Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems

P. Hunter Vegas, P.E.
Presenter –
P. Hunter Vegas, P.E.

- Born in Bay St. Louis, Mississippi
- Received BSEE from Tulane University
- Received MBA from Wake Forest University
- Holds PE Licenses in Electrical and Control Systems Engineering
- Designed Robotics and Automated gauging systems for Babcock and Wilcox, Naval Nuclear Fuel Division (Lynchburg, VA)
- Held numerous Instrumentation Engineering and Production Management positions for Cytec Industries (New Orleans, LA)
- Designed Next Generation Manufacturing Equipment for Bristol Myers Squibb (Greensboro, NC)
- Currently working for Avid Solutions as a Senior Project Manager doing various automation projects for numerous Specialty Chemical and Paper companies.
Introduction - Forward

• This Presentation is NOT intended for those who are unfamiliar with S88 and basic batch concepts. If the phrases “S88 Standard”, “Phases”, and “Units” are foreign to you then you probably need to buy the “Batch Ice Cream Book” and get caught up.

• This Presentation IS intended for the Control and/or Process Engineers who know basic batch concepts and are trying to implement it in their facility.

Disclaimer

• There is no one “Right” way to do batch. This presentation will offer several techniques for handling a variety of typical process issues in a batch plant. Generally these techniques work extremely well but if you have a different way of doing the same thing and it works for you, by all means do it!

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Introduction -

• S88 is rapidly becoming the standard across the industry.
• The days of “Write your own” Batch Code is (Thankfully!) coming to an end.
• The Recipe and Unit levels of the standard are generally well defined and most engineers agree on their implementation.
• The implementation of phases, however, is much less consistent. Engineers argue about what tasks to include in a phase and how complex and/or simple a phase should be.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Introduction -

- The decisions made at the beginning of a batch project have enormous impact on the ease of implementation, robustness of the system, and ease of maintenance.
- Get it right and you are hero.
- Get it wrong and you (or your replacement) will be cursing for a long time.
- This paper was written to help you get it right.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Introduction -

This paper focuses on the Phase Definition of Batch Projects and it addresses these issues:

• When to group tasks into a single phase and when to separate them into multiple phases
• When to use class based phases and when to avoid them
• The pros and cons of combining tasks into large equipment modules
• The pros and cons of running phases in series and parallel

The paper concludes with some general suggestions for anyone undertaking a batch project

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
The Trials and Tribulations of Phase Design

Determining what tasks a phase should include can be quite difficult:

- I once heard a World Batch Forum attendee argue that each valve and pump should have its own phase.
- I have seen some integrators combine so many tasks that they effectively created a “Make Product X Phase”.
- Obviously the answer is somewhere in the middle.

After working on numerous batch projects as a designer, implementer, user, and maintainer I have developed the “Puzzle Piece” method of phase design.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Phases are like puzzle pieces. If the Process Engineer has all the right pieces, he can perform practically any process task by simply rearranging the phases at the recipe level. No logic programming is necessary.

• The trick is to combine tasks whenever possible to reduce coding and ease maintenance...
  but
• divide the tasks with enough granularity to easily handle whatever curves Production throws at you.

This idea is probably easier to explain by example.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Example

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Example

Let’s analyze this example:

• For this case there are two Units (RE-100 and RE-200)
• Typical phases would be Agitate, Charge Material #1, and Charge Material #2
• The Agitate phases would be class based and use alias tags.
• Each Material Charge phase would use alias tags and be classed base as well.
• Would you create a single classed base phase for ALL material charges?

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Jacket Example

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Jacket Example

There are two ways to handle reactor Jacket Controls:

• Combine heating, cooling, draining, and venting logic into one large equipment module. Send the module commands from batch to put jacket into various modes.

• Split the logic into smaller, simpler phases such as “Heat On”, “Heat Up”, “Cool On”, Cool Down”, “Jacket Vent/Drain”, “Jacket Off”, etc. The recipe calls the phases as necessary.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Jacket Example

Pros and Cons of Jacket Equipment Module

Pros
• All jacket logic is implemented in one place.
• Initial programming MAY be less.

Pros and Cons of Individual Jacket Phases

Pros
• Phases are simple and easy to program and troubleshoot
• Modifications are easy to implement and will not affect other jacket mode logic
• Better coordination with Batch system (pause, hold, etc.)

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Jacket Example

Pros and Cons of Jacket Equipment Module

Cons
• Logic is very complex and hard to troubleshoot.
• Modifications can be very difficult to implement, a change to one mode may impact other logic.
• Logic tends to be harder to reuse.

Pros and Cons of Individual Jacket Phases

Cons
• Initial programming effort may be slightly greater

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Transfer Example

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Transfer Example

Rather than creating one large transfer phase consider the following “puzzle piece” phases:

• Transfer Setup Phase – allocates header and aligns valves between vessels
• Transfer Phase – Start pump, monitor level, and end when weight < XX lbs for YY sec.
• Nitrogen Purge – Open Nitrogen valve for XX seconds
• Water Charge to Reactor – Charge YY lbs of water
• Transfer Complete Phase – shuts all header valves and releases header for other phases.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Reactor Transfer Example

By programming in this method the recipe:

• Can perform a product transfer with or without nitrogen purge and/or water flush by simply choosing the desired phases. Any combination is easily implemented.

• The header is allocated throughout the transfer so there is no concern about having another phase seize the header before flushes or line blows are complete.

• The phases are simple and easy to program/troubleshoot

• You can also allocate just half of a header and allow other transfers to proceed simultaneously.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Phase/Recipe Structure

The layout of phases within a recipe can have a dramatic impact on system stability

- Each active phase consumes processing overhead and communication resources.
- When eight or ten phases are running simultaneously, the system can go unstable and even crash.
- Perform your initial recipe layout and then examine it for areas where too many phases are running in parallel.
- If you notice areas like this, consider the following options for eliminating this problem.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Phase/Recipe Structure – Initial Layout

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Phase/Recipe Structure – Optional Layouts

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
General Suggestions

Here are some ideas that any batch project manager might strongly consider:

• If you are new to Batch, GET HELP!!!
• Lay out the major recipes first.
  – Look for reusable chunks
  – Remember the Puzzle Piece method. Don’t combine things that you’ll want separated later.
  – Try to create phases that incorporate all the required variables
  – Consider using a ‘profile phase’ to handle setpoint ramping, etc.

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
General Suggestions

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Once you have the recipe laid out, THEN program the phases

- Here are some phase tip/tricks/issues to consider:
  - Remote vs. Local Mode for Valves and Pumps
  - Reset all valves on any phase restart. Don’t assume they stayed as you left them.
  - Delay reading and writing report parameters, let things settle.
  - Add LOTS of phase messaging
  - Employ counting timer phases
  - KISS!!!!!
Conclusion

Batch programming is not particularly difficult IF you consider your options and make wise design decisions early.

Do it right and things will go smoothly.

Do it wrong and you could be in for a VERY long project!

Good luck!

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems
Questions???

Please feel free to drop me a phone call or email. My contact information is:

P. Hunter Vegas, PE
336-970-4033 (work)
336-403-1913 (cell)
hvegas@avidapplicationsinc.com

Tips and Tricks to Applying S88 Standards to Chemical Plant Batch Systems