



GREEN BOOK

(Compilation of various standards related to new manufacturing plants set up)

Revision 01
March-2025





Green Book

Document Number	UML-GB-00
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CMD message

Dear Team,

As you are aware, our long-term business plan necessitates enhancing our production capacity by establishing new plants and expanding existing ones. These projects present an exciting opportunity to not only increase output but also elevate our processes, design, and infrastructure.

Customer demands are also evolving, with a growing focus on early quality maturation of new products, improved traceability, and competitive pricing. Additionally, maintaining a unified brand experience through a consistent design aesthetic across all plants is crucial.

To meet these requirements, we need to make our project planning and execution more structured and efficient, ensuring uniformity across the Group.

To support our project teams, a dedicated team has developed standards in the following areas:

1. Project Planning
2. Land Selection
3. Building Design
4. Plant Layout Design
5. Interior Design
6. Utility and IT Infrastructure
7. EHS & ESG aspects
8. Industry 4.0

I am pleased to announce that the team has worked collaboratively with various stakeholders and prepared a project management Green Book, capturing the standards in these areas.

I urge all teams to use this Green Book as a tool for more efficient plant setup, leading to improvements in plant SQPCDM (Safety, Quality, Productivity, Cost, Delivery, and Morale). The opportunity to set up new plants or expand existing ones occurs only once in 10-15 years. Therefore, we must capitalize on this opportunity to achieve significant improvements in all aspects of SQPCDM from the start of operations through better planning, one-piece flow layout, considering all EHS & ESG aspects, and embracing digitalization/Industry 4.0.

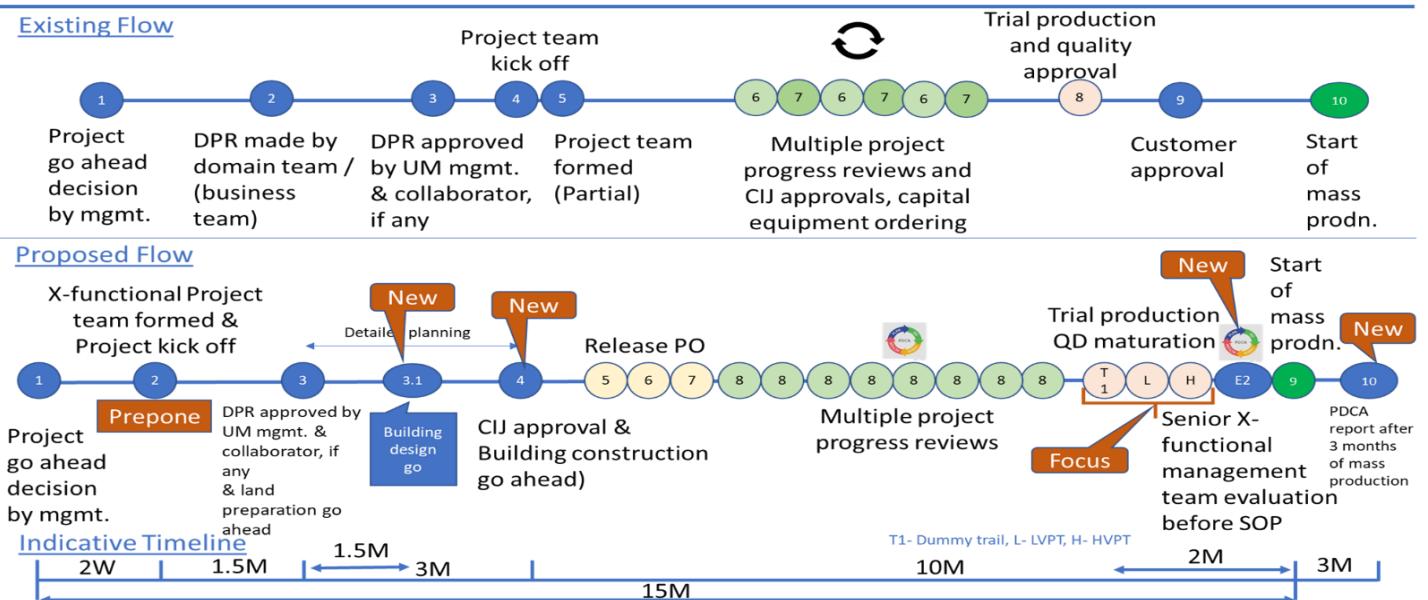
I strongly believe the above initiative will help us set up world class manufacturing facilities reaffirming Uno Minda market leadership.

Thank you for your commitment to these standards.

Amendment

- 1) Key user matrix is added (Page 9)
- 2) 3.1: Project implementation flow revised (Page 14) – As illustrated below

Difference Points Between Present & Proposed New Project Flow with Indicative Timeline



- 3) 3.2: Project team structure and Roles & responsibilities are defined (Page 16, Annexure 3-1)
- 4) 3.2: RASI for building construction & govt. approval is added (Page 16, Annexure 3-2)
- 5) 3.3 DPR flow chart & contents are kept as per MFM policy 29 with Project target setting sheet Annexure 3-3 (Page 17)
- 6) 3.4 New project overall planning workflow added for reference (Page 18-19)
- 7) 3.4.1: New plant target setting is modified as a project target setting (Page 20, Annexure 3-3)
- 8) 3.7: Master schedule is modified (Page 24)
 - a. PM00, 01, 02... are removed
 - b. Before start of construction activities are added
 - c. Functional training / OJT is added
 - d. Progress review frequency and reviewer are added
- 9) 3.7: Green book adherence checksheet is added (Page 24, Annexure 3-4)
- 10) 3.7: New project approval matrix is added (Page 25)
- 11) 7.2: Interior material finish specification template is added (Page 113)
- 12) 7.3: Colour standards for equipment, machines, SPM, & robots are added (Page 114)
- 13) 7.4: Colour standards for shopfloor/floors/walkway/offices are added (Page 116)
- 14) 11.3: Industry 4.0 various use cases are added (Page 180)
- 15) 11.5: Industry 4.0 scope finalization revised as per revised use cases (Page 182)
- 16) 11.7: Industry 4.0 team formation revised as per DT structure (Page 184)
- 17) 11.9: IoT enabled machine – Guidelines and checksheet are added (Page 185, Annexure 11-2, 11-3)
- 18) 12.: General guidelines are revised with new plant key guidelines (Page 204)
- 19) 13.: New chapter 13 (Learnings) is added (page 205)

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Key users - Matrix

User→ Chapter ↓	Project leader	Production engineering	Industrial Engineer	Utility & Maintenance	HR	PPC, Stores & Logistics	Business Team Industry 4.0	Minda Infra / Building contractor
Project planning	✓	✓			✓			✓
Land selection								
Building design	✓							✓
Layout design	✓	✓	✓					
Interior design	✓							✓
Utility	✓			✓				✓
IT infra								
EHS & ESG				✓	✓			
Industry 4.0	✓							✓
General guidelines	✓	✓	✓	✓	✓	✓		✓
Learnings	✓	✓	✓	✓	✓	✓		✓

User→ Chapter ↓	Unit Finance Head	Group IT	Corporate manufacturing & Industry 4.0 (New Projects)	Corporate EHS/ ESG	Govt liaisoning / Regulatory approvals	Plant Quality Head	Business Material Head	Product Development Head
Project planning	✓							
Land selection								
Building design					✓		✓	✓
Layout design							✓	✓
Interior design							✓	✓
Utility							✓	✓
IT infra		✓						
EHS & ESG				✓	✓			
Industry 4.0		✓	✓					
General guidelines				✓				
Learnings				✓				

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1 Brief about the Green Book

Objective

To bring uniformity & standardization in various aspects of setting up of new manufacturing plants at group level while keeping the ultimate goal of achieving operational excellence (SQPCDM).

Methodology/approach

By developing group level manual (Green book) using existing standards, processes and procedures, regulations, benchmarking, learnings from few past new projects while adhering to Vaastu guidelines, collaborators guidelines and corporate social responsibility guidelines.

Scope

All new plants (standalone and industrial complex- including relocation plants)

- Project planning
- Land selection
- Building design
- Plant layout design
- Interior design
- Utility and IT infra
- EHS & ESG aspect of plant
- Industry 4.0

2 Output from this Green Book

Overall output

To bring “uniformity and standardization” in new project planning, target setting, plant design, execution, review, and basic equipment specifications at the group level.

In terms of SQPCDM

Establish/ propose basic guidelines/ standards related to the following:

Safety (EHS & ESG)

- Safer building design.
- Safer equipment design (production, testing, utility equipment etc.).
- Building & equipment design related guidelines for achieving targeted reduction of environmental footprint.

Quality

- Item specs, building specs, building design (aesthetic aspect) for better quality building.
- Construction quality check mechanism for ensuring better quality construction.

Productivity

- Has a smoother flow and material movement.
- WIP optimization.

Cost

- Investment : Building and plant infrastructure specs to optimize investment.
: Mechanism to ensure that the project cost remains within target cost.
- Running cost : Building and utility equipment specs to minimize running cost of the plant (during mass production stage).

Delivery

- Plant design and layout basic concept /guideline so that the plant is future ready plant (plant design/ layout etc. made keeping in view long term business needs & technology trend).
- Equipment and system design so that the plant is industry 4.0 ready from the plant design stage itself.

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👉 **Morale**

- Establish a new plant planning, target setting, execution and progress review basic workflow (from project go till project completion) to achieve the following:
 - Smooth project planning & execution
 - Reduced project planning and execution time
 - Facilitate objective project target setting, progress review (PDCA rotation) & target achievement
 - Ensure govt. regulation compliance
- Establish basic building/utility equipment design related guidelines to improve the engagement level of the employees (like lux level, air quality, canteen design etc.)/ make the new plant an employee friendly plant.
- Establish a basic standard project target setting template for better project PDCA rotation.

👉 **Brief list of topics covered in the Green Book**

S. No.	Topics name
1	Project planning
2	Land selection
3	Plant layout design
4	Building design
5	Utility & IT Infra
6	EHS & ESG aspect of the plant
7	Interior design
8	Industry 4.0



3. Project planning

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3 Project planning

西红 Objective

The objective of this manual is to define the basic new project planning approach (including formats and workflow) that may be followed for any new project including green field, expansion in existing plant/project, brown field project.

西红 Scope

New project planning manual covers all aspects of any new project planning starting from management approval till the start of mass production and also includes a review of all the SQPCDME aspects even 3 months after the start of mass production (to check the project target achievement in real mass production conditions and to summarize the learnings from the project as a knowhow for the future projects).

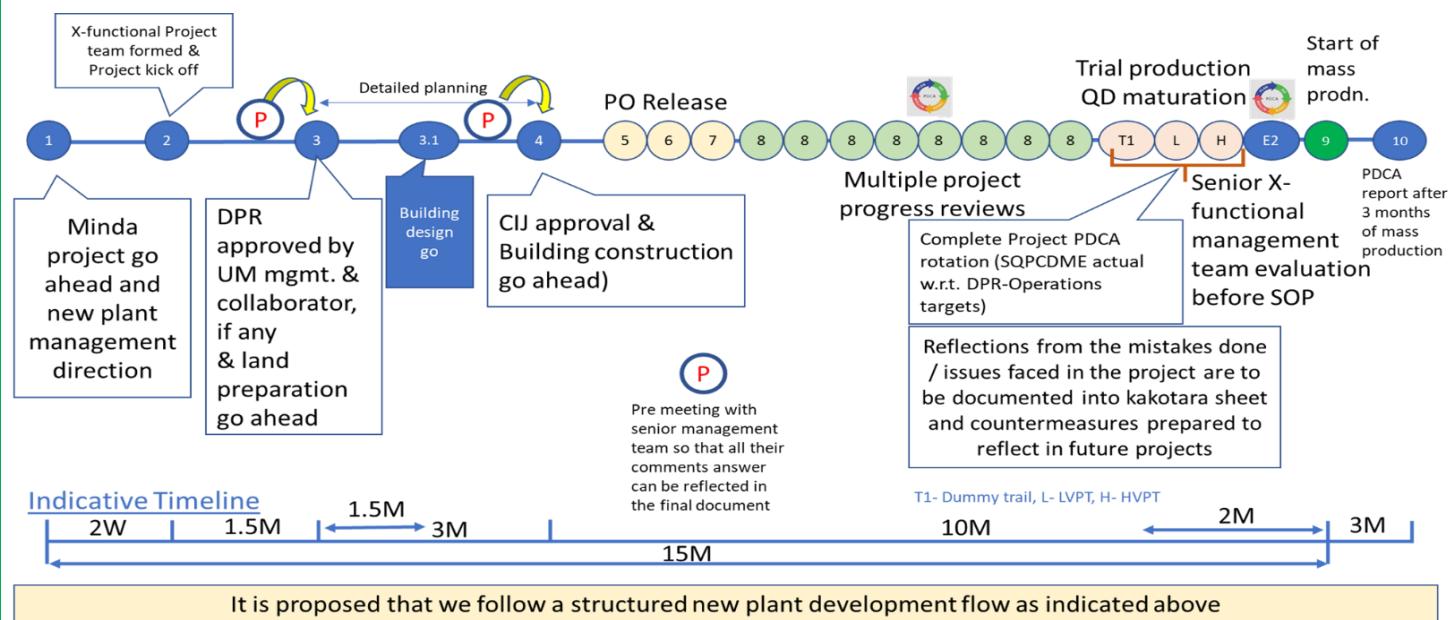
西红 Applicability

The enclosed processes /work flows as described/defined in the Green Book are applicable to all Uno Minda Group subsidiary companies. Other Uno Minda group companies may follow these processes / work flows or may follow their own processes /work flows. The choice is left to all such companies other than subsidiary companies.

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3.1 New project planning and implementation basic flow

The basic idea is to follow a structured approach towards project planning, implementation & project management with strong focus on planning and systematic periodic PDCA cycle rotation use in various review stages.



NOTE:

1. New Projects means:
 - a. Setting up of unit for new product is a new project and will follow the flow chart of new project approval.
 - b. Existing Business Expansion:
 - i. Existing product expansion by way of setting up new independent unit at different location from that of existing unit would be new project and will follow the flow chart for new project approval i.e., DPR approval (no need for PMS & PPR).
 - ii. Expansion of the exiting unit at the same site would not be a New Project. CAPEX for the expansion would be approved as part of budget approval.

Exception could be if the expansion at the existing site is substantial and it is decided by the budget committee that a separate DPR to be prepared/approved.
2. In case of expansion of existing products, review committee to give go ahead to make DPR on recommendation of the Domain head.
3. DPR Approval:
 - o DPR relating to 'new product' would be approved by Supervisory Board in Group Strategy Meeting and thereafter by the Board of Directors of the concerned company
 - o In case of DPR relating to 'existing product', DPR would be first approved by review committee and then by Board of Directors of the concerned company.
4. Any 'New Project' for new products on which Group Strategy at corporate office is working would be handed over to the concerned Domain after PMS/PPR as per decision of MD.
5. Main purpose of DPR (MFM policy 29) is as follows:
 - a. To fix basic project basic schedule
 - b. SQPCDME project targets set
 - c. Initial building goes ahead and long lead time equipment ordering approval
6. Main purpose of project completion final review before start of mass production is as follows:
 - a. To review the project performance in all area of SQPCDME before the start of actual mass

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- production Including the SQPCDME performance review of the LVPT/HVPT lots PDCA report.
- b. Actual mass production condition check by the senior management at the actual workplace (GEMBA).
 - c. To judge whether plant is ready for achieve actual mass production especially with respect to Q&D area.
 - 7. Main purpose of PDCA after 3 months of mass production is as follows:
 - a. To check whether SQPCDME targets are being achieved in the actual mass production condition or not (especially Q&D related target PDCA)
 - b. To make a learning sheet based on the gaps w.r.t set/target which can be used for the making of future projects.
 - 8. Any new project for new business on which group strategy at corporate office is working would be handed over to the concerned domain after PMS/PPR as per decision of the MD.

3.2 New plant start (Go) related basic documents

Any new project starts with a basic document issued by the management, called Project Go document. This document has basics about the project and also management direction regarding the project. Basic formats that may be used for this purpose is as below-

Content of Project Go document:

- **Background and need- Example**
 - Existing Manesar facility is in residential zone and we are currently operating with special permission from authority
 - Space constraint for future expansion w.r.t future sales increase opportunity
- **Management Direction- Example**

To set up globally competitive (in terms of SQPCDME), future ready, ecology and employee friendly manufacturing plants at Farukhnagar using this opportunity of relocation of the plant which will set a new benchmark in all areas of SQPCDME within Uno Minda group and where everyone is culturally aligned to the values of Uno Minda group & convert the limitation into an opportunity.
- **Key inputs specific to the project- Example**
 - Product(s) and Product segment (2W/4W etc.): _____
 - Collaborator (if any) and nature of collaboration (JV/TC/TAA): _____
 - Plant location: _____
 - Benchmark plant or mother plant (location): _____
 - Tentative capacity: _____
 - Tentative mass production start date: _____
 - Likely customers (including international customers, if any): _____
- **Content of project Kick off document**
 - Project Go documents
 - Project basic overall schedule.
 - Project organization chart (Refer to document below).



Organization
Structure (New project)

Annexure 3-1 Organization Structure (New project team) and R&R

- RASI for new project (Building construction related) – Refer to document below

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RASI chart_New
Projects_New plant_

Annexure 3-2 RASI chart: New Projects building construction related

- **Content of PDCA report of SQPCDME related targets after 3 months of start of mass production:**

D (Delivery)

- Daily plan vs actual for 3 months:
 - Gap, reason analysis, countermeasure plan & future learning

Q (Quality)

- Quality PPM plan vs actual:
 - Gap, reason analysis, countermeasure plan & future learning
- Customer complaints:
 - Reason analysis, countermeasure plan & future learning
- Warranty complaints:
 - Reason analysis, countermeasure plan & future learning

3.3 Contents of documents for various planning & progress reviews

S No	6M and E&T	Description	* Sheet No.	DPR	Final review before SOP	PDCA after 3 months of SOP
1	Management	Assumptions Sheet	A1	O	X	X
		Background and Need of the Project	A2	O	X	X
		Management direction	Chapter 3.3	O	X	X
		SWOT Analysis	A3	O	X	X
2	Money	Profit & Loss Statement	B1	O	O	X
		Schedules to Profit & Loss statement	B1.1 to B1.5	O	O	X
		Project Analysis Sheet	B2	O	O	X
		Working Capital Statement	B3	O	O	X
		Balance sheet	B4	O	O	X
		Project cost and means of financing	B5	O	O	X
		Cash flow statement	B6	O	O	X
		Details of Preoperative expenses	B7	O	O	X
		Subsidy/Incentives	B8	O	O	X
		Extra-long lead time equipment detail investment & proposed supplier	B9	O	X	X
3	Marketing	Business Development & Sales Plan	C1	O	O	X
4	Materials	RM Cost Details	C1	O	O	X
5	E&T	Technology Roadmap	D1	O	X	X
6	Manufacturing	Overall plant & each shop concept	Chapter 3.5&3.6	O	X	X
		Overall Project Schedule	E1	O	O	X
		** Project Target Setting	-	O	O	X
		Process Flowchart	E2	O	O	X
		Capacity sheet	E3	O	O	X
		Capex details	E4	O	O	X
		Details of power/water/ Compressed air requirements	E5	O	O	X
		Exports Commitments under EPCG	E6	O	O	X
		Plant layout	E7	O	O	X
		Man & Material Flow	E7.1	O	O	X
7	Manpower	Project Team	F1	O	O	X
		Details of Manpower	F2	O	O	X
		Organization Structure - aligned to SOS & MOS & Internal Transfers	F3	O	O	X
8	General	Financial Benchmarking	G1	O	O	X
		Appraisal Sheet	G2	O	O	X
		Gemba Check	-	X	O	X
		Management Remarks	-	X	O	X
		*** PDCA report of QD related targets after 3 months of start of mass production	-	X	X	O

* Sheet no. refers to the sheet no. in the DPR excel sheet (MFM policy 29).

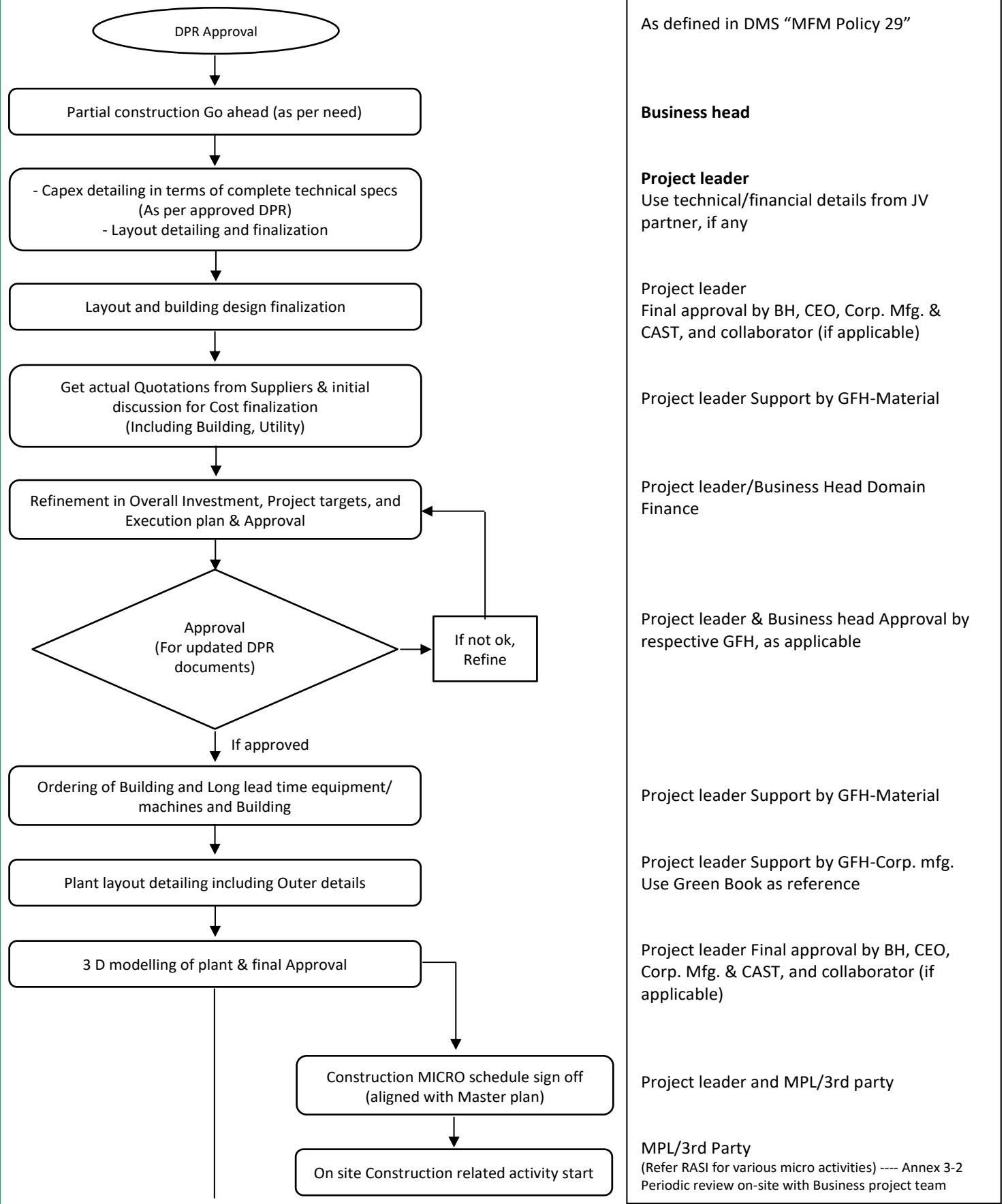
** Example of target setting sheet is enclosed as annexure 3-3.

*** Use relevant portion of target setting sheet for making PDCA report.

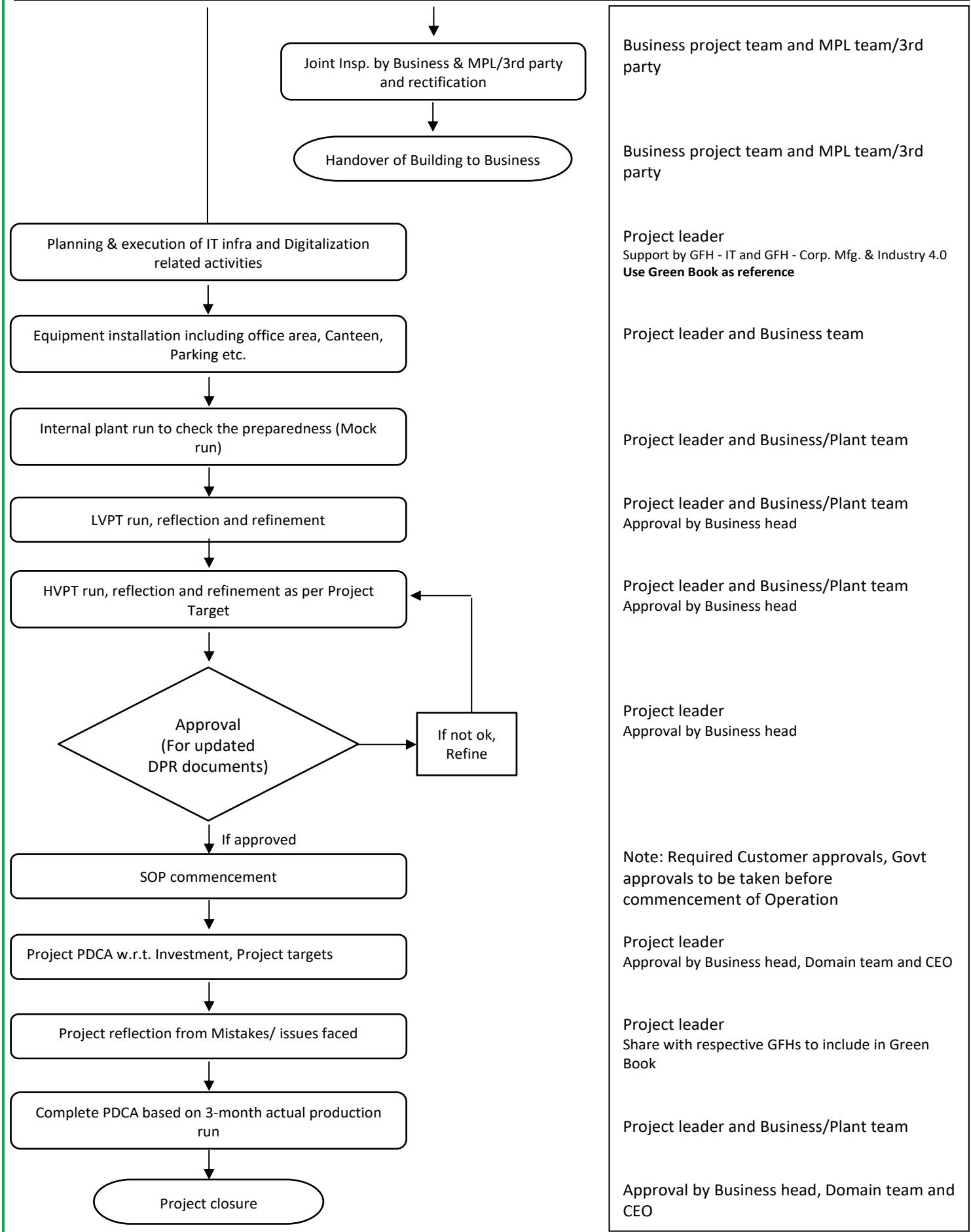
Note: Project review to be done as per MFM PLCY 29 Annexure III (Project MIS).

3.4 New project overall planning work flow (Operational aspect) – For reference only

The overall new project planning, approval, implementation, project reviews and PDCA flow chart is enclosed below:



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Note: For Approval, please follow SOP0501a Annexure A (as per MFM policy 29)

3.4.1 Project target setting as per new plant guidelines:

- **ESG:**
 - Carbon footprint reduction in New Plants to target minimum 50%, w.r.t. the level in any current plant of the same business or theoretical value calculation in case of no existing plant benchmark.
 - Non-hazardous Waste reduction by 50% than current level.
 - Hazardous Waste reduction by 50% than current level.
 - Water consumption to be planned with a 50% reduction than current levels for any existing operations or benchmark as per industry and plan for further reduction. All plant operations to be planned as per ZLD through adequate RO, ETP and STP installations. Rain water harvesting/ storage ponds to be ensured for targeting water positivity/ neutrality.
 - Air Quality Index - Indoor parameters to be maintained as CO< 9 ppm, Lead<1.5 microgram/m3, NOx <0.5 ppm, Ozone <0.12 ppm, PM 2.5 <15 microgram/m3, PM10 < 50 microgram/m3 & SOx < 0.03 ppm
- **Quality:**
 - All plants to ensure Zero Defect outflow (internal & external customers) from day one of operations through
 - All CTQ Process with Poka-yoke and 100% automated inspection (e.g., Camera inspection)
 - End to End Traceability
- **Productivity:**
 - From day one, Productivity improvement in New Plants for existing Businesses are expected to consider P50 - 50% decrease in manpower for same production or 50% increase in the production with same manpower through
 - Outsourcing/ offloading
 - Low-cost automation
 - Productivity improvement through TPS and line balancing
 - Reduction in line losses, i.e., rejection, breakdowns, stoppages etc.
- **Delivery:**
 - From day one, Kanban Implementation to be done, in all plants for Finished Goods store, within plant movement of material and supplies from local suppliers.
- **Manpower:**
 - All plants to ensure min of 25% manpower sourcing from existing plants/businesses under staff and associates with more than 5 years of tenure with Uno Minda.
- **Please refer attached project target setting document for reference below**



Project target
setting sheet .xlsx

Annexure 3-3 Project target setting sheet for reference

3.5 Basic concept of overall plant

The concept shall basically convey clearly high-level management view point related to the critical aspects of project planning.

The plant concept should have 3 main points:

- 1) Design
- 2) Workplace
- 3) Environment

Sample plant concept related documents are enclosed below for ready reference

Plant Concept



1. Design】

Aesthetically appealing plant which reflects the global image of the organization

- Green landscaping
- Uniform front elevation matching with the other plants in campus.
- Simple and elegant reception
- Adherence of Vaastu

2. 【Workplace】 -

Workplace that promotes collaborative ,comfortable, barrier free working while meeting the next gen imagination.

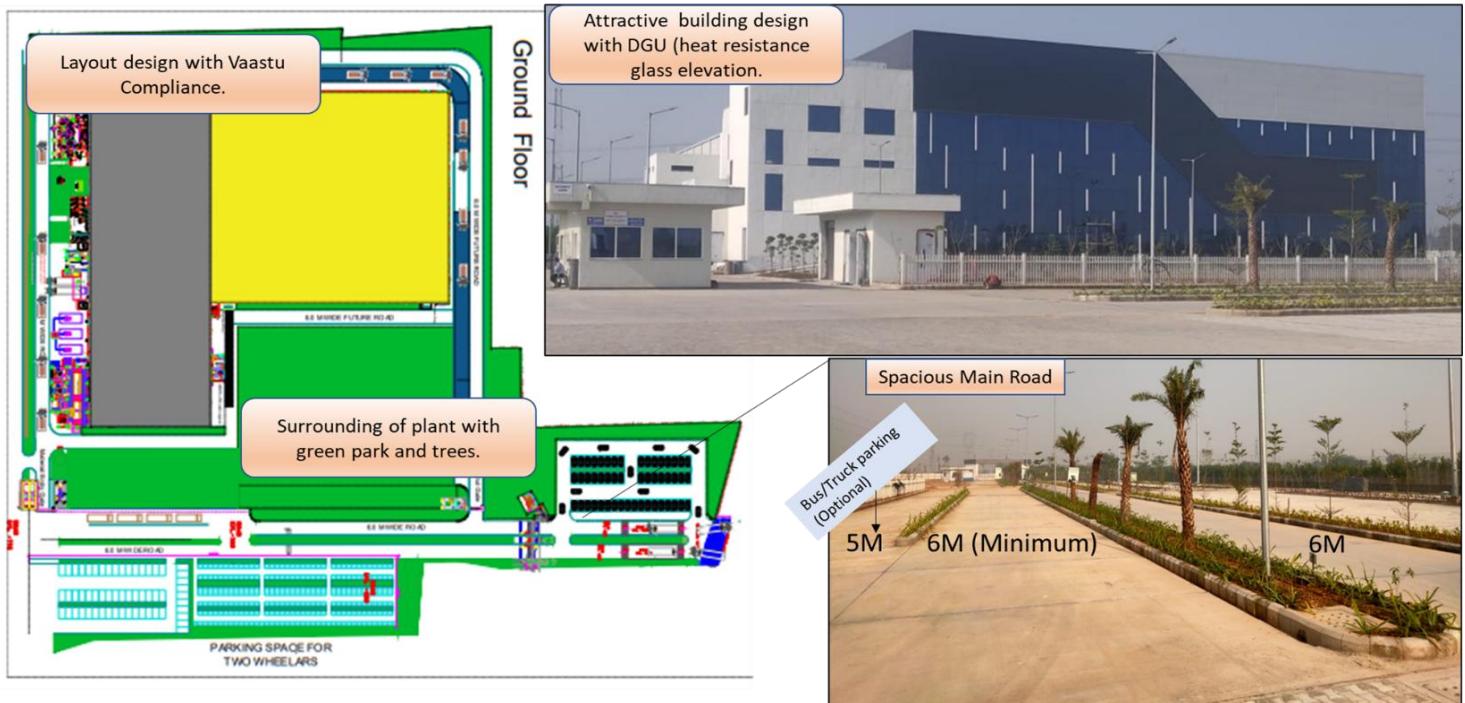
- Modern canteen with soothing colors, great ambience
- Adequate meeting/ Training infrastructure. Noise free working environment
- Workplace which provides feeling of freshness
- Adequate recreational & fitness area
- Shaded pathway for rainy season and sunny day

3. 【Environment】 -

Eco and employee friendly building

- Latest energy efficient Utility, energy management system and heat insulation building design
- 3R principle based plant & process design (reduce, recycle and reuse)
- Installation of on non fossil fuel equipment equipment/ Green/ renewable energy

Example:



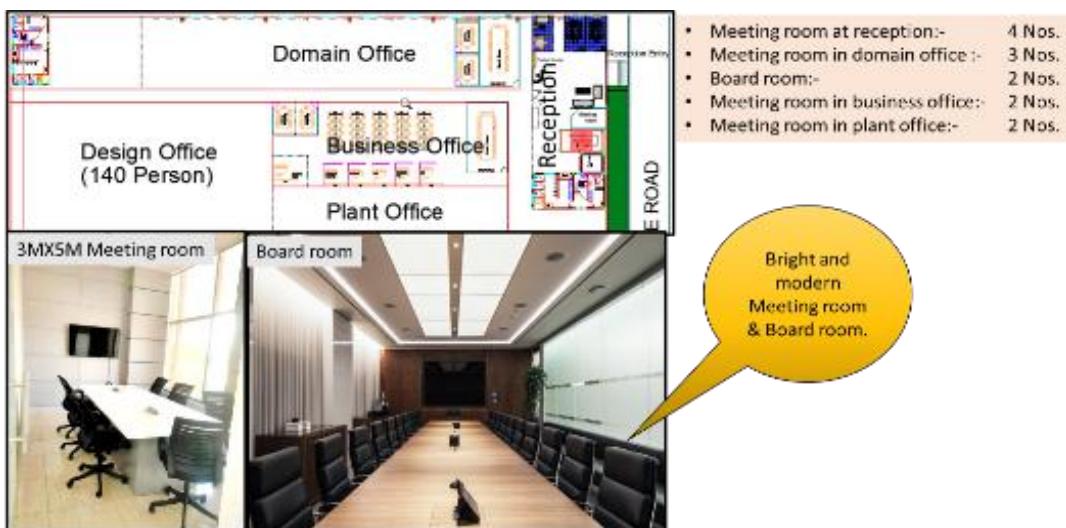
A. Reception design - Example



B. Canteen design - Example



C. Meeting room/board room - Example



D. Office area - Example

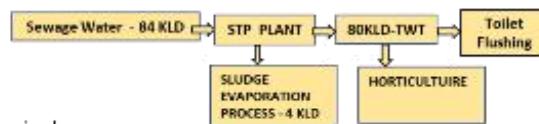


E. Environment - Example

Energy efficient & ecofriendly utilities

- Highly fuel efficient gas genset with eff. 4.68 kwh/scm, complying with CAQM guidelines & future ready for hydrogen as a fuel.
- VFD based compressor & chiller with most energy efficient IE4 motors, pumps, & EC fans for AHU.
- Green energy uses in the new plant based on use of roof top solar panels and green power sourcing through open access.
- Heat insulation in building by the use of PUF sandwich panel and the DGU glass in window and front face.

Water saving concept



- Use of water saving taps, & urinals.
- Use of all servo electric molding machine in future.
- Reuse of STP-treated water in toilets & horticulture

PNG genset



Roof top solar



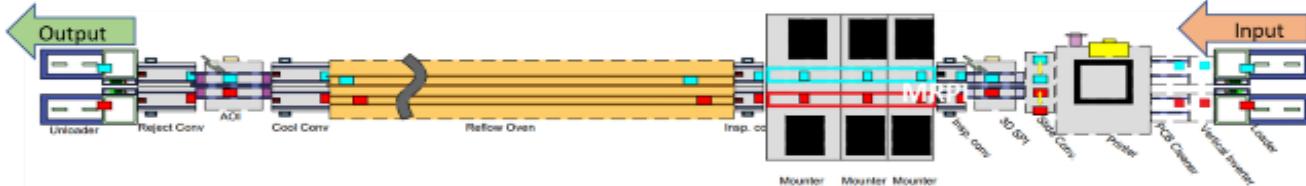
3.6 Basic concept of shop floor- Example SMT line

1 Benchmark plant meeting customer's requirement.

2 High efficiency, high capacity plant, less space consuming, future ready plant.

SMT Line

E.g. Installation of high speed dual lane SMT line which occupies less space and has higher capacity.



SMT shop overall concept:-

1. Dust free working environment
2. ESD Flooring.
3. Space for 10 SMT lines
4. Systems for traceability

Electronic parts storage

1. Vertical storage (for better space utilization)

3.7 Project master schedule (Example) & approval matrix

Project master plan image

S. N.	Main Activity	N			N+6				N+13	N+16
1	Master schedule (mile stones)	Project go ahead	DPR-Approval	CII Approval & Construction Go ahead	Mid Review		QD maturation events	Final Review	Start of mass production	SQPCDME parameters PDCA after 3 months of SOP
2	Team formation & kick-off									
3	Building Construction a. Before start of construction, building specs, equipment specs, plant layout, etc. to be frozen. b. A detailed schedule needs to be made for all sub-activities against all the major headings of SQPCDME.				All other activities/sub-activities are to be added as per Project requirements, New plant guidelines, and Project target setting sheet (Annexure 3-3).					
4	Govt approval & Environment									
5	Safety									
6	Quality a. Skill matrix needs to be finalized									
7	Productivity / Delivery a. LVPT, HVPT & production schedule b. Delivery schedule of BOP, consumables, plant & machinery, etc.									
8	Management/ Man a. Recruitment, b. FSDC, c. Functional training / OJT, etc.									
9	Information Technology / Digitization a. Server / Network for Industry 4.0 b. Industry 4.0 implementation									
11	Progress review at GEMBA	Project leader / Plant head	Business head	CEO	Every week	Every fortnight	Every month			

Green book adherence is to be ensured at each stage and use Green Book checkpoint sheet as reference.



Green Book_Check points.xlsx

Annexure 3-4 Green Book - Reference Checksheet

New project approval matrix (For reference)

Item	Project Go	DPR Approval		Final review before SOP	PDCA after 3 months of SOP
		I	II		
Main approval items →	New project basic framework / Management guidelines & directions for the project	<ul style="list-style-type: none"> SQPCDME targets including tentative investment (rough budget estimate), cashflow Project schedule, 	<ul style="list-style-type: none"> Final SQPCDME targets and action plan to achieve this Investment based on final equipment specs and equipment final negotiated prices, 	<ul style="list-style-type: none"> PDCA of SQPCDME targets. plant Gemba check to see plant readiness for mass production 	<ul style="list-style-type: none"> PDCA of SQPCDME targets w.r.t. what was the target taken in DPR operations Learnings from the project (what went right and wrong and why) Proposed action plan for future projects based on learnings
Prepared by	Domain CEO / BH	Project leader	Project leader	Project leader	Project leader
Evaluated by	-	Steering committee	Steering committee	Steering committee	Steering committee
Approved by	-	Investment committee	Domain CEO + GFH	Domain CEO / Business head	Domain CEO / Business head

- In addition to above, fortnight project progress review will be done by Business head.

Key points of the project master schedule:

- Every project schedule must have a project master schedule, starting with project go activity till start of mass production. It must also include the following project progress reviews related to project progress and LVPT / HVPT events related to QD maturation
- Schedule of activities related to critical project control parameters like Building construction, SQPCDME, IT, etc. must be included.
- All activities must be linked backward with the overall project master schedule and its various project progress review events like, LVPT, HVPT, etc.
- Each agency has to make a micro schedule for the activities in their area. Few examples are given below:

Quality: -

The detailed schedule for quality may include the following aspects-

- Schedule for finalization of quality concept and action plan for the project based on current quality issues, action plan to achieve the quality target, benchmarking
- Quality related documentation preparation schedule
- Quality related equipment procurement plan
- Product quality approval plan

3.7.1 Building construction

The detailed schedule of the building construction may include the following:

- Civil construction (This will be further subdivided into micro activities like land filling and levelling, column foundation work, truss installation, roofing, Building interiors etc.)
- Mechanical work (This will be further subdivided into micro activities of each equipment from procurement to installation, testing and trial, commissioning etc.)
- Electrical work (This will be further subdivided into micro activities of each equipment from procurement to installation, testing and trial, commissioning etc.)
- Horticulture (This will be further subdivided into micro activities like selection of plants, ordering and procurement, plantation etc.)
- Power supply arrangement details – Application for power connection, etc.



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3.7.2 Delivery/ Productivity

The detailed schedule of the delivery related activities may include the following:

- a) Production planning schedule including LVPT and HVPT schedule
- b) Parts / Consumables procurement & delivery schedule (local and imported)
- c) Equipment (including jig/ fixture etc.) ordering / procurement / delivery / installation & commissioning

3.7.3 Management / Morale

The detailed schedule of the delivery related activities may include the following:

- a) Manpower planning, recruitment, training etc.
- b) Government approvals related to the building / environment etc.

3.7.4 IT systems and Infra

A. Software

- a) Business requirement mapping including new requirement other than standard systems like SAP etc.
- b) Supplier selection for new software, system development, testing, go live etc.
- c) Data preparation of standard system installation and commissioning like SAP etc, system start, trial etc.

B. Hardware

- a) Identification of hardware requirement, ordering, set up, commissioning etc.



4. Land selection



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4 Land selection

Objective

The objective of this manual is to define the list of items that may be looked at while selecting a piece of land.

Scope

This manual covers all aspects of land being considered for any manufacturing units either for individual unit or housing multiple units in a big piece of plot) (does not cover the land being considered for an office in a commercial business district (CBD)).

Applicability

This procedure is applicable to all Uno Minda group subsidiary companies. Other Uno Minda group companies may follow these guidelines or may follow their own guidelines. The choice is left to all such companies other than subsidiary companies.

4.1 Factors to be considered/ looked at while selecting the land

S.No.	Category	Item	Remarks
1	Physical condition of the land	<ul style="list-style-type: none"> Land topography Ground level w.r.t. road level Is the soil rocky soil? Does rain water/ flood water get collected in or near the plot? Annual rainfall quantity? 	<ul style="list-style-type: none"> Cost of land filling may be involved or some extra drainage may need to be planned Availability of public drainage system and its quality / capacity needs to be checked.
2	Location of plot	<ul style="list-style-type: none"> Does the land fall in the overexploited region w.r.t. ground water? 	<ul style="list-style-type: none"> There may be limits to draw ground water or there may be restrictions to install borewell.
		<ul style="list-style-type: none"> Does the land fall in eco sensitive zone or air pollution affected zone like NCR etc.? What is the monthly AQI trend (identification of health hazard)? 	<ul style="list-style-type: none"> There may be limitation on building height We may not be allowed to put certain kind of shops like paint shop etc. or not allowed to operate Diesel back up power gen set etc.
		<ul style="list-style-type: none"> Distance w.r.t. major customers 	<ul style="list-style-type: none"> It may impact transportation cost and the finished goods stock level
		<ul style="list-style-type: none"> In which earthquake zone does it fall (1~5) Are there any history of thunderstorms in the area? 	<ul style="list-style-type: none"> Building design and cost may get impacted based on the earthquake zone of the plant
3	Water – Availability and quality	<ul style="list-style-type: none"> At what level ground water level is available? Is drawing water from ground permissible? Does some government agency supply water (through tankers or through pipeline) How is quality of ground water (TDS level etc.?) 	<ul style="list-style-type: none"> We may have to buy water from nearby areas which may involve extra cost We may have to put bigger water treatment facility involving extra investment as well as running cost

4.1 Factors to be considered/ looked at while selecting the land (cont.)

S. No.	Category	Item	Remarks
4	Power - Availability and quality	<ul style="list-style-type: none"> • Is the power supply situation good? • Does the place have good power utility infrastructure? • Can we get direct & dedicated power supply from the government power utility company? • Is the power utility infrastructure good enough to support our additional power requirement (does the substation have free capacity to meet our additional requirement?) • How far is power utility sub-station from our plot? • Is the government agency ready to put dedicated power line at their cost? 	<ul style="list-style-type: none"> • Available infra and quality of power may impact my power utility infra planning • Extra capacity creation may take time and may impact our schedule • Cost of dedicated power line from sub-station may be high. That may need to be budgeted
5	Natural gas availability	<ul style="list-style-type: none"> • Is there any PNG pipeline near the plot? • Do the oil and gas marketing companies have any plan to lay gas pipeline in the coming future? 	
6	Other infrastructure – availability and quality	<ul style="list-style-type: none"> • Quality & width of road near the plant site • If proper road is not there, has administration promised to build required roads / other infrastructure 	<ul style="list-style-type: none"> • Plant and business operations can get negatively impacted in the absence of proper infrastructure

4.1 Factors to be considered/ looked at while selecting the land (cont.)

S. No.	Category	Item	Remarks
6 Contd.	Other infrastructure - Availability and quality	<ul style="list-style-type: none"> • How far is the sea port? • How far is nearest domestic airport and international airport? • How far is the nearest railway station? • Is there any future plan for railway station, domestic or international airport in the foreseeable future? • How far is the nearest state highway? • How far is the nearest national highway? • Is regular transport facility available for manpower nearby? 	<ul style="list-style-type: none"> • Employees transport may need to be planned (as need be)
7	Other social infrastructure - Availability and quality	<ul style="list-style-type: none"> • Is there any good market nearby? • Are there any good schools/ colleges nearby? • Are there any good hospitals nearby? • Are there any good restaurants nearby? • Are there any good hotels nearby? 	
8	Law & order situation	<ul style="list-style-type: none"> • Does the area fall in an areas which is infected with labour union, mafia related issues, truck union etc.? 	

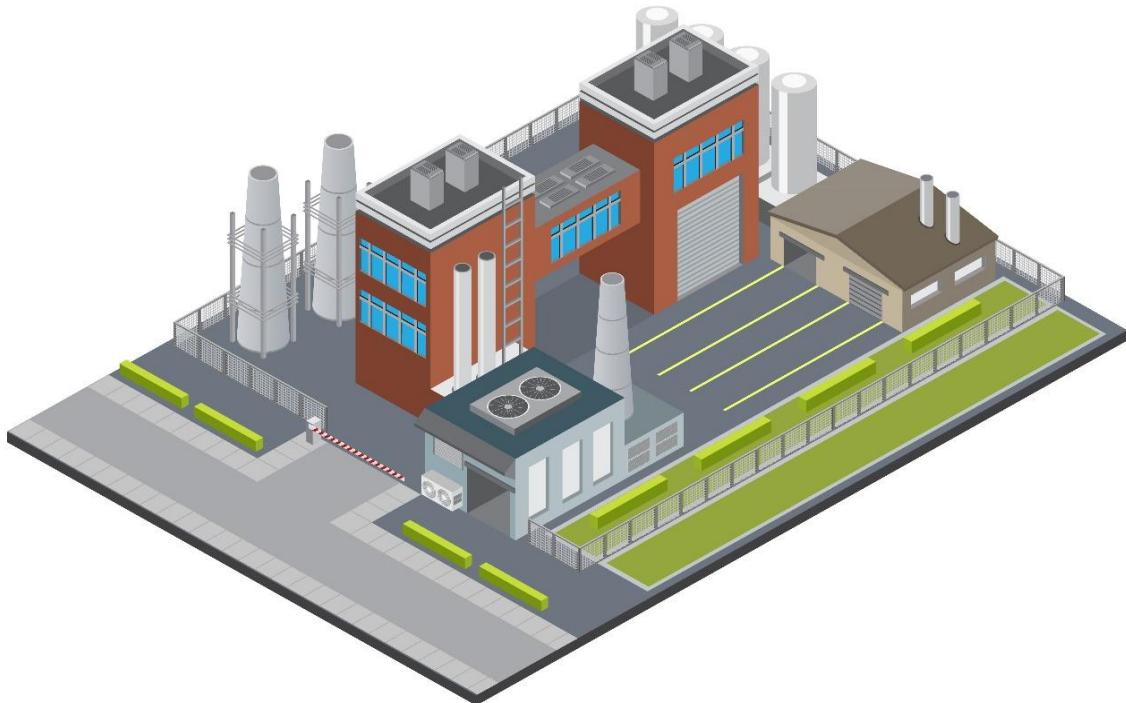
4.1 Factors to be considered/ looked at while selecting the land (cont.)

S.No.	Category	Item	Remarks
9	Business eco system	<ul style="list-style-type: none"> • Distance w.r.t. major customers? • Distance w.r.t. major suppliers who can meet sourcing or outsourcing requirements? 	
10	Surroundings & other points	<ul style="list-style-type: none"> • Is there any hazardous material producing or hazardous storing facility nearby? • Has zone type identified of location where plant is situated been done as per local governing authority? • Are some overhead power lines or HT power lines crossing the plot? • What is the affluence level in nearby villages etc.? • What is the level of basic health and education infrastructure in nearby villages? 	
11	Manpower related points (Skill, availability, wages and regulation etc.)	<ul style="list-style-type: none"> • Is availability of skilled and semi skilled manpower good? • What is the salary or wage level for both staff and skilled / semi-skilled shop related manpower? • Is there any regulation related to female employees working timing / transport facilities etc.? 	

4.1 Factors to be considered/ looked at while selecting the land (cont.)

S. No.	Category	Item	Remarks
12	Government incentives	<ul style="list-style-type: none"> • Are there any government incentives available in that area? 	
13	Network connectivity	<ul style="list-style-type: none"> • Is network connectivity good? (mobile signal strength etc.) 	
14	General (miscellaneous points)	<ul style="list-style-type: none"> • Is local administration supportive/cooperative? • Can more land be bought in the adjacent area for future expansion? • Does the plot fall into residential zone as per the city master plan for next 10-15 years? 	
15	Vaastu related points	<ul style="list-style-type: none"> • What is the shape of the plot? • How many entry / exist points are there or how many exist / entry can be created? • Entry point to the plot is facing which direction? • Vaastu approval is required (Must) at following stages a-final dwg approval stage b- Any layout design change c-Re-confirmation at site before SOP. 	
16	Ambient conditions	<ul style="list-style-type: none"> • One year temperature and humidity related data to be captured 	
17	Other points	<ul style="list-style-type: none"> • Is Zone type identified of location where plant is situated as per local governing authority? 	

Note: Land title etc. related issues are not being included in the factors. That is being considered as a very basic check point.



5. Building design



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5 Building design

西红 Objective

The objective of building design is to create spaces that are functional, safe, efficient to meet the requirements of process & occupants as well as help in standardization of building design across all new plants.

西红 Scope

This manual covers all aspects of civil part of the building design considered for any manufacturing unit (does not cover civil design of any standalone office building in a CBD).

西红 Applicability

This procedure is applicable to all Uno Minda group subsidiary companies. Other Uno Minda group companies may follow these guidelines or may follow their own guidelines. the choice is left to all such companies other than subsidiary companies.

5.1 Type of building structure

Types of building structure decision					
S. No.	Description	PEB	Hybrid	RCC	Remarks
1	Cost (Civil) (Reference scale)	Low	Medium	High	
		100	120-150	200	
2	Construction lead time (in months)	Low	Medium	High	
		06-08.	06-08.	10-12.	
3	Durability	Low	Medium	High	
4	Maintenance	Low	Medium	High	
5	Ease of expansion				In case of PEB structure, only horizontal expansion is possible.
a	Horizontal	Good	Good	Good	
b	Vertical	Not Feasible	Not Feasible	Good	
6	Cooling efficiency	Good	Good	Very Good	
7	Limitation of Span	Flexible	Flexible	Limitation	If larger span building is required, RCC design is not recommended.
8	Aesthetic	All are same			

Note:

- PEB building should be design as per AISC.
- Before design of building site contour and soil test must be available.

Conclusion:

- We should go for PEB structure building to reduce the capital investment.

5.2 Number of floors decision

- We can go up to 21m height only, in case want to go beyond that central Govt. approval is required.
- It will depend on the product, for light weight products it is recommended that we can go for 2-3 floors, but for heavy weight product like AW4W only one floor is recommended. But in case we go beyond two floors, common dining may become a bottleneck keeping in view of fatigue and movement time of employee.
- More no. of floors is mainly to increase the FAR coverage, this can be increased by putting certain utility on mezzanine on a case-to-case basis.

Key points

- We can make maximum up to 21m height building only, in case want to go beyond that central Govt. approval is required.
- In case the land is in eco sensitive zone e.g., near bird sanctuary we can make maximum up to 15m height building only.
- Govt. rule & regulations must study before finalizing the building design specially related to FAR (Floor area ratio) coverage and ground coverage ratio
 - FAR calculation in case Haryana as below (as example for reference only)
 - = Total Available Land Area (after deduction of road widening) X 150%

In case 2 floor building total coverage area of both floor area will be counted for FAR area.

Ground coverage area ratio in case of Haryana is below

$$= 60\% \text{ of total land area}$$

- FAR coverage should be followed by state norms, and each building should be designed considering maximum FAR coverage. (As per applicability of state Norms)
- Layout should be prepared in the manner that occupancy level in each floor is maximum and nearly equal, based on LTP.

Process Category	Product	Ground Floor (GF) Building	2 Floor Building (GF+1)	3 Floor Building (GF+2)	Remarks
Casting/Forging/Machining	AW4W/AW2W	O			
Injection moulding <20T	Child part etc.	O	O	O	
Injection moulding >20T	Child part etc.	O			
SMT only	PCB assembly	O			SMT will always be on GF due to vibration concern.
Assembly	Electronics/ Others	O	O	(O)	3F building may be considered if it meets FAR regulations.

5.3 Green building related aspects

- All building will be designed as per IGBC gold norms.
- Greenery Area: - As per IGBC standard
- 5% natural light (5% means area of total surface area) area will be provided by polycarbonate sheet or windows. (ex- PC band will be provided on north side where ever feasible)

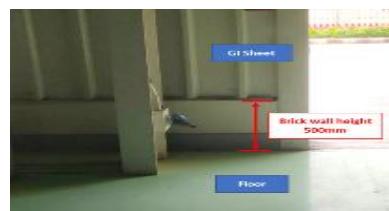
5.4 Other building design related guidelines

A. Major consideration:

- Building must be designed as per Vaastu guidelines.
- All building will be designed for specially abled person friendly.

B. Other points:

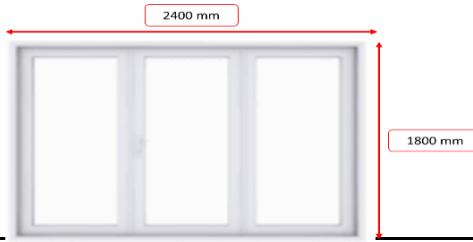
- Floor level
 - Finish floor level will be up at least 300mm from internal road. And internal road will be up 300mm from external govt road. In hilly area it will be as per design considering cost optimization. And it will be decided on case-to-case basis.
- Wall design
 - GI pre-color coated sheet will be fixed above 450mm brick wall with full height insulated / sandwich panel inside.



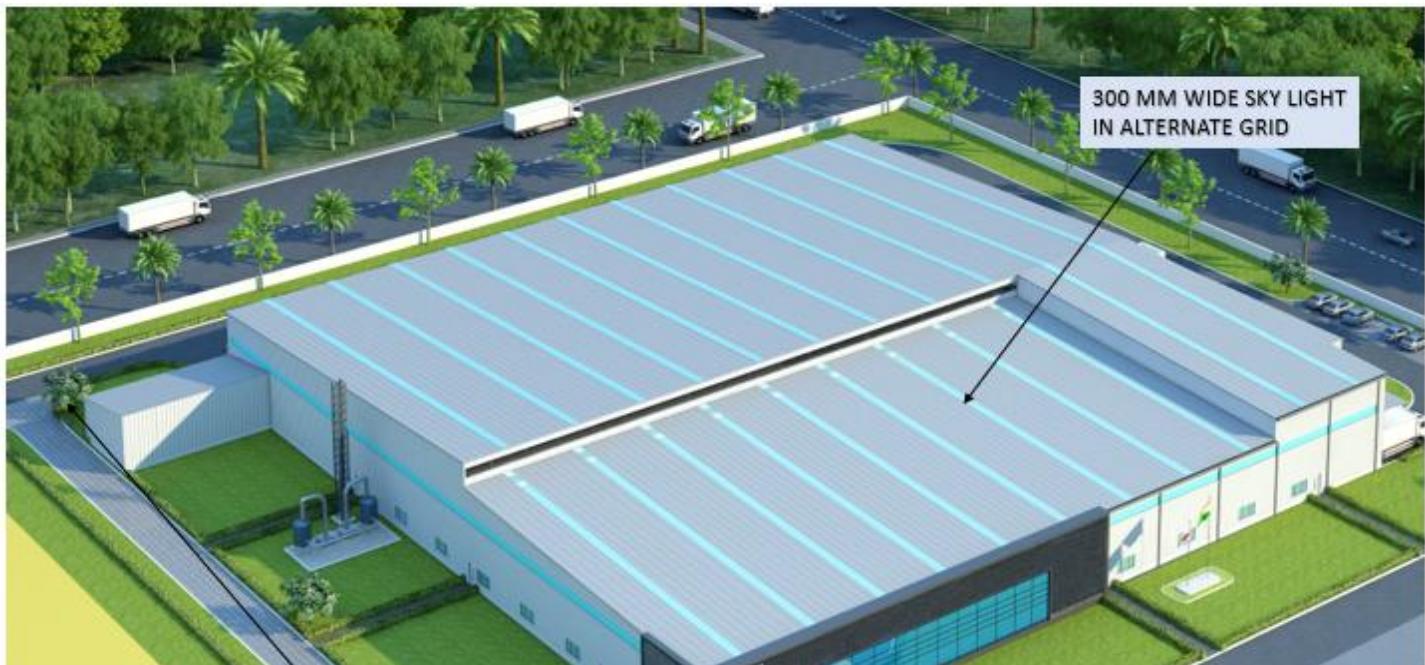
- Floor marking
 - Floor marking to be done with 50 mm width with yellow color.

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- Window design / size
 - Window size should be 1800x2400.



- Consideration for maximizing natural light
 - One-meter PC sheet band will run except south side.
Above is not applicable to shops which are having false ceiling.
 - Sky light with Min 300 mm wire mesh should be considered other than in the false ceiling area in alternate bay.

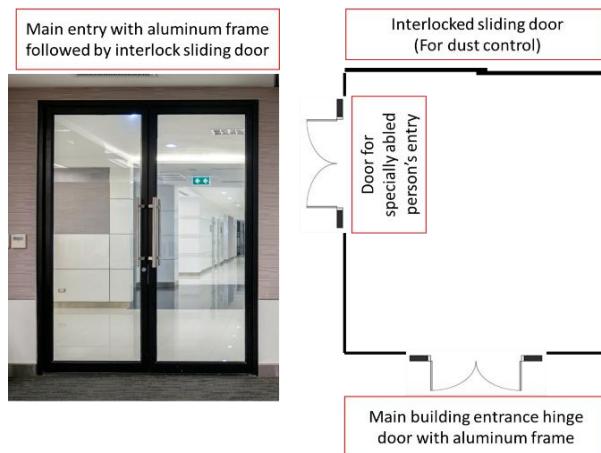


- Logo design & fixing location
 - LED LOGO should be fixed in a manner that it can be visible from distance.
 - LOGO size should be as per logo manual/ as per building Height

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- Main building entry door design
 - At Main entrance there should be double entry door.

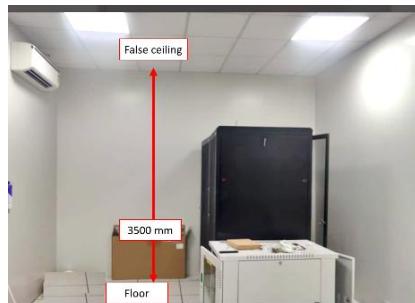


- At main entry door external door should be fixed in aluminum frame and internal door will be sensor sliding door. Both the doors should be interlocked specially in electronic plant.
- Stairs design
 - Minimum width of stair should be 1.5m.



- Server room design
 - Server room should be in brick work or fire proof gypsum partition with false flooring and gypsum false ceiling.

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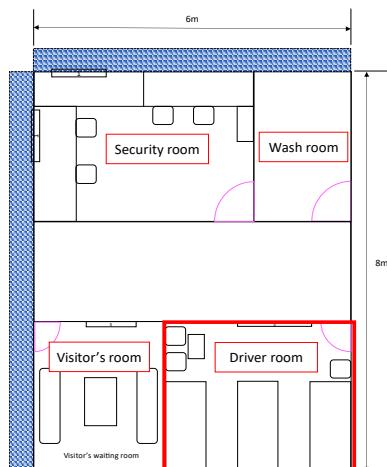
- Emergency door design
 - All the emergency door should resist 2 hours of fire. Rated door with panic bar size 1200x2100
 - Door should be opening outside (Push).



- False ceiling design
 - False ceiling minimum height must be 3.5m.



- Calculation standard for washroom etc.
 - For 25 person there must be one WC, 1 washbasin and 1 urinal for 15 persons.
- Driver room
 - For individual unit driver room with toilet must be designed with main security room (not applicable for industrial park).

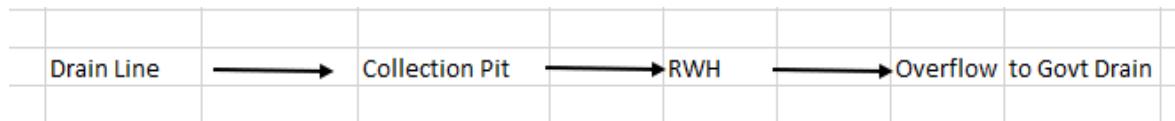


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- ATM room provision
 - In mega industrial park ATM machine space should be provided in the common dining area. No. of ATM machine can be decided as per requirement.



- Rain water harvesting
 - All the rain water harvesting should be designed as per govt. norms, for future plant we can do as below:



- If govt drain not available, pond should be made. Collection pit capacity should be as per state govt norms.
- Drainage line should be designed considering 125% of maximum average rainfall of 10 years of that area

- Hazardous material storage & scrap yard
 - Hazardous chemical storage should be made in RCC framed structure with brick wall. For ref. picture attached.
 - In scrap yard there should be one hazardous storage which will be in brick work with GI Sheet roof, for normal scrap partition should be either wire mesh fencing or sheet fencing.



5.5 Measures for ambient temperature control

A. Roof and Wall specs

Category	Roof				Wall(South side)
	PIR panel ROOF	GI standing seam sheet with 4mm bubble insulation	PUF sandwich panel		
Electronics/AC plant	O				O
Moulding/casting		O			O

Others	(O)	(O)	O		O
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B. Glass specs for window and front elevation (Size 2000X2400 MM)

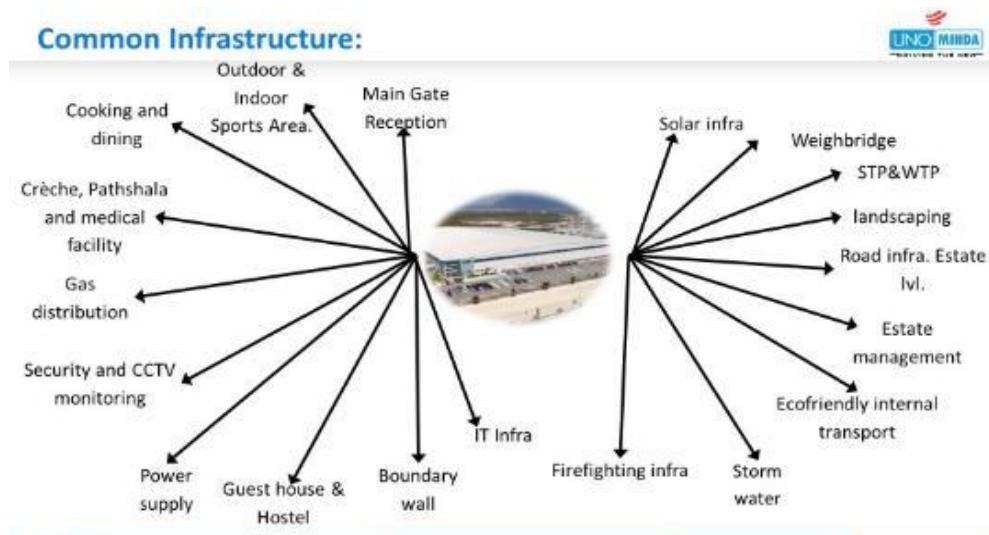
Direction	DGU glass	Normal plain glass
East	O (Min 01 window in each grid)	
West	O (Min 01 window in each grid)	
North		O
South	O (Min 01 window in each grid)	

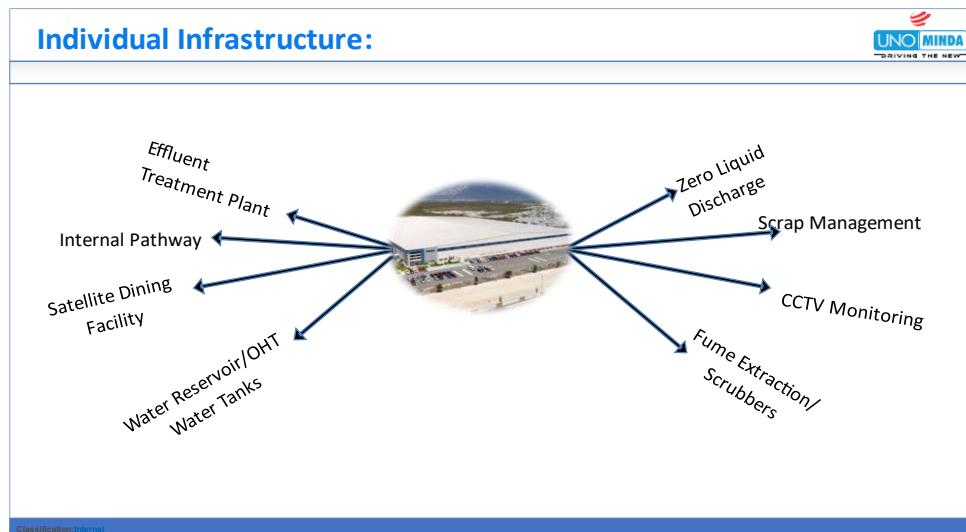
5.6 Utility location

- Utility location should be nearer to the building/ on the periphery of the building to reduce the investment.

5.7 Other general points

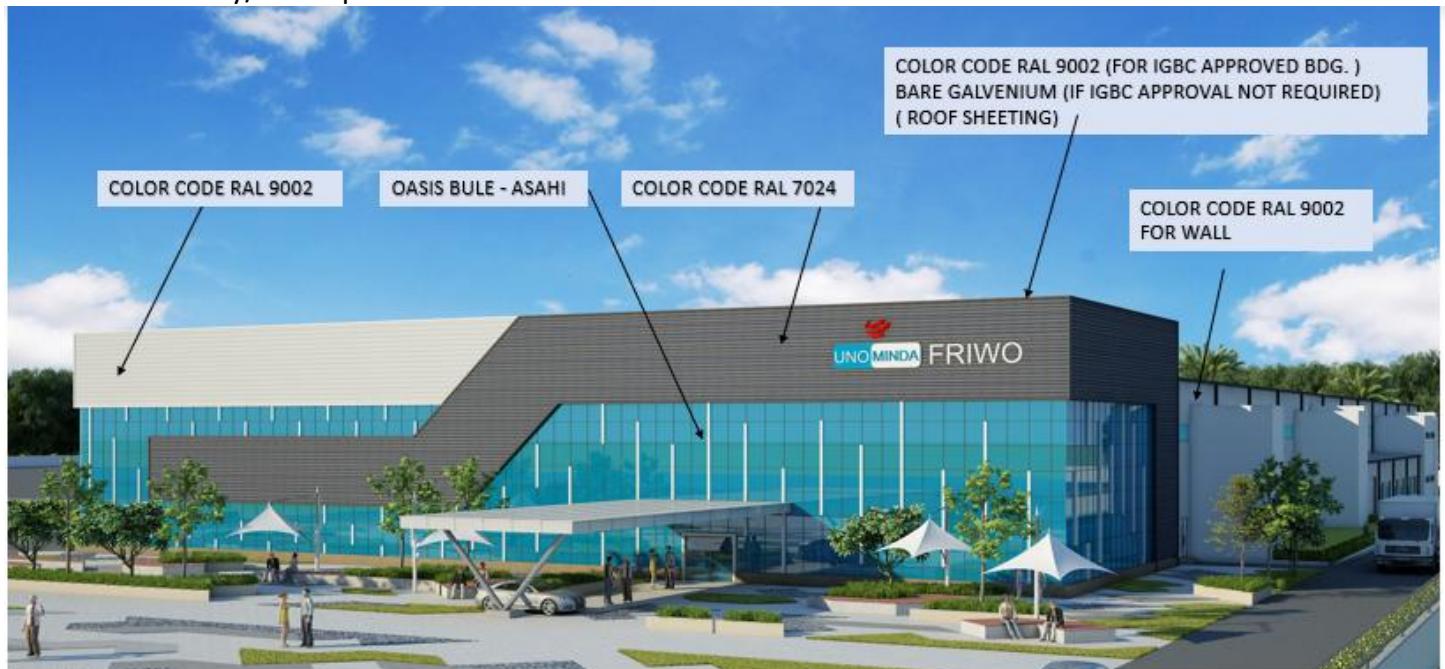
- Parking
 - 4-wheeler and 2-wheeler parking should be EV friendly. No. of charging point can be decided by unit.
 - All parking should have solar panel covering (to the extent possible).
- Lighting in parking and open areas
 - High mast light should be installed in parking and others area based on the requirements for mega park.
- Miscellaneous
 - Cooking area should preferably be at ground floor.
- Guideline related to common and individual infra
 - Common infra and individual infra basic guidelines are as per details below, but it will be decided as per case-to-case basis.





5.8 Front elevation for plant main building - Example

A. For 2 story/floors plants



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B. For single story/floor plants



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6. Layout design

6 Layout design

Plant Layout:

Plant layout is a technique of locating machines, processes and plant services within the factory so as to achieve the greatest possible output of highest quality at the lowest possible total cost of manufacturing.

6.1 Objectives of plant layout

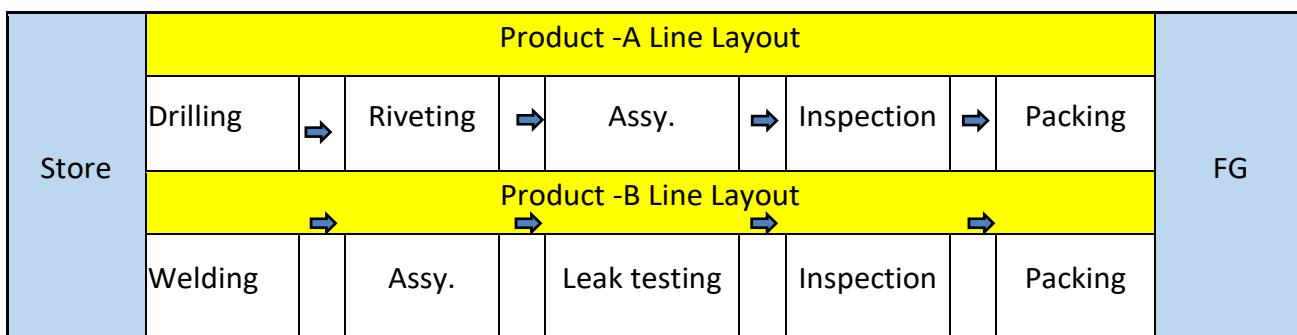
Overall Objective of a good plant layout is to create an efficient, safe, and effective workplace that maximizes productivity, minimizes work, and reduces cost.

Types of plant layout

1. Product or line layout
2. Process or functional layout

6.1.1 Product or line layout

If all the processing equipment and machines are arranged according to the sequence of operations of the product, the layout is called the product type of layout or line layout.



Advantages of product/line layout-

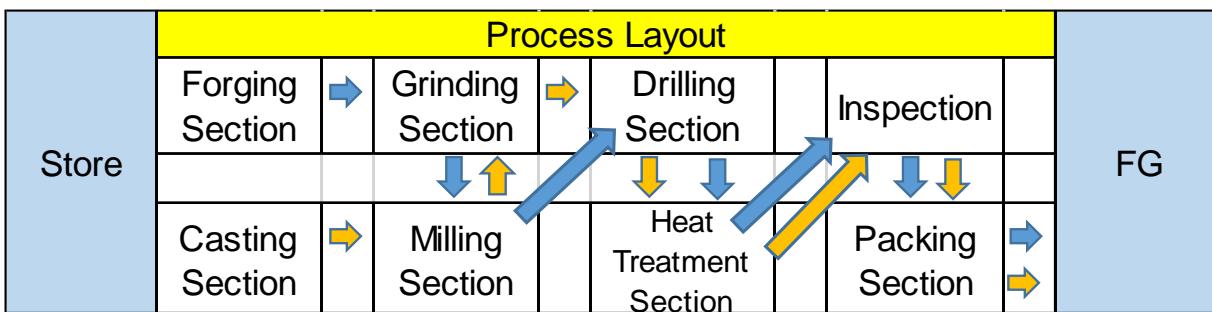
1. Reduced material handling cost due to straight flow.
2. Perfect line balancing which eliminates bottlenecks and idle capacity.
3. Short manufacturing cycle due to uninterrupted flow of materials.
4. Small amount of work-in-progress inventory.

Limitations of product/line layout-

1. Dependence of whole activity on each part; any breakdown of one machine in the sequence may result in a stoppage of production.

6.1.2 Process/Functional layout

In this type of layout, all machines performing similar types of operations are grouped at one location.



Advantages of Process/Functional layout -

1. Greater flexibility with regard to work distribution to machinery and personnel.
2. Lower investment due to general-purpose machines; which usually are less costly than special purpose machines.
3. Breakdown of one machine does not result in a complete stoppage of work.

Limitations of Process/Functional layout

1. Backtracking and long movements occurs in handling of materials.
2. Material handling costs are higher.
3. Production planning and control is difficult.
4. More space requirement as work-in-progress inventory is high-requiring greater storage space.

6.2 Basic considerations while designing overall layout

6.2.1 Overall Layout

1. Layout must be Vaastu compliant.
2. Consider safety as per EHS & ESG guidelines.
3. Material flow from RM/Receiving to dispatch to be linear.
4. Layout planning should be done considering business expansion as per LTP & beyond.
5. Vehicle size (both supplier & dispatch) to be considered for outer road size finalization.
6. Vehicle movement should be one way.
7. Set back in the plant – For fire brigade movement around the main manufacturing building.
8. Space for Public address system with centralize control should be considered in reception layout.
9. 3D- layout “MUST” be prepared before finalization & signoff of layout.

6.2.2 Main points for consideration related to Shop floor layout

a. RM and child parts store area

1. RM & store space calculation must be done considering the following:
 - No. of parts/ RM
 - Inventory norms
 - Size of bins/ boxes/ pallet/ trolleys etc.
2. Vertical space utilization for RM, parts storage must be considered.
3. Store location should follow Vaastu guidelines & should near to the usage location (material movement reduction)

b. Part production/Assy. shop

Space calculation must be done considering the following:

1. No. of parts/ RM (WIP), inventory norms (WIP & FG), size of bins/ boxes/ pallet/ trolleys etc.
2. Machine/ equipment size and orientation must consider the flow of material and location of the next customer.

3. Double door entry should be planned for all Man related entry exit points from direct outside in the building (prevent dust entry).
4. High speed shutter door entry should be planned for all material related entry/ exit points from direct outside in the building (to prevent dust entry).
5. High speed shutter door entry should be planned for all material related entry/ exit points in dust sensitive area i.e., Assembly etc.
6. No door should open in the main passage.
7. Adequate space must be left in layout for easy maintenance of equipment's/lines/fixtures etc.
8. Statuary information display boards location should be as per the guidelines

6.3 Layout preparation guidelines as per lean manufacturing

6.3.1 Productivity improvement through better layout

- **Muda elimination-** Layout should facilitate elimination of Muda of searching, transportation, walking.
- **Single person multiple process/operation / machine handling-** Layout to facilitate one-man multiple operation with minimum movement.

Example- Tools rack near to the machine, parts supermarket near to the lines

Placement of machine / lines as per below reference image (as per applicability)

Fig.- A

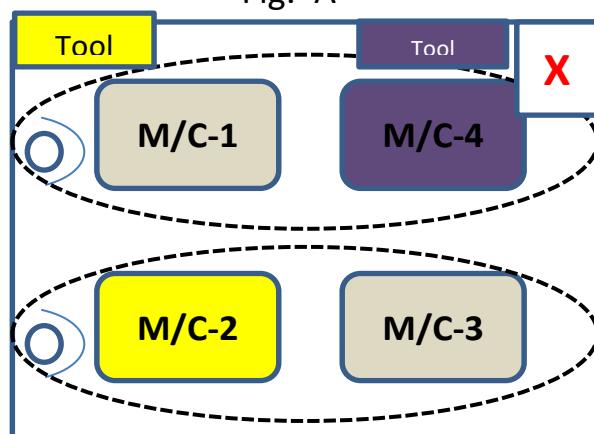
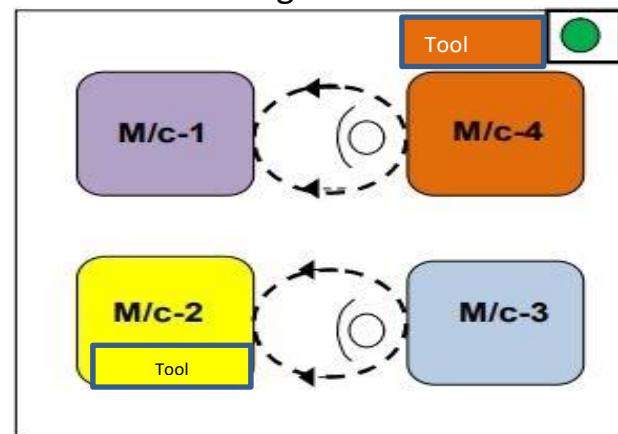


Fig.-B



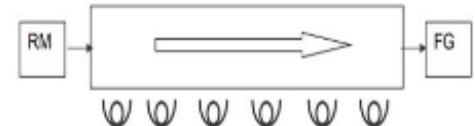
- Tool kept far away from machine
- Man-movement is high due to machine placement/ orientation

- Tool kept near to the machine
- Man-movement is reduced due to better machine placement/ orientation

6.3.2 Production system

- Single-piece flow production system**

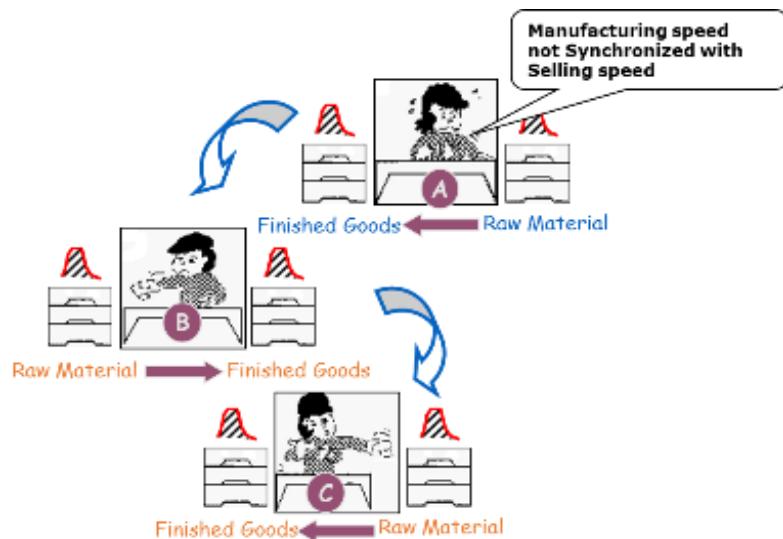
In this method, different variants of parts are processed one by one without any or less in-process stock.



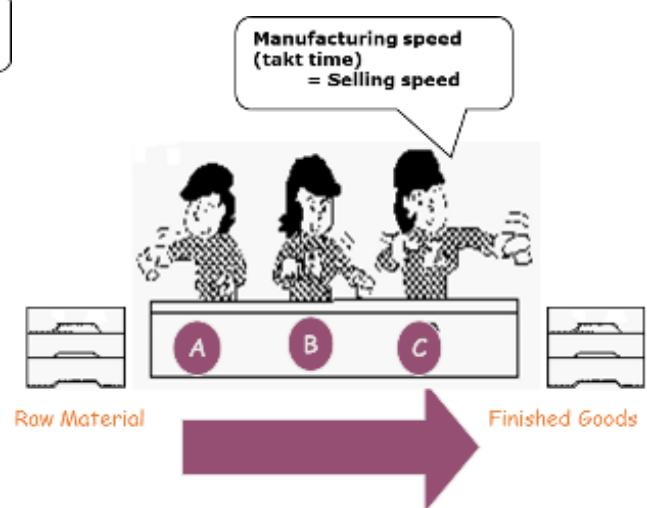
- Small lot production system**

Minimum lot to be defined as per customer pull or requirement.

Not Recommend



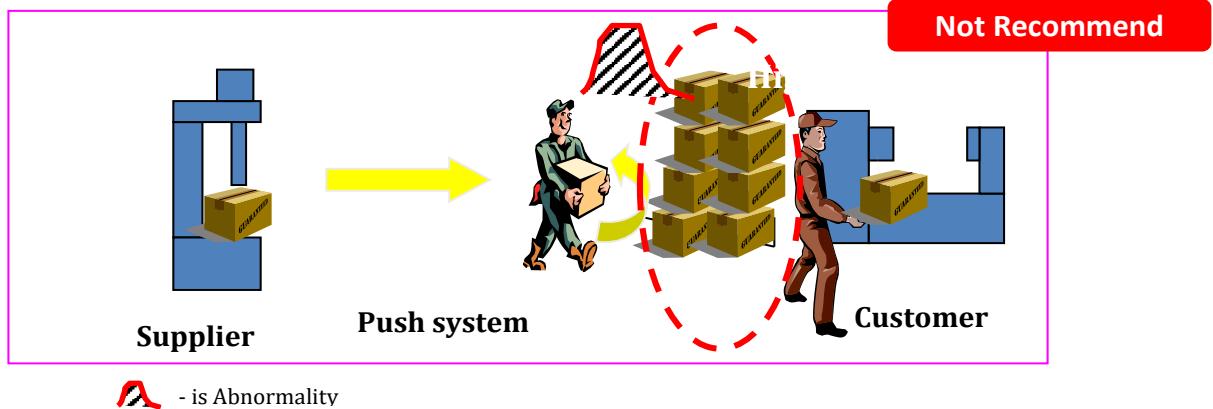
Recommended



6.3.3 Layout as per pull system approach

- **Push system approach**

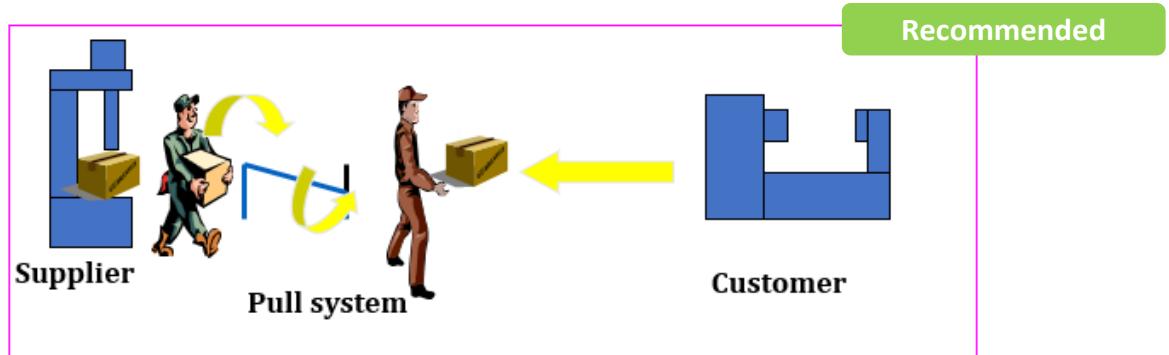
The preceding process pushes the finished goods to the following process, irrespective of demand.



- is Abnormality

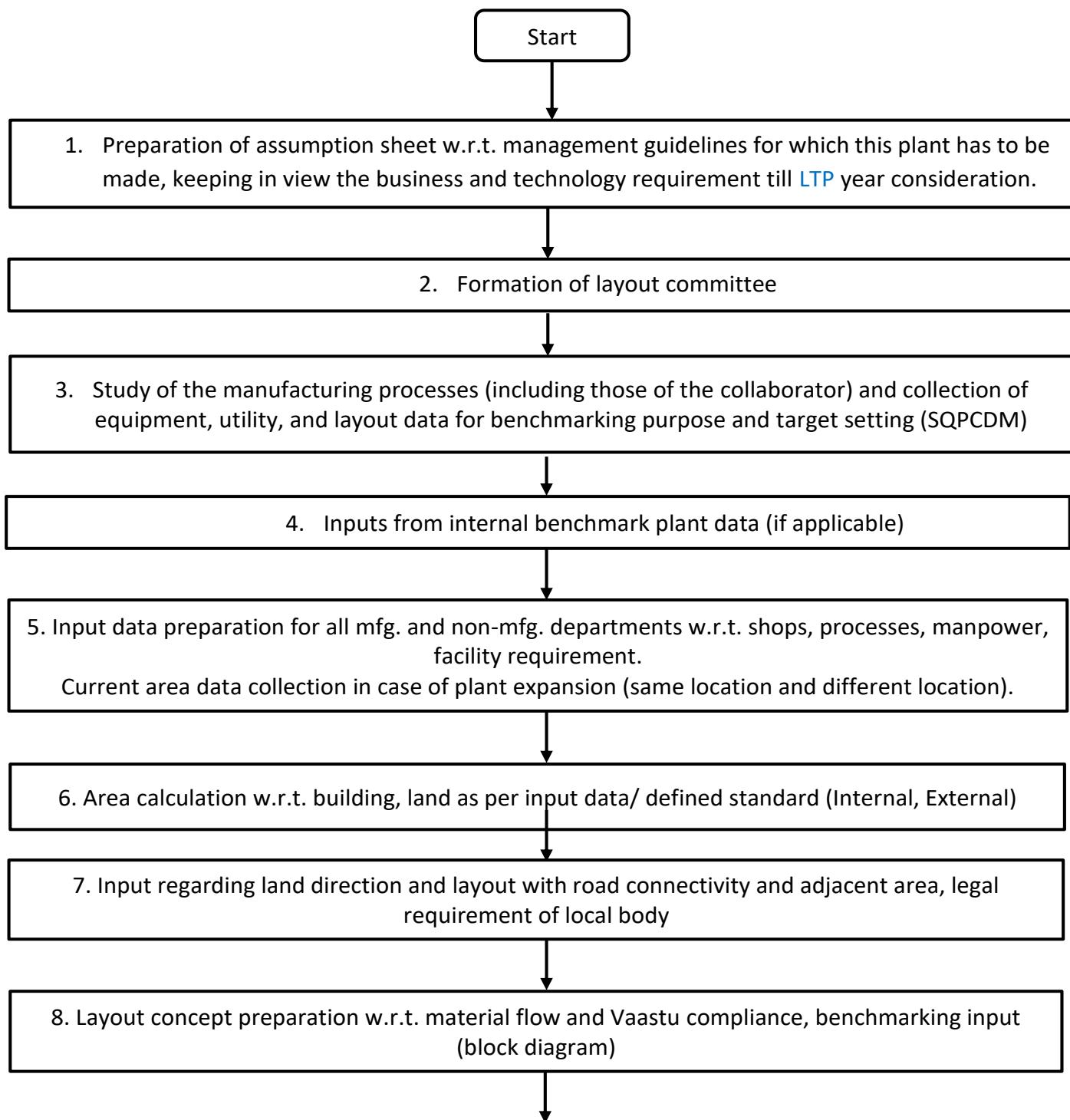
- **Pull system approach**

Following process withdraw from preceding process, "WHAT" they need, "WHEN" they need, "HOW MUCH" quantity they need.

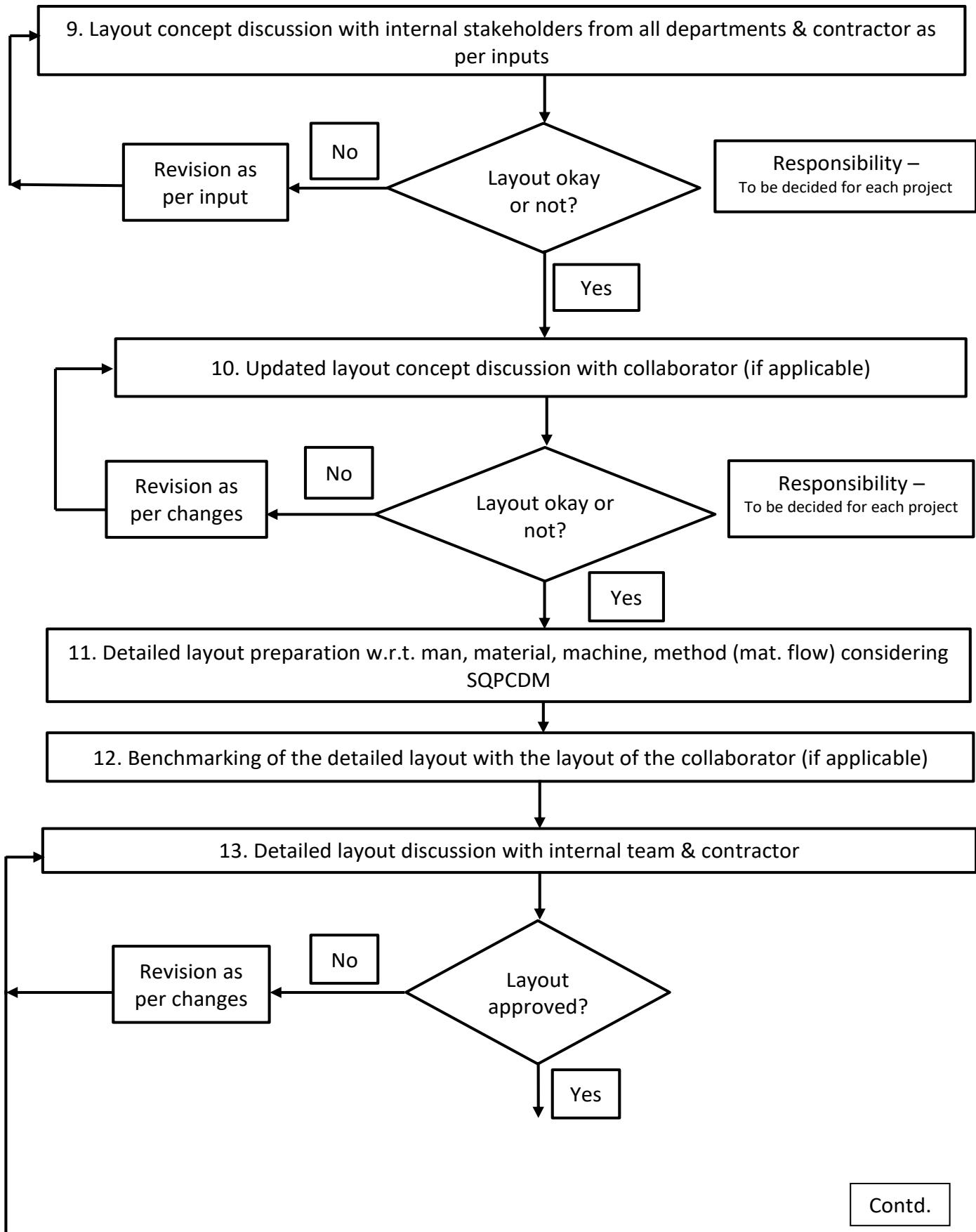


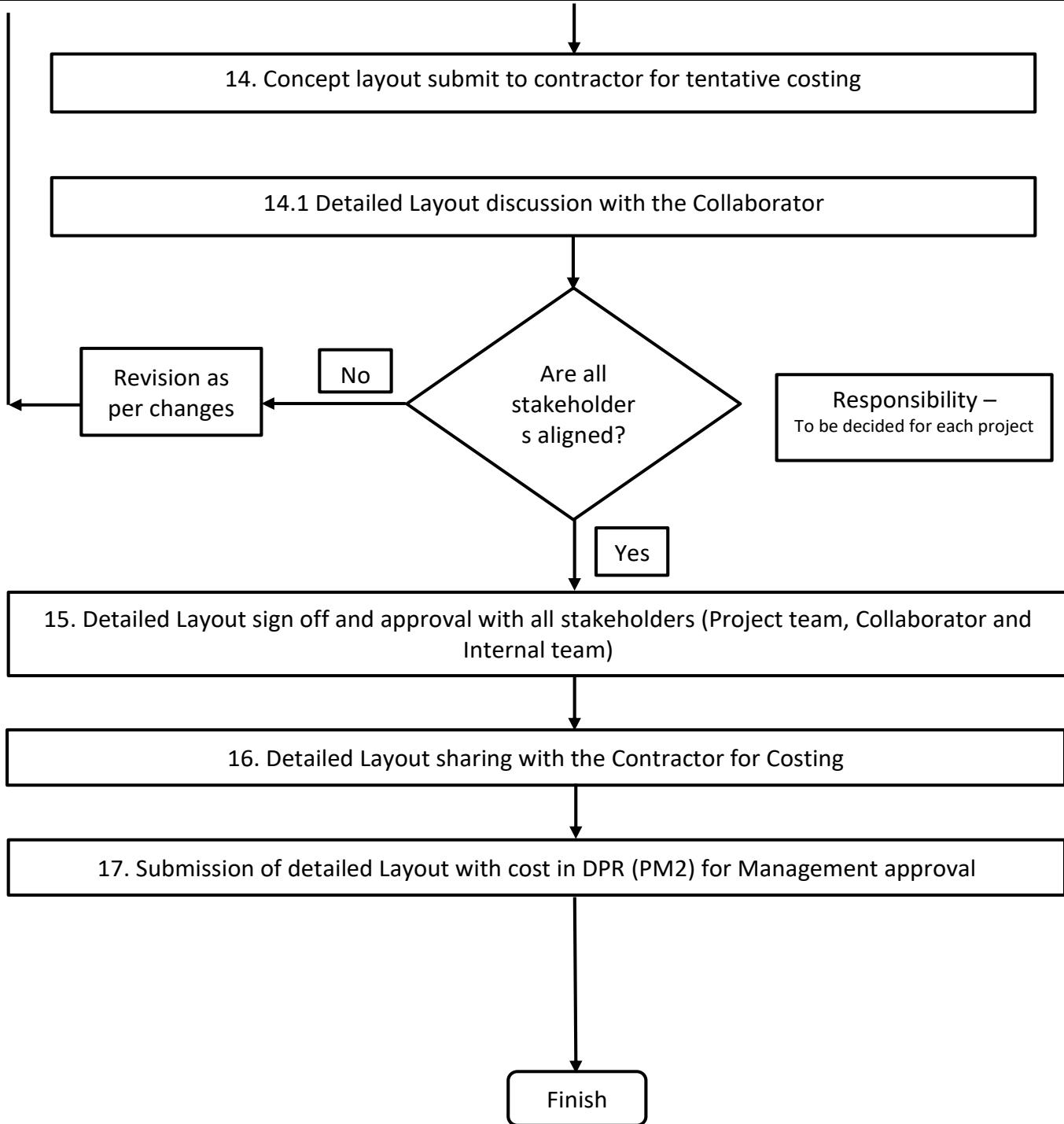
Pull production layout is also called as Lean layout.

6.4 Process flow for making a Layout



Contd.

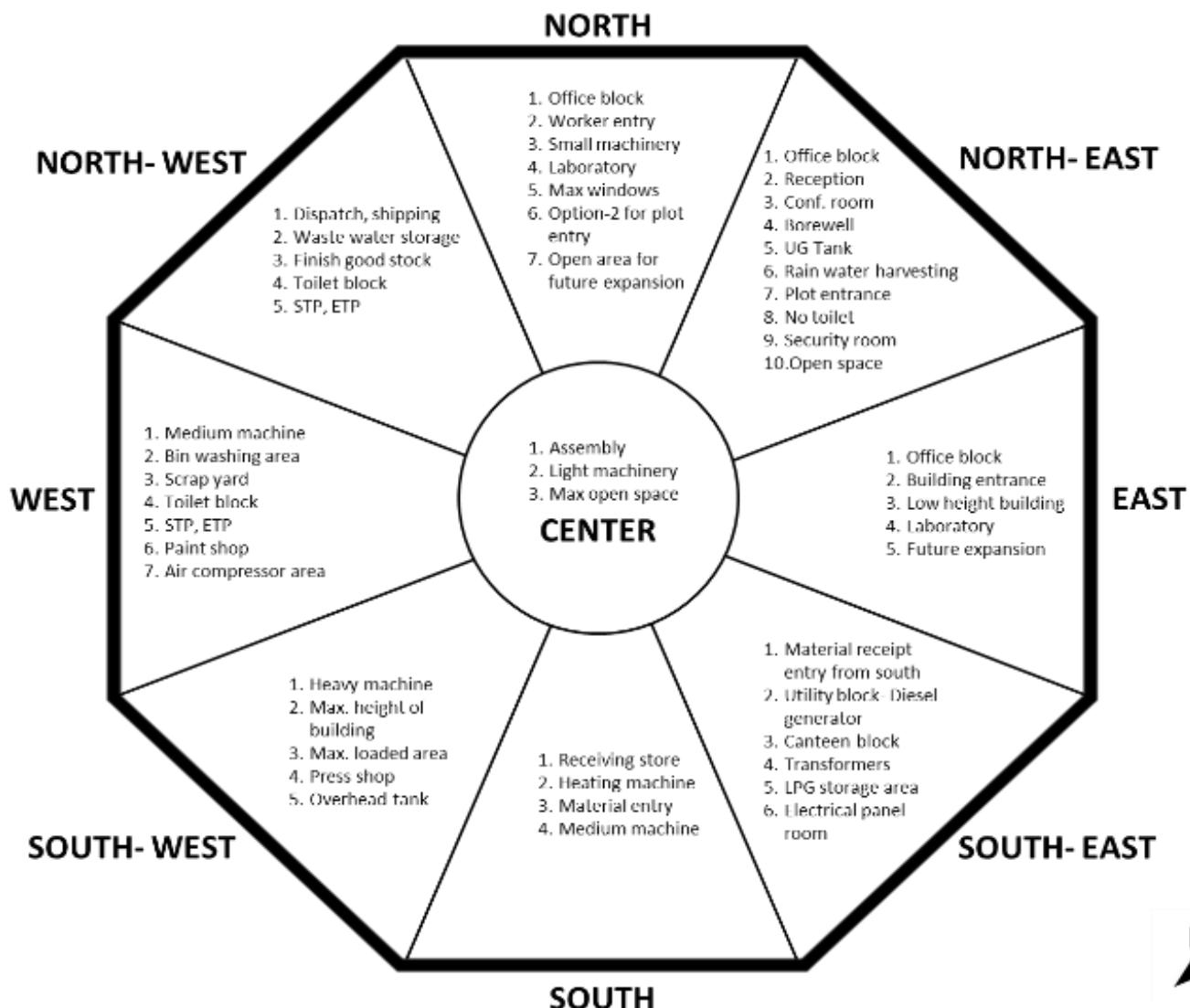




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6.5 Vaastu guidelines for Layout design

- Building layout to be approved as per following Vaastu guidelines after discussion and consulting from Group Vaastu consultant:



6.6 Department's list

Sections	S. No.	Departments/Areas
A. Office department	1.	HRM
	2.	PPC/ Finance /Marketing etc.
	3.	Engineering design
B. Manufacturing shops/area	4.	Assembly
	5.	Electronics
	6.	Other production shops
C. Utility & Infra	7.	Utility and maintenance
D. Others area	8.	FG/Bonded
	9.	Shipping and dispatch
	10.	Unloading and receiving
	11.	Main stores
	12.	Main gate
	13.	Roads outside buildings and passages inside plant
	14.	Security office
	15.	Emergency Assy. area
	16.	Scrap yards (Normal, Hazardous) & Chemical storage

6.6.1 Office department

HRM

Sections list		
Depts. No.	Department Name	Sections
1.	HRM	1.1 Reception
		1.2 Board room
		1.3 Meeting room
		1.4 Conference room
		1.5 Training room
		1.6 Medical room
		1.7 Creche
		1.8 Time office
		1.9 Pantry
		1.10 Rest rooms – Non-Staff
		1.11 Rest rooms – Staff
		1.12 Waiting lounge
		1.13 Interviewer room
		1.14 Canteen

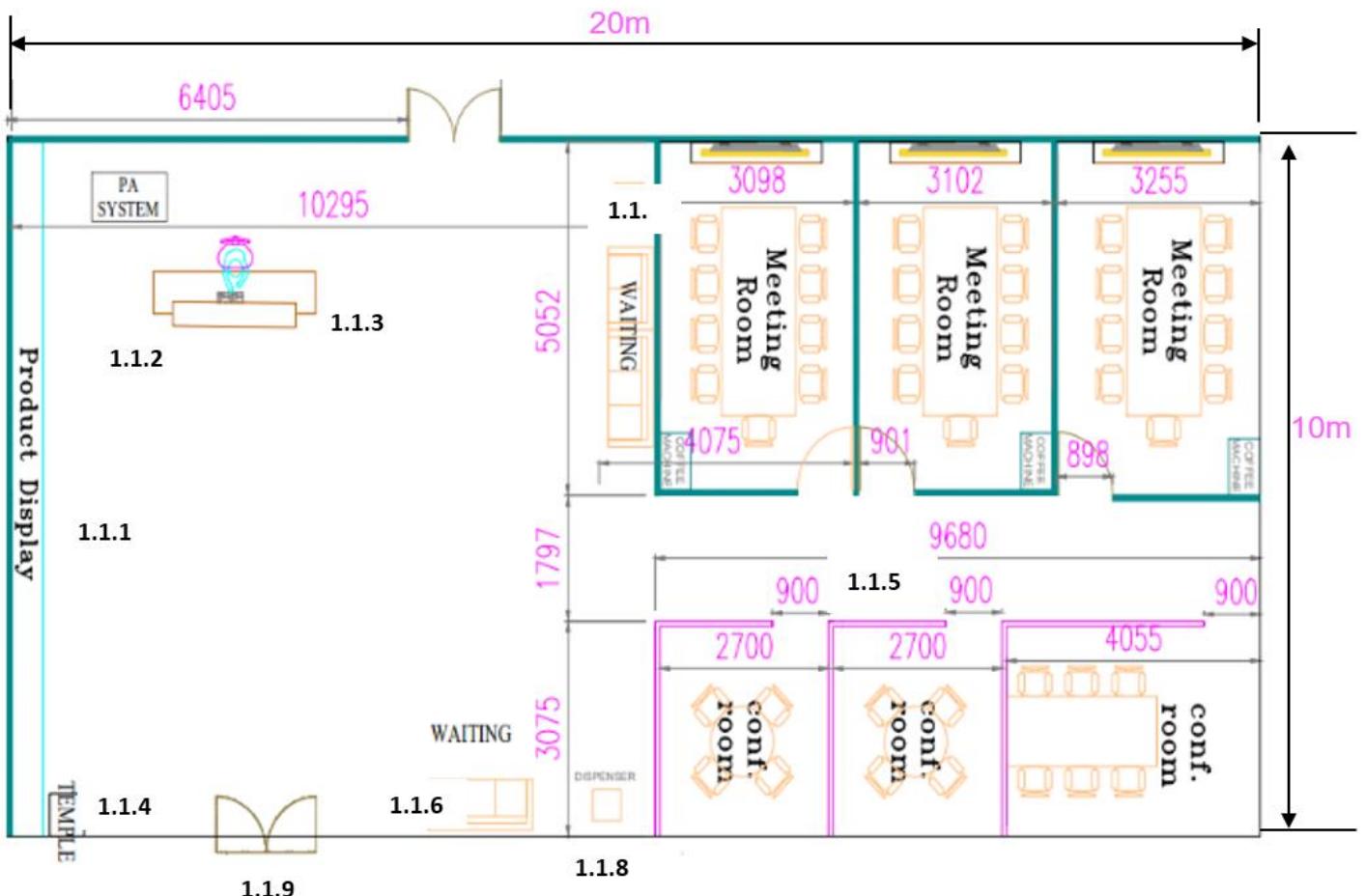
6.6.1.1 Reception

Reception Sub-Items list			
Item no.	Item	Sub-Item No.	Sub-Items List
1.1	Reception	1.1.1	Products display
		1.1.2	PA (Public Address) system and centralized control
		1.1.3	Receptionist table and chair
		1.1.4	God idol (To be procured by business)
		1.1.5	Discussion rooms (minimum 2 meeting rooms + 2 cubicles, maximum 4 ,4)
		1.1.6	Sofas and center table for visitors (minimum 6 persons seating)
		1.1.7	Magazine rack
		1.1.8	Water dispenser with cup holder
		1.1.9	Double door entry

Note: Scope of supply to be decided at the time of Item/Price finalization

Guidelines may not follow for 3rd Party(other than Uno Minda group) rented Factory premises.

Reception – Typical layout



Comments: -

- Reception includes external meeting rooms & low height open conference rooms.
- Keep provision of public address system, centralize control at the reception.
- Approved plant layout (CFT & safety officer) and to be displayed at site (marked with "You are here").
- Optional- aquarium, plants etc.
- God idol should be facing towards west (option-01), South -west(option-02)
- All dimension are Min recommended . dimensions

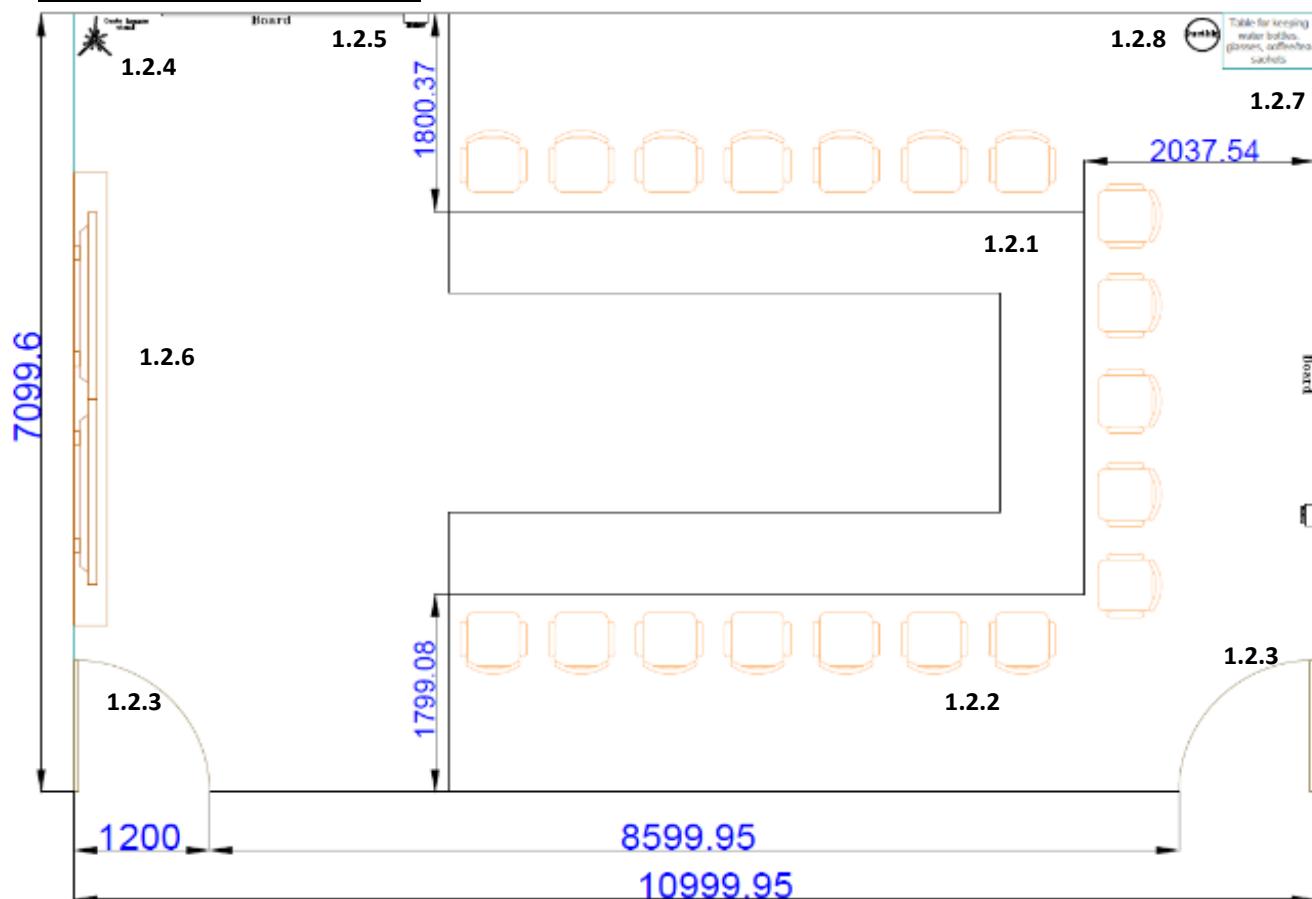
6.6.1.2 Board room

Board room sub-items list			
Item no.	Item	Sub-item no.	Sub-items list
1.2	Board Room	1.2.1	U-shaped table
		1.2.2	Chairs
		1.2.3	2 doors
		1.2.4	Coat hanger stand
		1.2.5	Board and marker keeping stand
		1.2.6	2 LED TVs / 1 big-sized LED TV

		1.2.7	Table for keeping water bottles, glasses, coffee and tea sachets
		1.2.8	Dustbin

- Assumed seating capacity – 21 persons.
- Size of board room: - 11 Mtr. *7 Mtr.
- 800 mm table space for every seated member.
- Video conferencing system.
- Award display keeping facility should be present on the wall adjacent to the door.
- Minimum 20 persons sitting capacity.
- Tables should be separate & easily relocatable as per the requirement.
- Minimum 1 mtr. space should be left behind the sitting chair.
- Sitting chair should be revolving type.
- Location for boardroom should be at a zero-noise place.
- ESD apron stand, if required.
- 1 Mic to be present on the table for every 2 persons.
- Smart TV 75" wall mounted with AV and IT Connectivity for digital connect (HDMI Connectivity).

Board room – Typical layout

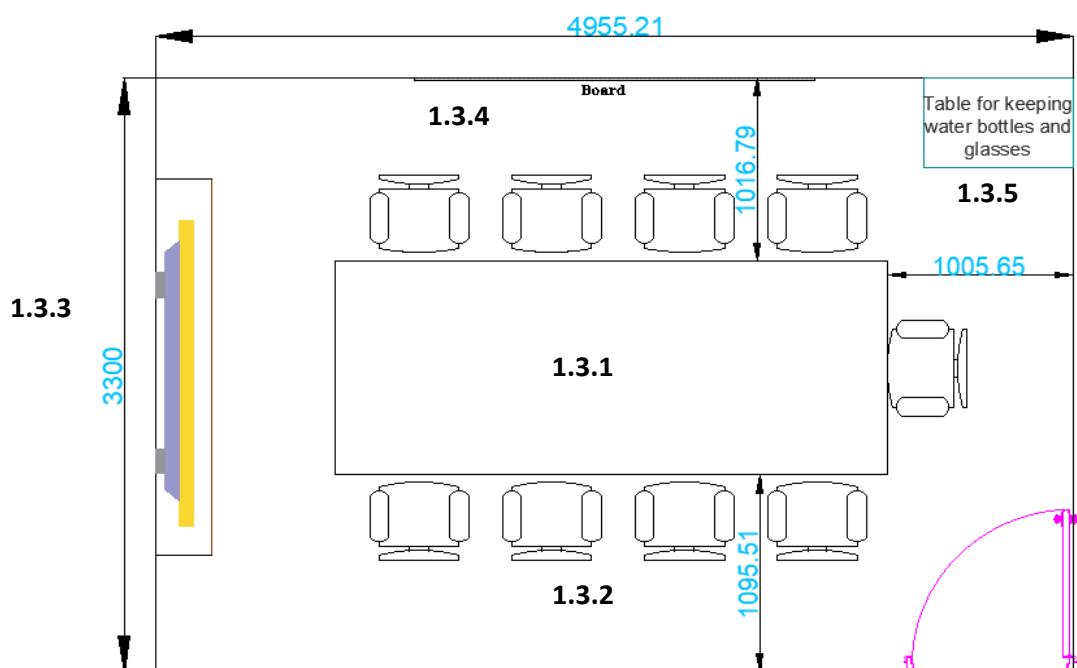


Comments: - Above is the ideal size & layout for a board room.

6.6.1.3 Meeting Room

Meeting room sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.3	Meeting room	1.3.1	Table
		1.3.2	Chairs
		1.3.3	LED TV
		1.3.4	Board and marker keeping stand
		1.3.5	Table for keeping water bottles, glasses, coffee and tea sachets and a Dustbin

Meeting room – Typical layout



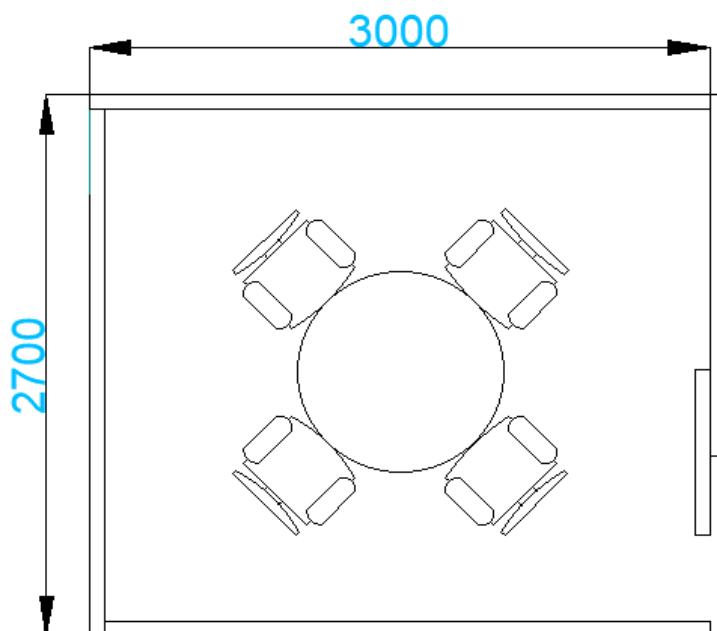
Comments: -

- Size of meeting room- 5 Mtr * 3.3 Mtr
- Assumed seating capacity- 9 persons

6.6.1.4 Conference Rooms/Small Meeting Rooms

Conference room / small meeting sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.4	Small meeting room	1.4.1	Table
		1.4.2	Chairs

Conference room – Typical layout



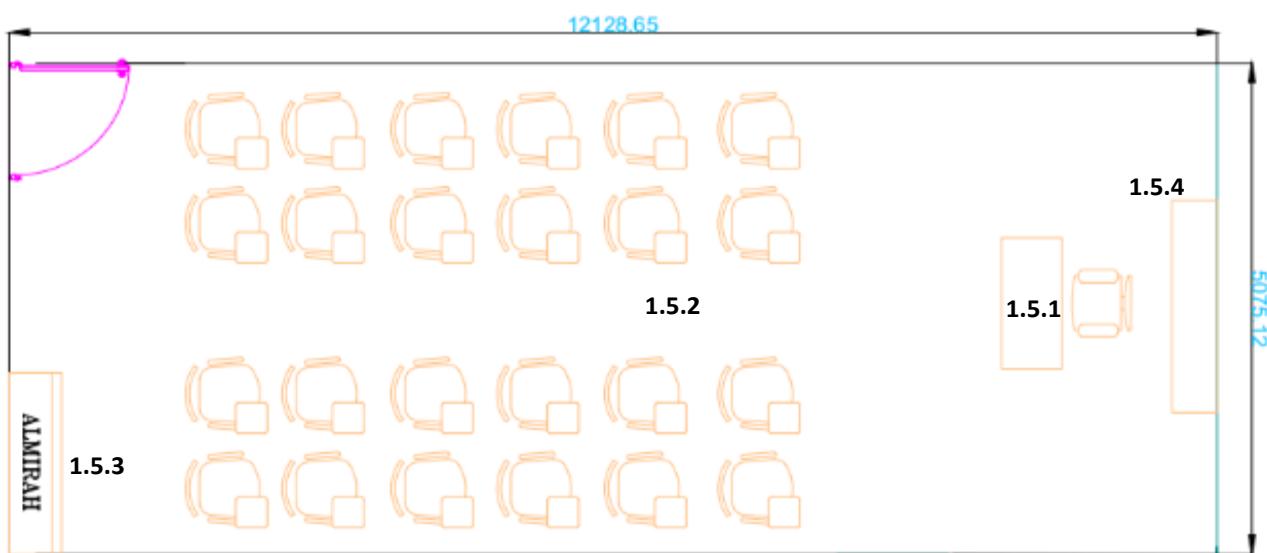
Comments: -

- Size of meeting room - 3 Mtr * 2.7 Mtr
- Height of wall - 1.2 Mtr
- Assumed seating capacity – 4 persons
- Conference room should have the minimum 4 person sitting capacity.
- Minimum 2 conference room should be there.
- Conference room should be near the reception or main entrance in the plant.

6.6.1.5 Training Room

Training Room Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.5	Training Room	1.5.1	Instructor table and chair
		1.5.2	Tablet arm chairs for trainees
		1.5.3	Almirah
		1.5.4	LED TV

Training room – Typical layout



Comments: -

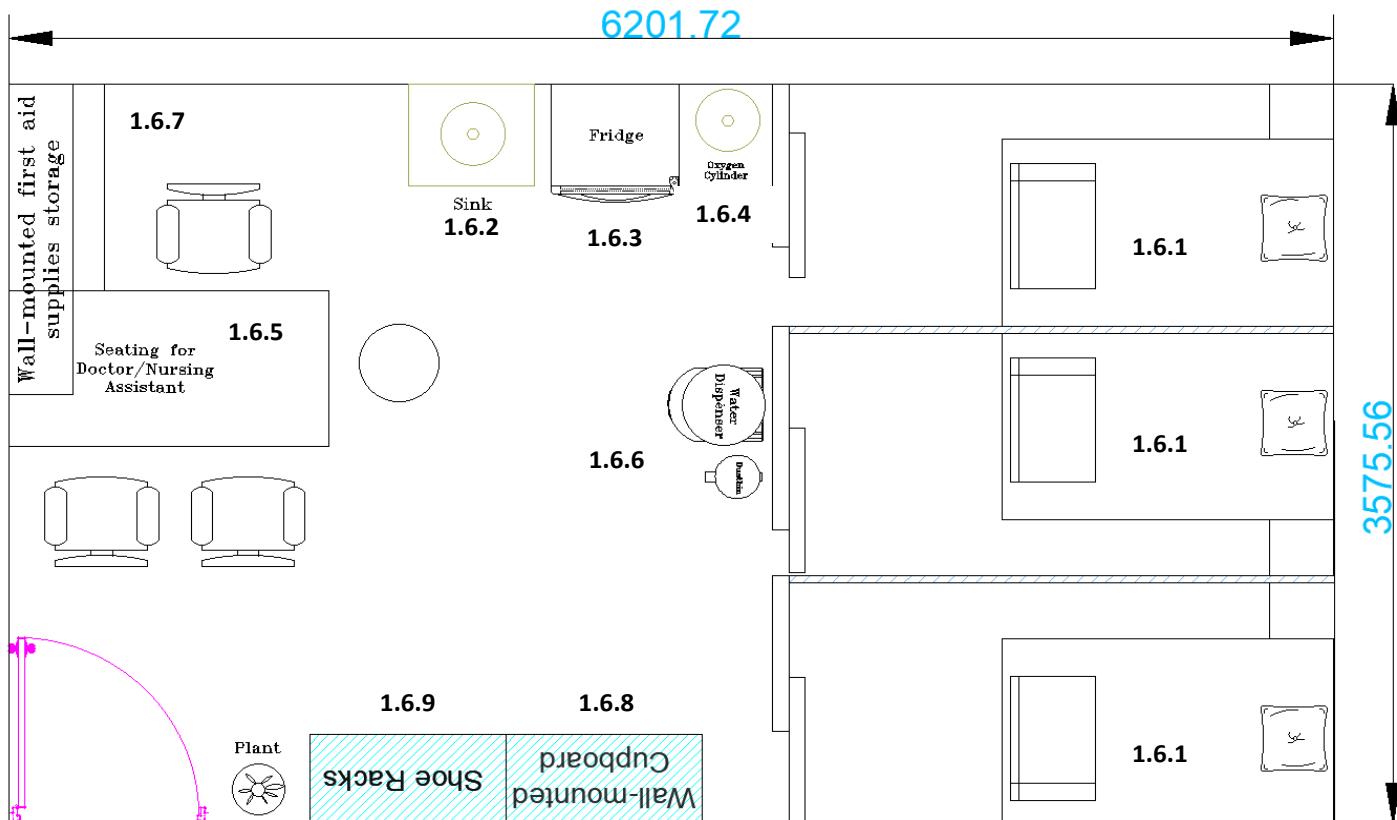
- Typical training room size: 12 Mtr * 5 Mtr.
- Assumed seating capacity - 24 people.
- Projector, computer and white-board facility to be provided.
- For a bigger batch size, dimensions will be increased accordingly.

6.6.1.6 Medical room

Medical room sub-items list

Item No.	Item	Sub-Item No.	Sub-Items List
1.6	Medical Room	1.6.1	3 beds (minimum)
		1.6.2	Sink
		1.6.3	Refrigerator
		1.6.4	Oxygen cylinder
		1.6.5	Seating facility for Doctor/Nursing Assistant
		1.6.6	Water dispenser and Dustbin
		1.6.7	Wall mounted first aid supplies storage
		1.6.8	Cupboard
		1.6.9	Shoes rack

Medical room – Typical layout



Comments: -

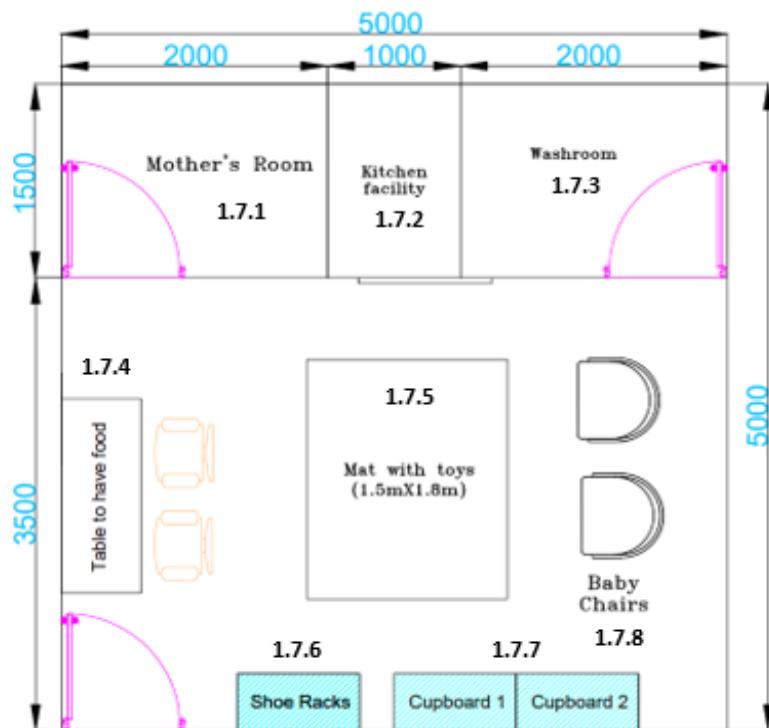
- Facilities to be created as per above layout.
- Table size of the doctor/nursing assistant to be 1200mm X 600mm.
- Bed size to be standard 1800mm X 900mm (assuming a 6 ft. person).
- Beds to be separate for both males and females.
- Curtain system to be provided.
- To be treated as a first-aid facility in case of a standalone plant.

- For a complex, 2 beds are enough.
- For a park, number of beds may be increased up to 6.

6.6.1.7 Creche

Creche Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.7	Creche	1.7.1	Mother's room
		1.7.2	Kitchen
		1.7.3	Washroom
		1.7.4	Table to have food and chairs
		1.7.5	Mat with toys
		1.7.6	Shoes rack
		1.7.7	Cupboards
		1.7.8	Baby chairs

Creche-Typical layout



Comments: -

- Facilities to be created as per above layout.
- Creche required If female Nos more than or equal to 30 Nos.

6.6.1.8 Time office

Item No.	Item	Sub-Item No.	Sub-Items List
1.8	Time office	1.8.1	Table
		1.8.2	Chairs
		1.8.3	File Racks/Cupboards for storage

Time office - Typical layout



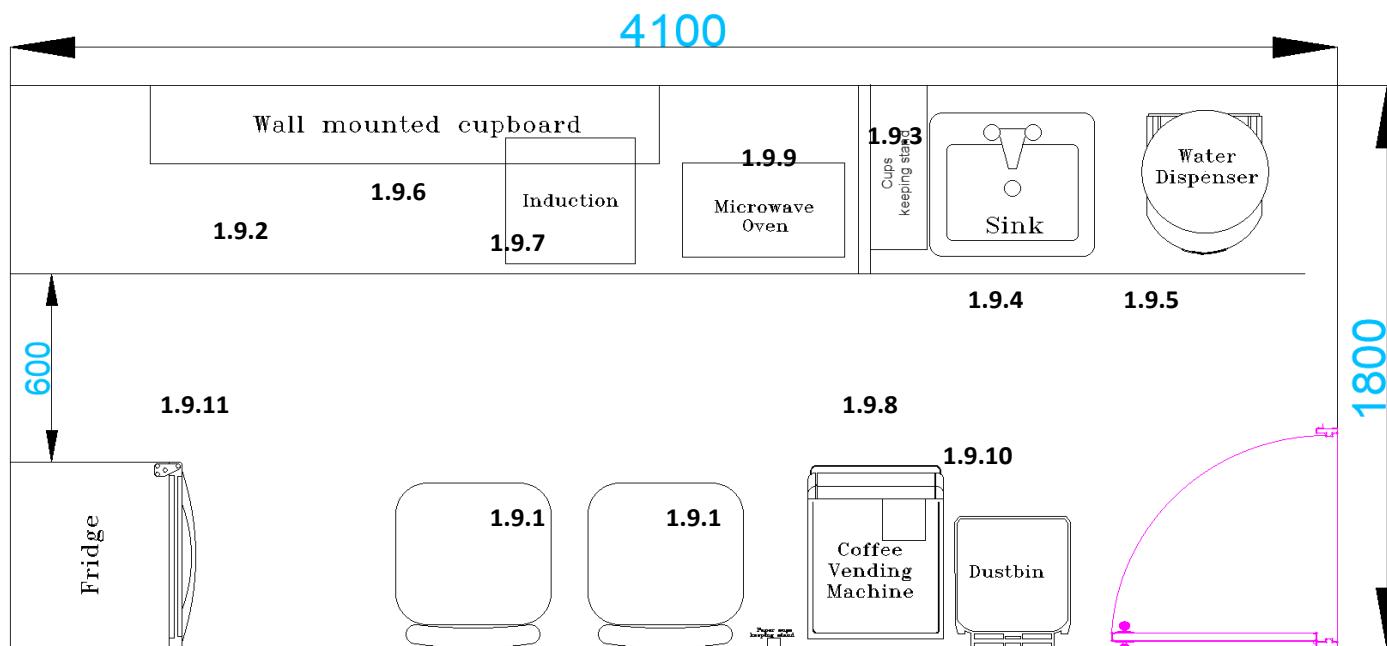
Comments: -

- Facilities to be created as per above layout.

6.6.1.9 Pantry

Pantry Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.9	Pantry	1.9.1	Chair
		1.9.2	Slab
		1.9.3	Cup keeping Stand
		1.9.4	Sink
		1.9.5	Water Dispenser
		1.9.6	Wall mounted cupboard
		1.9.7	Induction
		1.9.8	Coffee vending Machine
		1.9.9	Microwave Oven
		1.9.10	Dustbin
		1.9.11	Fridge

Pantry – Typical layout



Comments: -

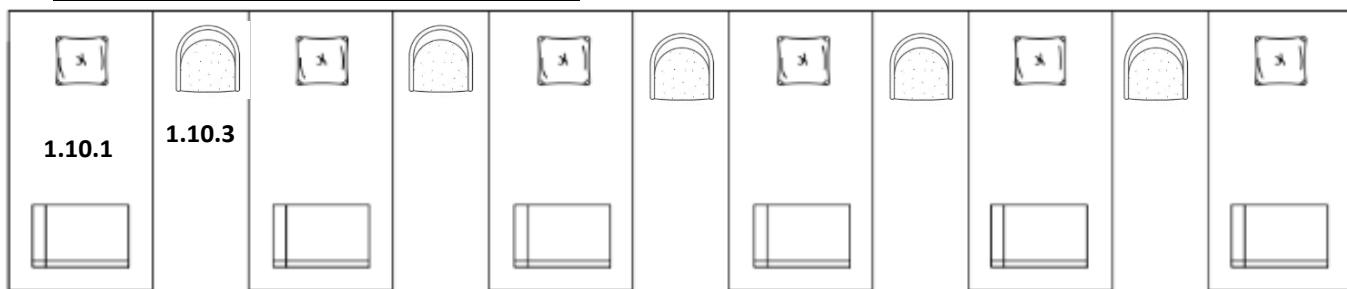
- Facilities to be created as per above layout.

6.6.1.10 Rest Room (Non-Staff)

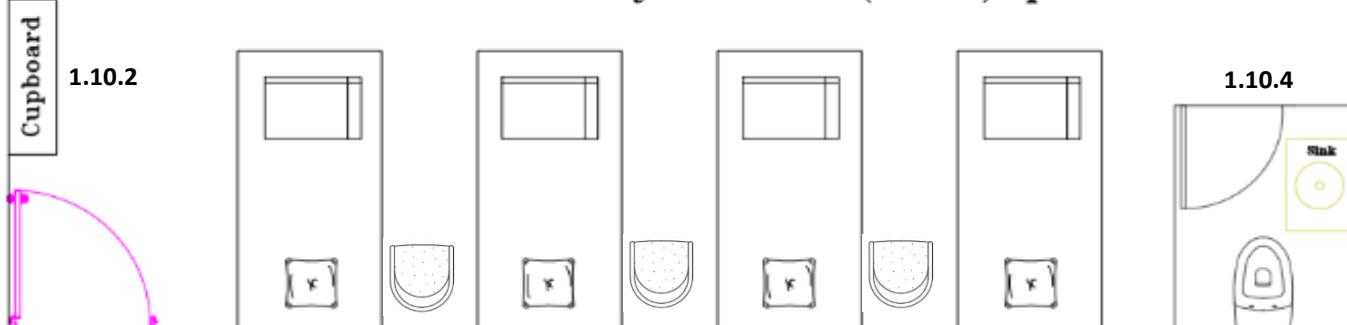
Rest Room (Non-Staff) Sub-Items list

Item No.	Item	Sub-Item No.	Sub-Items List
1.10	Rest Room (Non-Staff)	1.10.1	Bunker Bed (2 persons capacity)
		1.10.2	Cupboard
		1.10.3	Chair
		1.10.4	Washroom with WC

Rest room (Non- Staff) – Typical layout



Bunker bed facility for 20 (10X2) persons



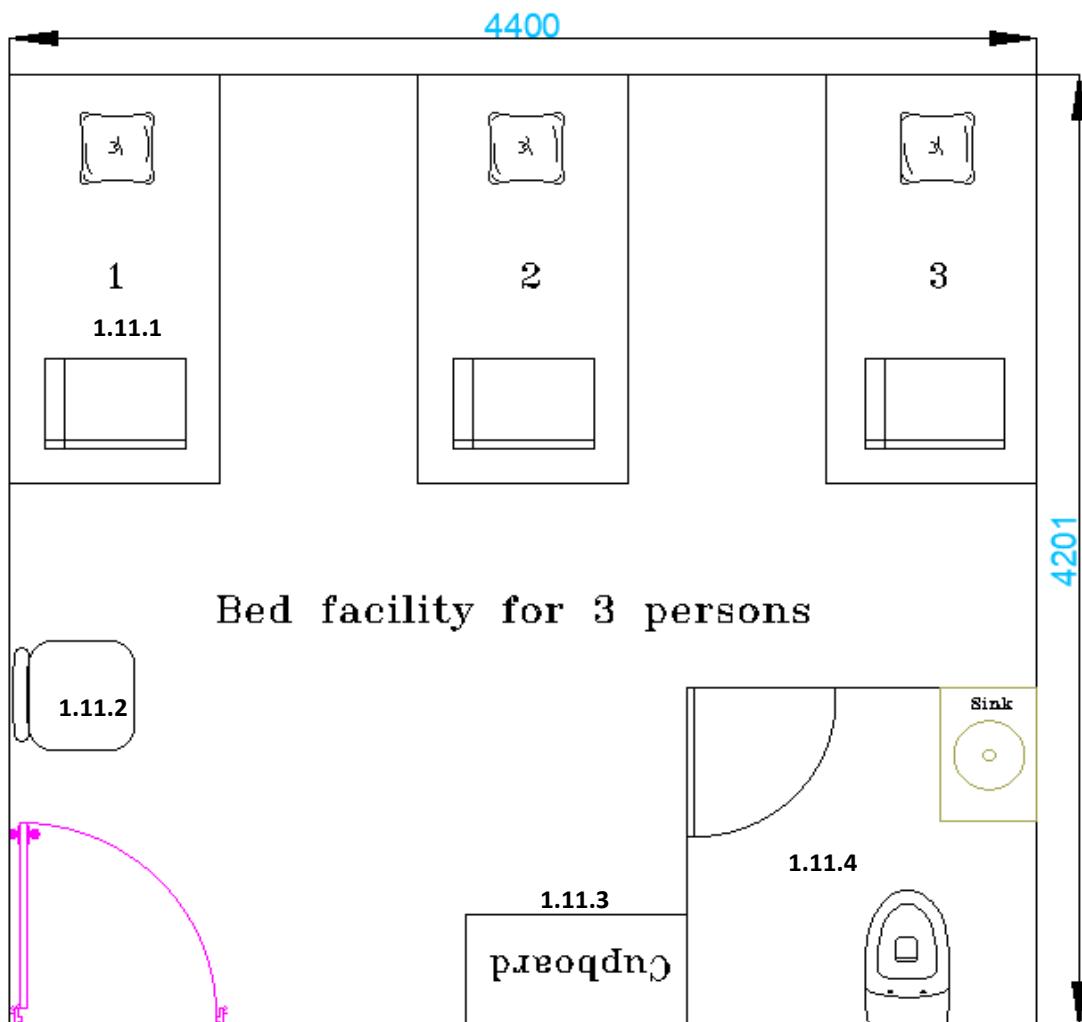
Comments: -

- Size of Rest Room - 10 mtr * 5 mtr
- Facilities to be created as per above layout

6.6.1.11 Rest room (Staff)

Rest Room (Staff) Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.11	Rest Room (Staff)	1.11.1	Bed
		1.11.2	Chair
		1.11.3	Cupboard
		1.11.4	Washroom with WC

Rest room (Staff) – Typical layout



Comments: -

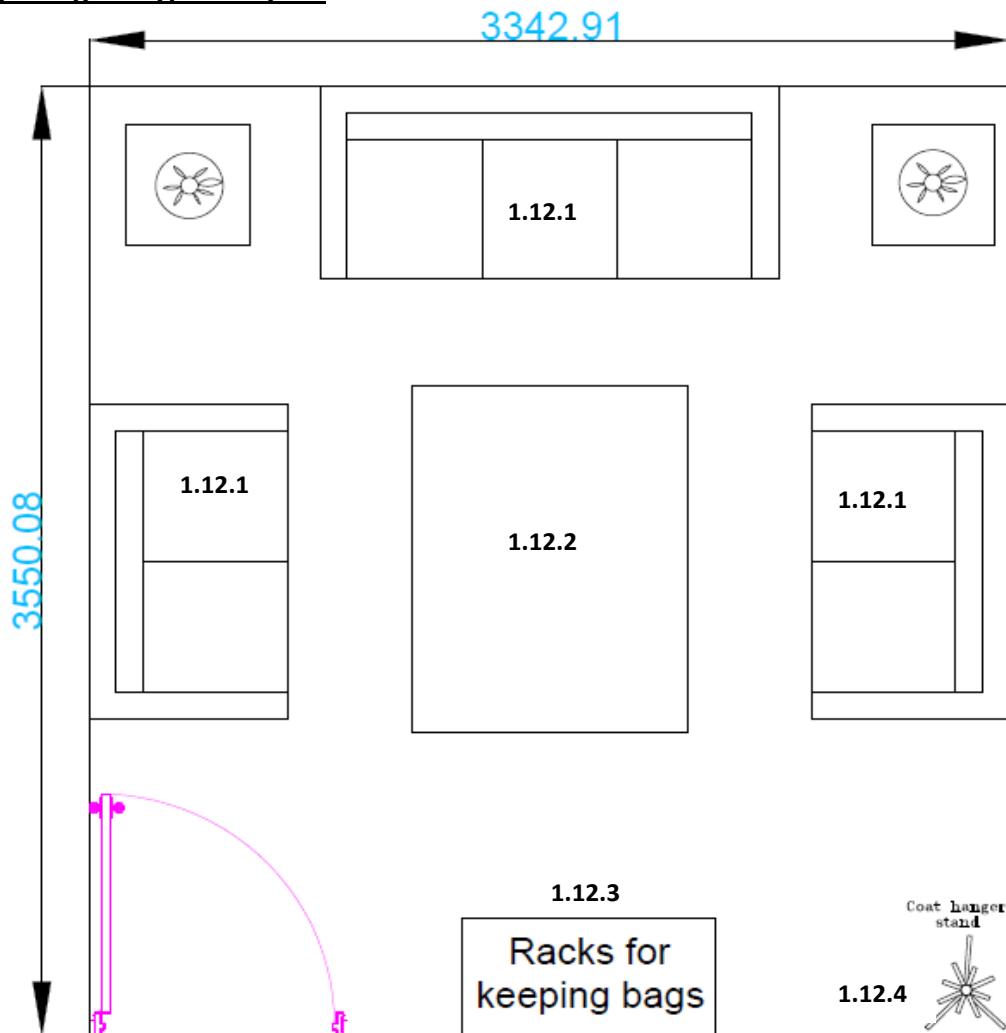
- Size of rest room = 4.4 mtr * 4.2 mtr.
- Facilities to be create as per attached layout.

6.6.1.12 Waiting Lounge

Waiting Lounge Sub-Items list

Item No.	Item	Sub-Item No.	Sub-Items List
1.12	Waiting Lounge	1.12.1	Sofas
		1.12.2	Centre table
		1.12.3	Racks for keeping bags and storing magazines
		1.12.4	Coat hanger stand

Waiting lounge – Typical layout



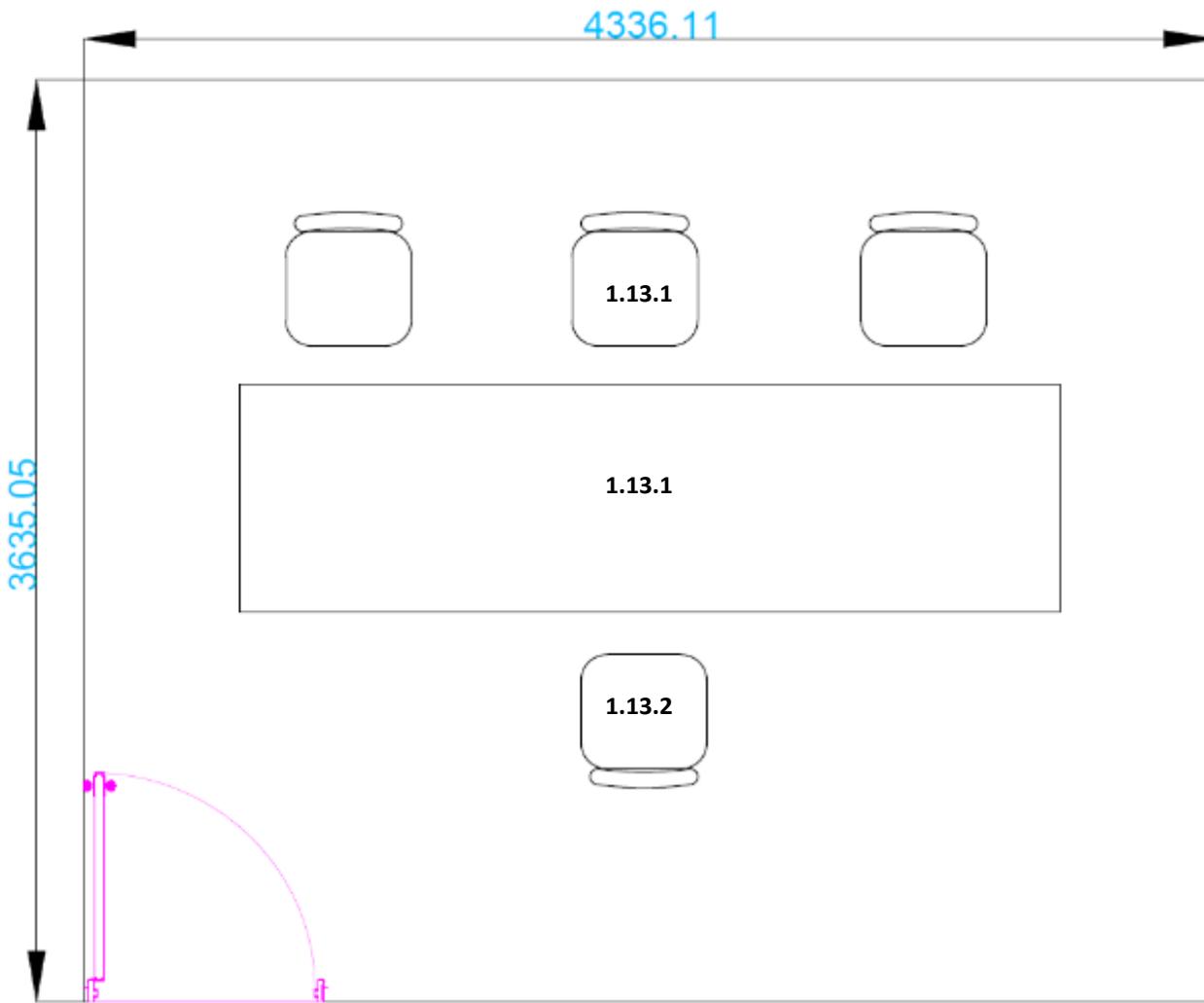
Comments: -

- To be provided, if more than 01 plant lies in one campus.
- May contain about 6 people seating capacity.

6.6.1.13 Interview room (Optional)

Interview room sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.13	Interview room	1.13.1	Table and chairs for the interviewers
		1.13.2	Chair for the interviewee

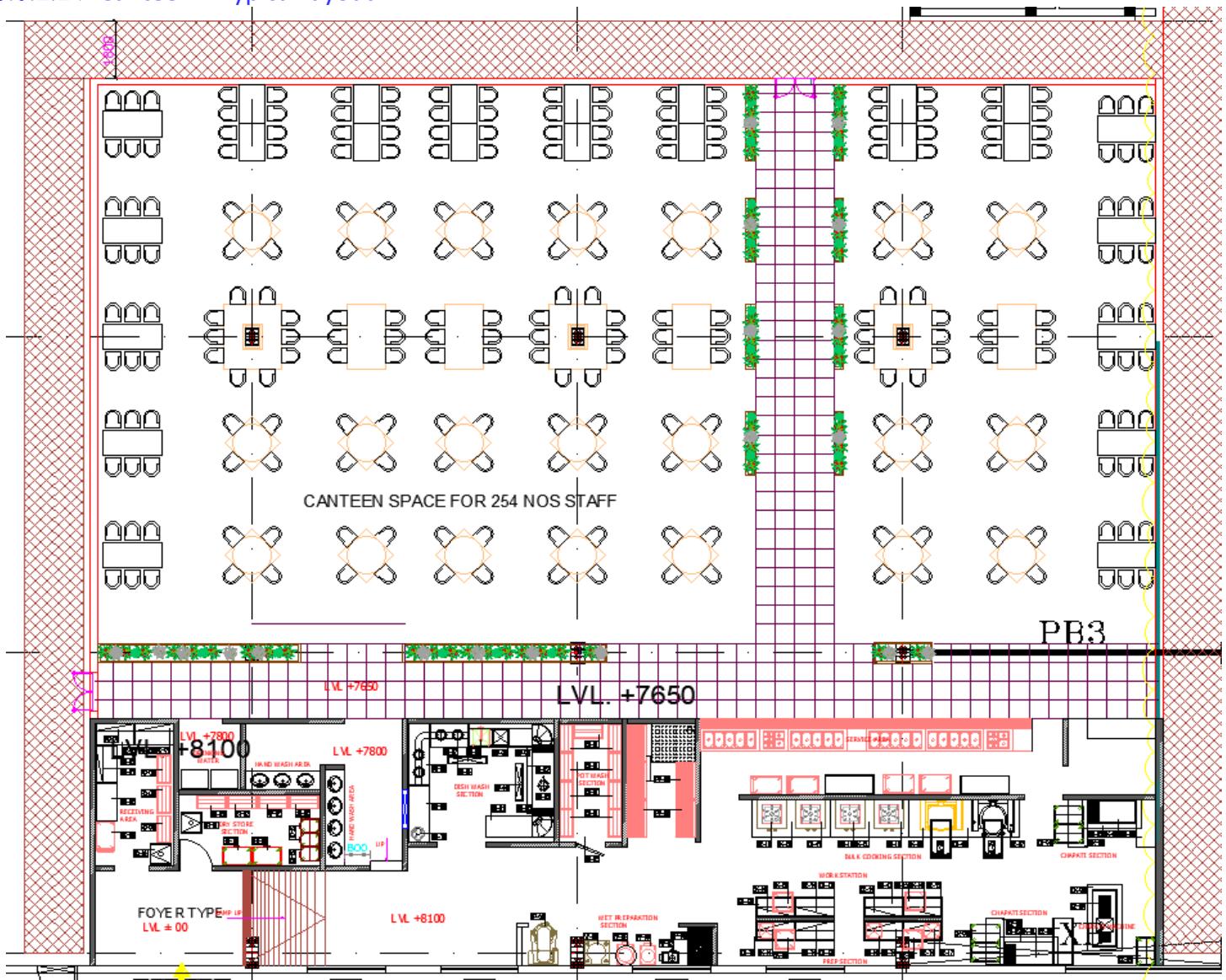
Interview room – Typical layout



Comments: -

- To be provided, if more than 01 plant lies in one campus.
- Video conferencing facility may be provided.

6.6.1.14 Canteen – Typical layout



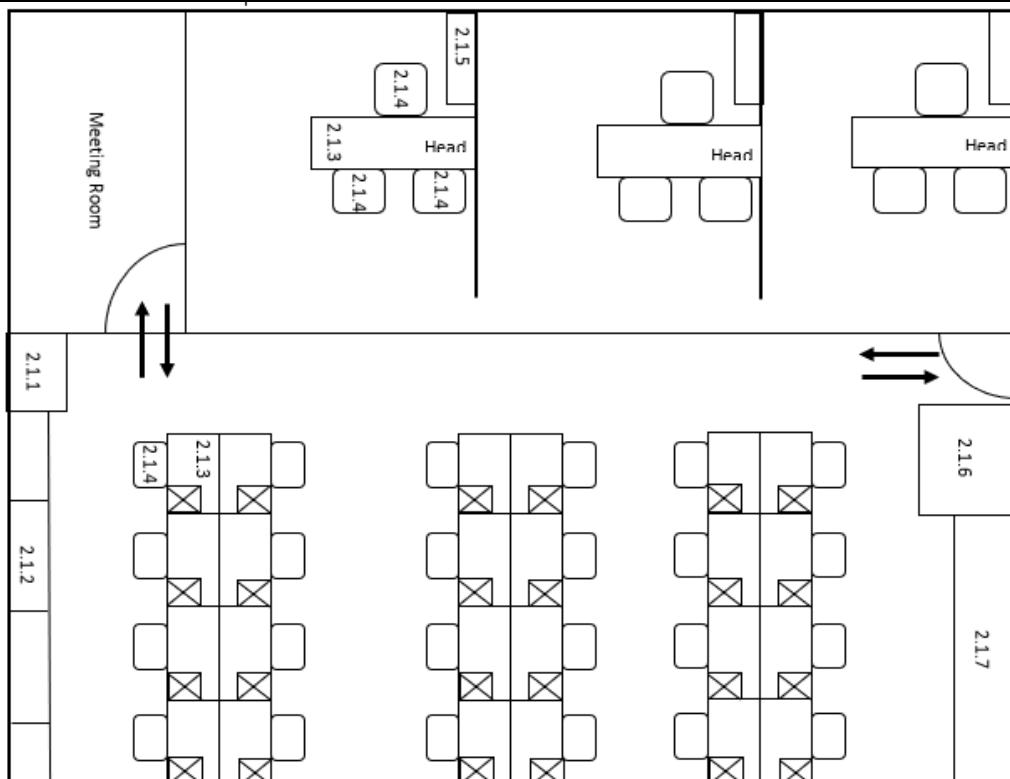
Comments: -

- Size considered – 254 numbers (reference only), sitting capacity/Layout to be decided as per Plant need w.r.t. LTP
- Canteen to be on the ground floor, preferably
- Sufficient tables/chairs inside canteen as per manpower in the plant
- Eating facilities provided under a roof
- Kitchen facility to be considered for More than 100 manpower
- Separate path for in & out for canteen
- Separate route for canteen material
- Toilet should be away from canteen to maintain hygienic conditions
- Safety & quality board display
- Separate, dedicated place for shopping counter
- Space consideration for unit address
- Arrangement to remove produced waste effectively and regularly
- Individual canteen to cater to a small facility and a park canteen to cater to a large facility

- Canteens to be categorized as –
 - Individual canteen with a cooking arrangement
 - Common canteen with a dining
 - Dining only
- Consider unit address space also
- Safety & quality board display
- Automatic vending machines for snacks
- Optional facilities –
 - ATM (depends upon size in the case of an individual canteen, but must in the case of a common canteen; may also be like a CSR initiative and be placed at the Main Gate)
 - Ice cream parlor
 - Snack area

6.6.1.15 General office layout for a department – Typical layout

Office area sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
2.1	Offices	2.1.1	Printer
		2.1.2	File cabinet
		2.1.3	Table
		2.1.4	Chair
		2.1.5	Small file cabinet
		2.1.6	DWM area
		2.1.7	6M board





Green Book

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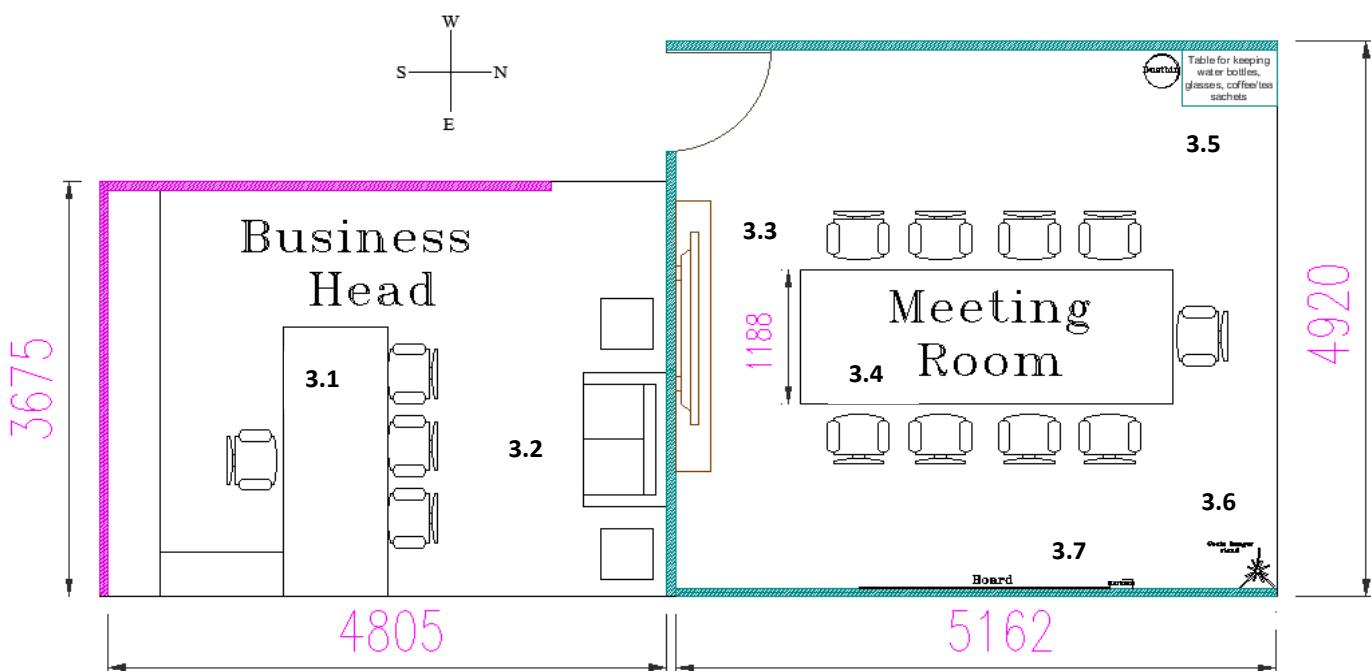
Comments: -

- Size of office area as per need & as per attached layout.
- Sitting area to be calculate- 3 sqm/ persons.
- Table to table (back side) gap should be 2 mtr.
- Dept. Head sitting area Should be 2 mtr *2.5 mtr or follow corporate guidelines.
- Available space per member should be enough for work.
- Space for all accessories like file racks, printers, discussion table.
- Height of Glass in a partition should be 1.2m from the ground level.
- Each department /office should have at least two doors.
- Morning meeting area should be near the display area with review board facility.
- Department should be separated by glass & fitting for easy in future expansion (if possible).
- Department heads to be facing in North direction, preferably.
- Work place should not be congested & under-utilized.
- Small space consideration may be done for God worship (Accounts/Finance, Molding, Maintenance, T/R Maintenance, etc.).
- For open cabin design need to follow QMS-APX-HRP-07 policy (No closed cabin policy).

6.6.1.16 Business head room and meeting room

BH room and meeting room sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
3	Offices	3.1	BH Table and Chairs
		3.2	Sofa
		3.3	LED TV
		3.4	Meeting table and chairs
		3.5	Table for keeping water bottles, glasses, coffee/tea/ sugar sachets, dustbin etc.
		3.6	Coat hanger stand
		3.7	Board with marker stand

Business head & meeting room – Typical layout



Comments: -

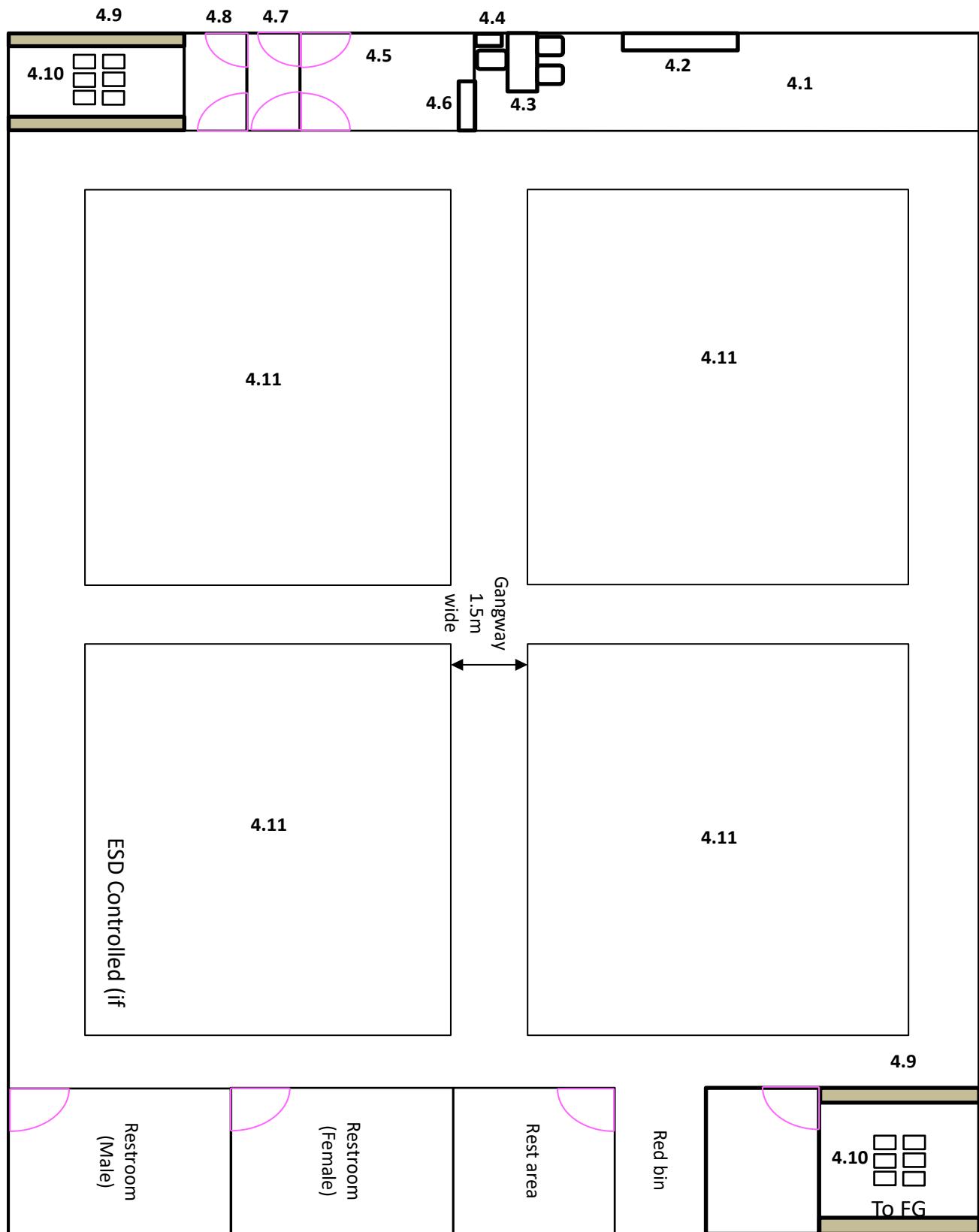
- Facilities & size should be as per attached layout.
- Coats hanging stand should be provided in the meeting room.
- Business head directions- 1st preference- North side
2nd preference- North- east side

6.6.2 Manufacturing Shops/Area

6.6.2.1 Assembly

Assembly Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
4.	Assembly (E.g.: Mindarika, Manesar)	4.1	Office Area
		4.2	DWM
		4.3	Head's Table and Chairs
		4.4	Cabinet
		4.5	Visitor's entry
		4.6	Shoe Rack
		4.7	Male Entry
		4.8	Female Entry
		4.9	High speed shutter
		4.10	Material Exchange
		4.11	Assembly Lines

Assembly – Typical layout





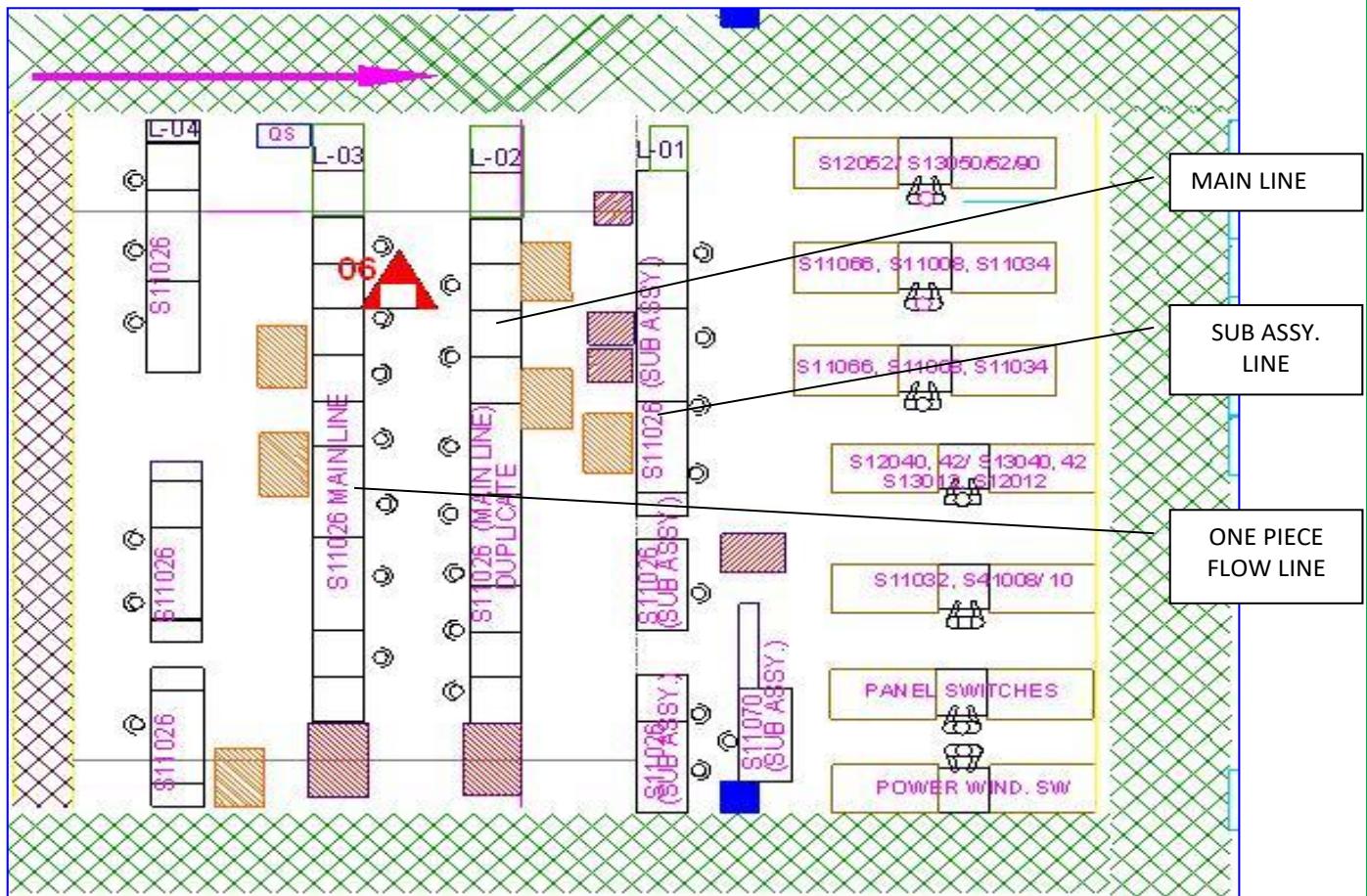
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Comments: -

- No door should open in the main passage.
- Shoe Change-over area available & separate. (No outside shoe allowed in plant).
- Expansion scope to be provided.
- Max material flow through conveyor.
- Space calculation w.r.t. no. of parts, Inventory norms, packing std for the part, raw material, etc.
- Safety stock calculation and space considering FIFO.
- Rack size and space as per packing standards, production rate, daily demand with safety stock.
- Dust entry to be prevented.
- Provision of natural light (Lux level to be maintained as per norms).
- Space for placement of trolleys when not in use.
- Gangway width as per material handling trolley.
- Min. 300 mm clearance should always be provided in between line/machine & passage.
- Min. 600 mm. space should be left on each side of the m/c for maintenance & SS purpose.
- Raw material storage should be near to the machines.
- Nothing should be kept above 1.5 m in height.
- Assembly lines facing each other, a distance of 1.4 m is to be kept from base.
- Working table size (1400x700), & (700x700).
- 350 Lux level at normal working station & 700 at final testing, visual inspection station.
- Parts storage on racks to be covered for dust prevention (store & FG).
- Associate side working distance (min) 1200 mm from table top to table top.
- Material feeding side distance (min) 1000 mm from table to table.
- High speed shutter door.
- All lines should have enough space for work and maintenance.
- Air cooling & conditioning to be marked in layout
- IT related points marking on the layout

6.6.2.2 Assembly line – Typical layout



Comments: -

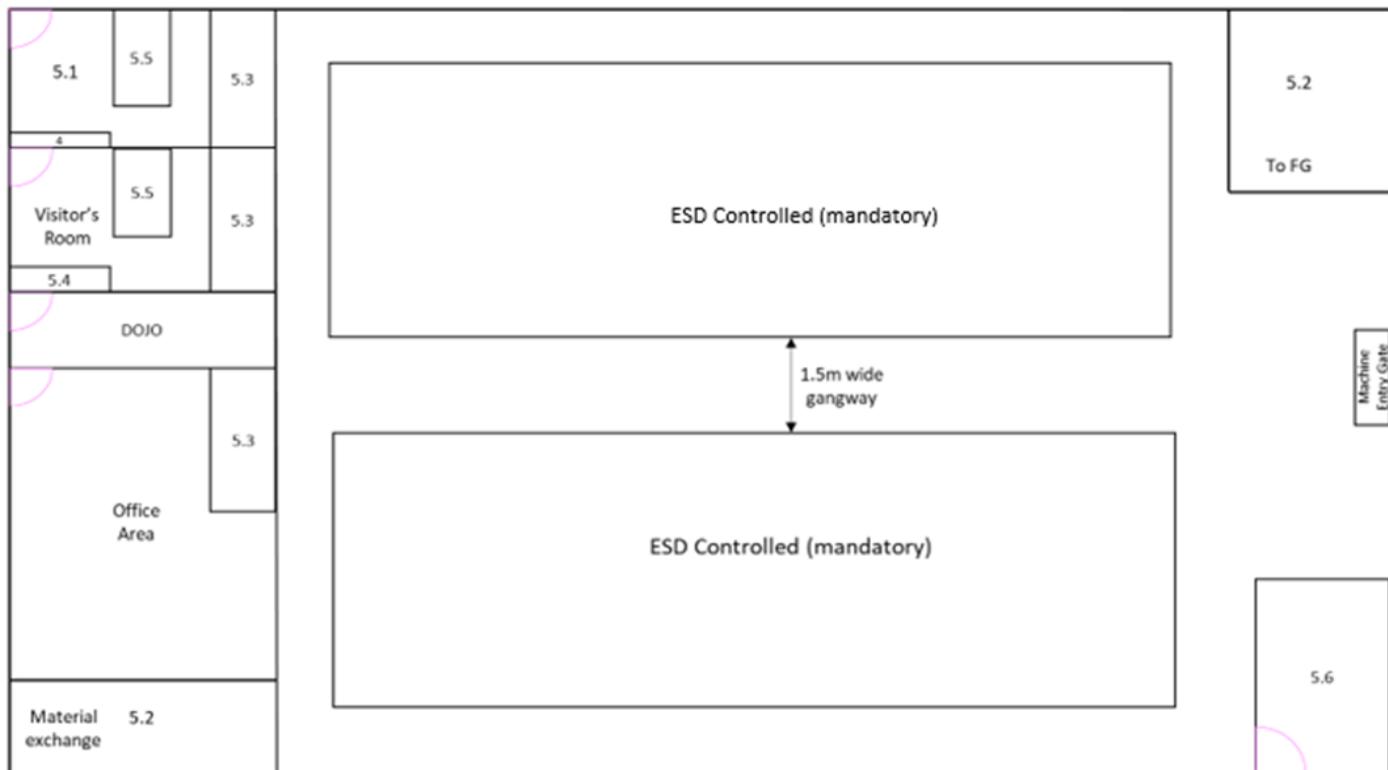
- Working passage and material feeding passage should be separate.
- Line to be kept back-to-back.
- Finished goods should come on common passage.

6.6.2.3 Electronics

Electronics Assembly Sub-Items list

Item No.	Item	Sub-Item No.	Sub-Items List
5.	Electronics Assy.	5.1	Room
		5.2	Pass box (big size for material entry)
		5.3	Air shower (minimum capacity 2 persons)
		5.4	Apron rack for visitors
		5.5	ESD turnstile gate system
		5.6	Facilities

Electronics – Typical layout



Comments: -

- Change room facility is to be provided.
- Shoe change over area is available & separate. (No outside shoes are allowed in shop)

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6.6.2.4 Other production shops- Layout considerations

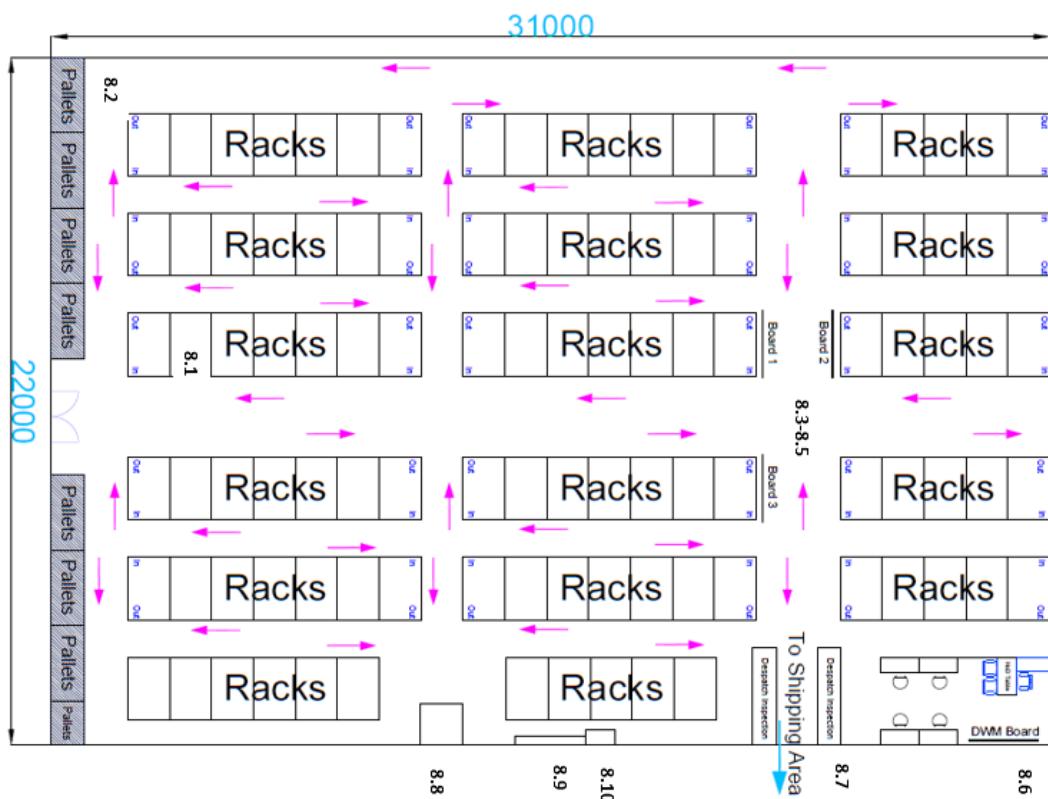
- Space calculation w.r.t. no. of parts, inventory norms, packing std for the part, raw material, etc.
- Safety stock calculation and space considering FIFO.
- Rack size and space as per packing standards, production rate, daily demand with safety stock
- Machine/equipment size and orientation considering the flow of material and location of the next customer
- Fire safety considerations to be incorporated in the layout
- Roof height to be considered as per the process shop.
- Dust entry should be prevented as much as possible
- No door should open in the main passage
- Provision of natural light (Lux level to maintain as per norms)
- Space for all moulds/dies as per variant (consider future expansion also)
- Space for placement of trolleys/forklifts when not in use.
- Gangway width as per material handling trolley and mould transfer forklift
- 3m passage all around the shop where forklift movement is there otherwise keep passage for man movement and should be straight, all clear & connected
- Expansion scope to be provided
- Centralized material feeding system in moulding shop.
- In paint shop, shoe change over area available & separate. (No outside shoes are allowed in plant)
- Tool room shall be nearer to mould shop/ die casting shop, press shop etc.
- Tools, dies, supporting equipment should be near the machines within easy reach.
- Press shop should be covered
- Machines should be placed on minimum 100 mm height for 5S purpose.
- All tool racks should be kept near the machine
- All machines should have enough space for work and maintenance.

6.6.3 Utility and maintenance – Layout considerations

- Utility, compressor, cooling tower should be placed outside the factory building.
- All utility machines should have enough space for work and maintenance.
- DG Stack should be more than 5 meters high from nearby building roof.
- Provision for rain water harvesting system.
- Solar system provision to be taken during plant layout.
- Overhead tank at terrace level will be as per plant build-up area/fire-load.
- Earthing of building/machine/lines, etc.
- Generators installed should be suitably earthed.
- Electrical distribution and LT panel should be double-earthed.
- Insulation mats with latest ISI standard to be placed in front of panel.
- Sufficient CO2 fire cylinders are to be placed near DG and transformer room.
- Transformer and VCB room to be locked properly and its key to be placed at identified location.
- DG is to be set in acoustic enclosure.
- Adequate noise protection should be provided (as per govt. rule) for workers working in generator rooms and restricted to access by authorized person only.

6.6.4 FG/Bonded – Typical layout

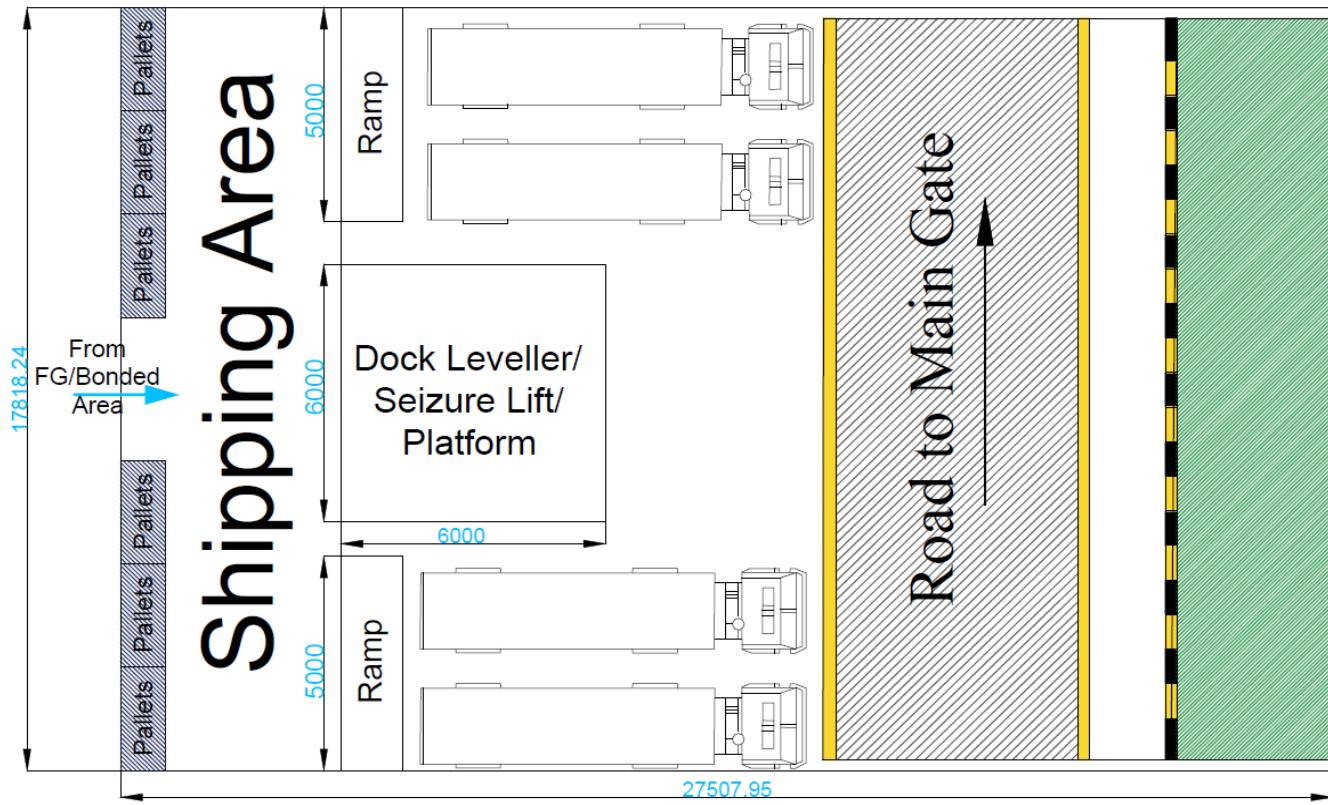
FG/Bonded Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
8.	FG/Bonded	8.1	Racks
		8.2	Pallets
		8.3	Board 1 – Shipping customer board
		8.4	Board 2 – BEST practices display board
		8.5	Board 3 – Visualization board
		8.6	Office area
		8.7	Dispatch inspection
		8.8	Goods lift
		8.9	FG kanban post rack
		8.10	Empty kanban rack



Comments: -

- Expansion scope to be provided.
- Use of 3C concept for material handling & storage in FG.
- Max. material flow through conveyer.
- Heavy parts should keep lower side of rack & light weight parts should kept at upper side in FIFO rack.
- DWM Board for product movement i.e., shipping control board on FG store.

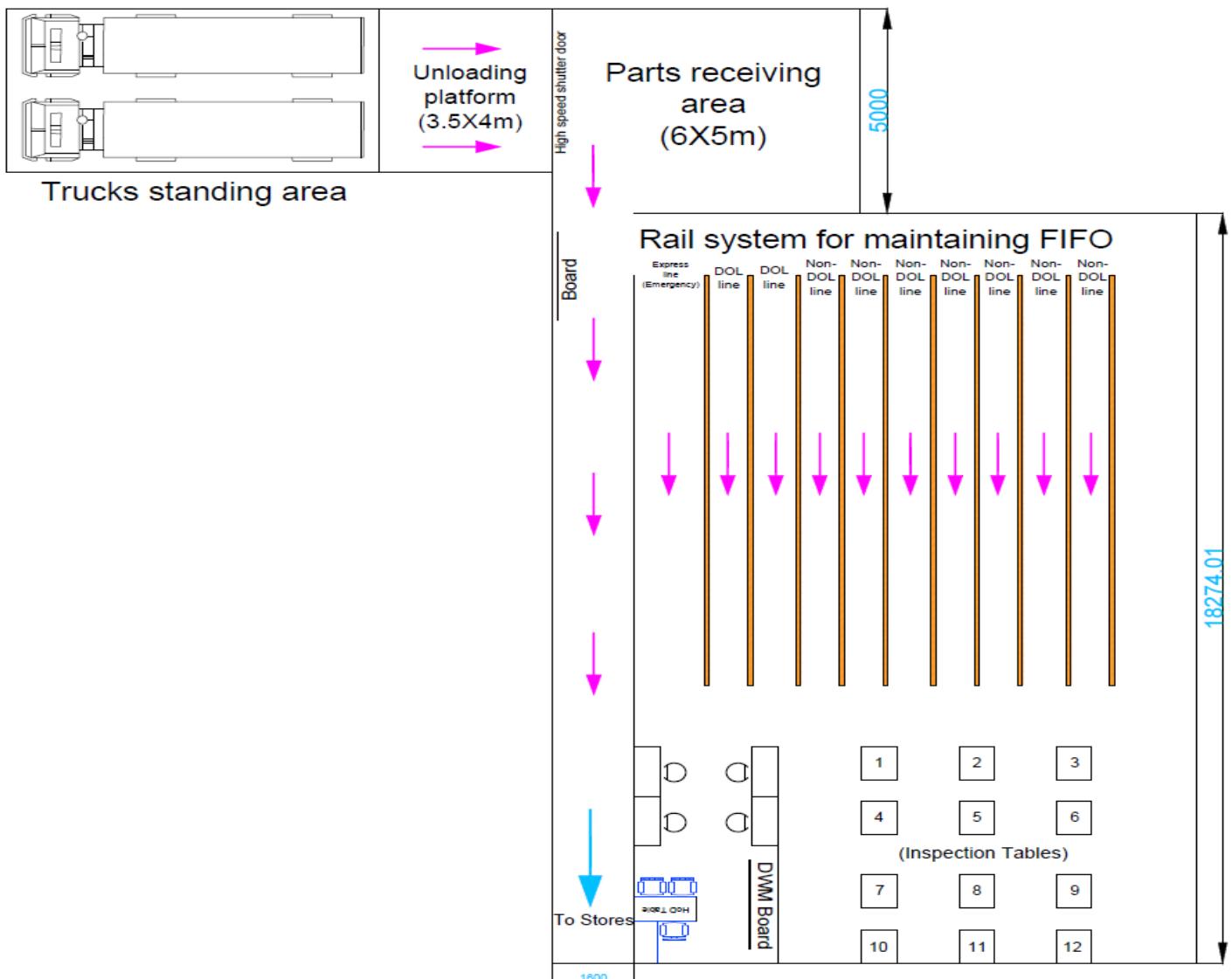
6.6.5 Shipping and loading/dispatch – Typical layout



Comments: -

- Layout to be designed as per plant need(Attached layout for reference only)
- Dispatch area should be covered to avoid any rain even from sides.
- Dock leveler for truck.
- Material flow from receiving area to dispatch area should be linear.
- Separate empty bin/trolley area e.g., FG bin/trolley near to dispatch area.
- Unloading in covered location.
- Set back in the plant - Fire brigade movement around main manufacturing building size of road is defined accordingly.

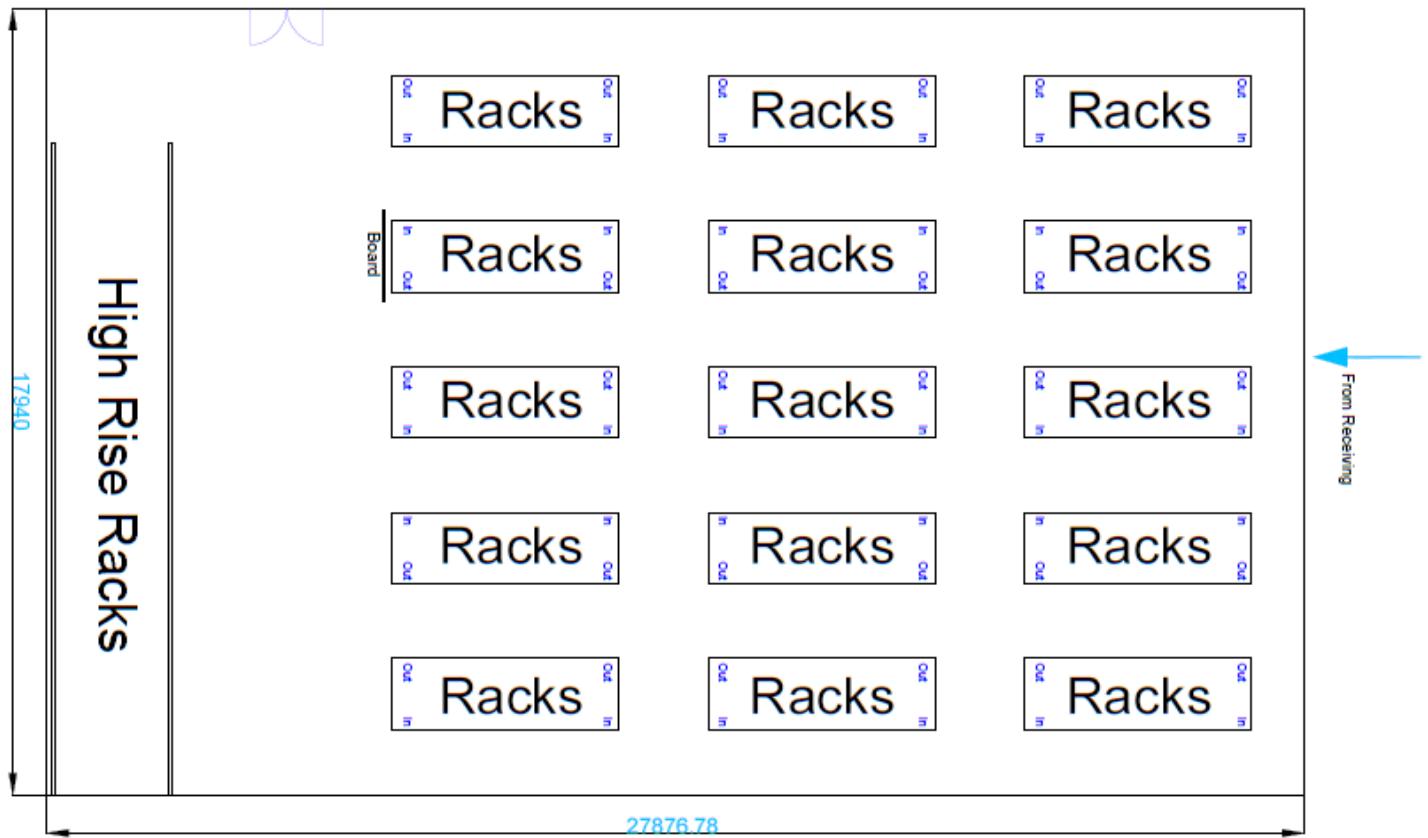
6.6.6 Unloading and receiving – Typical layout



Comments: -

- Receiving area should be covered to avoid any rain even from sides.
- Use of 3C concept for material handling & storage.
- DWM board for product movement i.e., supplier delivery board in receiving store.
- Material flow from RM/receiving to dispatch to be linear.
- Dock leveller for truck.
- Rolling gate.
- Unloading station.
- Canopy on unloading area.
- Trolley location system and rail system.
- Loading/unloading in covered location.
- Separate empty bin/trolley area e.g., area for supplier bins are near to receiving area.
- Material flow from RM/receiving to dispatch to be linear.

6.6.7 Main Stores – Typical layout



Comments: -

- Material IN/OUT identification in store.
- Expansion scope to be provided.
- Empty bin area is available & covered.
- Space calculation w.r.t. no. of parts, inventory norms, size of bins/ boxes/ pallet etc.

6.6.8 Main gate

S. No.	Types of gates	Min. dimension (m) (Width X height)
1	Main gate at company entrance	6.0 x 2.0 m
2	Side gate at company entrance	1.2 x 2.0 m
3	M/C entry gate at main building	4.0 x 4.5 m
4	Material entry gate at main building	2.5 x 4.5 m
5	FG dispatch gate at main building	3.0 x 4.5 m
6	Employee entry gate at main building	2.0 x 2.1 m
7	Department's entry gate	1.5 x 2.1 m
8	Emergency exit gate at shop floor area	1.2 x 2.1 m
9	Emergency exit gate department wise	1.2 x 2.1 m

S. No.	Type of passage	Min. dimension Mtr. width
1.	Main passage in shop floor (for M/C movement)	2.0 mtr
2.	Main walking passage (shop floor & assy.)	1.5 mtr.
3.	Material feeding & FG pick up (trolley size + 400 m)	1.2 mtr.
4.	Sub passage (for maintenance purpose)	1.0 mtr
5	Forklift movement	As per forklift guidelines
6.	AGV movement passage	AGV, trolley size + 400MM
7.	Roads (around the building)	6.0 mtr

Comments: -

- Boom barrier gate should be there on main gate.
- Material, machine entry gate size can change as per process need.
- Main gate should be motorized.
- M/C entry gate, raw material gate, FG dispatch gate should be on the main road.
- Material will come from 'In' gate and leave from 'Out' gate.
- Gates to be entirely different for man movement.
- Physical check facility.
- Note – Width and height of the truck is considered to be 3X4 m.

6.6.9 Roads outside building and passages inside plant

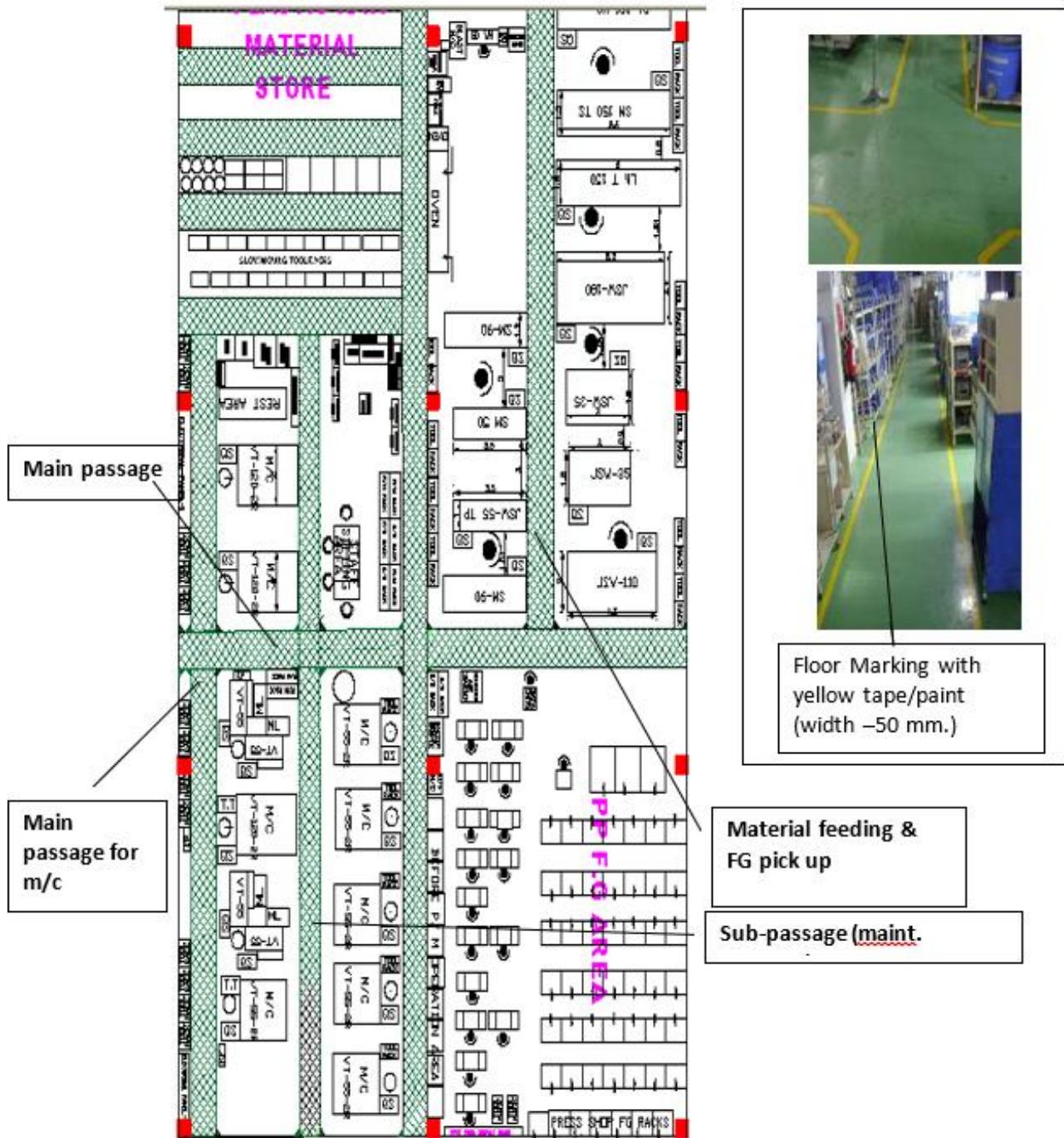
Comments: -

- All passages should be straight & linked with each other due to the safety factor.
- All passages should be chamfered 45 degrees at the connecting point (length=250 mm) for easy turning.
- Min. 300 mm distance in between m/c & yellow line.
- Marking on the floor should be done with yellow line (width 50 mm).
- Different pathway to be designed for employee & supplier/FG vehicle movement to avoid any accident
- Vehicle size (both supplier & dispatch) to be considered for outer road size finalization
- Different pathway to be design for Employee and supplier/FG vehicle movement to avoid any accident

- Speed breakers provided (wherever required)
- Display of Concave Mirrors wherever Intersections are occurred

Note: - Material, machine movement passage can be changed as per process need.

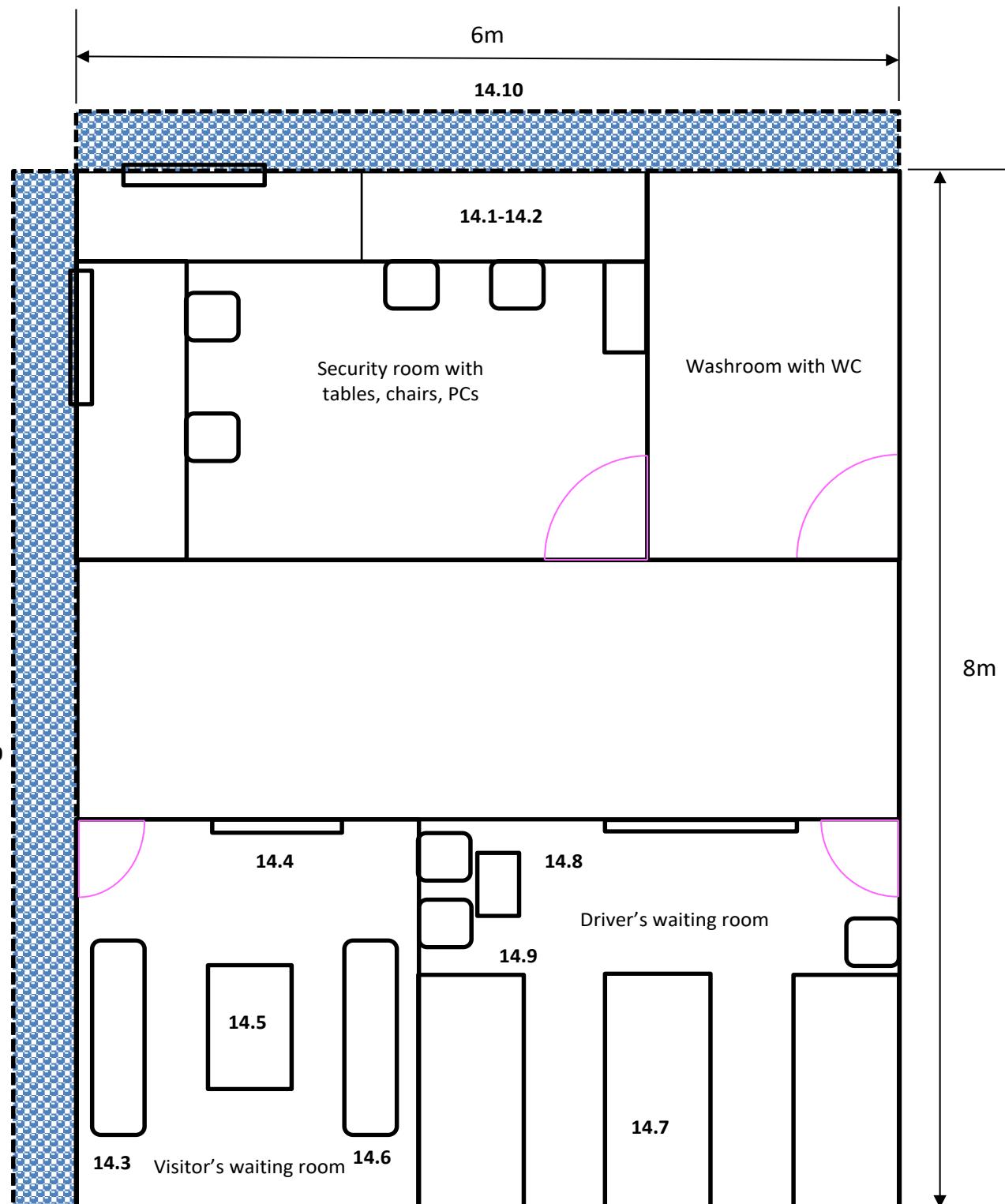
Passage & marking – Typical layout



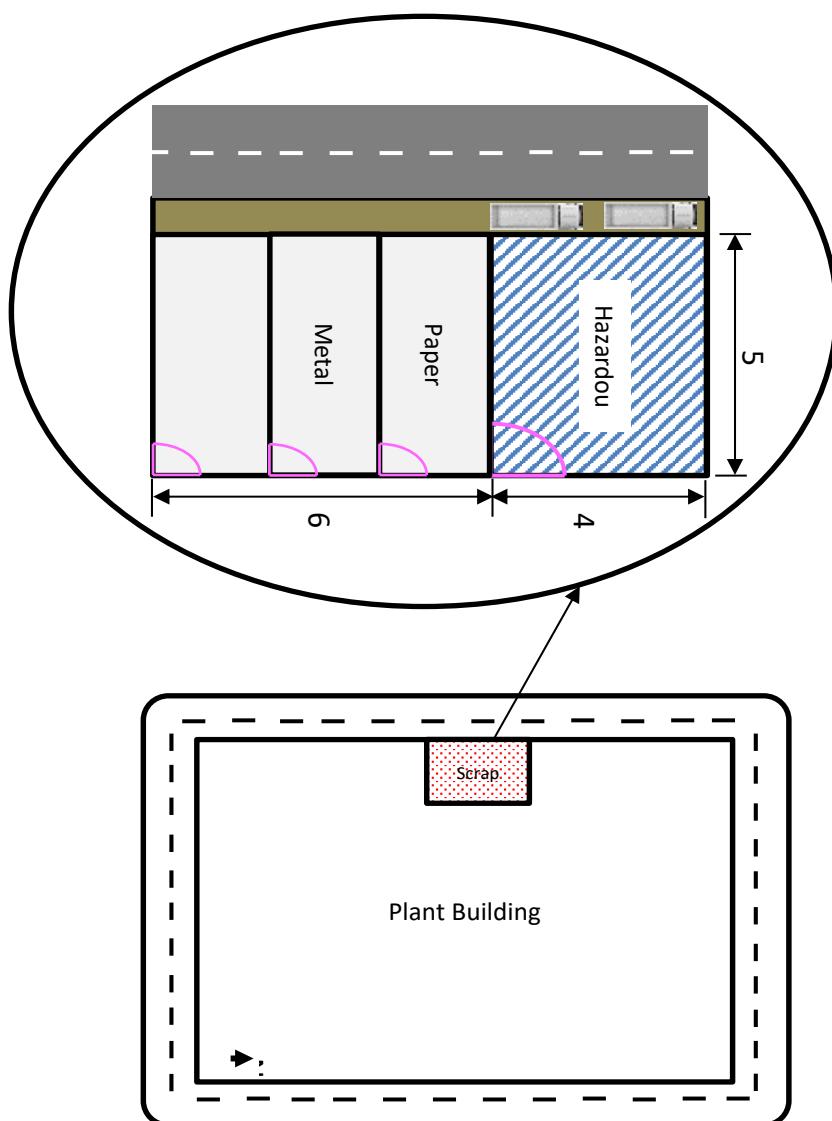
6.6.10 Security Office

Security Office Sub-Items list				
Item No.	Item	Item classification	Sub-item no.	Sub-items List
14	Security Office	Security room	14.1	Mobile phone deposit box
			14.2	Key box
		Visitor's waiting room	14.3	Sofa
			14.4	LED TV
			14.5	Centre table
			14.6	Storage/keeping facility for keeping visitor bags, helmets, etc.
		Driver's waiting room	14.7	Bunker bed
			14.8	Chairs
			14.9	Storage/keeping facility for keeping driver bags, helmets, etc.
		Others	14.10	Outer canopy (must)

Security Office – Typical layout



6.6.11 Scrap Yard and Chemical Storage – Typical layout

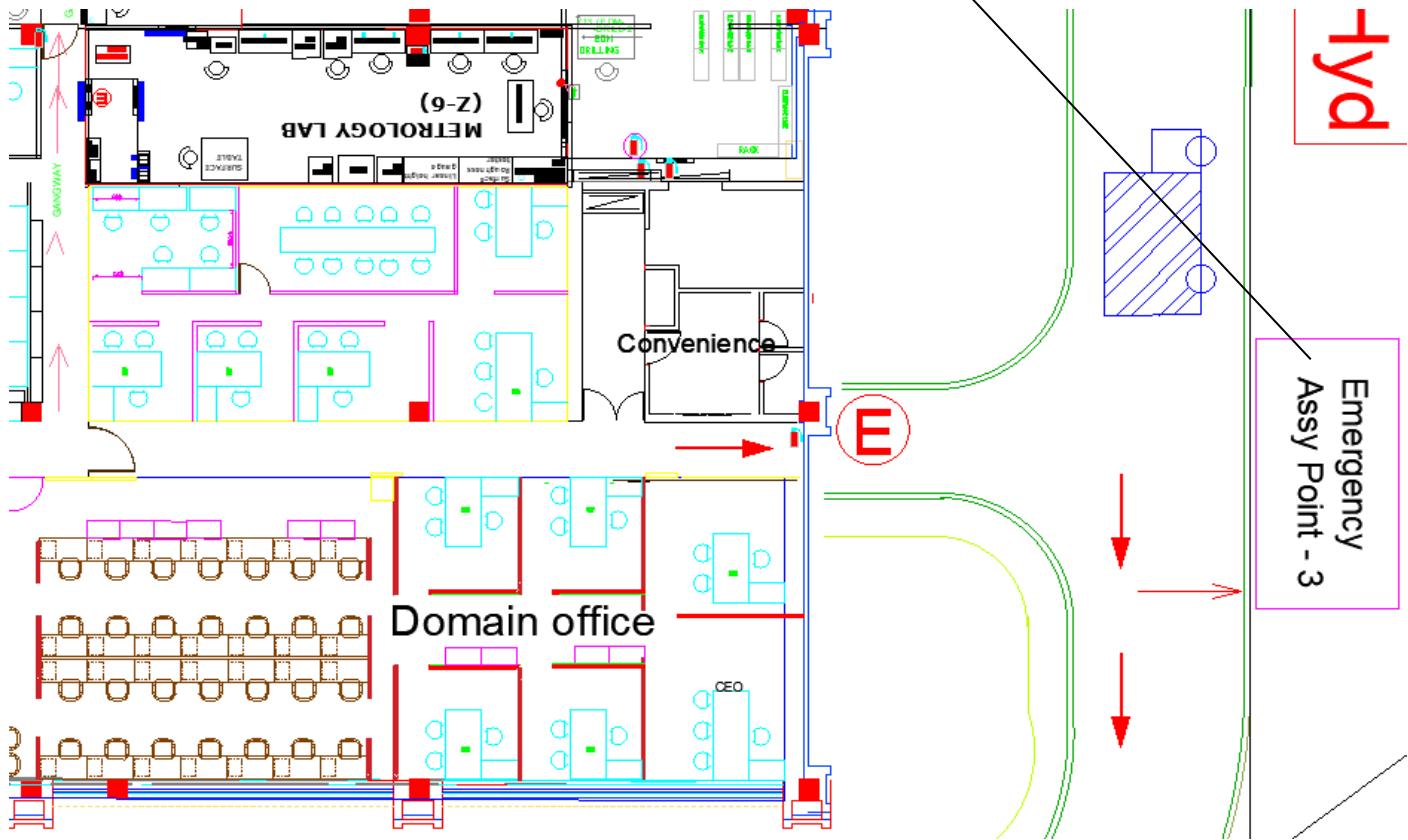


Comments: -

- Area of scrap keeping should be defined separately with partition for keeping hazardous/ Non-hazardous material.
- Chemical storage should be separate from the building area.
- There should be no floor drain.
- Eye wash facility should be available within 30m of where chemicals are stored.
- Fire extinguisher and sprinkle system should be available.
- Effective ventilation system in chemical storage area.
- Effective secondary containment system for liquid chemicals.

6.6.12 Emergency assembly area – Typical layout

EMERGENCY ASSEMBLY POINT



Comments: -

- Emergency assembly area (common & individual department).
- Emergency exit should be easily approachable with connected passage.
- There should be marked position for each department in emergency assembly area.
- Emergency exit points should be marked & visualize for everyone.
- Emergency exit gate should be according to the manpower in that area.
- Example of an assembly area exit gate – (W x H) {3.0x2.0}

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6.7 General/miscellaneous points for layout

Points needed to be considered during layout-

- Storage area capacity for-
 - Local parts – 15% more than requirement to take care of emergency situation
 - Imported parts
 - In-house made parts
 - Tool and dies
- Management jurisdiction- areas which are managed by 2 different teams should not be mixed together (to the extent possible)
- Space for supplier bin cleaning (including some machine)
- Capacity planning sheet is master for area calculation, allocation for manufacturing, storage areas.
- Display standardization across all areas like 4M change board, work station display, organization objectives display, kaizen gallery, product gallery etc.
- Separation of man/machine/trolley [Walk path & gangway]
- No obstacles of pillars for material flow
- Material and FG passage should be separate
- Material storage place is appropriate to prevent from the outside environment.
- Morning meeting/red bin meeting/DWM meeting/UMMC meeting - concerned corner to be identified & project meeting to be done in morning meeting area.
- High-cost equipment should be under covered location
- Flag post in front of main entry
- One shutter should be provided in the area from where the heavy machines can easily enter.
- Minimum height of shutter should be more than 5 m.
- High speed shutter door at all plant entry
- Green building area as per norms and tree plantation as maximum as possible.
- Car & 2-wheeler parking area is available & marking done
- High-speed shutter door at all plant entry from outside



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Abbreviations

S. No.	Abbreviation	Full form
1.	FG	Finished Goods
2.	RM	Raw Material
3.	WIP	Work-In-Process
4.	M/C	Machine
5.	LTP	Long Term Planning
6.	SQPCDM	Safety, Quality, Productivity, Cost, Delivery, Morale
7.	HRM	Human Resource Management
8.	PA	Public Address
9.	LED	Light Emitting Diode
10.	TV	Television
11.	ESD	Electro-static Discharge
12.	DWM	Daily Work Management
13.	FIFO	First-In-First-Out
14.	DG	Diesel Generator
15.	AGV	Automated Guided Vehicles



7. Interior design

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7 Interior design

📌 Objective

As a part of Green Book for plant standardization, the CFT for Interior design has tried to develop the standards for development which will bring uniformity, standardization, target setting & target achievement approach in various aspects of setting up of new manufacturing plants at group level while keeping the ultimate goal of achieving operational excellence (SQPCDM).

- To bring uniformity and standardization in the interior design of any upcoming manufacturing plant.
- To send a silent message to all the stakeholders about our vision and ambition to become a world class manufacturer in every sense
- To provide our employees a workplace that is not only aesthetically appealing but highly functional so that they can work in the most efficient manner

📌 Scope

1. The following document covers all the upcoming manufacturing plants of Uno Minda Group anywhere in the world.
2. The document broadly covers the following main areas.
 - a. Office Areas
 - i. Reception
 - ii. Board room
 - iii. Meeting room
 - iv. Small meeting room
 - v. Training room
 - vi. Medical room
 - vii. Creche
 - viii. Time office
 - ix. Pantry
 - x. Rest room
 - xi. Waiting lounge
 - xii. Interview room
 - xiii. Canteen
 - xiv. General office for a department
 - xv. Business head office & meeting room
 - b. Manufacturing Plant Areas
3. For both of the above-mentioned area i.e., Office Areas and Manufacturing Plant Areas
 - a. Floors (including carpet floor etc.)
 - b. Walls (including wall skirting)
 - c. Ceiling
 - d. Furniture (Table / Chairs/ Coffee making table / Coat hanger) – including basic size, shape etc.)
 - e. TV screen / Projection screen
 - f. Writing board including marking pen and duster stand / storage
 - g. Wall clock
 - h. Entry door
 - i. Room no or name plate / Office identification hanging plates etc.
 - j. Office zone identification plates
 - k. Color palette of the rooms and furniture etc.
 - l. Suggested meeting room sizes (proposed in collaboration with layout-related CFT team)
 - m. Suggested in-door plants (as needed)
 - n. Company name display (behind reception table)
 - o. Guest welcome message TV screen

- To ensure brand consistency across our facilities, we're establishing guidelines for creatives and messages displayed at the plant.
 - Approved Creatives:** The plant can utilize approved branding and messaging materials from the Corporate Communication desk's creative repository for display in appropriate locations within the facility.
 - Encouraging Creativity (with Approval):** While we encourage plant-level creativity, any new or non-standard creatives require prior approval from the Corporate Communication desk (communicationdesk@unominda.com).

7.1 Office areas

7.1.1 Reception

Reception Sub-Items list			
Item no.	Item	Sub-Item No.	Sub-Items List
1.1	Reception	1.1.1	Products display
		1.1.2	PA (Public Address) system and centralized control
		1.1.3	Receptionist table and chair
		1.1.4	God idol
		1.1.5	Discussion rooms (minimum 2 meeting rooms + 2 cubicles, maximum 4,4)
		1.1.6	Sofas and center table for visitors (minimum 6 persons seating)
		1.1.7	Magazine rack
		1.1.8	Water dispenser with cup holder
		1.1.9	Double door entry

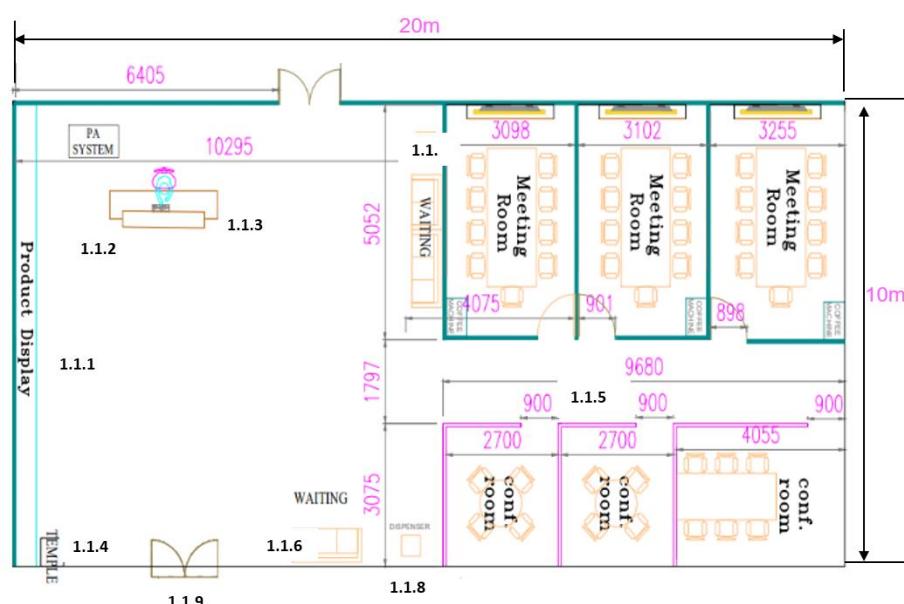


Figure 1 Typical layout of reception

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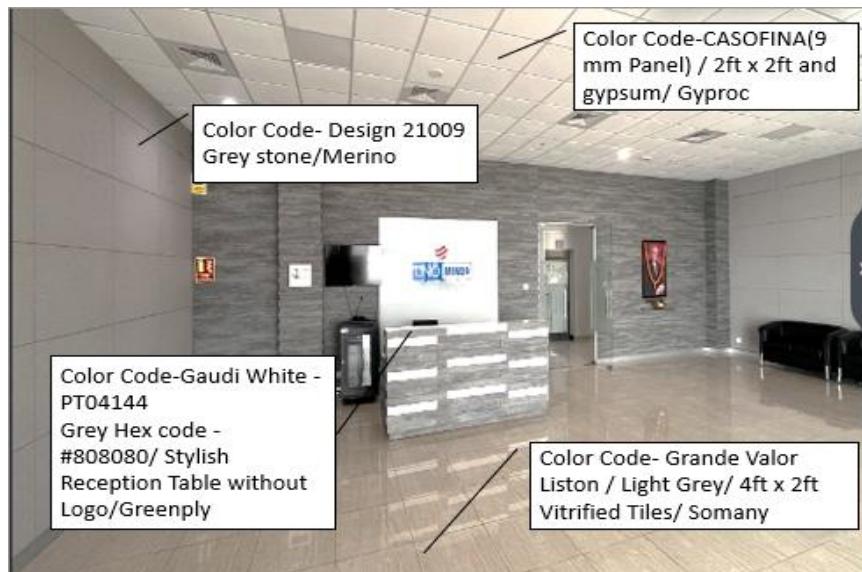


Figure 2 Visual illustration of typical reception

Comments: -

- Reception includes external meeting rooms & low height open conference rooms.
- Keep provision of public address system, centralize control at the reception.
- Approved plant layout (CFT & safety officer) and to be displayed at site (marked with “You are here”).
- Optional- aquarium, plants etc.

7.1.2 Board room

Board room sub-items list			
Item no.	Item	Sub-item no.	Sub-items list
1.2	Board Room	1.2.1	U-shaped table
		1.2.2	Chairs
		1.2.3	2 doors
		1.2.4	Coat hanger stand
		1.2.5	Board and marker keeping stand
		1.2.6	2 LED TVs / 1 big-sized LED TV
		1.2.7	Table for keeping water bottles, glasses, coffee and tea sachets
		1.2.8	Dustbin

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Comments:

- Assumed seating capacity – 21 persons.
- Size of board room: - 11 Mtr. *7 Mtr.
- 800 mm table space for every seated member.
- Video conferencing system.
- Award display keeping facility should be present on the wall adjacent to the door.
- Minimum 20 persons sitting capacity.
- Tables should be separate & easily relocatable as per the requirement.
- Minimum 1 mtr. space should be left behind the sitting chair.
- Sitting chair should be revolving type.
- Location for boardroom should be at a zero-noise place.
- ESD apron stand, if required.
- 1 Mic to be present on the table for every 2 persons.
- Smart TV 75" wall mounted with AV and IT Connectivity for digital connect (HDMI Connectivity).

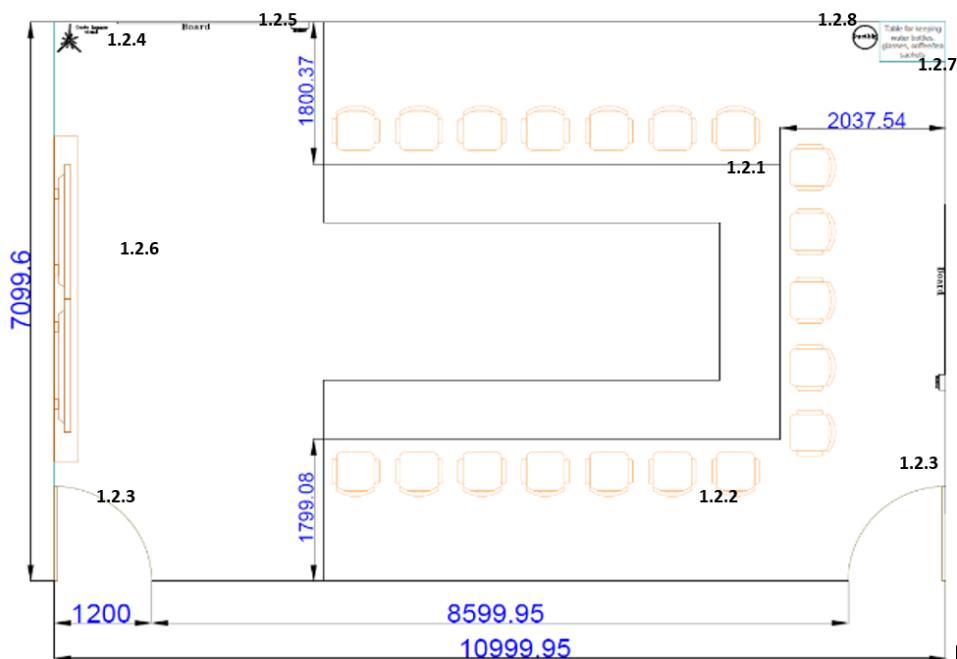


Figure 3 Typical layout of board room

Comments: - Above is the ideal size & layout for a board room.

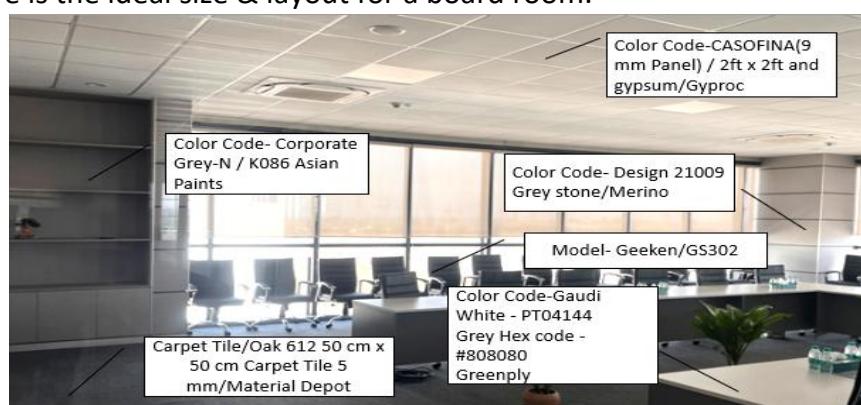


Figure 4 Visual illustration of typical board room

7.1.3 Meeting Room

Meeting Room Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.3	Meeting Room	1.3.1	Table
		1.3.2	Chairs
		1.3.3	LED TV
		1.3.4	Board and marker keeping stand
		1.3.5	Table for keeping water bottles, glasses, coffee and tea sachets and a Dustbin

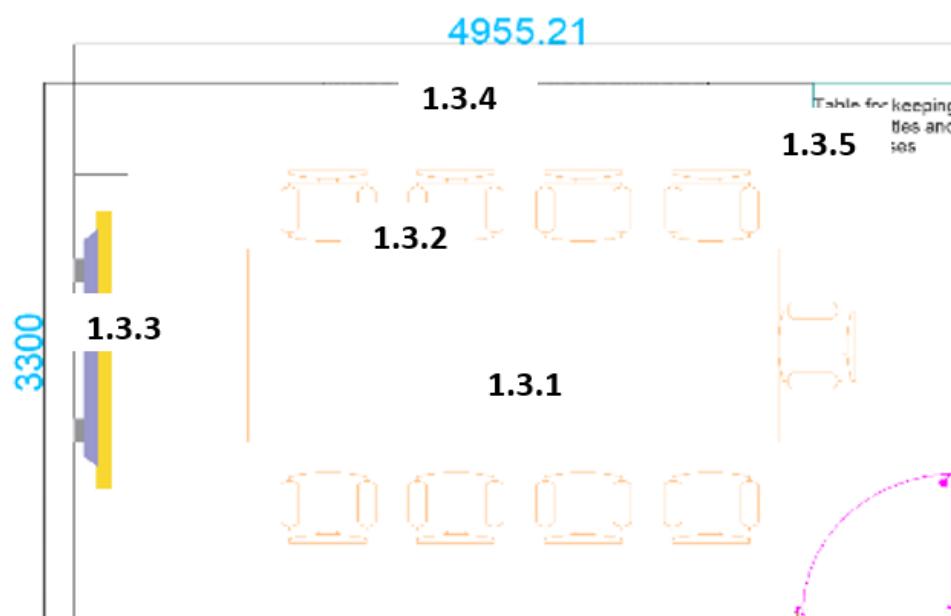


Figure 5 Typical layout of meeting room



Figure 6 Visual illustration of typical meeting room

Comments: -

- Size of meeting room- 5 Mtr * 3.3 Mtr
- Assumed seating capacity- 9 persons

7.1.4 Small Meeting Rooms

Small meeting room sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.4	Small Meeting Room	1.4.1	Table
		1.4.2	Chairs

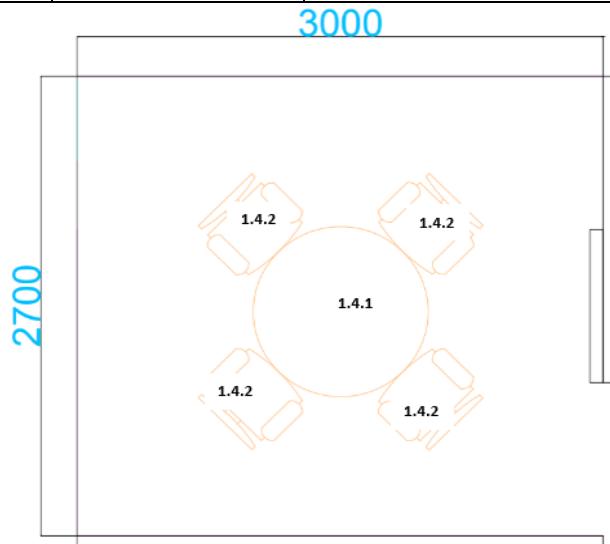


Figure 7 Typical layout of small meeting room



Figure 8 Visual illustration of small meeting room

Comments: -

- Size of meeting room - 3 Mtr * 2.7 Mtr
- Height of wall - 1.2 Mtr
- Assumed seating capacity – 4 persons
- Conference room should have the minimum 4 person sitting capacity.
- Minimum 2 conference room should be there.
- Conference room should be near the reception or main entrance in the plant.

7.1.5 Training Room

Training Room Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.5	Training Room	1.5.1	Instructor table and chair
		1.5.2	Tablet arm chairs for trainees
		1.5.3	Almirah
		1.5.4	LED TV

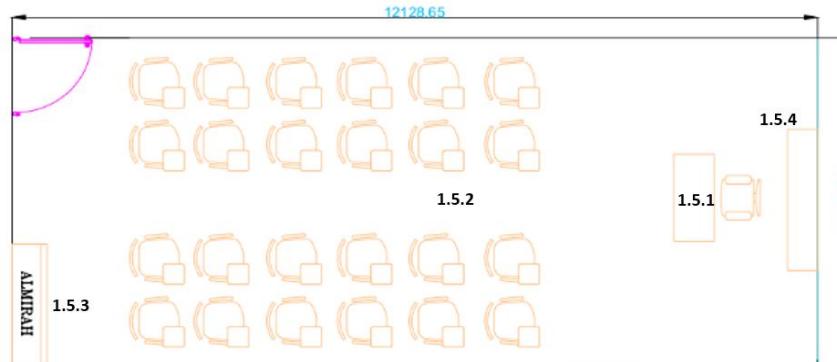


Figure 9 Typical layout of training room



Figure 10 Visual illustration of training room

Comments: -

- Typical training room size: 12 Mtr * 5 Mtr.
- Assumed seating capacity - 24 people.
- Projector, computer and white-board facility to be provided.
- For a bigger batch size, dimensions will be increased accordingly.

7.1.6 Medical room

Medical room sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.6	Medical Room	1.6.1	3 beds (minimum)
		1.6.2	Sink
		1.6.3	Refrigerator
		1.6.4	Oxygen cylinder
		1.6.5	Seating facility for Doctor/Nursing Assistant
		1.6.6	Water dispenser and Dustbin
		1.6.7	Wall mounted first aid supplies storage
		1.6.8	Cupboard
		1.6.9	Shoes rack



Figure 11 Typical layout of medical room

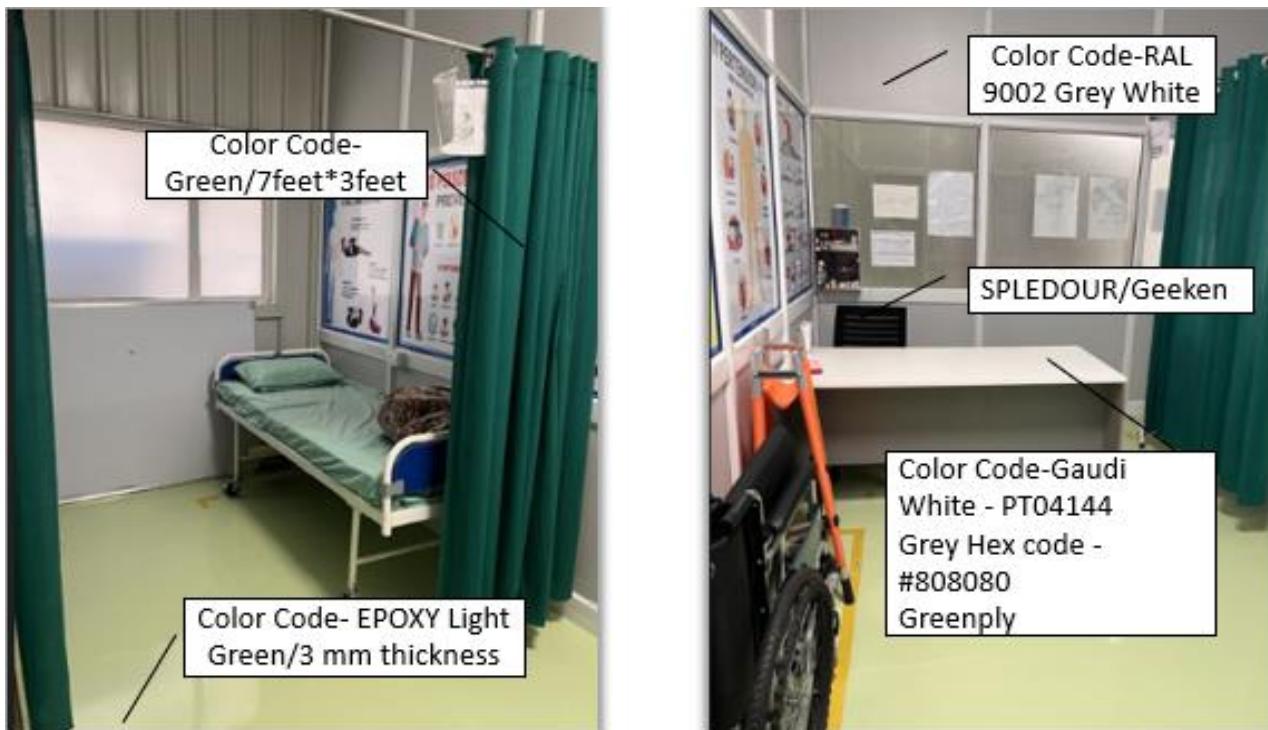


Figure 12 Visual illustration of medical room

Comments: -

- Facilities to be created as per above layout.
- Table size of the doctor/nursing assistant to be 1200mm X 600mm.
- Bed size to be standard 1800mm X 900mm (assuming a 6 ft. person).
- Beds to be separate for both males and females.
- Curtain system to be provided.
- To be treated as a first-aid facility in case of a standalone plant.
- For a complex, 2 beds are enough.
- For a park, number of beds may be increased up to 6.

7.1.7 Creche

Creche Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.7	Creche	1.7.1	Mother's room
		1.7.2	Kitchen
		1.7.3	Washroom
		1.7.4	Table to have food and chairs
		1.7.5	Mat with toys
		1.7.6	Shoes rack
		1.7.7	Cupboards
		1.7.8	Baby chairs

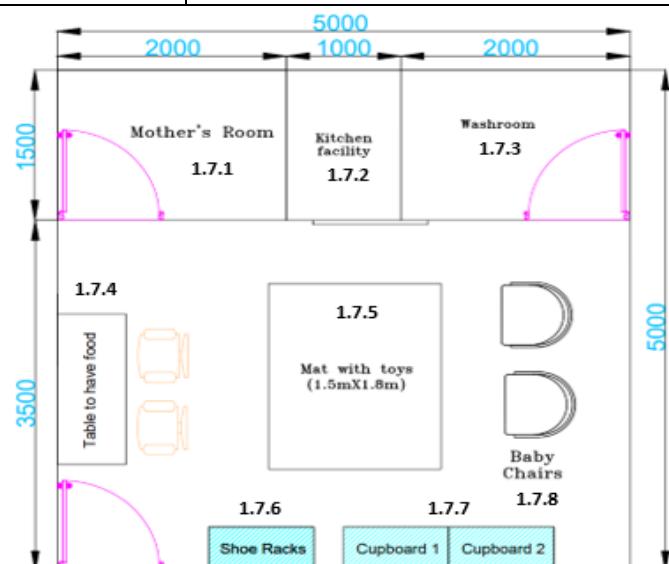


Figure 13 Typical layout of creche



Figure 14 Visual illustration of creche

Comments: -

- Facilities to be created as per above layout.

7.1.8 Time office

Item No.	Item	Sub-Item No.	Sub-Items List
1.8	Time office	1.8.1	Table
		1.8.2	Chairs
		1.8.3	File Racks/Cupboards for storage



Figure 15 Typical layout of time office

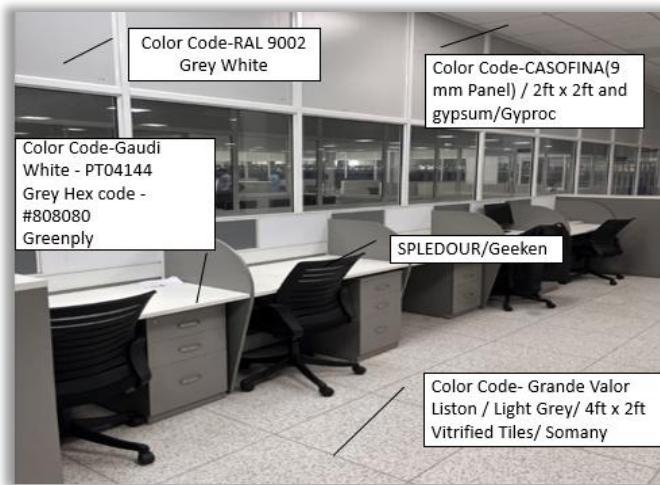


Figure 16 Visual illustration of time office

Comments: -

- Facilities to be created as per above layout.

7.1.9 Pantry

Pantry Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.9	Pantry	1.9.1	Chair
		1.9.2	Slab
		1.9.3	Cup keeping Stand
		1.9.4	Sink
		1.9.5	Water Dispenser
		1.9.6	Wall mounted cupboard
		1.9.7	Induction
		1.9.8	Coffee vending Machine
		1.9.9	Microwave Oven
		1.9.10	Dustbin
		1.9.11	Fridge

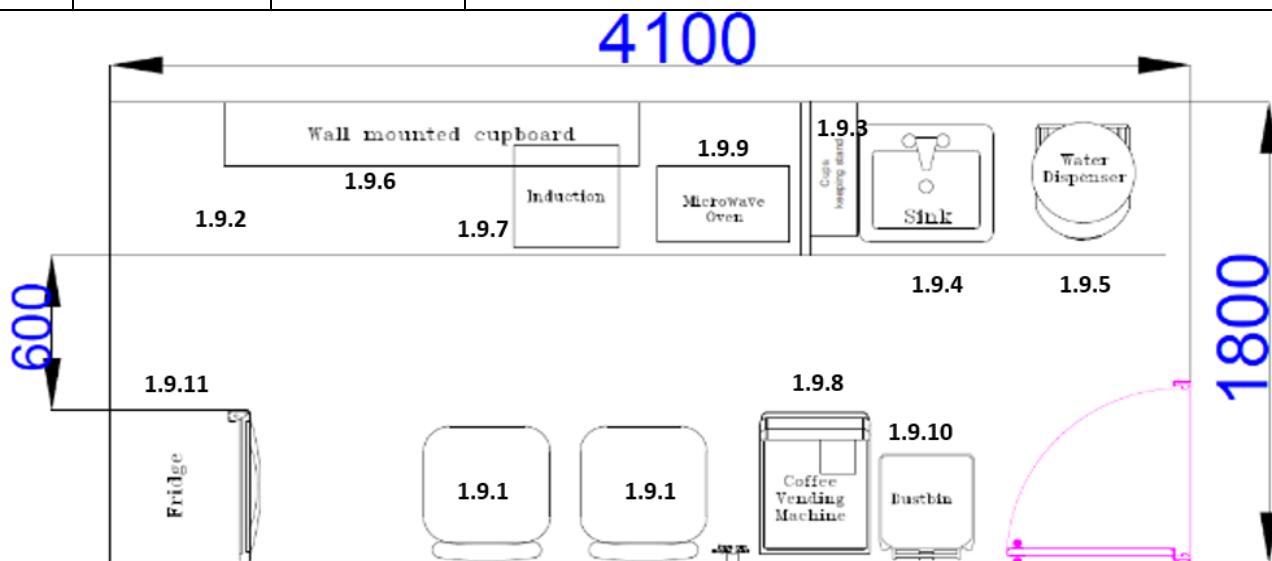


Figure 17 Typical layout of pantry

Comments: -

- Facilities to be created as per above layout.

7.1.10 Rest Room (Non-Staff)

Rest Room (Non-Staff) Sub-Items list

Item No.	Item	Sub-Item No.	Sub-Items List
1.10	Rest Room (Non-Staff)	1.10.1	Bunker Bed (2 persons capacity)
		1.10.2	Cupboard
		1.10.3	Chair
		1.10.4	Washroom with WC

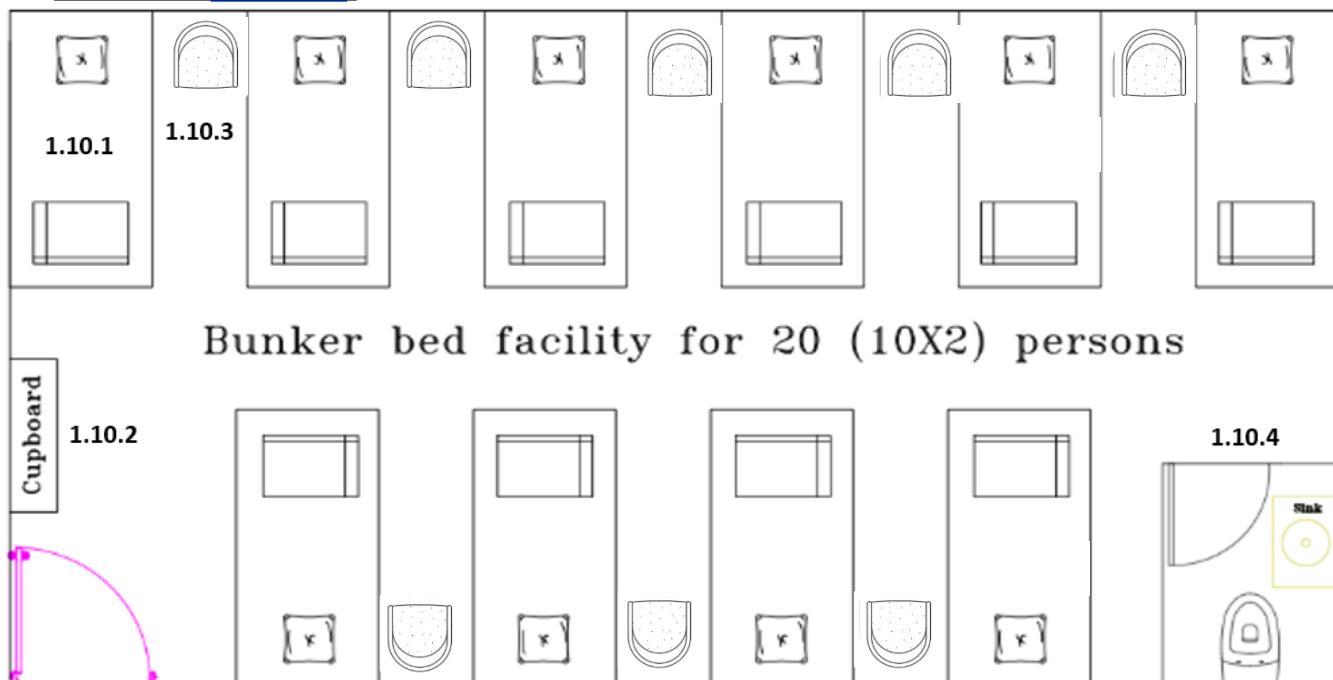


Figure 18 Typical layout of rest room (non-staff)

Comments: -

- Size of Rest Room - 10 mtr * 5 mtr
- Facilities to be created as per above layout

7.1.11 Rest room (staff)

Rest Room (Staff) Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.11	Rest Room (Staff)	1.11.1	Bed
		1.11.2	Chair
		1.11.3	Cupboard
		1.11.4	Washroom with WC



Figure 19 Typical layout of rest room (staff)

Comments: -

- Size of rest room = 4.4 mtr * 4.2 mtr.
- Facilities to be create as per attached layout.

7.1.12 Waiting Lounge

Waiting Lounge Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
1.12	Waiting Lounge	1.12.1	Sofas
		1.12.2	Centre table
		1.12.3	Racks for keeping bags and storing magazines
		1.12.4	Coat hanger stand

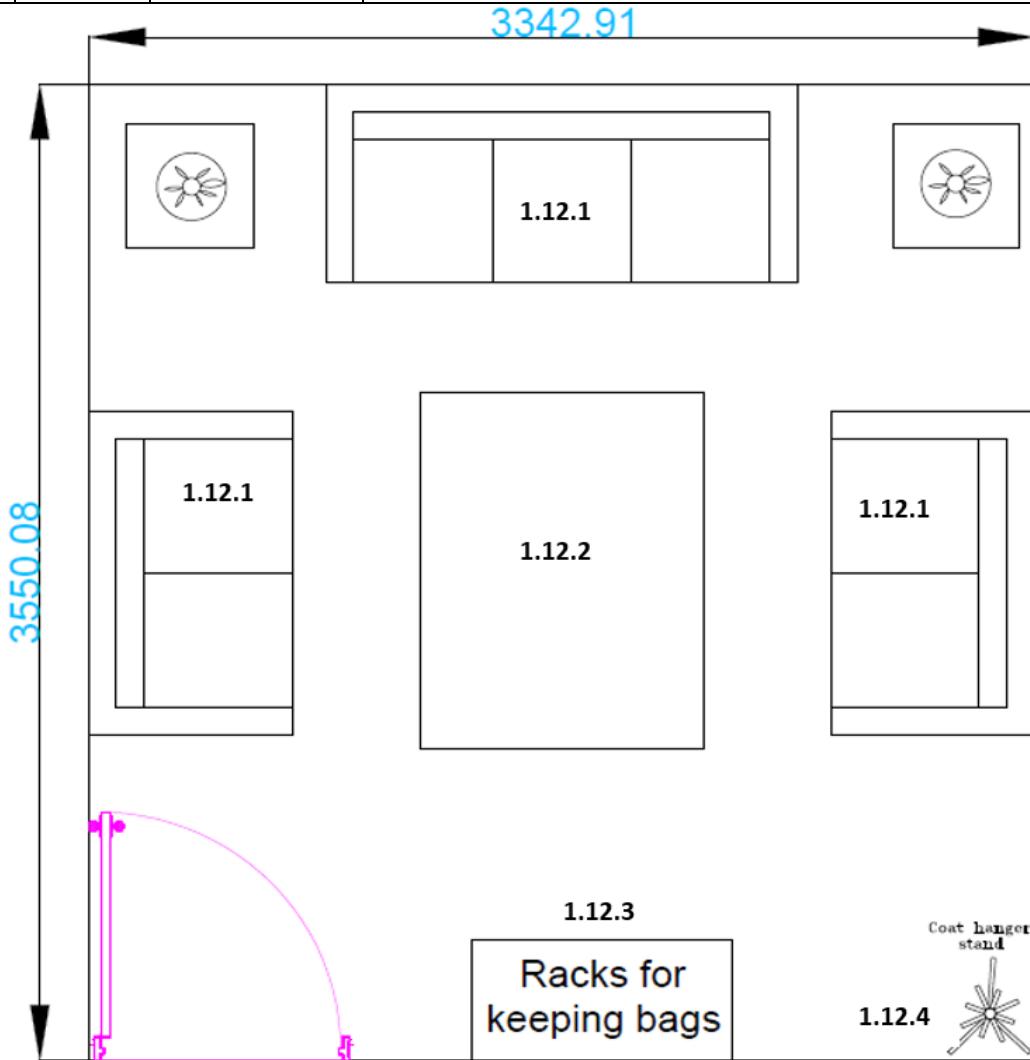


Figure 20 Typical layout of waiting lounge

Comments: -

- To be provided, if more than 01 plant lies in one campus.
- May contain about 6 people seating capacity.

7.1.13 Interview room (Optional)

Interview room sub-items list

Item No.	Item	Sub-Item No.	Sub-Items List
1.13	Interview room	1.13.1	Table and chairs for the interviewers (Same specs furniture as office furniture to be used)
		1.13.2	Chair for the interviewee (Same specs furniture as office furniture to be used)

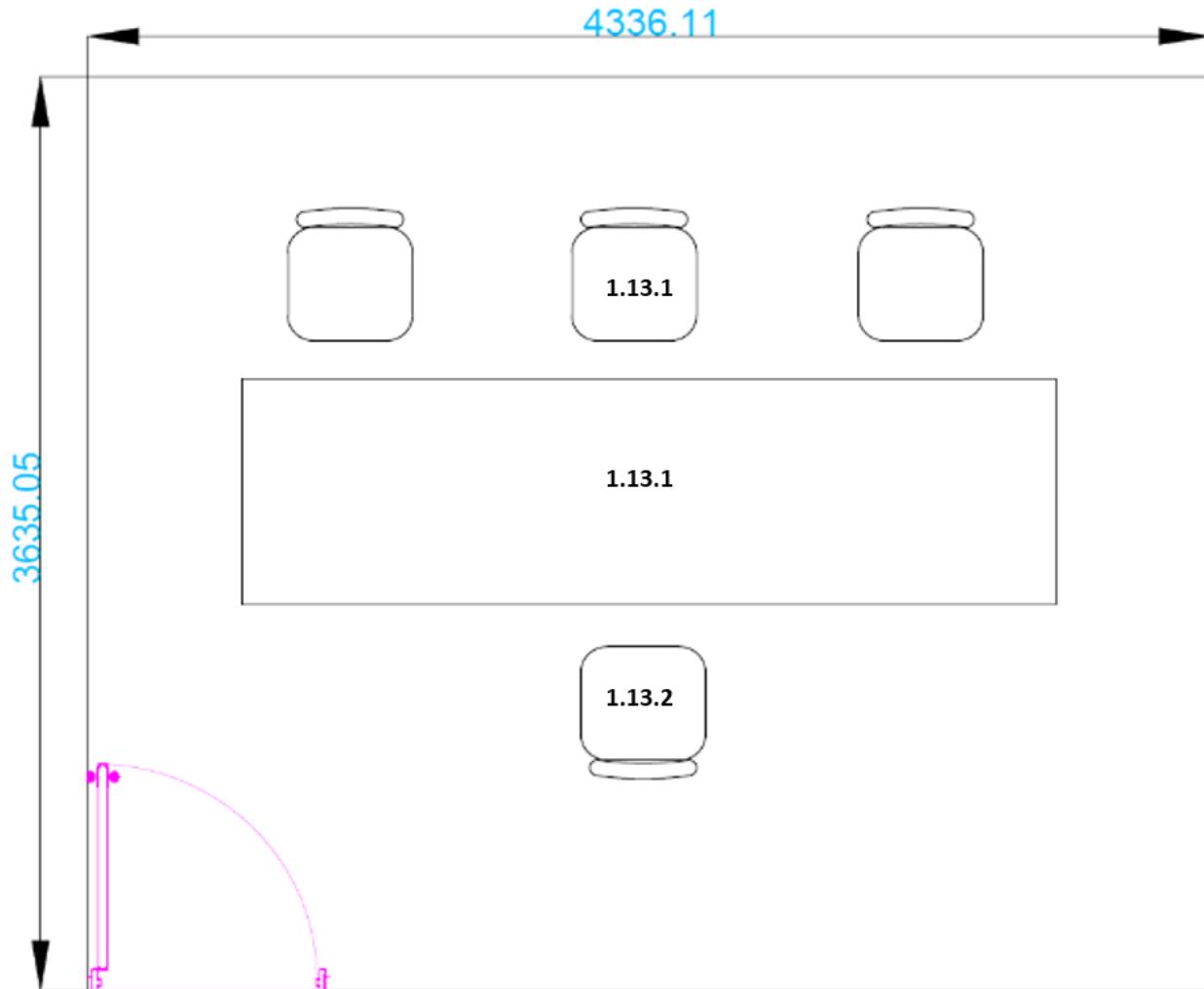


Figure 21 Typical layout of interview room

Comments: -

- To be provided, if more than 01 plant lies in one campus.
- Video conferencing facility may be provided.

7.1.14 Canteen

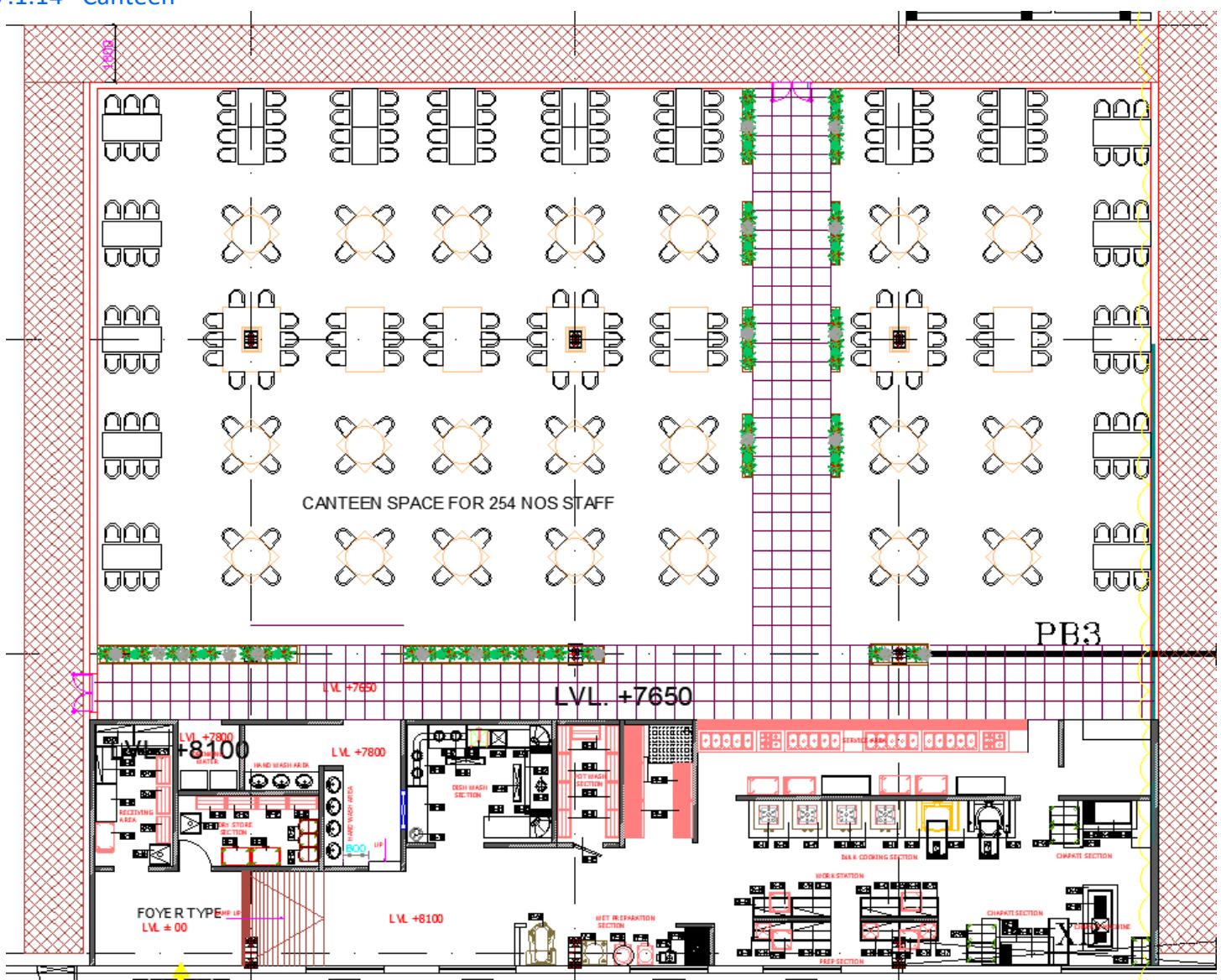


Figure 22 Typical layout of canteen



Figure 23 Visual illustration of canteen

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Comments: -

- Size considered – 254 numbers
- Canteen to be on the ground floor, preferably
- Sufficient tables/chairs inside canteen as per manpower in the plant
- Eating facilities provided under a roof
- Separate path for in & out for canteen
- Separate route for canteen material
- Toilet should be away 15 meters from canteen to maintain hygienic conditions
- Safety & quality board display
- Separate, dedicated place for shopping counter
- Space consideration for unit address
- Arrangement to remove produced waste effectively and regularly
- Individual canteen to cater to a small facility and a park canteen to cater to a large facility
- Canteens to be categorized as –
 - Individual canteen with a cooking arrangement
 - Common canteen with a dining
 - Dining only
- Consider unit address space also
- Safety & quality board display
- Automatic vending machines for snacks
- Optional facilities –
 - ATM (depends upon size in the case of an individual canteen, but must in the case of a common canteen; may also be like a CSR initiative and be placed at the Main Gate)
 - Ice cream parlor
 - Snack area

7.1.15 General Office Layout for a Department

Office Area Sub-Items list			
Item No.	Item	Sub-Item No.	Sub-Items List
2.1	Offices	2.1.1	Printer
		2.1.2	File cabinet
		2.1.3	Table
		2.1.4	Chair
		2.1.5	Small file cabinet
		2.1.6	DWM area
		2.1.7	6M board

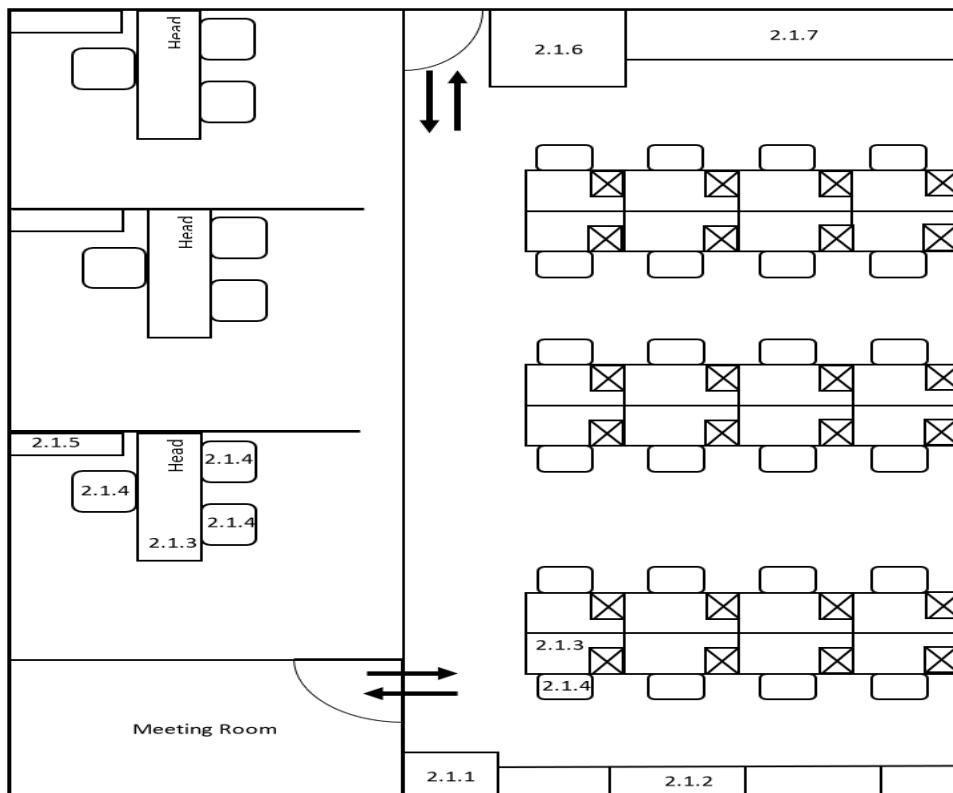


Figure 24 Typical layout of general office for department

Comments: -

- Size of office area as per need & as per attached layout.
- Sitting area to be calculate- 3 sqm/ persons.
- Table to table (back side) gap should be 2 mtr.
- Dept. Head sitting area Should be 2 mtr *2.5 mtr or follow corporate guidelines.
- Available space per member should be enough for work.
- Space for all accessories like file racks, printers, discussion table.
- Height of Glass in a partition should be 1.2m from the ground level.
- Each department /office should have at least two doors.
- Morning meeting area should be near the display area with review board facility.
- Department should be separated by glass & fitting for easy in future expansion (if possible).
- Department heads to be facing in North direction, preferably.
- Work place should not be congested & under-utilized.
- Small space consideration may be done for God worship (Accounts/Finance, Molding, Maintenance, T/R Maintenance, etc.).

7.1.16 Business head room and meeting room

BH room and meeting room sub-items list			
Item No.	Item	Sub-Item No.	Sub-Items List
3	Offices	3.1	BH Table and Chairs
		3.2	Sofa
		3.3	LED TV
		3.4	Meeting table and chairs
		3.5	Table for keeping water bottles, glasses, coffee/tea/ sugar sachets, dustbin etc.
		3.6	Coat hanger stand
		3.7	Board with marker stand

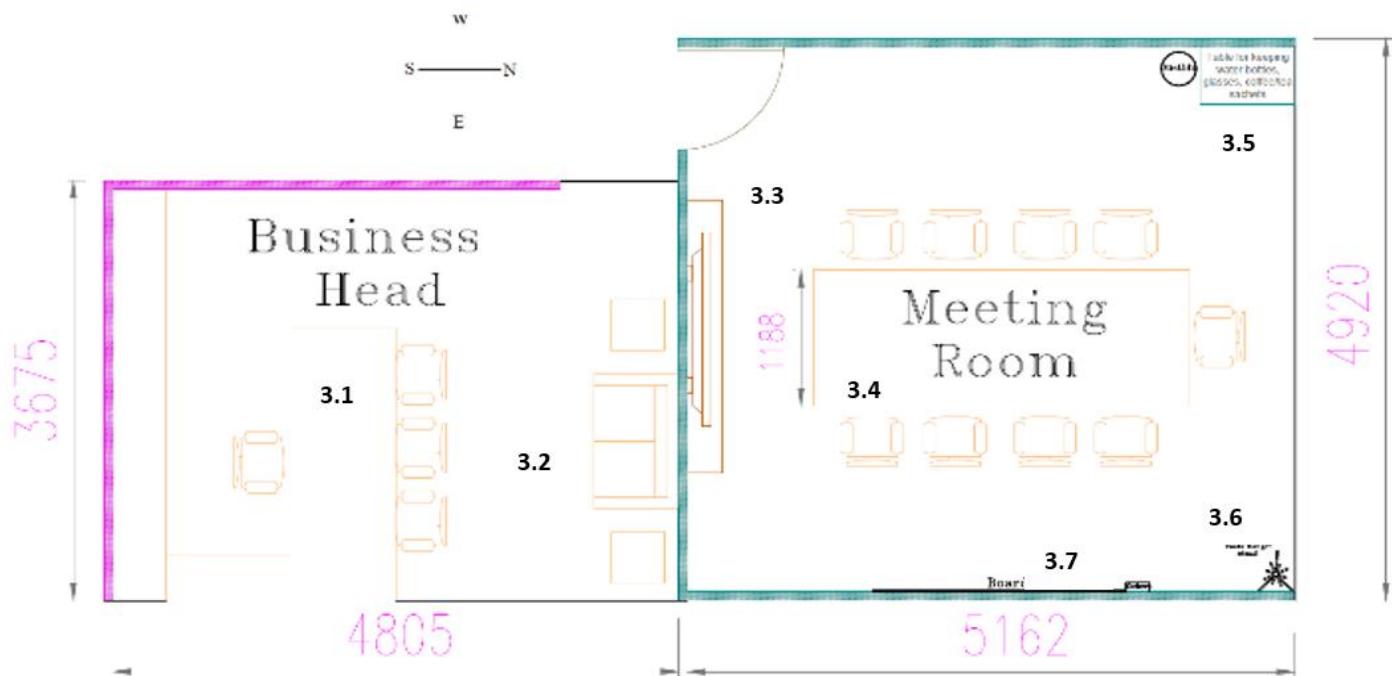


Figure 25 Typical layout of business head office & meeting room

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Figure 26 Visual illustration of business head office & meeting room

Comments: -

- Facilities & size should be as per attached layout.
- Coats hanging stand should be provided in the meeting room.
- Business head directions- 1st preference- North side
2nd preference- North- east side

7.2 Annexure Interior design



Annexure 7-1 Interior design

Civil contractor needs to submit interior material finish specification as per Annexure 7-1 in the template (Please see reference picture below)

Interior Material Finish Specifications													
Area	S. N.	Room Name	Live load	Floor	Skirting	H (MM)	DADO	H (MM)	Wall	Ceiling	CH (MM)	Vent.	Remarks

Reference picture:

AREA NO	ROOM NAME	LIVE LOAD	FLOOR	SKIRTING	H (MM)	DADO	H (MM)	WALL	CEILING	CH (MM)	VENT.	REMARKS	
OFFICE GF	1 LOBBY OFFICE & CORRIDOR	0.25 T/sqm	HT : 600x600	HT	100	AAC BLOCK PLASTERED + EP CURTAIN WALL (AL + GLASS)	100	AAC BLOCK PLASTERED + EP CURTAIN WALL (AL + GLASS)	AT 600x1200 3000	3000	A/C		
	2 MEETING SPACE	0.25 T/sqm	HT : 600x600	HT	100			AAC BLOCK PLASTERED + EP	AT 600x1200 3000	3000	A/C		
	3 OFFICE STAIRCASE	0.25 T/sqm	CT : 400x400	HT	100			AAC BLOCK PLASTERED + EP	NO CEILING	N/V	RAILING : SUS H=1100		
	4 GUEST TOILET (MALE)	0.25 T/sqm	CT : 400x400 (NON SLIP)					AAC BLOCK PLASTERED + CT 400x400	GT 600x1200 WR TYPE	2800	M/V	2 NOS WC, 2 NOS URINOAR, 2 NOS BASIN	
	5 GUEST TOILET (FEMALE)	0.25 T/sqm	CT : 400x400 (NON SLIP)					AAC BLOCK PLASTERED + CT 400x400	GT 600x1200 WR TYPE	2800	M/V	2 NOS WC, 2 NOS BASIN	
	6 WORKER ENTRANCE	0.25 T/sqm	EPOXY 1 MM	AL	100			AAC BLOCK PLASTERED + EP	GT 600x1200 3000	3000	M/V		
CT : CERAMIC TILE HT : HOMOGENOUS TILE				FH : FLOOR HARDENER AL : ALUMINIUM		AP : ACRYLIC PAINT EP : EMULSION PAINT		GB : GYPSUM BOARD GT : GYPSUM TILE		AT : ACOUSTIC TILE		NV : NATURAL VENTILATION M/V : MECHANICAL VENTILATION	
A/C : AIR CONDITIONING													

7.3 Colour standards for equipment, machines, SPM, & robots:

Equipment category					Examples	Colour	Remarks
Standards **	SPM/ Made to order	Robots	Conveyors	Others *			
7.3.1 Production-related equipment/machines							
				O	a) Chip melting furnace b) Melting cum holding Furnace c) Mould heating oven d) Heat treatment furnaces e) Paint shop oven	Heat resistant silver color (RAL 9006)	
	O				a) GDC machine b) Riser cutting machine c) Flow forming machine d) Shot blasting machine e) Leak test machine f) CNC machine (Turning center & VMC)	Apple Green (RAL 6019)	
		O			a) Robots b) CMM c) Runout & balancing M/C d) X-ray machine	As per manufacturer	May need to follow manufacturer color standards. We need to check with the equipment manufacturer . If they can agree to our color
			O		a) All roller conveyors	Apple Green (RAL 6019)	
					b) All overhead & floor conveyors	Black (RAL 9017)	
				O (Fencing)	All fencing & railing	Yellow (Shade- 0317)	
					Mezzanine bottom	White (RAL 7035)	
					Mezzanine top	Black (RAL 9017)	
					Mezzanine pillar/Beam	Apple Green (RAL 6029)	
7.3.2 Utility related equipment							
Standards **	SPM/ Made to order	Robots	Conveyors	Others *	Examples	Colour	Remarks
O					a) Compressor b) Generator Set c) Chiller unit	As per manufacturer Std	
	O				HT Panel / LT Panel	White (RAL 7035)	

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	O				STP, water treatment plant	As per manufacturer Std	
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7.3.3 Logistics-related equipment

Standards **	SPM/ Made to order	Robots	Conveyors	Others *	Examples	Colour	Remarks
O					a) Forklift b) Tow truck c) Dock leveler	As per manufacturer Std	

* Involving heat-related processes like ovens, furnaces etc. ** Catalogue equipment

Note:

1. Equipment colour guidelines must be followed even if some equipment from the existing operations / group company are getting transferred. (Equipment must be painted in the standard colours before being shifted to the new plant)
2. If some equipment is being supplied by collaborator and the collaborator has a different equipment colour standard, the new standards must be shared with the collaborator in time and they should be asked to follow our standard

7.4 Colour standards for shopfloor/floors/walkway/offices:

Area/floors					Colour shade	Colour code	Remarks
Shopfloor	Walkway	Lab / R&D cell / Offices	Forklift movement	Border			
O						RAL 6018	
	O					RAL 6037	
		O				RAL 7035	
			O		RAL 3020 TRAFFIC RED	RAL 3020	
				O		RAL 1026	



8. Utility



Green Book

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8 Utility

西红 Purpose

These guidelines define the process of utility planning and mentions its basic specs, it also recommends the most suitable suppliers.

西红 Scope

All utilities associated with a normal manufacturing plant.

西红 User

New project planning, utility & maintenance department teams.

8.1 Transformer selection process basic guidelines

8.1.1 Basic requirement sheet for electrical transformer

S. No.	Description- 1	UOM	Description- 2	Remarks- 1	Remarks- 2
1	What is the application/shop as per DPR			To be calculated from equipment list	
	a) Assembly shop	KVA		To be calculated from equipment list	
	b) Injection moulding machines	KVA		To be calculated from equipment list	
	c) CNC machines & machine shop	KVA		To be calculated from equipment list	
	d) Die casting machines	KVA		To be calculated from equipment list	
	e) Electronics SMT lines	KVA		To be calculated from equipment list	
	f) Painting & powder coating process	KVA		To be calculated from equipment list	
	g) Press shop	KVA		To be calculated from equipment list	
	h) Lab testing rigs & equipment	KVA		To be calculated from equipment list	
	i) Other equipment's	KVA		To be calculated from equipment list	
2	How much power does my facility/workshop use	KVA			
3	Diversity factor of plant load	KW		To be calculated as per the load requirement	
4	Tap changer				
5	What is my capacity requirement as per LTP	KVA		Kindly refer to the LTP	
6	Transformer type			Dry/Oil Type	

8.1.2 Long term transformer capacity planning sheet

Year	Transformer as per LTP Example										Requirement
	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32		
Standard Load 80% (KVA)	1600 KV										Based on Plant capacity To be calculated as per the DPR/LTP forecast and future expansions
Connected load	800 KVA		960 KVA		1200 KVA						*Connected load should not exceed 80% capacity of T/F Load calculation will be based on the DPR and future expansions.

Comments: -

8.1.3 Selection of type of transformer

Comparison between "Dry type, and Oil type transformers"

S. No.	Category	Description	Dry	Oil
1	Usage	Initial investment	High	Low
2		Operation	Continuous	Continuous
3		Voltage rating	Max 33KV	Wide range
4		Heat dissipation	Not good	Good better
5		Long duration running	Not suitable	Suitable
6	Quality	Recyclability	Low	High
7		Efficiency	Low	High
8				
9		Noise level	High	Low
10	Running cost	Maintenance cost	Low	High
11		Power cost	Oil type transformer High	Low

Conclusion: Oil type transformer is recommended in terms of cost of ownership if the usage is continuous.

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Other transformer spec. finalization process

Note: Comparison of proposal based to go for oil type transformer

1. **Type of transformer:** Step down transformers to be installed.
2. **Equipment earthing:** Transformer body, LV cable box, HV cable box, marshalling box are earthed properly.
3. **Insulator or switch hardware protection:** Arching horns should be installed for protection of insulator switch hardware on high voltage electric power transmission systems from damage during flashover.
4. **Sizing your transformer:** KVA rating must be 30% extra/ LTP or future load increases to ensure that the transformer capacity can accommodate expanding electricity needs.
5. **Location/ area consideration:** Make sure there is enough fresh air and that there are no sources of ignition or corrosion nearby.
6. **Noise:** Noise level below 64dB upon the KVA rating of the transformer.
7. **Output voltage control:** To regulate the output voltage of a transformer need to install a tap changer.
8. Single transformer should be used for one plant as much as possible considering the future expansions.

8.1.4 Recommendations related to manufacturer/ OEM:

1. Schneider Electric
2. ABB India Limited
3. Kirloskar Electric Company Ltd
4. VR Power
5. Siemens Limited
6. Voltamp Transformer Ltd.

8.2 Air compressor selection & basic guidelines

8.2.1 Basic requirement sheet

S. No.	Description 1	UOM	Description 2	Remarks-1	Remarks -2
1	What is the application/shop as per DPR?		Recommended air pressure (bar) – For general application it is between 4.5 -6 bar		Answer in Y/N
	a) SPM Jigs & fixture for assembly shop				
	b) Injection moulding machines.				
	c) CNC machines & machine shop				
	d) Die casting machines				
	e) Electronics SMT lines.				
	f) Painting & powder coating process				
	g) Press shop				
	h) Lab testing rigs & equipment				
	i) Other equipment				
2	How much air flow does my facility/workshop use	CFM		To be calculated from equipment list.	
3	What pressure is needed within the facility for any special machine or process?	bar or kg/cm ²		To be decided from the equipment list.	
4	Air Requirement: "constant or intermittent" operation			Depends on the type of process.	
	Do I need clean/dry air (use of dryer and filters)?	Nass Class		Yes- Nass Class 6	
5	Do I need oil free air?	PPM			
6	How many hours per day does my compressor operate?	hrs/day			

8.2.1 Basic requirement sheet (cont...)

S. No.	Description 1	UOM	Description 2	Remarks-1	Remarks -2
7	How many shifts do I run per day?	No's			
8	Is there a variation in flow demand between shifts?	CFM			Answer in Y/N
9	Is there requirement of different pressure on machines?	bar or Kg/cm ²			Answer in Y/N
10	What is my capacity requirement as per LTP	CFM		Kindly refer to the LTP	
11	Do I require IOT ready controller				Answer in Y/N
12	Do I require energy efficient compressor?				Answer in Y/N
13	Permissible noise level for compressor?	dB			
14	Space available for compressor system	SQM			

Comment: - Before finalizing the air compressor refer to the above table/ requirement sheet. This requirement sheet should be shared with the equipment maker along with the spec sheet to get best technology commercial offer.

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8.2.2 Long-term air compressor capacity planning sheet and guidelines

Example/case study of compressed air equipment capacity planning as per LTP

Year	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	Remarks
CFM requirement-A	100	140	170	250	300	450	600	650	800	To be calculated from equipment list
Theoretical required compressor capacity -B										25% higher than
	125	175	212.5	312.5	375	562.5	750	812.5	1000	CFM required (A)
Loading factor%- C	37.65	52.71	64.00	94.12	56.47	84.71	75.30	61.18	75.30	C= 75%
Proposed compressor & timing	332	~	332	~	~	~	332	332	~	~Consider next 4-5 year of capacity-B ~Proposed Compressor loading should be 25-70 %. Compressor loading %=(B/C)*100 ~Additional compressor capacity to be added one year before. ~Nearest available higher capacity model to be considered and compare long term overall investment considering various combination of higher range to meet the LTP requirement.
Cumulative capacity	332	332	664	664	664	664	996	1328	1328	

Comments: -

- Capacity of air compressor should be sufficient for minimum next 4-5 years projected LTP requirement.
- Capacity of air compressor should be 25% higher than the air requirement of next 4-5 years projected LTP requirement.

8.2.3 Type of compressors

Comparison between piston/ screw/centrifugal compressor:

S. No.	Description	Piston	Screw	Centrifugal
1	Initial investment	Low	High	Very high
2	Operation	Intermittent	Continuous	Continuous
3	Duty cycle	50-60%	100%	100%
4	Working pressure (kg/cm ²)	6 to 8	Up to 30	Up to 14 Bar
5	Long duration running	Not suitable	Suitable	Suitable
6	Reliability	Low	High	Very high
7	Oil carries forward	High	Low (oil free & oil injected)	Zero (only oil free)
8	Air contamination	High	Class 1 for oil Injected	Class 0
9	Noise level	High	Low	Low
10	Maintenance cost	High	Low	Low
11	Power cost	High	Low	Low
12	Cost of ownership	High	Low	Low (if base requirement is approx. 1700 CFM or higher)
13	Cooling type	Air & water cooled	Air & water cooled	Water cooled only
14	Pressure			
14.1	0-5.5 kg/cm ²	Double stage	Single stage	Double stage
14.2	5.5-10 kg/cm ²	Double stage	Single stage	Triple stage
14.3	10-13.5 kg/cm ²	Double stage	Single stage	Triple stage
15	Min. base load requirement (CFM)	10	10	1700-for ATLAS Copco 1200 FOR IR

E.g. Compressed air requirement with increase in no. of machines phase wise as per DPR at big complex at new location:

Requirement	Total	Phase-1	Phase-2	Phase-3	Phase-4
Rated-air- CFM	6662	2517	947	817	2381
With load factor-25% to 30%-(base load)	1998.6	755.1	284.1	245.1	714.3

Here total requirement is 6662 CFM with base load of 2000 CFM in phase -4.

- Although centrifugal compressor which is energy efficient & may be suitable for this application, detailed feasibility study to be done jointly with equipment supplier before taking a final call between centrifugal compressor or a VFD type screw compressor considering base load requirement/ fluctuating load requirement factors.
- While selecting compressor study specific energy requirement kW/CFM of compressor (SER) Conclusion: -
 1. Piston type compressor is recommended for intermittent usage only but it has low investment.
 2. Screw type compressor- is recommended for continuous running/ low to medium volume requirement.
 3. Centrifugal type compressor- It's recommended for high boosting pressure & flow and is suitable for base load requirement of 1700 CFM and above. Feasibility study to be done in case of higher pressure and volume requirement.

8.2.4 Accessories required for compressed air system along with air compressor

A. Refrigerant dryer

Type & specs.	Application
1. Refrigerant dryer (Due point < 5°C)	Pneumatic circuit, moulding machine, power press, CNC machine
2. Desiccant dryer (Due point < - 5°C)	SMT line, paint shop and other plant specific process

B. Line air filters (Inlet filter spec.-5 micron & outlet filter spec.- 0.01 micron)

C. Oil separator specification

Initial pressure difference : ≤0.02Mpa

Oil content : 3-6 ppm

Oil mist particles : ≤0.1µm

Working lifetime : 3500h--8000h

D. Air receiver should be with safety valve & auto drain facility.

E. Consider aluminum (Al) air piping for air supply with pressure gauge (to reduce energy losses).

8.2.5 Capacity planning of reservoir

Reservoir capacity 1 CFM = 5.6 ltr.

Example: -

Compressor (CFM)	100	200
Reservoir capacity (litre)	560	1120

Basic safety guidelines for air receiver tank:

- Only use ASME-certified air receiver tanks.
- Make sure the tank has a pressure gauge.
- Make sure that the tank has an ASME-certified safety relief valve.

8.2.6 Statutory test requirement of air compressor

Statutory testing of air compressor

S.No.	Test type	Measuring criteria	Frequency
1	Ultrasonic test	Ultrasonic leak detection utilizes high-frequency sound produced by a pressurized gas escaping from a vessel to identify a leak	Half yearly
2	Pressure relief valve test	Pop Test is a set pressure test of "Pressure Relief Valve" (PRV) by compressing the pressure into the inlet of PRV until Valve opens. The pressure that causes Valve to open (Pressure) will be compared with the Set pressure of the PRV to see how Valve open pressure on the set or not.	Half yearly
3	Hydrostatics test	Hydrostatic testing is done by filling containers with water at high pressure until they reach their designated capacity.	Quadrennial

Comment: - These statutory test certificates are required along with new air compressor.

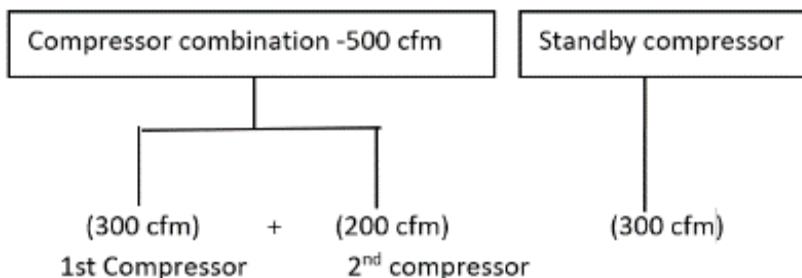
8.2.7 Guidelines for the requirement of standby compressor or small additional compressor for lean period usage

Standby compressor capacity must be equal to or bigger than existing bigger size compressor capacity.

1. Standalone basis

Example:-

As per LTP, we have 500 CFM plant air compressor requirement 500 cfm. Standby compressor should be as per below.



2. Small additional compressor for lean period usage

- a) Individual unit: In this document, a VFD compressor has been recommended which is suitable for up to 30% capacity usage (if compressor is of 100 CFM and requirement is just 30 CFM in the lean period, VFD compressor works reasonably efficiently). If the load requirement is less than 30% of the capacity on regular basis, then an additional small compressor may be considered based on the feasibility study.
- b) For units in mega park or industrial cluster: Combined requirement of the interconnected units may need to be considered before taking call for an additional compressor based on the logic mentioned in point a) above.

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8.2.8 Guidelines for common compressors in group companies industrial complex

For industrial complex-

Air pipe line to be interconnected with ball valve in closed position, so that in case of compressor failure in one plant, air supply from other plant can be taken for critical load or based on excess available compressor capacity.

8.2.9 Recommendations related to manufacturer/ OEM

- A. Atlas Copco- with energy efficient factor 6.5 CFM/KW
- B. Kaeser- with energy efficient factor 6.5 CFM/KW
- C. IR – for centrifugal compressor- May be considered If air demand is above 1700 cfm.

8.2.10 2 stage or 3 stage compressor selection guidelines

- **Pressure required:** Any pressure above 100 PSIG will demand a multi-stage compressor for the most efficiency. 2 stage or 3 stage will depend on the pressure requirement, that needs to be discussed with the equipment manufacturer.
- **Volume of air required:** If the volume of air required is high, multi-stage air compressor may be more suitable as it can pressurize more cubic feet of air per minute (CFM) than a single-stage compressor. Feasibility study needs be done jointly with equipment maker.
- **Need for temperature control:** Select multi-stage air compressors as it can regulate air temperature. The output air also has a lower temperature.
- **Need for oil-free applications:** most oil-free compressor systems are dual-stage.
- **Space you have:** If space is a limitation, please select a multi-stage compressor as that will save space.
- Decision regarding 2 stage or 3 stage air compressor needs to be taken jointly with air compressor manufacturer.

8.2.11 Compressor standard specification

S. No	Section	Specification
1	Enclosure	<ul style="list-style-type: none"> ➤ The compressor shall be enclosed in a steel sound attenuating canopy with removable panels.
		<ul style="list-style-type: none"> ➤ The sound attenuating material shall be flame retardant polyurethane foam / glass wool
2	Noise levels	<ul style="list-style-type: none"> ➤ The compressor package shall not exceed 61 dB(A) when measured in the free field conditions at one meter in accordance with the CAGI-Pneurop test code
3	Compressor element	<ul style="list-style-type: none"> ➤ The compression profile shall be of the asymmetric profile design with four lobes on the male rotor and six lobes on the female rotor.
		<ul style="list-style-type: none"> ➤ The male and female rotors shall have the same diameter. ➤ The element housing shall be of cast iron construction.
4	Drive Motor (energy efficient design)	<ul style="list-style-type: none"> ➤ With energy efficient motor IE4 or IE5 ➤ Motor should be IP 66 protection. ➤ The drive motor must be a Totally Enclosed Fan-cooled (TEFC) type or oil cooled preferably vertically mounted.
		<ul style="list-style-type: none"> ➤ Screw element should be directly coupled with motor.
		<ul style="list-style-type: none"> ➤ The inboard motor bearing shall be lubricated by the compressor lubricant and the rear motor bearings shall be greased for the life of the motor or oil lubricated bearings
		<ul style="list-style-type: none"> ➤ The complete motor shall be 100% maintenance-free
		<ul style="list-style-type: none"> ➤ The compressor package shall be fitted with an aluminium, air-cooled, oil cooler and after cooler. ➤ The cooling system shall include an axial cooling fan.
5	Cooling system	
6	Moisture separator	<ul style="list-style-type: none"> ➤ The compressor shall be equipped with a labyrinth style moisture separator integrated in the discharge side of the after-cooler
7	Electronic water drain	<ul style="list-style-type: none"> ➤ The compressor will have a zero-loss electronic water drain plumbed to the after cooler.
		<ul style="list-style-type: none"> ➤ These drains shall discharge no compressed air during removal of the condensate.
		<ul style="list-style-type: none"> ➤ The zero loss drains shall be monitored by the microprocessor controller
		<ul style="list-style-type: none"> ➤ A manual condensate drain shall also be included
8	Inlet air filter	<ul style="list-style-type: none"> ➤ The filter shall be a paper cartridge type and be factory installed inside the compressor enclosure.
		<ul style="list-style-type: none"> ➤ The filter shall have the following SAE fine efficiency ratings:
		<ul style="list-style-type: none"> ➤ 1 micron: 98.0% ➤ 2 microns: 99.5% ➤ 3 microns: 99.9%
		<ul style="list-style-type: none"> ➤ The service interval of the filter must be at least 4,000 hours.
9	Oil system	<ul style="list-style-type: none"> ➤ The oil system shall include an ASME approved air/oil separator with oil level indicator. The service interval of the separator element must be at least 4,000/ 8000 hours.
		<ul style="list-style-type: none"> ➤ The oil filter shall be a spin-on type with an integrated bypass valve. The oil filter element will have a service interval that must be at least 4,000 hours.

8.2.11 Compressor standard specification (cont...)

S. No	Section	Specification
9	Oil system (cont.)	<ul style="list-style-type: none"> ➤ The oil temperature shall be regulated by means of a thermostatic bypass valve. Oil circulation is achieved through differential pressure ➤ The oil must be synthetic and rated for a change interval of 8,000 hours.
10	Inlet Valve Electric cubicle	<ul style="list-style-type: none"> ➤ No Load/unload ➤ No Blow off ➤ The control cubicle must be designed to NEMA 3R or IP 54 standards. ➤ The cubicle must include a cooling fan and vent to force ambient air through the cubicle.
11	Regulating and control system	<ul style="list-style-type: none"> ➤ The compressor shall have a regulating system which is of the full load / no load design, controlled by an air compressor discharge pressure sensor which senses the pressure variations at the compressor discharge and maintains it within a pre-set adjustable range. ➤ The full load / no load regulation shall be combined with a start / stop regulation to automatically stop the compressor as required. ➤ The compressor shall be equipped with an onboard microprocessor controller which will control, monitor and protect the operation and condition of the air compressor. ➤ The controller shall allow programming of two pressure bands for loading and unloading. ➤ Time based start / stop and changeover for net pressure band shall be programmable. ➤ Compressor protective functions shall include 1-Emergency stop 2-Element outlet temperature 3-Service warnings 4-Drive and cooling fan motor overload.
12	Industry 4.0 compatibility-requirement	<ul style="list-style-type: none"> ➤ Compressor Controller- Compressor must be fitted with smart compressor controller (example: Sigma Controller 2 in case of Kaeser/ Electronikon Nana in case of Atlas Copco) that should be compatible with EMS system and could be connected to cloud.
		<ul style="list-style-type: none"> ➤ The compressor must be equipped with RFID technology on equipment to prevent unauthorized personnel from gaining access.
13	Size	<ul style="list-style-type: none"> ➤ Compressor should occupy minimum floor area.

8.2.12 Technical comparison for reference only

Technical Comparison with compressor specs - Example						
Sr. No	Parameters	Description	UOM	Spec - A	Spec - B	Remarks
1.a	Pressure	Band Range	Bar	4 to 12.5	7.5 to 10	A - can be used for Higher pressure
2	Motor	Motor Type		IPM (internal permanent magnet) Motor	Induction Motor	IPM motor is more efficient
		Efficiency	IE	IE5	IE4	IE5 motor is more efficient
		Water Ingress Protection	IP	IP 66	IP 65	IP 66 has better water ingress protection
		Cooling	Media	Oil-Cooled	Fan-Cooled	Oil cooling is better
		Transmission		Direct (No belt, no gear, no coupling, Hence no transmission losses and no maintenance)	Coupling (Transmission Losses & replacement required after 16000-18000 Hrs)	Direct transmission is better (has less loss and no maintenance)
		Drive Arrangement		Vertical	Horizontal	Vertical one may occupy less space (need to reconfirm)
3	SERVICE SCHEDULE	Motor Bearing Regreasing		Oil Lubricated Bearings	Grease lubricated bearing	using Comp. oil, Oil lubricated bearing require no lubrication
		Air Filter	Replacement frequency in hours	4000	3000	Higher replacement frequency is better for reducing maintenance cost
		Oil Filter		4000	3000	
		Oil Separator		8000	6000	
		Oil		8000 (Roto Extend)	6000	Check the cost of oil as it is one of the major element in maintenance cost
		Oil Charge(Ltr)		52	70	Model needing less oil may be better in terms of running cost
		Bearing Regreasing		Not required	2000	Maintenance free type better
		Drive arrangement maintenance		Direct - Not required	Coupling - has to be replaced after 16000-18000 hrs.	
4	MONITORING AND CONTROL		-----	Touch- Smart link, Online & remote Monitoring	Sigma Controller	Both are IoT ready types
5	INLET VALVE		-----	Sentinel Valve	Unloader Valve	Sentinel valve may require less maintenance
6	Transmission		-----	Single Shaft No Transmission Element	1:1 Drive Flexible Coupling	Single shaft may have less maintenance cost
7	Size		in cms	D: 1400 W : 1300 H: 1968	D: 2450 W : 1730 H: 2150	Please check the space availability and then decide keeping in view the available space and the final cost

The technical comparison sheet is just an additional tool to make better judgement. However, the team needs to take a final call based on all factors like initial investment, running cost and after sales support etc.

Energy comparison (250 CFM capacity) – Example

S. No.	Description	Spec-A	Spec-B	Remarks
1	Total unload power at zero flow	0	0	
2	Flow Capacity - CFM	250	250	
3	Sp. energy consumption (kW/CFM)	0.XXX	0.YYY	
4	Avg. requirement	250	250	
5	Load %	1	1	
6	Load power per hour	AA	BB	How to calculate?
7	Unload %	0	0	
8	Unload Power per hour	0	0	
9	Total power input (8rs per unit cost and 8000 working hrs per year)	ZZZ	FFF	
10	Savings (INR)	ZZZ-FFF	FFF-ZZZ	

Conclusion:

- We need to compare initial investment, operations & maintenance cost (use ref. comparison)
- Maintenance free.
- Look for compressor occupying less floor space

8.3 Mechanical utilities

S.No.	Content Title	Sub-Title	
1	WTP, STP, ETP, Gases (N2, O2, CO2, LPG, CNG etc.) related equipment selection process basic guidelines	1.1	Basic requirement sheet including long term requirement as per LTP
		1.2	Combined requirement of companies / divisions in the industrial park
		1.3	Selection of type of equipment
		1.4	Recommended list of suppliers for these utilities

8.3.1 Mechanical utilities selection process basic guidelines

Basic requirement sheet for above mentioned utilities (WTP, STP, ETP, Gases (N2, O2, CO2, LPG, CNG etc.)



Utility Requirement Sheet _ Blue Book.xls

Annexure 8-1 Utility (WTP,STP, ETP) requirement sheet

Note:

1. List of equipment & capacity calculation

- a. List of equipment may be edited depending on the kind of product that we plan to produce. Please use this sheet just as a reference sheet or as a data input sheet (as the case may be).
- b. In case of common utilities in a group companies industrial park or mega project, each business unit needs to prepare the utility data sheet. Then the infrastructure development company will combine all the data (current and long term based on the LTP), calculate combined requirement and propose a suitable capacity which needs be agreed by the project team / management teams of various projects and then taken forward.
- c. Project team members along with business team need to fill in the above utility requirement sheet for all those years when the plant expansion is taking place (till last year of LTP).
- d. Unlike other utilities where some standard off the shelf spec utilities is available, most of the mechanical utilities are generally customised based on the requirement(s).
- e. After the requirement sheet data is shared with infrastructure development company, detailed specs are prepared by the infrastructure development company, utility consultant and shared with the project team / users. Formal approval is to be given by the project team based on detailed discussion with the infrastructure development company supplier and the consultant.

2. Govt. regulations

- a. Government regulations should be thoroughly checked before deciding the size of the utility. (Certain regulations may apply if the size of the utility is higher than a particular limit, Example: Size of STP facility, capacity of LPG bullet etc. etc.)

3. Energy efficiency

- a. All utilities must use energy efficient motors etc.

4. Industry 4.0

- a. All utilities must be IoT compatible (we should be able to fetch the critical data that needs to be monitored or recorded to a central display screen / central data base)
- b. All data that needs to be monitored or recorded as per various government regulations /

authorities like Pollution Control Board etc. must be automatically captured, stored and analysed and actions initiated accordingly.

8.3.2 List of recommended suppliers for WTP, STP, ETP

1. Membrane Group India Pvt. Ltd.
2. Subham INC.
3. SIMA Lab
4. Aqua Engineers & Consultants India Pvt. Ltd.

8.3.3 List of recommended suppliers for gas storage etc.

1. Generally, gas suppliers may set up the facility.
2. Or we may choose a local good supplier depending on the location of the project

8.4 Basic requirement sheet for Generator

S. no.	Description 1	UOM	Description-2	Remarks-	Remarks -2
1	What is the application?		Stand by or continuous Running	To be calculated from equipment list.	Continuous running in case State electricity not available
	a) Assembly shop	KVA			
	b) Injection moulding machines	KVA			
	c) CNC machines & machine shop	KVA			
	d) Die-casting machines	KVA			
	e) Electronics SMT lines.	KVA			
	f) Painting & powder coating plant	KVA			
	g) Press shop	KVA			
	h) Lab testing rigs & equipment	KVA			
	i) Other equipment	KVA			
2	How much power does my facility/workshop use	KVA			
3	Diversity Factor of Plant Load	KW		To be calculated as per the load requirement.	40-60% depend upon equipment type
4	What is my capacity requirement as per LTP	KVA		Kindly refer to the LTP	
5	Generator type			Gas/Diesel	Based on location/capacity

Comment: - Before finalizing the generator refer to the above table/requirement sheet. This requirement sheets should be shared with the equipment maker along with the spec sheet to get the best commercial offer

Note: Sample load calculation sheet is enclosed for ref.

This calculation sheet to be filled before starting of project. Refer Annexure8-1

8.4.1 Long-term generator capacity planning sheet

Generator as per LTP Example										Requirement				
Year	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30	2030-31	2031-32	Requirement				
Connected load for plant	800 kVA	960 kVA	1200 kVA				Based on plant expansion							
							Connected load should not exceed 80% of generator capacity							
Standard load 80% of generator capacity	1500 kVA					Based on plant capacity			Increase the capacity finalization, select the nearest number					
									ST load to be calculated as per DPR/LTP forecast and future expansions					

Note: - Check power availability data, if power failure rate is less than 1%, then plan genset for critical load only, but the final call is to be taken by the plant/project team.

Comment: Calculate the maximum power that the generator may have to handle and purchase a generator with a tolerance of 20- 30% extra rating so that the rating load capacity should be sufficient for future expansions. Also, check the best possible genset capacity combination.

e.g.: - If the total load required to be more than 1000 to 1200kVA. Say, we require 1200 kVA.

So, proposed genset 1500KVA (1200kva + 20% extra)

e.g.: The possible genset combinations of various capacities going for 1500 kVA genset

S.No.	Fuel type	Genset capacity (kVA/Kwe)	No. of Genset	Total capacity (kVA)	Total capacity (Kw)	Loading factor	Usable capacity (Kw)
1	PNG/Diesel	500 KVA	3	1500	1200	80%	960
2	PNG/Diesel	750 KVA	2	1500	1200	80%	960
3	PNG	1521 (Kwe)	1	1901	1521	80%	1521

So, in bigger capacity gas gensets (1521 kwe), we are getting 100% rated capacity (no derating)

So, in place of going for smaller capacity multiple gensets, we may consider a bigger genset, resulting in:

- Electrical hardware cost & space saving
- Reducing cost -Rs/ kWh & Rs. /kVA
- More jerk load carrying capacity

8.4.2 Current government power supply & power quality status

- Look for availability of independent feeder(11kV/33kV/66kV).
 - Check power failure trend/data, if power failure is less than 1%, then plan genset for critical load only as backup on independent feeder. Final call to be taken by plant/project team.
- status of CNG /PNG pipeline supply- Check availability of the PNG pipeline/supply available in nearby area if away then the required timeline?

8.4.3 Current and future government emission regulations

Circular date	Circular Issuing Agency / (direction number)	Content of circular
16-Nov-2021	Commission for air quality management in NCR and adjoining areas (44)	Ban on use of DG sets, except for emergency purposes in the NCR.
08-Feb-2022	-do-(57)	Running of dual fuel genset fitted With RECD (retrofitted emission control device) allowed to run for 2hours/day
Newspaper announcement	Haryana State Pollution Control Board	Under all circumstances, industry will switch over to PNG or Biomass fuel with effect from 30.09.2022. In case the industry fails to meet this target, the industry / plant will be forced to shut down and will not be allowed to operate again
17-Mar-2022	-do-(62)	Directed where gas infrastructure and supply is available, shall under all circumstances completely switch over to PNG or biomass fuels, latest by 30.09.2022, failing which such industries shall be closed down and not permitted to schedule their operations thereafter
02-June-23	-do-(73)	For Genset Power-generating sets of all capacities running on LPG/Natural Gas/ Biogas/ Propane/Butane:- No Restriction 125 kW to less than 800 Kw:- DFK and RECD through certified vendors / agencies. 800 kW and above:-DFK OR Any other emission control device/ System Strictly subject to compliance for stack emissions as in the Footnote
02-June-23	MPCB Notice	Implementation of RECD with 70 % PM reduction No restriction Of Gas Genset or Use of DFK compulsory. Genset Manufactured or installed before 01.07.2004, not Complying CPCB I & CPCB II norms has to be scrapped
29-Sept-23	-do-(73)	Power-generating sets of all capacities running on LPG/Natural Gas/ Biogas/ Propane/Butane:- No Restriction Genset Copying CPCB IV+ Norms:- No Restriction 125 kW to less than 800 Kw:- DFK OR RECD through certified vendors/agencies. 800 kW and above:-Emission Parameters Defined & DG Stack 30 Mtr. Height

- Pollution norms are getting stringent day by day (For NCR region & nearby regions & will be applicable across the country near future) for we see from diff. notification from CAQM. (New emission norms for DG set CPCB IV+ implemented from Sept' 23)
- In the future, hydrogen will come as fuel. Hydrogen will be blended with CNG/ PNG. New gas genset which are available in market are able to operate on hydrogen as a fuel.



- Looking Into to above scenario we are recommending gas genset, which can run on Hydrogen.
- Even if in future, emission norms become more stringent the gas gensets will be complying with the norms. (Investment in gas genset will make the investment future proof)
- Check availability of the PNG pipeline/supply available in nearby area. If not available.
- Gas pipeline expected in next one-two years plan genset on rental basis. Then, buy gas genset when gas is available.
- If no visibility for gas: Consider CPCB IV+ Diesel genset.
- Final call to be taken by project team

8.4.4 Types of genset available (CNG generator, DG, etc.) and recommendation based on points above
 Generators are available based on fuel like diesel or gas

Comparison sheet for CPCB IV+ DG set vs GG set

S. No	Parameters	CPCB IV DG set	PNG gas genset
1	Technology	Diesel	PNG gas engine
2	Fuel	100 % diesel	100% PNG natural gas
3	Capacity	Genset ideal is 80 % with once in a while overloading up to 110 %	100 % rated capacity utilizable regularly
4	Service period	250-500 hrs. or 1 year in standby mode	1000 hrs or 2 year in standby mode
5	Operating cost	Upto 1.6 to 2 times of PNG genset	Upto 40 % savings vs diesel
6	Pollution control	Urea dosing being used in which Nozzles can get choked and corroded plus disposal of Scrubber water is another added cost as SCR releases some chemical rich water that may need to be treated in the ETP	Trouble free operation no urea, no SOx, no. particulate matter & no soot
7	Maintenance cost	High due to requirement of regular upgrades, multiple components and shorter timeline between services, more statutory monitoring and replacement costs. D check 7000hrs/ 4 years	Low due to single machine long life less statutory compliances. No D check required
8	Engine overhauling	18000 hrs/ 10-12 years	>84000hrs/ 70 year
9	Waste water disposal	SCR efficacy is possible only with Urea dosing system to control the exhausts. In standby operations the nozzles can get choked leading to unreliability of operation and it creates waste water disposal issues.	No such problem
10	Running cost	1.6 times to 2 times Higher than PNG	Almost 40-50% less than DG set
11	Statutory compliance for govt. department	Need to maintain record for Genset + Fuel and Emissions	No such record is required
12	Resale value	Zero usable value beyond 10-12 years in GRAP areas	Usable life is >4 times of DG
13	Future	Unpredictable	Will continue
14	Loading	Average load < 75%	Average load 100%
15	Fuel storage	Fuel storage tank is required	No fuel storage hassles
16	Multi fuel usage/use of hydrogen	Not possible only diesel	It's future ready & can run on 100% Hydrogen /Hydrogen PNG Mix.

From above it is clear that gas genset has many advantages over diesel genset like: -

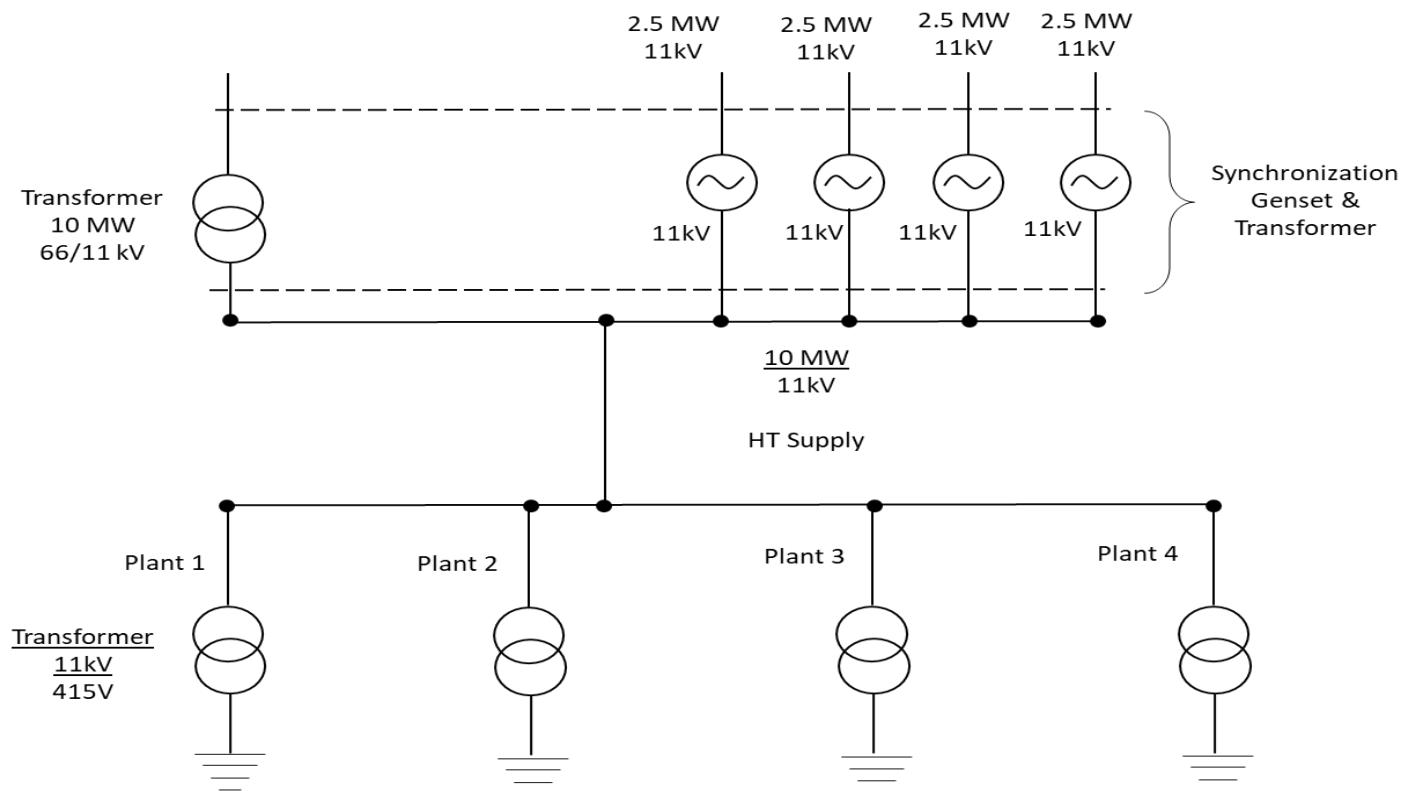
- Comply with the CAQM guidelines present & future also
- Reduction in carbon emission
- Beneficial for REC (Renewable Energy Credits)
- Lower running cost Rs/ kWh
- Lower maintenance cost
- Longer service duration
- No overhauling required till 84000 hours

8.4.4.1 Capacity of the generator in case of mega park based on point no 1.3 above and LTP of multiples units located in the park.

- If total Load in campus is to >1.5 MW (calculated as total campus load using the individual plant load sheet)
- We should consider bigger HT genset for whole campus & install near main transformer/substation.
- These HT gensets are in synchronized mode with the grid.

e.g. In the case of mega park of 10 MW capacity, following strategy may be adopted.

Following is circuit diagram:



Benefits: -

Genset running in sync with grids

1. Gensets are installed near to main incomer transformer.
2. Saving in capital cost. As HT gensets to be installed is synchronized with grid. After substation, infrastructure will be common for electricity & genset power.
3. Power generation cost will be low on bigger capacity gas gensets.
4. Less no. of standby (spare) generators are required. As we can have one stand by genset for campus rather than having spare genset at individual plant.
5. As genset running in sync. with grid/transformer, when power comes, genset will shift load from DG power to transformer gradually without any changeover tripping.

8.4.5 Technical specification sheet for DG set and for CNG generator set (including industry 4.0 related points)

8.4.5.1 Technical Specification for DG

Sr. No.	Description	Requirement
1	Fuel type	Diesel
2	Capacity (KVA)	As per requirement
3	Capacity (KW)	As per requirement
4	P.F.	0.8
5	Genset capacity	As per requirement
6	Engine Model no	As per manufacturer
7	Country of origin	
8	Technology	Rich burn/lean burn
9	Loading factor	80%
10	Ambient working temperature	50 '
11	Block loading capacity	> 40%
12	Block load (kW)	As per capacity
13	Time taken for full loading	<120 sec
14	Basic design	Standby/ Prime power
15	Jerk loading	40%
16	DG life (hrs) overhauling duration	>20000 hours
17	Replacement of head (hours)	>20000 hours
18	DG efficiency	40-45%
19	Suitable for hydrogen (future fuel)	No
20	Units generated kWh/ltr	<4
21	Radiator cooling	Yes
22	Radiator mounting	Within canopy Remote radiator: - In case higher capacity
23	B check kit duration	500 hrs or 1 years
25	IoT- compatibility	Yes
26	On line data monitoring & service support	Yes

8.4.5.2 Technical specification for GG

S. No.	Description	Requirement
1	Fuel Type	NG
2	Capacity (KVA)	As per requirement
3	Capacity (KW)	As per requirement
4	P. F.	1
5	Genset capacity	As per requirement
6	Engine model no	As per manufacturer
7	Country of origin	
8	Technology	Rich burn/lean burn
9	Loading factor	100%
10	Ambient working temperature	50 '
11	Block loading capacity	> 25%
12	Block load (kW)	As per capacity
13	Time taken for full loading	<120 sec
14	Basic design	Standby/ Prime power
15	Jerk loading	25-30 %
16	GG life (hrs) overhauling duration	>80000 hours
17	Replacement of head (hours)	>80000 hours
18	GG efficiency	40-45%
19	Suitable for hydrogen (future fuel)	Can Be upgraded
20	Units generated kWh/SCM	>4.5
21	Radiator cooling	Yes
22	Radiator mounting	Within canopy Remote radiator: - In case higher capacity
23	B check kit duration	1000 Hrs or 2 Years
25	IOT - Compatibility	Yes
26	On Line Data Monitoring & service Support	Yes

Key points:

1. **Place of installation:** Outdoor in silenced canopy/container.
2. **Engine safety protections:** The engine is equipped with automatic safety controls which will shut down the engine in the event of:
 - (A) Engine over speed
 - (B) Bearings high temperature
 - (C) Low lubricating oil pressure
 - (D) High coolant temperature etc.
 - (E) Overload protection
3. **Starting batteries, control batteries and chargers:** A suitable battery- charging alternator should be



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provided with sufficient capacity to recharge the batteries back to normal starting requirements quickly.

4. **Earthing for DG set:** Copper plate double body and double neutral earthing shall be provided for each & all capacity of DG sets. For DG set of 500 kVA or capacity or above- Copper strip
5. Accessories required for generator
 1. Control panel
 2. Battery charger
 3. Cooling tower
 4. Enclosure for silent type D.G. set
 5. Chimney

Comment: - The equipment shall be complete with all necessary accessories and materials in accordance with the specification of accessories required.

8.4.6 Statutory requirements related to the equipment

1. Layout to be submitted to the government authorization after which CEIG approval will be provided by the government authorized electrical inspector After successful inspection of site and documents.
2. It is recommended to hire a consultant firm for government-related and compliance approval.

Comment: - All relevant drawings, data test certificates and instruction manuals are required along with new generator

➤ Recommendations related to manufacturers/ OEM:

1. Cummins India Ltd
2. MTU India
3. F MTU
4. Caterpillar Inc
5. Generac

➤ **Proposed specification sheet for gensex with comparison of diff. make.**

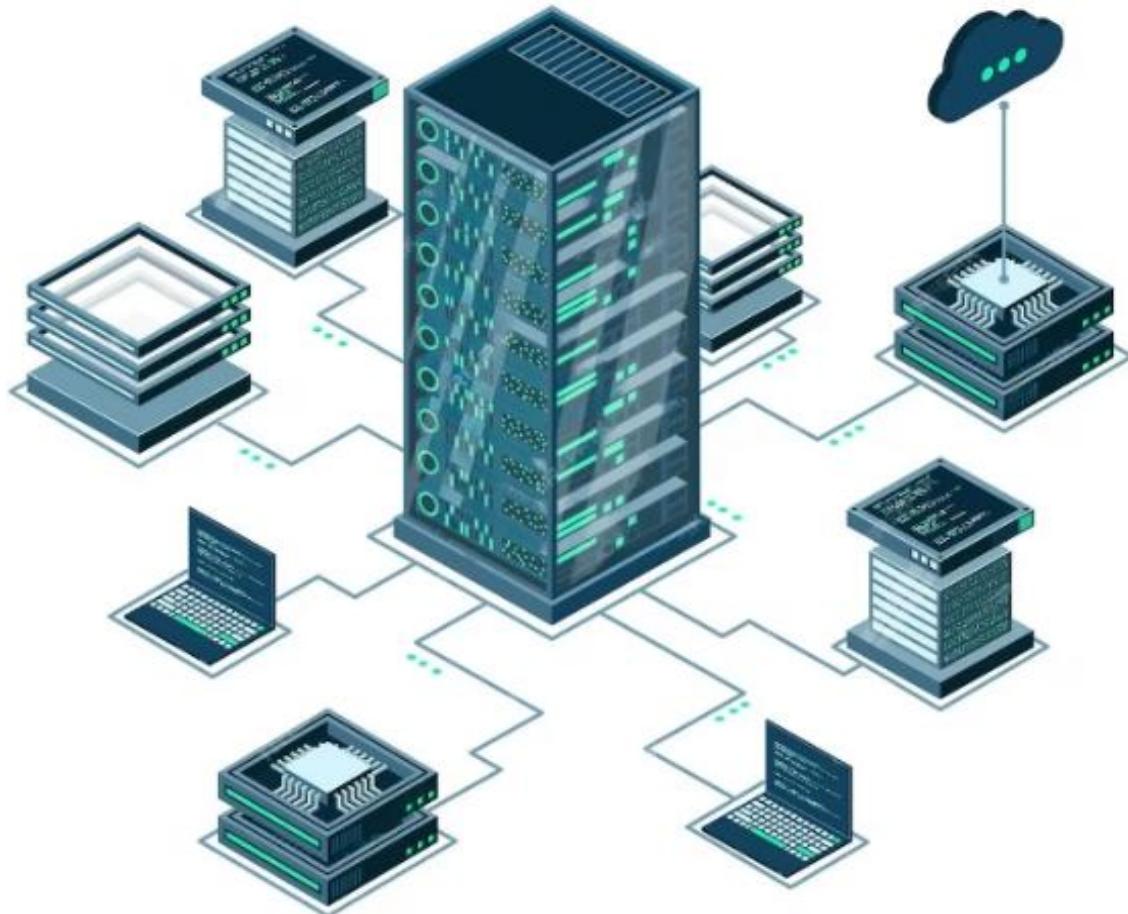
Example: Spec. sheet:

S.no.	Description	A	B	C
1	Fuel Type	NG	NG	NG
2	Capacity (KVA)	1875	1901.25	1875
3	Capacity (KW)	1500	1521	1500
4	P. F.	1	1	1
5	Gensex capacity	1500	1521	1500
6	Engine Model no	XXX	YYY	ZZZ
7	Country of Origin	Germany	Germany	Germany
8	Technology	Lean Burn	Lean Burn	Lean Burn
9	Loading Factor	100% of nominal capacity	100	100% of nominal capacity
10	Ambient Working temperature	45	50	45
11	Block Loading Capacity	27%	25%	27%
12	Block Load (KW)	405	380.25	405
13	Time Taken for Full Loading	105 Sec.	140 Sec	120
14	Basic design	Designed For Continous Running/Back up Purpose	Designed For Continous Running/Back up	Designed For Continous Running/Back up Purpose
15	Jerk Loading	20-30% of rated Capacity	25- 30% of rated Capacity	27% of rated Capacity
16	GG life (Hrs) without Overhauling	80000	84000	64000
17	Replacement of Head (Hours)	40000	84000	32000
18	GG efficiency	40.90%	44.50%	40.36%
19	Suitable for Hydrogen 100%(Future Fuel)	Suitable for 25% Hydrogen blending in Natural gas.	25% Hydrogen blending in Natural gas without Modification. 100 % with Modification	No
20	Units Generated KWH/scm	4.04	4.6	
21	Radiator Cooling	Water Cooled	Water Cooled	Water Cooled
22	Radiator Mounting	Remote Radiator	Remote Radiator	Extra Space for Radiator
23	Insulation	Class H	Class H	Class H
24	B check kit Duration	4000 hour or 1 year	1000 Hours or 2 Years	4000 hour or 1 year
25	IoT - Compatibility	Yes	Yes	Yes
25.1	On Line Data Monitoring & service Support	Yes	Yes	Yes

NG: Natural Gas

Note:

All electrical equipment to be installed as per IER 1956. Double grounding of each equipment to be ensured.



9. IT Infra

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9 IT Infra

西红 Purpose

To standardize the process of IT implementation and IT enablement in new business units.
To define the standard implementation procedures and guidelines to setup IT infrastructure, applications deployment, governance & risk management framework and trainings for new plants with in the Uno Minda group.

西红 Scope

All new manufacturing plants covering mainly the following areas:

1. Connectivity and network, data center, servers, cyber security tools.
2. IT infrastructure, applications deployment, governance & risk management framework.
3. OT/IoT infrastructure and applications.

西红 Main goals

1. To provide the safe and secure environment for business operations.
2. To ensure 100% availability and data security of IT infrastructure and business applications.
3. To ensure implementation of related standards and compliance.
4. To ensure ease of operation for business users.

西红 User

All Uno Minda employees, third party resources, consultants and service partners. Whoever will use the IT infrastructure and applications to meet the business requirements.

9.1 Baseline

Description	Stand-alone plant	Mega project
Server room (with all facilities)	Individual	Common
Server room for >50 users	Cloud	NA
Entire campus on Wi-Fi network	Individual	Individual (for each business)
Internet/MPLS	Individual	Common
Firewall/ servers	Individual	Common
10 Gbps network backbone in ring	Individual	Individual
Separate IoT/OT network	Individual	Individual
Role based access control and least privileges for IoT/OT network users	Individual	Individual
Internet connectivity for IoT/OT network	As per architecture /design	As per architecture /design
Plant will be under total surveillance and monitored by C&C Team	Yes	Yes

9.2 Technologies to be deployed as a basic standard for any new plant

9.2.1 Infrastructure

- **Firewall:** Next generation firewall (Fortinet/ Palo Alto) will be installed in HA Mode.
- Web application firewall: All web application (Internet facing) should be behind the WAF (Radware) in respect to cloud or on premise.
- **Access Points:** Wi-Fi AP (Ruckus/Meraki) should support Wi-Fi 6 Standards.
 - All Wi-Fi Access points will be connected on PoE Multigig (5Gbps) Switches.
 - Mandatory heatmapping before and after the installation of Access Points.
- **Switches:** All Switches (Juniper/Cisco) will be enterprise category which will support 10G Uplinks.
 - Layer 3 switches will be installed in HA mode.
 - Switches will be installed in Stacks for redundancy (wherever there are more than 1 SW).
 - Multi gigabit PoE switches for Wi-Fi Access points and IoT/OT devices.
 - VLAN's will be implemented which will give data protection and access control to all users.
- **Connectivity:**
 - Dual Internet and 1 MPLS link will be required to maintain the high up time and redundancy.
 - SDWAN will be used to connect with main data center and other plants to maintain the high availability.
 - Fiber Cables: Fiber optic cables (R&M) will be laid in Ring Topology from server room to all Racks and back to server room.
 - This fiber will support 10G+ bandwidth
- **VPN:** Remote users will be connected through VPN (AccelPro)
- **Anti-Virus:** Next Generation Anti-Virus (EDR+XDR – SentinelOne) in all end points and will be monitored by SOC Team 24x7
- **CCTV & IoT:** CCTV (Hikvision) & IoT Network will be completely separate from data network.
 - CCTV Network will be integrated with Building Management System which will offer complete security to anyone working in the plant.
- **NOC:** Network Operation Center will be created and integrated with not just data network but CCTV and IoT Network as well.
- **SOC (Security Operation Center):** All critical devices logs will be forwarded to SOC (Security Operation Center) for 24x7 monitoring, threat detecting and incident management.

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9.2.2 Applications

- **ERP:** SAP HANA will be deployed in all manufacturing plants & warehouse and BaaN will be deployed in all After Market business warehouses.
- Group IT Team (SAP Application) will provide the training of respective modules (MM, SD, FICO, PP, QM, PM and HCM) and do the deployment of SAP in respective plants.
- **SoD** tool will be implemented to manage the Segregation of Duties in SAP.
- **OneConnect** (Single sign on) shall be deployed from day one.
- **Fiori** will be deployed and training will be given to respective users.
- **Drishyam** will be deployed and training will be given to respective users.
- Web Application/Portal will be hosted on cloud (Azure/AWS/Yotta etc.)
- Web Application/Portal will be behind the WAF and NGFW with limited exposure to public network.

9.2.3 OT and IoT (as per the applicability)

- **Network:** Dedicated network will be used for IoT and OT devices.
- Integration of IoT /OT with Data Lake Platform.
- **MES** (Manufacturing Execution System) will be deployed along with IoT devices based on the business nature and requirement.
- **WMS** (Warehouse Management System) and asset tracking will be implemented based on the business requirement.
- **RPA** will be implemented for invoicing process as applicable.

9.2.4 Risk Management Framework

Based on the business nature and requirement:

- a) IT System Risk Management (IT Processes and Methodology)
- b) Enterprise Risk Management (Business Processes and Methodology)

Trainings: Group IT team will provide training for:

- All SAP modules and processes
- Drishyam
- SoD Tool
- SAP Fiori (SAP Mobility)
- Information Security Awareness
- IT Induction and IT Policies.
- OneConnect (single sign on)
- DLP and Data Classification

9.3 IT Infrastructure - Project implementation timeline

IT Infrastructure - Project implementation timeline		Timeline for year - XXXX									
Project Stages / Activity	Resp.	Apr	May	Jun	Jul	Aug	Sep - Dec	Jan	Feb	Mar	
Overall Project Master Schedule		Project start		DPR (PM1)		Revised DPR				Trial & Mass Production (PM3)	
Project Initiation		<----->									
Planning & Requirement gathering like Plant Layout, Users, N/w Points for machines*, IoT/OT Network, 5 years Planning etc.			<----->								
Define project tentative BoQ and Scope			<----->								
Set Objectives & Target				<----->							
Resource Planning				<----->							
Define Functional Requirement				<----->							
Define Technical Requirement				<----->							
Requirement Review & Approval						<----->					
IT Infrastructure Procurement and Implementation as per the SLA and Target date							<----->				
Post implementation Testing								<----->			
Documentation and Training								<----->			
Go Live								<----->			
Troubleshooting & Improvisation If any									<----->		
Review by Project Leader (Fortnightly)					<----->					<----->	
Review by Steer Co. (Monthly)							<----->			<----->	

Note:

- * All IT related points to be marked on the layout 1 months before PM2 event.
- Project timeline will be considered as per the project master schedule

Legends: -

Plan <----->
Actual <---->

9.4 Detailed breakdown of the technology infrastructure

S.No.	CONTENT	
	Title	Sub-Title
1	Passive Networking	1.1 Cat6 Cables (Brand -R&M) and Laying
		1.2 Separate Raceway and overhead tray for Data Cable
		1.3 User end side I/O (Brand -R&M), Gang Box & Faceplate
		1.4 User end side punching
		1.5 Feruling both sides
		1.6 Fluke Testing and Report
		1.7 Patch Panel Installation & Server Room I/O (Brand - R&M) punching
		1.8 Fiber Cable (Brand-R&M) laying and Termination
		1.9 Network Rack and Server Rack & Small Racks for inside the plants/ 42U Rack for CCTV
		1.10 UPS Power (Brand -Emerson or APC) for Small Racks
		1.11 Dedicated Earthing for Server Room and VC equipment's
2	MPLS & Internet Connectivity	2.1 Primary MPLS Connectivity from Airtel
		2.2 Secondary MPLS Connectivity from Tata
		2.3 Internet Connectivity (As per the Feasibility of ISP)
		2.4 Space for Tower (Should in 70 Meter range of Server Room)
3	Server Room	3.1 Fireproof wall (Preferred Brisk Wall) with fireproof Door & Paint & Raised Flooring
		3.2 Preferred location 1 st Floor and along with main office area.
		3.3 Water Leakage Detection System, Rodent Control System and CCTV.
		3.4 Electrical and Earthing work in Server Room
		3.5 Fire & Safety System (FM200) "VESDA
		3.6 10 KVA UPS@2 NOS
		3.7 AC 2 Nos with AC Auto Changer - Precision AC
		3.8 Temperature and Humidity Monitoring System
		3.9 Separate Industrial PDU Unit for server room
4	Active Networking (Wi-Fi Network AP Details)	4.1 Cisco Meraki MR44 - Up to 30 users Range of AP

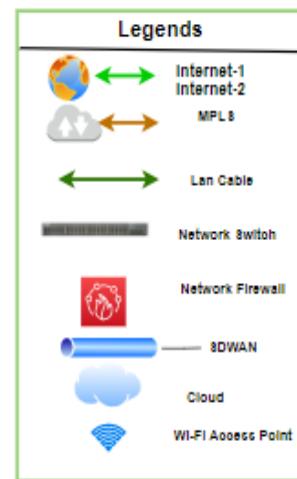
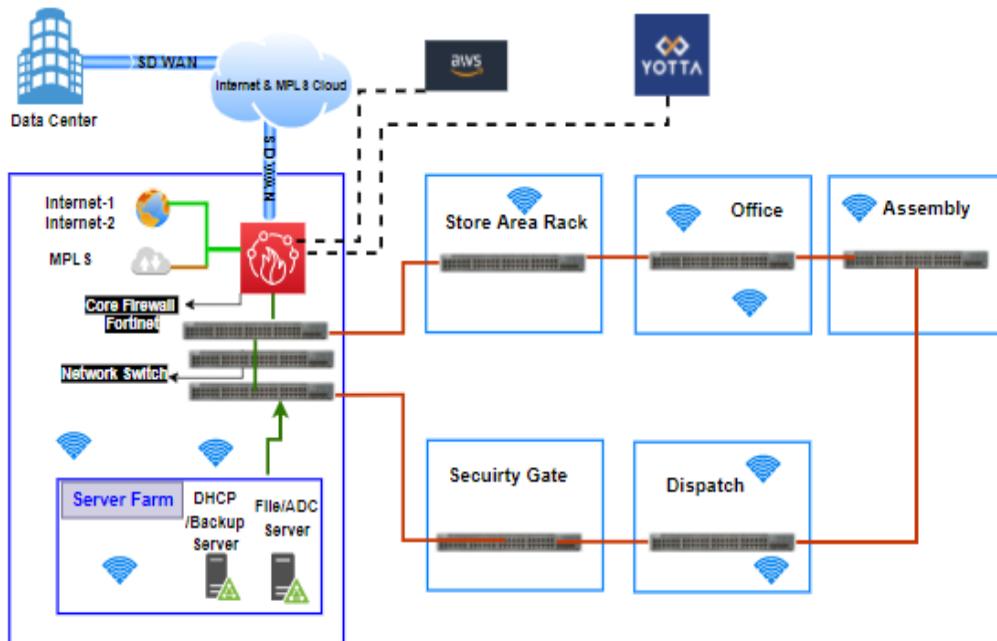
9.4 Detailed breakdown of the technology infrastructure (cont...)

S.No.	CONTENT	
	Title	Sub-Title
4	Active Networking (Wi-Fi Network AP Details) (cont...)	4.2 Cisco Meraki MR46 - Up to 50 users Range of AP
		4.3 POE Adapter - as per requirement
		4.4 24 Port POE Juniper Multigig Switches – in case PoE Switch required
		4.5 Installation and configuration
		4.6 Provision of Network and UPS PowerPoint for Wi-Fi Access Point
		4.7 Juniper EX 3400 24 Port Switches (for core Switch)
		4.8 Juniper EX 2300 24/48 Port Switches (For Access) as per requirement
		4.9 SFP Multimode
		4.10 FC Cables - Multimode LC-LC
		4.11 Stacking Cables
		4.12 Installation and configuration
		4.13 Firewall (Optional, only on a requirement basis)
5	Board room/ Meeting room and training room	5.1 LED Display for Meetings Rooms and Reception
		5.2 Provision for HDMI and VGA Cable
		5.3 Provision for AV Setup in Board Room
		5.4 Barco Device (Wireless Presentation Device)
		5.5 Audio System - Jabra Device or Logitech Conference System
		5.6 UPS Power Points
		5.7 Popup Boxes with LAN, HDMI, VGA and Power point
		5.8 Pana board for Board Room
		5.9 LED projector and Motorized Screen provisioning
		5.10 Provision for HDMI and VGA Cable

9.4 Detailed breakdown of the technology infrastructure (cont...)

S.No.	CONTENT	
	Title	Sub-Title
6	UPS	6.1 2 redundancy UPS of 10 kVA (minimum and for mega projects as the workload) for server room equipment. UPS supply for office and meeting room. 1 UPS and 2 raw power point for each user.
7	End-User Computing	7.1 Laptops/Desktop/Workstation-HP
		7.2 Display Screen 27" (VP and above)-HP
		7.3 Server- HPE/Lenovo/DELL/IBM
		7.4 Printer-Canon
		7.5 Provision for Printer (Space, N/w and UPS Power Point)
		7.6 Service Desk Tool
		7.7 Microsoft License (Windows Server/ Device CAL & Office)
		7.8 Barcode Printer/ Reader/ Scanner
		7.9 RFID
		8.1 CCTV Layout Finalization
8	CCTV Setup	8.2 CCTV/ NVR Brand/Models and Numbers
		8.3 CCTV Cat6 and Fiber laying
		8.4 Termination for Cat6 and Fiber Cable
		8.5 Network Switches for CCTV
		8.6 Racks for CCTV
		8.7 UPS Power Points for CCTV
		9.1 VMware
9	Server Hosting (VM/Cloud)	9.2 Hyper-V
		9.3 MS Azure
		9.4 AWS
		9.5 Plant/ Unit (Server & PC Backup)

UML Proposed Network Diagram



Prepared By -

Verified By

Approved By

Put Up Date :-
Removal Date :- Next Change

9.5 Scope of work for Infrastructure setup in new plant

S. No.	Task Description	IT Standards	Responsibility		Remarks	SLA from Group IT	Dependency
			Minda Projects	Plant IT			
1	Passive Networking						
a	Cat6 Cables (Brand -R&M) and Laying	R&M					MPL Team
b	Separate Raceway and overhead tray for Data Cables	Standard Raceway					MPL Team
c	User end side I/O (Brand - R&M), Gang Box & Faceplate	R&M					MPL Team
d	User end-side Punching	NA					MPL Team
f	Feruling both side	NA					MPL Team
g	Fluke Testing and Report						
h	Patch Panel Installation	R&M				4 weeks	Cat6 cable laying by MPL Team.
i	Server Room I/O (Brand - R&M) punching	R&M				4 weeks	
j	Fiber Cable (Brand-R&M) laying and Termination	R&M				4 weeks	Plant's final layout by MPL team
k	Network Rack and Server Rack	Rittal/ Valrack				4 weeks	Server room to be ready by MPL Team.
l	Small Racks for inside the plants	Rittal/ Valrack				4 weeks	
m	UPS Power (Brand - Emerson or APCO for small racks)	Emerson/ APC				4 weeks	

9.5 Scope of work for Infrastructure setup in new plant (cont.)

S. No.	Task Description	IT Standards	Responsibility		Remarks	SLA from Group IT	Dependency
			Minda Projects	Plant IT			
1	Passive Networking (cont.)						
n	Patch cables (1mtr, 2mtr) as per the requirements	R&M				4 weeks	As per node count
o	42U rack for CCTV	Rittal/ Valrack					
q	Dedicated earthing for server room and other IT equipment				Gel based earthing		MPL Team.

9.6 MPLS & internet connectivity

S. No.	Task Description	IT Standards	Responsibility			Remarks	SLA from Group IT	Dependency
			Minda Projects	Plant IT				
2	MPLS/Internet Connectivity							
a	Primary MPLS connectivity from Airtel		Min. 5 Mbps				8-10 weeks	# Feasibility to be check.
b	Secondary MPLS connectivity from Tata		Min. 5 Mbps				8-10 weeks	# RF tower space, distance should not be more than 70m.
c	Internet connectivity (Airtel or Tata)		Min. 2 Mbps				8-10 weeks	# Server room with UPS.
d	VC and MPLS connectivity (requirement basis) (Airtel)		Min. 2 Mbps				8-10 weeks	
e	Space for tower (should in 70meter range of server room)							# Space to be finalized for new tower in layout by Plant Team. (MPL will provide the space for tower with foundation).

9.7 Server Room

S. No.	Task Description	IT Standards	Minda Projects	Plant IT	Remarks	SLA from Group IT	Dependency
3	Server Room						
a	Fire Proof wall with fireproof Door & Paint				Brick Wall		
b	Raised Flooring						
c	Water Leakage Detection System	VERTIV			Jyoti Telecom	4 weeks	# To be shown in Plant Layout
d	Rodent Control System	TBD*				4 weeks	# To be shown in Plant Layout
e	Fire & Safety System (FM200) "VESDA"	Ceasefire					
f	Access Control	Savior/ VERTIV					
g	AC 2 Nos with AC Auto Changer - Precision AC	Bluestar					
h	Temperature and Humidity Monitoring System	VERTIV				4 weeks	
i	Separate Industrial PDU Unit for server room	Rittal				4 weeks	
j	EPBAX System				N/A		
k	Electrical and Earthing work in Server Room						
l	10 KVA UPS@2 NOS.	Emerson/ APC				4 weeks	

9.8 Active Networking (Wi-Fi network AP details)

S.No.	Task Description	IT Standards	Minda Projects	Plant IT	Remarks	SLA from Group IT	Dependency
4A	Wi-Fi Network AP Details:						
a	Cisco Meraki MR44 - Up to 30 users in Range of AP	Cisco				4 -6 weeks	
b	Cisco Meraki MR46 - Up to 30-50 users in Range of AP	Cisco				4 -6 weeks	# Final Plant Layout required. # Survey for wi-fi AP Requirement.
c	POE Adapter - as per requirement	Cisco				4 -6 weeks	
d	24 Port POE Juniper EX 2300 Switches - in case PoE Switch required	Juniper				4 -6 weeks	
e	Installation and configuration					4 -6 weeks	
f	Provision of Network and UPS Power Point for W-Fi Access Point				# Normal Electricity Point not on UPS.		

9.9 Active Networking Switching Details

S. No.	Task Description	IT Standards	Minda Projects	Plant IT	Remarks	SLA from Group IT	Dependency
4B	Switching Details:						
a	Juniper EX 3400 24 Port Switches	Juniper				4 -6 weeks	1. Plant final layout required. 2. Node counts. 3. Server room required with UPS power.
b	Juniper EX 2300 24/48 Port Switches as per requirement	Juniper				4 -6 weeks	
c	SFP Multimode	Juniper				4 -6 weeks	
d	FC Cables - Multimode LC- LC	Juniper				4 -6 weeks	
e	Stacking Cables	Juniper				4 -6 weeks	
f	Installation and configuration					4 -6 weeks	# As per layout & PO.
g	Firewall on rent (Optional, only on requirement basis)	Fortinet				4 -6 weeks	

9.10 Board Room /Meeting Room & Training Room

S. No.	Task Description	IT Standards	Responsibility		Remarks	SLA from Group IT	Dependency
			Minda Projects	Plant IT			
5	Board Room & Meeting Rooms						
	LED Display for Meetings Rooms and Reception	Samsung			# To be decided by Lighting Plant		
a	Provision for HDMI and VGA Cable						
b	Provision for AV Setup in Board Room						
c	Barco Device (Wireless Presentation Device)	Barco				4 -6 weeks	
d	Audio System - Jabra Device or Logitech Conference System	Jabra/ Logitech				4 -6 weeks	
e	UPS Power Points						
f	Popup Boxes with LAN, HDMI, VGA and Power point						
g	Pana board for Board room	Panasonic			N/A	4 -6 weeks	

9.10 Board Room /Meeting Room & Training Room (cont.)

S. No.	Task Description	IT Standards	Responsibility		Remarks	SLA from Group IT	Dependency
			Minda Projects	Plant IT			
6	Training Room						
a	LED projector and Screen provisioning						
b	LED Projector	Casio				4 -6 weeks	
c	Motorize Screen	Generic				4 -6 weeks	
d	Provision for HDMI and VGA Cable					4 -6 weeks	

9.11 UPS

S. No.	Task Description	IT Standards	Responsibility			Remarks	SLA from Group IT	Dependency
			Minda Projects	Plant IT	Remarks			
7	UPS Power for Users							
a	UPS Supply for Office & Meeting Room	Emerson/APC			# Will be connect with centralized UPS room.			
b	1 UPS and 2 Raw Power Point for each user							

9.13 End-User Computing

S.No.	Task Description	IT Standards	Responsibility			SLA from Group IT	Dependency
			Minda Projects	Plant IT	Remarks		
8	End User Computing						
a	Laptops	HP				4 -6 weeks	
b	Desktops	HP				4 -6 weeks	
c	Display Screen 27" (VP and above)	HP				4 -6 weeks	
d	Workstations	HP				4 -6 weeks	
e	Servers	HPE/Lenovo/DELL/IBM				4 -6 weeks	
f	Printers	Canon				4 -6 weeks	
g	Provision for Printer (Space, N/w and UPS Power Point)				Location given by Plant IT.		
h	Service Desk Tool	Asset Infinity				4 -6 weeks	
i	MS Windows Server Licenses	MS				4 -6 weeks	
j	MS Device CAL	MS				4 -6 weeks	
k	MS Office Licenses	MS				4 -6 weeks	
l	Barcode Printer					4 -6 weeks	
m	Barcode Reader					4 -6 weeks	
n	RFID					4 -6 weeks	
o	Barcode Scanner					4 -6 weeks	

9.14 CCTV Setup

S. No.	Task Description	IT Standards	Minda Projects	Plant IT	Remarks	SLA from Group IT	Dependency
9	CCTV Setup						
a	CCTV Layout Finalization				# Source will be finalized by Poonam Garg		
b	CCTV/ NVR Brand/Models and Numbers	Hikvision			# Source will be finalized by Poonam Garg		
c	CCTV Cat6 and Fiber laying				# Source will be finalized by Poonam Garg		
d	Termination for Cat6 and Fiber cable						
e	Network Switches for CCTV						
f	Racks for CCTV						
g	UPS Power Points for CCTV						

9.15 Server Hosting (VM/Cloud)

			Responsibility			SLA from Group IT	Dependency
S No	Task Description	IT Standards	Minda Projects	Plant IT	Remarks		
10	Virtualization						
a	VMware	VMware				4 -6 weeks	#License availability
b	Hyper-V	Microsoft				4 -6 weeks	#License availability

	Cloud Hosting						
a	MS Azure	Microsoft				4 -6 weeks	#License availability
b	AWS	AWS				4 -6 weeks	#License availability

	Backup Solution						
a	SAP HANA + PLM + Tableau	IBM Spectrum				4 -6 weeks	#License availability
b	MDSL Applications	Veeam				4 -6 weeks	#License availability
c	Plant/ Unit (Server & PC Backup)	Veritas/Commvault				4 -6 weeks	#License availability



10. EHS & ESG aspect of plant



Green Book

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10 EHS & ESG aspect of plant

西红 Purpose

To define the basic guidelines related to the EHS & ESG aspects of the building. The basic approach / philosophy is to use guidelines as design reference point while designing the building. Front loading of key EHS & ESG points so that the building is designed keeping in view EHS & ESG requirements.

西红 Scope

All units associated with manufacturing.

西红 User

Plant team, new project team, Building contractor.

10.1 EHS related key front-loading points at building design stage

Areas	Key points	E	H	S
1. Civil	Building should be designed as per seismic zone & cyclone history to sustain the impact of any earthquake & wind speed.			O
	All processes, storages, equipment's, plants, etc. involving serious explosion and flash fire hazard should be located in segregated building where the equipment shall be so arranged that only a minimum number of employees are exposed to such hazards at any one time.			O
	Plant ground floor level should be minimum 300 mm above w.r.t internal road.			O
	RCC Building / Shed / Furniture / Elevation colour will be as per Uno Minda standard.			
	Provision of maximum natural light to be taken during building design.	O		
	Roof Insulation to be done to optimize heat loss and to improve the working environment of shop floor.	O		
	Life Line on PEB (Pre-engineered building) shed to be provided			O
	Poarch to be provided at reception area.			
	Dispatch & receiving area should be covered to avoid any impact of rain even from sides.			
	Minimum height of shutter should be as more than maximum machine height, *** Unit will confirm the height.			O
	In partitions, height of glass should be 0.9 to 1.2mtr. from the ground level.	O		
	Main entry gate should be motorized		O	
	Every chamber, tank, vat, pipe, flue or other confined space where persons may have to enter opening should not be less than 16 inches long and 12 inches wide & in the case of a circular shape, should not be not less than 16 inches in diameter			O
	The gas cylinder shed or storage room's construction must to be fire resistant.			O
	Petroleum gas cylinders that have been dissolved and liquefied petroleum gas ought to have a vertical gas cylinder storage option.			O
	Separate storage provision should be in place for cylinders containing flammable gases and toxic gases and a suitable partition wall must be in place containing other types of gases.			O
	LPG cylinders should be directly connected to the manifold with meeting the requirements of IS :6044 Part-1			O
	Chemicals covered by MSIHC Rules Schedule-2 and meeting the threshold quantities should be kept in a separate storage facility.			O
	An aluminium storage shed needs to be built with a minimum 3-meter safety gap surrounding it. Furthermore, the area needs to have a sun shelter and side parapet wall projected in the form of a box at the entry.			O
	Specified area for the storage of waste or old batteries	O		

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
1. Civil (cont.)	Specified area for the storage of E-waste	O		
	Hazardous waste storage area -Flooring should be constructed with concrete floor & Dyke wall / Bund / Secondary containment system for liquid waste need to be provided.	O		
	For those plots where the rooftop space is 100 square meters or greater or plot size of at least 500 square meters or more, a rainwater harvesting system ought to be constructed.	O		
	A rainwater collection and storage facility should be in place.	O		
	In compliance with state requirements, the ETP and STP systems need to be installed.	O		
	Every emergency exit situated in areas of open space should be connected to a street.			O
	Exits must be positioned so that the distance travelled to reach at least one of them on the floor doesn't exceed 30 meters & When a Factory uses or stores high-hazard Materials, the distance to the exit is not more than 22.5 meters.			O
	The minimum allowable clear staircase width is 1.2 meters, while the minimum allowable tread width is 0.30 meters.			O
	Anti slip tape should be fixed on every stair.			O
	According to standards, plantings and greenery should be done (33%).	O		
	Miyawaki concept to be considered for plantation	O		
	There should be no use of Ozone Depleting Substances or Zero ODP Materials (HCFC & CFC). (as prescribed in SCHEDULE – I [See rule 2(e), (n), 3(2) and (3), 5(3)] e.g. Insulation, Fire suppression system, AC etc.	O		
	According to the Indian Boiler Act, every boiler must be registered and verified.			O

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
2. Electrical	All external electrical panels should be double door type & suitable for outdoor application.			O
	Lockout Tagout provision to be given in all electrical panels, Distribution boards & other energy sources.			O
	Mechanical Interlocking should be in all electrical panels.			O
	Insulation mats with latest ISI standard to be placed in front of all electrical panel.			O
	ELCB to be used in all DB, s as per norms.			O
	PESO Rules Chapter IV Rule No. 71 must be followed for all electrical installations in the HSD storage area.			O
	Electrical installations: All electric meters, distribution boards, switches, fuses, plugs and sockets, all electric fittings, fixed lamps, portable hand lamps, and motors must be of flameproof construction in accordance with IS or IEC-60079-1 if flammable gases are to be filled and stored in cylinders.			O
	All electrical systems and equipment's and all structures, plants and other non-current-carrying metallic parts of major electric apparatus or any major metallic object in any place where petroleum is refined, blended, stored, loaded or unloaded must be efficiently earthed.			O
	All joints in pipelines, valves, plants, storage tanks and associated facilities and equipment's for petroleum should be electrical continuity by bonding (the resistance value between each joint shall not exceed 1 ohm) ?			O
	Piping for petroleum must be effectively connected to the related tank or vessel by a flexible conductor and should be earthed if it is not in electrical contact.			O
	Proper earthing/ grounding of building /Machine / Lines etc to be ensured.			O
	Double Earthling for all Electrical Equipment's (Transformer, VCB, DG Sets and Electrical Panels) to be done.			O
	Separate earthing for body and neutral for Transformer & DG Set to be ensured.			O
	HT Sub Station Equipment's line Transformer and VCB should be fenced & locked properly and its key should be available at identified location.			O
	Electrical installation (Panel, DB's etc.) & water pipe line should not be provided on the same column.			O
	Area-specific lighting arrangement should be in compliance with IS 6665, and ensures that general illumination in interior manufacturing spaces occupied by humans is measured at least 65 Lux (a horizontal plane at a height of three feet above the floor).			O

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
2. 1 Energy Conservation	Green building measures should be adopted by all building on various plot sizes above 500 square metres and project certified from Green Rating for Integrated Habitat Assessment (GRIHA) /Indian Green Building Council (IGBC)/ Leadership in Energy and Environmental Design (LEED)	O		
	All multifunction meters (MFM) in LT panels should be suitable for capturing data for Energy Management System	O		
	Only IE 3 & above rating electric motors to be procured and installed.	O		
	Only energy efficient i.e. 5-star rating pumps to be procured and installed.	O		
	Only energy efficient equipment's such as ACs etc to be procured and installed.	O		
	Low losses transformers i.e. 5-star rating to be procured and installed.	O		
	Energy Monitoring system should be implemented to gather the real time basis information	O		
	Occupancy sensor should be provided in rest rooms, gangways, meeting rooms, at display areas etc.	O		
	Rooftop Solar Photovoltaic Power Plant for the buildings/ areas must be in accordance with the order bearing no. 22/52/2005-5 Power, dated 21st March 2016 notified by Renewable Energy Department, Haryana. (Ref. to other state specific rule)	O		
	LED lights to be installed and solar lights to be used in peripheral area.	O		
	Emergency lights should be provided in stairways, corridors, shop floor, emergency exit, assembly point and exit area.			O
	Moulding machines to be procured with availability of servo motors.	O		
	Power backup of each moulding machine with appropriate UPS to be ensured.	O		

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
3. Mechanical	Dock leveller to be provided at dispatch & receiving store area to load/ unload material from vehicles.			O
	High speed shutter to be provided as per unit requirement.			O
	One shutter should be provided in the area from where the heavy machines can easily enter.			O
	All cut-out (Duct entry, Cable entry, Pipe entry) should be sealed.			O
	No Pipeline, cable tray should be provided/fixed on ground to avoid trip Hazard (Permanent, flexible)			O
	suitable passageways should be provided for all rail track of overhead travelling cranes at least fifty-centimetre (twenty inches) width with toe boards and double hand rails ninety centimetre (three feet) shall be provided alongside, and clear of, the rail track of overhead travelling cranes			O
	A suitable passageway for rail track must be free from any moving part of the crane which may strike persons on the ways (passageway shall be at a lower level than the crane track itself)			O
	Safe access ladders should be provided at suitable intervals to afford to EOT rail track passageways.			O
	When storing below listed highly Toxic gases, a provision for a gas detection and alarm system must be in place: Trifluoride, Carbon Monoxide, Fluorine, Hydrogen Chloride, Cyanogen Chloride, Chlorine Trifluoride, Hydrogen Cyanide, Hydrogen Fluoride, Hydrogen Sulphide, Methyl Bromide, Nitrogen Tetroxide, Chlorine, Ammonia or Sulphur dioxide.			O
	Toxic and corrosive gas storage facilities must have an effective alarm system with an operating switch so that, in the event of an emergency, the control room can hear the alarm.			O
	Installation of cryogenic pressure vessels for LNG storage must comply with SMPV standards (DISTANCES FROM IMPOUND WALL AND PROPERTY LINE Table 1_SMPV Rules)			O
	Process-wise, a distinct water meter needs to be setup.	O		
	Installed DG must fulfil the legal guidelines of state pollution control board, CPCB, and NGT regulations (e.g., CPCB IV, RECD, DFK).	O		
	Installation of Industrial equipment's should maintain Ambient noise quality standards. Day Time_ 75 Night Time_ 70 Commercial Area: Day Time_ 65 Night Time_ 55 Residential Area: Day Time_ 55 Night Time_ 45 Silence Zone: Day Time_ 50 Night Time_ 40	O		

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
3. Mechanical (cont.)	Duct must have the manhole for the check and cleaning?			O
	All Ventilation ducts, pneumatic conveyors and similar equipment's involving a serious fire risk must be equipped with flame-arresting or automatic fire extinguishing appliances, or fire resisting dampers electrically interlocked with heat sensitive/smoke detectors and the air-conditioning plant system.			O
	Automatic fire suppression system to be installed in server room.			O
	Smoke & heat detection system to be provided in plant as per norms & to fulfil the Fire NOC requirement.			O
	Installation of sprinkler and fire hydrant systems must follow regulatory requirements. (e.g. Automatic sprinkler system installed as per / NBC -4 / IS 15105, Internal Hydrant system installed as per NBC-4 IS 3844 etc)			O
	Maximum Fire Hydrant Line should be routed above ground as per norms & to fulfil the Fire NOC requirement.			O
	Wet Scrubber Installation to be ensured as per requirement (paint shop, furnaces etc.)	O		
	The availability and operability of a Zero Liquid Discharge Plant (ZLD) should be ensured & ZLD (Zero Liquid Discharge) system to be considered in initial budget.	O		
	360 degree guarding of machines to be ensured during procurement & installation-need to be consider for equipment procurement & building design team.			O
	Furnace / Oven - must be the circuit that can block feeding fuel when abnormalities (gas leakage, fire in booth, earthquake) occurred.			O
	In Furnace/Oven - Flame monitor should be the double safety systems? (UV & Flame rod)			O
	Axial fan should be avoided for exhaust ventilation (chemical store).			O
	ventilation fan to be stopped automatically in conjunction with fire detection in the paint store and then actuation of the firefighting equipment (chemical store).			O
	Pipe line colour coding should be done as per IS:2379.			O
3.1 Water Conservation	RO reject water line should be connected with ETP inlet water tank.	O		
	STP treated water to be used in flushing and cooling Tower purposes.	O		
	There should be no waste water discharged to the main sewer system.	O		
	Water taps with sensors & aerator to be installed	O		
	Water less/ Low water consuming sanitary fittings to be ensured in rest rooms.	O		
	Digital water monitoring system should be implemented to gather the real time basis information.	O		

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
4. Layout	Separate scrap area needs to be constructed to store the Hazardous & non-hazardous waste material as per applicable norms.	O		
	Plastic storage should be outside the shop floor at minimum distance of 3 meter.			O
	Resin storage should be outside the shop floor at minimum distance of 3 meter.			O
	Separate location to be provided for storage of hazardous and now hazardous waste as per norms.	O		
	Covered empty bin area to be provided as per requirement.			O
	The site of the hazardous waste storage place should be designated as an isolated area with a lock and key system.			O
	A well-designed cylinder storage room is necessary: cool, dry, well ventilated place under cover, away from boilers, open flames, steam pipes or any potential sources of heat and such place of storage must be easily accessible			O
	Chemical storage area should be separate from the building & it should be fire resistant.			O
	Driver room to be provided at security gate.			O
	6 meter OR as per state requirement wide road to be made available around the building for the movement of fire tender.			O
	Flag post to be provided in front of reception main entry.			O
	Change room facility to be provided wherever electronics assembly shop is available.			
	Vehicle parking area to be provided and proper visualization to be done as per requirement.			O
	First aid room/OHC to be made as per requirement.			O
	Crèche to be provided as per requirement.			
	Separate entry point for manpower and material to be provided in canteen.			O
	Two or more entrance to be provided at paint warehouse.			O
	Number of toilets for both men and women should be as per manpower.			
	Toilet should be provided 15 meters away from canteen and it should be well ventilated.		O	
	Automatic Detection & Suppression system to be installed in UPS & Battery room			O
	Separate 3 mtr passage to be provided on shop floor for safe forklift movement as per requirement.			O
	ESD flooring to be provided as per requirement.			O

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
4. Layout (cont.)	Plant layout finalized by CFT including EHS & ESG Officer and relevant officials. It should be displayed at site too for visualization (marked with "You Are Here")	O		O
	Maximum Utility (Air Compressor, Cooling Tower etc.) should be placed outside the factory building.			O
	Plant layout to be designed to keep a view to reduce the material handling from one location/ station to next step. For e.g. Tool room to be provided near to mould shop/ die casting shop/ press shop etc.	O		O
	Utility layout should be in such a way which ensure to minimize the energy losses.	O		
	All utility machine, plant machine & lines etc. having enough space (minimum 3 ft.) for work and maintenance.			O
	Availability of electrical & water line layout to be ensured.			O
	Emergency light mapping for the interior, exterior, and other utility area of the plant should be mapped, along with UPS and battery backup.			O
	Solar system provision to be taken during plant layout.	O		
	DOJO room including EHS & ESG requirement to be developed.	O	O	O

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
5. Building Safety	According to the most recent NBC Norms, the plant should have firefighting pumps available (Ref to table 7 / NBC- 2016 Chapter IV)			O
	The water storage tank for the fire hydrant system ought to be above ground instead of below ground with a positive suction.			O
	First aid hose reels must adhere to legal requirements as per NBC-4 / IS 884			O
	No obstacle should be in front of Fire Hose Reel box, area should be obstacle free and slight antiskid ramp need to be provided instead of step, if Hose box is installed on height			O
	Installing a captive water storage tank should follow all applicable laws (NBC-4 / IS 15105, for example).			O
	Fire hydrants and other water sources (storage tanks, reservoirs, etc.) need to have enough volume and pressure, and there has to be foam producing equipment, automatic sprinklers, or water spray systems.			O
	Adequate overhead water storage tank to be made for firefighting and dedicated capacity should comply as per norms and to fulfil the FIRE NOC requirement.			O
	Adequate water storage capacity for firefighting to be ensured as per norms and to fulfil the FIRE NOC requirement.			O
	Hose reel to be provided as per norms & to fulfil the FIRE NOC requirement.			O
	Installing an alarm system and automatic fire detection in accordance with legal requirements (such as NBC-4 / IS 2189).			O
	Fire alarm repeater panel to be installed at main gate which shall be used as emergency control room.			O
	Fire detection & alarm system need to be provided as per legal norms e.g. NBC-4 / IS 2189			O
	Fire Resistant compartmentation to be provided for UPS & Battery room installation			O
	Fire resistant compartmentation to be provided for server room.			O
	Automatic fire suppression system to be installed in Chemical store.			O
	Flame proof light fittings to be used in fire prone areas like Chemical store / paint kitchen etc.			O
	Special Type fire extinguisher should be provided/ installed at outside of Chemical Storage Area, HSD yard near to entrance.			O
	Chemical storage -Ensure enough distance from high-voltage cables (more than 600V) and computer trunk cables to the facility.			O
	Chemical storage area should be made as per license (A, B &C) condition if applicable.			O

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
5. Building Safety (cont.)	Effective ventilation with proper ducting to be installed in chemical storage area.		O	O
	Paint Shop / Metalizing / Printing Chemical store should be air conditioned with duct able provision/ as per norms.			O
	Portable fire extinguishers and firefighting apparatuses, such as foam, inert gas, or dry chemicals, as well as fire control equipment need to be provided in haz waste room.			O
	Fire extinguisher installation should be in place as per/ NBC-4/ IS 2190.			O
	Fire extinguishers locations should be marked in layout.			O
	Automatic fire suppression system to be installed in Electrical panels.			O
	Each office level has a maximum area of 750 m ² and is divided into zones or compartments as per NBC.			O
	Body shower with Eye wash provision should be available near to the point of use and storage of chemicals.			O
	According to the Haryana Building Code, 2017 or the state-specific building code, buildings next to high-tension electrical lines must have a clearance zone.			O
	Electrical Installation should be done in compliance with CEA 2003 (latest amendment to be considered)			O
	No loose/naked/twist/joint wiring should be avoided.			O
	The distance between a petroleum storage tank and a boiler or furnace shall not be less than ninety meters.			O
	There should be a wall or fence around the petroleum storage area that is at least 1.8 meters high.			O
	DG Stack height should comply with CPCB/SPCB norms	O		
	Process Stack height should comply with CPCB/SPCB norms	O		
	Stability certificate of building to be obtained.			O
	Wind sock to be installed.			O
	CCTV to be installed to ensure the security in plant premises as per requirement (Inside & Outside area of plant).			O
	360 degree guarding of machines to be ensured during procurement & installation-need to be consider for equipment procurement & building design team.			O
	Clean room / Paint shop / Lacquer booth should have adequate safety norms, like flammable chemical kept in close container, proper earthing, secondary containment.			O

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
5. Building Safety (cont.)	Stability certificate of building to be obtained.			O
	Wind sock to be installed.			O
	CCTV to be installed to ensure the security in plant premises as per requirement (Inside & Outside area of plant).			O
	360 degree guarding of machines to be ensured during procurement & installation-need to be consider for equipment procurement & building design team.			O
	Clean room / Paint shop / Lacquer booth should have adequate safety norms, like flammable chemical kept in close container, proper earthing, secondary containment,			O
	Warning signages to be displayed/ available on all machines.			O
5.1 General Safety	PPE matrix & warning signs should be displayed in utility room.			O
	SLD should be displayed in Electrical Panel Room as well as on each electrical panel including DBs.			O
	Proper visualization (Fluorescent) to be ensured for Firefighting equipment's.			O
	All firefighting equipment's like Sand Bucket, Fire Extinguisher should be deployed in HSD Yard, LPG Yard, DG Set, Transformer, VCB & Panel Room as per fire load/NBC norms.			O
	Manual Call Point (MCP) to be installed as per norms & to fulfil the FIRE NOC requirement.			O
	Different/ separate pathway to be provided for men and vehicle movement to avoid any accident.			O
	Heavy m/c should be on vibration pad.			O
	Machines, utilities equipment's should be grouted properly.			O
	Emergency assembly area/ points should be provided and defined as per available manpower.			O
	Weighing machine purchases, installations, and maintenance will only be carried out by authorized service providers from metrology department.			O
	All EHS & ESG SOP'S, WI, formats, accident/incident reporting & analysis, vehicle inspection (forklift, hydra crane, lifting tools & tackles, inspection, visualization etc. should be followed as per group guidelines even during project phase.			O

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
5.2 Management	For the new project location, environmental clearance must be obtained.	O		
	Registration of the establishment is required for new projects as per BOCW.			O
	In compliance with BOCW regulations regarding Total Capital Investment, the cess amount must be deposited.			O
	Notification of the intention to begin building construction must be provided in Form VI.			
	Energy performance index ratio report in respect of the proposed building at the design stage should be duly certified by Empaneled Energy Auditors (Building) .			
	site plans must be submitted to government authorities for approval.			
	Once the relevant body has issued the OC Certificate, a closure assessment of registration must be completed.			O
	Factory license to be obtained.			O
	Air, Water consent & Hazardous waste authorization to be obtained from the state pollution as per requirement.	O		
	Fire NOC to be obtained			O
	Good lifts & Passenger lifts NOC to be obtained as per requirement			O
	Water connection approval to be obtained from relevant govt. authorities/ Approval to be obtained from CGWA to install bore well.	O		
	License for A, B & C class explosive to be obtained as per requirement.			O
	License for HSD storage to be obtained as per requirement			O
	Consent to establish to be obtained from the state pollution as per requirement.	O		
	The government-approved testing facility should authorize the measuring and weighing apparatus.			O
	written notification to the appropriate authorities of the plan to demolish a building or to construct, reconstruct, or modify any portion of a building to be submitted.			
	Before any building may be constructed or reconstructed, the building plan must be approved form appropriate authorities.			
	It is necessary to provide pre-, during-, and post-construction inspections by Govt. competent authority.			
	It is necessary to maintain the E-Register for the approval and registration of building plans.			

10.1 EHS related key front-loading points at building design stage (cont.)

Areas	Key points	E	H	S
5.2 Management (cont.)	Obtaining an occupancy certificate is required prior to operating the plant.			
	After the building is fully operational, the energy performance index report as per Form XIII under notification to the Bureau for two consecutive years need to be submitted.	O		
	State & Centre legal compliance to be ensured prior commissioning of plant.	O		
	Approval from CEIG to be taken for DG set / Transformer / VCB etc.			O
	License for gas cylinders storage to be obtained as per requirement.			O
5.3 Interior	PPE matrix & warning signs should be displayed in utility room.			O
	Adequate visualization (Fluorescent) such as danger sign, high voltage, restricted area, authorized entry warning signs etc. to be ensured			O
	Safety colour & signage as per IS 9457			O
	EHS & ESG related visual management to be done as per Visual management checklist i.e. SOP - 0905/F19	O	O	O
	Epoxy floor to be done as per layout.			O
	Canteen furniture should be installed as per Plant Manpower.			
	All EHS & ESG SOP'S, WI, formats, accident/incident reporting & analysis, vehicle inspection (forklift, hydra crane, lifting tools & tackles, inspection, visualization etc. should be followed as per group guidelines even during project phase.			O

10.2 EHS visualization guidelines



Annexure 10-1 EHS visualization



11. Industry 4.0



Green Book

Document Number	UML-GB-00
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11 Industry 4.0

Purpose

To prepare the basic guidelines relates to planning and implementation approach of industry 4.0 practices in any new manufacturing plant being setup.

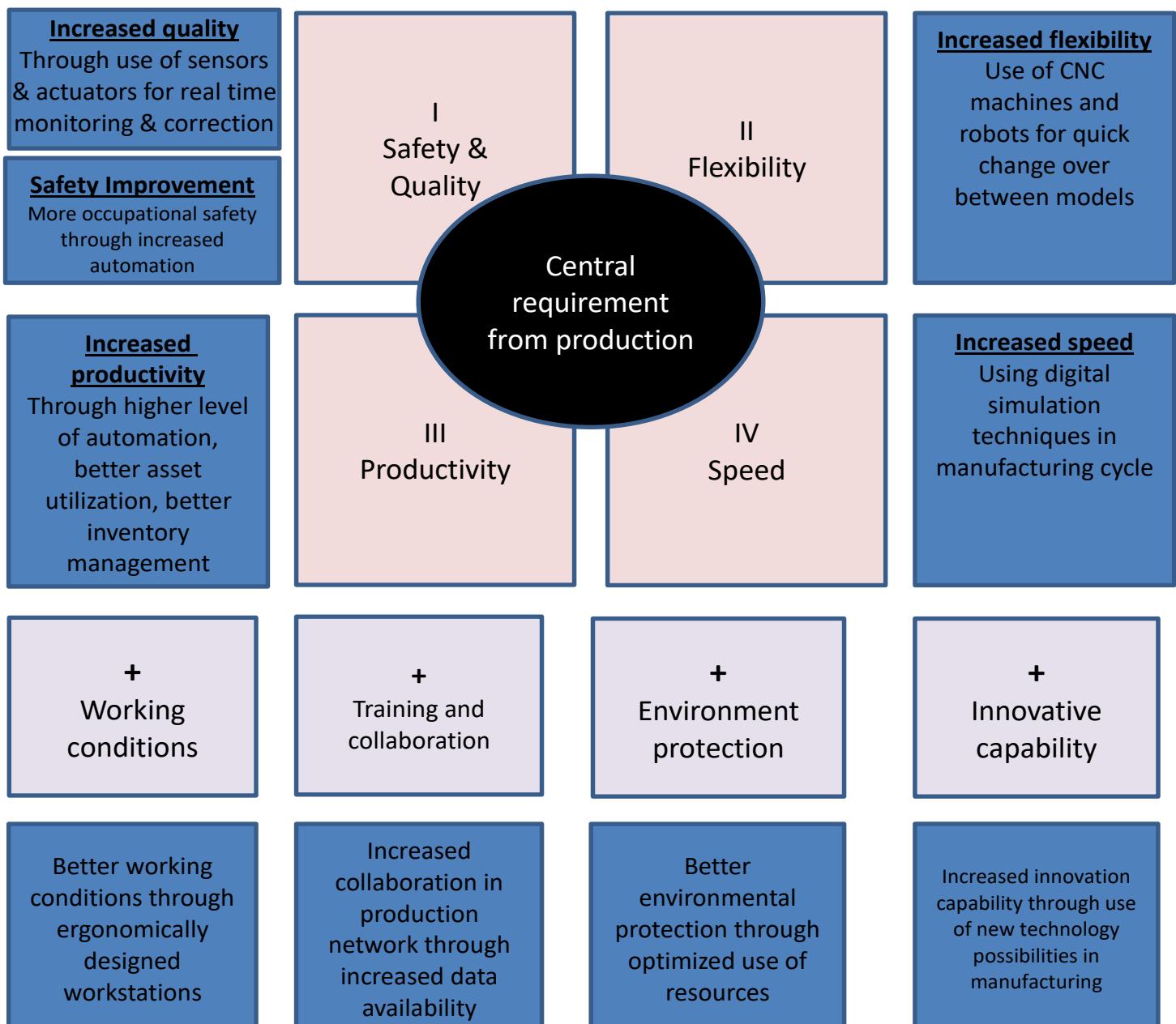
Scope

All units associated with manufacturing.

User

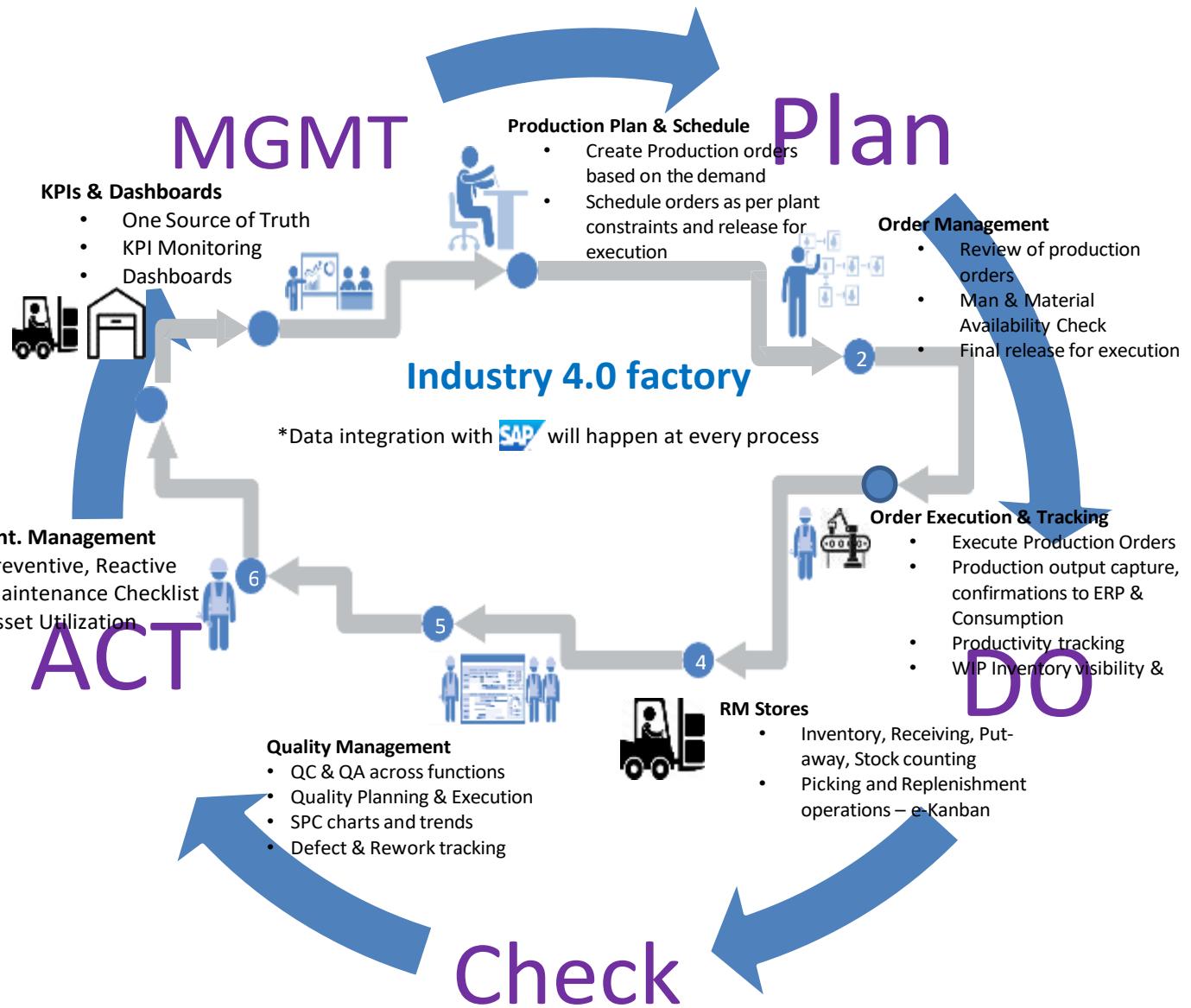
All manufacturing units and support functions i.e., manufacturing, IT, New project team.

11.1 Industry 4.0 Goals



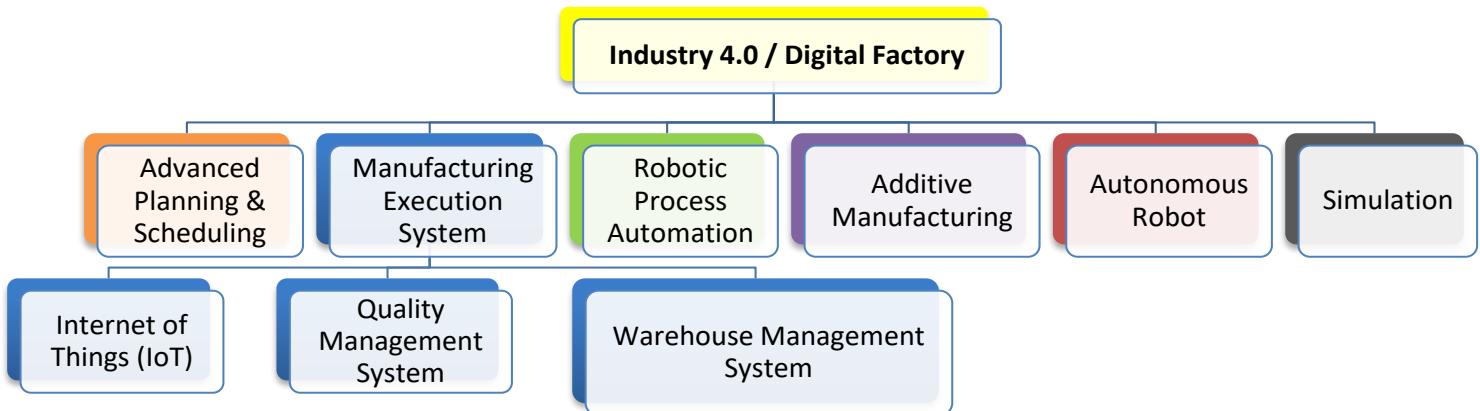
To improve Safety, Quality, Productivity, Flexibility and Speed

11.2 Industry 4.0 Factory Flow



The focus of the Green Book will be to cover all aspects of “Manufacturing Supply Chain”

11.3 Industry 4.0: Overview



Various indicative use cases for various manufacturing value chain

Manufacturing Value Chain	Planning	Product development	Marketing & Sales	Inbound logistics	Production	Outbound logistics	Maintenance & Services
Digital Use cases	Forecasting methods Demand management Safety stock optimization Line scheduling optimization	Product lifecycle management Collaborative engineering 3D product modelling Process simulation	Customer intelligence Distribution management E-commerce solutions	Track and trace Serialization JIT logistics Supplier collaboration Inventory management	Operational intelligence Manufacturing execution system Smart tools and machines Energy management Quality management Tracking & genealogy Smart Packaging	Inventory management Track and trace Warehouse management Transport management	Condition based monitoring Predictive maintenance Field services Remote maintenance

👉 All above mentioned tools are to be integrated with SAP as applicable.

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11.4 Manufacturing supply chain related target and various “Industry 4.0” tools for target achievement

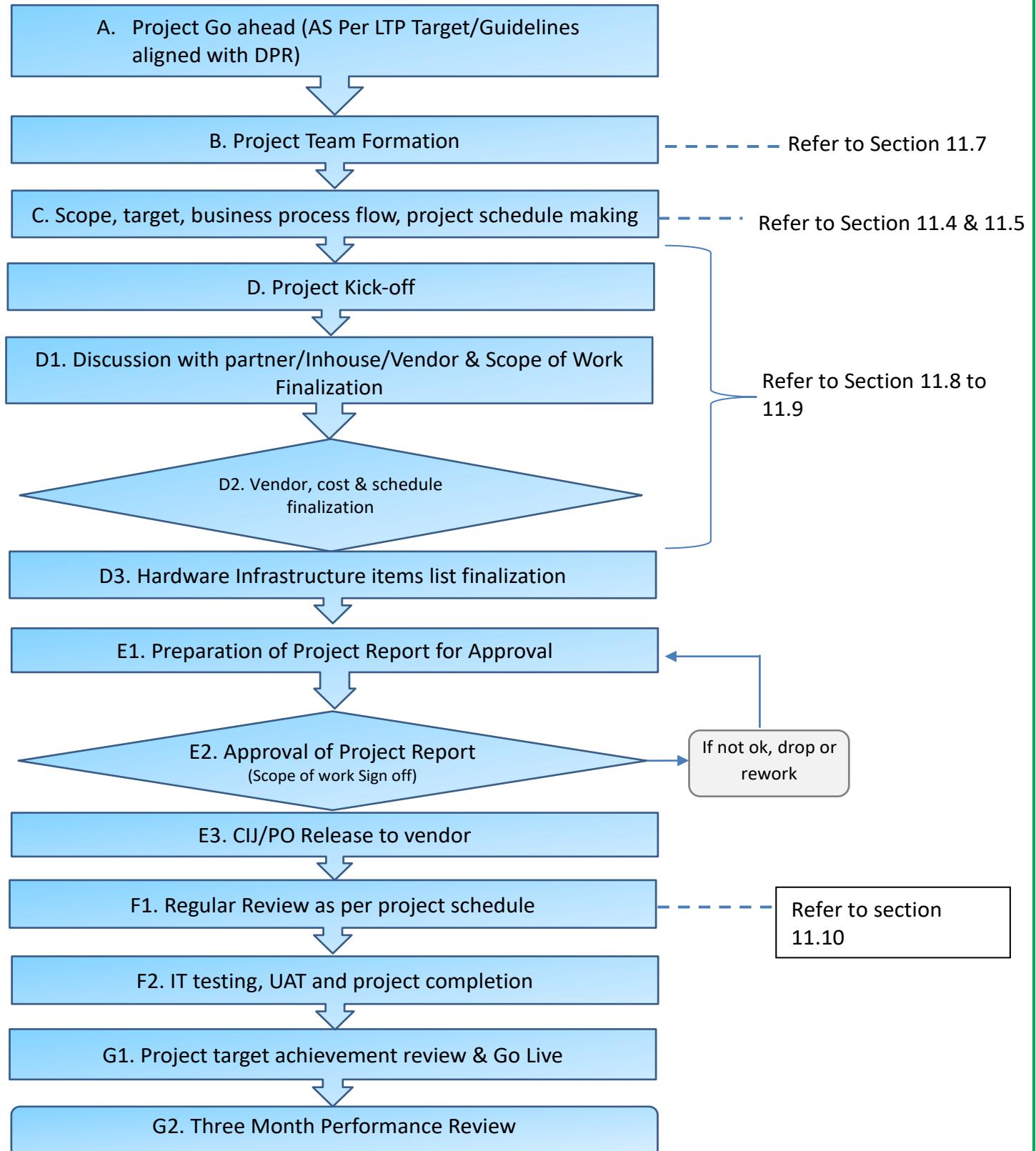
Category	Item	UOM	Target (Indicative)	Tools
S	Safety Awareness	Nos of accident	0	MES-IoT
Q	In process rejection	ppm		MES-QMS, WMS
	In process rework	ppm		
	Line end rejection	ppm		
	Line end rework	ppm		
P	Improvement in OEE	%	>85	MES-IoT
	Productivity Improvement	Performance rate	100%	Autonomous Robot
D	Reduction in work in progress inventory in each shop	No of days of production	1	MES- WMS
	Reduction in model changeover time	%	>50	MES-IoT
	Reduce development lead time	%		Additive manufacturing- 3D Printing
C	Reduction in cost of quality	% of sales	<X	Inspection automation / MES
	Reduction in power consumption	% of sales	>5	MES- IoT (Energy management system)
M	Risk management (End to end traceability)	% of production processes	100	MES- WMS
	Paperless working	% of business processes	>70	MES (including QMS)
	Automation of business processes	% of business processes	>20	RPA- indenting and invoicing APS- Automation in production planning
	Layout Simulation			Engg. software, Layout simulation

 Target selection is flexible as per Business/Plant team requirements and target must be selected before choosing Industry 4.0 implementation.

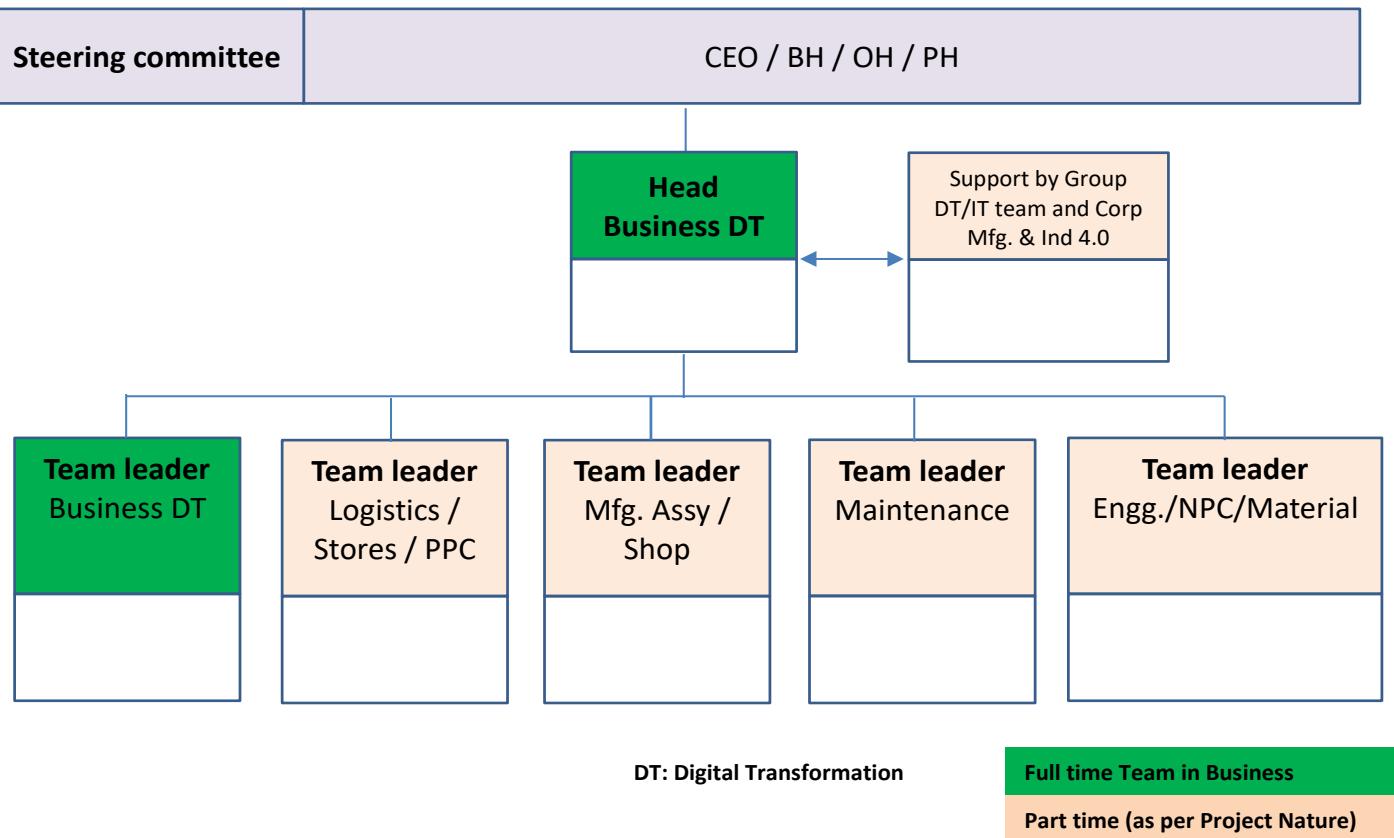
11.5 Industry 4.0: Scope Finalization

Manufacturing value chain	Digital use cases	Industry 4.0 solution / tool	Inclusion in Green Book	Must have (As per new plant guidelines)
Planning	Forecasting methods	Advanced Planning & Scheduling solution	O	O
	Demand management		O	O
	Safety stock optimization		O	O
	Line scheduling optimization		O	O
Product development	Product lifecycle management		O	
	Collaborative engineering	Additive manufacturing	O	
	3D product modelling	Additive manufacturing	O	
	Process simulation	Simulation	O	
Marketing & Sales	Customer intelligence	RPA	O	O
	Distribution management	RPA	O	O
	E-commerce solutions	RPA	O	O
Inbound logistics	Track and trace	MES	O	O
	Serialization		O	O
	JIT logistics		O	O
	Supplier collaboration			
	Inventory management		O	O
Production	Operational intelligence	IoT	O	O
	Manufacturing execution system	IoT	O	O
	Smart tools and machines	IoT	O	O
	Energy management	IoT	O	O
	Quality management	MES	O	O
	Tracking & genealogy		O	O
	Smart Packaging	Autonomous	O	
Outbound logistics	Inventory management	MES	O	O
	Track and trace		O	O
	Warehouse management		O	O
	Transport management			
Maintenance & Services	Condition-based monitoring	IoT	O	O
	Predictive maintenance	IoT	O	O
	Field services	IoT		
	Remote maintenance	IoT	O	

11.6 Ind 4.0 Project Flow



11.7 Industry 4.0: team formation



Team formation guidelines: -

- All stakeholders to be included in the team
- Above Members to be selected from the plant / Business Team
- IT Service Provider will also provide their CFT

Key role: -

- Lead the Project
- Execution as per signed-off Plan
- Use case identification
- Adoption & Utilization by team
- Implementation & Sustenance

Major KPIs: -

- Operational improvement (OEE/Energy consumption reduction/PPM reduction etc.)
- Meeting timeline
- Functional Skill development

11.8 Industry 4.0: Execution Guide

Plan:

- ☒ Define the scope, map the “to be” process image as clearly as possible, set the project targets, choose the appropriate industry 4.0 tools that you want to implement, raise the RFQ, finalize the price and select the IT service provider partner (IT lead activity), agree on master implementation time schedule, take budget in the DPR budget.

Do:

- ☒ Develop the application, test it in test environment, debug it, complete user testing and training, implement it in live environment (Go live).

Check:

- ☒ Identify the gaps (if any) with respect to the planned objectives and targets.

Act:

- ☒ Make an improvement plan (if any), standardize the process and flow, implement it and continuously monitor results, summarize the learnings that lead to the gap (so that it can be used as an input for the future projects).

- RFQ requirement sheet for an initial discussion with the vendor (Refer to below format / Excel Annexure).
- Requirement must be raised before DPR with the following supporting
 - Scope (Please see Reference sheet – Next Page)
 - Overall Business Process Mapping Example (AS IS If applicable, TO BE - Must) (Please see Reference Sheet Fig. 1 APS & Fig. 2 APS)
 - RFQ Sheet as per related Industry 4.0 lever. (Please see attached Excel Template – Next Page)



Annexure 11-1 Industry 4.0 requirement sheet

11.9 Guidelines & checksheet for new machines/equipments/SPMs

Please refer to **MFM Policy – 27 CIJ** approval (IoT Guidelines and checkpoints for new plant & machinery)



Key guidelines - IoT enabled machines_C

Annexure 11-2 Key Guidelines for IoT enabled machines

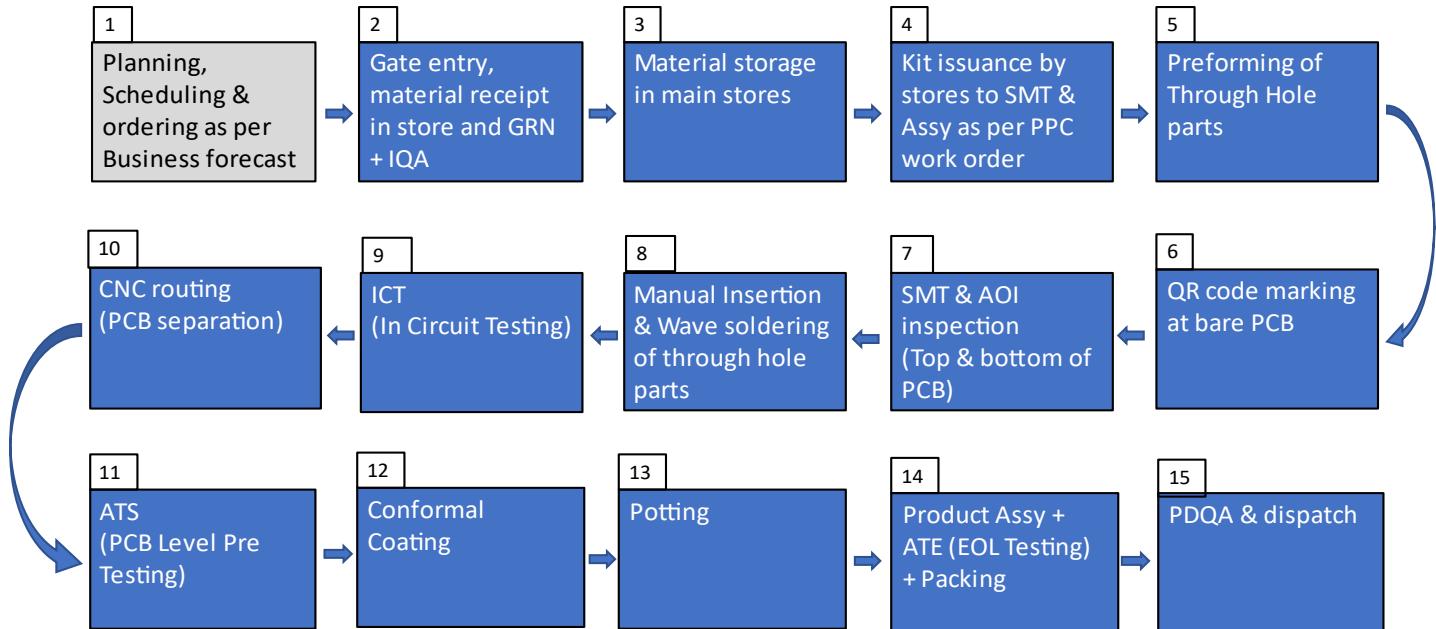


*IoT Check sheet for
New Machines.xlsx*

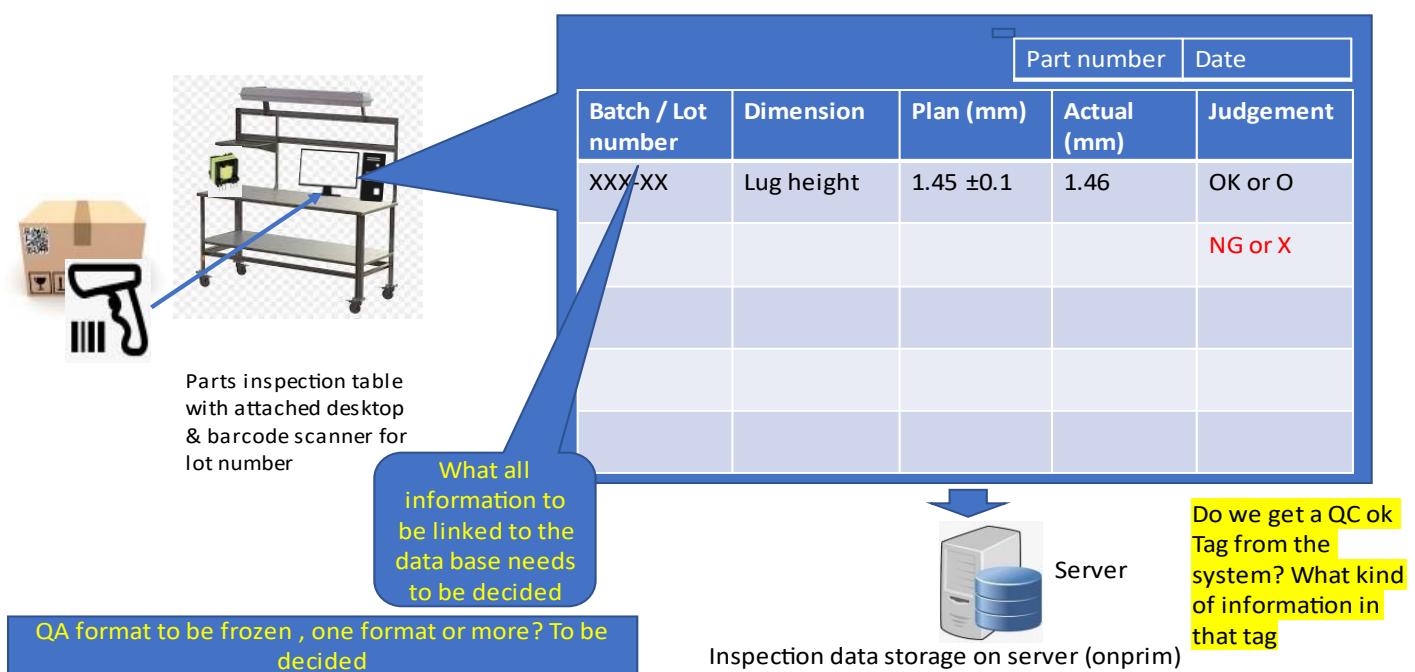
Annexure 11-3 IoT checksheet for new machines

11.10 Business process flow (For reference only)

① UnoMinda EVS Material/Process Flow



① Image of paperless IQA station - A



11.11 Execution: Time plan (after IT service provider selection)

Time plan to be set for all industry 4.0 levers as follows-

Ind 4.0 Project implementation timeline										
Project stages / activity	Resp.	Timeline for year - XXXX								
		Apr	May	Jun	Jul	Aug	Sep - Dec	Jan	Feb	Mar
Overall project master schedule		Project start		DPR (PM1)		Revised DPR				Trial & Mass Production
Project initiation		<----->								
Planning & requirement analysis			<----->							
Define project scope			<----->							
Set objectives & target				<----->						
Resource planning				<----->						
Define functional requirement				<----->						
Define technical requirement				<----->						
Requirement review & approval					<----->					
Software design & development						<----->				
Unit testing							<----->			
User acceptance testing							<----->			
Go live								<----->		
Troubleshooting & improvisation, if any									<----->	
Review by project leader (fortnightly)		<----->								
Review by steer Co. (monthly)		<----->								

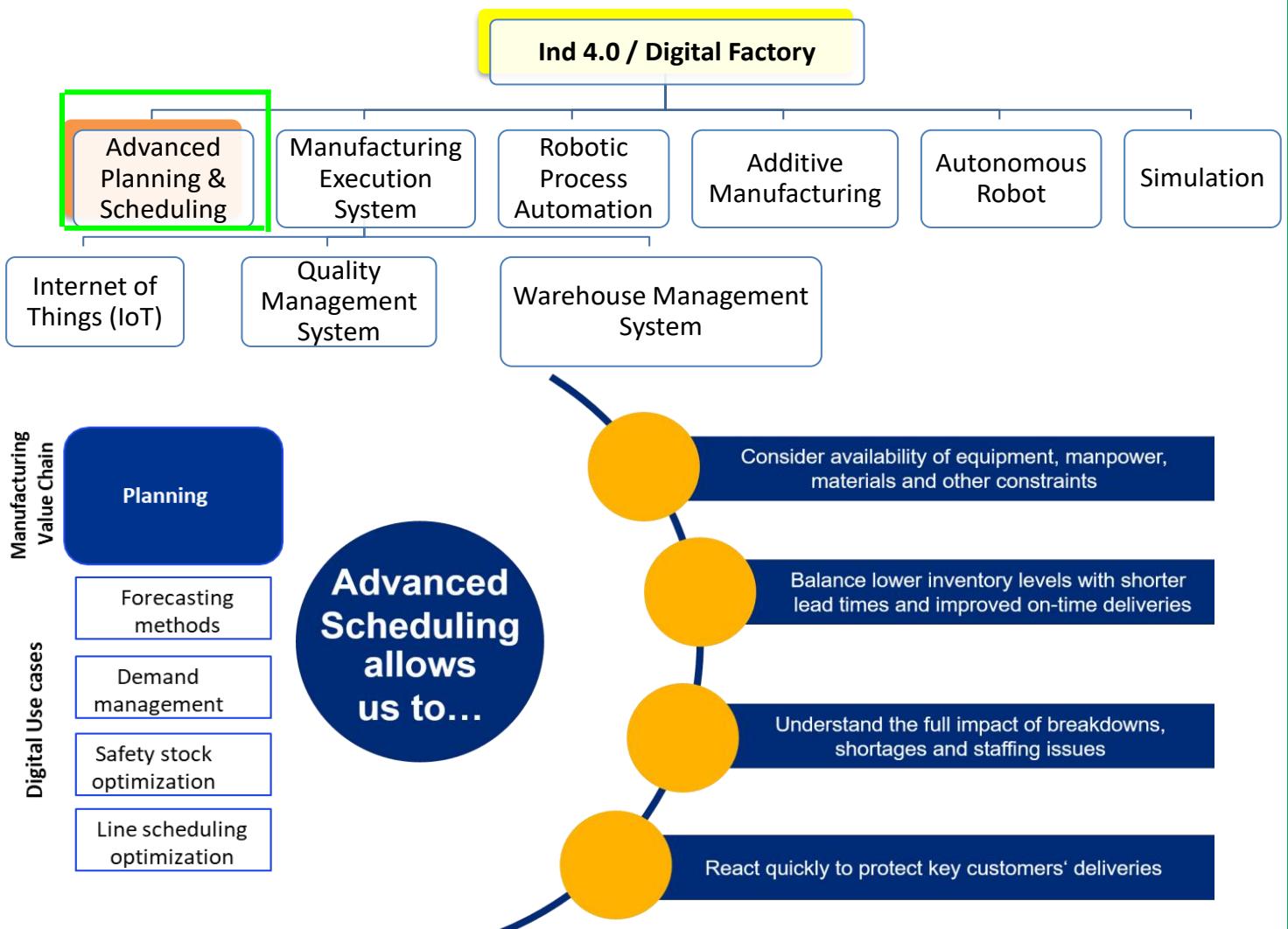
- Add additional activity as per the nature of the project.
- Plant business process digitization (Industry 4.0) project to be consider.

Legends: -

Plan <----->

Actual <----->

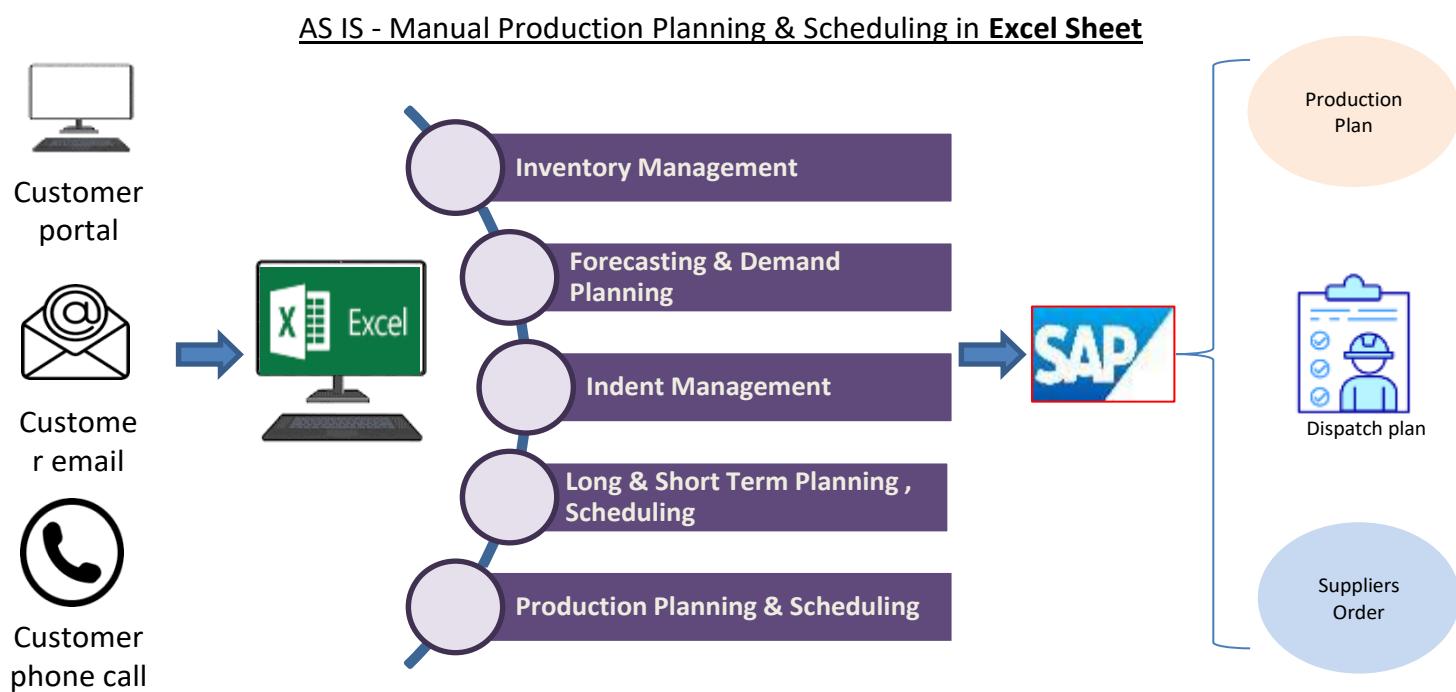
Advanced Planning & Scheduling (APS)



11.12 Advance Planning & Scheduling (APS)

APS is a software-based tool to support the industry in creating a demand-driven integrated supply chain solution and help to achieve goals by improving the supply chain efficiency and effectiveness. The scope of this project is to do long-term planning (M+...) considering demand fluctuation, lead time fluctuation, capacities, changeovers, priorities, and other business rules along with material and capacity constraints as defined.

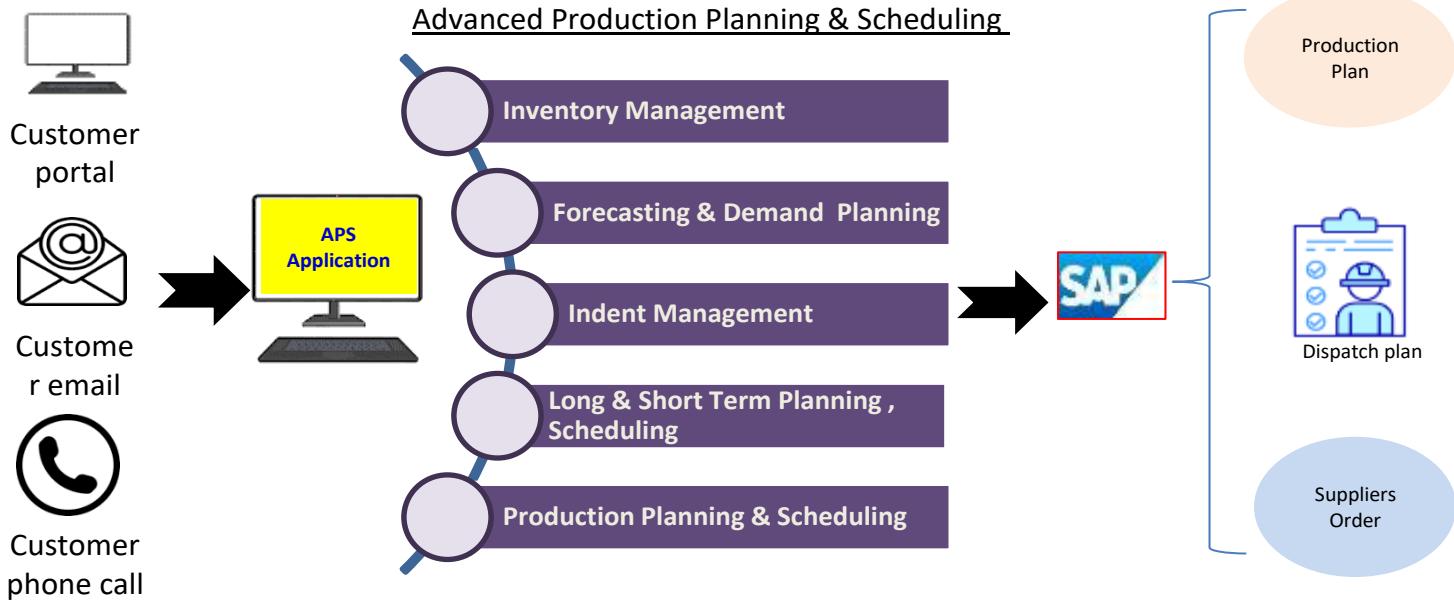
11.12.1 Production planning process flow AS IS vs proposed through APS



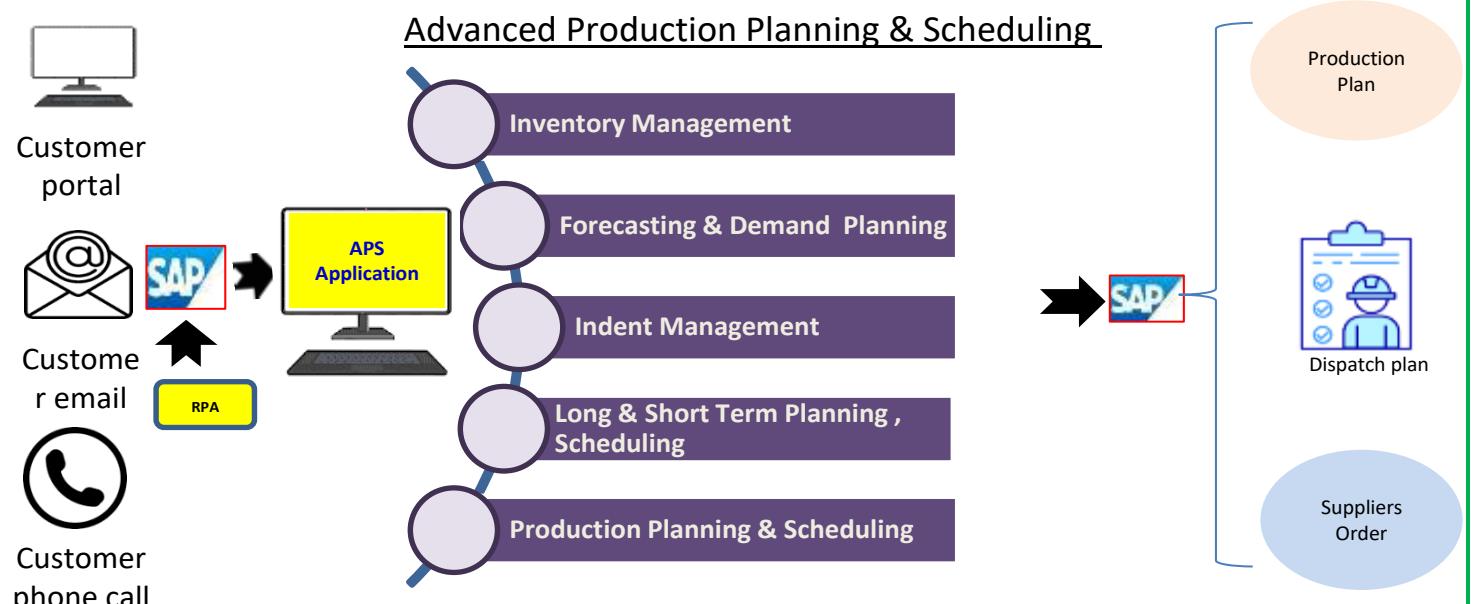
AS IS Process:

- We receive an annual forecast, and monthly/fortnightly/daily schedule from demand driven customers, also receive demand for child parts, STO, and RPT orders.
- Demands are received through the customer portal, mail, excel sheet, phone calls, etc.
- All demands are consolidated as final demand in the excel sheet as per Demand fluctuation and lead time fluctuation import and domestic planning.
- To ensure the production requirement schedule and work orders are created for each department.

TO BE Process (APS) Option-1:



TO BE Process (APS) Option-2:



TO BE Process:

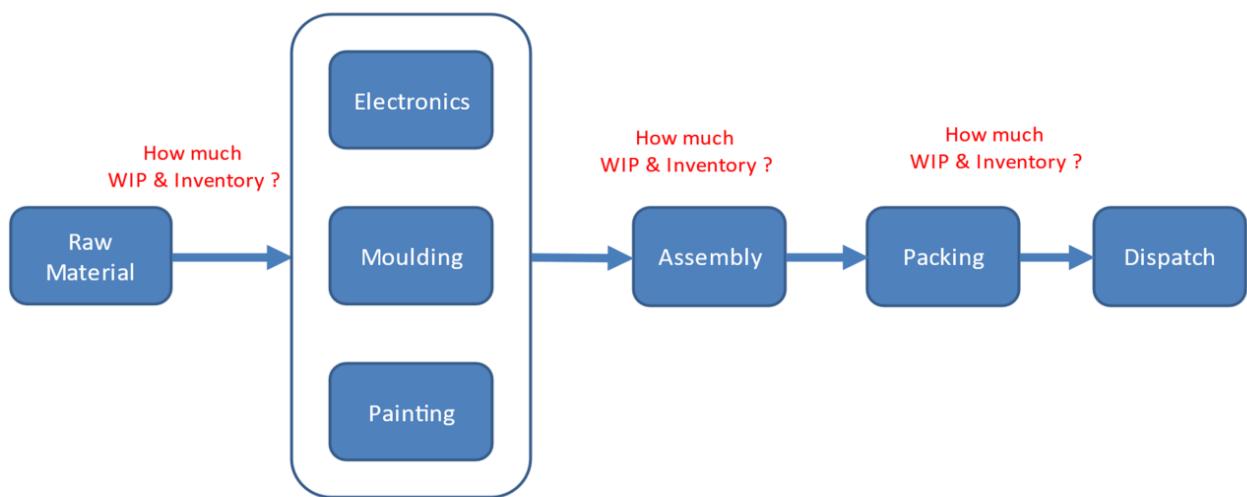
- Demands will be received through the Customer Portal, and on APS software.
- All demands are consolidated as final demand considering Demand fluctuation and lead time fluctuation import and domestic planning through the software itself.
- Automated planning & Schedule will be made based on customer demand, safety stock, MOQ & SPQ constraints.
- The same will be integrated with SAP to ensure complete supply chain.

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11.12.2 Steps to initiate the project APS

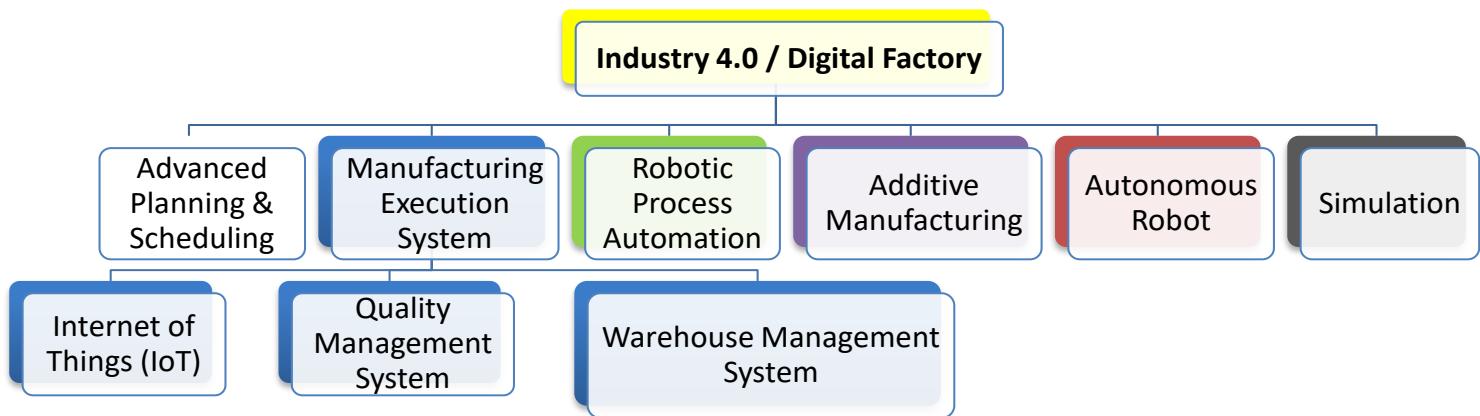
1. Set Objectives and targets for the project. (Please refer to section 11.4)
2. The business team needs to prepare material flow chart (Gate IN to Gate Out) as well as individual process mapping indicating current (if applicable) vs what to be done. (Please refer to section 11.9)
3. Finalize the scope as per the above process mapping.
4. The same needs to be shared with the IT team to discuss with the supplier for further discussion as per project flow section 11.6.

Basic material process flow (e.g., MRPL Manesar):



Note: Please prepare your own material process flow according to your business.

Manufacturing Execution System (MES)



11.13 Manufacturing Execution System (MES):

MES is the software-based integrated tool to track the transformation and document the information digitally which helps manufacturing decision makers to understand current conditions on the shop floor that can be optimized to improve output. MES works as real-time monitoring system to enable the control of multiple elements of the production processes Raw materials to Finished goods.

We have categorized MES into 3 co-levers named as follows:

- 1) Internet of Things (IoT)
- 2) Quality Management System (QMS)
- 3) Warehouse Management System (WMS)

11.13.1 Internet of Things (IoT)

This refers to connecting the individual machines named as connected machines and individual assembly lines or SMT lines named as connected lines. IoT collects information from machine panel/ PLC parameters i.e., Production count, voltage, current, temperature, pressure, etc. on the cloud network means facilitates communication between the device and cloud network as well as between devices themselves.



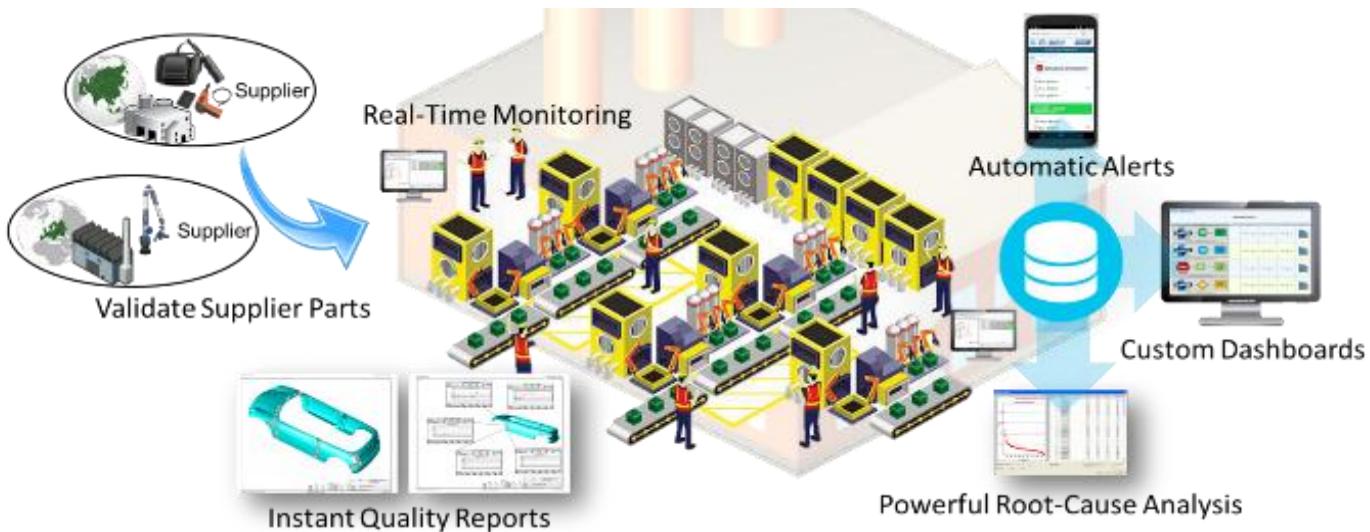
The dashboard includes real-time monitoring of production parameters:

- Production Performance
- Quality rate, Down Time
- OEE/OLE
- Daily/weekly/monthly reports etc.

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11.13.2 Quality Management System (QMS)

QMS in Industry 4.0 is a collection and activities of quality inspections, and document through IoT-based devices and display quality parameters and dashboard reports.



QMS Module main content (for comprehensive)

Category	Items	Category	Items
Quality / process control documents	Calibration	Daily operations management / training etc.	PM check sheet for machine / equip.
	Internal audit check sheet		Digital skill card
	Temp and humidity control		4M change management
	ESD sheet		TNI identification
	Daily process parameter check sheet		Training result capturing
	PQCS		Digital display of documents (OGS, Process Flow, Rule etc.)
	P Chart		Kanban store management
	Q chart		
	PCC		
	Kakotora		
	OGS (Operator guidance sheet or work instruction sheet)		
	Master sample check sheet		
	PPAP		

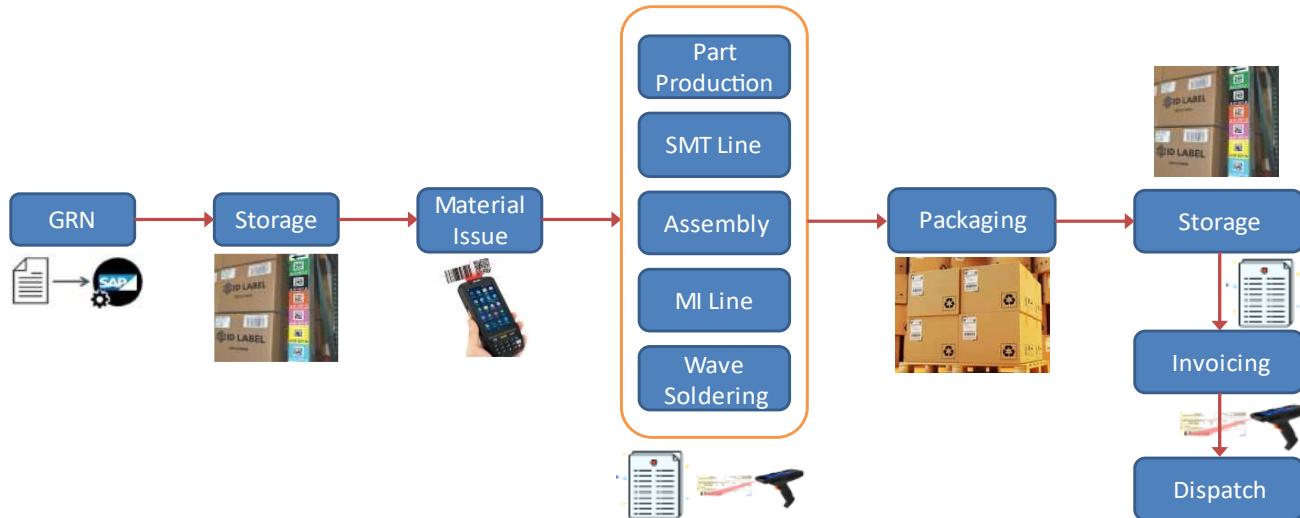
- Above module content shown for reference and can be added as per business requirement

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11.13.3 Warehouse Management System (WMS)

This tool captures the warehousing process starting from the raw material gate entry to material issue on the shop floor, individual operations, lines, machines, etc. traceability, barcoding solution, RFID tracking, and FIFO management.

Warehousing Solutions through Digital devices and barcoding



Steps to initiate the MES projects

1. Set Objectives and targets for the project (PM1). (Please refer to section 11.4)
2. The business team needs to prepare material flow chart (Gate IN to Gate Out) as well as individual process mapping indicating current vs what to be done. (Please refer to section 11.9)
3. Finalize the scope as per the above process mapping and prepare the requirement sheet in the below template and share with IT team.

11.13.4 Annexures (Example)

Machine Details – for MES

S No	IOT Readiness Requirement						Remarks
	Type of machine	Machine Controller	Communication Port	Communication protocol	PLC Parameter	PLC Software Version	
1	CNC	Fanuc	RJ485	Profinet	Voltage, Current, Temp, Pressure, Count, Etc.		
2	Moulding Machine						
3	Press Shop				Voltage, Current, Temp, Pressure, Count, Etc.		
4	Die Casting machine						
5	Energy Panel				Voltage, Current, Temp, Pressure, Count, Etc.		

Operation Details – for MES

Shopfloor/Part Code	SMT					
Machine ↓ \ Operation Name & Code ↗	Loader	Flipper	Laser Marker	Solder Paste Printer	SPI	Conveyor
Machine Name & Code						
Make(Machine)						
Model						
Data Capture						
Data File Type						
Front / Back						
Process						
Storage Location						
Status						
Interlocking						

Energy Meter Details – for Energy Monitoring Systems

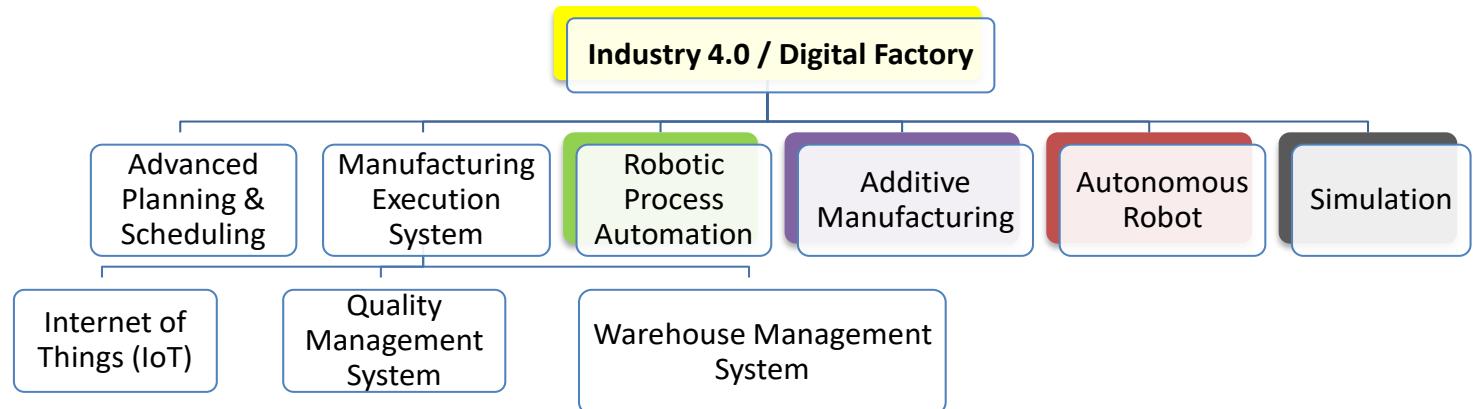
Meter No.	Meter Name	Meter Make	Model	Communication Port	Communication protocol	PLC Parameter	Gateway
1	Main Meter	Schneider/Energy	EM6400	RJ485	Profinet / Modbus	Voltage, Current, kWh	TGW - 718
2	Moulding Meter						
3	Press Shop Meter						
4	CNC Meter						
5	Compressor Meter						

Robotic Automation Process

Additive Manufacturing

Autonomous Robot

Simulation



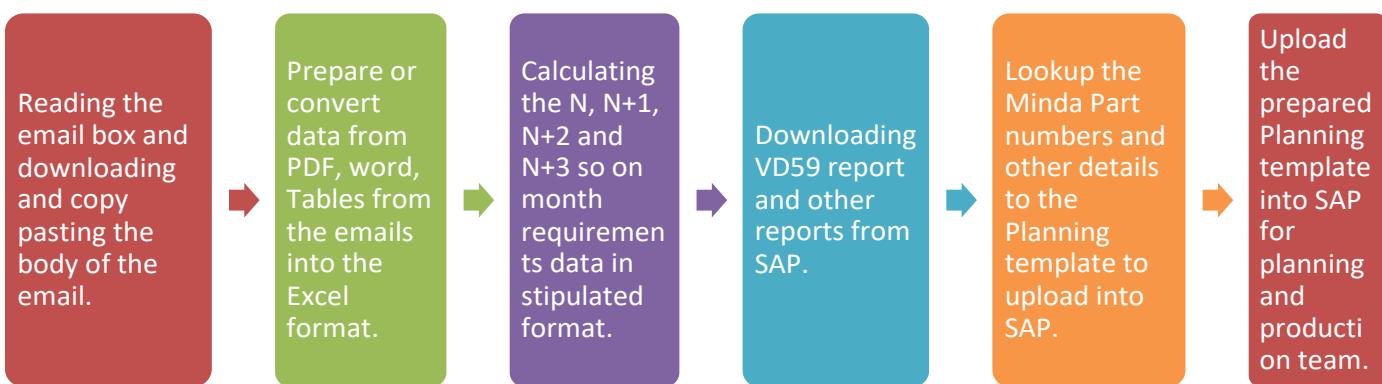
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11.14 Robotic Process Automation (RPA)

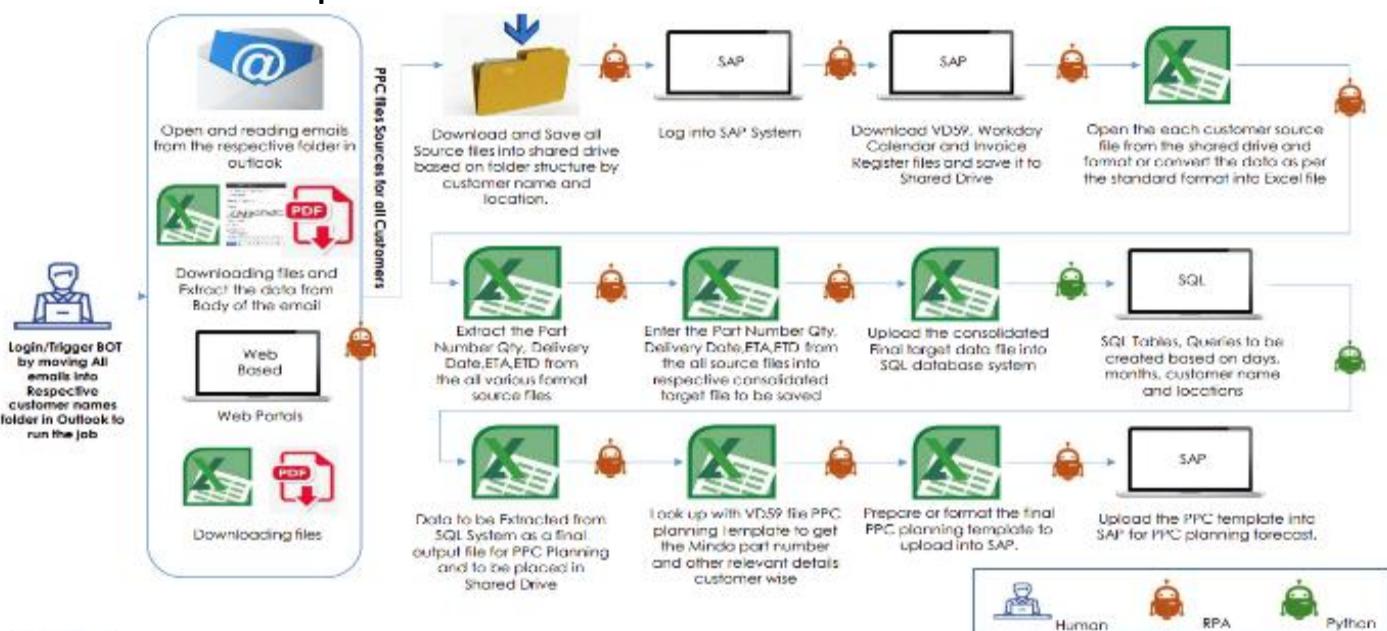
A process of planning and scheduling the production or delivery of the product for the various vendors based on the various requirements by validating the request in various formats to prepare consolidate planning file to address the manufacturing team to manufacture and deliver as per ETA and ETD timelines as per the PO. This planning template will be uploaded into SAP system and based on the planning details various plants and manufacturing teams start manufacturing the parts and items requested by customer.

Objective

Planning and scheduling the production or delivery of the product for the various vendors based on the various requirements by validating the request in various formats by automating below steps:



To be flow for example:





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- Eliminating the manual efforts.
- Increase the 100% accuracy & quality and reduce the process run time.
- Consistency throughout the process to achieve 100% ETA and ETD.

Steps to initiate the project

1. Set objectives and targets for the project ([PM1](#)). ([Please refer to section 11.4](#))
2. The business team needs to prepare material flow chart (Gate IN to Gate Out) as well as individual process mapping indicating current (if applicable) vs what to be done. ([Please refer to section 11.9](#))
3. Finalize the scope as per the above process mapping.
4. The same needs to be shared with the IT team to discuss with the supplier for further discussion as per project flow section 11.6.

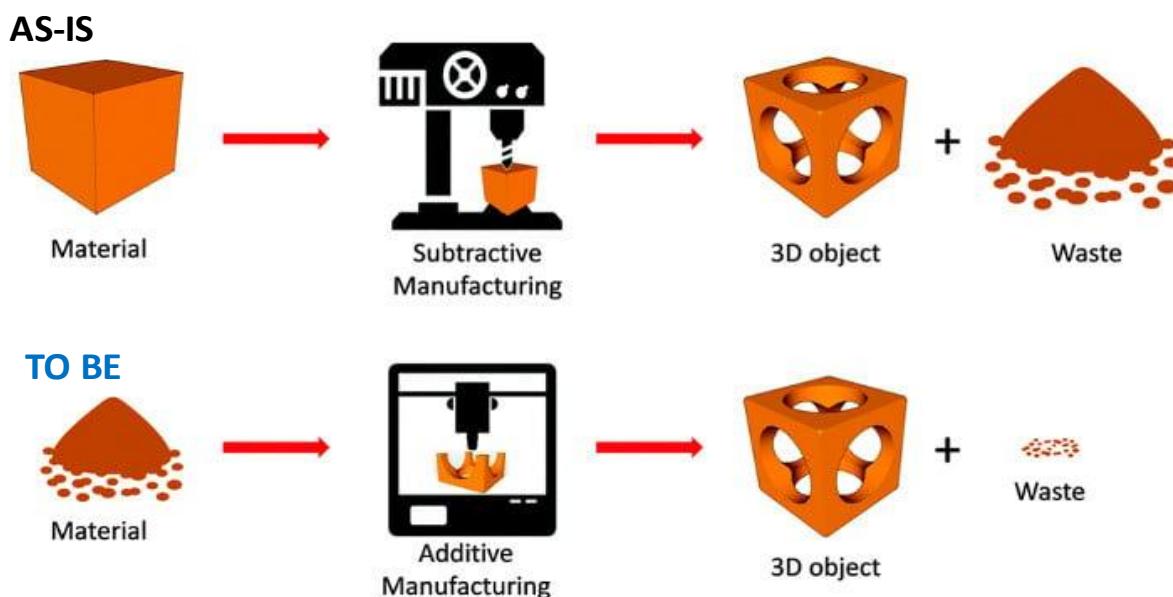
11.15 Additive Manufacturing

Additive manufacturing allows for the creation of complex 3D objects, which could lead to the development of innovative automotive components. Additive manufacturing can significantly reduce production costs and timelines, making it a valuable for rapid prototyping and production.

- Prototyping
- Product Design
- Tool Design

Objective:

- **Reducing lead time:** Additive manufacturing can reduce the time required to produce a part from weeks to days.
- **Reducing cost:** Additive manufacturing can reduce the cost of producing parts by eliminating the need for expensive tooling and reducing material waste.
- **Improving part performance:** Additive manufacturing can create parts with complex geometries that are difficult or impossible to produce using traditional manufacturing methods. These parts can have improved performance characteristics, such as increased strength or reduced weight.
- **Enabling sustainability:** Additive manufacturing can reduce material waste and energy consumption compared to traditional manufacturing methods, which can help in reducing environmental impact.



To be flow:



Steps to initiate the project:

1. Set objectives and targets for the project ([PM1](#)). ([Please refer to section 11.4](#))
2. The business team needs to prepare material flow chart (Gate IN to Gate Out) as well as individual process mapping indicating current (if applicable) vs what to be done. ([Please refer to section 11.9](#))
3. Finalize the scope as per the above process mapping.
4. The same needs to be shared with the IT team to discuss with the supplier for further discussion as per project flow section 11.6.

11.16 Autonomous Robot

Autonomous robots operate independently of human operators. These robots are usually designed to carry out tasks in open environments that do not require human supervision. They are quite unique because they use sensors to perceive the world around them, and then employ decision-making structures (usually a computer) to take the optimal next step based on their data and mission.

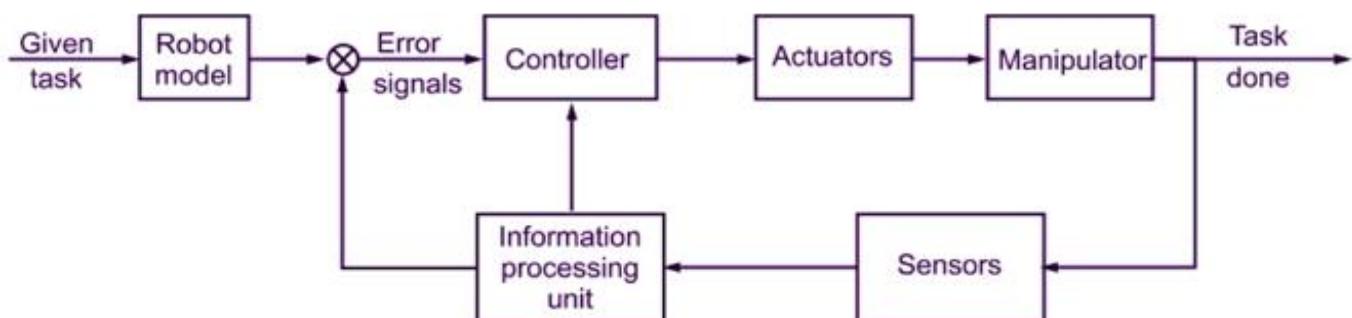
Autonomous robots are particularly useful in the automotive industry because of their flexibility, precision, and ability to work safely alongside humans. They can handle a wide range of tasks, from assembly lines to material handling, and are equipped to handle repetitive tasks, freeing up the human workforce for more complex tasks.

Objective

The objective of implementing autonomous robots is to streamline operations, reduce costs, and increase productivity.

Give dirty, dangerous, and dull jobs to robots to reduce repetitive strain and accidental injuries to humans.

To be flow:



Steps to initiate the project:

1. Set objectives and targets for the project ([PM1](#)). ([Please refer to section 11.4](#))
2. The business team needs to prepare material flow chart (Gate IN to Gate Out) as well as individual process mapping indicating current (if applicable) vs what to be done. ([Please refer to section 11.9](#))
3. Finalize the scope as per the above process mapping.
4. The same needs to be shared with the IT team to discuss with the supplier for further discussion as per project flow section 11.6.

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11.17 Supplier Recommendation

S. No.	MES	Recommended suppliers
1	IoT	Panasonic, Think 7, Cantier, Altizon, Liradolf
2	Traceability	Panasonic, Think 7, Cantier, Altizon
3	WMS	Panasonic, Cantier
4	QMS	Panasonic, Cantier
5	RPA	Mysoft Labs
5	Additive Manufacturing	Intec, Phinix
6	Autonomous Robot	Hi-Tech Robots
7	Simulation	Creat, 3D engineering

Any Change in recommended supplier, please take approval from Corp IT prior to project initiation.

Guidelines for supplier selection: -

- Expertise in the field
- Good Market Record
- Cost Competitive
- Customization in module



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12. General guidelines

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12 General miscellaneous new plant guidelines

1. Generally, the temperature on the shop floor should be maintained between 24-28 degree irrespective of ambient conditions. For areas with high heat load, compartmentalization and suitable reliever methodology or spot cooling should be adopted.
2. Make/Buy Decision:
 - Only high-value addition processes – EMS and new technology machines in line with MRM should be planned in-house. No conventional technology machines should be planned for in-house manufacturing. (Machines beyond useful life within existing plants to be decommissioned).
 - X/Y/Z decision for components in new product development to be taken accordingly.
3. Plant Maturity Assessment score is to be 2 – Stable, within the first year of operations.
4. Plants should plan for scalable, modular, and flexible manufacturing lines with single-piece flow and multiple products with minimum changeover time and capacity utilization of 80% maximum by 3rd year of operation (refer to SOP-0707_F02 for more details). Thus, the plant should be scalable for the next 5-6 years.
5. All workstations should be designed in an ergonomically suitable manner.
6. Vendor Milk Run should be planned from day one of operations along with Group Materials for different regions to ensure reduction in inventory and logistics costs.

13 Learnings

S. N	Category (SQPCDME)	Sub category	Issue / problem faced	Learning point	Future recommendation/ standard	Reference Picture & plant (If applicable)
1	Delivery	Building	Rainwater / dust entry	Absence of barrier to prevent rain water / dust (improper sealing even after closure of door)	Metal strip barrier behind the door to prevent water / dust entry inside, proposed to door opening outside	 UMRPL-FRN
2	Delivery	Building	Aesthetic	Absence of barrier to prevent rain water / dust (improper sealing even after closure of door)	Step design in the floor where the glass door is fitted to prevent water entry inside.	 UMRPL-FRN
3	Delivery	Building	Heat prevention	Heat insulation not provided for roof	Air pipeline etc. to be above the false ceiling.	 TRMN, Neemrana
4	Delivery	Building	Aesthetic	Aesthetic improvement	Puff Panel used in assembly and electronics instead of normal false ceiling.	 TRMN, Neemrana
5	Production	Shopfloor	Closed cabinet	Closed cabinet may cost effective	Transparent air shower for cleanroom entrance in assembly.	 TRMN, Neemrana

S. N	Category (SQPCDME)	Sub category	Issue / problem faced	Learning point	Future recommendation/ standard	Reference Picture & plant (If applicable)
6	Delivery	Building	Noise cancellation	Normal door may not prevent noises from outside vice versa	Modern Double door with High-class aluminium body.	 TRMN, Neemrana
7	Delivery	Building	Short width of canopy	Canopy width at main entrance appropriate for visitor comfort		 TRMN, Neemrana
8	Safety	Shop floor	Common gangway for trolley / forklift	To improve safety. Common walkway may cause to incident	Separate Pathway for Employee movement and material movement	 TRMN, Neemrana
9	Delivery	Building	No identification & cover	Identification & pit for earth pit for better visibility and maintenance	Earth pit with RCC platform and Identification.	 TRMN, Neemrana



14. Contribution

14 Contribution

S. No.	Content	Prepared by	Reviewed By	Approved By	Guided By	Project Mentor			
1	Project Planning	Ganeswar Beura Shubham Sharma	Rajeev Wasan	Vishnu Johri Rajeev Wasan	S. L. Gupta G. Beura Rajeev Agarwal	Ravi Mehra			
2	Land Selection	Rajeev Wasan Surender Singh	Rajeev Wasan						
3	Building design	Rajeev Wasan Yogesh Bhugra	Rajeev Wasan						
4	Layout Design	Naveen Sharma Lakshay Bansal	Amit Kumar Singh						
5	Interior Design	Abhishek Puri Shubham Prabhakar Vikas Shrivastava	Shubham Sunder						
6	Utility	Gagandeep Singh P. S. Mishra Sunil Jain (MILLP)	Surender Singh						
7	IT Infra	Giriraj Singh							
8	EHS & ESG Aspect	Sandeep Bansal Siddhant Sharma Anoop Poopal Abhishek Mishra	S. L. Gupta						
9	Industry 4.0	Siddharth Yadav Krishna Choudhary Gurmeet Makkar Dharamveer	J.P. Verma						



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Thank You

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