

SECTION 15  
INTERIOR FURNISHING

15.1 SCOPE OF WORK:

- 15.1.1 Extent: The work required under this section consists of all interior furnishings and related items necessary to complete the Work indicated on the Drawings and described in Specifications.

15.2 SHOP DRAWINGS:

- 15.2.1 Submit shop drawings to the Supervisor for approval of all items of interior furnishing. Obtain approval of shop drawings prior to proceeding with fabrication.

15.3 SAMPLES:

- 15.3.1 Submit samples in duplicate of the following materials or assemblies to the Supervisor for approval. Approval must be obtained prior to delivery or fabrication.
- (a) Curtains and curtain rails including accessories.
  - (b) Vertical blinds including accessories.

15.4 MATERIALS AND WORKMANSHIP:

- 15.4.1 General: When materials and workmanship specified in other section of this Specification are applicable to Works included in this section, the Works shall conform to those Specifications.

15.5 CURTAINS AND CURTAIN RAILS:

- 15.5.1 Curtains: The quality, color, pattern and accessories of curtain materials shall be determined by the Supervisor by samples to be submitted.
- 15.5.2 Curtains for shower spaces shall be of vinyl cloth of more than 0.2 mm thick or of waterproof treated cloth.
- 15.5.3 Curtain rails shall be of stainless steel or aluminum alloy fur-

nished with runners and other necessary accessories, and shall be the product determined by sample.

15.5.4 Furnish wood curtain boxes at locations indicated on the Drawing as detailed.

15.6 MIRROR:

Mirrors shall be installed at the places indicated on the Drawings. Mirror plate shall be similar to "Hi-Mirror" manufactured by Nihon Sheet Glass Co., Ltd. or products of Toto Kiki Co., Ltd. Mirrors shall in principle be fixed securely to mortar finished walls. The fixing shall be done by screwing the metal frames or fittings to the wood bricks embedded in the wall or in such a manner as may be approved by the Supervisor.

15.7 ROOMNAME PLATES:

Provide and install roomname plates as indicated on the Drawings and as directed by the Supervisor. The plates shall be of plastic plate of 8 cm x 20 cm. Roomnames shall be painted on by enamel both in Bengalese and English under the directions of the Supervisor.

15.8 MOSQUITO SCREEN:

Unless otherwise directed by Sueprvisor, the mosquito screen to be fitted be 16-mesh galvanized and vinyl coated iron.

15.9 BLIND:

Blinds shall be fitted to windows as shown on the Drawings. The blind shall be of the vertical type made of an aluminum alloy and its opening-closing motion shall be controlled by gearing. Slats shall be C-shaped with finished width of 34 mm and thickness of 0.15 mm.

Attachment brackets shall be fixed at both ends of a head box if the blind width is up to 1.8 m, and more than one additional brackets shall be fixed at the center of the head box, if the width is greater than 1.8 m. The blinds shall be fixed securely with screws or other suitable means.

15.10 SPRAYED ASBESTOS:

Sprayed asbestos shall be applied to the bottom side of folded steel plate roof of factories.

The manufacturers shall be those described in Appendix I or equal.

The thickness of spraying shall be 30mm, and smooth finish shall be made by trowelling, for example.

15.11 GYPSUM BOARDS:

The materials shall be Gypsum boards specified in JIS A 6901. They shall be used in regular size (90.9mm x 181.8mm) without cutting, if possible. They shall be fixed by screws to ceiling rails as specified in the Drawings. Joiners made of aluminium shall be used in one direction, and butt jointing shall be made in the other direction. Butt jointed part shall be carefully worked to be free from misalignment and gaps.

15.12 ASBESTOS CALCIUM SILICATE BOARDS:

The materials shall be what are specified in JIS A 5418. The thickness and form shall be as specified in the Drawings, and they shall be fixed by using joiners made of aluminium as a rule.

15.13 GLASSWOOL INSULATORS:

The glasswool insulators shall be fitted inside the internal finish of the injection pump room in the Heavy Repair Factory as shown. They shall be of the form of boards of the thickness of 50mm.

The materials shall be the products of the manufacturers indicated in Appendix I or equivalent.

The samples shall be submitted to the Supervisor for approval in advance.



SECTION 16  
METAL ROOF WORK

16.1 GENERAL:

16.1.1 Scope:

This section specifies folded steel plate roofing work to be used for factories and other buildings.

16.1.2 Materials:

The material shall be galvanized sheet iron of the thickness of 1.0 mm, colored on one side.

Fittings and bolts to be used shall be galvanized.

16.2 METHOD OF WORK:

16.2.1 Pitch:

Pitch of 1/50 shall be the standard, and the dimensions specified in the Drawings shall be followed.

16.2.2 Method of Work:

The method of work shall be what are specified by the manufacturers described in Appendix I or by equivalent manufacturers. Execution plan and execution drawing shall be submitted to the Supervisor for approval in advance.

16.2.3 Caulking:

Connecting and throating parts such as at walls shall be executed with particular care, and lapped parts shall be filled with caulking materials specified by the manufacturer.

16.3 OTHERS:

16.3.1 Curing:

As for curing of folded steel plates, when stacking them on the ground, make sure to place them on bases such as square timbers placed with small intervals. Further, with rain water taken into account, pitch for draining shall be provided. The number of plates to be

stacked shall be minimized if possible, and stacking shall be made in a manner that provides stability. Good care shall be exercised so as not to allow them to be deformed.

The plates having scars on the galvanized faces and/or colored surface shall not be used as a rule.

16.3.2 Inspection:

Inspection of condition of fitting, fastening, installation of joint fitting, condition of throating at connections, waterproofing treatment and condition of clean-up shall be made based on the execution drawing and execution plan, in witness of the Supervisor.

16.3.3 Supplementary Installation:

Eaves trough and fixtures shall conform to the requirements in Chapter 17.

SECTION 17  
MISCELLANEOUS WORK

17.1 SEALING:

17.1.1 Scope of Work:

This paragraph shall apply to the filling for connection and joint of component parts and the padding for glass by use of irregular-form elastic sealing material (hereinafter referred to as sealing material) and oilness coking material.

A general term for sealing material and oilness coking material shall be called 'material for sealing'.

17.1.2 Material:

(a) Sealing material shall be specified as follows.

- (1) Material shall be the product to be supplied from the specially designated factory as specified in the following Table 17.1.2.
- (2) Material shall indicate its compliance with the performance condition requisited by JIS A5757 (performance character by uses of sealing material for building construction), being accompanied by the official test record issued from the authorized laboratory.

Table 17.1.2 Standard and Durability of Sealing Material

Material	Standard	Durability
Silicone sealing material	JIS A5755 (Silicone sealing material for building construction)	1st class
Polysulfide sealing material	JIS A5754 (Polysulfide sealing material for building construction)	1st class
Urethane sealing material	-	1st class 2nd class
Water acryl sealing material	-	2nd class

- (3) Base and hardening agent for the binary system sealing material shall be of such compounding as designated by the factory.
- (4) Auxiliary material
  - (i) Primer shall be the product of the main material production factory and shall be suited for the adherent (the paint if used for coating).
  - (ii) Back-up material shall be made of either synthetic resin or synthetic rubber to be in no contact with sealing material. It shall be shaped suitably for the place of use and sized 2 mm wider than the width of joint.
  - (iii) Bond breaker shall be either polyethylene tape or polyethylene-applied paper tape.
- (b) Oilness coking material shall be of such standard as may satisfy the requirement set forth by JIS A5751 (oilness coking material for building construction).

#### 17.1.3 Storage:

- (a) Material shall be sealed tightly in the place protected from direct sun-beam or rain, being kept away from the place of high temperature and humidity.  
The storage time at the job site shall be restrained to possible minimum.
- (b) Primer and solvent shall be handled with serious caution against fire.

#### 17.1.4 Material Classification and Joint Size:

Classification and kind of sealing material shall be as specified in Table 17.1.4 and classification versus joint size shall be as specified in the special provision.



Table 17.1.4 Classification and Kind of Sealing Material

Classification	Kind
Grade A	Silicone sealing material (Unified system)
Grade B	Silicone sealing material (Binary system)
Grade C	Urethane sealing material (Binary system) Water acryl sealing material (Binary system)
Grade D	Oilness coking material

17.1.5 Joint Shape and Bed Treatment:

- (a) Each joint shall be of proper width, neither excessively broaden nor extremely narrowed, without any unevenness.
- (b) Joint bed shall be fully dried up and carefully cleared of oilness, dust particles, adhered mortar, paint and metal rust.
- (c) If joint depth is deeper than the corresponding depth of sealing material, back-up material shall be first filled to the required depth.
- (d) If joint depth is exactly same as required for urethane sealing materials of Grades A, B and C to be used, bond breaker shall be used at joint bottom.

17.1.6 Filling Method:

- (a) Each joint shall be filled up normally prior to finish of spraying. If the joint is filled after finish of spraying, filled material shall be fully cured by use of tape or the like so as to prevent overfilling out of the joint.
- (b) Work shall be suspended if dew is anticipated from rainfall or humidity.
- (c) Filling
  - (1) General matters
    - (i) The coking gun nozzle for filling shall be slightly undersized from the width of joint. It shall be pressurized for complete filling of material into every corner of the joint.

- (ii) Filled material shall be fully pressed down by use of a trowel. Filled surface shall be finished evenly and smoothly for tight contact at its bottom with joint bed.
  - (iii) Each joint shall be covered with the curing tape, if and when necessary, and the tape shall be removed immediately after being pressed with a trowelling.
  - (iv) If material is adhered to any other parts than the joint to be filled, such adherence shall be removed instantly.
- (2) Special provisions for sealing material
- (i) Besides those sub-items specified in the foregoing Item (1), the following provisions shall apply to the filling method.
  - (ii) Prior to material filling, primer shall apply to each joint after such treatment for joint bed as specified in 17.1.5 (b), (c) and (d). However, no primer shall apply to either back-up material or bond breaker.
  - (iii) Filling shall start immediately after setting to touch for 30 to 60 minutes of primer.
  - (iv) In either case where any refuse or dust particles may be adhered to the primer-coated surface or the situation may not permit the filling work to be performed on the same scheduled day, primer shall apply again to the joint after re-cleaning of the said portion.
  - (v) Sealing material of binary system shall be used for filling after full kneading, at such compounding ratio as designated by the factory, in appropriate quantity to be required for the time of filling.
  - (vi) In the case where temperature of the adherent may fall below 5°C or rise above 50°C at the time of

filling or within 12 hours after filling, the work shall be suspended. If the work has to continue for inevitable reason, wooden panels or sheet covers shall be provided for heat insulation or break.

17.1.7 Curing:

- (a) Final finish over the filled surface shall be done after hardening of the surface fill.
- (b) Curing shall be provided, if and when necessary, in the case where dust adherence, soilage or hurt may be anticipated.

17.2 CORNER BEAD, NON-SLIP AND OTHERS:

17.2.1 Corner Bead:

Material for corner bead shall be of vinyl chloride, whose sample shall be presented. Corner bead shall be provided to the height of 1.8 m or so from the floor level. Metallic adapter leg shall be sized at about 25 mm and spaced at about 300 mm each from the end to be held down.

17.2.2 Non-slip for Stairs:

- (a) Kind, type and size of non-slip shall be as shown in the Drawing.
- (b) Fitting method
  - (1) In the case where foot metal may be embedded into concrete, such metal shall be fitted rigidly at a space of about 300 mm each from both ends to be held down.
  - (2) In the case where the adhesion method may be used, metal shall be fitted with adhesives of epoxy resin after thorough cleaning of the dried foundation.

17.2.3 Door Mat:

Door mat shall be laid at the front doorway as shown in the drawing and shall be made of stainless steel including its frame.

17.2.4 Cut-off Board:

Cut-off board shall be provided for leakproofing at the expansion joint of the water reservoir shown in the drawing. It shall be made of synthetic rubber and sized at 200 mm in width and 6 mm in thickness. As shown in the arrangement drawing, the construction scheme drawing shall be prepared for effective tightness to insure waterproof.

17.2.5 Conduit Pipe:

- (a) Conduit pipe and other accessories shall be as specified in Table 17.2.5(a) and their material shall be as designated in the special provisions.

Table 17.2.5(a) Conduit Pipe and Other Accessories

Material	Standard	Quality and Others
Steel pipe	JIS G3442 (Galvanized sheet iron pipe for water supply)	
Drain pipe joint	JIS B2303 (Screw-type drain pipe joint) standard	Galvanized
Hard vinyl chloride pipe	JIS K6741 (Hard vinyl chloride pipe) standard	VP (pipe) Not to be used indoors.
Drain-use hard vinyl chloride pipe joint	JIS K6739 (Drain-use vinyl chloride pipe) standard	
Roof drain	Made of cast iron	To be treated for rust prevention by such measures as refined-tar baking and bituminous rust-proof painting.
Hard vinyl chloride eaves-gutter	JIS A5706 (Hard vinyl chloride gutter) standard	Gutter and its adhesives to be supplied from same manufacturing factory.
Galvanized iron sheet	JIS G3312 (Colored) JIS G3302 (Non-colored)	-
Fastening copper wire for gutter	-	1.2 mm diameter

- (b) Bracket for gutter shall be of galvanized steel and shall comply with Table 17.2.5(b) and 17.2.5(c) for its size and other Specifications.

Table 17.2.5(b) Bracket for Gutter

Pipe & Gutter	Vertical and Horizontal-run Conduit		Eaves Gutter of Galvanized Iron		Gutter of Hard Vinyl Chloride
Diameter (mm)	100 and below	Exceeding 100	120 and below	Exceeding 120	-
Bracket size (mm)	Larger than and including 25x2.8 (on market sale)	Larger than and including 25x4.5	Larger than and including 25x2.8 (on market sale)	Larger than and including 25x4.5	On market sale

Table 17.2.5(c) Required Space between Gutter Brackets

Pipe or Gutter	Steel Pipe and Hard Vinyl Chloride Pipe	Gutter of Hard Vinyl Chloride and Galvanized Iron	
	Vertical and Horizontal-run Conduit Pipe	Vertical and Horizontal	Eaves Gutter
Space	To be spaced at about 2m. However, the bracket shall be fitted into each individual floor slab if the pipe is installed indoors and the floor slab is at normal height.	1.2 m	0.9 m

17.2.6 Method for Installation of Gutter Supporting Bracket:

- (a) The bracket for vertical conduit support shall normally be of such type that the ring-shaped iron of hinge type shall be fastened to the foot iron by use of 2 small bolts.
- (b) The bracket for vertical conduit support shall be embedded to the depth of 60 mm of the reinforced concrete structure by splitting and folding the foot iron. It shall be either welded or bolted to the steel-fabricated structure.

- (c) In the case where the bracket for eaves gutter support may be affixed directly to the corrugated asbestos roof slate, it shall be fastened up with 2 small bolts through the liner and washer.
- (d) The bracket for eaves gutter support shall be affixed to the wooden structure by driving two nails into the side face of the rafter or directly nailed into the rafter.
- (e) The eaves gutter shall be fastened tightly to the gutter bracket by use of copper wire.

17.2.7 Method for Installation of Steel Conduit Pipe:

- (a) The joint shall be of drain pipe joint. However, for the pipe with a diameter exceeding 80 mm it may be of weld joint, if so required under the inevitable circumstance, by approval of the Supervisor..

The thread and weld portions after jointing of pipe shall be coated with paint for rust prevention.

- (b) Anti-sweat covering
  - (1) Anti-sweat covering shall be provided as specified in the special provisions. However, if not specifying provided, it shall be provided, as specified in Table 17.2.5(d), for wherever deemed necessary.
  - (2) The insulating tube shall be 20 mm in thickness for the diameter of less than 150 mm and 30 mm for the diameter larger than that, as set forth by JIS A9511 (Form polystyrene insulating material).
  - (3) Adhesive tape shall be as specified in JIS Z1525 (Vinyl adhesive tape).

Table 17.2.5(d) Anti-sweat Covering for Steel Conduit Pipe

Place of Conduit Laying	Covering Material and Work Sequence
Ordinary indoor exposure	Insulation tube setting, adhesive tape winding, paper winding, cotton fabrics winding and seal coating.
Inside of ceiling and wall	Insulation tube setting, adhesive tape winding, vinyl tape winding.
Exposure in bath room and kitchen	Insulation tube setting, adhesive tape winding, asphalt roofing (galvanized iron wire) winding, galvanized iron sheet winding (0.3 mm thickness) and paint coating.
Inside of pipe shaft in R.C. structure	No covering.
Outdoor exposure	No covering but coating only.

(c) In the case where the conduit pipe may go through the concrete or brick wall, the gap to be created around the pipe to the wall shall be filled with mortar.

(d) Two metal fittings of 6 mm in thickness shall be provided to hold up the pipe.

17.2.8 Method for Installation of Hard Vinyl Chloride Pipe:

(a) Each joint shall be cold-spliced and fixed together by use of adhesives.

(b) The same as board as gutter shall be used to support the pipe from possible sagging and fixed by use of adhesives (2) for each bracket.

17.2.9 Method for Installation of Hard Vinyl Chloride Gutter:

The method shall be as instructed by the manufacturing factory.

17.2.10 Method for Installation of Roof Drain Pipe:

(a) The roof drain pipe shall normally be laid prior to placing of concrete, at the position lower than the floor level and of good drainage. If necessary, the pipe route shall be supplemented with additional concrete.

- (b) If the pipe is laid after concrete placing, its circumferential gap shall be filled up with mortar mixed at a ratio (in volume) of cement 1 versus sand 3.

17.2.11 Cleaning Hole:

The opening for cleaning shall be provided at curved or bent portions of the pipe most likely to be fallen into clogging trouble, if the pipe runs horizontally for a long span.

17.2.12 Cleaning and Admission Test:

After finish of roof drain and gutter installation, they shall be cleaned and shall undergo hydraulic test.

17.3 CRANE WORK:

17.3.1 Kinds of Crane:

- (a) 2-ton overhead travelling crane
  - Heavy repair factory: 1 each, lift 8m
  - Training room: 1 each, lift 6m
- (b) 1-ton monorail crane of electrical trolley connecting type
  - Heavy repair factory: 1 each, lift 6m
- (c) 1-ton pillar type jib crane
  - Heavy repair factory: 1 each, lift 4m

17.3.2 General Matters:

- (a) The Design and Specifications shall be Standard Specifications of the manufacturers described in Appendix I or equal.  
Shop drawings and Specifications shall be submitted to the Supervisor in advance for approval.
- (b) The scope of work of the crane work as discriminated from other works at the connections shall be clarified so as not to allow occurrence of errors in operation or defect in workmanship.
- (c) The Supervisor shall assure, prior to commencement of work, that connection with cranes such as the parts where rails are to be installed and foundation of machines which are included in other works are free from problems for commencement of crane work.



17.4 FURNITURE AND UTENCILS:

Scope:

- (a) The furniture and utencils shall be those to be equipped in the general office, classrooms, dormitory and offices of heavy repair factory, parts storage and other factories, which are specified in the following table.

The Design and Specifications shall be Standard Specifications of the manufacturers described in Appendix I or equal.

Shop drawings and Specifications shall be submitted to the Supervisor for approval in advance.

17.5 List of fixtures and Spares in Construction Work:

Material	Shape & Size	Quantity
Gypsum Board	T = 9 m/m	10% of consumption
Asbestos Calcium Silicate Board	T = 9 m/m	Do.
Vinyl Baseboard		Do
Glass	Transparent Glass T = 5 m/m 1,800 x 1,200	Do.
	" T = 5 m/m 1,500 x 1,500	Do.
	Wired Opaque Glass 1,200 x 800	5% of consumption
Sealant	3 kg Can.	10 Nos.
Hardware	Hinge	
	Flush Bolt	5% of consumption
	Door Check	
	Hanger Door Runner	
	etc.	
Non-slip (stair)		Do.
Vitreous, Semi-vitreous Tile	Mosaic, 100 m x 100 m/m (W.) (L.)	Do.

SECTION 18  
EXTERIOR WORK

18.1 GENERAL:

18.1.1 Scope:

This section specifies the exterior work other than the Site, gates, fences and a part of drainage ditch which have already been constructed as separate works to be provided by Owner.

18.1.2 Exceptions:

The following works are specified in other sections of this Specification.

- (a) Excavation, grading, filling and backfilling
- (b) Foundation work

18.2 PAVEMENT:

18.2.1 Asphalt Simple Pavement with Brick Soling (Local Method)

(a) Subgrade

If there is any unsuitable place in the subgrade, or if any obstacle is found on the subgrade soil surface, such obstacle shall be removed to the extent of about 300 mm from the subgrade surface, and the space thus created shall be backfilled with the material identical to the surrounding, and be suitably rolled.

Rolling shall be thoroughly made over the entire subgrade. Rolling shall be executed with or without water sprayed with the soil in the moisture content suitable for rolling, in accordance with the soil quality and the kind of the machine to be used.

(b) Subbase course

The sand to be used for sand cushion shall be river sand of hard nature that does not contain harmful matters such as

earth and organic matters.

Crushed stones or brick chips shall be based on the specification of local method of work, and it shall be determined on thorough deliberation with the Supervisor.

Pressurization such as rolling is desired to be as thorough as possible. It shall be carefully performed with sufficient length of time allowed for it.

(c) Asphalt pavement (Locate Method)

Asphalt pavement shall be executed in accordance with the Drawings. Execution plan shall be submitted to the Supervisor for approval in advance.

18.2.2 Brick Pavement:

Brick pavement shall be carefully executed in accordance with the drawings. The materials to be used shall conform to Section 6 'Brick Work'.

Subgrade work shall correspond to Section 18.2.1.

18.3 DRAINING WORK:

18.3.1 (a) Scope of work

The draining work specified in this section covers drain ditches, drain conduits, catch basins and oil separating tank for draining water in the Site, draining water from roofs of buildings and for draining miscellaneous waste water from buildings.

(b) Separate works

Plumbing installations specified in Section 19.

(c) The terminal of drainage shall be excluded from this work.

18.3.2 Drainage Ditches:

Drainage ditches shall be made of reinforced concrete in accordance with the Drawings. The relationship with pavement plan shall be taken into account on execution of work. Level setting of draining gradient shall be determined with minute execution drawing prepared based on the design drawing, and with approval obtained from the Supervisor. Efficient plan free from waste shall be made with the conditions at the Site thoroughly surveyed.

18.3.3 Drain Conduits:

The drain conduits shall be of joint structure of reinforced concrete and bricks in accordance with the Drawings. The matters related to execution of work shall correspond to Section 18.3.2.

18.3.4 Catch Basins:

As shown in the Drawings.

18.3.5 Oil Separating Tank:

The oil separating tank shall be provided near heavy repair factory and car washer. It shall be made of reinforced concrete in accordance with the Drawings.

18.4 PLANTATION WORK:

18.4.1 Lawn Plantation:

The area specified in the Drawings shall be planted with quality lawn. Top soil shall be fertile soil suitable for growth of plants and be free from foreign elements such as rubbish, clay and weeds.

18.4.2 Plantation:

New plantation of trees and shrubs is not considered. Existing trees and shrubs which can be transplanted shall be suitably transplanted on deliberation with the Supervisor with the appearance of the exterior taken into consideration.

18.5 OTHERS:

18.5.1 Water Supply Tower and Water Tank:

Water tank and water supply tower shall be constructed in accordance with the Drawings.

(a) Water Tank:

Foundation, grading, reinforced concrete and waterproofing shall conform to the provisions made in other sections.

Joints of concrete shall be provided with cut-off plates as shown in the Drawings. The cut-off plates to be used shall be made of synthetic rubber, and they shall be products of the manufacturers described in Appendix I or equal.

(b) Water supply tower

The water supply tower shall be of steel structure as shown in the Drawings. Steel work and painting work shall conform to the provisions made in other sections.

18.5.2 Gas Station:

Construction work related to burial of fuel tanks and installation of equipment shall be executed in accordance with the Drawings.

18.5.3 Car Washer:

Construction work related to separate machinery and equipment work, electrical work and plumbing installation work shall be executed in accordance with the Drawings.

18.5.4 Watchman Station:

The watchman shall be of steel structure as shown in the Drawings.

18.5.5 Waste Oil Tank:

The waste oil tank shall be made of reinforced concrete as shown in the Drawing, and it shall be provided with a cover made of iron plate so as not to allow entry of rain water.

18.5.6 Gates and Fences (Separate Works):

Execution plan for construction of gates and fences shall be established with locally produced materials and local methods of construction incorporated to the maximum.

The structure shall be such that drainage ditches are provided inside the fences.

18.5.7 Ponds:

Existing ponds shall be used. The bottoms of ponds shall be finished with mortar on metal lathing by using wood trowels along the existing levels as shown in the Drawings. Curb stones shall be made of bricks laid in decorative form.

SECTION 19  
ELECTRICAL INSTALLATION WORK

- 19.1 General Provision
- 19.2 Common Provision
- 19.3 Special Specification
- 19.4 Specification of Equipment and Apparatus

19.1 GENERAL PROVISION:

19.1.1 Extent to be covered:

This specification shall be applied to the electrical installation works for the construction of Automobile Repair & Maintenance Workshop in Bangladesh.

19.1.2 Application of Law, Regulation and Standard:

The work shall be performed according to Law, Regulation and Standard of this installation.

19.1.3 Doubts:

If there are any doubts in the Drawings and the Specification on installation and on fabrication of the equipments, they shall be settled in the instruction of the Supervisor.

19.1.4 Slight Alteration:

Slight alteration of installation methods and of position of equipment, apparatus and materials in view of the settlement, fitting, etc., in the site shall be made according to the instruction of the Supervisor.

19.1.5 Selection of Equipments, Apparatus and Materials:

The equipments, the apparatus and the materials shall be principally selected in the manufacturers specified in the Special Specification and shall be approved by the Supervisor.

19.1.6 Approval and Inspection of Equipment, Apparatus and Materials:

The equipment, the apparatus and the materials for this installation shall be inspected and approved by the Supervisor when carried in

the Site.

And manufacturing drawings and sample shall be submitted to the Supervisor for approval.

19.1.7 Act and Cooperation for Procedures:

Procedures with the government and the other public office necessary for this installation shall be made for work and work together by the Contractor without delay.

19.1.8 Submission of Drawings:

The drawings of working, fitting positions, manufacturing, etc., necessary for work and manufacture shall be made without delay before working and manufacturing and submitted to the Supervisor for approval.

19.1.9 Inspection and Presence for Installation:

The installation items on which any inspection can not be made or is difficult after completion shall be inspected or checked by the Supervisor in the process of works.

19.1.10 Test and Inspection:

(a) The equipment, the apparatus and the materials which the Supervisor will recognize that it is necessary to inspect shall be inspected or tested in the manufacture's factory concerned in the presence of the Supervisor or the substitution of the Supervisor.

The report of test results shall be submitted to the Supervisor without fail.

(b) After the completion of installation, the inspection shall be conducted in the presence of the Supervisor. The records shall be submitted to the Supervisor.

(c) The charge for above items shall be included in the Contract amount.

19.1.11 Report of Installation:

The report of installation shall be submitted to the Supervisor according to the instruction of the Supervisor.



19.2 COMMON PROVISION:

19.2.1 Receiving and Distribution of Electricity:

(a) Receiving method and distribution method

They shall be shown in the Drawing and the Special Specification.

(b) Protective device

Unless the protection device is not stated in the Drawings, the protection device shall be provided for the equipments and for the smallest conductor.

19.2.2 Equipment and Apparatus:

(a) Equipment and apparatus

They shall be manufactured with complete work and a good run in accordance with the use.

(b) Mounting of equipment

Mounting location for the equipments shall be shown in the Drawings. The detail of installation shall be decided according to the instruction of Supervisor.

(c) Location of apparatus

The location of apparatus shall be shown in the Drawings. The detail for actual installation shall be decided with the study in the site according to the instruction of Supervisor.

19.2.3 Conductor (Cable and Wire):

(a) Kind and size

The kind and size of conductor for this installation shall be shown in the Drawings.

(b) Connection

The conductor shall be connected in a few points, the connection points shall be completed not to increase the resistance and not reduce the tension in more than 20%. The insulator of the connection point shall keep the effect more than the conductor.

(c) Connection to terminals

In the connection of conductor to the terminal of switch and apparatus, the connection shall be completely made and shall be firmly tightened at the end without becoming loose.

(d) Arrangement of wiring in order

The wirings shall be put in order on the basis of each electrical installation.

19.2.4 Conduit Tube:

(a) Kind and size

The kind and the size of conduit tube for this installation shall be shown in the Drawings.

(b) Laying method

The conduit tube shall be embedded and shall be penetrated in the structure, in case of the installation point without adverse influence. The tube end shall be made smooth in such a manner as the conductor coverings shall not be damaged.

(c) Connection

The connection between conduit tubes or between conduit tube and a box or the like shall be firmly tightened for the using a coupling of the screw type.

The connection between conduit tubes or between conduit tube and boxes or the like shall be made perfectly in a series with using a bonding materials in the case where the connection is electrically separated.

(d) Fixing of exposed conduit tube

The exposed conduit tube shall be installed in the proper positions to support in good order with the use of pipe hanger of the like.

(e) Boxes

The boxes shall be made of steel plate, the size shall be conform to the quantity of conductors and the volume of pipes.

#### 19.2.5 Underground Feeder:

##### (a) Laying method

Laying method for the underground feeder shall not make adverse influence of pressure from the ground. The connection of conductor shall not be made in the underground.

##### (b) Depth

The underground feeder shall be installed at the depth of more than -1,200 mm, where vehicles pass over the installation area. At the other installation area, they shall be set at a depth of more than -600 mm from the ground surface.

##### (c) Mark block

The underground feeder line shall have concrete mark blocks above the ground at the points with the instruction of the Supervisor.

##### (d) Manhole and handhole

They shall be shown in the Drawings.

#### 19.2.6 Earthing:

##### (a) Kind of earthing

The kind of earthing shall be shown in the Drawings.

##### (b) Installation of earthing

The installation shall be checked and inspected in the presence of the Supervisor. The earthing electrode position shall be selected in the incorrosive place at the depth of more than -700 mm from the ground surface.

The connection of earthing cables to the necessary thing shall be firmly made electrically and mechanically.

#### 19.3 SPECIAL SPECIFICATION:

##### 19.3.1 General Provision:

This installation shall be carried out sufficient cooperation with the other parts of this construction, in accordance with the specified installation period and with care of installation site, for establishment of the safe and convenient plant.

19.3.2 Installation Item:

The following items shall be completed in the construction.

- (a) Sub-station equipment
- (b) Main line
- (c) Power control system
- (d) Lighting fixture and socket outlet system
- (e) Telephone and electric clock system
- (f) Lightning conductor

19.3.3 Separate Work to be provided by the Owner:

- (a) 33 kV 3 phase 3 wire 50 Hz, lead-in cable system from outside to incoming panel provided in sub-station (see Drawings).
- (b) Lead-in wire for subscriber's line from outside to telephone exchange room (see Drawings).

19.3.4 Installation Outline:

- (a) Sub-station equipment  
Supply and installation indoor type incoming transformer equipment (see Specification of equipment and Drawings).
- (b) Main line  
Supply and laying main line cable from low voltage distribution panel provided in sub-station to power control board and distribution board fixed in each buildings.
- (c) Power control system  
Supply and fixing power control board, distribution board for power system, and switch, etc. in each building with piping and wiring from boards and switch above indicated to machine, apparatus and outlet boxes or the like.
- (d) Lighting fixture and socket outlet system  
Supply and fixing lighting fixture, ceiling fan, dehumidifier, switch, socket outlet, and distribution board with piping and wiring from fixture to distribution board.
- (e) Telephone and electric clock system
  - (1) Telephone system  
Supply and fixing private automatic branch-exchange,

attendant cabinet, dial telephone and terminal board with piping and wiring.

(2) Electric clock system

Supply and fixing master clock, secondary clock, attendance time recorder and bell or syren with piping and wiring.

(f) Lightning conductor

Supply and fixing lightning rod and conductor with piping, wiring and earthing.

19.3.5 Manufacturer for Electrical Equipment, Apparatus and Materials:

Electrical equipment, apparatus and material shall be principally made by the manufacturers specified in the Appendix of Japan or more than equals.

19.3.6 Spare Apparatus and Materials:

The followings shall be provided.

(a) Lighting fixture

A42	Type	:	Nos.	25
A41	"	:	"	40
d201	"	:	"	5
d401	"	:	"	10
d61	"	:	"	5
b61	"	:	"	5
a101	"	:	"	5

(b) Lamp

FL40W	:	Nos.	150
HF200W	:	"	10
HF400W	:	"	20
IL60W	:	"	20
IL100W	:	"	10
GL15W	:	"	10

(c) Ceiling fan

1400mm sweep	:	Nos.	10
--------------	---	------	----

(d)	Dehumidifier			
	450cc/H	:	Nos.	2
(e)	Secondary clock			
	300mm $\phi$	:	Nos.	5
(f)	Attendance time recorder			
		:	Nos.	5
(g)	Cable and wire			
	Cable			
	600V 3.5mm <sup>2</sup> -4C	:		200m
	Polyvinyl chloride insulated and sheathed cable			
	VVF2.0-3C	:		200m
	Ring-down wire			
	RD0.65-1P	:		200m
(h)	Socket out-let			
	2P-15A·E with plug	:	Nos.	50
	3P-15A·E "	:	"	10
(i)	Tumbler switch			
	1P-10A	:	Nos.	50
(j)	Box type switch			
	MCB 2P 225AF	:	Nos.	5
	" 3P 50AF	:	"	10
	" 3P 100AF	:	"	5
(k)	Molded case circuit breaker			
	1P 50AF	:	Nos.	50
	2P 225AF	:	"	5
	3P 50AF	:	"	50
	3P 100AF	:	"	5
(l)	Magnetic contactor			
	3P 50A	:	Nos.	10

19.4 SPECIFICATION OF EQUIPMENT AND APPARATUS:

19.4.1 Sub-station Equipment:

Indoor type enclosed switchboard shall be covered with steel sheet, installing necessary devices such as a circuit breaker, relays, meters, and line to terminals.

(a) Incoming panel and MOF panel (33 kV)

- (1) Quality : one set
- (2) Type : Indoor type sheet steel, enclosed switchboard
- (3) Comprising:
  - 1 - Voltage detector
  - 1 - 3 pole disconnecting switch, 36 kV 600A  
Manual operation with interlock magnet  
and auxiliary contacts
  - 1 - Oil circuit breaker, motor spring closing  
operation, low-oil-content type  
36 kV 1200A. Breaking current 20 kA
  - 1 - Single phase current transformers  
36 kV 60.30/5A
  - 3 - Over current relays with instant trip
  - 1 - Over current ground relay
  - 3 - A.C. ammeter with change over switch
  - 3 - Dry valve lightning arresters
  - 1 set - Metering out fit (M.O.F.) with maximum  
demand meter, watt hour meter
  - 1 set - Control switches and signal lamps
  - 1 set - Standard accessories and spare parts

(b) Bus duct

For transformer primary and secondary, with bus board: one set

(c) Transformer

- (1) Quality : one
- (2) Type : Oil immersed, self-cooled transformer  
nitrogen-sealed type
- (3) Rated primary voltage : 33 - 31.5 - 30 - 28.5 kV
- (4) Rated secondary voltage: 415 - 240V
- (5) Rated output : 1000 kVA

- (6) Rated frequency : 50 Hz
- (7) Connection : Primary - Delta  
Secondary - Star with external neutral  
(for 3 phases 4 wires type)
- (8) Standard accessories : one set

(d) Low voltage distribution panel

- (1) Quality : one set
- (2) Type : Indoor type sheet steel, enclosed switchboard
- (3) Comprising: 1 set - 400V class, molded case circuit breaker  
1 set - 400V class, earth leakage circuit breaker  
1 - Zero phase current transformer  
3 - Single phase potential transformer  
 $415V/\sqrt{3} / 110V/\sqrt{3}$   
3 - Single phase current transformers  
2000A/5A  
1 - Over current ground relay  
3 - Over current relays  
1 - Under voltage relay  
1 - Over voltage relay  
1 - A.C. voltmeter with change over switch  
1 - A.C. ammeter with change over switch  
1 - A.C. three phase power-factor meter  
1 - A.C. watt meter  
1 - A.C. watt hour meter  
1 - Frequency meter  
3 - Phase advancive condenser (static condenser) with discharge coil  
50 kVA  
1 set - Control switches and signal lamps  
1 set - Standard accessories and spare parts

(e) Storage batteries and battery charging equipment

- (1) Quality : one set
- (2) Type : Full automatic D.C. power source equipment



(Selenium rectifier type)

(3) Output voltage : D.C. 100V

(4) Rated batteries: 60AH/5Hr, 80 Cell  
(Alkaline-battery, enclosed cell type)

19.4.2 Distribution Board and Power Control Board:

Enclosed switch board shall be covered with steel sheet, installing necessary devices such as a molded case circuit breaker, magnetic contactor, relays, and so forth, in addition to the board earthing terminals. (see Drawings).

19.4.3 Ceiling Fan:

1,400 mm sweep ceiling fan shall consist of blade, 5-step speed regulator, canopy and down rod.

19.4.4 Dehumidifier:

Floor mounting type room dehumidifier shall be of capacity 450 cc/Hr. (at temprature 30°C, humidity 80%)

19.4.5 Lighting Fixture:

Lighting fixture of fluorescent lamp, incandescent lamp fluorescent high pressure mercury lamp, and germicidal lamp shall be shown in the Drawings.

19.4.6 Private Automatic Telephone Exchange:

(a) Automatic telephone exchange equipment

(1) System: Full common control crossbar exchange

(2) Number of circuit:

	Initial	Maximum
Station line terminals	150	200
Central office bothway trunk	5	10

(3) Facilities

(i) Line lock out

(ii) Howler tone automatic sending

(iii) Reset call

(iv) Class of service individual

(v) Universal numbering

(4) Technical condition

(i) Capability of central office trunk

Dial pulse speed:  $10 \pm 1$  imp/sec

Dial make ratio :  $33 \pm 3\%$

(ii) Station line

For class E:

Station line loop limit ...  $600\Omega$  at maximum (including telephone set)

Leakage resistance .....  $750\Omega$  at maximum

For class A,C:

Station line loop limit ...  $300\Omega$  at maximum (including telephone set)

Leakage resistance .....  $1.5M\Omega$  at maximum

Central office trunk:

Station line loop limit ...  $1,200\Omega$  at maximum

(b) Attendant cabinet

Cord-less type attendant cabinet : one set

(c) Power equipment

Batteries 50V/108AH (with rectifier): one set

(d) Main distribution frame : one set

(e) Telephone set

650A, telephone (color type) : 150 set

(f) Standard accessories and spare parts: one set

19.4.7 Time Signal Device:

(a) Master clock

Quality : one set

Type : Crystal clock

Accessory :  $\pm 1$  sec/week under normal operation

Output capacity: 800 mA D.C.

Program : 1 minute, 2 circuits

Power reserve : Nickel-cadmium battery (200 hours guarantee)

(b) Secondary clock

Wall fixture type 300 mm $\phi$ , 750 mm $\phi$  (See Drawings.)

(c) Attendance time recorder

Attendance time recorder shall have function of automatic printing, automatic day change, automatic ribbon reverse, etc. and works on a signal of master clock.

accessories for attendance time recorder shall be provided as the followings.

- (i) Steel made Card rack for 50 persons : 25 Nos.
- (ii) Card for monthly pay-roll periods : 15,000 p.c.s.



SECTION 20  
COOLING AND VENTILATING INSTALLATION WORK

20.1 GENERAL :

20.1.1 Scope of Work:

The scope of the work specified in this section is the entire ventilation and air conditioning work required for completing the Work shown in the Drawings and specified in the Specifications as well as their related works.

20.1.2 Doubt:

Should there be any matter that is not specified in the Design, or if any doubt arises, deliberation shall be made with the Supervisor. If it is difficult or inconvenient to follow the instructions given in design documents as to fitting and/or connection at site, deliberation shall be made with the Supervisor.

20.1.3 Shop Drawings, Execution Drawings, Samples, etc.:

Shop drawings, execution drawings, samples, etc. shall be promptly submitted to the Supervisor for approval as required.

20.1.4 Equipment and Materials:

Equipment and materials to be used shall be new articles which have been inspected and approved by the Supervisor or those the use of which has been permitted by the Supervisor.

Each one of the equipment shall be provided with a name plate that clarifies name of manufacturer, year and month of manufacture, model number, performance and other necessary particulars.

20.1.5 Completion Drawings, etc.:

On completion of the work, completion drawings, instruction manuals related to maintenance and equipment operation manuals shall be prepared in accordance with the instructions to be given by the Supervisor.

One set of tools which are required for maintenance and inspection of blowers and pumps shall be submitted to the Supervisor.

20.2 EQUIPMENT INSTALLATION WORKS:

20.2.1 Package Type Air Harmonizer:

- (a) The package type air harmonizer shall contain in its melamine-baked casing the components such as compressor, cooler, condenser, blower, air-filter, motor, control board, electrical control apparatus and temperature regulator.
- (b) The compressor shall be installed through either spring or vibration-proof rubber.
- (c) The cooler shall be of plate-fin coil type with insertion of fin made of either high-purity aluminum plate or tin-plating copper plate.

On the inlet side of the expansion coil the copper tube shall be connected directly to the refrigerant distributor and the tube header shall be installed on the outlet side.

- (d) The blower shall be of centrifugal type.
- (e) Safeguard system

The overload protection relay shall be installed as the safeguard device for the pressure relay, cooling water supply suspension relay, interlock and motor.

20.2.2 Blower:

- (a) The blower shall be centrifugal blower or axial flow blower, and its form, specifications and capacity shall be as specified in the drawings.
- (b) The blower shall have been adjusted by using a balance machine to provide dynamic and static balance.
- (c) The blower shall be driven by a motor through a vee belt as a rule. The belt drive shall be provided with belt guards made by shape steel, sheet iron and/or wire net, and such guards shall be rigidly fixed in place.
- (d) The bearing shall be ball bearings as a rule, and others shall be according to the specifications of manufacturers.

### 20.2.3 Ventilator Fan:

The ventilator fan shall be directly coupled to and driven by a condenser type induction motor. The fan blades shall provide good dynamic and static balance, little noise and vibration during operation and shall provide specified performance.

### 20.2.4 Roof Fan:

The roof fan shall be provided with reverse flow preventive mechanism and complete waterproof structure, and it shall be capable of performing stabilized operation.

### 20.2.5 Air Filter:

The air filter shall be of unit type, and it shall be such that filter frame is securely fitted to the frame made of anti-rust treated thin steel plate or aluminium plate. Standard size shall be 500W x 500H (mm), and it shall be of the structure that facilitates replacement of the unit and minimizes leakage.

The dust collecting efficiency shall be 50% (2.5 m/s) or more as a rule in the measurement under gravity method. Ten percent or more shall be provided as spare.

### 20.2.6 Installation of Equipment:

- (a) Package type air conditioner shall be installed on the concrete foundation, and the foundation shall be of the height that enables provision of gradient for drain pipes.
- (b) The blower shall be installed on common stand equipped with vibration damping device. Joint of the blower with the duct shall be provided with a flexible joint.

20.3 DUCT INSTALLATION WORK:

20.3.1 Duct Materials:

Ducts shall be fabricated of galvanized sheet iron as specified below.

(a) Sheet thickness and joint

Length of Long side mm	Sheet Thick- ness mm	Jointing Flange		Pitch of 4.5φ Rivets	Pitch of 7.5φ bolts
		Specifica- tion	Max. Gap		
Up to 450	0.5	L-25×25×3	3.6 m	65 mm	100 mm
460 ~ 1,000	0.6	L-25×25×3	2.7	65	100
1,100 ~ 1,750	0.8	L-30×30×3	1.8	65	100
1,750 ~ 2,500	1.0	L-40×40×3	1.8	65	100
2,510 or more	1.2	L-40×40×5	1.5	65	100

(b) Reinforcement

Sheet Thick- ness mm	Angle for Reinforcement		Pitch of 4.5φ Rivets
	Specification	Max. Gap	
Up to 0.5	L-25×25×3	1.8 m	65 mm
0.6	L-25×25×3	0.9	65
0.8	L-30×30×3	0.9	65
1.0	L-40×40×3	0.9	65
1.2	L-40×40×5	0.9	65

(c) Hangers

Duct mm	Supporting Angle	Bar Steel	Max. Gap
0.5	L-25×25×3	9 mm	2.7 m
0.6	L-25×25×3	9	2.7
0.8	L-30×30×3	9	2.7
1.0	L-40×40×3	9	2.7
1.2	L-40×40×5	9	2.7



### 20.3.2 Duct Accessories:

(a) Airflow control damper

The casing and movable vane shall be made of steel plate of the thickness of 1.2 mm or more. Where two or more vanes are used, they shall be opposed. The number of vanes shall be one per duct height of 250 mm or less as a rule for a rectangular duct, and the overlap of vanes shall be 15 mm.

Dumper shaft shall be made of galvanized steel bar, and the bearings shall be made of bronze. Opening indicator shall be provided.

(b) Blow-off port

The mounting frame for universal type blow-off port and movable vanes shall be made of aluminium plate or steel plate, and the sheet thickness of the frame shall be 1.0 mm or more.

(c) Suction port

The mounting frame and slits shall be made of aluminium plate or steel plate, and the sheet thickness of the frame shall be 1.2 mm or more. A shutter shall be provided in the rear part of the suction port.

(d) Fresh air intake louver and exhaust louver

These louvers shall be made of galvanized sheet iron or aluminium plate of the thickness of 1.0 mm or more, and sufficient reinforcement shall be provided.

The effective area of each louver shall be about 40 percent of frontal area, and the louver installed in the part that is exposed to rain shall be of the structure that is capable of preventing entry of rain water.

(e) Exhaust hood

The hood shall be made of stainless steel, and sheet thickness shall be as follows. Joints of sheets shall be welded.

Sheet Thickness mm	Long Side of Hood mm
0.5	450 or less
0.6	451 ~ 1,200
0.8	1,201 ~ 1,800
1.0	1,801 ~

The bottom end of the hood shall be provided with a drooping part of 50 mm or more, and the inclination of air collecting part shall be 10° or more to the horizon.

The internal periphery of the hood shall be provided with gutters equipped with cocks made of brass. The part where vapor containing oil and grease is emitted shall be provided with a grease filter.

The filter shall be installed with an inclination of 45° or more to the horizon, and be provided with a grease recollecting vessel. Where grease filters are installed, filters of the quantity identical to used quantity shall be provided as spares.

(f) Flexible joint

Flexible joint shall be prepared by laying asbestos cloth is dual, with piano wires fitted inside as required. The flange interval shall be about 150 mm.

20.3.3 Painting Work:

Two coats of oil paint of specified color shall be applied for finishing.

20.4 List of Spairs :

Unit type filter	500 × 500 × 25	4 pairs
Belt of blower	"	2 pairs
Bearing of blower	"	2 pairs

SECTION 21  
PLUMBING INSTALLATION WORK

21.1 GENERAL:

21.1.1 Scope of Work:

The scope of work specified in this section is the entire plumbing installations work required for completing the works shown in the drawings and specified in the Specifications as well as their related works.

21.1.2 Doubts:

Should there be any matter that is not specified in design documents, or if any doubt arises, deliberation shall be made with the Supervisor. If it is difficult or inconvenient to follow the instructions given in design documents as to fitting and/or connection at the Site, deliberation shall be made with the Supervisor.

21.1.3 Shop Drawings, Execution Drawings, Samples, etc.:

Shop drawings, execution drawings, samples, etc. shall be promptly submitted to the Supervisor for approval as required.

21.1.4 Equipment and Materials:

Equipment and materials to be used shall be new articles which have been inspected and approved by the Supervisor or those the use of which has been permitted by the Supervisor.

Each one of the equipment shall be provided with a name plate that clarifies name of manufacturer, year and month of manufacture, model number, performance and other necessary particulars.

21.1.5 Completion Drawings, etc.:

On completion of the work, completion drawings, instruction manuals related to maintenance and equipment operation manuals shall be prepared in accordance with the instructions to be given by the Supervisor, and they shall be submitted to the Supervisor.

One set of tools which is required for maintenance and inspection of blowers and pumps shall be submitted to the Supervisor.

21.2 WATER SUPPLYING INSTALLATION WORK :

21.2.1 Pipes and Joints:

Steel pipes with polyvinyl chloride linings shall be used. Pipe joints to be used shall be joints made of malleable cast iron of screw type with resin coating.

Lead pipes for water works shall be used at equipment joints and at the points where use of lead pipes is unavoidable for execution.

21.2.2 Valves:

Sluice valves of the diameter of 50 mm or less shall be of screw type made of bronze, and sluice valves of the diameter of 65 mm or more shall be of flange type made of cast iron (valve discs) and bronze (other major parts). All of the sluice valves shall provide pressure tightness of 5 kg/cm<sup>2</sup>.

Check valves to be installed at outlets of pumps shall be of Smolensky type; check valves of other applications of the diameter of 50 mm or less shall be of screw and swing type made of bronze, and those of the diameter of 65 mm or more shall be of flange and swing type made of cast iron (valve discs) and bronze (other major parts). All of the check valves shall provide pressure tightness of 10 kg/cm<sup>2</sup>.

21.2.3 Faucets:

Faucets shall be entirely made of bronze, be chrome plated and be equipped with handles. They shall have passed hydraulic pressure tightness test of 17.5 kg/cm<sup>2</sup>. Faucets in toilets shall be installed at the positions of FL +300.

21.2.4 Piping Work:

(a) The pipings to be embedded in concrete shall be partially executed prior to placing of concrete, and hydraulic pressure tightness test of the executed part shall also be carried out prior to placing of concrete.

(b) Each point along pipings where air pocket may be produced shall be provided with an air vent valve, and each point where mud may be accumulated shall be provided with a blow-off valve.

- (c) Piping supports shall be made of round steel or angle steel. Inserts shall be embedded in concrete ceilings in advance. Piping supports shall be installed in the following intervals.

For pipings which run horizontally:

Pipe diameter of 50 mm or less: 1,800 mm or less

Pipe diameter of 65 mm or more: 3,600 mm or less

For pipings which run vertically:

One point or more per floor

- (d) The depth of embedding of pipes under the ground shall be 300 mm or more in general site, and shall be 750 mm or more under passages of vehicles.
- (e) Hydraulic pressure tightness test at 10 kg/cm<sup>2</sup> shall be performed for 1 hour in witness of the Supervisor during piping work, before backfilling or before covering on completion of piping work.

#### 21.2.5 Antisweat Work and Anticorrosion Work

- (a) The material and sequence of execution of antisweat work classified by the kind of work shall be as follows.

(1) Indoor exposed piping

- ① Foam polystyrene insulation tube
- ② Adhesive tape
- ③ Craft paper
- ④ Cotton cloth joint painting

(2) Piping in ceiling or in pipe shaft

- ①② Same as (1) above.
- ③ Vinyl tape

(3) Outdoor exposed piping or piping in kitchen

- ①② Same as (1) above.
- ③ Asphalt roofing
- ④ Iron wires
- ⑤ Galvanized sheet iron

- (b) The thickness of antisweat material shall be 20 mm.
- (c) Pipings to be embedded shall be applied with two coats of coal-tar pitch.

- (d) Face sides of pipings shall be applied with two coats of oil paint. The color shall be as specified by the Supervisor.

21.2.6 Equipment:

(a) Water raising pump

The water raising pump shall be a multi-stage centrifugal pump directly coupled with a motor by a shaft coupling installed on the common bed base of cast iron. The pump body shall be made of gray cast iron, impeller shall be made of cast bronze and the shaft shall be made of stainless steel bar. Its operation shall be smooth with little vibration and without abnormal noise. It shall be of such a structure that does not allow entry of oil into pumped water.

This pump shall be provided with the following accessories.

(1) Sluice valve	1 each
(2) Check valve (Smolensky type)	1 each
(3) Foot valve	1 each
(4) Pressure gauge	1 pair
(5) Priming water funnel (with cock)	1 each
(6) Air vent cock	1 each
(7) Drain cock	1 set
(8) Suction cover (cast iron)	1 pair
(9) Shaft coupling protective cover (steel plate)	1 pair
(10) Phase flange (with bolts)	1 set
(11) Foundation bolts and other necessary accessories	1 set

The specifications such as delivery rate, head, and motor capacity shall be as specified in the Drawings.

(b) Well pump

The submarine motor pump for deep well shall be a centrifugal pump directly coupled with a submarine three-phase induction motor by means of a shaft coupling. The upper part of the pump shall be provided with a check valve, and the external periphery of the suction part shall be provided with a strainer made of stainless steel having sufficient effective area.

The materials of pump body, impeller and of shaft shall be identical to those of water pump. Thrust bearings shall be incorporated in the motor with corrosion resistance taken into consideration.

This pump shall be provided with the following accessories.

- |      |  |        |
|------|--|--------|
| (1)  | Sluice valve   | 1 each |
| (2)  | Pressure gauge   | 1 each |
| (3)  | Water feed pipe (galvanized steel pipe for water works of flange connection)     | 1 set  |
| (4)  | Electrode for low water level and control cable (length is 10 m from well cover) | 1 pair |
| (5)  | Delivery bend  | 1 each |
| (6)  | Air vent valve   | 1 each |
| (7)  | Phase flange (with bolts)  | 1 set  |
| (8)  | Well cover   | 1 each |
| (9)  | Submarine cable (length is 10 m from well cover)                                 | 1 set  |
| (10) | Foundation bolts and other necessary accessories                                 | 1 set  |

Specifications such as delivery rate, head, and motor capacity shall be as specified in the drawings.

(c) Elevated water tank

The elevated water tank shall be of panel type made of fibre reinforced polyester. This tank shall be provided with connecting ports for water pumping pipe, water feed pipe, water drain pipe, overflow pipe and air vent pipe and also with mounting seats for electrode. It shall also be provided with wave cancelling plates and a manhole (to be lockable). It shall also be equipped with a staircase made of iron in the exterior and a staircase made of F.R.P. in the interior.

Air vent pipe and overflow pipe shall be provided with mosquito nets made of synthetic resin.

(d) Installation of equipment

As for installation of water pump, concrete foundation shall be provided for each common bed. Installation shall be made in level condition, and alignment of shaft shall be correctly

made and nuts shall be uniformly tightened.

### 21.3 DRAINAGE INSTALLATION WORK :

#### 21.3.1 Pipes and Pipe Joints:

Hard polyvinyl pipes (VP) for general use shall be used as pipes, and vinyl pipe joints shall be used as joints.

Wall thickness of pipes shall be as follows.

Pipe diameter	25 mm	30 mm	40 mm	50 mm	65 mm	75 mm	100 mm	125 mm	150 mm
Wall thickness	3.1 mm	3.1 mm	3.6 mm	4.1 mm	4.1 mm	5.5 mm	6.6 mm	7.0 mm	8.9 mm

Galvanized steel pipe shall be used under road area.

Lead pipes for drainage may be used at minimum at the joints with equipment.

#### 21.3.2 Valves:

Valves to be used shall correspond to water supplying installations work.

#### 21.3.3 Drainage Fittings:

##### (a) Floor draining fittings

Floor drainage fittings shall be made of cast iron, and dishes shall be made of brass and be chrome plated.

##### (b) Floor drainage traps

Floor drainage traps shall be made of cast iron, and dishes shall be made of brass with minimum depth of sealing water of 50 mm.

##### (c) Cleaning opening fittings

Cleaning opening fittings shall be of screw type made of brass, and face side shall be chrome plated. Waterproof flange type shall be used for the floor having waterproofing layer.

##### (d) Sink drainage fittings and sink traps

Both of those having dishes and common plugs shall be made of brass and be chrome plated. Plugs shall be provided with chains. Sink traps shall be made of cast iron, and strainers shall be made of brass and be chrome plated.



#### 21.3.4 Piping Work:

- (a) The gradient of indoor horizontal pipes shall be 1/50 for pipes of nominal diameter of 75 mm or less and 1/100 for pipes of nominal diameter of 100 mm or more, as a rule. Air vent pipes shall be provided with gradient of 1/100 or more.
- (b) Piping supports shall be provided firmly in the intervals specified below.

Pipes of nominal diameter of 40 mm or less : 1 m or less

Pipes of nominal diameter of 50~100 mm : 2 m or less

Pipes of nominal diameter of 125 mm or more: 2.5 m or less

- (c) For hangers for horizontal pipes, inserts made of cast iron shall be installed prior to placing of concrete.
- (d) Where jointing is made between a hard polyvinyl chloride pipe and a lead pipe, lead pipe shall be soldered to the external periphery of the union socket; and vinyl socket shall be inserted into and adhered to the hard polyvinyl chloride pipe; and both of them shall be clamped by cap nuts.
- (e) The lead pipes to be embedded or concealed shall be wound with asphalt jute, and the part embedded in the ground shall be filled with earth.
- (f) Each air vent pipe shall be provided at top with a vent dish made of bronze and chrome plated.
- (g) Connection between air vent vertical pipes and air vent pipes of each floor shall be made at the level of overflow level of equipment on the subject floor +150 mm.
- (h) Water flow test shall be carried out on completion of installation of sanitary equipment.

#### 21.3.5 Antisweat Work:

- (a) Antisweat work for pipes exposed indoors, in ceilings and in pipe shafts shall be executed in correspondence to water supplying work.

21.3.6 Drainage pump:

The waste water pump shall be a centrifugal pump directly coupled with a submarine three-phase induction motor with a common shaft or a shaft coupling. The impeller shall be made of gray cast iron and the shaft shall be made of stainless steel bar. Thrust bearings shall be incorporated in the motor.

This pump shall be provided with the following accessories.

- |  |        |
|--|--------|
| (1) Phase flange (with bolts)                                | 1 pair |
| (2) Submarine cable<br>(length shall be 5 m above the floor) | 1 set  |

21.4 SANITARY INSTALLATION WORK:

21.4.1 Sanitary Ware and Accessories:

- (a) Sanitary ware shall be made of white ordinary porcelain.
- (b) Face sides of all the accessories shall be chrome plated.

21.4.2 Execution:

- (a) On installation of equipment, perform alignment in witness of the Supervisor based on detailed construction drawings.
- (b) Where installation is made to concrete or brick walls, installation shall be made so that face side provide good appearance with embedded bolts suitably used.
- (c) Where a part of a porcelain ware is embedded in concrete, asphalt covering of the thickness of 3 mm or more and jointing shall be applied to the entire surface of concrete or mortar that is to contact the porcelain ware as a means of protection so that the porcelain ware does not make direct contact to concrete or mortar.
- (d) Mounting height of equipment shall be as follows.

Urinal stall (From floor surface to top end of front edge)	
530 mm	
Wash basin (	)
720 mm	
Lavatory bowl(	)
760 mm	

- (e) Water feed and drain test shall be performed in witness of the Supervisor on completion of installation of equipment.

21.5 KITCHEN INSTALLATION WORK:

21.5.1 Materials:

The materials shall be stainless steel.

21.5.2 Working:

- (a) Jointing of stainless steel plates of the thickness of 0.8 mm or more shall be made by argon gas welding and be finished by buffing with a grinder.
- (b) Adjust balls made of stainless steel shall be provided at the bottom of legs of each equipment to enable the equipment to be placed flatly and rigidly on the floor.
- (c) Shop drawings shall be prepared based on the Drawings and be submitted to the Supervisor for approval, prior to commencement of fabrication.
- (d) Inspection shall be made as for performance and finish at ship on completion of fabrication, and bring-in to the site shall be made only when the result of such inspection is acceptable.

21.6 PURIFICATORY CISTERN INSTALLATION WORK:

21.6.1 System:

Human waste separate treatment, long-time air-rationing system (segregated air-rationing type).

21.6.2 Number of Persons to be treated:

- |     |                    |   |
|-----|--------------------|---|
| (a) | 120-person cistern | 1 |
| (b) | 100-person "       | 3 |
| (c) | 80-person "        | 1 |
| (d) | 40-person "        | 3 |
| (e) | 10-person "        | 2 |

21.6.3 Sewage Requirement:

0.05 m<sup>3</sup> per person per day

21.6.4 Water Quality:

- (a) Inflow B.O.D. 260 ppm
- (b) Outflow B.O.D. 90 ppm

21.6.5 Construction:

- (a) Concrete
  - Reinforced concrete FC = 180 kg/cm<sup>2</sup>
  - Plain concrete FC = 150 kg/cm<sup>2</sup>
  - Slab concrete FC = 135 kg/cm
- (b) Reinforcing bar Round steel (SR24)
- (c) Waterproofing work

The inner surface of the cistern shall be finished with water-proof mortar of resin compound.

21.6.6 Air-rationing Blower:

- (a) Type : Diaphragm type
- (b) Quantity : 2 units per each cistern (1 unit as a spare)
- (c) Specification:

120-person cistern	20A × 200ℓ/min × 0.15 kg/cm <sup>2</sup> × 0.4 kW
100-person "	20A × 170ℓ/min × 0.15 kg/cm <sup>2</sup> × 0.4 kW
80-person "	20A × 140ℓ/min × 0.15 kg/cm <sup>2</sup> × 0.4 kW
40-person "	15A × 80ℓ/min × 0.12 kg/cm <sup>2</sup> × 0.2 kW
10-person "	15A × 30ℓ/min × 0.1 kg/cm <sup>2</sup> × 30W

21.6.7 Air Spray System:

- (a) Type : Air spray pipe made of synthetic resin
- (b) Quantity : one per each cistern
- (c) Specification:

120-person cistern	70φ × 500ℓ
100-person "	70φ × 500ℓ
80-person "	70φ × 500ℓ
40-person "	70φ × 250ℓ
10-person "	70φ × 250ℓ

21.6.8

- (a) Type
  - 120-person cistern 32A × 100ℓ/min × 3m × 0.25 kW × 2 sets
  - Each cistern same as (a) above

21.7 FIRE FIGHTING INSTALLATIONS:

21.7.1 Type:

Powder fire extinguisher	Vehicle mounted type
Chemical weight	48 kg
Gas volume	1,500 l (N <sub>2</sub> )
Injection mechanism	Open/close type (hose length about 10 m)
Injection time	90 sec (at 20°C)
Injection distance	5 m ~ 10 m

21.7.2 Place of Installation and Quality:

Heavy Repair Factory	1 each
Inspection Factory	1 each
Periodical Repair Factory	1 each
Paint & Body Factory	1 each
Retreading & Metal Casting Factory	1 each

21.8 WELL BORING WORK:

21.8.1 Excavation:

- (a) Excavation shall be performed in the method that is best matched with the ground, and it shall be made completely vertically. Alignment shall be measured at each 10 m during excavation work, and reporting shall be made to the Supervisor.
- (b) The clearance between wall inside wall and periphery of casing pipe shall be 75 mm or more.
- (c) Clay slurry shall be caused to be circulated or be filled at all times during excavation work.

21.8.2 Electrical Logging:

- (a) Electrical logging shall be performed prior to lowering of casing on completion of excavation.
- (b) Measurement shall be taken at one meter intervals in two or more different kinds with electrode gap varied (varied between the length that is almost equal to hole bore and the length that is two to four times of hole bore).

#### 21.8.3 Casing:

- (a) The pipes to be used for casing shall be carbon steel pipes for piping.
- (b) The seams of the casing shall be welded and thorough reinforcement shall be made by using doubling plates, and jointing shall be made so that the casing is free from water leakage and breakage at joint.
- (c) Sinking shall be performed in such a manner that the entire casing is caused to correctly and vertically sink. The casing at the part that is close to the screen shall be provided with a centralizer.
- (d) The top of the casing shall be cut at the position of 600 mm above the finished ground surface, and it shall be provided with an iron cover.

#### 21.8.4 Screen:

- (a) The place to which the screen is to be located shall be approved by the Supervisor in advance.
- (b) As the screen, round holes shall be drilled in the casing in staggered positions. Sleeper wires shall be placed at the exterior of these holes and wires of trapezoidal shape shall be wound outside of sleeper wires and be spot welded to form coil winding form. The area that allows passage of water shall be 15 percent or more of the surface area of the casing.
- (c) The screen may be provided as split in accordance with the conditions of water-bearing strata.

#### 21.8.5 Filling with Gravel:

On completion of sinking of casing and screen, thoroughly fill the space around them with pea gravel of the diameter of 2~4 mm by throwing it by a small amount at a time to prevent collapse of well's inside wall and also to prevent inflow of sand.

The upper part of the well shall be provided with a suitable impermeable device for preventing entry of waste water.

21.8.6 Induction of Ground Water:

- (a) Perform swapping induction after thoroughly cleaning well water.
- (b) Swapping shall be repeated until fine sand in water-bearing strata around the screen pass through the clearances and is completely discharged to the well interior.
- (c) Sweep away the fine sand settled in the well and then perform swapping. Repeat this operation until such a condition that gravel filled around the screen is considered stabilized is reached.

21.8.7 Closing of Well Bottom:

Close the well bottom by filling it with cement paste on termination of induction of ground water.

21.8.8 Pumping Test:

- (a) Pumping test shall be comprised of time pumping test and stage pumping test.
- (b) Time pumping test shall be performed after slurry is thoroughly eliminated. Pump discharge shall be gradually increased up to the test pump discharge. Perform continuous pumping for three days at test pump discharge.

Check and measurement of natural water level shall be made on termination of pumping mentioned above.

- (c) Stage pumping test shall be of stage increasing of stage decreasing measurement method, and it shall be performed for the purpose of obtaining limit pump discharge and optimum pump discharge.

Perform pumping in the initial stage at the pump discharge that is  $1/7 \sim 1/8$  of that of previous test, and pump discharge in each of the subsequent stages shall be what is obtained by adding a fixed value to the pump discharge of the previous stage.

Pumping test in each stage shall be continued until pumping water level is stabilized, and water level shall be measured once every 10 minutes. It shall be judged that the pumping

water level is stabilized when the differential water level between two adjacent measurements is reduced to 10 mm or less. If stabilized water level with differential water level of 10 mm or less cannot be obtained, the pumping time per stage shall be one hour as a rule.

21.8.9 Sectional View of Geology:

Sectional view of geology shall be submitted on completion of work. The sectional view shall be entered by the measured values of electrical logging.

21.9 OIL TANK INSTALLATION WORK:

21.9.1 Oil Tank:

The oil tank shall be steel-plate welded, being provided with connections and seats to permit installation of the oil feed inlet, oil suction or transfer pipe, oil return pipe, steam pipe and drain pipe, together with the accessories as itemized below:

(a) Oil feed inlet (with pipe)	1 set
(b) Oil suction check valve (with pipe)	1 set
(c) Gauge inlet (with bar gauge)	1 set
(d) Leakage check pipe	1 complete unit
(e) Tank top cover	1 set
(f) Tank cover for inspection (for leakage check pipe and drain pipe)	1 complete unit
(g) Steam pipe fitting	1 (one)
(h) Guard cylinder, fixing band and other necessary accessories	1 complete unit

21.9.2 Oil Service Tank:

The oil service tank shall be steel-plate welded, being provided with connections for the oil feed pipe, return pipe, transfer pipe, discharge pipe, overflow pipe and steam pipe and with seats for installation of the float switch and oil level gauge, together with the accessories as specified below:

(a) Oil level gauge	1 set
(b) Manhole	1 complete unit
(c) Iron ladder	1 complete unit



### 21.9.3 Oil Pump:

The oil pump shall be a gear pump which is designed to insure the minimum noise level and no oil leakage. It shall be provided with the following accessories:

- |   |                |
|---|----------------|
| (a) Belt protection cover                               | 1 set          |
| (b) Coupling flange (with bolts)                        | 1 complete set |
| (c) Foundation bolts and<br>other necessary accessories | 1 complete set |

### 21.9.4 Erection Work:

- (a) The oil tank shall be coated over the outer surface for rust proofing. The coated surface shall be coated with asphalt primer and covered with asphalt roofing alternately to the ultimate thickness of 10 mm.

The tank shall be backfilled after being fixed to the concrete foundation with the fixing band. The top of the tank shall be covered with the RC-made cover sized larger by more than 0.6 m respectively than the length and width of the horizontal projection of the tank, with thickness of 0.3 m and larger. The top cover shall be so designed that its weight will not be imposed directly upon the tank.

- (b) The service tank shall be fixed rigidly to the steel-made rack to be specifically provided for this purpose. The oil feed pipe, return pipe and transfer pipe shall be fitted with flexible joints of stainless steel.
- (c) The oil pump shall be installed on the concrete foundation by use of holding-down bolts.

### 21.9.5 Piping:

- (a) Piping material shall be of carbon steel pipe.
- (b) Piping shall be of welded joint.
- (c) The underground pipe shall be enclosed with asphalt jute.

21.10 HIGH PRESSURE PNEUMATIC PIPING WORK:

21.10.1 Pipe Materials:

Carbon steel pipes for piping shall be used as pipes, and joints of screw type made of malleable cast iron shall be used as pipe joints.

21.10.2 Valves:

Stop valve shall be of screw type made of brass. The pressure tightness shall be 15 kg/cm<sup>2</sup>.

21.10.3 Piping Work:

The gradient of pipes shall be 1/100, and drain valve shall be installed at the lowest ends of pipes. The pipes shall be installed on the rack at road area in Construction Work.

21.10.4 Painting Work:

The pipes to be embedded under the ground shall be applied with two coats of anti-rust paint.

The face sides of pipes shall be applied with two coats of oil paint. The color shall be as specified by the Supervisor.

21.10.5 Outdoor exposed pipes shall be supported by steel racks of the height of 4 m. The racks shall be capable of fully withstanding strong wind and vibrations.

21.11 COMPRESSOR COOLING WATER INSTALLATION WORK :

21.11.1 Cooling Tower:

- (a) The cooling tower shall be composed of tower main unit, filler, water tank, blower, motor and accessories. It shall be of such a structure that produces little noise, vibration and splash of water drips during operation, and that provides sufficient performance in the specified position of installation.
- (b) The tower main unit shall be made of fibre reinforced laminated polyester resin plates. They shall be rigidly assembled to withstand strong wind pressure and vibration, to such a structure that facilitates internal inspection and cleaning.  
  
Water distributing device shall provide uniform dropping distribution of water. The louver and wire net to be provided at the air inlet shall be of the material same as the main unit, or shall be made of steel with resin coating.
- (c) The water tank shall be made of fibre reinforced laminated polyester resin plates. It shall be provided with ports for connection of water drain pipe, overflow pipe, water feed pipe and other necessary pipes. Its suction port shall be provided with a dust remover that makes use of wire (of 3 mm or less) made of corrosion resistant metal.
- (d) The filler shall be made of hard polyvinyl chloride. It shall thoroughly withstand ageing, and shall be of the structure and form that provide little resistance to passing air and cause dropping water drips to be divided into fine pieces.
- (e) The blower shall be an axial flow blower, and the exhaust port shall be provided with safety wire net providing corrosion resistance.
- (f) The motor shall be of totally-enclosed outdoor type.
- (g) This cooling tower shall be provided with the following accessories.

Belt and belt cover	1 set
Ball tap	1 set
Iron ladder	1 set
Legs made of angle steel and foundation bolts	1 set

21.11.2 Pump:

- (a) The body of the pump shall be made of gray cast iron, the impeller shall be made of cast bronze, and the shaft shall be made of stainless steel bar. The pump shall be of such a structure that provides little vibration and noise and that does not allow entry of oil into water being fed.
- (b) This pump shall be provided with the following accessories.

Pressure gauge	1 each
Sluice valve	1 each
Air vent cock and drain cock	1 set
Drain pipe	1 set
Foundation bolts	1 set
Other necessary accessories	1 set

21.12 PIPING WORK:

21.12.1 Pipe Materials and Accessories:

- (a) Pipes to be used shall be galvanized steel pipes for water works. Joints to be used shall be of screw type made of galvanized malleable cast iron.

21.12.2 Valves:

Sluice valves of the diameter of 50 mm or less shall be of screw type made of bronze, and sluice valves of the diameter of 65 mm or more shall be of flange type made of cast iron (valve discs) and bronze (other major parts). All of the sluice valves shall provide pressure tightness of 5 kg/cm<sup>2</sup>.

Check valves to be installed at outlets of pumps shall be of Smolenksy type; check valves of other applications of the diameter of 50 mm or less shall be of screw and swing type made of bronze and those of the diameter of 65 mm or more shall be of flange and swing type made of cast iron (valve discs) and bronze (other major parts). All of the check valves shall provide pressure tightness of 10 kg/cm<sup>2</sup>.

21.12.3 Flexible Couplings:

Flexible couplings shall be made of synthetic rubber with reinforcement inserts.

21.12.4 Piping Work:

- (a) Jointing of pipes shall be made by screws or by flanges.
- (b) Piping supports shall be made of round steel or angle steel. Inserts shall be embedded in concrete ceilings in advance. Piping supports shall be installed in the following intervals.

Pipe diameter of 50 mm or less: 1,800 mm or less

Pipe diameter of 65 mm or more: 3,600 mm or less

21.13 SPARES:

Submarine motor pump for deep well	
100mmφ x 800ℓ/min. x 35mAq x 11kW	1 set
Aeration blower for septic tank	
20A x 200ℓ/min. x 0.15kg/cm <sup>2</sup> x 0.4kW	1 each
Gland packing for water pump	4 pairs
Bearing for water pump	4 pairs



# APPENDIX





APPENDIX I

LIST OF SUPPLIERS FOR PROPRIETARY PRODUCTS REFERRED TO IN THE SPECIFICATION

(1) CONSTRUCTION

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Plaster Board	Gypsum Board	-Japan Gypsum Board Association 2-13-12, Nishi-Shinbashi, Minato-ku, Tokyo TEL (591) 6844
Asbestos Cement Silicate Board	Asbest-rax	-Nippon Asbestos Co., Ltd. 1-1-26, Daimon, Minato-ku, Tokyo TEL (433) 7241
Glass Wool Board	Glass Wool	-Asahi Fiber Glass Co., Ltd. 8-1, Ichigaya-hachiman-cho, Shinjuku-ku, Tokyo TEL (268) 1101 -Paramount Glass Mfg. Co., Ltd. 6-1, Yaesu, Chuo-ku, Tokyo TEL (273) 5011 -Nippon Mineral Fiber Mfg. Co., Ltd. 1, Iwamoto-cho, Chiyoda-ku, Tokyo TEL (253) 7781
Sprayed Asbestos	Spray Craft  Blonest	-Nippon Asbestos Co., Ltd. 1-1-26, Daimon, Minato-ku, Tokyo TEL (433) 7241 -Asahi Asbestos Co., Ltd. 7-10-6, Ginza, Chuo-ku, Tokyo TEL (573) 5111

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Vinyl Base Board		<p>-Tajima Ohyakako Co., Ltd. 3-11-13, Iwamoto-cho, Chiyoda-ku, Tokyo TEL (866) 6101</p>
Access Door		<p>-Naka Industry Co., Ltd. 39, Shin-machi, Yashio-city, Saitama Pref. TEL 0489 (36) 3781</p> <p>-Riken Light Metal Industry Co., Ltd. 1-10-5, Iwamoto-cho, Chiyoda-ku, Tokyo TEL (863) 1901</p>
Vertical Blind		<p>-Tachikawa Blind Co., Ltd. 4-30-7, Yoyogi, Shibuya-ku, Tokyo TEL (357) 1111</p> <p>-Nichibei Blind Co., Ltd. 3-15, Nihonbashi, Chuo-ku, Tokyo TEL (272) 2011</p>
Door Mat		<p>-Teramoto Co., Ltd. 1, Katsuyama-minami, Ikuno-ku, Osaka TEL 06 (717) 3721</p> <p>(Branch Office) 1-9, Higashi-komagata, Sumida-ku, Tokyo</p> <p>-Yamazaki Sangyo Co., Ltd. 5-10-12, Toranomon, Minato-ku, Tokyo TEL (432) 3821</p>
Steel Siding Folded Steel Plate		<p>-Sanko Metal Industrial Co., Ltd. 2-9-2, Kyobashi, Chuo-ku, Tokyo TEL (567) 3551</p>

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Steel Siding Folded Steel Plate		-Yodogawa Steel Works, Ltd. Kyobashi Bld., Hatchyobori, Chuo-ku, Tokyo TEL (551) 1171
Utensil Furniture		-Itoki K.K. 1-21-1 Nishi-Shinjuku, Shinjuku-ku, Tokyo TEL (346) 3311
Sealant (Polysulfide Rubber)	Better-Seal  Weather-Ban  Hama-Tight  Chio-Coak  Fine-Sealer	-Sunstar Chemical Co., Ltd. 1-3-36, Mita, Minato-ku, Tokyo TEL (453) 9301  -Sumitomo 3-M Co., Ltd. 2-33-1, Tamagawa, Setagaya-ku, Tokyo TEL (709) 8111  -Yokohama Rubber Co., Ltd. 6-1-11, Shinbashi, Minato-ku, Tokyo TEL (432) 7111 (Branch Office)  -ABC Trading Co., Ltd. 2-12-14, Nagata-cho, Chiyoda-ku, Tokyo TEL (507) 7111  -Nippon Tenkazai Kogyo Co., Ltd. 1-21-5, Maeno-cho, Itabashi-ku, Tokyo TEL (960) 8621
Cut-off board (Synthetic Rubber)		-Hayakawa Rubber Co., Ltd. 1-16-10, Saga, Koto-ku, Tokyo TEL (642) 9434  -Yokohama Rubber Co., Ltd. 6-1-11, Shinbashi, Minato-ku, Tokyo TEL (432) 7111  -Seibu Polymer Chemical Co., Ltd. 2-5, Kami-Ikebukuro, Toshima-ku, Tokyo TEL (916) 6121

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Expansion Join Filler	Maruesu Board	-Nisshin Kogyo Co., Ltd. 2-21-28 Senju-Higashi, Adachi-ku, Tokyo TEL (882) 2424
Polyethylene Film		-Sekisui Chemical Co., Ltd. 2-1-1, Nishi-Shinjuku, Shinjuku-ku, Tokyo TEL (347) 9111
Metal Fence		-Toshin Fence Co., Ltd. Minon-Shobokaikan Bldg., 2-9-16, Toranomon, Tokyo TEL (501) 8511 -Nippon Steel Metal Products Co., Ltd. 7-16-3, Ginza, Chuo-ku, Tokyo TEL (542) 8111
Corner Bead Joiner		-Tsukitoro Kinzoku K.K. 1-6, Ishihara, Sumida-ku, Tokyo TEL (624) 7331 -Naka Industrial Ltd. 39, Shin-machi, Yashio-city, Saitama Pref. TEL 0489 (36) 3781
Emulsion Paint (E.P.) Oil Paint (O.P.)		-Nippon Paint Co., Ltd. 4-1-15, Minami-Shinagawa, Shinagawa-ku, Tokyo TEL (474) 1111 -Kansai Paint Co., Ltd. 5-27, Fushimi-cho, Higashi-ku, Osaka TEL 06 (461) 5371 -Dainippon Paint Co., Ltd. 6-1, Nishikujo, Konohana-ku, Osaka TEL 06 (461) 5371 -Toa Paint Co., Ltd. 1-3-18, Takami, Konohana-ku, Osaka TEL 06 (461) 7031

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Emulsion Paint (E.P.) Oil Paint (O.P.)		-Shinto Paint Co., Ltd. 1-7-20, Yaesu, Chuo-ku, Tokyo TEL (272) 4011
Vitreous Tile		-Ina Seito Co., Ltd. 2-9-8, Hatchobori, Chuo-ku, Tokyo TEL (551) 6371 -Danto Co., Ltd. 3-7-2 Nihonbashi, Hama-cho, Chuo-ku, Tokyo TEL (664) 1621 (Branch Office)
Semi-Vitreous Tile		Do.
Mirror	Mirror 119 AS Series	-Toto Kiki Co., Ltd. 1, Toranomon, Minato-ku, Tokyo TEL (503) 6311 (Branch Office)
Glass		-Nippon Sheet Glass Co., Ltd. 1-8-3, Shinbashi, Minato-ku, Tokyo TEL (573) 0121 -Asahi Glass Co., Ltd. 2-1-2, Marunouchi, Chiyoda-ku, Tokyo TEL (218) 5555 -Central Glass Co., Ltd. 3-7-1, Kanda Nishiki-cho, Chiyoda-ku, Tokyo TEL (296) 7111
Waterproofed Mortar	Rotus  Gelka	-Kaijo Chemical Industry Co., Ltd. 2-28-7, Akabane, Kita-ku, Tokyo TEL (902) 3181 -Yoshida Kensetsu Kogyo Co., Ltd. 5-10-19, Roppongi, Minato-ku, Tokyo TEL (403) 0851

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Waterproofed Mortar	Magna	-Magna Industry Co., Ltd. 1-31, Yoyogi, Shibuya-ku, Tokyo TEL (370) 2211
Light Gauge Steel Frame Backing (Wall & Ceiling)		-Okumura-Jubei Co., Ltd. 22, Ise-machi, Kita-ku, Osaka TEL 06 (312) 4131 -Sakata Kentetsu Co., Ltd. 2-23-12, Fukagawa, Koto-ku, Tokyo TEL (642) 0661 -Suehiro Tetsumo Co., Ltd. 7-16-8, Nishi-Gotanda, Shinagawa-ku, Tokyo TEL (492) 4951 -Nippon Kenko Co., Ltd. 5-29-3, Nishi-Gotanda, Shinagawa-ku, Tokyo TEL (492) 4951
Non-Slip		-Naka Industry Ltd. 39, Shin-machi, Yashio-city, Saitama Pref. TEL 0489 (36) 3781 -Atras Sangyo Co., Ltd. 2-31-1, Higashi-Nippori, Arakawa-ku, Tokyo TEL (802) 4591
Gutter		-Orienta Metal Mfg. Co., Ltd. Kaji-cho, Chiyoda-ku, Tokyo TEL (256) 2719 -Sekisui Chemical Co., Ltd. Sanyo Bldg, Nishi-Shinjuku, Shinjuku-ku, Tokyo TEL (347) 9111

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Welded Mesh		-Teikoku Kanaami Co., Ltd. 3-1-30, Imazu, Minami, Tsurumi-ku, Osaka TEL 06 (961) 5171
Roof Drain		-Hasegawa FDY Co., Ltd. 1-2, Kanda, Awaji-cho, Chiyoda-ku, Tokyo TEL (255) 4051 -Ito Tekko Co., Ltd. 3, Motogo, Kawaguchi-city, Saitama Pref. TEL 0482 (22) 3176 -Daiichi Kizai Co., Ltd. 1-65-4, Akabane, Kita-ku, Tokyo TEL (902) 3141
Cast Iron Insert		-Toyo Kenzai Co., Ltd. 1-9-14, Kaigan, Minato-ku, Tokyo TEL (437) 0831 -Marui Sangyo Co., Ltd. 4-16-8, Kogo-naka, Hiroshima-city, Hiroshima Pref. TEL 0822 (72) 0101
Door & Window		-Fuji Mfg. Co., Ltd. 1-3, Takara-cho, Chuo-ku, Tokyo TEL (279) 1611 -Nikkei Aluminium Sales Company 7-3-5, Ginza Chuo-ku, Tokyo TEL (574) 3698 -Sankyo Alumi Industry Co., Ltd. Sumitomoseimei Bldg, Akasaka, Minatoku, Tokyo TEL (586) 8421

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Door & Window		<p>-Nittetsu Curtain Wall Co., Ltd. 1, Kanda-nishiki-cho, Chiyoda-ku, Tokyo TEL (295) 4511</p> <p>-Imamura Kogyo K.K. 4-5-11, Aoto, Katsushika-ku, Tokyo TEL (603) 0131</p>
Hardware		<p>-Miwa Lock Mfg. Co., Ltd. 3-1-12, Shiba, Minato-ku, Tokyo TEL (452) 5551</p> <p>-Goal Co., Ltd. 4-30, Tsuya-kitadori, Higashi-Yodogawa-ku, Osaka TEL 06 (309) 1271</p> <p>-Showa Lock Co., Ltd. 2-11-50, Nakano-Nakaminami, Yodogawa-ku, Osaka TEL 06 (303) 1121</p> <p>(Branch Office) 4-1-15, Nishiarai, Adachi-ku, Tokyo TEL (853) 1811</p> <p>-Nakanishi Sangyo Co., Ltd. 1-11, Kanda, Izumi-cho, Chiyoda-ku, Tokyo TEL (862) 2211</p>
Door Check Floor Hinge		<p>-Otori Kiko Co., Ltd. 2-2-17, Sotokanda, Chiyoda-ku, Tokyo TEL (255) 7971</p> <p>-Nikkana Co., Ltd. 3-9-12, Kudan-minami, Chiyoda-ku, Tokyo TEL (264) 1381</p> <p>-Nippon Door Check Mfg. Co., Ltd. 2-12, Kanda, Ogawa-machi, Chiyoda-ku, Tokyo TEL (293) 4831</p>



MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Pivot Hinge		<p>-Otori Kiko Co., Ltd. 2-2-17, Sotokanda, Chiyoda-ku, Tokyo TEL (255) 7971</p> <p>-Sugita Kinzoku Co., Ltd. 2-14-15, Midori, Sumida-ku, Tokyo TEL (633) 5151</p> <p>-Nakanishi Sangyo Co., Ltd. 1-11, Izumi-cho, Chiyoda-ku, Tokyo TEL (862) 2211</p> <p>-Nikkana Co., Ltd. 3-9-12, Kudan-minami, Chiyoda-ku, Tokyo TEL (264) 1381</p> <p>-Eiwa Industry Co., Ltd. 3-6-12, Sotokanda, Chiyoda-ku, Tokyo TEL (253) 0317</p>
Crane		<p>-Kito, Corp. 1084, Nakanoshima, Tama-ku, Kawasaki-city TEL 044 (944) 1111</p>
Special Hi-tension Bolt (Special-Type)	<p>TC Bolt</p> <p>PI Nut, Bil-ten</p> <p>Shinko Tol-con Bolt</p> <p>SS Bolt</p>	<p>-Nittetsu Bolten Co., Ltd. 980, Fukutomi, Yukuhashi-city, Fukuoka Pref. TEL 09302 (3) 2571</p> <p>-Sankyo Special Steel Bolt &amp; Nut Co., Ltd. 2-4991, Hironodai, Zama-city, Kanagawa Pref. TEL 0462 (51) 2311</p> <p>-Shinko Bolt Co., Ltd. 17, Futamatashin-machi, Ichikawa-city, Chiba Pref.</p> <p>-Sumitomo Metal Industry's Ltd. 1-3-2, Marunouchi, Chiyoda-ku, Tokyo TEL (282) 6111</p>

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Special Hi-tension Bolt (Grip-Type)	Fastac	-Sankyo Special Steel Bolt & Nut Co., Ltd. 2-4991, Hironodai, Zama-city, Kanagawa Pref. TEL 0462 (51) 2311
Reinforcing Bar (SD-30, SD-35)		-Kawasaki Steel Corp. 1-1-28, Kitamoto-machi-dori, Fukiai-ku, Kobe TEL 078 (221) 4141 -Kobe Steel Ltd. Daiichi-Tekko Bldg., 1-8-2, Marunouchi, Chiyoda-ku, Tokyo TEL (218) 7111 -Nippon Steel Corp. 2-6-3, Ote-machi, Chiyoda-ku, Tokyo TEL (242) 4111 -Sumitomo Metal Industry's Ltd. 1-3-2, Marunouchi, Chiyoda-ku, Tokyo TEL (282) 6111 -Toshin Seiko Co., Ltd. Sankei-shinkan Bldg., 1-7-2, Ote-machi, Chiyoka-ku, Tokyo TEL (242) 6711
Structural Steel Frame	Sumi-Column	-Sumitomo Metal Industry's Ltd. 1-3-2, Marunouchi, Chiyoda-ku, Tokyo TEL (282) 6111 -Nippon Steel Corp. 2-6-3, Ote-machi, Chiyoda-ku, Tokyo TEL (242) 4111

(2) ELECTRICAL INSTALLATION

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Sub-Station equipment		-Hitachi, Ltd. 2-6-2, Ote-machi, Chiyoda-ku, Tokyo TEL (270) 2111 -TAKAOKA ELECTRIC MFG. CO., LTD. 3-4-2, Kaji-machi, Kanda, Chiyoda-ku, Tokyo TEL (254) 5921
Power Control board Distribution board		Do. -Kyokujitsu Electric Works Co., Ltd. 4-23-4, Shimomeguro, Meguro-ku, Tokyo TEL (793) 8811
Lighting Fixture		-Matsushita Electric Works Ltd. 1048, Kadoma-City, Osaka TEL 06 (908) 1131 -Hitachi Lighting, Ltd. 1-11, Sakuma-cho, Kanda, Chiyoda-ku, Tokyo TEL (255) 5251
Telephone equipment	AX - 2S	-Hitachi, Ltd. 2-6-2, Ote-machi, Chiyoda-ku, Tokyo TEL (270) 2111 -Nippon Electric Company Limited 5-33-1, Shiba, Minato-ku, Tokyo TEL (454) 1111

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Time Signal device (Master clock) (Attendance time recorder)	QM - 12 9310 - F	-K. Hattori Co., Ltd. 2-5, Kyobashi, Chuo-ku, Tokyo TEL (563) 2111  -AMANO Corporation 275, Mamedo-cho, Kohoku-ku, Yokohama-City, Kanagawa Pref. TEL 045 (401) 1441
Ceiling Fan	F - 14 YNG	-Matsushita Seiko Co., Ltd. 6-2-61, Imafuku-Nishi, Jyoto-ku, Osaka TEL 06 (939) 1161  -Mitsubishi Electric Corporation 2-2-3, Marunouchi, Chiyoda-ku, Tokyo TEL (218) 3136
Dehumidifiers	RD - 2004E	-Hitachi, Ltd. 2-6-2, Ote-machi, Chiyoda-ku, Tokyo TEL (270) 2111  -Mitsubishi Electric Corporation 2-2-3, Marunouchi, Chiyoda-ku, Tokyo TEL (218) 3136
Wire Cable		-Hitachi Cable, Ltd. 2-1-2, Marunouchi, Chiyoda-ku, Tokyo TEL (216) 1611  -The Furukawa Electric Co., Ltd. 2-6-1, Marunouchi, Chiyoda-ku, Tokyo TEL (213) 0811
Tumbler switch Socket outlet etc.		-Matsushita Electric Works Ltd. 1048, Kadoma-City, Osaka TEL 06 (908) 1131

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME AND ADDRESS
Tumbler switch Socket outlet etc.		-Toshiba Electric Equipment Corporation 1-1-43, Shibaura, Minato-ku, Tokyo TEL (454) 8811
Conduit tube Accessory for conduit tube		Do.

## (3) VENTILATION &amp; AIR CONDITIONING

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Room Cooler		-Mitsubishi Electric Corporation 2-2-3, Marunouchi, Chiyoda-ku, Tokyo TEL (218) 3136  -Daikin Kogyo Co., Ltd. 2-6-1, Nishi-Shinjuku, Shinjuku-ku, Tokyo TEL (347) 8111
Cooling Tower		-Kuken Kogyo Co., Ltd. 1088, Tokunaga, Nishi-ku, Fukuoka-city TEL 09295 (6) 1377  -Shinwa Sangyo Co., Ltd 4-2-2, Hatchobori, Chuo-ku, Tokyo TEL (552) 8171
Pump		-Ebara Corporation 6-6, Ginza, Chuo-ku, Tokyo TEL (572) 5611  -Hitachi Ltd. 1-4, Marunouchi, Chiyoda-ku, Tokyo TEL (212) 1111
Fan		Do.
Roof Fan		-Kurita Electric Works 2-38-6, Kamiya, Kita-ku, Tokyo TEL (902) 8111  -K.K. Kamakura Seisakujo 2-7-11, Kita-Aoyama, Minato-ku, Tokyo TEL (403) 4311

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Galvanized Steel Plate		<p>-Nippon Steel Corp 2-6, Ote-machi, Chiyoda-ku, Tokyo TEL (242) 4111</p> <p>-Nishin Steel Co., Ltd 3-4-1, Marunouchi, Chiyoda-ku, Tokyo TEL (216) 5511</p>

(4) PLUMBING

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
PVC-Lining Steel Pipe Galvanized Steel Pipe		-Nippon Kokan K.K. 1-1-2, Marunouchi, Chiyoda-ku, Tokyo TEL (212) 7111 -Sumitomo Metal Industry's Ltd. 1-3-2, Marunouchi, Chiyoda-ku, Tokyo TEL (282) 6111
Polyvinyl Chloride Pipe		-Sekisui Chemical Co., Ltd. 2-1-1, Nishi-Shinjuku, Shinjuku-ku, Tokyo TEL (347) 9111 -Kubota Ltd. 2-22, Funade-cho, Naniwa-ku, Osaka-city TEL 06 (631) 1121
Valve		-Miyoshi Valve Co., Ltd. 5-10-18, Higashi-Gotanda, Shinagawa-ku, Tokyo TEL (441) 0191 -Kitazawa Valve Co., Ltd. 3-17-9, Minami-Aoyama, Minato-ku, Tokyo TEL (404) 1881
Pump		-Ebara Corporation 6-6, Ginza, Chuo-ku, Tokyo TEL (572) 5611 -Hitachi Ltd. 1-4, Marunouchi, Chiyoda-ku, Tokyo TEL (212) 1111

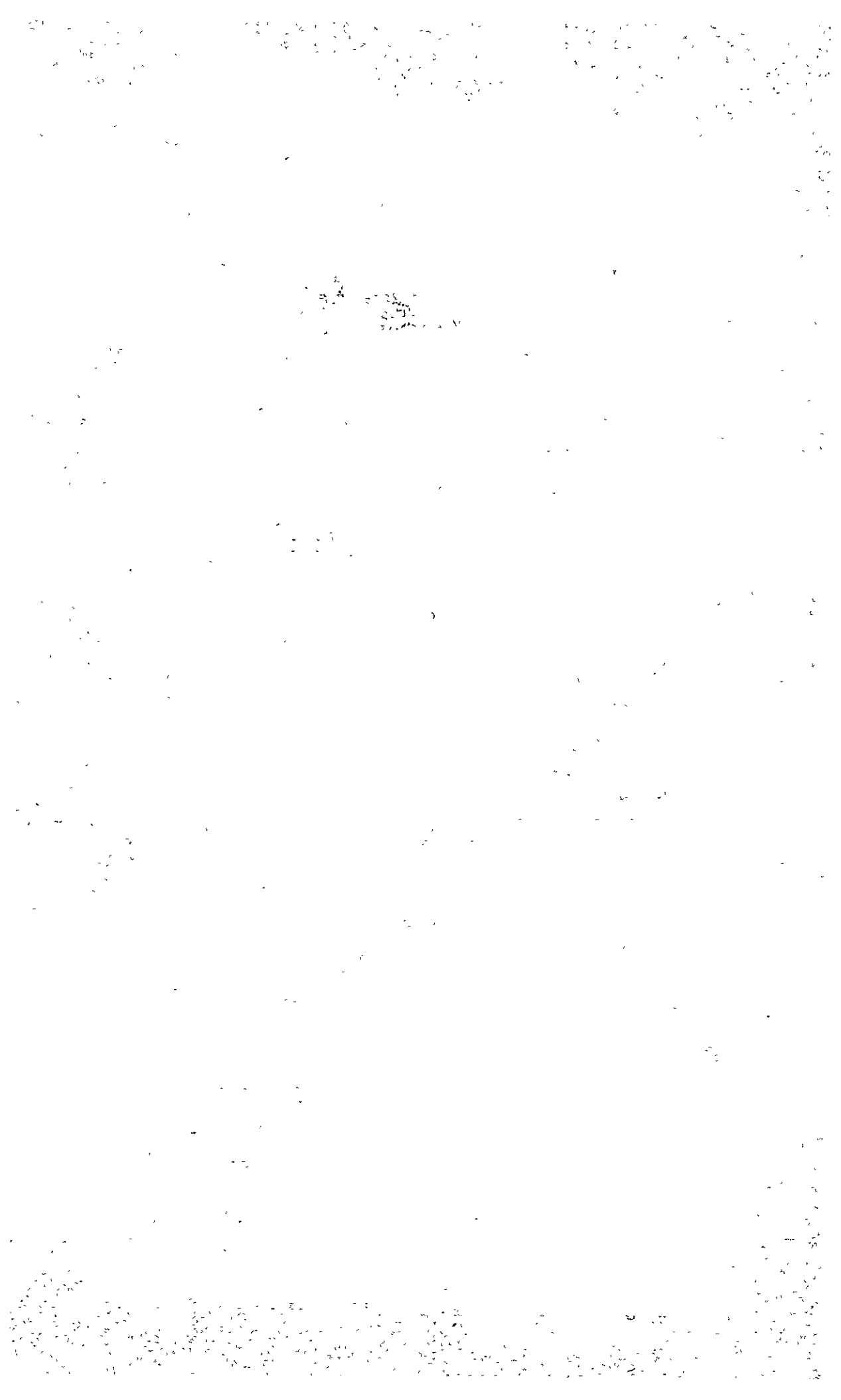


MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Sanitary Fixture		-Toto Ltd. 1, Shiba-Toranomon, Minato-ku, Tokyo TEL (503) 6311 -Ina Seito Co., Ltd.
Kitchen Equipment		-Fuji Chubo Setsubi Co., Ltd. 5-14-5, Shinbashi, Minato-ku, Tokyo TEL (434) 2271 -Sun Wave Industrial Co., Ltd. 3-3, Hon-cho, Nihonbashi, Chuo-ku, Tokyo TEL (279) 4331
Fire Extinguisher		-Miyato Industry Co., Ltd. 3678, Chigasaki, Chigasaki-city, Kanagawa Pref. TEL 0467 (85) 1211 -Nippon Dry Chemical Co., Ltd. 2-4-12, Kyobashi, Chuo-ku, Tokyo TEL (274) 4111
Water Tank		-Sekisui Koji Co., Ltd. 1-32, Dojima-naka, Kita-ku, Osaka-city, Osaka TEL 06 (344) 9251 -Bridgestone Tire Co., Ltd. 1-1, Kyobashi, Chuo-ku, Tokyo TEL (567) 0111
Septic Tank		-Nishihara Neo Corp., Ltd. 3-6-3, Shibaura, Minato-ku, Tokyo TEL (452) 4441

MATERIAL OR PRODUCT	COMMERCIAL BRAND, NAME OR NUMBER	SUPPLIER'S OR MANUFACTURE'S NAME & ADDRESS
Septic Tank		-Hitachi Chemical Shinjuku-Mitsui Bldg., Shinjuku-ku, Tokyo TEL (346) 3111
Heat Insulating Materials		-Omori Sekimen Kogyo K.K. 2-24, Kabuto-cho, Nihonbashi, Chuo-ku, Tokyo TEL (669) 2561 -Miyadera Asbestos Industrial Co., Ltd. 5-3, Minami-Shinagawa, Shinagawa-ku, Tokyo TEL (474) 3621







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