

# HLL LIFECARE LIMITED, CHENNAI

## Revival of DPT Vaccine Manufacturing Facility, PII, Coonoor

nne pharmanplan®

### User Requirement Specifications

Equipment/System

Microbial Fermentor

Identification #

D-FER 01

Document#

URS/D-FER 01

Effective Date #

2013-06-27

Revision#

07



## User requirement specifications Microbial Fermentor

Process Code	Area	Equipment code	Qty(Nos)	Capacity
D	DIPHTHERIA	D-FER01	1	500L G.V.

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### URS Annexure List

URS Annex No.	Detail
1.	Layout showing the location of the Fermentor in Diphtheria Block
2.	Tentative P&ID for Diphtheria Fermentor
3.	List of preferred make of components

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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 Vaccine 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 and authorized by the appropriate Project Authority.

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## 2.0 EQUIPMENT DESCRIPTION

The equipment described by this URS is a “**Fermentor**”. A fermentor is a special vessel that are designed for creating the optimal conditions for growth micro-organisms, based on controlling a number of parameters like temperature, pH and pO2 etc. The Fermentor including control panel will be installed in a clean room of Class “C”.

This Microbial Fermentor is for batch operation.

The equipment should have the following specifications to run the operation smoothly.

**2.0.1. TABLE 1**


S. No.	Description	Purpose	MOC
1.	Shell	Cylindrical, for fermentation	SS316L
2.	Top closure	Flat Lid	SS316L
3.	Bottom closure	Torispherical dish	SS316L
4.	Jacket	Hollow type; For temperature control	SS304
5.	Insulation	To avoid heat loss	Mineral wool
6.	Cladding	Cladding is welded to jacket around the insulation	SS304
7.	Agitator (top mounted)	For mixing the process fluid constantly & keep uniform solution and to avoid dead air pocket	SS316L
8.	Height/Diameter Ratio	1.2:1	-

**2.0.2. TABLE 2**

SI.NO	Description	Specification
1.	Geometric volume	500 L
2.	Maximum working volume	400L
3.	Quantity	1 No
4.	Min mixing volume	150L
5.	Working temperature range	35±1°C
6.	Rise in temperature (heating capacity)	4 deg C/min
7.	Fall in temperature (cooling capacity)	4 deg C/min
8.	Temperature control deviation	±0.1°C

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9.	Surface Finish	Internally Electro polished Ra ≤ 0.6 μm, according to ASME BPE
		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

**2.0.3.** The fermentor shall be skid mounted which should be supplied along with all the necessary piping, valves and instrumentation. The equipment must be designed for closed operation with the following specifications:

- a. **Dosing Unit for Inoculum:** Inoculum will be added to the fermentor by flexible hose through the sterile valve assembly and individual Peristaltic pump.
- b. **Dosing Unit for Antifoam:** Antifoam will be added to the fermentor by flexible hose through the sterile valve assembly and individual Peristaltic pump. The Foam shall be controlled by using the
  - Foam sensor
  - By the addition of Antifoam
- c. **Dosing Unit for Acid:** Acid will be added to the fermentor by flexible hose through the sterile valve assembly and individual Peristaltic pump. The pH shall be controlled by using :
  - In-situ sterilizable pH gel electrode, connecting cable and pH controller (Same for acid and alkali)
  - By the addition of acid
- d. **Dosing Unit for Alkali:** Alkali will be added to the fermentor by flexible hose through the sterile valve assembly and individual Peristaltic pump. The pH shall be controlled by using
  - By the addition of Alkali
- e. **Dosing unit for Media:** The pre-filtered media will be added to the fermentor by flexible hose through the sterile valve assembly after passing through filtration system for media with 0.45 micron and 0.22 micron filter pore size .
- f. **DO Monitoring:**
  - By using In-situ amperometric DO probe
- g. **Aeration Supply System(Sparger):** Aeration system for sparger consists of ring sparger. The air inlet Process air requirement for sparger is 20 LPM.

The Fermentor is having facility for supplying of process air during process. Process Air addition line is provided with:

- Pressure reducing valve
- Sterile Non return valve(NRV)
- Mass flow controller(MFC)
- Sterilizable SS housing with 0.2/0.22 micron sterile filter, which is to be sterilized along with vessel.
- Rotameter

- h. **Aeration Supply System (Overlay):** Aeration system consists for Overlay :

Process air requirement for overlay is 14 LPM

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- Pressure reducing valve
- Mass flow controller(MFC)
- Sterilizable SS housing with 0.2/0.22 micron sterile filter, which is to be sterilized along with vessel.
- Rotameter

i. **Temperature Control:** The temperature during fermentation shall be controlled via circulation of utilities (plant steam, Cooling water, Chilled water, etc) in the jacket with electric heater or steam and a circulation pump. Temperature control during cultivation 35-37°C (tolerance limit:  $\pm 0.1$  °C) & during sterilization (tolerance limit:  $\pm 0.1$  °C)

- The system consists of closed loop pressurized thermostat system with recirculation pump 2 heat exchangers for heating and cooling alternatively which provides a high flow through the hollow vessel jacket and ensures fast temperature control at high accuracy with PT 100 probe (sterilizable).
- Electrical heater ,Heat exchanger and steam for cooling water & chilled water for operation temperature
- Safety relief valve for jacket
- Bourdon type pressure gauge for jacket utility
- Pneumatically operated valves for steam and cooling water/ chilled water

j. **Pressure control:** Pressure of the vessel and CIP/SIP steps shall be controlled by the following:


- Compound Pressure gauge for vessel and Pressure transmitter
- Back pressure control valve in the exhaust line

k. **Agitator:** The vessel shall be designed with top driven agitator. Mechanism should provide minimum shear even at high speeds and maintenance. One impeller shall be Rushton type impeller with speed control from 20-600 rpm(approx.500 rpm will be the operating speed).The specifications of the agitator are as follows:

- The agitator shaft to be provided with 6 bladed Rushton turbine type impellers.
- Bearing frame and direct motor drive arrangement
- Shaft seal: Double mechanical dry running seal with Thermo syphon ,pressurization shall be by means of sterile air during operation, during seal SIP by means of pure steam.
- Shaft, length shall be decided by the vendor according to the height of the vessel
- VFD should be provided to control the RPM
- Vendor shall specify the following:
  - SS316 L , 6 Bladed Rushton turbine type shall be provided
  - Shaft diameter
  - Width of the blade
  - Height of the blade
  - Diameter of the disc
  - Tip speed
  - RPM:20 to 600
- Interconnection shall be provided with the sensoric arrangement (eg. DO sensor) of the system.

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- Thermo syphon shall be provided with the utility connection and CIP/SIP.

• MOC:

- SS 304 bearing frame
- SS 316L shaft of the agitator
- SS 316L disc
- SS316L Impeller

**I. Vent Line/Exhaust Line:** Fermentor vent line includes:

- an exhaust condenser,
- a sterile hydrophobic vent filter.
- Back pressure control valve in vent/exhaust line (Also mentioned Under pressure control)
- A Rupture disc is mounted on Fermentor vessel to relieve excess pressure during operations.

**m. Flush Bottom Valve:** It should be zero dead leg type valve attached directly to the at the bottom of the vessel, with a provision for sterilization. The diaphragm shall be of PTFE type.

**n. Sampling valve:** It should be zero dead leg type valve attached directly to the lower wall of the vessel, with a provision for sterilization. The diaphragm shall be of PTFE type.

**o. CIP (Cleaning – In – Place):** CIP shall be done using Mobile CIP trolley using CIP solution.

- SS 316L Spray ball shall be provided for the cleaning of the interior of the vessel and all the nozzles on the top lid and nozzles, ports on the vessel.
- Spray ball: Must be positioned properly to assure that all ports in top dish of vessel get properly sprayed and clean all the internal surfaces. So 2 no. of static spray ball shall be selected for the proper cleaning.

**p. SIP (Sterilization – In – Place) :**

The following principles will be applied for SIP of the system:


- The vessel should be provided with ESIP/FSIP features
- The exhaust air filters to be sterilized along with the vessel.
- The sampling valve and Flush bottom valve can be sterilized independently.
- All addition valve groups for media, inoculum, acid, alkali, antifoam are sterilized along with the vessel and also should be independently sterilizable.
- The sensors should be reusable and sterilizable type.
- Pressure reducing valve for pure steam lines
- SIP should be automatically controlled through PLC and HMI combination.

**q. Controller:** - PLC Based Controller (Non-editable data format to be obtainable) with a 15" HMI (Displaying data trends as Graphs, synoptic view of running parameters etc).

**r. SCADA software:** Windows based supervisory Control and DATA Acquisition Software for monitoring and control of various process parameters. The Software capable for remote logging and process control. The system suitable for supervisory control for multiple fermenters. The system, designed for process validation, batch management features, multi-parameter display, time based programming of set points, regulation of process by both measured and calculated variables (by using equations), equation writing and its integration for control of fermenter parameters, ability to set both high and low limits and alarms, graphic / plotting, off-line data integration (Non-editable data sheet and batch reports). Options for manual override of all values, set-points and Process parameters during the process.

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**s. The HMI shall be touch screen type (Provision for manual operation also to be provided). All setting shall be user adjustable.**

- HMI screen size shall be of 15 inches
- 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 the inoculum, media, acid, alkali and antifoam
- All Recipes/ sequences (Process, CIP, SIP, transfer etc)
- P&ID of the vessel along with instrumentation details
- Login details
- HMI screen showing simulation of valves

### 2.0.4. Nozzles to be provided :

#### 1. Top Dish

The Fermentor Top Dish will have:

- Port for foam sensor-1 No
- Port for agitator-1 No
- Port for addition of antifoam-1 No
- Port for Light/Sight Glass –Bolted with gasket-1 No
- Port for Hand hole – flushed flange with O-rings-1 No
- Port for Rupture Disc-1 No
- Port for Compound Pressure Gauge -1 No
- Port for Pressure sensor along with pressure transmitter-1 No
- Port for Spray Ball ( TC clamps with gasket)-2 Nos
- Port for exhaust Outlet Condenser with reusable, sterilizable Filter (hydrophobic vent filter 0.2µm)-1 No
- 25 mm Spare port-1 No
- Automatic back pressure control valve. -1 No

#### 2. Upper wall side:

The fermentor's upper wall side normally will have :

- Port for the addition of inoculum with sterile valve group-1 No
- Port for the addition of media sterile valve group-1 No
- Port for the addition of acid with sterile valve group-1 No
- Port for the addition of base with sterile valve group-1 No

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- 25 mm port for overlay air with separate filter -1 No
- 25 mm port for Sparger with separate filter -1 No
- Port for Differential pressure sensor-1 No
- 25 mm Spare port-1 No

#### Lower wall side:

The fermentor lower wall side shall have the following ports and elements shall be placed and fastened there:

- Ports for temperature sensor (e.g. PT 100)-1 No
- Ports for pH sensor-1 No
- Port for DO sensor-1 No
- Port for Sampling valve -1 No
- 25 mm Spare port-1 No

#### Bottom Connections

- Port for flush bottom valve – Flush welded to the bottom dish, sterilizable Zero dead leg valve -1 No
- Port for Differential pressure sensor-1 No

#### Jacket Connection

- **Jacket Bottom:** Jacket Inlet port, jacket drain
- **Jacket Upper side:** Jacket outlet port, jacket relief valve,

**Note:** The following points which are there in the IRS(Installation Requirement Specifications) are not applicable for this equipment:

➤ 4.1.10 , 4.1.11, 4.1.13,4.1.17

#### ➤ Sec 5.1 Table 2

- **SI.NO 2 and 3 :**FDA guidance for industry
- SI.NO 5 CE Conformity,
- SI.NO 7 ANSI/NSF 49-2008, ISO 14664, ISO 8362
- SI.NO 8 ISO 14664
- SI.NO 9 ISO 8362


➤ Sec 5.4.1 All metallic product contact / critical surfaces should be constructed of SS316 L grade with internal mirror finish (< 0.5m Ra for filling line and < 0.8m Ra for lyophiliser) and external surface matte finish (< 1.2μ Ra).

For surface finish values refer the point 9 under Sec 2.0.2 Table 2 mentioned in the URS

➤ Sec 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 an 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 become necessary the item must be clearly stated.
IV.	In case that the requirement includes a question or request or an 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. This TS is 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.	<b>Special Instruction</b> <ol style="list-style-type: none"> <li>If no comments against any specification shall be considered as "NO" and</li> <li>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.</li> </ol>
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/02

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Specifications	Remarks
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### 3.0 PROCESS DESCRIPTION

#### 3.1 Input & Charging method

*Note: This section also includes the charging method of process media along with charging method for material input.*

- 3.1.1 Inoculum from seed fermentor shall be transferred through sterile flexible piping with all requirements with the help of peristaltic pump (e.g. triclover clamps etc).
- 3.1.2 Pre filtered media shall be fed into the seed fermentor through sterile valve assembly using fixed speed peristaltic pump
- 3.1.3 Acid and base solution is added to the vessel to adjust the pH automatically according to set point.
- 3.1.4 Temperature of the broth to be adjusted to the working temperature with the help of utilities.
- 3.1.5 All the inlet ports to have sterile cross assemblies.

#### 3.2 Brief Process Steps

##### A) The tanks have to be designed for the preparation of media and propagation of microbial organisms respectively.

- 3.2.1 Transfer of inoculum, media, acid, alkali to the fermentor.
- 3.2.2 Antifoam is added into the vessel, whenever the foam to be controlled.
- 3.2.3 The temperature of the media is maintained by circulating the utilities in the jacket using heat exchanger or electrical heater, appropriate pumping system and temperature sensors.
- 3.2.4 Process parameters like agitator speed, pH, pressure, DO, air-flow and temperature are measured, during the process, samples can be taken through sampling ports.

#### 3.3 Output & Discharging method

- 3.3.1 The fermentation broth after the completion of fermentation cycle is harvested and clarified using membrane clarification system.

### 4.0 PRODUCTIVITY REQUIREMENT

#### 4.1 Desired/ suggested capacity

Maximum working volume – 400L

#### 4.2 Standard batch size

Max: 400L  
Min: 150L  
GV: 500L

#### 4.3 Other Productivity Requirement


- 4.3.1 Should have provision of indication of fermentation temperature, DO & pH, air-flow, pressure and agitator RPM.

### 5.0 CONTAINMENT

Not Applicable

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Specifications					Remarks
<b>6.0 GMP REQUIREMENTS</b>					
<b>6.1 Process control</b>					
The fermentor shall essentially have the necessary provisions for adjustment / control for the following critical process parameters:					
i) Temperature of the process					
ii) Pressure within the vessel					
iii) Foam					
iv) DO(Only monitoring)					
v) pH					
vi) Rate of flow of process Air (Overlay and Sparger)					
vii) Duration of CIP and temperature ,pressure during CIP					
viii) RPM of agitator					
ix) Pneumatically actuated individual valves for the clean utilities like Pure steam, CIP,PW and WFI at the header.					
<b>6.2 Failure mode detection</b>					
<b>A. Equipment shall be capable to detect the following failure, notify the operator with an alarm (if it exceeds by 0-10% (i.e. tolerance limit) of the set point value):</b>					
a) Agitator RPM is out of set range					
b) pH is out of set range					
c) Temperature is out of set range					
d) Low/high pressure					
e) Air flow being out of range					
f) Low/high volume					
g) Abrupt change in temperature in a particular time (at constant operating temperature)					
<b>6.3 In – Process control</b>					
i) Sampling of product solution.					
<b>6.4 Level of instrumentation</b>					
Sufficient and suitable instrumentation for the process, safety and productivity control as indicated in the following table:					
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### Specifications

### Remarks

Parameter

Purpose

Type of control and Instrumentation

Temperature vessel

To monitor, indicate and control the fermentation temperature.

Temperature probe with indicator and controller

Temperature jacket

To monitor, indicate and control the jacket temperature

Temperature probe with indicator and controller

pH

Monitor and control of pH (2-12)

pH probe/transmitter

Anti-foam

To monitor, control and indicate foam

Foam sensor

Dissolved oxygen

To monitor and indicate the dissolved oxygen (0-100%)

Amperometric pO<sub>2</sub> electrode

Weight/ Volume

To monitor, control and indicate weight/volume

DP sensor

Agitation

To monitor, control and indicate agitator speed

Variable frequency drive with indicator

Pressure

To monitor, indicate and control the vessel pressure and for CIP/SIP.

Pressure transducer with indicator and controller

Time

Timer control of process and monitoring CIP/SIP process

Timer (HMI)

Process Air for sparger and overlay

To monitor, control and indicate Air flow

Mass flow controller and Rotameter

Pump

To dose inoculum, media, antifoam, acid, base, etc

Peristaltic pump(4 Nos)

### 6.5 Batch data display and record printing

Refer IRS (Installation requirement Specification and Specific Instruction)

### 6.6 GMP requirements (Others)


6.6.1 The air housings in the vessel shall be provided with Staubli for in-situ integrity testing of the vent filters.

6.6.2 All nozzle connection shall be sanitary type and special attention shall be given in shape and dimension of the nozzle and connection to realize efficient cleaning and steaming process.

6.6.3 All nozzles shall be provided with sanitary valve which shall be flushed to the wall on closure and inside surface of the valves can be cleaned during CIP.


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Specifications					Remarks
6.6.4	Nozzle length shall be minimized (less than 2D) to avoid cold spot during steam sterilization.				
6.6.5	Bottom discharge and sampling valve shall be zero dead leg type.				
6.6.6	Vent shall be provided with sterilizing grade hydrophobic filter with suitable arrangement for CIP/SIP and provision for in place integrity testing.				
6.6.7	Utility operation shall be preferably automatic and valves shall be placed inside of aseptic area.				
6.6.8	Steam traps shall be provided where ever is required at the system				
6.7 Specific requirements					
6.7.1	In general the equipment has to be designed in a way to get easy and quick access to all necessary maintenance points.				
6.7.2	Nozzle shell shall be seamless.				
6.7.3	Nozzle connection to be Triclover.				
6.7.4	Nozzles, adaptors, instrument shall comply to ASME BPE compliant.				
6.7.5	Total motor drive assembly with SS304 cover with TEFC eff 1.				
6.7.6	Mechanical lifting device shall be provided to lift the top lid and to support the top mounted agitator. The supporting structure shall be included to hang or support the motor from the top.				
6.7.7	Manifold and necessary hose nipples, silicon tubes shall be provided at the top of the spray balls to connect CIP recipe/WFI, pure steam along with the pneumatic diaphragm valve operated directly through HMI.				
6.7.8	Sufficient space shall be provided from the bottom of the vessel for the cleaning and connection.				
6.7.9	Design Considerations: <ul style="list-style-type: none"><li>Jacket design Pressure: <i>(designed for Full vacuum)</i> <b>vendor to specify</b></li><li>Jacket design Temperature: <b>vendor to specify</b></li><li>Jacket working Pressure: Full Vacuum to 4 bar(g)</li><li>Jacket working Temperature: 2 °C to 135 °C.</li><li>Vessel design Pressure: <i>(designed for Full vacuum)</i> <b>vendor to specify</b></li><li>Vessel design Temperature: <b>vendor to specify</b></li><li>Vessel sterilization Temperature: 121 °C</li><li>Vessel working Pressure: Full Vacuum to 2.5 bar(g)</li><li>Vessel working Temperature: 25 °C to 134 °C.</li></ul>				
6.7.10	2 Nos of fixed speed Peristaltic pumps are required for Media, Inoculum addition with pump head compatible with the tube size:12x17 mm .				
6.7.11	2 Nos of fixed speed peristaltic pumps are to be provided for the addition of acid and alkali with the pump head compatible with the tube size:3.8 x 7 mm				
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HLL Pharmaplan®	User Requirement Specifications				
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Specifications					Remarks
6.7.12 1 No. of fixed speed peristaltic pump is required for the addition of antifoam with the pump head compatible with the tube size: 3.8 x 7mm					
6.7.13 <b>Cabling</b> All cabling and pneumatic tubing within the individual skid will be performed by Vendor. Cabling and pneumatic tubing is routed via stainless steel protective pipes with open ends. Segregation between power cables and signal cables will be provided. Motor cabling between the individual skids and the MCC's in the technical area will be performed by vendor, however cable ways and wall penetrations will be provided by the Customer. Ethernet cabling for the dedicated Control Network will be provided by Vendor, however cable ways and wall penetrations will be provided by the Customer. Line voltage supply for the individual cabinet will be provided by the Customer as follows: <ul style="list-style-type: none"><li>• 230 V AC and 230 V UPS (for controls) for each Local Control Cabinet</li><li>• 415VAC for each Motor Control Cabinet</li></ul>					
6.7.14 <b>Performance Criteria Required for FAT/SAT</b>					
Media hold with process simulation including all peripheral equipments including of seed fermentor during SAT					
Pressure hold test to be performed before every SIP					
Spray ball coverage Test during FAT					
Thermal mapping					
All control system simulation and tuning of control loops					
All FAT/SAT,IQ,OQ as per IRS					
7.0 CONSTRAINTS					
7.1 Equipment location and available space					
This equipment will be installed in the <b>Diphtheria block of DPT vaccine manufacturing Facility at PII, Coonoor.</b>  <b>Equipment Location:</b> <u>Fermentation room (B1G048)</u> <b>Block:</b> Diphtheria Block <b>Floor:</b> Ground Floor <b>Room Size:</b> 5800(L) X 6150(W) mm, 4300(L) X 4610(W) mm, 1600 (L) X4610(W) mm <b>False Ceiling height:</b> 4000 mm <b>Physical condition of the rooms:</b> <ol style="list-style-type: none"><li>1. Room will be BSL 2</li><li>2. Class: EU Class “C”</li><li>3. Differential Pressure:5 Pa</li><li>4. Temperature maintained: 22±2 °C</li><li>5. Relative Humidity: NMT 55% RH</li></ol> The equipment location is indicated in the relevant block of the layout enclosed as <b>URS Annex-1.</b>					
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Specifications	Remarks
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### 7.2 Available Utility

a) Plant steam @ 3–3.5 bar (g) and 130 <sup>0</sup> C-150 <sup>0</sup> C----- (Report requirement)	
b) Pure steam @2.4 bar (g) and 121 <sup>0</sup> C-130 <sup>0</sup> C----- (Report requirement)	
c) WFI (Hot loop) @2 bar(g) and 80 <sup>0</sup> -85 <sup>0</sup> C ----- (Report requirement)	
d) Cooling water @3 bar(g) and 28 <sup>0</sup> C-30 <sup>0</sup> C ----- (Report requirement)	
e) Chilled water @ 7 °C to 12 °C----- (Report requirement)	
f) Electricity – 415V/3ph/50Hz, 240V/1ph/50Hz	
g) Compressed air @ 6.0– 8.0 bar (g)	
<b>Note: Utility consumption to be specified by the vendor, in case if there is any deviation in the values mentioned above.</b>	

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## 8.0 ABBREVIATION

Abbreviation	Definition
°C	Degree Centigrade
FER	Microbial Fermentor
HMI	Human Machine Interface
ISO	International Standards Organization
MOC	Material Of Construction
NPI	NNE Pharmaplan India Ltd
PII	Pasteur Institute of India
PLC	Programmable Logic Controller
PID	Proportional Integral Derivative
QA	Quality Assurance
RPM	Revolutions Per Minute
SS	Stainless steel
NMT	Not More Than

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### REVISION INDEX

Revision	Date	Reason for Revision
00	2012-05-18	1 <sup>st</sup> draft for client's review
01	2012-10-18	Format changed as per HLL requirement
02	2013-01-24	HLL comments incorporated, received during the workshop dated 22 <sup>nd</sup> and 23 <sup>rd</sup> January 2013
03	2013-02-28	PIIC comments incorporated received on 26 <sup>th</sup> February 2013
04	2013-04-26	As per HLL comments dated on 25 <sup>th</sup> April 2013 by mail.
05	2013-05-15	As per the Telephonic discussion with HLL on 2013.05.13.Following major changes are incorporated: <ul style="list-style-type: none"> <li>Jacket MOC changed to SS304</li> <li>1 peristaltic pump is required for the addition of inoculum, media and 2 Peristaltic pump required for the addition of acid and alkali and 1 peristaltic pump for antifoam</li> <li>Electrical heater, heat exchanger and steam required for temperature control. Bourdon type pressure gauge for jacket is included under temperature control.</li> <li>HMI screen size changed as 15"</li> <li>Repeated points under SIP details are deleted</li> <li>No. of cycles for CIP,SIP deleted under process control</li> <li>Port for addition of inoculum provided on the upper wall side</li> <li>Sec 3.2.1 Input and charging method of media has been modified</li> <li>Sec 6.1 Under process control, No. of cycles(CIP,SIP) deleted</li> <li>Sec 6.4 Level of instrumentation <ul style="list-style-type: none"> <li>Mass flow controllers deleted</li> <li>No. of pumps changed to 4</li> </ul> </li> <li>Point 6.7.10 Peristaltic pump specifications modified as 1 No. of fixed speed peristaltic pump for the addition of inoculum and media with tube size:12 x17 mm</li> <li>Point 6.7.11 2 No.of Peristaltic pump for the addition of acid and alkali with tube size:3.8/7 mm</li> <li>Point 6.7.12 1 No.of Peristaltic pump for the addition of antifoam with tube size:3.8/7 mm</li> <li>URS Annex 3: List of preferred MAKE of components modified <ul style="list-style-type: none"> <li>SI.No 3 Agitator removed</li> <li>SI.No 6 Pressure sensor deleted</li> <li>SI.No 9 pressure regulator-FESTO retained</li> <li>SI.No 22 and 23: Sampling valve and Flush bottom valve: GEMU included</li> <li>SI.No 31 Control panel deleted from the list</li> <li>SI.No 34 Electrical motor deleted</li> </ul> </li> </ul>
06	2013-06-21	As per comments from HLL by email on 2013-06-12
07	2013-06-27	As per the comments received from HLL over telephone on 2013-06-27 <ul style="list-style-type: none"> <li>Sec 2.0.3 n) SIP <ul style="list-style-type: none"> <li>Included that the addition valve groups shall be Independently sterilizable</li> </ul> </li> <li>6.7.6 Hydraulic lifting device for lid replaced by mechanical lifting device</li> <li>2.0.4 SCADA <ul style="list-style-type: none"> <li>Non editable data format included</li> </ul> </li> </ul>

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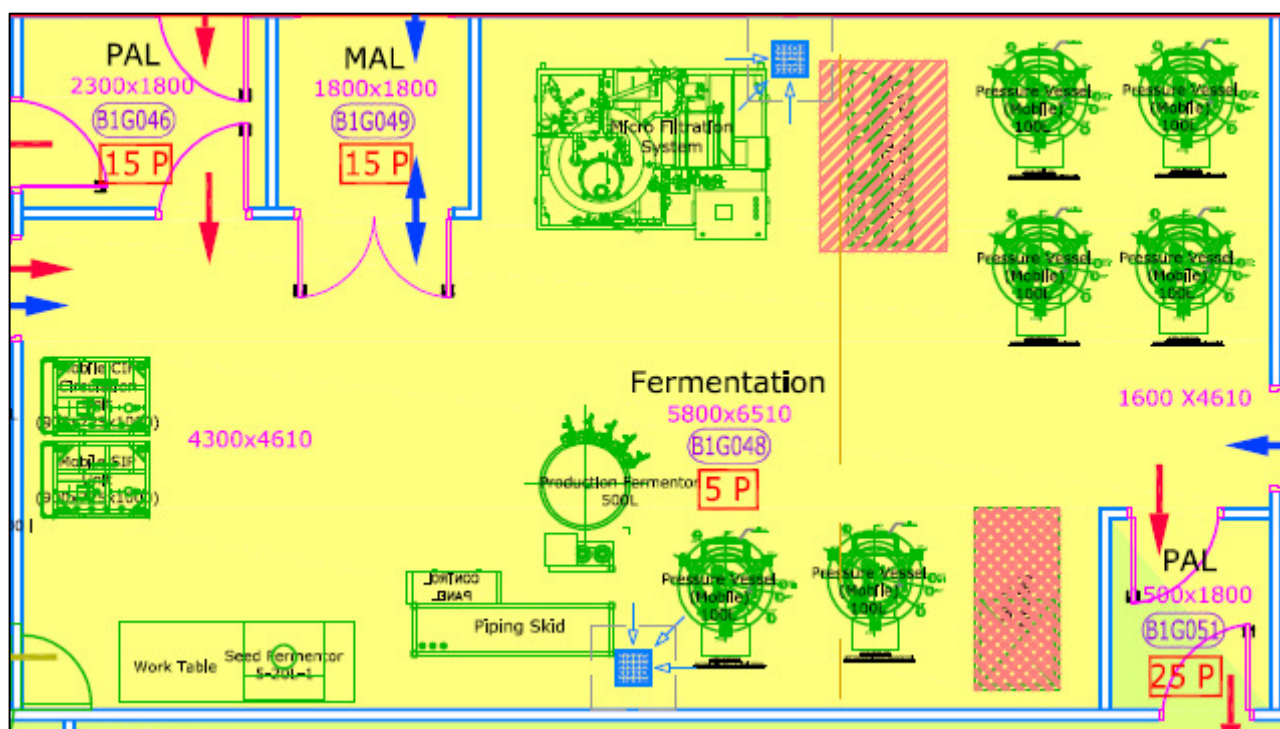
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### URS Annexure 1: LAYOUT OF DIPHTHERIA BLOCK

#### Room No: B1G048



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### URS Annexure 3: List of Preferred Make of components

SL.NO	DESCRIPTION	MAKE
<b>A</b>	<b>INSTRUMENTATION</b>	
1.	PLC	Allen Bradley/ Siemens
2.	Operator Interface/HMI	Allen Bradley/ Siemens
3.	Temperature transmitter	Radix/ Yokogawa/Emerson
4.	Temperature sensor	NEGELE
5.	p H sensor	METTLER TOLEDO/E&H
6.	Pressure transmitter	Wika /Dwyer/Sensocon
7.	Pressure regulator	FESTO
8.	Temperature indicator	Radix/ Wika/ Waaree instruments
9.	Steam trap	Spirax Marshall
10.	Printer	Epson/ HP/ Canon
11.	DC source	Shavision/ Yokogawa/ Emerson
12.	Rupture Disc	Zook / Elfab/Fike
<b>B</b>	<b>MECHANICAL</b>	
13.	Pressure gauges	WIKA/Denver/Negele
14.	Pre air filter cartridge	Sartorius/PALL / Millipore
15.	Vent filter cartridge	Sartorius/PALL/Millipore
16.	Filter housing	Sartorius/ PALL/Millipore
17.	Spray ball	HAKE/LECHLER
18.	Diaphragm valve(Manual)	GEMU/ Burkert
19.	Ball valve(Manual)	Modentic/Saunders/Alfa laval
20.	Non return valve	Modentic/Saunders/Alfa laval
21.	Sampling valve	Novaseptic/GEMU
22.	Flush bottom valve	Novaseptic/GEMU
23.	Pressure/Safety relief valve	HEROSE/SS Spirax /Amtech valves
24.	Flow switch	Orion/ Wika/Emerson
25.	Rotameter	GEMU/Allborg
26.	Agitator	PRG/Lightnin/Chemineer

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SL.NO	DESCRIPTION	MAKE
27.	Peristaltic pump	Watson Marlow/Masterflex
<b>C</b>	<b>PNEUMATIC</b>	
28.	Diaphragm valve(Automatic)	GEMU/ITT
29.	Angle seat valve(Automatic)	GEMU/ITT
<b>D</b>	<b>ELECTRICAL</b>	
30.	Lamp	PAPENMEIER
31.	Heater	Common wealth