

15 Ways to Safely Reduce the Size of Your Maintenance Crew!

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Discover 15 ways to operate so there is less maintenance, fewer maintenance people, lower maintenance costs and (because there is less maintenance) your plant runs reliably for longer! Most of the 15 topics covered are new to operations and maintenance. Each one reduces downtime, save money and improves operating uptime and performance.

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1. The Japanese Art of Maintenance – Improvement Culture

The inventors of ‘lean’ production have mastered the way to do maintenance in an operating plant. Now you can learn what they do that works so well and use it yourself.

Justify the Maintenance

- Only do maintenance if a risk – aesthetics not a driver
- Equipment Criticality analysis to validate the maintenance based in risk levels

Build Working Relationships

- Trades long-term dedicated to a set of operating plants
- Engineers long-term dedicated to a set of plants to achieve deep understanding for - problem solving, train others fast, to monitor production, to bring-in new technology, to understand plant/process interaction, to design-out problems
- Operators long-term; develop sound experience in plant/process

Put Skills and Knowledge in the Workforce

- Highly skilled artisans – trades trained to best-practices with appropriate equipment
- Operator minor maintenance – procedures permit basic up-keep and in-process condition inspections

Know What is Happening with the Plant

- Monitor for maintenance ‘on-condition’ – chart process parameters, inspect inside
- Stable process operation – everyone does it the one best way, controlled experiments
- Root cause investigated to full detail and thorough engineering analysis – documentation proving case for change is complete and unquestionable

Have the Information You Need to Make Right Decisions Quickly

- Repair and improvement knowledge transferred across organisation
- Complete and thorough documentation on all equipment designs and details of component materials kept on-hand

Continually Improve Reliability and Productivity of the Operation

- Design-out problems only if procedurally unmanageable – procedural changes cheapest of solutions
- Use equipment history to plan and justify improvements – 2-year plan based on last 8 years of history.
- Mechanisms in place to feedback operating experience to projects – formal meeting agenda item, office seating location

2. Precision Maintenance – An Accuracy Mind-Set

This is a philosophy created by Ralph Buscurello from the USA-based Uptime International in the late 1980's. Time and again it has saved companies fortunes in maintenance costs. Now it's fully explained so you can use it too.

Accuracy is Critical

- Shaft parallel alignment to under a hair's width.
- Machine vibration to below standard – balance, transfer isolation
- No soft-foot, no body distortion, no pinched parts on assembly
- Craftsmanship quality

Know the Machine Condition

- Vibration
- Oil
- Wear
- Stresses
- Fatigue
- High temperature
- Identify and use measurable parameters

Assembly, Disassembly and Re-assembly is to Specification

- Develop procedures and check sheets with target, tolerance, proof-test; keep assembly records
- Tolerance standards
- Check and prove all is correct prior assembly
- Test run, check and observe under operating conditions – base level machine condition values are where they should be

Creative Disassembly

- Know what is right to expect – drawings, specifications, component materials
- Measure and record wear; record operating life effects for comparison training and reference
- Identify root cause of the issue

3. Value Stream Mapping – Remove the Unnecessary; Support the Value Streams

Only do what brings value to the operation. Everything else is a non-value activity, a waste, which costs money ... and must be eliminated. You will learn how to spot value and non-value so you can remove the waste and leave the profit.

- All functions are involved in a transformation process
- Develop a time-scale block diagram chart of the process including all the steps capture process flows, material flows, information flows, decision points, feedback loops, review events
- Develop standard work sheets – Written list of tasks in actual sequence; all movements; all times; all distances; all use of tools, jigs or fixtures; inventories; locations of stock
- Measure time and distance moved by people, machines, inventory and ‘product’ in the process; complete the standard worksheets
- Calculate ratios – cycle time, job time, time in system, value ratio
- Draw a macro-overview current state map
- Identify the wastes and the value-adds
- What does the customer want?
- Reorganise around the core value streams – all support services support the value streams
- Draw a macro-overview future state map
- Complete the future standard worksheets
- Calculate future ratios
- Develop a one-page implementation plan including roles and responsibilities
- Track progress visually
- Focus on continuously improving the process

4. Just-in-Time Maintenance – Reliability ‘On-Tap’

JIT maintenance means that maintenance is there just before you need it ... not too early and never too late! Discover what you need to do to have that sort of service and the resulting production performance you get from it!

- **Understanding the Just-In-Time Concept**
- **What is JIT Maintenance?**
- **The Effects of Production Bottlenecks on Maintenance Resources**
 - Bottleneck is the Constraint
 - Manage and Improve the Bottleneck
 - Maximize Bottleneck Uptime
- **Why JIT Maintenance Improves Production Uptime**
 - Knowledge Transfer - Trades to Operators and Back; Across Rotating Shifts
 - Trained Equipment Specialist with the Equipment
 - Continual Watch keeping Opportunities
 - Increasing Operator Maintenance
 - More Thorough Problem Analysis
 - Teamwork and Relationships
- **System Support Requirements for JIT Maintenance**
 - Personnel Location
 - Stores
 - Planning
 - Purchasing
 - Information
 - Shutdowns
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5. Making the Operator - Maintainer Concept Work

For operators to successfully become maintainers they need to follow a particular process. For maintainers to successfully become operators they need to follow a particular process. Never try otherwise, as it is not possible. Find out what you need to do to make the Operator-Maintainer concept work and how it is done.

- **Why a Maintainer – Operator is so Appealing**
 - Multi-skilled
 - Lowest cost for most productivity
 - Highest likelihood of ‘ownership’ of the plant and its proper operation
 - ‘One-stop’ for all operational issues

- **Problems with the Maintainer – Operator Concept**
 - People can only be good at one thing – either operating or maintaining
 - Unless a trained technically-able tradesperson the operator cannot do strip-downs and re-builds to sufficiently high accuracy
 - Two prime duties divert focus from what is important. What comes first: production or maintenance? Is it Operator – Maintainer OR Maintainer – Operator?

- **How to Make the Concept Work**
 - Relative to complexity of plant and process: Simple – use Operator – Maintainer; Complex – use Maintainer - Operator
 - Company to specify and communicate how far to go with the concept, remembering lowest cost and greatest benefits come when all is done by the one classification
 - Clear duty statement of responsibilities emphasising the operating obligations and necessary work quality. (Don’t hire a mine mechanical fitter to rebuild jet engines)
 - Include level of necessary maintenance to be performed without assistance
 - Include technical knowledge required to perform duties to highest quality
 - Clear criteria of required maintenance skills and abilities to do required maintenance duties
 - Prior evidence of abilities and required work quality
 - Higher pay to reflect level of responsibility
 - Higher title to reflect importance of their duties
 - People to undertake an ‘apprenticeship’ to gain experience and knowledge - develop and instigate training for people with right attitudes but insufficient technical skills; test that they meet the required standard.

6. The Accuracy Controlled Enterprise –Quality Made Easy

The removal of defects and failures from business processes is the final frontier for controlling unplanned production stoppages. Seemingly random events that combine to cause a breakdown can now be controlled with a new methodology - ACE.

- **Definition of Quality**
 - *Quality is short term.* It is the degree to which a commodity meets the requirements of the customer at the start of its life. In manufactured products quality comes from its design definition and manufacturing accuracy.
 - *Quality is design specification driven*
 - *Quality is measured at start of life* – percent passing specification
 - *Quality is observable* - the number of rejects from production
- **The Importance of Quality Systems**
 - Meet customer satisfaction
 - Remove process variation
 - Standardise manufacturing approach
 - Detect non-conformance – identify defects against standard
 - Measure performance to compliance
- **Why Quality Systems Don't Work in Most Operations**
 - Installed for the wrong reason
 - To meet ISO 9000 demands from customers
 - For marketing purposes
 - To satisfy senior management initiative
 - Because competitor had one
 - Not ingrained into the culture – quality is seen as someone else's domain
 - No training system to lift people to the necessary level of skills and knowledge
 - No quality manager who's prime duty is to own the system and make it work
 - Original system documentation falls out of date and becomes irrelevant
 - Not set-up as a self-sustaining system that automatically operates.
 - No CEO and Executive Manager involvement
- **Can Quality Results be met without a 'Quality System'?**
 - Quality aim is repeatable consistency to design specification
 - Design specification is a target
 - The target specification is built into the operating procedure
 - Variation is controlled by use of tolerance around the target.
 - Conformance is achieved by measuring if commodity is within specification
 - Quality can be achieved without a 'quality system'
- **Examples of Accuracy Controlled Enterprise System**
 - 'Target, Tolerance, Test'
- **Accuracy Control is Easier and Cheaper than Quality Control**
 - Once in the procedure it becomes a the procedure user's responsibility
 - Self-sustaining as it is a job requirement
 - No longer needs a separate quality manager
 - Less involvement from line-managers and supervisors
 - Focus becomes system quality improvement not task quality control

7. Life Cycle Profit Optimisation –Design-in Reliability and Lower Costs

If maintenance is done poorly production costs rise fast. But maintenance done well delivers higher profits. ‘Repairs and Maintenance’ is classified as a cost by accountants, but in reality it is an enabler for improving production and lifting profits. Learn how to use maintenance to drive profits!

- **Reliability is Where The Profit Is**
 - *Reliability is long-term.* It is the probability a product will function correctly when needed, for the period required, in the specified environment. In manufactured products the reliability comes from its design, materials, manufacture and use in service.
 - *Reliability is customer satisfaction driven.*
 - *Reliability is measured at end of life* – probability of functioning to design for a set period of time.
 - *Reliability is observable* - number of returns and service call-outs from customers
- **Reliability is Designed-in – Request It.**
 - Reliability is designed-in using **failure reduction techniques** such as Failure Mode and Effects Analysis (FMEA), Design Options and Cost Total Optimisation Review (DOCTOR) and as predicted based on test results and models.
 - Forecast problems and unlikely ways to fail.
 - Prototype and make the item fail; then design-out problems.
- **Life-Cycle Profitability is Culture Critical**
 - Master plan for reliability improvement and a written company policy.
 - Company-wide buy-in – ‘common-mindset’ throughout/across organisation.
 - Make the improvement process visible – goals, targets, charts, deeds done.
- **‘Customer’ Communication**
 - User feedback’s captured and root cause failure analysis applied.
 - Competitor’s products examined for weaknesses and strengths.
- **Equipment Failure Database And Analysis**
 - Detailed equipment and component failure database developed.
 - Discover the actual root cause and identify clearly.
 - Analyse database for specific changes to include in next generation of items.
- **Product And Design Development**
 - Reliability is ‘designed in’ with appropriate engineering decisions.
 - Reliability level and matching project goals set with design team for each ‘project’.
 - Formal methodology of design, development and testing process developed and followed.
 - Project management applied to control reliability requirement during development.
- **Supply System Alignment**
 - The supplier’s components are the components your company will build its business on.
 - The supplier’s processes must deliver the required reliability.
 - Open, honest communication focused on mutual improvement needed.
- **Production and Maintenance Systems**

- Need the processes, equipment, tools and techniques to control variation.
- Production/Manufacturing is part of the design and development process so that production/manufacturing limitations are recognised and appropriate choices made.

8. The 'How To' of Planning and Scheduling Success

Studies show that in an 8-hour day maintenance people do 2 hours of tool-time work. Triple that figure with planning and scheduling secrets that keep them 'head-down and tail-up'!

- **Aim to Have Tradesmen on the Tools All The Time**

- Trades 'make money' only when they are adding value. That is only done when they are using their skills.
- Know the strengths and abilities; the weaknesses and shortcomings of each person so you can put them onto work they are good at doing and keep them away from work they are not.
- Go from completely prepared job to completely prepared job without a hitch.

- **Have a Planned Approach to Planning**

- Develop a Planning Policy and Procedure to ACE requirements
- Specify the skills and attributes needed of the Planner position
- Because you want to get the job done right first time!

- **Planning is a Separate Job**

- Needs its own time and place to do it well – own desk, computer, filing system, etc

- **Planning Needs Complete Information in a Systematic Way**

From my experience it is best to have a central library used by all, in which is kept every piece of available information about your equipment in equipment number order. Information on each item of plant equipment should cover all trades and disciplines and include:

- the original service duty specification,
- technical information of how the equipment works,
- model number with all suffixes, serial number, item description,
- purchasing information,
- maintenance manual,
- operating manual,
- a copy of the most current computer control program if the equipment is automated,
- set point parameters and units of measure,
- mechanical, electrical and control equipment parts manual including parts material specifications list and drawings,
- both the original historical applicable engineering specifications and the most current,
- foundation, mounting and structural support details,
- details of any changes done to the equipment since new,
- parts supplier information and contact details,
- drawings of the site location,
- general assembly drawings,
- drawings of the equipment assemblies,
- individual parts drawings and materials used in construction,
- electrical drawings of power supply and distribution,
- control logic diagrams and tables,
- history of work performed in the past and how it was done and what was found and learnt,
- completed test sheets and check sheets,
- statutory information if the equipment is a registered item of plant,

- photographs of the equipment,
 - copies of investigative and engineering reports conducted on the equipment,
 - the most current of operator work procedures,
 - the most current of maintenance procedures,
 - the most current originals of test sheets and check sheets,
 - tips and advice learnt about using and maintaining the equipment,
 - references to any useful information on the equipment or its construction and operation,
 - an index of what is listed in the library for that piece of equipment.
- Ideally you want all the information both in hard copy form and electronically. In electronic form it can be sent to any location where it can be received.

● **Look Ahead!**

- Aim to guiding the future actions of the maintenance crew so things are done right, on purpose. A good maintenance planner will make an average maintenance technician shine.
- All the right tools, information, parts and advice needed to do the job right in the shortest time possible. You're looking for all the fast, simple, accurate ways to do the job.
- Schedule the work with the Operations Group and make sure it has gone into their production plan.

● **The Work Pack**

The work pack is a folder handed over to the repairer containing all the information and details to complete the job accurately, in the shortest possible time.

In the work pack are the following details necessary to do the job right first time, in the shortest time possible:

- an index of what the folder contains,
- a job safety analysis and risk assessment,
- a list of all tools needed to do the job,
- a list of all parts needed for the job,
- drawings of how the item needing repair works and goes together,
- descriptions and photos of what they should find as they do the job,
- a step by step procedure including photos and descriptions of what to do, with clear indication and advice for the critical parts of the work,
- a test and check sheet to confirm accuracy of the work and to be a record of the job,
- a report back sheet for the repairer to advise the Planner what they found to be different to what was planned and expected,
- the planner's personal advice to the repairer on the best ways to do the job.

● **Replacement Parts, Special Tools, Outside Resources and Consumables**

- Repairer is given all the necessary parts and special tools to do the work.
- All external resources like cranes, elevated work platforms and specialist sub-contractors are there on time and are fully prepared for the job.
- Replacement parts are at-hand, and of the right size, specification and quantity.

● **Leave Nothing to Chance**

- If necessary the Planner sits down with the Repairer, or visits the job site, and discusses the work required in detail so that the repair understands clearly what needs to be done.
 - The job procedure promotes accuracy and has been well thought through, explaining what need to be done in the excellent detail, clarity and accuracy.
 - The work progresses through checks and tests to insure proper, precise assembly that matches, or better, the manufacturer's specifications
 - The work only proceeds when the previous step is proven correct.
- **Plan the Backlog of Work Based On Equipment Criticality**
 - **Schedule Planned Work with the Operating Group into the Operating Plan**
 - You cannot get planned work done unless time is given for it to be done.
 - Let Operations decide the date and time
 - Ensure the job is put it into their production schedule.
 - **Tell Everyone What Is Planned – Make a Picture of the Plan**
 - **If Things Go Wrong**
 - Confront problems quickly and solved as well as possible in the circumstances.
 - The lessons learned must be recorded for future reference
 - Planner goes and looks themselves what happened to cause the work to not go to plan.
 - Close-out meeting where problems are aired
 - **The Trades Assistant Prepares the Way**
 - Their job is to keep the trades working
 - Ensure all materials are on this job and the next job; ensure all required services are on the next job; ensure the plant is isolated so that trades go straight onto the next job.
 - They get anything that is missing from a job
 - In contact with the Planner, Store, Supervisor, Operations as necessary

9. A New Asset Management Standard

PAS 55 – Asset Management is a recent British Standards publication. It contains specifications for the optimised management of physical infrastructure assets. Compliance with *PAS 55: Asset Management* will give increased confidence that corporate risk issues are being tackled properly in a way that can be assessed and verified independently.

- **A System of Looking After Physical Assets That Maximises their Lifetime Profitability**
- **Provides for Maximum Use of Plant and Equipment with All Operating Risks Addressed**
- **No Specifications Or Limitations on How to Comply**
- **Requires Introduction of Systems to Create Work Processes That can Then be Optimised by use of Quality Control System**
- **Requires Setting Condition and Performance Targets for Assets**
- **Necessitates Maintaining Capability of Assets**
- **Suitable Support Systems, Skills and Equipment Necessary**

10. Internal Quality Control and Assurance

High reliability starts with high quality. High quality means working to standards and tolerances. Achieving the heights of quality is easy if standard operating procedures are designed with in-built performance measures that automatically guide people to success.

- **How to Ensure an Activity Goes Right As It Should the First Time?**

Driving from Perth to Adelaide the first time:

- Map it out
- Checkpoints to prove you are on track
- Timetable
- Prepare accommodation arrangements
- Call ahead to confirm preparations
- Get vehicle checked and serviced
- Etc ...

Purposefully introduce a process with checks and balances as a guide know that success looks like!

- **Quality Systems are Self-Improving and Self Correcting**

- Deming's Plan – Do – Check – Act Cycle
- Live it and it works for you – needs to be culturally ingrained in a company

- **ISO 9001 Controlled Operations and Maintenance**

- *Chapter 4 – Quality Management System - Re-map your current system as a process including all necessary supporting requirements and introduce measures to check conformance*
- *Chapter 5 – Top Management Responsibility – Authorise, establish, support, promote and improve the quality system*
- *Chapter 6 – Resource Management – Provide the people, facilities, work environment and training to deliver the required quality*
- *Chapter 7 – Product Realisation – Analyse and define what the customer requires and ensure your process is capable of delivering it*
- *Chapter 8 – Measurement and Monitoring – Confirm that your product gives the customer satisfaction. Where not; the issue is corrected.*

- **A Guaranteed way to Becoming Excellent!**

11. Point-of-Use Knowledge

Today so much information is required to deliver world-class maintenance, conduct fault diagnostics and achieve high reliability that no person can do it alone. In future, access to the right information when it is needed will give the best organisations a competitive advantage. No longer will you need to have the right people with knowledge, rather the knowledge will find the right people!

- **There is Too Much to Know and Remember!**
- **Details Need to be Provided When they are Needed**
- **Modern Technology Gives Rapid Access to Key Information**
- **Provide a Distributed Data Base of All the Right Information For Your People**
- **Give Everyone Access to It a Common Data Base**
 - i. Using the Data Base
 - ii. Definitions
 - iii. EH&S Policy Standards Procedures and Guidelines
 - iv. Asset Management System Manual
 - v. Procedures
 - vi. Policies
 - vii. Contingency Plans and Emergency Response Procedures
 - viii. Standards
 - ix. Legislation and Licenses
 - x. Quality Management Plans
 - xi. Hazard/Incident Reports
 - xii. Technical Information Sharing
 - xiii. Loss Control / Risk Management
 - xiv. Contracts
 - xv. Plant System Descriptions
 - xvi. Training
 - xvii. Corrective Action Requests
 - xviii. Facility Change Requests
 - xix. Asset by Asset
 - xx. Project Management Database
- **And Back the Other Way – Task and Equipment Knowledge back into Data Base**
- **Give People the Technology to Access the Knowledge They Need**

12. The Many Other Benefits of Standardisation

Learn how to standardise processes and equipment so it:

- **Saves Money**
 - Same unchanged specification is used throughout the organisation
 - Common parts for many equipment items
 - Parts can be shared geographically if necessary
- **It Saves Time**
 - Document is written once and a copy is reused many times
 - Filed in the central records system
 - Catalogue/store descriptions entered once
 - New geographic location for store copies existing catalogue
 - Project Group use existing descriptions and particulars for purchasing
- **It Saves Floor Space**
 - Less storage area
 - Fewer storage locations
- **It Saves Documentation**
 - Typed once and simply updated as required
- **It Saves Inventory**
 - Fewer parts – just alter max-min quantities
- **It Saves Training**
 - Trained once on equipment and used over again many times
- **It Simplifies Projects**
 - All documentation is already written
 - Can draw items from store and save special purchase
- **It Speeds Continuous Improvement**
 - Upgrades and design changes requiring new materials flow through to the rest of the same equipment
- **It Reduces The Need For Technical Specialist**
 - Once developed the engineering remains unchanged
 - Users who are not technical specialists can be sure that technical issues are correct
- **It Makes OEMs Partners**
 - Can feedback information to OEMs to incorporate in next generation of equipment specially for your benefit
- **Improves Purchasing Accuracy**
 - All suppliers get the same item description and specification
 - Project Group buy the same materials and equipments as now used
- **Standardise Tooling and Repair Equipment**

13. Multifunctional Teams for Best Performance

The distribution of talent amongst humans is haphazard and, at present, entirely in nature's control. But the selection of talent and skills to create best performing teams can be intentionally controlled. If you want highly able and successful production teams, you will be shown how to make them.

- **Allocation of Talent and Skills is Normally Distributed**
- **Implications for Organisations**
 - A few really able people; a few really poor; most in-between
 - People with limited range of skills and abilities in many positions ... 'Incompetent'?
 - Need specifications for job positions including business and inter-personal communication abilities
 - Need training plans for all persons to learn skills and knowledge to function at higher skill and ability levels
 - Need performance management and measures for all
 - Leave people doing what they are really good at doing and reward them in ways other than promotion
- **Addressing the Variation in Individual Abilities Within Work Groups**
 - Important to have diversity across teams
 - Identify level of skills and abilities required to perform the business process
 - Random groups of people contain an unorganised, unplanned mix of skills
 - Take randomness out of group by selecting people with required abilities and skills
- **Multifunction Team: People Working Together Using Their Best Talents**
 - Select team members to fulfil a need within the team
 - Select people who want to work in a team rather than alone. Their previous history tells you what they prefer
 - Use the right person from the team to suit the situation (Situational Leadership)
 - Get the able team members to train those less able and help lift everyone toward excellence
 - Measures for performance improvement of the team that each member contributes to and can influence
- **Create the Right Environment – “Water them and they grow!”**
(*Lee Hecht Harrison HR Consultants*)
 - **Appreciate Uniqueness**
 - So employees feel in-synch with their values and life concerns
 - **Align Aspirations**
 - So employees feel passionate about their mission, strategies and work of the organisation
 - **Anticipate the Future**

- So employee knows their place in the organisation and its future
- **Assess Capability**
 - So employee knows they are valued by the organisation
- **Accelerate Learning**
 - Challenge the employee in the job and put them into continuous learning mode

14. KPI's That Change Behaviour

'What get measured and rewarded gets done' is a management truism. If you want new behaviours then introduce measures and rewards that promote those behaviours.

There are five important Key Performance Indicators which you should be using if you want to promote:

- **Operational Excellence in Equipment Utilisation**
 - Overall Equipment Efficiency (OEE)
 - TEEP
- **Speed of Response**
 - Mean Time To Repair (measured in minutes)
- **Planning Efficiency**
 - Work Planned verses Total Backlog Work
- **Work Completed**
 - Actual Work Completed verses Total Backlog Work
- **Profitability**
 - Value Lost by the Problem/Issue (DAFT Cost)
- **Trend the Results for All to See**
- **Ask for Improvement – Challenge the Individual/Group How to do Better**

15. Continuous Improvement Through Skills Enrichment

Progress and development is an evolutionary process, not a revolutionary process. Those companies that evolve fastest will be more successful in future than those that wait for change to be forced on them. If you want rapid evolution in your operation then learn to develop the skills and knowledge of your people and let those who work with the problems find the best solutions for them.

- **The Most Successful Organisations Are Learning Organisations**
 - Toyota Motor Company
- **Development Plans**
- **Performance Management Discussions**
- **Manager as Coach**
- **Development Centres**
- **High Potential Development Programs**
- **Stretch Projects**
- **Mentoring Opportunities and Programs**
- **Technology Tools**
- **Pay for Performance**
- **Trend Information – Company, Industry, Career**