Can Quality Production Be Achieved Consistently on All Shifts?

Randy Long, Bon L Aluminum, USA

ABSTRACT --- The answer to this question is: if the commitment to the process is there, it can be achieved! One of largest hurdles in our industry is the inconsistency of quality production runs from die to die, shift to shift, and operator to operator. To be able to overcome these obstacles, we must all commit to following stringent process guidelines. The word “guidelines” is used because, as you know, the smallest of details can vary, and also cause variation in gaining consistency. A very important step is to fully assess your resources and their capabilities – personnel, equipment, and discipline to the process. This paper will give you ways to achieve consistency, but the decision must be made to instill a culture of stringent adherence to the process, and accept no deviation. This paper will cover some techniques in developing a quality culture in the personnel area, and then areas of the extrusion practices process that should be followed, to obtain consistent and repeatable successful extrusion production runs.

THE PROCESS

It takes all steps of the process to come together to make a consistent quality product. All personnel must be trained in all aspects of the process, not just the assigned task at hand. A better understanding of the total process helps your personnel have a good idea of how their assigned task “fits” into the big picture.

Some of the tools we have used in achieving this high level of understanding are:

- Pre-employment testing – a simple test of aptitude. Do they understand fractions, decimals, addition, division of numbers, reading a tape measure or rule, basic computer skills (data entry), and so on?
- Result review – interviewing after testing to find the best “fit” into production-related areas, setting the potential employee up for success (both personally and company).
- Training prior to assignment – show a film or slide show explaining the product that is produced, and how it is produced. Cover the plant rules, policies, and expectations prior to assigning a position, including quality and safety requirements. Take new employees on a plant tour with emphasis on their assigned area, and always include safety.
- Assignment training – prior to the new employee performing the physical task. Use or develop a training module – one that allows adequate time for the employee to gain knowledge of the task, include reporting and data collection required into the training.
- Training module – track employee skill level on assigned tasks. Do not allow employee to perform outside their trained skill level. One module that we favor is below:
The training module is used in appraising the actual level of the personnel’s capabilities.

- Five-minute production/safety talks – instill an atmosphere of communication between oncoming and off going shifts, prior to employees starting a shift. Have an agenda that allows for open communication about issues the prior shift is or has had – this is one of the most important steps to developing a quality, productive and safe environment, and positive attitude toward completing tasks and goals.

- Allow employees to learn other tasks (cross-training) – encourage and promote an employee to learn all tasks in a specified area (use the training module when doing this). Include departmental cross-training. This is an invaluable tool; employees that have experienced total production and departmental cross-training are not only a benefit to themselves, but also to their organization.

- Weekly supervisor/advisor/group leader meetings – meet with your individual teams and discuss production, quality, and safety items. Note specific items, and do not speak in general terms. Have an agenda prepared, and allow time for team participation – let them express their concerns.

- Hold monthly QSP (quality, safety and production) meetings – meet with all personnel, and all shifts at a convenient time. Managers of the related areas need to share what is going on without
any hidden agenda. Allow time for team participation and rebuttal. This should be kept to under an hour, and share expectations and future events at this meeting – sharing results is an invaluable tool.

Now, we will cover some techniques in developing a quality culture by defining areas of the process that should be followed to obtain consistent and repeatable successful extrusion production runs.

**Quoting Process**

- Understand the capabilities of your press(es) in relation to pressure, tooling support, quenching, and tolerances that can be held;

- Review the profile for quote per customer’s request. Alloy, finish, profile thickness, tongue ratio, tolerances requested, cut length, circumscribing circle diameter, end use, and feasibility of ability to extrude;

- Requests should be reviewed by a committee, not a single person. In this step, it is important to properly identify and quote the tooling necessary for initial die success;

- Once data is gathered from the quoting process, then communicate your capabilities to the customer. Most customers will work with you even if a part has to be redefined, or in many cases even redesigned.

**Figure 2.** Request for quote form.

**Die Ordering/Layout Process**

- Note: Saving money by not ordering the proper tool and support in this step will cause failures in the process and in customer satisfaction, and could cost more money than the correct initial investment would.
Figure 3. Die and support tooling.

- Layout design is important to the movement of metal throughout the facility. Note: In this step, consider the subsequent process that the customer is requiring, ensure the parts are stacked and racked for easy access by the next department, and that damage is held to a minimum.

Figure 4. Layout.

Determine Extrusion Practice

- Prior to extruding, verify the die received is made to the print parameters agreed upon by you and the vendor; incoming inspections can prevent die failures.
Use your (or group) expertise and past history on similar shapes to set up your initial trial or production run;

Document the trial parameters so the operator has a guideline to assist in first-time runs (trials);

Include in this guideline: die number, die temperature, support tooling required, alloy, billet temperature, billet length, number of billets requested, ram speed, quenching required, puller tension, dimensional/finish requirements, stretching requirements, front and end scrap requirements, cut length, number of cuts, stacking requirements, age cycle desired (if needed);

**Die Trial Parameter Data Sheet**

<table>
<thead>
<tr>
<th>Press:</th>
<th>Die Number:</th>
<th>Die Type:</th>
<th>Backer Number:</th>
<th>Bolster Number:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spacer Ring Number:</td>
<td>Cannister:</td>
<td>Minimum Die Soak Time:</td>
<td>Minimum Die Temp:</td>
<td></td>
</tr>
<tr>
<td>Preheat Bolster: yes - no</td>
<td>Log Furnace Settings:</td>
<td>Butt Length Setting:</td>
<td>Ram Speed:</td>
<td></td>
</tr>
<tr>
<td>Minimum Bolster Soak Time:</td>
<td>Zone 1:</td>
<td>Lubrication of Dummy Block Frequency:</td>
<td># of billets</td>
<td></td>
</tr>
<tr>
<td>Minimum Bolster Temperature:</td>
<td>Zone 2:</td>
<td>Use starter billet: yes - no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preheat Spacer Ring: yes - no</td>
<td>Zone 3:</td>
<td>Starter billet length:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Spacer Ring Soak Time:</td>
<td>Zone 4:</td>
<td>Starter Billet Temperature:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Spacer Ring Temperature:</td>
<td>Zone 5:</td>
<td>Save Pieces From 1st Billet: yes - no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Exit Temperature:</td>
<td>Puller Tension:</td>
<td>Use Block To Separate Holes: yes - no</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(verify with hand held pyrometer)</td>
<td>(on multihole - watch for orange peel)</td>
<td>(on leadout table - multihole dies)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overhead Fan Settings:</td>
<td>Runout Fan Settings: on – off</td>
<td>Undertable Fan Settings: on – off</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#1 Fan on – off</td>
<td>#5 Fan on – off</td>
<td>Front End Scrap: Tail End Scrap:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#2 Fan on – off</td>
<td>#6 Fan on – off</td>
<td>Rack Before Stack: yes – no</td>
<td>Use Spacers: yes – no</td>
<td></td>
</tr>
<tr>
<td>#3 Fan on – off</td>
<td>#7 Fan on – off</td>
<td>(stack in rack as extended)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#4 Fan on – off</td>
<td>#8 Fan on – off</td>
<td>Last Revision Date Of Data Sheet: By Whom:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#9 Fan on – off</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5.** Incoming die inspections.

**Figure 6.** Trial request form.
• Document the trial results and review the data;
• If trial is not successful, make necessary correction and re-trial, using the Trial Request Form as procedure, and document the results;
• Use a Die Correction Request Form to document necessary improvement needed;

Figure 7. Die correction request.

• If the trial is successful, document the information necessary for die release for production.
  Document the findings;
• Document the extrusion parameters. This can be done with computer input, computer generated or manually by the operator;

Figure 8. Process verification.

• Review data of the process parameters, versus the quality results of the product. If the process is proven to meet the customer’s expectation, then this becomes the process that must be enforced and re-enforced for press crews to follow. If gains can be made by making subtle changes, then make notation of the improvements; thus process improvements are made.
Controlled Process Parameters

- Whether you have the capability of computer-assisted process parameters, or just having to do the manual paperwork, controlling the process at each stage of the operation is the only way to achieve successful repetitive quality that the customer expects, and that we expect to satisfactorily perform in today’s extrusion environment;

- Consistent quality production requires that all team members are on board, at all levels, with strict adherence to their process as defined.

- A view of the screens that are made available through computerization interfaces with the press, furnace, and handling system are shown on the following pages.
10a. **ORDER PARAMETER ENTRY/DATA**

<table>
<thead>
<tr>
<th><strong>PRODUCTIVITY</strong></th>
<th><strong>DIELECTRIC</strong></th>
<th><strong>CUT LENGTH</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>5486</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>LENGTH</strong></th>
<th><strong>QUANTITY</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>870</td>
<td>19</td>
</tr>
<tr>
<td>5486</td>
<td>300</td>
</tr>
</tbody>
</table>

**Alloy:** 6005  **P**  
**Priority:** 1  
**Extrude Date:** 3/22/2006

10b. **VIEW OF ALL ORDERS – IN ORDER TO BE EXTRUDED**
10c. FURNACE SET-UP PARAMETERS

10d. PULLER SET-UP PARAMETERS

Figures 10a – 10d. Some computerized system data.

Using the above methodology is not new to our industry; we all use a variation of documenting the process. It doesn’t matter if you have new or old equipment, a manual system, the latest in computerized technology, or a combination of these, to gain quality consistency. It simply takes developing and maintaining a culture that expects the best from all personnel, all the time. Personnel at any and all levels must have confidence in each other, both in ability and commitment. Gaining confidence in each other comes from effective planning, implementation, execution, and commitment to the process. It must begin with the top management, and extend throughout the whole organization.
In the first full year of production we were able to:

- Produce 24.64 million pounds of extrusions
- Press scrap percent – 19.2
- Internal scrap percent – .7 (<1%)
- On time complete percent - 100
- Returns – 3.2 parts per million (all parts fabricated).

Communicate, Communicate, Communicate

Open communication at all levels will provide an environment of not only teamwork, but a level of confidence that every person is important and is a part of the process. You will find it is easier to correct deficiencies when personnel are confident this is being done with the greatest of intent! Then and only then can you “gain consistency in production on all shifts”!