Reactor air inlet valve(Open/Close)	DO	0/1
4003	SV 4003 02	100095	Reactor air inlet valve (FEEDBACK)	DI	0/1
4003	SV 4003 03	000096	Blower bypass valve(Open/Close)	DO	0/1
4003	SV 4003 03	100094	Blower bypass valve (FEEDBACK)	DI	0/1
4003	PS 4003 01	100110	Pressure switch bypass for recycling	DI	0/1

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DRAWING:	DD-8558-Z1-100-01	REV:	11	PREPARED:	J. GUBERN

CONTROL LOOP	EQUIPMENT	PLC ADRESS	DESCRIPTION	I/O	SIGNAL TYPE
4003	BLWR 4003 01	000103	Start/Stop of the blower	DO	0/1
4004	FT 4004 01	300129	Reactor outlet gas flow measurement	AI	4/20 mA
4004	DPT 4004 01	300140	Differential pressure measurement	AI	4/20 mA
4004	SCV 4004 01	400108	Reactor outlet gas flow set point	AO	4/20 mA
4005	HX 4005 02	000100	Start/Stop electrical resistance	DO	0/1
4005	TT 4005 01	300141	Reactor temperature measurement	AI	4/20 mA
4005	BLWR 4005 01	400104	Air extractor setpoint (lightening refrig.)	AO	0-10 V
4005	BLWR 4005 01	000099	Start/Stop of the extractor	DO	0/1
4005	BLWR 4005 01	100103	Thermal protection of the extractor	DI	0/1
4005	SV 4005 01	000088	Cooling water valve (Open/Close)	DO	0/1
4005	SV 4005 01	100086	Cooling water valve (FEEDBACK)	DI	0/1
4005	PP 4005 01	000102	Start/Stop of the pump	DO	0/1
4006	AT 4006 01	300125	Ph measurement	AI	4/20 mA
4006	TT 4006 01	300126	Temperature measurement (AT 4006 01)	AI	4/20 mA
4006	AT 4006 02	300127	Ph measurement	AI	4/20 mA
4006	TT 4006 02	300128	Temperature measurement (AT 4006 02)	AI	4/20 mA
4006	SV 4006 01	100091	Reactor acid inlet valve (Open/Close)	DI	0/1
4006	SV 4006 01	000083	Reactor base inlet valve (FEEDBACK)	DO	0/1
4006	SV 4006 02	100092	Reactor base inlet valve (Open/Close)	DI	0/1
4006	SV 4006 02	000082	Reactor base inlet valve (FEEDBACK)	DO	0/1
4006	PP 4006 01	000098	Start/Stop of the pump	DO	0/1
4006	PP 4006 02	000097	Start/Stop of the pump	DO	0/1
4006	WT 4006 01	-----	Acid balance	Eth	Ethernet
4006	WT 4006 02	-----	Base balance	Eth	Ethernet

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Av. Príncep d'Asturies 43-45, 1r-5a
E-08012 BARCELONA
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DIGITAL / ANALOGICAL SIGNALS LIST

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA				
PROJECT:	MELiSSA COMPARTMENT IVa	**DATE:**	18/11/2009	**CHECKED:**	J.MESTRE
DRAWING:	DD-8558-Z1-100-01	**REV:**	11	**PREPARED:**	J. GUBERN

CONTROL LOOP	EQUIPMENT	PLC ADRESS	DESCRIPTION	I/O	SIGNAL TYPE
4007	PT 4007 01	300135	Reactor pressure measurement	AI	4/20 mA
4007	PT 4007 02	300136	Reactor pressure measurement	AI	4/20 mA
4008	WT 4008 01	300133	Reactor weight cells	AI	4/20 mA
4009	AT 4009 01	300118	Biomass measurement	AI	4/20 mA
4009	AT 4009 02	300119	Biomass measurement	AI	4/20 mA
4009	AT 4009 02	300120	Biomass sensor failure	AI	4/20 mA
4010	AT 4010 01	300121	CO2/O2 analyser	AI	4/20 mA
4010	AT 4010 02	300122	CO2/O2 analyser	AI	4/20 mA
4010	AT 4010 03	300123	Dissolved O2 measurement	AI	4/20 mA
4010	PT 4010 01	300137	Outlet gas pressure measurement	AI	4/20 mA
4010	TT 4010 01	300143	Outlet gas temperature measurement	AI	4/20 mA
4010	SV 4010 01	000081	Analyser gas inlet valve (Open/Close)	DO	0/1
4010	SV 4010 01	100093	Analyser gas inlet valve (FEEDBACK)	DI	0/1
4010	HX 4010 01	000107	Start/Stop post condenser	DO	0/1
4011	TT 4011 01	300142	VS 4001 01 temp. measurement	AI	4/20 mA
4011	SV 4011 01	000087	Cooling water valve (Open/Close)	DO	0/1
4011	SV 4011 01	100087	Cooling water valve (FEEDBACK)	DI	0/1
4012	TT 4012 01	300144	VS 4002 01 temp. measurement	AI	4/20 mA
4012	SV 4012 01	000085	Cooling water valve (Open/Close)	DO	0/1
4012	SV 4012 01	100089	Cooling water valve (FEEDBACK)	DI	0/1
4013	LS 4013 01	100081	Foam measurement	DI	0/1
4014	SV 4014 01	000086	Steam inlet valve (Open/Close)	DO	0/1
4015	SV 4015 01	000092	Reactor Steam inlet valve (Open/Close)	DO	0/1
4015	SV 4015 01	100098	Reactor Steam inlet valve (Feedback)	DI	0/1

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E-08012 BARCELONA

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DIGITAL / ANALOGICAL SIGNALS LIST

CUSTOMER:	Universitat Autònoma de Barcelona / MELiSSA				
PROJECT:	MELiSSA COMPARTMENT IVa	**DATE:**	18/11/2009	**CHECKED:**	J.MESTRE
DRAWING:	DD-8558-Z1-100-01	**REV:**	11	**PREPARED:**	J. GUBERN

CONTROL LOOP	EQUIPMENT	PLC ADRESS	DESCRIPTION	I/O	SIGNAL TYPE
4016	SV 4016 01	000084	Steam inlet valve (Open/Close)	DO	0/1
-----	Emergency Buttons	100111	Emergency Buttons (any button pressed)	DI	0/1
-----	Emergency Buttons	000106	Electrical enclosure red LED	DO	0/1
-----	Emergency Buttons	100112	Emergency released	DI	0/1
-----	Emergency Buttons	000105	Electrical enclosure green LED	DO	0/1
-----	-----	300148	SPARE (NOT USED)	AI	4/20 mA
-----	-----	400110	SPARE (NOT USED)	AO	4/20 mA
-----	-----	400112	SPARE (NOT USED)	AO	4/20 mA
-----	-----	100100	SPARE (NOT USED)	DI	0/1
-----	-----	100102	SPARE (NOT USED)	DI	0/1
-----	-----	000107	SPARE (NOT USED)	DO	0/1
-----	-----	000101	SPARE (NOT USED)	DO	0/1
-----	-----	000108	SPARE (NOT USED)	DO	0/1
-----	-----	300124	CANCELLED (AT 4010 03 temp. meas.)	AI	4/20 mA
-----	-----	100088	CANCELLED (SV 4014 01 FEEDBACK)	DI	0/1
-----	-----	100090	CANCELLED (SV 4016 01 FEEDBACK)	DI	0/1

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ACCESSORIES SPECIFICATIONS

WEIGHT

CUSTOMER:	Universitat Autònoma de Barcelona	**PREPARED BY:**	J. GUBERN
PROJECT:	MELiSSA Compartment Iva	**CHECKED BY:**	J. MESTRE
DRAWING:	DD-8550-Z1	**REV:**	A
DATE:	20/01/2010	**PAGE:**	1

ITEM	**WT 4006 01**	**WT 4006 02**
PRODUCT	Acid solution	Base solution
PRODUCT DENSITY (kg/m^3)	1000	1000
OPERATION PRESSURE (bar)	atm	atm
TEMPERATURE (ºC)	atm	atm
SITUATION	VS 4006 01	VS 4006 02
TYPE	platform scale	platform scale
NUMBER OF CELLS	1	1
TRANSMITTER	Compact	Compact
MATERIAL	INOX	INOX
OUTLET SIGNAL	Ethernet	Ethernet
ELECTRICAL CLASIFICACTION ATEX	No	No
PROTECTION	IP43	IP43
MESURE WEIGHT RANGE	0…6 kg	0…6 kg
ACCURACY	1 g	1 g
OBSERVATIONS		

ITEM	**WT 2008 01**	**WT 4002 01**
PRODUCT	Water solution	Water solution
PRODUCT DENSITY (kg/m^3)	1000	1000
OPERATION PRESSURE (bar)	atm	atm
TEMPERATURE (ºC)	30 ºC	5 ºC
SITUATION	Bioreactor	VS 4002 01
TYPE	Weight cells	Platform scale
NUMBER OF CELLS	3	1
TRANSMITTER	M300	M300
MATERIAL	INOX	INOX
OUTLET SIGNAL	4…20 mA	4…20 mA
ELECTRICAL CLASIFICACTION ATEX	No	No
PROTECTION	IP65	IP65
MAXIMUM WEIGHT (NET+TARE)	750 kg	600 kg
ACCURACY		200 g
OBSERVATIONS		

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INSTRUMENTS SPECIFICATIONS

FLOW

CUSTOMER:	Universitat Autònoma de Barcelona	**PREPARED BY:**	J. GUBERN
PROJECT:	MELiSSA Compartment IVa	**CHECKED BY:**	J. MESTRE
DRAWING:	DD-8558-Z1	**REV:**	1
DATE:	08/02/2010	**PAGE:**	1

ITEM		**FT 4001 01**	**FT 4004 01**	
PRODUCT		Water solution	Process gas	
PRESSURE (bar)	IN			
	OUT			
FLOW (L/h)	MINIMUM	0,25	0	
	MAXIMUM	10	120	
TEMPERATURE (ºC)		7	10	
SITUATION		PL-1/2"-SS2-006	PG-1/2-SS2-007	
PROCES CONNECTION		Tri-Clamp 1/2"	1/4" O.D.	
MATERIAL IN CONTACT WITH PRODUCT		AISI 316L	AISI 316L / Kalrez	
PROCESS CONNECTION MATERIAL		AISI 316L	AISI 316L	
PIPE SIZE		1/2"	1/2"	
MESURE RANGE		0…20 kg/h	3…150 NL/h	
SENSOR TYPE		Coriolis		
TRANSMITTER TYPE		COMPACT		
ACCURACY		0,1 % / 2 g/cm^2	± 0,5 mm	
OUTLET SIGNAL		4…20 mA	4…20 mA / RS232	
ELECTRICAL CLASIFICACTION ATEX		No	No	
PROTECTION		IP67		
ELECTRICAL CONNECTION		85-260 VAC	+15 24 Vcc	
OBSERVATIONS		Software: Default liquid	Mesure on tube	
		Mesure on tube	Not Sterilizable	
		Auto-drainable	Filter required	
		Sterilizable		
QUANTITY		1	1	
SUPPLIER		ENDRESS&HAUSER	IBERFLUID	
MANUFACTURER		ENDRESS&HAUSER	BRONKHÖRST	
MODEL		PROMASS		

CERTIFICATES

	Yes	No
MATERIALS CERTIFICATE		
CALIBRATION CERTIFICATE		
ATEX CERTIFICATE		
PED 97/23/EC CERTIFICATE		

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INSTRUMENTS SPECIFICATIONS

LEVEL

CUSTOMER:	Universitat Autònoma de Barcelona	**PREPARED BY:**	J. GUBERN
PROJECT:	MELiSSA Compartment IVa	**CHECKED BY:**	J. MESTRE
DRAWING:	DD-8558-Z1	**REV:**	1
DATE:	08/02/2010	**PAGE:**	1

ITEM	**LT 4001 01**	**LS 4013 01**			
SITUATION	VS 4001 01	RCIVa			
TYPE	Microwave	Level switch			
OUTLET SIGNAL	4...20 mA	0/1			
TYPE OF SENSOR	Guided microwave				
MATERIAL IN CONTACT WITH PRODUCT	AISI 316L	AISI 316L			
CALIBRATION RANGE	0…100 %	N/A			
PROCESS CONNECTION	Tri-clamp 1 1/2"	Tri-clamp 1/2"			
PROCESS CONNECTION MATERIAL	AISI 316L	AISI 316L			
SENSOR LENGHT	1000 mm				
SENSOR MATERIAL	AISI 316L				
SENSOR DIAMETER	6 mm				
POWER SUPPLY					
PROTECTION	IP66 / IP67	IP66			
ELECTRICAL CLASIFICACTION ATEX	No	No			
ACCURACY	± 0,5 mm	N/A			
DIGITAL INDICATION (LCD METER)	No	No			
ELECTRICAL CONNECTION					
FLUID TYPE	Water solution	Water solution			
FLUID STATE	Liquid	Liquid			
VISCOSITY	1 cP aprox.				
OPERATION PRESSURE (barg)					
MAXIMUM PRESSURE (barg)					
OPERATION TEMPERATURE (ºC)	5	35			
MAXIMUM TEMPERATURE (ºC)					
QUANTITY	1	1			
SUPPLIER	VEGA				
MANUFACTURER	VEGA				
MODEL	VEGAFLEX61				

OBSERVATIONS

	Yes	No
MATERIALS CERTIFICATE	X	
CALIBRATION CERTIFICATE	X	
ATEX CERTIFICATE		X
PED 97/23/EC CERTIFICATE		X

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

INSTRUMENTS SPECIFICATIONS

PRESSURE

CUSTOMER:	Universitat Autònoma de Barcelona	**PREPARED BY:**	J. GUBERN
PROJECT:	MELiSSA Compartment IVa	**CHECKED BY:**	J. MESTRE
DRAWING:	DD-8558-Z1	**REV:**	1
DATE:	08/02/2010	**PAGE:**	1

ITEM	**PT 4007 01**	**PT 4007 02**	**PT 4010 01**	**DPT 4001 01/02**	**DPT 4004 01**
SITUATION	REACTOR	REACTOR	PG-1/2"-SS2-007	PL-1/2"-SS2-007/009	PL-1/2"-SS2-006
TYPE (absolut/gauge/differentiall)	abs	abs	abs	diff	diff
OUTLET SIGNAL	4...20 mA	4...20 mA	4...20 mA	4...20 mA	4...20 mA
TYPE OF SENSOR	VEGABAR	VEGABAR	VEGABAR	VEGADIF	VEGADIF
MATERIAL IN CONTACT WITH PRODUCT	AISI 316L	AISI 316L	AISI 316L	AISI 316L	AISI 316L
CALIBRATION RANGE	-1…5 bar	-1…1,5 bar	-1…5 bar	0/3 bar	0/3 bar
PROCESS CONNECTION	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"	Tri-Clamp 1 1/2"
PROCESS CONNECTION MATERIAL	AISI 316L	AISI 316L	AISI 316L	AISI 316L	AISI 316L
CAPILAR	N/A	N/A	N/A	Yes	Yes
CAPILAR MATERIAL	N/A	N/A	N/A	1 m	1 m
MEMBRANE	CERTEC	CERTEC	CERTEC		
MEMBRANE MATERIAL	Ceramic	Ceramic	Ceramic	AISI 316L	AISI 316L
CAPILAR FILLING FLUID	KN.59	KN.59	KN.59	KN.59	KN.59
POWER SUPPLY					
PROTECTION	IP66 / IP67	IP66 / IP67	IP66 / IP67	IP66 / IP67	IP66 / IP67
ELECTRICAL CLASIFICACTION ATEX	No	No	No	No	No
ACCURACY	0,10%	0,10%	0,10%		
DIGITAL INDICATION (LCD METER)	PLISCOM	PLISCOM	PLISCOM	LCD	LCD
ELECTRICAL CONNECTION					
FLUID TYPE	Water solution	Water solution	Process gas	Water solution	Process gas
FLUID STATE	Liquid	Liquid	Gas	Liquid	Gas
VISCOSITY					
OPERATION PRESSURE (barg)					
MAXIMUM PRESSURE (barg)					
OPERATION TEMPERATURE (ºC)	30	30	10	5	25
MAXIMUM TEMPERATURE (ºC)					
QUANTITY	1	1	1	1	1
SUPPLIER	VEGA	VEGA	VEGA	VEGA	VEGA
MANUFACTURER	VEGA/WIKA	VEGA/WIKA	VEGA/WIKA	VEGA/WIKA	VEGA/WIKA
MODEL	VEGABAR52	VEGABAR52	VEGABAR52	VEGADIF55	VEGADIF55

OBSERVATIONS

.

	Yes	No
MATERIALS CERTIFICATE	X	
CALIBRATION CERTIFICATE	X	
ATEX CERTIFICATE		X
PED 97/23/EC CERTIFICATE		X

De Dietrich Equipos Químicos, S.L.
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INSTRUMENTS SPECIFICATIONS

TEMPERATURE

CUSTOMER:	Universitat Autònoma de Barcelona	**PREPARED BY:**	J. GUBERN
PROJECT:	MELiSSA Compartment IVa	**CHECKED BY:**	J. MESTRE
DRAWING:	DD-8558-Z1	**REV:**	1
DATE:	20/01/2010	**PAGE:**	1

ITEM	**TT 4010 01**	**TT 4011 01**	**TT 4012 01**	**TT 4005 01**
TYPE	Pt-100	Pt-100	Pt-100	Pt-100
SITUATION	VS 4001 01	PG-1/2"-SS2-007	VS 4002 01	REACTOR
OUTLET SIGNAL	4...20 mA	4...20 mA	4...20 mA	4...20 mA
SENSIBLE ELEMENT				
POD MATERIAL	AISI 316L	AISI 316L	AISI 316L	AISI 316L
SENSOR DIAMETER				
TOTAL IMMERSION LENGHT (mm)				
PROCESS CONNECTION MATERIAL	Tri-Clamp 1/2"	Tri-Clamp 1/2"	Tri-Clamp 1"	Tri-Clamp 1"
CONNECTION MATERIAL	AISI 316L	AISI 316L	AISI 316L	AISI 316L
CALIBRATION RANGE	0…150 ºC	-10…150 ºC	-50…250 ºC	0…150 ºC
TRANSMITTER	Analogical	Analogical	Analogical	Analogical
ELECTRICAL CLASIFICACTION ATEX	No	No	No	No
PROTECTION				
POWER SUPPLY				
ELECTRICAL CONNECTION	M20 x 1,5	M20 x 1,5	M20 x 1,5	M20 x 1,5
DIGITAL INDICATION (LCD METER)	No	No	No	No
ACCURACY	± 0,1 ºC	± 0,1 ºC		± 0,1 ºC
DIGITAL COMMUNICATION				
FLUID TYPE	Water solution	Process gas	Water solution	Water solution
FLUID STATE	Liquid	Gas	Liquid	Liquid
VISCOSITY				
OPERATION PRESSURE (barg)				
MAXIMUM PRESSURE (barg)				
OPERATION TEMPERATURE (ºC)	5	10		35
MAXIMUM TEMPERATURE (ºC)	150	150	250	150
QUANTITY	1	1	1	1
SUPPLIER	WIKA	WIKA		BIOENGINEERING
MANUFACTURER	WIKA	WIKA	WIKA	BIOENGINEERING
MODEL	WE3593	WE3593		

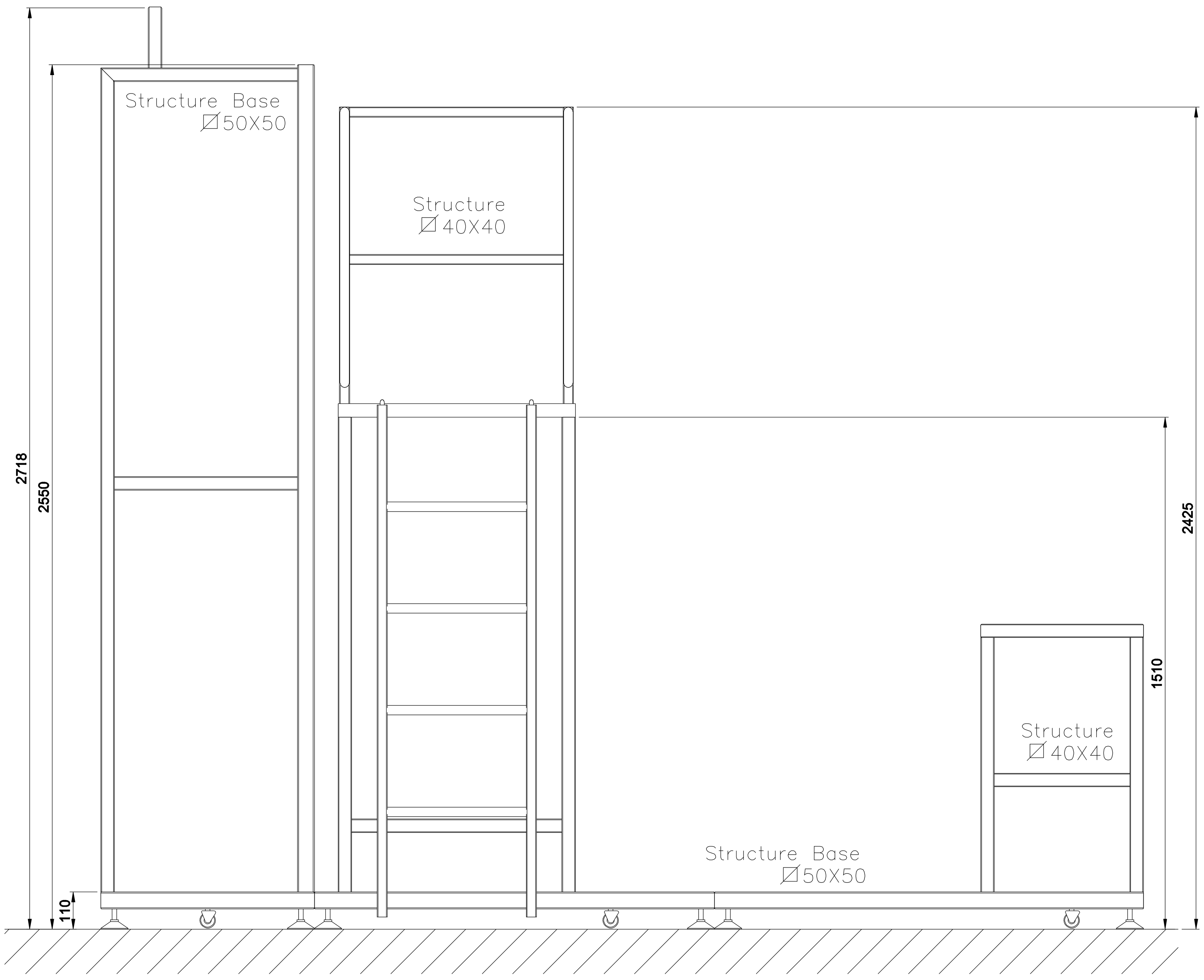
OBSERVATIONS

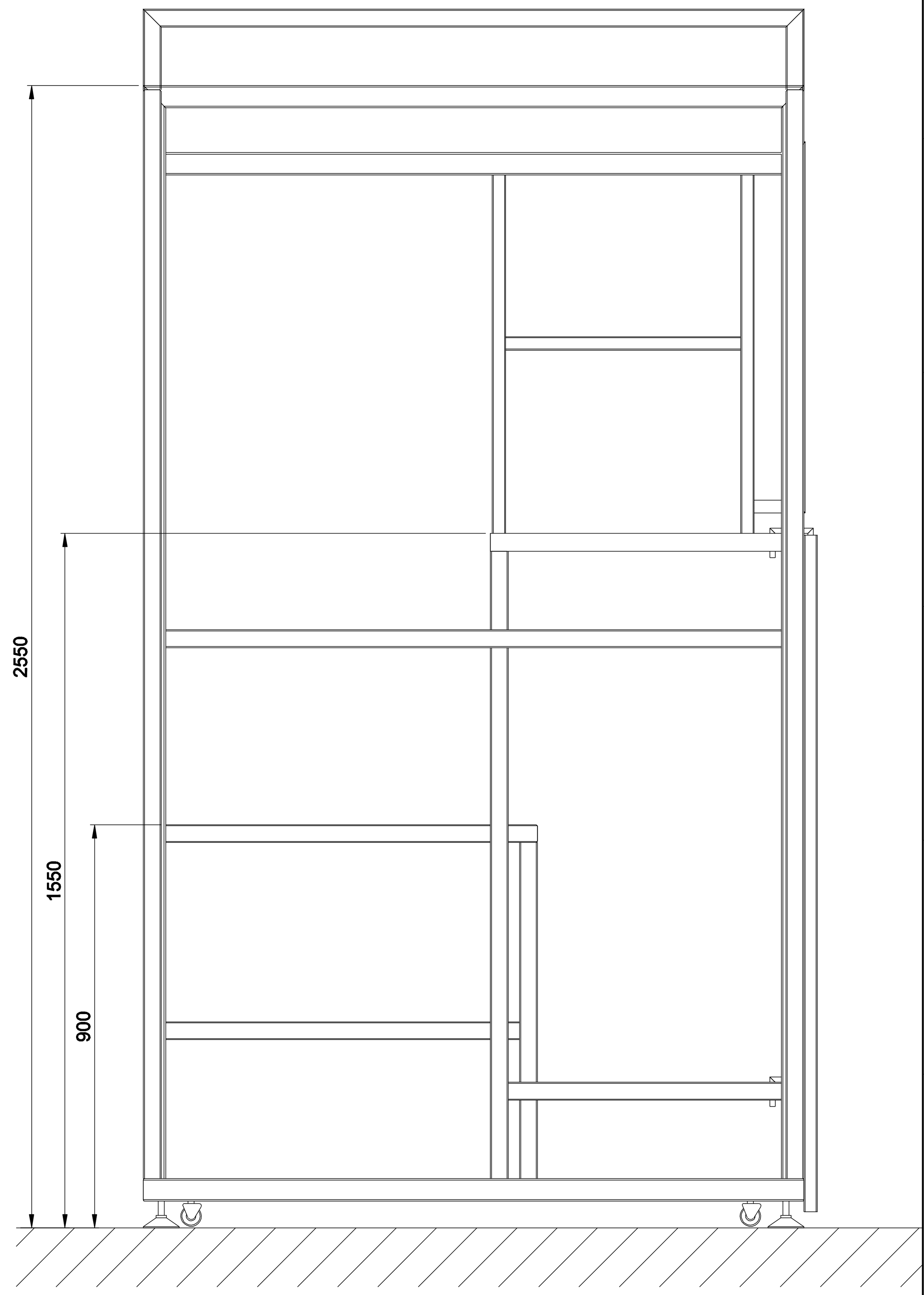
	Yes	No
MATERIALS CERTIFICATE	X	
CALIBRATION CERTIFICATE	X	
ATEX CERTIFICATE		X
PED 97/23/EC CERTIFICATE		X

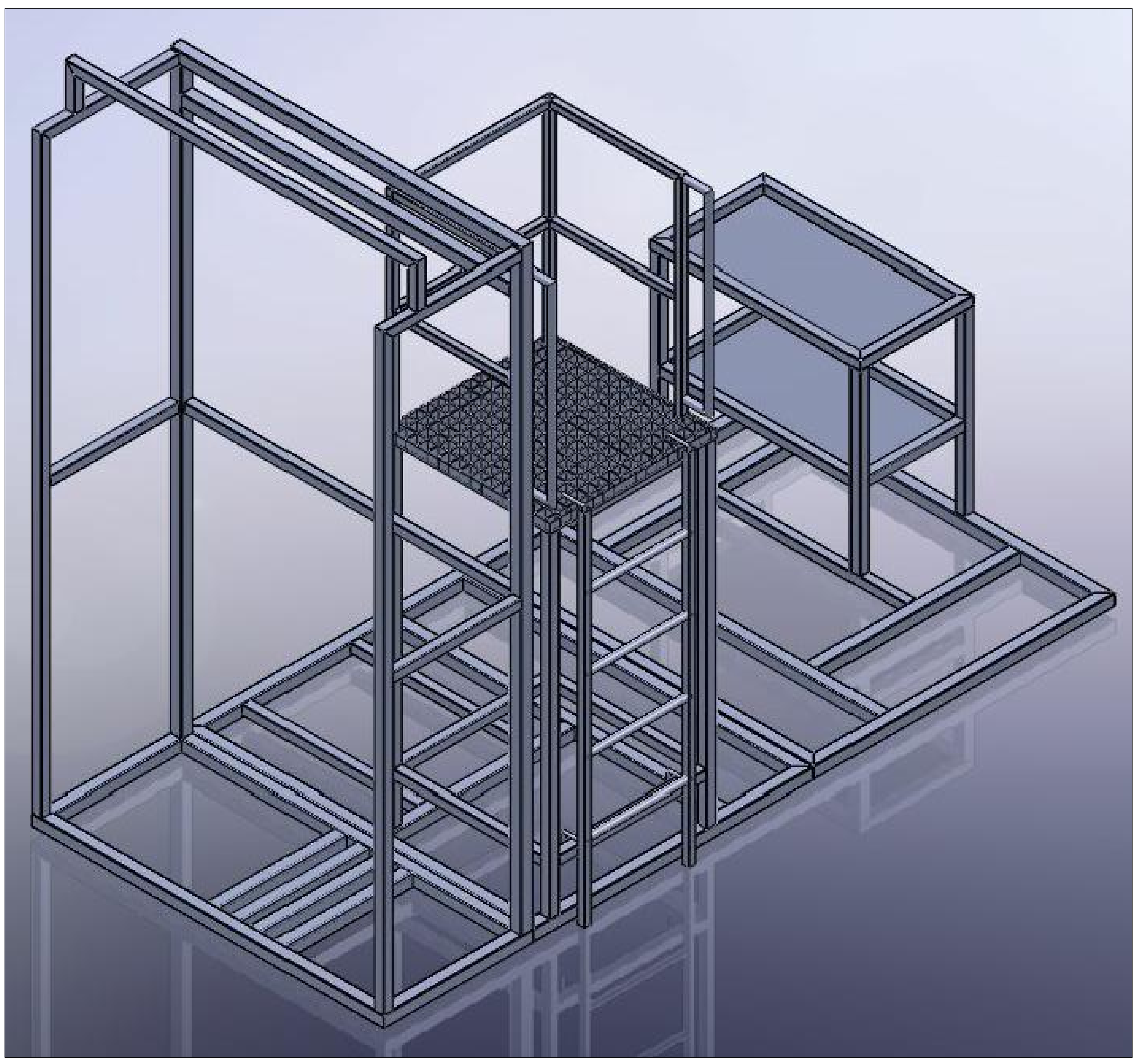
7. CONSTRUCTIVE DRAWINGS

7.1. Frame, supports and skid
7.2. Reactor
7.3. Feeding vessel
7.4. Harvest vessel

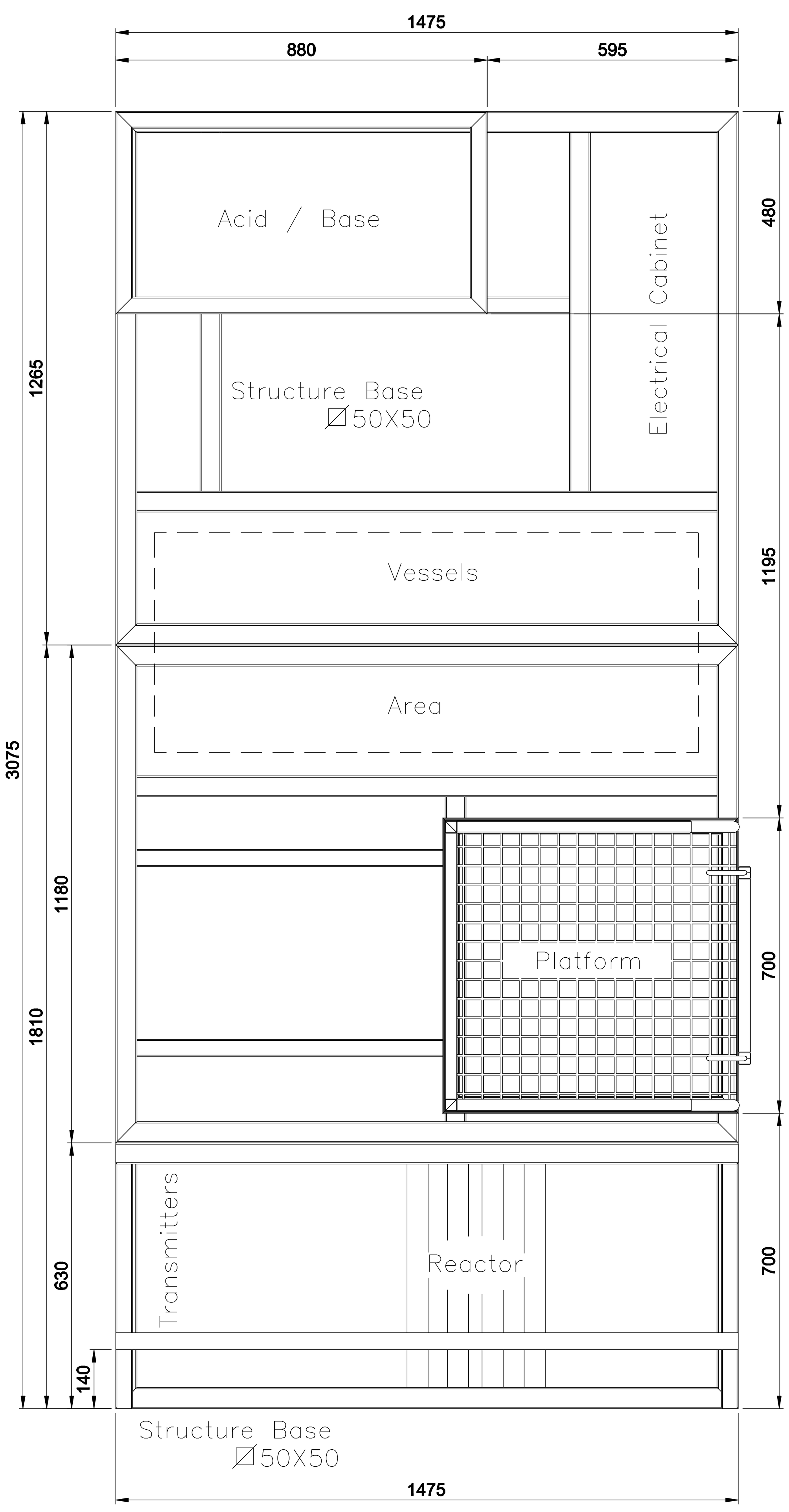
FORMATO: DIN A1

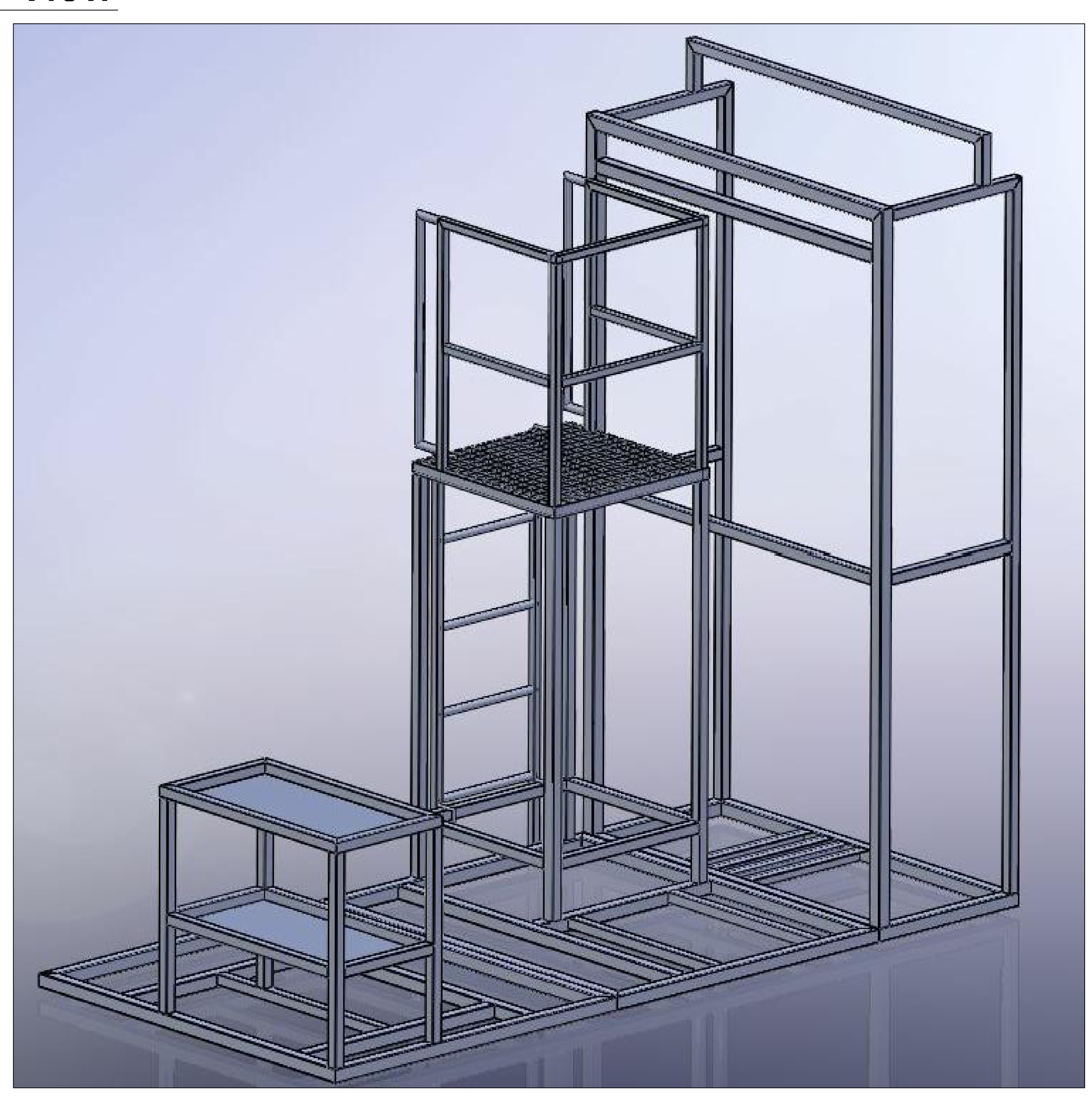






General View



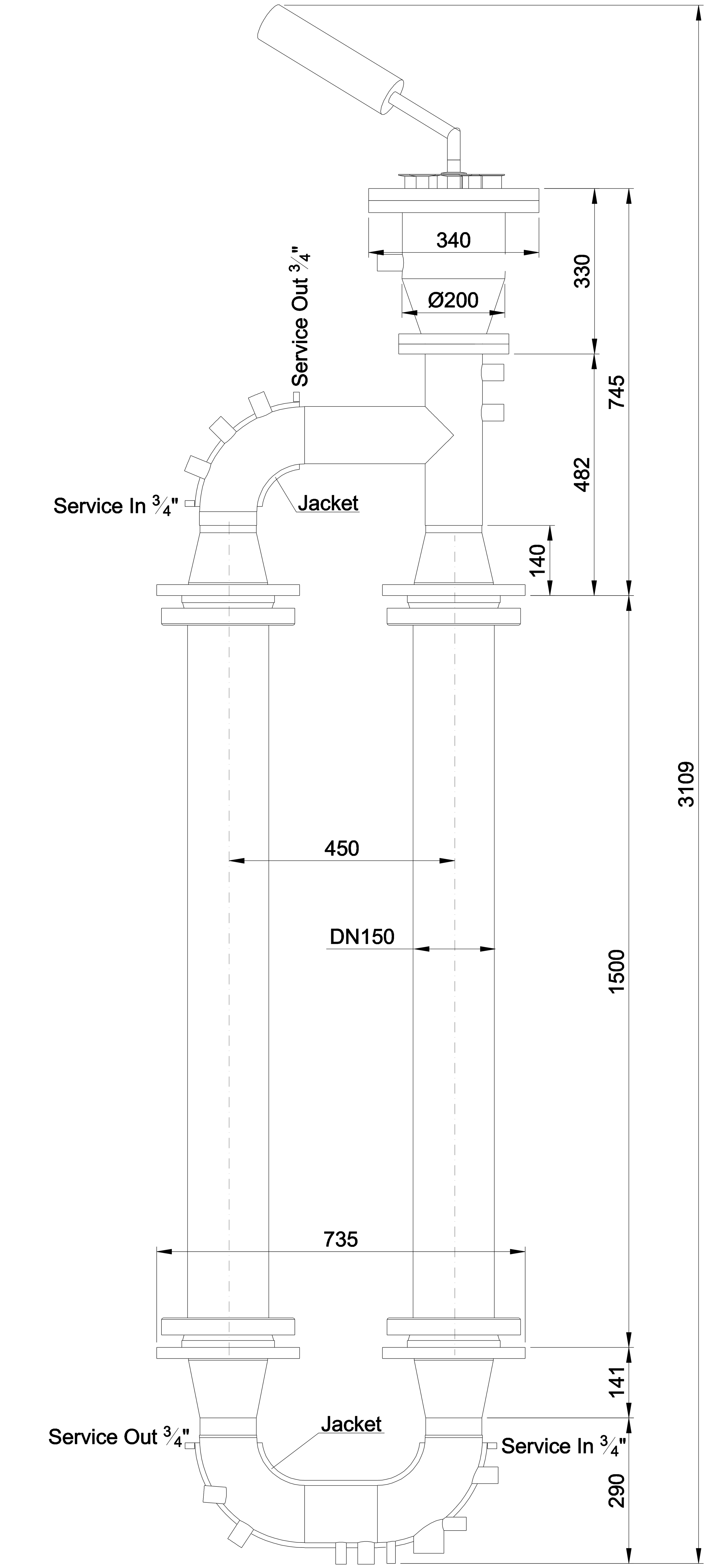


General View

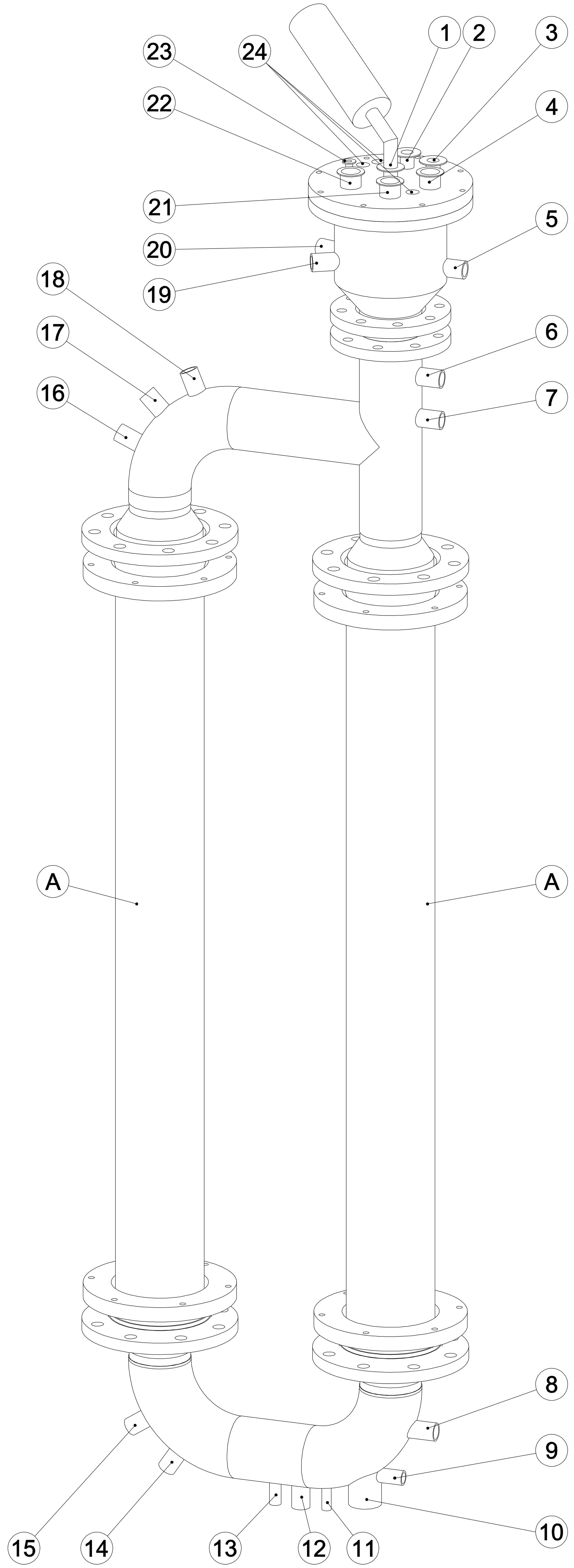
Material: ASTM-304

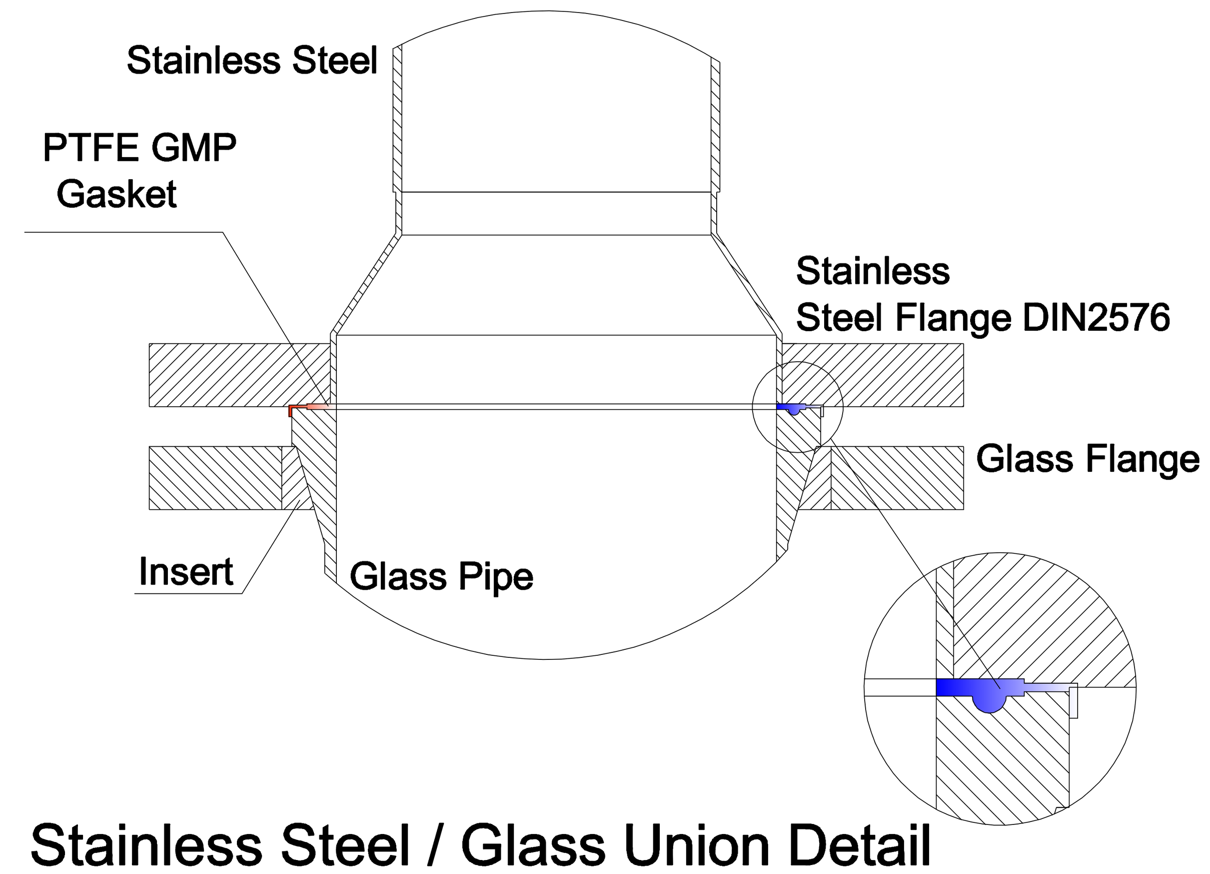
De Dietrich Equipos Químicos, S. L. Av. Princep d'Asturies 43-45, 1r-5a E-08012 BARCELONA — Member of De Dietrich PROCESS SYSTEMS		Dibujado	D. Tatay
		Comprobado	J. Mestre
		Fecha	11/11/2009
		Referencia	PRK-5393
PROYECTO: MELiSSA - Compartment IVa		CLIENTE: **Universitat Autònoma de Barcelona**	
TITULO: Structure Support			
PLANO N°: DD-8558-R1-105-01	Revisión: 5	Escala: 1/10	

Rev.	Nota de revisión	Fecha	Dib.	Verif.



General Dimensions





Stainless Steel / Glass Union Detail

Vessel Design Conditions	
Pressure (bar)	-1 / +2
Temperature (ºC)	+200

Position	Description	Dimension	Standard
A	Pipe section according QVF	PS150/1500	QVF WPR 2002
24	Free	1"	Ingold
23	Liquid outlet	1/2"	Clamp Imperial ASME BPE
22	Safety valve	1"	Clamp Imperial ASME BPE
21	Pressure transmitter	1"	Clamp Imperial ASME BPE
20	Air inlet (Biomass sensor cleaning)	1"	Ingold
19	Biomass transmitter	1"	Ingold
18	Dissolved O_2 transmitter	1"	Ingold
17	Ph transmitter	1"	Ingold
16	Temperature sensor	1"	Ingold
15	Ph tansmitter	1"	Ingold
14	Free	1"	Ingold
13	Jacket purge	1/2"	BSP
12	Liquid inlet	1"	Ingold
11	Free	3/8"	BSP
10	Total gas inlet	2"	BSP
9	Acid - Base inlet	1/2"	BSP
8	Sampling valve	1"	Ingold
7	Biomass transmitter	1"	Ingold
6	Free	1"	Ingold
5	Inoculum / Antifoam / Steam inlet	1"	Ingold
4	Pressure transmitter	1"	Clamp Imperial ASME BPE
3	Free	1"	Clamp Imperial ASME BPE
2	Level transmitter (Future implementation)	1"	Clamp Imperial ASME BPE
1	Conderser / Gas outlet	1"	Clamp Imperial ASME BPE

Rev.	Nota de revisión
Fecha	Dib. / Verif.

De Dietrich Equipos Químicos, 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
Fecha	16/11/2009
Referencia	PRK-5393

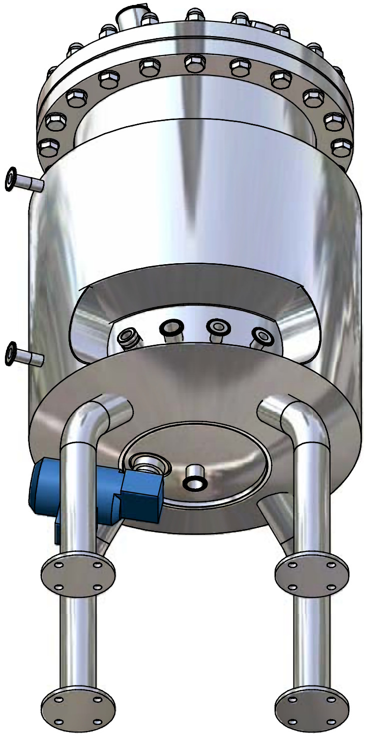
PROYECTO: MELiSSA - Compartment IVa

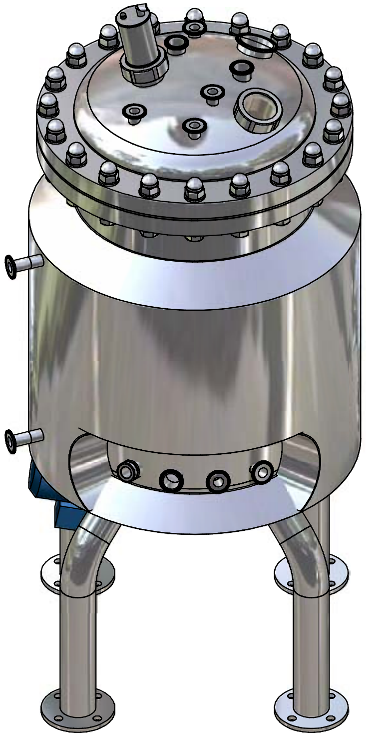
CLIENTE: Universitat Autònoma de Barcelona

TITULO: REACTOR

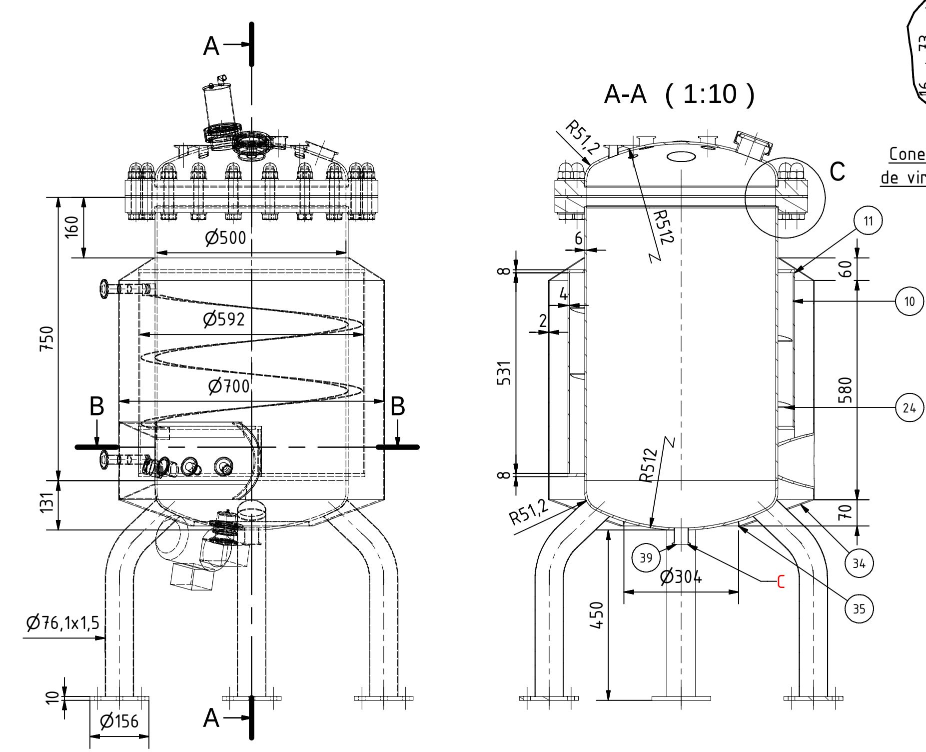
PLANO Nº: DD-8558-R1-102-01 — Revisión: 5 — Escala: %

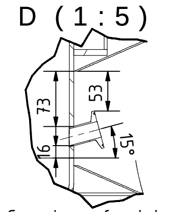
FORMATO: DIN A2



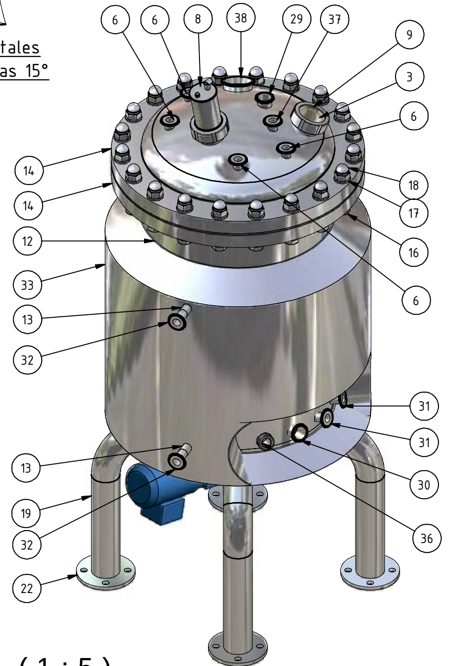


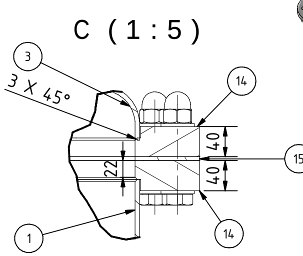
CLIENTE/Customer	DE DIETRICH		
PROYECTO/Project			
PEDIDO No./Order No.		**FABRICACIÓN No.**/Manufacture No.	0-3259
	FECHA/Date	**NOMBRE**/Name	TECALSA TECNICA Y CALDERERIA, S.A.L.
DIBUJADO Drawing by	12/11/2008	E. Muñoz	
COMPROBADO Checked by		G. Escobar	
ESCALA Scale 1:8	REACTOR 160L	**PESO NETO** Net Weight	
		TAMAÑO Size: A2	**PLANO No.** Drawing No. / **Rev.**



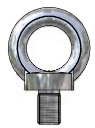


Conexiones frontales de virola inclinadas 15°

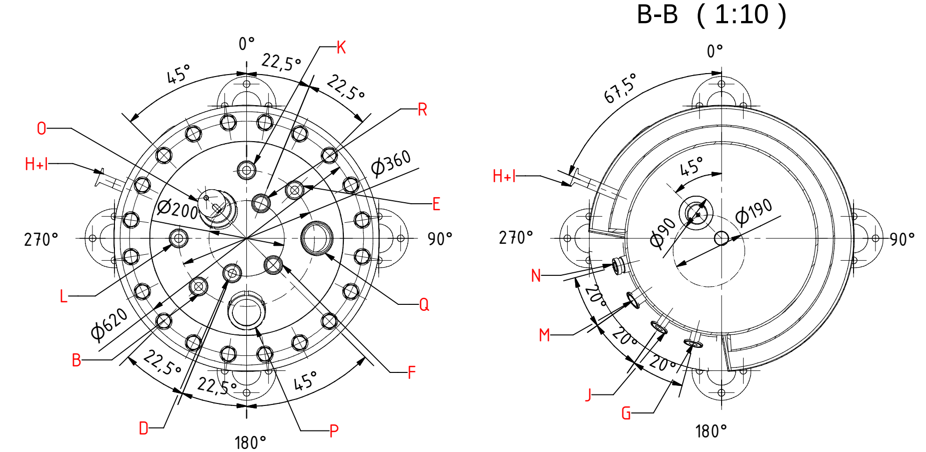




Sistema de cierre/apertura del reactor



Sistema de elevación 3 Cáncamos DIN580 M-30



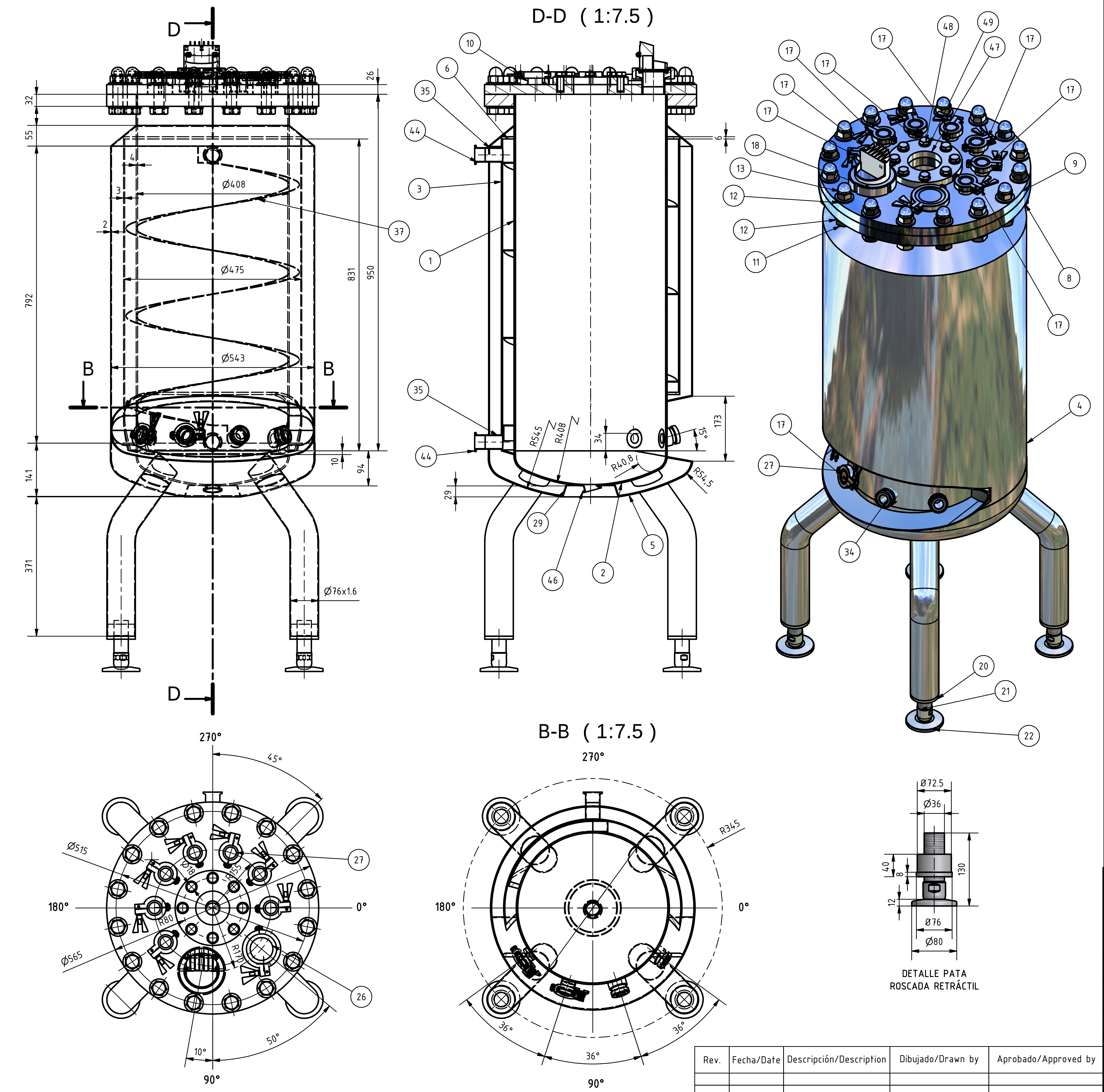
DATOS DE DISEÑO		
CÓDIGO DE DISEÑO	ASME Sección VIII División 1	ASME Sección VIII División 1
	CUERPO	CAMISA
Presión de diseño (bar)	-1/6	-1/6
Temperatura de diseño (°C)	170	170
Presión de prueba (bar)	9,9	9,9
Temperatura de prueba (°C)	Ambiente	Ambiente
Fluído	?	Glicol/Vapor
Tratamiento Térmico	No aplica	No aplica
Radiografiado (%)	No aplica	No aplica
Eficiencia de soladadura	0,7	0,7
Capacidad útil (m3)	0,16	0,037

39	1	Casquillo Clamp ASME BPE 1½in fondo	Ø	Ø38,1x1,65	AISI-316L	0,09 kg	Ra<0,5 micras
38	1	Casquillo Clamp ASME BPE 3in	Ø	Ø76,1x1,65	AISI-316L	0,15 kg	Ra<0,5 micras
37	1	Casquillo Clamp ASME BPE 1in	Ø	Ø25,4x1,65	AISI-316L	0,09 kg	Ra<0,5 micras
36	1	Conexión INGOL 1in	Ø	1"	AISI-316L	0,32 kg	
35	1	Aro inferior de cierre	ch.	e=3	AISI-304L	0,18 kg	Ra<0,8 micras
34	1	Cono inferior aislamiento	ch.	e=3	AISI-304L	7,73 kg	Ra<0,8 micras
33	1	Aislamiento	ch.	2205x580x2	AISI-304L	19,42 kg	Ra<0,8 micras
32	2	Casquillo Clamp ASME BPE 1in(camisa)	Ø	Ø25,4x1,65	AISI-316L	0,11 kg	Ra<0,5 micras
31	2	Casquillo Clamp ASME BPE 1in(virola)	Ø	Ø25,4x1,65	AISI-316L	0,1 kg	Ra<0,5 micras
30	1	Casquillo Clamp ASME BPE 1½in (virola)	Ø	Ø38,1x1,65	AISI-316L	0,08 kg	Ra<0,5 micras
29	2	Casquillo Clamp ASME BPE 1½in	Ø	Ø38,1x1,65	AISI-316L	0,07 kg	Ra<0,5 micras
28	2	Cierre frontal aislamiento	ch.	e=2	AISI-304L	0,72 kg	Ra<0,8 micras
27	1	Motor		180 W AC		3,09 kg	
26	1	Rotor	Ø		AISI-316L	0,26 kg	
25	1	Plato de soldadura	Ø	Ø90	AISI-316L	0,42 kg	Ra<0,5 micras
24	1	Guia espiral camisa calefacción	ch.	e=2	AISI-304L	2,15 kg	
23	2	Cierre lateral camisa	ch.	e=8	AISI-304L	0,04 kg	
22	4	Disco de apoyo	Ø	Ø156 e=10	AISI-304L	1,46 kg	
21	1	Aro frontal de camisa	ch.	e=8	AISI-304L	1,33 kg	
20	1	Aro inferior de camisa	ch.	e=8	AISI-304L	3,57 kg	
19	4	Pata Ø76,1x1.5	Ø	Ø76,1x1,5	AISI-304L	1,53 kg	Ra<0,8 micras
18	20	Tuerca DIN1587	Ø	M24	A4	0,2 kg	
17	40	Arandela DIN125	Ø	M24	A2	0,03 kg	
16	20	Tornillo DIN931	Ø	M24x120	A4	0,56 kg	
15	1	Junta plana	Ø	Ø670/500	Teflón	0,68 kg	
14	2	Brida de cierre	Ø	Ø670/500 e=40	AISI-316L	45,36 kg	Ra<0,8 micras
13	2	Carrete camisa ½in	Ø	Ø12,7x1,65 L=84	AISI-316L	0,08 kg	
12	1	Cierre aislamiento	ch.	e=2	AISI-304L	3,38 kg	Ra<0,8 micras
11	1	Aro cierre camisa	Ø	e=8	AISI-304L	4,94 kg	
10	1	Camisa de calefacción	ch.	1872x531x4	AISI-304L	29,82 kg	
9	1	Mirilla NW65 Inclinada	Ø	NW65	AISI-316L	1,21 kg	Ra<0,5 micras
8	1	Mirilla NW65 Central	Ø	NW65	AISI-316L	1,82 kg	Ra<0,5 micras
6	4	Casquillo Clamp ASME BPE 1in	Ø	Ø25,4x1,65	AISI-316L	0,09 kg	Ra<0,5 micras
3	1	Fondo Klopper superior	Ø	Øext512 e=6	AISI-316L	12,82 kg	Ra<0,5 micras
2	1	Fondo Klopper inferior	Ø	Øext512 e=6	AISI-316L	14,19 kg	Ra<0,5 micras
1	1	Virola	ch.	1587x725x6	AISI-316L	55,3 kg	Ra<0,5 micras
Marca	Nº pieza	DENOMINACION	Despiece	Dimensiones	Material	Peso	Observaciones
LISTA DE MATERIALES							

DESCRIPCIÓN DE CONEXIONES		
REFERENCIA	DESCRIPCIÓN	TAMAÑO
A	Agitador magnético	Sterimixer SMO 85/140
B	Entrada de líquido	1"
C	Conexión de salida	1½"
D	Venteo	1"
E	Entrada de vapor + Válvula de seguridad	1"
F	Sensor de nivel	1½"
G	Sonda de Temperatura	1"
H	Entrada de servicio	1"
I	Salida de servicio	1"
J	Tomamuestras	1"
K	Sensor de Presión	1"
L	Reserva	1"
M	Reserva	1½"
N	Reserva	1" Ingold
O	Mirilla + Proyector	NW65
P	Mirilla	NW65
Q	?	1½"
R	?	3"

CLIENTE/Customer	DE DIETRICH EQUIPOS QUÍMICOS S.L.		
PROYECTO/Project			
PEDIDO No./Order No.	CPK-004084	**FABRICACIÓN No.**/Manufacture No.	O-3259
	FECHA/Date	**NOMBRE**/Name	TECALSA TECNICA Y CALDERERIA, S.A.L.
DIBUJADO Drawing by	10/10/2008	E. Muñoz	
COMPROBADO Checked by		G. Escobar	

ESCALA Scale		PESO NETO Net Weight	312 Kg	
	REACTOR DE 160L	TAMAÑO Size	PLANO No. Drawing No.	Rev.
1:10	UAB	A2	3103	5



Marca	Nº pieza	DENOMINACION	Despiece	Dimensiones	Material	Peso	Observaciones
1	1	Virola Øint400	ch.	2000x1000x4	AISI-316	38,5 kg	
2	1	Fondo Klopper Virola	Ø	Ø408x4	AISI-316	5,73 kg	
3	1	Camisa de calefacción	ch.	2500x1000x3	AISI-304	27,2 kg	
4	1	Aislamiento	ch.	3000x1500x2	AISI-304	23,62 kg	
5	1	Fondo Klopper Aislamiento	Ø	Ø543x3	AISI-316	8,3 kg	
6	1	Aro de cierre superior de camisa	ch.	2000x1000x6	AISI-304	2,24 kg	
7	1	Chapa cierre camisa de calefacción	ch.	2500x1000x3	AISI-304	1,83 kg	
8	1	Brida DN400	Ø	Øext565 e=32	AISI-316	28,65 kg	
9	1	Brida ciega DN400	Ø	Ø565 e=26	AISI-316	45,11 kg	
10	8	Clamp 1.5in acoplado a tapa	Ø	Ø38x1.5 L=28	AISI-304	0,07 kg	
11	16	Tornillo DIN931 M27	Ø	M27 L=90	Acero dulce	0,6 kg	
12	32	Arandela DIN125 M27	Ø	M27	Acero dulce	0,04 kg	
13	16	Tuerca ciega DIN1587 M27	Ø	M27	Acero dulce	0,2 kg	
14	1	Macho Mirilla NW80	Ø	Ø84 L=35	AISI-316	0,62 kg	
15	1	Carrete Ø85x2	Ø	Ø85x2 L=20	AISI-316	0,08 kg	
16	1	Cristal Mirilla NW80.	Ø		Vidrio	0,04 kg	
17	9	Abrazadera 1.5in	Ø	Ø1½"	AISI-316	0,29 kg	
18	1	Tuerca Mirilla NW80	Ø		AISI-316	0,77 kg	
19	4	Pata Ø76x1.6	Ø	Ø76x1.6	AISI-316	1,92 kg	
20	4	Casquillo Pie Regulable_Ø76	Ø	Ø76 L=40	AISI-304	0,94 kg	
21	4	Pie regulable	Ø	Ø80 L=130	AISI-304	1,18 kg	
22	4	Placa apoyo	Ø	Ø80 L=12	AISI-304	0,61 kg	
23	7	Carrete Ø38.1.5	Ø	Ø38x1.65 L=23.5	AISI-316	0,03 kg	
24	1	Casquillo Clamp 3in	Ø	Ø76.1x1.5 L=28	AISI-316	0,13 kg	
25	1	Carrete Ø76.1x1.5	Ø	Ø76.1x1.5 L=23.5	AISI-316	0,07 kg	
26	1	Clamp ciego 3in	Ø	Ø76.1 L=10	AISI-316	0,3 kg	
27	9	Clamp ciego 1.5in	Ø	Ø38 L=10	AISI-316	0,09 kg	
17	1	Abrazadera 3in	Ø	Ø3"	AISI-316	0,44 kg	
29	1	Tapa cono inferior aislamiento	ch.	2000x1000x2	AISI-304	0,22 kg	
32	2	Carrete Ø38x1.5 (virola)	Ø	Ø38x1.5 L=20	AISI-316	0,02 kg	
33	2	Casquillo Clamp 1.5in virola	Ø	Ø38x1.5 L=28	AISI-316	0,07 kg	
34	2	Conexión INGOL	Ø		AISI-316	0,43 kg	
35	2	Carrete Ø38x1.5 (camisa)	Ø	Ø38x1.5 L=47	AISI-316	0,07 kg	
37	1	Guia espiral camisa calefacción	ch.	2000x1000x2	AISI-304	1,85 kg	
43	1	Cierre aislamiento	ch.	3000x1500x2	AISI-304	1,72 kg	
44	2	Casquillo Clamp 1.5in (camisa)	Ø	Ø38x1.5 L=28	AISI-316	0,07 kg	
46	1	Casquillo Clamp 1.5in (fondo)	Ø	Ø38x1.65 L=21.5	AISI-316	0,05 kg	
47	1	Brida DN80 DIN 2576	Ø	Øext200 Øint93.3 e=20	AISI-316	3,69 kg	
48	8	Tornillo DIN931 M16	Ø	Ø18 L=40	Acero dulce	0,13 kg	
49	8	Arandela DIN125 M16	Ø	Ø18	Acero dulce	0,01 kg	

LISTA DE MATERIALES

Rev.	Fecha/Date	Descripción/Description	Dibujado/Drawn by	Aprobado/Approved by

CLIENTE/Customer BIOPROCESS TECHNOLOGY

PROYECTO/Proyect

PEDIDO No./Order No.

FABRICACIÓN No./Manufacture No. O-2954

	FECHA/Date	NOMBRE/Name
DIBUJADO Drawing by	18/08/2007	E. Muñoz
COMPROBADO Checked by		G. Escobar

TECALSA
TECNICA Y CALDERERIA, S.A.L.

ESCALA Scale 1:7.5

REACTOR 120L

UAB

PESO NETO Net Weight

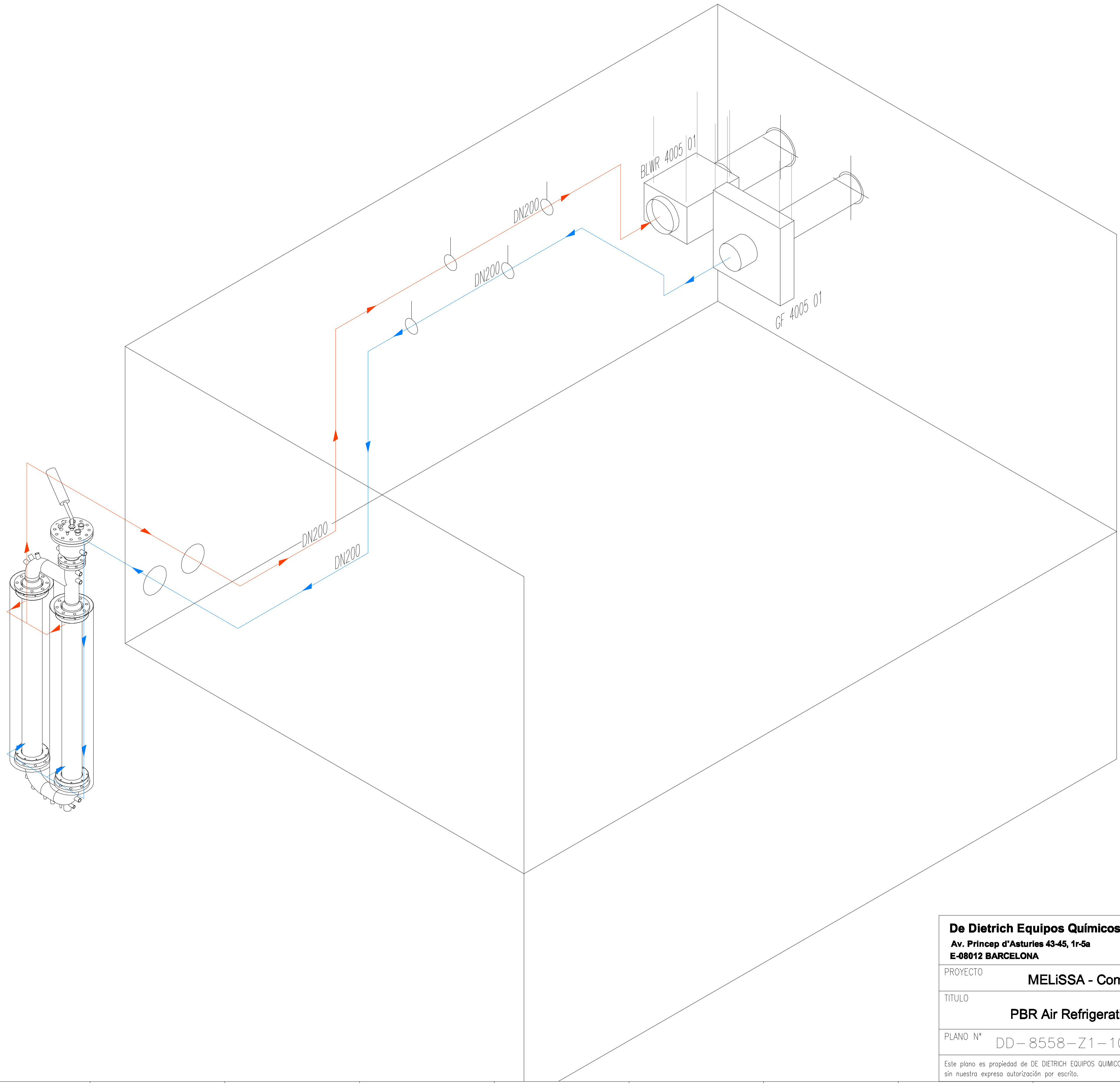
TAMAÑO Size A2

PLANO No. Drawing No.

Rev. 1

8. ISOMETRIC DRAWINGS

8.1. Air refrigeration system
8.2. PBR Gas inlet
8.3. PBR Gas outlet
8.4. PBR jacket water
8.5. PBR liquid inlet
8.6. PBR liquid outlet
8.7. Tank VS_4001_01
8.8. Tank VS_4002_01



Rev.	Nota de revisión	Fecha	Dib.	Verif.

De Dietrich Equipos Químicos, 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
Fecha	11-11-2009
Referencia	PRK-5393

PROYECTO: MELiSSA - Compartment IVa

TITULO: PBR Air Refrigeration System

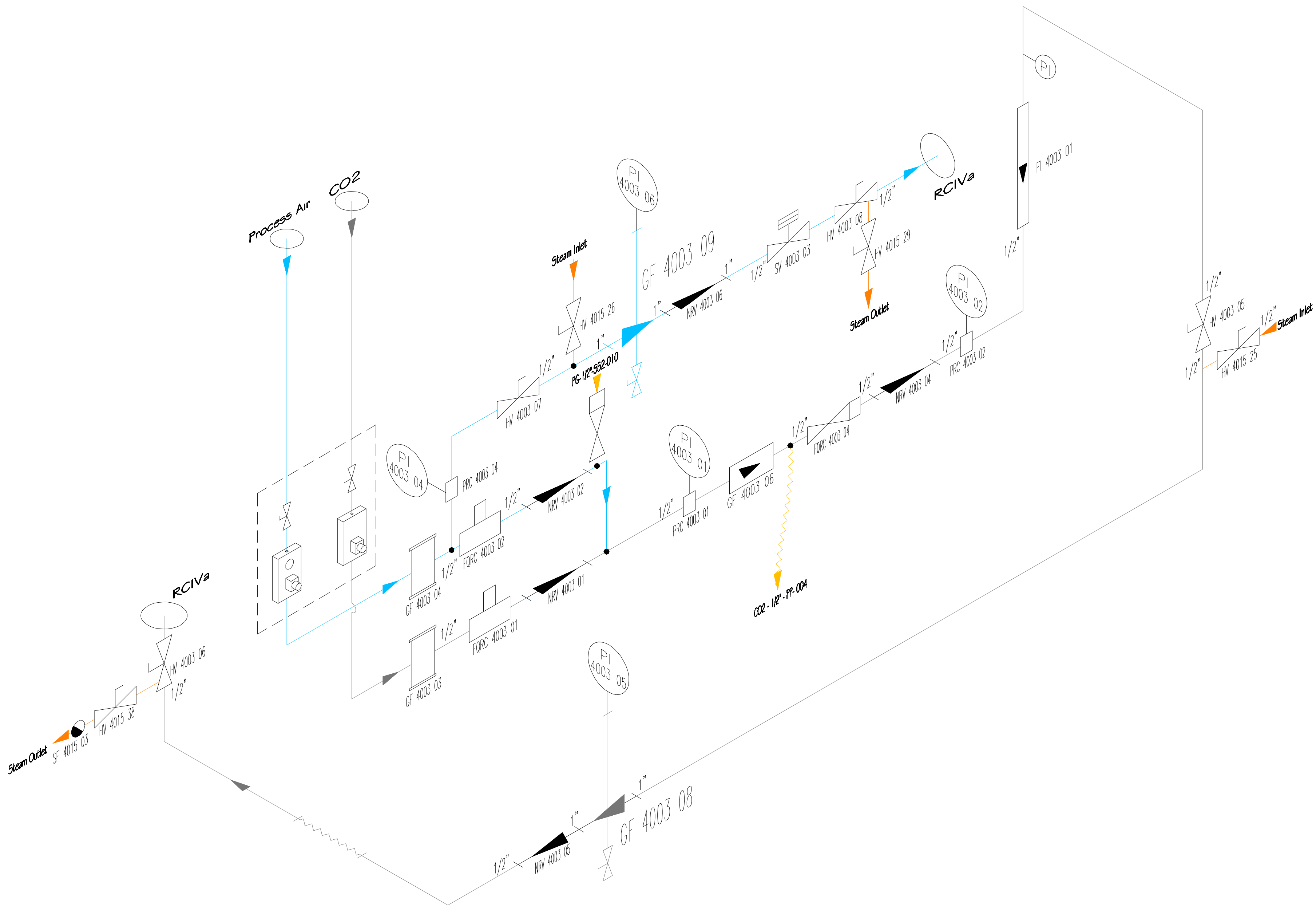
CLIENTE: Universitat Autònoma de Barcelona

PLANO N° DD-8558-Z1-102-02 | Revisión 1 | Escala %

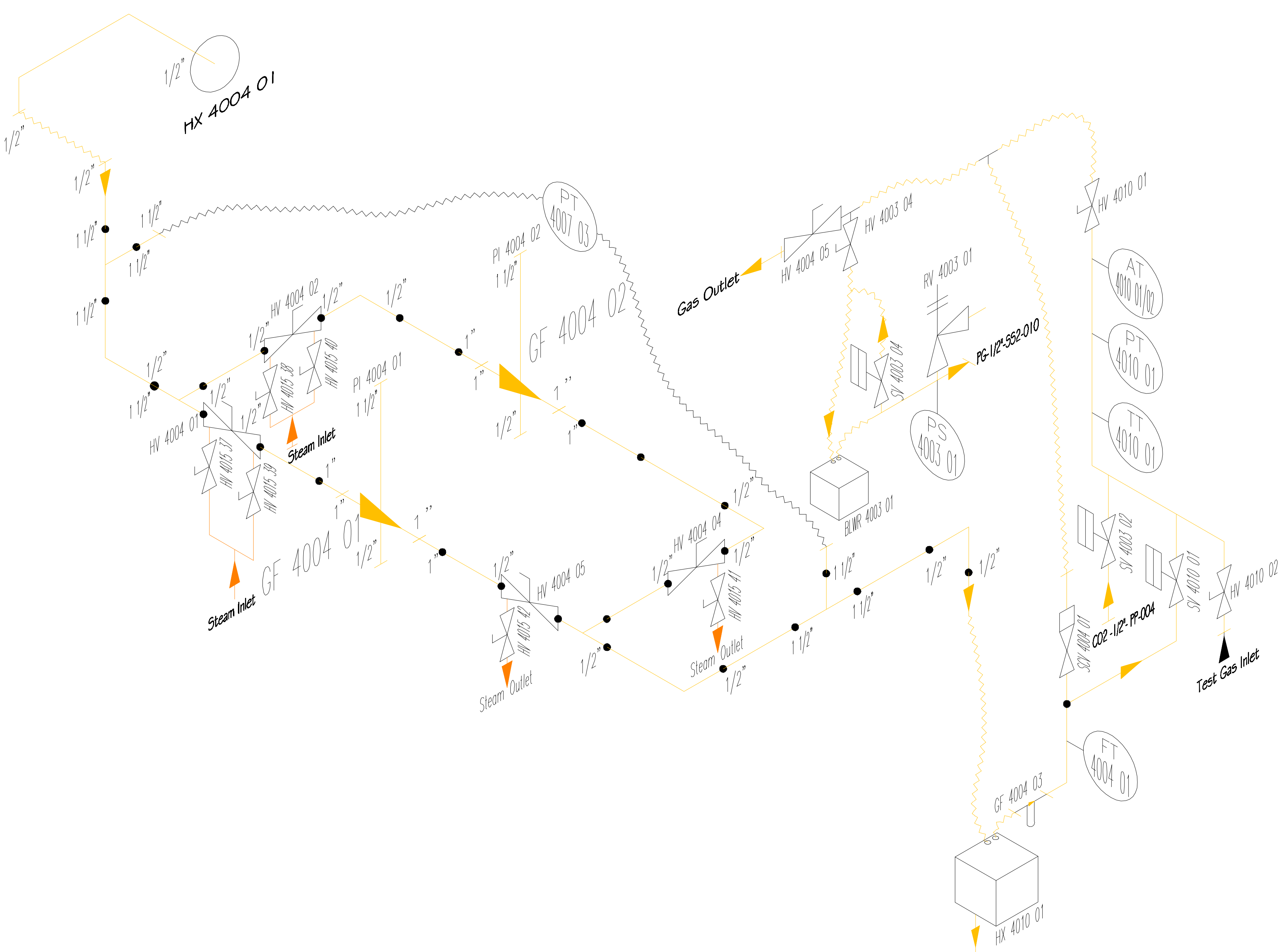
FORMATO: DIN A2

FORMATO: DIN A3

Rev.	Nota de revisión	Fecha	Dib.	Verif.



De Dietrich Equipos Químicos, 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
		Fecha	18-11-09
		Referencia	PRK-5393
PROYECTO	MELiSSA - Compartment IVa	CLIENTE	Universitat Autònoma de Barcelona
TITULO	PBR Gas Inlet		
PLANO Nº	DD-8558-Z1-106-05	Revisión	1
		Escala	%



Rev.	Nota de revisión	Fecha	Dib.	Verif.

FORMATO: DIN A3

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

Member of De Dietrich PROCESS SYSTEMS

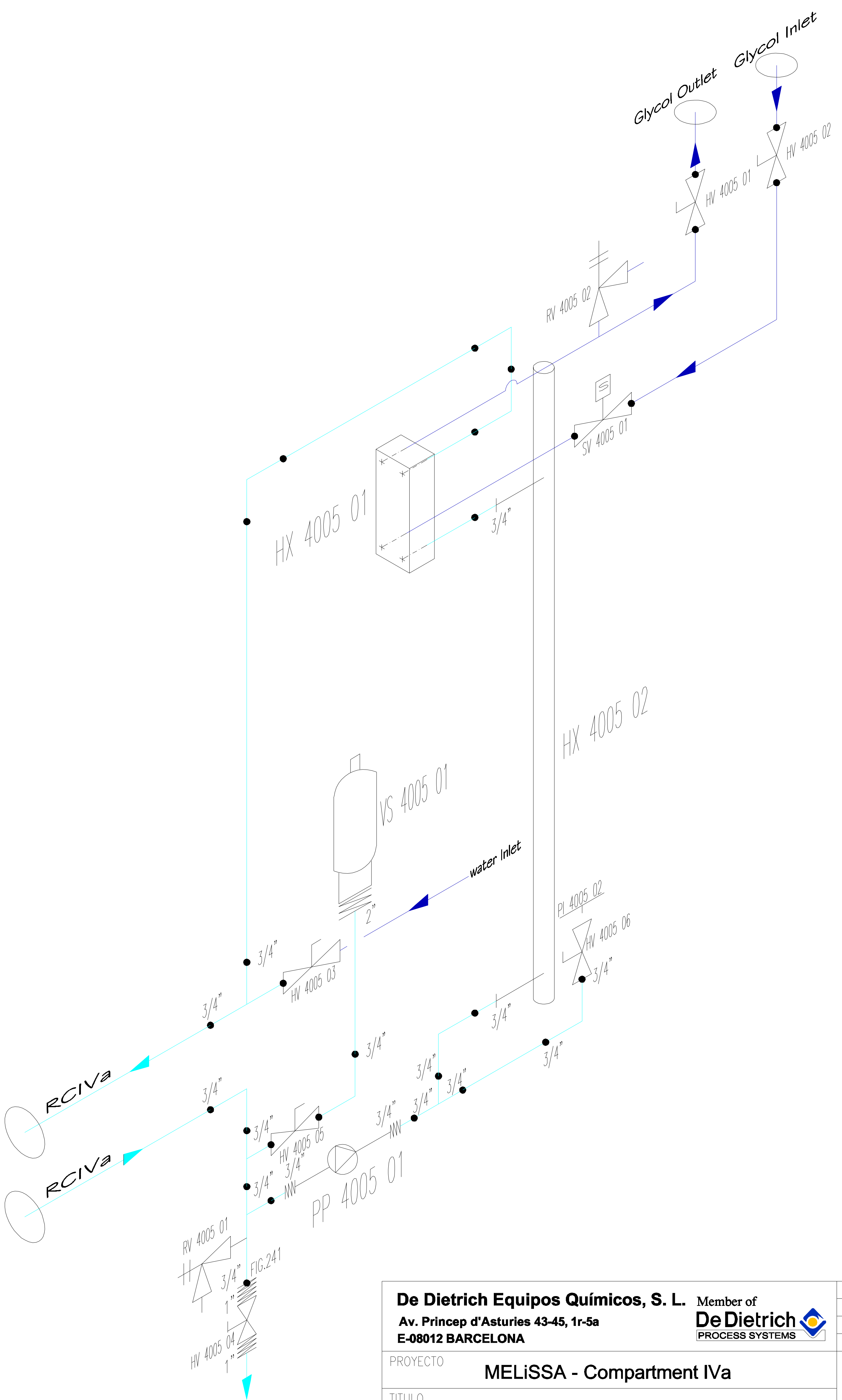
Dibujado	D. Tatay
Comprobado	J. Mestre
Fecha	18-11-09
Referencia	PRK-5393

PROYECTO: MELiSSA - Compartment IVa

CLIENTE: Universitat Autònoma de Barcelona

TITULO: PBR RCIVa Gas Outlet

PLANO Nº: DD-8558-Z1-106-04 | Revisión: 1 | Escala: %



Rev.	Nota de revisión	Fecha	Dib.	Verif.

FORMATO: DIN A3

De Dietrich Equipos Químicos, 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
Fecha	18-11-09
Referencia	PRK-5393

PROYECTO: MELiSSA - Compartment IVa

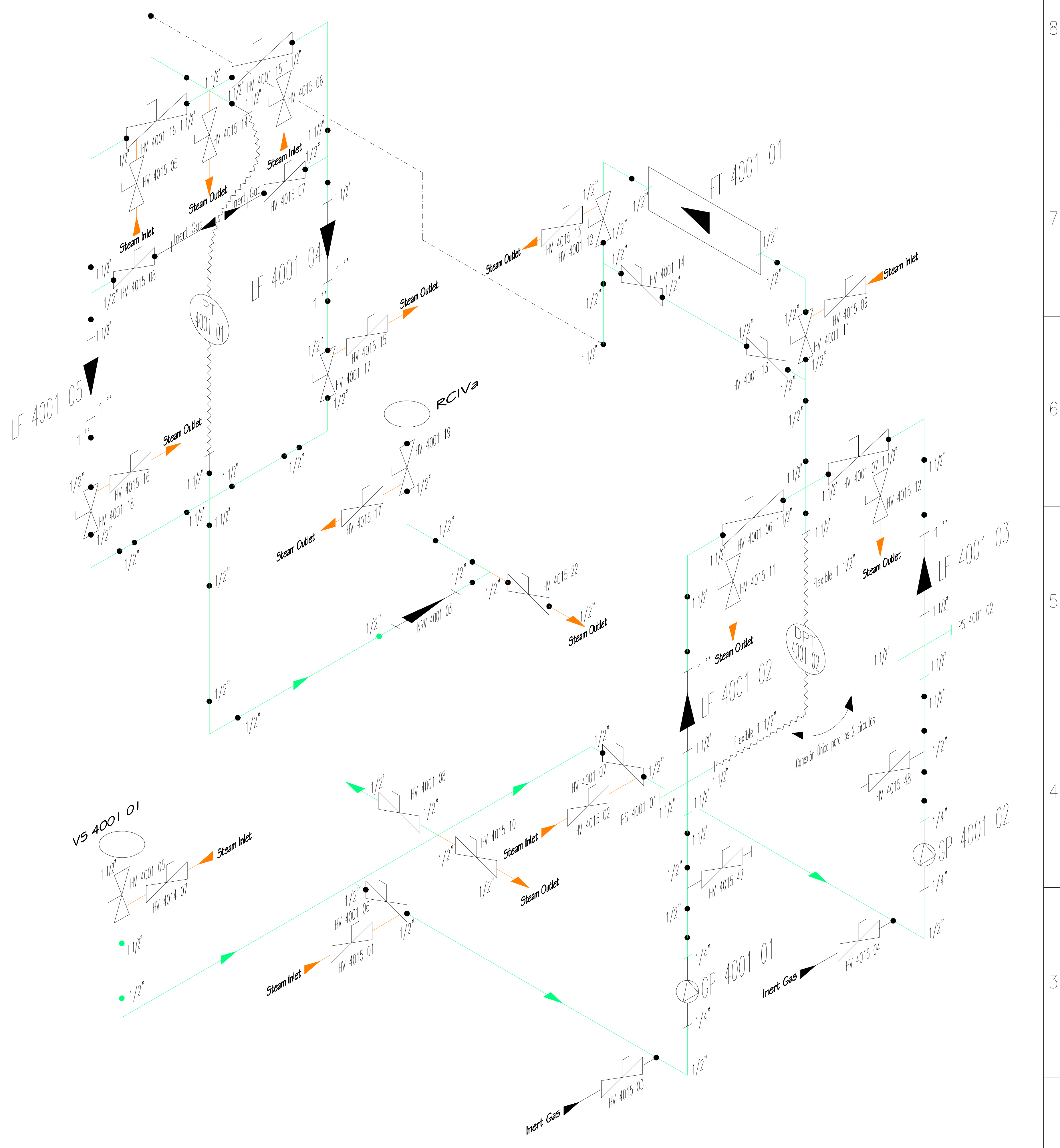
TITULO: PBR Jacket Water Inlet / Outlet

CLIENTE: Universitat Autònoma de Barcelona

PLANO Nº: DD-8558-Z1-106-02

Revisión: 1

Escala: %



Dibujado	D. Tatay
Comprobado	J. Mestre
Fecha	18-11-09
Referencia	PRK-5393

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

Member of De Dietrich PROCESS SYSTEMS

PROYECTO
MELiSSA - Compartment IVa

TITULO
PBR Liquid Inlet

CLIENTE
Universitat Autònoma de Barcelona

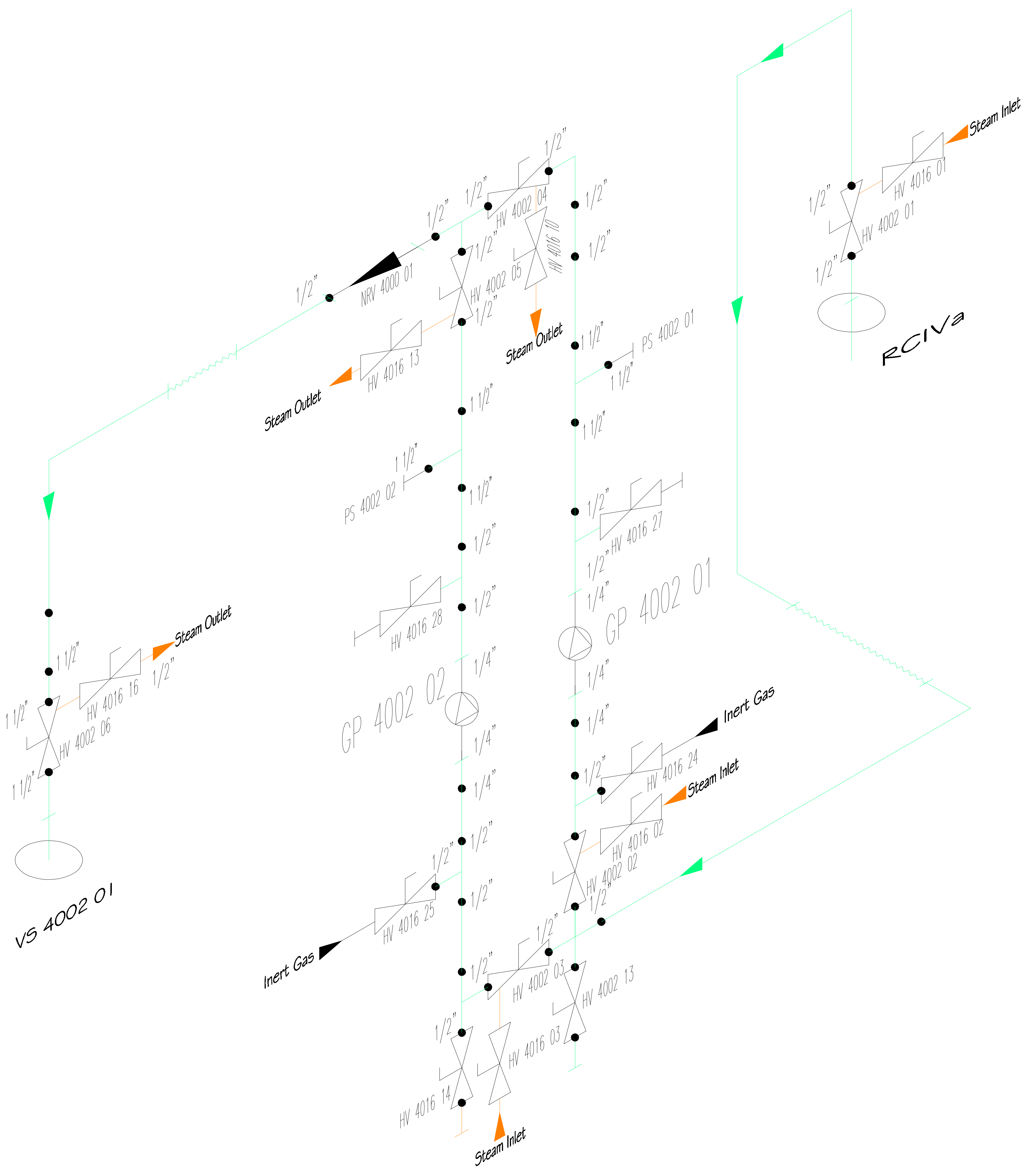
PLANO Nº DD-8558-Z1-106-01

Revisión 1

Escala %

FORMATO: DIN A3

Rev.	Nota de revisión	Fecha	Dib.	Verif.



Rev.	Nota de revisión	Fecha	Dib.	Verif.

De Dietrich Equipos Químicos, 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
Fecha	18-11-09
Referencia	PRK-5393

PROYECTO: MELiSSA - Compartment IVa

TITULO: PBR Liquid Outlet

CLIENTE: Universitat Autònoma de Barcelona

PLANO Nº: DD-8558-Z1-106-03

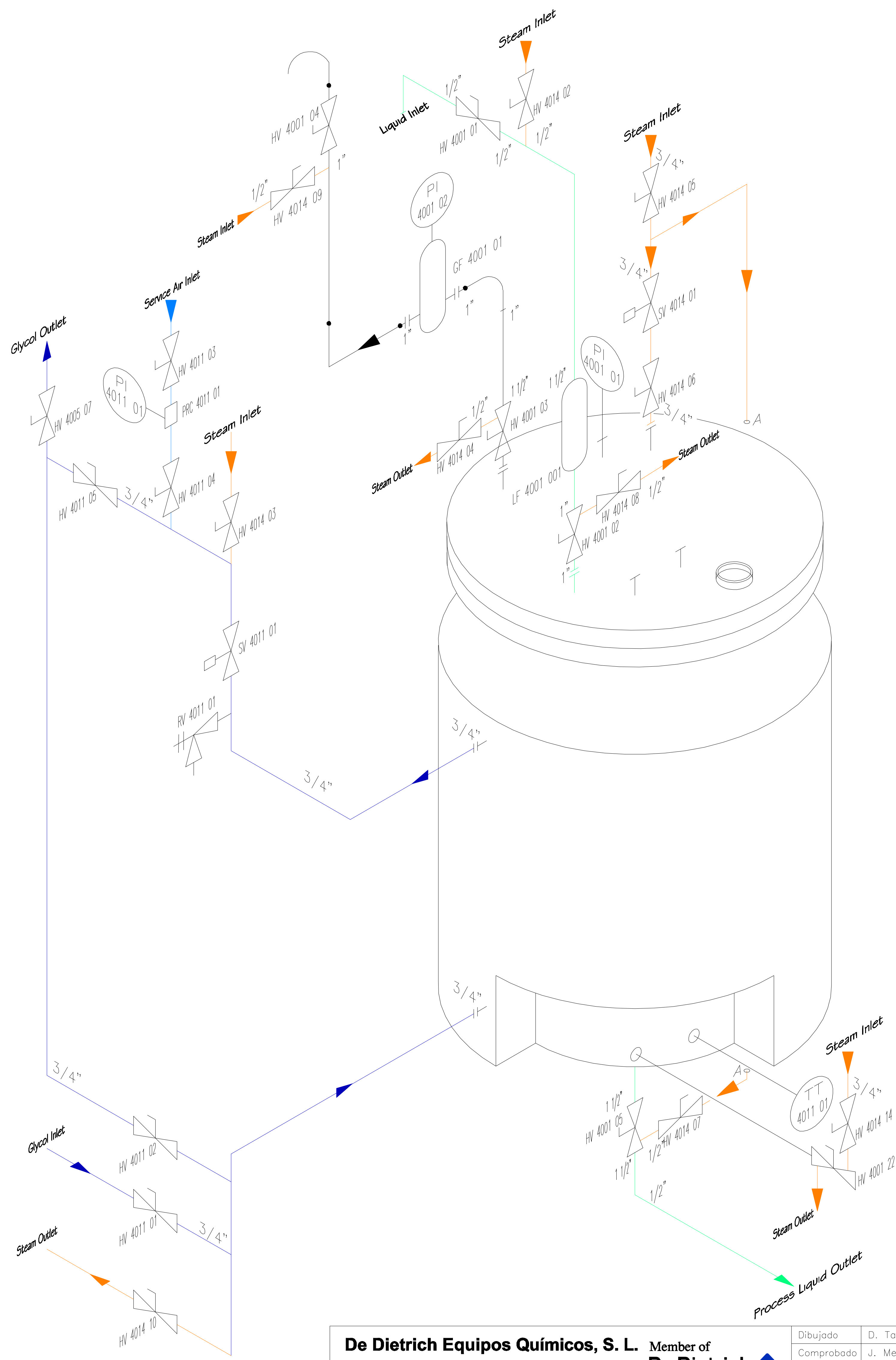
Revisión: 1

Escala: %

FORMATO: DIN A3

FORMATO: DIN A3

Rev.	Nota de revisión	Fecha	Dib.	Verif.



Dibujado	D. Tatay
Comprobado	J. Mestre
Fecha	18-11-09
Referencia	PRK-5393

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

Member of De Dietrich PROCESS SYSTEMS

PROYECTO: MELiSSA - Compartment IVa

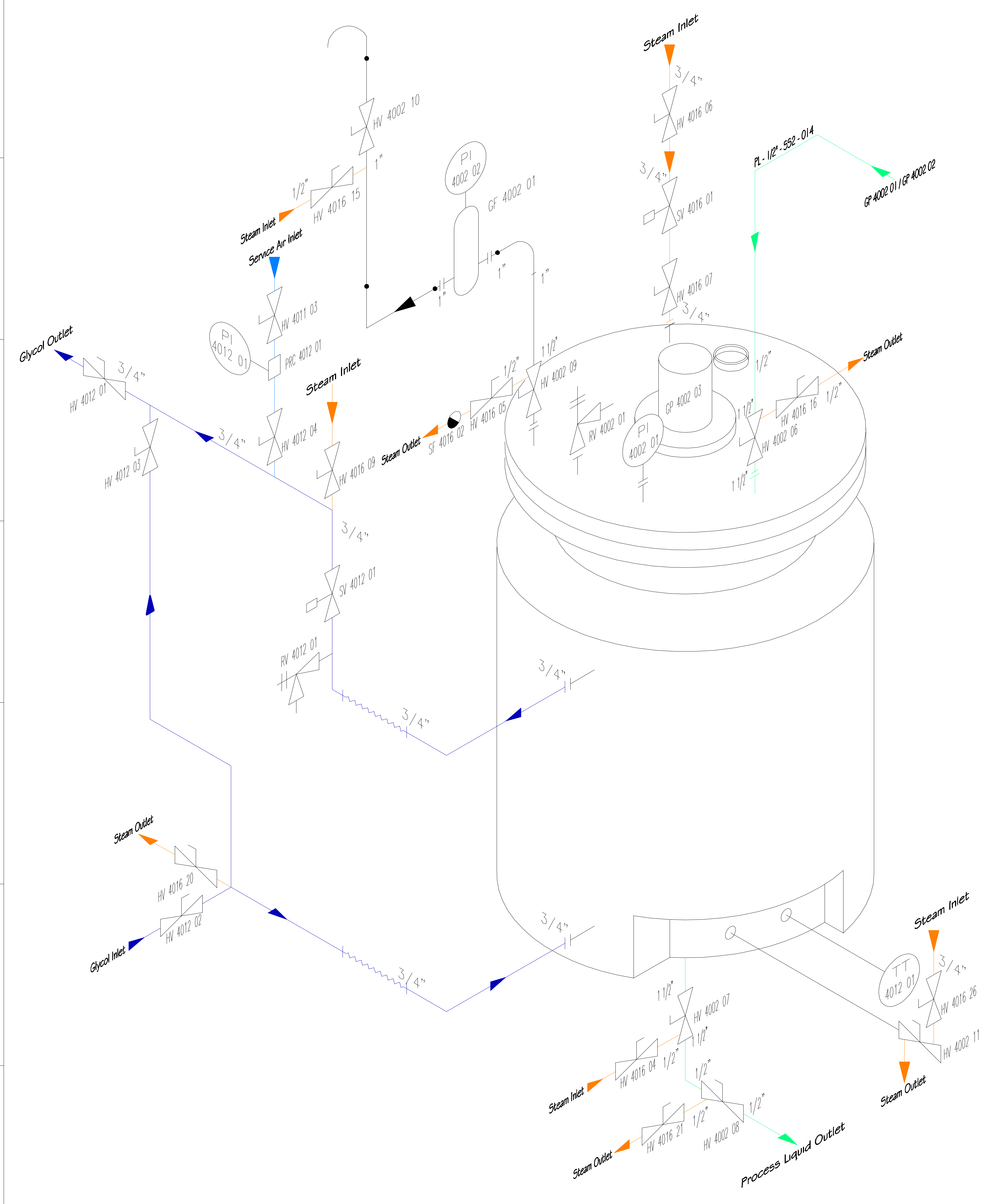
TITULO: TANK VS 4001 01

CLIENTE: Universitat Autònoma de Barcelona

PLANO Nº: DD-8558-Z1-106-05 | Revisión: 1 | Escala: %

FORMATO: DIN A3

Rev.	Nota de revisión	Fecha	Dib.	Verif.



De Dietrich Equipos Químicos, S. L. **Av. Princep d'Asturies 43-45, 1r-5a** **E-08012 BARCELONA**	Member of De Dietrich PROCESS SYSTEMS	Dibujado	D. Totoy
		Comprobado	J. Mestre
		Fecha	18-11-09
		Referencia	PRK-5393
PROYECTO	MELiSSA - Compartment IVa	CLIENTE	Universitat Autònoma de Barcelona
TITULO	HARVESTING TANK VS 4002 01		
PLANO Nº	DD-8558-Z1-106-05	Revisión 1	Escala %

9. FUNCTIONAL SPECIFICATION

FUNCTIONAL SPECIFICATION

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

IMPORTANT NOTE: The alarms and lock outs described in this document are only the ones considered by the hardware point of view. There will be more alarms concerning the process which are not defined in this document.

The documents of reference for this section are:

- P&ID DD-8558-Z1-100-02 rev. 8 (P&ID and control diagram)
- Final instruments lists and specifications

LOOP NUMBER	DESCRIPTION
4000	Bioreactor lighting control
4001	Inlet liquid flow control
4002	Outlet liquid flow control
4003	Inlet gas flow control
4004	Outlet gas flow control
4005	Bioreactor temperature control
4006	Bioreactor pH control
4007	Bioreactor pressure control
4008	Bioreactor liquid level control
4009	Bioreactor biomass production control
4010	Bioreactor outlet gas composition control
4011	Feeding tank temperature control
4012	Harvesting tank temperature control
4013	Antifoam control
4014	Feeding tank sterilization
4015	Bioreactor sterilization
4016	Harvesting tank sterilization

1 Loop 4000. Bioreactor lighting control

This loop regulates the light intensity. The intensity is controlled by the PLC and is not possible to do it locally. This loop is a manual actuation (Reactor light intensity measures don't exist).

To actuate directly over the light intensity, the loop 4009 (Bioreactor biomass production control) should be deactivated.

IMPORTANT NOTE: The activation of loop 4009 means the deactivation of loop 4000.

1.1 Control elements

- IRC 4000 01: Light supply system

1.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
IRC 4000 01	IRC_4000_MV	400115	Light Intensity	AO	0...100 %	4/20 mA

1.3 PLC Input signals *(Future installation)*

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
IRC 4000 01	IT_4000_01	300145	Light Power Phase 1*)	AI		4/20 mA
IRC 4000 01	IT_4000_02	300146	Light Power Phase 2*)	AI		4/20 mA
IRC 4000 01	IT_4000_03	300147	Light Power Phase 3*)	AI		4/20 mA

*) *Note: These signals are not implemented yet in the plant. The signals are foreseen in phoenix connectors' cabinet and connected to PLC. The connection of these signals was checked during CIVa electrical tests done by DDEQ/NTE.*

1.4 Alarms and warnings

Tag	Variable	Alarm	Action	Lock out
1)	Temperature	H	To notify alarm to supervision	
1)	Temperature	HH	To notify alarm to supervision and set safety value to light power	light intensity (safety value)

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

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4005 01	TT_4005_01	300141	Reactor temperature measurement	AI	0…150 ºC	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI	0…140 ºC	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI	0…140 ºC	4/20 mA

⚠ **From hardware point of view and regarding glass constraints, the permissible operating temperature is 200ºC, provided that there is no sudden temperature shock.**

(*See chapter 2.2.1.5: Operating permissible conditions* of the Operation Manual)

2 Loop 4001. Inlet liquid flow control

This loop regulates the reactor inlet liquid flow. Liquid input media is provided from two pumps (GP 4001 01 and GP 4001 02), working alternatively depending on the pre-filters blockage or pump maintenance.
Flow rate set point is provided by the supervision.

2.1 Control elements

- LT 4001 01: Level transmitter. Feeding tank (VS 4001 01) level measurement.
- PS 4001 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4001 01/02: Pressure switch. Lines over-pressure detection.
- DPT 4001 02: Differential pressure transmitter. ΔP measurement for pre-filters (LF 4001 02/03) blockage control.
- FT 4001 01: Liquid mass flow meter. Reactor inlet liquid flow measurement.
- DPT 4001 01: Differential pressure transmitter. ΔP measurement for filters (LF 4001 04/05) blockage control.
- GP 4001 01/02 speed regulator: Feed pumps. Liquid pumping to the reactor liquid inlet.
- GP 4001 03 speed regulator: Magnetic agitator. Feeding vessel agitation.

2.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
GP 4001 03	GP_4001_03_MV2	400113	VS 4001 01 agitator speed set point	AO	50 Hz = 1400 rpm	4/20 mA
GP 4001 01/02	GP_4001_01_MV2	400109	Flow setpoint to the inlet pumps	AO		4/20 mA
GP 4001 03		000110	Start/Stop GP 4001 03 converter	DO	N/A	0/1
GP 4001 01	GP_4001_01_MV1	000091	Start/Stop of the pump	DO	N/A	0/1
GP 4001 02	GP_4001_02_MV1	000090	Start/Stop of the pump	DO	N/A	0/1
GP 4001 01/02		000111	Start/Stop GP 4001 01/02 converter	DO	N/A	0/1

2.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FT 4001 01	FT_4001_01	300130	Total liquid inlet flow to reactor	AI	0…20 kg/h	4/20 mA
LT 4001 01	LT_4001_01	300131	VS 4001 01 level	AI	0…100 %	4/20 mA
DPT 4001 01	DPT_4001_01	300138	Differential pressure measurement	AI	0…3 bar	4/20 mA
DPT 4001 02	DPT_4001_02	300139	Differential pressure measurement	AI	0…3 bar	4/20 mA
GP 4001 03	GP_4001_03_ERR	100104	Thermal protection of the agitator	DI	N/A	0/1
PS 4001 01	PS_4001_01	100082	Pressure switch	DI	N/A	0/1
PS 4001 02	PS_4001_02	100083	Pressure switch	DI	N/A	0/1
PS 4001 03	PS_4001_03	100106	Pressure switch (GP 4001 01)	DI	N/A	0/1
PS 4001 04	PS_4001_04	100107	Pressure switch (GP 4001 02)	DI	N/A	0/1
GP 4001 01/02	GP_4001_01_ERR	100099	Thermal protection of the inlet pumps	DI	N/A	0/1

2.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**LT 4001 01**	Level	L	To notify alarm to supervision	------
2	**LT 4001 01**	Level	LL	To notify alarm to supervision	GP 4001 01/02 and GP 4001 03
3	**PS 4001 03/04**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
4	**PS 4001 01/02**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
5	**DPT 4001 02**	Differential pressure	H	To notify alarm to supervision	------
6	**DPT 4001 02**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02
7	**DPT 4001 01**	Differential pressure	H	To notify alarm to supervision	------
8	**DPT 4001 01**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02

1 → WARNING: Feeding vessel level is at ------% or lower.

2 → ALARM: VS 4001 01 is empty. Stop feeding pumps and vessel agitator.

3 → ALARM: The membrane of the feeding pump has broken.

⚠ **The pump works with a sandwich membrane which permits a quickly damage detection. If work membrane is broken, the process product is conducted through the control membrane to the pressure switch. When the sensors alarm is activated, the pump can continue with working by means of a fourth membrane during a maximum time of 24h.** *(*See chapter *10.1: Maintenance of pumps* of the Operation Manual*)*

4 → ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop feeding pumps.

5 / 7 → WARNING: The differential pressure (inlet/outlet of filter) has rise to ------bar. (Preventive maintenance)

6 / 8 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 0.3 bar. Stop feeding pumps.

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

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

3 Loop 4002. Outlet liquid flow control

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

IMPORTANT NOTE: The activation of loop 4002 means the deactivation of loop 4008 which controls indirectly the outlet liquid flow by controlling the PBR level.

3.1 Control elements

- PS 4002 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4002 01/02: Pressure switch. Lines over-pressure detection.
- WT 4002 01: Weight measurement. Harvesting tank (VS 4002 01) weight measurement for controlling the tank level.
- GP 4002 01/02 speed regulator: Feed pumps. Reactor outlet liquid pumping to the harvesting vessel.
- GP 4001 03 speed regulator: Mechanic agitator. Harvesting vessel agitation.

3.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
GP 4002 01/02	GP_4002_01_MV2	400111	Flow set point to the outlet pumps	AO		4/20 mA
GP 4002 03	GP_4002_03_MV2	400114	VS 4001 01 agitator speed set point	AO		4/20 mA
GP 4002 01	GP_4002_01_MV1	000089	Start/Stop of the pump	DO	N/A	0/1
GP 4002 02	GP_4002_02_MV1	000104	Start/Stop of the pump	DO	N/A	0/1
GP 4002 01/02		000112	Start/Stop GP 4002 01/02 converter	DO	N/A	0/1
GP 4002 03		000109	Start/Stop GP 4002 03 converter	DO	N/A	0/1

3.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
WT 4002 01	WT_4002_01	300132	Weight Balance (VS 4002 01)	AI	0…500 Kg	4/20 mA
GP 4002 01/02	GP_4002_01_ERR	100101	Thermal protection of the outlet pumps	DI	N/A	0/1
GP 4002 03	GP_4001_03_ERR	100105	Thermal protection of the agitator	DI	N/A	0/1
PS 4002 01	PS_4002_01	100084	Pressure switch	DI	N/A	0/1
PS 4002 02	PS_4002_02	100085	Pressure switch	DI	N/A	0/1
PS 4002 03	PS_4002_03	100108	Pressure switch (GP 4002 01)	DI	N/A	0/1
PS 4002 04	PS_4002_04	100109	Pressure switch (GP 4002 02)	DI	N/A	0/1

3.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**PS 4002 03/04**	Pressure	H	To notify alarm to supervision	GP 4002 01/02
2	**PS 4002 01/02**	Pressure	H	To notify alarm to supervision	GP 4002 01/02
3	**WT 4002 01**	Weight (level)	H	To notify alarm to supervision	
4	**WT 4002 01**	Weight (level)	HH	To notify alarm to supervision	GP 4002 01/02
5	**WT 4002 01**	Weight (level)	L	To notify alarm to supervision	GP 4002 03

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

1 → ALARM: The membrane of the harvesting pump has broken.

2 → ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop harvesting pumps.

3 → WARNING: Harvesting vessel level is at ------% or upper.

4 → ALARM: VS 4002 01 is full. Stop harvesting pumps.

5 → WARNING: Harvesting vessel level is at ------% or lower. Stop the vessel agitator.

4 Loop 4003. Inlet gas flow control

This loop regulates the reactor inlet gas flow and its composition. To do this, there is one control valve/flow meter installed in each reactor inlet gas pipe which permits to control the total flow as well as its composition.

4.1 Control elements

- FQRC 4003 01: Control valve/Flow meter. CO_2 flow measure and control.
- FQRC 4003 02: Control valve/Flow meter. Process air flow measure and control.
- FQRC 4003 03: Control valve/Flow meter. Circulated gas flow measure and control
- FQRC 4003 04: Control valve/Flow meter. Total inlet gas flow measure and control
- SV 4003 01: Control valve. Open/close the total inlet gas line to analyzer.
- SV 4003 02: Control valve. Open/close the inlet gas line for biomass sensor cleaning.
- SV 4003 03: Control valve. Open/close the compressor recycles.
- PS 4003 04: Pressure switch. Controls the valve SV 4003 04 in case of over pressure

4.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FQRC 4003 01	FQRC_4003_01_SP	400100	Inlet CO_2 flow set point	AO		0-5 V
FQRC 4003 02	FQRC_4003_02_SP	400101	Inlet Air flow set point	AO		0-5 V
FQRC 4003 03	FQRC_4003_03_SP	400102	Circulated air flow set point	AO		0-5 V
FQRC 4003 04	FQRC_4003_04_SP	400103	Total Inlet gas flow set point	AO		0-5 V
SV 4003 01	SV_4003_01_MV	000093	Analyzer gas inlet valve (Open/Close)	DO	N/A	0/1
SV 4003 02	SV_4003_02_MV	000095	Reactor air inlet valve (Open/Close)	DO	N/A	0/1
SV 4003 03	SV_4003_03_MV	000096	Blower bypass valve (Open/Close)	DO	N/A	0/1
BLWR 4003 01	BLWR_4003_01_MV1	000103	Start/Stop of the blower	DO	N/A	0/1

4.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FQRC 4003 01	FQRC_4003_01	300109	Inlet CO_2 flow measurement	AI		0-5 V
FQRC 4003 02	FQRC_4003_02	300110	Inlet Air flow measurement	AI		0-5 V
FQRC 4003 03	FQRC_4003_03	300111	Circulated air flow measurement	AI		0-5 V
FQRC 4003 04	FQRC_4003_04	300112	Total Inlet gas flow measurement	AI		0-5 V
SV 4003 01	SV_4003_01_FB	100097	Analyzer gas inlet valve (Limit switch)	DI	N/A	0/1
SV 4003 02	SV_4003_02_FB	100095	Reactor air inlet valve (Limit switch)	DI	N/A	0/1
SV 4003 03	SV_4003_03_FB	100094	Blower bypass valve (Limit switch)	DI	N/A	0/1
PS 4003 01	PS_4003_01	100110	Pressure switch bypass for recycling	DI	N/A	0/1

4.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**PS 4003 01**	Pressure	H	To notify alarm to supervision and to open SV 4003 03	------
2	**SV 4003 01**	(Limit switch)	Err	To notify alarm to supervision	------
3	**SV 4003 02**	(Limit switch)	Err	To notify alarm to supervision	------
4	**SV 4003 03**	(Limit switch)	Err	To notify alarm to supervision	Stop blower BLWR 4003 01

1 → ALARM: The pressure of the pipe is higher than the maximum compressor operating pressure (2.2 bar). Open the compressor recycle valve.

2 → ALARM: The automatic valve is not working. To notify failure.

3 → ALARM: The automatic valve is not working. To notify failure.

4 → ALARM: The automatic valve is not working. To notify failure and stop the compressor.

5 Loop 4004. Outlet gas flow control

This loop regulates the C.IVa outlet gas flow and its composition. This loop measures the gas flow and its composition and provides this information to the control system.

IMPORTANT NOTE: The activation of loop 4004 means the deactivation of loop 4007 which controls indirectly the outlet gas flow by controlling the reactor pressure.

5.1 Control elements

- DPT 4004 01: Differential pressure transmitter. ΔP measurement for filters (GF 4004 01/02) blockage control.
- FT 4004 01: Flow meter. Outlet gas flow measure.
- SCV 4004 01: Control valve. Outlet gas flow control.

5.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SCV 4004 01	SCV_4004_01_MV	400108	Reactor outlet gas flow set point	AO	0...100 %	4/20 mA

5.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI	0…20 Nl/min	4/20 mA
DPT 4004 01	DPT_4004_01	300140	Differential pressure measurement	AI	0...3 bar	4/20 mA

5.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	DPT 4004 01	Pressure	H	To notify alarm to supervision	
2	DPT 4004 01	Pressure	HH	To notify alarm to supervision	

1 → WARNING: The differential pressure (inlet/outlet of filter) has rise to ------bar. (Preventive maintenance)

2 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 0.3 bar.

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

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

6 Loop 4005. Bioreactor temperature control

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

6.1 Control elements

- TT 4005 01: Temperature transmitter. Bioreactor temperature measurement.
- TT 4006 01: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- TT 4006 02: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- BLWR 4005 01: Air Extractor. Air circulation in bioreactor refrigeration system by air.
- SV 4005 01: Control valve. Cooling water flow control.
- HX 4005 02: Electrical resistance. Electrical resistance for water heating.

6.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
BLWR 4005 01	BLWR_4005_01_MV2	400104	Air extractor setpoint (lightening refrig.)	AO	0…100 %	0-10 V
HX 4005 02	HX_4005_02_MV1	000100	Start/Stop electrical resistance	DO	N/A	0/1
BLWR 4005 01	BLWR_4005_01_MV1	000099	Start/Stop of the extractor	DO	N/A	0/1
SV 4005 01	SV_4005_01_MV	000088	Cooling water valve (Open/Close)	DO	N/A	0/1
PP 4005 01	PP_4005_01_MV1	000102	Start/Stop of the pump	DO	N/A	0/1

6.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4005 01	TT_4005_02	300141	Reactor temperature measurement	AI	0…150 ºC	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI	0…140 ºc	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI	0…140 ºc	4/20 mA
BLWR 4005 01	BLWR_4005_01_ERR	100103	Thermal protection of the extractor	DI	N/A	0/1
SV 4005 01	SV_4005_01_FB	100086	Cooling water valve (Limit switch)	DI	N/A	0/1

6.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	***)**	Temperature	H	To notify alarm to supervision	
2	***)**	Temperature	HH	To notify alarm to supervision	light intensity (safety value)
3	**BLWR 4005 01**		Thermal protection	To notify alarm to supervision	
4	**SV 4005 01**	Limit switch	Err	To notify alarm to supervision	

*) The temperature value to set these alarms will be defined in the control software depending on the type of data processing. There are three values of the reactor temperature measured: TT 4005 01, TT 4006 01 and TT 4006 02.

1 → WARNING: The PBR temperature has rise to ------ºC.

2 → ALARM: The PBR temperature has rise to ------ºC (maximum process admissible temperature). Set light intensity to safety value (--- %)

⚠ **From hardware point of view, and regarding glass constraints, the permissible operating temperature is <u>200ºC</u>, provided that there is no sudden temperature shock.**

(*See chapter 2.2.1.5: Operating permissible conditions* of the Operation Manual)

3 → ALARM: Alarm from the blower thermal protection.

4 → ALARM: The automatic valve is not working. To notify failure.

7 Loop 4006. Bioreactor pH control

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

7.1 Control elements

- AT 4006 01: pH sensor/transmitter. Bioreactor pH measurement. (BPR upper part)
- AT 4006 02: pH sensor/transmitter. Bioreactor pH measurement. (BPR lower part)
- SV 4006 01: Control valve. Acid addition regulation.
- SV 4006 02: Control valve. Base addition regulation.
- WT 4006 01: Scale. Acid bottle weight measurement for level control.
- WT 4006 02: Scale. Base bottle weight measurement for level control.

7.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4006 01	SV_4006_01_MV	000083	Reactor acid inlet valve (Open/Close)	DO	N/A	0/1
SV 4006 02	SV_4006_02_MV	000082	Reactor base inlet valve (Open/Close)	DO	N/A	0/1
PP 4006 01	PP_4006_01_MV1	000098	Start/Stop of the pump	DO	N/A	0/1
PP 4006 02	PP_4006_02_MV1	000097	Start/Stop of the pump	DO	N/A	0/1

7.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
AT 4006 01	AT_4006_01	300125	Ph measurement	AI	0…12	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI	0…140 ºC	4/20 mA
AT 4006 02	AT_4006_02	300127	Ph measurement	AI	0…12	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI	0…140 ºC	4/20 mA
SV 4006 01	SV_4006_01_FB	100091	Reactor acid inlet valve (Limit switch)	DI	N/A	0/1
SV 4006 02	SV_4006_02_FB	100092	Reactor base inlet valve (Limit switch)	DI	N/A	0/1
WT 4006 01	WT_4006_01	-----	Acid balance	Eth	0…6 Kg	Ethernet
WT 4006 02	WT_4006_02	-----	Base balance	Eth	0…6 Kg	Ethernet

7.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	***)**	pH	H	To notify alarm to supervision	
2	***)**	pH	L	To notify alarm to supervision	
3	WT 4006 01	Weight (level)	L	To notify alarm to supervision	
4	WT 4006 01	Weight (level)	LL	To notify alarm to supervision	PP 4006 01
5	WT 4006 02	Weight (level)	L	To notify alarm to supervision	
6	WT 4006 02	Weight (level)	LL	To notify alarm to supervision	PP 4006 02
7	SV 4006 01	Limit switch	Err	To notify alarm to supervision	PP 4006 01
8	SV 4006 02	Limit switch	Err	To notify alarm to supervision	PP 4006 02

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

1 → ALARM: The PBR pH has risen to ------.

2 → ALARM: The PBR pH has fallen to ------.

3 → WARNING: Acid vessel level is at ------% or lower.

4 → ALARM: VS 4006 01 is empty. Stop PP 4006 01.

5 → WARNING: Base vessel level is at ------% or lower.

6 → ALARM: VS 4006 02 is empty. Stop PP 4006 02.

7 → ALARM: The automatic valve is not working. To notify failure.

8 → ALARM: The automatic valve is not working. To notify failure.

8 Loop 4007. Bioreactor pressure control

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

IMPORTANT NOTE: The activation of loop 4007 means the deactivation of loop 4004 which controls the outlet gas flow.

8.1 Control elements

- PT 4007 01: Pressure transmitter. Bioreactor pressure measurement.
- PT 4007 02: Pressure transmitter. Bioreactor pressure measurement.
- SCV 4004 01: Control valve. Outlet gas flow control.
- FT 4004 01: Flow meter. Outlet gas flow measure.
- DPT 4004 01: Differential pressure transmitter. ΔP measurement for filters (GF 4004 01/02) blockage control.

8.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SCV 4004 01	SCV_4004_01_MV	400108	Reactor outlet gas flow set point	AO	0 to 100 %	4/20 mA

8.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
PT 4007 01	PT_4007_01	300135	Reactor pressure measurement	AI	-1…1,5 bar	4/20 mA
PT 4007 02	PT_4007_02	300136	Reactor pressure measurement	AI	-1…5 bar	4/20 mA
FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI	0…20 Nl/min	4/20 mA
DPT 4004 01	DPT_4004_01	300140	Differential pressure measurement	AI	0...3 bar	4/20 mA

8.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	***)**	Pressure	H	To notify alarm to supervision	
2	***)**	Pressure	HH	To notify alarm to supervision	FQRC 4003 04 (0 l/min)
3	**DPT 4004 01**	Pressure	H	To notify alarm to supervision	
4	**DPT 4004 01**	Pressure	HH	To notify alarm to supervision	

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

1 → WARNING: The PBR pressure has rise to -----bar.

4 → ALARM: The PBR pressure has rise to ----bar. Close FQRC 4003 04 (PBR gas inlet)

⚠ **From hardware point of view, the permissible operating pressure for the glass DN150 cylinders is from -1 bar$_g$ to 2 bar$_g$,**

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

4 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 0.3 bar.

9 Loop 4008. Bioreactor liquid level control

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

IMPORTANT NOTE: The activation of loop 4008 means the deactivation of loop 4002 which controls the outlet liquid flow.

9.1 Control elements

- WT 4008 01: Weight cells. Bioreactor weight measurement for level controlling.
- PS 4002 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4002 01/02: Pressure switch. Lines over-pressure detection.
- WT 4002 01: Weight measurement. Harvesting tank (VS 4002 01) weight measurement for controlling the tank level.
- GP 4002 01/02 speed regulator: Feed pumps. Reactor outlet liquid pumping to the harvesting vessel.
- GP 4002 03 speed regulator: Mechanic agitator. Harvesting vessel agitation.

9.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
GP 4002 01/02	GP_4002_01_MV2	400111	Flow set point to the outlet pumps	AO		4/20 mA
GP 4002 03	GP_4002_03_MV2	400114	VS 4001 01 agitator speed set point	AO		4/20 mA
GP 4002 01	GP_4002_01_MV1	000089	Start/Stop of the pump	DO	N/A	0/1
GP 4002 02	GP_4002_02_MV1	000104	Start/Stop of the pump	DO	N/A	0/1
GP 4002 01/02		000112	Start/Stop GP 4002 01/02 converter	DO	N/A	0/1
GP 4002 03		000109	Start/Stop GP 4002 03 converter	DO	N/A	0/1

9.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
WT 4008 01	WT_4008_01	300133	Reactor weight cells	AI	0…100 Kg	4/20 mA
WT 4002 01	WT_4002_01	300132	Weight Balance (VS 4002 01)	AI	0…500 Kg	4/20 mA
GP 4002 01/02	GP_4002_01_ERR	100101	Thermal protection of the outlet pumps	DI	N/A	0/1
GP 4002 03	GP_4001_03_ERR	100105	Thermal protection of the agitator	DI	N/A	0/1
PS 4002 01	PS_4002_01	100084	Pressure switch	DI	N/A	0/1
PS 4002 02	PS_4002_02	100085	Pressure switch	DI	N/A	0/1
PS 4002 03	PS_4002_03	100108	Pressure switch (GP 4002 01)	DI	N/A	0/1
PS 4002 04	PS_4002_04	100109	Pressure switch (GP 4002 02)	DI	N/A	0/1

9.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	WT 4008 01	Weight (level)	H	To notify alarm to supervision	
2	WT 4008 01	Weight (level)	HH	To notify alarm to supervision	GP 4001 01/02
3	WT 4008 01	Weight (level)	L	To notify alarm to supervision	
4	WT 4008 01	Weight (level)	LL	To notify alarm to supervision	GP 4002 01/02
5	PS 4002 03/04	Pressure	H	To notify alarm to supervision	GP 4002 01/02
6	PS 4002 01/02	Pressure	H	To notify alarm to supervision	GP 4002 01/02
7	WT 4002 01	Weight (level)	H	To notify alarm to supervision	
8	WT 4002 01	Weight (level)	HH	To notify alarm to supervision	GP 4002 01/02
9	WT 4002 01	Weight (level)	L	To notify alarm to supervision	GP 4002 03

1 → WARNING: PBR level is at ------L or upper.

2 → ALARM: PBR level is upper than ----- L. Stop feeding pump.

3 → WARNING: PBR level is at ------L or lower.

4 → ALARM: PBR level is lower than ----- L. Stop harvesting pump.

5 → ALARM: The membrane of the harvesting pump has broken.

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

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

7 → WARNING: Harvesting vessel level is at ------% or upper.

8 → ALARM: VS 4002 01 is full. Stop harvesting pumps.

9 → WARNING: Harvesting vessel level is at ------% or lower. Stop the vessel agitator.

10 Loop 4009. Bioreactor biomass production control

This loop measures the PBR biomass concentration and provides this information to the control system. This loop is a mixture of the inlet liquid flow control and the PBR lighting control.
In addition, this section includes biomass sensor cleaning logic.

IMPORTANT NOTE: The activation of loop 4009 means the deactivation of loops 4000/4001 which control the PBR lighting and the inlet liquid flow.

10.1 Control elements

- AT 4009 01: biomass sensor/transmitter. Bioreactor biomass measurement.
- AT 4009 02: biomass sensor/transmitter. Bioreactor biomass measurement.
- IRC 4000 01: Light supply system.
- LT 4001 01: Level transmitter. Feeding tank (VS 4001 01) level measurement.
- PS 4001 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4001 01/02: Pressure switch. Lines over-pressure detection.
- DPT 4001 02: Differential pressure transmitter. ΔP measurement for pre-filters (LF 4001 02/03) blockage control.
- FT 4001 01: Liquid mass flow meter. Reactor inlet liquid flow measurement.
- DPT 4001 01: Differential pressure transmitter. ΔP measurement for filters (LF 4001 04/05) blockage control.
- GP 4001 01/02 speed regulator: Feed pumps. Liquid pumping to the reactor liquid inlet.
- GP 4001 03 speed regulator: Magnetic agitator. Feeding vessel agitation.
- SV 4003 02: Control valve. Air inlet for sensor cleaning.

10.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
IRC 4000 01	IRC_4000_MV	400115	Light Intensity	AO	0...100 %	4/20 mA
GP 4001 03	GP_4001_03_MV2	400113	VS 4001 01 agitator speed set point	AO	50 Hz = 1400 rpm	4/20 mA
GP 4001 01/02	GP_4001_01_MV2	400109	Flow set point to the inlet pumps	AO		4/20 mA
GP 4001 03		000110	Start/Stop GP 4001 03 converter	DO	N/A	0/1
GP 4001 01	GP_4001_01_MV1	000091	Start/Stop of the pump	DO	N/A	0/1
GP 4001 02	GP_4001_02_MV1	000090	Start/Stop of the pump	DO	N/A	0/1
GP 4001 01/02		000111	Start/Stop GP 4001 01/02 converter	DO	N/A	0/1
SV 4003 02	SV_4003_02_MV	000095	Reactor air inlet valve (Open/Close)	DO	N/A	0/1

10.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
AT 4009 01	AT_4009_01	300118	Biomass measurement	AI	0…2 g/l	4/20 mA
AT 4009 02	AT_4009_02	300119	Biomass measurement	AI	0…5 g/l	4/20 mA
AT 4009 02	AT_4009_FAILURE_IND	300120	Biomass sensor failure	AI	(22 mA)	4/20 mA
FT 4001 01	FT_4001_01	300130	Total liquid inlet flow to reactor	AI	0…20 kg/h	4/20 mA
LT 4001 01	LT_4001_01	300131	VS 4001 01 level	AI	0,,,100 %	4/20 mA
DPT 4001 01	DPT_4001_01	300138	Differential pressure measurement	AI	0,,,3 bar	4/20 mA
DPT 4001 02	DPT_4001_02	300139	Differential pressure measurement	AI	0,,,3 bar	4/20 mA
GP 4001 03	GP_4001_03_ERR	100104	Thermal protection of the agitator	DI	N/A	0/1
PS 4001 01	PS_4001_01	100082	Pressure switch	DI	N/A	0/1

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
PS 4001 02	PS_4001_02	100083	Pressure switch	DI	N/A	0/1
PS 4001 03	PS_4001_03	100106	Pressure switch (GP 4001 01)	DI	N/A	0/1
PS 4001 04	PS_4001_04	100107	Pressure switch (GP 4001 02)	DI	N/A	0/1
GP 4001 01/02	GP_4001_01_ERR	100099	Thermal protection of the inlet pumps	DI	N/A	0/1
SV 4003 02	SV_4003_02_FB	100095	Reactor air inlet valve (Limit switch)	DI	N/A	0/1

10.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**AT 4009 02**	Sensor failure	Err	To notify alarm to supervision	
2	**LT 4001 01**	Level	L	To notify alarm to supervision	------
3	**LT 4001 01**	Level	LL	To notify alarm to supervision	GP 4001 01/02 and GP 4001 03
4	**PS 4001 03/04**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
5	**PS 4001 01/02**	Pressure	H	To notify alarm to supervision	GP 4001 01/02
6	**DPT 4001 02**	Differential pressure	H	To notify alarm to supervision	------
7	**DPT 4001 02**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02
8	**DPT 4001 01**	Differential pressure	H	To notify alarm to supervision	------
9	**DPT 4001 01**	Differential pressure	HH	To notify alarm to supervision	GP 4001 01/02
10	**SV 4003 02**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: The biomass sensor (AT 4009 02) is not working. To notify failure.

2 → WARNING: Feeding vessel level is at ------% or lower.

3 → ALARM: VS 4001 01 is empty. Stop feeding pumps and vessel agitator.

4 → ALARM: The membrane of the feeding pump has broken.

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

5 → ALARM: There is a line overpressure. (Probably because of a process pipe manual valve is closed). Stop feeding pumps.

6 / 8 → WARNING: The differential pressure (inlet/outlet of filter) has rise to ------bar. (Preventive maintenance)

7 / 9 → ALARM: The differential pressure (inlet/outlet of filter) has rise to 2.5-3 bar. Stop feeding pumps.

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

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

10 → ALARM: The automatic valve is not working. To notify failure.

11 Loop 4010. Bioreactor outlet gas composition control

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

11.1 Control elements

- FT 4004 01: Flow meter. Outlet gas flow measure.
- TT 4010 01: Temperature sensor/transmitter. Outlet gas temperature measurement.
- PT 4010 01: Pressure sensor/transmitter. Outlet gas pressure measurement.
- AT 4010 01/02: CO_2/O_2 Analyzer. Outlet gas composition measurement.
- AT 4010 03: Dissolved O_2 Analyzer. PBR O_2 composition measurement.
- SV 4010 01 Control valve. Gas inlet to analyzer.

11.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4010 01	SV_4010_01_MV	000081	Analyzer gas inlet valve (Open/Close)	DO	N/A	0/1

11.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
AT 4010 01	AT_4010_01	300121	CO2/O2 analyzer	AI		4/20 mA
AT 4010 02	AT_4010_02	300122	CO2/O2 analyzer	AI		4/20 mA
AT 4010 03	AT_4010_03	300123	Dissolved O2 measurement	AI		4/20 mA
PT 4010 01	PT_4010_01	300137	Outlet gas pressure measurement	AI	-1...5 bar	4/20 mA
TT 4010 01	TT_4010_01	300143	Outlet gas temperature measurement	AI	0…150 ºC	4/20 mA
FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI	0…20 Nl/min	4/20 mA
SV 4010 01	SV_4010_01_FB	100093	Analyzer gas inlet valve (Limit switch)	DI	N/A	0/1

11.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**PT 4010 01**	Pressure	H	To notify alarm to supervision	SV 4010 01
2	**TT 4010 01**	Temperature	H	To notify alarm to supervision	------
3	**SV 4010 01**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: pressure is out of analyzer operating range conditions. Close inlet valve SV 4010 01.

2 → ALARM: temperature is out of analyzer operating range conditions.

3 → ALARM: The automatic valve is not working.

12 Loop 4011. Feeding tank temperature control

12.1 Control elements

- TT 4011 01: Temperature sensor/transmitter. VS 4001 01 temperature measurement.
- SV 4011 01: Control valve. Cooling water inlet to VS 4001 01 jacket.

12.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4011 01	SV_4011_01_MV	000087	Cooling water valve (Open/Close)	DO	N/A	0/1

12.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4011 01	TT_4011_01	300142	VS 4001 01 temp. measurement	AI	-10…150 ºC	4/20 mA
SV 4011 01	SV_4011_01_FB	100087	Cooling water valve (Limit switch)	DI	N/A	0/1

12.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4011 01**	Temperature	H	To notify alarm to supervision	
2	**TT 4011 01**	Temperature	Err	To notify alarm to supervision	
3	**SV 4011 01**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: Temperature is upper than ----ºC.

2 → ALARM: Temperature sensor is not working.

3 → ALARM: The automatic valve is not working. To notify failure.

⚠ **From hardware point of view, the permissible operating temperature is 170ºC, for vessel and jacket.**

13 Loop 4012. Harvesting tank temperature control

13.1 Control elements

- TT 4011 01: Temperature sensor/transmitter. VS 4001 01 temperature measurement.
- SV 4011 01: Control valve. Cooling water inlet to VS 4001 01 jacket.

13.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4012 01	SV_4012_01_MV	000085	Cooling water valve (Open/Close)	DO	N/A	0/1

13.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4012 01	TT_4012_01	300144	VS 4002 01 temp. measurement	AI	-50…250 ºC	4/20 mA
SV 4012 01	SV_4012_01_FB	100089	Cooling water valve (Limit switch)	DI	N/A	0/1

13.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4012 01**	Temperature	H	To notify alarm to supervision	
2	**SV 4012 01**	Limit switch	Err	To notify alarm to supervision	

1 → ALARM: Temperature is upper than ----ºC.

2 → ALARM: The automatic valve is not working. To notify failure.

⚠ **From hardware point of view, the permissible operating temperature is 150ºC, for vessel and jacket**

14 Loop 4013. Antifoam control

This loop is not implemented yet in the plant. There is wired and connected the signal from the sensor for foam detection which is the next:

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
LS 4013 01	LS_4013_01	100081	Foam measurement	DI	N/A	0/1

15 Loop 4014. Feeding tank sterilization

15.1 Control elements

- TT 4011 01: Temperature sensor/transmitter. VS 4001 01 temperature measurement.
- SV 4014 01: Control valve. Steam inlet to VS 4001 01.

15.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4014 01	SV_4014_01_MV	000086	Steam inlet valve (Open/Close)	DO	N/A	0/1

15.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4011 01	TT_4011_01	300142	VS 4001 01 temp. measurement	AI	-10…150 ºC	4/20 mA

15.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4011 01**	Temperature	L	To notify alarm to supervision	
2	**TT 4011 01**	Temperature	H	To notify alarm to supervision	

1 → ALARM: Temperature is lower than ----ºC (admissible temperature for sterilization).

2 → ALARM: Temperature is upper than ----ºC.

⚠ **From hardware point of view, the permissible operating temperature for the vessel is 170ºC.**

16 Loop 4015. PBR sterilization

16.1 Control elements

- TT 4005 01: Temperature transmitter. Bioreactor temperature measurement.
- TT 4006 01: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- TT 4006 02: Temperature transmitter. Bioreactor temperature measurement (from pH sensor).
- SV 4015 01: Control valve. Steam inlet to PBR.

16.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4015 01	SV_4015_01_MV	000092	Reactor Steam inlet valve (Open/Close)	DO	N/A	0/1

16.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4005 01	TT_4005_02	300141	Reactor temperature measurement	AI	0…150 ºC	4/20 mA
TT 4006 01	TT_4006_01	300126	Temperature measurement	AI	0…140 ºc	4/20 mA
TT 4006 02	TT_4006_02	300128	Temperature measurement	AI	0…140 ºc	4/20 mA
SV 4015 01	SV_4015_01_FB	100098	Reactor Steam inlet valve (Limit switch)	DI	N/A	0/1
PT 4007 01	PT_4007_01	300135	Reactor pressure measurement	AI	-1…1,5 bar	4/20 mA
PT 4007 02	PT_4007_02	300136	Reactor pressure measurement	AI	-1…5 bar	4/20 mA

16.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	***)**	Temperature	L	To notify alarm to supervision	
2	***)**	Temperature	H	To notify alarm to supervision	
3	***²)**	Pressure	H	To notify alarm to supervision	
4	***²)**	Pressure	L	To notify alarm to supervision	
5	**SV 4015 01**	Limit switch	Err	To notify alarm to supervision	

*) The temperature value to set these alarms will be defined in the control software depending on the type of data processing. There are three values of the reactor temperature measured: TT 4005 02, TT 4006 01 and TT 4006 02.

***²)** The pressure value to set these alarms will be defined in the control software depending on the type of data processing. (PT 4007 01 and PT 4007 02)

1 → ALARM: Temperature is lower than ----ºC (admissible temperature for sterilization).

2 → ALARM: Temperature is upper than ----ºC.

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

3 → ALARM: Pressure has raised to ----bar

4 → ALARM: Pressure has fall to ----bar

⚠ **From hardware point of view, the permissible operating pressure for the glass DN150 cylinders is from -1 bar_g to 2 bar_g.**

5 → ALARM: The automatic valve is not working. To notify failure.

17 Loop 4016. Harvesting tank sterilization

17.1 Control elements

- TT 4012 01: Temperature sensor/transmitter. VS 4002 01 temperature measurement.
- SV 4016 07: Control valve. Steam inlet to VS 4002 01.

17.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
SV 4016 01	SV_4016_01_MV	000084	Steam inlet valve (Open/Close)	DO	N/A	0/1

17.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
TT 4012 01	TT_4012_01	300144	VS 4002 01 temp. measurement	AI	-50…250 ºC	4/20 mA

17.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	**TT 4012 01**	Temperature	L	To notify alarm to supervision	
2	**TT 4012 01**	Temperature	H	To notify alarm to supervision	

1 → ALARM: Temperature is lower than ----ºC (admissible temperature for sterilization).

2 → ALARM: Temperature is upper than ----ºC.

⚠ **From hardware point of view, the permissible operating temperature for the vessel is 150ºC.**

18 Digital/Analogical signals list

Loop	Equipment	Tag Variable	PLC ADDRESS	Description	I/O
4000	**IRC 4000 01**	IT_4000_01	300145	Light Power Phase 1 (NOT IMPLEMENTED)	AI
4000	**IRC 4000 01**	IT_4000_02	300146	Light Power Phase 2 (NOT IMPLEMENTED)	AI
4000	**IRC 4000 01**	IT_4000_03	300147	Light Power Phase 3 (NOT IMPLEMENTED)	AI
4000	**IRC 4000 01**	IRC_4000_MV	400115	Light Intensity	AO
4001	**FT 4001 01**	FT_4001_01	300130	Total liquid inlet flow to reactor	AI
4001	**LT 4001 01**	LT_4001_01	300131	VS 4001 01 level	AI
4001	**DPT 4001 01**	DPT_4001_01	300138	Differential pressure measurement	AI
4001	**DPT 4001 02**	DPT_4001_02	300139	Differential pressure measurement	AI
4001	**GP 4001 03**	GP_4001_03_MV2	400113	VS 4001 01 agitator speed set point	AO
4001	**GP 4001 03**		000110	Start/Stop GP 4001 03 converter	DO
4001	**GP 4001 03**	GP_4001_03_ERR	100104	Thermal protection of the agitator	DI
4001	**PS 4001 01**	PS_4001_01	100082	Pressure switch	DI
4001	**PS 4001 02**	PS_4001_02	100083	Pressure switch	DI
4001	**PS 4001 03**	PS_4001_03	100106	Pressure switch (GP 4001 01)	DI
4001	**PS 4001 04**	PS_4001_04	100107	Pressure switch (GP 4001 02)	DI
4001	**GP 4001 01**	GP_4001_01_MV1	000091	Start/Stop of the pump	DO
4001	**GP 4001 02**	GP_4001_02_MV1	000090	Start/Stop of the pump	DO
4001	**GP 4001 01/02**		000111	Start/Stop GP 4001 01/02 converter	DO
4001	**GP 4001 01/02**	GP_4001_01_ERR	100099	Thermal protection of the inlet pumps	DI
4001	**GP 4001 01/02**	GP_4001_01_MV2	400109	Flow setpoint to the inlet pumps	AO
4002	**WT 4002 01**	WT_4002_01	300132	Weight Balance (VS 4002 01)	AI
4002	**GP 4002 01**	GP_4002_01_MV1	000089	Start/Stop of the pump	DO
4002	**GP 4002 02**	GP_4002_02_MV1	000104	Start/Stop of the pump	DO
4002	**GP 4002 01/02**		000112	Start/Stop GP 4002 01/02 converter	DO
4002	**GP 4002 01/02**	GP_4002_01_ERR	100101	Thermal protection of the outlet pumps	DI
4002	**GP 4002 01/02**	GP_4002_01_MV2	400111	Flow setpoint to the outlet pumps	AO
4002	**GP 4002 03**	GP_4002_03_MV2	400114	VS 4001 01 agitator speed setpoint	AO
4002	**GP 4002 03**		000109	Start/Stop GP 4002 03 converter	DO
4002	**GP 4002 03**	GP_4001_03_ERR	100105	Thermal protection of the agitator	DI
4002	**PS 4002 01**	PS_4002_01	100084	Pressure switch	DI
4002	**PS 4002 02**	PS_4002_02	100085	Pressure switch	DI
4002	**PS 4002 03**	PS_4002_03	100108	Pressure switch (GP 4002 01)	DI
4002	**PS 4002 04**	PS_4002_04	100109	Pressure switch (GP 4002 02)	DI

Loop	Equipment	Tag Variable	PLC ADDRESS	Description	I/O
4003	FQRC 4003 01	FQRC_4003_01	300109	Inlet CO_2 flow measurement	AI
4003	FQRC 4003 01	FQRC_4003_01_SP	400100	Inlet CO_2 flow set point	AO
4003	FQRC 4003 02	FQRC_4003_02	300110	Inlet Air flow measurement	AI
4003	FQRC 4003 02	FQRC_4003_02_SP	400101	Inlet Air flow set point	AO
4003	FQRC 4003 03	FQRC_4003_03	300111	Circulated air flow measurement	AI
4003	FQRC 4003 03	FQRC_4003_03_SP	400102	Circulated air flow set point	AO
4003	FQRC 4003 04	FQRC_4003_04	300112	Total Inlet gas flow measurement	AI
4003	FQRC 4003 04	FQRC_4003_04_SP	400103	Total Inlet gas flow set point	AO
4003	SV 4003 01	SV_4003_01_MV	000093	Analyzer gas inlet valve (Open/Close)	DO
4003	SV 4003 01	SV_4003_01_FB	100097	Analyzer gas inlet valve (FEEDBACK)	DI
4003	SV 4003 02	SV_4003_02_MV	000095	Reactor air inlet valve(Open/Close)	DO
4003	SV 4003 02	SV_4003_02_FB	100095	Reactor air inlet valve (FEEDBACK)	DI
4003	SV 4003 03	SV_4003_03_MV	000096	Blower bypass valve(Open/Close)	DO
4003	SV 4003 03	SV_4003_03_FB	100094	Blower bypass valve (FEEDBACK)	DI
4003	PS 4003 01	PS_4003_01	100110	Pressure switch bypass for recycling	DI
4003	BLWR 4003 01	BLWR_4003_01_MV1	000103	Start/Stop of the blower	DO
4004	FT 4004 01	FT_4004_01	300129	Reactor outlet gas flow measurement	AI
4004	DPT 4004 01	DPT_4004_01	300140	Differential pressure measurement	AI
4004	SCV 4004 01	SCV_4004_01_MV	400108	Reactor outlet gas flow set point	AO
4005	HX 4005 02	HX_4005_02_MV1	000100	Start/Stop electrical resistance	DO
4005	TT 4005 01	TT_4005_01	300141	Reactor temperature measurement	AI
4005	BLWR 4005 01	BLWR_4005_01_MV2	400104	Air extractor set point (lightening refrigeration)	AO
4005	BLWR 4005 01	BLWR_4005_01_MV1	000099	Start/Stop of the extractor	DO
4005	BLWR 4005 01	BLWR_4005_01_ERR	100103	Thermal protection of the extractor	DI
4005	SV 4005 01	SV_4005_01_MV	000088	Cooling water valve (Open/Close)	DO
4005	SV 4005 01	SV_4005_01_FB	100086	Cooling water valve (FEEDBACK)	DI
4005	PP 4005 01	PP_4005_01_MV1	000102	Start/Stop of the pump	DO
4006	AT 4006 01	AT_4006_01	300125	Ph measurement	AI
4006	TT 4006 01	TT_4006_01	300126	Temperature measurement (AT 4006 01)	AI
4006	AT 4006 02	AT_4006_02	300127	Ph measurement	AI
4006	TT 4006 02	TT_4006_02	300128	Temperature measurement (AT 4006 02)	AI
4006	SV 4006 01	SV_4006_01_FB	100091	Reactor acid inlet valve (Limit switch)	DI
4006	SV 4006 02	SV_4006_02_FB	100092	Reactor base inlet valve (Limit switch)	DI
4006	SV 4006 01	SV_4006_01_MV	000083	Reactor base inlet valve (Open/Close)	DO
4006	SV 4006 02	SV_4006_02_MV	000082	Reactor base inlet valve (Open/Close)	DO
4006	PP 4006 01	PP_4006_01_MV1	000098	Start/Stop of the pump	DO
4006	PP 4006 02	PP_4006_02_MV1	000097	Start/Stop of the pump	DO
4006	WT 4006 01	WT_4006_01	-----	Acid balance	Eth
4006	WT 4006 02	WT_4006_02	-----	Base balance	Eth
4007	PT 4007 01	PT_4007_01	300135	Reactor pressure measurement	AI
4007	PT 4007 02	PT_4007_02	300136	Reactor pressure measurement	AI

Loop	Equipment	Tag Variable	PLC ADDRESS	Description	I/O
4007	**PT 4007 01**	PT_4007_01	300135	Reactor pressure measurement	AI
4007	**PT 4007 02**	PT_4007_02	300136	Reactor pressure measurement	AI
4008	**WT 4008 01**	WT_4008_01	300133	Reactor weight cells	AI
4009	**AT 4009 01**	AT_4009_01	300118	Biomass measurement	AI
4009	**AT 4009 02**	AT_4009_02	300119	Biomass measurement	AI
4009	**AT 4009 02**		300120	Biomass sensor failure	AI
4010	**AT 4010 01**	AT_4010_01	300121	CO_2/O_2 analyser	AI
4010	**AT 4010 02**	AT_4010_02	300122	CO_2/O_2 analyser	AI
4010	**AT 4010 03**	AT_4010_03	300123	Dissolved O_2 measurement	AI
4010	**PT 4010 01**	PT_4010_01	300137	Outlet gas pressure measurement	AI
4010	**TT 4010 01**	TT_4010_01	300143	Outlet gas temperature measurement	AI
4010	**SV 4010 01**	SV_4010_01_MV	000081	Analyser gas inlet valve (Open/Close)	DO
4010	**SV 4010 01**	SV_4010_01_FB	100093	Analyser gas inlet valve (FEEDBACK)	DI
4010	**HX 4010 01**	HX_4010_01_MV1	000107	Start/Stop post condenser	DO
4011	**TT 4011 01**	TT_4011_01	300142	VS 4001 01 temp. measurement	AI
4011	**SV 4011 01**	SV_4011_01_MV	000087	Cooling water valve (Open/Close)	DO
4011	**SV 4011 01**	SV_4011_01_FB	100087	Cooling water valve (FEEDBACK)	DI
4012	**TT 4012 01**	TT_4012_01	300144	VS 4002 01 temp. measurement	AI
4012	**SV 4012 01**	SV_4012_01_MV	000085	Cooling water valve (Open/Close)	DO
4012	**SV 4012 01**	SV_4012_01_FB	100089	Cooling water valve (FEEDBACK)	DI
4013	**LS 4013 01**	LS_4013_01	100081	Foam measurement	DI
4014	**SV 4014 01**	SV_4014_01_MV	000086	Steam inlet valve (Open/Close)	DO
4015	**SV 4015 01**	SV_4015_01_MV	000092	Reactor Steam inlet valve (Open/Close)	DO
4015	**SV 4015 01**	SV_4015_01_FB	100098	Reactor Steam inlet valve (Feedback)	DI
4016	**SV 4016 01**	SV_4016_01_MV	000084	Steam inlet valve (Open/Close)	DO
	Emergency Buttons	Emergency_Button_01	100111	Emergency Buttons (any button pressed)	DI
	Emergency Buttons		000106	Electrical enclosure red LED	DO
	Emergency Buttons	Emergency_Button_02	100112	Emergency released	DI
	Emergency Buttons		000105	Electrical enclosure green LED	DO
			300148	SPARE (NOT USED)	AI
			400110	SPARE (NOT USED)	AO
			400112	SPARE (NOT USED)	AO
			100100	SPARE (NOT USED)	DI
			100102	SPARE (NOT USED)	DI
			000107	SPARE (NOT USED)	DO
			000101	SPARE (NOT USED)	DO
			000108	SPARE (NOT USED)	DO
			300124	CANCELLED (AT 4010 03 temp. meas.)	AI
			100088	CANCELLED (SV 4014 01 FEEDBACK)	DI
			100090	CANCELLED (SV 4016 01 FEEDBACK)	DI

10. SAT PROTOCOLS

10.1. Electrical and instruments Test Protocol
10.2. Tightness pressure Test Protocol
10.3. Steam pressure Test Protocol

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ELECTRICAL TESTS

General information

1. Type of test to do: (cross out if it is not applicable)

➢ Verification of equipment/instruments wiring and electrical supply

➢ Power test:

In the power test will be checked that:

- The motor turns on/off and to the right direction
- The electronic variator receives the input signal from the PLC
- The PLC receives the alarm signal (thermal protection) from the electronic variator (if it is applicable)

➢ Instruments electrical test:

The instruments test includes the checking of the next:

- That the instrument receives the signal sent by the PLC (if it is applicable)
- That the PLC receives the signal/s sent by the instrument (if it is applicable)
- That the PLC receives the failure signal from the instrument (if it is applicable)

➢ Control valves electrical test:

Control valves electrical test includes that:

- The valve open/close depending on the order sent by the PLC
- PLC receives the limit switch/es signal/s (if it is applicable)

in motors:

....all motors..

and instruments:

...all instruments..

2. Test conditions:

3. Test/s results and comments:

....see the atached test report..

ATTENTION:

Before starting any test keep ALWAYS in mind the next points:

A. Previous inspection of the elements which are going to be tested (if it is appropriate):

- Electrical supply (tension) installed in equipment/instruments in accordance with technical plate
- Instrument appearance – state without visible physical deterioration
- Mechanical installation of the equipment according to the supplier instructions
- Instrument calibration range

B. Verification of the pneumatic installation: tubing, feeding pressure, pressure regulator valve …

C. Other:

....

....

....

....

....

COMMENTS:

....

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....

....

....

Conformity

The test acceptance will be given when:

1) The instruments/motors/lighting/… are electrically and mechanically installed in accordance with the project specifications
2) The power enclosure is designed according the project documentation and CE standards
3) The specific protection elements ensure the optimum security grade

The electrical installation WILL NOT be approved unless all the previous points are correct. If any point is NOT correct, it will be fixed and the corresponding test will be done again.

IMPORTANT: All the comments and incidents will be enclosed in the test/s report/s.

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NIF.: B-61720835

Date: 04/09/09

Responsible: Júlia Gubern Josep Mestre

Signature:

De Dietrich Equipos Químicos, S.L.
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TIGHTNESS/PRESSURE TESTS

De Dietrich Equipos Químicos, S.L. Av. Prìncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA Member of De Dietrich PROCESS SYSTEMS	PROJECT: PRK-5393 _ Melissa C.IVa	
	CUSTOMER: Universitat Autònoma de Barcelona (UAB)	
	PLANO: DD-8558-Z1-100	
	TIGHTNESS/PRESSURE TEST PROTOCOL	
	PREPARED: J. Gubern	**CHECKED:** J. Mestre
	Page1 of 4	**Tested by:** J. Garcia / J. Gubern

General information

1. Type of test to do: (cross out if it is not applicable)

   - Pipe/s tightness/pressure test
   - Vessel/s tightness/pressure test

in pipe/s:

.................all pipes...
.......(see P&ID DD-8558-Z1-100-01) → rev. 11.........
....
....
....
....

and vessel/s

........Reactor RCIVa, VS 4001 01 and VS 4002 01
....

2. Fluid/s of test and pressure test conditions:

........Water / Air...
........Conditions: see test reports..

3. Test/s results and comments:

.......see the attached test reports..................................
....

ATTENTION:

Before starting any test (tightness or pressure / pipe or vessel) keep ALWAYS in mind the next points:

A. The installation of the safety elements should correspond with the final P&ID.
B. Visual inspection of the pipes and vessels taking into account:
   - Pipes routing and slope.
   - Welding/s state.
   - Tightening of all the clamps (check that the joints are in the correct position).
   - Supports.
   - Safety elements installation and tare pressure.
C. General revision according to P&ID.
D. Revision of the vessels according to the corresponding constructive drawing.
E. Check the design conditions of the vessels
F. When starting the test, if pressure regulators are installed, check the installation and make sure they don't let the fluid flow with a high pressure.
G. The installation of solid end cap/s could be necessary if there are some open pipes.

COMMENTS:
During these tests will be checked the state of the valves too. It must be checked that all valves work, so, that they open and close correctly.
IMPORTANT: These tests will include all sampling valves

Approval Criteria

Test conditions:

All tests will be done at room temperature.

Pipes and vessels will be tested at a pressure ot 2 to 2.5 barg, considered right for tightness/pressure tests.

The reactor will be tested at 1 barg.

Pipe/s test/s will last minimum 20 minutes, being its maximum admissible pressure loss 0.1 bar.

Vessel/s test/s will last at least 2 hours, being its maximum admissible pressure loss the same as in pipe/s test/s (0.1 bar).

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	CUSTOMER: Universitat Autònoma de Barcelona (UAB)	
	PLANO: DD-8558-Z1-100	
	TIGHTNESS/PRESSURE TEST PROTOCOL	
	PREPARED: J. Gubern	**CHECKED:** J. Mestre
	Page4 of 4	**Tested by:** J. Garcia / J. Gubern

Conformity

The test acceptance will be given when:

1) The tare pressure of the safety elements fit the design conditions of the equipment where are placed.
2) The obtained pressure loss is lower than the pressure loss defined as admissible.

The installation WILL NOT be approved unless all the previous points are correct. If any point is NOT correct, it will be fixed: modification of the safety elements tare pressure or substitution of them, joints substitution, tight of clamps, …; and the test will be done again on the affected pipe/s or vessel/s.

IMPORTANT: All comments and incidents will be enclosed in the test/s report/s.

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NIF: B-61720335

Date: 04/09/09

Responsible: Júlia Gubern   Josep Mestre

Signature:

De Dietrich Equipos Químicos, S.L.
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STEAM PRESSURE TESTS

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PROJECT: PRK-5393 _ Melissa C.IVa	
CUSTOMER: Universitat Autònoma de Barcelona (UAB)	
PLANO: DD-8558-Z1-100	
STEAM PRESSURE TEST PROTOCOL	
PREPARED: J. Gubern	**CHECKED:** J. Mestre
Page1 of 3	**Tested by:** J. Garcia / J. Gubern

General information

1. Type of test to do: (cross out if it is not applicable)

   - Pipe/s steam pressure test
   - Vessel/s steam pressure test

in pipe/s:

all sterilizable pipes
(see P&ID DD-8558-Z1-100-01) → rev. 11

and vessel/s

Reactor RCIVa, VS 1001.01 and VS 1002.01

2. Fluid/s of test and pressure test conditions:

Steam
Conditions: see test reports

3. Test/s results and comments:

See the attached test reports

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	CUSTOMER: Universitat Autònoma de Barcelona (UAB)	
	PLANO: DD-8558-Z1-100	
	STEAM PRESSURE TEST PROTOCOL	
	PREPARED: J. Gubern	**CHECKED:** J. Mestre
	Page2 of 3	**Tested by:** J. Garcia / J. Gubern

Approval Criteria

Test conditions:

All tests will be done at a pressure range of 1.5 to 2 barg, which is the available pressure in plant, and it is considered right for test pressure.

Pipe/s and vessel/s test/s will last 20 minutes, being its maximum admissible pressure loss 0.1 bar.

COMMENTS:

During these tests will be checked the state of the valves too. It must be checked that all the valves work so, that they open and close correctly

IMPORTANT: The test will include all sampling valves.

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	CUSTOMER: Universitat Autònoma de Barcelona (UAB)	
	PLANO: DD-8558-Z1-100	
	STEAM PRESSURE TEST PROTOCOL	
	PREPARED: J. Gubern	**CHECKED:** J. Mestre
	Page3 of 3	**Tested by:** J. Garcia / J. Gubern

Conformity

The test acceptance will be given when:

1) The tare pressure of the safety elements fit the design conditions of the equipment where are placed.
2) The obtained pressure loss is lower than the pressure loss defined as admissible.

The installation WILL NOT be approved unless all the previous points are correct. If any point is NOT correct, it will be fixed: modification of the safety elements tare pressure or substitution of them, joints substitution, tight of clamps, …; and the test will be done again on the affected pipe/s or vessel/s.

IMPORTANT: All comments and incidents will be enclosed in the test/s report/s.

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Date: 04/09/09

Responsible: Josep Mestre   Júlia Gubern

Signature:

11. SAT AS-RUN PROCEDURES

11.1. Electrical and instruments Test
11.2. Tightness pressure Test
11.3. Steam pressure Test

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CONTROL VALVES TEST REPORT

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	7 th of July 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	FLUID	SIGNALS CONNECTION / CONFIGURATION CHECKING			COMMENTS
					OK	no OK	FIXED	
1	SV 4003 01	Inlet process gas to analyzer (Diaphragm automatic valve) (1 limit switch N/C + electrovalve)	CO2-1/2-SS2-004	Gas				Not installed. (too close to SV 4003 02).
2	SV 4003 02	Inlet process gas to analyzer (Diaphragm automatic valve) (1 limit switch N/C + electrovalve)	CO2-1/2-SS2-004	Gas	X			
3	SV 4003 03	Inlet process gas for biomass sensor cleaning (Diaphragm automatic valve) (1 limit switch N/C + electrovalve)	PAI-1/2-SS2-003	Gas	X			
4	SV 4003 04	Blower BLWR 4003 01 gas recycling (Diaphragm automatic valve) (1 limit switch N/C + electrovalve)	PG-1/2-SS2-009	Gas	X			
5	SV 4005 01	Glycol inlet to plate heat exchanger (Automatic ball valve) (electrovalve)	GLY-3/4-SS1-003	Glycol	X			
6	SV 4006 01	Acid addition to reactor for the pH control (Diaphragm automatic valve) (electrovalve)	PAC-1/2-SS2-002	Acid	X			
7	SV 4006 02	Acid addition to reactor for the pH control (Diaphragm automatic valve) (electrovalve)	PBA-1/2-SS2-002	Base	X			ok!
8	SV 4011 01	Glycol outlet from VS 4001 01 jacket for tank refrigeration (Automatic ball valve) (electrovalve)	GLY-3/4-SS1-002	Glycol	X			Pending air feed. Tested with a provisional air line
9	SV 4012 01	Glycol outlet from VS 4002 01 jacket for tank refrigeration (Automatic ball valve) (electrovalve)	GLY-3/4-SS1-008	Glycol		X	X 08/07/09	Pending air feed. Tested with a provisional line. [No contact → checked]
10	SV 4014 01	Steam inlet to VS 4001 01 for automatic sterilization (Automatic ball valve) (electrovalve)	ST-3/4-SS1-006	Steam	X			Existing valve. DI (Feedback) not avaible.

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CONTROL VALVES TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	7th of july 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gúbern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Sheibe

TEST	ITEM	DESCRIPTION	LOCATION	FLUID	SIGNALS CONNECTION / CONFIGURATION CHECKING			COMMENTS
					OK	no OK	FIXED	
11	SV 4015 01	Steam inlet to reactor for automatic sterilization (Automatic ball valve) (electrovalve)	ST-1/2-SS1-007	Steam		X	X 23/07	Valve not installed (8/07/09). Signals checked with a simulated signal in the connector.
12	SV 4016 01	Steam inlet to VS 4002 01 for automatic sterilization (Automatic ball valve) (electrovalve)	ST-3/4-SS1-020	Steam	X			IDEM SV 4014 01
13	FQRC 4003 01	Mass flowmeter + mass flow controller	CO2-1/2-SS2-001	Gas	X			
14	FQRC 4003 02	Mass flowmeter + mass flow controller	PAI-1/2-SS2-001	Gas	X			
15	FQRC 4003 03	Mass flowmeter + mass flow controller	PG-1/2-SS2-009	Gas	X			
16	FQRC 4003 04	Mass flowmeter + mass flow controller	CO2-1/2-SS2-002	Gas	X			
17	SCV 4004 01	~~Mass flow controller~~ Continuous control valve	PG-1/2-SS2-006	Gas		X		04/09 Pending task.
18	SV 4010 01	Analyzer gas inlet (1 limit switch N/C + electrovalve)	PG-1/2-SS2-007	Gas	X			

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POWER TEST REPORT

CUSTOMER:	UAB - MELISSA
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10
TEST DATE:	9th / 10th of july
PREPARED BY:	Júlia Guberu
APPROVED BY:	Josep Mestre

TEST	ITEM	DESCRIPTION	TYPE OF TEST	POWER (KW)	CHARACTERISTICS			TEST RESULTS			COMMENTS
					V	Hz	rpm	OK	no OK	FIXED	
1	GP 4001 03	Magnetic agitator motor (VS 4001 01)	Motor	2,2	230/400	50	1400	X			Start/Stop and thermal protection
			Electronic variator					X			Agitation speed
2	GP 4002 03	Agitator motor (VS 4002 01)	Motor	0,37	230/400	50	1500	X			Start/stop and thermal protection
			Electronic Variator					X			Agitation speed
3	GP 4001 01	Sanitary diaphragm pump for reactor feed inlet	MOTOR	0,37	400	50	1400	X			There is one thermal protection for two motors (GP 4001 01/02)
			ELECTRONIC VARIATOR					X			Variator for GP 4001 01 and GP 4001 02 (*)
4	GP 4001 02	Sanitary diaphragm pump for reactor feed inlet	MOTOR	0,37	400	50	1400	X			(*)
			ELECTRONIC VARIATOR					X			
5	GP 4002 01	Sanitary diaphragm pump for reactor liquid outlet	MOTOR	0,37	400	50	1400	X			One thermal protection for both motors (GP 4002 01/02)
			ELECTRONIC VARIAT...					X			Variator for GP 4002 01 and GP 4002 02 (D)

?

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POWER TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	9th/10th of july
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Oteiza

TEST	ITEM	DESCRIPTION	TYPE OF TEST	POWER (KW)	CHARACTERISTICS V	Hz	rpm	TEST RESULTS OK	no OK	FIXED	COMMENTS
6	GP 4002 02	Sanitary diaphragm pump for reactor liquid outlet	MOTOR	0,37	400	50	1400	X			
			ELECTRONIC VARIATOR					X			A
7	BLWR 4003 01	Compressor for outlet gas circulation to reactor	MOTOR	0,065	230	50		X			Start/stop the blower
8	BLWR 4005 01	On-line extractor for the reactor refrigeration system	MOTOR	0,14	230		2380	X			Start/stop blower and thermal protection
			ELECTRONIC VARIATOR					X			Blowing speed.
9	PP 4005 01	Centrifugal pump for reactor refrigeration water flow	MOTOR					X			Start/stop
10	PP 4006 01	Metering pump for acid additions to the reactor	MOTOR					X			Start/stop. Signal tested with a spare pump from customer (UAB)

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POWER TEST REPORT

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	9th of july 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Cubero
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	ITEM	DESCRIPTION	TYPE OF TEST	POWER (KW)	CHARACTERISTICS V	CHARACTERISTICS Hz	CHARACTERISTICS rpm	TEST RESULTS OK	TEST RESULTS no OK	TEST RESULTS FIXED	COMMENTS
11	PP 4006 02	Metering pump for base additions to the reactor						X			Start/stop. Signals tested with a spare pump from customer (UAB)
12	HX 4005 01	Plate heat exchanger for water cooling with glycol		5	230						N/A
13	HX 4010 01	Post-condenser for gas analysis	MOTOR	0,176	230	50		X			No DI/DO for this equipment. It works as an instrument and starts automatically with the current flow.

N/A ≡ Not applicable.

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INSTRUMENTS TEST REPORT -Pressure-

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	8th of July 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	JÚLIA GUBERN
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	JOSEP MESTRE

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
1	PS 4001 01	Pressure switch	GP 4001 01 outlet	-1…4 bar	0/1	X			No pressure in line. Contact forced.
2	PS 4001 02	Pressure switch	GP 4001 02 outlet	-1…4 bar	0/1	X			"
3	PS 4001 03	Pressure switch	GP 4001 02	N/A	0/1	X			No membrane breakaje. Contact forced on connector
4	PS 4001 04	Pressure switch	GP 4001 02	N/A	0/1	X			
5	PS 4002 01	Pressure switch	GP 4002 01 outlet	-1…4 bar	0/1	X			No pressure in line Contact forced.
6	PS 4002 02	Pressure switch	GP 4002 02 outlet	-1…4 bar	0/1	X			"
7	PS 4002 03	Pressure switch	GP 4002 02	N/A	0/1	X			No membrane breakaje Contact forced directly on the connector
8	PS 4002 04	Pressure switch	GP 4002 02	N/A	0/1	X			
9	PS 4003 01	Pressure switch	BLWR 4003 01 outlet	-1…2,5 bar	0/1	X			Contact forced on the connector

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INSTRUMENTS TEST REPORT -Pressure-

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	13th of July 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
10	PT 4007 01	Pressure measurement	RCIVa	-1…1,5 bar	4-20 mA	X			
11	PT 4007 02	Pressure measurement	RCIVa	-1…5 bar	4-20 mA	X			
12	PT 4010 01	Pressure measurement	RCIVa	-1…5 bar	4-20 mA	X			
13	DPT 4001 01	Differential pressure measurement		0…3 bar	4-20 mA	X			
14	DPT 4001 02	Differential pressure measurement		0…3 bar	4-20 mA	X			
15	DPT 4004 01	Differential pressure measurement		0…1 bar	4-20 mA	X			
16	PI 4001 01	Pressure gauge	VS 4001 01	-1…5 bar	N/A				N/A
17	PI 4001 02	Pressure gauge	VS 4001 01 vent filter (GF 4001 01)	-1…5 bar	N/A				N/A
18	PI 4002 01	Pressure gauge	VS 4002 01	-1…5 bar	N/A				N/A

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INSTRUMENTS TEST REPORT -Pressure-

CUSTOMER:	UAB - MELISSA	TEST DATE:	13th of July 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gibern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Melke

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
19	PI 4002 02	Pressure gauge	VS 4002 01 vent filter (GF 4002 01)	-1...5 bar	N/A				N/A
20	PI 4003 01	Pressure measurement	PRC 4003 01	0...1,5 bar	N/A				N/A
21	PI 4003 02	Pressure measurement	PRC 4003 02	0...1,5 bar	N/A				N/A
22	PI 4003 03	Pressure measurement	PRC 4003 03	0...1,5 bar	N/A				N/A
23	PI 4003 04	Pressure measurement	PRC 4003 04	0...1,5 bar	N/A				N/A
24	PI 4003 05	Pressure gauge	GF 4003 08 gas filter	-1...5 bar	N/A				N/A
25	PI 4003 06	Pressure gauge	GF 4003 09 gas filter	-1...5 bar	N/A				N/A
26	PI 4004 01	Pressure gauge	GF 4004 01 gas filter	-1...5 bar	N/A				N/A
27	PI 4004 02	Pressure gauge	GF 4004 02 gas filter	-1...5 bar	N/A				N/A

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INSTRUMENTS TEST REPORT -Pressure-

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	13th of july 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Cerbera
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
28	PI 4005 02	Pressure measurement	Reactor water refrigaration circuit	0...4 bar	N/A				N/A
29	PI 4011 01	Pressure measurement	Service air inlet (VS 4001 01 jacket)	0...1,5 bar	N/A				N/A
30	PI 4011 02	Pressure measurement	Service air inlet (VS 4002 01 jacket)	0...1,5 bar	N/A				N/A

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INSTRUMENTS TEST REPORT - Temperature-

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	13th of July 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
1	TT 4005 02	Reactor temperature measurement	RCIVa	configurated as 0... 150°C	4-20 mA	X			Same temperature on the display and PLC
2	TT 4010 01	Analyzed gas temperature measurement	PG-1/2-SS2-007	~~-50...150 °c~~ 0... 150°C	4-20 mA	X			
3	TT 4011 01	VS 4001 01 temperature measurement	VS 4001 01	~~-50... 150 °c~~ -10...150°C	4-20 mA	X			
4	TT 4012 01	VS 4002 01 temperature measurement	VS 4002 01	-50... 250°C	4-20 mA	X			4-20mA converter added on the Pt-100.

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INSTRUMENTS TEST REPORT - Level-

CUSTOMER:	UAB - MELISSA	TEST DATE:	13th of July 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
1	LT 4001 01	VS 4001 01 level measurement	VS 4001 01	0...100 %	4-20 mA	X			
2	LS 4013 01	Foam detection	RCIVa	N/A	0/1				Instrument not installed. DO to PLC simulated → OK

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INSTRUMENTS TEST REPORT - Weight-

CUSTOMER:	UAB - MELISSA	TEST DATE:	17th of july 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
1	WT 4002 01	Bench scale for VS 4002 01 level control	VS 4002 01	0...600 Kg	4-20 mA	X			
2	WT 4008 01	Weigh module for reactor RCIVa level control	RCIVa	0...660 Kg (3 x 220 Kg)	4-20 mA	X			
3	WT 4006 01	Bench scale for acid level/consumption control	VS 4006 01	~~0...3 Kg~~ 0... 6 kg	RS232		X		The signal (RS232) → ok!! 1)
4	WT 4006 02	Bench scale for base level/consumption control	VS 4006 02	~~0...3 Kg~~ 0... 6 kg	RS232		X		1) Pending task.
5									
6									

1) Acid/base bench scale have been changed for one superior model. New calibration range: 0... 6 kg.

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N/A ≡ not applicable

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INSTRUMENTS TEST REPORT - Analysis-

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	8th/14th of july 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
1	AT 4006 01	Reactor pH measurement	RCIVa	0...12	4-20 mA	X			Channel B
2	TT 4006 01	Reactor temperature measurement (pH)↑	RCIVa	0...140 ºC	4-20 mA	X			
3	AT 4006 02	Reactor pH measurement	RCIVa	0...12	4-20 mA	X			Channel A
4	TT 4006 02	Reactor temperature measurement (pH)↑	RCIVa	0...140 ºC	4-20 mA	X			
5	AT 4009 01	Reactor biomass measurement	RCIVa		4-20 mA				Sensor + transmitter not available (instrument being repaired)
6	AT 4009 02	Reactor biomass measurement	RCIVa	0... 30 g/l 5...4000 FTU	4-20 mA	X			
7	TT 4009 01	Reactor temperature measurement (biomass)↑	RCIVa	-30...130 ºC	4-20 mA	X			
8	AT 4010 01	CO_2/O_2 analyser	RCIVa		4-20 mA		X		The configuration of delivered equipment not [illegible]
9	AT 4010 02	CO_2/O_2 analyser	RCIVa		4-20 mA		X		pending task

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INSTRUMENTS TEST REPORT - Analysis-

CUSTOMER:	UAB - MELISSA	TEST DATE:	8th / 14th of july
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
10	AT 4010 03	Reactor dissolved O_2 measurement	RCIVa	6 ppb...saturated (100%)	4-20 mA	X			
11	TT 4010 02	Reactor temperature measurement (dissolved O_2)↑	RCIVa	0...70 ºC	4-20 mA	X			

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INSTRUMENTS TEST REPORT - Flow-

CUSTOMER:	UAB - MELISSA	TEST DATE:	13th of july 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	ITEM	DESCRIPTION	LOCATION	CALIBRATION RANGE	SIGNAL OUTPUT	CONNECTION / CONFIGURATION CHECKING			COMMENTS
						OK	no OK	FIXED	
1	FT 4001 01	Liquid flowmeter	PL-1/2-SS2-007	0…20 Kg/h	4-20 mA		X	X 7/09	Broken wire on 4-20 mA signal. The sensor measure is OK (read in the display) 2)
2	FT 4004 01	Gas flowmeter	PG-1/2-SS2-006	0…110 N l/h	4-20 mA		X		The mass flow meter should be checked in Iberfluid. 1)
3	FI 4003 01	Gas flowmeter	CO2-1/2-SS2-002		N/A				

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1) The flowmeter has been checked by Iberfluid and the instrument has been fixed. (sensor wire disconnected). The connection is still pending at 04/09/09.
2) The flowmeter has been repaired by the supplier. A Galvanic isolator has been installed in order to protect the instrument. 4-20 mA rechecking pending at 04/09/09. ⇒ Fixed on 7th of septembre

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EQUIPMENT TIGHTNESS / PRESSURE TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	23/07 & 02-03/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gibert
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	ITEM	DESCRIPTION	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
				P_T (barg)	T_T (°C)	t_T (min)	OK	no OK	FIXED	
1	RCIVa + condenser (proces fluid part)	Biological reactor in borosilicate glass/stainless steel. V = 77 L. Pmax=2 bar	Water	1	Room temp.	120		X	X 1/09/09	Leakage detected on the reactor upper flange. Flange screws have been tightened.
2	VS 4001 01 (Vessel)	Agitated tank in AISI 316L. V =160 L. Pdesign= -1/6 bar	Water	2'2	Room temp.	120	X			
3	VS 4001 01 (Jacket)	Agitated tank in AISI 316L. V =37 L. Pdesign= -1/6 bar	Water	2'3	Room temp.	120	X			
4	VS 4002 01 (Vessel)	Agitated tank in AISI 316L. V = 120 L.	Water	2'1	Room temp.	120		X	X 1/09/09	Two new Ingold blind plugs installed.
5	VS 4002 01 (Jacket)	Agitated tank in AISI 316L.	Water	2'0	Room temp.	120	X			
6	HX 4004 01 (cooling fluid part)	Reactor RCIVa reflux condenser	Glycol		Room temp.		X			Not tested.
7	HX 4005 01	Plate heat exchanger for water cooling with glycol	Water	2'2	Room temp.	20	X			
8	HX 4005 02	Electrical resistance for water heating	Water	2'2	Room temp.	20	X			

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EQUIPMENT TIGHTNESS / PRESSURE TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	23/07/09 and 02/03/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep [illegible]

TEST	ITEM	DESCRIPTION	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
				P_T (barg)	T_T (ºC)	t_T (min)	OK	no OK	FIXED	
9	HX 4010 01	Post-condenser for gas analysis	Air	1'8	Room temp.	20	X			
10	GP 4001 01	Sanitary diaphragm pump for reactor feed inlet	Water	2	Room temp.	20	X			
11	GP 4001 02	Sanitary diaphragm pump for reactor feed inlet	Water	2	Room temp.	20		X	X 01/09/09	Leakage detected in a clamp connection. Clamp tightened
12	GP 4002 01	Sanitary diaphragm pump for reactor liquid outlet	Water	2	Room temp.	20	X			
13	GP 4002 02	Sanitary diaphragm pump for reactor liquid inlet	Water		Room temp.					N/A. Not installed
14	BLWR 4003 01	Diaphragm compressor for gas circulation to reactor	Air	1'8	Room temp.	20	X			
15	BLWR 4005 01	On-line extractor for the reactor refrigeration system	Air		Room temp.					N/A. Pending tasks on the refrigeration system. (04/09/09)
16	PP 4005 01	Centrifugal pump for reactor refrigeration water flow	Water	2'2	Room temp.	20	X			

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EQUIPMENT TIGHTNESS / PRESSURE TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	23/07/09 and 02-03/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gvbern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep [illegible]

TEST	ITEM	DESCRIPTION	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
				P_T (barg)	T_T (°C)	t_T (min)	OK	no OK	FIXED	
17	PP 4006 01	Metering pump for acid additions to the reactor	Water		Room temp.					Pumps not installed. N/A
18	PP 4006 02	Metering pump for base additions to the reactor	Water		Room temp.					N/A
19	RCIVa jacket		Water	2	Room temp	120	X			

N/A ≡ not applicable

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LINES TEST REPORT

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	02/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (°C)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
1	PL-1/2-SS2-001	Water	1'95/2'00	Room temp.	20	X			
2	PL-1/2-SS2-004	Water				X			
3	PL-1 1/2-SS2-006					X			
4	PL-1 1/2-SS2-007						X	X 02/09	Clamp tigthened. Leakage detected on the connection
5	PL-1 1/2-SS2-008					X			
6	PL-1 1/2-SS2-009					X			
7	PL-1/2-SS2-010					X			
8	PL-1/2-SS2-011					X			
9	PL-1/2-SS2-012					X			
10	PL-1/2-SS2-013					X			
11	PL-1/2-SS2-014					X			
12									
13									
14									
15									

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LINES TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	02/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
			P_T (barg)	T_T (°C)	t_T (min)	OK	no OK	FIXED	
16	PL-1/2-SS2-015		1'95/2'00		20	X			
17	PL-1/2-SS2-016	Water	2		20	X			
18	PL-1/2-SS2-017	Water	2		20	X			
19	VT-1 1/2-SS2-001	Water	2'2		120	X			Included in VS 4001 01 test
20	VT-1 1/2-SS2-002	Water	~~2'5~~ 2'1		120	X			Included in VS 4002 01 test
21	GLY-3/4-SS1-001	Water	2'3		120	X			Included in VS 4001 01 jacket test
22	GLY-3/4-SS1-002	Water	2'3		120	X			Included in VS 4001 00 jacket test
23	GLY-3/4-SS1-003	Glycol			120	X			This line has been working at glycol pressure
24	GLY-3/4-SS1-004	Glycol			120	X			This line has been working at glycol pressure.
25	GLY-3/4-SS1-005								N/A
26	GLY-3/4-SS1-006								N/A
27									
28									
29									
30									

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LINES TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	02/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Merbe

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
			P_T (barg)	T_T (ºC)	t_T (min)	OK	no OK	FIXED	
31	GLY-3/4-SS1-007	Water	2		120	X			Included in VS 4002 01 jacket test
32	GLY-3/4-SS1-008	Water	2		120	X			Included in VS 4002 01 jacket test
33	AI-3/4-SS1-001								
34	AI-3/4-SS1-002								
35	AI-3/4-SS1-003								
36	AI-3/4-SS1-004								
37	WT-3/4-SS1-001	Water	2		120	X			
38	WT-3/4-SS1-002	Water	2		120	X			
39	CO2-1/2-SS2-001	Air	1'8		20	X			
40	CO2-1/2-SS2-002	Air	1'8		20		X	X 02/09	Leakage detected and fixed.
41	CO2-1/2-SS2-003	Air	1'7		20	X			
42	PAI-1/2-SS2-001	Air	1'8		20	X			
43									
44									
45									

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LINES TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	02/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Trestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
			P_T (barg)	T_T (ºC)	t_T (min)	OK	no OK	FIXED	
46	PAI-1/2-SS2-002	Air	1'8		20	X			
47	PAI-1/2-SS2-003	Air	1'8		20	X			
48	PG-1/2-SS2-001	Air	2		20	X			
49	PG-1/2-SS2-002	Air	2		20	X			
50	PG-1/2-SS2-003	Air	2		20	X			
51	PG-1/2-SS2-004	Air	2		20	X			
52	PG-1/2-SS2-005	Air	2		20	X			
53	PG-1/2-SS2-006	Air	2		20	X			
54	PG-1/2-PA-007	Air	2		20	X			
55	PG-1/2-SS2-008	Air	2		20	X			
56	PG-1/2-SS2-009	Air	2		20	X			
57									
58									
59									
60									

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CUSTOMER:	UAB - MELISSA	**TEST DATE:**	02/09/09
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Lilia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (ºC)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
61	~~PAI-1/2-SS2-001~~								
62	~~PAI-1/2-SS2-002~~								
63	PAC-1/2-PP-001	Water	1		20	X			
64	PAC-1/2-SS2-002	Water	1		20	X			
65	PAC-1/2-SS2-003	Water	1		20	X			
66	PBA-1/2-PP-001	Water	1		20	X			
67	PBA-1/2-SS2-002	Water	1		20	X			
68	Air ducts for reactor jacket cooling.								
69	↳	Air	(*)		20		X	X 22/09	Not obreserved any leakage of air in the circuit
70									
71									
72									
73									
74									
75									

(*) Fi[illegible] in operation

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EQUIPMENT STEAM PRESSURE TEST REPORT

CUSTOMER:	UAB - MELISSA	**TEST DATE:** 2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:** Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:** Josep Mestre

TEST	ITEM	DESCRIPTION	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (°C)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
1	RCIVa	Biological reactor in borosilicate glass/stainless steel. V = 77 L. Pmax=2 bar	Steam	1'5		20		X	X 3/09	Leakage in the gasket glass / stainless
2	VS 4001 01 (Vessel)	Agitated tank in AISI 316L. V =160 L. Pdesign= -1/6 bar	Steam	2		20	X			
3	VS 4001 01 (Jacket)	Agitated tank in AISI 316L. V =37 L. Pdesign= -1/6 bar	Steam	2		20	X			
4	VS 4002 01 (Vessel)	Agitated tank in AISI 316L. V = 120 L.	Steam	2		20	X			
5	VS 4002 01 (Jacket)	Agitated tank in AISI 316L.	Steam	2		20	X			
6	HX 4004 01	Reactor RCIVa reflux condenser	Steam	1'5		20	X			
7	HX 4005 01	Plate heat exchanger for water cooling with glycol								N/A
8	HX 4005 02	Electrical resistance for water heating								N/A

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EQUIPMENT STEAM PRESSURE TEST REPORT

CUSTOMER:	UAB - MELISSA	TEST DATE:	2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gilbert
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	ITEM	DESCRIPTION	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
				P_T(barg)	T_T(°C)	t_T(min)	OK	no OK	FIXED	
9	HX 4010 01	Post-condenser for gas analysis								N/A
10	GP 4001 01	Sanitary diaphragm pump for reactor feed inlet	Steam	2			X			See piping steam pressure test
11	GP 4001 02	Sanitary diaphragm pump for reactor feed inlet	Steam	2			X			
12	GP 4002 01	Sanitary diaphragm pump for reactor liquid outlet	Steam	2			X			
13	GP 4002 02	Sanitary diaphragm pump for reactor liquid inlet	Steam							N/A. Pump not installed
14	BLWR 4003 01	Diaphragm compressor for gas circulation to reactor								N/A.
15	BLWR 4005 01	On-line extractor for the reactor refrigeration system								N/A
16	PP 4005 01	Centrifugal pump for reactor refrigeration water flow								N/A

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EQUIPMENT STEAM PRESSURE TEST REPORT

CUSTOMER:	UAB - MELISSA		
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	TEST DATE:	2th / 3th of septiembre 2009
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	PREPARED BY:	Júlia Gubern
		APPROVED BY:	Josep Oterbe

TEST	ITEM	DESCRIPTION	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
				P_T(barg)	T_T(ºC)	t_T(min)	OK	no OK	FIXED	
17	PP 4006 01	Metering pump for acid additions to the reactor								N/A
18	PP 4006 02	Metering pump for base additions to the reactor								N/A
19		Reactor sampling valve	Steam				X			
20		VS400101 sampling valve	Steam				X			
21		VS4002 01 sampling valve	Steam				X			

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LINES TEST REPORT

STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	TEST DATE:	2th/3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gibert
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
			P_T (barg)	T_T (ºC)	t_T (min)	OK	no OK	FIXED	
1	PL-1/2-SS2-001	Steam	2		20	X			Included in VS 4001 01 test
2	PL-1/2-SS2-004	Steam	2		20	X			
3	PL-1 1/2-SS2-006	Steam	2		20	X			
4	PL-1 1/2-SS2-007	Steam	2		20	X			Pressure is maintained in the hole line throu the bypass because of the small section of the flowmeter FT 4001 01.
5	PL-1 1/2-SS2-008	Steam	2		20	X			
6	PL-1 1/2-SS2-009	Steam	2		20	X			
7	PL-1/2-SS2-010	Steam	2		20	X			
8	PL-1/2-SS2-011	Steam	2		20	X			
9	PL-1/2-SS2-012	Steam	2		20	X			
10	PL-1/2-SS2-013	Steam	2		20	X			
11	PL-1/2-SS2-014	Steam	2		20	X			
12									
13									
14									
15									

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STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (°C)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
16	PL-1/2-SS2-015	Steam	2		20	X			
17	PL-1/2-SS2-016	Steam	2		20	X			
18	PL-1/2-SS2-017	Steam	2		20	X			Included in VS 4002 01 test
19	VT-1 1/2-SS2-001	Steam	2		20	X			Included in VS 4001 01 test
20	VT-1 1/2-SS2-002	Steam	2		20	X			Included in VS 4002 01 test
21	GLY-3/4-SS1-001	Steam	2		20	X			Included in VS 4001 01 jacket test
22	GLY-3/4-SS1-002	Steam	2		20	X			Included in VS 4001 01 jacket test
23	GLY-3/4-SS1-003								N/A
24	GLY-3/4-SS1-004								N/A
25	GLY-3/4-SS1-005								N/A
26	GLY-3/4-SS1-006								N/A
27									
28									
29									
30									

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LINES TEST REPORT

STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	TEST DATE:	2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

	TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (°C)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
17	~~76~~	ST-3/4-SSI-063/017	Steam	2		20	X		—	
18	~~77~~	ST-3/4-SSI-052	Steam	2		20	X		—	
19	~~78~~	ST-3/4-SSI-057	Steam	2		20	X		—	
20	~~79~~	ST-1/2-SSI-054	Steam	2		20	X		—	
21	~~80~~	ST-3/4-SSI-019	Steam	2		20	X		—	
22	~~81~~	ST-1/2-SSI-077	Steam	2		20	X		—	
23	~~82~~	ST-1/2-SSI-012	Steam	2		20	X		—	
24	~~83~~	ST-1/2-SSI-014	Steam	2		20	X		—	
25	~~84~~	ST-1/2-SSI-075	Steam	2		20	X		—	
26	~~85~~	ST-1/2-SSI-013	Steam	2		20	X		—	
27	~~86~~	ST-1/2-SSI-041	Steam	2		20	X		—	
28	~~87~~	ST-1/2-SSI-043	Steam	2		20	X		—	
29	~~88~~	ST-3/4-SSI-042/044	Steam	2		20	X		—	
30	~~89~~	ST-1/2-SSI-010	Steam	2		20	X		—	
31	~~90~~	ST-1/2-SSI-068	Steam	2		20	X		—	

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LINES TEST REPORT

STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	TEST DATE:	2th/3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre.

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
			P_T (barg)	T_T (°C)	t_T (min)	OK	no OK	FIXED	
31	GLY-3/4-SS1-007	Steam	2		20	X			Included in VS 4002 01 jacket test
32	GLY-3/4-SS1-008	Steam	2		20	X			Included in VS 4002 01 jacket test
33	AI-3/4-SS1-001								N/A
34	AI-3/4-SS1-002								N/A
35	AI-3/4-SS1-003								N/A
36	AI-3/4-SS1-004								N/A
37	WT-3/4-SS1-001								N/A
38	WT-3/4-SS1-002								N/A
39	CO2-1/2-SS2-001								N/A
40	CO2-1/2-SS2-002								N/A
41	CO2-1/2-SS2-003	Steam	2		20	X			
42	PAI-1/2-SS2-001								N/A
43									
44									
45									

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STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	TEST DATE:	2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (ºC)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
46	PAI-1/2-SS2-002								N/A
47	PAI-1/2-SS2-003	Steam	2		20	X			From HV 40152 6 to reactor
48	PG-1/2-SS2-001	Steam	2		20	X			
49	PG-1/2-SS2-002	Steam	2		20	X			
50	PG-1/2-SS2-003	Steam	2		20	X			
51	PG-1/2-SS2-004	Steam	2		20	X			
52	PG-1/2-SS2-005	Steam	2		20	X			
53	PG-1/2-SS2-006								N/A
54	PG-1/2-PA-007								N/A
55	PG-1/2-SS2-008								N/A
56	PG-1/2-SS2-009								N/A
57									
58									
59									
60									

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STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Guberu
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Melre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (°C)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
61	PAI-1/2-SS2-001								N/A
62	PAI-1/2-SS2-002	~~Steam~~	~~2~~		~~20~~	~~X~~			N/A
63	PAC-1/2-PP-001								N/A
64	PAC-1/2-SS2-002	Steam	2		20	X			
65	PAC-1/2-SS2-003	Steam	2		20	X			
66	PBA-1/2-PP-001								N/A
67	PBA-1/2-SS2-002	Steam	2		20	X			
68									
69									
70									
71									
72									
73									
74									
75									

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LINES TEST REPORT

STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	**TEST DATE:**	2th/3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	**PREPARED BY:**	Júlia Gubern
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	**APPROVED BY:**	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
			P_T (barg)	T_T (ºC)	t_T (min)	OK	no OK	FIXED	
76	ST-3/4"-SSI-001	Steam	2		20	X			
77	ST-1/2-SSI-002	Steam	2		20	X			
78	ST-3/4-SSI-003	Steam	2		20	X			
79	ST-1/2-SSI-021	Steam	2		20	X			
80	ST-3/4-SSI-005	Steam	2		20	X			
81	ST-3/4-SSI-006	Steam	2		20	X			
82	ST-1/2-SSI-069	Steam	2		20	X			
83	ST-1/2-SSI-009	Steam	2		20	X			
84									
85	ST-1/2-SSI-007	Steam	2		20	X			
86	ST-1/2-SSI-008	Steam	2		20	X			
87	ST-1/2-SSI-027	Steam	2		20	X			
88	ST-1/2-SSI-028	Steam	2		20	X			
89	ST-1/2-SSI-070	Steam	2		20	X			
90	ST-3/4-SSI-026	Steam	2		20	X			

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STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	TEST DATE:	2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Guberu
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS P_T (barg)	T_T (ºC)	t_T (min)	TEST RESULTS OK	no OK	FIXED	COMMENTS
91	ST-3/4-SSI-061	Steam	2		20	X		—	
92	ST-3/4-SSI-062	Steam	2		20	X		—	
93	ST-1/2-SSI-071	Steam	2		20	X		—	
94	ST-1/2-SSI-030	Steam	2		20	X		—	
95	ST-1/2-SSI-031	Steam	2		20	X		—	
96	ST-1/2-SSI-064	Steam	2		20	X		—	
97	ST-1/2-SSI-026	Steam	2		20	X		—	
98	ST-1/2-SSI-029	Steam	2		20	X		—	
99	ST-3/4-SSI-061/062	Steam	2		20	X		—	
100	ST-1/2-SSI-059/060	Steam	2		20	X		—	
101	ST-1/2-SSI-033/067	Steam	2		20	X		—	
102	ST-3/4-SSI-022	Steam	2		20	X		—	
103	ST-3/4-SSI-061 A	Steam	2		20	X		—	
104	ST-3/4-SSI-062 A	Steam	2		20	X		—	
105	ST-1/2-SSI-~~015~~050	Steam	2		20	X		—	

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LINES TEST REPORT

STEAM PRESSURE TEST

CUSTOMER:	UAB - MELISSA	TEST DATE:	2th / 3th of septembre 2009
PROJECT:	MELISSA COMPARTMENT IVa (PRK-5393)	PREPARED BY:	Júlia Gubach
DRAWING:	DD - 8558 - Z1 -100 - 01 rev. 10	APPROVED BY:	Josep Mestre

TEST	PIPELINE Nr.	TESTING FLUID	TEST CONDITIONS			TEST RESULTS			COMMENTS
			P_T (barg)	T_T (ºC)	t_T (min)	OK	no OK	FIXED	
106	ST-1/2-SS1-072	Steam	2		20	X		—	
107	ST-1/2-SS1-046	Steam	2		20	X		—	
108	ST-3/4-SS1-045/047	Steam	2		20	X		—	
109	ST-1/2-SS1-016	Steam	2		20	X		—	
110	ST-1/2-SS1-074	Steam	2		20	X		—	
111	ST-1/2-SS1-073	Steam	2		20	X		—	
112	ST-1/2-SS1-051	Steam	2		20	X		—	
113	ST-3/4-SS1-020	Steam	2		20	X		—	
114	ST-3/4-SS1-057	Steam	2		20	X		—	
115	ST-3/4-SS1-050	Steam	2		20	X		—	
116	ST-3/4-SS1-055/056	Steam	2		20	X		—	

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12. ELECTRIC DIAGRAMS CE MARKING (NEW CABINET)

12.1. CE Declaration
12.2. New cabinet: electrical diagrams

PROCONTROL, S.L.

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Rambla del Poble Nou, 189 - 08018 Barcelona
Teléfono 93 309 51 16 - Fax 93 309 87 91
e-mail: comercial@procontrolsl.com – Info: www.procontrolsl.com

DECLARACIÓN CE DE CONFORMIDAD

La empresa:

Nombre:	PROCONTROL,S.L.
Dirección:	Rambla del Poble Nou, 189 – 08018 Barcelona
Teléfono:	93 309 51 16
FAX:	93 309 87 91
Email:	comercial@procontrolsl.com

declara bajo su única responsabilidad que el producto:

Descripción:	Armario de control Compartimento IVa. MELISSA Pilot Plant
Nº Inventario:	081398-6293

se halla en conformidad con las directivas europeas siguientes:

Referencias	**Título**
73/23/CEE	Material eléctrico destinado a utilizarse en determinados límites de tensión (Baja Tensión)
93/68/CEE	Modificación de la Directiva 73/23/CEE
89/336/CEE	Compatibilidad electromagnética
92/31/CEE	Modificación de la Directiva 89/336/CEE
93/68/CEE	Modificación de la Directiva 89/336/CEE

Nombre y apellidos _____MARC SANROMÀ SOLENCH_____

Cargo ____Responsable del proyecto______

Lugar y fecha __________18/06/2009______________

Firma

PROCONTROL, S.L.

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Teléfono 93 309 51 16 - Fax 93 309 87 91
e-mail: comercial@procontrolsl.com – Info: www.procontrolsl.com

Referencias de las normas técnicas aplicadas:

- Normas armonizadas

Número	**Título**
UNE-EN 50081-2	Compatibilidad electromagnética. Norma genérica de emisión
UNE-EN 50082-2	Compatibilidad electromagnética. Norma genérica de inmunidad
UNE-EN 61000-6-2	Compatibilidad electromagnética. Normas Genéricas
UNE-EN 60439	Baja Tensión. Requisitos para los conjuntos serie y los conjuntos derivados de serie

- Otras normas técnicas o especificaciones técnicas empleadas

Número	**Título**

- Otras soluciones adoptadas, los detalles de las cuales son incluidas en la documentación técnica:

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Las dos últimas cifras del año en el cual el marcado CE ha sido incorporado:__09_________________

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

Constructor De Dietrich

De Dietrich. Equipos Químicos, S. L.
Príncep d'Astúries, 43-45
08012
BARCELONA

Cliente final : Universitat Autònoma de Barcelona
Escola Tecnica Superior d'Enginyeria
Departament d'Enginyeria Química
08193
Bellaterra

Nombre del proyecto : Compartiment IVa. MELISSA Pilot plant

Emplazamiento : U. A. B. Bellaterra

Diseñador : M. Alcampel
Director de proyecto : J. Mestre
Tensión : 400-230VAC / 50Hz
Tensión de mando : 24VDC
Año de construcción : 2009

Total de páginas
43

De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA	REF: A	Proyecto	M. Alcampel	De Dietrich	Anterior:	
	Portada	INSTAL. =C_IV/A	Verificado	J. Mestre		Siguiente:	2
		LUGAR +INFO	Dibujado	M. Alcampel		Página:	1
			Fecha	13.Abr.2009			

Indice de páginas

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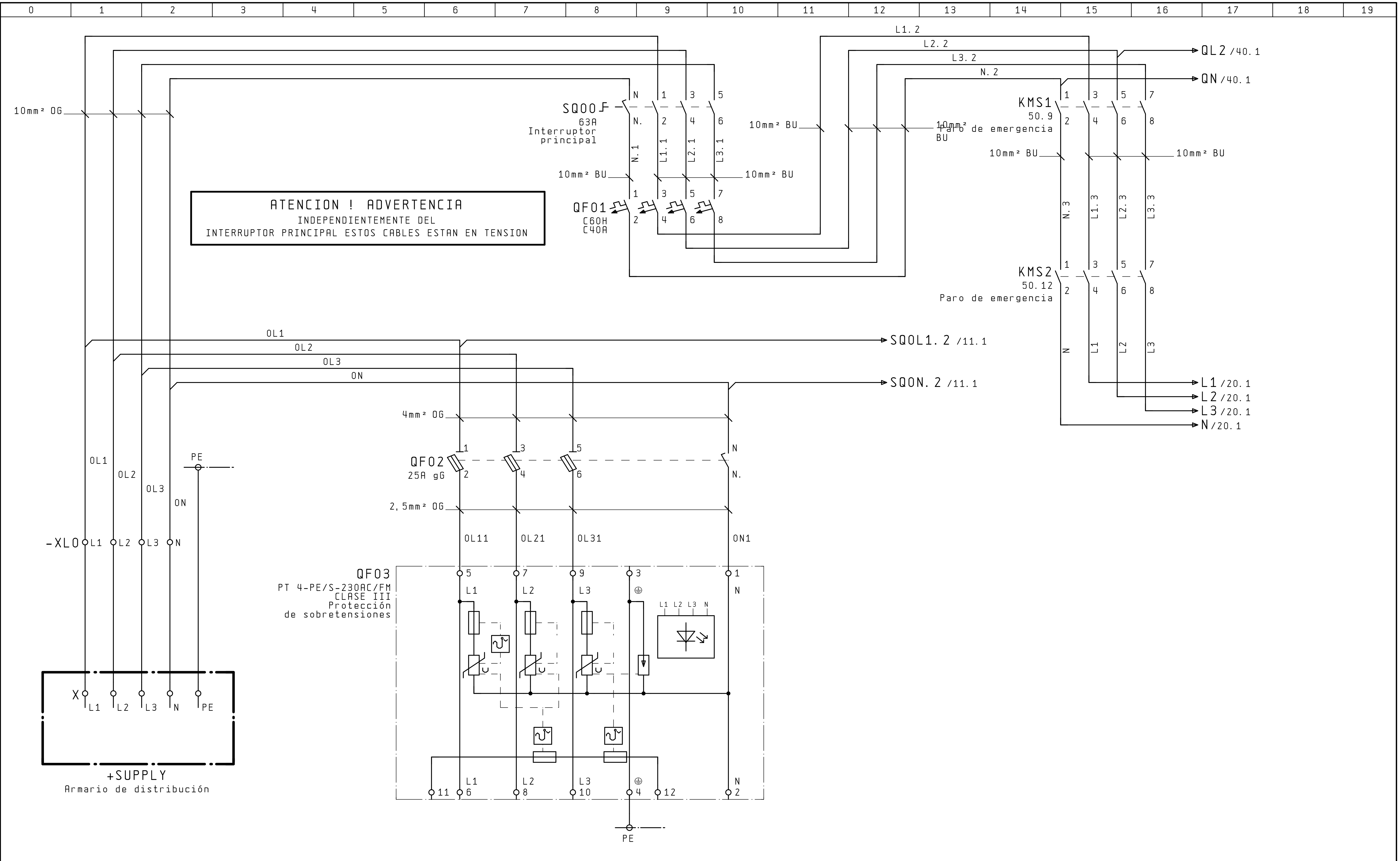
Indice de páginas

Columna x: una página creada automáticamente ha sido modificada manualmente



HE Alimentación AC400V

Protección de sobretensiones

De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA Alimentación AC400V/230V	REF: A INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto: M. Alcampel Verificado: J. Mestre Dibujado: M. Alcampel Fecha: 13.Abr.2009	De Dietrich	Anterior: +INFO/2a Siguiente: 11 Página: 10

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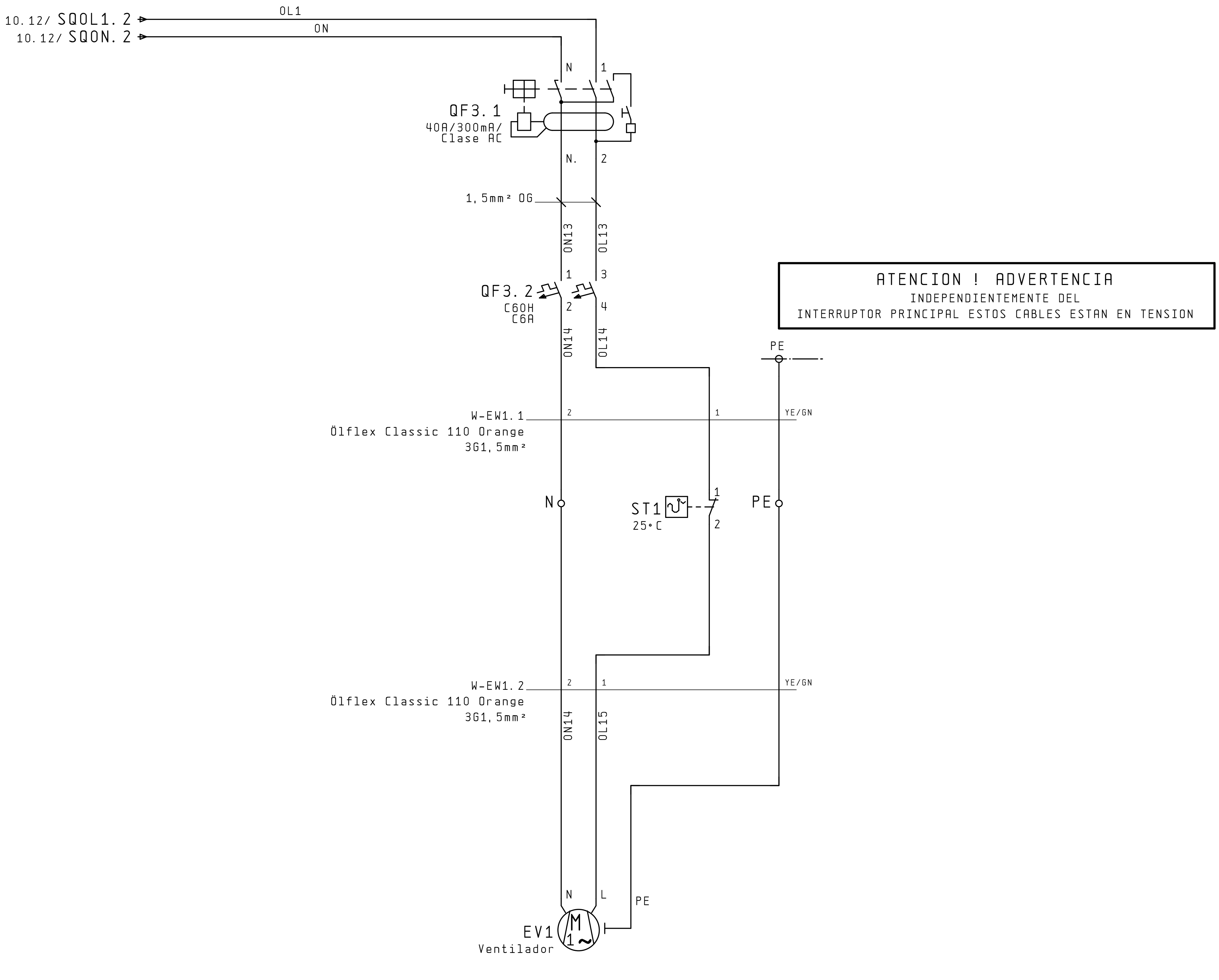
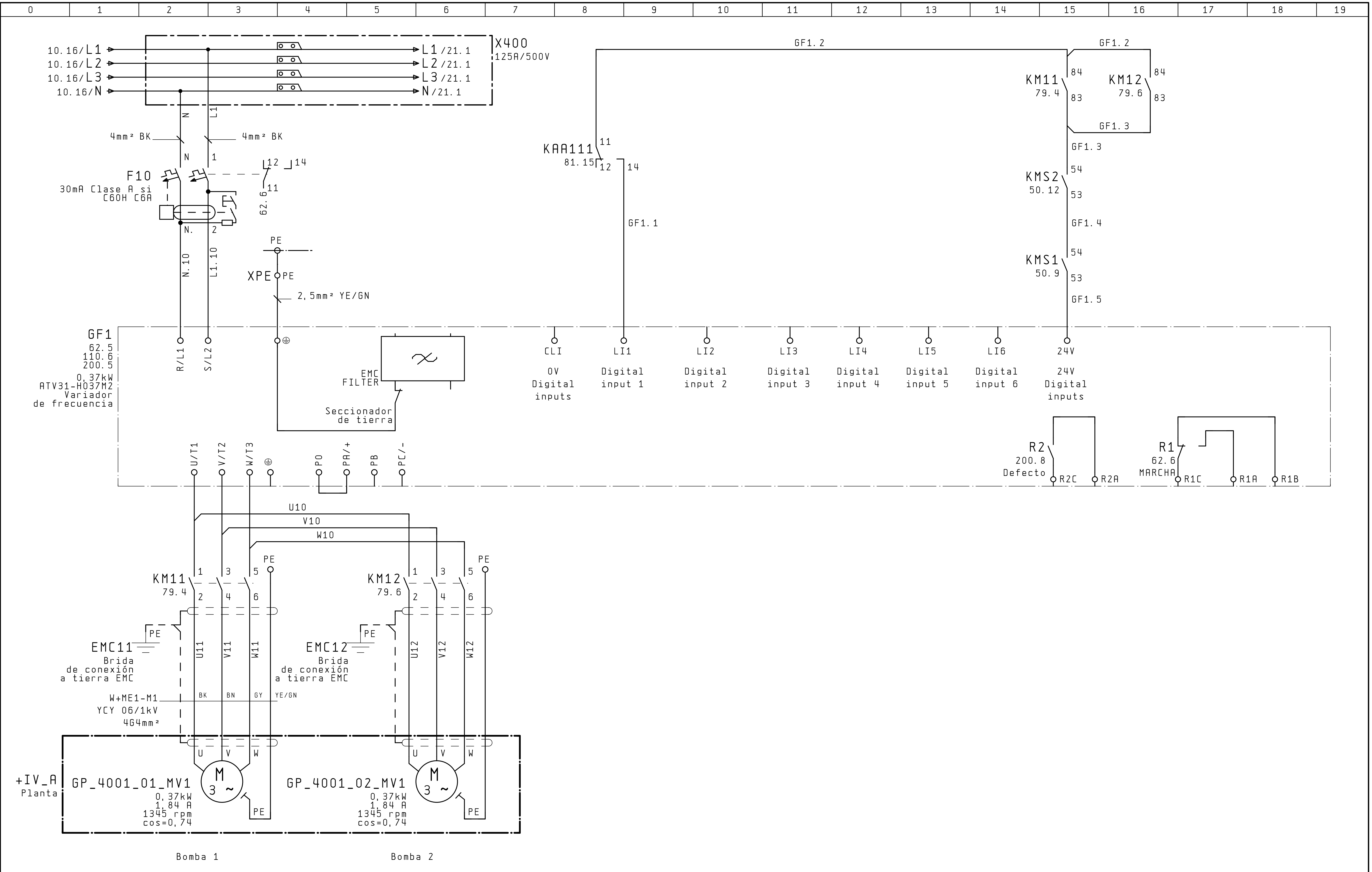
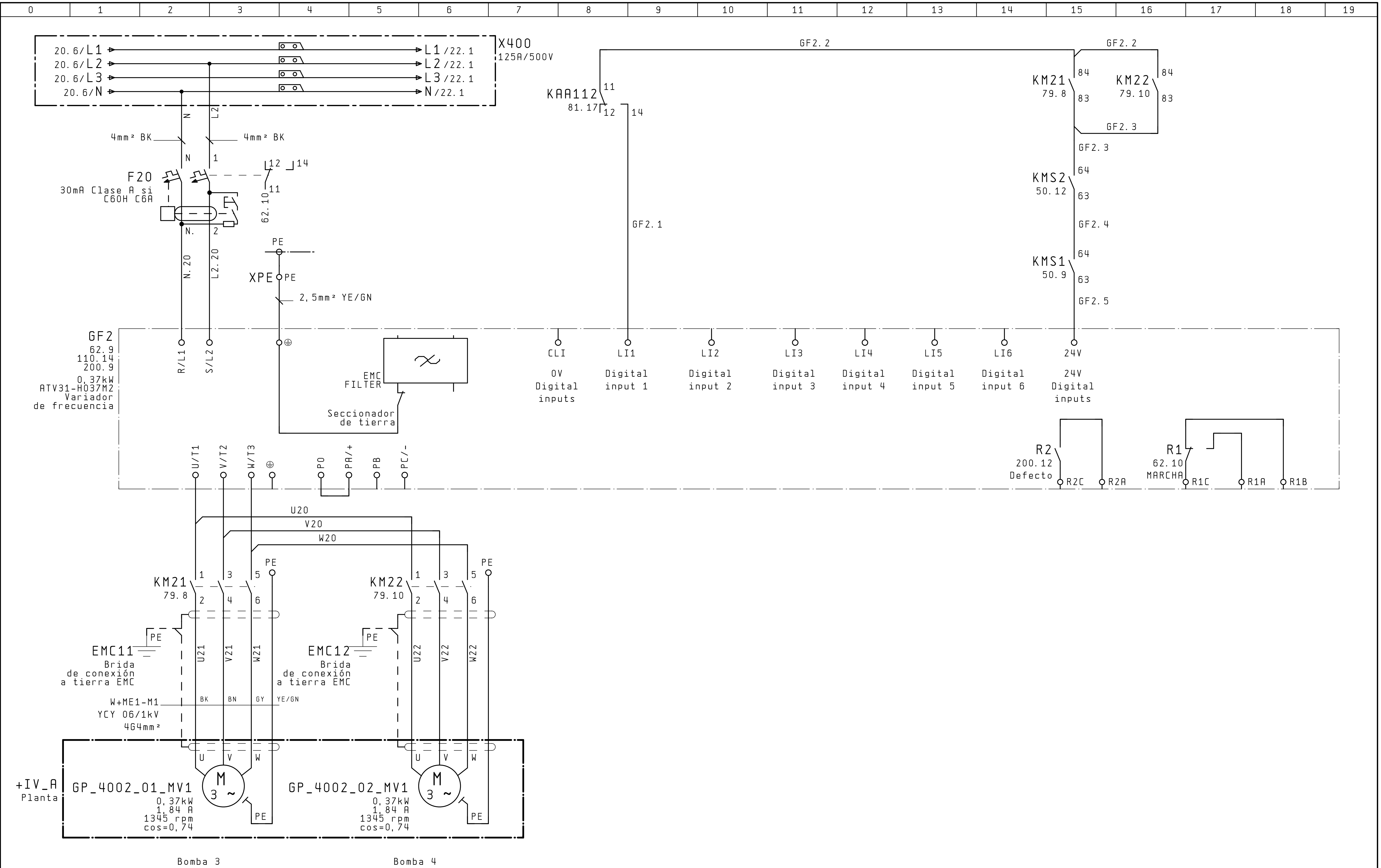


Ventilador

De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA	REF: A	Proyecto	M. Alcampel	Anterior: 10
	Alimentación AC	INSTAL. =C_IV/A	Verificado	J. Mestre	Siguiente: 20
	230V servicios auxiliares	LUGAR +MCC_01	Dibujado	M. Alcampel	Página: 11
			Fecha	13.Abr.2009	



De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA GP_4001_01_MV1 / GP_4001_02_MV1.	REF: INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto: M. Alcampel Verificado: J. Mestre Dibujado: M. Alcampel Fecha: 13.Abr.2009	Anterior: 11 Siguiente: 21 Página: 20



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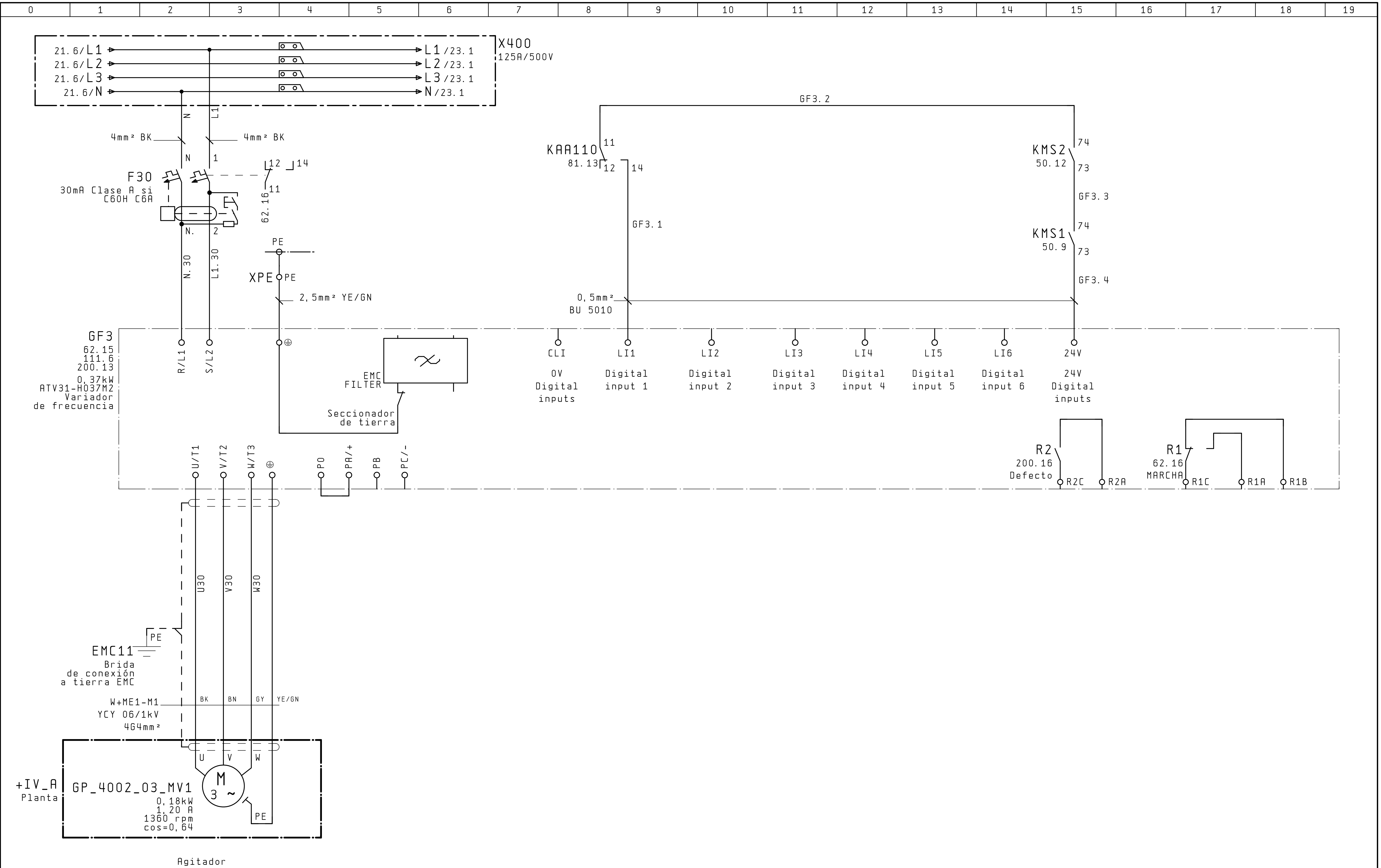
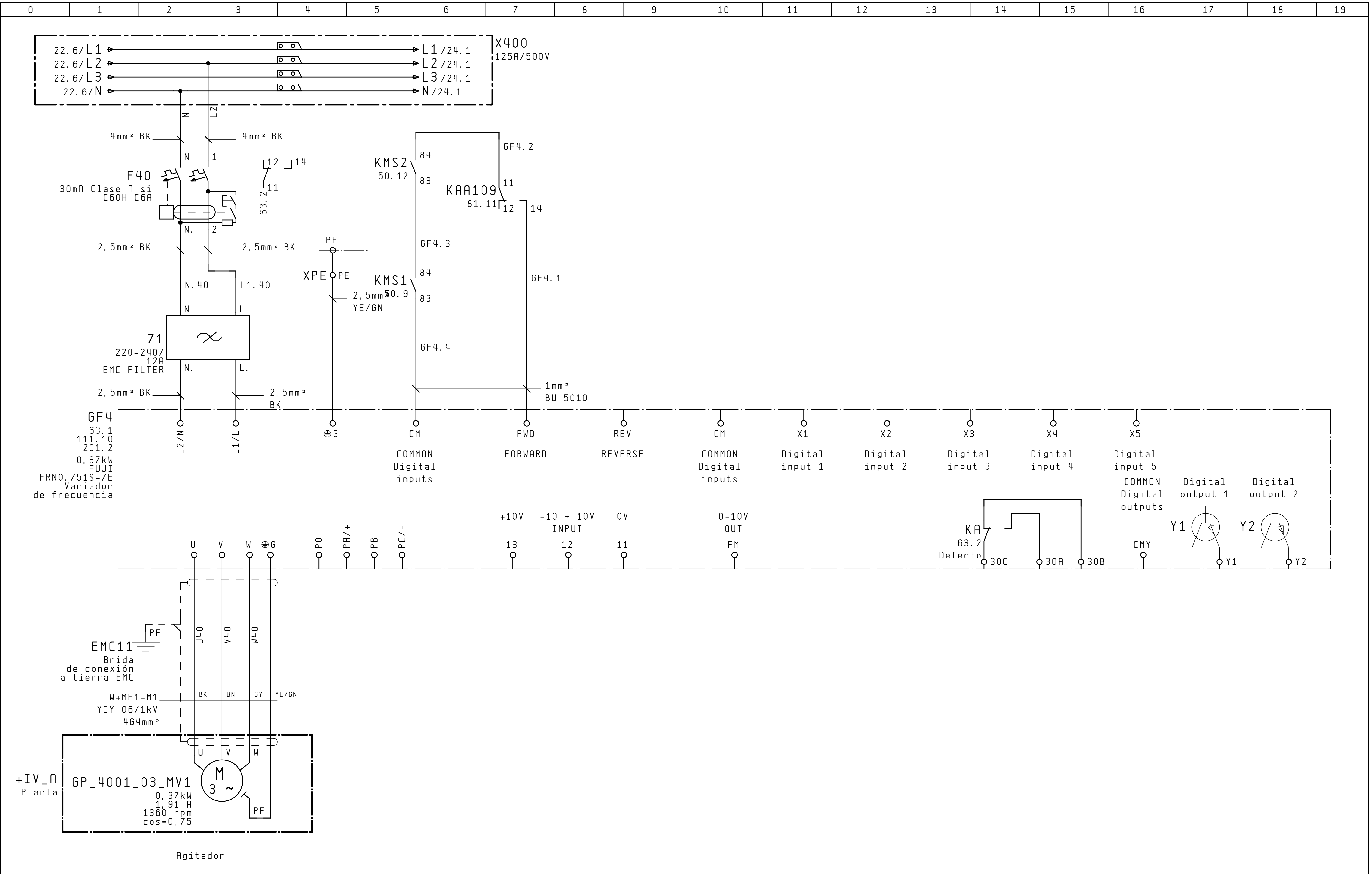
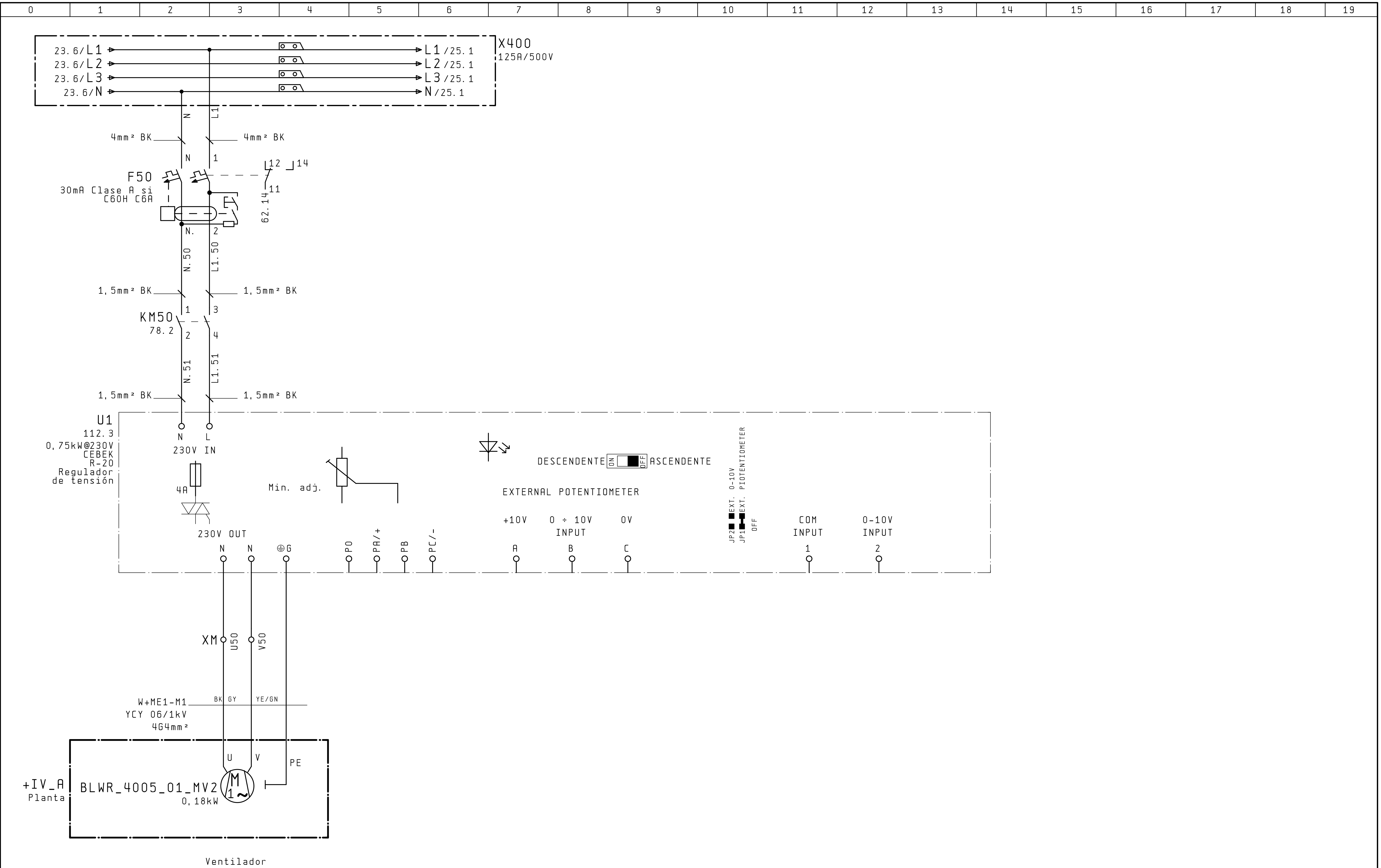


De Dietrich	IDENTIFICACION: PRIMERA VERSION OBRA	REF:	Proyecto	M. Alcampel
Equipos Químicos, S. L.	GP_4002_03_MV1.	INSTAL. =C_IV/A	Verificado	J. Mestre
			Dibujado	M. Alcampel
		LUGAR +MCC_01	Fecha	13.Abr.2009

De Dietrich



De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA GP_4001_03_MV1.	REF: INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto: M. Alcampel Verificado: J. Mestre Dibujado: M. Alcampel Fecha: 13.Abr.2009	De Dietrich	Anterior: 22 Siguiente: 24 Página: 23



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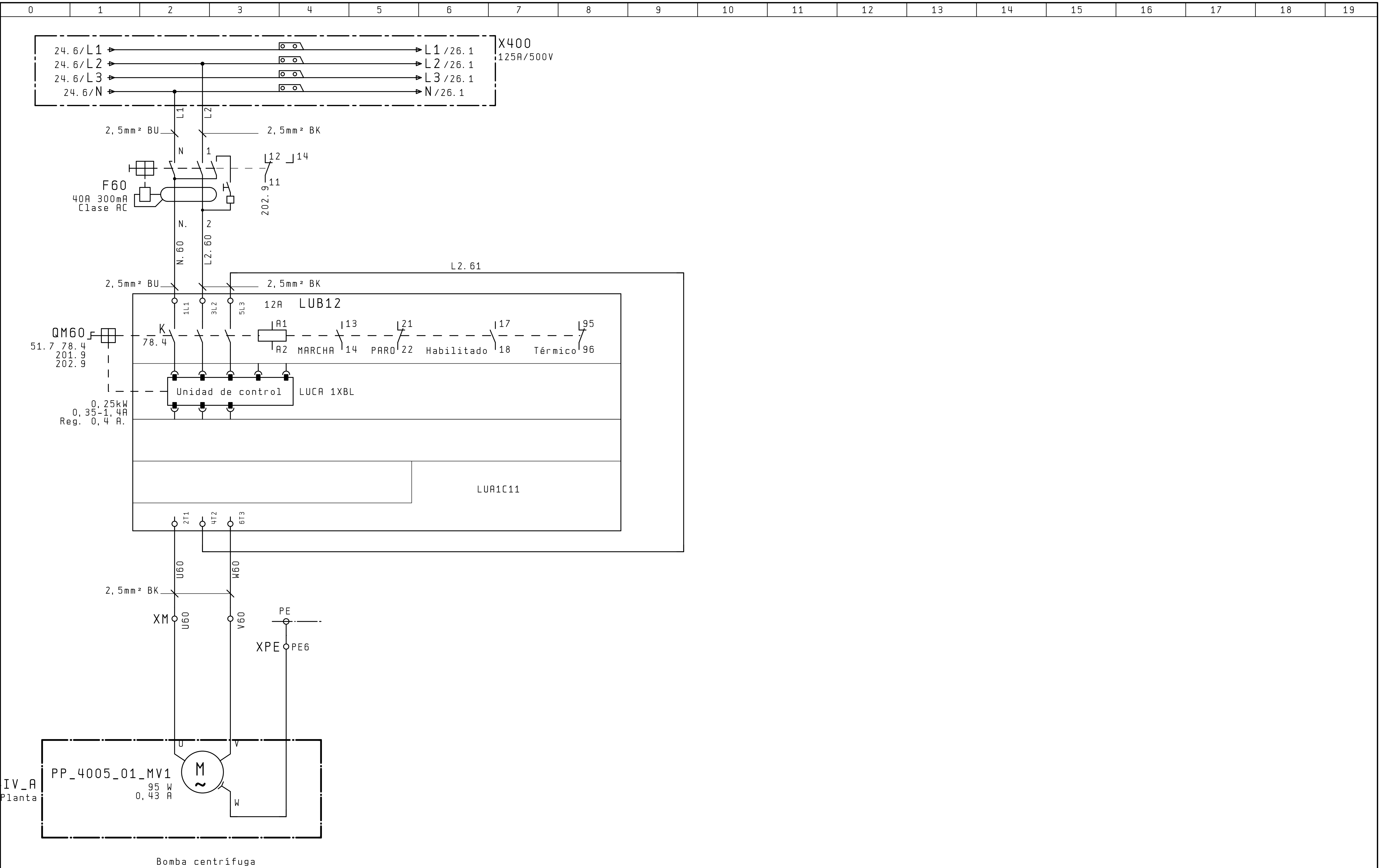

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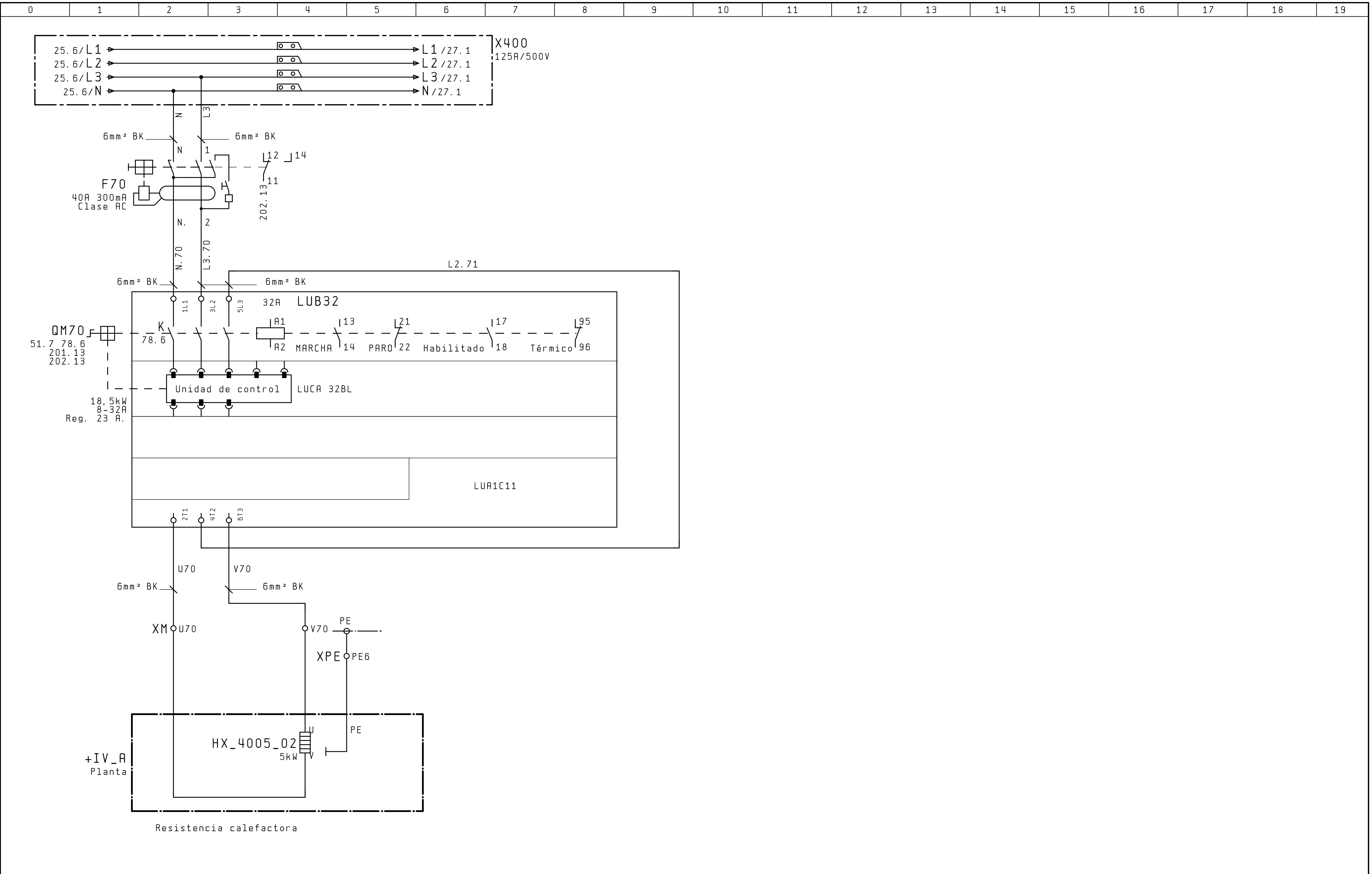

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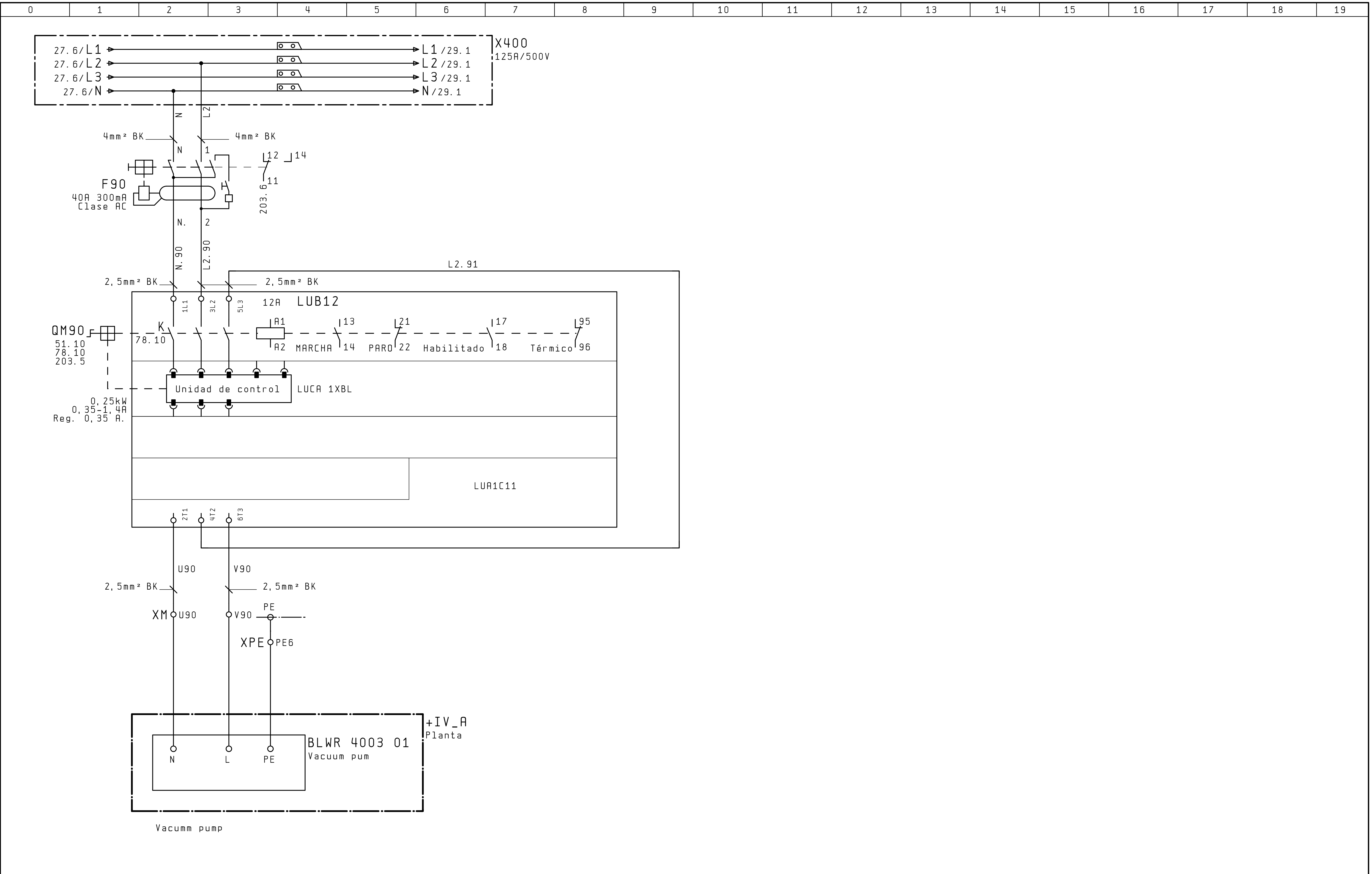
Equipos Químicos, S. L.	HX_4005_02.	INSTAL. =C_IV/A	Verificado	J. Mestre		Siguiente: 28
		LUGAR +MCC_01	Dibujado	M. Alcampel		
			Fecha	13.Abr.2009		Página: 26



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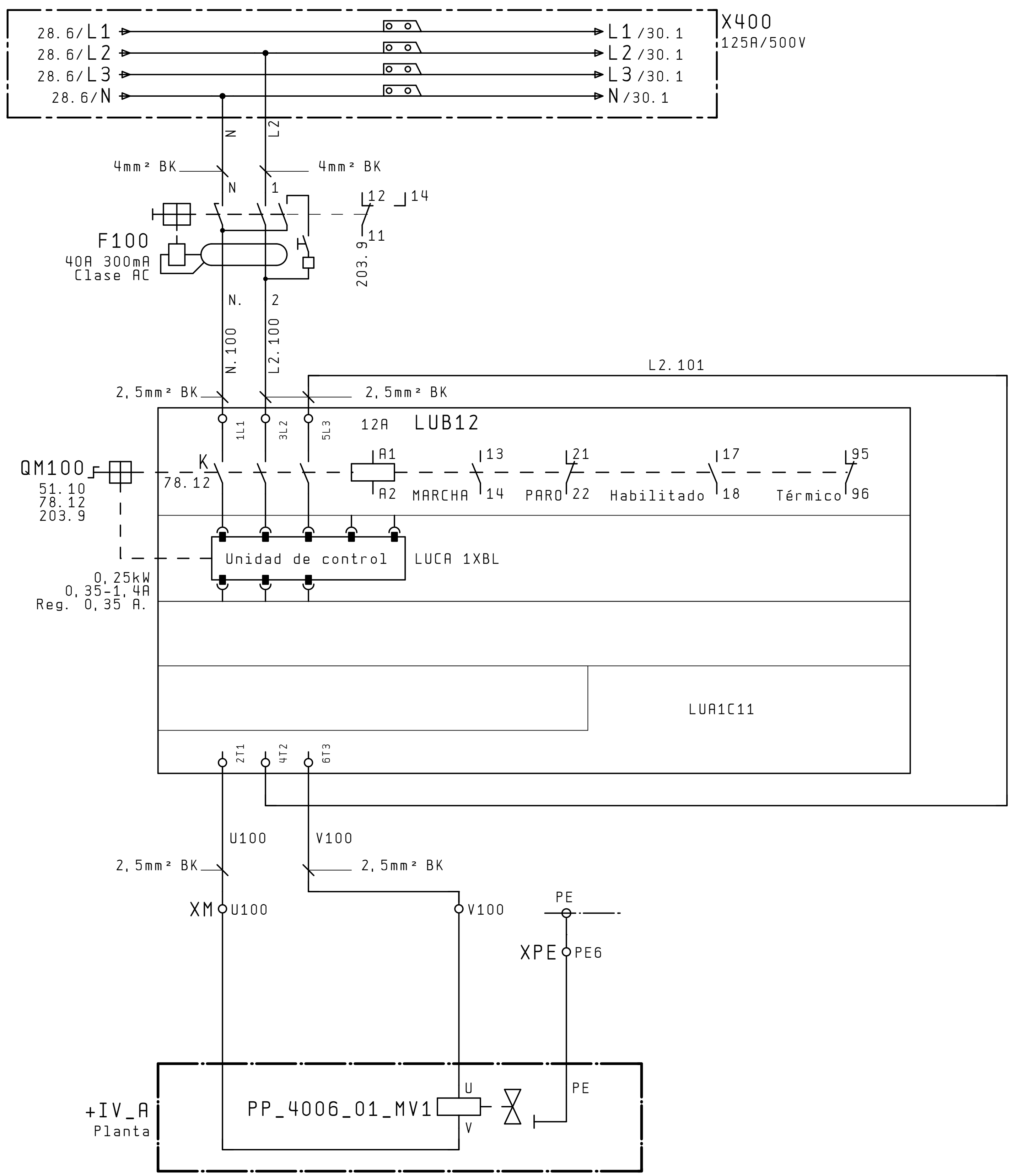

Bomba peristáltica 1

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Equipos Químicos, S. L.	PP 4006 01	INSTAL. =C_IV/A	Verificado	J. Mestre	Siguiente: 30
		LUGAR +MCC_01	Dibujado	M. Alcampel	Página: 29
			Fecha	13.Abr.2009	

De Dietrich

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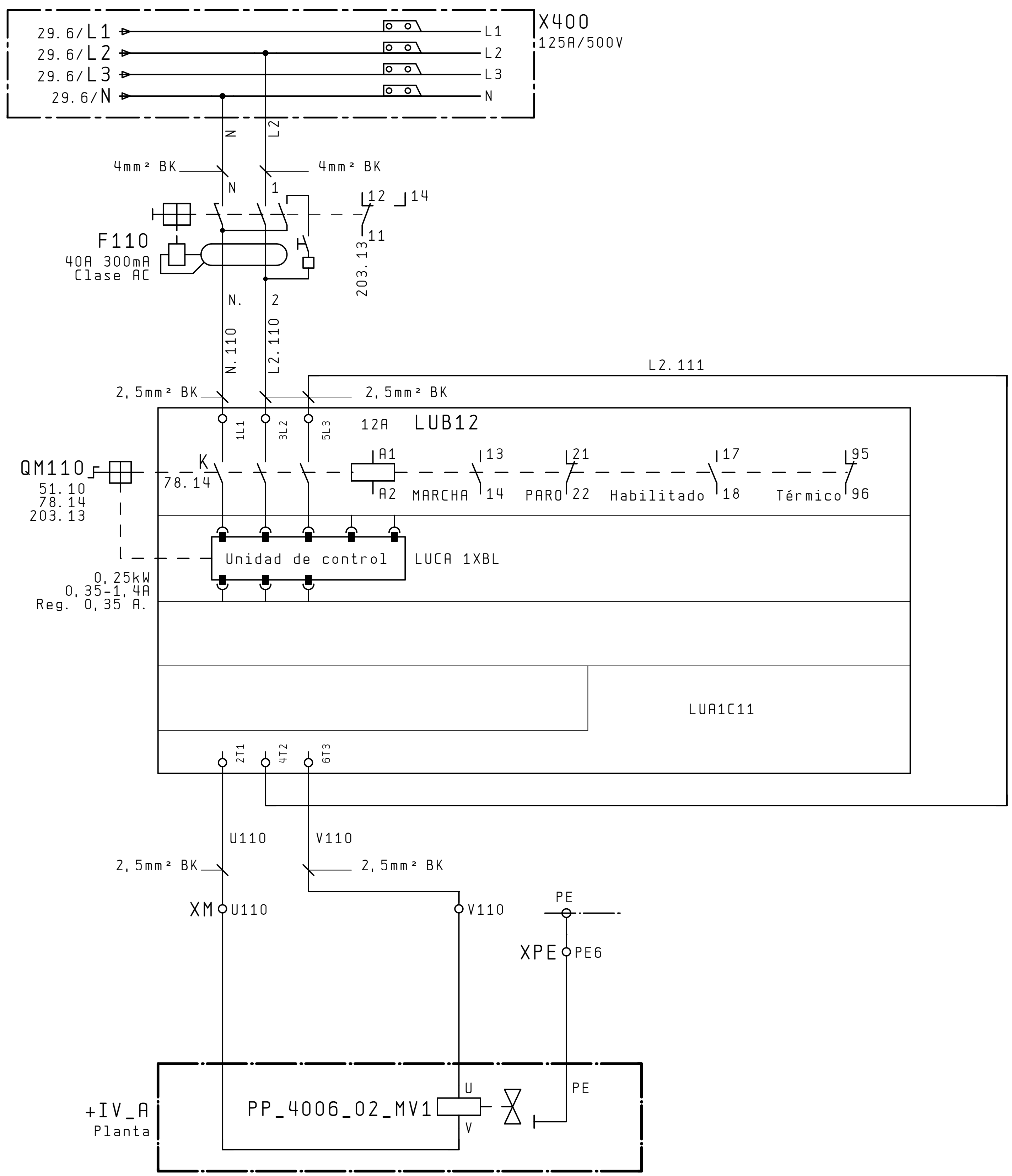

Bomba peristáltica 2

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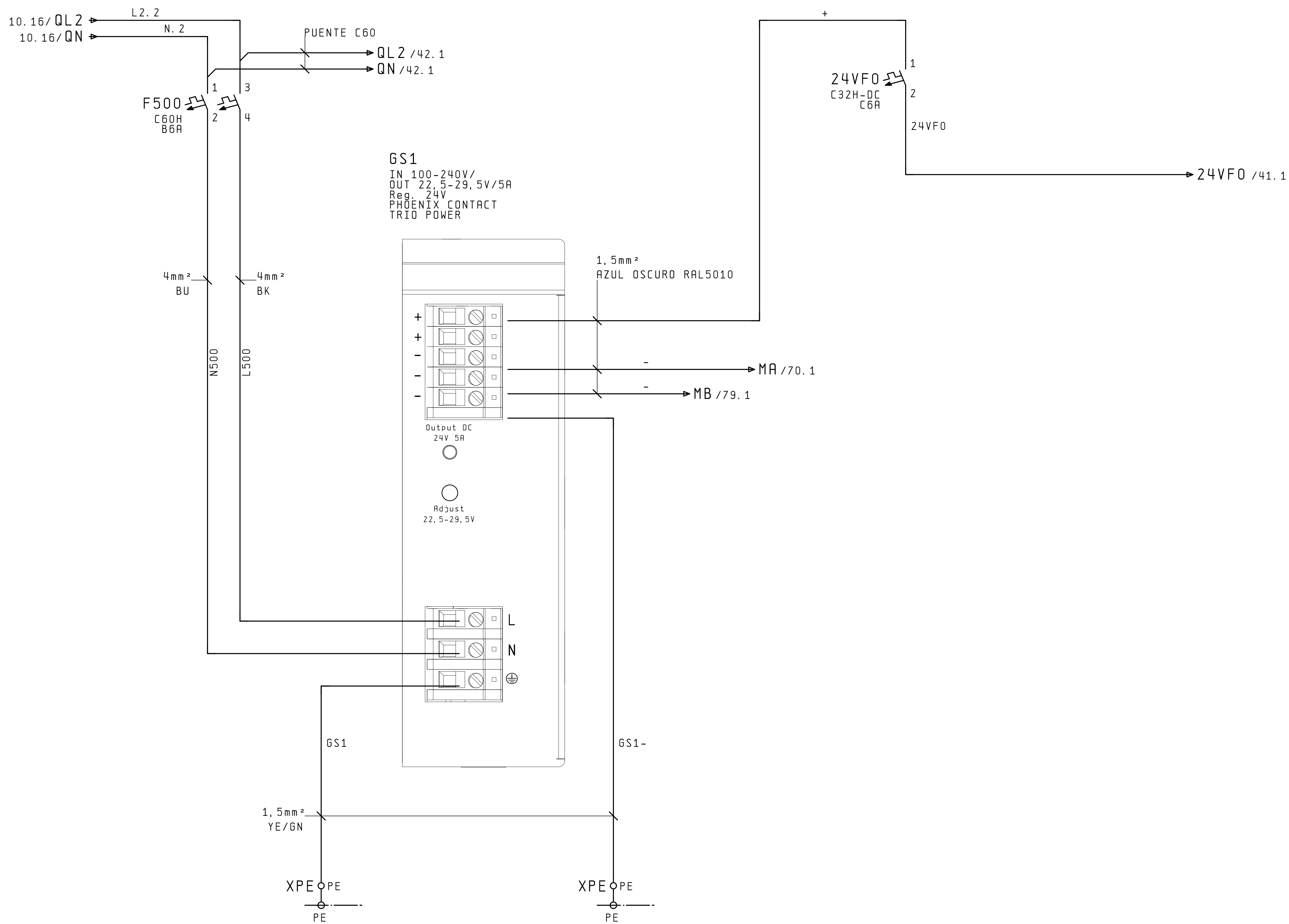

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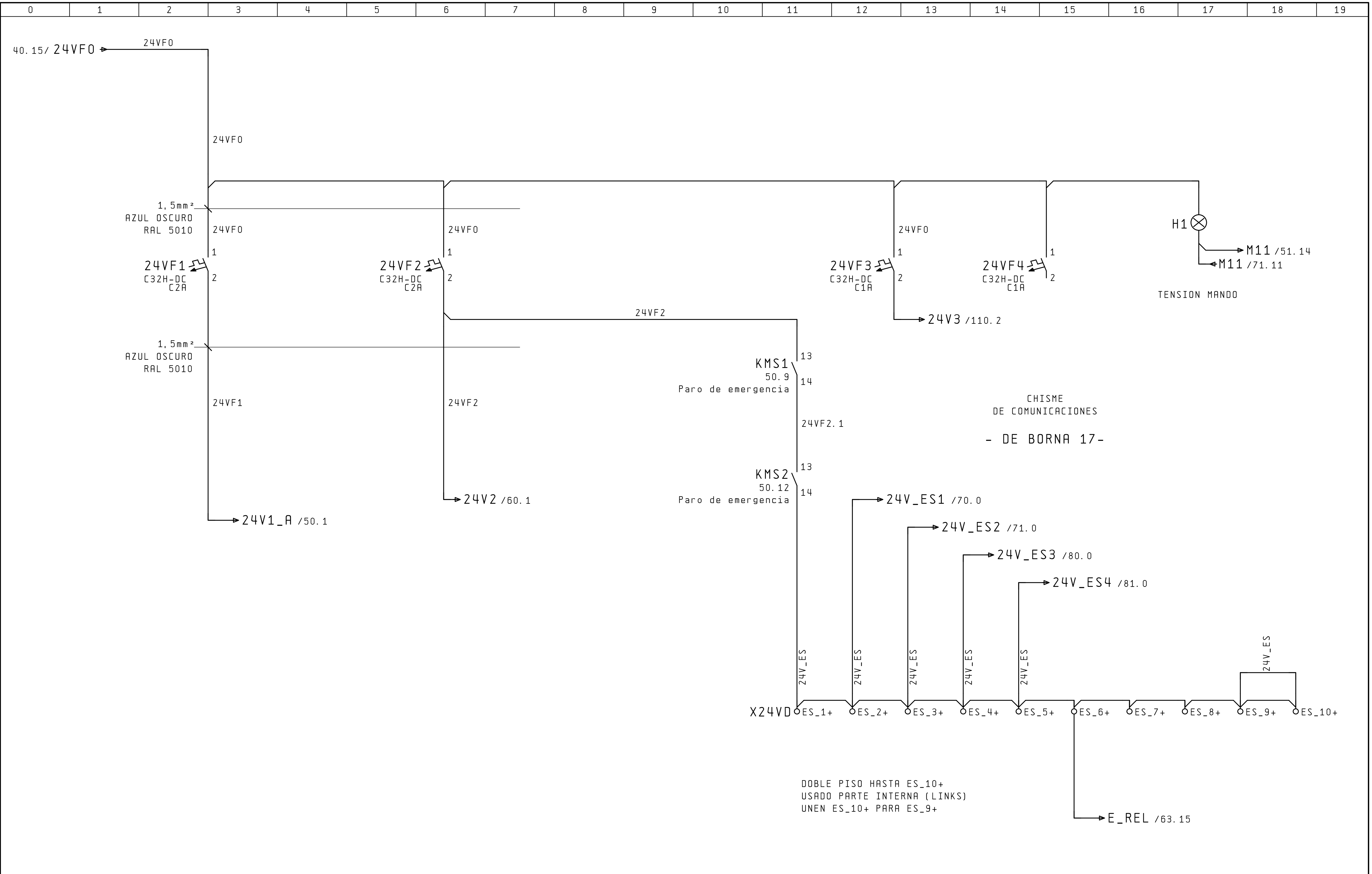
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C2A
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24VF2
24VF2.1
CHISME
DE COMUNICACIONES
- DE BORNA 17-
KMS2
50.12
Paro de emergencia
24V2 /60.1
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24V_ES4 /81.0
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X24VD
ES_1+ ES_2+ ES_3+ ES_4+ ES_5+ ES_6+ ES_7+ ES_8+ ES_9+ ES_10+
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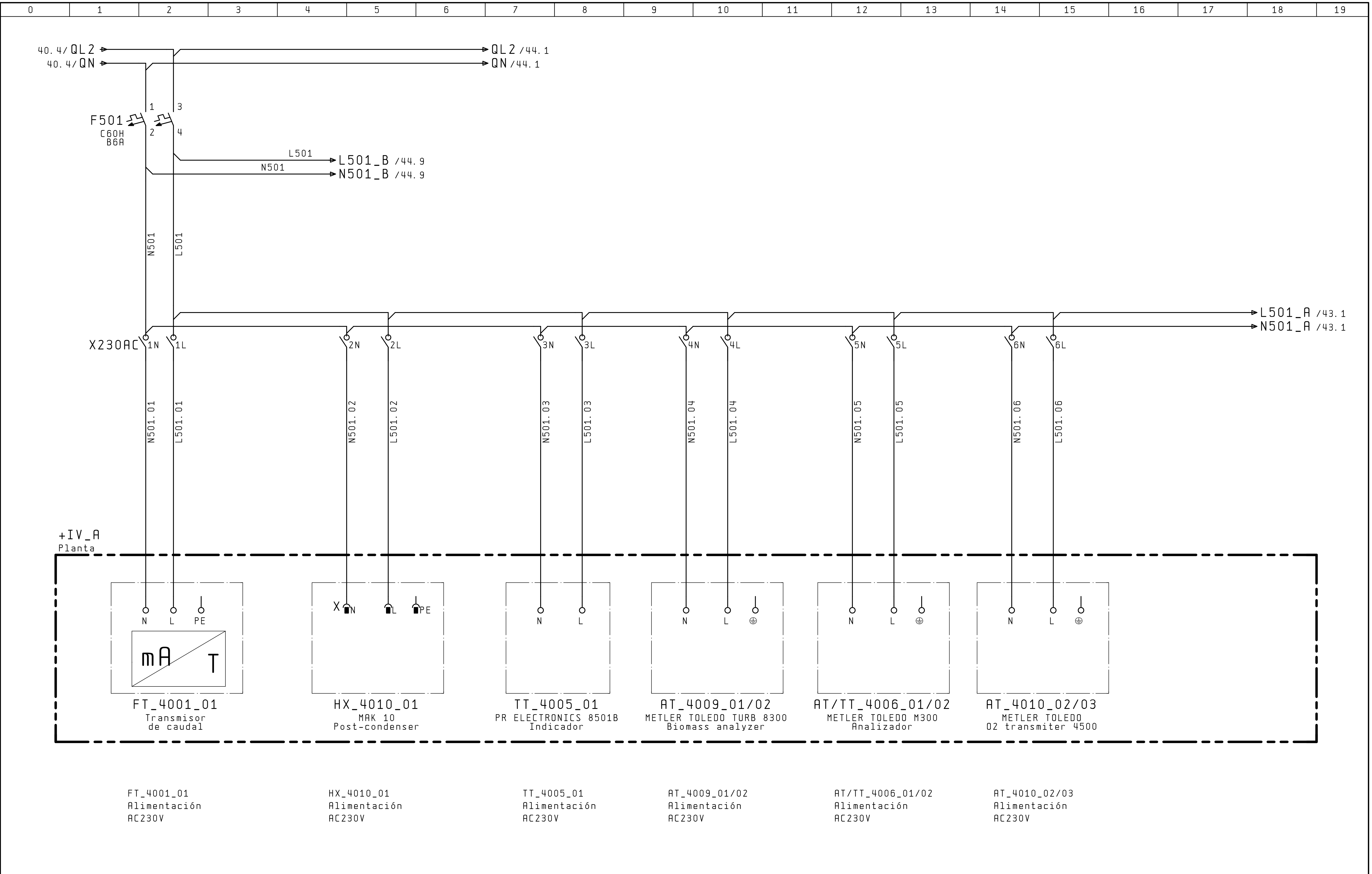

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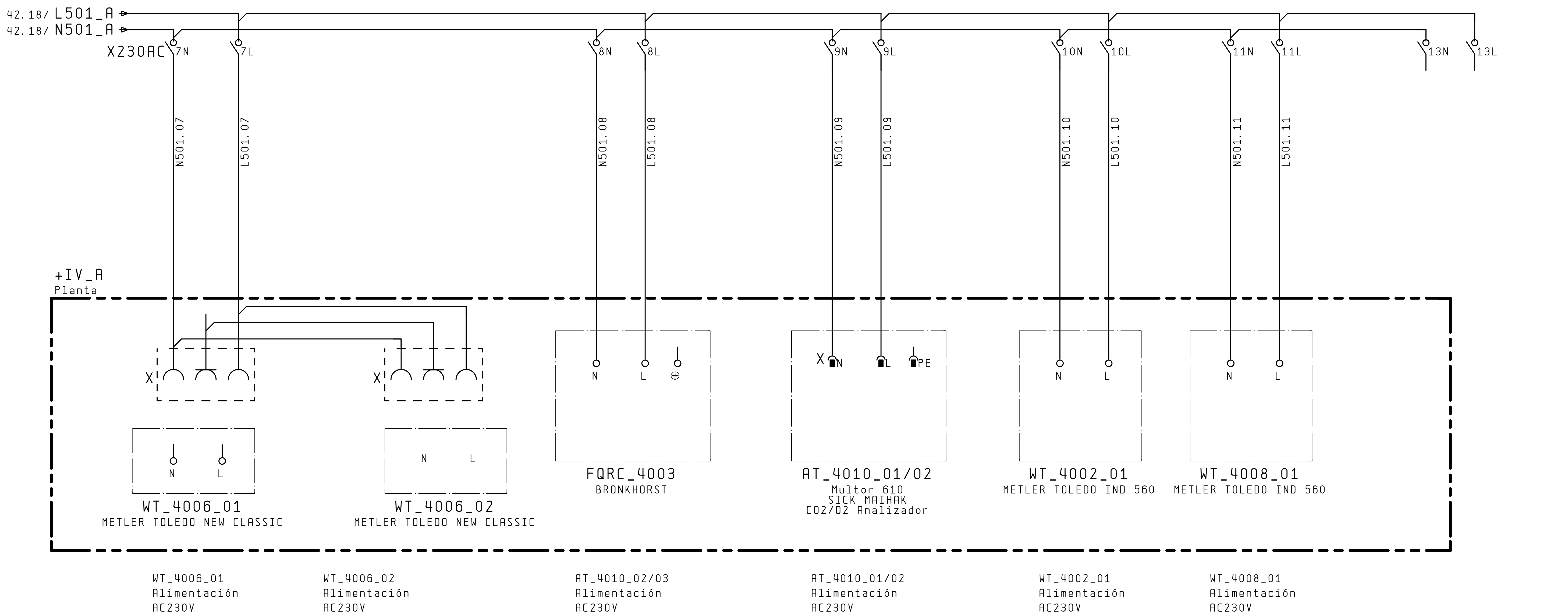
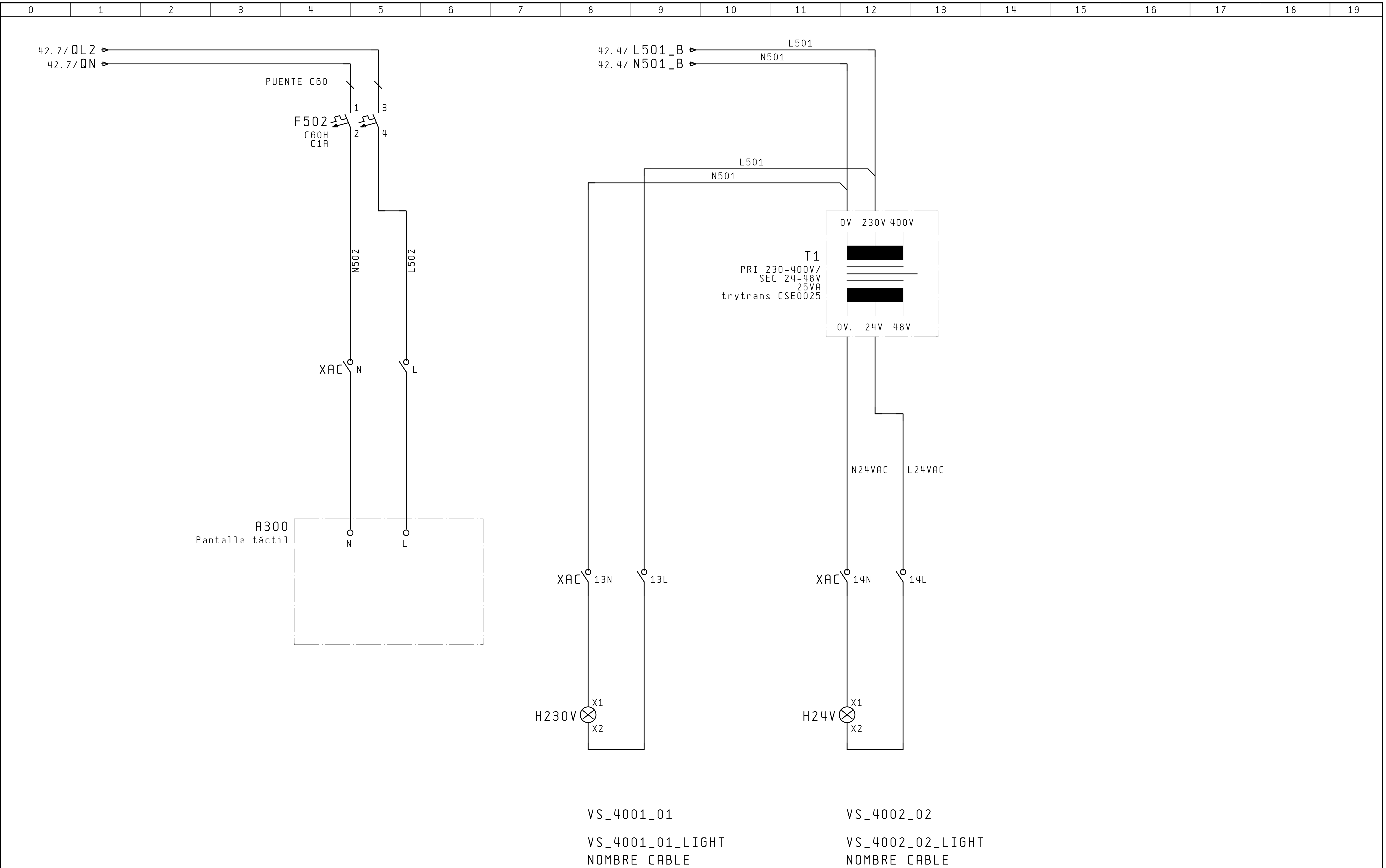


De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA Regulación de temperatura.	REF: INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto Verificado Dibujado Fecha	M. Alcampel J. Mestre M. Alcampel 13.Abr.2009	De Dietrich	Anterior: 42 Siguiente: 44 Página: 43



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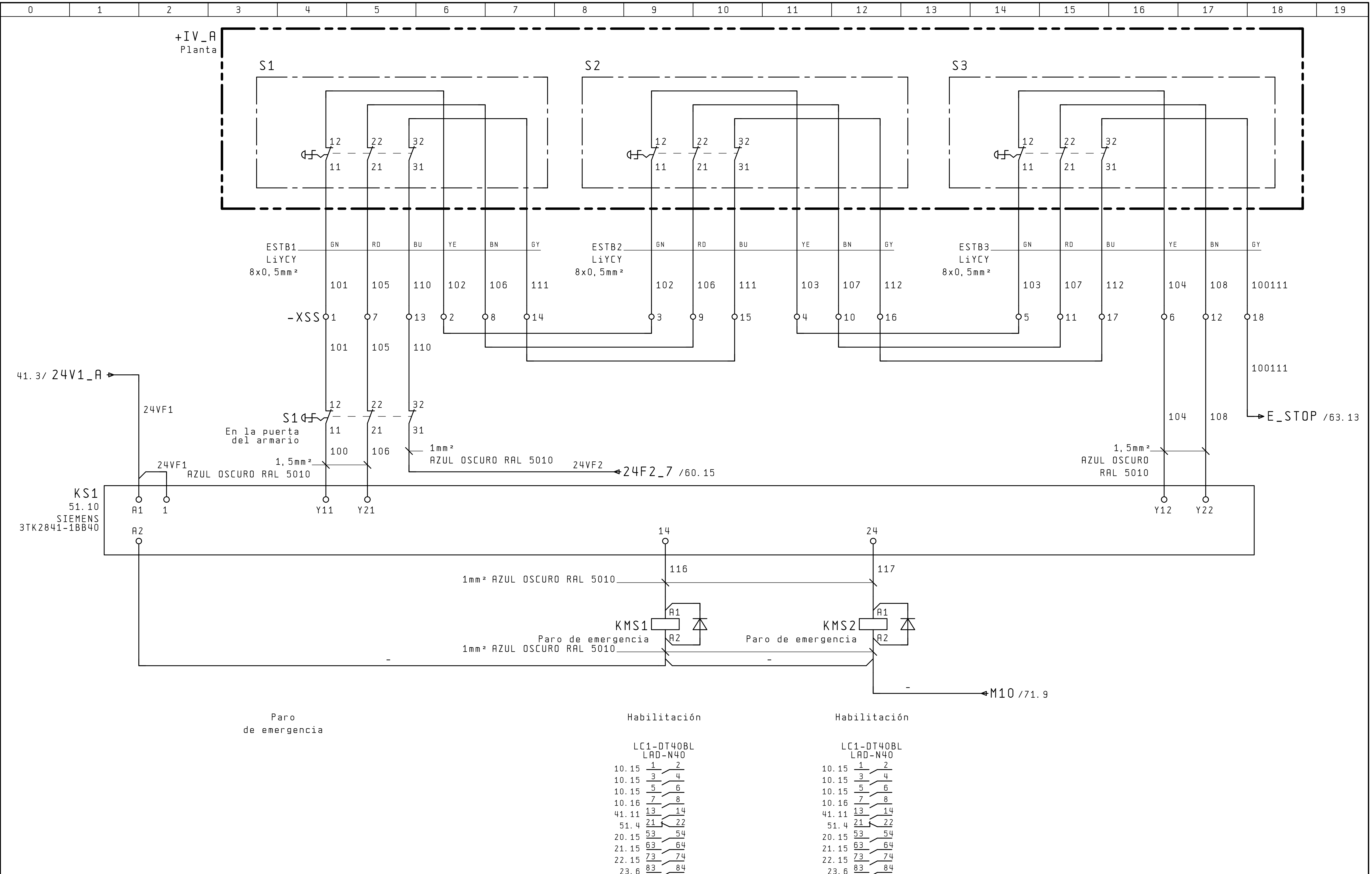

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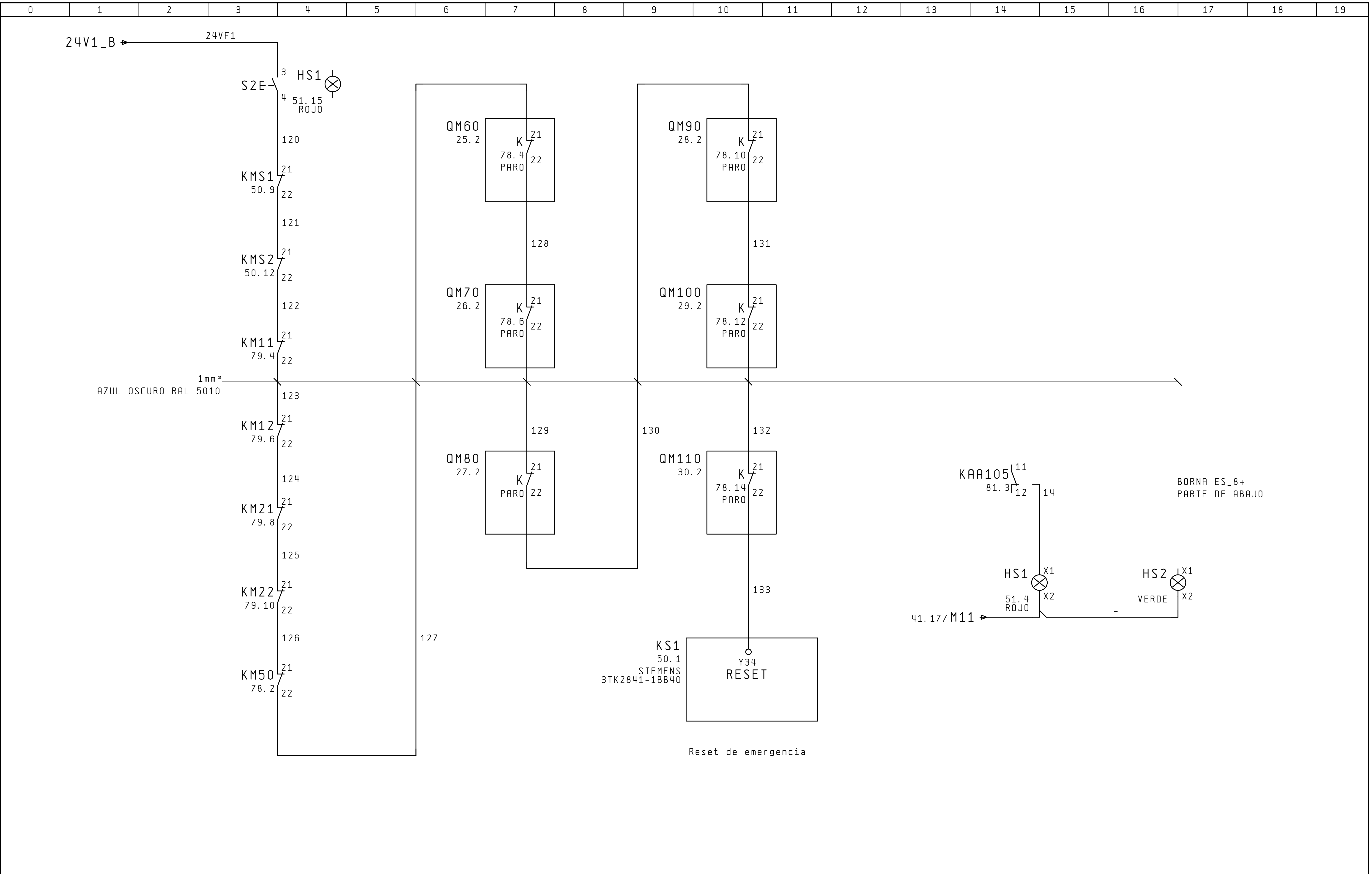

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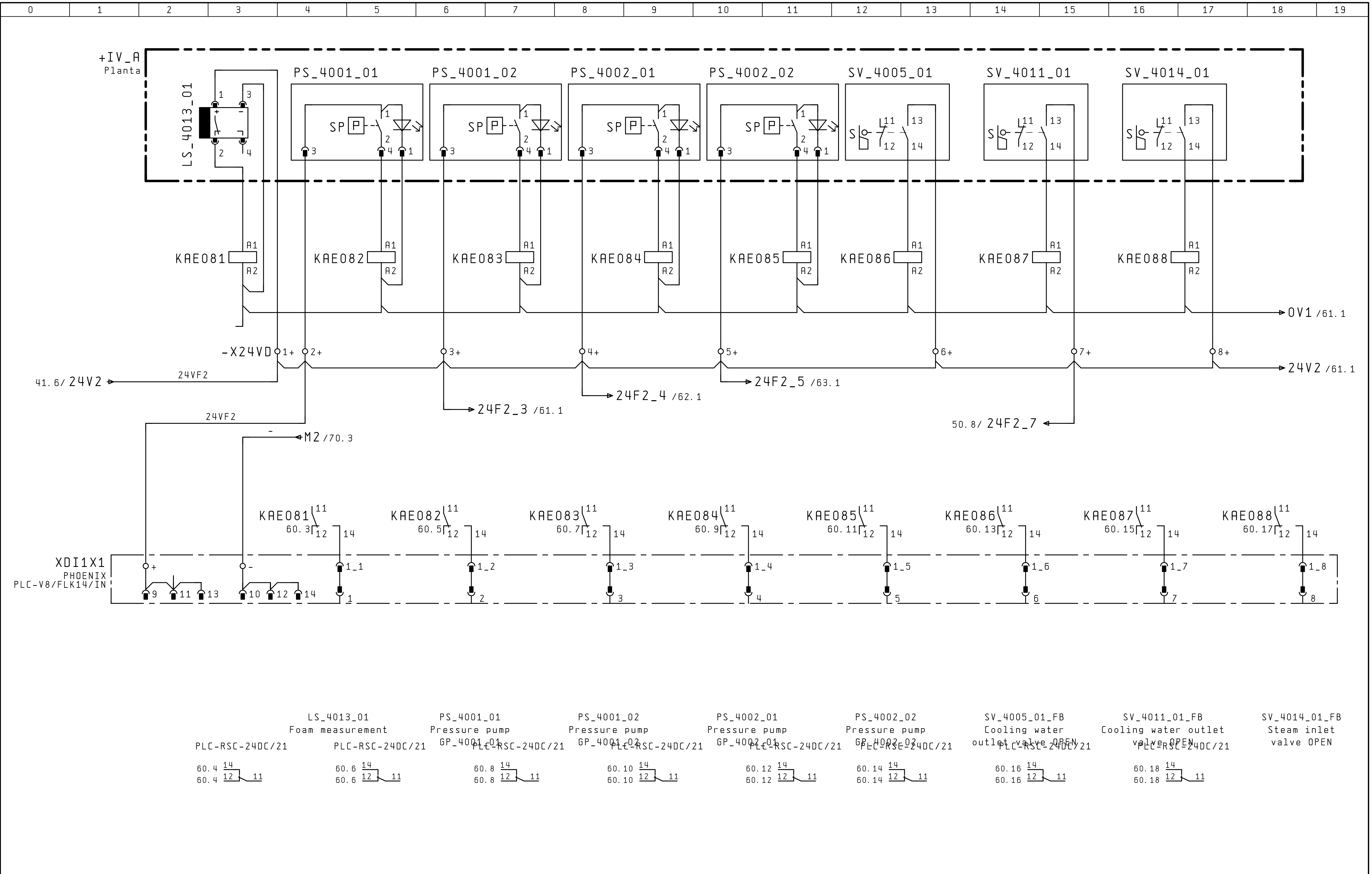

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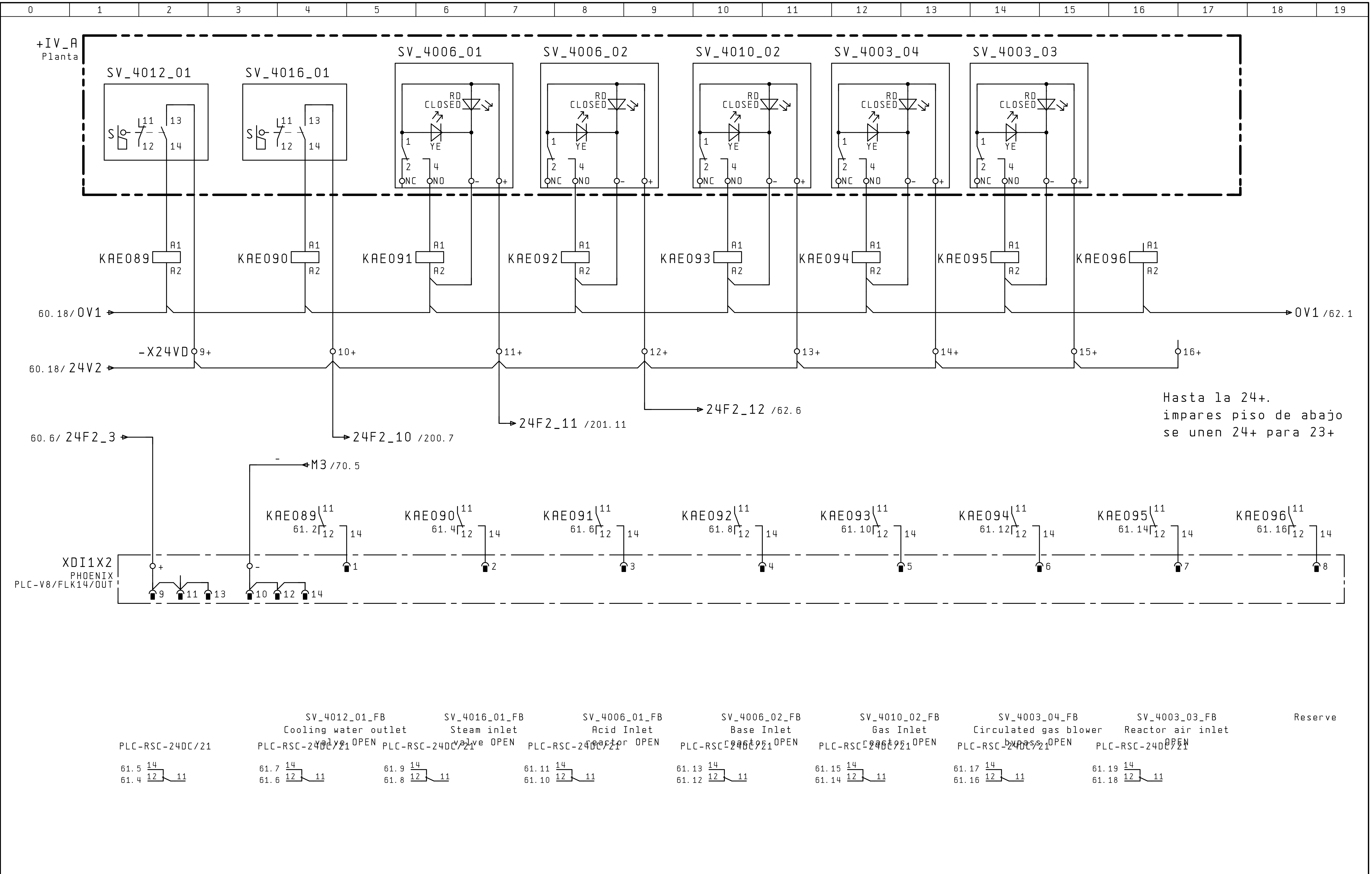

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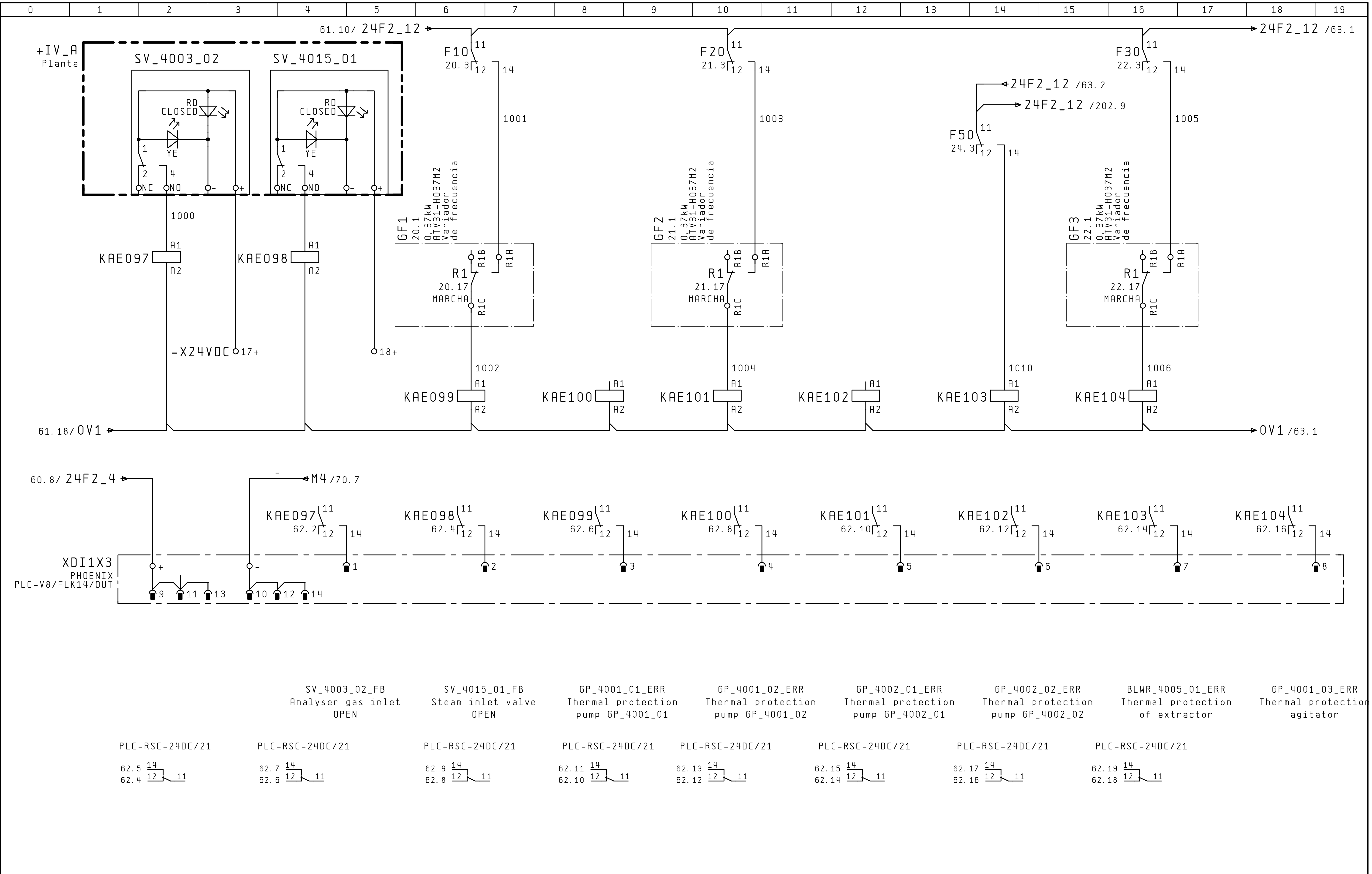

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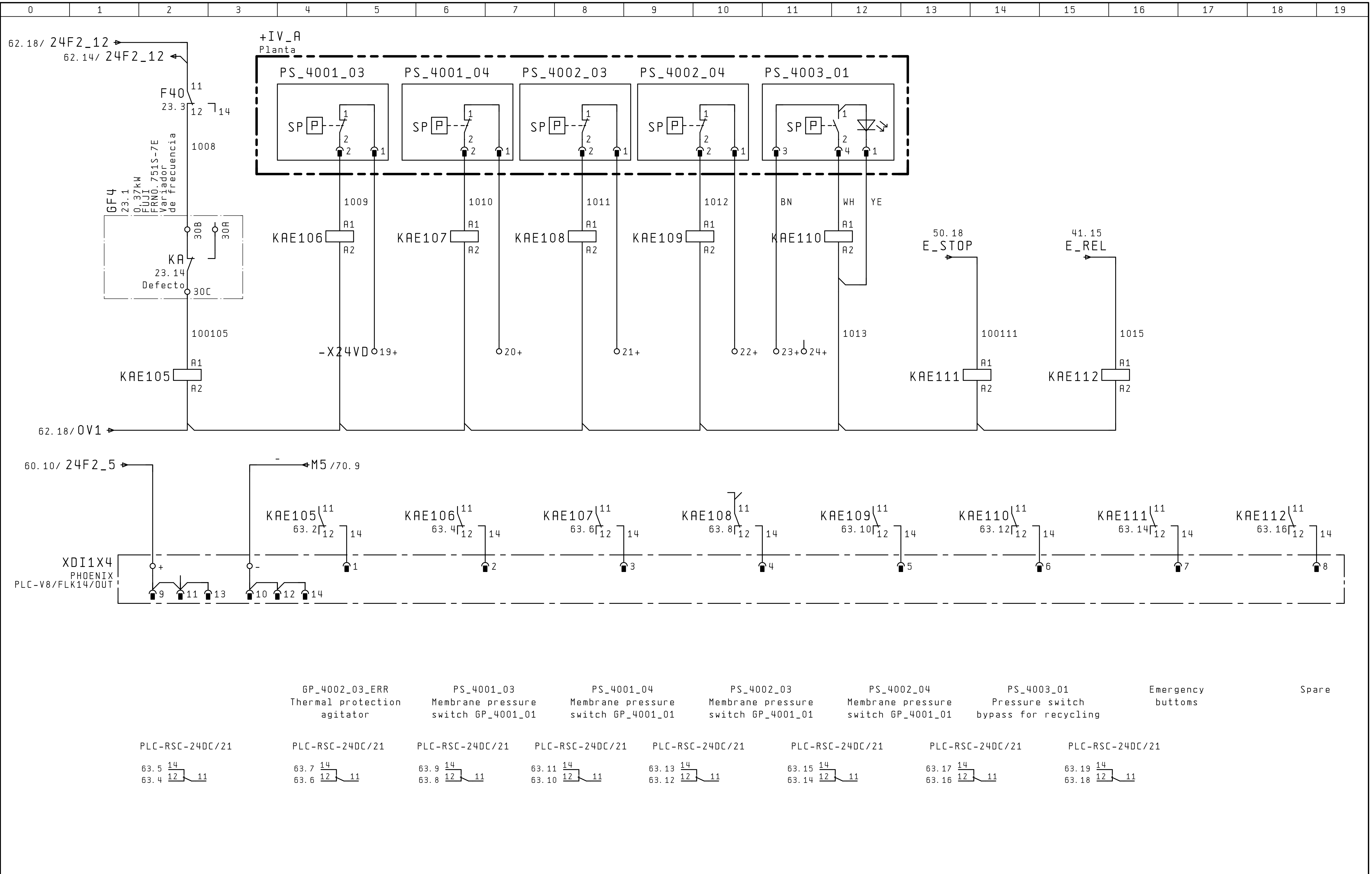

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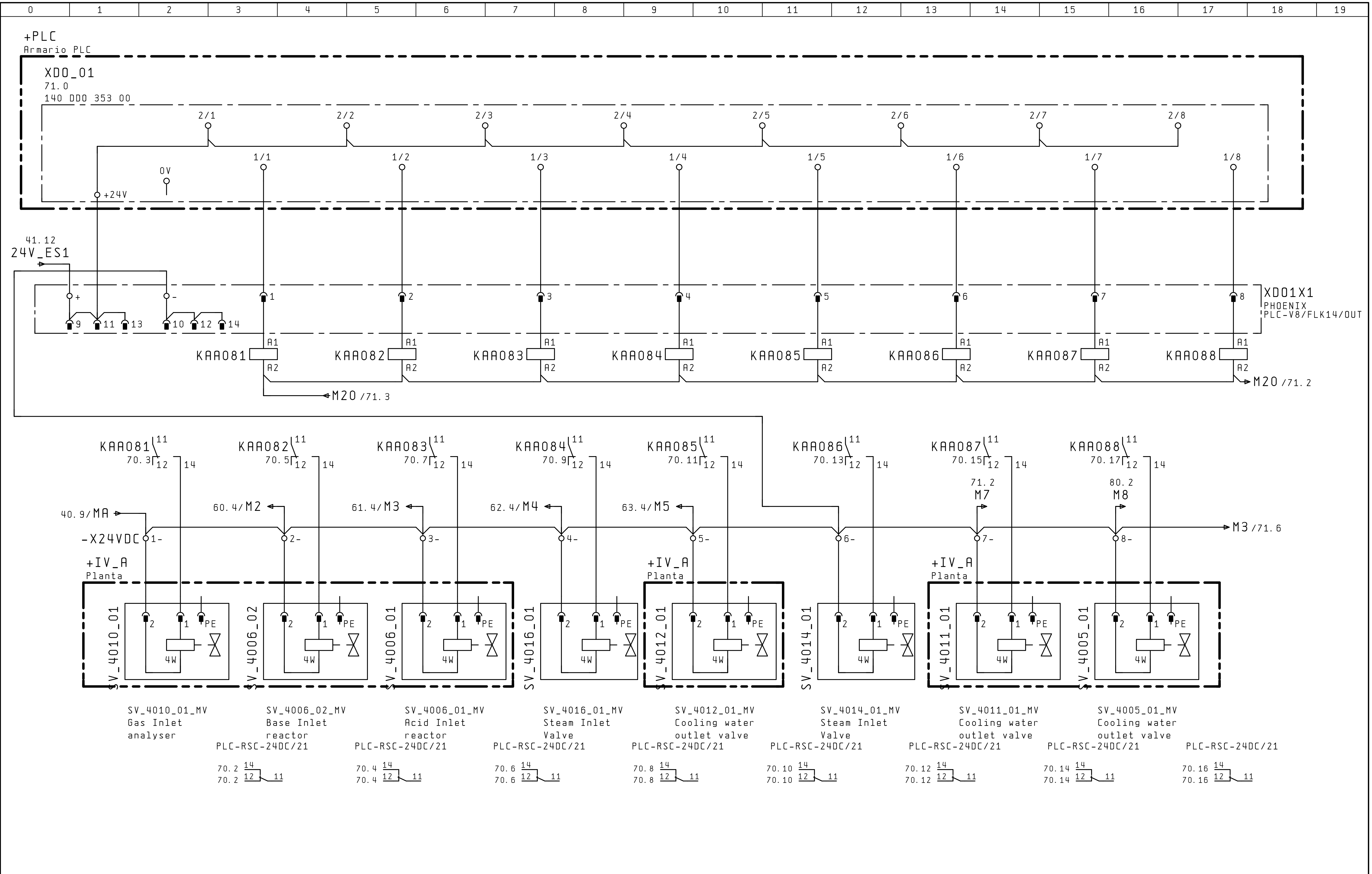

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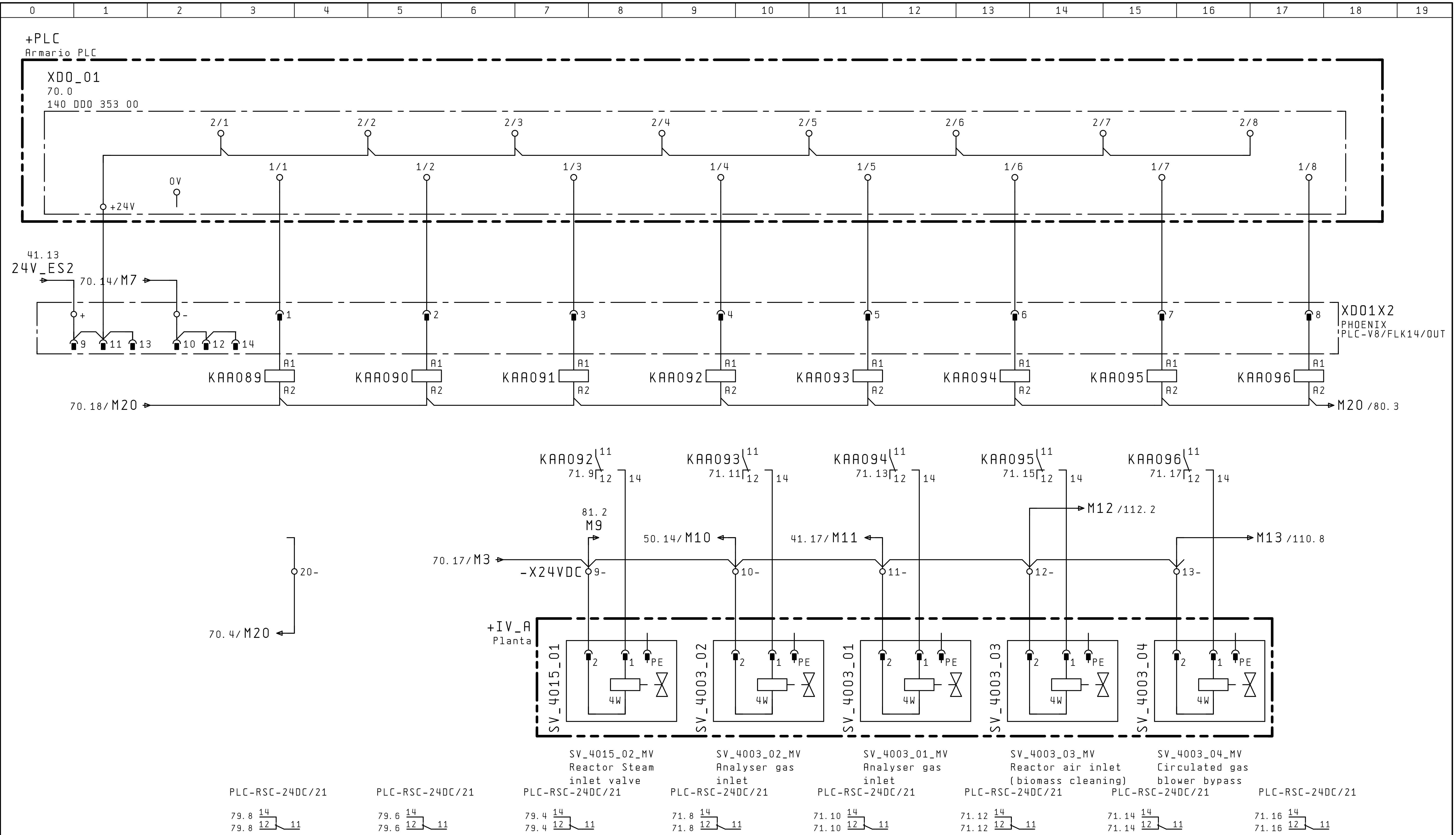

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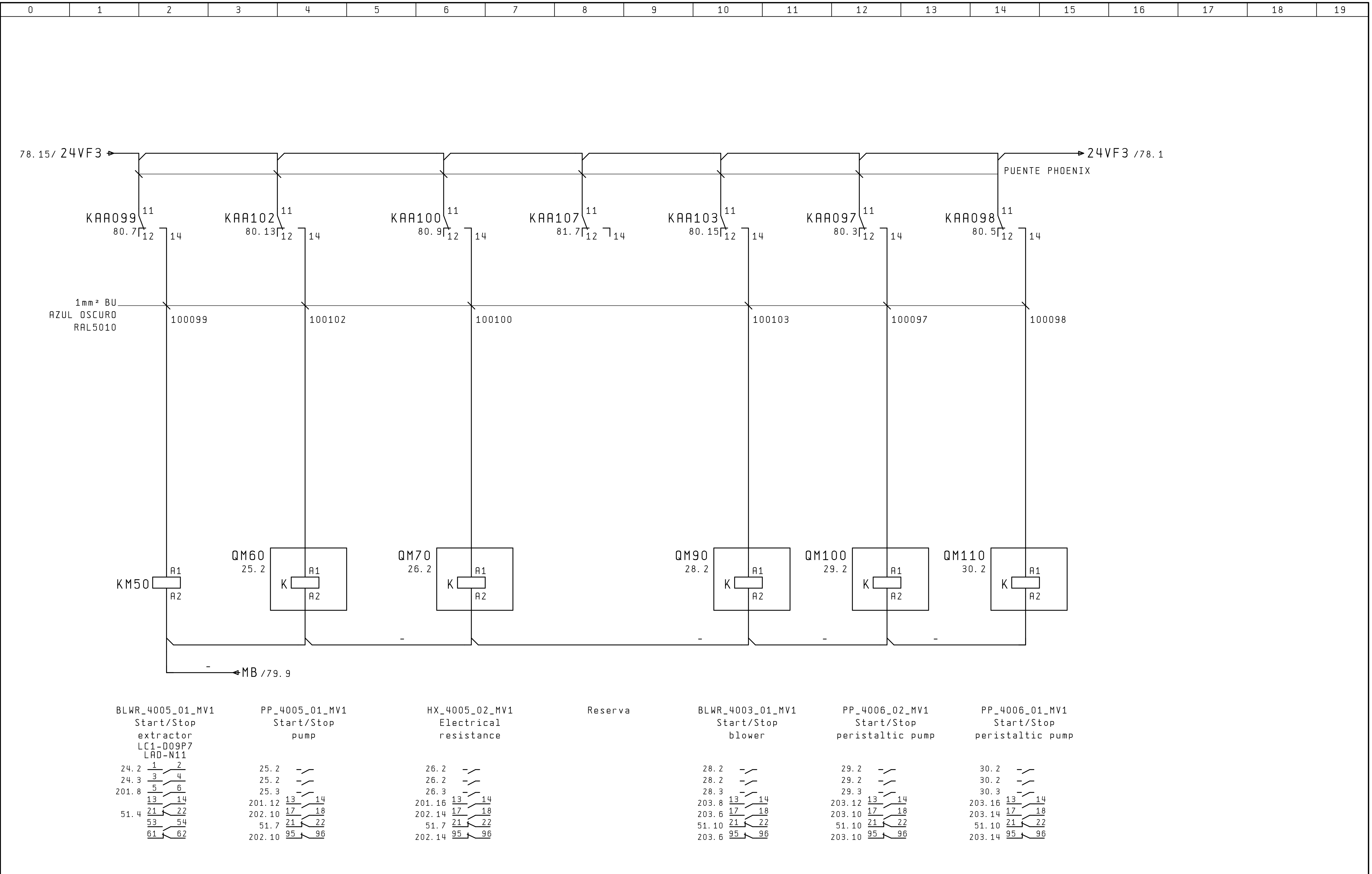

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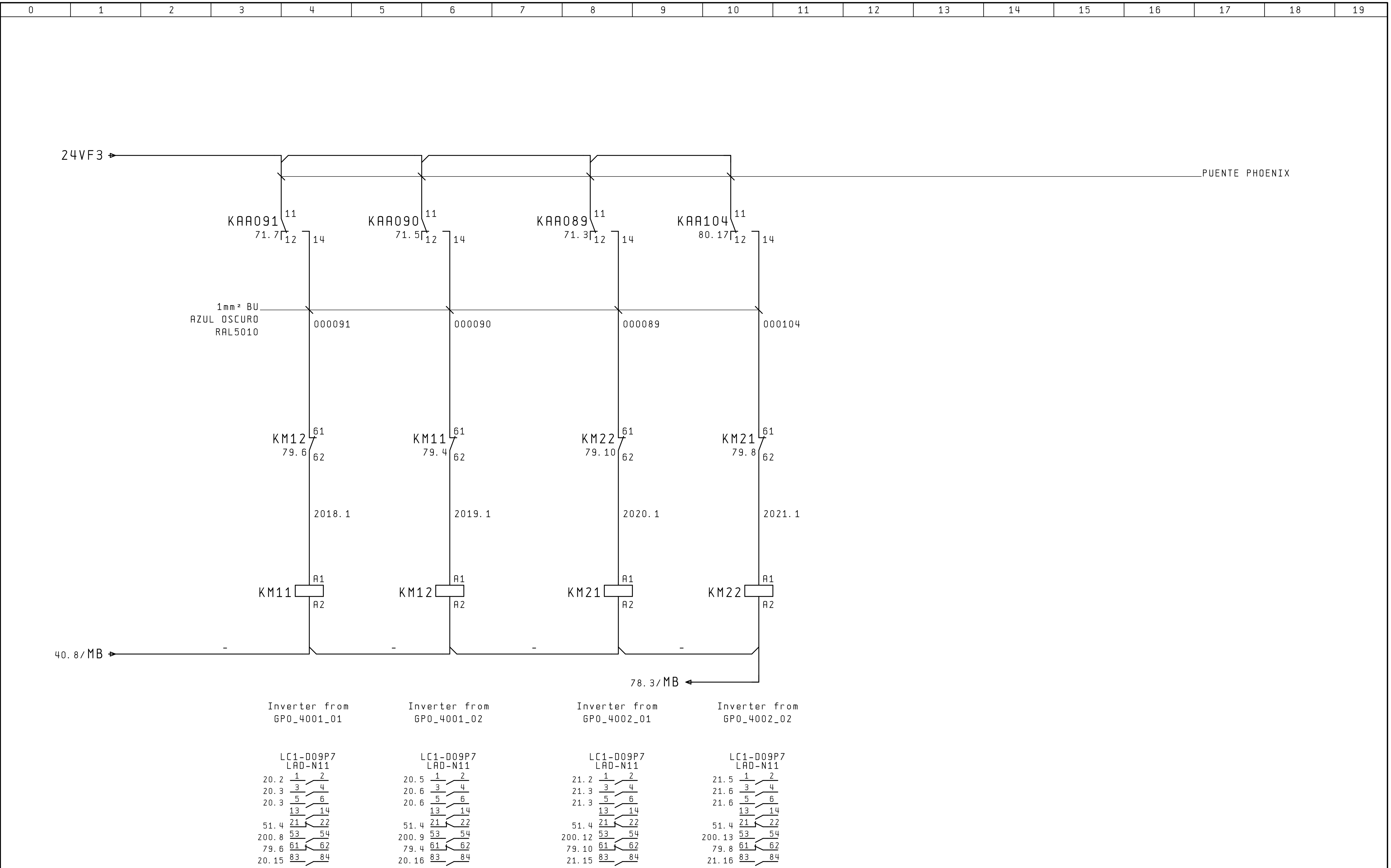
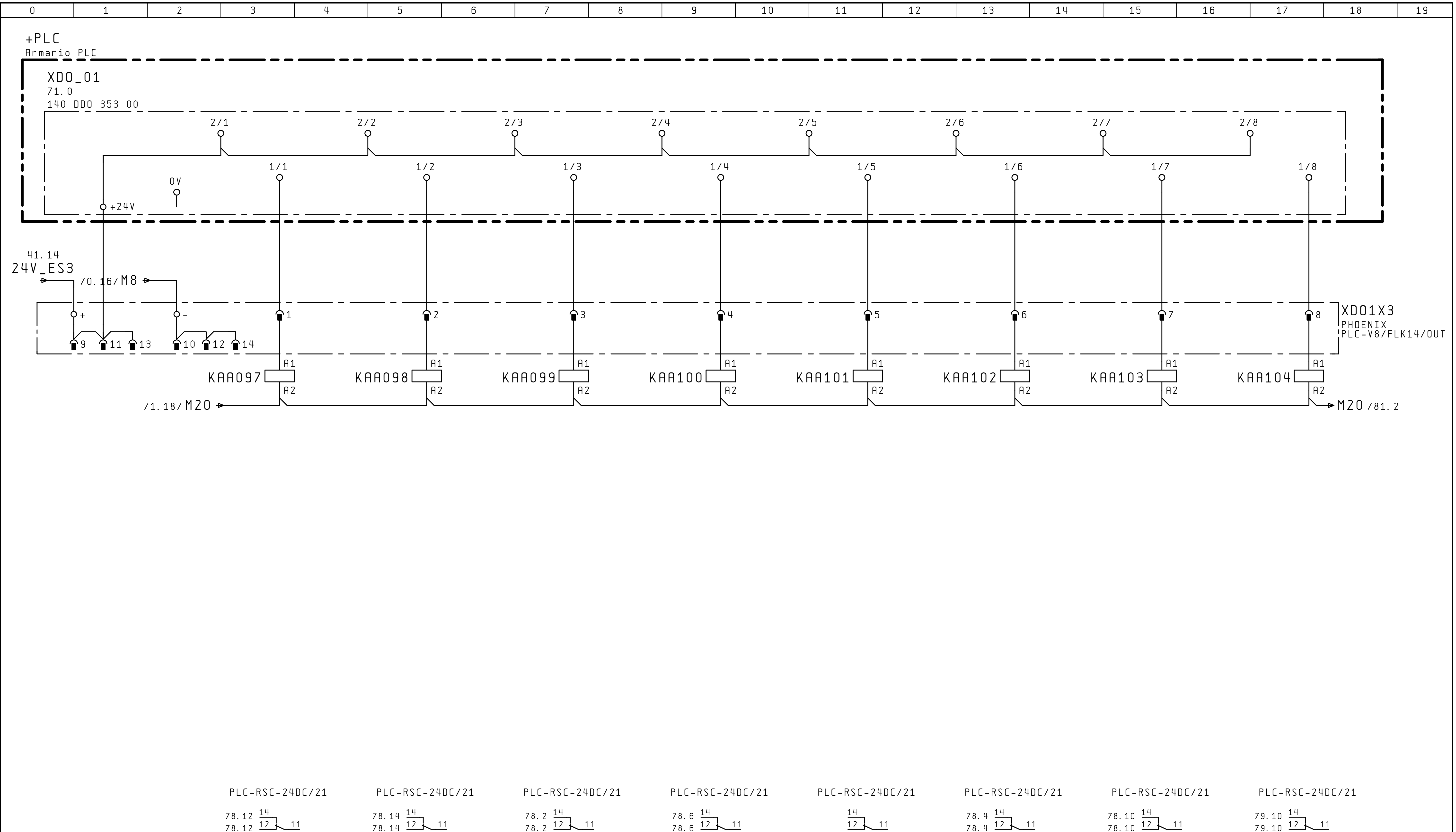


De Dietrich	IDENTIFICACION: PRIMERA VERSION OBRA	REF:	Proyecto	M. Alcampel	Anterior: 78
Equipos Químicos, S. L.	Seleccion variadores.	INSTAL. =C_IV/A	Verificado	J. Mestre	Siguiente: 80
		LUGAR +MCC_01	Dibujado	M. Alcampel	
			Fecha	13.Abr.2009	Página: 79

De Dietrich



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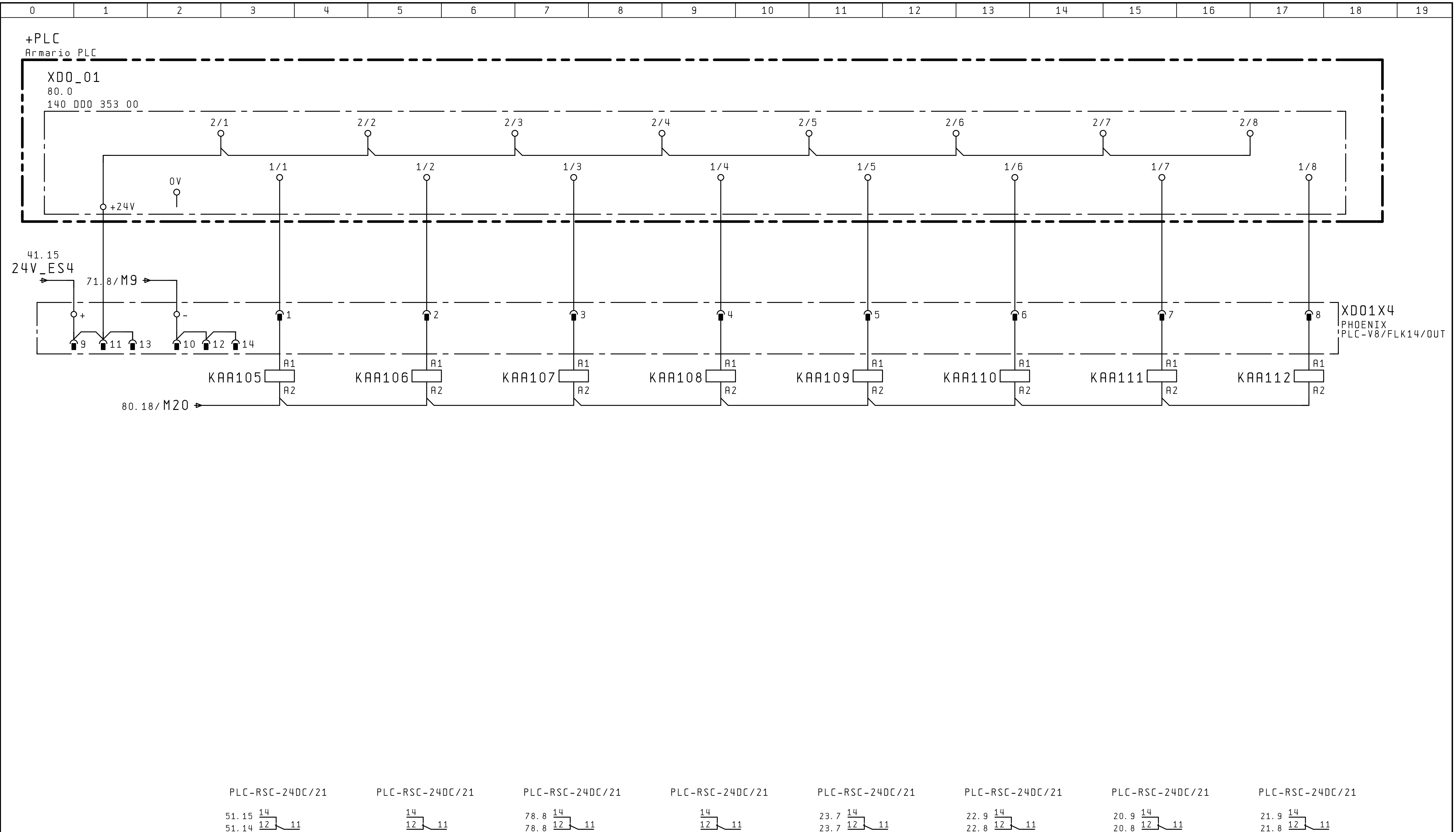

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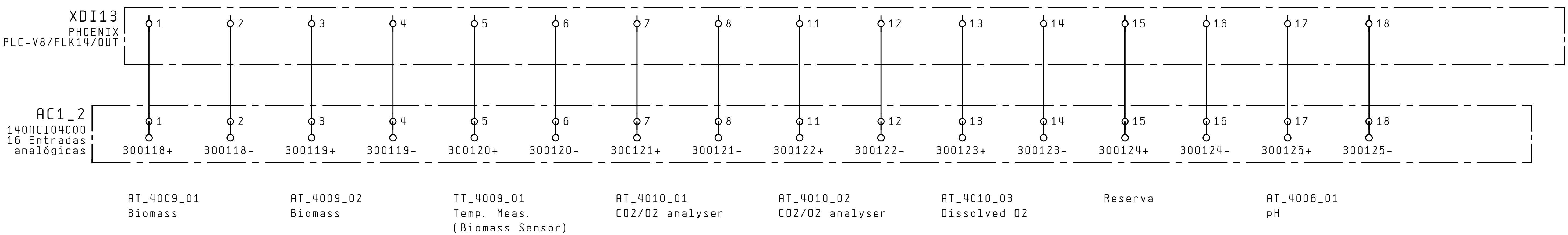

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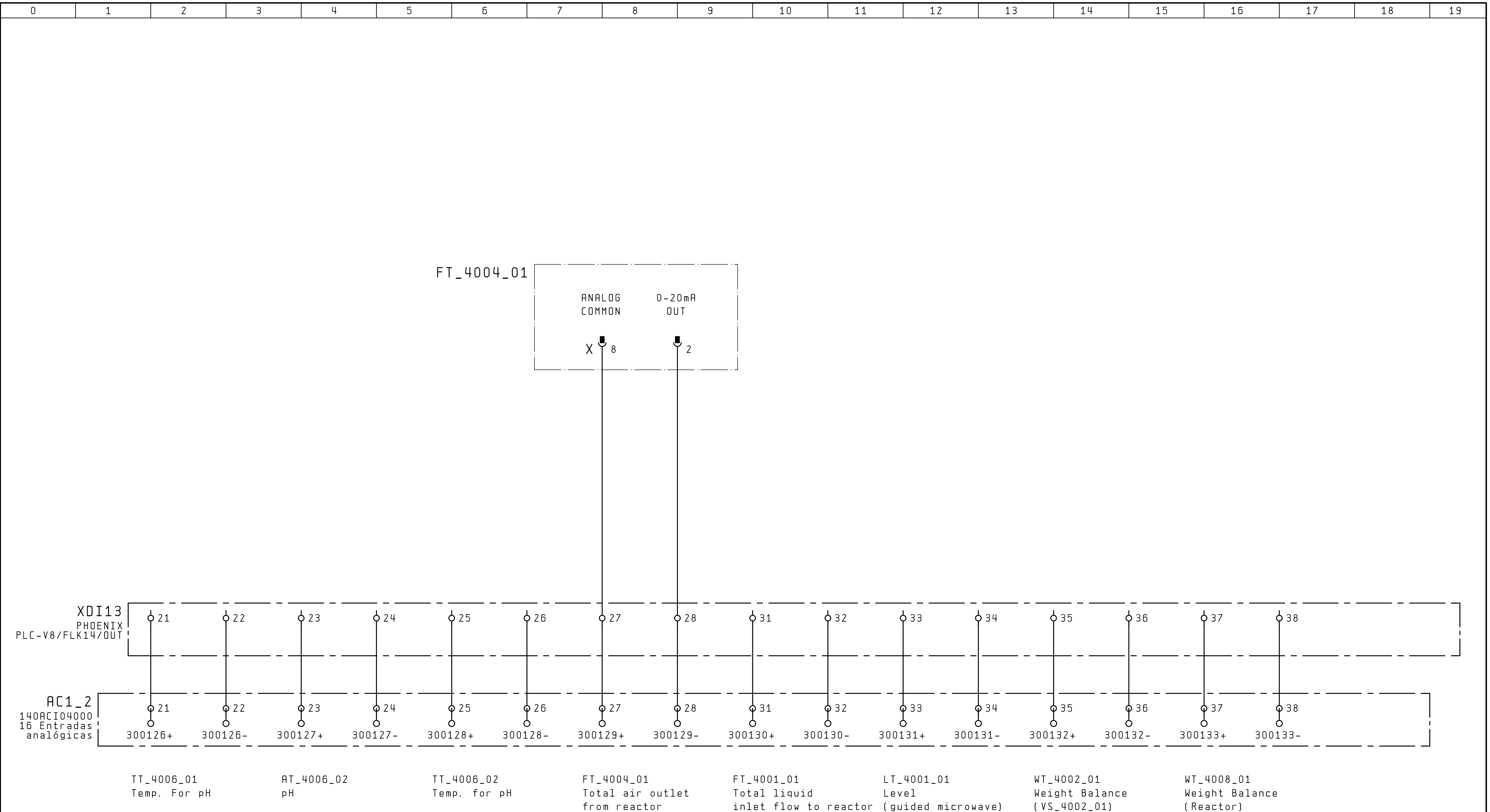

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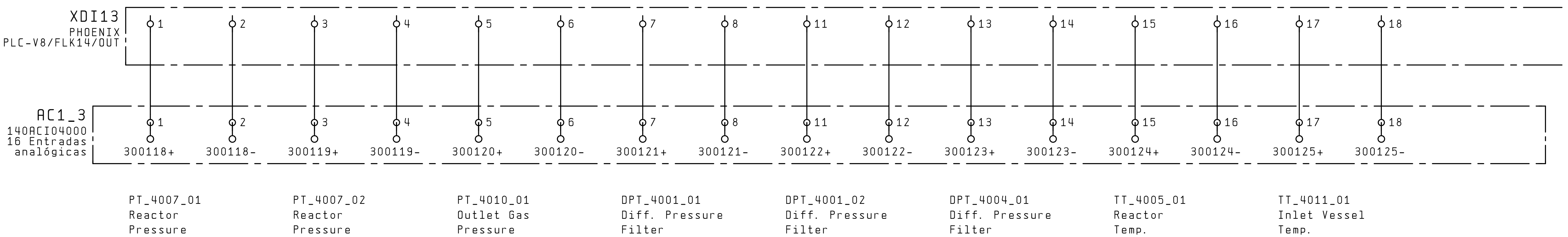

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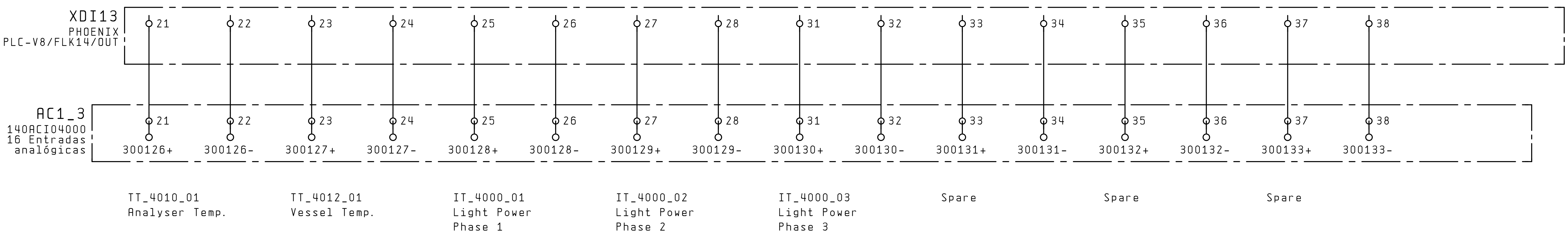
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Analyser Temp.
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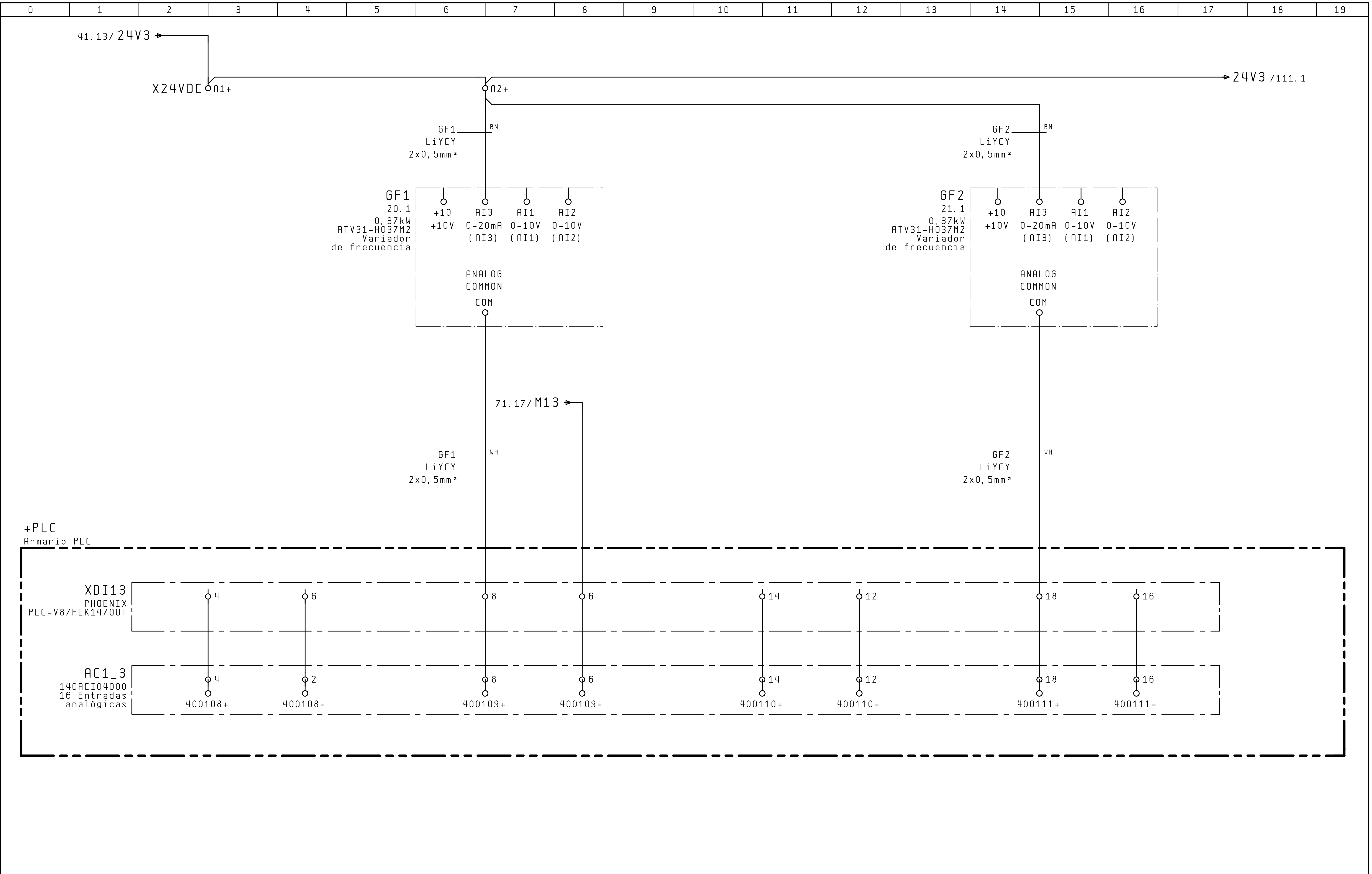
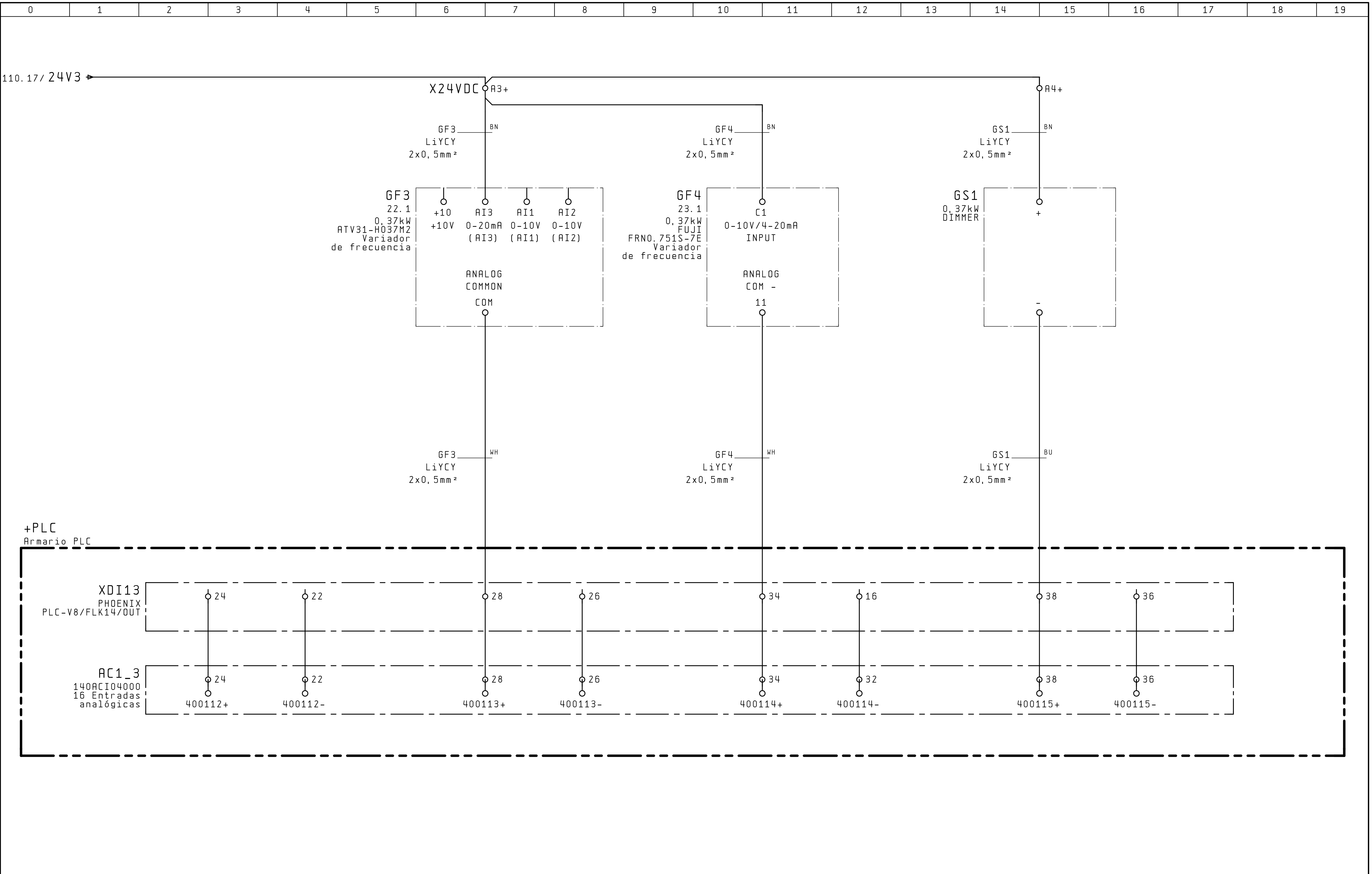
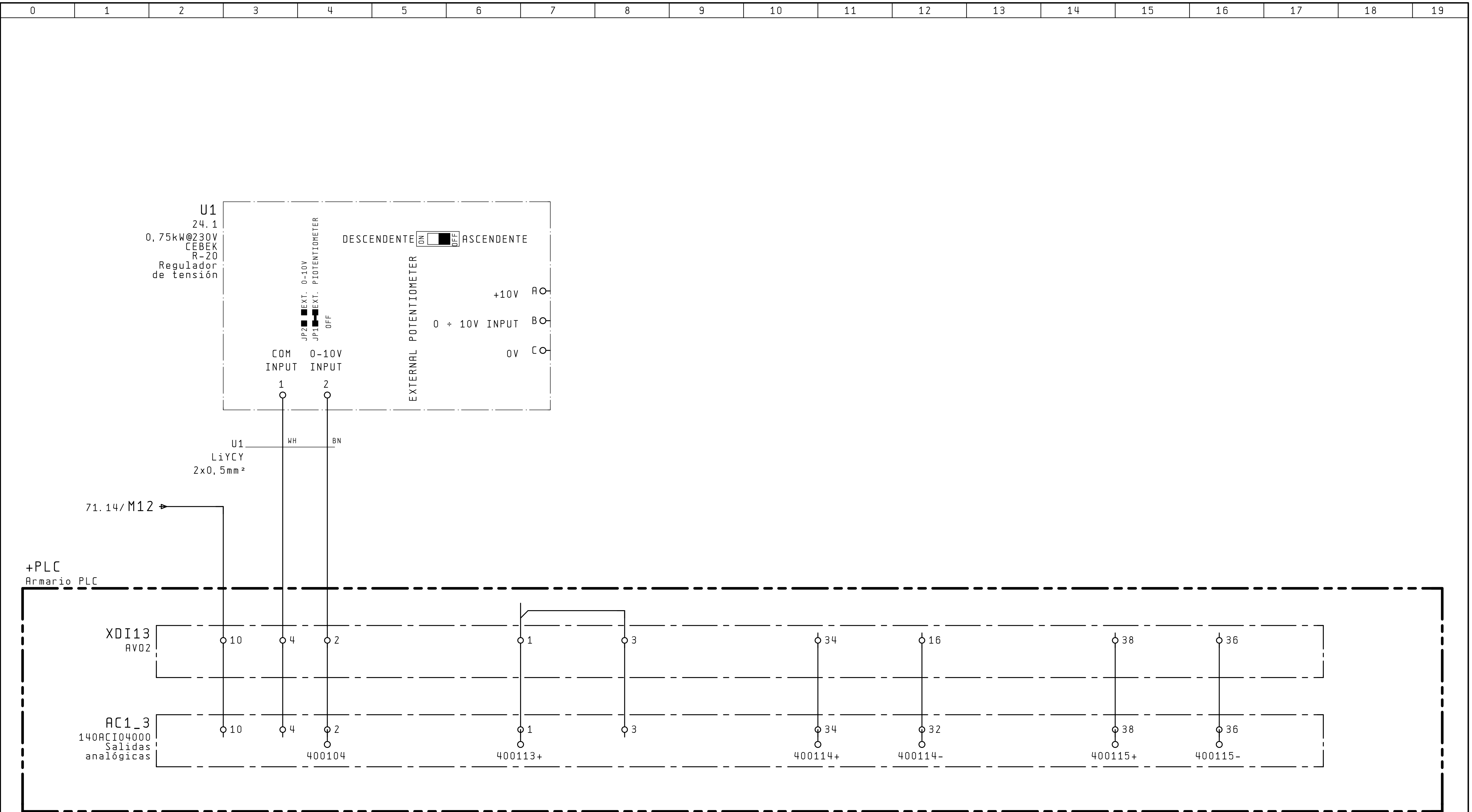


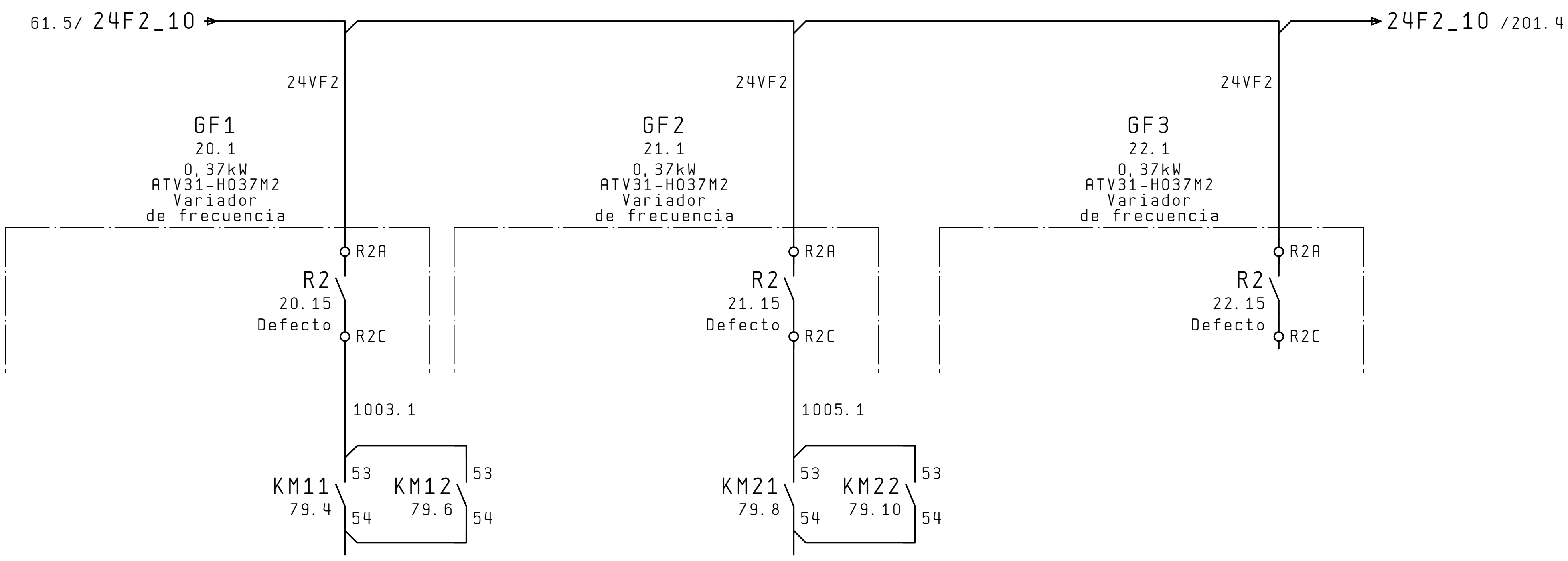
De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA Salidas analógicas	REF: INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto Verificado Dibujado Fecha	M. Alcampel J. Mestre M. Alcampel 13.Abr.2009	De Dietrich	Anterior: 103 Siguiente: 111 Página: 110

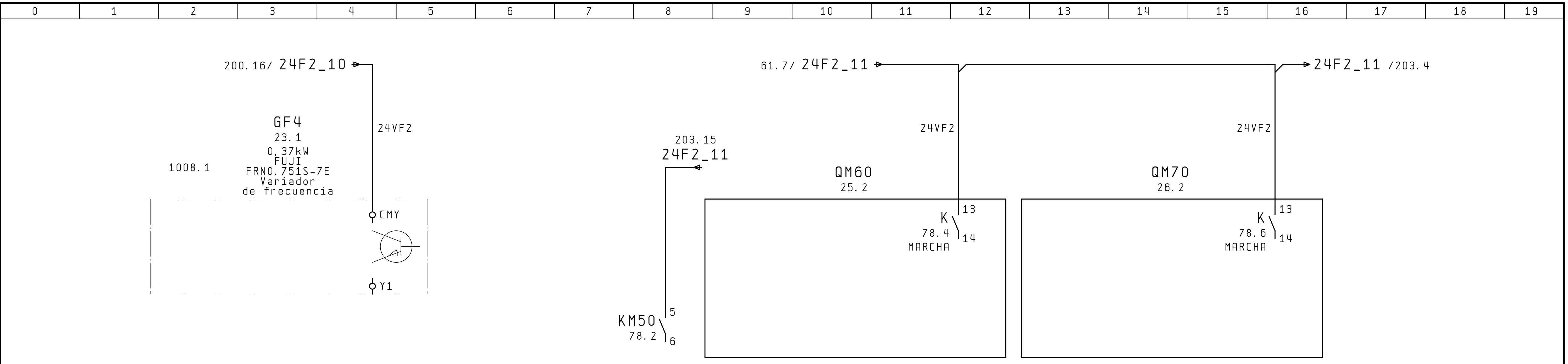


De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA Salidas analógicas	REF: INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto Verificado Dibujado Fecha	M. Alcampel J. Mestre M. Alcampel 13.Abr.2009	De Dietrich	Anterior: 110 Siguiente: 112 Página: 111



De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA Salidas analógicas	REF: INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto: M. Alcampel Verificado: J. Mestre Dibujado: M. Alcampel Fecha: 13.Abr.2009	De Dietrich	Anterior: 111 Siguiente: 200 Página: 112

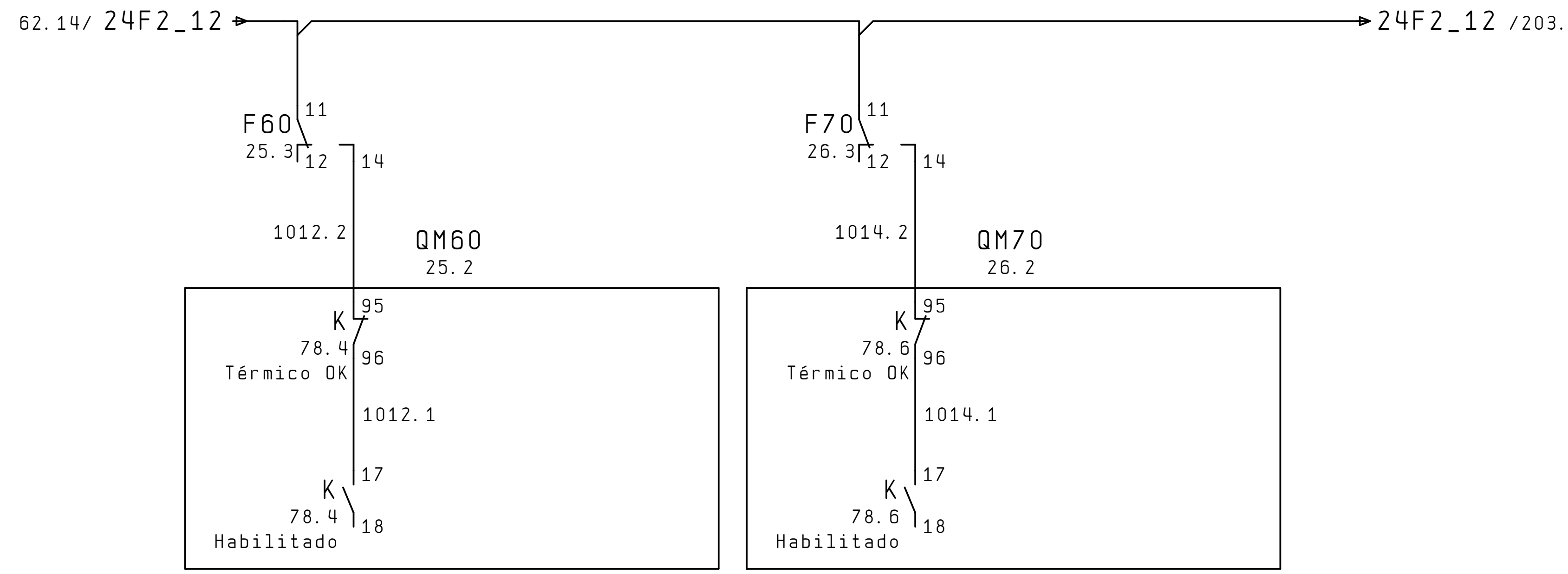

61.5/ 24F2_10
24F2_10 /201.4
24VF2
GF1
20.1
0,37kW
ATV31-H037M2
Variador
de frecuencia
R2A
R2
20.15
Defecto
R2C
1003.1
KM11
79.4
KM12
79.6
53
54
GF2
21.1
0,37kW
ATV31-H037M2
Variador
de frecuencia
R2
21.15
Defecto
1005.1
KM21
79.8
KM22
79.10
GF3
22.1
0,37kW
ATV31-H037M2
Variador
de frecuencia
R2
22.15
Defecto



De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA	REF:	Proyecto	M. Alcampel
	Entradas digitales	INSTAL. =C_IV/A	Verificado	J. Mestre
			Dibujado	M. Alcampel
		LUGAR +MCC_01	Fecha	13.Abr.2009

De Dietrich

Anterior: 200
Siguiente: 202
Página: 201


62.14/ 24F2_12
24F2_12 /203.1
F60
25.3
11
12
14
1012.2
QM60
25.2
K
78.4
Térmico OK
95
96
1012.1
K
78.4
Habilitado
17
18
F70
26.3
11
12
14
1014.2
QM70
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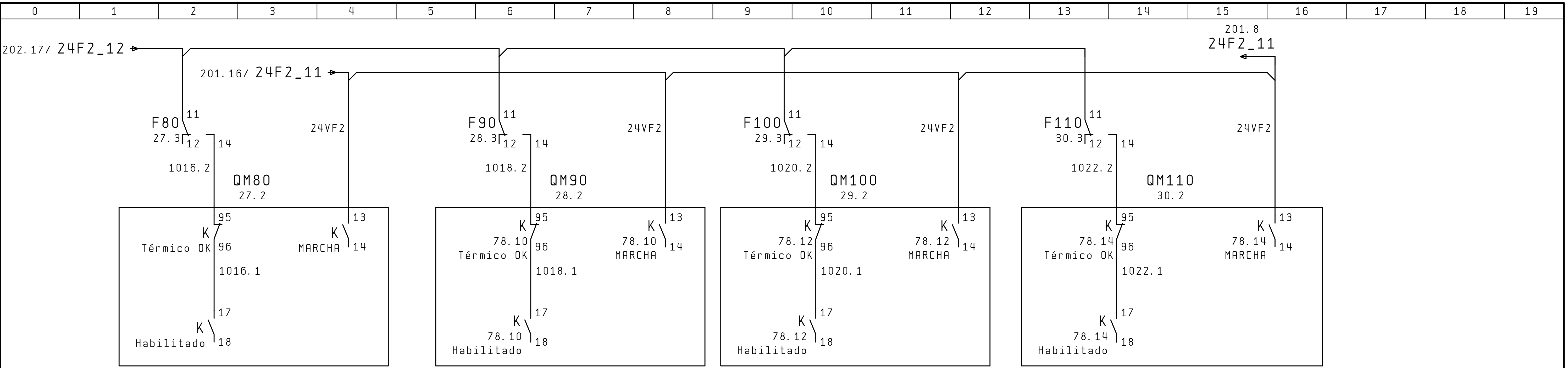
K
78.6
Térmico OK
95
96
1014.1
K
78.6
Habilitado
17
18



De Dietrich Equipos Químicos, S. L.	IDENTIFICACION: PRIMERA VERSION OBRA Entradas digitales	REF: INSTAL. =C_IV/A LUGAR +MCC_01	Proyecto Verificado Dibujado Fecha	M. Alcampel J. Mestre M. Alcampel 13.Abr.2009	Anterior: 202 Siguiente: Página: 203

13. CE MARKING (LIGHTING CABINET)

13.1. CE Declaration

13.2. Lighting cabinet: upgrade report

PROCONTROL, S.L.

CONTROL Y REGULACIÓN · ESTUDIO · MONTAJE · SERVICIO

Rambla del Poble Nou, 189 - 08018 Barcelona
Teléfono 93 309 51 16 - Fax 93 309 87 91
e-mail: comercial@procontrolsl.com – Info: www.procontrolsl.com

DECLARACIÓN CE DE CONFORMIDAD

La empresa:

Nombre:	PROCONTROL,S.L.
Dirección:	Rambla del Poble Nou, 189 – 08018 Barcelona
Teléfono:	93 309 51 16
FAX:	93 309 87 91
Email:	comercial@procontrolsl.com

declara bajo su única responsabilidad que el producto:

Descripción:	Armario de luces Compartimento IVa. MELISSA Pilot Plant
Nº Inventario:	081398-6201

se halla en conformidad con las directivas europeas siguientes:

Referencias	**Título**
73/23/CEE	Material eléctrico destinado a utilizarse en determinados límites de tensión (Baja Tensión)
93/68/CEE	Modificación de la Directiva 73/23/CEE
89/336/CEE	Compatibilidad electromagnética
92/31/CEE	Modificación de la Directiva 89/336/CEE
93/68/CEE	Modificación de la Directiva 89/336/CEE

Nombre y apellidos _____MARC SANROMÀ SOLENCH_____

Cargo ____Responsable del proyecto______

Lugar y fecha __________18/06/2009______________

Firma

PROCONTROL, S.L.

CONTROL Y REGULACIÓN · ESTUDIO · MONTAJE · SERVICIO

Rambla del Poble Nou, 189 - 08018 Barcelona
Teléfono 93 309 51 16 - Fax 93 309 87 91
e-mail: comercial@procontrolsl.com – Info: www.procontrolsl.com

Referencias de las normas técnicas aplicadas:

- Normas armonizadas

Número	**Título**
UNE-EN 50081-2	Compatibilidad electromagnética. Norma genérica de emisión
UNE-EN 50082-2	Compatibilidad electromagnética. Norma genérica de inmunidad
UNE-EN 61000-6-2	Compatibilidad electromagnética. Normas Genéricas
UNE-EN 60439	Baja Tensión. Requisitos para los conjuntos serie y los conjuntos derivados de serie

- Otras normas técnicas o especificaciones técnicas empleadas

Número	**Título**

- Otras soluciones adoptadas, los detalles de las cuales son incluidas en la documentación técnica:

____

____

____

Las dos últimas cifras del año en el cual el marcado CE ha sido incorporado:__09_________________

Lighting cabinet

1. Tasks performed in the cabinet:

The tasks performed on the lighting cabinet were:

i. Replacement of the rear wall of the cabinet. It was dented and distorted.
ii. Replacement of the right side wall of the cabinet. It was dented and distorted.
iii. Replacement of the transformer and its support. The transformer had the coils loosen. This would produce an increase of current for moving the coils away from the magnetic circuit. It showed blackened areas.
iv. New bus bar for 200 Ampere. With this configuration, the life of the cabling is largely extended, because the cabling were semi-rigid and they showed a crumbly insulation due to the heat, as they were connected to the secondary winding bars. Currently, the wear due to the heat by the Joule effect has disappeared, because from the secondary winding to the 6 mm² cabling the available surface for heat dissipation is enough to eliminate this effect.
v. Replacement of the current blower and installation of two new ones.
vi. Recabling of the 400V circuit.
vii. New protection against overvoltage. Conformity certifícate and characteristics on the pdf's.
viii. *New IGA. Conformity certifícate C60 and GV2 in the other ace.* Nuevo IGA. Certificados de conformidad C60 y GV2 en el otro ace.
ix. *New circuit breaker for the dimmer. Characteristics and UL certificate in the ace. Nueva protección magnetotérmica para el dimmer.* Características y certificado UL en el ace.
x. New methacrylate piece for the dimmer labelled "400 V".
xi. Restoring the tracks of the current dimmer.

IMPORTANT: Regarding the design, no change was performed so that the electrical diagrams have not changed.

2. *Technical datasheets and CE conformity certifícate of the electrical cabinet surge protector* **Hojas técnicas y certificado de conformidad CE del descargador armario de luces:**

PHOENIX CONTACT
Datos básicos

PT 4-PE/S-230AC/FM

Código de artículo: 2882459

http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2882459

Descargador enchufable tipo 3 (protección de aparatos) para redes trifásicas de alimentación de corriente con N y PE separados (sistema de 5 conductores: L1, L2, L3, N, PE), con contacto de indicación remota. Ancho total: 35 mm.

Datos mercantiles	
EAN	4046356081771
Paquete	5 pcs.
Arancel	85363090
Peso/Unidades	0,12424 KG
Página del catálogo	Página 46 (TT-2009)

Observaciones acerca del producto
Conforme a WEEE/RoHS desde: 07.06.2006

Tenga en cuenta que los datos indicados aquí proceden del catálogo en línea. Los datos completos se encuentran en la documentación para el usuario en http://www.download.phoenixcontact.es Son válidas las condiciones generales de uso de las descargas por Internet.

Datos técnicos

Normas

Material carcasa	PA
Clase de combustibilidad según UL 94	V0
Color	negro

PT 4-PE/S-230AC/FM Código de artículo: 2882459
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2882459

Normas para líneas de fuga y espacios de aire	DIN VDE 0110-1
	IEC 60664-1: 1992-10
	IEC 61643-1
	DIN EN 61643-11
Índice de protección	IP20
Construcción	Módulo para carril de dos piezas enchufable
Tipo de montaje	Carril simétrico 35 mm
Número de polos	4
Temperatura ambiente (servicio)	-40 °C ... 85 °C
Dirección de actuación	3L-N & N-PE
Anchura	35,40 mm
Altura	65,50 mm
Longitud	90,00 mm
Unidad	2 UD

Circuito de protección

Clase de ensayo IEC	III
	T3
Tipo EN	T3
Tensión nominal U_N	230 V AC (máx. 240/415 V AC)
	400 V AC (L-L)
Tensión de dimensionamiento de descargadores U_C	335 V AC (255 V AC / N-PE)
Tensión de dimensionamiento de descargadores U_C (L-N)	335 V AC
Tensión de dimensionamiento de descargadores U_C (N-PE)	255 V AC
Frecuencia nominal f_N	50 Hz
	60 Hz
Corriente nominal I_N	26 A (≤ 30 °C)
Corriente de derivación hacia PE a U_C	≤ 2,5 µA
Corriente transitoria nominal I_n (8/20) µs	1,5 kA (por canal)
Corriente transitoria nominal I_n (8/20) µs (L-N)	1,5 kA
Corriente transitoria nominal In (8/20) µs (L-PE)	1,5 kA
Corriente transitoria nominal I_n (8/20) µs (N-PE)	1,5 kA
Corriente transitoria Imáx (8/20) µs máximo	10 kA (N-PE)
Corriente transitoria Imáx. (8/20) µs máximo (L-N)	4,5 kA

PT 4-PE/S-230AC/FM Código de artículo: 2882459
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2882459

Corriente transitoria Imáx. (8/20) µs máximo (L-PE)	4,5 kA
Corriente transitoria Imáx. (8/20) µs máximo (N-PE)	10 kA
Choque combinado U_{oc}	4 kV
Nivel de protección U_p (L-N)	≤ 1,2 kV
Nivel de protección U_p (L-PE)	≤ 1,5 kV
Nivel de protección U_p (N-PE)	≤ 1,5 kV
Tiempo de reacción tA (L-N)	≤ 25 ns
Tiempo de reacción tA (L-PE)	≤ 100 ns
Tiempo de reacción tA (N-PE)	≤ 100 ns
Fusible previo máximo requerido	25 A (gL)
Resistencia al cortocircuito I_{cc} con fusible previo máximo (efectivo)	1,5 kA
Mensaje Protección contra sobretensiones defectuosa	indicación óptica, contacto de indicación remota

Contacto de indicación remota

Denominación Conexión	Contacto de indicación remota de defecto
Schaltfunktion_Int	Contacto cerrado
Tipo de conexión	Conexión por tornillo
Rosca de tornillo	M3
Par de apriete mín.	0,8 Nm
Longitud a desaislar	8 mm
Sección de conductor flexible mín.	0,2 mm²
Sección de conductor flexible máx.	2,5 mm²
Sección de conductor rígido mín.	0,2 mm²
Sección de conductor rígido máx.	4 mm²
Sección de conductor AWG/kcmil mín.	24
Sección de conductor AWG/kcmil máx.	12
Tensión de servicio máxima $U_{máx.}$ AC	250 V
Corriente de servicio máxima $I_{máx.}$	3 A AC/DC

Homologaciones

PT 4-PE/S-230AC/FM Código de artículo: 2882459
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2882459

Homologaciones CB, GOST, KEMA, OEVE

Accesorios

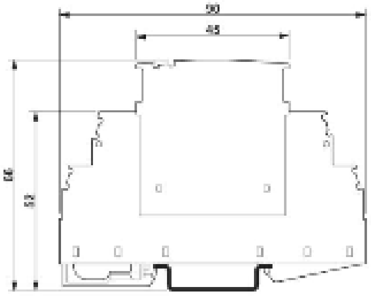
Artículo	Denominación	Descripción
Marcado		
0811228	X-PEN 0,35	Rotulador especial sin cartucho de tinta, para la rotulación manual de índices de rotulación, rotulación de gran resistencia al lavado, grosor de rotulado 0,35 mm
0811228	X-PEN 0,35	Rotulador especial sin cartucho de tinta, para la rotulación manual de índices de rotulación, rotulación de gran resistencia al lavado, grosor de rotulado 0,35 mm
0811228	X-PEN 0,35	Rotulador especial sin cartucho de tinta, para la rotulación manual de índices de rotulación, rotulación de gran resistencia al lavado, grosor de rotulado 0,35 mm
0814717	ZBF 16:SO/CMS	Tira Zack, plana, de 10 unidades, seccionable, rotulación especial, rotulada según las indicaciones del cliente
0808671	ZBF 6,LGS:FORTL.ZAHLEN	Tira Zack plana, rotulación longitudinal: 10 unidades, con los números 1-10, 11-20 etc. hasta 991-1000, color: Blanco
0810821	ZBF 6,LGS:GERADE ZAHLEN	Tira Zack plana, rotulación longitudinal: 10 unidades, con números pares idénticos, rotulada con los números: 2-20, 22-40, etc. hasta 82-100
0810863	ZBF 6,LGS:UNGERADE ZAHLEN	Tira Zack plana, rotulación longitudinal: 10 unidades, con números impares, rotulada con los números: 1-19, 21-39, etc. hasta 81-99
0808697	ZBF 6,QR:FORTL.ZAHLEN	Tira Zack plana, rotulación transversal: 10 unidades, con los números 1-10, 11-20, etc. hasta 151-160, color: Blanco
0808668	ZBF 6/WH-100:UNBEDRUCKT	Tira Zack plana, sin rotular: 10 unidades, para marcar con rotulador especial o ZBF-T, paquete grande, suficiente para la rotulación de 1000 bornes, color: Blanco
0808707	ZBF 6:SO/CMS	Tira Zack, plana, de 10 unidades, seccionable, rotulación especial, rotulada según las indicaciones del cliente
0808642	ZBF 6:UNBEDRUCKT	Tira Zack plana, sin rotular: 10 unidades, para marcar con rotulador especial o ZBF-T, suficiente para 100 bornes, color: Blanco
0800763	ZBN 18:SO/CMS	Indice de rotulación, 5 unidades, rotulación especial, rotulado según las indicaciones del cliente (se ruega indicar la rotulación deseada al hacer el pedido), para anchura de borne: 17,5 mm, color: Blanco
2809128	ZBN 18:UNBEDRUCKT	Índice de rotulación, sin rotular, tira con 5 índices para marcar con rotulador especial (B-STIFT) o sistema CMS, para una anchura de borne: 17,5 mm, color: Blanco

Productos complementarios

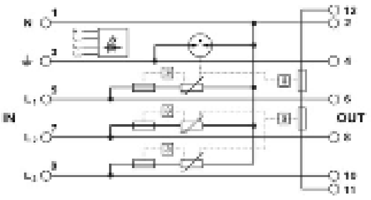
Artículo	Denominación	Descripción
Montaje		
2839295	SSA 3-6	Conexión rápida para pantalla para diámetro de cable 3-6 mm. Cable de conexión de potencial: 200 mm, negro
2839512	SSA 5-10	Conexión rápida para pantalla para diámetro de cable 5 - 10 mm. Cable de conexión de potencial: 200 mm, negro

Dibujos

Esquema de dimensiones



Esquema de cableado



PT 4-PE/S-230AC/FM Código de artículo: 2882459
http://eshop.phoenixcontact.de/phoenix/treeViewClick.do?UID=2882459

Dirección

PHOENIX CONTACT, S.A.
Parque Tecnológico de Asturias, parcelas 16-17
E-33428 Llanera (Asturias),Spain
Tel. +34 985 791 636
Fax +34 985 985 659
http://www.phoenixcontact.es

PHOENIX CONTACT

83093588.02

EG-Konformitätserklärung
EC-Declaration of Conformity

Hersteller / *Manufacturer*: **PHOENIX CONTACT GMBH & CO. KG**

Anschrift / *Address*: Flachsmarktstraße 8, D-32825 Blomberg, Germany

Produktbezeichnung / *Product description*: **PT 2-IT-230AC/ST**

(Artikelbezeichnung, / *Article description*, Artikel-Nr. / *Article no.*) **2805127**

Das vorstehend bezeichnete Produkt stimmt mit den wesentlichen Anforderungen der nachfolgenden Richtlinie(n) und deren Änderungsrichtlinien überein / *The above mentioned product is in line with the essential requirements of the below directive(s) and their modification directive(s):*

2006/95/EC **Niederspannungs-Richtlinie (NSR)** ***Low Voltage Directive (LVD)***

Für die Beurteilung der Übereinstimmung wurden folgende einschlägige Normen herangezogen:
For evaluation of the conformity following relevant standards were consulted:

EN 61643-11:2002 + A11

Weitere Anmerkungen (z. B. Dokumente, Prüfberichte, Einschränkungen, etc.) zur Konformitätsbewertung:
Additional remarks (for example documents, test reports, restrictions etc.,) of the conformity assessment:

Zertifikate einer benannten Stelle / *Certificates by a notified body*:

Anschrift / *Address*:

Referenz / *Reference*:

Anschrift / *Address*:

Referenz / *Reference*:

Die letzten beiden Ziffern des Jahres in dem die CE-Kennzeichnung angebracht wurde:
The last two figures of the year in which the CE marking was applied: 09
(nur einzutragen, bei der Niederspannungsrichtlinie / *only to be entered on the low voltage directive*)

☒ Diese Erklärung gilt auch für die im Anhang aufgelisteten Produkte. (wenn angekreuzt)
This declaration also applies for the products listed in the annex. (if marked with a cross)

Diese Erklärung bescheinigt die Übereinstimmung mit den wesentlichen Anforderungen der genannten Richtlinie(n), enthält jedoch keine Zusicherung von Eigenschaften. Die Sicherheits- und Einbauhinweise der mitgelieferten Produktdokumentation sind zu beachten.
This declaration certifies the conformity with the essential requirements of the indicated directive(s), it does not, however, covenant any characteristics. The instructions for safety and installation of the enclosed product documentation have to be observed.

Blomberg, 27.01.2009

J. Wosgien
Joachim Wosgien
Business Unit Surge Protection TRABTECH
Senior Engineer, Surge-Protection TRABTECH

p.p.a
Joachim Schimanski
Business Unit Surge Protection TRABTECH
Vice President, Head of the Business Unit

PHOENIX CONTACT

83093588.02

Anhang zur EG-Konformitätserklärung
Annex on EC Declaration of Conformity
vom / dated 27.01.2009

Produktbezeichnung / *Product description*: **PT 2-IT-230AC/ST**
(Artikelbezeichnung, / *Article description*, Artikel-Nr. / *Article no.*) **2805127**

Die Konformität mit den wesentlichen Anforderungen der Richtlinie(n) wird auch für folgende Produkte bescheinigt:
The conformity with the essential requirements of the directive(s) is also certified by the declaration for following products.

Artikel-Nr. / *Article no.*	Artikelbezeichnung / *Article description*
2805130	PT 2-IT-230AC/FM
2817958	PT 2+1-S-48DC/FM
2839282	PT-BE/FM
2839318	PT 2-PE/S- 24AC-ST
2839321	PT 2-PE/S- 60AC-ST
2839334	PT 2-PE/S-120AC-ST
2839347	PT 2-PE/S-230AC-ST
2839648	PT 2+1-S-48DC-ST
2856812	PT 2-PE/S-120AC/FM
2856906	PT 2+1-S/S1-48DC-ST
2858221	PT-BE/FM-N
2858357	PT 2-PE/S-230AC/FM
2859990	PT 2+1-S/S1-48DC
2880024	PT 2X1VA/S1-230AC-ST
2880736	PT MAIN-EST
2882459	PT 4-PE/S-230AC/FM
2882462	PT 4-PE/S-230AC-ST
2882475	PT 4-PE/S-BE/FM

3. Hoja técnica y certificado CE del nuevo transformador:

TORYTRANS S.L.	Pol. Ind. San Jorge, Parcelas 16-19 13270 ALMAGRO (C. Real) ESPAÑA Telf.: 926 86 14 49 – Fax: 926 86 14 10 www.torytrans.com

THECNICAL DATA

TRANSFORMADOR TRIFASICO DE AISLAMIENTO

Características eléctricas:

Potencia:	8 kVA
Tensión de primario:	3 x 400 V triangulo
Intensidad de primario:	11,5 A triangulo
Tensión de secundario:	12 V triangulo // 21 V estrella
Intensidad de secundario:	385 A triangulo // 220 A estrella
Frecuencia:	50-60 Hz
Grado de protección contactos:	IP00
Temperatura ambiente:	30° C
Test de rigidez dieléctrica:	3 KV / 50 Hz / 1 min.
Régimen de trabajo:	Continuo
Sistema refrigeración:	AN Aire Natural

Características constructivas:

Bobinado en cobre
Núcleo magnético bajas perdidas.
Clase térmica aislamiento H-180° C
Caja metálica esmaltada

Normas:

Conforme CE
Conforme Norma IEC60076

Dimensiones y peso:

Tipo	Dimensiones (ancho x fondo x alto)	Peso
TCS	300 x 175 x 300 mm	53 kg

CERTIFICADO DE CONFORMIDAD CE

TORYTRANS S.L

TRANSFORMACION Y REGULACION DE LA TENSION ELECTRICA

CLIENTE:	PROCONTROL
DENOMINACION DEL PRODUCTO:	Transformador Trifásico de Aislamiento
POTENCIA:	8 KVA
TENSIÓN PRIMARIO	400 V
SECUNDARIO	12V / 21V (Conexión D / Y)
CONEXIÓN	D / d-y
TEMPERATURA ASIGNADA	25 ºC
AISLAMIENTO	CLASE F
GRADO DE PROTECCION	IP-00
ACABADO	Tipo Seco
REFERENCIA DEL PRODUCTO:	TX008
PROTECCION	Clase I

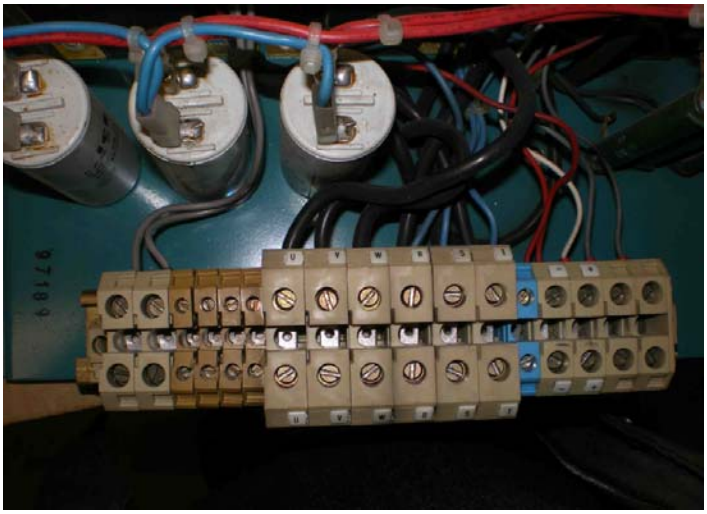
PRODUCTOS CONFORMES A LAS ESPECIFICACIONES

Nº PLANO	NORMATIVA	Directivas CE
TX008	EN 61558 EN 60076	73/23/CEE 93/68/CEE

OBSERVACIONES

REALIZADO	FIRMA	FECHA
J. Huertas DIRECTOR TECNICO		03-12-2009

4. **Imágenes del armario antes de reparar:**



14. REACTOR TANKS CE MARKING

14.1. Reactor CE marking
14.2. VS_4001_01 CE marking
14.3. VS_4002_01 CE marking

QVF

member of
De Dietrich
PROCESS SYSTEMS

DECLARATION OF CONFORMITY

as defined by Pressure Directive 97/23/EG Annex VII

Manufacturer:

QVF ENGINEERING GMBH
Hattenbergstraße 36
55122 Mainz
phone.: +49 (0) 6131/9704-0
fax: +49 (0) 6131/9704-500

Herewith we declare that the results to the below-mentioned Pressure Equipment corresponds to the pertinent Pressure Equipment Directive 97/23/EG. The Pressure Equipment is marked as follows (where needed):

CE 0035

Tested acc. to PED No. 97/23/EG: Mr. Steeg (Expert) / Mr. Winter (Technical Manager)

Modulus: H

Description of the Pressure Equipment

Parts acc. to WPR Components Catalogue QVF 2002

Section 2 – Pipeline components >DN25

Section 3 – Valves
remark: ball valves Type KHK / KHKP are marked with the CE- sign by QVF´s supplier

Section 4 – Glass vessels and components >DN25
remark: to single apparatus with nameplate a separate declaration of conformity will be issued

Section 5 – Glass- heatexchangers (all types)
remark: to single apparatus with nameplate a separate declaration of conformity will be issued

Section 6 – Column components >DN25 (only pressure- loaded parts)

Section 8 – Pressure – loaded parts > DN25 of measurement and control equipment
remark: Glass parts of the Flowmeters are marked with the CE- sign by QVF´s supplier

Section 9 – Pressure loaded parts of couplings, bellows

QVF

member of De Dietrich PROCESS SYSTEMS

Category:	All parts can be used for apparatus, pipelines and assemblies up to Category III
Manufactured in:	Mainz, Stafford, Paris
Design and Fabrication:	acc. to AD2000 rules, EN1595

Mainz, 17.02.03

i.V.

Technical Manager

i.A.

Expert

QVF ENGINEERING GMBH

P.O.Box 3369
55023 Mainz
Hattenbergstraße 36
55122 Mainz

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fax: +49 (0) 6131/9704-500
E-mail: mail@qvf.de
www.qvf.de

TECALSA Customized for you

DECLARATION OF CONFORMITY

MANUFACTURER	:	TÉCNICA Y CALDERERÍA S.A.L. TECALSA
ADDRESS	:	Pol Ind Alces, Avda. de las Bodegas nº5, 13600-Alcázar de San Juan, (Ciudad Real)
V.A.T. No.	:	A13020045
LEGAL RESPONSIBLE	:	Guillermo Escobar Romero

DESCRIPTION OF PRESSURE EQUIPMENT OR SET OF EQUIPMENT

Pressure Equipment	:	160L Reactor
Serial Number	:	3259 / 09
Manufacturing date	:	15/01/2009
Category	:	III

PROCEDURE USED FOR THE CONFORMITY DECALARATION

Final verification as per MODULE G

NOTIFIED BODY APPOINTED TO MAKE THE CONTROL

Notified body	:	EUROCONTROL S.A.L.
Address	:	C/Campo 58 - Entreplanta 13700 Tomelloso (Ciudad Real)
Identification code	:	0057
Conformity certification no.	:	12-CE-G-TEC-003/09

TECHNICAL SPECIFICATIONS

ASME VIII Division 1

TEMA Code Part 7

ASME IX: Welding Procedures

The under signer hereby declares that the pressure vessel described before is in conformity with the norms of the Directive 97/23/CE of the European Parliament and the Council of 29 May 1997 on the approximation of the laws of the Member States concerning design and manufacturing of pressure equipment.

TÉCNICA Y CALDERERÍA S.A.L. TECALSA

Fdo. Guillermo Escobar Romero

TECALSA

Fecha: 29/10/2009

TÜV CERT DIN EN ISO 9001:2000 Certificado Nº 01 100 06000

TECALSA
TECNICA Y CALDERERIA, S.A.L.

DECLARACIÓN DE CONFORMIDAD

FABRICANTE:	TÉCNICA Y CALDERERÍA S.A.L. TECALSA
DIRECCIÓN:	Polígono Industrial Alces Parcelas 3 a 6 13600-Alcázar de San Juan, (Ciudad Real)
C.I.F.:	A13020045
RESPONSABLE LEGAL:	Guillermo Escobar Romero

DESCRIPCIÓN DEL EQUIPO/S A PRESIÓN O DEL CONJUNTO.

Equipo a Presión:	Reactor 120L
Nº de fabricación:	2954
Fecha de fabricación:	01/10/2007
Categoría:	II

PROCEDIMIENTO UTILIZADO PARA DECLARACIÓN DE CONFORMIDAD.

Control interno de la fabricación según MÓDULO A1

ORGANISMO NOTIFICADO QUE HA EFECTUADO EL CONTROL.

Organismo notificado:	EUROCONTROL, S.A.
Dirección:	C/ Campo, 58 – Entreplanta 13.700 – Tomelloso (Ciudad Real)
Código de identificación:	0057
Certificado de conformidad nº:	12-CE-A1-TEC-114/07

ESPECIFICACIONES TÉCNICAS

- ASME VIII División 1
- Cógigo TEMA Apdo 7
- ASME IX: Procedimiento de soldadura

El abajo firmante declara que el equipo a presión definido anteriormente es conforme a los requisitos establecidos por la Directiva 97/23/CE relativa al diseño y fabricación de aparatos a presión.

TÉCNICA Y CALDERERÍA S.A.L. TECALSA

TECALSA
TECNICA Y CALDERERIA S.A.L.

Fdo.: Guillermo Escobar Romero
Fecha: 01/10/2007

15. HARDWARE ACCEPTANCE

De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA member of De Dietrich PROCESS SYSTEMS	**ACTA DE ENTREGA**
	CLIENTE: VAB
	Nº PROYECTO OT: PRK-5393
	TÍTULO PROYECTO: MELISSA C. IVa
	REF. ADMIN.:
	S/ PEDIDOS: PD155003503
	PÁG. 1 de 2

Los Señores:	En representación de:
Enrique Peiró	UAB (Melissa)
Josep Mestre	**DE DIETRICH EQUIPOS QUÍMICOS, S.L.**

Reunidos en obra, se procede a realizar la entrega de los documentos (protocolos de pruebas y resultados de las mismas) que certifican que las pruebas eléctricas y mecánicas (estanqueidad y presión) se han realizado y finalizado.

En la página 2 se relacionan las eventuales actividades que, de mutuo acuerdo, quedan pendientes con compromiso de resolución en las fechas que se indican.

Conforme se resuelvan los temas pendientes se actualizará los resultados en los documentos originales entregados.

Apartado de firmas		**Fecha:** 01/10/09	
Por:	UAB (Melissa)	Firma/s:	Enrique Peiró
Por:	DE DIETRICH EQUIPOS QUÍMICOS, S.L.	Firma/s:	

De Dietrich Equipos Químicos, S.L. Av. Príncep d'Asturies 43-45, 1r-5a E-08012 BARCELONA member of De Dietrich PROCESS SYSTEMS	**ACTA DE ENTREGA**
	CLIENTE: UAB
	Nº PROYECTO OT: PRK-5393
	TÍTULO PROYECTO: MELISSA C.IVa
	REF. ADMIN.:
	S/ PEDIDOS: PD155003503
	PÁG. 2 de 2

RELACIÓN DE ACTIVIDADES PENDIENTES Y/O UNIDADES DE OBRA A CORREGIR

DESCRIPCIÓN	FECHA PREVISTA	RESPONSABLE	
- Control valve SCV 4004 01: pending electrovalve connection	16/10/09	DDEQ →	Ok (02/10/0... julia EPC
- Mass flowmeter FT 4004 01: connection pending	16/10/09	DDEQ →	Ok (01.12.09 julia
- Acid / Base scales: connection pending	02/10/09	DDEQ →	Ok (02/10/09 julia EPC
- Biomass measurement: AT 4009 01 connection pending	16/10/09	DDEQ →	Ok (01.12.09 julia
- CO_2 / O_2 analyser AT4010 01/02: configuration pending	16/10/09	UAB/DDEQ	
- Air fan BLWR 4005 01: electronic variator configuration pending	02/10/09	DDEQ →	Ok (02/10/0... julia EPC

OBSERVACIONES:

Apartado de firmas		**Fecha:** 1.10.09	
Por:	UAB (MELISSA)	Firma/s:	Enrique Peiró
Por:	DE DIETRICH EQUIPOS QUÍMICOS, S.L.	Firma/s:	[signature]

De Dietrich
PROCESS SYSTEMS

TÜVRheinland
ISO 9001:2000
Nº 0.04.07135

De Dietrich Equipos Químicos, S.L.		Acta de Entrega
Cliente: **UAB / MELiSSA**	Plano OT: **DD-8558-Z1**	Pág: 1 de 3
Título proyecto: **MELiSSA COMPARTMENT IVa**	Proyecto nº: **PRK-5393**	

Los Señores:	En representación de:
Enrique Peiró	**UAB / MELiSSA**
Josep Mestre	**DE DIETRICH EQUIPOS QUÍMICOS, S.L.**
Roberto de Miguel	

Reunidos en obra, se procede a realizar el reconocimiento de la instalación (material y montaje) que ampara dicho contrato, aceptándose la misma.

En la página 2 se relacionan las eventuales actividades y/o unidades de obra que, de mutuo acuerdo, quedan pendientes con compromiso de resolución en las fechas que se indican.

El plazo de tiempo de Garantía fijado en el contrato comienza a contar a partir de la fecha de la presente Acta.

UAB / MELiSSA	**DE DIETRICH EQUIPOS QUÍMICOS, S.L.**
Firma/s: Enrique Peiró	Firma/s:
Nombre/s: Enrique Peiró	Nombre/s: Josep Mestre
Fecha: 26.01.10	26/01/2010

Mod. 7.1-01-02-02

De Dietrich PROCESS SYSTEMS

De Dietrich Equipos Químicos, S.L.	Acta de Entrega	
Cliente: UAB / MELiSSA	Plano OT: DD-8558-Z1	Pág: 2 de 3
Título proyecto: MELISSA COMPARTMENT IVa	Proyecto nº: PRK-5393	

RELACIÓN DE ACTIVIDADES PENDIENTES Y/O UNIDADES DE OBRA A CORREGIR

Descripción	Fecha prevista	Responsable	Fecha resolución	Verificado por
DOCUMENTACIÓN:				
- ACTUALIZACIÓN MANUAL OPERACIÓN	13/02/10	DDEQ/UAB	16/04/10	E. Peiró
- ESPECIFICACIONES INSTRUMENTOS / EQUIPOS	13/02/10	DDEQ	16/04/10 (1)	E. Peiró
- ACTUALIZACIÓN DOSIER	13/02/10	DDEQ/UAB	16/04/10	E. Peiró
- INFORME Y CERTIFICADO ICIT	13/02/10	DDEQ	16/04/10	E. Peiró
HARDWARE:				
- CALIBRACIÓN CÉLULAS DE CARGA (Mettler Toledo)	25/02/10	DDEQ	2/03/10 (2)	E. Peiró
- CONFIGURACIÓN VÁLVULA PROPORCIONAL (Bürkert)	29/01/10	DDEQ/UAB	8/02/10	E. Peiró
- PROPUESTA SISTEMA LIMPIEZA REACTOR / TANQUES	13/02/10	DDEQ →	15/02/10	Julia

OBSERVACIONES:
(1) Entregadas especifs. instrumentos y equipos críticos
(2) Pendiente clarificación de efecto periódico sobre la medida de pesada

UAB / MELiSSA	DE DIETRICH EQUIPOS QUÍMICOS, S.L.
Firma/s: Enrique Peiró	Firma/s:
Nombre/s: ENRIQUE PEIRO	Nombre/s: Josep Martínez
Fecha: 26.01.10	26/01/2010

De Dietrich
PROCESS SYSTEMS

De Dietrich Equipos Químicos, S.L.	Acta de Entrega	
Cliente: **UAB / MELiSSA**	Plano OT:	Pág: 3 de 3
Título proyecto:	Proyecto nº:	

De Dietrich
PROCESS SYSTEMS

TÜVRheinland ISO 9001:2000 Nº 0.04.07135

De Dietrich Equipos Químicos, S.L.		Acta de Entrega
Cliente: **UAB / MELiSSA**	Plano OT: **DD-8558-Z1**	Pág: 1 de 3
Título proyecto: **MELiSSA COMPARTMENT IVa**	Proyecto nº: **PRK-5393**	

Los Señores:	En representación de:
Enrique Peiró	**UAB / MELiSSA**
Josep Mestre Roberto de Miguel	**DE DIETRICH EQUIPOS QUÍMICOS, S.L.**

Reunidos en obra, se procede a realizar el reconocimiento de la instalación (material y montaje) que ampara dicho contrato, aceptándose la misma.

En la página 2 se relacionan las eventuales actividades y/o unidades de obra que, de mutuo acuerdo, quedan pendientes con compromiso de resolución en las fechas que se indican.

El plazo de tiempo de Garantía fijado en el contrato comienza a contar a partir de la fecha de la presente Acta.

UAB / MELiSSA	**DE DIETRICH EQUIPOS QUÍMICOS, S.L.**
Firma/s: Enrique Peiró	Firma/s:
Nombre/s: Enrique Peiró	Nombre/s: Josep Mestre
Fecha: 26.01.10	26/01/2010

Mod. 7.1-01-02-02

De Dietrich PROCESS SYSTEMS

De Dietrich Equipos Químicos, S.L.		Acta de Entrega
Cliente: **UAB / MELiSSA**	Plano OT:	Pág: 2 de 3
Título proyecto:	Proyecto nº:	

RELACIÓN DE ACTIVIDADES PENDIENTES Y/O UNIDADES DE OBRA A CORREGIR

Descripción	Fecha prevista	Responsable	Fecha resolución	Verificado por
DOCUMENTACIÓN:				
- ACTUALIZACIÓN MANUAL OPERACIÓN	13/02/10	DDEQ / UAB		
- ESPECIFICACIONES INSTRUMENTOS / EQUIPOS	13/02/10	DDEQ		
- ACTUALIZACIÓN DOSSIER	13/02/10	DDEQ / UAB		
- INFORME Y CERTIFICADO ICIT	13/02/10	DDEQ		
HARDWARE:				
- CALIBRACIÓN CÉLULAS DE CARGA (Mettler Toledo)	25/02/10	DDEQ		
- CONFIGURACIÓN VÁLVULA PROPORCIONAL (Burkert)	29/01/10	DDEQ / UAB		
- PROPUESTA SISTEMA LIMPIEZA REACTOR / TANQUES	13/02/10	DDEQ →	15/02/10	Julia
OBSERVACIONES:				

UAB / MELiSSA	DE DIETRICH EQUIPOS QUÍMICOS, S.L.
Firma/s: Enrique Peiro	Firma/s:
Nombre/s: ENRIQUE PEIRO	Nombre/s: Josep Montes
Fecha: 26.01.10	26/01/2010

De Dietrich
PROCESS SYSTEMS

De Dietrich Equipos Químicos, S.L.		Acta de Entrega
Cliente: UAB / MELiSSA	Plano OT:	Pág: 3 de 3
Título proyecto:	Proyecto nº:	

N°	SPECIFICATION (1)	PRIORITY	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE
1	Alternatives to existing plastic walls Maintain if possible steel upper and lower parts Tightness for sterilisation requirements	1	Design review: - Detailed drawing of Glass-steel coupling - Detailed drawing of reactor mounting on the skid - Detailed drawing of the top lid Leak proof test	PROPOSED OPTION	Glass	- Maintain current steel vessel; modify steel gaskets in contact with columns - Weight supported in bottom, previous adjustment of tensions when mounting, upper part allowing dilatation of glass - No new ports in vessel lateral - New ports in top lid (new lid or not, TBD) - Cooling transparent plastic and collector exhaust			12800 € Reactor	Glass columns	Final design review Pressure test of the vessel (01.09.09)	Final detail engineering datapackage, Section 6 SAT Test report DDEQ01.10.09	yes
				ALTERNATIVE 1	No alternatives considered								
				ALTERNATIVE 2									
2	Necessary ports Avoid dead zones	1	Design review: - Detailed drawing of steel reactor if modified - detailed drawing of new top lid	PROPOSED OPTION	Current vessel	Only new ports eventually necessary in top lid, depending on decisions on level sensor (level sensor requirements to be checked)				Modified ports on the top lid (clamp connections)	Final design review	Final detail engineering datapackage, Section 6	yes
				ALTERNATIVE 3									
				ALTERNATIVE 4									
3	Redundant outlet filters to cope for potential clogging	2	P&ID review Equipment list review	PROPOSED OPTION	Redundant filters with manual shift	- Redundant filters - Manual valves for filter shifting - Delta P sensors to detect clogging (range 100 mbar)		Manual shifting could not be enough in case of foam	Delta P sensor: 2000€	Redundant filters with manual shift	Basic design review	Basic engineering datapackage, Section 6, A.4	yes
				ALTERNATIVE 5	Foam breakers			Considered not safe for axenicity and not surely effective					
				ALTERNATIVE 6	Automatic swifting	Avoids accidental clogging	Guarantee constant feeding in case of clogging w/o supervision Should be considered for future if foam is very risky); foaming may be not prevented	Automatic shifting is not enough: previous sterilisation should be guaranteed	3710 € (including automatic valves, wiring, modif. Of electrical cabinet and pneumatic connection				
4	Antifoam feedings	3	Functional Tests	PROPOSED OPTION	Out of battery limits of DeDietrich delivery	Not included in the scope (it will be implemented in future in case of foaming being a high risk				To perform previous testing of commercial foam sensor in order to define future antifoam feedings (to be done manually in the meantime if needed)	N.A.	N.A.	No
				ALTERNATIVE 7									
				ALTERNATIVE 8									
5	Sterilising air inlet for cleaning biomass sensor	1	P&ID review Equipment list review Functional tests	PROPOSED OPTION	Filter (being sterilised in place) for air inlet pipeline to biomass sensor			Flow measurement to the sensor still not measured		Sterile filtered gas inlet branch to biomass sensor; pulse flushing	Basic design review Functional testing (control)	Basic engineering datapackage, Section 6, A.4 TN22 (pending)	yes (report pending)
				ALTERNATIVE 9	Branch to biomass sensor after sterilising filter		Simplified design	Airflow to bottom would be incorrect					
				ALTERNATIVE 10									
6	Evaluate current sampling probe design for axenicity	1	Design review: - Detailed drawing of sampling probe - Certificate for sanitary use? Testing sterile sampling?	PROPOSED OPTION	New sampling probe	New probe from BURKERT (sanitary)	Sanitary design Cost in quotation to be broken down	Sanitary design to be confirmed	(3) 2172 €	New sanitary sampling probe	Final design review	Final design datapackage, vol. Xx (datasheet)	yes
				ALTERNATIVE 11	New sampling probe (other)	New probe from SARTORIUS (sanitary) SVC 25	Sanitary design		3.250 €				
				ALTERNATIVE 12	Maintaining current probe			Not safe enough					
7	Stainless steel auxiliary tanks for feeding and harvesting and piping: - Steam sterilisable - Able to be maintained at 4°C	1	Design review: - P&ID - Equipment and instrument lists - Equipment data sheet Leak proof test SIP test	PROPOSED OPTION	Polishing =0,5 Blender: Magnetic driven top Pressure vessels Ports: Temperature, sampling probe + 2 spare clamp ports		Ideal for axenicity	High cost (to be broken down in quotation)	(2) 62500 € with Magnetic coupling. Temp. Transmitter (2) 940 €	Stainless steel auxiliary tanks Polishing =0,5 Blender: Magnetic driven top Pressure vessels Ports: Temperature, sampling probe + 2 spare clamp ports	Final design review Steam pressure tests DDEQ Sterilisation validation	Final design datapackage, section 1 (PID), 5 (Equipment lists), and 6 (constructive drawings) Test reports DDEQ01.10.09 Steril. Validation report (pending)	Yes (steril. Validation pending)
				ALTERNATIVE 13	Blender: Mechanical seal (single)		Lower cost (to be clarified)	Not safe enough foraxenicity	(2) 52700 € with single mech Seal				
				ALTERNATIVE 14	Blender: Mechanical seal (double)			Need of inert sterile fluid High cost (to be clarified)	Aprox. 2x single mech. Seal				

N°	SPECIFICATION (1)	PRIORITY	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE
8	Alternatives for peristaltic pumps for feeding, removal and pH control	1	Design review: - P&ID - Equipment and instrument lists - Equipment data sheet - Certificate for sanitary use Leak proof test	PROPOSED OPTION	- Dosing pumps for feeding and harvesting - peristaltic pumps for pH control	- LEWA sanitary pumps (2+1 spare) for media feeding and harvesting including PT to stop motor in case of high pressure - Massflowmeter Coriolis (1 mm) moved to the final inlet to be protected by filter. - Final redundant filters in parallel **(new specification)** - Avoid Coriolis flowmeter in harvest line due to the presence of solids; then to increase precision of level in harvesting tank - Bypass in flowmeter and prefilters before; flowmeter position to be located before the final filters - Peristaltic WATSON-MARLOW pumps for acid and base (use of current pumps to be checked by MPP)	LEWA pump: Sanitary design; FDA certification; double membrane, indication and alarm when external membrane leaks WATSON-MARLOW pump: good quality, frequency variator	LEWA pump: need to integrate the flow measurement (not constant flow) - CORIOLIS flowmeter: just 1 mm hole, risk of clogging	LEWA pumps (3): 7485 € P transmitter in outlet of pumps (2): 940 € Presostat pump (3): 1410 Massflowmeters (2): 10353 € Acid and base pumps (2): 4940 € Delta P sensor inlet filters: 2000 € Delta P sensor prefilters: 2000 € Ball acis/base inlet diaphragm valve (2) 820 €	- Dosing pumps for feeding and harvesting - peristaltic pumps for pH control	Final design review Steam pressure tests DDEQ Sterilisation validation CIFA Demonstration tests (several days)	Final design datapackage, section 1 (PID), 5 (Equipment lists), and 6 (constructive drawings) SAT Test report DDEQ01.10.09 Steril. Validation report (CIFA, under revision) Logbook CIVa (demonstration tests 2010)	Yes
				ALTERNATIVE 15	Automatic shifting of feeding pumps	To be included for 2nd step design (also in the layout)	Avoids stop the feeding by accidental failure	Automatic shifting is not enough: previous sterilisation should be guaranteed	3710 € (including automatic valves, wiring, modif. Of electrical cabinet and pneumatic connection				
				ALTERNATIVE 15b	Dosing pumps for feeding, alternative manufacturer	JESCO pump	Lower cost	Sanitary design not confirmed	(3) 3270 €				
				ALTERNATIVE 15c	Peristaltic pumps for acid and base, alternative manufacturer	BOYSER pump	Lower cost	Electrical variable speed in stead of frequency variator; quality non confirmed	(2) 3190 €				
				ALTERNATIVE 15d	Automatic shifting of final filters		Guarantee constant feeding in case of clogging w/o supervision	Automatic shifting is not enough: previous sterilisation should be guaranteed Clogging of final filters is prevented by prefilters and Delta P measurement and alarm	3710 € (including automatic valves, wiring, modif. Of electrical cabinet and pneumatic connection				
				ALTERNATIVE 16	Gear pumps for feeding			Not safe enough for axenicity					
				ALTERNATIVE 16b	Lobular possitive-displacement, rotary pumps for feeding			High cost Higher flow range High shear stress (not suitable for harvesting)					
				ALTERNATIVE 16c	Centrifugal pumps for feeding			Feeding flow is too low for those pumps					
				ALTERNATIVE 16d	Feeding based on loadcells			Precision would't be enough					
				ALTERNATIVE 16e	Volumetric flowmeters			Not enough precision					
9	Stainless steel vessels and pipelines for feeding, acid and base and outlet	1	Design review: - P&ID - Equipment and instrument lists - Equipment data sheet Leak proof test	PROPOSED OPTION	Stainless steel complete pipeline for feeding and outlet lines Plastic tubing for acid and base from bottles up to SIP; then stainless steel up to the bioreactor	Acid and base vessels are not considered in s.s. : Reconsider requirement for acid and base vessels (MPP) Acid and base tubing are not completely considered in s.s. : Reconsider requirement for acid and base vessels (MPP)			Glass vessels for acid and base (2): 380 €	Stainless steel complete pipeline for feeding and outlet lines Plastic tubing for acid and base from bottles up to SIP; then stainless steel up to the bioreactor	Basic design review Pressure tests DDEQ	Basic engineering datapackage, Section 8 (PID) and Section 6 (equipment list) SAT Test report DDEQ 01.10.09	Yes
				ALTERNATIVE 17									
				ALTERNATIVE 18									
10	Containment vessels for acid and base spills prevention	1	Design review: - Layout - Skid drawings	PROPOSED OPTION	Plastic containers for acid and base	Containment vessel in case of reactor/tanks spillage needs also to be guaranteed in the skid (new requirement, MPP)	Low cost Needed for safe operation			Plastic containers for acid and base	Visual inspection at the acceptance of the reactor	Installation acceptance DDEQ 26.01.10	Yes
				ALTERNATIVE 19									
				ALTERNATIVE 20									
11	Stainless steel pipelines for gas loop	2	Design review: - P&ID - Equipment list - Equipment data sheets Leak proof test	PROPOSED OPTION	Stainless steel pipelines, new connections with existing equipment					Stainless steel pipelines when feasible, new connections with existing equipment	Basic design review Pressure tests DDEQ	Basic engineering datapackage, Section 8 (PID) and Section 6 (equipment list) SAT Test report DDEQ 01.10.09	Yes
				ALTERNATIVE 21									
				ALTERNATIVE 22									
12	Improvement of temperature control (heating)	3	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	New heat exchanger for cooling and use existing for hot water	Improvement of cooling system (new requirement, MPP)	Improve temperature control	Higher cost	Solenoid ball valve (2) 640 € Outlet ball valve (2) 640 €	Electrical resistance for heating and new heat exchanger for cooling (current heat exchanger is not in good conditions)	Basic design review Functional tests (temperature control)	Basic engineering datapackage, Section 8 (PID) and Section 6 (equipment list) TN 22 (pending)	Yes (report pending)

N°	SPECIFICATION (1)	PRIORITY	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE
				ALTERNATIVE 23	Only resistance for heating - reuse current h e for cooling	Compatibility of h e material with glycol should be checked	Save one heat exchanger Heating not commonly needed, and lighting could be enough		300 €				
				ALTERNATIVE 24	Maintain current configuration, just substitute steam inlet solenoid valve		Lower cost	Direct glycol into jacket not convenient for 36°C					
13	Evaluate current overpressure safety valve Rupture disk as an alternative	1	Design review: - P&ID - Equipment list - Equipment data sheets Leak proof test	PROPOSED OPTION	Rupture disk in stead of safety valve		Safer for axenicity	If broken, operation shoud be stopped	(2) 1330	Sanitary safety valve	Basic design review	Basic engineering datapackage, Section 8 (PID) and Section 6 (equipment list)	Yes
				ALTERNATIVE 25	Maintain current safety valve			Current safety valve considered not adequate for axenicity					
				ALTERNATIVE 26	Sanitary safety valve	Sanitary design to be described	Safety valve in general is considered not safe enough for axenicity	Safety valve in general is considered not safe enough for axenicity	(2) 1370				
14	Upgrade of the illumination system	2	Design review: - Detailed report on illumination system upgrade - P&ID - Layout	PROPOSED OPTION	Maintain current electrical cupboard, cabling and lamps support Upgrade internally the cupboard; upgrade quality and safety of lamps support and cooling of the same	- Modify lamps stands with inox covering without reclabling - Electric cupboard: maintain close to the reactor, preferably in the back of the skid (layout to be verified, cost of potential enlargement of cables to be checked); repair or change elements out of service transformer (to be confirmed), blower - Include CE marking of electrical cupboard: new components, general protections and schemes for CE marking - New cooling system for hot air, including blower and transparent plastic jacket around the columns - Quotation to be broken down		Complex task: the whole system needs to be upgraded, involving components, aspect, certification, etc.	Electrical refurbishment: 28970 (not included new transformer, 1000€) Air cooling system: 6720 €	Maintain current electrical cupboard, cabling and lamps support Upgrade internally the cupboard; upgrade quality and safety of lamps support and cooling of the same	Final design review Ext. Company CE review	Final detail eng. Datapackage, Section 1 (PID) 11 (CE) and appendix (calculations) Lighting cabinet upgrade report DDEQ 261108 CE certificate ext. Company report xxx	Yes
				ALTERNATIVE 27		Electrical cupboard out of Area 9	Save space for MPP	High cost (to be avaluated). elongation of cabling is needed Difficult access to the cupboard					
				ALTERNATIVE 28		New electrical cupboard	Organise better the space in MPP High quality	High cost (to be evaluated)					
15	Refurbishing of weighting scales	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	New scale for feeding tank	Old scale is not adequate: max. Weight 160 Kg (estimated 500 Kg for new tank, full) - Precision in scale: 200g (2‰)			(2) 9680€; cost could be reduced 35% reducing precision	Guided wave level sensor	Final design review Functional testing	Final engineering datapackage, Sedction 1 (PID) and 5 (Equipment List) Functional test report (pending)	yes (report pending)
				ALTERNATIVE 29	Level sensor	Guided wave	ultrasound cheaper than microwave Ultrasound suitable because there is no foam	High cost (to be evaluated) ve)	1560 € Guided microwave				
				ALTERNATIVE 30	Differential pressure			Big size of membranes needed; poor precision due to small size of tanks					
16	Weighting scale for the harvesting tank	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	New scale for harvesting tank	Old scale is not adequate: max. Weight 160 Kg (estimated 500 Kg for new tank, full) - Precision in scale: 200g (2‰) - It is necessary higher precision than in feeding tank scale in the case the outlet flowmeter is cancelled			(2) 9680€; cost could be reduced 35% reducing precision	New Load cell	Basic design review Functional testing	Basic engineering datapackage, Section 6 1A (Equipment List) and 8 (PID) Functional test report (pending)	yes (report pending)
				ALTERNATIVE 31	Level sensor	Guided waves	ultrasound cheaper than microwave	High cost (to be evaluated) Ultrasound not suitable when there is foam (better guided microwave)	1560 € Guided microwave				
				ALTERNATIVE 32	Differential pressure			Big size of membranes needed; poor precision due to small size of tanks					
17	Weighting scales for acid and base	3	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Lab scales for weighing 5L bottles	METTLER TOLEDO, Including output signal to supervision (via RS-232) but not 4/20Ma	Allows inputs to supervision	Output to DCS requires implementation of communication hardware in the PLC (RS-232)	(2) 670 €	Lab scales METTLER	Basic design review Functional testing (pending?)	Basic engineering datapackage, Section 6 1A (Equipment List) and 8 (PID) Functional test report (pending)	yes (report pending)
				ALTERNATIVE 33	Lab scales for weighing 5L bottles	Not including output signal to supervision	Lower cost and easier implementation	Requires manual recording					
				ALTERNATIVE 34	Lab scales for weighing 5L bottles	METTLER TOLEDO, including outlet 4/20mA	Allows inputs to supervision; not requires implementation of new communication hardware	High cost	(2) 7030 €				
18	Pressure release valve to be checked for sizing	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Include regulating valve for pressure control		Independent pressure control		(3) 1470 €	New regulating valve for pressure control	Basic design review Functional testing	Basic engineering datapackage, Section 6 1A (Equipment List) and 8 (PID) Functional test report (TN22, pending)	yes (report pending)

N°	SPECIFICATION (1)	PRIORITI	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE
				ALTERNATIVE 35	Pressure relief based on outlet massflow regulation (current status)			Pressure control linked to flow regulation; only indirect control					
				ALTERNATIVE 36	Pressure relief based on outlet massflow existing valve			To be checked if existing valve in massflowmeter could be regulated by pressure measurement					
19	Check valves in gas pipelines to protect from steaming	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION		OK for inlet gas pipelines, not possible for outlet gas pipeline			(5) 2210 €	New chack valves	Basic design review Final detail design review	Basic engineering datapackage, Section 6 1A (Equipment List) and 8 (PID) Technical documentation DDEQ Vol. IV	yes
				ALTERNATIVE 37									
				ALTERNATIVE 38									
				Decision									
20	Skid refurbishing	2	Design review: - Detailed layout of the skid	PROPOSED OPTION	New skid		Lower cost than refurbishing Not convenient to repair current skid considering its bending and the need of new supports for pipelines, instruments, etc. Optimal design conditioned to old shape		22500 € Piping and metallic support structure 45300 € Construction and assembling - 1250 € existing support frame	New skid	Final design review	Final detail engineering, Section 6	yes
				ALTERNATIVE 39	Current skid	To be repaired and extended		Higher cost Will not fit properly					
				ALTERNATIVE 40									
21	pH and D.O. sensors in retractable probes	1	Design review: - Equipment list - Equipment data sheets	PROPOSED OPTION	METTLER retractable housings + new electrodes	- New electrodes are needed to fit with retractable housings - Amplifiers could be maintained, but they're out of catalogue		Future maintenance not guaranteed with current amplifier, out of catalogue (one of the two)	pH, including transmitters for both pH and DO: 5130 € DO 2860€	METTLER retractable housings + new electrodes	Basic design review Final design review	Basic engineering, Section 6 (Instrument List) Technical Documentation, Vol. VII	yes
				ALTERNATIVE 41	New amplifiers	Individual cost to be checked	Guarantee for future maintenance	Higher cost					
				ALTERNATIVE 42									
22	pH redundant: one additional sensor in bottom of the bioreactor	1	Design review: - P&ID - Equipment list	PROPOSED OPTION		Additional pH in bottom			Cost of individual probe to be broken down in quotation	Additional pH electrode in bottom	Basic design review Functional testing	Basic engineering, Section 6 (Instrument List) Functional test report (hydrodinamic characterisation, pending)	yes
				ALTERNATIVE 43									
				ALTERNATIVE 44									
23	Rest of sensors in retractable housings when available	2	Design review: - Equipment list - Equipment data sheets	PROPOSED OPTION	Dissolved oxygen sensor and new biomass sensor (METTLER) in retractable housing	Temperature: retractable probe not needed Other biomass sensors: retractable probe not available			Cost of retractable housings to be clarified in quotation	Dissolved oxygen sensor and new biomass sensor (METTLER) in retractable housing	Basic design review Final design review	Basic engineering, Section 6 (Instrument List) Technical Documentation, Vol. VII	yes (additional supplies pending for cleaning/steaming of housings)
				ALTERNATIVE 45									
				ALTERNATIVE 46									
24	New biomass sensor based on a different technology of current one	2	Design review: - Equipment list - Equipment data sheets - Pevious use in Arthrospira (Reporting) Testing	PROPOSED OPTION	Turbidity New sensor METTLER TOLEDO, in top of the reactor	Retractable probe available To be checked potential previous testing			7.590 €	Turbidity New sensor METTLER TOLEDO, in top of the reactor	Final design review	Final detail engineering, section 6 (drawings) and 5 (equipment list) Technical documentation, vol. VI	yes (repair of MONITEK sensor pending)
				ALTERNATIVE 47	OPTEK	Based on turbidity To be checked potential previous testing			Quotation pending				
				ALTERNATIVE 48	ABER/NTE	Based on capacitance To be checked potential previous testing	Amplifier for 4 sensors	Technology not demonstrated for Arthrospira Very high cost	36820 € for ABER				
25	Foam detection	1	Design review: - Instrument list - Equipment data sheet - Certificate for sanitary use	PROPOSED OPTION	Vibrating sensor sanitary (BURKERT)		Sanitary version Supplier offers testing before buying	Risk of getting dirty by clamps of Arthrospira (false positive); foam density needs to be adequate	1.060 €	To perform previous testing of commercial foam sensor	N.A.	N.A	No
				ALTERNATIVE 49	CHARIS	Conductivity	Successfully used for level control in bioreactors (LONZA)	Higher cost Risk of getting dirty (false positive) Not possible to test in advance	4.940 €				
				ALTERNATIVE 50	Guided Microwave		Successfully used in chemical reactors	Higher cost Risk of getting dirty (false positive)	1.560 €				
26	Improvement of temperature control = Requirement 12	3	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Only resistance for heating - reuse current h.e. for cooling - close cooling circuit	Compatibility of h.e. material with glycol should be checked	Save one heat exchanger Heating not commonly needed, and lighting could be enough		Solenoid ball valve (2) 640 € Outlet ball valve (2) 640 € Electric heater 300 € Expansion vessel 590 €	Electrical resistance for heating and new heat exchanger for cooling (current heat exchanger is not in good conditions)	Basic design review Functional tests (temperature control)	Basic engineering datapackage, Section 8 (PID) and Section 6 (equipment list) TN 22 (pending)	Yes (report pending)
				ALTERNATIVE 23	New heat exchanger for cooling and use existing for hot water	Improvement of cooling system (new requirement, MPP)	Improve temperature control	Higher cost					

N°	SPECIFICATION (1)	PRIORITY	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE
				ALTERNATIVE 24	Maintain current configuration, just substitute steam inlet solenoid valve		Lower cost	Direct glycol into jacket not convenient for 36°C					
27	Flow and pressure indication and control in gas to analysers, to provide stable and reliable measurements	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Rotameter + manual valves	- Manual valves to lead the needed flow to the analysers - Rotameter to check the flow - No measurement of pressure - No control of pressure and flow - Reconsider the requirement. to be checked the need of measurement or control of pressure, flow and temperature in the line to analysers (MPP)				- Automatic valves to lead the needed flow to the analysers - Flowmeter to check the flow in the main outlet line - Pressure measurement - Temperature measurement	Basic engineering review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) TN 22 (report pending)	yes (report pending)
				ALTERNATIVE 53	Indication and control of pressure in line to analyzers								
				ALTERNATIVE 54									
28	Differential pressure measurement for feed inlet filters to prevent clogging	1	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Redundant inlet filters Delta P measurement, manual shifting of filters	Differential pressure measurement, alarm in case of clogging Quotation to be broken down			2000 € Transmitter	Redundant inlet filters Delta P measurement; manual shifting of filters	Basic design review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Functional test report (pending)	Yes (report pending)
				ALTERNATIVE 55 = 15d	Automatic shifting of final filters		Guarantee constant feeding in case of clogging w/o supervision	Automatic shifting is not enough: previous sterilisation should be guaranteed Clogging of final filters is prevented by prefilters and Delta P measurement and alarm	3710 € (including automatic valves, wiring, modif. Of electrical cabinet and pneumatic connection				
				ALTERNATIVE 56									
29	Implement precise level control: differential pressure or load cells	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Load cells	Precision: 50 g	External to bioreactor; safe for axenicity		3.640 €	Load cells	Basic design review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Delivery acceptance record DDEQ, 26 01 10 Functional test report (pending)	No
				ALTERNATIVE 57	Differential pressure			Low precision for low overpressure; very small changes in pressure give very high changes in height (small diameter vessel) Would require large diameter diafragms, difficult in current reactor					
				ALTERNATIVE 58	Level sensor	CHARIS: based on conductivity	Successfully used for level control in bioreactors (LONZA)	Higher cost Not possible to test in advance	4.940 €				
30	Check current pressure sensor, implement redundant sensor, and guarantee operation and sterilisation ranges	1	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Two new P sensors, different range	One sensor for operation range **Other sensor for sterilisation? (redundancy TBC)**			1190 € each P sensor	Two new P sensors, different range	Basic design review Final detail review Steam pressure test DDEQ Functional testing: sterilisation tests	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Final eng. Datapackage, section 5 (Equpment list) Steam pressure test Report DDEQ Technical documentation, vol. 7 Functional sterilisation test report (pending)	Yes (report pending)
				ALTERNATIVE 59	Use current P sensor		Reduce cost	Nor safe for axenicity					
				ALTERNATIVE 60	Only one new sensor	Sterilisation controlled by temperature measurement	Reduce cost	Not precise enough for both ranges; no redundancy					
31	Improve feeding and harvesting flow control: based on scales weight measurement versus flowmeters	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Mass flowmeters in feeding and outlet lines	Coriolis flowmeter for inlet feeding Coriolis cancelled in the outlet (potential blocking); better increase precision of harvesting tank weight and measure the outlet flow based on that		Presence of cells in outlet line, could block the line (1 mm hole)	(2) 10350 €	Coriolis flowmeter for inlet feeding Coriolis cancelled in the outlet (potential blocking); better increase precision of harvesting tank weight and measure the outlet flow based on that (needed for future integration with other compartments)	Basic engineering review Final engineering review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Technical documentation, vol. V TN 22 (pending)	Yes (report pending)
				ALTERNATIVE 61	Flow measurement on weight (scales)		Already needed for level control in harvesting tank	Need a high precision; then high cost	(2) 6860 €				

N°	SPECIFICATION (1)	PRIORITY	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE
				ALTERNATIVE 62									
32	Light intensity or power consumption sensor	3	N.A.	PROPOSED OPTION	Not adressed, visual checking reccommended	No possible to provide specific indication of failing lamps unless recabling is made Reconsider the requirement (MPP)				No possible to provide specific indication of failing lamps unless recabling is made Reconsider the requirement (MPP)	N.A.	N.A.	N.A.
				ALTERNATIVE 63	Alarm when power consumption is low			Visually checking would give the same indication					
				ALTERNATIVE 64									
33	Axenic inoculation	1	Design review: - Detailed drawing of inoculation port - Equipment list - Equipment data sheet - Certificate for sanitary use	PROPOSED OPTION	Steam sterilisable connections	Build in-house			1 670 €	Steam sterilisable connections	Basic engineering review Functional (sterilisation and seeding) test review	Basic engineering datapackage Functional tests report (pending)	yes (report pending)
				ALTERNATIVE 65	Commertial inoculation port (SARTORIUS)		Potentially safer design	High cost	2 100 €				
				ALTERNATIVE 66									
34	Long term operation Axenicity CIP / SIP Ergonomics	1	Complete design review Functional tests	PROPOSED OPTION	All parameters considered in the design, except CIP	New filters for sterile air New diaphragm valves Clamp connections in valves and sensors Acid and base filtered on-line CIP not considered relevant (not to be often performed); so reconsider the requirement (MPP)				New filters for sterile air New diaphragm valves Clamp connections in valves and sensors Acid and base filtered on-line CIP not considered relevant (not to be often performed); so reconsider the requirement (MPP)	Final engineering review Visual inspection	Final engineering datapackage Installation accaptance DDEQ 26 01.10	Yes (to be checked during functional testing and long-term operation)
				ALTERNATIVE 67									
				ALTERNATIVE 68									
35	NEW REQUIREMENT: new compressor	3	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	New compressor	Old compressors not in good conditions	Reliability; low cost		375 €	New compressor (existing one not in good conditions)	Basic engineering review	Basic eng. Datapackage, section 6 (Equipment List) and 8 (PID)	yes
				ALTERNATIVE 69									
				ALTERNATIVE 70									
36	NEW REQUIREMENT: CE Marking	3	CE Certificate	PROPOSED OPTION	Only certify auxiliary tanks DDEQ comment	Auxiliary tanks and equipment marked CE; vessel and complete design not marked (considered a prototype) To be discussed with ESA: in principle, to be included in the quotation the CE Conformity declaration of the whole Compartment		High cost and time consuming: may arrive to 10-20% of the total cost of the equipment (to be confirmed)		Auxiliary tanks and equipment marked CE; vessel and complete design not marked (considered a prototype) To be discussed with ESA: in principle, it was supposed to be included in the quotation the CE Conformity declaration of the whole Compartment	Final eng. Review Visual inspection CE cerification lighing cabinet	Technical documentation CE cerification lighting cabinet report DDEQ	Yes
				ALTERNATIVE 69	Certify vessel		Probably just Pressure Directive is applicable						
				ALTERNATIVE 70	Certify the complete Compartment			High cost and several months of work					

(1) Source document : TN 87.24 on CIVa Redesign.

Enrique Peiro
01.04.10

N°	SPECIFICATION (1)	PRIORIT	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE	ACTIONS	ASSIGNEE	DUE DATE	REMARKS
4	Antifoam feedings	3	Functional Tests	PROPOSED OPTION	Out of battery limits of DeDietrich delivery	Not included in the scope (it will be implemented in future in case of foaming being a high risk				To perform previous testing of commercial foam sensor in order to define future antifoam feedings (to be done manually in the meantime if needed)	N A.	N A.	No	Testing commercial equipment	MPP	Before CIVa Start-up	Consider lab equipment rental
				ALTERNATIVE 7													
				ALTERNATIVE 8													
5	Sterilising air inlet for cleaning biomass sensor	1	P&ID review Equipment list review Functional tests	PROPOSED OPTION	Filter (being sterilised in place) for air inlet pipeline to biomass sensor			Flow measurement to the sensor still not measured		Sterile filtered gas inlet branch to biomass sensor, pulse flushing	Basic design review Functional testing (control)	Basic engineering datapackage, Section 6, A 4 TN22 (pending)	yes (report pending)	Delivery TN22	SHERPA	October 2010	
				ALTERNATIVE 9	Branch to biomass sensor after sterilising filter		Simplified design	Airflow to bottom would be incorrect									
				ALTERNATIVE 10													
7	Stainless steel auxiliary tanks for feeding and harvesting and piping: - Steam sterilisable - Able to be maintained at 4°C	1	Design review: - P&ID - Equipment and instrument lists - Equipment data sheet Leak proof test SIP test	PROPOSED OPTION	Polishing =0,5 Blender: Magnetic driven top Pressure vessels Ports: Temperature, sampling probe + 2 spare clamp ports		Ideal for axenicity	High cost (to be broken down in quotation)	(2) 62500 € with Magnetic coupling: Temp. Transmitter (2) 940 €	Stainless steel auxiliary tanks Polishing =0,5 Blender: Magnetic driven top Pressure vessels Ports: Temperature, sampling probe + 2 spare clamp ports	Final design review Steam pressure tests DDEQ Sterilisation validation	Final design datapackage, section 1 (PID), 5 (Equipment lists), and 6 (constructive drawings) Test reports DDEQ01 10 09	Yes (steril. Validation pending)	Sterilisation validation	MPP	August 2010	
				ALTERNATIVE 13	Blender: Mechanical seal (single)		Lower cost (to be clarified)	Not safe enough foraxenicity	(2) 52700 € with single mech Seal								
				ALTERNATIVE 14	Blender: Mechanical seal (double)			Need of inert sterile fluid High cost (to be clarified)	Aprox. 2x single mech. Seal								
				ALTERNATIVE 15d	Automatic shifting of final filters		Guarantee constant feeding in case of clogging w/o supervision	Automatic shifting is not enough: previous sterilisation should be guaranteed Clogging of final filters is prevented by prefilters and Delta P measurement and alarm	3710 € (including automatic valves, wiring, modif. Of electrical cabinet and pneumatic connection								
				ALTERNATIVE 16	Gear pumps for feeding			Not safe enough for axenicity									
				ALTERNATIVE 16b	Lobular possitive-displacement, rotary pumps for feeding			High cost Higher flow range High shear stress (not suitable for harvesting)									
				ALTERNATIVE 16c	Centrifugal pumps for feeding			Feeding flow is too low for those pumps									
				ALTERNATIVE 16d	Feeding based on loadcells			Precision would't be enough									
				ALTERNATIVE 16e	Volumetric flowmeters			Not enough precision									
12	Improvement of temperature control (heating)	3	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	New heat exchanger for cooling and use existing for hot water	Improvement of cooling system (new requirement, MPP)	Improve temperature control	Higher cost	Solenoid ball valve (2) 640 € Outlet ball valve (2) 640 €	Electrical resistance for heating and new heat exchanger for cooling (current heat exchanger is not in good conditions)	Basic design review Functional tests (temperature control)	Basic engineering datapackage, Section 8 (PID) and Section 6 (equipment list) TN 22 (pending)	Yes (report pending)	Delivery TN22	SHERPA	October 2010	
				ALTERNATIVE 23	Only resistance for heating - reuse current h e. for cooling	Compatibility of h e. material with glycol should be checked	Save one heat exchanger Heating not commonly needed, and lighting could be enough		300 €								
				ALTERNATIVE 24	Maintain current configuration, just substitute steam inlet solenoid valve		Lower cost	Direct glycol into jacket not convenient for 36°C									
15	Refurbishing of weighting scales	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	New scale for feeding tank	Old scale is not adequate max. Weight 160 Kg (estimated 500 Kg for new tank, full) - Precision in scale 200g (2‰)			(2) 9680€, cost could be reduced 35% reducing precision	Guided wave level sensor	Final design review Functional testing	Final engineering datapackage, Sedction 1 (PID) and 5 (Equipment List) Functional test report (pending)	yes (report pending)	Issue functional test report	MPP	End of COO8	
				ALTERNATIVE 29	Level sensor	Guided wave	ultrasound cheaper than microwave Ultrasound suitable because there is no foam	High cost (to be evaluated) ve)	1560 € Guided microwave								
				ALTERNATIVE 30	Differential pressure			Big size of membranes needed; poor precision due to small size of tanks									
16	Weighting scale for the harvesting tank	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	New scale for harvesting tank	Old scale is not adequate max. Weight 160 Kg (estimated 500 Kg for new tank, full) - Precision in scale. 200g (2‰) - It is necessary higher precision than in feeding tank scale in the case the outlet flowmeter is cancelled			(2) 9680€; cost could be reduced 35% reducing precision	New Load cell	Basic design review Functional testing	Basic engineering datapackage. Section 6 1A (Equipment List) and 8 (PID) Functional test report (pending)	yes (report pending)	Issue functional test report	MPP	End of COO8	
				ALTERNATIVE 31	Level sensor	Guided waves	ultrasound cheaper than microwave	High cost (to be evaluated) Ultrasound not suitable when there is foam (better guided microwave)	1560 € Guided microwave								
				ALTERNATIVE 32	Differential pressure			Big size of membranes needed; poor precision due to small size of tanks									
17	Weighting scales for acid and base	3	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Lab scales for weighing 5L bottles	METTLER TOLEDO, Including output signal to supervision (via RS-232) but not 4/20Ma	Allows inputs to supervision	Output to DCS requires implementation of communication hardware in the PLC (RS-232)	(2) 670 €	Lab scales METTLER	Basic design review Functional testing (pending?)	Basic engineering datapackage. Section 6 1A (Equipment List) and 8 (PID) Functional test report (pending)	yes (report pending)	Issue functional test report	MPP	End of COO8	
				ALTERNATIVE 33	Lab scales for weighing 5L bottles	Not including output signal to supervision	Lower cost and easier implementation	Requires manual recording									
				ALTERNATIVE 34	Lab scales for weighing 5L bottles	METTLER TOLEDO, including outlet 4/20mA	Allows inputs to supervision; not requires implementation of new communication hardware	High cost	(2) 7030 €								
18	Pressure release valve to be checked for sizing	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Include regulating valve for pressure control		Independent pressure control		(3) 1470 €	New regulating valve for pressure control	Basic design review Functional testing	Basic engineering datapackage, Section 6 1A (Equipment List) and 8 (PID) Functional test report (TN22, pending)	yes (report pending)	Delivery TN22	SHERPA	October 2010	
				ALTERNATIVE 35	Pressure relief based on outlet massflow regulation (current status)			Pressure control linked to flow regulation; only indirect control									
				ALTERNATIVE 36	Pressure relief based on outlet massflow existing valve			To be checked if existing valve in massflowmeter could be regulated by pressure measurement									

(1) Source document: TN 87.24: "C-IVa: status and refurbishment recommendations"

N°	SPECIFICATION (1)	PRIORIT	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE	ACTIONS	ASSIGNEE	DUE DATE	REMARKS
23	Rest of sensors in retractable housings when available	2	Design review: - Equipment list - Equipment data sheets	PROPOSED OPTION	Dissolved oxygen sensor and new biomass sensor (METTLER) in retractable housing	Temperature: retractable probe not needed Other biomass sensors: retractable probe not available			Cost of retractable housings to be clarified in quotation	Dissolved oxygen sensor and new biomass sensor (METTLER) in retractable housing	Basic design review Final design review	Basic engineering, Section 6 (Instrument List) Technical Documentation, Vol. VII	yes (additional supplies pending for cleaning/steaming of housings)	Define and purchase additional flexible pipes for cleaning/steaming of housings	MPP	Before CIVa start-up	
				ALTERNATIVE 45													
				ALTERNATIVE 46													
24	New biomass sensor based on a different technology of current one	2	Design review: - Equipment list - Equipment data sheets - Pevious use in Arthrospira (Reporting) Testing	PROPOSED OPTION	Turbidity New sensor METTLER TOLEDO, in top of the reactor	Retractable probe available To be checked potential previous testing			7 590 €	Turbidity New sensor METTLER TOLEDO, in top of the reactor	Final design review	Final detail engineering, section 6 (drawings) and 5 (equipment list) Technical documentation, vol. VI	yes (repair of MONITEK sensor pending)	Repair MONITEK sensor	MPP	Before CIVa start-up	
				ALTERNATIVE 47	OPTEK	Based on turbidity To be checked potential previous testing			Quotation pending								
				ALTERNATIVE 48	ABER/NTE	Based on capacitance To be checked potential previous testing	Amplifier for 4 sensors	Technology not demonstrated for Arthrospira Very high cost	36820 € for ABER								
25	Foam detection	1	Design review: - Instrument list - Equipment data sheet - Certificate for sanitary use	PROPOSED OPTION	Vibrating sensor sanitary (BURKERT)		Sanitary version Supplier offers testing before buying	Risk of getting dirty by clamps of Arthrospira (false positive); foam density needs to be adequate	1 060 €	To perform previous testing of commercial foam sensor	N.A.	N.A.	No	Testing commercial equipment	MPP	Before CIVa start-up	
				ALTERNATIVE 49	CHARIS	Conductivity	Successfully used for level control in bioreactors (LONZA)	Higher cost Risk of getting dirty (false positive) Not possible to test in advance	4 940 €								
				ALTERNATIVE 50	Guided Microwave		Successfully used in chemical reactors	Higher cost Risk of getting dirty (false positive)	1 560 €								
26	Improvement of temperature control = Requirement 12	3	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Only resistance for heating - reuse current h.e. for cooling - close cooling circuit	Compatibility of h.e. material with glycol should be checked	Save one heat exchanger Heating not commonly needed, and lighting could be enough		Solenoid ball valve (2) 640 € Outlet ball valve (2) 640 € Electric heater 300 € Expansion vessel 590 €	Electrical resistance for heating and new heat exchanger for cooling (current heat exchanger is not in good conditions)	Basic design review Functional tests (temperature control)	Basic engineering datapackage, Section 8 (PID) and Section 6 (equipment list) TN 22 (pending)	Yes (report pending)	Delivery TN22	SHERPA	October 2010	
				ALTERNATIVE 23	New heat exchanger for cooling and use existing for hot water	Improvement of cooling system (new requirement, MPP)	Improve temperature control	Higher cost									
				ALTERNATIVE 24	Maintain current configuration, just substitute steam inlet solenoid valve		Lower cost	Direct glycol into jacket not convenient for 36ºC									
27	Flow and pressure indication and control in gas to analysers, to provide stable and reliable measurements	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Rotameter + manual valves	- Manual valves to lead the needed flow to the analysers - Rotameter to check the flow - No measurement of pressure - No control of pressure and flow - Reconsider the requirement: to be checked the need of measurement or control of pressure, flow and temperature in the line to analysers (MPP)				- Automatic valves to lead the needed flow to the analysers - Flowmeter to check the flow in the main outlet line - Pressure measurement - Temperature measurement	Basic engineering review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) TN 22 (report pending)	yes (report pending)	Delivery TN22	SHERPA	October 2010	
				ALTERNATIVE 53	Indication and control of pressure in line to analyzers												
				ALTERNATIVE 54													
28	Differential pressure measurement for feed inlet filters to prevent clogging	1	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Redundant inlet filters Delta P measurement; manual shifting of filters	Differential pressure measurement; alarm in case of clogging Quotation to be broken down			2000 € Transmitter	Redundant inlet filters Delta P measurement; manual shifting of filters	Basic design review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Functional test report (pending)	Yes (report pending)	Issue functional test report	MPP	End of COO8	
				ALTERNATIVE 55 = 15d	Automatic shifting of final filters		Guarantee constant feeding in case of clogging w/o supervision	Automatic shifting is not enough: previous sterilisation should be guaranteed Clogging of final filters is prevented by prefilters and Delta P measurement and alarm	3710 € (including automatic valves, wiring, modif. Of electrical cabinet and pneumatic connection								
				ALTERNATIVE 56													
29	Implement precise level control: differential pressure or load cells	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Load cells	Precision: 50 g	External to bioreactor; safe for axenicity		3 640 €	Load cells	Basic design review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Delivery acceptance record DDEQ, 26.01.10 Functional test report (pending)	No	Propose	METTLER/DDEQ	Before end of COO8	
				ALTERNATIVE 57	Differential pressure			Low precision for low overpressure; very small changes in pressure give very high changes in height (small diameter vessel) Would require large diameter diafragms, difficult in current reactor									
				ALTERNATIVE 58	Level sensor	CHARIS: based on conductivity	Successfully used for level control in bioreactors (LONZA)	Higher cost Not possible to test in advance	4 940 €								
30	Check current pressure sensor, implement redundant sensor, and guarantee operation and sterilisation ranges	1	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Two new P sensors, different range	One sensor for operation range **Other sensor for sterilisation? (redundancy TBC)**			1190 € each P sensor	Two new P sensors, different range	Basic design review Final detail review Steam pressure test DDEQ Functional testing: sterilisation tests	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Final eng. Datapackage, section 5 (Equpment list) Steam pressure test Report DDEQ Technical documentation, vol. 7 Functional sterilisation test report (pending)	Yes (report pending)	Issue functional test report	MPP	End of COO8	
				ALTERNATIVE 59	Use current P sensor		Reduce cost	Nor safe for axenicity									
				ALTERNATIVE 60	Only one new sensor	Sterilisation controlled by temperature measurement	Reduce cost	Not precise enough for both ranges; no redundancy									

N°	SPECIFICATION (1)	PRIORITY	VERIFICATION METHOD	OPTION	DESCRIPTION	REMARKS	ADVANTAGES/OPORTUNITIES	DISADVANTAGES/RISKS	COST	DECISION	VERIFICATION TASKS	VERIFICATION REF.	COMPLIANCE	ACTIONS	ASSIGNEE	DUE DATE	REMARKS
31	Improve feeding and harvesting flow control based on scales weight measurement versus flowmeters	2	Design review: - P&ID - Equipment list - Equipment data sheets	PROPOSED OPTION	Mass flowmeters in feeding and outlet lines	Coriolis flowmeter for inlet feeding Coriolis cancelled in the outlet (potential blocking), better increase precision of harvesting tank weight and measure the outlet flow based on that		Presence of cells in outlet line, could block the line (1 mm hole)	(2) 10350 €	Coriolis flowmeter for inlet feeding Coriolis cancelled in the outlet (potential blocking), better increase precision of harvesting tank weight and measure the outlet flow based on that (needed for future integration with other compartments)	Basic engineering review Final engineering review Functional testing	Basic engineering datapackage, Section 8 (PID) and Section 6 (Instrument List) Technical documentation, vol V TN 22 (pending)	Yes (report pending)	Delivery TN22	SHERPA	October 2010	
				ALTERNATIVE 61	Flow measurement on weight (scales)		Already needed for level control in harvesting tank	Need a high precision; then high cost	(2) 6860 €								
				ALTERNATIVE 62													
32	Light intensity or power consumption sensor	3	N A	PROPOSED OPTION	Not adressed: visual checking reccommended	No possible to provide specific indication of failing lamps unless recabling is made Reconsider the requirement (MPP)				No possible to provide specific indication of failing lamps unless recabling is made Reconsider the requirement (MPP)	N A.	N.A.	N.A.	Requirement to be re-discussed with ESA (revision of the design process indicators)	MPP/ESA	QMS Review	
				ALTERNATIVE 63	Alarm when power consumption is low			Visually checking would give the same indication									
				ALTERNATIVE 64													
33	Axenic inoculation	1	Design review: - Detailed drawing of inoculation port - Equipment list - Equipment data sheet - Certificate for sanitary use	PROPOSED OPTION	Steam sterilisable connections	Build in-house			1 670 €	Steam sterilisable connections	Basic engineering review Functional (sterilisation and seeding) test review	Basic engineering datapackage Functional tests report (pending)	yes (report pending)	Issue functional test report	MPP	End of COO8	
				ALTERNATIVE 65	Commertial inoculation port (SARTORIUS)		Potentially safer design	High cost	2 100 €								
				ALTERNATIVE 66													
34	Long term operation Axenicity CIP / SIP Ergonomics	1	Complete design review Functional tests	PROPOSED OPTION	All parameters considered in the design, except CIP	New filters for sterile air New diaphragm valves Clamp connections in valves and sensors Acid and base filtered on-line CIP not considered relevant (not to be often performed), so reconsider the requirement (MPP)				New filters for sterile air New diaphragm valves Clamp connections in valves and sensors Acid and base filtered on-line CIP not considered relevant (not to be often performed), so reconsider the requirement (MPP)	Final engineering review Visual inspection	Final engineering datapackage Installation accaptance DDEQ 26 01 10	Yes (to be checked during functional testing and long-term operation)	Issue functional test report	MPP	End of COO8	Long-term axenicity requirement to be validated along demonstration tests and the operation of the compartment
				ALTERNATIVE 67													
				ALTERNATIVE 68													
36	NEW REQUIREMENT CE Marking	3	CE Certificate	PROPOSED OPTION	Only certify auxiliary tanks DDEQ comment	Auxiliary tanks and equipment marked CE, vessel and complete design not marked (considered a prototype) To be discussed with ESA, in principle, to be included in the quotation the CE Conformity declaration of the whole Compartment		High cost and time consuming; may arrive to 10-20% of the total cost of the equipment (to be confirmed)		Auxiliary tanks and equipment marked CE, vessel and complete design not marked (considered a prototype) To be discussed with ESA, in principle, it was supposed to be included in the quotation the CE Conformity declaration of the whole Compartment	Final eng. Review Visual inspection CE cerification lighing cabinet	Technical documentation CE cerification lighting cabinet report DDEQ	Yes	Requirement to be discussed with ESA	MPP/ESA		
				ALTERNATIVE 69	Certify vessel		Probably just Pressure Directive is applicable										
				ALTERNATIVE 70	Certify the complete Compartment			High cost and several months of work									

01.04.10

(1) Source document: TN 87.24: "C-IVa: status and refurbishment recommendations"

METTLER TOLEDO S.A.E.
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Certificado de comprobación / Revisión

Cliente DeDietrich Equipos Químicos, S.L.

UAB - Proyecto Melissa

Bellaterra

Los equipos listados a continuación han sido comprobados o revisados de acuerdo con las instrucciones contenidas en el manual de usuario o servicio. Todos los patrones empleados por **Mettler-Toledo, s.a.e.** son patrones certificados.
En equipos NO **Mettler-Toledo, s.a.e.** sólo se realiza comprobación.

Modelo	Nº de Serie	Modelo	Nº de Serie
PBA330-cc600B	3063280	------------	------------
IND560	3063279	------------	------------
------------	------------	------------	------------
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Los equipos de **Mettler-Toledo** revisados quedan en perfecto estado de funcionamiento.

Observaciones ---

Localidad Bellaterra   Fecha 02-03-10

Técnico J.Cabo   Firma 415

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Equipos de pesaje	Agarres y roces del sistema	Cableado y conexionado	Foso y desagües	Conexiones de tierra	Topes y apoyos mecánicos	Asentamiento y nivelado	Velocidad y bandas de transporte	Inspección y limpieza electrónica	Sistema y valor de pesa interna	Sistema magnético, freno, levas y óptico	Sistema de prepesada	Señales de control externas y rechazos	Reflectores, célula fotoeléc., sensores	Sistema apertura, ventilación, calentamiento	Funciones indicador y teclado	Test funcionamiento, impresión e identificación	Cristales, carcasa, funda y plato	Célula o células de medida	comprobación peso o volumen	Excentricidad sistema de pesada	...1	...2	...3 PBA330-CC60B S/N: 3063280	...4 IND560 S/N: 3063279	...5	...6	...7	...8	...9	...0
Plataformas industriales Procedimiento: MTE001st	●	●	●	●	●	●												●	●	●			X							
Básculas puente Procedimiento: MTE002st	●	●	●	●	●	●												●	●	●										
Tolvas, Silos y Reactores Procedimiento: MTE003st	●	●		●	●	●												●	●											
Controladora dinámica Procedimiento: MTE004st	●	●		●		●	●	●				●	●		●	●		●	●	●										
Balanzas Mecánicas Procedimiento: MTE005st					●	●			●	●	●					●	●	●	●	●										
Balanzas Analíticas Procedimiento: MTE006st		●		●		●		●	●					●	●	●	●	●	●	●										
Balanzas precisión y compactas Procedimiento: MTE007st		●		●		●		●	●						●	●	●	●	●	●										
Equipos desecación Procedimiento: MTE008st		●		●		●		●					●	●	●	●		●	●	●										
Indicadores y periféricos Procedimiento: MTE009st		●		●				●				●	●		●	●								X						
Sistemas peso y volumen Procedimiento: MTE010st	●	●		●		●	●	●				●	●		●	●		●	●	●										
Sistemas detectores de metal Procedimiento: MTE011st		●		●		●	●	●				●	●		●	●														

Nº orden en el albarán

Contrato	...1	...2	...3	...4	...5	...6	...7	...8	...9	...0
Contrato Estándar: Preventivo y correctivo. Incluye revisión, ajustes, tiempo de reparación y piezas										
Contrato Preventivo: Preventivo. Incluye revisión y ajuste del equipo a especificaciones (*)										
Contrato Estándar Sin Piezas: Preventivo y correctivo. Incluye revisión, ajustes y tiempo de reparación										
Contrato Certificación: Certificación ENAC, de Medida o MinWeigh. Incluye al ajuste del equipo a especificaciones (*)										

Servicio	...1	...2	...3	...4	...5	...6	...7	...8	...9	...0
Reparación: según tarifa **METTLER TOLEDO** y bajo requerimiento cliente										
Instalación: según tarifa **METTLER TOLEDO** y bajo requerimiento cliente			X	X						

Los equipos listados quedan en perfecto estado de funcionamiento

Todos los procedimientos arriba indicados son de aplicación exclusiva en revisiones preventivas de equipos en contrato de mantenimiento.
Todos los patrones empleados por **METTLER TOLEDO** en el mantenimiento preventivo están certificados.
(*) aplicable a equipos fabricados por **METTLER TOLEDO** cuyo rango de pesaje sea inferior a 60 Kg. No se incluyen las reparaciones si fueran necesarias.

Informe

El equipo se ha ajustado con la capacidad y resolución indicadas por el cliente (200 kg / 0,2 kg)

La calibración se ha realizado utilizando lastre por la imposibilidad de colocar pesas en el depósito.

Albarán **181119** Fecha **02/03/10**

Técnico **J.Cabo**

Nº Técnico **415**

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Equipos de pesaje	Puntos de control																				Nº orden en el albarán									
	Agarres y roces del sistema	Cableado y conexionado	Foso y desagües	Conexiones de tierra	Topes y apoyos mecánicos	Asentamiento y nivelado	Velocidad y bandas de transporte	Inspección y limpieza electrónica	Sistema y valor de pesa interna	Sistema magnético, freno, levas y óptico	Sistema de prepesada	Señales de control externas y rechazos	Reflectores, célula fotoeléc., sensores	Sistema apertura, ventilación, calentamiento	Funciones indicador y teclado	Test funcionamiento, impresión e identificación	Cristales, carcasa, funda y plato	Célula o células de medida	comprobación peso o volumen	Excentricidad sistema de pesada	...1 KIT DE CÉLULAS S/N: WT4008	...2 IND560 S/N: 3063278	...3	...4	...5	...6	...7	...8	...9	...0
Plataformas industriales Procedimiento: MTE001st	●	●	●	●	●	●												●	●	●										
Básculas puente Procedimiento: MTE002st	●	●	●	●	●	●												●	●	●										
Tolvas, Silos y Reactores Procedimiento: MTE003st	●	●		●	●	●												●	●		X									
Controladora dinámica Procedimiento: MTE004st	●	●		●		●	●	●				●	●		●	●		●	●	●										
Balanzas Mecánicas Procedimiento: MTE005st					●	●			●	●	●					●	●	●	●	●										
Balanzas Analíticas Procedimiento: MTE006st		●		●		●		●	●					●	●	●	●	●	●	●										
Balanzas precisión y compactas Procedimiento: MTE007st		●		●		●		●	●						●	●	●	●	●	●										
Equipos desecación Procedimiento: MTE008st		●		●		●		●					●	●	●	●		●	●	●										
Indicadores y periféricos Procedimiento: MTE009st		●		●				●				●	●		●	●						X								
Sistemas peso y volumen Procedimiento: MTE010st	●	●		●		●	●	●				●	●		●	●		●	●	●										
Sistemas detectores de metal Procedimiento: MTE011st		●		●		●	●	●				●	●		●	●														

	...1	...2	...3	...4	...5	...6	...7	...8	...9	...0
Contrato Estándar: Preventivo y correctivo. Incluye revisión, ajustes, tiempo de reparación y piezas										
Contrato Preventivo: Preventivo. Incluye revisión y ajuste del equipo a especificaciones (*)										
Contrato Estándar Sin Piezas: Preventivo y correctivo. Incluye revisión, ajustes y tiempo de reparación										
Contrato Certificación: Certificación ENAC, de Medida o MinWeigh. Incluye al ajuste del equipo a especificaciones (*)										

	...1	...2	...3	...4	...5	...6	...7	...8	...9	...0
Reparación: según tarifa **METTLER TOLEDO** y bajo requerimiento cliente										
Instalación: según tarifa **METTLER TOLEDO** y bajo requerimiento cliente	X	X								

Los equipos listados quedan en perfecto estado de funcionamiento

Todos los procedimientos arriba indicados son de aplicación exclusiva en revisiones preventivas de equipos en contrato de mantenimiento.
Todos los patrones empleados por **METTLER TOLEDO** en el mantenimiento preventivo están certificados.
(*) aplicable a equipos fabricados por **METTLER TOLEDO** cuyo rango de pesaje sea inferior a 60 Kg. No se incluyen las reparaciones si fueran necesarias.

Informe

El equipo se ha ajustado con la capacidad y resolución indicadas por el cliente (200 kg / 0,2 kg)

Se han detectado agarres y rozamientos que provocan variaciones de lecturas <= 10d

La calibración se ha realizado utilizando lastre por la imposibilidad de colocar pesas en el depósito.

Albarán **181119** Fecha **02/03/10**

Técnico **J.Cabo**

Nº Técnico **415**

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Cliente DeDietrich Equipos Químicos, S.L.

UAB - Proyecto Melissa

Bellaterra

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En equipos NO **Mettler-Toledo, s.a.e.** sólo se realiza comprobación.

Modelo	Nº de Serie	Modelo	Nº de Serie
Kit células	WT4008	-----------	-----------
IND560	3063278	-----------	-----------
-----------	-----------	-----------	-----------
-----------	-----------	-----------	-----------
-----------	-----------	-----------	-----------
-----------	-----------	-----------	-----------

Los equipos de **Mettler-Toledo** revisados quedan en perfecto estado de funcionamiento.

Observaciones --

Localidad Bellaterra

Fecha 02-03-10

Técnico J.Cabo

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METTLER TOLEDO

CIVa: PHOTOBIOREACTOR LEVEL CONTROL

1. OBJECT:

The object of this document is to explain the present situation of the reactor level control using the method of weighting the whole reactor, the problems appeared and the proposed solution to those problems.

2. BACKGROUND:

The design of the unit involves controlling the outlet of harvest liquid from the reactor maintaining the level of the unit.

Two alternatives were considered during the design stages of the module:

- To weight the reactor and keep constant this value during the operation.
- To read the liquid level through a pressure transmitter or delta pressure transmitter, assuming a real gas overpressure at top of the reactor.

At that moment it was decided the first alternative (weighting) because of the risk of measurement errors due at a possible settling of product in to the pressure transmitter.

3. PRESENT SITUATION AND PROPOSED SOLUTION

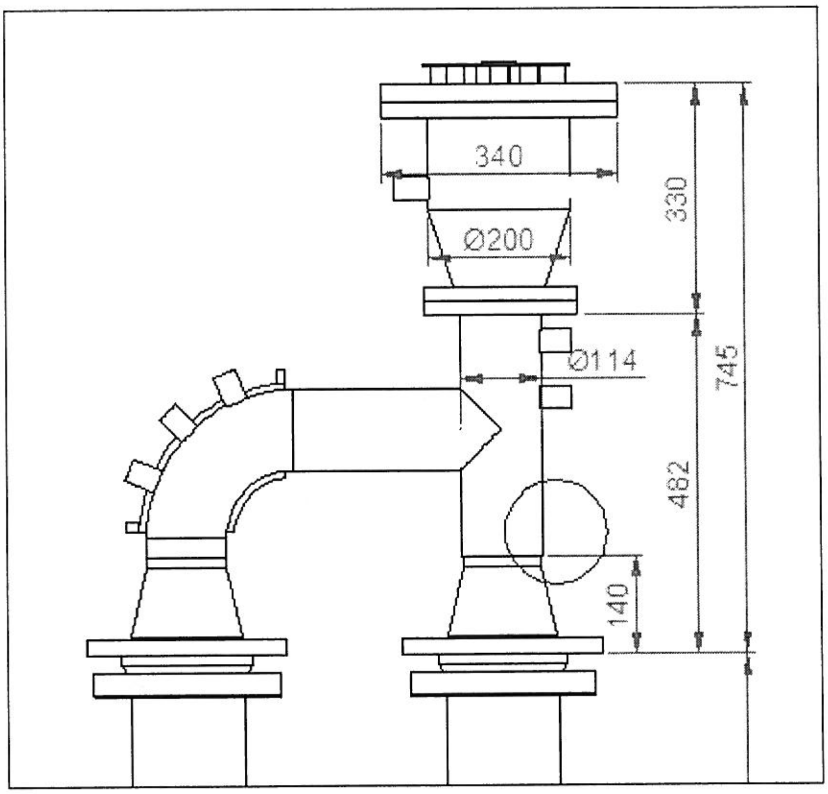
The weighting alternative has demonstrated to be not a proper solution.

Two types of problems have been noticed during the operation of the plant:

- Small variations in the weight values because of the difficulties of keeping the unit completely free of physical constraints.
- Important variations in the read values depending on time and with not known reasons.

Different tests have been carried out with the supplier of the weighting transmitter, Mettler Toledo, and at the end it has not been possible to determine the reasons of these random errors.

So, it has been decided to install a pressure transmitter in to the upper part of the reactor, in a point where a column of liquid can be measured.

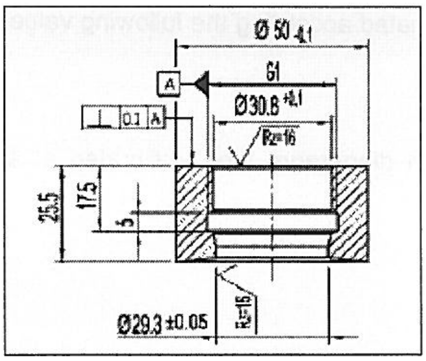


Physical location of the new pressure transmitter

The existing pressure transmitter at top of the reactor measures the gas overpressure of the reactor.

A difference between both values will define the real level of the unit.

It has been decided to install a flush diaphragm transmitter (diaphragm at reactor interior wall level) to minimize the risk of getting dirty during the operation. The indicated nozzle for installing the new transmitter is the next:



G1 EHEDG welding socket

4. PLANING OF WORKS

a) End of July: Disassembling of reactor because it is needed to proceed at cleaning of the unit.

b) End of July: Ordered the welding socket for the new transmitter to be welded in to the stainless steel top part of the reactor.

c) Beginning of September: The top part of the reactor shall be taken to the workshop to weld the nozzle.
A provisional plug will be mounted on it.

d) September: Disassembling of the weight cells and reactor supports adaptation.

e) September: Reassembling of the whole reactor.

f) Delivery time of new transmitters is scheduled at end of September. From that, this transmitter shall be installed when the operation of the plant permits such operation.

g) New parameters and values for control loop to be implemented.

h) Operation tests

5. ESTIMATED COST

The costs of the changes are estimated according the following values:

a) Pressure transmitter, flush diaphragm type, calibrated at a range of 0-300 mbarg in stainless steel.

Cost: 877 €

b) Special welding socket and provisional plug.

Cost: 116 €

c) Transports to/from workhouse/UAB and welding works.

Cost: 970 €

d) Disassembling of the weight cells and reactor supports adaptation.

Cost: --- €

*assumed by DDEQ

e) Cabling of the new unit and communication with PLC.

Cost: 380 €

f) New parameters to the control loop (by Sherpa)

Cost: --- €

g) Running tests assuming 2 days of a process engineer in collaboration with Sherpa for parameters adjusting.

Cost: 876 €

TOTAL ESTIMATED COST: 3219 €

6. WORKS TO BE DONE BY SHERPA

6.1 Changes to introduce on the control system:

As a consequence of the proposed changes on the hardware, some changes on the software will appear. Required changes on the control system will be:

- Configuration range of PT_4007_01:
  - New range for PT 4007 01 → 0…300 mbar (4…20 mA)
  - PLC Address → 300135

- Substitution of WT_4008_01 for PT_4008_01.
  - Weight cells will be substitute for a pressure transmitter.
  - Transmitter will be configured at 0…300 mbar (4…20 mA).
  - PLC Address → 300133

The new system will implicate to compare and subtract the value of top gas pressure transmitter to the value of the new transmitter.
That value will be used to control the flow of the harvesting pump.

6.2 Changes on the control loop:

The changes on the control loop 4008 (Bioreactor liquid level control) are:

6.2.1 Control elements

~~- WT 4008 01: Weight cells. Bioreactor weight measure for level control.~~
- PT 4007 01: Pressure transmitter. Bioreactor pressure measurement.
- PT 4008 01: Pressure transmitter. Bioreactor pressure measurement.
- PS 4002 03/04: Pressure switch. Pump membrane breakage detection.
- PS 4002 01/02: Pressure switch. Lines over-pressure detection.
- WT 4002 01: Weight measurement. Harvesting tank (VS 4002 01) weight measurement for controlling the tank level.
- GP 4002 01/02 speed regulator: Feed pumps. Reactor outlet liquid pumping to the harvesting vessel.
- GP 4002 03 speed regulator: Mechanic agitator. Harvesting vessel agitation.

6.2.2 PLC Output signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
GP 4002 01/02	GP_4002_01_MV2	400111	Flow set point to the outlet pumps	AO		4/20 mA
GP 4002 03	GP_4002_03_MV2	400114	VS 4001 01 agitator speed set point	AO		4/20 mA
GP 4002 01	GP_4002_01_MV1	000089	Start/Stop of the pump	DO	N/A	0/1
GP 4002 02	GP_4002_02_MV1	000104	Start/Stop of the pump	DO	N/A	0/1
GP 4002 01/02		000112	Start/Stop GP 4002 01/02 converter	DO	N/A	0/1
GP 4002 03		000109	Start/Stop GP 4002 03 converter	DO	N/A	0/1

6.2.3 PLC Input signals

Equipment	Tag Variable	PLC ADDRESS	Description	I/O	Range	Signal Type
~~**WT 4008 01**~~	~~WT_4008_01~~	~~300133~~	~~Reactor weight cells~~	~~AI~~	~~0…100 Kg~~	~~4/20 mA~~
PT 4007 01	PT_4007_01	**300135**	Reactor pressure measurement	AI	0…0,3 bar	4/20 mA
PT 4008 01	PT_4007_02	**300133**	Reactor pressure measurement	AI	0…0,3 bar	4/20 mA
WT 4002 01	WT_4002_01	300132	Weight Balance (VS 4002 01)	AI	0…500 Kg	4/20 mA
GP 4002 01/02	GP_4002_01_ERR	100101	Thermal protection of the outlet pumps	DI	N/A	0/1
GP 4002 03	GP_4001_03_ERR	100105	Thermal protection of the agitator	DI	N/A	0/1
PS 4002 01	PS_4002_01	100084	Pressure switch	DI	N/A	0/1
PS 4002 02	PS_4002_02	100085	Pressure switch	DI	N/A	0/1
PS 4002 03	PS_4002_03	100108	Pressure switch (GP 4002 01)	DI	N/A	0/1
PS 4002 04	PS_4002_04	100109	Pressure switch (GP 4002 02)	DI	N/A	0/1

6.2.4 Alarms and warnings

	Tag	Variable	Alarm	Action	Lock out
1	PT 4007/4008 01	Pressure (level)	H	To notify alarm to supervision	
2	PT 4007/4008 01	Pressure (level)	HH	To notify alarm to supervision	GP 4001 01/02
3	PT 4007/4008 01	Pressure (level)	L	To notify alarm to supervision	
4	PT 4007/4008 01	Pressure (level)	LL	To notify alarm to supervision	GP 4002 01/02
5	PS 4002 03/04	Pressure	H	To notify alarm to supervision	GP 4002 01/02
6	PS 4002 01/02	Pressure	H	To notify alarm to supervision	GP 4002 01/02
7	WT 4002 01	Weight (level)	H	To notify alarm to supervision	
8	WT 4002 01	Weight (level)	HH	To notify alarm to supervision	GP 4002 01/02
9	WT 4002 01	Weight (level)	L	To notify alarm to supervision	GP 4002 03

1 → WARNING: PBR level is at ------L or upper.

2 → ALARM: PBR level is upper than ----- L. Stop feeding pump.

3 → WARNING: PBR level is at ------L or lower.

4 → ALARM: PBR level is lower than ----- L. Stop harvesting pump.

5 → ALARM: The membrane of the harvesting pump has broken.

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

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

7 → WARNING: Harvesting vessel level is at ------% or upper.

8 → ALARM: VS 4002 01 is full. Stop harvesting pumps.

9 → WARNING: Harvesting vessel level is at ------% or lower. Stop the vessel agitator.

This proposal was received from DDEQ on 30.08.10 and accepted with comments on 20.09.10 by e-mail. (Ref. "Acta de entrega" DDEQ 26.01.10, observation (2) on 2.03.10)

Enrique Peiro

20.09.10

Enrique Peiro

De: Júlia Gubern [jgubern@dedietrich.es]
Enviado el: dilluns, 30 / agost / 2010 13:53
Para: Enrique Peiro
Asunto: ACTUACIÓN DDEQ a MELiSSA C.IVa
Datos adjuntos: Sustitución peso- presión.docx

Bona tarda Enrique,

Tal i com hem quedat, t'adjunto el document on s'explica la intervenció a realitzar en el mòdul C. IVa.
Recordar-te també que vindrem dimecres a primera hora.

Salutacions,

Júlia Gubern

Project Engineer

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

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Fax +34 932 184 709
jgubern@dedietrich.es
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Enrique Peiro

De: Enrique Peiro [enrique.peiro@uab.es]
Enviado el: dilluns, 20 / setembre / 2010 12:23
Para: 'Júlia Gubern'; 'Josep Mestre'
CC: 'Roberto De Miguel'; 'Francesc Godia'
Asunto: RE: Sustitución peso- presión_commentedEP_OG_DDEQ.DOC
Datos adjuntos: Sustitución peso- presión_commentedEP_OG_DDEQ_BL.DOC

Good morning,

As agreed during our last meeting in UAB, we confirm our technical acceptance of your proposal for the substitution of the loadcells in CIVa by a differential pressure system, conditioned to the compliance of the conditions that we already discussed at that time, and they're in fact included in our comments to the document (I'm attaching the last version of the doc. containing as well the comments from ESA that we discussed during the meeting):

- Location of the sensor: it needs to guarantee the nominal conditions, so only filling and downloading operations will be lost
- Accuracy of the method: it needs to be calculated by DDEQ, taking into account both the precission of the sensors, the calculations to be made (basically differential measurement) and the potential influence of the gassing on it (the gasflow can vary during the tests) and the potential influence of density changes as well (the density will slightly change during the growth evolution). This accuracy needs to be enough for the control system to be efficient for level control
- Apart of the offset (volume not measured), SAT should be made to demonstrate the validity of the system over time.

Regarding the cost issue, as we discussed, they're still some negotiation pending with METTLER on DDEQ side in order to send us a final proposal. UAB accepts this approach.

We keep them waiting for your confirmation above the above mentioned points and schedule for the load cells dismantling and vessel removal for welding the new port. Raul is today removing all the attachments to the upper steel part (by the way, there is one of the rigid pipes to the jacket that probably should be changed before mounting the columns to be sure that the vessel rests freely on the glass).

Best regards,

Enrique Peiro

De: Júlia Gubern [mailto:jgubern@dedietrich.es]
Enviat: dimecres, 1 / setembre / 2010 14:31
Per a: Enrique Peiro
Tema: Sustitución peso- presión_commentedEP_OG_DDEQ.DOC

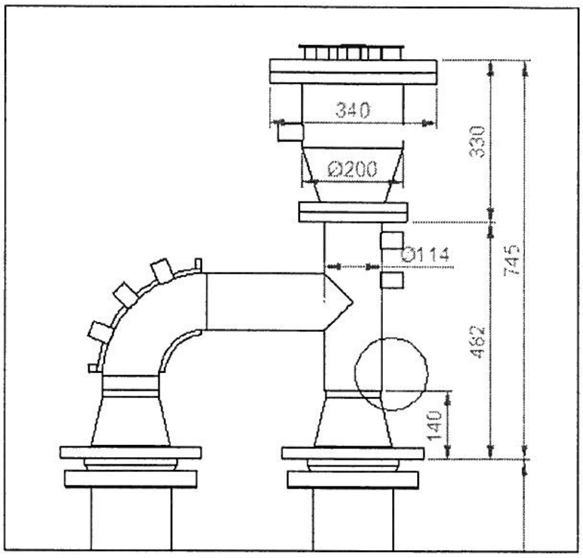
Buenos días Enrique,

Adjunto el documento con respuesta a los comentarios realizados.

Júlia.

CODE PROJECT: DD-8558-Z1		**Rev.** 0
CUSTOMER: UAB		
PROJECT: MELiSSA COMPARMENT IVa		
DATE: 04/10/2010	**PREPARED**: J.GUBERN	
PAGE 1 of 2	Ref.	

Cálculos referentes a la precisión del nuevo sistema de control de nivel



P_1 ≡ Valor de presión medido en transmisor instalado en la brida superior del reactor

P_2 ≡ Valor de presión medido en transmisor instalado en la nueva conexión lateral

$$\Delta P = (P_2 - P_1)$$

Error intrínseco a la precisión de los instrumentos.

NOTA: Consideramos que la densidad es 1000 kg/m^3.

- Rango del instrumento: 0…500 mbar
- Precisión del instrumento: 0,1% del SPAN

Estos datos nos llevan a un error del propio instrumento en la lectura de presión de ± 0,5 mbar.

Dado a que ambos instrumentos son idénticos, el error individual de cada uno de los instrumentos puede sumarse o compensarse de manera que:

$$\Delta P = (P_2 \pm 0{,}5\ mbar) - (P_1 \pm 0{,}5\ mbar) = P_2 - P_1 \pm 1\ mbar$$

Así pues, el error final máximo debido a la imprecisión teórica de los instrumentos es de ± 1 mbar → (± 10 mmH_2O).

Para la zona del reactor donde nos movemos (DN200), ± 1 mbar en el resultado de la diferencia de presión implica un error máximo en volumen de:

$$V = \frac{\pi}{4} \cdot (0{,}2\ m)^2 \cdot 0{,}01\ m = \pi \cdot 10^{-4}\ m^3 = 0{,}314\ l$$

Corrección del error con la variación de la densidad del medio.

NOTA: Consideramos que la densidad es diferente de 1000 kg/m^3.

El factor determinante para la variación de la densidad en el reactor será la presencia de gas dentro del medio. Durante la operación en estado estacionario, habrá una cierta cantidad de gas retenida dentro del reactor.

La cantidad de gas retenido es desconocida. Para realizar los próximos cálculos se supone que la cantidad de gas retenida es del 10% (valor conservativo).

Así pues, la nueva densidad será:

$$\rho = 1000\ kg/m^3 \cdot 0{,}9 + 1{,}29\ kg/m^3 \cdot 0{,}1 \cong 900\, kg/m^3$$

Corrección del volumen equivalente con la nueva densidad:

$$V = 0{,}314\, l \cdot \frac{1\, m^3}{1000 l} \cdot \frac{1000 \, {}^{kg}\!/\!{}_{m^3 medio}}{900 \, {}^{kg}\!/\!{}_{m^3 agua}} = 3{,}48 \cdot 10^{-4}\ m^3 medio = 0{,}348\ l\ medio$$

$$h\ (m) = \frac{3{,}48 \cdot 10^{-4}\, m^3}{\frac{\pi}{4} \cdot (0{,}2\ m)^2} = 0{,}011\, m = 11\, mm\ columna\ de\ medio$$

NOTA: Cabe señalar, que la diferencia entre ambos errores (348 ml - 314 ml = 34 ml), se podrá corregir vía Software conociendo el valor real de la densidad del medio durante la operación nominal del reactor.

Enrique Peiro

De: Júlia Gubern [jgubern@dedietrich.es]
Enviado el: dilluns, 4 / octubre / 2010 17:00
Para: Enrique Peiro
Asunto: CÀLCULS PRECISIÓ NOU CONTROL NIVELL CIVa
Datos adjuntos: Cálculos precisión sistema de control de nivel.docx

Bona tarda Enrique,

Adjunto el document amb els càlculs justificatius de l'error intrínsec màxim del sistema de control de nivell per mesura de la pressió diferencial.
Qualsevol dubte ho comentem,

Atentament,

Júlia Gubern

Project Engineer

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APPENDIX 1. CALCULATIONS

2009

Project code: PRK-5393

MELiSSA Compartment IVa

Customer: UAB / MPP

Date: 18 / 11 / 2009

Rev. 3

CALCULATIONS

1. PRESSURE DROP: BIOREACTOR REFRIGERATION LOOP

Parameters:

- Pipe length (including bioreactor jacket) = 5 m
- Pipe size = ¾"
- Number of 90º bends = 10
- Number of 45º bends = 5
- Number of tees = 4
- Number of valves = 2

Cool water flow = 1 m^3/h

Temperature = 15 ºC

The obtained results are:

ΔP = 0.5 barg **Flow type: Turbulent flow**

NOTE: The calculation has been carried out with a program called *Pipe Flow Expert* [1)], a software for fluid flow, pressure drop and friction loss calculations.

[1)] Pipe Flow Expert. Copyright © Daxesoft Ltd. 1994 – 2008.

2. PRESSURE DROP: BIOREACTOR OUTLET GAS

Parameters:

- Pipe length = 3 m
- Pipe size = ½"
- Number of 90º bends = 4
- Number of 45º bends = 2
- Number of tees = 10
- Number of valves = 6

Air flow = 0.21 l/min

Temperature = 20 ºC

The obtained results are:

ΔP = 0.0 barg **Flow type: Laminar flow**

NOTE: The calculation has been carried out with *Pipe Flow Expert* [1].

[1] Pipe Flow Expert. Copyright © Daxesoft Ltd. 1994 – 2008.

3. PRESSURE DROP: PROCESS GAS ENTERING THE PBR

Parameters:

- Liquid column height (H)= 2 m
- Media density (ρ)= 1000 kg/m^3

Equation:

$$P_{BIOREACTOR\ BOTTOM} = \rho \cdot H$$

Result:

ΔP = 0.2 barg

4. AIR REFRIGERATION SYSTEM FOR THE PBR LIGHTING

Parameters:

Lights:

- Number of halogen lamps = 350 units
- Power (for unit) = 12 V 20W

Air:

- Density (ρ)= 1.2 kg/m^3
- Cp = 1 KJ/Kg ºC
- $\Delta T_{ENT-OUT}$ = 10 ºC

Pipe Size:

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

Estimate ratio heat/power = 50%

Estimate loss heat = 20%

Safety coefficient= 20%

Equations and Results:

Total energetic consumption = $350 \cdot 20W = 7\ KW$

Contributed heat (by lights) = $7\ KW \cdot \frac{50}{100} \cdot \frac{(100-20)}{100} = 2.8\ KW = 10080\ {KJ}/{h}$

Air Flow = $\frac{10080\ {KJ}/{h}}{1 \cdot 10 \cdot 1.2} = 840\ {m^3}/{h} \cdot 1.2\ (safety\ coef.) \Rightarrow 1000\ {m^3}/{h}$

Free Area = $\left(\frac{\pi}{4} \cdot \left(D_{OUT}^2 - D_{IN}^2\right)\right) \cdot \frac{70}{100} = 0.0324\ m^2$

Air Velocity = $\frac{1000}{0.0324\ m^2} = 30864.2\ {m}/{h} \Rightarrow 8.6\ {m}/{s}$

Air Flow = 1000 m^3/h

Air velocity = 8.6 m/s

5. COOLING WATER FOR BIOREACTOR REFRIGERATION

Parameters

Lights:

- Number of halogen lamps = 350 units
- Power (for unit) = 12 V 20W

Cool Water:

- Density (ρ)= 1 kg/m^3
- Cp = 4.18 KJ/Kg ºC
- Flow = 1 m^3/h
- $T_{COOL\ WATER}$ = 15 ºC

Pipe Size:

- Pipe size = ¾"
- D_{out} = 19.05 mm
- D_{in} = 15.75 mm

Bioreactor:

- $U_{estimated}$ = 400 $Kcal/(m^2 \cdot h \cdot ºC)$
- $A_{bioreactor}$ = 0.3 m^2

Estimate ratio heat/power = 50%

Estimate loss heat = 20%

Equation and Results:

Total energetic consumption = $350 \cdot 20W = 7\ KW$

Contributed heat (by lights) = $7\ KW \cdot \frac{50}{100} \cdot \frac{(100-20)}{100} = 2.8\ KW = 10080\ {}^{KJ}\!/_{h}$

$\Delta T_{COOL\ WATER} = \frac{10080}{4.18 \cdot 10^3} = 2.5\ {}^{o}C$

Energy transfer:

$$q = U \cdot A \cdot \Delta T_{ML}$$

$$\Delta T_{ML} = \frac{2409.18\ {}^{Kcal}\!/_{h}}{400 \cdot 0.3} = 20\ {}^{o}C$$

$$\Delta T_{ML,AVAILABLE} = \frac{((35-15)-(35-20))}{\ln\left(\frac{(35-15)}{(35-20)}\right)} = 17\ {}^{o}C$$

6. STERILIZATION TIMING

Nomenclature:

V $\equiv$ Design criterion for sterilization

$$V = \ln\left(\frac{5.6 \cdot 10^{12}}{10^{-6}}\right) = 43.17$$

$N_0 = 5.6 \times 10^{12}$ spores $\equiv$ Number of viable spores initially presents

$N = 10^{-6}$ spores $\equiv$ Number of viable spores

T=120ºC $\equiv$ Sterilization temperature

K $\equiv$ Specific reaction rate for thermal spore destruction

h $\equiv$ Enthalpy of steam relative to raw medium temperature

s $\equiv$ Steam mass flow rate

Cp $\equiv$ Heat Capacity of Bioreactor medium

U $\equiv$ Over-all heat transfer coefficient

A $\equiv$ Area of Bioreactor

$T_{co} \equiv$ Temperature of cooling water

Type spore: Bacillus Sterothermophilus

Cycle: Heating up

- **Empty Bioreactor (Air)**

Parameters

Alfa	
h (kJ/kg)	2250
S (kg/min)	0,33
M (kg)	80
Cp (kJ/Kg ºC)	1
T_o (K)	298
U (Kcal/m^2 min ºK)	400
Área (m^2)	0,24
Tco (K)	288
T (K)	394

Time vs. Temperature		
time (min)	**Temperature (K)**	**K**
0	298,0	2,134E-12
10	387,1	0,939
11	395,7	6,482

Heating time to reach the sterilization temperature **= 10 min**

Cycle: Heating up

- **Full Bioreactor (Media)**

Parameters

Alfa	
h (kJ/kg)	2250
S (kg/min)	0,33
M (kg)	80
Cp (kJ/Kg ºC)	4,18
T_o (K)	298
U (Kcal/m^2 h ºK)	400
U(KJ/m^2 min ºK)	28
A (m^2)	0,24
T_{co} (K)	20
T (K)	394
Cooling water flow (kg/min)	16,67

Time vs. Temperature		
Time (min)	**Temperature (K)**	**K**
0	298,0	2,134E-12
10	319,3	5,086E-09
20	339,0	2,809E-06
30	357,3	5,243E-4
40	374,2	4,280E-02
50	390,0	1,830E+00
51	391,6	2,590E+00
52	**394,1**	**3,630E+00**

Heating time to reach the sterilization temperature **= 52 min**

Cycle: Sterilization

In order to sterilize, the temperature of the equipment should be kept on 121 ºC for a fixed time period.

- **Full Bioreactor (Media)**

Parameters

Alfa	
$K_{(120ºC)}(s^{-1})$	0.015

Sterilization time = 48 min

**NOTE: During the heating/cooling cycles some sterilization can proceed, but these values are not included in the calculations because are used as a safety factor.*

Cycle: Cooling

- **Full Bioreactor (Media)**

Parameters

Nomenclature	Values
t_1 ≡ initial media temperature (K)	394
t_2 ≡ final media temperatura (K)	308
T_1 ≡ jacket temperature(K)	270
Cp (kcal/Kg ºC)	1
U(Kcal/m^{2}minºK)	7
M (kg)	80
Area (m^2)	0,3

Time (min)	Temperature (K)
0	394,0
5	377,9
10	364,6
15	352,9
20	342,8
25	333,8
30	325,9
35	319,1
40	313,0
45	**307,7**

Cooling time (from 121ºC to 30ºC) = 45 min

- **Empty Bioreactor (Air)**

Parameters

Nomenclature	Values
t_1 ≡ initial media temperature (K)	394
t_2 ≡ final media temperatura (K)	308
T_1 ≡ jacket temperature(K)	270
Cp (kcal/Kg ºC)	0.237
U(Kcal/m^{2}minºK)	0.05
Air (kg)	0.08
Area (m^2)	0,3
Air Density (kg/m^3)	0,6206

Time (min)	Temperature (K)
0	393,0
1	325,8
2	295,3
3	281,5
4	275,2
5	272,4
6	271,1
7	270,5
8	270,2
9	270,1
10	270,1

Cooling time (from 121ºC to 30ºC) = 10 min

7. THERMAL TRANSFER TO THE LAMPS DURING THE PBR STERILIZATION WITH STEAM

This calculation is needed to know if the PBR lighting system needs to be removed during the PBR sterilization in order to avoid possible damages in the lamps (caused by high temperature).

7.1 Calculation basis:

- ✓ The calculation is done for ONE of the two existing section glass pipes.
- ✓ Pipe section dimensions: Ø150x1500
- ✓ Heat transfer surface: $A = 0.,5\ m \cdot \pi \cdot 1{,}5\ m = 0{,}70\ m^2$
- ✓ Glass global transfer coefficient:

- Conditions: INIERIOR: steam at 121 ºC (without circulation)
EXTERIOR: air at room temperature (21ºC)
Transfer in laminate flow

- $K = 49 \quad W/(m^2 \cdot K)$ ≡ Extrapolated value from QVF catalogue WPR

7.2 Transferred heat calculation:

- ✓ Initial situation:

  - Internal temperature: 121 ºC
  - External temperature: 21 ºC
  - $\Delta T = 100\ ^{o}C$

$$Q = \left[49 \quad W/(m^2 \cdot K) \right] \cdot 0{,}70\ m^2 \cdot 100\ ^{o}K = 3430\ W$$

✓ Final situation (supposing heated exterior air) :

- Internal temperature: 121 ºC
- External temperature: 50 ºC
- $\Delta T = 71\,^{o}C$

$$Q = \left[49 \quad W \big/ \left(m^2 \cdot K \right) \right] \cdot 0{,}70\, m^2 \cdot 71\,^{o}K = 2435{,}3\, W$$

7.2 Generated power by the lamps during its normal operation:

- Number of lamps for pipe section: 175
- Power: 20 W

$$P_{TOTAL} = 175 \cdot 20\, W = 3500 \quad W$$

7.3 Conclusions:

The maximum calculated value of heat transfer through the glass is 3430 W.
This value is slightly lower than the heat generated for the lamps itself during normal operation conditions. So it is possible to conclude that the sterilization does not produce any over-heating in the lamps.

Conclusion

APPENDIX 2. ICIT (TÜV) PLANT EVALUATION

TÜVRheinland®

Informe d'Auditoria

MELISSA PILOT PLANT COMPARTIMENT IV a

(UAB Universitat Autònoma de Barcelona – Escola Tècnica d'Enginyeria Dpt. d'Enginyeria Química – 08193 Bellaterra)

DE DIETRICH EQUIPOS QUIMICOS

de la seguretat dels equips de treball

TÜV Rheinland Ibérica Inspection, Certification & Testing, S.A.
C/ Garrotxa 10-12, Polígono Industrial "Mas Blau"
08820 El Prat de Llobregat

TEL: 934 78 11 31
FAX: 93 478 07 68
e-mail: info@tuv.es

TÜVRheinland®	Informe **Seguretat dels equips de treball**

Organització:	**TRI ICT, TÜV Rheinland Group en Espanya**	**Data auditoria:**	**15.02.2010**
Emplaçament:	**Parc de Negocis Mas Blau – C/ Garrotxa 10-12 – 08820 El Prat de Llobregat (Barcelona)**	**Data emissió:**	**05.03.2010**
Auditor:	**Francisco Carreño Hernández**	**Nº Informe:**	**33150259/10**

1. Definició de la auditoria

TÜV Rheinland Ibérica Inspection, Certification & Testing, S.A., ha procedit a realitzar la **diagnosi de seguretat de màquines** segons el **Reial Decret 1215/1997 (Annex I)** i posterior modificació, **Reial Decret 2177/2004** sobre seguretat de equips y màquines posades a disposició dels treballadors.

2. Abast de l'auditoria

a) Legislació aplicable

☒ Reial Decret 1215/1997 – Annex I

☒ Reial Decret 2177/2004

b) Normes utilitzades

- Procediment intern de treball

c) Altra documentació

- Procediment intern 6-PI2.008.00

3. Equips auditats

Página	Referencia	Equipos	Observaciones
3	DD-8558-Z1	MELISSA PILOT PLANT COMPARTIMENTO IV a	Conforme

4. Resultat dels equips

TÜV Rheinland Ibérica Inspection, Certification & Testing, S.A.
C/ Garrotxa 10-12, Polígono Industrial "Mas Blau"
08820 El Prat de Llobregat

Tel. +34 917 444 500
Fax +34 914 135 590
e-mail info@tuv.es

Organització:	**TRI ICT, TÜV Rheinland Group en Espanya**	**Data auditoria:**	**15.02.2010**
Emplaçament:	**Parc de Negocis Mas Blau – C/ Garrotxa 10-12 – 08820 El Prat de Llobregat (Barcelona)**	**Data emissió:**	**05.03.2010**
Auditor:	**Francisco Carreño Hernández**	**Nº Informe:**	**33150259/10**

FITXA D'EQUIP DE TREBALL

EMPRESA: DE DIETRICH EQUIPOS QUIMICOS.
SITUACIÓ: UAB - ESCOLA SUPERIOR D'ENGINYERIA - DPT. D'ENGINYERIA QUIMICA – 08193 BELLATERRA
DESCRIPCIÓ EQUIP: MELISSA PILOT PLANT COMPATIMENT IV a
Fabricant: DE DIETRICH PROCESS SYSTEMS
Any de fabricació: 2009
Identificació: DD-8558-Z1
Servei: BIOLOGICAL REACTOR

OBSERVACIONS:

Fig.1

Fig.2

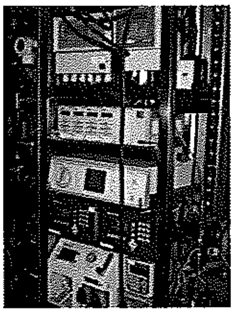

Fig.3

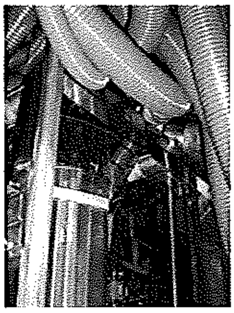

Fig.4

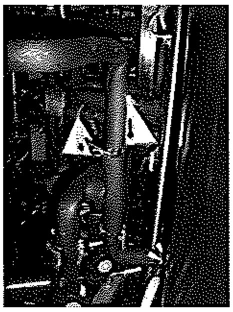

Fig.5

L'auditoria s'ha portat a terme pel tècnic sotasignat d'acord a la seva capacitació tècnica i a les seves atribucions en data, i conforme al procediment 6-PI2.008.00 rev. 1, de TÜV Rheinland Ibérica Inspection, Certification & Testing, S.A., Entitat d'Inspecció Acreditada por ENAC, amb nº de acreditació 11/EI016 i la següent reglamentació:

- ☑ Real Decreto 1215/1997 – Annexo I
- ☐ Real Decreto 2177/2004

Pel que en funció dels resultats de la auditoria obtinguts, es considera que l'EQUIP DE TREBALL, EN ELS PUNTS INDICATS és

☑ CONFORME / ☐ NO CONFORME

En El Prat de Llobregat a 05 / 03 / 2010

Rheinland ® 07101

Nom i signatura del tècnic:Francisco Carreño Hernández
Delegació de: El Prat de Llobregat
C/ Garrotxa 10-12, Pol. Ind. "Mas Blau"
CP: 08820 Tel: 934 78 11 31

TÜV Rheinland Ibérica Inspection, Certification & Testing, S.A.
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08820 El Prat de Llobregat

TEL: 934 78 11 31
FAX: 93 478 07 68
e-mail: info@tuv.es

5. Observacions generals

PUNTS A TENIR EN CONSIDERACIÓ

- Elaboració en el seu defecte de procediments d'actuació. (També operatius específics per a operacions específiques, com manteniment)
- Comprovació i manteniment dels dispositius de seguretat segons el Reglament de Màquines.
- Accionat el paro de emergència, la màquina tan sol ha de posar-se en marxa mitjançant un dispositiu de marxa, no rearmant el paro de emergència.
- Estudi de la adequació dels nivells de il·luminació, aplicables a cada tarea.
- Senyalització de les diferents fonts d'energia.
- Senyalitzar mitjançant pictogrames la obligatorietat del us de equips de protecció individual, uso de guants, mascarilles, risc de temperatura elevada, etc...
- Senyalitzar aquells riscs que no se han pogut eliminar ni controlar, així com la senyalització del risc elèctric els quadres elèctrics.
- Ordre i neteja son fonamentals en general, al igual que en el interior de quadres elèctrics havent d'estar aquests tancats i manipulats per personal qualificat.
- El us de roba de treball adequada es important a l'hora de evitar riscos addicionals.

TÜV Rheinland ®
01101

Francisco Carreño Hernández
Nom i signatura del auditor: