TESTING AND COMMISSIONING PROCEDURE

FOR

PLUMBING INSTALLATION

IN

GOVERNMENT BUILDINGS

OF

THE HONG KONG SPECIAL ADMINISTRATIVE REGION

2022 EDITION

ARCHITECTURAL SERVICES DEPARTMENT
THE GOVERNMENT OF THE HONG KONG SPECIAL ADMINISTRATIVE REGION

PREFACE

This Testing and Commissioning (T&C) Procedure aims to lay down the minimum testing and commissioning requirements to be carried out on Plumbing Installation in Government Buildings of the Hong Kong Special Administrative Region (HKSAR). Such requirements are applicable to both new installations upon completion and existing ones after major alteration.

The present edition was developed from the General Specification for Building Services Installation in Government Buildings of the Hong Kong Special Administrative Region 2022 Edition that was established by the Architectural Services Department (ArchSD).

Electronic version of this T&C Procedure is to be viewed on and free for download from the ArchSD Internet homepage. As part of the Government's efforts to limit paper consumption, hard copies will not be put up for sale.

The ArchSD welcomes comments on this T&C Procedure at any time since the updating of this T&C Procedure is a continuous process to tie in with technological advances.

DISCLAIMER

This T&C Procedure is solely compiled for Plumbing Installation carried out for or on behalf of the ArchSD in Government premises of the HKSAR.

There are no representations, either expressed or implied, as to the suitability of this T&C Procedure for purposes other than that stated above. Users who choose to adopt this T&C Procedure for their works are responsible for making their own assessments and judgement of all information contained here. The ArchSD does not accept any liability and responsibility for any special, indirect or consequential loss or damages whatsoever arising out of or in connection with the use of this T&C Procedure or reliance placed on it.

The materials contained in this document may not be pertinent or fully cover the extent of the installation in non-government buildings and there is no intimated or implied endorsement of the sales, supply and installation of the materials and equipment specified in this T&C Procedure within the territory of the HKSAR.

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Testing and Commissioning Procedure for Plumbing Installation

1. Introduction

The procedures stated in this Testing and Commissioning (T&C) Procedure cover the activities in preliminary tests and inspections, functional performance tests and the commissioning of newly completed Installations and existing ones after major alteration. They are so compiled to facilitate the work of Project Building Services Engineer (PBSE) and Project Building Services Inspector (PBSI) / Project Electrical and Mechanical Inspector (PEMI), who are appointed as the Supervising Officer's Representatives, in the following aspects with respect to testing and commissioning :

(a) to vet and approve the T&C procedures proposed and submitted by the contractor for the Plumbing Installation (Contractor);

(b) to witness those T&C procedures as specified; and

(c) to accept the T&C certificates and other supporting data.

The Contractor shall carry out the T&C works as detailed in this T&C Procedure. Supplementary T&C plans may be proposed by the Contractor as appropriate and agreed by PBSE, e.g. for special equipment supplied and/or installed by the Contractor.

The administrative requirements for T&C works are in general as specified in the General Specification for Building Services Installation in Government Buildings of the Hong Kong Special Administrative Region 2022 Edition and all current corrigenda/amendments thereto published before the date of first tender invitation for the Contract issued by the ArchSD (the General Specification).

All words and expressions shall have the meaning as assigned to them under the General Specification unless otherwise specified herein.

2. Objectives of the Testing and Commissioning Works

The objectives of the T&C works are:

(a) to verify proper functioning of the equipment/system after installation;

(b) to verify that the performance of the installed equipment/systems meet with the specified design intent and statutory requirements, if any, through a series of tests and adjustments; and

(c) to capture and record performance data of the whole Installation as the baseline for future operation and maintenance.

For the avoidance of doubt, depending on the specific demands of individual installation, the PBSE may require additional or substitute T&C works in regard to any elements in the Installation other than those indicated in this T&C Procedure.

3. Scope of the Testing and Commissioning Works

3.1 Tests and Inspections during Construction

The purpose of these tests is to ensure that all components and systems are in a satisfactory and safe condition before start up. Preliminary adjustment and setting of equipment at this stage shall also be carried out at the same time to pave way for the coming functional performance tests.

Before carrying out any test, the Contractor shall ensure that the Installations comply with all relevant statutory requirements and regulations. The T&C works shall also comply with all site safety regulatory requirements currently in force. In particular, the Contractor shall note the statutory requirements listed in the General Specification in carrying out the works.

3.2 Functional Performance Tests

The purpose of functional performance tests is to demonstrate that the Installations can meet the functional and performance requirements as specified in the Contract. Functional performance tests should proceed from the testing of individual components to the testing of different systems in the Installations.

The Contractor may have to make temporary modifications as the tests proceed. The specific tests required and the order of tests will vary depending on the type and size of systems, number of systems, sequence of construction, interface with other installations, relationship with the building elements and other specific requirements as indicated in the Contract. The testing of systems may have to be carried out in stages depending on the progress of work or as proposed by the Contractor.

Part of the tests may be required to be carried out in suppliers' premises in accordance with the provisions in the Contract.

Any performance deficiencies revealed during the functional performance tests must be evaluated to determine the cause. After completion of the necessary corrective measures, the Contractor shall repeat the tests.

If any test cannot be completed because of circumstances that are beyond the control of the Contractor, it shall be properly documented and reported to the PBSE, who shall then liaise with the relevant parties to resolve the situation. The Contractor shall resume his testing work immediately upon the attainment of a suitable testing environment.

3.3 Commissioning, Statutory Tests and Inspections

Commissioning is the advancement of the Installations from the stage of static completion to full working conditions and to meet the performance requirements as specified in the Contract. This will include setting into operation and regulation of the Installations. Fine-tuning of the commissioned system shall be done by the Contractor to match system performance to the actual needs of the building occupier more closely.

The Contractor shall carry out tests for the Installations to meet statutory requirements as specified in the Contract. After the proper testing and commissioning of the Installations, the Contractor shall notify the appropriate authority as specified in the Contract, through the PBSE of the completion of the Installations and its readiness for inspection and testing. The Contractor shall arrange for the necessary inspections and tests as required by the Authority.

3.4 Documentation and Deliverables

The Contractor shall submit his proposed T&C procedures together with the Testing and Commissioning Progress Chart shown in **Annex I** to PBSE for approval.

All inspection and T&C results shall be recorded by the Contractor in the appropriate test record forms. A complete set of these forms can be found in **Annex II**.

Data recorded in other formats may also be acceptable subject to prior approval of the PBSE. Upon completion of all the required T&C works, the Contractor shall complete and sign a testing and commissioning certificate as shown **Annex II** to the effect that the agreed T&C works have been duly carried out.

A functional performance test report covering all measured data, data sheets, and a comprehensive summary describing the operation of the system at the time of the functional performance tests shall be prepared and submitted to the PBSE. Deviations in performance as specified in the Contract or the design intent should be recorded, with a description and analysis included.

Where required in the Contract, the Contractor shall conduct a final evaluation of the performance of the Installations, the results of which shall be included in the commissioning report.

3.5 Other Requirements

3.5.1 Systems shall be properly commissioned to demonstrate that all the equipment deliver the designed capacities and that water flow rate is properly balanced in accordance with the design. Prior to any commissioning works, the Contractor shall check the completion of the associated builder's work and the building services installations, to ensure that commissioning can be proceeded without obstruction.

(a) Checking procedures on builder's work:-

(i) Plant rooms are completed and free of construction debris;

(ii) All plant room doors are fitted and lockable;

(iii) Permanent power supply of sufficient capacity is available and the Contractor is operating a security access procedure to all plant areas to prevent unauthorised switching of plant. (The normal security access system is one of "Permit to Work" arrangement and procedure proposed by the Contractor in accordance with the guidelines on "Permit to Work" issued by the Labour Department.);

(iv) All builder's work and building services installations in association with plumbing installation are satisfactorily completed; and

(v) All external doors, all stairs and lobbies, and toilet doors are completed and securable.

(b) Checking procedures on plumbing installation

The Contractor shall ensure that:-

(i) Plant room access is restricted to authorised personnel only;

(ii) Provision of power supply for the T&C works; and

(iii) All functional and safety devices are installed and operational.

Where necessary, after the proper testing and commissioning of the Installations, the Contractor shall notify the appropriate Authority as specified in the Contract, through the PBSE on the completion of the Installations and its readiness for final inspection.

3.5.2 All aspects of the commissioning procedure shall follow the recommendations including but not limited to:-

(a) Preliminary checks to ensure that all systems and system components are in a satisfactory and safe condition before start up;

(b) Preliminary adjustment and setting of all plant and equipment consistent with eventual design performance;

(c) Energising and setting to work on all plants; and

(d) Final regulation and demonstration that the installation delivers the correct rate of flow of fluids at the conditions specified in the Contract documents.

3.5.3 Progressive Commissioning

The Contractor shall not wait for completion of every part of the work but shall arrange for a progressive commissioning programme to achieve practical overall completion and have the whole work ready to be handed over by a date to suit the Contract completion date or any other agreed programme date.

3.5.4 Witness by Licensed Plumber

The final tests shall be carried out in the presence of Licensed Plumber or his representative (for plumbing installation).

4. Testing and Commissioning Procedures

4.1 Cold Water Supply Installation

4.1.1 Work Tests

(a) Work tests shall be carried out in accordance with the type normally associated with the specified item of equipment and to the standards as laid down in the Contract.

(b) Work static pressure tests shall be carried out for all items of plant and equipment, as laid down in the Contract.

4.1.2 Tests for Jointing of Copper Pipes for Potable Water Supply

(a) All soldering/brazing joints of copper pipes for potable water supply shall be in compliance with the chemical composition of lead-free grade to Table 3 of BS EN ISO 9453:2020 and cadmium-free grade to Table 7 of BS EN ISO 17672:2016 respectively.

(b) All pipe-fittings integrated with solder materials shall undergo random lead checks. Upon delivery of pipe-fittings with integral solder materials to site, samples shall be taken randomly from each batch of such pipe-fittings under the same GA Reference Number for conducting lead check on soldering materials prior to using that subject batch in plumbing installations. The number of samples to be taken for lead check will depend on the overall batch size. Pipe-fittings of different sizes and types under the same GA Reference Number delivered to site on the same date can be regarded as one batch for the purpose of sampling for lead check, i.e. minimum 1% of the total number of fittings (for all types and sizes in the batch) with a max of 10 samples. Pipe-fittings of different GA Reference Numbers are regarded as different batches even if they are delivered to site on the same date. All the samples in a batch shall pass the lead check before the batch shall be allowed to be used in the project.

(c) The Contractor shall keep samples of soldering/ brazing joints done by each individual plumber(s)/ worker(s) and submitted to project site staff for checking.

(d) If any of the above joints is found non-compliant, same number of samples of joints will be selected again at random by the PBSE for the Contractor to carry out the testing. If any of the joints is found non-compliant, it is sufficient to conclude that the soldering/brazing materials used are not lead-free/cadmium-free. The Contractor shall submit remedial plan to rectify the defects for approved by PBSE.

4.1.3 Mandatory Lead Check for Soldering Materials in Pipe-fittings with Integral Solder Ring upon delivery to Site

(a) All pipe-fittings integrated with solder materials shall undergo random lead checks upon delivery to site prior to installation in projects. Details shall be referred to Section 4.1.4 and Appendix 12 of Guide to Application for Water Supply.

(b) Upon delivery of pipe-fittings with integral solder materials to site, samples shall be taken randomly by the Contractor/Licensed Plumber from each batch of such pipe-fittings under the same General Acceptance (GA) Reference Number for conducting lead check on soldering materials prior to using that subject batch in plumbing installations

(c) Pipe-fittings of different sizes and types under the same GA Reference Number delivered to site on the same date can be regarded as one batch for the purpose of sampling for lead check, i.e. minimum 1% of the total number of fittings (for all types and sizes in the batch) with a max of 10 samples. Pipe-fittings of different GA Reference Numbers are regarded as different batches even if they are delivered to site on the same date.

(d) All the samples in a batch shall pass the lead check before the batch shall be allowed to be used in the project.

(e) Lead-free test shall be reference to BS EN ISO 9453:2020. This can be done by either the lead tester kit, the XRF analyser, or the chemical composition analysis by organisations accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or (HKAS), or organisations accredited by an accreditation scheme mutually recognised by HOKLAS or HKAS.

4.1.4 Pre-commissioning Checks of Water Distribution System

4.1.4.1 System Cleanliness

Irrespective of the precautions taken during the construction stage to keep the internal surfaces of pipework clean, the following procedures shall be used to clean the system.

(a) divide the pipework system into self-draining sections so that the maximum possible flushing rate is achieved;

(b) isolate or bypass items which are particularly sensitive to dirt such as pumps, feed tank, etc. which shall be isolated and flushed independently; and

(c) The Contractor shall ensure that:-

(i) flushing is carried out from the upper to the lower sections of a multi-section system, flushing with the lowest point; initial flushing shall always be from small bore to large bore pipe;

(ii) the large bore outlet is not opened until the section being flushed is fully primed;

(iii) the maximum possible flow rates are used; and

(iv) flushing continues until the outflow runs clear.

Where facilities exist, cleaning of systems can be achieved by circulation of the medium in order to collect dirt at filters or other selected points in the system. Where circulation is achieved by the use of a pump, this action shall be deferred until the pump has been set to work in accordance with the relevant paragraph below. The circulating velocity shall be 1.5 times of normal water velocity in pipe.

4.1.4.2 State of the System

The Contractor shall check:-

(a) that pressure tests have been completed throughout;

(b) that the system has been cleaned in accordance with para. 4.1.3.1; and

(c) that temporary water for pipe flushing is available, or, permanent water connections have been made.

4.1.4.3 Check of System before Filling

The Contractor shall check:-

(a) that probes, pockets, pressure gauges, taps and air vents are installed;

(b) that drains and overflows are connected and free from blockage;

(c) that connections to the appliances and fittings are correct in relation to the design water flow direction;

(d) that control and non-return valves are installed the right way round;

(e) that relief valves are installed as specified and are free to operate;

(f) that relief valve outlets are piped away to suitable drain points;

(g) the expansion devices for alignment and freedom from obstruction;

(h) that the strainer meshes are of the correct grade and material;

(i) that tanks are clean;

(j) that tank covers are provided where specified;

(k) that drain cocks are closed and other valves are left open or closed according to the plan for filling;

(l) that the feed connection is in its correct location; and

(m) that all pipework and fittings are adequately supported, guided and/or anchored where applicable.

4.1.4.4 Mechanical Checks

(a) Pumps

The Contractor shall check:-

(1) the external cleanliness of the pumps, remove and clean and replace all strainers;

(2) that the flow direction is correct and the rotation direction of the motor that must match the direction of rotation arrow on the pump;

(3) that all components, bolts, fixings, tie bars etc., are secured;

(4) that the impellers are free to rotate;

(5) the level and plumb of pump and motor shaft and slide rails; (direct drive pumps require particular attention in this respect);

(6) the anti-vibration mountings for correct deflection;

(7) that the correct drivers are fitted;

(8) that the pipework imposes no strain at the pump connections;

(9) the securing and alignment of pulleys and couplings;

(10) the belt tension and match;

(11) the cleanliness of the bearings;

(12) that the lubricant is fresh and of the correct grade;

(13) that the coolant is available at the bearings when specified;

(14) that glands are correctly packed and the gland nuts are finger-tight only, pending adjustment to correct drip rate after start-up; and

(15) that drive guards are fitted and the access for speed measurement is provided.

(b) Pump Panel

The Contractor shall check:-

(1) that all internal control panels are properly installed;

(2) that all components, bolts, fixings, tie bars etc., are secured;

(3) that equipment is dust-free and in good order;

(4) that cables and terminals have good protection; and

(5) that conduits and wirings are of appropriate size.

(c) Motorised Valves and Float Switches

The Contractor shall check:-

(1) that the valves are installed the correct way round;

(2) that the valve spindles are free to move;

(3) for freedom from excessive looseness;

(4) the fit of pins;

(5) the rigidity of the mountings;

(6) the stiffness of the linkage members;

(7) the tightness of locking devices; and

(8) the bearing lubrication.

4.1.4.5 Electrical Checks

Prior to the initial running of any electrically driven pump, valve or electric water heater, the following procedures shall be adopted.

(a) With all Electrical Supplies Isolated

The Contractor shall check:-

(1) the local isolation of motor and control circuits;

(2) that there are no unshrouded live components within the panels;

(3) that the panels and switchgears are clean;

(4) that the motor and surrounding areas are clean and dry;

(5) that the transit packing has been removed from contactors and other equipment;

(6) that all mechanical checks on the pump and motor or valve are completed, see para. 4.1.3.4;

(7) that all connections are tight on busbars and wirings;

(8) that the internal links on the starter are correct;

(9) that all power and control wirings have been completed in detail to the circuit diagram, paying special attention to circuit for start-delta connected or specially wound motors;

(10) that the fuse ratings are correct;

(11) that the starter overloads are set correctly in relation to the motor name-plate full load current;

(12) that insulation tests on the motor have been performed satisfactorily;

(13) that the adjustable thermal cut-outs are set correctly (check manufacturers' test certificates); and

(14) that all cover plates are fitted.

(b) With the Electrical Supply Available

The Contractor shall check:-

(1) check that the declared voltage range is available on all supply phases;

(2) where motor powers are substantial or reduced voltage starting or complex interlocks are involved, the control

circuit logic and the starter operation shall be tested before the motor is rotated. The supply shall first be isolated by the withdrawal of the 2 power fuses not associated with the control circuit or the disconnection of cables. The "red" phase shall be used for control circuit normally. The control circuit fuse must be checked to ensure that it is rated to give the correct discriminatory protection to the control circuit cables. The control circuit shall be activated and the starter operation observed. Adjust the timers. Check for positive operation of all contactors, relays and interlocks. Finally, open the isolators, reinstate the power connections and close the isolators;

(3) where small motors have direct-on-line starting and simple control circuits, the starter operation, etc., shall be checked when first starting the motor; and

(4) never energise electronic valve motors until the checks in para. 4.1.3.4(c) have been completed.

4.1.4.6 System Filling

All water tanks shall, after erection, be filled with water and shall remain filled for at least 24 hours during which all joints shall be carefully examined. Any defect shall be rectified immediately and the test repeated.

Before finally charging, the water systems shall be thoroughly flushed and all strainers, filters, etc. cleaned or replaced.

4.1.4.7 Hydraulic testing for water distribution pipe work system

(a) General

All water distribution pipework systems shall be hydraulically tested in sections as installation work progresses.

(b) Test Pressure

The hydraulic test pressure shall be 1.5 times the maximum static pressure whichever is higher if it does not exceed 1.5MPa or 1.3 times the maximum static pressure if it exceeds 1.5MPa.

(c) Method of Testing

(1) Check the test certificate and the functioning of the gauge which is in order prior to the test.

(2) Witness that the plumbing installation is slowly filled with water, with the highest draw-off point open to allow air to be expelled from the system.

(3) For a satisfactory and acceptable test, the pressure shall be maintained for a period of at least one hour or as otherwise stated in the Particular Specification, without pressure or loss of water or leakage after all weak joints, defective fittings and pipes disclosed by the initial application of the test are rectified. During the final testing period, the PBSE or his representative shall be invited to witness the tests. All sections of the work under test shall be accessible for inspection and selected welds shall be hammer tested.

(4) Witness the pressure release from a valve of tap which is selected by the PBSE or his representative. It is a check as to show the integrity of testing to the system.

(d) Hydraulic Test Certificates

Certificates of all hydraulic tests made on the Site shall be forwarded to the PBSE for approval. A separate and duplicated set of the Contractor's installation/shop drawings shall be provided for the purpose of keeping accurate records of site tests. One copy will be kept by the PBSE's representative on the Site and the other retained by the Contractor.

(e) Details on Test Certificate

All test certificates shall be signed by the Contractor and by the PBSE or his representative who has witnessed the tests. All test certificates shall contain the following particulars:-

- Date of test
- Apparatus or section under test by mark up the vertical plumbing diagram / plumbing plan with colour
- Makers number (if any)
- Nature, duration and conditions of test
- Result of test
- Name of Contractor's representative (in block letter) in charge of test
- Name of Supervisor Officer's Representative at witness of the test

A blank test certificate form shall be submitted by Contractor for PBSE's approval prior to carrying out the actual test on the Site.

4.1.5 Pump

4.1.5.1 Prior to Pump Started-Up, the Contractor shall check that:-

(a) all normally open isolating and regulating valves are fully open and that all normally close valves are closed;

(b) the direction sign of all non-return valves is along the same discharge direction of associated pumps;

(c) the horizontal or vertical alignment of all flexible joints is within the tolerances recommended by manufacturers' installation guideline;

(d) fully open the return and close the flow valve on the pump, close valves on standby pump. Closing the flow valve on the duty pump will limit the initial starting current, which is usually excessive at the first time a pump is running due to bearing stiffness.

(e) pump is filled with water fully; and

(f) pump shaft is free moving by rotating it in hand without friction.

4.1.5.2 Running of Pump Set

(a) check the pump pressure developed by means of the pump altitude gauges against the design pressure. If excessive pressure is developed at this stage, the cause shall be investigated and rectified;

(b) adjust the discharge valve so that the flow as determined roughly from the pump characteristic is between 100 and 110 per cent of the design value. Note that the motor full load current is not exceeded;

(c) the pump shall be run in accordance with the manufacturer's recommendations and shall be under fairly continuous observation. It shall not be left running outside normal working hours unless attended;

(d) check that the bearings and motor temperature remain steady, that no noise or vibration develops and that no bolts or fixing works is loosen;

(e) open the drain valve of the pressure vessel and drain out the water from the vessel to monitor the cut in and cut out pressure.

(Remark: Observations afterwards may then become less frequent, but it is advisable, while commissioning other parts of the system later, to check the pump from time to time.)

4.1.5.3 Standby Pump

(a) on installations with a standby pump, this standby pump shall also be commissioned;

(b) this pump can be checked against the other duty pump. In the unlikely event of failure of the duty pump, commissioning can continue using standby pump; and

(c) carry out a full diagnosis of the reasons for the failure of the duty pump before energising the standby pump to ensure that any contributory causes are remedied.

4.1.6 Licensed Plumber for Tests and Inspections

Provided that all pipes and fittings intended to be installed are approved by the Water Authority, the Contractor shall engage designated persons under WWO Chapter 102 to carry out / to supervise installation and to submit Waterworks Form WWO46 (Part I and II) to Water Supplies Department (WSD) for notification before commencement of plumbing work.

Waterworks Form WWO46 (Part IV) shall be submitted to WSD by Licensed Plumber (LP) for notification of final inspection of the plumbing work after the completion of the plumbing work. The name of engaged LP shall be checked with WSD's on-line record to verify if his/her status of not being suspended under WSD's Point Penalty System (PPS).

The Contractor shall maintain a sample board on site which shall display samples of taps, shower mixers, valves and pipes listed in the Form WWO1149 as well as solder materials if used, relevant certificates/testing reports/catalogues, etc. as appropriate are also required to be provided together with the sample board relevant certificates/testing reports/catalogues, etc. for checking by WSD.

Each sample, with clear numbering and labelling, shall be firmly fixed onto a rigid wooden or metal board. A list shall also be affixed on the sample board to show the item description, make and brand, country of origin and locations of installation.

The Contractor shall arrange all necessary inspections and approvals from the statutory authorities, i.e. WSD, in accordance with the Waterworks Ordinance (Cap. 102), for the following provisions: (a) Connection pipe provision; (b) Water meter/ check meter provision; (c) Water storage cistern provision.

During the final inspection of the inside service by WA, non-destructive tests of lead content at solder joints selected by the WA shall be carried out and WA will then randomly select water sampling points for conducting the water quality tests by the Contractor.

Alternatively, to speed up the final inspection process, the Contractor may opt for joining the Scheme on Voluntary Submission of Inspection Checklist and shall arrange self-inspection of the plumbing works and submit necessary inspection certificates and inspection checklists certified by qualified person. Details shall be referred to Section 4.3 – Inspections of Guide to Application for Water Supply.

4.1.7 Tests and Inspections for Projects Adopting Modular Integrated Construction (MiC) Method

Approval of plumbing works for projects adopting the Modular Integrated Construction (MiC) method shall be granted by WA subject to :

(a) satisfactory results of the final inspection stated in Section 4.3.3 of Guideline to Application for Water Supply and Section 4.1.5 above;

(b) satisfactory results of the interim inspections carried out by the Inspection Agent of the WA on the concealed parts of the plumbing works before they are covered up in the MiC factory

(c) Commissioning requirement specified in Section 4.4 of Guideline to Application and Section 4.1.16 below.

4.1.8 Systematic Flushing, Cleansing, Disinfection and Water Sampling

All water distribution pipework and water storage tanks shall be thoroughly flushed clean to remove rust, sludge and sediment upon commissioning. Potable water distribution pipework and associated water storage tanks shall be further disinfected before they are put into operation in accordance with the requirements in WSD 's Guide to Application for Water Supply, to remove organic matter which encourages the growth of biofilms and subsequently deterioration of water quality.

The Contractor shall submit a systematic flushing, cleansing & disinfection plan indicating the scope of work, detail of the compartmentation if any, work schedule, method statement for the disinfection work, detailed work sequence/procedures and equipment/tools for checking and testing, location of sampling, method statement for the de-chlorination, etc. for PBSE's approval prior to carrying out the disinfection work.

The Contractor shall arrange all necessary cleaning and disinfection of the water pipework upstream of the water meter, i.e. from the incoming fresh water mains to the water meter/check meter of the premise and the inside service, to the satisfaction of WSD.

4.1.8.1 Methodology of Systematic Flushing of Pipework

The Contractor is required to carry out three flushing cycles according to the flushing protocol to cleanse the newly installed plumbing system. The requirements and procedures shall follow Section 4.3.1.2, 4.4.1 and 5 as well as Appendix 17 of Guide to Application for Water Supply.

(a) Thoroughly flush the inside services at all drinking water taps. All strainers at the drinking water taps must be removed before carrying out systematic flushing;

(b) Allow the water to stand for at least 3 hours;

(c) Thoroughly flush the inside services at all drinking water taps after (b);

(d) Allow the water in the inside services to stand overnight for at least 12 hours;

(e) Conduct three flushing cycles for (a) to (d) above; and

(f) Final thorough flushing at all drinking water taps after three cycles of the systematic flushing.

4.1.8.2 Methodology of Disinfection of Fresh Water Inside Service

With the approved Systematic Flushing, Cleansing & Disinfection Plan, the Contractor shall then cleanse and disinfect the potable water inside service according to the guidelines as stipulated in Appendix 25 of Guide to Application for Water Supply before collecting water sampling for quality tests.

For underground fresh water mains, it shall be swab to remove the dirt and materials inadvertently left in the water mains and flush them with potable water. Then, it shall be completely filled with a homogeneous solution of chloride of lime for disinfection. The concentration of the solution has to meet the requirement that when the water mains are filled up with water, the free chlorine in the water will be at least 30 ppm. Keep the water mains under disinfection for at least 24 hours. After disinfection, flush the water mains thoroughly with potable water. Persons undertaking the disinfection shall be suitable trained and qualified.

For other fresh water inside service, follow one of the three procedures stated below to disinfect the inside service concerned:-

(a) Fill the inside service concerned with a homogeneous solution of chloride of lime for disinfection. The concentration of the solution has to meet the requirement that when the inside service is filled up with water, the free chlorine in the water will be at least 30 ppm. After keeping the inside service under disinfection for at least 24 hours, the inside service shall be immediately drained and thoroughly flushed with potable water.

(b) Fill the inside service concerned with chlorinated water at an initial concentration of 50 ppm for a contact period of one hour. If the free residual chlorine measured at the end of the contact period is less than 30 ppm, the disinfection process shall be repeated. After successful disinfection, the inside service shall be immediately drained and thoroughly flushed with potable water.

(c) Fill the inside service concerned with the disinfectant solution other than chlorine at the initial concentration and for the contact time specified by the manufacturer of the disinfectant. The disinfectant solution shall not contain any substances in quantities capable of causing deleterious or injurious health effects to consumers using the inside service disinfected in accordance with the manufacturer's instructions/ recommendations. If the residual of the disinfectant at the end of the contact time is less than the manufacturer's recommendation, the disinfection procedure shall be repeated. After successful disinfection, the inside service shall be immediately drained and thoroughly flushed with potable water. Flushing shall continue in accordance with the disinfectant manufacturer's instructions/ recommendations or until there is no evidence of the disinfectant chemical being present, or it is at a level that is no higher than that present in the potable water supplied.

The Contractor shall arrange all necessary cleaning and disinfection of the potable water supply pipework downstream after the water meter/check meter and water storage tanks not more than 7 days before hand over the water supply system to users for operation. Where the potable water supply system is not brought into use immediately after disinfection, it shall be disinfected before use unless it has been flushed weekly at full flow for a minimum period of one minute. If the water supply installation is partially handed over for operation by the users, the Contractor shall continuously flush the remaining portion of the system at regular interval until the whole system has been handed over for operation to the user or after the issue of Building Hand-Over Certificate (Form No. D/CA.320) by the Supervising Officer.

After disinfection, the Contractor shall flush the water pipework thoroughly with potable water. Flushing shall be continued until there is no evidence of the disinfectant being present, or is below an acceptable level which is allowed by WSD.

4.1.8.3 Discharge of disinfectant solution

Before water containing high-residual free chlorine is discharged to drain, it shall be de-chlorinated. Any discharge of the disinfectant solution shall comply with the Water Pollution Control Ordinance (Cap. 358). The

Contractor shall submit a method statement for the de-chlorination to PBSE for approval.

4.1.8.4 Compartmentation of System for Disinfection

The Contractor shall conduct disinfection of the entire potable water supply installation and it can be divided by different compartmentation for disinfection if considered necessary for suiting the prevailing site condition or in case of different stage(s) or portion(s) of handover, etc. The proposed compartmentation of potable water supply installation for disinfection shall be stated in the disinfection plan and submitted to PBSE for approval prior to conducting the disinfection work on the Site.

System, or parts of systems shall not be used during the disinfection process and all outlets shall be marked with "DISINFECTION IN PROGRESS, DO NOT USE". In this respect, the Licensed Plumbers should allow sufficient time to carry out sampling and analysis. After disinfection, the entire potable water supply installation should be flushed thoroughly with potable water.

4.1.8.5 Water Sampling and Analysis

The Contractor shall carry out Water Sampling Tests after systematic flushing, cleansing and disinfection of the plumbing system. Prior to conducting any tests, PBSE shall request the contractor to submit sampling and analysis methodology, including name of the accredited laboratory to be appointed and procedures from collection of test samples to submission of test results, for approval. The contractor shall declare in writing that the accredited laboratory appointed has no affiliation as a legal entity to the contractor and its sub-contractors.

Water samples shall not be taken at the following drinking water tap or sampling tap:

(a) Leaking tap;

(b) Drinking water tap installed with an inline water filter or a point-of-use filter with no bypass switch;

(c) Insufficient space below the tap to accommodate the sampling bottle;

(d) Environment with high risk of contamination such as close to works site or dusty environment or dirty water tap.

Never rinse sample bottle prior to sample collection.

PBSE/project site staff shall agree with the contractor either (i) to appoint representative(s) from the accredited laboratory to collect test samples on site or (ii) to arrange contractor's representative(s) to collect test

samples on site. PBSE/project site staff shall supervise the sampling and the contractor has to ensure that the representative(s) had strictly followed all the procedures stated in the approved methodology. Test samples collected shall be kept in sealed container inaccessible to unauthorised persons at all times.

The number and location of Water Samples and its collection procedures for Heterotrophic Plate Count (HPC) test and metal, chemical, physical & E. coli tests shall follow WSD's procedure, Section 4.4 and Appendix 19 of Guide to Application for Water Supply. The sampling and analysis of the on-site water samples shall be carried out by organisations accredited by the Hong Kong Laboratory Accreditation Scheme (HOKLAS) or Hong Kong Accreditation Service (HKAS), or organisations accredited by an accreditation scheme mutually recognised by HOKLAS or HKAS. All water samples shall be properly labelled immediately after collection, packed in a plastic bag and stored in a cold box for the transportation before delivered to an accredited organisation. Licensed Plumber shall supervise the sampling process.

The test parameters of water samples shall include but not limited to the following:-

	Parameter	**Acceptance Criteria**
	Physical and Chemical	
1.	Turbidity	≤ 3.0 NTU
2.	Colour	≤ 5 Hazen Unit
3.	pH at 25°C	≥ 6.5 and ≤ 9.2
4.	Free Residual Chlorine	> 0 mg/L and ≤ 1.5 mg/L
5.	Conductivity at 25°C	≤ 300 µS/cm
	Metals	
6.	Lead	≤ 10µg/L
7.	Chromium	≤ 50µg/L
8.	Nickel	≤ 70µg/L
9.	Cadmium	≤ 3µg/L
10.	Copper	≤ 2000µg/L
11.	Antimony	≤ 20µg/L
	Bacteriological	
12	HPC	≤ 20 cfu/mL
13.	E. coli	0 cfu/100mL

PBSE/project site staff shall supervise the transport and delivery of test samples to the accredited organisation. If the contractor appointed representative(s) from the accredited organisation to collect test samples on site, PBSE/project site staff shall witness that representative(s) from the accredited organization kept the test samples in sealed container before leaving the site. If the contractor arranged their own representative(s) to collect test samples on site, PBSE/project site staff shall escort the representative(s) on delivery of test samples in sealed container from the site to the accredited laboratory.

All the test reports for the water sampling tests shall be sent directly by the accredited organisation to the WA via email with a copy to the Project Officer and the Contractor. PBSE shall request the accredited organisation to submit test results in sealed envelope directly to PBSE instead of through the contractor. PBSE shall exercise caution to examine the validity and integrity of the test results. If there are any irregularities, contractual and disciplinary actions against the contractor shall be taken as appropriate.

If any result(s) of the water sampling test(s) fails to comply with any of the acceptance criteria mentioned above, re-testing shall be carried out as below:-

Parameters	**Scenarios**		
Physical and Chemical	Pass or Fail	Fail	Pass
Bacteriological (E.coli and HPC)	Pass or Fail	Pass	Fail
Parameters to be retested	**All parameters**	**All parameters other than metal**	

Sampling Report form should be made reference in Annex IV and used to record the sampling data collected. The Contractor shall submit the sampling report form to PBSE for approval prior to sampling collection.

4.1.8.6 Record of cleaning and disinfection

The Contractor shall maintain properly the record of dates of cleaning and disinfection of the potable water supply installation follow WSD's procedure and provide the record including the approved method statements of the cleaning and disinfection during handover.

4.1.9 Vibration Tests

Testing for equipment vibration is necessary as an acceptance check to determine whether equipment is functioning properly and to ensure that objectionable vibration and noise are not transmitted. As the vibration acceptance test is based on root mean square (r.m.s) velocity (mm/s) only, frequency measurement is not required. Vibration measurement shall be taken after the equipment had been running for 2 weeks.

(a) record the operating speeds of the equipment (i.e. driving speed of motor) indicated on the nameplates, drawings or measured by speed-measuring device;

(b) determine acceptance criteria from the Particular Specification or as indicated below;

Equipment	Allowable rms velocity, mm/s
Pumps	3.3

(c) perform visual and audible checks for any apparent rough operation of the equipment or any defective bearings, misalignment, etc;

(d) calibrate the vibration measuring instrument according to the user's manual;

(e) measure and record in vibration at bearings of driving and driven components in horizontal, vertical and, if possible, axial directions. There shall be at least one axial measurement for each rotating component (fan motor, pump motor);

(f) indicate other relevant information including date of measurement, type, model and calibration date of the instrument used as well as other observations in the measurement process; and

(g) re-calibrate the instrument after the measurement.

4.2 Hot Water Supply Installation

4.2.1 Hot Water Boiler and Calorifier System

T&C of hot water boiler and calorifier system shall follow the T&C Procedure for Steam Boiler and Calorifier as published by ArchSD.

4.2.2 Solar Water Heating System

T&C of solar hot water heating system shall follow the T&C Procedure for Air-conditioning, Mechanical Ventilation and Refrigeration Installation as published by ArchSD.

4.2.3 Hot Water Supply Distribution System

T&C of the whole hot water supply distribution system, except the Hot Water Boiler and Calorifier System as stipulated in Clause 4.2.1 and the Solar Water Heating System as stipulated in Clause 4.2.2 shall follow the Cold Water Supply Installation as stipulated in Clause 4.1, including the cleaning and disinfection of potable water supply installation and water storage tank as described in clause 4.1.6.

4.3 Flushing Water Supply Installation

T&C of the whole flushing water supply distribution system shall follow the Cold Water Supply Installation as stipulated in Clause 4.1, except that disinfection of the pipework and water storage tanks is not required.

4.4 Automatic Meter Reading (AMR) System

4.4.1 Inspection and Equipment Test

The Contractor shall inspect the supplied equipment for verification of the brand, model, capacity, clock speed, ratings, specifications, serial numbers of the hardware as well as the brand, version, serial number, licence keys, licence documents of all hardware, software and firmware supplied.

The Contractor shall carry out equipment test including, but not limited to, the following procedures:

(a) Verify the correct inventory of hardware including software licences, authentication certificates, cables, etc.;

(b) Demonstrate that all spare memory, equipment capacity and system expansion requirements;

(c) Demonstrate that all input and output expansion requirements have been met, including wiring and signal isolation, and verify that power supplies are capable of supporting the increased load for this expansion;

(d) Demonstrate all hardware and software boot-up and diagnostics;

(e) Verify all power supply voltages are within tolerance;

(f) Verify proper earth connections and isolation of instrumentation earth for all equipment;

(g) Demonstrate that all preloaded software and firmware have been properly installed and are operating correctly;

(h) Verify the connectivity and speed of the communications network equipment; and

(i) Demonstrate the systems to full functioning.

4.4.2 Testing and Commissioning

After completing the installation of the AMR Outstation and prior to setting to work, individual equipment shall be tested to ensure that it performs in accordance with the specified requirements and is in satisfactory working conditions.

Before carrying out the required site test, the Contractor shall ensure the following:

(a) The AMR Outstation is installed in accordance with all relevant drawings, circuit diagrams and the specified requirements;

(b) All cables and individual conductors are labelled and ferruled as per the relevant drawings;

(c) All items of the AMR Outstation are adequately and correctly labelled and identified;

(d) The insulation resistance and continuity of all conductors of cables, etc. are acceptable;

(e) The earthing arrangements are completed and a satisfactory value of earth loop impedance has been achieved; and

The test procedures and format of test records shall be submitted to the WSD for approval prior to the scheduled commencement of testing and commissioning.

All measuring instruments, indicators, testing computers, network testing instruments and other apparatus necessary for carrying out the tests shall be provided by the Contractor and accepted by the WSD.

The Contractor shall submit a comprehensive T&C procedure including, but not limited to, the following items for approval:

(a) Integrity of the AMR data on the data concentration unit (DCU);

(b) Integrity of the AMR data on the Router/Modem;

(c) Integrity of the AMR data on the AMR Master Station;

(d) Configuration and operation check on the meter interfacing units (MIUs);

(e) Operation check on the programmable logic controller (PLC);

(f) Change over test on the backup battery unit;

(g) Operation check on the AMR Outstation upon a.c. power supply failure;

(h) 6-hour discharge test on the battery of the AMR Outstation;

(i) Demonstration of remote programming and diagnosis of the AMR Outstation.

Final acceptance test for full function of the AMR Outstation including successful data transmission to the AMR Master Station shall be conducted by the Contractor to the satisfaction of the WSD.

5 Calibrated Equipment/Instruments

The Contractor shall supply calibrated equipment/instruments and shall make available to the PBSE the calibration certificate of the testing equipment/instruments and the associated calibration records etc. before the relevant test is performed as stipulated in the Contract for the inspection, measuring and testing of the Installations. (Remarks: The equipment shall be calibrated by by organisations accredited by the Hong Kong Laboratory Accreditation Scheme under the (HOKLAS) or by the Hong Kong Accreditation Service (HKAS), or organisations accredited by an accreditation scheme mutually recognised by HOKLAS or HKAS.)

A list of testing equipment/ instruments proposed by the Contractor to be used for T&C **(Annex III)** must be agreed with the PBSE prior to commissioning the work.

Annex I

Testing and Commissioning Progress Chart for Plumbing Installation

Contract Number : _____

Contract Title : _____

Name of Sub-contractor : _____

Name of Main Contractor : _____

Contract Period: __/__/20__ to __/__/20__ *Revised /Actual Completion Date: __/__/20__
dd/mm/yyyy dd/mm/yyyy

	Testing and Commissioning Progress Chart for Plumbing Installation (Rev.) (Note 1)																		
		Dates (Note 2)																	Remark
	Activities	Reference to T&C Procedure	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S	A	
1.	**Cold Water Supply**	4.1																	
1.1	Cleanliness & State Check	4.1.4.1, 4.1.4.2																	
1.2	Mechanical Check	4.1.4.4																	
1.3	Electrical Check	4.1.4.5																	
1.4	Hydraulic testing for water distribution pipe work system	4.1.4.7																	
1.5	Solder Joint Sampling Check	4.1.2																	
1.6	Check for Pump head and flow	4.1.5																	
1.7	Statutory Inspection by Licensed Plumber	4.1.6																	
1.8	Connection Pipe Provision	Ditto																	
1.9	Water Meter/ Check Meter Provision	Ditto																	
1.10	Water Storage Cistern Provision	Ditto																	
1.11	Systematic Flushing. Cleaning, Disinfection and Water Sampling	4.1.8																	
1.12	Vibration Tests	4.1.9																	

	Testing and Commissioning Progress Chart for Plumbing Installation (Rev.) (Note 1)																		
		Dates (Note 2)																	Remark
	Activities	Reference to T&C Procedure	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S	A	
2	**Hot Water Supply**	4.2																	
2.1	Hot Water Boiler Calorifier System	4.2.1																	
2.2	Solar Water Heating System	4.2.2																	
2.3	Hot Water Supply Distribution System	4.2.3																	
2.3.1	Cleanliness & State Check	Ditto																	
2.3.2	Mechanical Check	Ditto																	
2.3.3	Electrical Check	Ditto																	
2.3.4	Hydraulic testing for water distribution pipe work system	Ditto																	
2.3.5	Functional Performance Tests	Ditto																	
2.3.6	Check for Pump head and flow	Ditto																	
2.3.7	Statutory Inspection by Licensed Plumber	Ditto																	
2.3.8	Connection Pipe Provision	Ditto																	
2.3.9	Water Meter/ Check Meter Provision	Ditto																	
2.3.10	Water Storage Cistern Provision	Ditto																	
2.3.11	Cleaning, Disinfection and Water Sampling	Ditto																	
2.3.12	Vibration Test	Ditto																	

	Testing and Commissioning Progress Chart for Plumbing Installation (Rev.) (Note 1)																		
		Dates (Note 2)																	Remark
	Activities	Reference to T&C Procedure	S	A	S	A	S	A	S	A	S	A	S	A	S	A	S	A	
3	**Flushing Water Supply**	4.3																	
3.1	Cleanliness & State Check	Ditto																	
3.2	Mechanical Check	Ditto																	
3.3	Electrical Check	Ditto																	
3.4	Hydraulic testing for water distribution pipe work system	Ditto																	
3.5	Functional Performance Tests	Ditto																	
3.6	Check for Pump head and flow	Ditto																	
3.7	Statutory Inspection by Licensed Plumber	Ditto																	
3.8	Connection Pipe Provision	Ditto																	
3.9	Water Meter/ Check Meter Provision	Ditto																	
3.10	Water Storage Cistern Provision	Ditto																	
3.11	Vibration Test	Ditto																	
4	**Automatic Meter Reading System**	4.5																	
4.1	Equipment Test	4.5.1																	
4.2	Site Test	4.5.2																	
4.3	Final Acceptance Test	4.5.2																	

Notes

* Delete as appropriate

(1) Insert revision no.

(2) Insert additional columns as necessary
S - schedule % completion
A - actual % completion

Annex II

Testing and Commissioning Certificate for Plumbing Installation

Contract Number : _____

Contract Title : _____

Part 1 Details of Project

1.1 Project title : _____

1.2 P.W.P. No. : _____

1.3 Contract Number : _____

1.4 Sub-contractor : _____

1.5 Main Contractor : _____

1.6 Name of *PBSE : _____

1.7 Name of *PBSI : _____

Part 2 Declaration

2.1 I certify that the Plumbing Installation as specified in the Contract/Sub-contract/Quotation at the above location has been inspected, tested and commissioned in accordance with this Testing and Commissioning (T&C) Procedure and/or any other procedures as agreed between the *PBSE and the Contractor. The results are satisfactory in the aspects as mentioned in Part 3 and/or as recorded in Part 4 of this Certificate, except that indicated in the COMMENTS items.

2.2 I also certify that site tests have been performed in accordance with the requirements set in this T&C Procedure and that the results are satisfactory. A record of the tests has been prepared and submitted to the *PBSE.

Name of Authorised Contractor's Representative:	Signature:
Designation /Post of Contractor's Representative:	Date Signed:
Name and Stamp of Contractor:	Telephone Number:

* delete /amend if required

Part 3 Items Inspected and Tested

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.1	**Cold Water Supply Installation**		
3.1.1	Pre-commissioning Checks		
a)	General Requirements as indicated in the T&C Procedure have been complied.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Licensed Plumber (LP) shall be appointed to carry out the plumbing work and undertake the correctness of the installation to WSD.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Upon delivery of soldering and brazing materials to site with LP for connection of copper pipes, verification is done on checking the approved materials including samples and document submission.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Commencement of Plumbing Work – Application Form WWO46 (Part I and II) shall be submitted to WSD for notification.	*Yes/No/N.A.	*Yes/No/N.A.
e)	All pipes and fittings intended to be installed are approved by the WSD.	*Yes/No/N.A.	*Yes/No/N.A.
f)	Completion of Plumbing Work – Application Form WWO46 (Part IV) shall be submitted to WSD by the Licensed Plumber for notification of final inspection of the plumbing work.	*Yes/No/N.A.	*Yes/No/N.A.
3.1.2	Connection Pipe		
a)	Size of the Connection Pipe shall be adequate to supply all plumbing installations. (TR 4.3.5.3)	*Yes/No/N.A.	*Yes/No/N.A.
b)	All Piping including the Connection Pipe before meter positions shall be exposed or laid in a proper service duct. (TR 3.3.2.2, 4.2.4.1, 4.3.5.3 & 5.4.1.4)	*Yes/No/N.A.	*Yes/No/N.A.
3.1.3	Water Meter/ Check Meter Position		
a)	Meters on indirect supply systems shall be sited at roof level or at other convenient locations and housed in meter rooms/boxes.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Check meter positions will be required at the connections to the common inside service and to the sump tank.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Proper drainage, lighting and flood prevention facilities shall be provided at the water meter room. (WW Reg 27, TR 3.1.9, 3.2.2.4, 3.2.2.5, 3.2.3.1, 3.2.4.1 & 3.3.5)	*Yes/No/N.A.	*Yes/No/N.A.
d)	All domestic units shall be separately metered (TR 3.1.3). Water supplies for metering types are classified into domestic, construction, shipping and trade purposes. (WW Reg. 2)	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
e)	A standard meter position shall be provided with bushes or reducers at both sides of the meter position and with a distance piece of hollow tube with conspicuous holes drilled through the body placed in between. A longscrew (connector) shall be provided immediately after the bush or reducer at the delivery side.	*Yes/No/N.A.	*Yes/No/N.A.
f)	Meters shall be arranged in groups and sited at convenient locations in communal area and housed in meter rooms/boxes. (TR 3.2.1.2, 3.2.2.4, 3.2.2.5, 3.2.3.1, 3.2.4.1 & 3.3.5)	*Yes/No/N.A.	*Yes/No/N.A.
g)	Brass fittings shall be used at meter position if copper, lined galvanised steel or thermal plastic materials are used inside service. PVC-U fittings shall be used at meter position if PVC-U materials are used as inside service. (TR 3.2.1.4)	*Yes/No/N.A.	*Yes/No/N.A.
3.1.4	Water Storage Cistern		
a)	Every cistern shall be located so as to minimise the risk of contamination of the stored water. (WW Reg. Sch. 2 Pt III Para 4 & 9, TR 6.2.1.2 & 6.2.3.1)	*Yes/No/N.A.	*Yes/No/N.A.
b)	Every cistern shall be constructed of concrete, galvanised steel or other approved material. Fibreglass storage cisterns for potable water shall be of an approved type. (WW Reg Sch 2 Pt III Para 2 & 3, TR 4.3.2 & 6.2.2.4)	*Yes/No/N.A.	*Yes/No/N.A.
c)	Cisterns shall be fitted with a ball valve controlled inlet in the case of a gravity supply or with an automatic control switch in the case of a pumped supply.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Ball valves of the water cistern are readily accessible.	*Yes/No/N.A.	*Yes/No/N.A.
e)	An overflow pipe of one commercial size larger than the inlet pipe, and in no case less than 25 mm diameter, shall be fitted to each cistern and shall be extended to terminate in a conspicuous position in a communal area easily visible and accessible by the occupants.	*Yes/No/N.A.	*Yes/No/N.A.
f)	No part of the overflow pipe shall be submerged inside the storage cistern. The top of the overflow pipe shall be not less than 25mm below the invert of the inlet pipe or the face of the outlet nose of the ball valve. (TR 6.2.4.2.9)	*Yes/No/N.A.	*Yes/No/N.A.
g)	A stop valve shall be provided on the outlet of every cistern and provision shall be made for a drain off pipe to enable the cistern to be emptied.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Safe access shall be provided to all cisterns by means of a secure permanent ladder or readily available portable ladder.	*Yes/No/N.A.	*Yes/No/N.A.
i)	A grating and a self-closing non-return flap shall be provided at the overflow pipe outside the storage cistern.	*Yes/No/N.A.	*Yes/No/N.A.
j)	Double sealed covers with locking devices shall be provided for all storage cisterns other than cisterns for flushing and fire-fighting purposes. (WW Reg	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
	Sch 2 Pt III Para. 5, 6, 7 & 10, TR 6.2.3, 6.2.4.1.1, 6.2.4.2.9, 6.2.4.3.3, 6.2.4.4.2 & 6.2.2.4.8)		
k)	Cistern shall be fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply or with an automatic control switch and without any stop valve in the case of a pumped supply.	*Yes/No/N.A.	*Yes/No/N.A.
l)	Float switches in the water tanks for controlling the water pumps function properly.	*Yes/No/N.A.	*Yes/No/N.A.
m)	High and low water level indications for the water tanks function properly.	*Yes/No/N.A.	*Yes/No/N.A.
n)	Size of the water pump suction water pipe from the water tank is matched with the size of the pump suction inlet.	*Yes/No/N.A.	*Yes/No/N.A.
o)	Each water pump is provided with an independent suction pipe from supply tank.	*Yes/No/N.A.	*Yes/No/N.A.
p)	Strainers are cleaned in water tank.	*Yes/No/N.A.	*Yes/No/N.A.
q)	Cleaning and disinfection of each potable water storage tank not more than 7 days in advance before handed over.	*Yes/No/N.A.	*Yes/No/N.A.
3.1.5	Piping		
a)	Pipes and fittings shall conform to Part I of Schedule 2 of the Waterworks Regulations.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Hydraulic tests are performed satisfactorily for water tightness of all sections of the pipework.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Lead-free and Cadmium-free solder which shall comply with BS EN ISO 9453:2014 and BS EN ISO 17672:2016 are used respectively for copper pipe and fitting connections	*Yes/No/N.A.	*Yes/No/N.A.
d)	Pipes on fresh water inside service shall be made of cast iron, ductile iron, PVC-U, polybutylene, steel or copper or any approved material.	*Yes/No/N.A.	*Yes/No/N.A.
e)	No pipe shall be less than 20 mm diameter, except that a branch pipe may be 15 mm diameter if the pipe run is short and the pipe supplies only one draw-off point. (WW Reg Sch. 2 Pt. I Para. 2)	*Yes/No/N.A.	*Yes/No/N.A.
f)	All pipework before meter positions shall be exposed or laid in proper service duct. (TR 3.3.2.2, 4.2.4.1, 4.3.5.3 & 5.4.1.4)	*Yes/No/N.A.	*Yes/No/N.A.
g)	The piping which solely serve a particular flat/unit shall not run through other flats/units as far as practicable.	*Yes/No/N.A.	*Yes/No/N.A.
h)	A loose jumper type stopcock shall be provided and placed with spindle in the vertical position before the meter position.	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
i)	Fullway gate valves shall be fitted before meter positions when the meters are sited at roof level.	*Yes/No/N.A.	*Yes/No/N.A.
j)	Cisterns shall be fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply or with an automatic control switch and without any stop valve in the case of a pumped supply.	*Yes/No/N.A.	*Yes/No/N.A.
k)	Fullway gate valve shall be provided on the outlets of every cistern.	*Yes/No/N.A.	*Yes/No/N.A.
l)	Spring taps, of non-concussive type and of approved pattern, shall be used for public or communal lavatory basins.	*Yes/No/N.A.	*Yes/No/N.A.
m)	For connections larger than 40 mm diameter, a gate valve shall be provided before the meter position and a non-return or check valve fitted on the delivery side as close as possible to the meter. (TR 3.1.5, 3.1.6, 3.1.7, 6.2.4.2.9, 6.2.4.3.3 & 6.7.1.2)	*Yes/No/N.A.	*Yes/No/N.A.
n)	Individual stop valves shall be provided at all draw-off points or at a series of draw-off points if situated close together. (TR 6.6.1)	*Yes/No/N.A.	*Yes/No/N.A.
o)	Boundary valves shall be provided at the connection points as close to the lot boundary as possible. (TR 3.1.9, 3.3.5 & 3.3.4.12)	*Yes/No/N.A.	*Yes/No/N.A.
p)	Tee-branch valve(s) shall be provided for the conditions: (i) for all underground water pipes; (ii) if the main pipe is a communal inside service; (iii) in a flushing system if the main pipe serves more than one domestic unit or commercial floor. (TR 4.2.4.5 & 4.3.5.7)	*Yes/No/N.A.	*Yes/No/N.A.
q)	Stop valve shall be provided to the supply pipe serving the series of draw-off points. (TR 6.6.1)	*Yes/No/N.A.	*Yes/No/N.A.
r)	Dead legs and stagnant corners shall be avoided.	*Yes/No/N.A.	*Yes/No/N.A.
s)	The number and length of spur of the piping shall be minimised.	*Yes/No/N.A.	*Yes/No/N.A.
t)	Purge valves is provided at the pipe ends of all unavoidable spurs or stagnant points for weekly purging.	*Yes/No/N.A.	*Yes/No/N.A.
u)	When infra-red sensor operated automatic taps are used as inside services, a stop cock or gate valve must be installed at the upstream of each fitting for manual isolation of water supply.	*Yes/No/N.A.	*Yes/No/N.A.
v)	Self-closing taps, of non-concussive type and of approved pattern, shall be used for the public or communal lavatory basins.	*Yes/No/N.A.	*Yes/No/N.A.
w)	Flow rate of each draw-off tap, shower fitting and float-operated valve shall be the same as the specified requirement.	*Yes/No/N.A.	*Yes/No/N.A.
x)	All pipework is properly electrically bonded for equipotential bonding.	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.1.6	Setting-out Check and Balancing		
a)	All piping are properly flushed and ensure no foreign objects trapped inside.	*Yes/No/N.A.	*Yes/No/N.A.
b)	The equipment associated with the system has undergone the mechanical and electrical checks and the results are satisfactory.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Valves are closed in clockwise direction.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Pressure reducing valve sets function properly.	*Yes/No/N.A.	*Yes/No/N.A.
e)	By-pass arrangement shall be incorporated with the provision of a second pressure reducing valve, except for fire service installations for ease of replacement.	*Yes/No/N.A.	*Yes/No/N.A.
f)	Pressure indicator shall be installed at the Pressure Reducing Valve system for pressure monitoring.	*Yes/No/N.A.	*Yes/No/N.A.
g)	Automatic air release valves function properly.	*Yes/No/N.A.	*Yes/No/N.A.
h)	The hot-water draw-off point shall be at the left hand side.	*Yes/No/N.A.	*Yes/No/N.A.
i)	The water flow rates of the system have been regulated and balanced in accordance with this T&C Procedure. The results are satisfactory meeting the specified requirements.	*Yes/No/N.A.	*Yes/No/N.A.
j)	Cleaning and disinfection of the potable cold water piping system is conducted not more than 7 days in advance before being put into operation.	*Yes/No/N.A.	*Yes/No/N.A.
k)	The potable cold water piping system is flushed thoroughly after disinfection.	*Yes/No/N.A.	*Yes/No/N.A.
l)	The disinfectant solution is de-chlorinated.	*Yes/No/N.A.	*Yes/No/N.A.
m)	After disinfection of the potable cold water piping system as described in clause 3.1.9(k), the system is maintained for regular flushing weekly until hand over to clients for operation.	*Yes/No/N.A.	*Yes/No/N.A.
n)	Proper record of cleaning and disinfection is provided during handover.	*Yes/No/N.A.	*Yes/No/N.A.
o)	Proper record of water sampling test for four additional test parameters, i.e. Lead, Cadmium, Chromium and Nickel as required. (Guide to Application for Water Supply)	*Yes/No/N.A.	*Yes/No/N.A.
p)	Sample board(s) for taps, shower mixers, valves, pipes, solder material (if used), etc. as listed in the Form WWO1149 Guide to Application for Water Supply)	*Yes/No/N.A.	*Yes/No/N.A.

3.1.7 Water Pumps

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
a)	A standby pump set for both fixed water pump system and booster water pump system shall be provided. (TR 4.2.4.10)	*Yes/No/N.A.	*Yes/No/N.A.
b)	Water pumps and motors are run at the designed discharge water pressure and operating electrical current.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Water pumps are run at an acceptable noise and vibration levels.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Water pump control switches and indicating lights function properly.	*Yes/No/N.A.	*Yes/No/N.A.
e)	The protective devices of water pump function properly.	*Yes/No/N.A.	*Yes/No/N.A.
f)	The temperatures of the water pump bearings at running condition are normal.	*Yes/No/N.A.	*Yes/No/N.A.
g)	The temperatures of the pump motors at running condition are normal.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Non-return valves connected to the pumps function are installed properly.	*Yes/No/N.A.	*Yes/No/N.A.
i)	A fullway gate valve shall be provided on the drain-off pipe. (TR 6.2.4.3.3)	*Yes/No/N.A.	*Yes/No/N.A.
j)	Prior to pump start-up, the contractor shall check the horizontal or vertical alignment of all flexible joints is within the tolerances recommended by the manufacturers' installation guideline.	*Yes/No/N.A.	*Yes/No/N.A.

k) Measurement

Location: No: _____

_____

	Designed	Measured	Remarks
Volume flow rate (l/s)			
No flow head (kPa)			
Full flow head (kPa)			
Starting current (A)			
Running current (A)			

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post : Tel. No. : Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post : Tel. No. : Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.1.8	Electrical Wiring		
a)	The electrical wiring system shall be tested satisfactorily in accordance with the T&C Procedure No. 2 for Electrical Installation and to Electricity Ordinance requirements.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Starter overloads are set currently in relation to the motor name-plant full load current.	*Yes/No/N.A.	*Yes/No/N.A.
c)	All conductors shall be correctly and securely connected and identified.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Methods of protection against direct contact shall be properly applied.	*Yes/No/N.A.	*Yes/No/N.A.
e)	Isolation and switching devices are properly and correctly installed.	*Yes/No/N.A.	*Yes/No/N.A.
f)	Protective devices and monitoring devices are properly and correctly installed and set (e.g. MCB, control fuse, ammeter & voltmeter).	*Yes/No/N.A.	*Yes/No/N.A.
g)	The electric circuits, fused, switches, terminals, bonding, etc. are properly and correctly labelled.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Danger notices, warning notices, schematic diagrams, instructions and similar information are correctly and adequately provided.	*Yes/No/N.A.	*Yes/No/N.A.
3.1.9	Pump Panels		
a)	All internal control panels are properly earthed.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Nuts and bolts are tightened and connected properly.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Equipment dust-free and in good order.	*Yes/No/N.A.	*Yes/No/N.A.
d)	All cables and terminals have good protection.	*Yes/No/N.A.	*Yes/No/N.A.
e)	All conduits and wirings are of appropriate size.	*Yes/No/N.A.	*Yes/No/N.A.
f)	All level switch/ level sensor (i.e. Low level cut-in, low level cut-out, high level cut out) are set correctly and performed properly.	*Yes/No/N.A.	*Yes/No/N.A.
g)	All indication lamps are performed properly.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Buzzer is set correctly in relation to the system / equipment failure and performed properly.	*Yes/No/N.A.	*Yes/No/N.A.
3.1.10	Comments	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.2	**Hot Water Supply Installation**		
	Installation of hot water mixing valves is approved by WSD provided that both the cold and hot water are drawn from the same source, i.e. both hot and cold water supplied from a common storage cistern, or under direct mains pressure.	*Yes/No/N.A.	*Yes/No/N.A.
3.2.1	Water Heater		
	The following types of water heaters may, with the written permission of the WSD, be connected direct to a main: -		
	(i) non-pressure type water heaters where no restriction of flow can be effected beyond the inlet control valve;	*Yes/No/N.A.	*Yes/No/N.A.
	(ii) cistern type water heaters;	*Yes/No/N.A.	*Yes/No/N.A.
	(iii) instantaneous water heaters where the guaranteed test pressure of the water heater is at least 1½ times the static head available at the water heater;	*Yes/No/N.A.	*Yes/No/N.A.
	(iv) electric water heaters of the thermal storage type: - a. having a storage capacity not exceeding 200 litres; b. having a guaranteed test pressure at least 1½ times the static head available at the water heater; c. and not being provided with an individual expansion pipe but complying with WWReg Sch 2 Pt IV Para 11.(WWReg Sch 2 Pt IV Para 1(2)(a)(b)(c) & (d)) (WWReg Sch. 2 Pt. IV & TR 4.2.7)	*Yes/No/N.A.	*Yes/No/N.A.
3.2.2	Non-centralised Hot Water System		
a)	Unvented type electric thermal storage water heaters shall comply with TR 4.2.7 and equip with safety devices that comply with Electrical Products (Safety) Regulation.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Storage cistern of pressure type thermal storage heaters, other than unvented heaters shall be equipped with a vented pipe.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Water released out of the relief valves of unvented electric thermal storage type water heaters shall be discharged to a safe and visible location.	*Yes/No/N.A.	*Yes/No/N.A.
3.2.3	Centralised Hot Water System		
a)	The centralised hot water systems utilising a boiler and cylinder shall be provided with a vent or an expansion pipe taken from the highest point of the cylinder or calorifier.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Safety valve or pressure relief valve shall be provided to the boiler or to the primary flow pipe.	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
c)	Screwed plug with a removable key shall be provided at the lower part of the system for the purpose of draining down or emptying the system.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Cleaning and disinfection of each water storage type calorifier is done not more than 7 days in advance before handed over.	*Yes/No/N.A.	*Yes/No/N.A.
e)	Cleaning and disinfection of the potable hot water piping system is conducted not more than 7 days in advance before hand over.	*Yes/No/N.A.	*Yes/No/N.A.
f)	The portable hot water piping system is flushed thoroughly after disinfection.	*Yes/No/N.A.	*Yes/No/N.A.
g)	The disinfectant solution is de-chlorinated.	*Yes/No/N.A.	*Yes/No/N.A.
h)	After disinfection of the potable hot water piping system as described in clause 3.2.2(e) of Annex II, the system is maintained for regular flushing weekly.	*Yes/No/N.A.	*Yes/No/N.A.
i)	Proper record of cleaning and disinfection is provided during handover.	*Yes/No/N.A.	*Yes/No/N.A.
j)	Proper record of water sampling test for four additional test parameters, i.e. Lead, Cadmium, Chromium and Nickel as required. (WSD Circular Letter No. 1/2015Guide to Application for Water Supply)	*Yes/No/N.A.	*Yes/No/N.A.
k)	Sample board(s) for taps, shower mixers, valves, pipes, solder material (if used), etc. as listed in the Form WWO1149 (WSD Circular Letter No. 8/2015 Guide to Application for Water Supply)	*Yes/No/N.A.	*Yes/No/N.A.

3.2.4 Comments

3.2.5 Solar Hot Water Heating System

Visual Inspections

a)	Pipework pressure test records are acceptable	*Yes/No/N.A.	*Yes/No/N.A.
b)	Panels securely fixed on support	*Yes/No/N.A.	*Yes/No/N.A.
c)	Panel absorber surface has obvious sign of oxidation or de-colourisation	*Yes/No/N.A.	*Yes/No/N.A.
d)	Pipework, heat exchangers and solar hot water calorifier are well insulated and with UV protection layer	*Yes/No/N.A.	*Yes/No/N.A.
e)	Hydraulic system has been balanced	*Yes/No/N.A.	*Yes/No/N.A.
f)	All valve settings are appropriate	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
g)	All electrical/signal connections of sensors, controllers and data acquisition devices are properly connected	*Yes/No/N.A.	*Yes/No/N.A.
h)	All sensors are properly installed	*Yes/No/N.A.	*Yes/No/N.A.
i)	All sensors have been calibrated	*Yes/No/N.A.	*Yes/No/N.A.
j)	All sensors' locations are appropriate	*Yes/No/N.A.	*Yes/No/N.A.
k)	Automatic air vent locations are appropriate	*Yes/No/N.A.	*Yes/No/N.A.
l)	All labels & signages are provided	*Yes/No/N.A.	*Yes/No/N.A.

Measurements		**Designed**	**Measured**	**Remarks**
Collector Panel Array				
Solar collector type				
Solar collector gross area of each panel	(mm x mm)			
Solar collector net area (absorber area) of each panel	(mm x mm)			
No. of solar collector panels connected in series within a bank	(No.)			
No. of solar collector panels bank connected in parallel within the array	(No.)			
Panel tilted angle	(° to horizontal)			
Panel array orientation				
Water flow rate of solar panel array	(l/s)			
Panel array entering water temperature	(°C)			
Panel array leaving water temperature	(°C)			
Panel array pressure drop	(kPa)			
Ambient air temperature	(°C)			
Wind speed	(m/s)			
Solar irradiation	(W/m2)			
Chemical treatment _____(chemical)	(ppm)			

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

Measurements		**Designed**	**Measured**	**Remarks**
_____(chemical) _____(chemical)	(ppm) (ppm)			
System Controller				
Circulation pump auto start-stop setting				
Temperature different between solar panel output and water tank for pump on	(°C)			
Temperature different between solar panel output and water tank for pump off	(°C)			
Calorifier				
Calorifier storage volume	(m^3)			
Vent type (vented/ unvented)				
Calorifier shell/ lining materials				
Pressure/Temperature relief valve Setting Purging temperature Purging pressure	 (°C) (kPa)			
Auxiliary heater type				
Auxiliary heater rating	(kW)			
Over temperature thermostat setting	(°C)			
Calorifier maximum heat transfer capacity	(kW)			
Pressure drop of calorifier heating loop	(kPa)			
Insulation type				
Insulation thickness	(mm)			
Circulation Pumps				
Voltage	(V)			
Current	(A)			
Power	(W)			
Flow rate	(l/s)			
Pump head	(kPa)			

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

3.2.6 Comments

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.3	**Flushing Water Supply Installation**		
3.3.1	Connection Pipe		
a)	Size of the Connection Pipe shall be of 40mm diameter minimum for flushing water supply. (TR 4.3.5.3)	*Yes/No/N.A.	*Yes/No/N.A.
b)	All piping including the Connection Pipe before meter positions shall be exposed or laid in a proper service duct. (TR 3.3.2.2, 4.2.4.1, 4.3.5.3 & 5.4.1.4)	*Yes/No/N.A.	*Yes/No/N.A.
3.3.2	Water Meter/ Check Meter Position		
a)	Salt water supply for flushing water system will not be metered, but a space reserved for meter position shall be provided.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Proper drainage, lighting and flood prevention facilities shall be provided at the water meter room. (WW Reg 27, TR 3.1.9, 3.2.2.4, 3.2.2.5, 3.2.3.1, 3.2.4.1 & 3.3.5)	*Yes/No/N.A.	*Yes/No/N.A.
3.3.3	Water Storage Cistern		
a)	Cisterns shall be fitted with a ball valve controlled inlet in the case of a gravity supply or with an automatic control switch in the case of a pumped supply.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Ball valves of the water cistern are readily accessible.	*Yes/No/N.A.	*Yes/No/N.A.
c)	An overflow pipe of one commercial size larger than the inlet pipe, and in no case less than 25 mm diameter, shall be fitted to each cistern and shall be extended to terminate in a conspicuous position in a communal area easily visible and accessible by the occupants.	*Yes/No/N.A.	*Yes/No/N.A.
d)	No part of the overflow pipe shall be submerged inside the storage cistern. The top of the overflow pipe shall be not less than 25mm below the invert of the inlet pipe or the face of the outlet nose of the ball valve. (TR 6.2.4.4.2)	*Yes/No/N.A.	*Yes/No/N.A.
e)	A stop valve shall be provided on the outlet of every cistern and provision shall be made for a drain off pipe to enable the cistern to be emptied.	*Yes/No/N.A.	*Yes/No/N.A.
f)	Safe access shall be provided to all cisterns by means of a secure permanent ladder or readily available portable ladder.	*Yes/No/N.A.	*Yes/No/N.A.
g)	A grating and a self-closing non-return flap shall be provided at the overflow pipe outside the storage cistern.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Cistern shall be fitted with a ball valve and a fullway gate valve at the inlet in the case of a gravity supply or with an automatic control switch and without any stop valve in the case of a pumped supply.	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
i)	Float switches in the water tanks for controlling the water pumps function properly.	*Yes/No/N.A.	*Yes/No/N.A.
j)	High and low water level indications for the water tanks function properly.	*Yes/No/N.A.	*Yes/No/N.A.
k)	Size of the water pump suction water pipe from the water tank is matched the size of the pump suction inlet.	*Yes/No/N.A.	*Yes/No/N.A.
l)	Each water pump is provided with an independent suction pipe from supply tank.	*Yes/No/N.A.	*Yes/No/N.A.
m)	Strainers are cleaned in water tank.	*Yes/No/N.A.	*Yes/No/N.A.
3.3.4	Flushing Devices		
a)	Valve Type Flushing Cistern/ Dual Flush Cistern. The valve sealing of the flushing cistern shall be easily replaceable.	*Yes/No/N.A.	*Yes/No/N.A.
b)	The flushing volume of the flushing devices shall be compatible with the toilet bowl to ensure that effective clearance can be achieved by a single flush of water.	*Yes/No/N.A.	*Yes/No/N.A.
c)	The maximum flushing cistern volume including that of dual flush cisterns shall not exceed 7.5 litre per flush.	*Yes/No/N.A.	*Yes/No/N.A.
d)	For dual flush devices, the reduced flushing volumes shall not be more than two-third of its larger flushing volume.	*Yes/No/N.A.	*Yes/No/N.A.
e)	The component of all valve flushing devices shall be resistant to salt water corrosion.	*Yes/No/N.A.	*Yes/No/N.A.
3.3.5	Flushing Valve		
a)	Installation of filter before flushing valves is required.	*Yes/No/N.A.	*Yes/No/N.A.
b)	The cartridge and other valve components shall be easily replaceable.	*Yes/No/N.A.	*Yes/No/N.A.
c)	The valve components shall be resistant to salt water.	*Yes/No/N.A.	*Yes/No/N.A.
d)	The flushing volume of the flushing valves shall be adjusted to suit the toilet bowl to ensure that effective clearance can be achieved by a single flush.	*Yes/No/N.A.	*Yes/No/N.A.
e)	Flushing valves shall be used within the range of working pressures specified by the manufacturer.	*Yes/No/N.A.	*Yes/No/N.A.
f)	The maximum flushing volume of the flushing valves to be installed shall not exceed 7.5 litres.	*Yes/No/N.A.	*Yes/No/N.A.
g)	Flushing valves shall be set to be height which is operated by hand except for those operated by foot.	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.3.6	Piping		
a)	Pipes and fittings shall conform to Part I of Schedule 2 of the Waterworks Regulations.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Hydraulic tests are performed satisfactorily for water tightness of all sections of the pipework.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Pipes on salt water inside service shall be made of salt water resistant materials.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Final connection of the underground water mains to both newly installed fresh water and flush water supply, utmost clear identification for the connection shall be made by the Licensed Plumber and arranged WSD for inspection before they put into operation.	*Yes/No/N.A.	*Yes/No/N.A.
e)	All pipework is properly electrically bonded for equipotential bonding, except non-metallic material is used, such as PVC pipe.	*Yes/No/N.A.	*Yes/No/N.A.
3.3.7	Setting-out Check and Balancing		
a)	All piping are properly flushed and ensure no foreign objects trapped inside.	*Yes/No/N.A.	*Yes/No/N.A.
b)	The water inside service has been properly cleaned to WSD's requirement and then filled with water.	*Yes/No/N.A.	*Yes/No/N.A.
c)	The equipment associated with the system has undergone the mechanical and electrical checks and the results are satisfactory.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Valves are closed in clockwise direction.	*Yes/No/N.A.	*Yes/No/N.A.
e)	Pressure reducing valve sets function properly.	*Yes/No/N.A.	*Yes/No/N.A.
f)	By-pass arrangement shall be incorporated with the provision of a second pressure reducing valve, except for fire service installations for ease of replacement.	*Yes/No/N.A.	*Yes/No/N.A.
g)	Pressure indicator shall be installed at the Pressure Reducing Valve system for pressure monitoring.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Automatic air release valves function properly.	*Yes/No/N.A.	*Yes/No/N.A.
3.3.8	Water Pumps		
a)	A standby pump set for both fixed water pump system and booster water pump system shall be provided. (TR 4.2.4.10)	*Yes/No/N.A.	*Yes/No/N.A.
b)	Water pumps and motors are run at the designed discharge water pressure and operating electrical current.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Water pumps are run at an acceptable noise and vibration levels.	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
d)	Water pump control switches and indicating lights function properly.	*Yes/No/N.A.	*Yes/No/N.A.
e)	The protective devices of water pump function properly.	*Yes/No/N.A.	*Yes/No/N.A.
f)	The temperatures of the water pump bearings at running condition are normal.	*Yes/No/N.A.	*Yes/No/N.A.
g)	The temperatures of the pump motors at running condition are normal.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Non-return valves connected to the pumps function properly.	*Yes/No/N.A.	*Yes/No/N.A.
i)	A fullway gate valve shall be provided on the drain-off pipe. (TR 6.2.4.3.3)	*Yes/No/N.A.	*Yes/No/N.A.
j)	Prior to pump start-up, the contractor shall check the horizontal or vertical alignment of all flexible joints is within the tolerances recommended by the manufacturers' installation guideline.	*Yes/No/N.A.	*Yes/No/N.A.

Measurements		**Designed**	**Measured**	**Remarks**
Volume flow rate	(l/s)			
No flow head	(kPa)			
Full flow head	(kPa)			
Starting current	(A)			
Running current	(A)			

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.3.9	Electrical Wiring		
a)	The electrical wiring system shall be tested satisfactorily in accordance with the T&C Procedure No. 2 for Electrical Installation and to Electricity Ordinance requirements.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Starter overloads are set correctly in relation to the motor name-plant full load current.	*Yes/No/N.A.	*Yes/No/N.A.
c)	All conductors shall be correctly and securely connected and identified.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Methods of protection against direct contact shall be properly applied.	*Yes/No/N.A.	*Yes/No/N.A.
e)	Isolation and switching devices are properly and correctly installed.	*Yes/No/N.A.	*Yes/No/N.A.
f)	Protective devices and monitoring devices are properly and correctly installed and set (e.g. MCB, control fuse, ammeter & voltmeter).	*Yes/No/N.A.	*Yes/No/N.A.
g)	The electric circuits, fused, switches, terminals etc. are properly and correctly labelled.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Danger notices, warning notices, schematic diagrams, instructions and similar information are correctly and adequately provided.	*Yes/No/N.A.	*Yes/No/N.A.
3.3.10	Pump Panels		
a)	All internal control panels are properly earthed.	*Yes/No/N.A.	*Yes/No/N.A.
b)	Nuts and bolts are tightened and connected properly.	*Yes/No/N.A.	*Yes/No/N.A.
c)	Equipment dust-free and in good order.	*Yes/No/N.A.	*Yes/No/N.A.
d)	All cables and terminals have good protection.	*Yes/No/N.A.	*Yes/No/N.A.
e)	All conduits and wirings are of appropriate size.	*Yes/No/N.A.	*Yes/No/N.A.
f)	All level switch/ level sensor (i.e. Low level cut-in, low level cut-out, high level cut out) are set correctly and performed properly.	*Yes/No/N.A.	*Yes/No/N.A.
g)	All indication lamps are performed properly.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Buzzer is set correctly in relation to the system / equipment failure and performed properly.	*Yes/No/N.A.	*Yes/No/N.A.
3.3.11	Comments		

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
3.4	**Automatic Meter Reading (AMR) System**		
3.4.1	Equipment Test		
a)	Inventory of hardware including software licences, authentication certificates, cables, etc. are correct.	*Yes/No/N.A.	*Yes/No/N.A.
b)	All spare memory, equipment capacity and system expansion requirements are met.	*Yes/No/N.A.	*Yes/No/N.A.
c)	All input and output expansion requirements have been met, including wiring and signal isolation, and verify that power supplies are capable of supporting the increased load for this expansion.	*Yes/No/N.A.	*Yes/No/N.A.
d)	All hardware and software boot-up and diagnostics are in normal.	*Yes/No/N.A.	*Yes/No/N.A.
e)	All power supply voltages are within tolerance.	*Yes/No/N.A.	*Yes/No/N.A.
f)	Proper earth connections and isolation of instrumentation earth for all equipment.	*Yes/No/N.A.	*Yes/No/N.A.
g)	All preloaded software and firmware have been properly installed and are operating correctly.	*Yes/No/N.A.	*Yes/No/N.A.
h)	Connectivity and speed of the communications network equipment are in normal.	*Yes/No/N.A.	*Yes/No/N.A.
i)	The systems are in full functioning	*Yes/No/N.A.	*Yes/No/N.A.
3.4.2	Before carrying out the site test		
a)	AMR Outstation is installed in accordance with all relevant drawings, circuit diagrams and the specified requirements	*Yes/No/N.A.	*Yes/No/N.A.
b)	All cables and individual conductors are labelled and ferruled as per the relevant drawings	*Yes/No/N.A.	*Yes/No/N.A.
c)	All items of the AMR Outstation are adequately and correctly labelled and identified	*Yes/No/N.A.	*Yes/No/N.A.
d)	The insulation resistance and continuity of all conductors of cables, etc. are acceptable	*Yes/No/N.A.	*Yes/No/N.A.
e)	The earthing arrangements are complete and a satisfactory value of earth loop impedance has been achieved	*Yes/No/N.A.	*Yes/No/N.A.
3.4.3	Final Acceptance Test		
a)	Integrity of the AMR data on the data concentration unit (DCU).	*Yes/No/N.A.	*Yes/No/N.A.
b)	Integrity of the AMR data on the Router/Modem.	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

		Items tested / Checked by Contractor	Items Witnessed by PBSE/PBSI
c)	Integrity of the AMR data on the AMR Master Station.	*Yes/No/N.A.	*Yes/No/N.A.
d)	Configuration and operation check on the meter interfacing units (MIUs)	*Yes/No/N.A.	*Yes/No/N.A.
e)	Operation check on the programmable logic controller (PLC)	*Yes/No/N.A.	*Yes/No/N.A.
f)	Change over test on the backup battery unit	*Yes/No/N.A.	*Yes/No/N.A.
g)	Operation check on the AMR Outstation upon a.c. power supply failure	*Yes/No/N.A.	*Yes/No/N.A.
h)	6-hour discharge test on the battery of the AMR Outstation	*Yes/No/N.A.	*Yes/No/N.A.
i)	Remote programming and diagnosis of the AMR Outstation	*Yes/No/N.A.	*Yes/No/N.A.

Tested / Checked by : (Name of Authorised Contractor's Representative)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	
Witnessed by : (Name(s) of *PBSE/PBSI)	Signature - ( )	Post :	
		Tel. No. :	
		Date :	

Part 4: Test Record attached to the Test Certificate

4.1 Test Data

Proforma for recording following data can be found in the succeeding pages and these shall be properly filled in before submission to the PBSE with any relevant comments related to site conditions.

- Vibration Test – Equipment Vibration Measurement Record

Proforma for Vibration Test – Equipment Vibration Measurement Record

Name of project : _____
Date and time of measurement : _____
Weather condition : _____
Measured by : _____

Measurement instrument used : _____
Model no. : _____
Serial no. : _____
Last date of calibration : _____

Equipment	Indicated operation speed (rev/s)		Measured speed (rev/s)		Visual /audible check	Vibration acceptance criteria (mm/s)	Vibration measured (mm/s)			Other observations /remarks
	Motor	Equipment	Motor	Equipment			Horizontal	Vertical	Axial	

Attachment includes a sketch showing the positions of measuring points for each equipment.

Annex III

List of Calibrated Equipment/ Instruments Necessary for the Testing and Commissioning Works

Type	Model	Serial No. of Instrument	Date of Calibration

Annex IV

Sampling Report

This *sampling report form is served as reference for water sampling and analysis as stipulated in this T&C Procedure and General Specification of Building Services Installation.

Sampling reference no.:			Name of laboratory		
Sample point reference:			Sampling purpose:		
Sample point name:					
Sample point location:					
Weather conditions:					
Time of sampling:			Date of sampling:		
Bottle type:			Preservation and storage:		
Field tests					
Storage in transit:					
Sampler's name:			Signature:		
Sampler's contact no.:					
Analysis required:					
Hazards:					
Sampler's comments:					
Time received in laboratory:			Date:		
Received by:			Signature:		
Laboratory comments:					
Special instructions to the analyst:					

(*Remark: This form is made reference to BS ISO 5667-21:2010)