STANDARD OPERATING PROCEDURE (SOP)

HYDRO TEST SAFETY

Prepared by	Reviewed and verified by	Authorized by
M/s Chola MS Risk Services (Bhanodaya.V) 09/02/2023	Arbind Sharma (Project Head - Infrastructure) Jose Numpeli (Project Head - Downstream) 14/02/2023 Samar Suri (Project Head - Upstream)	Santhosh Mundhada (Executive Director) 13-02-2023

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1 PURPOSE

The purpose of this procedure is to define pressure testing requirements of pressure vessel, pipes to ensure hydro test is conducted in a safe and efficient manner.

The hydro test is carried out:

- Identify the leaks.
- To check the strength of the welded joint.
- To check the capacity/strength of the system.

2 SCOPE

This procedure shall apply to all AMNS project sites and related work areas including contractors to meet –

- Legal and regulatory requirements
- AMNS HSE requirements
- ISO 45001 and ISO 14001 standard requirements
- AMNS HSE Policy

3 DEFINITIONS AND ABBREVIATIONS

3.1 DEFINITIONS

Hydro test
Hydrostatic testing is defined as the application of internal pressure above the normal or maximum operating pressure to a segment of piping or pressure containing component. This pressure is applied for a fixed period of time, utilizing a liquid test medium.

Authorized Inspector
An employee of AMNS / authorized agency, who is qualified and/or certified to perform piping and pressure vessel inspections.

Calculated Test Pressure
The test pressure determined for the hydro test.

Maximum Test Pressure
The highest allowable test pressure gauge reading. (The pressure test rating of the weakest component in the test system.)

Minimum Test Pressure
The lowest allowable test pressure gage reading. (The calculated test pressure excluding the additional pressure resulting from the static head of the test fluid.)

System Test
A test that includes multiple sections of piping, having the same or different design pressures, but are tested together at one time using a single test procedure and pressure.

Test Temperature
The minimum temperature occurring during the test period of the metal temperature of the piping being tested (including any vessels or equipment included in the test).

3.2 ABBREVIATIONS:

PTW	:	Permit to Work
JSA	:	Job Safety Analysis
ELCB	:	Earth Leakage Circuit Breaker
MSDS	:	Material Safety Data Sheet
HSE	:	Health, Safety & Environment
QA/QC	:	Quality Assurance / Quality Control
HIRAC	:	Hazard Identification, Risk Assessment and Control

4 RESPONSIBILITIES

Project Head

Shall be responsible for overall implementation of the work procedure, coordination with parties involved in the lay-up activities. The Project Head shall ensure that specified preparatory works and associated documentation are prepared in accordance with this procedure.

Authorized Inspector

Responsible for witnessing/approval of the activity, to ensure that the in-site Layup of piping/equipment is performed and developed in an orderly controlled manner in compliance with the AMNS Standards, Project Specifications and applicable inspection and test plan.

Authorized Inspector shall be responsible to coordinate the communication way for the lay-up activities between CONTRACTOR and COMPANY.

Is responsible for monitoring the compliance of the lay-up.

Construction Manager

Shall be responsible for executing the work in strict compliance of this procedure, following and controlling the safety procedure during the lay-up activities. Secure all necessary work permits prior to carry out the activity.

Is responsible for ensuring that system Lay-up is maintained.

HSE Manager

Is responsible for ensuring that only trained and authorized personnel are involved in Hydro test activity.

Is responsible to ensure that all precautions are in place before the start of the activity.

5 HYDROTEST ACTIVITY - SAFETY ASSURANCE PROCESS

5.1 HAZARDS DURING HYDRO TEST

The potential hazards associated with Hydro test are:

- Breaking/failure of line, gasket, flanges, and gauges.
- Air entrapment inside the pipe.
- Usage of an engine operated pump.
- Inadvertently/suddenly increase of pressure due to underrated or non-calibrated pressure gauges.
- Substandard support.
- Pressure Safety Valve failure.

5.2 PREPARATION FOR TEST

- Ensure that the item is ready for pressure test and all examination and inspection activities required to be completed prior to pressure tests have been satisfactorily completed.
- Ensure that all applicable non-conformities have been satisfactorily resolved and closed
- Ensure that the item under test contains no foreign objects and is properly supported for the test
- Prepare and close the openings using suitable closure capable of withstanding the test pressure except fort the upper most nozzle, which shall be closed only after it is ensured that the vessel is fully filled with the test medium. Install suitable pressure gauge, vent, drain and pressurizing connections.

5.3 TEST MEDIUM AND FILLING

- Care shall be taken to insure the use of clean water for hydrostatic tests. And the sea water is prohibited to be used.
- A suitable filter should be provided in the filling line to the systems in order to remove foreign matter such as sand, rust or other particles in the proposed test water.
- Hydrostatic testing shall be performed using clam potable water with a chloride content of max 50 ppm for austenitic steels. In case this requirement can't be fulfilled the pipeline shall be reamed completely and flushed with water fulfilling the above requirement of 50 ppm max of chlorides.
- During filling, vent all high points to ensure that item under test is completely filled with test medium and to purge possible air pockets
- All low pressure filling lines shall be disconnected or isolated by valves or other suitable means after filling and venting is completed.

5.4 TEST GAUGES AND RECORDERS

LOCATION

A minimum of two nos. calibrated pressure gauges with proper assembly valves shall be attached to the item under test such that the gauges are clearly visible to the operator who is pressurizing the system. Atleast one gauge will be mounted close to the highest point on the item

RANGE

The range of pressure guages shall be about double the intended test pressure but in no case its range be less than 1.5 or more than 4 times the intend test pressure.

GUAGE CALIBERATION

All test guages used shall be claiberated and having a valid caliberation certificate

Validity of calibration shall be verified on the calibration sticker pasted on the pressure indicators

5.5 TEST TEMPERATURE

- It is recommended that the metal temperature during the test be maintained at least 17 degree centigrade above the minimum design metal temperature to minimize the risk of brittle fracture. The permissible test temperature will be specified on the drawing
- If the metal temperature during test exceeds 50 degree Centigrade, it is recommended that close examination of the item under test be delayed untill the temperature is reduced to 50 degree Centigrade or less.

5.6 TEST PRESSURE

- The test pressure shall be based on the applicable requirements of the code and shall be specified on the drawing.
- Direct sunlight on an equipment can cause an increase in temperature resulting in an increase of pressure during the holding time. If this condition exists, pressure is to be monitored and vented as necessary.

5.7 APPLICATION OF TEST PRESSURE, HOLDING TIME AND EXAMINATION

- The pressure shall be gradually increased until the required pressure has been reached. Once the pressure has been achieved and stabilized (for about 10 minutes), the pressurizing system must be isolated from the pressure source.
- If leaks are observed, the system is De-pressurized and the leaking points are attended suitably (by tightening or by replacing gaskets if necessary).

- After checking that, there is no leak, the pressure is gradually increased to the test pressure. The authorized inspector shall record the start time of the test after reaching the test pressure.
- The test pressure shall be held for specified minimum holding time. If holding period is not specified, the pressure shall be maintained for 60 minute minimum.
- After the holding time is elapsed, the pressure is reduced (by bleeding the test system) to the inspection test pressure. At this point, the authorized Inspector shall visually inspect the vessel to detect leaks. All weld joint and connections shall be checked visually.
- If leaks are detected at flange joints the pressure shall be reduced to zero, the concerned flanges tightened and retested.
- If leaks are detected at weld, the test item is considered to have failed in the test NCR shall be raise & disposition shall be undertaken.
- If the test is satisfactory, the authorized Inspector shall approved it by endorsing the test report with attachments like chart, calibration certificates of pressure gauge etc.
- Upon completion of the test, the pressure shall be gradually reduced to zero before openings the drains.
- The test fluid shall be drained off from the test system and the system shall be cleaned and isolated.

5.8 ACCEPTANCE CRITERIA

The pressure test shall be considered as acceptable when there is no evidence of leakage and there is no visible deformation on any component.

5.9 PRE- ACTIVITY SAFETY CHECKS

- Engage trained and authorized personnel only to conduct Hydro test
- Approved Permit to Work (PTW) shall be taken with authorized person and made available at site.
- Remove all unwanted material from Hydro test job including Oil, Grease, cables etc.
- Ensure all arrangement & document has been made as per approved drawing
- Entire hydro test area shall be barricaded and provide warning boards to prevent personnel entry.
- Calibrated pressure gauges and Pressure safety valves only shall be used.
- Communication System like Walkie – Talkie made available (if required)
- Ensure proper arrangement to drain out hydro test medium from shop in case of leakage.
- Rating of fittings, pressure gauges, vent valves, gaskets shall be suitable for the test pressure.

- All the temporary welding shall be performed by qualified welders and approved by AMNS QA/QC team.
- Ensure air vent provided at the highest elevation.
- Gradual filling of lines shall be done keeping vent to open.
- Ensure that the line is vented to remove air pockets before pressurization.
- Pressure should be raised gradually under control to allow time for pipes to strain and time for personnel to check for leaks.
- There shall be at least two pressure gauges, one at lowest point and another at the highest point in the system
- Hydro testing crew should not stay in the direction of the blind flanges to prevent injury in case of flange rapture.
- All hoses/ piping/gaskets and connectors/clamps shall be of adequate rating to withstand pressure.
- Whip lash arrestor shall be provided at hose connection.
- Personnel shall not approach the system under high Pressure.
- Only essential and trained persons shall be allowed at the Hydro test work location
- Access shall be free from any obstacle.
- Job Safety Analysis shall be done for any hydro test job

5.10 AFTER ACTIVITY SAFETY CHECKS

- Ensure Pressure Gauge reading should be Zero.
- Water should be properly drained and vessel should be empty.
- Slippery surface should be cleared.
- Make visual check before leaving the Hydro test Area

5.11 MINIMUM PPE REQUIREMENT

Head Protection	Helmet with chin strap	**Hand Protection**	Gloves
Eye protection	Safety glasses	**Foot Protection**	Safety shoes
Additional PPE shall be used as per Job Safety Analysis			

6 CHECKING, CORRECTIVE AND PREVENTIVE ACTION

Hydro test activity shall be inspected by authorized inspector as per drawing and Inspection Checklist

In case of abnormal condition observed, immediately corrective and preventive action to be taken by Project Head.

7 TRAINING

All the personnel involved in the hydro test shall be trained on the procedure.

Tool Box Talk shall conduct those are involved in Hydro test activity before start & record should be maintained.

8 RECORDS

S. No.	Title	Location	Retention period
1	Hydro test procedure training	HSE Department	Until completion of Project

9 REFERENCE DOCUMENTS

S. No.	Format No.	Standard Name
1	AMNS/Project/SS/HSEM/05	TRAINING, AWARENESS AND COMPETENCE
2	AMNS/Project/SS/HSEM/08	HIRAC
3	AMNS/Project/SS/HSEM/10	Permit to Work (PTW)
4	AMNS/Project/SS/HSEM/15	ENVIRONMENTAL MANAGEMENT
5	AMNS/Project/SOP/HSEM/11	WASTE MANAGEMENT PLAN