

# Sport Authority Of Gujarat

General Specification For H.V.A.C., Astrotuff, Landscaping, Firefighting.

✓ HVAC. Specification	Page 1 to 13
✓ AstroTruff Specification	Page 14 to 15
✓ Fire Fighting Specification	Page 15 to 26
✓ Landscape Specification	Page 27 to 53

**01.HVAC SPECIFICATION****TECHNICAL SPECIFICATIONS****AIR DISTRIBUTION SYSTEM****1.0 SCOPE**

1.1 The scope under this section covers air distribution system consisting of :

Sheet metal ducting  
Dampers & Air Balancing  
Grilles and Diffusers

**2.0 STANDARDS**

2.1 The following standards shall be applicable :

- a) IS : 655 Metal air ducts
- b) IS : CP352 Mechanical ventilation and air conditioning in buildings
- c) IS : 2629 Recommended practice for hot-dip galvanizing of iron & steel
- d) SMACNA Standard for low pressure duct construction

**3.0 MATERIAL**

3.1 The material for sheet metal ducting shall be cold rolled sheets continuous galvanized with zinc coating of total 120 gm per sq. mt. for conforming to IS : 277.

3.2 The gasket for duct joints shall be 3mm formed rubber or expanded polyethylene. The bonding material shall be mastic sealant.

3.3. The duct flanges and supporting material shall be mild steel structure steel section.

3.4 All duct hangers shall be mild rod with threaded end with adjustable nuts for leveling.

3.5 The material for various applications shall be as follows.

APPLICATION	MATERIAL
1. Ducting for Air conditioning	Cold rolled sheets continuous Galvanized with a zinc coating of 180 grams / sq.mtr. conforming IS : 277
a) Indoor	- Class 4
b) Outdoor insulated	- Class 4
c) Outdoor un insulated	- Class 3
2. Duct for ventilation & exhaust	----- do -----
3. Kitchen exhaust	----- do -----
4. Supports & duct flanges	M.S. structural steel sections
5. Gasket	Foamed rubber 3.2mm (1/8")
6. Bonding	Master sealant

3.6 All galvanized plain sheets shall be reasonably flat and free from twist. The zinc coating shall be clean, even and free from un galvanized spots. Sheets shall not crack or peel during bending or fabrication. All sheets shall be procured from approved manufactures.

**4.0 GENERAL REQUIREMENTS**

4.1 The sheet metal ducting shall be done for the proper distribution of air in air conditioned / ventilated space. The ducting shall be designed on the basis of equal pressure drop and shall incorporate necessary accessories like

reducers, bends, splitters, dampers and guide vanes for proper control and smooth air flow.

4.2 The selection of air diffusing attachments and their location shall be done to achieve uniform air distribution. The grilles and diffusers shall be extruded aluminium sections duly powder coated as specified and shown on the drawing.

4.3 The ducting shall be supported by means of hangers from the ceiling slab using anchor bolts and shall not rest on the false ceiling.

4.4. Duct crossing walls and slabs shall be encased in wooden frame work and the openings shall be closed properly unless indicated on the drawing for the purpose of return air.

4.5 Volume control dampers of splitter or louvered type shall be provided as shown on the drawings. Additional dampers if required shall be provided for proper balancing of the air distribution system.

4.6 Fire dampers shall be provided at the AHU outlet and return air inlet to the Air Handling Equipment/room Additional fire dampers shall be provided as per the codes of local fire authorities.

4.7 Access door shall be provided adjacent to the fire, splitter and louvered dampers.

4.8 Air outlets shall be selected based on the air quantity, throw and aerodynamic noise power not exceeding NC 30. The location size and shape of the air outlets shall be co-ordinated with interior and false ceiling scheme.

## **5.0 DUCT FABRICATION**

5.1 The ducts shall be rectangular or circular as indicated on the drawings. The minimum thickness of the sheets shall be as shown below :

- a) Up to 600 mm - 0.65 mm (24 SWG)
- b) 650 to 1000 mm - 0.80 mm (22 SWG)
- c) 1050 to 2250 mm - 1.00 mm (20 SWG)
- d) 2300 & above - 1.25 mm (18 SWG)

5.2 The ducts shall be provided with reinforcement as shown below :

- a) Up to 400 mm - Cross break
- b) 450 TO 1000 mm - 25x25x3mm girth angles spaced @ 1000 mm to 750 mm
- c) 1050 to 2250 mm - 40x40x4mm girth angles spaced @ 750 mm
- d) 2300 and above - 50x50x4mm girth angles spaced @ 750 mm

5.3 The traverse joints shall be as shown below :

- a) Up to 800mm - 25 mm pockets
- b) 650 to 800 - 25x25x3mm companion flanges c)
- 850 to 1000 - 40x40x3mm companion flanges d)
- 1050 and above - 50x50x4mm companion flanges

5.4 The companion flanges and girth angles shall be metered and welded at corners and riveted to the duct at 75mm centers. The longitudinal seams shall be inside groove or pits burg type. The flanged joints shall be made air tight with 3mm rubber or 6mm felt gasket and secured with 10mm GI bolts at 150mm centers. Ducts shall not be cross broken, if insulated. The seams and joints shall be rendered air tight with mastic sealant

5.5 The elbows shall have a minimum R/D ratio of 1:3. The elbows of R/D rate of less than 1:3 and square elbows wherever provided due to site condition, shall be with equally spaced guide vanes for smooth flow. Splitter dampers shall be provided for all branch splits. All branches, feeding more than two outlets, shall be provided with control dampers.

5.6 Capped air flow connections shall be provided, wherever shown, for testing and balancing of air distribution.

## **6.0 DAMPERS & GUIDE VANES**

6.1 The GUIDE VANES shall be provided as shown below :

- a) At every non-split branch take off
- b) At every bend/elbow of less than 1.3 R/D ratio
- c) At first 4 collars after the fans and first two collar after every bends.

The vanes shall be double walled and properly curved for smooth air flow and change in direction of flow and shall be fabricated out of 0.8 mm GI sheets. The vanes shall be fixed to the side runners at equidistant and riveted / bolted to the ducts.

6.2 The SPLITTER DAMPERS shall be double walled aerofoil blade fabricated out 1.6mm (16 SWG) GI sheet. The damper shall be complete with flanged sheet metal enclosure to suit the upstream and down stream duct connections, hinge at the down stream and operating rod at the upstream end. The GI enclosure shall be one size thicker than the up stream duct.

6.3 The LOUVRED DAMPERS shall be multi blade aerofoil construction with opposed/parallel blades of maximum 250 x 1200 mm size . The blades shall be mounted on 50mm channel with suitable gang operated linkage and operating rod. The operation rod shall be terminated in a locking quadrant with position indicator.

6.4 The FIRE DAMPERS shall be rated for 2 hrs. fire resistance conforming to BS : 476-1 and CP-413 and shall be housed in a GI sheet enclosure flanged at both ends and shall include the damper blades, fusible link, holding spring, manual adjustable handle etc. The material for fabrication of fire dampers shall be as shown below :

- a) Damper blades - 3mm (10 SWG) Galvanized sheet steel
- b) Casing - 2mm (14 SWG)
- c) Bearing - Sintered
- d) Spring - SS 304
- e) Fusible link - Set for 7 deg C fusing temperature

6.5 All dampers larger than 1200 mm width shall be fabricated in multiple sections. The damper rods shall be MS epoxy coated with bronze bushes at one end and locking quadrant with damper position indicator at the other end. The damper rods shall extend beyond the enclosure frame and insulation wherein provided.

6.6 The access doors for dampers shall be 400 x 400mm steel bolted with rubber gasket.

## **7.0 AIR OUTLETS**

7.1 The air outlets shall be grille or diffuser type as indicated on the drawing. The grilles and diffusers shall be Aluminium Sections duly Powder coated as shown on the drawing and schedule of material

7.2 Supply air grilles shall be double deflection type with horizontal face bars and vertical rear bars placed in a rigid marginal frame. Bars shall be shaped and spaced at 18mm centers with swaged pivot pins positively holding the defections setting under all conditions of velocity and pressure. All grilles shall be provided with integral opposed blade, grille face kept-operated dampers.

7.3 Return grilles shall have fixed face bars shaped and set at 18mm centers. Bars shall be set at 5 degree deflection for vision proof installation. The grilles shall be complete with rigid marginal frames and shall be matching with the supply grilles.

7.4 Ceiling diffusers shall be round/square/rectangular face flush type horizontal air diffusion pattern. Diffusers shall have ample margins to minimize ceiling smudge. Half diffusers shall be provided with face operated volume control dampers. Half diffusers shall be similar to full diffusers.

7.5 All MS grilles and diffusers shall be fabricated out of 1.0mm mild steel and painted with two coats of red oxide. All duct collars terminating on to a grille or diffuser shall be given two coats of black paint for a length of 300mm.

7.6 Aluminium grilles and diffusers wherever specified shall be of extruded aluminium with margins & GSS butterfly dampers. Grilles shall have horizontal face bars only.

7.7 Linear diffusers/grilles shall be die formed, flush mounted type with single or double directional air flow. The diffuser/grille shall be in a frame with minimum 20mm margin. All linear air diffusing equipment shall be fitted with a distribution sheet metal plenum as shown on the drawings.

## **8.0 AIR INTAKES & EXHAUST OUTLETS**

8.1 The outside air intakes and exhaust air outlets shall consist of louvers, bird screen and enclosure, the total assembly fitted into wall with clear opening and the edges sealed with mastic sealant.

8.2 The sheet metal enclosure shall be made out of 1.25mm GI sheets flanged at both ends and with minimum 4 hold fast. The enclosure shall be minimum 250mm long or 100mm more than the width of the wall.

8.3 The louvers shall be 100mm wide mounted at 45 deg. and spaced at 100mm centers and shall be fabricated out of 1.25mm GI sheets.

8.4 The bird screen shall be made out of 15 x 15mm 1.0 mm GI wire mesh inset with 0.8mm GI frame and bolted to the enclosure flange at 150mm centers using 12mm MS brass bolts and nuts.

## **9.0 INSTALLATION**

9.1 The ducts shall be supported at the traverse joints as indicated below :

- a) Up to 1800 mm - 40 x 40 x 3mm M.S angle with 10mm tie rod
- b) 1850 to 2500 mm - 40 x 40 x 6mm M.S angle with 10mm tie rod
- c) 2550mm & above - 50 x 50 x 6mm M.S angle with 10mm tie rod

9.2 Additional supports wherever considered necessary by the Engineer - in-charge shall be provided. Supports shall be taken from steel members grouted in the RCC work and fixing of steel members shall involve minimum damage. The entire supporting system shall meet with the approval of the Engineer-in-charge.

9.3 All duct supports, flanges, hanger shall be given two coats of red-oxide before installation and one coat of aluminium paint after erection.

9.4 Where ducts are connected to the wall, such connections shall be made through mild steel frame fixed to the wall through suitable shear fasteners.

## **10.0 INSTALLATION**

10.1 The ducts shall be routed as shown on the drawing or as instructed. Working drawing shall be got approved before taking up the fabrication and erection.

10.2 Ducts connecting to air moving apparatus shall be through 15 OZ mildew resistant double canvas as directed by the Engineer. On all circular spigots the flexible material is to be screwed or clip band with adjustable screw or toggle fitting. For rectangular ducts the material is to be flanged and bolted with a backing flat or bolted to mating flange with backing flat. The flexible connection shall not be less than 75mm and not more than 200mm.

## **11.0 TESTING & BALANCING**

11.1 The entire air distribution shall be adjusted and balanced for delivery of design air quantities or as required for achieving design space conditions. After all adjustments are made, the air readings shall be recorded on the drawings vis-a-vis the space conditions. All dampers after adjustment shall be set and locked in position. All air and static pressure measurements shall be done through probe type meters. Vane type meter readings are not considered reliable.

## **THERMAL & ACOUSTIC INSULATION WORK**

### **1.0 SCOPE**

1.1 The scope under this section covers thermal insulation of pipes, ducting, roof and walls.

## 2.0 STANDARDS

2.1 The following standards shall be applicable :

- a) IS : 7240 COP for application and finishing of thermal insulation material at temp. between 80 degree C to 40 degree C.
- b) IS : 7413 COP for application and finishing of thermal insulation material at temp. 40 degree to 700 degree C.
- c) IS : 10556 COP for storage and handling of insulation material
- d) IS : 3346 Method of determination of thermal conductivity of thermal insulation material
- e) IS : 3690 Specification for glass wool mats for thermal insulation
- f) IS : 4671 Specification for expanded polystyrene for thermal insulation purposes
- g) IS : 8183 Specification for bonded mineral wool
- h) IS : 702 Specification for industrial bitumen

## 3.0 GENERAL REQUIREMENTS

3.1 The material and thickness for insulation shall be as specified and shown on the bill of material. The thermal conductivity and the equivalent thickness of insulation shall be as shown below :

SL.NO.	MATERIAL	DENSITY	K VALUE	EQUIVALENT THICKNESS			
		Kg/cum M	w/mk	mm	mm	mm	mm
1.	Resin bonded glass wool	32	0.037	125	100	50	30
2.	Expanded Polystyrene TF-quality	18	0.0326	100	75	50	25
3.	Expanded Polyurethane	32	0.025	80	40	40	20
4.	Rigid Phenolic foam	32	0.022	70	50	25	20
5.	Resin bonded mineral wool	48	0.041	125	100	60	30
6.	Expanded Polyethylene foam	30	0.035	100	75	80	30

3.2 The insulation, bonding and the Vapor Barrier shall be suitable for the temperature of the surface to be insulated and the location.

3.3 All wooden batten and plug used shall be teak wood anti termite treated with 3 coats of shalimar clear liquid. All screws shall be of GI, brass or powder coated.

3.4 All surface to be insulated shall be thoroughly cleaned and dusted before applying the insulation and bonding material. The bonding material shall applied to both surfaces to be bonded.

3.5 The pipe insulation shall be carried out using performed circular/semi circular pipe sections of internal diameter matching the external diameter of the pipe.

3.6 Air pocket between the surface and insulation or between insulations shall not be acceptable. All joints shall be staggered and filled with bonding material.

3.7 Minimum 50mm over lapping shall be provided for joints in vapor barrier and cladding.

#### 4.0 MATERIAL

4.1 The material for cold insulation shall be as shown below :

- a) Fire inhibiting expanded polystyrene of density 18 kg/cum having thermal conductivity not exceeding 0.035 w/mk at 10 deg.C mean temperature conforming to IS : 4671.
- b) Expanded Polyurethane foam of density 32 kg/cum having thermal conductivity not exceeding 0.025 w/mk at 10 deg. C mean temperature conforming to BS specification.
- c) Rigid Phenolic foam of density 32 kg/cum having thermal conductivity not 0.022 w/mk at 10 deg.C mean temperature conforming to BS:3927 with 50 micron aluminium foil fixing.
- d) Expanded Polyethylene foam of density 30 kg/cum having thermal conductivity not exceeding 0.035 w/mk at 10C mean temperature.

4.2 The material for hot insulation shall be as shown below :

- a) Resin bonded Glass Wool of density 32 kg/cum having thermal conductivity not exceeding 0.037 w/mk 60 deg C mean temperature
- b) Expanded Polyurethane foam of density 32 kg/cum having thermal conductivity not exceeding 0.025 w/mk at 10 deg. C mean temperature conforming to BS specification.
- c) Rigid Phenolic foam of density 32 kg/cum having thermal conductivity not exceeding 0.022 w/mk at 10 deg.C mean temperature conforming to BS:3927 with 50 micron aluminium foil fixing.
- d) Resin bonded Mineral Wool of density 48 kg/cum having thermal conductivity not exceeding 0.041 at 10 deg C mean temperature conforming to IS : 8183 with 50mm

4.3 The material for fixing Vapor barrier and other material shall be as shown below :

##### a) BONDING MATERIAL

- i) Industrial bitumen-85/40 and 85/25 conforming to IS:702.
- ii) GI chicken wire mesh - 20 mm 24 SWG
- iii) CPRX compound
- iv) 18 SWG GI binding wire

##### b) VAPOUR BARRIER

- i) Aluminium foil 50 micron
- ii) Aluminium cladding 28 SWG for pipe and 6 SWG for wall
- iii) 2mm PYPKOTE with Aluminium foil finish for surface exposed to the weather
- vi) 4mm PYPKOTE polymeric corrosion tape for anticorrosion treatment for underground

##### FIXING MATERIAL

- i) Bituminized wood balk 50 x 50mm thick insulation and 50 x 100 up to 150mm thick insulation
- ii) GI brass or powder coated.

#### 5.0 INSULATION THICKNESS

The thickness of insulation and the cladding material for various utilities shall be as specified under each section.

##### 5.1 PIPE INSULATION

5.1.1 The insulation material and the thickness and cladding for the piping work shall be as shown below unless otherwise specified. The thickness of insulation shall be suitably modified depending upon the material used. The insulation thickness and cladding material for pipe and valves shall be as described below

---

SR.NO.	PIPE	LAYER & THICKNESS	MATERIAL	CLADDING
--------	------	-------------------	----------	----------

Dated Signature Of Contractor \_\_\_\_\_

Page 6 of 76

---

**A. COLD INSULATION**
**1. REFRIGERANT SUCTION**

a) + 3 Deg C. suction	2 x 50	Expanded & Shalikota Polystyrene	Al.foil
b) - 5 Deg C. suction	2 x 75	Expanded & Shalikota Polystyrene	Al.foil
c) - 20 Deg C.suction	2 x 100	Expanded & Shalikota Polystyrene	Al.foil

2. CHILLED WATER CIRCUIT	1 x 50	Expanded Polystyrene	Al. foil
--------------------------	--------	-------------------------	----------

**3. COOLING COIL DRAIN**

a) 10 Deg.C	1 x 25	Expanded Polystyrene	Al. foil
b) 3 to 5 Deg. C	1 x 100	Expanded Polystyrene	Al. foil
c) -10 to -20 Deg.C	2 x 150	Expanded Polystyrene	Al. foil
4. Hot water circuit	1 x 40	Expanded Polystyrene	Al. cladding
5. Steam circuit	2 x 50	Resin bonded Glass wool	Al. cladding
6. Condensate	1 x 50	Resin bonded Glass wool	Al. cladding

---

**7.0 DUCT INSULATION**

7.1 The insulation and cladding for ducting work shall be as shown below :

---

SR.NO.	DUCT	LAYER x THICKNESS	MATERIAL	FINISH
--------	------	-------------------	----------	--------

---

**1. SUPPLY AIR DUCT**

a) Air conditioning space		----- Nil -----		
b) Non-air conditioned space	1 x 9	Nitrile Rubber	Nil	

**2. RETURN AIR DUCT**

a) Air conditioned space		-----Nil -----		
b) Non-air conditioned space	1 x 9	Nitrile Rubber	Nil	

3. Outdoor ducts	1 x 50	Expanded Polystyrene	4mm Plaster	
------------------	--------	-------------------------	-------------	--

---



**8.0 CEILING / WALL INSULATION**

8.1 The ceiling/wall insulation shall be as shown below :

SL.NO.	SURFACE	LAYER X THICKNESS	MATERIAL	CLADING
1.	Exposed concrete roof	1 x 50	Expanded Polystyrene	Plaster
2.	Over exposed concrete roof	1 x 30	Polyurathene foam	
3.	Exposed GI or ACC roof	1 x 75	Expanded Polystyrene	A/c sheet
4.	Exposed wall	1 x 50	Expanded Polystyrene	Plaster
5.	False ceiling	1 x 50	Resin Fiber bonded glass wool	Poly Bags

**9.0 APPLYING INSULATION****9.1 CHILLED WATER SYSTEM**

9.1.1. Apply CPRX compound uniformly at 1.5 kg/sq.m on the pipe surface and internal surface of the insulation pipe section, hold them together and apply pressure till the bond is made. Additional layers shall be done on similar basis by applying CPRX on the outer surface of previous layer of insulation and the internal surface of the additional layer. All joints on vertical as well as horizontal shall be staggered.

9.1.2. A vapor seal of hot bitumen at 2.5 kg/ sq.m shall be applied uniformly on the final surface and finished smoothly with aluminium foil. Pairs of semicircular wooden supports shall be provided for fixing the pipes. There is no need of additional foil insulation sections are with aluminium foil finish.

9.1.3 The chilled water exposed to ambient shall be cladded with shalikote or 4mm PYPKOTE.

9.1.4. Chilled water load underground shall be wrapped with 4mm thick PYPKOTE .

9.1.5. The insulation of chiller, pumps and valves shall be similar to the pipe but by using insulation slabs. The insulation shall be carried in such a way that the flanges and covers. Can be dismantled without disturbing the major portion of insulation. The air handling units shall be insulated in similar manner from inside, the insulation requirement being as shown below :

a) AHU with ducted return air : 1 x 25 mm all over

b) AHU located in return air : 1 x 25 mm fan section only chamber that the flanges and covers can be dismantled.

**10.0 REFRIGERANT SYSTEM**

10.1 The insulation of the refrigerant pipes shall be similar to chilled water piping.

**11.0 HOT WATER SYSTEM**

11.1 The insulation of hot water piping shall be similar to chilled water system except that there is no need of wooden supports.

**12.0 STEAM PIPING**

12.1 The insulation of steam piping shall be with un bonded mineral wool or glass wool. The insulation shall be directly fixed on the pipe line and held in position with GI wire mesh. The insulation shall be finally claded with 28 SWG aluminium sheets.

### **13.0 RCC ROOF**

- 13.1 The thickness of insulation required is 50mm expanded polystyrene unless otherwise specified.
- 13.2 Make wooden frame work at 600 to 750 mm centers on ceiling slab by fixing 50 x 50 wooden battens using 75mm long wooden screws and self expanding nylon timbles. Clean the surface of slab and apply 3mm high softening grade R 85/25 bitumen. Apply one coat of bitumen on the bonding surface of the insulation and press against the slab till the bonding is achieved.
- 13.3. Fix 18 SWG 100 x 100 mm GI washers at the junction of the wooden frame work and made GI melting in cross binding pattern to hold the insulation.
- 13.4 The insulation provided above false ceiling and non visible areas need not have cladding unless otherwise specified. The insulation provided in the visible areas shall be plastered by other agencies after providing chicken wire mesh.

### **14.0 WALLS**

- 14.1 The thermal insulation for the walls shall be similar to RCC slab. The thermal insulation shall be provided on West, North West and East side exposed walls, if specified.

### **15.0 GI OR ACC ROOFING**

- 15.1 The thickness of insulation required is 120mm resin bonded glass wool unless otherwise specified.
- 15.2 Weld 25 x 3 x 130mm M.S flats with 6mm hole at the free end to the purlins at intervals not exceeding 750mm. Apply 3mm bitumen to the roofing material and one coat to the insulation. Press the insulation against the roof till the bonding is achieved.
- 15.3 Make GI melting in cross bind pattern to hold the insulation. Clad the insulation with FRP tissue sheet or aluminium foil applying bitumen on the insulation as well as the cladding material.
- 15.4 Care shall be taken to close all openings especially for corrugated sheets to ensure stoppage of hot air through the opening/corrugation space place ACC sheet, if required, shall be provided below the insulation to avoid entry of heat and to hold the insulation in position. The ACC sheets shall be considered as separate item unless otherwise indicated in the BOQ.

## **AIR HANDLING UNITS (DOUBLE SKIN)**

### **1.0 AIR HANDLING UNITS:**

#### **1.1 GENERAL:**

The air handling units shall be complete in all respects and shall generally comply with the specifications as given in the following paragraphs.

#### **1.2 SCOPE:**

Scope of work under this section comprises the supply, erection, testing and commissioning of double skin air handling units of capacities specified in the Schedule of Equipment.

#### **1.3 AIR HANDLING UNITS:**

The air handling units shall be double skin, draw through type and shall include pre filter, mixing chamber, fan section, coil section, filter sections etc. as mentioned below.

##### **Fan Section**

The fan shall be forward/ backward curved, double inlet double width type. The wheel & housing shall be fabricated from heavy gauge galvanized steel. The fan impeller shall be mounted on a solid shaft supported to housing with angle iron frame & pillow block heavy duty ball bearings. The fan shall be selected for a speed not exceeding 1000 RPM. Shaft sizes shall be carefully calculated and designed such that the maximum operating speed (RPM) shall not exceed 75% of the first critical speed. The impeller & fan shaft shall be statically and dynamically balanced. The fan

outlet velocity shall not be more than 2000 FPM. Fan housing with motor shall be mounted on a common steel base mounted inside the air handling housing on anti-vibration springs mounts or cushy foot mount. The fan outlet shall be connected to casing with the help of fire retardant canvass. The fan shall be complete with multi 'V' belt drive, belt guard and adjustable motor mounting base. All AHU fans for 75mm or higher static pressure shall of backward curved type. Makes = Imported Nicotra / Kruger makes

**Cooling Coil:**

The cooling coil shall be of seamless copper tubes, not less than 0.4 mm thick and 12 mm O.D. The coils shall have 0.16mm thick anticorrosive hydrophilic aluminium fins. The fins shall be spaced by collars forming integral part of the fins. The tubes shall be staggered in the direction of air flow. The fins shall be uniformly bonded to the tubes by mechanical expansion of the tubes and casing of coil shell in 18 Gauge MS / GI construction.

The coils shall be tested against leaks at a hydraulic pressure of 10 kg/sq.cm. This pressure shall be maintained for a period of 2 hours. No drop in pressure should be observed during this period indicating any leaks.

The water headers shall be of copper pipes, to connect all the tubes. The headers shall be complete with water in/out connections, vent plug on top and drain at the bottom, and designed to provide water velocity between 0.6 to 1.8 m/s (2 to 6 fps).

**Filter Section:**

Each AHU shall include Pre-filters & For Clean Areas with 3 Micron Micro Vee Filters conforming to specifications as mentioned in section "Air Filters".

- a) 10 Micron Pre filter of 90% efficiency by weight.

**Drain Pan:**

The sandwiched drain pan shall be of 2.0mm stainless steel internal sheet and SS drain connection of suitable size, complete with 25mm rigid insulation. The external sheet shall be of also 22 SWG SS steel.

**Coil and Filter Housing:**

The cooling coils, special and standard filters etc., shall all be housed in a separate enclosure of suitable size and length.

The enclosure shall be sized to accommodate the absolute and high efficiency filters. The inspection doors, shall have double synthetic rubber seals doors and locking arrangements. The gaps between filter frames and housing shall have synthetic rubber packing, to eliminate any air leakage. All filter frame shall be epoxy painted.

**AHU Enclosure/Housing:**

The AHU housing shall be made of double skin design with main structure made of structural channel frame work in different sections. The panels shall be double skin sandwich type with 0.60 mm galvanized sheet on the outside and 0.80mm aluminium sheet side on inside with 30 mm thick injected polyurethane foam insulation density 36 kg./m<sup>3</sup> material in between. All sections shall be bolted to each other with neoprene rubber gasket in between them for perfect airtight joints. Drain tray 18 GSS with Thermal break profile sections.

**Fan Motor & Starter:**

- a) The totally enclosed fan cooled squirrel cage fan motor 415V  $\pm$  10% Volt, 50 Hz + 5%, 3 Phase, TEFC speed not to exceed 1440 RPM shall have a minimum rating as given under "Schedule of Equipment". The starter rating shall match the motor rating and will conform to specifications under "Motor and Switch Gears. Drive to fan shall be provided through belt-drive arrangement. Belts shall be oil resistant type.

**Fresh Air Controls:**

An adjustable manual damper of MS Sheet along with birdscreen, air inlet louvers and air filters shall be provided for

fresh air entry.

#### 1.4 TESTING:

The air handling unit shall be tested to measure air quantity and coil performance by measuring temperature difference, water pressure drop across coil and then calculating the capacity.

#### 1.5 LIMITATIONS:

a) The air velocity across the cooling coil shall not exceed 500 FPM.

b) The fan outlet velocity shall not exceed 2000 FPM.

The air velocity across the filters shall not exceed 500 FPM.

### MODE OF MEASUREMENT

The following measurement code shall apply :

#### 1.0 SHEET METAL WORK:

##### 1. DUCTING

The final finished sheet area in m<sup>2</sup> shall be measured only.

Vanes, splitters, flanges, access doors etc. shall not be separately measured. These shall be treated as part of duct work.

Bends, elbows, transformation, pieces etc. shall be measured along the centre line and measured as per duct work.

Canvas connections, duct supports, stiffening members, frames etc. shall not be measured separately and shall form part of duct work.

##### 2. GRILLS/DIFFUSERS/FIRE DAMPERS:

All grills/ diffusers/ fire damper areas will be measured in terms of effective area (Neck Area). Any Extruded aluminium grill/diffusers having an area less than 0.1 m<sup>2</sup> shall be accounted as 0.1 m<sup>2</sup>.

##### 3. BOX DAMPERS:

No separate measurement of box dampers shall be done since they form part of duct.

Fresh air dampers shall be measured as effective areas only. No separate measurements for bird screen inlet/outlet louvers shall be done.

#### 2.0 PIPING WORK:

The length of piping accessories & fittings shall be measured along its centre line in meters and no measurements for bends, elbows, tees etc. shall be made. All such fittings/ accessories shall be treated as part of the piping work.

Flanges shall not be measured separately, as they form part of piping work.

All kinds of supports, hangers etc. shall be part of piping work & no extra measurements shall be done.

No additional price for installation of purge & de-scaling valves as required at site shall be paid.

#### 3.0 INSULATION:

##### 3.1 A) Insulation of Duct:

1. This shall be measured on the basis of bare duct surface area i.e. the area of duct insulation & area of duct shall be same.

##### B) Insulation of Chilled Water / Drain Water:

Insulation of pipes shall be measured in terms of linear length of pipe for each size.

For insulation of bends, elbows, tees etc. it shall be measured along with the centre line of insulation and shall be measured in meters.

Insulation of valves shall be separately accounted as per Schedule of Quantities.

**C) Insulation of Chiller / Expansion Tank/ Suction Line:**

The insulation of the above equipment shall be deemed to form part of equipment and no separate measurement for insulation of such items will be accounted for payment.

**D) Acoustic Lining of Duct & Plenum:**

This shall be measured on the basis of bare duct surface area i.e. the area of duct lining & area of duct shall be same.

**3.2 STRUCTURAL SUPPORTS:**

No extra price shall be paid on account of structural supports required for piping, ducting & cabling

**APPROVED MAKES**

SR.NO.	ITEM / COMPONENT	APPROVED MAKES
01	AIR HANDLING UNIT	CITIZEN / CARYAIRE / ZECO / ETHOS / CHAUHAN / ETA
02	ELECTRIC MOTOR	CROMPTON / BHARAT BIJLEE / ABB
03	G. I. SHEETS	JINDAL / SAIL / ISPAT / NATIONAL / TATA
04	EXPANDED POLYSTYRENE	BEARDSSELL / COOLINE / OWNES CORNING
05	FIBREGLASS	UP TWIGA / KIMMCO / OWNES CORNING
06	GRILLES	DYNACRAFT / COMSOS/ PANCHAL AIR PRODUCT / AIRMASTER
07	JET NOZZLES	COSMOS / DYNACRAFT / PANCHAL AIR PRODUCT / AIRMASTER
08	CABLES	CCI / FINOLEX/ POLYCAB
09	ELECTRICAL COMPONENT	SIEMENS / L&T
10	METERING DEVICE	AE / L&T / SIEMENS
11	INDICATING LAMPS	SIEMENS / L&T
12	MCB/ ELCB / ELMCB	SIEMENS / LEGRAND
13	GI PIPE	TATA / SURYAPRAKASH

14 PVC WATER PIPE : PRINCE / SUPREME

15 NITRILE RUBBER : ARMACELL / A FLEX / K FLEX

---

**02.ASTROTURF SPECIFICATION****1. Top Clean X-Treame Performance Protection**

Photoreticulated Polythane treatment reinforced by extremely durable mico-practicies

Active protection

Easy Maintenance.

No stripping

Provides excellent protection against scratches – sole marks – rubber stains

Excellent surfaces friction for improved grip control

**2. Resistance**

Pigmented wear layer made from pure PVC

**3. Improved Hygiene**

Sanitized treatment located with in the flooring system helps to protect against the localization of bacteria and fungus.

**4. Dimensional Stability**

Foam PVC sub-layer with an unwoven fiberglass mat.

**5. Reinforcement**

Compact PVC layer

**6. omnisorb with HCF Technology**

Shock absorbent highly cellularised, acoustic chemical foam.

This highly cellularised foam has an extremely dense cellular structures. In addition to providing unrivalled acoustic comfort and ideal impace absorption, Omnisorb's Bounce Back Technology also facilities natural ball bounce levels.

**7. Adhesion**

Scientifically engineered honeycomb backing for perfect adhesion to base.

**Product Characteristics**

Characteristics	Speed	Training	Reference	Excel
Weight	3.295 Kg/M <sup>2</sup>	4.20 kg/ M <sup>2</sup>	4.710 kg/ M <sup>2</sup>	6.150 kg/ M <sup>2</sup>
Width	2 m	2 m	2 m	2 m
Length	20.5 m	20.5 m	20.5 m	20.5 m
Thickness	3.45mm	5mm	6.5mm	8.3mm
Fire Classification	Cfl-S1	Cfl-S1	Cfl-S1	Cfl-S2(loose laid+Tarkolay) Cfl-S1(gluded installation)
Slipperiness	95	100	88	103
Gloss	15.6%	11%	14.4%	10.8%
Shock Absorption	5.6%	19%	26%(loose laid 27% (glued installation) 28 % (Tarkolay)	32%(loose laid 33% (glued installation) 34 % (Tarkolay)
Vertical Deformation	0.4mm	1.0mm	1.1mm(loose laid) 1.3mm (glued installation+tarkolay)	1.2mm(loose laid) 1.3mm (glued installation)1.4mm (tarkolay)
Vertical Ball Rebound	98 %	98.4%	100%(loose laid+tarkolay)+99%(glued installation)	100%(loose laid+tarkolay)+99%(glued installation)
Rolling Load	<0.5 mm No	0.22 mm	0.3 mm (loose laid and	0.1 mm (loose laid and

	damage		glued installation) / 0.4 mm (tarkolay) no damage	glued installation) / 0.3 mm (tarkolay) no damage
Abrasion	0.128g	0.13g	0.098g	0.129g
Colours	15	14	14	14
Warranty	5 years	5 years	5 years	5 years

***Dated signature of Contractor With Stamp.***

---

### **03.FIRE FIGHTING SPECIFICATION**

#### **SCOPE**

This specification covers the general requirements regarding the following:

Water cum Foam Monitor.

Non- Percolating Flexible Fire Fighting Delivery Hose with Coupling.

Fireman's Axe.

Portable Extinguishers.

Portable Fire Extinguishers (CO<sub>2</sub> Type).

Fire Buckets.

Landing Valves.

#### **REFERENCE DOCUMENTS**

IS: 5                Colours for ready mixed paints & enamels

IS: 226            Structural steels

IS: 280            MS wire for General Engineering purposes

IS: 291            Machining purposes

IS: 307            CO<sub>2</sub>

IS: 318            Lead, Tin, Bronze, Ingots & Castings

IS: 320            High tensile brass rods & sections

IS: 380            French chalk

IS: 513            Cold rolled low carbon steel sheets & strips

IS: 617            Aluminium & aluminium alloys ingots & castings General Engineering purposes

IS: 636            Non percolating flexible fire fighting delivery hose

IS: 778            Copper alloy Gate, Globe & Check valves for water works purposes

***Dated Signature Of Contractor*** \_\_\_\_\_



IS: 903	Fire hose delivery couplings, branch pipe, nozzles & nozzles spanner
IS: 926	Fireman's Axe
IS: 1030	Carbon steel castings for General Engineering purposes
IS: 1079	Hot rolled carbon steel sheets & strips
IS: 1239	MS tubes, tubular & other wrought steel fittings
IS: 1285	Wrought Al & Al alloys – Extruded round tube & hollow sections for General Engineering purposes
IS: 1367	Technical supply conditions for threaded steel fasteners
IS: 1977	Low tensile structure steel
IS: 2171	Portable fire extinguisher, dry powder
IS: 2546	Galvanized MS fire bucket
IS: 2629	Recommended practice for hot dip galvanizing of iron & steel
IS: 2643	Pipe threads ware pressure – Tight joints are not made not threads- DMNS tolerances & designation
IS: 2712	Gaskets & packings
IS: 2878	Fire extinguisher, CO <sub>2</sub> type (Portable & trolley mounted) (PART-I)
IS: 2932	Enamel, synthetic, exterior a). Under coating b). Finishing
IS: 3203	Methods of testing local thickness of electroplated coatings
IS: 3224	Valve fittings for compressed gas cylinder excluding LPG cylinder
IS: 3444	Corrosion resistant high alloy steel & nickel base castings for general applications
IS: 4225	Recommended practice for straight beam, UT testing of steel plates
IS: 4308	Dry chemical powder for fighting B & C class fire
IS: 4450	Alcoholic drinks- brandies
IS: 4600	Flexible shafts
IS: 4687	Gaskets & packings- gland packing asbestos
IS: 4947	Gas cartridges for use in fire extinguisher
IS: 5290	Landing valves

IS: 6392	Steel pipe, flanges
IS: 6528	Stainless steel wire
IS: 6603	Stainless steel bars & flats
IS: 6912	Copper & copper alloy forging stock & forgings
IS: 7285	Seamless steel gas cylinder
IS: 7608	Phosphor bronze wire for General Engineering purposes
IS: 8442	Functioning requirement for stand post type water monitor for fire fighting
IS: 11662	Preservative treatment for textiles

In the event of conflict between various codes and standards, the most stringent condition will apply. Unless specified otherwise the International System of metric units (S.I.) is to be used.

#### **GENERAL**

In accordance with the requirements of this specification, the contractor shall submit the details specified in the following paragraphs regarding the materials covered by this specification.

#### **WATER CUM FOAM MONITOR**

##### **SCOPE**

This specification covers the general requirements regarding the material, design and construction, performance and test for stand post type water cum foam monitor.

##### **MATERIAL**

Monitor body, swivel joints, worm wheel, base flange and change over valve assembly shall be made of copper alloy confirming to IS: 8442 Clause 3.3.1. Body shall be of C.S. pipe heavy grade confirming to IS: 1239 and base flange shall be of M.S. confirming to IS: 226 or IS: 6392.

Foam and water barrel shall be extruded aluminium pipe confirming to IS: 1285. Water barrel can be from M.S. seamless pipe confirming to IS: 1239 heavy grade.

Water nozzle shall be made from aluminium alloy confirming to IS: 617 designation 4450 when water barrel is made from extruded aluminium pipe. It shall be made from copper alloy as specified in IS: 8442 Clause 3.3.1 when water barrel is of MS pipe confirming to IS: 1239 heavy grade.

Pick up tube shall be made from rubber hose with chrome plated brass strainer.

Worm gear for traverse mechanism shall be made from phosphorus bronze or copper alloy as per Clause. 3.3.1 of IS: 8442.

Nuts and bolts for base flange and change over valve shall confirm to IS: 1367 clause 10.9 and 12 respectively while gasket shall be of CAF 40 confirming to IS: 2712.

Drain valve shall confirm to IS: 778 class 2. Locks on swivels shall be made of brass confirming to IS: 291.

##### **DESIGN AND CONSTRUCTION**

Monitor shall be capable of discharging 1750 lpm at a pressure of 7 Kg/cm<sup>2</sup>.

It shall have traversing mechanism to give 360° in either direction in horizontal plane and 125° in vertical plane (80° - 45°) through geared unit with worm wheel operated by separate hand wheel for horizontal and vertical rotation.

Swivel joints shall be provided both for horizontal and vertical rotation. The arrangement shall be such that monitor shall be self locking type and operated by a single person.

The monitor shall be provided with a change over valve along with its assembly for instantaneous switch over of discharge from water to foam or vice versa as desired. The valve shall be lever operated type.

A foam inductor shall be provided behind the air intake chamber of foam maker in foam monitor. A flexible rubber pick up tube of 3m length having strainer at the inlet shall be provided. A foam compound control valve capable of metering and inducing 3% to 6% of foam compound shall also be provided.

The monitor shall be mounted on a 100mm (4") N.B. flat face slip on type flange confirming to ANSI B 16.5-150 lbs rating. Bolts and nuts for base flange shall have dimension confirming to ANSI B 16.5 Gasket shall be full face 3mm thick with drilling dimension same as for flange.

Near the base flange a drain connection shall be provided with a 15mm (1/2") NB drain valve at the end of pipe. The drain pipe shall be long enough to drain water away from the base flange.

The threaded end of the water nozzle shall be hexagonal to facilitate screwing of the nozzle on the water barrel with nozzle spanner. Threads shall confirm to IS: 2643 (Part-I) with class A tolerance.

The inner surface of the nozzle shall be finished smooth and polished for the converging length of the nozzle.

### **HYDRAULIC PERFORMANCE**

Monitor shall be capable of discharging 1750 lpm at a pressure of 7 Kg/cm<sup>2</sup>. The horizontal ranges for water and foam jet shall be 60m and 45m respectively while the vertical throw shall be 30m and 20 to 25m respectively.

### **WORKMANSHIP AND FINISH**

All the parts shall have good workmanship and finish. All burrs and sharp edges shall be removed particularly water way foam way and nozzle shall have smooth finish.

### **ANTICORROSIVE TREATMENT AND PAINTING**

All steel components subject to direct water or foam contact shall be hot dipped galvanized to a minimum thickness of 0.12mm. The thickness of coating shall be measured as per IS: 3203. External surfaces and non ferrous components may be wetted with lead tin alloy by electrical deposition process.

Monitor's steel part shall be painted with fire red colour confirming to IS: 5 shade no. 536 and the paint shall confirm to IS: 2932 and copper alloy part shall be polished.

### **TEST**

Monitor shall be tested to fulfill requirements at clause 6.0.

The entire assembly shall be hydraulically tested to a pressure of 2.1 MN/m<sup>2</sup> (21 Kgf/cm<sup>2</sup>) for 5 minutes without any leakage.

### **MARKING**

**Each monitor shall be clearly and permanently marked with the following:**

Manufacturer's name or trade mark

Year of manufacture

Purchaser's name

### **NON- PERCOLATING FLEXIBLE FIRE FIGHTING DELIVERY HOSE WITH COUPLING**

#### **SCOPE**

This specification covers the general requirement regarding the material, design and construction, performance and test for non-percolating flexible fire fighting delivery hose with gunmetal male & female type instantaneous coupling.

## **MATERIAL**

The material for Delivery hose shall be rubberized fabric lined as per IS: 636 TYPE A. The material for Male and Female instantaneous type coupling shall be of Gunmetal as per IS: 903.

## **DESIGN & CONSTRUCTION**

The hose shall be constructed from a circular woven jacket having a waterproof rubberized fabric lining on the inside, facing the waterway. The jacket shall be seamless and compactly woven from good quality cotton yarn or from yarn made from suitable synthetic fibre of polyamide or polyester type of good quality or from their combinations.

Fire hose with outer coating/covering shall be manufactured using synthetic yarn only.

The Fire hose shall be of 15m length and of Ø- 63mm.

If cotton yarn is used in the construction of jacket, this shall be root proofed as per IS: 636 and method as per IS: 11662.

The average mass of hose per meter length shall not exceed 0.425kg.

The delivery hose couplings shall be of Ø- 63mm and consist of male half and female half coupling assembled with washer as per IS: 903.

## **PERFORMANCE REQUIREMENTS**

The delivery hose pipe shall be tested for kink, hydrostatic burst pressure, change in length and diameter, adhesion, abrasion resistance, moisture absorption and heat resistance as per methods and parameters mentioned in IS: 636.

The couplings shall be subjected to a hydraulic pressure of 2.1MN/mm<sup>2</sup> for a period of 2.5 minutes for the purpose of locating porosity in the casting and other defects. The couplings shall not show any sign of leakage or sweating.

## **WORKMANSHIP & FINISH**

The jacket shall be practically free from dirt, knots, lumps, irregularities of the yarn and other visible defects.

Inner lining shall be of rubberized fabric and shall be generally smooth and practically free from pitting and other imperfections.

All fittings shall be of good workmanship, finish, clear of burrs and sharp edges. All forgings and castings shall be dean and sound and shall be free from porosity, blowholes, scales, cracks and other imperfections and shall not be repaired or filled so as to hide casting defects. The water way of the fillings shall have a smooth finish.

## **PACKING & MARKING**

### **PACKING**

The hoses may be dusted with French Chalk as per IS: 380 on the inside and shall be packed and delivered in a length of 15M in neat, clean and dry condition in Polyethylene bags.

### **MARKING**

#### **FIRE HOSE**

Beginning at a point not less than one meter from each end, each length of hose shall be marked with clear and indelible letters at least 20mm in height indicating:

Manufacturers name or trade-mark or both

Type, length and size of Hose

Month and year of manufacture

The Fire Hose shall also be marked with the BIS certification mark.

#### **DELIVERY COUPLINGS**

The male and female instantaneous couplings shall be separately, clearly and permanently marked with following information:

Manufacturers name and trade-mark

Size of couplings

Year of manufacture

The Couplings shall also be marked with the BIS certification mark.

## **FIREMAN'S AXE**

### **SCOPE**

**The specification covers the general requirement regarding the material, shape, dimensions and construction of fireman's axe.**

### **MATERIAL**

Axe head shall be of steel made by forging. The chemical composition and requirements of steel shall be as per IS: 926.

Axe handle shall be of steel conforming to IS: 1977.

The axe handle shall be insulated. The insulated handle shall be of vulcanized rubber.

### **SHAPE, DIMENSIONS & CONSTRUCTION**

The shape and dimensions of the axe shall be as per IS: 926.

The axe head shall be soundly forged to shape and the steel handle shall be welded to the head.

The pick and the blade shall be well and evenly hardened and tempered.

The handle grip shall be of knurled surface to make it non-slippery.

### **PERFORMING TEST**

The cutting edge of the axe shall not show any sign of damage when tested for single heavy blow as per the procedure mentioned in IS: 926.

The cutting edge of the axe shall receive no damage when tested for load and buckling as per IS: 926.

The insulated handle shall be capable of withstanding 20,000 volts for 60 seconds.

### **WORKMANSHIP & FINISH**

All parts shall be of good finish, clear of burrs.

All forgings shall be clean and sound and shall be free from porosity, blow-holes, scales and cracks.

### **MARKING**

Each axe shall be clearly and permanently marked with the following information:

Manufacturers name or trade-mark

Year of manufacture

Tested to 20,000 volts and

ISI certification mark

## **PORTABLE EXTINGUISHERS**

### **SCOPE**

This standard lays down requirements regarding construction, material, shape, anticorrosive treatment and test for ordinary dry powder type fire extinguisher.

**MATERIAL, SHAPE TYPES, CONSTRUCTION, ANTICORROSIVE TREATMENT, PAINTING AND TESTS**

The construction, material, shape, anticorrosive treatment, painting, and test shall comply with IS: 2171 (latest edition).

Extinguisher body shall be made out of M.S. sheet of not less than 1.6mm thickness as per IS: 513. All the fire extinguishers shall be of welded construction fitted with leaded tin bronze (Gunmetal) cap as per IS: 318, high pressure discharge hose and squeeze grip nozzle. Plastic or PVC fittings will not be provided with initial fittings.

Dry chemical powder supplied with extinguisher shall be non-toxic as per IS: 4308 and ISI marked. The extinguisher shall have gas cartridge of pressure type. CO<sub>2</sub> gas cartridge shall be [SI marked and shall not be less than a capacity of 120 gm as per IS: 4947.

The extinguisher shall have cap having vent holes, gas cartridge holder, plunger rod & piercing mechanism cap joint washers siphon tubes, braided hose of sufficient length and discharge nozzle.

All the extinguishers shall be treated with lead - tin alloy for anti-rust, anti-corrosive treatment by electrolytic deposition process. Extinguishers coated by dip coating process will not be acceptable.

**PRINCIPLE**

The method of expulsion of dry powder shall be as per IS: 2171 (latest edition) with either of the method of operation specified therein. Vendor shall indicate clearly the method adopted for operation.

**CAPACITY**

Nominal capacity of the extinguisher and the dry powder contents of the assembled body or dry powder container shall be as follows when charged with dry powder conforming to IS: 4308 (latest edition.)

<b>NOMINAL CAPACITY OF EXTINGUISHER</b>	<b>DRY (KG) WHEN CHARGED MIN (KG)</b>	<b>POWDER CONTENTS</b>
1	1	
2	2	
5	5	10
10		

Only dry powder confirming to IS: 4308 (latest edition) shall be used for charging the extinguisher.

**ACCESSORIES**

Each extinguisher shall be supplied with a suitable wall bracket or holder into which it may be mounted and from which it may be removed for use in an emergency and screws and spanner as may be necessary. Extinguishers shall be supplied with all accessories, initial charge etc.

## **MARKING**

Each extinguisher shall be clearly and permanently marked with the information specified in IS: 2171 along with BIS certification mark and purchaser's name. Each extinguisher shall be painted fire red and clearly marked with following:

Manufacturer's name and trade mark

Method of operation

A large size picture showing a man operating the extinguisher in the correct manner

The word "DCP Type (Capacity)"

The size of gas cartridge used

Liquid level to which the extinguisher is to be checked

The word "Tested to a hydraulic pressure 2.5 MN/m<sup>2</sup>"

The word "Keep this end up"

Year of manufacture

## **INSPECTION**

Third party inspection agency at Contractor's cost shall have access at all reasonable times to the Manufacturer's work where extinguishers are being manufactured and / or tested. Samples from lots under a quality control system shall be done as per Appendix B of IS: 2171. The cylinder shall be hydraulically tested for 30kg/cm<sup>2</sup> of pressure.

## **PORTABLE FIRE EXTINGUISHERS (CO<sub>2</sub> TYPE)**

### **SCOPE**

This standard lays down requirements regarding construction, material, shape, and method of operation, performance and test of portable fire extinguisher of carbon dioxide type.

### **MATERIAL, SHAPE, CONSTRUCTION, METHOD OF OPERATION, PERFORMANCE, CONTENTS AND TESTS**

The construction, material, shapes, method of operation, performance, and test shall comply with IS: 2878 (latest edition) with ISI mark and approved by C.C.E. Nagpur.

The extinguisher shall be following nominal sizes in kg: 1, 2,3,4,5 and 6. The sizes being denoted as per clause 4.11 of IS: 2878.

CO<sub>2</sub> gas used shall conform to IS: 307 and extinguisher shall be filled as per IS 2878 Cl. 6.0.

The cylinder shall be made of cold drawn seamless steel cylinders as per IS: 7285 and fitted with screw down type high pressure control valve as per IS: 3224 with a provision of safety release. Riveted joints will not be acceptable.

The extinguishers shall be fitted with discharge tube with swivel joint of atleast 1m length with electrical non-conductor discharge horn.

### **APPROVALS**

Approval/clearance certificate of filling the extinguisher from "chief controller explosive" govt. of India, Nagpur shall be submitted for each cylinder. Testing of the extinguisher, painting, markings etc. shall be as per IS: 2878 with ISI marked.

## **MARKING**

Each extinguisher shall be clearly and permanently marked as per IS: 2878 along with BIS certification mark and following:

Manufacturer's name and trade mark.

Method of operation.

A large size picture showing a man operating the extinguisher in the correct manner.

The word "CO<sub>2</sub>" Type (Capacity)'.

The size of gas cartridge used.

Liquid level to which the extinguisher is to be checked.

Year of manufacture.

### **ACCESSORIES**

Each extinguisher shall be supplied with M.S. bracket and spanner as may be necessary. The details of the same shall be submitted. The extinguisher shall be complete with wall mounting brackets and screws.

### **INSPECTION**

Third party inspection agency at Contractor's cost shall have access at all reasonable times to the manufacturer's work where extinguishers are being manufactured and / or tested.

### **FIRE BUCKETS**

#### **SCOPE**

The specification covers the general requirement regarding the material, shape, design, dimensions, manufacture, finish and tests of galvanized mild steel fire bucket.

#### **MATERIAL**

Buckets shall be of mild steel black sheets confirming to grade ST42 of IS: 1079.

Rod used for top & bottom handles shall be of mild steel confirming to IS: 226.

Wires used for stiffening of top rim shall be of mild steel, confirming to IS: 280.

Painting of fire bucket shall be as follows:

**Inside - Two coats of white paints (enamel finish), as per IS: 2932.**

**Outside - Two coats of fire red paints confirming to Shade No. 536 of IS: 5 (enamel finish), as per IS: 2932.**

**Ears, Handles & Letters - Two coats of black paints, as per IS: 2932.**

#### **SHAPE, DIMENSIONS AND CONSTRUCTION**

The shape and dimensions of the fire bucket shall be as per IS: 2546.

The body of fire bucket shall be in two halves and to be joined together by butt welding. Top rim of the body shall be wired and uniformly beaded without gaps. Thickness of body shall be 1.0 mm & dia of beading wire 3.55 mm.

Bottom sheet of fire bucket shall be 1.0 mm thick and dished. It shall be joined to the body by butt welding to avoid raw edge on the inside of the bucket.

Thickness of mild steel sheet for ears shall be 2.8 mm and shall be fitted to the body at the top by welding with the flat head on the side.

Top & bottom handle shall be of mild steel rod of 10.0 mm dia. The grip shall have no sharp edges.

#### **PERFORMANCE TEST**

The bucket shall be fully filled with water and kept for 15 minutes, there shall not be any leakage for that period.

The dry empty bucket with its top facing upward shall be pressed down the water in a water tank of suitable size



vertically. In such a way that top of the bucket shall be minimum 6.0 mm above the water level. Water shall not enter inside the bucket.

After taking out the bucket, the bucket shall be reversed and pressed inside the water tank vertically. There shall not be any air bubble seen escaping through the water.

### WORKMANSHIP AND FINISH

All parts shall be of good finish, clear of burrs.

All gas welds shall clean and sound and shall be free from porosity, blow- holes, scales and brittleness.

The bucket shall be galvanized after manufacturing with thickness of zinc coating on any portion not less than 0.06 gm/cm<sup>2</sup> (both sides inclusive) as per IS: 2629.

### MARKING

Each fire bucket shall be clearly and permanently marked with the following information:

Manufacturers name or trade-mark,

Year of manufacture & capacity,

Word "FIRE" shall be painted in black centrally on outside with letters 75 mm high & 12 mm thick.

### LANDING VALVES

#### SCOPE

**The specification covers the general requirement regarding the material, design and construction, performance, test and type of landing valve.**

The single I double outlet landing valve mainly consists of landing valve with complete set.

### MATERIAL

Sl. NO.	ITEM / COMPONENT	MATERIAL OF CONSTRUCTION
1.	Valve body	Shall be of corrosion resistant alloy steel or nickel brass casting conforming to IS: 3444
2.	Bonnet, check-nut, stop valve, instantaneous female outlet and blank cap	Shall be of leaded tin bronze conforming to grade LT B-2 of IS: 318 or aluminium alloy conforming to IS designation 4225, 4450 and 4600 of IS: 617. All aluminium parts shall of be die-cast.
3.	Valve spindle	Shall be made of brass rod conforming to IS: 320 for valve body of leaded tin bronze and of stainless steel conforming to IS: 6603 for valve body of aluminium.
4.	Handle wheel	Shall be made of M.S. conforming to IS: 1030.
5.	Seat valve and washer	Shall be of leather conforming to IS: 581
6.	Gland packing	Shall be asbestos threaded conforming to IS: 4687.
7.	Spring	Shall be of phosphor wire conforming to IS: 7608 for valve body of leaded tin bronze and of stainless steel wire conforming to IS: 6528 for valve body of aluminium.
8.	Tooth	Shall be forged from forged brass material conforming to grade FLB of IS: 6912
9.	Blank cap	ABS plastic

The materials shall be as per IS: 5290. The various alternatives available in the BIS for landing valve body are aluminium alloy, Lead—Tin-Bronze and stainless steel. However, materials selection shall be as per data sheet (if available) / Company's approval.

Flanges for hydrant valve shall have dimensions conforming to ANSI B 16.5 150 lbs rating flat slip-on type or MS plate flange as per IS 6392 table 17.

## **DESIGN & CONSTRUCTION**

The design and construction of landing valve shall be as per IS: 5290, TAC guidelines and other government codes/regulations and as mentioned in this specification.

Water mains coming to post shall be of Ø-150 mm & Ø-100 mm M.S construction and provided with Double outlet landing valve.

All hydrant outlets shall be situated 1 m above floor level.

Only oblique hydrants with outlet angled towards floor shall be used. The hydrant couplings shall be of the instantaneous spring lock (female) type of 60mm dia and valves shall be of the slow down type.

## **PERFORMANCE REQUIREMENTS**

### **WATER TIGHTNESS TEST FOR THE VALVE**

The stop valve shall be fully closed by screwing down the spindle. A hydrostatic pressure of 1.4 MN/rn2 (14 kgf/cm2) shall then be applied to each valve on its inlet side. There shall be no leakage through the valve and its seat.

### **HYDROSTATIC PRESSURE**

Each assembled landing valve shall be subjected to a hydrostatic pressure of 2.1 MN/mm<sup>2</sup> (21 kg/cm<sup>2</sup>) as per IS: 5290 with the valve open and outlet closed for a period of 2<sup>1</sup>/<sub>2</sub> minutes for the purpose of locating porosity in the casting when so tested, it shall not fail or show any sign of leakage either through the valve body or through the gland of the spindle.

### **FLOW TEST**

Test shall be discharged through the valve assembly and its flow shall be measured using flow meter or V-notch. The flow shall not be less than 900 lpm for Type A and 1800 lpm for Type 5 at 7MN/m<sup>2</sup> (7kg/cm<sup>2</sup>) provided feed to the valves is not less than these figures.

### **WORKMANSHIP & FINISH**

All parts shall be of good finish, clear of burrs and sharp edges. All castings shall clean and sound and shall be free from plugging, welding or repair of any defects.

The valve top except the face of the flange and the instantaneous outlet shall be painted fire red of shade no. 536 of IS: 5. The outside of instantaneous outlet shall be highly polished. The hand wheel shall be painted black. Paints shall conform to IS: 2932: 1974.

### **ANTI-CORROSIVE TREATMENT & PAINTING**

All steel components subject to direct water contact shall be hot dipped galvanized to minimum thickness of 12mm. The thickness of coating shall be measured as per IS: 3203. External surfaces and non ferrous components may be wetted with lead tin alloy by electrical deposition process.

The valve top except the face of the flange and the instantaneous outlet shall be painted fire red of shade No. 536 of IS 5. The outside of instantaneous outlet shall be highly polished. The hand wheel shall be painted black. Paints shall confirm to IS: 2932.

### **MARKING**

Each assembled valve shall be clearly and permanently marked on the valve body as follows:

Manufacturers name or trade-mark

Code letter indicating the type of valve (Inscribing type of instantaneous female outlet),

Year of manufacture

The valve assembly shall also be marked with the BIS certification mark.

### **ACCEPTANCE CRITERIA**

The "FIRE FIGHTING SYSTEM" shall fulfill the said criteria unless otherwise mentioned.

Technical Notes.

Query from contractor about.

**04- Landscape Specification****1. ALL GENERAL**

This statement is written in order to support the Full Planning Application for Surrounding Sharmistha Lake area of at Vadnagar, Gujarat, India.

Landscaping design solution therefore is informed by the design philosophy adopted by the design team. There are no trees or shrubs on the site at present.

We have chosen to plant new indigenous specimen trees in strategic locations within the site and (where considered suitable) on the boundaries. This form and quantum of planting along with some ground cover shrubs to some of the open areas alongside the private drive is considered both sufficient and appropriate given the nature of the proposed development.

**General Notes**

**1.1:-** The Rate shall include cost of materials, labour, loading and unloading, all types of tax, transportation, removal of vegetation, clearing and grubbing, Royalties, disposal of excess good and unused soil from site to designated disposal area, pest control and all other incidental charges etc., with all leads and lifts, 3 months Maintenance full comprehensive covers horticulture operations

**1.2:-** Landscape area shall be as per drawing, instruction/ Concept by the architect & Contractor shall have to submit shop drawing in 3 copies incl. all types of calculation, material list, material sample, work method etc. at least 15 days ago before start work & got the approval from Architect / Consultant as per instruction/drawing by the architect.

**1.3:-** The Tendere shall, prior to submitting his tender for the work, visit & examine the site of work and its surroundings at his own expense, and obtain and ascertain for himself on his own responsibility all information that may be necessary for preparing his tender and entering in to contract, and take the same in to account in the quoted contract price for the work.

The tendere shall satisfy themselves about the following factors:

- i. Site condition including access to the site, existing and required roads and other means transport/ Communication for use by him in connection with the work including diverting and re- routing work.
- ii. Requirement other availability of land and other facilities of this enabling works, establishment of his nursery, office, store etc.
- iii. Ground conditions including those bearing upon transportation, disposal, handling & storage of materials require for the work or obtained there- from
- iv. Source and extent of availability of suitable materials, including water etc., and labor (skilled and unskilled) required for work, and laws and regulations governing their use and employment.
- v. Geological, meteorological, topographical and other general features of the site and its surroundings as are pertaining to and needed for the performance of the work.
- vi. The limit and extent of surface and subsurface water to be encountered during the performance of the work, and the requirement of drainage and pumping.
- vii. The type of equipment and facilities needed, for and in the performance of the work;
- viii. The extent of lead and lift required for the work in complete form over the entire duration of the contract, and
- ix. All other information pertaining to and needed for the work including information as to the risks, contingencies and other circumstances which may influence or affect the work or the cost thereof under this contract.

**1.4:-** The tenderer should note that information, if any, in regard to the local conditions, as contained in these tender documents, has been given to tenderer merely for guidance and is not warranted to be complete.

**1.5:-** A tenderer shall be deemed to have full knowledge of the site, whether he inspect it or not, and no extra charges consequent on any misunderstanding or otherwise shall be allowed.

**1.6:-** The tenderer and any of his personnel or agents will be granted permission by the Site-In-Charge or his authorized nominee, on receipt of formal application in respect thereof a week in advance of the proposed date of inspection of site, to enter upon his premises and lands for purpose of such inspection, but only on the express condition that the tenderer (and his personnel and agents) will relieve and indemnify the Employer (and his personnel and agents) from and against all liability in respect thereof and will be responsible for personnel injury (whether fatal or otherwise), loss of or damage to property and any other loss, damage, costs and expenses however caused which, but for the exercise of such permission, would not have arisen.

**a) Design & Details:**

Contractor has to work as per the designs and lineout details provided by Landscape Consultant. Difficulty on site in execution as per the plan/ design has to be brought to the notice of site-in charge immediately.

Any discrepancies in the design subject to execution hurdles and alteration required should be reported to site-in-charge and the same should be improvised by the landscape consultant or as per instruction of the site-in-charge and contractor shall have to work only after due approval of the modification.

**b) SPEEDY WORK:**

Follow-up with the Civil Contractors for handing over of the site in desired state for speedy landscape works. Owner shall not be responsible for any delay on account of the said reasons whatsoever.

**c) SITE CLEARANCE:**

The landscape Contractor shall ensure the area of concern to be cleared of all the unwanted materials like cement mix, aggregates, debris, and wastes of any type or left over of the civil contractors before starting his work. The same should be cleared off by the civil contractor and to be followed-up by the landscape contractor. In-event of the same not being removed off the site by the civil contractors, Landscape Contractor shall be required to get the undesirable waste including wild vegetations cleared off the off the site as per instruction of the Site-In-Charge. The site clearance and preparation shall be at no additional cost but form the part and parcel of the landscape works. The site shall be signed off for landscape works only after signoff by the Site-In-Charge on joint inspection with the Landscape Contractor.

**d) SOIL PREPARATION:**

Rough grading and earthworks per section 2 of the specification. This work shall include the supply, placement, shaping of earth worms, and or excavation and removal of unwanted soils to tip, as may be required and as indicated in the grading drawings, details and tender documents. This section includes the setting and formation of rough grading to plus or minus 15cm with suitable materials to achieve the level, worms and earth contouring as indicated in the drawings and documents. This section includes the fine grading to finish levels to plus or minus 25mm. The contractor shall be responsible for plantation works in the right soil medium (pH-value not exceeding 7.5) besides other chemical composition suitable for planting materials. The contractor shall be required to get the proposed good soil tested as recommended & accepted by the owner for entire Landscape site at definite intervals (As per instruction of the site-in-charge) as per instruction of the Site-In-Charge. Also the soil test shall be for the final mixture ready for plantation and should be reported appropriate for plantation works. The test will be conducted on behalf of the contractor by the owner and shall be liable for deduction form the landscape bill as raised by the contractor on plantation works. Also the contractor shall be required to create landforms (mounds & worms) as per drawing and instruction of the site-in-charge for facilitation of the drainage and aesthetic value in the landscape area. This section includes the fine grading to finish levels to plus or minus 25mm. The payment shall be on the basis of the total volume of the earthworks payable in cu.mt.

**SI.No Parameters Acceptance value**

- 1)pH Value 7.5
- 2)Nitrogen Between 25-60 ppm
- 3)Total Soluble Solids 0.01%
- 4)Chloride 20 mg/kg
- 5)Carbonates Between 1 & 60%
- 6)Organic Matter Between 1 & 60%

- 7) Phosphorous Between 4 & 5 ppm
- 8) Calcium Between 150 & 250 ppm
- 9) Magnesium Between 11 & 20% Between 7 and 10 ppm
- 10) Salinity Between 420 & 12 Months 0 ppm
- 11) Sodium Less than 5%
- 12) Potassium Between 90 & 125 ppm
- 13) Sodium Adsorption Ratio (SAR) Between 12% to 15 %
- 14) Sulphure as Sulphate Between 7 & 12 ppm
- 15) Iron Between 5 & 20 ppm
- 16) Boron Between 0.5 & 1.0 ppm
- 17) Zinc Between 1.2 & 3.5 ppm
- 18) Copper Between 0.3 & 1.0 ppm

#### # TOPSOIL AND GROWING MEDIA

#### # GRADING SUBSOIL

General: Grade to smooth flowing contours to achieve specified finished levels of topsoil. Areas of thicker topsoil: Excavate locally.

#### # SUBSOIL SURFACE PREPARATION

- General: Excavate and/ or place fill to required profiles and levels, as section D20.
- Loosening:
- Light and non-cohesive subsoils: When ground conditions are reasonably dry, loosen thoroughly to a depth of 300 mm by ripping.
- Stiff clay and cohesive subsoils: When ground conditions are reasonably dry, loosen thoroughly to a depth of 450 mm by ripping.
- Rock and chalk subgrades: Lightly scarify to promote free drainage.
- Stones: Immediately before spreading topsoil, remove stones larger than 50 mm.
- Remove Arisings, contaminants and debris.

#### # TOPSOIL ANALYSIS

- Not required

#### # PREPARATION OF UNDISTURBED TOPSOIL

Standard: In accordance with BS 4428 --- Grading and cultivation: Hard ground: Break up thoroughly.

Clearing: Remove visible roots and large stones with a diameter greater than 50mm. Areas covered with turf or thick sward: Plough or dig over to full depth of topsoil. Fallow period (minimum): One month.

Weed control: At appropriate times treat with a suitable translocated non-residual herbicide.

#### # SURPLUS TOPSOIL TO BE RETAINED

- Generally: Spread and level on site:
- Locations: Any areas where topsoil is required for new planting.
- Protected areas: Do not raise soil level within root spread of trees that are to be retained --- East of Plot One only.

#### # IMPORTED TOPSOIL TO BS 3882

- Quantity: Provide as necessary to make up any deficiency of topsoil existing on site and to complete the work.
- Standard: To BS 3882.
- Classification: Multipurpose.
- Source: Contractor's choice

#### # COMPOST FOR ALL PLANTING AREAS

Standard: In accordance with PAS 100. Supplier: Local source.

Product reference: Peat-free compost, contractor's choice.

Type: Sanitized and stabilized compost. Horticultural parameters:

- pH (1:5 water extract): 7.0---8.7.
- Electrical conductivity (maximum, 1:5 water extract): 200 mS/m.
- Moisture content (m/m of fresh weight): 35---55%.
- Organic matter (minimum): 25%.
- Grading (air dried samples): 99% passing 25 mm screen, and 90% a 10 mm screen mesh aperture.
- Carbon:Nitrogen ratio (maximum): 20:1.
- Texture: Friable.
- Objectionable odour: None.
- Composting Association certification: Required.
- Submit: Declaration of analysis.
- Additional analyses: Not required.
- Samples: Supply 5 kg sample before ordering.
- Application rate: As per tree pit drawing.
- Timing: Apply prior to cultivation.

### CONTAMINATION

General: Do not use topsoil contaminated with subsoil, rubbish or other materials that are:

- Corrosive, explosive or flammable.
- Hazardous to human or animal life.
- Detrimental to healthy plant growth.

Subsoil: In areas to receive topsoil, do not use subsoil contaminated with the above materials.

### HANDLING TOPSOIL

Aggressive weeds: Give notice and obtain instructions before moving topsoil. Plant: Select and use plant to minimize disturbance, trafficking and compaction. Contamination: Do not mix topsoil with:

- Subsoil, stone, hardcore, rubbish or material from demolition work.
- Other grades of topsoil.

Multiple handling: Keep to a minimum. Use or stockpile topsoil immediately after stripping.

Wet conditions: Handle topsoil in the driest condition possible. Do not handle during or after heavy rainfall or when it is wetter than the plastic limit as defined by BS 3882, Annex N2.

### SPREADING TOPSOIL

Temporary roads/surfacing: Remove before spreading topsoil.

Layers:

- Depth (maximum): 150 mm for grassed areas. 450mm for shrub beds
- Gently firm each layer before spreading the next. Depths after firming and settlement (minimum): 450 mm.

Crumb structure: Do not compact topsoil. Preserve a friable texture of separate visible crumbs wherever possible.

### FINISHED LEVELS OF TOPSOIL AFTER SETTLEMENT

Above adjoining paving or kerbs: 30 mm.

Below dpc of adjoining buildings: Not less than 150 mm. Shrub areas: Higher than adjoining grass areas by 75 mm.

Within root spread of existing trees: Unchanged.

Adjoining soil areas: Marry in. Thickness of turf or mulch: Included.

### e) PLANTATION WORKS:

The landscape contractor shall be required to complete the plantation works as per the planting schedule

All plants shall conform to BS 3936 and be in accordance with the National Plan Specification. Supplying nurseries shall be registered under the HTA Nursery Certification Scheme. All plants shall be packed and transported in accordance with the Code of Practice for Plant Handling as produced by CPSE. Planting shall not be carried out when the ground is waterlogged, frost bound or during periods of cold drying winds. All bare root stock shall be root dipped in an approved water---retained polymer. All stock to be of native provenance. If topsoil depths are inadequate the contractor should inform the contract administrator.



**PLANNING CONDITION COMPLIANCE**

The soft landscaping scheme shall be carried out as approved no later than the first planting season following the occupation of the dwelling to which it relates or the completion of development, whichever is the earlier. The management plan shall be implemented in accordance with the details contained therein.

Any trees, shrubs or hedges forming part of the approved landscaping that die, are removed, become diseased or unfit for purpose [in the opinion of the LPA] within five years of the implementation of the landscaping scheme shall be replaced during the next available

planting season by the Developers, or their successors in title with an equivalent size, number and species being replaced. Any replacement trees, shrubs or hedgerows dying within five years of planting shall themselves be replaced with an equivalent size, number and species. Thereafter the planting scheme shall be carried out in accordance with the approved details at the first available planting season.

**f) EXISTING TREES:**

The landscape contractor is required to assess and take over maintenance works of existing fully grown trees within the site

**g) MAINTENANCE WORKS:**

The contractor shall be responsible for maintenance of the Plantations works for a period of 3 Months after handover. The cost of fertilizer, pesticides, manure, and labour will be included in the quotation. The Contractor shall adhere to the maintenance schedule During the maintenance period of all the Plants, contractor shall be responsible for any replacement towards mortality and the trees or the area of the plantation under shrubs/creepers/ground covers etc should be in healthy condition during the inspection conducted by the site-in charge on every 25th day of the month to avoid the penalty clause and also subsequently amounting to holding of the payment due for quarterly instalment..Contractor shall maintain record of maintenance & operations on site and submit daily report for all the areas certified for virtual completion of the work. Also the contractor shall take note of the observation of the site-in-Charge or his representative/Horticulturist and seek compliance of the same at the earliest before nearest schedule to avoid any penalty as per penalty terms

**2. SCOPE OF WORK**

The scope of the work is to provide soft landscaping works at Different project of ARG Creation Pvt. Ltd. Ahmedabad, India. The scope of this contract is the soft landscaping only, the works of which are listed below.

The landscape contractor shall from the date of commencement of contract, furnish all materials, labor, and related items necessary to complete the work indicated and specified herein. Along with site management, the responsibilities will include soft landscaping works (horticulture works related to landscape) and being responsible of these newly created works for a period of 6 months from the date of virtual completion i.e. from the day of complete execution of the entire works as certified by the LANDSCAPE CONSULTANT i.e. during the defects liability period.

**Preparation**

The landscape site should be free of any Construction Debris or wild vegetation. It shall be responsibility of the contractor to ensure that the site is in working condition as per instruction of the site-incharge. The contractor shall also ensure proper grading of the landscape site in terms of aesthetics as well as drainage providing mounts and slopes with a gentle slope towards natural drainage direction All rubbles and debris if any and dispose it of in the suitable location possibly in low lying areas as identified by the contractor and approved by site-in-charge.

**Soil Testing**

The Soil to be used as Top Soil (Good Soil/earth) for all plantation works shall be primarily imported fertile soil from agriculture fields off the site. The contractor should get the soil test report and accordingly with experts and consultants would meet the requirement for additives and soil conditioner to possibly maintain pH value of the soil between 7.0 - 7.5 before plantation works. Also after every 6 months or as required on poor performance of the plantation shall accordingly get the soil tested and measures taken for maintaining the pH value within acceptable range. Also Contractor shall undertake treatment as per advice of the experts to soil conditioning during the entire maintenance period.

**Reports**

The Contractor shall maintain weekly report on the deployment details as well as work planned for the day to the Site-In-

Charge in prescribed format. All instructions and activities shall be recorded as per the desired format. Any problem or hindrance shall be brought to notice in the weekly report along with evidence in form of photographs. Also the contractor shall be required to maintain Stock Register at all times for the planting material sourced to Owner's site and Supply for plantation in the Nursery maintained by the Contractor.

#### **Nursery Maintenance Office Set-up**

The Contractor shall be required to set-up Office for its staff and Nursery with good micro- climate to store the supply of the plants. In case of propagation of the plants in the nursery, the same shall be used on site only.

#### **Vermi-Composts**

Contractor shall mandatory have Vermo-Composting System developed at appropriate location where all the pruning wastes, organic wastes shall be dumped with weeds, weed seeds or bulbs, stones etc., mix it well in the soil in the ratio ( 6:1), level as per grade.( point of unloading 0-50m). The process shall be require approval of the site-In-Charge and periodic maintenance of the activity. Approval of site in charge prior to dispatch of material for use on site is must.

#### **SI.No Terms of Reference Instruction & Procedures a. Supply of Trees**

##### **i. Physical Condition**

All plant materials shall be healthy, sound, vigorous with good foliage, Plants supplied shall be conforming to the names listed on the plant list. No plant materials will be accepted if branches are damaged or broken. All material must be protected from the sun and weather until planted.

##### **ii. Health of Trees**

All plant materials shall be free from plant diseases, insect pests, or their eggs, and shall have healthy well-developed root systems. Plant material shall be well formed and shaped true to type and free from disease, insect and defect such as knots, windburn, sun-cold, injuries, abrasion or disfigurement.

##### **iii. Specification of Trees**

In no case, the specification of the material in terms of height, Girth & Foliage as mentioned in the BoQ shall be acceptable for plantation works. In case of in- availability of the particular species or the planting material as per specification in BoQ ,the alternate species or lower specification as the case may be shall have to be approved by site-incharge in special case after due confirmation of the landscape consultant.

**Lower Specification as mentioned in the BOQ accepted by the site-in-charge under special condition shall be re-negotiated for a lower rate depending upon the specification of the plants sourced by the contractor.**

#### **b) Planting of Trees**

##### **i.Pit Size:**

Minimum Pit Size for all trees should be of the size as specified in BOQ. In case of larger trees pit size should be of as specified in BOQ.

##### **ii. Soil Preparation:**

Preparation of tree pits:

The soil shall be essentially good Earth mixed with 1/3rd of decomposed farmyard manure along with additives like Gypsum, sulphur ,Zinc Sulphide (ZnS)etc or as specified in BOQ to maintain ph-value of the soil between 7 - 7.5.

##### **iii. Planting of trees:**

Planting of trees and stacking / propping to protect the trees from wind and irrigate on need basis. Maintain the tree basins - free of weeds by regular hoeing. Planting the tree with root ball in the pit (tin grown / poly bag grown) after removing carefully and without disturbing the root. Pressing the soil firmly around the tree planted. Preparing the basin around the tree and watering after staking and tying. The plant should be well maintained, disease free, well trimmed at the time of handing over. In case of death of the plant the contractor need to replace the same with equally well grown healthy plant.

##### **iv. Stacking / Propping:**

To ensure protection from Winds-staking/ propping it with bamboo tripod using jute string. In all condition, tree should be standing in erect position The staking should have anti-termite treatment.

##### **v. Fertilizers /organic solid manures and liquid manures, spray bio insecticides,parasites,predators:**

All the planting materials shall be periodically examined for termite attacks or plant disease and appropriate measure (application of liquid manures/ growth regulators/ pesticides as per need, weeding regularly so as to keep the plant healthy all the time) shall be undertaken for entire period of the contract... Required at the time of Plantation and entire period of maintenance as per Maintenance Schedule

**vi. Watering Arrangement**

Making basin around Trees ( 1mtr dia clear space) and maintaining Tools and Tackles/Hose-pipes, tractor mounted Water Tankers or as required in sense all arrangement for water distribution and watering equipments/manpower to be managed by the Contractor for watering the trees.

**c) Handing Over of Trees**

**i. Name Plate for Trees**

All Trees planting should have Name Tag with name of the relevant species and well placed on trees with good visual characteristics .In case of row plantation of similar species, the same can be repeated at definite intervals may be on every 5th tree from the start.

**d) Maintenance of Trees**

**i. Maintenance of Trees**

Apart from the essential watering of the plants as per the maintenance manual, Nurture the trees with organic solid manures and liquid manures, spray bio insecticides, parasites, predators to protect the trees from pest and disease. Amend the soil on regular basis with proper soil amendments to keep the pH level between

7 - 7.5 after completion of (12)Twelve month maintenance period the plants should be maintained by regular watering, weeding, replacing dead plants, applying pesticides, Use of plant physical protection measures etc. so as to grow them vigorously. Newly Planted should be maintained by

- a. Watering every alternate days @ 20 litres/watering cycle
- b. Applying FYM @ 10kg/ tree/ annum
- c. The Trees should have proper staking so as the tree should stand erect till the Tree settles with no possibility of bending due to Wind or Rain
- d. Trimming, pruning as & when required under guidance of the site-in-charge etc.

**SHRUBS PLANTATIONS**

**a) Sl.No Terms of Reference Description**

**b) Supply of Shrubs, Creepers, Ground Covers**

Health of Shrubs/Ground Cover/Creepers etc

Plant material shall be well formed and shaped true to type and free from disease, insect and defect such as knots, windburn, sun-cold, injuries, abrasion or disfigurement.

Physical Condition

All plant materials shall be healthy, sound, vigorous with good foliage, and free from plant diseases, insect pests, or their eggs, and shall have healthy well-developed root systems. Plants supplied shall be conforming to the names listed on the plant list. No plant materials will be accepted if branches are damaged or broken. All material must be protected from the sun and weather until planted.

Specification of Shrubs

The species should be in appropriate specification in terms of height & Foliage as provided in BOQ. Species below specification shall be liable for deduction of the item rate as agreed upon.

**c) Planting of Shrubs, Creepers,Ground Covers**

**Bed Sizes**

As per the specification and depth should be minimum 300 mm deep exclusive of the top 50mm where top edge is defined for watering and flooding. The plantation bed shall be the basis of all billing purpose including maintenance charges to be paid to the contractor

Soil Preparation

Dig and remove all weeds, debris, rubbles, and stones from 18" depth of the surface soil level to be maintained in due course. The soil shall be essentially good Earth mixed with 1/3rd of decomposed farmyard manure along with additives like Gypsum, sulphur etc to maintain ph-value of the soil between 7 - 7.5.

Preparation of soil for grass, ground cover, edges, shrubs and flower

beds: . Then prepare the same soil with 2-3" thick layer of well decomposed, weed free farm yard manure or vermicompost. Treat the soil with chlorophyriphos / Lindane / Neemcake depends upon the infestation of soil borne pests. Treat the soil with proper herbicide to control the weeds only on need basis. Finally level the soil as per the drawing or planting details.

Preparation of pits for shrubs, creepers and hedges : The bed shall be prepared with good earth mixed with 1/3rd quantity of decomposed farmyard manure along with Planting a sapling of shrubs, ground covers, lilies, suckering plants etc. as per design plant spacing – 30-60 cm. maintaining( application of liquid manures/ growth regulators/ pesticides as per need,

Weeding - regularly so as to keep the plant healthy all the time) it for a period of 3Months days from the date of virtual completion of development work Planting shrub/ground cover- Planting of shrub in the bed prepared earlier by filling garden soil and manure (67:33 ratio).Planting the shrub with root ball in the pit (tin grown / poly bag grown) after removing carefully and without disturbing the root. Pressing the soil firmly around the tree / shrub planted. Preparing the bed around the shrub and watering after staking and tying. Maintenance of shrub/ground cover up to 3months by regular watering and attending the inter-cultivation practices such as weeding, racking, watering gap filling ,free of weeds by regular hoeing. etc. The plant should be well maintained, disease free, well trimmed at the time of handing over. In case of death of the plant the contractor need to replace the same with equally well grown healthy plant. Nurture the shrubs/ground cover with organic solid manures and liquid manures, spray bio-insecticides, parasites, predators to protect the trees from pest and disease. Amend the soil on regular basis with proper soil amendments to keep the pH level between 7 - 7.5 Planting hedges / edges - Planting of hedge / edge in the ground prepared earlier by filling garden soil and manure Preparing a pit of require size (for accommodating the root ball of plant) Planting the plants in 2/3 rows (as per instructions) at specified distance with root ball removed carefully and without disturbing the root ball from poly bag. Pressing the soil firmly around the plant Preparing the basin for watering. Maintain hedge / edge up to two months by regular watering and attending the inter-cultivation practices such as weeding, raking, gap filling, trimming and pruning etc. The hedge/ edge should be well maintained, disease free, well trimmed at the time of handing over. In case of death of the plant the contractor need to replace the same with equally well grown healthy plant.

Planting Ground cover - Planting of ground cover plants in the ground prepared earlier by filling garden soil and manure. Preparing a pit of require size in the ground. Planting the ground cover plant root ball at nine inches apart in the pit after removing carefully. and without disturbing the root ball. Pressing the soil firmly around the plant Preparing the basin around the plant watering. Maintenance of ground cover up to two month by regular watering and attending the inter-cultivation practices such as weeding, raking, gap filling, trimming and pruning etc. The ground cover should be well maintained, disease free, well trimmed at the time of handing over. In case of death of the plant the contractor need to replace the same with equally well grown healthy plant. Fertilizers /organic solid manures and liquid manures, spray, bio insecticides, parasites, predators required at the time of Plantation and entire period of maintenance as per Maintenance Schedule.

Watering Requirements- Tools and Tackles/Hose-pipes, tractor mounted Water Tankers or as required to be managed by the Contractor for watering the trees.

#### **d) Handing Over of Shrubs**

Date of Handing Over

The Shrubs planting should be done in the selected stretch as released complete /partial scope of work Name Plate for Shrubs The Shrubs planting shall be provided with Name Plate to specify the type of shrubs planted as per the bed and in case of longer beds at appropriate intervals so that the same can be identified at distant observations.

#### **e) Maintenance of Shrubs**

After completion of planting works during the subsequent 12(Twelve) month maintenance period the plants should be maintained by regular watering, weeding, replacing dead plants, applying pesticides etc. so as to grow them vigorously.

Trees & plants: should show regular healthy growth through regular maintenance by manuring, fertilizing. Use of plant protection measures, adequate watering etc.

Maintenance of all developed features ground cover, hedges and shrubs etc. of the complex. Maintenance work includes

timely pruning, weeding and cutting of ground cover plants, hedges, edges, plants planted in the areas mentioned above. Application of fertilizers, manure, etc to the lawn, plant and spraying pesticide etc. as and when required.

Seasonal flower beds have to be replaced as and when required (approximately thrice in a year). Plant species can be changed w.r.t. season only in consultation with horticulture department. Removal of wild grass normally found growing in rainy season by cutting and/or uprooting so as to keep the areas free of grass

#### **SUPPLY OF LAWNS**

Plant material shall be well formed and shaped true to type and free from disease, insect and defect such as knots, windburn, sun-cold, injuries, abrasion or disfigurement. Supply and planting of lawn: Planting of lawn grass ( Paspalum/ cynadon sp./ zoasia sp./ stenotaphrum etc) as per drawing without disturbing the desired gradient and level, maintaining (forking, mowing, weeding, fertilizer application) it for a period of 12 Months of completion of virtual completion( No irrigation system provided, however water is available free of cost). Contractor has to make his own arrangement for water distribution)

Specification of Lawns:- Supply and Laying of carpet lawn (zoasia sp.) as per drawing without disturbing the desired gradient and level, maintaining (forking, mowing, weeding, fertilizer application) it for a period of 12 Months of virtual completion of development work( No irrigation system provided, however water is available free of cost). Contractor has to make his own arrangement for water distribution)

##### **a) Planting of Lawns**

##### **Soil Preparation**

Top 200 mm depth: The soil shall be essentially good Earth mixed with 1/3rd of decomposed farmyard manure along with additives like Gypsum, sulphur etc to maintain ph-value of the soil between 7 - 7.5. Planting Dibbling of grass: Fine level the soil, apply thin layer of sand, vermicompost and Neemcake mixture of 1" thickness and dibble the grass at 3" distance. Roll the lawn after planting. Irrigate the lawn regularly. Remove weeds on periodical basis. Nurture the lawn with organic, bio-insecticides, parasites, predators to protect the lawn from pest and disease. Mow the lawn regularly and maintain the grass at 50 mm (2") height. Trim all the edges after mowing keep the edges with trees, shrubbery and flower beds clean. The Carpet Grass primarily Japonica would be brought in Rolled carpet form in healthy condition and shall be placed on the already prepared surface and Light roller should be used for setting of the edges for smooth carpet lawns. The watering of the lawn should be sufficient for thriving of the lawn to grow then vigorously Fertilizers /organic solid manures and liquid manures, spray bio insecticides, parasites, predators Required at the time of Plantation or as per maintenance schedule Watering Requirements Tools and Tackles/Hose- pipes, tractor mounted Water Tankers or as required to be managed by the Contractor for watering the trees.

##### **b) Handing Over of Lawns**

The lawn areas should be considered fit for handing over once the lawns have settled and the surface starts showing the lawn effect.

##### **c) Maintenance of Lawns**

For 3 month maintenance period the Lawns should be maintained by regular watering, weeding, replacing dead Spots, applying pesticides etc. so as to grow them vigorously. The Lawn should be regularly mowed and maintained as good green carpet till the final completion of the maintenance period as per the maintenance schedule.

#### **MAINTENANCE SCHEDULE**

##### **3.3A GENERAL OBLIGATIONS**

a) The Landscape Contractor shall maintain the works for the maintenance period. The Employer reserves the right to terminate the maintenance period at any time, whereby no additional charges are to be made by the Landscape Contractor to the Employer.

b) The extend of the landscape to be maintained by the Landscape Contractor shall be deemed to cover and include all softscape landscape areas within the overall project boundaries as shown on the drawings including any existing soft landscape not affected by the Sub-Contract works and retained intact or nearly so through the end of the Sub-Contract period as well as all the landscape works covered in the Sub- Contract scope of works. No additional charges will be allowed unless specifically agreed to by the Landscape Architect in writing.

c) The Landscape Contractor's Horticulturist to inspect the site once every week and if required submit a report to the

owner on their actions and closure of the pending works. Also on monthly basis, the Contractor's Horticulturist shall prepare a brief schedule of operations planned for the week with target dates.

d) The weekly report and the monthly schedule shall be running record of proposed operations which would be checked at the maintenance inspections every month. If in the opinion of the Landscape Architect/Site-In- Charge, the maintenance works have not been satisfactorily carried out according to site conditions and the specifications, the quarterly payment will be withheld until the works have been satisfactorily carried out besides the penalty as in the penalty clause.

e) The Landscape Contractor shall take all necessary measures to ensure that all pot plants, trees and shrubs and other plants shall thrive and become established within this period. All landscape areas will be inspected and list of remedial works issued after each inspection. All items on the remedial lists are to be carried out by the time of the next inspection. f) The Landscape Contractor shall keep the landscape areas clean and tidy at all times and dispose of all waste materials arising from the cleaning.

g) If the Landscape Contractors works are found to be unsatisfactory, payment shall be withheld and the maintenance period extended for the period of time that the landscapes maintenance has not been satisfactory. All cost associated with the extension of time shall be borne by the contractor.

**MAINTENANCE OF PLANTED AREAS: TREES, SHRUBS, CLIMBERS, HERBACEOUS PLANTS AND GROUNDCOVERS**

a) The Landscape Contractor shall water all trees, palms, shrubs, groundcover, herbaceous plants and other planting areas as often as necessary to keep the ground moist all around and to the full depth of the roots.

b) Only fresh water shall be used for the Works. The Owner shall provide water requirement of the planting materials but watering shall be all time (Work presence of the Contractor on site) responsibility of the Contractor till the time proper system (Irrigation) is placed by the Owner. Landscape Contractor shall supply all water requirements at his own costs. The Landscape Contractor shall supply his own hoses and sprinklers to distribute the water.

c) Water shall be applied using an approved rose or sprinkler so as not to cause compaction or wash-outs of the soil or loosening of plants. The Landscape Contractor shall immediately make good any such damage.

d) All planting beds are to be kept in a weed free condition with a weeding operation as per maintenance schedule or more regularly as required. All weeds, stones and rubbish collected from this operation shall be removed from the site by the Landscape Contractor.

e) Firming up and adjusting of stakes/ties shall be carried out monthly to ensure that the trees and shrubs are firmly held in ground. If required, guy ropes or tree ties shall be adjusted, tightened or loosened. If tree ties or ropes are rubbing the bark of the trees, the ties are to be taken off and retied. Any damaged branches are to be carefully pruned and the wounds sealed.

f) All protective fencing is to be maintained and kept in good condition as long as required on site.

g) All shrubs and groundcovers are to be reviewed monthly and pruned as per maintenance schedule or as and when required during the Maintenance Period to promote bushy growth and good flowering characteristics. The shrubs shall be checked and all dead wood, broken, damaged or crossed branches shall be cut back, depending on species.

h) Pruning for all plants shall be carried out as follows:

i. Pruning is to be done with the cut just above and sloping away from an outward facing healthy bud.

ii. Removal of branches is to be done by cutting flush with the adjoining stem and in such a way that no part of the stem is damaged or torn.

iii. Ragged edges of bark are to be trimmed with a sharp knife.

iv. Any cuts or wounds over 25mm diameter are to be painted with an approved sealant such as Arbrex after trimming.

v. All pruning are to be cleared up and removed from operation site after pruning for Vermi-Composting.

i) All hedges, mat forming herbaceous plants and groundcover plants shall be clipped with shears as often as necessary (at least monthly) to maintain a tidy appearance. Tall hedges are to be cut to forms shown on the drawings.

j) Selective pruning of flowering plants shall be done where special flowering characteristics are required such as for Ixoras, Hibiscus, and Bougainvillea etc

k) The Landscape Contractor shall on continual basis supervise and attend to fertilizer needs/disease control/termite or fungus control as maintenance operations during the entire period of contract. An approved fertilizer/insecticides/pesticides shall be applied to each plant at the rate provided in the maintenance schedule or as suggested by the Horticulture Advisor to the Owner. Fertilizer shall be applied evenly spread over the entire area and lightly forked into the soils. All areas shall be well watered immediately after application of fertilizer.

l) The horticultural requirements of different plants or areas may involve variations to those techniques (such as the use of organic liquid fertilizers for sensitive plants) and variations in method will be authorized as required.

m) Mulching. An additional 25mm deep mulching layer is to be spread over all planted areas (except groundcover and turf), once every 6 months or as specified in Maintenance Schedule.

n) The Landscape Contractor shall make regular weekly checks to ensure that the plant material is insect and pest free.

### **3.3C MAINTENANCE OF LAWN AREAS**

a) The Landscape Contractor shall mow all lawn areas using approved cutting equipment to maintain a close sward to a height of not less than 20mm and not more than 45mm for all grass types. Mowing shall be carried out weekly, except in dry weather and grass shall not be allowed to flower between cuts. All clippings to be gathered up and removed.

b) All grass areas are to be watered during dry weather as often as is required to keep the grass green and the soil moist. The Landscape Contractor shall make weekly inspections to determine the need for water.

c) Fertilizer of NPK value 10-15-15 or similar approved be spread at a rate of 40g/m<sup>2</sup> over all grass areas at 6 months intervals using approved spreading equipment to give an overall even spread. Every three months between the NPK application the grass areas will receive an application of 46-0-0 at 1kg/100m<sup>2</sup>. Grass areas that have been fertilized shall be watered immediately. If the tops of the grass turn red a light application of lime using magnesium, limestone or agricultural lime in powder form is to be applied in dry weather at a rate of 50g/m<sup>2</sup>. After application this is to be well watered into the soil.

d) The Landscape Contractor shall apply top dressing of not more than 15mm depth of fine sand and granulated compost raked and spread evenly over the lawn areas to fill in the low spots and level the grass areas. The next top dressing shall be applied only after the grass has grown to a mowable height.

e) There shall be at least two applications of top dressing during the maintenance period. If depressions or bumps over 25mm deep or high occur in turf areas during the maintenance period these are to be levelled out by lifting the turf and raising the soil level with sand/compost mix or trimming soil to level grades, followed by returfing.

f) Grass areas are to be kept free from weeds, annual grasses, fungus and insect attack, and stones or other debris throughout the maintenance period as often as is required. Assessment of these operations is to be prepared on the basis of the bi-weekly maintenance inspection chart.

g) If compaction or consolidation takes place or hard panning or baking of the soil occurs, the soil areas are to be well watered first and lightly loosened by mechanical means such as spiking, slitting or hollow tinning using equipment approved by the Landscape Architect.

### **DETAILS OF PERIODIC MAINTENANCE ACTIVITIES**

a) Sl.No Operation Frequency (Times) Period/Duration after Handing Over

i. Irrigation As per Demand or as specified under

a. In Summer 1.5 Month-Every Alternate Day

b. In rainy Season 5 to 7 monthly or as per climatic condition

c. In winter 10 times Monthly

ii. Weeding- 2 times Monthly

iii. Forking of the Plants & Shrubs- 2 Monthly iv. Edging- Once Monthly

v. Grass Cutting- 2 Monthly

vi. Trimming of Shrubs/Ground Covers:

vii. Once Monthly or as per instruction of the Site-in-charge.

viii. Pruning of Big Trees 2 Yearly

- ix. Mulching i.e., 50mm thick layer fine powdered FYM or Coco pit /vermin compost Once in a month
- x. Fertilizing
  - # Lawn (NPK value 10-15-15)-250 Grm/sq.mt at interval of after planting with enough watering Once Quarterly/Half Yearly as instructed by Site-In-Charge
  - # Shrubs & Ground Covers etc @ 50 grm per sq.mt with enough watering Once Quarterly/Half Yearly as instructed by Site-In-Charge
  - # Trees @ 50 grams per Tree Once Quarterly/Half yearly as instructed by Site- In-Charge.
- xi. Gypsum+ Sulphur for maintaining pH Value at 7 to 7.5 @ 200 grm/sq.mt or as
- xii. instructed by Site-In-Charge in consultant with Horticulturist or Landscape Consultant Once Yearly.
- xiii. Site Cleaning & maintenance of General Appeal of the Site Daily as & when required but site should be maintained clean.

#### **DETAILS OF MAINTENANCE STAFF REQUIREMENT**

As per the minimum need of the maintenance requirement to the landscape developed area on gross basis as per the maintenance schedule, the following number of the person shall be required for desired activities based on 1800 sqm of landscape area within the 3 acre campus.

#### **Sl.No Manpower Description Nos:**

- a) Trained Gardeners/ labourers - 1 person daily basis
- b) Supervisor / tractor driver / helper - as required for maintenance
- c) Besides, the contractor shall have to deploy a horticulturist as per criteria specified in relevant Clause

#### **PLANTING PRACTICES-APPLICATION**

##### **a) REQUIREMENT OF SOIL PREPARATION, PLANTING AND MAINTENANCE MATERIALS**

##### **i. Soil Conditioner**

Soil Conditioner shall be Peat Moss, organic compost composted rice hulls or other approved fibrous organic matter suitable for mixing with topsoil to make a friable growing medium for plants. It shall be resistant to rapid decay, free from soluble salts (below 900ppm), pH 6-7, free from large lumps or debris. Coco-Peat will not be accepted. A sample shall be submitted to and approved by the Landscape Architect prior to installation.

##### **ii. Organic Compost**

Organic compost shall be an organic vegetable compost produced thorough a horticultural or industrial composting process. Compost is to be clean, decomposed, smell free, and free of any debris, refuse, clay or visible fungus. A sample and test data is to be submitted for approval before use. All compost is to be sterilized before being packed for transport. Any odorous materials delivered to site will be rejected. Any vermin resulting from use of organic compost will have to be controlled by the Landscape Contractor within 12 hours.

##### **iii. Peat Moss**

Peat Moss shall be fibrous fresh water peat from vegetable fibre. Peat will have a pH of 5.8 – 6.5 and shall be free of soluble salts greater than 900 micromos; Peat shall be free of lumps, sticks or stones greater than 5mm.

##### **iv. Composted Rice Hulls**

Rice hulls shall be partially composted and free from live rice or weed seeds. The rice hull compost shall be nitrogen stabilized and free of particles greater than 5mm.

##### **v. Sand**

Sand shall be clean, coarse, well graded material, free from soluble salts. Particles shall range in size so that 80-100% passes the 1mm sieve and 0-50% passes the 250 micron sieve.

##### **vi. Fertilizers**

Chemical fertilizers shall be approved granular fertilizers. Fertilizer may be single element or compound, normal or slow release compound fertilizers. They shall be stored in waterproof sealed bags under shelter away from water and direct sunlight. Samples shall be submitted to, and approved by the Landscape Architect, before use in the Works. Organic fertilizers shall be organic products such as organic liquid fertilizer, pellets or granules manufactured primarily from organic materials. These products are to be from accredited sources and technical data indicating sources of origin and manufacturing process must be submitted and approved before use. Animal by-products must be sterilized before



being packed for transport and odorous materials used on site will be rejected.

**vii. Mulches**

Mulches shall be an approved friable-composted organic material such as Oil Palm husks, organic compost or an approved mix. Coco-peat will not be allowed unless mixed in a proportion of 50-50 with another mulching material free from soluble salts or toxic materials and resistant to rapid decay. Mulches shall have a pH of 5.5 -7.0. Samples are to be submitted to the Landscape Architect and approved before use. Mulches are to be applied in a 50mm thick layer over the entire surface of shrub and groundcover areas. Mulching is to be re-applied to expose soil in planting areas every 3 months after initial installation until the end of the maintenance period or until complete surface cover by vegetation is achieved. Initial mulching is to take place within two days of installation of planting.

**b) STAKING & SUPPORTS**

**i. General**

Stakes shall always be used when planting instant trees, standards and single stem palms and for tall shrubs as indicated in the drawings. Stakes shall be mangrove poles, bamboo or equal and shall be appropriate to the size of the plant to be supported.

**ii. Guying**

Guying shall be used for large trees or palms. A minimum of three wire guys are to be used per tree. Each guy wire is to be fastened by a loop around the lowest branches of the tree at the junction with the main trunk or stem. Loops are to have protective rubber or plastic hose to prevent chafing and are to be fastened back to the guy wire by means of U-clamps. Wire shall be 2.5mm PVC coated GI wire, green colour. Palms shall have 5mm x 3mm x 30mm batons fastened about the trunk with GI wire at the height where the guy wires are to be secured. Guy wires will fasten to the batons and not to the main trunk.

Guy wires are to be fastened at ground level to short stakes firmly driven at an angle into the ground. Stakes shall be 5mm GI coated angle iron or 75mm mangrove. Stakes shall be a minimum length of 600mm and are to be driven deep enough to resist movement. A notch is to be made near the top of each stake for the fastening of the guy wire. Stakes shall be positioned equally around the tree and shall extend at least 300mm beyond the tree pit. Distance away from the tree shall be gauged on site to provide firm and secure guying. Distance of stakes and final positions shall be finalized on site to provide firm and secure guying.

Each guy wire is to have one turnbuckle located near the fastening to the stake. Guy wires are to be kept properly tension and adjusted to maintain the tree in a vertical position without guy wires being rigid.

**iii. Double Staking**

Double staking shall be used for standard trees. Two 50mm x 50mm stakes shall be driven into the ground vertically on either side of and outside the root ball of the tree so as to form a straight line with the stem at the centre. Stakes shall be driven in to penetrate the bottom of the tree pit and be deep enough to resist lateral movement when tested. Stakes shall not extend beyond the lowest branch of the tree and if necessary are to be sawn off at the top.

**iv. Fastening or securing of the tree may be carried out by using either:**

o **Cross bar** – a wooden cross bar of same section as the stakes is fastened in a horizontal position to the outside of the stakes by nails or tying securely at a level below the lowest branch. The tree is fastened to the cross bar with a single adjustable tie of an approved rubberized or plastic type with a spacer and shall be fastened to prevent any chafing or abrasion of the bark. Nails or fittings are not to be driven into the tree trunk.

o **Wire/Hose loops** – Two separate wire or rope loops are made about the stem just below the lowest branch with each being fastened back to one of the vertical stakes. Each loop is to have a protective outer covering or sheath of rubber hose to prevent chafing or abrasion of the bark. The wire is to be fastened to the stakes in a manner that allows adjustment of the tension to be made easily. Tension on each wire to be equal to maintain the tree in a vertical position. The wire shall be 2.5mm PVC-coated GI wire, green colour. Where directed by the Landscape Architect the tree may be secured with a second set of loops at a lower level.

o **Single Staking**- Single Staking shall be used for field trees. A single 50mm x 50mm stake is driven vertically into the ground 150mm – 250mm away from the tree. The stake is driven down beyond the base of the tree pit and shall be firm when tested. The top of the stake shall be 100mm below the top of the tree. Ties are to be fastened to avoid rubbing,

chafing or abrasion of the bark.

**o "Dead Man" Guying**

"Dead Man" Guying shall be used where directed by Landscape Architect.

This method of supporting trees is for use in areas where other conventional methods of support are not feasible. Prior to backfilling two pairs of preservation treated hardwood planks, minimum 100mm x 50mm, are laid across the top of the rootball at right angles so that the trunk or stem is enclosed in a square. The timber planks should be positioned as far out towards the edge of the rootball as possible but kept approximately 100mm in from the edge. Two pairs of galvanized or stainless steel cables are then led over at right angles to the timber planks and the ends firmly fastened into the ground at the base of the rootball or preferably fastened to a structure nearby. Twin buckles at the mid point of each cable are installed to tighten the cables to a suitable degree. Cables should be tightened only to hold the root-ball firm. Over-tightening may cause the rootball to settle deeper into the ground than desired. Wherever "Dead Man" guying is directed refer to the Sub-Contract drawings for particulars. If Dead Man guying is directed without a drawing the Landscape Contractor is to notify the Landscape Architect.

**o Climber Wires**

Climber wire for training climbing plants against walls shall be approved lightweight PVC coated wire mesh, fixed at 600mm intervals to GI screw eyes. Maximum mesh coverage shall be 12 Months 0mm high x 2400mm wide. The climbing plants shall be trained through the wire mesh with the shoots directed upwards and tied.

**c) WATERING OF ALL PLANTS**

After planting of all plants are to be thoroughly watered using enough water to soak the ground all around the rootball. After the water has percolated away leaving the surface relatively dry the soil is to be lightly cultivated to give an even soil tilt.

**d) MULCHING**

After completion of planting, watering and light cultivation operations, a 50mm deep layer of approved mulch shall be spread over all planting areas except turf and groundcover beds. Mulching is to be done within 2 days of completing planting and watering in. The cost of mulching is cleared to be included in the unit rates for planting.

**e) FERTILIZING**

After planting and before the commencement of maintenance operations all planting areas will be fertilized at three month intervals. Planting beds and pits shall be fertilized with an approved slow release fertilizer at the rate of:

Trees: 250gm per tree Shrubs/Climbers: 50gm per plant or 50gms/m<sup>2</sup>

Groundcover: 50gm per square meter

Herbaceous/Rooted shoots: spread around the base of the plants

Turf areas shall receive area 46.0.0 at a rate of 1kg/100m<sup>2</sup>. All fertilized areas are to be watered immediately after fertilizer application

**f) DISEASE CONTROL**

The Landscape Contractor shall take all necessary precautions to prevent or eradicate any outbreak of disease or insect attack.

**g) PLANTING INTO TURF AREAS**

Where planting is to be carried out in areas of turf, the turf shall be carefully cut to the size of the tree or shrub pit, rolled and stored for re-use, being kept moist and in shade. After planting, turf shall be re-laid around the base of the plant. The Landscape Contractor shall replace any turf, which is damaged during planting operations. Trees in turf areas shall receive a 15cm high plastic trunk collar to protect the trunk from damage during turf cutting.

**h) PROTECTION OF PLANTED AREAS**











The Landscape Contractor shall be responsible for protecting all planted areas. If it is necessary for the Landscape Contractor to erect temporary protective fencing, the Landscape Contractor shall be responsible for keeping the fencing in position and in good repair until the end of the maintenance period. Fencing proposals shall be submitted to the Landscape Architect for approval.

**i) MAINTENANCE PRIOR TO COMPLETION**

i. After planting and prior to the onset of the maintenance period, the Landscape Contractor shall be responsible for

carrying out all necessary measures to ensure that the plant material thrives and becomes established and that the landscape areas are kept in a clean and tidy condition

ii. The Landscape Contractor shall allow for carrying out the following maintenance operations when necessary prior to the onset of the maintenance period, all as specified in section 7 of this specification.

-  Replacement of dead/missing plants
-  Grass cutting
-  Watering
-  Cultivation and loosening of soil
-  Weeding
-  Pruning and clipping
-  Firming up and adjustment stakes and ties
-  Eradication of pest or insect attack
-  Top drawing and mulching
-  Fertilizing

iii. The Landscape Contractor shall be responsible for replacing any plants which fail to survive as a result of inadequate maintenance operations, poor workmanship or poor quality of plant material prior to completion

iv. The Certificate of completion will not be issued until all plans scheduled on the Drawings and Schedule of Works are installed in a healthy condition in the manner specified.

**a) GENERAL**

Horticultural operations shall be started on ground previously levelled and dressed to require formation levels and slopes. In case where unsuitable soil is met with, it shall be either removed or replaced or it shall be covered over to a thickness decided by the Engineer-in-Charge with good earth.

In the course of excavation or trenching during horticultural operations, any walls, foundations, etc., met with shall not be dismantled without pre-measurement and prior to the written permission of the Engineer-in-Charge

**i.Grass**

- o Cynodon Dactylon-Doob, Calcutta, Rajghat Bermuda
- o Improved/hybrid strains of Bermuda grass
- o Zoyasia grasses

The grass shall be fresh, free from weed and rank vegetation but having #Rhizome# with sufficient nodes and shall be approved by Engineer-in-Charge before planting.

ii. **Farm yard manure** : It shall be well decayed free from grits and any other unwanted materials.





iii. **Good Earth** : The soil shall be suitable for gardening free from kanker, Moorum, shingle, rocks, stones, brick-bats, building rubbish and any other foreign matter. The earth shall be free from clods or lumps of sizes bigger than 75 mm in any direction. It shall have P.H. Value ranging from 6 to 8.5.

iv. **Oil Cake (Neem/Castor)** : The cake shall be free from husk, dust, grit and any other foreign matter.

v. **Sludge** : It shall be obtained from approved disposal works

**EXECUTION**

**i. Trenching** : Trenching shall consist of the following operations :

-  The whole plot shall be divided into narrow rectangular strips of about 1.5 m. width or as directed by the Engineer-in-Charge.
-  These strips shall be sub-divided lengthwise into about 1 m. long sections. Such sections shall be excavated serially and excavated soil deposited in the adjacent section preceding it.
-  In excavation and depositing care shall be taken that the top soil with all previous plant growth including roots, get buried in the bottom layers of trenched area, the dead plants so buried incidentally being formed into humus.
-  The excavated soil shall be straight away dumped into the adjoining sections so that double handling otherwise involved in dumping the excavated stuff outside and in back filling in the trenches with

leads is practically eliminated.

## **II Rough dressing the trenched ground:**

Rough dressing the area shall include making kiaries for flooding. The trenched ground shall be levelled and rough dressed and if there are any hollows and depressions resulting from subsidence which cannot be so levelled, these shall be filled properly with earth brought from outside to bring the depressed surface to the level of the adjoining land and to remove discontinuity of slope and then rough dressed again. The supply and spreading of soil in such depressions is payable separately. In rough dressing, the soil at the surface and for 75 mm depth below, shall be broken down to particle to size not more than 10 mm in any direction.

### **II. Spreading Good Earth**

a. Good earth sludge shall be removed from stacks by head load and spread evenly over the surface to the thickness ordered by the Engineer-in-Charge. It shall be spread with a twisting motion to avoid segregation and to ensure that spreading is uniform over the entire area.

### **III. Uprooting Weeds From Trenched Areas**

a. After 10 days and within 15 days of flooding the rough dressed trenched ground with water, the weeds appearing on the ground, shall be rooted out carefully and the rubbish disposed off as directed by the Engineer-in-Charge.

### **IV. Fine Dressing The Ground**

a. Slight unevenness, ups and downs and shallow depressions resulting from the settlement of the flooded ground, in drying and from the subsequent weeding operations, shall be removed by fine dressing the surface to the formation levels of the adjoining land as directed by the Engineer-in-Charge, and by adding suitable quantities of good earth, brought from outside, if necessary. Such supply and spreading of good earth stacked at site is however, payable separately. In fine dressing, the soil at the surface and for 40 mm depth below shall be broken down to particles of size not exceeding 6 mm in any direction.

### **V. Mixing Of Good Earth And Sludge / Manure**

a. The stacked earth shall, before mixing, be broken down to particles of sizes not exceeding 6 mm in any direction. Good earth shall be thoroughly mixed with sludge or manure in specified proportion as described in the item or as directed by the Engineer-in-Charge. The mixing shall be spread as described in 18.5.1 to the thickness ordered by the Engineer-in-Charge.

### **VI. GRASSING WITH 'DOOB GRASS'**

vii. The area from where the grass roots are to be obtained shall be specified by the Engineer-in-Charge at the time of execution of the work and no royalty shall be charged on account from the contractor. The soil shall be suitably moistened and then the operation of planting grass shall be commenced. The grass shall be dibbled at 10 cm, 7.5 cm., 5cm., apart in any direction or other spacing as described in the item. Dead grass and weeds shall not be planted. The contractor shall be responsible for watering and maintenance of levels and the lawn for 30 days or till the grass forms a thick lawn free from weeds and fit for moving whichever is later. Generally planting in either direction at 15 cm., 10 cm, spacing is done in the case of large open spaces, at 7.5 cm. spacing in residential lawns and at 5 cm, spacing for Tennis Courts and sports ground lawns.

### **PRECAUTIONS :**

During the maintenance period, any irregularities arising in ground levels due to watering or due to trampling by labour, or due to cattle straying thereon, shall be constantly made upto the proper levels with earth as available or brought from outside as necessary. Constant watch shall be maintained to ensure that dead patches are replanted and weeds are removed.

### **1.1 STAGE - I: EXECUTION**

All Landscape Horticulture Works as shown in Drawings for:

- a) Tree/ Palm plantation
- b) Lawn/ grass plantation ----
- c) Shrubs and ground cover plantation –
- d) Area demarcation drawing.

e) Irrigation lay out

### **1.2 MAINTENANCE OF HORTICULTURE WORK**

Maintenance for horticultural works includes watering, managing, weeding (weeding up to 1000 mm around planted areas), fertilizing, using of pesticides or fungicides as required, and other works for the healthy growth of the plants.

After planting, all planted areas that have exposed soil will have to be mulched with straw or hay. Mulching will be evenly spread to cover any exposed soil.

In addition, the contractor will also be responsible for filling gaps, thinning and transplanting, or replanting where plants may need to be replaced. Along with other planting, the contractor will also be responsible for improving soil conditions for planting. This may include import /export of sand/soil to/from site. The contractor will also clear vacant area from existing grasses, keep the site clean and maintain the already planted areas free of weeds, pests or insects that cause diseases. All weeds, unwanted grasses and plant material will be cleared up to 1000mm from the edge of planting of newly created and already existing horticultural works (such as boundary trees). The contractor will also be responsible for protection of the plants from salt spray that may occur during the monsoons.

All the works envisaged in the contract shall be executed generally as per the indicated concepts in the accompanying drawings, strictly confirming to the Indian standard specification and code of practices, as applicable

### **1.3 DEFECTS LIABILITY PERIOD:**

All work shall be carried out strictly in accordance with the specification and shall be free from faulty planning, workmanship, execution, testing and interpretations. If any trouble or defect originating with the results and reports submitted arise at any time prior to from the date of completion of the above work under the contract the Landscape Contractor, at his own expense and within the time limit set by the Employer, shall make such alterations, reworking at field and at laboratory as may be necessary and submit the revised reports. Employer's decision in this respect shall be final and binding on the Landscape Contractor.

### **2.1 SUPERVISION**

The contractor is required to have "On site "during all work hours, a competent, full time supervisor (acceptable to the Employer/ Landscape Architect) who will be responsible to the Employer/Landscape Architect for the conduct of the work and who has the authority to receive and act on such instructions as the employer / landscape architect may give. The work of the contractor is subject to inspection by the Employer / consultant at all times, but such inspection does not relieve the contractor of any of the responsibility.

The Contractor's on site supervisor will be responsible for providing any information regarding the site conditions such as the presence of existing trees, boulders, rocks, shrubbery, difference in levels, etc. To the Landscape architect as requested by the Landscape architect or if the information given in the drawings do not coincide with the site conditions and should take the permission of the Landscape architect to proceed with on the works.

### **2.2 FACILITIES TO OTHER CONTRACTORS:**

The Employer reserves the right to use the premises and any portion of the site for the execution of any work not included in this contract which he may desire to have carried out by other agencies / parties, and the contractor is to allow all reasonable facilities for the execution of such work but is not required to provide any plant or materials for execution of such work except by special requirement with the Employer. Such work shall be carried out in such a manner without impeding the progress of the works included in the contract and the contractor is not to be responsible for any damage or delay which may happen to be occasioned by such works. Consultants will co-ordinate the activities of all the agencies / persons.

### **2.3 ALTERATION IN QUANTITY OR WORK, SPECIFICATION & DESIGN / ADDITION OF WORK / DELETION OF WORK**

The Landscape Architect consultant / Employer shall have power to make any alterations / additions to or substitutions for the original specifications, drawings, design and instructions that may appear to him to be necessary during the progress of work. For that purpose or if for any other reason it shall in his opinion be

desirable, he shall have power to order the contractor to do and the contractor shall do any or all of the follows:

- a) Increase or decrease the quantity of any work included in the contract. b) Delete any such work.
- c) Change the character or quantity or kind of any such work.
- d) Change the levels, liners, positions and dimensions of any part of the work.
- e) Execute additional work of any kind necessary for the completion of the works f) Change in any specified sequence, method of timing of the work.

The contractor shall be bound to carry out the work in accordance with any instructions in this connection which may be given to him in writing signed by the Landscape Architect Consultant / Employer or other competent authority and shall not in any way vitiate or invalidate the contract. Deviation in the work may be ordered by the Accepting officer / Consultant up to a maximum of Ten percent of Contract value.

#### **2.4 PENALTY FOR BAD WORK, REMOVAL OF IMPROPER WORK:**

If at any time before expiry of defect liability period, it shall appear to the employer that any work has been executed with unsound, imperfect or unskilled workmanship or with materials of inferior quality or that any materials or articles provided by him for the execution of the work are unsound or of a quality not in accordance with the contract, it shall be lawful for the employer to intimate this fact in writing to the contractor and then notwithstanding the fact that the work, materials or articles complained or may have been paid for, the contractor shall be bound forthwith to rectify or remove and reconstruct the work so specified and provide other proper and suitable materials or articles at his own charge and cost. In the event of the contractor failing to do so within a period to be specified by the employer in the written intimation aforesaid, the Employer may rectify, or remove and re-execute the work or remove and replace the materials or articles complained of, as the case may be at the risk and expense in all respects of the contractor.

#### **2.5 WEEKLY REPORT:**

The contractor shall also maintain a work report for work completed each week. The same report in English will be sent to the landscape architect every week. The landscape architect shall verify completed work as per the report. Contractor will be responsible for meeting deadlines for the completion of the job.

#### **2.6 RESPONSIBILITY:**

- a) The contractor's work shall not hinder other work, either underground or over ground, such as electrical, phone lines, water or sewage lines, etc. In areas of overlap, the contractor shall work in coordination with other related contractors. Any damage by the landscape contractor's team to such utilities will be penalized and contractor shall be responsible for cost for such damages.
- b) The contractor shall abide by the Security rules / procedures of the Employer, and shall obtain gate pass, issue I.D. badges to all their employees on site, etc. as prescribed by the Employer.

### **3. TECHNICAL SPECIFICATIONS**

#### **3.1 CLEARING OF SITE:**

The client will have to provide the land for execution of horticulture works by clearing the site of unusable materials and other construction materials of the surrounding buildings under construction and transporting the same to a site as indicated by the engineer-in-charge. Before finally leaving the site upon completion of the work, the previous concern contractor shall remove all his infrastructure facilities like huts, tools, equipment, scaffoldings, centering materials, rubbish etc., and the site shall be left clean and tidy.

#### **3.2 APPROVAL OF SAMPLES:**

The contractor is required to provide a sample of work before commencing with the works. Sample of saplings, soil, Farm Yard Manure etc. of acceptable quantities and sizes that is sufficient to gauge quality of work / product and get it approved by the consultant before executing the work on site. If the contractor fails to comply with this clause and the work executed is not to the satisfaction of the consultant / employer the

contractor shall at his cost redo the entire work as per the instruction of the consultant / employer.

### **3.3 ESTABLISHMENT OF NURSERY:**

Due to the expanse of the project, various plants will have to be procured and maintained at the site. For this purpose, a shade net area will be made available by the contractor at site. The nursery area will have a shade net area with potting shed. Approximately 2000 sq. Mt. of Shade net area using Agro net, green color will be required to be maintained and replaced whenever necessary, for which no extra payment will be made by the employer. The contractor will have to have a satisfactory stock of plants specified in this tender in the nursery and share details of the same with the employer and its landscape consultant.

The Contractor will be responsible for maintaining adequate number of all varieties of plants that have been proposed by the Landscape Consultant at any given point of time. The Contractor shall take approval from the Landscape Consultant regarding the plants stocked / propagated before he proceeds with planting in the designated areas. He shall also maintain an additional of 20% of the numbers specified of all the varieties of plants for gap filling and replacement due to mortality.

The Contractor will establish the nursery within **0.5 months** from the date of Letter of Acceptance with using established nursery during the work and maintain the same for the entire period of the contract and the defects liability period at his own cost. At end of the defects liability period he shall hand over the nursery to the concerned authority of the employer with adequate number of plants of all species required for filling of gaps, replacement etc. that would have been planted at site as proposed by the Landscape Consultant.

### **3.4 WATERING/IRRIGATION OF LANDSCAPE:**

Water will be made available in landscape area by irrigation network like hydrant by the client. If the water on site is insufficient then the client shall be responsible for importing water, in water tankers for the general upkeep of the plants. No plants shall be allowed to wither or die due to lack of proper watering.

### **3.5 REPLACEMENT OF PLANTS:**

Those plants that are not up to the standards, and do not meet specifications shall be replaced by the contractor at no extra cost to the Employer.

When the plants are to be replaced either for filling gaps or poor quality, then the contractor shall replace within 15 days of the plants in that area. For this purpose, extra numbers of plants of those used in the project will have to be maintained in the Nursery.

### **3.6 PLANT REQUIREMENTS:**

Plants and shrubs shall be sourced by the contractor from available nurseries, unless otherwise specified. Seeds shall be acquired from reputed organizations and hybrid seeds will be used where possible - particularly for flower varieties. No plant material shall be changed without the consent of the landscape architect.

### **3.7 PLANT MATERIALS:**

All plant materials shall be healthy, found vigorous, free from plant diseases, insect pests or their eggs and shall have healthy well developed root systems. All plants have to be of specified height and should be bushy with plenty of leaves. Plants that are not full grown, or are weak and without adequate leaves shall be rejected and not counted towards any payment - partial or full.

Plant supplied shall confirm to the names listed on both the plan and the plant list. Numbers of plants will vary depending on area at site. Any discrepancy with numbers from those specified in the Tender should be brought to the attention of the Landscape Architect before proceeding with the work.

### **3.8 SUPPLY & SUBSTITUTION:**

Upon submission of evidence that certain materials including plant materials are not available at the time of execution, the contractor shall be permitted to substitute other materials and plants, with an equitable adjustment of price. All substitutions shall be of the nearest species and variety to the original specified and shall be subject to the approval of the Landscape Architect.

### **3.9 EQUIPMENT:**

All labor should be provided with tools required for regular maintenance and upkeep of a garden. Lawn mowers, hoses, garden scissors, pruning shears, trowels, spading forks for loosening soil will be available on the laborers at all times.

Safe custody of these tools / equipment shall be the responsibility of the contractor.

**3.10 Filling of Garden Soil Mixture:**

Supplying and filling of tree pits, shrub bed & lawn beds with Fertile Soil Mix with Farm Yard Manure on datum level in the following percentage - 10% Farm yard Manure, 90% locally available garden soil by volume graded towards the drains & chambers located at site with a minimum slope of 1%.

**3.11 Development of Hillock:**

Supplying and filling of garden soil/ Goradu soil to develop hillock of average 0.6 MT height, 8.5 MT width and length as per site condition, as per design. It includes grading, compacting up to 85% and shaping hillock as per design (attached typical plan & Section).

**4.00 TREE PLANTING:**

Whenever planting, the following specifications will be followed by the contractor. Wherever sand is to be removed, the following specifications shall be followed after refilling the area with good soil.

**4.01 DIGGING OF PITS:**

Tree pits of 900mm x 900 mm x 1000 mm shall be dug. For shrubs bed and ground cover bed, the land will be prepared by digging up to 450 mm in depth. If the soil quality is poor, it shall be replaced with soil mixture acceptable to the landscape architect. The soil condition will have to be approved by the landscape architect. Tree pit shall be filled with dry husk @ 100mm from bottom. Pest/termite prevention chemicals or any other approved chemical to be applied into the soil before planting as per supplier's specification.

When shrubs or ground covers planting are in more than one row, then pits will be dug in a zigzag fashion ensuring a diagonal planting in each row.

**4.02 PLANTING MIXTURE:**

The topsoil will be prepared with 10% Farm yard Manure, 90% locally available "garden" Soil by volume. This mixture will be filled in pits before and after planting.

**4.03 BACK FILLING:**

The soil is back filled in tree pit on 50 mm layer of dry husk, watered thoroughly and gently pressed down a day previous to planting, to make sure that it may not further settle down after planting.

**4.04 PLANTING:**

No tree pits shall be dug until a final tree position has been pegged out for approval. Care shall be taken that the plant sapling when planted is not buried beyond the level of the pot containing it. Planting should not be carried out in waterlogged soil.

**4.05 STAKING:**

If necessary, a single vertical stake 1 to 1.5 meter longer than the clear stem of the plant, driven 300 mm to 450 mm (approx. 1ft to 1'6") into the soil shall be used. Each plant should be secured to the stake so as to prevent excess movement.

**4.06 WATERING:**

The landscape contractor shall allow for the adequate watering of all newly planted trees, shrubs and groundcover immediately after planting and during the following growing season, shall keep the plant material well watered. Water supply and irrigation network will be provided by the client free of cost.

**4.07 PLANTING ALONG THE EDGE OF THE BUILDING:**

All plants proposed to be planted by edge of building in front façade of building should be planted with special care so as to ensure the following:

- a) The painting/cladding of walls is not soiled and kept clean at all times
- b) Watering is done with care so as to ensure water is not entering windows or muddy water is not splashed on walls.



- c) Plants growing over the height of windows should be trimmed below window height.

#### 4.08 PROTECTION:

The client will be responsible and should take measures to protect the planted saplings from cattle, salt spray and high wind pressure. Rates indicated in the Bill of Quantities shall exclude such costs of protecting the plants including any physical construction such as walls, tree guards, etc. that may be required for the same.

#### 5.00 All Landscape Horticulture Works of Stage - I mentioned below will be a part there of:

- A. The effective date for commencement of maintenance is from the date of virtual completion as certified by the Landscape Consultant after successful completion of all the works as per the Tender.
- B. The Contractor shall not sub contract any of the work specified in this contract.
- C. The rates quoted shall be firm for the entire duration of the contract (including the defects liability period). The concerned authority / Landscape consultant has the option to terminate the contract if he so desires any time during the tenure of the contract, after giving an advance notice of 15 days.
- D. At the end of the defects liability period the site shall be handed over to the concerned authority / Consultant complete in all respects in good condition along with all records, log books.
- E. If the concerned authority desires to associate his operating personnel along with the contractor's personnel during the maintenance period, the contractor shall arrange for the same. However, this shall not relieve the contractor of his obligations under this contract.
- F. The contractor shall deploy his own experienced, competent, qualified personnel who are working permanently in his organization and have at least **2 years** of experience in maintenance of Landscape & arboriculture works.
- G. The Contractor shall furnish the organizational chart indicating various categories of technical and administrative staff envisaged for satisfactory maintenance of the Landscape works. This information shall be submitted along with the tender.
- H. The Contractor shall bring his own tools and equipment's required for maintenance of Landscape works.
- I. The contractor shall make his own transport arrangements for reaching the work site and for movement within the plant premises and accommodation for his staff at no extra cost to employer.
- J. The Contractor shall furnish to the concerned authority of the employer / Landscape Consultant MAINTENANCE SCHEDULE **one month** in advance to the commencement of the maintenance period with details of lawn mowing, manuring, pruning, staking, mulching, spraying of pesticides, watering etc.
- K. The Contractor shall be responsible for the safety of plants executed by him under this tender and provide adequate security staff at no extra cost to the employer.
- L. The Contractor's Site supervisor will be responsible for forwarding weekly reports to the Landscape Consultant and employer regarding the progress of works.
- M. The Contractor shall adhere to all Statutory Regulations and Accepted Safety norms.
- N. The Contractor shall maintain the nursery for the entire period of the maintenance and at the end of the defects liability period the Contractor shall hand over the nursery with adequate number of plants - particularly the species of plants that are regularly used for filling of gaps, replacements, etc. to the Accepting Officer at no extra cost.
- P. STAKING - The Contractor if necessary, provide a single vertical stake 1 meter (approx. 3 ft.)

longer than the clear stem of the plant, driven 300 mm to 450 mm (approx. 1ft to 1'6") into the soil shall be used. Each plant should be secured to the stake so as to prevent excess movement.

**Q WATERING** - The landscape contractor shall allow for the adequate watering of all planted trees, shrubs and groundcover during the following growing season, shall keep the plant material well watered. In the absence of rain, lawn shall be watered daily - heavily, soaking the soil thoroughly to a depth of at least 150 mm.

Water supply and irrigation network will be provided by the client free of cost.

**R LOOSENING THE SOIL & MULCHING** - Soil around the planted areas - i.e around trees, shrubs, ground cover has to be loosened periodically and the area around trees and shrubs have to be maintained in the form of shallow pits for watering. All planted areas including around trees which have open soil that is exposed will have to be mulched with straw or hay.

**S** All plants - trees, shrubs, ground cover planted by edge of building or in front façade of building should be maintained with special care so as to ensure the following:

1. The painting/cladding of walls is not soiled and kept clean at all times
2. Watering is done with care so as to ensure water is not entering windows or muddy water is not splashed on walls.
3. All plants growing over the height of windows should be trimmed below window sill height.

**T PROTECTION** -The client will be responsible and should take measures to protect the planted saplings from cattle, salt spray and high wind pressure by constructing physical construction such as walls, tree guards, etc. that may be deemed necessary at his own cost.

**U CUTTING** - For the lawns the scythe must continue to be used for **several months** until the grass is sufficiently secure in the ground to bear the mowing machine. The edges shall be kept neat and must be cut regularly with the edging shears.

**V MANURING & FERTILIZING** - Adequate manure and fertilizers shall be supplied and sprayed at periodic intervals as per the instructions of the Landscape Consultant.

The lawn shall be fed warm culture manure or castor crack @ 3 kg /Sq. Mt. / Year. (In three dose per year)

Need based Bio- fertilizers and Bio - pesticides which are environment friendly should be used. Use of Chemical based fertilizers is to be avoided.

Manure to be used should be organic compost as it is bio - degradable and environment friendly and hence would not pollute the ground water.

**W REPLACEMENTS** - When the plants are to be replaced either for filling gaps or poor quality, the contractor shall replace within **15 days**. For this purpose, extra numbers of plants of those used in the project will have to be maintained in the Nursery.

**X WEEDING** - The Contractor shall be responsible for maintaining the planted areas free of weeds. He shall employ adequate labor to manually remove the weeds in the planted areas and in the lawn. Weeding has to be done for up to 1000mm around the planted areas. In the lawns, weeding has to be done before mowing is done.

**Y MOWING** - The lawn has to be mowed with the lawn mower to maintain a uniform level of the grass periodically depending on the growth. The Contractor has maintained adequate number of lawn mowers and employ sufficient labor for the same. Electricity and plug points in garden area as per requirement will be provided by the client.

The overall objectives for this management plan are:

- To secure the long---term health and retention of the existing trees and boundary hedgerows to the site;
- To secure the implementation and establishment of the proposed landscaping scheme and to secure wildlife and ecological benefits where ever possible;

- To ensure best horticultural and health and safety practices at all times;
- To maintain high standards of landscape development thorough considered management procedures;
- To ensure that methods employed respect and encourage wildlife, wherever possible;
- and
- Defects in the landscape are identified early and addressed promptly.

#### **# Landscape Management Preambles**

The Contractor will visit the site and take note of all existing conditions including levels, condition of vegetation, soil conditions, and access.

At all times care will be taken to avoid interference with the established levels and contours of the ground, and to avoid damage to footpaths, roads, drains, manholes and existing structures and vegetation.

All work will be carried out by experienced and qualified operatives holding the necessary training certificates to undertake the prescribed works. All works detailed in the following specifications shall be carried out in accordance with good horticultural practice, using materials, plant and machinery appropriate to the task, undertaken in such a manner that avoids damage and/or nuisance to the site and its surroundings. Any plant material that dies as a result of the Contractors neglect will be replaced at their cost.

#### **# Insurances and Certification**

The appointed maintenance contractor must provide details of all necessary insurances and certification to carry---out the works specified in this management plan. It is the responsibility of the appointing authority to ensure that all submitted insurances and certificates are up to date and provide the appropriate level of cover for the specified works.

#### **# Environmental Considerations**

All chemical weed control must be carried out by suitable trained staff in accordance with the manufacturers recommendations and the legislation set out below:

- The Food and Environment Protection Act (1985);
- The Control of Pesticides Regulations (1986);
- The Control of Substances Hazardous to Health Regulations (2002);
- The Environment Protection Act (1990)

It is the Contractor's responsibility to ensure that all operatives are fully conversant with the foregoing legislation and other relevant Codes of Practice and British Standards. The Contractor will make any notifications as are required under the terms of The Food and Environment Protection Act (1985), and will be responsible for any damage caused through the inappropriate use or application of any such hazardous substances.

Horticultural peat is not to be used as mulch on any beds or as a soil conditioner. Where appropriate arising from the site should be recycled.

All arising (unless otherwise specified) will be removed from site and deposited at an approved tip or registered green compost facility. Watering operations will be carried out as specified in this management plan. A water source will be identified by the appointing authority. If no water source is available then watering will be carried out using a bowser.

#### **# Litter Removal**

The Contractor will ensure that the entire site is kept free of litter and other debris through a regular programme of monitoring, collection and disposal, coinciding with visits to maintain grassed areas and planting.

Particular care will be taken to remove all broken bottles, glass, tins, sharp objects and other items likely to constitute a hazard.

The Contractor will take particular care when carrying out litter collection to ensure that any discarded needles or syringes are removed as soon as they are discovered. Such items must be packaged separately from other litter, and be contained within appropriately labeled, puncture---proof sharps containers and disposed of in a safe manner.

All litter and debris shall be removed off site to an authorised tip specified by the Contractor.

This shall be carried out in accordance with the Code of Practice on Litter and Refuse issued under Section 89 of the

Environment Protection Act (1990).

#### # Management of Existing Trees and Hedgerows

Following the completion of the construction phase and commencement of the landscape management phase all levels and surface finishes will be checked around all retained trees and boundary hedgerows. Where levels and/or surfaces are considered unsatisfactory these will be rectified to a satisfactory condition.

At each visit all trees and hedgerows will be inspected and cleared of litter and debris in accordance with the details set out above.

All works to trees and hedgerows will be carried out to avoid the Birds Nesting Season (March to Mid---August). Any works to retained trees must be approved by a qualified Ecologist to safeguard potential Bat habitat.

Retained trees will be inspected at each visit and any deadwood considered dangerous will be removed in accordance with the recommendations set out in BS 3998: 2010 'Tree work recommendations'.

Any deadwood in trees will be either retained on site in the form of eco stacks (please refer to agreement details for such features set out in the following sections of this plan), or removed from site to a registered tip.

The hedgerow will be maintained to a height no less than 2 metres using with an average height of between 2m to 3m.

Any dead section of hedgerow should be removed and in---filled. Areas of hedgerow infill and gapping up will be agreed with the appointing authority as part of the monitoring process and implemented during the following planting season (October to end of March) to the specification detailed on the soft Landscape proposals.

#### # MANAGEMENT PLAN REVIEW & MAINTENANCE SCHEDULES

The sequence of agreement, monitoring and review is set out below. It is envisaged that

at each stage agreement will be reached between SA Properties and Landscape Contractor. It is the responsibility of the Contractor to bring to the attention of the Developer any issues that require immediate attention. Any such issues left unchecked that result in permanent damage or degradation of the landscape and associated environment will be put right at the Contractors expense. The stages of agreement, monitoring and review are set out below: Management plan and annual maintenance schedules to be agreed by all parties involved in the on---going management of the landscape and features specific to this plan;

At the end of year 1 the Contractor and appointing authority are meet on site and review all open spaces;

Following this monitoring stage appropriate adjustments to the management objectives, operations and frequencies of visits are to be agreed and the plan amended;

Monitoring visits and amendments to the plan are to be continues between years 1 to years 5;

At the end of year 5 there will be a wholesale review of this plan and any changes to it (including the removal/insertion of operations and/or the change in frequency of operations) will be agreed between the Contractor and Developer/Client.

#### TECHNICAL SPECIFICATION FOR IRRIGATION WORKS

##### 1.01 PIPING WORKS

###### PVCPIPE:-

- All underground irrigation pipes shall be PVC, conforming to IS 4985:1988 standards for both mainlines and laterals. Makes of pipes shall be as specified in the List of Approved Manufacturers / Makes.

- Pipes shall be made using virgin material and shall be continuously and permanently marked with following information. Pipes shall be of uniform wall thickness, smooth finish inside and outside shall show no evidence of interior scratches, extrusion marks, blisters, groves or any manufacturing or transit damage.

###### HDPEPIPE:-

- All underground irrigation pipes shall be HDPE, conforming to IS 4984 standards for both mainlines and laterals. Makes of pipes shall be as specified in the List of Approved Manufacturers / Makes.

Pipes shall be of uniform wall thickness, smooth finish inside and outside shall show no evidence of interior scratches, extrusion marks, blisters, groves or any manufacturing or transit damage.

##### 1.02 FITTINGS [I] PVC FITTINGS

All PVC fittings shall have a minimum pressure rating of 6Kg/sq.cm working pressure (for the respective PN rating of pipes), confirming to the standards and shall be of the same material as that of the pipes. All fittings including the threaded ones shall be of injection moulded type.

**[II] HDPE FITTINGS**

All HDPE EF fittings shall have a minimum pressure rating of 6Kg/10Kg working pressure (for the respective PN rating of pipes), confirming to the standards and shall be of the same material as that of the pipes.

**1.03 JOINT CEMENT AND PRIMER**

Solvent cement and primer for PVC pipes shall be as per pipe manufacturer's recommendations.

**1.04 QUICK COUPLING VALVES (QCV)**

The quick coupling valves shall be self-closing, spring loaded quick coupling of 1" inlet size made of brass & having self-closing thermoplastic hinged lid. A 1" key for quick coupling hydrant made up of brass must be provided for operating the QCV. Brass Swivel Hose Elbow 1" X 1" should be provided along with MS saddles with GI risers of adequate sizes to allow the QCV arrangement on the pipes.

**1.05 PVC BALL VALVES**

The ball valves shall be of PVC with Teflon seats having flow indicator when lever is removed. The security pivot should maintain lever in space. The valve shall have a double water tight joint, direct injection stem non mechanical, with a base which permits maximum penetration into the valve.

**1.06 AIR RELEASE VALVE.**

Air release valve shall be double acting type, made of high strength fiber glass reinforced plastic. The Air release valve shall be capable of both releasing and admitting air from and into the line. The working pressure shall be 10 Bars and testing pressure shall be 16 Bars.

**1.07 VALVE BOXES**

All valve boxes shall be PVC of suitable size with poly vinyl chloride reinforcement and shall have green top cover.

Valve boxes shall be available in both round and rectangular models. Where larger size is required a combination of round and rectangular valve boxes may be used.

**1.08 PUMP STATION**

A) Pumping system shall have Open well pump set from Kirloskar or equivalent complete with anti-vibration pad, all necessary G.I. /M.S. inlet and delivery manifolds, Brass/GM NRV, isolation valves, water meter, hydraulic pressure release valve, Pressure switch and pressure tank, Control panel with L & T or Siemens starter and weather proof connectors and box.

B) Pumps: A 3.0 HP pump with designed discharge and 35 m head, fitted with appropriate size accessories such as ARV, PRV, gate valves etc. shall be provided at the water source.

**1.08 Sprinkler**

Sprinkler heads shall be brass / gunmetal with quartz bulb with temperature rating of 68 degree celsius. Sprinkler heads shall be of type and quality approved by the local fire brigade authority/NFPA 13. The inlet shall be screwed. Sprinkler heads spacing shall be pendent, recessed or special side all type. All sprinklers shall conform to the specifications given by TAC, IS, NFPA, FOC, UL & FM.

**PENDENT TYPE SPRINKLER HEAD**

Sprinkler heads shall be quartzite bulb type with bulb, valve assembly, yoke and the deflector. The sprinkler shall be of approved make and type with 15 mm nominal diameter outlets.

The bulb shall be made of corrosion free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall be shatter when the temperature of the surrounding air reaches at 57 c.

The nominal bore shall 15 mm diameter and color of liquid shall be Red / Yellow.

**CONCEALED TYPE / WITH ROSSETE SPRINKLER HEAD**

Adjustable concealed sprinklers shall be provided as specified in B.O.Q. in areas where an attractive appearance is primary concern. Concealed Sprinkler heads shall be infinitely adjustable for a full 15 mm so as to compensate for uneven ceiling heights & allow adjustment of the sprinkler cover at any timer. The sprinkler shall be of approved make

and type with 15 mm nominal diameter outlets.

The bulb shall be made of corrosion free material strong enough to withstand any water pressure likely to occur in the system. The bulb shall be shatter when the temperature of the surrounding air reaches at 68 c.

The nominal bore shall 15 mm diameter and color of liquid shall be Red / Yellow.

#### **INSATLLATION CONTROL VALVE & REALATED EQUIPMENTS FOR SPRINKLER STSTEM**

The sprinkler system shall have installation control valve (Flow switch with Isolation Valve and Drain arrangement) along with assemblies at entry of main header in each floor.

#### **FLOW SWITCH**

Flow switch shall have a paddle made up of flexible material of the width to fit within the pipe bore. The terminal box shall be mounted over the paddle / pipe through a connecting socket. The switch shall be potential free in either NO or NC position as required. The switch shall be able to trip and make/ break contact on the operation of a single sprinkler head. The terminal box shall have connections for wiring to the Fire alarm panel. The seat shall be of stainless steel. The flow switch shall have IP: 55 protections.

The flow switch shall work at a minimum flow rate of 100 LPM. Further, it shall have a retard to compensate for line leakage or intermittent flows.

#### **BUTTERFLY VALVE**

The Butterfly valve shall be suitable for waterworks and tested to minimum of 16 kg/sq cm Pressure. The valves shall fulfill the requirements of BIS(Indian Standard)BS: 5155 or AWWA C 504, API 609 and MSS-SP-67.

The body shall be of cast iron to IS: 210 in circular shape and of high strength to take the minimum water pressure of 10 kg/sq cm. The disc shall be heavy-duty cast iron with anti-Corrosive epoxy or nickel coating.

The valve seat shall be high grade elastomer or nitrile rubber. The valve in closed position shall have complete contact between the seat and the disc throughout the perimeter. The elastomer rubber shall have a long life and shall not give away on continuous applied water pressure. The shaft shall be of ENB grade carbon steel.

The valve shall be fitted between two flanges on either side of pipe flanges. The valve edge rubber shall be projected outside such that they are wedged within the pipe flanges to prevent leakages.

The valve shall be supplied with manual gear operated opening/ closing system by lever.

#### **DRAIN VALVE**

50 MM diameter G.I. pipe conforming to I.S.:1239 (heavy grade) with 50 mm diameter gunmetal full way valve shall be provided for drainage of any water in the system in low pockets.

#### **SPECIFICATIONS OF PLANTS (SH 3 TO 10)**

The plants included under Sub Head 3 to 10 should be as per following specification.

- 1 The plants should be full of fresh and healthy foliage.
- 2 The plants should be free from insect, pest and disease.
- 3 Plant should be healthy and vigorous growth
- 4 The height of the plants will be measured from top of the pots.
- 5 The plants should be well settled and should not be newly shifted.
- 6 The plants should be true to the variety and named Variety should be tagged.
- 7 Moss stick used should be made on plastic pipe.
- 8 Moss stick should be straight and properly fixed in the pot.
- 9 The rejected plants materials should be removed from the site immediately.
- 10 Moss stick should be covered with the plants in case of plants supplied with moss stick.
- 11 The Plant should be well stablished and good spread.
12. Good earth and manure used for filling the pot/poly bag free from any inert materil and mixed to proper ratio.
14. Pot/ Poly bag used for filling the plants should be proper size good quality not damaged.
15. There should be proper drainage in pots for plants.
- 16 The flowering plants should also have proper flowering and should be true to the variety.
- 17 All plant should have the tendency of growth and should not be stunted type.
18. There should be no stagnation of water in the pots

S.No	Correction Slip No.	Reference No.	Contents in Brief

Page 54 of 76