

Revival of DPT Vaccine Manufacturing Facility, PII, Coonoor

nne pharmaplan®

User Requirement Specifications



Equipment/System

Microbial Fermentor

Identification #

P-FER 01-02

Document#

URS/P-FER 01-02

Effective Date #

2013-06-27

Revision#

07

User requirement specifications

Microbial Fermentor

Process Code	Area	Equipment code	Qty(Nos)	Capacity
P	PERTUSSIS	P-FER 01	2	500L G.V.
		P-FER 02		500L G.V.

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URS Annexure List

URS Annex No.	Detail
1.	Layout showing the location of the Microbial fermentor in Pertussis Block
2.	Tentative P&ID for Pertussis Microbial 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 “**Microbial fermentor**”. A Microbial 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 Microbial fermentor including control panel will be installed in a clean room of Class “C”.

This Microbial fermentor is for batch operation.

The equipment should consist of the following parts in order to run the operation smoothly.

2.0.1. Table -1

S. No.	Description	Purpose	MOC
1.	Shell	Cylindrical, for fermentation	SS316L
2.	Top closure	Torispherical dish	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 to be 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	500L
2.	Maximum working volume	400L
3.	Quantity	2 No
4.	Min mixing volume	180 L
5.	Fermentation temperature	35±1 ⁰ C
6.	Rise in temperature (heating capacity)	4 deg C/min
7.	Fall in temperature (cooling capacity)	4 deg C/min

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8.	Temperature control deviation	$\pm 0.1^{\circ}\text{C}$
9.	Surface Finish	Internally Electro polished $Ra \leq 0.6 \mu\text{m}$, conforming to SFC4, according to ASME BPE(2009)
		Externally Mechanically polished up to $Ra < 1.2 \mu\text{m}$ matt finish for the jacket. Top and bottom dish - mirror finish.
		Stainless steel piping interior $Ra \leq 0.6 \mu\text{m}$, conforming to SFC4, according to ASME BPE(2009)

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:

- Dosing Unit for Inoculum:** Inoculum will be added to the fermentor by flexible hose through the sterile valve assembly and individual Peristaltic pump .
- 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
- 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
- Dosing unit for Media:** Media shall be brought into the pressure vessel and then transferred in microbial fermenter using pump. Media shall be sterilized and cool down to the ambient temperature.
- DO monitoring::**
 - By using In-situ amperometric DO probe
- Aeration Supply System(Overlay):** Aeration system consists for Overlay :

Process air requirement for overlay is 14-18 LPM


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

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

- 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 $35-37^{\circ}\text{C}$ (tolerance limit: $\pm 0.1^{\circ}\text{C}$) & during sterilization (tolerance limit: $\pm 0.1^{\circ}\text{C}$)

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- 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

h. 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

i. 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.
 - Thermosyphon 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

j. 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.


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- k. 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.
- l. 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.
- m. CIP (Cleaning – In – Place):** CIP shall be done using by using Mobile CIP trolley.
- 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.
- n. 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 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 line
 - SIP shall be automatically controlled through PLC and HMI combination .
- o. 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).
- p. SCADA software:** Common SCADA for the fermenters shall be provided.
- 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.
- q. 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
 - All Recipes/ sequences (Process, CIP , SIP, transfer etc)
 - P&ID of the vessel along with instrumentation details
 - Login details

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- HMI screen showing simulation of valves

2.0.4. Nozzle schedule :**1. Top Dish**

The Microbial fermentor top dish will have:

- Port for Light/Sight Glass – Bolted with gasket-1 No
- Port for Hand hole – flushed flange with O-rings-1 No
- Port for agitator-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 0.22µm) - TC clamps with gasket -1 No
- 25 mm Spare port-1 No
- Automatic back pressure control valve.-1 No

2. Upper wall side:

The Microbial 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 with sterile valve group-1 No
- Port for the addition of acid with sterile valve group- 1 No
- Port for the addition of Alkali with sterile valve group-1 No
- 25 mm port for overlay air with separate filter -1 No
- 25 mm Spare port1 No-1 No
- Port for DP sensor1 No-1 No

3. Lower wall side:

The Microbial 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

4. Bottom Connections

- Port for flush bottom valve – Flush welded to the bottom dish, sterilizable Zero dead leg valve-1

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No

- Port for DP sensor- 1 No

5. 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 becomes 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.	<p>Special Instruction</p> <p>a. If no comments against any specification shall be considered as "NO" and</p> <p>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.</p>
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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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 Microbial fermentor shall be transferred through sterile flexible piping with all requirements with the help of peristaltic pump (e.g. triclover clamps etc), Provision for sterilization.					
3.1.2 Media solution from the pressure vessel will be transferred to the fermentor with the help of peristaltic pump. And Insitu sterilisation of the media shall take place and cool down of the temperature.					
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 has been 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 preparation of media and propagation of microbial organisms respectively.					
3.2.1 Transfer of inoculum, media, acid, alkali to the Microbial fermentor.					
3.2.2 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.					
3.2.3 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 fermented broth shall be transferred to the microfiltration system through fixed SS piping with the help of pressure.					
4.0 PRODUCTIVITY REQUIREMENT					
4.1 Desired/ suggested capacity					
Maximum working volume – 400L					
4.2 Standard batch size					
Max: 400L Min: 180L 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.					
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4.4 Change over time					
Not Applicable					
5.0 CONTAINMENT					
Not Applicable					
6.0 GMP REQUIREMENTS					
6.1 Process control					
6.1.1 The Microbial 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) DO(Only monitoring)					
iv) pH					
v) Rate of flow of process Air (Overlay)					
vi) Duration of CIP and temperature ,pressure during CIP					
vii) RPM of agitator					
viii) Pneumatically actuated individual valves for the clean utilities like Pure steam, CIP,PW and WFI at the header.					
6.2 Failure mode detection					
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):					
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)					
6.3 In – Process control					
i) Sampling of product solution.					
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Remarks

6.4 Level of instrumentation

Sufficient and suitable instrumentation for the process, safety and productivity control as indicated in the following table:

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
Dissolved oxygen	To monitor and indicate the dissolved oxygen (0-100%)	Amperometric pO ₂ 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	Air flow to monitor, indicate and control	Mass flow controller and Rotameter
Pump	To dose inoculum, media, acid, alkali etc	Peristaltic pump(3 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 connectors 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

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closure and inside surface of the valves can be cleaned during CIP.					
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 in the system				
6.7 Specific requirements					
6.7.1	Seed Transfer through flexible piping from the seed Microbial fermentor in the same room (peristaltic pump control)				
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, clean 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">Jacket design Pressure: (designed for Full vacuum) vendor to specifyJacket design Temperature: vendor to specifyJacket working Pressure: Full Vacuum to 4 bar(g)Jacket working Temperature: 2°C to 135°C.Vessel design Pressure: (designed for Full vacuum) vendor to specifyVessel design Temperature: vendor to specifyVessel sterilization Temperature: 121 °CVessel working Pressure: Full Vacuum to 2.5 bar(g)Vessel working Temperature: 25°C to 134°C.				
6.7.10	1 No. of fixed speed Peristaltic pump is required for Media, Inoculum addition with the pump head compatible with the tube size:12/17 mm				
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Specifications		Remarks
6.7.11	2 Nos. of fixed speed Peristaltic pump is required for acid and alkali addition with pump head compatible with the tube size:3.8/7 mm	
6.7.12	1 No1s. of fixed speed Peristaltic pump is required for antifoam addition with the pump head compatible with tube size:3.8/7 mm	
6.7.13	Cabling 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">• 230 V AC and 230 V UPS (for controls) for each Local Control Cabinet• 415VAC for each Motor Control Cabinet	
6.7.14	Performance Criteria Required for FAT/SAT	
	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 DPT vaccine manufacturing Facility at PII, Coonoor. Equipment Location: <u>Fermentation room (B1G009)</u> Block: Pertussis Block Floor: Ground Floor Room Size: 4300(L) X 4610(W) mm, 3410(L) X 6510(W) mm, 1600(L) X 4610(W) mm False Ceiling height: 4000 mm Physical condition of the rooms: <ol style="list-style-type: none">1. Room will be BSL 22. Class: EU Class “C”3. Differential Pressure:5 Pa Absolute4. Temperature maintained: 22±2 °C5. Relative Humidity: < 55% RH The equipment location is indicated in the relevant block of the layout enclosed as URS		
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Specifications	Remarks
Annex-1.	
7.2 Available Utility	
a) Plant steam @ 3–3.5 bar (g) and 130°C-150°C----- (Report requirement)	
b) Pure steam @2.4 bar (g) and 121°C-130°C----- (Report requirement)	
c) WFI (Hot loop) @2 bar(g) and 80°-85°C ----- (Report requirement)	
d) Cooling water @3 bar(g) and 28°C-30°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)	
Note: Utility consumption to be specified by the vendor, in case if there is any deviation in the values mentioned above.	

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 st 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 nd and 23 rd January 2013
03	2013-02-28	PIIC comments incorporated, received on 26 th February 2013
04	2013-04-26	As per HLL comments dated on 25 th 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"> Jacket MOC changed to SS304 1 peristaltic pump is required for the addition of inoculum, media and 2 Peristaltic pump required for the addition of acid and alkali . Electrical heater, heat exchanger and steam required for temperature control. Bourdon type pressure gauge for jacket is included under temperature control. HMI screen size changed as 15" Repeated points under SIP details are deleted No. of cycles for CIP, SIP deleted under process control Port for addition of inoculum provided on the upper wall side Input and charging of media modified in sec 3.1 Sec 6.1 Under process control, No. of cycles(CIP, SIP) deleted Sec 6.4 Level of instrumentation <ul style="list-style-type: none"> No. of pumps changed to 4 Point 6.7.10 Peristaltic pump specifications modified as 1 No. of fixed speed peristaltic pump for the addition of inoculum and media with size:12 x17 mm Point 6.7.11 2 No.of Peristaltic pump for the addition of acid and alkali with tube size:3.8/7 mm Point 6.7.12 1 No.of Peristaltic pump for the addition of antifoam with tube size:3.8/7 mm URS Annex 3: List of preferred MAKE of components modified <ul style="list-style-type: none"> SI.No 3 Agitator removed SI.No 6 Pressure sensor deleted SI.No 9 pressure regulator-FESTO retained SI.No 22 and 23: Sampling valve and Flush bottom valve: GEMU included SI.No 31 Control panel deleted from the list SI.No 34 Electrical motor deleted
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"> Sec 2.0.3 n) SIP <ul style="list-style-type: none"> Included that the addition valve groups shall be Independently sterilizable 2.0.4 p)SCADA Non editable data format included 6.7.6 Hydraulic lifting device for lid is replaced by mechanical lifting device

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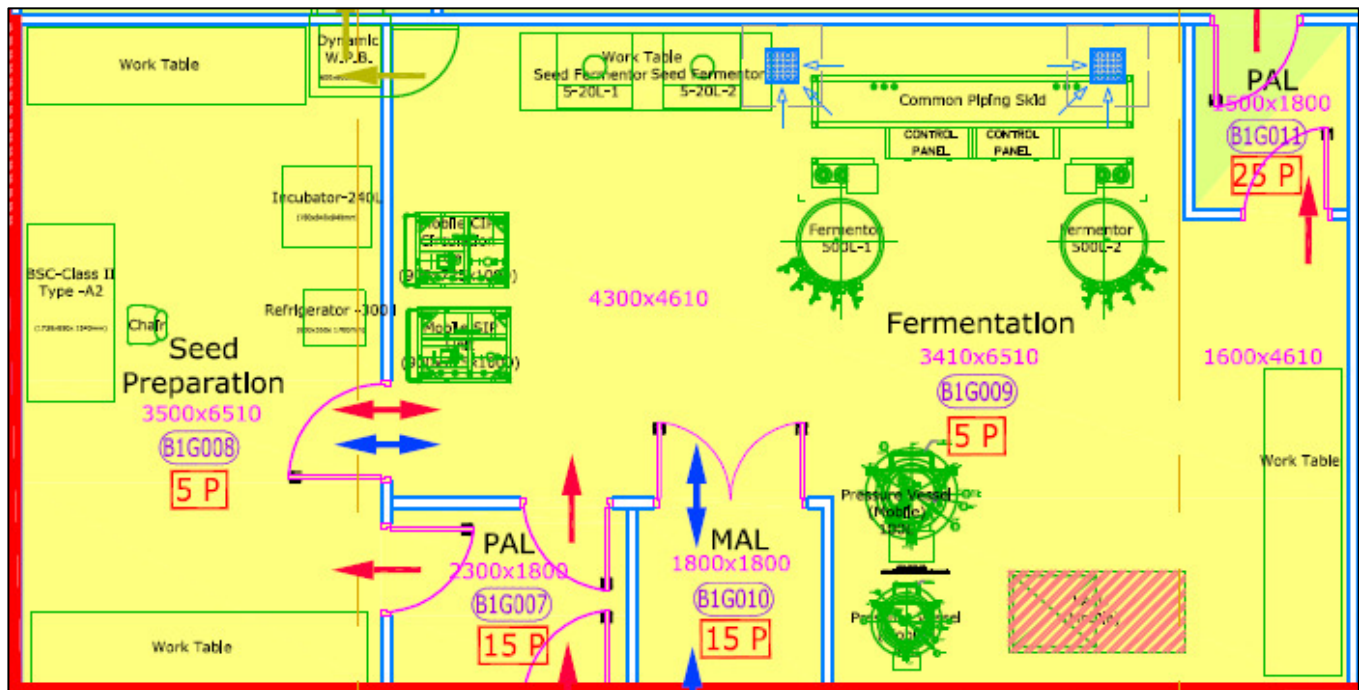
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URS Annexure 1: LAYOUT OF PERTUSSIS BLOCK

Room No : B1G009



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URS Annexure 3: 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
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	MECHANICAL	
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
27	Peristaltic pump	Watson Marlow/Masterflex

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C

PNEUMATIC

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Diaphragm valve(Automatic)

GEMU / ITT

29

Angle seat valve(Automatic)

GEMU / ITT

D

ELECTRICAL

30

Lamp

PAPENMEIER

31

Heater

Common wealth