**TBRM Scheduling problem description**

*A flexible flow shop system:* A characteristic flow of main operation types. An operation can be processed in alternative machines.

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AI-generated content may be incorrect.

*Scheduling problem description:* Parallel machine scheduling with compatibility constraints.

There is FTE requirement for each metal forming machine. Manual machines require 30% of the active execution time an operator for loading, unloading, and control purposes. This FTE requirement is 10% for automated machines.

|  |  |  |
| --- | --- | --- |
| Machine | Type | Alternatives |
| Haas 5 axis (M5-03) | Manual | M5-04, M5-05 |
| Haas 5 axis (M5-04) | Automated | M5-03, M5-05 |
| Haas 5 axis (M5-05) | Manual | M5-03, M5-04 |
| Haas 3 axis (M3-03) | Manual |  |
| FR5\_01 (automated) | Automated |  |
| FR5\_02 (automated) | Automated |  |
| FR4\_01 (automated) | Automated | FR4\_02 |
| FR4\_02 (automated) | Automated | FR4\_01 |
| FR3\_01 (manual) | Manual |  |
| FR3\_02 (manual) | Manual | M3-03 |

The production is executed in three shifts of one workday, and they are specified below.

|  |  |  |
| --- | --- | --- |
| Shift | No | Operators |
| 08:00-16:59 | 1 | 3 |
| 17:00-23:59 | 2 | 1 |
| 00:00-07:59 | 3 | 0 |

*Batching:* Customer orders will be used as reference to batch sizes respecting the BOM of the final products. Job processing times will be adjusted with certain granularity, half hour or 15 mins.

*Input information:* The input information will be in three forms as follows.

* *Input in a decided format:* New customer orders, new product information.
* *Input as information of management:* Machines, properties of them like manual or automated. Alternative use of machines. Operators and their availability.