

ABSA 54th Annual Biological Safety Conference

Technical Presentation – November 1, 2011



*How to Upgrade an Existing
Biowaste Decontamination
Installation?*

Presentation of the latest biowaste decontamination technologies, options and considerations for an expansion or a replacement project

I have to upgrade my decontamination system...



***To find the most appropriate
system to meet your
requirements,
some questions to answer...***



1

Treatment Efficiency

How to be sure my biowaste will be decontaminated properly?



2

Users' Needs Definition

What needs?
What volume to treat?
What's the most compliant with my utilities & layout?



3

Technical Solutions

What is the most cost-effective solutions for my requirements?



1



TREATMENT EFFICIENCY

What kind of *treatment* for biowaste?



What is the treatment (F0) to apply?

Do I have to treat conventional or non conventional germs?

Sterilization or inactivation?

What about GMO?

Conventional germs...

CONVENTIONAL GERMS

- Bacteria
- Viruses
- Parasites
- Fungus

Contain DNA



Data on thermal resistance are known:

Generally applied for viruses
90°C during 15 minutes
or 105°C during 30 seconds

Example to be validated according to germs heat sensitivity

Data on thermal resistance are unknown :

Sterilization Rate
(Temperature / Holding Time)

Minimum F0 = 20
Recommended F0 = 30
Generally Applied F0 = 50

NON-CONVENTIONAL GERMS

Infectious agents which are not bacteria nor viruses, nor parasites, nor fungus.

PRION is classified in this category

No DNA



Specific Treatment

EXAMPLE: PRION

Temperature = 134°C
Holding Time = 18 minutes
Pressure = 45 PSI

GMO ?

As GMO contains DNA, we can treat them like
Conventional Germs

Contain DNA



Data on thermal
resistance are
known:

Generally applied for GMO
110°C during 1 minute

Example to be validated according to GMO heat sensitivity

Data on thermal
resistance are
unknown :

Sterilization Rate

(Temperature / Holding Time)

Minimum F0	= 20
Recommended F0	= 30
Generally Applied F0	= 50

Lethality rate

How to obtain a 30 F0

30 minutes at 121°C

or

3.9 minutes at 130°C

or

72 seconds at 135°C

or

24 Seconds at 140°C

or

8 seconds at 145°C

*(with a water-like substance based on a reference germ: the *Bacillus Stearotherophilus*)*

2



User's Need

Dimensioning



Storage

Flush

Regular inlet



System Sizing

Daily volume

Instantaneous volume

Weekly volume

Extract of storage sizing spreadsheet

EQUIPMENTS	Category	Lt/Minute	Minutes/Use	No. Equipement	Events/Day/Equipm ent	Quantity	10% Contingen cy	Litres /Day
	Fermentor CIP	70	180	1	1	12600	1260	13 860,00
	Fermentor SIP	15	120	1	1	1800	180	1 980,00
	Fermentor Rinse	70	45	1	1	3150	315	3 465,00
	Vessel CIP/SIP/RINSE	140	120	1	1	16800	1680	18 480,00
	Autoclave CIP/SIP/RINSE					0	0	0,00
	Freeze dryer CIP/SIP/RINSE					0	0	0,00
	Ultrafiltration CIP/SIP/RINSE					0	0	0,00
	Chromatography CIP/SIP/RINSE					0	0	0,00
	Chromatography Rinse					0	0	0,00
Steam Condensate	30	220	2	1	13200	1320	14 520,00	
Additional Item1	15	30	4	2	3600	360	3 960,00	
Total								56 265,00

Estimation includes all the fluids coming from different sources, during different cycles...

PERIPHERICS	Category	Lt/Minute	Minutes/Use	No. Persons	Events/Day/Person	Quantity	10% Contingen cy	Litres /Day
	Lab Sink	6	0,5	10	2	60	6	66,00
	Hand basin	6	0,5	10	2	60	6	66,00
	Fume cupboard	6	0,5	1	1	3	0,3	3,30
	Floor waste					0	0	0,00
	Shower	9	5	3	1	135	13,5	148,50
	Safety shower	9	5	1	0,01	0,45	0,045	0,50
	Eye wash	9	5	1	0,01	0,45	0,045	0,50
	Utensil Washer	1	60	1	1	60	6	66,00
	Additional Item1					0	0	0,00
Total								350,79

EQUIPMENT during CIP, SIP, Rinsing cycles like:

- FERMENTORS
- VESSELS
- Or steam condensate

indicative data, this can be adapt to your case.

FLUID	Category	Concentrati on active matter	Concentrati on	Volume	Events/Day/Person	Quantity	10% Contingen cy	Litres /Day
	Acid	55%	2%	128	2	256	25,6	281,60
	Soda	70%	3%	384	2	768	76,8	844,80
	Chloride		10%	1	1	1	0,1	1,10
	Distilled water	100%	100%	2	1	2	0,2	2,20
	Additional Item1					0	0	0,00
Total								1 129,70

PERIPHERICS like:

- SHOWERS
- SINKS

please indicate concentration of corrosive agent

SOLID <5mm	Category	Maximum size	Concentrati on	Volume	Events/Day/Person	Quantity	10% Contingen cy	Litres /Day
	Organic material					0	0	0,00
	Faecal material					0	0	0,00
	Animal tissue					0	0	0,00
	Additional Item1					0	0	0,00
Total								0,00

In case of solid, grid is required and crushing option must be choosen.

Auxiliary fluids like:

- Cleaning solutions
-



TOTAL FLOW COLLECTED

57 745L/ Day

Extract of decontamination system sizing (flow) spreadsheet

Day per Cycle	DAY 1																		
Hour per Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Hour per Cycle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	

Hourly Live Waste to Decon System [L]	160,9	0,9	160,1	0,1	160,1	0,1	160,1	18,9	217,1	61,5	160,4	0,0	160,0	0,0	160,0	14,7	174,7	2944,9	
Live Waste to Decon System [L] cumulated	160,9	161,8	321,8	321,9	481,9	482,0	642,0	661,0	878,1	939,5	1099,9	1099,9	1259,9	1259,9	1419,9	1434,7	1609,4	4554,3	
Decontamination flowrate	0	0	0	0	0	0	150	150	150	150	150	150	150	0	150	0	150	1000	
Decontaminated volume	0	0	0	0	0	0	150	300	450	600	750	900	1050	1050	1200	1200	1350	2350	
Effluent left in the storage	160,9	161,8	321,8	321,9	481,9	482,0	492,0	361,0	428,1	339,5	349,9	199,9	209,9	209,9	219,9	234,7	259,4	2204,3	
System status	off	off	off	off	off	off	low flow	low flow	low flow	low flow	low flow	low flow	low flow	st by	low flow	st by	low flow	high fl	

DAY 2								
...	14	15	16	17	18	19	20	...
...	38	39	40	41	42	43	44

...	1163,9	431,3	0,8	160,8	0,8	430,8	1,7	...
...	18675,4	19106,7	19107,5	19268,4	19269,2	19700,0	19701,7	...
...	1000	1000	1000	1000	1000	1000	150	...
...	13850	14850	15850	16850	17850	18850	19000	
...	4825,4	4256,7	3257,5	2418,4	1419,2	850,0	701,7	
...	high fl	high fl	high fl	high fl	high fl	high fl	low flow	

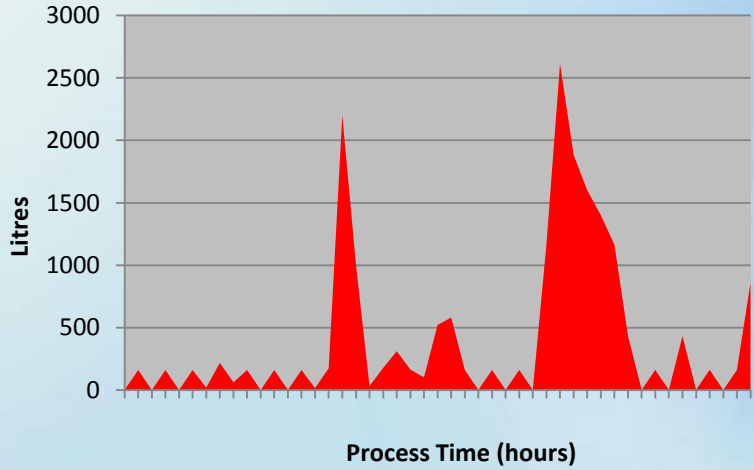
DAY 4								
...	17	18	19	20	21	22	23	0
...	89	90	91	92	93	94	95	96

...	160,1	0,1	160,1	18,9	217,1	61,5	160,4	0,0
...	27693,0	27693,1	27853,1	27872,1	28089,1	28150,6	28311,0	28311,0
...	150	0	150	150	150	0	150	0
...	27550	27550	27700	27850	28000	28000	28150	28150
...	143,0	143,1	153,1	22,1	89,1	150,6	161,0	161,0
...	low flow	st by	low flow	low flow	low flow	st by	low flow	st by

MAX. VOLUME COLLECTED IN AN HOUR: 2,945 L

TOTAL VOLUME COLLECTED IN A CYCLE: 28,311 L

BioWaste - Hourly Supply



Dimensionning



Storage Tank Capacity

<i>Minimum</i>	➔	<i>1-day capacity</i>
<i>Comfortable</i>	➔	<i>3-day capacity</i>
<i>Optimum</i>	➔	<i>1-week capacity</i>

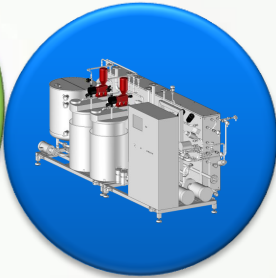
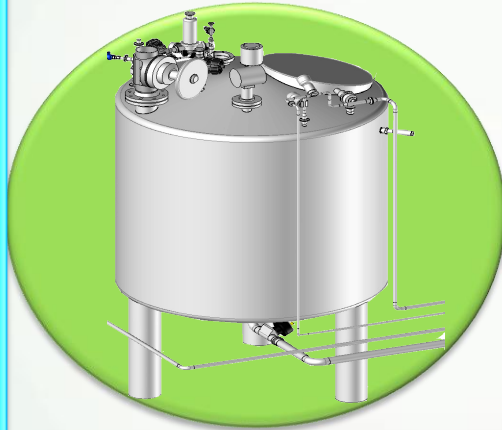


Decontamination System Capacity

<i>Minimum</i>	➔	<i>20-hour operation / day</i>
<i>Comfortable</i>	➔	<i>16-hour operation / day</i>
<i>Optimum</i>	➔	<i>8-hour operation / day</i>

2 opposite cases

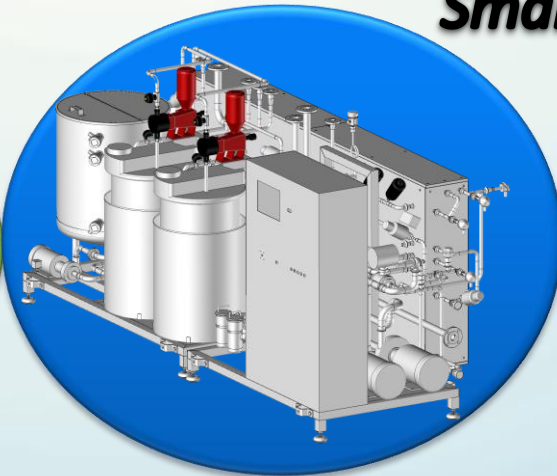
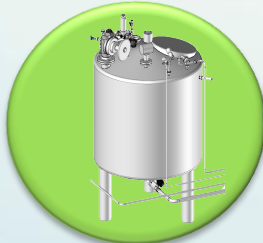
Capacity



Large Storage ↘ **Small Treatment Unit**



For plant having large flowrate during short time, several times per week



Small Storage ↗ **Large Treatment Unit**



For plant having large regular flowrate with no peak flow

3



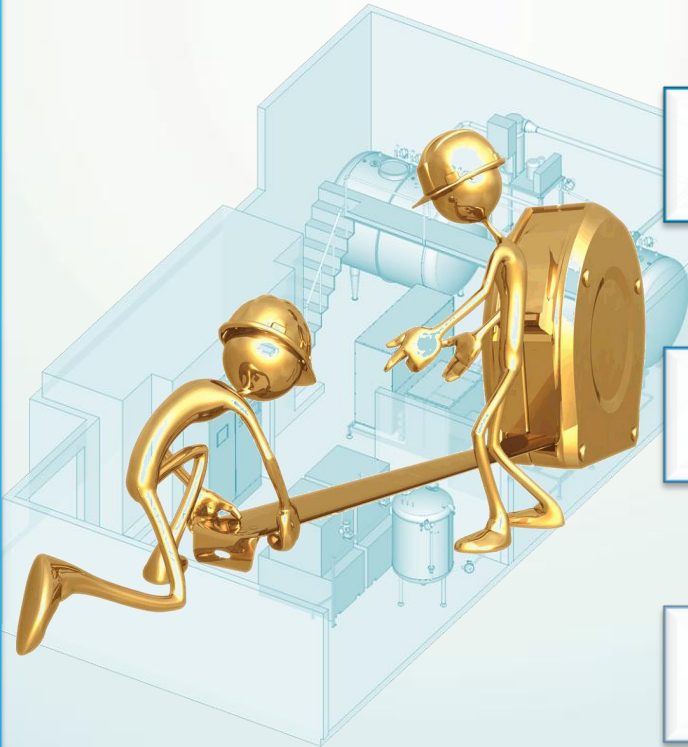
TECHNICAL SOLUTIONS

Example: capacity increase

Do I have enough Space?

DO I HAVE ENOUGH SPACE?

Layout



Same room?

Modification?

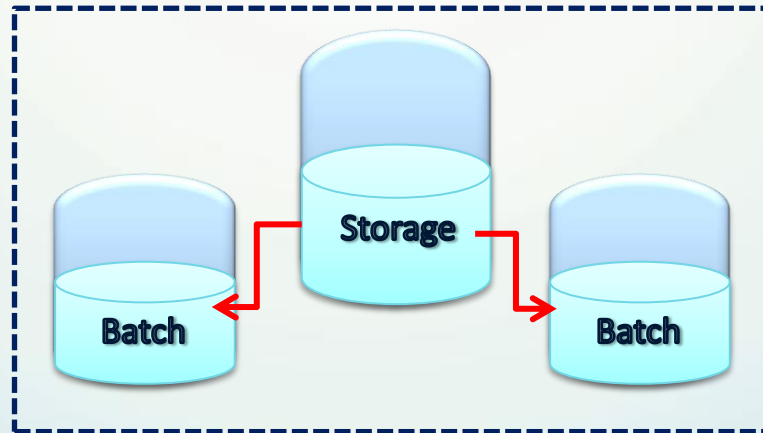
New building?

BATCH TECHNOLOGY

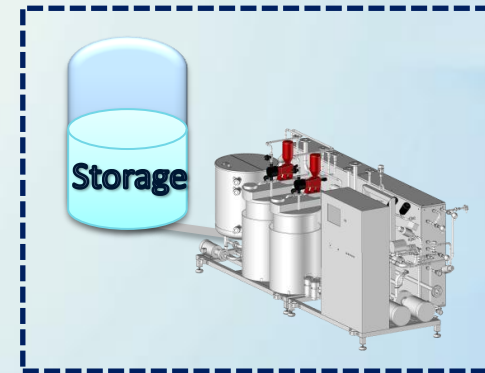
VS

CONTINUOUS TECHNOLOGY

Layout



Larger layout
> No problem for new building



Smaller layout
> Less expensive for new building
> Ideal for expansion or replacing

Can I use existing materials?

Can I use existing materials?



Kill tanks As balance / storage tanks

What kind of energy and utilities?



Steam?

Electricity?

Water?

Chilled Water?

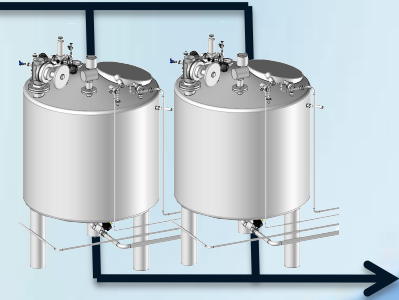
EXAMPLE

*Capacity Increase
with **NO CHANGE** in Energies and Layout*

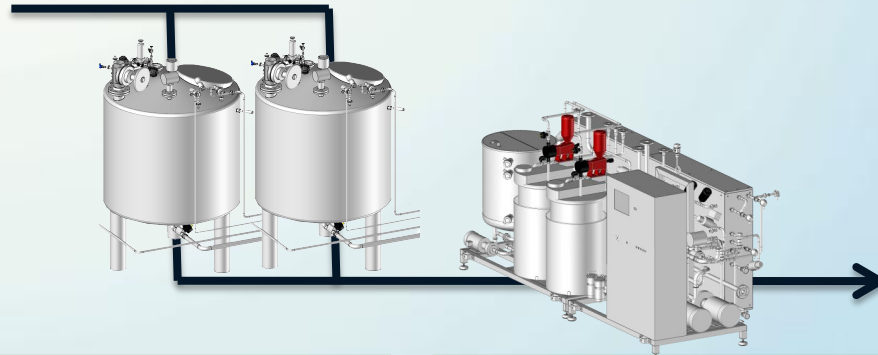
Options for capacity increase with **NO CHANGE** in Energies and Layout

Unit before upgrade

**Two 2,000 L batches
Daily capacity: 20,000 L**



**New requirements:
40,000 l/day**



**Two 2,000 L batches
used as balance Tank**

**2,500 l/h flow
decontamination skid**

Capacity

Comparison

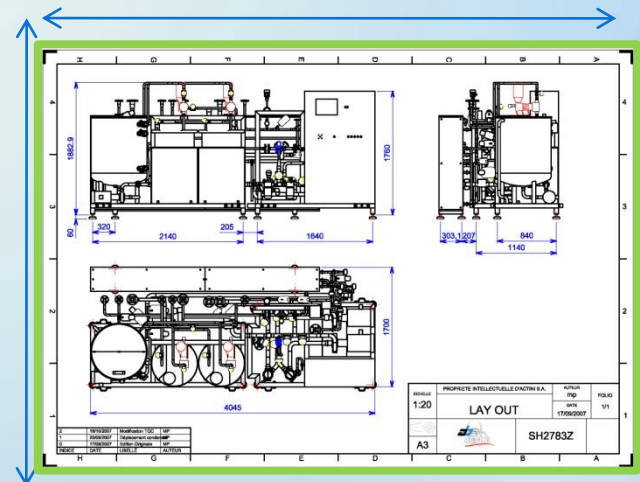
	BEFORE UPGRADE		AFTER UPGRADE	
	Batch System – 20,000 L/DAY		Flow System – 40,000 L/DAY	
STEAM	470 pounds/hour	74 USD / day	275 pounds/hour	42 USD / day
COOLING WATER	27,000 L/day	7 USD / day	3,000 L/day	0.78 USD / day
CLEANING SOLUTIONS and START UP	0	0	23 L	25 USD / day
ELECTRICITY	5 kw/h	0.35 USD/day	40 kw/h	2.80 USD/day
TOTAL COST PER DAY	For 20 m3 81.35 USD		For 40 m3 70.58 USD	

Budget

Layout for 2,500 l/h
flow decontamination skid

6 feet

13 feet



Main differences

BATCH TECHNOLOGY

VS

CONTINUOUS TECHNOLOGY

Chilled water required

Chilled water consumption

9 times lower w/ FLOW system
Mainly due to need in chilled water

No use for chilled water due to the recovery section

Complete heating

Steam Consumption

3.5 times lower w/ FLOW system

Preheating due to the recovery section

Equivalent in operating Costs
to treat 40,000 liters a day

Batch: 162.70 USD

Flow system : 70,58 USD

Budget



Pay Back



Construction



Equipment



Time



Energy



Qualifications

The more you save, the more you earn



Budget

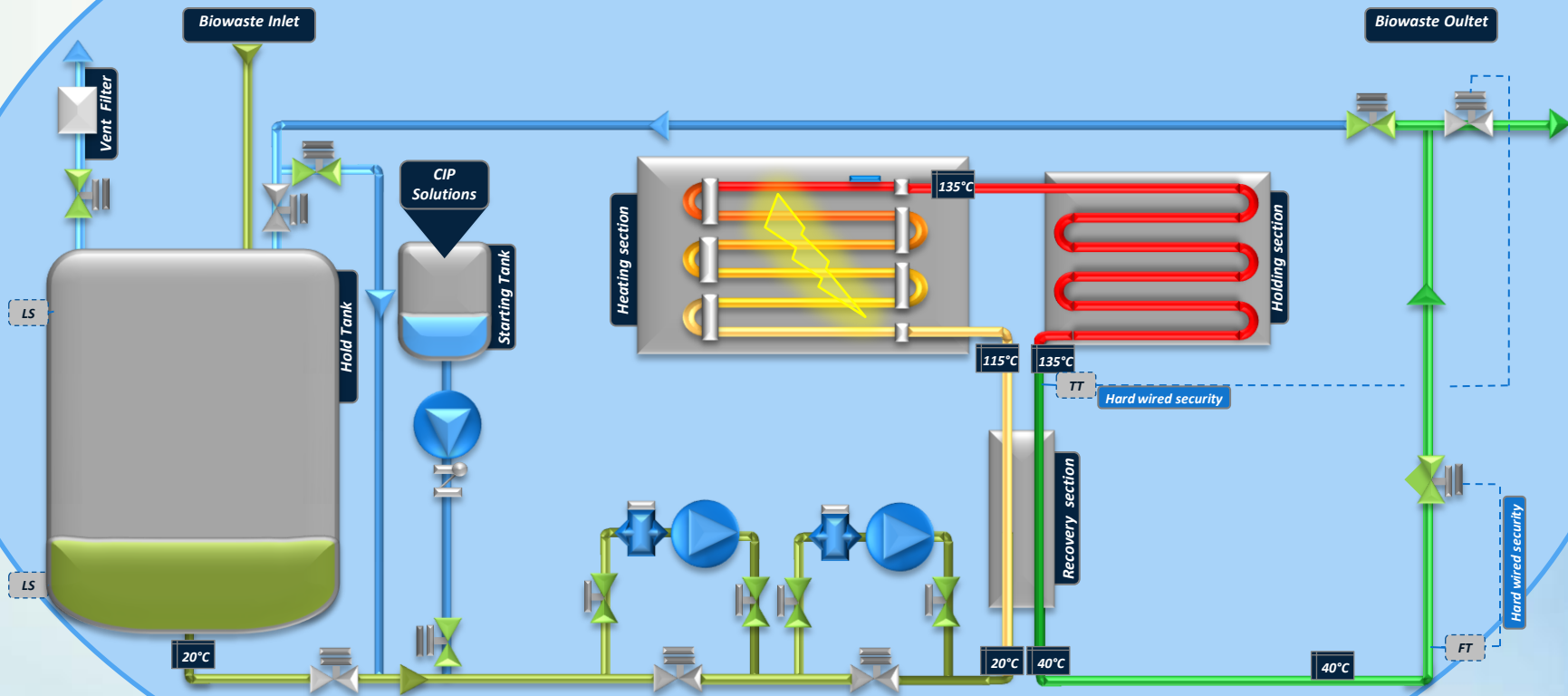
Reminder about Flow Technology?



SOME DETAILS ABOUT THIS TECHNOLOGY

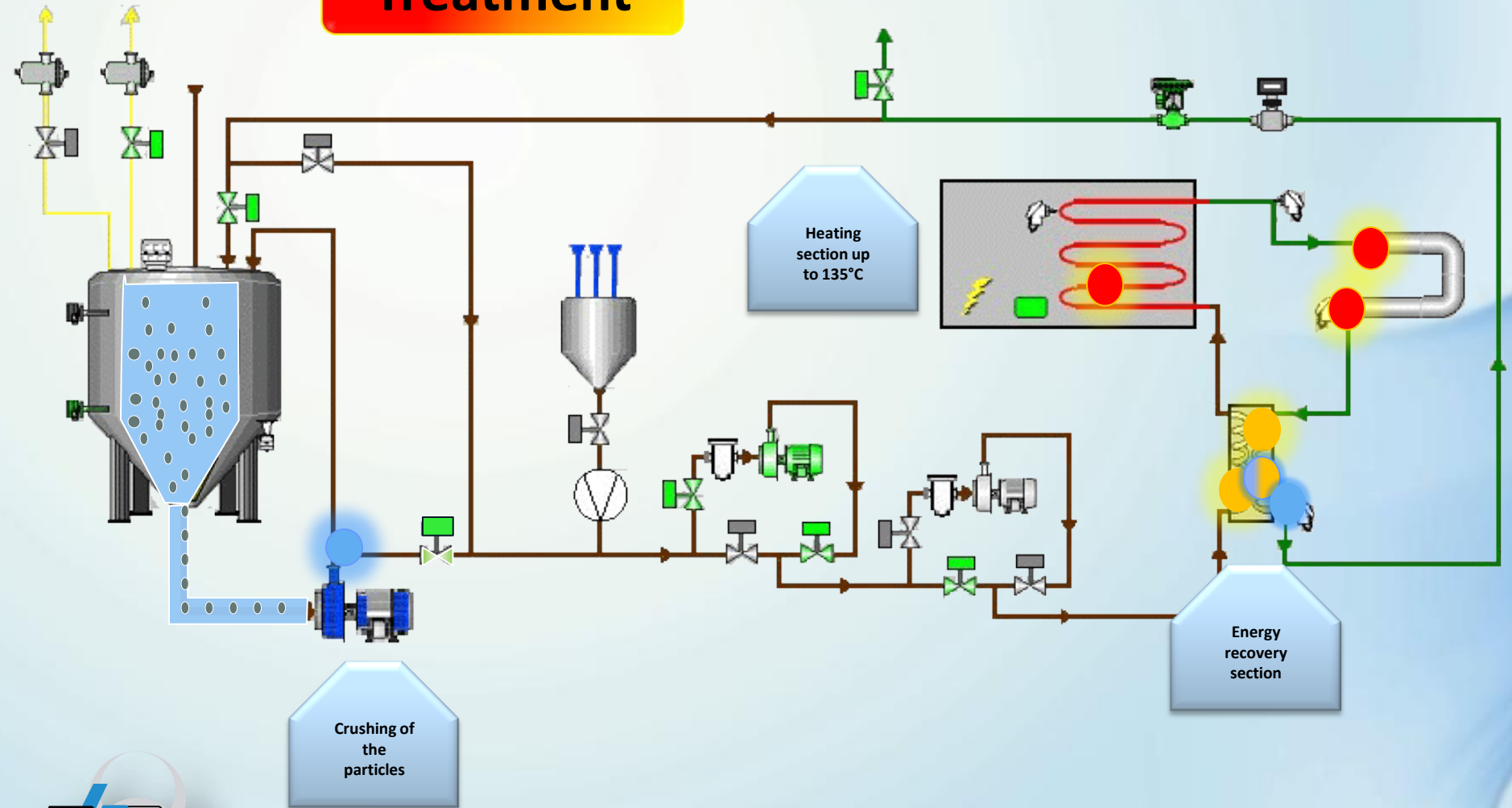
Flow Diagram

BSL2 ELECTRICAL



Continuous System... Operation

Treatment



Tubular Heating Technologies

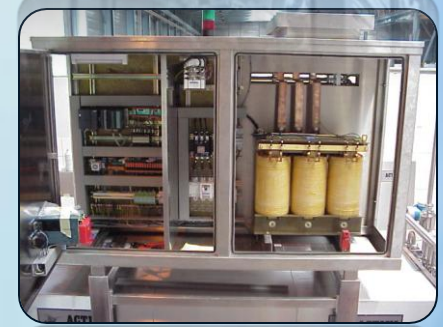
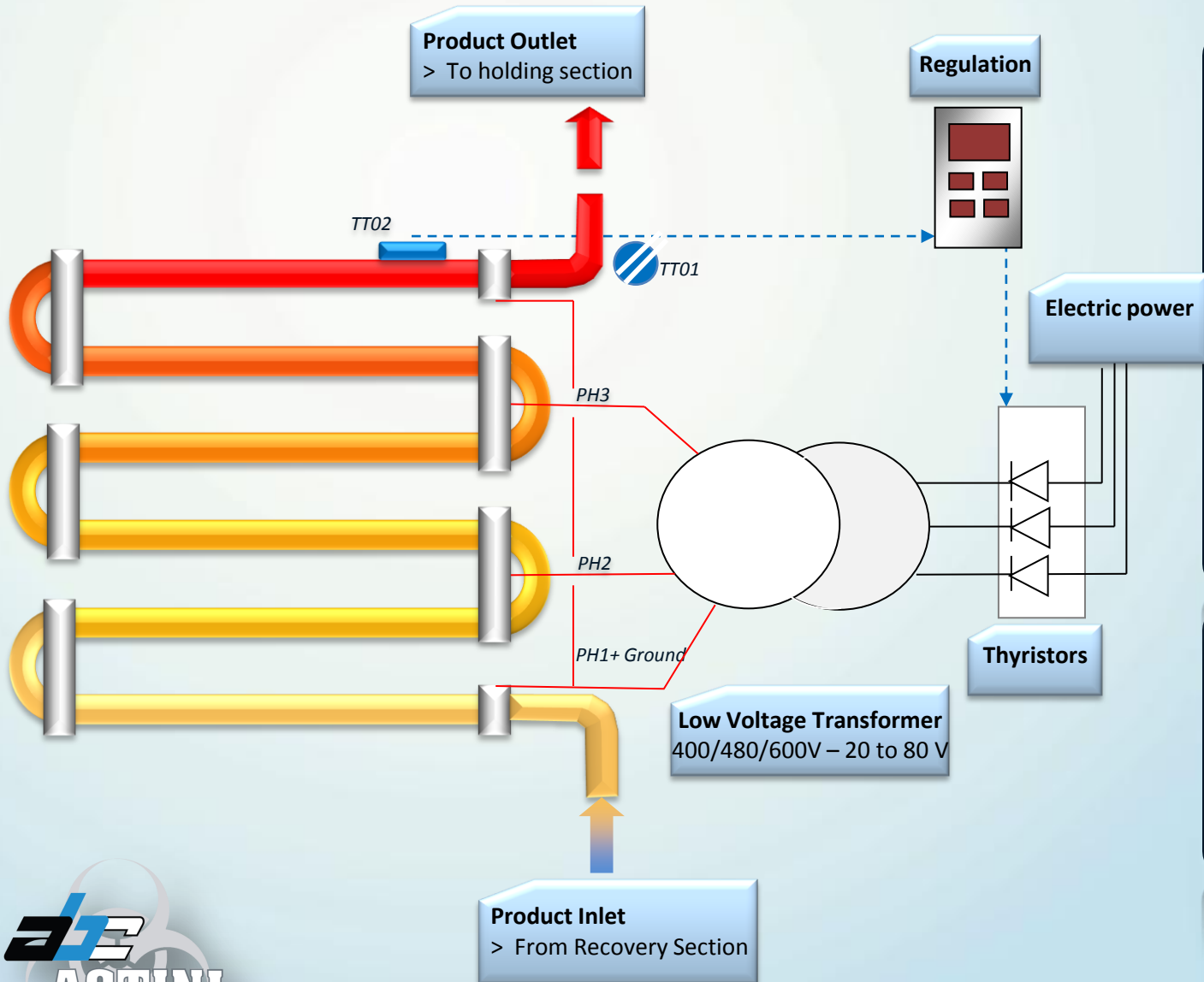


ACTIJOULE Electrical Heating



Steam-operated System

Single Pass System



Energy Recovery System

To Heating Section

Biowaste Outlet
115°C

Biowaste Inlet
135°C

From holding Section

Heating up due to
the downstream
flow

Cooling down due to
the upstream flow

No use for chilled water

Energy saving (80%)

Biowaste Outlet 40°C

To drain

Biowaste Inlet
20°C



Thank you for your time and attention

A Clear Process
for a Clean World



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