Quality Systems Basics 2009

QSB Strategies

1. Fast Response
   - Fast Response Process
   - Problem Solving
   - Lessons Learned
2. Control of Non-Conforming Product
3. Verification Station
4. Standardized Operations
   - Work Place Organization – The 7 Wastes
   - Standardized Work Instructions – SOS
   - Operator Instructions – JES
   - Manufacturing Gage Control (NEW)
5. Standardized Operator Training – JIT
6. Error Proofing Verification
7. Layered Process Audits
8. RPN Risk Reduction (Reverse PFMEA)
9. Contamination Control
10. Supply Chain Management
11. Managing Change (NEW)

Rules of Engagement

STANDARD:

- Assess the Supplier per the Latest QSB Audit to Determine which Strategies are Red and Require a Workshop.
  - ➢ (SQE Only)
- Deliver Strategies as Required Based on the Audit Results and obtain an Action Plan to all Red and Yellow Audit Questions.
  - ➢ (SQE or 3rd Party)

Quality Systems Basics

Focus – ONE LANGUAGE GLOBALLY

- Common Principles
- Common Methods
- Common Processes

1.0 FAST RESPONSE

Solving problems faster & earlier upstream through visual management

FAST RESPONSE
Outline

1.0) Introduction; Purpose , Scope, Responsibility

1.1) Benefits

1.2) Fast Response

- Problem Identification, Sources
- Meeting Structure
- Responsibilities
- Design, Template, Exit Criteria, Statusing
- Performance Metrics

1.3) Problem Solving

- Description, Fundamentals
- 6 Core Steps to Solving Problems

1.4) Lessons Learned

1.5) Summary, Shalls

FAST RESPONSE

1.0 - Introduction

PURPOSE:

- Immediately address quality failures
  - External / Internal
- Defines the process to be followed
- Defines method of displaying important information as a visual management tool, supporting status at a glance.
- Applies discipline in responding to issues through a systematic approach.

SCOPE:

- Assembly Area
- Manufacturing Operations
- Shipping / Receiving
- All Operations
- Other Support Functions

RESPONSIBILITY:

- Ownership
  - ✓ Operations Manager
- Contingency Plan for All Situations

FAST RESPONSE

1.1 - Benefits

- Improves Quality metrics - reduces PPM, warranty costs, reduces PRR's and increases customer satisfaction.
- Provides a systematic approach for *Problem Solving* and communication of Quality issues.
- Ensures the Natural owner is assigned to each issue.
- Supports continuous improvement.
- Strengthens documented implementation of *Lessons Learned*.
- Prevents repetitive mistakes and reduces waste of resources.
- Engages all stakeholders in an organization.

FAST RESPONSE

1.2 - Fast Response

Fast Response is a system which:

- Standardizes reaction to significant External/Internal Quality failures.
- Instills problem solving discipline through use of a standard documented format for all problems.
- Promotes communication and a sharing of knowledge through daily meetings.
- Utilizes a visual method of displaying important information to drive closure.
- Moves problem identification upstream from the customer to addressing internal issues sooner.

FAST RESPONSE

1.2 - Fast Response

Problem Identification:

In **preparation** for the Fast Response meeting, at the start of the day, Quality shall identify **significant** quality concerns from the **past 24 hours** which include:

- External Concerns:
  - Customer concerns (PRR's, Liaison Issues, Customer Calls, Warranty)
  - Supplier concerns (Suppliers should be notified in advance when they are to report out at the meeting).
- Internal Concerns:
  - *Verification Station* Findings
  - *Layered Process Audit* Systemic issues
  - Line stops and Teardown issues
  - Other internal Quality concerns (Dock Audits, containment activity)
  - *Error Proof* device failures

FAST RESPONSE

1.2 - Fast Response

Structure:

The meeting is a manufacturing review meeting owned by Manufacturing and supported by Quality, Engineering, Maintenance, and support staff.

Shall be held daily to review the significant quality concerns gathered by Quality. Some organizations may choose to hold meetings on each shift.

It is a communications meeting, not a problem solving meeting.

It should be a 10 - 20 minute stand up meeting held on the shop floor.

Each issue shall be documented on a Practical Problem Solving Report (PPSR) or equivalent. This form is reviewed at the meeting to provide structure for the report out and keep the meeting to its allotted time frame.

- Suppliers are expected to use a standard problem solving form for their report out for the initial Containment phase, Root Cause and Corrective Action updates.

FAST RESPONSE

1.2 - Fast Response

Responsibilities:

New issues shall be updated on the Fast Response board prior to the meeting by the owner (lead contact in the case of supplier issues).

Owners shall be responsible for assuring all problem solving and exit criteria are met in a timely manner through:

- Cross-functional team reviews outside the Fast Response meeting.
- Update the Fast Response Board Exit Criteria and status columns.
- Distribute updates to team members or key contacts.

Owner shall report progress to the team during each of these steps:

- Problem Definition, Containment
- Root Cause Analysis (5-Why)
- Short/Long Term Corrective Action
- Validation of Corrective Action and Lessons Learned.

FAST RESPONSE

1.2 - Fast Response

Responsibilities:

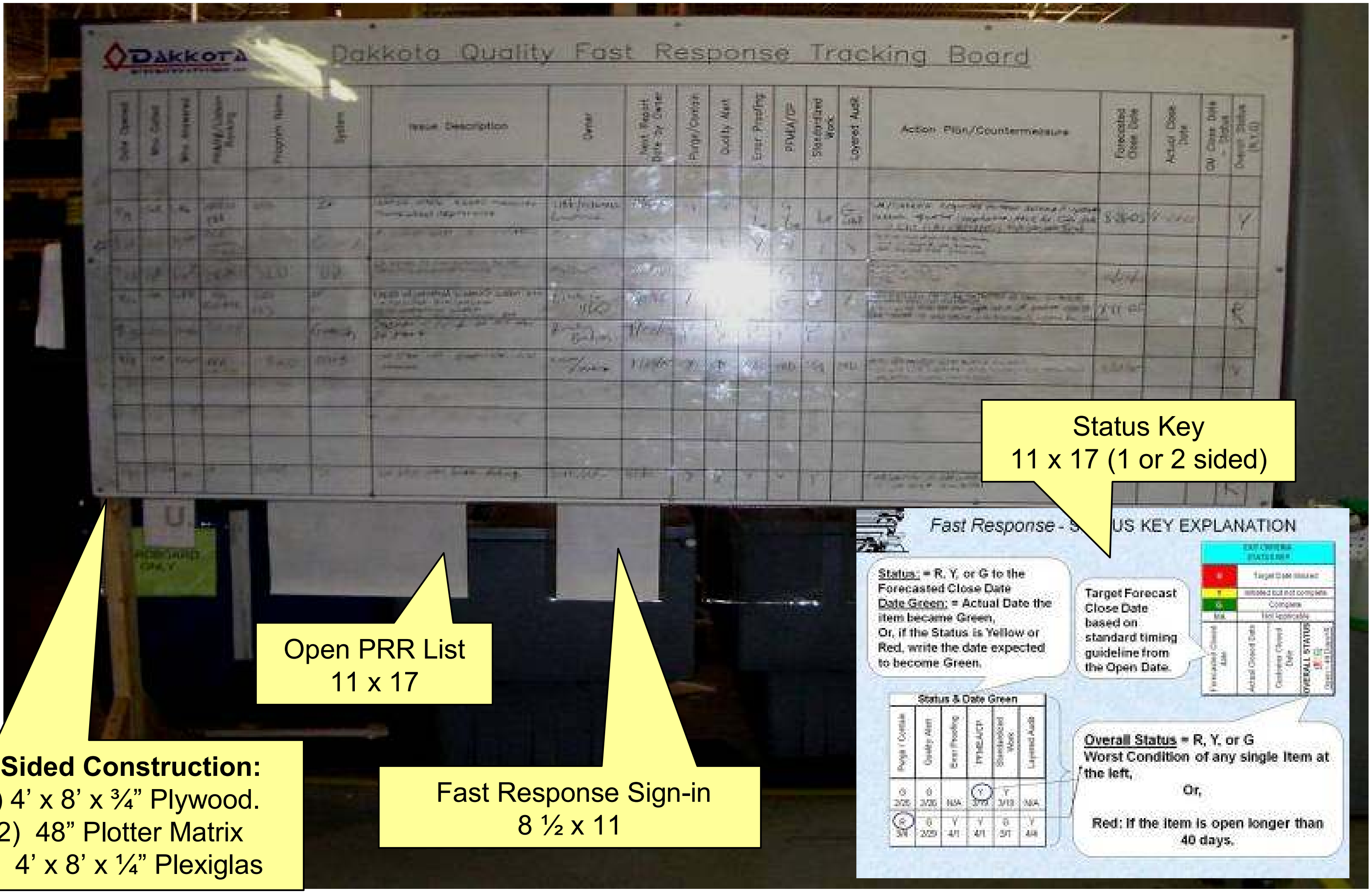
The Plant Manager or designated manufacturing lead shall:

- Ensure that Fast Response process is maintained and effective.
- Designate a champion & co-champion as the facilitator.

At the Fast Response meeting, site leadership shall:

- Designate a leader (natural owner) for each concern/issue if one has not been already assigned.
- Ensure proper support from all disciplines through attendance.
- Identify action required and owner for items statused as RED.
- Establish the next report out date for the issue if it is not closed.

FAST RESPONSE TRACKING BOARD (Example)



Fast Response - Status Key Explanation

Status: = R, Y, or G to the Forecasted Close Date
Date Green: = Actual Date the item became Green,
Or, if the Status is Yellow or Red, write the date expected to become Green.

Target Forecast Close Date based on standard timing guideline from the Open Date.

Overall Status = R, Y, or G
Worst Condition of any single item at the left,
Or,
Red: If the item is open longer than 40 days.

Status Key
11 x 17 (1 or 2 sided)

Open PRR List
11 x 17

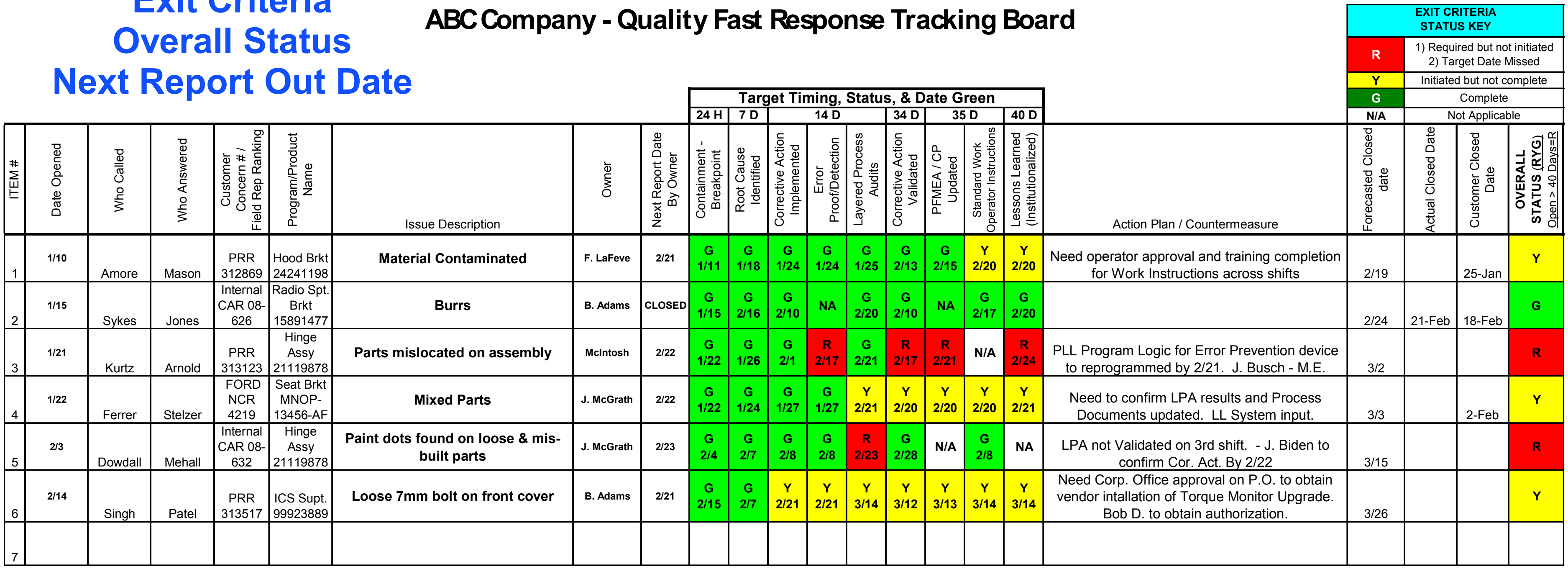
Fast Response Sign-in
8 ½ x 11

2 Sided Construction:
2) 4’ x 8’ x ¾” Plywood.
2) 48” Plotter Matrix
2) 4’ x 8’ x ¼” Plexiglas

FAST RESPONSE TRACKING BOARD (Example)

To optimize visual management, this form is displayed in the meeting area (e.g. 4' x 8' dry erase board, laminated poster, etc.)

Points to Review:
Ownership
Exit Criteria
Overall Status
Next Report Out Date



ABC Company - Quality Fast Response Tracking Board

EXIT CRITERIA STATUS KEY	
🟥 R	1) Required but not initiated 2) Target Date Missed
🟨 Y	Initiated but not complete
🟩 G	Complete
N/A	Not Applicable

									Target Timing, Status, & Date Green													
									24 H	7 D	14 D			34 D	35 D		40 D					
ITEM #	Date Opened	Who Called	Who Answered	Customer Concern # / Field Rep Ranking	Program/Product Name	Issue Description	Owner	Next Report Date By Owner	Containment - Breakpoint	Root Cause Identified	Corrective Action Implemented	Error Proof/Detection	Layered Process Audits	Corrective Action Validated	PFMEA / CP Updated	Standard Work Operator Instructions	Lessons Learned (Institutionalized)	Action Plan / Countermeasure	Forecasted Closed date	Actual Closed Date	Customer Closed Date	**OVERALL STATUS (RYG)** Open > 40 Days=R
1	1/10	Amore	Mason	PRR 312869	Hood Brkt 24241198	**Material Contaminated**	**F. LaFeve**	2/21	G 1/11	G 1/18	G 1/24	G 1/24	G 1/25	G 2/13	G 2/15	Y 2/20	Y 2/20	Need operator approval and training completion for Work Instructions across shifts	2/19		25-Jan	Y
2	1/15	Sykes	Jones	Internal CAR 08-626	Radio Spt. Brkt 15891477	**Burrs**	**B. Adams**	CLOSED	G 1/15	G 2/16	G 2/10	NA	G 2/20	G 2/10	NA	G 2/17	G 2/20		2/24	21-Feb	18-Feb	G
3	1/21	Kurtz	Arnold	PRR 313123	Hinge Assy 21119878	**Parts mislocated on assembly**	**McIntosh**	2/22	G 1/22	G 1/26	G 2/1	R 2/17	G 2/21	R 2/17	R 2/21	N/A	R 2/24	PLL Program Logic for Error Prevention device to reprogrammed by 2/21. J. Busch - M.E.	3/2			R
4	1/22	Ferrer	Stelzer	FORD NCR 4219	Seat Brkt MNOP-13456-AF	**Mixed Parts**	**J. McGrath**	2/22	G 1/22	G 1/24	G 1/27	G 1/27	Y 2/21	Y 2/20	Y 2/20	Y 2/20	Y 2/21	Need to confirm LPA results and Process Documents updated. LL System input.	3/3		2-Feb	Y
5	2/3	Dowdall	Mehall	Internal CAR 08-632	Hinge Assy 21119878	**Paint dots found on loose & mis-built parts**	**J. McGrath**	2/23	G 2/4	G 2/7	G 2/8	G 2/8	R 2/23	G 2/28	N/A	G 2/8	NA	LPA not Validated on 3rd shift. - J. Biden to confirm Cor. Act. By 2/22	3/15			R
6	2/14	Singh	Patel	PRR 313517	ICS Supt. 99923889	**Loose 7mm bolt on front cover**	**B. Adams**	2/21	G 2/15	G 2/7	Y 2/21	Y 2/21	Y 3/14	Y 3/12	Y 3/13	Y 3/14	Y 3/14	Need Corp. Office approval on P.O. to obtain vendor intallation of Torque Monitor Upgrade. Bob D. to obtain authorization.	3/26			Y
7																						

For Red or Yellow Status – Include Target Date expected to go Green

FAST RESPONSE

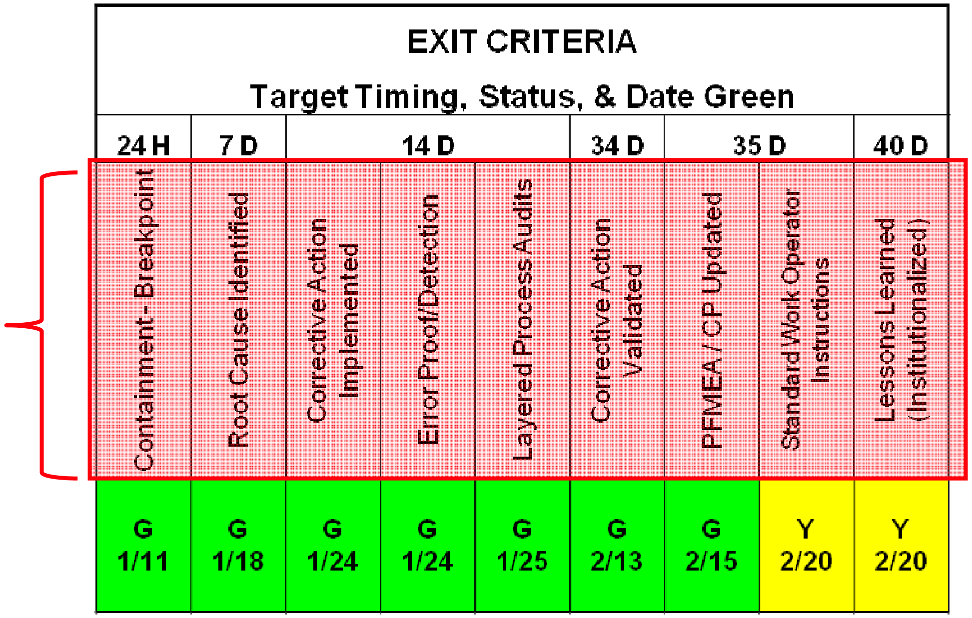
1.2 - Fast Response

Exit Criteria, Statusing:

Exit criteria shall be established for each key step in the problem solving process.

In addition, key items to include in identifying opportunities for validation of corrective action through *Layered Process Audits* and prevention of recurrence through *error proofing* and Lessons Learned institutionalized shall also be documented.

Typical Exit Criteria



EXIT CRITERIA

Target Timing, Status, & Date Green

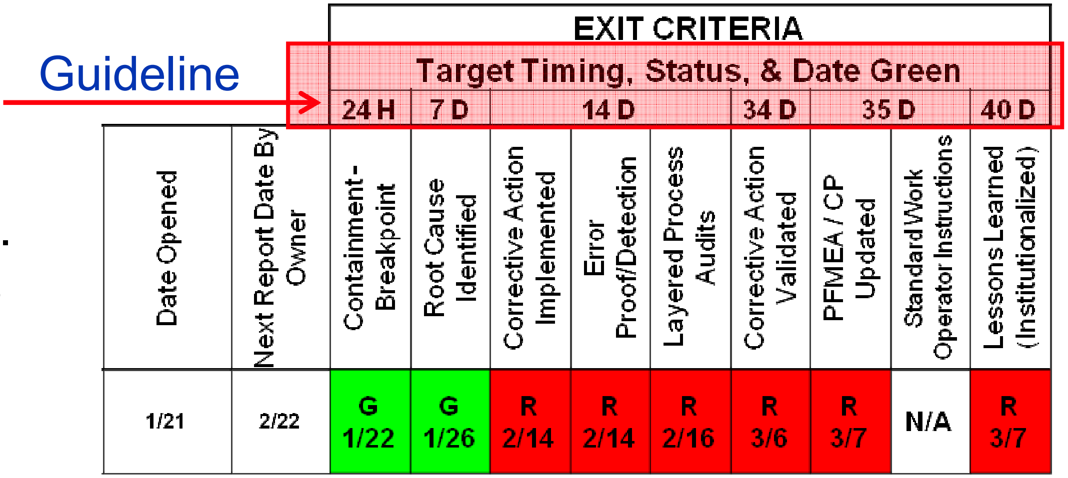
24 H	7 D	14 D			34 D	35 D		40 D
Containment - Breakpoint	Root Cause Identified	Corrective Action Implemented	Error Proof/Detection	Layered Process Audits	Corrective Action Validated	PFMEA / CP Updated	Standard Work Operator Instructions	Lessons Learned (Institutionalized)
G 1/11	G 1/18	G 1/24	G 1/24	G 1/25	G 2/13	G 2/15	Y 2/20	Y 2/20

- Evidence of each criteria should be reviewed by the Owner at the Fast Response Meeting (Leadership approval to close/green status).

FAST RESPONSE

1.2 - Fast Response

Exit Criteria, Statusing:



		EXIT CRITERIA								
		Target Timing, Status, & Date Green								
		24 H	7 D	14 D			34 D	35 D		40 D
Date Opened	Next Report Date By Owner	Containment - Breakpoint	Root Cause Identified	Corrective Action Implemented	Error Proof/Detection	Layered Process Audits	Corrective Action Validated	PFMEA / CP Updated	Standard Work Operator Instructions	Lessons Learned (Institutionalized)
1/21	2/22	G 1/22	G 1/26	R 2/14	R 2/14	R 2/16	R 3/6	R 3/7	N/A	R 3/7

Timing for each of the exit criteria shall be established in order to properly status each item as Red, Yellow, or Green. The default when a problem is first opened is Yellow until it's timing is exceeded, RED, or Completed, GREEN.

In the example above, the date the problem was opened is 1/21.

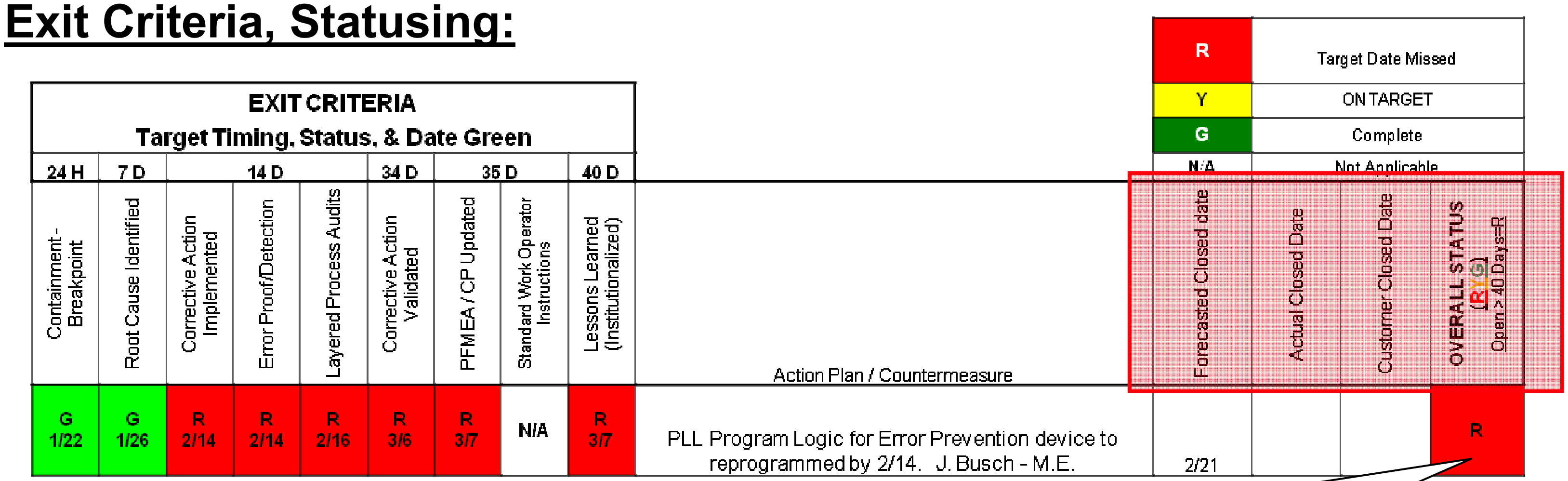
- Containment was achieved within 24 hours.
- Root Cause was identified within 7 days.
- Corrective action was not implemented within 14 days so it is RED with the expected date to be GREEN shown as 2/14.

This Red status should show details in a action/status comment column explaining the next step.

FAST RESPONSE

1.2 - Fast Response

Exit Criteria, Statusing:



🟥 R	Target Date Missed
🟨 Y	ON TARGET
🟩 G	Complete
N/A	Not Applicable

EXIT CRITERIA Target Timing, Status, & Date Green													
24 H	7 D	14 D			34 D	35 D		40 D					
Containment - Breakpoint	Root Cause Identified	Corrective Action Implemented	Error Proof/Detection	Layered Process Audits	Corrective Action Validated	PFMEA / CP Updated	Standard Work Operator Instructions	Lessons Learned (Institutionalized)	Action Plan / Countermeasure	Forecasted Closed date	Actual Closed Date	Customer Closed Date	OVERALL STATUS (RYG) Open > 40 Days=R
G 1/22	G 1/26	R 2/14	R 2/14	R 2/16	R 3/6	R 3/7	N/A	R 3/7	PLL Program Logic for Error Prevention device to reprogrammed by 2/14. J. Busch - M.E.	2/21			R

Overall Status = R, Y, or G
Worst Condition of any single Item at the left

Forecast Closed Date should be 30 days as a target. The maximum should be 40 days.

FAST RESPONSE: REPORT OUT FORMAT

FAST RESPONSE

1.2 - Fast Response

(Example)

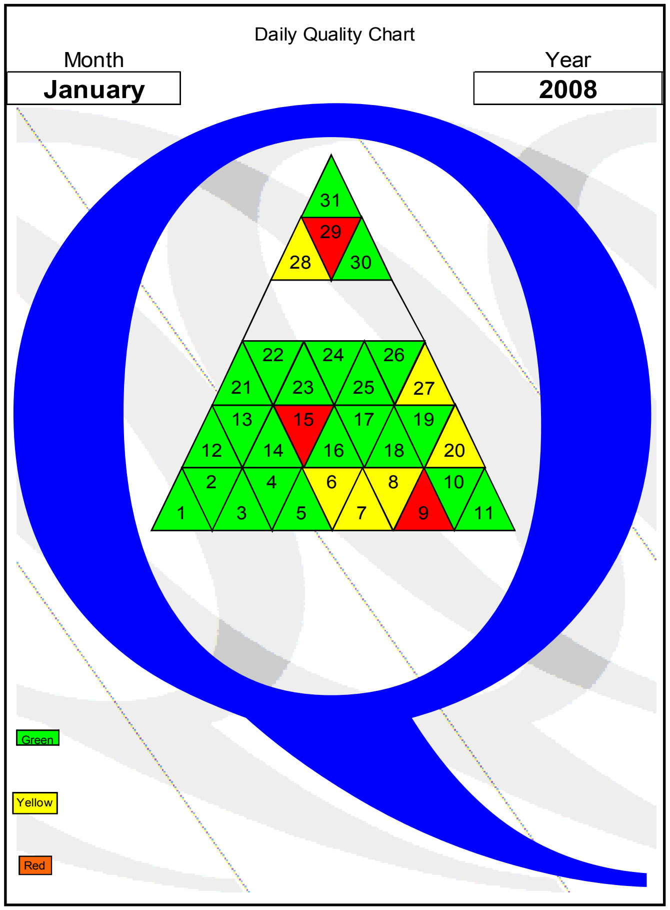
Performance Metrics:

Leadership shall ensure that Fast Response process is effective and quality status is displayed.

How do you know the Fast Response process is working?

Any type of visual management can be used such as a calendar, trend charts which represent at minimum monthly data:

- The number of days Red or Yellow
- Number of issues Closed
- Average days open for closed issues

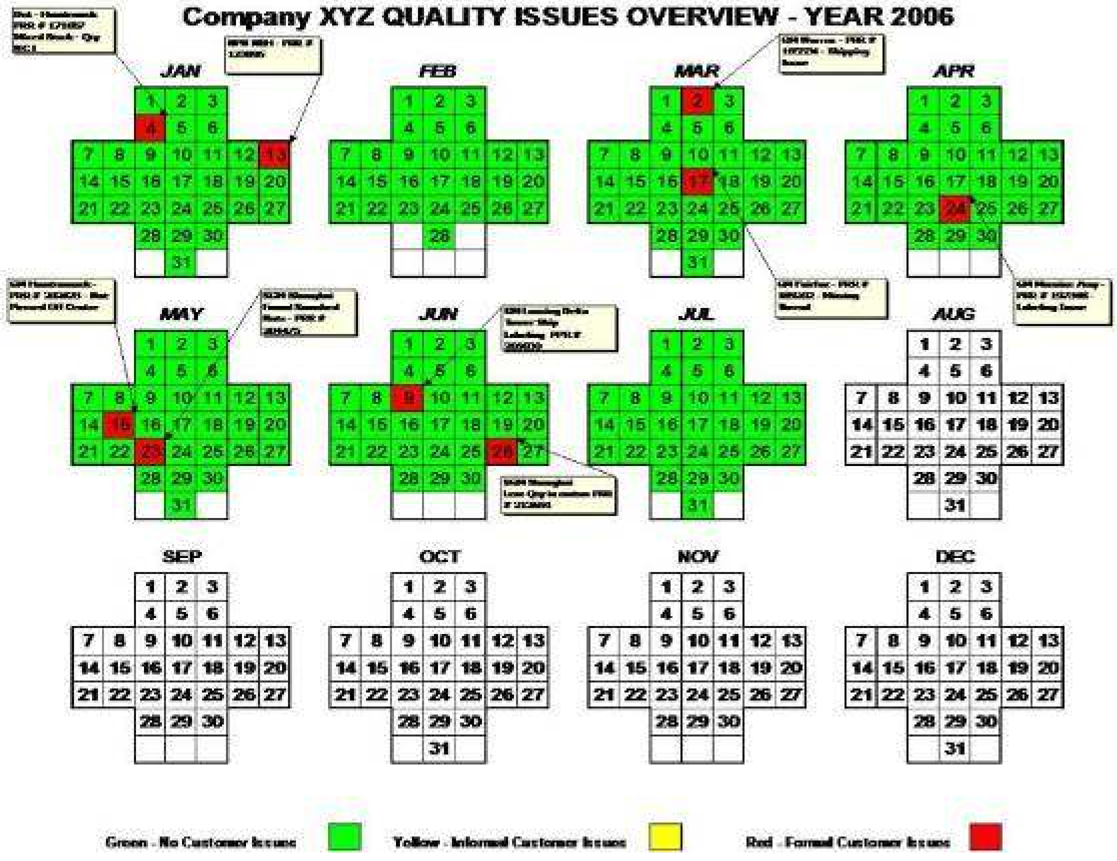


FAST RESPONSE

1.2 - Fast Response

Performance Metrics:

(Example)



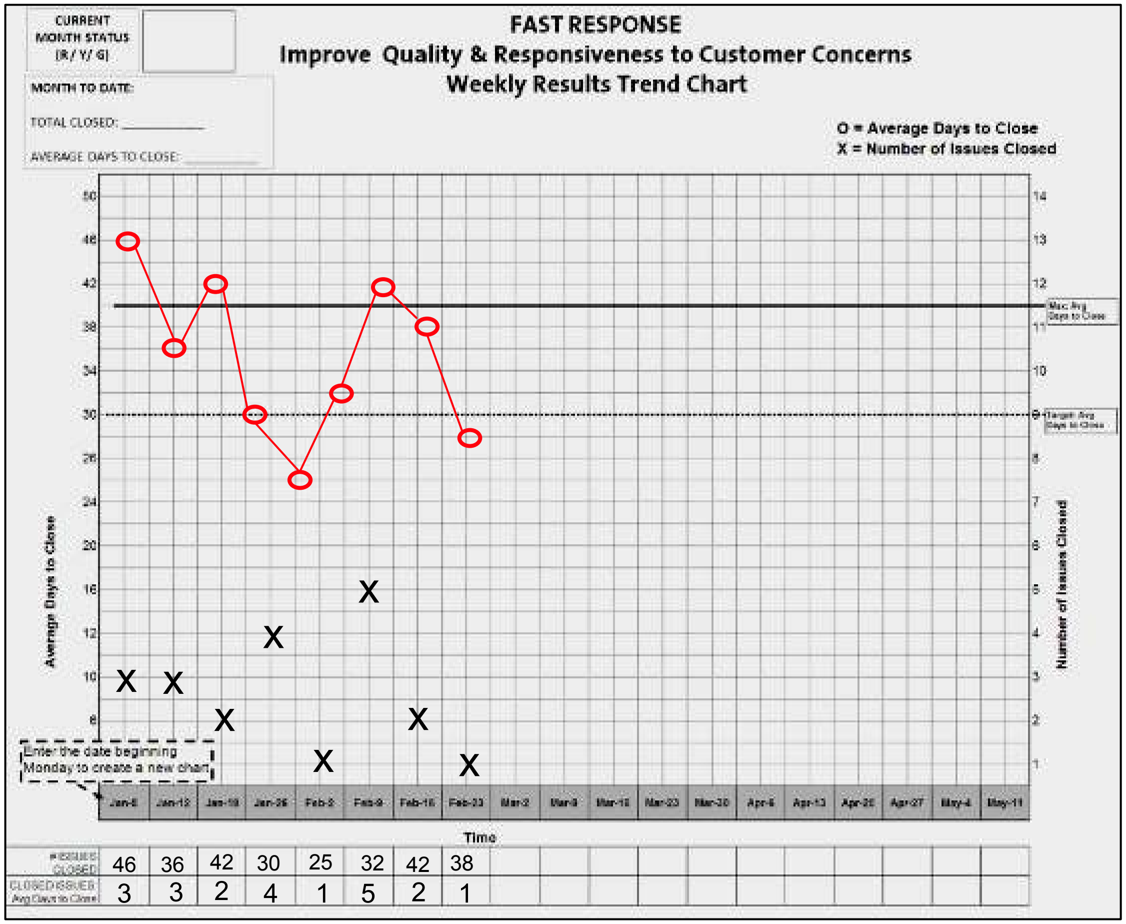
FAST RESPONSE

1.2 - Fast Response

Performance Metrics:

Weekly tracking of the number of issues closed and average days open for the closed issues.

(Example)



# ISSUES CLOSED	46	36	42	30	25	32	42	38
CLOSED ISSUES Avg Days to Close	3	3	2	4	1	5	2	1

FAST RESPONSE

1.2 - Fast Response Summary

FAST RESPONSE PROCESS KEY STEPS

Quality gathers significant issues from the past 24 hours.

Daily Fast Response Meeting assigns owner to each issue. Outside the meeting the owner utilizes the Problem Solving process to correct and prevent ecurrence.

Issues are tracked on the Fast Response Tracking Board. Owners are required to give periodic updates at Fast Response meeting.

Owner responsible for completion of all exit criteria including Lessons Learned. Results of Problem Solving process communicated. Fast Response Tracking Board indicates exit criteria is green.

FAST RESPONSE

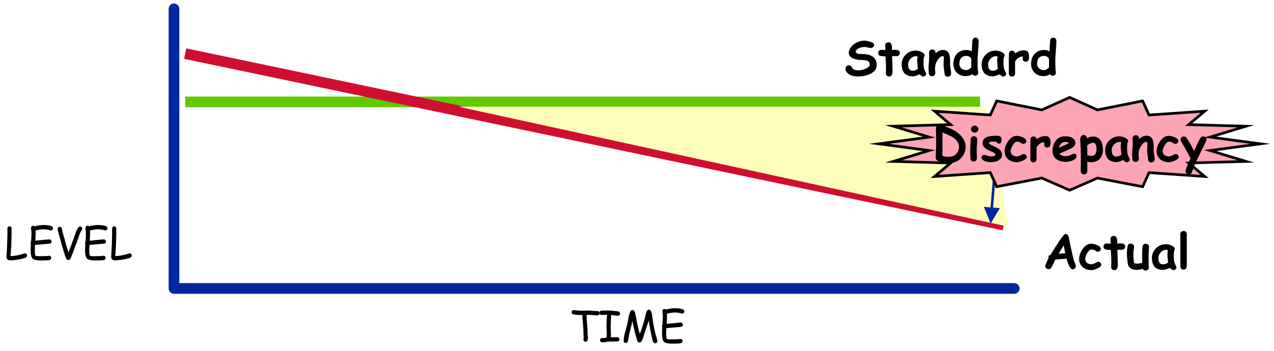
1.3 – Problem Solving

Organizations shall have a defined process for Problem Solving including a standard for documenting tools used for root cause identification and elimination.

WHAT IS A PROBLEM?

- **It is the GAP between the current situation and customer satisfaction.**

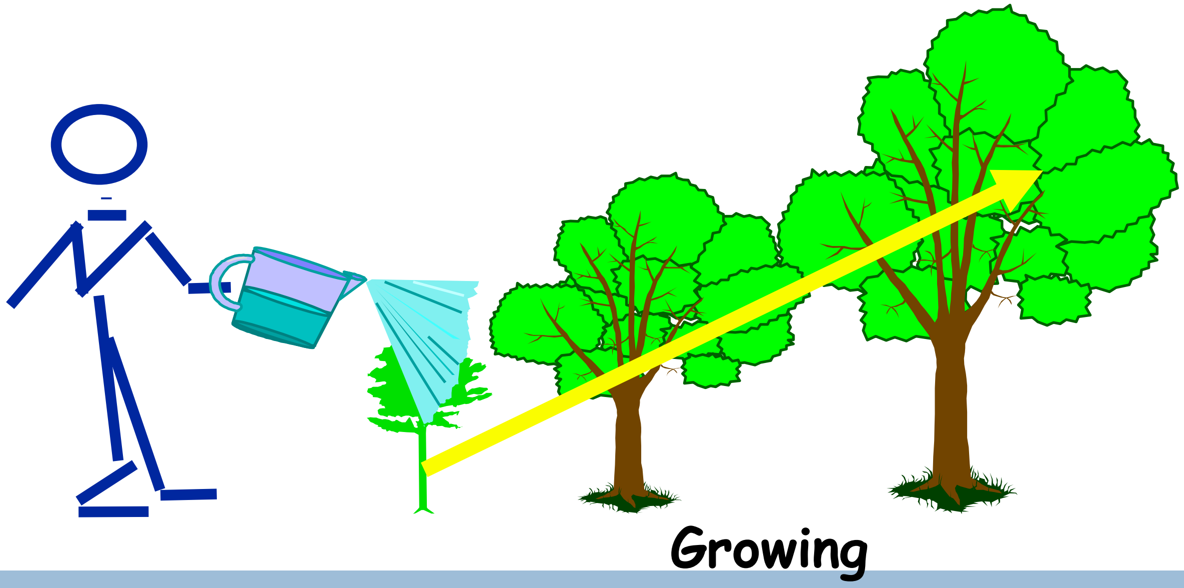
- Defined As a Discrepancy Between an Existing Standard or Expectation and the Actual Situation.



FAST RESPONSE

1.3 – Problem Solving

- Problems Are the Seeds for Improvement!
  - Problems Are Positive Opportunities!
    - If There Are No Problems Then Something Is Wrong!



FAST RESPONSE

1.3 – Problem Solving

FUNDAMENTAL PRINCIPLES OF PROBLEM SOLVING

Set aside pre-conceived ideas.

Don’t respond to problems without data.

Break the problem down.

See abnormal occurrence and Point of Cause first hand.

Delay cause analysis until you have a thorough grasp of what is actually happening.

What is the standard? What is happening compared to what should be happening?

Establish Cause/Effect relationships.

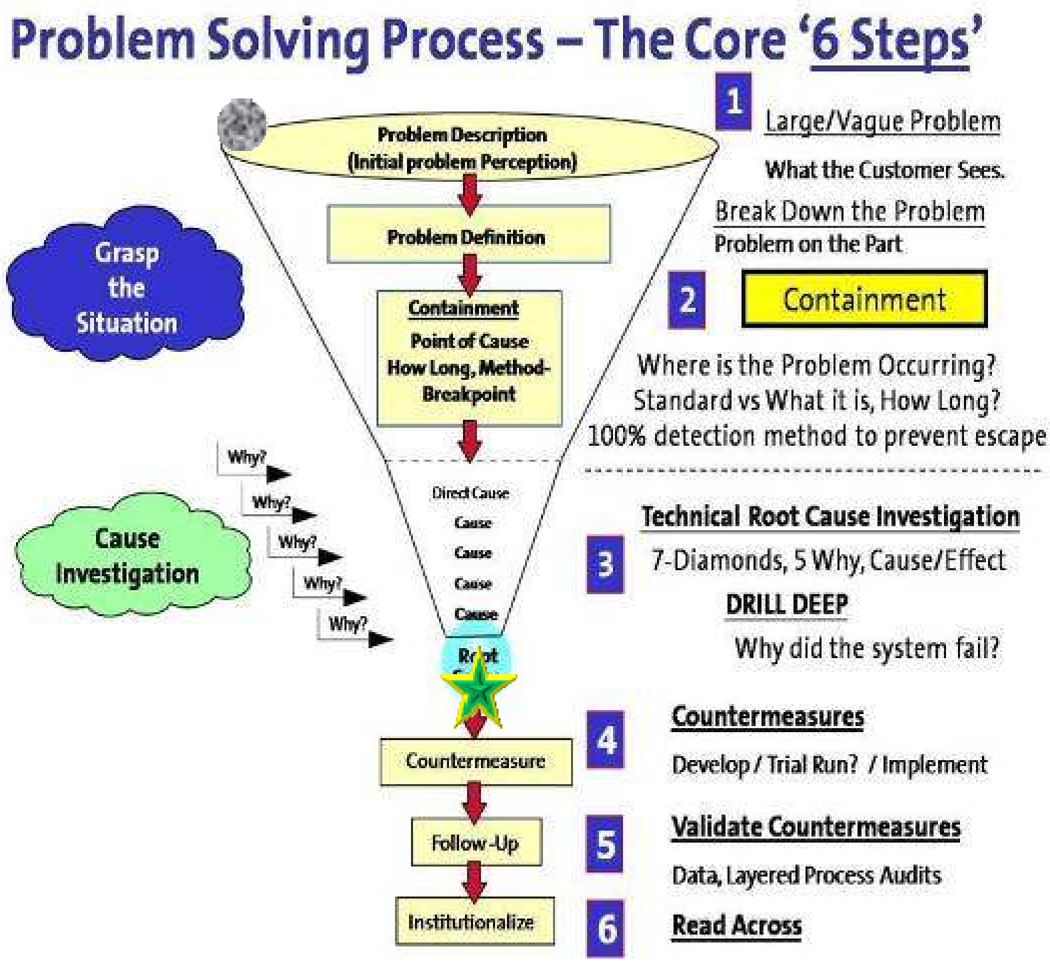
Continue asking “Why”? until you can prevent reoccurrence of the problem by addressing its root cause.

FAST RESPONSE

1.3 – Problem Solving

Definition:

- A structured process that identifies, analyzes, and eliminates the discrepancy between the current situation and an existing standard or expectation, and prevents recurrence of the root cause.



Problem Solving Process – The Core '6 Steps'

Grasp the Situation

Problem Description
(Initial problem Perception)

Problem Definition

Containment
Point of Cause
How Long, Method-Breakpoint

Cause Investigation

Why?
Why?
Why?
Why?
Why?

Direct Cause
Cause
Cause
Cause
Cause
Root

Countermeasure

Follow-Up

Institutionalize

1 Large/Vague Problem
What the Customer Sees.
Break Down the Problem
Problem on the Part

2 Containment
Where is the Problem Occurring?
Standard vs What it is, How Long?
100% detection method to prevent escape

3 Technical Root Cause Investigation
7-Diamonds, 5 Why, Cause/Effect
DRILL DEEP
Why did the system fail?

4 Countermeasures
Develop / Trial Run? / Implement

5 Validate Countermeasures
Data, Layered Process Audits

6 Read Across

FAST RESPONSE

1.3 – Problem Solving

Step 1-DEFINE THE PROBLEM:

Problem Description

- State the Problem That Is Occurring

- **Problem Definition** - Specifically Define the Situation
  - The Standard - What should be happening?
  - The Actual or Gap - What is happening?
  - The Time Period - How long has it been happening?

Grasp the Situation

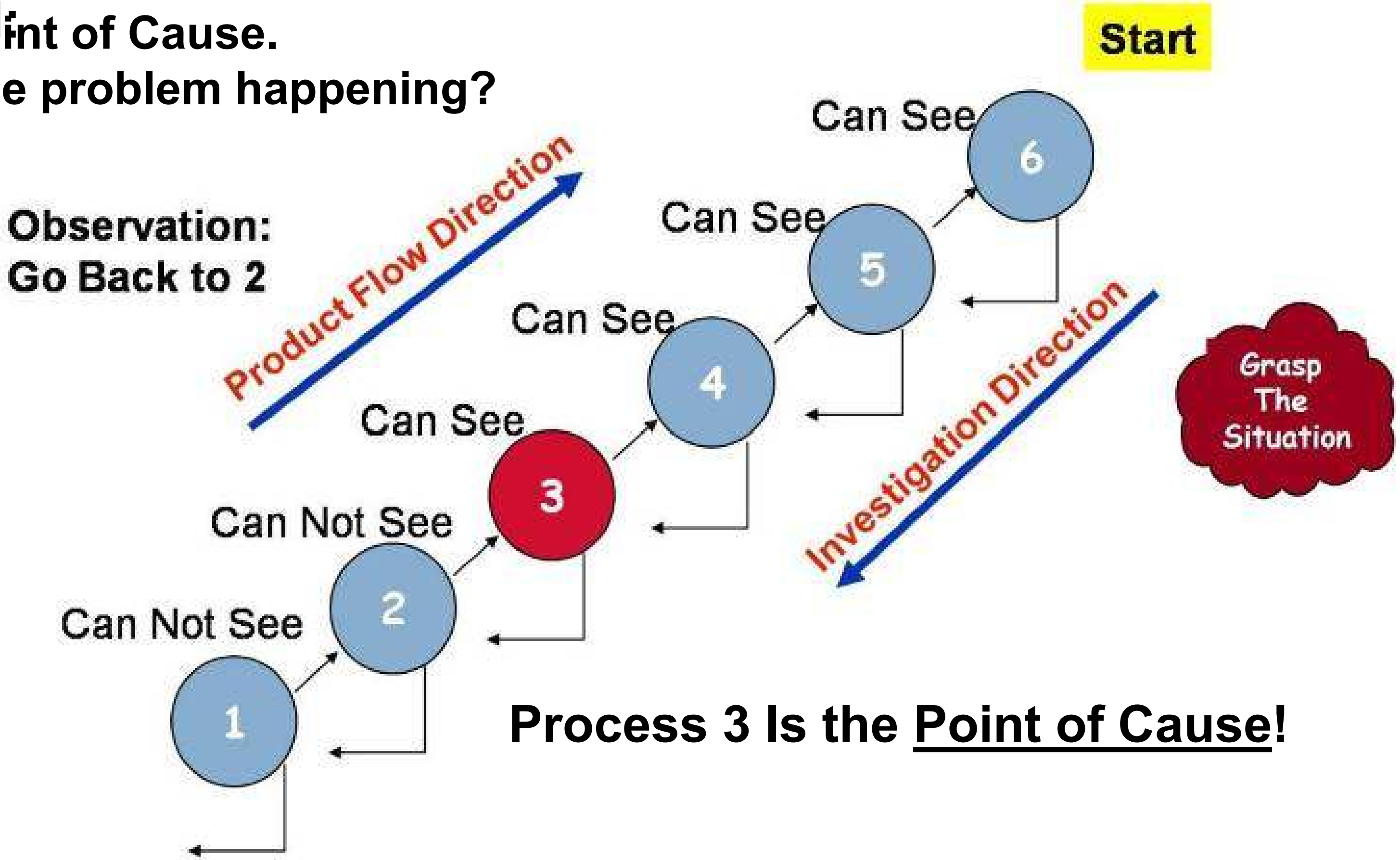
FAST RESPONSE

1.3 – Problem Solving

Step 2-CONTAIN THE PROBLEM:

Go-See; Point of Cause.

Where Is the problem happening?



Process 3 Is the Point of Cause!

FAST RESPONSE

1.3 – Problem Solving

Step 2-CONTAIN THE PROBLEM:

Once the Point of Cause is determined, the team needs to apply the non-conforming procedure to determine:

- The best method to contain the defect.
- How long has this been happening?
  - Review data for last known good part for the specific characteristic in question.
  - Engage operators regarding changes or abnormal conditions and timing.
  - Initiate a containment work sheet and establish a potential quantity to verify all material is question Is captured for that time frame.
- Determine whether other areas or customers are impacted by the problem and to what extent.

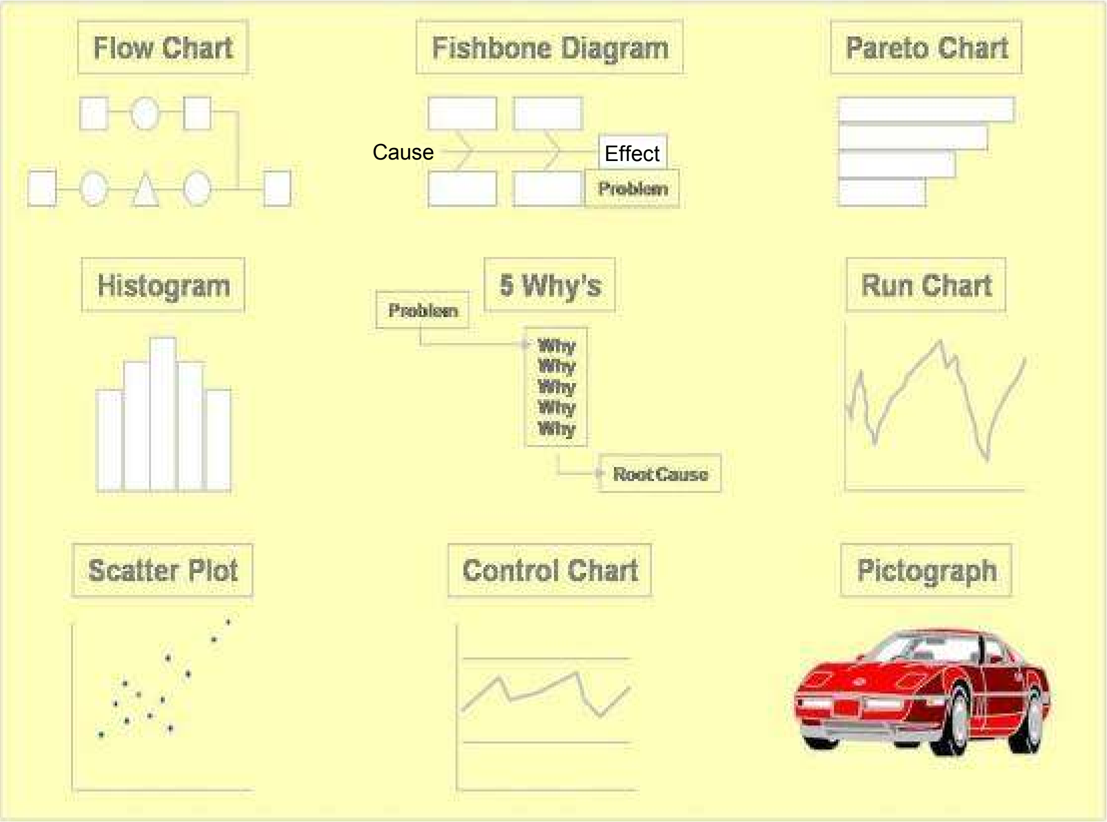
FAST RESPONSE

1.3 – Problem Solving

Step 3 – Identify the Root Cause:

(Example)

There are several tools available to problem solve and get to the root cause. Their use is dependent upon the complexity of the process, the type of failure mode, Fit, Function, or Finish, and the system used to measure the specific characteristic that failed which will be attribute or variable data.



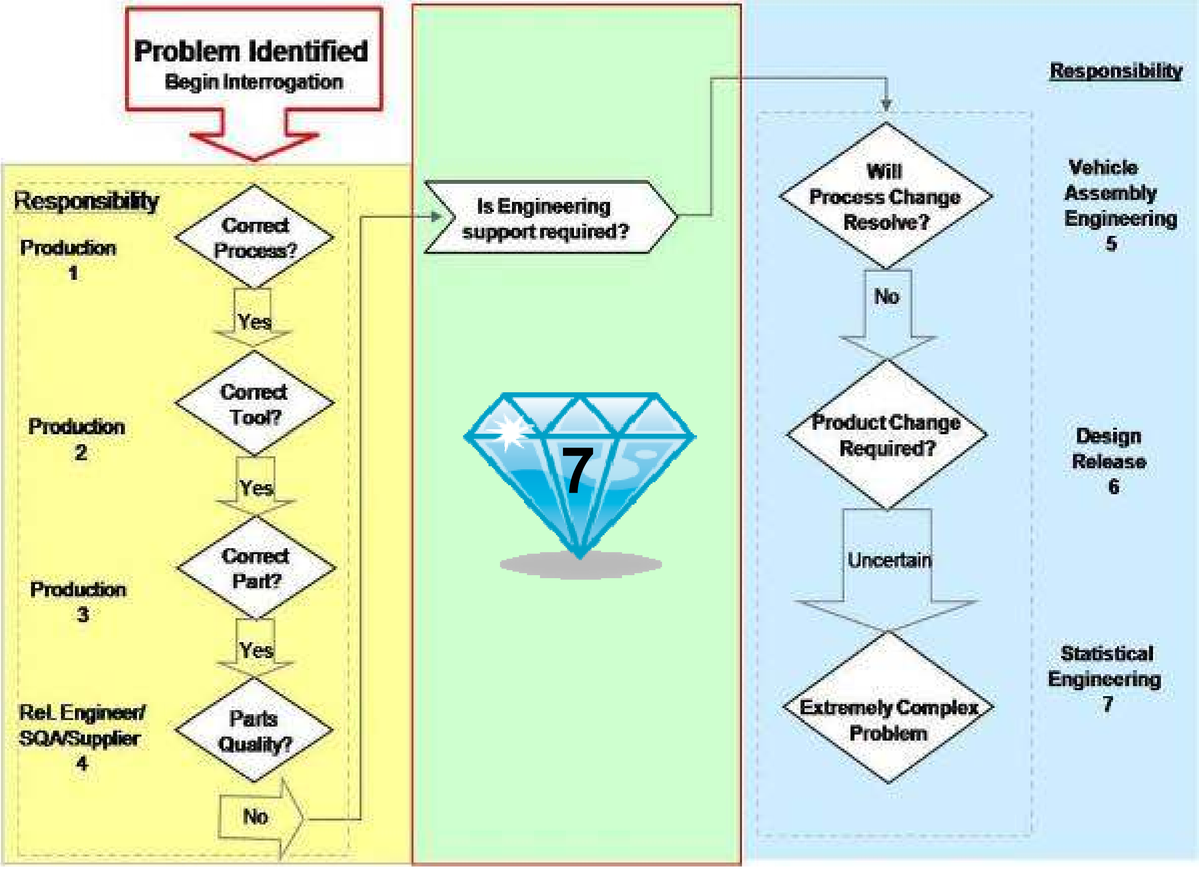
FAST RESPONSE

1.3 – Problem Solving

Step 3 – Identify the Root Cause:

As an initial root cause step, General Motors uses the 7 diamond process as an immediate reaction to internal Quality issues. The first 4 steps are used to quickly determine if an out of standard condition (special cause) exists. This will prevent excessive use of the statistical problem solving techniques.

(Example)



FAST RESPONSE

1.3 – Problem Solving

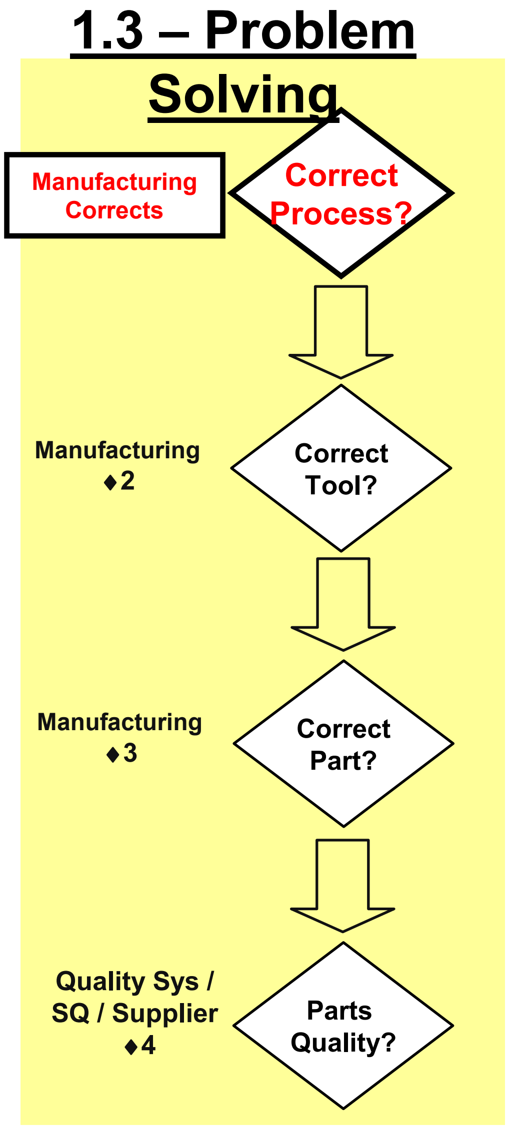
Step 3 – Identify the Root Cause:

Diamonds 1 – 4 are **Used to determine if production is running manufacturing process to design intent.**

- Diamonds 1-4 evaluate the stability of the process.
- Once a problem has been identified, the automatic response should be to immediately perform diamonds 1-4.
- Initial investigation is done where the defect was found.
- If investigation determines the cause of the problem is upstream, then investigation should be conducted at the upstream source as well.
- Statistical Engineering occurs when the manufacturing process does meet design intent and the problem still exists.

FAST RESPONSE

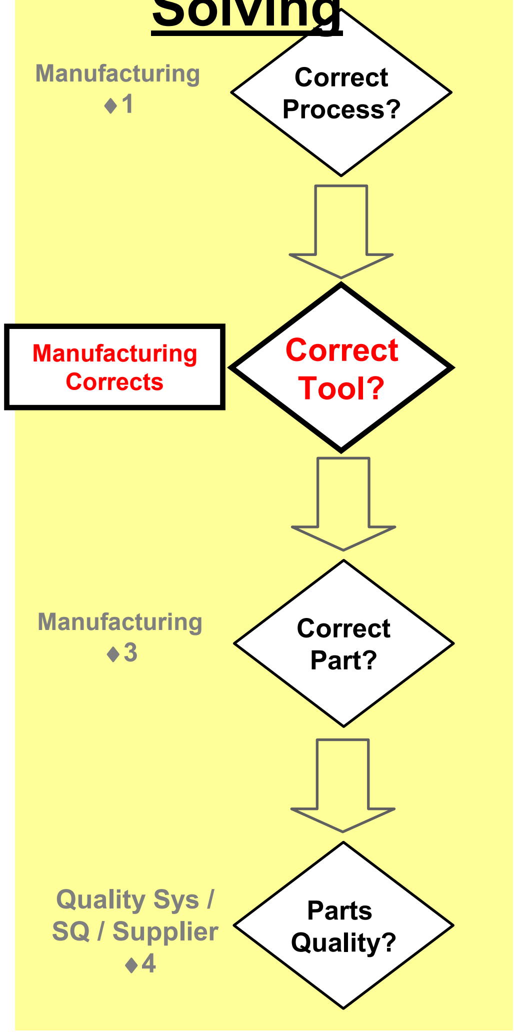
1 Correct Process (Example)



Can any of these cause the problem?

- Is the correct *Standardized Work* posted?
- Is *Standardized Work* being followed?
- Are build documents being adhered to (if applicable)?
- Are gaging requirements / frequencies being adhered to?
- Is the job being done the same on all shifts?
- Does the operator understand what the product standards are?
- Is it the regular operator? Has there been a lot of turnover on the job?
- Has the operator been properly trained?
- Are the visual aids current?
- Does the operator understand the quality outcomes of her/his job?
- Does the operator know how to communicate when he/she has a problem?

1.3 – Problem Solving



FAST RESPONSE

2 Correct Tool

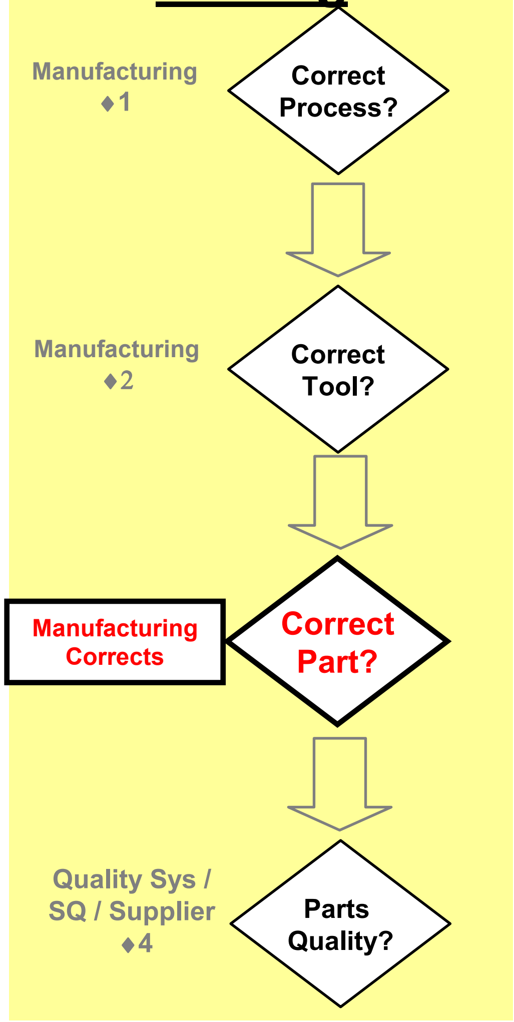
(Example)

Can any of these cause the problem?

- Are the correct tools & fixtures being used? (all shifts)
- Are the tools set to the specified requirements?
- Are they properly calibrated?
- Are both shifts using the same tool?
- Are the tools worn?
- Do the tools & fixtures have mutilation protection?
- Has the workstation been error proofed?
- Have the tools or *error proofing* been bypassed?
- Does the workstation layout allow the operator to work effectively?
- Has the Preventive Maintenance been done? (check log)
- Are tools functioning correctly?

FAST RESPONSE

1.3 – Problem Solving



3 Correct Part

(Example)

Can any of these cause the problem?

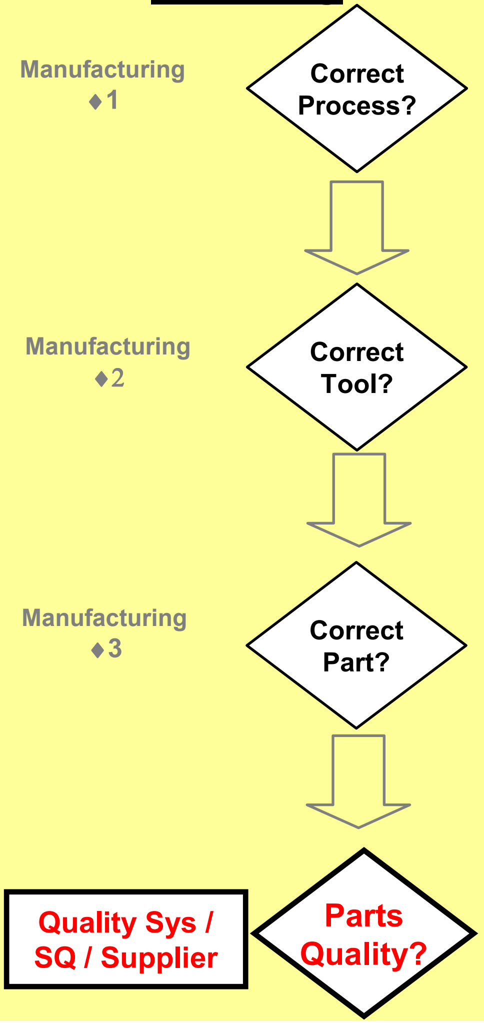
- Is the part's routing current?
- Are the correct parts being used?
- Are parts stocked in the correct location?
- Do the part numbers on the boxes agree with their location?
- Is *error proofing* needed?
- Is existing *error proofing* device working correctly?

FAST RESPONSE

4 Part Quality

(Example)

1.3 – Problem Solving



Manufacturing ♦1

Correct Process?

Manufacturing ♦2

Correct Tool?

Manufacturing ♦3

Correct Part?

Quality Sys / SQ / Supplier

Parts Quality?

Quality Systems is responsible for determining if parts have changed and overall part quality:

Supplier Data
CMM Checks
Fixture Checks
Visual Part to Part
Visual Lot to Lot

If part's quality (out of specification) is determined to be the problem's root cause, then Quality Systems will notify manufacturing and/or the supplier that there is a problem and work with manufacturing and/or the supplier to validate the corrections.

FAST RESPONSE

1.3 – Problem Solving

Step 3 – Identify the Root Cause:

For each NO response in Diamonds 1-4, a 5-Why analysis is performed.

When a cause is found, ask why until you find the **real root cause** (5 Why's)

EXERCISE

ROLE PLAY 5-WHY QUESTIONS AND ANSWERS

TWO VOLUNTEERS

FAST RESPONSE

1.3 – Problem Solving

Step 3 – Identify the Root Cause: FIVE WHY PROBLEM SOLVING TOOL

Cause Investigation

Why did the robot stop?

A fuse in the robot has blown

Why is the fuse blown?

Circuits overloaded

Why did the circuit overload?

The bearings have damaged one another and locked up

Why have the bearings damaged one another?

There was insufficient lubrication in the bearings

Why was there insufficient lubrication in the bearings?

The oil pump on the robot is not circulating sufficient oil.

Why is the pump not circulating sufficient oil?

Pump intake is clogged with metal shavings.

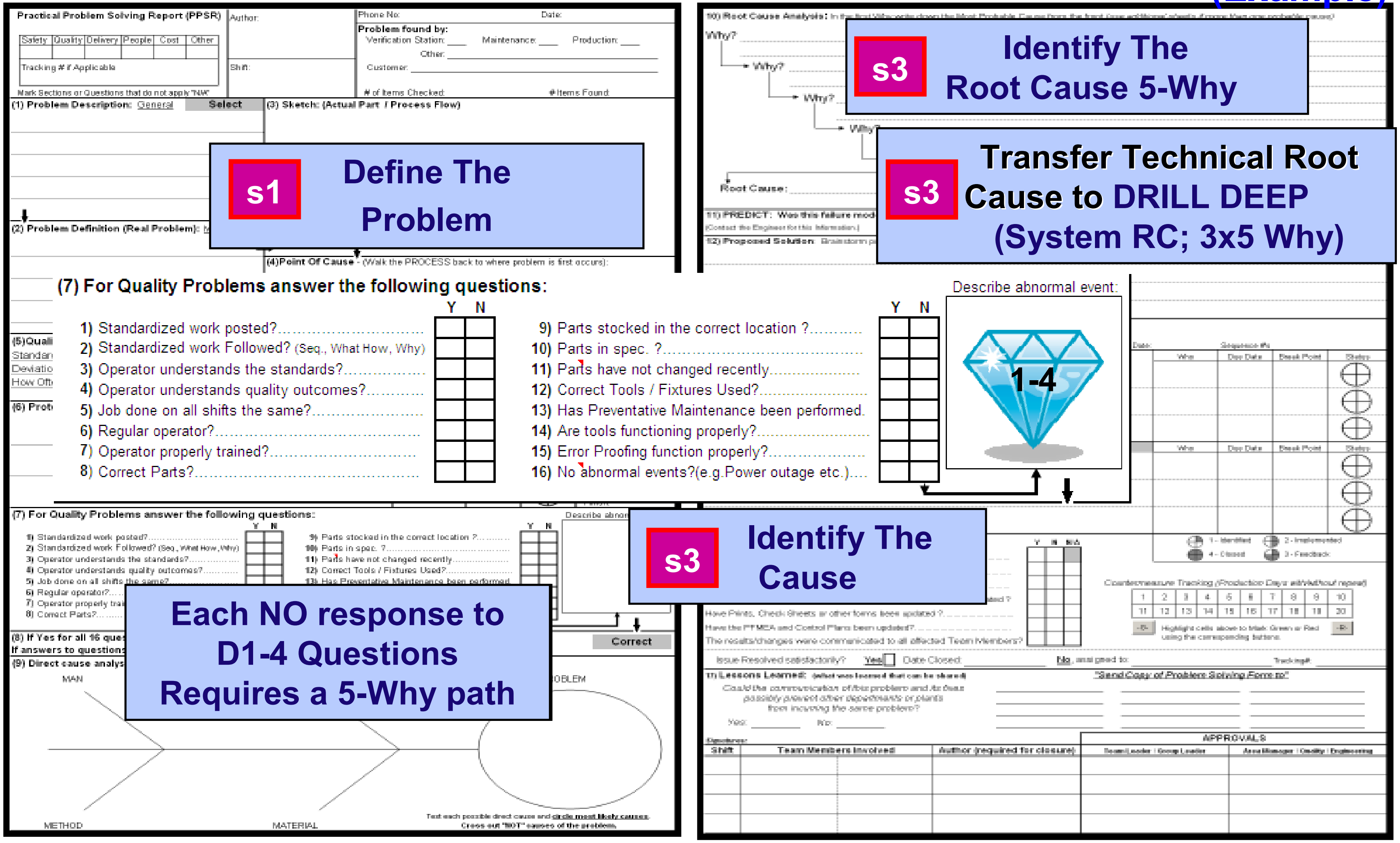
Why is the intake clogged with metal shavings?

No filter on the pump intake.

Why was there no filter on the pump intake?

The pump was not designed with a filter.

PRACTICAL PROBLEM SOLVING FORM (Example)



s1 Define The Problem

s3 Identify The Root Cause 5-Why

s3 Transfer Technical Root Cause to DRILL DEEP (System RC; 3x5 Why)

(7) For Quality Problems answer the following questions:

	Y	N
1) Standardized work posted?..............................		
2) Standardized work Followed? (Seq., What How, Why)		
3) Operator understands the standards?................		
4) Operator understands quality outcomes?...........		
5) Job done on all shifts the same?......................		
6) Regular operator?..		
7) Operator properly trained?................................		
8) Correct Parts?..		

	Y	N
9) Parts stocked in the correct location ?...........		
10) Parts in spec. ?..		
11) Parts have not changed recently....................		
12) Correct Tools / Fixtures Used?.......................		
13) Has Preventative Maintenance been performed.		
14) Are tools functioning properly?.......................		
15) Error Proofing function properly?....................		
16) No abnormal events?(e.g.Power outage etc.)....		

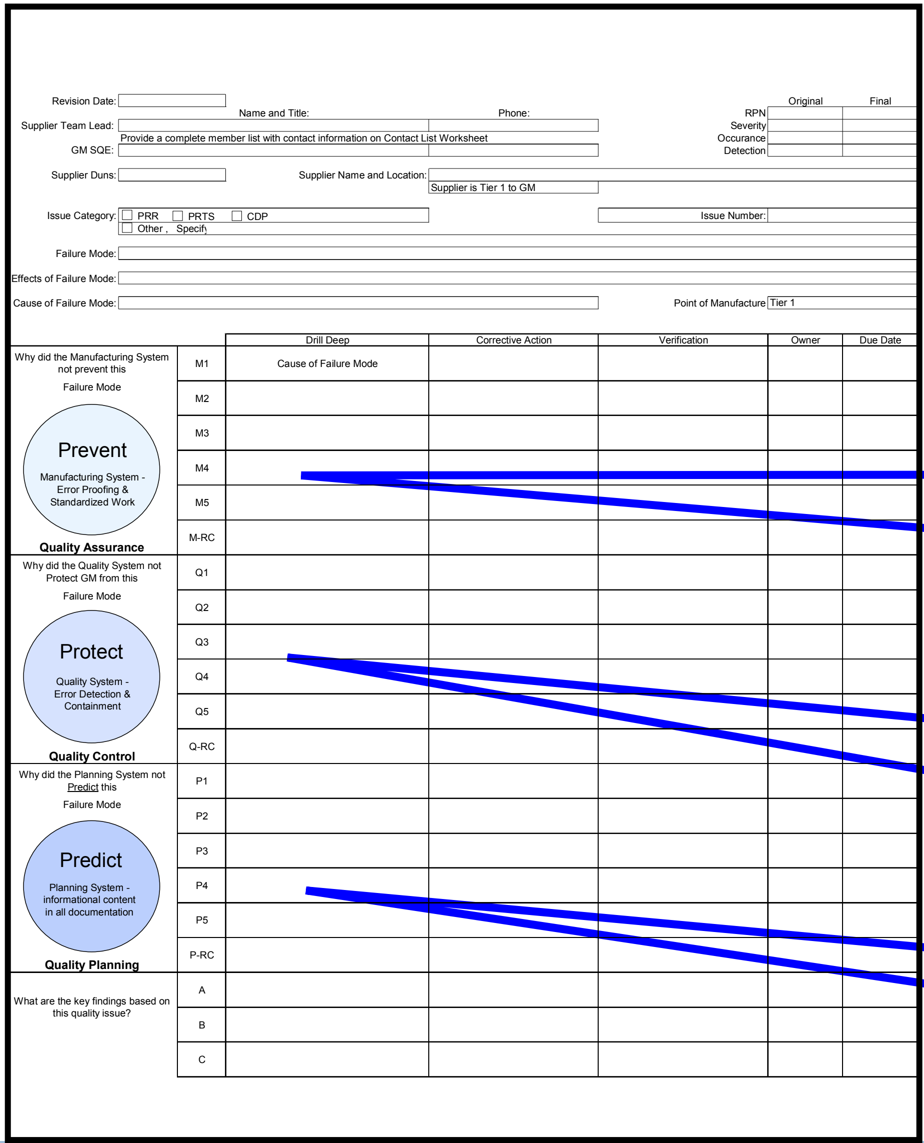
Describe abnormal event:

s3 Identify The Cause

Each NO response to D1-4 Questions Requires a 5-Why path

Drill Deep Analysis/Worksheet

(Example)



Revision Date:

Supplier Team Lead: Name and Title: Phone:

Provide a complete member list with contact information on Contact List Worksheet

GM SQE:

	Original	Final
RPN		
Severity		
Occurance		
Detection		

Supplier Duns:

Supplier Name and Location:

Supplier is Tier 1 to GM

Issue Category: ☐ PRR ☐ PRTS ☐ CDP

☐ Other , Specify

Issue Number:

Failure Mode:

Effects of Failure Mode:

Cause of Failure Mode:

Point of Manufacture Tier 1

		Drill Deep	Corrective Action	Verification	Owner	Due Date
Why did the Manufacturing System not prevent this Failure Mode Prevent Manufacturing System - Error Proofing & Standardized Work **Quality Assurance**	M1	Cause of Failure Mode				
	M2					
	M3					
	M4					
	M5					
	M-RC					
Why did the Quality System not Protect GM from this Failure Mode Protect Quality System - Error Detection & Containment **Quality Control**	Q1					
	Q2					
	Q3					
	Q4					
	Q5					
	Q-RC					
Why did the Planning System not Predict this Failure Mode Predict Planning System - informational content in all documentation **Quality Planning**	P1					
	P2					
	P3					
	P4					
	P5					
	P-RC					
What are the key findings based on this quality issue?	A					
	B					
	C					

5 Whys – After the technical root cause is found, determine **WHY the System failed**. Ask **"WHY"** until actual root cause for each is determined.

Prevent – Why did the manufacturing process not prevent the defect?

Protect – Why did the Quality process not protect the customer (GM) from the defect?

Predict – Why did the planning process not predict the failure?

FAST RESPONSE

1.3 – Problem Solving

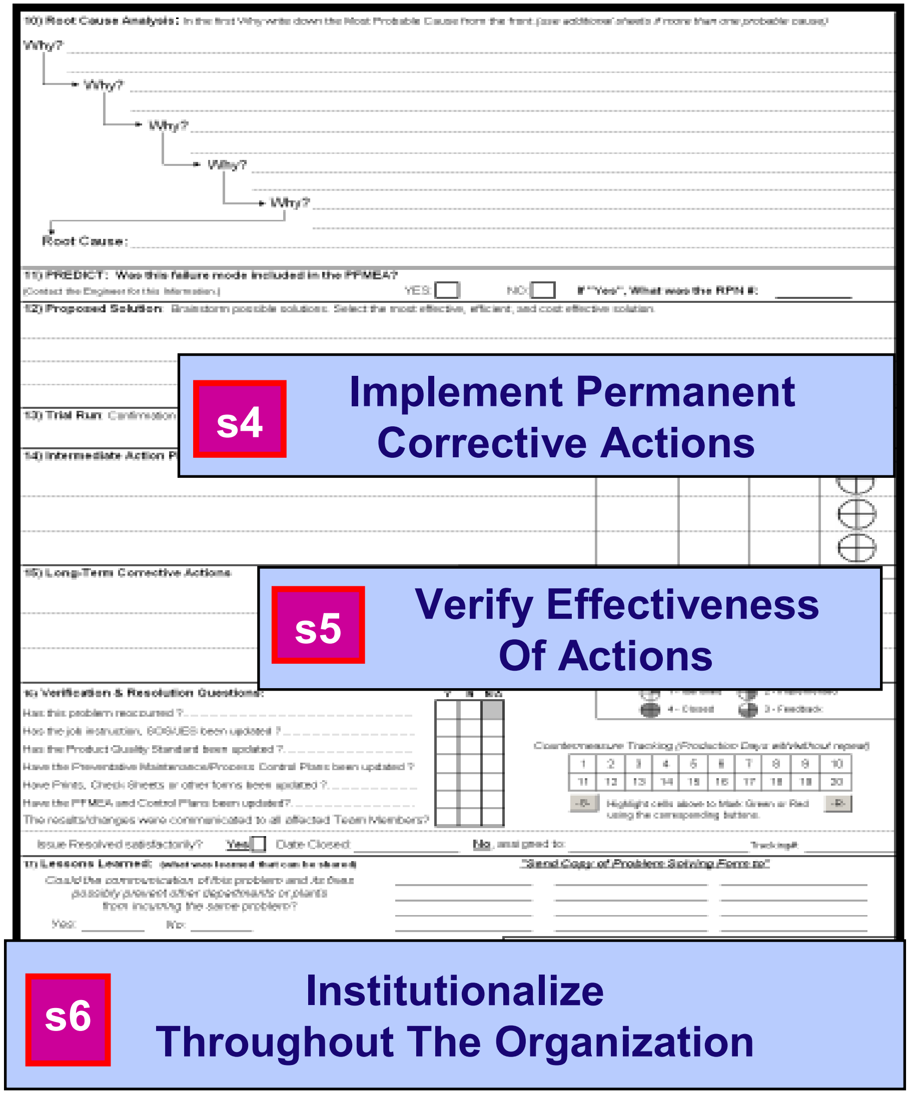
Step 4– Implement Corrective Action:

Brainstorm possible solutions and select the most effective, efficient and cost effective solution.

Determine if a trial run is needed to confirm and test the proposed solution to verify it is effective and has no other adverse effects.

Determine the steps and actions needed to implement and timing.

Identify the breakpoint of implementing to all key stake holders.



10) Root Cause Analysis: In the first Why write down the Most Probable Cause from the front (use additional sheets if more than one probable cause)

Why?
Why?
Why?
Why?
Why?
Root Cause:

11) PREDICT: Was this failure mode included in the PFMEA? (Contact the Engineer for this information) YES: ☐ NO: ☐ If "Yes", What was the RPN #: ________

12) Proposed Solution: Brainstorm possible solutions. Select the most effective, efficient, and cost effective solution.

13) Trial Run: Confirmation

14) Intermediate Action P

15) Long-Term Corrective Actions

16) Verification & Resolution Questions:

	Y	N	N/A
Has this problem reoccurred ?			
Has the job instruction, SOS/JES been updated ?			
Has the Product Quality Standard been updated ?			
Have the Preventative Maintenance/Process Control Plans been updated ?			
Have Prints, Check Sheets or other forms been updated ?			
Have the PFMEA and Control Plans been updated?			
The results/changes were communicated to all affected Team Members?			

4 - Closed
3 - Feedback

Countermeasure Tracking (Production Days without repeat)

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20

Highlight cells above to Mark Green or Red using the corresponding buttons.

Issue Resolved satisfactorily? Yes ☐ Date Closed: ________ No, assigned to: ________ Tracking#: ________

17) Lessons Learned: (what was learned that can be shared) "Send Copy of Problem Solving Form to"

Could the communication of this problem and its fixes possibly prevent other departments or plants from incurring the same problem?

Yes: ________ No: ________

s4 Implement Permanent Corrective Actions

s5 Verify Effectiveness Of Actions

s6 Institutionalize Throughout The Organization

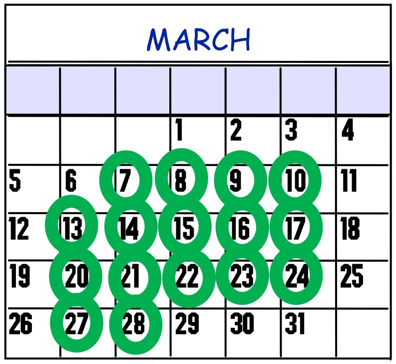
FAST RESPONSE

1.3 – Problem Solving

Step 5 – Verify Effectiveness of Actions:

Follow Up and Check

- Implement *Layered Process Audits* to verify changes to the system are being performed consistently and working as intended.
- Verify effectiveness through measurement and data.
- Establish a verification period (duration/date).
- Determine who will follow up.
- Create a standardized process or method.
- Remove excess work from containment.



FAST RESPONSE

1.3 – Problem Solving

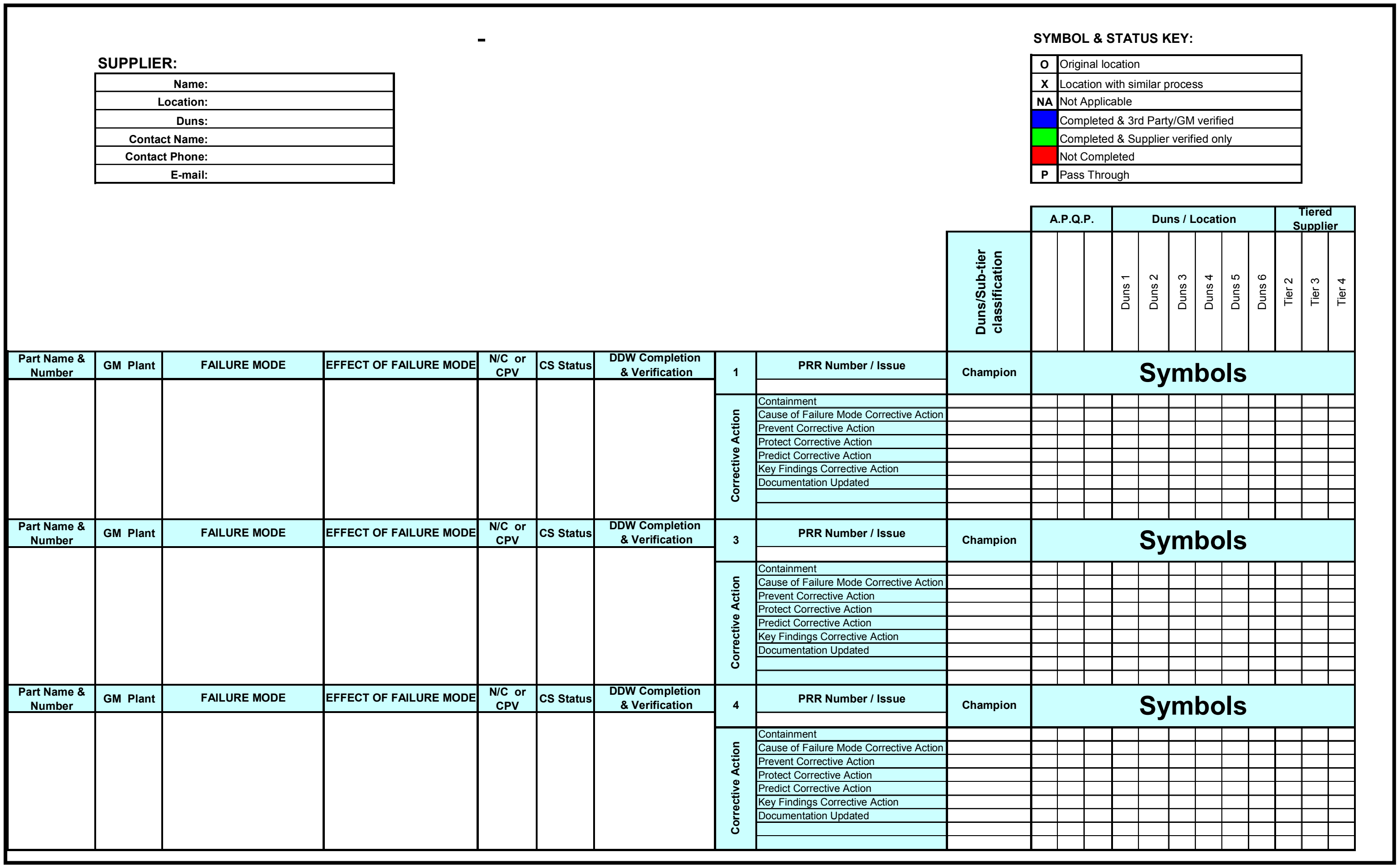
Step 6 - Institutionalize:

- Identify similar products and processes which potentially have or may produce the same failure mode.

Send a copy of this Problem Solving Report to other Departments/Plants with the potential of experiencing this problem.

- Implement the solution across the organization.
- Update the necessary documentation:
  - PFMEA
  - Control Plan
  - *Error Proofing Verification*
  - *Standardized Work*
  - *Operator Instructions*
  - *Lessons Learned*

DRILL WIDE MATRIX (Example)



-

SUPPLIER:

Name:	
Location:	
Duns:	
Contact Name:	
Contact Phone:	
E-mail:	

SYMBOL & STATUS KEY:

O	Original location
X	Location with similar process
NA	Not Applicable
🟦	Completed & 3rd Party/GM verified
🟩	Completed & Supplier verified only
🟥	Not Completed
P	Pass Through

Duns/Sub-tier classification	A.P.Q.P.			Duns / Location						Tiered Supplier		
				Duns 1	Duns 2	Duns 3	Duns 4	Duns 5	Duns 6	Tier 2	Tier 3	Tier 4

Part Name & Number	GM Plant	FAILURE MODE	EFFECT OF FAILURE MODE	N/C or CPV	CS Status	DDW Completion & Verification	1	PRR Number / Issue	Champion	Symbols
							Corrective Action	Containment		
								Cause of Failure Mode Corrective Action		
								Prevent Corrective Action		
								Protect Corrective Action		
								Predict Corrective Action		
								Key Findings Corrective Action		
								Documentation Updated		

Part Name & Number	GM Plant	FAILURE MODE	EFFECT OF FAILURE MODE	N/C or CPV	CS Status	DDW Completion & Verification	3	PRR Number / Issue	Champion	Symbols
							Corrective Action	Containment		
								Cause of Failure Mode Corrective Action		
								Prevent Corrective Action		
								Protect Corrective Action		
								Predict Corrective Action		
								Key Findings Corrective Action		
								Documentation Updated		

Part Name & Number	GM Plant	FAILURE MODE	EFFECT OF FAILURE MODE	N/C or CPV	CS Status	DDW Completion & Verification	4	PRR Number / Issue	Champion	Symbols
							Corrective Action	Containment		
								Cause of Failure Mode Corrective Action		
								Prevent Corrective Action		
								Protect Corrective Action		
								Predict Corrective Action		
								Key Findings Corrective Action		
								Documentation Updated		

Drill Wide - analysis of opportunities of system deficiencies and corrective actions that encompass all GM parts, manufacturing processes, and other plant locations.

FAST RESPONSE

1.3 – Problem Solving

Summary:

- ✓ No problem solving means no improvement.
- ✓ Encourage problems and solutions.
- ✓ Provide the necessary training and resources.
- ✓ Have patience.
- ✓ Develop problem solvers.
- ✓ Managers should have the questions, not the answers.
- ✓ Make decisions based on fact, *not* opinion (Emotion).
- ✓ Use teamwork to solve problems.

FAST RESPONSE

1.4 – Lessons Learned

A Lessons Learned system:

- Establishes a process for capturing information that will support continual improvement to all operations/processes.
- Prevents repeated mistakes allowing an organization to capitalize on its successes.
- Applies to all functions and responsibilities, therefore, everyone in the organization should participate.

All documentation that will support continuous improvement should be entered into a Lessons Learned system. (e.g. Master PFMEA, *Problem Solving*, Read Across)

FAST RESPONSE

1.4 – Lessons Learned

Lessons Learned may be identified by anyone.

Examples of activities to Identify Lessons Learned:

- APQP Process
- *Layered Process Audits*
- *Error Proofing* Verification Failures
- Problem Solving activity for Internal or external Issues
- *Verification Station* Findings
- Continuous Improvement Teams
- *Risk Reduction*-Reverse PFMEA Team Activity
- Suggestion Programs
- Company Business/Quality Operating System Management Reviews

A disciplined approach to problem prevention using Lessons Learned shall be established. Activities within an organization to prevent future problems or improve performance that build Lessons Learned may include.

- GM Drill Wide-Read Across communication and follow up
- APQP Program reviews of Lessons Learned

FAST RESPONSE

1.4 – Lessons Learned

Lessons Learned shall be documented. Documentation may include:

- Lessons Learned Form
- APQP Checklist
- Master PFMEA
- Computer Form or Website, etc.

Lessons Learned shall be communicated and kept available to all current
and potential users. Communication can be performed by:

- Posting the lessons learned form
- Including on a lessons learned website
- Utilizing a company newspaper or closed circuit TV
- Distribution of pocket cards, etc.

Leadership shall review the Lessons Learned process to assure Implementation.

FAST RESPONSE

1.5 – Summary; Shalls

Organizations shall…

- ✓ Identify significant Quality concerns from the past 24 hours
- ✓ Hold a daily Fast Response meeting.
- ✓ Utilize a format such as the Fast Response Tracking Board to identify:
  - ❑ Overall status of the significant Quality concerns.
  - ❑ Ownership of each concern.
  - ❑ Exit criteria required to close a concern.
- ✓ Owners shall:
  - ❑ Update the Fast Response board prior to meeting.
  - ❑ Use a standard problem solving form for all Fast Response issues.
  - ❑ Report out to each of the problem steps.
  - ❑ Ensure all Exit Criteria are completed.

FAST RESPONSE

1.5 – Summary; Shalls (Continued)

- ✓ Ensure that Fast Response process is:
    - ❑ maintained and effective
    - ❑ has a designated champion & co-champion as the facilitator
    - ❑ is supported by all disciplines.
- ✓ Display the Daily Quality status
- ✓ Have a defined process for Problem Solving which includes the core “6 Steps” and a standard for documenting tools used for root cause identification and elimination.
- ✓ Empower everyone in the organization to participate in Problem Solving and Lessons Learned.
- ✓ Establish and institutionalize a system to document Lessons Learned.
- ✓ Establish a disciplined approach to problem prevention using Lessons Learned.
- ✓ Review the Lessons Learned process to assure implementation.

2.0 - CONTROL OF NONCONFORMING PRODUCT

Containment, Identification, Segregation, Disposition

CONTROL OF NONCONFORMING PRODUCT
Outline

2.0) Introduction; Purpose, Scope, Responsibility

2.1) Benefits

2.2) Nonconforming Identification

2.3) Segregation

2.4) Containment

- 2.4.1 - Containment Worksheet
- 2.4.2 - Communication - Quality Alert, Internal/External

2.5) Disposition

- 2.5.1 - Reusable/Rework
- 2.5.2 - Reintroduce product
- 2.5.2 - Scrap

2.6) Summary; Shalls

CONTROL OF NONCONFORMING PRODUCT

2.0 - Introduction

PURPOSE:

- Ensure that product that does not conform to specified requirements is:
  - Prevented from unintended use
  - Contained and/or segregated
  - Dispositioned by Management
- Ensure proper communication if there is an escape.
- Establish a consistent labeling identification process using Visual Management such as (Stoplight) RED, YELLOW. GREEN method.

SCOPE:

- Production material or components.
- Engineering Samples
- Prototype Samples
- Incomplete Processed material
- Other materials not intended to be shipped to the customer.

RESPONSIBILITY:

- Ownership
  - ✓ Quality Manager
- Contingency Plan for All Situations

CONTROL OF NONCONFORMING PRODUCT

2.1 - BENEFITS

- Assures all suspect and nonconforming product is contained.
- Increases customer satisfaction and communication.
- Reduces quality disruptions.
- Assures all issues are resolved with all customer contacts:
  internal and external.
- Assures a systematic approach for all issues.

CONTROL OF NONCONFORMING PRODUCT

2.2 - Material Identification

IDENTIFICATION OF NONCONFORMING OR SUSPECT MATERIAL IS PARAMOUNT

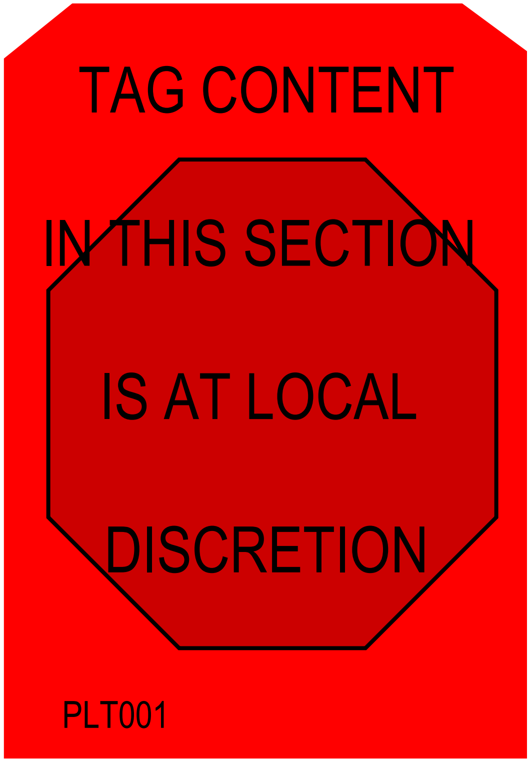
- The achievement of customer expectations relies on a method to contain defects (Nonconforming product) within the manufacturing process and implement corrections to protect the next downstream customer.
- Organizations shall establish a method to ensure product that does not conform to specified requirements is prevented from unintended use or installation by:

– Using consistent identification and visual management(e.g. tagging, dedicated scrap bins, paint dot etc.)

– Released using a defined process and authority.

(Example)

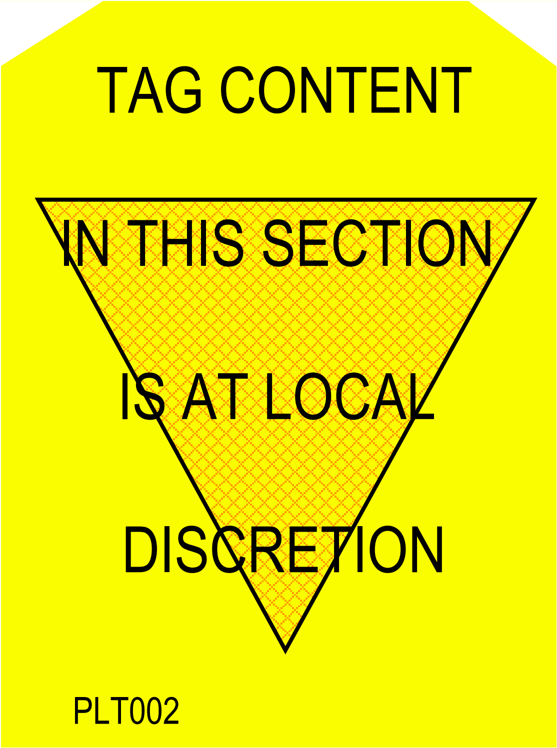
SCRAP



REQUIRED FOR SCRAP PRODUCT/CONTAINERS

(SCRAP BINS PAINTED RED DO NOT REQUIRE A TAG)

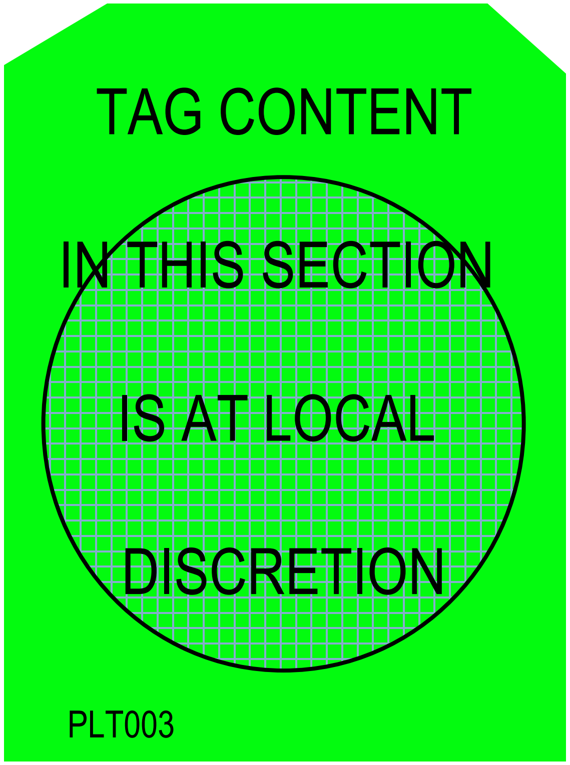
SUSPECT
DO NOT USE



REQUIRED FOR REWORK, REINSPECT, SUSPECT PRODUCT/ CONTAINERS

TAG SHOULD SHOW LAST OPERATION.TO ASSURE PROPER REINTRODUCTION

OK FOR USE



ANY COLOR (except red or yellow) FOR CONFORMING PRODUCT IS ACCEPTABLE

(IF YELLOW IS NOT USED TO DISTINGUISH SCRAP FROM SUSPECT, THE RED TAG shall HAVE DISPOSITION.)

CONTROL OF NONCONFORMING PRODUCT

2.3 - Segregation

All nonconforming and suspect product shall be segregated to prevent unintended use or installation through containment.

- At the end of each shift, non-conforming product should be counted, documented, and should be removed from the process/manufacturing area to an off line designated containment area or into scrap containers.

SEGREGATION AREAS:

- Segregation areas shall be foot printed or otherwise identified.

Example:
- Scrap bins
- Rework Tables
- Containment areas
- Nonconforming material hold areas

- A method to inventory non-conforming material is required (Including Date, P/N, Defect, MRB disposition)

CONTROL OF NONCONFORMING PRODUCT

2.4- Containment

Leadership shall develop, organize and maintain a system for control of nonconforming product to include the following:

- A documented containment procedure to prevent identified defects from flowing to the next customer.
- Containment Worksheet, Quality Alert, Instructions, Operator training records.
- A clear understanding of the standard and the deviation supported by a good visual explaining the standard.

Note: Customer approval may be required during a containment activity where task are performed to bring the product back to the standard. This may also require supporting documentation such as work instructions, trial runs, etc.

CONTROL OF NONCONFORMING PRODUCT

2.4- Containment

- For product containment issues, containers shall be identified:

  Red = Nonconforming product
  Yellow = Suspect product
  Green = After breakpoint conforming product

- When sorting, product identified as nonconforming shall not be placed into standard work-in-process or finished goods containers.

CONTROL OF NONCONFORMING PRODUCT

2.4.1 - Containment Worksheet

A Containment worksheet shall be used and completed to:

- Provide a systematic approach to containing all suspect product
- Identify a potential quantity and all areas to be checked for nonconforming product
  - Reconcile expected quantities of suspect material vs. actual
- Document the defect condition and standard to be met

A Containment worksheet should also be used to :

- Document the sort method (e.g. visual, gage, boundary sample)
- Specify the identification method for sorted good/bad product.
- Track and document results of the containment activity
  - Trigger a customer notification if an escape is possible

CONTROL OF NONCONFORMING PRODUCT

2.4.1 - Containment Worksheet (Continued)

CONTAINMENT WORKSHEET

(Example)

DEPARTMENT: *Laboratory*	DEPARTMENT CONTAINMENT OWNER: G. Hall	DATE: 1/6/2003

PRODUCT NAME / NUMBER: **10066044**

PRODUCT NONCONFORMANCE:
Burr on flange

PRODUCT CONTAINMENT SCOPE
IDENTIFY ALL AREAS WHERE SUSPECT PRODUCT COULD BE LOCATED

LOCATION	POTENTIAL QTY.	AREA VERIFIED	SUSPECT PROD. FOUND? QTY?	VERIFICATION RESPONSIBILITY
Receiving	500	P.S.	500	P. Smith
Laboratory	6	K.C.	6	T. Brown
WIP Storage Areas	1000	P.S.	1000	P. Smith
Outside Processing - (Plating)	1000	C.J.	1000	C. Jones
Scrap Bins	42	K.C.	42	C. Jones
Rework Areas	0	B.T.	0	C. Jones
Shipping Dock	0	K.C.	0	C. Jones
Heat Treater	0	P.S.	0	C. Jones
At Customer	0	B.T.	0	C. Jones
In Transit	0	B.T.	0	C. Jones
Service Parts Operations	0	P.S.	0	C. Jones
TOTAL FOUND	2548		2548	C. Jones

SEGREGATE SUSPECT PRODUCT TO (location, as feasible): 2548 pcs to Containment Area
SORT METHOD (eg. visual, gage, mating part): Visual for burrs
SORT CRITERIA (clear pass / fail standards): Max Burr per standard
I.D. METHOD CONFORMING (eg. mark, tag, sign): White paint dot near defect area
I.D. METHOD NONCONFORMING (eg. mark, tag, sign): Mark defect with red paint.

CONTROL OF NONCONFORMING PRODUCT

2.4.2. - Communication

- The organization's containment process shall include a Quality Alert notification system to communicate the problem. Quality Alerts shall:
  - Be posted and promptly communicated to all stakeholders.
    - ✓ Internal Departments, Operators
    - ✓ Tiered suppliers or vendors
    - ✓ Customers
  - Be used for internal or external issues.
- The Quality organization is responsible to issue, post and remove the quality alert.

NOTE: The Quality Alert should only be removed after corrective action has been validated and the work instructions have been updated if appropriate.

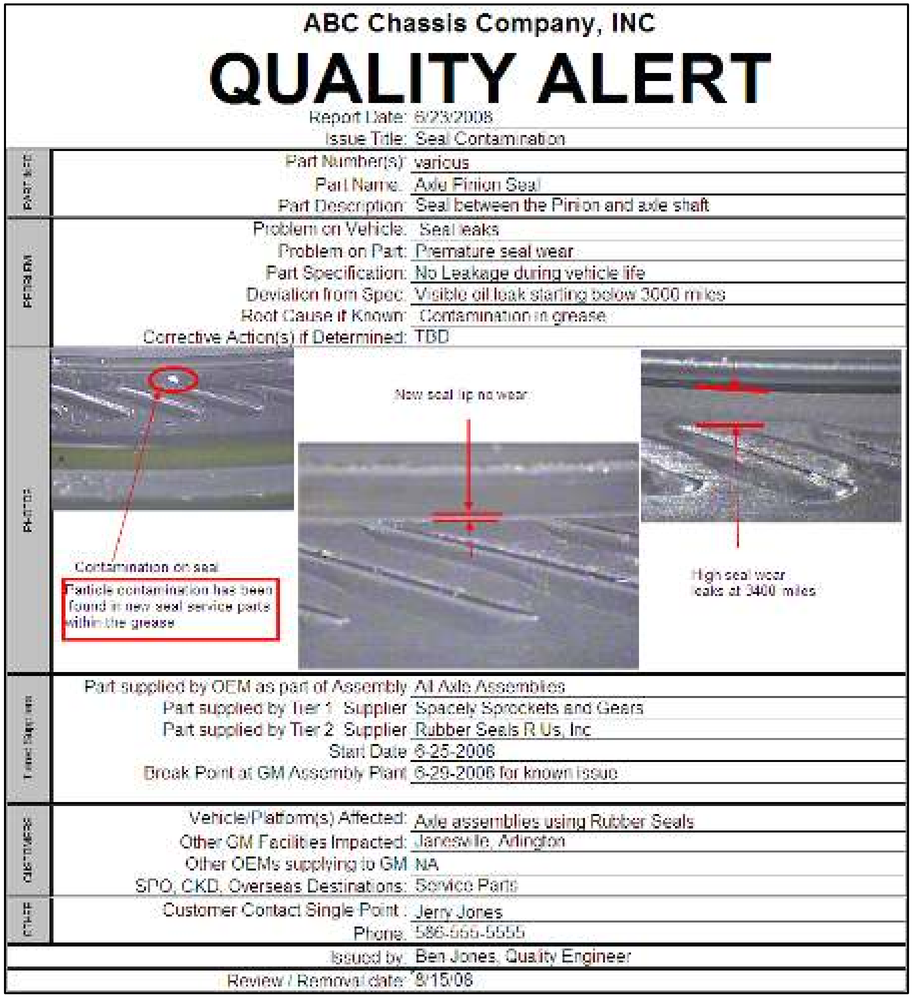
CONTROL OF NONCONFORMING PRODUCT

2.4.2. - Communication

(Example)

Quality Alert

- A quality alert shall:
  - Establish the tasks, time line and communications necessary to ensure customer requirements are met.
  - Define the problem, the standard, and the deviation to the standard
- Should include pictures or samples explaining the deviation
- Should document operator review and understanding by signing the document.



ABC Chassis Company, INC

QUALITY ALERT

Report Date: 6/23/2008
Issue Title: Seal Contamination
Part Number(s): various
Part Name: Axle Pinion Seal
Part Description: Seal between the Pinion and axle shaft
Problem on Vehicle: Seal leaks
Problem on Part: Premature seal wear
Part Specification: No Leakage during vehicle life
Deviation from Spec: Visible oil leak starting below 3000 miles
Root Cause if Known: Contamination in grease
Corrective Action(s) if Determined: TBD

Contamination on seal

Particle contamination has been found in new seal service parts within the grease

New seal lip no wear

High seal wear leaks at 3400 miles

Part supplied by OEM as part of Assembly All Axle Assemblies
Part supplied by Tier 1 Supplier Spacely Sprockets and Gears
Part supplied by Tier 2 Supplier Rubber Seals R Us, Inc
Start Date 6-25-2006
Break Point at GM Assembly Plant 6-29-2006 for known issue
Vehicle/Platform(s) Affected: Axle assemblies using Rubber Seals
Other GM Facilities Impacted: Janesville, Arlington
Other OEMs supplying to GM NA
SPO, CKD, Overseas Destinations: Service Parts
Customer Contact Single Point : Jerry Jones
Phone: 586-555-5555
Issued by: Ben Jones, Quality Engineer
Review / Removal date: 8/15/08

CONTROL OF NONCONFORMING PRODUCT

2.4.2- Communication

Break Point

Only give a break point after:

- You understand the **DEFECT**
- Have contained all suspect product internally and externally
- Have a method to identify and sort out the defect until material from the corrected process is available.
- 100% Inspection ensures defect free/certified stock to the customer

Remember:

Violating the BREAKPOINT is a serious customer dissatisfier.

CONTROL OF NONCONFORMING PRODUCT

2.4.2. - Communication

WHEN DO YOU CALL THE CUSTOMER?

A potential external issue exists when you are not confident all product is contained as evidenced by:

- The containment worksheet shows that the potential quantity exceeds the quantity found.
- The oldest material in-house contains product which exhibits the non-conformance .

If Yes to either statement…CALL!

Who to Contact :

- Assembly Plants
- Service Parts (SPO)
- Tiered Suppliers as required

CONTROL OF NONCONFORMING PRODUCT

2.4.2. - Communication

Contact External Customer

Needs to be a “live” conversation – no voice or email.

A phone list for contacts is established.

Establish conference calls when required by customer.

» A supplier executive acts as lead and single point for communication.

» All stakeholders including Tier suppliers participate in calls.

(Example)

GM Contacts

Initial contact must be made with at least one person at each affected facility.

GM SQ Mgmt Team	Name	Responsibility	E-mail	Phone

GM EngineerTeam	Name	Responsibility	E-mail	Phone

GMT 560 (Flint)				
Department	Name	Responsibity & shift	E-mail	PHONE

CONTROL OF NONCONFORMING PRODUCT

2.4.2. - Communication

Develop & implement containment and certification plans

Initiate at customer locations with appropriate sort instructions.

A Customer should be informed of the following items:

- Certification method.
- Description and picture(s) of the marked parts.
- Description and picture(s) of any marked or added labels.

Begin shipping certified stock

Identify parts/labels.

Begin to ship certified stock.

Notify customer of breakpoints.

CERTIFIED STOCK SHIPMENTS (Example)

Assembly Plant	Ship		Arrival		Carrier	Tracking number	Quantity
	Date	Time	Date	Time			
Arlington							
Flint 880							
Pontiac							

Assembly Plant	Ship		Arrival		Carrier	Tracking number	Quantity
	Date	Time	Date	Time			
Silao							
Toluca							
Mishawaka							

CONTROL OF NONCONFORMING PRODUCT

2.5 - DISPOSITION (Reusable or scrap)

2.5.1 Reusable; (rework/repair)

- A work instruction to perform rework
- A method to identify scrap and rework product traceability
- Customer approval may be required

2.5.2 Reintroduce product

- All control plan inspections and tests shall be performed;
- Product removed from the approved process flow should be reintroduced into the process stream at or prior to the point of removal.
- Reintroduced product needs to be identified.
- Best practice would suggest that you do not run product more than twice.

NOTE: When it is not possible to reintroduce at or prior to removal: an approved (Quality Manager) documented rework and inspection procedure shall be used to assure conformance to all specification and test requirements.

CONTROL OF NONCONFORMING PRODUCT

2.5.3 - SCRAP

Suppliers shall have a procedure to ensure that scrap:

- **Is tracked and prevented from being reintroduced to the process or normal material flow.**
- **Scrap is reduced through on-going continuous improvement team efforts.**

CONTROL OF NONCONFORMING PRODUCT

2.6 – Summary: shalls

Nonconforming Material shall be:

✓Clearly identified using consistent identification (tagging).

✓ Segregated in properly identified areas and containers.

✓ Contained through the use of a Containment Worksheet.

✓ Released using a defined process and authority.

✓ Reintroduced into the process stream at or prior to the point of removal and includes all control plan inspections & test.

  ✓If is not possible, a rework & inspection plan is provided.

✓ Organization shall have a nonconformance alert and containment procedure that meets customers requirements .

✓ Scrap is prevented from use & is tracked with a plan to reduce.

✓ Product containment issues shall be reviewed by leadership

3.0 VERIFICATION STATION

IN-PROCESS CONTROL & VERIFICATION

Satisfy Your Customer. . .

Do not

Accept
Build
Ship

a Defect!

Solve Problems Through Teamwork!

VERIFICATION STATION
Outline

3.0) Introduction: Purpose, Scope, Responsibility
3.1) Benefits
3.2) Description, Roles, and Responsibilities
3.3) Defects Entering the Station
  - Alarm & Escalation
  - Immediate Response
  - Leadership Support
3.4) Defects Leaving the Station
  - Quality Feedback-Feed Forward
  - Performance Metrics
3.5) Problem Solving
3.6) C.A.R.E
3.7) Summary, Shalls

VERIFICATION STATION

3.0 – Introduction

PURPOSE:

- Improve first time quality (FTQ) and process capability.
- Alert team members of changes in the process and know who and when to call for help.
- Obtain the proper support to solve problems as they occur.
- Prevent escape of defects.
- Engage team members in Problem Solving to meet improvement goals.
- Ensure feedback from downstream customers

SCOPE:

- Manufacturing Operations
- Assembly Areas
- Anywhere 100% Inspection or containment is implemented.

RESPONSIBILITY:

- Ownership
  - ✓ Manufacturing Leadership
- Support from all Manufacturing, Engineering, Materials, and Quality leadership and staff

VERIFICATION STATION

3.1 - BENEFITS:

- Ultimately lowers the number of defective parts, improving the plant's first time quality, direct run and lowers costs while providing a better product to the customer.
- Establishes standard communication pathways between operations, departments, and customers.
- Increased customer satisfaction

VERIFICATION STATION

3.2 – Description, Roles, Responsibility

VERIFICATION STATIONS

Definition: The system of building quality in station through prevention, detection, and containment of abnormalities.

VERIFICATION STATION

3.2 – Description, Roles, Responsibility

WHAT IS THE PURPOSE OF A VERIFICATION STATION?

- Verification Stations check if your process is giving you what it was designed to give you.

- Provides the means through an alarm system to address highest priority customer concerns (PR&R type defects).
  - It will also draw attention to the frequent, low severity non-conformances. (e.g. dirt, burns, burrs, orange peel)

- To improve the process by immediately engaging the Team in problem solving as the defects occur.

VERIFICATION STATION

3.2 – Description, Roles, Responsibility

Where Are Verification Stations Placed?

- Points in the process or operation where there exists:
    - high risk
    - Poor FTQ
    - high RPN
    - low capability (Ppk, Cpk) Any operation with a Cpk or Ppk below 1.33 requires 100% inspection
- Between departments or distinct processes at point of cause.

VERIFICATION STATION

3.2 – Description, Roles, Responsibility

VERIFICATION STATION (VS) DESCRIPTION:

- **A Verification Station is a process that keeps us focused on Building Quality in Station through Feedback from the process. This is achieved by:**
  - A Verification Station operator reviews each part using a standardized work inspection process and gives feedback to the Team.
  - 100% In-Line or End of Line testing which can be considered as part of feedback mechanism through audio/visual signals, notifies the team there is a problem. Fault codes or data such as 3 in a row, 5 in an hour, with an alarm limit goal of '1' for each as the process matures.
  - The use of variable SPC charts and notification for out-of-control conditions.

VERIFICATION STATION

3.2 – Description, Roles, Responsibility

VERIFICATION STATION (VS) DESCRIPTION:

- **Functions Full Time**
  - Prevents the flow of quality discrepancies beyond the VS by detecting and resolving issues immediately.
- **Discrepancies identified for correction**
  - Data Drives Teams in Problem Solving Process with Leadership Support
- **Performance is tracked based on internal metrics**
  - Verifies that the Verification Station is working
- **Management Process Verification**
  - VS is calibrated by “downstream” data

VERIFICATION STATION

3.2 – Description, Roles, Responsibility

VERIFICATION STATION ROLES & RESPONSIBILITIES

Verification Station Operator

- Performs quality checks.
- Reacts to nonconformance.
- Initiates escalation when alarm limits are reached.

Engineer, Supervisor, and Maintenance

- Supports the Verification Station Alarms for identified discrepancies.

Plant Manager (Manufacturing Lead Person)

- Owns the Verification Station Process.
- Develops and promotes problem solving and *Error Proofing*.
- Attends Verification Station Report Out Daily.
- Facilitates support for the team to ensure the process is working.

Quality Manager Supports

- The daily Verification Station meeting.
- Problem Solving and follow-up.

VERIFICATION STATION INFORMATION BOARD

(2 Examples)

Integrate current systems and build on it to meet the intent.

This may include or incorporate Team data such as productivity, quality alerts, start of shift TPM Check Sheets, Team safety data or any other current standard Team data.

VERIFICATION STATION TEMPLATE

(Example)

Shop Floor Management

Defects Entering VS

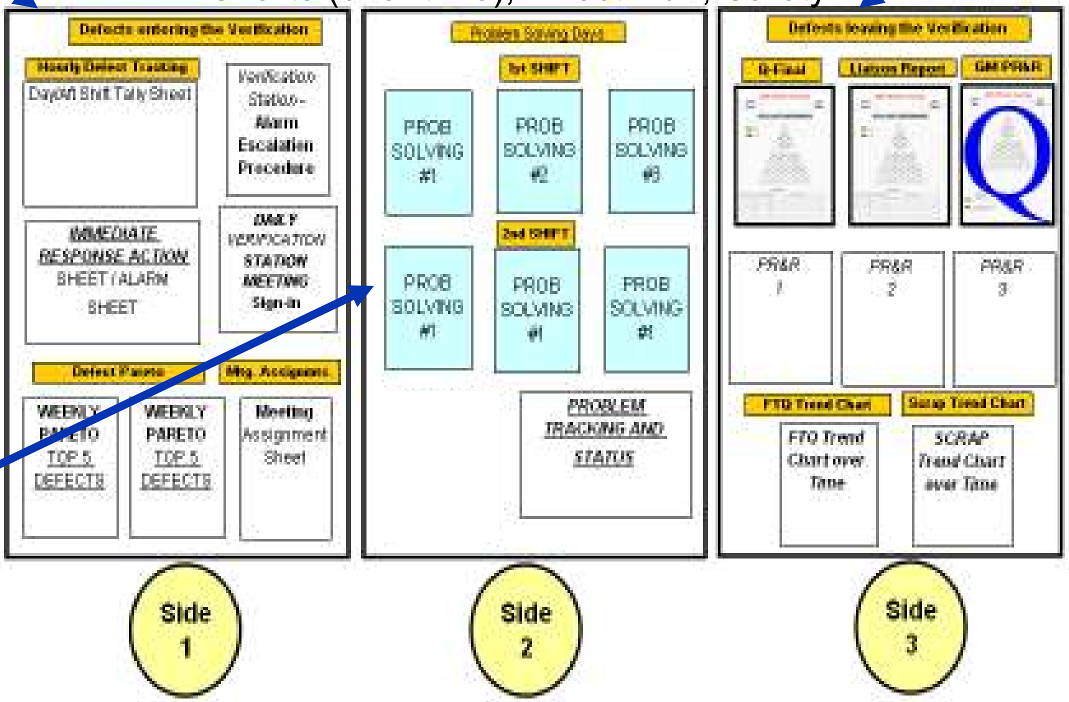
- ➢Inspection of product (Attribute/Variable)
- ➢Prioritizing of defects
- ➢Alarm Escalation Procedure Who/when
- ➢Immediate Responses – Record of Calls for help and escalation.
- ➢Leadership meeting every shift
- ➢Meeting Assignments
- ➢Pareto Analysis, Defects over time
- ➢ Attendees Sign-in Sheet

Problem Solving – Driving fixes into station - BIQ

- ➢ Team select new problems based on pareto analysis, assignable cause.
- ➢Team reports out weekly on status
- ➢ Tracking R, Y, G Reviewed for roadblocks, problem escalation.

Defects Leaving VS Station - Feedback

- ➢ Dock Audit/Containment/Field Rep-Liaison Issues
- ➢ Formal Customer Complaints - Reports
- ➢ Team Performance Data, FTQ & SCRAP Trend Charts (over time), Direct Run, Safety.



VERIFICATION STATION

3.3 – Defects Entering the Station

Defects Entering VS Station

Checking the part for defects and raising Alarms

VERIFICATION STATION

3.3 – Defects Entering the Station

Alarm and Escalation:

- Alarm limits are set based on type and number of defect found.
- Alarm limits can be divided into two groups PR&R type defect, and High frequency low severity type defects.

Past Customer defects shall always have an alarm of 1.

Variable based on: Need, process, situation

High frequency low severity type.
THIS is an estimate based on the ability to detect. Use your judgment.

It is best to not to have too many alarm levels so keep it simple. Group the Alarms based on the levels and Highlight them so it clear as to When to Call for Help.

VERIFICATION STATION

3.3 – Defects Entering the Station

Alarm and Escalation:

SCOPE OF CHANGING ALARM LIMITS

Alarm limits are changed or reduced when there is:

- An intentional, permanent change in the actual process such as through problem solving, or continuous improvement activity.
- A special cause variation, where despite our best efforts to discover the cause we are unable to make the correction and problem solving efforts have been escalated.

The Goal for all alarms is ‘1’.

No Alarms = No Improvement.

Alarms Set too high increase the risk for an escape!

VERIFICATION STATION

3.3 – Defects Entering the Station

Alarm and Escalation:

When a defect is detected, feedback to the appropriate team or individual will be given by using a communication system.

The alarm is raised by using audio/visual signals (e.g. Andon).

The alarm process directs the support functions to:

- **'Go and See'** the problem
- Apply containment to prevent further flow of defects
- Initiate problem solving

VERIFICATION STATION

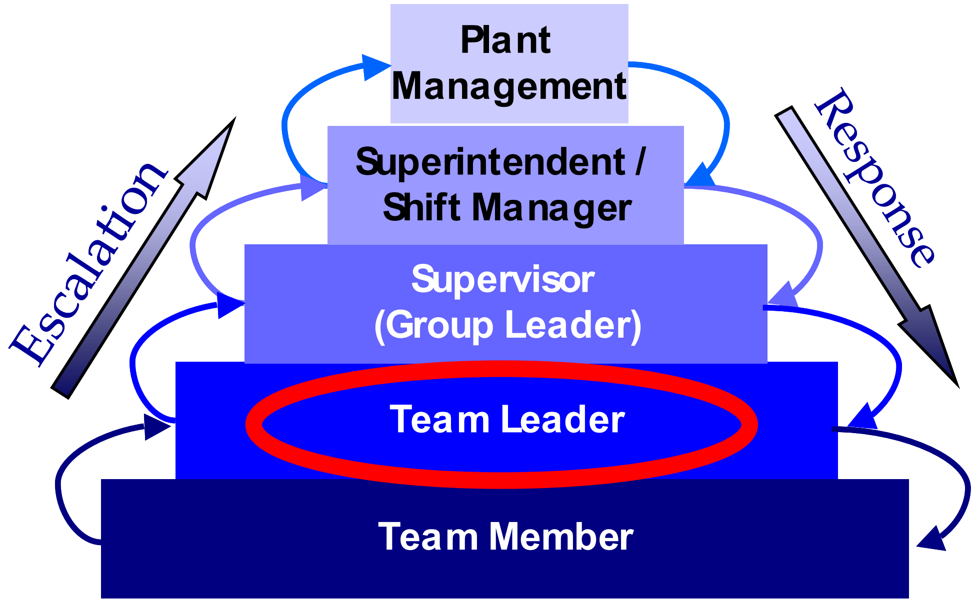
3.3 – Defects Entering the Station

Alarm and Escalation:

If problems repeat, subsequent alarms shall be escalated to the relevant support functions to respond. (ref: Diamonds 1-4)

Alarm & escalation process will be documented and used in Verification Stations or any manufacturing step.

As alarms are triggered, the problem solving process is initiated to contain, determine root cause, apply effective countermeasures and establish a breakpoint for subsequent alarms.



Escalation

Response

Plant Management

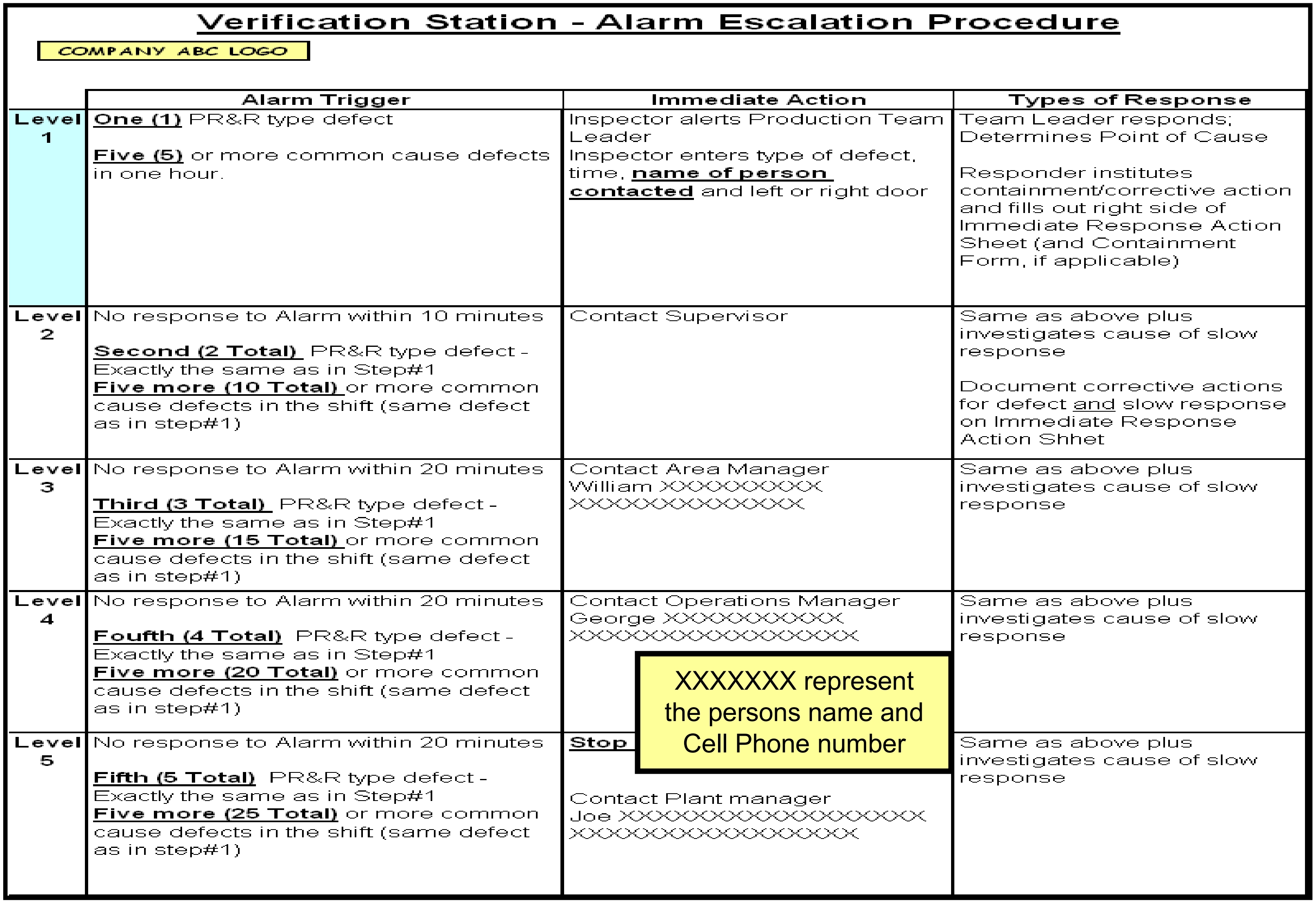
Superintendent / Shift Manager

Supervisor (Group Leader)

Team Leader

Team Member

(Example)



Verification Station - Alarm Escalation Procedure

COMPANY ABC LOGO

	Alarm Trigger	Immediate Action	Types of Response
Level 1	**One (1)** PR&R type defect **Five (5)** or more common cause defects in one hour.	Inspector alerts Production Team Leader Inspector enters type of defect, time, **name of person contacted** and left or right door	Team Leader responds; Determines Point of Cause Responder institutes containment/corrective action and fills out right side of Immediate Response Action Sheet (and Containment Form, if applicable)
Level 2	No response to Alarm within 10 minutes **Second (2 Total)** PR&R type defect - Exactly the same as in Step#1 **Five more (10 Total)** or more common cause defects in the shift (same defect as in step#1)	Contact Supervisor	Same as above plus investigates cause of slow response Document corrective actions for defect and slow response on Immediate Response Action Shhet
Level 3	No response to Alarm within 20 minutes **Third (3 Total)** PR&R type defect - Exactly the same as in Step#1 **Five more (15 Total)** or more common cause defects in the shift (same defect as in step#1)	Contact Area Manager William XXXXXXXXXX XXXXXXXXXXXXXX	Same as above plus investigates cause of slow response
Level 4	No response to Alarm within 20 minutes **Fouth (4 Total)** PR&R type defect - Exactly the same as in Step#1 **Five more (20 Total)** or more common cause defects in the shift (same defect as in step#1)	Contact Operations Manager George XXXXXXXXXXX XXXXXXXXXXXXXXXXX	Same as above plus investigates cause of slow response
Level 5	No response to Alarm within 20 minutes **Fifth (5 Total)** PR&R type defect - Exactly the same as in Step#1 **Five more (25 Total)** or more common cause defects in the shift (same defect as in step#1)	**Stop** Contact Plant manager Joe XXXXXXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXXX	Same as above plus investigates cause of slow response

XXXXXXX represent the persons name and Cell Phone number

VERIFICATION STATION

3.3 – Defects Entering the Station

Alarm and Escalation:

The Tally Sheet:

- records the number of each type of problem by the hour.
- addresses special cause variation.
- alerts operator when alarm limit is reached.
- is located at or near the point of inspection.

(Example)

#	Defects	VS Alarm Trigger #	1st Hour	2nd Hour	3rd Hour	4th Hour	5th Hour	6th Hour	7th Hour	8th Hour	Total
			6:00-7:00			9:00-10:00	10:00-11:00	12:00-1:00	1:00-2:00	2:00-3:00	
			4:00-5:00	5:00-6:00	6:00-7:00	7:00-8:00	8:00-9:00	11:00-12:00	12:00-1:00	1:00-2:00	
1	Scratches	6	II	I	II						5
2	Bolt Reject	1	I		I						4
3	Lash Reject	4		II	I						3
4	Crank Torque	5	II	III	I						6

Trigger an Alarm!

2nd Alarm is Escalated!

Trigger an Alarm

Alarm by shift not hour.

VERIFICATION STATION

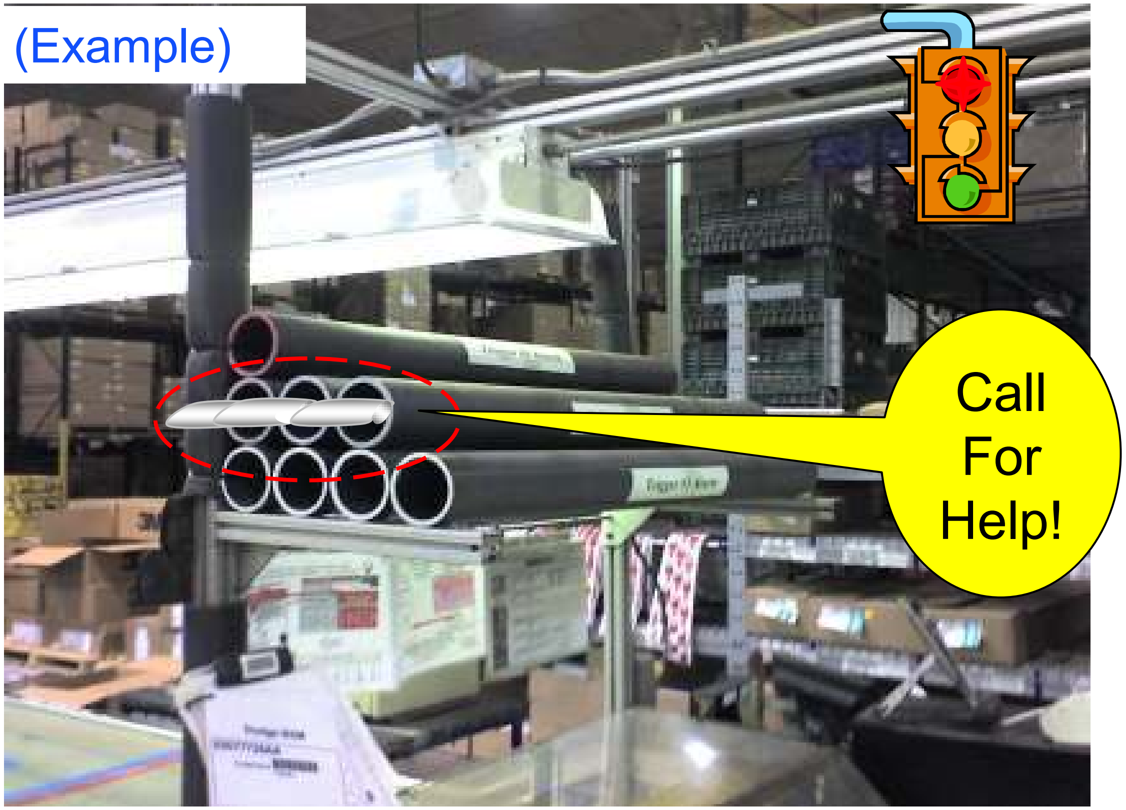
3.3 – Defects Entering the Station

Alarm and Escalation:

Multiple Alarm Levels – Visual Management

Alarm Trigger Collection Point at the end of the assembly process.

2nd alarm Trigger is 3 pieces for Assembly type Defects – VS operator calls for help.



VERIFICATION STATION

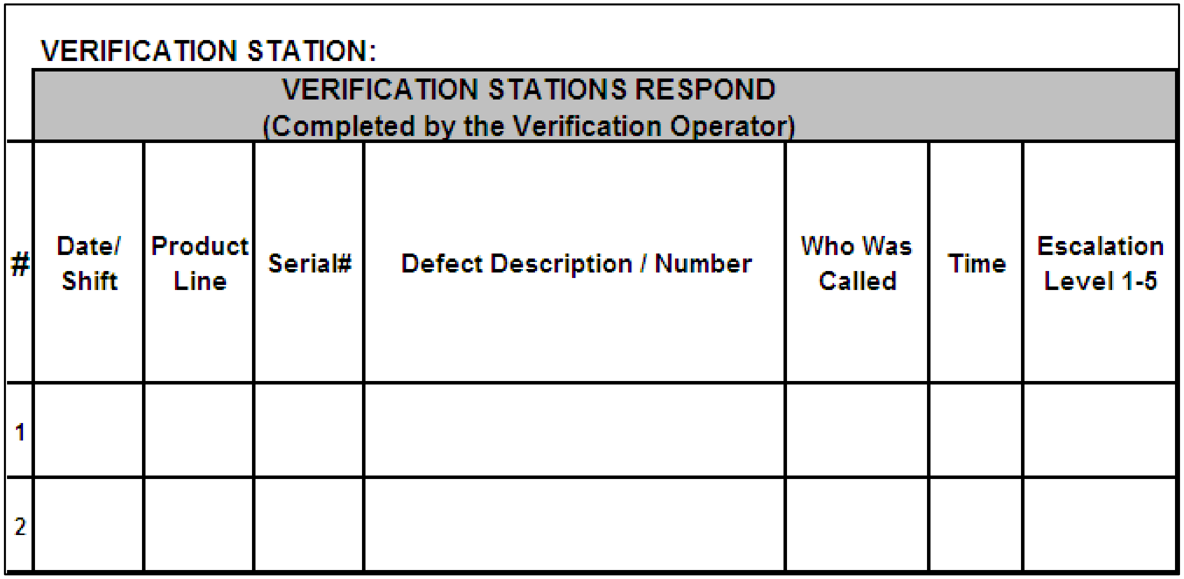
3.3 – Defects Entering the Station

Immediate Response Process:

VS Operator/Inspector Section

(Example)

When an alarm is triggered, the verification station operator shall take immediate action & call for help, then fills in the left side of the immediate response document.



VERIFICATION STATION:

VERIFICATION STATIONS RESPOND
(Completed by the Verification Operator)

#	Date/ Shift	Product Line	Serial#	Defect Description / Number	Who Was Called	Time	Escalation Level 1-5
1							
2							

Repeat alarms are noted by the escalation level. The next level responder is called.

VERIFICATION STATION

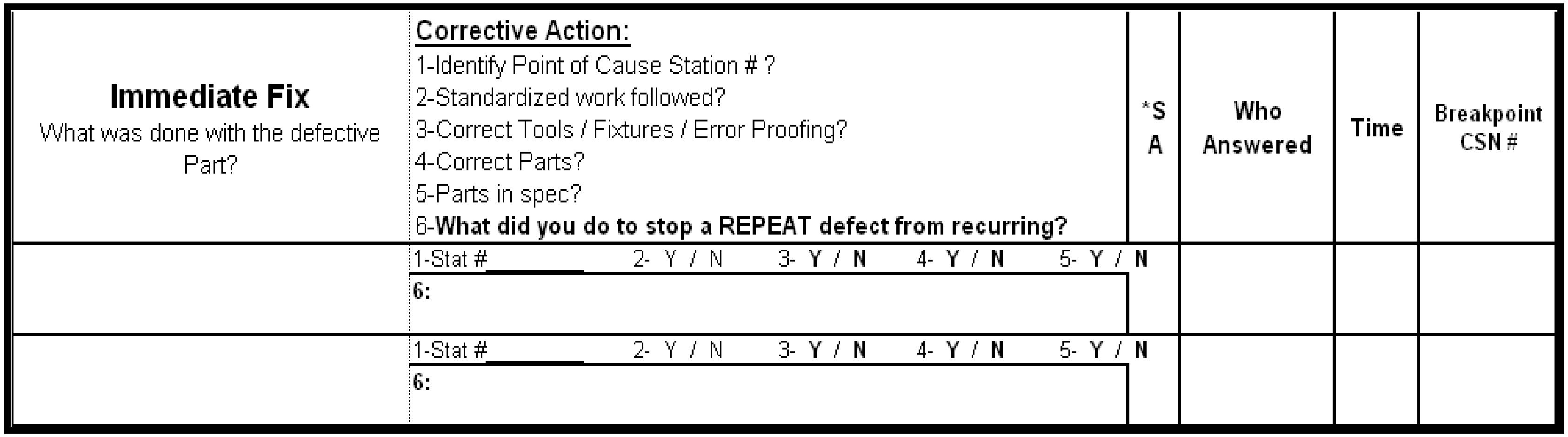
3.3 – Defects Entering the Station

Immediate Response Process:

Responder’s Section

- The responder begins the problem solving process immediately and shall document the results.
  - Containment, Immediate fix (sort, repair, scrap)
  - Point of Cause, Root Cause, Corrective Action
  - Was it Process Related or a Supplier Issue?

(Example)



Immediate Fix What was done with the defective Part?	**Corrective Action:** 1-Identify Point of Cause Station # ? 2-Standardized work followed? 3-Correct Tools / Fixtures / Error Proofing? 4-Correct Parts? 5-Parts in spec? 6-**What did you do to stop a REPEAT defect from recurring?**	*SA	Who Answered	Time	Breakpoint CSN #
	1-Stat #________ 2- Y / N 3- Y / N 4- Y / N 5- Y / N 6:				
	1-Stat #________ 2- Y / N 3- Y / N 4- Y / N 5- Y / N 6:				

VERIFICATION STATION

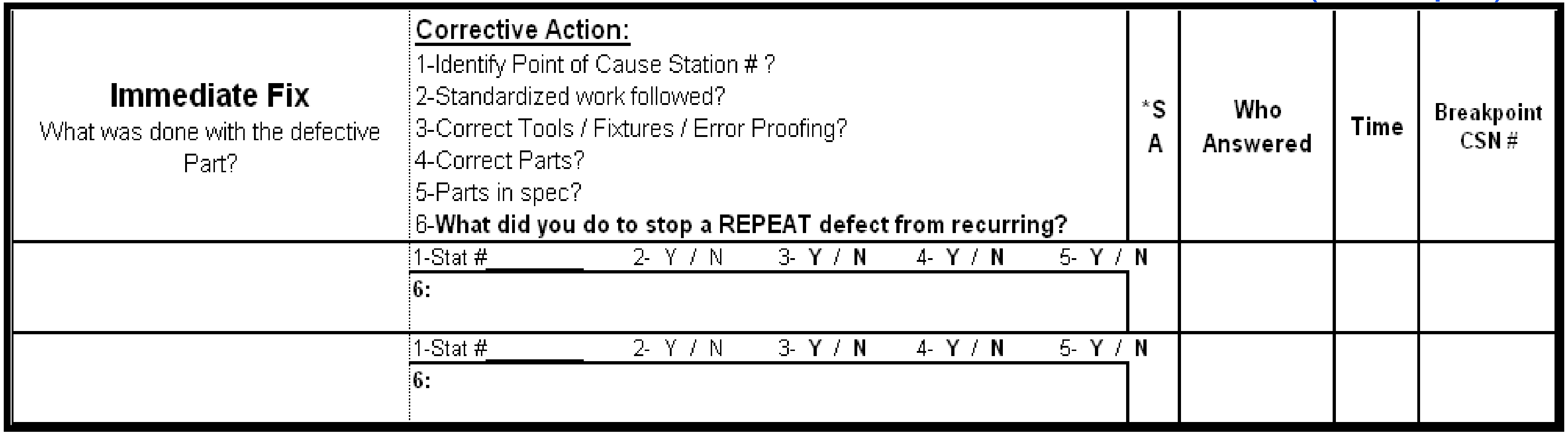
3.3 – Defects Entering the Station

Immediate Response Process:

Responder's Section (Cont.)

- The Break Point is the point at which all subsequent parts are known to be good due to containment and/or corrective action having taken place.
  - Both time and location should be recorded.
  - First good part should be identified so the Verification Station knows when the Break Point passes.

(Example)



Immediate Fix What was done with the defective Part?	Corrective Action: 1-Identify Point of Cause Station # ? 2-Standardized work followed? 3-Correct Tools / Fixtures / Error Proofing? 4-Correct Parts? 5-Parts in spec? **6-What did you do to stop a REPEAT defect from recurring?**	***SA**	**Who Answered**	**Time**	**Breakpoint CSN #**
	1-Stat #________ 2- Y / N 3- Y / N 4- Y / N 5- Y / N **6:**				
	1-Stat #________ 2- Y / N 3- Y / N 4- Y / N 5- Y / N **6:**				

VERIFICATION STATION

3.3 – Defects Entering the Station

Leadership Support:

DAILY MANAGEMENT WALK-THROUGH

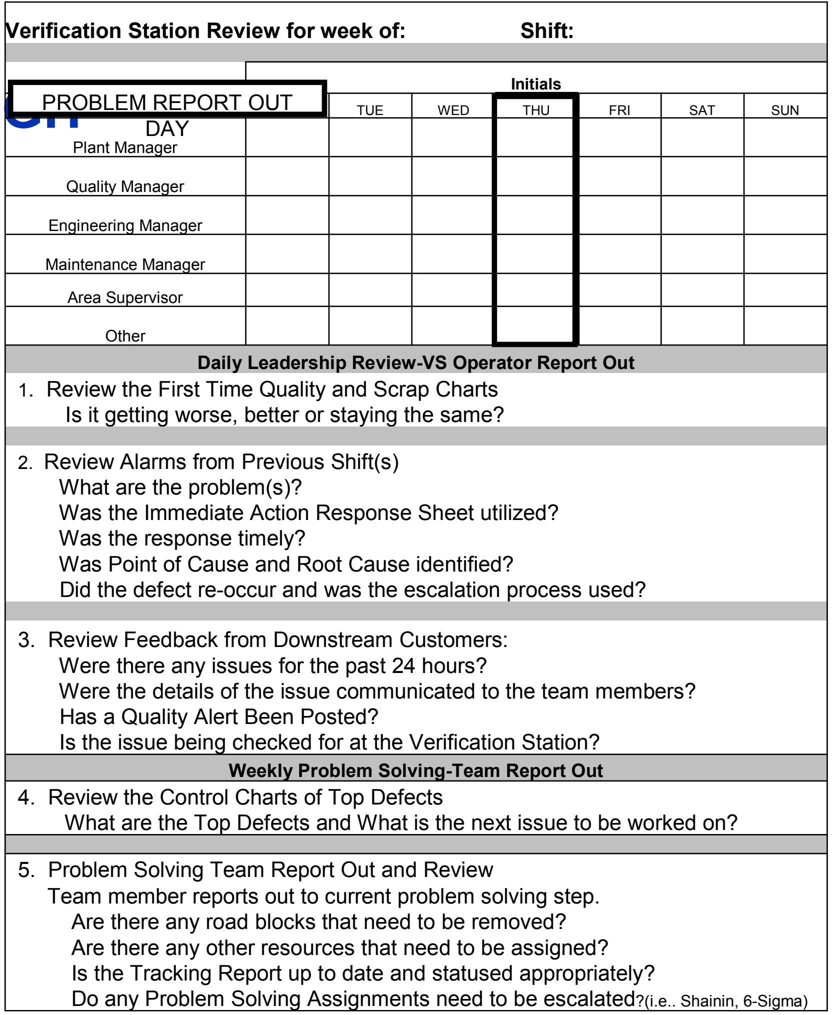
Management Walk –Through/Meeting shall be held daily on each shift at selected Verification Stations.

Points to review at the station are outlined in the example at the right.

Once per week, the Team also reports on a problem they are working to resolve.

Sign in sheet indicates presence and support at Management Walk - Through/Daily Meetings.

(Example)



Verification Station Review for week of: **Shift:**

				Initials			
PROBLEM REPORT OUT DAY		TUE	WED	THU	FRI	SAT	SUN
Plant Manager							
Quality Manager							
Engineering Manager							
Maintenance Manager							
Area Supervisor							
Other							

Daily Leadership Review-VS Operator Report Out

1. Review the First Time Quality and Scrap Charts
   Is it getting worse, better or staying the same?

2. Review Alarms from Previous Shift(s)
   What are the problem(s)?
   Was the Immediate Action Response Sheet utilized?
   Was the response timely?
   Was Point of Cause and Root Cause identified?
   Did the defect re-occur and was the escalation process used?

3. Review Feedback from Downstream Customers:
   Were there any issues for the past 24 hours?
   Were the details of the issue communicated to the team members?
   Has a Quality Alert Been Posted?
   Is the issue being checked for at the Verification Station?

Weekly Problem Solving-Team Report Out

4. Review the Control Charts of Top Defects
   What are the Top Defects and What is the next issue to be worked on?

5. Problem Solving Team Report Out and Review
   Team member reports out to current problem solving step.
   Are there any road blocks that need to be removed?
   Are there any other resources that need to be assigned?
   Is the Tracking Report up to date and statused appropriately?
   Do any Problem Solving Assignments need to be escalated?(i.e.. Shainin, 6-Sigma)

VERIFICATION STATION

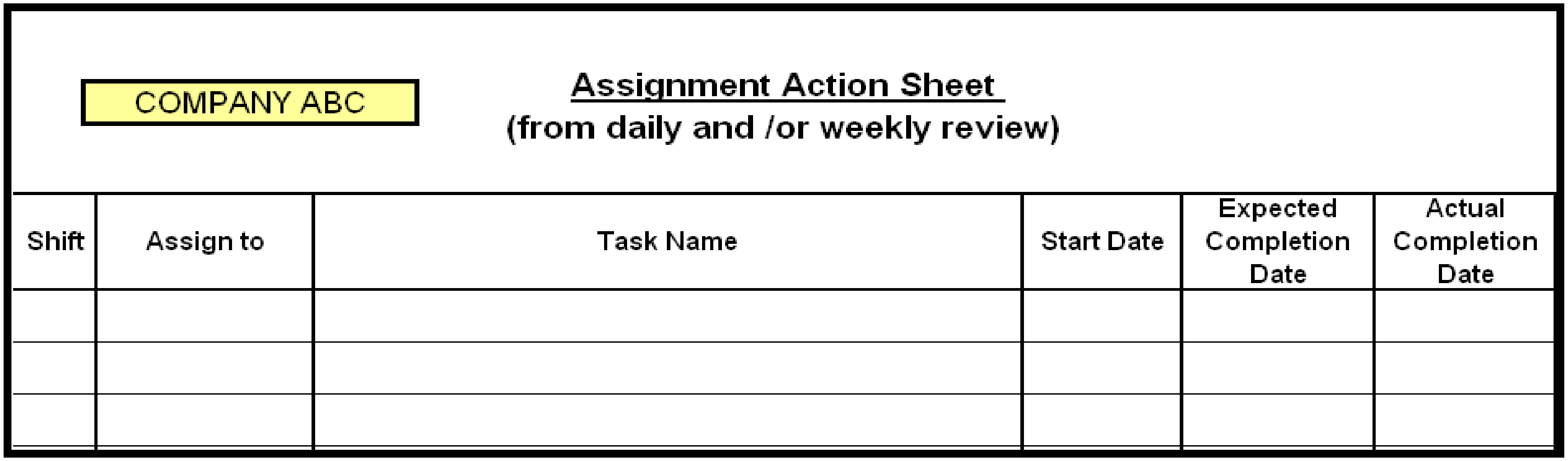
3.3 – Defects Entering the Station

Leadership Support:

ASSIGNMENT ACTION SHEET

As issues come up at the daily VS or weekly Problem Solving report out meeting, any assignments given are captured here and reviewed at next meeting. Issues may include; material presentation, delivery, support needed to do their job better, faster or more accurately.

(Example)



COMPANY ABC

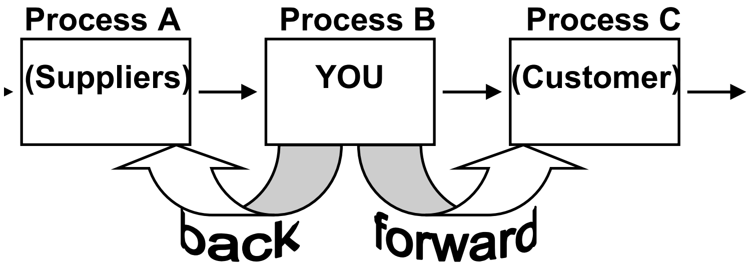
Assignment Action Sheet
(from daily and /or weekly review)

Shift	Assign to	Task Name	Start Date	Expected Completion Date	Actual Completion Date

VERIFICATION STATION

3.4 – Defects Leaving the Station

Quality Feedback/ Feed Forward:



Process A | Process B | Process C

(Suppliers) → YOU → (Customer) →

back | forward

Definition: The communication of quality expectations and results between customers and suppliers through standardized communication pathways.

Purpose: To ensure that information on quality reaches those who need it.

VERIFICATION STATION

3.4 – Defects Leaving the Station

Quality Feedback/ Feed Forward:

How do we Know that the Verification Station is doing its job and driving Quality back into Station?

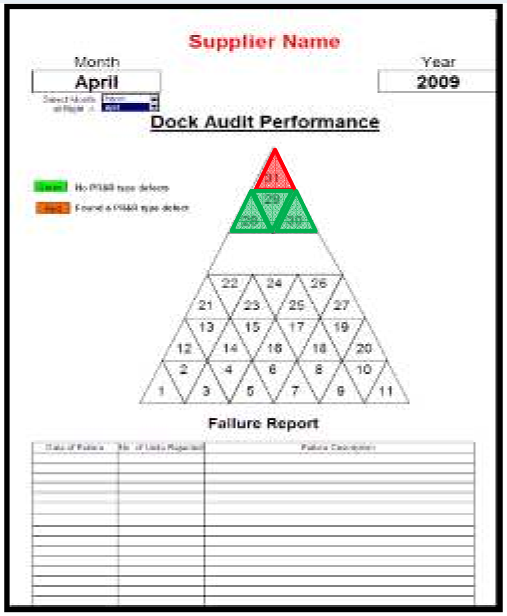
VERIFICATION STATION

3.4 – Defects Leaving the Station

Quality Feedback/ Feed Forward:

Feedback details are communicated from all downstream customers including between departments at the manufacturing site.

Defects found at internal audit or containment check points including GP12



Supplier Name

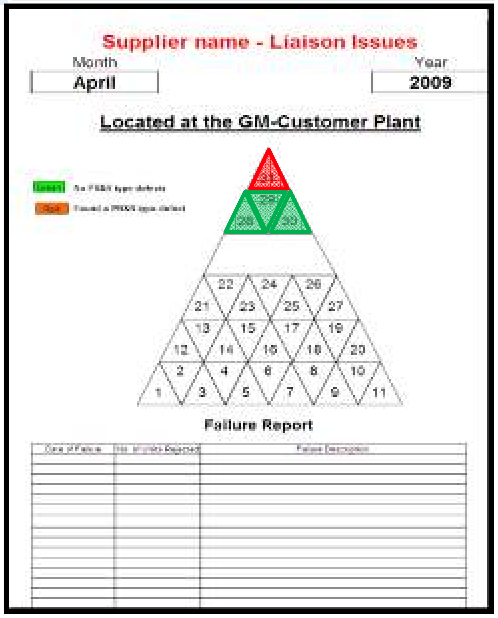
Month: April

Year: 2009

Dock Audit Performance

Failure Report

Issues that escaped to the Customer and are caught by the Supplier contact



Supplier name - Liaison Issues

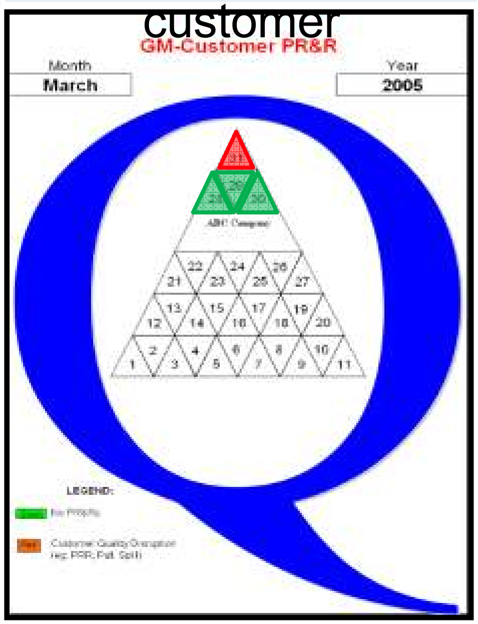
Month: April

Year: 2009

Located at the GM-Customer Plant

Failure Report

Issues that escaped to the customer and are found by the customer



GM-Customer PR&R

Month: March

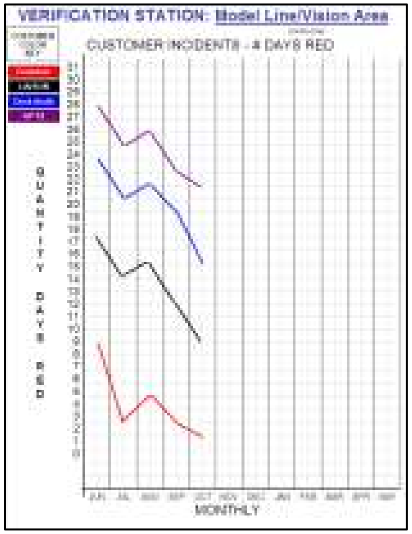
Year: 2005

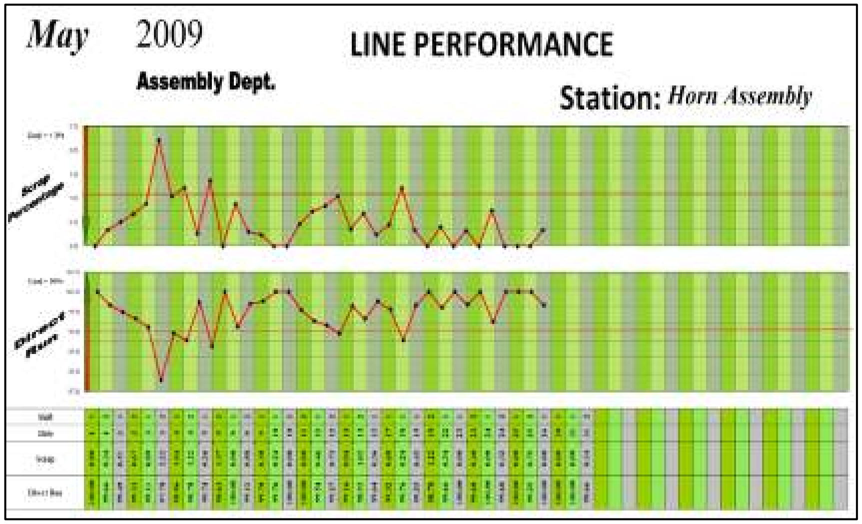
VERIFICATION STATION

3.4 – Defects Leaving the Station

Performance Metrics:

The check portion of Implementing a Verification Station is measuring the effectiveness and seeing results. This can be done by using a simple line graph representing the number of red days for each upstream customer as well as tracking internal metrics such as scrap, direct run, internal ppm, efficiency, uptime.





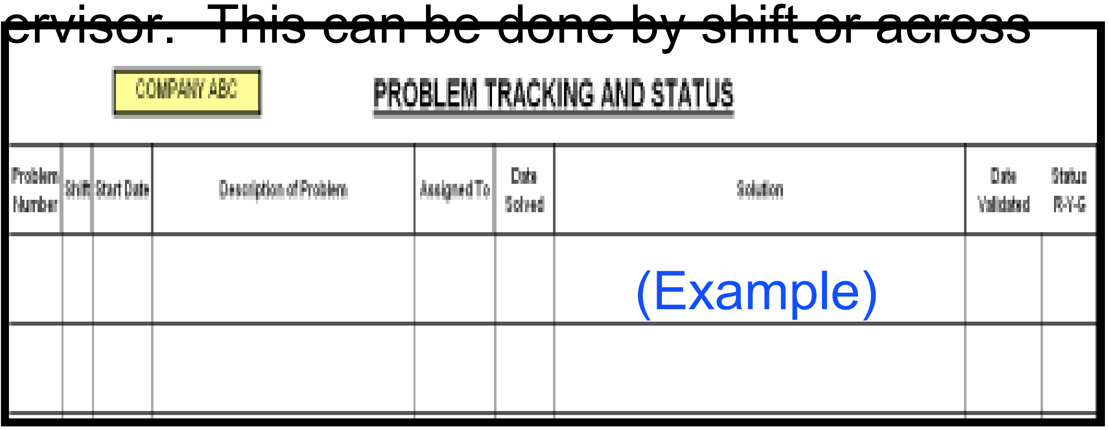
VERIFICATION STATION

3.5 – Problem Solving

Leadership shall support problem solving by the Team based on VS data.

The pareto of defects is discussed and problems assigned to the team led by the Team Lead/Supervisor. This can be done by shift or across shifts.

Problems shall be tracked and the status reviewed weekly.



COMPANY ABC

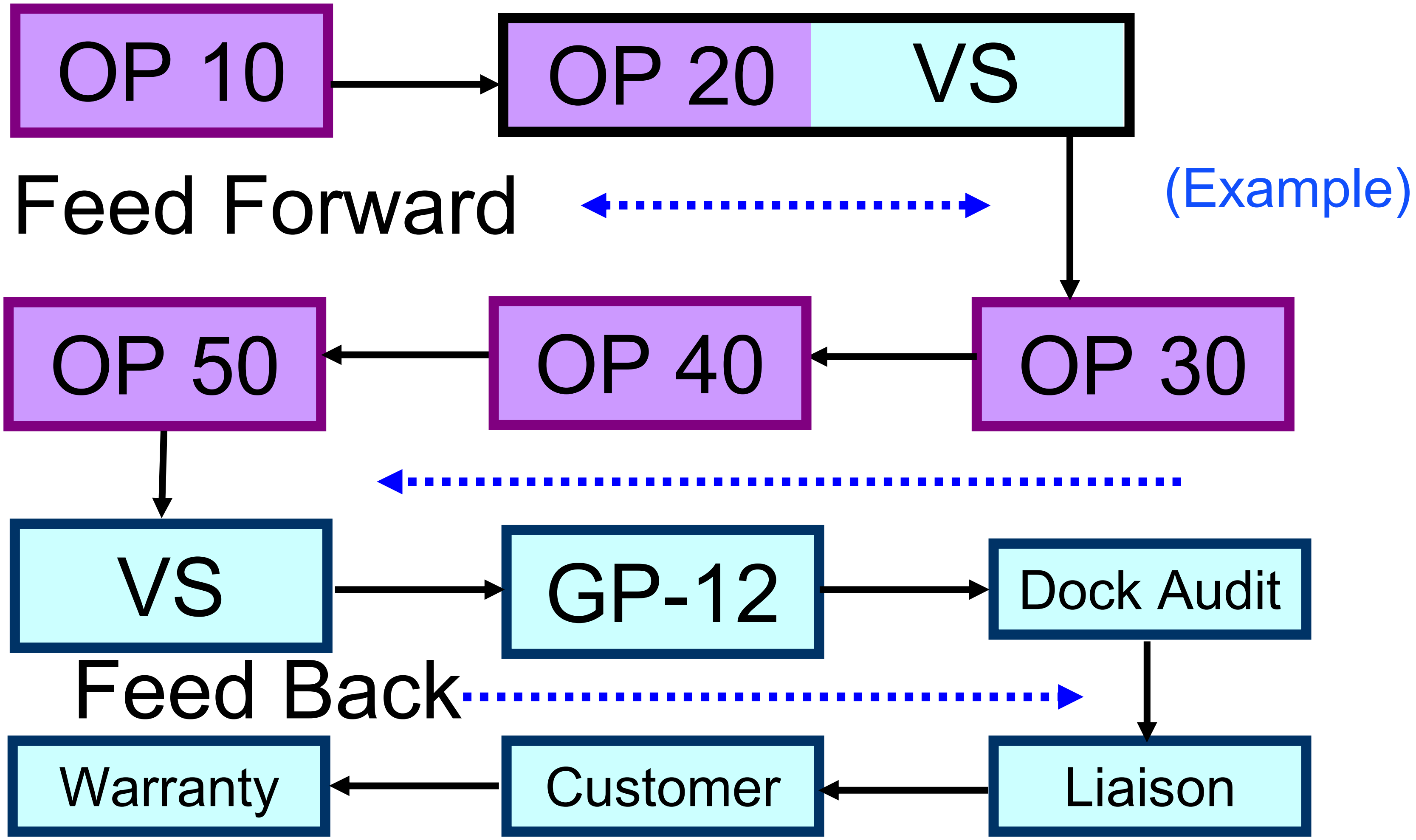
PROBLEM TRACKING AND STATUS

Problem Number	Shift	Start Date	Description of Problem	Assigned To	Date Solved	Solution	Date Validated	Status R-Y-G
						(Example)		

The Team is trained and uses the standard internal problem solving form to report out weekly during the Verification Station report out.

Leadership should identify when problems need to be escalated to the next level of problem solving such as statistical techniques.

PROCESS DIAGRAM



Verification Station(s) can be placed anywhere in the process.
Alarm & Escalation should be applied to each step in the process.

VERIFICATION STATION

3.6 – C.A.R.E

CUSTOMER ACCEPTANCE REVIEW & EVALUATION

- Protects your customer from non-conforming product, discrepancies and labeling errors.
- Verifies that process controls are effective.
- Applies to customer satisfaction items that are part related.
  - Pass Through Characteristics
  - Labeling
  - Past Formal Customer Issues
- The Plant Manager & Quality Manager should facilitate activities.
- The Alarm Limit is Always ONE!
- Report Non-Conforming Data to the *Fast Response* Meeting.
- Add the Root Cause/Corrective Action to the Layered Process Audit.

VERIFICATION STATION

3.7 – Summary, Shalls

Organizations shall:

✓ Implement **at least one** Verification Station.
Note: GMPT suppliers shall implement C.A.R.E.

✓ Institute 100% inspection when variable data cannot be used.

✓ Take immediate action when an alarm limit is reached and use escalation for subsequent alarms for the same defect.

✓ Past Customer defects shall always have an alarm of 1.

✓ Conduct daily Verification Station meetings at the Station.

✓ Document Responses to Calls for Help

✓ Support problem solving by the Team based on VS data and review weekly.

VERIFICATION STATION

IN-PROCESS CONTROL & VERIFICATION

Satisfy Your Customer. . .

Do not

a Defect!

Solve Problems Through Teamwork!

4.0 - STANDARDIZED OPERATIONS

WORKPLACE ORGANIZATION-5S

A clean, well-organized work environment.

STANDARDIZED WORK (SOS)

What are the Major Steps, how long should it take?

OPERATOR INSTRUCTIONS (JES)

Detailed Steps for What, How, and Why.

MANUFACTURING GAGE CONTROL

Product is qualified per plan to known standards & specifications

STANDARDIZED OPERATIONS
Outline

4.1) Introduction: Purpose, Scope, Responsibility

4.2) Benefits

4.3) 7-Types of Waste, WPO 5-S

4.4) Standardized Work

  4.4.1) Standard Operation; Major Steps, Time, Materials, Work Flow

  4.4.2) Operator Instructions; Job Element Details, What, How, & Why

4.5) Manufacturing Gage Control

4.6) Summary, Shalls

STANDARDIZED OPERATIONS

4. 1 - Introduction:

PURPOSE :

- To establish a repeatable, predictable baseline for continuous improvement involving the operator in both the initial and ongoing improvements to achieve the highest levels of safety, quality and productivity.

SCOPE :

- Assembly Area
- Manufacturing Operations
- Repair/Rework Area
- All Operations
- Shipping / Receiving
- Other support functions (e.g. Inspection)

RESPONSIBILITY:

- Single or Dual Ownership
  - Manufacturing Engineering
  - Production Manager

STANDARDIZED OPERATIONS

4. 2 - Benefits:

7-Types of Waste, 5S

- Provides “Status at a Glance” makes non standard conditions visible.
- Makes it easy to identify and eliminate *waste*
- Provides for a safe, clean and well organized work environment
- Improves employee mind-set & performance in Safety, Quality and Productivity .
- Optimizes workspace flow and reclaims wasted floor space.
- Provides an environment to sustain standardized work.

STANDARDIZED OPERATIONS

4. 2 - Benefits:

Standard Work

- Ensures all operators are performing tasks and procedures the same across all shifts.
- Process improvements and waste is easily identified.
- Operator training simplified and consistent.
- Promotes safety and quality consciousness.
- Minimizes missed steps in the process for:

- safety checks
- operations
- omitted or incorrect components
- quality checks
- labeling

- Increases the operator's level of understanding.
- Standardizes operator training process.

MANUFACTURING GAGE CONTROL

4. 2 - Benefits:

Manufacturing Gage Control

- Standardizes Gage Process
- Improved Part Quality
- Identifies Non-Conformances
- Traceability and Capability of the process
- Provides immediate feedback to the process

STANDARDIZED OPERATIONS

4.3 WORKPLACE ORGANIZATION-5S

Visual Management of Out-of-Standard Conditions

4.4 STANDARDIZED WORK

4.4.1 – Standard Operation;

Major Steps, how long should it take? **(SOS)**

4.4.2 - OPERATOR INSTRUCTIONS;

Detailed Steps for What, How, and Why. (JES)

4.5 MANUFACTURING GAGE CONTROL

Product is qualified per plan to known standards & specifications

7 types of Waste
Workplace Organization and Visual Control, 5-S

4.3 - Introduction

PURPOSE:

- Define what tangible waste is
- Develop process and identify ways to eliminate waste.
- Develop 5-s strategy
- Apply 5-S to the work environment
- Monitor / Measure Waste Elimination Process.

SCOPE:

- Assembly Area
- Manufacturing Operations
- Shipping / Receiving
- Other Operations
- Other Support Function Areas

RESPONSIBILITY:

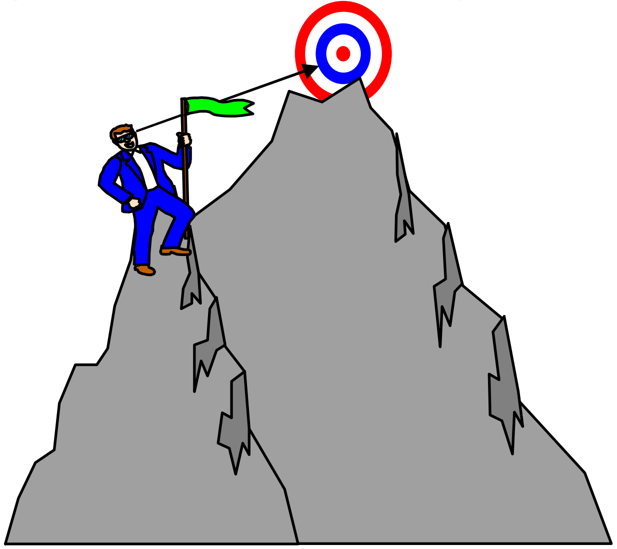
- Ownership
  - ✓Operations Manager
- All Plant Personal

ELIMINATION OF WASTE

It is everyone's responsibility to promote and participate in a continuous improvement culture within their daily activities. Continuous Improvement is an ongoing process – it has no end as we can always improve. Even when a process is stable, and Business Plan requirements have been met, we should look for further ways to improve.

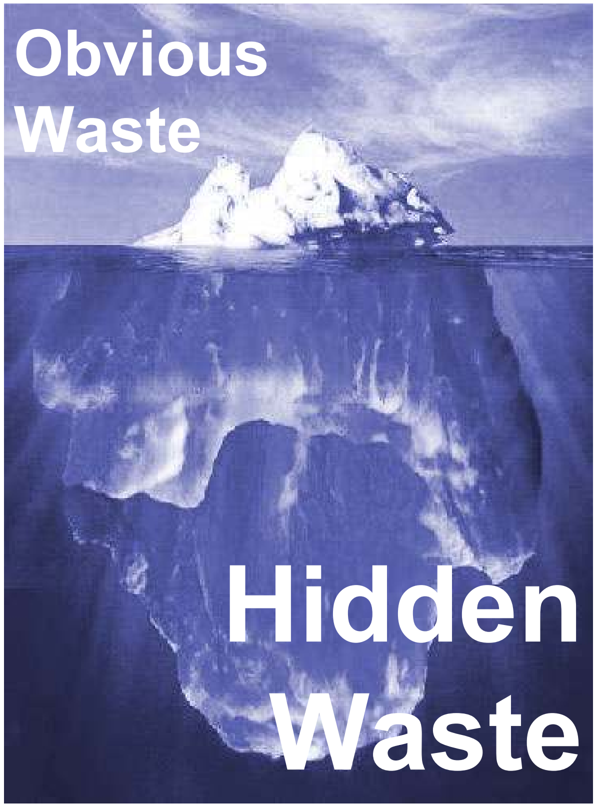
Only if you climb to the summit. . .

. . . Can you see the next objective!



ELIMINATION OF WASTE

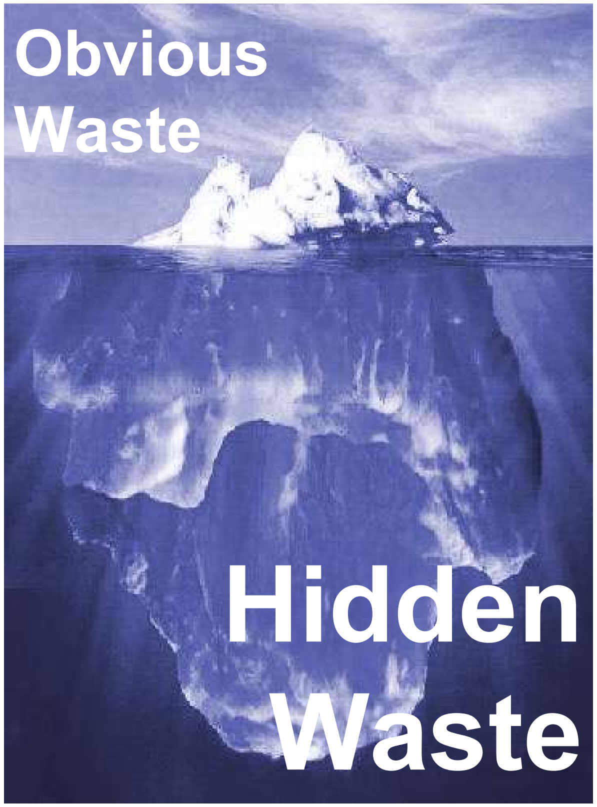
Traditional Thinking



- Waste not defined
- React to large scale examples
- Reactive Improvement

ELIMINATION OF WASTE

QSB Thinking



- Waste is tangible
- Identify many small incremental opportunities
- Continuous improvement

ELIMINATION OF WASTE

Enemy #1: Waste

Before we can understand the concept of waste, we need to be able to differentiate between non-value added and value added work.

Non Value Added Work

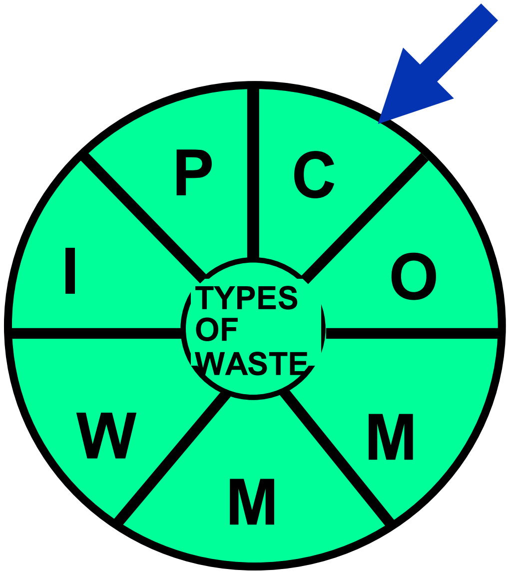
This type of work does not add value to the product, however some non-value added work is necessary. For example, picking up a tool is necessary. It is the *unnecessary* non - value added work that is waste.

Value Added Work

Work that directly adds value to the products. Value added work is defined as a change to the product, that adds value to the product and that the customer is willing to pay for (e.g. assembly of parts, application of paint, etc.).

- Waste is any step that is *unnecessary* in carrying out the job. It includes things like waiting, rearranging materials, looking for things, and unnecessary walking.

CORRECTION

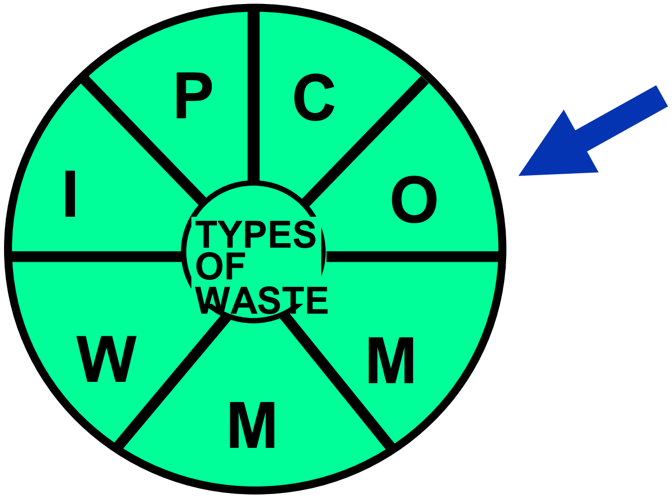


Definition: Doing something over which requires additional motion, additional processing, additional inventory and/or waiting. All repair activities are opportunities to eliminate waste.

Characteristics: Additional resources required to repair, reactive organization.

Main Causes: Poor training, inadequate tools, large inventory.

OVERPRODUCTION

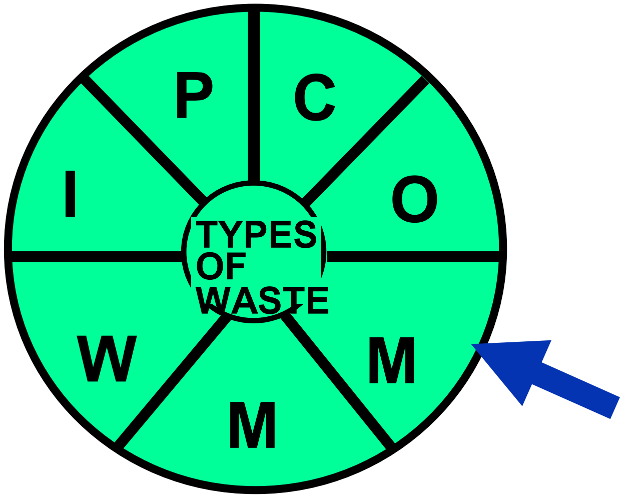


Definition: Generating excess parts, information, etc., too soon or too fast in a process. The waste of overproduction often causes other forms of waste.

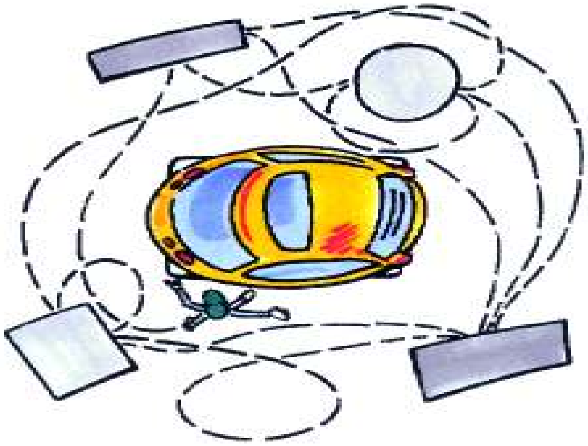
Characteristics: Large inventory within the process, busy areas, large movement of parts and people, increased staffing and energy costs.

Main Causes: Unbalanced operations, lack of communication, high equipment downtime.

MOTION



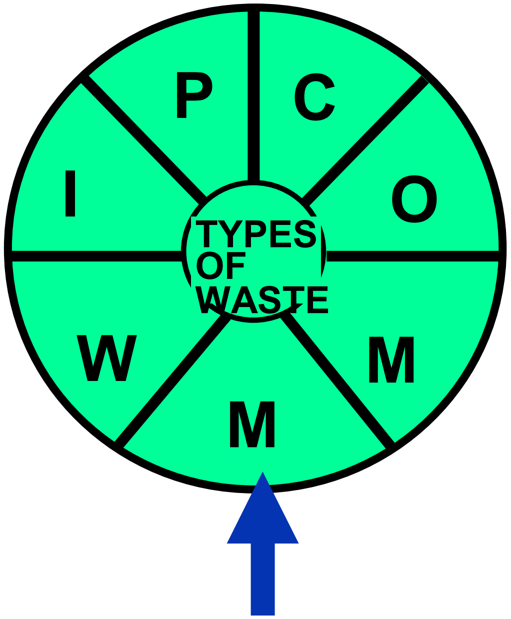
Definition: Unnecessary work movements by a team member or machine which is not necessary in adding value to the product.



Characteristics: Extra walking, excessive use of force, excess handling.

Main Causes: Worksite poorly laid out or standardized work sequence not properly planned or followed.

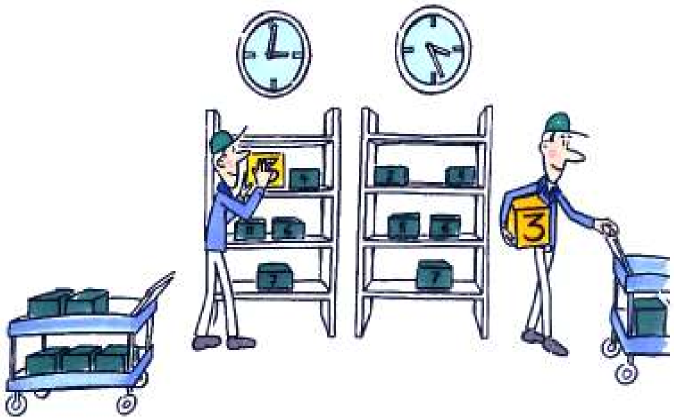
MATERIAL MOVEMENT



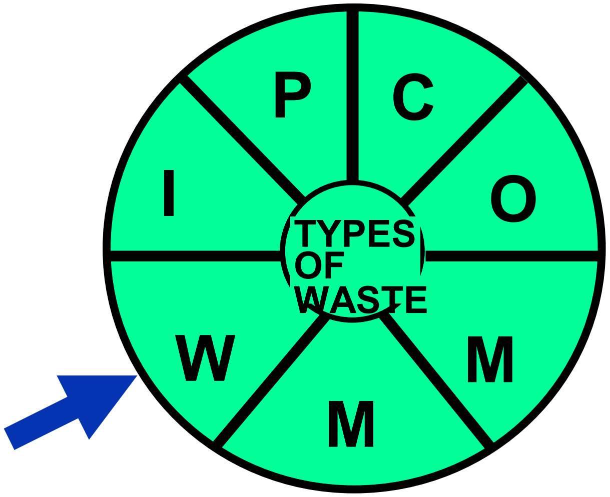
Definition: Unnecessary transporting, storing or rearranging of items, parts, equipment, etc. which is not required for production.

Characteristics: Moving or rearranging of materials, temporary storage areas.

Main Causes: Large batches, lack of workplace organization.



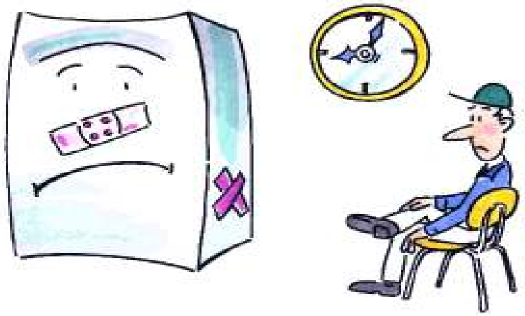
WAITING



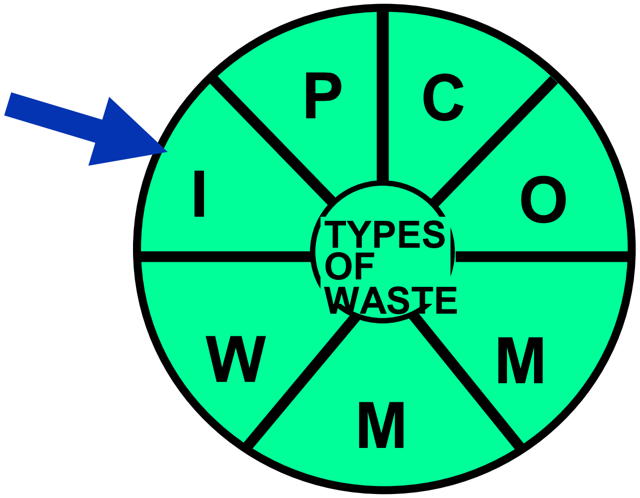
Definition: To remain in one place while doing something other than what is related to the task at hand. It is an unproductive use of time as it adds no value to the process.

Characteristics: Worker waiting for a machine or another worker. Waiting for people, information or meetings to start on time is waste.

Main Causes: Operations not balanced, broken equipment.



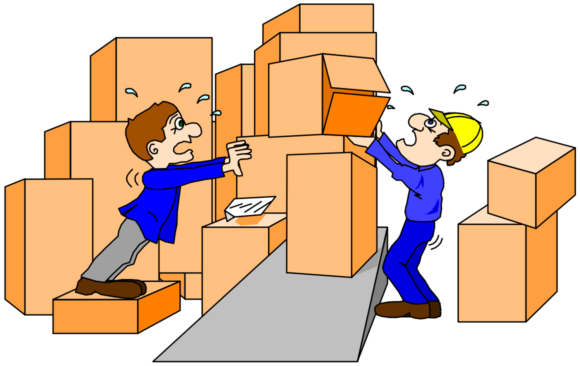
INVENTORY



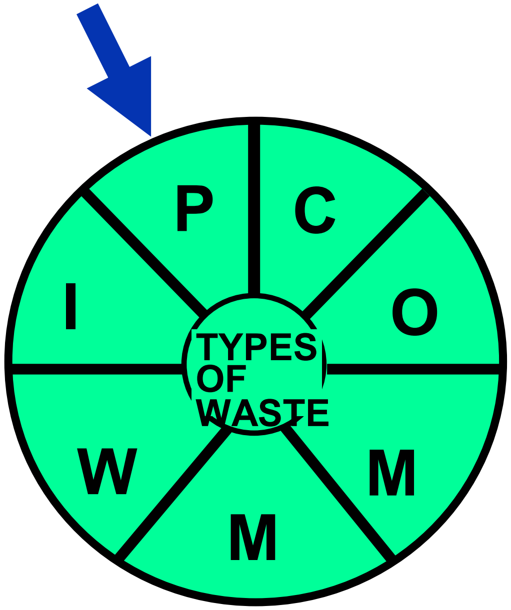
Definition: Too much of anything which may take up space, lead to obsolescence, impact safety, cause waste of motion or waste of material movement.

Characteristics: Large receiving docks, extra bins, racks and fork trucks.

Main Causes: Unlevel scheduling, no pull system, too many material storage areas.



PROCESSING



Definition: Doing something the customer does not perceive as adding value to the product.

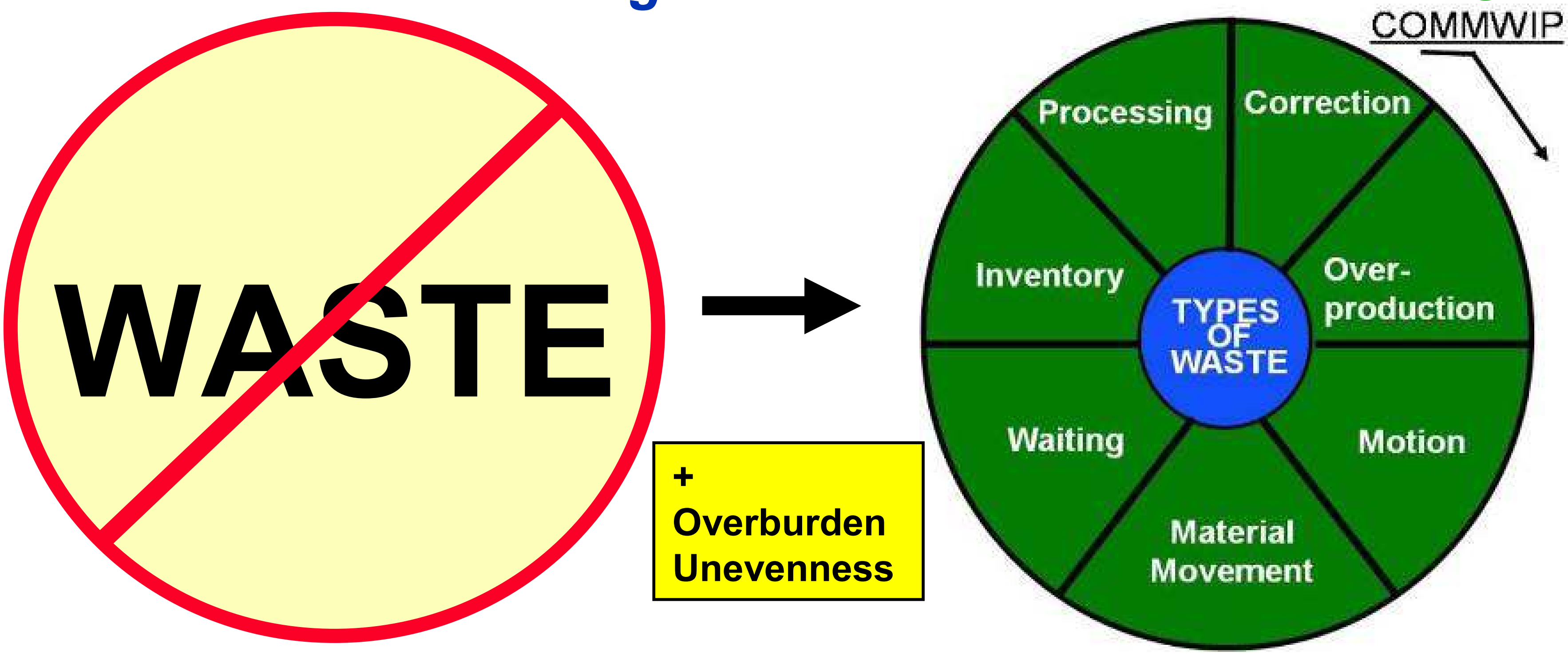
Characteristics: Clicking a torque wrench twice when one is sufficient by the quality standards, polishing the underside of a hood, mixed pallets.

Main Causes: Lack of standards, no existing or inefficient procedures.

ELIMINATION OF WASTE

Abstract Thinking

Concrete Thinking



+ Overburden Unevenness

- ➢ Waste NOT Defined
- ➢ React To Large Examples
- ➢ Reactive Improvement

- ➢ Waste Is "Tangible"
- ➢ Identify Many Small Opportunities
  - ❖Leads To Large Overall Change
- ➢ Continuous Improvement

Note: The memory aid for the 7 Types of Waste is COMMWIP.

WORKPLACE ORGANIZATION

Organizations shall utilize a systematic approach to implement and maintain Workplace Organization to ensure:

- Work areas are organized for safety, quality, ergonomics and optimal use.
- Only required and regularly used equipment, tools and materials are present in the work area.
- Work areas are controlled using visual management.
- Product and information flow is easily understood.
- Housekeeping is defined by work area instructions.
- Regular management reviews *(Layered Process Audits)* are performed.
- Waste elimination and continual improvement.
- A clean, bright workplace.

Good Workplace Organization establishes a standard that leads to the Identification & Elimination of Waste.

FIRST IMPRESSIONS

"You never get a second chance to create a first impression."

FIRST IMPRESSION: MAIN ENTRANCE TO PLANT

What is your first impression of this facility?

FIRST IMPRESSION: PLANT MAIN AISLE

5 S WORKPLACE ORGANIZATION

STEP	ORIGINAL 5 S	OTHER 5 S TERMINOLOGY				QSB	DEFINITION	PURPOSE
1	**Seiri**	Organization	Sift	Tidiness	Clear	**Sort**	Determine the purpose of the area and remove all unnecessary items from the workplace.	To prepare the workplace for the next 4 steps and to eliminate items that could cause injury, excessive cost, or any of the forms of wastes.
2	**Seiton**	Neatness	Sort	Orderliness	Organize	**Straighten**	Identify the best location for all required items in the workplace.	To eliminate many of the forms of waste (such as correction & motion) and make items readily available to the user.
3	**Seiso**	Cleaning	Sweep	Cleanliness	Clean	**Shine**	To become aware of and eliminate all unwanted dirt, dust, grime, paint, labels, tape, etc…	To eliminate unsafe conditions, improve quality of our products, enhance the workplace environment, identify and correct equipment problems (cleaning is checking), and initiate corrective action to prevent future accumulation of unwanted materials.
4	**Seiketsu**	Standardization	Sustain	Standardization	Standardize	**Standardize**	The standardization required to maintain the steps of work place organization.	To allow for quick, easy, and effective maintenance of the workplace organization process.
5	**Shitsuke**	Discipline	Self-Discipline	Discipline	Continuous Improvement	**Sustain**	The system designed to sustain and support continuous improvement of workplace organization.	To assure continuous growth of this process.

Workplace Organization is applicable to all types of environments (e.g. offices, conference rooms, tool cribs, operator workstations, team/group rooms, etc.).

S-1: SORT – Divide the needed and unneeded items at the job site, removing any unneeded items.

- Four areas of focus:
  - Equipment
  - Tools
  - Inventory/Storage
  - Personal items

- Sort and Tag:
  - Place a green tag on any item in regular use.
  - Place a red tag on any item which isn't used or is not in working condition.
  - Place a yellow tag on any item that use or condition isn't known for sure.

S-2: SET IN ORDER – A place for everything and everything in it's place.

- Categorize:
  - How often do I use this item?
- Determine a location:
- There is a "best" place for every item.
  - If used frequently – keep near
    If not – place at the rear.
  - Use Shadow Boards.
- Set limits for material levels:
  - Standard packs.
  - Work in process.
  - Container size and identification.

S-3: SHINE - Eliminate the source of dirt and leaks (oil, air, water, etc.).

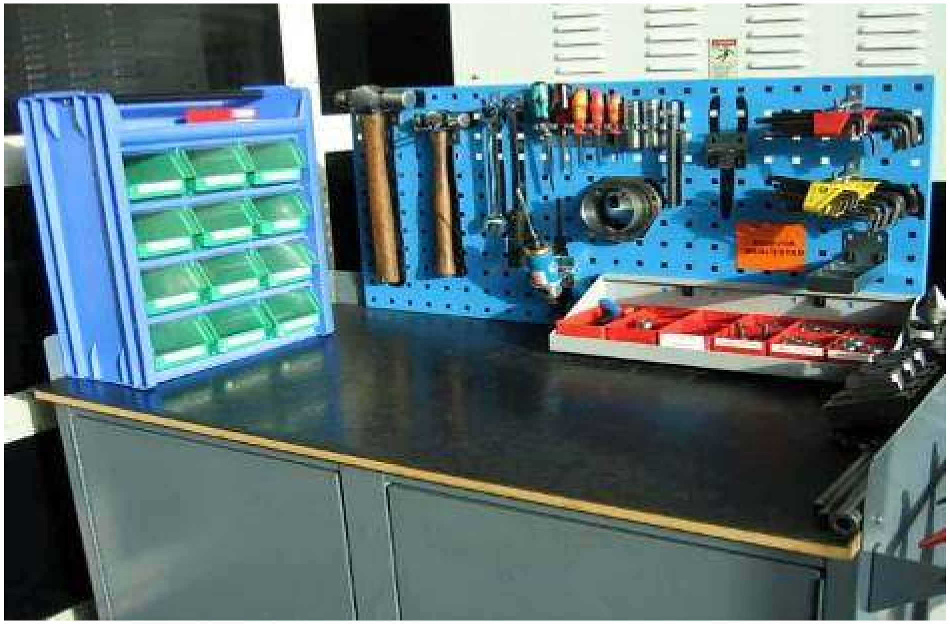
- Clean machines, tools, floors, cabinets.
- Develop instructions for cleaning methods and frequency.
- Organize for cleaning (correct materials, rags, brooms, etc.).
- Find ways to reduce the time required for cleaning.

(Examples)

Out-of-standard conditions can be easily identified and corrected.

S-4: STANDARDIZE - Standardize the area visually and mark the location of each item.

- Color coding for designated areas.
- Designate area shapes.
- Consistent label height and color throughout facility.
- Storage containers and storage areas practices.



(Example)

S-4: STANDARDIZE (CONTINUED)

- Determine cleaning schedule and methods.
- Standardize cabinet organization.
- Define a simple method to identify problems using visual controls.

(Example)

All item locations are properly

S-4: STANDARDIZE (continued)

GMPT FLOOR MARKING COLOR SPEC.

(Example)

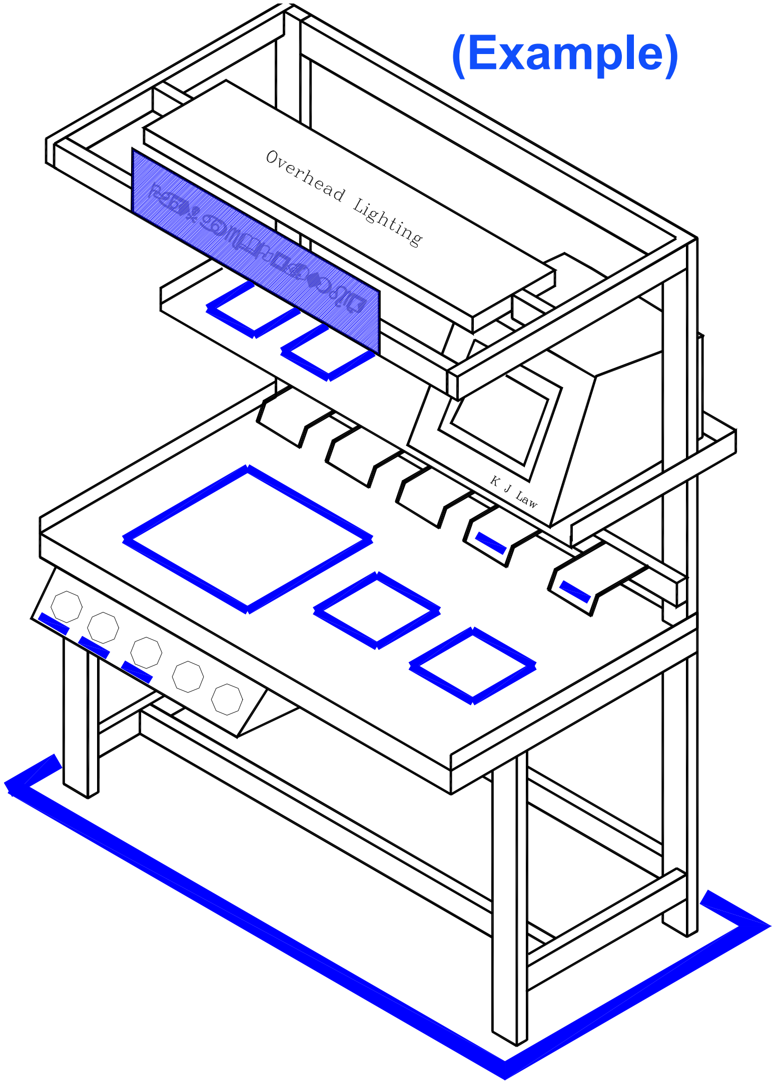
COLOR	Floor Marking Application	*LIVONIA* CRIB CODE
BLUE	**QUALITY ITEMS** *OPERATION GAGE TABLES & GAGE CARTS* *QUALITY INFORMATION DISPLAYS* *OTHER QUALITY RELATED ITEMS*	**M-2307**
GREEN	**PRODUCTIVE MATERIAL** *RAW STOCK, PURCHASED PARTS* *IN-PROCESS MATERIAL* *FINISHED MATERIAL*	**M-2311**
RED	**SCRAP MATERIAL** *SCRAP BINS* *SCRAP CARTS* *OTHER SCRAP RELATED ITEMS*	**M-2309**
YELLOW	**TOOLING AND SUSPECT MATERIAL** *TOOL CARTS* *TOOL TABLES* *SUSPECT MATERIAL*	**M-2310**
WHITE	**ALL OTHER ITEMS** *TRASH BINS* *HOUSEKEEPING STATIONS* *ALL OTHER ITEMS*	**M-2308**

S-4: STANDARDIZE (continued)

FLOOR MARKING:
PAINT / TAPE A BLUE LINE 2-4" WIDE ON THE FLOOR SIZED TO SUIT TABLES WITH DESCRIPTION LABELED.

OVERHEAD SIGN:
SIGN TO INDICATE DEPARTMENT AND OPERATION #. TO BE ATTACHED TO THE TABLE OR HANGING FROM ABOVE AS APPROPRIATE.

LABELS & SILHOUETTES:
PLACEMENT OF GAGES AND DOCUMENTATION IS TO BE MARKED ON THE TABLE ALONG WITH THE APPROPROPRIATE SERIAL NUMBER OR DESCRIPTION FOR EACH.



(Example)

GMPT FLOOR MARKING COLOR SPEC.

BLUE - QUALITY

BLUE - #2 PMS286

(Example)

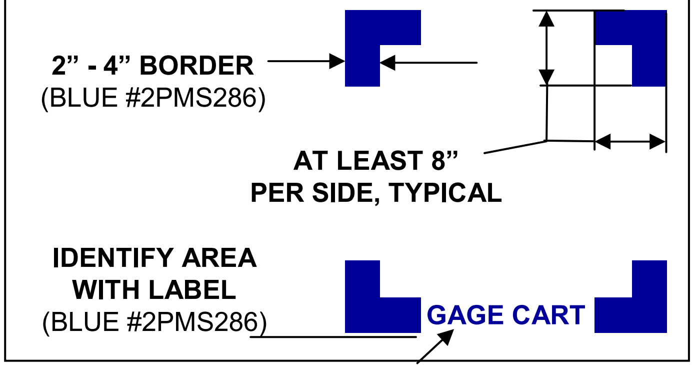
QUALITY ITEMS

- OPERATION GAGE TABLES
- OPERATION GAGE CARTS
- STANDS OR DISPLAYS FOR QUALITY INFORMATION
- LAST CHECKED PARTS AND DISPLAY PARTS
- ANY OTHER QUALITY RELATED ITEMS

SPECIFCATIONS

- GM COLOR SPECIFICATIONS TO BE USED
- ALL MARKED SURFACES WILL BE LABELED
- AREA IS RECTANGULAR, SLIGHTLY LARGER THAN ITEM FOOTPRINT
- CORNER BORDER OR SOLID BORDER USE OPTIONAL
- **FOR CORNER BORDER:**
  - *2”(50 MM) - 4”(100 MM) BORDER TO BE APPLIED TO (4) CORNERS*
  - *CORNERS TO BE AT LEAST 8” (200 MM) ON EACH SIDE*
  - *USE BLUE #2PMS286 PAINT FOR LABEL TEXT*
- **FOR SOLID BORDER:**
  - *2 ”(50 MM) - 4”(100 MM) BORDER TO OUTLINE OBJECT*
  - *USE WHITE #GMP01 PAINT FOR LABEL TEXT*

CORNER BORDER EXAMPLE

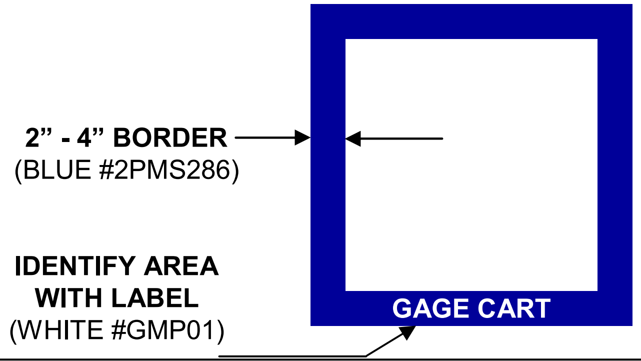


2” - 4” BORDER
(BLUE #2PMS286)

AT LEAST 8”
PER SIDE, TYPICAL

IDENTIFY AREA
WITH LABEL
(BLUE #2PMS286)

SOLID BORDER EXAMPLE



2” - 4” BORDER
(BLUE #2PMS286)

IDENTIFY AREA
WITH LABEL
(WHITE #GMP01)

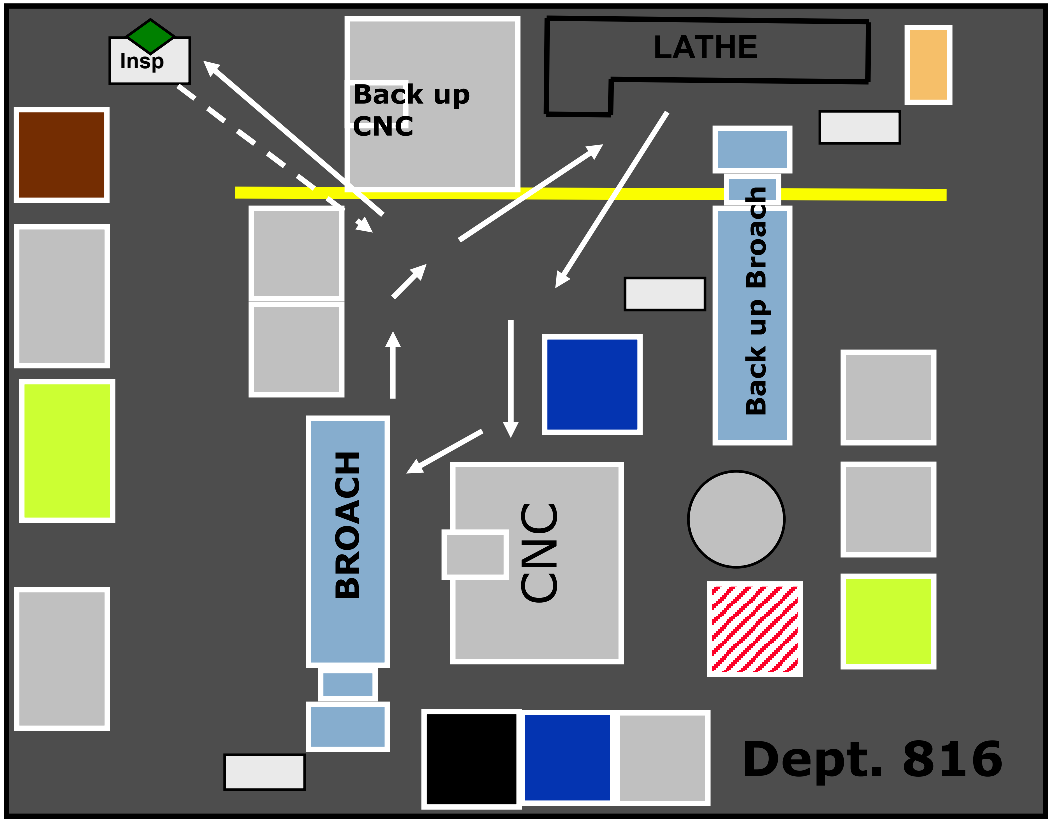
S-5: SUSTAIN – Ongoing compliance and continual improvement.

- Leadership commitment and involvement (top down).
- Drive 5S throughout the organization.
- Incorporate housekeeping into Operator Instructions.
- Training is the key to continual improvement.
- Establish formal housekeeping audit/checklists.
- Incorporate 5S compliance into a formal *Layered Process Audit* program.
- Keep trying to find a better way.

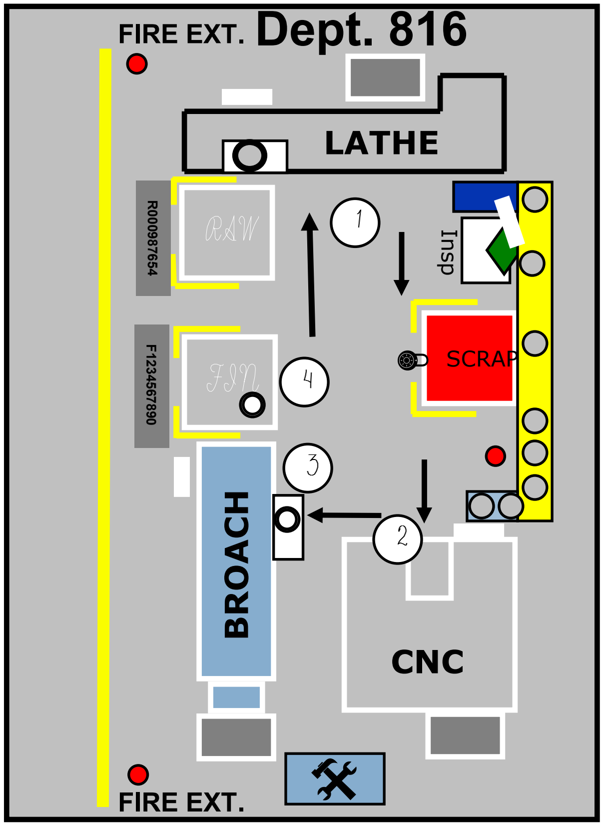
A well organized workplace is the best place to visualize your Standardized Work – work flow, operator movement, time, etc.

FLOOR LAYOUT (Example)

Before



After



Create a checklist:

5S Evaluation

(Example)

Date: ____________ Name : ______________________________ Area: ______________

Item No.	Description	5S Evaluation & Scoring Criteria Rating Scale: 0-5 (Poor = 0, Excellent = 5)	Item Score (0-5)	Notes for Next Level of Improvement
1	Removing Unnecessary Items	All items not necessary to performing work are removed from the workplace; only tools & products are present at work		
2	Storage of cleaning	All cleaning equipment is stored in a neat matter ; handy & easily available when needed.		
3	Floor cleaning	All floors are clean and free of debris, oil & dirt. Cleaning of floors is done routinely - - daily at a minimum.		
4	Bulletin boards	No outdated, torn or soiled announcements are displayed. All bulletins are arranged ina straight and neat manner.		
5	Emergency Access	Fire hoses and emergency equipment are unobstructed & stored in a prominent easy-to-locatemanner. Stop switches & breakers are marked or color-coded for easy visibility.		
6	Items on floor	Work-in-process, tools & any other material are not left to sit directly on the floor. Large items such as tote bins are positioned on the glance; lines are straight and at right angles with no chipped or soiled paint.		
7	Aislewys - marking	Aisles & walkways are clearly delineated and can be identified at a glance; lines are staight and at right angles with no chipped or soiled paint.		
8	Aislewys - maintenance	Aisles are always free of material & obstructions: nothing is ever placed on the lines & objects are always placed at right angles to the aisle lines.		
9	Storage & arrangement	Storage of boxed, containers & material is always neat at right angles. When items are stacked, they are never crooked or in danger of toppling over.		

React to Audit Findings:

(Example)

5-S Work Place Organization Audit Countermeasure Sheet (Continuous Improvement)

Item #	Date	Location	Problem Description	Owner	Countermeasure	Target date	Initials	Complete Date

STANDARDIZED OPERATIONS

4.3 WORKPLACE ORGANIZATION-5S

Visual Management of Out-of-Standard Conditions

4.4 STANDARDIZED WORK

4.4.1 – Standard Operation;

Major Steps, how long should it take? **(SOS)**

4.4.2 - OPERATOR INSTRUCTIONS;

Detailed Steps for What, How, and Why. (JES)

4.5 MANUFACTURING GAGE CONTROL

Product is qualified per plan to known standards & specifications

4.4 - STANDARDIZED WORK

Definition:

The document of work functions performed in a repeatable sequence, which are agreed to, developed, followed, and maintained by the functional organization.

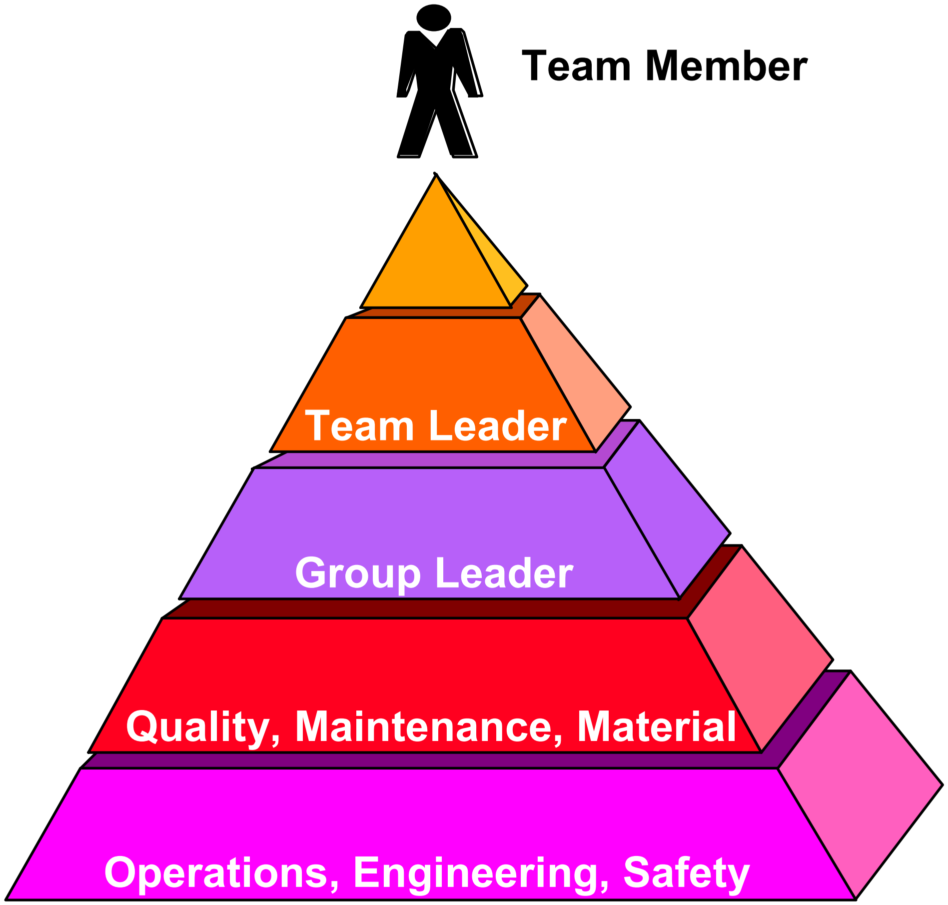
WITHOUT STANDARDIZED WORK

WITH STANDARDIZED WORK

Purpose:

To establish a repeatable, predictable baseline for continuous improvement and to involve the operator in both the initial and ongoing improvements to achieve the highest levels of safety, quality and productivity.

ORGANIZATIONAL FOCUS



Team Member

Team Leader

Group Leader

Quality, Maintenance, Material

Operations, Engineering, Safety

Team Member

Roles in Standardized Work

- Participate in developing Standardized Work (SW) & contribute ideas
- Suggest improvements to SW
- Provide feedback to Team Leader on SW
- Use SW as the basis for problem solving & training
- Follow Standardized Work

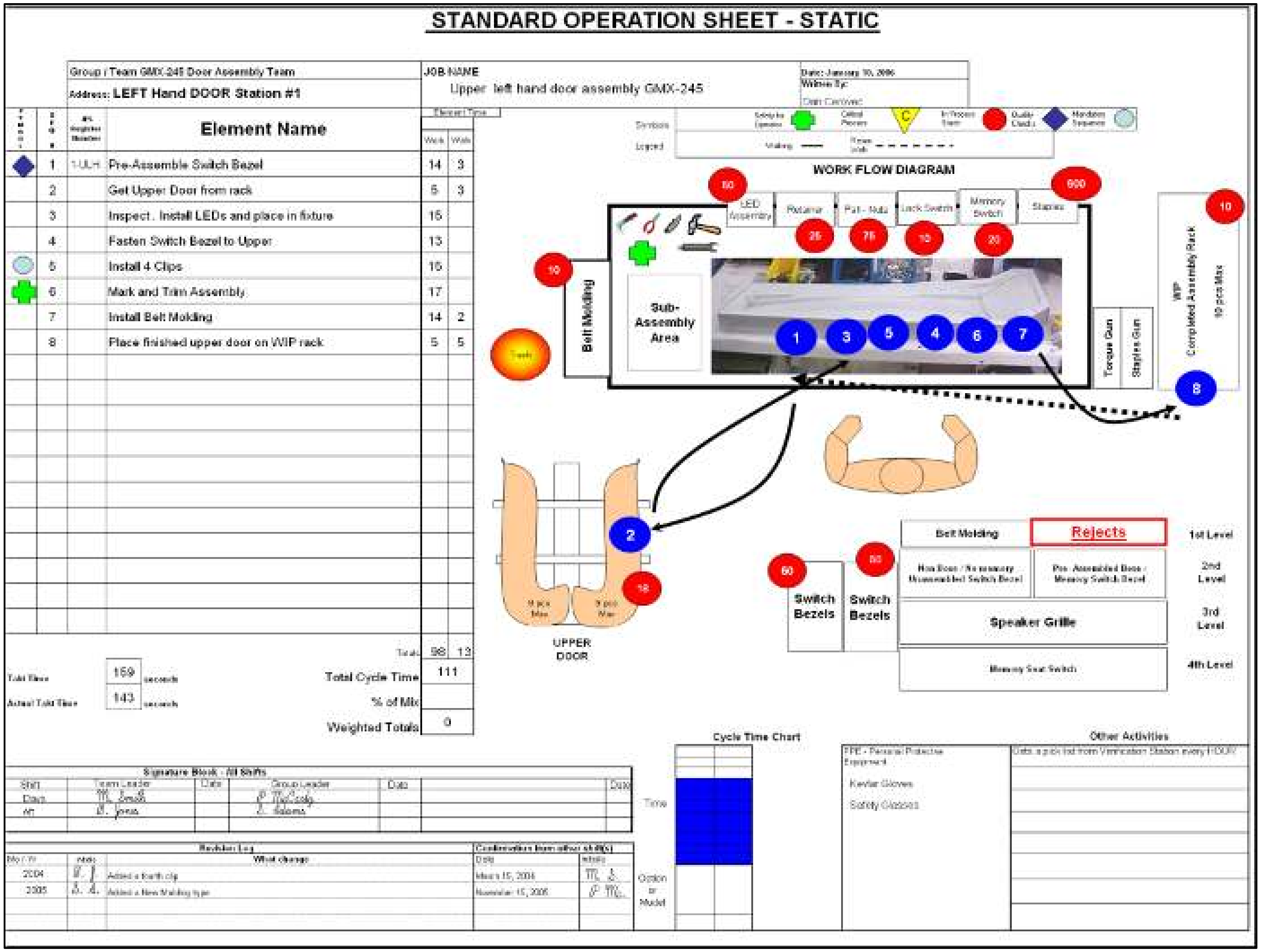
The function of everyone, including the Support Staffs, is to support production Team Members.

4.4.1 - STANDARDIZED WORK

STANDARDIZED WORK PROVIDES A FOUNDATION FOR:

- Ensuring operators are consistently performing tasks and procedures the same across all shifts and personnel.
- An efficient production sequence.
- Identifying value added tasks.
- Reduced variation within a process.
- *Waste* reduction, line balancing and quality built in station
- Continuous improvement and problem solving
- A lean organization
- Auditing operator conformance to work instructions *(Layered Process Audit).*

4.4.1 - STANDARDIZED WORK (Example)



STANDARD OPERATION SHEET - STATIC

Group / Team GMX-245 Door Assembly Team

Address: **LEFT Hand DOOR Station #1**

JOB NAME: Upper left hand door assembly GMX-245

Date: January 10, 2006

Written By: Dan Carlovec

[illegible]	[illegible]	[illegible]	**Element Name**	Work	Walk
◆	1	1-ULH	Pre-Assemble Switch Bezel	14	3
	2		Get Upper Door from rack	5	3
	3		Inspect . Install LEDs and place in fixture	15	
	4		Fasten Switch Bezel to Upper	13	
○	5		Install 4 Clips	15	
✚	6		Mark and Trim Assembly	17	
	7		Install Belt Molding	14	2
	8		Place finished upper door on WIP rack	5	5
			Totals	98	13

Takt Time: 159 seconds

Actual Takt Time: 143 seconds

Total Cycle Time: 111

% of Mix:

Weighted Totals: 0

Signature Block - All Shifts

Shift	Team Leader	Date	Group Leader	Date		Date
Days	M. Smith		[illegible] McCarty			
Aft	B. Jones		[illegible] Adams			

Revision Log

Mo / Yr	Initials	What change	Confirmation from other shift(s) Date	Initials
2004	[illegible]	Added a fourth clip	March 15, 2004	M. S.
2005	S. A.	Added a New Molding type	November 15, 2005	P. M.

Other Activities

PPE - Personal Protective Equipment	Gets a pick list from Verification Station every HOUR
Kevlar Gloves Safety Glasses	

4.4.1 - STANDARDIZED WORK

MANUAL VS ELECTRONIC STANDARDIZED WORK

- Team Leaders need to thoroughly understand the output (doing the work manually helps create this understanding).
- Documents should be easy to maintain.
- Documents should be flexible, easy to understand and visually depict all *waste* in the system.
- The Team Leaders' first responsibility is to support the operator (not a computer system).
- Many enablers are required to allow an electronic system to be more effective than manual development & maintenance.

USE PAPER and PENCIL PLEASE !!

4.4.1 - STANDARDIZED WORK

- Cross-functional team(s) shall identify and **list all operations** to implement Standardized Work.

  Examples of how to prioritize:
  - Customer Quality Concerns
  - Necessity for a Defined sequence or method of work
  - Off-line Rework
  - High RPN
  - Employee Flow-through

- Cross-functional teams shall develop Standardized Work.

- Impacted and new employees shall be trained in the use of Standardized Work *(Standard Operator Training).*

- Cross-functional team(s) shall continuously develop and improve Standardized Work.

4.4.1- STANDARDIZED WORK

STANDARD OPERATION SHEET (SOS)

Definition:

- The agreed upon order of the job elements a team member follows in order to maximize safety, quality & efficiency
- A team member-*based* document that organizes job elements into a sequence that can be successfully repeated.

This document (standard) can then be used for:

- Training new team members
- Analyzing jobs for improvement opportunity
- Auditing (*Layered Process Audits*)
- Problem solving

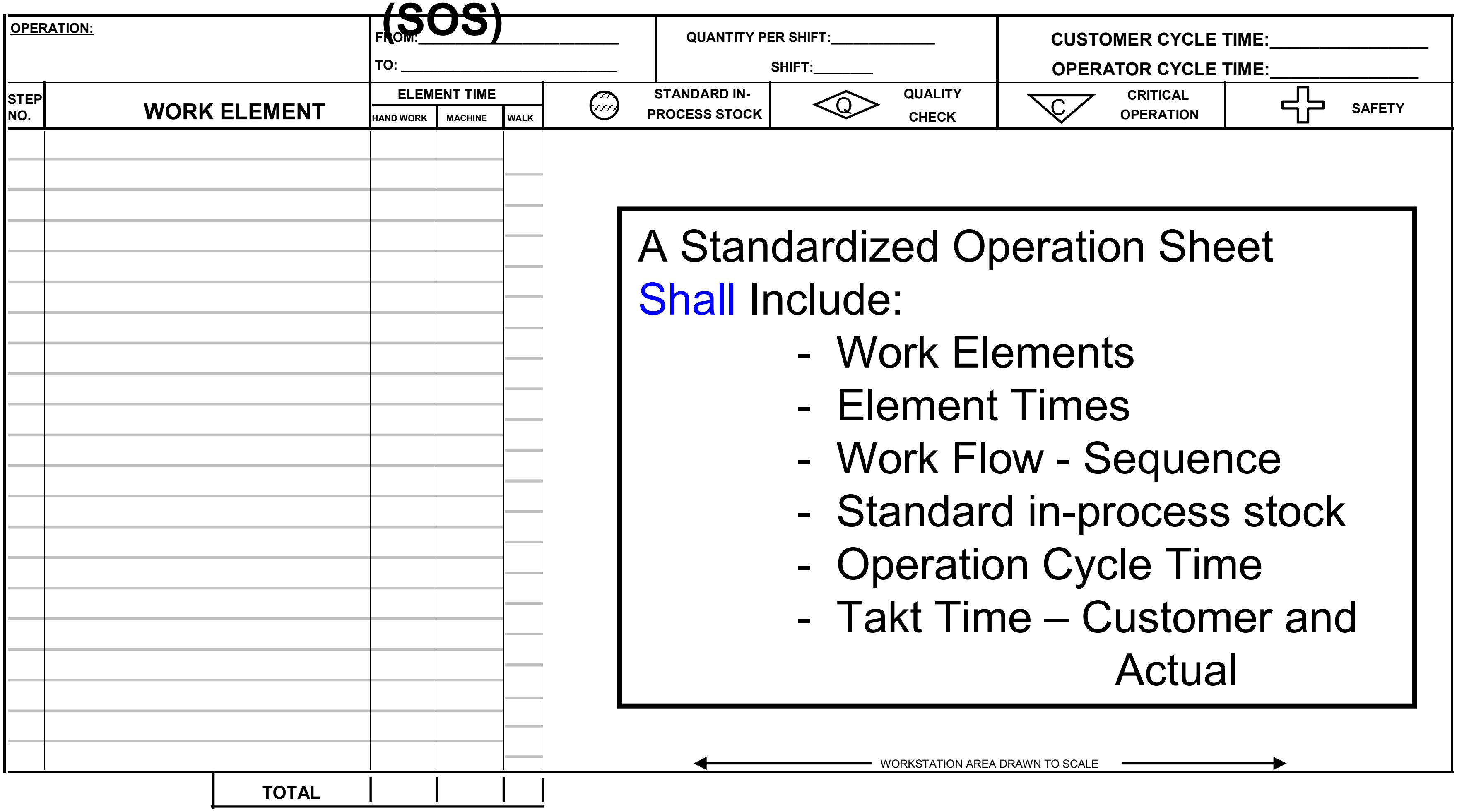
The advantages of the SOS sheet:

- Summary of the current best method
- Visual control tool
- Basis for problem solving
- Makes visible the *waste* in a process
- Training tool to instruct new team members

4.4.1 - STANDARDIZED WORK

(Example)

Standard Operation Sheet (SOS)



OPERATION:

FROM: ____________

TO: ____________

QUANTITY PER SHIFT: ____________

SHIFT: ________

CUSTOMER CYCLE TIME: ____________

OPERATOR CYCLE TIME: ____________

STEP NO.	WORK ELEMENT	ELEMENT TIME			STANDARD IN-PROCESS STOCK	Q QUALITY CHECK	C CRITICAL OPERATION	SAFETY
		HAND WORK	MACHINE	WALK				
	TOTAL							

WORKSTATION AREA DRAWN TO SCALE

A Standardized Operation Sheet Shall Include:

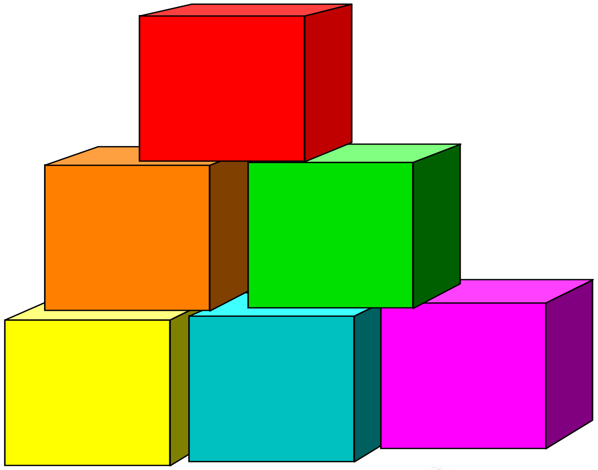
- Work Elements
- Element Times
- Work Flow - Sequence
- Standard in-process stock
- Operation Cycle Time
- Takt Time – Customer and Actual

4.4.1 - STANDARDIZED WORK

ELEMENT DEFINITION

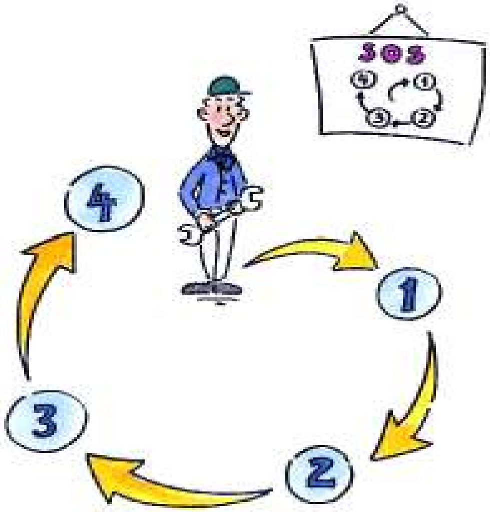
A work element is a logical grouping of actions that advances work to its successful completion

Elements are the basic building blocks of SW. They are used during training to teach the job in manageable chunks.



Work Sequence

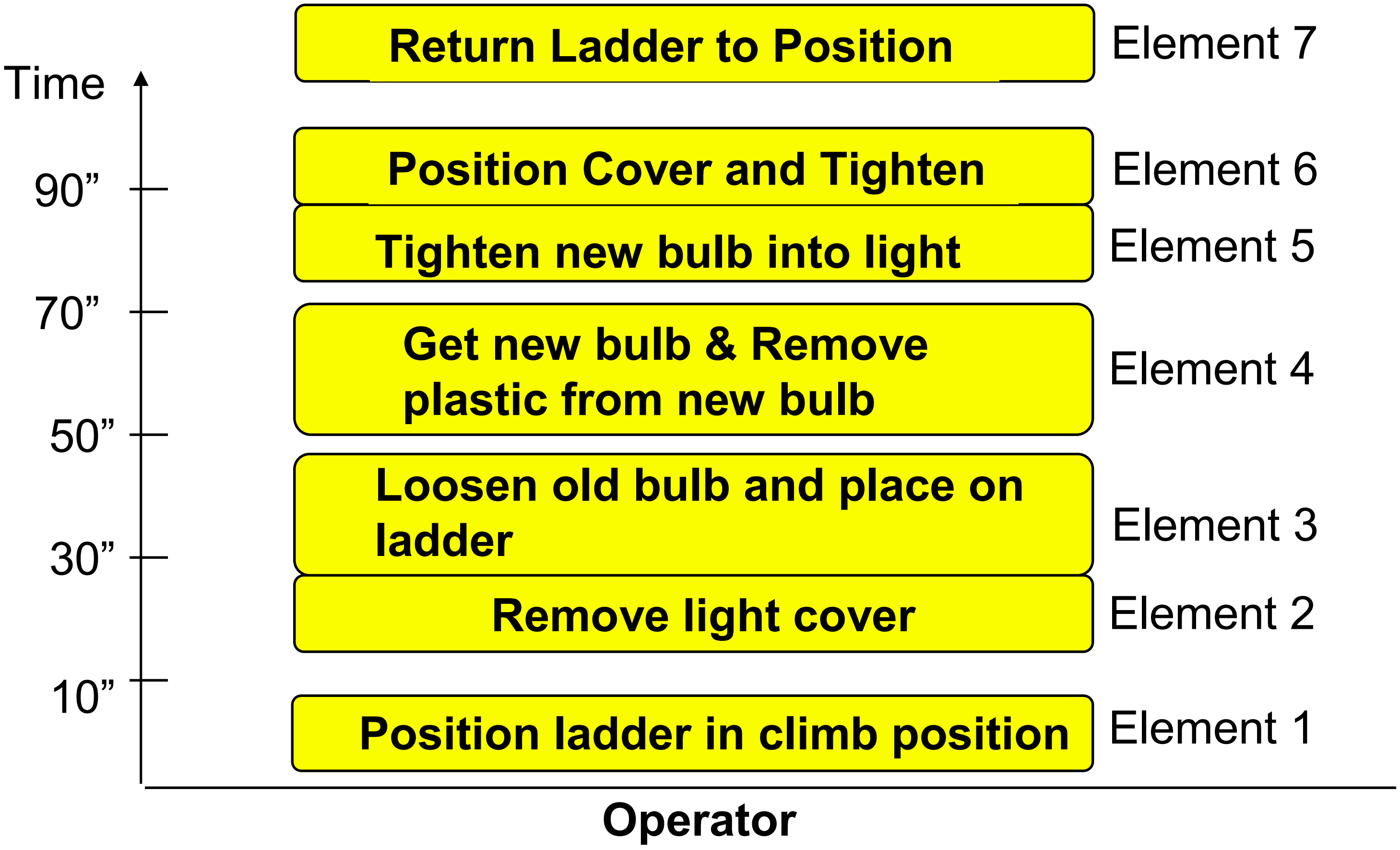
Agreed upon order in which work is done to maximize safety, quality, and efficiency.



WORK ELEMENTS (Example)

Any Job can be broken down into job elements. . .

Changing a light bulb



Return Ladder to Position	Element 7
Position Cover and Tighten	Element 6
Tighten new bulb into light	Element 5
Get new bulb & Remove plastic from new bulb	Element 4
Loosen old bulb and place on ladder	Element 3
Remove light cover	Element 2
Position ladder in climb position	Element 1

4.4.1 - STANDARDIZED WORK

KEYS TO BUILDING WORK ELEMENTS

Factors to consider:

- Geographic build location
- Product grouping
- Time required to complete the element
- Walking is not an element, and usually not included in element sheets.
- The first element in any job can be, “read manifest and get parts”.
- Don’t automatically use the groupings as described in your current engineering Standardized Work. Use common sense to break the job down the way you think of it every day.

4.4.1 - STANDARDIZED WORK

TAKT TIME

Total available Production Time per shift/day: MINUS Breaks and Lunches

Definition:

The maximum time available to produce a product or service based on customer demand.

GM Assembly Plant DEMAND in <u>pieces</u> per shift/day

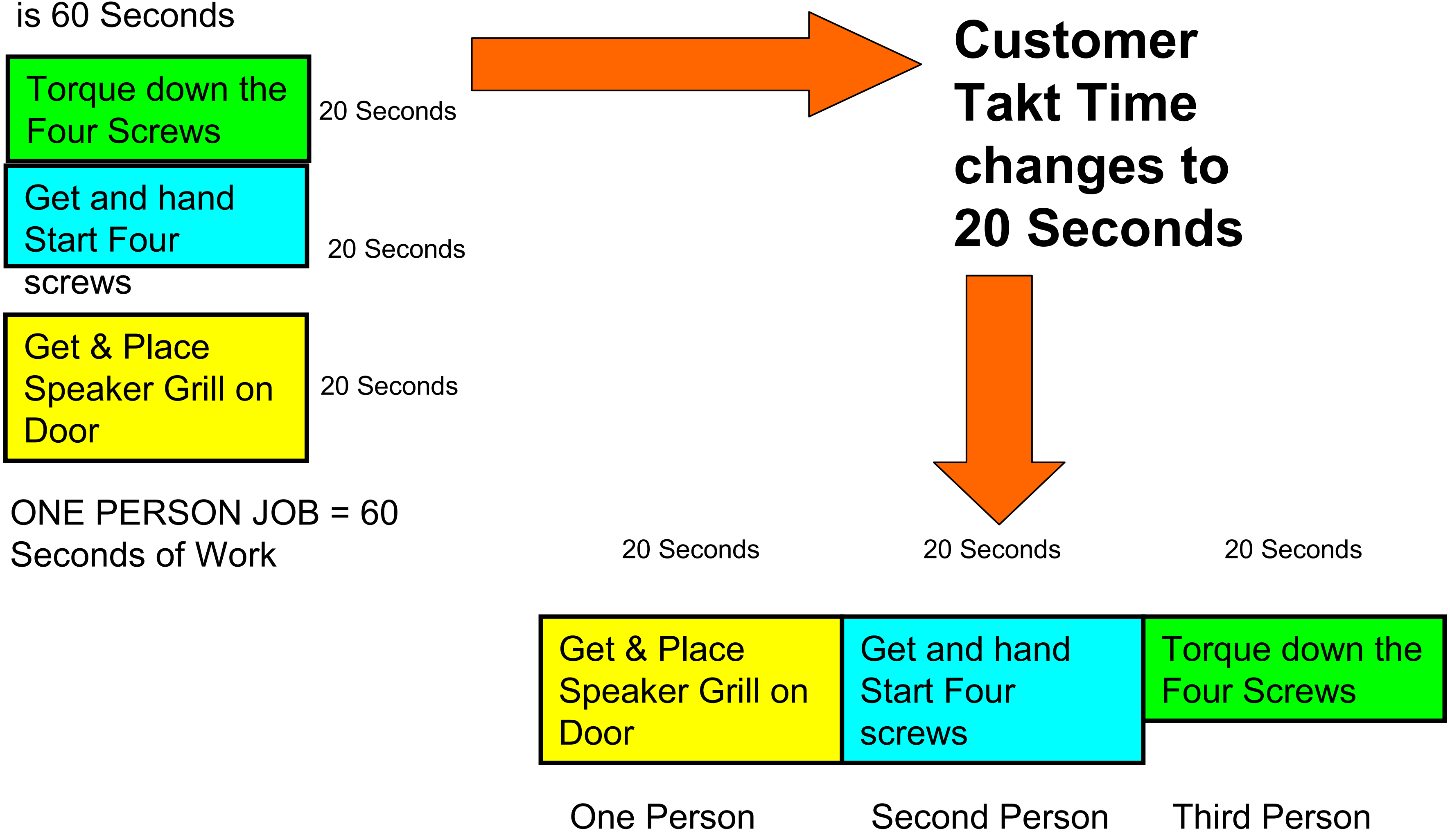
<u>Formula:</u>

$$TT = \frac{\text{Production Time Available Per Period}}{\text{Customer Demand Per Period}}$$

4.4.1 - STANDARDIZED WORK

WORK ELEMENT (Example)

Customer Takt Time is 60 Seconds



Torque down the Four Screws — 20 Seconds

Get and hand Start Four screws — 20 Seconds

Get & Place Speaker Grill on Door — 20 Seconds

ONE PERSON JOB = 60 Seconds of Work

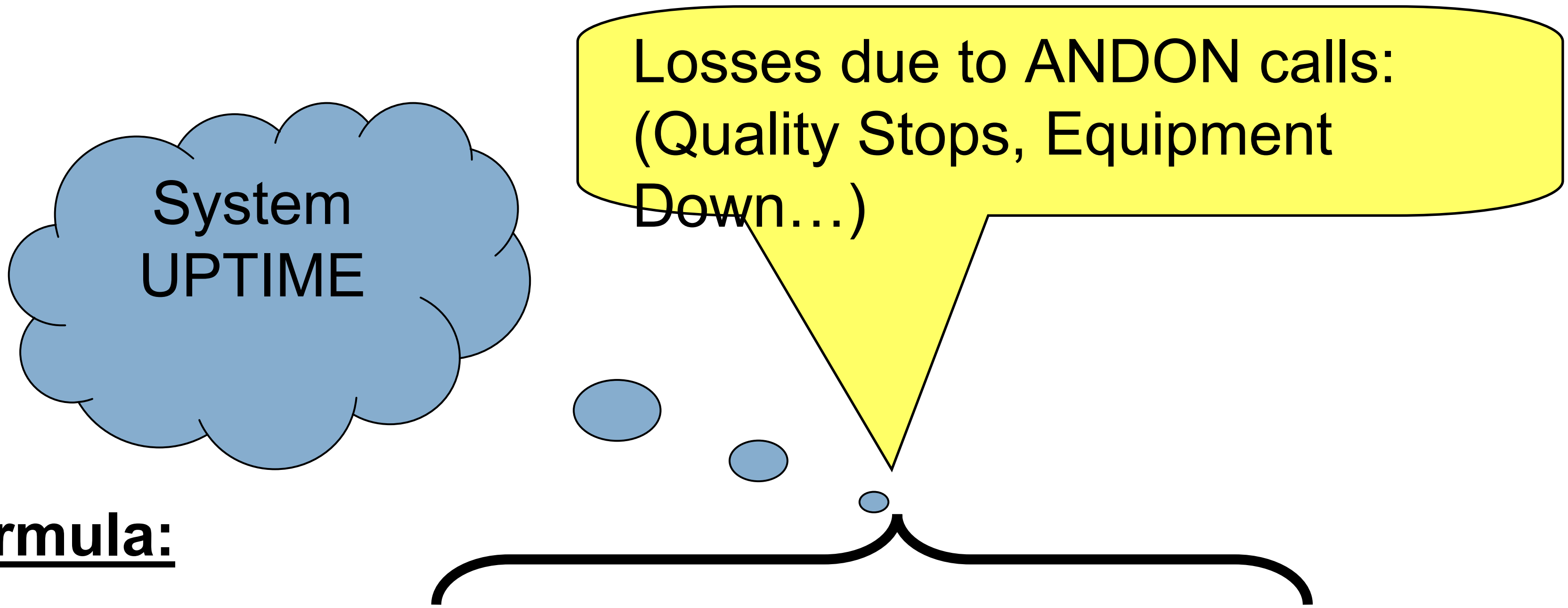
Customer Takt Time changes to 20 Seconds

20 Seconds	20 Seconds	20 Seconds
Get & Place Speaker Grill on Door	Get and hand Start Four screws	Torque down the Four Screws
One Person	Second Person	Third Person

4.4.1 - STANDARDIZED WORK

Actual Takt Time (ATT)

Definition: The planned time available to produce a product or service after accounting for system losses.



System UPTIME

Losses due to ANDON calls: (Quality Stops, Equipment Down…)

Formula:

$$\text{ATT} = \overbrace{\mathbf{(1 - System\ Losses\ \%)} \times \mathbf{Takt\ Time}}$$

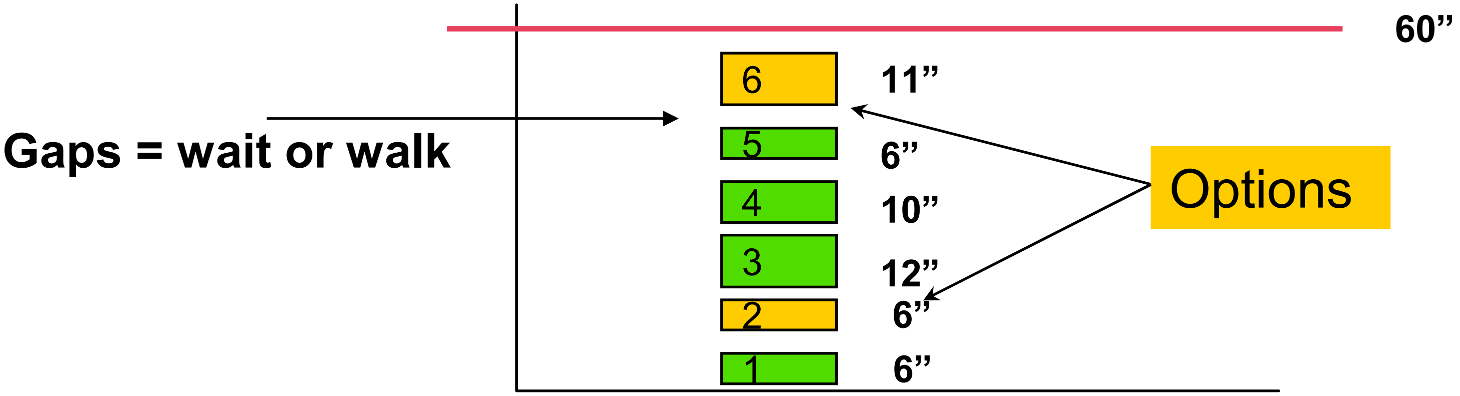
4.4.1 - STANDARDIZED WORK

ELEMENT TIME

Time Required to Complete the Element:

- A rough guideline could be to set element size to about 10% of the job (ATT) .

(Example)



GM Assembly - Customer

Takt Time

Customer Requirement - DEMAND

392 Finished CARS per Shift

Time Available to Produce CARS

480 min. - Breaks & Lunches

435 min. available to produce cars

$$TT = \frac{435 \text{ Minutes}}{392 \text{ Cars per shift}} \text{ X } 60 \text{ Sec.}$$

= 66.5 Seconds to produce one car
if there was **NO WASTE** in the System

Actual Takt Time

System Losses:

Down Time due to ANDON Calls

10% Down Time = 43 Min.

System Uptime = 100% - 10% = 90%

ATT = (90% system uptime) X (66.5 Sec.)

= 59.9 Seconds to produce one car
with 10% WASTE in the System

Can the "Time Available To Produce" be different between GM & supplier?

Supplier Calculations

Takt Time

Customer Requirement - DEMAND

392 Finished INSTRUMENT PANELS per Shift

Time Available to Produce INSTRUMENT PANELS

480 min. - Breaks & Lunches

450 min. available to produce INSTRUMENT PANELS

$$TT = \frac{450 \text{ Minutes}}{392 \text{ INSTRUMENT PANELS per shift}} \text{ X } 60 \text{ Sec.}$$

= 68.9 Seconds to produce one INSTR. PANEL
if there was **NO WASTE** in the System

Actual Takt Time

System Losses:

Down Time due to ANDON Calls

10% Down Time = 45 Min.

System Uptime = 100% - 10% = 90%

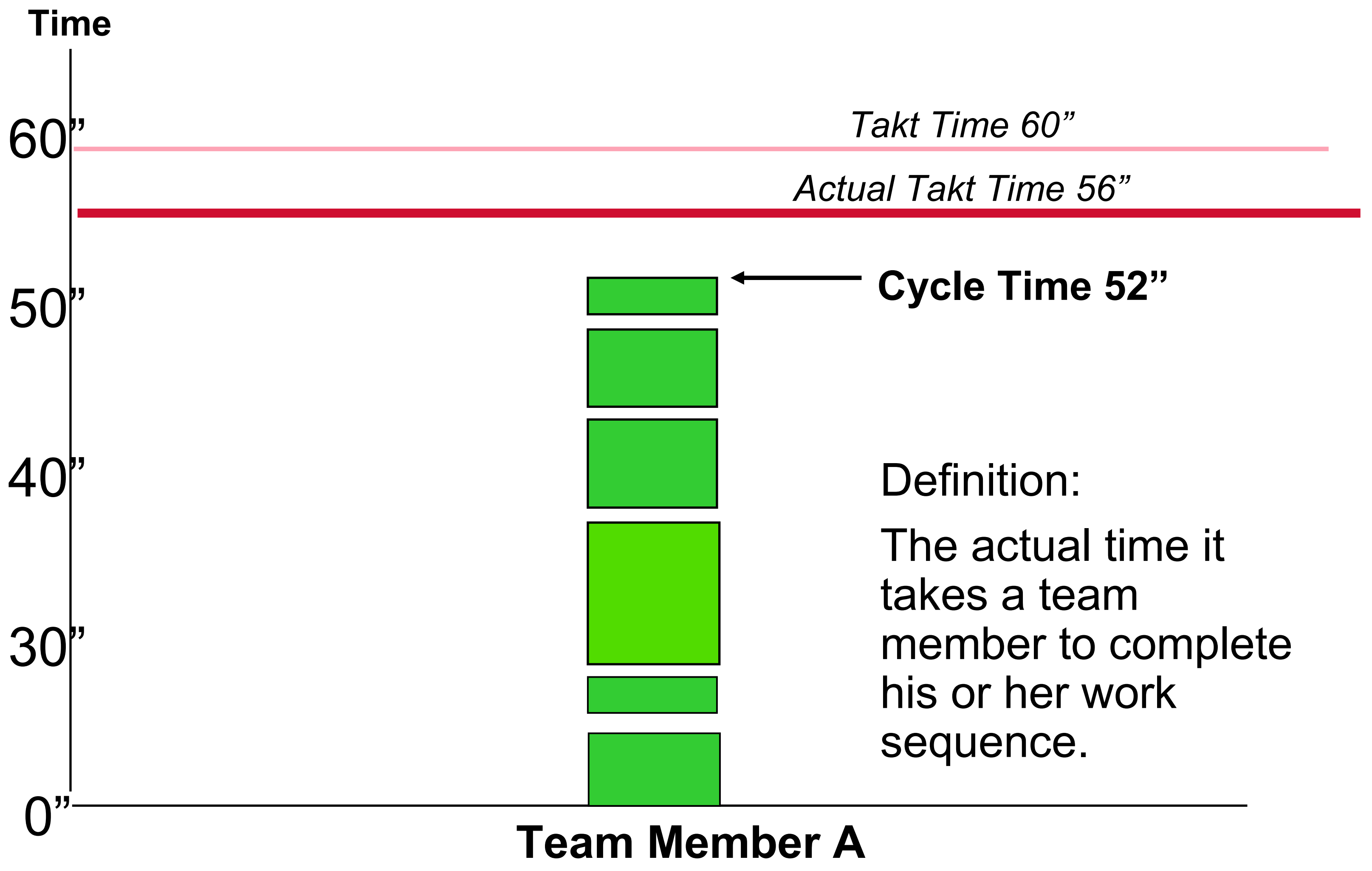
ATT = (90% system uptime) X (68.9 Sec.)

= 62.0 Seconds to produce one INSTR. PANEL
with 10% WASTE in the System

Can the Supplier ATT be slower than GM?

4.4.1 - STANDARDIZED WORK

CYCLE TIME



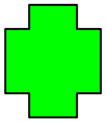
Definition:

The actual time it takes a team member to complete his or her work sequence.

4.4.1 - STANDARDIZED WORK

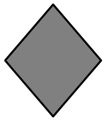
STANDARD OPERATING SYMBOLS

Place symbols on the layout as appropriate:



- Safety

  As Indicated on Job Element Sheet

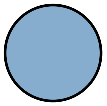


- Quality Check

  100% Gauging / Testing

- Standard In-Process Stock- (Minimum in one container at workstation)

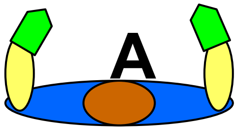
- Critical Operation



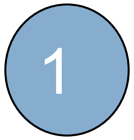
- Mandatory Sequence

WORK FLOW

Add team member work path to the layout



– Identify Team Member/process



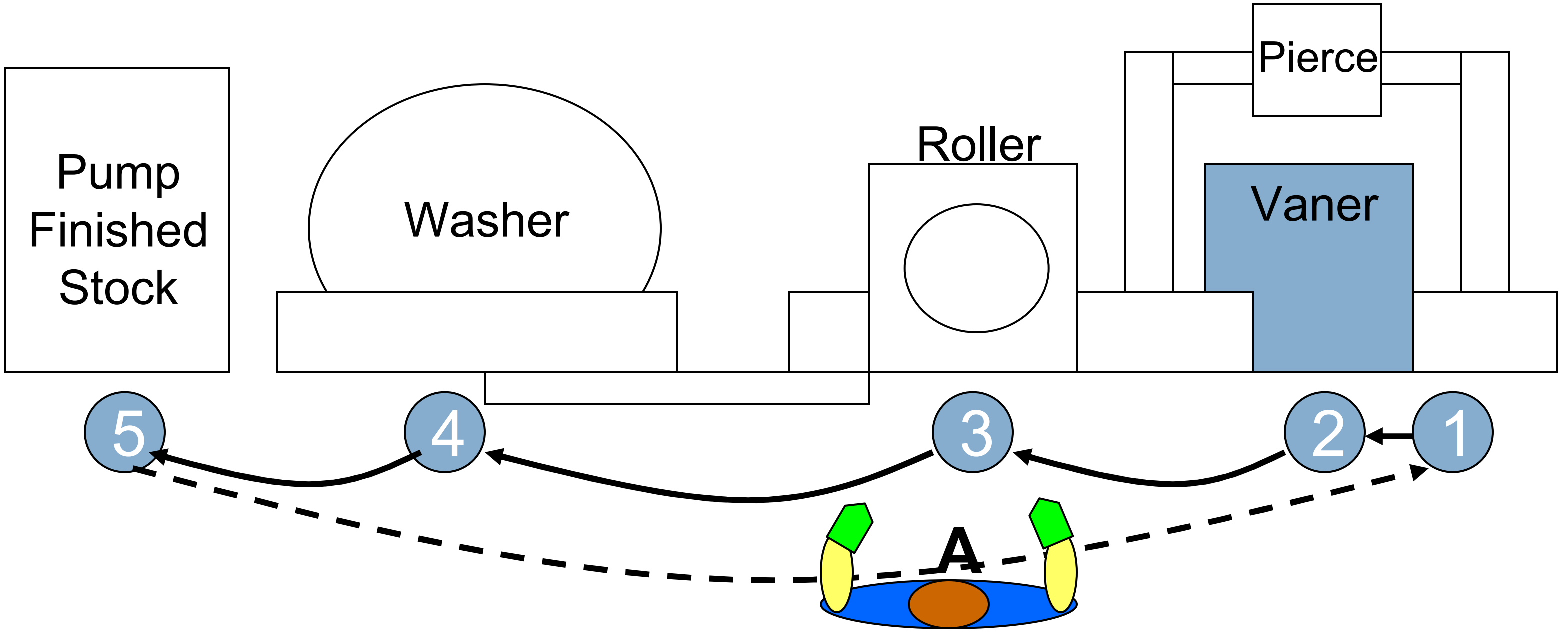
– Identify location where each job element is performed

– Indicate forward walk path through process

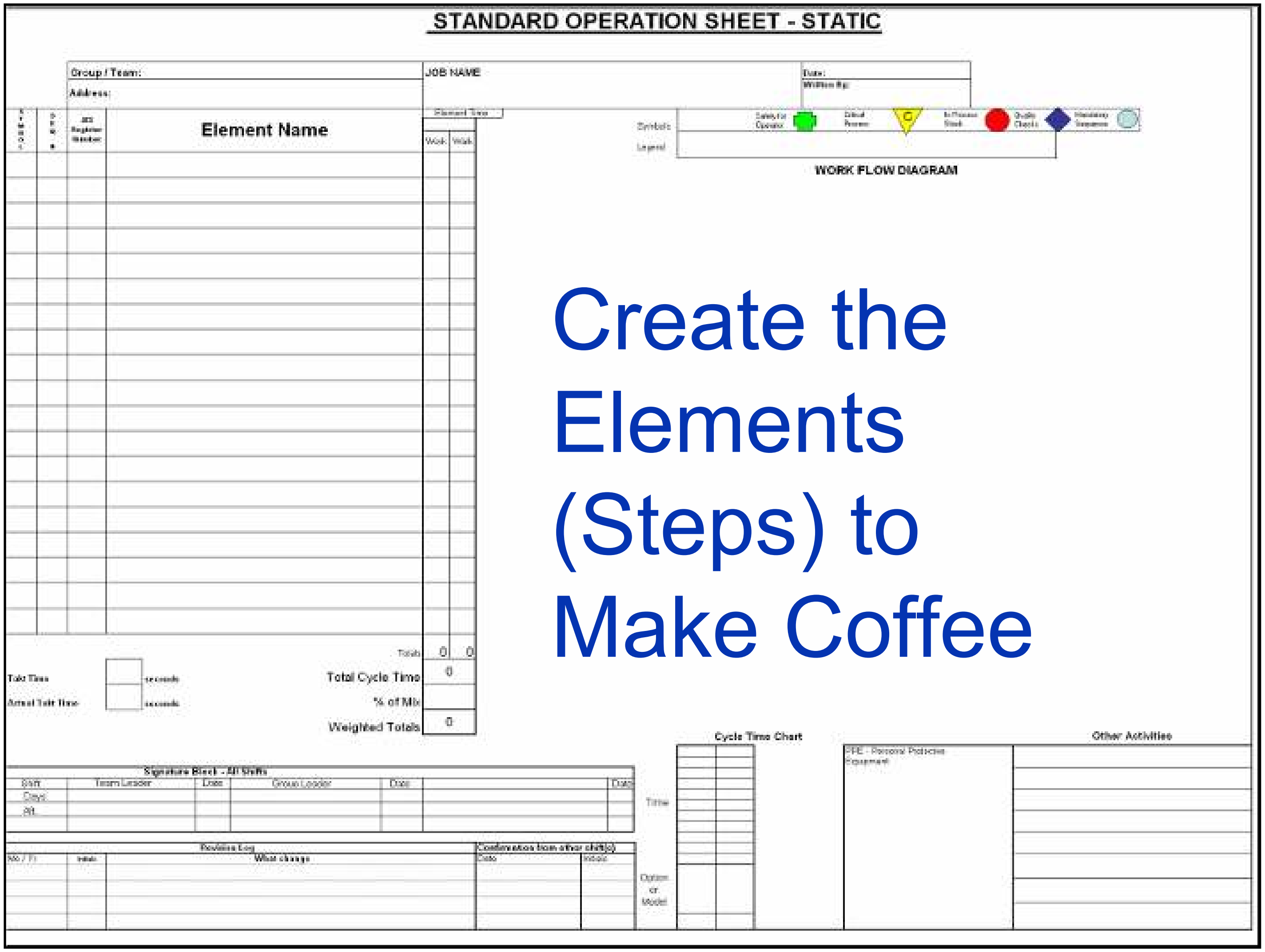
– Indicate return walk path from last job element to first

4.4.1 - STANDARDIZED WORK

WORK FLOW



CLASS EXERCISE



STANDARD OPERATION SHEET - STATIC

Group / Team:

Address:

JOB NAME

Date:

Written By:

Element Name

Element Time

Work | Walk

Symbols

Legend

Safety for Operator

Critical Process

In Process Stock

Quality Checks

Standard Sequence

WORK FLOW DIAGRAM

Totals 0 0

Takt Time seconds

Actual Takt Time seconds

Total Cycle Time 0

% of Mix

Weighted Totals 0

Cycle Time Chart

Time

Option or Model

Other Activities

PPE - Personal Protective Equipment

Signature Block - All Shifts

Shift | Team Leader | Date | Group Leader | Date | Date

Days

Aft.

Revision Log

What change

Initials

Confirmation from other shift(s)

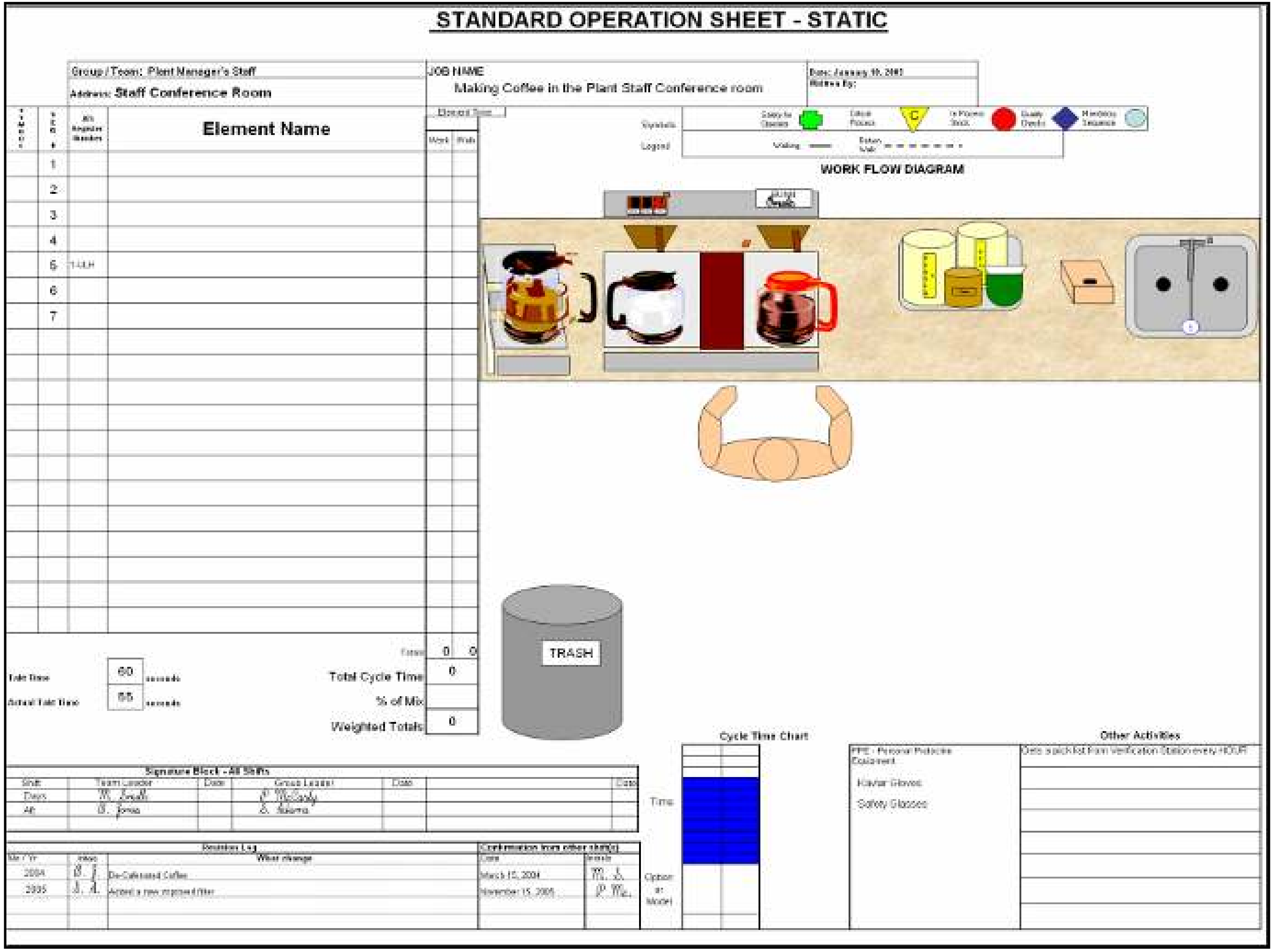
Date | Initials

Create the Elements (Steps) to Make Coffee

4.4.1 - STANDARDIZED WORK

Standard Operation Sheet

(Example)



STANDARD OPERATION SHEET - STATIC

Group / Team: Plant Manager's Staff
Address: Staff Conference Room

JOB NAME
Making Coffee in the Plant Staff Conference room

Element Name

Work | Walk

1
2
3
4
5
6
7

WORK FLOW DIAGRAM

Symbols
Legend

Totals 0 0

Takt Time 60 seconds
Actual Takt Time 55 seconds

Total Cycle Time 0
% of Mix
Weighted Totals 0

Signature Block - All Shifts

Shift	Team Leader	Date	Group Leader	Date		Date
Days	M. Smith		P. McCarty			
Aft	B. Jones		S. Adams			

Revision Log | Confirmation from other shift(s)

Cycle Time Chart

Time

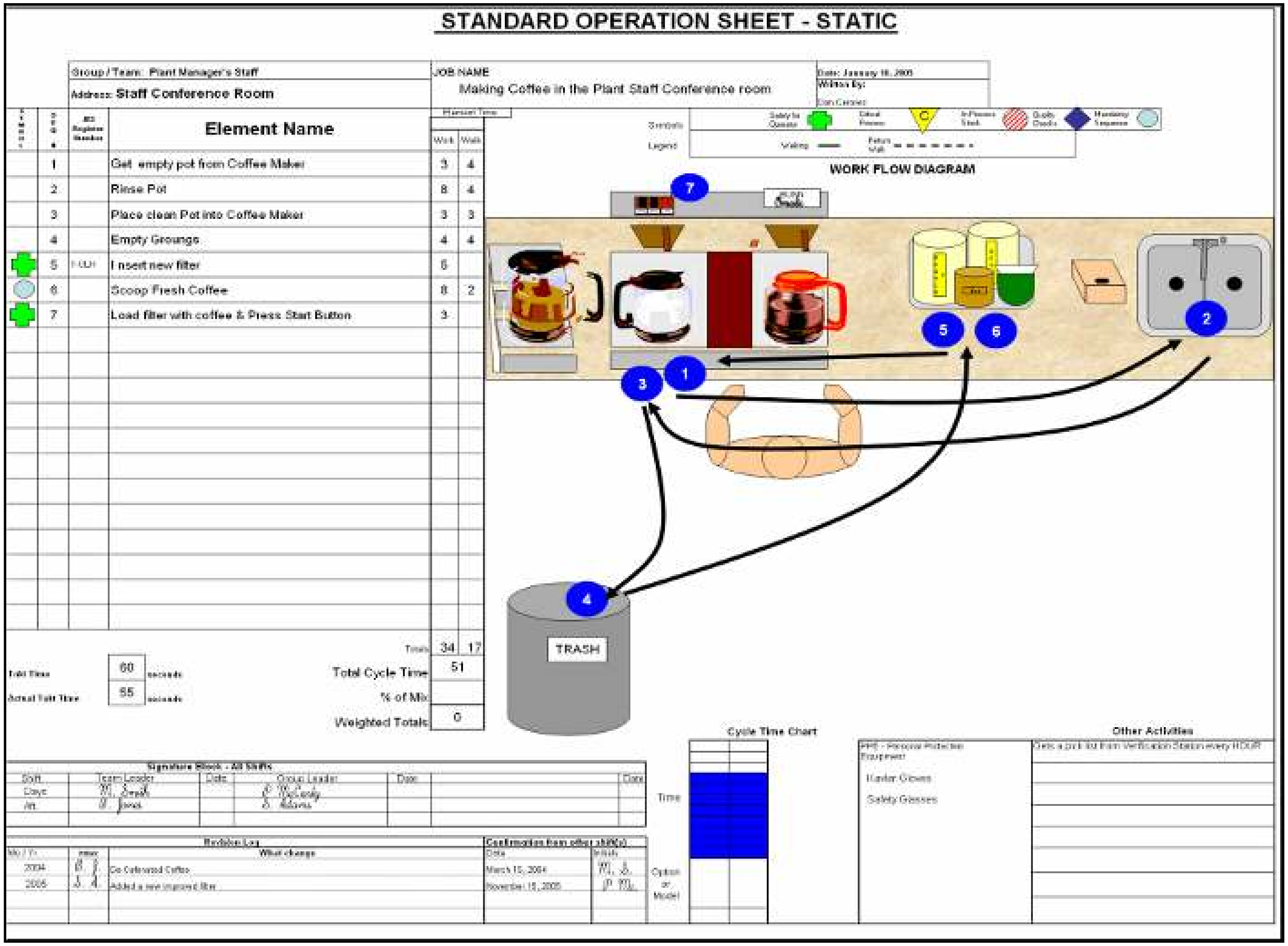
Option or Model

PPE - Personal Protective Equipment
Kevlar Gloves
Safety Glasses

Other Activities

4.4.1 - STANDARDIZED WORK

(Example)



STANDARD OPERATION SHEET - STATIC

Group / Team: Plant Manager's Staff

Address: Staff Conference Room

JOB NAME

Making Coffee in the Plant Staff Conference room

Date: January 18, 2005

Written By:

Dan Carsten

Symbols	Seq #	JIS Register Number	Element Name	Work	Walk
	1		Get empty pot from Coffee Maker	3	4
	2		Rinse Pot	8	4
	3		Place clean Pot into Coffee Maker	3	3
	4		Empty Groungs	4	4
✚	5	FJLH	I nsert new filter	5	
○	6		Scoop Fresh Coffee	8	2
✚	7		Load filter with coffee & Press Start Button	3	
			Totals	34	17
			Total Cycle Time	51	
			% of Mix		
			Weighted Totals	0	

Manual Time

Takt Time 60 seconds

Actual Takt Time 55 seconds

Signature Block - All Shifts

Shift	Team Leader	Date	Group Leader	Date		Date
Days	M. Smith		C. McCurdy			
Aft.	B. Jones		S. Adams			

Revision Log

Mo / Yr	Initials	What change	Date	Initials
2004	B. J.	Go Caffeinated Coffee	March 15, 2004	M. S.
2005	S. A.	Added a new improved filter	November 15, 2005	P. M.

Confirmation from other shift(s)

Cycle Time Chart

Time

Option or Model

PPE - Personal Protective Equipment

Kevlar Gloves

Safety Glasses

Other Activities

Gets a pick list from Verification Station every HOUR

DISPLAY OF STANDARDIZED WORK (SOS)

Standardized Work **shall** be displayed at or near each operation.

- Operations performed same way every time.
- Reduces the risk of omitting components.
- Quality checks and frequency are indicated.
- Process improvements easily identified.

WORK ELEMENTS

OPERATOR MOVEMENT

- Training is simplified and consistent.
- Reminds operator of correct sequence.
- Alerts operator to safety concerns.
- Assures operator is following approved process *(Layered Process Audits).*

- Assures leadership operation is running as approved.
- Operator knows if equipment is showing signs of wear.
- Machine and operator hand work and walk time separated.
- Time allocated for quality checks are included.

OPERATION CYCLE TIME

Standardized Work provides a basis for effective Operator Instructions.

STANDARDIZED OPERATIONS

4.3 WORKPLACE ORGANIZATION-5S

Visual Management of Out-of-Standard Conditions

4.4 STANDARDIZED WORK

4.4.1 – Standard Operation;

Major Steps, how long should it take? **(SOS)**

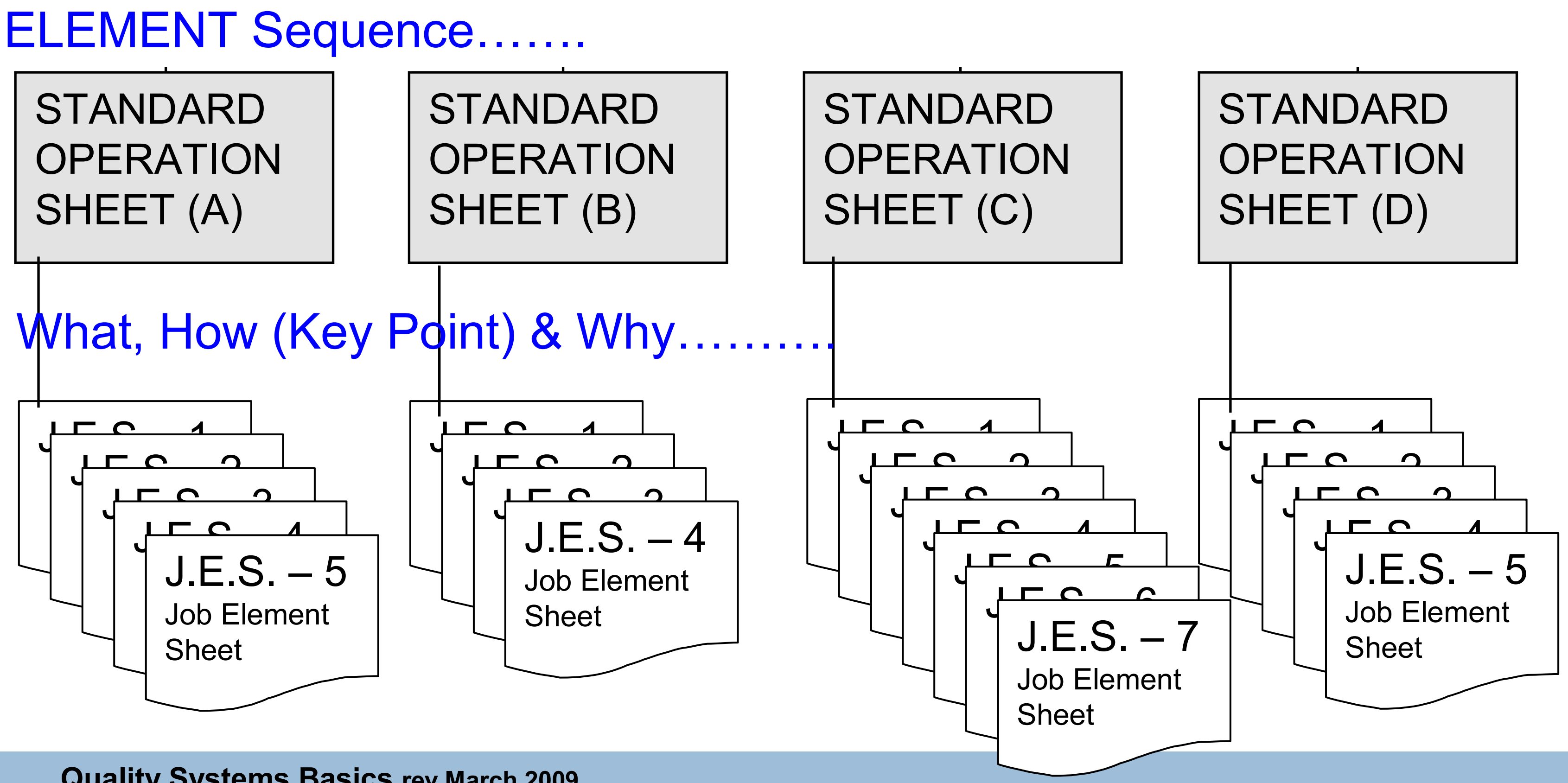
***4.4.2* - OPERATOR INSTRUCTIONS;**

***Detailed Steps for What, How, and Why.* (JES)**

4.5 MANUFACTURING GAGE CONTROL

Product is qualified per plan to known standards & specifications

STANDARDIZED WORK DOCUMENTS



ELEMENT Sequence…….

STANDARD OPERATION SHEET (A)

STANDARD OPERATION SHEET (B)

STANDARD OPERATION SHEET (C)

STANDARD OPERATION SHEET (D)

What, How (Key Point) & Why……….

J.E.S. – 1
J.E.S. – 2
J.E.S. – 3
J.E.S. – 4
J.E.S. – 5
Job Element Sheet

J.E.S. – 1
J.E.S. – 2
J.E.S. – 3
J.E.S. – 4
Job Element Sheet

J.E.S. – 1
J.E.S. – 2
J.E.S. – 3
J.E.S. – 4
J.E.S. – 5
J.E.S. – 6
J.E.S. – 7
Job Element Sheet

J.E.S. – 1
J.E.S. – 2
J.E.S. – 3
J.E.S. – 4
J.E.S. – 5
Job Element Sheet

JOB ELEMENT SHEET

Definition:

A user friendly document that provides detailed information on a specific element of work to ensure the successful execution of that element.

Purpose:

To provide detailed training information for new team members.

To bridge the gap between engineering information and shop floor knowledge.

To provide a written history of that element.

To provide a baseline for auditing, problem solving, continuous improvement, rebalancing of work and documentation transfer.

OPERATOR INSTRUCTIONS

Where to use operator instructions?

Operator instructions are commonly available for:

- manufacturing and assembly
- inspection and data collection
- pack out
- laboratory

Often overlooked activities include:

- offline rework and containment
- set-up and change-over events
- prototype and engineering activities
- process labeling points
- material handling
- shipping and receiving
- maintenance/repair
- office

JOB ELEMENT SHEET

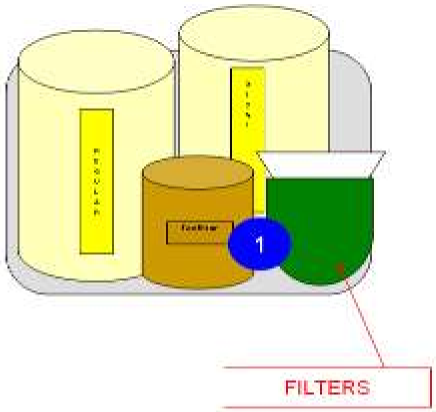
VEH.	PAD	Stn # - Reg #
GMX-245		1-ULH
		Page _1_ of _1_

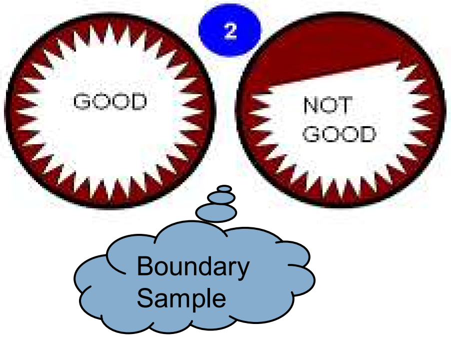
Element Name: Option: ○ Basic: ●

5 - Insert new filter

Symbols: Safety for Operator ✚ Quality Checks ◆ Critical Process C Mandatory Sequence ○

Written by: Dan Cerovec





Symbol	Step #	Major Step (What)	Key Point (How)	Reason (Why)
✚	1	Get Filter	Moisten Fingers under tap water and then separate filters from each other	Filters are very thin and will stick together. Moist fingers will help separate them.
			Do not BLOW on fiters to separate them.	Could spread germs
			Do not LICK fingers to separate filters	Could spread germs
◆	2	Align filter with wall of basket.	Make sure the filter is pressing against the edge of the filter basket.	Filter could fold over while the Coffee is brewing, and the Coffee grounds could get into the coffee pot

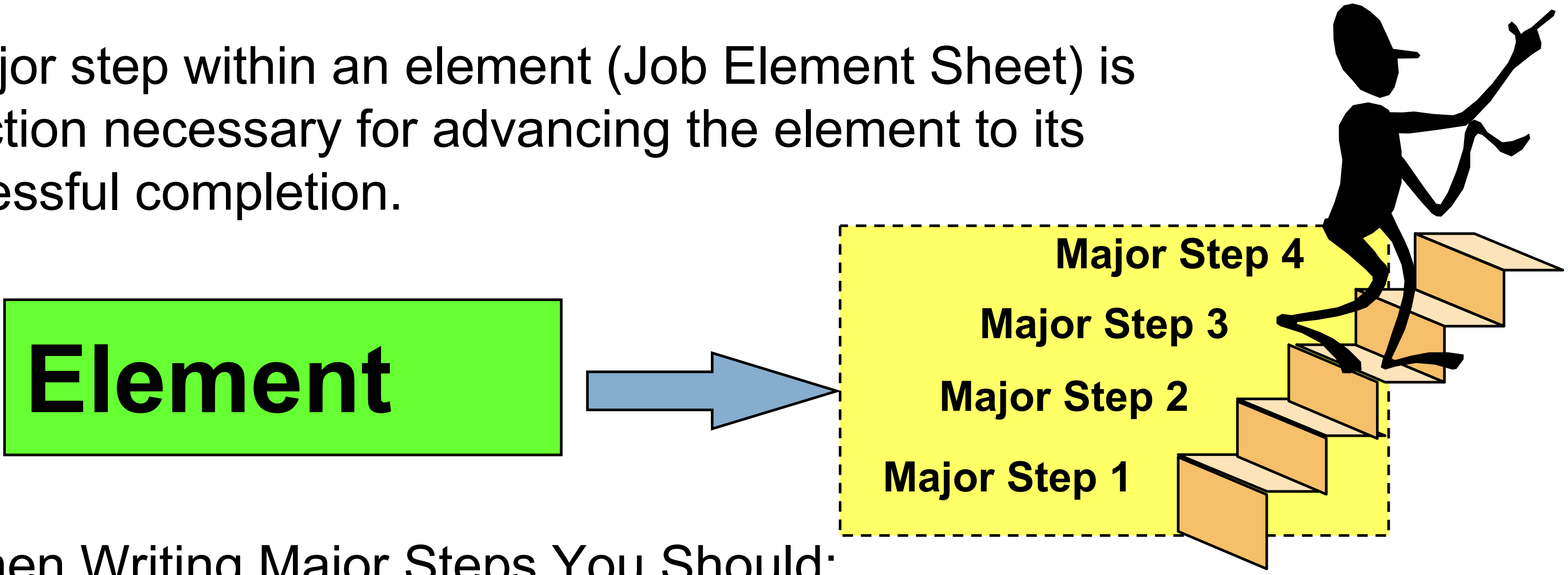
		Team Leader	Group Leader
Shift	Sign.	M. Smith	P McCarly
	Date	March-16-05	March-16-05
Shift	Sign.	E. Jones	S. Adams
	Date	March-15-05	March-15-05
Shift	Sign.	J. Bon	J. Walker
	Date	March-14-05	March-14-05

Station # history:	#1-Upper-LH	#1-Upper-LH		
Work Time history (in seconds):	3	5		
Date of change	January-05-05	March-16-05		

Name	Signature	Description of change
M. Smith	M. Smith	Added aligning of the filter

MAJOR STEPS - WHAT

A major step within an element (Job Element Sheet) is an action necessary for advancing the element to its successful completion.



Element

Major Step 4

Major Step 3

Major Step 2

Major Step 1

- When Writing Major Steps You Should:
  - Be brief
  - Describe a single action
  - Avoid use of abbreviations, acronyms and jargon

Examples:

- Place part in fixture.
- Rotate jog switch to the Run position.
- Press Start Cycle button

KEY POINTS - HOW

Key Points describe how to perform a step (not all steps require Key Points).

Examples of when to write Key Points:

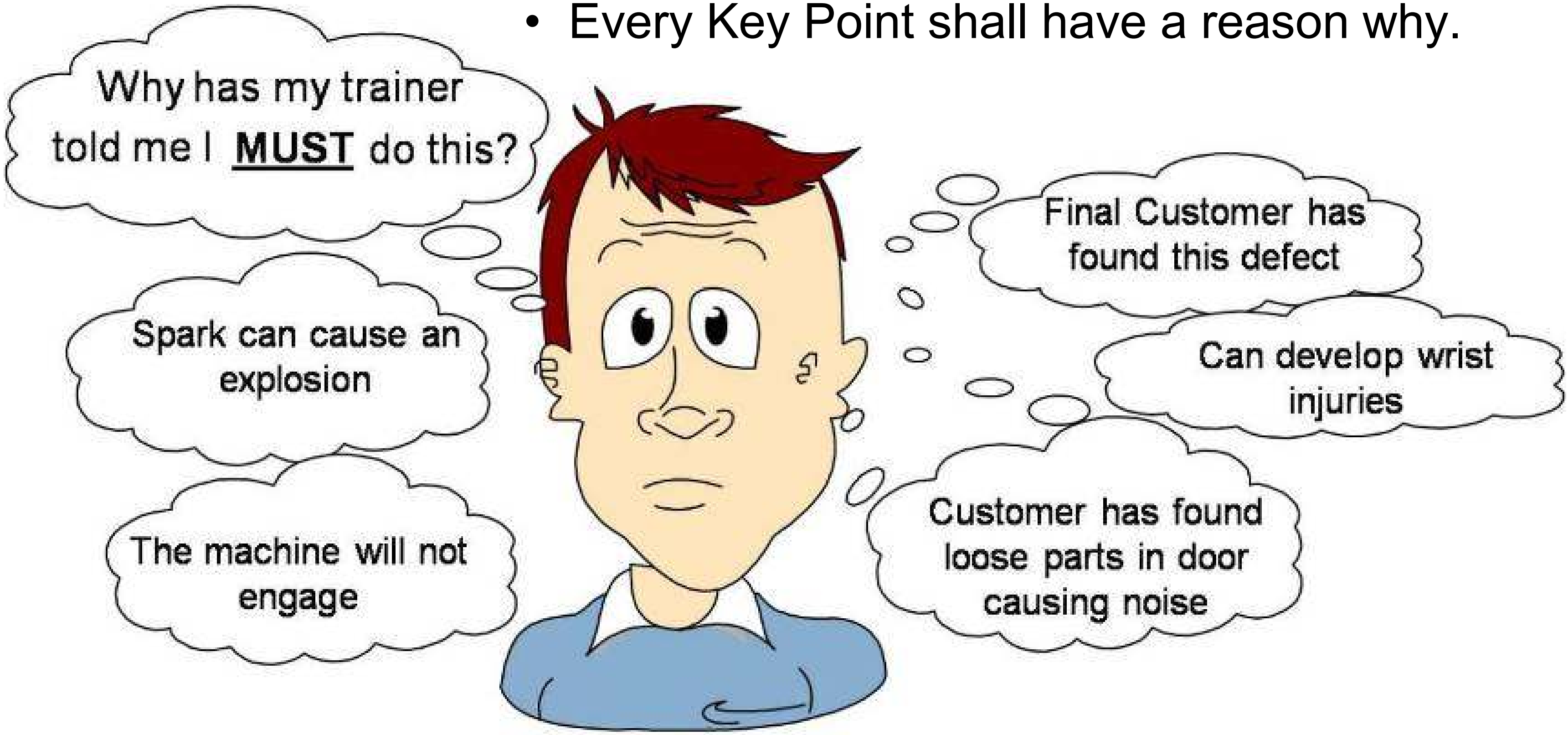
- Could the team member get injured if they failed to follow a certain method or technique?
- Does success or failure depend on performing the work a certain way?
- Have you learned an easier way to perform the step?
- Is there a product quality standard associated with the task?

Types of Key Points :

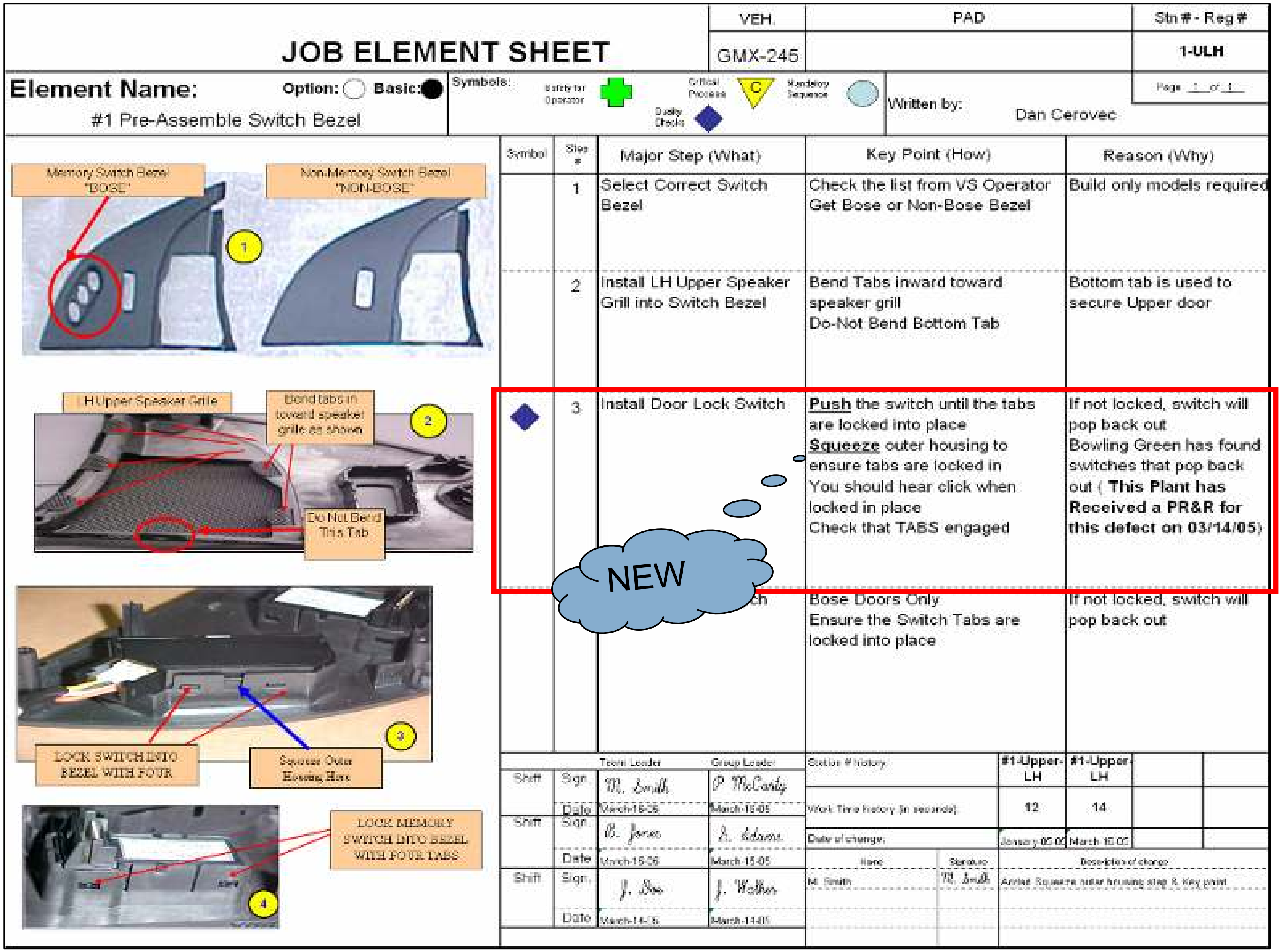
1. Safety	Points in a job operation which could result in team member injury
2. Success	Operational points on which the success or failure of a particular job depends
3. Hints	Points which make the job performance easier
4. Quality	Points that describe quality requirements for an operation

REASONS WHY

- What happens if the key point is ignored?
- Why is it done this way? What is the reason?
- Every Key Point shall have a reason why.



“The reason this key point is so important is. . . “



JOB ELEMENT SHEET

VEH.	PAD	Stn # - Reg #
GMX-245		1-ULH

Page 1 of 1

Element Name: #1 Pre-Assemble Switch Bezel

Option: ○ Basic: ●

Symbols: Safety for Operator ✚ Critical Process C Mandatory Sequence ○ Quality Checks ◆

Written by: Dan Cerovec

Symbol	Step #	Major Step (What)	Key Point (How)	Reason (Why)
	1	Select Correct Switch Bezel	Check the list from VS Operator Get Bose or Non-Bose Bezel	Build only models required
	2	Install LH Upper Speaker Grill into Switch Bezel	Bend Tabs inward toward speaker grill Do-Not Bend Bottom Tab	Bottom tab is used to secure Upper door
◆	3	Install Door Lock Switch	**Push** the switch until the tabs are locked into place **Squeeze** outer housing to ensure tabs are locked in You should hear click when locked in place Check that TABS engaged	If not locked, switch will pop back out Bowling Green has found switches that pop back out (**This Plant has Received a PR&R for this defect on 03/14/05**)
		ch	Bose Doors Only Ensure the Switch Tabs are locked into place	If not locked, switch will pop back out

		Team Leader	Group Leader
Shift	Sign.	M. Smith	P. McCarty
	Date	March-15-05	March-15-05
Shift	Sign.	B. Jones	A. Adams
	Date	March-15-05	March-15-05
Shift	Sign.	J. Doe	J. Walker
	Date	March-14-05	March-14-05

Station # history	#1-Upper-LH	#1-Upper-LH		
Work Time history (in seconds)	12	14		
Date of change:	January 05 05	March 15 05		

Name	Signature	Description of change
M. Smith	M. Smith	Added Squeeze outer housing step & Key point

Quality Systems Basics rev March 2009

OPERATOR INSTRUCTIONS (Example)

Rev. Date: 5/15/03	**JOB ELEMENT SHEET**	Page: **1** of **1**

Control Block	Shift	Team Leader	Supervisor/Group Leader	Date
	1	Bill Jones	John Doe	05/15/03
	2	John Steele	Jane Smith	05/15/03
	3	Amy James	Andy Johnson	05/15/03

Area/Cell/Department:	**FINAL DRIVE**
Operation Number:	**N/A**
Process/Part Name:	**HEAVY DUTY/VOLVO UNLOAD**

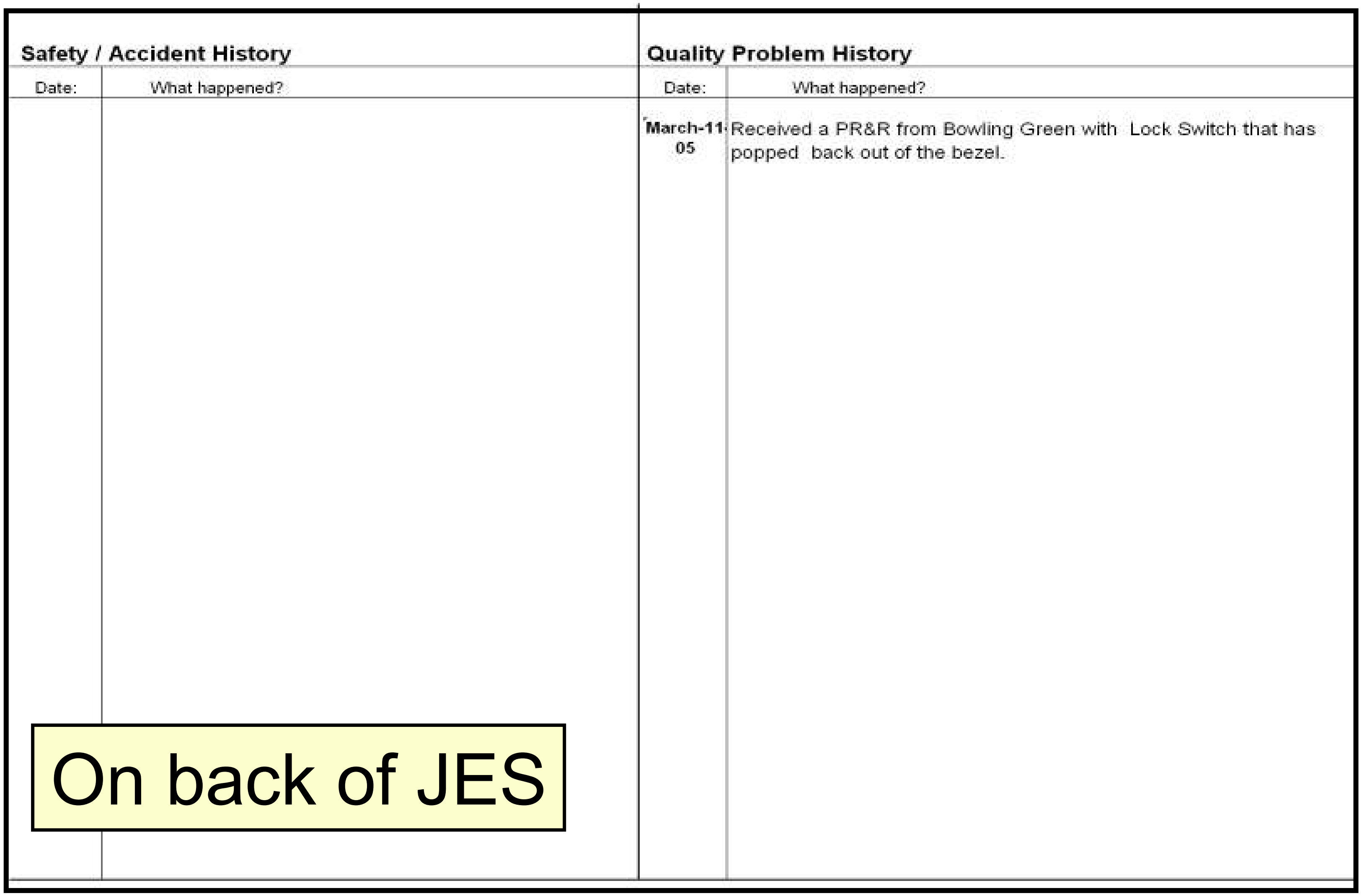
NO. 2A

SEQ	- STEP (What) -	SYM	- KEY POINT (How) -	REF	- REASON (Why) -
1	VISUALLY INSPECT DUNNAGE	◆	1A USE BLUE VINYL GLOVES		1A CUSTOMER DEMAND
		◆	1B REMOVE ALL TAGS, STICKERS AND DEBRIS		1B PROPERLY IDENTIFIED ASSEMBLIES TO CUSTOMER
		◆	1C SET ASIDE DAMAGED OR DIRTY DUNNAGE		1C REDUCE SEDIMENT LEVELS
2	VISUALLY INSPECT ASSEMBLY AND WRITE CORRESPONDING STACK HEIGHT NUMBER ON INTERNAL GEAR. *ONLY #'s 3 THROUGH 9 ARE TO BE USED*	◆	2A ENSURE CORRESPONDING INKJET INFORMATION IS CORRECT WITH STACK HEIGHT NUMBERS WRITTEN IN WHITE ON HEAVY DUTY, PINK ON VOLVO AND A YELLOW DOT ON VOLVO INTERNAL		2A PROPERLY IDENTIFIED ASSEMBLIES TO CUSTOMER *NUMBERS 3 THROUGH 9 ARE THE ONLY ONES ACCEPTED BY OUR CUSTOMER. OTHERS ARE TO BE PUT INTO REJECT BUGGY*
3	DEPRESS PARK LOCK PAWL INTO PARKING GEAR	◆	3A ACKNOWLEDGE SPRING TENSION AND WINDOW CLEARANCE		3A OBTAINS "PARK" STATUS IN AUTOMOBILE
4	INSERT SHORT END OF SHIPPING PIN INTO INTERNAL GEAR PIN HOLE, LONG END LOCKING PARK LOCK PAWL IN POSITION	K	4A TURN INTERNAL GEAR WHILE DEPRESSING PARK LOCK PAWL UNTIL PARK LOCK PAWL ADVANCES INTO FULL DEPTH		4A ALLOWS FINAL DRIVE ASSEMBLY TO BE INSTALLED INTO TRANSMISSION CASE AT ASSEMBLY PLANTS
5	REMOVE ASSEMBLY FROM LINE AND LOAD INTO CORRESPONDING DUNNAGE	Ⓔ	5A INSERT UNLOAD ASSIST DEVICE INTO THE SUN GEAR SHAFT AND LIFT FINAL DRIVE ASSEMBLY INTO THE BASKET USING THE "UP" AND "DOWN" CONTROL LEVERS		5A REDUCES BODY STRAIN
			5B LOWER ASSEMBLY CAREFULLY INTO DUNNAGE,		5B PREVENT BEARING FRACTURE

Symbol Legend (SYM):	✚ Safety	Ⓔ Ergonomics	◆ Quality	**K** Knack	▽C Critical

File/Ref:ES-705-FAHDVU

TECHNICAL MEMORY



Safety / Accident History		**Quality Problem History**	
Date:	What happened?	Date:	What happened?
		March-11-05	Received a PR&R from Bowling Green with Lock Switch that has popped back out of the bezel.

On back of JES

STANDARDIZED OPERATIONS

4.3 WORKPLACE ORGANIZATION-5S

Visual Management of Out-of-Standard Conditions

4.4 STANDARDIZED WORK

4.4.1 – Standard Operation;

Major Steps, how long should it take? **(SOS)**

4.4.2 - OPERATOR INSTRUCTIONS;

Detailed Steps for What, How, and Why. (JES)

4.5 MANUFACTURING GAGE CONTROL

Product is qualified per plan to known standards & specifications

MANUFACTURING GAGE CONTROL

4.5 Introduction

PURPOSE:

To establish a common set of definitions and set minimum requirements and guidelines of a system for managing calibration, surveillance of gages, and other measurement devices used within GM Supplier manufacturing sites to evaluate conformance to specifications of parts and products.

SCOPE:

Applies to all devices used to evaluate conformance to part and product specifications

RESPONSIBILITY:

- Ownership
  - ✓Quality Leadership
- Contingency Plan for All Situations

MANUFACTURING GAGE CONTROL

4.5.1 - Overview

This Procedure applies to all GM Supplier Manufacturing sites.

At a minimum, sites should include the following devices within their gage procedures:

- Gages included in the sites control plan
- Devices used to evaluate conformance to part and product specifications
- Masters used to evaluate/adjust all devices under gage control
- Metrology lab and layout room devices
- Coordinate measuring machines and optical comparators
- Product torque wrenches and transducers
- Leak test orifices
- Balance, flow test weight viscosity and surface texture devices
- Functional test transducers e.g. torque to turn, final test
- Hardness testers and chemistry analyzer
- Personal tools and measuring devices
- Measuring, tools used to qualify or maintain production tools

MANUFACTURING GAGE CONTROL

4.5.1 – Overview (continued)

Organizations shall have written, documented procedures for developing, maintaining and establishing proper use and functions for manufacturing gages within GM supplier locations.

Gage Definitions:

Gage—Any device used to obtain measurement, or assess the conformance of a part or characteristic relative to specifications.

Adjustment—A set of operations to bring a gage into a state of performance suitable for its use.

Calibration—A set of operations that compares and evaluates under specified conditions, the relationship between a gage and a traceable standard

Certification—A set of operations to document the results of a calibration, indicating conformance or non-conformance to specifications.

Master– a device used to check and/or adjust a gage to a specified value.

Mastering—A set of operations to verify that the gage results agree with the master.

MANUFACTURING GAGE CONTROL

4.5.1 – Overview (continued)

Additionally:

The supplier should indicate in their gage procedure, whether other special measuring devices, such as *Error Proofing* are in or out of scope for gage control activity.

Device Mastering is a part of the gage procedure, but the frequency is at the discretion of the supplier.

Last Part Checked should be held for confirmation of last known good part at a frequency of at minimum of 1 per shift. Best practice would be to retain hourly samples for each inspection, retained for the entire shift or previous 8 hours.

MANUFACTURING GAGE CONTROL

4.5.2 - Responsibilities

The quality system group at the manufacturing duns location is responsible for the local gage procedure.

Supplier local gage procedures shall comply with GM specific requirement “GM 1925 Fixture Standards.”

Suppliers who utilize outside services for gage control, shall ensure their gage service provider adheres to GM 1925.

MANUFACTURING GAGE CONTROL

4.5.3 – Calibration, Control, & Maintenance

Guidelines:

In addition to their calibration schedule, suppliers should establish a process of regular gage surveillance to assure the equipment is fit for use (may be part of a layered audit process) and a program of periodic GR&R studies to establish measurement variability to be incorporated in process capability determination.

MANUFACTURING GAGE CONTROL

4.5.3 – Calibration, Control, & Maintenance (Continued)

Guidelines:

- New programs should adopt a common gage numbering scheme.
- The calibration interval specified for a device should initially be set in accordance with the manufacturer's recommendation. Revisions to this frequency should be made on the basis of: gage type, past experience, GR&R level, calibration history, frequency/severity of use, type, and tolerance of characteristic being checked.

MANUFACTURING GAGE CONTROL

4.5.3 – Calibration, Control, & Maintenance (Continued)

Gage Calibration Frequency Reference Table

	No of Months	
	Minimum	Maximum
Attribute gages for Process verification	12	24
Variable Gage Masters	12	24
Optical Template Gages	12	24
Attribute Fixture Gages	12	36
Any Gage in Full-Time Use		12

MANUFACTURING GAGE CONTROL

4.5.4 – Gage Instructions

Best Practices Operator Gage Instructions:

- Operator gage instructions shall, when appropriate, be updated if a process or product change impacts gaging.

- Operator Instructions should be:
  - developed by the gage manufacturer and supplier with customer GD&T requirements.
  - used for *Standardized Operator Training.*

STANDARDIZED OPERATIONS SUMMARY

4.6 – Summary; Shalls

Organizations shall…

- ✓ Utilize a systematic approach to implement and maintain Workplace Organization.
- ✓ Utilize cross-functional teams to develop, identify & list all operations, and work to improve Operator Instructions for all work.
- ✓ Include - Work Elements & Times, Work Flow Sequence, Standard in-process stock, Operation Cycle Time, Takt Time (Customer and Actual) in Standardized Work Instructions.
- ✓ Develop operator instructions that include the what, how & why thought process.
- ✓ Train impacted and new employees in the use of Standardized Work Instructions *(Standardized Operator Training)*.
- ✓ Post Standardized Work Instructions at or near all operations.
- ✓ Verify, *(Layered Process Audits)* maintain and update operator instructions as processes/parts change.

MANUFACTURING GAGE CONTROL SUMMARY

4.6 – Summary; Shalls (Continued)

Organizations shall…

- ✓ Have written, documented procedures for developing, maintaining and establishing proper use and functions for manufacturing gages.
- ✓ When appropriate, update Gage Instruction if a process or product change impacts gaging
- ✓ Comply with GM 1925 Fixture Standards.

5.0 STANDARDIZED OPERATOR TRAINING

Was Operator training verified and documented?

STANDARDIZED OPERATOR TRAINING
Outline

5.0) Introduction: Purpose, Scope, Responsibility
5.1) Benefits
5.2) The Principles of Learning
5.3) How to Train - 4 Step Training Method
5.4) Training Certification - Records
5.5) Summary, Shalls

STANDARDIZED OPERATOR TRAINING

5.0 - Introduction:

PURPOSE:

- To ensure all Trainers are trained to and apply the same method of training when teaching others.
- To ensure all operators including temporary or supplemental employees work safely, follow *standardized work* and meet all quality and productivity requirements
- To ensure jobs are properly staffed and identify where additional training or follow up is required to reduce the risk of failures escaping the process.

SCOPE:

- Manufacturing Operations
- Assembly Area
- Shipping / Receiving
- All Operations
- Other Support Functions

RESPONSIBILITY:

- Ownership
  - ✓Operations Manager
- Contingency Plan for All Situations

STANDARDIZED OPERATOR TRAINING

5.1 - BENEFITS

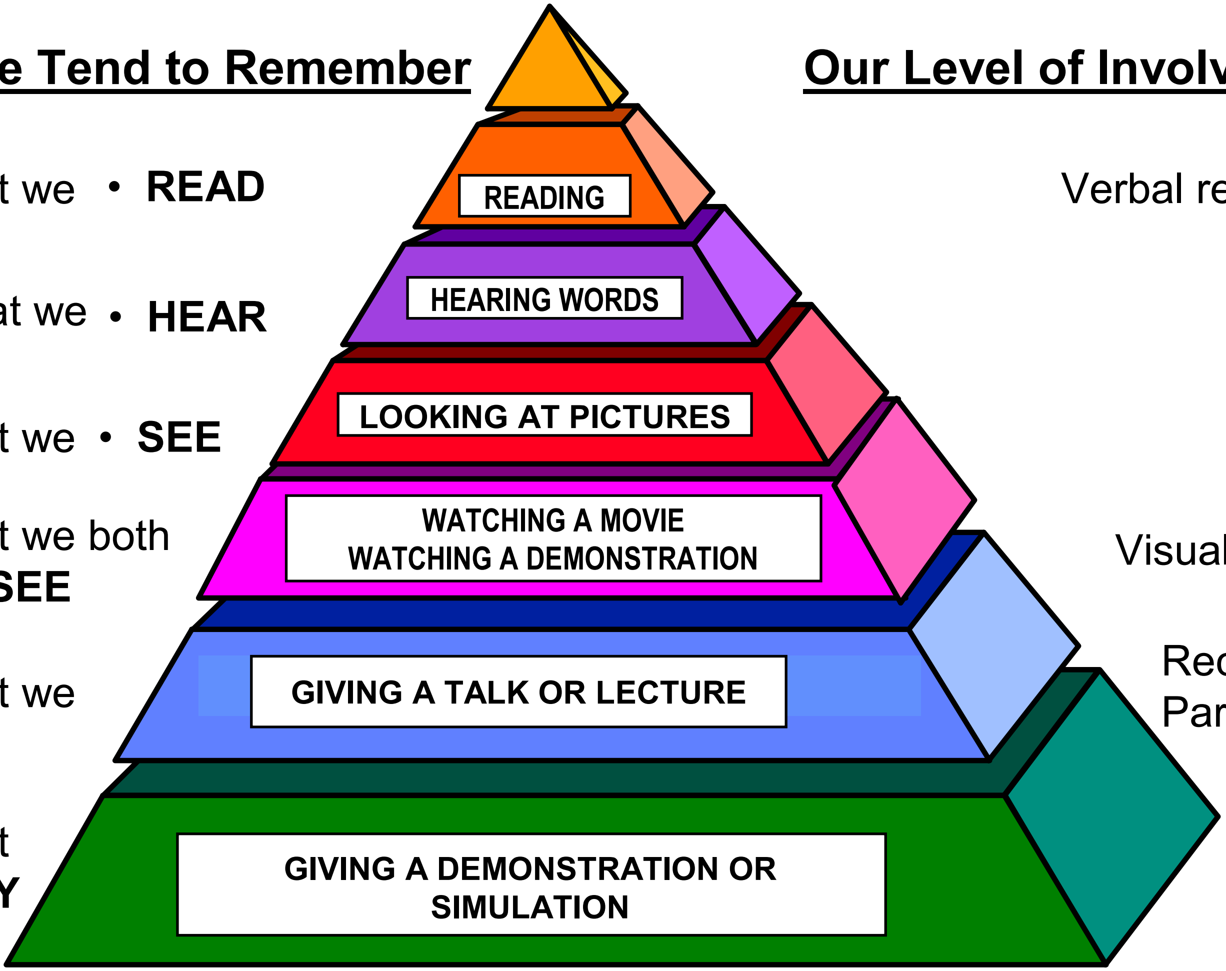
- Assures all operators have adequate and similar training.
- Assures unqualified operators receive training prior to operating equipment.
- Reduces sort, rework and containment activities.
- Communicates operator status to all stakeholders.
- Supports *Standardized Work* and Job Rotation

STANDARDIZED OPERATOR TRAINING

5.2 – The Principles of Learning

How Much We Tend to Remember

- 10% of what we • **READ**
- 20 % of what we • **HEAR**
- 30% of what we • **SEE**
- 50% of what we both **HEAR** and **SEE**
- 70% of what we **SAY**
- 90% of what we both **SAY** and **DO**



READING

HEARING WORDS

LOOKING AT PICTURES

WATCHING A MOVIE
WATCHING A DEMONSTRATION

GIVING A TALK OR LECTURE

GIVING A DEMONSTRATION OR SIMULATION

Our Level of Involvement

PASSIVE

Verbal receiving

Visual receiving

ACTIVE

Receiving & Participating

Doing

STANDARDIZED OPERATOR TRAINING

5.2 – The Principles of Learning

PRINCIPLES OF LEARNING

1) Meaningful Learning
2) Active Learning
3) Multi-Sense Learning
4) Repeated Practice
5) Feedback
6) Reward / Recognition
7) Primacy and Recency

TRAINING

DOs:

- Always show an interest for the student's well being.
- Have an interest in the topic matter.
- Know the topic matter thoroughly.
- Be prepared.
- Trust the student and allow them to grow.

DON'Ts:

- Never laugh at the student for a "stupid" question.
- Never assume that you know everything, and that you can't learn.
- Do not just lecture, but ask questions to check understanding.

STANDARDIZED OPERATOR TRAINING

5.3 - How to Train - 4 Step Training Method

THE 4 STEPS OF OPERATOR TRAINING

What Are the Four Steps to Job Instruction Training?

Step 1	Prepare team member
Step 2	Demonstration
Step 3	Try-out performance
Step 4	Follow-up

- Remember, Good Training Is the Key to Your Success!
- Take Time to Prepare and Train Right the First Time!

STANDARDIZED OPERATOR TRAINING

5.3 - How to Train - 4 Step Training Method

GOOD TRAINING PREPARATION

Select the job to be trained

Review job documentation

- Standard operating sheets (SOS)
- Job element sheets (JES)

Perform workstation audit / workplace preparation

Prepare job instruction form

Prepare flexibility charts

Notification of team members

STANDARDIZED OPERATOR TRAINING

5.3 - How to Train - 4 Step Training Method

Step 1 - Prepare Team Member:

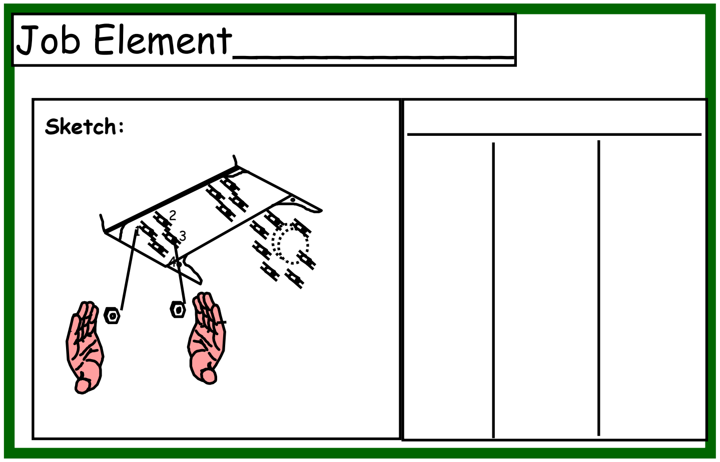
- Put the Team Member at Ease
- Find Out What the Team Member Already Knows About the Job
- Review Safety Documentation / Information
- State the Job – Verbalize/Explain (Using Standardized Operation Sheet)
- Review Workstation Documentation
- Get the Team Member Interested in Learning Job

STANDARDIZED OPERATOR TRAINING

5.3 - How to Train - 4 Step Training Method

Step 2 - Present Operation:

Review the Job Element Sheets



Demonstrate the Operation

- Show & explain one element & its major steps (What)
- Show & explain one element & its major steps (What) and key points (How)
- Show & explain one element & its major steps (What), key points (How) & reasons (Why)
- Instruct clearly, completely & be patient
- Do not teach more than the team member can master

STANDARDIZED OPERATOR TRAINING

5.3 - How to Train - 4 Step Training Method

Step 3 - Try Out Performance:

Team Member to Perform the Operation

- Select 1st set of elements (based on job competency)
- Have Team Member do the job with Team Leader Reading the Major Steps
- Have Team Member Explain Each Element and Major Steps While They Perform the Job
- Have Team Member Explain Each Major Step and Key Points As they Perform the Job Again
- Have Team Member Explain Each Major Step, Key Points and Reasons Why As They Perform the Job Again
- Add More Elements and Repeat Job for Understanding & Correct Performance
- Continue Performing Job Until You Know The Team Member Knows the Job Completely

STANDARDIZED OPERATOR TRAINING

5.3 - How to Train - 4 Step Training Method

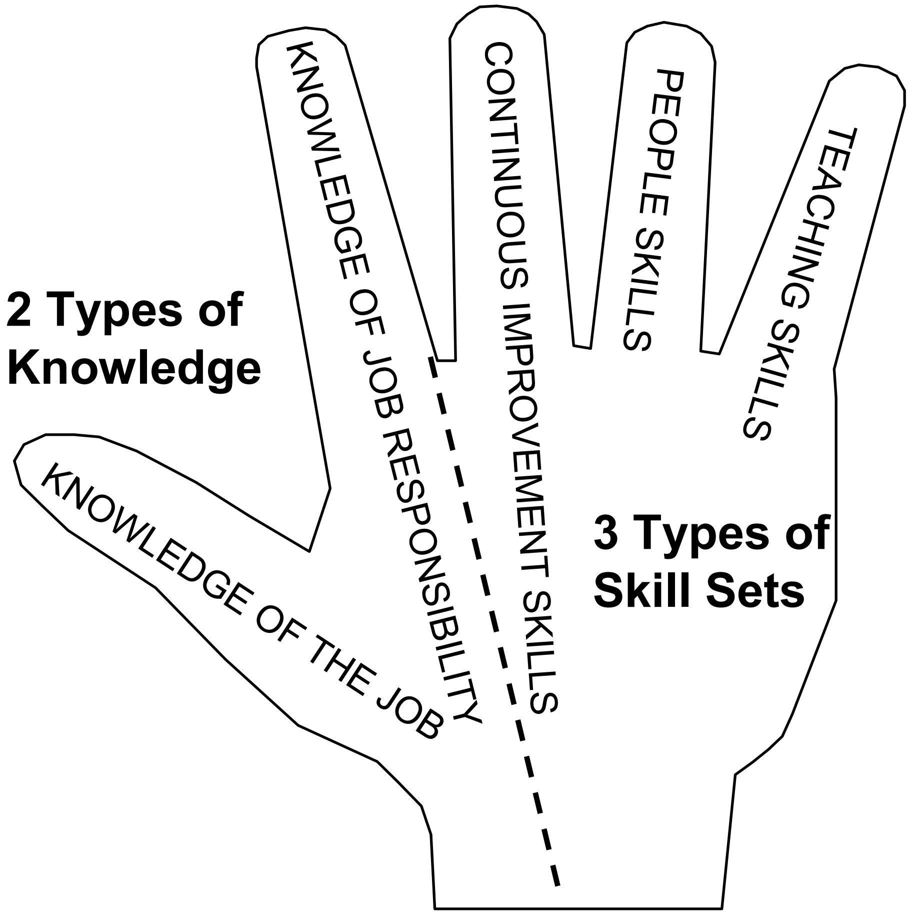
Step 4 – Follow-Up

- Verify team member job competency (meeting quality stds. in takt time)
- Have team member demonstrate understanding & capability of:
  - Safety Requirements
  - *Standardized Work*
  - Quality Requirements
- Trainer completes quality checks
  - Minimum of 15 units/job or as appropriate
- Leave team member to work on his/her own
- Designate to whom the team member goes to for help (such as Supervisor, Problem Solver, Process Control Manager, Quality Network Reps, Specs, etc.)
- Check Frequently
- Encourage Questions
- Give Any Necessary Extra Training Needed

STANDARDIZED OPERATOR TRAINING

5.4 - Training Certification, Records

Prerequisites to be a Good Trainer



STANDARDIZED OPERATOR TRAINING

5.4 - Training Certification, Records

Standardized Operator Training shall be used to:

- Have a standardized method to train (e.g. 4-Step).
- Identify who in the organization is certified to train.
- Define the minimum training content for each operation.
- Establish required documentation and tracking methods.

- Trainers shall train operators using a standard operation training record to ensure all job functions and responsibilities are reviewed. (e.g. safety, quality, work instructions, 5S, paperwork)
- Trainers shall monitor new operators' activities and retrain if necessary to assure *Standardized Work* Instructions are being followed.
- The trainer should notify downstream operations of potential defects.

STANDARDIZED OPERATOR TRAINING

Standard Operation - Training Record

(Example)

Training Sign - Off Sheet

Workcell

Mold / Station #

Associate Name: **Shift:** **Date:**

Training Criteria	Associate Initials	Trainer Initials	Comments
SAFETY			
Fire Exits / Extinguisher Location			
Safety Glass Policy			
Personal Protective Equipment			
MSDS Location			
QUALITY			
Gate trimming Technique			
Visual Defects			
Scrap Procedure			
PAPERWORK			
Production reporting			
Scrap Reporting			
Bar Code Scanning / Label Verification			
OPERATIONS			
Operator 1 Work Instructions - Min. 16 Hrs.			
Operator 3 Work Instructions - Min. 16 Hrs.			
Packaging Requirements (Regular / Service)			
WORKCELL ORGANIZATION			
5S Responsibilities			
Supply Cabinet Location / Contents			
Work Cell Board Review			

Employee Signature **Trainer Signature**

Date: **Date:**

Form Ref: Rev.# Date:

STANDARDIZED OPERATOR TRAINING

Standard Operation - Training Record

Application : The following shall be completed with any new operator (for any given operation).

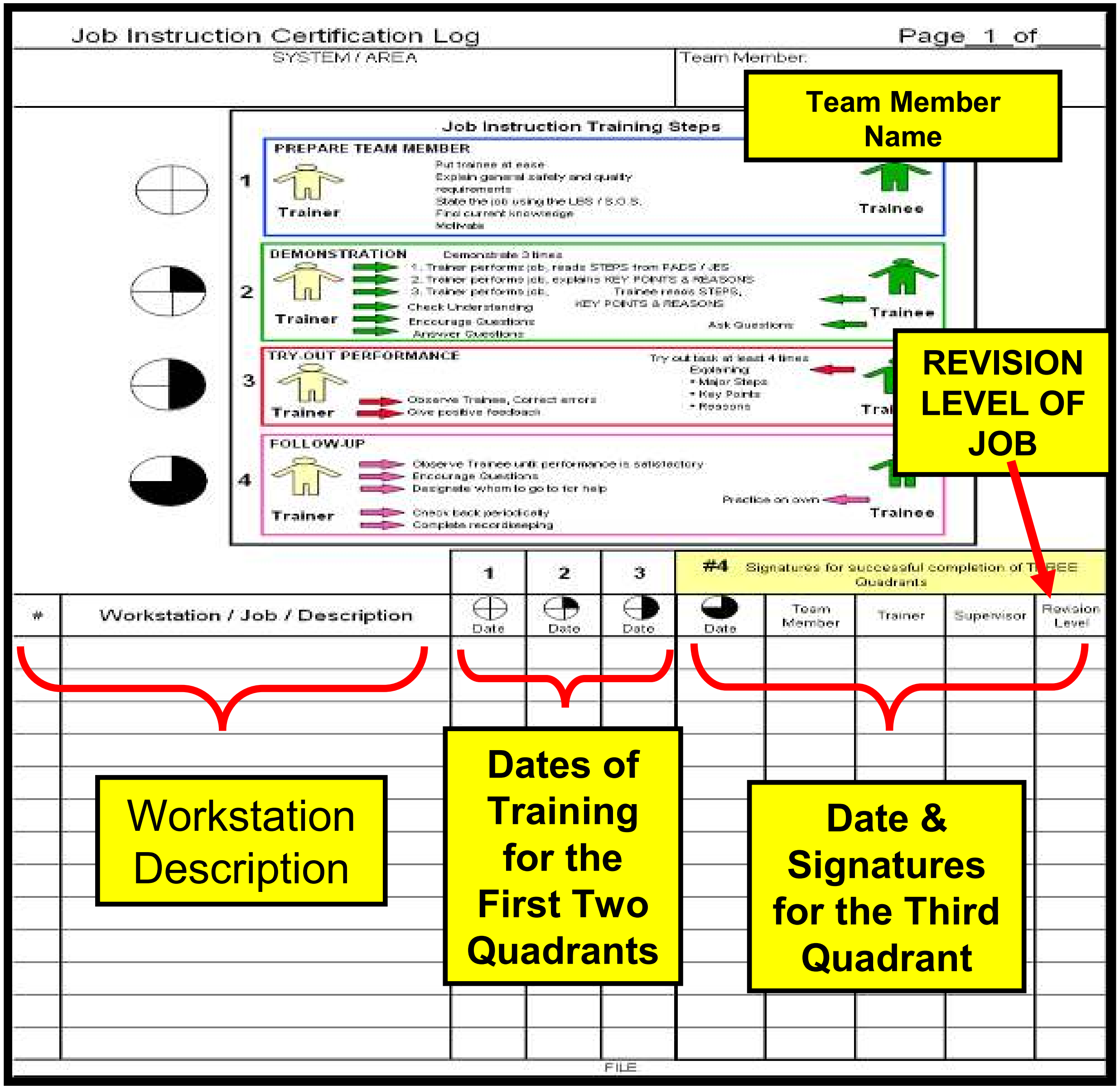
(Example) *Operation Name and #* ____________________

Review	Complete
Safety/ Equipment Operation	
Review operator job instructions/ Discuss critical points	
Explain and demonstrate Standardized Work Instructions	
Quality records to be filled out (e.g. Check sheets)	
Part (product) function	
Demonstrate the operation and answer questions	
Demonstrate gaging and answer questions	
Have new employee run operation and answer questions	
Teach past problems (e.g. FMEA, Top Problems List)	
Verify first units produced, coach as needed	
Return within the shift, verify std work & product quality again	
Return in approx. 1 day, verify std work & product quality again	
Notify downstream operations of potential defects	

Employee Signature ________________ Trainer Signature ________________

(Example)

Individual's Job Instruction Certification Record Filled out by the Trainer for all Training



Job Instruction Certification Log

Page 1 of

SYSTEM / AREA

Team Member:

Job Instruction Training Steps

1 PREPARE TEAM MEMBER

Trainer

Put trainee at ease
Explain general safety and quality requirements
State the job using the LBS / S.O.S.
Find current knowledge
Motivate

Trainee

2 DEMONSTRATION

Trainer

Demonstrate 3 times
1. Trainer performs job, reads STEPS from PADS / JES
2. Trainer performs job, explains KEY POINTS & REASONS
3. Trainer performs job. Trainee reads STEPS, KEY POINTS & REASONS
Check Understanding
Encourage Questions
Answer Questions

Ask Questions

Trainee

3 TRY OUT PERFORMANCE

Trainer

Observe Trainee, Correct errors
Give positive feedback

Try out task at least 4 times
Explaining
- Major Steps
- Key Points
- Reasons

Trai

4 FOLLOW-UP

Trainer

Observe Trainee until performance is satisfactory
Encourage Questions
Designate whom to go to for help
Check back periodically
Complete recordkeeping

Practice on own

Trainee

#	Workstation / Job / Description	1	2	3	#4 Signatures for successful completion of T REE Quadrants				
		Date	Date	Date	Date	Team Member	Trainer	Supervisor	Revision Level

FILE

Team Member Name

REVISION LEVEL OF JOB

Workstation Description

Dates of Training for the First Two Quadrants

Date & Signatures for the Third Quadrant

STANDARDIZED OPERATOR TRAINING

5.4 - Training Certification, Records

Explanation of Legend

◔ = **Knows Steps (in Training)**

◕ = **Can Perform Job to Quality, Safety and in Takt Time Without Supervision**

◑ = **Can Perform Job to Quality and Safety but not in Takt Time**

● = **Can Train to Job Instruction Standard**

STANDARDIZED OPERATOR TRAINING

5.4 - Training Certification, Records

- The trainer shall verify quality at a frequency determined necessary to assure all standards are met. At a minimum the trainer shall return within the shift and again within approximately one day.

- Operator training shall be tracked on “Individual Operator Training Tracking Sheets”.

- A record to track training of operators to the latest work instruction change level for each job shall be maintained

- Scheduling of refresher training for assigned operators is at local site discretion.

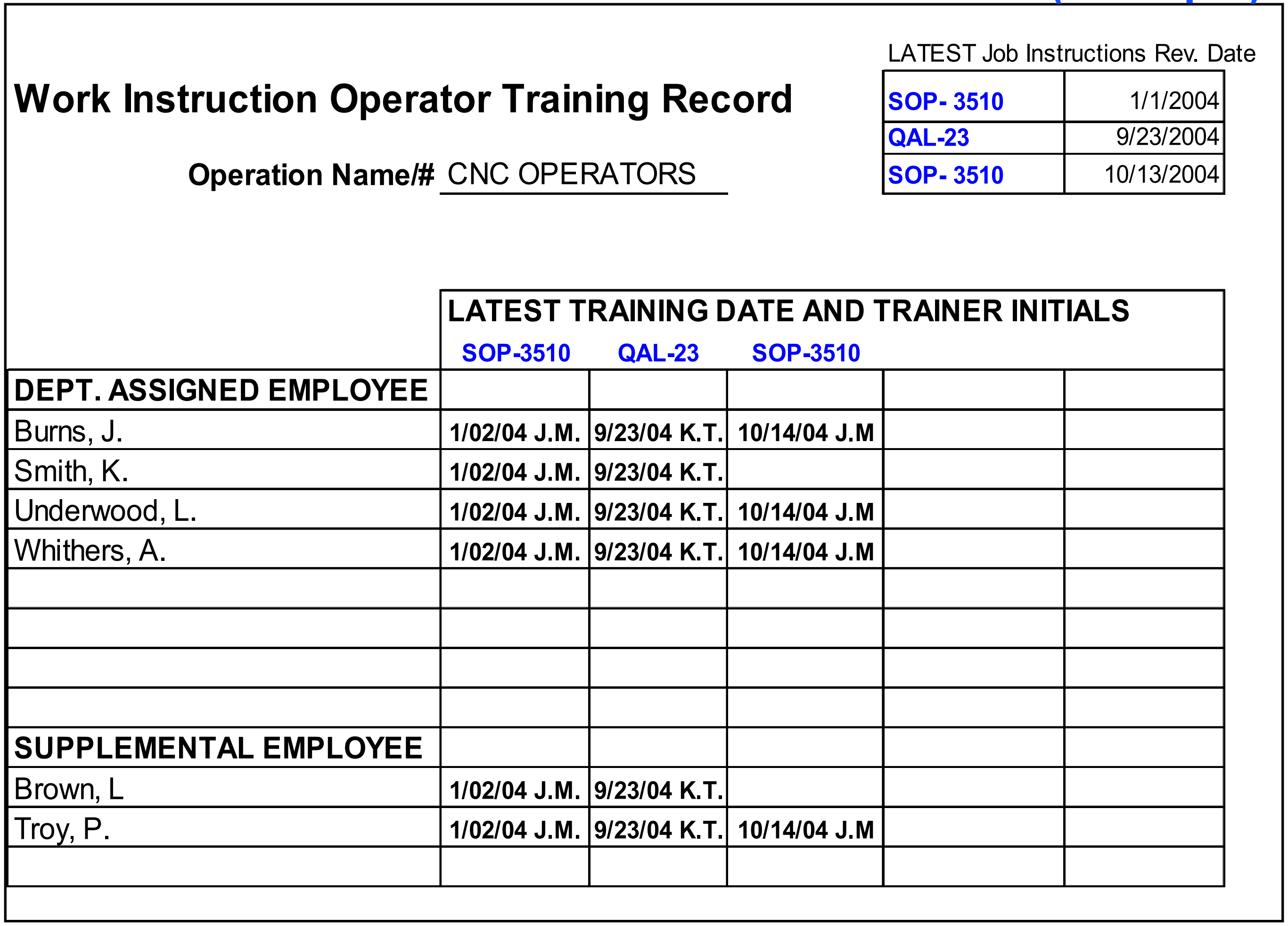
- Supplemental/Temporary employees shall not perform the job unless they have been trained within the last three months.

STANDARDIZED OPERATOR TRAINING

5.4 - Training Certification, Records

(Example)

Tracking Record of All personnel Trained on a particular Job to a Specific Job Instruction Change Level



Work Instruction Operator Training Record

Operation Name/# CNC OPERATORS

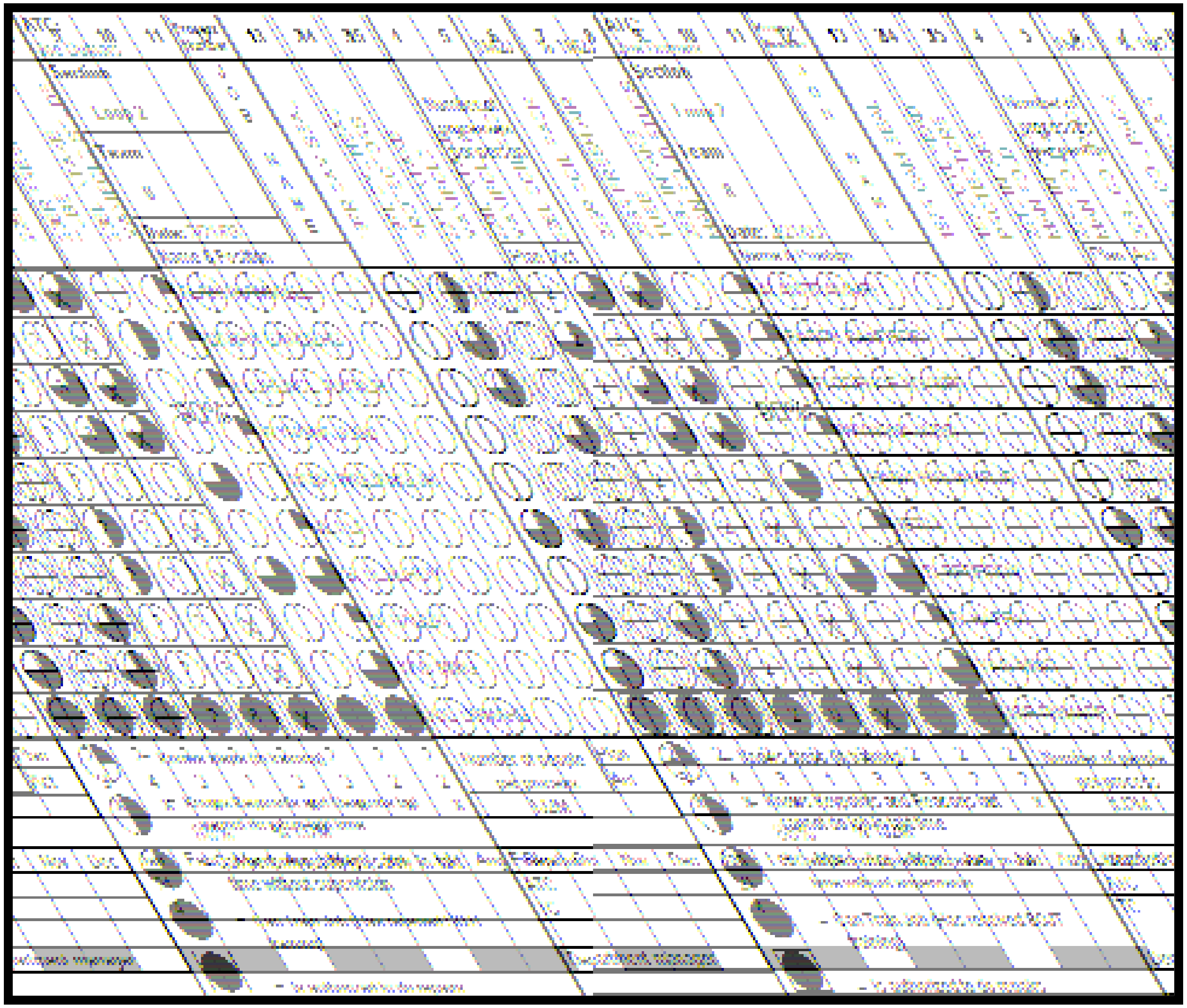
LATEST Job Instructions Rev. Date

SOP- 3510	1/1/2004
QAL-23	9/23/2004
SOP- 3510	10/13/2004

	LATEST TRAINING DATE AND TRAINER INITIALS				
	SOP-3510	QAL-23	SOP-3510		
DEPT. ASSIGNED EMPLOYEE					
Burns, J.	1/02/04 J.M.	9/23/04 K.T.	10/14/04 J.M		
Smith, K.	1/02/04 J.M.	9/23/04 K.T.			
Underwood, L.	1/02/04 J.M.	9/23/04 K.T.	10/14/04 J.M		
Whithers, A.	1/02/04 J.M.	9/23/04 K.T.	10/14/04 J.M		
SUPPLEMENTAL EMPLOYEE					
Brown, L	1/02/04 J.M.	9/23/04 K.T.			
Troy, P.	1/02/04 J.M.	9/23/04 K.T.	10/14/04 J.M		

FLEXIBILITY CHART

(Example)



OUTPUTS

- Helps Analyze Job Requirements (Illustrates the number of trained team members per job)
- Identifies Potential Workforce issues / Weaknesses
- Helps Plan Job Instruction Training needs to support job rotation.
- Supports Continuous Improvement

STANDARDIZED OPERATOR TRAINING

5.5 – Summary, Shalls

Organizations shall…

✓ Have a standard operation training method (e.g. 4-Step).

✓ Ensure only trained operators perform standard work.

✓ Ensure only certified trainers train.

✓ Define the minimum training content for each operation.

✓ Ensure operator training is being documented and tracked.

✓ Define re-training frequency.

6.0 ERROR PROOFING VERIFICATION

Was error proofing verified?

ERROR PROOFING VERIFICATION
Outline

6.0) Introduction; Purpose, Scope, Responsibility

6.1) Benefits

6.2) Method of Verification

6.3) Management Review

6.4) Summary; shall

ERROR PROOFING VERIFICATION

6.0 - Introduction

Purpose:

Assures error proof/detection devices are working as intended to prevent *nonconforming product* from being made or transferred .

Scope:

- Assembly Area
- Manufacturing Operations
- Other support Functions

Responsibility:

✓ Ownership

-Quality Manager

✓ Contingency plan for all situations

ERROR PROOFING VERIFICATION

6.1 - Benefits

- Assures error proof/detection devices are working as intended.
- Prevents *nonconforming product* from being made or transferred.
- Establishes a history for each device; indicates when preventative maintenance or repair is needed.
- Instills discipline within the process.

ERROR PROOFING VERIFICATION

6.2 - Method of Verification

All error proofing/detection devices with the potential to fail, wear, misalign, or otherwise become out-of-adjustment shall be verified at a minimum of once per day. Considerations for establishing the frequency would include:

- Lot size of parts run between Error Proofing verification
- History of process to determine verification frequency
- How robust is the process?
- How easy is it to contain suspect product?

The preferred method is for a team member/leader to perform as part of start-up and throughout the shift.

Note: This is not mastering a gage, (e.g. Setting gage to zero). It is sending known good & bad parts through to confirm the device is operating correctly.

ERROR PROOFING VERIFICATION

6.2 - Method of Verification (continued)

Error Proofing Device – (CAN NOT MAKE) - Devices which prevent the manufacture or assembly of *nonconforming product*.

Error Detection Device – (CAN NOT PASS or CAN NOT ACCEPT) Devices which prevent the transfer of *nonconforming product* (e.g. 100% in-line inspection equipment).

Note: This QSB section will use the term error proofing device to incorporate error proofing and error detection devices.

- Error proofing devices shall be verified and their respective locations documented.
  - Master document of error proofing devices, with identification number and location.
  - Verification frequency should be documented
  - Identify masters(Good/Bad) and defect being checked
  - Define certification requirements for all masters.

ERROR PROOFING VERIFICATION

6.2 - Method of Verification (continued)

Verification results shall be recorded with immediate responses to failures:

- Develop log of error proof verification failure with reaction plans to nonconformities including containment.
- Develop a procedure to notify of nonconformities and escalate reaction to nonconformities.
- Corrective action report (Core “6 steps”/*Fast response*) should be opened to prevent error proofing device from failing again.

ERROR PROOFING VERIFICATION

6.2 - Method of Verification (continued)

- Reaction plans; when the error proofing devices fail, product shall be verified back to that last good check
  - Refer to strategy 2.0 (*Control of nonconforming product*)

6.3 - Management Review

- Verification results shall be reviewed by site leadership
  - Method for getting information to management
  - Determine how information is to be displayed

ERROR PROOFING VERIFICATION

(Example)

SHIFT: ____________________

DATE: ____________________

ERROR PROOFING VERIFICATION CHECKLIST

SNAP RING PRESENCE

op#		*THESE ITEMS ARE TO BE CHECKED DAILY*	Code	YES	NO	PROBLEM
OP 30	4	OPERATE L&R SNAP RING INSTALLATION TOOL WITHOUT SNAP RING - IS PART REJECTED ?	4			
OP 30	5	DID RED LIGHT ON LIGHT TREE TURN ON ? (L&R)	5			
OP 30	6	DID REJECTED PART STAY IN STATION ? (L&R)	6			
OP 30	7	DID ANDON ALARM SOUND? (L&R)	7			
OP 40	8	OPERATE SMALL SNAP RING INSTALLATION TOOL WITHOUT SNAP RING - DID GAGE REJECT PART ?	8			
	9	DID RED LIGHT ON LIGHT TREE TURN ON ? (SMALL SNAP RING)?	9			
	10	DID REJECTED PART STAY IN STATION? (SMALL SNAP RING)	10			
	11	DID ANDON ALARM SOUND ? (SMALL SNAP RING)?	11			
	12	DOES PART STILL STAY IN STATION WHEN HAND VERIFICATION TOOL DISPLAYS A RED REJECT LIGHT?	182			
	13	IS SMALL SNAP RING VISUAL IN PLACE ?	15			
	14	IF SMALL SNAP RING TOOL IS DOWN, IS THE BACK-UP GAGE USED?	12			
	15	DOES BACK-UP GAGE REJECT PART IF NO SNAP RING IS PRESENT?	13			
	16	DOES THE LIGHT TURN RED? (SMALL SNAP RING BACK-UP)?	14			

SUPERVISOR: ____________________

TOTAL # OF X'S IN EACH COLUMN →

YES	NO

AUDITOR: ____________________

🟨 **ANY ITEM SHADED NOT WORKING PROPERLY, THE SUPERVISOR MUST BE NOTIFIED IMMEDIATELY.**

ANY ITEM OUT OF COMPLIANCE SHOULD BE REVIEWED WITH SUPERVISOR OR A COPY OF THE AUDIT GIVEN TO SUPERVISOR.

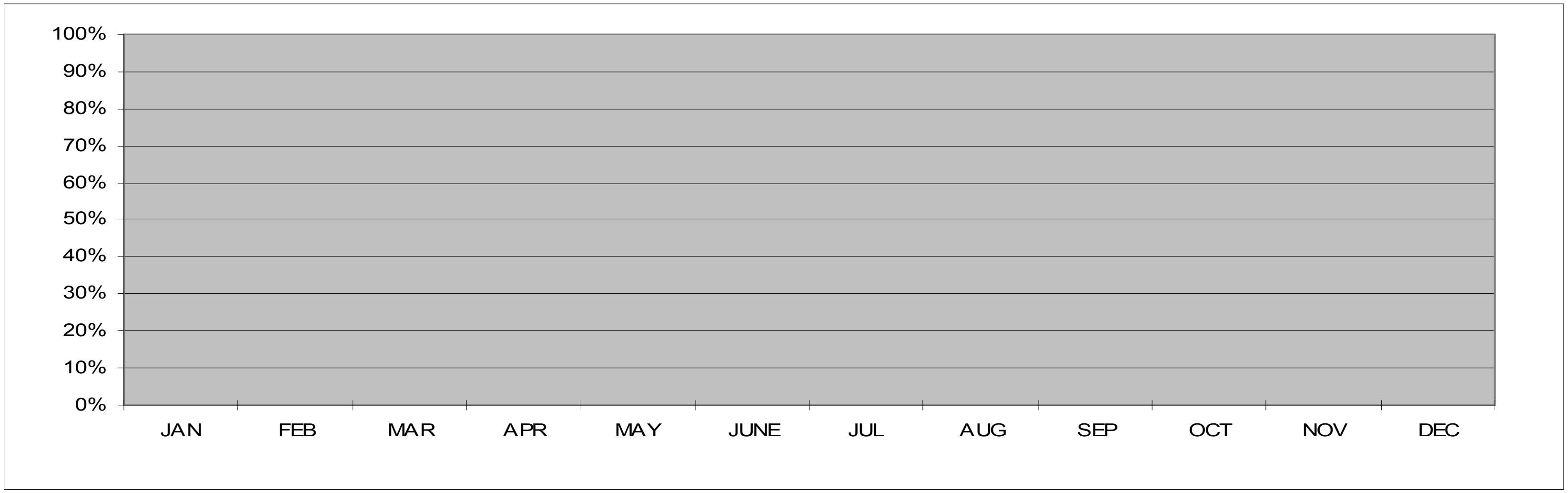
Completion of the verification shall be documented and easily accessible. The device's verification status should be visible to everyone in the area.

ERROR PROOFING VERIFICATION

DEPT.______________

ERROR PROOFING VERIFICATION RESULTS

(Example)



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
% IN COMPLIANCE:												
# OF ITEMS ON CHECKLIST:												
# OF VERIFICATIONS												
TOTAL # OF ITEMS VERIFIED:												
# OF ITEMS IN COMPLIANCE:												

ITEMS NOT IN COMPLIANCE	NUMBER OF ITEMS NOT IN COMPLIANCE											

ERROR PROOFING VERIFICATION

6.4 - Summary; shalls

- ✓ Error proofing devices shall be verified at least once per day.
- ✓ Error Proofing device locations shall be documented.
- ✓ Have reaction plans to device failures (e.g. *Control of nonconforming product*; strategy # 2)
- ✓ Verification results shall be recorded.
- ✓ Leadership shall review verification results.

7.0 LAYERED PROCESS AUDITS

Were Leadership Layered Process Audits Performed?

LAYERED PROCESS AUDITS
Outline

LAYERED PROCESS AUDITS

7.0 - Introduction

PURPOSE:

- Ensure consistent application and execution of standards.
- Improve built-in-quality and increase operator/leadership awareness facilitated by coaching/teaching interaction between leadership & operators

SCOPE:

- Assembly Area
- Manufacturing Operations
- Shipping / Receiving
- All Operations
- Other Support Functions

RESPONSIBILITY:

- Ownership
  - ✓Plant / Operations Mgr
- Contingency Plan for All Situations

LAYERED PROCESS AUDITS

7.1 - Benefits

- Layered Process Audits provide a system to:
  - verify compliance to the documented process.
  - instill discipline.
  - improve communication.
  - improve overall quality.

•Ensures a high level of process control by identifying & controlling high risk / significant process elements.

•Maintains proper application of standards as defined & achieved through operational readiness process.

•Identify opportunities for improvement & provide a process for effective follow up.

LAYERED PROCESS AUDITS

7.2 - Process explanation

- Layered Process Audit (LPA) is a standardized audit performed on a regular, frequent basis by all layers of the organization to verify adherence to operational standards.

- LPA's are an industry standard.

- LPA's supplement ongoing control plan and job instruction checks.

- LPA's shall be owned by manufacturing leadership (Team Leader – Plant / Operations Manager).

- Quality and other functions will participate and support the LPA system.

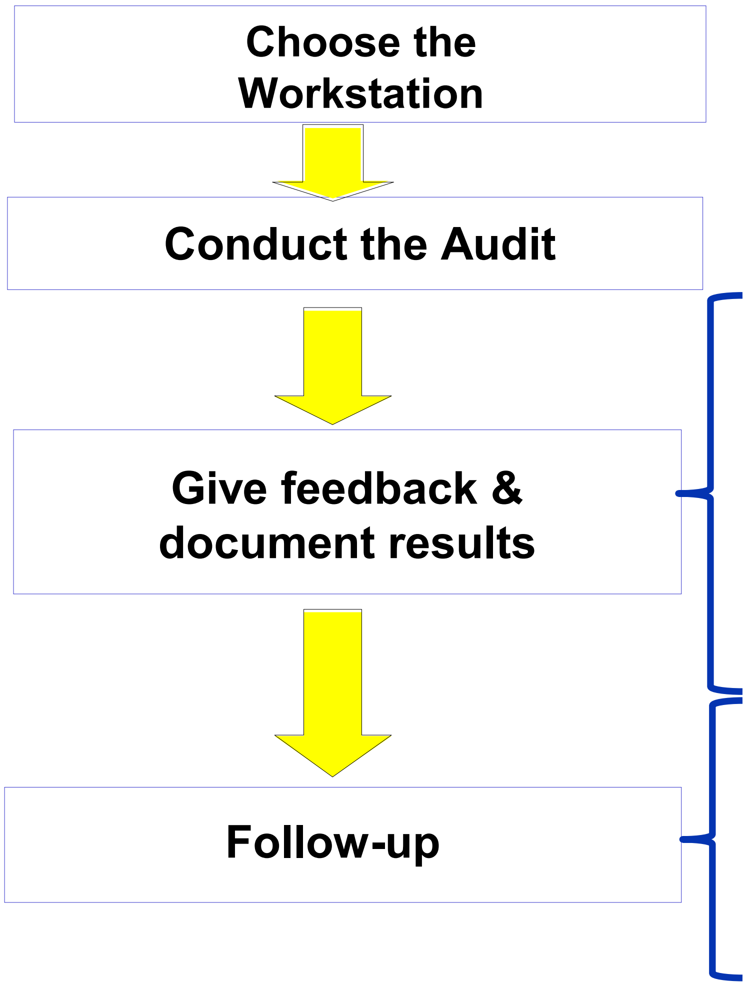
LAYERED PROCESS AUDITS

7.2 - Process explanation (continued)

- **The Layered Process Audit system includes:**
  - Schedule and tracking of audits.
  - Identifying high risk items for the LPA.
  - A LPA Checklist that evaluates current processes to established standards.
  - Identification of corrective action requirements and countermeasures.
  - Regular review process by senior management of the audit results and corrective actions.

LAYERED PROCESS AUDITS

7.2 - Process explanation (continued)



Choose the Workstation

- ➢ Pick the station to be audited based on the LPA schedule

Conduct the Audit

- ➢ Follow LPA Check sheet

Give feedback & document results

- ➢ Immediately inform all Team members about the audit results.
- ➢ Record all deviations on LPA Check sheet and Countermeasure sheet.
- ➢ Assign target close date & champion
- ➢ Implement suggested countermeasures as soon as possible.

Follow-up

- ➢ Follow-up on open items, make sure to close by target close date.
- ➢ Elevate problem to higher level after target Close date.
- ➢ Perform Management review.

LAYERED PROCESS AUDITS

7.2.1 - Scheduling and tracking

- Define the organization levels to perform audits.
- Define audits frequency for each level of the organization.

Layered Process Audits levels & frequency:

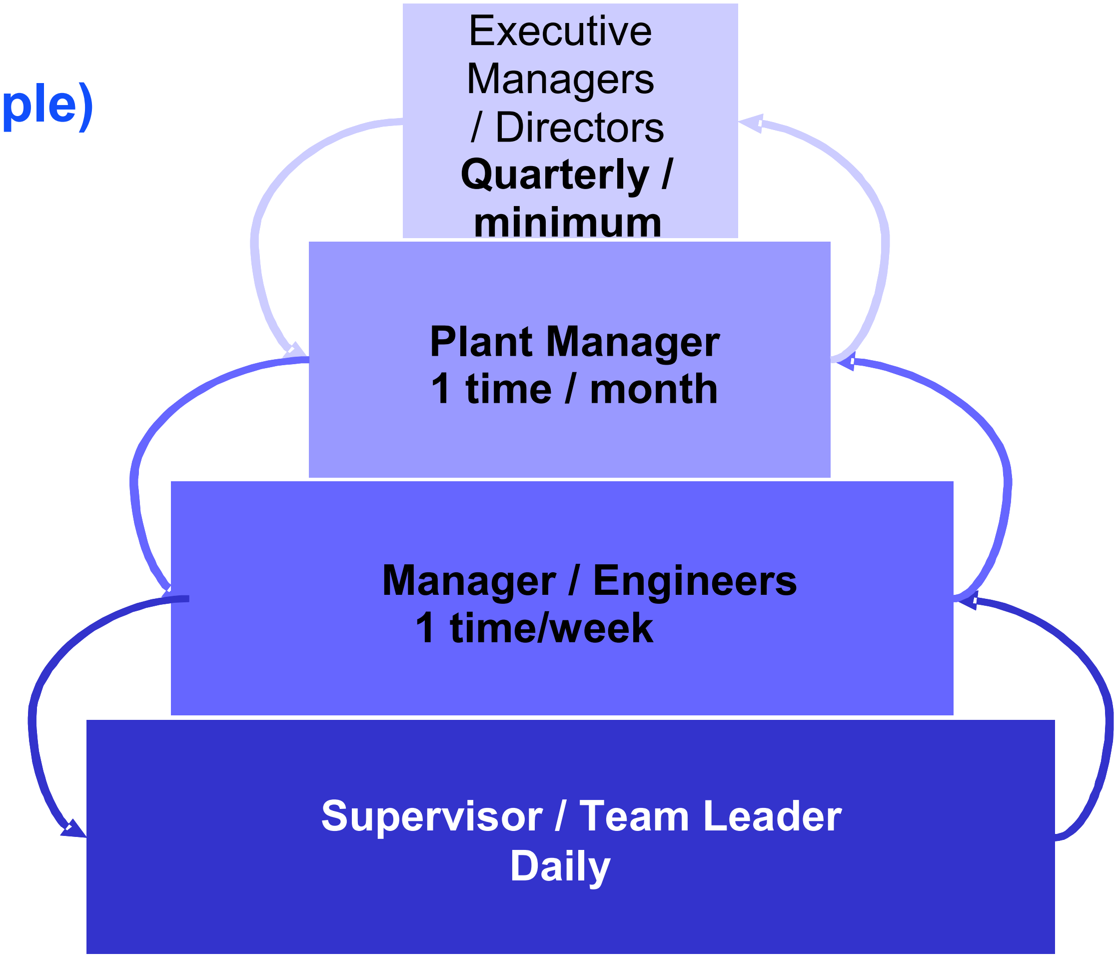
- Daily, the manufacturing supervisor shall perform audits.
- Weekly, the manufacturing area manager shall audit & verify that supervisor verification is being completed.
- Monthly, the site leadership shall conduct Layered Process Audits and review audit results and corrective actions.

LAYERED PROCESS AUDITS

7.2.1 - Scheduling and tracking

(continued)

(Example)



Executive Managers / Directors
Quarterly / minimum

Plant Manager
1 time / month

Manager / Engineers
1 time/week

Supervisor / Team Leader
Daily

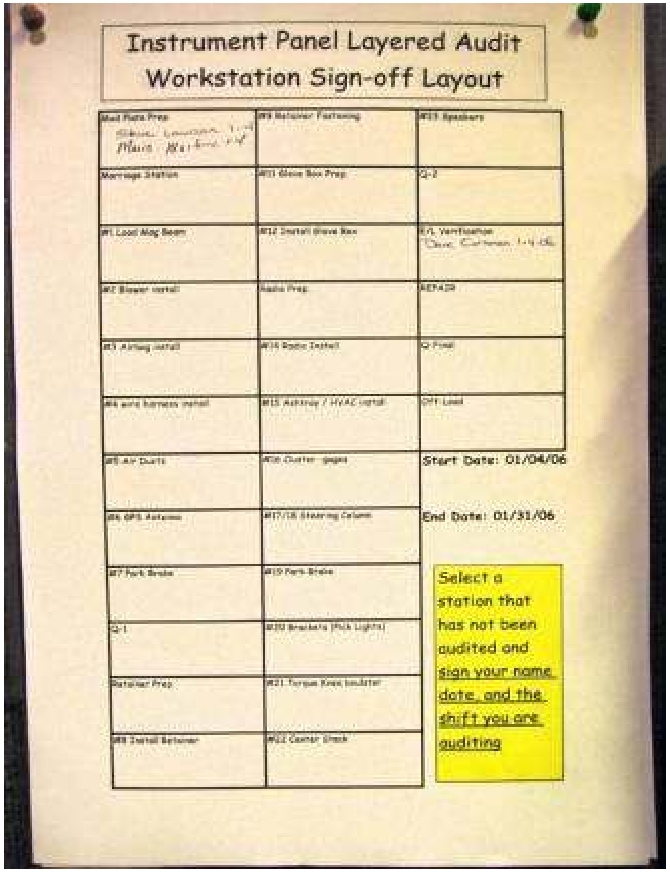
LAYERED PROCESS AUDITS

7.2.1 - Scheduling and tracking

(continued)

The example at the right is another way to ensure each station within a work area is evaluated at a minimum, on a monthly basis. This chart is used by all auditors to determine which stations have not yet been audited and requires the auditor to write down their name, date, and shift for the stations they chose for the audit.

The goal is to audit each work station where a team member is present one time each month.



Instrument Panel Layered Audit
Workstation Sign-off Layout

Start Date: 01/04/06

End Date: 01/31/06

Select a station that has not been audited and <u>sign your name, date, and the shift you are auditing</u>

(Example)

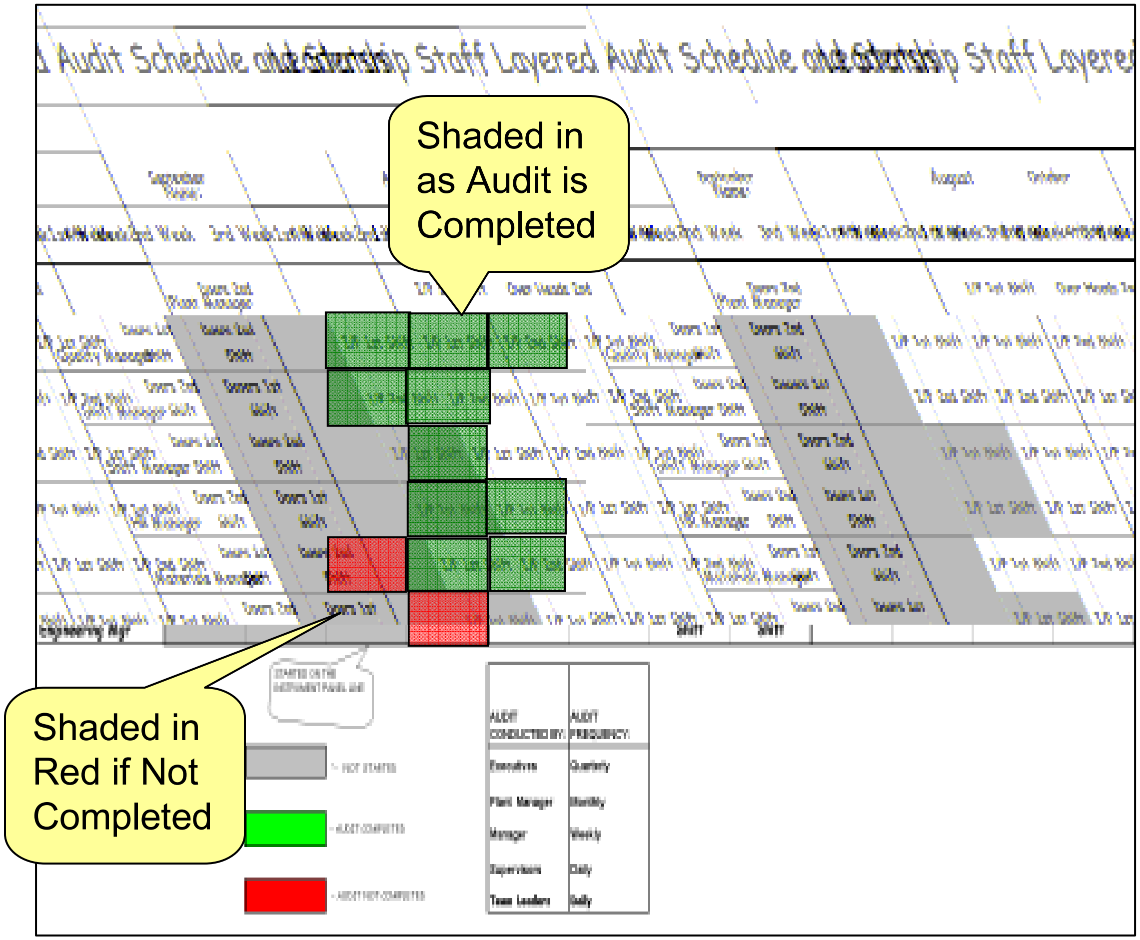
LAYERED PROCESS AUDITS

7.2.1 - Scheduling and tracking

(continued)

(Example)

Identifying Audits to be completed by the leadership staff is essential to ensure that all areas on the shop floor interact with the management team. An example schedule at the right addresses both the required frequency by manager and the status of this interaction.



Shaded in as Audit is Completed

Shaded in Red if Not Completed

⬜ = NOT STARTED

🟩 = AUDIT COMPLETED

🟥 = AUDIT NOT COMPLETED

AUDIT CONDUCTED BY:	AUDIT FREQUENCY:
Executives	Quarterly
Plant Manager	Monthly
Manager	Weekly
Supervisors	Daily
Team Leaders	Daily

LAYERED PROCESS AUDITS

7.2.2 - Development of high risk items for auditing

High risk items shall be identified and included in the audit.

They should be organized by 3 main sections:

- Work Station– list of checks, applicable to all work stations
- Quality Focused – checks are specific to operations and developed by plant, based on quality feedback, process knowledge, and problem solving
- Manufacturing System – list of system checks that focused on compliance to plant operations

LAYERED PROCESS AUDITS

7.2.2 - Development of high risk items for auditing (continued)

Examples of Work Station issues:

- Ensuring proper safety practices and PPE are being followed.
- Ensuring proper tools, gages and materials are available & used.
- Ensuring *standardized work* & quality standards are understood & followed.
- Ensuring Andon system is functioning properly.
- Ensuring Workplace Organization & Visual Management standards are maintained (e.g. according to the plant WPO standards and Visual Management policy).
- Ensuring compliance to Material Processes – FIFO/Min.-Max. levels.

LAYERED PROCESS AUDITS

7.2.2 - Development of high risk items for auditing (continued)

Examples of Quality Focused issues :

- Specific to a Product Line or Area of the plant
- Specific items regarding corrective action implementation to customer concerns. (e.g. *error proofing* verification, use of fixture added to complete *standardized work*
- Ensure *error proofing* is functioning properly and identified high risk/ significant process elements are controlled to prevent known problems from reoccurring.
- Ensure required quality inspection and/or documentation is being completed.

LAYERED PROCESS AUDITS

7.2.2 - Development of high risk items for auditing (continued)

Examples of Manufacturing System issues :

- Completion of safety talks & tours
- Compliance to Process Control Plans
- Conformance to Workplace Organization standards
- Proper use of the Andon System
- Effective Problem solving & countermeasure implementation
- Effective use of Layered Process Audits process for control and follow up

Verification that special process audits are performed shall be included as applicable. (e.g. CQI 9, 11, 12, Weld Audit, Chrome Audit, Paint Process Audit)

LAYERED PROCESS AUDITS

7.2.3 - LPA Check sheet

- **LPA results are documented on LPA Check sheet .**

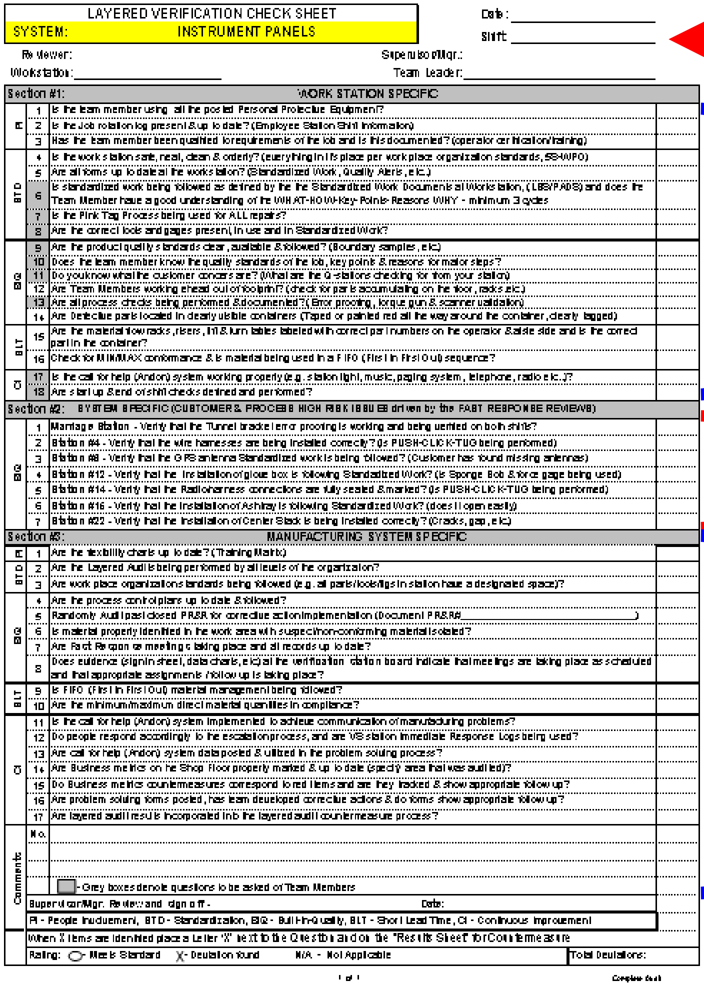
The intent is to have a single page LPA Check sheet form that is manually completed on production floor. The back side of the form is available to write down the non-compliance comments.

- **Establish LPA Check sheet questions from the high risk items.**
  - A LPA Check sheet should have two common sections (Work Station and Manufacturing System) and one section (Quality Focused), that is customized to a specific Product Line or Area of the Plant.
  - Work Station and Quality Focused sections of the LPA Check sheet shall be completed by all auditors. The Manufacturing System section shall be completed by the site leadership only.
  - A LPA Check sheet should be created for each unique processing area

LAYERED PROCESS AUDITS

7.2.3 - LPA Check sheet (continued)

(Example)



LAYERED VERIFICATION CHECK SHEET

SYSTEM: INSTRUMENT PANELS

Date: ____________

Shift: ____________

Reviewer:

Supervisor/Mgr.:

Workstation: ____________

Team Leader: ____________

Section #1:		WORK STATION SPECIFIC	
PI	1	Is the team member using all the posted Personal Protective Equipment?	
	2	Is the Job rotation log present & up to date? (Employee Station Shift Information)	
	3	Has the team member been qualified to requirements of the job and is this documented? (operator certification/training)	
BTD	4	Is the work station safe, neat, clean & orderly? (everything in it's place per work place organization standards, 5S-WPO)	
	5	Are all forms up to date at the workstation? (Standardized Work, Quality Alerts, etc.)	
	6	Is standardized work being followed as defined by the the Standardized Work Documents at Workstation, (LBS/PADS) and does the Team Member have a good understanding of the WHAT-HOW-Key Points-Reasons WHY - minimum 3 cycles	
	7	Is the Pink Tag Process being used for ALL repairs?	
	8	Are the correct tools and gages present, in use and in Standardized Work?	
BIQ	9	Are the product quality standards clear, available & followed? (Boundary samples, etc.)	
	10	Does the team member know the quality standards of the job, key points & reasons for major steps?	
	11	Do you know what the customer concerns are? (What are the Q-stations checking for from your station)	
	12	Are Team Members working ahead out of footprint? (check for parts accumulating on the floor, racks etc.)	
	13	Are all process checks being performed & documented? (Error proofing, torque gun & scanner validation)	
	14	Are Defective parts located in clearly visible containers (Taped or painted red all the way around the container, clearly tagged)	
SLT	15	Are the material flow racks, risers, tilt & turn tables labeled with correct part numbers on the operator & aisle side and is the correct part in the container?	
	16	Check for MIN/MAX conformance & is material being used in a FIFO (First In First Out) sequence?	
CI	17	Is the call for help (Andon) system working properly (e.g. station light, music, paging system, telephone, radio etc..)?	
	18	Are start up & end of shift checks defined and performed?	
Section #2:		SYSTEM SPECIFIC (CUSTOMER & PROCESS HIGH RISK ISSUES driven by the FAST RESPONSE REVIEWS)	
BIQ	1	Marriage Station - Verify that the Tunnel bracket error proofing is working and being verified on both shifts?	
	2	Station #4 - Verify that the wire harnesses are being installed correctly? (Is PUSH-CLICK-TUG being performed)	
	3	Station #8 - Verify that the GPS antenna Standardized work is being followed? (Customer has found missing antennas)	
	4	Station #12 - Verify that the installation of glove box is following Standardized Work? (Is Sponge Bob & force gage being used)	
	5	Station #14 - Verify that the Radio harness connections are fully sealed & marked? (Is PUSH-CLICK-TUG being performed)	
	6	Station #16 - Verify that the installation of Ashtray is following Standardized Work? (does it open easily)	
	7	Station #22 - Verify that the installation of Center Stack is being installed correctly? (Cracks, gap, etc)	
Section #3:		MANUFACTURING SYSTEM SPECIFIC	
PI	1	Are the flexibility charts up to date? (Training Matrix)	
BTD	2	Are the Layered Audits being performed by all levels of the organization?	
	3	Are work place organization standards being followed (e.g. all parts/tools/jigs in station have a designated space)?	
BIQ	4	Are the process control plans up to date & followed?	
	5	Randomly Audit past closed PR&R for corrective action implementation (Document PR&R#______________)	
	6	Is material properly identified in the work area with suspect/non-conforming material isolated?	
	7	Are Fast Response meetings taking place and all records up to date?	
	8	Does evidence (sign in sheet, data charts, etc) at the verification station board indicate that meetings are taking place as scheduled and that appropriate assignments / follow up is taking place?	
SLT	9	Is FIFO (First In First Out) material management being followed?	
	10	Are the minimum/maximum direct material quantities in compliance?	
CI	11	Is the call for help (Andon) system implemented to achieve communication of manufacturing problems?	
	12	Do people respond accordingly to the escalation process, and are VS station Immediate Response Logs being used?	
	13	Are call for help (Andon) system data posted & utilized in the problem solving process?	
	14	Are Business metrics on the Shop Floor properly marked & up to date (specify area that was audited)?	
	15	Do Business metrics countermeasures correspond to red items and are they tracked & show appropriate follow up?	
	16	Are problem solving forms posted, has team developed corrective actions & do forms show appropriate follow up?	
	17	Are layered audit results incorporated into the layered audit countermeasure process?	
Comments	No.		
		▨ - Grey boxes denote questions to be asked of Team Members	
	Supervisor/Mgr. Review and sign off -	Date:	
	PI - People Involvement, BTD - Standardization, BIQ - Built-In-Quality, SLT - Short Lead Time, CI - Continuous Improvement		
	When X items are identified place a Letter "X" next to the Question and on the "Results Sheet" for Countermeasure		
	Rating: ○ - Meets Standard X - Deviation found N/A - Not Applicable		Total Deviations:

1 of 1

Complete Audit

HEADER: **Enter the System Name Product line or an area of the Plant**

1. Molding
2. Paint/Coating
3. Assembly
4. Warehouse/Shipping

Section #1:
COMMON Work Station Questions

Section #2:
UNIQUE Quality Focused Questions

Section #3:
COMMON Manufacturing System Questions

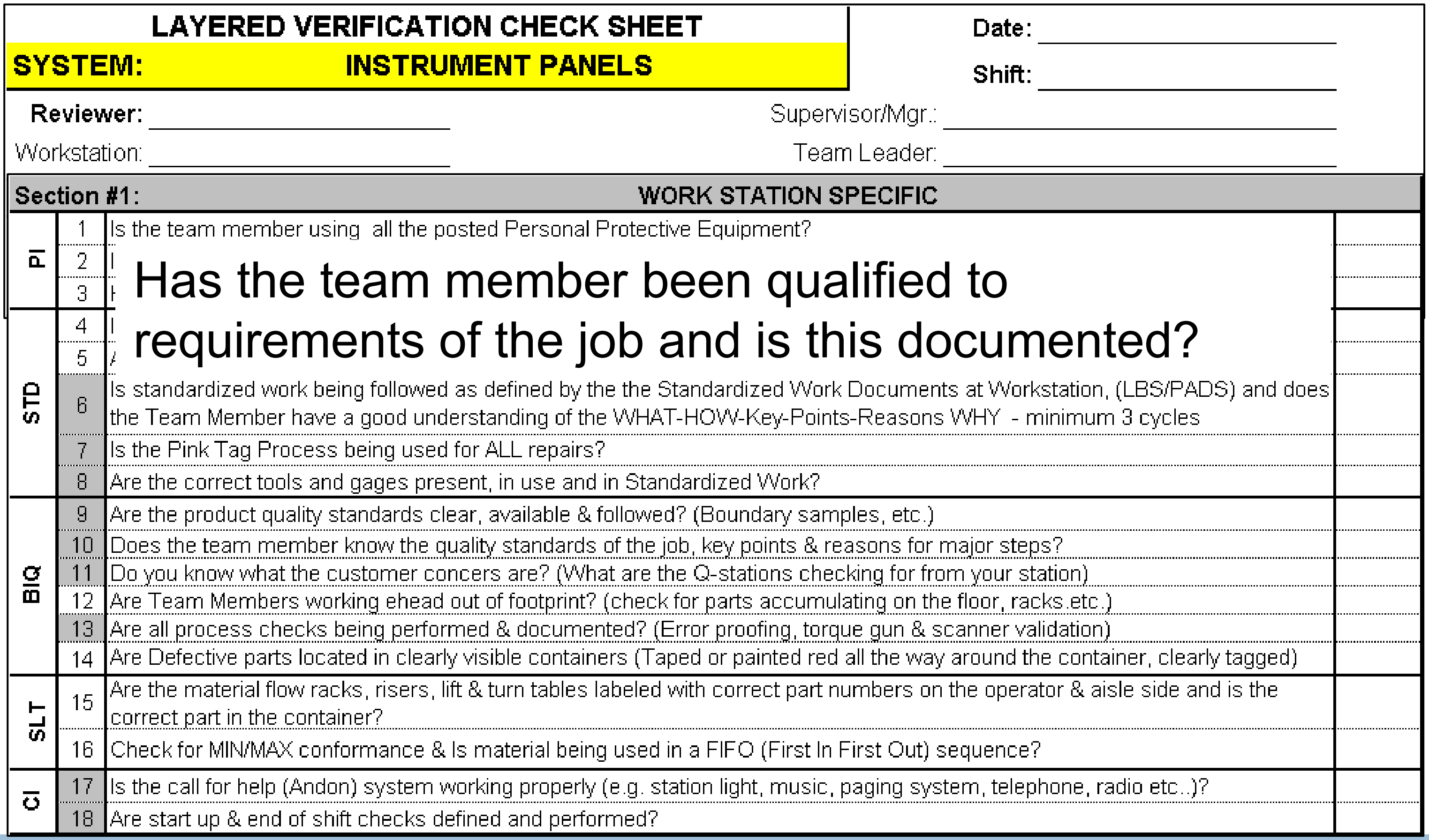
In this Example the Manufacturer would have (4) four unique one page audit forms/files, to cover all processes.

LAYERED PROCESS AUDITS

7.2.3 - LPA Check sheet (continued)

Header & Work Station Specific

(Example)



LAYERED VERIFICATION CHECK SHEET

SYSTEM: **INSTRUMENT PANELS**

Date: ______________________

Shift: ______________________

Reviewer: ______________________

Supervisor/Mgr.: ______________________

Workstation: ______________________

Team Leader: ______________________

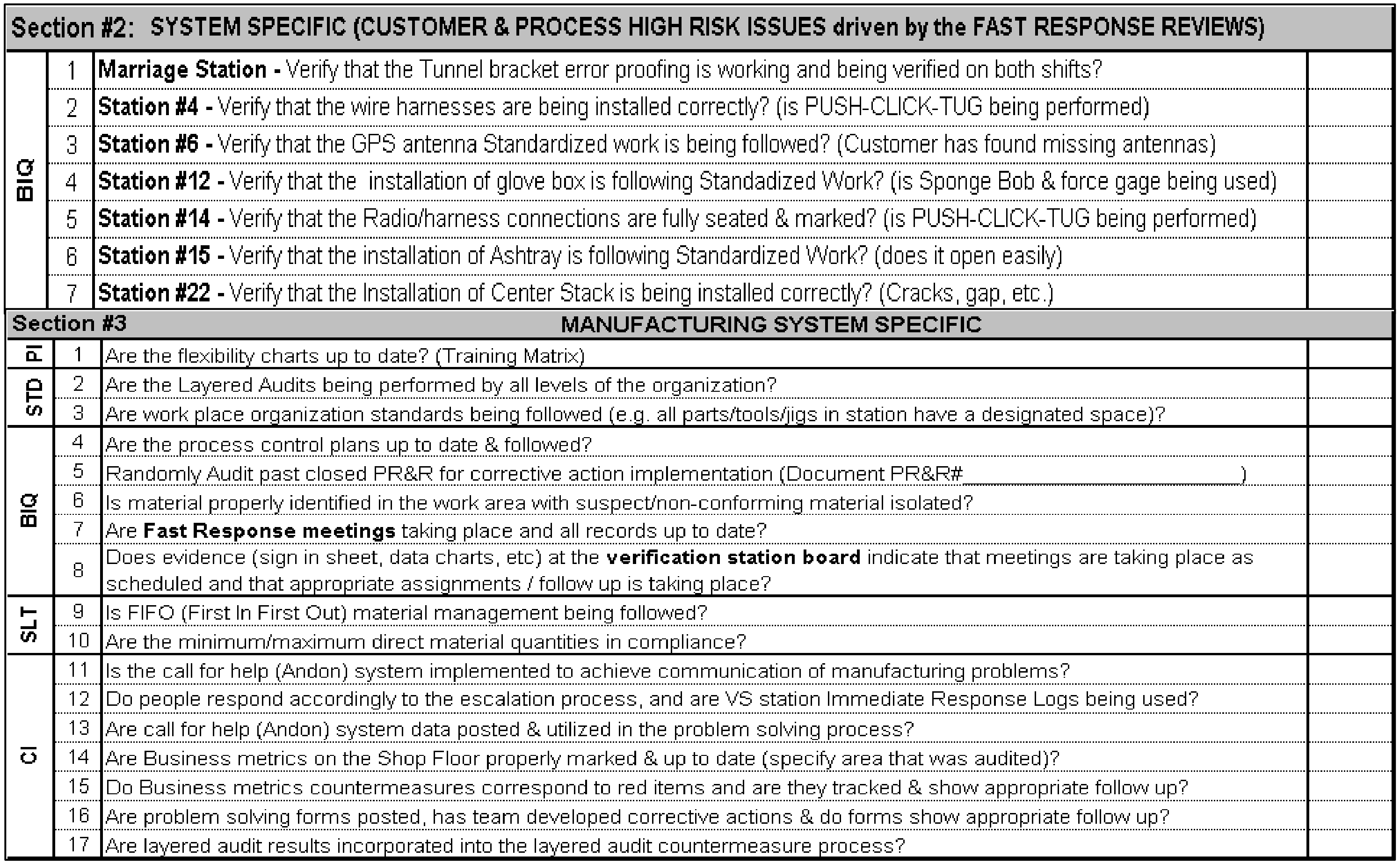
Section #1:		**WORK STATION SPECIFIC**	
PI	1	Is the team member using all the posted Personal Protective Equipment?	
	2	I	
	3	H	
STD	4	I	
	5	A	
	6	Is standardized work being followed as defined by the the Standardized Work Documents at Workstation, (LBS/PADS) and does the Team Member have a good understanding of the WHAT-HOW-Key-Points-Reasons WHY - minimum 3 cycles	
	7	Is the Pink Tag Process being used for ALL repairs?	
	8	Are the correct tools and gages present, in use and in Standardized Work?	
BIQ	9	Are the product quality standards clear, available & followed? (Boundary samples, etc.)	
	10	Does the team member know the quality standards of the job, key points & reasons for major steps?	
	11	Do you know what the customer concers are? (What are the Q-stations checking for from your station)	
	12	Are Team Members working ehead out of footprint? (check for parts accumulating on the floor, racks.etc.)	
	13	Are all process checks being performed & documented? (Error proofing, torque gun & scanner validation)	
	14	Are Defective parts located in clearly visible containers (Taped or painted red all the way around the container, clearly tagged)	
SLT	15	Are the material flow racks, risers, lift & turn tables labeled with correct part numbers on the operator & aisle side and is the correct part in the container?	
	16	Check for MIN/MAX conformance & Is material being used in a FIFO (First In First Out) sequence?	
CI	17	Is the call for help (Andon) system working properly (e.g. station light, music, paging system, telephone, radio etc..)?	
	18	Are start up & end of shift checks defined and performed?	

Has the team member been qualified to requirements of the job and is this documented?

LAYERED PROCESS AUDITS

7.2.3 - LPA Check sheet (continued)

Quality Focused & Manufacturing System (Example)



Section #2:		SYSTEM SPECIFIC (CUSTOMER & PROCESS HIGH RISK ISSUES driven by the FAST RESPONSE REVIEWS)	
BIQ	1	**Marriage Station -** Verify that the Tunnel bracket error proofing is working and being verified on both shifts?	
	2	**Station #4 -** Verify that the wire harnesses are being installed correctly? (is PUSH-CLICK-TUG being performed)	
	3	**Station #6 -** Verify that the GPS antenna Standardized work is being followed? (Customer has found missing antennas)	
	4	**Station #12 -** Verify that the installation of glove box is following Standadized Work? (is Sponge Bob & force gage being used)	
	5	**Station #14 -** Verify that the Radio/harness connections are fully seated & marked? (is PUSH-CLICK-TUG being performed)	
	6	**Station #15 -** Verify that the installation of Ashtray is following Standardized Work? (does it open easily)	
	7	**Station #22 -** Verify that the Installation of Center Stack is being installed correctly? (Cracks, gap, etc.)	
Section #3		MANUFACTURING SYSTEM SPECIFIC	
PI	1	Are the flexibility charts up to date? (Training Matrix)	
STD	2	Are the Layered Audits being performed by all levels of the organization?	
	3	Are work place organization standards being followed (e.g. all parts/tools/jigs in station have a designated space)?	
BIQ	4	Are the process control plans up to date & followed?	
	5	Randomly Audit past closed PR&R for corrective action implementation (Document PR&R#_______________________)	
	6	Is material properly identified in the work area with suspect/non-conforming material isolated?	
	7	Are **Fast Response meetings** taking place and all records up to date?	
	8	Does evidence (sign in sheet, data charts, etc) at the **verification station board** indicate that meetings are taking place as scheduled and that appropriate assignments / follow up is taking place?	
SLT	9	Is FIFO (First In First Out) material management being followed?	
	10	Are the minimum/maximum direct material quantities in compliance?	
CI	11	Is the call for help (Andon) system implemented to achieve communication of manufacturing problems?	
	12	Do people respond accordingly to the escalation process, and are VS station Immediate Response Logs being used?	
	13	Are call for help (Andon) system data posted & utilized in the problem solving process?	
	14	Are Business metrics on the Shop Floor properly marked & up to date (specify area that was audited)?	
	15	Do Business metrics countermeasures correspond to red items and are they tracked & show appropriate follow up?	
	16	Are problem solving forms posted, has team developed corrective actions & do forms show appropriate follow up?	
	17	Are layered audit results incorporated into the layered audit countermeasure process?	

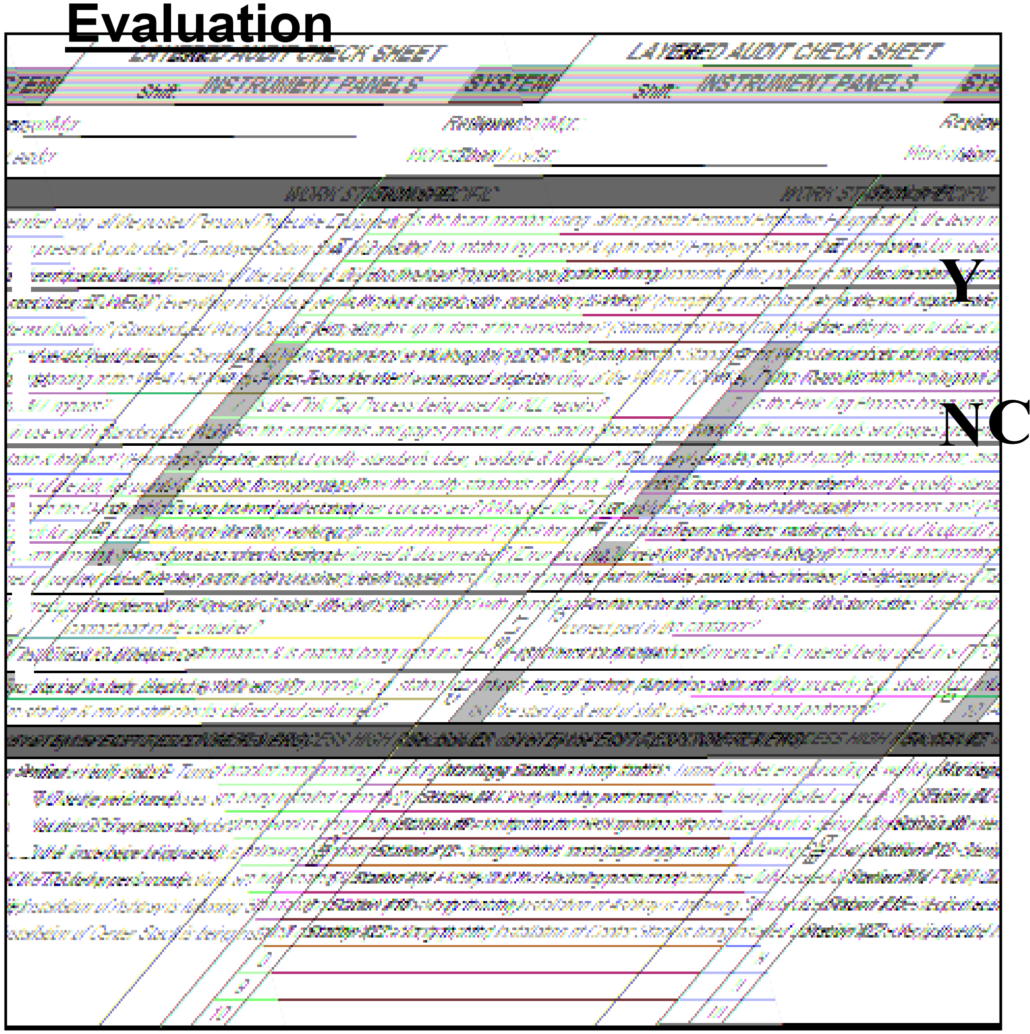
LAYERED PROCESS AUDITS

7.2.4 - LPA Check sheet Evaluation

- There are four results that can come out of each audit question:
  - Y – No deviation found
  - N – Deviation found / not corrected during audit
  - NC – Deviation corrected during audit – drive this behavior
  - N/A – Not applicable (established at Plant/Shift Leader level)
- All Deviations shall be recorded on the LPA Check sheet .
- Describe deviations in the detail section on the back of the LPA Check sheet
- Any Deviations that can be corrected immediately will have a letter 'C' next to N.
- Any Deviations that cannot be immediately corrected should have additional detail written and transferred to a Countermeasure Sheet.
- Reasons for non-compliance should be understood.

LAYERED PROCESS AUDITS

7.2.4 - LPA Check sheet Evaluation



(Example)

N = Deviation Found
Y = Meets Standard

If the item is Corrected Immediately

LAYERED PROCESS AUDITS

7.2.5 - Countermeasure Sheet

All questions answered “N” on the LPA Checks sheet that cannot be resolved immediately will be entered on the Countermeasure Sheet as an open item.

- The Countermeasure Sheet tracks the specific open issues on an operation/workstation for each group.
- All questions answered “N” on the LPA Check Sheet that cannot be resolved immediately will be entered on the Countermeasure Sheet as an open item.
- The Countermeasure Sheet will be updated and signed off as issues are resolved.

LAYERED PROCESS AUDITS

7.2.5 - Countermeasure Sheet (continued)

(Example)

Item #	Date	Location	Problem Description	Owner	Countermeasure	Target date	Initials	Complete Date
4	7/7/08	005R	New option Side marker lamp, parts don't have a standard marked location.	TL1	Re-layout work station to include one shift's requirement of lamps.	7/28/08	JC	7/26/08
6	7/7/08	005R	tool for installing drainplugs is different from standard, TM used replacement without informing TL	TL1	get standard tool from store, replace at workstation	8/3/08	RS	

LAYERED PROCESS AUDITS

7.2.6 - Management Review Requirements

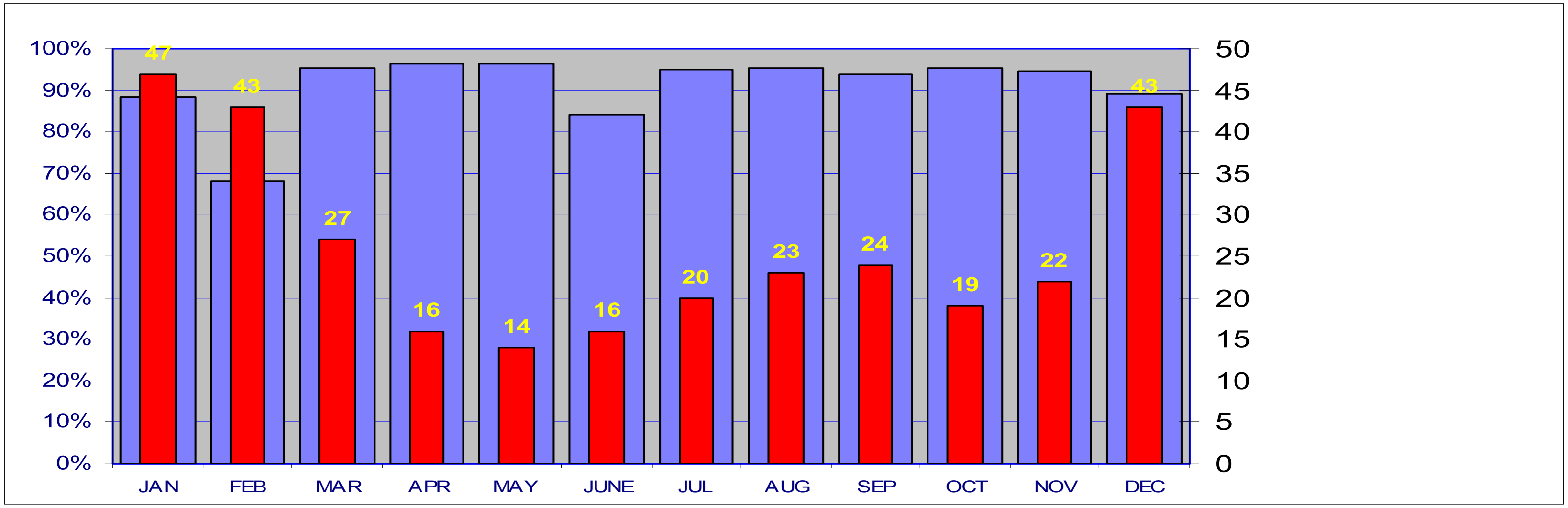
- **LPA Review Process**
  - Shift Leader is Process Owner
  - Regularly schedule review meeting
  - Review compliance & completion performance
  - Elevate past due countermeasures to next level
  - Review audit questions for Continuous Improvement (add, delete, revise as needed)
- When appropriate, the Layered Process Audit nonconformance shall be added to the *Fast Response* system and/or the *C.A.R.E.* checklist.
- Layered Process Audit results shall be added to the *Lessons Learned* database when appropriate.
- Audit results shall be summarized and reviewed by the manufacturing site leadership.

LAYERED PROCESS AUDITS

(Example)

DEPT.________________________

LAYERED PROCESS AUDIT RESULTS



	JAN	FEB	MAR	APR	MAY	JUNE	JUL	AUG	SEP	OCT	NOV	DEC
% IN COMPLIANCE:	88%	68%	95%	96%	97%	84%	95%	95%	94%	95%	95%	89%
# OF ITEMS ON ASSESSMENT:	20	15	20	30	20	10	20	25	20	20	20	20
# OF ASSESSMENTS	20	9	28	15	20	10	20	20	20	20	20	20
TOTAL # OF ITEMS ASSESSED:	400	135	560	450	400	100	400	500	400	400	400	400
# OF ITEMS IN COMPLIANCE:	353	92	533	434	386	84	380	477	376	381	378	357
NON CONFORMANCES	47	43	27	16	14	16	20	23	24	19	22	43

NON CONFORMANCES	NUMBER OF ITEMS NOT IN COMPLIANCE											
Safety	10	8	5	2	1	1	1	1	1	1	1	1
Missed Audits	10	8	3	2	3	4	5	2	1	1	1	10
5S Related	2	7	7	3	2	2	2	2	2	2	3	2
Product	10	4	3	2	1	1	1	1	1	1	1	10
Voice of Customer	6	4	2	2	3	4	4	4	3	2	2	10
Systemic	9	7	1	2	2	2	2	2	2	2	2	2
Gage Calibration		5	6	3	2	2	5	6	7	2	2	2
Poke Yoke								5	7	8	10	6

LAYERED PROCESS AUDITS

7.3 - Summary, Shalls

Organizations shall…

- ✓ Designate manufacturing to own and conduct Layered Audits.
- ✓ Identify high risk items to be verified during audit process.
- ✓ Verify special process audits are performed as applicable.
- ✓ Establish a schedule & frequency by level.
- ✓ Ensure all levels participate in the audit process.
- ✓ Track and review the results of Layered Process Audits.
- ✓ Link LPA issues to *Fast Response*, *C.A.R.E., & Lessons Learned*

8.0 - RISK REDUCTION PROCESS

PROACTIVE

REDUCING THE RISK OF A POTENTIAL QUALITY FAILURE.
REVERSE PFMEA PROCESS

REACTIVE

ERROR PROOFING PAST QUALITY FAILURES

RISK REDUCTION
Outline

RISK REDUCTION PROCESS

8.0 - Introduction

PURPOSE:

- Reduce the risk of a initial quality failures
- *Error proofing* past quality failures
- Ensure that Failure Modes have proper controls (prevention/detection) and work properly.

SCOPE:

- Assembly Area
- Manufacturing Operations
- Shipping / Receiving
- All Operations
- Other Support Functions

RESPONSIBILITY:

- Ownership
  - ✓Engineering Manager
  - ✓Operations Manager
- Contingency Plan for All Situations

RISK REDUCTION PROCESS

8.1 - Benefits

- Supports continual improvement as expected by TS16949.
- Allows leadership to allocate limited resources to critical areas.
- Provides a basis for effective error-proofing and problem solving.
- Core tool for APQP and PPAP requirements.
- Provides a Lessons Learned archive.
- Promotes cross-functional teamwork.
- Meets customer expectations for “living documents”.

RISK REDUCTION PROCESS

8.2 - PFMEA Overview

PFMEA definition:

- An analytical technique for each process step that identifies:
  - Ways a process may fail to meet requirements.
  - Consequences to the internal / external customer (severity).
  - Frequency the failure will/could happen (occurrence).
  - Effectiveness of current controls (prevention & detection).
  - Ranking of causes and effects (risk priority number).
- A structured procedure for identifying and eliminating process related failure modes.

RISK REDUCTION PROCESS

8.2 - PFMEA Overview (Continued)

(Example)

What can go wrong?

How does it affect customer?

How likely are we to notice if this happens?

POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
(PROCESS FMEA)

15xx xx

MODEL Y R / CARLINE :
PRODUCTIO LANT :

REV'D DATE :
FMEA DATE :
FMEA CONDUCTED BY :

B/P Level: 001, 7-NOV-02

PROCESS NAME/ NUMBER	PROCESS FUNCTION	POTENTIAL FAILURE MODE	POTENTIAL EFFECT(S) OF FAILURE	SEV	CLASS	POTENTIAL CAUSE(S)/ MECHANISM(S) OF FAILURE	OCC	CURRENT CONTROLS		DET	RPN	RECOMMENDED ACTION(S)	RESPONSIBILITY & TARGET COMPLETION DATE	ACTION RESULTS				
								PREVENTION	DETECTION					ACTIONS TAKEN	SEV	OCC	DET	RPN
10	Install pilot bearing	Incorrect part installed	Misbuild: part does not function.	7		Manual: incorrect part selected	7	No prevention	No detection	10	490	Sensor to detect bearing type	Shad, B.	3/1/02	7	7	4	146
20	Correct sub-assy	Incorrect or reversed sub-assembly	unable to install	7		Machine Vision ID Incorrect	3	No prevention	In-line Audits	6	126	New Laser Station.	NA		7	3	2	42

(AIAG PFMEA Manual)

How often does this cause happen?

How high is the risk?

RISK REDUCTION PROCESS

8.2 - PFMEA Overview (Continued)

PFMEA Severity, Occurrence and Detection numbers are determined by cross-functional FMEA team using AIAG PFMEA manual

SEVERITY RANKINGS

Effect	Criteria: Severity of Effect This ranking results when a potential failure mode results in a final customer and/or a manufacturing/assembly plant defect. The final customer should always be considered first. If both occur, use the higher of the two severities. (Customer Effect)	Criteria: Severity of Effect This ranking results when a potential failure mode results in a final customer and/or a manufacturing/assembly plant defect. The final customer should always be considered first. If both occur, use the higher of the two severities. (Manufacturing/Assembly Effect)	Ranking
Hazardous without warning	Very high severity ranking when a potential failure mode affects safe vehicle operation and/or involves noncompliance with government regulation without warning.	Or may endanger operator (machine or assembly) without warning.	10
Hazardous with warning	Very high severity ranking when a potential failure mode affects safe vehicle operation and/or involves noncompliance with government regulation with warning.	Or may endanger operator (machine or assembly) with warning.	9
Very High	Vehicle/item inoperable (loss of primary function).	Or 100% of product may have to be scrapped, or vehicle/item repaired in repair department with a repair time greater than one hour.	8
High	Vehicle/item operable but at a reduced level of performance. Customer very dissatisfied.	Or product may have to be sorted and a portion (less than 100%) scrapped, or vehicle/item repaired in repair department with a repair time between a half-hour and an hour.	7
Moderate	Vehicle/item operable but Comfort/Convenience item(s) inoperable. Customer Dissatisfied.	Or a portion (less than 100%) of the product may have to be scrapped with no sorting, or a vehicle/item repaired in repair department with a repair time less than a half-hour.	6
Low	Vehicle/Item operable but Comfort/Convenience item(s) operable but at a reduced level of performance.	Or 100% of product may have to be reworked, or vehicle/item repaired off-line but does not go to repair department.	5
Very Low	Fit and Finish/Squeak and Rattle item does not conform. Defect noticed by most customers (greater than 75%).	Or the product may have to be sorted, with no scrap, and a portion (less than 100%) reworked.	4
Minor	Fit and Finish/Squeak and Rattle item does not conform. Defect noticed by 50% of customers.	Or a portion (less than 100%) of the product may have to be reworked, with no scrap, on-line but out-of-station.	3
Very Minor	Fit and Finish/Squeak and Rattle item does not conform. Defect noticed by discriminating customers (less than 25%.	Or a portion (less than 100%) of the product may have to be reworked with no scrap, on-line but in-station.	2
None	No discernible effect.	Or slight inconvenience to operation or operator, or no effect.	1

OCCURRENCE RANKING

Probability	Likely Failure Rates	PpK	Ranking
Very High: Persistent Failure	≥ 100 per Thousand Pieces	< 0.55	10
	50 per Thousand Pieces	≥ 0.55	9
High: Frequent Failures	20 per Thousand Pieces	≥ 0.78	8
	10 per Thousand Pieces	≥ 0.86	7
Moderate: Occasional Failure	5 per Thousand Pieces	≥ 0.94	6
	2 per Thousand Pieces	≥ 1.00	5
	1 per Thousand Pieces	≥ 1.10	4
Low: Relatively Few Failures	0.5 per Thousand Pieces	≥ 1.20	3
	0.1 per Thousand Pieces	≥ 1.30	2
Remote: Failure is Unlikely	≤ 0.01 per Thousand Pieces	≥ 1.67	1

DETECTION RANKINGS

Rating	Detection	Criteria	Error Proofed	Gauging	Manual Inspection	Suggested range of detection methods
10	Almost Impossible	Absolute certainty of non-detection.			X	Cannot detect or is not checked.
9	Very Remote	Controls will probably not detect.			X	Control achieved with Indirect or random checks only.
8	Remote	Controls have poor chance of detection.			X	Control is achieved with visual inspection only.
7	Very Low	Controls have poor chance of detection.			X	Control is achieved with double visual inspection only.
6	Low	Controls may detect.		X	X	Control is achieved with charting methods, such as SPC.
5	Moderate	Controls may detect.		X		Control is based on variable gauging after parts have left the station, or go/no-go gauging performed on 100% of the parts after parts have left the station.
4	Moderately High	Controls have a good chance to detect.	X	X		Error detection in subsequent operations, OR gauging performed on set-up and first piece check (for set-up causes only).
3	High	Controls have a good chance to detect.	X	X		Error detection in station, OR error detection in subsequent operations by multiple layers of acceptance: Supply, select, install, verify. Cannot accept discrepant part.
2	Very High	Controls almost certain to detect.	X			Error detection in-station (automatic gauging with automatic stop feature). Cannot pass discrepant part.
1	Certain	Controls certain to detect.	X			Discrepant parts cannot be made because item has been error proofed by process/product design.

RISK REDUCTION PROCESS

8.3 - PFMEA Overview (Continued)

- PFMEA's shall be developed and maintained by cross-functional teams for all manufacturing processes and support functions as required by the AIAG manual.
  - Exist for all product lines / part numbers.
  - Support functions include: (receiving inspection, material handling, labeling, shipping, repair, rework, etc.).

- PFMEA's shall:
  - Conform to current AIAG guidelines and customer requirements.
  - Have accurate Severity/Occurrence/Detection ratings.
  - Be updated on a regular basis (living documents).
  - Be utilized for Continuous Improvement (per GP-8 procedure).

RISK REDUCTION PROCESS

8.3 - PFMEA Review Process

Cross-functional teams shall review PFMEA's periodically.

- The frequency and/or number of PFMEA reviews shall be determined by supplier leadership based on:
  - Customer expectations (PR/Rs, DDW, Launch activities, etc.)
  - Process capability (FTQ, SPC, etc.)
  - Changes to the process (*Error proofing*, Tier 2 changes, etc.)
- Criteria to prioritize which PFMEA to review include:
  - Product from an acquisition, tool move or change in supplier.
  - PFMEA developed without adequate cross-functional involvement.
  - PFMEA for part(s) with history of PR/R, Customer complaints,
  - Warranty or FTQ issues.
  - Occurrence ratings (FTQ, scrap, etc.) have changed significantly.
  - PFMEA with oldest revision dates.

RISK REDUCTION PROCESS

8.3 - PFMEA Review Process Continued)

- PFMEA shall be reviewed and updated based on the following:
  - Verification that all operations/processes (paint, heat treat, material handling, labeling, rework/repair, etc.)are included and accurate.
  - All process controls are included.
  - Detection ratings are accurate.
  - Occurrence ratings are analyzed using data (SPC, FTQ, Quality Gate, *C.A.R.E.**, Scrap, *Layered Process Audits* results, etc.).
  - Verification that the PFMEA meets customer requirements and expectations (AIAG, PPAP, Launch, DDW, etc.).

RISK REDUCTION PROCESS

8.4 - PFMEA Risk Reduction Process

Per GP-8, Section 4.2, suppliers are required to have a formal and documented RPN reduction process

- Proactive RPN Reduction Process-Reducing the risk of potential quality failures
  - Reverse PFMEA Process
- Reactive RPN Reduction Process-*Error proofing* past quality issues

8.4.1 - PFMEA Proactive Risk Reduction Process

Upon completion of the PFMEA review:

- Establish and maintain a list of the highest (RPN) Risk Reduction opportunities based on the updated PFMEA documents.
- An action plan or equivalent shall be utilized by the cross-functional team to track progress in reducing the RPN ratings.

RISK REDUCTION PROCESS

8.4.1 - PFMEA Proactive Risk Reduction Process (Continued)

List of the Highest (RPN) Risk Reduction Opportunities (Proactive)

(Example)

No.	OP No.	Function & Failure Mode	RPN Value	Who	Recommended Actions	Completion Date	Revised RPN
1	10	INCORRECT BEARING INSTALLED	490	B. SHAD	SENSOR TO DETECT BEARING TYPE	12/1/2008	112
2	20	INCORRECT OR REVERSED SUBASSEMBLY	126	N. ADAMS	INSTALL LASER STATION	12/31/2008	42
3	50	HOLE MISSING	168	S. BROWN	INSTALL POST ON ASSEMBLY FIXTURE	12/23/2008	42
4	60	INCORRECT LABEL	112	V. WAGNER	IMPLEMENT SCANNER	1/30/2009	21

The number of RPN reduction opportunities on the list is dependent on complexity of parts and process, size of plant, customer feedback, etc.

RISK REDUCTION PROCESS

8.4.2 - Reverse PFMEA Process

Reverse PFMEA definition:

Reverse PFMEA is an on-station review of all failure modes included in PFMEA conducted by cross-functional team, focused to verify that all failure modes have proper controls (prevention/detection) and they are working properly.

Reverse PFMEA purpose:

Reverse PFMEA is intended as a tool to assist in PFMEA reviews and RPN reduction efforts based on actual data from in-station audits of all the failure modes. This review is an attempt to discover or create new Potential Failure Modes not considered during PFMEA development as well as validate Occurrence and Detection ratings based on real data.

RISK REDUCTION PROCESS

8.4.2 - Reverse PFMEA Process (Continued)

Process explanation:

- Teams and an audit schedule should be defined. With one external auditor as "fresh eyes" for the audit.
- In order to standardize the audit concept, the teams should work together on a Reverse PFMEA. This will assure that the same criteria is used to avoid affecting the result of the audit.
- Confirm the current failures modes have the identified methods and controls in place.

RISK REDUCTION PROCESS

8.4.2 - Reverse PFMEA Process (Continued)

Process explanation: (Continued)

- Experiment with the station in order to try to find new failure modes (example: using similar components that could be mixed, or try to assemble parts inverted to see what happened, etc.)

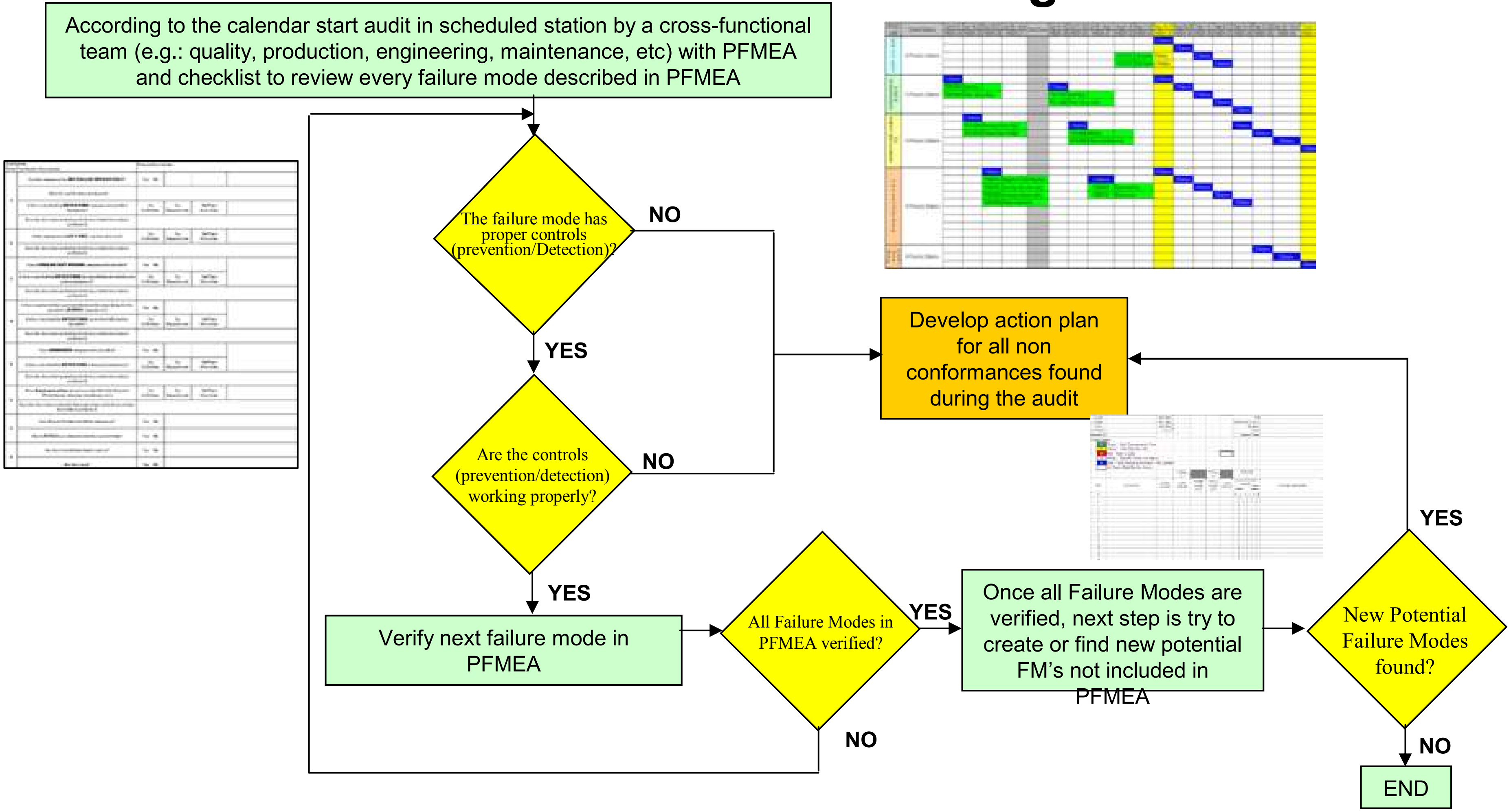
NOTE: This verification will be under the supervision of the maintenance engineer to avoid any damage to the station.

- Once they finished the audit all the findings should be documented in an action plan with champion and dates to complete and increase the prevention of defects at the production line.

RISK REDUCTION PROCESS

8.4.2 - Reverse PFMEA Process (Continued)

Reverse-PFMEA Flow Diagram



According to the calendar start audit in scheduled station by a cross-functional team (e.g.: quality, production, engineering, maintenance, etc) with PFMEA and checklist to review every failure mode described in PFMEA

The failure mode has proper controls (prevention/Detection)?

Are the controls (prevention/detection) working properly?

Develop action plan for all non conformances found during the audit

Verify next failure mode in PFMEA

All Failure Modes in PFMEA verified?

Once all Failure Modes are verified, next step is try to create or find new potential FM's not included in PFMEA

New Potential Failure Modes found?

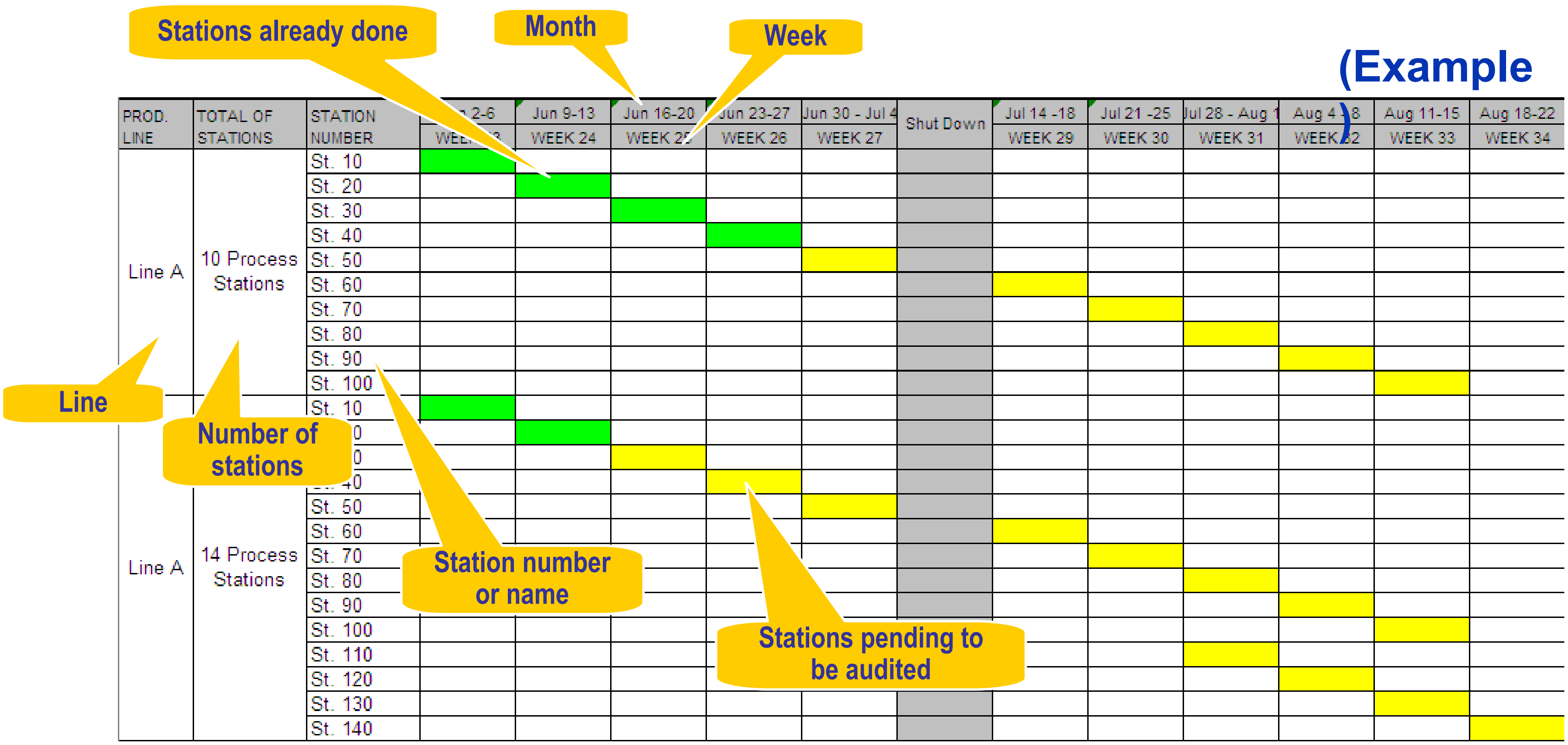
END

RISK REDUCTION PROCESS

8.4.2 - Reverse PFMEA Process (Continued)

Audit Schedule

(Example)



PROD. LINE	TOTAL OF STATIONS	STATION NUMBER	n 2-6 WEE 3	Jun 9-13 WEEK 24	Jun 16-20 WEEK 25	Jun 23-27 WEEK 26	Jun 30 - Jul 4 WEEK 27	Shut Down	Jul 14 -18 WEEK 29	Jul 21 -25 WEEK 30	Jul 28 - Aug 1 WEEK 31	Aug 4-8 WEEK 32	Aug 11-15 WEEK 33	Aug 18-22 WEEK 34
Line A	10 Process Stations	St. 10	🟩											
		St. 20		🟩										
		St. 30			🟩									
		St. 40				🟩								
		St. 50					🟨							
		St. 60							🟨					
		St. 70								🟨				
		St. 80									🟨			
		St. 90										🟨		
		St. 100											🟨	
Line A	14 Process Stations	St. 10	🟩											
		0		🟩										
		0			🟨									
		40				🟨								
		St. 50					🟨							
		St. 60							🟨					
		St. 70								🟨				
		St. 80									🟨			
		St. 90										🟨		
		St. 100											🟨	
		St. 110									🟨			
		St. 120										🟨		
		St. 130											🟨	
		St. 140												🟨

🟩 GREEN	Station Audited	🟨 YELLOW	Station Pending but on time	🟥 RED	Audit Delayed

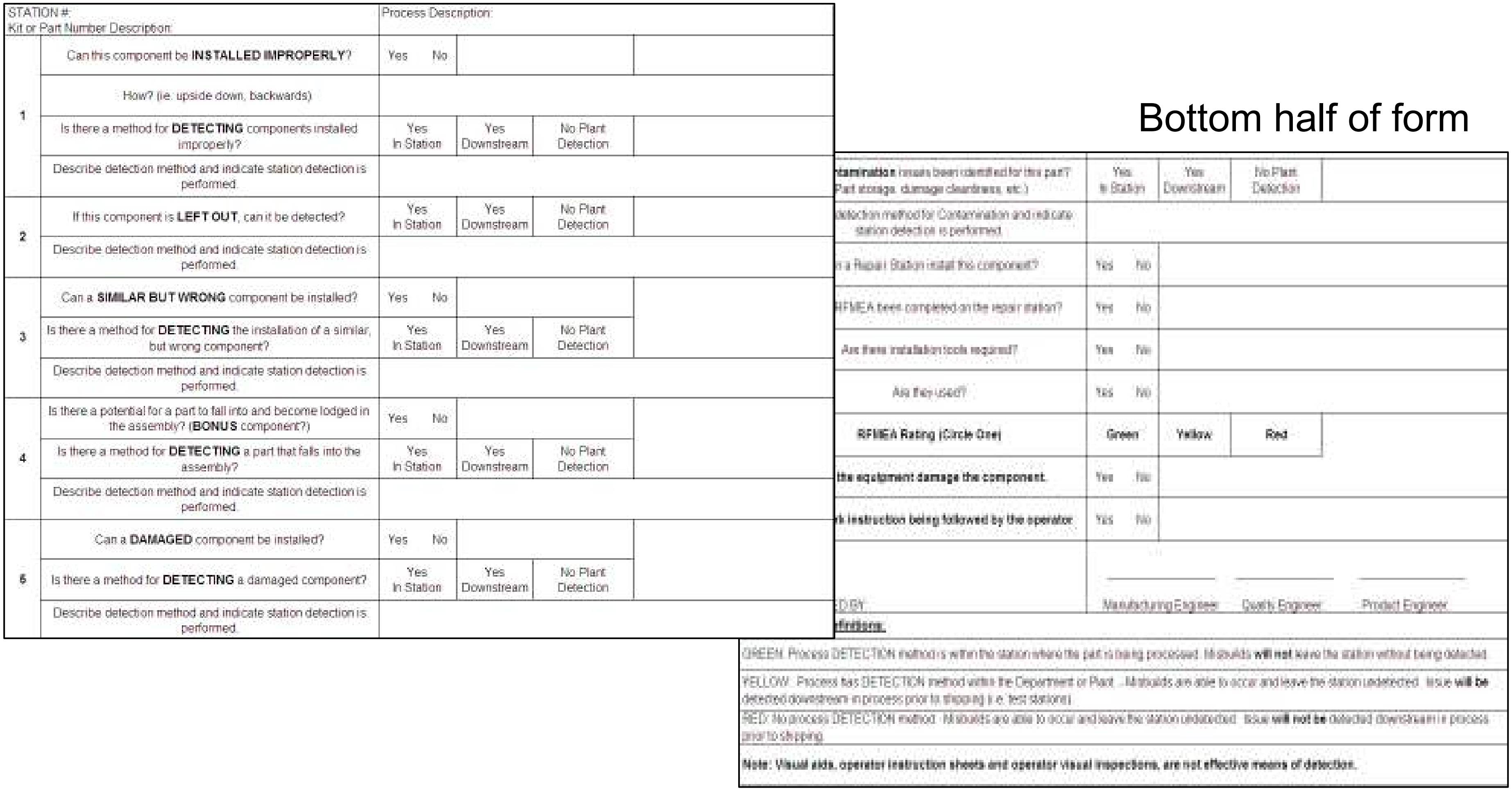
RISK REDUCTION PROCESS

8.4.2 - Reverse PFMEA Process (Continued)

Top half of form

Checklist example

Bottom half of form



STATION #: Kit or Part Number Description:		Process Description:			
1	Can this component be **INSTALLED IMPROPERLY**?	Yes No			
	How? (ie. upside down, backwards)				
	Is there a method for **DETECTING** components installed improperly?	Yes In Station	Yes Downstream	No Plant Detection	
	Describe detection method and indicate station detection is performed.				
2	If this component is **LEFT OUT**, can it be detected?	Yes In Station	Yes Downstream	No Plant Detection	
	Describe detection method and indicate station detection is performed.				
3	Can a **SIMILAR BUT WRONG** component be installed?	Yes No			
	Is there a method for **DETECTING** the installation of a similar, but wrong component?	Yes In Station	Yes Downstream	No Plant Detection	
	Describe detection method and indicate station detection is performed.				
4	Is there a potential for a part to fall into and become lodged in the assembly? (**BONUS** component?)	Yes No			
	Is there a method for **DETECTING** a part that falls into the assembly?	Yes In Station	Yes Downstream	No Plant Detection	
	Describe detection method and indicate station detection is performed.				
5	Can a **DAMAGED** component be installed?	Yes No			
	Is there a method for **DETECTING** a damaged component?	Yes In Station	Yes Downstream	No Plant Detection	
	Describe detection method and indicate station detection is performed.				

ntamination issues been identified for this part? Part storage, damage cleanliness, etc.)	Yes In Station	Yes Downstream	No Plant Detection	
detection method for Contamination and indicate station detection is performed.				
n a Repair Station install this component?	Yes No			
RFMEA been completed on the repair station?	Yes No			
Are there installation tools required?	Yes No			
Are they used?	Yes No			
RFMEA Rating (Circle One)	**Green**	**Yellow**	**Red**	
the equipment damage the component.	Yes No			
k instruction being followed by the operator	Yes No			
ED BY:	Manufacturing Engineer	Quality Engineer	Product Engineer	

efinitions:

GREEN: Process DETECTION method is within the station where the part is being processed. Misbuilds **will not** leave the station without being detected.

YELLOW: Process has DETECTION method within the Department or Plant. Misbuilds are able to occur and leave the station undetected. Issue **will be** detected downstream in process prior to shipping (i.e. test stations)

RED: No process DETECTION method. Misbuilds are able to occur and leave the station undetected. Issue **will not be** detected downstream in process prior to shipping.

Note: Visual aids, operator instruction sheets and operator visual inspections, are not effective means of detection.

RISK REDUCTION PROCESS

8.4.3 - Reactive RPN Reduction Process

Risk Reduction through *Error proofing* of past quality issues:

- When corrective actions have been implemented, team shall validate the new Occurrence and Detection rankings and resultant RPN.
- Team shall update PFMEA's with all corrective action measures.
- *Error proofing* shall be verified per the *Error Proofing Verification* process.

RISK REDUCTION PROCESS

8.5 - Management Requirements

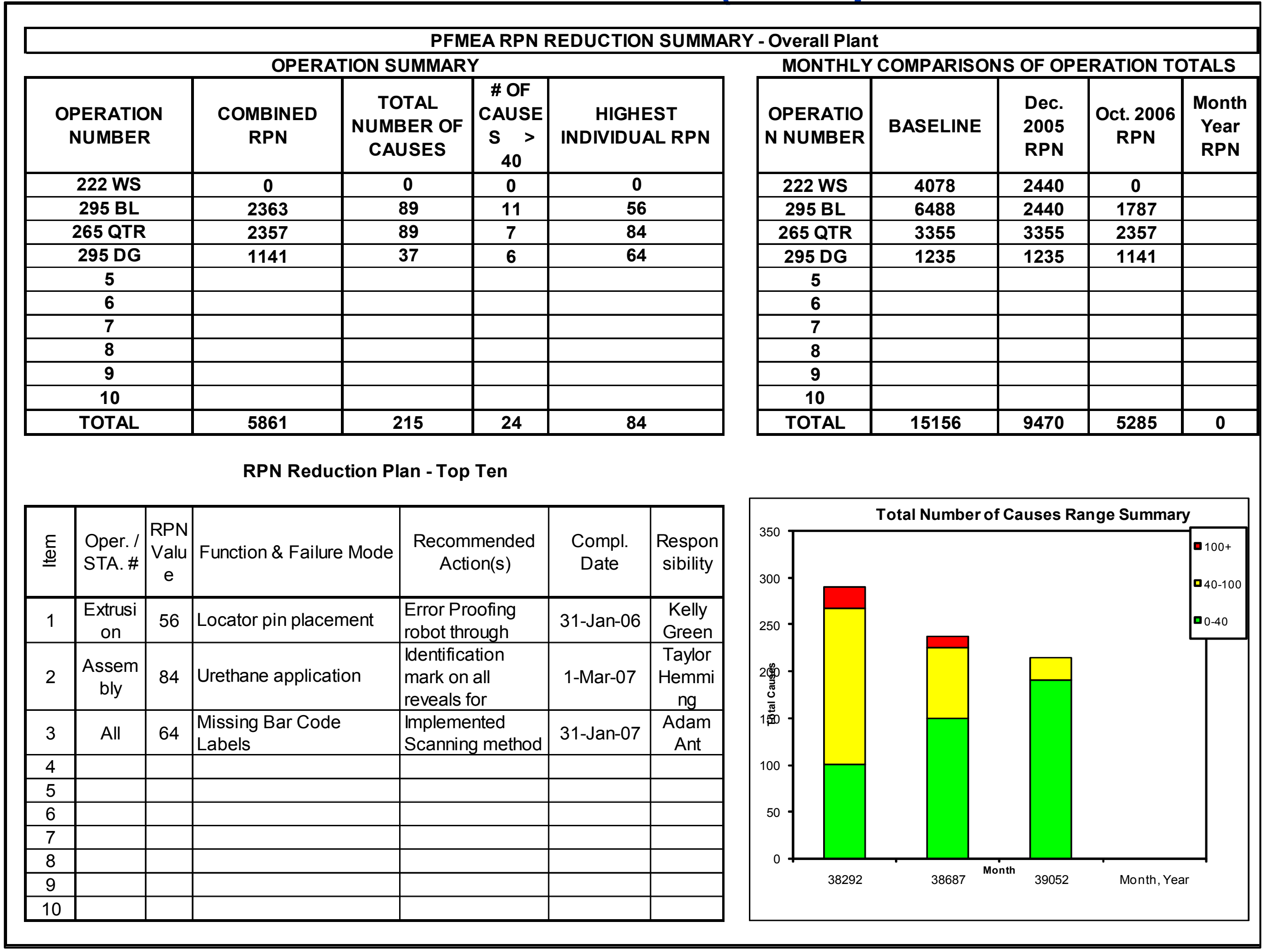
Site Leadership Responsibilities:

- Should review the need for PFMEA training at least once per year.
- Shall support RPN reduction activities and provide necessary resources.
- Shall monitor and review the RPN reduction activities.
- Shall ensure that formal cross-functional teams are utilized in the preparation and ongoing review of PFMEA’s.

RISK REDUCTION PROCESS

8.5.1 - Tracking Matrix

(Example: GM form1927-21)



PFMEA RPN REDUCTION SUMMARY - Overall Plant

OPERATION SUMMARY

OPERATION NUMBER	COMBINED RPN	TOTAL NUMBER OF CAUSES	# OF CAUSES > 40	HIGHEST INDIVIDUAL RPN
222 WS	0	0	0	0
295 BL	2363	89	11	56
265 QTR	2357	89	7	84
295 DG	1141	37	6	64
5				
6				
7				
8				
9				
10				
TOTAL	5861	215	24	84

MONTHLY COMPARISONS OF OPERATION TOTALS

OPERATION NUMBER	BASELINE	Dec. 2005 RPN	Oct. 2006 RPN	Month Year RPN
222 WS	4078	2440	0	
295 BL	6488	2440	1787	
265 QTR	3355	3355	2357	
295 DG	1235	1235	1141	
5				
6				
7				
8				
9				
10				
TOTAL	15156	9470	5285	0

RPN Reduction Plan - Top Ten

Item	Oper. / STA. #	RPN Value	Function & Failure Mode	Recommended Action(s)	Compl. Date	Responsibility
1	Extrusion	56	Locator pin placement	Error Proofing robot through	31-Jan-06	Kelly Green
2	Assembly	84	Urethane application	Identification mark on all reveals for	1-Mar-07	Taylor Hemming
3	All	64	Missing Bar Code Labels	Implemented Scanning method	31-Jan-07	Adam Ant
4						
5						
6						
7						
8						
9						
10						

Total Number of Causes Range Summary

RISK REDUCTION PROCESS

8.7 - Summary, Shalls

- ✓ Leadership shall support RPN reduction activities and provide necessary resources for periodic cross-functional team reviews.
- ✓ Cross-functional teams shall completely review PFMEA's for:
  - ☐ Conformance to AIAG and Customer Requirements
  - ☐ All processes and controls are included and accurate
  - ☐ Occurrence and Detection ratings are accurate to real data
  - ☐ Updates are made for each reactive & proactive event.
- ✓ A list of the highest (RPN) Risk Reduction opportunities shall be established.
- ✓ An action plan or equivalent shall be utilized to track progress in reducing the RPN ratings.
- ✓ Corrective actions shall be validated for the new Occurrence and Detection rankings and resultant RPN.
- ✓ A Reverse PFMEA process should be implemented

9.0 CONTAMINATION CONTROL

CONTAMINATION CONTROL
Outline

9.0) Introduction: Purpose, Scope, Responsibility
9.1) Benefits
9.2) Contamination Philosophy
- Identifying contamination issues within individual operations (external / internal) which would potentially contaminate sensitive parts.
    - 9.2.1) Sediment
        - 9.2.1.1) Monitoring and measuring sediment (Sediment Lab)
        - 9.2.1.2) Sediment reduction strategies
        - 9.2.1.3) Clean rooms
    - 9.2.2) Extra Parts reduction strategies
    - 9.2.3) Dirt in paint
    - 9.2.4) Retained material in castings

9.3) Communication, Report Out Format
9.4) Problem Solving

Refer to Section 1.1.2 - *Fast Response* – Problem Solving

9.5) Summary, Shalls

CONTAMINATION CONTROL

9.0 Introduction

PURPOSE:

- Improve part cleanliness over time via measurement, control and process / handling improvements.
- Utilize a standardized systematic and a structured approach to monitor and control contamination sources such as sediment, extra parts in assemblies, paint and painted parts contamination.
- Apply a disciplined approach when responding to issues.

SCOPE:

- Manufacturing Operations
- Assembly Area
- Shipping / Receiving
- All In-plant operations

RESPONSIBILITY:

- **Ownership**
  - ✓ Process / Manufacturing Engineering
- Evaluation of Performance
  - ✓ Operations Manager
  - ✓ Quality Manager
  - ✓ Contingency reaction plan for all failures.

CONTAMINATION CONTROL

9.1 BENEFITS:

- Provides a systematic approach for *Contamination Control* and communication of Contamination issues.
- Provides elements of an effective control system.
- Assigns responsibility for contamination reduction.
- Supports and establishes defined areas of continual improvement.
- Prevents repetitive mistakes and reduces *waste* of resources.
- Transfers knowledge to all stakeholders in an organization.
- Improves Quality metrics: reduces PPM and warranty costs.

CONTAMINATION CONTROL

9.2 Contamination Philosophy

This section will focus on FOUR distinct areas of contamination and the necessary controls to minimize its effect on product appearance and / or function.

- Sediment
- Extra Parts reduction strategies
- Dirt in paint
- Retained material in castings

Suppliers shall have procedures and work instructions for Contamination Control where appropriate.

Work instructions may require:

- Process monitoring
- SPC or data collection
- Routine maintenance
- Preventative or predictive maintenance

Note: All contamination failure modes shall be included in PFMEA and Control Plans under "Process Controls"

CONTAMINATION CONTROL

9.2.1 Sediment

Definition: Sediment – small particles of material that will adversely affect the function of the product.

- Particulate examples include contaminants like lint, dirt, sand, plastic, machined chips etc.
- Examples of products that are adversely affected are:
    - Engines
    - Transmissions
    - Brakes
    - Steering Gears
    - Fuel Modules
    - Compressors

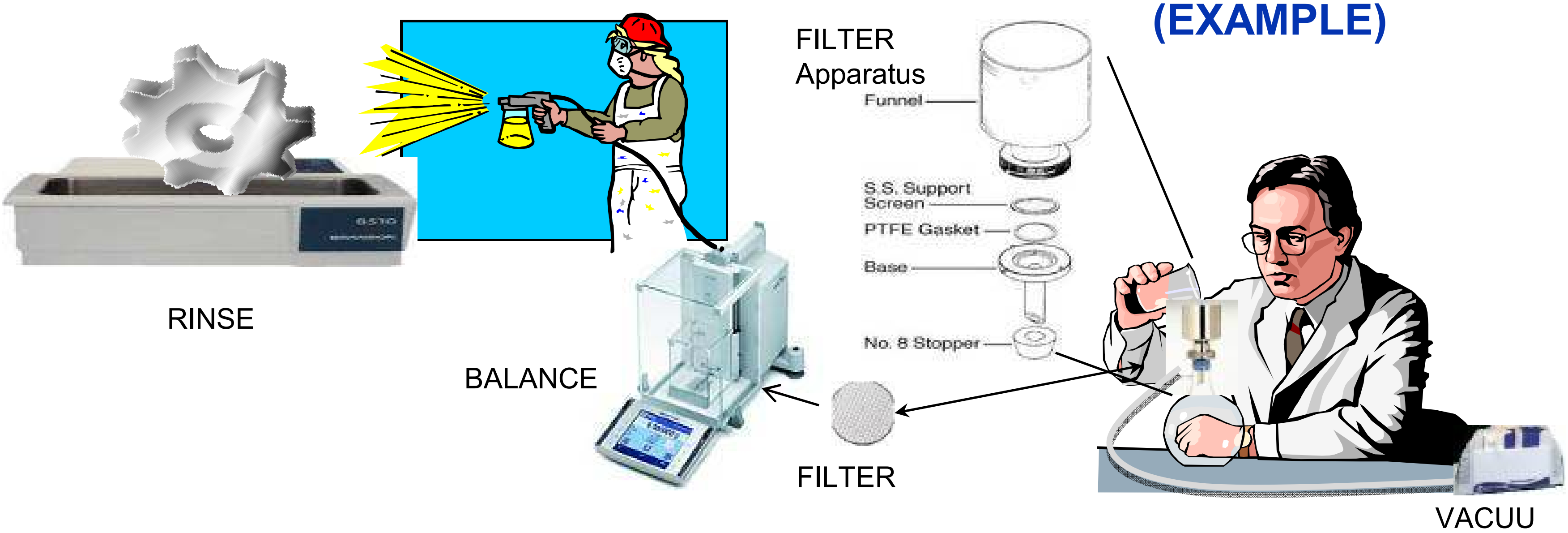
CONTAMINATION CONTROL

9.2.1.1 Monitoring and measuring Sediment

Sediment Lab:

Test Method To Quantify Foreign Material GMN6752

(EXAMPLE)



This method involves removal of sediment from production components by rinsing, collecting the sediment using a suitable filtering apparatus, weighing and reporting the total weight and composition of solids found.

CONTAMINATION CONTROL

9.2.1.1 Monitoring and measuring Sediment (continued)

- Establish an acceptable initial level of part/process cleanliness
- Establish appropriate processes and controls
- Require a procedure to measure part cleanliness at a specified frequency
- Require recording/plotting of these measures
- Require control limits be utilized to trigger reaction plans
- Require corrective action to prevent *nonconforming products*

Monitoring of the process shall be included in *Layered Process Audits* and non-conformances included as candidates for *Fast Response*.

Debris weight/size limits may be utilized to establish process upper control limits or targets values in a component's Statements of Requirements (SOR) without formally being applied to an engineering drawing.

CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY

Process Controls:

Each manufacturing site shall define procedures for the method and frequency of checks required to ensure proper functionality of equipment and processes designed to remove/prevent sediment contamination:

- Parts Washers
- De-burr operations
- Metal working fluid controls
- Fluid / air probe flush station controls
- Dunnage and part storage systems
  - Includes Purchased parts and materials and Finished Goods
- Work Station Cleanliness

CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

Parts Washer:

Local procedures need to be developed to define and maintain washer systems that will ensure their effectiveness.

Minimum requirements shall include but are not limited to:

- Daily verification that nozzles are functioning (e.g. not plugged, broken, misdirected, etc.)

  Examples of verification include:
  - Crisco tests
  - Physical verification of nozzles
- Daily verification to ensure washer fluids are at the correct concentration levels, correct temperature if applicable and do not exceed contamination/dirt requirements.
- Documented PM program for washers are required.

CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

De-Burring Operation:

Types of deburring include water, mechanical, flame, etc.

Local procedures need to be developed to define and maintain deburring systems that will ensure their effectiveness.

Minimum requirements shall include but are not limited to:

- Daily verification of functionality.
  Examples include:
  - Paint/Bluing of parts to ensure deburring equipment is functioning.
  - Physical verification of product to ensure burrs have been adequately removed.
- Daily verification of process parameters/settings need to be established.
- Documented PM program for deburring operations are required.

CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

Metal Working Fluid Controls:

Local procedures need to be developed to define and maintain the method and frequency of checks required to ensure metal working fluid quality and cleanliness.

Minimum requirements shall include but are not limited to:

- Metal working fluid properties (e.g. concentration ratio, bacteria, tramp oil, etc.)
- Cleanliness/Particulate (e.g. dirt, chips, etc.) suspended in fluid
- Documented Preventive Maintenance Program which includes filtration methods, pumps, separators, etc.

CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

Fluid / Air Probe Flush Station Controls:

Local procedures need to be developed to define and maintain the method and frequency of checks required to ensure functionality of fluid/air probe flush stations.

Minimum requirements shall include but are not limited to:

- Probes/Flush nozzles are not plugged
- Fluid Is flowing at desired flow rate, pressure, and direction
- Preventive maintenance as required

CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

Work Station Cleanliness Controls:

Local procedures need to be developed to define and maintain work station cleanliness (specifically areas of the work station that physically touch the part like nests, hangars, storage surfaces)

Minimum requirements shall include but are not limited to:

- Daily verification of an established cleanliness standard

  (Note: Tape test is an effective method to monitor cleanliness) See example next page.
- *Standardized work* describing cleaning methods, equipment, and frequency are required.

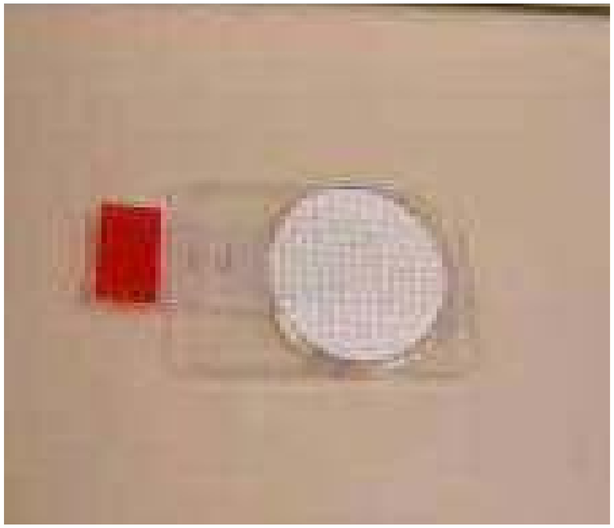
CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

Example of Tape-Lift Testing

Tape lift method:

- Define area to be checked.
- Apply transparent tape to surface to be verified
- Transfer tape to a white piece of paper
- Any dirt/debris will be visible against the white paper
- Compare these results to a cleanliness acceptance standard



CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

Dunnage and Parts Storage Systems:

Local procedures need to be developed to define and maintain the methods used to verify materials and processes involved in part storage and transport to minimize and/eliminate sediment on components.

Minimum requirements **shall** include but are not limited to:

- A dunnage cleaning process to include frequency and method (Note: Includes W.I.P. and Finished Goods dunnage)
- Monitoring material storage areas for cleanliness (e.g. Finished goods are safely protected from contamination being introduced during transport and storage)
- Storage environment controls to maintain the integrity of the product (e.g. Temperature, humidity, dirt, dust, pests, etc.)
- The use of cardboard should be limited

CONTAMINATION CONTROL

9.2.1.2 SEDIMENT REDUCTION STRATEGY (continued)

Purchased Parts and Materials:

Local procedures need to be developed to define which purchased components require sediment monitoring and/or cleaning prior to use.

Minimum requirements shall include but are not limited to:

- If purchase parts are cleaned/washed in-house then local procedures shall define requirements
- Method and frequency to check purchased parts
- Acceptable limits need to be established

CONTAMINATION CONTROL

9.2.2 Extra Parts

Definition: Parts or materials which fall into or stick to products which are not intended as part of the finished product.

The manufacturing site shall include process controls to eliminate or reduce extra parts:

- Utilize Rollovers and Dump Stations (Monitor findings)
- Parts assembled at prescribed location / rework station
- Magnetic wrench functionality
- Correct use of masks where the potential exists for parts to fall into assemblies
- Rework operations to use same tools as primary operation
- *Layered Process Audit* to verify proper part storage
- Monitor findings of extra parts / Use data management / Corrective Actions

CONTAMINATION CONTROL

9.2.3 Clean Rooms

If clean rooms are required as part of the manufacturing process, the following set of requirements should be considered as best practices:

- Limited access to clean rooms by employees to limit exposure to contaminants
- Clean room protective clothing defined and enforced (e.g. hair nets, shoe covers, lint free lab coats, rags, gloves, etc.)
- Positive pressure to stop outside air/contaminants from being drawn into the clean room.
- Air locks to enter/exit clean rooms
- Sticky mats to remove contaminants from footwear
- Atmospheric air quality monitoring per standard
- Anti-static devices (ESD) and verification to compliance prior to entrance to the area as applicable. (e.g. ground straps, wrist bands)
- Control of Chemicals detrimental to the process (e.g. windex, lotions, fragrances, aerosol sprays, etc.)

CONTAMINATION CONTROL

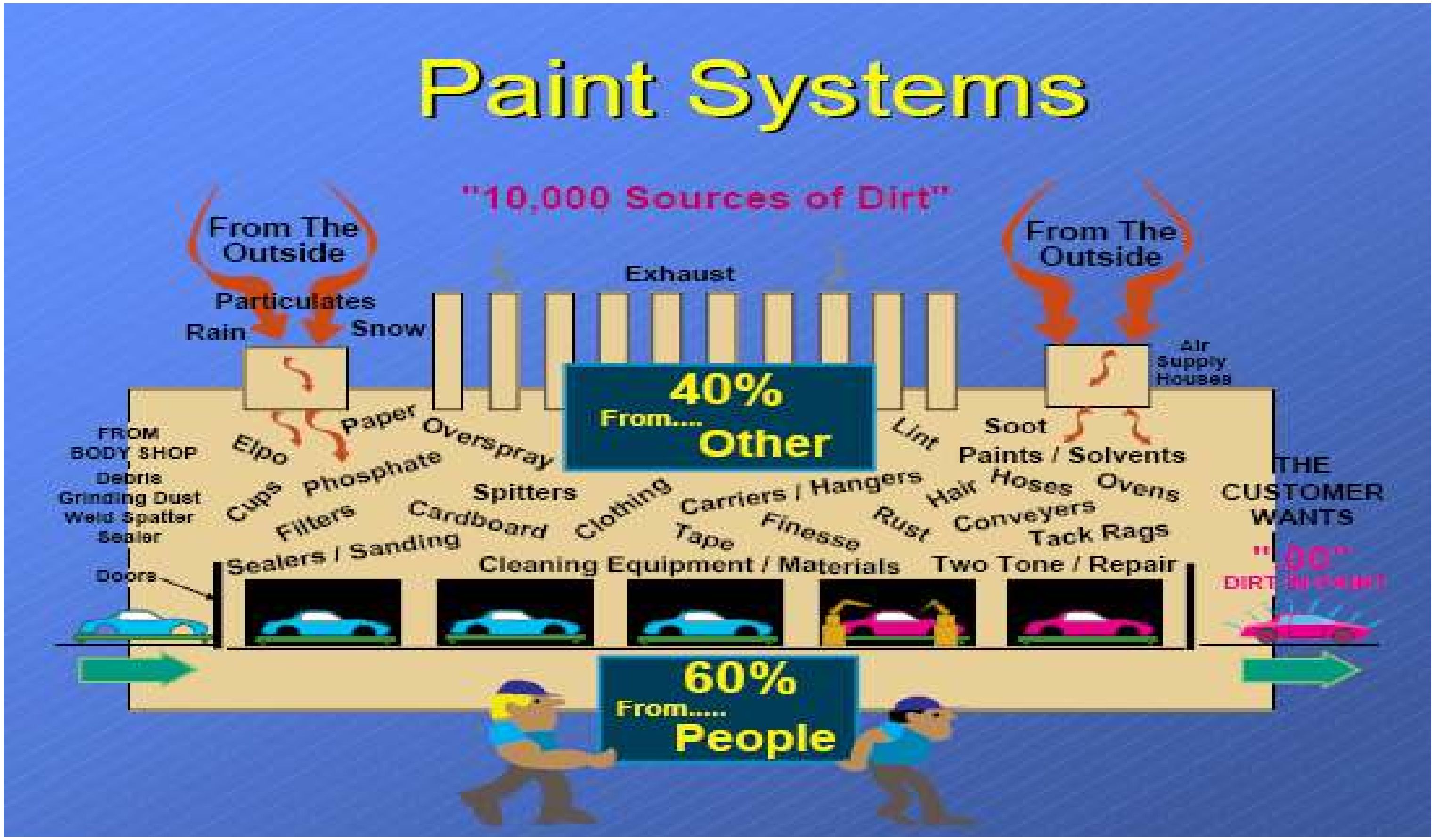
9.2.3 Dirt in Paint

Definition and Philosophy:

- Dirt is an undesired foreign inclusion in the paint film caused by disturbances in the paint process or operation.
- Dirt contamination as a group represents the greatest group of paint defects.
- Sources should be minimized in all areas.
- Dirt control shall be continuous and ongoing to be effective.

CONTAMINATION CONTROL

9.2.3 Dirt in Paint (Continued)



CONTAMINATION CONTROL

9.2.3 Dirt in Paint (Continued)

Key issues in the People area:

- "Dirt Awareness" training
- Self inspection/clean up on all operations
- Entire paint shop considered a "clean area"
- Communicate expectations
  - Approved attire only
  - Understand and follow personal product restrictions such as use of deodorants, silicone wrist bands and aerosol sprays which contain silicone and cause craters.
  - No Food/Drink/Smoking
  - No fibrous materials in the paint shop
  - Newspapers, paper towels, cardboard, etc.

CONTAMINATION CONTROL

9.2.3 Dirt in Paint (Continued)

Key issues in the Process area:

- Dirt Sources - Prevention
  - Paint Spatter, chips, overspray
  - Hair, Clothing, towels, Cardboard
  - Conveyor lubricants
  - Rust, minerals from Condensation
- Communicate expectations
- Ensure PM Schedule is Adhered to
- Monitor the Process
- Audit to Requirements

CONTAMINATION CONTROL

9.2.3 Dirt in Paint (Continued)

Key issues in the Facilities area:

- Facility maintenance relating to dirt sources in all ovens and booths.
  - Cleaning
  - Filter changes
  - Balance requirements
- General Housekeeping requirements.
- Racks clean and in proper repair
- Entire Paint Shop closed and sealed.
- Positive ventilation 24 hours per day.
- No traffic access.

CONTAMINATION CONTROL

9.2.3 Dirt in Paint (Continued)

Key issues in the Material area:

- Entire Paint Shop clean room wear.
  - Proper laundry
  - Proper wear methods/procedures
- Proper consumable controls.
  - No eating, drinking or smoking.
  - Approved personal products only.
- Correct paint materials, mix instructions and work methods.
- Proper storage area identification and reject area controls.

CONTAMINATION CONTROL

9.2.3 Dirt in Paint (Continued)

Elements of an Effective Contamination Control System:

- Make controls visible.
  - Maintain a list of acceptable/unacceptable products in easily accessed areas.
  - Make the list easy to update.
  - Make information clear & concise.
  - Personal product lists displayed on posters in locker rooms and employee areas.
- Clearly define those products that need to be totally eliminated from the paint shop.
- Clearly define those products that can be used in the paint shop, but should be kept away from product surfaces.

CONTAMINATION CONTROL

9.2.3 Dirt in Paint (Continued)

Suppliers with painted product shall ensure that the paint operation standards and maintenance schedules are adhered to. Whether the process is internal or through *Supply Chain Management*.

This includes:

Process Monitoring such as

- Dirt count (SPC, U-Charts)
- Dirt identification (Pareto)

Process analysis and investigative techniques

Establish and maintain a Dirt Reference Handbook

Layered Process Audits and Communication of results

CONTAMINATION CONTROL

9.2.4 Retained material in Castings GMN11174 -

Quantify Cleanliness of Sand Cast Cylinder Blocks and Heads-

This document outlines a method to quantify the loose and loosely adhered foreign material in and on sand cast (e.g. greensand, precision sand, semi-permanent mold, and lost foam). Iron and aluminum castings are included.

At a minimum, the final operation (foundry, heat treatment, painting, impregnation, or cubing/pre-machining) that ships the casting to the final machine plant is required to perform this test. The use of the test after any other operations is optional, but recommended, at least until their process is shown to be stable and capable.

Its purpose is to insure that the cleaning methods utilized before the part reaches the final machining source are operating correctly and re-moving excess foundry materials, heat treat quenching materials, cleaning media, pre-machining burrs, grinding burrs and any other foreign material.

CONTAMINATION CONTROL

9.2.4 Retained material in Castings

The method involves two steps:

1. Step one involves impacting the casting to loosen retained material, and then collecting the loosened material by manipulating/rotating the part to allow material to fall out of passages. Compressed air may be used to blow material out of the casting. Determine and record the weight of solids collected. (Foundry slang term – "Tunk" Test).
2. Step two involves a visual inspection of all surfaces of the part, documenting any potentially detrimental loosely adhered foreign material on the surface of the casting (e.g. burn-on, burn-in, core or pattern coating, fragile metal fins from core/mold misalignment, excess metal in the form of the EPS beads from lost foam cast parts, etc.) and comparing to a standard established for the specific part.

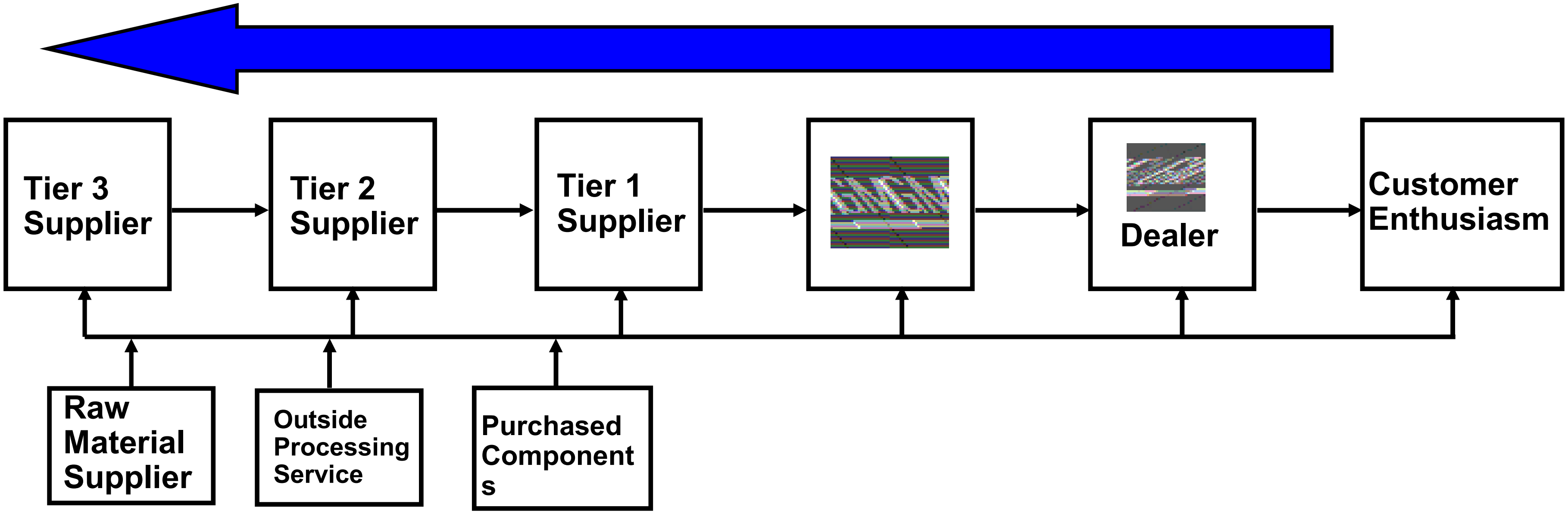
CONTAMINATION CONTROL

9.5) Summary, Shalls

Organizations shall…

- Have procedures and work instructions for Contamination Control where appropriate.
- Document all contamination failure modes and include in PFMEA and Control Plans
- Monitor the process through *Layered Process Audits* and non-conformances included as candidates for *Fast Response*
- Have a documented Preventive Maintenance Program for contamination control
- Site leadership shall review contamination data to determine the necessary corrective actions.

10.0 - SUPPLY CHAIN MANAGEMENT



Tier 3 Supplier

Tier 2 Supplier

Tier 1 Supplier

Dealer

Customer Enthusiasm

Raw Material Supplier

Outside Processing Service

Purchased Components

What are Your expectations of Your suppliers?

SUPPLY CHAIN MANAGEMENT
Outline

SUPPLY CHAIN MANAGEMENT

10.0 - Introduction

PURPOSE:

- To provide a standard process for managing all of the supplier tiers in the supply chain.
- Ensure all tiers of the supply chain have systems and processes to evaluate, select, communicate expectations and requirements, measure performance, and develop their suppliers.

SCOPE:

- Applies to a supplier’s entire supply chain, including all Tiers, sub-suppliers of raw material, outside processes, and purchased component suppliers.

RESPONSIBILITY:

- Ownership
  - ✓Senior Purchasing Leader
- Champion:
  - ✓Supplier Quality Leader

SUPPLY CHAIN MANAGEMENT

10.1 - BENEFITS

- Supports continuous improvement efforts and achievement of goals through applying common principles, methods, and processes.
- Improves Quality metrics, reduces PPM and warranty costs.
- Creates the ability to identify where problems exist and actions required to prevent additional problems entering the supply chain that negatively impact customer enthusiasm.

SUPPLY CHAIN MANAGEMENT

10.2 - Expectations

Supply chain quality expectations:

- Development of a supply chain management system.
- Compliance to GM quality guidelines.
- Implementation of Quality System Basics strategies.
- Use of GM problem solving methodology (Drill Deep & Wide).
- APQP, PPAP and PSW for supplied material.
- Data metrics such as: FTQ, PPM, Internal/external quality.
- Continual improvements geared toward higher levels of quality and lower costs.

A proactive approach!

SUPPLY CHAIN MANAGEMENT

10.2 - Expectations

These systems and processes should be similar to those GM uses with their suppliers.

- Supplier Assessments for:
  - Potential New Suppliers
  - Manufacturing Quality Systems
  - Evaluation and continuous improvement to Best Practices
- Change Management Process
  - Internal changes to process or product
  - Supplier changes to process or product
  - Tool Move or Source Changes & Banking Strategies
- Advance Quality System
  - Part Approval Process to GM and Tier 1
- TS requirements relative to supplier performance.

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

Supplier Assessments:

Potential Suppliers

- All new suppliers shall be evaluated prior to placing business.
  - Does the supplier have systems in place which meet all customer requirements?
    - ✓ Such as TS-16949, GM Specific Requirements
- Whenever new business is being placed with an upstream supplier for which you have no performance history, you shall have:
  - A method to evaluate that supplier's capabilities. (e.g. PSA)
  - The ability to weigh the risk of sourcing with that supplier.

POTENTIAL SUPPLIER ASSESSMENT AUDIT (PSA)

Quality

Category	Sub-Category	Item	Risk	Risk Rating Guideline	Score	Threshold	Comments
Management		1	What best represents the suppliers process?	○ 0 - Simple, sequential, easy to follow Process Flow ● 3 - Realitively good flow, but opportunities for improvement ○ 5 - Process flow difficult to understand and follow	3	3	**(Example)**
		2	Formal process is identified to protect pipeline supply chain (MRP, KAN BAN, etc.) and provide safety inventory.	● 0 - Supplier has demonstrated Supply Chain Protection system. ○ 3 - Supplier has supply chain protection system, but needs minor enhancements. ○ 5 - Supplier has supply chain protection system, but needs major enhancements. ○ 10 - Supplier has no supply chain protection plan in place.	0	5	
		3	Supplier demonstrates understanding of Process Validation.	○ 0 - Supplier has demonstrated understanding of Process Validation. ● 10 - Supplier has some Process Validation skills, but needs major enhancementsments. ○ 20 - Supplier has no Process Validation tasks in place.	10	10	
		4	Supplier has Material Identification Traceability System supported with current data.	○ 0 - Supplier has demonstrated Material Identification/Traceability System. ○ 3 - Supplier has generic Material Identificatio ● 5 - Supplier has generic Material Identificatio ○ 10 - Supplier has no Material Identification/T	5	5	
		5	Tier 1 Supplier has plan on how Tier 2-3-4 suppliers will be managed.	○ 0 - Supplier has strong Tier 2-3-4 managem ○ 10 - Supplier has generic Tier 2-3-4 manage ○ 15 - Supplier has generic Tier 2-3-4 manage ● 20 - Supplier has no Tier 2-3-4 management			
		6	Supplier has capability on Change Management enforcement for entire supply chain.	○ 0 - Supplier has demonstrated capability on Change Management enforcement ○ 5 - Supplier has capability on Change Management enforcement, but needs improvement. ○ 10 - Supplier has minimal capability on Change Management enforcement. ● 15 - Supplier has no capability on Change Management enforcement,	15	10	
Quality		7	Supplier utilizes formal layered audit process on their quality/manufacturing systems.	● 0 -Documented formal audits conducted by management with immediate corrective actions ○ 3 - Documented formal audits conducted and reviewed with management - needs minor imprc ○ 5 - Documented formal audits - not properly supported or conducted frequently enough - improvemen ○ 10 - No evidence a process exists or is not supported properly	0	5	
		8	Supplier utilizes formal audits focused on quality/manufacturing systems of their suppliers.	○ 0 - Documented formal audits conducted by "supplier quality", reviewed with their manageme ○ 5 - Documented formal audits conducted and reviewed with management - needs minor improvement ○ 10 - Documented formal audits - not properly supported or conducted frequently enough - improver ● 15 - No evidence a process exists or is not supported properly	15	10	

WEIGH THE RISK OF DOING BUSINESS WITH A NEW SUPPLIER

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

Supplier Assessments:

Manufacturing Quality Systems

Suppliers shall develop a system to measure performance to requirements and best practices for all of their suppliers. Techniques used to measure the supply chain would include using audits such as a QSB audit, Process Control Plan Audit, Labeling Audit, Special Process Audits (e.g. CQI-9 Heat Treat Process).

The Supply Chain should complete the following requirements:

- Develop a tier supplier quality management system with the goal of conforming to ISO/TS 16949 and General Motors specific requirements.
- Use tools to track compliance to requirements for their strategic suppliers (APQP, GM General Procedures GP-5, Drill Deep and Wide, GP-9 GP-12, AIAG Standards, etc.)

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

Quality Systems Basics Audit:

The focus is on Key System Strategies which provides a solid baseline to ensure quality product and processes through teamwork in the elimination of *waste*.

GM Tier 1 suppliers are expected to have been audited by Gate 1 and compliant by Gate 3 beginning with all 2010 model year programs.

The expectation is that this requirement shall be cascaded through the supply chain.

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

Labeling Best Practices:

All suppliers in the supply chain should use a labeling FMEA to understand risk and put in place the appropriate control methods in their labeling system.

Label issues are a very serious problem. They have resulted in stockouts, downtime, and on occasion resulted in a major disruption.

Based on current GMNA PRR performance, approximately 12% of all formal customer complaints are related to labeling issues. Material or components with the wrong label, unreadable, wrong format, or wrong information.

Prevention of labeling issues is key with the mindset of “No part without a label, and no label without a part.”

An assessment of the supply chain labeling process is required to ensure all specifications are met and the proper controls are in place.

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

Labeling Best Practices:

LABEL *ERROR PROOFING* PFMEA

(Example)

Process Function/ Requirement	Potential Failure Mode	Potential Effect(s) Of Failure	SEV	Class	Potential Cause(s) / Mechanism(s) of Failure	OCCUR	Current Process Controls	DETECT	RPN	Responsibility & Target Date Completion	Actions Taken	SEV	OCCUR	DETECT	RPN
Remove all old labels from container/pallet	Containers/pallets are not free of old labels (**external AIAG labels**) before reaching the mfg. floor				Procedure does not assign responsibility for removing old external AIAG labels before container/pallet reaches mfg. floor										
					Unable to remove old external AIAG labels										
	Containers/pallets are not free of old labels (**internal labels**) before being re-introduced to the process				Procedure does not assign responsibility for removing old internal labels before container/pallet is re-introduced to process										
					Unable to remove old internal labels										
Generate component label	Component labels are not available to the operator				Equipment downtime (no back-up system)										
					Lack of trained, back-up personnel to generate component labels										
	Component label is not legible or scannable				Component label contamination (e.g. dirt, grease, torn, writing through barcode)										
					Equipment problems (e.g. printer misfeed, out of ink, misaligned)										
	Component label does not contain correct information or does not meet all QS9000 procedures & engineering requirements				Database information is incorrect										
					Manual data entry to generate component label										
Apply component label to component part	Component label does not match component				Written work procedure for changeover is not available in the work cell										
					Similar components produced on the same line										
					Component labels available for more than one component number in work cell										

SUPPLY CHAIN MANAGEMENT

KEY POINTS OF THE AUDIT

Does the supplier have a labeling PFMEA?

Is the Labeling Process error proofed?

Is the supplier making labels up ahead? (Batching or tricking the system to produce a label before it is needed)

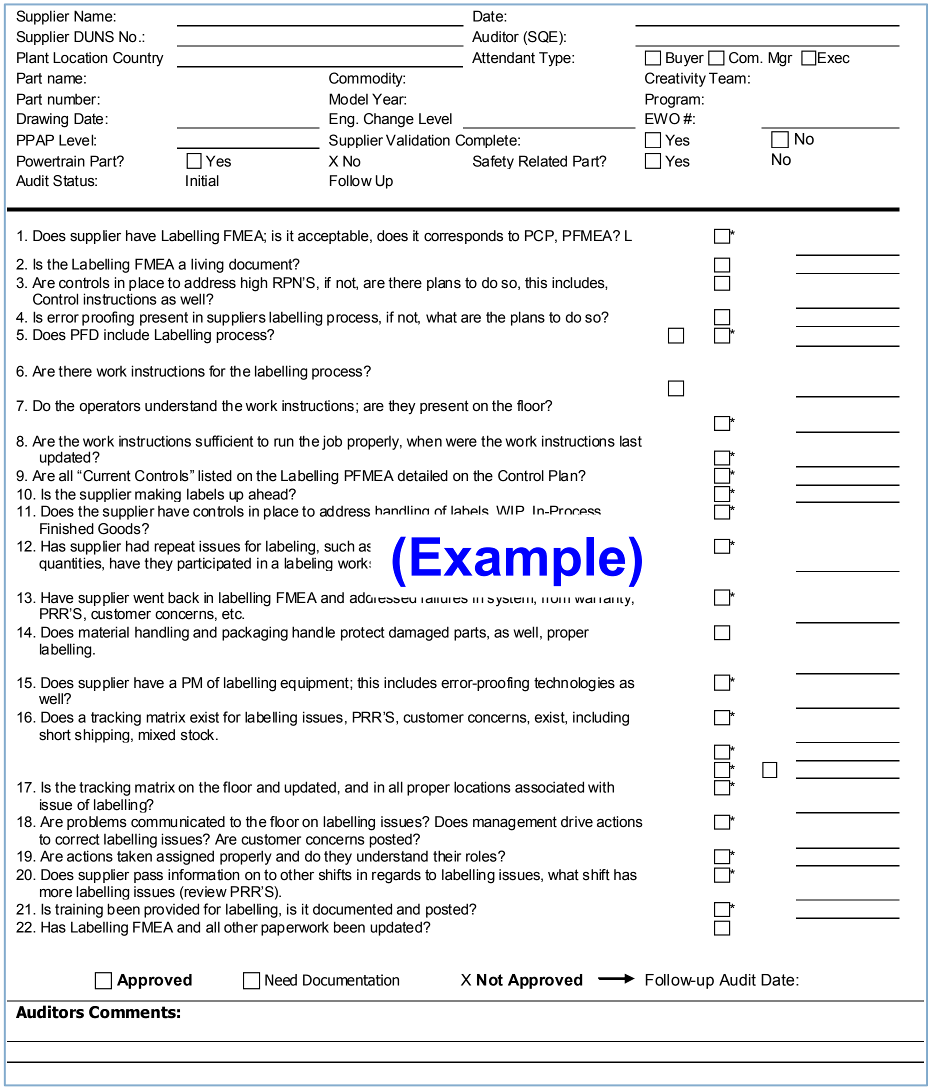
Do the finished labels comply with GM requirements?

Is the label computer system password protected?

Is there a backup system to prevent manual labeling or old labels from being generated?

Are labeling issues communicated and the PFMEA updated?

Have their been tiered supplier labeling issues and have they been audited?



Supplier Name: ______ Date: ______
Supplier DUNS No.: ______ Auditor (SQE): ______
Plant Location Country ______ Attendant Type: ☐ Buyer ☐ Com. Mgr ☐Exec
Part name: Commodity: Creativity Team:
Part number: Model Year: Program:
Drawing Date: ______ Eng. Change Level ______ EWO #: ______
PPAP Level: ______ Supplier Validation Complete: ☐ Yes ☐ No
Powertrain Part? ☐ Yes X No Safety Related Part? ☐ Yes No
Audit Status: Initial Follow Up

1. Does supplier have Labelling FMEA; is it acceptable, does it corresponds to PCP, PFMEA? L ☐*
2. Is the Labelling FMEA a living document? ☐ ______
3. Are controls in place to address high RPN'S, if not, are there plans to do so, this includes, Control instructions as well? ☐ ______
4. Is error proofing present in suppliers labelling process, if not, what are the plans to do so? ☐ ______
5. Does PFD include Labelling process? ☐ ☐* ______
6. Are there work instructions for the labelling process? ☐ ______
7. Do the operators understand the work instructions; are they present on the floor? ☐* ______
8. Are the work instructions sufficient to run the job properly, when were the work instructions last updated? ☐* ______
9. Are all "Current Controls" listed on the Labelling PFMEA detailed on the Control Plan? ☐* ______
10. Is the supplier making labels up ahead? ☐* ______
11. Does the supplier have controls in place to address handling of labels WIP In-Process Finished Goods? ☐*
12. Has supplier had repeat issues for labeling, such as quantities, have they participated in a labeling work ☐* ______
13. Have supplier went back in labelling FMEA and addressed failures in system, from warranty, PRR'S, customer concerns, etc. ☐* ______
14. Does material handling and packaging handle protect damaged parts, as well, proper labelling. ☐ ______
15. Does supplier have a PM of labelling equipment; this includes error-proofing technologies as well? ☐* ______
16. Does a tracking matrix exist for labelling issues, PRR'S, customer concerns, exist, including short shipping, mixed stock. ☐* ______
☐* ______
☐* ☐ ______
17. Is the tracking matrix on the floor and updated, and in all proper locations associated with issue of labelling? ☐* ______
18. Are problems communicated to the floor on labelling issues? Does management drive actions to correct labelling issues? Are customer concerns posted? ☐* ______
19. Are actions taken assigned properly and do they understand their roles? ☐* ______
20. Does supplier pass information on to other shifts in regards to labelling issues, what shift has more labelling issues (review PRR'S). ☐* ______
21. Is training been provided for labelling, is it documented and posted? ☐* ______
22. Has Labelling FMEA and all other paperwork been updated? ☐

☐ **Approved** ☐ Need Documentation X **Not Approved** → Follow-up Audit Date:

Auditors Comments:

(Example)

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

Special Processes:

All suppliers in the supply chain shall assess vendors of processes which apply to AIAG Special Process Assessments CQI-9 Heat Treat System, CQI-11 Plating System, and CQI-12 Coating Systems.

These documents specify process requirements for an organization or it's suppliers performing applicable processes, who need to:

- Demonstrate the ability to consistently provide product that meets customer and applicable regulatory requirements, and
- Enhance customer satisfaction through the effective application of the system including processes for continual improvement of the system.

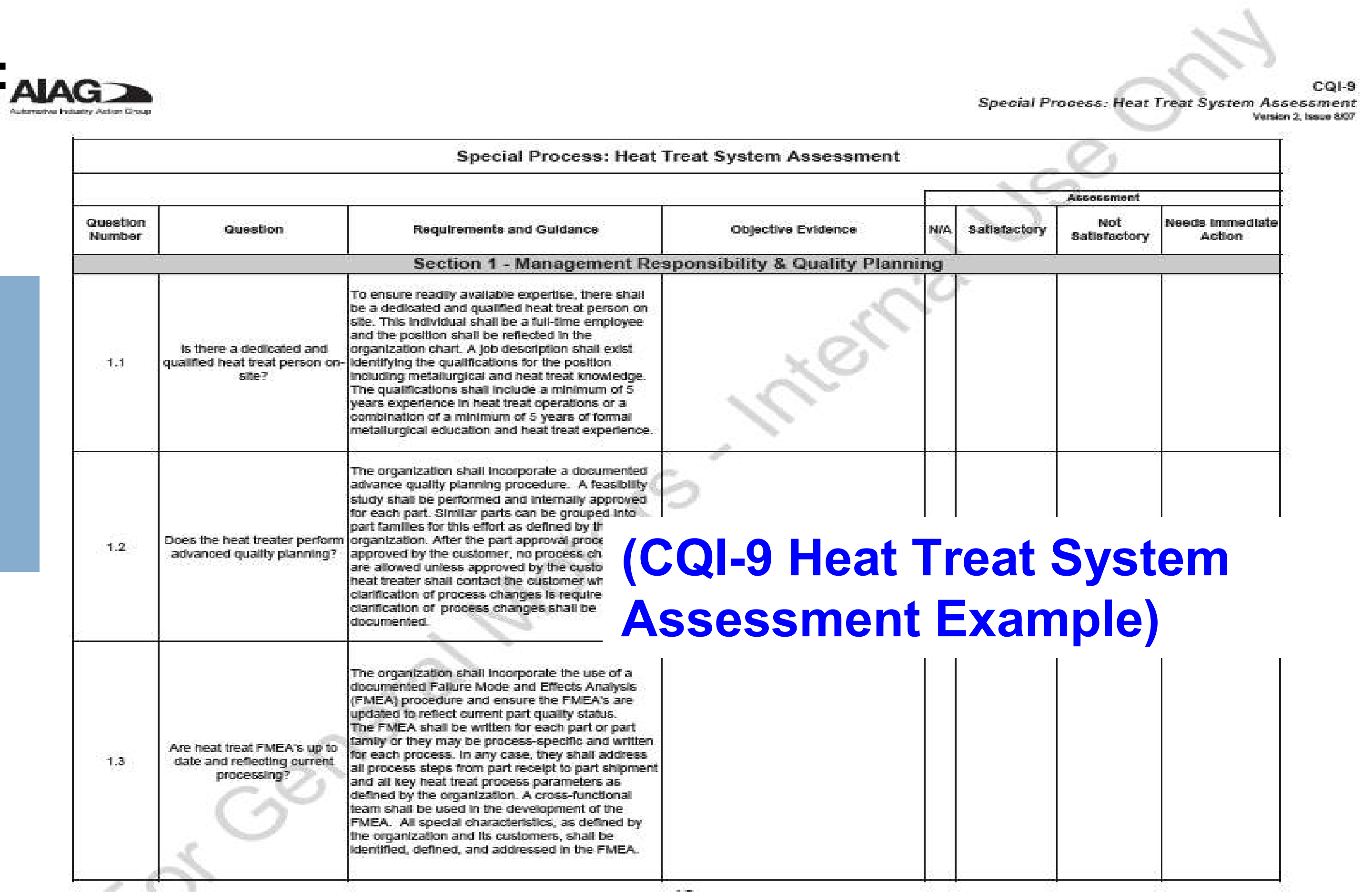
These assessments are applicable to sites where customer-specified parts for production and/or service are processed throughout the automotive supply chain.

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

Special Processes:

These Special Process Assessments are available from AIAG



AIAG
Automotive Industry Action Group

CQI-9
Special Process: Heat Treat System Assessment
Version 2, Issue 8/07

Special Process: Heat Treat System Assessment							
				Assessment			
Question Number	Question	Requirements and Guidance	Objective Evidence	N/A	Satisfactory	Not Satisfactory	Needs Immediate Action
Section 1 - Management Responsibility & Quality Planning							
1.1	Is there a dedicated and qualified heat treat person on-site?	To ensure readily available expertise, there shall be a dedicated and qualified heat treat person on site. This individual shall be a full-time employee and the position shall be reflected in the organization chart. A job description shall exist identifying the qualifications for the position including metallurgical and heat treat knowledge. The qualifications shall include a minimum of 5 years experience in heat treat operations or a combination of a minimum of 5 years of formal metallurgical education and heat treat experience.					
1.2	Does the heat treater perform advanced quality planning?	The organization shall incorporate a documented advance quality planning procedure. A feasibility study shall be performed and internally approved for each part. Similar parts can be grouped into part families for this effort as defined by th organization. After the part approval proce approved by the customer, no process ch are allowed unless approved by the custo heat treater shall contact the customer wh clarification of process changes is require clarification of process changes shall be documented.					
1.3	Are heat treat FMEA's up to date and reflecting current processing?	The organization shall incorporate the use of a documented Failure Mode and Effects Analysis (FMEA) procedure and ensure the FMEA's are updated to reflect current part quality status. The FMEA shall be written for each part or part family or they may be process-specific and written for each process. In any case, they shall address all process steps from part receipt to part shipment and all key heat treat process parameters as defined by the organization. A cross-functional team shall be used in the development of the FMEA. All special characteristics, as defined by the organization and its customers, shall be identified, defined, and addressed in the FMEA.					

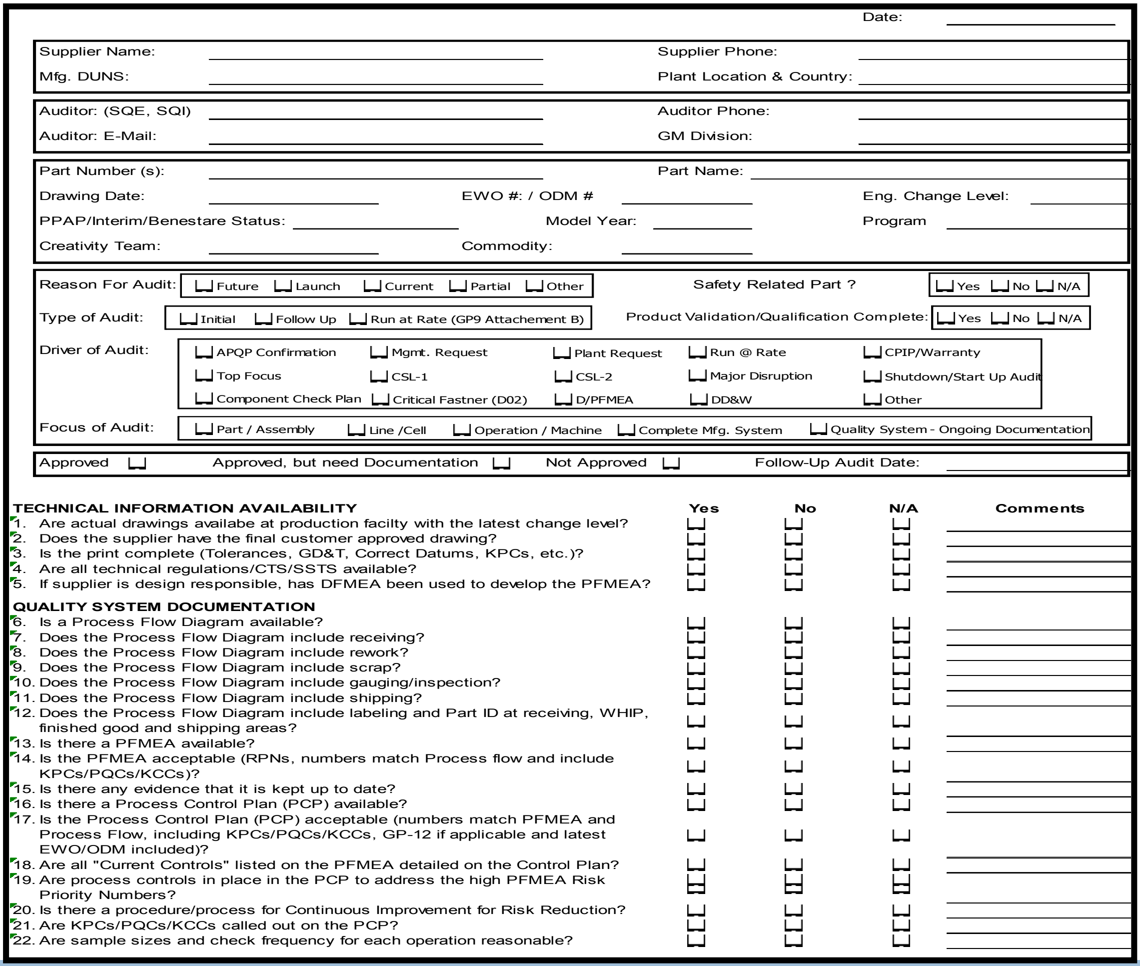
(CQI-9 Heat Treat System Assessment Example)

SUPPLY CHAIN MANAGEMENT

10.3 – Selection & Evaluation

PRODUCT & PROCESS SPECIFIC AUDITS **(Example)**

Process Control Plan Audit Summary Sheet



Date: ______

Supplier Name: ______ Supplier Phone: ______
Mfg. DUNS: ______ Plant Location & Country: ______

Auditor: (SQE, SQI) ______ Auditor Phone: ______
Auditor: E-Mail: ______ GM Division: ______

Part Number (s): ______ Part Name: ______
Drawing Date: ______ EWO #: / ODM # ______ Eng. Change Level: ______
PPAP/Interim/Benestare Status: ______ Model Year: ______ Program ______
Creativity Team: ______ Commodity: ______

Reason For Audit: ☐ Future ☐ Launch ☐ Current ☐ Partial ☐ Other
Safety Related Part ? ☐ Yes ☐ No ☐ N/A
Type of Audit: ☐ Initial ☐ Follow Up ☐ Run at Rate (GP9 Attachement B)
Product Validation/Qualification Complete: ☐ Yes ☐ No ☐ N/A
Driver of Audit: ☐ APQP Confirmation ☐ Mgmt. Request ☐ Plant Request ☐ Run @ Rate ☐ CPIP/Warranty ☐ Top Focus ☐ CSL-1 ☐ CSL-2 ☐ Major Disruption ☐ Shutdown/Start Up Audit ☐ Component Check Plan ☐ Critical Fastner (D02) ☐ D/PFMEA ☐ DD&W ☐ Other
Focus of Audit: ☐ Part / Assembly ☐ Line /Cell ☐ Operation / Machine ☐ Complete Mfg. System ☐ Quality System - Ongoing Documentation

Approved ☐ Approved, but need Documentation ☐ Not Approved ☐ Follow-Up Audit Date: ______

TECHNICAL INFORMATION AVAILABILITY	Yes	No	N/A	Comments
1. Are actual drawings availabe at production facilty with the latest change level?	☐	☐	☐	______
2. Does the supplier have the final customer approved drawing?	☐	☐	☐	______
3. Is the print complete (Tolerances, GD&T, Correct Datums, KPCs, etc.)?	☐	☐	☐	______
4. Are all technical regulations/CTS/SSTS available?	☐	☐	☐	______
5. If supplier is design responsible, has DFMEA been used to develop the PFMEA?	☐	☐	☐	______
QUALITY SYSTEM DOCUMENTATION				
6. Is a Process Flow Diagram available?	☐	☐	☐	______
7. Does the Process Flow Diagram include receiving?	☐	☐	☐	______
8. Does the Process Flow Diagram include rework?	☐	☐	☐	______
9. Does the Process Flow Diagram include scrap?	☐	☐	☐	______
10. Does the Process Flow Diagram include gauging/inspection?	☐	☐	☐	______
11. Does the Process Flow Diagram include shipping?	☐	☐	☐	______
12. Does the Process Flow Diagram include labeling and Part ID at receiving, WHIP, finished good and shipping areas?	☐	☐	☐	______
13. Is there a PFMEA available?	☐	☐	☐	______
14. Is the PFMEA acceptable (RPNs, numbers match Process flow and include KPCs/PQCs/KCCs)?	☐	☐	☐	______
15. Is there any evidence that it is kept up to date?	☐	☐	☐	______
16. Is there a Process Control Plan (PCP) available?	☐	☐	☐	______
17. Is the Process Control Plan (PCP) acceptable (numbers match PFMEA and Process Flow, including KPCs/PQCs/KCCs, GP-12 if applicable and latest EWO/ODM included)?	☐	☐	☐	______
18. Are all "Current Controls" listed on the PFMEA detailed on the Control Plan?	☐	☐	☐	______
19. Are process controls in place in the PCP to address the high PFMEA Risk Priority Numbers?	☐	☐	☐	______
20. Is there a procedure/process for Continuous Improvement for Risk Reduction?	☐	☐	☐	______
21. Are KPCs/PQCs/KCCs called out on the PCP?	☐	☐	☐	______
22. Are sample sizes and check frequency for each operation reasonable?	☐	☐	☐	______

SUPPLY CHAIN MANAGEMENT

10.4 – Performance Monitoring

All suppliers to General Motors shall have a comprehensive, documented approach to managing their supply base:

- Ranking for key suppliers
- Ranking system for key metrics
- System to address supplier concerns
- Issuance of Corrective Action Requests
- Documented process for supplier improvement
- Control of Pass Through characteristics

Supplier chain management shall include updates on the following:

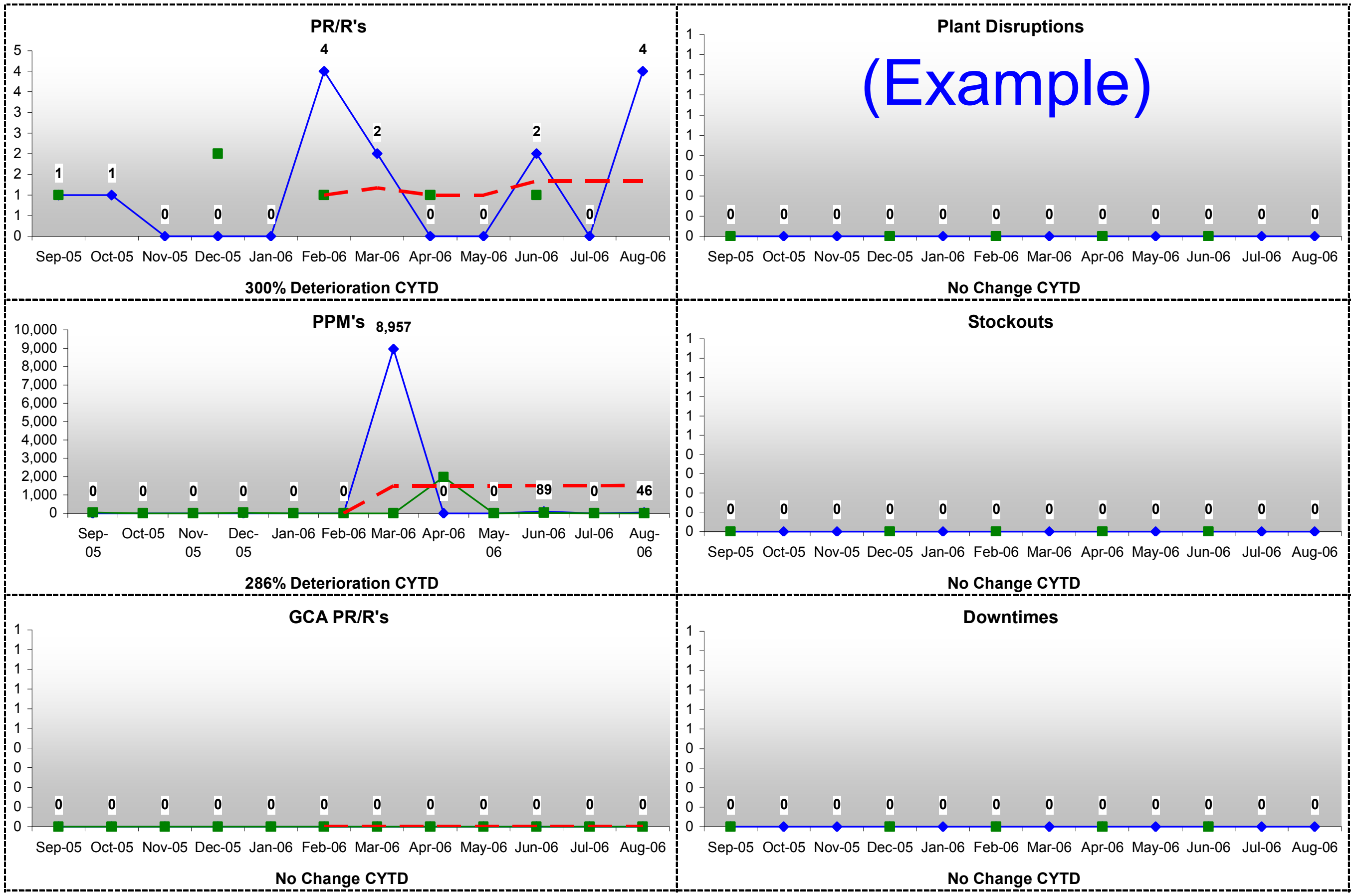
- Supplier concerns and responses
- Unacceptable supplier performance to expectations
- Current supplier quality activities

The workshop team should discuss how to define a key supplier.

SUPPLY CHAIN MANAGEMENT

10.4 – Performance Monitoring

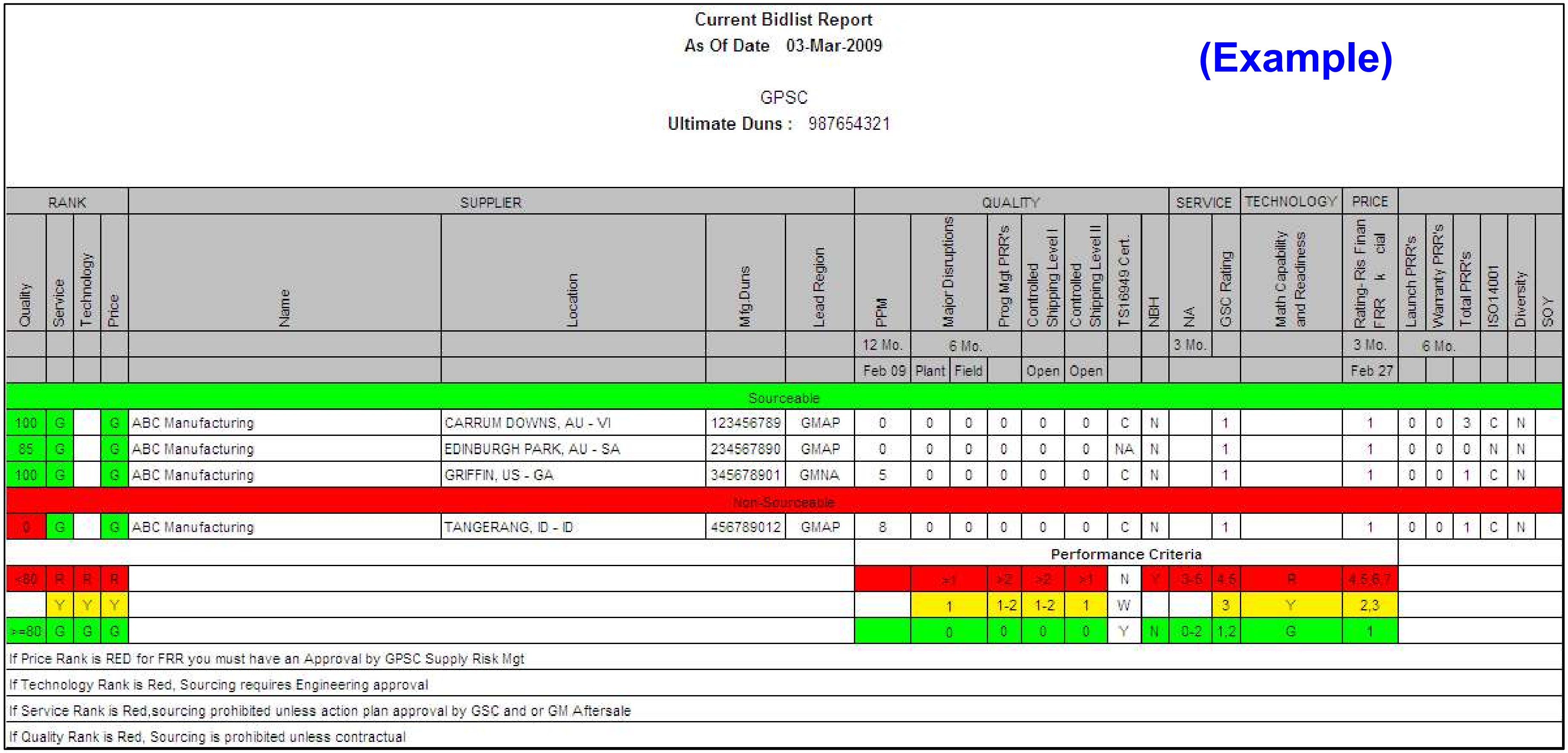
SIX PANEL CHART



Report Name: Supplier Activity / Charts **PRR Types = Quality | Warranty | Cust. Sat.** **Data As Of Sep 16 2006**

SUPPLY CHAIN MANAGEMENT

10.4 – Performance Monitoring



Current Bidlist Report
As Of Date 03-Mar-2009

(Example)

GPSC
Ultimate Duns : 987654321

RANK				SUPPLIER				QUALITY								SERVICE		TECHNOLOGY	PRICE						
Quality	Service	Technology	Price	Name	Location	Mfg Duns	Lead Region	PPM	Major Disruptions		Prog Mgt PRR's	Controlled Shipping Level I	Controlled Shipping Level II	TS16949 Cert.	NBH	NA	GSC Rating	Math Capability and Readiness	Rating-Risk FRR Financial	Launch PRR's	Warranty PRR's	Total PRR's	ISO14001	Diversity	SOY
								12 Mo.	6 Mo.							3 Mo.			3 Mo.	6 Mo.					
								Feb 09	Plant	Field		Open	Open						Feb 27						
Sourceable																									
100	G		G	ABC Manufacturing	CARRUM DOWNS, AU - VI	123456789	GMAP	0	0	0	0	0	0	C	N		1		1	0	0	3	C	N	
85	G		G	ABC Manufacturing	EDINBURGH PARK, AU - SA	234567890	GMAP	0	0	0	0	0	0	NA	N		1		1	0	0	0	N	N	
100	G		G	ABC Manufacturing	GRIFFIN, US - GA	345678901	GMNA	5	0	0	0	0	0	C	N		1		1	0	0	1	C	N	
Non-Sourceable																									
0	G		G	ABC Manufacturing	TANGERANG, ID - ID	456789012	GMAP	8	0	0	0	0	0	C	N		1		1	0	0	1	C	N	
								Performance Criteria																	
<80	R	R	R						>1		>2	>2	>1	N	Y	3-6	4,5	R	4,5,6,7						
	Y	Y	Y						1		1-2	1-2	1	W			3	Y	2,3						
>=80	G	G	G						0		0	0	0	Y	N	0-2	1,2	G	1						

If Price Rank is RED for FRR you must have an Approval by GPSC Supply Risk Mgt

If Technology Rank is Red, Sourcing requires Engineering approval

If Service Rank is Red,sourcing prohibited unless action plan approval by GSC and or GM Aftersale

If Quality Rank is Red, Sourcing is prohibited unless contractual

SUPPLY CHAIN MANAGEMENT

10.4 – Performance Monitoring

(Example)

					Supplier Metrics					
Overall Status	**Supplier**	**Location**	**Contact**	**Contact Number**	**PPM (6 Month Rolling)**	**CARs (6 Month)**	**QS 9000 TS 16949**	**Controlled Shipping (open)**	**Supplier Audit Score**	**Date of Last Supplier Quality Visit**
Y	ACB	Detroit, MI	Bill Smith	888.888.8888	G	G	Y	G	Y	
G	ZXW	Cleveland, OH	Debra Jones	999.999.9999	G	G	N/A	N/A	G	10/11/2008
R	MNO	PONTIAC, MI	Kathy West	555 555 5555	R	R	N/A	R	R	

R	Below minimum requirement or requirement not initiated
Y	Improvement or not complete
G	Meets requirements or Complete
N/A	Not Applicable

SUPPLY CHAIN MANAGEMENT

10.5 – Problem Resolution Tracking

All suppliers to General Motors shall demonstrate a systematic and disciplined approach to problem solving. This applies to all tiers in the supply chain.

> At a minimum, root cause analysis will include a 5-Why analysis to lead to the technical root cause. Other tools such as Fish Bone (Ishakawa), Is-Is not are also acceptable. The intent is to demonstrate discipline in applying the prescribed or preferred analysis method(s).

The next level, Drill Deep and Wide or also known as the 3x5 why, shall be used through the supply chain to determine why the system failed . (ref *Fast Response*)

1. Why did the current planning process fail to Predict the defect?
2. Why did the current process allow the defect to be made?
3. Why did the current control method not detect or prevent the defect from being shipped?

SUPPLY CHAIN MANAGEMENT

10.6 – Summary, Shalls

GM expects you, as a supplier to use a system that manages your suppliers in a similar manner to that used by your customers to manage you.

Organizations Shall:

- Manage their suppliers using a documented systematic approach.
- Use management tools for their suppliers:
  - ✓ To assess compliance and audit supplier activities to requirements as well as measure gaps to best practices by performing:
    - – Potential Supplier Assessments, Quality Systems Basics Audit, Labeling Audit, AIAG Special Process Audits, Drill Deep & Wide Audit.
  - ✓ Monitor supplier performance to established goals.
  - ✓ Have a system to track response to issues verifying a systematic and disciplined approach to problem solving using root cause tools:

11.0 – Managing Change

MANAGING CHANGE
Outline

11.0) Introduction page: Purpose, Scope, Responsibility

11.1) Benefits

11.2) Change Process

11.3) PTR Process

11.4) Banking Process

11.5) By-Pass Process

11.6) Summary, Shalls

MANAGING CHANGE

11.0 - Introduction

PURPOSE:

- Have a system to manage all plant process changes.
  - Planned Changes
  - Unplanned Changes (Emergency)
- Establish a common Trial Run process with standardized communication, readiness reviews and quality reviews.
- Define minimum requirements for bypassing existing production processes.
- Implement a controlled banking process

SCOPE:

- Changes that may affect the final product.
- Machines and systems that have been approved by the Customer.
- Manual and automated stations within the plant.
- Controlled through a Document Control Process.

RESPONSIBILITY:

- Ownership
  - ✓ Operations Manager
  - ✓ Manufacturing/Engineering Manager
  - ✓ Quality Manager

MANAGING CHANGE

11.1 - Benefits

- Improves notification and awareness throughout the organization regarding actions taken which may create out-of-control conditions.
- Assigns responsibility and process for communicating and conducting production trial runs.
- Improves quality of banked parts.
- Proactively defines and approves process methods / controls for by-passing and returning to an existing production process.
- Assures a systematic approach for all changes to customer approved processes.

MANAGING CHANGE

11.2 - Change process

All suppliers shall have a procedure for Plant Process Changes:

- Changes should be documented utilizing a plant process change form (reference Powertrain PPCR example).
- All process change forms shall be controlled through a Document Control Process.
- The procedure shall cover both Planned and Emergency changes (Typically temporary modification to process/standard work due to unplanned situations, such as downtime, stockout, authorized customer rework, schedule fluctuations, etc.).

The purpose of the Plant Process Change Request (PPCR) is to:

- Maintain a record of all changes that may impact the final product.
- Track system changes that may have a negative impact on the process, but not necessarily on the final product quality.
- Ensures all key stakeholders are made aware of change requirements and have input to control out of standard conditions.

MANAGING CHANGE

11.2 - Change process

(Continued)

PPCR's are required for any hardware or software changes that may effect the following:

- Final Piece Cost
- Machine / System Reliability
- Machine / System Capability
- Job Instructions
- Training Material
- Maintenance Procedures

Examples of some requests for changes that require PPCR's might include:

- Modifications to Calibration Procedures
- Operating Instructions
- Machine Setup Targets
- Process Control Plan changes
- Approved EWO's

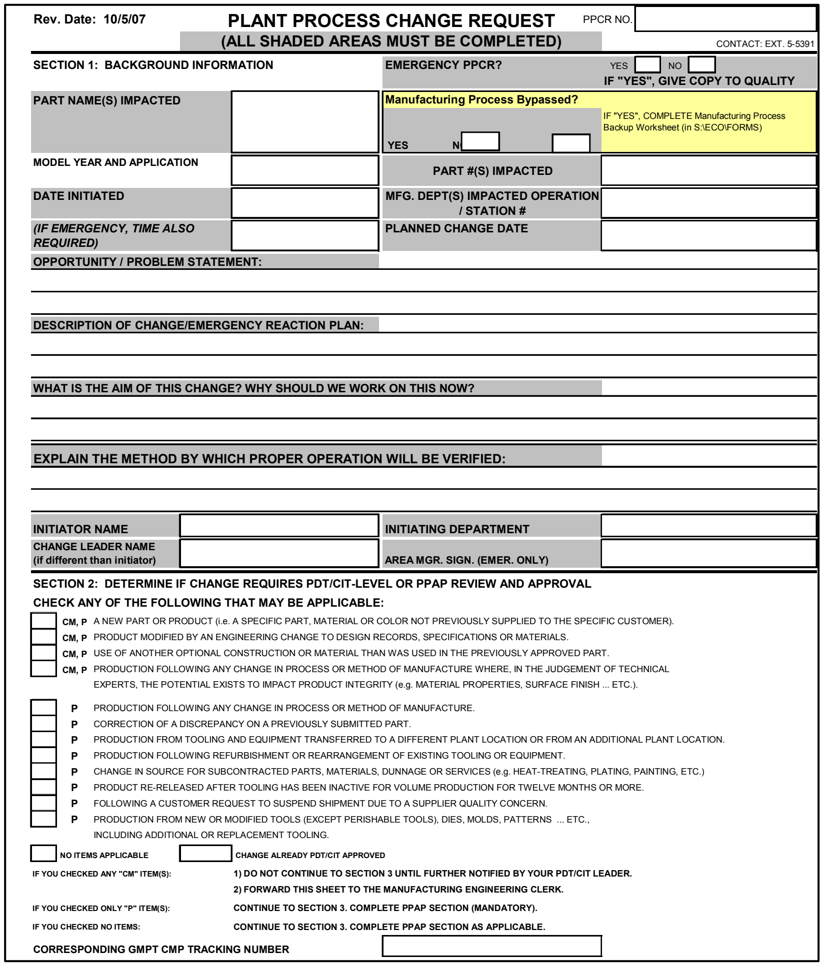
MANAGING CHANGE

11.2 - Change process

(Continued)

Plant Process Change Request Form

(EXAMPLE)



Rev. Date: 10/5/07 **PLANT PROCESS CHANGE REQUEST** PPCR NO. ☐

(ALL SHADED AREAS MUST BE COMPLETED) CONTACT: EXT. 5-5391

SECTION 1: BACKGROUND INFORMATION

EMERGENCY PPCR? YES ☐ NO ☐ **IF "YES", GIVE COPY TO QUALITY**

PART NAME(S) IMPACTED ☐

Manufacturing Process Bypassed? **YES** ☐ **NO** ☐ IF "YES", COMPLETE Manufacturing Process Backup Worksheet (in S:\ECO\FORMS)

MODEL YEAR AND APPLICATION ☐

PART #(S) IMPACTED ☐

DATE INITIATED ☐

MFG. DEPT(S) IMPACTED OPERATION / STATION # ☐

(IF EMERGENCY, TIME ALSO REQUIRED) ☐

PLANNED CHANGE DATE ☐

OPPORTUNITY / PROBLEM STATEMENT:

DESCRIPTION OF CHANGE/EMERGENCY REACTION PLAN:

WHAT IS THE AIM OF THIS CHANGE? WHY SHOULD WE WORK ON THIS NOW?

EXPLAIN THE METHOD BY WHICH PROPER OPERATION WILL BE VERIFIED:

INITIATOR NAME ☐

INITIATING DEPARTMENT ☐

CHANGE LEADER NAME (if different than initiator) ☐

AREA MGR. SIGN. (EMER. ONLY) ☐

SECTION 2: DETERMINE IF CHANGE REQUIRES PDT/CIT-LEVEL OR PPAP REVIEW AND APPROVAL

CHECK ANY OF THE FOLLOWING THAT MAY BE APPLICABLE:

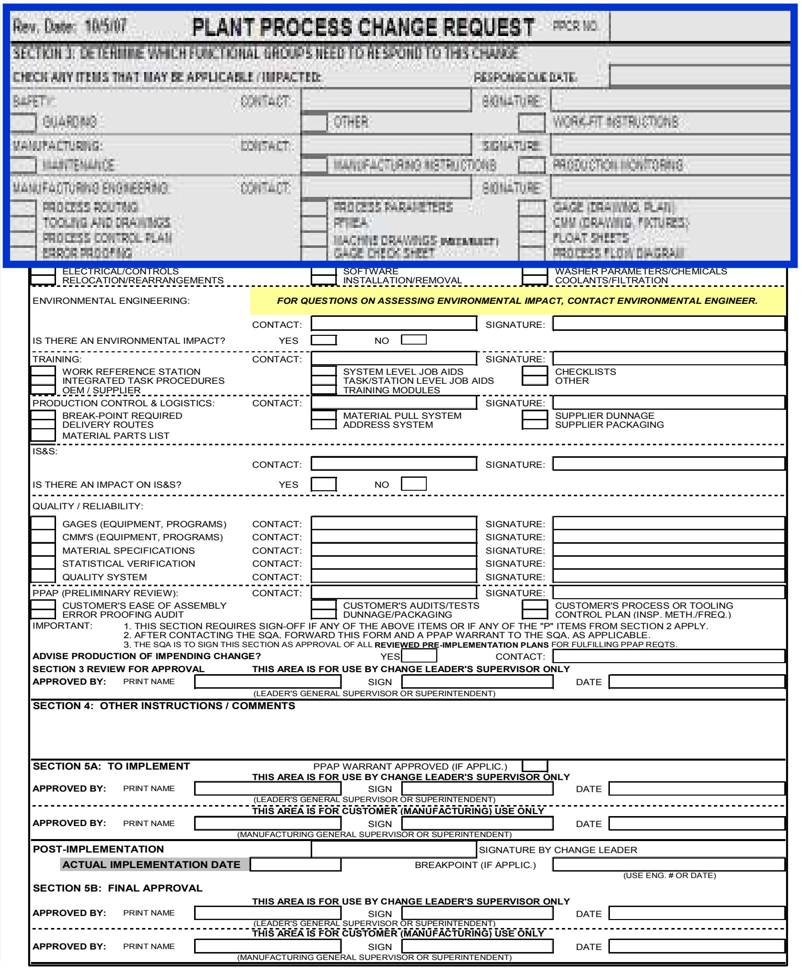
- ☐ **CM, P** A NEW PART OR PRODUCT (i.e. A SPECIFIC PART, MATERIAL OR COLOR NOT PREVIOUSLY SUPPLIED TO THE SPECIFIC CUSTOMER).
- ☐ **CM, P** PRODUCT MODIFIED BY AN ENGINEERING CHANGE TO DESIGN RECORDS, SPECIFICATIONS OR MATERIALS.
- ☐ **CM, P** USE OF ANOTHER OPTIONAL CONSTRUCTION OR MATERIAL THAN WAS USED IN THE PREVIOUSLY APPROVED PART.
- ☐ **CM, P** PRODUCTION FOLLOWING ANY CHANGE IN PROCESS OR METHOD OF MANUFACTURE WHERE, IN THE JUDGEMENT OF TECHNICAL EXPERTS, THE POTENTIAL EXISTS TO IMPACT PRODUCT INTEGRITY (e.g. MATERIAL PROPERTIES, SURFACE FINISH ... ETC.).

- ☐ **P** PRODUCTION FOLLOWING ANY CHANGE IN PROCESS OR METHOD OF MANUFACTURE.
- ☐ **P** CORRECTION OF A DISCREPANCY ON A PREVIOUSLY SUBMITTED PART.
- ☐ **P** PRODUCTION FROM TOOLING AND EQUIPMENT TRANSFERRED TO A DIFFERENT PLANT LOCATION OR FROM AN ADDITIONAL PLANT LOCATION.
- ☐ **P** PRODUCTION FOLLOWING REFURBISHMENT OR REARRANGEMENT OF EXISTING TOOLING OR EQUIPMENT.
- ☐ **P** CHANGE IN SOURCE FOR SUBCONTRACTED PARTS, MATERIALS, DUNNAGE OR SERVICES (e.g. HEAT-TREATING, PLATING, PAINTING, ETC.)
- ☐ **P** PRODUCT RE-RELEASED AFTER TOOLING HAS BEEN INACTIVE FOR VOLUME PRODUCTION FOR TWELVE MONTHS OR MORE.
- ☐ **P** FOLLOWING A CUSTOMER REQUEST TO SUSPEND SHIPMENT DUE TO A SUPPLIER QUALITY CONCERN.
- ☐ **P** PRODUCTION FROM NEW OR MODIFIED TOOLS (EXCEPT PERISHABLE TOOLS), DIES, MOLDS, PATTERNS ... ETC., INCLUDING ADDITIONAL OR REPLACEMENT TOOLING.

☐ **NO ITEMS APPLICABLE** ☐ **CHANGE ALREADY PDT/CIT APPROVED**

IF YOU CHECKED ANY "CM" ITEM(S):	**1) DO NOT CONTINUE TO SECTION 3 UNTIL FURTHER NOTIFIED BY YOUR PDT/CIT LEADER.** **2) FORWARD THIS SHEET TO THE MANUFACTURING ENGINEERING CLERK.**
IF YOU CHECKED ONLY "P" ITEM(S):	**CONTINUE TO SECTION 3. COMPLETE PPAP SECTION (MANDATORY).**
IF YOU CHECKED NO ITEMS:	**CONTINUE TO SECTION 3. COMPLETE PPAP SECTION AS APPLICABLE.**

CORRESPONDING GMPT CMP TRACKING NUMBER ☐



Rev. Date: 10/5/07 **PLANT PROCESS CHANGE REQUEST** PPCR NO. ☐

SECTION 3: DETERMINE WHICH FUNCTIONAL GROUPS NEED TO RESPOND TO THIS CHANGE

CHECK ANY ITEMS THAT MAY BE APPLICABLE / IMPACTED: RESPONSE DUE DATE: ☐

SAFETY: CONTACT: ☐ SIGNATURE: ☐

☐ GUARDING ☐ OTHER ☐ WORK-FIT INSTRUCTIONS

MANUFACTURING: CONTACT: ☐ SIGNATURE: ☐

☐ MAINTENANCE ☐ MANUFACTURING INSTRUCTIONS ☐ PRODUCTION MONITORING

MANUFACTURING ENGINEERING: CONTACT: ☐ SIGNATURE: ☐

☐ PROCESS ROUTING	☐ PROCESS PARAMETERS	☐ GAGE (DRAWING, PLAN)
☐ TOOLING AND DRAWINGS	☐ PFMEA	☐ CMM (DRAWING, FIXTURES)
☐ PROCESS CONTROL PLAN	☐ MACHINE DRAWINGS [illegible]	☐ FLOAT SHEETS
☐ ERROR PROOFING	☐ GAGE CHECK SHEET	☐ PROCESS FLOW DIAGRAM
☐ ELECTRICAL/CONTROLS	☐ SOFTWARE	☐ WASHER PARAMETERS/CHEMICALS
☐ RELOCATION/REARRANGEMENTS	☐ INSTALLATION/REMOVAL	☐ COOLANTS/FILTRATION

ENVIRONMENTAL ENGINEERING: ***FOR QUESTIONS ON ASSESSING ENVIRONMENTAL IMPACT, CONTACT ENVIRONMENTAL ENGINEER.***

CONTACT: ☐ SIGNATURE: ☐

IS THERE AN ENVIRONMENTAL IMPACT? YES ☐ NO ☐

TRAINING: CONTACT: ☐ SIGNATURE: ☐

☐ WORK REFERENCE STATION	☐ SYSTEM LEVEL JOB AIDS	☐ CHECKLISTS
☐ INTEGRATED TASK PROCEDURES	☐ TASK/STATION LEVEL JOB AIDS	☐ OTHER
☐ OEM / SUPPLIER	☐ TRAINING MODULES	

PRODUCTION CONTROL & LOGISTICS: CONTACT: ☐ SIGNATURE: ☐

☐ BREAK-POINT REQUIRED	☐ MATERIAL PULL SYSTEM	☐ SUPPLIER DUNNAGE
☐ DELIVERY ROUTES	☐ ADDRESS SYSTEM	☐ SUPPLIER PACKAGING
☐ MATERIAL PARTS LIST		

IS&S:

CONTACT: ☐ SIGNATURE: ☐

IS THERE AN IMPACT ON IS&S? YES ☐ NO ☐

QUALITY / RELIABILITY:

☐ GAGES (EQUIPMENT, PROGRAMS)	CONTACT:	☐	SIGNATURE:	☐
☐ CMM'S (EQUIPMENT, PROGRAMS)	CONTACT:	☐	SIGNATURE:	☐
☐ MATERIAL SPECIFICATIONS	CONTACT:	☐	SIGNATURE:	☐
☐ STATISTICAL VERIFICATION	CONTACT:	☐	SIGNATURE:	☐
☐ QUALITY SYSTEM	CONTACT:	☐	SIGNATURE:	☐

PPAP (PRELIMINARY REVIEW): CONTACT: ☐ SIGNATURE: ☐

☐ CUSTOMER'S EASE OF ASSEMBLY	☐ CUSTOMER'S AUDITS/TESTS	☐ CUSTOMER'S PROCESS OR TOOLING
☐ ERROR PROOFING AUDIT	☐ DUNNAGE/PACKAGING	☐ CONTROL PLAN (INSP. METH./FREQ.)

IMPORTANT:
1. THIS SECTION REQUIRES SIGN-OFF IF ANY OF THE ABOVE ITEMS OR IF ANY OF THE "P" ITEMS FROM SECTION 2 APPLY.
2. AFTER CONTACTING THE SQA, FORWARD THIS FORM AND A PPAP WARRANT TO THE SQA, AS APPLICABLE.
3. THE SQA IS TO SIGN THIS SECTION AS APPROVAL OF ALL **REVIEWED PRE-IMPLEMENTATION PLANS** FOR FULFILLING PPAP REQTS.

ADVISE PRODUCTION OF IMPENDING CHANGE? YES ☐ CONTACT: ☐

SECTION 3 REVIEW FOR APPROVAL **THIS AREA IS FOR USE BY CHANGE LEADER'S SUPERVISOR ONLY**

APPROVED BY: PRINT NAME ☐ SIGN ☐ DATE ☐
(LEADER'S GENERAL SUPERVISOR OR SUPERINTENDENT)

SECTION 4: OTHER INSTRUCTIONS / COMMENTS

SECTION 5A: TO IMPLEMENT PPAP WARRANT APPROVED (IF APPLIC.) ☐

THIS AREA IS FOR USE BY CHANGE LEADER'S SUPERVISOR ONLY

APPROVED BY: PRINT NAME ☐ SIGN ☐ DATE ☐
(LEADER'S GENERAL SUPERVISOR OR SUPERINTENDENT)

THIS AREA IS FOR CUSTOMER (MANUFACTURING) USE ONLY

APPROVED BY: PRINT NAME ☐ SIGN ☐ DATE ☐
(MANUFACTURING GENERAL SUPERVISOR OR SUPERINTENDENT)

POST-IMPLEMENTATION ☐ SIGNATURE BY CHANGE LEADER

ACTUAL IMPLEMENTATION DATE ☐ BREAKPOINT (IF APPLIC.) ☐
(USE ENG. # OR DATE)

SECTION 5B: FINAL APPROVAL

THIS AREA IS FOR USE BY CHANGE LEADER'S SUPERVISOR ONLY

APPROVED BY: PRINT NAME ☐ SIGN ☐ DATE ☐
(LEADER'S GENERAL SUPERVISOR OR SUPERINTENDENT)

THIS AREA IS FOR CUSTOMER (MANUFACTURING) USE ONLY

APPROVED BY: PRINT NAME ☐ SIGN ☐ DATE ☐
(MANUFACTURING GENERAL SUPERVISOR OR SUPERINTENDENT)

MANAGING CHANGE

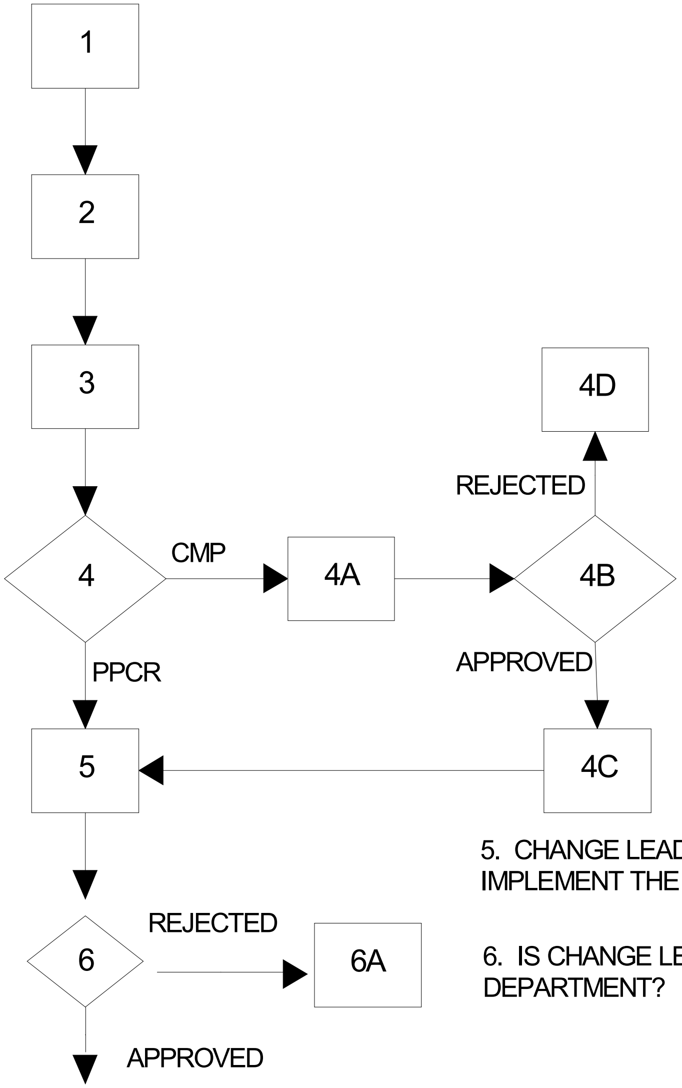
11.2 - Change process

(Continued)

Suggested Guidelines for the Change Management Process:

- Anyone can initiate a PPCR.
- A Document Control Process tracks all open and closed PPCR's.
- A process is defined to assign a Change Leader to each PPCR.
- Define type of change and what systems it impacts.
- Determine which functional groups are involved with the change.
- Prior to implementation, management shall sign off on the change.
- After implementation, the Change Leader shall sign and date the post-implementation section and document the breakpoint.
- After all open issues are resolved / closed, management shall sign the final approval section.

PPCR PROCESS FLOW



1. INITIATOR COMPLETES PPCR FORM SECTION 1 AND SELECTS CHANGE LEADER.

2. CHANGE LEADER COMPLETES SECTION 2.

3. INITIATOR OBTAINS PPCR TRACKING NUMBER FROM MANUFACTURING ENGINEERING CLERK

4. IS THE PROPOSED CHANGE TO GO THROUGH CHANGE MANAGEMENT PROCESS (CMP) SYSTEM OR REMAIN IN PPCR SYSTEM?

4A. THE PPCR FORM IS REVIEWED WITH MFG. FOCUS TEAM (PDT/CIT). PDT/CIT WILL GUIDE THE CHANGE THROUGH CMP UNTIL IT IS EITHER ACCEPTED OR REJECTED.

4B. HAS THE PDT/CIT APPROVED OR REJECTED THE CHANGE?

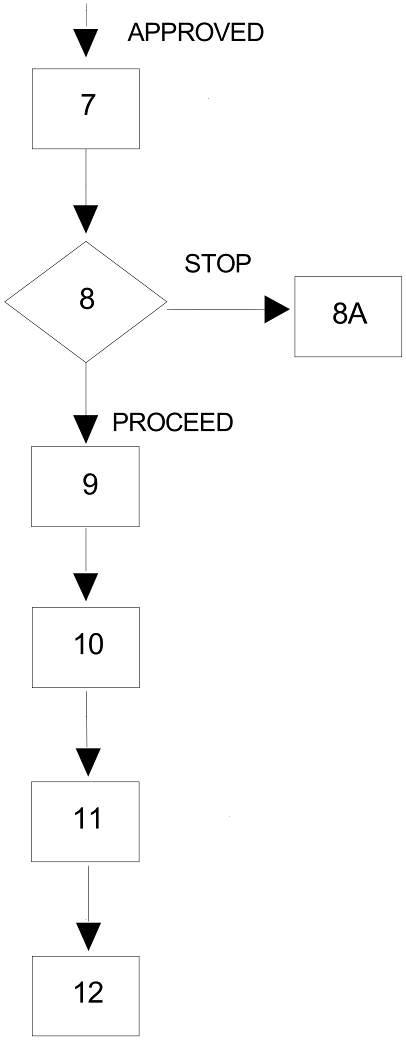
4C. THE PDT/CIT LEADER NOTIFIES THE CHANGE LEADER OF APPROVAL OR REJECTION.

4D. THE CHANGE PROCESS IS STOPPED.

5. CHANGE LEADER DETERMINES THE APPROPRIATE PERSONS/DEPARTMENTS REQUIRED TO IMPLEMENT THE CHANGE AND COMPLETES SECTION 3 OF PPCR FORM.XLS.

6. IS CHANGE LEADER ABLE TO OBTAIN APPROVAL SIGNATURES FROM EACH DESIGNATED DEPARTMENT?

PPCR PROCESS FLOW (CONTINUED)



6A. IF ANY SIGNATURE CANNOT BE OBTAINED, THE CHANGE PROCESS STOPS. ALL OTHER DEPARTMENTS CONTACTED IN SECTION 3 OF PPCR FORM.XLS MUST BE NOTIFIED OF THE REJECT.

7. CHANGE LEADER REVIEWS PENDING PROCESS CHANGE WITH HIS/HER GENERAL SUPERVISOR OR SUPERINTENDENT (SEE SECTION 3 OF PPCR FORM.XLS).

8. DOES THE CHANGE LEADER ACQUIRE WRITTEN DIRECTION TO PROCEED WITH CHANGE (OTHER INSTRUCTIONS, SECTION 4 PPCRLOG.XLS) FROM HIS/HER GENERAL SUPERVISOR OR SUPERINTENDENT, ALONG WITH SIGNATURE (SIGNATURE BLOCK, SECTION 5A OF PPCR FORM)?

8A. IF DIRECTED TO NOT PROCEED, STOP. NOTIFY ALL CONCERNED PARTIES (SECTION 3 OF PPCR FORM.XLS) WITH REASON FOR CHANGE REJECTION.

9. CHANGE LEADER, ALONG WITH THE PARTIES NAMED IN SECTION 3 OF PPCR FORM.XLS, IMPLEMENTS PROCESS CHANGE

10. CHANGE LEADER RECORDS THE DATE THE PROCESS CHANGE WAS IMPLEMENTED ON THE PPCR FORM (PPCR FORM.XLS) AND ON THE PPCR LOG SHEET (PPCRLOG.XLS, SEE SECTION 5B).

11. CHANGE LEADER ATTACHES APPLICABLE WORK SHEETS AND FORWARDS COMPLETED PPCR FORM TO GENERAL SUPERVISOR OR SUPERINTENDENT FOR FINAL APPROVAL. SECTION 5B (PPCRLOG.XLS)

12. CHANGE LEADER GIVES ORIGINAL COPY OF FINAL APPROVED PPCR TO MFG ENGINEERING CLERK.

MANAGING CHANGE

11.3 - Production Trial Run (PTR) process

Suppliers shall establish and utilize a defined PTR process that provides the following elements to ensure successful PTR execution:

- Standardized Communication and Documentation
- Build Readiness Reviews
- Quality Reviews before and after the change

Key elements of an Effective PTR Process:

- A PTR is a limited , controlled and contained production tryout used to evaluate a change prior to full production implementation.
- The PTR confirms the manufacturability of a change within the normal production environment.
- The PTR is not a substitute or extension of the product validation process.
- A written procedure and flow chart shall define the PTR process and requirements.

MANAGING CHANGE

11.3 - Production Trial Run (PTR) process (Continued)

- A Communication Form shall be used to document each step of the process and to record all approvals and results .

Suggested Sections of the Production Trial Run Communication Form:

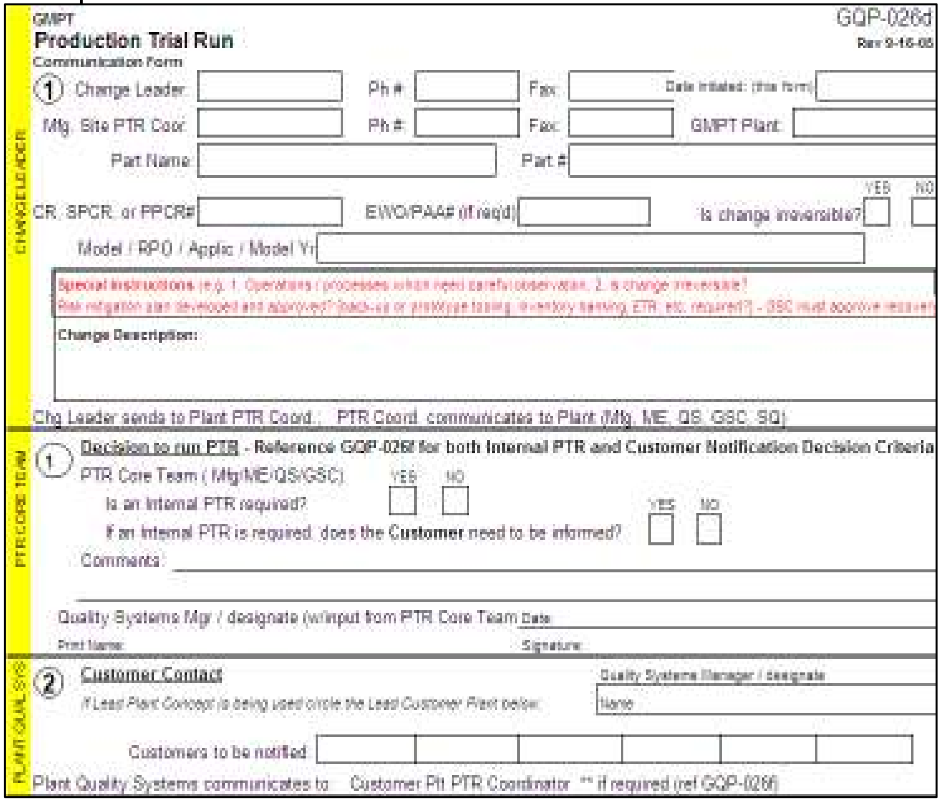
- Change Leader PTR Request and Information
- PTR Core Team PTR Decision and Approval to Run PTR
- Customer Contacts
- Customer / Internal PTR Requirement Decision
- PTR Readiness Approval
- Internal PTR Valve Review and Approval
- Customer Evaluation of PTR

MANAGING CHANGE

Production Trial Run Form

(EXAMPLE)

Top half of form



CHANGE LEADER

GMPT

Production Trial Run

Communication Form

GQP-026d

Rev 9-16-05

① Change Leader: ☐ Ph #: ☐ Fax: ☐ Date initiated: (this form) ☐

Mfg. Site PTR Coor: ☐ Ph #: ☐ Fax: ☐ GMPT Plant: ☐

Part Name: ☐ Part #: ☐

CR, SPCR, or PPCR#: ☐ EWO/PAA# (if req'd): ☐ Is change irreversible? YES ☐ NO ☐

Model / RPO / Applic / Model Yr: ☐

Special instructions (e.g. 1. Operations / processes which need careful observation, 2. Is change irreversible? Risk mitigation plan developed and approved? (back-up or prototype testing, inventory banking, ETR, etc. required?) - GSC must approve

Change Description:

Chg Leader sends to Plant PTR Coord.; PTR Coord. communicates to Plant (Mfg, ME, QS, GSC, SQ)

PTR CORE TEAM

① **Decision to run PTR** - **Reference GQP-026f for both Internal PTR and Customer Notification Decision Criteria**

PTR Core Team (Mfg/ME/QS/GSC)

Is an Internal PTR required? YES ☐ NO ☐

If an Internal PTR is required, does the Customer need to be informed? YES ☐ NO ☐

Comments:

Quality Systems Mgr / designate (w/input from PTR Core Team Date:

Print Name: Signature:

PLANT QUAL SYS

② **Customer Contact**

If Lead Plant Concept is being used circle the Lead Customer Plant below:

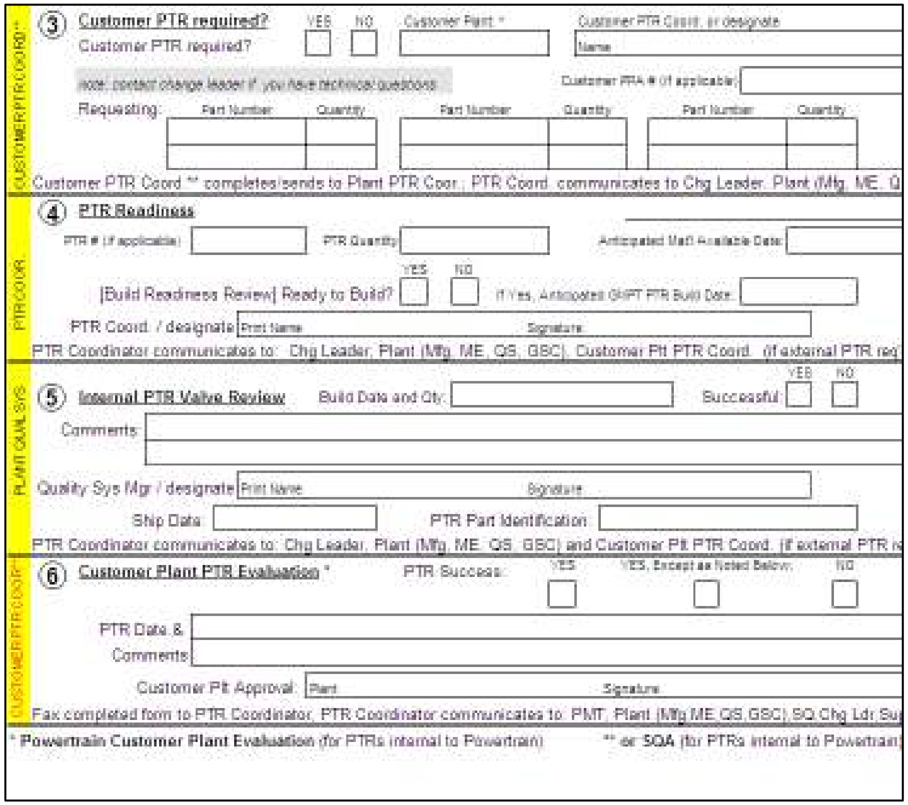
Quality Systems Manager / designate

Name:

Customers to be notified: ☐ ☐ ☐ ☐ ☐ ☐

Plant Quality Systems communicates to: Customer Plt PTR Coordinator ** if required (ref GQP-026f)

Bottom half of form



CUSTOMER PTR COORD**

③ **Customer PTR required?**

Customer PTR required? YES ☐ NO ☐

Customer Plant *: ☐

Customer PTR Coord. or designate

Name:

note: contact change leader if you have technical questions

Customer PRA # (if applicable): ☐

Requesting:

Part Number	Quantity	Part Number	Quantity	Part Number	Quantity

Customer PTR Coord ** completes/sends to Plant PTR Coor.; PTR Coord. communicates to Chg Leader, Plant (Mfg, ME, Q

PTR COOR

④ **PTR Readiness**

PTR # (if applicable): ☐ PTR Quantity: ☐ Anticipated Mat'l Available Date: ☐

[Build Readiness Review] Ready to Build? YES ☐ NO ☐ If Yes, Anticipated GMPT PTR Build Date: ☐

PTR Coord. / designate: Print Name: Signature:

PTR Coordinator communicates to: Chg Leader, Plant (Mfg, ME, QS, GSC), Customer Plt PTR Coord. (if external PTR req'

PLANT QUAL SYS

⑤ **Internal PTR Valve Review**

Build Date and Qty: ☐ Successful: YES ☐ NO ☐

Comments:

Quality Sys Mgr / designate: Print Name: Signature:

Ship Date: ☐ PTR Part Identification: ☐

PTR Coordinator communicates to: Chg Leader, Plant (Mfg, ME, QS, GSC) and Customer Plt PTR Coord. (if external PTR r

CUSTOMER PTR COOR*

⑥ **Customer Plant PTR Evaluation** *

PTR Success: YES ☐ YES, Except as Noted Below: ☐ NO ☐

PTR Data & Comments:

Customer Plt Approval: Plant: Signature:

Fax completed form to PTR Coordinator; PTR Coordinator communicates to: PMT, Plant (Mfg,ME,QS,GSC),SQ,Chg Ldr,Su

* **Powertrain Customer Plant Evaluation** (for PTRs internal to Powertrain)

** or **SQA** (for PTRs internal to Powertrain)

MANAGING CHANGE

11.4 - Banking Process

- All suppliers shall develop a procedure for the identification, protection and retrieval of parts when stored for extended periods of time. Some examples where this might be required are:
  - Business transfers (BTAB Tool moves)
  - Engineering changes
  - Tool refurbishments
  - Planned shutdowns
- Organizational responsibility for the banking process:
  - Material Manager: Process Implementation, execution and material traceability
  - Operations Manager: Proper protective packaging and storage
  - Quality Manager: Quality Control process

MANAGING CHANGE

11.4 - Banking Process

(Continued)

Banking Process Guidelines

- All banked material shall be placed in approved racking or dunnage designed for the specific material.
- Storage racks shall have clear tagging (date, lot #, etc.) on multiple sides.
- FIFO process shall be followed.
- Location of the stored material shall be free of water leaks, oil leaks, and any other environmentally damaging properties (humidity, temperature, etc.) that may promote nonconformance to the product. (e.g. rust, *contamination*, mold, distortion).

MANAGING CHANGE

11.4 - Banking Process

(Continued)

Banking Process Guidelines (Continued)

- All material banked will be protected. For example - seal in vapor corrosion inhibiting (VCI) packaging materials.
- Weekly LPA shall be performed to ensure the process is followed.
- All LPA issues shall be documented and corrective actions implemented.
- Quality requirements shall be established and followed for all banked material prior to shipment.

MANAGING CHANGE

11.4 - Banking Process

(Continued)

Lessons Learned / Best Practices

- Never use wood dividers when storing finished product in a bank. Wood can add moisture or it can negatively react with certain metals to cause permanent damage, such as rust.
- It is recommended to manually apply rust preventative solution on components manufactured with iron prior to placement into the VCI bags. This is most essential when the final product is stored in a high humidity, high temperature environment.
- Part washers should use anti-corrosion chemicals.
- Protection against heat, humidity, thermal cycling.
- Extended travel delivery should be accounted for when protecting the material.

MANAGING CHANGE

11.5) Bypass Process

Any time the process is altered outside the approved documented control plan, suppliers shall establish a Bypass Process Control procedure that:

- Defines the minimum requirements for bypassing an existing manufacturing process.
- Defines minimum requirements for verification of the original process when exiting the bypass.

Examples when a Bypass Process may be required:

- Torque gun failures
- Any back up operation outside the normal process flow
- *Error Proofing* or gaging that are turned off
- Any temporary rework to bring part back to specification

MANAGING CHANGE

11.5) Bypass Process

(Continued)

The Process Bypass Control procedure should incorporate the following:

- The process methods/controls defined for bypassing an existing manufacturing process are approved by the Operations Manager (process owner), the Engineering Manager and the Quality Manager.
- A list of processes approved for bypass are maintained through the Document Control Process.
- The PFMEA and Control Plan include the bypass process.
- *Standardized Work* Instructions are established for the bypass process.
- A form of communication is posted at each active bypass point.

MANAGING CHANGE

11.5) Bypass Process

(Continued)

Monitoring and control of the Bypass Process should be maintained by the following guidelines:

- A Manufacturing Process Bypass Worksheet is developed and used to track each process that is in the bypass procedure.
- The Backup Worksheet and Action Plan for each active bypass process are reviewed at the daily ***Fast Response*** meeting.
- Starting and ending breakpoints are recorded.
- A LPA is developed for each bypass process.
- Operators performing the bypass process are trained and certified.
- Before return to the original process, after Bypass, the process parameters and settings are verified and a pre-established quantity of parts are validated.
- The Operations Manager approves the return to the original process.

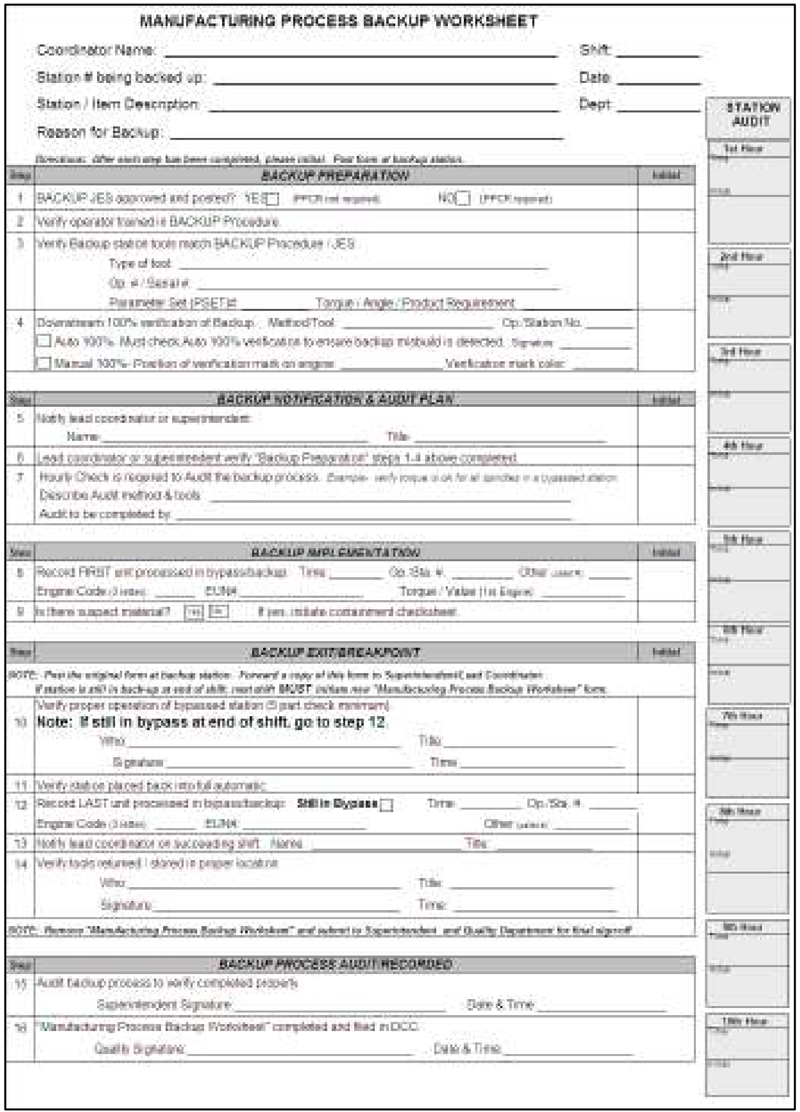
MANAGING CHANGE

(EXAMPLE)

Manufacturing Process Backup Worksheet

This document is a record that documents:

- breakpoints of entering and exiting the by-pass process
- identifies tooling, inspection, and audit requirements



MANUFACTURING PROCESS BACKUP WORKSHEET

Coordinator Name: ______________________ Shift: ________
Station # being backed up: ______________________ Date: ________
Station / Item Description: ______________________ Dept: ________
Reason for Backup: ______________________

STATION AUDIT

1st Hour
2nd Hour
3rd Hour
4th Hour
5th Hour
6th Hour
7th Hour
8th Hour
9th Hour
10th Hour

Directions: After each step has been completed, please initial. Post form at backup station.

Step	BACKUP PREPARATION	Initial
1	BACKUP JES approved and posted? YES ☐ (PPCR not required) NO ☐ (PPCR required)	
2	Verify operator trained in BACKUP Procedure.	
3	Verify Backup station tools match BACKUP Procedure / JES Type of tool: ____________ Op. # / Serial #: ____________ Parameter Set (PSET)#: ________ Torque / Angle / Product Requirement: ________	
4	Downstream 100% verification of Backup. Method/Tool: ________ Op./Station No. ________ ☐ Auto 100%. Must check Auto 100% verification to ensure backup misbuild is detected. Signature: ________ ☐ Manual 100%- Position of verification mark on engine: ________ Verification mark color: ________	

Step	BACKUP NOTIFICATION & AUDIT PLAN	Initial
5	Notify lead coordinator or superintendent: Name: ____________ Title: ____________	
6	Lead coordinator or superintendent verify "Backup Preparation" steps 1-4 above completed.	
7	Hourly Check is required to Audit the backup process. *Example: verify torque is ok for all spindles in a bypassed station* Describe Audit method & tools: ____________ Audit to be completed by: ____________	

Step	BACKUP IMPLEMENTATION	Initial
8	Record FIRST unit processed in bypass/backup: Time: ________ Op./Sta. #: ________ Other (specify): ________ Engine Code (3 letters): ________ ELN#: ________ Torque / Value (1st Engine): ________	
9	Is there suspect material? ☐ Yes ☐ No If yes, initiate containment checksheet.	

Step	BACKUP EXIT/BREAKPOINT	Initial
	NOTE: Post the original form at backup station. Forward a copy of this form to Superintendent/Lead Coordinator. *If station is still in backup at end of shift, next shift **MUST** initiate new "Manufacturing Process Backup Worksheet" form.*	
10	Verify proper operation of bypassed station (5 part check minimum) **Note: If still in bypass at end of shift, go to step 12.** Who: ____________ Title: ____________ Signature: ____________ Time: ____________	
11	Verify station placed back into full automatic.	
12	Record LAST unit processed in bypass/backup: **Still in Bypass** ☐ Time: ________ Op./Sta. #: ________ Engine Code (3 letters): ________ ELN#: ________ Other (specify): ________	
13	Notify lead coordinator on succeeding shift. Name: ____________ Title: ____________	
14	Verify tools returned / stored in proper location. Who: ____________ Title: ____________ Signature: ____________ Time: ____________	
	NOTE: Remove "Manufacturing Process Backup Worksheet" and submit to Superintendent and Quality Department for final signoff.	

Step	BACKUP PROCESS AUDIT/RECORDED
15	Audit backup process to verify completed properly. Superintendent Signature: ____________ Date & Time: ____________
16	"Manufacturing Process Backup Worksheet" completed and filed in DCC. Quality Signature: ____________ Date & Time: ____________

MANAGING CHANGE

11.6) Summary, Shalls

Organizations Shall:

- ✓ Establish and maintain a Document Control Process.
- ✓ Have a Plant Process Change procedure.
  - ☐ Covers planned and emergency changes.
  - ☐ Utilizes a process change form.
  - ☐ Maintain a record of all process changes.

- ✓ Establish a proactive Process Bypass Control procedure.
  - ☐ Define minimum requirements for bypassing and re-entering an approved manufacturing process.

- ✓ Utilize a defined Production Trial Run (PTR) procedure.
- ✓ Implement a Banking Process to control & protect all banked material.

KEY STRATEGIES

1. Fast Response
    - Fast Response Process
    - Problem Solving
    - Lessons Learned
2. Control of Non-Conforming Product
3. Verification Station
4. Standardized Operations
    - Work Place Organization – The 7 Wastes
    - Standardized Work Instructions – SOS
    - Operator Instructions – JES
    - Gaging Standards
5. Standardized Operator Training
6. Error Proofing Verification
7. Layered Process Audits
8. Risk Reduction
9. Contamination Control
10. Supply Chain Management
11. Managing Change

No Major Disruptions

No PRR'S

\+ 0 PPM'S

= World Class Quality

WORKSHOP

WORKSHOP AGENDA NOTES

Workshop time is valuable. Please refrain from spending group time to work on other issues.

If the group needs outside resources (HR, IE, etc.), contact those who can help. Contact the Workshop Trainer or Supplier Champion.

Results will be delivered to the Top Management of the company during the second day of training. Use this as an opportunity to enhance the procedures already in place and meet all the requirements for each strategy by presenting each team's ideas.

The presentations are starting points and will need more development by employees and management as they are implemented.

Results that cannot be achieved by the closing meeting, shall be included in the QSB Action Plan.

DIVIDING INTO WORKSHOP TEAMS

Form teams of three to five people when possible.
The following are suggestions on how to pair strategies and assign personnel:

RISK REDUCTION **ERROR PROOFING VERIFICATION** **CONTAMINATION CONTROL** **MANAGING CHANGE**	Manufacturing Engineers, Maintenance, Operators, Supervisors, Auditors/Quality
OPERATOR TRAINING **STANDARDIZED OPERATIONS** **NONCONFORMING PRODUCT** **SUPPLY CHAIN MANAGEMENT**	Supervisors, Operators, Training or Human Resources, Manufacturing Engineering, Quality Engineer
LAYERED PROCESS AUDITS **VERIFICATION STATIONS** **FAST RESPONSE**	Operations Manager, Quality Manager, Operators

WORKSHOP TEAM DELIVERABLES

Review the presentation and determine if all **SHALLS** are presently being met by your systems.

- Is there a form? How is the requirement being documented?
- How is the requirement being tracked and analyzed?
- Is management reviewing the results?
- How are results communicated to the workforce? Are results posted? Are results discussed in employee team meetings?
- Has the requirement been included in a QS 9000 procedure?

Develop suggestions for forms, tracking methods, management review timing and communication responsibilities.

Develop a ‘To-do List’ or use the ‘Action Plan’ form to begin listing actions required to implement strategy.

As a group decide how and who will present the team’s ideas.

WORKSHOP PRESENTATION AGENDA

- Introduce each team member.
- State the strategy to be presented.
- BRIEFLY describe the requirements and their status: being met in all cases, partially met in some areas, not being met, etc.
- Present your suggestions: forms, tracking methods, etc.
- Present your 'To-do List' or 'Action Items'.
- Ask for questions and comments.

NOTE: The presentation for each strategy should take approximately 10 minutes.