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The Importance of Spare Strategy in a Research Facility

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ABSTRACT: This document shows the importance of spare part strategy in a research facility at one of the most important medical schools in the world. It presents technical concepts related to equipment criticality analysis and spare part management integrated with computerized maintenance management systems (CMMS). A case study utilizing VFDs on campus will be produced to reveals gaps, benefits, and opportunities to improve the current spare part management system. Challenges in the spare part process will also be addressed in this document, such as storage and external vendor support.

KEYWORDS: Spare Parts, Asset Criticality, Research Facility, Equipment Reliability, CMMS.

I. INTRODUCTION

In 2023, a study was conducted in one of the most important medical schools in the world to understand the importance of a spare part strategy for that environment. The main focus of this study was to identify how spare part strategies could potentially impact national research and document additional actions to mitigate issues related to spare parts.

The Facilities Team working in that school is in charge of keeping building systems and select research and lab equipment in good working order. The objective is to minimize downtime as much as possible, and having spare parts available promptly allows Facilities to meet their operational goals, ensure the welfare of people, research animals, research reliability, and meet students' needs. Without having critical parts on hand, the Facilities Team is also increasingly subject to the long lead times in the global market, with estimated delivery times up to one year.

During that study, it has been identified that there was no spare part management procedure in place at the medical school, which puts facilities managers and personnel in a difficult position when breakdowns occur, often leading to superficial or temporary repairs and the higher expenses of rush procurement, delivery, and installation.

In general, immediate benefits of a good spare parts management system are the Optimization of the spare parts purchasing process, reduction in costly equipment downtime, elimination of redundancies and obsolete components, and cost-effective resource usage (THOMPSON, 2020). In a broader view, the main factors affecting spare parts inventories are inventory control, operating strategy, stockout sources, and lead time for restocking (THOMPSON, 2020).

The objective of this paper is to analyse the spare part situation at that facility, present a case example, evaluate the potential impacts on critical research, illustrate the process to implement a spare part strategy, and suggest next steps.

II. CONTEXTUAL REFERENCE

Prior to that study, the medical school has been acquiring spare parts based solely on reactive measures to equipment failure, with almost no proactive approach to identify spare part needs in advance. The issues to address range from consumable materials used in routine maintenance, to stocking spare equipment with specific uses. Recently the Facilities Team has started ordering some critical components such as VFD drives, but a formal process to identify critical items across the campus is not in place yet.

The few spare parts currently at the medical school are located mainly at the penthouse of one of the research buildings and are tracked in the computerized maintenance management system (CMMS), Maximo, as spare. This was a recent implementation and not all spare equipment available has been catalogued. It is also important to note that most of the spare parts/assets available are used items saved from previous renovations. There is no procedure in place to evaluate the functional condition of much of this equipment, or it's longevity if put back in service. Are these assets deployable as-is, or being kept for their components, which in some cases may out of production? Determining the functional level of these assets is important. They take up the finite storage space available and can also lead to a false sense of having a viable backup.

III. STUDY OF CASE

A frequency drive failure at one of the research buildings occurred, taking the air handling equipment offline and impacting conclusion of critical national studies. Although there were spare drives available, they were not large enough (100HP) to work as a replacement. The lead time for a replacement drive of similar size was approximately 52 weeks. The only alternatives available in the meantime were workarounds to energize the down equipment, or the possibility of renting equipment. All of these measures significantly increased the cost associated with correcting this failure. These costs came in the form of initial measures to triage the situation, additional monitoring of the system until a replacement is in hand, and lastly Labor to replace the failed component.

Therefore, this case shows how a poor spare part strategy can lead to loss of critical national research and increased costs to maintain infrastructure systems running properly. In research buildings like this one, critical medical research is in place, such as COVID-19 treatment or cancer therapies. This can bring a dimension of how serious an equipment failure can be and the impacts to the societal welfare.

IV. CRITICAL ASSETS AND SPARE PART STRATEGY

As described by OLIVEIRA (2024), spare part management is part of a bigger process that is frequently utilized to improve asset management in multiple industries. Usually, this step is put in place after the analysis of the maintenance strategy for each asset. The spare part strategy is an important analysis that will directly influence the budget applied to general asset management and the management of the space available for storing materials, equipment, and parts.

Still according to OLIVEIRA (2024), “the main objective of this step is simply to ensure that materials, equipment and spare parts will be available when required and in a timely manner in the event of failures so as not to harm campus operations and the development of critical research.” During this critical step, the criticality of each asset for the continuity of operations, the type of maintenance strategy defined, and the time required to obtain new equipment or spare parts to address possible infrastructure failures are deeply analyzed.

In the consequence classification, first the consequence that a failure in an asset could have on the operation of the installation is analysed. In other words, in the case of universities and research facilities, the impact that a failure of an asset would have on the development of research and the academic environment. This analysis is based on the severity of the failure (Trout, 2024).

Therefore, once the consequences and probabilities have been determined, the degree of consequence classification for each asset is defined. The higher or more critical the consequences and the greater the probability of the failure occurring, the higher the classification level (Trout, 2024).

Regarding the study of case presented above, the first step to address the issues is to identify the areas that are most vulnerable. A ready method would be to utilize the current asset data stored in the Maximo CMMS database and identify the types of equipment that pose the highest risk to operations. Assets should be graded according to criticality of the failure and availability of spare part. Below is the methodology and definitions utilized to accomplish this task:

A. *Criticality: The impact to operations due to lose of equipment would be:*

a. Minor – Downtime has little to no impact or is local/end of line devices. Corrective action, though not critical or immediate.
b. Important – Downtime will marginally impact operation of the other systems or result in less-than-optimal operation. System capacity or redundancies are in place to compensate. Corrective action as soon as possible.
c. Significant – Downtime will have a negative effect on quality of life and research. Other systems will not perform or need to be adjusted while it is offline. Proactive corrective measures should be in place.
d. Major – Downtime will have a direct negative impact on building occupancy and research operations. Damage to physical plant or research may occur if not corrected immediately. Proactive corrective measures and contingency should be in place.

B. *Availability: Failure and time to fix would be:*

a. Low – Common machinery, parts/components readily available of the shelf.
b. Medium – Some lead time to acquire parts. Spares on-hand recommended common to most uses.
c. High - Significant lead time to acquire parts. Spares on-hand recommended, specific to sizing or other technical needs. Lead time measured in weeks-months.
d. Very High – Specialized equipment with limited sourcing options. Lead time to acquire replacement measured in months.

To conduct this process, multiple parties with building knowledge should be engaged about specifics of each building system.

V. MAXIMO CMMS ASSET INFORMATION

Once critical systems are identified, the next step is to draw on detailed information about that equipment. With a fully realized CMMS database, make, model, sizing, and key technical data about equipment can be utilized to develop a trend. This trend data can be used to determine the appropriate number of spare parts that should be on hand, proportional to the quantity of equipment and the technical specifications the spares would need to meet.

Computerized maintenance management systems are the tools that integrate all the stages in the asset management process and the best known on the market are SAP, MAXIMO, MANAGERPLUS, FIIX and EMANT. These systems are generally divided into several modules and require specific training for their users (IBM, 2024). Furthermore, it functions as a work control system for personnel responsible for carrying out maintenance in the field, where historical maintenance data and associated costs are stored.

Referencing the VFD example given above, identifying the technical specifications of all VFDs on campus will identify where the gaps in inventory may be.

VI. STORAGE

One of the main points of keeping a long list of spare parts is the storage space available. The amount of storage space in a research facility is finite, and leaving equipment in areas not intended for long term storage can lead to some negative outcomes, such as:

a. The spare equipment is scattered, not accessible or difficult to find.
b. The spare equipment is too accessible and can be borrowed to alleviate lead times on other projects.
c. The storage area has conditions which may damage the stored equipment.
d. The equipment requires a certain upkeep regime to maintain its components, and therefore cannot be left and forgotten.

A widely used solution to help organizations with limited physical space is the transfer of spare parts management to suppliers or partner companies (OLIVEIRA. 2024).

VII. EXTERNAL PROVIDERS

A second point to consider when keeping a long list of spare parts is the cost involved in keeping these items operational. It is even more important when considering specialized equipment serviced by external vendors. The availability of these items can be tricky. Those items should be put through the same risk assessment as other assets in the facility. In these cases, an additional inquiry should be made to determine if the age of the equipment will mean scarcity of available parts. Utilizing accurate data, can the Facilities Team determine:

a. How many of the same type still exist on campus?
b. Is there a renewal schedule/funding available?
c. Has the team retained ownership of other decommissioned assets of the same type which can be used to source parts internally?

VIII. RESULTS

After analyzing the information in the database, 263 VFDs were found of 11 different manufactures and multiple sizes. A second analysis was performed to identify VFDs associated with equipment classified as major or significant criticality and spare availability ranging from medium to very high. After this second analysis, the list of VFDs went from 263 to 54 units. A third analysis was done on these 54 units to identify how many types and sizes should be considered. The final result of this analysis process identified 4 different VFDs that were instantly ordered and stored in place for immediate action as needed.

Additional steps have been identified to improve the spare part strategy at the medical school and its entire asset management system with a focus on ensuring critical research performance and lab equipment reliability.

IX. NEXT STEPS

The main points identified by the study conducted at the medical school that need additional work and should be considered in the future are storage management, vendor participation, and identification of other critical assets.

Talking about storage, the following actions could be implemented:

a. Clean up or out the current storage areas and identify new storage areas. Eliminate equipment that would not be practical to put back in service.
b. Fully catalogue all spare equipment on hand and identify if equipment is ready to deploy or kept solely for harvesting components.
c. Engage with vendors/suppliers to utilize their warehouse capabilities. Engage with them about the feasibility and cost for keeping stock on their premise until it's needed.
d. Investigate options for off-site or alternative storage solutions which would allow Facilities to accept larger orders of stock.

Regarding vendor participation, the actions below would help with the spare part management:

a. Being proactive about parts, which means bringing in the various vendors and suppliers that Facilities utilizes.
b. Engage with vendors and suppliers about expectations for delivery, and that will require approaching some of our maintenance habits differently. As an example, filters typically have a short lead, but may also be delayed due to special orders or just out of stock at the time. The current method is to "order as you go", which delays planning efforts and leads to overdue preventive maintenance. A better approach is to be proactive with the needs and communicate that to vendors. What filters are needed to perform normal, timely maintenance this year? Communicate to the vendors the sizes, types and quantities of filter stock required in the next 6-12 months.
c. Don't wait for individual work orders. Ordering in bulk will save on both time and cost, and ideally put Facilities in a position to take delivery of stock immediately.

Finally, as expected, not only VFDs but all additional critical assets utilized in national research and lab infrastructure systems must be identified and evaluated to understand what the best maintenance strategy and spare part program are to have in place.

X. CONCLUSIONS

This paper has presented academic concepts about asset integrity, specifically spare part strategy, equipment criticality, and computerized maintenance management systems (CMMS). An analyse of the spare part situation of the research facility at one of the most important medica schools of the world showed that four spare parts will be storage to cover over two hundred VFDs running on campus.

Another conclusion is that additional asset categories must be analysed to ensure all critical assets are covered by the spare part strategy. As potential impacts, the lack of a proper spare part strategy can cause interruption and loss of national critical research.

Finaly, additional work is required to understand what the best approach is for storage management and vendor participation in this process.

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