Subjects highlighted in gray are already written or reserved			
No	SUBJECTS	DEFINITIONS OF SUBJECTS	Status
		Related to Maintenance Management	
1	**Relations between maintenance and other processes**	Maintenance is one of the processes of industrial companies that has a strong impact on performances. It has also strong relationships with the other processes (acquisition/creation, operation, modernisation, disposal, support processes) as well as with organizational strategic plan of the company. These relations must be identified and managed so that maintenance contributes effectively to the management of the assets. Business, corporate and maintenance objectives must be consistent in order to properly manage the assets, assets systems and assets portfolio. It is to consider the maintenance within the Asset Management. Maintenance is one of the processes of industrial companies that has a strong impact on performances. It has also strong relationships with the other processes (acquisition/creation, operation, modernisation, disposal, support processes) as well as with organizational strategic plan of the company. These relations must be identified and managed so that maintenance contributes effectively to the management of the assets.	Validated
2	**Maintenance process description – roles & responsibilities**	The maintenance process includes corrective maintenance, preventive maintenance and the process of improving intrinsic reliability and maintainability of equipment. It also includes all the support processes that make it possible to carry out maintenance actions on assets (management of resources, maintenance during design phase, etc.). The description of these processes and their interrelationships is useful to determine the roles and responsibilities of the stakeholders, to define indicators and to manage the entire maintenance process.	Reserved
3	**Life cycle management**	Management of costs over the life cycle of assets encloses total cost of acquisition, ownership and disposal of the assets. Maintenance costs are of particular concern because they have a significant impact on direct costs (direct maintenance costs) and indirect costs (availability of assets, plant safety, company image, etc.). Continuous improvement methods (as PDCA) apply to the maintenance process during the assets life cycle.Management of costs over the life cycle of assets encloses total cost of acquisition, ownership and disposal of the assets. Maintenance costs are of particular concern because they have a significant impact on direct costs (direct maintenance costs) and indirect costs (availability of assets, plant safety, company image, etc.).	Validated
4	**Life cycle extension**	Maintenance is particularly concerned with the decision to extend the lifetime of assets. Indeed, the durability of assets and their renovation costs can be decisive factors in the choices made by assets managers.	
5	**Maintenance, and investment decisions**	Investment decisions often depend on the maintenance costs and unavailability factor of installed assets, and on estimation of the maintenance costs of future investments. Moreover, maintenance must be taken into account in the choices of the assets to be acquired and/or to be designed in order to minimize their overall cost of ownership.	Validated
6	**Rebuilding & Reinvestment strategies**	Rebuilding and reinvestment strategies depend in part on the maintenance effectiveness and maintenance costs. The assets reliability and maintainability assessed through the analysis of experience feedback are important elements for decision-making.	
7	**Regulations and relations with auditing & safety organizations**	A part of the maintenance tasks are required by regulations and close relationships must be established with the organizations/authorities in charge of safety of the installations to carry out and monitor the mandatory tasks. In addition, internal or external audits are often carried out to verify the implementation and results of maintenance, which is a strategic function for companies. Knowledge of regulations and relevant technical standards are paramount.	
8	**Uncertainty in maintenance management**	Reliability data, maintenance costs of assets and effectiveness of maintenance plans are often uncertain data. That leads decision-makers to use stochastic techniques that evaluate the uncertainties obtained on the results of models calculating the performances of these assets and thus make decisions more robust.	
9	**Maintenance and Sustainability**	Maintenance is an essential lever for sustainable development because when maintenance is involved in the design phase of the assets and when these assets are designed to be maintainable and reliable then their useful life is increased. A longer useful life and appropriate maintenance actions is a way to act on the economical, ecological and social aspects of companies and to ensure sustainability of the assets. In particular Maintainability is a guarantee of sustainable development.	Reserved
10	**Maintenance and industry 4.0**	Industry 4.0 is a new concept based on digitalization of information. It includes cyber-physical systems, the Internet of things, cloud computing and cognitive computing. Maintenance is directly concerned by these new technologies where diagnosis, prognosis and all maintenance processes based on data collection and analysis will be strongly impacted. Therefore, the management process must take into account these new techniques to establish its maintenance strategy.	Validated
11	**Total Productive Maintenance**	TPM (Total Productive Maintenance) is a method to manage maintenance activities in order to improve productivity of manufacturing processes, especially by reducing downtimes and increasing OEE (Overall Equipment Effectiveness). While RCM is essentially technical, TPM is more concerned by organization and work process. It involves operators as well as maintenance staff, starting with simple but efficient actions as 5S, then prioritizing and solving problems through teamwork.	Reserved
12	**FRACAS (Failure Reporting Analysis Corrective Action System)**	FRACAS methods are based upon the principles of problem solving techniques, they aim to improve the dependability of current and future designs by feedback of testing, modification and use experience. They include methods as PCDA (Plan-Do-Check-Act), DMAIC (Define Measure Analyse Improve Control), Ishikawa, KT (Kepner and Tregoe), KAISEN, 6 SIGMA, 8D (8 Disciplines), A3 (Toyota method), etc.	Reserved
13	**Value based maintenance**	This approach was introduced to quantify the economic added value of maintenance in terms of cash flows (especially through calculation of Net Present Value). It helps to identify the value drivers, to measure and to benchmark performances in order to apply best practices (e.g. : equipment probability improvement, work processes, information systems, …).	Reserved

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14	**Communication, training and coaching : basic principles and techniques**	The explanation of maintenance objectives and strategies, the supervision and coordination of activities and the presentation of maintenance results require good knowledge of oral and written communication techniques. The ability to establish effective relationships with people involved in maintenance activities, company employees as well as external service providers, is essential to manage all the tasks to be performed with maximum efficiency. Communication, training and coaching techniques must be mastered by everyone involved in maintenance management.	
15	**Negotiation techniques and industrial relations**	The maintenance manager must set up a network of industrial relations and know the negotiation techniques. These techniques consist of knowing how to set specific goals, how to listen the other parties, ask the right questions, propose innovative solutions, make concessions to find a compromise and finalize agreements. The manager must develop the necessary qualities to be a good negotiator.	
16	**Organizational models, work cycles, responsabilities**	The maintenance process, as described in EN17007, must be carried out by an organization adapted to the company and the activity sector. It is therefore necessary to determine the best organizational model and to allocate responsibilities. To do this, it is necessary to determine the interfaces with the other processes and choose a maintenance service organization model (eg centralized maintenance or decentralized maintenance by trade, division into departments according to the production system, etc.)	
17	**Fundamentals of projects and control management**	Project management plays a crucial role in achieving objectives. Different methods are used to determine tasks, milestones and schedule. They allow identify the critical path and know how to react quickly and be agile in case of unexpected events. They are used to create teams, to communicate, to prioritize everyone's tasks and to monitor the progress of the project.	
	Related to Maintenance execution		
18	**Fault diagnosis**	Fault diagnosis covers the methods and techniques that make it possible to detect faults and to locate them. This includes testing for fault detection on standby items and techniques for localisation of faulty components when an item is in downstate due to failure.	
19	**Root Cause Analysis**	Root cause analysis (RCA) is a "systematic process to identify the cause of a fault, failure or undesired event, so it can be removed by design, process or procedure changes" [IEV 50(192)]. Root Cause Analysis is a method to identify the preliminary causes of an event (especially failures). Different techniques can be performed to find causes, as why-because analysis, Ishikawa diagrams, fault trees, Bayesian networks, etc. It is based on past events in order to avoid recurrence of similar situations by changing conditions, actions or organization and to improve continuously the maintenance process.	Reserved
20	**Criticality analysis (RCM, …)**	RCM is a "systematic method for determining the respective maintenance tasks and associated frequencies, based on the probability and consequences of failure" [IEV 50(191)]. The method consists in identification of failure modes and there causes which are critical against objectives (availability, safety, costs, etc.), then to determine the efficient and cost effective maintenance tasks to prevent the occurrence of these failures. The data used may be derived from experience feedback analysis and used in FMECA. RCM may also initiate modifications of design or procedures to carry out improvements.	Validated
21	**Maintenance and risk management (RBI, …)**	Risk Based Inspection (RBI) is a method used to determine where inspections (generally Non Destructive Testing) must be performed to avoid serious failures. This approach applies more especially to passive items characterized by High Impact – Low Probability (HILP) failures (examples : pipes, structures, ...). Reliability modeling is used to identify where and when degradation mechanisms are more likely expected in order to focus inspections on critical areas. Approaches based on expert opinion are often called Risk Informed Inspection (RII).	Reserved
22	**Work preparation & scheduling**	Preparation of maintenance tasks consists in writing and updating the maintenance procedures which describe the actions to be performed (including safety of individuals), define the necessary resources, and estimate the workload. Scheduling consists in setting in order the tasks to be done and determining the starting and ending dates according to the constraints (production, …).	
23	**Shutdown & turnaround management**	Shutdowns require a special organization to secure the installation, carry out maintenance tasks according to an established schedule, organize logistic support, take into account the hazards, and carry out the necessary tests and requalification to return the equipment to the operator. All of these activities must be optimized to minimize costs and unavailability, given existing constraints.	
24	**Condition monitoring techniques (vibration analysis, thermography, tribology, etc.)**	Condition monitoring techniques are part of condition based maintenance which consist of measuring "at predetermined intervals the characteristics and parameters of the physical actual state of an item" [EN13306]. They include especially vibration analysis, thermography, tribology, etc. and don't lead to unavailability of the asset.	Reserved
25	**Non Destructive Testing (ultrasonic testing, Eddy current, radiography, etc.)**	Non destructive testing are maintenance techniques, part of condition based maintenance, which consist of measuring, observing, or testing the relevant characteristics of an item. They include ultrasonic testing, Eddy current, radiography, gammagraphy, etc. and lead generally to unavailability of the asset.	
26	**Diagnosis & Prognosis and Predictive maintenance**	Predictive maintenance is a part of condition based maintenance “carried out following a forecast derived from repeated analysis or known characteristics and evaluation of the significant parameters of the degradation of the item” [EN13306]. These techniques consist of a diagnosis to evaluate the state of the items and a prognosis to estimate its evolution over time.	Validated

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27	**Equipment health analysis**	Prognosis and Health Management (PHM) is a discipline which uses news technologies (especially digital electronics) to assess health of items (degradation levels) and to predict in real-time their reliability and remaining useful life. It is used in different industrial sectors such as aerospace, military systems, automobiles, etc., to improve maintenance and logistic support. That allows to carry out maintenance based on current and predicted health of the items and to be more efficient in detecting faults or degradations and in decreasing downtimes and costs.	Reserved
28	**Ageing and degradation mechanism modelling**	Prediction of failures requires representing the failure mechanisms of items which can be done using : - "Black box" approaches based on the statistics of time to failure (distribution of useful lifetimes), - "Gray box" approaches that represent the evolution of degradation over time from measurements but without describing the physical mechanism, - "White box" approaches based on simulation of a physical model of the failure mechanism.	Reserved
29	**Remaining useful life assessment**	Useful life is the "time interval from a given instant until the instant when a limiting state is reached. The limiting state may be a function of failure rate, maintenance support requirement, physical condition, economics, age, obsolescence, changes in the user's requirements or other relevant factors" [EN13306]. The remaining useful life (RUL) takes into account the knowledge of the current state of an item and its estimation is a part of prognosis and health management. It provides key information in decision making by quantifying how much time is left until failure. Useful life is the "time interval from a given instant until the instant when a limiting state is reached. The limiting state may be a function of failure rate, maintenance support requirement, physical condition, economics, age, obsolescence, changes in the user's requirements or other relevant factors" [EN13306]. The remaining useful life (RUL) takes into account the knowledge of the current state of an item and its estimation is a part of prognosis and health management. It provides key information in decision making by quantifying how much time is left until failure. Useful life is the "time interval from a given instant until the instant when a limiting state is reached. The limiting state may be a function of failure rate, maintenance support requirement, physical condition, economics, age, obsolescence, changes in the user's requirements or other relevant factors" [EN13306]. The remaining useful life (RUL) takes into account the knowledge of the current state of an item and its estimation is a part of prognosis and health management. It provides key information in decision making by quantifying how much time is left until failure.	
30	**e-maintenance**	e-maintenance is a maintenance performed via computing, usually remotely, to monitor equipment and detect early degradation so that it is possible to refurbish the equipment at a convenient time.	
31	**Operator Based Maintenance**	These are the maintenance actions carried out by an operator. These actions are generally simple and can be early preventive actions to mitigate failure mechanisms or detection of symptoms leading to subsequent actions carried out by maintenance personel.	Reserved
32	**Remote maintenance**	Remote maintenance consists of maintenance actions "performed without direct physical personnel to the item". Robots can be used to perform this kind of maintenance.	
33	**Disassembly and reassembly processes**	Disassembly and reassembly of items sometimes require special studies due to their accessibility and to the accessibility to their components. Computerized simulations of items' handling, storage and repair can be used to determine feasibility and to optimize maintenance times.	
34	**Qualification of equipment**	Some equipment must be qualified to be put into service. They are testing to demonstrate their ability to meet the requirements and in particular those in relation to safety. Some equipment must be re-qualified after maintenance tasks.	Reserved
35	**Reliability & maintainability improvements**	when preventive maintenance does not provide good operational reliability or when maintainability is not sufficient to achieve a good level of availability, improvements of item are required in terms of reliability or maintainability. Analysis must be carried out to assess dependability characteristics and identify efficient and cost effective changes in the item design or manufacturing.	
		Related to Maintenance Support	
36	**Replacement investments**	Replacement investment is generally an optimization problem often linked to life extension of items. Operational research techniques are used to find the best trade-off between costs and expected benefits of replacements.	
37	**Budgetary control**	to establish each year the maintenance budget it is necessary to identify the regular and exceptional costs. It is then necessary to know the rules of the budgetary control to follow the deviations and to signal them to the management so as to take the necessary measures	Reserved
38	**Maintenance knowledge & best practices**	Maintenance improvement is based on Maintenance knowledge & best practices. That requires learning, training, benchmarking and implementation of better ways of ensuring high maintenance performance. Benchmarking makes it possible to identify best practices which must be analyzed and adapted to other context. Maintenance knowledge must be capitalized and carefully transferred within the company which requires an ad hoc organization.	
39	**Maintenance documents**	Maintenance documentation contains different types of documents (equipment technical data, maintenance plans, maintenance procedures, spare parts catalogs, etc.) which must be managed in order to be available when required with relevant and updated information.	

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40	**Maintenance standards**	Many maintenance standards are produced by various technical committees of standardization bodies at the national (national standardization bodies), European (CEN/TC319) and international levels (IEC/TC56, ISO/TC108, 135, 251, ...). These standards are documents, usually of voluntary application, that represent a consensus of experts on a given subject. It is important to monitor them, to participate in their development and to keep an up-to-date list in relation to the topics covered.	
41	**Maintenance data collection**	Observations and resulting data are needed to the maintenance improvement process. These maintenance data must be collected, which means they must be defined (what must be measured?), measured, and stored in appropriate databases. Collection of maintenance data covers data related to : preventive and corrective activities, costs, spare parts, tools, human resources, sub-contractors, safety of individuals, reliability and maintainability of equipment, global performances of systems/plants (availability, environment, quality, safety, value, …), customer/client satisfaction, etc.	Validated
42	**Performance Indicators & Dashboards**	Maintenance Key performance Indicators (KPI) are measured characteristics related to an item or a maintenance activity to support management in achieving maintenance excellence. The use of sets of associated, consistent and complementary indicators (dashboard) providing synthetic and global information allows developing strategies to meet the maintenance objectives. KPI can be focused on the past (lagging indicators) or on the future (leading indicators) and dashboards must gather these two categories. Definition and collection of indicators is the first step for a maintenance improvement process.	Reserved
43	**Big data for maintenance and asset management**	Nowadays, the information digitalization techniques coming from industry 4.0 (Internet of things, cloud computing, data lakes, cognitive computing, etc.) make it possible to treat a big volume of data and to increase efficiency of diagnosis and prognosis. Condition based and predictive maintenance will benefit from these new opportunities.	
44	**Occupational diseases and accidents**	Maintenance occupations cause a higher proportion of occupational accidents and diseases than the average value. It is then essential to identify dangers and investigate and address the risks associated with maintenance activities.	Reserved
45	**Risk assessment in maintenance**	Risks analyzes related to health and safety of maintenance personnel must be carried out systematically during the preparation of maintenance tasks. More generally they must also be carried out to identify and to prevent risks in the workplace, especially in workshops, warehouses and all areas where maintenance activities are carried out.	Reserved
46	**Good practices in Health and Safety**	In the field of safety, good practices must be identified and shared in order to reduce accidents and occupational diseases. The pooling of good practices, both to prevent risks and to reduce their consequences must be undertaken systematically and as widely as possible.	Reserved
47	**Good practices in environmental preservation**	In the field of environment preservation, good practices must be identified and shared in order to reduce pollution and damages to the environment. The pooling of good practices, both to prevent risks and to reduce their consequences must be undertaken systematically and as widely as possible.	
48	**Maintenance of real estates**	Wharehouses, workshops, offices are infrastructures that require constant maintenance to ensure that the installations function properly and to prevent unforeseen expenses. In particular, emergency items and infrastructures must be maintained according to given regulations.	
49	**Facility management**	To ensure, support and improve the effectiveness of the organization's core activities, actions as cleaning operations, routine maintenance on buildings (painting, plumbing, glazing, etc.) must be carried out.	
50	**RAMS management during design**	Reliability, Availability, Maintainability and Safety (RAMS) is a generic term to encompass analysis performed in the early stages of an industrial or building project. It covers reliability analysis (failure modes, effects and criticality analysis, human error analysis, etc.), safety analysis (preliminary hazard analysis, probabilistic safety assessment, sneak analysis, vulnerability analysis, etc.), preliminary definition of maintenance (preventive and corrective actions), maintainability and supportability analysis (accessibility, repairs, spare parts, tools, etc.). RAMS is rather the implementation of methods than a single method but it results in global trade-offs between allocation of reliability, maintainability and logistic support to meet the dependability and safety requirements.	Reserved
51	**Maintainability studies**	Maintainability studies must be carried out during the design and development phase. In conjunction with reliability studies they are used to guide design decisions and predict the item maintainability. Maintainability studies cover many factors as accessibility, interchangeability modularity, ability to tolerate the fault, ability to detect degradations, ability to be safe for maintenance personnel, testability, etc.	Validated
52	**Design out maintenance**	Design Out Maintenance consists of eliminating the need for maintenance during the design phase of an item. That can be done though over-sizing of items or any other solution which makes it possible to avoid critical degradation mechanisms or the consequences of these mechanisms. It can also results in determination of ways to detect hidden failures.	

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53	**Integrated Logistic Support**	"Management process to co-ordinate the provision of all materials and resources required to meet the needs for the operation and maintenance." [IEV 50(192)] ILS is a method introduced by the US Army (MIL-STD1388) to consider the activities and resources required to operate and maintain a product in service. It covers maintenance actions, manpower, training, spare parts provisioning, technical documentation, packaging and handling, storage and transportation, support equipment (tools, test and monitoring equipment, software) and disposal. Logistic Support Analysis (LSA) must be performed iteratively throughout the design process in order to ensure that the product can be operated and supported at an affordable cost. Indeed, the expenses due to logistic support are a major contributor to the life cycle cost (LCC) of a product and increasingly customers are making purchase decisions based on life cycle cost rather than initial purchase price alone.	Reserved
54	**Lean Maintenance**	The objective of Lean maintenance is to link different methods as TPM, RCM, Kaizen, etc. in order to improve productivity and quality and to reduce the amount of inputs and wastes. The use of CMMS (computerized maintenance management system) or EAM (Enterprise Asset Management) is strongly advised. Lean maintenance is rather principles than a formalized method.	
55	**Decision making in maintenance**	Decision in maintenance must often consider multiple criteria leading to complex choices. Decision making techniques can be used to aggregate criteria, to evaluate the costs and benefits of the alternatives and to synthesize the opinions of experts.	
56	**Benchmarking**	When KPIs have been collected, the second step is to compare their values to a point of reference. Benchmarking is a process which consists of comparing KPIs between different but similar items, possibly belonging to different companies. Reference targets are taken from the items having the best performances. Benchmarking helps maintenance decision makers to find the opportunities for improvement that will give competitive advantages. Methods can be used to take into account differences between items in order to provide adjusted and realistic targets.	Reserved
57	**Maintenance process diagnosis & audits**	Audits and diagnostics consist of methodical and formal examination of the maintenance process carried out to identify the strengths and weaknesses, determine objectives and targets to be reached and plan improvement actions. Results from benchmarking and questionnaires covering all the different maintenance/ maintenance support sub-processes can be used for this purpose.	Validated
58	**Modelling and simulation of maintenance strategies**	Maintenance decisions to control risks and to increase competitiveness can be based on quantitative information provided by modeling and simulation. Computational models make it possible to assess the performances of different maintenance strategies taking into account operating and environmental conditions of the system. Models must represent the causal chain leading to the malfunctioning of a system in order to estimate the costs of maintenance and downtime. In particular modeling can include degradation mechanisms, symptoms, failure modes, preventive and corrective maintenance tasks and maintenance logistic support.	Reserved
59	**Customer satisfaction surveys**	An effective customer satisfaction survey program allows measuring customer perceptions of how well the requested performances are meet. In addition to the measurement of objective performances, perception of how customer's problem is understood is an important factor. Different techniques can be used to collect customer satisfaction (face to face, questionnaires, automatic notifications, etc.) and to analyze the results.	
60	**Best practices identification**	Identification and measurement of KPI and comparison to points of reference, for example, through benchmarking or modeling and simulation, provide directions for improvement. Then the last and essential step of the improvement process is to propose and to implement actions. Identification of best practices with questionnaires, interviews, etc., especially from the best organizations identified through benchmarking, and adjustment of these practices to the company can be used to carry out appropriate improvement actions	
61	**Tools for expert evaluation**	Expert judgments are very often useful when decisions have to be taken without available quantitative data. Various methods and tools exist for assessing and combining expert opinions. They allow elicitation of quantities and uncertainties, frequencies, probabilities, etc. and can provide consensus expected to be better than individual judgments.	
62	**Human error analysis**	Methods may be used to assess the probability of a human error during the completion of a maintenance task and to reduce this probability. They consider human factors having a significant effect on performance and may use cognitive models of human behavior to understand how and why humans make mistakes in order to propose prevention actions.	Reserved
63	**Education & training in maintenance, E-learning in maintenance**	This subject contains all the pedagogical resources that allow the initial education and the continuous training in maintenance methods, techniques and practices as well as all the support knowledges which are required at the different levels of responsibility.	Reserved
64	**Competences, qualification and Certification of maintenance personnel**	Work profiles require different levels of competence and some require qualification or certification from maintenance personnel. It is necessary to establish the relationships between the positions and the requirements in terms of competence, qualification and certification.	
65	**Relations between Operation and Maintenance staff**	Maintenance and operation are two processes, generally carried out by separate teams, but having strong inter-relationships. There is a need for communication and meeting facilities within companies to effectively coordinate these two teams.	Reserved
66	**Contracting & outsourcing & insourcing**	Maintenance is often outsourced and the division between tasks to be carried out internally and externally must be established. Then competent companies must be selected and maintenance contracts drawn up to help the parties to manage their relations so that the tasks are carried out in accordance with the expectations.	Validated

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67	**Spare part management**	Corrective and preventive maintenance task often require spare parts and materials to maintain and restore assets. The management of these items consists of defining the necessary spare parts and materials and their optimum quantities, ordering, receiving and storing these items at defined locations, providing the items to maintenance personnel when required and monitoring the stock in order to satisfy the needs at minimum cost.	Reserved
68	**Obsolescence management**	Obsolescence is "the inability of an item to be maintained due to the unavailability on the market of the necessary resources at acceptable technical and/or economic conditions" [EN13306]. This situation must be managed by maintenace personnel in charge of logistic support and selection of maintenance tasks by detecting, priotizing and mitigating obsolescent items.	Reserved
69	**Maintenance Information Systems**	It is a tool to manage all the information needed for maintenance. In particular, the information system manages information concerning assets, maintenance activities (corrective, preventive, etc.), safety of individuals, maintenance resources (spare parts, documentation, tools, personnel, ...), budgets, purchases, performance indicators, collection of feedback experience, etc.	Reserved
70	**Instrumentation & Wireless techniques**	Instrumentation techniques are progressing and they make it possible monitoring and diagnosing better and better the equipment and predicting their future behaviors. These means lead to evolution and effectiveness increase of condition based maintenance techniques, and more particularly of predictive maintenance tasks.	
71	**Visualization for maintenance diagnosis**	The maintenance diagnosis requires the use of signals or images visualization techniques to compare them with references. These techniques make it possible to reveal deviations and to deduce the level of severity of the degradations or failures observed.	
72	**Traceability**	Traceability is an important characteristic for maintenance since it allows the causal chain between events to be established and thus to understand the phenomena, the situations and their root causes. The traceability of components is also sometimes necessary to better manage risks and ensure a high level of reliability.	
73	**Augmented reality techniques**	Augmented Reality allows superimposing information about an item or a document. This enables maintenance personnel to have up-to-date technical documentation, safety information, lists of operations to be performed, diagnostic tools, etc., while they carry out maintenance tasks on an item.	
74	**Robotics and remote handling**	Special constraints (safety, accessibility, precision, etc.) lead to use robot or remote handling to carry out maintenance tasks. Many industrial sectors as space, aeronautics, energy, medical, etc., use these techniques.	
75	**Maintenance tasks modelling and simulation**	CAD (Computer Aided Design) models can be used to test maintenance tasks in order to optimize disassembly, repairs, assembly, handling, etc., to decrease time to restoration and costs and to increase safety. These simulation tools are also useful to help trainees learning maintenance procedures through interactive exercises.	