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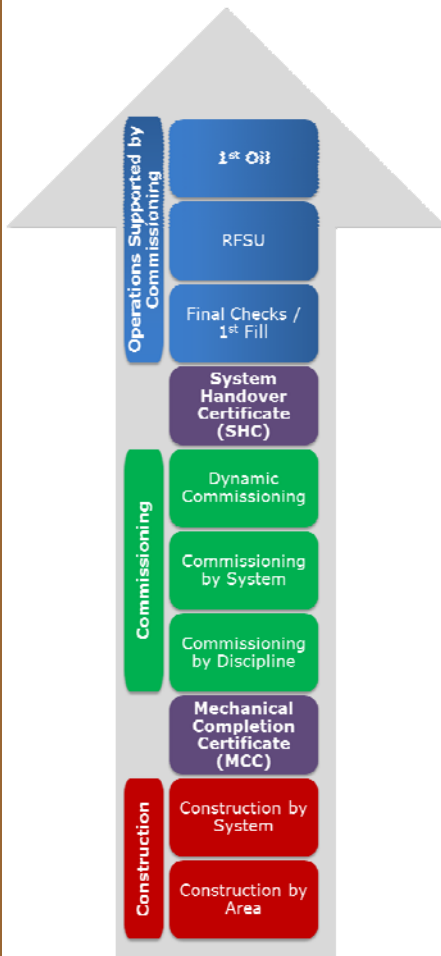


Figure 1—From Construction to Operations



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The Different Skill Sets Between Construction & Commissioning

It comes up very often in projects—"Why can't the construction team do the commissioning". On smaller projects this may be acceptable with an experienced team and involvement with operations, but for major capital projects it pays to have a dedicated seasoned commissioning team to execute pre-commissioning and commissioning work.

Roles & Responsibilities of Commissioning

Commissioning can be defined as the group of dynamic and energized checks / tests to be carried out in order to ensure that the installation has been constructed to satisfactory standards and is ready for start-up. The primary goal of commissioning is to hand-over an asset to the operating authority that is proven to be clean, safe, functional, and operable to the design performance criteria. As some of the steps and activities involved with this commissioning effort may be potentially dangerous, it is of utmost importance for the commissioning management team to plan and perform this work in the safest manner possible as to avoid any damage to people or assets.

Setting the commissioning schedule and prioritization of systems to the project milestones to guide construction on the sequence of handover is another critical activity of the commissioning team. High priority systems which enable milestones such as Quarters Habitable (QH) and Certificate of Inspection (COI) need to be worked with the construction team to achieve a smooth turnover of systems in the right sequence to allow commissioning to perform activities to certify and demonstrate they are ready for operation.

In addition to the above, the commissioning team will assist with demonstration and verification of regulatory systems to certifying authorities such as ABS and USCG. Non-regulatory systems are tested and proven "ready for operations" by means of loop checks, electrical checks, motor runs, alignments, PSV certifications, P&ID walk-downs, cause and effect testing, and finally dynamic commissioning.

Commissioning's role is between construction and operations, whereby commissioning has two interfaces—construction and operations. Commissioning has the role of:

1. Accepting from Construction that the systems are Mechanically Complete — This is the first handover and is documented via a mechanical completion certificate (MCC). With this handover Commissioning will have a quality control function inherent in the process as they would not want to accept something they cannot commission.
2. Handing over to Operations that systems are ready for start-up (RFSU) and this is done via a System Handover Certificate (SHC).

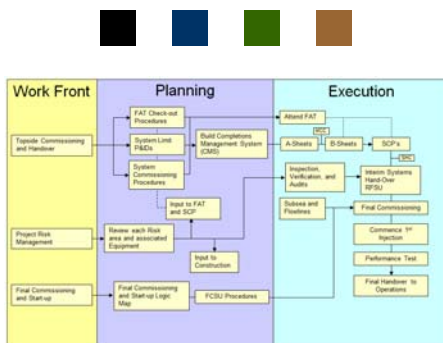
Commissioning Management System (CMS)

To certify and demonstrate systems are ready, commissioning will build and utilize a completions or commissioning management system (CMS). This software tool is utilized to track pre-commissioning of instruments, punch-lists, and dynamic commissioning activities. The CMS is vitally important to manage the transfer of systems from mechanical completion to operations. The CMS is a necessary tool for reporting to management the level of completeness and readiness of the asset for first production. If systems fall behind schedule, necessary resources can be mobilized based on an accurate level of outstanding work.

As shown in Figure 1, a key role for the commissioning team is to manage the handover process from construction to the Operations team in a progressive, systematic, uniform, and consistent manner, ensuring that the identification of what is being handed over is clearly defined at all locations and phases, so that operational activities can be carried out in a safe manner. The work is tracked in a CMS database and systems are transferred via two certificates, MCC (from construction to commissioning) and SHC (from commissioning to operations).

Commissioning vs Construction—During Construction

Commissioning is in the position of accepting the as-built system from construction, verifying design intent, performing a QA/QC function, ensuring cleanliness, tightness, verifying system functionality, proving readiness for start-up, and handing over the project systems to operations.



There are two phases to the commissioning effort: Planning and Execution. Within the two phases, there are three distinct work fronts:

1. Commissioning and Handover Onshore / Offshore
2. Risk Management
3. Planning for FCSU

Upstream engineering for offshore oil and gas specializing in:

- Chemical Systems Engineering
- Materials & Corrosion
- Flow Assurance
- Waterflood
- Commissioning & Startup



Construction is generally completed by module or area, where commissioning must be carried out per system, or partial system. There should be a point in the construction phase of the project (typically about 70%) where the commissioning team directs the sequence of which systems are to be completed. This allows commissioning of “early” systems (instrument air for example) to commence before construction is completely finished. Commissioning will set forth the sequence for systems completion and handover in a way that is “reverse engineered” from the start-up plan — thus achieving RFSU in the most logical fashion.

Commissioning personnel look for temporary commissioning loop availabilities and work-arounds to dynamically run equipment such as pigging pumps. They will take vendor information and system design to prepare a dynamic system commissioning procedure (SCP). The SCP will outline the necessary steps to function test the equipment as close as possible to design. Systems can then be tuned enabling smooth start-up of the equipment and facility.

Construction personnel generally have a limited understanding of equipment performance versus design criteria. Commissioning should be present during the construction phase to identify potential problems early while it is easy to fix and provide necessary input for resolution. Things like elevation of pipes and tanks can look good on paper but may not be functional when actually constructed. Construction personnel generally have limited experience with identifying design deficiencies and will build as per isometrics without questioning.

Factory acceptance testing (FAT) should be carried out by a multi-disciplined commissioning crew before the module or piece of equipment leaves the yard. Construction personnel should have finished their check of the equipment, welding records and construction QA/QC before the FAT. Commissioning personnel will be looking for a different set of faults and issues compared to someone with a construction background.

The commissioning manager may use key personnel from the construction team to join the commissioning crew. These individuals are sometimes known as “Tiger Team” personnel who will be invaluable for small modifications that need to be done during the commissioning phase. These personnel may continue to report to construction, but should be driven under the direction of the commissioning team.

Lastly, but no less important is cleanliness and preservation after handover from construction. Commissioning will perform flushing and cleaning of critical systems prior to final leak/integrity testing. During this phase, cleaning of systems such as lube oil circuits, fuel gas, or subsea umbilical lines is performed and must be maintained in a pristine condition for start-up.

Commissioning personnel have a different understanding of HSE and safety of working around live equipment. Construction sites are typically not set-up to operate a permit to work system for dynamic testing of equipment such as energizing electrical systems.

Commissioning vs Construction—Process Knowledge

Construction has a keen knowledge of installation, welding, hydrotesting, reinstatements, material handling/lifting and are not expected to be experts in running of equipment. Construction crews normally have a completely different skill set compared to commissioning engineers. They typically have limited experience of how the process systems work; therefore, they may not know how to commission them properly. In the same vein, a commissioning crew could not be expected to construct a process facility.

Most commissioning personnel have oil process separation experience and / or start-up experience with particular equipment such as power generation. Commissioning ensures that the completed construction will work as per the design intent. A good Commissioning team will look at things like operability of a system, maintenance of a system, access and egress, and “commissionability” of equipment, things that a construction crew would not be expected to know about.

Prior to start-up, commissioning personnel will identify alternative methods to commission a system in the absence of the design product by using preservation fluids, diesel, or treated water.

Conclusion

Commissioning is a specialized discipline required to execute the final phase of a project prior to start-up. Thorough knowledge of equipment, functionality, and regulatory requirements is required as well as understanding and managing the process of accepting, commissioning, and handing over systems to the operations team is vital. Construction teams have a specific skill set that is respected and commissioning is much the same way. Given the different skill sets and the quality function afforded by the handover process via a MCC, it is wise to have a separate independent commissioning team. Utilizing experienced/seasoned commissioning personnel can reduce the risk of major damage to equipment and limit major project delays.