

## CHAPTER 3 PLUMBING WORK

### 3.1 GENERAL

#### 3.1.1 SCOPE OF WORKS

**WATER SUPPLY AND SANITARY DRAINAGE:** Hot and cold water service and mains supply to point of connection including rainwater downspouts; sanitary drainage and trade waste drainage including soil and waste piping systems to the point of connection to the drainage system; and associated pipework, reticulation, accessories, fixtures and fittings and associated apparatus.

#### 3.1.2 STANDARDS

**REFERENCE DOCUMENTS:** The following standards of the latest edition are referred to in this section:-

The installation shall be carried out in accordance with Chinese Standard Codes, JIS or equivalent.

Where specific standards or codes are referred to in the Bills of Quantities or the Specifications or the drawings, other authoritative standards that ensure an equal or higher quality than the standards mentioned will also be acceptable. It will be incumbent on the Contractor to verify the equal or higher quality and to submit comparative standards (both specified and proposed standards) for review.

#### STEEL PIPE

Steel Tubes

#### COPPER PIPE

Copper pipe

Capillary fittings for copper pipe

Copper fittings for waste

#### POLYETHYLENE PIPE

Polyethylene pressure pipe

Polyethylene fittings

Polyethylene pipe installation

Plastic waste fittings

#### UPVC PIPE

UPVC soil & waste fittings

UPVC pressure pipes

UPVC rubber ring joint

UPVC pipe installation

Solvent cement

Plastic waste fittings

#### MISCELLANEOUS

Paint colors  
Plugs for fixtures  
Stainless steel material  
Basins  
Vitreous China  
Stainless steel sinks and drainers  
Vitreous china WC's  
Laundry troughs  
Toilet seat of molded plastic  
Pipeline identification  
Flushing cisterns  
Copper alloy taps  
Copper alloy gate valves  
Fire hose reel installation

### 3.1.3 AUTHORITIES AND APPROVALS - PLUMBING

**AUTHORITIES:** Authorities whose requirements apply to the work of this section include:

- the Provincial Building Board or Town Building Authority
- the Provincial Health Division
- the Fire Fighting Service, Department of Civil Aviation

**APPROVALS:** Documents evidencing approval of such authorities shall be surrendered before the Certificate of practical Completion is issued.

**WORKS BY AUTHORITY:** If the responsible authority elects to perform or supply part of the works, make the necessary arrangements and pay any fees.

### 3.1.4 DRAWINGS AND DIMENSIONS

**DIAGRAMMATIC LAYOUTS:** Drawings showing pipework layouts are diagrammatic only. Before commencing work, verify the exact positions of fixtures, appliances and the like to which the pipework is to be connected.

**AS-BUILT DRAWINGS:** If requested provide 'As-built' drawings showing the locations of pipes and fittings, including the depth of underground pipework, positions of control valves, and the like. Give co-ordinate dimensions where applicable. Do not use scaled dimensions. Use given dimensions only.

### 3.1.5 SUPERVISION

**PERSONNEL:** Work shall be done by under the direct supervision of appropriately licensed tradesmen.

### 3.1.6 INSPECTION

Give sufficient notice so that inspection may be made at the following stage:

- Trenches excavated and ready for pipe laying
- Work ready for specified testing
- Underground or enclosed work ready to be covered up or concealed
- At any other stage as required

### 3.1.7 EXISTING SERVICES.

**ALTERATIONS:** Deal with existing services as necessary to complete the work specified in this section. Take precautions when altering metallic service pipework that may form part of an electrical earth electrode and ensure that a continuous path to earth is maintained at all times.

**INTERRUPTIONS:** Obtain approval before interrupting an existing service, and perform the work in accordance with an approved program so that the duration and number of interruptions is reduced to a minimum.

## **3.2 TESTING**

### **3.2.1 TESTING**

**TESTS:** Supply apparatus and materials necessary, and carry out tests required by the regulatory authorities in the presence of the authorized representatives and where specified, the Engineer.

**CONCEALED WORK:** Do not cover or conceal underground or enclosed work until it has been inspected and tested to approval. Leave pipe joints exposed to enable observation during the tests.

**REJECTION:** Pipework which fails required test, or which vibrates or is noisy because of insufficient support or loose fittings, is liable to be rejected.

**UPVC PIPEWORK:** Ensure solvent cement joints have been cured for at least 24 hours before testing.

### **3.3 WORKMANSHIP**

#### **3.3.1 INSTALLATION**

**GENERALLY:** Arrange and install pipework in straight lines and uniform grades with proper supports that prevent sagging or vibration but allow thermal and other necessary movement. Provide bends and sets as required, and sufficient unions, flanges and isolating valves for satisfactory removal of piping and fittings for maintenance. Keep the number of joints to a minimum.

**DISSIMILAR METALS:** Avoid contact between dissimilar metals which are likely to generate electrolytic, galvanic or other corrosive action. Make junctions between such metals with special fittings manufactured in suitable compatible material.

**CHANGES OF DIRECTION:** Use bends where practicable in preference to elbow. Use elbows where pipes are led up or along walls and then through to fixtures.

**JOINTS:** Fit joints tightly, seal and make leakproof, with no internal projections, burr or obstructions.

**CONCEALED PIPEWORK:** Arrange pipework runs to be horizontally parallel to each other and to adjacent building members. Leave 25 mm clear space between pipes, and 50 mm between pipes and electric wiring. Take off branches at right angles for water supply and with appropriate bends for waste piping. Provide suitable removable access covers to allow servicing of drainage inspection openings.

**STUD WALLS:** Pipework may be run inside timber or metal stud walls providing that no framing member will lose more than one third of its cross-sectional area without prior approval.

#### **3.3.2 ACCESSIBILITY**

**CONCEALMENT:** Where practicable, conceal pipework so that it is accessible within ducts or non-habitable enclosed spaces and does not appear on external walls. If concealment is not practicable and if required, pipework and accessories shall be chrome plated copper and located only where approved.

**ENCLOSED PIPEWORK:** If pipework is proposed to be enclosed in an inaccessible location, obtain prior approval and if required record the actual locations on As-built drawings.

**SANITARY PIPEWORK:** Locate pipe fittings requiring maintenance access including inspection openings, cleaning points and the like, in accessible positions.

### 3.3.3 UNDERGROUND WATER PIPES

**TRENCHES:** General open-trench excavation and backfilling is specified in SERVICE TRENCHES-SITWORKS.

**BEDDING** Trim trench bottom to provide continuous, uniform and adequate support to the pipe. Bed the pipe in sand or selected excavated material free from hard or sharp objects or lumps and fill to 150 mm above the top of the pipe.

**MINIMUM COVER:** Unless over-ridden by regulatory requirements provide minimum cover over pipes of:

- 450 mm for pipes not subject to vehicular loading
- 600 mm for pipes subject to vehicular loading

**SHARED TRENCHES:** Where water pipes are laid in the same trench as a stormwater or sewer drain they shall be located on a shelf excavated at one side of the trench not less than 50 mm wide and at least 100 mm above the highest part of the drain.

**PIPEWORK UNDER SLABS:** Protect pipework under concrete floor slabs by supporting on compacted underlay material 150 mm thick, and provide compacted overlay and side support of sand or clean excavated material to not less than 150 mm above the top of the pipe.

### 3.3.4 CLEANING OUT

**REQUIREMENT:** Remove all foreign matter and flush out the system to provide clean water at outlets.

### 3.3.5 SLEEVES AND CHASES

**SLEEVES:** If required, where pipes pass through concrete walls, floors, beams and columns provide purpose-made metal or plastic sleeves with min. 5 mm clearance around all pipes, packed with gunned silicone rubber joint sealer (self extinguishing grade).

**CHASES:** Where possible form chases as concrete is being poured. Where necessary cut chases with a power saw unless otherwise approved. Do not chase reinforced concrete work without approval. Keep size of chases the minimum necessary.

**PIPE ENCASED IN CONCRETE:** Provide a minimum cover of 25 mm and lay in continuous lengths without fittings unless the fittings are permanently accessible. Provide approved flexible waterproof wrapping to allow for thermal movement.

### 3.3.6 CAPPING OFF

During construction, temporarily seal open ends of pipes and valves to prevent the entry of foreign matter into pipe systems. Provide purpose made covers of copper, pressed steel or rigid plastic. Do not use rags, paper or wood plugs.

### 3.3.7 BACKFLOW & CROSS CONNECTION PREVENTION

Install the water systems so as to prevent non-potable liquids, solids or gases from being introduced into the potable water supply through cross connections or by backflow, in accordance with the Chinese Plumbing Standard.

## 3.4 FASTENINGS

### 3.4.1 SUPPORTS

Provide supports including hangers, saddles, bolted clips and the like, sufficient to secure the pipework to adjacent surfaces and to support it at joints, at changes of direction, and at intervals suitable to the size and type of pipe and as necessary to prevent sagging of pipework. Make provision for adjustment of gradient as required. Clips for wall mounting shall be screwed, not nailed to supports.

**SUPPORT MATERIALS:** The same material as the pipe or galvanized or non-ferrous bonded PVC or fiberglass woven tape sleeves to separate dissimilar metals. Provide fixings of compatible material.

### 3.4.2 COVER PLATES

Where pipelines emerge from wall, floor or ceiling surfaces, provide cover plates of non-ferrous metal finished to match the pipe. Cover plate diameter shall be nominally 50 mm larger than the pipe.

### 3.5 PIPEWORK

#### 3.5.1 PIPING MATERIAL

**SELECTION:** Acceptable piping materials are listed below for various building applications. The use of alternative materials will require prior approval.

##### INTERNAL WATER SUPPLY:

- exposed to view                      COPPER-chrome plate finish
- concealed                              COPPER, POLYBUTYLENE

##### EXTERNAL WATER SUPPLY:

- exposed to vandalism              GALVANIZED STEEL
- underground                        COPPER, POLYETHYLENE
- within concrete                    COPPER

##### SANITARY DRAINAGE:

- all locations                        CAST IRON, GALVANIZED STEEL PIPE

##### TRADE WASTE DRAINAGE

- in ground                            REINFORCED CONCRETE PIPE

#### 3.5.2 PIPING SIZES

Unless otherwise indicated on the drawings or required by the relevant authorities, pipework shall be sized as follows:

Water Supply	Nominal diameter (mm)
• Connections serving less than 10 water fittings	20
• Connections serving 10 or more water fittings	25
• Internal lines	20
<b>Soil/Waste</b>	
• Waste from hand basins	40
• Waste from other fittings	50
• Waste vents	50/80/100
• Soil pipes	100
• Terminal vent pipes	100



### 3.5.3 GALVANIZED STEEL PIPING

Galvanized steel tubes shall be to medium grade with screwed joints. Galvanized steel tubes and accessories shall not be used underground or in concrete slabs except for standpipes.

### 3.5.4 COPPER PIPING

Copper piping shall be to relevant standard - Type for Water Supply  
- Type for Sanitary Plumbing

Fittings shall be de-zincification resistant if required by the relevant authorities.

- Capillary fittings:
- Compression fittings:

Jointing shall use capillary fittings or compression fittings. Make slip joints using a proper tool, soften and expand the pipe to form a slip joint of not less than the following lengths:

Nominal pipe size (mm)	Length of slip joint (mm)
• 15 - 20	10
• 25 - 32	12
• 40 - 65	16
• 80 - 100	20

### 3.5.5 POLYETHYLENE PIPING

Pipe, fittings and Installation shall be to relevant standards.

### 3.5.6 UNPLASTICISED POLYVINYL CHLORIDE (UPVC)

Pipe, fittings and Installation shall be to relevant standards.

### 3.5.7 PIPE FINISHES

All exposed pipes (except chrome plated pipes) in front of a painted surface shall be painted. Colors to match adjacent wall surface unless identification colors are required. Paint systems description refer PAINTING Section, also APPLICATION-PAINTING.

**IDENTIFICATION:** If required by the authorities apply flow direction arrows and identification colors by means of tape or paint.

### 3.5.8 PIPEWORK INSULATION

Water supply, drainage, fire fighting and hot water pipes shall be insulated as described in this section.

The thickness of the insulation of the pipework, valves and fittings shall be as follows: -

PIPE	PIPE SIZE	INSULATION THICKNESS
Water supply	0 - 80	20 mm
drainage	100 - 150	25 mm
fire fighting	200	40 mm
Hot water	0 - 25	25 mm
	32 - 50	30 mm
	65 - 150	40 mm

All pipes shall be insulated with rigid molded sectional closed cell expanded polystyrene, or rigid fiberglass. All insulated pipework shall be provided with an approved vapour barrier of "Sisalation 450" adhesive bonded to the insulation. All insulation shall have a Thermal conductivity of 0.036 W/m deg C and a density of not less than 17.5KG/M<sup>3</sup>. All insulation joints shall be of the lapped construction with vapour barrier joints lapped a minimum of 25 mm and sealed with tape.

All pipes shall use glass wool insulation not less than 40 kg/m<sup>3</sup>.

Where paperwork is exposed to the weather, install a further sheathing of 0.3 mm thick stainless sheet steel, rolled to diameter of the insulation and lapped 10 mm at the seam, popped riveted with blind rivets to the pipework and fittings. Alternative protection where pipework runs at groups level shall be as shown on the drawings.

## **3.6 VALVES**

### **3.6.1 ACCESSORIES**

Provide each fixture with the accessories, including tapes, valves, and the like, necessary for proper functioning compatible with the fixtures they serve, and of types as shown on the drawings or specified.

### **3.6.2 TAPS AND COCKS**

Copper ally taps shall be easy clean type pillar or bib cocks as appropriate in chrome plate finish. External laundry tub and standpipes shall have brass hosecocks.

Provide chrome plated brass wall extension pieces for bib taps to allow taps to discharge properly into bowls of fittings. Tap Heads shall be star type chrome plate brass, unless specified otherwise. Provide purpose made chrome plate flanges or cover plates and bed in sealant for a neat waterproof seal between tapes and their mounting surface.

### **3.6.3 VALVES**

Gate and non-return valves shall be of copper alloy to relevant Standards. Full bore gate type with screwed connections. Valve spindles shall be non-rising type. Install valves with spindles in a vertical position where practicable.

Conceal valves wherever possible in ducts or non habitable spaces provided that they shall be accessible as specified in ACCESSIBILITY - PLUMBING. Valves in visible positions shall be finished to match that of adjoining visible pipework.

### **3.6.4 VALVE ACCESS**

Provide access shaft and lid for access to underground gate valves. Lid shall be 150 thick 300 x 300 concrete lid.

150 mm diameter UPVC pipe flush with ground surface and extending down and slotted over service line shall be provided to give clear access to the valve wheel or spindle. Surround top 100 mm of shaft with a 300 x 300 concrete collar with top surface trowelled level.

### **3.6.5 SHOWER**

Install either dual shower bib taps and mixing box or proprietary shower mixer valve, where both hot and cold water supplies are available to the shower, as specified.

Shower head shall be arm mounted swivel type 100 mm chrome plated head, mounted, 1,800 mm above floor level unless specified otherwise.

### **3.7 MAINS WATER SUPPLY**

#### **3.7.1 MAINS CONNECTION**

Connect the water supply system to the supply main through a stop valve and a meter, if required. Provide underground connection from the meter to the building.

**RISER:** The supply riser from the underground connection, shall be protected above ground from vandalism by either concealment (i.e. inside a duct or wall) or encasement in a protective sleeve consisting of galvanized steel pipe extending up to 2,000 mm above ground level.

**STOP VALVE:** Provide access shaft as for VALVE ACCESS - PLUMBING.

ved precast concrete box.

### **3.8 FIRE SERVICES.**

#### **3.8.1 FIRE HOSE REELS & SPRINKLERS - PLUMBING**

Install fire hydrants, hose reels according to the drawings, to the manufacturer's recommendations, and the requirements of Plumbing Standard.

**IDENTIFICATION OF PIPEWORK:** Provide distinguishing coat of full gloss enamel paint system color bright red.

### **3.9 HOT WATER**

#### **3.9.1 HOT WATER UNIT**

Electric Hot Water Unit shall be packaged proprietary automatic water heater including the connections, controls and fittings necessary for the proper functioning of the unit.

**INSTALLATION:** To comply with the supplier's recommendations.

**HOT TAPS:** For sink, basin, shower or other specified fittings with hot and cold taps, ensure the hot tap is installed on the left or above the cold tap. Clearly and permanently mark tap with an "H" or "Hot" or by a red marker.

**LAGGING:** Lag all hot water distribution pipes with approved performed, flexible vermin proof, closed cell foamed elastomeric pipe lagging where exposed to external air movement or passing through masonry work. Size lagging to match pipe diameter and with a nominal wall thickness of 10 mm.

#### **3.10 STANDPIPES**

**DRAINAGE:** Unless indicated otherwise on the drawings fall slab to an open earth drain to discharge where directed.

### **3.11 SANITARY PLUMBING**

#### **3.11.1 SOIL AND WASTE SYSTEMS**

Install pipework and sanitary fixtures in accordance with relevant Standard, as specified and shown on the drawings, or as required.

Copper fittings, UPVC fittings shall be to relevant Standard, and shall have fire collars fitted where required.

Hydrostatic or air test of a pressure and duration as required by the regulatory authorities shall be conducted.

**SIZES:** Refer to 3.5.2 Piping Sizes.

**FINISHES:** Refer to 3.5.8 Piping Finishes.

#### **3.11.2 BRANCHES**

When a branch line enters a vertical pipe, the branch fittings shall be wholly outside the vertical pipe so that the internal bore is maintained at all places.

#### **3.11.3 TRAPS**

Loose ring P trap and S trap - fitted to all wastes. Diameter to match the waste pipe.

Material of traps shall match material of connecting pipework.

In visible location finish traps to match adjoining visible pipework.

#### **3.11.4 FLOOR TRAPS, RISERS AND GRATES**

Provide traps and inlet risers of the same material as the outlet pipework.

Grates shall be screw in type, either UPVC or chrome plate finish cooper.

#### **3.11.5 CONNECTION TO SEWER DRAIN**

Connect discharge and vent pipes to disconnecter gully level inlets or appropriate drain fittings.

### 3.11.6 TRADE WASTE DRAINAGE

Provide grates, traps pipework, coalescing Plate Separator and holding tank and connect to disconnect traps.

### 3.12 SANITARY FIXTURES

#### 3.12.1 Fixtures

Install fixtures as specified in the Schedule of Sanitary Fittings or indicated on the drawings in accordance with the manufacturer's recommendations and the appropriate standards and regulations.

**NOTE: WHERE A PARTICULAR PROPRIETARY ITEM IS NOT SPECIFIED, THE FIXTURES SHALL BE AS FOLLOWS:**

**WATER SUPPLY:** Provide suitable water supply, cocks and taps. Refer to 3.6.2 Taps & Cocks.

#### **MATERIALS:**

- Vitreous China
- Stainless steel
- Fabrication
- Fixtures subject to corrosive action in service shall be stainless steel, welded with molybdenum type electrodes.
- Enameled Pressed Steel
- Alternative Materials may only be used with approval.

#### **FINISHES:**

Unless specified otherwise

- Vitreous China and enamel fittings **WHITE**.
- All stainless steel **BRIGHT**.

**PLUGS:** To relevant Standard

#### 3.12.2 SHOWER TRAYS

Shower Trays shall be minimum 100 mm deep single seamless unit, 1.2 mm stainless steel or pressed steel vitreous enamel. Apron front with flanged back and sides to accept sheet or tile wall linings. Size to properly fit the recess indicated on the drawings.



### 3.12.3 WALL BASINS

Wall Basins shall be to Vitreous China, pressed stainless steel or pressed steel vitreous enameled to the size indicated. Basin shall be complete with recess for soap and suitable for the number and type of taps required.

Supports shall be proprietary concealed wall mounting bracket system.

Height shall be set at rim 750 mm above finished floor level.

### 3.12.4 VANITY BASINS

**REQUIREMENT:** As for wall basins and shall be self rimming.

**SUPPORT:** Securely fix to vanity unit top and bed on approved white, silicon sealant.

### 3.12.5 WASH TROUGHES

1.2 mm stainless steel wash trough. Length as indicated on drawings with minimum 250 mm wide x 200 mm deep trough, 150 mm high, back upstand to accommodate bib cocks, 25 mm wide front and end rims turned down and in. Install to ensure sufficient falls to waste pipe to prevent ponding.

**SUPPORTS:** Stainless steel concealed wall mounting brackets.

**HEIGHT:** Rim 750 mm above finished floor level.

### 3.12.6 SINK/DRAINERS

Sink/Drainers shall be 1.2 mm stainless steel, to the size and bowl/draining configuration indicated on the drawings. Unless flat rim type is specifically noted the unit shall be aproned on front and exposed sides with minimum 100 mm upstands to back and sides abutting walls. Drainers shall be grooved self draining type, installed to prevent any ponding.

Where flat rim i.e. bench inset type is specified, install according to manufacturer's recommendations. Seal rim in bedding on a continuous bed of silicon sealant. Neatly finish by fillet of approved color sealant between rim and bench top.

Height shall be as indicated on the sink bench drawings, otherwise at 900 mm above finished floor level.

### 3.12.7 WATER CLOSETS

Pedestal pan shall be floor mounted vitreous china to with "S" trap as indicated or as appropriate.

Pedestal shall be fixed to floor by;

- Brass screw to timber floor
- Cement mortar bed and approved plug or expansion type fixing to concrete floor

Pedestal seat shall be non-rigid molded plastic. Recessed underside and matching cover flap, standard hinged. Color white, or as otherwise specified.

Pedestal pan cistern shall be to relevant Standard. Molded white plastic, low level-push button. Capacity 11 liter nominal for mains water.

### 3.12.8 URINALS

Unless otherwise specified provide wall mounted automatic flushed, vitreous china individual stall type. Top or back inlet as appropriate with integral flushing rim and chrome plate flushing spreader and "dome" waste grate connector.

### 3.12.9 THERMOSTATIC MIXING VALVE

Supply and install a thermostatic mixing valve to disabled area complete with locking device and cover plate for access.

### 3.12.10 COALESCING PLATE SEPARATOR

Supply and install a coalescing plate separator complete with pump and fittings required to complete the installation.

## 3.13 WASTE WATER TREATMENT

### 3.13.1 OILY WASTE DRAINAGE

Oily waste drainage discharged from maintenance building shall be treated as separate to oil and water by a holding tank with coarser.

The separated waste water shall be drain into the sewer waste drainage line.

## **CHAPTER 4 ELECTRICAL WORK**

### **4.1 GENERAL**

#### **4.1.1 GENERAL**

The work covered in this section comprises the supply, installation, testing, commissioning and guarantee for a period of twelve (12) months of the complete electrical services installation as described in detail in the following clauses or shown on the drawings, and in conformity with the specification applicable to the work.

The complete installation shall be tested to ensure that all systems function satisfactorily and comply with the detailed requirements of this specification and any statutory authority having jurisdiction over the installation.

The installation shall be commissioned with all systems set into operation and demonstrated to the nominated occupants of the completed building. The Client is to be instructed as to the function of all equipment, the method of operation and the day-to-day maintenance requirements.

The installation shall be maintained for the defects liability period of twelve (12) months in first class working condition, periodical testing being carried out as specified, all faults rectified and any defective equipment replaced. A comprehensive operations and maintenance manual (3 copies) shall be provided not less than seven (7) days before practical completion of the installation. As 'Installed Drawing' (3 sets) plus an Auto Cad Disk giving the precise details of all controls, electrical circuitry, pipe work and duct work, etc. shall be provided not later than thirty (30) days after practical completion of the installation.

#### **4.1.2 SCOPE**

The work under this section of the contract shall comprise the complete electrical installation and all other associated works necessary to place the electrical installation in full working order in accordance with this specification and details shown on the contract drawings.

A general description of the work is as follows:

- a) Supply and installation of general purpose outlet (GPO) indicated on the drawings.
- b) Supply and installation of light fittings indicated on the drawings and specified herein.
- c) Supply and installation of all exit and emergency lighting, indicated on the drawing and specified herein.

- d) Supply and installation of telephone cable and conduit to points as indicated on the drawings.
- e) Wiring isolation switch, and control panel for exhaust fans, air-conditioning unit and pump supplied and installed by contractor.
- f) Public Address system.
- g) Emergency alarm system

All other work whether specifically mentioned or not, necessary to provide a completely operative installation in accordance with the intentions of the specification and drawings.

#### 4.1.3 ELECTRICITY SUPPLY

The electricity supply is 380/220V 3 phase 50 Hz.

All equipment selected shall be suitable for operation on the above voltage and frequency.

#### 4.1.4 BALANCE OF LOAD

The Contractor shall, as far as possible, balance the load on the distribution boards and also on the complete installation over the individual phases of the supply.

#### 4.1.5 EARTHING

The complete installation shall be earthed to approval in accordance with the Chinese Standards, JIS or equivalent. Wiring Rules and the requirements of the Supply Authority.

#### 4.1.6 SEGREGATION OF SERVICES

All wiring associated with other services such as Telephone, TV, computer and alarm systems shall be segregated as required under the Code.

#### 4.1.7 DANGER SIGNS AND LABELS

Danger signs and labels of an appropriate size shall be fitted in areas and on equipment where dangerous conditions exist.

#### 4.1.8 GUARANTEES

The Contractor shall guarantee that all equipment used in this installation complies fully with the intent and meaning of this specification and all relevant standards, as well as the requirements of all authorities having jurisdiction over such work and equipment.

The Contractor shall, where called for and where applicable, provide confirmation of such capacities, ratings and duties as well as overall performance. Any such items found wanting in this respect shall be replaced entirely, or rectified to the Engineer's satisfaction at the expense of the contractor.

The Contractor shall guarantee all equipment and work against faulty workmanship and materials for a period of twelve (12) months from the date of practical completion. If tenderers include in their tender equipment that which is covered by a lesser guarantee, they shall allow for and include the cost of extending that guarantee to the whole of the defects liability period.

#### 4.1.9 ADJUSTMENT

The Contractor shall carry out at his own expense all necessary tests and adjustments to the plant and equipment to attain the specified performances and conditions of operation prior to the occupation of the building. However, if for any seasonal or other agreed reasons some adjustments and tests cannot be completed at this time, they shall be carried out during the period of twelve (12) months after the date of practical completion.

The latter adjustments will have to be made while the building is occupied. The Contractor shall allow for any additional costs that may be involved in carrying out these adjustments at the convenience of the Client, outside normal working hours if necessary.

#### 4.1.10 DEFECTS LIABILITY PERIOD

During the defects liability period any equipment requiring regular routine servicing shall be served by the Contractor at no additional cost to the Client. The Contractor shall be entirely responsible for performing all regular inspections and servicing during the defects liability period in accordance with the maintenance and operating instructions provided by him as required by the specification. The contractor shall prepare and utilize a schedule of maintenance procedures and duties which, following the performance of such procedures and duties shall be signed by the authorized representative of the Client. Service visits shall be carried out at intervals of not longer than three (3) months.

Where materials, equipment and/or workmanship are replaced during the defects liability period, such material, equipment and/or workmanship shall carry a further defects liability period equal to the originally specified defects liability period, but shall not be subject to maintenance and servicing by the Contractor beyond the date of expiry of the contract defects liability period.

#### 4.1.11 STANDARDS AND APPROVAL

Where specific standards or codes are referred to in the Bills of Quantities or the Specifications or the drawings, other authoritative standards that ensure an equal or higher quality than the standards mentioned will also be acceptable. It will be incumbent on the Contractor to verify the equal or higher quality and to submit comparative standards (both specified and proposed standards) for review.

The work of the electrical services installation shall be completed to the satisfaction of the Engineer. Workmanship and materials shall be the best of their respective kinds in regard to quality, quantity, duty, performance and arrangement.

All work shall comply in all respects with the relevant rules and regulations of statutory authorities having jurisdiction over this installation.

The installation shall be in accordance with the particular requirements of the local supply authority.

#### 4.1.12 SHOP DRAWING

After the date of notification of acceptance of the tender, the contractor shall commence the preparation of necessary working drawings so as to meet the time schedule with due regard to the time required for the examination by the Engineer and for the time required for possible alteration and resubmission.

The Contractor shall, on the shop drawings submitted for approval, or by covering letter, indicate clearly any equipment or material that does not comply with either the specification, the tender drawings, or the accepted tender and shall indicate the reasons for non-compliance. In the absence of such statement the Engineer shall assume that drawings are in accordance with the specification, the tender drawings and/or the accepted tender.

The Engineer's permission to use shop drawings will not relieve the Contractor of responsibility for any deviation from the requirements of the contract documents, unless such deviation has been approved in writing by the Engineer.

The Engineer's permission shall not relieve the Contractor from responsibility for errors or omissions in the shop drawings. No work requiring shop drawings shall be commenced until permission to use such drawings has been given.

#### 4.1.13 INSTALLATION, FEES AND NOTICES

Each item of equipment shall be installed completely in accordance with the requirements and recommendations of the manufacturer or his licensed representative, subject to the requirements of all statutory authorities having jurisdiction, unless specified directions to the contrary are given with the approval of the Engineer.

The inspecting authorities requirements in regard to testing and giving notice, paying of fees and similar items shall be met in all regards in carrying out the works of this contract. All relevant test and approval certificates shall be handed to the Engineer at the completion of the works of the contract.

All fittings, apparatus or accessories shall be tested as required under the Electricity Act and the Contractor shall pay all fees associated with these tests.

#### 4.1.14 REJECTION OF PLANT

If the complete plant or any portion thereof be defective or fails to fulfill the requirements of this contract, such plant shall be made good or shall be liable to rejection in accordance with the conditions of contract.

## 4.2 SWITCHBOARDS

### 4.2.1 DISTRIBUTION SECTION

#### a) General

Supply and install the distribution section complete with circuit breakers generally in accordance with the following requirements.

The general schematic of the distribution section shall be as indicated on the drawings.

#### b) Construction

The distribution board shall be of the dead front, multi-pole totally enclosed type, recess mounted, containing moulded case circuit breakers and other equipment that may be required as indicated on the drawings.

It shall be constructed from 1.6 mm zinc coated steel. The finish shall be Electrical Orange Color to Chinese Standards, JIS or equivalent, applied by baked enamel and red oxide undercoat method.

Escutcheons shall be fixed to the panelboard box by fastening screws to allow easy access to the panelboard interior.

The doors shall be of the dished type constructed from 1.6 mm zinc coated steel and the finish shall be the same as for the panelboard. The doors shall be fitted with locks, keyed alike, and two keys supplied per panelboard. The doors shall be easily removable and shall cover the escutcheon screws.

Multiple size knockouts shall be provided top and bottom of the distribution board.

Neutral size knockouts shall be provided top and bottom of the distribution board.

Neutral and earth bars of adequate size shall be fitted.

The board shall be securely bolted into position using a minimum of four (4) bolts.

#### c) Busbars

The busbar and tee-offs shall be made of high conductivity, hard drawn copper and shall be fully insulated and color coded. The busbar system shall be Type Tested at a fault level of as stated on the schematic drawings.



Tongues shall be provided for all future circuits where circuit breakers are not installed.

d) **Circuit Breakers**

Circuit breakers shall be of the clip-on type and interconnected with a three phase busbar system which must not rely on the circuit breaker terminals for support. The circuit breakers shall be to Chinese Standard, JIS C 8370 or equivalent for fault capacities of 10 KA or more and to Chinese Standard, JIS C 8370 or equivalent for miniature overcurrent circuit breakers up to 100A current rating and less than 10KA fault capacity.

Construction shall allow for complete interchangeability of single or multi-pole breakers without alteration to busbar connection or breaker mounting fixture. A separate fit-out tray assembly shall be provided to mount breakers and busbar supports.

Earth leakage devices to Chinese Standard, JIS C 8374 or equivalent shall be provided integral with circuit breaker protection operation.

Circuit breakers shall be Email Quicklag or equal approved and shall incorporate both thermal or magnetic protection.

e) **Power Switches**

Manual power switches for isolating as scheduled or indicated on the drawings shall be fuse switch units fitted with links or alternatively double air-break, rotary operation flush mounted type.

The handles of rotary operation switches shall be of the level type designed to give a marked and positive indication of switched position.

f) **Contactors**

Supply and install contactors to Chinese Standard, JIS C 8325 or equivalent controlling the lighting as indicated on the drawings.

The contactors shall be similar to Sprecher and Schuh and shall be fitted with minimum 20 amp contacts to AC3 rating.

g) **Motor starters**

Motor starters shall be provided with thermal overload relays single-phase protective relays and reverse sequence protect relays. Thermal overload relays shall have thermal characteristics suitable for associated motor and its starting characteristics, and suitably compendased for ambient air temperature variations.

**h) Schedule**

A mechanical schedule of circuits shall be provided at all distribution boards.

**4.2.2 DISTRIBUTION BOARDS**

Distribution boards shall be of the totally enclosed metal clad type complete with the equipment indicated on the drawings.

The distribution boards are to be constructed to fit in the space allocated. A general arrangement of the distribution boards is shown on the contract drawings. All distribution boards shall have hinged lockable door with seal to Chinese Standard, JIS or equivalent and internal hinged escutcheon panel.

Provide and install for each distribution board an approved typewritten circuit schedule. The schedule shall be protected by plastic or glass and fixed in a suitable frame adjustment to the distribution boards.

The distribution boards shall be painted with primer and two (2) coats of orange color enamel.

Provide distribution board labeling to Chinese Standard, JIS or equivalent.

Marking shall include labels for each switchboard control, circuit designations and ratings, fuses fitted to fuse holders, current limiting fuses, warnings notices for operational and maintenance personnel and the like.

Three (3) copies of dimensioned layout drawing for the distribution boards shall be submitted for approval before manufacture begins.

## 4.3 ELECTRICAL ACCESSORIES

### 4.3.1 CONDUITS

All conduits shall comply with the requirements of the relevant Chinese Standard Specifications. No conduit less than 20 mm diameter shall be used without prior approval.

Flexible conduit shall be used to connect conduit runs to free standing equipment and equipment subject to vibration.

Arrange the building-in of conduits and inserts as the work proceeds.

All conduits shall be heavy duty UPVC to Chinese Standard, JIS C 8430 or equivalent or metal where specifically indicated. Conduits shall be laid to straight and symmetrical lines with easy sets of bends. Bends or sets must be made without altering the section of the conduit. Where it is not practicable to set the conduit, spring bends shall be used. PVC conduit shall be joined using the manufacturer's recommended solvent and following closely his printed instructions.

Conduits cast-in situ shall be securely fixed to the steel reinforcement with heavy binding wiring to prevent the movement of the conduit during the pouring and vibrating of the concrete.

Conduits installed in screeds and chases shall be secured at intervals not exceeding 1.5 m with approved fixings. Conduit stub-ups through concrete surfaces and foundations shall be adequately braced to prevent shifting during pouring.

Obtain approval to run surface mounted conduit.

Surface mounted conduits, if approved, shall be fastened at intervals not exceeding 1.0 m. Where conduits enter distribution boards and accessories of any kind, the conduit shall be secured at each side of the entry.

The conduits, particularly in cavity walls etc., shall be arranged such that, under no circumstances, will they aid the passage of moisture into the building.

The wiring of a particular section shall not be carried out until the completion and final fixing of conduits in that section.

All conduit runs where cast into the concrete slab shall be looped at their terminal points to adjacent conduit runs in order that alternative paths can be provided should conduit blockages be encountered.

All conduit systems shall be installed to form a "draw-in" type wiring installation.

Conduits and accessories shall be fully assembled complete with draw-in wires before the drawing in of cables.

#### **4.4 LIGHTING FIXTURES**

##### **4.4.1 STANDARDS**

All fittings shall be constructed in accordance with the details of this clause. Where any fitting is referred to by a supplier's catalogue number this does not necessarily mean that the firm's product is required. Alternative supplier's products will be considered provided they comply with the standards specified in respect to design, type and quality.

All lighting fixtures shall comply with Chinese Standard, JIS C 8105 or equivalent.

##### **4.4.2 SAMPLE FITTINGS**

The Contractor shall deliver to the Engineer a sample of each fitting.

Approval of each sample fitting shall be obtained before commencing manufacture.

Sample fittings must be clearly labeled with the manufacturer's name and type number.

Failure to comply with this requirement may mean rejection of the fitting.

##### **4.4.3 GUARANTEE**

Obtain from the manufacturer a guarantee that all equipment is warranted against faulty design or faulty workmanship for the defects liability period. Replace any equipment which proves defective in normal operation during that period without cost to the principal.

All lamps and/or tubes which fail within the defects liability period shall be replaced and installed at no cost. Such replacements shall be carried out at times to be arranged with the Client.

##### **4.4.4 GENERAL**

Supply and install lighting fixtures as scheduled on the drawings

All fittings shall be of a standard manufacture and shall comply with the latest codes and their amendments.

The light fittings indicated by catalogue numbers are the preferred manufacture, however alternatives may be submitted for consideration.

All fitting shall be supplied complete with lamps and/or tubes and their associated control equipment ready for installation.

The installation of all light fittings shall be carried out in a workmanlike manner, so that they may be removed without undue difficulty for the purpose of maintenance and servicing.

Provide all necessary support brackets and fixings which may be required for light fittings.

#### 4.4.5 FLUORESCENT LIGHTING FIXTURES

a) General

Except where specified or shown as being aluminum, metalware or fluorescent lighting fixtures, reflectors, channels etc. shall be constructed from zinc-anneal sheet not less than 0.8 mm thickness. All corners and joints exposed to normal view shall be welded, ground smooth and filed where necessary before painting.

Fittings shall have closed ends unless otherwise specified or detailed. Where a diffuser is specified the diffuser shall be for the full length and width of the fitting.

After fabrication, metal surfaces shall be thoroughly cleaned back to the parent metal and all dust, moisture, grease or oil shall be removed by an approved de-greasing process.

The metalware shall be primed and given one coat of hot sprayed enamel on both sides and stoved. Total thickness of paint build up shall be not less than 0.5 mm. Finish color shall be to approval on all surfaces.

b) Fluorescent tubes

Fittings shall be supplied complete with energy saving tubes and any associated equipment ready wired for installation.

Fluorescent lamps shall be 'white' with an apparent color temperature of 4200K.

c) Ballasts

All ballasts shall comply with Chinese Standard, JIS C 8108 or equivalent.

d) Capacitors

Power factor correction capacitors shall be supplied with all fluorescent and high discharge fittings.

They shall be designed for continuous operation and shall effect power factor correction not less than 0.8 lagging.

e) **Wiring**

All wiring within the light fitting shall be suitably temperature rated and neatly secured within the casing.

Terminal blocks shall be provided for all fittings and all fittings shall be individually fused.

f) **Location and method of fixing auxiliary equipment**

All auxiliary gear shall be securely fixed to the fitting body, not to the gear tray cover. The gear mounting screws shall be non-rotating type, either square headed or spot welded so as to allow auxiliaries to be changed without demounting the fitting.

g) **Starters**

Starters shall have radio interference suppression condensers. They shall be readily accessible by removal of the diffuser only and may be changed without removal of the tubes. All starters shall be matched to suit the tubes they control.

h) **Diffusers**

Diffusers shall be fitted to light fittings as scheduled on the drawing.

i) **Lamps**

All fluorescent fittings shall be fitted with standard color 26 mm energy saver tubes.

Incandescent and HID lamps shall be as specified on the schedule of fittings.

All fittings shall have approved lamp holders suitable for the fitting and duty and shall be resistant to tracking.

All fittings shall be complete with lamps or tubes as applicable.

j) **High intensity discharge fittings**

All HID fittings shall comply generally with all requirements of previous clauses of this section where applicable.

k) **Ventilation**

All fittings shall be well ventilated so that components do not exceed the makers recommended operating temperatures during continuous fitting operation.

- l) **Fusing of Lighting Fixtures**  
All fluorescent fittings shall be fused.

#### 4.4.6 SCHEDULE OF TYPE OF LIGHTING FIXTURES

Refer to the Schedule of Lighting Fixtures or the legends on the drawings which form a part of this specification for details of the types of Lighting Fixtures to be supplied and installed.

#### 4.4.7 EXIT SIGNS

Supply and install the emergency exit signs in the position indicated on the drawings. The units shall be complete with lamps, control gear, diffuser, batteries, etc. basically as specified below.

- a) **Electronic control gear**  
The control gear shall consist of a battery charger, automatic switching circuitry, low voltage cutout, mains initiation circuitry, a two power transistor inverter.

Performance of the control gear shall be of a standard to fully comply with Chinese Standard or equivalent.

- b) **Battery**  
The battery pack shall consist of resealable nickel cadmium cells.
- c) **Thermal isolation**  
Adequate thermal isolation shall be provided between the battery and the heat generating parts.
- d) **Control/monitors**  
A test switch and LED monitor shall be fitted to each luminaire.
- e) **Diffuser**  
The diffuser shall be injection molded and dished out from the luminaire to provide a downward component of light.

The legend, including arrows if required, shall be silk screened and fully comply with the requirements of Chinese Standard or equivalent.



#### 4.4.8 EMERGENCY LIGHTING

- a) **General**  
Where indicated on the drawings supply and install emergency battery power packs to operate the fluorescent tube.
- b) **Power pack**  
The fluorescent power pack shall comply with Chinese Standard or equivalent.
- c) **Inverter and indicators**  
The inverter shall operate both switched and rapid start luminaries. It shall be capable of maintaining the specified lamps. The inverter shall be equipped with a low voltage cutout, short circuit proof charger, and require mains power to activate circuits after installation. There shall be an indicator to signify mains supply and charger functioning. The lamp shall be removable from the luminaries without damage to circuitry.
- d) **Battery**  
The Battery shall consist of the required number of nickel cadmium cells. Each cell shall be high temperature to 60 degrees celsius and constructed with polypropylene (electrolyte) separators. Cells will be interconnected with soldered tabs and battery shall be connected to the inverter by plug and socket.
- e) **Installation**  
The fluorescent power pack shall be installed in the luminary with the battery as far as practicable for the ballast, as space will allow.
- f) **Fittings**  
The type and make and fitting shall be indicated on the drawing schedule.

## **4.5 WIRING AND FIXINGS**

### **4.5.1 METHOD OF WIRING**

All wiring shall be concealed in the walls, floors or ceilings unless otherwise specified or shown on the drawings.

Generally where there are no false ceilings wiring shall be run in rigid PVC conduits cast into the concrete slab. The conduits in this case shall be kept above the bottom layer of re-enforcement shell. Deep or extended type junction boxes shall be used.

Wiring within stud walls, roof and ceiling spaces shall be consist of crosslinked polyethylene insulated power cable (XLPE power cable, IEC 502) in PVC conduit as scheduled on the drawings and specified herein.

Wiring within concrete slabs, chased in masonry and brick walls or exposed on the surface shall be in conductors as specified and enclosed in rigid PVC conduit.

In blockwork and concrete walls, wall boxes for switches and GPO's shall be of the deep or extended type.

Carry out wiring on the loop-in system. Jointing of cables and use of connectors will only be permitted at outlets.

Wiring shall not be run through light fillings and the like; wiring shall enter and leave at one point.

All lighting fittings shall be switched and arranged as indicated on the drawings.

The circuit zones for wiring the lighting fittings associated with each distribution board shall be as indicated on the drawings. Accessories shall be squarely fixed to wall boxes, skirtings, architraves etc., using approved screws with plastic head covers or chrome plated screws to suit the fittings concerned.

Due consideration shall be given to the height of tiling, brick course, or other special wall finishes and outlets shall not be mounted across the junction of different finishes.

Where practicable, switches at the one location shall be grouped under one plate.

The locations of light and power outlets shown on the contract drawings are diagrammatic and shall be confirmed with the Engineer prior to installation.

Light switches shall be installed at a height of approximately 1.00 m above floor level unless otherwise indicated on the contract drawings.

Common neutrals shall not be used on single phase circuits unless otherwise specified.

Separate earth wires shall be run for all circuits and shall originate at the switchboard concerned and run in same conduit.

All point to point wiring shall be undertaken using the circuit schedules.

Wiring in the landscaped areas shall consist of XLPE power cables installed in non-metallic conduits.

Secure accessible XLPE power cables by approved strap clips.

Run XLPE power cables in a neat and regular manner, concealed except where otherwise noted.

Protect exposed XLPE power cables liable to mechanical damage with approved metal cover strips or steel conduit.

#### 4.5.2 WIRING

All wires and cables except where otherwise specified shall be PVC insulated wire in conduit or XLPE power cables. XLPE power cables wiring shall not be run where exposed to view throughout the installation.

#### 4.5.3 BRACKETS AND FIXINGS

To allow implementation and installation of works, the Contractor shall supply and fix in position all brackets, troughs, trays, supporting racks as required for the running of wiring and equipment in general.

#### 4.5.4 LABELING

All labels shall be engraved Traffolyte type which shall be firmly fixed to the boards in an approved manner by means of chrome plated metal thread screws.

All GPO's switches and permanently connected equipment shall be fitted with circuit identification. The identification shall indicate the circuit's origin as well as the circuit number and phase color.

#### 4.5.5 FIXINGS

All nuts, screws, bolts, washers, clamps shall be cadmium or zinc plated.

Where plugs are necessary for the fixing of equipment, conduit and other fittings to floors, walls or ceilings approved metal plastic expansion devices shall be used.

#### 4.5.6 LIGHTNING PROTECTION

Lightning protection shall be provided by a protection system integral with the roof on top of the Buildings shown on the Drawings and earthing wire bonded to the steel structure. The earthing to ground shall be by earth copper plate. The tested earthing resistance shall not to exceed four ohms.

## **4.6 MANUALLY OPERATED ELECTRIC FIRE ALARM SYSTEM**

### **4.6.1 GENERAL**

The Manually Operated Electric Fire Alarm System shall be provided as generally indicated on the accompanying drawings. However, the final installed system shall conform in all respects to the requirements of all relevant Authorities. The drawings indicate the approximate extent of the system, however, the Contractor shall provide the system protection to suit the building, fitting and services at no additional cost the Builder.

### **4.6.2 INSTALLERS STATEMENT**

The Contractor shall provide an installers statement and certificate in the form set out in Chinese Standard or equivalent, before the date of practical completion.

### **4.6.3 FIRE INDICATOR PANELS**

The fire indicator panel shall be contained within a robust, painted metal enclosure including a battery charger and standby batteries and shall comply with Chinese Standard or equivalent.

The power supply shall have primary inputs of 220 volts.

All alarm and indicators shall be indelibly labeled indicating the function of the particular indicator. (Label to be engraved perspex or similar, screw fixed).

The FIP shall be fitted with a spare parts section to contain the log book and spare parts to included the following:

A log book and operating instructions shall be provided inside the indicator panel. The operating instructions shall provide, in a condensed form, with particulars of the installation and a brief description and explanation of the sequence of the system and control panel.

The finish color of the fire indicator panel shall be selected and advised by the Engineer.

### **4.6.4 SHOP DRAWINGS**

The contractor shall provide shop drawings showing information related to this installation. Five (5) sets shall be submitted. After the date of practical completion this contractor shall update drawings to an "As built" condition and issue four (4) prints and one (1) sepia.

#### 4.6.5 DETECTORS-MECHANICAL SERVICES

All detectors shall be fitted with a light emitting diode which shall face the likely path of approach by fire brigade or fire alarm personnel. A faulty self indicating device shall not render the detector inoperative under fire conditions.

Each detector head shall be readily removable and replaceable without damaging the surrounding surfaces or causing changes to the wiring configuration.

Any sensitivity adjustments to individual detectors shall be carried out in the workshop only.

##### Smoke Detector:

Smoke detectors to comply with Chinese Standard or equivalent  
Selection to be in accordance with Chinese Standard or equivalent  
Where smoke detectors are mounted in air return duct of the Mechanical Services, they shall be provided with approved air sampling device. The location of sampling device in return air ducts shall be determined on site.

All detectors shall be approved by the Local Fire Brigade and other relevant Authorities.

#### 4.6.6 MANUAL CALL POINTS

A "Break Glass" manual call point shall be provided in the main fire indicator board door or adjacent and as shown on accompanying drawings.

The manual call points shall comply with Chinese Standard or equivalent.

All manual call points shall be recessed unless noted otherwise. Provide a stainless steel surround to these manual call points.

#### 4.6.7 ALARM BELL

Supply and install, where indicated on the drawings a fire alarm of an approved type and manufacture. The bell shall comply with Chinese Standard or equivalent and be:

- Weatherproof
- Undergoing type, minimum size 150 dia, and shall be suitable for operation from the systems battery supply;
- Mounted direct onto the wall with a back conduit entry;
- Painted red with words "Fire Alarm" painted in a contrasting color.

#### 4.6.8 EMERGENCY WARNING SYSTEM

Emergency warning shall be provided by a system of fire warning speakers positioned around the building.

The system of fire warning speakers shall be powered by the fire indicator panel. The Contractor shall supply all equipment ( e.g. amplifiers, batteries, connections, etc.) required to make the system work.

The actuation of the Manually Operated Electric Alarm System shall comply with Chinese Standard or equivalent.

#### 4.6.9 WIRING AND INSTALLATION

All wiring for this installation shall be carried out by this Contractor. Wiring Rules Chinese Standard, JIS or equivalent.

#### 4.6.11 CONDUITS

Where required, provide conduit to Chinese Standard, JIS or equivalent.

Run surface conduits square with building elements. Minimum size of all conditions to be 20mm nominal diameter with inspection fittings and draw-in boxes throughout to ensure a complete draw-in system is provided.

#### 4.6.12 TESTING AND COMMISSIONING

In-situ test all equipment in the presence of the Engineer and Local Fire Brigade after completion of the installation work to determine the satisfactory operation of the system.

Replace without cost any item of equipment that does not operate within the limits of the applicable standards and codes.

#### 4.6.13 MECHANICAL SERVICE

Smoke detectors with air sampling devices shall be installed in the return air duct of the air handling systems.

Should the Manually Operated Electric Fire Alarm Systems operate in the building, then the FIP shall cause the air handling system to shut down.

All wiring between the FIP and mechanical services switchboard (MSSB) shall be carried out as part of the Manually Operated Electric Fire Alarm System. Cutting of holes in ductwork, internal wiring (MSSB) between and (MSSB) and mechanical service equipment shall be carried out as par of the Mechanical Services.



## **4.7 PUBLIC ADDRESS SYSTEM**

### **4.7.1 SCOPE**

The Public Address system shall consist of an amplifier with switching capabilities to enable announcements to be made from several points as shown on the drawings and provide high quality sound reproduction in all areas of the building.

### **4.7.2 STANDARDS**

The system shall comply with the Chinese Standard or equivalent

### **4.7.3 AMPLIFIER AND CONTROL EQUIPMENT**

Supply and install a power amplifier within the fire night-duty room suitable for public address throughout the building. Controls shall include input gain control, tone control, ON / OFF switch, treble tone control low cut-out switch. Provide central switching system unit complete with volume control for each zone capable of adjustment to provide the required sound pressure levels and means of locking this adjustment once the required sound pressure levels have been pre-set. The system shall incorporate volume feedback control and automatic switching of microphone inputs so that not more than one microphone can be operated at a time. Microphone shall be uni-directional hand held unit with built in ON / OFF switch, LED speech priority indicator.

### **4.7.4 LOUDSPEAKERS**

Suitable for duty required and shall be matched to amplifier equipment supplied.

### **4.7.5 WIRING AND INSULATION**

All wiring for this installation shall be carried out by the Contractor, and shall be in accordance with Chinese Standard, JIS or equivalent.

## **4.8 MISCELLANEOUS**

### **4.8.1 GENERAL**

All conduit and cables to power and telephone outlets shall be fully concealed in walls or in floor channeling. Co-ordinate with the supplier of furniture where outlets are built into fixtures.

### **4.8.2 TOILET EXHAUST FANS**

Toilet exhaust fans shall be wired to turn on the light switch with over-run timer.

### **4.8.3 PAINTING**

All exposed metallic materials, wiring ducts, etc., including those mounted in service cupboards, riser ducts, ceiling spaces, shall, unless otherwise directed, be painted to approval after erection with two (2) coats of best quality enamel or lacquer of colors selected by the Engineer.

Prior to painting these two (2) coats and between the coats, any blemishes to previous work shall be filled and rubbed smooth. Paint is to be ready mixed and used straight from the original containers without thinning.

Preparation of surfaces, priming of previously unpainted work and application of paint shall be strictly as recommended by the paint manufacturer.

All painting shall be done by an approved firm of painting contractors employing men skilled in the trade.

The painting finish on all fittings and equipment supplied under this contract shall be left in a perfect condition. Any blemishes shall be repaired and, if necessary, the equipment repainted to the satisfaction of the Engineer.

### **4.8.4 CLEAN UP AND FINISH**

Remove all packing and waste associated with the work as the job progresses.

On completion, ensure that all fittings and equipment installed under this contract are clean and left in a workmanlike condition to the complete satisfaction of the Engineer.

#### 4.8.5 AS-BUILT DRAWINGS, OPERATING AND MAINTENANCE MANUAL AND INSTRUCTIONS

As-built drawings, operating and maintenance manuals and instructions shall be provided. These documents shall include instruction to cover every action necessary for the efficient operation and maintenance of the plant and equipment supplied.

A preliminary submission of the manual having been made previously in time to permit adequate checking and, if necessary, correction.

Particular attention is to be paid to the following:-

- (1) List of Light fittings and equipment containing each item installed with maker's name and address, serial number and name plate data.
- (2) Operating instructions for the correct starting, operating, etc. for each system. Instructions for adjusting all controls and cut out settings. These shall include instructions for actions to be taken in event of abnormal or emergency conditions.
- (3) Maintenance Instructions setting out in detail all requirements for preventative maintenance of the equipment supplied. This shall be arranged in sections and recommended daily, weekly, monthly and annual maintenance. Provide for each section a check sheet for recording maintenance done.
- (4) Particular items  
In particular the following items shall be covered and described in full.
  1. Main Switchboard
  2. General Schematic of the Light and Power including all circuitry
  3. Distribution Switchboards
  4. Accessories

#### 4.8.6 SCHEDULE OF TECHNICAL DATA - ELECTRICAL SERVICES

In accordance with the equipment the tenderer proposes to use and upon which his tender is based, two copies of these schedules dully filled in, shall be provided by the tenderer. Tenderers shall include additional information where called for in duplicate. Tenders wherein the schedule of technical data is not completed may be rejected.

These schedules are of a limited nature only and the tenderer may be called upon to supply additional information. Upon entering into a contract, the successful tenderer is required to submit for approval details of all equipment he proposes to use. The completed schedule will be used to assess the merits of tenders received and the fact that the schedule will become part of the contract documents will not absolve the Contractor from complying the performance and warranty provisions of this specification.

## CHAPTER 5 FIRE HYDRANT SYSTEM

### 5.1 MECHANICAL EQUIPMENT

#### 5.1.1 GENERAL

The General Specifications for the Plant and Materials to be used in for the Mechanical Systems are as follows;

- a) Transitional phenomena of the pumps and piping under various conditions must be analyzed prior to, and form the basis for the design, manufacturing and selection of the equipment. Furthermore, thorough understanding of the operation methods, etc is required.
- b) Equipment and plant must be compatible and interchangeable, and designed to be easily maintained and overhauled.
- c) Revolving equipment must be balanced for weight of revolving elements to reduce vibration.
- d) Noise levels of the Equipment must designed to clear noise pollution regulations at the site boundary for the system as a whole.
- e) Rated output for each Equipment other than electric exhaust valve will be continuous rated output.
- f) Each Equipment must be capable of uninterrupted operation in the event of instantaneous power failure. They will also be designed for sufficient mechanical and electrical strength for the resumption shock after instantaneous power failure.
- g) Each Equipment, Material and System must be designed to not propagate disruption or failure in any part of the system.
- h) Each Equipment will be anti-seismic design.
- i) The preparation of the base for painting of each Equipment and material will be grade 1. Priming will be by Zinc-Rich Primer for Epoxy Resin paints and Etching Primer for Phatalic base paints.

#### 5.1.2 PLANT AND MATERIALS

The Specifications for the Plant and materials used in this works will be as shown below;

- a) Fire Pumps
  - 1) Specifications

Item	Specifications
Type	Double Intake Volute Pump
Number	3 Units (1 Spare)
Intake Diameter	$\phi$ 200 $\times$ $\phi$ 150
Rated Discharge	60-97.5 * /Min.

Rated Total Head	50-69 M
Revolution	About 1500 Rpm
Over Discharge Range	Over 120%
Warranted Efficiency	Over 72 %
Electric Motor Type	Open Drip Proof Squirrel-Cage Motors
Rated Power of Motor	75 kW
Operation Type	Water Level Controlled
Intake and Discharge direction	Horizontal Intake -Horizontal Discharge
Center Height of Intake Pipe	+4.875 m (reference)
Center Height of Discharge Pipe	+4.875 m (reference)
Intake Water Level	HWL +6.200 (reference)
Pump Borehole Level	LWL +2.400 (reference)
Specification of Flange	JIS or Chinese Standards Flat Flange 1.0 K
Liquid Type	Clean Water

2) Material Of Main Parts

Casing	FC 250 or equivalent
Impeller	SCS13 or equivalent
Main Shaft	S35C or equivalent
Main Bearing	Ball Bearing
Main Shaft Sleeve	BC6 or equivalent

3) Ancillary Equipment ( for every one unit)

Common Bed	1 Set
Foundation Bolts	1 Set
Pressure Gauge for Discharge	1 Piece
Intake Cumulative Counter	1 Piece
Air Valve	1 Set
Other Ancillary Equipment	1 Set

b) Electric Cutoff Valve

1) Specifications

Item	Intake			Discharge		
	External Cutoff Valve	Screw	Electric	External Cutoff Valve	Screw	Electric
Number	3 units			3 units		
Diameter	φ 300			φ 250		
Flange Specification	JIS 10K or equivalent Chinese Standard			JIS 10K or equivalent Chinese Standard		
Operational Pressure	Normal 6.0 kg/ *			Normal 6.0 kg/ *		
Electric Motor	0.4 kW			0.2 kW		
Opening / Shutting Speed	about 0.2m/min.			about 0.2m/min.		
Liquid	Clean Water			Clean Water		

2) Material of Main Parts

Main Body	FC200 or equivalent
Valve	FC200 or equivalent
Valve Bed	BC6 or equivalent
Valve Shaft	C3771B or equivalent

c) Piping , Etc.

1) Specifications

Item	Specification
1. Fire Hydrant and Water Supply Pipe	Ductile Cast-Iron Pipe, JIS 5526, 5527 or Equiv.

<ul style="list-style-type: none"> <li>• <math>\phi</math> 75 and over</li> <li>• <math>\phi</math> 65 and under</li> </ul>	Chinese Standard Zinc-plated Water Pipe JIS 3442 or equiv. Chinese Standard
2. Piping under runway pavement, etc	Seamless Steel Pipes ( Anti-corrosive finish)
3. Protection covering for piping under pavement	Cement-Mortar Lined Steel Pipe
4. Cutoff Valve <ul style="list-style-type: none"> <li>• over 65 mm</li> <li>• under 50 mm</li> </ul>	Cast Iron Valve 10K JIS b 2031 or equiv. Chinese Standard Bronze valve 10K JIS B 2011 or equiv. Chinese Standard
5. Check Valve	Cast Iron 10k JIS B 2031 or equiv. Chinese Standard
6. Fire Hydrant <ul style="list-style-type: none"> <li>• Type</li> <li>• Diameter</li> <li>• Material</li> </ul>	Single Connector Underground type Fire Hydrant(w/ Box) 100 mm Cast Iron
7. Water Supply Faucet <ul style="list-style-type: none"> <li>• Type</li> <li>• Diameter</li> <li>• Material</li> </ul>	Stop Valve 10K (w/ Box) JIS B 2011 or equiv. Chinese Standard 50 mm Bronze

## 5.2 ELECTRICAL EQUIPMENT

### 5.2.1 SCOPE OF DESIGN

The scope of Design for the Electrical Equipment includes the power supply, lighting, control of building equipment and lighting arresters and grounding.

The 110 kV intake cable is not included in the design for this Work. The electricity supply for the Fire Watch Room from the Fire Pump Room should refer to the Design for Electricity Supply of the Watch Room.

### 5.2.2 SUMMARY OF THE DESIGN

#### a) Electricity Supply

The high-tension side will be divided into two circuit by Single Linebus bar. Each



circuit will have a 400 kVA transformer to step down 10 kV to 380-220V . Each transformer will be capable of taking the entire operational load .

Low-Tension Side will be divided into two circuits with single linebus bar. Both bus bars will be connected by a connector breaker. Under normal operation mode, the breaker will be open and each circuit will take half the load. When either circuit fails, the breaker will close automatically and operations will resume under one operating transformer.

b) Control

All Fire Pumps will be capable of control either at aite or from the low-tension distribution room. All electric control valves will be monitored from the control panel.

c) Lighting and Lighting Arrester

The Design Luminosity for the Pump Room will be 100 lux. The Pump room area will have lawn lighting.

Lighting Arrester will be installed on the roof and connected to grounding device with wiring. The Design grounding resistance will be under 10  $\Omega$  and design grounding resistance of Equipment will be under 4  $\Omega$ .

### 5.2.3 CONSTRUCTION

#### a) Lighting Arrestors and Grounding Works

- 1) The Lighting Arrestors on the roof will use zinc-plated round steel bars.  
The Grounding Electrode will be square section pipes made of zinc- bars.  
Intake wire for the lighting arrestors will be zinc-plated steel flat bars installed along the inside of galls.
- 2) The depth of the Grounding Electrode will be 0.8 m below ground level.
- 3) Each connection will be securely welded and grounding resistance will be less than  $4 \Omega$ .
- 4) Installation will follow "Drawings for Electrical Installations"

#### b) Installation of Lighting

- 1) general lighting for rooms will be by embedded G15 electric pipe and BV-500 2.5  $\times$  wiring.
- 2) Embedded switches will be at 1.4 m height from floor and embedded receptacles will be 0.3 m from floor. Wiring will be BV-500 4  $\times$  in G15 piping.
- 3) Wall Brackets will be installed 2.0 m from floor. All other lighting fixtures will hung at a height of 3.2 m from the floor.
- 4) Wiring for 3-phase receptacle will use VV-1kV 3 $\times$ 4+1 $\times$ 2.5 in G20 piping.

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

SCIENCE AND TECHNOLOGY COMMISSION OF  
SHANGHAI MUNICIPAL PEOPLE'S GOVERNMENT,  
PEOPLE'S REPUBLIC OF CHINA

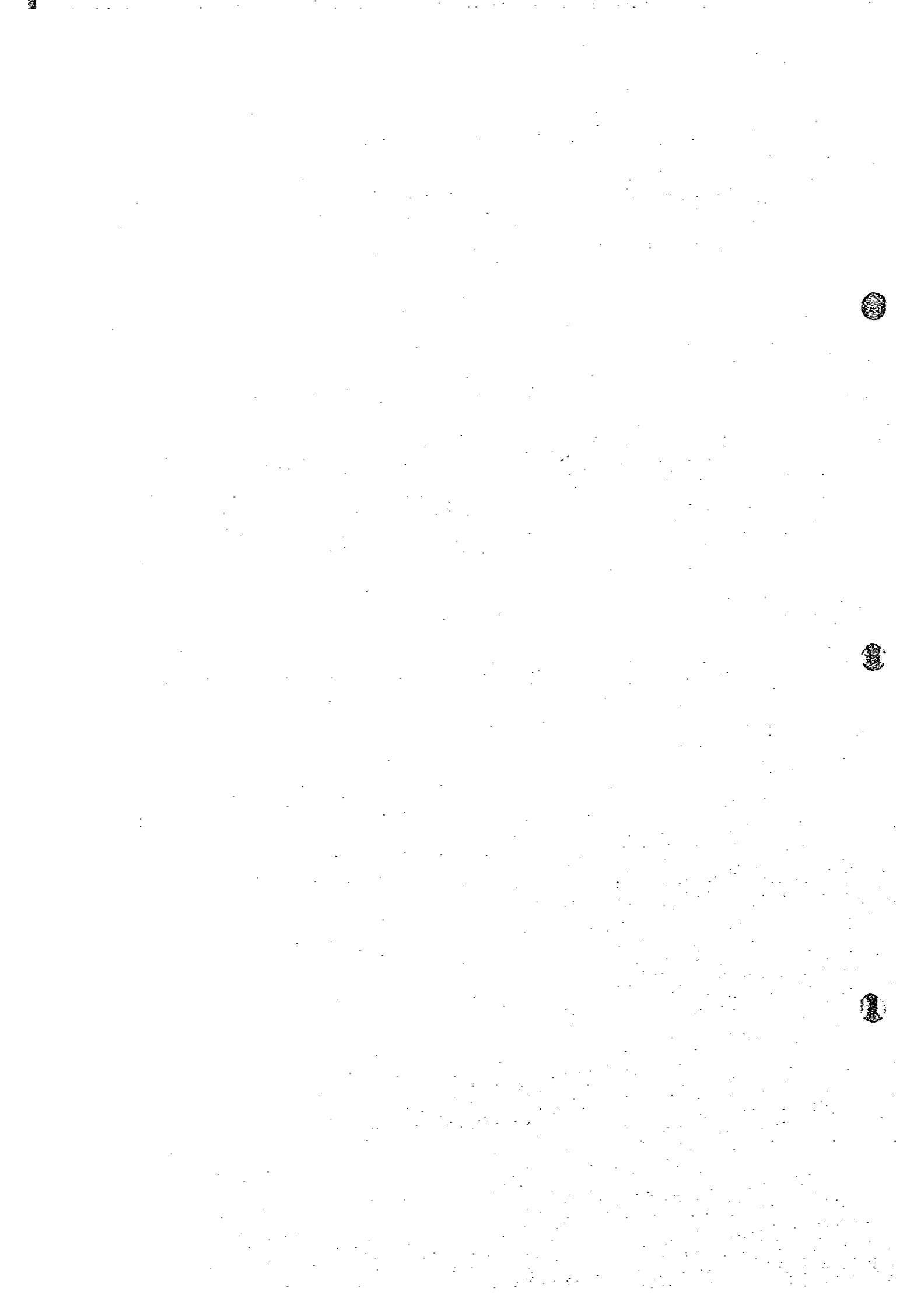
**DETAILED DESIGN  
OF  
SHANGHAI PUDONG INTERNATIONAL  
AIRPORT  
FINAL REPORT**

**VOLUME III  
TENDER DOCUMENT**

**PART IV-5  
SPECIFICATION  
FOR  
EQUIPMENT PURCHASE  
( FIRE FIGHTING AND RESCUE FACILITIES )**

SEPTEMBER 1997

**NIPPON KOEI CO., LTD.  
NIKKEN SEKKEI LTD.**



PEOPLE'S REPUBLIC OF CHINA  
SHANHAI MUNICIPAL PEOPLE'S GOVERNMENT

SHANGHAI PUDONG INTERNATIONAL AIRPORT PROJECT  
FINAL REPORT

TENDER DOCUMENT  
PART IV-5  
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**SECTION 1**

**GENERAL PROVISION**





## SECTION 1 GENERAL PROVISION

### 1. GENERAL SPECIFICATIONS

#### 1.1.

The technical specifications for each of the following items are guidelines for the Bidder.

The Bidder may substitute with an item of equal or better quality and performance provided that he expressly calls attention to the substitution and explains in detail the reasons for it.

Modification of standard equipment is not allowed.

#### 1.2

Pursuant to Clause 14.3 of Instructions to the Bidder, in addition to documents furnished by the Bidder, the Purchaser has a right to inspect and test prior to award, certain equipment offered as necessary, including the right to inspect the facilities for after sales service and spare parts inventories.

#### 1.3

Rescue and Fire Fighting Vehicles shall be adopted in accordance with Annex 14 and Airport Service Manual, Part 1 "Rescue and Fire Fighting" of the International Civil Aviation Organization (ICAO): Doc. 9137-AN898.

#### 1.4 ROAD SURFACE CONDITIONS

For equipment to be driven on waste, the manufacturer shall take measures necessary to reinforce the suspensions of the vehicles so they can withstand working on roads with rough surfaces, as well as measures to prevent the intrusion of dust, mud, sand or other elements into vital parts of the equipment.

#### 1.5 ALL VEHICLES SHALL BE EQUIPPED WITH:

- a) A revolving red lamp (siren and loud speaker, on the body)
- b) A mobile radio communication system (with power source)
- c) Airconditioner in the cabin

#### 1.6 COATING

- a) All vehicles shall be coated with a coating that is not oxidized by salt or the foam liquid.
- b) The finish color codes and inscriptions shall be discussed at the time of negotiations.

## 1.7 PLACE AND TIME OF DELIVERY

- a) Place of delivery  
Airport Main Fire Fighting Station
- b) Time of delivery  
The Contractor shall consult with the Purchaser on the time of delivery.

## 1.8 MEETINGS

The Contractor shall meet with the Purchaser as he feels required in order to carry out this Contract appropriately and smoothly.

The Contractor shall promptly prepare minutes of meetings on the items discussed with the Purchaser and obtain the approval of the Purchaser.

## 1.9 APPROVAL

Soon after the signing of the Contract, the Contractor shall meet with the Purchaser on the details of vehicle specifications. Based on the results of this meeting the Contractor shall prepare the related documents as shown below, submit three copies of each, (of which one copy is for return) and obtain the approval of the Purchaser. With respect to the contents, format, etc., of the documents to be submitted, the Contractor shall consult with the Purchaser.

- a) Fabrication and delivery schedule documents  
Implementation schedule, delivery plan and other documents that describe essential matters.
- b) Fabrication specifications
- c) Fabrication drawings  
Fabrication drawings shall consist of drawings of the external appearance, construction drawings, lists of equipment used, materials and parts, drawings of equipment details, power distribution diagrams, electrical system diagrams, and lists of loaded items, etc.  
Provided, however, where specification details can be confirmed by a parts list, catalog, etc., such may be used as alternatives.
- d) Outline for tests
- e) Outline for training and guidance  
The outline for training and guidance shall consist of handling instructions, maintenance instructions, a spare parts list, an execution schedule, etc.
- f) Other documents, which may be needed by the Purchaser  
Provided that the time of the submission of item e) above shall be discussed with the Purchaser.

## 1.10 DOCUMENTS TO BE SUBMITTED

### a) Completion document

The Contractor shall submit the following completion documents to the Purchaser when making delivery of commodities under this Contract:

- 1) Fabrication specifications
  - 2) As-built drawings
  - 3) Test performance records
  - 4) Handling instructions
  - 5) Completion photographs
  - 6) Other documents, which may be needed by the Purchaser
- Provided, however, that where the details of the specifications can be confirmed by catalog, etc., such may be used as alternatives.

## 1.11 HANDLING INSTRUCTIONS

The Contractor shall, soon after delivery of the vehicles to the Purchaser, give handling instructions on vehicle performance and the overall system to familiarize the personnel designated by the Purchaser with the handling of the vehicles.

## **2. EQUIPMENT TO BE SUPPLIED**

### **2.1 EQUIPMENT OF FOREIGN ORIGIN**

- a) One (1) unit of the Rapid Intervention Vehicle (hereinafter referred to as "RIV"), including fire fighting equipment and spare parts.
- b) Four (4) units of the Major Rescue and Fire Fighting Vehicle (hereinafter referred to as "MJV", including fire fighting equipment and spare parts.
- c) One (1) unit of the Rescue Truck, including rescue equipment and spare parts.
- d) One (1) unit of the Dry Chemical Fire Extinguisher Vehicle, including dry chemical fire fighting equipment and spare parts.
- e) Two (2) units of the Ambulance (I), including interior/exterior equipment and spare parts.
- f) One (1) unit of the Rescue Commander's Vehicle, including interior/exterior equipment and spare parts.
- g) One (1) unit of the Medical Service Vehicle, including medical service equipment for emergencies and spare parts.

### **2.2 EQUIPMENT MANUFACTURED IN CHINA**

Equipment of this clause shall be manufactured in China, and, excluded from the bid using OECF Loan.

- a) One (1) unit of the Chemical Fire Engine, including fire fighting equipment and spare parts.
- b) Two (2) units of the Water Tanker, including fire fighting equipment and spare parts.
- c) One (1) unit of the Lighting Vehicle, including lighting equipment and spare parts.
- d) One (1) unit of the Fire Fighting Commander's vehicle, including interior/exterior equipment and spare parts.
- e) One (1) unit of the Crew Transporter, including interior/exterior equipment and spare parts.
- f) One (1) unit of the Foam Agent Tanker, including foam agent equipment and spare parts.
- g) Three (3) units of the Ambulance (II), including interior/exterior equipment and spare parts.

**SECTION 2**

**SPECIAL PROVISION**



## SECTION 2 SPECIAL PROVISION

### 1. RAPID INTERVENTION VEHICLE (RIV)

#### 1.1 GENERAL

- a) The RIV shall be adopted in accordance with Annex 14 and Airport Service Manual, Part 1 "Rescue and Fire Fighting" of the International Civil Aviation Organization (ICAO): Doc. 9137-AN898.
- b) The RIV shall be available for the rescue of aircraft passengers and crews, to fight aircraft fires, and for general fire fighting purposes.
- c) The operational objective of the rescue and fire fighting service should be to achieve a response time of not more than three minutes to the end of the runway in optimum visibility and surface conditions.
- d) The RIV shall have a chassis with an allowable gross vehicle weight of not over 33 tons with an all-wheel-driven diesel engine, a 5,000-liter water tank, a 600-liter foam liquid tank, 250-kg dry chemical fire extinguisher, a means of controlling the turret nozzle from the cabin, and be equipped with the required accessories for fire fighting and rescue work.
- e) All coupling systems shall comply with Chinese Industrial Standards or equivalent standards.
- f) A mobile radio communication system shall be provided and mounted on the RIV.
- g) One unit of the RIV shall be supplied.

#### 1.2 VEHICLE PERFORMANCE AND REQUIREMENTS

According to ICAO recommendations, the RIV shall meet the following performance requirements.

- a) Acceleration: 0 ~ 80 km/h within 25 sec.
- b) Top speed: - Not less than 105 km/h
- c) Service brake: - Capable of bringing a fully loaded vehicle to a hold on a 50% gradient
- d) Dimensions and weight, etc.
  - 1) Overall length: Not more than 11,000 mm
  - 2) Overall width: Not more than 2,900 mm
  - 3) Overall height: Not more than 3,700 mm
  - 4) Ground clearance: Not less than 310 mm
  - 5) Minimum turning radius: Not greater than 25 m
  - 6) Approach angle: Not less than 30°
  - 7) Departure angle: Not less than 30°
  - 8) Minimum angle of tilt (static): Not less than 30°
  - 9) Gross vehicle weight: Not more than 33 tons

### 1.3 CHASSIS

- a) Engine: Rear-mounted engine  
2 or 4 cycle water-cooled diesel engine of not less than 400 HP
- b) Transmission: Automatic 4 or 5 speeds forward, 1 reverse
- c) Mode of drive: All-Wheel-Drive
- d) Steering: Center or left hand steering, power assisted
- e) Brakes:  
Main brakes: Pneumatic with ABS (Anti-Skid-Braking-System)  
Parking brake: - Pneumatic
- f) Suspension: - Front and back suspension  
2-level shock absorbers on the front
- g) Removal hatch: On the engine compartment
- h) Tires and wheels: Single wheels both front and rear
- i) Electrical equipment:  
Alternator: Not less than 12 V or 24 V, 100 A  
Battery: Not less than 12 V or 24 V, 200 A

### 1.4 CABIN

- a) General  
The cabin shall have a seating capacity, with seat belts, for 3 persons, including the driver. The driver's seat shall be separate and located in the center on the left side of the cabin. Both sides of the cabin shall be designed for quick entry, and a large door with a handrail and a step shall be provided for exiting. The windows shall be made of safety glass. Cabin noise and vibration shall be kept to a minimum.
- b) Construction  
For the safety of the crew, water-tight construction and metals of sufficient strength shall be used in the cabin's fabrication. The cabin shall be equipped with an overhead hatch of sufficient size to allow the crew access to the monitor turret during an emergency.
- c) Equipment operation from the cabin  
When necessary the following equipment shall be operable from the cabin, even during fire fighting.
  - 1) Lighting equipment and indicators
    - i) Direction indicator board
    - ii) Cab light
    - iii) Front headlights on both sides
    - iv) Rotating red lamp (bar-type, on the body)
    - v) Search light
    - vi) Public address system (siren and loud speaker, on the body)



vii) Mobile radio communication system

- ① The VHF AM-transceiver specified shall be mounted on the RIV of the airport and shall be used for air-ground communications.
- ② The equipment shall be completely solid state and compact.
- ③ The equipment shall be provided with 10 preset channels.
- ④ The equipment shall be operated with DC 12 V.
- ⑤ The equipment shall meet the standards and recommendations of the ICAO Annex 10.

2) Indicators and operator controllable devices

- i) Fuel gauge
- ii) Engine water temperature gauge
- iii) Differential lock switch
- iv) Main switch attachment
- v) Engine throttle
- vi) Windshield wiper and washer controls
- vii) Low air pressure warning indicator or buzzer
- viii) Air pressure gauge
- ix) Air conditioning and defroster switch
- x) Transmission oil temperature gauge
- xi) Ignition switch
- xii) Voltmeter
- xiii) Speedometer (km/h)
- xiv) Tachometer with hour meter

1.5 EQUIPMENT STORAGE COMPARTMENTS

The equipment storage compartments shall have wide doors and enough space to comfortably store equipment. A ladder or step shall be installed for access to the top of the body.

1.6 FIRE FIGHTING EQUIPMENT

a) General

The RIV shall have a water tank, foam liquid tank, monitor turret for discharging water and foam solution, power-take-off driven water pump, and foam system for mixing water and foam liquid.

b) Monitor turret

This turret nozzle shall discharge both water and foam solution and shall be controlled from the cabin by a lever.

1) Discharge rate:

High: Not less than 4,000 liters/min.

Low: Not less than 1,500 liters/min.

- 2) Discharge distance: Not less than 70 m (straight stream, no wind)
- 3) Discharge width: Not less than 10 m (disperse)
- 4) Horizontal sweep: Not less than 200\_ (Right: 100\_, Left: 100\_)
  - Vertical travel:
  - Elevation: Not less than 45\_
  - Depression: Not less than 20\_

c) Fire pump

Power-take-off driven 2 or 3 stage centrifugal fire pump with automatic primer that can be controlled from the cabin. A power divider shall be provided for engagement of the power-take off while the vehicle is running.

1) Materials:

- Body: Bronze casting
- Impeller: Bronze casting
- Pump shaft: Stainless steel

2) Discharge rate: Not less than 6,000 liters/min. at 16 kg/cm<sup>2</sup>

3) Suction inlet:

One (1) suction inlet of a nominal 100 mm (approx. 4 inches) wide a thread coupling shall be provided. It shall be placed on one side of the vehicle approx. 1.2 meters from the ground.

4) Discharge valve (outlet):

Two (2) discharge valves of a nominal 65 mm (approx. 2.5 inches) wide instantaneous couplings shall be provided. They shall be placed one on each side of the vehicle approx. 1.2 meters from the ground.

5) Removal panel for the pump:

It shall be installed on the body.

d) Water tank

It shall be used to make the foam solution and shall be independent of the vehicle body. The removal panel shall be installed on the water tank.

1) Capacity:

Not less than 5,000 liters

2) Materials:

Steel plate or stainless steel plate or aluminum light alloy or fiberglass.

3) Water level gauge:

It shall be placed in the cabin where it can be referred to.

4) Four (4) tank fill connection of a nominal 65 mm (approx. 2.5 inches) shall be provided in a position where they can easily be reached from the ground.

e) Foam liquid tank

The foam liquid tank shall be used to make foam solution (AFFF) and shall be independent of the vehicle body. The removal panel shall be installed on the foam liquid tank.

1) Capacity:

Not less than 600 liters (AFFF)

- 2) Materials:  
Steel plate or stainless steel plate or aluminum light alloy or fiberglass
  - 3) Level gauge:  
A level gauge shall be placed in the cabin where it can be referred to.
  - 4) Flushing device:  
A flushing device shall be installed for cleaning piping and the pump.
- f) Hose reel  
One (1) hose reel and rubber hose of a nominal 25 mm x 30 m with a gun nozzle shall be placed on each side of the compartment.
- 1) Discharge distance: Not less than 15 m.
  - 2) Discharge capacity: Not less than 200 liters/min. (each nozzle)
- g) Under-the-truck nozzle  
The under-the-truck nozzle shall be controlled from the cabin.
- 1) Quantity: 2
  - 2) Discharge rate: In total, not less than 150 liters/min.
- h) Bumper turret  
The bumper turret shall be controlled from the cabin.
- 1) Quantity: 1
  - 2) Discharge rate: Not less than 400 liters/min.
  - 3) Discharge width: Not less than 6 m (dispersed)
  - 4) Discharge distance: Not less than 40 m (straight stream, no wind)
  - 5) Horizontal sweep: Not less than 180\_ (right 90\_, left 90\_)
  - 6) Vertical travel
    - Elevation: Not less than 45\_
    - Depression: Not less than 20\_
- i) Dry chemical fire extinguisher
- ① An ABC-type dry chemical fire extinguisher shall be mounted on the RIV.
  - ② Capacity:  
Not less than 250 kg
  - ③ Propellant (N<sub>2</sub> gas or CO<sub>2</sub> gas):  
The propellant agent shall be N<sub>2</sub> or CO<sub>2</sub> gas and it shall provide a sufficient quantity of gas to expel all the dry chemical powder.
  - ④ Hose reel for discharging:  
The RIV shall be equipped on each side with a hose reel and hose (nominal 19 mm x 30 m).
  - ⑤ Discharge rate:  
Not less than 2 kg/sec.

## 1.7 COATING

The RIV shall be coated with a coating that is not oxidized by salt or the above chemical agent and foam liquid.

**1.8 STANDARD FIRE FIGHTING AND RESCUE EQUIPMENT**

The RIV shall have the following standard fire fighting and rescue equipment.

	Component	Quantity
1	Suction hose strainer: nominal 100 mm	1
2	Delivery hose: nominal 65 mm x 18 m	10
3	Basket strainer	1
4	Suction hose spanner	2
5	Suction hose: nominal 100 mm x 3 m	2
6	Water nozzle : nominal 65 mm	2
7	Foam nozzle, nominal 65 mm	2
8	Spare tire and wheel	1
9	Tire pressure gauge	1
10	Tire inflator hose	1
11	Fire extinguisher	1
12	Electric foam liquid pump	1 set
13	Funnel for dry chemical powder	1
14	Operation manual	3
15	Service manual	3
16	Parts catalogue	3

1.9 ADDITIONAL EQUIPMENT FOR RESCUE OPERATIONS RECOMMENDED BY THE ICAO

The RIV shall have the following additional equipment for rescue operations as recommended by the ICAO.

	Equipment	Quantity
1	Rescue axe: large, non-wedge-type	1
2	Rescue axe: small, non-wedge- or aircraft-type	2
3	Bolt cutter: 61 cm	1
4	Crowbar: 95 cm	1
5	Flashlight	4
6	Hammer: 1.8 kg	1
7	Metal cutting saw or hacksaw: heavy duty, complete with spare blades	1
8	Extension ladder: 11 m	1
9	Rope line: 30 m	1
10	Side-cutting pliers: 17.8 cm,	1
11	Screw drivers: assorted (set)	1 set
12	Power rescue saw: complete, with two blades; or, pneumatic rescue chisel: complete, plus a spare cylinder, chisel and retaining spring	1
13	Harness-cutting tool	2
14	Flame resistant gloves	4
15	Breathing apparatus and cylinder	2
16	Spare air cylinder	2
17	First aid kit	1
18	Heat-resistant suit	4

1.10 LIST OF SPARE PARTS

The RIV shall have the following spare parts.

[BODY]

	Part	Quantity
1	Gland packing	1
2	Diaphragm: special stop valve	1
3	Valve: special stop	1
4	Non-return valve	1
5	Rubber hose	1
6	Packing discharge outlet	10
7	Packing suction	2
8	LED lamp valve	5
9	LED lamp valve monitor	5
10	Bulb pump control switch	10
11	Control switch	1
12	Magnetic relay	4
13	Bulb 24 V - 12 W	5
14	Bulb 24 V - 40 W	2
15	Fuse 20 A	1
16	Fuse 10 A	1
17	Fuse 15 A	1
18	Fuse 40 A	1
19	Pneumatic solenoid valve	4
20	Filter regulator	1
21	Flasher relay	2
22	Door switch	2
23	Timer source	1
24	Bulb 24 V - 60 W	1
25	Actuator assembly	1
26	Flexible joint	10
27	Flexible tube	1
28	Check valve	1
29	Swivel joint	1
30	Seal service kit	1
31	Seal kit butterfly valve	1
32	Seal kit discharge cock	1
33	Relay motor siren	1
34	Circuit protector	2
35	Timer source	1
36	Flasher relay	1
37	Other manufacturer-recommended spare parts for the RIV body	

[CHASSIS]

	Part	Quantity
1	Shift unit axle	1
2	Brake chamber	2
3	Quick-release valve	2
4	Control throttle	1
5	3-way valve	1
6	Oil pressure gauge	1
7	Metric speedometer	2
8	Oil temperature gauge	2
9	Fuel gauge	2
10	Voltmeter gauge	2
11	Flexible wiper blade	4
12	Wiper assembly motor	2
13	Primary element	5
14	Secondary element	5
15	Set of 2 V- belts	10
16	Belt set of 3 belts	5
17	Element	25
18	Oil filter cartridge	5
19	Oil seal	5
20	Seal	5
21	Oil cartridge	5
22	Relay	1
23	Breaker circuit	5
24	Breaker	5
25	Inversion valve	1
26	Synchro valve	1
27	Modulating valve	1
28	Repair kit	1
29	Dual treadle valve	1
30	Valve relay	2
31	Air governor	1
32	Switch	2
33	Air chamber	2
34	Front spring assembly	1
35	Brake chamber wedge	2
36	Power steering reservoir	2
37	Hydraulic vane pump	2
38	Link steering gear drag	1
39	Drive shaft steering	1
40	Solenoid valve	1
41	Air chamber clutch	1
42	Spare tire	1
43	Other manufacture-recommended spare parts for the RIV chassis	

## 1.11 TESTS

The Contractor shall conduct the following tests in the presence of the Purchaser and with the following standards. Provided, however, that where matters that can be confirmed by certificates, etc., or by acknowledgment of type in the country of fabrication or by certificates, etc., of inspection authorities that they conform to the laws and specifications of the People's Republic of China, tests may be omitted. Also, presence at fabrication tests at the plant may be partly or completely omitted where examination of documents submitted in advance, such as those for production schedules, quality control conditions, internal test facility conditions, etc., of the Contractor, prove to be adequate.

Personnel, facilities, measurement instruments, fire extinguishing chemicals, fuel, consumables, etc., required for the tests shall be provided by the Contractor at his expense.

- a) Fabrication test at the plant
  - 1) Equipment simple substance test
  - 2) Pressure proof test
  - 3) Structure and functioning test
  - 4) Travel performance test
    - i) Maximum speed performance test
    - ii) Acceleration performance test
    - iii) Low-speed travel discharge performance test
    - iv) Climbing performance test
    - v) Sideways inclination test at a standstill
    - vi) Braking performance test
    - vii) Turning, load distribution test
  - 5) Fire extinguishing performance test (water discharge, foam discharge for formation of an aqueous membrane)
    - i) Fire extinguisher equipment performance test (confirmation by simultaneous discharge of all nozzles)
    - ii) Discharge quantity test (each nozzle, dry chemical fire extinguishing system)
    - iii) Discharge performance test (each nozzle, dry chemical fire extinguishing system)
- b) Acceptance test
  - 1) Structure and operation test
  - 2) Travel performance test
    - i) Maximum speed performance test
    - ii) Acceleration performance test
    - iii) Low-speed travel discharge performance test
  - 3) Fire extinguishing performance test
    - i) Water discharge test



## 2. MAJOR RESCUE AND FIRE FIGHTING VEHICLE (MJV)

### 2.1 GENERAL

- a) The MJV shall be adopted in accordance with Annex 14 and Airport Service Manual, Part 1 "Rescue and Fire Fighting" of the International Civil Aviation Organization (ICAO): Doc. 9137-AN898.
- b) The MJV shall be available for the rescue of aircraft passengers and crews, to fight aircraft fires, and for general fire fighting purposes.
- c) The operational objective of the rescue and fire fighting service should be to achieve a response time of not more than three minutes to the end of the runway in optimum visibility and surface conditions.
- d) The MJV shall have a chassis with an allowable gross vehicle weight not over 42 tons with all-wheel-drive from a rear-mounted diesel engine, a 10,000-liter water tank, a 1,200-liter chemical tank, a 250 kg-dry chemical fire extinguisher, a means of controlling the turret nozzle from the cabin, and be equipped with the required accessories for fire fighting and rescue work.
- e) All couplings system shall be complied with Chinese Industrial Standards or equivalent standards.
- f) A mobile radio communication system shall be provided and mounted on the MJV.
- g) Four units of the MJV shall be supplied.

### 2.2 VEHICLE PERFORMANCE AND REQUIREMENTS

According to ICAO recommendations, the MJV shall meet the following performance requirements.

- a) Acceleration: 0 ~ 80 km/h within 40 sec.
- b) Top speed (maintainable on a road): Not less than 100 km/h
- c) Service brake: Capable of bringing the fully loaded vehicle to a hold on a 50% gradient
- d) Dimensions and weight, etc.
  - 1) Overall length: Not more than 12,000 mm
  - 2) Overall width: Not more than 3,100 mm
  - 3) Overall height: Not more than 3,800 mm
  - 4) Ground clearance: Not less than 350 mm
  - 5) Minimum turning radius: Not greater than 30 m
  - 6) Approach angle: Not less than 30°
  - 7) Departure angle: Not less than 30°
  - 8) Minimum angle of tilt (static): Not less than 28°
  - 9) Gross vehicle weight: Not more than 42 tons

## 2.3 CHASSIS

- a) Engine: Rear-mounted engine  
2 or 4 cycle water-cooled diesel engine of not less than 400 HP  
SAE 400 HP (SAE J1349 gross brake power)
- b) Transmission: Automatic  
4 or 5 speed forward, 1 reverse
- c) Mode of drive: All-Wheel-Drive
- d) Steering: Center or left hand steering, power assisted
- e) Brakes  
: Main brakes: Pneumatic with ABS (Anti-Skid-Braking-System)  
: Parking brake: Pneumatic
- f) Suspension: Front and back suspension  
2-level shock absorbers on the front
- g) Removal hatch: On the engine compartment
- h) Tires and wheels: Single wheels on both the front and rear
- i) Electric equipment  
: Alternator Not less than 12 V or 24 V, 100 A  
: Battery Not less than 12 V or 24 V, 200 A

## 2.4 CABIN

- a) General  
The cabin shall have a seating capacity, with seat belts, for 3 persons, including the driver. The driver's seat shall be separate and located in the center on the left side of the cabin. Both sides of the cabin shall be designed for quick entrance, and a large door with a handrail and a step shall be provided. The windows shall be made of safety glass. Cabin noise and vibration shall be kept to a minimum.
- b) Construction  
For the safety of the crew, water-tight construction and metals of sufficient strength shall be used in the cabin's fabrication. The cabin shall be equipped with an overhead hatch of sufficient size to allow the crew access to the turret nozzle during an emergency.
- c) Equipment operation from the cabin  
When necessary the following equipment shall be operable from the cabin, even during fire fighting.
  - 1) Lighting equipment and indicators
    - i) Direction indicator board
    - ii) Cab light
    - iii) Front headlights on both sides
    - iv) Rotating red lamp (bar-type, on the body)
    - v) Search light
    - vi) Public address system (siren and loud speaker, on the body)

vii) Mobile radio communication system

- ① The VHF AM-transceiver specified shall be mounted on the MJV of the airport and shall be used for air-ground communications.
- ② The equipment shall be completely solid state and compact.
- ③ The equipment shall be provided with 10 preset channels.
- ④ The equipment shall be operated with DC 12 V.
- ⑤ The equipment shall meet the standards and recommendations of the ICAO Annex 10.

2) Indicators and operator controllable devices

- i) Fuel gauge
- ii) Engine water temperature gauge
- iii) Differential lock switch
- iv) Main switch attachment
- v) Engine throttle
- vi) Windshield wiper and washer controls
- vii) Low air pressure warning indicator or buzzer
- viii) Air pressure gauge
- ix) Air conditioning and defroster switch
- x) Transmission oil temperature gauge
- xi) Ignition switch
- xii) Voltmeter
- xiii) Speedometer (km/h)
- xiv) Tachometer with hour meter

2.5 EQUIPMENT STORAGE COMPARTMENTS

The equipment storage compartments shall have wide doors and enough space to comfortably store equipment. A ladder or step shall be installed for access to the top of the body.

2.6 FIRE FIGHTING EQUIPMENT

a) General

The MJV shall have a water tank, foam liquid tank, monitor turret for discharging water and foam solution, power-take-off driven water pump, and foam system for mixing water and foam liquid.

b) Monitor turret

This turret nozzle shall discharge both water and foam solution and shall be controlled from the cabin by an electrical or hydraulic lever.

1) Discharge rate

- : High: Not less than 4,000 liters/min.
- : Low: Not less than 2,000 liters/min.

- 2) Discharge distance: Not less than 70 m (straight stream, no wind)
- 3) Discharge width: Not less than 10 m (dispersed)
- 4) Horizontal sweep: Not less than 200\_ (right: 100\_, left: 100\_)
- 5) Vertical travel
  - : Elevation: Not less than 45\_
  - : Depression: Not less than 20\_

c) Fire pump

The power-take-off driven 2- or 3-stage centrifugal fire pump with automatic primer shall be controlled from the cabin. A power divider shall be provided for engaging the power-take-off while the vehicle is running.

1) Materials

- : Body: Bronze casting
- : Impeller: Bronze casting
- : Pump shaft: Stainless steel

2) Discharge rate: Not less than 6,000 liters/min. at 16 kg/cm<sup>2</sup>

3) Suction inlet:

One (1) suction inlet of a nominal 100 mm (approx. 4 inches) thread coupling shall be provided. It shall be placed on one side of the vehicle at approx. 1.2 meters from the ground.

4) Discharge valve (outlet):

Two (2) discharge valves of a nominal 65 mm (approx. 2.5 inches) instantaneous coupling shall be provided. It shall be placed one on each side of the vehicle at approx. 1.2 meters from the ground.

5) Removal panel for the pump:

It shall be installed on the body.

d) Water tank

It shall be used to make foam solution and shall be independent of the vehicle body. A removal panel shall be installed on the water tank.

1) Capacity:

Not less than 10,000 liters

2) Materials

Steel plate or stainless steel plate or aluminum light alloy or fiberglass.

3) Water level gauge:

It shall be placed in the cabin where it can be referred to.

4) Four (4) tank fill connections of a nominal 65 mm (approx. 2.5 inches) shall be provided in a position where they can easily be reached from the ground.

e) Foam liquid tank

The foam liquid tanks shall be used to make foam solution (AFFF) and shall be independent of the vehicle body. The removal panel shall be installed on the foam liquid tank.

1) Capacity:

Not less than 1,200 liters (AFFF)

- 2) Materials:  
Steel plate or stainless steel plate or aluminum light alloy or fiberglass.
  - 3) Level gauge:  
They shall be placed in the cabin where it can be referred to.
  - 4) Flushing device:  
It shall be installed for cleaning the piping and pump.
- f) Hose reel  
One (1) hose reel and rubber hose (nominal 25 mm x 30 m) with a gun nozzle shall be installed on each side of the compartment.
- 1) Discharge distance: Not less than 15 m.
  - 2) Discharge capacity: Not less than 200 liters/min. (each nozzle)
- g) Under-the-truck nozzle  
The under-the-truck nozzle shall be controlled from the cabin.
- 1) Quantity: 2
  - 2) Discharge rate: In total, not less than 150 liters/min.
- h) Bumper turret  
The bumper turret shall be controlled from the cabin.
- 1) Quantity: 1
  - 2) Discharge rate: Not less than 400 liters/min.
  - 3) Discharge width: Not less than 6 m
  - 4) Discharge distance: Not less than 40 m
  - 5) Horizontal sweep: Not less than 180\_ (Right 90\_, Left 90\_)
  - 6) Vertical travel
    - Elevation: Not less than 45\_
    - Depression: Not less than 20\_
- i) Dry chemical fire extinguisher
- 1) An ABC-type dry chemical fire extinguisher shall be mounted on the MJV.
  - 2) Capacity:  
Not less than 250 kg
  - 3) Propellant (N<sub>2</sub> gas or CO<sub>2</sub> gas):  
The propellant agent shall be N<sub>2</sub> or CO<sub>2</sub> gas and it shall provide a sufficient quantity of gas to expel all the dry chemical powder.
  - 4) Hose reel for discharging:  
The MJV shall be equipped on each side with a hose reel and hose (nominal 19 mm x 30 m).
  - 5) Discharge rate:  
Not less than 2 kg/sec.

## 2.7 COATING

The MJV shall be coated with a coating that is not oxidized by salt or the above foam liquid.

## 2.8 STANDARD FIRE FIGHTING EQUIPMENT

The MJV shall have the following standard fire fighting and rescue equipment.

	Equipment	Quantity
1	Suction hose strainer: nominal 100 mm	1
2	Delivery hose: nominal 65 mm x 18 m	10
3	Basket strainer	1
4	Suction hose spanner	2
5	Suction hose: nominal 100 mm x 3 m	2
6	Water nozzle: nominal 65 mm	2
7	Foam nozzle: nominal 65 mm	2
8	Spare tire and wheel	1
9	Tire pressure gauge	1
10	Tire inflator hose	1
11	Fire extinguisher	1
12	Electric foam liquid pump	1
13	Operation manual	3
14	Service manual	3
15	Parts catalogue	3

2.9 ADDITIONAL EQUIPMENT FOR RESCUE OPERATIONS RECOMMENDED BY THE ICAO

The MJV shall have the following additional equipment for rescue operations as recommended by the ICAO.

	Equipment	Quantity
1	Adjustable wrench	1
2	Rescue axe: small, non-wedge- or aircraft-type	2
3	Crowbar: 1.65 m	1
4	Cold chisel: 2.5 cm	1
5	Flashlight	4
6	Hook: grab- or salving type	1
7	Fire-resistant blanket	1
8	Extension ladder: 11 m	1
9	Extension ladder: 7 m	1
10	Slip-joint pliers: 25 cm	1
11	Tin snips	1
12	Wheel cocks: 15 cm high	1
13	Power rescue saw: complete, with two blades; or, pneumatic rescue chisel: complete, plus a spare cylinder, chisel and retaining spring	1
14	Harness cutting tool	2
15	Breathing apparatus and cylinder	2
16	Spare air cylinder	2
17	Hydraulic or pneumatic forcing tool	1
18	Heat-resistant suits	5
19	Flame-resistant gloves	5

2.10 LIST OF SPARE PARTS FOR MJV

The RIV shall have the following spare parts  
[BODY]

	Part	Quantity
1	Gland packing	1
2	Special stop valve diaphragm	1
3	Special stop valve	1
4	Non-return valve	1
5	Flexible joint	10
6	Flexible tube	1
7	Check valve	1
8	Swivel joint	2
9	Rubber hose	1
10	Packing discharge outlet	10
11	Seal service kit	1
12	Packing suction	2
13	LED lamp valve	5
14	LED lamp valve monitor	5
15	Bulb tank level monitor	8
16	Bulb pump control switch	10
17	Control switch	1
18	Magnetic relay	14
19	Seal kit turret	2
20	Seal kit butterfly valve	1
21	Seal kit discharge cock	1
22	Relay motor siren	1
23	Bulb 24 V - 12 W	12
24	Bulb 24 V - 100 W	2
25	Bulb 24 V - 40 W	5
26	Fuse 5 A	2
27	Fuse 10 A	2
28	Fuse 15 A	2
29	Fuse 30 A	2
30	Pneumatic solenoid valve	4
31	Filter regulator	1
32	Flasher relay	2
33	Door switch	2
34	Circuit protector	2
35	Timer source	1
36	Bulb 28 V - 100 W	1
37	Bulb 24 V - 60 W	2
38	Actuator assembly	1
39	Flasher relay	1
40	Other manufacturer-recommended spare parts for the MJV body	



[CHASSIS]

	Part	Quantity
1	Rear hub	1
2	Shift unit axle	3
3	Brake chamber	4
4	Quick-release valve	2
5	Control throttle	1
6	3-way valve	2
7	Oil pressure gauge	1
8	Metric speedometer	2
9	Oil temperature gauge	2
10	Fuel gauge	2
11	Voltmeter gauge	2
12	Flexible wiper blade	4
13	Wiper assembly motor	2
14	Primary element	15
15	Secondary element	15
16	V- belt set of 2 belts	10
17	Belt set of 3 belts	10
18	Element	35
19	Oil filter cartridge	10
20	Oil seal	10
21	Seal	15
22	Oil cartridge	10
23	Relay	3
24	Breaker circuit	5
25	Breaker	5
26	Gasket	4
27	Inversion valve	1
28	Synchro valve	1
29	Modulating valve	1
30	Repair kit	1
31	Dual treadle valve	1
32	Valve relay	2
33	Air governor	1
34	Switch	2
35	Air chamber	2
36	Front spring assembly	1
37	Brake chamber wedge	2
38	Power steering reservoir	2
39	Hydraulic vane pump	2
40	Link steering gear drag	1
41	Drive shaft steering	1
42	Solenoid valve	1
43	Chamber air clutch	1
44	Spare tire	1
45	Other manufacturer-recommended spare parts for the MJV chassis	

## 2.11 TESTS

The Contractor shall conduct the following tests in the presence of the Purchaser and with the following standards. Provided, however, that where matters that can be confirmed by certificate, etc., or by acknowledgment of type in the country of fabrication or by certificate, etc., checks by inspection authorities that they conform to the laws and specifications of the People's Republic of China may be omitted. Also, presence at fabrication tests at the plant may be partly or completely omitted where examination of documents submitted in advance, such as those for production schedules, quality control conditions, internal test facility conditions, etc., of the Contractor, prove to be adequate.

Personnel, facilities, measurement instruments, fire extinguishing chemicals, fuel, consumables, etc., required for the tests shall be provided by the Contractor at his expense.

- a) Fabrication test at the plant
  - 1) Equipment simple substance test
  - 2) Pressure proof test
  - 3) Structure and functioning test
  - 4) Travel performance test
    - i) Maximum speed performance test
    - ii) Acceleration performance test
    - iii) Low-speed travel discharge performance test
    - iv) Climbing performance test
    - v) Sideways inclination test at a standstill
    - vi) Braking performance test
    - vii) Turning, load distribution test
  - 5) Fire extinguishing performance test (water discharge, foam discharge for formation of an aqueous membrane)
    - i) Fire extinguisher equipment performance test (confirmation by simultaneous discharge of all nozzles)
    - ii) Discharge quantity test (each nozzle, dry chemical fire extinguishing system)
    - iii) Discharge performance test (each nozzle, dry chemical fire extinguishing system)
- b) Acceptance test
  - 1) Structure and operation test
  - 2) Travel performance test
    - i) Maximum speed performance test
    - ii) Acceleration performance test
    - iii) Low-speed travel discharge performance test
  - 3) Fire extinguishing performance test
    - i) Water discharge test

### **3. RESCUE TRUCK**

#### **3.1 GENERAL**

- a) This vehicle shall be available for the rescue of aircraft passengers and crews, and for fighting aircraft fires.
- 1) One unit of the Rescue Truck shall be supplied.

#### **3.2 MAJOR ITEMS**

The structure and performance of the Rescue Truck shall be as follows, and driving operation and inspection and maintenance shall be readily done. Where no provisions are made, they shall be the standard specifications of the manufacturer.

a) Chassis

- 1) Type of chassis: Cab-over-type chassis with cab
- 2) Type of engine: Water-cooled 4 cycle diesel engine
- 3) Capacity: At least 5 persons
- 4) Top speed: Not less than 100 km/h
- 5) Dimensions & weight, etc.
  - Overall length: Not more than 7,600 mm
  - Overall width: Not more than 2,300 mm
  - Overall height: Not more than 3,200 mm
  - Gross vehicle weight: Not more than 9 tons

b) Body

The Rescue Truck shall have a hydraulic winch, lighting device, etc., and shall have required materials and equipment loaded in containers in the body, as well as a 3-stage ladder, etc., loaded on the outside of the body.

- 1) The doors of the containers for equipment and materials shall be of a roller-shutter type.
- 2) Equipment and materials shall be such that they can be readily removed and fixed by means of aluminum case containers and sliding mechanisms, etc. In consideration of operation procedures in the case of an emergency and objective of use and type of equipment and materials used, they shall be stored and laid out accordingly.

## 3.3

## EQUIPPED ITEMS AND LOADED ITEMS

## a) Equipped items

Item	Remarks	Quantity
1) Hydraulic winch	5,000 kg capacity	Lump sum
2) Lighting device		
i) Generator	Output of at least 5KVA	Lump sum
ii) Ascending & descending device	Extension height of at least 4m (from ground)	Lump sum
iii) Floodlight projector	At least 4 halogen floodlights	Lump sum
iv) Operation distribution board		Lump sum
3) Electrical equipment		
i) Electronic siren	W/loud speaker	Lump sum
ii) Scatter-type alarm lamp	For electronic siren W/speaker enclosed	Lump sum
iii) Power source for radio equipment loaded on vehicle	DC-DC converter (at least 12 V 10 A)	Lump sum
4) Other standard equipment		Lump sum

b) Loaded items

Item	Quantity required
<p>1) General fixtures for rescues</p> <ul style="list-style-type: none"> <li>i) Ladder w/lock</li> <li>ii) 3-stage ladder</li> <li>iii) Metal folding ladder or wire ladder</li> <li>iv) Pneumatic rescue mattress or rescue screen</li> <li>v) Life saving rope firing gun</li> <li>vi) Survivor sling or rescue binding belt</li> <li>vii) Flat stretcher</li> <li>viii) Rope</li> <li>ix) Karabiner</li> <li>x) Pulley</li> </ul>	<p>1 1 1 1 1 1 1 200 m x 2 20 5</p>
<p>2) Fixtures for removing heavy objects</p> <ul style="list-style-type: none"> <li>i) Hydraulic jack</li> <li>ii) Hydraulic spreader</li> <li>iii) Portable winch</li> <li>iv) Lump sum of mat-type pneumatic jack</li> <li>v) Large pneumatic hydraulic spreader</li> <li>vi) Wire rope</li> </ul>	<p>1 1 1 1 1 2 ~ 3</p>
<p>3) Cutting tools</p> <ul style="list-style-type: none"> <li>i) Cutting machine</li> <li>ii) Engine cutter</li> <li>iii) Gas melting cutter</li> <li>iv) Chain saw</li> <li>v) Steel wire cutter</li> <li>vi) Pneumatic saw</li> <li>vii) Large pneumatic hydraulic cutter</li> </ul>	<p>1 1 1 1 1 1 1</p>
<p>4) Demolition tools</p> <ul style="list-style-type: none"> <li>i) Universal axe</li> <li>ii) Hammer</li> <li>iii) Rock drill</li> <li>iv) Hammer drill</li> </ul>	<p>2 ~ 3 1 1 1</p>
<p>5) Measurement instruments</p> <ul style="list-style-type: none"> <li>i) Flammable gas measurement instrument</li> <li>ii) Poisonous gas measurement instrument</li> <li>iii) Oxygen concentration measurement instrument</li> <li>iv) Radioactive ray measurement instrument</li> </ul>	

6)	Respiratory devices	
i)	Air breathing device (spare cylinder and replenishing cylinder)	5 6
ii)	Oxygen breathing device (spare cylinder)	5 5
iii)	Simple breathing device	2~3
iv)	Air blower and exhaust device	1
v)	Dustproof mask	5
7)	Equipment for crew protection	
i)	Insulated gloves	5
ii)	Insulated clothes	2~3
iii)	Insulated pants	2~3
iv)	Insulated boots	2~3
v)	Anti-gas clothes	2~3
vi)	Leather gloves	5
vii)	Safety belt	5
8)	Other rescue tools	
i)	Lump sum of flood light projectors	
ii)	Portable loud speaker	
iii)	Portable radio	
iv)	First aid kit	
v)	Lump sum of other portable rescue equipment	
vi)	Fire ladder	

#### 3.4 ACCESSORIES AND SPARES

Item	Remarks	Quantity
a)	Spare tire	1 set
b)	Cord for keeping lubricant warm	Type-2 cabtyre cable: 10m 1 no.
c)	Paint for repairs	1 can
d)	Light bulb for floodlight projector	500W halogen sealed beam 2 no.
e)	Various light bulbs	Lump sum
f)	Various fuses	Lump sum
g)	Other standard accessories	Lump sum

### 3.5 TESTS

The Contractor shall conduct tests on the following items in the presence of the Purchaser. Provided that items which can be confirmed from certificates as conforming to the laws and specifications of the People's Republic of China and items which can be confirmed from acknowledgment of type in the fabrication drawings or from certificates of inspection authorities, tests may be omitted:

a) Structure and operation test

The structure and operation test of the vehicles shall confirm that the test satisfies all contents of items provided for in the preceding item 3.2.

b) Equipped items and loaded items

Equipped items and loaded items shall be checked to see whether they meet the content requirements for each item provided for in the preceding items 3.3 and 3.4.

## 4. DRY CHEMICAL FIRE EXTINGUISHER VEHICLE

### 4.1 GENERAL

- a) This vehicle shall be available for fire fighting with a dry chemical fire extinguisher.
- b) One unit of this vehicle shall be supplied.

### 4.2 PERFORMANCE

- a) Running performance
  - 1) Acceleration: 0 ~ 80 km/h within 40 sec.
  - 2) Top speed: Not less than 90 km/h
- b) Fire extinguishing performance
  - 1) Discharge rate (dry powder) Not less than 15 kg/sec.

### 4.3 STRUCTURE

The structure shall conform with the following provisions and shall readily enable driving and operation and inspection and maintenance, as well as have sufficient strength and durability.

- a) Dimensions and weight, etc.
  - 1) Overall length Not more than 7,100 mm
  - 2) Overall width Not more than 2,500 mm
  - 3) Overall height Not more than 3,660 mm
  - 4) Passenger capacity 3 persons
  - 5) Gross vehicle weight Not more than 11 tons
- b) Chassis
  - 1) The chassis shall be of solid frame construction, and when loaded the chassis frame shall be strong enough to withstand the maximum bending stress intensity.
  - 2) The engine shall have an output, torque and number of revolutions sufficient to demonstrate vehicle performance.
- c) Operator compartment  
The operator compartment shall have sufficient strength, durability and heat proofing to ensure the safety of the operator.
- d) Fire extinguishing system
  - 1) A twin agent system shall be installed on the vehicle.
  - 2) Capacity:

Pre-mix container	Not less than 1,000 liters
Dry powder container	Not less than 1,000 kg
  - 3) Propellant (N<sub>2</sub> gas or CO<sub>2</sub> gas):



The propellant agent shall be N<sub>2</sub> or CO<sub>2</sub> gas and it shall provide a sufficient quantity of gas to expel all the dry chemical powder.

4) Twin agent turret nozzle

The twin agent turret nozzle shall be controlled from the cabin.

Discharge rate: Foam Not less than 1,800 liters/min

: Dry powder Not less than 800 kg/min

5) Twin agent handling nozzle

Discharge rate: Foam Not less than 190 liters/min

Dry powder Not less than 100 kg/min

#### 4.4 EQUIPPED ITEMS, ACCESSORIES AND SPARES

As per the standard specifications of the manufacturer.

#### 4.5 TESTS

The Contractor shall conduct tests on the following items in the presence of the Purchaser:

Provided, however, that items which can be confirmed by certificate, etc., to conform with the laws and specifications of the People's Republic of China and items which can be confirmed by acknowledgment of type in manufacturer's country or by certificate, etc., of testing institutions, may be omitted.

Prior to testing in the presence of the Purchaser, the Contractor shall submit internal test performance records to the Purchaser for his approval.

Personnel, equipment, measurement instruments, fuel, consumables, etc., shall be provided by the Contractor at his expense.

a) Structure and functioning test

The structure and functioning test of the dry chemical fire extinguisher vehicle shall confirm that all contents of each item provided for in the preceding item 6.3 are satisfied in both unloaded and fully loaded states.

b) Running performance

The running performance test shall confirm that all contents of each item provided for in the preceding item 4.2 are satisfied in both unloaded and fully loaded states.

## 5. AMBULANCE (I)

### 5.1 GENERAL

- a) This vehicle is generally used for ambulance and medical services in emergency situations.
- b) Two units of the Ambulance are to be supplied.

### 5.2 VEHICLE PERFORMANCE AND REQUIREMENTS

This Ambulance shall have the following performance and meet the following requirements.

- a) Dimensions and weight, etc.
  - 1) Overall length: Less than 5,400 mm
  - 2) Overall width: Less than 1,700 mm
  - 3) Overall height: Less than 2,500 mm
  - 4) Vehicle weight: Approx. 2,100 kg
  - 5) Gross vehicle weight: Approx. 2,540 kg
- b) Top speed: Not less than 100 km/h
- c) Turning radius (Min.): Not more than 5 m
- d) Climbing ability (Max.): Not less than  $\tan \theta = 0.6$

### 5.3 CHASSIS

The chassis of the Ambulance shall meet the following performance requirements.

- a) Engine
  - 1) Type: 4 stroke-cycle water-cooled, petrol (gasoline) or diesel engine
  - 2) Piston displacement: Not less than a nominal 2,000 cc
  - 3) Max. output : Not less than 100 PS/5000rpm
  - 4) Max. torque : Not less than 17 kg m/rpm
- b) Transmission: Automatic, semi-automatic or manual, 4 or 5 speeds forward, 1 reverse
- c) Mode of drive: 4-Wheel-Drive (4WD)
- d) Steering: Left hand

### 5.4 EQUIPMENT

Equipment other than the following shall meet the manufacturer's standard specifications:

- a) Light scattering rotary lamp (built-in electronic siren speaker) Lump sum
- b) Front air conditioner, rear overhead cooler Lump sum
- c) Ignition prevention unit Lump sum

5.5 ACCESSORIES

The accessories shall meet the manufacturer's standard specifications.

## **6. RESCUE COMMANDER'S VEHICLE**

### **6.1 GENERAL**

- a) This vehicle is generally used as the rescue commander's vehicle in emergency situations.
- b) One unit of the commander's vehicle is to be supplied.

### **6.2 VEHICLE PERFORMANCE AND REQUIREMENT**

- a) Dimensions and weight, etc.
  - 1) Overall length: Less than 4,900 mm
  - 2) Overall width: Less than 1,850 mm
  - 3) Overall height: Less than 2,000 mm
  - 4) Vehicle weight: Approx. 2,100 kg
  - 5) Gross vehicle weight Approx. 2,600 kg
- b) Top speed: Not less than 120 km/h
- c) Turning radius (Min.): Not more than 7 m
- d) Climbing ability (Max.): Not less than  $\theta = 0.6$

### **6.3 CHASSIS**

- a) Type of chassis 4-Wheel Drive van vehicle
- b) Engine  
The engine shall have an output, torque and number of revolutions sufficient to demonstrate performance.
- c) Capacity At least 4 persons

### **6.4 EQUIPPED ITEMS**

Other than the following, the equipped items shall meet the manufacturer's standard specifications:

- a) Light scattering rotary lamp (built-in electronic siren speaker)
- b) Electronic siren (w/loud speaker)
- c) Front air conditioner
- d) Surgical lamp (10 W)
- e) Ignition prevention unit

### **6.5 ACCESSORIES**

The accessories shall meet the manufacturer's standard specifications.

## 7. MEDICAL SERVICES VEHICLE

### 7.1 GENERAL

- a) The medical services vehicle shall convey medical services equipment to the site of aircraft accidents where there are emergencies and shall become a key element in rescues. The vehicle shall be large enough to deal with 60 persons.
- b) One unit of this vehicle is to be supplied.

### 7.2 PERFORMANCE

- a) Running performance
  - 1) Acceleration: 0 ~ 80 km/h within 65 sec.
  - 2) Top speed (maintainable on the road): Not less than 90 km/h

### 7.3 STRUCTURE

The structure of the Medical Services Vehicle shall be in accordance with the following provisions and shall be such that it will readily enable driving, operation and inspection and maintenance, as well as have sufficient strength and durability.

- a) Dimensions and weight, etc.
  - 1) Overall length: Not more than 8,000 mm
  - 2) Overall width: Not more than 2,500 mm
  - 3) Overall height: Not more than 3,500 mm
  - 4) Gross vehicle weight: Not more than 8 tons
  - 5) Capacity: 3 persons
- b) Chassis

The chassis shall be of a solid frame construction, and when loaded be strong enough to withstand the maximum bending stress intensity.
- c) Engine

The engine shall have an output, torque and number of revolutions sufficient to demonstrate performance of the Medical Services Vehicle.

  - 1) Type of engine: Water-cooled diesel engine
  - 2) Cycle 4
  - 3) Starting mode: D-C motor driven (DC 24 V)
  - 4) Cooling mode: Water-cooling by means of closed forced circulation
  - 5) Exhaust system:
    - i) The exhaust system shall be of construction so as not to cause inadequate backing pressure
    - ii) The tail pipe shall be of a construction that enables the discharge of exhaust gas upward or out the rear, and it shall be installed in a position where it will not interfere with the provision of first aid services.

- iii) The exhaust pipe and muffler shall be of such a construction that no damage will be sustained even when traveling on uneven terrain.
    - iv) The ignition prevention unit shall be installed at the end of the exhaust system.
  - d) **Steering wheel system**  
The steering wheel shall be installed on the left side as the operator takes a seat in the driver's compartment.
  - e) **Wheels**  
All tires shall be tubeless and the tread pattern shall be appropriate for traveling on paved roads and uneven terrain.
  - f) **Carrier bed, etc.**
    - 1) Carrier bed of medical service vehicle shall be aluminum pan type construction and shall have sufficient space to load medical equipment and materials.
    - 2) Inner plate of carrier bed shall have sufficient strength against shock by medical equipment and materials.
    - 3) The carrier bed shall be of such a construction that no water or dust will enter in situations where all openings are closed.
    - 4) The height of the floor surface at the rear part of the carrier bed shall be 1,100 mm as the standard in an unloaded state.
  - g) **Doors, etc.**
    - 1) Surfaces on both sides of the carrier bed of the Medical Service Vehicle shall have a door so that all side surfaces of the carrier bed can be opened, with the exception of the main pole of the carrier bed.
      - i) Two doors shall be installed, and they shall be about equally divided against the total length of the side face of the carrier bed.
      - ii) The doors shall be constructed such that they can be opened upward 90° with the other door touching the ground.  
The doors shall be able to be opened and closed by motor or hydraulically, and in the event of power failure, they should also be able to be operated manually.  
The speed of door opening and closing shall be such that safety can be ensured.
      - iii) The door operation devices on both sides shall be installed near the lower parts on both sides of the front part of the carrier bed on the right side for the door on the right side and on the left side for door on the left side, respectively.  
These operation devices shall have two independent power or manual locking functions and an alarm that gives warnings for door opening and closing by means of a continuous sound or intermittent sound, or by means of voice generation, etc.
      - iv) Steps which workers can safely go up and down when moving in or out medical services equipment or materials or conducting rescue

operations, shall be provided inside the doors on both side faces of the carrier bed.

- ① The steps shall be provided along the whole width of the shelf for the loading of medical services equipment or materials, and the riser and tread shall be of such a size that workers can easily go up and down.
  - ② The steps shall have strength to withstand the weight of workers going up and down.
  - ③ The steps shall have a non-slip coating, etc., as required.
- h) Loading shelf for medical services equipment and materials and the layout of loaded items
- 1) In the carrier beds of the Medical Service Vehicle, shelves, etc., for loading medical services equipment and materials shall be provided. Frames shall be steel and shelf boards shall be wooden with anti-corrosive coatings.
  - 2) Shelves shall be rigidly fixed to the carrier bed and have sufficient strength to withstand the load of medical services equipment and materials and movement of the vehicle.
  - 3) To prevent the shelves from the falling of loaded items due to vibration from vehicle movement or the moving of items, appropriate protective measures shall be taken.
  - 4) The standard layout of medical services equipment and materials loaded on the carrier bed is shown in Table 1, which is separately attached.
- i) Electrical devices
- ① Standard voltage  
The standard voltage of the Medical Services Vehicle shall be DC 24 V with (-) grounding.
  - ② Power source
    - i) The output of the alternator on the vehicle engine shall be at least 40 A.
    - ii) In addition to the aforementioned alternator, the vehicle engine shall have an AC generator (AC 100 V, at least 3.5 kW) for lamps to light the area around the Medical Services Vehicle.
    - iii) The storage batteries to be equipped on the Medical Services Vehicle shall be the storage batteries for the vehicle (at least 120 Ah 2 ea.).
    - iv) A convenient receptacle socket (DC 24 V, at least 20 A) shall be provided in the Medical Services Vehicle for an outside DC source for charging the storage batteries. The receptacle socket shall be sufficiently weatherproof during travel and rescue operations, and construction shall be such that no wrong connections can be made. The plug connected to the receptacle socket shall be constructed such that it automatically drops when the engine is started, and can also be removed manually.
    - v) As the power source for radio equipment loaded on the Medical Services Vehicle, a DC-DC converter (12 V, at least 10 A) shall be provided in an adequate location in the operator compartment.

The connection terminal shall be a convenient outlet-type.

- 3) Lighting devices
  - i) Illumination lamps for operations
    - ① On the upper parts of both side faces of the Medical Services Vehicle incandescent lamps (AC 100 V, at least 500 W/ea.) shall be provided so that lighting operations can be handled from outside the vehicle near the operator compartment.
    - ② Incandescent lamps (AC 100 V, at least 500 W/ea.), 1 ea. on the right and left, respectively, on the upper parts of the front side faces, and 2 ea. on the upper parts suitable at the rear of the trailer.
    - ③ The intensity of the illumination shall be at least 25 lx above the ground 10 m ahead.
  - ii) Illumination lamp in the carrier bed

On the carrier bed of the Medical Services Vehicle, a DC fluorescent lamp (with protective cover) shall be provided.

This lamp shall be operated by means of switches at each door and the main switch of this circuit shall be provided in operator compartment and on the carrier bed.
- 4) Electrical parts
  - i) The Medical Services Vehicle shall have a microphone with a curl cord (with a manual switch) and a loud speaker system (output 60 W with a volume adjuster) which will be provided at a suitable location in the operator compartment and with a speaker on the roof of the operator compartment.
  - ii) A red alarm lamp indicating when the carrier bed door is open shall be provided in the operator compartment. The alarm lamp may be used for a lighting switch of each door.
  - iii) The Medical Services Vehicle shall have a buzzer that actuates when the vehicle is backed up.
  - iv) The Medical Services Vehicle shall have a rack for radio equipment, a rack for the aerial antenna, and a conduit for running high-frequency coaxial cable (with running wire).
- 5) Electric wiring
  - i) The electric wiring used in the Medical Services Vehicle shall be the low voltage wire for vehicles, or better, and shall have a sufficient cross-sectional area of a capacity that conforms to the specifications of the electrical equipment used.

However, the electric wiring of circuits that require AC 100 V and 200 V shall be excepted.
  - ii) Terminals for wiring and electrical parts shall be wiring terminals for vehicles, or better.
  - iii) The main circuit and branch circuits shall have wiring circuit breakers



of a capacity that conforms to the respective electric power used.  
To prevent electrical equipment, wiring, etc., from burning, fusible links, etc., of adequate capacity shall be provided.

iv) In principle, wirings shall have wire numbers and be finished with vinyl tubes or vinyl adhesive tape, etc., which shall be suitably bundled and fixed to the body of the vehicle with a protective material.

6) Others

All electrical parts and wirings, etc., to be installed in the Medical Services Vehicle shall have no interference with radio equipment being used for communication.

#### 7.4 LOADED ITEMS AND SPARES

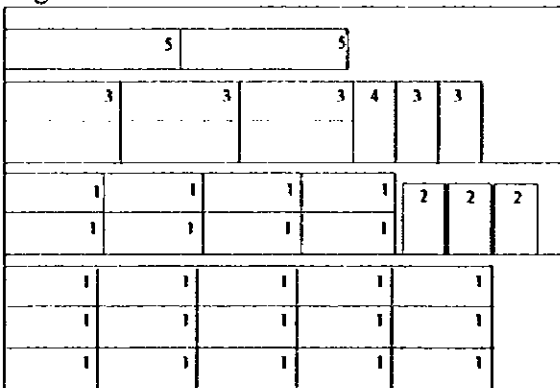
- a) The following medical equipment and materials on the separately attached Table 1 shall be loaded on the carrier bed in order to deal with 60 persons at an airport.
- b) In addition to the loaded equipment on the carrier bed, medical services equipment and materials, including stretchers, for dealing with 130 persons shall be stored as spares.

Table 1, separately attached.

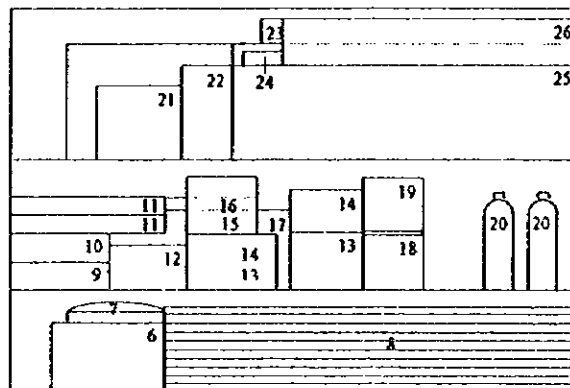
Example of the layout of medical services equipment and materials.

1. Blanket
2. Cord reel (30 cm)
3. Gloves (plastic)
4. Cord reel (50 cm)
5. Chair
6. Resuscitator
7. Wash bowl
8. Separate-type stretcher
9. Motorized aspirator
10. Caldiroscope (proper and power source)
11. Identification tag
12. Electronic cardiograph
13. Grape sugar solution
14. Ringer's lactic acid solution
15. Handy light
16. Identification tag recovery box (small)
17. Instillation stand for bed
18. Stanching band, packet mask
19. Splint for neck fixing
20. Oxygen cylinder
21. Spare tank for generator
22. Generator (proper)
23. Rotary alarm lamp
24. Rotary alarm lamp stand
25. Decompression-type fixed stretcher
26. Lamp holder
27. Rope
28. Artificial resuscitator
29. Narrow-type stretcher
30. Instillation set
31. Folding-type stretcher
32. Folding-type stretcher with roller
33. Gloves (leather)
34. First aid medical services set
35. Canvas bed
36. Tent assembly set
37. Flow meter
38. Rubber tape
39. Sand bag
40. Pipe stick
41. Pole for tent assembly set
42. Hammer
43. CPR board
44. Tent assembly canvas
45. Desk
46. Transistor megaphone
47. Splint set
48. Fluorescent lamp
49. Flag (including pole)

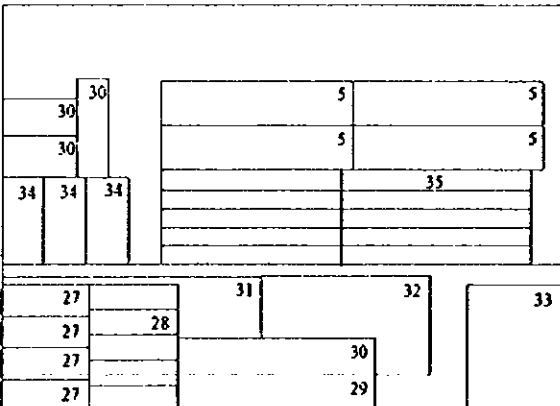
Right rear



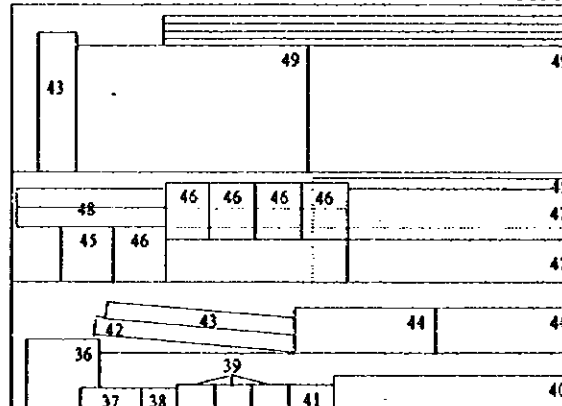
front



Left front



rear



7.5 Accessories

The following accessories shall be standard and items that conform to the Medical Services Vehicle shall be added.

a) Tools

Item	Specifications	Quantity
1) Tools for assembling and disassembling For the vehicle proper	Tools required for daily inspections and maintenance	1 set
2) Charging device	Input AC 100 V; output DC 24 V, 20 A	1 unit
3) Cord for charging storage batteries	2 core 2.0 mm <sup>2</sup> 2 cabtyre cable 10m	1 - no.
4) Operation lamp	DC 24 V 40 W; AC 100 V, 60 W (bulb protective metal w/cabtyre cable 6 m)	1 - ea.

b) Fluorescent lamp

Removable magnetic red rotating lamp 1 ea.  
(which should be seen easily from a distance of 300 m)

c) Fire extinguisher ABC 10-type for the vehicle 1 ea.

7.6 TESTS

The Contractor shall conduct tests on the following items in the presence of the Purchaser. Provided, however, that where matters that can be confirmed by certificates, etc., or by acknowledgment of type in the country of fabrication or by certificates, etc., of inspection authorities that they conform to the laws and specifications of the People's Republic of China, tests may be omitted..

Also, prior to the conducting of tests in the presence of the Purchaser, the Contractor shall submit internal test performance records and obtain approval of the Purchaser. Personnel, equipment, measurement instruments, fuel, consumables, etc., required for tests shall be provided by the Contractor at its expense.

a) Construction and functioning tests

The construction and functioning tests of the Medical Services Vehicle shall confirm that the contents of all items provided for in 7.2 above are satisfied, in unloaded and fully loaded states.

b) Running performance

The running performance test shall confirm that all contents of each item provided for in the preceding item 7.2 are satisfied both in unloaded and fully loaded states.

## 8. CHEMICAL FIRE ENGINE

### 8.1 GENERAL

- a) The Chemical Fire Engine shall be available for the rescue of aircraft passengers and crews, fighting aircraft fires, and for general fire fighting.
- b) The Chemical Fire Engine shall be made in the People's Republic of China and shall meet the standard specifications of the manufacturer, except for the following performance and standards:
- c) One unit of the Chemical Fire Engine is to be supplied.

### 8.2 PERFORMANCE

- a) Running performance
  - 1) Acceleration: 0 ~ 80 km/h within 40 sec.
  - 2) Top speed: Not less than 90 km/h
  - 3) Service brake: Capable of bringing the fully loaded vehicle to a hold on a 50% gradient.
- b) Fire extinguishing performance
  - 1) Turre  
The turret nozzle shall discharge boss water and foam solution and shall be controlled from the cabin.
    - i) Discharge rate: Not less than 48 liters/sec (water)  
Not less than 300 liters/sec(foam)
    - ii) Discharge distance: Not less than 60 m (water)  
Not less than 55 m (foam)

### 8.3 CONSTRUCTION

Construction of Chemical Fire Engine shall meet the following provisions, be such that driving, operation and inspection and maintenance can be done readily, and shall have sufficient strength and durability:

- a) Dimensions and weight, etc.
  - 1) Overall length: Not more than 8,000 mm
  - 2) Overall width: Not more than 2,550 mm
  - 3) Overall height: Not more than 3,400 mm
  - 4) Passenger capacity: 6 persons
  - 5) Gross vehicle weight: Not more than 16 tons
- b) Chassis
  - 1) The chassis of the Chemical Fire Engine shall have a rigid frame construction, and the chassis frame in a fully loaded state shall have sufficient strength to withstand the maximum bending stress intensity.

- 2) Engine  
The engine shall have an output, torque and number of revolutions so that the vehicle can sufficiently demonstrate its performance.
- 3) Power transmission system for the fire extinguisher
  - i) The power transmission system for the fire extinguisher shall be such that the water pump can be driven and operated with sufficient durability either at stand still or while the vehicle is in motion and shall cause no excess heat generation nor abnormal vibration and noise during operation.
  - ii) Inspection and maintenance of the power transmission system for the fire extinguisher shall be able to be done readily.
- c) Operator cabin  
The operator cabin shall have sufficient strength, durability and heat resistance to ensure the safety of crews.
- d) Fire extinguishers
  - 1) Water pump
    - i) The water pump shall be such that stable continuous operation can be done without abnormal vibration, noise, leakage or excess heat generation.
    - ii) Standard water discharge capacity At least 3000 liters/min
  - 2) Water storage tank  
Loading capacity shall be at least 4,500 liters.
  - 3) Chemical foam tank  
Loading capacity shall be at least 1,500 liters.

#### 8.4 EQUIPPED ITEMS, ACCESSORIES AND SPARES

These shall be the standard specifications of the manufacturer.

#### 8.5 TESTS

Tests shall be conducted on the following items in the presence of the Purchaser. Provided, however, that where matters can be confirmed by certificate, etc., that they conform to the laws and standards of the People's Republic of China, tests may be omitted.

Personnel, equipment, measurement instruments, fuel, consumables, etc., required for tests shall be provided by the Contractor at its expense.

- a) Construction and functioning tests  
Construction and functioning tests of the Chemical Fire Engine shall confirm that all contents of each item provided for in 8.2 and 8.3 above are satisfied.
- b) Equipped items  
It shall be confirmed that all contents of each equipped item provided for in 8.4 above are satisfied.

## 9. WATER TANKER

### 9.1 GENERAL

- a) The Water Tanker shall supply water to the airport's Chemical Fire Engine used for extinguishing fires and for rescues in the event of aircraft accidents.
- b) The Water Tanker shall be made in the People's Republic of China and shall have the standard specifications of the manufacturer, except for the following performance requirements and standards:
- c) Two units of the Water Tanker shall be supplied.

### 9.2 PERFORMANCE

- a) Running performance
  - i) Acceleration: 0 ~ 80 km/h within 50 sec.
  - ii) Top speed (maintain a road speed): Not less than 90 km/h
  - iii) Service brake: Capable of bringing the fully loaded vehicle to a hold on a 50% gradient.
- b) Discharge capacity  
Standard discharge capacity At least 2,000 liters/min
- c) Water supply capacity  
By pumping from a water storage tank, the tanker shall be able to supply at least 3,600 liters/min of water to the Chemical Fire Engine.

### 9.3 CONSTRUCTION

Construction of the Water Tanker shall meet the following provisions, and be such that driving, operation and inspection and maintenance shall be able to be done readily, and shall have sufficient strength and durability:

- a) Dimensions and weight, etc.
  - 1) Overall length: Not more than 8,500 mm
  - 2) Overall width: Not more than 2,560 mm
  - 3) Overall height: Not more than 3,800 mm
  - 4) Ground clearance: Not less than 270 mm
  - 5) Passenger capacity: 5 persons
  - 6) Gross vehicle weight: Not more than 20 tons
- b) Chassis  
The chassis of the Water Tanker shall be of rigid frame construction and shall have sufficient strength to withstand maximum bending stress intensity in a fully loaded state.
  - 1) Engine  
The engine of the Water Tanker shall be such that output, torque and number

of revolutions should be sufficient to demonstrate the performance of the tanker.

- 2) Power transmission system for the fire extinguisher
  - i) The power transmission system for the fire extinguisher shall permit driving and operation of the water pump either at a standstill or while traveling, have sufficient durability, and shall not cause excess heat generation nor abnormal vibration and noise during operation.
  - ii) Inspection and maintenance of the power transmission system for fire extinguisher shall be able to be done readily.
- c) Operator cabin  
The operator cabin shall have sufficient strength, durability and heat resistance to ensure crew safety.
- d) Fire extinguisher
  - 1) Water pump
    - i) The water pump shall be such that it causes no abnormal vibration, noise, leakage, or excess heat generation to ensure stable continuous operation.
    - ii) The water pump shall be a centrifugal-type pump.
    - iii) Water pump capacity  
Rated discharge capacity: 3,600 liters/min
  - 2) Vacuum pump
    - i) The vacuum pump shall be a type that can be fixed to the water pump
    - ii) The vacuum pump shall be a blade-type eccentric rotary pump.
  - 3) Water storage tank
    - i) The shape of the water storage tank shall be completely oval as standard, and the material shall be rolled steel for general structures (SS41 steel plate), or better.
    - ii) Loading capacity shall be at least 7,000 liters.
  - 4) Discharge gun  
One discharge gun shall be provided on the upper face of the pump room at rear of the operator cabin.
    - i) Discharge quantity At least 2,000 l/min
    - ii) Rotation range Horizontal direction 360\_  
Vertical direction Angle of elevation: 60\_  
Angle of depression: 30\_ (in the traverse direction)
  - 5) Pump operation panel  
On both sides of the water tanker an operation panel consisting of a suction port, a discharge port, an operation lever for each valve, a vacuum pump operation lever, a water pump compound gauge, a water pump revolution counter, and an engine speed control handle, etc., shall be provided.
    - i) Suction port  
Nominal number 100 Screw-type coupling receptacle (with ball valve) 1 ea. Respectively

- Suction pipe constant connection
- ii) Discharge port
  - Nominal number 65 plug-in coupling receptacle (with a ball valve cap)
  - 2 ea. respectively

#### 9.4 EQUIPPED ITEMS, ACCESSORIES AND SPARES

These shall conform to the standard specifications of the manufacturer.

#### 9.5 TESTS

The Contractor shall conduct tests on the following items in the presence of the Purchaser. Provided, however, that items which can be confirmed by certificate, etc., as conforming to the laws and standards of the People's Republic of China, tests may be omitted.

Personnel, equipment, measurement instruments, fuel, consumables, etc., required for tests shall be provided by the Contractor at its expense.

- a) Construction and functioning tests
  - Construction and functioning tests of the Water Tanker shall confirm that all contents of each item provided for in 9.2 ~ 9.3 are satisfied.
- b) Equipped items
  - It shall be confirmed that all contents of each equipped item provided for in 9.4. are satisfied.



## 10. LIGHTING VEHICLE

### 10.1 GENERAL

- a) The roles of the Lighting Vehicle shall be to light the site of aircraft accidents and be used for fire extinguishing and rescue operations.
- b) The Lighting Vehicle shall be a product of the People's Republic of China and shall meet the standard specifications of the manufacturer, except for the following performance requirements and rating capacities:
- c) One unit of the Lighting Vehicle is to be supplied.

### 10.2 PERFORMANCE

- a) Running performance
  - 1) Acceleration: 0 ~ 80 km/h within 50 sec.
  - 2) Top speed: Not less than 90 km/h
- b) Lighting capacity  
The Lighting Vehicle shall be equipped with a system that can provide adequate night lighting.

### 10.3 MAJOR ITEMS

The major items shall be such that the following driving, operation and inspection and maintenance items shall be able to be done readily.

- a) Chassis
  - 1) Chassis type: Microbus-type chassis with cab
  - 2) Engine type: The engine shall have an output, torque and number of revolutions that permits sufficient demonstration of the performance of the Lighting Vehicle.
  - 3) Passenger capacity: 3 persons
  - 4) Top speed: Not less than 90 km/h
  - 5) Dimensions and weight,

Overall length:	Not more than 5,400 mm
Overall width:	Not more than 2,000 mm
Overall height:	Not more than 2,700 mm
Gross vehicle weight:	Not more than 3.5 tons
- b) Body  
The Lighting Vehicle shall have generator equipment and a lighting system that can be raised and lowered.

### 10.4 EQUIPPED ITEMS

- a) Lighting system

- 1) Generator equipment: Output of at least 10 KVA
  - 2) Raising and lowering system: Can be extended at least 5 m (from ground)
  - 3) Floodlight projector: 1,000 W halogen sealed beam; at least 3 ea.  
The lighting system shall be able to rotate with:  
Horizontal travel angle: 360\_  
Vertical travel angle: At least 90\_
- b) Others shall be the standard outfitted by the manufacturer.

#### 10.5 LOADED ITEMS, ACCESSORIES AND SPARES

These shall be to the standard specifications of the manufacturer.

#### 10.6 TESTS

The Contractor shall conduct tests on the following items. Provided, however, that where items can be confirmed by certificate, etc., as conforming to the laws and standards of the People's Republic of China, type recognition in the country of fabrication and items that can be confirmed by certificate of inspection institution, etc., tests may be omitted.

- a) Construction and functioning tests  
Construction and functioning tests shall confirm that all contents of each item provided for in 10.2 ~ 10.3 above are satisfied.
- b) Equipped items and loaded items  
It shall be confirmed that all contents of each equipped and loaded item provided for in 10.4 above are satisfied.

## 11. FIRE FIGHTING COMMANDER'S VEHICLE

### 11.1 GENERAL

- a) This vehicle is generally used as the fire fighting commander's vehicle in emergency situations.
- b) This vehicle shall be a product of the People's Republic of China and shall conform to the manufacturer's standard specifications, except for the following performance requirements and rating capacities:
- c) One unit of the Commander's Vehicle is to be supplied.

### 11.2 VEHICLE PERFORMANCE AND REQUIREMENTS

- a) Dimensions and weight, etc.
  - 1) Overall length: Less than 4,900 mm
  - 2) Overall width: Less than 1,850 mm
  - 3) Overall height: Less than 2,750 mm
  - 4) Vehicle weight: Approx. 2,100 kg
  - 5) Gross vehicle weight: Approx. 2,600 kg
- b) Top speed: Not less than 120 km/h
- c) Turning radius (min.): Not more than 7 m
- d) Climbing ability (max.): Not less than  $\theta = 0.6$

### 11.3 CHASSIS

- a) Chassis type: 4-wheel drive van-type vehicle
- b) Engine type: The engine shall have output, torque and number of revolutions to demonstrate performance sufficiently.
- c) Passenger capacity: At least 4 persons

### 11.4 EQUIPPED ITEMS

The equipped items shall conform to the manufacturer's standard, except for the following:

- a) Light scattering rotary lamp (built-in electronic siren speaker)
- b) Electronic siren (with loud speaker)
- c) Front air conditioner
- d) Ignition prevention unit

### 11.5 ACCESSORIES

The accessories shall conform to the manufacturer's standard.

## 12. CREW TRANSPORTER

### 12.1 GENERAL

- a) The roles of the Crew Transporter shall include the emergency transport of fire crews and rescue equipment and materials in the event of an aircraft accident.
- b) The Crew Transporter shall be a product of the People's Republic of China and shall conform to the manufacturer's standard specifications, except for the following:
- c) One unit of the Crew Transporter is to be supplied.

### 12.2 MAJOR ITEMS

The construction and performance of the Crew Transporter shall satisfy the following, and driving and operation and inspection and maintenance shall be able to be done readily.

- a) Chassis
  - 1) Chassis type: Chassis for a front engine-type truck
  - 2) Engine: The engine shall have the output, torque and number of revolutions which can demonstrate the performance of the vehicle.
  - 3) Dimensions and weight, etc.

Overall length:	Not more than 6,900 mm
Overall width:	Not more than 2,400 mm
Overall height:	Not more than 3,100 mm
Passenger capacity:	2 persons
Loading capacity of the carrier bed:	Not less than 4 tons
Gross vehicle weight:	Not more than 9 tons
  - 4) Top speed: Not less than 90 km/h
- b) Body

The body shall conform to manufacturer's standard specifications, except for the following:

  - 1) Carrier bed

The carrier bed shall have a hood.  
The carrier bed shall have removable seats for 12 persons.

### 13. FOAM-AGENT TANKER

#### 13.1 GENERAL

- a) The Foam Agent Tanker shall be available for the transport and supply of foam agent to the Fire Fighting Vehicles.
- b) The Foam Agent Tanker shall be a product of the People's Republic of China and shall conform to the manufacturer's standard specifications, except for the following:
- c) One unit of the Foam Agent Tanker shall be supplied.

#### 13.2 PERFORMANCE

The Foam Agent Tanker shall be able to supply at least 300 liters/min (pumping pressure of 3.0 kgf/cm<sup>2</sup>) to the airport's Chemical Fire Engine through suction of solution from the Foam Agent Tanker.

#### 13.3 CONSTRUCTION

The construction of the Foam Agent tanker shall be with the following as standard, shall enable driving, operation and inspection and maintenance to be done readily, and shall have sufficient strength and durability.

All materials and parts used in fabrication of the Foam Agent Tanker shall be new.

- a) Dimensions, etc.
  - 1) Overall length: Not more than 7,200 mm
  - 2) Overall width: Not more than 2,500 mm
  - 3) Overall height: Not more than 3,000 mm
  - 4) Passenger capacity: At least 3 persons
  - 5) Gross vehicle weight: Not more than 12,000 kg
- b) Chassis, body
  - 1) Type: Cab over-type chassis with cab
  - 2) Driving mode: 4 x 2 rear axle drive
  - 3) Top speed: Not less than 90 km/h
  - 4) Others
    - i) At the end of the engine exhaust system, an ignition prevention unit shall be installed.
    - ii) On the sides and at the rear of the Foam Agent Tanker a storage room for equipped items shall be provided.
    - iii) At the rear of the Foam agent Tanker a step shall be provided as required.
- c) Foam agent system

- 1) **Foam agent pump**  
 The foam agent pump shall be a geared pump--driven by power transmitted from the power take off (PTO)--that sucks and supplies the foam agent. On the discharge side a safety valve shall be provided so as to enable a bypass to the suction side.
- 2) **Foam agent tank**
  - i) The foam agent tank shall be stainless steel (SUS 316) or better and shall be strong enough to prevent deformation from the pressure of the solution.
  - ii) The specifications of the foam agent tank shall be the following:
    - ① Shape: An oval cylinder
    - ② Filling capacity: 4,000 liters (2,000 liters x 2 divisions)
    - ③ Filling ports: More than 1 ea. per division
  - iii) On the upper part of the Foam Agent Tank manhole ports shall be provided at each division. Also to be provided are: a work area made of striped steel plate, around the manhole ports, etc., and a ladder with a non-slip surface at the rear of the vehicle.
  - iv) Construction of the interior of the foam agent tank shall be such that pitching of foam agent can be prevented.
  - v) On the bottom of the foam agent tank a solution discharge valve shall be provided.
  - vi) The filling port shall be a nominal number 65 screw-type coupling receptacle (with ball valve cap).
  - vii) Accessories
    - ① Air vent system  
 An air vent system shall be constructed such that abnormal pressure will not occur within the foam agent tank.
    - ② Dosimeter  
 One dosimeter shall be provided at each division.
- 3) **Suction port, supply port, etc.**  
 On both sides of the Foam Agent Tanker, a suction port, a foam connector, levers for each valve operation, a foam agent pressure gauge, a foam agent compound gauge, etc., shall be provided. Piping and valves, etc., of parts that constantly come in contact with the solution shall be stainless steel (SUS 316) or better.
  - i) **Suction port**  
 Nominal number 65 Screw-type coupling receptacle (with ball valve cap) 1 ea.
  - ii) **Supply connection**  
 Nominal number 65 Screw-type coupling (with ball valve cap) 1 ea.

d) **Electrical system**

The standard voltage, power source equipment, the lighting system and other equipment shall conform to the manufacturer's standard specifications.

**13.4 ACCESSORIES AND SPARES**

The accessories and spares shall be with the following as standard and items that conform to foam agent tanker shall be added.

a) **Accessories**

1) **Equipped items**

The Foam Agent Tanker shall be equipped with the following items.

Item	Specification	Quantity
i) Suction pipe	Nominal No. 50: 50m long (nominal No. 65 with screw-type coupling receptacle)	2 no.
ii) Pick-up pipe for drum barrel suction	Nominal No. 65 with screw-type coupling	1 no.
iii) Supply hose	Nominal No. 65: 20 m long (with screw-type coupling)	3 no.
iv) Fire extinguisher	ABC: 6 kg-type	2 ea.

2) **Accessories**

Item	Specifications	Quantity
i) Drum barrel opening and closing metal		1 ea.
ii) Hose tightening spanner		2 ea.
iii) Wheel nut wrench		1 ea.
iv) General assembly and disassembly tool	Tools required for daily inspection and maintenance	Lump sum
v) Accessories box		1 ea.

b) **Spares**

Item	Specifications	Quantity
1) Spare tire	Wheel unit	1 ea.
2) Touch up paint	Red 0.7 kg/can	1 can
3) Various light bulbs	Except headlights	2 ea.
4) Various fuses		2 sets

**13.5 TESTS**

The Contractor shall conduct tests on the following items in the presence of the Purchaser. Provided, however, that items impossible to test at the plant of the

manufacturer can be tested at the place of delivery if nothing there interferes with testing.

Where items can be confirmed as conforming to the laws and standards of the People's Republic of China by certificate, etc., by recognition of the type in the country of manufacture, where items which can be confirmed by certificate, etc., of inspection institutions, and where items for which approval of the Purchaser have been obtained from the calculation documents, tests may be omitted.

Also, in cases where examination of the production process, quality control conditions at the plant of the Contractor, conditions at internal testing facilities and documents submitted in advance, including internal testing performance records, etc., prove that they are adequate, part or all of attendance may be omitted.

Personnel, equipment, measurement instruments, fuel, consumables, etc. shall be provided by the Contractor at its expense.

a) Construction and functioning tests

Construction and functioning tests of the Foam Agent Tanker shall confirm that all contents of each item provided for in 13.2 ~ 13.4 above are satisfied.

b) Performance test

The performance test shall confirm that all contents of each item provided for in 13.2 above are satisfied.



## 14. AMBULANCE (II)

### 14.1 GENERAL

- a) This vehicle is generally used for ambulance and medical services in emergency situations.
- b) The Ambulance shall be a product of the People's Republic of China and shall conform to the manufacturer's standard specifications, except for the following performance specifications and requirements:
- c) Three units of the Ambulance are to be supplied.

### 14.2 VEHICLE PERFORMANCE AND REQUIREMENTS

This Ambulance shall have the following performance and requirements.

- a) Dimensions and weight, etc.
  - 1) Overall length: Less than 4,800 mm
  - 2) Overall width: Less than 1,700 mm
  - 3) Overall height: Less than 2,500 mm
  - 4) Vehicle weight: Approx. 1,650 kg
  - 5) Gross vehicle weight: Approx. 2,400 kg
- b) Top speed: Not less than 100 km/h
- c) Turning radius (min.): Not more than 5 m
- d) Climbing ability (max.): Not less than  $\theta = 0.6$

### 14.3 CHASSIS

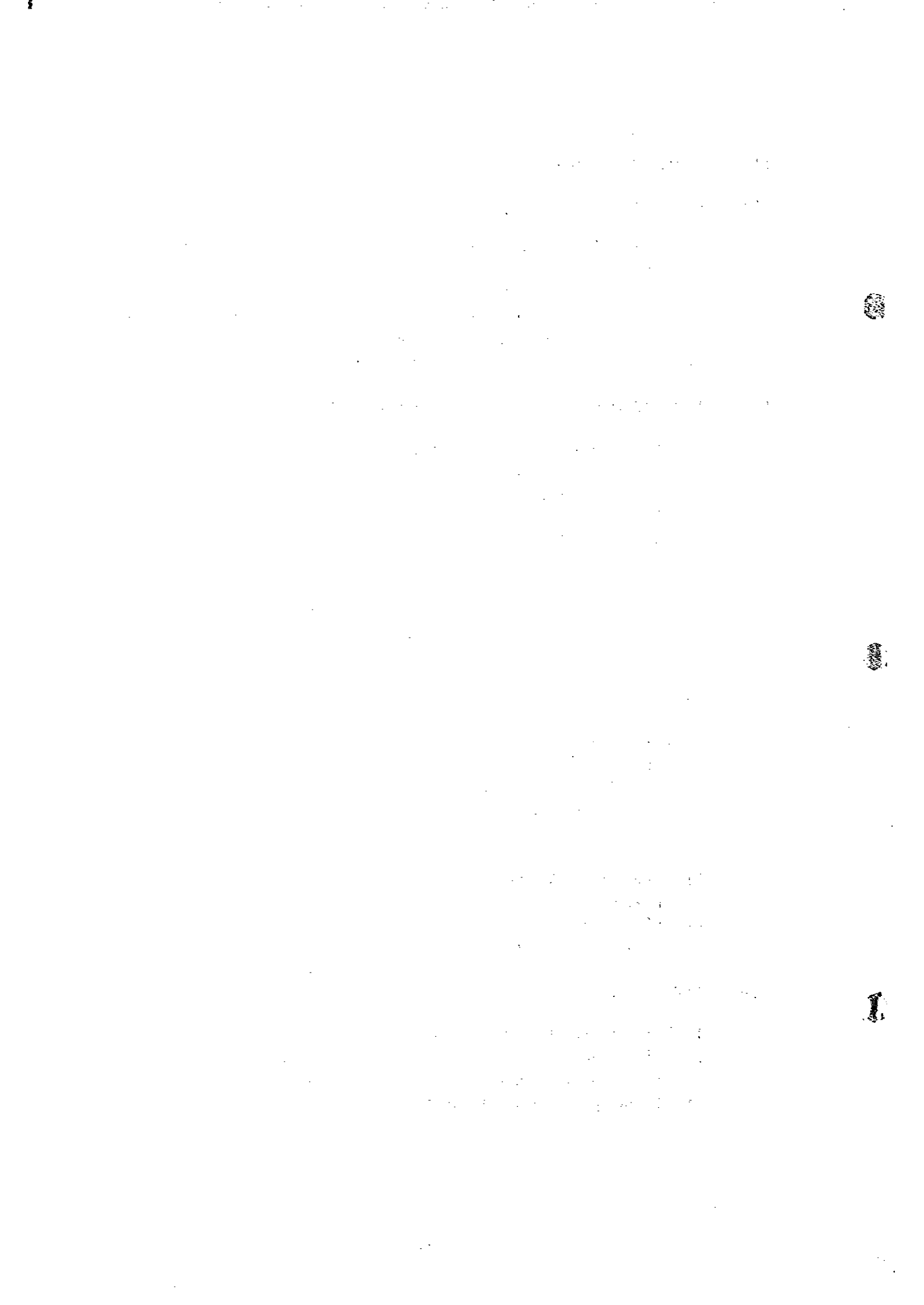
The chassis of the Ambulance shall meet the following performance requirements.

- a) Engine
  - 1) Type: 4 stroke-cycle water-cooled, petrol (gasoline) or diesel engine
  - 2) Piston displacement: Not less than a nominal 2,000 cc
  - 3) Max. output : Not less than 100 PS/5000rpm
  - 4) Max. torque : Not less than 17 kg m/rpm
- b) Transmission: Automatic, semi-automatic or manual, 4 or 5 speeds forward, 1 reverse
- c) Mode of drive: 4-Wheel-Drive (4WD)
- d) Steering: Left hand

### 14.4 EQUIPMENT

Equipment shall conform to the manufacturer's specifications, except for the following:

- a) Light scattering rotary lamp (built-in electronic siren speaker) Lump sum
- b) Front air conditioner, rear overhead cooler Lump sum
- c) Ignition prevention unit Lump sum









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