CHAPTER 6

Conclusions and recomendations

This thesis is concerned with establishing the standard times and operations and potential productivity improvements in the fabrication section of an air-conditioner manufacturing company. The thesis considered only the production process of sheet-metal parts from raw material to the process of bending. Details of production data such as layout of workplace, machines and equipments, products, flows of material, etc., must be collected before the beginning of standards establishment.

Standard times and standard operations

The work measurement system used by the thesis was Predetermined Motion Time System (PMTS) under the technique called " Basic MOST ". MOST will produce standards with accuracy approximately equivalent to that of higher-level systems, but with far less effort and development time.

Each operation time is composed of *setup time* and *processing time*. Times used for each setup are also composed of *basic* and *allowance time*. Processing time is obtained by computing a basic and allowances time per piece and then multiplying this value by number of pieces per batch. The standard time for a batch produced is the sum of the setup and processing times. Finding a standard processing time

(of a production of sheet-metal parts) for any operation can be achieved if details of subactivities with their time values are analyzed.

At least two operations (at the workplace covered in the thesis) are required for most sheet-metal parts. The analyst is responsible for checking the length and order of operations and determining times and activities through all operations. *Operation lead time* or *flow time* for a batch of parts production is the sum of total operation times of all operations.

The results after standard time and operation establishment are :

1) Know the time value of subactivities of each operation. Knowing these activity time values, the standard times for all types of parts then can be computed. Eventhough different types of workpiece production have the same or similar subactivities there are two differences which will vary processing time. One is *time* used for each subactivity and the other is *frequency* of each subactivity. Standard time calculation sheets can still be used to compute standard times for all types of workpieces in spite of these differences.

2) The documents from 1) also used as *standard operation sequences* for shop floor activity control.

3) Flow time per lot can be computed.

Standard times and operations provide advantages on the shop floor and also provide an important data base used for planning the production and material requirements.

Productivity improvement

After analyzing the workplace layout it was found that the material handling distance from shearing machines to other machines was too long and of too high a frequency. The existing machine and equipment layout indicates an average metre distance is traveled per day. If it is changed by the proposed layout the distance will be shorteneds to 4,180 metre. The material handling time is reduced and operators will have longer machine work times.

A manual punch press machine uses an average 15 minutes for setup and each machine averages six setups a day (or 20 % of total working time. After converting the setup actions from *internal* to *external*, only 5 minutes are required for one setup. In addition to the reduction of setup time, smaller batch sizes (than the old method) can be produced in a same working time period. This causes flow time reductions compared to the old method.

Normally a workpiece requires more than one punching step. The old method for an existing punching operation uses one punch press machine and multiple operations to produce the workpiece to a finished configuration. By using adjacent multiple punch press machines and individual to another punching steps you can reduce material handling equipment, work-in-process, and flow time.

In the original production system, there are no reports about daily production. Nobody knew and/or could determine such important technical and engineering data as machine capacity, actual production rates, process routes, operation times, and others. With proper training and instruction, the proposed *inslip sheet* can be used on shop.

The sheet gives many advantages in the field of planning, engineering, and cost accounting.

After these proposed plans are applied on the shop floor, the productivity index should improve to 1.77 and people productivity for each work center should improve to 24.12, 11.10, and 9.23 pieces/man-hour for shearing, punching, and bending respectively. Actual production rates are as 2,050 and 3,560 and 2,636 pieces/shift at these different work centers. With these unbalanced rates, some punch press machines will have idle time and work-in-process will accumulate at thebending work centers.

Recommendation

For higher shop floor productivity in the future, the following is proposed :

1) The factory should continually develop the determination of standard times and operations. The only industrial engineer probably could not collect a great deal of data by himself because there are about 1,000 active workpieces manufactured in the shop. Foremen and their workers are the people that are most familiar with the actual production and they should record the details of production. Also foremen and their workers are the ones who can revise the inappropriate points. The documents to be prepared for recording may be like the figure shown at the next page. When filled out and collected they should be immediately converted to the *computerized data base* by industrial engineering.

2) The batch size of sheet-metal parts should not be over 200

pieces in order to eliminate shortages (not only inside the fabrication section but also between production sections, i.e., fabrication and assembly sections).

3) One reason why sheet-metal parts are not sent on time from the shearing work centers to other work centers is excessive batch size production (1,000 pieces or higher). The shearing work center should share working time to prepare parts as needed.

4) A shearing machine and press brake machine should be added to better balance work center production rates.

5) Sufficient equipment and tools such as tape-measures, punch holders, hand trucks, and equipment for increasing production rates such

Part Name ..... Page 2 of 2
Part No. .....
Model .....

Step	Operation Description	machine	No. of Setup	Processing time (min/piece)
1				
2				
3				
4				
5				

Remarks : page 1 is the drawing of sheet-metal parts.

as completed die sets, automatics backgauges, and workpiece counters should be supplied to the shop to reduce operation delays.

6) For the future, if more machines are added to the shop, the machine layout should be changed from process to groups to turn

production into a *cellular manufacturing system.* Setup time and batch size will be reduced. This also reduces confusion and material handling.