Market Driven Systems (FRTN20)

Exercise 3 - Solutions

Batch Control

Last updated: 2014

1. According to the standard ISA88: A batch process is a process that leads to the production of finite quantities of material by subjecting quantities of input materials to an ordered set of processing activities over a finite period of time using one or more pieces of equipment.

   There are a number of characteristics typical to batch processes:

   - Production of products in batches.
   - Discountinuous flow of materials.
   - Production run determined by time/end point.
   - Production goes through steps of operations.
   - Fluid and dry processing.

   Examples of batch systems are:

   - Making of cookies.
   - Making of head-ache pills.

2.
   - A batch process can be single-product, multi-grade or multi-product. A single product batch plant produces the same product in each batch, e.g., a batch pulp digester. The same operations are performed on each batch and the same amount of raw materials is used. A multi-grade batch plant produces products that are similar but not identical. The same operations are performed on each batch but the quantities of raw materials and/or processing conditions such as, e.g., temperatures, may vary with each batch. The multi-product batch plant produces products utilizing different methods of production or control. The operations performed, the amount of raw materials and the processing conditions may vary with each batch.

   - The basic types of batch structures are series (single-stream), parallel (multi-stream) and a combination of the two. A series structure is a group of units through which the batch passes sequentially. If the plant has several serial groups of units placed in parallel but without interaction the plant has a parallel structure. If interactions exists between the parallel branches, a series/parallel structure is achieved. Other names for the series, parallel and series/parallel structures are single-path, multi-path and network-structure.

3. One example of how to classify the process cell: The process cell contains two units: Unit 1 and Unit 2. Equipment Module 1 is a common resource (stand-alone), exclusive-use. Equipment Module 2 is part of Unit 2. See Figure 1.
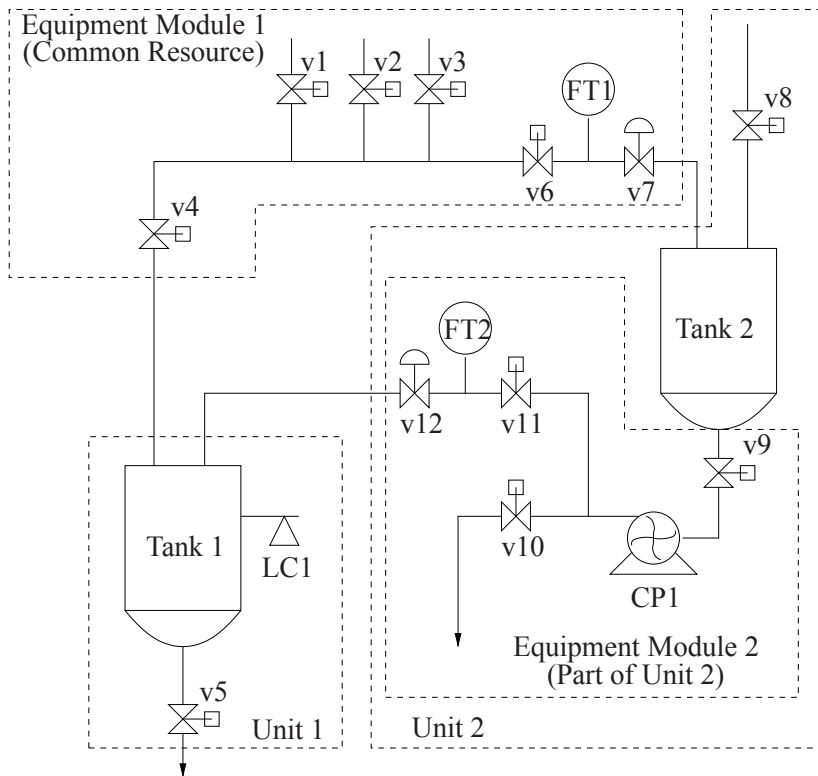

Figure 1

4.

a. A recipe contains administrative information, formula information, requirements on the equipment needed, and the procedure that defines how the recipe should be produced. The procedure is organized according to the procedural control model.

b.
- General recipe: The general recipe is an enterprise level recipe that serves as a basis for the other recipes. The general recipe is created without specific knowledge of the process cell equipment that will be used to manufacture the product.

- Site recipe: The site recipe is specific to a particular site. The language in which it is written, the units of measurements, and the raw materials are adjusted to the site.

- Master recipe: The master recipe is targeted to a specific process cell. A master recipe is either derived from a general recipe or created as a stand-alone entity by people that have all the information that otherwise would have been included in the general or the site recipe.

- Control recipe: The control recipe is originally a copy of the master recipe which has been completed and/or modified with scheduling, operational and equipment information. A control recipe can be viewed as an instantiation of a master recipe.
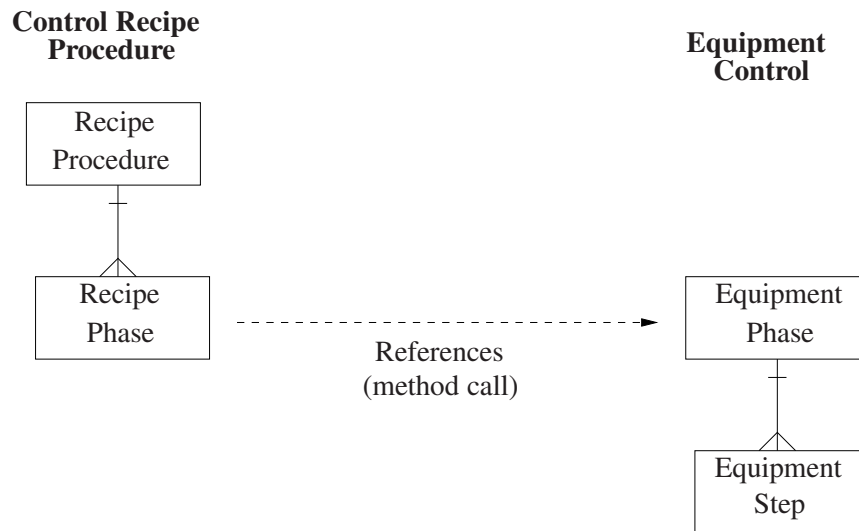
Figure 2

5. The dashed levels could either be contained in the control recipe or in the equipment control. The most common configuration used in industry is shown in Figure 2.

6. No solution provided.