Spare Parts Identification strategy for fertilizer plants

Document Development Guidance
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AmmoniaKnowHow
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UreaKnowHow.com
Where the Urea industry meets

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1 SYNOPSIS

AmmoniaKnowHow.com and UreaKnowHow.com support fertilizer manufacturers by providing essential services to the industry, using our syngas technologies and scientific knowledge developed in multiple projects worldwide.

Together we initiate a program to enhance the guidelines and procedures for operation, engineering, maintenance and process safety in the fertilizer industry utilizing the best practices and standards available today.

Using knowledge gained from our industry, historic risk registers, lessons learned from projects and from FIORDA members we are committed to give proper advice to improve safety, reliability and projects performance of fertilizer plants.

2 WHY DEVELOP SPECIFIC GUIDELINES AND PROCEDURES

Guidelines and Procedures are developed to help staff and management teams run the organization. In the best use situations, procedures play a strategic role in an organization. They are developed in light of the mission and objectives of the company and they become the media by which management's plans, rules, intents, and business and operation processes become documented and communicated to all staff.

Carefully drafted and standardized guidelines and procedures save the company countless hours of management time. Guidelines, procedures and employee handbook should be an important part of the operation. They should be the first thing given to a new employee (either in hard copy or an electronic version). They should also be easily accessible in their most up-to-date version. Hence it is extremely important that an organization's procedures are a "living document" prepared and saved in Microsoft Word and easily exported into portable versions (like PDF) and made available over the company network.

3 PURPOSE OF THIS DOCUMENT

The purpose of this document is to provide guidance in the best practice of identifying those spares required to support the Reliability and Maintenance operation, and the management of those spares so that they are available when they need to be fitted, and they are fit for purpose at the same time.

4 METHODOLOGY

All current business units, and small and major capital projects should develop and utilize a repair and spares strategy based on the common template.

The purpose of the Repair and Spares Strategy is to:

- Allocate the optimum approach to equipment repair,
- Identify the demand for spare parts created by the requirement to carry out corrective and preventative maintenance,
- To connect the supply of spare parts to the demand.

The successful implementation of this strategy reduces the costs associated with holding unnecessary spare parts, while at the same time verifying that equipment availability is maximized.

The output from the repair side of this strategy is the Repair Response, indicating if spare component parts or complete units should be held for the equipment. The Repair Response (demand) is the starting point for the Spares (supply) Strategy, which determines the quantities, location and ownership of any spares inventory required to support the equipment.

To enable the correct spare parts to be available in good time, the following should be established:

- Alignment of existing business processes
- Equipment Functional Failure identification and analysis
- Equipment criticality classification
- Accurate Bill of Materials (BoM)
- Accurate Computerized Maintenance Management System (CMMS) data
- Analysis of spares required for critical equipment
- Accurate "time to restore" information
- Smart maintenance planning and scheduling
- Effective spare parts management
- Robust "line of sight" supply chain agreements

There are many stakeholders involved in the various stages of spares management. Stakeholders are measured on the success of their individual roles, but the impact their success has on the other stakeholders is often overlooked. “Best in Class” companies align these competing objectives by verifying that the ultimate stock owner is clearly defined, and objectives are aligned by the use of a strategy document that sets out the standards required.

Application of the approach described within the repair and spares strategy will facilitate:

- Alignment of objectives between the operations, maintenance and logistics functions
- Identification of optimum maintenance inventory management
- Effective utilization of working capital

Reduction in time to repair through clarity of approach, minimization of logistic delays and effective utilization of required maintenance inventory.

When equipment requires preventive maintenance or repair, failure to have timely access to the required spare parts may lead to significant avoidable production loss and additional expenditure. On the other hand, holding excessive or inappropriate inventory ties up capital and may have a significant impact upon operating costs.

A number of basic principles apply within the Repair and Spares Strategies:

- No spare parts should be held other than field replaceable items that can be used by on site personnel.
- Complete spare units may be held where suitable storage is available and replacement is within the capacity of the on-site personnel.
- Specialist vendors undertaking on site repairs should supply a complete package including spare parts.
- For repair work undertaken off-site, no spare parts holding on-site is needed.
- When the equipment downtime associated with shipping spare parts is not acceptable and restoration of equipment operation is a high priority, critical replacement units should be stored on-site.
- Operational judgment should be necessary where storage of critical replacement units on site is impractical or undesirable due to:
    - Their size.
    - Locations weight and environmental considerations,
- Spare Parts for Non-Critical equipment should not normally be company owned; these items should be ordered when the unit fails.

Having identified the equipment for which the spares review is required and allocated the appropriate repair response, the equipment criticality will assist in determining the initial spares response, and this will in turn determine if spare units or components to be used in a repair should be held or provisioned as required.

Applying the principle of holding only those spare parts that can be used by on site personnel reduces:

- The cost and administrative burden to the operating asset by minimizing expenditure on spare parts and storage and in reducing waste due to expired shelf lives, item obsolescence, or degradation owing to less than ideal storage conditions.
- The contractor or approved vendor can gain economies of scale from a holding of spare parts that can be used for a number of clients, whereas an operating asset will incur costs.
- Efficiency of the repair process can also be improved as the contractor is best placed to confirm that the correct, serviceable spare parts are available to the team performing the work.

Capital Spares are high value items that are unique to a particular asset and are defined as property, plant or equipment, and for which the usage is not anticipated, but the consequence of not having the spare is high.

A long lead-time is often associated with these parts, but it should be borne in mind that many long lead-times can be mitigated by agreement with the vendor. Capital Spares may require specialized storage as

part of a preservation procedure, e.g. nitrogen pressurized cocoon, space heaters or connection to a trickle power supply.

Often the manufacturer is better placed to provide this type of storage. The long lead-time, high costs, and unique application of many Capital Spares items make them unattractive and prohibitively costly for a company to hold, and increasingly manufacturers are offering to hold these parts for a percentage of the value of the item.

Because the asset is at significant risk of production loss without appropriate cover of capital spares, the business justification for capital spares in the form of spare parts and complete units should be subject to risk / cost analysis using an appropriate risk / cost spares analysis tool.

Holding spare parts for obsolete equipment in house may be required where contractors or OEMs (Original Equipment Manufacturer) have withdrawn support.

5 PLANNING AND SCHEDULING SPARE PARTS

Effective planning and scheduling directly affects the spares holding.

- Smart planning should identify equipment repair, overhaul and replacement objectives.
- Smart planning requires that CMMS system should contain asset level information, work force resource information, and spare parts information in a format that is up to date, structured, and interlinked.
- There should be a plan for all equipment, and these plans should be broken down into job plans detailing the resource required including labour, special tools and spare parts.
- Spare parts demand, criticality, classification, supply lead-time, capacity, and availability should be recorded to aid scheduling.
- Maximo should capture the knowledge of how long it takes to mobilize labour, special tools and spare parts in the system.
- The standard job plans in CMMS system should be updated with the actual task time is essential to verify they are accurate.
- The skills required for any given task, and the quantity of spare parts required, should be recorded in CMMS system to understand the manpower capacity restraints.

6 FERTILIZER INDUSTRY EXPERIENCE

The ordering of a new piece of equipment provides the end user a prime opportunity to input maintenance concerns, familiarize personnel with specific fabrication details and procedures, and to personally observe actual fabrication. The objective is to establish a plan for maintenance and eventual repairs. Based upon industry experience, the following considerations should be made and exercised if practical and possible:

Review equipment design and specifications with the process licenser to become familiar with their requirements and to input any concerns the local plant may have.

Review fabricator detail drawings to become familiar with equipment and determine what the future maintenance requirement will be.

When equipment involves special gaskets and so on to make sure drawings are provided with appropriate dimensions to allow for these to be made locally if necessary.

Select spare parts with both operation and maintenance in mind. Keep in mind that some of the materials involved with lining, welds, tubes, and so on are relatively exotic and long lead.

Obtain the recommendation of a process licenser and fabricator for future inspection, maintenance and repair activities.

7 EMERGENCY AND SCHEDULED SHUTDOWNS

BE PREPARED! This should be the credo for carrying out safe maintenance at minimum downtime. This applies for both emergency and scheduled shutdowns. In either case, the following suggestions are provided below:

7.1 Emergency shutdown

Keep in stock, some welding and lining materials that match those utilized in each type of HP equipment in the plant.

Based upon industry experience recommendations:

- 10% of welding materials
- 10% of lining materials
- 15% of internal bolting
- 5% of tubes
- 10% of gasket for internals
- Two gaskets for each type of connection
- One complete set of ferrules (strippers)
- 5% of piping material
- 10% of each size of HP pipe
- 10% of welding materials for HP pipe This list may be expanded by process licenser and equipment fabricator recommendations.
- If not already available in your plant, be prepared to employ directly or indirectly, skilled workers such as welders, fitters and nondestructive testing technicians for availability within 24 h. This means make a list beforehand, so the calling can begin immediately.
- Maintain in good working order all devices allowing access to the inside of the equipment, especially the urea reactor.
- Maintain lifting device in good working order.
- Maintain in good working condition with a backup spare set all the tools required for welding repair, including the GTAW (TIG) welding machine and torch with gas lens. Knowing beforehand what tools are necessary helps reduce downtime.
- Keep in stock a reasonable number of pure (welding grade) argon bottles.

Note that some of the considerations for scheduled shutdown may also apply here (i.e., need to involve an authorized inspector).

7.2 Scheduled shutdown

A scheduled shutdown must be properly planned and prepared for well in advance of the intended date. This becomes very evident when it comes to supply of materials that may be needed for the turnaround. Some of the materials involved in urea plant equipment have lead times of up to 6 months.

The following issues should be considered:

- Review previous shutdown reports to determine condition of equipment.
- Determine which equipment will be inspected.
- Determine which equipment items will be repaired.
- Develop an estimate of the total amount of work to be done; this may result in the establishment of a priority schedule covering work that must be done and work that may be done provided time is

available. Note, until the equipment is actually opened and inspected, the amount of work (and consequently time) is only an estimate.

- Order materials required for shutdown (materials kept in stock for emergency shutdowns are not depleted. In fact, this may also be an opportunity to replenish materials for stock that have been used for prior emergency). Note, materials must be ordered to fully comply with process licenser specifications.
- Arrange for (if required) involvement of "Authorized Inspector."
- Determine how the work will be executed, namely:

  (1) Work to be done utilizing in-plant personnel: when inspection and maintenance activities are performed by in-plant personnel, we recommend ordering 20% more material (including material for welding) than the estimated need.

  (2) Work executed by specialized companies: when inspection and maintenance activities are performed by specialized companies, it is important to clearly define the limits of responsibility and scope of activity, monitor and inspect work utilizing your own personnel, and, for foreign firms, arrange for entry visas and residence permits if required.

Note that suggestions for emergency shutdown also apply.

8 RESPONSIBILITY

Spare Parts Identification strategy is a document owned by the Maintenance department within the organization. They are responsible to develop the guidelines and philosophy for Projects and Facilities to support the delivery of company maintenance strategy.

9 DEVELOP YOUR OWN ORGANIZATION PROCEDURES

Although templates can give you a head start on procedures development, other factors must be considered as you write your own internal documents.

One factor is your organization’s culture. Organizational attitudes toward procedures determine the spectrum. On one end of the scale are companies that have a procedure for everything. At the other end of the spectrum are companies that only have only a few guidelines (only those required by the laws that are relevant to that company). Most companies fall somewhere in between these two extremes. The manager writing any guideline needs to understand where on the spectrum the company it falls and how the policy can be made to fit the organization’s culture to enhance compliance.

Other two factors to be consider when developing guidelines and procedures are the fertilizer technology that company employs and local and international standards applicable to the industry. Internal standards and procedures must be developed in line with these factors, being applicable for your own plants and in line with regulatory requirements.

The last, but not least, factor when developing your own procedures is the best industry practice that you need to employ. Liaison with your fertilizer association, participation in industry meetings and conferences and using fertilizer industry consultants can bring a fresh eye, new ideas and enhance the quality of your own guidelines and procedures.

10 DEFINITIONS

CMMS	Computer Maintenance Management System
GTAW	Gas tungsten arc welding
HP	High Pressure
R & M	Reliability & Maintenance

11 REFERENCE

1. Enzo Colosio and James E. Fischer Italian Petrochemical Manufacturers (IPM) Spa, Milano, Italy, Maintenance Program for Urea Plant High-Pressure Process Equipment.

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