

TECHNICAL DESIGN BASIS

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1107304/5 OCEAN SPACE CENTRE

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PROJECT OCEAN SPACE CENTRE

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2 Introduction

2.1 Objective

This Technical Design Basis document specifies the overall requirements for the Ocean Space Centre project.

Detailed requirements to buildings, laboratories and other installations being part of Ocean Space Centre are given in separate requirement documents and functional descriptions.

2.2 Project description

The concept Ocean Space Centre has been chosen for the renewal of the marine science laboratories at SINTEF Ocean and the department of marine technology at NTNU in Trondheim. Statsbygg is responsible for implementation of the Ocean Space Centre project, which will be executed in close cooperation with SINTEF and NTNU.

The Ocean Space Centre will house research and higher educational institutions operating under one roof, seamlessly integrating fundamental and applied research areas within the Marine Engineering and Life Science fields. When completed, the OSC will consist of a unique range of laboratories with simple and robust student labs, highly advanced laboratories for fundamental research, some of the world's largest hydrodynamic laboratories for large-scale and industrial research, and finally full-scale field laboratories in the fjord and ocean areas outside Trondheim. All of this combined with advanced computational and numerical facilities. The new laboratories will replace the existing facilities that are currently located at Tyholt in Trondheim.

The new Ocean Basin will be a world leading facility used for advanced hydrodynamic testing. The facility will have a weather generation system and a movable floor that will enable model testing in both shallow and deep water. The new facility will incorporate customized wave generating systems and current generation system and shall be equipped with highly efficient wave absorption units. The facility will have advanced wave generation algorithms and techniques, to produce waves and current beyond present state-of-art. At the same time, the facility will be designed for reliable, efficient and cost-effective operation thereby increasing the accessibility and outreach to both industry and research institutions.

The dry laboratories will facilitate scientific development of technology and concepts for energy- and propulsion systems onboard ships and other marine vessels and fish farming installations.

The Ocean Space Centre will also contain new office facilities, educational areas and educational wet and dry laboratories. This will provide NTNU with unique world class leading facilities for modern education and scientific development.

At Tyholt the Ocean Space Centre occupy three different buildings:

- Building A: Educational areas and office facilities for NTNU and Sintef
- Building B: Ocean Basin laboratory and Seakeeping and Manoeuvring Basin laboratory as well as workshops and storage facilities
- Building C: Educational wet and dry laboratories.

The Fjord Laboratory will have the operational centre at the Trondheim biological station in Heggdalen. Fjord Laboratory will also have facilities on Frøya and Ålesund, as well as installations in 3 sea areas equipped with advanced measuring systems for full scale testing.

2.3 Project Performance Goals

The project performance goals are linked to the project's effects on the users. The performance goals are given by NFD and are as follows:

The Ocean Space Centre will make the Norwegian ocean space industries more productive through:

- Knowledge and technology development
- Knowledge externalities
- World-leading educational environment
- Contribution to restructuring of business

NTNU/SINTEF is responsible for achieving the performance goals.

2.4 Main governing documents

The following overall governing documentation is applicable and provides guidelines for the scope of the project:

- Main governing document with attachments dated 15.02.2021
- Report, KS2 (Atkins/Oslo Economics)
- Project downscaling memo dated 09.07.2021
- Assignment letter from NFD dated 22.03.2022
- Approved zoning plan, Trondheim Municipality

2.5 Local conditions

2.5.1 General

Ocean Space Centre is located at Tyholt in Trondheim Municipality. Furthermore, part of the Fjord Laboratory will be located at the Trondheim biological station in Heggdalen. Fjord Laboratory also has facilities on Frøya and Ålesund, as well as installations in 3 sea areas.

2.5.2 Climate conditions

Information about climatic conditions that are relevant to the Ocean Space Centre project can be found in official historical data from the Norwegian Institute of Meteorology. www.met.no.

2.5.3 Geotechnical conditions

Company has engaged Multiconsult Norge AS to carry out geotechnical investigations in connection with the development of the Ocean Space Center at Tyholt in Trondheim. Document OSC-30-H003-G-RA-00005, Geotekniske grunnundersøkelser summarize the results of these investigations. The area is suitable for location of the wet laboratories supported directly in solid rock.

According to the danger zone map on NVE-Atlas [atlas.nve.no], there are no known danger zones for quick clay on the relevant area at Tyholt. The nearest danger zone, no. 184 "Singsaker-Tyholt", is approx. 400 m west of the area. The zone is classified with a low degree of danger.

2.6 Definitions, abbreviations and translations

Definitions:

Company:	Statsbygg, which is the Norwegian government's key advisor in construction and property affairs, building commissioner, property manager and property developer.
Purchaser:	Company
Contractor:	The party named as such in the Form of Agreement
Subcontractor:	Third Party who has entered into an agreement with the Contractor for the supply of goods or services in connection with the Works.
End-user:	SINTEF Ocean and NTNU
Plant:	The machinery, apparatus, materials, articles, documentation, software and other products to be supplied by the Contractor under the Contract.
Works:	The plant, installation of the plant and any other work to be carried out by the Contractor under the contract.
Company Materials:	Equipment, systems, and/or materials supplied by Company and which are to be incorporated in the Contract Object.

Abbreviations and translations:

Abbreviation	Explanation English	Abbreviation	Explanation Norwegian
DG	Design Group	PG	Prosjekteringsgruppe
UE	User Equipment	BUT	Brukerutstyr
OB	Ocean Basin		Havbasseng
SMB	Seakeeping and Manoeuvring Basin		Sjøgangsbasseng
NFD	Ministry of Trade, Industry and Fisheries		Nærings- og Fiskeridepartementet
NTNU	Norwegian University of Science and Technology	NTNU	Norges Teknisk-Naturvitenskaplig Universitet
OSC	Ocean Space Centre	OSC	Ocean Space Centre
	Carriage		Kjørevogn
	Fast Running Carriage		Hurtiggående kjørevogn
SWL	Still Water Level		Stillevannsnivå
TOR	Top Of Rail		Topp av skinner (for kjørevogner)
WAS	Wave Absorption System		Bølgeabsorberingssystem
WGS	Wave Generation System		Bølgegenereringssystem

	Movable Floor		Bevegelig bunn
	Center Pit		Senterhull
	Marine Flex Labs		Marintekniske studentlaboratorier
	Hydro-Cybernetics Lab		Hydrokyblabben
	Subsea Basin		Dyptanken
	Towing Tank		Slepetanken
Small-CWT	Small Circulating Water Tunnel		Lille strømningsstanken
	Flow Cell		Grensesjiktunnelen
	Small Cavitation Tunnel		Lille kavitasjonstunnelen
	Deep Water Wave Flume		Dypvannsbølgerenna
	Shallow Water Wave Flume		Gruntvannsbølgerenna
	Sloshing Rig		Sloshingriggen
	Hexapod		Hexapoden
	Drop Tank		Dropptanken
	Prototyping Lab		Byggelabben
	Student Flex Lab		Studentfleksilabben
	Motion Simulation Lab		Bevegelsessimuleringslabben
	Visualization Lab		Visualiseringslabben
	Remote Operations Control Room		Fjernkontrollrommet
	Student M-lab		Student M-labben
	Student K-lab		Student K-labben
DFO	Documentation for Operation	FDVU	Dokumentasjon for Forvaltning, Drift, Vedlikehold og Utvikling
HLCC	Hydro Laboratory Centralized Control		Hydro Laboratory Overordnet styringssystem
MC	Mechanical Completion		Mekanisk Ferdigstillelse
MDP	Master Document Plan		
NS	Norwegian Standard	NS	Norsk Standard

3 General requirements

3.1 Technical Life time

The Contract objects shall as a minimum fulfil the following requirements with respect to lifetime:

Type object / Installation	Life time requirement (year)	Comments
Concrete structures	50 (min.)	
Water and sewage systems	100	
Main mechanical equipment and systems	40	
Other technical installations	40	

3.2 Main functional requirements

The buildings with offices, teaching areas and laboratories must be arranged for efficient work processes and a good working and teaching environment.

The buildings and facilities must be designed with step-free and threshold-free transport routes.

Operational temperature, humidity, and water quality requirements:

Wet laboratories	Air temperature	20°C - 23°C
	Humidity	60% RH
	Water temperature	15°C ± 2°C
	Water chemistry	1 ppm Cl
	Water pH	6.8 – 8.0
Dry Laboratories	Air temperature	20°C - 23°C

The laboratories must have the same common floor level to be able to move equipment between them. There must be step-free delivery of goods for transport to and from workshops, warehouses and laboratories. The facility must have sufficient manoeuvring space for large vehicles (trailers, etc.) until delivery.

Functional descriptions have been prepared for the individual laboratories, confidential information.

3.3 Noise and vibration requirements

Supplier of user equipment to OSC must be able to document the sound effect or measured noise pressure level per octave band at a given distance from the equipment (typically 1 meter distance). Documented noise effect/noise pressure level must be so low that requirements for total noise in the room (sum of noise from all equipment in the room) are satisfied. TEK17 requirements for total noise are specified in NS 8175:2012 for the relevant room type and in "B16 Prerequisite report acoustics - Wing B".

The supplier of user equipment must be able to document that the package/equipment is satisfactorily vibration-insulated; That is, 90-95% degree of insulation at problem frequency/rotation frequency/vibration frequency.

3.4 Earthquake resistance

Building structures must be dimensioned for seismic loads according to NS-EN 1998-1:2004+A1:2013+NA:2021. The buildings belong to seismic class III, are located on a rock with low ground acceleration and satisfies the exclusion criterion given in NA.3.2.1. There is therefore no need to carry out seismic analyses of the buildings.

3.5 Building technical requirements

The following main building technical requirements apply to the project;

- Act on planning and construction proceedings (Planning and Building Act)
- Building technical regulation (TEK17)
- NS-EN 1997-1:2004+A1:2013+NA:2016, Geotechnical engineering - Part 1: General rules
- NS-EN 1998-1:2004+A1:2013+NA:2021: Eurocode 8, Design of structures for earthquake resistance
- NS-EN 1990:2002+A1:2005+NA:2016, Basis for the design of constructions
- NS-EN 13670:2009+NA:2010, Construction of concrete structures, execution class 3
- NS 8175:2012, Acoustic conditions in buildings - Sound classification of various types of buildings

3.6 Process technical requirements

All Work shall be in accordance with the latest editions at the time of Contract of all Norwegian Regulations and in particular the following:

- EU machinery directive 2006/42/EC
- Forskrift om maskiner (FM) FOR-2009-05-20-544 (Regulations on machines)
- NEK IEC 60204-1 Safety of machinery - Electrical equipment of machines - Part 1: General requirements
- Forskrift om sikkerhet ved arbeid i og drift av elektriske anlegg (FSE) (Regulations on safety when working in and operating electrical installations)
- Forskrift om elektriske lavspenningsanlegg (FEL) (Regulations on low-voltage electrical systems)
- EMC-requirements: NEK EN 61000-6-2 and NEK EN 61000-6-4

Internationally acknowledged standards shall be used in design, material selection, fabrication, testing, installation, and commissioning. Some relevant standards and guidelines are listed below:

- NS-EN 1990:2002 Eurocode: Basis of structural design
- EN 1993 (all parts), Eurocode 3: Design of steel structures
- NS-EN 1090-1:2009 Execution of steel structures and aluminium structures - Part 1: Requirements for conformity assessment of structural components
- NS-EN 1090-2:2018 Execution of steel structures and aluminium structures - Part 2: Technical requirements for steel structures

- NS-EN 1090-3:2019 Execution of steel structures and aluminium structures - Part 3: Technical requirements for aluminium structures
- NS-EN 1090-4:2018 Execution of steel structures and aluminium structures - Part 4: Technical requirements for cold-formed structural steel elements and cold-formed structures for roof, ceiling, floor and wall applications
- NS-EN 1090-5:2017 Execution of steel structures and aluminium structures - Part 5: Technical requirements for cold-formed structural aluminium elements and cold-formed structures for roof, ceiling, floor and wall applications
- NS-EN 10025-1:2004 Hot rolled products of structural steels - Part 1: General technical delivery conditions
- NS-EN 10025-2:2019 Hot rolled products of structural steels - Part 2: Technical delivery conditions for non-alloy structural steels
- NS-EN 10025-3:2019 Hot rolled products of structural steels - Part 3: Technical delivery conditions for normalized/normalized rolled weldable fine grain structural steels
- NS-EN 10025-4:2019 Hot rolled products of structural steels - Part 4: Technical delivery conditions for thermomechanical rolled weldable fine grain structural steels
- NS-EN 10025-5:2019 Hot rolled products of structural steels - Part 5: Technical delivery conditions for structural steels with improved atmospheric corrosion resistance
- ASTM A1090/A1090M:19 Standard Specification for Forged Rings and Hollows for Use as Base Plates in Power Transmission Structures
- EN-ISO-13849-1:2006: Safety of machinery -safety-related parts of control system-
 - Part 1: General principles for design.
- EN-ISO14121-1:2007 Safety of machinery-Risk assessment.
- EN-ISO-12100 Safety of machinery-Basic concepts
- EU Directive 2004/108/EG (EMC)
- EU Directive 2006/95/EG (Low voltage electrical equipment)
- NEN 1010:2007 Safety provisions for low-voltage installations
- NEK 400:2022, electrical low voltage installations (Based on IEC 60364)
- NEK 399:2022, Connection of electrical installations and ecom networks in buildings to the public network

Material quality for equipment such as steel structures, lifting equipment, pipes and pipe parts, valves, instruments, tanks and pumps must be assessed based on requirements for service life in relation to corrosion and chemical durability. Material quality requirements are given in document OSC-30-H004-Z-RA-00004, Material Selection Report. Requirements related to corrosion protection are given in document OSC-30-H004-Z-RA-00004, Requirements for Corrosion Protective Coatings.

3.7 Tagging system

In the Ocean Space Centre project all tagging shall comply with the document NS3457 and document OSC-80-SB-O-SD00001 TFM-amendment TFM-tagging of User Equipment. The TFM amendment document deals with adaptations of the marking system to handle the special user equipment that will be part of the project. NS3457-7 is only available in Norwegian language.

Requirements for physical tagging of equipment, components etc. are specified in document OSC-80-SB-O-SD-00003, Tagging Requirements.

3.8 Requirements for daily operation during the construction phase

During the entire construction phase, End-user SINTEF and NTNU must be able to maintain its activities in the current Ocean Laboratory and Ship Towing Tank. However, the Ship Towing Tank will be shortened and rebuilt at the eastern end to make room for the new Seakeeping and Manoeuvring Basin and the Ocean Basin.

3.9 Requirements for daily operation after final completion

The DFO shall specify in detail all maintenance activities necessary to be performed in order to fulfil the guarantee requirements and technical lifetimes.

3.10 Sustainable design

The Ocean Space Centre is to be developed in the most sustainable way possible and which gives positive effects to Trondheim, the Innovation Capital of Norway and to the local environment at Tyholt and Valentinlyst.

3.11 HSWE requirements

A high standard of HSWE work and good cooperation between all companies involved are expected so that Company's vision of zero injuries can be achieved.

Company HSWE plan (Health, safety and working environment plan) is the client's tools for ensuring that the risks associated with the building work carried out under this project are dealt with in a satisfactory manner in accordance with the Norwegian Construction Client Regulations of 2010, revised January 1st, 2021.

Contractors and suppliers (including user equipment) shall follow then HSWE requirements given in the following documents:

- OSC-30-SB-Y-MA-00005 Statsbygg OSC HSWE plan
- OSC-30-SB-Y-SP-00003 Special requirements for HSWE and seriousness
- OSC-30-SB-Y-MA-00004 Self-reporting by supplier

3.12 Water treatment system

For the new Ocean Basin and Seakeeping and Manoeuvring Basin a new water treatment system with capacity of handling approx. 120.000 m³ water including balance tanks shall be established. The total volume of water shall circulate through the water treatment system at least once a week.

For the Marine Flex Labs a separate water treatment system shall established, and this system shall have the same functions as the main water treatment system for Ocean Basin and Seakeeping and Manoeuvring Basin.

4 The existing buildings at Tyholt

Certain parts of the current marine technical research and educational centre at Tyholt will be retained and rehabilitated as part of the Ocean Space Centre project.

The western part of the Ship Towing Tank, which lies towards Paul Fjermstads veg, has a high antiquarian value and must be preserved. This part will be reused, primarily as a canteen, meeting centre and library.

The existing Ocean Laboratory has antiquarian value and will be converted into various dry and wet research laboratories (Marine Flex Labs).

The part of the building containing the existing cavitation tunnel must remain, although certain modifications may be required.

5 Selected references

- OSC-30-H004-Z-RA-00002 Requirements for Corrosion Protective Coatings
- OSC-30-H004-Z-RA-00004 Material selection report
- OSC-80-SB -O-SD-00001 Requirements for supplier documentation including DFO
- OSC-80-SB-O-SD-00004 Strategi for Systematisk Ferdigstillelse i OSC
- OSC-80-SB-O-SD-00008 Strategy for Systematic Completion of BUT
- OSC-80-SB-O-SD-00003 Tagging requirements
- OSC-80-SB-O-SD-00002 TFM-Amendment TFM-tagging of User Equipment
- OSC-30-SB-O-SD-00008 Grensesnittbeskrivelse / Interface Description
- OSC-30-SB-Y-MA-00005 Statsbygg OSC HSWE plan
- OSC-30-SB-Y-SP-00003 Special requirements for HSWE and seriousness
- OSC-30-SB -Y-MA-00004 Self-reporting by supplier