

Method Statement for Installation of HVAC Ductwork

1.0 Scope:

- 1.1 This method statement applies to installation of HVAC Supply, Return and Exhaust ducts, dampers, fire dampers and access doors. The fire rated duct and accessories method statements will be separately submitted.

2.0 Purpose:

- 2.1 The purpose of this method statement is to outline the method of storage and installation of HVAC supply, return and exhaust ducts including fixing of dampers, fire dampers and access doors.

3.0 Application:

- 3.1. G.I. Sheet metal ducts are used for exhaust ducting. Pre-insulated ducts are used for supply, return and treated fresh air ducting.

4.0 Material:

- 4.1 Pre fabricated ducts made of G.I. Sheet.
- 4.2 Pre fabricated ducts made of pre-insulated panels.
- 4.3 Flanges and cleats for joining the G.I. ducts factory fabricated of G.I. Sheet steel as per SMACNA HVAC construction standards 1985.
- 4.4 Aluminium flanges and profiles, PVC cleats, etc., for joining of pre-insulated ducts as per approved submittals.
- 4.5 Threaded rods, G.I. angles, etc., for supporting system.
- 4.6 Duct sealant, Gaskets & Adhesives.
- 4.7 VCDs, Fire dampers and Access doors as per approved submittals/samples.

5.0 Method:**5.1 Storage**

- 5.1.1 When off-loading, the ducts shall be carefully lowered to ensure no damage to edges or duct surface.
- 5.1.2 All ducts shall be stored properly to safeguard ducts from any abrasions and damages.
- 5.1.3 All delivered ducts will be stacked and covered by polythene sheets to protect from dust etc.
- 5.1.4 Duct sealant, adhesive, gaskets, etc., shall be stored in enclosed area in as per manufacturer's recommendations.

5.2 Preparation:**5.2.1 G.I. Ducting**

5.2.1.1 Ducts are pre-fabricated and longitudinally pre-assembled to a maximum length of 1.2m at the workshop as per the construction schedule enclosed. Preparation/formation of flanges for transverse joints are made at workshop.

5.2.1.2 Ducts received at site as above shall be joined together on the floor, to form manageable lengths.

5.2.1.3 Wherever branch take-off collars are to be fixed, suitable cut out shall be made in the ducts. The size of cut out shall be equal to the duct cross sectional area and secured using aluminium pop rivets and the joint between collar flange and duct surface shall be sealed with approved duct sealant.

5.2.1.4 Wherever flexible ducts are to be fixed, a suitable diameter prefabricated collar shall be fixed to the main duct-using dovetail joining system. A sample of the same will be made at site for approval prior to proceeding with installation.

5.2.2 Pre-insulated Ducting

5.2.2.1 Ducts are pre-fabricated in the workshop and longitudinally assembled to a maximum length of 4m.

Preparation for the traverse joints including the fixing of the flanges/profiles as applicable as per the construction schedule is carried out at workshop. Please refer attached Annexure-II (revised)

5.2.2.2 Ducts received at site as above shall be joined together on the floor to form manageable lengths.

5.2.2.3 Branch take-off collars are tap-in glued type and will have shoe configuration at the take-offs. Wherever branch take-offs are to be made, suitable cut out shall be made on the main duct with 45° angle cutter to form the 45° female part of the joint. The branch/take-offs with 45° male cut ends are secured to the main duct by the joining glue. The joint is sealed with approved duct sealant and finished with self-adhesive aluminium foil tape.

5.2.2.4 Wherever flexible ducts are to be fixed, pre-fabricated G.I. collars of required diameter are fixed to the main duct by means of a pre-fabricated groove on the collar (to prevent the inward movement against the panel face) and dovetail folding at the inner side of the panel. Approved duct sealant is applied at the joint.

6.0 Installation:

6.1 The layout of duct to be installed shall be as per approved drawing.

6.2 Position of duct supports shall be marked on the underside of the slab / structural member/vertical walls as the case may be and mechanical anchor fasteners shall be installed in slab or suitable clamps shall be installed if support to be taken from structural member, to facilitate suspension of threaded rods for duct trapeze support. The support details and spacing shall be as per the DW 144 / approved drawings for G.I. ducts and as per manufacturer's recommendation for pre-insulated ducts.

6.3 Threaded rod of suitable size as per DW144 shall be fixed to the mechanical anchor fastener / clamps using proper lock nut.

- 6.4 G.I. angle, cut to required size of duct (to have clearance of 50mm on either side) shall be fixed to the threaded rod suspension and locked in position by suitable zinc coated nuts and washers.
- 6.5 Assembled, as above, ducts shall be lifted and shall be installed on trapeze.
- Similarly the next length of duct shall be erected and two are joined together by means of suitable cleats, zinc coated bolts, nuts, washers, gaskets, etc., as applicable as per the construction schedules for G.I ducts. Care shall be taken to seal the corners and transverse joints with approved duct sealant.
- Pre-insulated ducts are joined either by glue in type male & female joints or with PVC H bayonet cleats for flanged joints as applicable as per the construction schedule. Duct sealant is applied at the male and female joint and finished by self-adhesive aluminum tape. For flanged joints, sealant is applied on all 4 corners and the corners are finished with PVC lock-in type corner caps.
- 6.6 On laying the ducts as detailed above to form the required layout, the ducts shall be properly aligned and levelled to maintain B.O.D. and distances as per approved drawing.
- 6.7 Riser / Shaft Ducts: Necessary scaffolding arrangement to suit site conditions shall be made. Duct supports shall be taken at each floor / vertical wall as the case may be and shall be as per approved drawings. Successive ducts shall be installed starting from low level as the successive higher floors are constructed. The open end of the upper most ducts shall be sealed properly.
- 6.8 The insulation of the flexible ducts shall be rolled upto 100mm from the edges and the flexible duct shall be slipped on to the collar fixed on the main duct and shall be secured firmly using G.I. Straps and clips. Then the insulation of flexible duct shall be rolled back and fixed firmly on to spigots and adjoining duct surface and finished with self-adhesive aluminium foil tape.
- 6.9 Flexible ducts installed as above shall be supported using 25mm G.I. strip wound around the duct and suspended from slab if the flexible duct length exceeds 1 metre.
- Suitable plenum box as applicable shall be connected to main duct through pre-insulated flexible ducts. These diffuser plenums shall be prefabricated as detailed above, connection through round collars fixed to plenum. Diffuser plenum boxes shall be suspended from underside of slab using central hanger made of galvanized threaded rod fixed to mechanical anchor fastener and secured using zinc coated nuts and washers. The single rod suspension shall be limited to square diffuser plenums of size upto 300mm and multiple suspensions shall be provided for higher size. For slot diffuser plenum boxes suspension rod shall be provided on center of two shorter sides of the plenum.
- 6.10 Manual volume control dampers as approved shall be fixed in the ducting system wherever mentioned in the drawing. The type of fixation shall be a companion flange. Care shall take to allow the operation of VCD handles.
- 6.11 Insulation of VCDs installed in the pre-insulated ducts shall be carried out using closed cell electrometric foam insulation.
- 6.12 Fire damper shall be installed as per approved drawing / manufacturer installation details.
- 6.13 Access doors shall be provided for fire dampers wherever applicable. Suitable cut out to suit the size of the access door shall be made in the duct either in the bottom or side as per site conditions. The mounting frame of access door is fixed to the duct using dovetail joint system for G.I. ducts or with aluminium profiles glued-in type for pre-insulated ducts. The door is secured in position within the mounting frame using cam locks provided in the access door. The access door shall be pre-insulated panel

type for pre-insulated ducts and double skin type with sandwiched insulation for G.I. ducts. For smaller duct sizes where providing access door is not feasible, access to the fire damper will be made through a small length of duct removable by providing flanged joints (Refer sketch attached vide Annexure-III).

6.14 Diffusers plenum/droppers shall be leveled properly to suit false ceiling.

6.15 The ducts are identified (service wise) as per approved identification labels (directional arrows).

7.0 Inspection:

7.1 After the duct installation ETA's QC shall inspect the complete installation and offer the same for consultant's inspection.

7.2 On fixation of final fix items like grilles / diffusers etc, consultant's engineer shall be invited for final inspection and certification.

8.0 Safety:

8.1 Safety precautions shall be followed inline with established project safety plan.

8.2 People shall use PPE such as safety harnesses, safety shoes, helmets, etc.

8.3 Safety Officer shall check and ensure that all safety precautions are taken before starting the work in the shafts and heights (including proper lighting and ventilation in the shafts).

8.4 Safety Officer shall check and ensure that all scaffoldings used are having duly signed tags.

9.0 References:

9.1 Specification section # 15800.

9.2 Material submittals Ref:M-004, M-006

10.0 Attachments:

10.1 Annexure-I Ductwork construction schedule for G.I. ductwork.

10.2 Annexure-II Ductwork construction and method statement for pre-insulated ductwork (revised).

10.3 Annexure-III Access arrangement for fire dampers installed on duct sizes 150mm & below.

10.4 Annexure-IV Pre insulated riser duct support arrangement.

Method Statement for Installation & Testing of Chilled Water Piping

1.0 Scope:

- 1.1 This method statement applies to installation, pressure testing, insulation and cladding of chilled water piping including valves and accessories, as per specification 15010, 15050, 15180, 151700.

2.0 Purpose:

- 2.1 Purpose of this method statement is to outline the method of storage, handling, fabrication, installation, pressure testing, insulation and cladding of chilled water piping including valves and accessories.

3.0 Material:**3.1 Pipes**

ERW, black steel, SCH 40, Grade 'B'

3.2 Fittings

Upto 50mm dia. MI fittings, Black, threaded ends

65mm dia and above – Steel Butt welding type/Grooved coupling joint type.

3.3 Valves

Upto 50mm : Threaded ends

65mm and above : Flanged ends

3.4 Accessories

Pressure gauges, thermometer, test points, airvents, water meters, etc.

3.5 Elastomeric Closed cell insulation, adhesives.**3.6 Supporting Materials**

Clevis hangers, MS angles / channels, threads rods, anchor fasteners etc. As per attached sketches.

4.0 Method:**4.1 Storage:**

4.1.1 All material while unloading shall not be dropped, but slowly lowered to the ground.

4.1.2 For pipes, wooden supports shall be placed beneath at equal distance.

4.1.3 Pipes shall be stacked on a flat surface with adequate supports.

- 4.1.4 End caps of pipes shall be in place until removed for installation.
- 4.1.5 While stacking, it shall be ensured that pipes of bigger sizes are placed below and smaller sizes on top.
- 4.1.6 All pipes shall be covered and shall not be exposed to direct sunlight.
- 4.1.7 All other items such as valves, fittings, gauges, etc. shall be kept on racks within site stores and shall be segregated as per size, model, type etc. for easy retrieval.
- 4.1.8 Elastomeric insulation shall be stored in manufacturer's packing and shall not be exposed direct sun light.
- 4.1.9 Insulation material shall be segregated as per size, thickness for easy retrieval.
- 4.1.10 The adhesive material shall be stored in a covered and ventilated storage area.
- 4.1.11 All supporting materials shall be stored in a covered storage area, segregated according to size, type, model, etc. for easy retrieval.
- 4.1.12 Manufacturer's instructions for storage shall be followed for applicable items.
- 4.1.13 Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any advertent use.

4.2 **Preparation:**

- 4.2.1 Check and ensure all drawings used for installation are latest and approved for construction.
- 4.2.2 Mark the pipe routing and support locations in the trench as per approved drawings.
- 4.2.3 Check the co-ordination of piping layout with other services and decide pipe route with minimum bends/offsets.
- 4.2.4 Check and ensure sufficient clearance around pipe for applying insulation / cladding as applicable.
- 4.2.5 Check the access and clear space around valves, vent points, drain points locations for maintenance and servicing.
- 4.2.6 Fabricate the structural supports form MS angles/channels as per support schedule as required.

4.2.7 Clean and apply primer / red oxide on all ERW black pipes.

4.3 Installation:

4.3.1 Drill the holes in trench wall for fixing supports.

4.3.2 Fix the anchors and threaded rods with clevis hangers / structural supports as applicable. Threaded rod length shall be sufficient to allow for levelling of piping. Supports details as per attached sketches.

4.3.3 Cut the pipes accurately to measurements determined at site.

4.3.4 Prepare the pipe ends according to the type of joints ie. threaded joints, welded joints / grooved coupling joints.

4.3.5 The end preparation shall be done at site work shop.

4.3.6 For grooved joints pipe end should be square and cut with machine.

4.3.7 Flow process of grooving the pipe will incorporate a 1 Mtr long spirit level at least two nos. of pipe stands for 6 Mtr long pipe and a completion check for squareness.

4.3.8 Threading and grooving as applicable shall be done as per fittings / coupling manufacturer's recommendations.

4.3.9 End preparations for welded joints shall be done as per approved welding procedure. Refer Method Statement MS-017 Rev. 02.

4.3.10 After the end preparation clean the pipe ends and ensure no material and dust is left inside.

4.3.11 Depending on site conditions, assemble the piping into manageable lengths on the floor. Using threaded, welded/groove coupled jointing as applicable.

4.3.12 Qualified and approved welders with current certificates shall be engaged for welding works.

4.3.13 Install the pipe sections at heights as per approved drawing in a neat and tidy manner.

4.3.14 Insert the approved hard insulating material of suitable thickness between the pipe and support.

4.3.15 Align and level the piping as per approved drawings.

4.3.16 Sleeves of suitable sizes shall be provided at wall crossings.

- 4.3.17 Expansion grooved couplings shall be installed at locations as designated by specialist (Victaulic)
- 4.3.18 Hole saw cutter shall be used to cut the holes in the pipe work for fixing branch connections for Victualic fittings.
- 4.3.19 Install the valves in locations as per approved drawings.
- 4.3.20 Install the piping connections with valves and accessories wherever equipments are installed as per approved drawings.
- 4.3.21 Fix the blind plugs / temporary valves on all drain, air vent, pressure gauge, thermometer and test points tappings approved drawings.
- 4.3.22 Check and ensure proper supporting is provided as per approved drawings.
- 4.3.23 Make temporary tapping provisions at multiple points for easy and quick filling and draining of pressure testing water.
- 4.3.24 Ensure all joints are properly tightened in line with manufacturer recommendation.
- 4.3.25 While installation is going on of the pipe work, the insulation will be fitted to the pipe work prior to pressure testing as explained in 4.5 pipe insulation. **But all fittings and joints will be left exposed until the pressure testing and inspection is completed.**
- 4.3.26 Raise the “WIR” for piping installation by NMX QA/QC and consultant. Obtain signoff for hydraulic pressure testing.

Note: For installation and testing of chilled water piping (Pre-insulated) Refer MS: M/002.A.

4.4 Pressure Testing:

- 4.1 The chilled water piping shall be tested according to the system working pressure and PN ratings of the pipes, pipe fitting and valves used in the piping.
- 4.2 The piping may be tested in sections or in total, depending on site requirements.
- 4.3 Estimate the piping volume and make arrangement for required quality of clean water.
- 4.4 Arrange for temporary piping / hose pipe connections for filling and draining the water.
- 4.5 Fix the temporary valves at air vent / drain points and pressure gauges.

- 4.6 Fill the piping system with clean water.
- 4.7 During initial filling, employ sufficient man power to monitor the entire length of the piping system for possible leakages.
- 4.8 If leakages are observed, arrest the leakage immediately. If leakages are major, isolate the leaking portion with nearest isolating valve and / or stop the water filling.
- 4.9 Rectify the leakages and again fill with water.
- 4.10 Ensure no leakages throughout the entire piping system.
- 4.11 Observe for the leakages and pressurise the system using hydraulic test pump.
- 4.12 During pressurisation observe the joints and entire piping system for leakages.
- 4.13 Pressurise the system till pressure on the pressure gauge at lowest part of the system indicates pressure.
- 4.14 Observe the pressure gauges readings for 8 hours and ensure there is no drop in gauge pressure.
- 4.15 Raise the “WIR” for witnessing the hydraulic pressure testing by NMX QA/QC and consultant.
- 4.16 Obtain signoff with clearance for insulation only after satisfactory pressure testing.

4.5 Pipe Insulation

- 4.5.1 The pipe surface shall be thoroughly cleaned to remove dust, traces of oil, grease etc. All welded joints are painted with red oxide primer.
- 4.5.2 For smaller pipe sizes, pre-formed insulation pipe section of suitable thickness, as per approved drawings/submittals to be used. For larger pipe sizes insulation sheet shall be used in thickness described in the materials submittal.
- 4.5.3 Smaller pipe which are not exposed to direct sunlight and insulation is not susceptible for damage, insulation may be done by inserting the pipes in to insulation sections during pipe installation.
- 4.5.4 When insulation is done after pressure testing following procedure shall be followed.

- 4.5.5 Slit the pipe insulation section, longitudinally and apply adhesive on inner surface and longitudinal slit as recommended by manufacturer.
- 4.5.6 Apply the adhesive on the surface of the pipe to be insulated, as recommended by manufacturer.
- 4.5.7 Fix firmly the insulation on the pipe surface and hand press the insulation to remove any air locks. The longitudinal seam shall be joined properly by hand pressing.
- 4.5.8 Fix the elastomeric self adhesive tape over the longitudinal seam.
- 4.5.9 Continue the same procedure for successive lengths. Adhesive shall be applied on circumferential joint properly. Seal the circumferential joint by fixing self adhesive tape.
- 4.5.10 For larger pipe sizes, cut the insulation sheet of suitable width to suit pipe size. The length shall be as manageable as per site conditions.
- 4.5.11 Complete the insulation as explained earlier in point No. 4.5.6. to 4.5.9.
- 4.5.12 Under no circumstances insulated pipes shall be exposed to direct sunlight.
- 4.5.13 Vapour seal must be achieved 100%.
- 4.5.14 Raise the “WIR” for NMX QA/QC and consultants and obtain the signoff for cladding wherever applicable.

5.0 Inspection

- 5.1 “WIR” by NMX QA/QC and Consultant shall be raised for piping installation, pressure testing, joint insulation and signed by Consultant.
- 5.2 Inspection shall be carried out as per installation checklist during installation, testing and insulation stages.
- 5.3 The entire installation work shall be supervised by the supervisors/engineers.

6.0 Safety

- 6.1 All safety precautions shall be followed as per established project safety plan and procedure.
- 6.2 Warning signs shall be displayed while carrying out pressure testing.
- 6.3 Only experienced and skilled technicians shall be engaged for carrying out installation and testing work.

- 6.4 The people involved in the installation shall used PPE such as safety helmets, safety shoes, helmets, gloves etc. as required.
- 6.5 Safety office shall check and ensure that all safety precautions are followed.
- 6.5 Safety office shall check and ensure chat all scaffolding and ladders used at site are having duly signed tags.
- 6.6 Hot work permit to be obtained before welding.

7.0 **Records**

- 7.1 “WIR” duly singed by ETA/NMX QA/QC and consultant for
 - i) Piping Installation
 - ii) Pressure Testing
 - iii) Insulation

Method Statement for Installation & Testing of Chilled Water Piping (Pre- insulated)

1.0 Scope:

- 1.1 This method statement applied to installation, pressure testing, joint insulation of chilled water piping including and accessories.

2.0 Purpose:

- 2.1 Purpose of this method statement is to outline the method of storage, handling, fabrication, installation, pressure testing, joint insulation and water piping including fittings.

3.0 Material:**3.1 Pipes**

ERW, black steel, SCH 40, Grade 'B'

3.2 Fittings

Fabricated MI fittings, grooved ends.

3.3 Supporting Materials

Fabricated MS structured supports. (Sketch enclosed)

4.0 Method:**4.1 Storage :**

- 4.1.1 All material while unloading shall not be dropped, but slowly lowered to the ground with the help of mobile / tower crane.
- 4.1.2 For pipes, wooden supports shall be placed beneath at equal distance. If stored on the floor.
- 4.1.3 Pipes shall be stacked on a flat surface with adequate supports.
- 4.1.4 End caps of pipes shall be in place until removed for installation.
- 4.1.5 While stacking, it shall be ensured that pipes of bigger sizes are placed below and smaller sizes on top.
- 4.1.6 All pipes shall be covered and shall not be exposed to direct sunlight.
- 4.1.7 Insulation material shall be segregated as per size, thickness for easy retrieval, stores out of direct heat.
- 4.1.8 Manufacturer's instructions for storage shall be followed for applicable items.

4.2 Preparation:

- 4.2.1 Check and ensure all drawings used for installation are latest and approved for construction.
- 4.2.2 Mark the pipe routing and support locations in the trench as per approved drawings.
- 4.2.3 Check the co-ordination of piping layout with other services and decide pipe route with minimum bends/offsets.
- 4.2.4 Check and ensure sufficient clearance around pipe for applying joint insulation.
- 4.2.5 Fabricate the structural supports from MS angle / channels.

4.3 Installation:

- 4.3.1 Lift pipe with the help of mobile / tower crane and rope / chain and kept on 40 Ft. trailer.
- 4.3.2 Shift drive trailer to the site.
- 4.3.3 Lift pipe with the help of tower crane rope / chain.
- 4.3.4 Unload at required position on the support and adjust the pipe.
- 4.3.5 Drill the holes in trench wall for fixing supports.
- 4.3.6 Fix supports, as per sketch attached.
- 4.3.7 Lay full length of 12m long as it fits to the requirement.
- 4.3.8 For the shorter lengths requirement, measure the length as per site condition.
- 4.3.9 Mark short length requirement on the pipe, remove the insulation locally, cut the pipe with the help of gas cutting set, 200mm longer than required then machine cut end of pipe to extract length.
- 4.3.10 Short pieces to be jointed by grooved ends will be square cut with mechanical cutter.
- 4.3.11 Prepare the pipe ends according to the type of joints ie. welded joint / grooved joints.
- 4.3.12 The end preparation shall be done at site workshop.
- 4.3.13 Welding / grooving as applicable shall be done as per fitting / coupling manufactures recommendations. Refer attached copy of relevant pages of Victaulic catalogue for groove preparation.

- 4.3.14 Shorter lengths of pipe that can be handled by machine (upto 2 Mtr) may be grooved joint or welded joint. Larger length pipes shall have one welded joint either side.
- 4.3.15 End preparations for welded joints shall be done as per approved welding procedure. Method Statement M-017.
- 4.3.16 After the end preparation clean the pipe ends and ensure no material and dust is left inside.
- 4.3.17 Depending on site conditions, assemble the piping into manageable lengths on the floor. Using threaded, welded/groove coupled jointing as applicable.
- 4.3.18 Qualified and approved welders shall be engaged for welding works. Current certificates provided with M/S-M-017.
- 4.3.19 Install the pipe spool at heights as per approved drawings in a neat and tidy manner.
- 4.3.20 Align and level the piping as per approved drawings.
- Pipes to be kept on the levelled (with the help of water column tubes) supports.
 - Bring the pipe ends touching to each other.
 - Check the alignment with the help of spirit level / set square at the four opposite point on the pipe periphery.
 - Adjust the alignment with help of slight knocking of hammer on the pipe.
 - Repeat above procedure till spirit level / sequence give $\pm 15\%$ deflection.
- 4.3.21 Make provisions for installing drain and air vent points as per approved drawings.
- 4.3.22 Fix the blind plugs / temporary valves on all drain, air vent.
- 4.3.23 Make temporary tapping provisions at multiple points for easy and quick filling and draining of pressure testing water.
- 4.3.24 Ensure all joints are properly tightened.
- 4.3.25 Raise the "Work Inspection Request (WIR)" of piping installation by NMX QA/QC and consultant. Obtain clearance for hydraulic pressure testing.

4.4 Pressure Testing:

- 4.1 The chilled water piping shall be tested according to the system working pressure and PN ratings of the pipes, pipe fitting and valves used in the piping. Test pressure as follows :
- Floor piping test pressure: 15 Bar
Risers (Low & High) and trench piping: 20 Bar
- 4.2 The piping may be tested in sections or in total, depending on site requirements.
- 4.3 Estimate the piping volume and make arrangement for required quality of clean water.
- 4.4 Arrange for temporary piping / hose pipe connections for filling and draining the water.
- 4.5 Fix the temporary valves at air vent / drain points and approved and pressure gauges. (Calibration Certificates provided).
- 4.6 Fill the piping system with clean water.
- 4.7 Warning signs will be displayed while carrying out pressure testing, barriers to be erected to exclude other workers.
- 4.8 During initial filling, employ sufficient man power to monitor the entire length of the piping system for possible leakages.
- 4.9 If leakages are observed, arrest the leakage immediately. If leakages are major, isolate the leaking portion with nearest isolating valve and / or stop the water filling / drain down completely where tests are partial and no valves are installed.
- 4.10 Rectify the leakages and again fill the water.
- 4.11 Ensure no leakages throughout the entire piping system.
- 4.12 Observe for the leakages and pressurise the system using hydraulic test pump.
- 4.13 During pressurisation observe the joints and entire piping system for leakages.
- 4.14 Pressurise the system till pressure on the pressure gauge at lowest part of the system indicates pressure.
- 4.15 Observe the pressure gauges readings for 8 hours and ensure there is no drop in gauge pressure.
- 4.16 Raise the “WIR” for witnessing the hydraulic pressure testing by NMX QA/QC and consultant.

- 4.17 Obtain proceed with clearance for insulation only after satisfactory pressure testing.

4.5 Joint Insulation

Field joint insulation procedure

Field joint insulation shall be applied after the preinsulated pipes are installed and joined, either by welding or mechanically with mechanical couplings, and pressure-tested per the project's specifications. If the preinsulated piping system is supplied with leak detection / location system, please refer to the leak detection installation procedure prior to insulating the joints. Field insulation application at joints shall be as follows:

4.51. Joint Preparation

Ensure that the joint was tested and leak-free. Clean the surface of the pipe joint and remove any foreign material around the joint to be insulated. Make sure the joint is clean and dry. Apply by brush, red-oxide primer to the welded area and any scratched or damaged area.

4.5.2 Installation of G.I. sheet metal mould

- 4.5.3 Place the galvanized sheet metal mould/roll-up around the joint area. Ensure that the length of the mould is centered and equally distributed at each of the adjoining jacket pipe ends.

- 4.5.4 Locate the pouring hole and position on top of the joint.

- 4.5.5 Fasten the mould tightly with plastic straps or wires at three locations to ensure tightness between the jacket and the mould.

- 4.5.6 To ensure a complete closure of the G.I. sheet metal mould, apply 4mm Dia rivets every 2" distance along the G.I. overlapping ends.

- 4.5.7 Seal both of the mould ends utilizing two wraps of mastic, duct or gray tape of 2" width.

4.5.8 Pouring of PU foam chemicals

After the sheet metal mould is securely placed on the field joint to be insulated, weigh the required amount of chemicals, Polyol & Isocyanate (ISO), in separate cups. Please note that Polyol has a distinctive smell, with a pale-to-dark yellow color; ISO is colored black. Both chemicals should not be exposed to air-moisture or heat for long hours. Make sure the chemicals containers are closed tightly after usage.

First, pour the Polyol (weighed in a cup) into the mixing cup/bucket. When ready to mix, pour the ISO (weighted in a cup) into the mixing cup/bucket with Polyol and using electric drill with mixer blade attached, mix the two chemicals for 20 seconds. Make sure the chemicals are thoroughly mixed.

When the color of the mixture changes (from dark to pale yellow) or when the mixture is starting to rise, pour immediately (as quickly as possible) the mixture through the pouring hole of the mould. Allow few minutes for the foam to rise, then, plug the pouring hole to refrain rising foam from coming out of the hole.

- 4.5.9 Polyol and Isocyanate has to be kept in closed container until it is finally poured in the mixing bucket.
- 4.5.10 Heat shrinkable sleeve will only be applied to the ends of the HDPE mould for sealing.
- 4.5.11 Remove any excess foam at the mould seams and pouring hole. Clean the surface of the sheet metal mould. Remove the plastic straps/wires.
- 4.5.12 Cut the shrink sleeve to the required length. Remove the plastic backing of the shrink sleeve and place one end of the shrink sleeve on top of the mould and wrap around the joint allowing some overlap at the top of the joint (about 50mm for smaller pipe sizes to 150mm for larger pipe sizes). Ensure that the width of the shrink sleeve is centered with the joint to be sealed, completely covering the entire length of the mould.
- 4.5.13 The shrink sleeve should be loose when in place. This will compensate for the shrinkage of the material when heated.
- 4.5.14 Using the torch, pre-heat slightly the inner adhesive part of the closure patch. Position the closure patch so that the patch is centered on the overlap along the full width of the shrink sleeve.
- 4.5.15 With the torch, heat up the closure patch evenly. Do not overheat the closure patch and with a gloved-hand, smoothen and tap lightly the closure patch to ensure good bonding.
- 4.5.16 Start shrinking the sleeve from one end or from the middle and apply heat circumferentially with the torch in brush-stroke motion until the shrink sleeve is fully bonded on the joint. Do not overheat!
- 4.5.17 The sealing of the joint is completed when the melted adhesive is coming out from the edges of the sleeves.

5.0 Inspection

- 5.1 “WIR” by NMX QA/QC and Consultant shall be raised for piping installation, pressure testing, joint insulation and signed by Roberts & Partners.
- 5.2 Inspection shall be carried out as per installation checklist during installation, testing and insulation stages by ETA QA/QC Dept.
- 5.3 The entire installation work shall be supervised by the supervisors/engineers.

6.0 Safety

- 6.1 Hot work permit will be obtained prior to the commencement of any hot works.
- 6.2 All safety precautions shall be followed as per established project safety plan and procedure.
- 6.3 Warning signs shall be displayed while carrying out pressure testing.
- 6.4 Only experienced and skilled technicians shall be engaged for carrying out installation and testing work.
- 6.5 The people involved in the installation shall use PPE such as safety helmets, safety shoes, helmets, gloves etc.
- 6.6 Safety office shall check and ensure that all safety precautions are followed.
- 6.7 Safety office shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.
- 6.8 Fire extinguishers will be provided near to the hot work areas.
- 6.9 Welder screen for Arc Welding will be erected to protect against arc eye of other persons.
- 6.10 Necessary precautions shall be taken for fumes which are flammable, toxic and dangerous to humans.

7.0 References

- 7.1 “WIR” duly signed by ETA/NMX QA/QC and consultant for
 - i) Piping Installation
 - ii) Pressure Testing
 - iii) Insulation

8.0 Non Destructive Testing

See Method Statement M-018 (shall be submitted by specialist)

Method Statement for Welding Procedure

1.0 Purpose

To define the Method of Welding Pipe Lines.

2.0 Scope

The Method is applicable to all Chilled Water Pipe work using mild steel and carbon steel pipes and fittings, for pipe sizes 65mm dia and above in accordance with Specification Section 15050, Clause 3.04, Clause 3.07 and our material submittals reference M:002 & M:30

3.0 Method**3.1 Preparation**

Before commencement of any welding the following works are required to be carried out.

3.1.1 Check materials to be used have approved material submittals.

3.1.2 Check work areas are clean and safe ensuring that the area is free of all flammable or volatile material.

3.1.3 All welding work shall be carried out in open or ventilated areas.

3.1.4 Welders qualification will be verified as per requirement.

3.2 Welding Procedure

3.2.1 Measure length of pipe required, making due allowance for any pipe fittings to be used and cut the pipe to the measured length.

3.2.2 Prepare the end of the pipe to be welded to the right angle of level and the size of the root face in accordance with procedure Specification (copy attached). The surfaces to be welded shall be smooth, uniform and free from tears, scale, slag, grease, paint and other materials that might affect the quality of welding. Power tools or hand tools will be used for cleaning, grinding or both.

3.2.3 The two prepared ends to be welded, pipe to pipe or pipe to fitting, shall be aligned as accurately as is practical and ensuring that the spacing between the abutting ends is in accordance with the procedure specification used. The alignment of the abutting ends shall minimize any offset between the surfaces caused by dimensional variations and will equally distribute around the circumference of the pipe any such offset. Hammering of the pipe to obtain proper lineup will be kept to a minimum.

- 3.2.4 The two prepared ends shall be tack welded together in four positions at ninety degrees. After tacking, the alignment shall be checked to confirm the integrity of the alignment has been preserved. During the welding process the tacks shall be removed by grinding.
- 3.2.5 The welding process will commence, ensuring that the correct filler metal, electrical current, polarity, voltage, amperage and number of passes is in accordance with the welding procedure. All slag or foreign matter shall be removed from each pass of welding, including the repair of any visible defects, such as crack, cavities, etc., prior to commencing the succeeding passes. Any such impurities shall be removed using a grinder.
- 3.2.6 The weld shall be visually inspected to check for inadequate penetration, excessive undercutting, burn-through, and to ensure the weld is free from cracks by ETA QA Engineer.
- 3.2.7 Clean the joint by wire brush prior to painting.
- 3.2.7 The weld shall not be cooled by water.
- 3.2.8 All welds to be painted red oxide primer as soon as pipe is cool.

3.3 Welding Electrode Storage and Handling

- 3.3.1 The welding electrodes upon delivery are stored in an air-conditioned area. The electrodes are transferred to a welding rod holding oven when space in the oven available. The oven is thermostatically controlled and maintains a constant 100°F (38°F). The shelves are vented to allow an even heat distribution in the oven. All welding electrodes will be pleased in the oven for a minimum of 48 hours before they are transferred to site for use.
- 3.3.2 Once transferred to the site the electrodes are stored in each welding operatives heated quiver. Operatives are instructed to take only the quantity they require to carryout the welding work presently undertaken. However, any surplus electrodes will be checked and stored back in the oven.

4.0 Inspection & Testing

- 4.1 100% visual inspection will be carried of all welded joints by ETA QA Engineer.
 - 4.1.1 The joint will be prepared for butt welding as shown on the sketch. 60° angle & 3.0 to 3.6mm gap. Joint inspection to be carried out by ETA/QA/QC Engineer and R&P Inspector.

- 4.1.2 Root weld to be carried out (one of the joint sketch) for 3mm weld deposit with 3.2mm dia welding rod.
- 4.1.3 Clean the joint by wire brush/hand grinder.
- 4.1.4 Filler weld to be carried out (2 to 5 of the joint sketch) for 8mm weld deposit with 2.5/3.2mm dia welding rod.
- 4.1.5 After every welding run point 4.1.3 shall be done.
- 4.1.6 ETA QA/AC shall keep a record of all the joints with joint number, size of pipe, welder and date of weld.
- 4.1.7 Joint number shall be marked on the pipe.
- 4.2 All weld joints will be subjected to hydrostatic testing to a minimum of 1.5 times the operating pressure. See method statement ETA/MS/M-002A.
- 4.3 WIR's will be raised for Consultants visual inspection and witness testing.
- 4.4 Radiographic examination of 5% of weld joints & magnetic particle testing of 5% weld joints by an independent testing agency will be in accordance with MACE, E.I.No.40.
- 4.5 In the event that 10% of all tests carried out fail, all welds are tested by the same above methods and to the same proportion. All joints failed are cut and removed. All subsequent replacement welds will be tested by radiographic test.
- 4.6 Refer MS No.018 for weld test method statement (by specialist)

5.0 **Reference Documents**

- 5.1 Applicable approved drawing
- 5.2 Specification Section 15050, Clause 3.04, clause 3.07
- 5.3 Welding Procedure Specification and PQR (Enclosed)

M&E / WPS / 1779
ETA-M&E/PQR/1698
- 5.4 Welders Certificates

Welder's Qualification Certificates Enclosed.

6.0 Safety

- 6.1 Safety items to be provided shall include fire extinguishers and welding screens.
- 6.2 Welding cables to be checked regularly for visual signs of damage. Joints to be sheathed and taped.
- 6.3 Prior to commencement of work check welding M/C, current, voltage, earthing, etc., for safety.
- 6.4 Safety equipment (Example: Hardhats, Safety shoes, Overalls, Gloves, Goggles as necessary) to be worn at all times. Standard welding Safety kit of shields, gloves, etc. to be provided for each welder. Glasses to be checked for cracks / weld spatter.
- 6.5 Hot work permit to be obtained as per the site safety procedures prior to the commencement of work.
- 6.6 Site safety officer will check and ensure all safety precautions are taken prior to commencement of welding.

Flushing and Chemical Cleaning of Chilled Water Piping System

1.0 Scope:

The scope of this method statement is to define the procedure for Flushing and chemical cleaning of chilled water piping system.

Note

- Refer to method statement Ref. ETA/MS/M-002 for Installation and Hydrostatic Testing of Chilled Water Piping System.
- A separate method statement Ref. ETA/MS/M-014 shall be submitted for startup and commissioning of Chemical dosing System.

2.0 Material:

- 2.1 Chemicals for cleaning and chilled water treatment.
- 2.2 Chilled water piping system.
- 2.3 Circulation pumps.

3.0 Preparation:

The following preparation checks / works shall be carried out prior to commencement of flushing and cleaning of chilled water system.

- 3.1 Check the installation of piping system is completed including supports, vibration isolation, jointing etc. as per approved layout drawings.
- 3.2 Check and ensure the system is hydrostatically pressure tested and verify test certificate.
- 3.3 Check all in-line valves are in full open position and drain valves are closed.
- 3.4 Check the provision of air vents at location as per approved drawings.
- 3.5 Check and ensure sufficient quantity of chemicals are available as per requirement.
- 3.6 Place warning signs and warning tape as required.

4.0 Flushing & Cleaning:

- 4.1 Close all the branch lines for initial flushing of the main liners.
- 4.2 Fill the system with clean water and drain the water after 30 minutes.
- 4.3 Refill the system with clean water and run the chilled water pump for 2 hours.
- 4.4 Open the drain valves in the main lines and drain the water completely.
- 4.5 Clean the strainers

- 4.6 After the pre-cleaning of main lines is completed as above, the branch lines shall be cleaned step by step by the same process.
- 4.7 During the above flushing process the drain valves shall be kept open while the pump is running, until the water appears clean.
- 4.8 The process of flushing as described will be continued until all branch and main lines are clean.
- 4.9 Remove all strainers, clean and refix.
- 4.10 Close all the drain valves
- 4.11 Refill the system with clean water and add chemicals in required quantities as per Specialist supplier's instructions (See specialist supplier's details).
- 4.12 Samples of solution shall be collected from various parts of the system to ensure the chemical solution has reached all parts of the system.
- 4.13 Run the pump and circulate the water (with chemicals added) for a minimum period of 24 hours and maximum period of 72 hours as per specialist supplier's recommendations.
- 4.14 After system has been treated in accordance with the attached culligan procedure, the system will be drained into tankers and disposed of into DM approved waste disposal facility, such as the waste dump at Jebil Ali by NMX.
- 4.15 After the cleaning process is completed as described above the cleaning solution shall be flushed out.
- 4.16 The entire system is re-filled with fresh and clean water and treated with corrosion and scale inhibiting treatment chemicals as approved. Specialist contractor shall collect samples and conduct tests until satisfactory results are obtained as required.

Note

After satisfactory completion of flushing and cleaning as described above, the specialist supplier shall check the same and proceed with the testing, commissioning of the chemical dosing system.

5.0 Safety :

- 5.1 The area shall cordon off with and warning signs shall be placed as required during the process of flushing and cleaning.
- 5.2 Only competent personnel shall be engaged for flushing and cleaning.
- 5.3 All PPE shall be used as required by the technicians involved in the activity.
- 5.4 Safety officer shall check and ensure all safety precautions are followed as per the project safety plan.
- 5.5 Chemicals shall be stored in a proper place due to health hazard.

6.0 Inspection :

- 6.1 The inspection request shall be raised for Main Contractor and Consultant to witness the flushing and cleaning process.
- 6.2 Work Inspection Request (WIR) shall be retained as records.
- 6.3 Certification of the system cleanliness by the specialist supplier M/s.Culligan shall be documented and recorded.

7.0 Reference :

- 7.1 Specification Sections 15200.
- 7.2 Approved technical submittals
- 7.3 Approved drawings
- 7.4 Manufacturer's instructions

8.0 Attachment :

- 8.1 Specialist supplier, M/s.Culligan's procedure & Checklist formats.

Sequence of Chilled Water System Flushing

SEQUENCE OF CHW SYSTEM FLUSHING

1. Isolate the floor branch pipes from the risers by valves at Location 'A' as shown in the attached sketch.
2. Open all FCU valves (at location 'B') and fill clean potable water.
3. Pressure test the floor piping including FCUs and valve package connections. Offer for witnessing.
4. Release the pressure but retain water in the floor branch circuit till final flushing time.
5. Repeat the above procedure for all the floor's branches.
6. Ensure that all floor branch valves are closed (at location 'A')
7. Pressure test the entire header pipes circuit including the risers (through C1, C2, C3, C4, C5, C6 and C7). Offer for witnessing.
8. Drain the system (excluding floor branches – valves closed at 'A') through drain valves provided at the bottom of risers and in the HEX room (at the bottom of trench pipes below entry point to HEX room).
9. Refill the entire system with clean water.
10. Ensure that the system is free of air by properly venting the system.
11. Ensure that the heat exchanger valves at 'C' are closed and open the flushing bypass valve (at location 'D') provided across the heat exchangers.
12. Isolate FAHU coil by keeping the 3-way valve (at location 'E') in the bypass mode.
13. Open the flushing bypass valve provided at the end of risers (at location 'F').
14. Start the secondary chilled water pumps (SP) and run for 2 hours.
15. Drain the system as given in Procedure 8.
16. Clean all strainers.
17. Refill the entire system with clean water.
18. Start and run the pumps.
19. Open the floor branch valves at location 'A' for 5 floors and circulate water for 2 hours and close the valves.

20. Repeat procedure `19` for all other floors (i.e., with 5 floors branch valves open at a time).
21. Open all floor branch valves.
22. Drain the entire system.
23. Clean all strainers.
24. Refill the entire system.
25. Start and run the pumps.
26. Bleed of the system at bottom drain points and add make up water continuously until the water appears clean.
27. Clean all strainers.
28. Close all drain valves and ensure that the system is full of water and free of air by venting at the highest points.
29. Add chemicals in required quantities as per specialist supplier's instructions.
30. Samples of water shall be collected from various part of the system to ensure the chemical solution has reached all parts of the system.
31. Run the pump and circulate the water (with chemicals) for a period of 24 hours minimum and 72 hours maximum as per specialist suppliers' recommendations.
32. Stop the pumps after completing procedure number 32.
33. Drain off the system from the drain valves (at locations described in procedure number 8) into the disposal tankers to be arranged by NMX.
34. Refill the system with clean water and drain again at all drain points to remove the traces of chemicals in the system.
35. Refill the system again with clean water and run the pumps.
36. Bleed off the system at the bottom drain points and add makeup water continuously till water runs clear and chemical analysis report indicates that parameters are within the limits to add the final treatment chemicals.
37. Raise WIR before adding the final chemicals for witnessing.

B. Safety

1. The area shall cordoned off and warning signs shall be placed as required during the process of flushing and cleaning.
2. Only competent personnel shall be engaged for flushing and cleaning.
3. All PPE shall be used as required by the technicians involved in the activity.
4. Safety officer shall check and ensure all safety precautions are followed as per the project safety plan.
5. Chemicals shall be stored in a proper place due to health hazard.

C. References

1. Specification section 15200
2. Enclosed sketches showing the typical location of equipments, valves, etc, for low rise and high rise circuits.

Method Statement for Installation of Fan Coil Units

1.0 Scope

- 1.1 This method statement applies to Fan Coil Units and associated valve package and controls, as per Specification Section 15700.

2.0 Purpose

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of fan coil units, valve package and controls.

3.0 Material

- 3.1 Fan Coil Units.
- 3.2 Gate valves, 2 way control valves, and commissioning set.
- 3.3 Piping accessories as per approved submittals.
- 3.4 Threaded rods, fasteners, etc., for supports.

4.0 Method**4.1 Receiving**

- 4.1.1 When received at site, each Fan Coil Unit shall be checked for quantities, Model Nos., physical damages and coil connection details and notify supplier of any non-compliance. After completion of inspection, FCUs shall be stored properly with protective covering.
- 4.1.2 Any items found damaged or not suitable as per the project requirements shall be removed from site. Until such time, the damaged/non-compliant material shall be clearly marked and stored separately to prevent any inadvertent use.
- 4.1.3 Valves and other accessories shall be checked for size, Model and quantity. As in 4.1.2 above any non-compliant material will be returned to the supplier for suitable replacement.
- 4.1.4 Valves and controls shall be segregated as per sizes/models and stored on racks within a covered store.

4.2 Storage

- 4.2.1 While unloading, the FCUs shall be carefully and slowly lowered to the ground. Adequate manpower will be engaged for safe handling of the FCUs. The FCUs will be segregated model wise and stacked accordingly for easy retrieval.
- 4.2.2 Manufacturer's instructions shall be strictly followed as applicable.

METHOD STATEMENT	FAN COIL UNIT	HVAC
	4.2.3 A maximum of 5 Nos. FCUs or as recommended by the manufacturer shall be stacked one above the other in one lot. 4.2.4 Where applicable, the bigger size FCUs shall be stored at the bottom and smaller size FCUs above. 4.2.5 Store Keeper will be responsible for proper storage and maintenance of records, as required.	
4.3	<u>Preparation</u>	
	4.3.1 Mark the support locations as per approved drawings/manufacturers details and fix the approved anchor fasteners in the slab. 4.3.2 Fix the duct flexible connection on air outlet side of the Fan Coil Units. 4.3.3 Ensure ducting is provided with acoustic lining as per approved shop drawings. 4.3.4 Check co-ordination with false ceiling and other services prior to installation. 4.3.5 Ensure easy accesses and sufficient clearance for servicing and maintenance i.e. for cleaning of filters, removal of motors, maintenance of valve packages.	
4.4	<u>Installation</u>	
	4.4.1 Follow the manufacturer's instructions while installing the FCU. 4.4.2 Install Fan Coil Unit with threaded rod and G.I. fasteners and rubber bushes supplied by the manufacturer. Sufficient manpower will be engaged for safe installation. 4.4.3 Check the slope of the drain tray in the direction of drainpipe connection. 4.4.4 Flow test the drain tray and ensure water is drained out completely. 4.4.5 Complete the valve package and piping connections as per approved drawings. 4.4.6 Ensure 2-way valves, and commissioning set is installed correctly as per direction of the flow. 4.4.7 Connect the drain piping as per approved drawings. 4.4.8 Ensure the provision for cleaning of drain tray. 4.4.9 Install the electrical connections as per approved drawings and as per approved method statement reference ETA/MS/E-015.	

METHOD STATEMENT	FAN COIL UNIT	HVAC
	4.4.10 Clean the interiors of FCU and drain tray.	
	4.4.11 FCU CHW inlet and outlets shall be connected to CHW piping by using Di-electric couplers.	
4.5	<u>Testing</u>	
	4.5.1 FCU and valve package shall be pressure tested along with chilled water piping system.	
	4.5.2 Flow test the drain tray and ensure water is drained out completely.	
5.0	<u>Inspection</u>	
	5.1 Work Inspection Request shall be raised for Consultant's inspection and sign off.	
	5.2 Inspection shall be carried out as per the installation checklist.	
	5.3 Inspection shall be recorded in the approved format.	
6.0	<u>Safety</u>	
	6.1 All safety precautions shall be followed as per established project safety plan and procedure.	
	6.2 Only experienced and skilled technicians shall be engaged for carrying out FCU installation work.	
	6.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, safety harness, gloves, etc., as required.	
	6.4 Safety officer shall check and ensure that all safety precautions are followed.	
	6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.	
7.0	<u>References</u>	
	7.1 Manufacturer's catalogue.	
	7.2 Approved submittal.	
	7.3 Approved shop drawings.	
	7.4 Specification section: 15700.	
8.0	<u>Records</u>	
	8.1 'Work Inspection Request' duly signed by the Consultant.	
	8.2 Fan Coil Unit installation checklist.	

Method Statement for Installation of Air Inlets & Outlets

1.0 Scope

- 1.1 This method statement describes the method of storage, handling and installation of air inlet and outlet devices, such as grilles, diffusers, louvers, etc., as specified in Section 15800.

2.0 Applicable Locations

Towers E1, E2, E3, W1, W2, W3, Podiums and Villas.

3.0 Material

- 3.1 Supply air register, return air grilles.
- 3.2 Supply air diffusers, return air diffusers.
- 3.3 Supply air slot diffusers, return air slot diffusers.
- 3.4 Threaded rods, plenum boxes, screws, fasteners, etc.

4.0 Method**4.1 Receiving**

- 4.1.1 When grilles/diffusers are received at stores, they shall be checked for any damages, quantities, model numbers and sizes as per the order.
- 4.1.2 Any item found damaged or not found suitable as per project requirements shall be guaranteed. Non-compliant material shall be clearly marked and stored separately to prevent any inadvertent use until returned to vendor.

4.2 Storage

- 4.2.1 All grilles/diffusers shall be stored in original factory packing.
- 4.2.2 Grilles/diffusers shall be stored on a flat surface in a covered area.
- 4.2.3 The grilles/diffusers shall be stored and stored separately as per size and model for easy traceability.
- 4.2.4 Manufacturer's instructions for storage shall be followed as applicable.

4.3 Preparation

- 4.3.1 Check and ensure all drawings used for installation are latest and approved for construction.
- 4.3.2 The plenum boxes/collars for grilles/diffusers as per approved drawings shall be installed in coordination with the installation of false ceiling grid works.
- 4.3.3 The location of grills/diffusers shall be as per approved coordinated false ceiling layout.

METHOD STATEMENT	AIR TERMINALS	HVAC
4.3.4	The flexible duct length shall be sufficient to allow for minor adjustments/relocation of diffuser/grilles, if required.	
4.3.5	The supporting rods of plenum boxes shall be fixed to soffit with extra length for allowing level adjustments.	
4.3.6	The grille/diffuser fixing arrangement shall be coordinated with false ceiling contractor.	
4.3.7	Check and ensure grille/diffuser is free from scratches/defects and fit for installation.	
4.3.8	Check and ensure the dampers are properly operating.	
4.4	<u>Installation</u>	
	<u>Air Inlets/Outlets – Installed on false ceiling</u>	
4.4.1	Coordinate with false ceiling contractor for cutout in the false ceiling tiles to match the fixing arrangement of grille/diffuser.	
4.4.2	Adjust the level and position of diffuser/grille plenum (as applicable) to match the opening in the false ceiling tile.	
4.4.3	Check and ensure the gasket provided with diffuser/grille is in place.	
4.4.4	Check and ensure the damper of diffuser/grille is in operating condition and in full open position.	
4.4.5	Fix the diffuser/grille to the plenum box/collars with screws/fasteners as shown on the attached sketches.	
4.4.6	Check and ensure the sides of grille/diffuser are paralleled and in proper orientation with respect to false ceiling grids or walls as applicable.	
4.4.7	Check and ensure the edges of the grilles/diffusers are in complete contact with false ceiling tile and there is no abnormal gap.	
4.4.8	For return air diffuser fixing, GI grid frame to be provided by false ceiling contractor all around the diffuser neck corresponding to different size requirements.	
4.4.9	Disc valve inner GI supporting ring is fixed above the false ceiling tile. Exposed part shall be pushed to in from outside and will be clamped with GI ring by means of built in leaf type springs provided in the disc valve body.	
	<u>Air Inlets/Outlets – Installed on Wall</u>	
4.4.10	The wall opening shall be provided with levelled, smooth and even finish by civil contractor as per dimensions of air inlets and air outlets.	
4.4.11	Terminate the duct at the inner face of the wall with chair profile at the duct end and seal with sealant or aluminium tape.	
4.4.12	Install the grille in the opening by means of push and lock type fixing clips provided by the manufacturer. Adjust the level of the grille.	
	Page 3 4	

4.4.13 Manufacturer's instructions shall be strictly followed for installation as attached.

5.0 Inspection

- 5.1 QC inspection shall be carried out as per the installation checklist and manufacturer's instructions.
- 5.2 W.I.R shall be raised for Consultants inspection.
- 5.3 Inspection shall be recorded in the approved format.

6.0 Safety

- 6.1 All safety precautions shall be followed as per established project safety plan and procedure.
- 6.2 Only experienced and skilled technicians shall be engaged for carrying out air inlet/outlets installation work.
- 6.3 The people involved in the installations shall use PPE such as safety helmets, safety shoes, harness, hand gloves, etc., as required.
- 6.4 Safety officer shall check and ensure that all safety precautions are followed.
- 6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

7.0 References

- 7.1 Manufacturers catalogues.
- 7.2 Approved submittals.
- 7.3 Shop drawings.
- 7.4 Specification section 15800

8.0 Attachments

- 8.1 Manufacturers fixing details for air inlet and outlets.

Method Statement for Installation of Fresh Air Handling Units (Floor Mounted)

1.0 **Scope**

- 1.1 This method statement applies to the installation of floor mounted air handling units as per the Specification Section 15700.

2.0 **Purpose**

- 2.1 Purpose of this method statement is to outline the method of storage and installation of Floor mounted Air Handling Units.

3.0 **Material**

- 3.1 Fresh air handling units.
- 3.2 Pipes and fittings as per approved submittals/drawings.
- 3.3 Ducting and accessories as per approved submittals/drawings.
- 3.4 Electrical cables, control panel, other accessories if any, as per approved drawings and submittal.

4.0 **Method****4.1** **Receiving**

- 4.1.1 On arrival at site all Air Handling Units (AHUs) shall be checked for quantities, type and model number, physical damages, orientation of coil connections, access doors, etc.
- 4.1.2 Upon delivery material on site inspection shall be carried by R&P/NMX/MACE.
- 4.1.3 Upon satisfactory inspection the AHUs shall be stored properly with protective covering.

4.2 **Preparation**

- 4.2.1 Check the AHUs foundation and ensure it is as per approved drawings.
- 4.2.2 Check the area around the foundation and ensure access to the AHUs from all sides as applicable.
- 4.2.3 Ensure availability of sufficient slope to the drainpipe, for easy draining of condensate drain.
- 4.2.4 Check the foundation surface and it shall be smooth finish to avoid any dust accumulation.
- 4.2.5 The foundation surface shall be even in all directions.
- 4.2.6 The foundation surface shall be cleaned before installation of AHUs.
- 4.2.7 Mark the AHUs position on the foundation for centralisation.
- 4.2.8 Place the anti vibration ribbed rubber pads of correct thickness as per approved drawings/submittals.

4.2.9 In case of multiple rubber pads the pads shall be placed one above the other, with the ribs at right angle to each other.

4.2.10 AHU sections are assembled at site/location by factory trained personal.

4.3 Installation

4.3.1 Shift the AHUs to the place of installation in safe manner using fork lift/crane as applicable. Sufficient manpower will be engaged as required for safe shifting and installation.

4.3.2 Ensure that the correct AHU is shifted to the place of installation.

4.3.3 Air inlet, outlet, fresh air connection and chilled water connection orientation are as per approved drawings.

4.3.4 If the AHUs are shipped in multiple sections, the AHUs will be assembled strictly as per the manufacturer's instructions.

4.3.5 Remove the movement arrestors provided inside AHUs at Fan and impeller which are fixed during transportation.

4.3.6 The AHUs are placed correctly on foundation with vibration isolator rubber pads at right location.

4.3.7 The AHUs will be properly levelled and parallel to room walls/other installations.

4.3.8 AHUs shall be inspected again for any damage during hoisting/shifting and installation by R&P/ETA.

4.3.9 Upon satisfactory positioning of AHUs any open air/water outlets of AHUs shall be closed properly and area shall be cleaned, complete protection in areas where other trades are working.

4.4 Air, Chilled water, Electrical and Condensate Drain connections

4.4.1 Air side connections

4.4.1.1 Ducting connection shall be done as per approved shop drawings.

4.4.1.2 Provide flexible duct connections as applicable/as approved submittal.

4.4.1.3 Provide proper supports as per approved drawings.

4.4.1.4 The weight of ducting shall not act on AHUs panel.

4.4.1.5 Before making final connections to AHUs ensure inner area of AHUs is clean, especially the impeller of the fan.

4.4.2 Chilled Water connections

4.4.2.1 Chilled water connections shall be made as per approved drawings.

4.4.2.2 Ensure supply and return connection is made properly.

4.4.2.3 Provide pipe flexible connection and other piping accessories as per approved drawings and submittals.

4.4.2.4 The piping shall be free of any strain and shall not exert any load on, AHUs panel/AHUs.

4.4.2.5 Provide vibration isolators to piping supports as per approved submittals/drawings.

4.4.2.6 Install the control valves, strainer, commissioning set correctly as per direction of flow as per approved drawings.

4.4.2.7 Ensure proper operation of valve handles and sufficient space for valve installation.

4.4.2.8 The location and orientation of the gauges and commissioning sets shall allow for easy accessibility and readability of readings.

4.4.3 Electrical connections

4.4.3.1 Electrical power connections shall be done as per approved drawings.

4.4.3.2 Cables shall be installed and terminated as per approved method statement Ref;ETA/MS/E/015.

4.4.4 Condensate drain piping connections

4.4.4.1 Condensate drain piping shall be terminated at the nearest floor drain.

4.4.4.2 Provide the 'U' trap in the condensate drain piping.

4.4.4.3 Ensure provision for cleaning of 'U' traps.

4.4.4.4 Ensure proper slope to enable easy draining.

4.4.4.5 Ensure trap is deeper than ESP of fan – eg., 70mm > 650pa

4.5 Cleaning

4.5.1 Clean the interiors of AHUs including the impeller, drain tray.

4.5.2 After completion of installation, it shall be checked and certified by the supplier/manufacturer and inspected by R&P/ETA.

4.6 Testing

4.6.1 The piping connections to AHUs shall be pressure tested to 1.5 times the working pressures. Coils not included in test.

4.6.2 Strainer shall be cleaned after pressure testing and initial flushing of chilled water piping system.

4.6.3 Flow test of the AHUs drain tray, condensate drain pipe and ensure water is drained out completely.

5.0 Inspection

- 5.1 Work Inspection Request (WIR) shall be raised for consultant's inspection.
- 5.2 QC inspection shall be carried out as per the installation checklist and manufacturer's instructions.
- 5.3 Inspection shall be recorded in the approved format and signed off by R&P.

6.0 Safety

- 6.1 All safety precautions shall be followed as per established project safety plan and procedure.
- 6.2 Only experienced and skilled technicians shall be engaged for carrying out AHUs installation work.
- 6.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, harnesses, gloves, etc as required.
- 6.4 Safety officer shall check and ensure that all safety precautions are followed.
- 6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

7.0 Reference

- 7.1 Manufacturer's catalogue.
- 7.2 Approved submittal.
- 7.3 Shop drawings.
- 7.4 Specification section 15700.

8.0 Records

- 8.1 'Work Inspection Request' (WIR) duly signed by the Consultants.
- 8.2 Air Handling Unit installation checklist signed off by R&P.

Method Statement for Installation of Chilled Water Pumps

1.0 **Scope**

- 1.1 This method statement applies to installation of chilled water pumps and associated valve package.

2.0 **Purpose**

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of chilled water pumps and valve package.

3.0 **Material**

- 3.1 Pump and motor assembled on a common base frame, coupled using suitable coupling arrangement by the manufacturer.
- 3.2 Isolation valves, strainers, NRV, flexible connectors and piping accessories as per approved submittals.
- 3.3 Pump foundation as per approved drawings.

4.0 **Method****4.1** **Receiving**

- 4.1.1 When received at site, each pump shall be checked for quantities, model number, physical damages, etc., and notify supplier of any discrepancies for suitable rectification or replacement.
- 4.1.2 Valves and other accessories shall be checked for size, model and quantity. Receiving inspection shall be conducted by the storekeeper, engineer and QC engineer, which shall be documented.
- 4.1.3 Valves shall be segregated as per sizes/models and stored on racks within a covered store.
- 4.1.4 Any items found damaged or not found suitable as per the project requirements shall be quarantined. Non-compliant material shall be clearly marked and stored separately to prevent any inadvertent use until returned to vendor.

4.2 **Storage**

- 4.2.1 Upon completion of receiving QC inspection, the pumps will be segregated model/size wise and stored accordingly for easy retrieval.
- 4.2.2 Pumps shall be stored on a flat surface in well ventilated and covered storage area.
- 4.2.3 Inlet and outlet flange blanks shall not be removed until ready for connection to pipe work.
- 4.2.4 Manufacturer's instruction shall be strictly followed as applicable.
- 4.2.5 If the pumps are stored for longer periods the shaft shall be periodically rotated.

4.3 Preparation

- 4.3.1 The foundations designed to meet the vibration and sound control requirements shall be provided by Main Contractor. Inertia bases will be supplied along with vibration isolators.
- 4.3.2 Check and ensure that the shop drawings used are latest and approved for construction.
- 4.3.3 ETA will co-ordinate the location of foundation as per approved shop drawings.
- 4.3.4 Co-ordinate with the main contractor to ensure that the foundations/concrete filling to inertia bases made as per approved shop drawings.
- 4.3.5 The foundation surface shall be flat and level and smoothly finished top surface.
- 4.3.6 Check co-ordination with other services prior to the installation.
- 4.3.7 Check the piping support locations and cable tray routing locations in co-ordination with pump and piping layout and ensure they are not obstructing the space around pump.
- 4.3.8 Ensure easy accesses and sufficient clearance for servicing and maintenance i.e, for replacement of pump, motor, cleaning of strainer, valves etc.

4.4. Installation

- 4.4.1 Mark the locations of the pump base frame.
- 4.4.2 Install the inertia base/pumps as per attached Annexure-I.
- 4.4.3 Shift the pumps to the place of installation in safe manner. Use hand trolley/fork lift/crane as applicable/required as per site conditions.
- 4.4.4 Alignment of coupling arrangement between motor and pumps, after pump installation shall be rechecked by the pump supplier before testing.
- 4.4.5 Ensure proper coupling guards are provided, where applicable.
- 4.4.6 Complete the piping and valve package installation as per approved drawings. Remove the end caps fixed on the inlet and outlet flanges.
- 4.4.7 Install the electrical power connections as per approved drawings and test for continuity.
- 4.4.8 Provide grounding wiring as per approved drawings/manufacturers instruction.
- 4.4.9 Follow the manufacturer's instructions while installing the pump.

5.0 Inspection

- 5.1 After completion of pump installation and piping connections, QC inspection shall be carried out as per pump installation check list.

5.2 “Work Inspection Request” shall be raised for consultants inspection.

6.0 Safety

6.1 All safety precautions shall be followed as per established project safety plan and procedure.

6.2 Only experienced and skilled technicians shall be engaged for carrying out pump installation work.

6.3 The people involve din the installation shall use PPE such as safety helmets, safety shoes, harness, gloves, etc., as required.

6.4 Safety officer shall check and ensure that all safety precautions are followed.

6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

7.0 References

7.1 Manufacturers catalogue.

7.2 Approved chilled water pump submittals.

7.3 Shop drawings.

7.4 Specification Section 15700.

8.0 Records

8.1 `Work Inspection Request` duly signed by the Consultant’s for installation.

8.2 Pump installation check list.

Method Statement for Start up and Commissioning of Chilled Water Pumps

1.0 Scope

The scope of this Method Statement is to define the method of Start-up and Commissioning of Tertiary Chilled Water Pumps installed in accordance with the Specification Sections 15700 & 15050.

Note

- a. The testing and balancing of Chilled Water System will be covered under a separate Method Statement Ref. ETA/MS/M-015, which will be submitted for Consultant's review prior to start-up. This will also include the required test formats.
- b. For installation of CHW Pumps refer to Method Statement Ref. ETA/MS/M-006, Rev. 0.

2.0 Material

Tertiary chilled water pumps as per the enclosed schedule.

3.0 Test Equipment

- 3.1 Digital Multimeter
- 3.2 Clamp Meter
- 3.3 Tachometer

Note

The calibration certificates of testing instruments shall be verified prior to usage and copies shall be included in the test reports and copies of certificates issued to NMX for record prior to commencement.

4.0 Pre-commissioning checks prior to start-up**4.1 Mechanical**

- 4.1.1 Check and inspect the installation of CHW Pump is complete, verify the installation as per approved drawings.
- 4.1.2 Verify compliance to the manufacturer's installation instructions.
- 4.1.3 Obtain installation certification from manufacturer or their authorized representative.
- 4.1.4 Check and ensure adequate clearance available for service and maintenance of pumps and motors.
- 4.1.5 Check the installation is coordinated with other services.
- 4.1.6 Ensure the shipping bolts / chambers are removed.

- 4.1.7 Check all nuts, bolts, screws, fasteners etc., are fixed and tightened as required.
- 4.1.8 Check the alignment is completed as per manufacturer's instructions (where applicable).
- 4.1.9 Check all piping connections are complete including flexible connections where applicable.
- 4.1.10 Check and ensure the safety guards are in place and secure.
- 4.1.11 Rotate the pump manually and ensure free and smooth rotation.
- 4.1.12 Ensure the pumps are cleaned prior to start-up and all identification labels and tags are in place.

4.2 Electrical

- 4.2.1 Check all power cabling and control wiring is completed and dressed neatly. Check continuity.
- 4.2.2 Check the power isolator is fixed close to the pump motor or emergency stop push buttons are provided close to the pumps for emergency power isolation.
- 4.2.3 Check all terminations are completed and tightened as required.
- 4.2.4 Check the grounding connections are completed and tightened as required.
- 4.2.5 Ensure the overload protections are set correctly as per the pump motor load current.
- 4.2.6 Ensure all identification tags and labeling works are complete.

5.0 Start-up and Testing

- 5.1 Check the line voltage and phase rotation before energizing the power.
- 5.2 Switch ON the power and start the pump and check the rotation is in the correct direction.
- 5.3 Immediately on start-up, check for any abnormal noise and vibration. Rectify as / if required. Consult manufacturer if required.
- 5.4 Observe for the correct operation of motor, pump and drive system.
- 5.5 Measure the current drawn (amperage) by the pump motor, measure the rpm and record the same.

- 5.6 After about an hours operation, check the tightness of all nuts, bolts, screws, etc., and retighten if necessary.
- 5.7 Recheck the alignment and adjust if required (where applicable).
- 5.8 Record all pump and motor nameplate data in the commissioning format.
- 5.9 Ensure compliance to all manufacturer's commissioning instructions, as applicable.
- 5.10 Give clearance to the testing, adjusting & balancing agency for further testing, adjusting and balancing.

6.0 Safety

- 6.1 Only experienced and skilled personnel shall be engaged for start-up and commissioning of chilled water pumps.
- 6.2 Safety guards shall be in place and secured prior to start-up.
- 6.3 Cable test reports shall be verified prior to energisation.
- 6.4 Warning signs and tapes shall be placed during start-up and commissioning as required.
- 6.5 All safety procedures shall be followed in accordance with the project health and safety plan.
- 6.6 Safety Officer shall check and ensure all safety precautions are followed.

7.0 Inspection

- 7.1 "Work Inspection Request" shall be raised for consultant's inspection.

8.0 Records

- 8.1 Work Inspection Request (for Witness of start-up and commissioning) duly signed by NMX and Consultants
- 8.2 Signed-off pre-commissioning checklists
- 8.3 Commissioning reports
- 8.4 Calibration certificates of testing instruments

9.0 References

- 9.1 Specification Sections 15700 & 15050
- 9.2 Manufacturer's start-up and commissioning instructions.
- 9.3 Approved CHW Pump submittals / drawings.
- 9.4 Approved shop drawings.

10.0 Attachments

- 10.1 Appendix 1 – Schedule of Pumps

Method Statement for Installation of Exhaust Fans (Parking Area)

1.0 **Scope**

- 1.1 This method statement applies to installation of Exhaust Fans (Parking Area) and associated accessories.

2.0 **Purpose**

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of Exhaust Fans (Parking Area) and accessories.

3.0 **Material**

- 3.1 Exhaust Fans (Parking Area).
- 3.2 Threaded rods, fasteners for supports.
- 3.3 Duct flexible connections.
- 3.4 Electrical cables.

4.0 **Method****4.1** **Receiving**

- 4.1.1 On arrival at site all Fans shall be checked for quantities, model number, physical damages, and notifies the supplier of any discrepancies. After completion of inspection, fan shall be stored properly with protective covering.
- 4.1.2 Any items found damaged or not suitable as per the project requirements shall be removed from site. Until such time, the damaged/non-compliant material shall be clearly marked and stored separately to prevent any inadvertent use.

4.2 **Storage**

- 4.2.1 While unloading the fans shall be carefully and slowly lowered to the ground. Adequate manpower will be engaged according to the size of the fan. Upon completion of receiving QC inspection, the fans will be segregated model/size wise and stacked accordingly for easy retrieval.
- 4.2.2 Fans shall be stored on a flat surface in well ventilated and covered storage area.
- 4.2.3 Manufacturer's instructions shall be strictly followed as applicable.
- 4.2.4 While stacking the fans, ensure that bottom most fan packing shall not be damaged.
- 4.2.5 Where applicable, the bigger size Exhaust Fans shall be stored at the bottom and smaller size Exhaust Fans above.
- 4.2.6 Store Keeper will be responsible for proper storage and maintenance of records, as required.

4.3 **Preparation**

- 4.3.1 Check and ensure all drawings used for installation are latest and approved for construction.

METHOD STATEMENT	EXHAUST FANS	HVAC
	4.3.2 Mark the support locations as per approved drawings/manufacturers details and fix the approved anchor fasteners in the slab.	
	4.3.3 Ensure easy access and sufficient clearance for maintenance and removal of motors.	
	4.3.4 Comply with Manufacturer's instruction as applicable.	
4.4	<u>Installation</u>	
	4.4.1 Shift the fans to the place of installation in safe manner. Sufficient manpower will be engaged for safe shifting and handling of the fans.	
	4.4.2 The fans shall be shifted to the site only after preparations for fan installation is complete.	
	4.4.3 The bigger fans shall be shifted to site on hand trolley/fork-lift/crane as applicable/required.	
	4.4.4 Drill holes in the slab as required and fix the hangers and supports.	
	4.4.5 Unpack the fans for installation.	
	4.4.6 Fix the flexible duct connector to fan inlet as per approved drawings.	
	4.4.7 Lift and install fans carefully on the supports. Engage sufficient manpower as required for safe installation.	
	4.4.8 Provide anti-vibration isolators as applicable.	
	4.4.9 Check the level of the installation in co-ordination with other services and approved drawings.	
	4.4.10 Cut and trim the support rods after finalising the levels. Leave 25mm extra length of the support rods for final adjustments. Threaded rod ends to be painted zinc rich primer.	
	4.4.11 Remove burrs and sharp edges, if any.	
	4.4.12 Install the electrical power connections as per approved drawings and as per approved method statement Ref:ETA/MS/E-105.	
	4.4.13 Clean the interior of the fans.	
	4.4.14 Install the ducting connection piece at the inlet of the fan and terminate at the intake wire mesh grille/louvers.	
	4.4.15 Follow the manufacturer's instructions while installing and leveling the fans.	
4.5	<u>Electrical connections</u>	
	4.5.1 Electrical power connections shall be done as per approved drawings.	
	4.5.2 Cables shall be installed and terminated as per approved method statement Ref:ETA/MS/E/015	
4.6	<u>BMS Interfacing</u>	
	BMS interfacing as defined in Material Submittal No.NMX/BDR/4045/GEN/CD/10809 dated 10.10.04 (ETA M-024, Rev.3)	

5.0 Inspection

- 5.1 Upon completion of installation, Work Inspection Request shall be raised for Consultant's inspection.
- 5.2 QC inspection shall be carried out as per the installation checklist.

6.0 Safety

- 6.1 All safety precautions shall be followed as per established project safety plan and procedure.
- 6.2 Only experienced and skilled technicians shall be engaged for carrying out fans installation work.
- 6.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, safety harness, gloves, etc as required.
- 6.4 Safety officer shall check and ensure that all safety precautions are followed.
- 6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

7.0 Reference

- 7.1 Manufacturer's catalogue.
- 7.2 Approved submittal.
- 7.3 Shop drawings.
- 7.4 Specification section 15800.

8.0 Records

- 8.1 `Work Inspection Request' duly signed by the Consultant.
- 8.2 Signed off Fan's installation checklist.

Method Statement for Installation of Fans (Central Exhaust)

1.0 Scope

- 1.1 This method statement applies to the installation of Central Exhaust Fans as per the Specification Section 15800.

2.0 Purpose

- 2.1 Purpose of this method statement is to outline the method of storage and installation of Central Exhaust Fans.

3.0 Material

- 3.1 Exhaust fans.
- 3.2 Ducting and accessories as per approved submittals/drawings.
- 3.3 Electrical cables, control panel & other accessories if any, as per approved drawings.

4.0 Method**4.1 Receiving**

- 4.1.1 On arrival at site all Fans shall be checked for quantities, type and model number, physical damages, etc., and notify supplier of any discrepancies.
- 4.1.2 Upon satisfactory inspection, the fans shall be stored properly with protective covering.
- 4.1.3 Any items found damaged or not suitable as per the project requirements shall be removed from site. Until such time, the damaged/non-compliant material shall be clearly marked and stored separately to prevent any inadvertent use.

4.2 Preparation

- 4.2.1 Check and ensure all drawings used for installation are latest and approved for construction.

4.2.2 For Floor Mounted Fans

- 4.2.2.1 Check the fan's foundation and ensure it is as per approved drawings.
- 4.2.2.2 Check the area around the foundation and ensure access to the fans from all sides as applicable.
- 4.2.2.3 Check the foundation surface and it shall be smooth and even finish to avoid any dust accumulation.
- 4.2.2.4 The foundation surface shall be cleaned before installation of fans.
- 4.2.2.5 Mark the fan's position on the foundation.
- 4.2.2.6 Fix the anti-vibration mounts/pads as applicable as per approved drawings/submittals.

4.2.3 For Ceiling Suspended Fans

- 4.2.3.1 Check and ensure that clearance and proper access is available at the place of installation.

- 4.2.3.2 Mark the support locations as per approved drawings/manufacturers details and fix the approved anchor fasteners in the slab.
- 4.2.3.3 Fix the hanger rods and supports as per manufacturers instructions.
- 4.2.3.4 Provide anti vibration isolators as applicable as per the approvals.
- 4.2.3.5 Ensure easy access and sufficient clearance for maintenance and removal of fan/motor.

4.3 Installation

4.3.1 Floor Mounted Fans

- 4.3.1.1 Shift the fans to the place of installation in safe manner using hand trolley, fork lift/crane as applicable. Sufficient manpower will be engaged as required for safe shifting and installation.
- 4.3.1.2 Ensure that the correct fan is shifted to the place of installation.
- 4.3.1.3 Ensure air inlet and outlet connections orientation are as per approved drawings.
- 4.3.1.4 Fix the flexible duct connector to fan inlet and outlet as per approved drawings/manufacturers instructions.
- 4.3.1.5 The fan is placed correctly on foundation with anti vibration mounts (if applicable) at the right location.
- 4.3.1.6 The fans will be properly levelled and parallel to room walls/other installations.
- 4.3.1.7 Fans shall be inspected again for any damage during hoisting/shifting and installation.
- 4.3.1.8 Clean the interior of the fans.
- 4.3.1.9 Follow the manufacturer's instructions while installing the fans.

4.3.2 For Ceiling Suspended Fans

- 4.3.2.1 Shift the fans to the place of installation in safe manner using hand trolley, fork lift/crane as applicable. Sufficient manpower will be engaged as required for safe shifting and installation.
- 4.3.2.2 Ensure that the correct fan is shifted to the place of installation.
- 4.3.2.3 Ensure air inlet and outlet connections orientation are as per approved drawings.
- 4.3.2.4 Fix the flexible duct connector to fan inlet and outlet as per approved drawings/manufacturers instructions.
- 4.3.2.5 Lift and install the fan carefully on the supports. Engage sufficient manpower as required for safe installation.
- 4.3.2.6 Check the level of the installation in co-ordination with other services and approved drawings.

METHOD STATEMENT	EXHAUST FANS	HVAC
	4.3.2.7 Cut and trim the support rods after finalising the levels. Leave 25mm extra length of support rods for final adjustments. Threaded rod ends to be painted zinc rich primer. 4.3.2.8 Remove burrs and sharp edges if any. 4.3.2.9 Fans shall be inspected again for any damage during hoisting/shifting and installation. 4.3.2.10 Clean the interior of the fans. 4.3.2.11 Follow the manufacturer's instructions while installing the fans.	
4.4	<u>Air side and Electrical Connections</u>	
	4.4.1 <u>Air side connections</u> 4.4.1.1 Ducting connection shall be done as per approved shop drawings. 4.4.1.2 Provide proper supports as per approved drawings. 4.4.1.3 The weight of ducting shall not act on fans. 4.4.1.4 Install the sound attenuators if applicable as per approved drawings and material submittals. 4.4.1.5 Before making final connections to fans ensure inner area of fans is clean, especially the impeller of the fan. 4.4.2 <u>Electrical connections</u> 4.4.2.1 Electrical power connections shall be done as per approved drawings. 4.4.2.2 Cables shall be installed and terminated as per approved method statement Ref;ETA/MS/E/015.	
5.0	<u>Inspection</u>	
	5.1 Work Inspection request shall be raised for consultant's inspection and sign off. 5.2 QC inspection shall be carried out as per the installation checklist and manufacturer's instructions. 5.3 Inspection shall be recorded in the approved format.	
6.0	<u>Safety</u>	
	6.1 All safety precautions shall be followed as per established project safety plan and procedure. 6.2 Only experienced and skilled technicians shall be engaged for carrying out fans installation work. 6.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, harness, gloves, etc as required.	

- 6.4 Safety officer shall check and ensure that all safety precautions are followed.
- 6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

7.0 **Reference**

- 7.1 Manufacturer's catalogue.
- 7.2 Approved submittal.
- 7.3 Approved shop drawings.
- 7.4 Specification section 15800.

8.0 **Records**

- 8.1 'Inspection Request' duly signed by the Consultants.
- 8.2 Signified off Fan's installation checklist.

Method Statement for Installation of Pressurization Fans

1.0 Scope

- 1.1 This method statement outlines the method of storage, handling and installation of Pressurisation Fans and accessories as specified in the Section 15800.

2.0 Application

- 2.1 Pressurisation of staircases and lift wells/core.

3.0 Material

- 3.1 Pressurisation Fans.
- 3.2 Threaded rods, fasteners for supports.
- 3.3 Duct flexible connections.
- 3.4 Electrical cables, controls and accessories.

4.0 Method**4.1 Receiving**

- 4.1.1 On arrival at site all Fans shall be checked for quantities, type and model number, physical damages, and notify the supplier of any discrepancies. After completion of inspection, fan shall be stored properly with protective covering.
- 4.1.2 Any items found damaged or not suitable as per the project requirements shall be removed from site. Until such time, the damaged/non-compliant material shall be clearly marked and stored separately to prevent any inadvertent use.

4.2 Storage

- 4.2.1 While unloading the fans shall be carefully and slowly lowered to the ground. Adequate manpower will be engaged according to the size of the fan. Upon completion of receiving QC inspection, the fans will be segregated model/size wise and stacked accordingly for easy retrieval.
- 4.2.2 Fans shall be stored on a flat surface in well ventilated and covered storage area.
- 4.2.3 Manufacturer's instructions shall be strictly followed as applicable.
- 4.2.4 While stacking the fans, ensure that bottom most fan packing shall not be damaged.
- 4.2.5 Store Keeper will be responsible for proper storage and maintenance of records, as required.

4.3 Preparation

- 4.3.1 Check and ensure all drawings used for installation are latest and approved for construction.

4.3.2 For Floor Mounted Fans

- 4.3.2.1 Check the fan's foundation and ensure it is as per approved drawings.

METHOD STATEMENT	PRESSURIZATION FANS	HVAC
	4.3.2.2 Check the area around the foundation and ensure access to the fans from all sides as applicable. 4.3.2.3 Check the foundation surface and it shall be smooth and even finish to avoid any dust accumulation. 4.3.2.4 The foundation surface shall be cleaned before installation of fans. 4.3.2.5 Mark the fan's position on the foundation. 4.3.2.6 Fix the anti-vibration mounts/pads as applicable as per approved drawings/submittals. 4.3.3 <u>For Ceiling Suspended Fans</u> 4.3.3.1 Check and ensure that clearance and proper access is available at the place of installation. 4.3.3.2 Mark the support locations as per approved drawings/manufacturers details and fix the approved anchor fasteners in the slab. 4.3.3.3 Fix the hanger rods and supports as per manufacturer's instructions. 4.3.3.4 Provide anti vibration isolators as applicable as per the approvals. 4.3.3.5 Ensure easy access and sufficient clearance for maintenance and removal of fan/motor.	
4.4	<u>Installation</u>	
	4.4.1 <u>Floor Mounted Fans</u> 4.4.1.1 Shift the fans to the place of installation in safe manner using hand trolley, fork lift/crane as applicable. Sufficient manpower will be engaged as required for safe shifting and installation. 4.4.1.2 Ensure that the correct fan is shifted to the place of installation. 4.4.1.3 Ensure air inlet and outlet connections orientation are as per approved drawings. 4.4.1.4 Fix the flexible duct connector to fan inlet and outlet as per approved drawings/manufacturers instructions. 4.4.1.5 The fan is placed correctly on foundation with anti vibration mounts (if applicable) at the right location. 4.4.1.6 The fans will be properly levelled and parallel to room walls/other installations. 4.4.1.7 Fans shall be inspected again for any damage during hoisting/shifting and installation. 4.4.1.8 Clean the interior of the fans. 4.4.1.9 Follow the manufacturer's instructions while installing the fans. 4.4.2 <u>For Ceiling Suspended Fans</u>	

METHOD STATEMENT	PRESSURIZATION FANS	HVAC
	4.4.2.1 Shift the fans to the place of installation in safe manner using hand trolley, fork lift/crane as applicable. Sufficient manpower will be engaged as required for safe shifting and installation. 4.4.2.2 Ensure that the correct fan is shifted to the place of installation. 4.4.2.3 Ensure air inlet and outlet connections orientation are as per approved drawings. 4.4.2.4 Fix the flexible duct connector to fan inlet and outlet as per approved drawings/manufacturers instructions. 4.4.2.5 Lift and install the fan carefully on the supports. Engage sufficient manpower and equipments as required for safe installation. 4.4.2.6 Check the level of the installation in co-ordination with other services and approved drawings. 4.4.2.7 Cut and trim the support rods after finalising the levels. Leave 25mm extra length of support rods for final adjustments. Threaded rod ends to be painted zinc rich primer 4.4.2.8 Remove burrs and sharp edges if any. 4.4.2.9 Fans shall be inspected again for any damage during hoisting/shifting and installation by ETA QA/QC. 4.4.2.10 Clean the interior of the fans. 4.4.2.11 Follow the manufacturer's instructions while installing the fans. 4.4.2.12 All open ends to be sealed.	
4.5	<u>Air side and Electrical Connections</u>	
	4.5.1 <u>Air side connections</u>	
	4.5.1.1 Ducting connection shall be done as per approved shop drawings. 4.5.1.2 Provide proper supports as per approved drawings. 4.5.1.3 The weight of ducting shall not act on fans. 4.5.1.4 Before making final connections to fans ensure inner area of fans is clean, especially the impeller of the fan.	
	4.5.2 <u>Electrical connections</u>	
	4.5.2.1 Electrical power connections shall be done as per approved drawings. 4.5.2.2 Cables shall be installed, terminated and tested as per approved method statement Ref;ETA/MS/E/015.	
4.6	<u>BMS interfacing</u>	
	BMS interfacing shall be done as defined in Material Submittal No.NMX/BDR/4045/GEN/CD/10809 dated 10.10.04 (ETA 024, Rev.3)	

5.0 Inspection

- 5.1 QC inspection shall be carried out as per the installation checklist and manufacturer's instructions.
- 5.2 Work Inspection Request shall be raised for consultant's inspection.
- 5.3 Inspection shall be recorded in the approved format.

6.0 Safety

- 6.1 All safety precautions shall be followed as per established project safety plan and procedure.
- 6.2 Only experienced and skilled technicians shall be engaged for carrying out fans installation work.
- 6.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, harness, gloves, etc as required.
- 6.4 Safety officer shall check and ensure that all safety precautions are followed.
- 6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

7.0 Reference

- 7.1 Manufacturer's catalogue.
- 7.2 Approved submittal.
- 7.3 Approved shop drawings.
- 7.4 Specification section 15800.

8.0 Records

- 8.1 'Work Inspection Request' duly signed by the Consultants.
- 8.2 Signed off Fan's installation checklist.

9.0 Attachments

- 9.1 Installation check list for Pressurisation Fans.

INSTALLATION CHECK LIST**PRESSURIZATION FANS**

<u>Location / Area:</u>			
S. No.	Activities / Items to be Inspected	Verification Sign off	
		Engineer	QC
1.	Check the fans and associated material have approved material submittals.		
2.	Check and ensure drawings used for installation are current and approved.		
3.	Inspect fans installed are new and undamaged.		
4.	Check the model, type, capacity, etc., as per approved drawing/s.		
5.	Anti-vibration provision are made as per approved drawings/material submittals, where applicable.		
6.	Check the fans are installed correctly as per drawings.		
7.	Check the installation is coordinated with other services.		
8.	Ensure adequate access available for inspection and maintenance including removal of motor, pulley, belts, etc.		
9.	Check drive guards are provided as required, where applicable.		
10.	Check the flexible duct connections are completed, where applicable.		

INSTALLATION CHECK LIST**PRESSURIZATION FANS**

<u>Location / Area:</u>			
S. No.	Activities / Items to be Inspected	Verification Sign off	
		Engineer	QC
11.	Check all nuts, bolts, screws etc, are fixed and tight.		
12.	Ensure electrical connections and grounding are completed and tightened as required.		
13.	Ensure electrical and control wiring are completed as per the fire alarm / fire protection scheme requirements to put the fan into operation in the case of emergency.		
14.	Check and ensure the fan interiors are clean and free from dust and foreign material.		
15.	Check that the fan and motor are aligned properly, where applicable.		
16.	Check and ensure the rotating/sliding parts are lubricated, if required.		
17.	Check the identification labels/tags are provided as required.		
18.	Rotate impeller by hand and ensure it rotates freely.		

Method Statement for Start-up & Commissioning of Fans

1.0 Scope

The scope of this Method Statement is to describe the procedure for pre-commissioning checks, start-up and commissioning of ventilation and pressurization fans installed within Burj Dubai – The Residences Project, in accordance with the Specification Section 15800.

Note

- a. For installation of Fans, refer to method statement Ref. ETA/MS/M-003, M-007 & M-008.
- b. TAB Method Statement shall be covered under Ref. ETA/MS/M-015

2.0 Material

- 2.1 Fans as per approved submittals.
- 2.2 Ductwork connections as applicable.
- 2.3 Electrical Starters and Controls.

3.0 Test Equipment

- 3.1 Digital Multimeter
- 3.2 Clamp Meter

Note

The calibration certificates of testing instruments shall be verified prior to usage and copies shall be included in the test reports. Calibration certificates to be forwarded to NMX, for review prior to commencement.

4.0 Pre-commissioning checks prior to start-up**4.1 Mechanical**

- 4.1.1 Carefully inspect the unit and check the installation with anti vibration materials is complete.
- 4.1.2 Check and ensure the shipping bolts / clamps are removed.
- 4.1.3 Check tightness of all nuts / bolts, screws, fasteners etc. as applicable
- 4.1.4 Check the alignment of belts and adjust the tension (where applicable).
- 4.1.5 Check the ductwork connections are complete as per approved drawings / details.

4.1.6 Ensure the fan interiors and the ducts are clean and free from foreign material.

4.1.7 Properly secure all safety guards (where applicable)

4.1.8 Rotate the fan by hand and ensure free rotation.

4.2 Electrical

4.2.1 Ensure the connected cables have been tested and verify the test reports

4.2.2 Check all terminations are complete and tightened as required

4.2.3 Check the cabling / wiring including grounding is completed and dressed neatly.

4.2.4 Check the isolator/emergency stop switch is fixed close to the fan for emergency power shutdown.

4.2.5 Ensure all identification and labelling is completed.

4.2.6 Set the overload relay to correct setting as per the fan motor current on the nameplate.

5.0 Start-up and Testing

5.1 Check the line voltage and phase rotation before energizing the power.

5.2 Switch ON the power and ensure the rotation of fan is in correct direction.

5.3 Verify for the proper operation of the motor, drive system and fan impeller.

5.4 Measure the current drawn (amperage) by the fan motor and record the same.

5.5. Check for any abnormal noise and vibration on start-up. Rectify as / if required.

5.6 After about an hours operation, check that all nuts / bolts, screws, clamps etc. are tight and secure.

5.7 Check the tension of 'V' Belts and adjust if required (where applicable).

5.8 Measure the total airflow delivered by the fan, check against the design flow and record the same in the approved format.

5.9 Record the fan and motor nameplate data in the commissioning format.

5.10 Ensure compliance to the manufacturer's instruction as applicable.

5.11 Check the operations/monitoring of respective fans on BMS as per the logic and sequence defined in the material submittal No.NMX/BDR/4045/GEN/CD/10809 dated 10.10.04 (ETA 024, Rev.3).

5.12 Give clearance for TAB works

6.0 Safety

6.1 Only experienced and skilled personnel shall be engaged for start-up and commissioning.

6.2 Warning signs and tapes will be placed as required.

6.3 Safety guards shall be in place and secured prior to start-up.

6.4 Cable test reports shall be verified prior to energisation.

6.5 All other safety procedures shall be adhered to as per Project Health and Safety Plan, as applicable.

6.6 Safety Officer shall check and ensure all safety precautions are followed.

7.0 Inspection

7.1 Work Inspection Request shall be raised for Consultants approval.

7.2 Inspection shall be recorded in the approved format.

8.0 Records

8.1 Inspection requests duly signed by NMX and Consultants

8.2 Signed-off pre-commissioning checklists

8.3 Commissioning reports

8.4 Calibration certificates of testing instruments

9.0 References

9.1 Specification Section 15800

9.2 Manufacturer's instructions

9.3 Approved Fan Submittals

9.4 Approved shop drawings

Location / Area:			
S. No.	Activities / Items to be inspected	Verification Sign off	
		Engineer	QC
1.	Check the installed fans for any damages and make good as required.		
2.	Check the installation as per approved drawings and manufacturer's instructions.		
3.	Ensure the method statement and test report formats are approved prior to testing and commissioning.		
4.	Check availability for access to all components for testing and balancing.		
5.	Check shipping bolts / clamps, if any, are removed		
6.	Check the provisions for anti-vibration as per approved drawings/details.		
7.	Check all nuts, bolts, screws etc., are tight and secure.		
8.	Check the duct connections are completed as approved.		
9.	Check the fan rotates freely by hand.		
10.	Check the direction of rotation, noise and vibration on initial startup.		
11.	Check the identification labels / tags are provided.		

<u>Location / Area:</u>			
S. No.	Activities / Items to be inspected	Verification Sign off	
		Engineer	QC
<u>Check Electrical Prior to Start-up</u>			
1	Check the cabling and wiring is completed as per approved drawings / manufacturer's instructions.		
2	Check the provision of grounding.		
3	Check all cables and wires have been terminated and tightened as required.		
4	Ensure incoming and outgoing cables have been tested. Verify test reports prior to energization.		
5	Check the isolator is installed close to the fan for emergency shutdown and maintenance.		
6	Ensure all identification works are completed.		

SECTION 1

1.General Requirements For Air & Water Balancing

2. Safety Precautions

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

SECTION 1

1. GENERAL REQUIREMENTS

Prime Technologies, as Independent Testing & Commissioning agency will perform the Testing, Balancing and Adjusting of the HVAC System in compliance with the specified tolerance and limitations outlined with CIBSE & BSRIA standards, guidelines and with reference to project specification.

Before commencement of any test, Prime Technologies shall determine and schedule a list of the commissioning information requirements, which shall include the following:

1. Full pre-commissioning check-list for the specified systems & equipments
2. The scope of works, system functions and interrelation with other services if any.
3. Technical specifications, tolerance and limits of the system.
4. Set of as built drawings, design drawings and approved submittal of Materials & Equipment
5. Design Criteria
6. Schedules of all HVAC Equipments
7. Manufacturer's setting to work and operating instructions.
8. Sound levels in selected areas
9. Power demands, starting currents, running currents and control logic
10. All room temperature, humidity and air pressure requirements.
11. All other details necessary to identify the performance of the installed HVAC plant and equipments
12. Program time period of completion as required by the client

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13. Witnessing procedures by the consultant/client.

Prior to commissioning works, the following checks shall be carried out

- 1 Proper installation of Fire Dampers and Volume Control Dampers.
- 2 Correct sizing of grilles, registers and diffusers.
- 3 Equipments installation are in accordance with the approved drawing
- 4 Pipe installation and correct pipe size.
- 5 Terminal boxes electrical wiring for both power and control as per the recommendation of the supplier.
- 6 Starter, overload relay ranges, motor sizes and speed controllers verified.
- 7 Type, size and quality of filters are verified.

2. SAFETY PRECAUTIONS

Safety awareness should be followed during execution of Testing & Commissioning works:

1. Secure Work Permit in conjunction with the approved safety plan before starting the work.
2. Usage of proper tools, instrument to be handled by the authorized person only.
3. Usage of proper safety shoes, safety belts, safety helmets, gloves, goggles, mask, earplugs & any other safety accessories as required during commissioning works.
4. Guards of approved design shall be provided for all V-belts drives, coupling shafts and exposed rotating machinery.
5. Electrical power supply shall be isolated and panel switchgear shall be locked whenever carrying out work on any rotating equipment or electrical panels.

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6. No commissioning works shall be carried out without adequate lighting available.
7. Approved Project Safety Plan & Procedures shall be followed during execution of commissioning works.
8. Provide Warning Boards / Tapes as required during Testing & Commissioning works

SECTION 2

PRELIMINARY CHECKS

For

1. Air System

**2. Chilled Water
System**

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

SECTION 2

Preliminary Checks

The following checks shall be carried out in order to ensure that the system is in a satisfactory and safe condition before starting up fans.

1. Air System

A. State of the Building and System

1. All doors and windows are fitted.
2. Suspended ceilings fitted.
3. Access available to all areas to be tested.
4. Leakage test to builder's shafts and plenums complete.

B. System Cleanliness

System shall be free from construction debris and dust. The following checks for cleanliness shall be carried out:

1. Air intake screens
2. Fan & other equipment chambers
3. Fan Internals
4. Heater and Cooler batteries
5. Cooling & Condensate Trays
6. Condensate drainage traps
7. Humidifiers
8. Volume Control Dampers and linkages

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9. Ducting & other airways

10. Sensing elements

11. Terminal units

C. Check that the system is installed as per the design or approved drawings.

D. Air Regulating Devices and Other components within Airways

1. Volume Control dampers are properly operating and accessible

2. Free movement throughout the range on motorised damper control linkages.

3. Dampers are secured throughout the system.

4. Turning Vanes, thermal insulation, acoustic linings, and sensing elements have been fitted and are undamaged.

5. Measurement points are identified and Test Holes prepared

6. Terminal units are fitted and cleaned

7. Louvers and Diffusers are set properly.

8. Flexible Ducts are installed properly.

9. VAV Units are installed as per the approved drawings & as per manufacturer recommendation.

10. Control sensor and transmitter are installed in correct location.

E. Visual Checks for Air Tightness

1. Builders work ducts and shafts are sealed.

2. Ductwork joints, including flexible joints couplings are airtight

3. Inspection covers are fitted

4. Plugs or covers for Test Holes are fitted.

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F. Fan Checks

The following should be checked:

1. Direction of rotation is correct
2. Fan and motor are lubricated
3. Fan rotates freely
4. Drive guard is fitted
5. Motor and pulleys are level and aligned and belt tension is correct.
6. Anti-vibration mountings and the removal of transit bolts and packing materials
7. Internal and external of the fans are cleaned.

G. General Electrical Checks

Prior to the initial start-up of any electrically driven fan, electric air heater or automatically advancing filter, the following shall be checked:

1. Local isolation of motor and control circuits
2. No unshrouded live components within panels
3. Panels and switchgear are clean
4. All electrical panels are site checked.
5. Motor insulation test is completed.
6. Motor surroundings are clean.
7. Transit packing of contactors and other equipments are removed.
8. All power and control wiring is completed in detail to the circuit diagram
9. Fuse ratings are correct

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

10. Starter overload is set correctly
11. Adjustable thermal cut outs are set correctly
12. All cover plates are fitted.

H. Initial Running of Fan Set

Wherever possible the first start of any motor should be on light load and shall check the following:

1. Direction of rotation is correct
2. Motor, drive and fan are free from vibration or undue noise.
3. Motor starting current for sequence timing adjustment is correct. (star-delta changeover point)
4. Motor running current and voltages on all phases are within the specified motor rating and the readings are recorded.
5. No overheating of motors
6. No seepage of lubricant from housing
7. No overheating of bearings
8. Oil rings are running freely
9. Check motor rpm

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Preliminary Checks

2. Chilled Water System

A. The following Preliminary checks shall be carried out to find out that the system is in satisfactory and safe conditions.

1. All plant items are installed in accordance with the design drawings, specifications and the manufacturer's instruction
2. Correct installation procedures were followed
3. Acceptable system cleanliness
4. Pumps are installed in accordance with specs, manufacturers recommendation and approved drawing
5. Water connections are provided as required
6. Manual and automatic air vents are provided as required.
7. Drain valves and air vents of appropriate sizes are connected and free from blockage
8. Connection to FCU, AHU, etc., are correct in relation to design water flow and direction
9. Control, regulating valves and nonreturn valve are installed as per design and direction
10. Strainers are fixed (where applicable)
11. Pipe & fittings are adequately supported.
12. Adequate space is provided to access equipment and system component as required.
13. Local isolation of motor and control circuit is provided.
14. Panels and switchgear are clean
15. All connections are tight on bus bar and wiring.

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16. Starters overload are correctly set/range is ok
17. Motor terminal wiring is correct.
18. All power and control wiring is complete as per approved drawing
19. Insulation test on pump motor has been performed satisfactorily.
20. Inward cut outs are correctly set.
21. All fuse ratings are correct.
22. All mechanical checks are completed on pump/valves
23. Declared voltage is available on all supply phases.
24. Alignment of the pump & motor is checked
25. Pressure gauges and thermometers are fixed as per approved drawings.

B. Before initial start up of the Chilled water pumps for Flushing purposes, the following checks shall be carried out

1. System is pressure tested, water tight and thoroughly flushed
2. Strainers have been cleaned.
3. Valves are open
4. Bearings and external parts are clean
5. Components are secure, impeller is free to rotate and flow direction is correct
6. Couplings are securely aligned.
7. Drive guard are fitted securely.
8. Motor and pump bearings are lubricated.
9. Power supplies are operational.
10. Direction of rotation checked.
11. Non-return valve is installed correctly and operating properly.

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Note: Chilled water system flushing and cleaning shall be carried out as per the specialist contractor's procedures and recommendations (Please refer to separate Method Statement Ref: ET/MS-M-011.

C. ELECTRICAL CHECKS:

Before the first operation of any electrical component or appliance the following procedure should be adopted

1. Appliance and control circuits are locally isolated
2. There are no unshrouded live components within the panels
3. Panels and switchgear are clean
4. Transit packing has been removed from contactors and other equipments
5. No mechanical damage to switchgear
6. All connections on busbars and wiring are tight
7. All power and control wiring has been completed in accordance with the circuit diagram
8. All fuse ratings are correct
9. Internal links on the starter are correct
10. Starter overloads are set to the motor full load current.
11. The adjustable thermal cutouts are set correctly.
12. All the cover plates are fixed.

D. Pumps Initial run

Where appropriate, check that:

1. The direction and speed of rotation of the motor shaft are correct.
2. The motor, pump and drive are free from vibration and undue noise.

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3. For star-delta starters, the starter sequence timing has been adjusted as necessary in the light of motor starting current.
4. The motor running current is balanced between phases and does not exceed the motor nameplate stated rating.
5. No overheating of pumps & motors.
6. No seepage of lubricant from the housing
7. Free movement of valve spindle.
8. No overheating of bearings & are lubricated.
9. Ventilation systems of air-cooled motors are operating correctly.

System Balancing

Whole system will be initially balanced in manual mode and random checking of the same will be carried out when the system is in full auto mode with peak demand.

SECTION 3

Method Statement

1. AIR BALANCING

2. WATER BALANCING

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

METHOD STATEMENT

1. AIR BALANCING

A. Fan Coil Units

- 1 Check that all automatic controls are fully commissioned and operating properly
- 2 All pre-commissioning checks have been carried out
- 3 Select the specified speed of the Fan Coil (Medium)
- 4 Set all the dampers in the grill outlet at full open position
- 5 Take initial total flow of the unit by adding up all the measured volume from each outlets (initial scan)
- 6 Compare the reading against the designed flow. Find out the percentage of the design flow.
7. Find out the index outlet (i.e. which has the very low percentage of reading) from the initial scan.
8. Keep the index outlet damper fully open (i.e. opposed blade damper of grill)
9. Then throttle the air volume at each outlet to get the design percentage of flow proportionally by using the Flow hood (balometer).
10. Each time when you throttle the outlet by closing the diffuser / grill damper, the index outlet airflow rises gradually. Measure the index point each time.
11. By the time the last outlet is completed, air volume at all outlets including the index is proportionally balanced.
12. Note all the readings at all outlets and keep records.

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B. Ventilation Fan (Extract Fan)

1. Check that all pre-commissioning checks have been carried out.
2. Measure the motor ampere & fan rpm of all fans and shall be set to provide total air volume within acceptable tolerances
3. Fan speed & motor current shall not exceed the maximum allowable range set by the manufacture
4. Set all the main duct & branch duct dampers at full open position
5. Check the total flow of the fan by traverse method, flow will be set to 105 % of design.
6. Check the flow in all branches and find out the index branch
7. Balance the branches in proportion with the same percentage of total flow by adjusting the volume control dampers and keeping the index branch damper at fully open position.
8. Measure the index branch and proportionally balance it to the same percentage.

9 TERMINAL BALANCING (Using Anemometer & Flow Hood)

- Measure the flow at each outlet of the terminal branches
 - Find out the index terminal and keep the damper fully open
 - Balance the other outlets proportionally to the same percentage of flow set in the branch duct.
 - Check the flow in each outlet and record including the index terminal
10. Take the total flow in the main duct again and record by using traverse duct method.

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11. After Total System balance, the following values shall be measured and recorded:

- Fan RPM
- Motor voltage and amperes
- Static pressure entering the Fan
- Static pressure leaving the fan

12. Static pressure entering and leaving the fan shall be measured as follows:

- Static pressure readings leaving the fan shall be taken as far as from the fan as is practical, but shall be before any restrictions in the duct (such as duct turns)
- No readings shall be taken directly at the fan outlet or through the flexible connection
- Static pressure entering the fan shall be measured in the inlet duct upstream of any flexible connection and downstream of any duct restriction.
- Static pressure entering a double inlet fan shall be measured through the wall of the plenum, which houses the fan
- In all cases, the reading shall be taken to represent as true a value as possible. True value is actual measured static pressure.

C. AHU with Constant Volume System:

1. Set the fan rpm to provide design total air quantity within acceptable limits.

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2. Fan speed shall not exceed the maximum allowable rpm as established by the fan manufacturer.
3. Set all the main duct & branch duct dampers and outlet dampers at full open position.
4. Check the total flow of the fan by duct traverse method, flow will be set to 105 % of design flow
5. Check the flow in all branches and find out the index branch.
6. Balance the branches in proportion with the same percentage of total flow by adjusting the volume control dampers and keeping the index branch dampers at fully open condition.
7. Measure the index branch and proportionally balance the air terminals.
8. The final setting of fan rpm shall not result in overloading the fan motor in any mode of operation. Dampers shall be modulated, and the ampere of the supply fan motor shall be measured to ensure that no motor overload can occur.
9. After Total System balancing, the following values shall be recorded:
 - a. Fan rpm
 - b. Motor voltage and current
 - c. Entering static pressure
 - d. Leaving static pressure.

D. BALANCING AIR TERMINALS PROCEDURE:

Depending upon location and access to air terminals, various types of airflow measuring instruments will be utilized to record the actual airflow at terminals.

Assuming adequate access provided, a direct reading balometer would be used which gives a direct reading of volume rather than velocity, which cancels out the need for effective grille areas, terminal configuration consideration and velocity corrections.

If access is restricted then a rotating vane anemometer shall be used and the velocity reading obtained would be converted to volume (velocity x free area = volume) and a comparison between the pitot traverse reading will be made to obtain a correction factor, which

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would be incorporated to give a true velocity reading. Alternatively, the effective area provided by the register / grille manufacturer will be incorporated in the design velocity calculations.

1. Air quantities shall be measured according to CIBSE Application Guide 3/89 Standards.
2. Any main branch may be chosen to start with but as normal practice and having carried out a rough balance of main and sub-branches, start with the most remote branch and then sub-branch.
3. Locate the terminal, which is discharging the lowest percentage of its design flow rate. This is generally the last terminal in the run. If not, adjust the damper in the last terminal unit until it is working with the same percentage as the lowest one previously measured.
4. Measure the flow from the terminal next to the index and work out the percentage flow as close as possible to that of the index. Fix the damper in position.
5. Repeat the procedure for the next terminal, again comparing it with the index.
6. As the dampers are closed along the run, more air will be driven towards the downstream terminals and the volume of air discharged at the terminal index will rise. This does not affect the balancing procedure since each terminal being adjusted is related in turn with the index.
7. When all the terminals have been balanced on a sub-branch, each terminal will be running with an equal percentage of the design flow rate, within the allowable tolerances.
8. The flow rates at each terminals must be measured and recorded. Once again a summation should be made to check that the total is in reasonable agreement with the measured sub-branch flow.
9. Test results shall be recorded in the approved test sheets and documents.

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E. STAIRWELL PRESSURIZATION FAN (MULTIPLE INJECTION SYSTEM)

1. Check all pre-commissioning checks have been carried out.
2. Set the all dampers in the grill outlet at full open position.
3. Take the initial flow of fan by adding up all the measured volume from each outlet (Initial scan)
4. Compare the readings against the design volume, find the percentage of design flow rate.
5. Find the index outlet (least favored outlet) from the scan.
6. Keep the index outlet damper fully open.
7. Then throttle the air volume at each outlet to get the design percentage of flow proportionally by anemometer with effective area.
8. Each time when you throttle the outlet by closing the damper, the index outlet the airflow rises gradually, measure the index point of each time.
9. Balance the air volume at all terminal (Including index) proportionally.

10. PRESSURE MEASUREMENT

- Check that the fan is functional.
- Ensure that all fire doors are closed while the fan is running.
- Differential pressure measurement will be carried out between the floor (unpressurised zone) & staircase (pressurized zone) by the following method:

Pass a probe under the closed door and connect it to a calibrated manometer. Two tubes should be used so that the pressure at equal points on each side of the door can be measured. Each measuring point should be atleast 50mm above the floor

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- Record the readings and compare with the specified pressure differential.

F. LIFT CORE PRESSURIZATION FAN

1. Check that all pre-commissioning checks have been carried out.

2. Measure the motor ampere & rpm of the fan and shall be set to provide total air volume within acceptable tolerances

3. Fan speed & motor current shall not exceed the maximum allowable range set by the manufacturer

4. Measure the total flow from main duct by traverse method.

5. Find the performance of the fan with manufacture specification and record the readings.

6. PRESSURE MEASUREMENT

- Fan functional will be checked.
- All lift doors are closed during fan running will be confirmed.
- Differential pressure measurement will be carried out between lift shaft & floor
- Record the readings and compare with the specified pressure.

G. CARPARK TRANSFER FAN

1. Check that all pre-commissioning checks have been carried out.

2. Measure the motor ampere & fan rpm of all fans and shall be set to provide total air volume within acceptable tolerances

3. Fan speed & motor current shall not exceed the maximum allowable range set by the manufacturer

4. Measure the velocity from discharge of the fan with the use of anemometer or velgrid.

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5. Find the total volume with average velocity and multiplied by effective area.

6. Find the performance of the fan with manufacture specification and record the readings.

I. WITNESSING

After satisfactory completion of Testing, Adjusting and Balancing of the Air Conditioning & Ventilation system, Prime Technologies will demonstrate test results to the Consultants/Clients, provided the witnessing takes place within a reasonable period of time after completion of testing, adjusting and balancing.

2-CHILLED WATER BALANCING

The aim of balancing is to apply a disciplined procedure of adjustment to water flow rates throughout a system to meet the particular requirements of the design. The balancing of water flow rates should be carried out to specified tolerances.

A. SECONDARY PUMPS

Pump shut-off head test

To verify the performance of the pump, the following tests shall be carried out in order to measure and compare against the manufacturer pump data's.

- 1 Connect a suitable differential pressure gauge across the suction and discharge pressure test points of the pumps.
- 2 Set all the supply, return valves and control valves in the system at full open position (Cooling coil valve fully open to cooling coil, chilled water flow through the AHU etc.).
- 3 With the pump on running condition, slowly close the discharge valve for a period of less than 1 minute. Effort should be made to obtain the readings as rapidly as possible in order to minimize the time that the pump is shut off.
4. Determine the shut-off pressure differential, check against the manufacturer data to zero flow then slowly re-open the discharge valve.

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5. Where the test results coincides with the manufacturers test data proceed to next paragraph. Where this is not the case, draw a curve parallel to that shown on the published data, starting at the shut-off head pressure.

6. Record the total pressure with the differential pressure gauge at full flow rate and read the actual flow from the manufacturer's data, or from the corrected graph curve as appropriate.

B. Preliminary Flow Rate Check

With all valves is fully open, measure and record the total actual flow rate and compare this with the total system design flow rate. Where necessary, close the main regulating valve to provide a flow of approximately 110 % design flow rate.

C. Balancing the chilled water main, branches, sub branches, risers, header & terminal by Proportional flow

1. Keep all the DRV's & isolating valves at fully open position.
2. Take the initial flow across the heat exchangers.
3. Record the flow and compare with the design flow.
4. Measure the initial flow at all the risers.
5. Find out the index branch riser (lower percentage of volume)
6. Keep the DRV of the index riser at fully open position.
7. Throttle the other risers proportionally to the same percentage of total flow measured.
8. Monitor the index percentage after throttling each riser as it increases gradually.
9. By the time the last riser is complete, the flow is balanced at all risers including the index riser.
10. Record the reading of all the risers.

The same method (proportional balancing) can be followed for branches & sub-branches of the Fan Coil Units and Air Handling Units located at the various floors.

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

COMMISSIONING STANDARDS & METHODS FOLLOWED

Our Commissioning Team generally follows the following Standards and Methods for Testing & Commissioning Activities but it follows strictly to the specified standards in particular projects.

S.NO.	ACTIVITY	STANDARD / CODE	CHAPTER
1	For Air Balancing.	1. CIBSE / A : 1996	Air Distribution system.
		2. BSRIA / Application Guide 3 / 89 / Guide 3/ 89 - 3	The Commissioning of Air system in Buildings.
		3. SMACNA	HVAC System – Testing, Adjusting and Balancing
		4. AABC – Associate Air Balance Council	Air Balancing
		5. NEBB-National Environmental Balancing Bureau	Air Balancing
		6. BSRIA – Application Guide 1/91	Commissioning of VAV System in Building
2	For Water Balancing	1. CIBSE / W : 1994	Water Distribution system.
		2. BSRIA / Application Guide 2 / 89	The Commissioning of Water system in Buildings.
		3. NEBB - National Environmental Balancing Bureau	Water Balancing
3	For All HVAC Equipments	ASHRAE standards and SMACNA	Commissioning of Activities

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

LIST OF INSTRUMENTS & CALIBRATION PERIOD

The following are the list of instruments, which are used in testing & commissioning of HVAC system.

1. AIRFLOW MEASUREMENT.

SL. NO.	NAME	MODEL	MAKE	FUNCTION OF THE INSTRUMENT	QTY.
1	Anemometer (Rotating Vane Type)	• EDRA-6	Air Flow	Air Velocity Measurement at Inlets, outlets and terminals	4 Nos.
2.	Anemometer (Rotating Vane Type)	• DVA-30VT	Air Flow	Air Velocity Measurement at Inlets, outlets and terminals	1 No.
3.	Anemometer (Rotating Vane Type)	• LCA – 6000	Air Flow	Air Velocity Measurement at Inlets, outlets and terminals	2 Nos.
4.	Anemometer (Rotating Vane Type)	• AV–6	Air Flow	Air Velocity Measurement at Inlets, outlets and terminals	1 No.
5	Air Data Multimeter	• ADM – 870	Shortridge Instrument Inc, USA	• Direct Air flow measurement at outlets and inlets terminals • Static Pressure Measurement • Air Velocity Measurement in the ducts and grills	6 Nos.
6	Air Data Multimeter	• ADM – 850	Shortridge Instrument Inc, USA	• Direct Air flow measurement at outlets and inlets terminals • Static Pressure Measurement • Air Velocity Measurement in the ducts and grills	2 Nos.

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

SL. NO.	NAME	MODEL	MAKE	FUNCTION OF THE INSTRUMENT	QTY.
7	Flow Hood Kit	8405	Airflow	To measure the direct air volume at the grilles, diffusers and other outlets when use with air data multimeters	8 Nos.

2. *HYDRONIC MEASUREMENT.*

SL. NO.	NAME	MODEL	MAKE	FUNCTION OF THE INSTRUMENT	Qty.
1	U-Tube Manometer	PK 30 Mercury Filled	Perflow	To measure the differential pressure across DRVs, Orifices, Heat Exchange Coils	6 Nos.
2	U-Tube Manometer	PK 30 Fluid Filled	Perflow	To measure the differential pressure across DRVs, Orifices, Heat Exchange Coils	6 Nos.
3	Digital Meter	PSW – 2000 ACS	Crane – Per Flow	Advanced commissioning unit to measure the differential pressure	1 No.

3. *TEMPERATURE MEASUREMENT.*

SL. NO.	NAME	MODEL	MAKE	FUNCTION OF THE INSTRUMENT	Qty.
1	Digital Thermometer	727	Digwell – U.K.	To measure the temperature of water and air	1 No.
2	Psychrometer	DT-2	Branan – U.K.	To measure the temperature of water, dry and wet bulb temperature of air	5 Nos.
3.	Thermo Hygrometer	S 201	Fuso	For measuring the relative humidity & dry bulb temperature.	3 Nos.

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

4. *ROTATION AND NOISE MEASUREMENT*

SL. NO.	NAME	MODEL	MAKE	FUNCTION OF THE INSTRUMENT	Qty.
1.	Tachometer	3403	• Hioki	For measuring rotating speed (r. p. m.)	2 Nos.
2.	Tachometer	DT 2236	• Lutron	For measuring rotating speed (r. p. m.)	5 Nos.
3.	Noise level meter	CEL-328/3	CEL	For measuring sound pressure level in dbs. at different octave band frequencies	1 No.

5. *ELECTRICAL MEASUREMENT*

SL. NO.	NAME	MODEL	MAKE	FUNCTION OF THE INSTRUMENT	Qty.
1.	Tong Tester (Analog)	K-2805	Kyoritsu	To measure current, voltage and Resistance	8
2.	Tong Tester (Digital)	3280	Hioki	To measure current, voltage and Resistance	5
3.	Megger	3451	Hioki	To measure the insulation resistance of cables, winding	3
4.	Phase Detector	3126	Hioki	To check the sequence of phases	3

6. *CALIBRATION FREQUENCY*

- i. All the instruments are calibrated externally once in 12 months or as per the recommendation of the Manufacturer whichever comes earlier and the records are maintained.
- ii. All are used under their allowable ranges and limits.

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

- iii. All equipments are stored in the service station under the suitable environmental condition when they are not in use and verified their accuracy at regular intervals.
- iv. Prior to commencement of Testing & Commissioning activities, Test Certificates of all instruments will be submitted for Consultant Approval.

SECTION 4

**LIST
OF
INSTRUMENTS**

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

LIST OF INSTRUMENTS & CALIBRATION PERIOD

The following are the list of instruments, which are used in testing & commissioning of HVAC system.

1. AIRFLOW MEASUREMENT.

SL.NO.	NAME	MODEL	MAKE
1	Rotating vane Anemometer.	DVA 30VT EDRA – 6 LCA – 6000	Air Flow
2	Flow Hood Kit + Shortridge Instrument. (Air Flow, Pressure Measurement included)	ADM – 870	Shortridge

2. WATER FLOW MEASUREMENT.

SL.NO.	NAME	MODEL	MAKE
1	Manometer.	HG Type / SG 1.88	Per Flow
2	Electronic Water Flow Meter		Crane – Per Flow

3. TEMPERATURE MEASUREMENT.

SL.NO.	NAME	MODEL	MAKE
1	Digital Thermometer	7000	Tif
2	Psychrometer	-	Branan – U.K.

HEATING VENTILATION AND AIR CONDITIONING (HVAC)

4. OTHER INSTRUMENTS.

SL.NO.	NAME / MAKE	DESCRIPTION
1	Hygrometer - Fuso	For measuring the relative humidity & dry bulb temperature.
2	Tachometer -	For measuring rotating speed (r. p. m.)
3	Megger, Tong Tester, Multimeter	Electrical instrument to measure the insulation resistance, amperage, voltage respectively.
4.	Pressure Gauge	For measuring system pressure.
5.	Noise level meter	CEL-328/3 For measuring sound pressure.

5. CALIBRATION FREQUENCY

- v. All the instruments are calibrated externally once in 12 months or as per the recommendation of the Manufacturer whichever comes earlier and the records are maintained.
- vi. All are used under their allowable ranges and limits.
- vii. All equipments are stored in the service station under the suitable environmental condition when they are not in use and verified their accuracy at regular intervals.
- viii. Prior to commencement of Testing & Commissioning activities, Test Certificates of all instruments will be submitted for Consultant Approval.

UNDERGROUND DRAINAGE PIPING SYSTEM

1.0 Scope

- 1.1 This method statement details the method for installation and hydrostatic testing of underground drainage piping.

2.0 Material

- 2.1 UPVC Pipes to EN1401-1 (Formerly BS 4660) with push-fit grooved joints.

3.0 Applicable Location

East and West Podium – Basement level.

4.0 Method

4.1 Storage

- 4.1.1 When off loading pipes shall be lowered to the ground either manually or with mechanical aid like crane depending on the quantity of the pipe and should not be dropped to the ground. Refer – Manufacturer's instruction for transport, handling and storage (Annexure – 1).
- 4.1.2 Pipes shall be given adequate support at all times and shall be stacked on a flat surface free from any sharp objects.
- 4.1.3 Timber supports of a least 3" wide shall be placed beneath the pipes with spacing not greater than 1.8 mtrs. Closer supports will be required for sizes below 160mm.
- 4.1.4 Pipes shall not be stored under direct sunlight to avoid ultra violet degradation.
- 4.1.5 Socketed pipes shall be stacked in layers with sockets placed at alternate ends of the stack and with the sockets protruding to avoid unstable stacks and the possibility of imparting a permanent set to the pipes.
- 4.1.6 Larger pipe sizes of thicker class shall always be placed at the bottom.

4.2 Preparation

- 4.2.1 The width of the trench at the crown of the pipe shall not be less than the outside diameter of pipe 300mm to allow proper compaction of side fill material.
- 4.2.2 The bedding shall consists of a free running granular material passing a 19mm sieve, but with a minimum of fine particles.
- 4.2.3 The thickness of the prepared bed shall be at least 100mm. It shall be well compacted and brought to an even surface so as to provide uniform support for the pipe.
- 4.2.4 Trenches shall be kept free of water by pumping the water out, if any.

4.3 Installation

- 4.3.1 Pipes are brought to the work place manually from the store to the hoist area and are shifted to the respective floors through the hoist.
- 4.3.2 Ensure that the mating areas of spigot and socket are thoroughly clean and square.
- 4.3.3 Set the rubber ring into groove.
- 4.3.4 Assess the full socket depth by simple measurement and mark spigot accordingly.
- 4.3.5 Apply lubricant to the spigot side and to the inside of the joint on rubber.
- 4.3.6 Accurate axial alignment of the spigot and socket prior to jointing is important, hand feed spigot into rubber joint until resistance from the inner sealing section is felt.
- 4.3.7 Complete the joint by applying leverage to the following socket and using a timber block to prevent damage.

Important Notice

If pipes are cut on site, make sure that the new spigots are cut square with a fine toothed saw and are chamfered to half pipe thickness with a coarse file before jointing.

- 4.3.7 All pipes and fittings delivered to site for the work should be stored in an approved manner to avoid deterioration due to accidental damage and atmospheric condition.
- 4.3.8 Before final erection, all pipes should be free of dust, scale rust or other form of corrosion.
- 4.3.9 All pipes will be laid to a uniform slope as indicated on the drawing on a prepared trench bed.
- 4.3.10 Before laying, all pipes and fittings should be checked for defects and jointing spaces cleaned properly.
- 4.3.11 Socketed pipes to be laid with sockets uphill. Scoop out compact bed locally at pipe sockets where socket pipes are used. Adjust pipes to line and level with the help of 1 mtr. Long spirit level and if required the surveyor's help can be obtained. Ensure pipe bottoms rest uniformly on the bedding.
- 4.3.12 To avoid possible damage or deformation of the pipe, its support by the ground in which it is laid should be made as uniform as possible and must be free from large stones, sharp edged flints or other hard objects.

4.4 Back-Filling

- 4.4.1 Before commencing to place any side fill material; any levelling pegs or temporary packing shall be removed.
- 4.4.2 Filling around the pipes shall be done with the same bedding material to a minimum height of 100mm and a maximum of 300mm and be thoroughly compacted.
- 4.4.3 Normal filling of trench shall then proceed in layers of 150mm with selected materials.

- 4.4.4 Plastic identification tape shall be installed during back filling operations. The tape shall be centered on the pipeline with lettering facing upwards.

5.0 Testing

5.1 Air Testing

- 5.1.1 The length of drain or sewer to be tested including any connections should be effectively plugged.
- 5.1.2 Air is pumped into the test length by suitable means (eg., hand pump) until a pressure of 100mm of water is indicated on a manometer connected to the system.
- 5.1.3 A suitable time should be allowed for stabilization of air temperature.
- 5.1.4 The air pressure should not fall below 75mm of water during a period of five minutes, without further pumping.
- 5.1.5 In case of unsatisfactory air test, hydrostatic test is to be followed so that the leakage can be assessed and located.
- 5.1.6 Testing will be inspected by main Contractor / Consultant to their satisfaction and document for correct test will be maintained by getting approval in test certificate by Consultant and Main Contractor.

5.2 Hydrostatic Testing

- 5.2.1 Water test is conducted to ensure and prove the tightness of the joints and ensure there are no leaks in the piping system.
- 5.2.2 The water pressure test can be applied to the system in its entirety or in sections. All openings in the piping will be tightly closed by special cast iron pipe plugs or by another suitable means and the system filled with water to the point of overflow from the highest point. The plugs can be temporally opened to make sure that all air has been vented and that water has reached all parts of the system.
- 5.2.3 No section of the pipe shall be tested to less than 1.5 meter head of water. In testing successive sections of piping, at least the upper 3 meters of the next proceeding section will be tested. Except the upper most 3 meters, the whole

system shall have been subjected to a height of less than 1.5 meter head of water.

- 5.2.4 The water shall be kept in the system or in the portion under test for at least 30 minutes before inspection starts. While the system is under pressure, a careful inspection shall be made on all pipes and joints. If any leaks in joints or evidence of defective pipe or fittings is revealed, the defective pipe / fitting should be immediately replaced with new joints and materials.
- 5.2.5 After the correction is made, the test pressure will be maintained for minimum 30 minutes and witnessed by QA/QC Engineer.
- 5.2.6 Testing will be inspected by main Contractor / Consultant to their satisfaction and document for correct test will be maintained by getting approval in test certificate by Consultant and Main Contractor.
- 5.2.7 Only after approval of testing back filling of trench will be allowed.

6.0 Records

Prepare work inspection request (WIR) and have them signed by Consultant.

7.0 Attachments

- 7.1 Test Format.

ABOVE GROUND DRAINAGE PIPING**1.0 Scope:**

- 1.1 This method statement details the method for installation and hydrostatic testing of above ground drainage piping.

2.0 Material:

- 2.1 UPVC pipes to EN 1329 (Formerly BS 4514) and BS EN 1455 (Formerly BS 5255).
- 2.2 Types of joints
- | | | |
|---------------------------|---|------------------------|
| a) For 1 ¼" dia to 2" dia | - | Solvent weld jointing. |
| b) For 3" dia & above | - | Push fit jointing. |

3.0 Applicable locations:

Towers, Podium & Villas.

4.0 Method:**4.1 Storage.**

- 4.1.1 When off-loading, pipes shall be lowered to the ground either manually or with mechanical aid like crane depending on the quantity of the pipe and should not be dropped to the ground. Refer Manufacturer's instruction for transport, handling and storage (Annexure – 1).
- 4.1.2 Pipes shall be given adequate support at all times and shall be stacked on a flat surface free from any sharp objects.
- 4.1.3 Timber support of at least 3" wide shall be placed beneath the pipes with spacing not greater than 1.8 mtrs. Closer supports will be required for sizes below 160mm.
- 4.1.4 Pipes shall not be stored under direct sunlight to avoid ultra violet degradation.
- 4.1.5 Socketed pipes shall be stacked in layers with sockets placed at alternate ends of the stack and with the sockets protruding to avoid unstable stacks and the possibility of importing a permanent set to the pipes.
- 4.1.6 Longer pipes of thicker class shall be kept at the bottom.

4.2 Preparation:

- 4.2.1 Drawings for installation are approved & co-ordinated with other services.
- 4.2.2 Location / Area ready for installation of piping.

4.3 Installation:

- 4.3.1 Pipes are brought to the work place manually from store to the hoist area and are shifted to the respective floors through the hoist.
- 4.3.2 Mark-up the pipe routing on the soffit of slab as per the setting-out.
- 4.3.3 Install anchor fasteners for support as per the approved support distances for different pipe sizes.
- 4.3.4 All supporting of pipes will be done as per specified spacing both horizontally and vertically. Supporting of both horizontal & vertical pipes shall be done in accordance with the approved details, drawings and specifications.
- 4.3.5 Pipes will be run to proper slope requirements as per the approved shop drawing.
- 4.3.6 Pipes & fittings will be joined by solvent weld jointing for pipe sizes 1 ¼” to 2”. Following steps, will be taken during the jointing.
 - 4.3.6.1 Pipes will be cut to square before assembly of fittings & all burrs to be rubbed-off.
 - 4.3.6.2 Cleaning fluid to be applied on both surfaces to be joined. The cleaning fluid will remove all dirt & soften the surface for the chemical solvent weld.
 - 4.3.6.3 Solvent cement will be applied evenly over mating surfaces of the both pipe & socket, and insert pipe into the socket with slight twisting action to full socket depth.
 - 4.3.6.4 Surplus cement of the joint will be removed by cloth.
 - 4.3.6.5 After jointing, it will be allowed for 3 minutes to get dried.
- 4.3.7 Clean-outs are provided to enable the maintenance in case of choking of drainage system at each change of direction.
- 4.3.7 Expansion couplings are provided at necessary locations as per manufacturer’s recommendations & shop drawing. Refer Anneuxre-I for Manufacturer’s recommendation to allow for the expansion.
- 4.3.8 All open-ended pipes to be plugged during installation phase.
- 4.3.9 Pipes & fittings will be joined by push fit method for the pipe sizes 3” to 6”. Following steps taken during installation.
 - 4.3.9.1 Ensure that the mating areas of spigot and socket are thoroughly clean and square.
 - 4.3.9.2 Set the rubber ring into groove.
 - 4.3.9.3 Assess the full socket depth by simple measurement and mark spigot accordingly.

- 4.3.9.4 Apply lubricant to the spigot side and to the side of the joint on rubber.
- 4.3.9.5 Accurate axial alignment of the spigot and prior to jointing is important, hand feed spigot into rubber joint until resistance from the inner sealing section is felt.
- 4.3.9.6 Complete the joint by applying leverage to the following socket and using a timber block to prevent damage.

Important Notice:

If pipes are cut on site, make sure that the new spigot are cut square with a fine toothed saw and are chamfered to half pipe thickness with a coarse file before jointing.

- 4.3.9.7 All pipes and fittings delivered to site for the work should be stored in an approved manner to avoid deterioration due to accident damage and atmospheric condition.
- 4.3.9.8 Before final erection, all pipes should be free of dust, scale rust or other form of corrosion.
- 4.3.9.9 All pipes will be laid to a uniform slope as indicated on the drawing.
- 4.3.9.10 Before laying, all pipes and fittings should be checked for defects and jointing spaces cleaned properly.
- 4.3.9.11 Socketed pipes to be laid with sockets uphill. Adjust pipes to line and level.

5.0 Testing

5.1 Air Testing

- 5.1.1 The length of drain or sewer to be tested including any connections should be effectively plugged.
- 5.1.2 Air is pumped into the test length by suitable means (eg., hand pump) until a pressure of 100mm of water is indicated on a manometer connected to the system.
- 5.1.3 A suitable time should be allowed for stabilization of air temperature.
- 5.1.4 The air pressure should not fall below 75mm of water during a period of five minutes, without further pumping.
- 5.1.5 In case of unsatisfactory air test, hydrostatic test is to be followed so that the leakage can be assessed and located.

5.2 Hydrostatic Testing:

- 5.2.1 Water test is conducted to ensure and prove the tightness of the joints and ensure there are no leaks in the piping system.
- 5.2.2 The water pressure test can be applied to the system in its entirety or in sections. All openings in the piping will be tightly closed by special cast iron pipe plugs or by another suitable means and the system filled with water to the point of overflow from the highest point. The plugs can be temporally opened to make sure that all air has been vented and that water has reached all parts of the system.
- 5.2.3 No section of the pipe shall be tested to less than 1.5 meter head of water. In testing successive sections of piping, at least the upper 3 meters of the next proceeding section will be tested. Except the upper most 3 meters, the whole system shall have been subjected to a height of less than 1.5 meter head of water.
- 5.2.4 The water shall be kept in the system or in the portion under test for at least 30 minutes before inspection starts. While the system is under pressure, a careful inspection shall be made on all pipes and joints. If any leaks in joints or evidence of defective pipe or fittings are revealed, the defective pipe/fitting should be immediately replaced with new joints and materials.
- 5.2.5 After the correction is made the test pressure will be maintained for minimum 30 minutes.
- 5.2.6 Testing will be inspected by Main Contractor / Consultant to their satisfaction and document for correct test will be maintained by getting approval in test certificate by Consultant and Main Contractor.

6.0 Acoustic Insulation

- 6.1 Refer MS/P-017.

7.0 Safety:

- 7.1 During the installation & testing, all safety precautions shall be followed as per the established Project safety plan.

8.0 Records :

- 8.1 Work Inspection Request (WIR) duly signed by the Consultant.
- 8.2 Test certificates duly signed by the Consultant.

9.0 Attachments :

- 9.1 Test Format

ACOUSTIC INSULATION OF DRAINAGE PIPES

Scope

- 1.1 This method statement applies to installation of acoustic insulation for drainage piping.

2.0 Purpose

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of acoustic lining for drainage piping.

3.0 Materials

- 3.1 Revac SGQ 50-25FF Metallic foil faced flexible polymer sheet laminated to quilted glass wool approximately 24mm thick, tested to ISO 140-3/95.

4.0 Method

4.1 Receiving

- 4.1.1 When received at site, each pallet shall be checked for quantities, model numbers, physical damages, etc.
- 4.1.2 Receiving inspection shall be checked by Storekeeper, Engineer and QC Engineer, which shall be documented.

4.2 Storage

- 4.2.1 All Revac pallets are stored in a covered store.
- 4.2.2 Storekeeper will be responsible for proper storage and maintenance of records, as required.

4.3 Installation

- 4.3.1 The following areas of drainage pipes will be covered by acoustic lining.
- 4.3.1.1 High-level drain pipes in living areas/bed rooms, entrance foyers of apartments, lift lobbies, main lobby/reception areas, control room/offices, kitchens, bathrooms and any other occupied space.
- 4.3.2 Clean the drainage pipes prior to commencement of acoustic lining.
- 4.3.3 Wrap the pipes and fittings by Revac SGQ 50-25 FF sheets.

4.3.4 Revac SGQ 50-25 FF can cover either butt joint or overlap joint.

4.3.5 Aluminium foil tape should be used at maximum 250mm centers. All joints should also be covered with aluminium foil tape. Cut ends of glass fibre shall be enclosed by tape.

4.3.6 Vertical pipe lagging may require the acoustic barrier to be adhered to pipe to stop the material moving.

Note Refer attached manufacturer's instructions.

5.0 Inspection

5.1 Acoustic lining for drainage pipes shall be witnessed during false ceiling clearance inspections.

6.0 Safety

6.1 All safety precautions shall be followed as per established project safety plan and procedure.

6.2 Only experienced and skilled insulators shall be engaged for carrying out this work.

6.3 The people involved in the insulation shall have PPE safety helmets, safety shoes, gloves, etc., as required.

6.4 Safety officer shall check and ensure that all safety precautions are followed.

6.5 Safety officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

7.0 References

7.1 Manufacturer's catalogue.

7.2 Approved submittal for acoustic lining for drainage piping. Ref. Submittal P-003.

7.3 Shop drawings.

8.0 Records

8.1 Work Inspection Request (WIR) duly signed by the Consultant.

9.0 Attachments

9.1 Manufacturer's instructions.

TESTING OF DRAINAGE STACKS

1. After completing the installation, flush all the stacks thoroughly with clean water.
2. Identify the stacks by appropriate serial nos., mark the same on the drawings.
3. Take tennis/golf balls, mark the stack serial no. as on the drawing with paint/ permanent marker.
4. Arrange a net for collecting the balls in the respective tower manhole.
5. Drop the ball in the respective stack via water closet connected to the stack.
6. Flush water through the stacks, check ball nos. collected against the stack nos.
7. If any ball no. is missing, open the bottom of that particular stack and clear the debris.
8. Repeat the test for the particular stack which debris are cleared.
9. Record all the tests by WIR's.

SUMP PUMPS

1.0 Scope

- 1.1 This method statement applies to installation of sump pumps as per specification.

2.0 Purpose

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of sump pumps, valve package and controls.

3.0 Material

- 3.1 Pump, guide rail, floats, cables, pedestal, stainless steel chain.
- 3.2 Valves (gate valves NRV, etc.) and piping accessories as per approved submittals shop drawings.

4.0 Application Location

- 4.1 Podium Basement.

5.0 Method

5.1 Receiving

- 5.1.1 When received at site, each pump, valves, grid rails, pedestals, stainless steel chain shall be checked for quantities model numbers, physical damages, etc., and notify supplier of any discrepancies for suitable rectification or replacement.
- 5.1.2 Valves shall be segregated as per sizes/models and stored on racks within a covered store.
- 5.1.3 Any items found damaged or not found suitable as per the project requirements shall be quarantined. Non-complaint material shall be clearly marked and stored separately to prevent any inadvertent use until returned to vendor.

5.2 Storage

- 5.2.1 Pump shall be stored on a flat surface in well ventilated storage area.
- 5.2.2 Inlet and outlet flange blanks shall not be removed until ready for connection to pipe work.
- 5.2.3 Manufacturer's instructions shall be strictly followed as applicable.
- 5.2.4 If the pumps are stored for longer periods the shaft shall be periodically rotated and lubricated, if required.

5.2.5 The stored pumps are to be inspected periodically for obvious conditions such as standing water, parts theft, excess dirt buildup or any other abnormal condition.

5.2.6 Storekeeper will be responsible for proper storage and maintenance of records, as required.

5.3 **Preparation**

5.3.1 The sump pit designed to meet Dubai Municipality requirements shall be provided by Civil Contractor (NMX).

5.3.2 Examine the sump pits for suitability as per approved drawings/requirements.

5.3.3 Check and ensure that the shop drawings used are latest and approved for construction.

5.3.4 ETA will coordinate the locations and requirements as per approved shop drawings.

5.3.5 Check the piping support locations, cable entry floats are coordination in coordination with pump and piping layout and ensure they are not obstruction the space around pump.

5.3.6 Ensure easy access and sufficient clearance for servicing and maintenance i.e. for replacement of pump.

5.3.7 Ensure vertically of guide rails for easy removal of pump for maintenance.

5.4 **Installation**

5.4.1 Provide proper ventilation before getting into the sump pit.

5.4.2 Mark the location of the pump guide rail, piping works in line with the shop drawings / requirement.

5.4.3 Drill the suitable size holes were applicable.

5.4.4 Shift the pumps and other associated accessories to the place of installations in safe manner use hand trolley / fork lift /crane as applicable / required as per site conditions.

5.4.5 Check and ensure free rotation of shaft.

5.4.6 Position the pump base on the area, which are already marked and drilled. After proper alignment fix the duct foot bend properly.

5.4.7 Fix guide rail and lifting chain properly.

5.4.8 Complete the piping and valve package installation as per approved drawings.

5.4.9 Install the electrical control panel and power connections as per approved drawings.

5.4.10 Provide grounding wiring as per approved shop drawing / manufacture recommendation.

5.4.11 Follow the manufacturer's instructions while installing the pump.

5.4.12 After completion of the installation, same shall be checked and certified by the manufacturer / authorised local representative.

6.0 Inspection

6.1 After completion and pump installation and piping connections, the same shall be checked and certified by the pump manufacturer/authorised local representative.

6.2 Request for inspection shall be raised for consultant's inspection.

7.0 Safety

7.1 All safety precautions shall be followed as per established project safety plan and procedure.

7.2 Only experienced and skilled technicians shall be engaged for carrying out pump installation work.

7.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, harness, gloves, coverall, goggle, etc., as required.

7.4 Safety officer shall check and ensure that all safety precautions are followed.

7.5 Safety officer shall check and ensure that all scaffolding and ladders use at site are having duly signed tags.

8.0 References

8.1 Manufacturer's instructions.

8.2 Approved sump pump submittal.

8.3 Approved shop drawings.

8.4 Specification Section.

9.0 Records

9.1 Request for Inspection duly signed by the Consultant.

9.2 Pump installation checklist.

9.3 Installation certificate from manufacturer's authorised local representative.

10.0 Attachment

10.1 Installation checklist.

TESTING & COMMISSIONING OF SUMP PUMPS

1.0 Scope

The scope of this Method Statement is to define the method of Start-up and Commissioning of Sump Pumps installed within the Burj Dubai – The Residences, in accordance with the Specification, manufacturer's instructions attached.

2.0 Material

Refer to Appendix 1 – Schedule of Sump Pumps.

3.0 Test Equipment

3.1 Digital Multimeter

3.2 Clamp Meter

Note

The calibration certificates of testing instruments shall be verified prior to usage and copies shall be included in the test reports.

4.0 Pre-commissioning checks prior to start-up

4.1 Mechanical

4.1.1 Check and inspect the installation of Sump Pump is complete, verify the installation as per approved drawings.

4.1.2 Verify compliance to the attached manufacturer's installation instructions.

4.1.3 Obtain installation certification from manufacturer or their authorized representative.

4.1.4 Check and ensure adequate clearance available for service and maintenance of pumps and motors.

4.1.5 Check the installation is coordinated with other services.

4.1.6 Ensure the shipping bolts / chambers are removed.

4.1.7 Check all nuts, bolts, screws, fasteners etc., are fixed and tightened as required.

4.1.8 Check the alignment is completed as per manufacturer's instructions (where applicable).

4.1.9 Check and ensure the safety guards are in place and secure.

4.1.10 Rotate the pump manually and ensure free and smooth rotation.

4.1.11 Ensure the pumps are cleaned prior to start-up and all identification labels and tags are in place.

4.2 Electrical

4.2.1 Check all power cabling and control wiring is completed and dressed neatly.

4.2.2 Check the power isolator is fixed close to the pump motor for emergency stop and power isolation.

4.2.3 Check all terminations are completed and tightened as required.

4.2.4 Check the grounding connections are completed and tightened as required.

4.2.5 Ensure the overload protections are set correctly as per the pump motor load current.

4.2.6 Ensure all identification tags and labeling works are complete.

5.0 Start-up and Testing

5.1 Check the line voltage and phase rotation before energizing the power.

5.2 Switch ON the power and start the pump and check the rotation is in the correct direction.

5.3 Immediately on start-up, check for any abnormal noise and vibration. Rectify as / if required Consult manufacturer if required.

5.4 Observe for the correct operation of motor, pump and drive system.

5.5. Measure the current drawn (amperage) by the pump motor and record the same.

5.6 Record all pump and motor nameplate data in the commissioning format.

5.7 Ensure compliance to all manufacturer's commissioning instructions, as applicable.

6.0 Safety

6.1 Only experienced and skilled personnel shall be engaged for start-up and commissioning of Sump pumps.

6.2 Cable test reports shall be verified prior to energisation.

- 6.3 Warning signs and tapes shall be placed during start-up and commissioning as required.
- 6.4 All safety procedures shall be followed in accordance with the project health and safety plan.
- 6.5 Safety Officer shall check and ensure all safety precautions are followed.

7.0 Records

- 7.1 Inspection request (for Witness of start-up and commissioning) duly signed by Consultants
- 7.2 Signed-off pre-commissioning checklists
- 7.3 Commissioning reports
- 7.4 Calibration certificates of testing instruments

8.0 References

- 8.1 Specification
- 8.2 Manufacturer's start-up and commissioning instructions.
- 8.3 Approved Sump Pump submittals / drawings.
- 8.4 Approved shop drawings.

9.0 Attachments

- 9.1 Appendix 1 – Schedule of Pumps
- 9.2 Pre-commissioning checklist
- 9.3 Manufacturer's instructions.

Installation Check List of Sump Pump

S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
1	Check the pumps to be used have approved material submittal.	
2	Ensure drawings used for installation are current and approved.	
3	Inspect pumps and control panel upon receipt at site as per approved submittals.	
4	Examine the sump pits for suitability as per approved drawings / requirements.	
5	Check the installation as per manufacturer's instructions and approved drawings.	
6	Check the piping connection to the pump completed satisfactorily and as per drawings.	
7	Ensure piping is supported properly and pipe weight is not transferred to pump.	
8	Installation to guide rails completed and supported as per manufacturer's instructions.	
9	Check the location of pumps as per approved drawings and ensure adequate space available for maintenance and removal of pumps.	
10	Check the control panel is installed as per approved drawings and all terminations are tight.	
11	Check the electrical power grounding and control wiring completed as per manufacturer's requirements/drawings.	
12	Ensure the piping to the sump pump is tested and verify the test reports prior to startup	

Test Certificate for Sump Pump

S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
1	Obtain pump manufacturers test curve prior to commencement	
2	Check Electrical connections properly made (Terminal covers fitted, level switches connected properly)	
3	Check overload setting correct and record setting on test sheets.	
4	Check fuse rating correct and record setting on test sheets.	
5	Check direction and speed of rotation are correct.	
6	Check and record pump and motor name plate details on test sheets.	
7	Check motor current on all phases and record result.	
8	Check valves and non return valves are fitted and area fully open.	
9	Record pump flow and head.	
10	Check auto change over to stand-by pump (if applicable).	

S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
11	Check float switches located at correct location proper start-stop-high level indication.	
12	Check pumps can be removed and re-fixed without problem.	
13	Check guide bar, lifting chains are fixed properly and secured.	
14	Check for dry run protection.	
15	Check for proper operation of pumps.	

DOMESTIC WATER PIPING SYSTEM

1.0 Scope

The scope of this method statement is to detail the method of installation and hydrostatic pressure testing of Domestic Water Piping System.

2.0 Material

2.1 Copper piping to BSEN 1057 Class X –

2.1.1 Cold water riser piping from the pumps to the roof tanks.

2.1.2 Cold water supply piping from the tank to the individual floors upto the PRV station.

2.1.3 Hot water piping inside the toilets from the water heater to the outlets.

2.2 UPVC piping to BS 3505 class E – Cold water distribution pipes after the PRV.

2.3 Cross-linked Poly-ethylene (PEX) pipes to DIN –16892/16893 – Hot and cold water piping concealed in block wall (wall drops).

3.0 Applicable Location

Towers, East and West Podiums and Villas.

4.0 Method

4.1 Storage

4.1.1 The pipes and fittings while unloading shall be slowly lowered, not dropped to the ground.

4.1.2 Timber supports of suitable size shall be placed at equal distance below the pipes.

4.1.3 Pipes shall be stacked on a flat surface free from any sharp objects and shall be given adequate supports at all times.

4.1.4 Pipes and fittings shall not be stored under direct sunlight.

4.1.5 While stacking it shall be ensured that pipes of bigger sizes will be placed at the bottom and smaller sizes at top.

4.1.6 Manufacturers instructions shall be followed, for storage, where applicable.

4.1.7 End caps shall be in place for all pipes until taken out for installation.

4.2 Installation

4.2.1 Ensure only approved drawings are used for installation.

4.2.2 Mark the pipe routing on the soffit of slab or as required, duly coordinated with other services and as per approved layout drawings.

4.2.3 Install hangers and supports with approved material.

4.2.4 The spacing of the supports for the vertical and horizontal pipes shall be in accordance with the approved details drawings and standards as applicable.

4.2.5 The pipes shall be installed at designated levels as per the coordinated layout.

4.2.6 The pipes are cut to required length, and all sharp edges and burrs shall be removed.

4.2.7 Before jointing, the pipes and fittings shall be checked for defects and the jointing surfaces are cleaned thoroughly.

4.2.8 The copper pipes shall be jointed by brazing by suitably qualified and skilled tradesmen.

4.2.9 Manufacturer's installation procedure shall be followed as applicable.

4.2.9.1 Refer Annexure-I (Soldering of Copper pipes)

4.2.9.2 Refer Annexure-II (Brazing of copper pipes)

4.2.9.3 Refer Annexure-III (Solvent cement jointing of UPVC pipes)

4.2.10 Only manufacturer's fittings shall be used for jointing, change in direction, change in sizes etc., as required.

4.2.11 Expansion couplers / bellows shall be installed in the piping, where it crosses the buildings expansion joints.

4.2.12 The entire piping shall be evenly pitched to achieve 0.2 percent slope towards drain valves.

4.2.13 Approved valves shall be installed for all risers and branches as per approved layout drawings.

4.2.14 All valves shall be installed in an easily accessible location and adequate space shall be available for maintenance.

4.2.15 PRVs will be installed as per manufacturers instructions at locations approved on layout drawings.

4.2.16 All pipe joints shall be left exposed until satisfactory completion of hydrostatic pressure testing.

4.2.17 All hot water copper pipes shall be plastic coated.

4.2.18 Drain valves shall be installed at all low points.

4.2.19 The pipe work, valves etc., shall be identified as per specifications and approved submittals.

4.3 **Joining Methods**

Five types of joining methods will be followed in this project.

4.3.1 Copper Pipes

Three types of joining methods will be carried out for copper pipes.

a. Brazing

Brazing will be carried out for

(i) cold water risers from pumps to roof tank and

(ii) cold water down take riser pipes 66.7mm to 108mm

by experienced and skilled personnel.

b. Soldering

Soldering will be carried out for internal hot water piping for washrooms and kitchens.

c. Victaulic Grooved Joints

This method will be used for cold water riser pipe work of 159mm dia only.

4.3.2 UPVC Pressure Pipes

UPVC pressure pipes shall be jointed by solvent cement (Refer Annexure-III)

4.3.3 PEX Pipes

The vertical dropper pex pipes are connected to the distribution pipes through a male union of approved type.

5.0 Hydrostatic Testing

- 5.1 Upon completion of installation, the open ended pipes shall suitably be plugged or blanked-off.
- 5.2 All the joints shall be left uncovered until satisfactory completion of testing.
- 5.3 Flush the section of the pipe work under test with water.
- 5.4 Connect a calibrated pressure gauge to the pipe work at a suitable location (Refer Annexure-IV for sample calibration certificate copy).
- 5.5 Check and ensure all drain valves are closed and in-line valves are open.
- 5.6 Fill the section of pipe work under test with clean water.
- 5.7 Subject the piping to a static pressure of 350 Kpa above the operating pressure by using a mechanical hand pump.
- 5.8 After pressurising the pipe work to the required pressure, a holding time of 2 hours shall be allowed.
- 5.9 Inspect all joints, valves, fittings etc. for leaks, if there is a drop in pressure.
- 5.10 Repair leaks and defects, if any, with new material as required and retest the pipe work until satisfactory results are obtained. After rectification, the test pressure shall be maintained for a minimum period of 2 hours.
- 5.11 Consultant shall be notified at least 48 hours in advance to witness the test by submission of work inspection request (WIR).
- 5.12 Only calibrated pressure gauge shall be used for pressure testing.

6.0 Safety

- 6.1 All safety precautions shall be followed as per established project safety procedures.
- 6.2 Warning sign shall be placed at required location.
- 6.3 Fire blanket to be kept at the required location.
- 6.4 Fire extinguisher to be placed at the work spot.
- 6.5 Hot work permit to be obtained from the concerned safety officer.

7.0 Records

- 7.1 Work Inspection request (WIR).
- 7.2 Installation checklist duly signed by QA/QC.
- 7.3 Test certificate duly signed by Consultant.

8.0 Attachments

- 8.1 Test Format
- 8.2 Annexure-I Copper pipes Joining (Soldering)
- 8.3 Annexure-II Copper pipes joining (Brazing)
- 8.4 Annexure-III UPVC pipes joining (Solvent weld)

ELECTRIC WATER HEATERS

1.0 Scope

- 1.1 This method statement applies to installation of water heaters as approved.

2.0 Purpose

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of water heaters and pertaining accessories.

3.0 Material

- 3.1 Ceiling mounted water heaters
- 3.2 Pressure and temperature relief (P&T) valves

4.0 Applicable Location

- 4.1 East and West Towers
- 4.2 Villas & Podium

5.0 Method

5.1 Receiving

- 5.1.1 When received at site, heaters shall be checked for quantities, model numbers and physical damages, if any.
- 5.1.2 P&T Valves shall be checked for size, model and quantity, receiving inspection shall be conducted by the storekeeper, engineer and QC Engineer.
- 5.1.3 P&T Valves and drain cock shall be segregated as per sizes / models and stored on racks within covered area.
- 5.1.4 Any items found damaged or not found suitable as per the project requirements shall be quarantined, non-compliant materials shall be clearly marked and stored separately to prevent any inadvertent use until returned to vendor.

5.2 Storage

- 5.2.1 Upon completion of receiving QC inspection the heaters will be segregated model / size wise and stored accordingly for easy retrieval.

- 5.2.2 Water heaters shall be stored on a flat surface in ventilated and covered area and protected from dust.
- 5.2.3 Inlet, outlet blanks shall not be removed until ready for connection to pipe work.
- 5.2.4 Manufacturer's instruction shall be strictly followed as applicable.
- 5.2.5 Storekeeper will be responsible for proper storage and maintenance of records, as required.

5.3 Preparation

- 5.3.1 Check and ensure that the shop drawings used are latest and approved for construction.
- 5.3.2 Check coordination with other services prior to the installation.
- 5.3.3 Check the piping supports locations and power supply routing locations in coordination water heater and piping layout and ensure it does not obstruct the space around water heater for removal and maintenance.
- 5.3.4 Ensure easy access and sufficient clearance for servicing and maintenance i.e. for replacement of water heaters, thermostat, heating elements.

5.4 Installation

- 5.4.1 Install the fabricated water heater support.
- 5.4.2 Install the water heater on the support.
- 5.4.3 Complete the piping and valve package installation as per approved drawings. Remove the end caps on the inlet, outlet points.
- 5.4.4 Install the electrical power connections as per approved drawings.
- 5.4.5 Connect the P&T valve.
- 5.4.6 Check and ensure availability of adequate access for removal and maintenance of water heater.
- 5.4.7 Provide grounding wiring as per approved drawings / suppliers instruction.
- 5.4.8 Ensure compliance to the manufacturers instructions while installing the water heaters.

6.0 Inspection

- 6.1 After completion of Water heaters and piping connections, the same shall be inspected and certified by QA/QC Engineer.
- 6.2 “Work Inspection Request” shall be raised for Consultants inspection and sign off.

7.0 Safety

- 7.1 All safety precautions shall be followed as per established project safety plan and procedure.
- 7.2 Only experienced and skilled technicians shall be engaged for carrying out this work.
- 7.3 The people involved in the installation shall have PPE such as safety helmets, safety shoes, gloves, coverall, goggles, etc. as required.
- 7.4 Safety Officer shall check and ensure that all safety precautions are followed.
- 7.5 Safety Officer shall check and ensure that all scaffolding and ladders used at site are having duly signed tags.

8.0 Reference

- 8.1 Manufacturers catalogue
- 8.2 Approved Water heater schedule
- 8.3 Shop drawings

9.0 Records

- 9.1 “Work Inspection Request” duly signed by Consultant for installation.
- 9.2 Signed-off water heaters check list

10.0 Attachment

- 10.1 Installation check sheet for Water heater

SANITARY FIXTURES

1.0 Scope:

This procedure covers the installation of sanitary wares as per Specification.

2.0 Material:

- 2.1 Water closet
- 2.2 Wash hand basin
- 2.3 Bath tub
- 2.4 Shower tray
- 2.5 Shower
- 2.6 Kitchen sink,
- 2.7 Urinal

3.0 Storage:

- 3.1 Upon completion of receiving QC inspection, the sanitary ware will be segregated model / size wise and stored accordingly for easy retrieval.
- 3.2 Sanitary ware shall be stored on a flat surface in well-ventilated and covered storage area.
- 3.3 Manufacturer's instructions shall be strictly followed as applicable.
- 3.4 Store Keeper will be responsible for proper storage and maintenance of records, as required.

4.0 Installation of Sanitary wares:

After completion of plumbing & drainage and completion of floor, wall tiles and room doors, we can start to install sanitary ware.

4.1 Water Closet

4.1.1 Type

Back to wall W.C. pan with horizontal outlet, seat & cover and concealed cistern.

4.1.2 Fixing Method

- 4.1.2.1 After getting the civil clearance, the concealed cistern shall be assembled and mounted on the wall as per approved manner as well as manufacturer's recommendations.
- 4.1.2.2 Cistern water inlet and flush outlet connection shall be completed with suitable fittings and same to be tested before closing the panel/duct.
- 4.1.2.3 Drainage pipe (W.C. outlet/branch) shall be positioned properly to receive the W.C. connector.
- 4.1.2.4 Concealed portion like cistern, plumbing pipe works to be covered with panels as per approved manner.
- 4.1.2.5 Cut out/opening for W.C. outlet, flush outlet, cistern knob/actuator are to be marked on the panel and same to be cut as per requirement.
- 4.1.2.6 W.C. pan shall be mounted on floor and mark the location of fixing points (space will be allow for connector).
- 4.1.2.7 Holes to be made on the floor for screwing.
- 4.1.2.8 Ensure that W.C. connector rubber seal is correctly located on rim of connector.
- 4.1.2.9 Lubricate W.C. spigot and rubber seal of connector.
- 4.1.2.10 Insert W.C. spigot into connector and push together.
- 4.1.2.11 W.C. screwed to floor.
- 4.1.2.12 Joint/cap to wall/panel and floor sealed with waterproof sealant after commissioning the system.

4.2 Wash Basin

4.2.1 **Type** – Oval under countertop basin with deck mount mixer.

4.2.2 Fixing method

4.2.2.1 After getting the civil clearance, the water supply and drainage arrangements shall be made clear and tidy.

4.2.2.2 As per manufacturer's recommendation, using basin as a template to determine proper counter.

4.2.2.3 Counter with marble shall be made perfect and properly leveled.

4.2.2.4 For wooden or similar countertop 'fixing clips' shall be used. For marble or similar countertop basin, be supported on a timber framework.

4.2.2.5 After carefully placing the basin, under the rim and joint/cap shall be sealed with waterproof sealant.

4.2.2.6 Mixer location (as per approved) to be marked on the counter and the same to be cut.

4.2.2.7 Then mixer shall be fitted and water supply, drainage connection will be made.

4.3 Bath Tub / Shower Tray

4.3.1 Type

4.3.1.1 Bath Tub – White acrylic 1700 x 800mm

4.3.1.2 Tray - Built-in shower

4.3.2 Fixing Method

4.3.2.1 After getting the civil clearance, the bath tub/tray shall be placed on the approved location and same to be fixed over the block work and leveling the height and slope.

4.3.2.2 Tub/tray drain outlet shall be connected to waste pipe using approved adaptor/bush.

4.3.2.3 Joint/cap an around the tub/tray sealed with waterproof sealant.

4.3.2.4 Shower door/glass framework shall be made by NMX.

4.4 Shower

4.4.1 **Type** – Built-in shower mixer – Chrome plated with single lever.

Adjustable shower head.

4.4.2 Fixing Method

4.4.2.1 Before wall tiling work, the mixer approved location shall be marked and hot & cold water points are to be terminated accordingly (should be flushed with wall tiling work)

4.4.2.2 The same above procedure to be followed for the shower head.

4.4.2.3 After the tiling work, the exposed mixer/shower head will be fixed as per manufacturer's recommendation.

4.5 Kitchen Sink

4.5.1 Water supply and drainage arrangements to be made clear and tidy.

4.5.2 Counter with finish to be made perfect and properly levelled.

4.5.3 Install the kitchen sink in the exact position (as specified in drawing) and bedded on mastic / sealant.

4.5.4 Fix the sink mixer and connect with cold and hot water supply with angle valve.

4.5.5 Fix the waste with 'P' Trap (with strainer) and connect to the drainpipe.

4.5.6 Seal the gap between kitchen sink and marble.

4.6 Urinals

- 4.6.1 Before the tiling work, the urinal outlet point, and water supply feeding point either flush valve/cistern are to be marked as per approved location as well as manufacturer's recommendation and same are to be terminated accordingly (should be flushed with tile wall).
- 4.6.2 After the tiling, the wall urinal shall be fixed using with supplied clips/bracket as per manufacturer's recommendation.
- 4.6.3 Water and drainage connection to be made with approved fittings.
- 4.6.4 Joint/cap an around the urinal sealed with waterproof sealant.

5.0 Protection:

- 5.1.1 Installed sanitary ware will be suitably protected after inspection of installation.

5.2 Care & Maintenance

- 5.2.1 To clean, simply apply a mild liquid detergent or non-abrasive cleaner with soft damp cloth rub gently, rinse and wipe dry.
- 5.2.2 To maintain the smooth and lustrous surface, or to remove marks, scratches, stains, or even burns, simply buff the area with non-abrasive metal polish.
- 5.2.3 Do not use abrasive cleaners or heavy duty scouring pads, nail polish remover, etc.

6.0 Safety:

- 6.1 All safety precautions shall be followed as per established project safety plan and procedures.
- 6.2 Only experienced and skilled Technicians shall be engaged for carrying out sanitary wares installation work.
- 6.3 The people involved in the installation shall use PPE such as Safety Helmets, Safety Shoes, Gloves, etc. as required.

6.4 Safety Officer shall check and ensure that all safety precaution are allowed

7.0 Attachment:

7.1 Installation check list

DOMESTIC WATER PUMPS

1.0 Scope

- 1.1 This method statement applies to installation of Domestic Water Pumps as per Specification and manufacturer's instructions.

Note

A separate method statement will be submitted for Start-up and Commissioning of Domestic Water Pumps.

2.0 Purpose

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of Domestic Water Pumps, valve package and controls.

3.0 Material

- 3.1 Transfer pump set.
- 3.2 Booster pump set.
- 3.3 Gate valves, NRV, pressure gauge on discharge manifold and piping accessories as per approved submittals.
- 3.4 Float switches for level control.
- 3.5 Pressure transducer and pressure switch for booster pumps and pressure switch for transfer pumps.
- 3.6 Pump foundation as per approved drawings.
- 3.7 Control Panel including protection starters and controller.
- 3.8 Pressure vessel.

4.0 Applicable Location

- 4.1 Transfer pump set – Tower W2 Basement level & Tower E2 Basement level.
- 4.2 Booster pump set – All towers roof level.

5.0 Method

5.1 Receiving

- 5.1.1 When received at site, each pump, valves, control panels, flat switches shall be checked for quantities, Model Nos., physical damages etc. and notify supplier of any discrepancies for suitable rectification or replacement.
- 5.1.2 Valves shall be segregated as per sizes/models and stored on racks within a covered store.
- 5.1.3 Any items found damaged or not found suitable as per the project requirements shall be quarantined. Non-complaint material shall be clearly marked and stored separately to prevent any inadvertent use until returned to vendor.

5.2 Storage

- 5.2.1 Pump shall be stored on a flat surface in well ventilated storage area.
- 5.2.2 Inlet and outlet flange blanks shall not be removed until ready for connection to pipe work.
- 5.2.3 Manufacturer's instructions shall be strictly followed as applicable.
- 5.2.4 If the pumps are stored for longer periods the shaft shall be periodically rotated and lubricated, if required.
- 5.2.5 Storekeeper will be responsible for proper storage and maintenance of records, as required.

5.3 Preparation

- 5.3.1 The foundations designed to meet the vibration and sound control requirements shall be provided by Civil Contractor.
- 5.3.2 Check and ensure that the shop drawings used are latest and approved for construction.

- 5.3.3 ETA will co-ordinate the location of foundation as per approved shop drawings.
- 5.3.4 The foundation surface shall be flat and level and smoothly finished top surface.
- 5.3.5 Check the piping support locations and cable tray routing locations in co-ordination with pump and piping layout and ensure they are not obstruction the space around pump.
- 5.3.6 Ensure easy access and sufficient clearance for servicing and maintenance i.e. for replacement of pump, motor, pressure vessel.

5.4 Installation Pump Set

- 5.4.1 Mark the locations of the pump base frame and hole locations.
- 5.4.2 Drill the suitable size holes in the foundations.
- 5.4.3 The pump and the other associated accessories including the piping manifold are pre-assembled on a base frame. Shift the pumps to the place of installation in safe manner. Use hand trolley / folk-lift / crane as applicable / required as per site conditions.
- 5.4.4 Check and ensure free rotation of the shaft.
- 5.4.5 Position the pump frame assembly on the foundation and fix the anchor fasteners.
- 5.4.6 Water level the pump assembly by placing the shim plates below the base frame as required.
- 5.4.7 Position the pressure vessel and do the interconnecting pipe work as per approved drawings for the booster pump.
- 5.4.8 Ensure proper coupling guards are provided.
- 5.4.9 Complete the piping and valve package installation as per approved drawings. Remove the end caps fixed on the inlet flange.
- 5.4.10 Install the electrical control panel and power connections as per approved drawings.

5.4.11 Provide grounding wiring as per approved drawings/manufacturers instruction.

5.4.12 Follow the manufacturer's instructions while installing the pump.

5.4.13 After completion of the installation, the same shall be checked and certified by the supplier/manufacturer.

6.0 Inspection

6.1 After completion and pump installation and piping connections, the same shall be checked and certified by the pump supplier.

6.2 Request for Inspection shall be raised for Consultants inspection.

7.0 Safety

7.1 All safety precautions shall be followed as per established project safety plan and procedure.

7.2 Only experienced and skilled technicians shall be engaged for carrying out pump installation work.

7.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, harness, gloves, coverall, goggle, etc., as required.

7.4 Safety officer shall check and ensure that all safety precautions are followed.

7.5 Safety officer shall check and ensure that all scaffolding and ladders use at site are having duly signed tags.

8.0 References

8.1 Manufacturer's instructions.

8.2 Approved domestic water pump submittal.

8.3 Approved shop drawings.

9.0 Records

- 9.1 Request for Inspection duly signed by the Consultant.
- 9.2 Pump installation checklist.
- 9.3 Installation certificate from Manufacturer / Local Representative.

10.0 Attachment

- 10.1. Installation check list reference

TESTING & COMMISSIONING OF DOMESTIC WATER PUMPS

1.0 Scope

The scope of this Method Statement is to define the method of Testing and Commissioning of Domestic Water Pumps installed, in accordance with the manufacturer's instructions attached.

2.0 Material

Refer to Appendix 1 – Schedule of Domestic Water Pumps.

3.0 Test Equipment

3.1 Digital Multimeter

3.2 Clamp Meter

Note

The calibration certificates of testing instruments shall be verified prior to usage and copies shall be included in the test reports.

4.0 Pre-commissioning checks prior to start-up

4.1 Mechanical

- 4.1.1 Check and inspect the installation of Domestic Water Pumps is complete, verify the installation as per approved drawings.
- 4.1.2 Verify compliance to the attached manufacturer's installation instructions.
- 4.1.3 Obtain installation certification from manufacturer or their authorized representative.
- 4.1.4 Check and ensure adequate clearance available for service and maintenance of pumps and motors.
- 4.1.5 Check the installation is coordinated with other services.
- 4.1.6 Ensure the shipping bolts / chambers are removed.
- 4.1.7 Check all nuts, bolts, screws, fasteners etc., are fixed and tightened as required.

- 4.1.8 Ensure the piping is pressure tested. Verify test certificates.
- 4.1.9 Check all piping connections are complete at pumps, flow meter and pressure relief line including flexible connections where applicable.
- 4.1.10 Check and ensure the piping is flushed and cleaned.
- 4.1.11 Check the alignment is completed as per manufacturer's instructions.
- 4.1.12 Check and verify the water level in the water tank is full.
- 4.1.13 Check and ensure safety guards are in place and secure.
- 4.1.14 Adjust desired cut-in and cut off pressure as per requirements.
- 4.1.15 Rotate the pump manually and ensure free and smooth rotation.
- 4.1.16 Ensure the pumps are cleaned prior to start up and all identification labels and tags are in place.

4.2 Electrical

- 4.2.1 Check all power cabling and control wiring is completed and dressed neatly.
- 4.2.2 Check the power isolator is fixed close to the pump motor for emergency stop and power isolation, as per approved drawings/details.
- 4.2.3 Check all terminations are completed and tightened as required.
- 4.2.4 Check the grounding connections are completed and tightened as required.
- 4.2.5 Ensure the overload protections are set correctly as per the pump motor load current.
- 4.2.6 Ensure all identification tags and labeling works are complete.

5.0 Start-up and Testing

- 5.1 Refer enclosed procedure.

6.0 Safety

- 6.1 Only experienced and skilled personnel shall be engaged for start-up and commissioning of domestic water pumps.
- 6.2 Safety guards shall be in place and secured prior to start-up.

- 6.3 Cable test reports shall be verified prior to energisation.
- 6.4 Warning signs and tapes shall be placed during start-up and commissioning as required.
- 6.5 All safety procedures shall be followed in accordance with the project health and safety plan.
- 6.6 Safety Officer shall check and ensure all safety precautions are followed.

7.0 Records

- 7.1 Inspection request (for Witness of start-up and commissioning) duly signed by Consultants
- 7.2 Signed-off pre-commissioning checklists
- 7.3 Commissioning reports (Refer attached format)
- 7.4 Calibration certificates of testing instruments

8.0 References

- 8.1 Specification Sections
- 8.2 Manufacturer's start-up and commissioning instructions.
- 8.3 Approved Domestic Water Pump submittals / drawings.
- 8.4 Approved shop drawings.

9.0 Attachments

- 9.1 Schedule of domestic water pumps
- 9.2 Pre-commissioning checklist
- 9.3 Manufacturer's instructions.

Test Certificate for Domestic Water Pumps

S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
1.	Check the make, model and type of the installed pump as per approved drawings and submittal.	
2.	Check the location of pumps as per approved drawings.	
3.	Ensure the method statement and test report formats are approved prior to testing and commissioning.	
4.	Check availability for access to all components for testing and commissioning.	
5.	Check shipping bolts/clamps are removed prior to start up.	
6.	Ensure alignment is checked and completed as per manufacturer's instructions.	
7.	Check the provisions for anti-vibration as per approved details and submittals.	
8.	Check all piping connections are complete including flexible connections as per approved details.	
9.	Check all nuts, bolts, screws etc, are secure and tightened as required.	
10.	Rotate the pump shaft manually and ensure it rotates freely.	
11.	Check the emergency manual start.	
12.	Check automatic start and stop.	

13.	Check auxiliary alarm contacts.	
14.	Check identification labels/tags are provided as per approved submittals/details.	
15.	Installation of pump/s certified by manufacturer or their authorised representative.	
16.	On initial start up check for correct direction of rotation.	
17.	Check for any unusual noise and vibration on start up.	
	<u>Electrical Checks prior to Start-up</u>	
18.	Check all cabling and control wiring is completed and tightened as required.	
19.	Check the provision of grounding as per approved drawings and details.	
20.	Check cables have been tested verify test reports prior to start-up.	
21.	Check the isolator is fixed close to pumps for emergency shutdown and maintenance, as per approved drawings.	
22.	Check the line voltage and phase rotations as per requirement prior to start up.	
23.	Ensure all identification works are complete.	
24.	Check the current drawn by pump motor is normal on initial startup	
25.	Record all test results on approved commissioning format.	

Installation Check List for Water Heaters

<u>Location / Area :</u>		
S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
1	Check the installed water heaters have approved submittals	
2	Check the location of water heaters as per approved drawings.	
3	Check make, type, size and capacity as per approved submittal and drawings.	
4	Check the water heater is installed straight and leveled properly.	
5	Check the water heater is provided with proper and adequate supports.	
6	Check valves are installed to facilitate isolation of equipment.	
7	Check provision of safety valve, thermostat, overheat protection as per approved drawings/submittals.	
8	Check the electrical connections including grounding are completed and tightened, as required.	
9	Adequate space available for inspection, maintenance and removal water heater/heating elements.	
10	Check and ensure the piping connected to the water heater is tested. Verify test certificates.	
11	Check and ensure identification is completed as per specifications and approved submittals.	

Installation Check List for Sanitary Fixtures

S. No.	Activities / Items to be Inspected	Verification Sign	
		Engineer	QC
1	Ensure drawings used for installation are latest and approved.		
2	Check all fixtures are new and free from damages.		
3	Check the installation of sanitary ware fixtures as per approved drawings and manufacturer's instructions.		
4	Check the water supply line are connected as required and pressure tested.		
5	Check all drainage works are completed and pressure tested.		
6	Check adequate space is available for fixtures and accessories.		
7	Check the installation of fixture is coordinated with architectural details and other MEP services.		
8	Ensure all fixtures are cleaned.		

SPRINKLER PIPING SYSTEM

1.0 Scope

The scope of this method statement is to describe the method of installation of sprinkler piping system in Burj Dubai – The Residences Project in accordance with the project specifications.

2.0 Material

- 2.1 Sprinkler pipes to ASTM A536 GR 'B'
- 2.2 Zone Control Valve
- 2.3 Test and Drain Valves
- 2.4 Alarm valves
- 2.5 Pressure gauges
- 2.6 Flow switches
- 2.7 Pressure reducing valves
- 2.8 Water motor gong
- 2.9 Other associated materials

3.0 Applicable Location

Towers, East and West Podiums and Villas.

4.0 Method

4.1 Storage

- 4.1.1 All material while unloading shall be lowered to the ground either manually or with mechanical aid like crane depending on the quantity of the pipe and should not be dropped to the ground.
- 4.1.2 For pipes, timber supports shall be placed beneath at equal distance.
- 4.1.3 Pipes shall be stacked on a flat surface with adequate supports.
- 4.1.4 End caps of pipes shall be in place until removed for installation.
- 4.1.5 While stacking, it shall be ensured that pipes of bigger sizes are placed below and smaller sizes on top.
- 4.1.6 All pipes shall be covered and shall not be exposed to direct sunlight.
- 4.1.7 All other items such as valves, gauges, switches shall be kept on racks within site stores and shall be segregated as per size, model, type etc. for easy retrieval.

- 4.1.8 Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4.2 Preparation

- 4.2.1 Check and ensure all drawings used for installation are latest and approved for construction.
- 4.2.2 Check the coordination of piping layout with other services and reflected ceiling and resolve problems, if any.
- 4.2.3 Mark the pipe routing on the ceiling as per approved drawings.

4.3 Installation

- 4.3.1 Fix supports and hangers with approved material, as per approved layout drawings.
- 4.3.2 Cut all excess hanger rods to leave only 25mm lengths below the support for final adjustment of levels, if required.
- 4.3.3 Machine cut the pipes square to required length and ream the pipes to remove burrs and clean thoroughly before installation.
- 4.3.4 Pipe work upto 50mm shall have threaded joints and pipes 765mm and above shall be with grooved coupling joints. The pipe work shall be grooved and installed as per coupling manufacturers instruction and grooving equipment as supplied by manufacturer shall be used.
- 4.3.5 Install pipe work at heights and to gradients shown on approved drawings, in a neat and tidy manner.
- 4.3.6 Holesaw cutter shall be used to cut holes in the pipe work where required for fixing mechanical Tees etc.
- 4.3.7 PVC Sleeves of suitable sizes shall be provided at wall crossings and fire stopping with approved material shall be completed.
- 4.3.8 Only standard fittings shall be used for changes in directions, reduction in pipe sizes, Tee joints, etc. Only long radius bends shall be used where required.
- 4.3.9 Expansion couplers shall be installed at location where piping crosses the building expansion joints (Refer Annexure-I for manufacturer's recommendations).
- 4.3.10 All vertical pipes shall be installed plumb with at least 25mm clearance from the wall / surface.

- 4.3.11 Install valves, supervisory switches, flow switches, pressure gauges etc. as per approved drawings and manufacturer's instruction.
- 4.3.12 Install drain valves at all low points as shown on approved drawings and ensure that water can be drained from all sections of pipe work.
- 4.3.14 Inspectors test drain valves of suitable size shall be provided at the farthest point in the system in each zone as per approved drawings.
- 4.3.15 Check and ensure easy access is available for maintenance and removal of all components such as valves, switches etc.
- 4.3.16 The droppers for sprinkler heads are installed at location as per approved layout / coordinated drawings.
- 4.3.17 Plug or cap-off all open ends in the piping during the installation phase.
- 4.3.18 Flush and clean the entire piping with clean water until the system is clean.
- 4.3.19 Install correct type of sprinkler heads as per approved drawings and manufacturers instruction.
- 4.3.20 Clean the pipe work thoroughly to remove all dirt, soil, oil, etc. and apply one coat of primer.
- 4.3.21 Provide identification and flow directional arrows to the pipe work, valves and other components as per approved submittals / details.
- 4.3.22 The entire installation shall be supervised, checked and certified by FIREX prior to testing and commissioning of the system.
- 4.3.23 The details of the entire installation of the system shall be inspected and approved by the Dubai Civil Defence Authority.

5.0 Testing & Commissioning

- 5.1 The entire pipe work shall be hydrostatically pressure tested as per method statement Ref. ETA/MS/P-011.
- 5.2 The final testing and commissioning of the system shall be carried out as per Method Statement Ref. ETA/MS/P-014.

6.0. Water Supply Treatment

- 6.1 NFPA 13-9-1.5 states "In areas with water supplies known to have contributed to micro biologically influenced corrosion (MIC), water supplies shall be

tested and appropriately treated prior to filling or testing of metallic piping systems”.

- 6.2** But, the chemical composition of DEWA water clearly shows that there is no microbiologically influenced corrosion. As water from DEWA is filled in the fire protection system, water treatment is not required for the wet system (Annexure-V).

7.0 Safety

- 7.1 Warning signs shall be placed at required location during pressure testing of the pipe work and barriers where required to protect other services.
- 7.2 All precautions shall be followed as per established project safety procedures.

8.0 Records

- 8.1 Work Inspection Request (WIR) duly signed by Consultants.
- 8.2 Installation check lists signed by QA/QC.
- 8.3 Installation report / certification by specialist fire protection contractor.

9.0 Attachments

- 9.1 Test Certificate for Piping System

WET RISER PIPING

1.0 Scope:

This method statement is applicable to the installation of Wet Riser Pipes and Hose reels, related fittings and accessories, to ensure that the pipe work and other related fittings and accessories are properly installed and conforms to the requirement of contract specification and NFPA 14.

2.0 Purpose:

To define the installation of Wet Riser Pipes with Mechanical Grooved and Threaded fittings, Fire fighting accessories e.g. Hose reel, Landing valve, etc.

3.0 Applicable locations:

3.1 East and West Towers and Podiums.

4.0 Method:

4.1 Preparation work

Before commencing any installation of Wet Riser Piping with fittings and accessories the following activities shall be carried out by the responsible representative of the company.

- 4.1.1 Check that the approved construction drawing of current revision is readily available for installation.
- 4.1.2 Verification of material used for installation, should have an approved material submittal.
- 4.1.3 Check the type and working conditions of pipe and applicable or required fittings and accessories as per the contract specifications.
- 4.1.4 Verify the availability of all required accessories on construction SITE prior to start of any installation activity.
- 4.1.5 Loading and unloading of pipes should be carried out by hands and use of skids should be avoided. Pipes should not be dragged along rough surface. Extra care should be exercised in handling small dia pipes to avoid damage.
- 4.1.6 Check the work area as per the safety aspect; it should be clean, tidy and safe for installation of fire fighting piping systems.

4.2 Installation Procedure

- 4.2.1 Mark out the location of hangers and supports for fire pipes and accessories as per the approved construction drawings.
- 4.2.2 Drill the marked position for the hangers and supports by using a drill of appropriate or required size.
- 4.2.3 Fix the flush anchor at drilled position by gentle and uniform hammering. During hammering use the “Setting Tool” of appropriate size for proper grip of the anchor in concrete.
- 4.2.4 Before fixing the threaded rod, insert a washer of appropriate size in to the rod.
- 4.2.5 Fix the threaded rod of appropriate dia and length into the anchor by twisting. For easy and balancing twisting of the rod use preferably two nuts locked together and a wring spanner for tightening.
- 4.2.6 Finally fix the washer near to the slab by tightening a nut over it; this will improve the strength and load bearing capacity of threaded rod and lock the support in place.
- 4.2.7 Measure length of pipe required, make due allowance of any pipe fittings to be used. Cut the pipe to the measured length in machine, ensuring that the ends are cut square. Flame cut ends will not be used for grooving.
- 4.2.8 For pipes more than 2 ½” dia grooved joints are required. With help of grooving machine prepare grooves at the pipe end to accept the Victaulic mechanical joints fittings as per the specifications and manufacturers recommendations.
- 4.2.9 For pipe less than 2 ½” dia, threaded joint is required, for this purpose, make external threads on the pipe’s end by using proper threading machine.
- 4.2.10 After making thread, these will be covered with jute. Wrap the jute around the entire length of the threads beginning with the second number thread from the end. Then screw the threaded end of the pipe in the adjacent fitting or pipe.
- 4.2.11 After preparing threads and the grooves, check them for their proper formation and depth.
- 4.2.12 The pipe will be checked for correct level and position and if necessary adjusted on the pipe support, or re-level the pipe with spirit level and tape.

4.2.13 For vertically installed pipes, install wall hangers at drilled position by adopting the same procedure. Install the pipes in the clips and “U” clamps. Provide additional support, to hang each landing valve.

4.2.14 Refer Annexure-I for a typical arrangement of landing valve.

4.3 Installation of Landing Valve

4.3.1 Mark out the location of landing valves on the pipes as per the approved construction drawing of current revision.

4.3.2 Provide mechanical Tee in the pipe to install the landing valve with the help of appropriate hole saw cutting machine prior to install the landing valve.

4.3.3 Install the “U” clamp fittings with each landing valve fitting.

4.3.4 Keep the canvas 2 ½” x 30 meter hose in the pre-installed metallic fire cabinet after the commissioning stage.

4.4 After completion of installation, remove burrs, dirt and construction debris and repair any damaged finishes including chips, scratches and abrasion. Make good paint finish.

4.5 After completion of installation work, work inspection request (WIR) shall be raised for Consultant’s inspection.

4.6 Hydrostatic test shall be performed as per attached format for the entire system to a pressure of 15 bars.

4.7 FIREX shall supervise the installation and testing and certify the same.

5.0 Equipment / Tools Required:

5.1 Electric drilling machine.

5.2 Mobile scaffold and step ladder.

5.3 Mechanical tool kit.

5.4 Measuring tape.

5.5 Water level.

5.6 Cutting tool.

5.7 Grinding machine.

5.8 Threading tool.

5.9 Grooving machine.

6.0 Safety

- 6.1 All safety regulations prevailing to this project site shall be strictly adhered to.
- 6.2 Ensure work area is clean and tidy.
- 6.3 Safety equipment (example hard hats, safety shoes, coverall gloves, goggles when necessary etc) to be worn all the times.
- 6.4 Ensure area is kept clear while lifting is in progress and cordon area off if necessary with warning tape.
- 6.5 Check all lifting equipment for visual sign of damage.
- 6.6 Check electric drill machine and extension leads for visual sign of damage.
- 6.7 Safety Officer shall check and ensure all safety measures are taken as required.

7.0 Attachment

- 7.1 Hydrostatic Test Certificate

TESTING & COMMISSIONING OF FIRE PROTECTION SYSTEM

1.0 Scope:

This scope of this method statement covers the testing and commissioning of sprinklers and Wet Riser system within the Burj Dubai – The Residences in accordance with the following.

1.1 Technical specifications.

1.2 NFPA-13 & NFPA-14.

2.0 Purpose:

To test the sprinklers and Wet Riser system for leaks and defects and to perform all required acceptance tests in accordance with NFPA-13 & NFPA-14 (Inspection and testing of water based Fire Protection Systems).

3.0 Applicable locations:

3.1 E1, E2, E3, W1, W2 & W3 Towers, East & West Podiums and Villas.

4.0 Parties Involved:

Client

Project Manager

MEP Consultant

MEP Sub-Contractor

Main Contractor

Fire Protection Contractor

5.0 System Components:

5.1 Sprinkler piping

5.2 Alarm valves and Flow detectors

5.3 Landing valves

5.4 Hose reels

5.5 Fire Extinguishers.

6.0 Technical Section:

Pressure Guage – 4” DIAL, 0-300 PSIG

Note: The calibration certificate of the pressure gauge shall be checked and verified prior to use.

7.0 Testing Procedure:

For convenience, the entire testing procedures have been divided into various parts as below:

7.1 Sprinkler Test

7.1.1 The sprinkler system will be tested separately for the tower area and podium areas.

Tower

7.1.1.1 A flow test will be conducted for sprinkler system in the tower's floor areas.

7.1.1.2 Water flow will be established by opening the inspector test and drain valve of zone control valve assembly. The flow shall be equivalent to flow through our sprinkler head as it is pre set in test and drain valve.

7.1.1.3 Ensure that fire alarm is activated when inspectors test valve is opened, which means flow detector shall be interfaced with fire alarm system (fire signal)

7.1.1.4 Ensure that water motor gong will operate in the pump room when the pump is in running condition.

- 7.1.1.5 Manufacturer's written instruction shall be followed for the testing of sprinkler.

Podium

- 7.1.1.6 The sprinkler system in the podium area will be tested, by operating one of the upright sprinkler heads.
- 7.1.1.7 Upright sprinkler head will be operated by heating the glass bulb of the head, once the temperature reaches 79°C, the glass bulb of the sprinkler breaks and water will flow.
- 7.1.1.8 Ensure that fire alarm is activated when inspectors test valve is opened, which means flow detector shall be interfaced with fire alarm system (fire signal).
- 7.1.1.9 Ensure that water motor gong will operate in the pump room area when the pump is in running condition.

7.2 Alarm Valves

- 7.2.1 Verify that auxiliary drains are closed and that the system is free of leaks.
- 7.2.2 Open the system test valve (and any auxiliary vents provided to facilitate the removal of air from the system) to allow air to escape from the system while it is filling with water.
- 7.2.3 If desired, close the alarm shut-off valve to prevent local alarms from operating while filling the system.
- 7.2.4 Slowly open the water supply main control valve.
- 7.2.5 Allow the system to completely fill with water. Allow water to flow from the system test valve and any other open vents provided until all air is exhausted from the system.
- 7.2.6 After all air is exhausted from the system, close the system test valve and all other open vents.

7.2.7 The pressure gauge on the system side of Alarm Check Valve Clapper should indicate water pressure equal to greater than the water pressure indicated on the gauge located on the supply side of the clapper.

7.2.8 OPEN the Alarm Shut-Off valve in the Alarm Valve trim, and verify that all other valves are in their normal operating position.

7.2.9 Secure all valves in their normal operating position.

7.3 Water Flow Detector

7.3.1 A flow test will be conducted for water flow detector.

7.3.2 Water flow will be established through the inspectors test connection.

7.3.3 Ensure that fire alarm is activated when inspectors test valve is opened, which means flow detector shall be interfaced with fire alarm system (fire signal).

7.3.4 Manufacturer's instruction shall be followed for the testing of main drain valve.

7.4 Landing Valve & Fire Hoses

7.4.1 After completing the hydrostatic pressure testing of wet riser piping, a flow test will be conducted to ensure proper operation of the landing valve.

7.4.2 Unwind the 2 ½" dia fire hose and connect one end of fire hose to branch pipe and other end to the outlet of landing valve.

7.4.3 Slowly turn the hand wheel of the landing valve, till we get a constant flow through the branch pipe outlet.

7.4.4 Ensure the flow and pressure at the outlet of branch pipe.

7.5 Fire Hose Reel

7.5.1 Once the hose reel piping is under pressure and tested, a flow test will be conducted to ensure proper operation of the hose reel.

- 7.5.2 Unwind the hose from the hose reel, and after removing 2-3 metre of hose from the hose reel, the automatic valve will open automatically.
- 7.5.3 Open the nozzle and ensure the flow and pressure at the nozzle of the hose reel.
- 7.5.4 1" dia. PRV shall be used to maintain an outlet pressure of 4 bars.
- 7.5.5 One of the remote hose reels will be operated to measure the quantity of water discharge. The water discharged from the hose reel will be collected in a calibrated container to measure the water flow per minute to establish the flow rate which shall be 23 l/min approximately.

7.6 Fire Extinguisher

- 7.6.1 Check for physical conditions for the fire extinguisher and the pressure gauge reading of the fire extinguisher.
- 7.6.2 Inspect the fire extinguisher to determine that the hose and horn is unobstructed and the plastic tamper seal is intact. Recharge if the weight has reduced more than 5% of the extinguisher content weight.
- 7.6.3 Portable fire extinguishers supplied and installed will be inspected and checked during the commissioning period to ensure that they are in good working condition. Any extinguisher losing 10% of its nominal content by weight will be recharged to the required standard.
- 7.6.4 All cylinders containing the chemical extinguishing agents will be checked to ensure that the contents are up to the specified standards and are so marked with paint on the outside of cylinders.
- 7.6.5 A sample fire extinguisher (as selected by the Consultant) shall be discharged during testing & commissioning demonstration. The discharged cylinder will be replenished as required.

8.0 Manufacturer's Recommendations

- 8.1.1 Manufacturer's instructions, as applicable, will be followed for testing and commissioning of system components. Find attach the manufacturer's instructions for the fire protection equipments.

- 8.1.2 All recommendations as per NFPA 13, NFPA 14 and NFPA 25 shall be followed and will be incorporated in the O &M Manual.

9.0 Record and Report Data:

- 9.1 A written report shall be prepared by Fire Protection Specialist upon completion of Testing and commissioning to certify the results.
- 9.2 All the test results will be recorded in the test format, which has been prepared inline with the NFPA format. A sample test format is attached to this method statement for approval.
- 9.3 WIR request duly signed off by NMX and Roberts & Partners.

10.0 Safety:

- 10.1 All PPE such as helmet, safety shoes, harness, gloves, etc., shall be used by the personnel, as required.
- 10.2 Warning signs shall be placed at required location during pressure testing of pipe work.
- 10.3 Only experienced and skilled personnel shall be engaged for carrying out the pressure testing work.
- 10.4 All other precautions shall be followed as per established project safety procedures.
- 10.5 Safety officer shall check and ensure all safety measures are followed as required.
- 10.6 All concerned shall be notified prior to testing activities are commenced.

11.0 Attachment:

- 11.1 Testing and Commissioning certificate for sprinkler system.
- 11.2 Testing and Commissioning certificate for wet riser system.

FIRE PUMPS

1.0 Scope

- 1.1 This method statement applies to installation of Firewater pumps as per Specification, manufacturer's instructions and NFPA-20.

2.0 Purpose

- 2.1 Purpose of this method statement is to outline the method of storage, handling and installation of firewater pumps, valve package and controls.

3.0 Material

- 3.1 Pump and motor assembled on a common base frame, coupled using suitable coupling arrangement by the manufacturer.
- 3.2 OS&Y valves, NRV, flexible connectors and piping accessories as per approved submittals.
- 3.3 Pump foundation as per approved drawings.

4.0 Applicable Location

- 4.1 West Tower – W2 Basement Floor.

5.0 Method

5.1 Receiving

- 5.1.1 When received at site, each pump, valves, air vent, pressure relief valve and water meter shall be checked for quantities, Model Nos., physical damages etc. and notify supplier of any discrepancies for suitable rectification or replacement.
- 5.1.2 Valves shall be segregated as per sizes/models and stored on racks within a covered store.
- 5.1.3 Any items found damaged or not found suitable as per the project requirements shall be quarantined. Non-compliant material shall be clearly marked and stored separately to prevent any inadvertent use until returned to vendor.

5.2 Storage

- 5.2.1 Pump shall be stored on a flat surface in well-ventilated storage area.
- 5.2.2 Inlet and outlet flange blanks shall not be removed until ready for connection to pipe work.

- 5.2.3 Manufacturer's instructions shall be strictly followed as applicable.
- 5.2.4 If the pumps are stored for longer periods the shaft shall be periodically rotated and lubricated, if required.
- 5.2.5 The stored motor should be inspected periodically for obvious conditions such as standing water, parts theft, excess dirt buildup or any other abnormal condition.
- 5.2.6 Storekeeper will be responsible for proper storage and maintenance of records, as required.

5.3 Preparation

- 5.3.1 The foundations designed to meet the vibration and sound control requirements shall be provided by Main contractor.
- 5.3.2 Check and ensure that the shop drawings used are latest and approved for construction.
- 5.3.3 ETA will co-ordinate the location of foundation as per approved shop drawings.
- 5.3.4 The foundation surface shall be flat and level and smoothly finished top surface.
- 5.3.5 Check the piping support locations and cable tray routing locations in co-ordination with pump and piping layout and ensure they are not obstructing the space around pump.
- 5.3.6 Ensure easy access and sufficient clearance for servicing and maintenance i.e for replacement of pump, motor.

5.4 Installation

5.4.1 Electric Driven Pumpset (Main & Jockey)

- 5.4.1.1 Mark the locations of the pump base frame and hole locations.
- 5.4.1.2 Drill the suitable size holes in the foundations.
- 5.4.1.3 The pump and motor are assembled on the base frame by suitable flexible coupling arrangement. Shift the pumps to the place of installation in safe manner. Use hand trolley / folk-lift/ crane as applicable/ required as per site conditions.
- 5.4.1.4 Check and ensure free rotation of the shaft.

- 5.4.1.5 Position the pump frame assembly on the foundation and fix the anchor fasteners.
- 5.4.1.6 Water level the pump assembly by placing the shim plates below the base frame as required. Gap between motor and pumps, after pump installation shall be rechecked by the pump supplier before testing.
- 5.4.2 Ensure proper coupling guards are provided.
- 5.4.3 Complete the piping and valve package installation as per approved drawings. Remove the end caps fixed on the inlet flange.
- 5.4.4 Install the electrical control panel and power connections as per approved drawings.
- 5.4.5 Incoming and outgoing cables to be insulation resistance/continuity tested.
- 5.4.6 Provide earth wiring as per approved drawings/manufacturers instruction.
- 5.4.7 Follow the manufacturer's instructions while installing the pump.
- 5.4.8 After completion of the installation, it shall be checked and certified by the supplier/manufacturer.

6.0 Inspection

- 6.1 After completion and pump installation and piping connections, the same shall be checked and certified by the pump supplier.
- 6.2 Request for Inspection' shall be raised for Consultants approval.

7.0 Safety

- 7.1 All safety precautions shall be followed as per established project safety plan and procedure.
- 7.2 Only experienced and skilled technicians shall be engaged for carrying out pump installation work.
- 7.3 The people involved in the installation shall use PPE such as safety helmets, safety shoes, harness, gloves, coverall, goggle, etc. as required.
- 7.4 Safety officer shall check and ensure that all safety precautions are followed.

- 7.5 Safety officer shall check and ensure that all scaffolding and ladders use at site are having duly signed tags.

8.0 References

- 8.1 Manufacturers instructions
- 8.2 Approved fire water pump submittal.
- 8.3 Approved shop drawings.
- 8.4 Specification section 15500
- 8.5 NFPA 20

9.0 Records

- 9.1 Work Inspection Request dully signed by the NMX and Consultant.
- 9.2 Pump installation checklist.
- 9.3 Installation certificate from manufacturer

10.0 Attachment

- 10.1 Schedule of Fire Water Pumps
- 10.2 Installation checklist

TESTING & COMMISSIONING OF FIRE WATER PUMPS

1.0 Scope

The scope of this Method Statement is to define the method of Start-up and Commissioning of Fire Water Pumps installed within Burj Dubai – The Residences, in accordance with the Specification, applicable NFPA and manufacturer's instructions attached.

2.0 Material

Refer to Appendix 1 – Schedule of Fire Water Pumps.

3.0 Test Equipment

3.1 Digital Multimeter

3.2 Clamp Meter

Note

The calibration certificates of testing instruments shall be verified prior to usage and copies shall be included in the test reports.

4.0 Pre-commissioning checks prior to start-up

4.1 Mechanical

- 4.1.1 Check and inspect the installation of Fire Water Pump is complete, verify the installation as per approved drawings.
- 4.1.2 Verify compliance to the attached manufacturer's installation instructions.
- 4.1.3 Obtain installation certification from manufacturer or their authorized representative.
- 4.1.4 Check and ensure adequate clearance available for service and maintenance of pumps and motors.

- 4.1.5 Check the installation is coordinated with other services.
- 4.1.6 Ensure the shipping bolts / chambers are removed.
- 4.1.7 Check all nuts, bolts, screws, fasteners etc., are fixed and tightened as required.
- 4.1.8 Ensure the piping is pressure tested. Verify test certificates.
- 4.1.9 Check all piping connections are complete at pumps, flow meter and pressure relief line including flexible connections where applicable.
- 4.1.10 Check and ensure the piping is flushed and cleaned.
- 4.1.11 Check the alignment is completed as per manufacturer's instructions.
- 4.1.12 Check and verify the water level in the water tank is full.
- 4.1.13 Check and ensure the safety guards are in place and secure.
- 4.1.14 Adjust desired cut-in and cut off pressure as per requirements.
- 4.1.15 Rotate the pump manually and ensure free and smooth rotation.
- 4.1.16 Ensure the pumps are cleaned prior to start-up and all identification labels and tags are in place.

4.2 Electrical

- 4.2.1 Check all power cabling and control wiring is completed and dressed neatly.
- 4.2.2 Check the power isolator is fixed close to the pump motor for emergency stop and power isolation.
- 4.2.3 Check all terminations are completed and tightened as required.
- 4.2.4 Check the grounding connections are completed and tightened as required.

4.2.5 Ensure the overload protections are set correctly as per the pump motor load current.

4.2.6 Ensure all identification tags and labeling works are complete.

5.0 Start-up and Testing

5.1 Electric Driven

5.1.1 Open suction gate valves.

5.1.2 Check that pumps is full of water and that all air contained in pumps has been allowed to escape through the air release valve.

5.1.3 Compress packing evenly with gland (Gland nut should be finger tight).

5.1.4 Lower setting of pressure switch (senses discharge pressure) to prevent pump from starting.

5.1.5 Place the main disconnect switch in the 'ON' position.

5.1.6 Place circuitry breaker in the 'ON' position and check if Power on light is illuminated.

5.1.7 Check direction of driver rotation by pressing momentarily the 'Start' and then 'Stop' push buttons on the controller (proper direction is indicated by arrow on pump casing), for in-line pump use a light on shaft to see rotation (this is clockwise looking down from top of motor). If rotation is wrong interchange motor leads in panel per instructions in panel.

5.1.8 Bring the timer setting down to one (1) minute for automatic start test purpose.

5.1.9 Open system butterfly valve.

5.1.10 Bleed the system by opening a valve on the pressure sensing line to create a pressure drop.

5.1.11 As soon as fire pump starts check if full load current valve is within the electric motor name plate rating with service factor taken into account.

5.1.12 Check packing adjustment to obtain slight leak of approximately 1 drop per second.

5.1.13 After running for one minute (time set on the running period timer), stop pump with stop button. If you try stopping it before the time set on the timer, the pump will not stop.

5.1.14 Bleed again until desired start-up pressure is attained.

5.1.15 Allow jockey pump to stop automatically at pressure switch setting.

5.1.16 Measure the total flow of water from the pump, at the outlet, and verify the same against the design requirements. Record the results in the commissioning format.

5.2 Automatic Operation

5.2.1 Open system butterfly valve and turn all the isolating valves to the fully open position.

5.2.2 Place the main disconnect switch one the ON position.

5.2.3 Switch fire pump circuit breaker to the ON position.

5.2.4 Switch the jockey pump to AUTO (the power ON light must be lit).

5.3 Record all pump and motor nameplate data in the commissioning format.

5.4 Ensure compliance to all manufacturer's start-up and commissioning instructions, as applicable.

6.0 Safety

6.1 Only experienced and skilled personnel shall be engaged for start-up and commissioning of chilled water pumps.

6.2 Safety guards shall be in place and secured prior to start-up.

- 6.3 Cable test reports shall be verified prior to energisation.
- 6.4 Warning signs and tapes shall be placed during start-up and commissioning as required.
- 6.5 All safety procedures shall be followed in accordance with the project health and safety plan.
- 6.6 Safety Officer shall check and ensure all safety precautions are followed.

7.0 Records

- 7.1 WIR (for Witness of start-up and commissioning) duly signed by Consultants
- 7.2 Signed-off pre-commissioning check lists
- 7.3 Commissioning reports
- 7.4 Calibration certificates of testing instruments

8.0 References

- 8.1 Specification Sections 15500
- 8.2 Applicable standards – NFPA
- 8.3 Manufacturer’s start-up and commissioning instructions.
- 8.4 Approved Fire Water Pump submittals / drawings.
- 8.5 Approved shop drawings.

9.0 Attachments

- 9.1 Annexure-I Schedule of Pumps
- 9.2 Pre-commissioning checklist
- 9.3 Plant performance test sheet.

Installation Check List for Fire Water Pumps

S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
1	Check the installed pumps and accessories have approved submittals	
2	Ensure the drawings used for installation are latest and approved	
3	Verify the pumps and accessories are as per approved submittals.	
4	Check the plinths and ensure the same is as per manufacturer's requirements / approved drawings.	
5	Installation of equipment and accessories is as per approved drawings.	
6	Check and ensure water meter is installed as per approved drawings.	
7	Ensure installation complies with manufacturer's instructions.	
8	Check all nuts, bolts, clamps etc., are fixed and secured.	
9	Check the installation of piping is completed as per approved drawings.	
10	Check the control panels are installed as per drawings.	
11	Check all cable and wiring is completed and terminated.	
12	Check and ensure adequate access available for maintenance and service including removal of components.	
13	Check and ensure the installation complies with NFPA 20	
14	Check the identification labels / tags are provided as per the requirement.	
15	Ensure the equipment is cleaned and free from dust and debris.	

Pre commissioning Check list for Fire Water Pumps

S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
1	Check the make, model and type of the installed pump as per approved drawing and submittal.	
2	Check the location of pumps as per approved drawings.	
3	Ensure the method statement and test report formats are approved prior to testing and commissioning.	
4	Check availability for access to all components for testing and commissioning.	
5	Check shipping bolts/clamps are removed prior to start-up.	
6	Ensure alignment is checked and completed as per manufacturer's instructions.	
7	Check the provisions for anti vibration as per approved details and submittals.	
8	Check all piping connections are complete including flexible connections as per approved details.	
9	Check all nuts, bolts, screws, etc., are secure and tightened as required.	
10	Rotate the pump shaft manually and ensure it rotates freely.	

S. No.	Activities / Items to be Inspected	Verification Sign of Engineer
11	Check the emergency manual start.	
12	Check automatic start and stop.	
13	Check auxiliary alarm contacts.	
14	Check identification labels/tags are provided as per approved submittals/details.	
15	Installation of pump/s certified by manufacturer or their authorised representative.	
16	On initial start-up check for correct direction of rotation.	
17	Check for any unusual noise and vibration on start-up.	
	<u>Electrical Checks prior to Start-up</u>	
18	Check all cabling and control wiring is completed and tightened as required.	
19	Check the provision of grounding as per approved drawing and details.	
20	Check cables have been tested verify test reports prior to start-up.	
21	Check the isolator is fixed close to pumps for emergency shutdown and maintenance, as per approved drawings.	
22	Check the line voltage and phase rotations as per requirement prior to start-up	
23	Ensure all identification works are complete.	
24	Check the current drawn by pump motor is normal on initial startup.	
25	Record all test results on approved commissioning format.	