Systematic Layout Planning (SLP)

Process Charting for Layout Planning

Main Points

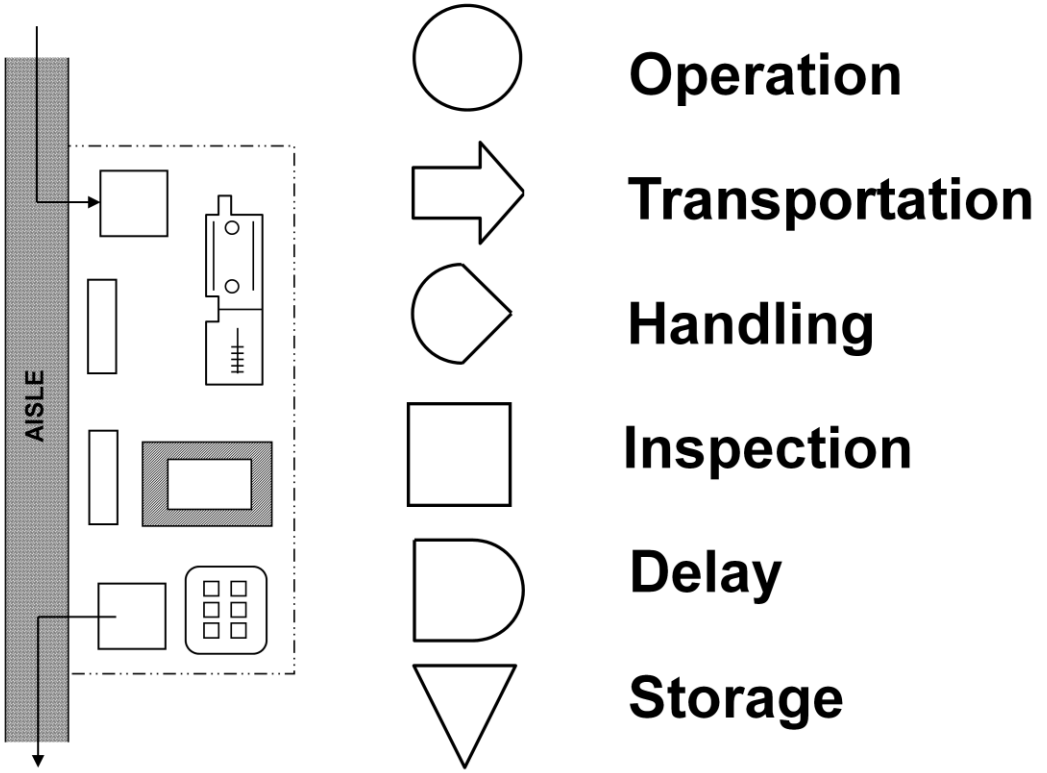
In industry, six things happen to parts or materials:

1. An operation changes the physical form of products or materials.
2. A transportation changes the location of products or materials.
3. A handling changes the position of products or materials as they are arranged or prepared for another action.
4. An inspection verifies and changes the status of products or materials.
5. A delay is a temporary hold when conditions do not permit or require the performance of the next planned action.
6. A storage holds products or materials against unauthorized removal.

These symbols (except for handling) are the standard ASME process charting symbols as defined in ANSI Y15.3M 1979. (They are available in Microsoft Visio as the TQM stencil).

Process Analysis

Six Things Can Happen to The Material(s) or Part(s)



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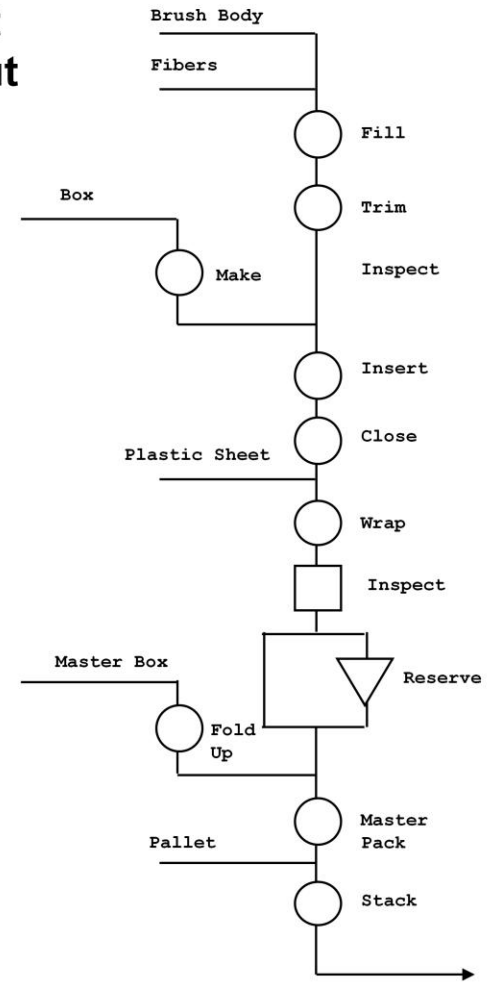
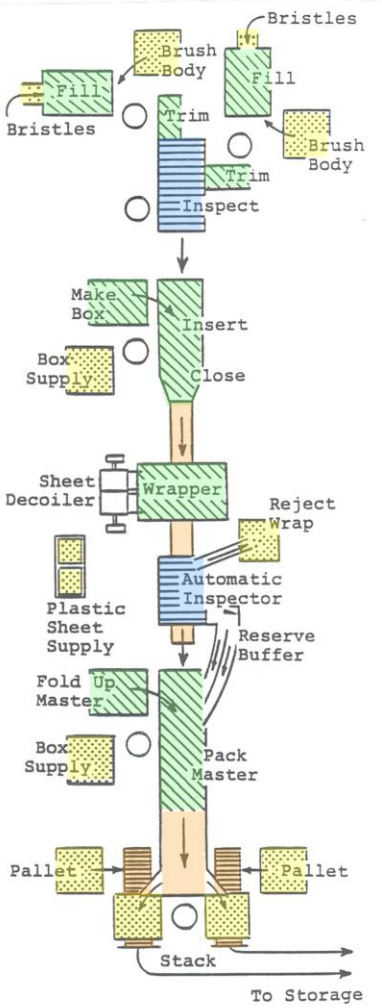
Notes

Main Points

1. When flow dominates the layout relationships, as it does in most manufacturing cells and in production lines, the operation process chart pictures the layout and is almost a layout in itself.
2. In this example, the process chart on the left is for making, sorting, and packing hair brushes. The actual layout is on the right.

The Process Chart Pictures the Layout





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3

Notes

Main Points

1. When the process is straight-forward, without frequent or important assembly or disassembly operations, the process analysis can be made on a pre-printed form.
2. The Flow Process Chart is a classical industrial engineering tool. It was developed in the late 1920s by Frank and Lillian Gilbreth, and popularized in the 1930s and '40s by Allan Mogensen, in his Work Simplification Program of Continuous Improvement.
3. Built into the chart are classical analyses and actions that may improve the process.
4. Pre-printed symbols assure that we identify all moves and record their distance and quantity or intensity of flow. Processing, delay, and storage times can also be recorded.
5. In Mogensen's words: "The process chart is the lifeblood of work simplification. It is an irreplaceable tool. It is a guide and stimulant. It takes time to properly utilize but there is absolutely no doubt that it works."

Note:

Form 531 is available in Microsoft Excel format from our website at www.RichardMuther.com

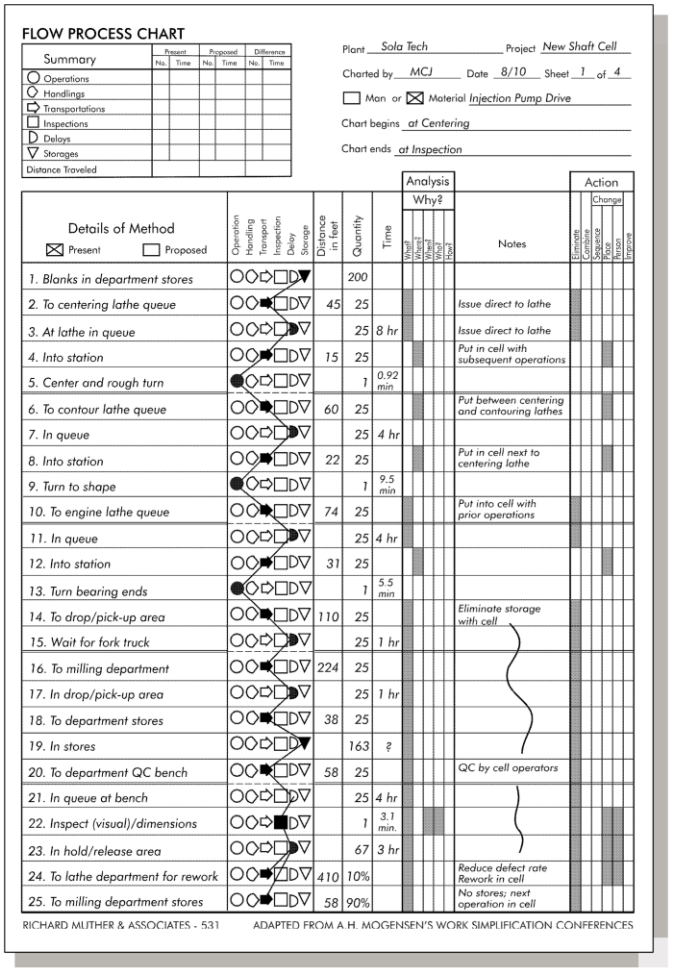
Pre-Printed Flow Process Chart

Analysis

1. What is the purpose of this operation? Why?
2. Where should this operation be done? Why?
3. When should this operation be done? Why?
4. Who should do this operation? Why?
5. How should this operation be done? Why?

Action

1. Eliminating unnecessary activity.
2. Combining or changing the place where an operation is performed.
3. Combining or changing the timing or sequence of the operation.
4. Combining or changing the person who performs the operation.
5. Simplifying or improving the method, including the tools, fixtures, or machinery used.



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FROM THE BOOK: PLANNING MANUFACTURING CELLS, BY HALES & ANDERSEN.

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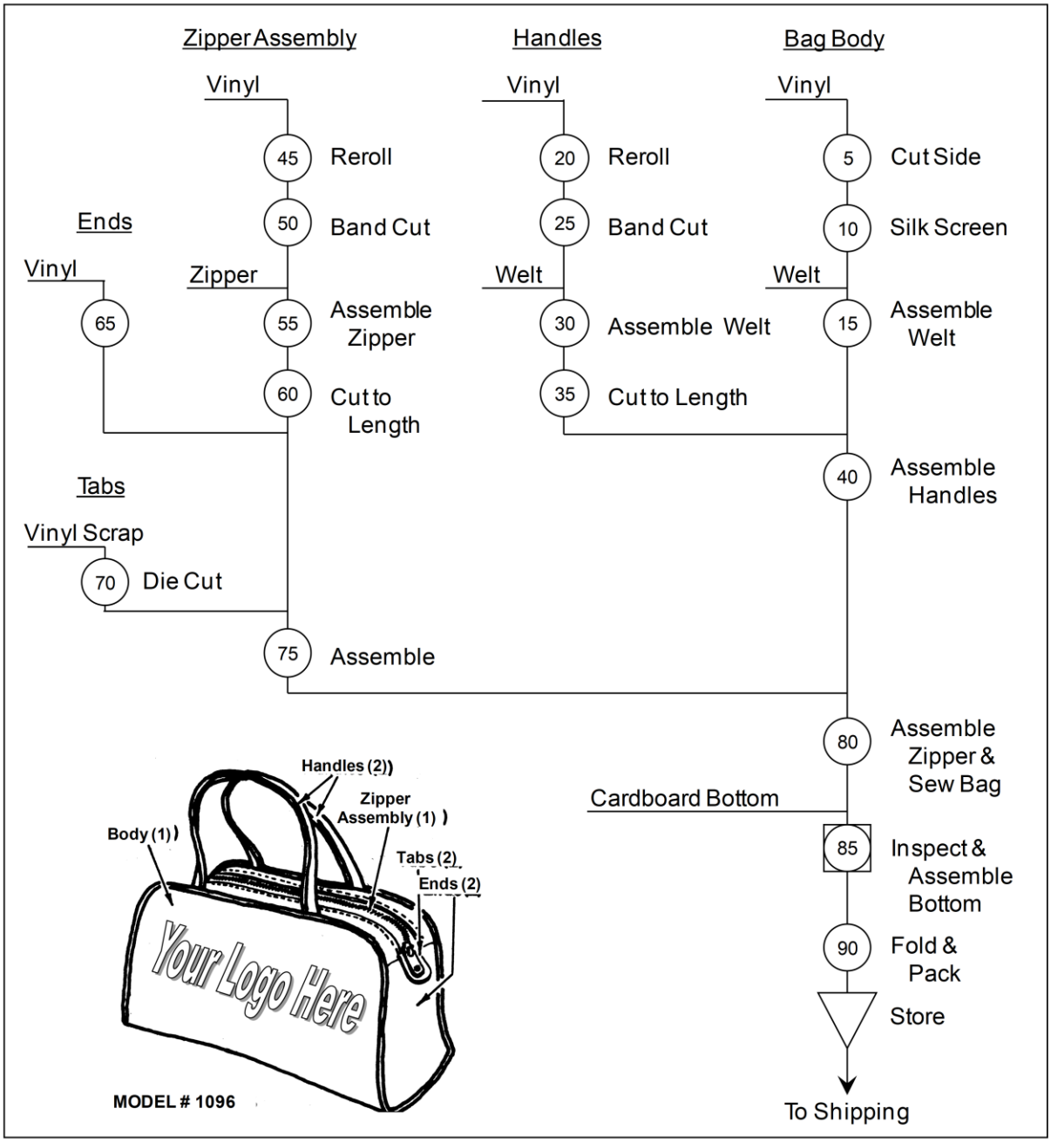
Notes

Operation Process Chart

Operation Process Chart showing the chronological sequence of operations and how and where the components go together.

With the exception of the final storage, only operations and inspection are shown. Intermediate delays, transports, handlings or storages do not appear.



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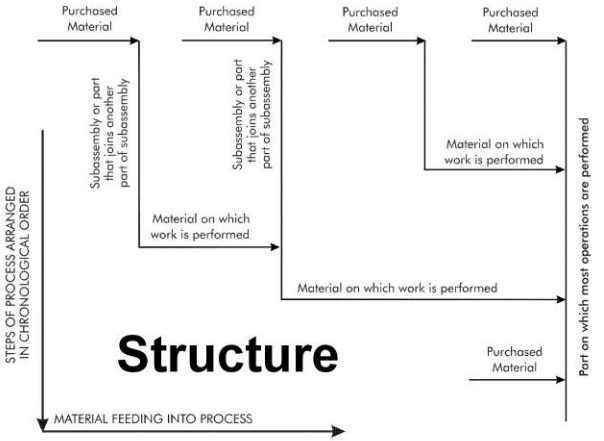
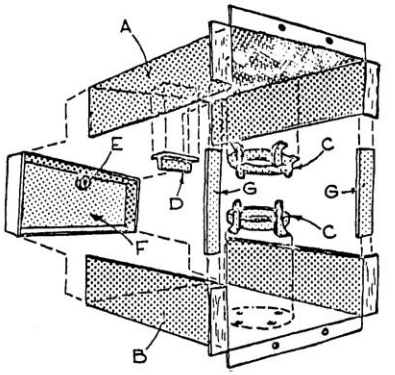
Operation Process Chart

Main Points

1. Traditional operation process charting shows only the steps required to make and/or assemble an item or product. It is performed on a plain sheet of paper using ANSI standard process charting symbols. Typically, only operations (circles) and inspections (squares) are shown.
2. The steps of the process are arranged in chronological order from top to bottom. The part on which work is performed runs down the right side. Added materials, parts, or assemblies feed in from the left.
3. Decimal times are given for each operation.
4. The operation process chart is ideal for representing assembly and disassembly operations with many in-coming or out-going materials.





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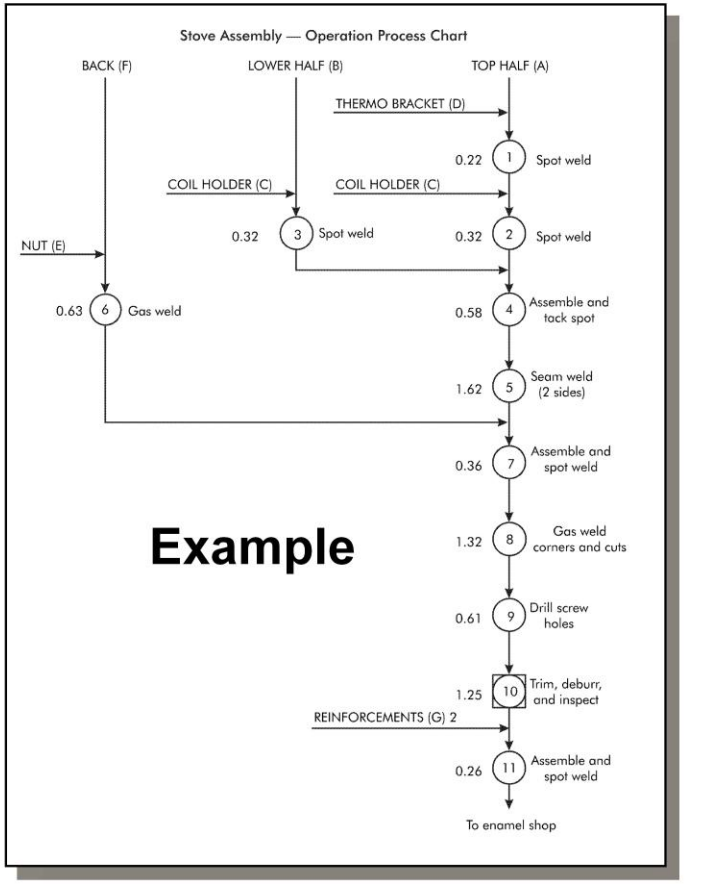

FROM THE BOOK: PLANNING MANUFACTURING CELLS, HALES & ANDERSEN.

6

Notes

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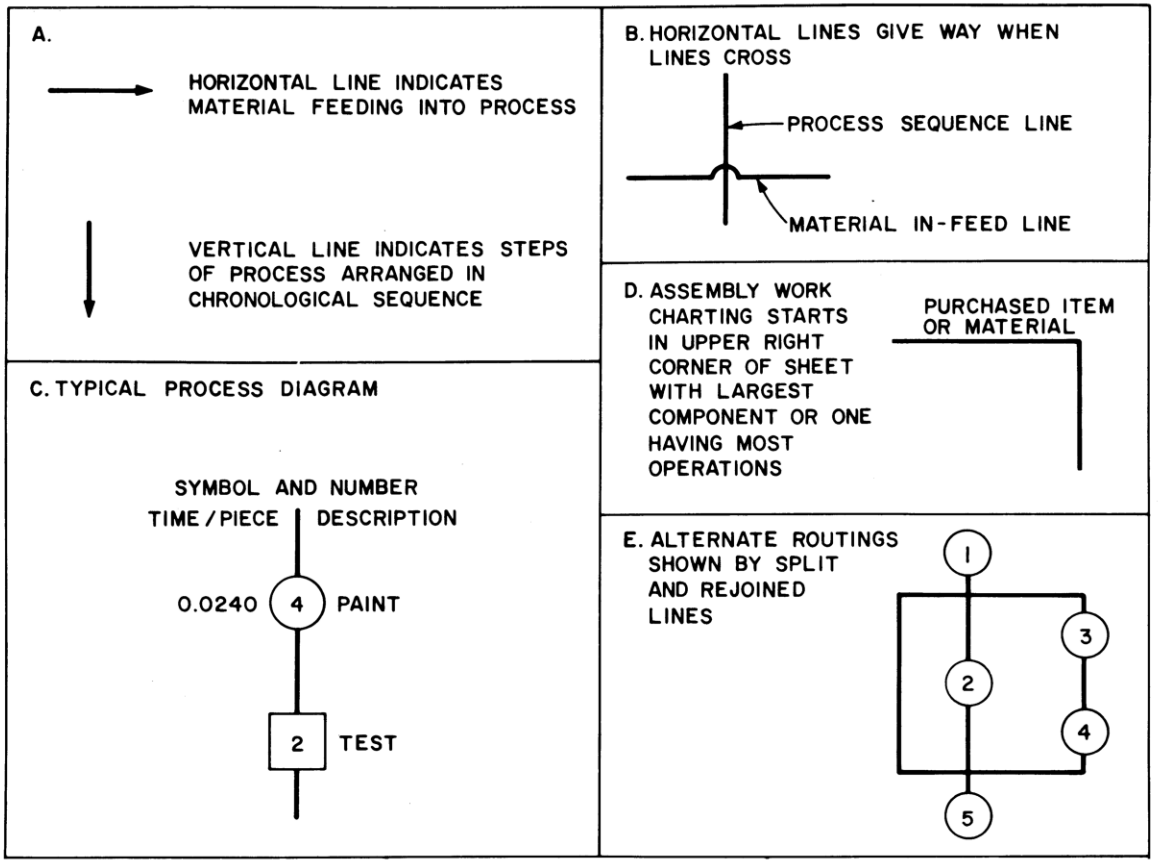
Main Points

Conventions and modifications in making process charts. Extracted from American National Standard ANSI Y15.3M – 1979 on Process Charts. (Formerly ASME Standard 101, Operation and Flow Process Charts).

Conventions for Making Process Charts



RICHARD MUTHER & ASSOCIATES - SLP FIG. 4-3a-ppt

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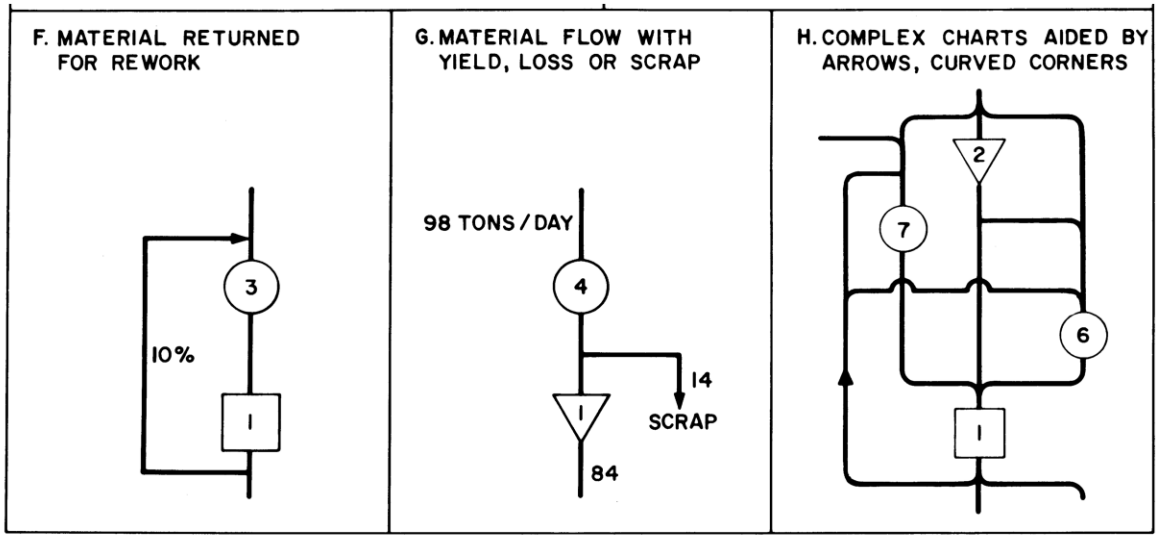
Notes

Main Points

Conventions and modifications in making process charts. Extracted from American National Standard ANSI Y15.3M – 1979 on Process Charts. (Formerly ASME Standard 101, Operation and Flow Process Charts).

Conventions for Making Process Charts



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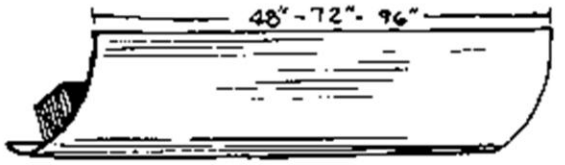
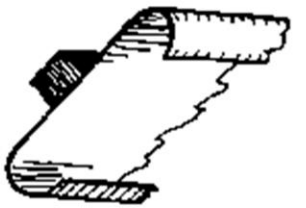
Notes

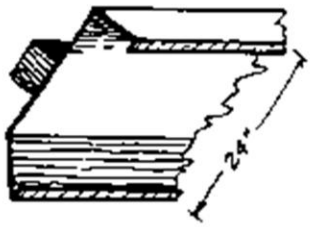
White Lighting – Phase III

SKETCHES OF MAJOR COMPONENTS OF FLUORESCENT FIXTURES

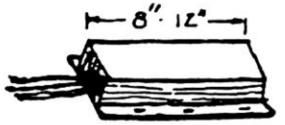
Typical end castings (2/fixture)





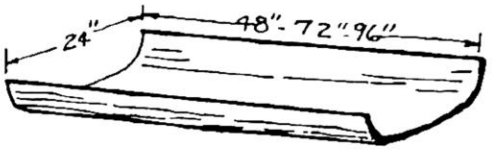


Reflectors & Housings



Ballast

Wiring Harness



Diffusers

White Lighting – Phase III

SIMPLIFIED DESCRIPTION OF OPERATION -- Fluorescent Fixture Assembly

Component	-	Operation
• End Castings	-	Drill, deburr and clean (30% of end castings)
• Housing	-	Sub-assemble with end castings (2 end castings per housing)
• Ballast, Wiring, Harness, Reflector, Lamp	-	Assemble into/or with housing
• Diffuser	-	Install (on same 30% of fixtures that take drill, deburr, and clean of end casting)
• Complete Fixture	-	Test-light each fixture on shaker table
• Carton	-	Fold and staple; pack finished fixture; close carton; place on pallet; move full pallets to Finished Fixtures Storage

Fluorescent Assembly Dept. Operation Process Chart

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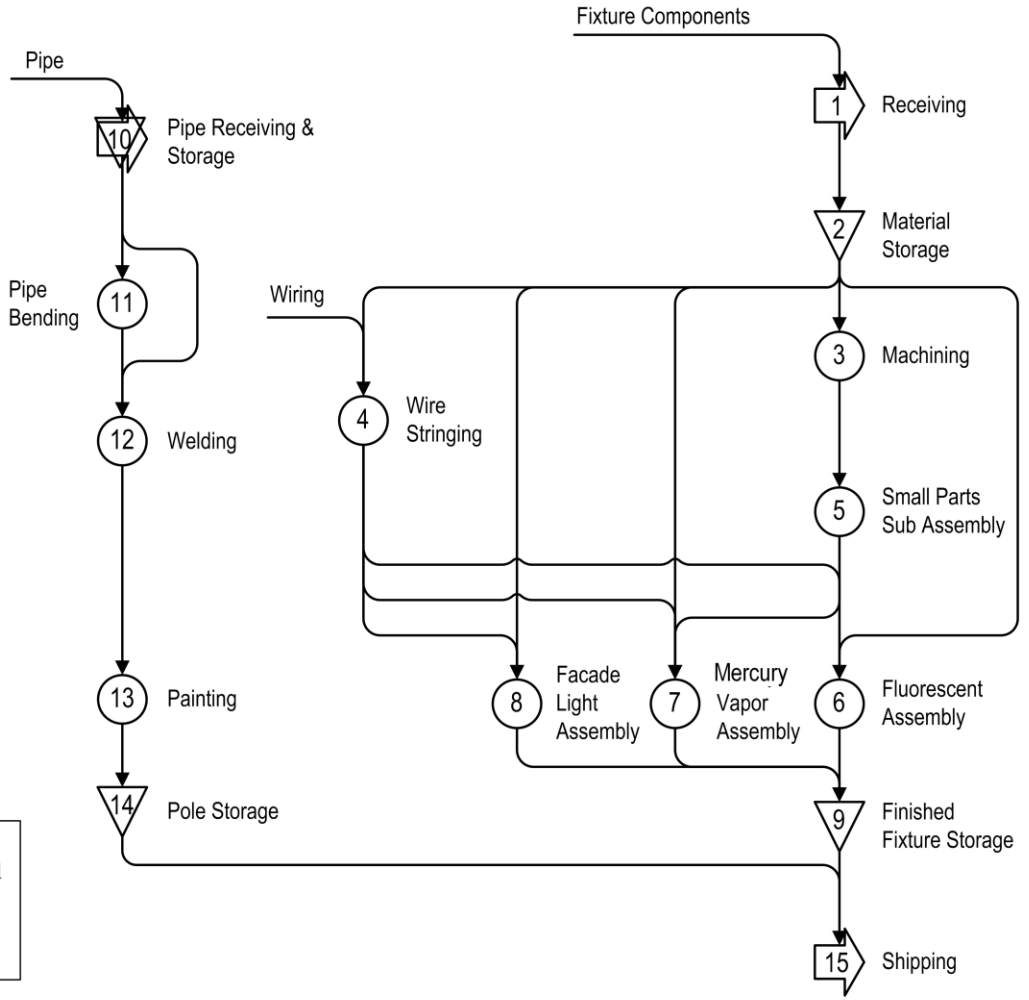
Main Points

1. The operation process charting technique can be adapted to summarize a plant-wide manufacturing process.
2. This example shows the flows between activity-areas of the White Lighting Company.
3. Note that the chart is a *flow* process chart. It shows storages and the arrows on each connecting line indicate moves between activity-areas.
4. Note also that the arrow symbol for transportation is "extended" to show the transport-related activity-areas of Receiving and Shipping.
5. Note that the numbering of symbols (activity-areas) deviates from the standard for operation process charting.
6. This chart shows the sequence of operations but not the magnitude of material movement or *intensity* of material flow over each route.

White Lighting Company
Modified
Flow Process Chart



Symbol	Activity -- Action
○	Operation
⇨	Transportation
▽	Storage
□	Inspection

Note: Numbering of the activities (or actions) is modified from standard process charting procedure to provide specific numerical identity for each activity.

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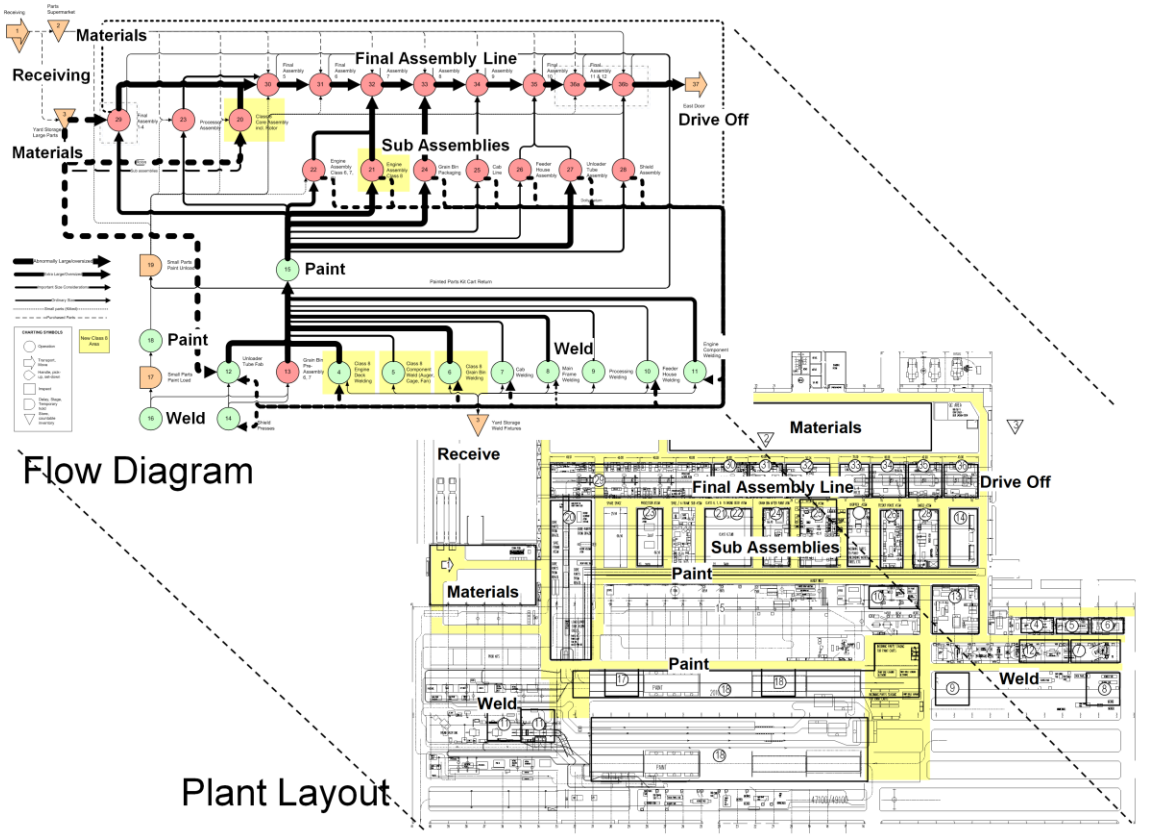
Notes

Process Chart Pictures the Layout

Main Points

1. In progressive assembly operations where flow dominates, the process chart pictures the layout. In this example for the manufacture of large agricultural machinery, each numbered symbol represents an activity-area. Welding stations at the bottom feed to painting in the middle, which feeds sub-assembly lines, which then feed final assembly stations along the top.
2. The placement of sub- and final assembly lines and stations are largely dictated by the product structure and assembly requirements. There is somewhat more flexibility in locating welding stations. But overall, the layout should look very much like the process chart, subject to constraints of the site, building, and current activity locations.
3. The chart is oriented "upside down" to reflect the actual orientation in the existing layout with North at the top.
4. Small parts will be brought to final assembly stations on the opposite side of the line from major sub-assemblies.
5. The actual flow on each line is determined by build rate and model mix. This could be recorded on a From-To Chart but may not be necessary.



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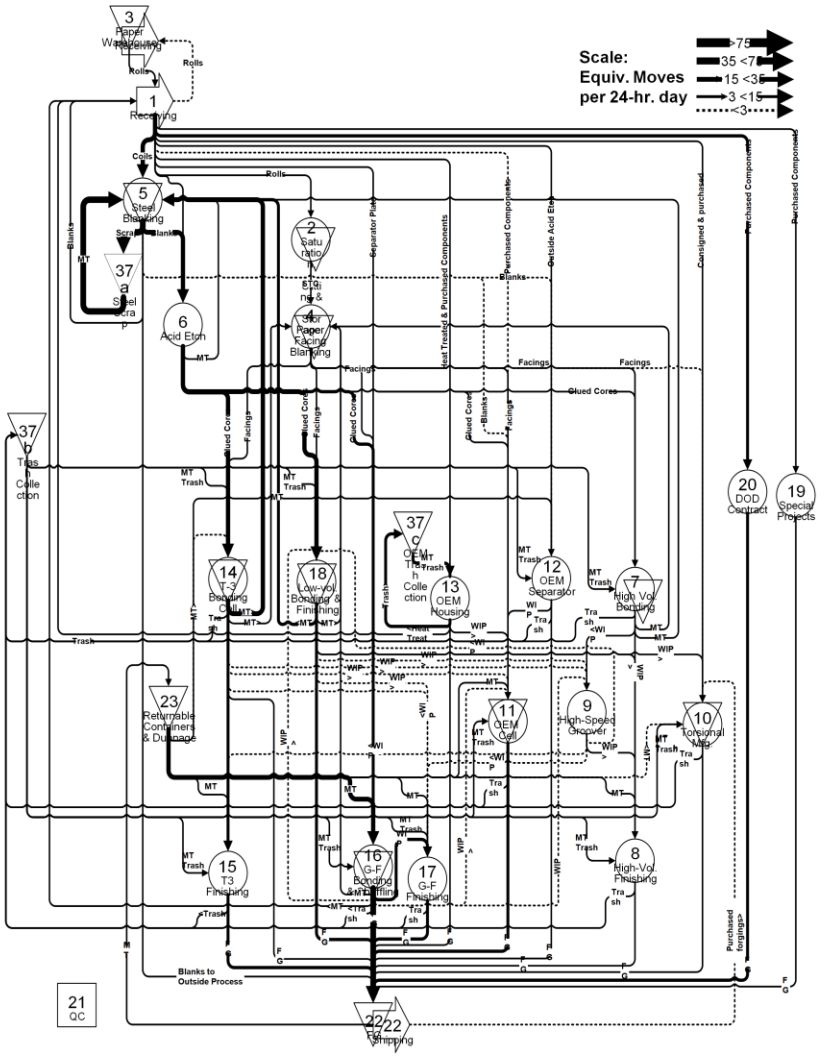
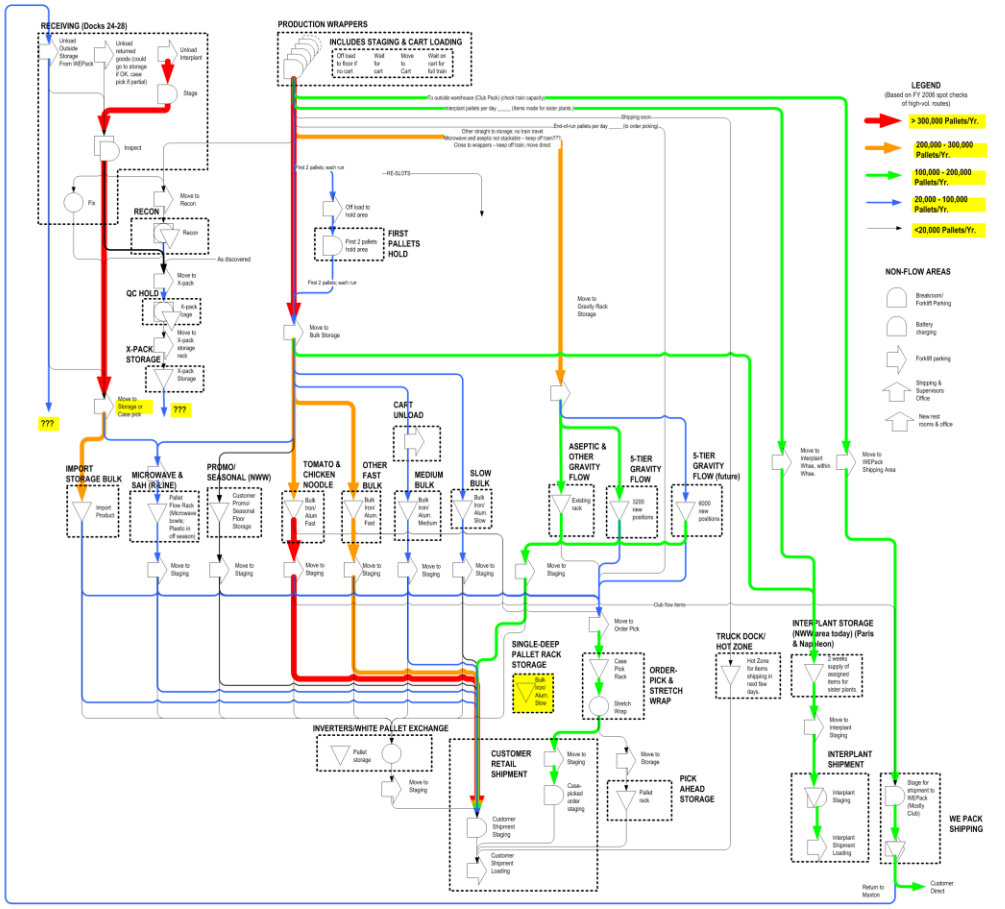
Notes

Flow Process Charts for Facility Layout



450,000 sq. ft.; 45,000 sq. m.
of manufacturing facility



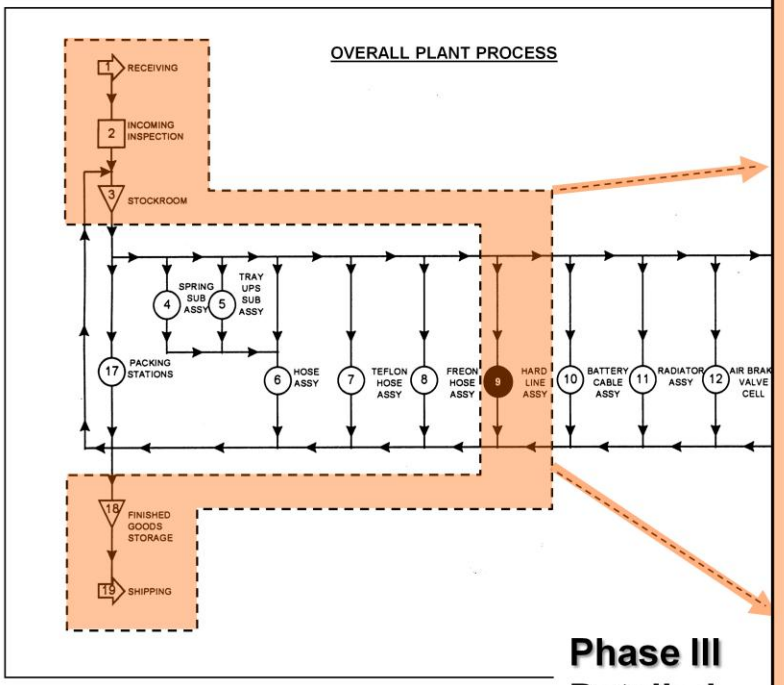
800,000 sq. ft.; 80,000 sq. m.
of distribution facility

Nested flow process charts

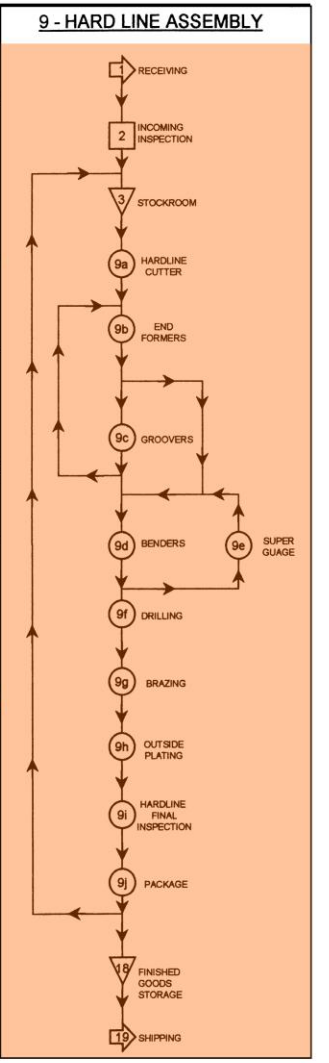
Main Points

1. This plant assembles 16 different items for large highway trucks. The process for each assembly is "exploded" on a separate detailed chart.
2. The Phase II general overall layout will be planned around the operations on the overall plant chart.
3. Phase III detail layouts will be planned for the operations on each detailed chart.
4. In this example, one operation – Hard Line Assembly – consists of 10 detailed operations. In this way, a great many operations can be easily charted and managed.

Phase II Overall Layout



Phase III Detailed Layouts



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Notes

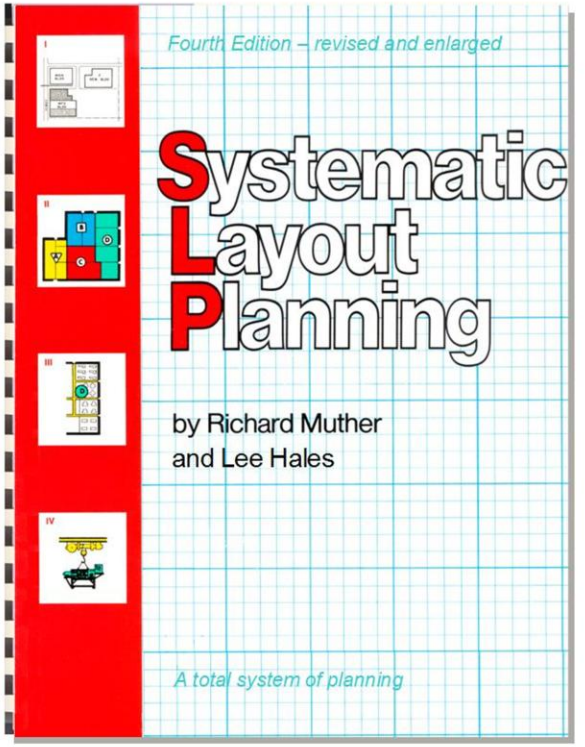
Here's What I Know

Question	Which Answer Is (Most) Correct	Got It
1. How many physical actions are represented in traditional process charting?	A. Four: Plan, Do, Check, Adjust B. Five: Customer-Supplier, Process, Inventory, Push, Pull C. Six: Operation, Transport, Handle, Inspect, Delay, Store	
2. When charting the actions in a work cell or production line, the process chart typically pictures the layout.	A. True B. False	
3. Pre-printed forms can be used to chart progressive transforming of materials without significant assembly or disassembly.	A. True. B. False.	
4. Using symbols to represent activity-areas in a layout, we can chart the flows of materials between areas.	A. True. B. False.	
5. In complex layouts, making several products for which some processes are shared, the process chart is unlikely to picture the actual layout.	A. True B. False	
6. Flow process charts show logistical actions such as receiving, shipping, transport, storage and staging.	A. True B. False	

Summary

- Traditional process charting symbols record the six things that can happen to parts and materials as they move through an area or facility: operation (change form); transport (change place); handle: (pick-up/set-down; get); inspection (verify); delay (temporary hold or staging); store (hold against unauthorized removal). These are defined in an old ANSI standard Y15.3M – 1979.
- This symbology is especially useful for layout planning. By stringing symbols together in a process chart, we can identify and visualize the routes on which parts, materials, and products will move through the area being planned.
- In some situations, the process chart will picture the layout of a production line, or even an entire facility.
- When a sequential process transforms material without assembly or feeding in of parts or sub-assemblies, the process chart can be prepared on a pre-printed form.
- Where multiple products are made and certain operations are shared, the chart will become complex and is not likely to picture the actual layout.
- When a chart shows only operations and inspections it is called an "operation process chart." When a chart includes transports and logistical operations such as receiving and shipping, and includes storages and delays, it is called a "flow process chart."

Supplemental Reading



For more depth on this topic, see Chapter 4

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