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How to Gain Efficiency in Large Projects by Taking Commissioning Early and Seriously

We find repeatedly during our consulting interventions that Commissioning as a project activity is vastly underestimated and this leads to significant delays, inefficiencies and sometimes even failures to reach the expected facility performance. In this White Paper we review what the best practices are in terms of commissioning phase execution in a project. Well managed, instead of being a constraint that delays project delivery and generates substantial rework, commissioning can become an opportunity for savings and earlier Project delivery.

The Importance of Commissioning

The exact coverage of Commissioning might vary between organizations. It covers all testing and putting in service of equipment from the point where it is built and ready to be integrated as a system. This exact starting point might be the mechanical completion, or some stage of pre-commissioning (including local testing and energizing). That transition point may vary from project to project but needs to be clearly defined.

The commissioning phase is an essential transition during the project as the work logic switches from a geographical/ area view to a sub-system/ system view. This hence requires a very strong coordination with construction as commissioning will commence while construction works are still ongoing in some areas of the facility.

Commissioning is typically on the critical path of the production start for a facility, and plays a key role in guaranteeing the integrity of the facility and proper functionality of all necessary control systems. In some instances commissioning records are a substantial part of the safety case that is to be produced to the regulator before it can authorize start-up. It is also the last line of defence against construction defects.

Main failure modes for commissioning during project execution

The following failure modes are most often observed:

- As main failure mode, the lack of early preparation of commissioning: commissioning teams are too often mobilized late in the project with barely the time to prepare the actual commissioning phase. It is then even more impossible to influence Engineering, Procurement, Quality Control (QC) or Construction to make commissioning easier or even to anticipate some commissioning activities in fabrication yards.
- Commissioning managed as a project buffer: the initial period planned for commissioning in the schedule is being used as a buffer and thus constantly reduced as the project progresses. Coupled with insufficient anticipation and hence lack of clarity on the actual activities to be performed, expectations about expediting

commissioning become unreasonable which often creates excessive pressure and crisis.

- Due to poor coordination commissioning is started in some areas while heavy construction activities continue in the same location that jeopardize commissioning integrity or results, or damage commissioned equipment. This creates rework and sometimes requires the replacement of material or equipment.
- Failure to anticipate commissioning as early as possible including on manufacturing sites or fabrication yards: even if it may require the mobilization of some additional resource and equipment, it is generally recommended to anticipate as much as possible all possible commissioning activities as actual cost and constraints will be much less compared to when the equipment will be integrated in the larger plant, not to mention the cost of rectification if required.
- Poor team work between commissioning, construction and QC department: a successful commissioning relies on the quality of construction and all those functions must work as a team to ensure a proper quality of the delivery. Some checks that are critical to commissioning performance (e.g. flange alignment and management) have to be performed early by construction and QC and this need have to be reinforced by commissioning.
- Excessive breakdown of commissioning work packs leading to excessive indirect resource utilization – there is an optimal point in terms of breakdown of commissioning activities that allow to optimize with ongoing construction but avoid excessive mobilization/ demobilization of the work force for commissioning tests (e.g. scaffolding, testers, electricians etc.).
- Lack of proper commissioning tool. Commissioning will typical involve thousands of checks that need to be rolled up at the sub-system and system level to allow their start-up. A system must be available that manages the necessary interlocks to declare sub-systems ready for operation and collects all commissioning results for traceability purpose. A process must also be enforced whereby any

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component that has been commissioned and is subsequently reworked or dismantled by construction needs to see its commissioning tests invalidated.

- Lack of proper protection and preservation of equipment before or after commissioning, leading to jeopardizing integrity or validity of commissioning tests.
- Utilization of a commissioning manager with insufficient experience in the type of facilities to be commissioned.
- Utilization of commissioning technicians with insufficient level or experience, or mobilization of an insufficiently numerous team. While contractors are sometimes tempted to save on commissioning workforce, the consequences are too significant in terms of consequential impact to avoid employing a suitably qualified workforce of the right size.
- Lack of integration of the future operators in the commissioning team. The commissioning phase is an ideal moment for the future operator to learn about the intricacies of the facility.
- Poor management of vendor representatives for major equipment, which are generally costly to mobilize.
- Lack of joint work between Owner and contractor during commissioning, creating unnecessary interfaces and inefficiencies. While the responsibilities for schedule and plant performance need to remain clearly defined as per the Main Contract, it is of the interest of both parties to expedite this phase with the least inefficiency possible.

Lack of early preparation of commissioning in projects is the main failure mode

Best practices for commissioning in projects

From the observations detailed above, best practices ensue:

- Mobilize a commissioning manager with relevant experience early in the project, ideally at the constructability review stage of engineering design. This will serve to provide the necessary inputs and linkages with other functions as well as develop a

realistic commissioning plan. Benefits for the project can be significant, and much higher than the associated cost:

- Optimization of construction priorities to account for commissioning logic, and early commissioning activities brought to fabrication sites resulting in schedule savings,
- Proper QC focus during construction on aspects that are essential for commissioning acceptance, thus minimizing late rework and retrofit on the actual facility,
- Optimization of vendor representative assistance, FAT, and adequate provision of commissioning spares in advance.
- Ensure that commissioning is properly integrated in the Project Management Team with a proper level of authority and that adequate teamwork is developed with engineering, procurement, construction, and the future operator.
 - Ensure proper collaboration between commissioning teams of the Owner, of the contractor, as well as with the future facility operator.
- Implement a proper commissioning IT system and relevant processes in the project. Commissioning aspects need to be taken into account during constructability reviews, at purchase order awards, as check points for QC and during the course of construction.
- Develop and execute a detailed commissioning plan that links with relevant mobilization schedules for all contributors.

Conclusion

Commissioning is a serious business in delivering Projects. Failing to account for commissioning creates headaches, facility performance issues and substantial delays.

Commissioning needs to be properly anticipated and the commissioning manager integrated early into the Project Management Team. If that is the case, instead of being a constraint that delays project delivery and generates substantial rework, commissioning can become an opportunity for savings and earlier delivery.



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