1. Maintenance within Physical Asset Management

1.1. Physical Asset Management

Overview

- Understanding the concept of Physical Asset Management
- Ability to interpret the company policy

Subject	Knowledge	Skills	Responsibility and autonomy
1.1.1 Physical Asset Management	**A maintenance technician should be able to:** - Mention Physical Asset Management and its effects on the maintenance processes	**A maintenance technician should be able to:** - Work according to the Physical Asset Management plan	**A maintenance technician should be able to:** - Follow the plan for maintenance work
1.1.2 Company processes	**A maintenance technician should be able to:** - Mention production processes for relevant industries	**A maintenance technician should be able to:** - Work according to maintenance strategies, targets, and policies to the company´s processes	**A maintenance technician should be able to:** - Follow and do the work according to the maintenance planning
1.1.3 Company policy	**A maintenance technician should be able to:** - Mention why a company policy needs be set up		
1.1.4 Quality and Environmental regulations and systems	**A maintenance technician should be able to:** - Mention quality and environmental regulations and systems - Mention the basics in recommended environmental regulations and systems	**A maintenance technician should be able to:** - Follow quality and environmental regulations	**A maintenance technician should be able to:** - Follow and do the work according to the quality and environmental regulations
1.1.5 Maintenance within Physical Asset Management	**A maintenance technician should be able to:** - Mention basic data that is needed for maintenance within Physical Asset Management - Mention the relations between maintenance and production processes	**A maintenance technician should be able to:** - Use data that is needed for maintenance within Physical Asset Management	**A maintenance technician should be able to:** - Follow the maintenance plan in an adapted total structure

References

ISO 55000:2014 – Asset management Overview, principles and terminology:

- This standard gives an overview of asset management, its principles and terminology, and the expected benefits from adopting asset management. It can be applied to all types of assets and by all types and sizes of organizations.

EN 16646:2014 – Maintenance within physical asset management:

- This standard introduces physical asset management as a framework for maintenance activities. It also introduces the relationship between organizational strategic plan and maintenance management system and describes the interrelations between maintenance process and all the other physical asset management processes. It addresses the role and importance of maintenance within physical asset management system during the whole life cycle of an item. It can be applied to production organizations of all sizes and consists of guidance and recommendations.

1.2. Production

Overview

- Understanding the relation between maintenance and production planning, safety and quality
- Quality management system (EN 15628:2014 A.3:e)
- Quality management system and principles (EN 15628:2014 A.6:b)

Subject	Knowledge	Skills	Responsibility and autonomy
1.2.1 Production planning	**A maintenance technician should be able to:** – Mention systems for production planning, account system and maintenance planning (CMMS) and the relation between them – Mention how production is planned – Mention the common effects of the production planning regarding maintenance	**A maintenance technician should be able to:** – Follow maintenance plans according to maintenance and production planning	**A maintenance technician should be able to:** – Integrate planning of production with plan for maintenance
1.2.2 Production safety	**A maintenance technician should be able to:** – Explain predicted, and prevent safety consequences – Explain different types of incidents that the maintenance activities shall prevent (e.g. consequences on health, safety, and environment)	**A maintenance technician should be able to:** – Act preventively and/or correctively to increase production safety	**A maintenance technician should be able to:** – Integrate safety system in the production control system
1.2.3 Production quality	**A maintenance technician should be able to:**	**A maintenance technician should be able to:**	**A maintenance technician should be able to:**

	− Mention the essential contribution from the maintenance activities to achieve good product quality − Mention how quality production is increased by personal engagements − Mention how to follow rules and regulations − Mention how to define quality and quality assurance − Mention standards and methods for quality assurance regarding maintenance − Mention the basics in TQC Total Quality Control − Mention 4M Man, Machine, Method, Material − Mention how maintenance activities will have an influence on the production quality	− Act preventively and/or correctively to maintain or increase production quality − Work for that maintenance activities are integrated in production quality activities	− Work integrated in production

References

ISO 55000:2014 – Asset management – Overview, principles and terminology:

− This standard gives an overview of asset management, its principles and terminology, and the expected benefits from adopting asset management. It can be applied to all types of assets and by all types and sizes of organizations.

EN 16646:2014 – Maintenance within physical asset management:

− This standard introduces physical asset management as a framework for maintenance activities. It also introduces the relationship between organizational strategic plan and maintenance management system and describes the interrelations between maintenance process and all the other physical asset management processes. It addresses the role and importance of maintenance within physical asset management system during the whole life cycle of an item. It can be applied to production organizations of all sizes and consists of guidance and recommendations.

2. Maintenance Management

2.1. Maintenance management

Overview

- Understanding the basics in Maintenance Management
- Maintenance objectives (EN 15628:2014 A.1:h)

Subject	Knowledge	Skills	Responsibility and autonomy
2.1.1 Maintenance management	**A maintenance technician should be able to:** – Mention Maintenance Management and the different parts in the process	**A maintenance technician should be able to:** – Support the implementation of an effective maintenance management process	**A maintenance technician should be able to:** – Cooperate with the management of maintenance activities
2.1.2 Maintenance policy	**A maintenance technician should be able to:** – Mention aims and goals in maintenance policy	**A maintenance technician should be able to:** – Act according to a maintenance policy	**A maintenance technician should be able to:** – Follow the maintenance policy
2.1.3 Maintenance objectives	**A maintenance technician should be able to:** – Mention the general requirements for maintenance objectives	**A maintenance technician should be able to:** – Act to achieve maintenance objectives	**A maintenance technician should be able to:** – Follow the maintenance objectives
2.1.4 Maintenance strategies	**A maintenance technician should be able to:** – Mention different maintenance strategies	**A maintenance technician should be able to:** – Use relevant maintenance strategies based on the maintenance policy and strategies	**A maintenance technician should be able to:** – Follow decided strategies in relation to specific production lines
2.1.5 Key Performance Indicators (KPI)	**A maintenance technician should be able to:** – Mention the Key Performance Indicators OEE for production control	**A maintenance technician should be able to:** – Use the key performance indicators OEE for production control	**A maintenance technician should be able to:** – Use OEE information for maintenance optimizing

References

EN 17007:2017-MAN.1 – Establish the maintenance policy, strategy and development actions:

- Based on the company's missions, values, regulations compliance and general objectives, the policy establishes the direction, which gives priority to:
  - Safety of individuals and items, product quality, environmental protection.
  - Availability and useful life of the items.
  - Optimization of maintenance costs, etc.

- The maintenance strategy, which results from the maintenance policy, requires that choices be made for:
  - Developing, adapting or implementing maintenance methods.
  - Organizing the internal resources (maintenance teams, stocks of spare parts and consumables, documentation, tools, etc.).
  - Insourcing and/or outsourcing and/or contracting some or all the maintenance tasks.
  - Studying the economic impact of item modifications or improvements.
- The development of maintenance processes according to the strategy and the process to determine and prioritize improvements are defined and decided.

EN 17007:2017-MAN.5 – Oversee the actions:

- All the actions included in the maintenance process are coordinated, supervised and, if applicable, decided on by Management in order to achieve the goals and objectives defined in terms of safety, availability, costs, environment, quality, etc.

2.2. Maintenance economics and budgeting

Overview

- Understanding the basics in maintenance economics and budgeting

Subject	Knowledge	Skills	Responsibility and autonomy
2.2.1 Maintenance economics	**A maintenance technician should be able to:** – Mention basic economic models regarding maintenance	**A maintenance technician should be able to:** – Calculate or estimate actual costs (EN 17007:2017 BUD.1)	**A maintenance technician should be able to:** – Calculate individual maintenance works
2.2.2 Maintenance budget	**A maintenance technician should be able to:** – Mention the components in maintenance budgeting	**A maintenance technician should be able to:** – Provide documentation for maintenance budgeting process (EN 17007:2017 BUD.2, EN 17007:2017 BUD.3, EN 17007:2017 BUD.4, EN 17007:2017 BUD.5)	**A maintenance technician should be able to:** – Calculate and document individual maintenance works
2.2.3 Economical maintenance plan	**A maintenance technician should be able to:** – Mention the key parts in economical maintenance plans	**A maintenance technician should be able to:** – Act according to the economical maintenance plans for activities, items, equipment and assets	**A maintenance technician should be able to:** – Calculate individual maintenance works

References

EN 17007:2017-MAN.4 – Prepare and negotiate the budgets:

- Economic plans (Budgets) are approved and adjusted by Management based on the budgeting process (BUD).

EN 17007:2017-BUD – Budget maintenance of items:

- Schedule economic planning (short, medium and long-term) based on a defined cycle, for regular maintenance (expenditures and costs related to the company's operation) and exceptional maintenance (investments) activities.

2.3. Maintenance activities

Overview

- Good knowledge in different internal and external maintenance activities
- Perform the inspection tasks to highlight and prevent the item degradation (EN 15628:2014 A.1:b)
- Comply with the required procedures, standards and operational methods of work (EN 15628:2014 A.1:f)
- Principles, logic and parameters of operation and utilization of asset and item (EN 15628:2014 A.1:g)
- Standards and operational methods of work (EN 15628:2014 A.2:a)
- Work according to quality and safety principles (EN 15628:2014 A.2:c)
- Processes and work cycles (EN 15628:2014 A.2:f)
- Procedures (EN 15628:2014 A.5:d)
- Perform properly, efficiently and effectively the assigned maintenance tasks (EN 15628:2014 A.6:a)
- Control the correct execution of the work and the personnel productivity (EN 15628:2014 A.6:b)
- Verify the proper functionality of the maintained object when the task is complete (EN 15628:2014 A.6:c)

Subject	Knowledge	Skills	Responsibility and autonomy
2.3.1 Requirements for maintenance activities	**A maintenance technician should be able to:** – Explain the requirements for the maintenance activities	**A maintenance technician should be able to:** – Apply relevant maintenance activities	**A maintenance technician should be able to:** – Analyse the technical requirements and based on that, plan the work
2.3.2 Quality assurance of maintenance activities	**A maintenance technician should be able to:** – Mention quality assurance of maintenance activities – Mention different methods and techniques to achieve an optimized result for the company by the maintenance activities	**A maintenance technician should be able to:** – Carry out quality in the maintenance activities	**A maintenance technician should be able to:** – Handle safe maintenance in the work process

2.3.3 Analyse the results of maintenance activities	**A maintenance technician should be able to:** – Mention how to analyse the results of maintenance activities – Mention common methods to measure and analyse the result of maintenance activities	**A maintenance technician should be able to:** – Carry out measurement and analysis of the maintenance activities	**A maintenance technician should be able to:** – Analyse pros and cons in results of maintenance activities
2.3.4 Life cycle extension	**A maintenance technician should be able to:** – Mention aspects of technical service life in relation to costs for work, and replacement of components	**A maintenance technician should be able to:** – Carry out the work for life cycle extensions	**A maintenance technician should be able to:** – Use long term thinking based on achieved information from operation and models to carry out the work for life cycle extension
2.3.5 Operator maintenance	**A maintenance technician should be able to:** – Describe what operators should do regarding maintenance – Describe how operators should report tasks	**A maintenance technician should be able to:** – Support the production with knowledge concerning maintenance activities and resources for operator-based maintenance	**A maintenance technician should be able to:** – Analyse suitable activities for operators and adapted information for acceptance of technical and economic goals

References

EN 17007:2017-MAN.2 – Identify the internal or external activities:

- The maintenance policy and strategy make it possible to clearly identify the activities carried out internally and those assigned to participating companies. In connection to budgeting this identification leads to choosing between those assigned to participating companies and between “making” and “buying” and specifying the required skills.

2.4. Maintenance organisation

Overview

- Understanding in a maintenance organisation
- Business job descriptions and roles (EN 15628:2014 A.1:d)
- Principles and techniques distinctive of the individual profession (EN 15628:2014 A.1:f)
- Manage the work organization (EN 15628:2014 A.5:c)
- Legislation and technical standards (EN 15628:2014 A.5:f)

Subject	Knowledge	Skills	Responsibility and autonomy
2.4.1 Maintenance organisation	**A maintenance technician should be able to:** – Explain the advantages and the disadvantages with the different types of organizations and the combination of them	**A maintenance technician should be able to:** – Maintain the competence in actual organization	**A maintenance technician should be able to:** – Follow the plans for maintenance organization using own and purchased resources
2.4.2 Jobs and competences	**A maintenance technician should be able to:** – Explain how to use the right maintenance competence within the organisation	**A maintenance technician should be able to:** – Cooperate in the team to assure the right maintenance competence	**A maintenance technician should be able to:** – Analyse needed competences for various types of work
2.4.3 Labour laws and regulations	**A maintenance technician should be able to:** – Mention relevant national laws and regulations	**A maintenance technician should be able to:** – Follow the required labour laws and regulations for maintenance work	**A maintenance technician should be able to:** – Carry out maintenance tasks according to labour agreement and legislation in labour market

References

EN 17007:2017-MAN.3 – Determine the organization, job profiles and responsibilities:

- Based on the direction and choices expressed in the policy and strategy, an organization is set up to realize the maintenance processes. Tasks and job profiles are established as well as possible needs to update present skills Responsibilities are defined and assigned to the company's personnel.

2.5. Leadership, training and coaching

Qualifications for Maintenance Technician Specialists (EQF level 5)

Overview

- Understanding in technical training and coaching methods and techniques
- Ability to lead, train and coach working groups
- Take care, within the limits of his responsibility, organization and discipline of operating personnel (EN 15628:2014 A.1:d)
- Techniques of communication, training and coaching (EN 15628:2014 A.5:a)
- Organize the work of operating personnel, assigning the necessary tasks and ensuring the use of individual and collective protective equipment (EN 15628:2014 A.5:c)
- Ensure the discipline of employees (EN 15628:2014 A.5:e)
- Take care, within the limits of his responsibility, of training, coaching and professional development of personnel (EN 15628:2014 A.5:f)
- Verify that collaborating personnel is able to meet the minimum requirements for the assigned tasks (EN 15628:2014 A.5:g)
- Communication techniques (EN 15628:2014 A.6:c)

Subject	Knowledge	Skills	Responsibility and autonomy
2.5.1 Communication and presentation techniques	**A maintenance technician should be able to:** – Mention pedagogical methods to communicate and present in the best way	**A maintenance technician should be able to:** – Professionally communicate and present actual and relevant information	**A maintenance technician should be able to:** – Understand and practise different pedagogical ways to communicate results, both oral and in text
2.5.2 Leadership	**A maintenance technician should be able to:** – Mention the basics in a collegially leadership	**A maintenance technician should be able to:** – Lead the team in project-oriented work	**A maintenance technician should be able to:** – Practice a collegially leadership regarding to actual situation
2.5.3 Methods and techniques for training	**A maintenance technician should be able to:** – Mention actual local needs within competence for technical education and training	**A maintenance technician should be able to:** – Execute own education and training	**A maintenance technician should be able to:** – Use different pedagogical ways to transfer technical subjects in respect of used machinery
2.5.4 Coaching	**A maintenance technician should be able to:** – Mention coaching methods for improving maintenance competence within the organization	**A maintenance technician should be able to:** – Coach and train the employees in a professional manner	**A maintenance technician should be able to:** – Use methods for coaching and supporting labour force in the process to increase the competence
2.5.5 Working groups	**A maintenance technician should be able to:** – Mention different types of working groups	**A maintenance technician should be able to:** – Lead, train, and coach working groups	

References

Qualifications for Maintenance Technician Specialists (EQF level 5)

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3. Maintenance Execution

3.1. Failure and fault theory

Overview

- Very good knowledge in theories regarding failures and faults
- Apply the diagnostic techniques (failure analysis and troubleshooting techniques) and the on-condition maintenance (EN 15628:2014 A.1:g)
- Interpret the first signs of failures and use fault diagnosis methods (EN 15628:2014 A.2:a)
- Fault diagnosis methods (EN 15628:2014 A.2:i)

Subject	Knowledge	Skills	Responsibility and autonomy
3.1.1 Failure patterns	**A maintenance technician should be able to:** - Describe different methods for troubleshooting covering system and functions of a production line - Describe the mechanism that causes the failures - Describe the theory of failure patterns - Describe the definitions of a failure and a fault - Explain different causes for a fault (e.g. specification, design, installation, operation, maintenance) - Mention different types of human failures and what causes them - Mention how human failures can be prevented and avoided - Describe different statistical distributions for failures (e.g. Exp, Ln, Weibull, etc.)	**A maintenance technician should be able to:** - Aim to troubleshooting including characterize and prioritize failures, find malfunctions due to latent or hidden faults that can have harmful and significant consequences on availability, reliability, personal safety, the environment, product or service quality, the value of the assets and costs - Choose the appropriate maintenance method depending on the actual failure distribution (e.g. corrective, preventive, condition based, modification) - Characterize undesirable events (EN 17007:2017 PRV.1) - Classify and consider the different consequences of a fault - Analyse the result obtained to make it possible to define the actions to be taken to avoid these events or control their consequences - Perform a human error analysis	**A maintenance technician should be able to:** - Carry out the process to identify different types of failures and used maintenance methods to improve the processes

3.1.2 Wear and tear	**A maintenance technician should be able to:** – Describe different types of wear and tear – Describe how to avoid wear and tear	**A maintenance technician should be able to:** – Carry out counteractions to minimize wear and tear	**A maintenance technician should be able to:** – Carry out maintenance activities related to wear and tear
3.1.3 System and functional analysis	**A maintenance technician should be able to:** – Describe how processes are designed and programmed for preparing activities for troubleshooting and modification	**A maintenance technician should be able to:** – Carry out activities for troubleshooting and modification	**A maintenance technician should be able to:** – Practice system and functional analysis with the goal to optimize the process and CBM methods

References

EN 17007:2017-PRV – Prevent undesirable events by avoiding failures and faults:

- Characterize and prioritize the events (failures, malfunctions due to la-tent or hidden faults) that can have harmful and significant consequences on availability, reliability, personal safety, the environment, product or service quality, the value of the assets and costs. (PRV.1)
- Determine the actions to be taken on the items to achieve the objectives set in the maintenance policy (availability, reliability, safety, costs, etc.). (PRV.2)

3.2. Planning and scheduling

Overview

- Very good knowledge in planning and scheduling
- Maintenance plans, standards and operational methods of work (EN 15628:2014 A.1:a)
- Perform planned task according to the maintenance plans (EN 15628:2014 A.1:a)
- Principles, logic and parameters of operation and utilization of asset and item (EN 15628:2014 A.2:h)
- Methods and rules about preparing and scheduling tasks (EN 15628:2014 A.5:b)
- Perform the preparation and regulation of machines, instrumentation and equipment necessary for the work (EN 15628:2014 A.4:c)
- Take care of the completion of tasks performed (EN 15628:2014 A.5:d)

Subject	Knowledge	Skills	Responsibility and autonomy
3.2.1 Planning and scheduling	**A maintenance technician should be able to:** – Mention planning and scheduling methods	**A maintenance technician should be able to:** – Carry out planning, scheduling, and the work in maintenance	**A maintenance technician should be able to:**

	– Mention the different steps in the work order process; planning, scheduling, realization, and reporting		- Carry out the maintenance work and follow up maintenance plans including prioritizing of activities
3.2.2 Prioritizing maintenance activities	**A maintenance technician should be able to:** – Mention different prioritizing tools – Mention SLA (Service Level Agreement)	**A maintenance technician should be able to:** – Prioritize the maintenance events in short or medium terms according to their importance and realization constraints – Rank the maintenance events according to operation demands (EN 17007:2017 ACT.1)	
3.2.3 Maintenance plans	**A maintenance technician should be able to:** – Explain details in maintenance plans	**A maintenance technician should be able to:** – Use and update the Maintenance Plans (EN 17007:2017 PRV.2) – Determine and carry out the actions to be taken on the items to achieve the objectives set in the maintenance policy (availability, reliability, safety, costs, etc.) – Use real time data for developing plans when maintenance is needed	**A maintenance technician should be able to:** - Create and follow up maintenance plans including optimizing activities
3.2.4 Work order process	**A maintenance technician should be able to:** – Describe the work order process and use of the maintenance management system (CMMS) – Describe needed information in a work order	**A maintenance technician should be able to:** – Prepare maintenance information to complete and carry out maintenance tasks safely – Set the timeline of the planned tasks in order, based on the sequencing constraints and constraints related to required resources (material, human, etc.) to create a schedule that considers any uncertainties that may arise	**A maintenance technician should be able to:** - Coordinate the work by using the CMMS system
3.2.5 Maintenance planning	**A maintenance technician should be able to:** – Explain the aim of maintenance planning – Mention different tools for maintenance planning	**A maintenance technician should be able to:** - Carry out maintenance to complete maintenance tasks safely	**A maintenance technician should be able to:** - Guide and control the maintenance work based on developed activities via the CMMS

Qualifications for Maintenance Technician Specialists (EQF level 5)

3.2.6 Maintenance scheduling	**A maintenance technician should be able to:** – Mention basic factors for maintenance scheduling – Mention different tools for maintenance scheduling	**A maintenance technician should be able to:** - Schedule the maintenance tasks (EN 17007:2017 ACT.4) - Prepare the provisional schedule (start date, end date) of the tasks Decide about the intervals between preventive maintenance actions	**A maintenance technician should be able to:** - Follow and record measures of the maintenance activities in CMMS
3.2.7 Maintenance realization	**A maintenance technician should be able to:** – Explain different methods and techniques for maintenance realization	**A maintenance technician should be able to:** – Start, perform, and finalize the tasks by assigning the corresponding actions to the necessary individuals who are competent and available on the planned date of the tasks according to the processes: ▪ Begin the scheduled maintenance tasks (EN 17007:2017 ACT.5) ▪ Perform the scheduled maintenance tasks (EN 17007:2017 ACT.6) ▪ Finish the scheduled maintenance tasks (EN 17007:2017 ACT.7)	**A maintenance technician should be able to:** - Carry out a planned maintenance program and eventually use twin techniques for improvements
3.2.8 Verification before start	**A maintenance technician should be able to:** – Explain the principles of verification tests and measures before start or restart	**A maintenance technician should be able to:** – Assure that verification before start/restart is executed properly all the time	**A maintenance technician should be able to:** – Carry out the verification before first start and restart after maintenance activities

References

EN 17007:2017-ACT – Act preventively and/or correctively on the items to maintain:

- The events to deal with in the short or medium term with preventive maintenance (potential or actual failures) are prioritized according to their importance and realization constraints. A ranked list of events is established and updated continuously. (ACT.1)
- Prepare the maintenance information needed to complete a maintenance task safely. (ACT.2)
- Set in order the timeline of the planned tasks based on the sequencing constraints and constraints related to required resources (material, human, etc.) in order to create a schedule that takes into account any uncertainties that may arise. (ACT.3)
- Prepare the provisional schedule (start date, end date) of the tasks. (ACT.4)

3.3. Preventive maintenance

Overview

- Very good knowledge in preventive maintenance activities

Subject	Knowledge	Skills	Responsibility and autonomy
3.3.1 Preventive maintenance	**A maintenance technician should be able to:** - Describe preventive maintenance and the different strategies to ensure a high dependability	**A maintenance technician should be able to:** - Plan, implement and carry out effective preventive maintenance plans	**A maintenance technician should be able to:** - Analyse and optimize the process for all preventive maintenance tasks
3.3.2 Predetermined maintenance	**A maintenance technician should be able to:** - Describe methods and techniques for predetermined maintenance - Describe how to perform predetermined maintenance	**A maintenance technician should be able to:** - Plan, implement and carry out effective predetermined maintenance plans	**A maintenance technician should be able to:** - Analyse and optimize the process for all predetermined maintenance tasks
3.3.3 Condition-based maintenance	**A maintenance technician should be able to:** - Describe methods and techniques for condition-based maintenance (e.g. subjective and objective condition-based maintenance methods) - Describe different types of condition monitoring systems (e.g. continuous, by intervals, on request, centralized or decentralized) - Describe P-F Interval and how it is used - Describe methods and techniques for inspection (condition-based maintenance)	**A maintenance technician should be able to:** - Carry out and follow plans for the intervals between inspections and condition-based maintenance - Carry out and follow plans for inspection and condition-based maintenance system - Decide and communicate where non-predictive maintenance should be carried out - Use sight, hearing and feeling to recognize the status	**A maintenance technician should be able to:** - Analyse and optimize the process for all condition-based maintenance tasks
3.3.4 Predictive maintenance	**A maintenance technician should be able to:**	**A maintenance technician should be able to:**	**A maintenance technician should be able to:**

	– Describe how to perform predictive maintenance – Describe predictive maintenance methods – Describe the difference between predictive and non-predictive maintenance	– Carry out and follow plans where predictive maintenance should be done – Use suitable tools and systems for predictive maintenance	– Analyse and optimize the process for all predictive maintenance tasks

References

EN 17007:2017-ACT – Act preventively and/or correctively on the items to maintain:

- Start the tasks by assigning the corresponding actions to the necessary individuals who are competent and available on the planned date of the tasks. (ACT.5)
- Restore the item to the required state. This restoration may be carried out either as a preventive measure or after a fault is detected. (ACT.6)
- Finalize the task by restoring the maintenance area, returning the item to the user and compiling the feedback. (ACT.7).

3.4. Corrective maintenance

Overview

- Very good knowledge in corrective maintenance activities
- Ability to restore the items to their required state
- Detect promptly the failure causes and determine appropriate corrective actions (EN 15628:2014 A.2:b)
- Perform restoration tasks in accordance with the required methodologies and standard works (EN 15628:2014 A.2:d)
- Take care and coordinate, within the limits of his responsibility, the execution of repair and restoration tasks (EN 15628:2014 A.2:e)

Subject	Knowledge	Skills	Responsibility and autonomy
3.4.1 Corrective maintenance	**A maintenance technician should be able to:** – Describe corrective maintenance and the different strategies to minimize unplanned stops	**A maintenance technician should be able to:** – Carry out corrective maintenance and report the activities	**A maintenance technician should be able to:** – Analyse the result of corrective maintenance tasks to develop preventive tasks
3.4.2 Fault diagnosis	**A maintenance technician should be able to:** – Describe how to detect and diagnose faults – Describe the different fault detection and diagnose methods and techniques	**A maintenance technician should be able to:** – Detect faults, locate them, and identify the primary cause and document in CMMS according to the processes: ▪ Classify the actual events (EN 17007:2017 COR.1)	**A maintenance technician should be able to:** – Analyse functions and system were faults can be located

		▪ Diagnose the state of the items in question (EN 17007:2017 COR.2)	
3.4.3 Immediate Corrective Maintenance	**A maintenance technician should be able to:** – Describe the difference between immediate and deferred corrective maintenance – Describe the work when to perform immediate corrective maintenance	**A maintenance technician should be able to:** – Decide when a corrective maintenance action is immediate – Take immediate corrective action in cases of exceptional events	**A maintenance technician should be able to:** – Optimize the process to take care of rapid realization to minimise stop time
3.4.4 Deferred Corrective Maintenance	**A maintenance technician should be able to:** – Describe the difference between immediate and deferred corrective maintenance – Describe when to perform deferred corrective maintenance	**A maintenance technician should be able to:** – Decide when a corrective maintenance action is deferred	**A maintenance technician should be able to:** – Optimize the process to minimize stop time
3.4.5 Restoration techniques	**A maintenance technician should be able to:** – Describe different restoration techniques – Explain the principles of verification tests and measures before start or restart	**A maintenance technician should be able to:** – Decide which restoration technique to use and carry out needed test before start – Report performed activities in CMMS	**A maintenance technician should be able to:** – Optimize restoration activities for minimizing stop times

References

EN 17007:2017-COR – Restore the items to their required state:

- The actual events to deal with in the short or medium term with corrective maintenance are prioritized according to their importance and realization constraints. A ranked list of events is established and updated continuously. (COR.1)
- Detect any faults, locate them and identify the primary cause(s). (COR.2)

EN 17007:2017-ACT – Act preventively and/or correctively on the items to maintain:

- Start the tasks by assigning the corresponding actions to the necessary individuals who are competent and available on the planned date of the tasks. (ACT.5)
- Restore the item to the required state. This restoration may be carried out either as a preventive measure or after a fault is detected. (ACT.6)
- Finalize the task by restoring the maintenance area, returning the item to the user and compiling the feedback. (ACT.7).

3.5. Continuous improvement

Overview

- Good knowledge in continuous improvements
- Identify and propose actions or projects to improve reliability, availability and maintainability of assets (EN 15628:2014 A.1:c)
- Pursue the continuous improvement in maintenance (EN 15628:2014 A.6:d)

Subject	Knowledge	Skills	Responsibility and autonomy
3.5.1 Continuous improvement	**A maintenance technician should be able to:** - Describe continuous improvement and what effect these will have on the dependability	**A maintenance technician should be able to:** - Apply the principles for continuous improvement in the daily work	**A maintenance technician should be able to:** - Create the way to work by picking up all small ideas to improvement and development structural reforms
3.5.2 Improvement of items	**A maintenance technician should be able to:** - Describe basic mathematical formulas within availability, reliability, maintainability and supportability - Mention common types of data for improvement of items - Mention requirements regarding reliability performance (e.g. what is regarded as failures, active maintenance time, waiting time and how the availability is defined) - Mention how a verification will be performed - Mention consequences if the verified results are different from the requirements - Mention how to perform in steps, an RCA (Root Cause Analysis)	**A maintenance technician should be able to:** - Perform the continuous improvement work adapted to the processes: ▪ Use of collected data (EN 17007:2017 IMP.1) ▪ Define reliability, maintainability, safety and logistic support requirements (EN 17007:2017 IMP.2) ▪ Establish specifications for the required improvements of the item (EN 17007:2017 IMP.3) ▪ Issue an invitation to tender to internal or external suppliers (EN 17007:2017 IMP.4) ▪ Analyse and choose options and validate the solutions (EN 17007:2017 IMP.5) ▪ Carry out realization (EN 17007:2017 IMP.6)	**A maintenance technician should be able to:** - Use relevant methods to support the process to improve the items aiming to better conditions

		▪ Verify conformity with the reliability, maintainability, safety and logistic support requirements (EN 17007:2017 IMP.7) ▪ Establish the initial maintenance plan (EN 17007:2017 IMP.8) Determine the initial logistical resources (EN 17007:2017 IMP.9) ▪ Identify skills and training needs (EN 17007:2017 IMP.9)	
3.5.3 Improvement of results	**A maintenance technician should be able to:** – Mention different improvements techniques due to maintenance results – Explain how to calculate OEE (Overall Equipment Effectiveness)	**A maintenance technician should be able to:** – Perform the work adapted to the processes: ▪ Determine areas for improvements, prioritize areas of improvements (EN 17007:2017 OPT.1) ▪ Prioritize areas of improvement related to other processes (EN 17007:2017 OPT.1 EN 17007:2017 OPT.5) ▪ Prioritize and specify modifications of existing items (EN 17007:2017 OPT.6) – Specify, plan, control and follow up improvements – Use the indicator OEE to measure and improve the results	**A maintenance technician should be able to:** – Use various methods and techniques to take care of the results to improve the production conditions
3.5.4 Improvement techniques	**A maintenance technician should be able to:** – Mention different improvements techniques due to maintenance requirements: ▪ Kaizen ▪ TPM, Total Productive Maintenance ▪ PDCA; Plan, Do, Check, Act ▪ 5 why 1 how ▪ 5S, Systematic order in 5 steps ▪ 6M; Man, Machine, Method, Material, Measurement and Management	**A maintenance technician should be able to:** – Plan and execute different improvement and life extension techniques	

	▪ 7QCT, Seven Quality Control Tools – Name different methods of life extensions and how to execute them – Mention how different maintenance activities will have an influence on the lifetime of the production equipment		
3.5.5 Maintenance and industry 4.0	**A maintenance technician should be able to:** – Mention the fundamentals of industrial digitizing – Mention how the new technology can be used for maintenance activities: ▪ IIoT (Industrial Internet of Things) ▪ Digital twins ▪ eMaintenance ▪ AI (Artificial Intelligence) ▪ Machine Learning – Describe how maintenance will change due to the new technologies	**A maintenance technician should be able to:** – Use adapted tools for maintenance within Industry 4.0	**A maintenance technician should be able to:** – Support the process and use new technique and methods in maintenance
3.5.6 Benchmarking	**A maintenance technician should be able to:** – Mention bench marking methods and various ways to compare maintenance results	**A maintenance technician should be able to:** – Apply methods based on best practise	**A maintenance technician should be able to:** – Use benchmarking to support the development of the maintenance processes and share the knowledge of the improvements
3.5.7 Future maintenance needs	**A maintenance technician should be able to:** – Mention ways to define and assure the future maintenance needs of a company in relation to the physical asset management – Mention the future needs of maintenance and its influence on the actual activities	**A maintenance technician should be able to:** – Work and reflect about future maintenance needs and report feedbacks. – Work with maintenance improvements for future investments (EN 17007:2017 OPT.7)	**A maintenance technician should be able to:** – Use methods to improve coming maintenance including calculating investments and implement planned maintenance

	− Mention which factors that are important for the need of maintenance activities and how they might be changed in the future − Mention the importance for maintenance of taking part in the design and development phases		

References

EN 17007:2017-MAN.7 – Define policy and strategy areas of improvement:

− All information (technical, organizational, economic and social) is analysed to continuously adjust and improve the maintenance policy and strategy.

EN 17007:2017-IMP – Improve the items:

− The purpose of this process is to define, monitor or realize and validate improvements of the item when improvement is a better solution than preventive or corrective actions to manage failures or their consequences. The item is improved in terms of reliability and/or maintainability and/or safety at a convenient cost. It defines the initial reliability, maintainability and maintenance support requirements. Initial maintenance plans, the maintenance providers' related skills and the various logistical resources (hardware, documentation, spare parts, etc.) needed to implement the maintenance plan on the improved item are also defined.

EN 17007:2017-OPT – Improve the results:

− This process represents a part of continuous improvement loop which analyses the internal and external feedback data to determine actions to be taken, targets to be achieved and best practices to be applied for each of the processes.

4. Health, Safety & Environment in maintenance

4.1. Health, Safety & Environment

Overview

- Good knowledge in health, safety and environment in maintenance
- Risk assessment tools/methodologies (EN 15628:2014 A.1:e)
- Legislation and technical standards (EN 15628:2014 A.3:a)
- Use the required individual and collective protective equipment (EN 15628:2014 A.3:a)
- Comply with the objectives and directives of the “management system” of 1) Quality, 2) Safety and workers’ health and 3) Environment (EN 15628:2014 A.3:b)
- Procedures (EN 15628:2014 A.3:b)
- Observe laws, procedures and business rules (EN 15628:2014 A.3:c)
- Being aware of the effects of choices and actions on safety, health and environment (EN 15628:2014 A.3:c)
- Safety and health management system (EN 15628:2014 A.3:d)
- Take care and / or comply with the organization of the workplace protection (EN 15628:2014 A.3:d)
- Use the machines, equipment and instruments required by laws and European regulations (EN 15628:2014 A.3:e)
- Environmental management system (EN 15628:2014 A.3:f)
- Be aware of choices and actions on safety, health and the environment (EN 15628:2014 A.6:a)

Subject	Knowledge	Skills	Responsibility and autonomy
4.1.1 Risk assessment	**A maintenance technician should be able to:** – Mention risk assessment in maintenance work – Describe different conditions in the production equipment that may cause risks for health, safety, and the environment (inside and outside the company) – Mention the possibility to prevent incidents by maintenance activities, including co-operation with other departments in the company and external parties	**A maintenance technician should be able to:** – Perform the work in relation to the health and safety and the right environment conditions according to the processes: ▪ Prepare a carry out risk assessment (EN 17007:2017 HSE.1) ▪ Identify risks (EN 17007:2017 HSE.2) ▪ Prioritize risks (EN 17007:2017 HSE.3) ▪ Propose and carry out measures for preventing risks and consequences of identified risks (EN 17007:2017 HSE.4) ▪ Monitor and carry out risk management (EN 17007:2017 HSE.5)	**A maintenance technician should be able to:** – Understand various types of risks and from good knowledge perform work safely

4.1.2 Safety and environment protection equipment	**A maintenance technician should be able to:** – Describe what safety equipment is needed to perform maintenance tasks – Explain individual and collective protective equipment – Explain environmental protection equipment	**A maintenance technician should be able to:** – Be familiar with, and use necessary safety and environment protection equipment	**A maintenance technician should be able to:** – Carry out correct balance between risks and activities in machine lines and processes and develop proactive activities
4.1.3 Relations with auditing and safety organizations	**A maintenance technician should be able to:** – Mention information regarding auditing and safety organizations requirements	**A maintenance technician should be able to:** – Report HSE issues with auditing and safety organizations	**A maintenance technician should be able to:** – Follow and perform work according to given guidelines
4.1.4 Human error analysis	**A maintenance technician should be able to:** – Mention human error analysis – Mention different types of human errors and risks connected to these	**A maintenance technician should be able to:** – Before work start perform human risk analysis – Keep daily systems for analysing human risks before a task will start	**A maintenance technician should be able to:** – Initiate active measures to minimize human errors based on individual reports
4.1.5 Laws and regulations	**A maintenance technician should be able to:** – Mention laws and regulations that have a direct influence on the maintenance activities	**A maintenance technician should be able to:** – Follow laws and regulations regarding HSE and technical aspects	**A maintenance technician should be able to:** – Follow international and national laws, rules and regulations in the own organization
4.1.6 Environment	**A maintenance technician should be able to:** – Mention how maintenance actions will affect the environment – Mention maintenance actions to avoid impact on the environment	**A maintenance technician should be able to:** – Act according to an environment plan for the maintenance organisation	**A maintenance technician should be able to:** – Carry out activities to minimize influences on environment outside the plant and indoors for better conditions

References

EN 17007:2017-HSE – Ensure personal health and safety to individuals and preserve environment in maintenance:

– The purpose of this process is to ensure personal health and safety and protect the items and the environment during maintenance tasks. It therefore entails evaluating the risks related to these tasks and Define measures for preventing and responding to the accidental situations described in the Prevention and Safety Plan.

Qualifications for Maintenance Technician Specialists (EQF level 5)

5. Maintenance Engineering Techniques

5.1. Mechanics

Overview

- Very good knowledge in mechanics
- Ability to perform mechanical tasks
- Use the machines, equipment and tools necessary for the execution of maintenance tasks (EN 15628:2014 A.1:e)

Subject	Knowledge	Skills	Responsibility and autonomy
5.1.1 Mechanics	**A maintenance technician should be able to:** - Describe general mechanics for relevant industry - Explain the basics in movement, mass, force, moment of inertia, kinetic energy, friction - Explain basic physical principles for mechanical parts and components	**A maintenance technician should be able to:** - Carry out general mechanical issues regarding maintenance for industrial processes	**A maintenance technician should be able to:** - Have a basic knowledge and skills in mechanical design and physical principles to understand used techniques
5.1.2 Mechanical parts and components	**A maintenance technician should be able to:** - Describe basic physical principles for mechanical parts and components	**A maintenance technician should be able to:** - Handle actual physical principles to carry out the maintenance work	
5.1.3 Hydraulics and pneumatics	**A maintenance technician should be able to:** - Explain what is significant with hydraulic systems - Explain environmental factors and risks associated with hydraulics - Explain what is significant with pneumatic systems	**A maintenance technician should be able to:** - Perform maintenance work with hydraulic tasks with high pressure and high cleanness - Perform maintenance work with pneumatics in advanced automated solutions	**A maintenance technician should be able to:** - Have a basic knowledge and skills in mechanical design to understand basics in hydraulics and pneumatics in automation
5.1.4 Bearings	**A maintenance technician should be able to:** - Describe different types of bearings and how to handle them in maintenance work	**A maintenance technician should be able to:** - Perform maintenance work with bearing tasks	**A maintenance technician should be able to:** - Have a basic knowledge and skills in mechanical design to understand the function of various types of bearings

	– Describe different types of wear factors; friction, vibration, greasing of plain (babies) and rolling bearings		
5.1.5 Welding and soldering	**A maintenance technician should be able to:** – Explain different welding techniques – Describe the standards, rules, and regulations for welding – Explain different soldering techniques	**A maintenance technician should be able to:** – Carry out welding and soldering tasks in consideration to international rules and standards	**A maintenance technician should be able to:** – Have a basic knowledge and skills in mechanical design to understand welding and soldering principles
5.1.6 Vibration	**A maintenance technician should be able to:** – Explain the principles of vibration and the measuring techniques	**A maintenance technician should be able to:** – Carry out vibration tasks with or without the assistance of other maintenance personnel or experts	**A maintenance technician should be able to:** – Have a basic knowledge and skills in mechanical design to understand vibration and resonance
5.1.7 Tribology	**A maintenance practitioner should be able to:** – Describe the fundamentals of: ▪ Friction ▪ Wear ▪ Lubrication ▪ Different lubrication techniques – Explain different type of common greasing substances and oils	**A maintenance practitioner should be able to:** – Carry out tribological tasks	**A maintenance practitioner should be able to:** – Have a basic knowledge and skills in mechanical design to understand friction and tribology

References

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Qualifications for Maintenance Technician Specialists (EQF level 5)

5.2. Electrics

Overview

- Good knowledge in general electrics
- Ability to perform electrical tasks with or without the assistance of other maintenance personnel or suppliers

Subject	Knowledge	Skills	Responsibility and autonomy
5.2.1 Electrics	**A maintenance technician should be able to:** – Explain general electrics for industrial production	**A maintenance technician should be able to:** – Carry out electrical tasks with or without the assistance of other maintenance personnel or suppliers	**A maintenance technician should be able to:** – Have a basic knowledge and skills in electrics to understand used techniques
5.2.2 Electro techniques	**A maintenance technician should be able to:** – Explain resistant, impedance, currant, voltage and frequents and the relations between these – Explain single-phase and three-phase circuits including areas, currants, voltage, and earthing	**A maintenance technician should be able to:** – Carry out electro techniques with or without maintenance personnel and suppliers – Calculate AC circuits and energy consumptions	**A maintenance technician should be able to:** – Have basic knowledge and skills in electro techniques to understand used techniques
5.2.3 Electrical safety	**A maintenance technician should be able to:** – Describe the risks with high voltage and high currents – Explain different methods for personal protection	**A maintenance technician should be able to:** – Plan and carry out electrical work in a safe way – Follow safety rules and regulations for working in electrical installations	**A maintenance technician should be able to:** – Have basic knowledge and skills in electrical design to understand and follow general safety regulations
5.2.4 Power distribution	**A maintenance technician should be able to:** – Explain methods for distribution of energy with different voltage, currants, transformers earthing, safety etc.	**A maintenance technician should be able to:** – Follow safety rules and regulations for working in electrical installations	**A maintenance technician should be able to:** – Have basic knowledge and skills in electrical design to understand used distribution for high and low voltage

References

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Qualifications for Maintenance Technician Specialists (EQF level 5)

5.3. Automation

Overview

- Good knowledge in automation
- Ability to perform automation tasks

Subject	Knowledge	Skills	Responsibility and autonomy
5.3.1 Automation	**A maintenance technician should be able to:** - Describe general automation with different types of structure, on both system and functional level - Describe common principles in automation with primary, higher, and lower systems, primary and secondary systems, signal exchange and physical blocks in the total systems including Industry 4.0 - Describe the principles for common sensors and actuators, relays, vales, contactors in PLC/PC systems - Describe how control programs in PLC/PC are designed - Describe the basic principles in PID control - Describe the principle for robot technics according to construction and function	**A maintenance technician should be able to:** - Carry out general automation issues - Understand and handle system and function for improvement of the maintenance process - Use and read both horizontal and vertical designed electronic automation drawings, including common symbols and fault descriptions to analyse functions in the machines - Carry out troubleshooting and maintenance of automated systems, including risk assessments - Connect common sensors, pneumatic valves, and relays - Practically handle PID system - Handle the basic functions of the robot when performing maintenance work	**A maintenance technician should be able to:** - Perform maintenance in automation systems with various principles for design in different levels of the systems
5.3.2 Programming	**A maintenance technician should be able to:** - Describe sequence programming of PC and PLC based on analysing functions and system requirements	**A maintenance technician should be able to:** - Do programming with or without the assistance of other maintenance personnel or suppliers	**A maintenance technician should be able to:** - Have a good knowlwdge in how programs can be designed and working together in systems
5.3.3 Electronics	**A maintenance technician should be able to:** - Describe how to handle electronic parts in production equipment	**A maintenance technician should be able to:** - Perform electronical tasks with or without the assistance of other maintenance personnel or suppliers	**A maintenance technician should be able to:** - Handle electronic parts in automation regarding to the design

References

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5.4. Material technology

Overview

- Good knowledge in material technology
- Ability to discuss material technology issues with maintenance personnel and / or suppliers

Subject	Knowledge	Skills	Responsibility and autonomy
5.4.1 Material technology	**A maintenance technician should be able to:** – Explain different material groups; steel, copper, aluminium, ceramics, polymers – Explain materials mechanical, chemical, electrical, thermal, optical, and magnetic properties – Explain how different materials react to wear, tear, temperature, media etc. – Explain degradation and corrosion processes	**A maintenance technician should be able to:** – Use material, and carry out maintenance work regarding to the material characteristics	**A maintenance technician should be able to:** – Handle material and the use of right material for specific application
5.4.2 Non-destructive Testing	**A maintenance technician should be able to:** – Mention the five most common methods in NDT and how to use them in the basic levels	**A maintenance technician should be able to:** – Prepare and use NDT for analyse of materials with maintenance personnel and suppliers	**A maintenance technician should be able to:** – Carry out work with the most common NDT methods
5.4.3 Heat treatment	**A maintenance technician should be able to:** – Explain different heat treatment techniques – Explain processes for hardening – Explain what happens in materials when heated	**A maintenance technician should be able to:** – Use heat treatment techniques and observe undesirable heat treatment, when necessary together with experts	**A maintenance technician should be able to:** – Know the basic principles for heat treatments and how to use them

References

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5.5. Design and modification

Overview

- Understanding in the general requirements for design and mdification

Subject	Knowledge	Skills	Responsibility and autonomy
5.5.1 Design requirements	**A maintenance technician should be able to:** - Mention the general requirements for design - Explain system design and functions in an item for a modification	**A maintenance technician should be able to:** - Transfer production requirements into functional requirements (e.g. equipment dependability) and into quantitative and qualitative maintenance requirements (e.g. reliability and maintainability) and optimize the resources according to the processes: ▪ Collect feedback data (EN 17007:2017 MRQ.1) ▪ Perform risk analyses (EN 17007:2017 MRQ.2) ▪ Develop reliability, maintainability and logistic support requirements (EN 17007:2017 MRQ.3) ▪ Oversee or contribute to the drafting of specifications (EN 17007:2017 MRQ.4) ▪ Issue an invitation to tender to suppliers (EN 17007:2017 MRQ.5) ▪ Participate in the analysis and choice of options and validate the solutions (EN 17007:2017 MRQ.6) ▪ Follow up realization (EN 17007:2017 MRQ.7)	**A maintenance technician should be able to:** - Maintain the platform for progress for the company based on a solid design understanding in: ▪ Production requirement ▪ Maintenance plan ▪ Facility plan ▪ Future requirements

		▪ Verify conformity with the reliability, maintainability and logistic support requirements (EN 17007:2017 MRQ.8) ▪ Establish the initial maintenance plan (EN 17007:2017 MRQ.9) ▪ Determine the initial logistical resources (EN 17007:2017 MRQ.10) ▪ Identify skills and training needs (EN 17007:2017 MRQ.11)	
5.5.2 LCC/LCP techniques/methods	**A maintenance technician should be able to:** – Mention how the concepts of LCC/LCP can be used in different situations – Mention how to verify the LCC values and the consequences if the verified result is not in accordance with specified requirements	**A maintenance technician should be able to:** – Use the LCC/LCP method to verify and motivate the best purchase of an item or a system	**A maintenance technician should be able to:** – Support with material to follow up the figures of LCC and LCP in the company
5.5.3 Modification	**A maintenance technician should be able to:** – Explain the difference between modification and improvement	**A maintenance technician should be able to:** – Discuss and make decisions about modification and improvement in production	**A maintenance technician should be able to:** – Carry out modifications to minimise problem and work with improvement for a more efficient production

References

EN 17007:2017-MRQ – Deliver maintenance requirements during items design and modification:

- The purpose of this process is to define, monitor or realize and validate item investments, modifications and when the operational objectives are no longer reachable or have been changed. It defines the initial reliability, maintainability and maintenance support requirements, maintenance plans, the maintenance providers' related skills and the various logistical resources (hardware, documentation, spare parts, etc.) needed to implement the maintenance plan on these items.

5.6. Facility maintenance

Overview

- Understanding in facility maintenance
- Ability to perform facility maintenance tasks

Qualifications for Maintenance Technician Specialists (EQF level 5)

Subject	Knowledge	Skills	Responsibility and autonomy
5.6.1 Maintenance services for buildings	**A maintenance technician should be able to:** – Mention the most common systems in a facility as; ventilation, heating, sewage, water, gas installations etc.	**A maintenance technician should be able to:** – Perform facility maintenance with maintenance personnel and suppliers for development	**A maintenance technician should be able to:** – Have a basic knowledge in the estate design to perform necessary maintenance

References

EN 15331:2011 – Criteria for design, management and control of maintenance services for buildings:

- This European Standard specifies the criteria and the general methods that can be used in the planning, management and control of maintenance in buildings and their surrounding area according to the applicable legal requirements, objectives of the owners and users and the required quality of maintenance.

6. Maintenance Support

6.1. Documentation

Overview

- Good knowledge in documentation handling
- Ability to manage documentation
- Technical documentation and maintenance manuals (EN 15628:2014 A.1:b)
- Technical documentation and maintenance manuals (EN 15628:2014 A.2:b)

Subject	Knowledge	Skills	Responsibility and autonomy
6.1.1 Maintenance documents	**A maintenance technician should be able to:** – Describe which documents are needed to perform the maintenance tasks, including, work order, technical instructions, maintenance procedures, list of necessary resources, maintenance plans, work schedules, maintenance records and any other document needed to perform maintenance – Explain common systems for managing documentation	**A maintenance technician should be able to:** – Use the documentation according to the processes: ▪ Define and manage rights to the documentation (EN 17007:2017 DOC.1) ▪ Classify and structure the documentation (EN 17007:2017 DOC.2) ▪ Compile (collect, create) and update the reference documentation (EN 17007:2017 DOC.3) ▪ Ensure access at all times to necessary information (EN 17007:2017 DOC.4)	**A maintenance technician should be able to:** – Bring order in needed maintenance document including validity and actuality
6.1.2 Technical documentation and maintenance manuals	**A maintenance technician should be able to:** – Describe how to produce and maintain technical documentation: – Maintenance manuals – Electrical, mechanical pneumatic, electronic, hydraulic schemes and building drawings and CAD-systems	**A maintenance technician should be able to:** – Use electrical, mechanical pneumatic, electronic, hydraulic schemes, building drawings and maintenance manuals	**A maintenance technician should be able to:** – Follow and use different standards in maintenance document
6.1.3 Documentation systems	**A maintenance technician should be able to:** – Explain relevant tools for the maintenance and technical documentation	**A maintenance technician should be able to:**	**A maintenance technician should be able to:** – Use the system for maintenance documentation

		− Maintain and/or update the maintenance documentation system to ensure that all documentation is up to date − Manage the way in which operational documentation is made available (EN 17007:2017 DOC.5)	

References

EN 17007:2017-DOC – Deliver the operational documentation:

− To provide all those concerned, at the place of use, with all the up-to-date and usable documents they need to prepare for and perform the tasks for which they are responsible while optimizing logistic times.

6.2. Information and data management

Overview

− Good knowledge in information and data management
− Ability to manage information and data
− Use and ensure the utilization of the maintenance management system (EN 15628:2014 A.7:a)
− Use and ensure the utilization of the technological tools related to his job (EN 15628:2014 A.7:b)
− Finalize the technical and economic completion in printed form or electronic form, according to procedures (EN 15628:2014 A.7:c)

Subject	Knowledge	Skills	Responsibility and autonomy
6.2.1 Maintenance information systems	**A maintenance technician should be able to:** − Explain types of information systems and the combination of these (e.g. the customer requirements on maintenance, the efficiency of the plant equipment and the machinery, the different contracts for the maintenance performance) − Explain Maintenance Information Systems (for planning, work order, technical / economical analysis etc.)	**A maintenance technician should be able to:** − Use the maintenance information systems	**A maintenance technician should be able to:** − Use maintenance information system including CMMS and other information handling systems if such systems are in use

	– Explain Different types of information for maintenance activities (e.g. workorder, work control, planning, work preparation, spare parts, LCC/LCP, safety, risks, environment, production results, betterment, modifications, investments, etc.)		
6.2.2 Information handling systems	**A maintenance technician should be able to:** – Explain how to use the information handling systems for maintenance tasks	**A maintenance technician should be able to:** – Use the information handling systems for maintenance tasks	
6.2.3 Maintenance data collection	**A maintenance technician should be able to:** – Mention how to collect maintenance data – Explain common data management systems – Explain how to use the data management systems for maintenance tasks – Mention fundamental requirements regarding the security for data management and the need of backup for computer systems	**A maintenance technician should be able to:** – Use and update the data in the systems according to the processes: ▪ Store and validate the raw data in a library and/or a database (EN 17007:2017 DTA.1) ▪ Evaluate the reliability and maintainability of the items by maintaining an actual state assessment of the items (EN 17007:2017 DTA.2) ▪ Draw up and maintain an up-to-date list of critical items (EN 17007:2017 DTA.3)	
6.2.4 Data evaluation	**A maintenance technician should be able to:** – Mention techniques for data evaluation for maintenance processes	**A maintenance technician should be able to:** – Use and update the data in the systems according to the processes: ▪ Evaluate and analyse maintenance data and HSE data (EN 17007:2017 DTA.4) ▪ Evaluate and analyse data related to spare parts (EN 17007:2017 DTA.5) ▪ Evaluate and analyse cases of known or predictable obsolescence (EN 17007:2017 DTA.6) ▪ Collect and analyse events at other organizations (EN 17007:2017 DTA.7)	

		▪ Compare maintenance practices and materials used by other operators or recommended by suppliers (EN 17007:2017 DTA.8)	
6.2.5 Data monitoring	**A maintenance technician should be able to:** – Mention techniques for data monitoring of maintenance processes	**A maintenance technician should be able to:** – Use and update the data in the systems according to the processes: ▪ Monitor methods, technologies, regulations, standards, etc. (EN 17007:2017 DTA.9) ▪ Save and provide access to data in a data processing system (EN 17007:2017 DTA.10) ▪ Calculate, save, and provide access to performance and monitoring indicators (EN 17007:2017 DTA.11)	**A maintenance technician should be able to:** – Process data to improve the maintenance
6.2.6 Computerized Maintenance Management Systems (CMMS)	**A maintenance technician should be able to:** – Describe the different structures in a CMMS – Describe how to use the CMMS for maintenance tasks	**A maintenance technician should be able to:** – Use the CMMS for maintenance tasks	**A maintenance technician should be able to:** – Use an existing CMMS including proper use in the organization
6.2.7 Technical process control systems	**A maintenance technician should be able to:** – Explain common technical process control systems on both system and functional level – Explain the relationship between the process control system and the maintenance information system – Explain common types and the principle of expert systems	**A maintenance technician should be able to:** – Use technical process control systems for troubleshooting and solving problems	**A maintenance technician should be able to:** – Use various technical PC and PLC process control system

References

EN 17007:2017-MAN.6 – Define, select, analyse and communicate the information:

– The technical, organizational, economic and social information that shall be communicated internally and/or externally is defined, selected, analysed and made available to the relevant entities.

EN 17007:2017-DTA – Manage data:

- Collect, analyse, store and transmit all data needed to document and im-prove the maintenance process..

6.3. Resource management

Overview

- Understanding in needed recourses regarding infrastructures, Human Resources, external maintenance services and material, tools and equipment
- Ability to manage resources
- Business job descriptions and roles (EN 15628:2014 A.2:d)
- Principles and techniques distinctive of the profession (EN 15628:2014 A.2:g)
- Materials management techniques and methods (EN 15628:2014 A.4:a)
- Define the needs of technical materials related to maintenance plans (EN 15628:2014 A.4:a)
- Regulatory and procedural constraints related to the management of maintenance equipment and tools (EN 15628:2014 A.4:b)
- Ensure the availability of materials and equipment required for corrective maintenance in accordance with corporate procedures (EN 15628:2014 A.4:b)
- Define and guarantee the availability of materials, machines, equipment and labour necessary for the assigned work (EN 15628:2014 A.5:a)
- Use in an efficient and effective mode the available resources (EN 15628:2014 A.5:b)
- Business job descriptions (EN 15628:2014 A.5:e)

Subject	Knowledge	Skills	Responsibility and autonomy
6.3.1 Infrastructure	**A maintenance technician should be able to:** – Explain needed infrastructural recourses; appropriate and safe premises and areas, necessary power, utilities, and services for maintenance	**A maintenance technician should be able to:** – Plan needed resources according to the processes: ▪ Plan and provide appropriate and safe premises and areas (EN 17007:2017 IST.1) ▪ Plan and provide the necessary power, utilities, and services (EN 17007:2017 IST.2) ▪ Maintain and/or update the infrastructures and facilities (EN 17007:2017 IST.3)	**A maintenance technician should be able to:** – Plan needed resources for the infrastructure
6.3.2 Human resources	**A maintenance technician should be able to:** – Mention how to handle Human Resources in the working team	**A maintenance technician should be able to:** – Plan and provide internal human recourses for the maintenance organization according to the processes:	**A maintenance technician should be able to:** – Follow the Human Resource policy for maintenance

	– Mention why a Human Resources policy must be set up and what the fundamental requirements are for such a policy	▪ Manage jobs and skills (EN 17007:2017 RES.1) ▪ Recruit competent staff (EN 17007:2017 RES.2) ▪ Ensure training, qualification, and certification of internal staff (EN 17007:2017 RES.3) ▪ Provide internal Human Resources (EN 17007:2017 RES.4)	
6.3.3 External maintenance services	**A maintenance technician should be able to:** – Mention the needed external maintenance services to carry out work including, contacts between external and internal maintenance personnel, work scheduling, work execution and reporting	**A maintenance technician should be able to:** – Carry out the external maintenance services and their quality and quantity according to the processes: ▪ Identify competent external companies (EN 17007:2017 SER.1) ▪ Contract with external companies (EN 17007:2017 SER.2) ▪ Manage contracts and evaluate companies and services (EN 17007:2017 SER.3) ▪ Provide external services (EN 17007:2017 SER.4)	**A maintenance technician should be able to:** – Cooperate with external resources as a part of total maintenance in the company. These activities include reporting activities and in cooperation in CMMS system
6.3.4 Material, tools and equipment	**A maintenance technician should be able to:** – Mention needed equipment to perform maintenance tasks; material, tools, measuring and control equipment, computer equipment, handling equipment (slings, fork-lift trucks, hoists, etc.), means of access (scaffolding, ladders, platforms, etc.) – Mention common requirements for handling materials, tools, and equipment	**A maintenance technician should be able to:** – Handle the material, tools and equipment and their location, quality and quantity according to the processes: ▪ Determine and provide the support equipment needed for maintenance (EN 17007:2017 TOL.1) ▪ Store the support tools and equipment (EN 17007:2017 TOL.2) ▪ Maintain and/or Update the support equipment (EN 17007:2017 TOL.3)	**A maintenance technician should be able to:** – Plan for basic material, tools, and equipment for maintenance

		▪ Deliver the tools and other support equipment (EN 17007:2017 TOL.4) ▪ Determine and provide a maintenance management, decision support software tools and documentation system (EN 17007:2017 TOL.5) ▪ Maintain and/or update the maintenance documentation system (EN 17007:2017 TOL.6)	
6.3.5 Remote maintenance	**A maintenance technician should be able to:** – Mention common remote maintenance methods	**A maintenance technician should be able to:** – Perform remote maintenance	**A maintenance technician should be able to:** – Carry out maintenance outside own plant
6.3.6 Contracting, outsourcing and insourcing	**A maintenance technician should be able to:** – Name ways of contracting, outsourcing, and insourcing maintenance resources – Mention the pros and cons of outsourcing maintenance	**A maintenance technician should be able to:** – Cooperate with insourced and outsourced maintenance resources to carry out the maintenance work	**A maintenance technician should be able to:** – Handle legal aspects round own and supporting maintenance resources

References

EN 17007:2017-IST – Provide the needed infrastructures:

- Provide the infrastructures and facilities that all maintenance personnel need to fully perform their tasks in a manner that is safe for the individuals, the items and the environment.

EN 17007:2017-RES – Provide internal Human Resources:

- Provide in a timely manner the internal Human Resources who have the necessary skill levels and certification to perform the maintenance activities.

EN 17007:2017-SER – Provide external maintenance services:

- Provide in a timely manner the maintenance services carried out by external companies who have the necessary skill levels and certification to perform the maintenance activities.

EN 17007:2017-TOL – Deliver the tools, support equipment and information system:

- Provide users with the operational technical resources needed for maintenance (conventional and specialized tools, test, handling and other equipment, and information and maintenance management systems)

6.4. Spare parts management

Overview

- Very good knowledge in spare parts management
- Ability to manage spare parts

Subject	Knowledge	Skills	Responsibility and autonomy
6.4.1 Spare parts management	**A maintenance technician should be able to:** – Describe the key factors regarding spare parts management	**A maintenance technician should be able to:** – Carry out and implement an efficient spare parts management	**A maintenance technician should be able to:** – Manage spare part handling and routines for purchase and delivery adapted for planned maintenance
6.4.2 Spare part calculations	**A maintenance technician should be able to:** – Explain common methods for spare parts calculations, e.g. Wilson formula, ABC-analysis – Describe how to calculate the total amount of spare parts and how many of each type, inclusive the typical mathematical formulas for this purpose	**A maintenance technician should be able to:** – Determine the spare items and the volumes to keep in stock for maintenance (EN 17007:2017 SPP.1)	**A maintenance technician should be able to:** – Calculate best stock of spare parts in relation to the needs and eventually emergency situations
6.4.3 Material and store handling	**A maintenance technician should be able to:** – Describe different ways of organizing the spare part store (e.g., centralized, decentralized, at the supplier)	**A maintenance technician should be able to:** – Manage stocks for an efficient maintenance (EN 17007:2017 SPP.2)	**A maintenance technician should be able to:** – Develop and keep a system for spare stock management
6.4.4 Logistics support	**A maintenance technician should be able to:** – Explain routines and organization for an optimized logistic support (e.g. purchasing, quality control, delivery systems inside the maintenance organization, etc.)	**A maintenance technician should be able to:** – Carry out the logistic support of maintenance resources according to the processes: ▪ Reserve or issue a purchase request for spare items (EN 17007:2017 SPP.3) ▪ Order spare items from suppliers (EN 17007:2017 SPP.4) ▪ Establish and monitor contracts with suppliers (EN 17007:2017 SPP.5)	**A maintenance technician should be able to:** – Develop and keep a total system for handling spare parts in the store including quality and meeting ageing problem

6.4.5 Spare part handling	**A maintenance technician should be able to:** – Describe the different factors that will have an influence on an optimized organisation of the spare part consumption (e.g. cost for lack of spare parts, cost for storage, cost for interest, etc.)	**A maintenance technician should be able to:** – Carry out for an efficient spare part handling according to the processes: ▪ Receive ordered or repaired spare items (EN 17007:2017 SPP.6) ▪ Add the spare items to stock (EN 17007:2017 SPP.7) ▪ Perform preventive maintenance on spare items in stock (EN 17007:2017 SPP.8) ▪ Deliver spare items (EN 17007:2017 SPP.9) ▪ Assess replaced items (EN 17007:2017 SPP.10) ▪ Repair replaced items (EN 17007:2017 SPP.11) ▪ Dispose faulty or damaged items (EN 17007:2017 SPP.12)	**A maintenance technician should be able to:** – Plan, organize and administrate a spare part store

References

EN 17007:2017-SPP – Deliver spare parts:

– Provide the maintenance teams with the spare parts and, more generally, all spare items (spare parts, consumables, materials, etc.) needed for the maintenance actions within the required timeframes.

6.5. Procurement

Overview

– Good knowledge in procurement of maintenance parts and services

Subject	Knowledge	Skills	Responsibility and autonomy
6.5.1 Procurement	**A maintenance technician should be able to:** – Explain the different steps in procurement of maintenance recourses	**A maintenance technician should be able to:**	**A maintenance technician should be able to:**

	– Explain the influence of maintenance in the procurement – Explain procedures regarding procurement including technical specifications	– Discuss and make decisions regarding procurement issues with the procurement department	– Support the general aspects of procurement including technical specifications
6.5.2 Replacement investments	**A maintenance technician should be able to:** – Explain company rules for replacement investments	**A maintenance technician should be able to:** – In cooperation with production, advise when to invest in replacements	

References

EN 13269:2016 – Guideline on preparation of maintenance contracts:

– This European Standard provides guidance on the preparation of private contracts for maintenance services.

6.6. Risk based maintenance

Overview

– Good knowledge in Risk Based Maintenance

– Ability to use risk assessment in maintenance prepare the risk assessment, identify risks, prioritize risks, propose measures for preventing risks and consequences of identified risks and monitor risk management

Subject	Knowledge	Skills	Responsibility and autonomy
6.6.1 Risk assessment in maintenance	**A maintenance technician should be able to:** – Describe common risks and how it is defined – Describe common steps in general risk analysis – Describe common technical and human related risks and how to handle them	**A maintenance technician should be able to:** – Calculate and prevent risks within maintenance – Judge the quality on performed risk analysis	**A maintenance technician should be able to:** – Manage risk prevention related to production and to maintenance
6.6.2 Methods for risk analysis	**A maintenance technician should be able to:** – Describe common methods for risk analysis and when they can be used (e.g. FMEA, RCM, Criticality Analysis, Fault-tree)	**A maintenance technician should be able to:** – Apply and carry out different methods for risk analysis	**A maintenance technician should be able to:** – Handle existing methods on the market and implement best methods

	− Describe the different steps in a Reliability Centred Maintenance (RCM) − Describe the different steps in a Criticality Analysis		
6.6.3 Monitor risk management	**A maintenance technician should be able to:** − Describe common methods for risk monitoring	**A maintenance technician should be able to:** − Plan and perform risk monitoring	**A maintenance technician should be able to:** − Handle accrued incidents.

References

EN 16991:2018 – Risk-based inspection framework:

− This European Standard specifies the Risk-Based Inspection Framework (RBIF) and gives guidelines for Risk-Based Inspection and Maintenance (RBIM).

7. Basic knowledge

7.1. Maintenance terminology

Overview

- Very good knowledge in maintenance terminology
- Ability to use the proper terminology when discussing maintenance with maintenance personnel, production, and suppliers

Subject	Knowledge	Skills	Responsibility and autonomy
7.1.1 General terminology	**A maintenance technician should be able to:** – Describe general maintenance terminology	**A maintenance technician should be able to:** – Use proper general terminology when discussing and documenting maintenance with maintenance personnel, production, and suppliers	**A maintenance technician should be able to:** – Understand and correct use common technical words and concepts.
7.1.2 Availability	**A maintenance technician should be able to:** – Describe how reliability has to do with the time of the ready state for the equipment – Describe the definition of availability – Describe the connection and differences between dependability, availability, reliability, maintainability, and supportability – Describe the measure of availability – Describe the influence of availability on the production – Describe different ways to improve the availability	**A maintenance technician should be able to:** – Use the proper terminology when discussing availability with maintenance personnel, production, and suppliers – Calculate the availability with respect to down time, running time, operational cycles, production, calendar time, etc. – Analyse what causes low availability	**A maintenance technician should be able to:** – Understand how the availability affects the production process including calculation, vocabulary, and concepts
7.1.3 Reliability	**A maintenance technician should be able to:** – Describe how reliability has to do with the number of failures and the disabled states due to maintenance activities – Describe the definition of reliability	**A maintenance technician should be able to:** – Use a proper terminology when discussing and documenting reliability with maintenance personnel, production, and suppliers	**A maintenance technician should be able to:** – Understand how the reliability affects the production process including calculation, vocabulary, and concepts

	– Describe different measures of reliability (MTBF and MTTF) – Describe different types of redundancies – Describe different ways to improve the reliability (e.g. the choice of components, redundancies, design, preventive maintenance, better operational use)	– Calculate the reliability probability for single, serial, and parallel system and for active and passive redundancies	
7.1.4 Maintainability	**A maintenance technician should be able to:** – Describe how reliability has to do with active time for maintenance – Describe the definition of maintainability – Describe different measures of maintainability (MRT and M) – Describe different ways to improve the maintainability (e.g. design, documentation, maintenance equipment, education) – Describe which time elements that are included or not included in the calculation (e.g. preparation time, functional check out, waiting for resources)	**A maintenance technician should be able to:** – Use the proper terminology when discussing and documenting maintainability with maintenance personnel, production, and suppliers – Calculate the maintainability and analyse what causes the length of active maintenance times	**A maintenance technician should be able to:** – Understand how the maintainability affects the production process including calculation, vocabulary, and concepts
7.1.5 Maintenance Supportability	**A maintenance technician should be able to:** – Describe how reliability has to do with waiting times for maintenance resources – Describe the definition of supportability – Describe the measure of supportability (MWT) – Describe different ways to improve the supportability (e.g. assure faster access of personnel, documentation, spare parts, maintenance equipment, transports and assure faster administrative routines)	**A maintenance technician should be able to:** – Use the proper terminology when discussing and documenting supportability with maintenance personnel, production, and suppliers – Calculating supportability and analyse what causes the length of the waiting times	**A maintenance technician should be able to:** – Understand how the maintenance supportability affects the production process including calculation, vocabulary, and concepts

References

Qualifications for Maintenance Technician Specialists (EQF level 5)

EN 13306:2017 – Maintenance terminology:

- This European Standard specifies generic terms and definitions for the technical, administrative and managerial areas of maintenance.

7.2. Basics in mathematics, physics and chemistry

Overview

- Good knowledge in mathematics, physics, and chemistry
- Ability to use basics in mathematics, physics, and chemistry

Subject	Knowledge	Skills	Responsibility and autonomy
7.2.1 Mathematics	**A maintenance technician should be able to:** – Explain basic academical and practical mathematics	**A maintenance technician should be able to:** – Use the basics in mathematic calculations	**A maintenance practician should be able to:** – Use mathematics, physics, chemistry, and statistics in daily work
7.2.2 Physics	**A maintenance technician should be able to:** – Explain basic academical and practical physics	**A maintenance technician should be able to:** – Use the basics in physics applications	
7.2.3 Chemistry	**A maintenance technician should be able to:** – Explain basic academical and practical chemistry	**A maintenance technician should be able to:** – Use the basics in chemistry applications	
7.2.4 Statistical methods	**A maintenance technician should be able to:** – Explain common statistical methods	**A maintenance technician should be able to:** – Use the common statistical methods for analysis	

References

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Qualifications for Maintenance Technician Specialists (EQF level 5)

7.3. Maintenance standards

Overview

- Understanding in European standards within maintenance

Subject	Knowledge	Skills	Responsibility and autonomy
7.3.1 EN 13269:2016 Guideline on preparation of maintenance contracts	**A maintenance technician should be able to:** – Name in brief the standard EN 13269:2016 Guideline on preparation of maintenance contracts	**A maintenance technician should be able to:** – Use the standard EN 13269:2016 Guideline on preparation of maintenance contracts	**A maintenance technician should be able to:** – Use the standard in normal work including vocabulary and concepts
7.3.2 EN 13306:2017 Maintenance Terminology	**A maintenance technician should be able to:** – Mention the standard EN 13306:2017 Maintenance Terminology	**A maintenance technician should be able to:** – Use the standard EN 13306:2017 Maintenance Terminology	
7.3.3 EN 13460:2009 Maintenance Documentation	**A maintenance technician should be able to:** – Name in brief the standard EN 13460:2009 Maintenance Documentation	**A maintenance technician should be able to:** – Use the standard EN 13460:2009 Maintenance Documentation	
7.3.4 EN 15331:2011 Criteria for design, management and control of maintenance services for buildings	**A maintenance technician should be able to:** – Name in brief the standard EN 15331:2011 Criteria for design, management, and control of maintenance services for buildings	**A maintenance technician should be able to:** – Use the standard EN 15331:2011 Criteria for design, management, and control of maintenance services for buildings	
7.3.5 EN 15341:2019 Maintenance Key	**A maintenance technician should be able to:** – Name in brief the standard EN 15341:2019 Maintenance Key Performance Indicators	**A maintenance technician should be able to:** – Use the standard EN 15341:2019 Maintenance Key Performance Indicators	

Performance Indicators			
7.3.6 EN 15628:2014 Qualifications of maintenance personnel	**A maintenance technician should be able to:** − Name in brief the standard EN 15628:2014 Qualifications of maintenance personnel	**A maintenance technician should be able to:** − Use the standard EN 15628:2014 Qualifications of maintenance personnel	
7.3.7 EN 16646:2014 Maintenance within physical asset management	**A maintenance technician should be able to:** − Name in brief the standard EN 16646:2014 Maintenance within physical asset management	**A maintenance technician should be able to:** − Use the standard EN 16646:2014 Maintenance within physical asset management	
7.3.8 EN 16991:2018 Risk-based inspection framework	**A maintenance technician should be able to:** − Name the standard EN 16991:2018 Risk-based inspection framework	**A maintenance technician should be able to:** − Use the standard EN 16991:2018 Risk-based inspection framework	
7.3.9 EN 17007:2017 Maintenance process and associated indicators	**A maintenance technician should be able to:** − Name in brief the standard EN 17007:2017Maintenance process and associated indicators	**A maintenance technician should be able to:** − Use the standard EN 17007:2017Maintenance process and associated indicators	

References

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7.4. Technical English

Overview

− Good knowledge in technical English

Subject	Knowledge	Skills	Responsibility and autonomy

Qualifications for Maintenance Technician Specialists (EQF level 5)

7.4.1 Maintenance technical English	**A maintenance technician should be able to:** – Describe the basics in English maintenance vocabulary – Understand maintenance terms in the English language	**A maintenance technician should be able to:** – Understand and apply technical text and maintenance terms in English	**A maintenance technician should be able to:** – Read and understand technical documents

References

– Language test in English is adapted for test takers which have other mother tongue than English.