

DIVISION 15 MECHANICAL

SECTION 15.10 VENTILATION SYSTEM

15.10.1 GENERAL

1. SCOPE OF WORK

Provide all labor, materials, equipment and incidentals necessary to furnish and install the ventilating systems complete as shown on the drawings and specified herein. The work includes all supply air fans, except those supplying conditioned (cooled) air, all exhaust fans, all ductwork connected with the supply and exhaust fans, louvers, hangers, electric wiring and support.

The following types of fans shall be specified hereinafter and the fans shall be complete with electric motor, louver or automatic louver where specified and all other necessary appurtenances.

- a. Propeller fans
- b. Roof fans

2. REFERENCES

The following standards are referred to.

- | | |
|------------|---|
| JIS B 8330 | Testing Methods for Turbo-Fans |
| JIS G 3141 | Cold Reduced Carbon Steel Sheets and Strip |
| JIS H 4000 | Aluminium and Aluminium Alloy Sheets and Plates, Strips and Coiled Sheets |

3. SCHEDULE OF VENTILATING SYSTEM

Schedule of ventilating system will be specified in the Particular Specifications and/or the drawings.

4. GENERAL ARRANGEMENTS

4.1 General

The contract drawings indicate the extent and general arrangement of the ventilating systems. The Contractor shall be responsible for installing the proposed system as indicated, without violation of specification requirements. Except where dimensions are shown to locate ductwork or equipment, the drawings show duct size and arrangement only. Equipment and ductwork arrangements shall fit into the space as indicated, and shall allow adequate and approved clearances for entry, servicing and maintenance.

4.2 Data Submittal

Literature and shop drawings, describing each item of equipment, shall be submitted to the Engineer

for approval. The literature and shop drawings shall include sufficient descriptive materials such as catalogs, cuts, diagrams and other data published by the manufacturer, to demonstrate conformance with requirements of the Contract Documents.

4.3 Capacity

Capacities of equipment and materials shall be not less than those indicated.

4.4 Name Plates

Each major item of equipment shall have the manufacturer's name, address, serial and model number on a plate securely attached to the item.

4.5 Safety Requirements

Belts, pulleys, chains, gears, couplings, projecting set-screws, keys, and other rotating parts, so located that personnel can come in close proximity thereto, shall be fully enclosed or properly guarded.

4.6 Verification of Dimensions

The Contractor shall visit the premises to thoroughly familiarize himself with all details of the work and working conditions and verify all dimensions in the field. The Contractor shall be specifically responsible for the coordination and proper relation of his work to the building structure.

4.7 Materials and Equipment

Materials and equipment shall conform to the requirements specified herein and as show on the drawings and shall be the products of manufacturers regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least five (5) years. Where more than one unit of same capacity is required they shall be the same model with all parts interchangeable.

4.8 Factory Performance Tests

Unless otherwise specified, all fans shall be tested at the manufacturer's plant to demonstrate complete compliance with these specifications. Six (6) copies of test data including flow and pressure characteristic curve, required power, current and others shall be submitted for approval prior to shipment.

4.9 Field Tests

Upon completion, and prior to acceptance of the installation, the Contractor shall subject the ventilating systems to such operating tests as may be required by the Engineer to demonstrate satisfactory functional and operating efficiency. Operating tests shall cover a period of not less than six (6) hours for each system, and all tests shall be conducted at such times as the Engineer may direct.

If tests do not demonstrate satisfactory operation of the ventilating systems, deficiencies shall be corrected and tested. All instruments, facilities, and labor required to properly conduct the tests shall be provided by the Contractor.

In the testing, the Contractor shall take the precautionary measures to protect all staff of the Employer, the Engineer and the Contractor, and third party from physical injury.

4.10 Motors

Unless otherwise specified, motors shall be totally enclosed, fan cooled type. All motors shall be as hereinafter specified under Section 16.17 Motors.

15.10.2 PROPELLER FANS

Propeller fans shall be supply or exhaust and high pressure industrial types.

Fan shall be three blade type and blades shall be designed to ensure low noise, high volume of air flow and high efficiency. Fan shall be directly coupled with motor and fan and motor shall be supported by heavy metal frames.

Fan shall be fabricated from steel sheets conforming to JIS G 3141: SPCC or aluminium alloy sheets conforming to JIS H 4000: 5052 P. Frame shall be fabricated from steel sheets specified above. When anti-acid type will be specified, fan, frame, shaft, bolts and nuts, and other major parts shall be of type 304 stainless steel.

Unless otherwise specified, automatic louvers shall be provided with all propeller fans. An automatic louver shall be gravity shutters and shall be factory fabricated, parallel-blade type delicately balanced blades that open automatically when the fan starts and close by gravity when fan stops. The louver blades shall be fabricated from aluminium sheets. The edges of the blades shall be provided with felt or rubber strips to prevent rattling. Louver blades shall be supported on aluminium frames and shall be connected to a vertical bar so all blades open equally.

When specified, fixed louvers or outdoor rain hoods shall be provided. Fixed louvers shall be parallel-blade type and fabricated from aluminium sheets. Outdoor rain hoods shall be of type 304 stainless steel and shall have enough opening area.

Automatic louvers, fixed louvers and outdoor rain hoods shall be supplied by the same manufacturer as that of fans unless otherwise specified.

Equipment and component items, when fabricated from ferrous metal, shall be factory finished with epoxy resin paint of manufacturer's standard.

Factory performance tests for propeller fans specified shall be executed in accordance with JIS B 8330 or other standards approved by the Engineer.

15.10.3 ROOF FANS

Roof fans shall be specially designed for installation on building roof and shall be exhaust type unless otherwise specified.

Roof fans shall consist of body frame, guard net, fan motor unit and top hood. The body frame and top hood shall be designed to have optimum spacing for air flow and to ensure high efficiency. The top hood shall be hinged, swing open type for easy maintenance, and shall have reverse flow prevention flaps and anti-resonant vibration bar. The body frame shall have a square bottom with installation foot.

Fan shall be designed to have deeply twisted blades, and to ensure high volume air flow at high static pressure and high efficiency. Fan shall be directly coupled with motor, and fan and motor shall be supported by heavy metal support unit. Fan motor unit shall be bolted to the body frame and shall be designed to be easily dismantled from the body frame.

The body frame and top hood shall be fabricated from steel sheets conforming to JIS G 3141: SPCC. Minimum thickness of sheet for the body frame and top hood shall be 1.6 mm and 1.2 mm respectively. Fan shall be fabricated from steel sheets as specified above or aluminium alloy sheets conforming to JIS H 4000, 5052 P.

Equipment and component items, when fabricated from ferrous metal, shall be finished with epoxy resin paint of manufacturer's standard or hot-dipped galvanizing except that parts exposed outside shall have shop coats of "Paint System A", alkyd resin paint system as specified in the Standard Specifications titled "Painting" of Section 9.1.

DIVISION 15 MECHANICAL WORKS

SECTION 15.11 PUMPING EQUIPMENT (FOR SEWERAGE)

15.11.1 SUBMERSIBLE SEWAGE PUMP (FOR SUMP)

1. GENERAL

This pump shall be used to discharge the sewage held in the pipe gallery, etc. It shall be constructed to be sturdy to endure continuous operation in water. It shall have the minimum bore diameter of 50 mm.

The pump shall be constructed to produce less vibration and noise and operate smoothly, and especially, shall not produce harmful phenomenon of cavitation.

2. DESIGN CONDITIONS

- (1) The influent water shall be sewage which has been collected in the floor drain pit of the pipe gallery, etc.
- (2) It shall be permitted for no-discharge operation.

3. FABRICATION

3.1 Drive unit

The motor to be used with the pump shall be a submersible motor.

3.2 Casing

The casing shall be made up of good quality cast iron considering the mechanical strength to internal pressure, vibration, etc. as well as the resistance to corrosion and wear.

The casing shall be constructed for easy disassembly and assembly.

(a) Removable type

The casing discharge flange shall be of slide type, and when mounting the pump, shall be connected positively along the discharge bend flange surface.

(b) Stationary type

A support stand shall be provided at the underside of the casing, and the pump shall be installed on the floor inside the pit.

3.3 Impeller

The impeller shall be a stout product of good quality and shall be sturdy to ingress of solids.

The impeller shall be constructed with a minimum number of blades and well in balance, and the surface shall be finished smooth.

3.4 Main Shaft

The main shaft is an extension of the motor shaft. It shall be strong enough to the transmission torque and torsional vibration.

3.5 Shaft Sealing Equipment

The shaft sealing portion shall consist of mechanical seals and it shall be a two-stage structure with oil sealed in an intermediate portion to prevent foreign substances from ingress into the motor whether the motor in operation or at stop. It shall be constructed for easy replacement of seals, etc.

3.6 Bearing

The bearing installed in the motor shall bear the weight of rotary portions and the hydraulic thrust. It shall be constructed to endure a long time of continuous operation and be capable of smooth self-lubrication.

3.7 Flange

Flanges for piping connection shall be in accordance with JIS 10K or equivalent.

4. MATERIALS

- (a) Casing : Cast iron
- (b) Impeller : Cast iron
- (c) Main shaft : Stainless steel

5. PROTECTION EQUIPMENT

- (1) A thermal switch to detect abnormal temperature, etc. shall be built in.
- (2) A water pocket room to prevent oil and water from ingress into the motor section shall be provided.

6. ACCESSORIES (PER UNIT)

- (a) Submerged cable (up to terminal box) x 1 set
- (b) Lifting chain x 1 set
- (c) Pump removable equipment (in the case of removable type) x 1 set
- (d) Foundation bolt and nut x 1 set
- (e) Compound pressure gauge (diaphragm type) x 1 set
- (f) Automatic air vent valve (if necessary) x 1 set
- (g) Power cable terminal box x 1 set

7. EXECUTION

Refer to various sub-sections in Section 15.1.

15.11.2 SUBMERSIBLE SLUDGE PUMP

1. GENERAL

The submersible sludge pump shall be used for sludge transfer and shall be constructed to be sturdy to endure continuous operation in the sludge. Also, it shall be constructed to operate smoothly with less vibration and noise, as well as produce no harmful cavitation.

2. DESIGN CONDITIONS

2.1 Operating conditions

This pump shall be able to operate on no-discharge operation basis.

3. FABRICATION

3.1 Drive Unit

The motor to be used with this pump shall be a submersible motor.

3.2 Casing

- 1) The casing shall be a product of good quality cast iron considering mechanical strength against internal pressure, vibration, etc. as well as corrosion and wear.
- 2) The casing shall be constructed to be easy to disassemble and reassemble, and in the case of disassembly, to be taken out upward with the impeller mounted on the main shaft.

3.3 Impeller

The impeller shall be a strong product of good quality and shall be sturdy against ingress of solids. Moreover, the impeller shall be a screw type non-clogging single vane type and be sufficiently balanced and the surface finished smooth.

3.4 Main Shaft

The main shaft is an extension of the motor shaft and shall be sufficiently strong to the transmitted torque and torsional vibration.

3.5 Shaft sealing device

The shaft sealing portion shall use mechanical seals and shall have two-stage construction with oil sealed in between to prevent ingress of foreign substances into the motor irrespective of the pump being in operation or at stop.

3.6 Bearing

The bearing installed in the motor shall support the weight of the rotating portions and the thrust, and shall be constructed to endure continuous operation for a long time and be able to be self-lubricated smooth.

3.7 Flange

The flange for piping connection shall be in accordance with JIS10K or equivalent.

4. MATERIALS

Materials shall be as follows.

- (a) Casing : Cast iron
- (b) Impeller : Cast iron or equivalent
- (c) Main shaft : Stainless steel

5. PROTECTION EQUIPMENT

- (1) A thermal switch to detect abnormal temperature rises shall be built in.
- (2) The pump shall be provided with a submersion detector for detection and indication of submersion.

6. ACCESSORIES (PER UNIT)

- (a) Submersible cable (up to terminal box) x 1 set
- (b) Lifting chain (stainless steel) x 1 set
- (c) Pump removal equipment x 1 set (in case of removable type)
- (d) Foundation bolt and nut x 1 set
- (e) Compound pressure gauge x 1 set (diaphragm type)
- (f) Automatic air vent valve (if necessary) x 1 set
- (g) Power cable terminal box x 1 set

7. EXECUTION

Refer to various sub-sections in Section 15.1.

15.11.3 SUBMERSIBLE SEWAGE PUMP

1. GENERAL

This pump shall be used to pump the sewage. It shall be constructed to be sturdy to endure continuous operation in water. The maximum size of delivery pipe shall be 70% of the mouth diameter.

The pump shall be constructed to produce less vibration and noise and operate smoothly, and especially, shall not produce harmful phenomenon of cavitation.

2. DESIGN CONDITIONS

- (1) The influent water shall be sewage, which discharge to screen after removing the sands.
- (2) It shall be able to make on and off immediately.

3. FABRICATION

3.1 Drive Unit

The electric motor to be used with the pump shall be submersible induction motor.

3.2 Casing

The casing shall be made up of good quality cast iron considering the mechanical strength to internal pressure, vibration, etc. as well as the resistance to corrosion and wear.

The casing shall be constructed to be easy to disassemble and reassemble, and in the case of disassembly, to be taken out upward with the impeller mounted on the main shaft.

3.3 Impeller

The impeller shall be a strong product of good quality and shall be sturdy against ingress of solids. Moreover, the impeller shall be a screw type non-clogging single vane type and be sufficiently balanced and the surface finished smooth.

3.3 Main shaft

The main shaft is an extension of the motor shaft and shall be sufficiently strong to the transmitted torque and torsional vibration.

3.4 Shaft sealing device

The shaft sealing portion shall use mechanical seals and shall have two-stage construction with oil sealed in between to prevent ingress of foreign substances into the motor irrespective of the pump being in operation or at stop.

3.5 Bearing

The bearing installed in the motor shall support the weight of the rotating portions and the thrust, and shall be constructed to endure continuous operation for a long time and be able to be self-lubricated smooth.

3.6 Flange

The union flange for piping connection shall be made in accordance with JIS B2239 (pressure 10K) or JIS B2063 (7.5K). Pump plumbing and disassembling of nut, bolt shall be in accordance to U S304.

4. MATERIALS

Materials used shall be as given below.

Name / Section	A	B
Casing	Above FC200	Above Fc200
Impeller	Above FC200	13 Cr stainless cast steel or
Main shaft	13 Cr stainless steel	13 Cr stainless steel

5. PROTECTION EQUIPMENT

- (1) A thermal switch shall be installed to know any abnormal increase of temperature.
- (2) A water pocket room to prevent oil and water from ingress into the motor section shall be provided. The water collecting chamber shall be separated from motor chamber by the motor seal.
- (3) A water inspection equipment is established in water collecting chamber (in case of motor capacity above 2.2 kW) to show the level of water.

6. EXECUTION AND TEST

Test of pump shall be conducted as per the electrical equipment construction manual. Efficiency test shall be conducted according to the JIS B8301 after completion of factory manufacturing. Further, the pump efficiency indicated in special specification should not be less than the regulated revolution frequency and efficiency.

7. FOUNDATION

The foundation shall be designed and adjusted according to the water level equipment. Power cable should be above the pump. The electric terminal shall be fixed above 1.2 m of base.

The support to power cable and chain in pump well shall be designed as per metal fitting standards (S U S 304).

8. ACCESSORIES (PER UNIT)

- | | |
|--|-------|
| (a) Submerged cable (up to terminal box) | 1 set |
| (b) Lifting chain | 1 set |
| (c) Pump removable equipment (in the case of removable type) | 1 set |
| (d) Foundation bolt and nut | 1 set |
| (e) Compound pressure gauge (diaphragm type) | 1 set |
| (f) Automatic air vent valve (if necessary) | 1 set |

- | | |
|---|-------|
| (g) Power cable terminal box | 1 set |
| (h) Special tool (Including all) | 1 set |
| (i) Other associated material (Including 1) | |
| (j) Mechanical seal | 1 set |

15.11.4 NON-CLOG TYPE PUMP

1. GENERAL

This pump shall be installed for the transfer of the sludge.

2. DESIGN CONDITIONS

- (1) The impeller shall be screw type having a non-clogging single vane.
- (2) It shall be permitted for no-discharge operation during the discharge valve startup time (within 30 seconds).
- (3) The pump suction side shall require no hand hole.

3. FABRICATION

Fabrication shall be as follows.

- (1) The pump casing shall be volute type. It shall be made of good quality of cast iron free from blowhole and have smooth cast surface. It shall be sturdy and have a wall thickness with ample allowance to shock, wear, corrosion and piping load.
- (2) The impeller shall be shaped to pass solids of foreign substances without trouble. It shall be well in balance and shall not produce abnormal vibration during operation.
- (3) The portion at which the main shaft penetrates through the shell shall be provided with a stuffing box. The shaft seal water system shall be gland packing system, water spray mechanical seal system or no-water spray mechanical seal system.
- (4) The bearing shall have been constructed best suited to loads. It shall have a sufficient supporting capacity, and shall be durable because of complete lubrication and freedom from overheating, etc. It shall have a sufficient capacity to axial thrusts as well.
- (5) The motor specifications shall be totally enclosed fan-cooled type and of continuous rating.
- (6) The pump flange shall be JIS 10K or equivalent.

4. MATERIALS

- | | | |
|-------------------|---|--|
| (a) Casing | : | Cast iron |
| (b) Impeller | : | Cast iron |
| (c) Suction cover | : | Cast iron |
| (d) Main shaft | : | Carbon steel (with stainless steel sleeve) |

5. ACCESSORIES (PER UNIT)

(a) Common base	x 1 set
(b) V-belt (in the case of pulley drive)	x 1 set
(c) V-pulley (in the case of pulley drive)	x 1 set
(d) Coupling (in the case of the motor direct coupling)	x 1 set
(e) Belt cover or coupling cover	x 1 set
(f) Pressure gauge (diaphragm type)(compound pressure gauge if necessary)	x 1 set
(g) Foundation bolt and nut	x 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.11.5 PROGRESSIVE CAVITY PUMP

1. GENERAL

This pump shall be a progressive cavity pump used to supply sludge at a constant rate to the coagulation-mixing tank or the dewatering unit.

2. DESIGN CONDITIONS

This pump shall be constructed to have stable performance to sludge of water content 95 to 98%, to be free from clogging with sludge and not to cause overloading of the motor.

3. FABRICATION

- (1) The pump casing shall have smooth cast surfaces and be sturdy and shall have wall thickness having an adequate allowance for shock, wear, corrosion and piping loads.
- (2) The rotor shall be one-axis eccentric screw type and shall not cause vibration during operation.
- (3) The portion of the shell where the main shaft penetrates through shall be provided with a stuffing box and the shaft sealing equipment shall be a gland packing or mechanical system.
- (4) To facilitate replacement of the stator, the pump shall be constructed to permit removal of suction casing and discharge casing and the piping and replacement space shall be determined.
- (5) The bearing shall have been constructed to have an adequate supporting capacity to the load. Because of complete lubrication, it shall be free from overheating, etc. Moreover, it shall have an adequate allowance for axial thrust.

The motor specifications shall be totally enclosed fan-cooled type, and of continuous rating.

4. MATERIALS

- | | |
|-----------------|---|
| (a) Common base | : Cast iron or rolled steel |
| (b) Casing | : Cast iron |
| (c) Rotor | : Alloy tool steel + hard chromeplating |

or Stainless steel + hard chromeplating
or equivalent

(d) Stator : Synthetic rubber

(e) Shaft : Stainless steel

5. ACCESSORIES (PER UNIT)

- (a) Safety cover x 1 set
- (b) Common base x 1 set
- (c) Pressure gauge (diaphragm type) x 1 unit
- (d) Foundation bolt and nut x 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.11.6 VERTICAL SHAFT MIXED FLOW PUMP

1. GENERAL

The Pump shall be used for pumping sewage water, and shall be firmly structured withstanding continuous duty. The Pump shall be capable of smooth operation with low-vibration and low-noise, and especially shall be designed to prevent harmful cavitation.

2. DESIGN CONDITION

Sand and trash shall be removed from influent sewage water in the course of the sedimentation and screening. The Pump shall be capable of valve full-close operation on starting-up.

3. FABRICATION

3.1 Casing

Casing shall be of high-quality cast iron construction with consideration of mechanical strength against internal pressure and vibration, corrosion and abrasion. Column pipe shall be separated into some pieces for convenience of assembling and dismantling work, and each piece shall be flange connected. Also, column pipe shall be connected to bottom flange of discharge casing, which is fastened on the round-shaped flange type base plate. Wearing liner shall be attached to the Casing side of wearing part between Casing and impeller. And, the wearing liner shall be easily replaceable when it is worn down. If necessary, ladder and maintenance stage shall be equipped at sealing and bearing device for convenience of inspection. Loose flange shall be connected to the discharge side of the pump discharge casing.

3.2 Impeller

Impeller shall be of high-quality and heavy-duty construction, and shall have durability against suction of solid materials. Impeller shall be of open-type, and the number of its vane shall be minimized. Also, impeller shall be well balanced as well as its surface shall be smoothly finished.

3.3 Main Shaft

Main shaft shall have sufficient strength against transfer torque and torsional vibration. At sealing part and submersible bearing part, abrasion-resistant shaft sleeve with sufficient thickness shall be attached. Shaft sleeve shall be easily replaceable when it is worn down or corroded. Shaft enclosing tube, whose internal diameter has enough clearance between main shaft, shall prevent main shaft from being directly exposed to sewage water. Shaft enclosing tube also shall be used as water supply pipe for submersible bearing lubrication. At the shaft connection, suitable shaft coupling, which is of easy-assembling/disassembling construction and is well balanced, shall be selected.

3.4 Bearing

Submersible bearing shall be of rubber construction, and lubrication method for the bearing shall be of external pressured clear water type. Submersible bearing shall be rated for long hours of continuous running. Thrust bearing shall be mounted on pump discharge casing, and shall be of easy-assembling/disassembling construction. The weight of the pump rotating parts and hydraulic thrust load shall be supported by thrust bearing. Thrust bearing shall be rated for long hours of continuous running, and shall be self-lubricated with grease.

3.5 Sealing

Shaft sealing method shall be of mechanical seal type.

Drain piping shall be arranged from the sealing device and all the other drainage part to the nearest drain gutter.

3.6 Pedestal

Steel-made motor pedestal shall be installed above the discharge casing, and shall support the weight of motor.

3.7 Flange

Flange rating of the pump discharge side shall conform to JIS B2064 7.5k or equivalent.

3.8 Sealing and Lubrication Water

Water supply flow for mechanical seal and submergible bearing lubrication shall be detected by flow-relay, and shall be controlled by electric valve.

4. MATERIALS

Materials used for each pump part shall be as follows.

- (a) Suction Bellmouth : Cast iron (JIS FC250)
- (b) Impeller : Stainless steel (JIS SCS13)
- (c) Wearing Liner : Stainless steel (JIS SUS304/SUS403/SCS1/SCS13)
- (d) Discharge Bowl : Cast iron (JIS FC250)
- (e) Discharge Casing : Cast iron (JIS FC250)
- (f) Column Pipe : Cast iron (JIS FC250)
- (g) Main Shaft : Stainless steel (JIS SUS403)
- (h) Shaft Sleeve : Stainless steel (JIS SUS304)
- (i) Shaft Enclosing Tube : Stainless steel (JIS SUS304)

5. PROTECTION EQUIPMENT

- (1) Mechanical Protection Equipment Sealing and lubrication water flow and others shall be considered as one of pump operating conditions.
- (2) Other Protection Equipment at the dangerous part around the motor pedestal and so on, safety measures shall be installed.

6. TEST AND INSPECTION

Each pump set shall be subjected to a complete shop test performed by the manufacturer. If necessary, test on one pump set shall be witnessed by customer or consultant. All tests shall be performed in accordance with JIS B8301 standard.

7. EXECUTION

Refer to various sub-sections in Section 15.1.

15.11.7 CENTRIFUGAL PUMP

1. GENERAL

This pump shall be a single-stage or multistage volute pump for elevated water tank storage, filter cloth washing water, compression, etc.

2. DESIGN CONDITIONS

- (1) The pump shall have wall thickness having an adequate allowance for shock, wear and corrosion.
- (2) The pump shall be constructed to produce no vibration and noise during operation and endure continuous operation for a long time sufficiently.
- (3) The motor specifications shall be totally enclosed fan-cooled type and of continuous rating.

3. MATERIALS

- (a) Casing : Cast iron
- (b) Impeller : Cast iron or bronze casting
- (c) Main shaft : Carbon steel with stainless steel sleeve or stainless steel shaft

4. ACCESSORIES (PER UNIT)

- (a) Coupling cover x 1 set
- (b) Common base x 1 set
- (c) Pressure gauge or compound pressure gauge x 1 set
- (d) Foundation bolt and nut x 1 set

5. EXECUTION

Refer to various sub-sections in Section 15.1.

DIVISION 15 MECHANICAL WORKS

SECTION 15.12 CONVEYING SYSTEM (FOR SEWERAGE)

15.12.1 MANUAL CHAIN BLOCK

1. GENERAL

Chain block is necessary equipment to install the machinery and tools. Manual chain block shall be used to carry in, carry out, foundation, assembling, maintaining and inspecting the pump under water.

2. DESIGN CONDITION

The manufacturing of chain block shall be conducted according to the Labor Ministry's regulation [safety regulation of crane etc], labor ministry notice [crane construction regulation] and regulation of JIS etc, along with the safety and the durability it is required to.

Specification

Item	Specification	Note
(1) Shape	Manual chain block	
(2) Rated weight	0.5 t	
(3) Total raising limit	7 m	
(4) Operation chain length	6 m	
(6) Number of chain	1	

3. FABRICATION

3.1 Raising Equipment

Gear mechanism and controlling mechanism shall be achieved by the combination of spur gear and hand sprocket wheel equipment. The power will be transferred by gear mechanism to heavy sprocket wheel by manual operation of chain. This power creates revolution, and is known as raising system.

3.2 Heavy Sprocket Wheel

Forge manufacturing material or cast manufacturing material shall be used.

3.3 Heavy Chain

Heavy chain shall be produced with special alloy steel by heat treatment method in the furnace. Breaking strength shall have to be above 800 N/m². It shall be made rust and corrosion proof by suitable metal surface treatment.

3.4 Operation of Chain

It shall be of 30 cm length above the base. During chain operation, adequate care shall be taken not to

detached and get out of place.

3.5 Hook

It shall be of key shape. The safety lever shall be attached to spherical suspended wire rope.

3.6 Side moving Equipment

Hand chain shall be attached to the hand foil. Hand foil will revolve by the hand chain operation. The reverse movement shall also be possible from spur gear. The driving force will be achieved from the side wheel

4. PROTECTION EQUIPMENT

Break equipment

Raising equipment and hand chain operation can be stopped in small time by the mechanical break system.

5. EXAMINATION AND TEST

The efficiency test for chain block shall be conducted according to JIS B8802 (Delivery test) after completion of factory manufacturing.

6. COATING

It shall be done by manufacturer's standard coating.

7. ACCESSORIES

- | | |
|---|-------|
| (1) Chain bracket (Steel manufacturing) | 1 set |
| (2) Hanging hook (If necessary) | 1 set |

15.12.2 BELT CONVEYOR

1. GENERAL

The belt conveyor shall be used to transport the screenings, sludge, etc. and shall be composed of conveyor frame, drive pulley, tail pulley, take-up, belt, skirt, carrier roller, return roller, receiving plate, water supply and drain system for washing.

2. DESIGN CONDITION

The capacity of the belt conveyor shall be designed with sufficient safety factor, the characteristics of the transported material shall be considered. Cycloid reduction gear, planetary reduction gear or motor pulley shall be used as driving method.

3. FABRICATION

- (1) The head pulley shall transmit the power effectively without slip.
- (2) The carrier roller, return roller and side roller shall be smooth, shall have minimal friction, and sufficient strength.
- (3) A take up shall be provided at the tail pulley in order to apply tension to the rubber belt.
- (4) Skirt and receiving plate shall be provided for the entire length of conveyor to prevent screenings from scattering. The chute shall be installed on the connection part of conveyor. The receiving plate shall be made of stainless steel and shall be of a shape that can be cleaned conveniently.
- (5) The conveyor frame shall be made of welded or bolted sections and shall be mounted on the base firmly. The conveyor frame shall have sufficient strength to endure both static load and dynamic load.

4. MATERIALS

- | | |
|--------------------------------------|---|
| (1) Conveyor frame support | : Rolled steel |
| (2) Head pulley drum | : Rolled steel + rubber lining (external) |
| (3) Tail pulley drum | : Rolled steel |
| (4) Rubber belt | : Oil resistance rubber |
| (5) Carrier, return roller main body | : PVC or rubber lining steel pipe |

5. PROTECTION EQUIPMENT5.1 Mechanical protection

The built in torque limiter shall be provided in the reduction gear against the over load. (except motor pulley)

5.2 Electrical protection

The limit switches to detect winding shall be provided in the side roller. (conveyor length <20m : 2nos / unit, others: 4nos / unit)

6. ACCESSORIES (PER UNIT)

- | | |
|---|---------|
| (1) Belt cleaner | x 1 set |
| (2) Stressing device | x 1 set |
| (3) Skirt, chute and receiving plate | x 1 set |
| (4) Anchor bolts | x 1 set |
| (5) Side roller with winding limit switch | x 1 set |
| (6) Carrier roller, return roller and side roller | x 1 set |
| (7) Wire-type emergency stop device | x 1 set |

7. EXECUTION

Refer to various sub-sections in Section 15.1.

15.12.3 GEARED TROLLEY CHAIN BLOCK

1. GENERAL

The chain block shall be used for the carry-in and carry-out, installation, maintenance and check of equipment, apparatus and the materials required therefore installed in the building. It shall be of manual operation type and all of hoist and traverse motions shall be manually operated.

2. DESIGN CONDITION

The chain block shall be manufactured to operate safely and accurately, as well as to be structurally durable and convenient for maintenance.

3. FABRICATION

3.1 Hoist equipment

The hoist equipment shall be composed of a gear mechanism constructed with a combination of spur gears, a control mechanism, a hand chain wheel mechanism and a take-up mechanism. When the hand chain is manually operated, the force is transmitted to the gear mechanism, which turns the load sheave to wind up the load chain.

3.2 Load sheave

The load sheave to be used shall be a forged or cast one and shall be fabricated and treated so as not to cause damage to the load chain during winding.

3.3 Load chain

The load chain to be used shall be made of galvanized steel or corrosion resistant material. It shall demonstrate excellent rust and corrosion resistance.

3.4 Operating chains

For hoisting and traversing, separate chains shall be used. These chains shall be long enough to reach up to approximately 30 cm above the floor. Adequate consideration shall be given to ensure that they are free from bouncing, coming-off, etc. during operation.

3.5 Hooks

The hook shall be a single-hook type and be provided with a safety lever.

3.6 Traversing equipment (geared trolley)

When the hand chain mounted to the hand wheel is operated, the hand wheel is turned so that the spur gear mounted on the opposite side may drive half of the traverse wheels (on one side).

4. MATERIALS

- (1) Load chain : Galvanized steel or corrosion-resistant material
- (2) Hand chain: Stainless steel or corrosion-resistant material

5. PROTECTION EQUIPMENT

5.1 Mechanical protection equipment

5.2 Braking equipment

When hand chain operation is stopped, the hoisting equipment shall be stopped at once by the mechanical braking mechanism.

6. ACCESSORIES (PER UNIT)

- (1) Spare hook for re-hoisting (as necessary) x 1 set

7. EXECUTION

Refer to various sub-sections in Section 15.1.

15.12.4 BRIDGE CRANE

1. GENERAL

The overhead crane system shall be used for the installation, assembly, maintenance and check of the pump system and other equipment and apparatus installed in the building. All or part of traverse, travel, hoist-up and hoist-down motions shall be motor-driven and operated by means of push-button switches hanging down from the crane on the floor inside the building. This crane shall be intended to handle shape steel beam structures.

2. DESIGN CONDITION

The crane shall be manufactured to operate safely and accurately, as well as be structurally durable and convenient for maintenance. The main dimensions of the crane shall be determined by adequate survey of the building construction, etc.

3. FABRICATION

3.1 Main girder

The main girder shall be an I-shape steel structure. At the top, a check walkway with handrails shall be provided.

3.2 Travel rails

The rail to be used shall be safe in full-load operation. Rails shall be mounted to runway girders installed by civil and architectural works. They shall be adjusted in horizontal and parallel centering and shall be mounted safely and firmly by means of hook bolts. At either ends of the rail, wheel stoppers or stoppers shall be provided.

3.3 Saddle

The saddle to be used shall be constructed with shape steel and steel plate by welding them in a box form. It shall be provided with travel wheels and the load shall be distributed uniformly to the wheels.

3.4 Motor-driven hoist

The hoist shall be a double-rail hoist constructed with hoisting equipment and traverse equipment arranged in compact. Its construction and function shall be in accordance with JIS C 9620 “Electrical Hoists” or equivalent.

3.5 Gears

The gear to be used shall be a machine cut gear having sufficient strength.

3.6 Shafts

The shaft to be used shall be made of materials of good quality. The major portions shall be finished carefully. The gear shall be fitted accurately and fixed to the shaft.

3.7 Motors

The motor to be used shall be manufactured specifically for hoists and cranes. It shall have minimum moment of inertia and adequate mechanical strength as well as heat capacity enough to endure severe working conditions. Motors shall be in accordance with related standards.

3.8 Controller

The on-floor controller shall be a push-button type used for starting and stopping motors.

3.9 Electromagnetic brakes

The braking force shall resort mostly to the spring. In the event of unexpected power service interruption or otherwise current being shutdown, this brake shall be able to brake the motor by the

spring force positively.

3.10 Switch box

The switch box shall be a case made of steel plate to accommodate circuit breakers, electromagnetic contactors and relays.

3.11 Lubricating equipment

The lubricating equipment shall be a grease sealing type and shall bear a long period of use.

3.12 For transition into the crane

For transition from the architectural stage into the crane, frames, handrails, open-close fences, stairways, etc. shall be provided for safe walking.

4. MATERIALS

- (a) Main beam : Rolled steel
- (b) Gear : Carbon steel
- (c) Shaft : Carbon steel
- (d) Drum : Rolled steel
- (e) Brake drum : Cast iron

5. PROTECTION EQUIPMENT

5.1 Mechanical protection equipment

Traverse rails and travel rails shall be provided with wheel stoppers or stoppers.

5.2 Electrical protection equipment

Over-hoist prevention equipment, electromagnetic brake, current-application confirmation lamp, etc. shall be installed.

6. ACCESSORIES (PER UNIT)

- (a) Lubricator x 1 set
- (b) Grease x 1 can
- (c) Disassembly tool x 1 set (common for all units)

7. EXECUTION

Refer to various sub-sections in Section 15.1.

15.12.5 SCREW GRIT CONVEYOR

1. GENERAL

The screw grit conveyor shall be composed of separation tank, screw conveyor, drive unit, etc. The screw grit conveyor shall be constructed to promote the solid-liquid separation without blockage.

2. DESIGN CONDITION

- (1) This equipment shall be sturdily constructed to endure the pressure of influent grit and water.
- (2) This equipment shall be constructed to separate solid-liquid effectively and transport them.

3. FABRICATION

3.1 Separation tank

- (a) The separation tank shall be made of steel plate and assembled by welding or with bolts and nuts. The separation tank shall be of waterproof structure and shall endure the water pressure.
- (b) The opening for overflow shall be sized to accommodate the specified overflow rate.
- (c) The drainage line shall be piping (not less than 150A) or trough and of a non-clogging structure.

3.2 Screw conveyor

- (a) The screw shaft shall be made of steel pipe or other corrosion-resistant material.
- (b) The impeller made of steel plate shall be welded to the screw shaft. The impeller shall have an efficient shape for the transportation of the grit.

3.3 Drive unit

Planetary reduction gear coupled directly with motor (with torque limiter) shall be used as drive unit.

4. MATERIALS

- | | |
|--|-----------------------------------|
| (a) Impeller of screw conveyor | : Rolled steel or equivalent |
| (b) Main shaft of screw conveyor | : Carbon steel pipe or equivalent |
| (c) Front and rear shaft of screw conveyor | : Carbon steel pipe or equivalent |
| (d) Trough of screw conveyor | : Rolled steel or equivalent |
| (e) Separation tank | : Rolled steel or equivalent |

5. PROTECTION EQUIPMENT

5.1 Electrical protection

An over-current relay with instantaneous converter shall be provided against over load.

5.2 Mechanical protection

The built in torque limiter in the reduction gear shall be provided against over load.

6. ACCESSORIES (PER UNIT)

- (1) Anchor bolts and nuts x 1 set
- (2) Drainage valve x 1 unit

7. EXECUTION

Refer to various sub-sections in Section 15.1.

DIVISION 15 MECHANICAL WORKS**SECTION 15.13 VALVES, GATES AND APPURTENANCES (FOR SEWERAGE)****15.13.1 GATE VALVE****1. GENERAL**

This valve shall be installed at the sewage or sludge discharge pipe-line of pump to seal the water and to adjust the flow.

2. DESIGN CONDITION

- (1) Sizes shown are nominal pipe diameter, unless otherwise noted.
- (2) Operators shall be sized based on the maximum expected torque recommended by valve manufacturer.
- (3) Gate valves shall be provided to isolate supply and return services to each piece of equipment or appliance without disturbing the piping systems. The valves shall be located to be easily accessible to operator of equipment.
- (4) Gate valves shall not be installed with stem in the vertical down position.
- (5) Gate valves shall be provided complete with necessary operators, hand wheels, chain wheels, operating nuts, chains, wrenches and other accessories required for the proper operation and system maintenance.

3. FABRICATION

- (1) All gate valves shall be of solid wedge gate type generally with rising spindles.
- (2) Gate valves shall comply with JIS B2031 or equivalent.
- (3) Gate valves shall have cast iron bodies, stainless steel rising spindles, wedge gates with discs and seats. Discs shall be cast iron or equivalent and seals shall be bronze casting or equivalent.
- (4) The body, bonnet, gate, and stuffing box shall be cast iron or equivalent.
- (5) All valves shall be capable of being operated by one man with an operating torque not exceeding 250N at the hand-wheel.
- (6) All valves shall close by clockwise direction rotation of hand-wheel and the directions of opening and closing shall be cast on the hand-wheel. The valves shall be provided with open/shut position indicator.
- (7) All valves shall have a rated working pressure of 0.98MPa unless otherwise stated.
- (8) When valves are installed inaccessible positions, extension spindles, tee-keys, headstocks or chain-wheels shall be provided, as the situation requires. Headstocks shall be clearly marked to indicate the opening and closing positions of the valves.

4. MATERIALS

- (a) Body : Cast Iron or equivalent
- (b) Disc : Cast Iron or equivalent

- (c) Stem : Stainless Steel or equivalent
- (d) Seat : Bronze casting or equivalent

5. ACCESSORIES (PER UNIT)

- (a) Bolts and Nuts : 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.13.2 MOTOR DRIVEN GATE VALVE

1. GENERAL

This valve shall be installed at the sewage discharge pipeline and/or the sludge withdrawal pipeline of pumps to stop and/or to control the flow automatically.

This valve shall be composed of open/close valve and electric actuators.

2. DESIGN CONDITION

- (1) Sizes shown are nominal pipe diameter, unless otherwise noted.
- (2) Operators shall be sized based on the maximum expected torque recommended by valve manufacturer.
- (3) Gate valves shall be provided to isolate supply and return services to each piece of equipment or appliance without disturbing the piping systems. The valves shall be located to be easily accessible to operator of equipment.

3. FABRICATION

3.1 Gate valve

Gate valves shall be complying with the requirements of Section 120.

3.2 Electrical actuators

- (a) Actuators shall be suitable for operation on 380 volts, 50 Hertz, 3 phase power supply and shall incorporate into a single integral unit a squirrel cage motor, reduction gearbox, limit and torque switch mechanism.
- (b) Actuators shall be made up of cast iron or other equally approved material.
- (c) Actuators shall be mounted on the valves. Actuators shall be sized to guarantee complete opening/closing of the valves at the maximum and minimum pressure head.
- (d) Actuators shall have a linear displacement rate of 200mm and more per minute with clockwise rotation indicated by an arrow on the hand-wheel for closing.
- (e) The electrical motor shall be capable of operating the actuator over its full travel for two continuous opening and closing cycles or with a time rating of 15 minutes whichever is the longer, at an average load of at least 33% of maximum torque. The motor shall be Class E or other

equally approved class and shall be air cooled, specifically designed for actuator operation.

- (f) Motor for actuators shall be suitable for operation on a 380V, 50cycles, 3-phase power supply.
- (g) All gears shall be designed for 100% overload and all single moving parts shall have adequate lubrication. The actuator gearbox shall be of the totally enclosed oil bath lubricated type or enclosed grease-lubricated type.
- (h) Provision shall be made for manual operation of valve. When in manual operation, power shall be automatically disconnected from motor. Likewise, the manual hand-wheel shall be automatically disengaged and remain stationary when the motor is connected.
- (i) Manual operation shall be instantly available when power operation ceases or fails and transition from manual to power operation shall produce no shock or movement.
- (j) Position limit and torque are to be provided to indicate extreme valve positions and for over-load protection.
- (k) The actuator shall include digital local position indicator to monitor the valve position to show whether the valve is fully open, fully close or in some intermediate position.

4. MATERIALS

4.1 Valve

- (a) Body : Cast Iron or equivalent
- (b) Disc : Cast Iron or equivalent
- (c) Stem : Stainless Steel or equivalent
- (d) Seat : Bronze casting or equivalent

4.2 Electrical Actuator

- (a) Body : Cast Iron or equivalent

5. ACCESSORIES (PER UNIT)

- (a) Bolts and Nuts : 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.13.3 BUTTERFLY VALVE

1. GENERAL

This valve shall be installed at the pipeline to seal the water and to adjust the flow.

2. DESIGN CONDITION

Valves shall be suitable for throttling operations and for infrequent operation after periods of inactivity.

3. FABRICATION

- (1) Butterfly valves shall comply with JWWA B114 or equivalent.
- (2) The body of the valve shall be made from cast iron or ductile iron.
- (3) Valves shall have fabricated steel, cast iron or ductile iron discs with a resilient rubber-sealing ring.
- (4) Valve stem shall be sized to withstand bearing loads and shall be stainless steel designed for both torsion and shearing stresses when the valve is operated with permanently self-lubricated shaft stub bearing.
- (5) Butterfly valves shall be provided with hand-wheels and rack and pinion gearing operation. The valves shall open by turning the hand-wheel in an anticlockwise direction. The direction of valve opening and closing shall be marked on the hand-wheel casting.
- (6) The valves shall be designed to hold the disc in any intermediate position between fully opened and fully closed without creeping or fluttering by manual or electric operation.

4. MATERIALS

- (a) Body : Carbon steel or Cast iron or equivalent
- (b) Disc : Carbon steel or Cast iron or equivalent
- (c) Stem : Stainless Steel or equivalent
- (d) Seat : Rubber or equivalent

5. ACCESSORIES (PER UNIT)

- (a) Bolts and Nuts : 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.13.4 MOTOR DRIVEN BUTTERFLY VALVE

1 GENERAL

This valve shall be installed at the pipeline to seal the water and to adjust the flow.

2. DESIGN CONDITION

- (1) Valves shall be suitable for throttling operations and for infrequent operation after periods of inactivity.

3. FABRICATION

- (1) Butterfly valves shall comply with the requirement of 15.13.3.
- (2) Stuffing box shall be provided at the actuator end of shaft and be arranged such that the O-rings can be replaced without removing the actuator.
- (3) Electrical actuator shall be in compliance with the requirement of 15.13.2.

4. MATERIALS

4.1 Valve

- (a) Body : Carbon steel or Cast iron or equivalent
- (b) Disc : Carbon steel or Cast iron or equivalent
- (c) Stem : Stainless Steel or equivalent
- (d) Seat : Rubber or equivalent

4.2 Electrical Actuator

- (a) Body : Cast iron or equivalent

5. ACCESSORIES (PER UNIT)

- (a) Bolts and Nuts : 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.13.5 MOTOR DRIVEN ECCENTRIC VALVE

1. GENERAL

This valve shall be installed at the sludge drawing pipeline, and shall be capable of opening and closing in the automatic operation of the pump.

2. DESIGN CONDITION

- (1) Sizes shown are nominal pipe diameter, unless otherwise noted.
- (2) Operators shall be sized based on the expected maximum torque recommended by valve manufactures.
- (3) The valves shall have an opening area of more than 80% of the whole area in fully opened condition.
- (4) The valves shall be adjustable and replaceable without removal from the connected pipes.

3. FABRICATION

- (1) Eccentric valves shall be of the non-lubricated type with Rubber resilient faced disc.
- (2) The valve bodies shall be cast iron or ductile iron and shall be fitted with corrosion resistant seats.
- (3) All valves shall have a rated working pressure of maximum 0.3MPa unless otherwise stated.
- (4) The disc face to body seat interference shall be adjustable with the valve closed and without taking the valve out of service.
- (5) Electrical actuator shall be in compliance with the requirement of Section 120. However, the time for fully opening and closing shall be 20 to 40 seconds.

4. MATERIALS

- (a) Body : Cast Iron or Ductile iron
- (b) Disc : Cast Iron or Ductile iron
- (c) Body seat : Corrosion resistant material
- (d) Disc seat : Rubber
- (f) Stem : Stainless steel or Cast iron with rubber lining

5. ACCESSORIES (PER UNIT)

- (a) Bolts and Nuts : 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.13.6 MANUALLY OPERATED CAST IRON GATE

1. GENERAL

The cast iron gate shall be composed of the gate leaf, a spindle, an open-close device, etc. It shall be installed in the water treatment facility for the purpose of water sealing and influent flow adjustment. The gate shall be constructed to be watertight on four sides. It shall be opened and closed by manual operation. Its spindle shall be of outside screw type.

2. DESIGN CONDITIONS

- (1) The gate leaf shall be made of cast iron of good quality free from cast blowhole. Strength calculations shall be made under the assumption that a water pressure of the indicated water level (lowest water level 5m with reference to the intake bottom) is applied on the pressure side and there is no water on the opposite side.
- (2) The force, which is required to operate the gate, shall be calculated from the water pressure and the load of self-weight including the spindle, etc.

3. FABRICATION

Fabrication shall be as follows.

- (1) The main portion of the gate leaf shall have the calculated wall thickness added with a corrosion allowance.
- (2) Watertight sheet, wedge block, spindle connection bracket, etc. shall be provided. However, the spindle connection bracket may be cast integral with the gate leaf.
- (3) Guide portions for gate leaf open-close shall be provided. The guide portion may be cast integral with the guide frame.
- (4) The spindle shall be made from a stainless steel rod. It shall be able to move the gate leaf up and down smoothly and safely.

- (5) If a pin is to be used in the connection between the gate leaf and the spindle, it shall be made of stainless steel.
- (6) If a vibration-preventing metal is to be provided at an intermediate of the spindle length, it shall be made of cast iron or steel.
- (7) Manual open-close device
 - (a) The open-close device shall be of horizontal handle type or gear type (bevel gear type, worm gear type).
 - (b) The stand and the hand wheel shall be made of cast iron. The hand wheel shall be marked to indicate the direction of turning. When the handle is turned counterclockwise, the gate leaf shall be opened.
 - (c) At the top of the open-close device, a spindle cover shall be mounted.
 - (d) To indicate the degree of opening, a clock type rotary opening-degree meter shall be provided in the case of gear type (bevel gear type, worm gear type), or an opening-degree meter shall be provided to the spindle cover or the stand in the case of the horizontal handle type. The opening-degree meter shall have a scale calibrated in mm and the major portions of the opening-degree meter shall be made of stainless steel.

4. MATERIALS

Materials shall be as follows.

- (a) Gate leaf : Cast iron
- (b) Guide frame : Cast iron
- (c) Watertight sheet : Bronze casting or stainless steel
- (d) Wedge : Bronze casting + stainless steel or Cast iron
- (e) Spindle : Stainless steel
- (f) Spindle cover : Steel or stainless steel pipe

5. ACCESSORIES (PER UNIT)

- (a) Coupling for spindle x 1 set
- (b) Foundation bolt and nut x 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.13.7 MOTOR DRIVEN CAST IRON GATE

1. GENERAL

The cast iron gate shall be composed of the gate leaf, a spindle, an open-close device, etc. It shall be installed in the water treatment facility for the purpose of water sealing and influent flow adjustment. The gate shall be constructed to be watertight on four sides. It shall be opened and closed by motor

operation. Its spindle shall be of outside screw type.

2. DESIGN CONDITIONS

- (1) The gate leaf shall be made of cast iron of good quality free from cast blowhole. Strength calculations shall be made under the assumption that a water pressure of the indicated water level (lowest water level 5m with reference to the intake bottom) is applied on the pressure side and there is no water on the opposite side.
- (2) The force required to operate the gate shall be calculated from the water pressure and the load of self-weight including the spindle, etc.

3. FABRICATION

- (1) The main portion of the gate leaf shall have the calculated wall thickness added with a corrosion allowance.
- (2) Watertight sheet, wedge block, spindle connection bracket, etc. shall be provided. However, the spindle connection bracket may be cast integral with the gate leaf.
- (3) Guide portions for gate leaf open-close shall be provided. The guide portion may be cast integral with the guide frame.
- (4) The spindle shall be made from a stainless steel rod. It shall be able to move the gate leaf up and down smoothly and safely.
- (5) If a pin is used in the connection between the gate leaf and the spindle, it shall be made of stainless steel.
- (6) If a vibration-preventing metal is to be provided at an intermediate of the spindle length, it shall be made of cast iron or steel.
- (7) Motor-driven open-close device
 - (a) A limit switch shall be provided which operates positively at the position where the opening degree of the gate leaf is set. The limit switch shall be adjustable.
 - (b) The mechanism of the motor-driven open-close device shall be such that if the torque applied to the motor abnormally increases during the open-close operation, the torque switch shall stop the motor positively.
 - (c) The motor-driven open-close device shall be constructed such that if the gate is to be operated manually, the motor-driven circuit may be opened simply and positively and safety may be secured. This device shall be constructed such that it can be switched from manually to the motor-driven operation.
 - (d) The manual operation shall be done by means of a hand wheel.
 - (e) The opening-degree indicator shall be provided.
 - (f) Strength calculation of various portions shall be conducted considering safety to provide adequate strength with respect to the rated torque of the motor.
 - (g) The motor shall be a totally enclosed fan-cooled type and 15-minute (standard) rating provided with braking.

4. MATERIALS

- (a) Gate leaf : Cast iron

- (b) Guide frame : Cast iron
- (c) Watertight sheet : Bronze casting or stainless steel
- (d) Wedge block : Bronze casting + stainless steel or Cast iron
- (e) Spindle : Stainless steel
- (f) Spindle cover : Steel pipe or stainless steel

5. ACCESSORIES (PER UNIT)

- (a) Coupling for spindle x 1 set
- (b) Foundation bolt and nut x 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.

15.13.8 ADJUSTABLE WEIR

1. GENERAL

The adjustable weir shall be composed of the adjustable weir leaf, a spindle, an open-close device, etc. It shall be installed in the water treatment facility for the purpose of water sealing and influent flow adjustment.

The adjustable weir shall be constructed to be watertight on three sides. It shall be opened and closed by manual operation. Its spindle shall be of outside screw type.

2. DESIGN CONDITIONS

- (1) The weir leaf shall be made of cast iron of good quality free from cast blowhole. Strength calculations shall be made under the assumption that a water pressure of the water level corresponding to the indicated lift head is applied on the pressure side and there is no water on the opposite side.
- (2) The force, which is required to operate the adjustable weir, shall be calculated from the water pressure and the load of self-weight including the spindle, etc.

3. FABRICATION

Fabrication shall be as follows.

- (1) Regarding the specifications for the adjustable weir, the following requirements shall be observed.
 - (a) The adjustable weir shall be constructed such that it shall be watertight at each degree of opening.
 - (b) On each of three sides of the opening, a weir plate suited for flow measurement shall be provided.

The watertight sheet shall be made of stainless steel or bronze casting. The adjustable weir shall be

constructed to be watertight on three sides, as standard.

- (2) The main portions of the weir leaf shall have the calculated wall thickness added with a corrosion allowance.
- (3) Watertight sheet, weir plate, spindle connection bracket, etc. shall be provided. However, the spindle connection bracket may be cast integral with the weir leaf.
- (4) Guide portions for weir leaf open-close shall be provided. The guide portion may be cast integral with the guide frame.
- (5) The spindle shall be made from a stainless steel rod. It shall be able to move the weir leaf up and down smoothly and safely.
- (6) If a pin is to be used in the connection between the weir leaf and the spindle, it shall be made of stainless steel.
- (7) If a vibration-preventing metal is to be provided at an intermediate of the spindle length, it shall be made of cast iron or steel.
- (8) Manual Open-close Device

It shall be in accordance with that in section 140 Manually operated cast iron gate.

4. MATERIALS

- (a) Weir leaf : Cast iron
- (b) Guide frame : Cast iron
- (c) Watertight sheet
 - Weir leaf side : Stainless steel or bronze casting
 - Guide frame side : Stainless steel or bronze casting
- (d) Spindle : Stainless steel
- (e) Spindle cover : Steel pipe or stainless steel

5. ACCESSORIES (PER UNIT)

- (a) Coupling for spindle x 1 set
- (b) Foundation bolt and nut x 1 set

6. EXECUTION

Refer to various sub-sections in Section 15.1.