

Maintenance Manual

For the Equipment of Adani Kandla Bulk Terminal Pvt Ltd.,

Document No: ES-AKBTPL/001/ Maintenance Process Manual

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**ADANI KANDLA BULK TERMINAL PVT LTD.,
OFF TEKRA NEAR TUNA**

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Process KPIs

Templates

Appendix - Business Requirement Documents (BRD)

Counter for the forecasted value of daily usage for planning maintenance schedules of hours based equipment

Incorporate extra field to capture failure related information in breakdown notification screen

Mapping of Fault Code Catalogue in SAP

Manpower cost to be tagged at the job level in SAP for all maintenance jobs (PM00, PM10, PM 20, PM40, PM50)

Integrate maintenance handheld devices with SAP for automated data capturing for all maintenance jobs

Separate time capturing for each order in a job order having both mechanical and electrical activities

Install PI tags / other systems for automated data capturing

Root Cause Failure Analysis Report

Definitions, abbreviations and symbols**Standard abbreviations:**

KPI	Key performance indicator
OEE	Overall Equipment Effectiveness
SIPOC	Supplier, Input, Process, Output, Customer
RACI	Responsible, Accountable, Consult, Inform

Process specific abbreviations and terminology:

ES	Engineering Services
MPC	Maintenance Planning Cell
QRT	Quick Response Team
AKBTPL	Adani Kandla Bulk Terminal Pvt Limited
HOD	Head of Department
HOS	Head of Section
RCA	Root Cause Analysis
O&M	Operations and Maintenance
PM20	Preventive Maintenance Order
PM10	General Maintenance Order
PM00	Breakdown Maintenance Order
PM30	Calibration Testing Order
PM40	Audit Order
PM50	Refurbishment Order
PM60	Internal Project Order

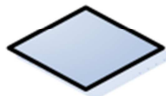
Symbols used in the process map



Process



On- page
connector



Decision box



Off- page
connector



Pre-defined
process



Document

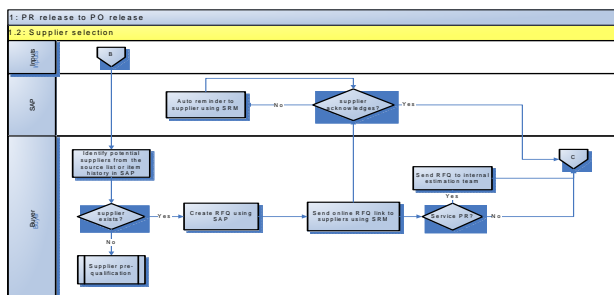


Start/ End

Process document structure

The process document structure has following elements.

1. Process map



The process map details the sub processes highlighting functions/roles involved in the same. It also demonstrates the flow of activities in the process.

2. Process Notes

4.2.3 Supplier selection

- 1) **Attach written confirmation from supplier for repeat order:** Category buyer shall invite quotations when the material does not fall under rate contract or repeat order process. For repeat orders, category buyer shall attach confirmation from supplier in the PO
- 2) **Identify potential suppliers:**
 - a) Category buyer shall identify potential suppliers for the PR using SAP source list/ item history in SAP
 - b) Category buyer shall identify new suppliers if no supplier exists for a particular item and initiate the supplier pre-qualification/ registration process

Process notes detail out the activities carried out the process elements. Process notes also cover any additional detail that does not get covered as part of the process map and SIPOC.

3. SIPOC

Process Tag	Process	Supplier	Input	Output	Customer
PR creation	Check inventory stock and budget before raising the PR	User department	Material code	Existing inventory level corresponding to material code	User department
PR creation	Ensure material/ service code correctness and completeness	User department	Material/ Service code	Material/ Service code description in SAP	User department
PR creation	Ensure budget availability	User department	Department code/ cost center code	Available budget for the current FY	User department

To help understand process further, SIPOC tabulates the following:

- Supplier of inputs
- Inputs to the process
- Output of the process
- Customer of the output

* Process gets covered in process map.

4. RACI

Process Tag	Process	Responsible	Accountable	Consult	Inform
PR creation	Check inventory stock and budget before raising the PR	CIP, User (Requestor)	HOD – User department	Stores	
PR creation	Ensure material/ service code correctness and completeness	User (Requestor)	HOD – User department		
		Manager	HOD – Manager		

RACI table maps all activities defined in the process to all roles which participate in the respective activities in various capacity.

5. Templates

[illegible]

All templates marked in the process map to enable respective activities are tabulated here.

6. Exceptions: Process steps which differ/not applicable for a respective department

Objective and applicability

The objective of this manual is to ensure that maintenance of equipment is carried out in a systematic way using SAP PM module so that the asset is available for intended use at its desired level of performance. The master list equipment shall be prepared once the installation is completed and the data would be uploaded to SAP. For capturing the cost of maintenance SAP PM module shall be utilized with unique identification of functional location. The equipment shall be assigned to functional locations/ fund center/ cost center.

The objective can be achieved focusing on the following aspects:

- By identifying the need for maintenance based on the criticality of the equipment and planning and execution of maintenance- preventive/condition based/ predictive.
- By analyzing the repetitive failures using SAP functionality on PM module and analyzing the causes to eliminate the overall impact on operations (The detailed process map and steps included in document
- By reducing the MTTR (mean Time to repair) by ensuring the breakdown maintenance execution is conducted with minimum response time to breakdown incidence.
- By enabling maximum usage of SAP PM Module for effective maintenance planning, material planning and manpower planning. Focus is also on enabling the monitoring of manpower productivity using SAP PM module

Maintenance Philosophy:

For any asset to perform its intended use at its desired efficiency level, the operation and maintenance is of paramount importance. The traditional approach has been attending to break down maintenance, preventive maintenance. Of late with the advent of IT, the technology, the machines are monitored for its behavior much more closely. Such observations and followed by corrective and preventive maintenance, the reliability of the asset is greatly enhanced. AKBTPL- Engg Services, has evolved a SAP based maintenance plan for Break Down. Preventive, Calibration, Condition based maintenance. A complete process mapping is provided below.

Condition based monitoring:

Condition Based Maintenance (CBM) or predictive maintenance is a maintenance philosophy which focuses on anticipating the future failures by analyzing the actual working condition of equipment and by analyzing some critical parameters of equipment like working fluid / Vibration of drives/Thermal imaging etc. It may also be defined as Maintenance actions based on actual condition obtained from as simple as operator's observations, performance history and daily and weekly visual checks to highly technical devices installed on equipment monitoring the critical working parameters of equipment.

CBM is one of the means of improving the overall effectiveness the equipment. It shall also provide the means to improve product quality, productivity and profitability and meet or extend the asset life

Reliability Centered Maintenance (RCM):

Reliability-centered maintenance is a process used to determine maintenance requirement of any physical asset based on its operating context by systematically analyzing an engineered system to understand:

- i) Its functions
- ii) The failure modes of its equipment that support these functions
- iii) How then to choose an optimal course of maintenance to prevent the failure modes from occurring or to detect the failure mode before a failure occurs
- iv) How to determine spare holding requirements
- v) How to periodically refine and modify existing maintenance over time

The objective of RCM is to achieve reliability for all of the operating modes of a system.

An RCM analysis, when properly conducted, should answer the following seven questions:

- i) What are the system functions and associated performance standards?
- ii) How can the system fail to fulfill these functions?
- iii) What can cause a functional failure?
- iv) What happens when a failure occurs?
- v) What might the consequence be when the failure occurs?
- vi) What can be done to detect and prevent the failure?
- vii) What should be done if a maintenance task cannot be found?

Typically, the following tools and expertise are employed to perform RCM analyses:

- i) Failure modes, effects and criticality analysis (FMECA). This analytical tool helps answer
- ii) RCM decision flow diagram.
- iii) Design, engineering and operational knowledge of the system
- iv) Condition-monitoring techniques
- v) Risk-based decision making (e.g., the frequency and the consequence of a failure in terms of its impact on safety, the environment and commercial operations)

Documenting and implementing the following formalize this process:

- i. The analyses and the decisions taken
- ii. Progressive improvements based on operational and maintenance experience
- iii. Clear audit trails of maintenance actions taken and improvements made

- iv. Once these are documented and implemented, this process shall be an effective system to ensure reliable and safe operation of an engineered system.

Maintenance Planning Cell (MPC):

In order to move towards the CBM and RCM various initiatives are envisaged at AKBTP.

As maintenance planning is one of the foundation pillars for any of the maintenance philosophy, the initiative of creating a Maintenance Planning Cell (MPC) for every ES department has been taken. The MPC shall take care of all maintenance planning, scheduling and SAP data related jobs allowing the actual maintenance staff to focus completely on the core function of maintenance execution and breakdown attendance.

The structure of MPC shall be decided by HOD based on the complexity and the span of operation under respective ES department and requirements of a department shall be reviewed at regular intervals. The major task of MPC members shall be of maintenance planning and scheduling and the looking after all data related jobs in and out of SAP.

The detailed functions of MPC shall be as follows:

MPC planning manager/Maintenance planner/Maintenance Planner:

- Prepare resource plan using resource planning model
- Ensure material availability by doing periodic material check
- Receive and collate material requirements from all verticals coming in purview of respective MPC
- Co-ordinate with operations for timely receipt of weekly ops. Plan in departments providing weekly operations plan. For departments, where weekly Ops plan is not feasible, the alternate method of weekly planning to be co-ordinated.
- Co-ordinate with operations for any change in schedule and format of the weekly operations plan in conjunction with HoS. In case, operations cannot weekly operations plan, the maintenance schedule to be revised on daily/weekly basis in conjunction with operations.
- Review and confirm monthly maintenance schedules
- Co-ordinate with stores for ensuring material availability for the required period
- Co-ordinate with stores for periodic material check
- Raise PR in case of scheduled PM job is due and material is required only for exceptional cases, else PR to be raised automatically through SAP for MRP items.
- Follow up with procurement department for status check of open PRs
- Co-ordinate with maintenance for regular follow up of the short notice plan

- Provide information to operations about tentative duration of maintenance
- Ensure that any pending PM20/10/30 jobs for a week extracted from weekly maintenance plan and from Short Notice Plan are incorporated in the next planned schedule as per applicability respective department
- Monitor the KPI performances and highlight significant issues(if any)
- Escalate to HOD in case of any issue in adherence to the maintenance planning and scheduling process
- Review and monitor the SAP data management
- Identify areas of improvement in maintenance planning process
- Monitor planned Vs unplanned work and draw towards 80/20 principal
- Ensure quality input of Notifications and feedback on work orders
- Produce weekly / daily maintenance plans using available software (MS Excel / MS Project). The objective shall be to move towards MS Project where departments are using MS Excel
- Organize spares and resources for breakdowns when required

Note: The MPC planning manager/Maintenance planner needs to keep a check of material availability and intimate stores and procurement department in case of unavailability of required material. The material planning shall be in purview of stores and procurement department.

***Resource Planning Model:** An excel based model to provide a planning level idea for manpower requirement on monthly level based on number of PM20/10/30 jobs to be performed and standard hours required to complete those jobs.

MPC SAP data executive:

- Receive maintenance jobs data from technicians on daily basis
- Inform the Maintenance Planner / MPC manager in case of non receipt of PM20/30/10 checklists
- Conduct a sanity check of hard copies to ensure all required data is filled
- Inform the technician in case of missing data and get the pending fields filled
- Enter complete data into SAP on daily basis
- Generate reports as per the requirements of department's senior management
- Escalate the issue in case of any non adherence to the data management process
- Prepare periodic MIS reports as per the finalized definitions of maintenance KPIs
- Maintain standard performance monitoring report and provide to planning manager as and when required
- Prepare and provide other relevant reports as per the requirements of individual departments

- Identify areas of improvement in the data collection and SAP uploading process

QRT for Breakdown Maintenance:

In order to address breakdown maintenance, a dedicated team called QRT (Quick Response Team) shall be formed which shall attend breakdowns at the first priority. This team shall comprise of engineers and technicians from electrical, mechanical and E&I streams equipped with general and special tools. However, it shall not be a entirely dedicated team for attending breakdowns only. The QRT shall be formed at shift level comprising of available resources and QRT team members shall be involved in regular day to day work in case of no breakdown.

The major responsibilities of QRT shall be:

- The reporting of break down shall be communicated through SAP notifications by the operating shift in charge. This is mandatory with a view to capture all break down incidents through SAP.
- Respond to the breakdown notification raised by Shift In charge in case of a breakdown incidence
- Attend breakdowns on first priority
- Issue material in case of extra requirement during execution
- Inform shift in-charge in case of any extra support / requirement
- Capture breakdown maintenance information
- Get vehicle / tools / spares issued from shift in-charge
- Handover Vehicle / Tools / Spares to shift in-charge
- Co-ordinate with operations department for handover of equipment
- Co-ordinate with QHSC for site access & safety approvals
- Provide critical feedbacks of the breakdown incident if any
- Identify improvement areas in breakdown execution process
- Perform regular duties assigned by shift in-charge beside breakdown maintenance in case of no breakdown

Applicability:

These processes shall be standard for complete preventive/ Condition based /Break down maintenance encompassing, the planning, scheduling and execution for all Engg Services departments of AKBTPL

Processes in scope:

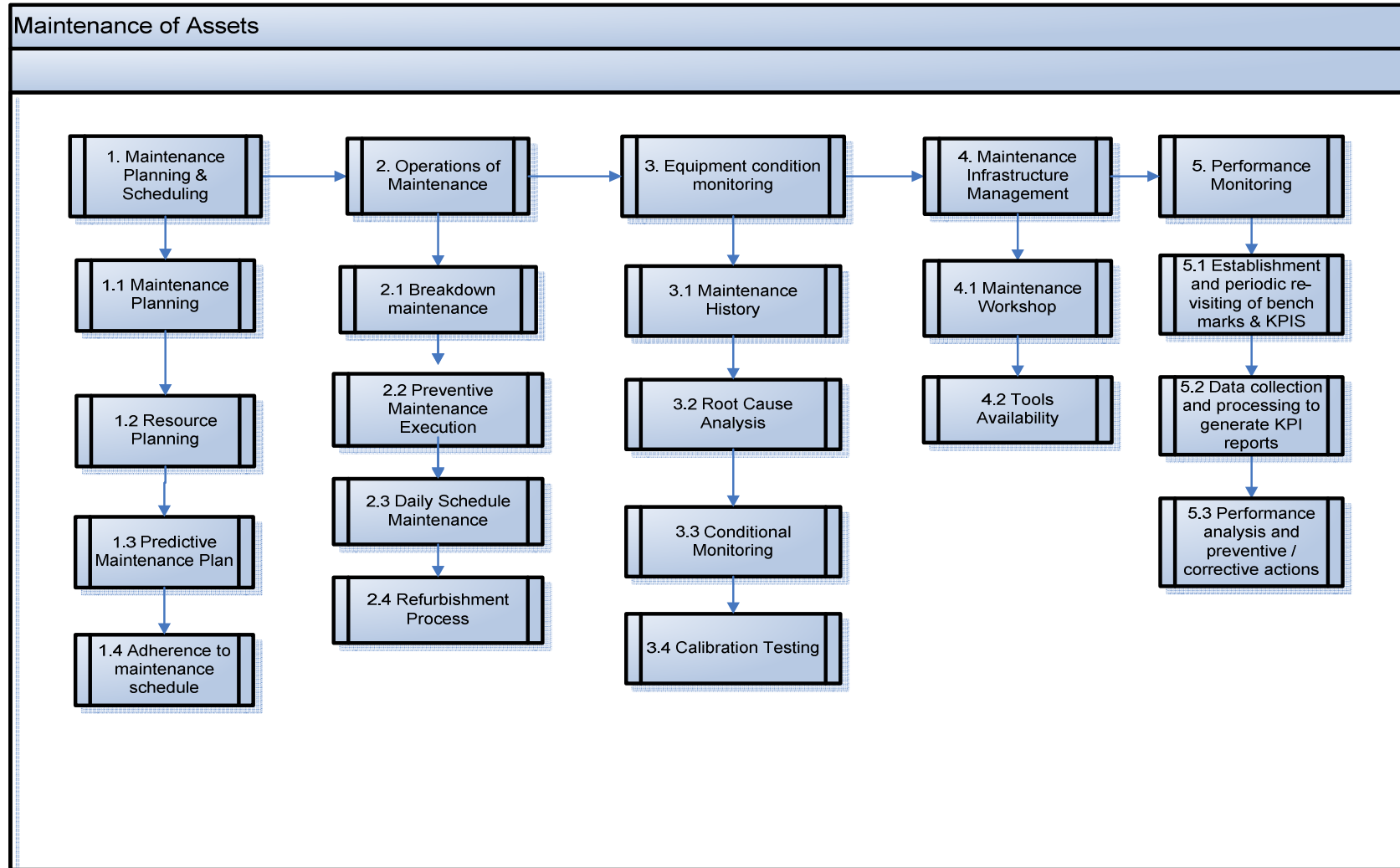
Broadly this covers the following sub-processes:

- 1) Maintenance Planning
- 2) Resource Planning

- 3) Maintenance Scheduling
- 4) Maintenance Execution
- 5) Equipment Conditional Monitoring
- 6) Maintenance Infrastructure
- 7) Performance Monitoring

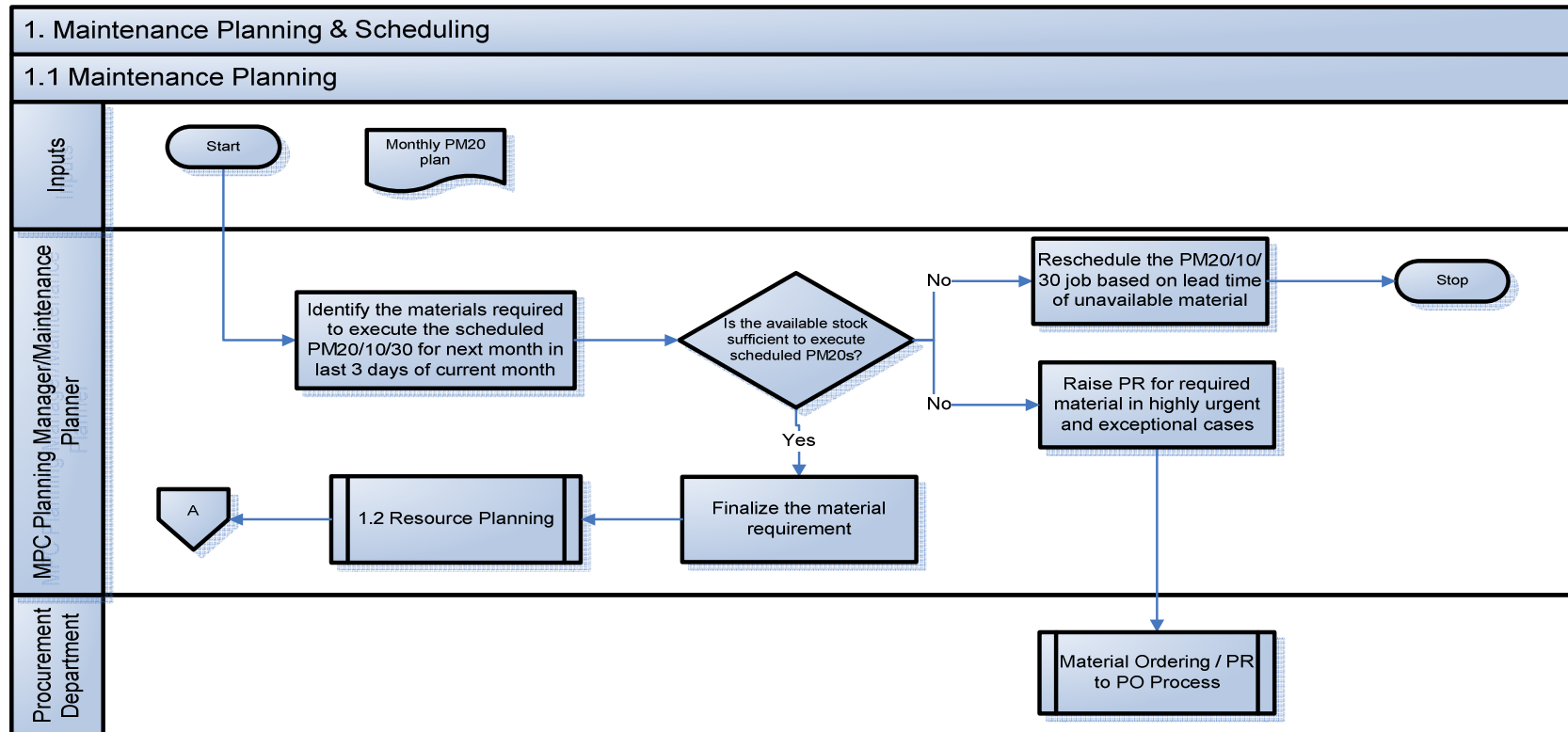
Process documentation

Maintenance of Assets/equipment – Overall Process Map



AM1-Maintenance Planning & Scheduling

AM1.1a: Maintenance Planning - Process Map



*Note: The Maintenance Planning manager/Maintenance planner needs to keep a check of material availability and intimate stores and procurement department in case of unavailability of required material. The material planning shall be in purview of Inventory Management, stores and procurement department and the PRs shall be raised automatically through SAP

AM 1.1b: Maintenance Planning – Process Description

- a) The material availability status and shortage intimation shall be done by MPC planning manager/Maintenance planner of each department. However, the actual stock level shall be maintained by stores on the basis of material type (MRP, Insurance, critical etc).
- b) The planning manager/Maintenance planner shall identify the materials required for the scheduled maintenance jobs based on the standard list of items which are consumed in respective PM20/30/10 jobs on a monthly basis
- c) The Planning manager/Maintenance planner shall ensure that the required material is available in stores 2-3 days prior to the scheduled date of PM20/30/10 job
- d) In case the required material is not available,
 - Raise a PR request to procurement department to purchase required material in highly urgent and exceptional cases
 - Reschedule the PM20/30/10 job for which required material is not available to a suitable date based on the actual lead time of procuring the material
- e) The Planning manager/Maintenance Planner should need to follow up with the procurement department regarding the status of open PR
- f) If the procurement lead time for unavailable material is more than a month from the fixed vendors, inform and seek permission from HOD-ES department to procure the required material on an urgent basis from any other available vendor. The MPC manager shall only conduct a material stock check and keep a follow up. Procurement department to ensure the availability within required time.
- g) Based on approval of urgent procurement, intimate the procurement department to take the necessary action.
- h) While placing an emergency order with a new vendor, the quality aspect of the material shall not be compromised.
- i) The planning manager/Maintenance planner shall inform the material availability status to HoS / HoD

AM1.1c: Maintenance Planning – SIPOC Framework

Supplier	Input	Process	Output	Customer
1. SAP	Monthly preventive maintenance plan	2.1 Material Planning	Material requirement status	Engineering Services/Procurement Department
2. MPC Manager/Maintenance Planner	Material requirement		PRs for the month	Procurement department

*supplier SAP shall not be misconstrued here. It refers to source/ data/material/resource

AM1.1d: Maintenance Planning –

Responsibility-Accountability-Consult-Inform (RACI)matrix

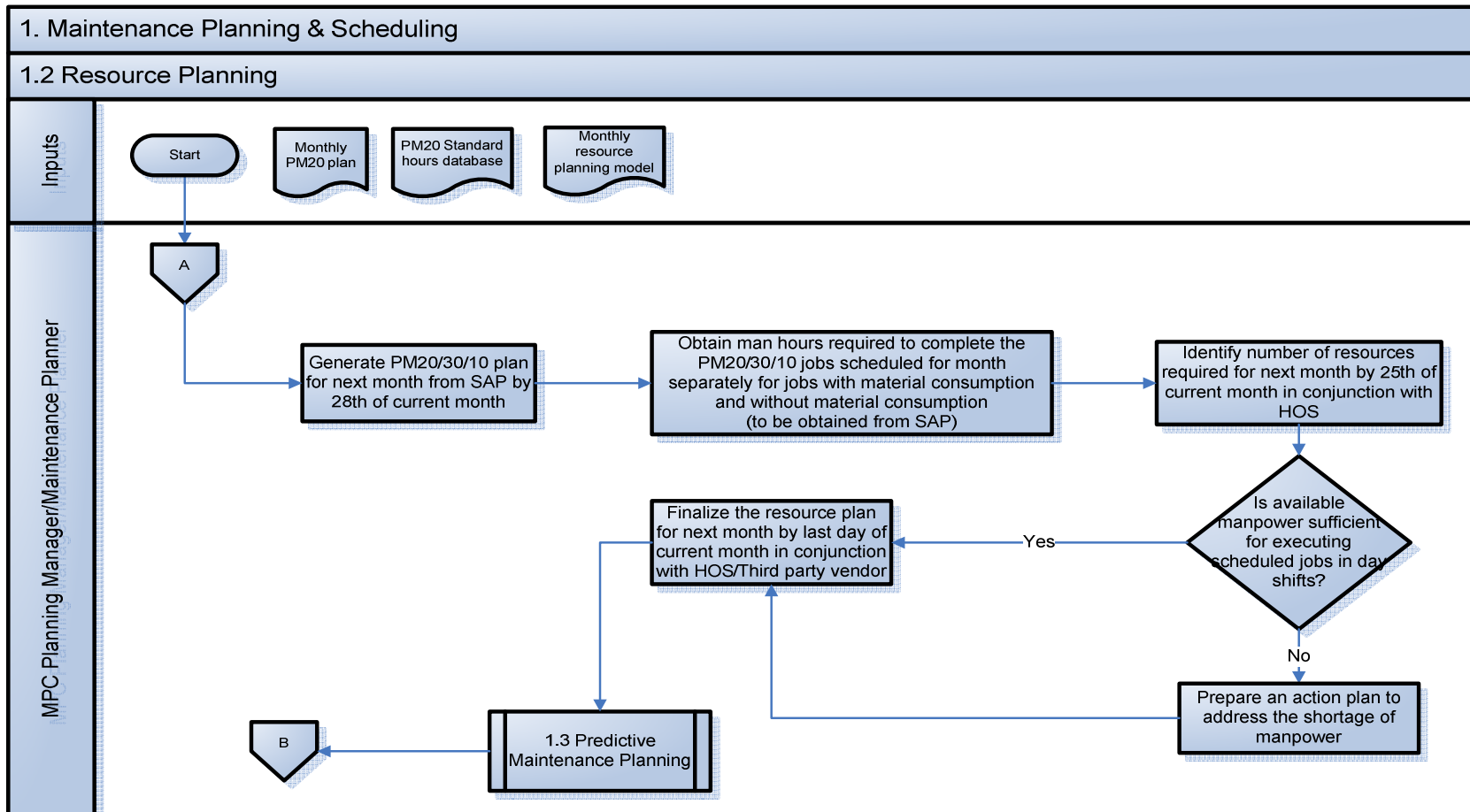
Process Step	Responsible	Accountable	Consult	Inform
1. Identify the materials required to execute the scheduled PM20s for next month by 28th of current month	MPC planning manager/Maintenance planner/Maintenance Planner	ES-HOD	1. Stores 2. HoD	1. Procurement Department 2. Shift Incharge
2. Raise a PR for required material	MPC planning manager/Maintenance planner/Maintenance Planner	ES-HOD	1. HoD	1. Procurement
3. Finalize the material requirement	MPC planning manager/Maintenance planner/Maintenance Planner	ES-HOD	1. HoD	1. Procurement Department

AM1.1e Maintenance Planning - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Identify the materials required to execute the scheduled PM20s for next month by 28th of current month	One month time period for material planning might lead to material shortage	Modifying the material planning horizon based on lead times as and when required
2.	Raise a PR for required material	Procurement lead times might be high leading to unavailability of material at the time of requirement	ES departments to inform procurement for any material purchase as per the actual procurement lead times

AM 1.2: Resource Planning

AM1.21a- Resource Planning - Process Map



AM1.21b-Resource Planning- Process Notes/ Description

- a) The planning manager/Maintenance Planner shall conduct the following activities in consultation with the Head of Section (HOS) and the third party vendor for departments where maintenance execution is outsourced
- b) The Planning manager/Maintenance planner shall extract the PM20/10/30 plan from SAP for the coming month
- c) The Planning manager /Maintenance planner shall identify the standard hours required for all PM20 / 10/30 jobs for the planning month based on the standard hours of each activity which shall be developed in due course/ or reference shall be made with respect other sources.
- d) Identify the resources required to complete the PM20 / 10/ 30 jobs of planning month by using the Resource Planning Model
- e) The information to be entered into Resource Planning model shall be:
 - a) PM20/30/10 job description
 - b) PM20/10/30 job frequency
 - c) PM20/10/30 job standard hours
 - d) Manpower required for the PM20 /10/30 jobs i.e. number of engineers and number of technicians
 - e) Any modification required to be made in the maintenance check list should first be brought into HOD's notice and he approval shall be taken
- f) Communicate resource availability status for next month to the HoS / HoD
- g) In case of resource shortage, identify the alternatives to address the shortage. The alternates could be any option of the following ones' or others
 - a) Overtime by the available resources
 - b) Arranging extra manpower on a contractual basis
- h) Ensure the availability of the required manpower for the planned PM20/30/10 jobs
- i) Reschedule the PM20/10/30 jobs in case of shortage of manpower. These rescheduled PM20/10/30 jobs to be attended on first priority.

AM1.21c-Resource Planning - SIPOC Framework

Supplier	Input	Process	Output	Customer
SAP	Duration/Month of Preventive maintenance plan	1. Generate PM20/10/30 plan for next month from SAP by 25th of current month	Planned PM 20's for the required duration/month	The planning manager
SAP/Standard man-hours data base	Status of maintenance man hours to be completed for the duration	2. Obtain man hours required to complete the PM20/10/30/10/30 jobs based on monthly resource planning model	Man hours requirement status for the month	The Maint Planner
Maint Planner	Man hours requirement status in resource planning model	3. Compute number of resources required for next month by 28th of current month	Resource requirement status	MPC planning manager/Maintenance planner/ES - HOS
Maint Planner	Analysis of available options for overcoming resource shortage	4. Assign overtime to resources or schedule PM20/10/30 jobs in night shift	Action plan for resource deployment	ES – HOS/Shift In charge
Maint Planner	Analysis of available options for overcoming resource shortage	5. Finalize the resource plan for next month by last day of current month	Action plan for resource deployment	ES – HOS/Shift In charge

AM1.21d: Resource Planning - RACI Matrix

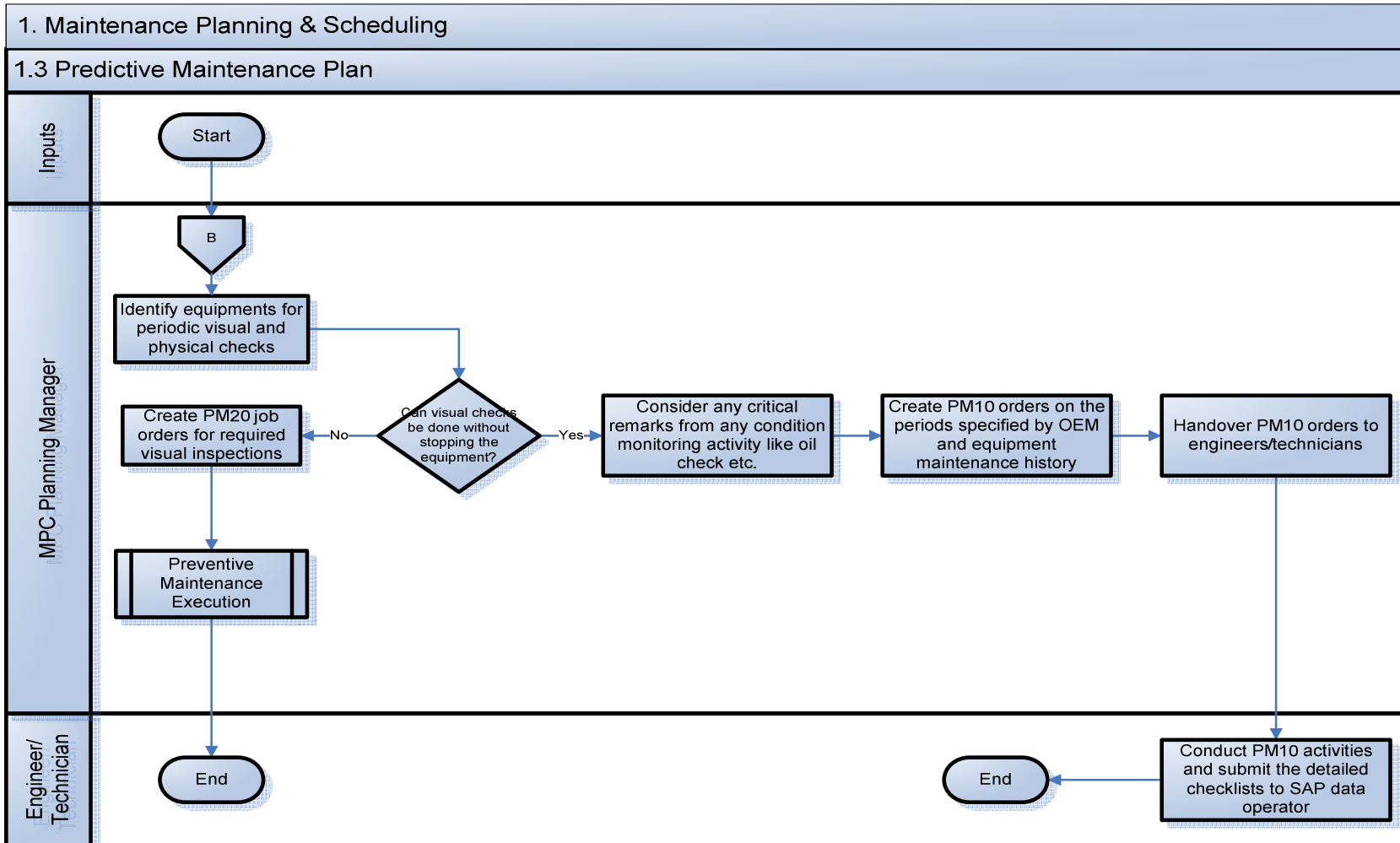
Process Step	Responsible	Accountable	Consult	Inform
1.2 Resource Planning				
1. Generate PM20/10/30 plan for next month from SAP by 25th of current month	Planning manager/	ES-HOD	1. MPC data operator	
2. Obtain man hours required to complete the PM20/10/30 jobs based on monthly resource planning model	Planning manager/	ES-HOD	NA	NA
3. Compute number of resources required for next month by 28th of current month	Planning manager/	ES-HOD	NA	HoD
4. Assign overtime to resources or schedule PM20 jobs in night shift	Planning manager/	ES-HOD	1. Shift In charge	1. Shift In charge 2. HoS
5. Finalize the resource plan for next month by last day of current month	Planning manager/	ES-HOD	1. HoS	1. HoD

AM1.21e Resource Planning - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Compute man hours required to complete the PM20 jobs based on monthly resource planning model	Wrong standard hours might lead to incorrect resource planning	Complete validation of standard hours needs to be done before using them for resource planning
2.	Compute number of resources required for next month by 28th of current month	One month planning horizon might not be sufficient for accurate resource planning	Redefining planning horizon as per the requirement and actual conditions
3.	Assign overtime to resources or schedule PM20 jobs in night shift	Incorrect resource planning might lead to incorrect job allocation leading to underutilized manpower	Job allocation should be done only after all constraints have been analyzed
4.	Finalize the resource plan for next month by last day of current month	One month planning horizon might not be sufficient for accurate resource planning	Redefining planning horizon as per the requirement and actual conditions

AM 1.3: Predictive Maintenance Plan

AM 1.31a: Predictive Maintenance Plan - Process Map



AM 1.31b: Predictive Maintenance Plan – Process Notes

- a) HOS shall provide the list of equipment to be taken up for predictive maintenance
- b) The equipment selection for maintenance planning can be based on breakdown history, FMEA and other critical criteria like vibration analysis, oil analysis (all criteria to be finalized with HOD)
- c) MPC planning manager/Maintenance planner shall extract the list of equipment for which visual and physical inspections to be done
- d) Identify the PM10 job orders to be done for the required period based on observations made during previous PM20 jobs
- e) Create and hand over the PM10 job orders to the technicians / engineers as and when scheduled
- f) Engineers / Technicians shall do the PM10 job as per the standard checklist with all list of activities to be performed
- g) After finishing the PM10 job , engineers / technicians should fill all the information like start time, end time, resources deployed, total hours consumed for the entire PM10 job
- h) Handover the completely filled check list to MPC data operator

AM 1.31c: Predictive Maintenance Plan - SIPOC Framework

Supplier	Input	Process	Output	Customer
ES – MPC planning manager/Maintenance planner	Breakdown analysis reports/conditional monitoring notifications	1. Identify equipment for periodic visual and physical checks	Equipment to be taken for predictive maintenance plan	Maintenance department
MPC planning manager/Maintenance planner	Predictive maintenance plan for identified equipment	2. Create PM20 job orders for required visual inspections	PM20 job orders	Maintenance department
MPC planning manager/Maintenance planner	Predictive maintenance plan for identified equipment	3. Create PM10 orders on the periods specified by OEM and equipment maintenance history	PM10 job orders	Maintenance department
Shift In charge	PM 10 job orders	4. Handover PM10 orders to engineers/technicians	PM10 job orders with engineers	Engineer-ES
PM10 job order	PM 10 job list having all tasks to be done	5. Conduct PM10 activities and submit the detailed checklists to SAP data operator	Completed PM10 job	SAP data operator

AM 1.31d: Predictive Maintenance Plan -

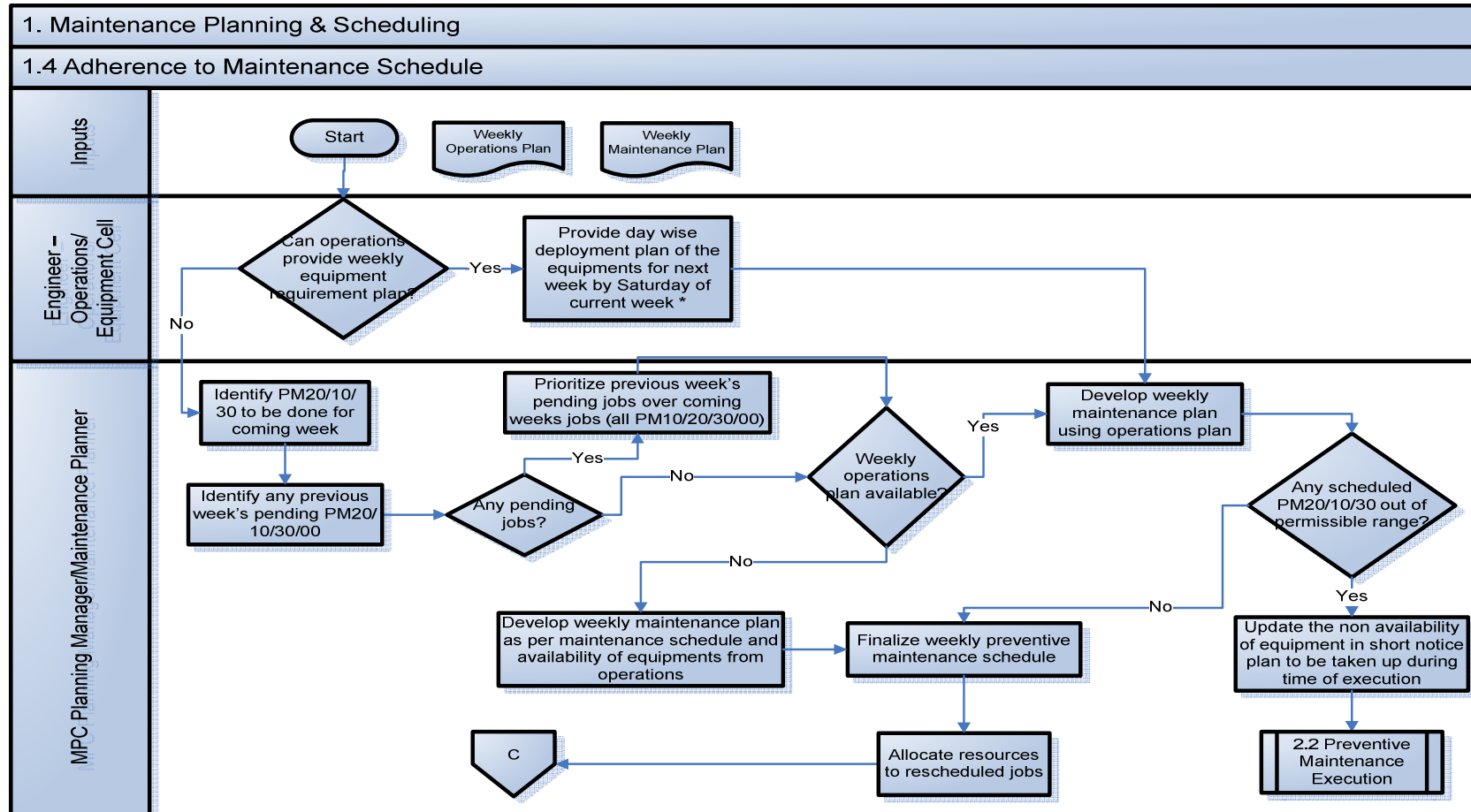
Responsibility-Accountability-Consult-Inform (RACI)matrix

Process Step	Responsible	Accountable	Consult	Inform
1.3 Predictive Maintenance Plan				
1. Identify equipment for periodic visual and physical checks	Shift In charge	HoS	1. OEM 2. planning manager/Main tenance planner/Maint enance Planner	1. HoS
2. Can visual checks be done without stopping the equipment?	Shift In charge	HoS	1. Operator	1. Operator 2. Maintenance team 3. MPC data operator
3. Create PM20 job orders for required visual inspections	MPC data operator	Planning manager/Main tenance planner/Mainte nance Planner	NA	1. Shift In charge 2. Maintenance team
4. Create PM10 orders on the periods specified by OEM and equipment maintenance history	MPC data operator	Planning manager/Main tenance planner/Mainte nance Planner	NA	1. Shift In charge 2. Maintenance team
5. Handover PM10 orders to engineers/technicians	MPC data operator	Planning manager/Main tenance planner	NA	1. Shift In charge 2. Maintenance team

6. Conduct PM10 activities and submit the detailed checklists to SAP data operator	Maintenance team	Shift In charge	1. Stores 2. Operators	1.Shift In charge
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AM 1.31e: Predictive Maintenance Plan - Risks & Controls

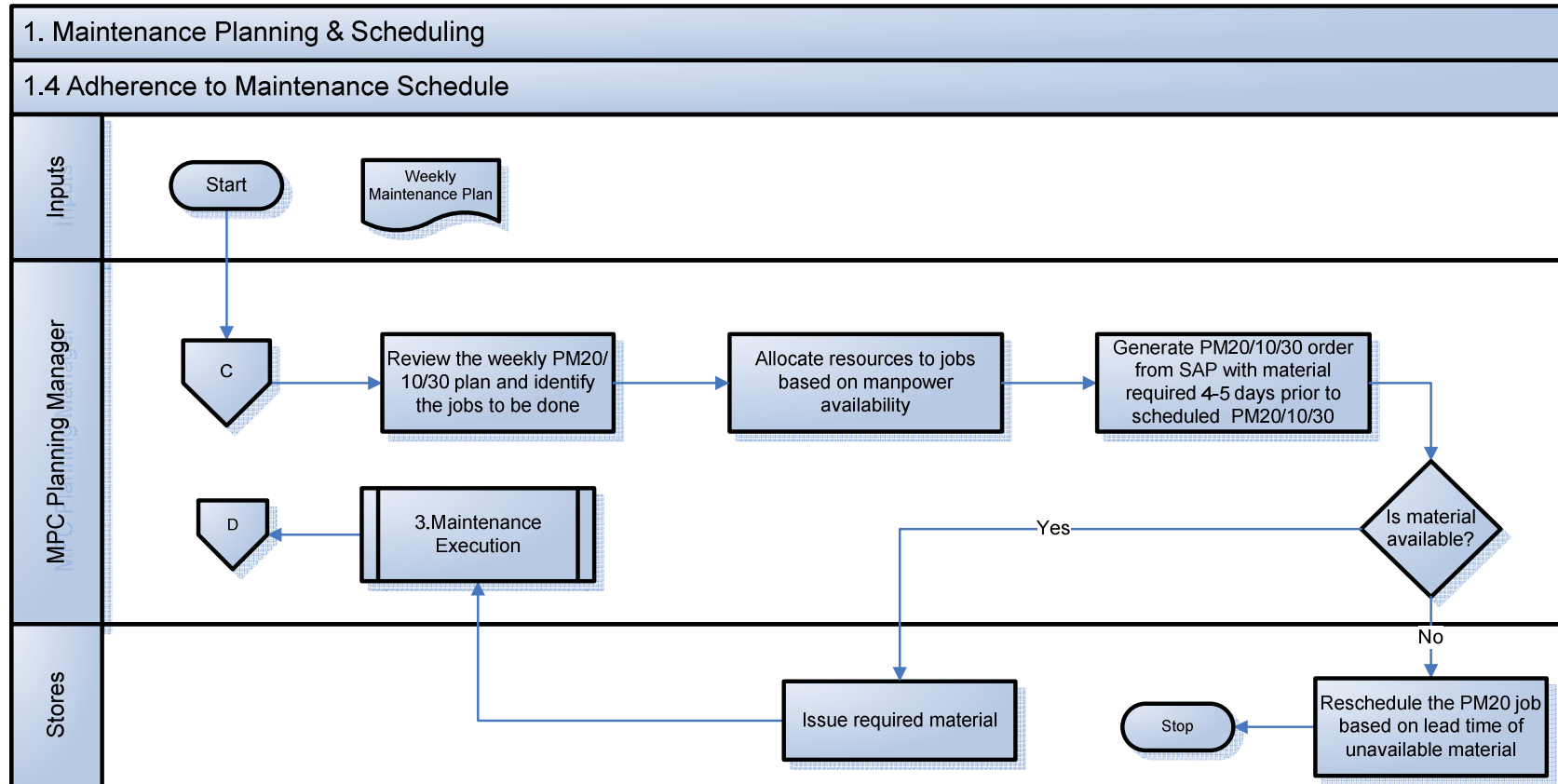
Process Tag	Activity Description	Risks	Controls
1.	Identify equipment for periodic visual and physical checks	Risk of missing any critical equipment while identification for visual and physical checks	List of equipment need to be reviewed based on PM20 and PM00 reports periodically
2.	Create PM10 orders on the periods specified by OEM and equipment maintenance history	Risk of missing any critical equipment/maintenance job mentioned in PM20 & PM00 reports	List of visual maintenance jobs need to be reviewed based on PM20 and PM00 reports periodically
3.	Conduct PM10 activities and submit the detailed checklists to SAP data operator	Risk of missing any critical detail of maintenance job required to be recorded	Through sanity check by MPC data operator should be done

AM 1.4: Adherence to maintenance schedule**AM 1.41a: Adherence to maintenance schedule - Process Map**

Note: The adherence to maintenance schedules is mandatory, however the business exigencies shall be kept in mind and maintenance jobs shall be rescheduled and first priority to be given to operations.

AM 1.4: Adherence to maintenance schedule

AM 1.41b: Adherence to maintenance schedule - Process Map



AM 1.41b: Adherence to maintenance schedule – Process Notes

- a) Identified person from operations department shall forward the weekly operations plan for the next week (Monday to Sunday) to the MPC planning manager/Maintenance planner if operations department can provide the weekly operations plan
- b) The operations department SIPOC shall provide following information in the weekly operations plan:
 - a) Equipment requirement
 - b) Equipment deployment status
 - c) Future tentative date of availability in case the equipment is deployed on a particular day
- c) MPC planning manager/Maintenance planner to extract PM20/30/10 jobs scheduled for the planning week from SAP
- d) MPC planning manager/Maintenance planner shall compare the maintenance schedule with weekly operations plan and identify if there any equipment scheduled for maintenance on a particular date is deployed in operations
- e) Check the future or any previous date from the operations plan when the equipment is free or shall be free tentatively
- f) Identify the feasibility of rescheduling PM20/10/30 job to any prior or available future date
- g) If feasible, reschedule the PM20/10/30 plan to nearest available date
- h) In case of PM30 (Calibration testing) and PM40(Regulatory) jobs, inform the operations to release the equipment on scheduled date and inform the HOD/HOS simultaneously regarding the urgency of the maintenance job to be performed
- i) In case, the rescheduled dates are exceeding the acceptable limits of delay, enter that respective PM20 job into the SNP to be taken as per the unplanned availability of equipment during the week.
- j) Provide the rescheduled maintenance plan for the next week to shift in-charge
- k) Assign resources (engineers/technicians) to all scheduled jobs.
- l) Share the resource allocation plan with Shift In-charge and take his feedback for any required changes
- m) Once maintenance schedule is finalized and resources are allocated to PM20 / 10 jobs, check out stock level of material required to perform PM20/10 jobs

- n) Confirm availability of material and raise material issue 4 days prior to the scheduled date of maintenance.
- o) The issued material to be kept with stores only.
- p) Technicians shall collect the material from store on the day of maintenance
- q) Store to register the material issue and provide a copy to PM20 team
- r) In case the weekly operations plan cannot be provided:
- s) Maintenance planner shall generate the weekly maintenance schedule using SAP and identify the equipment to be taken up for maintenance jobs (20/30/10)
- t) Maintenance Planner shall prepare a weekly schedule with resource allocation based on availability of equipment from operations
- u) Maintenance Planner shall allocate resources on daily basis for jobs scheduled after discussion with operations team on daily basis

AM 1.41c: Adherence to maintenance schedule – SIPOC Framework

Supplier	Input	Process	Output	Customer
Operations department	Weekly Operations Plan	1. Provide day wise deployment plan of the equipment for next week by Saturday of current week 2. Identify PM20, PM10 and any pending breakdown job to be executed in the week 3. Develop weekly maintenance plan using operations plan	Revised weekly maintenance schedule	Maintenance department
ES-MPC planning manager/Maintenance planner	Weekly Maintenance schedule	4. Any scheduled PM20/10/30 out of permissible range?	Revised Weekly Maintenance Schedule	Maintenance department

Maintenance Manual for the equipment of AKBTP

		5. Finalize weekly preventive maintenance schedule		
		6. Allocate resources to rescheduled jobs	Resource Allocation for weekly schedules	Maintenance Department
		7. Update the non-availability of equipment in short notice plan to be taken up during time of execution	Pending PM20 jobs status in SNP	MPC planning manager/Maintenance planner/Maintenance Planner
		8. Generate PM20/10/30 order from SAP with material required 1-2 days prior to scheduled PM20/10/30	Material Required	Maintenance Department
Stores	Material availability status for week	9. Issue required material	Material requirement	Maintenance department

AM 1.41d-Adherence to maintenance schedule –

Responsibility-Accountability-Consult-Inform (RACI) Matrix

Process Step	Responsible	Accountable	Consult	Inform
1.4 Adherence to Maintenance schedule				
1. Provide day wise deployment plan of the equipment for next week by Saturday of current week	SIPOC from operations department		Marketing department	Maintenance department
2. Identify PM20/10/30 and any pending breakdown job to be executed in the week	ES - MPC planning manager/Maintenance planner/Maintenance Planner	Head of Department - ES	Shift In charge	Shift In charge
3. Develop weekly maintenance plan using operations plan	ES- MPC planning manager/Maintenance planner/Maintenance Planner	Head of Department - ES	Shift In charge	Shift In charge
4. Any scheduled PM20 out of permissible range?	ES- MPC planning manager/Maintenance planner/Maintenance Planner	Head of Department - ES	Shift In charge	Shift In charge
5. Finalize weekly	ES- MPC	Head of	Shift In	Shift In charge

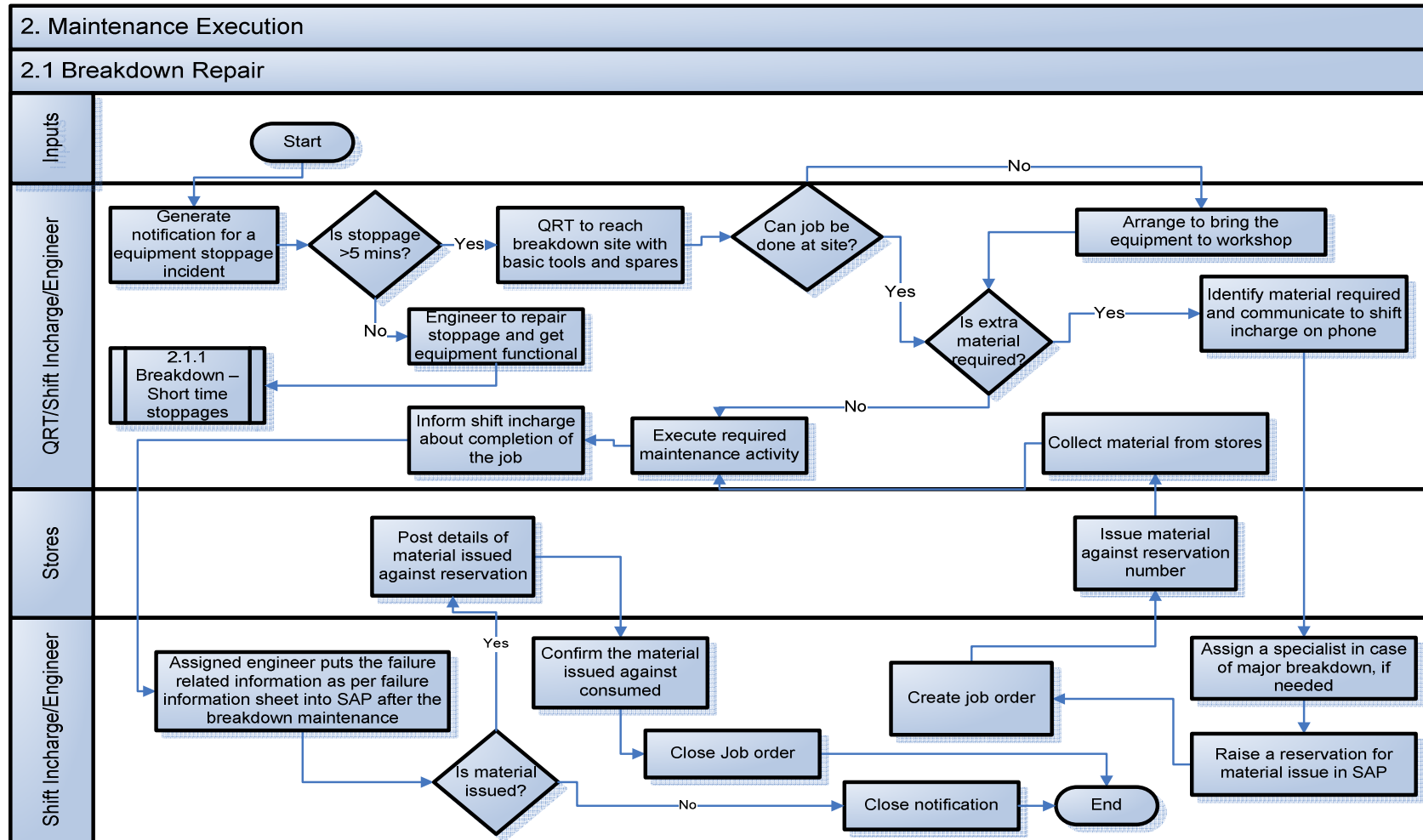
preventive maintenance schedule	planning manager/Maintenance planner/Maintenance Planner	Department - ES	charge	
6. Allocate resources to rescheduled jobs	ES- MPC planning manager/Maintenance planner/Maintenance Planner	Head of Department - ES	Shift In charge	Shift In charge
7. Update the non-availability of equipment in short notice plan to be taken up during time of execution	Shift in charge	Head of Section -ES	MPC data operator	
8. Review the weekly PM20/10/30 plan and identify the PM20s to be done	ES – MPC planning manager/Maintenance planner/Maintenance Planner	Head of Department		Shift In charge
9. Allocate resources to jobs using resource allocation model	ES – MPC planning manager/Maintenance planner/Maintenance Planner	Head of Department	Shift in charge	Shift in charge

10. Generate PM20 order from SAP with material required 1-2 days prior to scheduled PM20	ES – MPC planning manager/Maintenance planner/Maintenance Planner	Head of Department		Stores
11. Issue required material	Store supervisor	Stores Incharge		Shift in charge

AM 1.41e: Adherence to maintenance schedule – Risks & Controls

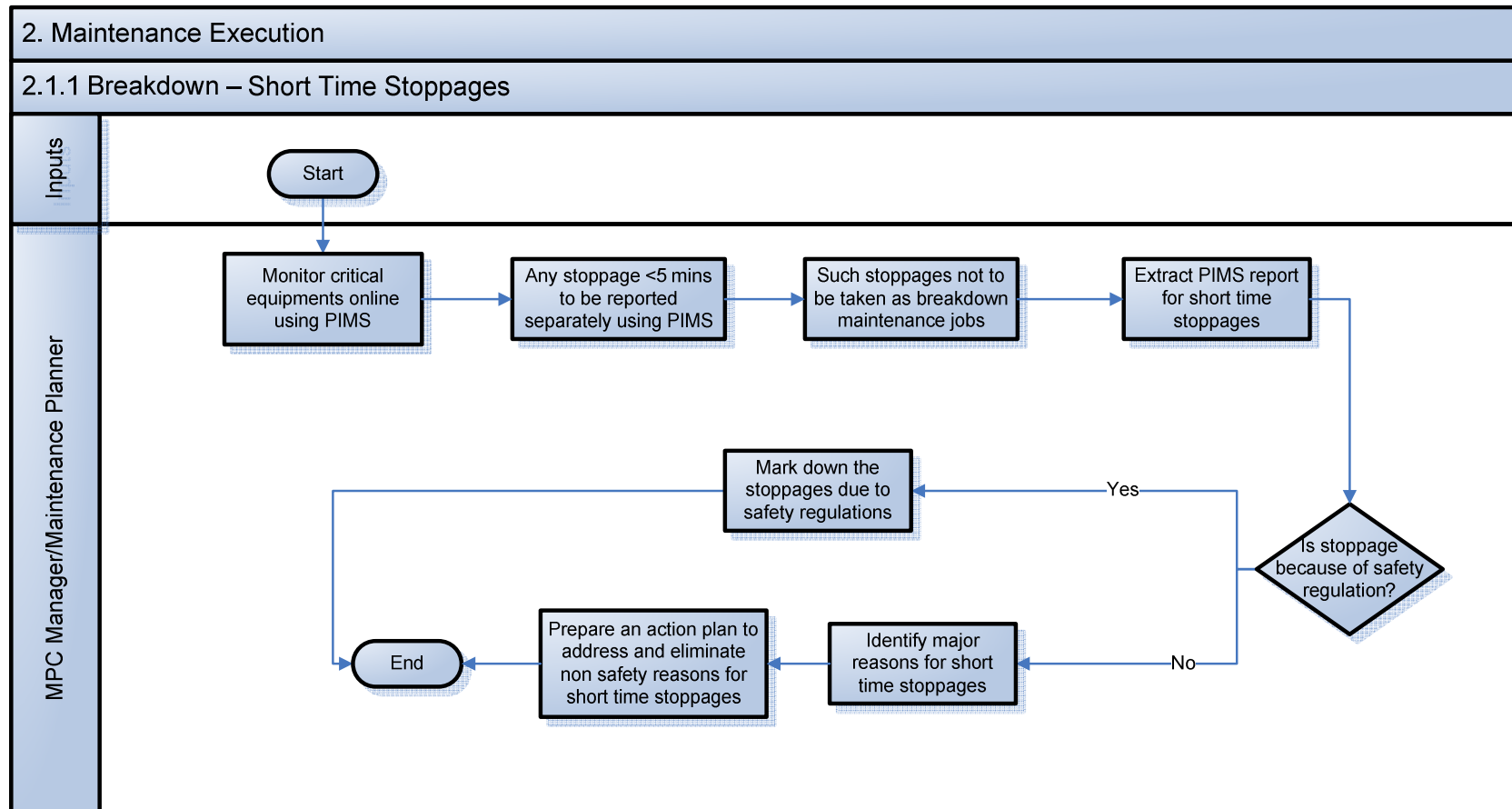
Process Tag	Activity Description	Risks	Controls
1.	Provide day wise deployment plan of the equipment for next week by Saturday of current week	Day wise deployment plan can change due to uncertainty in arrivals of vessels leading to changed deployment plan	Any unplanned change in the weekly plan should be communicated between operations and maintenance using SNP
2.	Identify PM20,PM10 and any pending breakdown job to be executed in the week	Risk of missing any pending job scheduled for the week	Detailed review of SNP and SAP plan should be done to ensure all jobs are covered

3.	Develop weekly maintenance plan using operations plan	Risks of unavailability of equipment at the day of maintenance due to uncertainty of Operations Plan	Any unplanned change in the weekly plan should be communicated between operations and maintenance using SNP
4.	Any scheduled PM20 out of permissible range?	Risk of failure/underutilization of equipment due to delayed/preponed maintenance job	Ensuring availability of equipment for maintenance within permissible range using SNP
5.	Allocate resources to rescheduled jobs	Shortage / underutilization of manpower due to unavailability / sudden availability of equipment	Buffer resource planning for any unplanned maintenance job while doing monthly resource plan
6.	Update the non-availability of equipment in short notice plan to be taken up during time of execution	Risk of missing to update any pending job to SNP might lead to non-adherence of maintenance schedule	Immediate update of pending job in SNP after the information has been received by maintenance team on call
7.	Generate PM20 order from SAP with material required 1-2 days prior to scheduled PM20	Cancellation of PM20 job in case of non-availability of equipment on the day of maintenance job due to advance PM20 order generation	PM20 order to be generated once the weekly maintenance plan, SNP and operations plan has been thoroughly analyzed
8.	Issue required material	Accountability of material	Track of material by stores and SAP data operator

AM2.0: Operation of Maintenance (execution)**AM2.1a: Operation of Maintenance – Process Maps**

AM2.0: Maintenance Execution

AM2.1b Breakdown – Short Time stoppages – Process Maps



AM2.1: Breakdown Maintenance – Process Notes

- a) The reporting of break down shall be communicated through SAP notifications by the operating shift in charge. This is mandatory with a view to capture all break down through SAP.
- b) Shift In charge shall identify the QRT for every shift
- c) The QRT structure shall vary as per the requirements of each department
- d) The identified QRT shall attend any breakdown with first priority
- e) In case of no breakdown, the QRT shall perform the normal maintenance jobs as directed by the shift in charge
- f) In case of breakdown, shift in charge shall inform the QRT by a phone call
- g) Shift in charge shall raise a breakdown notification simultaneously to phone call through SAP
- h) QRT shall reach the breakdown site with mobile vehicle and general tools
- i) QRT shall diagnose the incident and identify if maintenance and repair can be done at sight or the equipment needs to be taken back to workshop.
- j) QRT shall also identify if any new material is required
- k) QRT shall inform the shift in charge about material requirement and shift in charge shall raise a reservation for material issue through SAP
- l) In case of new material , the helper shall go to store and issue the material
- m) Stores shall issue the material against breakdown notification & reservation
- n) The protocol for material issue for breakdown maintenance shall be finalized.
- o) QRT shall execute the breakdown maintenance job and complete the information check list
- p) The information check list shall record following critical information:
 - a) Equipment Type & Number
 - b) Time of breakdown – *Need to be added to analysis report*
 - c) Start time and end of breakdown execution - *Need to be added to analysis report*
 - d) Type of breakdown, major or minor - *Need to be added to analysis report*
 - e) Material consumed in maintenance execution - *Need to be added to analysis report*
 - f) Number and names of resources deployed in breakdown maintenance execution

- g) Total man hours consumed for breakdown execution - *Need to be added to analysis report*
- h) Major cause of breakdown as per the fault code – *Need to be modified*
- q) After completing the maintenance execution, QRT shall hand over the detailed information checklist to MPC data operator.
- r) The MPC data operator needs to do a sanity check of checklist and identify if all required information is properly filled
- s) In case the any required information is missing, data operator shall call the QRT member to come and complete the checklist at the same time
- t) MPC data operator shall not enter the data in SAP till checklist is completely filled
- u) Once all required information is filled in checklist, the MPC data operator shall enter all details into SAP and close the breakdown notification

AM2.1: Breakdown Maintenance – SIPOC Framework:

Supplier	Input	Process	Output	Customer
Equipment Operator	Breakdown information	1. Carry necessary tools and spares 2. Reach breakdown site 3. Perform investigation	Breakdown notification	Control Room / Shift In charge
QRT	Breakdown notification	3. Perform investigation	Breakdown investigation	QRT
QRT			Breakdown type	QRT
		4. Can job be done at site?		
QRT	Breakdown repair requirement	5. Arrange to bring the equipment to workshop	Equipment in workshop	Workshop
		6. Is extra material required?		
Engineer	Material requirement diagnosis	7. Identify material required	Material requirement status	Stores/Workshop
Shift In charge	Expertise requirement	8. Assign a specialist in case of major breakdown, if needed	Specialist	Maintenance Team
QRT	New material	9. Raise a	Reservation for	Stores

	requirement	reservation for material issue in SAP	material	
QRT	Breakdown job requirement	10. Create job order	PM00 job order	QRT
QRT	Material requirement	11. Issue material against reservation number	Issued material	QRT
Stores	Material reservation	12. Collect material from stores	Physical material issue	QRT
QRT	PM00 job order	13. Execute required maintenance activity	Completed PM00 job order	Operations
QRT	PM00 job completion	14. Inform shift in charge about completion of the job	Equipment availability for operations	Operations
QRT	Breakdown analysis report	15. Assigned engineer puts the failure related information as per failure information sheet into SAP after the breakdown maintenance	Fault Code Catalogue	Maintenance Department
QRT	Material consumed	16. Post details of material issued against reservation	Material closure report in SAP	SAP
QRT	Material consumed	17. Confirm the material issued	Material closure report	SAP

		against consumed	in SAP	
PM00 job closure check list	Job closure	18. Close Job order	Closed PM00 job in SAP	SAP
PM00 job closure check list	Notification closure	19. Close notification	Closed PM00 job in SAP	SAP

AM2.1: Breakdown Maintenance –

Responsibility-Accountability-Consult-Inform (RACI) Matrix

Process Step		Responsible	Accountable	Consult	Inform
2.1 Breakdown Maintenance					
1.	Carry necessary tools and spares	QRT	Shift In charge	Shift in charge	Operator
2.	Reach breakdown site	QRT	Shift In charge		Operator
3.	Perform investigation	QRT	Shift In charge		
4.	Can job be done at site?	QRT	Shift In charge	Shift in charge	Operator and workshop
5.	Arrange to bring the equipment to workshop	QRT	Shift In charge	Shift in charge	Operator and workshop
6.	Is extra material required?	QRT	Shift In charge	Shift in charge	Operator and workshop
7.	Identify material required	QRT	Shift In charge	Shift in charge	Shift in charge, stores and workshop supervisor

8.	Assign a specialist in case of major breakdown, if needed	Shift In charge	Head of section	QRT & Head of section	Head of section
9.	Raise a reservation for material issue in SAP	Shift In charge	Head of section		Stores
10.	Create job order	Shift In charge	Head of section		Stores
11.	Issue material against reservation number	Store supervisor	Store In charge		Shift In charge
12.	Collect material from stores	QRT	Shift In charge		Shift In charge
13.	Execute required maintenance activity	QRT	Shift In charge		Operator Shift in charge
14.	Inform shift in charge about completion of the job	QRT	Shift In charge		Shift In charge
15.	Assigned engineer puts the failure related information as per failure information sheet into SAP after the breakdown maintenance	QRT	Shift In charge	Shift In charge	Shift in charge
16.	Post details of material issued against reservation	MPC data operator	MPC planning manager/Maintenance planner		MPC planning manager/Maintenance planner
17.	Confirm the material issued against consumed	MPC data operator	MPC planning manager/Maintenance planner	Stores	MPC planning manager/Maintenance planner

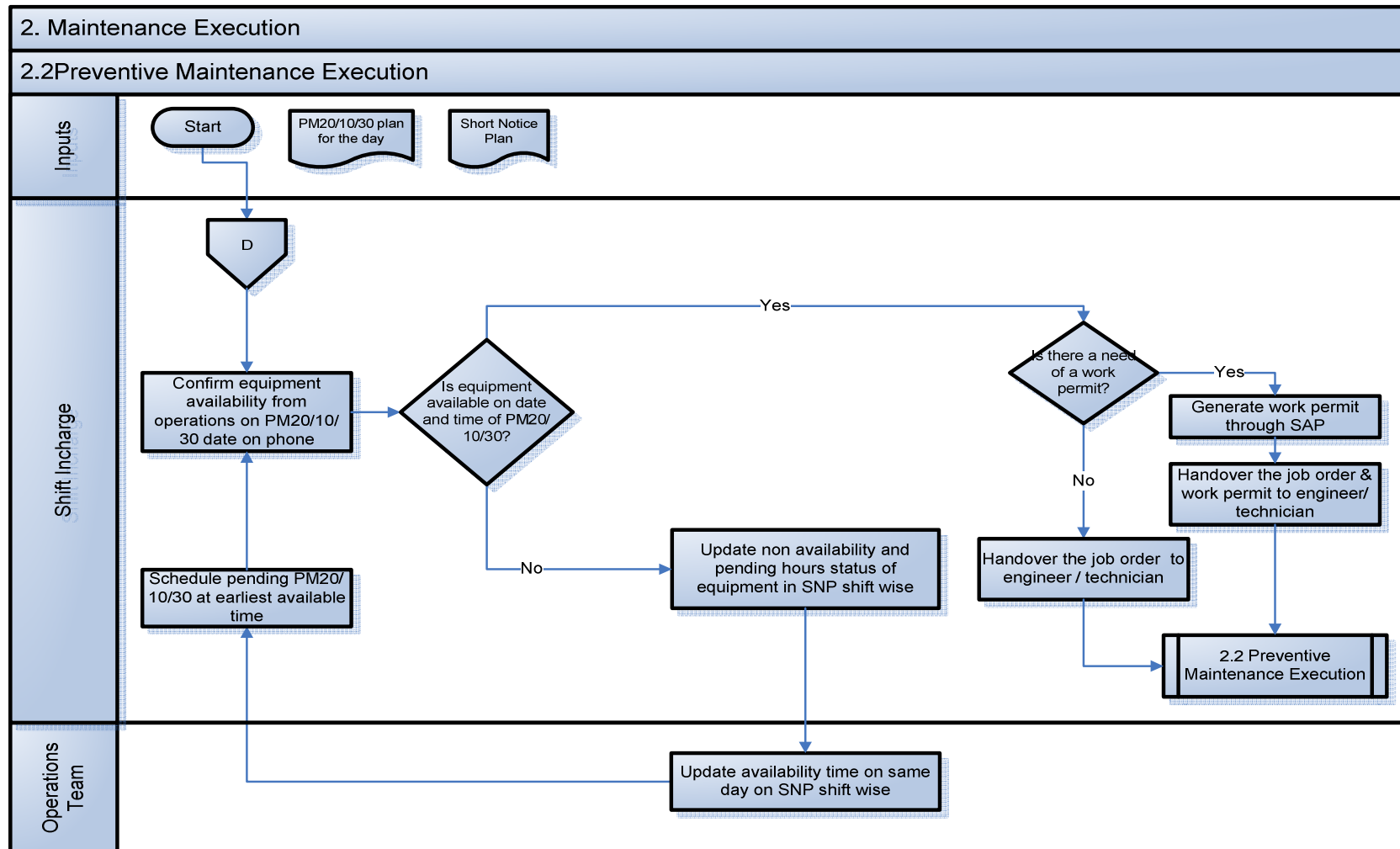
18. Close Job order	MPC data operator	MPC planning manager/Maintenance planner	NA	MPC planning manager/Maintenance planner
19. Close notification	MPC data operator	MPC planning manager/Maintenance planner	NA	MPC planning manager/Maintenance planner

AM2.1: Breakdown Maintenance – Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Assign a specialist in case of major breakdown, if needed	Time taken to complete the PM20 job might increase due to new resource allotment	Buffer resources to be planned while doing resource planning
2.	Raise a reservation for material issue in SAP	The documentation work might increase the MTTR due to delay in material issue	Material should be issued on call from QRT to shift in charge and SAP work can be done later
3.	Issue material against reservation number	Accountability of material	Order closure should be done only after receiving material consumption/return from stores
4.	Assigned engineer puts the failure related information as per failure information sheet into SAP after the breakdown maintenance	Risk of missing any critical detail by engineer required for breakdown analysis	Complete sanity check should be done by the SAP data operator

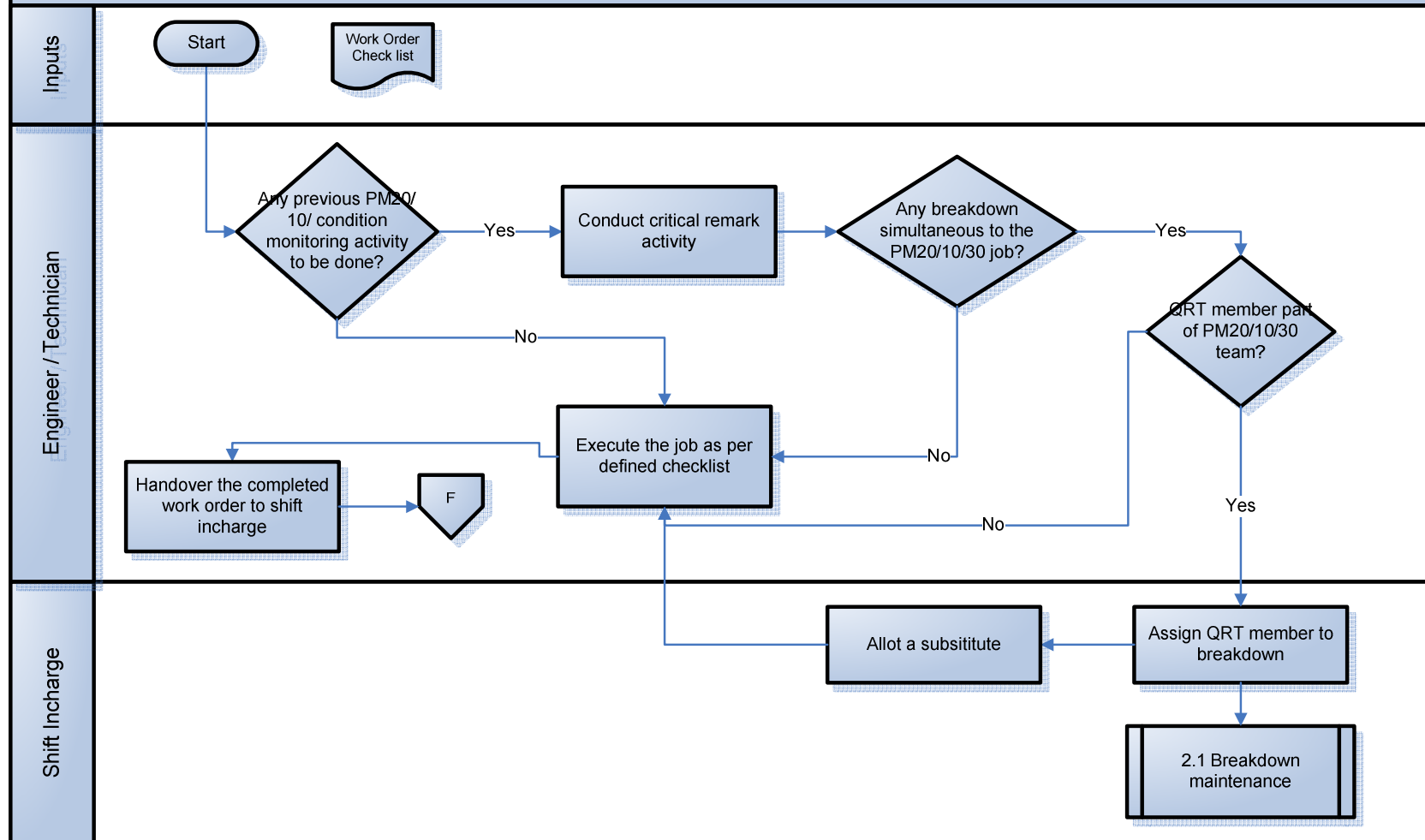
AM 2.2: Preventive Maintenance Execution

AM 2.2: Preventive Maintenance Execution – Process Map



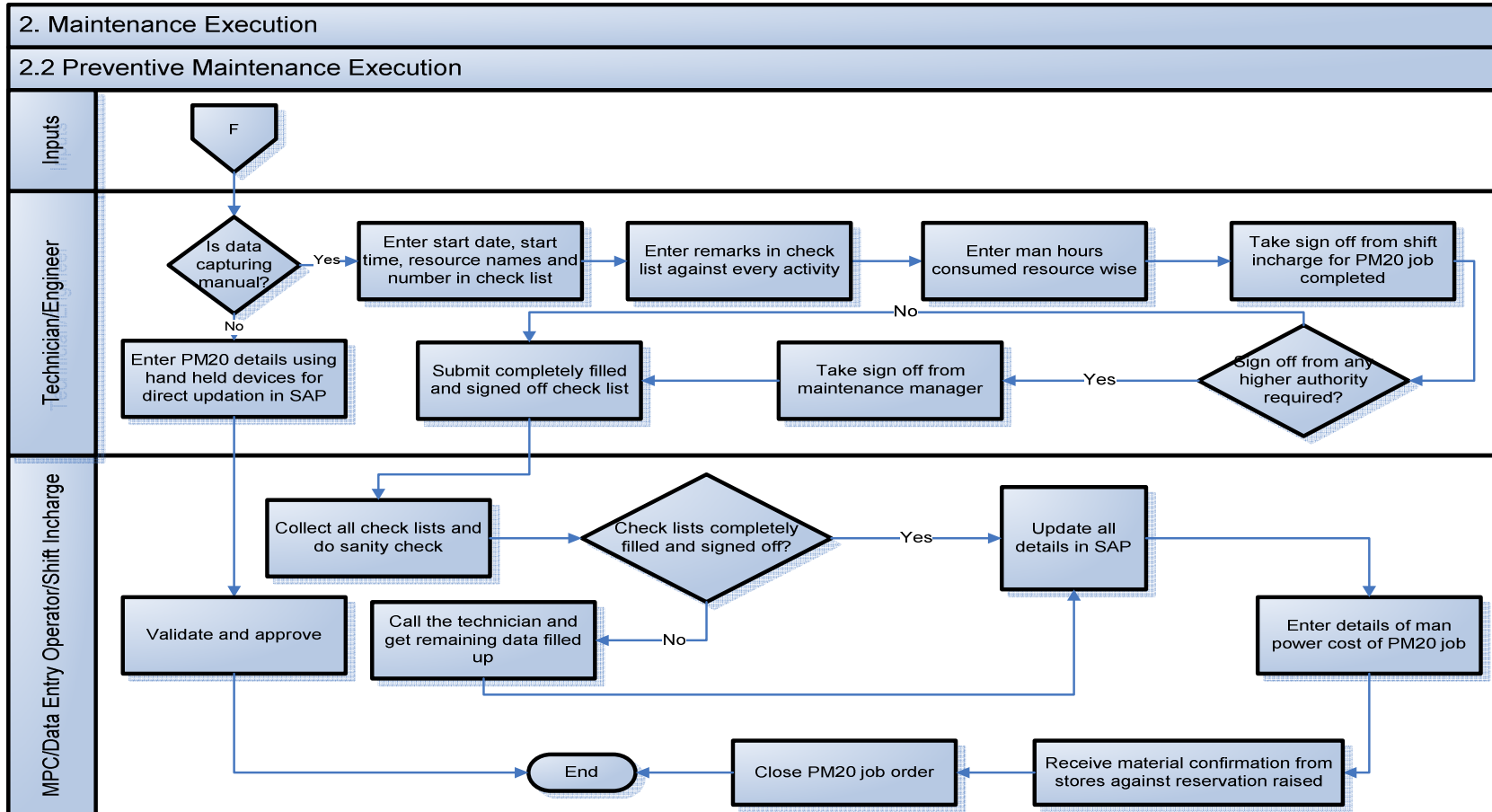
2. Maintenance Execution

2.2 Preventive Maintenance Execution



AM 2.2: Preventive Maintenance Execution

AM 2.2: Preventive Maintenance Execution – Process Map



AM 2.2: Preventive Maintenance Execution –Process Details

- Operations Shift In charge shall confirm availability of equipment from operations on the day of maintenance as follows:

A.) In case the PM20 job is frequency based:

- a) Confirm the availability of equipment from operations by a phone call
 - b) If the equipment is available, generate a work permit (if required) and the work order through SAP
 - c) Hand over work permit and work order to the engineer/technician to initiate the PM20 job execution
 - d) Receive the equipment from operations Incharge for maintenance and provide a tentative time for which equipment shall be under maintenance.
 - e) Operations Incharge should ensure that equipment is provided to maintenance after basic cleaning of equipment.
 - f) Complete the PM20 execution as per the activities mentioned in the standard checklist
 - g) Check if there is any critical activity remark carried from previous scheduled maintenance (PM20/10) a day prior to actual execution of job
 - h) If there is any, conduct the critical remark activity first and then complete the usual course of PM20 / 10 job
 - i) In case of a breakdown, if any QRT member is performing the PM20 job, he shall move out to attend the breakdown and other members of PM20 team shall inform shift in charge for allotting a new resource.
 - j) Once the PM20 job is completed, enter the complete details of job in the standard check list
-
- k) The details to be entered are as following and detailed out in attached picture:
 - Equipment Detail
 - Standard hours of PM20 job
 - Scheduled and actual start date of PM20 job
 - Start time and end of PM20 job

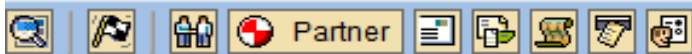
- Material consumed in PM20 job
 - Number and names of resources deployed in breakdown maintenance execution (Manpower tagging at job level being given as a SAP requirement)
 - Total man hours consumed for breakdown
 - Remarks against every individual activity of PM20 job
- l) Take a sign off from higher authority if required
 - m) Handover the completely filled check list to MPC data operator
 - n) MPC operator to do a sanity check of check list and call back the operator to fill any pending detail in check list
 - o) MPC data operator shall enter the details into SAP only once all the details in check list are completely filled.

B.) In case the PM20 job is actual running hours based:

- a) Shift in charge shall confirm the availability of equipment from operations by a phone call
- b) If the equipment is available, check if the scheduled hours of maintenance have been completed or not
- c) If the scheduled hours for maintenance are completed, take the equipment for maintenance from operations and generate a work permit (if required) and work order
- d) Hand over the work permit and work order to the engineer/technician to initiate the PM20 job execution
- e) Complete the PM20 execution as per the activities mentioned in the standard checklist
- f) Before starting the usual course of maintenance job, check if there is any critical activity remark carried from previous scheduled maintenance (PM20/10)
- g) If there is any, conduct the critical remark activity first and then complete the usual course of PM20 / 10 job
- h) In case of a breakdown, if any QRT member is performing the PM20 job, he shall move out to attend the breakdown and other members of PM20 team shall inform shift in charge for allotting a new resource.
- i) Once the PM20 job is completed, enter the complete details of job in the standard check list

- j) The details to be entered are as following which are detailed out in attached picture:
- Equipment Detail
 - Standard hours of PM20 job
 - Scheduled and actual start date of PM20 job
 - Start time and end of PM20 job
 - Material consumed in PM20 job
 - Number and names of resources deployed in breakdown maintenance execution
 - Total man hours consumed for breakdown
 - Remarks against every individual activity of PM20 job
- k) Take a sign off from higher authority if required
- l) Handover the completely filled check list to MPC data operator
- m) MPC operator to do a sanity check of check list and call back the operator to fill any pending detail in check list
- n) MPC data operator shall enter the details into SAP only once all the details in check list are completely filled

Change PM Notification: Maint. Notification



Notification 10051145 N1 Main/LIB-03 Engine lug down during hoist
 Notific. Status NOPR ORAS
 Order 50007567

Notification Documents Malfunction, breakdown Location data Scheduling overview

Reference object

Functional loc. 2002-QUA2-MHSY-LB03 LIBHEF FOUR CRANE 3
 Equipment 10007993 F/LIB 3
 Assembly

Subject

Coding GND Equipment
 Description Main/LIB-03 Engine lug down during hoist

25.09.2012 11:44:39 Mr Shivabhai Deriya (30007646)
 Lib-3 hold due to Air filter jam
 25.09.2012 17:03:42 Deepak Parmar (20186123)
 Replac/LIB-03 Fuel & Air filter chalk so remove and new filter
 change
 11.10.2012 16:11:07 Sandip Patil (20185958)
 ing & Lowering operation
 11.10.2012 16:22:05 Sandip Patil (20185958)
 Break Down Statement : Engine lug down during the hoisting operation

Responsibilities

Planner group MHS / 2001 Mat. Handling Sys.
 Main WorkCtr PMS-MHS / 2001 MAINTENANCE TEAM MATERIAL HANDLING SYS.
 Reported by SMITESH Notif.date 24.09.2012 22:30:00

Start/End Dates

Required Start 24.09.2012 22:30:00 Priority 1-Very high

For illustration only

AM 3.3 : Preventive Maintenance Execution

Supplier-Input-Process-Output Framework

Supplier	Input	Process	Output	Customer
Shift In charge	Day wise maintenance schedule	1. Confirm equipment availability from operations on PM20/10/30 date on phone	Resource allocation and material issue	Maintenance Team
Shift In charge	Day wise maintenance schedule	2. Is equipment available on date and time of PM20/10/30?	Resource allocation and material issue	Maintenance Team
		3. Is PM job hours based?		
		4. Are scheduled hours completed?		
Shift In charge	Scheduled hours incomplete status	5. Do not generate job order		
Engineer	Equipment run hours status	6. Update non availability and pending hours status of equipment in SNP shift wise	SNP	Maintenance Department
		7. Is there a need of a work permit?		
Engineer	Equipment run hours status	8. Update availability time on same day on SNP shift wise	SNP	Maintenance Department
		9. Generate work permit		

		through SAP		
		10. Handover the job order & work permit to engineer/technician		
Maintenance Team	PM20/10/30 completed checklists of maintenance information	11. Schedule pending PM20/10/30 at earliest available time	Signed PM20/10/30 checklists	MPC data operator
		12. Any previous PM20/10/30 / condition monitoring activity to be done?		
Engineer	Critical remark	13. Conduct critical remark activity	Critical activity done	
Engineer	Checklist	14. Execute the job as per defined checklist 15. Any breakdown simultaneous to the PM20/10/30 job?	Completed checklist	Maintenance Team
		16. QRT member part of PM20/10/30 team?		
Shift In charge	Breakdown intimation	17. Assign QRT member to breakdown	New resource	QRT
Shift In charge	Breakdown intimation	18. Allot a substitute	New resource	QRT
		19. Is data capturing manual?		
Engineer	Breakdown details	20. For Manual - Enter start date, start time, resource names and	PM information in check lists	SAP

		number in check list		
Engineer	Breakdown details	21. Enter remarks in check list against every activity	PM information in check lists	SAP
Engineer	Breakdown details	22. Enter man hours consumed resource wise	PM information in check lists	SAP
Engineer	Breakdown details	23. Take sign off from shift Incharge for PM20/10/30 job completed	PM information in check lists	SAP
		24. Sign off from any higher authority required?		
Engineer	Breakdown details	25. Take sign off from maintenance manager	PM information in check lists	SAP
Engineer	Breakdown details	26. Submit completely filled and signed off check list	PM information in check lists	SAP
Engineer	Pm job check lists	27. Collect all check lists and do sanity check	Verified check lists	SAP data operator
Engineer	Pm job check lists	28. Call the technician and get remaining data filled up	Verified check lists	SAP data operator
SAP data operator	PM job orders	29. Update all details in SAP	PM job orders closed in SAP	SAP
SAP data operator	PM job orders	30. Enter details of man power cost of PM20/10/30 job	PM job orders closed in SAP	SAP
SAP data	PM job orders	31. Receive material confirmation from	PM job orders	SAP

operator		stores against reservation raised	closed in SAP	
SAP data operator	PM job orders	32. Close PM20/10/30 job order	PM job orders closed in SAP	SAP
Engineer	PM job information by hand held devices	33. Automatic - Enter PM20/10/30 details using hand held devices for direct updation in SAP	PM job orders detail in SAP	SAP

AM 2.2: Preventive Maintenance Execution –RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
2.2 Preventive Maintenance Execution				
1. Confirm equipment availability from operations on PM20/10/30 date on phone	MPC planning manager/Maintenance planner	HOD	Operations	Shift In charge
2. Is equipment available on date and time of PM20/10/30?	MPC planning manager/Maintenance planner	HOD	Operations	Shift In charge
3. Is PM job hours based?	MPC planning manager/Maintenance planner	HOD	Operations	Shift In charge
4. Are scheduled hours completed?	MPC planning manager/Maintenance planner	HOD	Operations	Shift In charge

	nce planner			
5. Do not generate job order	MPC data operator	MPC planning manager/ Maintenance planner	MPC planning manager/ Maintenance planner	MPC planning manager/ Maintenance planner
6. Update non availability and pending hours status of equipment in SNP shift wise	MPC planning manager/ Maintenance planner	HOD	Operations	Shift In charge
7. Is there a need of a work permit?	Shift In charge	Head of Section	HOS	Maintenance engineer
8. Update availability time on same day on SNP shift wise	MPC planning manager/Main tenance planner	HOD	Operations	Shift In charge
9. Generate work permit through SAP	MPC data operator	NA	NA	NA
10. Handover the job order & work permit to engineer/technician	MPC data operator	NA	NA	NA
11. Schedule pending PM20/10/30 at earliest available time	planning manager/Maint enance planner	HOD	Operations	Shift In charge
12. Any previous PM20/10/30 / condition monitoring activity to be done?	Maintenance Engineer	Shift in charge	Previous PM20/10/30 remarks	

13. Conduct critical remark activity	Maintenance Engineer	Shift in charge	Previous PM20/10/30 remarks	
14. Execute the job as per defined checklist	Maintenance Engineer	Shift in charge	Previous PM20/10/30 remarks	
15. Any breakdown simultaneous to the PM20/10/30 job?				
16. QRT member part of PM20/10/30 team?	NA	NA	NA	NA
17. Assign QRT member to breakdown	Shift in charge	HOS	NA	PM20/10/30 team QRT
18. Allot a substitute	Shift in charge	HOS	NA	PM20/10/30 team QRT
19. Is data capturing manual?				
20. For Manual - Enter start date, start time, resource names and number in check list	PM20/10/30 team	Shift in charge	NA	Shift in charge
21. Enter remarks in check list against every activity	PM20/10/30 team	Shift in charge	NA	Shift in charge
22. Enter man hours consumed resource wise	PM20/10/30 team	Shift in charge	NA	Shift in charge
23. Take sign off from shift Incharge for PM20/10/30 job	PM20/10/30 team	Shift in charge	NA	Shift in charge

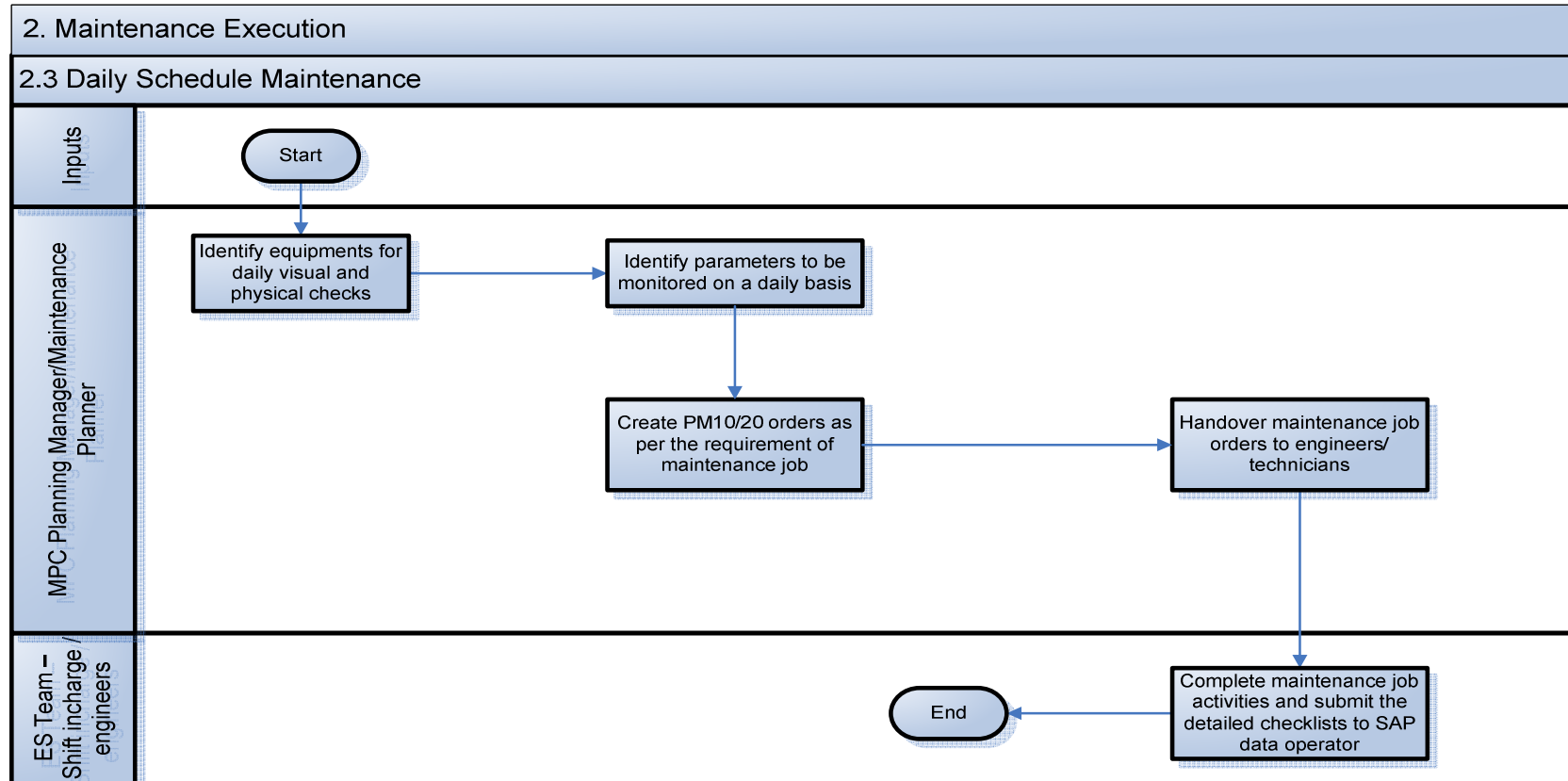
completed				
24. Sign off from any higher authority required?	PM20/10/30 team	Shift in charge	Shift in charge	HOS
25. Take sign off from maintenance manager	PM20/10/30 team	Shift in charge	Shift in charge	HOS
26. Submit completely filled and signed off check list	PM20/10/30 team	Shift in charge	Shift in charge	MPC data operator
27. Collect all check lists and do sanity check	MPC data operator	MPC planning manager/Maintenance planner	Shift in charge	PM20/10/30 team
28. Call the technician and get remaining data filled up	MPC data operator	MPC planning manager/Maintenance planner	Shift in charge	PM20/10/30 team
29. Update all details in SAP	MPC data operator	MPC planning manager/Maintenance planner	Shift in charge	PM20/10/30 team
30. Enter details of manpower cost of PM20/10/30 job	MPC data operator	MPC planning manager/Maintenance planner	Shift in charge	PM20/10/30 team
31. Receive material confirmation from stores against reservation raised	MPC data operator	MPC planning manager/Maintenance planner	stores	Shift in charge
32. Close PM20/10/30 job order	MPC data operator	MPC planning manager/Maintenance planner		Shift in charge MPC planning manager/Maintenance planner

33. Automatic - Enter PM20/10/30 details using hand held devices for direct updation in SAP	PM 20 team	Shift in charge		Shift in charge
34. Validate and approve	MPC data operator	MPC planning manager/Maintenance planner	PM20/10/30 team	Shift in charge MPC planning manager/Maintenance planner PM20/10/30 team

AM 2.2: Preventive Maintenance Execution –Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Confirm equipment availability from operations on PM20/10/30 date on phone	Risk of miscommunication between maintenance and operations leading to wrong information	Maintenance should ensure the equipment to be taken up for maintenance job before asking operations
2.	Update non availability and pending hours status of equipment in SNP shift wise	Risk of missing to update the pending hours status on SNP	Instant uploading of pending hours status on SNP by maintenance team
3.	Operations shall update availability time on same day on SNP shift wise	Risk of missing to update availability time on SNP	Instant uploading of availability time on SNP by operations team

4.	Generate work permit through SAP	Documentation work might lead to increased time for maintenance	Generate work permit only for jobs for which it is strictly required
5.	Conduct critical remark activity	Chances of missing to conduct any critical remark activity leading to failure	PM20/10/30 team to strictly check out for any critical activity to be conducted before starting the PM20/10/30 job
6.	Assign QRT member to breakdown	Increase in PM20/10/30 execution time due to allotment of new resource / expert resource requirement for scheduled job	PM20/10/30 job allotment to QRT should be done taking breakdown maintenance into account
7.	Allot a substitute	Increase in PM20/10/30 execution time due to allotment of new resource / expert resource requirement for scheduled job	PM20/10/30 job allotment to QRT should be done taking breakdown maintenance into account
8.	For Manual - Enter start date, start time, resource names and number in check list	Risk of missing any critical information to be recorded	Complete sanity check by SAP data operator before closing the job
9.	Automatic - Enter PM20/10/30 details using hand held devices for direct updation in SAP	Risk of failure of hand held devices at the time of maintenance job execution	Maintenance team to keep a hardcopy of checklist as a back up
10.	MPC data operator- Validate and approve	Risk of missing any critical detail to be recorded in SAP	Complete field by field sanity check to be done by SAP data operator before starting updating of information to SAP

AM2.3: Daily Schedule Maintenance*AM2.3: Daily Schedule Maintenance - Process Map*

Note: The type of order (PM 20 or PM10) to be generated by individual departments as per their requirements and applicability.

AM2.3: Daily Schedule Maintenance - Process Details

- a) Maintenance Planner/MPC manager shall identify the equipment to taken up for daily maintenance check based on OEM instructions
- b) Identify the parameters to be monitored on a daily basis
- c) Maintenance Planner/MPC manager shall generate & hand over the work permit and work order to the engineer/technician to initiate the daily maintenance job execution
- d) Complete the daily maintenance execution as per the activities mentioned in the standard checklist
- e) Before starting the usual course of maintenance job, check if there is any critical activity remark carried from previous scheduled maintenance (PM20/10)
- f) If there is any, conduct the critical remark activity first and then complete the usual course of daily maintenance job order
- g) In case of a breakdown, if any QRT member is performing the daily maintenance job, shall move out to attend the breakdown and other members of ongoing daily maintenance team shall inform shift in charge for allotting a new resource.
- h) Once the job is completed, enter the complete details of job in the standard check list
- i) The details to be entered are as following which are detailed out in attached picture:
 - Equipment Detail
 - Standard hours of PM10 job
 - Scheduled and actual start date of PM10 job
 - Start time and end of PM10 job
 - Total man hours consumed for breakdown
 - Remarks against every individual activity of PM10 job
 - Name and signature of engineer who conducted the job
- j) Take a sign off from higher authority if required
- k) Handover the completely filled check list to MPC data operator
- l) MPC operator to do a sanity check of check list and call back the operator to fill any pending detail in check list
- m) MPC data operator shall enter the details into SAP only once all the details in check lists are completely filled.

AM2.3: Daily Schedule Maintenance - SIPOC Framework

Supplier	Input	Process	Output	Customer
OEM	Daily checks instructions	1. Identify equipment for daily visual and physical checks 2. Identify parameters to be monitored on a daily basis	Daily checks report	ES department
ES-MPC planning manager/Maintenance planner	Breakdown analysis report		Daily checks to be done	ES department
		3. Can visual checks be done without stopping the equipment?		
ES-MPC planning manager/Maintenance planner	Daily maintenance job list	4. Create job orders on daily basis	PM10 job order	Engineer
SAP data operator	Daily Maintenance schedule	5. Handover job orders to engineers/technicians	PM10 job order	Engineer
Engineer	PM10 job order	6. Conduct job activities and submit the detailed checklists to SAP data operator	Daily Maintenance job order completed	SAP data operator
SAP data operator	Instructions from Shift in charge	7. Create PM job orders for required visual inspections	Daily Maintenance job order	Engineer

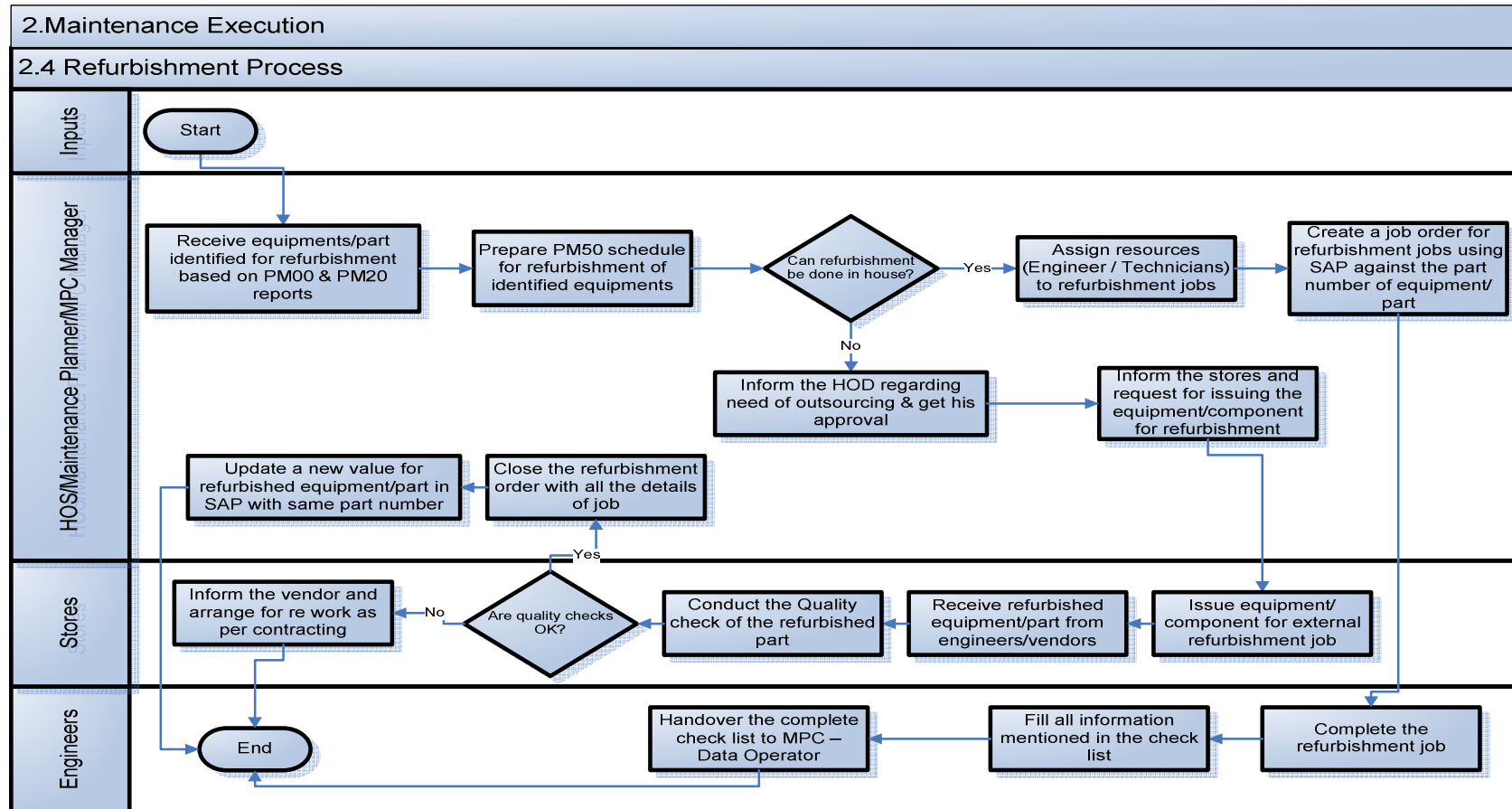
AM2.3: Daily Schedule Maintenance - RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
2.3 Daily Schedule Maintenance				
1. Identify equipment for daily visual and physical checks	Shift in charge	HOS	MPC planning manager/ Maintenance planner	Engineer
2. Identify parameters to be monitored on a daily basis	MPC planning manager/Maintenance planner/Maintenance Planner	HOD	HOS/ Shift in charge	Shift in charge
3. Create daily maintenance orders on daily basis	MPC data operator	MPC planning manager/Maintenance planner		
4. Handover job orders to engineers/technicians	Shift in charge	HOS		Engineers
5. Conduct job activities and submit the detailed checklists to SAP data operator	Engineers	Shift in charge	Operators	Shift in charge
6. Create PM20 job orders for required visual inspections	MPC data operator	MPC planning manager/Maintenance planner		Engineer

AM3.4: Daily Schedule Maintenance - Risks & Controls

Process Tag	Activity Description	Risks	Controls
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1.	Identify equipment for daily visual and physical checks	Risk of missing any critical equipment to be monitored for visual checks	List of equipment to be reviewed regularly based on PM20 & PM00 reports
2.	Identify parameters to be monitored on a daily basis	Risk of missing any critical parameter to be monitored on daily basis	List of parameters to be reviewed regularly based on PM20 & PM00 reports
3.	Can visual checks be done without stopping the equipment?	Incomplete visual checks due to movement of equipment / risk of any physical injury due to moving equipment	Clearly identify the jobs which require stationary vehicle
4.	Create PM20 job orders for required visual inspections where equipment need to be stopped	Chances of creating non required PM20 job orders	Clearly identify the jobs which require stationary vehicle

AM2.4: Refurbishment Process*AM2.4: Refurbishment Process - Process Map*

Refurbishment Process: A process where a part or equipment is undertaken for complete over hauling and brought back to the stores and system to be used a new part. Before consuming new part, a refurbished part to be used first.

AM2.4: Refurbishment Process - Process Notes

- a) MPC manager/Maintenance Planner shall receive the list of equipment which have to be taken up for refurbishment based on PM20 remarks and breakdown reports
- b) MPC manager/Maintenance Planner shall also receive the details of refurbishment work to be done for the received equipment
- c) MPC manager/Maintenance Planner shall identify if the refurbishment activity can be done in house or needs to be outsourced
- d) In case, material is repairable and refurbishment can be done in house, inform the shift in charge about the refurbishment jobs to be performed
- e) MPC manager/Maintenance Planner shall assign the resources for the refurbishment job in conjunction with shift in charge
- f) Shift In charge shall create a job order for refurbishment jobs using SAP against the part number of equipment/part
- g) Engineers / Technicians shall take the work order from the shift in charge and conduct the refurbishment activity
- h) HOS – ES shall ensure that the refurbishment job is done in general shift as the norm
- i) Manager – ES / Shift In charge shall receive the confirmation of completion of refurbishment job from engineers/technician
- j) HOS/shift in charge shall conduct the quality check of refurbished part and certify the job
- k) SAP team shall update the refurbished part in system with same number but new location.
- l) The new value of refurbished part shall be identified and updated to system.
- m) In case, the material is rotatable and refurbishment job is cannot be done in house, shift in charge shall raise a request for outsourcing of refurbishment job to HOS - ES
- n) HOS-ES shall make a contract of outsourced job of refurbishment with identified external vendor after consultation with HOD and if required Maintenance Planner
- o) Shift In charge/Stores shall confirm the receipt of refurbished equipment / part to HOS - ES
- p) Shift In charge along with HOS to conduct the quality check of the refurbished part and provide the fitness certificate
- q) In case, the refurbished part does not pass the quality checks, the HOS shall inform the HOD and then to vendor to decide the further action item as per the contracting done with vendor

- r) Once the refurbished part clears the quality check, SAP team shall update the refurbished part in system with same number but new location.

AM2.4: Refurbishment Process - SIPOC Framework

Supplier	Input	Process	Output	Customer
Equipment operator	Equipment failure information	1. Receive equipment/part identified for refurbishment based on PM00 & PM20 reports	Equipment Health check up	Maintenance department
Maintenance department	Feedback on equipment's health	2. Prepare PM50 schedule for refurbishment of identified equipment	Decision on refurbishment process	Maintenance department / external vendor
Maintenance department	Refurbished equipment / part information	3. Can refurbishment be done in house?	Material code for refurbished item	Stores / Maintenance department
		4. Yes - Assign resources (Engineer / Technicians) to refurbishment jobs		
SAP data operator	Feedback on refurbishment	5. Create a job order for refurbishment jobs using SAP against the part number of equipment/part	Refurbishment job order	Engineer
Shift In charge	Refurbishment	6. Complete the	Completed	Maintenance

	job order	refurbishment job	refurbishment job order	Department
Engineer	Job order details	7. Fill all information mentioned in the check list	Filled check list	SAP data operator
SAP data operator	Filled check list	8. Receive refurbished equipment/part from engineers/vendors	Closed refurbishment order	SAP
SAP data operator	Filled check list	9. Close the refurbishment order with all the details of job	Closed refurbishment order	SAP
Shift In charge	Refurbished part's details	10. Get a new part number for refurbished equipment/part in SAP	New part number for refurbished part	Stores
Engineer	Job order details	11. Handover the complete check list to MPC – Data Operator	Filled check list	SAP data operator
Shift In charge	Requirements of refurbishment job	12. No - Inform the Manager regarding need of outsourcing & get his approval	Decision if the job can be done in house	HOS/HOD
Shift In charge	Approval from HOS/HOD	13. Outsource the equipment/part for refurbishment to external	Outsourced contract with external vendor	External Vendor

		vendor		
		14. Perform as mentioned before from step 8.		

AM2.4: Refurbishment Process - RACI Matrix

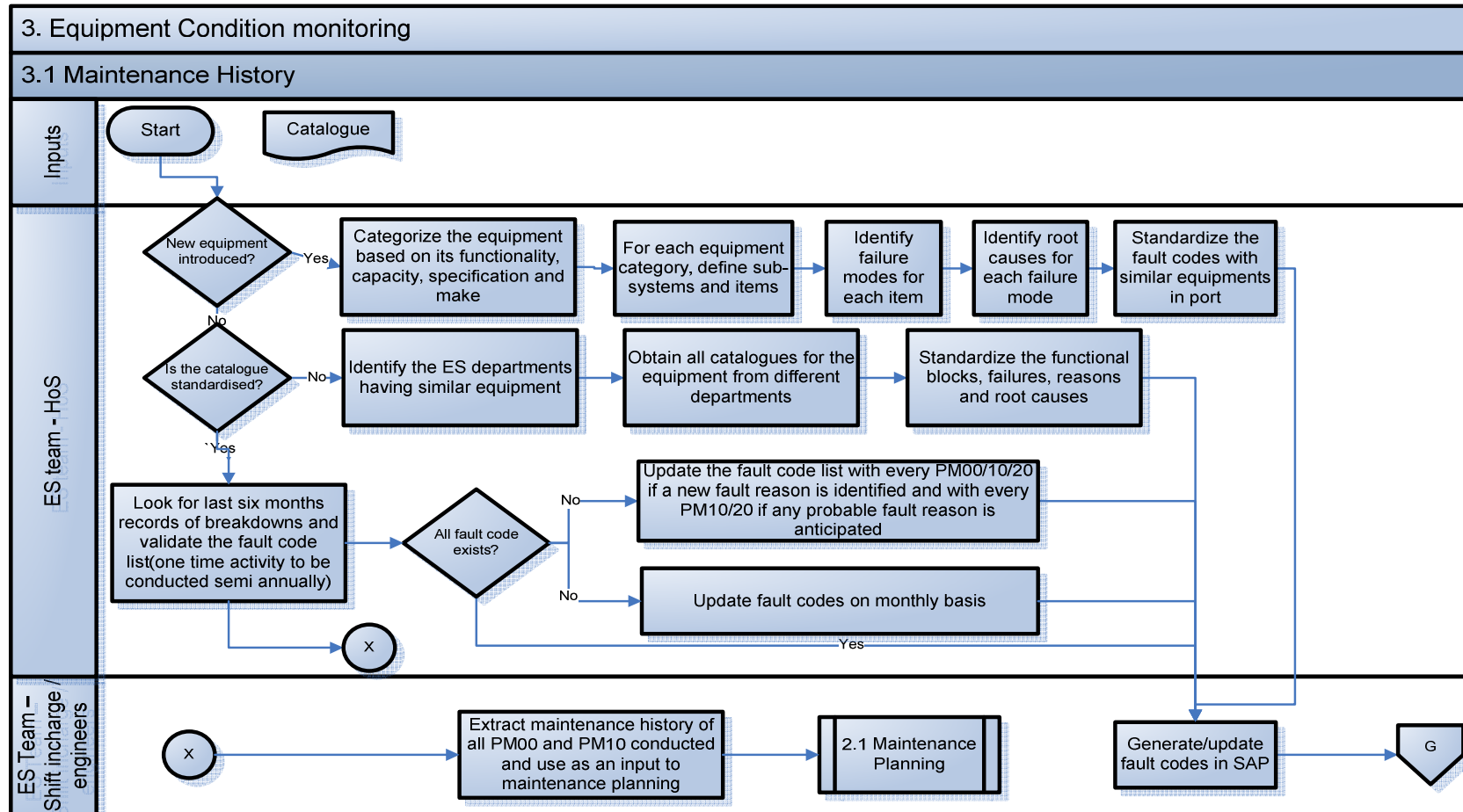
Process Step	Responsible	Accountable	Consult	Inform
2.4 Refurbishment Process				
1. Receive equipment/part identified for refurbishment based on PM00 & PM20 reports	HOS	HOD	MPC planning manager/Maintenance planner/Maintenance Planner	HOD
2. Prepare PM50 schedule for refurbishment of identified equipment	Shift In charge	HOS	HOS	HOS/HOD
3. Can refurbishment be done in house?	Shift In charge	HOS	HOS	HOS/HOD
4. Yes - Assign resources (Engineer / Technicians) to refurbishment jobs	Shift In charge	HOS	HOS	HOS/HOD Engineers
5. Create a job order for refurbishment jobs using SAP against the part number of	MPC data operator	MPC planning manager/Maintenance planner	Shift In charge	Shift In charge

equipment/part				
6. Complete the refurbishment job	Engineers	Shift In charge	Shift In charge	Shift In charge
7. Fill all information mentioned in the check list	Engineers	Shift In charge	Workshop supervisor	MPC data operator Shift In charge
8. Receive refurbished equipment/part from engineers/vendors	Shift In charge	HOS		HOS/HOD
9. Close the refurbishment order with all the details of job	MPC data operator	MPC planning manager/Maintenance planner	Engineers / Shift In charge	Shift In charge
10. Get a new part location for refurbished equipment/part in SAP	HOS	HOD	SAP team	HOD/Shift In charge
11. Handover the complete check list to MPC – Data Operator	Engineers	Shift In charge	Shift In charge	MPC data operator Shift In charge
12. No - Inform the Manager regarding need of outsourcing & get his approval	Shift In charge	HOS	Engineers Workshop supervisor Stores	HOS
13. Outsource the equipment/part for refurbishment to external vendor	HOS	HOD	Shift In charge HOD	External Vendor HOD
14. Perform as mentioned before from step 8.				

AM2.4: Refurbishment Process - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Receive equipment/part identified for refurbishment based on PM00 & PM20 reports	Refurbishing equipment which could be taken up for PM20 jobs	Defining the criteria for all equipment to be taken up for refurbishment job
2.	Prepare PM50 schedule for refurbishment of identified equipment	Increased cost and repair time due to outsourcing by creating non required PM50 job orders	Defining the criteria for all jobs for which PM50 order needs to be generated
3.	Can refurbishment be done in house?	Increased time and cost for refurbishment due to wrong assessment of refurbishment job complexity	Develop framework to classify in house vs. outsourced refurbishment jobs
4.	Create a job order for refurbishment jobs using SAP against the part number of equipment/part	Increased cost and repair time due to outsourcing by creating non required PM50 job orders	Defining the criteria for all jobs for which PM50 order needs to be generated
5.	Manager ES-Close the refurbishment order with all the details of job	Chances of closing the work order with old part number	Confirm the new part number from IT department before closing the order
6.	Get a new part location for refurbished equipment/part in SAP	Risk of duplicity of same equipment / component with 2 part numbers	Ensure that refurbished equipment/component has been entered with new part number and old part number is out of system.

7.	No - Inform the Manager regarding need of outsourcing & get his approval	Chances of outsourcing a job which could be taken up internally only	Manager to ensure the necessity of outsourcing the job before approving the request
8.	Outsource the equipment/part for refurbishment to external vendor	Chances of outsourcing the job in less cost effective manner	Thoroughly analyze the quotations sent by external vendors before finalizing any vendor

AM3.0: Equipment Condition Monitoring*AM 3.1: Maintenance History – Process Map*

**Every PM00/20/10 job shall be TECOed in SAP within a day's time from completion of job to avoid any backlogs*

AM3.1: Maintenance History – Process Notes

- a) For equipment which have been procured / commissioned for the first time, new catalogues would have to be created.
- b) An equipment is to be divided into logical sub-assemblies and mapped as a functional location with sub-assemblies as its sub-functional locations in SAP
- c) Map the object group and included object parts for each sub assembly in SAP and identify the possible failure modes for each object part.
- d) Further enlist the root causes for these failure modes
- e) Establish a final fault code catalog for the equipment. Same catalog to be used for all similar equipment.
- f) For existing equipment, if a standard fault code catalog exists in system, replicate and map it to the equipment.
- g) If a standard fault code catalog does not exist, obtain applicable fault code catalogues for similar equipment from other departments, modify and map to the equipment after standardization.
- h) Review for new fault codes / root cause on a monthly basis; if a new fault code emerges, update the relevant fault code catalogue.

OR

- i) Update the fault code list with every PM00/10/20 if a new fault reason is identified and with every PM10/20 if any probable fault reason is anticipated

AM3.1: Maintenance History – SIPOC Framework

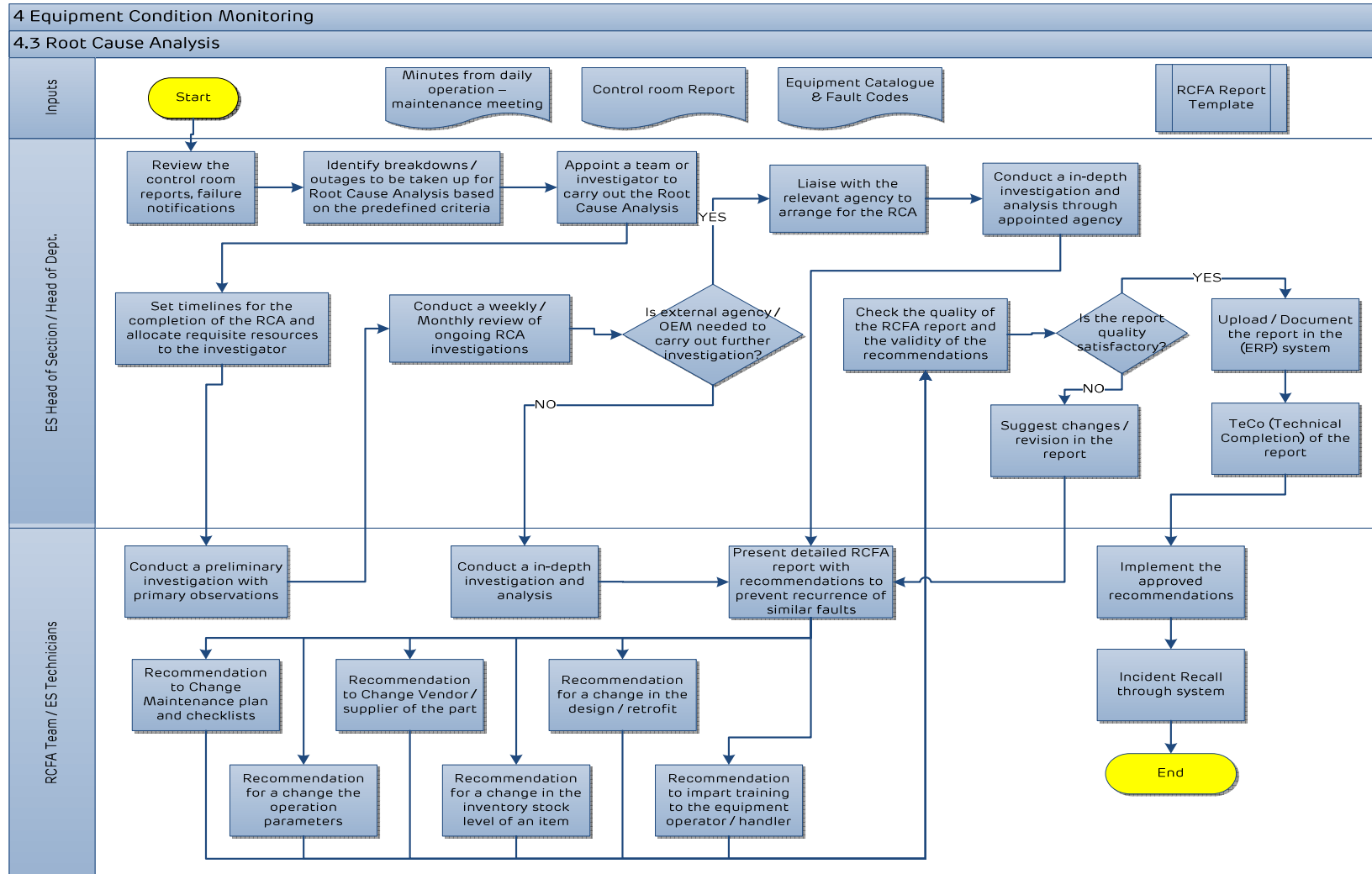
Supplier	Input	Process	Output	Customer
Maintenance Engineer	Fault Code Catalogues	4.2 Maintenance History	Maintenance History Log Root Cause Failure Analysis Report	Head of Section Head of Department

AM3.1: Maintenance History – RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
3.1 Maintenance History				
1. Categorize equipment, divide into sub-assemblies, object group, object parts	Head of Section	Head of Section	Equipment Engineer	Head of Department
2. Identify Failure modes, causes, create a fault code catalogue	Head of Section	Head of Section	Equipment Engineer	
3. Obtain similar fault code catalogues from other departments	Head of Section	Head of Section	Equipment Engineer	Head of Department
4. Incorporate new fault codes on a monthly basis	Equipment Engineer	Head of Section		
5. Update fault code catalogues on a monthly basis	Equipment Engineer	Head of Section		

AM3.1: Maintenance History – Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Categorize equipment, divide into sub-assemblies, object group, object parts	Maintaining homogeneity across object groups and object parts of similar components in different equipment	Use of standardized templates for object group and parts
2.	Identify Failure modes, causes, create a fault code catalogue		
3.	Obtain similar fault code catalogues from other departments	Unavailability may necessitate development of new catalogues	HoS / HoD to facilitate development of new catalogs
4.	Incorporate new fault codes on a monthly basis	Distinction between cause and damage may be unclear	Discuss with HoS / HoD while incorporating new fault codes. Apply definition to distinguish between them
5.	Update fault code catalogues on a monthly basis	Non compliance	HoD / HoS to review monthly Root Cause Analysis reports and ensure catalog updation

AM3.1: Root Cause Analysis*AM3.2: Root Cause Analysis - Process Map*

AM3.2: Root Cause Analysis - Process Details

- a) The Head of Department along with the team shall identify the major breakdowns from the daily report of the control room based on the following criteria:
 - a) Any breakdown which results in an effective operation stoppage for 2 hours or more than 2 hours during a shift operation
(and /or)
 - b) Any breakdown which involves a maintenance cost of more than INR 2,00,000/- (Rupees Two Lac)
- b) Head of the department shall nominate an investigator / team of investigators to conduct a preliminary investigation and analysis of available data
- c) Head of the department shall set timelines for completion of the root cause failure analysis and allocate necessary resources to the investigator / team to conduct the analysis.
- d) The investigator / team to conduct a preliminary assessment of the breakdown and present its findings to the head of department during (weekly / monthly) review.
- e) If external expertise from the OEM is required, the team / HoD to establish contact and liaise with the expert to conduct an in-depth analysis. If external expertise is not needed the team shall continue the investigation as per set timelines,
- f) The Head of the Department shall review the findings of the analysis and recommendations thereof as per the set timelines.
- g) All recommendations and changes proposed to prevent future recurrences should result in one or more of the following:
 - i. Change in the equipment design / retrofitting
 - ii. Change in the maintenance schedules / check lists
 - iii. Revision of the operating parameters
 - iv. Addition of spares to stock
 - v. Conducting training for the technicians and operators
 - vi. Changing the vendor
- h) The analysis including investigation, observations, corrective action and prevention plan is to be formally documented in a standardized root cause failure analysis template and attached with the respective work order or notification order. (Refer annexure for template).
- i) The template is to be mandatorily documented for all root cause failure analyses carried out.
- j) The Head of the Department shall review the quality of the investigation and report prepared. In case of deficiencies or short falls the recommendations from the HoD are to be incorporated and a revised report shall be submitted.
- k) The HoD shall then approve the analysis conducted and shall formally TeCo (Technical Completion) the report in SAP.
- l) In case of a design change / retrofit, the engineer has to initiate a design change request which is to be approved by the HoD. Upon approval, the revised design / drawings are to be formally documented and the technical manuals are to be updates with the revised drawings.

- m) In case of a maintenance schedule modification, the engineer is to prepare a revised maintenance schedule / check list. After the approval of the HoS/ HoD the revised maintenance schedule is to be uploaded in SAP.
- n) In case of revision of the operating parameters the operators and technicians to be intimated of the revised values of the parameters. Same to be updated in the maintenance check lists and monitoring systems.
- o) In case of addition of spares to stock, the engineer to prepare a quarterly estimation of the stock levels needed for the spare(s). PR to be raised for procurement of additional stock (if needed).
- p) In case of training requirement for technicians and operators, the same to be organized through the HoD/HoS and HR technical training cell.
- q) In case a decision is taken to change the vendor, the commercial team to be involved by the HoD/ HoS to find / suggest a suitable vendor to supply the spares.
- r) Major Root Cause Failure Analyses which are of significance to other engineering departments operating / maintaining similar assets are to be recalled from the system and shared with those concerned during Quarterly Engineering Forums through the CoE.

Exceptions

- 1) In case of outages / breakdowns which do not satisfy the criteria in Step 1 of the process, but are deemed fit to qualify for a root cause failure analysis due to repetitive nature or any other reason the Head of Department may authorize a root cause analysis in such cases as well
- s) The criteria described in Step 1 of the Process shall be parameterized in SAP and can be modified to account for variations owing to location based peculiarities or during annual procedure reviews.

AM3.2: Root Cause Analysis - SIPOC Framework

Supplier	Input	Process	Output	Customer
Maintenance Engineer	Fault Code Catalogues	4.3 Root Cause Analysis	Root Cause Failure Analysis Report	Head of Section Head of Department

AM3.2: Root Cause Analysis - RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
3.2 Root Cause Analysis				
1. Generate breakdown reports, identify and shortlist major breakdowns for RCA	Head of Section	Head of Section		Head of Department
2. Conduct initial diagnosis and analysis of the breakdown	Equipment Engineer	Head of Section	Head of Department	Head of department
3. Identify corrective action	Equipment Engineer	Head of Section	Head of Department	Head of department
4. Select team to execute the corrective action	Equipment Engineer	Head of Section	Head of Department	Head of department
5. Define timelines and secure funding	Head of section	Head of Section		Head of Department
6. Perform the corrective action	Technicians	Equipment Engineer	Head of section	Head of Department
7. Creation of the root cause analysis report (MS Word / SAP)	Equipment Engineer	Equipment Engineer	Head of Section	Head of Department
8. Conduct a monthly inter-departmental meeting to share the outcomes of analyses	Head of MPC	Head of MPC		
9. Inclusion of major findings in tool talks	Shift Incharge	Equipment Engineer	Head of Section	Head of Department

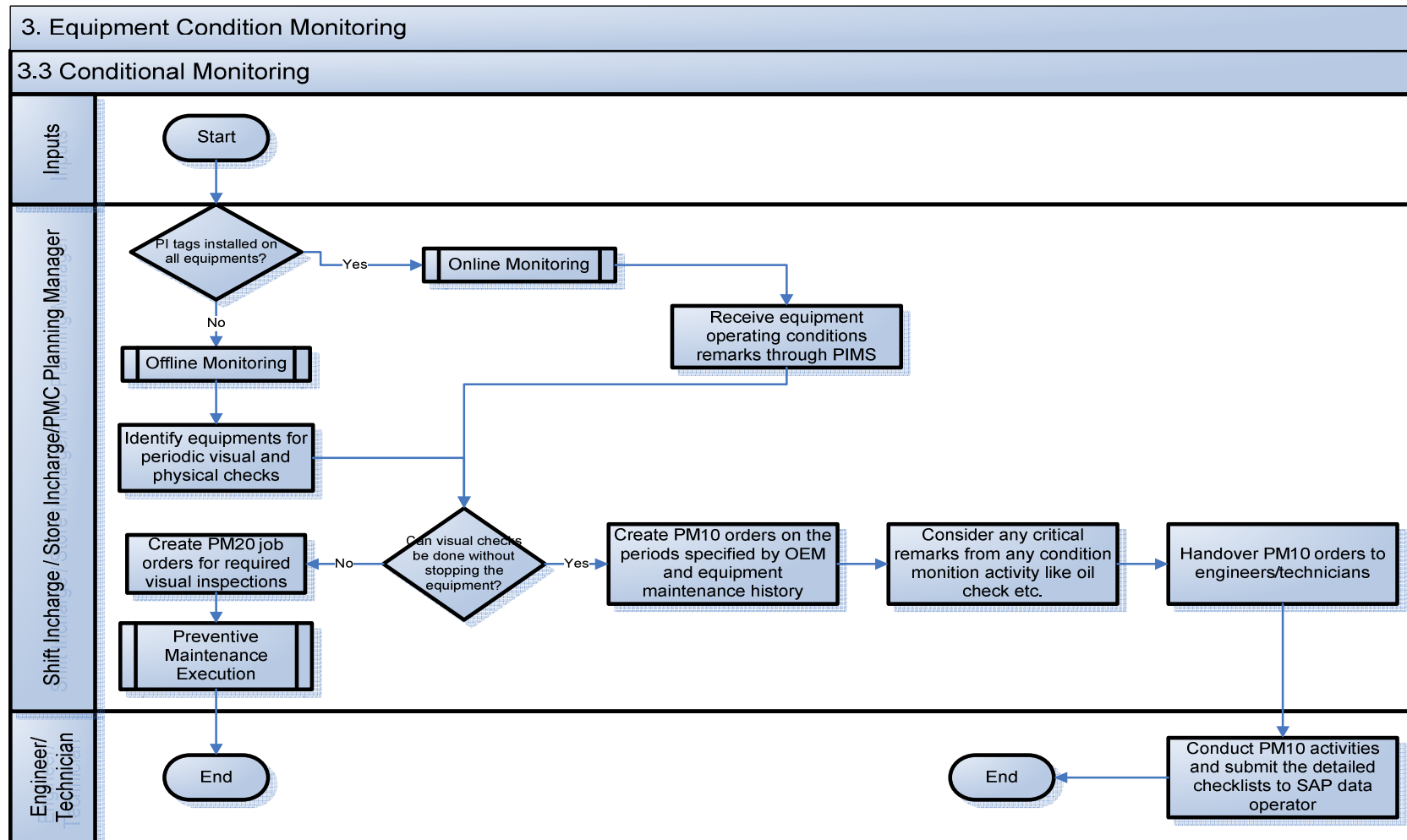
10. Revision of operating parameters in the operating manual	Equipment Engineer	Equipment Engineer	Head of Section	Equipment Operators Shift Incharge
11. Design Modifications / Retrofitting, communication to procurement for future procurements	Equipment Engineer	Equipment Engineer	OEM / Head of Section	Head of Department
12. Incorporation of design changes for further procurements	Capex Procurement team	Capex procurement head	Head of Section	Head of department
13. Revision of maintenance plans, PM schedules, checklists	Equipment Engineer	Equipment Engineer	Head of Section	Head of department
14. Change of vendor	Head of Section	Head of Section	Procurement Team	Procurement Head Head of Department
15. Addition of Spares to stock	Equipment Engineer		Head of Section	Head of department

AM3.2: Root Cause Analysis - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Generate breakdown reports, identify and shortlist major breakdowns for RCA	Compliance or negligence	HoS / HoD to review monthly reports and help identify cases for RCA
2.	Conduct initial diagnosis and analysis of the breakdown		

3.	Identify corrective action	Based on judgment and analysis, might not be suitable	HoS to approve / authorize the corrective action
4.	Select team to execute the corrective action		
5.	Define timelines and secure funding		
6.	Perform the corrective action	Due diligence is needed in executing corrective actions	Deploy capable personnel to execute corrective action
7.	Creation of the root cause analysis report (MS Word / SAP)	Compliance / delays	For all authorized investigations, the RCA Reports to be reviewed by HoS on a monthly basis
8.	Conduct a monthly inter-departmental meeting to share the outcomes of analyses		
9.	Inclusion of major findings in tool talks		
10.	Revision of operating parameters in the operating manual	Frequent changes may hamper operations.	Parameters should be revised after thorough investigation and analysis
11.	Design Modifications / Retrofitting, communication to procurement for future procurements	Design changes could result in an unforeseen effect on other areas / components of the equipment	Proposed changes should be discussed with the OEM / Equipment Expert / CoE before finalizing

12.	Incorporation of design changes for further procurements		
13.	Revision of maintenance plans, PM schedules, checklists	Very frequent and dynamic changes to schedules shall hamper maintenance planning	HoD / HoS should decide on a suitable interval (quarterly / annually) when schedules shall be revised
14.	Change of vendor		
15.	Addition of Spares to stock	Inventory build up	Spares addition to be considered if no alternative with better quality / life is available

AM3.3: Conditional Monitoring*AM 3.3: Conditional Monitoring - Process Map*

AM 3.3: Conditional Monitoring - Process Notes

- a) Manager-ES shall identify the equipment with PI tags installed
- b) Based on the status of installation of PI tags, equipment shall be classified for online Vs offline monitoring based on RCA reports, Maintenance history and any other analysis report.
- c) Manager – ES shall identify the equipment which could be taken up for online and offline conditional monitoring
- d) For online monitoring:
 - i. Continuously monitor equipment working conditions through information and notifications being generated by PIMS/RCMS through PI tags
 - ii. The critical parameters to be monitored for condition based monitoring shall be decided before installation of PI tags in case of new installations
 - iii. Shift in charge shall receive information from control room in case any equipment needs to be checked on critical parameters
 - iv. In case, the maintenance check cannot be done without stopping the equipment, shift in charge shall not raise a PM10 work order / notification and raise a PM20 notification for the maintenance job
 - v. Engineers/ technicians shall perform the maintenance check considering any critical remarks from any previous condition monitoring report like oil check report etc.
 - vi. Engineers / technicians shall perform the maintenance check activity as per the order and shall submit completely filled check list to MPC data operator
- e) For offline monitoring:
 - i. Shift in charge to identify equipment to be taken up for periodic health check up
 - ii. Shift in charge along with Manager-ES shall also identify the critical parameters which can be monitored physically
 - iii. Operator shall inform the control room in case any significant variation working condition / value of any of the identified critical parameters
 - iv. Shift in charge shall receive information from control room in case any equipment needs to be checked on critical parameters
 - v. In case, the maintenance check cannot be done without stopping the equipment, shift in charge shall not raise a PM10 work order / notification and raise a PM20 notification for the maintenance job

- vi. Engineers/ technicians shall perform the maintenance check considering any critical remarks from any previous condition monitoring report like oil check report etc.
- vii. Engineers / technicians shall perform the maintenance check activity as per the order and shall submit completely filled check list to MPC data operator

AM 3.3: Conditional Monitoring - SIPOC Framework

Supplier	Input	Process	Output	Customer
PIMS/RCMS	Alert notification	1. PI tags installed on all equipment?	PM20/10 job order	Maintenance department
MPC-planning manager	Breakdown analysis report	2. No - Offline Monitoring	Conditional monitoring remarks	Maintenance department
MPC-planning manager	Breakdown analysis report	3. Identify equipment for periodic visual and physical checks	Conditional monitoring remarks	Maintenance department
MPC-planning manager	Requirements for maintenance job	4. Can visual checks be done without stopping the equipment?	PM 20 or PM10 job order	Maintenance department
MPC manager	Requirements for maintenance job	5. Yes - Create PM10 orders on the periods specified by OEM and equipment maintenance history	PM10 job order	Engineer
Engineer	CBM report	6. Consider any critical remarks from any condition monitoring activity	Critical activities to be done	Engineer

		like oil check etc.		
SAP data operator	PM10 job orders	7. Handover PM10 orders to engineers/technicians	Physical handover of PM10 job orders	Engineers
Engineer	PM10 order check list	8. Conduct PM10 activities and submit the detailed checklists to SAP data operator	Complete PM10 job order	SAP data operator
		9. Online Monitoring		
PIMS/RCMS	Equipment working condition	10. Receive equipment operating conditions remarks through PIMS/RCMS	Critical parameter notification for maintenance	Maintenance Department
		11. Repeat from step 4		

AM 3.3: Condition Monitoring - RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
3.3 Conditional monitoring				
1. PI tags installed on all equipment?	NA	NA	NA	NA
2. No - Offline Monitoring	NA	NA	NA	NA
3. Identify equipment for periodic visual and physical checks	Shift In charge	HOS	MPC planning manager/ Maintenance planner	Maintenance team
4. Can visual checks be done without stopping the equipment?	Maintenance team	Shift In charge	Shift In charge	Shift In charge
5. Yes - Create PM10 orders on the periods specified by OEM and equipment maintenance history	MPC data operator	MPC planning manager/Maintenance planner	MPC planning manager/ Maintenance planner	Shift In charge
6. Consider any critical remarks from any condition monitoring activity like oil check etc.	Shift In charge	HOS	MPC planning manager/ Maintenance planner	Maintenance Team

7. Handover PM10 orders to engineers/technicians	Shift In charge	HOS		Maintenance Team
8. Conduct PM10 activities and submit the detailed checklists to SAP data operator	Maintenance team	Shift In charge	Operators	Shift In charge
9. Online Monitoring	NA	NA	NA	NA
10. Receive equipment operating conditions remarks through PIMS/RCMS	Shift In charge	HOS	HOS	Maintenance Team
11. Repeat from step 4	NA	NA	NA	NA

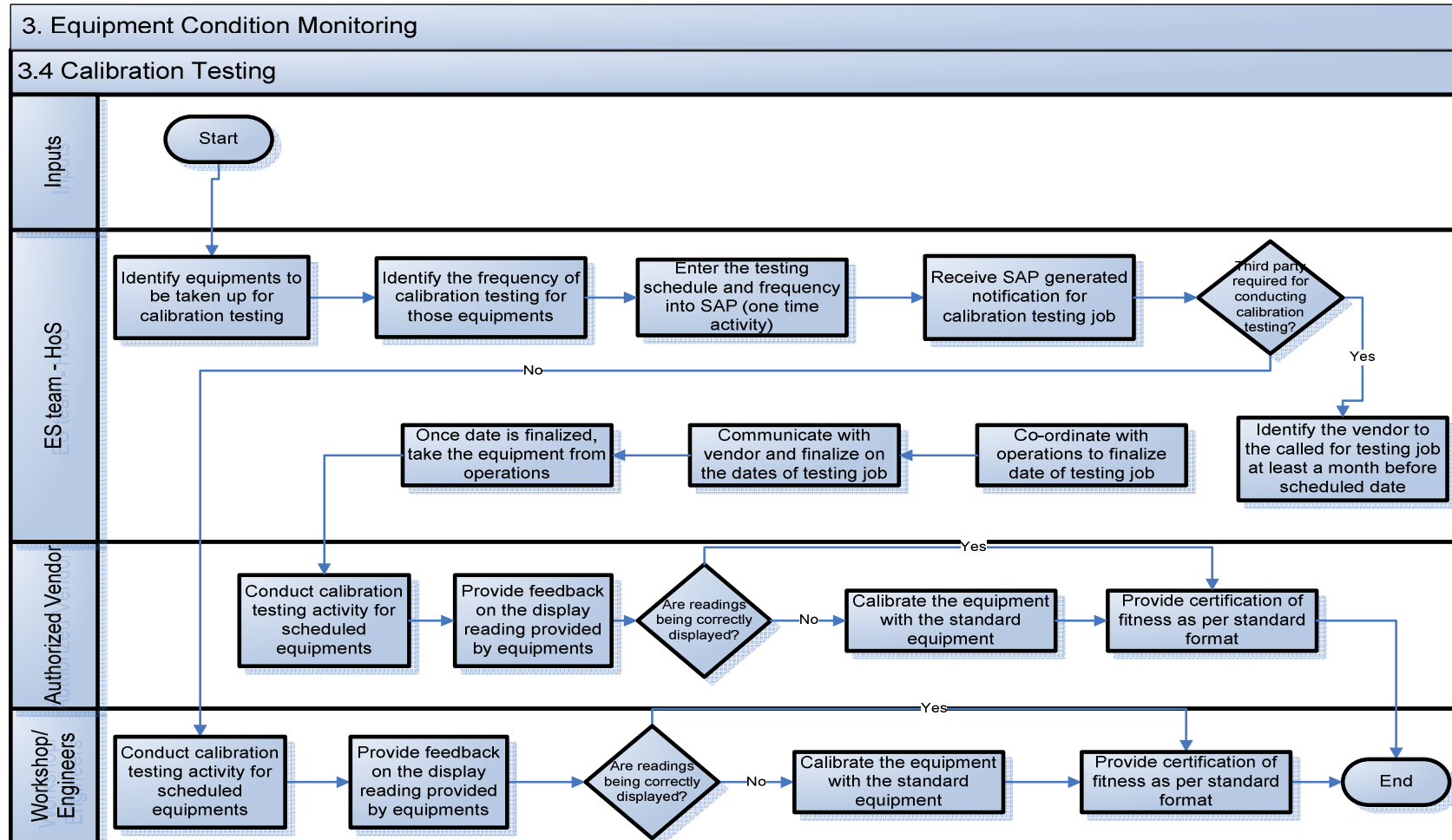
AM 3.3: Conditional Monitoring - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	For Offline Monitoring -		
2.	Identify equipment for periodic visual and physical checks	Risk of missing any critical equipment to be monitored for visual checks	List of equipment to be reviewed regularly based on PM20 & PM00 reports

3.	Can visual checks be done without stopping the equipment?	Incomplete visual checks due to movement of equipment / risk of any physical injury due to moving equipment	Clearly identify the jobs which require stationary vehicle
4.	Yes - Create PM10 orders on the periods specified by OEM and equipment maintenance history	Risk of generating an incorrect order	Maintenance jobs should be clearly classified for which equipment needs to be stopped
5.	Consider any critical remarks from any condition monitoring activity like oil check etc.	Risk of missing any critical parameter to be monitored based on any condition monitoring activity	Complete check should be done while creating PM10 job orders list based on PM20,PM00 and any condition monitoring activity
6.	For Online Monitoring		
7.	Receive equipment operating conditions remarks through PIMS/RCMS	Risk of failure of automated condition monitoring	Regular review of condition monitoring jobs to be done based on previous history of equipment failure

AM3.4: Calibration Testing

AM3.4: Calibration Testing - Process Map



AM3.4: Calibration Testing - Process Notes

- a) Head of section – ES shall identify the equipment needs to be taken up for periodic calibration testing.
- b) Head of section – ES shall also identify the frequency of calibration testing.
- c) The frequency based schedule of identified equipment shall be entered into SAP
- d) HOS shall receive a notification from SAP for any scheduled calibration testing job
- e) HOS shall consult with the operations department and intimate them about scheduled calibration job
- f) A date shall be finalized to execute the scheduled calibration testing job by HOS in agreement with operations
- g) Calibration Testing job shall be performed as per scheduled date by internal engineers
- h) In case, the calibration testing job requires third party certification, then:
 - i) Based on scheduled date of job, HOS shall communicate with external certified vendors to confirm the date of job
 - j) HOS shall confirm the availability of equipment for calibration testing job on scheduled date
 - k) HOS shall take over the equipment from operations department on scheduled date of calibration testing job
 - l) External certified vendor shall conduct the calibration test of scheduled equipment
 - m) External certified member shall provide a certification if the readings of equipment are being displayed accurately
 - n) In case, readings are not displayed correctly, vendor shall calibrate the equipment with a standard device kept permanently for calibration purpose
 - o) Vendor shall also conduct the load tests and provide certificate of operations if the equipment is working as per the required standards

AM 3.4: Calibration Testing - SIPOC Framework

Supplier	Input	Process	Output	Customer
Government Regulatory Authorities	Calibration testing frequency	1. Identify equipment to be taken up for calibration testing	Calibration testing schedules and certificate of operations	Maintenance team - ES
Government Regulatory Authorities	Calibration testing frequency	2. Identify the frequency of calibration testing for those equipment	Calibration testing schedules and certificate of operations	Maintenance team - ES
		3. Enter the testing schedule and frequency into SAP (one time activity)		
Government Regulatory Authorities	Calibration testing frequency	4. Receive SAP generated notification for calibration testing job	Calibration testing schedules and certificate of operations	Maintenance team - ES
HOD	Type of calibration testing job	5. Identify the vendor to be called for testing job at least a month before scheduled date	Identified vendor	Vendor
MPC planning manager/Maintenance planner	Scheduled date of testing job	6. Co-ordinate with operations to finalize date of	Final date of testing job	Testing Vendor

		testing job		
HOS	Scheduled date of testing job	7. Communicate with vendor and finalize on the dates of testing job	Final date of testing job	Testing Vendor
HOS	Scheduled date of testing job	8. Once date is finalized, take the equipment from operations	Equipment taken for job	Testing Vendor
Testing Vendor	Calibration testing details	9. Conduct calibration testing activity for scheduled equipment	Complete calibration job	Maintenance department
Testing Vendor	Calibration testing details	10. Provide feedback on the display reading provided by equipment	Complete calibration job	Maintenance department
Testing Vendor	Calibration testing details	11. Are readings being correctly displayed?	Complete calibration job	Maintenance department
Testing Vendor	Calibration testing details	12. Calibrate the equipment with the standard equipment	Complete calibration job	Maintenance department
Testing Vendor	Calibration testing details	13. Provide certification of fitness as per standard format	Complete calibration job	Maintenance department

AM3.4: Calibration Testing - RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
3.4 Calibration Testing				
1. Identify equipment to be taken up for calibration testing	HOS	HOD	OEM	Shift In charge
2. Identify the frequency of calibration testing for those equipment	HOS	HOD		
3. Enter the testing schedule and frequency into SAP (one time activity)	HOS	HOD	OEM	Shift In charge
4. Receive SAP generated notification for calibration testing job	HOS	HOD	OEM	Shift In charge
5. Identify the vendor to be called for testing job at least a month before scheduled date	HOS	HOD	OEM	Shift In charge
6. Co-ordinate with operations to finalize date of testing job	HOS	HOD	OEM Operators	Shift In charge

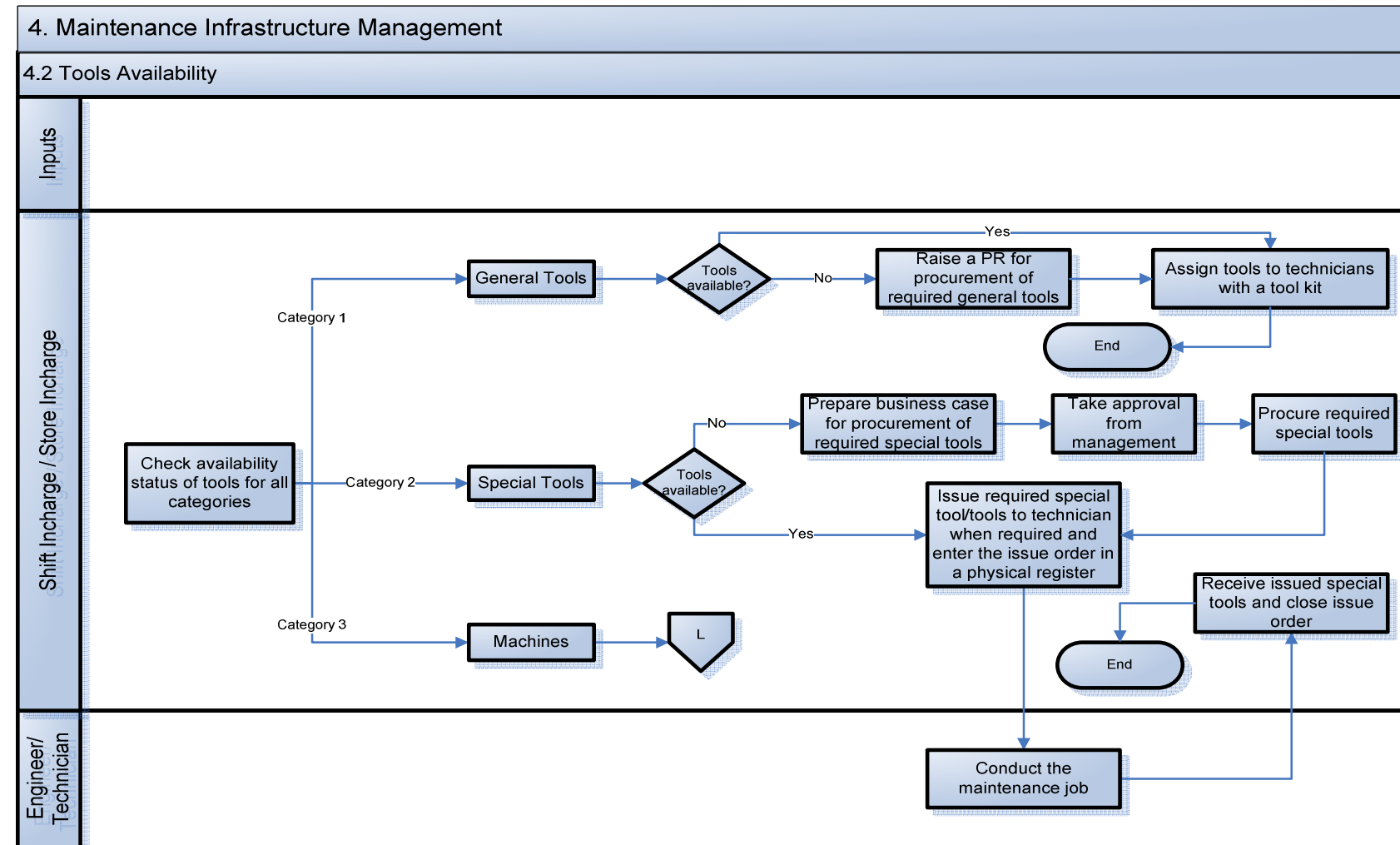
7. Communicate with vendor and finalize on the dates of testing job	HOS	HOD	OEM	External Vendor Shift In charge
8. Once date is finalized, take the equipment from operations	HOS	HOD	OEM	External Vendor Shift In charge
9. Conduct calibration testing activity for scheduled equipment	Vendor	NA		HOS
10. Provide feedback on the display reading provided by equipment	Vendor	NA	HOS Shift In charge Operators	HOS
11. Are readings being correctly displayed?	Vendor	NA	HOS Shift In charge Operators	HOS
12. Calibrate the equipment with the standard equipment	Vendor	NA	HOS Shift In charge Operators	HOS
13. Provide certification of fitness as per standard format	Vendor	NA	HOS	HOS / HOD

AM3.4: Calibration Testing - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Identify equipment to be taken up for calibration testing	Risk of missing any critical equipment / maintenance job of an equipment for calibration testing job	Complete list of all equipment and maintenance jobs to be entered in SAP which should be reviewed at regular interval
2.	Identify the frequency of calibration testing for those equipment	Risk of missing any critical maintenance job as required by regulatory standards	Complete list of all maintenance jobs to be entered in SAP which should be reviewed at regular interval as per regulatory norms
3.	Enter the testing schedule and frequency into SAP (one time activity)	Risk of missing any critical maintenance job as required by regulatory standards	Complete list of all maintenance jobs to be entered in SAP which should be reviewed at regular interval as per regulatory norms
4.	Receive SAP generated notification for calibration testing job	Risk of missing any critical maintenance job as required by regulatory standards	Complete list of all maintenance jobs to be entered in SAP which should be reviewed at regular interval as per regulatory norms
5.	Identify the vendor to be called for testing job at least a month before scheduled date	Non availability of licensed external vendor required for calibration testing job	Vendor identification and appointment should be taken well before scheduled time of calibration testing job

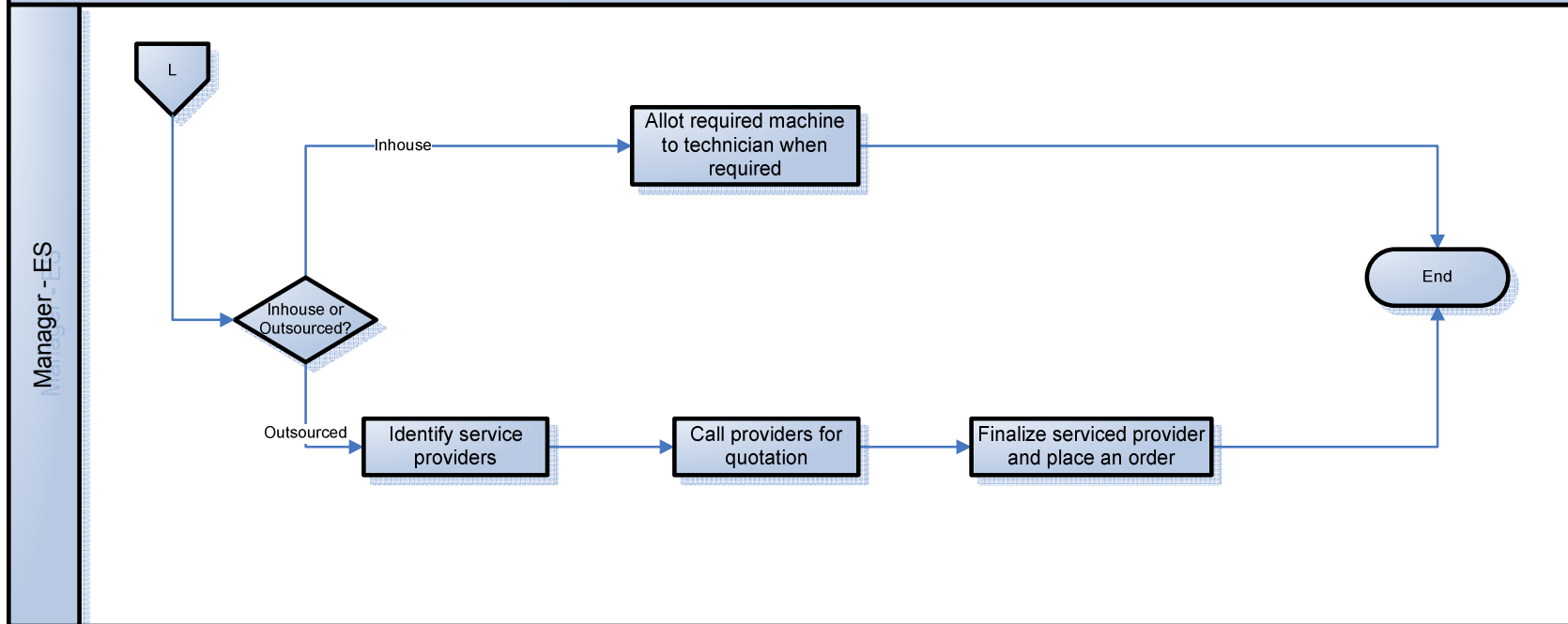
6.	Co-ordinate with operations to finalize date of testing job	Non availability of equipment required for calibration testing job	Co-ordination with operations should be done well before scheduled time of calibration testing job
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AM4.0: Maintenance Infrastructure Management*AM4.2: Tools Availability - Process Map*

4. Maintenance Infrastructure Management

4.2 Tools Availability



AM4.2: Tools Availability - Process Notes

- a) Shift In charge shall identify the required tools on a periodic basis
- b) Shift In charge / Work shop in charge shall categorize the required tools/machines into following categories:
 - i) General Tools
 - ii) Special Tools
 - iii) Machines
- c) For General Tools:
 - i) Shift in charge shall provide list of required general tools to work shop in charge
 - ii) Workshop in charge shall check the tools status of required tools with that available in workshop
 - iii) If required tools are available, shift in charge in co-ordination with work shop in charge shall assign and allot the general tools to all engineers / technicians along with a tool kit of standard design with required documentation
 - iv) If required tools are not available in work shop, shift in charge shall raise a purchase request to procurement department after approval from HOD – ES
- d) For Special Tools:
 - i) Shift in charge shall provide list of required special tools to workshop in charge
 - ii) Workshop in charge shall check the tools status of required tools with that available in workshop
 - iii) If required tools are available, work shop in charge shall issue the special tools to engineers / technicians when required against the PM20 / OO order
 - iv) Workshop in charge shall collect the issued special tools at the completion of maintenance job and inform shift in charge about receipt of special tools with job order number
 - v) If required tools are not available in work shop, shift in charge along with HOD-ES shall prepare a business case and present it to management for its approval
 - vi) Once approved from management, raise a PR to procurement department for purchase of approved special tools
 - vii) In case, management rejects the business case, shift in charge along with Manager-ES shall check the feasibility of taking required special tools on hire as and when required

e) For Machines:

- i) Shift in charge shall provide list of required machines to workshop in charge
- ii) Workshop in charge shall check and confirm the availability status of machines
- iii) If required machines are available, work shop in charge shall issue the machines to engineers / technicians when required against the PM20 / OO order
- iv) Workshop in charge shall inform the shift in charge about the release of machine once the maintenance job is completed
- v) If required machine is not available in work shop, shift in charge shall identify the feasibility of outsourcing the maintenance job and raise a request of same to HOD
- vi) Once approved from HOD, shift in charge shall invite quotations from identified vendors / service providers
- vii) Based on quotations and supplier performance , Manager – ES shall finalize a supplier and place an order to external supplier for required maintenance job

AM4.2: Tools Availability - SIPOC Framework

Supplier	Input	Process	Output	Customer
Shift In charge	Tools requirement	1. Check availability status of tools for all categories	Tools availability	Maintenance department
		2. General Tools - Tools available?		
Workshop	Tools availability	3. Yes - Assign tools to technicians with a tool kit	Physical issue of tools	Maintenance department
Workshop	Tools availability	4. No - Raise a PR for procurement of required general tools	Non availability status of tool	Procurement department
Workshop	Tools availability	5. Assign tools to technicians with a tool kit	Physical issue of tools	Maintenance department

Workshop	Tools availability	6. Special Tools - Tools available?	Physical issue of tools	Maintenance department
Workshop	Tools availability	7. Yes - Issue required special tool/tools to technician when required and enter the issue order in a physical register	Physical issue of tools	Maintenance department
Engineer	Maintenance job details	8. Conduct the maintenance job	Complete maintenance job	Maintenance department
Engineer	Issued Tools	9. Receive issued special tools and close issue order	Physical receipt of tools	Workshop
Shift In charge	Tools requirement	10. No - Prepare business case for procurement of required special tools	Business case for new tools	Management/HOD
Shift In charge	Tools requirement	11. Take approval from management	Approval from management	Management/HOD
Shift In charge	Approval from management	12. Procure required special tools	PR	Procurement
		13. Repeat – Step 7		
		14. Machines - In- house or Outsourced?		
Workshop	Machine availability	15. In-house - Machine	Issue machine	Maintenance department

	status	available?		
Workshop	Machine availability status	16. Yes - Allot required machine to technician when required	Issue machine	Maintenance department
Shift In charge	Tools requirement	17. No - Prepare business case for procurement of required machine	Business case for new tools	Management/HOD
Shift In charge	Approval from management	18. Take approval from management	PR	Procurement
NA	NA	19. Procure required machine	NA	NA
Shift In charge	Tools requirement	20. Outsourced - Identify service providers	Identified vendor	Maintenance department
HOS	Identified vendors	21. Call providers for quotation	Quotations	Maintenance department
HOS	Identified vendors	22. Finalize serviced provider and place an order	Quotations	Maintenance department

AM4.2: Tools Availability - RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
4.2 Tools Availability				
1. Check availability status of tools for all categories	Shift In charge	HOS	Workshop supervisor	HOS/HOD
2. General Tools - Tools available?	Shift In charge	HOS	Workshop supervisor	HOS/HOD
3. Yes - Assign tools to technicians with a tool kit	Shift In charge	HOS	Workshop supervisor	HOS/HOD
4. No - Raise a PR for procurement of required general tools	Shift In charge	HOS	Workshop supervisor	HOS/HOD
5. Assign tools to technicians with a tool kit	Shift In charge	HOS	Workshop supervisor	HOS
6. Special Tools - Tools available?	Shift In charge	HOS	Workshop supervisor	HOS/HOD
7. Yes - Issue required special tool/tools to technician when	Work shop supervisor	Workshop In charge	Shift In charge	Shift In charge

required and enter the issue order in a physical register				
8. Conduct the maintenance job	Engineers	Shift In charge		Shift In charge Workshop supervisor
9. Receive issued special tools and close issue order	Work shop supervisor	Workshop In charge	Shift In charge	Shift In charge
10. No - Prepare business case for procurement of required special tools	Shift In charge	HOS	HOS Workshop supervisor	HOD
11. Take approval from management	HOS	HOD	HOD	Procurement Department
12. Procure required special tools	Procurement Department	Procurement Head		HOS-ES
13. Repeat – Step 7				
14. Machines - In-house or Outsourced?	Shift In charge	HOS	Workshop supervisor	HOS
15. In-house - Machine available?	Shift In charge	HOS	Workshop supervisor	HOS
16. Yes - Allot required machine to technician when required	Shift In charge	HOS	Workshop supervisor	Engineers
17. No - Prepare	HOS	HOD	Workshop	HOD

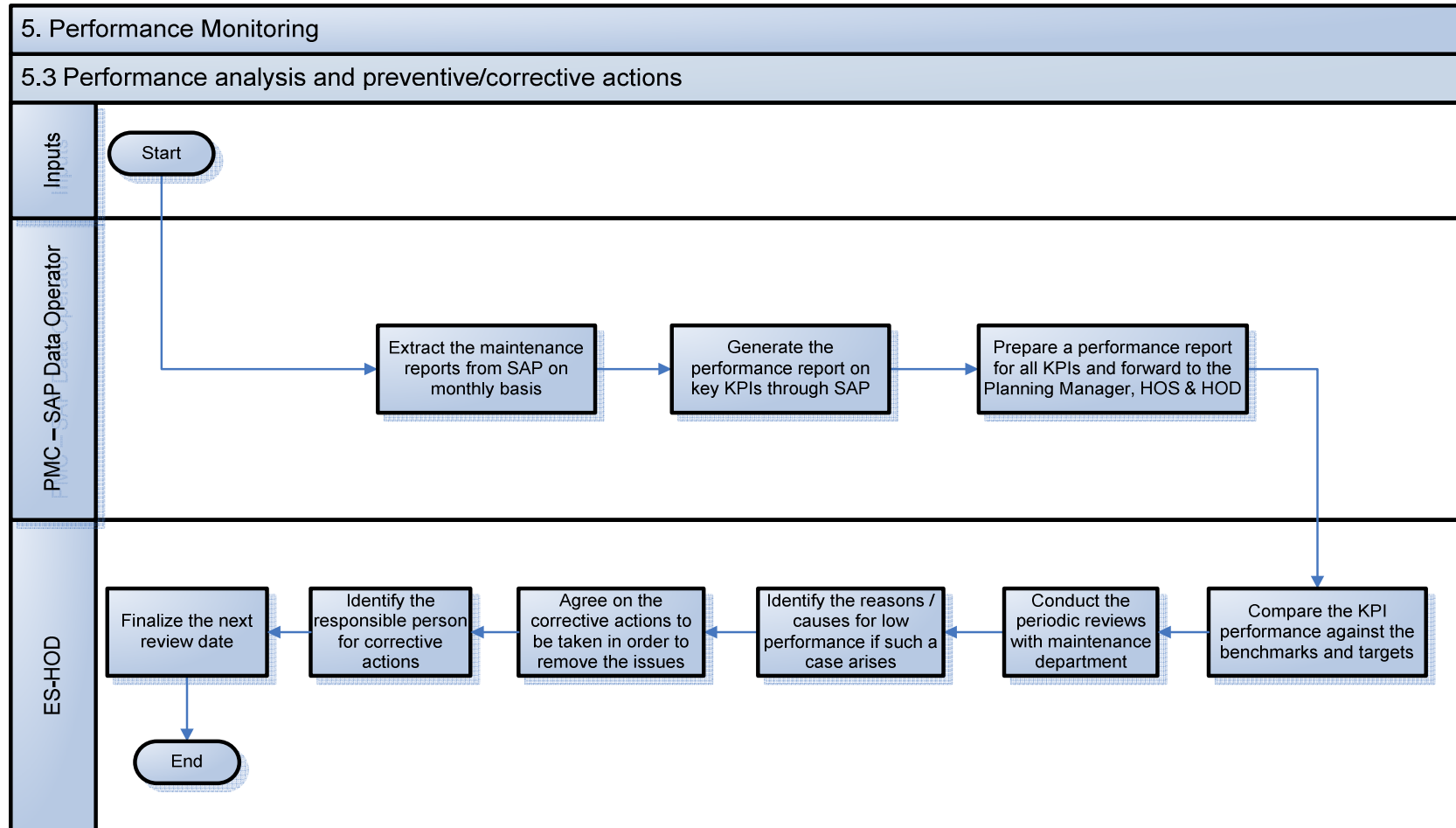
business case for procurement of required machine			p superviso r	
18. Take approval from management	HOS	HOD	Worksho p superviso r	HOD
19. Procure required machine	Procurement Department	Procurement Head		HOS-ES HOD-ES
20. Outsourced - Identify service providers	HOS	HOD	Worksho p superviso r	HOD
21. Call providers for quotation	HOS	HOD		HOD
22. Finalize serviced provider and place an order	HOS	HOD		HOD Procurement Department

AM4.2: Tools Availability - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	General Tools - Tools available?		
2.	Yes - Assign tools to technicians with a tool kit	Accountability of tools	Checking mechanism to ensure safety of tools to be taken up by shift in charge

3.	No - Raise a PR for procurement of required general tools	Risks of raising PR for tools which are not necessarily required	PR to be raised after complete cost benefit analysis is done and HOD approval has been taken
4.	Assign tools to technicians with a tool kit	Accountability of tools	Checking mechanism to ensure safety of tools to be taken up by shift in charge
5.	Special Tools - Tools available?		
6.	Yes - Issue required special tool/tools to technician when required and enter the issue order in a physical register	Accountability of tools	Checking mechanism to ensure safety of tools to be taken up by shift in charge
7.	No - Prepare business case for procurement of required special tools	NA	NA
8.	Procure required special tools	Risks of procuring tools which are not necessarily required	Business case to be prepared after complete cost benefit analysis is done and HOD approval has been taken
9.	Machines - In-house or Outsourced?		
10.	In house - Machine available?		
11.	Yes - Allot required machine to technician when required		
12.	Outsourced - Identify service providers		

13.	Call providers for quotation	Risk of missing any potential service provider	Exhaustive list of all potential and available services providers need to be prepared
14.	Finalize serviced provider and place an order	Risk of appointing any inefficient service provider	Detailed analysis of supplier based on its past records and evaluation framework need to be done before placing any order

AM5.0: Performance Monitoring*AM5.3: Performance Analysis and preventive/corrective actions - Process Maps*

AM5.3: Performance Analysis and preventive/corrective actions - Process Notes

- a) MPC data operator shall extract maintenance reports from SAP on a periodic basis as and when required by Planning Manager / HOS / HOD
- b) MPC data operator shall calculate the KPIs and prepare a performance report in a standard format and provide them to Planning Manager / HOS / HOD
- c) Planning Manager / HOS / HOD shall compare the KPI performance with the benchmarks and internally set targets for the period
- d) Planning Manager / HOD shall conduct a periodic review with HOS and other key members of ES department and identify the reasons in case of low performance against benchmarks and targets
- e) The team shall finalize and agree on the corrective actions to be taken to address key reasons for un desired performance
- f) The team shall also finalize and agree on the responsible person accountable for each corrective actions
- g) Once the corrective actions are finalized , the target and review date for next period shall also be agreed and finalized
- h)

AM5.3: Performance Analysis and preventive/corrective actions - SIPOC Framework

Supplier	Input	Process	Output	Customer
ES-MPC data operator	Maintenance information	1. Extract the maintenance reports from SAP on monthly basis	KPI performance report	HOD/HOS/shift in charge
HOD/HOS/shift in charge	Low performance analysis outcomes	2. Calculate the key KPIs of the maintenance department using standard definitions	Corrective actions plan	Identified responsible person for corrective actions
HOD/HOS/shift in charge	Low performance analysis	3. Prepare a performance report for all KPIs	Corrective actions plan	Identified responsible person for

	outcomes	and forward to the Planning Manager, HOS & HOD		corrective actions
HOD/HOS/shift in charge	Low performance analysis outcomes	4. Compare the KPI performance against the benchmarks and targets	Corrective actions plan	Identified responsible person for corrective actions
HOD/HOS/shift in charge	Low performance analysis outcomes	5. Conduct the periodic reviews with maintenance department	Corrective actions plan	Identified responsible person for corrective actions
HOD/HOS/shift in charge	Low performance analysis outcomes	6. Identify the reasons / causes for low performance if such a case arises	Corrective actions plan	Identified responsible person for corrective actions
HOD/HOS/shift in charge	Low performance analysis outcomes	7. Agree on the corrective actions to be taken in order to remove the issues	Corrective actions plan	Identified responsible person for corrective actions
HOD/HOS/shift in charge	Low performance analysis outcomes	8. Identify the responsible person for corrective actions	Corrective actions plan	Identified responsible person for corrective actions
HOD/HOS/shift in charge	Low performance analysis outcomes	9. Finalize the next review date	Corrective actions plan	Identified responsible person for corrective actions

AM5.3: Performance Analysis and preventive/corrective actions - RACI Matrix

Process Step	Responsible	Accountable	Consult	Inform
5.3 Performance analysis and preventive / corrective actions				
1. Extract the maintenance reports from SAP on monthly basis	MPC data operator	MPC planning manager/Maintenance planner	MPC planning manager/Maintenance planner	MPC planning manager/Maintenance planner
2. Calculate the key KPIs of the maintenance department using standard definitions	MPC data operator	MPC planning manager/Maintenance planner	MPC planning manager/Maintenance planner	MPC planning manager/Maintenance planner
3. Prepare a performance report for all KPIs and forward to the Planning Manager, HOS & HOD	MPC data operator	MPC planning manager/Maintenance planner	MPC planning manager/Maintenance planner	MPC planning manager/Maintenance planner
4. Compare the KPI performance against the benchmarks and targets	ES-HOD MPC planning manager/Maintenance planner	CEO / HOD	HOS	Shift In charges HOS
5. Conduct the periodic reviews with maintenance department	ES-HOD MPC planning manager/Maintenance planner	CEO / HOD	HOS	Shift In charges HOS

6. Identify the reasons / causes for low performance if such a case arises	ES-HOD MPC planning manager/Main tenance planner	CEO / HOD	HOS Managers – ES	Shift In charges HOS
7. Agree on the corrective actions to be taken in order to remove the issues	ES-HOD MPC planning manager/Main tenance planner	CEO / HOD	HOS	Shift In charges HOS
8. Identify the responsible person for corrective actions	ES_HOD MPC planning manager/Main tenance planner	CEO / HOD	HOS	Shift In charges HOS
9. Finalize the next review date	ES-HOD MPC planning manager/Main tenance planner	CEO / HOD	HOS	Shift In charges HOS

AM5.3: Performance Analysis and preventive/corrective actions - Risks & Controls

Process Tag	Activity Description	Risks	Controls
1.	Extract the maintenance reports from SAP on monthly basis	NA	NA
2.	Get the key KPIs performance report from SAP	Risk of wrong evaluation of KPIs due to incorrect logic	Evaluation criteria and definitions need to be put correctly and standard definition need to be followed
3.	Compare the KPI performance against the benchmarks and targets	Wrong evaluation of KPI performance due to changing/non relevant benchmarks	Relevant benchmarks/targets need to be established
4.	Identify the reasons / causes for low performance if such a case arises	Risk of missing on any critical key reason of low performance	Detailed root cause analysis need to be done using techniques like fishbone diagram
5.	Agree on the corrective actions to be taken in order to remove the issues	Risk of missing on any critical key reason of low performance	Detailed root cause analysis need to be done using techniques like fishbone diagram
6.	Identify the responsible person for corrective actions	Risk of appointing non relevant person for corrective actions to be taken	Responsible person should be appointed on the basis of exact requirements of the corrective actions to be performed

Process KPIs

KPI	Formula	Unit of Measurement (UoM)
OEE	<p>OEE (%) = Productivity X Utilization X Availability</p> <p>Productivity = Actual output / Design output</p> <p>Utilization (%) = Equipment running hours / Total Available hours</p> <p>Availability (%) = 1 – ((Planned Maintenance hours + downtime hours) / Total calendar hours)</p>	Percentage (%)
Availability	<p>Availability = 1- (Planned maintenance hours + downtime hours) / Total calendar hours)</p> <p>Note</p> <p>While calculating availability, following hours to be excluded from planned maintenance hours:</p> <ul style="list-style-type: none"> Hours of opportunity based maintenance PM10 hours if maintenance is done without stopping equipment PM 10 hours for maintenance for external service orders However, all maintenance hours need to be recorded 	Percentage (%)

Reliability	$\text{Reliability} = 1 - (\text{Downtime hours} / \text{Total deployed hours})$ Note $\text{Total Deployed hours} = (\text{Running hours} + \text{downtime hours})$	Percentage (%)
MTTR	$\text{MTTR} = \text{Total downtime hours} / (\text{Total \# of breakdowns})$ *To be tracked as trend	Hours
MTBF	$\text{MTBF} = \text{Equipment running hours} / (\text{Total \# of breakdowns})$ *To be tracked as trend	Days
Maintenance Cost	(Direct Manpower cost + Material cost + Indirect Manpower cost)	INR
Number of Accident / Incidents	No. of Accident / Incidents = total number of accident or incident involving ES staff / ES contractors	Number
Lost Time due to Injury (LTI)	LTI = Number of production man-hours lost due to injury or stoppages	Man Hours
PM-20 schedule adherence	Percentage of PM-20 schedules completed within +/- 10% of scheduled time / total number of PM-20 schedules (excluding daily PM20 & inspection PM-20)	Percentage (%)
Unplanned to planned maintenance hours	$\text{UPP ratio} = \text{Downtime hours} / \text{planned maintenance hours}$ $[\text{Ratio of (PM-00 hours)} / (\text{PM-10 hours} + \text{PM-20 hours} + \text{PM} - 30 \text{ hours})]$ Note <ul style="list-style-type: none"> External service hours to be excluded 	Percentage (%)

Templates

Serial No.	Name	Template
1	Weekly Operations Plan	Under preparation for AKBTPL
2	Resource Planning Model	Under Preparation- shall be addressed on installation of all equipment/ OEMs recommendation for Maintenance etc
3	Short Notice Plan	"
4	KPI definitions chart	"

Resource Planning Model - Illustrative

	A	B	C	D	E	F	G	H	I	J
1	Job details and Manhour Analysis									
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Weekly Operations Plan – Illustrative

From		4/8/2013	
To		4/14/2013	

Sr.No	Date & Day		4/15/2013 Mon											4/16/2013 Tue											
			Equipments(Stevedoring)					Equipments(backup)			Time			Equipments(Stevedoring)					Equipments(backup)			Time			
	Vessel	Location	ShoreCrane	Excavator	Loader trailer	fortlift	Goliath	Excavator	Loader	fortlift	Conveyor	Time from	Time to	Expected time of availability	ShoreCrane	Excavator	Loader trailer	fortlift	Goliath	Excavator	Loader	fortlift	Conveyor	Time from	Time to
1	MV MARVELOUS	B-1	MHC-3	2	1			1	6			0:00	12:00:00 PM	0	MHC-3	2	1			1	6			0:00	12:00:00 PM
			MHC-4	2	1										MHC-4	2	1								
2	MV NAVDHENU PURNA	B-5	LIB-2	1	2			2	2			0:00	12:00:00 PM	0	LIB-2	1	2			2	2			0:00	12:00:00 PM
			LIB-4	1	2										LIB-4	1	2								
3	MV TBN	B-5																							
4	MV GREAT SONG	B-6	LIB-7	2	1							0:00	12:00:00 PM	0	LIB-7	2	1							0:00	12:00:00 PM
			LIB-8	2	1										LIB-8	2	1								
5	MV AASHNA	B-6																							
6	MV TBN	B-7	LIB-1			8			1			20:00	12:00:00 PM	20 HRS	LIB-1		8				1			0:00	8:00 AM
7	MV BBC HUDSON	B-8				10			1	1		22:00 PM	12:00 PM	22 HRS			10				1	1		12:00 AM	22:00 PM
8	MV SKYMARINER	B-2																							

Weekly Template Sheet3 Sheet1 Sheet2

Average: 1649.829093 Count: 449 Sum: 372861.375 100%

9/16/2013 3:56 PM

AM – IT Functional Requirements

Process Tag	Activity	IT Requirements
AM 1.2: Resource Planning		
1.2.1	Record the manpower cost for every maintenance job	<ol style="list-style-type: none"> 1. A new field in SAP to record all resources deployed with man hours consumed for a maintenance job and manpower cost 2. The actual hours consumed for completing the job shall be entered 3. Based on salaries paid to deployed resources SAP to calculate the manpower cost for that maintenance job 4. The calculated manpower cost for maintenance job to be displayed in a separately created field
AM 2.1 : Breakdown Maintenance		
2.1.1	Record complete information of Breakdown Maintenance job	<ol style="list-style-type: none"> 1. Maintenance team should be able to enter the critical details of a breakdown maintenance job in SAP. The extra fields required are as follows: <ol style="list-style-type: none"> a) Equipment Running Condition b) Technicians man hours deployed c) Engineers man hours deployed d) Name of technicians and engineers 2. Maintenance team should be able to enter the breakdown analysis report directly into SAP rather than uploading a word document against breakdown as being done currently
AM 2.2 : Preventive Maintenance Execution		
2.2.1	Preventive maintenance scheduling for hours based equipment on the basis of forecasted run hours of equipment based on historical data	<ol style="list-style-type: none"> 1. New logic to calculate the forecasted value of daily run to be fed in SAP as one time input 2. A new field to capture and display forecasted value of daily run hours to be created 3. Based on new logic of forecasted value, SAP to calculate the forecasted value on daily basis and derive a maintenance date by converting daily run hours into number days required to complete run hours at which maintenance is scheduled 4. Preventive maintenance schedule to be generated on monthly basis for hourly based equipment which shall be rescheduled (depends on actual run of equipment)at the time of weekly maintenance scheduling

2.2.2	Integrate maintenance handheld devices with SAP for automated data capturing for all maintenance jobs	<ol style="list-style-type: none"> 1. PM20 / 10 / 00 team should be able to record maintenance information using handheld devices for instant capturing of data 2. Handheld devices should be integrated with SAP for automated data capturing of maintenance jobs in order to reduce manual interventions
2.2.3	<ol style="list-style-type: none"> 1. Separate time recording for electrical and mechanical activities done under on PM job 2. Separate time recording for PM jobs done in parts 	<ol style="list-style-type: none"> 1. Maintenance team should be able to enter the start time and end time of every activity if a maintenance job is not completed in single execution 2. Actual hours of a maintenance job should be calculated only on the basis of actual start time and end time of the job and not by adding the individual times of all separate activity which happens if a job order contains both, mechanical and electrical activity
AM 3.1 : Maintenance History		
3.1.1	Mapping of Fault Code Catalogue in SAP.	<ol style="list-style-type: none"> 1. A unique catalogue describing the object group, object part, damage group, damage, cause group and cause to be created for each equipment and replicated for all similar equipment 2. This fault code catalogue to act as an input for the root cause failure analysis as well as for minor incident reporting and creation of a maintenance history 3. A new fault catalogue to be created for every new type of equipment added

AM 3.2: Root Cause Analysis

3.2.1	Root Cause Analysis to be done using SAP	<ol style="list-style-type: none"> 1. A root cause failure analysis report is to be created for all major breakdowns for equipment in the port. The following criteria is to be adhered to in this case: <ul style="list-style-type: none"> • All breakdowns / unplanned stoppages resulting in a loss of 2 hours or more of production time <p style="text-align: center;">And/or</p> <ul style="list-style-type: none"> • All breakdowns / unplanned stoppages resulting in a repair and maintenance expense of INR 2,00,000/- or more 2. The report to be created by each engineering services department for the equipment under their purview in a standard format. 3. The report to be available to all other engineering services departments for viewing and analysis purpose.
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AM 3.3 : Condition Based Monitoring

3.3.1	Monitoring actual working condition of an equipment	<ol style="list-style-type: none"> 1. Tags to be installed on identified equipment 2. PI tags to monitor the critical parameters already identified 3. The tolerance limits for each critical parameter shall be decided 4. As any critical parameter reaches the tolerance limit, a notification to be generated either through phone call or SMS to the control room. PIMS/RCMS to be integrated with SAP and a condition based maintenance notification to be generated through SAP
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