

HLL LIFECARE LIMITED, CHENNAI

Revival of DPT Vaccine Manufacturing Facility, PII, Coonoor

HLL Lifecare Pharmaplan®	User Requirement Specifications				
	Equipment/System	Micro Filtration System			
	Identification #	D-MFS 01	Document#	URS/D-MFS 01	
	Effective Date	2013-12-13	Revision#	08	

User Requirement Specifications Micro Filtration System

Process Code	AREA	EQUIPMENT TAG	QUANTITY	CAPACITY/ VOLUME (G.V.)
D	DIPHTHERIA	D-MFS 01	1no.	500L

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URS Annexure List

URS Annex No.	Detail
1.	Layout showing location of installation of the Microfiltration System in the fermentation room
2.	Tentative P&ID for Microfiltration

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1.0 APPROVAL SIGNATURE

This document is prepared by the Process, Validation and GMP Compliance team of "NNE Pharmaplan India" for the project "Revival of DPT Vaccines manufacturing Facility" (**Project number:-110831**) of Pasteur Institute of India, Coonoor under the authority of their Project Manager. Hence, this document before being effective shall be approved by the QA team of Pasteur Institute of India, and authorized by the appropriate Project Authority.

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2.0 EQUIPMENT DESCRIPTION

The equipment described by this URS is a “**Micro Filtration System (with PVDF membrane)**” (**Quantity- 1NO.**). This system will be used for the clarification of the broth after the fermentation process.

2.1 Operating Conditions:

- Pressure bar:0-4 bar
- Flow range: vendor to specify
- Temperature range: 0-40°C during process and 134 °C during SIP
- Surface area of the membrane: 10 m²
- Minimum working Volume: 1% of the total working volume i.e.4L

2.2 System Specifications

TABLE 1

S. No.	Description	Purpose	MOC	Capacity/Size
1.	System frame	To hold cassette holder	SS304	Vendor to specify
2.	Cassette holder	To hold filter cassettes	SS316L	10 m ²
3.	Recirculation pump	To recirculate the retentate	Sanitary type-SS316L	Vendor to specify according to membrane area
4.	Flow path	For the circulation of feed, permeate and retentate	SS316L	Vendor to specify
5.	Pressure transmitter in the feed, permeate and retentate lines	To measure Pressure differential (ΔP) and Trans Membrane Pressure (TMP)	Sanitary type with SS316L diaphragm	NA
6.	Surface Finish	Internally Electro polished and passivated $Ra \leq 0.6 \mu m$, according to ASME BPE guidelines (2009)		
		Externally Mechanically polished and passivated up to $Ra < 1.2 \mu m$		
		Stainless steel piping interior $Ra \leq 0.6 \mu m$, according to ASME BPE guidelines (2009)		

System should be designed to achieve high flux at low TMP and low cross flow rate.

All pressurized parts of the system should be hard piped and connected via sanitary connections

System should be provided with rotary lobe pump proven to handle shear sensitive cells with suitable flow rate and pressure with variable speed control and auto cut off of the pump in case of dry condition in the tank.

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2.3 Vessel Specifications

TABLE 2

S. No.	Description	Purpose	MOC
1.	Shell	Cylindrical	SS316L
2.	Top closure	Flat Lid	SS316L
3.	Bottom closure	Torispherical dish	SS316L
4.	Spray Ball	For the cleaning of the interior of the vessel.	SS 316L
5.	Jacket	Hollow type; For temperature control	SS304
6.	Insulation	To avoid heat loss	Mineral wool
7.	Cladding	Cladding is welded to jacket around the insulation	SS304

2.4 Vessel design specification

TABLE 3

SI.NO	Description	Specification
1.	Geometric volume	500 L
2.	Maximum working volume	400L
3.	Quantity	1 No
4.	Working temperature range	25°C-134°C
5.	Surface Finish	Internally Electro polished Ra ≤ 0.6 μm, according to ASME BPE guidelines
		Externally Mechanically polished up to Ra <1.2μm matt finish for the jacket. Top and bottom dish - mirror finish.
		Stainless steel piping interior Ra≤ 0.6μm, according to ASME BPE guidelines

2.4.a The Chassis mounted system (with lockable castor wheel) comprises of One Microfiltration unit, Semi-Automatic System and jacketed feed tank. The tank is to be integrated with microfiltration system with pump and accessories on skid. The following are the features:

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- A. Dosing unit for feed/buffer/saline:** Fermentor broth shall be transfer to feed tank of the system with the fixed piping with the help of sterile nitrogen/ sterile air through a sterile valve assembly.
- B. The sterile valve assembly:** should have
- Steam Inlet Valve
 - Condensate drain valve
 - Temperature sensor/ transmitter
- C. Temperature Control:** Provision for the supply of chilled water/cooling water and plant steam into the system to be made so as to reduce the temperature of the feed inlet and during SIP.
- Suitable inlet and outlet valves for temperature control
 - Suitable inlet and outlet valves with steam trap for SIP
 - Auto control Valve for jacket inlet
- D. Air Filters:**
- Inlet Air filters:
 - Reusable and sterilizable SS housing with 0.2/0.22µm sterile filter (Code 7) with manual diaphragm valve, which is to be sterilized along with vessel.
 - Exhaust Air filters:
 - Exhaust filter with manual diaphragm valve
- E. Pressure Indication:** To indicate the Pressure of the vessel
- Compound Pressure gauge for vessel
 - Rupture disc, to release the excess pressure in the vessel
- F. Flush bottom valve:** It should be zero dead leg type valve attached directly to the bottom of the vessel. The diaphragm shall be of PTFE type.
- G. Feed Line:**
- Pressure transmitter
- H. Permeate Line:**
- Pressure transmitter
 - Sampling valve
- I. Retentate Line:**
- Pressure transmitter

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- Electromagnetic flow meter for measuring the flow of conductive fluids in process applications
- Retentate Sampling
- Control Valve for ΔP and TMP

J. CIP(Clean in Place):

- CIP of the system to be carried out along with the tank and the associated pump

K. SIP (Sterilization in Place): Steam will be injected directly into the vessel and pressure is controlled by a pressure transmitter.

- Inlet air filter and vent filter with associated manual diaphragm valve at the filter housing drain.
- Temperature indication at the lowest point before the drain point
- Steam traps to be provided as per the process and wherever required.
- The exhaust filter is to be sterilized together with the vessel
- The pressure regulator should maintain the pressure in the vessel to 2 bar till the SIP cycle is complete

L. General characteristics of the microfiltration membrane:

- Filter area of 10m²
- pH range operation pH 2-12.
- Membrane pore size 0.45 μm.
- Hydrophilic in nature.
- Open channel membrane
- PVDF membrane
- SIPable membrane material suitable to handle toxin and fermentation broth shall be provided
- High velocity and high particulate level capability.
- Maximum containment of hazardous fluids.
- Low hold-up volume
- Low protein binding.
- Good compatibility with most of the cleaning, sanitizing, depyrogenation and storage agents

Note: membrane made up of equivalent polymer with above characteristics is optimal for use.

M. Additional requirements: Calibration of measuring instruments according to international standards, full-loop calibration is required for GMP and quality relevant instruments. The Supplier has to provide calibration protocols and guidelines for writing SOPs for recalibration. System should be designed to achieve high flux at low TMP and low cross flow rate.

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N. Controller: PLC Based Controller and SCADA with a 10" industrial touch screen large HMI (Displaying data trends as Graphs, synoptic view of running parameters etc).

O. The HMI shall be touch screen type (Provision for manual operation also to be provided)

- HMI screen size shall be of 10inches
- Human machine interface must be used to enter the process details, which should appear in the print out.
- All critical alarms
- All critical parameters & interlocks
- Addition of buffer
- Sequences (process, CIP , SIP, transfer etc)
- P&ID of the vessel along with instrumentation details
- Login details

P. Nozzles Schedule :

Top Head Plate (*design of shell to be provided by the vendor*)

- GMP type Spray ball/s assembly- static type - 360°
- Sterilizing grade hydrophobic inlet filter and vent filter (0.2/0.22 µm filter) with SS housing and manual diaphragm valve
- Rupture disc
- Hand hole - flushed flange with O-rings
- Port for Light/Sight Glass –Bolted with gasket.
- Port for pressure gauge/ indicator
- Port for Spare port
- Port for level sensorPort for inlet of Retentate

Upper side wall:

- Port for the addition of feed/ buffer/ saline with peristaltic pump
- Permeate recirculation port with "J" type nozzle

Lower side wall/ Bottom Connection:

- Port for temperatureindicator
- Port for pH transmitter
- Flush bottom valve – Flush welded to the bottom dish.

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Jacket Connection

- Jacket Bottom: Jacket Inlet port with angle seat valve, jacket drain
- Jacket Upper side: Jacket outlet port, safety relief valve, jacket vent
- Provision for condensate drain
- Design of the feed vessel shall compliance with ASME and ASME-BPE guidelines (Current version)

Q. All points of the IRS except the below mentioned would be applicable for the equipment

- 4.1.10, 4.1.11, 4.1.13, 4.1.17
- FDA Guidance for industry for sterilization equipments,
- CE Certification,
- ANSI/NSF 49-2008, ISO 14664, ISO 8362
- 5.6

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Note:

I.	This Technical Specification is the basis for an inquiry to a vendor and therefore the basis for the vendor's proposal.
II.	The vendor is asked to state in "REMARKS" column with "yes" if the described requirement will be completely fulfilled and with "no" in case the requirement will not or cannot be fulfilled with the proposed equipment. In case of a deviation a comment must be inserted or enclosed as a separate annexure by referring to the respective URS specification number.
III.	The vendor must clearly comment each item of the Technical Specification. The comments must be in English language. If extra cost for necessary options becomes necessary the item must be clearly stated.
IV.	In case that the requirement includes a question or request or information from the vendor, the answer / information should be stated in the "REMARKS" column.
V.	The final version of this document including the vendor's comments will become basis of a potential purchase order or contract.
VI.	The Technical Specification serves to define a summary of all vendor's requirements concerning scope of delivery and services.
VII.	The vendor is responsible for technically unobjectionable function of the equipment. TS are not intended to dictate a technical design to the vendor. If agreed upon with the vendor, the vendor can apply his practically proven design.
VIII.	<p>Special Instruction</p> <ul style="list-style-type: none"> a. If no comments against any specification shall be considered as "NO" and b. If there is no reply / comments against the complete URS by the vendor then it shall be treated as unresponsive / technically non-compliant and rejected.
IX.	All the instruments and controls mentioned in the URS(s) are expected to be standard supply and part of your standard equipment model. In case of any deviation or redundancy or additional scope of supply is noticed, vendor is required to obtain clarification from HLL before submitting the quotes.
X.	The makes requested are standard international makes. In case of any deviation, vendor to seek clarification from HLL before submitting the offers.
XI.	Refer document Installation Requirement Specification and Specific Instructions with URS; NPI_110831_IRS_PII_01
XII.	Refer Tender document with URS; NPI/110831/EQP/TD/03

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Specifications	Remarks
3.0 PROCESS DESCRIPTION	
3.1 Input & Charging method	
3.1.1 The feed from fermentor shall be fed into the filtration unit (firstly in feed tank) by sterile compressed air.	
3.2 Brief Process Steps	
3.2.1 The equipment will be used for clarification of toxin fermentation broth <ul style="list-style-type: none"> a) The broth (400L) from the fermenter shall be directly fed into the feed vessel of the system b) The desired filtration size of membrane modules shall be installed in the module holders of the MF system (pore size 0.45 µm). c) The required number of filtration membrane modules shall be installed as per the required filtration area of 10 m² in multiples of 1.7m² membrane cassettes. d) Permeate and retentate will be recirculated into the vessel till the equilibrium is achieved. e) After achieving the equilibrium, permeate is collected and send to next step & retentate shall be recirculated till the collection of required quantity of permeate and after that the retentate will be decontaminated and discarded. f) Separate provisions to be made for permeate recovery from the system. 	
3.3 Output & Discharging Method	
a) The permeate/filtrate – diphtheria toxin is collected in 100 L (W V) pressure vessel and this will be further transferred to the sterile filtration unit (0.45 µm + 0.2/0.22 µm filters) and stored in Nalgene bottles.	
4.0 PRODUCTIVITY REQUIREMENT	
4.1 Desired/ suggested capacity	
400 L Vessel (working volume) / 500L (Gross Volume)	
4.2 Standard batch size	
Feed: 400L broth from fermentor	
4.3 Change over time	
Not applicable	
4.4 Other (if any)	
Not applicable	
5.0 CONTAINMENT	
Not Applicable	

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Specifications	Remarks
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6.0 GMP REQUIREMENTS

6.1 Process control

6.1.1 The Microfiltration unit should essentially have the necessary provisions for adjustment / control of the following critical process parameters:

- a) TMP regulation parameters
- b) Differential pressure regulation parameters
- c) Pressure indication
- d) Temperature control for inactivation of bacterial mass
- e) Volume in the vessel
- f) Pump start up speed(During Flush, NWP, Microfiltration, Washing, CIP,DP regulation)
- g) NWP stabilization and measurement time
- h) Duration of cycle (During Flush, NWP, Microfiltration,Washing, CIP,DP regulation)
- i) Pump recirculation speed during storage
- j) Jacket pressure indicator

6.1.2 Following conditions need only notification to operator for procedural control:

- k) Emergency stop activated.
- l) Power failure.
- m) Malfunction of sensors of temperature, pressure and flow

6.2 Failure mode detection

A. Equipment shall be capable to detect the following failure, notify the operator with alarm and shutdown the process:

- a) ΔP
- b) TMP control
- c) SIP temperature and pressure of the vessel - Indication
- d) Temperature controlfor inactivation of bacterial mass
- e) pH indication

6.3 In-Process control

6.1.1 Temperature measurement and control

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Specifications	Remarks
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6.1.2 Pressure control in the feed inlet, retentate and permeate lines	
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6.1.3 Measurement and control of fluid level in the tank.	
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6.4 Level of instrumentation	
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Sufficient and suitable instrumentation for the process, safety and productivity control as indicated in the following table:

Type of control/test	Purpose	Instrumentation
Temperature	Monitor and control the temperature	RTD sensor and temperature indicator & controller on the tank and SIP drain
Pressure (TMP& Δ P)	Monitor and control the pressure of feed, retentate and permeate	Pressure transmitter
Pressure	To monitor and indicate , control record the tank pressure	Pressure sensor
Flow rate	Monitor the rate of flow of retentate	Electromagnetic flow meter
pH	To monitor and indicate of pH of the system	pH transmitter in tank
Instrument air pressure	To maintain the flow and pressure of the instrument air	Regulator with pressure switch
Level of the volume	To maintain the correct volume	Level Sensor (radar type) With the accuracy of 1% of the completed range.

6.5 Batch data display and record printing	
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<p style="text-align: center;">Refer IRS (Installation requirement Specification and specific Instruction) .</p> <p style="text-align: center;">Non editable data shall be available / transferred to USB Drive for printing the batch report, alarm log.</p> <p style="text-align: center;">Realtime online printing shall be available for batch report</p>	
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6.6 GMP requirements (Others)	
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6.6.1 Equipment design must be designed for aseptic processing.	
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6.6.2 All process relevant wiring has to be executed in fail safe manner.	
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6.6.3 All parts of the machine exposed in A/C area must be resistant to standard disinfectants or vendor shall provide the name of specific disinfectants.	
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Specifications	Remarks
6.7 Specific requirements	
6.7.1 The equipment has to be designed in a way to get easy and quick access to all necessary maintenance points	
6.2.1 Pressure reducing valve for pure steam of the inlet air filter	
6.7.2 All ports should be attached with Sanitary tri clamps	
6.7.3 Feed tank inlet shall have a sterile valve assembly with steam inlet and condensate drain valve.	
6.7.4 A separate provision to be made for product recovery to flush the module.	
6.7.5 Automated pressure control during clarification process.	
6.7.6 <u>Pump specification: Sterile Sanitary design</u> MOC: SS316L Elastomers: EPDM–FDA/ USP CIP : Yes SIP: Yes Surface finish: Ra <0.6µm (electro polished)	
6.7.7 Nozzle shell shall be seamless.	
6.7.8 Nozzle connection to betriclover.	
6.7.9 Nozzles, adaptors, instrument shall comply with ASME BPE guidelines compliant.	
6.7.10 Total motor drive assembly with SS304 cover with TEFC eff 1.	
6.7.11 All process Utility piping from header to the vessel skid: SS 316L. Ra <0.6µm	
6.7.12 Necessary sanitary TC end flexible hoses to be provided for all the utilities like pure steam, chilled water, cooling water, plant steam and for product recovery	
6.7.13 Performance Requirements: Vendor to demonstrate the following during FAT/SAT <ul style="list-style-type: none"> Sterility of the completesystem Flux- to be demonstrated with model solution CIP- effectiveness to be demonstrated andspray ball coverage. Temperature Control along with the level accuracy to be demonstrated. 	
6.7.14 Design Considerations: <ul style="list-style-type: none"> Vessel working Pressure: 0 to 3 Bar (g) Vessel working Temperature: 0°C to 125°C. Vessel design Pressure: 4 bar Vessel design Temperature: 0-150⁰ C Jacket working Pressure: 0 to 4 bar (g) Jacket working Temperature: 0°C to 125°C. 	

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Specifications	Remarks
<ul style="list-style-type: none"> Jacket design Pressure: 5 bar(g) Jacket design Temperature: 0-150⁰ C Vessel sterilization Temperature: 121°C(Design: 150°C) 	
6.7.15 Basic requirement shall be provided by the vendor to calculate the filter area	
6.7.16 Vendor shall provide the FRL (Filter, regulator, lubricator), automatic valve assembly and air pressure switch for instrument air. Connections to automatic diaphragm valve shall be in vendor scope.	
6.7.17 Online integrity test provision shall be provided for cassette and exhaust filter	
6.7.18 Software Design Specifications/Implementation Guidelines (SDS)	
6.7.19 The development of the PLC Application Software will be done in accordance to the GAMP5 Guideline with the preparation of: <ul style="list-style-type: none"> Functional Specifications (FS) Hardware Design Specifications (HDS) Chartless Recorder with online printing Non-editable data format to be obtainable 	
6.7.20 Dummy cassettes to carry out the validation activities.	

7.0 CONSTRAINTS

7.1 Equipment location and available space

This equipment will be installed in the Diphtheria Block of **Revival of D.P.T Vaccine Manufacturing Facility, PII, Coonoor.**

Equipment Location:

Fermentation room (B1G048)

Block: Diphtheria Block
 Floor: Ground Floor
 Room Size: 5800mm x 6510mm
 False Ceiling: 3000 mm

Physical condition of the rooms:

1. Room will be BSL 2
2. Class: EU Class "C"
3. Differential Pressure: 5 Pa Absolute
4. Temperature maintained: 22±2 °C
5. Relative Humidity: <55% Rh

The equipment location is indicated in the relevant block of the layout enclosed as **URSAnnex-1.**

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Specifications	Remarks
7.2 Available Utility	
7.2.1 Electricity: 3 ph, 415V AC, 50Hz	
7.2.2 Water for Injection: 80-85° C	
7.2.3 Pure Steam: 3 bar	
7.2.4 Plant steam: 3-3.5bar g	
7.2.5 Chilled Water Supply: 6-7°C, Return: 11-12° C (or depends on process)	
7.2.6 Compressed air: 8-10 bar g	
7.2.7 <i>Vendor needs to take care the utility requirement as desired for the system. As per the system if changes required in the utility pressure vendor should consider within the package.</i>	

8.0 ABBREVIATION

Abbreviation	Definition
db	Decibel
DQ	Design Qualification
HMI	Human Machine Interface
MOC	Material Of Construction
MFS	Micro Filtration System
NPI	NNE Pharmaplan India Ltd
NPW	Nominal Water Permeability
PII	Pasteur Institute of India
PLC	Programmable Logic Controller
PID	Proportional Integral Derivative
QA	Quality Assurance
RPM	Revolutions Per Minute
SS	Stainless steel

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REVISION INDEX

Revision	Date	Reason for Revision
00	09.12.2011	First Draft
01	18.05.2012	Client's comments incorporated
02	2012-10-22	Format changed as per HLL requirement
03	2013-02-05	HLL Comments incorporated, received during the workshop dated 22 nd and 23 rd January, 2013
04	2013-02-28	PIIC comments incorporated, received on 26 th February 2013
05	2013-02-21	PIIC comments incorporated, received on 18 th March 2013
06	2013-05-14	Format internally revised
07	2013-11-11	Updated as per MOM dated 28.05.2013 & 29.05.2013 and Telecon dated 08.11.2013
08	2013-12-13	Updated as per commented URS received through E-Mail on 09.12.2013

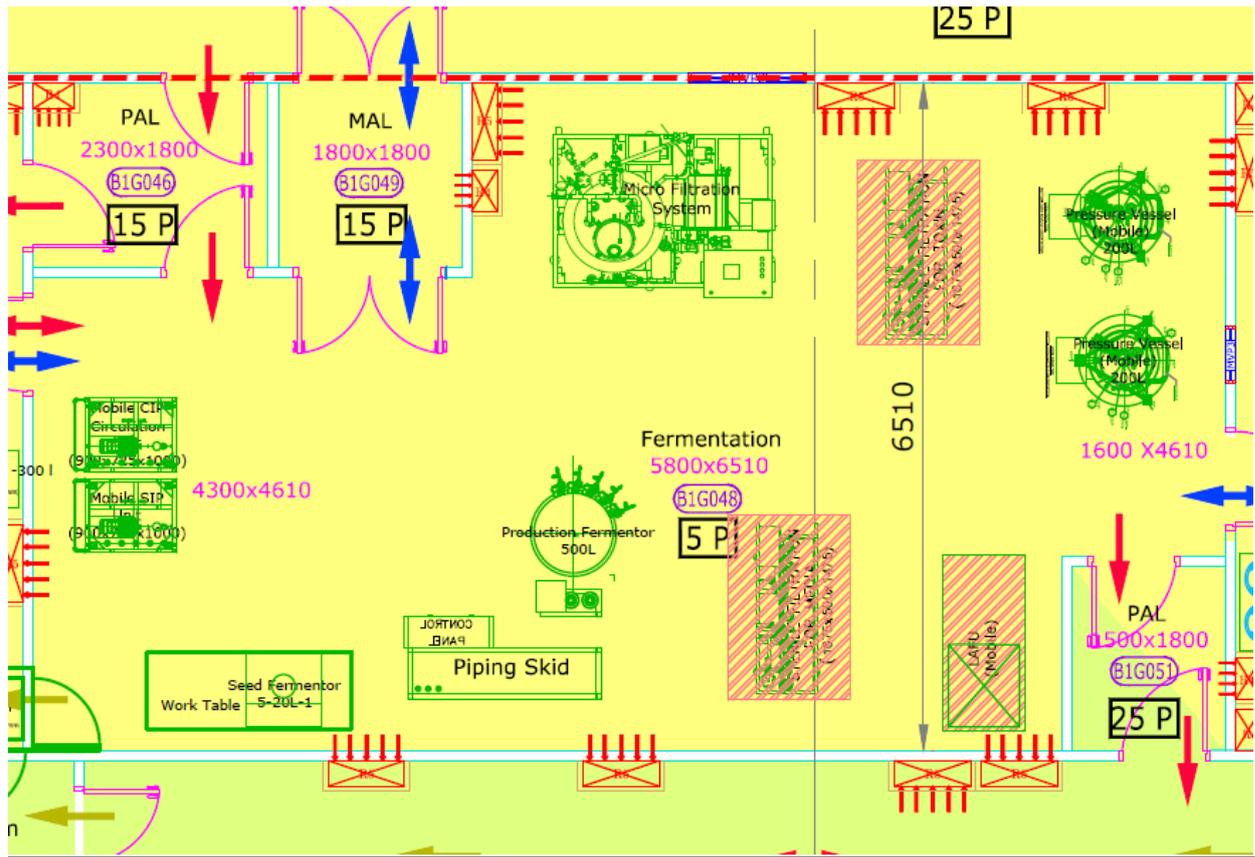
HLL LIFECARE LIMITED, CHENNAI

Revival of DPT Vaccine Manufacturing Facility, PII, Coonoor

	User Requirement Specifications			
	Equipment/System	Micro Filtration System		
	Identification #	D-MFS 01	Document#	URS/D-MFS 01
	Effective Date	2013-12-13	Revision#	08

URS Annexure 1: LAYOUT POSITION

Room: (Diphtheria Block): B1G048



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Revival of DPT Vaccine Manufacturing Facility, PII, Coonoor

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	Effective Date	2013-12-13	Revision#	08	

List of Preferred Make of components

SL.NO	DESCRIPTION	MAKE
A	INSTRUMENTATION	
1.	PLC	Allen Bradley/ Siemens
2.	Operator Interface/HMI	Allen Bradley/ Siemens
3.	Temperature transmitter	Radix/ Yokogawa/Emerson
4.	Temperature sensor	NEGELE/E&H
5.	pH sensor	METTLER TOLEDO/E&H
6.	Pressure transmitter	Wika /Dwyer/Labom
7.	Pressure regulator	FESTO
8.	Flow meter	E&H / Khronne Marshall/ Rosemount
9.	Steam trap	Spirax Marshall
10.	Rupture Disc	Fike
11.	Printer	Canon/Epsilon/HP
B	MECHANICAL	
12.	Pressure gauges	WIKA/Denver/Negele
13.	Vent filter cartridge	Sartorius/PALL/Millipore
14.	Filter housing	Sartorius/ PALL/Millipore
15.	Spray ball	HAKE/LECHLER
16.	Diaphragm valve	GEMU/SED
17.	Ball valve	Modentic/Alfa laval
18.	Flush bottom valve	Novaseptic/GEMU
19.	Sampling Valve	Novaseptic/GEMU
20.	Flow switch	E&H/ Wika/Emerson
21.	Recirculation Pump	Johnson/ Alfa Laval
C	PNEUMATIC	
22.	Diaphragm valve(Automatic)	GEMU/ SED
23.	Angle Seat valve	GEMU/Spirax/SED
D	ELECTRICAL	
24.	Lamp	PAPENMEIER