

# Cold Commissioning Schedule


## (Equipment Checkout and Training Philosophy)

CO<sub>2</sub> Capture Facility

Kårstø, Norway

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## Cold Commissioning Schedule (Equipment Checkout and Training Philosophy)

### 1.0 PURPOSE

The purpose of this document is to outline the Contractor's philosophy with regard to equipment checkout (cold commissioning), and training of Owner's plant operations personnel.

### 2.0 SCOPE

This document specifies the roles and responsibilities of facility management, operations, and maintenance organizations subsequent to turnover of the facility or systems thereof to the Owner.

### 3.0 DEFINITIONS

CRO	Control Room Operator
Energization	Milestone in cold commissioning phase
Green Tag	Green Colored Tags affixed to all equipment at the time of turnover to startup from construction, denoting that tagged equipment is under the care, custody, and administrative control of startup
LOTO	Lock-Out-Tag-Out – Plant safety and clearance system
PSUM,	Contractor's Project Startup Manger, manages the commissioning and startup phase of the project
SOP's	Standard Operating Procedures
Startup Organization	Contractor commissioning team personnel
Startup	Generic reference to Contractor's startup team [group]
OJT	On-the-job-training
Owner's Organization	Owner's management and operations team personnel
WA	Work Authorization

### 4.0 RESPONSIBILITIES

The Startup Organization, managed by the PSUM, will perform cold commissioning checkout of the plant systems and equipment, document required task completion via standard inspection and test form, manage the over all commissioning schedule, administer plant LOTO program, and coordinate training of the Owner's operations personnel.

The Owner's Organization will provide the recommended plant operating staff, including experienced plant operators, who will attend the training program and also actively participate in commissioning activities, and operate plant systems under the direction of the Startup Organization direction as part of OJT until turnover of the facility to the Owner.

## **5.0 DESCRIPTION, COLD COMMISSIONING**

Once mechanical completion has been achieved, systems are turned over from construction to startup to begin cold commissioning.

System acceptance by startup constitutes mechanical completion of the system and that it is ready for commissioning.

Once a system has been accepted by startup, the system is green tagged cold commissioning activities then begin, followed by commissioning and startup [hot commissioning phase]. This is also generally known as the startup phase.

The Contractor will prepare a Project Startup Manual containing a description of the Contractor's startup process, including, but not limited to, administrative and technical procedures, detailed commissioning schedule, organization chart, and definition of the subdivision of the plant into discrete portions to facilitate phased turnover from the Contractor's Construction group to the Contractor's Startup group.

Cold commissioning will be performed utilizing the contractor's standard test and commissioning procedures (STCP's), and will be carried out in a manner compliant with Norsok Z007 standard. Refer to Mechanical Testing and Completion Schedule, 28474-000-583-U07G-00001.

The Contractor will incorporate the Owners operations personnel as part of the cold commissioning activities, which will for the initial OJT for the operators.

In addition to planning and scheduling, startup will perform the following tasks during this phase:

- Monitor precommissioning activities.
- Inspect construction records.
- Check equipment/systems and prepare preliminary punch lists.
- Verify that mechanical completion checks have been performed.
- Prepare all necessary inspection records and test certificates; ensure that all documentation is in place to allow systems to progress to the commissioning phase.

- Generally expedite the transition from pre-commissioning to commissioning.
- Monitor vendor representative activities so that personnel are used efficiently and contribute effectively to the vendor training program, both in the classroom and in the field.
- Perform final inspection of vessels and other equipment internals on a selected basis and closing and leak testing of such vessels and equipment where applicable. (Final inspection of some vessels may take place in the initial stage of the commissioning phase.)
- Perform final cleanliness inspection prior to closing key piping.

#### Cold Commissioning Activities Listing

- A-6      Install Temporary Commissioning Test Equipment as Required
- Install such items as temporary sensing lines, differential pressure gauges, vessel level indicators, vibration monitoring, etc. Make electrical connections to temporary instruments, recorders, etc. Document temporary modifications in accordance with project procedures.
- A-7      Complete Preparations for Velocity Flushing, Air Blowing, Chemical Cleaning, and Air/Steam Blows
- If not already done, write/revise specific flushing/chemical cleaning and air/steam blow technical procedures to conform to field installations. This activity also refers to final Construction work, originally started as activity C-1, required to support these activities.
- A-8      Perform Flushing, Chemical Cleaning, and Steam and Air Blows
- Flush plant water systems; alkaline/degrease cleaning of amine loops;; steam blow steam systems; and air blow instrument and plant air lines, propane, LPG, etc., lines.
- A-9      Install All Orifice Plates
- Install system orifice plates following flushing/cleaning activities. This includes witnessing requirements and appropriate documentation as required.
- B-5      Calibrate and Test Instruments
- Perform all required initial instrument calibration activities.

- B-6      Initially Energize and Test Control Loops
- Use the calibrated instruments from activity B-5. A signal or input (voltage, current, mechanical pressure, etc., as applicable) is used to establish the integrity of loop wiring, piping, and mechanical linkage. Additionally, each individual component in the loop is checked for proper functional response. Control valves operated by analog loops are stroked and their limit switch settings verified.
- B-8      Stroke Control Valves/Dampers/etc.
- Stroke all pneumatically or hydraulically operated control valves/dampers/etc., not tested in activity B-6. Verify stroke length and any limit switch settings.
- C-5      Install Temporary Pipe for Flushing and Cleaning (Construction)
- Coordinate installation of temporary pipe, pipe supports, tanks, hose connections, etc., required to support cleaning programs as identified by Commissioning group during engineering phase. This also includes temporary installations required for chemical cleaning of boiler systems, steam blowing, oil flushing, etc.
- C-6      Perform API Valve Tightness Test
- Perform tests defined by specifications/standards/Owner requirements.
- C-8      Inspect Temporary Strainers and Differential Gauges
- Verify actual installation and suitability of strainers for intended use.
- C-9      Perform Equipment Oil Flushes
- Perform cleaning flushes for specified plant equipment and oil piping, including lubricating oil, seal oil, and control oil systems.
- D-5      Schedule Vendors for Functional Testing
- Schedule vendor representatives to provide technical support for functional testing of critical vendor-supplied equipment. Backcharge-related time or activities are properly documented by Startup and reported to the Project Subcontracts Manager.
- D-6      Load packing and Chemicals and Close Up
- Load balls, rings, and saddle packing in reactors, columns, etc. Some of these activities may be performed by Startup to best fit commissioning execution.

- D-7 Provide Chemistry Consulting Services  
Provide a chemist for information, services, and training as necessary.
- D-8 Load Initial Charge of Resins, Filter Media, Chemicals, etc.  
Load resin charges, filter media, and chemicals. This activity continues through the Commissioning and Operations phases to support system flushing and initial system testing and operation. Some of these activities may be performed by Startup to best fit commissioning execution.
- D-9 All Support Utilities Available  
Verify that utility services such as power and cooling water are available to support ongoing commissioning activities.
- E-5 Calibrate/test Meters, Relays, CTs, PTs, and Secondary Circuits  
Manage subcontractor or direct perform program testing for electrical power systems protective metering and relays. Check power factors, turns ratios, and CT/PT secondary winding circuits.
- E-6 Perform additional cable & equipment Hi-pot/megger tests as required  
Conduct high-potential or other high voltage insulation tests on transformers, generators, motors, and electrical buses prior to initial energization.
- E-7 Test Power Transformers and Major Electrical Equipment  
Perform ratio, power factor, polarity, and double testing and insulating oil tests.
- E-8 Initially Energize Major Power Supply Systems, Including Phase Checks  
Initially energize, using coordination, communication, and joint checkout and testing with the power producer/supplier for the first-time energization of switchgear and load centers.
- F-7 Bump Motors for Rotation  
Turn over, test controls and bump motors uncoupled. Startup group bumps motors for rotation then performs activity F-8. This testing is performed before initial coupling of the driven equipment. Craft support is then scheduled to perform activity F-9 in preparation for activity F-10. This step does not apply to such items as motor-operated valves (MOVs) and gates.

- F-8      Run-In and Vibration Test Motors Uncoupled
- Run-in and vibration test motors bumped in activity F-7. This testing is performed before initial coupling of the driven equipment. It does not apply to such items as MOVs and gates.
- F-9      Couple Rotating Equipment (Construction)
- Couple motors tested in activities F- 7 and F-8. This activity is scheduled by Startup and performed by Construction. As required, a hot recheck of alignment is performed after equipment run-in. (Refer to F-10)
- G-5      Conduct Control Room HVAC Checkout Test and In-service Test
- Perform initial HVAC system checkout, testing, operation and balancing.
- G-6      Power-up DCS
- Power-up the DCS for the first time, including the operator's console in the control room.
- G-7      Complete preparations for process system high pressure leak test
- Make preparations for high pressure testing process system piping in accordance with approved technical procedures.
- H-5      Set MOV Torque Switches and Adjust Limit Switches
- Set torque switches and perform functional checks of actual limit switch settings and operation.
- H-6      Electrically Operate MOVs
- Complete operational tests of all MOVs, motor-operated vanes and dampers, motor-operated gates, etc.
- H-7      Remove and Set Safety Relief Devices
- Remove, test, adjust, re-seal, and reinstall safety relief devices as required.
- H-8      Perform Required Maintenance on Equipment and Systems
- Perform preventive and corrective maintenance of items following the turnover of systems/ components from Construction to Commissioning. This includes maintaining equipment operating (run time) records. Both construction and startup have responsibility for this activity.



- H-9 Complete the Data Sheets and Test Records
- Complete documents, forms, records, etc., specified in the Commissioning Manual, the Instrument Calibration Program, or the Meter and Relay Calibration Program.
- J-6 Manage the Clearance and Safety Tagging Program
- Manage and control, in accordance with the Project Safety Tagging Procedures (refer to J-1), all work performed on systems and equipment that have been handed over from Construction to Commissioning.
- J-7 Complete Insulation and Painting (Construction)
- Complete remaining plant insulation and painting.
- J-8 Identify Design Problems to Responsible Engineering Organization for Resolution
- Prepare, follow-up, and resolve Startup Field Reports or other design documents prepared during the precommissioning phase for engineering issues.
- J-9 Remove all Scaffolding and Combustible Materials (Construction)
- Complete this safety activity before the energization/operation/hydrocarbon admission of facility systems and equipment.

FIGURE 1, COLD COMMISSIONING ACTIVITES

## Pre-commissioning Phase (Cold Commissioning), from Figure 1, Project Completion Phases, Mechanical Testing and Completion Schedule, 25474 - 000 -583 - U07G - 00001

The phase where component testing occurs. This phase is sometimes referred to as “precommissioning,” “cold commissioning,” “construction completion,” or “pre-op.” Typically this phase of execution follows system/component turnover from construction but may vary depending on contract requirements. Performance of activities in this phase are typically executed by Startup personnel however some may be executed in the Construction Completion Phase by other experienced testing personnel trained and knowledgeable of Bechtel Startup Department processes and procedures. Support labor for these phase activities may be subcontractors, construction or Startup direct depending on project execution plan.

	5	6	7	8	9
A		Install temporary commissioning test equipment as required	Complete preparations for flushing, chemical cleaning, steam & blows	Perform flushing, chemical cleaning, steam & air blows	Install all orifice plates
B	Calibrate & test instruments	Initially energize & test control loops		Stroke control valves/ dampers, etc.	
C	Install temporary pipe for flushing & cleaning	Perform API Valve tightness test		Inspect temporary strainers & differential gauges	Perform equipment oil flushes
D	Schedule Vendors for functional testing	Load catalyst, chemicals, & Close-up	Provide chemistry consulting services	Load Initial charge of resins, filter media, chemicals, etc.	All support utilities available
E	Calibrate/test meters, relays, CTs, PTs, & secondary circuits	Perform additional cable & equipment Hi-pot/megger tests as required	Test power transformers & major electrical equipment	Initially energize major power supply systems including phase checks	
F			Bump motors for rotation	Run-in & vibration test motors uncoupled	Couple rotating equipment
G	Control room HVAC checkout & in-service test	Power up DCS	Complete preparations for process system high pressure leak tests		
H	Set MOV torque switches & adjust limit switches	Electrically operate MOVs	Remove & set safety relief devices	Perform required maintenance on equipment & systems	Complete the data sheets and test records
J		Manage the clearance & safety tagging program	Insulation & painting complete	Identify design problems to engineering for resolution	Remove all scaffolding & combustible materials

