MAINTENANCE TECHNOLOGY

**Suggestions from a maintenance professional for point-of-use maintenance information delivered by visual aids and equipment manuals.**

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Diagrams, charts, labels, signs, and other visual aids attached to plant equipment, printed in procedures and documentation, and posted throughout the plant speed maintenance and operating tasks as well as contribute to plant safety.

While attending a recent total productive maintenance (TPM) conference, I was reminded of the importance of visual aids in the classic approach to TPM. Work efficiency is increased when team members and other personnel can quickly see whether gauges are reporting normal or abnormal values and when adjustments are within suggested operating ranges, or when they can see which grease fitting is the one to be charged daily.

Visual aids help reduce downtime and safety incidents. If an employee is new to the plant or area and must turn off a machine or fluid supply, the process is quicker and safer if everything is properly labeled. The ready availability of an experienced craftsperson for the job cannot be taken for granted. It is not an insult to anyone to have too much labeling.

The visual aid suggestions that follow have been collected from seminars, training courses, articles, and experience, and are offered with the thought that they can be adapted for purchasing documents or added to maintenance checklists.

**Labeling equipment**

Components of new equipment should be labeled before they are brought into the plant, when possible, to provide visual assistance to installers, maintainers, and operators. The supplier could be asked for the following:

- Identify each valve by name and unique number. The name should indicate the equipment served by the valve. All valves--hydraulic, air, power, drain, etc.--should carry an identifying label, especially dump valves.
- Identify fluid flow directions at the source and frequently along the flow circuit as appropriate.
- Identify each gauge with a unique number and name that identifies the equipment it serves.
- Permanently mark gauges, sight glasses, and other instruments with the safe operating range. Gauges also should be marked with the normal operating value or range. It must be immediately obvious to operators or maintainers when pressures or other parameters are out of tolerance, especially if such an operation presents dangerous consequences.
- Mark appropriate travel points on equipment that moves with the product or during the processing of a product. The equipment may need marks indicating the minimum and maximum travel points to help avoid "maxing out" the component.
- Distinguish lubrication points with a visual code indicating frequency. If some items need lubricating daily and some weekly, the different points should be easily identified, typically by color coding.
- Provide labels with lubricant specification at lubrication points. Labels should state special lubrication procedures or cautions.
- Post warning signs on equipment if there is a danger from stored energy such as air or hydraulically operated rolls that can fall when de-energized.
- Apply appropriate visual aids to components that require adjustment.
- Mark tanks and chambers with appropriate fluid levels. Consider signs that indicate appropriate levels under various operating conditions such as hot, cold, running, or full.

Visual aids can be anything from a line scribed or painted on a gauge or machine base to special engraved signs cemented to the component; however, all marks must be permanent and easy to see.

Safety or danger signs, however, should include standard materials, colors, and lettering styles throughout the plant.

The visual aid concept can be easily extended to manuals supplied by vendors with their equipment. If needed information is not contained in the manuals, personnel should be assigned to search out the information and

append it to the manual to make it a complete reference package. The following items are suggested.

### Operating manuals

- Description of the "design intent" of the equipment and an overview of the equipment
- Identification of all controls and instruments
- Midrange settings for any adjustable items, such as air settings on cylinders, pressure settings on hydraulic cylinders, and measurements for setup on adjustable assemblies or subassemblies; a minimum/ maximum approach to putting a machine together to run (distances and tolerances for position where position is adjustable)
- Complete safety information including warnings, lockouts, precautions, do's and don'ts, and material safety data sheets where applicable
- Normal operating procedures, cleanup frequency, and lubrication frequencies
- Material flow
- Operator's role
- Startup and shutdown procedures
- Setup procedures
- Troubleshooting procedures
- Emergency shutdown procedures
- Special cold or hot weather pro-cedures.

### Parts manuals

- Complete bill of materials with manufacturer part numbers
- Drawings when possible
- Recommended spares
- Recommended critical spares
- List of long delivery items

- List of 24 hour delivery items
- Recommended quantities
- List of company contacts, including engineers who provide technical advice on parts (two minimum)
- List of startup parts (parts that are typically consumed at startup).

**Maintenance manuals**

- Preventive maintenance procedures
- Preventive maintenance frequencies
- Troubleshooting guide (appropriate for craft personnel, more in-depth information than in operator manual)
- Lubrication routes with recommended frequencies and types of lubricants
- Special maintenance safety warnings and procedures
- Maintenance warnings (example: do not weld on scanner without covering lens, or lower rolls and insert pin before doing maintenance so rolls do not fall)
- Procedures for subassembly repair and replacement (list common wear components); any particular rebuild procedures
- Tolerances for misalignment, pressure readings, chain and belt tension
- Setup procedures
- Stored energy hazards
- Recommended frequencies for chain replacement; flights where appropriate
- Alignment procedures
- Calibration procedures
- Special tool requirements, including safety equipment.

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