

**Republic of the Philippines**  
**METROPOLITAN NAGA WATER DISTRICT**  
40 J. Miranda Avenue, Naga City

**OPERATING SPECIFICATIONS/REQUIREMENTS**

**I. PUMP**

- 1) The pump must have minimum capacity of 45 LPS at a Total Dynamic Head design of 77.26 meters (253.49 ft.) and with minimum pump laboratory efficiency of 75% at design head.
- 2) There shall be no point within the operating range of the pump wherein the required horsepower exceeds the rated motor horsepower. In addition, the design point shall be located within the best efficiency range of the pump. Efficiency range shall be within the  $\pm 5\%$  of the pump's peak efficiency.
- 3) Constructed of stainless steel shaft, SS 431
- 4) Stainless steel inlet strainer prevents the entry of sand and other extraneous material
- 5) Built-in with stainless steel jam free check valve
- 6) High wear resistance stainless steel impeller and diffuser ensuring optimal performance
- 7) With stainless steel cable guard
- 8) The impellers shall be of the enclosed type, made of stainless steel, accurately fitted, smoothly finished and dynamically balanced at normal pump speeds.
- 9) They shall have removable stainless steel or rubber wear rings and lateral seal rings mounted in their companion cases.
- 10) The bowl cases shall be constructed of stainless steel.
- 11) Pump bearings shall be at least  $2\frac{1}{2}$  times the diameter of the shaft.
- 12) The pump must be secured with a pump guard.
- 13) All other pump materials shall be made of stainless steel.
- 14) All material requirements must be certified brand new and Contractor/Supplier should provide three (3) years warranty against factory defects under normal operating condition.
- 15) A Manufacturer's Standard Brochure with the pump performance curve must be provided to the MNWD.

**II. MOTOR**

- 1) The motor shall be of squirrel cage, submersible induction type, encapsulated and rewindable type rated at 75Hp, 460VAC, 3-phase, 3525 rpm, 60 hertz AC.
- 2) The motor must be Double Flanged NEMA Mounting Design, complete with cable guard and motor pigtail.
- 3) The motor shall be designed for continuous duty operation and shall have a minimum service factor of 1.15.
- 4) Stainless steel splined shaft.
- 5) Shall be factory filled with non-toxic water-soluble fill solution.
- 6) With Six feature encapsulation system.
- 7) Field replaceable lead.
- 8) With external sand slinger on shaft.
- 9) Mechanical face seal at shaft exit.
- 10) Copper bar rotor.
- 11) Model shall be Variable Frequency Drive (VFD) approved.
- 12) Pump and motor must pass laboratory testing in the presence of a duly authorized representatives from MNWD before actual delivery.
- 13) All material requirements must be certified brand new and Contractor/Supplier should provide three (3) years warranty against factory defects under normal operating condition.

- 14) All labors, tools and equipment necessary for the complete, correct and efficient installation of these items shall entirely be provided for.

### **III. COLUMN (RISER) PIPE**

- 1) The column pipe shall be made of heavy type uPVC pipe with rubber seals at the ends of the threads.
- 2) The column pipe shall be provided with square threads designed to ensure proper gripping and to withstand heavy load and vibration.
- 3) The column pipes shall be connected with the couplers with a locking system and rubber rings between the joints.
- 4) The column pipe shall have the following minimum technical load and permissible hydrostatic pressure capacities.
  - Safe pulling load with chain pulley : 18,050 kgs.
  - Ultimate breaking load : 22,000 kgs.
  - Safe allowable hydrostatic pressure : 26 kgs/cm<sup>2</sup>
- 5) All the column pipes must be certified brand new and shall be covered by warranty clause.
- 6) All labors, tools and equipment necessary for the complete, correct and efficient installation of the column pipes shall entirely be provided for.

### **IV. FLOWMETER**

- 1) The supplier shall provide and install one (1) flowmeter to be installed at the pump station as shown in the drawings.
- 2) The meter shall be of the propeller-type and shall be suitable for a normal flow of 108 cubic meters per hour and shall register within ( $\pm 2\%$ ) of the actual flow in normal operation between its minimum and maximum rates of flow.
- 3) The meter should be installed in accordance with the following pipe run requirements:
  - a) Upstream Requirement: The meter should be installed a minimum distance of five (5) times the pipe diameter downstream of any obstructions.
  - b) Downstream Requirements: The downstream run should be a minimum of one (1) diameter of straight pipe length after the meter.
- 4) The register shall have at least six digit straight-reading-type totalizer which shall indicate flows in cubic meters.
- 5) The flowmeter shall be designed to operate at 1.03 Mpa (150psi) normal working pressure and at water temperature of range of 0 to 30 degrees centigrade.
- 6) The meter shall operate on the principle of recording (thru the register) the revolutions of the propeller as caused by the force of flowing water that strikes the blades.
- 7) The meter body (casing) shall be protected against corrosion with epoxy coating (or with approved equivalent), shall have the same inside diameter throughout its length, and shall be furnished with non-corrosive, non-toxic liners with flows straightening vanes equally spaced apart.
- 8) The propeller drive shall be magnetically coupled to the register drive by means of permanent type ceramic magnets.
- 9) The propeller should be sufficiently rigid to retain its shape during high flow conditions throughout the life of the meter with shaft made of stainless steel.
- 10) The propeller shall be designed for easy removal of the operating assembly from the body as complete unit without disturbing the connection to the pipeline.
- 11) Must passed the testing and calibration procedures, and results must be submitted to MNWD (with certification of testing and calibration).

### **V. CONTROL PANEL**

## **Variable Frequency Drive (Main Controller)**

### **A. GENERAL SPECIFICATIONS**

The Variable Frequency Drive (VFD) shall act as the main starter, it shall be adequately sized and capable to handle the operations of the pump load with a minimum rating of 75Hp, 460VAC, 3-phase, 60Hz at different conditions of the day. The VFD must be installed indoor, wall-mounted type, with viewing glass, complete with Manual Transfer Switch (MTS), associated accessories and cabling works (feeder and control cables including pipes and accessories from existing control panel to VFD panel) and shall be completely wired in NEMA enclosure.

The VFD and all associated equipment shall be UL listed according to UL 508C-Power Conversion equipment and a UL approved for mounting in plenums and compartments handling conditioned air. It shall be designed, constructed and tested in accordance with UL, NEMA and NEC standards. A UL label shall be attached on the enclosure.

The VFD shall be able to respond accordingly with the signal transmitted in such a way that the needed pressure in the distribution system is attained and satisfied. The VFD shall be capable to operate or adaptable to MNWD existing transformer connection (grounded secondary) as a standard of CASURECO II, the local power provider.

### **B. VFD MINIMUM TECHNICAL FEATURES:**

- 1) Built-in electronic motor overload protection
- 2) Self-tuning to motor parameters
- 3) NEMA 12 enclosure from 10 to 200Hp
- 4) 200-240V or 380-480V three-phase input voltage
- 5) Detachable/Non-detachable smart keypad with 16-character backlight LCD display with three-liner (minimum) screen, providing parameter identification using clear informative text. Parameter set-up should be performed quickly and easily.
- 6) 50/60Hz nominal frequency
- 7) Capable of pump control (start/stop) to reduce surges during starting and stopping of centrifugal pump by smooth acceleration and deceleration of motor, respectively.
- 8) Metering Devices:
  - a. Three-phase current
  - b. Three-phase voltage
  - c. Power in Kw
  - d. Power consumption in Kwh
  - e. Elapsed time/run time
  - f. Motor thermal capacity/temperature
- 9) Fault display indicator:
  - a. Ground/line fault
  - b. Power loss
  - c. Voltage/current/phase unbalance
  - d. Phase reversal
  - e. Over/under voltage
  - f. No/Under/Over load
  - g. Over temperature
  - h. Dry run detection
- 10) Protective features
  - a. Over / under voltage
  - b. Motor short circuit protection
  - c. Motor over-current
  - d. Instantaneous over-current

- e. Phase loss / phase imbalance detection
  - f. Over / under load supervision
  - g. Stall protection
  - h. VFD over-temperature
  - i. External trip input
  - j. Motor thermistor input
  - k. Loss of reference / feedback (4 – 20 mA)
  - l. Built-in MOV (surge protection)
- 11) Control features
- a. Local/remote control
  - b. DC breaking
  - c. Torque boost
  - d. Adjustable V/Hz profile
  - e. Maximum/minimum adjustable motor speed limits
  - f. Adjustable output current limit
  - g. Jog start and PID regulator
- 12) Display readings
- a. Motor speed
  - b. Frequency
  - c. Voltage
  - d. Current and torque
  - e. Input/output power (Kw)
  - f. Fault identification
  - g. Elapsed time/run time
- 13) Ambient: 14° F (-10° C) to 113° F (45° C), 330 ft. (1,000m) altitude, 90% humidity, non-condensing.
- 14) Energy-saving flow compensation
- 15) User-friendly for quick and easy operation

#### C. MCCB AND OTHER COMPONENTS

- 1) Enclosure shall be powder-coated based on NEMA 12 (minimum) gasket- type, with viewing glass, wrinkled beige finish using epoxy powder paint, oven-baked.
- 2) 1 unit MCCB rated in amperes (capacity depending on size of motor)
- 3) 1 unit rotary-type manual transfer switch (MTS) rated in amperes
- 4) 1 unit control transformer rated in volt-ampere (VA)
- 5) 1 unit phase and voltage protection relay
- 6) Pilot lights: 1 unit green LED light (RUN)  
1 unit red LED light (STOP)  
1 unit yellow LED light (FAULT/RESET)
- 7) Push button switch: 1 unit push button (RUN)  
1 unit push button (STOP)  
1 unit push button (FAULT/RESET)
- 8) Equipped with exhaust fans as cooling device.
- 9) Equipped with water level relay or floatless relay.
- 10) Equipped with manual selector switch for HAND/OFF/AUTO (HOA) selections.

#### D. FIELD WIRING

- 1) Includes wires to and from tapping point of splicing (sizes and length of wires may vary).
- 2) Includes uPVC pipes and flexible hose as enclosure of wirings (sizes and length of conduits may vary).
- 3) Includes terminal blocks/lugs, straps, wrap, markers for proper termination.

## E. FIELD INSTRUMENTATION

- 1) Pressure transmitter should be provided complete with the following specifications:
  - Pressure ratings : 0 – 10 bars or 0 – 16 bars
  - Output signal : 4 – 20mA
  - Input Voltage : 7 – 33 VDC
  - Process connection : ½” National Pipe Thread (NPT)
  - Wirings : Stranded wire (size and length may vary)  
uPVC pipe or flexible hose for wire enclosure
- 2) Installation manual should be provided.

## F. ENGINEERING WORKS

- 1) Assembly of motor control panel as specified from scope of work
- 2) Delivery and installation
- 3) Testing and Commissioning
- 4) Training of MNWD personnel on the operation and handling of equipment
- 5) As-built plan

## G. WARRANTY

- 1) Contractor/Supplier should provide one (1) year warranty against factory defects under normal operating condition.

## **Soft Starter (Back-up Controller)**

### A. GENERAL SPECIFICATIONS

The Soft Starter (SS) shall act as back-up starter in cases the VFD is not operational. The SS shall be adequately sized and capable to handle the operations of the pump load with a rating of 75Hp, 460V, 3-Phase, 60 Hz at starting and stopping conditions. The pump load shall be able to operate at soft starting and soft stopping in accordance to the programmed acceleration and deceleration times, the soft starter shall be able to respond accordingly with the programmed parameters and shall be able to detect all standards protections as set therein, the soft starter controller shall be provided with all standard accessories such as breakers, relays, current transformers, protective devices, meters, push buttons, pilot lights and other standard accessories and shall be completely wired in NEMA enclosure.

### B. STANDARD TECHNICAL FEATURES:

- 1) 200-240V or 380-480V, 50/60 Hz input power supply
- 2) Programmable auxiliary contacts
- 3) Three-phase SCR controller
- 4) Built-in bypass SCR
- 5) Three-phase current transformer
- 6) Built-in Electronic Motor Overload Protection
- 7) Ground fault protection
- 8) Capable of pump control (Start/Stop)
- 9) Pump control module with built-in anti backspin timer
- 10) LCD display : Minimum three line 16-character backlit LCD display provides parameter identification using clear and informative text.
- 11) Metering devices:
  - a. Three-phase current
  - b. Three-phase voltage

- c. Power in KW
  - d. Power Factor
  - e. Elapsed time / Run time
  - f. Motor thermal capacity
- 12) Fault display:
- a. Ground / Line fault
  - b. Power loss
  - c. Voltage / Current / Phase imbalance
  - d. Phase reversal
  - e. Over / under voltage
  - f. No / under / over load
  - g. Over temperature
  - h. Number of start / stop
  - i. Shorted SCR
  - j. Bypass failure
  - k. Dry run detection
- 13) Protective features:
- a. Motor overload
  - a. Under and over current
  - b. Power supply phase loss
  - c. Motor phase loss
  - d. Phase reversal
  - e. Soft starter over temperature and external fault
  - f. Built-in MOV (surge protection)
  - g. Under / over voltage
  - h. Over temperature
- 14) Control features:
- a. Local / remote control
  - b. Acceleration and deceleration independently adjustable ramps
  - c. Bypass relay
  - d. JOG
  - e. DC breaking
  - f. Energy saving
  - g. Auto-reset and fault history
- 15) Display readings:
- a. Motor speed
  - b. Frequency
  - c. Voltage
  - d. Current and torque
  - e. Input/output power (Kw)
  - f. Fault identification
  - g. Elapsed time/run time
  - h. Motor amps
  - i. Fault identification
- 16) Ambient : 14° F (-10° C) to 113° F (45° C), 300 m (1,000 ft.) altitude, 90% humidity, non-condensing.
- 17) Detachable / non-detachable keypad with LCD display

## C. MCCB AND OTHER COMPONENTS

- 1) Enclosure shall be powder-coated based on NEMA 12 (minimum) gasket-type, with viewing glass, wrinkled beige finish using epoxy powder paint, oven-baked.
- 2) 1 unit MCCB rated in amperes (capacity depending on size of motor)
- 3) 1 unit rotary-type manual transfer switch (MTS) rated in amperes

- 4) 1 unit control transformer rated in volt-ampere (VA)
- 5) 1 unit phase and voltage protection relay
- 6) Pilot lights: 1 unit green LED light (RUN)  
1 unit red LED light (STOP)  
1 unit yellow LED light (FAULT/RESET)
- 7) Push button switch: 1 unit push button (RUN)  
1 unit push button (STOP)  
1 unit push button (FAULT/RESET)
- 8) Equipped with exhaust fans as cooling device.
- 9) Equipped with water level relays or floatless relays.
- 10) Equipped with manual selector switch for HAND/OFF/AUTO (HOA) selections.

#### D. FIELD WIRING

- 1) Includes wires to and from tapping point of splicing (sizes and length of wires may vary).
- 2) Includes uPVC pipes and flexible hose as enclosure of wirings (sizes and length of conduits may vary).
- 3) Includes terminal blocks/lugs, straps, wrap, markers for proper termination.

#### E. FIELD INSTRUMENTATION

- 1) Pressure switch should be provided complete with the following specifications:  
 Pressure ratings : Diff : 0 – 10 psi and 0 – 350 Kpa  
                               Main : 0 – 2 Mpa and 0 – 300 psi  
 Process connection : ½” NPT  
 Wirings : Stranded wire (size and length may vary)  
                               uPVC pipe or flexible hose for wire enclosure
- 2) Installation manual should be provided.

#### F. ENGINEERING WORKS

- 1) Delivery and installation
- 2) Assembly of motor control panel as specified from scope of work
- 3) Testing, commissioning, start-up and monitoring
- 4) Training of MNWD personnel on the operation and handling of equipment
- 5) As-built plan

#### G. WARRANTY

- 1) Contractor/Supplier should provide one (1) year warranty against factory defects under normal operating condition.

### VI. GATE VALVE

- 1) Must be wheel type butterfly gate valve.
- 2) Body and bonnet made of grey cast iron, CG-25 to DIN 1691.
- 3) Electrostatically coated with epoxy resin to DIN 30677, internally and externally.
- 4) Stainless steel stem with hand wheel.
- 5) Stem sealing of NBR wiper ring, 2 NBR, O-rings inside and 2 outside plastic bearing, NBR rubber manchette.
- 6) Wedge made of ductile iron, encapsulated with EPDM rubber with integral wedge nut and thrust collar of dezincification resistant brass.
- 7) Bonnet bolts made of zinc coated steel 8.8, hot melt sealed.

## **VII. CHECK VALVES**

- 1) Check valves shall have flanged connections and shall be of the swing-type with outside lever and weight.
- 2) Valve body shall be cast iron.
- 3) The valve shall have bronze gate and seat rings and type 416 stainless steel ring pin.
- 4) The check valve shall be field repairable. Disc, seats and other parts shall be replaceable without removing the valve from the line.

## **VIII. PRESSURE GAUGE**

Pressure gauge shall have 100mm (4 inches) dial 6mm (1/4 inches) threaded connections and shut-off cock, oil-immersed. The pressure element of the gauge shall be protected against excessive pulsations and surges by an external snubber (range is 0 -150 psi).

## **IX. PRESSURE SWITCH**

The Contractor shall furnish and install a pressure switch of the required setting range. The actual setting shall be determined by the Engineer in the field, upon testing and commissioning. The switch shall be single pole, single throw spring type for indoor and outdoor installation.

## **X. AIR RELEASE VALVE**

- 1) The body and cover shall be of gray cast iron in accordance with ASTM A126, Class B or ductile iron in accordance with ASTM A536, Grade 65-45-12. The valve trim, float, and all working parts shall be constructed of stainless steel, brass, or other corrosion resistant material.
- 2) The base must be cast iron with galvanized steel bolt and nut.

### **NOTE:**

All materials and equipment must be brand new. All materials and equipment including labor from control panel to the submersible motor, complete with motor controllers, discharge elbow head and other appurtenances, as specified herein and shown on the drawings shall be included in the supplier/contractor scope of work including all expenses prior and after the installation, testing and commissioning. The supplier/contractor shall furnish, deliver, install, test and commission at site all mechanical/electrical equipment including all materials for discharge assembly specified herein (please see attached technical specifications and drawings). The supplier/contractor shall provide the necessary supervision, tools, materials, supplies and appurtenances for the proper installation, testing and operation of the completely assembled equipment.