

The global standard realizing process of the Tire Production Facility and Process Line

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Abstract: *The tire production facility is a large-scale construction with the complexity of a manufacturing process. The process utilities should be wide-ranging as an effective arrangement of them is highly important. All the necessary information should be clarified together with the manufacturer at the basic planning stage, and this design should be developed to comply with the local culture and regulations. It is important to carry out more advanced engineering in terms of process, cost and quality, even if it is difficult to standardize due to the cultural and geographical conditions and regulations. The key point is to reflect all the given conditions and make a clear design during the design stage, to eliminate the problems after the construction has begun. Another key point is the delivery system, which must be totally managed from the initial design stage until the construction stage by proven companies. Flexibility, quick action, and single responsibility will be the fundamental features in all the steps of the project.*

Keywords: *global standard, tire production facility, process line, coordination, time schedule*

I. INTRODUCTION

In the global standardization of the construction of the tire production facility, there are some features which will be the key point. The tire production facility is a large-scale construction with the complexity of a manufacturing process. The process utilities should be wide-range as effective arrangement of them is highly important. All the necessary information should be clarified together with the manufacturer at the initial planning stage, and this design should be developed to comply with the local culture and regulations.

The production facility and the process line project are made up of a planning stage, a design & engineering stage, and a construction stage. The most important stage is a 'basic plan' at the planning stage; the success or failure of the project can be decided on the completion of the planning stage as 50%, and on the completion of the design stage as 80%. If this basic plan has not been sufficiently studied, there is a high likelihood of a considerable loss of time and cost impact at the installation & commissioning stage for the process lines, even if the production facility could have been completed.

It is important for the tire production facility project to carry out more advanced engineering in terms of process, cost and quality, even if it is difficult to standardize due to the local cultural and geographical conditions and regulations.

II. OUTLINE OF TIRE PRODUCTION FACILITY AND CHARACTERISTICS

Tire production facility is divided into several function area based on the process flow.

- A. Compounding and mixing area
- B. Component preparation area
- C. Tire building area
- D. Curing area

E. Inspection (Final finish) area

As there is a special characteristic due to the processes and the material handling in each area, the required process utility should be considered separately. Sharing this information at an early stage will be quite important for effective planning.

Toward standardization in the tire production facility, the items to be clarified with the manufacturer are described below based on the characteristics of each area.

A. Compounding and mixing area

The material can be remained as a powder dust in the room, and it is important to ensure sufficient ventilation. To control the powder in this room, the ventilation equipment needs to be adjusted to a negative pressure. Also, it should be determined whether the explosion protection is required by the regulations.

There will be a chamber with high temperature for softening the material. Therefore, the room needs to be designed with enough thermal insulation.

The requirements for the room such as its size and the finishing specification are depend on each manufacturers, and as a result, it is difficult to standardize. Important point is to confirm and set it up at an early planning stage.

There are other characteristics in this area. Because of the flammable material stored, the fire prevention plan is important and needs to be in line with the local fire regulations. The building structure design, such as superstructure and pit foundation, will be very much affected by the process machine layout plan. As the power consumption is heavy, a substation room will be located close to the room.

B&C. Component preparation & Tire building area

This area is a highly professional and individual for each manufacturer and cannot be standardized.

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To reduce the uncertainty, it is important to clarify thoroughly the input information about the process machines, such as the needs of the pit foundation, the type and consumption of the process utilities, and the detailed layout of each process machines.

Also, the part of the area requires a constant temperature and humidity, and a detailed specification is necessary.

D. Curing area

Because steam is used to heat the system, this area tends to be high temperature due to its exhaust heat. A ventilation system for exhaust heat is necessary. In addition to adequate ventilation air volume, it must be studied in detail how to effectively remove the heat by the exhaust fan.

Various process utilities need to be provided for vulcanization process. To set the layout of huge amount of process utilities piping & cable lines in order, considering usability and balance according to the number and arrangement of the equipment, it is necessary to elaborate the execution plan by using 3D CAD.

The boiler room and the machine room are better to locate close to this area as it is important from the point of view of the initial running cost reduction.

E. Inspection area

It is important to make a prior consultation about the confirmation of the transfer method, and the required load capacity of the floor and the upper structure. Depending on the characteristics of the testing device, horizontal accuracy of the building floor can be required.

F. General remarks

Because the conveyor system of the tire runs through the building from the tire building area, it is important to coordinate it with the building plan. Especially, it is necessary to incorporate it from the initial design for the particular load condition to the structure (floor and upper structure).

Since all area contains a large amount of flammable materials, damage in the event of fire can be enormous. Therefore, it is advisable to install a sprinkler system in the building entirely to reduce the risk. In addition, it is essential to design the location of a fire wall to keep the fire compartment efficiently, in compliance with the building law and the fire regulations.

The tire production facility in many cases needs to plan for an extension to increase the production capacity in the future. At the time of the site selection of a new production facility project, it must be ensured that there is a sufficient infrastructure supply in the future, especially large electric consumption.

These are general and essential conditions in the tire production facility which must be adjusted to suit the respective proprietary technology of each manufacturer. It is important to design the production facility and the

process utility as an integral one from the basic design stage, to realize the economic layout and efficient supply method.

III. CONCLUSION: POINT FOR MANAGEMENT OF TIRE PRODUCTION PROJECT

A. Preliminary design

In case of the tire production facility project, it is necessary to examine the optimal layout, structure, and method of construction planning at the initial stage of the project in coordination with the manufacturer to confirm the points mentioned above. Especially the structure systems and the fire protection plan must be carefully designed in accordance with the local land characteristics (climate and regulations).

B. Design development

One of the most important points in the management of the project is to reflect all the given conditions and to make a clear design at the design stage. Then it is possible to eliminate the problems after the construction has begun.

C. Time schedule control

From the point of the overall time schedule control, it is important to know the delivery time of the major utility machines, and to place the order at the right time.

In case of the example project in Europe, the major utility machines (boiler, compressor, transformer, and chiller) need at least 6 months for the production. To fulfil the requirement of each utility supply time schedule, the total management (supply schedule management of the utilities), that is not limited to the facility utilities, was conducted and controlled the procurement throughout the execution stages.

In facility building construction, a study of the overall time schedule, examining the geographical conditions and regulations is essential. Winter time construction is not reasonable; excavation work is impossible due to frozen ground (depend on the location), non-economical period due to a temporary heating and short day-time.

D. Total management

To achieve a successful completion of the project, the most efficient delivery system is design-build, to make total management from the initial design stage until the construction stage by proven companies. Flexibility and quick action, single responsibility will be the key features in case of design-change at the construction stage, and it is possible to provide a high-efficiency, high-performance production facility without a loss of time and cost.