PROJECT NORWEGIAN OCEAN TECHNOLOGY CENTRE

STRATEGY FOR SYSTEMATIC COMPLETION OF USER EQUIPMENT

07	07.05.2024	Updated figures, specified descriptions of total test phase and trial periode related to Orgalime, quotation form and tender documents.			EW	DH	AM
06	15.11.2023	Updated English translation to “Norwegian Ocean Technology Centre”			EW	DH	AM
05	10.11.2023	Revised to clarify the process implemented on the Norwegian Ocean Technology Centre project. This includes updating the process, which includes user equipment. These processes are implemented in O365.			EW	DH	AM
04	13.09.2022	Updated Chapter 1.1 and 1.2 ref. SAT definition, figure 1 to 5 and Chapter 5.2 ref. Company’s approval for transfer of A-punch at phase transition, and Chapter 7.5.1 ref. deadline test			BSK/DH	OJH	SIB
03	05.09.2022	Issue for procurement			BSK/DH	OJH	SIB
02	30.08.2022	Norwegian/English			BSK	OJH	SIB
01	04.11.2021	Draft issue			TS	OJH	SIB
Version	Date	Text			Prep by	Checked by	Approved
Project number: **1107305**	**Issued by:** **Statsbygg**	**Project name** **Norwegian Ocean Technology Centre**	**Code:** **O**	**Document type:** **Governing document**	**Document code:** **OSC-SB-O-SD-00008**		**Version:** **07**

Strategy for systematic completion of User Equipment in **the NOTC Project**

Purpose	Ensure that the completion of M3 and M4 user equipment in the NOTC project is carried out in a structured and systematic manner, so that the project is taken over by Company and end user according to plan. Completion and tests must be documented in order for the owner and the end user to be able to verify the functionality and performance of the deliverables.
Follow-up responsibility	Project Manager Completion
Executed by	Company, Engineering team, Contractors
Referrals	PA 0701-1 og -2 Systematisk ferdigstillelse PA 0702 Systematisk innsamling av FDVU-dokumentasjon NS 3935 Integrerte teknisk bygningsinstallasjoner NS 6450 Idriftsetting og prøvedrift av tekniske bygningsinstallasjoner BA2015s veileder i Systematisk ferdigstillelse NS 3457-7 Veiledning til bruk av TFM-Systemet OSC-80-SB-Q-SD-00002 Kvalitetsplan OSC-80-SB-O-SD-00001 Krav til FDVU-dokumentasjon - Requirements for supplier documentation including DFO OSC-80-SB-O-SD-00003 Tagging requirements OSC-80-SB-O-SD-00002 TFM-Amendment - m/vedlegg OSC system codes and component codes OSC-80-SB-O-SD-00009 ITB-rolle

Table of Contents

1. Abbreviations and definitions

1.1. Abbreviations

Abbreviation	Description English
FAT	Factory Acceptance Test
FST	Full scale test
IT	Integrated test
MC	Mechanical Completion (Building/Installation)
MCC	Mechanical completion checklist. Assembly control/checklist when mechanical completion
M3	Specialized lab equipment with control system with a few suppliers. Often acquired upon request to several suppliers.
M4	Custom equipment adapted to buildings. Few suppliers. Procurement takes place to specification and associated requests (typically pools/tanks built on site)
PL	Punch list
RFS	Ready for shipment
RFC	Ready For Commissioning
RFO	Ready For Operation - can start Total test
RFT	Ready For Trial operation period
QC	Quality control
SAT	Site Acceptance Test
SC	Systematic Completion
SFT	System function test
SI	System interconnected
TCC	Test control/checklist
LUN	Living up notification
NOTC	Norwegian Ocean Technology Centre
DFO	Documents for operation
ITB	Integrated Technical Building Installations

1.2. Definitions

Systematic Completion
Systematic completion is a collective term for the process described in this document, which includes the activities of product's Mechanical Completion (MC) and Testing (Function/System), as well as the method used for structured control, overview and status between the different completion phases RFS, RFC, RFO and RFT, and up to completion certificate and handover protocol.

Completion system
The database tool (OMEGA365) is used to manage all relevant processes within Systematic Completion.

Location code (eg. ++6030)
The location code identifies the building or outdoor area were the objects is physically located.

System Group (eg. ++6030=6610)
System Group is the highest level in a functional hierarcy (processes) that divides the entire project's technical completion into system groups (ref. TFM-Amendment).

System (eg. ++6030=6610.003)
A system is the second level in a functional hierarchy (processes) that divides the system group into systems (ref. TFM-Amendment).

Sub-system (eg. ++6030=6610.003.01)
A sub-system is the third highest level in a functional hierarchy (processes) that divides the systems into sub-systems (ref. TFM-Amendment).

Main Component (eg. ++6030=6610.003.01-KTD001%KTD.001)
A Main component is the lowest level in a functional hierarchy (processes) that divides the systems into main components (ref. TFM-Amendment).

Object ID (Equipment Code/Tag eg. ++6030=6610.003.01-KTD001%KTD.001)
A unique number that identifies each individual physical component of a system. All tagging should be in accordance with the regulations specified in NS3457 and contract TFM-amendments.

Punch items (Deviation)
Are deviation revealed in a check of the work performed related to Systematic Completion. These shall be classified as A or B deficiencies according to severity.

System/process drawing
All technical / functional systems must have a system diagram/ process diagram showing the function of the system. System form should not be larger format than A2 as it should also be specified in SD/top.system. Composite drawings can be used.

Boundary drawing
Is a drawing or sketch with markings showing the scope of work/boundary of one or more MC.

Factory acceptance test
Is a technical verification and approval test performed at the Contractor's or Supplier's production facilities prior to shipment of the equipment.

Living up notification (LUN)
A Warning of energized systems. A notification to inform all parties involved that plant parts, equipment or systems will be applied energy, (e.g. voltage, pressure). Warnings shall provide an adequate description of the activity, as well as provide information, locking or restrict access to areas or provide other necessary safeguards at the construction site.

System Function test (SFT)
When the individual systems are regulated (rough regulation) there is a basis for a system function test. It is important that the system test includes interfaces to other systems (if necessary, only terminal block test).

Intgrated test (IT)
Tests for more than 2 systems that have a physical interface or a communication interface. Several of the systems will have interfaces with other contracts.

Scenario test
Depending on the complexity, integrated tests will be put together in scenarios that cover an overall function and tested accordingly.

Full scale test (FST)

Full scale test is defined in this project as the test of the overall function and scope for the contract.

Stability and performance test
After an approved full-scale test, the period begins where the contract object's stability and performance must be documented. Contractor must carry out simulations/extrapolations for this to be satisfactory. The method is to be agreed with Company.

Total test
Total test is defined in this project as the test of the overall functional delivery across the contracts performed by Company and Contractors/suppliers.

Verification test
Test conducted by Company, Users and Contractors/suppliers to verify the overall function within the individual contract and across contracts.

Site Acceptance Test (SAT)
The SAT consists of documented tests with procedures within the System Hierarchy to verify/validate the function and the entirety of the complex system integrated with operational, overall control and management systems and other systems. SAT contains of both Full Scale Test and Stability and Performance Test as defined in this document.

RFS Ready for Shipment
After assembly of the equipment and a successful FAT, where there is none outstanding deviation. This is documented with a RFS certificate.

RFC Ready for Commissioning
When all object has phsyically interconnected and performed a SC control, then they will be ready for commissioing. This is documented with a RFC certificate.

RFO Ready for Operation
When full scale test and performance and stability test are performed, then all contract systems are ready for operation. This is documented with a RFO certificate.

RFT Ready for Trial period
When the full scale test and verification test are successfully completed and approved by Company, and systems functionality and reliability comply with the requirements of the Contracts. Then the systems are ready for the trial operation period, and this is documented by issuing a RFT certificate.

Completion certificate
When all the systems has been tested accordingly Company's test requirements, verification test and trial operation period have been conducted and Punch lists have been signed off. The system is ready for handover, and a completion certificate is to be issued.

Preservation
Is the process of preserving all plant parts during the project so that these are protected from potential external or internal degradation and delay decomposition and aging. This includes both first-time preservation from the supplier and subsequent preservation maintenance at the construction site.

2. Introduction

2.1. Purpose

To achieve the overall objective of project completion, as well as contribute to the planned start of the buildingsite, both with regard to safety and quality, the Norwegian Ocean Technology Centre project demands systematic completion of all contracts. The intention is to be able to ensure the best possible overview and status of all deliveries, from the manufacturer/factory to the operational phase, as well as to clarify all deficiencies as early as possible in the process during design, building and testing in an efficient manner. Contract parties and external users will be given training and support by the Company so that all parties should get the most out of the process of systematic completion.

The purpose of this document is to describe the strategy for Systematic Completion for M3 and M4 user equipment in the NOTC project. The document describes:

- Overall and general requirements
- Organization and responsibility
- Design and fabrication phase requirements
- Building and installation phase requirements
- Commissioning phase requirements
- Final phase requirements
- Miscellaneous definitions, requirements and activities

The document deals with system based project completion, split in project phases with integration in Omega365. This also requires a structured Object-based engineering in accordance with NS-3457 and contract amendments as well as the use of a common design database in dRofus for continuous exchange of technical information to all users, e.g. BIM, SC, contractors/suppliers, Company and to the DFO.

2.2. Goals

The overall goal of systematic completion is that the building and all user equipment should be fully tested, and have the expected quality and functionality, so that the users can take over the contract objects at the agreed time. Furthermore is the goal to eliminate all deficiencies continuously in the implementation, and thus ensure contract objects with the correct functional requirements and quality, which have been fully tested before handover to Statsbygg and on to NTNU/SINTEF. In this process, the project will use the computer system OMEGA365 to monitor and assist in completion activities.
Systematic completion project goals:

Tabell 1 NOTC-SC Goals

Phase	Goal	Measurement/documentation
Design and fabrication	Executed table-test on all systems	Documented in Omega 365
All phases	For every phase transition A-punches shall be rectified. B-punches shall be attempted rectified within current phase.	0 A- and B-punches at phase transition
All phases	Meet documet delivery deadlines (ref tabel 3 this document) prior to completion activity	Documeted in Omega365
All phases	Execute completion activities according to a detailed progress plan	Contracters progress plan
Commisioning phase	Execute all planned tests according to testprocedures	Documented in Omega365

	for verification and documentation of achivevement of requirements	
Commissioning phase	Meet deadlines for execution of trainingplan for owner and users	Contractor
Total test phase	Secure a complete technical status for the contract objects with a verified functional status as a basis for a hand over to the owner	Company

2.3. Success factors

The following are seen as success factors for systematic completion for the Norwegian Marine Technology Centre project:

- A common strategy and method for the systematic completion of all scope of work throughout the project implementation.
- Establish anchoring of the strategy in management and motivate project staff.
- Focus on system-based completion and procedure-controlled functional testing.
- A common computer system for systematic follow-up and technical status throughout all project phases until takeover from the executor.
- Ongoing follow-up and control of established objects complied with NS-3457-7.
- Use of object-based checklists within the various disciplines and types of work.
- Continuous documented check-out and status after completed work in the field.
- Systematic overview of errors and deficiencies, as well as ongoing actions on the correct persons responsible.
- Status of completed work and technical quality at all times, as well as an overview of remaining work/work not done.
- Ensure that the project and contractors complete the scope of work in the progress plan, with correctness quality and function.

3. Systematic completion

3.1. Definition

Systematic completion is a management-led, planned and structured process that ensures that the project meets all functional requirements within time, cost and quality requirements and must deal with the entire project from design to completion of building/equipment.Systematic completion is a process that takes care of:

- Quality assurance of components, execution, test procedures, etc.
- Ensures defined acceptance criteria.
- Early involvement and training of operating personnel.
- DFO delivered in time before the start of physical tests and early testing of geometry and function.

The work starts at project start-up and continues in iterations throughout the project. This requires backward planning where you start with how you want the result to be. By early to define the result with acceptance criteria, it is easier to be specific about what is required in planning, engineering and construction at an early stage.

3.2. Process for sytematic completion NOTC

In order to achieve the overall objective of project completion, both in terms of safety and quality, Company have requirements for Systematic Completion in all contracts.

SC activities in the project are carried out in four phases, Design and fabrication, Building and Installation, Commissioning and Final phase. Completion will begin early in the Design and fabrication phase to prepare and plan subsequent phases. The strategy is based on (and requires) early planning and systematic preparations for completion. The following phases is included in systematic completion process at the NOTC project:

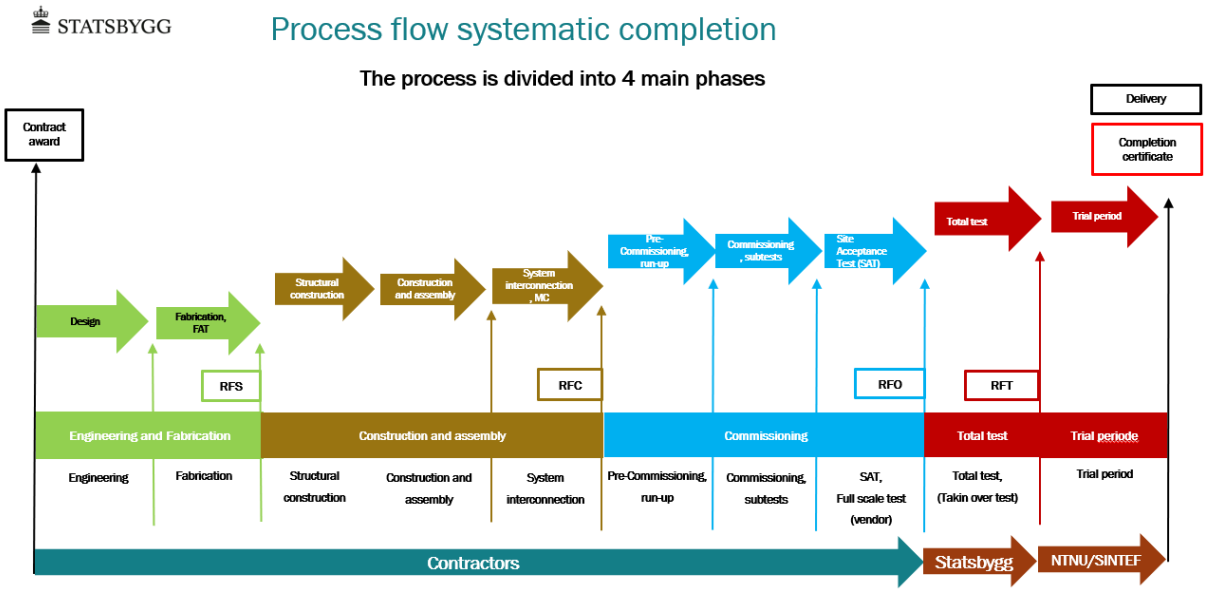


Figure 1 Process flow systematic completion NOTC

Technical status in OMEGA365 will be managed by Contractors issuing phase transition certificates up to and including RFO. Company will issue certificates for RFT and completion certificate. Systematic implementation and achievement of the certificates will help ensuring the handover of the Norwegian Ocean Technology Centre with expected technical quality at the agreed time.

4. Overall requirements

4.1. General

Implementation of Systematic Completion in accordance with the requirements shall be a continuous process in the project and generally follow the steps below:

- Establish SC process and documentation based on the basis from engineering.
- Update OMEGA365 in preparation for building and testing verifications.
- Plan and time the scope of work for SC and align these plans with the planning system.
- Carry out verifications in the field when building and testing as prepared.
- Issue certificates for technical status during transition both in and between phases.
- Issue Completion certificate as technical basis for handover protocol.
- Monitor the technical status and report in OMEGA365 as needed.
- Collect, organize and archive relevant SC documentation in OMEGA365.

4.2. Organization

In order to follow up the requirements for SC in the project, Contractor shall establish a SC organization dimensioned in line with the size and complexity of the systems. In Contractors SC team it shall always include a position/function that exercises the management of Systematic Completion as well as the associated functions necessary to lead and coordinate SC activities.

4.3. Key personnel

The Contractor shall nominate a Manager for Systematic Completion who will be included in the Contractor's project management and lead all SC activities on the behalf of Contractor. In other contracts it is named ITB-role, i.e. responsible for functionality, integration between systems, and between systems in other contracts.

The nominated person shall be approved by the Company and classified as "key personnel" in accordance with the contract (also called ITB-Coordinator), and start-up of the nominated person shall be agreed with Company.

The role of senior manager Systematic Completion (PL-SC) is held by Company and is a part of Company's project management team and will integrate the various Contractors' work deliveries.

Company's SC team will assist Contractor from the various technical subjects/disciplines upon verifications and tests to ensure the achievement of technical requirements, specifications and quality.

4.4. Responsebility

Contractor is responsible for all SC activities for its scope of work up to technical status at handover protocol and must deliver and make available early and continuously all technical information that SC teams need to work on the preparation and implementation of SC in all project phases.

Contractor shall assist in the implementation of SC activities in line with the schedule of the SC packages that correspond to the structure of OMEGA365.

Company shall have the right to participate, but is not obliged to, with personnel on Contractor's SC activities.

Relevant spare parts for test and commissioning activities, temporary equipment and consumables, as well as first refills (e.g. oil or glycol) must be delivered from the respective contractors. Contractor is also responsible for the correct storage of his material prior to use (look to chapter 5.5 preservation in this documet).

Contractor shall prepare and carry out training of operators and maintenance personnel of the respective systems prior to end of the trial operational period. This will be carried out as classroom teaching, as well as practical courses at the facility.

4.5. Documents of refrence

Central documents for the work on Systematic completion in the Norwegian Ocean Technology Centre project:

- OSC-80-SB-O-SD-00004 Strategy for systematic completion Norwegian Ocean Technology Centre
- OSC-80-SB-O-SD-00008 Strategy for systematic completion of BUT (This doc.)
- OSC-80-SB-Q-SD-00002 Quality plan OSC
- PA 0701 Systematic Completion

These documents describe work processes, activities and deliveries that must be ensured during construction of buildings and main use equipment.

5. General requirements

5.1. Subcontractors

Contractors and other parties that uses subcontracts in the project shall implement the

requirements for Systematic Completion (this document) in all their contracts.

Subcontractors' relevant documentation and checklists and other relevant documentation such as procedures, drawings, control plans, punch list, test reports (including FAT), as well as preservation status, shall be part of Contractors follow-up and documented to the objects in OMEGA365.

All subcontractor equipment that is not classified as off-the-shelf (bulk material), i.e., all vendor equipment specially fabricated for the project, shall have issued Ready for Shipment (RFS) certificate in OMEGA365 prior to shipment to the site.

The subcontractor shall close all punch items before shipping the delivery to the site in accordance with the routine for processing punch lists.

5.2. Punch lists

A punch describes a deficiency or deviation for product or process to contract, approved documents for assembly/construction/installation or regulatory requirements that are linked towards a work scope, MC-scope or an object. Contractor is responsible for creating the punch lists in OMEGA365.

All punches identified after contractors own quality inspections and after completed MC, SI and TC inspections shall be written down, including remaining work, and registered in OMEGA365 as part of the status. Punch items must be signed by person conducting the inspection/verification, but also by others who participate in the verification.

Punch shall have deadlines for clearance, and the receipt and clearance of a punch shall be made upon signing, either directly in OMEGA365 or on the appropriate report from OMEGA365 documenting this. This applies also for Contractor's subcontractors/vendors.

If there have been discovered deviation (punch) from the QC activities, this shall be registered in Omega365. This applies for all completion activities in all phases and phase transitions in the process for Design and Fabrication, Building and Installation, Commissioning and Final phase.

Company can also register punch in OMEGA365, as well as verify that punch have been cleared/carried out by Contractor.

Punch shall be classified in category A or B depending on the severity:

- A-punch are significant deviations and deficiencies that prevent completion/testing/functionality and that must be cleared/rectified before approval/delivery in the current completion phase. (The principle is: Before handover, after FAT, before transition certificate RFS, RFC, RFO and RFT).
- B-punch are less important deficiencies that do not have the same consequences as an A-punch and can therefore be postponed to a later completion phase if accepted by the Company or recipient of certificates. (The principle is: Before handover, before transition certificates RFO and RFT).

Tabell 2 Requirements for punch rectification at completion phase transition

Phase transition	Abbreviation	Issue of	Punch requirement
Ready for shipment	RFS	Certificate	None A-punch
Ready for commissioning	RFC	Certificate	None A-punch
Ready for operation	RFO	Certificate	None A-punch or B-punch

Ready for trial period	RFT	Certificate	None A-punch or B-punch

Any transfer of A-punch items at a phase transition must be approved by Company.

Company can, and in accordance with his own understanding, up- or downgrade categories on punch in OMEGA365. In cases where there is disagreement about the severity, disputed punch, a separate follow-up code must be used to track this in the system, and Company's process for disputed punch followed.

Furthermore, if the total number of B-punch on a list appears unreasonably high, the entire list can be classified as a (severe) A-punch, thereby withholding the delivery or approval of certificates until several points are rectified.

5.3. Notification of activities

Contractor shall invite Company to participate in test verifications/validations for all relevant systems objects, equipment, units and areas. Deadline for notification of planned activities within regular working days shall be as shown below:

Tabell 3 Notification deadlines for invitations to Company

Description	**Notification deadlines**	**Comments**
FAT, incl. factory assembly verification (MC)	6 Weeks	Procedures/programs and other relevant documentation shall be available at the time of notification
Construction and installation control (MC/QC)	1 week	Sequential completion shall be executed where O365 must be up to date at the time of notification and relevant documentation must be available
Verification Ready for commissioning (RFC)	1 week	O365 shall be updated with RFC approved at date of notification
Commission phase test activities	6 weeks	Procedures and other relevant information shall be available upon notification
Inspection «Ready for Commissioning» RFO	2 weeks	OMEGA365 must be updated at the time of notification.
Total test activities	4 Weeks	Procedures and other relevant documentation shall be available at the time of notification.

All relevant SC packages, procedures, drawings and documents, as well as other necessary references shall be listed in the invitation together with a clear description of the scope of work, time and place.

5.4. Work permit system

When Contractor enters the Commissioning phase, a new regime will be introduced for approval of work in area where equipment/systems are energized. Approval is obtained by the main contractor for the building.

Contractor shall establish a work permit procedure to ensure safety during the test activities carried out in parallel with construction activities. The system must be sufficiently advanced to provide an overview and manage risks that may arise from parallel activities between construction, testing and operating mode.

In connection with the test activities, Contractor shall have a procedure for locking equipment parts on the system undergoing testing such as it cannot release energy to other equipment/system. Tags shall identify equipment parts that has been locked out, area shall be

cordoned off and marked as energized, and only approved person shall remove the locks and cordons when equipment are de-energized again.

Special cordons and marking for this purpose shall be approved by the Company so it is unique and understood by all Contractors. The marking shall inform that the equipment is undergoing testing and that a signed work permit is required if work is to be carried out on or near the equipment, or in the same area.

5.5. Preservation

Contractor is responsible for carrying out all routine and periodic preservation of its scope of work. Preservation shall be based on the supplier's recommendations, as well as separate internal routines that the contractor uses to ensure that the work is carried out correctly.

Contractor is responsible for all preservation activities during all project phases from fabrication to the trial operation period.

Contractor shall prepare a preservation program with periodic activities (e.g. days, weeks, months) in OMEGA365 and use suitable checklists to verify that preservation is followed up on all materials and equipment, whether in stock or placed on site. OMEGA365 shall be used for status overview and reports on performed periodic preservation.

5.6. Progress schedule

Contractor shall on a detailed level implement the completion process in its progress schedule, where it shall be structured in the order/sequence of Contractors SC activities. This is to ensure that Company receives status on a sufficient detailed level for coordination with other Contractors. Progress plans must therefore incorporate system-based planning and overview coordinated with SC, this is especially important for the test planning.

The systematic completion process has various certificates integrated through all phases of the contract (ref. Figure 1). This shall be included in Contractor’s progress schedule and follow the same detailing level as the various systems in Omega365.

5.7. System training plan

Contractor shall develop and establish a plan for when and how training of operating personnel is to be carried out. The plan shall ensure that the operating staff receives relevant and sufficient training in the operation of the buildings and the user equipment and the outdoor facilities. Basically, it must be planned for the following arenas to be used for training:

- Theoretical training sessions
- Participation in tests
- Practical training sessions

Contractor must carry out training for various categories of personnel in accordance with an approved training plan. This includes both training of operating personnel who will be responsible for the day-to-day operation of the systems, as well as training of operators and the Company's system managers on various subject areas (i.e. more detailed and in-depth knowledge of the systems). The training plan shall be established early, divided into natural subject areas, and must contain at least:

- Training in the use of equipment and user equipment.
- Training in the use of DFO documentation (including instructions, use of internal control for electrical installations, drawings, etc.).
- Structure, function and connection between technical facilities (interdisciplinary).
- Overview of which facilities are covered by the Internal Control Regulations.
- Operation and inspection of technical facilities and equipment and user equipment (incl. troubleshooting and replacement of components).
- Training in periodic maintenance. Including review of maintenance intervals, e.g. 5 and 10

year interval for maintenance/replacement, and procedures for maintenance and replacement of various components based on updated DFO documentation.
- Training in condition-based monitoring and maintenance outside defined maintenance intervals if this is relevant for the system.
- Training in emergency procedures, i.e. which measures should be implemented in the event of a system shutdown.
- Training in the use of digital systems to operate the various systems (SD, HLCC).

The training plan is defined as part of the document delivery and must be sent to Statsbygg for approval. The training plan must be coordinated for all subjects and systems, i.e. the plan must be interdisciplinary and include all deliveries. The digital systems (DFO, SD, HLCC, etc.) used for operation must also be used in the training, and the training must be carried out on "ready-made systems".

All training must be completed in 2 rounds before the start of the trial period. The training shall be divided into several sessions of 2-3 hours within the subject areas, so that the operating organization can plan for resources that will participate. Contractor must include a timetable in the training plan which preliminarily shows how this is to be carried out. Contractor shall repeat the training after takeover and after one year of operation.

Training documentation shall be available for Company 4 weeks prior scheduled training.

5.8. DFO

The contracting party must prepare routines for planning, production and quality assurance of DFO documentation in its own organisation. Documentation must be uploaded into O365 for control and approval, and this must have undergone a documented self-check and be quality assured by the contracting party. The contracting party is made aware that at each handover in the process for completion, DFO documentation must be updated in O365. Otherwise, for the implementation of DFO collection, reference is made to OSC-80-SB-O-SD-00001 Requirements for DFO documentation.

5.9. SC Computer system

OMEGA365 shall be the main tool for preparing and adapting the scope of work for systematic completion (SC) from start to handover. Contractors' scope of work must be systematized in completion hierarchy following TFM structure. All building and technical installations shall be reported with status and underlying documentation.

Completion rate and status are reported for all contracts and phases as specified in this document. If Contractor wants to expand the level of detail in OMEGA365 this can be implemented.

In general, all completion activities shall be checked out with relevant documentation. For some activities there is a simple check-out where it is only verified that the activity has been carried out, while for other completion activities, there are underlying checklists that the contracting parties must work through from planning the completion activity until it is carried out and reported. This applies, among other things, to the completion activities (see checklists in attachments 1 to 5):

- Systems and functions
- Table test
- Factory acceptance test (FAT)
- Mechanical completion (MC)
- System function test
- Integrated test
- Scenario test

- Full scale test (SAT)
- Stability and performance test (SAT)

If the contracting party wishes to expand the level of detail of systems, components, control areas, etc. where completion activities are set up, this must be agreed with Company. In general, Company will cooperate with Contractor to meet an appropriate level based on the contract deliveries, and so that it helps to provide one overall technical status of the Norwegian Ocean Technology Centre project.

Contractor has the overall responsibility for delivering the contract work with the right quality and must use its own quality system (QA) to achieve / ensure this along the way. O365 does not replace internal and external QA routines but is a supplement to ensure that work is completed with agreed technical status between the parties for the various phases. Contractor is given free use of O365 if internal QA routines are desired to be used in O365.

Completed completion activities, handovers, and punch list status, shall provide a total status of the contract objects' technical completion level in O365, and will ultimately form the basis for the handover protocol. It is therefore important that Contractor is committed to use O365 as the umbrella completion tool in the project and ensure that it is continuously updated according to progress. Contractor is therefore given free use of O365 by Company.

6. Phase requirements systematic completion NOTC

6.1. Process flow and completion activities

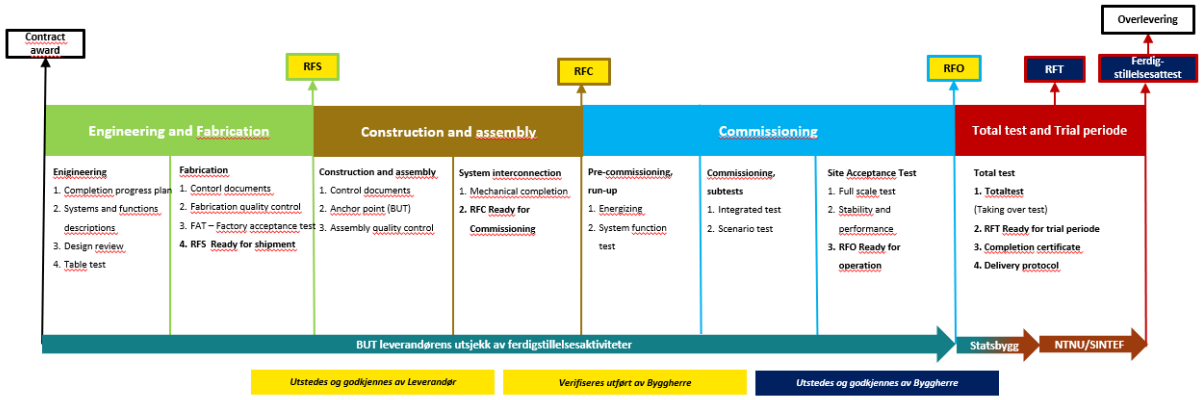


Figure 2 Process flow and completion activities

- For a main user equipment system, there are approximately 25 generic completion activities with checklists per systemcomponent/system depending on phase.
- The completion activities are linked to Contractor's delivery of systems and components.
- The completion status is documented by checking out the completion activities and phase handovers with associated checklists, and upload necessary documentation in the checklists, as well as the punch list status. This applies throughout all phases of the process for systematic completion.
- Within the quality control activities, Contractor document quality checks have been carried out in accordance with control documents.
- The principle for MC inspection on site is that these are carried out when systems are interconnected, and contractor's checklists are used for the MC inspections. However a MC inspection shall be within a reasonable scope.

6.2. Requirements in all phases

6.2.1. Quality control

For the completion activity quality control, Contractor must document that its quality assurance is carried out in O365. The minimum documentation for this is that Contractor documents the executed control plan with relevant documentation such as checklists, certificates, reports, photos, videos etc. This must be uploaded in O365 to document the correct quality. Punch lists from status inspections must be registered in O365.

6.2.2. Phase transitions

At the conclusion of the main phases of the process for systematic completion, there is a completion activity called "Handover". The purpose of the phase handovers is to verify that the contract objects have an agreed technical status that allows the next phase to be started. This means that for phase handovers, an approval and verification is done in O365 of, among other things following:

- All completion activities in the phase have been carried out.
- All outstanding punches are recorded.
- All significant punches preventing completion/functionality/testing have been corrected.
- DFO documentation is updated and registered.
- All preservation activities have been carried out and documented.
- Declaration of conformity(s) has been issued and registered.

The following phase handovers are the contract party's responsibility to carry out, but may differ

somewhat regard to which system types the deliveries to the contracting party are:

- RFS - Ready for shipment
- RFC – Ready for commissioning
- RFO – Ready for operation

Company is responsible for carrying out the following phase handover:

- RFT – Ready for trial operation

A certificate of completion will be issued by the Company and will be included as technical status in a handover protocol. The process flow for the handovers is shown in the figure below:

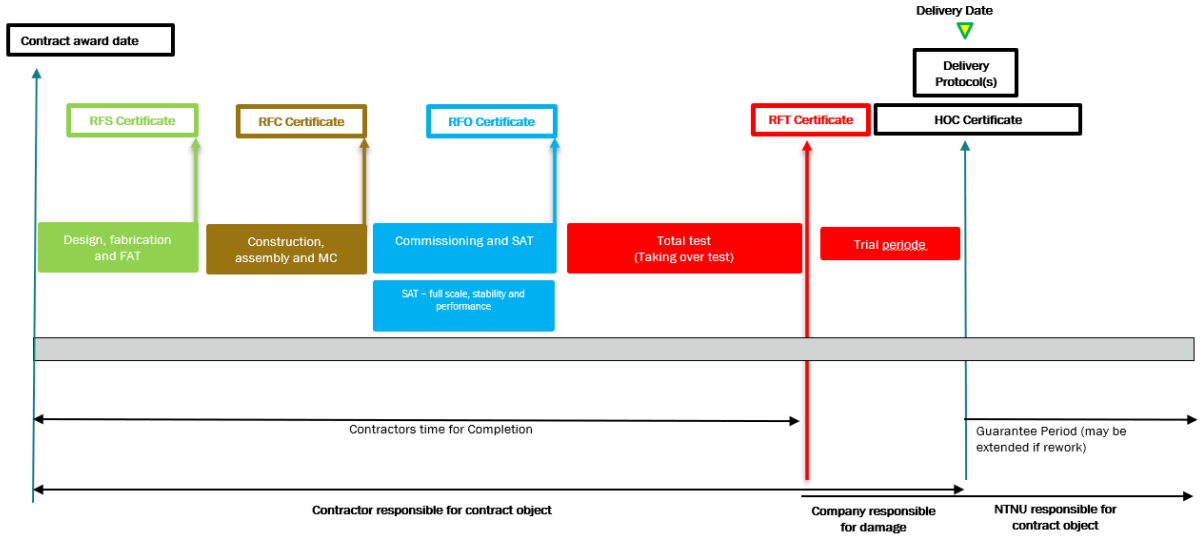


Figure 3 Phase transitions of systems in completion

Contractors scope of work may have seperate timelines when they achieve the phase transition certificates, that must be synchronized with the dependencies to other contracts phase transition certificates.

If the Contractor is only responsible for Construction/Installation and not Commissioning, all phase transition certificates shall nevertheless be sequentially issued and signed in OMEGA365 up to the handover protocol. This to control remaining defects (punch) as well as to retain similarity in the structure for all types of works.

6.2.3. Scope setup all systems Omega 365 - user equipment

Contractor is required to deliver a structured Object-based engineering in accordance with NS-3457 and contract amendments. Company will use this information to keep the object database in dRofus up to date. Based on this data Company will scope activities for all systems in O365. Example given in figur below.

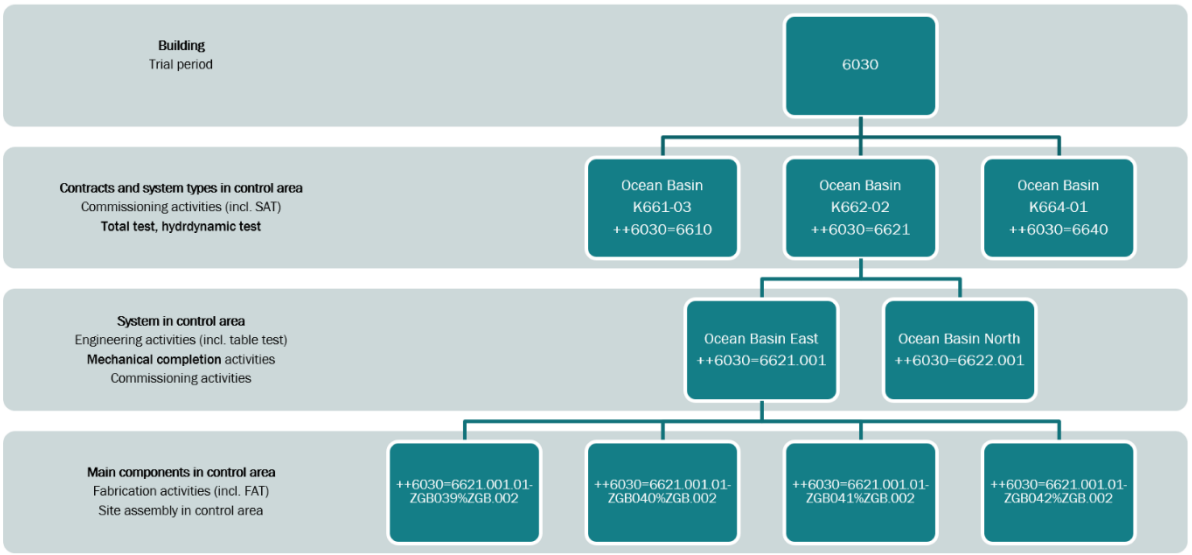


Figure 4 Example System hierarcy completion

6.3. Phase 1: Design and fabrication

6.3.1. General

Technical information from the design, such as BIM, drawings, documents, and object information, shall be the basis for defining the scope of work for work with systematic completion, objects undergoing MC, various controls and checklists in OMEGA365. These must be structured according to the code manual for the project, and shall be divided into a hierarchical tree structure, and kept up to date in OMEGA365 throughout the project execution.

6.3.2. Preparatory tasks

Contractor shall commence preparation of the completion process early in the Design and fabrication phase. This to prepare and plan upcoming activities, as well as to update its scope of work in the SC process in O365. This includes for Contractor to implement the completion packages in OMEGA365 with assign Object ID and checklists. The main tasks will be to prepare checklists for approval/verification of systems and status for follow-up from factory production to completed installation at the construction site.

The status in OMEGA365 will control and approve the issuance of phase transition certificates and help ensure a safe commissioning in accordance with the agreed schedule and expected quality.

Ordinary use of planning tools shall be maintained as usual were SC activities shall be adressed specifically, O365 will be an tool for monitoring technical status.

Contractor's preparatory main activities for Systematic Completion shall include at least:

- Establish an SC plan/manual for use in the contract that reflect the requirements of this document and describes the implementation of principles and requirements for

Systematic Completion and integration with SINTEF/NTNU automation systems.

- Create boundary drawings that show the extent of completion within each SC scope and boundaries between them. Boundaries are marked on relevant surfaces from engineering and shall primarily be available in electronic format.
- Cooperate with Company to ensure that scoping of activities in O365 is in accordance with how inspections and testing is planned carried out.
- Establish relevant subject/discipline checklists linked to SC activities.
- Update SC scope with contract relationships, milestones, sites, phases, plan, etc. for status and reporting as needed.
- Organize all SC basis with focus on system completion and testing.

6.3.3. Planning

SC activities shall be able to be carried out in accordance with system-based planning that follows the division of systems in accordance with the Norwegian regulations NS3457-7, the contracts TFM-Amendment and dRofus. This applies in particular to achieve system-based completion through testing, as well as for managing handover from Contractor to Company and further on to SINTEF/NTNU.

Progress plans shall have integration with all completion activities, i.e. systems, FAT, MC, phase transition certificates, commissioning test activities (including their dependencies) shall have references into the planning system for coordinating activities between the progress plan and the completion in O365. Plans must be submitted during the design phase.

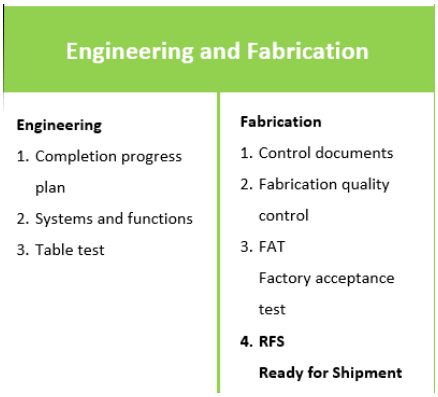


Figure 5 Design and fabrication phase

6.3.4. Systems and functions

System list
A clear master system list must be established in dRofus. This is a list of systems that should installed in the project, which buildings and areas the systems serve, where the systems are located and important key data such as quantity, capacity etc. The purpose is to create an overview of which systems to be established in the project, as well as form the basis for overall descriptions of technical infrastructure, function descriptions, interface matrix etc. and not least setup of completion activities and progress. Company will establish the list in dRofus. However Contractor shall ensure that the system list is accurate.

System chart
For all technical / functional systems, a system diagram must be drawn up showing the function of the system. Composite drawings can be used.

System function description
The system function description is a description of which functions a given system must have and how the installation should work in practice, as well as interfaces with other systems and contracts. The functional description forms the basis for the design, execution, testing and verification. Functional description must be provided for all systems that have a "function".

Integrated functional description
"Integrated functional descriptions" must be established which describe how the system is integrated with other systems, e.g. top-systems such as HLCC and MIS, and how it is meant to function. Alternatively, that integrated functions are described in the individual function descriptions.

All of the delivery requirements in this chapter (6.3.4) shall be submitted during the design phase prior to fabrication.

6.3.5. Table test

Table test is a theoretical test, where designers, Contractor, sub-contractors, and operating personnel linked to the respective system participate. The test must be carried out before equipment and components are ordered.

All systems are listed, and they are then reviewed individually or in natural connected groupings. The purpose of the test is to show that it functions as a stand-alone system and in interaction with other systems is in line with the design basis and user's expectations, and that the designed solution meets the specified requirements. For some systems it may be appropriate to carry out the table test in several rounds. Time for implementation of the various table tests, seen in relation to the system's maturity and complexity, must be planned in cooperation with Company. Table test report must be prepared and outstanding punch registered in O365. See Appendix 2.

6.3.6. Factory Acceptance Test (FAT)

Planning and execution
The purpose of carrying out a FAT is to verify the delivery with regard to assembly (MC), as well as function, capacity, and performance before it is sent to the site. The Company shall be invited to witness the FAT.

An internal acceptance test (IAT) shall be carried out and documented by Contractor before Company is invited to witness a FAT, this to ensure that the delivery is complete and ready for FAT without significant deficiencies (A-punch).

A detailed FAT test program, test procedure, and other relevant documentation must be sent to Company for review no later than 6 weeks before the planned FAT.

The FAT program and test procedure should include at least the following information:

- Documents/ drawings/ sketches (and revisions) included
- Test equipment to be used
- Description of test rig/ setup
- Detailed testing procedure and expected results
- Checklists and reports

The FAT shall check that the equipment is delivered at least in accordance with the following requirements:

- That the delivery is built in accordance with requirements, design and documentation
- That the functionality, capacity and performance of the delivery are in accordance with the specifications
- Satisfactory operation of the equipment in both regular and irregular modes
- That the equipment meets requirements for maintenance during the operational phase

The FAT shall be regarded as a combination of MC and functional testing and shall comply with the same requirements and routines as for SC and OMEGA365 in general.

Software and Electronics
FAT on software installed in systems with PLC/ controllers shall be carried out with the use of test drive that allows simulation of all signals for inputs and outputs, where the signals shall be encoded with ID according to requirements for signal coding in the code manual.

Each software test setup should be performed as much as possible equal to a normal operating state, or where one simulates such a condition.

FAT on the production of electronics and circuit boards shall include tests according to the type of equipment and standard routine tests for that type of electronics.

Electronic equipment produced for installation on the outside of buildings must be "splash-tested" to check/ document that it is waterproof.

6.3.7. Ready for shipment (RFS) certificate

All equipment that is not classified as off-the-shelf (bulk material), i.e., all vendor equipment specially fabricated for the project, shall have issued Ready for Shipment (RFS) certificate in O365 prior to shipment to the site. Issue of RFS certificate requires FAT has been completed and documented, and any punch corrected.

Contractor has the full responsibility for verification and execution of own SC scope work, and the work done by its sub-contractors, when signing the RFS certificate.

Company shall be informed when a RFS checklist is executed and signed, and will conduct controls to check the RFS scope status. Company can await signing the certificate if the RFS scope has not been fulfilled.

6.4. Phase 2: Construction and assembly phase

6.4.1. General

Mechanical Completion (MC) is part of the SC process where deliveries or facilities are built and installed discipline-wise, and where the status of these on site is verified/confirmed to be in accordance with contract, drawings, specification, and regulatory requirements/regulations.

MC check means that one does a 100% verification after completed construction/assembly/installation, and when systems are interconnected, by using checklists. Status from such verification and possible punch lists shall be entered and updated continuously in O365.

The same applies for Contractor's deliveries from subcontractors /vendors to the factory/construction site.

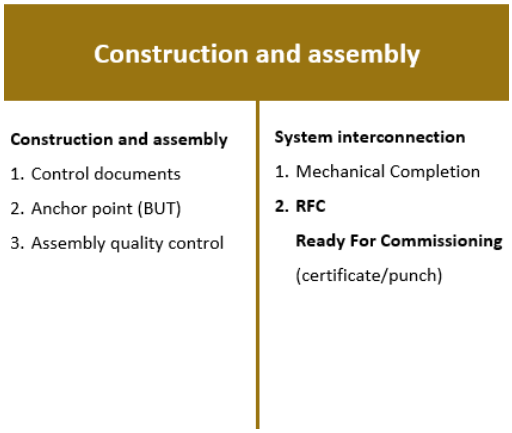


Figure 6 Bulding and installation phase

When objects are physically installed/constructed on the site, Contractor have the full responsibility for verification of own SC scope work, and the work done by its sub-contractors, when completing the phase transition checklist. The checklist states that the objects are ready to be interconnected into an operational system.

6.4.2. Mechanical completion

Before the commissioning phase only static tests are permitted, e.g. pressure test of pipes, electrical test with test equipment/pusher, load test of lifting equipment, termination control/ callout, etc.

Company shall be invited to witness Contractors MC verifications on site. Notice must be provided to Company no later than 1 week in advance of the activity. As part of the invitation, the Contractor shall submit relevant engineering information, checklists, punch list, boundary drawing and as-built drawings in the relevant MC-activity in O365.

All inspections and tests must be carried out and documented in a holistic manner and all relevant documentation shall be available to Company.

MC check shall be carried out continuously after completing the installation or construction of relevant scope. Result from MC checks shall be uploaded/updated in in O365 no later than next working day.

MC inspections and testing shall at least include the following:

- All equipment parts/structures are in place and type/quantity is correct
- All equipment parts/structures are free of damage
- All equipment parts /structures are correctly installed/built
- All electrical equipment is correctly assembled, wired, terminated, measured, and controlled
- All field equipment has been tested as far as possible without operating energy (e.g. with the use of relevant test equipment)
- All systems are interconnected
- Punch lists are registered in O365

6.4.3. Electric static loop test (Termination and continuity)

Verification of performed terminations and continuity in electric loops are in accordance with drawings, standards, specifications etc. shall be carried out as part of the building and installation phase. This shall be carried out without tension, i.e. before connecting normal operating tension to the equipment.

Loop tests must be documented in O365 using checklists (MC) with associated termination drawings, signal lists, etc.

6.4.4. Mechanical Completion preparation

In order to keep track and overview of relevant documentation belonging to MC verification and check-out on site, Contractor shall execute a pre-MC checklist in O365 at the designated location.

The pre-MC checklist shall collect all relevant documentation for check-out in the field, such as:

- Boundary drawings showing corresponding MC sope
- Relevant documents, drawings, overviews
- As built-drawings
- Measurement values and results
- Pictures and explanations
- I/O test results
- Any other relevant documentation

6.4.5. Ready for commissioning (RFC) Certificate

Upon completion of construction/installation, system interconnection and mechanical completion (MC), an RFC certificate from O365 shall be issued to confirm phase transition of the finished built/installed MC scope are approved and transferred to the Commissioning phase.

The system shall be ready for energization when issuing the RFC certificate, and Contractor's work change from static equipment inspections to dynamic/active functional testing where relevant and required.

RFC certificates are also issued for MC scope without direct requirements for technical functional testing, e.g. buildings, rooms, facilities, roads, areas, etc.

Contractor has the full responsibility for verification and execution of own SF activities, and the

work done by its sub-contractors, when signing the RFC certificate.

Company shall be informed when a RFC checklist is executed and signed, and will conduct controls to check the RFC scope status. Company can await signing the certificate if the RFC scope has not been fulfilled.

6.5. Phase 3: Commissioning phase

6.5.1. General

Testing can only start after completion of construction/ installation when RFC certificate has been issued and approved by Companys responsible person.

Test status shall be based on completed and signed procedures and checklists, as well as any punch lists registered in O365.

After testing has been documented through the commissioning procedures and SF activities with signed off checklists, the systems will be ready to go into an operational state when issuing a Ready for Operation (RFO) certificate.

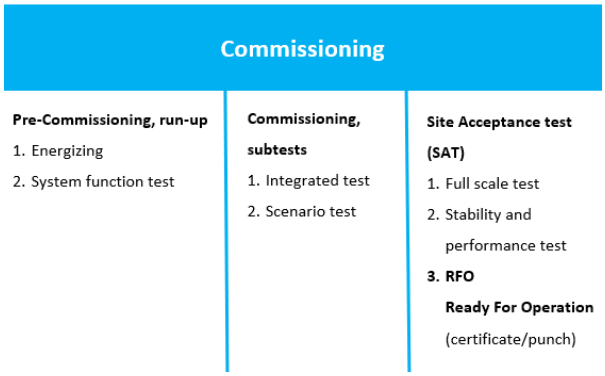


Figure 7 Commissioning phase

6.5.2. Test requirements

All system parts/equipment must be verified, functionally tested and documented to Company that the system is ready to be put in an operational condition.

The focus shall be on dynamic functions and verifications/validations, but static tests can also be included where relevant. Generally, static tests shall be performed as part of the building and installation phase, e.g. pressure test, load test, termination and static loop check, etc.

In connection with system integration and overall testing, the contractor shall, if necessary, allow other Contractors and Company to access their installed equipment, parts of equipment and systems for joint testing and integration.

All testing shall follow the general principles for Systematic Completion in this document and be fully completed before issuance of the RFO phase transition certificate.

Satisfactory dynamic function and operation of equipment shall be demonstrated within scope of testing in O365. Testing should be carried out using safe and effective methods.

If a single test, or group of tests, does not meet the criteria, it must be reported, rescheduled, and repeated until the requirements have been met.

If Company's personnel are required for the completion of the test, this shall be arranged in accordance with the requirements of the contract.

6.5.3. Commissioning/Test procedures

Contractor shall describe all testing in commissioning/test procedures that define all requirements for its execution and expected results, explained in a step-by-step and logical process. The procedures shall also collect and record all the necessary data and values from the testing and compare them against the requirements.

A test procedure can be made for equipment, systems or part systems structured according to

the division of the code manual. The procedures should always have reference to the objects tag number included in the test scope.

Contractor's commissioning/test procedures shall be sent to the Company for review no later than 6 weeks before the scheduled time for testing.

Procedures for testing equipment parts in systems that have interfaces with superior control/monitoring systems, shall also refer to these objects tag numbers in Contractor's procedures.

Contractor shall notify Company without delay if there are any changes in agreed commissioning/test procedures and document these changes in O365.

6.5.4. Commissioning test preparation

In order to keep track and overview of relevant documentation belonging to each test setup and check-out on site, Contractor shall execute a pre-test checklist in O365 at the designated location.

The pre-test checklist shall collect all relevant documentation for check-out in the field, such as:

- Test procedure with reference to tag numbers for systems included in test
- Descriptive text/ program/ configuration
- Test setup and equipment
- Requirements and acceptance criteria
- Read values and results
- Boundary drawing with reference to marked systems included
- TCC (Test control/checklists from O365)
- Engineering basis and shop drawings
- Print of relevant test reports
- As built documentation (red-markup)
- Accepted/approved nonconformities from contract
- Punch list (updated and from O365)

All results from tests shall be reported in O365, including:
- System function test
- Integrated test
- Scenario test
- Full scale test
- Stability and performance test

6.5.5. Commissioning phases

The commissioning phase consist of several phases and all systems shall undergo the phase transitions, as part of the commissioing phase, either individually or as part of a integrated scope. These are summarized as:

<u>Pre-commisioning, run-up. Energizing – system function test</u>
Contractor shall consecutively report in O365 when a system in a zone or controlarea have been energized. Energizing shall be controlled within every zone for the systems. Contractor is responsible to maintain a prosess that secures unintentional energizing of interface systems.

If the adjustment of the system is divided into a 2-stage process, where a "rough adjustment" is carried out before the system function test and the systems have been put into operation. Then this will be reviewed, and the final adjustments will be outstanding work and must be punched for the relevant systems in O365. Final adjustment shall be executed before the nest test stage. Interfaces to other systems must, as far as possible, be included in the system function test (if

required only terminal block test).

After executed energizing and system function test, the system is ready for commisioning.

Commissioning, sub-tests. Integrated- and scenario tests
After the individual systems have been functionally tested, the functional interfaces must be checked. This is done with Integrated tests and scenario tests. For BUT-contracts these tests will include testing of interconnection with HLCC and MIS.

The purpose of the scenario test is that based on an assessment of risk with respect to integrated function where there are many functional interfaces between systems, a selection of scenarios is established which is tested to verify the interaction between the systems takes care of the overall function. Company and end user will participate actively in scenario tests.

Commissioning tests – SAT – Full scale, stability and performance
Full scale test – When all systems in the contract have been checked and all punch is closed, the contract object shall undergo full-scale test. Full-scale test is defined in Norwegian Ocean Technology Centre as the overall project function in the contract integrated with HLCC and MIS. The entire contract delivery. Company and end user will participate actively in this test.

Stability and performance test - After an approved full-scale test, the systems stability and performance must be documented. If Contractor has to carry out simulations/extrapolations to provide an accepted test, the method for this must be agreed with the client.

SAT – full scale, stability and performance tests shall be executed in waterfilled basins.

Ready for operation
Upon completion of the Full scale test, and Stability and performance test,

Contractor have the full responsibility for verification and execution of SC activities and testing, and testing done by its sub-contractors, when signing the RFO certificate. No category A and B punch are allowed.

Company shall be informed when an RFO certificate is signed and will conduct a verification of the contract delivery status. The contract scope will achieve the RFO status first after Company's verification and signature. The certificates shall list all related systems and contain relevant information about the status of testing, as well as punch list and other relevant attachments.

6.6. Phase 4: Total test phase

6.6.1. General

The purpose of Total test ~~and hydrodynamic test~~ is to verify the function of the complex system integrated up to operational overall control. The test are managed with personnel and expertise from the Company and the organizations SINTEF and NTNU.

The following requirements must be complied with:
- Testing activities shall only take place after approved RFO certificate by Company.
- Testing activities shall be carried out in cooperation with Company and SINTEF/NTNU instructions.
- The Total test and hydrodynamic test will be approved first when Company signs the Ready for Trial operation period certificate.
- Company must approve all remaining punches in O365 after testing
- Company must approve the phase transition certificate Ready for Trial period.

6.6.2. Total test / (Taking over test ref. Orgalime)

Total test is defined in this project as the test of the overall functional delivery across the

contracts performed by Company and Contractors/suppliers (Building and BUT-systems integrated). SINTEF/NTNU will participate in this test with operating personel. Company will prepare test procedures and check lists for the Total test. Contractors will perform the tests described in Company's test procedure. Outstanding verifications from SAT will be executed in this testphase.

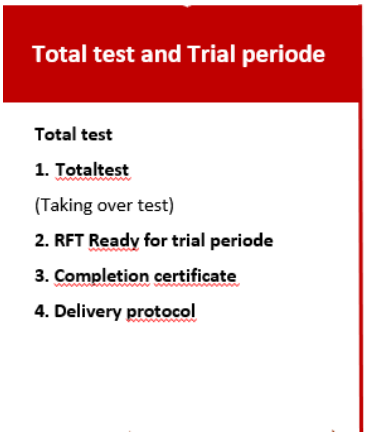


Figure 8 Final phase

6.6.3. ~~Hydrodynamic test~~

~~When the Total test for all contracts in the building are completed, the hydrodynamic test starts. This~~ test will be document with measurements to verify that the functional requirements set by SINTEF/NTNU are obtained and repeated over a time period. The period for the test is set to ~~will be from 3-~~6 ~~months~~weeks. Contractor shall assist during this test as required by Company.

~~6.6.4. Completion certificate~~

~~Upon a successful hydrodynamic test period a Completion certificate from O365 shall be issued to confirm that the equipment has achieved an acceptable technical status in order to be delivered from Contractor to Company, and sub-sequently to SINTEF/NTNU. This indicates the start of the trial period.~~

~~The Completion certificate shall be issued by Company and included in the handover protocol. Figure 4 shows the completion activities and how the technical certificates «Ready for Commissioning» and «Ready for Operation» are linked up to the Contract delivery process.~~

~~6.6.5.~~6.6.4. Trial operational period

Upon a successful Total test (taking over test) a Ready for Trial period certificcate is issued to confirm that the equipment has achieved an acceptable technical status in order to be delivered from Contractor to Company, and sub-sequently to SINTEF/NTNU. This indicates the start of the trial period. A trial operational period is~~are~~ required to be carried out when equipment ~~in~~and systems are put into normal operation for commercial use. The activities with the performance of the operation will be followed up with technical status in OMEGA365. As a minimum, the operational trial period shall document:

- Stability – Stable function in all operational situations.
- Performance - Equal performance in repetitive operations.
- Capacity – Enough capacity at maximum load.

NTNU and SINTEF, or those authorized to do so, shall operate and maintain the contract objects in according to manuals and instructions drawn up by Contractor. The formal responsibility for the contract objects in the trial period are with Contractor, who must be available to assist if needed. Contractor must establish the necessary contact persons for the various professional areas.

During the trial period, Contractor must:

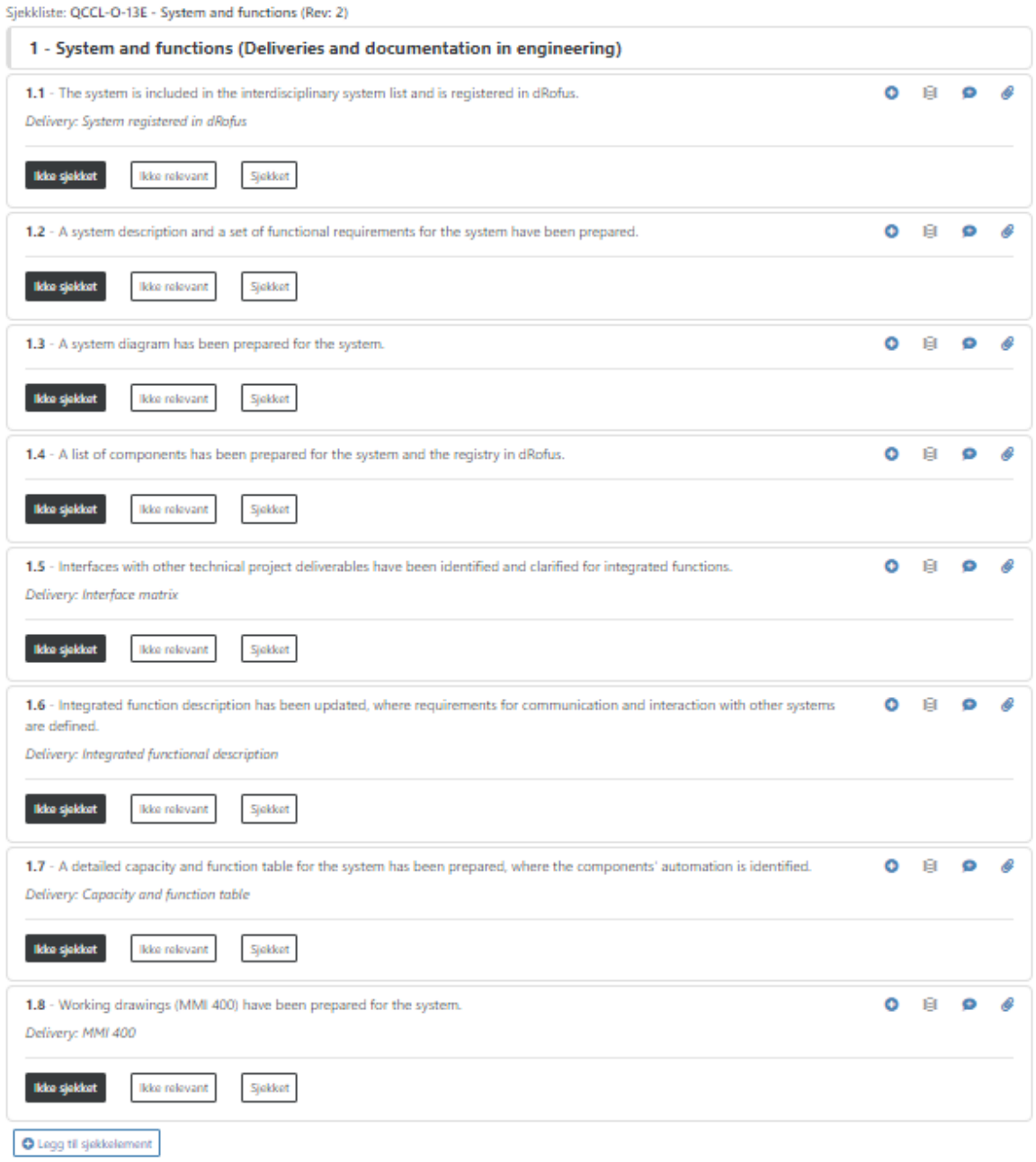
- Keep a record of incidents. Operations managers report incidents.
- Carry out a review of the facilities every month in collaboration with operations managers.
- Keep trial operation protocol.
- Test the facilities for "maximum" load (design outdoor temperature, seasonal dependence).
- Completion of stability tests.
- Carry out a function test of the facilities on which deviations have been registered at the end of the trial run.
- Follow up energy use, budget against energy use.

6.6.5. Completion certificate

At end of Trial period a Completion certificate from O365 shall be issued

The Completion certificate shall be issued by Company and included in the handover protocol. Figure 4 shows the completion activities and how the technical certificates «Ready for Commissioning» and «Ready for Operation» are linked up to the Contract delivery process.

Attachment 1 Checklist O365 – System and functions



Sjekkliste: QCCL-O-13E - System and functions (Rev: 2)

1 - System and functions (Deliveries and documentation in engineering)

1.1 - The system is included in the interdisciplinary system list and is registered in dRofus.

Delivery: System registered in dRofus

Ikke sjekket | Ikke relevant | Sjekket

1.2 - A system description and a set of functional requirements for the system have been prepared.

Ikke sjekket | Ikke relevant | Sjekket

1.3 - A system diagram has been prepared for the system.

Ikke sjekket | Ikke relevant | Sjekket

1.4 - A list of components has been prepared for the system and the registry in dRofus.

Ikke sjekket | Ikke relevant | Sjekket

1.5 - Interfaces with other technical project deliverables have been identified and clarified for integrated functions.

Delivery: Interface matrix

Ikke sjekket | Ikke relevant | Sjekket

1.6 - Integrated function description has been updated, where requirements for communication and interaction with other systems are defined.

Delivery: Integrated functional description

Ikke sjekket | Ikke relevant | Sjekket

1.7 - A detailed capacity and function table for the system has been prepared, where the components' automation is identified.

Delivery: Capacity and function table

Ikke sjekket | Ikke relevant | Sjekket

1.8 - Working drawings (MMI 400) have been prepared for the system.

Delivery: MMI 400

Ikke sjekket | Ikke relevant | Sjekket

Legg til sjekkelement

Attachment 2 Checklist O365 – Table test

Sjekkliste: QCCL-O-19E - Tabletop test (Rev: 1)

1 - Preparations for the table test

1.1 - Is the scope clarified for the tests to be carried out.

Document that describes how a system is to be tested and which criteria must be met for the tests to be considered successful. The intention is that the systems to be tested are tested in the right way and that they are only approved under the right circumstances.

Ikke sjekket | Ikke relevant | Sjekket

1.2 - Have all function descriptions and test procedures been revised and approved.

When function descriptions and test procedures have been revised and approved, but before equipment is ordered, bench tests must be held, one for each individual system as well as for integrated / scenario tests. General contractor invites Company.

Ikke sjekket | Ikke relevant | Sjekket

1.3 - Are supporting functions and interlocks defined and verified.

Ikke sjekket | Ikke relevant | Sjekket

1.4 - Have scenario tests been developed for the area being tested.

Scenario tests must be carried out for interconnected functions, "what happens if...?"

Ikke sjekket | Ikke relevant | Sjekket

1.5 - The basis for the table test has been prepared and distributed to participants.

As a basis for these tests, models/drawings, system diagrams, function descriptions, product specifications and test procedures are used.

Ikke sjekket | Ikke relevant | Sjekket

1.6 - All relevant participants are invited to the table test.

In addition to all subcontractors and suppliers involved, Companyss representatives must be invited to these tests. Interfaces with other systems must be ensured with representatives from all disciplines.

Ikke sjekket | Ikke relevant | Sjekket

1.7 - Interfaces are taken care of in the table test.

The tests must ensure that all system information and all test procedures are sufficient and correct and that all interfaces are taken care of.

Ikke sjekket | Ikke relevant | Sjekket

2 - Execution of table test

2.1 - A table test has been carried out and any errors and deficiencies have been registered in O365.

When the table test is carried out, uncovered errors or deficiencies (punch) in the substrate, which entail a need for revision of the functional descriptions and procedures, must be registered in O365 continuously and corrected by the General Contractor within 2 weeks.

Ikke sjekket | Ikke relevant | Sjekket

2.2 - Table test reporting has been carried out.

Checklists from table tests must be documented to the Company.

Ikke sjekket | Ikke relevant | Sjekket

Attachment 3 Checklist O365 – Factory Acceptance Test (FAT)

Sjekkliste: QCCL-O-14E - Factory Acceptance Test (FAT) (Rev: 1)

1 - PRE FAT CHECKLIST - DOSSIER (UPLOAD)

1.1 - Internal acceptance test (IAT) has been be carried out and documented.

Ikke sjekket | Ikke relevant | Sjekket

1.2 - FAT test program and test procedure have been sent to Statsbygg, this includes:

Ikke sjekket | Ikke relevant | Sjekket

1.2.1 - Documents/ drawings/ sketches (and revisions).

Ikke sjekket | Ikke relevant | Sjekket

1.2.2 - Test equipment to be used.

Ikke sjekket | Ikke relevant | Sjekket

1.2.3 - Description of test rig/ setup

Ikke sjekket | Ikke relevant | Sjekket

1.2.4 - Detailed testing procedure and expected results

Ikke sjekket | Ikke relevant | Sjekket

1.2.5 - Checklists and reports

Ikke sjekket | Ikke relevant | Sjekket

2 - POST FAT CHECKLIST

2.1 - FAT report is compiled (upload report).

Ikke sjekket | Ikke relevant | Sjekket

2.2 - Is there any outstanding scope for the FAT (if yes describe).

Ikke sjekket | Ikke relevant | Sjekket

2.3 - Outstanding punch items defined and recorded in Statsbygg completion system.

Ikke sjekket | Ikke relevant | Sjekket

2.4 - Verify there is no outstanding significant deficiencies (A-punch).

Ikke sjekket | Ikke relevant | Sjekket

Attachment 4 Checklist O365 – Mechanical completion

Sjekkliste: QCCL-O-06E - Mechanical completion (Rev: 3)

1 - PRE INSPECTION CHECKLIST - DOSSIER (UPLOAD)

1.1 - Mechanical completion checklist, including systems interconnections check.

Ikke sjekket | Ikke relevant | Sjekket

1.2 - Boundary drawing showing the scope for the mechanical completion.

Ikke sjekket | Ikke relevant | Sjekket

1.3 - Completed ITP for the installation.

Ikke sjekket | Ikke relevant | Sjekket

1.4 - Red markup drawings (as built) for the installation.

Ikke sjekket | Ikke relevant | Sjekket

1.5 - Test and measurements results from the installation.

Ikke sjekket | Ikke relevant | Sjekket

1.6 - Necessary declaration of conformity for the installation.

Ikke sjekket | Ikke relevant | Sjekket

1.7 - Any other relevant documentation such as pictures, explanations, etc.

Ikke sjekket | Ikke relevant | Sjekket

1.8 - Invitation sent to Statsbygg for participating as observer at the mechanical completion inspection.

Ikke sjekket | Ikke relevant | Sjekket

2 - POST INSPECTION CHECKLIST

2.1 - Mechanical completion inspection check report is compiled (upload report).

Ikke sjekket | Ikke relevant | Sjekket

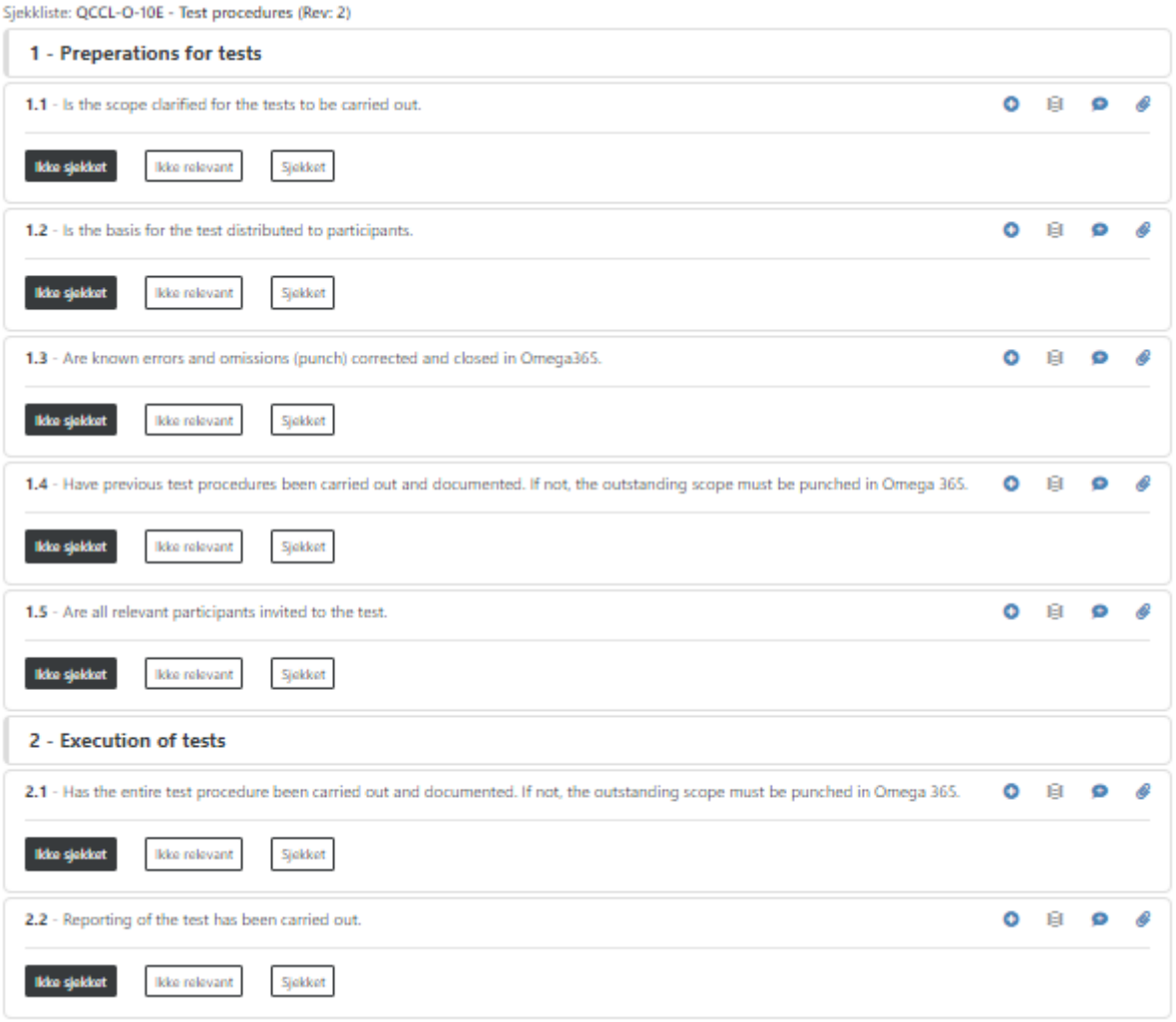
2.2 - Outstanding punch items defined and recorded in Statsbygg completion system.

Ikke sjekket | Ikke relevant | Sjekket

2.3 - Verify systems are interconnected and ready for commissioning
(if not describe what is outstanding).

Ikke sjekket | Ikke relevant | Sjekket

Attachment 5 Checklist O365 – Test procedures
This checklist is used at system function test, integrated test, scenario test, full scale test (SAT) and satbility and performance test (SAT) in O365.


Sjekkliste: QCCL-O-10E - Test procedures (Rev: 2)

1 - Preperations for tests

1.1 - Is the scope clarified for the tests to be carried out.

Ikke sjekket | Ikke relevant | Sjekket

1.2 - Is the basis for the test distributed to participants.

Ikke sjekket | Ikke relevant | Sjekket

1.3 - Are known errors and omissions (punch) corrected and closed in Omega365.

Ikke sjekket | Ikke relevant | Sjekket

1.4 - Have previous test procedures been carried out and documented. If not, the outstanding scope must be punched in Omega 365.

Ikke sjekket | Ikke relevant | Sjekket

1.5 - Are all relevant participants invited to the test.

Ikke sjekket | Ikke relevant | Sjekket

2 - Execution of tests

2.1 - Has the entire test procedure been carried out and documented. If not, the outstanding scope must be punched in Omega 365.

Ikke sjekket | Ikke relevant | Sjekket

2.2 - Reporting of the test has been carried out.

Ikke sjekket | Ikke relevant | Sjekket