

CALAMBA WATER DISTRICT

PROJECT: WATER SOURCE DEVELOPMENT FACILITIES & ACCESSORIES
SUBJECT: SCOPE OF WORKS AND SPECIFICATIONS

C. CIVIL WORKS

I. **Scope of Works** **C.1 Earthworks**

Excavation:

Except when specifically provided to the contrary, excavation shall include the removal of materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the work. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such materials shall be removed from the site prior to performing any excavation or placing any fill. The Contractor shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other approved measures for the removal or exclusion of water, including taking care of storm water and waste water reaching the site of the work from any source so as to prevent damage to the work or adjoining property.

The walls and faces of all excavations in which workers are exposed to danger from unstable ground shall be guarded against by a shoring system, sloping of the excavation, or some other acceptable method. The contractor shall furnish, install, and maintain such sheeting, bracing, etc., as may be necessary to protect the workers and to prevent any movement of earth which could injure or delay the work or endanger adjacent structures. In excavations which workers may be required to enter, excavated or other materials shall be effectively stored and retained at least 600mm or more from the edge of the excavation. All excavation and trenching operations shall conform to any and all national, provincial and local safety requirements.

Excavation beneath proposed structures. Except where otherwise specified for a particular structure or ordered by the Engineer, excavation shall be carried to the grade of the bottom of the footing or slab. Where shown and ordered, areas beneath proposed structures shall be over-excavated. When such over-excavation is shown on the drawings, both over-excavation and subsequent backfill to the required grade shall be performed by the Contractor at his own expense. When such over-excavation is not shown but is ordered by the Engineer, such over-excavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established; otherwise payment will be made in accordance with negotiated prices. After the required excavation or over-excavation has been completed, the exposed surface shall be scarified to a depth of 150 mm (6-in.) brought to optimum moisture content, and rolled with heavy compaction equipment to ninety-five percent (95%) of maximum density.

Excavation beneath Areas to be paved. Excavation under areas to be paved shall extend to the bottom of the aggregate base, if such base is called for; otherwise it shall extend to the bottom of paving. After the required excavation has been completed, the exposed surface shall be scarified, brought to optimum moisture

content, and rolled with heavy compaction equipment to ninety percent (90%) of maximum.

C.2 Columns and CHB Wall

1. *Preparation of Equipment:* All equipment for mixing and transporting concrete shall be clean. Debris shall be removed from spaces to be occupied by concrete. Forms shall be properly coated. Masonry filler units that will be in contact with concrete shall be well drenched. Reinforcement shall be thoroughly clean of deleterious coatings. All laitance and other unsound material shall be removed before additional concrete is placed against hardened concrete.
2. *Mixing, Placing and Curing of Concrete:* All concrete shall be mixed until there is uniform distribution of materials and shall be discharged completely before mixer is recharged. Curing shall be maintained above 10°C and in moist condition for at least the first 7 days after placement.
3. *Formworks Design and Removal:* Forms shall result in a final structure that conforms to shapes, lines, and dimensions of the members as required by the design drawings and specifications. It should be tight to prevent leakage of mortar; also it shall be properly braced or tied together to maintain position and shape. Forms shall be removed in such manner as not to impair safety and serviceability of the structure. All concrete to be exposed by form removal shall have sufficient strength not to damage thereby.
4. *General Procedures:* Placed CHB, steel reinforcements, concrete, ties and all other appurtenances as shown and as required to provide a complete and workable installation. Where steel reinforcement spacing details are shown, the reinforcement bars shall conform thereto and shall be placed as indicated; provided, that the reinforcement bars shall be complete and adequate regardless of whether or not these reinforcement bars are specifically shown.
5. *Laying of CHB Wall:* Excavated areas shall be in a reasonably dry condition when the reinforcement bars, concrete and CHB are laid. All inside spaces shall be filled with grout/mortar and shall encase fully the reinforcing steel. The minimum thickness for wall shall be 150 mm. The reinforcement shall be limited to a maximum spacing of 1200 mm on center. The minimum diameter shall be 10 mm. Horizontal reinforcement shall be provided in the top of the wall footing and at the top of the wall openings.
6. *Column Fabrication:* Excavated areas shall be the same as CHB wall lying. Shoring and scaffolding shall be undertaken properly and adequately so as to support or brace masonry units during construction and throughout the period of hardening its grout. Grouting shall be done in layers that will assure proper filling of all voids and keyed properly to prevent slippage of bond. The number of vertical reinforcement shall not be less than four (4), nor shall the diameter less than 10 mm. Lateral ties as shown enclose all longitudinal bars. Lateral ties shall be placed not less than 38 mm and not more than 125 mm from the surface of the column. Maximum tie spacing shall be 200 mm.

7. *Reinforcement:* At time concrete is placed steel reinforcements shall be free from coating that would destroy or reduce bond. Steel reinforcement shall be cut to its desired length as specified on the plan.
8. *Testing:* Testing of masonry materials shall be done by applicable government bodies or their authorized agencies, according to testing procedures and other relevant requirements needed for such tests. In the absence of the above, testing shall be done in accordance with ASTM C140-70, Method of Test for Concrete Masonry Units.

C.3 Backfill/Restoration

1. A newly laid CHB wall shall be backfilled at least 0.60 m to 0.80 m above the top of the footing at the end of each day with selected material obtained from the excavation. Materials used for backfill shall be selected, free from grass, roots, brush or other vegetation, or rocks having maximum dimensions larger than 150mm (6 in). If in opinion of the Engineer, said material is unsuitable for backfill purposes, borrow material having the sand equivalent value of not less than twenty (20) (ASTM – D2419) shall be used for this portion of the trench backfill. Selected material shall first be brought up to mid – height of the column post and CHB wall's dimension below natural ground level and then compacted; then the remainder of the backfill to 150mm (6in) above the pipe may be placed and compacted. Such material shall be compacted to ninety five percent (95%) of max. density where the trench is located under proposed structures and ninety percent (90%) of max. density elsewhere. Compaction shall be obtained by tamping it not more than 150mm (6in) layers or by using excess water and passing a concrete vibrator between the pipe and the side of the trench. Obtain and complete (IR) inspection request form prior to backfilling; the works may proceed upon approval of the Supervising Engineer. Remainder of the trench shall be backfilled not later than the following day.

Barricades and warning lights satisfactory to the Engineer shall be provided and maintain for all in which case of heavy steel plates, adequately braced bridges or other type of crossing capable of supporting vehicular traffic shall be furnished.

2. Concrete pavement shall be replaced with the same kind or better material in conformance with the latest specifications, rules and regulation, and subject to the inspection and approval of the agency having jurisdiction.

C.4 Wooden Cabinet

General Requirements

The work calls for the performance of all operations to fabricate and install wooden cabinets, cabinet doors, hinges, catches, edger, and all miscellaneous cabinet items not specifically noted, but required for proper execution of the work. Materials to be applied shall be thoroughly clean and dry and coated with ducco paint finish, free from any defect that might affect the application.

Unless specifically noted in other sections of this specification all miscellaneous cabinet items shall be fabricated and installed in accordance with the requirements of this section of the specifications. The contractor shall verify all measurements in the field; submit shop drawings to the Engineer, showing sizes, details of the fabrication, method of assembly and installation. Fabrication of work shall not commence until all shop drawings are approved.

Materials and accessories shall be carefully handled at all times in storing and handling to prevent damage to the surfaces, edges and ends.

Cabinets shall be carefully handled at all times during delivery. Any damage to the surfaces and edges shall be bear (repair or retouch) by the contractor.

Painting work – follow paint manufacturer's specifications.

C.5 Frame and Panaflex Signboard

The work calls for the performance to install panaflex sign board with steel or aluminum frame, letterings and all miscellaneous items, but required for proper execution of the work. Materials to be applied shall be thoroughly clean, free from rust, free from any defect or scratches that might affect the quality of the items coated with primer.

The contractor shall verify all measurements in the field; submit shop drawings to the Engineer or owner's representative, showing sizes, details and method of installation. Installation work shall not commence until all shop drawings are approved.

1. *Steel or Aluminum Frame:* Frame shall be fabricated and installed in accordance with sizes, thickness, gauges, height and length and or specified in the drawing.
2. *Letterings:* All letterings shall be high quality material in accordance with orientation, sizes, dimensions, height and corner curve as specified in the drawing.

Mechanical Works

Exhaust Fan: Use 1 set of exhaust fan with 75mm to 100mmø pvc pipe connector. Exhaust fan installation shall be in accordance to standards and specified drawing.

II. MATERIAL SPECIFICATIONS

A. Concrete Hollow Blocks

Size of concrete hollow blocks shall be 12.5cm (5") x 20cm x 40cm no deforms and dried as delivered.

- fisk
- h. Plywoods:
 - 3/4" thk marine plywood for flooring and walling
 - 1/4" thk ordinary plywood for back board.
 - c. Liston edger: 25mm x 25mm kiln dry good lumber
 - d. Wood Frame: 50mm x 75mm kiln dry lumber base support
 - e. Cabinet Handle: 8mmø x 100mm stainless type cabinet handles
 - f. Catches: Standard type magnetic catches
 - g. Hinges: Stainless type cabinet piano hinges with complete screw fastener
 - h. Paint: Duco "White Color".
 - i. Adhesive: Stikwel glue.

Frames and Lettering Works

1. *Frame*: Steel or Aluminum 25mm to 38mm angle bars
2. *Letterings*: High quality material for letterings

Painting Works

1. *Concrete*: Latex paint for concrete wall.
2. *Wood*: Flat wall enamel and QDE Ducco paint.
3. *Steel*: Epoxy primer with epoxy paint gray top coat

W. DISCHARGE PIPE SYSTEM

Galvanized Iron Pipes

Pipe Description: Pipes shall conform to the requirements of the ASTM A53/A53M or ASTM A120 and shall be Schedule 40.

Pipe fittings shall conform to the requirements of ASME/ANSI B16.3 (Malleable Iron Threaded Fittings Class 150 and 300) and shall be Class 150.

Pipe Construction: The pipe shall be practically straight and both ends of the pipe shall be at right angle to the axis of the pipe. The inside and outside surfaces of the pipe shall be free from injurious defects. Unless otherwise specified, the length of the pipe shall be 6 meters. The tolerance shall be plus 6 meters without negative tolerance. Pipes shall be clearly marked with Trademark, Nominal Size, Length and Class of Pipe.

The pipe threads shall be made according to American Standard Pipe Taper Thread (NPT) with taper angle equal to 1°47'.

Pipe shall be coated with zinc, both inside and outside surfaces, in accordance to ASTM A153/A153M-05 (Standard Specification for Zinc Coating (Hot - Dip) on Iron and Steel Hardware)

Pipe Dimensions: Pipe shall conform to the following dimensions and weights:

Nominal Pipe Size, in	2	3	4
Nominal Diameter, mm	50	75/80	100
Outside Diameter, mm	60.3	88.9	114.3
Tolerance (outside diameter, mm)	±1%	±1%	±1%
Wall Thickness, mm	3.9	5.49	6.02
Tolerance (wall thickness)	-12.5%	-12.5%	-12.5%
Weight per meter, kg	5.00-5.43	10.3-11.3	14.5-16.1

Pipe Thread: The pipe threads shall be made according to "American Standard Pipe Taper Thread (NPT) with taper angle equal to 1°47'.

Nominal Pipe Size, in	2	3	4
Nominal Diameter, mm	50	75/80	100
Thread per inch	11 ½	11 ½	11 ½
Pitch, in	0.087	0.087	0.087

Coatings: Pipes shall be coated with zinc both inside and outside surfaces.

Random Testing: For every size, two (2) sample pipes representing each lot of one hundred (100) pieces or less shall be tested for compliance with this specification. Any visible defect or failure to meet the quality standards herein will be grounds for rejecting the entire order.

Certification: The manufacturer shall furnish a sworn statement that the inspection and metallurgical and pressure tests have been results thereof comply with the requirements of the applicable Standard(s) herein specified. A copy of the Certification shall be submitted to Calamba Water District.

WATER METER

Meter description The water meter shall conform to requirements of ISO 4064 part 1: Measurement of Water Flow in Closed Conduits-Meters for Cold Potable Water, subject to the following additional requirements.

Meter shall be manufactured by a company with a minimum of 40 years experience in the manufacturing of water meters.

Meter capacity and dimensions shall be:

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Meter Size		75mm (3")	100mm (4")
Maximum Registration	m ³	1,000,000	10,000,000
Maximum Water Temperature	°C	50	50
Maximum Working Pressure	bar	16	16
Starting Flow	m ³ /h	0.22-0.40	0.25-0.60
Maximum Flow rate	m ³ /h	80-170	120-300
Transitional Flow $q_t \pm 2\%$	m ³ /h	1.4-8.0	2-12
Minimum Flow $q_{min} \pm 5\%$	m ³ /h	0.8-1.2	1.5-1.8
Overall Length	mm	200-300	250-360
Weight	kg	14.1-15.5	17.0-19.4

The meter body (or casing) shall be brand new manufactured from cast iron, coated with polyester. Meter bodies shall be smoothly finished free from defects. Bodies which have been repaired are not acceptable. All coating shall be free from defects of any kind. Meter bodies shall have a common inlet-outlet axis and shall be suitable for horizontal installation.

Meter shall be factory tested and shall register in accordance with ISO 4064 standards. Any meter not meeting these standards will be subject to rejections.

Register

Register compartments shall be self-contained and hermetically sealed. Register compartments that rely upon a compressed gasket for the hermetical sealing and which can be opened to repair the gear train, shall include an approved desiccant capsule. Register reading shall be of straight reading in cubic meter.

Pulse Output

Register shall include electrical outputs with a range of electric output options. Pulser can be easily fitted on site without disturbing the calibration seal or interrupting the water supply. The pulser /electrical output shall be bi-directional designed to interface with almost all or any products, providing a pulse resolution in accord with the fitted position on the register. Capable of volume and flow rate measuring control, remote reading system or computerized data acquisition system, including connectors and/or cable, shall be bi-directional designed to interface with the existing CWD multi-log data logger or products and any other measuring gadgets.

Maximum Contact Voltage

24-28 V dc

Maximum Output Pulse	Volume and flow rate
Maximum Contact Current	50mA
Maximum Power	

Dial Lens

The lens covering the register dial shall be securely fastened to achieve hermetical sealing and shall be of clear tempered glass of 5mm minimum thickness (or of suitable synthetic polymer which shall be of high impact, ultra violet stabilized polycarbonate resin film of clear transparency.). Dial lens shall be resistant to impact and abrasion. Impact resistance shall be taken as the capability to resist the impact of a 12mm diameter steel ball dropped from a height of one (1) meter without sustaining any evident damage. Abrasion resistance shall be taken as the capability to resist permanent scratch marks using a material not harder than Philippine one-peso coin. Meter dial lenses shall be held in place by a hinged lid or similar holding device of suitable synthetic polymer.

Register Box Ring (Bonnet) and Lid

Register box ring and lid shall be of the same material composition as the meter body or of suitable synthetic polymer.

Sealing

Each meter shall be supplied with 2.5mm diameter copper wire and other suitable type of seal system to discourage unauthorized opening or removal of the meter and also to indicate if such unauthorized act has been made. All elements of the sealing system, including length of wire, location of wire holes, etc., shall be suitable for covering all possible means of tampering, in particular, disturbance of the coupling nuts; of the accuracy adjustment device, if there is any; and of the register assembly. The seal shall be blank and suitable for sealing by a compression tool. The sealing elements shall be provided in such a way that after sealing, both before and after the water meter has correctly installed, there is no possibility of altering or dismantling the meter without damaging the sealing elements.

Steel-flange

The flange shall be cast iron and shall be furnished with bolts, nuts and gaskets. The flange bolt circle and bolt holes shall match with two (2) ends water meters.

Cable and/or Electrical Output Connector

The cable /connector shall be adaptable to the QWD multi-log data logger and other products.

Test Method and Equipment

The methods and means to be employed in determining the compliance of water meter shall be in accordance with ISO 4064/3. (Test methods and equipment).

Initial Accuracy test
Pressure Tightness Test
Head Loss Test
Accelerated Endurance Test
Metallurgical Test
Final Accuracy test

Warranty

The manufacturer also guarantees that replacements, (whole meter), replacement parts and service shall be made available within thirty (30) calendar days from notice during a period of at least five (5) years from date of acceptance.

Certification

The manufacturer shall furnish a sworn statement that the inspection and all of the specified tests have been results thereof comply with the requirements of the applicable Standard(s) herein specified. A copy of the Certification shall be submitted to Calamba Water District including laboratory test of accuracy from a reliable local laboratory such as in Maynilad / Manila Water.

Cast Iron Fittings

Cast iron fitting shall conform to the requirements of AWWA C110 (American standard for cast iron and ductile iron fittings, 2-in through 48-in., for water and other liquids) or is r13 (cast iron pipes, special casting and cast iron parts for pressure mainlines).

Fitting shall have a wall thickness of not less than that of the pipe with which they are used and the ends shall have the ends suitable for making watertight joints.

Fitting Construction: Fittings are manufactured of ductile iron grade 70-50-05 (minimum tensile strength: 70,000psi; minimum yield strength: 50,000; minimum elongation: 5%) as specified in AWWA C110 or C153. The flanges can be tapped for studs when specified. Unless otherwise specified flanges will have bolt holes straddling centerline, bolt hole drilling can be rotated when so specified.

Fittings shall be furnished with mechanical or flanged joints

Mechanical Joints: All mechanical joint fittings will be Bell and Bell unless otherwise specified. Mechanical joint fittings shall be rated for 350 psi working pressure for sizes 4" – 24".

Flanges: All flanges are plain without projections and are furnished smooth or with shallow serrations. The flanges can be tapped for studs when specified. Unless otherwise specified flanges will have bolt holes straddling centerline. Bolt hole drilling can be rotated when so specified. Flanged fittings shall be rated for 250 psi working pressure for sizes 4" – 64".

Bolts, Studs and Nuts: Bolts are hex head machine bolts with regular or heavy hex nuts as specified. Studs with one hex nut each are required for tapped flanges. Bolts, studs and nuts are low-carbon steel per ASTM A307 Grade B; threads are ANSI B1.1 Coarse Thread Series, Class 2A external and Class 2B internal. Recommended studs are the same length as corresponding bolt length with "tap end" threaded approximately the same length as flange thickness.

Coating: All fittings shall be epoxy coated internally and externally in accordance to AWWA C116 (protective fusion-bonded epoxy coatings for the interior and exterior surfaces of ductile-iron and gray-iron fittings for water supply service).

D. Gate Valves

All valves shall conform to the AWWA Specifications C509 (STANDARD FOR RESILIENT SEATED GATE VALVES). Component parts are constructed of heavy, rugged proportions for extra strength to withstand pipe strain and possible shifting in underground service. Gate valves shall be flange or mechanical joint where the pipelines design pressure is 1.0MPa (150 psi) or less be designed for minimum water working pressure of 1.0 MPa (150 psi).

The body shall be cast iron.

The gate valve shall be flanged and mechanical joint. Flanges and drilling shall conform to ISO 7005 – 2

All the resilient gate valves have a full bore with same nominal diameter as the pipeline. The full bore ensures minimum pressure loss, as the valve does not cause any reduction in the flow path, other great advantages are that the full bore allows drilling and facilitates pipe pigging to ensure high quality potable water.

The ductile iron core is full vulcanized with EPDM rubber internally and externally. No iron parts are exposed to the medium and the excellent rubber vulcanization prevents creeping corrosion underneath the rubber.

The fixed integral wedge nut reduces the number of moveable valve parts and risk of malfunction.

The valve shall be non-rising stem with a minimum two "O" ring seals (at least one above the stem collar), or rising stem.

The valve shall have 50mm (2 in) square operating nut with cast arrow showing direction in which the nut is to be turned open the valve.

The body and cover bolts and nuts shall meet specifications of ASTM A-307 (rust proofed).

The valve shall be encapsulated and shall conform to the following dimensions:

Nominal Size,	2	3	4	6
Nominal Diameter, mm	50	75	100	150

Length (Face to Face)	mm	178-180	203-205	221-229	267-268
Height (above Centerline)	mm	241-326	297-318	334-345	443-448
Weight	kg	13-18	20-23	26-33	51-53

All valve casting to be shot blasted prior to epoxy coating. Epoxy coating shall conform to AWWA Specifications C550 (PROTECTIVE EPOXY INTERIOR COATINGS FOR VALVES AND HYDRANTS). Body and bonnet are coated internally and externally. Layer thickness shall be 250-400 microns on flat and pressurized parts and 150-300 microns on convex outer edge.

A. STRAINER

- a) The strainer should be designed for minimum weight and pressure loss.
- b) The screen shall be made of perforated stainless steel plate and shaped to give maximum rigidity against the flow stream forces.
- c) The effective straining area shall be at least double that of the meter main case inlets.
- d) An access cover plate shall be provided.
- e) Strainers shall be furnished with dual round-type flanged connections which are faced and drilled. Bolt circle, length and diameters shall be compatible with meter connection dimensions in conformance to ISO 7005 - 2. Sufficient flange bolts, nuts and gaskets shall be furnished.
- f) The housing and cover shall be cast iron. Raised letters indicating the flow direction will be clearly visible.
- g) Casing bolts, nuts, screws and washers shall be made of a copper alloy containing not less than 57 percent copper or stainless steel.

ELECTRICAL WORKS SCOPE OF WORKS

E.1 GENERAL SPECIFICATIONS:

1. The work under this Division consist of furnishing all materials, equipment, tools, labor and all other services necessary to complete and make ready for operation the Electrical Power described below and or indicated in the electrical plan and specifications in accordance with the latest edition of the Philippine Electrical Code with the local requirements of the utility companies concerned and with the local government.
2. A. Service to the pump and motor load must be 440V, 3Ø, 3W+1G power system and service to the perimeter lighting must be 230V, 1Ø, 2W + 1G power system. (For Barandal Pump Station) B. Service to the pump 230V, 3Ø, 3W+1G power system (For Pasong Kalabaw Pump Station)

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3. The low voltage cables are THHN insulated, stranded and copper conductor. All ground wires shall be insulated grounds.
 4. Cable sizes are selected by applying appropriate de-rating factors for ambient conditions of installation as per PEC.
 5. Power factor for all loads is assumed 0.80
 6. Size of grounding wire will be based on PEC table 3.10.1.16
 7. Ampacities of feeders supplying continuous loads are taken as 125% of full load current as per PEC
 8. All electrical materials shall be new and listed with the underwriters laboratories inc. shall meet their requirements and shall bear their label wherever standards have been established and label service is regularly furnished by that agency
 9. Mounting height shall be as follows:
 - a. Convenience outlet shall be 300mm above floor finish
 - b. Convenience outlet shall be 300mm above lavatories
 - c. Wall switches shall be 140mm on center from floor finish
 10. Wiring methods shall be as follows:
 - a. Poly vinyl chloride (PVC) or unplasticised poly vinyl chloride (uPVC) – used when embedded in concrete wall or masonry and can be laid underground within 500mm deep from earth grade.
 - b. Rigid Steel Conduit (RSC) – used in exposed / wet location and can be laid underground within 20mm deep from earth grade.
 11. To simply identify the polarity, use color coded THHN/THWN and TW stranded copper conductor
 - a. RED – positive or line 1
 - b. YELLOW – negative or line 2
 - c. BLUE – line 3
 - d. GREEN – ground
 - e. WHITE – neutral or lineside ground
 - f. BLACK – homerun or main feederline
 12. PVC and metal conduit shall be joined boxes or pull box to make a rigid and waterproof connection. If metal conduit is used as insulated busihing shall be provided at the end of the metal conduit on the inside of the junction box or pull box to prevent scuffing of the cable insulation
 13. All works herein shall be don under the strict supervision of a duly LICENSE ELECTRICAL ENGINEER

E.2 LIGHTING FIXTURES SPECIFICATIONS:

All luminaries and ballasts shall be certified by the manufacturer

Fixture Type A

- 18W CFL w/ ceiling socket of 4" Ø finish

Fixture Type B

- 30W Floodlight (CFL Type Lamp)

E.3 OUTLETS AND SWITCHES SPECIFICATIONS

1. Duplex wide series universal convenience outlet – grounding type w/ faceplate 15 A 230V, 1-phase
2. 1- gang normal switch (wide series), 10A 230V
3. 2- gang normal switch (wide series), 10A 230V

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E.4 PULLBOX (S), JUNCTIONS BOX(S) AND UTILITY BOX (X) SPECIFICATIONS:

1. The junction box cover shall be made watertight with a suitable gasket and secured with stainless steel or cadmium plated screws or bolts
2. Junction boxes shall be PVC type or galvanized steel
3. Junction boxes shall be flanged and designed for flush mounting if encased in concrete
4. Junction boxes shall be drilled or tapped for all conduit connection. Junction boxes shall be installed such the covers are removable.

E.5 PULLBOX (S), JUNCTIONS BOX(S) AND UTILITY BOX (X) SPECIFICATIONS:

1. Wire gutter/wireway body and cover are fabricated or factory assembly at minimum 16-gauge thickness GI sheet or galvanized steel, depth (H-150x, D-100 x L-1200mm)
2. Flush and surface wireway covers are available
3. Wireway are exceeding 72 inches in length has two overlapping covers.
4. Variety of fittings allow runs which can change direction, junction and terminate.
5. Standard wireway connectors (sold separately) have a unique gate feature which can swing completely open allowing for continuous runs of wire and cable.
6. Universal connectors are also available for adapting to other manufacturer wireway
7. Gray acrylic electrocoat finish

E.6 PULLBOX (S), JUNCTIONS BOX(S) AND UTILITY BOX (X) SPECIFICATIONS:

1. Factory assembly
2. The panel board shall be UL listed
3. GENERAL: Except as otherwise indicated provide panel boards enclosures and ancillary components of types, size, and ratings indicated which comply with manufacturer standard materials design and construction in accordance as required for complete installation. Where more than one type of component meets indicated requirements selection is installer's option. Where types, sizes or ratings are not indicated .
4. Enclosures: Provide galvanizes sheet steel cabinet type enclosures in sized and NEMA types as indicated, code-gauge, minimum 16-gauge thickness. Construct with multiple knockouts and wiring gutters. Provide fronts with adjustable indicating trim clamps and doors with flush locks and keys all panel board enclosures keyed alike with concealed door hinges and door swings equip with interior circuit-directory frame and card with clear plastic covering provide PWDER COATED GRAY finish.
5. Wet location panel boards shall be NEMA 4 enclosures
6. Use NEMA 1 enclosures for indoor use, primarily to provide a degree of protection against limited amounts of falling dirt.
7. Equipment shall have a nameplate installed and mounted to the front cover and indicated panel board type, amp rating, voltage rating and short-circuit rating.

III. MATERIALS SPECIFICATIONS:

1. CONDUITS

i. RSC

Rigid Metal Conduit (RSC)

Rigid Metal Conduit shall be hot-dip galvanized steel.
Threads shall be hot galvanized after cutting.

Pipe size		Nominal Outside Diameter (mm)	Nominal Wall Thickness (mm)
in	mm		
¾	21	26.70	2.7
1	27	33.40	3.2
1 ¼	35	42.20	3.4
1 ½	41	48.30	3.5
2	53	60.30	3.7

EM. ELECTRO MECHANICAL EQUIPMENT

EM.1 VARIABLE SPEED DRIVE

Features:

1. Drive manufacturing facility shall be ISO 9001 and 14001 certified.
2. Part / accessories shall be UL type 1 listed to protect from dust and splashed water.
3. Enclosure shall be UL Type 1 listed to protect dust and splashed water
4. Efficiency shall be 98% or better at full speed and load.
5. Shall be protected from atmospheric contamination by chemical gasses and solid particles.
6. Shall be protected from vibration.
7. Provide AC line Choke or DC choke that reduce rectifier peak current and total harmonic distortion with accessories that protection from power line transients like utility power factor correction capacitor switching transients and RFI emissions.
8. With ready terminal for PC connection
9. Shall have accessory that prolong motor insulation life.
10. Can operate the pump and motor during maintenance or breakdown.
11. With over voltage and under voltage accessory or motor load protection.
12. Control panel shall be user friendly and in English language.
13. Displays – psi reading.

Submittals – Shall include the following information:

1. Outline dimension
2. Weight
3. Compliance to IEEE 519

EM.2 GAS CHLORINATOR

1. The chlorinator shall have a maximum capacity of 10 PPD (4.53 kg/day) of chlorine feed and shall be equipped with a chlorine flow meter of 10 PDD.
2. The chlorinator design shall be of the vacuum operated solution feed type.
3. The chlorinator shall be constructed of materials suitable for wet and dry gas service.
4. All springs used in the vacuum regulator shall be of tantalum alloy.

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5. The rate valve and seat shall be solid silver. A double thickness diaphragm shall be provided for vacuum regulation.
 6. The rate of gas feed shall be set manually and shall remain constant until manually changed.
 7. The gas shall flow at sonic velocity and a differential pressure regulator shall not be required.
 8. The vacuum regulator shall mount directly on the container valve by means of corrosion resistant yoke assembly. A spring opposed inlet valve shall close tight upon loss of vacuum.
 9. Each vacuum regulator shall be equipped with a loss of gas indicator and a gas flowmeter. A spring-loaded diaphragm actuated pressure relief valve integral to the vacuum regulator shall be provided to relieve gas pressure.
 10. The vacuum regulator and ejector body shall be made up of most durable material such as fluoroplastics and fiberglass reinforced thermo-plastic that can withstand attack by chlorine in any form and to give the longest operational life.
 11. The inlet capsule shall be a complete module installed without the use of any tools.
 12. The vacuum producing device shall be an ejector with a spring loaded check valve to prevent flooding of the vacuum regulator.
 13. Automatic switchover shall be provided with automatic reset and integrally mounted vacuum regulator flow indicator.
 14. The chlorinator vacuum regulator vent gas arrestor designed to treat occasional chlorine gas vent release that may accompany chlorine container changeovers and fouled vacuum regulator inlet valves.
 15. The minimum feed capacity for gas flowmeter is $1/20^{\text{th}}$ of the maximum capacity. Accuracy is within $\pm 4\%$ of maximum flowmeter capacity.
 16. Length of connection tubing must not lower than 40ft (12m).

B. ELECTROMAGNETIC METERING PUMP

Scope

1. The electromagnetic metering pump shall consist of a pump unit, a driving unit and a control unit.
2. The drive unit shall be an electromagnetic solenoid.
3. The shaft shall be attached to a stroke rate up to 360 strokes per minute results in high resolution feed eliminating the slug feed effects. The accuracy is within $\pm 2\%$ linearity is within $\pm 3\%$ and stroke stability is within $\pm 1\%$.

Metering Pump

1. The metering pump shall be hydraulically and electrically tested at the factory and shall be assembled to the fullest extent possible. Package shall be furnished with all required lubricants, special tools and installation instructions.
2. Meter size
 - Metering pump shall be small, quiet and lightweight
3. Double ball check valve
 - The ball, seat and guide assembly shall ensure a tight seal to prevent loss of prime.
4. Diaphragm
 - PTFE laminate over EPDM shall be molded into a
5. Dimension, capacity and material

A. Dimension

Dimensions in mm	
Length	178
Width	100
Height	184

B. Dimension

Dimensions in mm	
Max capacity L/H	2.28
ml/min	38
MI/shot	0.11
Max discharge pressure, Mpa	1.0
Stroke rate	0-360spm
Stroke length	1.00mm (fixed stroke length)
Power Supply	AC220-240V, single phase 60Hz
Current Input	0.5A
Connection tubing ISxOD	4x6mm
Insulation type etc	B type insulation and built in thermal protector with 2.0m power cable without plug

*Max capacity is measured with clean water under the max discharge pressure
Actual discharge capacity may increase if the discharge pressure is low

*Operating condition:

Ambient temperature: 0-40 degrees Celsius

Relative humidity: 35-90% non-condensing

C. Material

Wet-end part materials	
Pump head	PVC
Valve	Alumina ceramic
Valve seat	FKM
Valve guide	PBC
Gasket	PTFE
O-ring	FKM
Diaphragm	PTFE coated EPDM

PVC: Polyvinyl chloride

GFRPP: Glass fiber reinforced polypropylene

PTFE: Polyterafluoroethylene

EPDM: Ethylene propylene diene monomer

FKM: Fuoroelastmer

Unpacking and delivery

Open the shipped carton and inspect contents for damage. If any items are missing or damaged the delivery shall not be accepted.

**Metering pump shall be manufactured by a company with a minimum of 20 years experience in the manufacturing of metering pump.*

EM3.1 BOOSTER PUMP

1. H-64M; Q-20gpm
2. Max. Working Pressure – 315 psi
3. Max suction lift – 15feet (4.56m)
4. Maximum limits – prolonged use with liquids above 140 F is not recommended
5. Discharge-cast iron
6. Motor adapter and base – cast iron
7. Shell – stainless steel 304 grade
8. Impeller – acetal
9. Diffuser – Polycarbonate
10. Shaft – Stainless steel 304 grade
11. O-Rings – buna-N
12. Mechanical seal-carbon/ceramic Buna-N

EM3.2 SUBMERSIBLE PUMP AND MOTOR

SCOPE:

1. The submersible pump and motor shall be designed for continuous submerged operation.
2. The pump shall be driven by a motor attached below pump section.

SYSTEM CAPACITY:

1. The pump shall have a capacity 18 Lps (285.3 GPM) of when operating against a heads of 88 meter of water.

PUMP DESIGN

1. There shall be a check valve integrally designed into the pump discharge housing.
2. The pump shall have integrated protection against upthrust.
3. The pumping downthrust shall be absorbed by the motor thrust bearing.
4. Each impeller shall be fitted with a seal ring around its eye or skirt to prevent hydraulic losses.
5. A filter screen shall be included as part of the suction inlet assembly.
6. The pump shall be radial design and includes prime screw(s) fastened on the pump shaft.

PUMP MATERIALS OF CONSTRUCTION

1. The pump in grey cast iron bowl construction fitted with noryl impellers and stainless shall with 3" diameter built-in check valve. The shaft and coupling shall be 300 or 400 series stainless steel. No moving parts shall be constructed from plastic or other brittle materials.
2. The intermediate and top bearings shall be nitrile rubber (NBR)

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SUBMERSIBLE PUMP AND MOTOR AND WEIGHT:

Description	SP*	Motor
Length	810-811	875-876
Piping Dia. (mm)	144-145 (verify)	Follow the SP's size.
Sp and motor wt. (kg)		107

-The pump and motor shall be manufactured by a company with a minimum of 10 years experience in the manufacturing of motors and pump.

SUCTION AND DISCHARGE PIPE

1. The suction and discharge pipe shall be 3" (75mm) in diameter. Thus requires a reducer.

MOTOR DESIGN

1. The motor shall be a squirrel -cage induction motor designed for continuous underwater operation in conformance to NEMA standards
2. The motor shall have a thrust bearing capable of carrying the maximum pump thrust loads.
3. The motor shall be water filled for cooling and lubrication. No oils or grease lubrication shall used.
4. A flexible diaphragm shall be provided to permit expansion and contraction of the internal motor fluid when the motor heats and cools during operation.
5. A shaft seal shall be provided to ensure the internal motor fluid is not mixed with the pumped fluid.

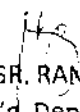
MOTOR MATERIALS OF CONSTRUCTION

1. The motor diaphragm shall be nitrile rubber of type 100 hydrin.
2. The shaft seal shall be a nitrile rubber or type 100 hydrin
3. The motor shall be of 300 series stainless steel

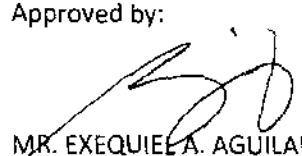
DOCUMENTATIONS

Building permit approval documentations and structural, civil, electrical, mechanical, sewer and plumbing duly sign by the approving Engineers prior to start of the project.

Prepared by:


ENGR. RANELLY S. CARTAGO
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Approved by:


MR. EXEQUIEL A. AGUILAR JR.
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