Module: TPM

Element: Quick Changeover (SMED)
Training pack
Aims & Objectives

• **Target Audience:**
  - Aerotooling, operations, programme planning, engineering

• **Purpose of Module:**
  - To provide participants with the knowledge of ‘quick changeover’ techniques to enable them to fully participate in ‘quick changeover’ workshops

• **Aims & Objectives:**
  - Communicate where the techniques are applicable (i.e. not just machines)
  - Communicate the 5 steps of ‘quick changeover’
  - Why we need to reduce changeover times
  - To provide an opportunity to experience changeover improvement scenarios
Why Quick Change Over?

Quick Change Over

MORE FREQUENT CHANGEOVERS

- REDUCED BATCH SIZES
- REDUCED W.I.P STOCK
- INCREASED FLEXIBILITY
- REDUCED LEAD TIME
- IMPROVED QUALITY
- REDUCED WASTE
- INCREASED CAPACITY
“Quick Change Over” is a method of analysing and reducing the time needed to change a process from producing one good part to producing the next good part by using a team approach.
2 Key Elements in Any Change Over

• **Internal Activities**
  – must be performed while the machine / process is stopped i.e. not making parts

• **External Activities**
  – can be performed whilst the machine / process is running i.e. making parts
6 Steps in a Change Over Improvement

1. Select appropriate set up to reduce
2. Observe / measure the current process
3. Separate / internal and external activities
4. Convert internal activities into external activities
5. Reduce internal activities
6. Reduce external activities
Change Over Activity “Detail”

- **Producing Good Parts**
  - Pre-Staging: to prepare for Change Over
  - Last Good Part

- **Down or Producing Bad Parts**
  - Machine Downtime: to Exchange Tools
  - Adjustment Time: to make first "Good Piece"

- **Producing Good Parts**
  - Post-Staging: to return workstation to standard

**Clock Starts** → **Time #1** → **Time #2** → **Time #3** → **Clock Stops**

Change Over
Tools for the Team (Check List)

• Agree team roles
  – Timer (not critical)
  – Scribe
• Agree and get all support materials
  – Video Camera (must be an operator)
  – Tools / Fixtures / Gauges / Information / set up sheet / route cards
• Special note for Camcorder, for the team to video the process
  – Team to view, any operator & Trade union
  – Team can brainstorm ideas from tape
  – Repeatability preserved
• All to Determine set-up activities
  – Set-up activities should be less than 3 minutes (get the detail waste)
• All to observe for improvements
Step 1. Select appropriate set up to reduce

**Why?** What is the need? i.e. Increased capacity, flexibility and multi-manning, etc.

**When?** After the appropriate personnel have been trained and objectives have been set (e.g., Minimum 50% reduction in first year).

**What?** Establish a policy of low/no cost solutions in the early stages: 40-60% of all reductions can be achieved with little or no cost.

**Where?** Identify the bottlenecks in the process. These are the limiting factors in the manufacturing cycle and therefore the places to tackle first.

**Who?** Establish a taskforce team, operator involvement is key, action based approach.

**How?** Identify potential obstacles and conflicts and overcome them, communicate programme throughout the organisation.
Step 2. Observe the current Process

- Observe, describe and map the current Change Over process
- Determine all activities in the Change Over process
- Start to think which are internal and external elements
Step 2. Workshop Activities

- Perform the FIRST setup (BASELINE)

- The key is to map full process and in detail

- Map the change over process, video operations, timing them, look at the walk pattern, scrap, excessive effort and 7Wastes

- Think about what are internal and what are external activities in the change over process
## Change Over Sheet

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Step 3. Separate Internal & External Activities

Differentiate the activities in a change over into internal and external activities.
Step 3. Separate Internal & External Activities

• From current process Map / Change Over sheet

• Define Internal & Externals
  • Safely can define I from E
  • Quality can define I from E
  • Is it physically possible for it to be external

• Define activities that can be moved now

• Define activities that can be moved with minor changes

• Define activities that can be moved with major changes

• Remember safety can not be compromised
Step 3. Workshop Activities

- Map out the new setup process (what, where, when)
  
  Before | During | After
  Set-up | Set-up | Set-up

- Look for additional improvements

- What went well, what did go so well (we are all learning)
Step 4. Convert I to E

- The key is to prepare in advance for the change over
- Simplify & standardise the changer over process / tools
- Remove activities fundamentally (is it critical to the process)
Step 4. Convert Internal to External Activities

• Prepare operating conditions prior to the changeover
  – Develop checklist needed changeover (what, where, when, how many etc)
  – Use visual management: “on deck circle,” scheduling board
  – Have everything at hand, at point of use, place tools / parts / material in order of usage to position for quick insertion into machine
  – Preheat, pre-set, pre-cut, or pre-adjust i.e. dress grinding wheels offline
  – Store high-use items at the machine i.e. Consumables
  – Very accurate presetting tools with minimum adjustments
  – Standard (one fits all) bolts, clamps, Dowels, location / datum points.
  – Replace fewest parts possible.

• Check all items to ensure proper fit and function
• Cleanup & Return Removed Tools After First Good Part
• Use intermediary fixtures/jigs
Step 4. Workshop Activities

• Map out the new setup process (what, where, when)
  
  Before               During               After
  Set-up               Set-up               Set-up

• Design improvements which can be Implemented during and after this Workshop
  – WHO, WHAT, WHERE, WHEN & WHY
  – Can we Do them Now ??

• Try Revised Set-up??

• Look for Additional Improvements
  – What went well, what did go so well (we are all learning)
  – Can other steps can be done externally?
Step 5. Reduce Internals Activities

- Reduce effort, motions or distances
- Simultaneous operations
- Teamwork to quickly hit the set-up activity
- Develop one touch operations
Step 5. Reduce Internal Activities

• Eliminate time lost removing and installing bolts
Step 5. Reduce Internal Activities

• Standardize Operations to Minimize Internal Adjustments
  – Pressures, size, shapes, Dies, tools, jigs
  – Bolts, hoses, & handles, Height and Stroke
  – Die height, Machine stroke height
  – Machine level, Handling & storage level
Step 5. Reduce Internal Activities

- Perform parallel operations

- Improve clamping mechanism

- Eliminate all adjustments
  - Graduated scales
  - Calibrated values
  - Measurement devices
  - Standard datum's

- Automate activities where appropriate?
Step 5. Workshop Activities

- Map out the new setup process (what, where, when)
  
  | Before | During | After |
  | Set-up | Set-up | Set-up |

- Design improvements which can be implemented during and after this Workshop
  - WHO, WHAT, WHERE, WHEN & WHY
  - Can we Do them Now ??

- Try Revised Set-up??

- Look for Additional Improvements
  - What went well, what did go so well (we are all learning)
  - What other steps can be done externally?
Step 6. Reduce Externals Activities

- Reduce effort, motions or distances
- Determine optimum storage locations
- Establish user friendly systems e.g. sign-off procedures
Step 6. Reduce External Activities

- Avoid Time Lost Looking for or Verifying Correct Items:
  - **Color Coding**
  - **Number Coding**

![Diagram showing die storage and die labeling changes before and after implementation of color coding and number coding systems.]
Step 6. Reduce External Activities

- Proper Arrangement and Orderliness
  - (5c)

- Carts Reserved for Changeovers
  - (VMS)

- Material Flow Racks

- Simplify Adjustments
  - Go-No Go Gauges
    - Part specific inspection package/ equipment

- Continuously Collect Ideas to Improve Setup!
  - Kaizen
Change over Check Sheet

- Set-up road map (STANDARD OPERATIONS)
  - (what, where, when + care points)
    - Materials
    - Machine tools (cutters)
    - Setting tools (Allen keys, etc)
    - Setting consumables
    - Gauges
    - Fixtures
    - Route card
    - tool setting sheet
    - drawing
    - set-up sheet, m/c program, offsets, etc.....
    - Machine settings: pressure, temperature
Step 6. Workshop Activities

• Map out the new setup process (what, where, when)
  
  Before | During | After
  Set-up | Set-up | Set-up

• Design improvements which can be implemented during and after this Workshop
  – WHO, WHAT, WHERE, WHEN & WHY
  – Can we Do them Now ??

• Try Revised Set-up??

• Look for Additional Improvements
  – What went well, what did go so well (we are all learning)
  – What other steps can be done externally?
Final Workshop Activities

• Do the New Set-up With a New Operator (verification)

• Wrap Up Workshop
  – **Document achievements (before / after photo)**
  – **Document changes to process standards**
  – **Develop action plans to implement longer-term improvements**
  – **Present achievements to management and work-team**
## Changeover Improvements

### Set-up Schedule

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### Action Plan

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### Initial Set-up
- 50 mins

### Current Target
- 25 mins

### Target period
- Nov/Dec

### Best to Date
- 36 mins

### Rolling Average
- 38 mins
Before

Finished production run  

Good parts produced by a stable process  

Loss
After

Finished production run

Loss

Good parts produced by a stable process
Aims & Objectives

• Target Audience:
  – Aerotooling, operations, programme planning, engineering

• Purpose of Module:
  – To provide participants with the knowledge of ‘quick changeover’ techniques to enable them to fully participate in ‘quick changeover’ workshops

• Aims & Objectives:
  – Communicate where the techniques are applicable (i.e. not just machines)
  – Communicate the 5 steps of ‘quick changeover’
  – Why we need to reduce changeover times
  – To provide an opportunity to experience changeover improvement scenarios

Did we succeed?