



Table of Contents

1.0 TESTING, ADJUSTING, BALANCING AND COMMISSIONING REQUIREMENTS.....	3
1.1 GENERAL.....	3
1.2 INSPECTION AND TESTING PLAN (ITP).....	4
1.2.1 Pre Delivery Stage.....	5
1.2.2 Delivery Stage.....	6
1.2.3 Installation Stage.....	7
1.2.3.1 Visual Inspection.....	7
1.2.3.2 Testing	8
1.3 COMMISSIONING.....	9
1.3.1 Handing Over Documents.....	9
1.3.2 System Familiarization Program	9
2.0 TESTING INSTRUMENTS AND ACCESSORIES.....	10



List of Table

<i>Table 1 : Sample of Inspection and Testing Plan</i>	<i>5</i>
<i>Table 2: Verify and Inspection.....</i>	<i>6</i>
<i>Table 3: Visual Inspection of Dry Riser System.....</i>	<i>7</i>
<i>Table 4: Test List in Installation Stage.....</i>	<i>8</i>
<i>Table 5: Testing Instruments.....</i>	<i>10</i>



1.0 TESTING, ADJUSTING, BALANCING AND COMMISSIONING REQUIREMENTS

1.1 GENERAL

This section specifies the requirements for all testing, adjusting, balancing and commissioning (TABC) of mechanical works to be carried out under the contract. The objectives of TABC are;

- i. To verify the delivered materials are as per approved specification and good physical condition.
- ii. To verify the installation works are carried out in accordance to specification and good engineering practises.
- iii. To verify the performance in terms of functionality, safety, maintainability and operational ability of the installed equipment/systems meet the specified design intention through a series of tests and adjustments.
- iv. To ensure all test results are systematically recorded and verified prior to system commissioning.

TABC works are divided into four stages as the following;

- i. Pre Delivery stage.
- ii. Delivery stage.
- iii. Installation stage.
- iv. Functional Performance Test stage.

Contractor shall submit Inspection and Testing Plan (ITP) of TABC works to be carried out in accordance to this specification to superintendent Officer (S.O) for review and approval.



1.2 INSPECTION AND TESTING PLAN (ITP)

ITP shall consist of;

i. List of all TABC Requirement

All TABC works with specific scope and boundaries shall be clearly stated at every stage of TABC works and comply with the regulation of Jabatan Bomba dan Penyelamat Malaysia and document contract. Sample of Inspection and Testing Plan as per Table1.

ii. TABC Work Schedules

TABC work schedules shall be integrated into main project schedules.

iii. Method Statements

TABC method statements shall consists of TABC procedures, responsibility, necessary tools, measuring equipment and accuracy, consumables and acceptance criteria. Type of test required is listed in Schedule of Inspection and Testing.

Method statements and acceptance criteria for all equipment installation stage inspection and functional performance testing shall be endorsed by manufacturer or manufacturer's valid representative.

Acceptance criteria shall be stated as per Schedule of Design Requirements, technical specification or any applicable standards.

ITP shall be updated for any changes and resubmitted to S.O/S.O's representative for approval.

Prior to the commencement of the TABC works as per approved ITP, contractor shall issue Request for Inspection and Testing (RFIT) to the S.O. During the TABC, contractor shall have his supervising foreman and mechanics available to aid in testing and to perform any adjustments as directed. The TABC works shall be carried out under the direction of experienced personnel and witnessed by S.O or S.O's representatives. No subsequent installation works shall proceed without S.O approval of the test result.

Depending on the specific demands of individual installation, S.O's Representative may require additional or substitute testing works in regard to any elements in the installation other than those indicated in this specification

**Table 1 : Sample of Inspection and Testing Plan**

Stage	Inspection and Test Name	Scope and Boundaries	Responsibility	Method Statement	Test Form No	Expected Date
Delivery Stage	Visual Inspection	Pipe, landing valve, breaching inlet, cradle hose.	Contractor	MS-ITP-01	TF-01	17-Mar
	Measurement		Contractor	MS-ITP-02	TF-02	17-Mar
	Documentation (DO, QA etc.)		Contractor	MS-ITP-03	TF-03	17-Mar
Installation Stage	Leak Test	Pipe and fittings	Contractor	MS-ITP-04	TF-04	17-Jun

1.2.1 Pre Delivery Stage

Pre-delivery inspection and performance test shall be conducted if stated in the Schedule of Inspection and Testing requirements. These tests may be witnessed by the government's representative if deemed necessary by the S.O. All travelling, food and accommodation cost of government representatives related to witnessed performance test shall be borne separately by the government.

A factory test is understood to mean testing at a dedicated test facility, often at manufacturer's plant or at an independent and accredited test facility and to be agreed by the S.O.

Performance test method statement, test standard and acceptance criteria shall be submitted to S.O for approval prior to such testing. The manufacturer shall conduct the test, passes judgement of acceptance and produces a signed test report. All test report shall be submitted to S.O for approval. Manufacturer shall be responsible for any reworks and adjustment of the equipment if the test results fail to adhere to the agreed acceptance criteria.



1.2.2 Delivery Stage

All incoming material and equipment to site shall be verify by visual inspection, documentation and measurement that delivered items are comply with technical specification, as per approved materials and good physical conditions. Materials delivered to site shall be free from defects and adequately protected against site conditions.

List of verify and inspection during delivery stage as per Table 2:-

Table 2: Verify and Inspection

Verify and Inspection	Description
Visual/Defect	<ul style="list-style-type: none">• Good physical conditions• Free from defects• Adequately protected
Documentation	<ul style="list-style-type: none">• Delivery Order• Quality Assurance• Technical Data
Measurement	<ul style="list-style-type: none">• Size and dimension• Orientation of equipment and Plant Layout



1.2.3 Installation Stage

1.2.3.1 Visual Inspection

List of visual inspection and testing during installation as per Table 3;

Table 3: Visual Inspection of Dry Riser System

Inspection / Test Name	System/Component	Objectives
Visual Inspection	Piping	Verify types of pipe, protection and colour coding. Verify the length of pipework between alarm valve and water alarm gong
	Automatic Air Release Valve (AARV) test	Verify no air pocket in the pipe line
	Incoming Pipe	Verify inhibitors
	Hanger and Supports	Verify hanger and supports as per drawing and technical specification
	Pipe Sleeves	Verify all the pipe sleeves with the right size.
	Fire Seal	Verify seal thru any floor, wall or partitions using non-combustible or fire resistant sealant material
	Breeching Inlet	Verify the types of breeching inlet
	Landing Valve, Spacing of Dry Riser Hose Cradle	Verify working space to swing the cradle, physical condition of hose cradle and landing valve



1.2.3.2 Testing

List of inspection and testing works during installation as per Table 4;

Table 4: Test List in Installation Stage

Inspection / Test Name	System/Component	Objectives
Hydrostatic Pressure Test	Piping	Verify integrity of all Automatic Air Release Valve (AARV), pipe joints and fittings.
Pipe Flushing and Leak Test	Piping	Verify integrity of all pipes, joints and fittings, pipe internally clean and water quality are acceptable

a. Hydrostatic Pressure Test

All pipes, valves, fittings, etc. shall be tested to operation of 14 bar or 1.5 times the working pressure whichever is higher for period of 48 hours. All tests shall be done in accordance to ASME B31.9.

During the pressure test, all welding joints, bends, fitting, Automatic Air Release Valve (AARV) and valves shall be visual checked for any leaks or deformations for the entire piping system.

Pressure drop allowable not more than 5% from the tested value for the period of testing.

b. Pipe Flushing and Leak Test

All pipes shall be flushed before pressure test. Flushing will be done by a fresh potable water or dry compressed air wherever water flushing is not desirable to clean the pipe of all dirt, debris or loose foreign materials. No leakage of any kind will be permissible during testing. Flushing will be continued till the inside of the pipe is fully cleaned to the satisfaction of the S.O. Test reports shall be submitted to S.O after completion of flushing procedures. As a minimum, the test records shall contain detail of testing and the results.



1.3 COMMISSIONING

Commissioning includes achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria.

All completed test forms and test summary shall be submitted to S.O/S.O's representative for final review and approval. Having satisfied that all appropriate tests have been conducted and the performance of the installation meet the design objectives; S.O's representative will issue or recommends to the S.O for the issuance of Certificate of Practical Completion (CPC)..

1.3.1 Handing Over Documents

After issuance of Certificate of Practical Completion, contractor shall submit all related project handing over documents as the following;

- a) Test Report complete with fully verified Inspection checklist and Test Forms.
- b) Defects List
- c) Operation and Maintenance Manual which includes
 - *Manual/Standard Operating Procedures*
 - *Preventive Maintenance Schedule and Manual*
 - *Equipment/Product Engineering Data.*
 - *Contractor and manufacturer contact details*
 - *Inventory List*
- d) As-Built drawings
- e) Schedule of System Familiarization Program to end users.

1.3.2 System Familiarization Program

In-class and practical System Familiarization Program shall be conducted to the personnel nominated by S.O within one (1) month of issuance of Certificate of Practical Completion. Program shall focus on:

- Overview of design concept and objectives
- Operation instruction & competency requirement
- Maintenance procedures
- Critical operating parameters monitoring
- Emergency response & safety procedures and
- Jabatan Bomba dan Penyelamat Malaysia requirement and procedures.

Contractor shall submit program modules and materials to S.O for approval prior to commencement of training. Particulars of trainee shall be recorded and send to S.O for records.



2.0 TESTING INSTRUMENTS AND ACCESSORIES

All gauges use for measurement of pressure and flow shall be factory calibrated and all calibration certificates shall be submitted to S.O prior to testing works.

The contractor shall provide all necessary testing, calibrating instruments and labour required for the testing, adjusting, balancing and commissioning of the complete fire fighting system installed under the contract.

The contractor shall also allow for any necessary replacement of parts in order to achieve the conditions specified in the drawings and specification.

Testing equipment specification shall be as per Table 5.

Table 5: Testing Instruments

Measurement	Type	Accuracy
Pressure Gauge	Heavy duty shock proof	± 0.05 of reading 15