

Water Pressure Testing Chamber 10MPa/20L (Stainless Steel) Instructions for Use and Safety Manual

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Read and understand this manual completely before operating the equipment.
Failure to follow these instructions may result in equipment damage, property damage, serious personal injury, or death.

This equipment is intended for professional use only.



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1. General Product Information

1.1 Product Overview

The Water Pressure Testing Chamber 10MPa/20L (Stainless Steel) is a professional hydrostatic pressure testing system designed for pressure testing subsea and underwater components using fresh water as the test medium. The system is intended for industrial, laboratory, research and development (R&D), and professional engineering applications.

1.2 General Specifications

Specification	Description
Product Name	Water Pressure Testing Chamber 10MPa/20L (Stainless Steel)
Product SKU	BS-TAE-WPTCH-SSX-10A1
Serial Number	XXXXXXXXXXXXXXXX
Intended Use	Hydrostatic pressure testing of subsea components
Pressure Medium	Fresh Water Only
Maximum Allowable Pressure	10 MPa / 100 bar
Equivalent Water Depth	Approx. 1,000 m / 3,280 ft
Pressure Gauge Range	0–16 MPa
Hydraulic Pump Range	0–16 MPa
Chamber Volume	20 L
Chamber Material	304 Stainless Steel
Hatch Cover Material	304 Stainless Steel
Operating Temperature	Recommended: 5–40 °C
Maximum Operating Temperature	50 °C
Minimum Operating Temperature	Above 0 °C (Do Not Freeze)
Chamber Weight	Approx. 200 kg
Pressure Connection Method	Quick Coupling
Hatch Openings	18 Openings
Fulcrum Wheels	8 pcs
Intended Users	Professional / Industrial / R&D Use Only

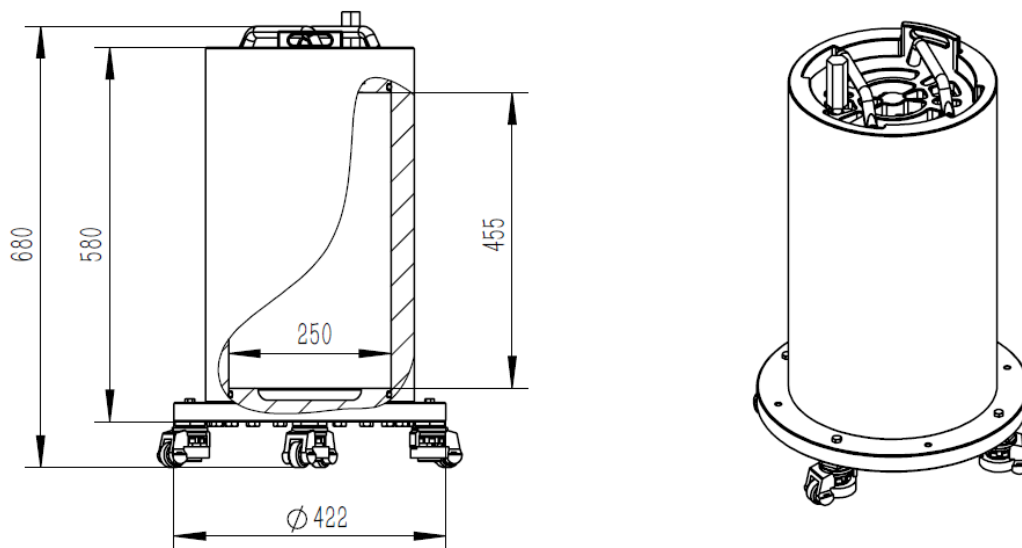
1.3 Main Dimensions

The following dimensions are provided for installation, handling, lifting, workspace planning, and integration purposes.

Dimension	Value
Chamber Internal Height	455 mm
Chamber Inner Diameter	250 mm
Chamber Outer Diameter	324 mm
Chamber Wall Thickness	36 mm

Dimension	Value
Bottom Cover Thickness	52 mm
Top Cover Thickness	40 mm

1.4 Dimension Drawing



1.5 Main Components Included

Component	Description
Pressure Chamber	Main pressure vessel
Hatch Cover	Rotating locking cover
Hydraulic Pump	Manual pressure generation system
Pressure Gauge	Digital pressure measurement
Safety Ratchet / Limit Block	Prevents hatch rotation during operation

1.6 Important Operating Limits

Parameter	Requirement / Limit
Product Name	Water Pressure Testing Chamber 10MPa/20L (Stainless Steel)
Intended Use	Hydrostatic pressure testing of subsea and underwater components
Maximum Allowable Pressure	10 MPa / 100 bar / approximately 1,450 psi
Equivalent Simulated Water Depth	Approx. 1,000 m / 3,280 ft
Test Medium	Clean Fresh Water Only
Approved Fluids	Fresh water only
Prohibited Media	Salt water, seawater, oils, solvents, chemicals, compressed air, nitrogen, oxygen, flammable liquids, or any gas
Gas Pressurization	Strictly prohibited

Parameter	Requirement / Limit
Chamber Volume	20 L
Recommended Operating Temperature	5 °C to 40 °C
Maximum Operating Temperature	50 °C
Minimum Operating Temperature	Above 0 °C (Do Not Freeze)
Freezing Conditions	Not permitted
Pressure Gauge Range	0–16 MPa
Hydraulic Pump Range	0–16 MPa
Maximum Chamber Pressure	10 MPa regardless of pump or gauge capability
Intended Users	Professional / Industrial / Laboratory / R&D Personnel
Operator Training Requirement	Trained personnel only
Chamber Opening Under Pressure	Strictly prohibited
Operation Without Safety Ratchet / Limit Block	Strictly prohibited
Test Article Compatibility	User must verify suitability and pressure rating before testing
Operating Environment	Indoor, dry, controlled environment
Outdoor Exposure	Not recommended unless adequately protected
Corrosive Environment Exposure	Not permitted
Modification of Equipment	Not permitted
Operation with Damaged Components	Not permitted
Recommended Monitoring	Continuous operator monitoring during pressurization and pressure holding
Pressure Relief Verification Before Opening	Mandatory
Storage Requirement	Store dry and above freezing temperature
Residual Pressure Assumption	Always assume pressure may remain until verified otherwise

2. Scope, Intended Use, and Operating Limits

2.1 Product Scope

The Water Pressure Testing Chamber 10MPa/20L (Stainless Steel) is a professional hydrostatic pressure testing system designed to safely simulate underwater pressure conditions using fresh water as the pressure medium. It is intended for validating the pressure resistance and watertight integrity of subsea and underwater components.

The chamber is capable of generating hydrostatic pressure up to a maximum of 10 MPa (100 bar), equivalent to approximately 1,000 meters (3,280 feet) of water depth.

This equipment is intended for professional use only in industrial, laboratory, research and development (R&D), and quality assurance (QA) environments.

2.2 Intended Use

This system is designed exclusively for hydrostatic pressure testing using fresh water. Typical applications include testing of:

- Underwater enclosures and housings
- Cable penetrators and bulkhead connectors
- Subsea electrical and mechanical components
- Sensors, cameras, and instrumentation housings
- ROV, AUV, and marine robotics components
- Prototype and production underwater assemblies

Hydrostatic testing using water is inherently safer than pneumatic (gas-based) testing due to significantly lower stored energy in the system. However, this does not eliminate the hazards associated with high-pressure equipment. The chamber still operates at pressures up to 10 MPa / 100 bar, and appropriate safety precautions must be followed at all times, including proper setup, controlled pressurization, continuous monitoring, controlled depressurization, and verification of zero pressure before opening.

2.3 Approved Test Medium

Only clean fresh water shall be used as the test medium.

The use of any other medium is strictly prohibited.

Do not use:

- Salt water or seawater
- Brine or contaminated water
- Oils or hydraulic fluids
- Solvents or alcohol
- Fuels or flammable liquids
- Acids or alkaline solutions
- Corrosive or chemically reactive liquids
- Compressed air or any gas (including nitrogen or oxygen)

Use of non-approved media may result in:

- Severe corrosion and material degradation
- Seal failure or leakage
- Contamination of the hydraulic system
- Incorrect test results
- Increased risk of injury due to stored energy (especially with gases)

2.4 Operating Temperature Limits

The chamber is designed for operation within a controlled temperature environment.

- Recommended operating temperature: 5 °C to 40 °C
- Maximum allowable operating temperature: 50 °C
- Minimum allowable temperature: above freezing (0 °C)

Do not operate above 50 °C.

Do not allow water inside the system to freeze.

Freezing water can cause expansion, leading to:

- Permanent structural damage to the chamber
- Damage to seals, fittings, and valves
- Failure of the hydraulic pump and gauge system
- Unsafe operating conditions

The chamber, pump, and pressure gauge should be operated within the specified operating temperature limits.

2.5 Maximum Pressure Limit

The maximum allowable operating pressure of the chamber is:

10 MPa (100 bar / approximately 1,450 psi)

This limit must never be exceeded.

Although the pressure gauge and hydraulic pump may be capable of operating up to 16 MPa, this does not increase the allowable pressure of the chamber itself. The maximum allowable operating pressure of the Water Pressure Testing Chamber 10MPa/20L (Stainless Steel) remains 10 MPa / 100 bar under all conditions. Additional changes or upgrades to ancillary components such as the pressure gauge or hydraulic pump may occur over time; however, these do not alter the rated pressure of the chamber. Always operate the system within the specified chamber pressure limits regardless of the capabilities of connected components.

Exceeding 10 MPa may result in:

- Structural damage to the chamber
- Failure of sealing surfaces or components
- Sudden release of pressurized water
- Risk of serious injury or equipment damage

2.6 Prohibited Use

The chamber must not be used for any of the following:

- Pneumatic or compressed gas testing
- Air, nitrogen, oxygen, or any gas pressurization
- Testing with any medium other than fresh water
- Operation above 10 MPa
- Operation above 50 °C or below freezing conditions
- Use with flammable, toxic, or corrosive substances
- Human or animal occupancy
- Food, medical, or life-support applications
- Operation by untrained or unauthorized personnel
- Operation with damaged, modified, or missing components
- Operation without the hatch fully closed and secured
- Opening the chamber while pressurized

2.7 User Responsibility

The safe operation of this equipment is the responsibility of the user.

The user must:

- Ensure the chamber is used only within its specified limits
- Confirm compatibility of the test article with hydrostatic pressure testing
- Use only clean fresh water as the test medium
- Ensure all operators are trained in hydraulic pressure safety
- Verify proper setup before each test
- Monitor pressure continuously during operation
- Prevent unauthorized access to the test area
- Immediately stop operation if leakage, deformation, or abnormal behavior is observed
- Follow all applicable local safety and regulatory requirements

Failure to follow these instructions may result in equipment damage, property damage, or serious personal injury.

3. Safety Warnings and Residual Hazards

3.1 General Safety Warning

This equipment operates at high pressure and must be used with extreme caution. Improper use, incorrect setup, or failure to follow these instructions may result in:

- Sudden release of pressurized water
- Equipment failure
- Property damage
- Serious personal injury or death

This system is intended for use by trained personnel only.

3.2 High-Pressure Hazard

The chamber operates at pressures up to **10 MPa (100 bar)**.

High-pressure water systems contain stored energy that can be released suddenly if a component fails or if the system is opened under pressure.

Never exceed the rated pressure of 10 MPa.

During pressurization and pressure holding:

- Keep a safe distance from the chamber
- Do not stand directly over the hatch or fittings
- Do not place hands or body near seals, ports, or connections
- Do not attempt to tighten fittings while the system is pressurized

3.3 Prohibition of Gas Pressurization

This chamber is designed strictly for **hydrostatic (liquid) testing**.

Do not use compressed air or gas under any circumstances.

Gas pressurization introduces significantly higher stored energy and creates a much greater risk of explosive release in the event of failure.

3.4 Opening Under Pressure

Never attempt to open, rotate, loosen, or remove the hatch cover while the chamber is pressurized.

Before opening:

- Confirm the pressure gauge reads **zero**
- Slowly open the pressure relief valve
- Confirm all internal pressure has been released
- Open the pressure relief screw to verify no residual pressure remains

Failure to fully depressurize may result in:

- Violent ejection of the hatch
- Sudden release of pressurized water
- Severe injury or equipment damage

3.5 Residual Pressure and Trapped Energy

Even after pressure release, residual pressure may remain due to:

- Trapped fluid in lines or fittings
- Blocked or partially obstructed relief paths
- Malfunctioning valves or gauges

Always:

- Depressurize slowly

- Verify pressure is fully released before opening
- Assume pressure may still be present until confirmed otherwise

3.6 Mechanical and Structural Hazards

The chamber is a heavy mechanical system (approximately **200 kg**).

Hazards include:

- Crushing during lifting or positioning
- Tipping during transport or uneven handling
- Pinch points at the hatch, handles, and locking mechanism
- Impact injury from dropped components

Do not attempt to lift the unit manually.

Always use:

- Rated lifting equipment
- Proper lifting points
- Trained personnel

Keep hands clear of:

- Hatch rotation areas
- Locking mechanisms
- Handle pivot points

3.7 Seal and O-Ring Failure

The sealing system is critical for safe operation.

Seal failure may result in:

- Sudden leakage
- Rapid pressure loss
- High-velocity water jets

Before each use:

- Inspect all O-rings and sealing surfaces
- Ensure seals are clean and properly lubricated
- Replace damaged or worn seals immediately

Do not operate if:

- Seals are damaged
- Surfaces are scratched or contaminated
- Leakage is observed

3.8 Hydraulic System Hazards

The manual hydraulic pump, hoses, and fittings operate under pressure and must be handled carefully.

Risks include:

- Hose rupture
- Fitting failure
- Sudden release of pressurized water
- Injection-type injuries from high-pressure leaks

Always:

- Use only properly connected and secured fittings
- Avoid bending or stressing hoses
- Never operate with damaged hoses or couplings
- Keep body parts away from connections during pressurization

3.9 Test Article Failure

The item being tested may fail during pressurization.

Failure modes include:

- Leakage
- Cracking or rupture
- Implosion or collapse
- Sudden release of trapped air or components

The operator must:

- Verify the pressure rating of the test item
- Set appropriate test pressure limits
- Monitor the test continuously
- Be prepared to stop the test immediately if failure occurs

3.10 Water Leakage and Spill Hazard

Water may leak or be released during:

- Filling
- Pressurization
- Depressurization
- Opening

Risks include:

- Slipping hazards
- Damage to surrounding equipment
- Electrical hazards if water contacts powered equipment

Ensure:

- Adequate drainage or containment
- Dry working surfaces
- Protection of nearby electrical equipment

3.11 Temperature-Related Hazards

Operating outside recommended temperature limits may result in:

- Seal degradation
- Material expansion or contraction
- Inaccurate pressure readings
- Increased risk of leakage or failure

Freezing conditions may cause:

- Ice expansion damage
- Cracking of components
- Failure of seals and fittings

Do not operate below 0 °C or above 50 °C.

3.12 Corrosion and Material Degradation

Improper use or maintenance may lead to corrosion.

Risk factors include:

- Use of salt water or contaminated water
- Failure to dry components after use
- Exposure to humid or corrosive environments

Corrosion may weaken:

- Bolts and fasteners
- Sealing surfaces
- Structural components

After each use:

- Drain and dry the chamber
- Dry all exposed metal components
- Inspect for signs of corrosion

3.13 Unauthorized Modification

Do not modify, alter, or disassemble the chamber or its components.

Unauthorized modifications may:

- Compromise structural integrity
- Invalidate pressure ratings
- Create unsafe operating conditions

Use only approved components and replacement parts.

3.14 Safe Work Area

Operate the chamber in a controlled environment.

Ensure:

- Clear space around the unit
- No unnecessary personnel nearby
- Adequate lighting
- Stable, level ground
- Safe access to pressure controls

Establish a controlled test zone during pressurization.

3.15 Emergency Conditions

Immediately stop operation if any of the following occur:

- Visible leakage
- Sudden pressure drop
- Abnormal noise or vibration
- Excessive force required to operate the pump
- Deformation of the chamber or hatch
- Gauge malfunction or erratic readings

In an emergency:

1. Stop pumping immediately
2. Keep personnel at a safe distance
3. Slowly depressurize the system
4. Do not approach until pressure is fully released
5. Remove the unit from service until inspected

4. Unpacking, Handling, and Installation

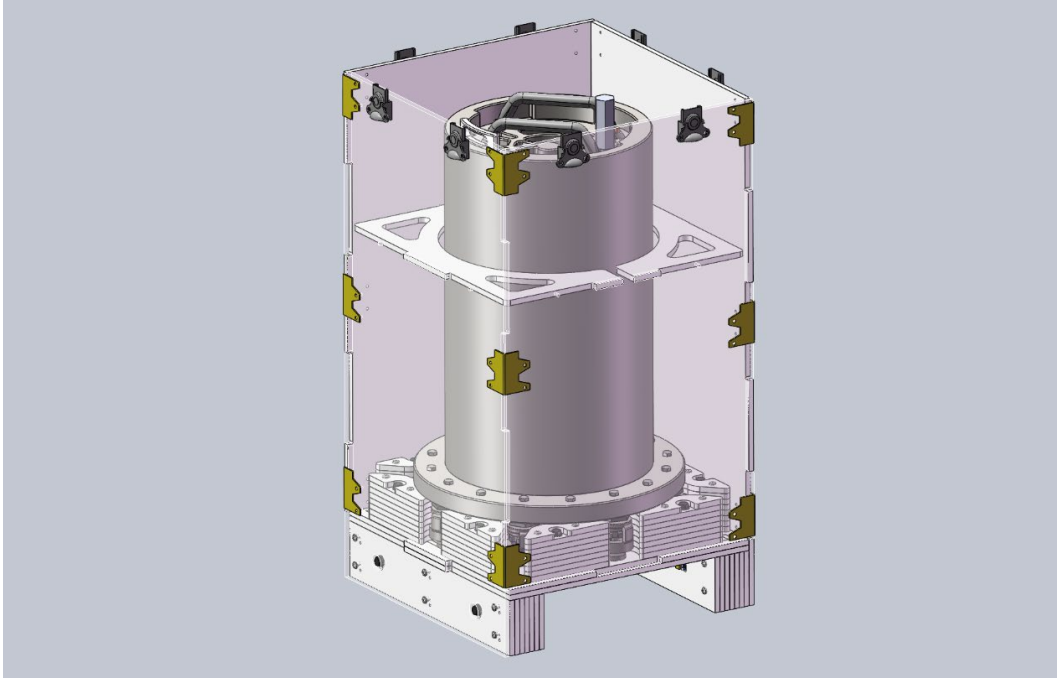
4.1 General Handling Requirements

The Water Pressure Testing Chamber 10MPa/20L (Stainless Steel) is a heavy industrial unit with an approximate weight of **200+ kg**. Improper handling may result in serious injury, equipment damage, or instability during operation.

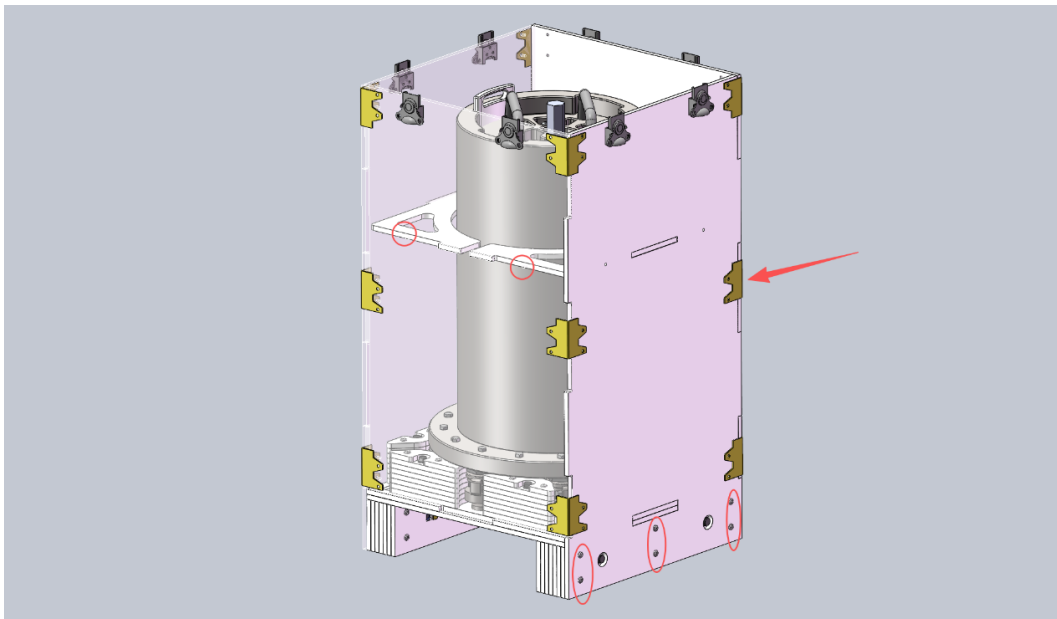
The chamber must be handled using appropriate lifting and transport equipment at all times.
Do not attempt to lift or move the chamber manually.

4.2 Unpacking Procedure

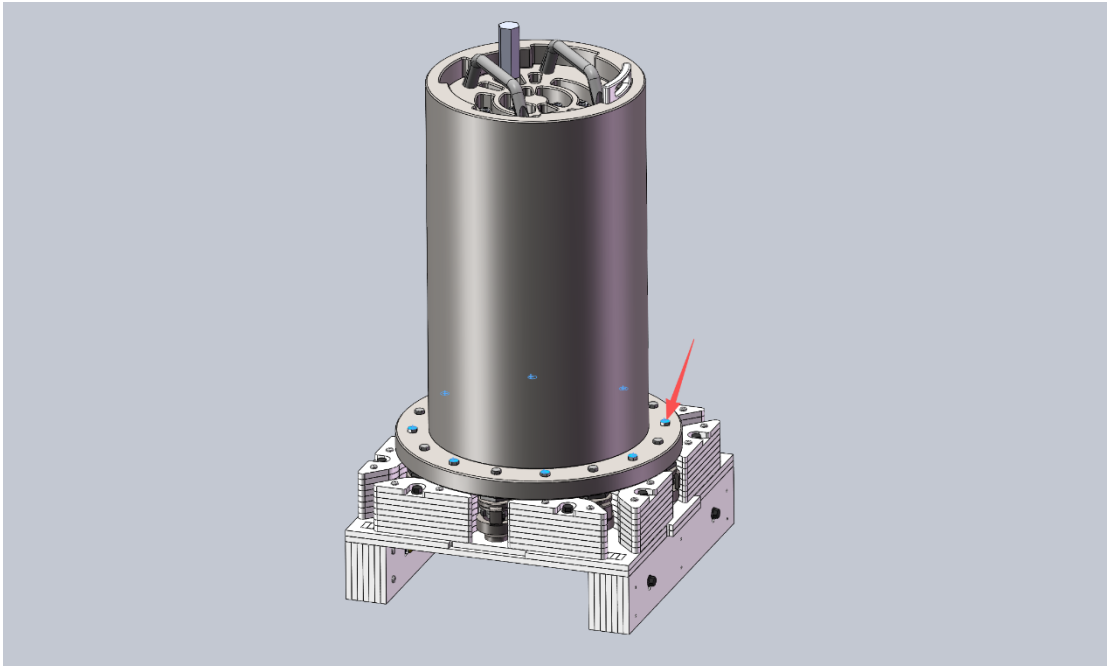
1. Place the packaged unit on a stable, level surface before unpacking.
2. Inspect the outer packaging for visible damage before opening.
3. Unlock and remove the top cover of the packaging.



4. Use a Phillips screwdriver to remove all 12 stainless steel corner guards and the 12 screws on the base. Remove the side panels around. The large hexagon bolt on the base does not need to be removed. Carefully expose the chamber and verify all components are present. Inspect the chamber, pump, gauge, hoses, and fittings for visible damage.



5. Remove the 8 hex bolts fixed to the base, being careful not to remove the bolts connecting the wheels.



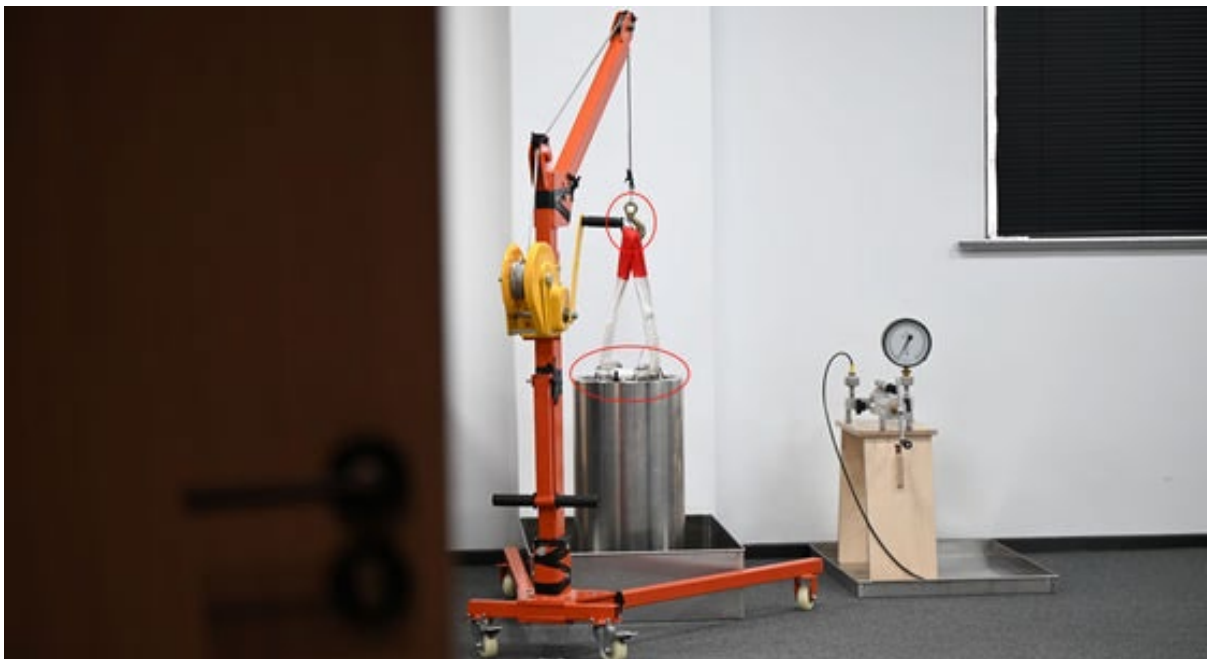
6. Use qualified lifting ropes and cranes. Thread the lifting rope through the two handles, then slowly lift. After moving to the appropriate position, lower it onto the ground.

Do not use the equipment if any structural damage, deformation, or missing components are observed.

When using a pallet jack or hydraulic truck:

- Always use both forks
- Do not lift with a single fork, as this may cause tipping

Caution: Safety blocks must be in place to prevent rotation and detachment. Do not let the sling rub against the high-pressure water inlet. Do not attempt to lift it by hand. If there is no suitable crane, place it on original pallet for use instead of attempting to lift it.



4.3 Lifting and Moving the Chamber

The chamber must be lifted using **mechanical lifting equipment only**, such as:

- Crane
- Hoist
- Forklift
- Rated lifting frame or rigging system

Lifting procedure:

1. Ensure the chamber is empty (no water inside).
2. **Confirm the hatch is properly secured and the safety stop/block is installed.**
3. Use rated lifting slings or ropes.
4. Pass lifting slings through the designated handles.
5. Ensure slings are positioned evenly to maintain balance.
6. Lift slowly and steadily.
7. Keep all personnel clear of the load during lifting.
8. **Do not allow slings to contact or rub against:**
 - **Pressure fittings**
 - **Gauge**
 - **Pump connections**
 - **High-pressure inlet**
9. Lower the chamber slowly onto a stable surface.

Never lift the chamber by hand.

Never lift using a single attachment point.

4.4 Positioning and Placement

Install the chamber on a surface that meets the following requirements:

- Level and stable
- Adequate load-bearing capacity for the full system weight
- Non-slip surface
- Free from vibration
- Protected from impact or accidental movement

The installation area must provide:

- Sufficient clearance to fully open and remove the hatch
- Clear access to the pump and pressure controls
- Adequate space for safe operator movement
- A dry and clean working environment
- Proper drainage or spill containment

4.5 Use of Fulcrum Wheels

The chamber is equipped with fulcrum wheels to assist with positioning on flat surfaces.

- Use the wheels only for short-distance movement on smooth, level ground
- Do not use the wheels on slopes or uneven surfaces
- Do not attempt to move the chamber when filled with water
- Ensure the chamber is stable and secure before operation

If resistance is encountered when moving:

- Stop immediately
- Use appropriate lifting equipment instead

4.6 Installation Environment

The chamber must be installed in a controlled environment:

- Ambient temperature: **5 °C to 40 °C**
- Dry, non-corrosive atmosphere
- No exposure to salt spray or chemical vapors
- No exposure to freezing conditions
- Adequate lighting for safe operation
- Away from high-traffic or uncontrolled areas

Avoid installation in:

- Wet or flooded areas
- Outdoor environments without protection
- Areas exposed to corrosive gases
- Locations with strong vibration or impact risk

4.7 Equipment Setup

Before first use:

1. Position the chamber in its final operating location.
2. Ensure the unit is stable and cannot move during operation.
3. Install the pressure gauge securely.
4. Connect the hydraulic pump to the chamber using the appropriate quick coupling.
5. Verify all connections are properly seated and secured.
6. Ensure all unused ports are sealed with appropriate plugs.
7. Confirm that the pressure relief valve and shut-off valve operate smoothly.
8. Verify that the pump reservoir is filled with clean fresh water.
9. Confirm that the pressure gauge is powered and functioning.
10. Ensure all components are clean and free of debris.

4.8 Pre-Installation Safety Check

Before placing the chamber into service, verify:

- No visible cracks, dents, or deformation in the chamber body
- Hatch cover is undamaged and fits correctly
- All sealing surfaces are clean and intact
- O-rings are present, clean, undamaged, and properly seated (and lubricated)
- All bolts and fasteners are secure
- Pump, hoses, and fittings are undamaged
- Pressure gauge is readable and returns to zero
- All safety components (including the limit block) are present

Do not operate the chamber until all checks are completed and any issues are corrected.

4.9 Responsibility for Installation

The user is responsible for ensuring that:

- The installation location is suitable and safe
- The chamber is properly supported
- All connections are correctly installed
- The equipment is used within its specified limits
- Local safety and regulatory requirements are followed

Improper installation may result in unsafe operation, equipment damage, or injury.

5. Pre-Use Inspection and Setup Procedure

5.1 General Requirement

A complete inspection and setup check must be performed before every use.

Failure to perform proper inspection may result in leakage, equipment failure, inaccurate test results, or unsafe operation.

The chamber must not be pressurized until all checks are completed and confirmed.

5.2 Visual Inspection of Chamber Body

Before each use, inspect the chamber for:

- Cracks, dents, or deformation of the pressure vessel
- Damage to the hatch cover or sealing surfaces (including O-rings)
- Signs of corrosion, especially around:
 - Bolts and fasteners
 - Threaded ports
 - Sealing interfaces
- Damage to hatch locking features or interlocking components

Do not use the chamber if any structural damage is observed.

5.3 Hatch, Seal, and O-Ring Inspection

The sealing system must be inspected carefully before every test.

Check the following:

- O-rings are installed and correctly seated
- O-rings are free from:
 - Cuts
 - Cracks
 - Flattening
 - Swelling
 - Contamination
- Sealing surfaces on the hatch and chamber are:
 - Clean
 - Smooth
 - Free from debris, scratches, or foreign material

Apply a suitable lubricant to the O-ring if required. We recommend using DuPont **MOLYKOTE® 111 Compound** as the lubricant for the O-rings during assembly and maintenance to help support proper sealing, reduce wear, and maintain watertight integrity.

Do not operate if sealing surfaces are damaged or contaminated.

5.4 Port and Penetrator Check

Inspect all hatch openings and ports:

- Ensure all unused ports are fully sealed with appropriate plugs
- Confirm installed penetrators or fittings are:
 - Properly tightened
 - Equipped with O-rings
 - Free from visible leakage paths
- Verify the pressure relief screw is installed and functional

Any unsealed port or missing O-ring will prevent pressurization and may cause leakage.

5.5 Pressure Gauge Check

Before pressurization:

- Confirm the pressure gauge is securely installed
- Power on the gauge
- Verify the display is functioning correctly
- Confirm the reading returns to **zero** before pressurization

If the gauge does not read zero:

- Reset using the zero function (only when not pressurized)

Do not use the chamber if the gauge is malfunctioning or unreadable.

5.6 Hydraulic Pump and Hose Check

Inspect the hydraulic system:

- Confirm the pump reservoir contains clean fresh water and is completely full
- Ensure hoses are:
 - Undamaged
 - Free from cracks or wear
 - Properly connected
- Check quick couplings are:
 - Fully engaged
 - Secure
 - Clean and free of debris
- Confirm valves operate smoothly:
 - Shut-off valve
 - Pressure relief valve

Do not operate with damaged hoses, fittings, or pump components.

5.7 Air Removal Preparation

Hydrostatic testing requires removal of air from the system.

Before pressurization:

- Ensure sufficient water is available for filling
- Confirm the pump reservoir is filled
- Verify that venting paths are accessible
- Prepare to remove air from:
 - The chamber
 - The pump
 - The connection lines

Air trapped in the system can lead to:

- Unstable pressure readings
- Reduced test accuracy
- Increased stored energy risk

5.8 Safety Component Check

Confirm all safety features are present and functional:

- Safety ratchet / limit block is available
- Hatch locking mechanism operates correctly
- Pressure relief screw is accessible

- Pressure relief valve functions properly

The chamber must not be pressurized unless the safety ratchet / limit block is installed.

5.9 Work Area Check

Before operation:

- Ensure the area around the chamber is clear
- Remove unnecessary personnel from the test zone
- Confirm adequate lighting
- Verify the floor is dry and non-slip
- Ensure drainage or spill containment is available
- Protect nearby electrical equipment from potential water exposure

5.10 Test Article Verification

Before placing any item inside the chamber:

- Confirm the test article is suitable for hydrostatic pressure testing
- Verify its pressure rating is equal to or greater than the intended test pressure
- Ensure it is properly sealed if required
- Confirm it does not contain trapped air unless intentionally part of the test
- Ensure no loose components are present that could shift under pressure

The operator is responsible for defining safe test parameters for the test article.

5.11 Final Pre-Use Checklist

Before pressurization, confirm all of the following:

- Chamber body is undamaged
- Hatch and sealing surfaces are clean and intact
- O-rings are installed and in good condition
- All ports are sealed or properly fitted
- Pressure gauge is functioning and reads zero
- Pump and hoses are correctly connected
- Pump reservoir is filled with clean fresh water
- Valves operate smoothly
- Safety ratchet / limit block is installed
- Work area is clear and safe
- Test article is properly prepared

Do not proceed with operation unless all items are confirmed.

6. Filling, Venting, and Pressurization Procedure

6.1 General Requirements

All operations must be carried out slowly and in a controlled manner.

- Use **clean fresh water only**
- Do not rush any step
- Do not apply force to components
- Monitor the system continuously during operation

The chamber must be fully filled and properly vented before pressurization to ensure safe hydrostatic testing conditions.

6.2 Filling the Chamber

1. Ensure the chamber is fully depressurized and open.
2. Confirm all pre-use inspection checks have been completed.
3. Verify that all required penetrators, fittings, and plugs are installed.
4. Pour clean fresh water into the chamber.
5. Place the test article into the chamber, ensuring it is fully submerged.
6. Continue filling the chamber until the water level reaches the appropriate height:
 - The chamber should be nearly full
 - Minimize any trapped air volume

Avoid leaving large air pockets inside the chamber.

6.3 Preparing the Seal

1. Inspect the O-ring and sealing surfaces.
2. Ensure all sealing surfaces are clean and free from debris.
3. Apply a suitable lubricant to the O-ring if required.
4. Ensure the O-ring is properly seated in its groove.

Contamination or improper sealing may result in leakage or failure to pressurize.

We recommend using DuPont **MOLYKOTE® 111 Compound** as the lubricant for the O-rings during assembly and maintenance to help support proper sealing, reduce wear, and maintain watertight integrity.

6.4 Closing and Securing the Hatch

1. Carefully place the hatch cover onto the chamber.
2. Keep hands clear of pinch points.
3. Rotate the hatch cover until the locking positions align fully.
4. Ensure the hatch is fully seated and correctly engaged.
5. Install the **safety ratchet / limit block** to prevent rotation.

Do not pressurize the chamber unless the hatch is fully locked and secured and the safety ratchet / limit block is installed.

6.5 Venting and Air Removal

Removing air from the chamber is critical for safe and accurate hydrostatic testing.

Air trapped in the chamber may:

- Cause unstable pressure readings
- Reduce test accuracy
- Increase stored energy within the system
- Result in inconsistent pressure behavior during testing

To vent and remove air from the chamber:

1. After the hatch cover has been closed and locked, continue injecting clean fresh water through the pressure relief opening.
2. Continue filling until water flows steadily from the pressure relief opening.
3. Continue injecting water until no visible air bubbles are observed.
4. Confirm that the chamber is filled with water and that trapped air has been minimized.
5. Reinstall and tighten the pressure relief screw securely.
6. Install the water injection plug into the appropriate port.

6.6 Pump Preparation

After the chamber has been filled and vented, prepare the manual hydraulic pump as follows:

1. Open the shut-off valve.

2. Open the pressure relief valve.
3. Unscrew or open the water injection hole on the hydraulic pump.
4. Fill the pump liquid storage cup / reservoir through the water injection hole using clean fresh water only.
5. Keep the shut-off valve open.
6. Close the pressure relief valve.
7. Install the safety ratchet / limit block before pressurization (if not already completed).

During pressurization, observe the water level in the pump reservoir and add clean fresh water through the water injection hole as required.

The pump must not draw air during operation. Air in the pump or hydraulic circuit may cause unstable pressure readings, inconsistent pressure generation, and reduced test accuracy.

6.7 System Setup for Pressurization

1. Close the pressure relief valve.
2. Keep the shut-off valve open unless otherwise required.
3. Confirm all connections are secure.
4. Ensure the pressure gauge is visible and functioning.
5. Verify the safety ratchet / limit block is installed.
6. Confirm all personnel are clear of the chamber.

6.8 Pressurization Procedure

1. Begin pressurization by **slowly operating the manual pump**.
2. Increase pressure gradually.
3. Continuously monitor the pressure gauge.
4. Observe all components for:
 - Leakage
 - Movement
 - Abnormal behavior
5. During pressurization:
 - **Maintain water level in the pump reservoir**
 - Add water if necessary to prevent air from entering the system through the liquid filling port on the manual pump.
6. Continue pressurizing until the target test pressure is reached.

Never exceed 10 MPa (100 bar).

6.9 Pressure Control

- Apply pressure gradually and smoothly
 - Avoid sudden pressure increases
 - Do not operate the pump aggressively
 - Do not force the pump if resistance becomes excessive
- Increased resistance near maximum pressure is normal. Continue slowly and carefully.

6.10 Monitoring During Pressurization

During pressurization, continuously monitor:

- Pressure gauge reading
- Chamber body
- Hatch and seals
- Fittings and connections
- Pump and hose

Immediately stop pressurization if any of the following occur:

- Visible leakage
- Sudden pressure drop
- Unusual noise or vibration
- Excessive force required on the pump
- Movement or instability of components

6.11 Reaching Target Pressure

Once the desired test pressure is reached:

1. Stop pumping.
2. Confirm the pressure is stable.
3. Begin the pressure holding phase as required by the test procedure.

6.12 Important Safety Notes

- Do not leave the chamber unattended during pressurization
- Do not stand directly over the chamber or fittings
- Do not attempt adjustments while pressurized
- Always maintain control of the system

7. Pressure Holding and Depressurization Procedure

7.1 General Requirements

The pressure holding and depressurization stages must be performed in a controlled and deliberate manner.

- Maintain continuous awareness of system pressure
- Do not leave the chamber unattended while pressurized
- Be prepared to respond immediately to abnormal conditions
- Ensure all personnel remain at a safe distance during operation

7.2 Pressure Holding Procedure

Once the target pressure has been reached:

1. Stop pumping immediately.
2. Record the target pressure and start time if required.
3. Maintain the chamber at the desired pressure for the specified test duration.

During the holding period:

- Continuously monitor the pressure gauge
- Observe the chamber, fittings, and test article for leakage
- Watch for pressure drop or instability
- Ensure no visible deformation or abnormal behavior occurs

A small decrease in pressure over time may occur due to:

- Temperature variation
- Minor system compliance

This is normal, provided no leakage is present.

7.3 Monitoring During Pressure Hold

During the hold period, observe:

- Pressure stability
- Seal integrity

- Condition of fittings and penetrators
- Behavior of the test article

Immediately stop the test if any of the following occur:

- Visible leakage
- Rapid or unexplained pressure drop
- Abnormal noise or vibration
- Deformation of the chamber or hatch
- Movement of fittings or components

If any abnormal condition is observed, proceed to controlled depressurization.

7.4 Preparing for Depressurization

At the end of the pressure holding period:

1. Confirm all personnel are clear of the chamber.
2. Ensure the pressure gauge is clearly visible.
3. Verify that the pressure relief valve is accessible.

Depressurization must always be performed slowly and in a controlled manner.

7.5 Controlled Depressurization

1. Open the shut-off valve on the pump.
2. Slowly open the pressure relief valve on the pump.
3. Allow pressure to decrease gradually.

Do not release pressure rapidly.

Rapid depressurization may cause:

- Sudden fluid movement
- Shock loading of components
- Instability in the system

7.6 Monitoring During Depressurization

During pressure release:

- Continuously observe the pressure gauge
- Ensure pressure decreases steadily
- Watch for abnormal discharge or leakage

Keep hands and body clear of:

- Pressure relief ports
- Fittings and connections
- Potential discharge paths

7.7 Confirming Zero Pressure

Before proceeding:

1. Verify that the pressure gauge reads **zero**.
2. Allow sufficient time for pressure stabilization.
3. Do not rely on gauge reading alone.

After the gauge reads zero:

4. **Slowly loosen** or open the pressure relief screw on the hatch cover.
5. Confirm that no residual pressure or fluid discharge is present.

Do not proceed unless zero pressure is fully confirmed.

7.8 Removal of Safety Components

Once zero pressure is confirmed:

1. Remove the safety ratchet / limit block.
2. Ensure the chamber remains stable.

Do not remove safety components while pressure is present.

7.9 Opening the Chamber

After complete depressurization:

1. Rotate the hatch cover slowly.
2. Keep hands clear of pinch points.
3. Lift the hatch cover carefully using proper handling technique.
4. Remove the test article from the chamber.

Ensure the test article is safe to handle before removal. Use caution when handling failed or damaged test articles, as pressure-related failure may create sharp edges, cracked surfaces, loose fragments, or other hazards. Wear appropriate protective gloves and do not handle damaged components with bare hands.

7.10 Post-Test Observations

After opening the chamber:

- Inspect the test article for leakage or damage
- Check the chamber interior for signs of leakage or debris
- Inspect seals and fittings for wear or damage

If any abnormal condition is observed:

- Remove the chamber from service
- Investigate and correct the issue before further use

7.11 Important Safety Notes

- Never attempt to open the chamber while pressurized
- Always depressurize slowly
- Always verify zero pressure before opening
- Always assume residual pressure may be present until confirmed otherwise

Failure to follow proper depressurization procedures may result in serious injury or equipment damage.

8. Post-Use Maintenance and Storage

8.1 General Requirements

Proper maintenance after each use is essential to ensure safe operation, long service life, and reliable performance.

All maintenance must be performed **only after the chamber has been fully depressurized and opened safely**.

Failure to properly clean and maintain the chamber may result in:

- Corrosion
- Seal degradation
- Leakage
- Reduced performance
- Unsafe operating conditions

8.2 Draining and Drying

After each test:

1. Ensure the chamber is fully depressurized.
2. Remove the test article.
3. Drain all water from the chamber.
4. Wipe down internal surfaces using a clean, dry cloth.
5. Dry all accessible areas thoroughly, including:
 - Chamber interior
 - Hatch cover
 - Sealing surfaces
 - Ports and threaded openings
6. Ensure no standing water remains in the chamber.

Water left inside the chamber may lead to corrosion or contamination.

8.3 Drying of Bolts and Fasteners

The chamber uses high-strength fasteners that may be susceptible to corrosion if not properly maintained.

After exposure to water:

- Dry all exposed bolts and fasteners thoroughly
- Pay special attention to:
 - Bottom fasteners
 - Handle fasteners
 - Threaded ports

If necessary, apply a light protective coating suitable for exposed metal fasteners, including high-strength steel fasteners. Do not apply coatings to sealing surfaces, O-rings, pressure ports, or areas where contamination could affect sealing or pressure integrity.

8.4 O-Ring and Seal Maintenance

After each use:

1. Inspect all O-rings for:
 - Cuts
 - Cracks
 - Deformation
 - Wear
 - Contamination
2. Clean O-rings with a lint-free cloth if required.
3. Apply a suitable lubricant if needed.
4. Ensure O-rings are properly seated before next use.

Replace O-rings immediately if any damage is detected.

Do not operate the chamber with damaged or worn seals.

We recommend using DuPont **MOLYKOTE® 111 Compound** as the lubricant for the O-rings to help support proper sealing, reduce wear, and maintain watertight integrity.

8.5 Cleaning

Clean all components using appropriate methods:

- Use clean water and a soft cloth for general cleaning
- Do not use:
 - Solvents
 - Alcohol
 - Gasoline
 - Harsh chemicals

These substances may damage seals, surfaces, or components.

8.6 Hydraulic Pump Maintenance

After use:

- Ensure the pump contains clean fresh water
- If contamination is present:
 - Drain and replace the fluid immediately

Inspect the pump for:

- Leakage
- Damage
- Loose fittings

Keep the pump clean and dry when not in use.

8.7 Pressure Gauge Care

After use:

- Turn off the pressure gauge
- Protect it from impact or vibration
- Store in a clean, dry location
- Remove the battery if being stored for extended periods

Do not:

- Expose the gauge to moisture or corrosive environments
- Clean with chemical solvents

Replace the battery as required using the specified battery type.

8.8 Inspection for Damage

After each use, inspect the entire system:

- Chamber body
- Hatch cover
- Sealing surfaces
- Ports and fittings
- Pump and hoses
- Pressure gauge

Remove the equipment from service if any of the following are observed:

- Cracks or deformation
- Persistent leakage
- Damaged threads or fittings
- Corrosion affecting structural components
- Malfunctioning valves or gauge

Do not resume operation until the issue is corrected.

8.9 Storage Conditions

Store the chamber and components under the following conditions:

- Clean and dry environment
- Ambient temperature above freezing
- Protected from moisture and humidity
- Away from corrosive gases or chemicals
- Away from direct heat sources

- Away from vibration or impact

Do not store the chamber with water inside.

8.10 Long-Term Storage

For extended storage:

- Ensure the chamber is fully cleaned and dried
- Leave the hatch loosely closed or protected to prevent contamination
- Store O-rings in a clean and lubricated condition without excessive compression
- Protect exposed metal surfaces as required
- Store pump and gauge separately if needed

8.11 Return to Service

Before returning the chamber to operation after storage:

- Perform a full pre-use inspection
- Verify all components are clean and undamaged
- Confirm proper operation of pump and gauge
- Check all seals and fittings
- Perform a low-pressure test before full operation

8.12 User Responsibility

The user is responsible for maintaining the equipment in safe working condition.

Regular maintenance and inspection are required to ensure:

- Continued safe operation
- Reliable test results
- Compliance with internal and local safety requirements

Failure to maintain the equipment properly may result in unsafe conditions and equipment failure.

9. Pressure Gauge and Pump Operation Details

9.1 General Description

The system includes a manual hydraulic pump and a digital pressure gauge used to generate and monitor pressure within the chamber.

- The hydraulic pump is used to manually increase system pressure using fresh water
- The pressure gauge provides real-time pressure measurement during testing

The pump and gauge must be used together as part of the pressure system and operated in accordance with these instructions.

9.2 Hydraulic Pump Specifications and Limits

- Pressure range: **0–16 MPa**
- Medium: **Fresh water only**
- Connection: Quick coupling
- Operating temperature: Room temperature conditions

Although the pump is capable of generating pressure up to 16 MPa, the chamber must **never exceed 10 MPa**.

9.3 Hydraulic Pump Setup

Before operation:

1. Connect the pressure gauge to the designated gauge port.

2. Connect the high-pressure hose between the pump and the chamber.
3. Ensure all connections are:
 - Fully engaged
 - Secure
 - Free from contamination
4. Open both:
 - Shut-off valve
 - Pressure relief valve
5. Fill the pump reservoir with clean fresh water.
6. Remove air from the pump system:
 - Allow water to flow through the system
 - Ensure no air is trapped in the pump or hose

The pump must not operate with air in the system.

9.4 Hydraulic Pump Operation

To increase pressure:

1. Close the pressure relief valve.
2. Ensure the shut-off valve is open.
3. Begin operating the hand pump slowly.
4. Increase pressure gradually while monitoring the gauge.

During operation:

- Maintain a steady pumping motion
- Do not apply excessive force
- Do not operate the pump aggressively
- Expect increased resistance as pressure approaches 10 MPa

At higher pressures, greater force will be required to operate the pump. This is normal.

9.5 Hydraulic Pump Safety Precautions

- Do not exceed the chamber pressure limit of 10 MPa
- Do not operate with contaminated water
- Do not operate with loose or damaged connections
- Do not apply sudden or forceful movements
- Do not operate the pump if abnormal resistance or malfunction is observed

If contamination is suspected:

- Drain and replace the fluid immediately

9.6 Pressure Gauge Specifications

The supplied pressure gauge is a digital precision instrument.

Typical characteristics include:

- Pressure range: up to 16 MPa
- Accuracy: approximately 0.4% full scale
- Measurement units: MPa, bar, psi, and others
- Battery-powered operation

The gauge is used as both a measurement and monitoring device during testing.

9.7 Pressure Gauge Operation

The digital pressure gauge is used to monitor chamber pressure during filling, pressurization, pressure holding, and depressurization.

Before each use:

- Confirm the pressure gauge is securely installed
- Confirm the display is functioning correctly
- Confirm the gauge reads zero before pressurization

Do not begin pressurization unless the gauge is operating correctly and the display is clearly readable.



Power On / Off

To turn the pressure gauge on or off:

1. Press and hold the **Power** button for approximately 3 seconds.
2. Confirm the display powers on or off correctly.

Unit Selection

The pressure gauge can display pressure in multiple units.

Press the **Unit** button to cycle through the available units:

- kPa
- MPa
- psi
- mmHg
- bar
- kgf/cm²

Use a consistent unit of measurement throughout testing.

For this chamber, the recommended primary unit is **MPa**.

The maximum allowable chamber pressure is **10 MPa**. Do not exceed this pressure regardless of the display unit selected.

Backlight Function

Press the **P/A** button to enable the display backlight when additional visibility is required.

Ensure the display remains clearly visible throughout operation.

Maximum and Minimum Pressure Display

The **Set** button is used to display the maximum and minimum recorded values during the current measurement cycle.

During operation:

1. Press the **Set** button once to display the maximum recorded value. The display will show **"HI"**.

2. Press the **Set** button again to display the minimum recorded value. The display will show “LO”.

Resetting Maximum and Minimum Values

While the maximum or minimum value is being displayed:

1. Press the **Zero** button to reset the displayed maximum or minimum value to zero.

Zero Reset

The **Zero** button is used to reset the gauge reading to zero before pressurization.

Before each test:

1. Confirm the chamber and hydraulic system are fully depressurized.
2. Confirm the gauge is exposed only to atmospheric pressure.
3. If the display does not read zero, press the **Zero** button once to reset the reading.
4. Confirm the display reads zero before pressurization.

Do not press the Zero button during pressurization or while pressure is present in the system.

Resetting the gauge under pressure may result in incorrect pressure readings and unsafe operation.

Important Operating Notes

- Always verify the gauge reads zero before pressurization.
- Always monitor the pressure gauge continuously during operation.
- Do not exceed the chamber maximum allowable pressure of 10 MPa.
- Do not operate the chamber if the gauge display is unstable, unreadable, or malfunctioning.
- Do not rely solely on the maximum/minimum display values during testing. Always observe the live pressure reading.
- Do not expose the pressure gauge to impact, excessive moisture, corrosive liquids, or chemical solvents.

9.8 Pressure Gauge Safety Precautions

- Do not exceed the gauge’s rated range
- Avoid mechanical shock, impact, or dropping
- Do not expose the gauge to moisture or corrosive environments
- Do not disassemble the gauge
- Do not clean using chemical solvents

Improper handling may result in inaccurate readings or device failure.

9.9 Battery Installation and Replacement

The pressure gauge requires a lithium battery. The battery specification is a 3.6V ER14505 Lithium Battery.



When installing or replacing:

1. Carefully rotate and open the gauge housing, then gently lift the housing cover while taking care not to strain, pull, or damage the internal cables.
2. Insert the battery with correct polarity
3. Reassemble the housing securely by rotating it back into place

Use only the specified battery type.

Do not:

- Short-circuit the battery
- Use damaged batteries
- Use any battery type other than a 3.6V ER14505 lithium battery

9.10 Monitoring During Operation

During testing:

- Continuously monitor the pressure gauge
- Ensure readings increase smoothly during pressurization
- Observe for:
 - Sudden pressure drops
 - Unstable readings
 - Erratic behavior

If abnormal readings occur:

- Stop the test immediately
- Depressurize the system
- Inspect the gauge and connections

9.11 Shutdown After Use

After completing testing:

- Turn off the pressure gauge
- Disconnect the pump if required
- Protect all components from damage
- Store the gauge and pump in a clean, dry environment

9.12 Responsibility for Measurement Accuracy

The user is responsible for:

- Verifying gauge functionality before use
- Ensuring accurate readings during testing
- Replacing batteries as required
- Maintaining the gauge in good condition

If accurate pressure measurement is critical:

- Periodic calibration verification is recommended

10. Inspection, Service, and Replacement of Components

10.1 General Requirements

Regular inspection and maintenance are essential to ensure safe operation and long-term reliability of the **Water Pressure Testing Chamber 10MPa/20L (Stainless Steel)**.

All inspection and service activities must be performed **only when the system is fully depressurized**.

Do not attempt any inspection, repair, or replacement while the chamber is pressurized.

10.2 Inspection Frequency

The following inspection schedule is recommended:

Before each use:

- Perform full pre-use inspection (Section 5)

After each use:

- Clean, dry, and visually inspect all components

Periodic inspection (based on usage):

- Weekly or every defined number of test cycles:
 - Inspect seals and O-rings
 - Inspect fittings and ports
 - Inspect pump and hoses

Annual or site-defined interval:

- Verify pressure gauge performance
- Perform full system inspection
- Review maintenance records

The user must adjust inspection frequency based on usage intensity and site requirements.

10.3 Components Requiring Regular Inspection

Inspect the following components regularly:

- Chamber body and pressure vessel
- Hatch cover and locking mechanism
- Sealing surfaces
- O-rings
- Threaded ports and plugs
- Pressure relief screw
- Hydraulic pump
- High-pressure hose
- Quick couplings and fittings
- Pressure gauge

10.4 O-Ring and Seal Replacement

O-rings are consumable components and must be replaced as needed.

Replace O-rings if any of the following are observed:

- Cuts or cracks
- Flattening or permanent deformation
- Swelling or chemical degradation
- Surface damage or contamination
- Leakage during operation

Replacement procedure:

1. Ensure the chamber is fully depressurized and open.
2. Remove the existing O-ring carefully.
3. Clean the O-ring groove and sealing surface.
4. Install a new O-ring of the correct size and material.
5. Apply a suitable lubricant if required.
6. Ensure proper seating before reassembly.

Only use compatible replacement O-rings.

We recommend using DuPont **MOLYKOTE® 111 Compound** as the lubricant for the O-rings to help support proper sealing, reduce wear, and maintain watertight integrity.

10.5 Inspection of Sealing Surfaces

Sealing surfaces must remain smooth and free of defects.

Inspect for:

- Scratches
- Corrosion
- Debris or contamination
- Surface irregularities

Do not operate if sealing surfaces are damaged.

Minor contamination must be cleaned before use.

10.6 Threaded Ports and Fittings

Inspect all threaded components:

- Check for thread damage or wear
- Ensure fittings can be installed smoothly
- Confirm O-rings are present and properly seated

Damaged threads may cause leakage or failure under pressure.

Replace or repair damaged components before use.

10.7 Hydraulic Pump and Hose

Inspect the hydraulic system for:

- Hose wear, cracks, or deformation
- Leakage at fittings or connections
- Loose or damaged couplings
- Smooth operation of valves

Do not use the system if:

- Hose damage is present
- Connections are not secure
- Valves do not operate correctly

Replace damaged hoses or fittings immediately.

10.8 Pressure Relief Components

Inspect pressure relief components:

- Pressure relief valve
- Pressure relief screw

Ensure:

- Smooth operation
- No blockage or obstruction
- Proper sealing when closed

Do not operate if relief components are not functioning correctly.

10.9 Pressure Gauge Inspection

Regularly verify:

- Gauge powers on correctly
- Display is clear and readable

- Reading returns to zero when not pressurized

If the gauge shows:

- Erratic readings
- Inability to zero
- Physical damage

Remove from service and replace or verify calibration.

10.10 Fasteners and Structural Components

Inspect all accessible fasteners:

- Check for looseness
- Check for corrosion
- Check for damage

Pay particular attention to:

- Handle fasteners
- External structural bolts

Tighten or replace as required.

10.11 Corrosion Monitoring

Corrosion may occur if components are not properly maintained.

Inspect for:

- Rust on bolts or fasteners
- Surface corrosion on metal components
- Degradation of sealing surfaces

If corrosion is detected:

- Clean affected areas
- Replace affected components if necessary

Prevent corrosion by drying all components after use.

10.12 Criteria for Removal from Service

Immediately remove the chamber from service if any of the following are observed:

- Structural deformation of the chamber
- Cracks or damage to pressure-containing components
- Persistent leakage
- Damaged or non-functional sealing surfaces
- Failure of pressure relief components
- Damaged or unreliable pressure gauge
- Significant corrosion affecting structural integrity

Do not return the chamber to service until the issue has been fully corrected.

10.13 Replacement Parts

Use only compatible replacement components.

Replacement parts must match the original component requirements, including:

- Size
- Material
- Pressure rating
- Function

For replacement parts, contact Blu-Sub directly. Depending on availability, Blu-Sub may provide replacement parts directly, prepare a quotation, or refer the user to a suitable local distributor. Improper replacement parts may compromise safety, sealing performance, pressure integrity, and overall equipment reliability.

10.14 Unauthorized Repair and Modification

Do not:

- Modify the chamber
- Alter pressure components
- Replace parts with non-compatible components
- Disassemble pressure-containing structures

Unauthorized modifications may result in unsafe conditions and loss of pressure integrity.

10.15 Record Keeping

The user should maintain records of:

- Inspection dates
- Maintenance performed
- Component replacements
- Observed issues
- Test history

Maintaining accurate records supports safe operation and long-term reliability.

11. Troubleshooting and Fault Conditions

11.1 General Requirements

If any abnormal condition occurs during setup, pressurization, pressure holding, or depressurization:

- Stop operation immediately
- Do not continue pressurization
- Do not attempt repairs while the system is pressurized
- Depressurize the system safely before inspection

The chamber must not be returned to service until the issue has been identified and corrected.

11.2 Chamber Will Not Build Pressure

Possible causes:

- One or more ports are not sealed
- Missing or damaged O-rings
- Pressure relief valve is open
- Pressure relief screw is not installed or not tightened
- Leakage at fittings or penetrators
- Air present in the system
- Insufficient water in the pump reservoir

Corrective actions:

1. Stop pumping and inspect all ports and fittings.
2. Confirm all penetrators and plugs are installed and sealed.
3. Check that all O-rings are present, undamaged, and properly seated.
4. Ensure the pressure relief valve is fully closed.
5. Verify the pressure relief screw is properly installed.

6. Refill the pump reservoir with clean fresh water.
7. Remove air from the system and repeat the filling and venting process.

11.3 Pressure Builds Slowly or Cannot Reach Target

Possible causes:

- Small leak in system
- Air trapped in chamber or pump
- Pump not fully primed
- Insufficient water supply in pump
- Improper valve configuration

Corrective actions:

1. Inspect for visible leaks at all connections.
2. Re-vent the system to remove trapped air.
3. Ensure the pump reservoir is filled.
4. Verify correct valve positions.
5. Check that all connections are tight and properly installed.

11.4 Pressure Drops During Holding Period

Possible causes:

- Minor temperature-related pressure variation (normal)
- Small leakage at seals or fittings
- Leakage from test article
- Incomplete sealing of ports

Corrective actions:

1. Observe whether pressure drop stabilizes.
2. Inspect for visible leakage.
3. Verify sealing surfaces and O-rings.
4. Confirm all ports are properly sealed.
5. Check the test article for leakage.

If leakage is confirmed:

- Stop the test
- Depressurize safely
- Correct the issue before retesting

11.5 Visible Leakage During Operation

Possible causes:

- Damaged O-ring
- Contaminated sealing surface
- Loose fitting or penetrator
- Damaged thread or port
- Seal misalignment

Corrective actions:

1. Stop pressurization immediately.
2. Depressurize the system slowly.
3. Identify the source of leakage.
4. Replace or repair the affected component.
5. Clean sealing surfaces before reassembly.

Do not continue operation if leakage is present.

11.6 Pump Difficult to Operate

Possible causes:

- High pressure approaching system limit
- Valve configuration incorrect
- Mechanical issue with pump
- Air in the system

Corrective actions:

1. Confirm system pressure is within normal range.
2. Check valve positions.
3. Ensure pump is filled with water.
4. Remove air from the system.

Increased resistance near maximum pressure is normal.

Excessive or abnormal resistance is not.

11.7 Pump Cannot Generate Pressure

Possible causes:

- Air in pump or system
- Low fluid level in reservoir
- Pressure relief valve open
- Leakage in system
- Faulty pump components

Corrective actions:

1. Refill pump with clean fresh water.
2. Remove air from pump and system.
3. Confirm pressure relief valve is closed.
4. Inspect for leaks.
5. Verify all connections are secure.

11.8 Pressure Gauge Malfunction

Possible causes:

- Battery depleted
- Gauge not powered on
- Electrical or internal fault
- Mechanical damage

Symptoms:

- No display
- Unstable or erratic readings
- Incorrect zero reading

Corrective actions:

1. Replace or install battery.
2. Restart the gauge.
3. Reset to zero (only when depressurized).
4. Inspect for physical damage.

Remove the gauge from service if malfunction persists.

11.9 Pressure Does Not Return to Zero

Possible causes:

- Residual pressure in system
- Blocked or restricted relief path
- Faulty pressure gauge

Corrective actions:

1. Open pressure relief valve slowly.
2. Open pressure relief screw on hatch cover.
3. Allow additional time for pressure stabilization.
4. Verify that no pressure remains before opening.

Never assume zero pressure without confirmation.

11.10 Hatch Cannot Be Opened

Possible causes:

- Residual pressure still present
- Safety ratchet / limit block still installed
- Mechanical misalignment

Corrective actions:

1. Confirm pressure gauge reads zero.
2. Open pressure relief screw to verify no pressure remains.
3. Remove safety ratchet / limit block.
4. Attempt to rotate hatch slowly.

Do not force the hatch.

If resistance is present, assume pressure may still be trapped.

11.11 Excessive Corrosion or Rust

Possible causes:

- Inadequate drying after use
- Exposure to moisture or humidity
- Use of non-fresh water

Corrective actions:

1. Clean and dry all affected areas.
2. Replace heavily corroded components.
3. Improve drying and storage procedures.

Prevent recurrence by following post-use maintenance procedures.

11.12 Abnormal Noise or Vibration

Possible causes:

- Structural stress
- Loose components
- Internal failure
- Test article failure

Corrective actions:

1. Stop operation immediately.
2. Depressurize the system safely.
3. Inspect all components thoroughly.

Do not resume operation until the cause is identified.

11.13 Deformation of Chamber or Hatch

Possible causes:

- Overpressure
- Material failure
- Structural damage

Corrective actions:

1. Stop operation immediately.
2. Depressurize the system.
3. Remove the unit from service.

Do not reuse the chamber if deformation is observed.

11.14 Test Article Failure

Possible causes:

- Exceeding test article pressure rating
- Defective test item
- Improper setup

Corrective actions:

1. Stop the test immediately.
2. Depressurize safely.
3. Remove and inspect the test article.

Verify test article suitability before retesting.

11.15 When to Remove Equipment from Service

Remove the chamber from service if:

- Structural damage is present
- Persistent leakage cannot be resolved
- Pressure cannot be controlled reliably
- Gauge or pump is malfunctioning
- Safety components are not functioning

The chamber must not be used until all issues are resolved.

12. Product Identification, Compliance, and Documentation

12.1 Product Identification

Each Water Pressure Testing Chamber 10MPa/20L (Stainless Steel) must be identifiable by a unique product and traceability record.

The following information shall be provided on the unit, packaging, or accompanying documentation:

- Product name
- Serial number
- Maximum allowable pressure
- Fabrication date
- Manufacturer / supplier: Blu-Sub Mechatronics
- Contact: contact@blu-sub.com

The serial number must be retained for all service, inspection, and documentation records.

12.2 Regulatory Classification (EU – Sound Engineering Practice)

This equipment is supplied as pressure equipment designed and manufactured in accordance with Sound Engineering Practice (SEP) under Article 4(3) of Directive 2014/68/EU (Pressure Equipment Directive – PED).

- The equipment is not CE marked under PED
- A PED EU Declaration of Conformity is not applicable
- The equipment must not be treated as PED CE-certified equipment

This classification applies because the chamber:

- Uses water as the pressure medium (Group 2 fluid)
- Has a maximum allowable pressure of 100 bar
- Has a volume of 20 L

Equipment meeting these conditions falls within Article 4(3) and must be manufactured according to sound engineering practice rather than a formal PED conformity assessment route.

12.3 Instructions for Use Requirement

In accordance with applicable requirements, this equipment is supplied with:

- Operating instructions including safety information and maintenance guidance

These instructions must:

- Be retained by the user
- Be made available to all operators
- Be followed during installation, operation, and maintenance

For use within the European Union, instructions and safety information must be available in a language easily understood by the end user in the country of use. Please contact Blu-Sub if translated documentation is required.

12.4 End-User Regulatory Responsibility

Regulatory requirements for pressure equipment vary by:

- Country
- State or province
- Local jurisdiction
- Facility-specific safety policies

The end user is responsible for:

- Confirming applicable regulations in the region of use
- Determining whether registration or inspection is required
- Ensuring compliance with workplace safety requirements
- Implementing any required inspection or certification programs

The manufacturer does not pre-register or certify the equipment for all jurisdictions.

12.5 Supplied Documentation

The following documentation is supplied with the unit:

- Instructions for Use and Safety Manual, including safety information, operating instructions, maintenance guidance, and user responsibilities.
- Product identification and serial number traceability information marked on the unit or supplied with the unit

Additional documentation may be available upon request.

12.6 Technical Documentation (Manufacturer Retained)

Technical documentation supporting the design and safe operation of the equipment is maintained by the manufacturer and may include:

- Design and pressure data

- Material specifications
- Engineering calculations
- Drawings and dimensions
- Factory pressure test records
- Inspection and verification data

This documentation is retained for traceability and may be provided to authorities upon request, where required.

12.7 Traceability and Record Keeping

The user should maintain records associated with the specific unit, including:

- Serial number
- Date of receipt
- Installation location
- Inspection and maintenance records
- Test history
- Observed issues and corrective actions

Traceability supports safe operation, maintenance planning, and regulatory compliance.

12.8 Product Modifications

The equipment must not be modified.

Do not:

- Alter pressure-containing components
- Modify ports or fittings
- Replace components with non-compatible parts
- Change operating limits

Unauthorized modification may:

- Compromise structural integrity
- Create unsafe operating conditions
- Invalidate supporting documentation

12.9 Liability and Safe Use

Safe operation of this equipment depends on:

- Proper installation
- Correct use
- Regular inspection and maintenance
- Operator training

The user is responsible for ensuring the equipment is used safely and within its specified limits.

Failure to follow these instructions may result in equipment damage, property damage, or personal injury.

12.10 Final Note

This manual forms an integral part of the product and must remain with the equipment throughout its service life.

13. Manufacturer Contact Information

For technical support, service inquiries, or replacement parts, please contact:

Blu-Sub Mechatronics

BluSphere Innovations Inc.
2186 Mountain Grove Avenue
Suite 252
Burlington, Ontario, L7P 4X4
Canada

Email: contact@blu-sub.com

Website: www.blu-sub.com

When contacting support, please provide:

- Product name
- Serial number
- Description of the issue
- Photos or videos (if applicable)

14. Final Safety and Responsibility Statement

This equipment is intended for professional use only and must be operated by trained personnel familiar with hydraulic pressure systems.

The user is solely responsible for:

- Ensuring safe operation of the equipment
- Verifying suitability of the test article
- Operating within specified pressure and temperature limits
- Following all instructions provided in this manual
- Complying with all applicable local safety and regulatory requirements

Failure to follow these instructions may result in:

- Equipment damage
- Property damage
- Serious personal injury

The manufacturer assumes no responsibility for damage or injury resulting from:

- Improper use
- Unauthorized modification
- Failure to follow operating instructions
- Use outside specified limits

This manual must be retained with the equipment and made available to all operators.