NO. 31 STEEL FITTINGS, MACHINERY AND TOOLS, PLATES.

FE (Phthalic acid resin paint finish)

Coating Process	No.of coats	Type of Paint	Drying hour	Amount kg/m^2
1. Surface preparation		Phospheric acid chemical coat treatment by metal surface treating agent		
2. First coating	1-2	Oil-primer	longer than 10 hrs.	0.08-0.11
3. Puttying		Oil putty		
4. Grinding		Sanding with water		
5. Second coating	2	Oil surfacer	longer than 16 hrs.	0.12-0.15
6. Grinding	2	Sanding with water		
7. Finish coating	2	Phthalic acid resin paint	longer than 15 hrs.	0.11-0.13

Notes:
1. Wash-primer shall be used instead of chemical treatment by phospheric acid in process No.1
2. Number of paint in processes No.5 and No.6 shall indicate the repetition of process.

NO. 32 STEEL SASH, MACHINERY AND TOOLS, PLATES.

SOP (Synthetic resin mix paint finish)

Coating process	No.of coats	Type of Paint	Drying hour	Amount kg/m^2
1. Surface preparation		Completely remove rust, moisture, oil and other impurities by sander, cleaner and scraper		
2. First coating	2	Rust-proof synthetic resin	longer than 15 hrs.	0.12-0.15
3. Second coating	1	Synthetic resin mix paint	-ditto-	0.11-0.13
4. Finish coating	1	- ditto -	-ditto-	0.11-0.13

* * * *

NO. 33 INSIDE OF STEEL, INSIDE OF WATER TANK

EXP (Epoxy resin paint finish)

1. Surface preparation		Remove rust by sand brust or shot brust and clean by volatilizer		
2. First coating	2	Rust-proof epoxy resin	longer than 24 hrs.	0.15-0.20
3. Second coating	1	Second coating paint for epoxy resin paint	-ditto-	0.12-0.15
4. Finish coating	1	Finish coating paint for epoxy resin paint	-ditto-	0.12-0.15

Notes:
1. First coat shall be applied once within 5 hours after surface preparation.
2. Paint for inside of potable water tank shall be that recommended by a manufacturer.
3. After finish paint is applied inside of water tank water tank shall be kept out of water for more than 7 days.

NO.34 INSIDE OF STEEL DUCT, INSIDE OF WATER TANK

T/E x p (Tar-epoxy resin paint finish)

Coating Process	No.of Coats	Type of Paint	Drying hour	Amount kg/m^2
1 Surface preparation		Remove rust by sand blast or shot blast		
2. First coating	1	Tar-epoxy resin paint	longer than 24 hrs.	0.20-0.25
3. Second coating	1	- ditto -	-ditto-	0.20-0.25
4. Finish coating	1	- ditto -	-ditto-	0.20-0.25

Notes:
1. First coat shall be applied once immeidately after surface preparation.
2. Coloring finish, when necessary, shall conform to the specification recommended by a manufacturer.
3. Paint for inside of potable water tank shall be that recommended by a manufacturer.
4. After finish paint is applied inside of water tank, water tank shall be kept out of water for more than 7 days.

* * * *

NO. 35 HEAT-PROOF STEEL

HEAT-PROOF (Heat-proof paint finish)

1. Surface preparation		Remove rust by sand brust or shot brust and clean by volatilizer
2. First coating	1-2	Rust-proof heat-proof paint
3. Finish coating	2	Heat-proof paint

Notes:
1. First coat shall be applied once within 5 hours after surface preparation.
2. This specification shall be prepared for temperature under 150°C.
3. Painted surface shall be kept out of use for more than 5 days after application of last coat.
4. Finish color shall be silver as possible. Color selection shall be carefully done as there is the possibility of color change

NO. 36 FLOOR - WOOD IN CLEAR FINISH

UC (Polyurethane resin clear finish)

Coating Process	No.of Coats	Type of Paint	Drying hour	Amount kg/m^2
1. Surface preparation		Clean and sand to plane surface		
2. Coloring	1-2	N.G.R. Stain	longer than 2 hrs.	
3. Coloring sealer	1	Polyurethane resin wood-sealer	longer than 5 hrs.	0.10-0.13
4. Second coating	1-2	Polyurethane resin clear	longer than 20 hrs.	0.10-0.13
5. Grinding	1-2	Grind by proper grinding tool		
6. Finish coating	1	Polyurethane resin clear	longer than 20 hrs.	0.08-0.10

Notes:
1. Percentage of water content in material to be painted shall be less than 15%.
2. Processes No.2 and No.3 shall be omitted, but number of coat in process No.4 shall be applied twice.
3. Number of paint in processes No.4 and No.5 shall indicate the repetition of process.
4. Painted surface shall be kept out of use for more than 3 days after application of last coat.

No.37 FLOOR - WOOD IN CLEAR FINISH

W-AA (Amino-alkyd resin clear finish for wood)

Coating Process	No.of Coats	Type of Paint	Drying hour	Amount kg/m^2
1. Surface preparation		Clean and sand to plane surface		
2. Coloring	1-2	N.G.R. Stain	longer than 2 hrs.	
3. Coloring sealer	1	Wood-sealer for amino-alkyd resin	-ditto-	0.09-0.11
4. Second coating	1-2	Amino-alkyd resin clear	between 2-8 hrs.	0.09-0.11
5. Grinding	1-2	Grind by proper grinding tool		
6. Finish coating	1	Amino-alkyd resin clear	between 2-8 hrs.	0.08-0.10

Notes:
1. Alkalized area on plaster and cement surfaces shall be neutralized by water and painted.
2. Percentage of water content in material to be painted shall be less than 15%.
3. Processes No.2 and No.3 shall be omitted, but number of coat in process No.4 shall be applied twice.
4. Number of coat in process No.4 and No.5 shall indicate the repetition of process.
5. Painted surface shall be kept out of use for more than 3 days after application of last coat.

NO. 38 FLOOR- CONCRETE AND MORTAR

EXP (Epoxy resin paint finish)

Coating process	No.of coats	Type of Paint	Drying hour	Amount kg/m^2
1. Surface preparation		Dry, clean and free from impurities		
2. First coating	1	First coating paint for epoxy resin	longer than 24 hrs.	
3. Finish coating	2	Epoxy resin paint	-ditto-	

Notes:
1. Degree of dryness on the surface to be painted shall be kept under 6% in water content and below pH 9.5.
2. Amount of paint and number of paint shall be as directed by the supervisor as they vary with the conditions of surface and required thickness of coating.
3. Painted surface shall be kept out of use for more than 7 days after application of final coat.

NO. 39 FLOOR - CONCRETE AND MORTAR

VP (Solvent vinyl chrolide resin paint finish)

Coating Process	No.of coats	Type of Paint	Drying hour	Amount kg/m^2
1. Surface preparation		Dry, clean and free from impurities		
2. Surface sealing	1	Sealer for solvent vinyl chrolide resin	longer than 2 hrs.	
3. Second coating	1	Solvent vinyl chrolide resin enamel	longer than 4 hrs.	0.11-0.14
4. Finish coating	2	- ditto -	-ditto-	0.11-0.14

Notes:
1. Degree of dryness on the surface to be painted shall be kept under 6% in water content and below pH 9.5.
2. Amount of sealer for surface sealing and number of coat in process No.7 shall be as directed by the supervisor as they vary with the surface conditions and required thickness of coating.
3. Painted surface shall be kept out of use for more than 3 days after application of final coat.

20. Interior and Exterior Finishes

20.1 General

20.1.1 Scope

This section shall conform to the work of interior and exterior finish materials described in the following.

20.1.2 Materials

A. Type, quality, shape and size of interior and exterior finish materials shall be specified in each heading. Color tone and ornament shall be decided by submission of sample.

B. Type and size of nails, screws, bolts or others used to apply interior and exterior finish materials shall be decided by their types and shapes.

C. Adhesives for installation of interior and exterior finish materials shall be in accordance with materials to be applied and quality of backing. Notes of special importance shall be described in each heading.

20.1.3 Backing

A. Backing

(1) Material and method of application for wood shall comply with Chapter 12 Carpentry.

(2) Material and method of application for plastering shall comply with Chapter 15 Mortar and plaster.

(3) Material, construction and finish where special backing shall be required shall be as stated in the drawing, in the particular specification or as directed by the Supervisor.

(4) Backing shall be thoroughly dryed so as not to impair interior and exterior finish. Dryness shall be as directed by the supervisor.

(5) Interior finish shall be applied after backing is thoroughly cleaned.

B. Reference line

Reference line shall be set on backing before construction and approved by the supervisor.

C. Protection

Protection in proper method shall be provided with direction of the supervisor at the completion of interior and exterior finish. Protection shall be removed at the specified date and cleaned.

20.1.4 Paint Finish

Paint finish shall comply with Chapter 19 Painting.

20.2 Obliterated

20.3 Flooring Block and Flooring Board

20.3.1 Materials

A. Grade, size, class and species of tree shall be as stated in the particular specification. Class and species of tree shall be B and beech respectively unless otherwise specified.

Table 3.1 Grade and class of flooring

Class	A Class	B Class	C Class
Grade	First	Second	Third
Thickness	18 mm	15 mm	15 mm

B. Tieing hard-ware for flooring block shall be of steel in thickness of more than 0.7 mm and depth of more than 24 mm.

C. Damp-proof paint
Asphalt for damp-proof shall be applied in the back of flooring block bonded by mortar.

D. Adhesive
Mixing ratio of bonding mortar for flooring block shall be 1 to 3. Adhesive for flooring board shall be approved by the supervisor.

20.3.2 Method of Installation

A. Appointment of worker shall be stated in the particular specification.

B. Flooring block
-Backing shall be concrete or mortar.
-Backing shall be finished flat by wood trowel and dryed so that its face is about 50 mm below block finish.
-Bonding mortar shall be stiff consistency of mixing ratio 1:3 and shall be pressed so as not to have irregularity and gap between backing and block. Block shall be layed in line in accordance with layout drawing. Damp sawdast, light oil, etc. shall be scattered on the surface to avoid warping of blocks by moisture out of mortar and cured for 5 to 7 days.
-Block shall be sandered as necessary, soaked with floor oil and wiped off.

C. Flooring board
Finish shall be as set forth in Table 3.2. Finish shall be B class and species of tree shall be beech of 75 to 90 mm in width more than 500 mm in length and 15 mm in thickness unless otherwise specified.

Table 3.2 Classification of finish

A Class	B Class	C Class
1. Having installed, the face shall be finished by deck sander and sandpaper and waxed.	Same as A	Same as A
2. Sandpaper for deck sander shall be as follows. First time #24 Second #36-40 Third #60 Fourth #80	Same as A First time #20-24 Second #36-40 Third #60	Same as A First time #20-24 Second #36-40

Layout of boards shall be planned before setting. Joist shall be placed level and with no gap. Boards shall be properly nailed at every joist without any damage to sides, ends, tongue, groove, etc. Other performance shall conform to Chapter 12 Carpentry.
Protection shall be provided with sawdust, or strow-mat to protect boards from moisture, stain, direct sun-shine, etc. Brown paper shall be used for protection of A-class.

20.4 Mosaid Parquet Flooring

20.4.1 A. Grade, size, class and species of tree shall be as stated in the particular specification. Class and species of tree shall be B and oak respectively unless otherwise specified.

Table 4.1 Grade and class of mosaic parquet flooring

Class	A Class	B Class
Grade	Special Grade	Passing Grade
Thickness	8 mm	8 mm
Length of Piece	160 mm	120 mm - 160 mm

20.4.2 Method of Installation
A. Appointment of worker shall be stated in the particular specification.
B. Backing
(1) Mortar backing
(a) Concrete slab face shall be roughened and damped with water after laitance, dust,

rubbish, etc. are removed. Mixing ratio 1:1 of cement paste shall be applied before setting mortar.

(b) Mortar thickness shall be 20 mm - 25 mm and mixing ratio shall be 1:2.5:1.

(c) Mortar shall be screeded and tapped with wood trowel. It shall be free of trowel trace and unlevelness.

(d) Curing period shall be from 3 to 4 weeks depending on conditions of location and protected properly.

(e) Vapor resisting material shall be placed before setting mortar when moisture is likely to transmit from the ground.

(2) Wood floor backing

(a) Sufficiently dried boards of more than 15 mm in thickness and around 110 mm in width shall be placed without unlevelness, gap and irregularity.

(b) Water-proof veneer of 6 mm in thickness shall be bonded and nailed with a spacing of less than 15 cm in both ways. As an alternative water-proof particle board of more than 20 mm in thickness shall be placed without irregularity.

C. Installation

(1) Rubbish and dust shall be taken off thoroughly.

(2) Marking shall be carefully done to avoid unequal size all around.

(3) Specified adhesive shall be evenly applied on raked backing.

(4) Mosaic parquet flooring shall be placed on top of bond.

(5) Paper face shall be wetted by brush or rag and left for 2 minutes before paper is removed (paper shall be pulled off as level as possible).

(6) Flooring shall be pressed by roller, feet or hands, and joint irregularity shall be simultaneously corrected.

(7) All markings shall be fixed.

(8) Care shall be taken for hardening period of 24 to 48 hours depending on type of adhesive used.

D. Sanding finish

Finish shall be as set forth in Table 4.2. Finish shall be B class unless otherwise specified.

Table 4.2 Classification of finish

1. After installation the face shall be finished by deck sander and disk sander around the edge. Special care shall be taken in the corner.		Same as A class
2. Sandpaper shall be as follows.		Sandpaper shall be as follows.
First time	#24-30	First time #20-24
Second	#36-40	Second #36-40
Third	#60	Third #60
Fourth	#80	

E. After sanding, floor oil, wax, resin, etc. shall be applied in accordance with the particular specification.

20.5 Linoleum Sheet, Rubber Sheet, and Plastic Sheet

20.5.1 Material

A. Type, color, thickness and manufacturer of linoleum sheet shall be as stated in the particular specification. Thickness shall be 2.5 mm unless otherwise specified.

B. Type, color, shape, size and manufacturer shall be as stated in the particular specification. Color tone shall be decided at the submission of sample.

C. Adhesives shall be product by linoleum sheet, rubber sheet or plastic sheet manufacturer or other product recommended by the above manufacturer and also approved by the supervisor.

20.5.2 Method of Installation

A. Backing

(1) Backing shall be finished flat in compliance with article 1.3-A. Wood backing face shall be planed in compliance with B class described in Chapter 12 Carpentry, Article 1.4 Table (3).

(2) Mortar backing face shall be smooth without trowel trace.

B. Sheet shall be pre-placed until it sufficiently expands and contracts. Finish placing shall be done with approval of pre-placing by the supervisor. Linoleum sheet shall be held in place by border, edging strips, etc. as necessary.

C. Finish placing

(1) Position of joint and splice shall be directed by the supervisor in compliance with the drawing. Sheet at joint, splice, around opening and column shall be carefully cut without gap. Brass edging strip of 1.5 mm in thickness and 18 mm in width shall be used to hold sheet around floor opening.

(2) Specified adhesive shall be evenly spread on backing and on back of sheet as necessary. Adhesive shall be applied on all surface as a rule.

(3) After installation, all extra adhesives shall be wipped off, and sheet shall be pressed by roller or other appropriate means and held in place by strips as necessary. Work shall be cured as long as the supervisor finds of its necessity.

(4) Proper care shall be taken with direction of the supervisor when temperature is likely to affect installation.

D. Finish

Surface shall be cleaned with watered cloth after checking the condition of adhesive and let it dry. After dried, water-soluble wax shall be spread and polished.

20.6 Asphalt Tile, Plastic Tile, Linoleum Tile, and Rubber Tile

20.6.1 Material

A. Type, shape, size, method of installation and manufacturer of asphalt tile shall be stated in the particular specification.

B. Type, shape, size, method of installation and manufacturer of linoleum tile, rubber tile and plastic tile shall be stated in the particular specification. Color tone shall be decided at the submission of samples.

C. Adhesives shall be product by manufacturer of tile to be used or other product recommended by the above manufacturer and also approved by the supervisor.

20.6.2 Method of Installation

A. Backing

(1) Concrete or mortar backing shall be smoothly flat and free of trowel trace. Coating of asphalt primer on backing surface shall conform to Chapter 9 Water-proofing. Backing mortar shall be sufficiently dryed so that moisture content in mortar shall be kept below 10% and free of rubbish.

(2) Wood backing shall be stated in the particular specification.

B. Installation

(1) Installation shall be comply with drawing or direction of the supervisor.

(2) Adhesive shall be spread evenly over the backing and tiles shall be layed with joint in line and no gap at splice. Tiles shall be pressed by proper means and cured until adhesive hardens.

(3) Work shall be proceeded by warm work area or keeping tile warm with direction of the supervisor when low temperature is likely to affect work.

(4) Surface finish shall comply with 4.2-D.

Table 6.2 General notes on quality of asphalt tile, plastic tile, adhesive, characteristics of method of installation shall be as set forth in Table 6.2. Linoleum tile and rubber tile shall also comply with this Table.

Table 6.2

			Quality	Symbol	Thickness (mm)	Adhesive	Under Coat	Characteristics of Method	Conditions not Recommended for Use	Area not to be Used By Quality	Area not to be Used By Adhesive
1st Class (Asbestos Contained)	Semi-Hard Type	Common Product	Vinyl-asbestos tile	V A-2A		Asphalt	Asphalt primer	Inexpensive and ordinary	Where condensed " exposed to rain " exposed to the sun " panel-heated " wood-floored	Operation room	Machine room, laboratory, wash-room and kitchen
				V A-3A	2.0						
				V A-2F		Polyvinyl acetate		Strong against the sun, but weak in water	Where condensed " exposed to rail	Ditto	Ditto
				V A-3F	3.0						
				V A-2EP		Epoxy		Water-proof and heat and chemical proof		Ditto	
				V A-3EP							
		Exclusive Product	Vinyl-asbestos tile	HVA-2F	2.0	Polyvinyl acetate synthetic rubber tex		Strong against the sun, but weak in water	Where condensed " exposed to rain " panel-heated	Ditto	Laboratory and machine room
				HVA-3F							
				HVA-2EP	3.0	Epoxy		Water-proof and heat and chemical proof		Ditto	
				HVA-3EP							
	Soft Type		Vinyl-asbestos (soft) tile	SVA-2F	2.0	Polyvinyl acetate		Strong-proof and heat and chemical proof	Where condensed " exposed to rain " wood-floored		Laboratory, machine room and wash-room
				SVA-3F							
				SVA-2EP	3.0	Epoxy		Heat and chemical proof			
				SVA-3EP							

Table 6.2 - continued -

		Quality	Symbol	Thickness (mm)	Adhesive	Under Coat	Characteristics of Method	Conditions not Recommended for Use	Area not to be Used By Quality	Area not to be Used By Adhesive
2nd Class (No asbestos contained)	Homogenious vinyl tile	Vinyl-tile	V T-2F	2.0	Polyvinyl acetate polymer		Strong against the sun, but weak in water	Where condensed " exposed to rain " moistured mortar floor	Operation room	Laboratory, machine room and wash-room
			V T-3F							
			V T-2EP	3.0	Epoxy		Water and chemical proof		Ditto	
			V T-3EP							
	Pure vinyl tile		PVT-3F	3.0	Polyvinyl acetate polymer		Strong against the sun, but weak in water	Where moistured mortar floor	Ditto	Ditto
			PVT-3EP		Epoxy		Water, wear and chemical proof		Ditto and where heated	
Asphalt		Asphalt tile (dark color)	A-3A	3.0	Asphalt	Asphalt primer	Inexpensive and ordinary	Where stained by oil	Machine room	Laboratory and machine room
			A-3EP		Epoxy		Highly water-proof		Laboratory and machine room	Kitchen and wash-room

Note: Cement for vertical application shall be used for baseboard, wall and other vertical areas. Others shall be otherwise specified.

20.7 Fused Asphalt Mortar

20.7.1 Material

A. Types of asphalt

Table 7.1 A Type of asphalt

	Interior Floor		Exterior Floor	
	Floor of Light Load	Floor of Heavy Load	Floor of Light Load	Floor of Heavy Load
Type of Asphalt	Straight	Straight	Straight	Blown
Penetration Depth	10-30	10-30	10-30	20-30

B. Types of aggregate

Table 7.1 B Types of aggregate

Crushed Stone	Size of grain 3-5 mm crushed granite stone for floor of heavy load.
Sand	Ordinary sand.
Stone Powder	Size of grain - those pass through 0.14 mm sift and 60% through 0.074 mm sift (Limestone powder)

20.7.2 Method of Installation

A. Mixing ratio

Table 7.2 Mixing volume ratio of asphalt mortar

	Floor of Light Load	Floor of Heavy Load	For Floor of Color	
Straight Asphalt	12-18	5-7	20-25	Asphalt 60% Resin 5% Pigment 35%
Blown Asphalt		7-10		
Crushed Stone	0	25-30		
Sand	60-70	45-50	50	
Stone Powder	18-22	13-15	20-25	

B. Backing

Asphalt primer shall be evenly spread at 0.3/1 m^2 on sufficiently dryed concrete face.

Asphalt primer shall be evenly spread at 0.3/1 m^2 on lath-mortar with a thickness of 15-18 mm for wood floor.

C. Placing

Crushed stone, sand and stone powder shall be mixed and dryed by heating. Melted asphalt shall be added to the mixture and mixed to homogeneous state. This shall be spread with a thickness of 15-18 mm at the temperature of around 130°C and pressed several times by heated trowel.

20.8 Acid-Proof Asphalt Mortar

20.8.1 Material

A. Types of asphalt

Table 8.1 A Types of asphalt

	Ordinary Temperature	Area Where Touches 20-40°C Acid	Area Where Touches 40-60°C Acid	Area Where Touches 60-80°C Acid
Asphalt	Blown Asphalt	Blown Asphalt	Asphalt Compound	Asphalt Compound
Penetration Depth	30-40	20-30	15-25	15-25
Softening Point	65°	75°	100°	120°

B. Aggregates

Table 8.1 B Types of aggregate

Agalmatolite Powder	White Size of grain - those pass through 0.147 mm sift and 60% through 0.074 mm sift.
Silica Powder	The same as above.
Silica Sand	Silica acid more than 98% Size of grain - those pass through 0.168 mm sift and 50-70% through 0.177 mm and less than 30% through 0.047 mm.
Sand	Clean Size of grain - the same as above.

20.8.2 Method of Installation

A. Mixing ratio

Table 8.2 Mixing ratio of acid-proof asphalt mortar

	Area Where Touches Acid and Alkaline Salt at All Times	Other Area
Asphalt	25 - 30	20
Agalmatolite Powder or Silica Powder	40 - 45	20 - 30
Silica Sand	25 - 30	-
Sand	-	50 - 60
Thickness	More Than 25 mm	More Than 25 mm

B. Backing and placing shall comply with fused asphalt mortar finish.

20.9 Magnesia Cement Finish

20.9.1 Material

A. Magnesia shall have large content of magnesia.
B. Magnesium chloride shall be more than 80% contents.
C. Saw dust shall be 3 mm grain with percentage of water content less than 12% and resin content less than 7%. Cork or vermiculite shall be used as an alternative.
D. Tree powder shall be powder passed less than 1% through 0.3 mm sift with percentage of water content less than 12% and resin content less than 5%.
E. Asbestos powder, lime powder, talc powder and pigment shall be chemically inactive and fine.

20.9.2 Method of Installation

A. Mixing ratio

Table 9.2 Mixing ratio of magnesia cement floor

	Magnesia	Limestone Powder	Asbestos Powder	Tree Powder Sawdust	Pigment
Prime Coat	1	0.65	-	3.3	-
Finish Coat	1	0.7	0.07	0.75	Proper Quantity

B. Mortar backing shall be moistened, and all steel that touches installed floor shall be covered with asphalt.
C. Mortar face shall be moistened with bittern, and backing material shall be spread with a thickness of 10 mm and levelled off with wood trowel.
D. Finish coat shall be spread with a thickness of 5 - 9 mm and levelled off and smoothed with steel trowel until it is lustered.
E. Wax or linseed oil shall be spread after checking dryness of finish coat.

20.10 Synthetic Resin Floor Finish

20.10.1 Material

A. Synthetic resin shall be polyvinyl acetate emulsion, epoxy resin, polyester resin and synthetic rubber tex.
B. Filling materials shall be silica sand, talc, tree powder, carborundum, asbestos fiber, glass fiber, hydraulic cement, and coloring material shall be durable, inorganic pigment.

20.10.2 Method of Installation

A. Backing shall be mortar levelled off with trowel and left for two weeks for drying.
B. Coating thickness shall be 5 - 6 mm and applied on backing.
C. Finish shall consist of two coats of prime coat and two coats of finish coat.

20.11 Electrically Conductive Floor

20.11.1 Coated Floor

A. Terrazzo joint of lattice pattern:
Brass joint spacing of field polished terrazzo shall be 15 cm on center in both ways. Intersecting point of joint shall be soldered to be electrically uniform and properly grounded.
B. Terrazzo with carbon:
Acetylene carbon black shall be mixed to mortar part of standard terrazzo and grinded. Percentage of carbon mixing, mixing ratio of cement and sand, water-cement ratio, grading of sand and aggregates and component of sand shall be stated in the particular specification.
C. Terrazzo with brass pin:
Conductive layer mixed with acetylene carbon black shall be covered with ordinary terrazzo.
D. Terrazzo with conductive mortar backing:
Backing of conductive cement as a principal component shall be covered with ordinary field polished terrazzo.

20.11.2 Setting Floor

A. Brass mosaic tile:
Porcelain mosaic tile shall be layed on mortar backing with carbon black. Brass tile shall be set at every few cm. in both ways.

B. Conductive tile:
40 mm square conductive mosaic tile shall be layed on mortar backing with mixing ratio of 1 part of conductive cement to 3 parts of sand. Joint shall be filled with water-proof mortar.

C. Checked mosaid tile:
Ordinary mosaic tile and conductive mosaic tile shall be layed in mix on conductive mortar backing.

D. Conductive linoleum tile:
30 cm square conductive linoleum tile with thickness of 4 mm which are made of linoleum and carbon black shall be placed by conductive adhesive on mortar and 0.5 cm thick asphalt felt. Copper tape shall be put on the back of tiles to be electrically uniform.

E. Conductive vinyl tile:
One to two copper tapes of 6 mm width shall be placed at every row of tiles over mortar backing coated with asphalt primer. Tiles shall be layed with conductive adhesive.

20.12 Fiber Board, Gypsum Board, Asbestos Slate, Excelsior Board, and Plywood

20.12.1 Material

A. Fiber board, gypsum board, asbestos slate and excelsior board shall conform to the following types, shapes and size, however, shall be in accordance with the particular specification JIS A 5905 (soft fiber board) insulation board, JIS A 5906 (semi-hard fiber board) semi-hard board, JIS A 5907 (hard fiber board) hard board, JIS A 5908 (particle board), JIS A 6901 (gypsum board), JIS A 5410 (asbestos cement board), and JIS A 5404 (excelsior board).

B. Plywood shall conform to Japan Agricultural and Forestry Standard on Standard Plywood, and tree species, description, grading, number of plies and size shall be as set forth in Table 2.1. B class shall be used unless otherwise specified. Tree species shall be lauan in plain finish or paint of natural finish and Japanese Linden others. Class 2 shall be used where exposed to rain or alike. Incombustible plywood shall be class 2.

Table 12.1 Classification of plywood

Type	A Class	B Class	C Class
Class	Class 2	Class 3	Class 4
Grading Number of Plies	Rotary 1st grade more than 3	Rotary 1st grade 3	Rotary 1st grade 3
Size	In accordance with the particular specification.		

C. Wood screw and nail shall be of brass-zinc plated or chrome plated and nail for each type of board shall be as set forth in the following. Nail spacing shall be about 120 mm with approval of the supervisor.
(a) Plywood, hard fiber board, particle board - Brass or stainless nail.
(b) Gypsum board - Stainless (SUS27) Zinc plated for plastering backing.
(c) Asbestos cement board - Brass nail or brass wood screw.
(d) Printed plywood - Color nail.

D. Screw hole for asbestos cement board used for divider in balcony, etc. shall be about 2 mm larger than screw diameter in order to avoid cracks caused by expansion and contraction.

E. Adhesive shall be stated in the particular specification.

20.12.2 Method of Installation

A. Backing shall comply with Chapter 12 Carpentry.

B. Material shall be cut in size and planed as indicated in the drawing and directed by the supervisor.

C. Material shall be installed flat with joints in line by nailing, screwing or adhesive. The use of adhesive shall be in accordance with the particular specification.

D. Hard board shall be wetted before installing.

E. All others not described above shall comply with Chapter 12 Carpentry.

20.13 Overlaid Plywood, Printed Plywood, Painted Plywood and Other Special Plywoods

20.13.1 Material

A. Type, shape and size of overlaid plywood, printed plywood, painted plywood and other special plywood shall be stated in the particular specification.

B. Nail and adhesive shall be those recommended by the manufacturer and also approved by the supervisor.

20.13.2 Method of Installation

A. Backing shall comply with the drawing or manufacturer's specification. Backing shall be comply with Chapter 12 Carpentry unless otherwise specified.

B. Cutting for layout shall be as indicated in the drawing or directed by the supervisor.

C. Material shall be installed flat and no gaps with joints in line by nailing, screwing or adhesive. The use of adhesive shall be in accordance with the particular specification.

D. Installing of plywoods with open joint.
(1) Vinyl tape shall be applied at joints in bathroom and washroom.
(2) Paper tape shall be applied in all others.

E. All others not described above shall comply with Chapter 12 Carpentry.

20.14 Paper, Cloth, Plastic, Veneer, and Vinyl Leather

20.14.1 Material

A. Sample shall be submitted for approval of the supervisor for color tone, ornaments, quality, etc.

B. Type and manufacturer of finish paper, cloth and plastic shall be stated in the particular specification.

C. Underlay paper shall comply with Standard set in Table 14.1.

Table 14.1 Type of underlay paper.

Area of Use	Type of Paper
Seal up for gypsum board plywood	Midium grade of tissue paper
Solid pasting	Same as above
Pasting around edges of paper	Directed by the supervisor

D. Adhesive

(1) Appropriate adhesive shall be used for application of paper, cloth and plastic.

20.14.2 Method of Application

A. Backing

(1) In case of plaster and mortar, second coat shall be applied and finished by steel trowel and sufficiently dried in accordance with Chapter 15 Mortar and plaster.

(2) Method of applying for boards and plywood shall comply with Chapter 20.12.2.

(3) All others not described above shall be stated in the particular specification.

B. Work schedule for wall covering shall be as set forth in Table 14.2 B-class shall be used unless otherwise specified.

Table 14.2 Work schedule for wall covering (Backing - Plaster, mortar, boards)

Work Schedule (Times)	Type A-Class	Type B-Class	Type C-Class	Remarks
Seal up boards as backing	1	1	1	
Solid pasting	1	1	1	Directed by the supervisor or otherwise specified.
Pasting around edge	2	1		
	1	1		
Finish covering	1	1	1	

C. In case of application on ceiling, backing shall be gypsum board and plywood as a rule. Seal-up shall be done once and solid pasting twice before finish covering for A class and B class. Seal-up shall be done once and solid pasting once before finish covering for C class.
D. Condition of dryness shall be checked before proceeding to next stage.
E. Finish covering shall be applied by cutting to fit ornaments and without looseness. Bead and string, if used, shall be placed securely.
F. All others not described above shall be in accordance with manufacturer's specification unless otherwise specified.

20.15 Metal Ceiling Finish

20.15.1 Material

A. Quality of material shall conform to the requirements of the following JIS. Type of material quality shall be zinc-plated thin steel plate unless otherwise specified.
JIS G 3131 (hot drawn rolled steel plate or steel band)
JIS G 3302 (zinc-iron plate)
JIS H 4321 (zinc-plate)
JIS G 3112 (steel bar for reinforcing concrete)
Light metal plate shall be in compliance with material for light metal work.
B. Shape, size, ornament and combination of metal ceiling shall be stated in the particular specification.
C. Nail for application shall be galvanized flat nail of 18-24 mm in length. Copper nail shall be used for copper plate. All others shall be stated in the particular specification.

20.15.2 Method of Application

A. Backing
(1) Wood board backing shall comply with Chapter 12 Carpentry and Chapter 20.1.3.
(2) Wood framing backing shall comply with Chapter 12 Carpentry and Chapter 20.1.3, and spacing of nailing block shall be about 300 mm x 600 mm in accordance with layout of metal ceiling.
B. Painting
(1) Rust-proof paint
Painting shall be in accordance with the particular specification. Rust-proof paint for galvanized thin steel plate shall conform to paint specification No.8 of Chapter 19 Paint.
(2) Gap shall be filled with putty and oil paint shall be applied in accordance with Chapter 19 Painting.

20.16 Non-Combustible Rock-Wool Acoustic Ceiling Board

20.16.1 Material

Material shall be rock wool formed by bond.

A. Light steel backing
9 mm thick gypsum board shall be laid.
Wood backing
6 mm thick water-proof veneer or 9 mm thick gypsum board shall be laid.

B. Application
Exclusive adhesive shall be placed at 9 points (0.3 kg/m^2) of 303 mm square non-combustible rock wool acoustic board. Color nail shall be used.

C. Care at work
Work shall not be proceeded when moisture is detected in concrete or where moisture content is more than 90% such as in bathroom, restaurant, kitchen, etc.

20.16.2 Standard Size

Standard size shall be as set forth in the following Table.

Size	Thickness
303 mm x 303 mm	12 mm
303 mm x 454.5 mm	12 mm
303 mm x 606 mm	12 mm
454.5 mm x 454.5 mm	12 mm

Note: Both chamfering and square edge are available in each size and other special size shall be stated in the particular specification.

20.17 Movable Partition

20.17.1 Material and Construction

Frame, type of finish material, accessory, construction and size shall be as stated in the drawing or the particular specification. Quality of material shall comply with the specification of the work concerned.

20.17.2 Method of Installation

Installation shall comply with the work concerned of material used unless otherwise specified. Anchor shall be securely fixed in correct position. Partition shall be precisely placed with alignment in both ways.

20.18 Carpet

20.18.1 Scope

This section shall apply to rug and carpet.

20.18.2 Material

A. Pile thread shall be 100% wool without shoddy and combings.

B. The use of synthetic fiber shall be as directed by the supervisor.
C. Carpet shall be stated in the particular specification.
D. Pile shall be more than 12 mm in rug and 4 - 10 mm in carpet.
E. 5 - 10 mm thick cow fur felt or hemp felt shall be used as underlay.

20.18.3 Rug

A. Color tone, ornament, etc. of rug shall be decided by sample. Drawing necessary for weaving or sample weaving shall be prepared from the drawing and full scale drawing and approved by the supervisor.
B. Dyeing shall be substantial and durable.

20.18.4 Insect Control Preservation

Treatment against insect, decay, fire shall be stated in the particular specification.

20.18.5 Weaving Finish

A. Work shall be done so that there is no unevenness and scratch in weaving and color. Shearing and starching shall be sufficiently conducted. Necessity and extent of shearing shall be conducted prior to execution.
B. Material for weaving shall be sufficiently free of oil. Field measurement shall be taken to check measurement before weaving.

20.18.6 Laying

A. Preparation
Underlay felt shall be joined by butt joint and nailed in case of board backing and applied by adhesive in case of concrete backing.
B. Direction of laying and fitting of side and ornament shall be decided with direction of the supervisor. Joint shall be patched with strong cotton thread or hemp thread.
C. Cutting edge of rug shall be treated by pile thread of similar color. Cutting edge of carpet shall be finished by folding after fixing pile thread.
D. Carpet or rug shall be preset to check irregularity and unevenness and nailed around edges at about 100 mm on center.
E. In case of laying on stairs both edges shall be nailed at 100 mm on center and lower edge of riser shall be sufficiently nailed and held by 15 mm diameter of brass polish pipe wood-screwed at both ends and middle with spacing of 300 mm. 12 mm diameter of brass polish pipe shall be wood screwed at both ends and middle with spacing of 300 mm.

20.19 Curtain

20.19.1 Material

A. Curtain cloth
Cloth shall be a specified product and cloth of special weaving shall be stated in the particular specification.

B. Curtain rail
Curtain rail shall be of steel or aluminium unless otherwise specified. Large size rail shall be used for curtain of heavy weight. Runner shall be of synthetic resin and runner spacing shall be determined by weight of cloth. Leech hook shall be of brass.

C. Tassel
Tassel shall be of the same cloth as curtain with a width of 60 mm. There shall be no knots. Hanging hardware for tassel shall be B plated of brass W.

D. Sample of curtain rail, runner and tassel shall be submitted for approval of the supervisor.

20.19.2 Type — Curtain shall be a draw type unless otherwise specified.

20.19.3 Tailoring

A. Lower edge of curtain shall be at 90 mm above finished floor or 90 mm above window sill, or at finished floor for light intercepting curtain.

B. A minimum width shall be at least 1.5 times that of the window for drapes and 2 times for lace and casement-cloth.

C. Top of curtain shall be provided with rise. Side joint shall be vertically sewed and both ends shall be hemmed as a rule.

D. Lower edge of cloth shall be folded back 90 mm.

E. Fold back of light intercepting curtain shall be covered with vinyl sheet when requested.

F. Lap portion of draw curtains shall be 300 mm. Drape shall not be lapped when lace and drape are used together.

20.19.4 Pulling Device — Manual pulling device by rope shall be installed when height of curtain rail is over 3.5 m from the finished floor or when requested pulley or weight shall be attached at lower end of rope. Rail shall be stated in the particular specification.

20.19.5 Installation — Rail shall be installed accurately at curtain box or specified location. Rail shall be longer than the opening by 100 mm at both ends. Runner spacing shall be within 120 mm and number of runners shall be even pieces. Spacing of rail attachment shall be properly decided by the weight of curtain. Location of tassel shall be decided with direction of the supervisor.

20.19.6 Electric Pulling Device — Detail for installing electric pulling device shall be decided in consultation with the supervisor.

20.19.7 Field Measurement — Field measurement shall be taken before tailoring of curtain.

20.20 Venetian Blind

A. Slat shall be of steel, plastic or aluminium alloy and its finish color shall be as directed by the supervisor. Sample shall be submitted for approval of the supervisor.

	Type	Material Quality	Thickness (mm)	Width (mm)
Aluminum	S or C	Surface treated corrosion-proof aluminum alloy with synthetic resin varnish baking finish	0.2	50
Steel	S or C	Carbon steel with 0.8-0.9 carbon contents, baking finish	0.10-0.17	50

B. Tape for slat shall be made of strong fiber and processed with synthetic resin on both sides. Width shall be between 15 mm and 30 mm. Color and location of tape shall be decided with approval of the supervisor.

C. Tape for lifting shall be made of 18-8 stainless steel with width of 6 mm.

D. Code for operation shall be made of surface-treated, strong synthetic fiber with diameter of 4 mm. Location and length of operation cord shall be decided in consultation with the supervisor.

E. Head-box shall be made of surface-treated, rolled formed 0.45 - 0.5 mm thick polish steel plate. Width and height shall be 57 mm and 51 mm respectively.

F. Bottom rail shall be made of surface-treated, rolled formed 0.35 mm thick polish steel plate. Lap at both ends shall, however, be of synthetic resin. Width and height shall be 50 mm and 20 mm respectively.

20.20.2 Operation — Lifting and angle adjusting of slats shall be controlled by single cord unless otherwise specified. Operation for blind with light penetrating function and other special blind shall be as directed by the supervisor.

20.20.3 Installation — Blind shall be accurately placed at existing box or designated position, and tests for lifting and angle-adjusting of slat shall be held without fail per every blind set.

20.20.4 Electric Device — Detail for electric device shall be decided in consultation with the supervisor.

20.21 Vertical Blinds

20.21.1 Material

A. Quality of louvre shall be as stated in the particular specification. Sample of finish color shall be submitted for approval of the supervisor.

B. Hanger rail shall be made of surface treated aluminium alloy.

C. Chain for opening and angle-adjusting of louvre shall be durable and easy operating.
D. Rod, runner and all other parts shall be of proper quality and shape and strength.

20.21.2	Type	Type of vertical blind shall be that of hanging with rail only at the top.
20.21.3	Instal-lation	Blind shall be accurately placed at existing box or designated position and tests for opening and angle-adjusting of louvre shall be held without fail per every blind set.
20.21.4	Electric Device	Detail for electric device shall be decided in consultation with the supervisor.
20.22	Curtain Wall	Quality, shape, method of assembly and connection and accuracy of curtain wall shall be as indicated in the drawing or stated in the particular specification.

21. Miscellaneous

21.1	Name Plate for Room	Name plate shall conform to drawing or particular specification and removable.
21.2	Blackboard	Blackboard shall conform to JIS S 6007 (wood blackboard) and dimension in accordance with drawing. Blackboard shall be firmly fastened to wall and color shall be stated on drawing or particular specification.
21.3	Smoke-Stack for Bath	Smoke-stack shall conform to drawing or particular specification.
21.4	Ventilation-Hole for Under Floor and Ceiling	Ventilation-hole shall conform to drawing or particular specification.
21.5	Inspection-Hatch for Floor and Ceiling	Inspection-hatch shall conform to drawing or particular specification. In case not stated in the particular specification, inspection-hatch shall be 450 mm square and material and performance shall comply with floor work.
21.6	Man-Hole for Roof	Man-hole shall conform to drawing or particular specification.

21.7 Furniture — Furniture shall be produced at factory and may be painted at site.

21.8 Sink, Table and Other Kitchen Cabinets — Kitchen furnitures shall conform to drawing and particular specification. Hung cabinet shall be firmly secured by bolts to avoid deformation.

21.9 Insect and Rat Proof — Insect and rat proof shall conform to drawing and particular specification. In case not stated on the particular specification, insect-proof-net and rat-proof-net shall be provided with approval of the supervisor.

21.10 Milk and Mail Box — Milk and mail box shall be plastic or stainless steel product and dimension shall conform to drawing.

21.11 External Fence — Fence shall conform to concerned chapter of this specification in accordance with material. Steel-fence shall be corrugated sheet, gas-pipe or net, concrete foundation, painted in accordance with Chapter 19 Painting of this specification and performed with care to avoid any deformation.

21.12 Gardening — Gardening shall conform to drawing and particular specification.

21.13 Drainage

21.13.1 Material

A. Mixture of concrete shall conform to Chapter 5 Concrete and form work and mortar shall conform to Chapter 15 Mortar and plaster.

B. Drainage pipe shall be earthware pipe, concrete pipe or hume pipe and conform to JIS R 1201 (earth ware pipe - straight pipe), JIS R 1202 (earth ware pipe - bent pipe), JIS A 5302 (reinforced concrete pipe) and JIS A 5303 (reinforced concrete spun pipe).

21.13.2 Performance

A. Drainage pit shall conform to the following Table 20.2 Dimension of drainage pit unless otherwise specified.

Table 20.2 Dimension of drainage pit

Depth of Pipe	Width and Length	Thickness of Wall	Thickness of Slab	Thickness of Hard-Core
600 mm	450x450 mm	100 mm	100 mm	100 mm
610-900 mm	600x600 mm	120 mm	120 mm	120 mm
910-2,000 mm	750x750 mm	150 mm	150 mm	150 mm
2,010-3,000 mm	900x900 mm	150 mm	200 mm	200 mm

Pit deeper than 1,200 mm shall be provided with galvanized iron steps and wall shall be reinforced with 9 ϕ mm reinforcing bar for interval of 200 mm vertically and horizontally. Depth of pit shall be more than 150 mm deeper than depth of pipe. Interior of pit shall be finished with mortar 15 mm thick. Cover and Man-hole of pit shall be otherwise specified or indicated on drawing.

B. Drainage pipe:
   (1) Bedding for earth-ware-pipe shall be sloped to required grade and properly compacted.
   (2) Bedding for concrete-pipe and hume-pipe shall be sloped to required grade and properly compacted. Bedding for joint of above stated pipes shall be compacted with stone and blinding and lean concrete placed.
   (3) Joint of earthware-pipe shall be packed properly with mortar.
   (4) Joint of concrete-pipe and hume-pipe shall be provided with packing and packed with mortar.
   (5) Hume-pipe drainage shall be provided with expansion joint at every 30 m in accordance with manufacturers expansion joint standard.

C. Side ditch shall conform to JIS A 5305 (casted reinforced concrete U-shape) or JIS A 5306 (concrete or reinforced concrete L-shape). Cover shall be concrete product or coal tar coated cast-iron.

SECTION 7 GENERAL SPECIFICATION

Part 4 Air-Conditioning and Ventilating Work

SECTION 7 GENERAL SPECIFICATION

Part 4 Air-Conditioning and Ventilating Work

INDEX

1.	Air-Conditioning Unit	
1.1	General	The equipment stated in the index as 1.1 to 1.11 shall confirm to the particular specification.

2. Piping and Ducting Material

2.1 Piping Material and Accessories

2.1.1 Piping Material A. Standard Piping Material shall conform to Table 4-6.

Table 4-6

Piping	Standard	Type	
Steel pipe	JIS G3452 (Carbon steel pipe)	White Black	Water supply, Hot water supply, Drain, Stack, Children water
Copper pipe	JIS H3603 (Deoxidized copper pipes) Dimensions and Tolerance corresponding to ASTM 88-L (Hard copper pipes)	Class 1	Hot water supply
PVC Pipe	JIS K6742 (Hard vinyl chloride pipe for water supply use)		Water supply Drainage, Stack
Vinyl Lining Steel Pipe	JWWA K-118 (Anti shock Hard P.V.C. Water Supply Pipe) JWWA K-116 (Hard P.V.C. Water Supply Pipe)		Water Supply, Drainage, Cooling Water Supply.

B. Joint Standard shall conform to Table 4-7

Table 4-7

Name	Standard	
Steel joint	JIS B2302 (Threaded steel pipe joint) JIS B2211 (Basic dimension of 5 kg/cm^2 iron and steel pipes flanges) JIS B2212 (Basic dimension of 10 kg/cm^2 iron and steel pipe flanges)	Galvanized
Copper pipe joint	Quality of copper pipe joint shall conform to the standard of manufacture and came as copper pipe.	Hot Water Supply
Vinyl pipe joint	JIS K6743 (Hard vinyl chloride pipe joint for Water supply use)	Water Supply Drainage Vent.
Vinyl lining steel pipe joint	Threaded joint shall conform to JIS B2301 and shall be lining by Hard P.V.C. of 0.2 mm or more, or epoxy lining of 0.15 mm or more. Calking shall be harmless for health and shall not affect to the water quality. Frange joint shall conform to JIS B 2211 or JIS B 2212. Frange welded to steel pipe and lined by P.V.C.	Water Supply Drainage Cooling Water

2.1.2 Valves and Cocks

A. Standard of Valves and Cocks shall conform to Table 4-8.

Table 4-8

Name	Nominal Dia.	
Gate Valve	Less than 50 mm	JIS B2013 Threaded gate valve, Bronze 5 kg/cm^2 JIS B2023 Threaded gate valve, Bronze 10 kg/cm^2
Globe Valve	More than 65 mm	JIS B2021 Threaded globe valve, Bronze 10 kg/cm^2 JIS B2031 Cast iron flanged gate valve male thread 5 kg/cm^2 JIS B2041 Cast iron glanged globe valve 10 kg/cm^2 JIS B2044 Cast iron flanged gate valve male threaded 10 kg/cm^2
Check Valve	Less than 50 mm More than 65 mm	JIS B2025 Threaded swing check valve,Bronze 10kg/cm^2 JIS B2045 Flanged swing gate valve cast iron 10kg/cm^2
Sluice Valve		JIS B2062 Sluice valve for water supply use.
Corporation cock		Shall be of bronze, conforming to the standard of local Authorities.
Stop cock		Same as above
Faucet		JIS B2061 (faucet)
Ball tap	Ball tap shall be made of bronze and ball shall be made of copper. Nominal diameter less than 50 mm shall be threaded joint and more than 65 mm shall be flange joint.	

Check valve shall be swing type in all case.

B. Butterfly valve

Temperature : -10°C ∽ 90°C
Pressure : 1 ∼ 16 kg/cm^2
Test : Test pressure, 20 kg/cm^2 to 10 kg/cm^2 type
32 kg/cm^2 to 16 kg/cm^2 type

2.1.3 Accessories

A. Pressure reducing equipment

Pressure reducing equipment shall be the combination of pressure reduce valve, strainer, relief valve, pressure gauge and method shall conform to HASS-405.

B. Trap equipment

Trap equipment shall be the combination of trap, dirt pocket strainer and gate valve and by-pass shall be provided.
Steam traps shall be tested as specified in JIS B8401 (performance and test method os steam traps)

C. Automatic Thermal Control Valve

Two way valve for steam and two way or three way valve shall be provided in accordance with the drawings.
Pressure gauges shall be provided at the inlet and outlet side of steam line Automatic Thermal control valve.

2.1.4 Expansion Joint

Type of expansion joint shall be as follows:

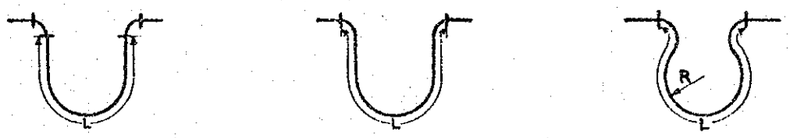

Table 4-9

Temperature difference		mm 40	50	65	80	100	125	150	200
150°C	L (m)	3.5	4.0	4.5	5.0	5.5	6.2	7.0	8.0
	R (m)	0.35	0.40	0.45	0.50	0.55	0.62	0.70	0.8
150 - 200°C	L (m)	4.0	4.5	5.2	5.8	6.5	7.2	8.0	9.0
	R (m)	0.40	0.45	0.62	0.58	0.65	0.72	0.80	0.90

2-2 Duct material and Accessories

2.2.1 Duct material

A. Galvanized iron sheet to be used for air duct shall be of first-class plate in conforming to JIS G3302 (Galvanized iron sheet)

B. Duct material to be used for duct installed at bath-room, kitchen, battery room, where damp or exposed to corrosion gas, shall be specified in the drawings and particular specification.

C. Steel for duct reinforce and flange shall conform to JIS 3101 (rolled steel for general structural use) and shape and dimensions shall be from 25x25x3 to 40x40x5 in accordance with duct size.

D. Steel sheet to be used for spiral duct shall conform to JIS G3302 (Galvanized Steel sheet)

Thickness of galvanized iron sheet shall conform to Table 4-10.

Table 4-10

Nominated duct diameter	Sheet thickness	Joint plate thickness	
200 or less	0.5	0.5	60 or more
210 - 600	0.6	0.6	80 "
610 - 800	0.8	0.8	100 "
810 - 1,000	1.0	1.0	100 "

E. Flange packing shall be 3 mm thick asbestos tape made of asbestos thread conforming to JIS R3450 (asbestos thread).

2.2.2 Duct supports — Steel for duct support shall conform to JIS G3101 (rolled steel for general structure use), JIS G3191 (Steel bar) or JIS G3302 (Galvanized iron sheet) class 2.

2.2.3 Air Outlet — Shape dimension, type, capacity, accessories, finish shall conform to the drawings. Prior to the fabrication, shop drawing sand samples shall be provided and approved by the supervisor.
Outlet shall be free from much noise.

2.2.4 Intake

3. Installation of Equipment and Piping Work

3.1 Installation of Equipment

3.1.1 General

A. Concrete foundation for equipment shall conform to the drawings. Concrete shall be mixed with the ratio 1:2.5:3.5 and cement shall conform to JIS R5210 (Portland Cement). Finish shall be mortar-finished with the thickness of 20 mm unless otherwise specified.

B. Drain channel shall be provided around the edge of the foundation of pump and refregerating machine to effect drainage through the PVC Pipe of 40 mm in nominal diameter. Such drain pipe shall be provided with a drain greating.

C. Any load shall not be applied to the foundation within 10 days after concrete placing.

3.1.2 Installation of Refregerating Machine

Foundation for refregerating machine shall be vibration-proof using rubber, cork or spring. Refrigerating machine shall be installed true to the horizontal and vertical lines, grade and center by means of a level, a leveling string, plumb-bob, etc. in accordance with the drawings.

3.1.3 Installation of Air-conditioner

A. Air cleaner shall be installed level on the concrete foundation finished with mortar and covered with asphalt installation layer. The water tank and the casing shall be connected air tight by means of rubber packing inserted in between flange.

B. Air-Filter

Top surface of foundation on which air filter is to be installed shall be finished level with water-proofing mortar. In case of unit type air filter, air-tightness shall be effected by installing the fixing frame, and in case of other types of filter, air filter itself shall be installed, so as to close the edge of the filter or clearance between filters.

3.1.4 Installation of Blower

Centrifugal blower shall be installed on the concrete foundation or steel trestles of vibration-proof construction. Vibration-proof material shall be specified in the drawings and particular specification.

3.1.5 Installation of Boiler

A. Prior to installation, erection specification, installation specification and layout drawings shall be submitted and shall be approved by the supervisor.

B. Boiler foundation shall be of plain or reinforced concrete and shall be constructed on such foundation as may withstand a long sustained loading.

C. In case brick wall is necessary to assemble around the boiler, water pressure test shall be executed prior to the assemble of wall.

D. Boiler shall be erected and installed in accordance with the above requirement and also with the applicable requirements for 18 Steel steam boiler erection as specified in JIS B8201 (construction of land steel steam boilers).

E. Except as otherwise specified here after, construction of furnace wall shall be as specified in the specifications for construction of Furnace Wall, Installation of Cast Iron Boilers and Brick laying for Steel Steam Boilers provided for by Japan Boilers Association.

3.1.6 Oil Tank and Service Tank

Oil tank and service tank shall be installed to the concrete foundation firmly with the anchor bolts true to the horizontal and vertical line. Installation of oil tank or service tank shall pass to the requirement of local code.

3.1.7 Installation of Pipe

Unless otherwise specified, pump shall be installed at 300 mm above the floor finish and installation shall conform to the"blower".

3.1.8 Installation of Motor

Motor shall be provided with electrical power supply terminal and installed.
Wiring shall be made by electrical work.

3.1.9 Operation panel Control panel & Alarm panel

Unless otherwise specified, control panel, operation panel shall be made by electrical work.

3.2 Piping Work

3.2.1

Piping materials shall conform to table 2-4-6, drawings and particular specification.

3.2.2 Piping in Common

A. All pipes shall be cut square and true to the pipe axis by means of suitable tools without reduiing the pipe diameter.
Prior to making connection, the interior of each pipe shall be checked, and all chips dirt and other foreign matters shall be throughly removed. Whenever the piping work is to be suspended, the completed section of pipe line shall be protected against entry of foreign matters.

B. Earth covering on underground pipes shall be at least 600 mm in general ground, at least 1,000 mm where subject to heavy vehicular traffic.

C. Where pipes penetrate through beams, ceiling, slab or wall, shop drawings shall be provided and PVC pipe sleeves shall be provided prior placing the concrete.

D. For branches to be made in two ways from the main, fee shall be used in all case.

3.2.3 Hot Water and Steam Piping

A. Installation of piping shall be performed with the consideration given to expansion and contraction due to thermal change and in a manner not to allow excess load to act on piping during the piping being expanded. Care shall be exercised so as to install the piping at the prescribed grade.

B. Piping provided with expansion joint shall be fixed at effective points.

C. Expansion pipe shall be connected at the highest point of Hot water supply pipe and shall be connected to the expansion tank.
Valve shall not be installed to the expansion pipe.

D. Steam piping shall be installed at a grade of 1/250 and 1/100 for reverse grade.
Return steam piping shall be 1/250.

E. Trap shall be provided where indicated in the drawings.

F. Interior exposed-to-view pipe shall be installed close to the wall or column within the length of pipe hanger.

G. Where piping penetrate through the wall or floor, steel sleeve shall be installed prior to the installation.

3.2.4 Water Supply Piping — Water supply piping work shall conform to the section of water supply work unless otherwise specified.

3.2.5 Drainage Piping — Drainage piping work shall conform to the section of Drainage work unless otherwise specified.

3.2.6 Oil Supply Piping — Oil supply piping work shall conform to the Plumbing Work, piping in common and piping material shall conform to JIS G3452 (carbon steel pipe). Finish shall be at least two coats of oil paint or wrapped by anti-corrosive tape at underground.

3.2.7 Gas Piping — Gas piping shall conform to the section of Plumbing Work, gas supply unless otherwise specified.

3.2.8 Valves

For steam pipe with pressure of $2kg/cm^2$ or more : $10kg/cm^2$ globe valve
For return steam pipe " $2kg/cm^2$ or more : $10kg/cm^2$ gate valve
For steam supply and return pipe with pressure of $2kg/cm^2$ or less: $5kg/cm^2$ gate valve

3.2.9 Connection of Piping

A. Pipe connection shall use threaded joint or flange joint. Thread shall conform to JIS B 0203.

B. In no case shall stiff mix paint or hemp shall be used.

C, Main pipe shall be provided with flanged joint to facilitate removal of the piping, unless otherwise specified.

D. In case of flange joint, asbestos joint board (contain more than 65% of rockwool fiber) or conform to JIS R3453 (asbestos joint boards).

3.2.10 Support spacing

A. Pipe hanger shall be made of steel and shall be fixed to the insert which is placed in concrete. Where the horizontal run of pipes is to be supported at the pipe bottom, metal roller supports shall be used.

B. Horizontal run of piping shall be supported at the interval specified in Table 4-12.

Table 4-12

Nominal dia.	less than 20	25 - 40	50 - 80	90 - 125	over 150 mm
Interval (mm)	1,800	2,000	3,000	4,000	5,000

C. Riser or down pipe penetrating through floor, shall be fixed at suitable points with the expansion and contraction taken into consideration and in a manner to support the weight of the pipe.

3.2.11 Test

Prior to the installation of insulation work, hydraulic pressure test and steam test shall be made in the presence of the Supervisor.
Test pressure shall conform to HASS-406 and as follows.
Test pressure shall be twice the maximum working pressure, but limited to 4 kg/cm^2 minimum.
Period of test is more than one hour.

3.2.12 Air test

Oil service pipe shall be tested with the pressure air 1.2 times of working pressure.

3.3 Duct Work

3.3.1 Common

Installation of duct shall conform to the drawings, and duct sample shall be provided prior to the commencement of the work and shall be approved by the Supervisor.
In case if it is necessary to change the duct rout, those changes shall be approved by the Supervisor.

3.3.2 Fabrication of duct

A. Sheet thickness and reinforcement of Low-Velocity Air Duct shall conform to Table 4-13 and Table 4-14.

Table 4-13

Standard thickness	Width of rectangular duct	Diameter of circular duct	Angular		Flange	
			Shape steel	Interval	Shape steel	Interval
0.5	150 - 450	150 - 500	Angular Seam	900 or less	25x25x3	3,600 or less
0.6	460 - 750	510 - 750	25x25x3	1,800 "	25x25x3	3,600
0.8	760 - 1,500	760 - 1,000	30x30x3	900 "	30x30x3	2,700
1.0	1,510 - 2,250	1,010 - 1,250	40x40x3	900 "	40x40x3	1,800
1.2	2,260 - above	1,260 - above	40x40x5	900 "	40x40x5	1,800

Corner joint of rectangular air duct shall be jointed to form an angular hook seam or Pittsburg seam.
Joint of flange steel shall be welded and finish smooth.

Table 4-14

Width of Rectangular air duct	Standard thickness of original sheet	Type of Seam	Type of joint, thickness of sheet, size of shape steel					(m) Joint interval	Span of joint dimension of reinforce
			S. Slip D. Slip	Bar Slip D. Slip	Bar Slip	Pocket Lock	Flange joint		
450 or less	0.50	Button punch Snap Lock (Pittsburg Lock)	0.60	-	-	(0.60)	(25x25x3)	3.6	-
460 - 750	0.60	- " -	-	0.60	-	0.60	(25x25x3)	3.6	Standing Seam or Reinforce member (1.2) 1.2 O.C.
760 -1000	0.70	- " -	-	0.80	-	0.80	(30x30x3)	2.7	
1010 -1500	0.80	- " -	-	0.80	0.80 30x30x3	0.80	(30x30x3)	1.8	Angle (30x20x3) 0.9 O.C.
1510 -2250	1.0	- " -	-	-	-	-	40x40x3	1.8	Angle (40x40x3) 0.9 O.C.
2260 or more	1.2	Pittsburg Lock	-	-	-	-	40x40x5	1.8	Angle (40x40x5) 0.9 O.C.

B. High-velocity duct shall be made of circular duct or spiral duct. Thickness of galvanized iron sheet shall conform to Table 4-15.

Table 4-15

Diameter of circular duct	Width of rectangular duct	Standard thickness	Joint thickness
200 or less	-	0.6	0.8
210 - 450	450 or less	0.8	1.0
460 - 750	460 - 950	1.0	1.2
760 - 1,000	910 or more	1.2	1.2

C. For circular air duct, the interval radius of air duct curvature shall be greater than its diameter and for rectangular air duct, shall be 1.25 times greater than its width in the direction of that radius. When the shape of air duct cross-section is to be changed, sharp change shall be avoided but at gradual change in either enlargement or reduction of cross-section.
Maximum degree of slope to be formed shall be 15 degree or less.

D. The fitting between steel angle and sheet shall be rebetted every 50 mm on center for frange and 75 mm on center for reinforce member with 4.5 mm diameter rivet.

3.3.3 Installation of Air Duct

A. Low-velocity duct shall be connected by means of jointing flange. Flange connection shall be applied with the asbestos tape having the same width as that of the duct, using adhesive than bolted airtight with 9 mm bolt 75 mm intervals.

B. Details shall be approved at corner of duct, branch, and damper joint.

C. Metal hangers for duct shall conform to Table 4-16, 4-17.

Table 4-16

Thickness	Shape steel	Steel bar	Intervals
0.5	25x25x3	9	2,700 or less
0.6	30x30x3	9	2,700 "
0.8	40x40x3	9	2,700 "
1.0	40x40x5	9	1,800 "
1.2	50x50x6	12	1,800 "

Metal hanger shall be installed into the insert which was placed in the concrete slab. Length of steel bar shall be adjusted by the turnbuckle.

Table 4-17

Width of Duct mm	Metal Hanger				Metal Support	
	Hanger plate mm	Rivet x Position	Angle	Pitch	Angle	Distance
450 or less	D.Slip Plate 1.2 x 25	dia. 4 mm x 2	(25x25x3) dia. 9	2.7	25x25x3	2.7
460 - 750	S.Slip Plate 1.6 x 25	dia. 4 mm x 3	(25x25x3) dia. 9	2.7	25x25x3	2.7
769 - 1000	- ditto -	- ditto -	(30x30x3) dia. 9	2.7	30x30x3	2.7
1010 - 1500	-	-	30x30x3 dia. 9	2.7	30x30x3	2.7
1510 - 2250	-	-	40x40x3 dia. 9	2.7	40x40x3	2.7
2260 or more	-	-	40x40x5 dia. 9	2.7	40x40x5	2.7

D. For joint between air-duct and blower, canvas joint shall be used.

E. The joint for high-velocity and joint at kitchen and bath room where moisted area, all joint shall be solded.

F. Tee shall be used for the branch from circular duct and bell and spigot joint shall be used. Outside face of the bell and spigot joint shall be applied with adhesive and the both ends shall be inserted into the duct.

G. For the joint between the concrete duct and steel duct, anchor bolt shall be placed in concrete then, shaped steel shall be fixed. The joint between concrete and steel duct shall be made by means flange joint.

H. Thermal meter and humidity meter shall be installed at following place.

a. Inlet side of re-heater
b. Inlet side of air-cleaner
c. Between Air-cleaner and re-heater
d. Fresh air duct
e. Return duct
f. Supply duct

I. Damper shall be installed air tight in a manner to facilitate its adjustment, and the axis of damper shall be located at the center of five wall or floor.

3.3.4 Test — Test shall be performed in accordance with the instruction of the Supervisor.

3.4 Smoke exhaust — Smoke exhaust system shall conform to the requirement of Local Authorities.

4. Insulation Work

4.1 General

A. Work shall be executed after completion of inspection and prime coat of all the equipment and piping has been finished. The joint clearance between heat insulation material shall be minimized and longitudinal seams shall be staggered.

B. The thickness of heat insulation shall mean the thickness of heat insulation material itself and not include the thickness of theathing and supplementary materials used in conjunction therewith. When the thickness of insulation is over 50 mm, then material shall be installed in two coat.

C. In all case, wire tying shall be made spirally round the band material at 50 mm intervals or less. Cylindrical material shall be double tied for each section. When affixed by adhesive tape, all the seams and joints shall be sealed with the tape.

D. Insulation material used at vertical port shall be fixed with number of tack rivets so as not to apart from pipe or duct.

E. Plate shape insulation material shall be installed by means of rivet or asphalt adhesive.

F. Diatom-earth insulation work shall conform to JIS A9501 section 5.1

G. Foam-polystyrene shall be applied only for insulation of cooling purpose and adhesive shall not be asphalt.

H. In all case, taping shall be done with a lap width of more than 15 mm and all other typing shall be done at a lap width of more than 30 mm. The material wrapped with water proof hemp cloth shall be applied with two coats of asphalt primer and lap width shall be more than 20 mm.

I. Steel sheet for wrapping the insulation shall be ridge-seamed, bent shall be knee-cap seam, and the seam at peripheral portion shall be interlocked.

J. Toothed-edge escatheon shall be attached to the end of indoor insulating piping and a band shall be attached to branched and curved point.

K. Insulation shall be inspected and approved by the Supervisor after the completion of work.

4.2 Material

4.2.1 Insulation Material

A. Diatom-earth

Diatom-earth heat insulating material shall be the standard product in accordance with JIS A9503 (diatom-earth heat insualting material) mixed with diatom-earth and shall be class 1.

B. Rock-wool

Heat insulating board, cylinder, band and blanket of rock-wool shall be standard products conforming to JIS A9504 (rock-wool heat insulating and mineral wool heat insulating materials)
Heat insulating board shall be class 1 or 2, heat insulating band shall be class 2, but that used circular air duct shall be class 2 material covered with glass fiber on one surface.

C. Glass wool

Heat insulating board, cylinder, band and blanket of glass wool shall comply with JIS A9505 (glass wool heat insulating material). Heat insulating board shall be class 2, b and c, heat insualting cylinder shall be class 2; blanket shall be class 1.

D. Carbonized cork

Carbonized cork board shall conform to JIS A9507 (carbonized cork board) class 1 or 2. Heat insulating cylinder shall be formed of the above specified material and manufacturing process.

E. Cow fur felt

Cow fur felt heat insulating shall conform to JIS A9508 class 2.

F. Foam polystyrene

Heat insulating board and cylinder of form polystyrene shall conform to JIS A9511 class 3.

G. Hemp cloth and tape

Hemp cloth and tape shall conform to JIS L3405 class 7 (270g/m^2)

H. Cotton cloth and tape

Cotton cloth shall be 110g/m^2 or more

I. Waterproof hessian cloth

Waterproof hessian cloth shall be the product of hessian cloth No.7 conforming to JIS L3405 (hessian cloth), being applied to one side with blown asphalt.

J. Blown asphalt

Blown asphalt shall conform to JIS K2207 (petroleum asphalt) and shall be of penetration degree 10 - 20.

K. Asphalt felt

Kraft paper shall be the molding paper specified by the manufacturing process of JIS A6005 (asphalt felt) having weight of 17 kg. per roll (42 m^2) or more.

L. Asphalt roofing

Asphalt roofing shall be the product manufactured by the manufacturing process of JIS A6006 (asphalt roofing) having weight of 17 kg. per roll (21 m^2) or more.

M. Tar felt

Tar felt shall be having weight of 6 kg. per roll (42 m^2) or more.

N. Craft paper

Craft paper shall be the molding paper specified by the manufacturing process of JIS A6006 (asphalt roofing) having weight of 370 kg. per m^2.

O. Galvanized iron sheet

Galvanized iron sheet shall be flat sheet conforming to JIS G3302 (galvanized iron sheet). Thickness of sheet shall be 0.4 mm. Zinc amount shall be 244g/m^2.

P. Steel wire

Steel wire specified by JIS G3305 class 3, having diameter of 1.2 mm galvanized steel wire.

Q. Aluminum sheet

Aluminum sheet shall conform to JIS H4000 (Aluminum sheet and disk sheet) having thickness of 0.4 mm or more.

R. Aluminum cloth

Aluminum cloth shall be of 0.02 mm thick aluminum foil laminated with incombustible cotton cloth of 55 g. per 1 m^2 or more using polyethylene resin agent, film thickness after hardening shall be 0.006 mm or more.

S. Wire lath

Wire lath shall conform to JIS A5504 (wire lath) using the galvanized wire No.18 having mesh 25 mm.

T. Metal lath

Metal lath shall be the product conforming to plain lath No.1 conforming to JIS A5505 (metal lath).

U. Vinyl tape

Vinyl tape shall be the product conforming to JIS Z1901 (anti-corrosive vinyl tape) having 0.2 mm thickness.

V. Polystyren film

Polystyren film shall be the first class with the thickness of 0.05 mm or more.

W. Adhesive agent

Adhesive agent shall be adequate to adhesion required and approved by the supervisor.

X. Solder

Solder shall conform to JIS Z3282 (solder).

Y. Board

Fiber board shall conform to JIS A5907 (hard fiber board) with thickness of 315 mm or more.

Gypsum board shall conform to JIS A6901 (gypsum board) with thickness of 9 mm or more.

Asbestos cement board shall conform to JIS A5403 (asbestos cement board) with thickness of 3 mm or more.

Z. Cement

Cement shall conform to JIS R5210 (portland cement).

α Hard cement - Mix ratio shall be : Asbestos..... 75%
Asbestos fiber .. 3%
Cement 22%

β Dolomite plaster - conform to JIS A6903.

4.2.2 Installation Insulation thickness, material and installation sequence shall conform to Table 4-18.

Table 4-18

Where to apply	Installation sequence	Insulation thickness m/m
Condenser	1. i) Blown asphalt ii) Rock-wool or glass wool iii) Iron wire iv) Asphalt roofing v) Metal lath, cement mortar plaster	75
	2. i) Adhesive ii) Foam polystyrene iii) Adhesive tape iv) Asphalt roofing v) Metal lath, cement mortar, plaster	50
Boiler, Steel Flue	i) Rock-wool blanket ii) Hexagonal wire net iii) Iron wire iv) Asbestos cement v) Galvanized iron sheet paint finish	50 25
Expansion tank, Oil service tank Header Heat exchanger	i) Rock-wool or glass wool ii) Hexagonal wire net iii) Iron wire iv) Galvanized iron sheet paint finish	50
Air-conditioner Fun	1. i) Blown asphalt ii) Rock-wool or glass wool iii) Asphalt roofing iv) Wire lath, cement mortar, plaster	50

<table>
<tr><th colspan="2">Where to apply</th><th>Installation sequence</th><th>Insulation thickness m/m</th></tr>
<tr><td colspan="2"></td><td>2. i) Adhesive
ii) Foam polystrene
iii) Adhesive tape
iv) Asphalt roofing
v) Wire lath, cement mortar, plaster</td><td>50</td></tr>
<tr><td colspan="2">Chilled water pump hot water pump and valves</td><td>i) Bloun asphalt
ii) Carbonized cork
iii) Iron wire
iv) Wire lath, cement mortar, plaster</td><td>50</td></tr>
<tr><td rowspan="4">Steam pipe</td><td>Interior exposed pipe</td><td>i) Rock-wool or glass wool
ii) Iron wire
iii) Craft paper
iv) Cotton cloth</td><td rowspan="4"><table><tr><th>Nominal dia.
Steam Pressure</th><th>32 or less</th><th>40 100</th><th>125 or more</th></tr><tr><td>2 or less</td><td>25</td><td>30</td><td>40</td></tr><tr><td>2 or more</td><td>30</td><td>40</td><td>50</td></tr></table>kg/cm^2</td></tr>
<tr><td>Behind ceiling within pipe shaft</td><td>i) Rock-wool or glass wool
ii) Iron wire
iii) Craft paper
iv) Hemp cloth and tape</td></tr>
<tr><td>Underground, within pipe pit</td><td>i) Rock-wool or glass wool
ii) Iron wire
iii) Asphalt roofing
iv) Water-proof hemp cloth</td></tr>
<tr><td>Exterior exposed</td><td>i) Rock-wool or glass wool
ii) Iron wire
iii) Asphalt roofing
iv) Iron wire
v) Galvanized iron sheet solded joint</td></tr>
</table>

Where to apply		Installation sequence
Cooling water pipe Water supply pipe Drain pipe		i) Far felt ii) Cow fur felt iii) Asphalt felt iv) Craft paper v) Vinyl tape
Chilled Water Pipe, Hot water pipe, Refrigerant pipe	Interior pipe exposed	1. i) Rock-wool, Glass wool or Foam polystyrene ii) Iron wire iii) Asphalt roofing iv) Craft paper v) Vinyl tape 2. i) - iii) Same as 1. iv) Metal lath, Cement mortar plaster
	Behind ceiling, within pipe shaft	i) - iv) Same as 1. v) Hemp cloth
	Underground, within trench pit	i) - iii) Same as Interior expose pipe iv) Water-proof hemp cloth v) Blown asphalt
	Exterior Exposed pipe	i) - iv) Same as above v) Galvanized iron sheet with solded joint paint finish

Insulation Thickness m/m

Pipe \ Nominal dia.	40 or less	50 or more
Cooling water pipe Water supply pipe	20	25
Drain pipe	20	20

Pipe \ Nominal dia.	20 or less	30 65	80 or more
Rock-wool Glass wool	30	40	50
Foam Poly-styrene			

Where to apply		Installation sequence	Insulation thickness m/m
Duct	Interior Exposed	1. i) Tack rivet, adhesive or asphalt ii) Glass wool, rock-wool iii) Asphalt roofing iv) Wire lath, cement mortar plaster finish 2. i) - iii) Same as above iv) Heat resist board paint finish 3. i) - iii) Same as above iv) Craft paper v) Cotton cloth	Supply duct 25 Return duct 20
	Concealed in Ceiling	1. i) - iii) Same as above iv) Hemp cloth v) Wire mesh 2. i) - iii) Same as above iv) Polystyrene film v) Wire mesh	Same as above
	Underground trench pit	i) - iii) Same as above iv) Water-proof hemp v) Blown asphalt	Same as above
	Exposed exterior	1. i) - v) Same as above 2. i) - iii) Same as above iv) Iron wire v) Galvanized iron sheet with solded joint paint finish	Same as above

Where to apply	Installation sequence	Insulation thickness m/m
Steel water storage tank	i) Tack rivet ii) Rock-wool iii) Asphalt roofing iv) Metal lath, cement mortar Plaster finish	Temperature difference / Thickness 25°C or less — 50 25°C or more — 60

5. Painting Work

5.1 General

5.1.1 Inspection — All paint shall conform to respective JIS Standard. All paints shall be delivered to the site in sealed containers and shall be approved by Supervisor on product date, standard, etc.

5.1.2 Storage at Site — Combustible paint shall be stored at exclusive storage with the fire caution sign board.

5.1.3 Sample — Color conditioning of finish coat paint shall be shop mixed by paint manufacturer to designated color and luster. Sample color panel for each coat shall be submitted to the Supervisor for the approval of color and luster.

5.1.4 Surface condition — During time shall be determined with minimum time required between coat of paint just applied and that of next coat.

5.1.5 Inspection — Each paint coat shall be inspected and approved by the Supervisor.

5.1.6 Color coding — Pipe and Duct shall be color corded in accordance with JIS Z9102 and direction of flow and type shall be clearly marked on.

Type	Color coding	Standard color	
Water	Blue	2.5 PB	5/6
Steam	Dark red	7.5 R	3/6
Air	White	N 9.5	-
Gas	Yellow	2.5 Y	8/12
Acid	Dark perple	2.5 P	5/5
Oil	Yellow red	7.5 YP	5/6
Electric	Light yellow red	2.5 YR	7/6

5.2 Material Standard

Type of paint	JIS NO.	JIS Name
Finish and intermediate coat	JIS K 5511	Ready-mixed white zinc oil paint
	5512	Ready-mixed titanium white oil paint
	5513	Ready-mixed white zinc light tint oil paint
	5514	Ready-mixed titanium white light tint oil paint
	5515	Ready-mixed tint oil paint
	5516	Ready-mixed synthetic resin paint
	5451	Stiff mix white zinc paint
	5452	Stiff mix white lead paint
	5453	Stiff mix white tint paint
	5572	Resin Enamel
	5492	Aluminum paint
	5532	Lacquer enamel
	5663	Synthetic resin emulsion paint
	5581	Vinyl chloride vanish
	5582	Vinyl chloride enamel
Under coat	5506	Ready-mixed primer for wood surface
	5591	Oil primer
	5592	Oil putty
	5583	Vinyl chloride primer
Anti Rust-proof coat	5621	General anti-corrosive paint
	5622	Red lead anti-corrosive paint
	5623	Lead suboxide anti-corrosive paint
	5626	Zinc dust anti-corrosive paint
	5627	Zinc chromate anti-corrosive paint

5.3 Painting Method

5.3.1 Preparation of Surface

Surface	Working sequence	Treatment of Surface
Ferrous Surface	Removal of stain and foreign matter	Removal by scraper or wire-brush
	Removal of oil and Grease	Cleaned by Volatile oil
	Removal of Rust	Removed by scraper or wire-brush or emery cloth #180. If it is specified, Acid-treated, and washed by neatralized hot water or removed by Sand-blasting.
Galvanized ferrous surface	Removal of stain and foreign matter	Removal by steel wire
	Removal of oil and Grease	Cleaned by volatile oil and washed by water.
	Chemical treatment	JIS K 5633 (Primer for metal surface treatment) One coat by brush.
Wooden Surface	Removal of stain	Stain and other forging matters shall be removed in a manner not to damage surfaces, and oil and grease cleaned with volatile oil.
	Removal of resin	Scrape off exuded resin. The portion where resin is likely to exude shall be heated by electric iron to force out the resin, and clean out with volatile oil.

(Cont'd) Wooden surface	Sanding	Benziner planer marks, bristered grain, shag shall be sanded with #120 - #420 sand paper.
	Knot stopping	Two coats of shellac varnish shall be applied to and around a knot.
	Filling holes	Puttying one or two times at split, check, hole, crack, pit.

5.3.2 Type and Number of coats

Surface	Type of surface	Type of paint and No. of coats			
		Prime coat	No. of coats	2nd and finish coat	No.of coats
Insulation surface	Cotton cloth (Exposed)	Sealer	1	Ready-mixed paint	2
	Galvanized Iron Sheet (Exposed)	Anti-corrosive paint	1	Ready-mixed paint	2
Electrical conduit	(Exposed)	Ready-mixed paint	1	Ready-mixed paint	1
Pipes and Pipe supports	Steel pipe Black (Exposed)	Anti-corrosive paint	2	Ready-mixed paint or Aluminum paint	2
	Steel pipe Black (Concealed)	Anti-corrosive paint	1	Anti-corrosive paint	2
	Steel pipe White	Anti-corrosive paint	1	Ready-mixed paint or Aluminum paint	2

Pumps Refrigerators Cooling tower Fun	Exposed	Anti-corrosive paint	2	Ready-mixed paint	3
Duct Water tank Expansion tank Oil tank	Galvanized (Exposed)	Anti-corrosive paint	1	Ready-mixed paint	2
	Steel (Exposed)	Anti-corrosive paint	2	Ready-mixed paint	2
	Steel (Concealed)	Anti-corrosive paint	1	Anti-corrosive paint	2
Boiler Heating furnace	Galvanized steel (Exposed)	Anti-corrosive paint	1	Lacquer of Melamine backing	2
	Steel	Anti-corrosive paint	2	Lacquer of Melamine backing	2
	Steel	Anti-corrosive paint	2	Ready-mixed paint	2
Support and Frame	Steel (Exposed)	Anti-corrosive paint	2	Ready-mixed paint or Aluminum paint	2
	Steel (Concealed)	Anti-corrosive paint	1	Anti-corrosive paint	2
	Wood (Exposed)	Anti-corrosive paint	1	Ready-mixed paint	2
	Wood (Concealed)	Creosote Oil	1	Creosote Oil	1

SECTION 7 GENERAL SPECIFICATION

Part 5. Plumbing

SECTION 7 GENERAL SPECIFICATION

Part 5. Plumbing

INDEX

1. Work in Common Piping

1.1 Piping Materials

A. Piping material shall compile with the requirement of Water Supply Authorities.

B. Standard of material shall conform to JIS or JWWA.

C. Material made of cast iron shall be of good quality.

D. Where pipe is installed through the fire wall, material shall compile with the law or regulation.

E. Emergency drainage equipment shall compile with the code.

1.2 Tools and Spare parts

Tools and spare parts shall be provided for engine and shall be as follows.

a. Tool (with tool box) ..... 1 set
b. Spare parts (with spare parts box) ..... 1 set
c. Fuel ..... 18 ℓ 1 can
d. Oil ..... 2 ℓ 1 can

1.3 Shealing Material

A. Lead for solder shall conform to JIS H 2105

B. Solder shall conform to JIS Z 3282

C. Plastun shall be made of 50 Sn or 40 Sn.

D. Mold solder shall be Sn-An alloy and mold temperature shall be 220°C or more.

E. Yarn shall be made of jute.

F. Packing material shall conform to JIS K 6353, JIS R 3453.

G. Adhesive for P.V.C. pipe shall be specified in JIS K 6743.

H. Welding rod shall conform to JIS Z 3211.

1.4	Gauge and Miscellaneous	A. Pressure gauge	JIS B 7050
		B. Thermometer	JIS B 7528, JIS B 7529
			JIS B 7411
			JIS B 7412

C. Flout switch:
Flout switch shall be water-proof type and flout shall be made of copper with thickness of 1.2 mm or more.

D. Electrical level detector:
Electrical rod shall conform to JIS G 4303.

E. Pressure switch:
Pressure switch shall react in accordance with the inner pressure of the tank.

F. Tank regulator:
Tank regulator shall react in accordance with the temperature of hot water to supply the steam into the hot water storage tank.

1.5 Piping

A. All pipes shall be cut square and true to the pipe axis by means of suitable tools without reducing the pipe diameter, and the cut ends of pipes shall be finish smooth. Prior to making connection, the interior of each pipe shall be checked, and all chips, dirt and other foreign matters shall be throughly removed.

B. Prior to commencement of the piping work, relations to pipes and equipment for other installations shall be carefully examined and the piping position shall be precisely determined, taking fall into consideration. In case of the interior piping work, fixing of hangers and embedding of pipe sleeves shall be carried out without delay along with the progress of the work.

C. Pipings installed on the concrete slab shall be firmly fixed or anchored to the floor with packing to prevent the damage of pipe.
Pipe shall not be bent with bender where cross with other pipe or change to upward.

D. Where the lead pipe embeded into the concrete, pipe shall be wraped with jute and two coat of asphalt primer shall be applied.

E. Where pipes are to be laid directly in the ground, bed shall be sufficiently compacted, necessary protection for piping shall be taken.

F. Backfill shall be done after the approval if Supervisor in such a manner not to damage the pipe line and shall be restored to the original stage.

G. No caulking repair of steel piping, cast iron piping and lead piping shall be permitted.

H. Where pipes penetrate through water proof part, pipe sleeves shall be provided and clearance between pipe sleeve and pipe shall be filled with yarn and molt lead for waterproof.

I. Where pipes penetrate through fire partition or fire wall of the fire proof construction part, the entire clearance around the pipe and pipe sleeve shall be completely filled with rock wool or other suitable non-combustible material. Where pipe penetrate through the underground of structure, flexible joint or other means shall be provided for protection in equal settlement.

J. Where exposed-to-view piping having no antisweat covering penetrates through the ceiling, floor or wall, escutcheons shall be provided.