CME Three phase Guide Specification

Part I – GENERAL

1.1 WORK INCLUDED

A. Single Pump Variable Speed Pump

1.2 REFERENCE STANDARDS

The work in this section is subject to the requirements of applicable portions of the following standards:

A. Hydraulic Institute
B. ANSI – American National Standards Institute
C. ASTM – American Society for Testing and Materials
D. IEEE – Institute of Electrical and Electronics Engineers
E. NEMA – National Electrical Manufacturers Association
F. NEC – National Electrical Code
G. ISO – International Standards Organization
H. UL – Underwriters Laboratories, Inc.

Part 2 – PRODUCTS

2.1 SINGLE PUMP VARIABLE SPEED PUMP

A. Furnish and test a single pump variable speed pumping system to maintain constant water delivery pressure.

B. The pump system shall be a standard product of a single pump manufacturer. The entire pump system including pump, motor, variable frequency drive and pump controller, shall be designed and built by the same manufacturer.

C. The complete motor and drive shall be certified and listed by UL for conformance to U.S. and Canadian Standards.

2.2 PUMPS

A. The pumps shall be ANSI/NSF 61 approved for drinking water.

B. The pumps shall be of the end-suction horizontal multi-stage design with the discharge vertical on the centerline of the pump.

C. The head-capacity curve shall have a steady rise in head from maximum to minimum flow within the preferred operating region. The shut-off head shall be a minimum of 20% higher than the head at the best efficiency point.

D. Cast Iron Horizontal End-suction Multi-Stage Pumps (12mm or 16mm shaft, Nominal flow from 10 to 130 gallons per minute) shall have the following features:

1. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement with a Stop Ring and Nord-lock® washer or similar, which makes it possible to disassemble the pump from the pump side.

2. The suction/discharge shall have internal pipe thread (NPT) connections as determined by the pump station manufacturer.

3. On the top of the inlet part should be a priming plug to allow the pump to be nearly completely filled with the liquid to be pumped.

4. On the lower side of the inlet part should be a drain plug.

5. Pump Construction.

a. Inlet Part, Discharge Part:	Cast iron (Class 30)
b. Impellers, chambers:	304 Stainless Steel
c. Shaft:	431 Stainless Steel
e. Spacing Pipe:	316 Stainless Steel
f. O-rings:	EPDM

6. The shaft seal shall be an o-ring seal with fixed driver type with the following features:

a. Retainer and Driver for Seal Ring:	304 or 316 Stainless Steel
b. Spring:	304 or 316 Stainless Steel
c. Stationary Seal:	Silicon Carbide (Graphite Imbedded)
d. Rotating Seal:	Silicon Carbide (Graphite Imbedded)
e. O-rings:	EPDM

E. AISI 304 or 316 Stainless Steel End-suction Horizontal Multi-Stage Pumps (12mm or 16mm shaft, Nominal flow from 10 to 130 gallons per minute) shall have the following features:

1. The pump impellers shall be secured directly to the pump shaft by means of a splined shaft arrangement with a Stop Ring and Nord-lock® washer or similar, which makes it possible to disassemble the pump from the pump side.

2. The suction/discharge shall have internal pipe thread (NPT) connections as determined by the pump station manufacturer.

3. On the upper area of the flange should be a priming port to allow the pump to be nearly completely filled with the liquid to be pumped.

4. On the bottom side of the pump sleeve should be a drain hole

5. Pump Construction.

a. Flange:	Cast Iron
b. Impellers, Chambers, Sleeve:	304 or 316 Stainless Steel
c. Shaft:	304 or 316 Stainless Steel
e. Spacing Pipe:	316 Stainless Steel
f. O-rings:	EPDM

6. The shaft seal shall be an o-ring seal with fixed driver type with the following features:

a. Retainer and Driver for Seal Ring:	304 or 316 Stainless Steel
b. Spring:	304 or 316 Stainless Steel
c. Stationary Seal:	Silicon Carbide (Graphite Imbedded)
d. Rotating Seal:	Silicon Carbide (Graphite Imbedded)
e. O-rings:	EPDM

2.3 INTEGRATED VARIABLE FREQUENCY DRIVE MOTOR

A. Each motor shall be of the Integrated Variable Frequency Drive design consisting of a motor and a Variable Frequency Drive (VFD) with a built-in pump system controller. The complete VFD/motor assembly shall be built and tested as one unit by the same manufacturer.

B. The VFD/motor shall have an IP55 (TEFC) enclosure rating as a complete assembly. The motor shall have Class F insulation.

C. The VFD/motor shall have a drain hole with plug on the bottom side of the motor flange for use in situations where condensation may build in the motor. If drain plug is removed motor shall be IP34 enclosure rating.

D. The VFD shall be of the PWM (Pulse Width Modulation) design using up to date IGBT (Insulated Gate Bipolar Transistor) technology.

E. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of the motor. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump control and to eliminate the need for motor de-rating.

F. The VFD shall have, as a standard component, an RFI filter (Radio Frequency Interference) to minimize electrical noise disturbances between the power electronics and the power supply. The VFD/motor shall meet all requirements of the EMC directive concerning residential and light industry equipment (EN 61800-3).

G. The VFD shall have a minimum of two skip frequency bands which can be field adjustable.

H. The VFD shall have internal solid-state overload protection designed to trip within the range of 125-150% of rated current.

I. The VFD/motor shall include protection against input transients, loss of AC line phase, over-voltage, under-voltage, VFD over-temperature, and motor over-temperature. The motor over-temperature protection shall consist of three series connected PTC thermistors, one for each motor phase.

J. The VFD/motor shall provide full nameplate output capacity (horsepower and speed) within a balanced voltage range of 180 to 264 or 414 to 528 volts.

K. Automatic De-Rate Function: The VFD/motor shall reduce speed during periods of overload allowing for reduced capacity pump operation without complete shut-down of the system. Detection of overload shall be based on continuous monitoring of current, voltage and temperature within the VFD/motor assembly.

L. The VFD/motor shall have, as a minimum, the following input/output capabilities:

1. Speed Reference Signal: 0-10 VDC, 4-20mA
2. Digital remote on/off
3. Fault Signal Relay (NC or NO)
4. Fieldbus communication port (RS485)

M. Motor drive end bearings shall be adequately sized so that the minimum L10 bearing life is 17,500 hours at the minimum allowable continuous flow rate for the pump at full rated speed.

2.4 PUMP SYSTEM CONTROLLER AND USER INTERFACE

A. The pump system controller (Proportional-Integral) shall be a standard component of the integrated variable frequency drive motor developed and supported by the pump manufacturer.

B. The pump system controller shall have an easy to use interface mounted on the VFD/motor enclosure. Pump system start/stop and set-point adjustment shall be possible through the use of two push buttons located on the drive enclosure.

C. The VFD/motor shall be capable of receiving a remote analog set-point (4-20mA or 0-10 VDC) as well as a remote on/off (digital) signal.

D. Pump status and alarm state shall be indicated via two LED lights located on the VFD/motor enclosure.

E. Advanced programming and troubleshooting shall be possible via an infra-red hand held programmer or a field connected personal computer. Pump system programming (field adjustable) shall include as a minimum the following:

System Pressure set-point, psig	System start pressure, psig
System Stop pressure, psig	Minimum Pump Speed, %
Pressure Transducer supply/range	Maximum Pump Speed, %
System Time (Proportional Gain)	Integral Action Time

F. The infra-red programmer shall be capable of displaying the following status readings:

Pump Status (on, off, min., max.)	System Set-point, psig
Actual system pressure, psig	Remote set-point, %
Pump speed, rpm	VFD/Motor input power, W or kW
VFD/Motor total cumulative kWh	VFD/Motor total operating hours

G. The infra-red programmer shall also be capable of displaying the following alarms, with the last five alarms stored in memory:

Loss of sensor signal	Loss of external set-point signal
Under-voltage & Over-voltage	Motor overload (blocked pump)
Motor over-temperature	Drive over-temperature
Drive Over-current	

2.5 SEQUENCE OF OPERATION

The system controller shall receive an analog signal [4-20mA] from the factory installed pressure transducer indicating the actual system pressure. When a flow demand is detected (system pressure drops below the start pressure) the VFD/motor shall start and increase speed until the actual system pressure matches the system set-point. As flow demand changes (increases or decreases), the speed of the pump shall be adjusted to maintain the system set-point pressure.

If a no flow shut-down is required (periods of zero demand) a bladder type diaphragm tank shall be installed. The tank shall be downstream of the pump. When zero flow is detected by the system controller, the pump shall be switched off. When the system pressure drops to the start pressure, (flow begins after shut-down), the pump shall be switched on, increasing speed to maintain the system set-point pressure. Zero flow conditions shall be detected by the system controller/factory installed pressure transmitter without the use of additional flow switches or motor current sensing devices.

2.6 SYSTEM CONSTRUCTION

A. The CME pump shall have a maximum working pressure ranging up to 232 psig at a temperature of 248°F.

B. A diaphragm tank (field installed) is required for the stop function. A minimum diaphragm tank connection size of ½" (half inch) shall be provided on the discharge piping by others.

2.7 TESTING

A. The entire pump motor and VFD shall be factory performance tested as a complete unit prior to shipment.

2.8 WARRANTY

A. The warranty period shall be a non-prorated period of 24 months from date of installation, not to exceed 30 months from date of manufacture.