A PREVENTATIVE MAINTENANCE PLAN FOR CONTINUOUS PAINT AREA PROCESS IMPROVEMENT

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ABSTRACT

Effective and Efficient Manufacturing Process Engineering will make the difference between a profitable / non-profitable balance sheet, and in addition contribute to the Profitable Business Requirements of the Customer and the Plant Operating Team. The Definition and Implementation of the right Preventative Maintenance Strategies supporting the Paint Process Phase will not only produce additional bottom line profits, but continue to add value for the life of the Manufacturing process and the manufacturing equipment.

The author will present a Paint Area Preventative Maintenance Program that will allow for the reduction of cost in a typical Tier II or III Coating Facility. In order to improve the first time quality in the Painting Process, we have an obligation to hire, train and coach all the Paint Area Employees in minimum time frames. Existing Production and safety requirements along with addition ISO / Lean Manufacturing recording procedures will assist in producing the "Continuous Improvement" results, we require for Paint Process survivability. This Presentation is designed for all Parts Manufacturer's and smaller Sub-Contractors, to reduce waste, increase production uptime and improve the overall Manufacturing Value Added on a daily basis.

OVERVIEW

The Paper objective regarding Painted Part Manufacturing, will Develop Major Preventative Maintenance Strategies in support of the goals, such as ….

- FOCUS ON A COMMITMENT FOR CONTINUOUS IMPROVEMENT – AUDITS
- ACCELERATION TO HIGH LEVEL OF QUALITY-FIRST TIME ACCEPTENENCE
- WASTE STREAM MANAGEMENT / SCRAP REDUCTION PROGRAMS
- EMPLOYMENT OF QUANTITATIVE MEASUREMENTS
- TRAIN THE EMPLOYEES, COACH THE EMPOWERMENT PROCESS
- FOSTER INNOVATION, PRIDE, ACCOUNTABILITY
- EDUCATE THE PLANT CULTURE TO UNDERSTAND THE PAINTING PROCESS
- IDENTIFY PAINT MANUFACTURING COST DRIVERS
- DEVELOP POSITIVE LONG TERM VENDOR RELATIONSHIPS

As we explore Preventative Maintenance Paint Shop Strategies, we will focus on such aspects as: safety, filtration, transfer efficiency, waste stream management, job descriptions, work orders and trend analysis. Goal setting must be a part of the inner Plant relationship between molding and paint to produce quantifiable and realistic cost saving results. Preventative Maintenance is often the most ignored aspect of Painted Part Manufacturing. This Presentation will lead to a more "Value Added" relationship of delivery of coated parts on time and Painting them in a less costly Environment for the Customer's Quality satisfaction.

INTRODUCTION

How can we simultaneous provide Customer Value, improve our Quality and decrease our Costs, all with improving the profit picture for the company we work for? (Sound familiar?) Product Leadership is the key to improving market share. We have been cutting prices too long, in an attempt to maintain our competitive edge with foreign markets. Company Strategies must change from cost cutting at the Customers expense, to improving their slice of the target markets segments. Market share can only be accomplished trough Product Leadership and innovative Manufacturing processes.

There are currently numerous outside technologies and economics that will alter the future of coated parts. One critical issue will be that of Product Appearance and Performance. How can we improve while trying to maintain an economic advantage. This Paper Sponsored by Sur / Fin 2006, will highlight major areas (as starting points) for Paint Facilities to be concerned with in the future of creating Quality Products and Improved Market Share.

The Paint Shop, as we know it today, offers significant dollar risks in Cost Per Unit (CPU) accounting within a Total Fluids Management Program. As we pursue the latest Technology in production, air, water, fluids, equipment Management, we are finding their sensitivities to the Quality of the Product and the cost of the CPU. Future Preventative Maintenance Programs will be determined by the Supplier in conjunction with the cross effects of Fluids, Environment and Painting Operations. A dirty spray booth, grates, flood sheets or exhaust fans will not allow for the proper air flow/wash of over-spray, thus affecting the first run capability and CPU. No matter how current the existing technology is in your facility, we need to establish a Program to control the Basics of a Paint Shop, regarding - Air, Fluids, Environment and Paint Operations. When a Paint Operation is allowed to become compromised by inadequate basic cleaning and maintenance functions, the Quality first run figures will decrease at an abnormally higher ratio.

SAFETY - WHO'S JOB, IS IT? - "EVERYONE'S"

Poor Safety/Housekeeping has been cited on numerous audits as the primary and contributing cause for accidents, poor quality, State VOC Violations, high scrap, poor yields, insurance violations and even attendance/morale. Is it the Cleaning Crews lack of vision or communication? It is a serious issue, when no one takes the time to do their job with pride and the end result is an accident or a rejected part (hopefully found before shipping).

Was it really the cleaning crew's job? Can anyone expect to have that many people assigned to clean up operations? The sad fact is that this accident was totally unnecessary. Had one of those employees taken the time to pick the pipe up, the accident would not have occurred. Safety / Housekeeping are everyone's job and we can not count on the third shift to make up for the continuous lack of persistence in these areas by the first or second shift. It is everyone's responsibility, just as it is for quality and internal customer part acceptance.

The continuing issues are (1) Documentation (2) Communication (3) Proper Equipment and (4) Focus. These issues are the buckets that most failures fall in to.

SAFETY PROGRAM REFERANCES AND AUDITORS

- Inspectors evaluate hardware and installation methods for compliance with
- Occupational Safety and Health Administration (OSHA) standards;
- National Fire Protection Association (NFPA) Bulletin 33 (Spray Applications);
- NFPA 70 (National Electrical Code, or NEC);
- BOCA National Fire Prevention Code; National Building Code;
- UFC Uniform Fire Code;
- OBC Uniform Building Code;
- SBCCI Standard Fire Prevention Code; Standard Building Code; and
  Any local ordinances.
- For guidelines on the acceptability of certain spray booth components, OSHA refers to:
  Factory Manual and Industrial Risk Insurers (IRI)
- Insurance Inspectors

Audit Criteria……

Initial Audit Parameters - "Quantitative Measurement of Performance" DEEPCLEANS

- In a new Facility, we start with the audit/cleaning procedure of working from the outside in and with an on-going Paint facility we work from the inside out. (E.g. On a new Facility we start with building pressurization and air supply, on an existing Facility, we start from the Customer and work backwards in the Paint Process.) In most cases regardless of starting point, follow product flow.
- The initial step in a successful audit is to successfully identify all key operating variables, while trying to define what makes a difference to your Customers quality issues... Often, this involves a detailed review (with manufacturing and process engineers to Safety and Quality), of the complete Paint system. Helping improve overall efficiency is the overall vision. Building a base line for standardization is a key element in defining what your goals are.
- While it is critical to identify, isolate and control the mentioned variables, it is essential to go beyond this review and benchmark the quantitative segments with associated savings programs.

Key Audit Questions

1. Are Process Specifications set? (Quality, PPAP, APQP, Customer)
2. Does the Selling Price Expectations, match reality?
3. Future Customer Expectations?
4. Best Initial Approach?
5. Five Why Evaluation? Problems - Root Cause Analysis?
6. How much/cost of Process Development is required?
7. Specify which option(measurement) will be used to determine which savings
8. Specify data analysis procedures and assumptions
9. How will Applications Unfold? Time lines?
10. How do Manufacturing Challenges Impact the selling price?
11. How do we deal with Supplier/Manufacturer Expectations during Transition?
12. How do we Benchmark/Update Business Model? Follow-up data collection?
13. How do we Sustain Funding during Transition? Engineering change funding?
14. How do we bridge employee / cultural gap? Empowerment, Training, HR?

Audit Results

- Must meet an Engineering/Manufacturing Need and ability to offer a quality solution
- Must Provide a Clear Market Leadership Advantage – "Value Added Focus"
- Must offer Strategic/Tactical Advantages - Product Differentiators
- Innovation and Continuous Improvement
- Must fit the Business Strategic Objectives "Quality, Cost and meeting Delivery Schedules"
- Must be expected to achieve a Reasonable Savings (potential Customer shared basis)
- How will our customers will recognize our Excellence
- Complete look at our business from the customer's perspective

Quality Initiatives

Quality has become the universal manufacturing word, which represent two key issues - A) Customer Satisfaction and B) Bottom line profits. These initiatives have changed our mindset and presented the most dramatic change to our Manufacturing Process. In the new millennium, the production base has switched to that of a global responsibility. If we are not producing Quality as a Manufacturing initiative, we are NOT competing as a global platform. If we are not competing, our days as a manufacturing base will be numbered. Plants will be closed for an overseas opportunity. Quality must be adopted as a major manufacturing strategy from the CEO to the Paint Booth Sprayer.

As we switch our focus towards Customer satisfaction, we must acknowledge that we are utilizing Quality initiatives to achieve that goal. Every level of Manufacturing has a Customer internally that they are delivering internal product to. The Quality process does NOT just fall on the shipping Department - final inspection, but on every level on Manufacturing from the inbound raw materials shipment, molding, paint and on to the shipping dock.

Paint Quality Parameters

- Safety Program, Safety Procedures, Safety Equipment
- Pretreat? Washer? (Operational and PM Programs) Vendor? Training? Quality? Cost? Effectiveness? Post Heat? Drain?
- Transfer Efficiency? Total Paint Cost per part?
- Soils, dirt, contamination? Source?
- Production Assemblies?
- Physical size and Process Limitations of Product?
- Paint Process itself? Part Paint ability? Paint Chemistry? Fluid Flows? Spay Patterns? Operator Techniques? Air Pressures? Air Source? Patterns? Maintenance? Preventative Maintenance? Transfer Efficiency? Booth Balance? Air/Paint Filtration? Heat/AC? Paint Heaters? QC Raw Materials? Ovens? Masking?
- Production Rates? Line Speeds?
- Paint Specifications – In-house, Customer
- Paint Expectations, Production, test panels
- Paint Supplier?
- Process Controls? Repair Procedures/Equipment? Value Added?
- Preventative Maintenance?
- Lighting?
- Space or System Limitations?
- Local, State, Federal Regulations? OSHA? Voc's? MSDS?
- Safety Programs? NFPA?
- Energy Source and limitations?
- Manpower Resources?
- Training – Internally and from Vendors?
- Financial Limitations? Paint/Equipment/Energy Cost's?
- Part Selling Price? Standard Cost?

- Competition Analysis – SWOT
- Market Niche? Sales Plan?
- Two Year Plan?
- Quality Analysis (ISO) Quality Reports?
- Housekeeping?
- Manpower Efficiencies?
- Equipment Analysis – Efficiencies?
- Conveyor- Lube/Clean/Maintenance/Speed?
- Waste Stream Management? (Air and Paint) Detack?
- Line and Rack Density? Rack Design? Rack Cleaning?

TRAINING AS A QUALITY TOOL

Training is the ultimate measurement of Product Quality. Our Employees are an extension of the Management's philosophy and business strategy regarding our Customer satisfaction ratings. From Employee turnover rates to self education requirements, the properly Cross Trained Employee is one of the key elements in successful Painting Operation. A well executed and documented Program will not only Train but re-train on a continuous basis and cross train to meet the Plants Manufacturing demands.

SPRAY OPERATOR TRAINING MODEL

Safety Issues – Line Stoppage
Fire Prevention - Safety
Measurements /Mix Ratios / Balance Scales
Relief Operations / Painter Fatigue
Film Builds / Hiding
Transfer Efficiencies
Mix Room Operations
Booth Balance
Filtration
Gun Breakdown/ Cleaning / Repair
Robot Setup / Controls / Troubleshoot
P-Mix Setup/ Controls / Troubleshoot
Work Instructions
Paint / Specifications
MSDS – Right to Know
Air and Fluid Pressures (Caps and Tips)
Spray Techniques / Evaluations / Troubleshoot
Personnel Protective Equipment
Paint Line Cleaning / Booth Cleaning
Flash-off Tunnels
Oven Parameters
Part Prep Procedures (Prime)
Air / Paint Filter Management
Dirt Identification
Substrate Contamination
Inspect Criteria

CMMS Program…

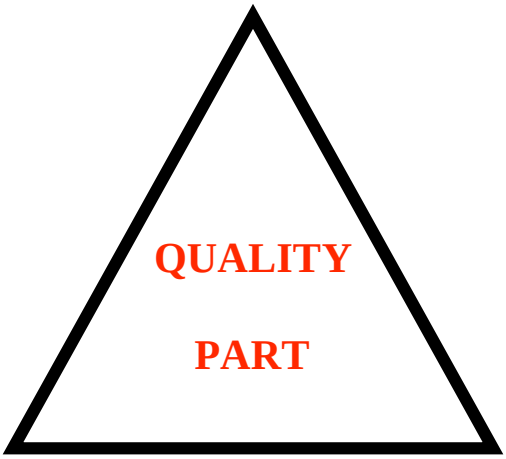
A complete Computerized Maintenance Management System provides all the tools you need to control all of your Preventative Maintenance Data.

The Program to be discussed today (MS 2000) is designed to help you organize maintenance activities, simplify preventative maintenance administration and maximize the efficiency and productivity of your entire Maintenance Operation. MS 2000 will keep track of all your maintenance activities, job descriptions and maintenance histories, providing you with detailed reports that show how you are utilizing your maintenance resources.

The first step in starting any CMMS Program is deciding what you want to accomplish. Do you have requirements for:

- General ledger Accounts
- Customer Surveys
- Inspection Points
- Specifications / Failures
- Work Orders / Tasking
- Purchase Orders
- Daily and Weekly schedules
- Labor, Costs, Documents, Assets
- Preventative Maintenance Tasking

PAINT QUALITY MODEL



ENVIRONMENT

- **SAFETY**
- **HOUSEKEEPING**
- **COMTAMINATION**
- **AIR FILTERS**
- **PRODUCT**
- **PAINT FILTERS/LINES**
- **PEOPLE – CLOTHING**
- **LIGHTING**

OPERATIONS

- SAFETY
- CUSTOMER AUDITS
- PART PREP
- LINE EQUIPMENT
- PREVENTATIVE MAINTENENCE
- QUALITY
- CONVEYOR
- SPRAY EQUIPMENT
- MANPOWER
- PEOPLE ATTITUDES – TRAINING - JOB DESCRIPTIONS
- RACK / LINE EFFICENCY
- HOUSEKEEPING
- EQUIPMENT AUDITS
- INSPECTION/REWORK
- PROCESS WINDOW

FLUIDS

- SAFETY
- PAINT
- MANUFACTURER
- QC AUDITS
- MIX ROOM
- WASTE STREAM
- FILTRATION
- TEMPERATURE
- VISCOSITY
- STORAGE
- SPECIFICATIONS
- TRANSFER EFFICIENCY
- INVENTORY

SPRAY PROCESS VARIABLES

- Plant Environment
  - Plant Temp-inside/outside
  - Humidity
  - Compressed Air Environment
  - Paint Temperature, Ventilation
  - Stacks – Fans – Balance
  - Filter Program and Log
  - Part Prep and Handling (Gloves)
  - Housekeeping, Dirt Team
  - Problem Solving Methods
  - Engineering/Quality Standards
  - People – Training
  - Part Specification – Inspection QC
  - Documented PM Program, FEMA
  - Work Instructions, Part Boards
  - Repair Area – Rework
  - Flash Zones - Ovens – Air Seals
  - Materials – Order, Supply, Storage

- Pretreatment
  - Chemical Concentrations
  - Solution Flow Rates
  - Temperatures
  - Flow Rates
  - Water – Chemical Waste
  - Equipment Cleanliness

- Coatings
  - Booth Balance / Air Flow
  - Humidity –Temp – Air Destat
  - Paint Visc
  - Air Filters, Silhouettes
  - Part Temp – Static Pressure
  - Equipment - Line Speed
  - Dirt Imprint
  - Part Traceability (Part to Batch)
  - Personal Protective Equipment PPE

- Spay Gun Control
  - Fluid Flows, Regulators
  - Air Pressures, Regulators
  - Fluid Tips, Caps
  - Fan / Atomization
  - Gun Techniques
  - Turbine Data- Speed
  - Voltage Control
  - Gun Balance, Trigger Points
  - Regulators
- Conveyor / Racks
  - Line Speed
  - Efficiency - Design
  - Grounding
  - Maintenance, Cleaning
  - Clean Hooks, Racks
  - Part / Rack Movement

- Paint Mix Room
  - Safety - Fire
  - Records, Monitored, Recorded, Charted, MSDS
  - Range of Measurements
  - Color Change Parameters
  - Stock Rotation
  - Mix Ratios
  - Solvent Control
  - Housekeeping – Dirt Control – Floor Covering
  - Temp / Humidity
  - Spare Parts
  - Incoming QC
  - Preventative Maintenance
  - Equipment (PPE)
  - Quarantine Area
  - Spill Equipment
  - Inventory Control (FIFO)
  - Mix Room Log
  - Paint Lines – Temp
  - Calibration Plan

Implementation Program

- Must have Top Executive Sponsorship
- Select Key Paint Trained Individuals for the Team
- Define Priorities and Expectations for the Team
- Prepare a Mission Statement, with Executive buy in
- Identify Critical Production Limitations / Factors
- Interview Team Players - Production and Maintenance
- Establish a Benchmark for Success Plan / Communication Plan
- Prepare a Preventative Maintenance Plan
- Perform an Audit
- Identify Critical Bottlenecks / Share Information
- Verify Job descriptions / Training / Safety / Incentive Program
- Design a Data Base
- Document / Re-evaluate / Monitor
- Celebrate Successes

Defect Analysis

The inspection process is the focal point of the Preventative Maintenance Program. At the information gathering point, it will generate many documents within the CMMS Program to identify and qualify the work order. Most Systems have the pass/fail-reporting document, which will define the scope of Maintenance in terms of Scheduling, Hours, Cost and the final impact on other systems within the Production System.

Consistent Training of Inspection people is critical to the process. Each member should have the same Standards and Judgment factors. Cross Training of the Employees to better understand the complete process will result in improved performance throughout. The first thing that's required is an understanding of what the Program includes, what the Objectives are and how to achieve those goals. This means that the Manufacturing Facility is willing to do all those things necessary to make the program a success.

· Invest in the Program

· Develop a Team

· Willingness to make changes

· Continuation of the Program after Short Term Goals are Achieved

· Commitment of time and budget by the Management

The overlooked issues for the Skills and Abilities requirement for a Defect Analyst are:

- · Knowledge of the Paint Process
- · Communication Expertise - Computer Skills
- · Self Motivation and Team Worker
- · Problem Solving ability / Analysis Skills

- Savings through Labor Productivity
- · Savings through Material Management
- · Savings through Equipment Productivity
- · Measuring the Savings through:
    - Inventory Controls
    - Equipment log's
    - Breakdown Analysis

Conclusion

Current Technology and Plant Process applications have produced an exceptional high level of creating in-house measurement tools to produce higher quality effects for the Manufacturing Process. We as a manufacturing culture must realize that our competition is not right next store, but rather on a different Continent. Quality issues are resolved by Preventative Maintenance Practices. While it is impossible to present all facets of the problems/solutions, we must start at the Customer Level to analyze their preferences. That value analysis will allow us to plot the critical issue to improve quality and thus establish a prioritized Preventative Maintenance Program.

Prevention of Line Failures, Dirt in Paint, Off Color/Gloss and other defects will come to light as we pursue the Painted Part Quality Initiative. 99% First time run capability is a perfect goal, but we have to remember the various and different initiatives that will get us there. Unfortunately in Paint there is no clear cut solution, no on/off switch, we are dealing with a science that has a vast amount of parameters that all affect each other, at different ratios. Each System is different and has its own set of specifications and expectations, (from the Paint Mix Room to the Ovens); each system must be analyzed on its own merit to produce its own list of preventative Maintenance Solutions.

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EPAC TECHNOLOGY – WWW.EPACST.COM EPA - WWW.EPA.GOV

LOCAL ENVIRONMENTAL COMPLIANCE –WWW.LGEAN.ORG

Special Thanks goes to Sur / Fin 2006 and the Paint Process People at PPG, Toyota, General Motors, Ford and numerous Professional Associates here in the US and Mexico who have contributed to my background over the past years.

Walt 's background…

Walt comes to us with an Automotive OEM background in Sales and Marketing in the Paint and Chemical Industry. He has an Environmental Preventative Maintenance back ground and is familiar with all phases of Automotive Painting , Preventative Paint Shop Maintenance and Paint Process. He has been associated with Automotive, and Chemical Manufactures for the past twenty-four years and has been responsible for direct sales to Central Offices, Technical Centers and Plants on an Executive Level in the United States and Mexico.

His Degree is from Michigan State University in Business, with a Masters from the USAF in Aeronautical Science which compliments his position. He is a Retired Officer from the Air Force and has served in the capacity of a Pilot, Squadron Commander and Wing Safety Director. He has logged over 3500 hours in Single Seat Fighters in the US, Europe, and Central America.

Walt is a member of SME, Engineering Society of Detroit, Michigan Pilots Association and the Retired Officers Association and has presented numerous professional papers on Paint Process Preventative Maintenance in the Coating Industries. He has resided in Eastern Iowa for the past two years, as the Paint Shop Manager for Allsteel Office Products .

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