

**Memorandum for the Review Committee on Quality Assurance Issues  
Relating to Fresh Water Supply of Public Housing Estates  
of the Hong Kong Housing Authority**

**Procurement Matters Relating to Fresh Water Supply System in Housing  
Authority's Public Housing Developments**

**PURPOSE**

This paper informs Members about the procurement matters in respect of Fresh Water Supply System in Hong Kong Housing Authority (HA)'s Public Housing Developments.

**BACKGROUND**

2. HA, as a procuring entity governed by the Agreement on Government Procurement of the World Trade Organisation (GPA), is committed to securing competent and reliable contractors or services providers through equitable procurement principles<sup>1</sup> and operations, so that HA can deliver our business effectively with the best value for money in accordance with the established procurement strategies and principles<sup>2</sup>. This paper covers procurement matters for building contracts and nominated subcontract in pre-contract stage corresponding to **Step 6 of the Flow Chart in Annex 1 of**

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1 The basis of the HA's procurement principles are as follows -

- (a) Obtain Value for Money;
- (b) Incorporate Risk Management in a holistic manner;
- (c) Maintain a focus on continuous improvement at all levels;
- (d) Provide effective governance which is accountable and transparent;
- (e) Provide for open and fair competition in the market place; and
- (f) Procure in a fair, reasonable and ethical manner with due regard to probity.

2 The procurement strategies and principles include –

- (a) To achieve competitive tendering by securing a sufficient number of tenderers in each tender exercise;
- (b) To identify capable contractors for delivery of public housing construction and maintenance works by allocating tender opportunities commensurate with the performance and capability; and
- (c) To maintain a balanced risk level to HA through fair and equitable risk allocation by conducting competitive tender, containing concentration risk and securing the appointment of better performers.

**Paper No. RC 6/2015.** This paper should be read in conjunction with Paper No. **RC 11/2015** regarding contractual arrangements.

3. To achieve the objectives of the procurement strategies and principles, HA adopt a series of procurement measures, covering list management, allocation of tender opportunities and tender evaluation, with a view to protecting the interest of HA and also that of the general public in the course of delivering construction and maintenance services.

### **LIST MANAGEMENT**

4. As a prudent risk management measure and to address the frequent need of inviting tenders of similar nature for works, HA has established and maintained HA Lists of qualified contractors (**Annex A** refers) for selective tendering. It is our prime objective for having a sufficient number of potential bidders on each HA List to ensure competitive bidding for each tender. To avoid concentration risk, we apply workload capping limit, tender restriction threshold, and restriction in the number of contracts to be awarded within a rolling 6-monthly period for building (new works) contractors.

5. HA does not have direct contractual relationship with the subcontractors, However, for works requiring relatively high expertise in technical skills, HA maintains contractor lists for the following specific types of building services installation works under nominated sub-contract arrangement.

- (a) Electrical Installation;
- (b) Lifts and Escalators Installation; and
- (c) Fire Services and Water Pump Installation.

6. For other builder's works such as plumbing installation works, HA adopts domestic sub-contracting approach for the main contractor to select their own sub-contractor who must be registered under the Subcontractor Registration Scheme administered by the Construction Industry Council. HA does not have a list of plumbing installation contractors, and it is not until January 2013 when the Government has established such a List, "Plumbing Installation" (PI) Category under the List of Approved Suppliers of Materials and Specialist Contractors for Public Works, which is administrated by the Development Bureau (DEVB) and managed by Architectural Services Department<sup>3</sup>. DEVB had started to invite tenders from the PI category of

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3 The Architectural Services Department will be responsible for servicing and monitoring the performance of all contractors under the plumbing installation category.

specialist contractors for plumbing installation contracts on public works from July 2014 onwards. So far HA has not been applying specific risk management measures to avoid concentration risk for plumbing subcontractors and Licensed Plumbers undertaking such works for HA's building contractors. Arising from this incident, it may be prudent for the HA to consider introducing the following measures for more effective risk management –

- (a) specifying the use of plumbing subcontractors that are on the PI Category under the List of Approved Suppliers of Materials and Specialist Contractors for Public Works which is administered and managed by DEVB and Architectural Services Department respectively, in order to enable more effective control on competent performers to be employed by building contractors; and
- (b) applying capping limit to plumbing subcontractors and Licensed Plumbers, in order to avoid concentration risk.

## **SELECTION OF TENDERERS**

7. In order to identify capable and competent contractors, contractors' participation in tender exercises are commensurate with their performance on HA contracts, as well as using their PASS (Performance Assessment Scoring System) scores in tender assessments. The contractors are grouped into different bands with different tendering opportunities based on their PASS scores<sup>4</sup>.

8. HA also enhanced the tender opportunities of smaller sized Building Contractors by increasing the tender limit of NW1<sup>5</sup> Contractors (Paper No. **TC 17/2014** refers). To increase the number of eligible and capable tenderers, HA have also introduced NW1 Contractors to undertaking smaller scale and non-complex building and maintenance contracts. (Paper No. **TC 29/2014** refers).

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4 Contractors in the upper quartile of the PASS score league (i.e. the best performers) will be given full tender opportunity, whilst those in the middle band (between the upper and lower quartiles) will be given partial opportunities to be determined by the Department. Contractors in the lower quartile will be given minimum tender opportunity. Wildcard contractors will also be allocated minimum tender opportunity commensurate with their performance track records in comparable non-HA contracts.

5 Building Contractors in New Works Category are divided into two groups, namely Group NW1 and Group NW2. Group NW1 contractors are eligible to tender for contracts with value of up to \$550M, while Group NW2 contractors are eligible to tender for contracts of unlimited value.

## TENDER ASSESSMENT

### Building Contracts

9. For tender assessments, HA adopts Preferential Tender Award System (PTAS) to assess works tenders based on a pre-determined price to non-price score ratio. Breakdowns of the score ratio are shown at **Annex B**.

----- 10. For **new works building contracts**, HA adopts the following approach in tender assessment –

#### **(A) Price and Non-Price (Single-Envelope)**

For building contracts of simple nature, a non-price to price ratio of 25:75 has been adopted for tender evaluation. The non-price component comprises 17% PASS score and 8% Corporate score for the desired corporate best practices (Paper No. **TC 22/2009** refers). In line with GPA, the criterion for awarding the contract has been stipulated in the tender documentation and made known to all tenderers.

#### **(B) Price and Non-Price with Technical Proposal (Two-Envelope)**

For building contracts of high complexity<sup>6</sup>, a two-envelope system with a pre-defined marking scheme for technical proposal is adopted for tender evaluation. A non-price to price ratio of 35:65 has been adopted, with 10% for the technical proposal in the non-price portion. In addition, only tenderers attaining scores above the threshold score of 60% in the technical proposal will be considered further<sup>7</sup>.

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6 Since early 2011, the scores for technical proposals of capital works building and piling contracts of high complexity are 10 and 15 respectively (Paper No. **TC 13/2011** and Paper No. **TC 30/2011** refer).

7 Since 16 September 2011, threshold score of 60% to the overall score of the technical proposal (before normalization) had been established to all complex building and complex piling contracts. Tenders whose overall score for technical proposal are less than 60% will not be considered further in the tender evaluation and their tender price envelopes will not be opened (Paper No. **TC 81/2011** refers).

11. Most of the new works building contracts are classified as complex and adopt the two-envelope system in tender evaluation. The technical proposal which accounts for 10% of the score comprises –

- (a) planning, programme of works, construction and risk management (3%);
- (b) contractor's capability, experience and manpower resources (2%);
- (c) technical considerations (3%);
- (d) contractor's plant and equipment (1%); and
- (e) ICU/statutory/environmental/safety submission (1%).

12. Since HA adopts modular flat design, plumbing installation works is usually considered as relatively straight forward in design and construction input. Hence, expertise by contractor is not required. In this connection, plumbing installation work is usually not included in technical proposal.

### **Nominated Sub-Contracts (NSC)**

13. For Building Services Sub-contracts, the Building Services design is typical and technical in nature, separate technical proposal from tenderers will not be required. Therefore, Building Services NSCs generally adopt **Price and Non-Price (Single-Envelope)** with a non-price to price ratio of 25:75<sup>8</sup> for tender evaluation.

## **PERFORMANCE ASSESSMENT SCORING SYSTEM (PASS)**

### **Building PASS**

14. HA designed the PASS to measure contractors' performance objectively against a set of defined standards; and provide a consistent and transparent means of comparing performance of individual contractors on individual projects. Better performers will have more chances to bid than poor performers.

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<sup>8</sup> Since April 2011, the pre-determined 25:75 ratio for non-price to price scores has been changed to 30:70 for the evaluation of capital works lift and escalator tenders (Paper No. **TC 13/2011** and Paper No. **TC 30/2011** refer).

15. PASS assessment for Building Contracts comprise the following components, as shown at **Annex C**–

- (a) Output Assessment;
- (b) Input Assessment; and
- (c) Maintenance Period Assessment (MPA).

Under the component of **Architectural Works**, contractor's performance on plumbing installation including type and size, pipe brackets, pipe sleeve, soundness, plumb, level/fall will be assessed. For material compliance, it is assessed under the component of **Management Input**. Details of assessment items on plumbing are extracted at **Annex D**. There is no separate assessment item on solder joint material. Arising from the incident, it may be prudent for the HA to consider including soldering material in the compliance assessment.

## **BSPASS**

16. Similar to Building PASS, BSPASS for building services nominated sub-contract are also carried out for Electrical, Fire Services and Water Pump, and Lift and Escalator Installations. The scores assigned to each component are shown at **Annex C**.

17. For Fire Services and Water Pump (FSWP) Sub-contract, the component of Management Input covers assessment for management of their sub-contractors. For plumbing related items in FSWP installation, BSPASS assesses water pump installation including pipework, fittings, pump sets and control cubicle, etc. within the pump rooms only (**Annex E** refers).

## **REGULATORY ACTION**

18. In accordance with the Guide to Registration of Works Contractors and Property Management Services Providers” (the “Guide”), HA may take the following actions against contractors due to their non-performance and inability to comply with contract requirements –

- (a) Restriction or Suspension from Tendering  
Regulatory action will be imposed if a contractor fails to meet HA's contractual requirements or adverse performance (paragraph 4.1.8 of Part I of the “Guide” refers).

(b) Removal from the List

In the event that a contractor has been involved in serious incidents of wages in arrears, quality or safety problems which had brought disrepute to the HA, or other serious incident that has aroused grave concern of the Government and members of the public, it will be removed from relevant or all HA Lists (paragraph 4.10.1 of Part I of the “Guide” refers).

(c) Removal from Premier League Status (PLS)<sup>9</sup>

Should a Premier League Contractor, after admission, be subject to regulatory actions imposed by HA in the form of suspension, downgrading and/ or removal from the HA list of Main Contractors, it will be removed from the PLS immediately (paragraph 4, Section 11 of Part II of the “Guide” refers).

(d) Quarantine

HA will put those tenderers who have been involved in circumstances that are defined as serious incidents under “quarantine”, if they are one of the top three scorers, regardless of whether or not they have marks deducted, for any serious incidents occurring within the six-month period preceding the tender closing date or within the tender assessment period preceding the tender award date.

### **Precedent Cases on Actions Taken on Contractors Due to Non-compliance with Contract Requirements**

19. There are some past incidents of non-compliance with contract requirements for works carried out by the main contractors. Relevant and appropriate regulatory actions may be imposed depending on various factors of considerations such as the seriousness and implications of the non-compliance, cause of the non-compliance, responsibility of the contractor in the incident, and commitment of the contractor in undertaking remedial measures.

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<sup>9</sup> Amongst the four subject contractors in the “incident”, China State, Shui On and Yau Lee are Premier League Contractors. Currently, only these three contractors have Premier League Status which will expire by 30 September 2015. A new applicant, Hip Hing Engineering Company Limited, has applied for admission to the PLS recently and the application is under process.

## IMPROVEMENT MEASURES BEING ADOPTED

20. After the incident, immediate actions taken as follows –

### By the Tenderers

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- (a) Requiring those tenderers ranked among the top three in combined score of all the five building tenders to submit Quality Assurance Proposal to ensure the water pipes to be installed in the HA contracts for which they have submitted tenders will meet the contract requirements. The requirements on Quality Assurance Proposal, including the action items covering the following actions according to job stages, are in **Annex F**; and

### By HA

- (b) Considering list management measures for more effective risk management and make recommendation to HA's Tender Committee for consideration-
- specifying the use of plumbing subcontractors that are on the PI Category under the List of Approved Suppliers of Materials and Specialist Contractors for Public Works which is administered and managed by DEVB and Architectural Services Department respectively, in order to enable more effective control on competent performers to be employed by building contractors; and
  - applying capping limit to plumbing subcontractors and Licensed Plumbers, in order to avoid concentration risk.
- (c) Considering enhancing performance assessment in building PASS by including soldering material in the compliance assessment.



## **INFORMATION**

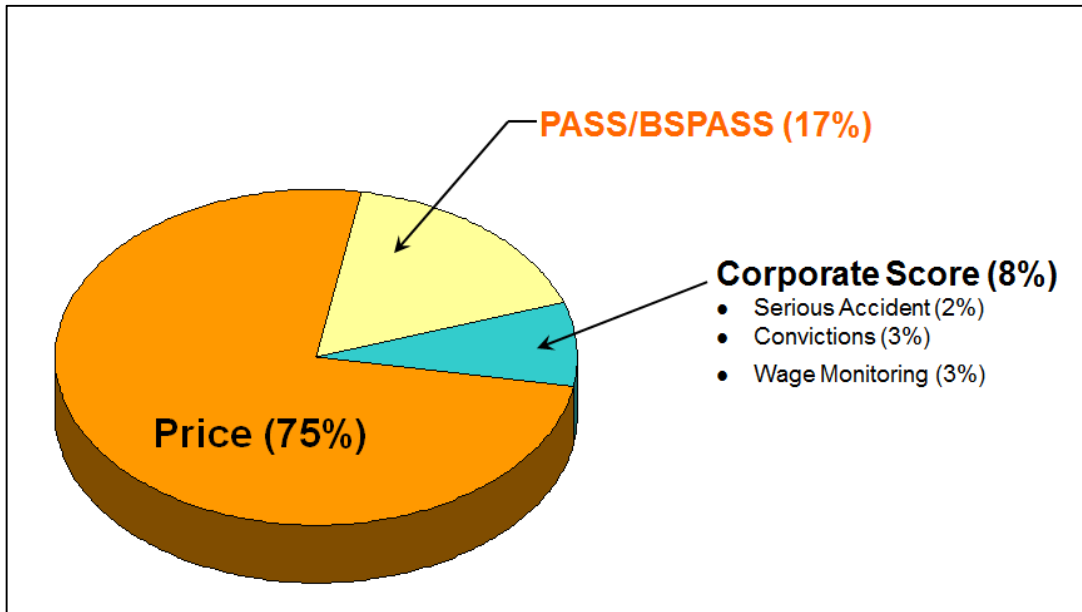
21. This paper is for Members' information.

Miss Michelle LAU  
Secretary, Review Committee  
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Fax No.: 2761 0019

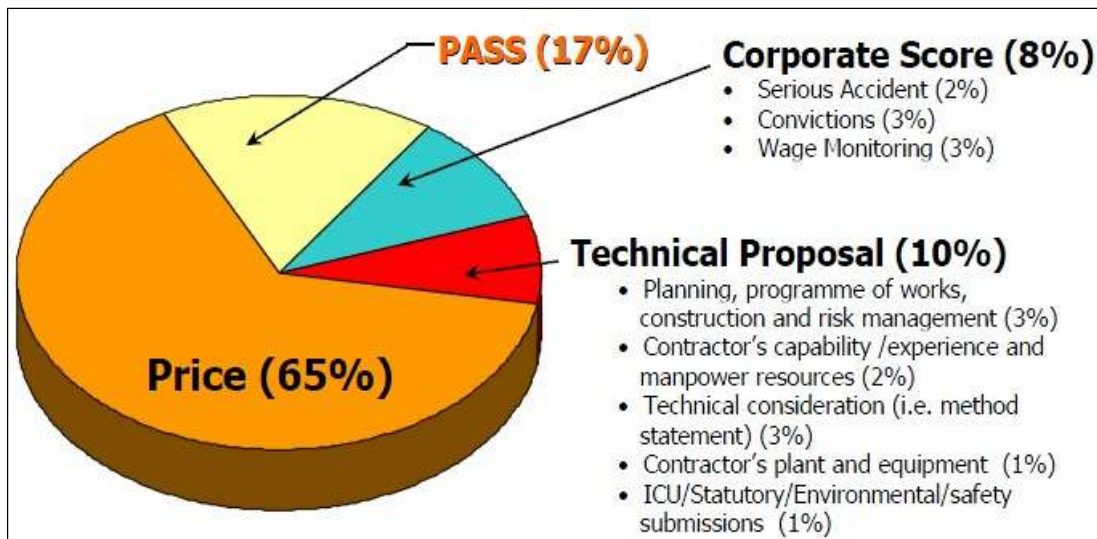
File Ref. : HD (C) DS 624/1  
Date of Issue : 14 August 2015  
(Revised 25 September 2015)

**Housing Authority Lists of Contractors**

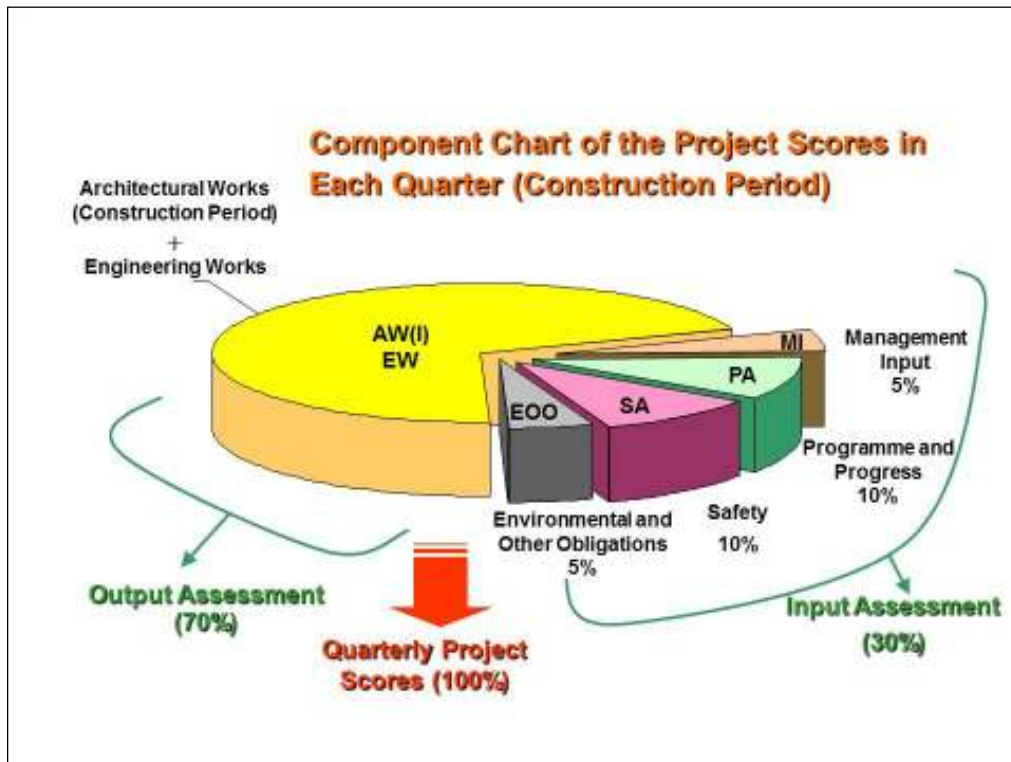
<b>HA Lists of Contractors</b>		<b>Number of contractors as of end July 2015</b>
(1)	Building (NW) – NW1	18
	Building (NW) – NW2	23
	Building Maintenance – M1	16
	Building Maintenance – M2	31
(2)	Piling – Large Diameter Bored Piling (LDBP)	10
	Piling – Percussive Piling (PP)	9
(3)	Demolition	16
(4)	Ground Investigation	10
(5)	Electrical	27
(6)	Lift	10
	Escalator	9
(7)	Fire Services & Water Pump	16
(8)	Soft Landscape – SL1	9
	Soft Landscape – SL2	6
(9)	Material Testing Laboratories for Pile Testing	5
(10)	Property Services Agents	27
(11)	Cleansing Service Contractors	32
(12)	Security Service Contractors	22
<b>Total</b>		<b>296</b>



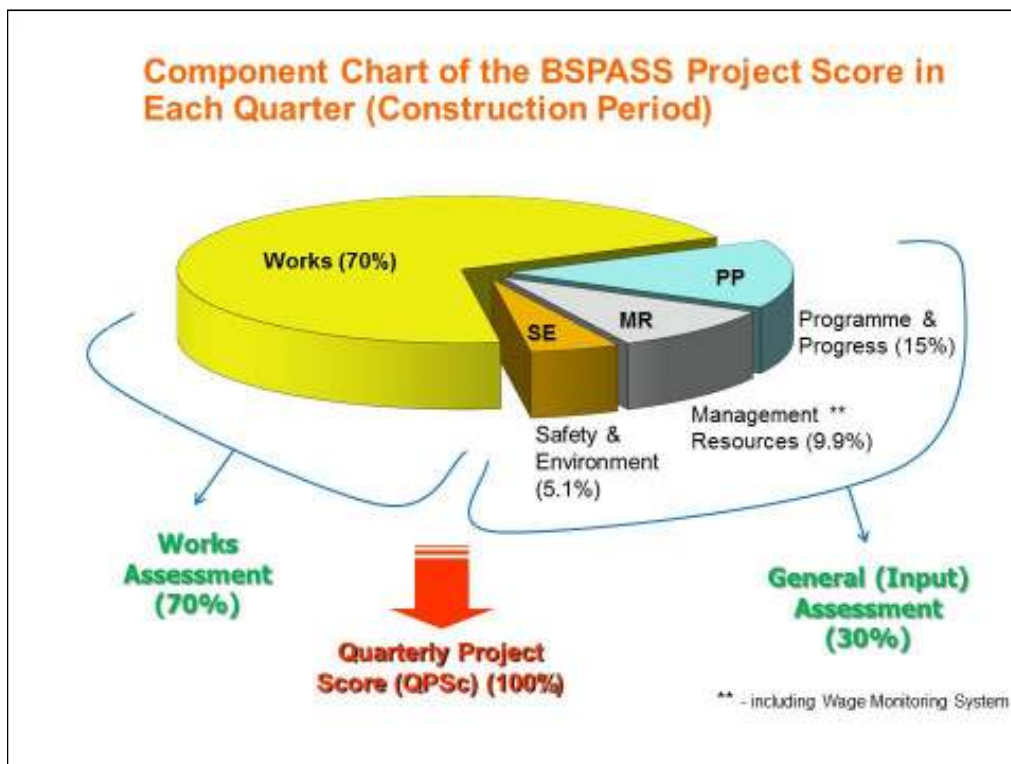
**Price and Non-Price (Single-Envelope)**  
**(for Building and Building Services)**



**Price and Non-Price with Technical Proposal (Two-Envelope)**  
**(for Building)**



**Score Components in PASS Assessment**



**Score Components in BSPASS Assessment**

Details of PASS assessment items  
Architectural Works (Interim) - Plumbing Works  
Management Input – Quality Control

Assessment Standards for Interim Assessment

Factor/Sub-factor/Item Standard/Remark

## 6. Plumbing / Drainage

### 6.1 Plumbing – Above Ground (Fresh Water pipes / Flush

#### Water Pipes)

1. Type and Size	<ul style="list-style-type: none"> <li>Type and size of pipes and brackets are as approved and specified</li> </ul>	(A) Compliance (B) - (C) - (D) Non-compliance (E) - (N) N.A.
2. Pipe Brackets	(i) Pipe brackets are provided at correct centres as specified and neatly / tightly fixed. (ii) Pipes should be at least 25mm from finished wall. (iii) Lined with plastic which fitted between pipes and brackets.	(A) Compliance (B) - (C) - (D) Non-compliance with either (i), (ii) or (iii)- (E) Non-compliance with any two or all of (i), (ii) and (iii) (N) N.A.
3. Pipe Sleeve	(i) Pipes sleeves with correct projection are provided (min. 40mm for vertical pipes; MPD: +20mm to -5mm for horizontal pipe) ; (ii) Void between pipes and sleeves are properly filled / caulked as approved and specified	(A) Compliance (B) - (C) - (D) Non-compliance with either (i) or (ii) (E) Non-compliance with both (i) and (ii) or any $D > 2 \times$ MPD in (i) (N) N.A.
4. Soundness	(i) Pipes/Joints/Brackets are free from cement stain and paint etc. (ii) Open ends are properly covered (iii) Pipes, brackets and/or joints are free from rust, crack, and damage.	(A) Compliance (B) - (C) Non-compliance with either (i) or (ii) (D) Non-compliance with (i) and (ii) (E) Non-compliance with (iii) (N) N.A.
5. Plumb	<ul style="list-style-type: none"> <li>Installed vertically For vertical pipes: MPD: 3mm/1.2m</li> </ul>	(A) Compliance (B) - (C) - (D) Non-compliance (E) - (N) N.A.
6. Level / Fall	<ul style="list-style-type: none"> <li>Installed horizontally or installed to specified direction of fall. For horizontal pipes: MPD: 3mm/1.2m</li> </ul>	(A) Compliance (B) - (C) - (D) Non-compliance (E) - (N) N.A.

## 3.2. Quality Control

### 3.2.1. Control of Workmanship

- (a) The Contractor is to execute the works<sup>Ⓞ</sup> in strict accordance with the Contract and to the satisfaction of the CM/CMR.
- (b) Ensure that results of test, measurements and examinations of the works<sup>Ⓞ</sup> as required in the Contract or as instructed by the CM/CMR are to be in conformance with the Specification and Drawings.

Grading <sup>Ⓞ</sup>	Standard
(A)	No non-compliance.
(C)	Minor non-compliance <sup>Ⓞ</sup> .
(E)	Major non-compliance <sup>Ⓞ</sup> .
(N)	-

- Remarks:
- ① Refer to the definitions in sub-section 3/1.
  - Ⓞ The FT should counter check that the assessment given is compatible with other inter-related items on "quality control" and "communications, compliance and co-operation".

### 3.2.2. Material Compliance

Failure to ensure material(s) comply with the required Specification or approved sample(s) without justifiable reason(s) will constitute a non-compliance case.

Grading <sup>Ⓞ</sup>	Standard
(A)	No non-compliance noted.
(C)	Minor non-compliance <sup>Ⓞ</sup> .
(E)	Major non-compliance <sup>Ⓞ</sup> .
(N)	-

- Remarks:
- ① Refer to the definitions in sub-section 3/1.
  - Ⓞ The FT should counter check that the assessment given is compatible with other inter-related items on "quality control" and "communications, compliance and co-operation".

Details of BSPASS Works Assessment Items  
Water Pump Installation

**BSPASS - FW Manual**

**Assessment Standards for Works Assessment**  
**FW04 - Water Pump Installation**

**3/6**

<u>Sub-factor</u>	<u>Item</u>	<u>Assessment Standard</u>
4.1 Pumpset	a. Pump	i. Same make as approved. (Critical Failure)  <i>(Guidance : “Non-compliance” shall be given if no nameplate is found on the body and add remarks.)</i>
		ii. Same model as approved. (Critical Failure)  <i>(Guidance : “Non-compliance” shall be given if no nameplate is found on the body and add remarks.)</i>
		iii. No apparent damage or rust.
		iv. Baseplate: Horizontal pump is mounted on a single baseplate constructed of stainless steel of grade 316. Fabricated steel baseplate is a stainless steel plate welded on a stainless steel channel base frame. Vertical pump with integral base suitable for direct mounting onto the pump plinth.
	b. Coupling	i. Stainless steel see-through protective guard for every pumpset, which is ready for running, is provided.
		ii. No apparent damage or rust.
	c. Motor	i. Same make, model & rating as approved catalogue. (Critical Failure)
		ii. No apparent damage or rust.
	d. Supply Cable	i. Supply cable is of approved make and type.  <i>(Guidance : Assess the cables connected between the motor and the motor starter inside control panel.)</i>
		ii. Armoured supply cable, if used, is of correct size as approved drawing and is supported by approved cable cleat/saddle and terminated with approved cable gland.
		iii. Single core supply cables, if used, are of correct size as approved drawing-and are drawn in PVC sheathed flexible steel conduit with correct size of circuit protective conductor provided.
		iv. Cables are tightly terminated.

**Assessment Standards for Works Assessment**  
**FW04 - Water Pump Installation**

<u>Sub-factor</u>	<u>Item</u>	<u>Assessment Standard</u>
4.2 Valves & Accessories	a. Valve	i. Same make and size as approved sample/ catalogue. (Critical Failure) ii. No apparent damage or rust. iii. Check valve is at correct direction. <i>(Guidance: "Not applicable" will be given if no direction flow marked on body.)</i>
	b. Strainer	i. Same make and size as approved sample/ catalogue. (Critical Failure) ii. No apparent damage or rust. iii. Caused no obstruction for dismantling and cleansing of strainer.
	c. Flexible Connector/ Pipeline Vibration Eliminator	i. Same make and size as approved sample/ catalogue. (Critical Failure) ii. No apparent damage or rust. iii. Control rod complete with cable assembly is provided to prevent damage from excessive movement. <i>(Guidance: The control rod shall be mounted without visible distortion. "Not applicable" will be given if the <u>cable</u> is not provided at the stage of construction work.)</i> iv. No excessive offset/extension/compression at static condition.
	d. Pressure Reducing Valve	i. Same make and size as approved sample/ catalogue. (Critical Failure) ii. No apparent damage or rust. iii. Pressure reducing range and setting as specified.(+) iv. Flow direction is correct.



**Assessment Standards for Works Assessment**  
**FW04 - Water Pump Installation**

<u>Sub-factor</u>	<u>Item</u>	<u>Assessment Standard</u>
4.3 Pipe Work	a. Pipe	i. Same make as approved sample/catalogue.(+) (Critical Failure)  <i>(Guidance: Record check of the pipe work is same as approved sample before applying primer.)</i>
		ii. No apparent damage or rust.
		iii. Size & arrangement as approved drawings.
	b. Accessories	i. A 25mm dia. drain cock with hose bib is provided between the check valve and gate valve at the pump discharge to facilitate draining of riser pipe.  <i>(Guidance: For fresh water, flush water and F.S. feed pump only. "Compliance" may be given if the hose bib is provided but the rubber hose diverted to the drain pipe is not provided.)</i>
c. Fitting		i. Same make and type as approved sample/ catalogue. (Critical Failure)
		ii. No apparent damage.
		iii. Approved standard fitting used.
		iv. Bend and tees in accordance with the Specification.  <i>(Guidance: All bend shall be of long radius type and all tees shall be of the pitcher or twin elbow type (not applicable to UPVC lined fitting), unless otherwise indicated or approved.)</i>
		v. In the case of suction lift, eccentric reducer used at pump suction as approved.  <i>(Guidance : "Not applicable" will be given if eccentric reducer is provided for the case of <u>non-suction lift</u>.)</i>
d. Pipe Joint	i. G.S pipe jointed according to the specification.  <i>(Guidance: GS pipe of 100mm and below jointed with screwed fitting/ flange/union and of 150mm jointed with screwed flange.)</i>	

**Quality Assurance Proposals to Ensure the Quality of  
Fresh Water of Housing Authority Projects**

**PURPOSE**

In view of the recent “excessive lead content in fresh water in public housing estates” incidents, tenderers are required to submit quality assurance proposals to ensure the water pipes to be installed in Housing Authority (HA) projects for which they have submitted tenders will meet the contract requirements.

**REQUIREMENTS OF THE PROPOSAL TO BE SUBMITTED**

The proposals are to include (but not limited to) the following –

- (a) Quality assurance plan to ensure all materials of water pipes and their associated fittings, soldering materials (if applicable) for jointing, etc. delivered to site shall comply with the specification requirements;
- (b) Procurement, site management (including management of plumbing domestic sub-contractors, licensed plumbers and workers) and site supervision plan to ensure:
  - Only the approved materials [including soldering materials (if applicable), fittings, etc.] are delivered and used in site;
  - The approved method of installation (including jointing) of water pipes has been adhered to;
  - Ways to ensure adequacy of skilled plumbing workers;
  - Workmanship shall meet the contract requirement;
- (c) Testing procedure for the installed plumbing system;
- (d) Reporting mechanism to Contract Manager throughout the whole construction period, including final inspection;
- (e) Defect rectification procedures and monitoring process; and
- (f) Action items as detailed in **Appendix 1** as attached.

**PROPOSALS TO BE BOUND INTO CONTRACT IF AWARDED**

The relevant proposals as agreed by HA will be bound into contract in case the submitted tender is awarded.

**Improvement Measures to Assure Quality of Plumbing Installations**

(Issue 1 – 9 August 2015)

Improvement measures to assure quality of plumbing installation works (in order to prevent the risk of lead in solder joints) include the following actions, depending on the stage of work -

**Action 1 – Testing of water samples upon completion :** Carry out test for water samples for each zone according to the latest additional water sample testing requirements (including lead, cadmium, chromium, nickel) published under WSD’s Circular Letter No. 1/2015 on 13 July 2015.

**Action 2 –Testing of finished work :** Apply hand held equipment or other quick test methods for on-site checks to detect the presence of lead in solder joints, and conduct confirmatory laboratory tests if deemed appropriate.

**Action 3 – Supervision of workers :** Apply more stringent subcontractor supervision plan (down to worker’s level) for enforcement, to ensure that all workers will use only lead-free category of solder materials for jointing of copper pipes.

**Action 4 – Quarantine of materials :** Apply more stringent material handling plan by quarantine, sample testing before release for use of lead-free category of solder materials for jointing of copper pipes.

**Action 5 – Reduce / Remove the risk :** Review plumbing installation action plan, by (a) Restricting the use of lead-free solder materials ONLY for jointing of those copper pipes that can be executed in a workshop or factory environment, under close supervision and surveillance; and (b) Allowing the use of mechanical “push fit” jointing method only, when workers are working on upper floors where close supervision and surveillance may not be practical. (“Press fit” jointing method may require more working space, though permissible.)

**Apply the improvement measures according to job stages as follows -**

**Action 1** : at completion stage when water is available for testing

**Action 2** : at any time during construction stage (before water is available for testing, or even after testing of water samples)

**Action 3** : during active construction stage

**Action 4** : during active construction stage

**Action 5** : For contracts during early stage, contracts yet to be awarded / tenders to be issued