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Chemical Feed System & Metering Pump Specifications for General Use

Introduction:

This guide specification is presented to assist the writer in specifying chemical metering pumps or complete packaged chemical feed systems. This specification contains provisions for options and alternates. Bold face type indicates areas where a selection or choice must be made. The specification writer must conform this specification to meet the requirements of the particular application. It is recommended that each chemical application be defined by one or more data sheets to describe additional details of the service.

Use of this Spec:

Determine the chemical, flow rates, and pressures required for the installation.

Determine the actual scope to be furnished, i.e., metering pumps only or complete chemical feed systems.

Select the paragraphs from the attached pages to define the items and accessories which will comprise the system.

Select the appropriate language for each bold face section, deleting the unwanted portion.

Request bulletin AB-2000 *Sizing and Selecting Metering Pumps/Planning a Metering Pump Installation* for further information on pump selection and system design.

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1. SCOPE

The **(contractor/vendor)** shall provide **(quantity)(completely pre-assembled, packaged chemical feed system(s)/chemical metering pump(s))** as manufactured by Neptune Chemical Pump Company. Package 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.

1. PUMP

The chemical metering pump shall be of the hydraulically actuated, high pressure, diaphragm type, equal to Neptune Series 500 "dia-Pump" capable of operation against a minimum of **(300 psi/enter higher pressure as required).** Pump capacity and materials of construction shall be as shown on the Pump Data Sheet. Pump shall use a **(Teflon disc/Viton tubular)** diaphragm.

Pump capacity must be adjustable through 100% of range by **(manual micrometer dial/automatic electric positioner with manual override)** while the pump is running or stopped. The micrometer dial shall have a bright, high contrast scale easily read in low level light. The micrometer scale shall be protected with a chemically resistant clear plastic cover. Pump stroking speed shall not exceed 150 spm. All parts of the power train must operate submerged in oil.

Pump shall be sized to deliver the required capacity at 85% of maximum stroke length. Stroke adjustment shall be variable oil by-pass type mechanism with the plunger powered through its entire travel. Lost motion designs are not acceptable.

Pump shall include an automatic vent and refill mechanism on the hydraulic side, which operates once each stroke. The pump shall have an internal hydraulic relief valve which is externally adjustable.

Double ball check valves shall be provided on both suction and discharge to insure accurate repeatable metering. The pump valves shall be removable for cleaning or replacement without the need to disturb suction or discharge piping.

*(**Note to Specification Writer**: Statement regarding replaceable valves is very important. The most frequent maintenance operation performed on any chemical metering pump is valve cleaning and inspection.)*

Pump shall be field convertible to automatic stroke adjustment without the use of special tools and without the need to replace any major frame parts.

Pump shall be furnished with a factory mounted driver suitably sized for continuous operation at the maximum relief setting. Motor shall be sized for the maximum relief setting. Motor shall be **(integrally mounted direct coupled/flange mounted with flexible coupling).** No belts or pulleys should be used in the drive train or for capacity adjustment. Pump and motor shall be suitable for **(indoor/outdoor)** operation in **(non-hazardous/hazardous, Class __, Group __, Division ___)** area, as shown on the Pump Data Sheet.

2.1 ELECTRIC STROKE ADJUSTMENT

*(**Note to Specification Writer**: Use this section only for specifying pumps to be controlled automatically by a command signal. Electric stroke length control is more reliable and has a much lower total installed cost than pneumatic length stroke control. Pneumatic stroke length control is available. Electric stroke length control offers superior performance over variable stroking speed control through the use of variable speed drives for some applications.)*

Pumps shall be furnished with automatic electric stroke length positioner to follow a **(4-20 mA/0-5volt/other)** signal proportional to **(flow/pH/other).** Stroke positioner will include provision for local manual override and will include a local position indicator.

Positioner should be suitable for connection to either 115v or 230v single phase power without external transformers. Units shall be suitable for use with either milliamp or voltage inputs without field modifications. Positioner will include adjustable limit switches with outputs for alarm purposes and will provide an isolated 4 - 20 mA output signal for remote monitoring.

The stroke positioner shall include necessary logic and terminals to allow connection to remote control stations if desired. Positioner should allow remote features to be added without modification or replacement. Only the purchase of the actual control stations should be necessary to achieve remote stroke length display, remote auto/manual selection and the ability to manually override the stroke length from the remote location.

On loss of signal, the control unit must be able to "FAIL" in the last command position or to "FAIL" to a pre-selected adjustable position. Positioner should provide contacts to alarm or loss of signal.

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3.0 FEED SYSTEM

Complete Chemical Feed System(s) shall be furnished suitable for handling **(insert chemical name(s)).** Each system will consist of **(quantity)** pump(s), tank, **(portable mixer)** and piping and accessories as defined below. Manufacturer will select all materials in contact with chemical and guarantee their suitability for the particular service. Pump(s) shall be mounted **(below/beside/in front)** of the tank.

4.0 TANK

The tank(s) shall be constructed of **(polyethylene/304SS/316SS/other)** and furnished with a hinged removable cover. Tank shall include connections for pump suction, drain, level gauge, chemical fill, dilution water, level switch, and relief valve return piping. Drain connection shall be separate from pump suction connection. Drain shall be located in the bottom of the tank for complete emptying of contents. Suction outlet connection should be on the side wall of the tank, a minimum of 2" above the bottom to prevent sediment from being drawn into the suction line.

Tank will be furnished with **(drain valve) (level switch) (level gauge).**

5.0 MIXER

A portable clamp mount mixer with **(304SS/316SS/PVC coated)** shaft and propeller shall be furnished. Mixer clamp shall allow angular and radial adjustment of shaft angle. Mixer propeller shall operate at **(1750 RPM/350 RPM).** The purpose of the mixer shall be to **(mix liquid/dissolve powder in liquid/create and maintain a suspension).**

*(**Note to Specification Writer**: A tangential fill connection may be specified in place of a mixer for liquid chemicals that disperse easily in water. The swirling action created by the force of the water flowing into the tank through the tangential fill connection provides adequate mixing.)*

6.0 PIPING

Package is to be furnished complete with pump suction and discharge piping and accessories as described in Section 7.0. A **(PVC/steel/stainless steel)** valve and strainer shall be provided at the tank outlet (and a valve shall be provided at each pump inlet (if more than one pump per tank.)) Pump suction piping shall be sized to satisfy pump NPSH requirements. Piping shall be **(PVC/steel/304SS/316SS/other) (tubing/pipe).**

*(**Note to Specification Writer**: Specify discharge piping if more than one pump is piped to a common outlet.)*

Two Pump System: Pump discharges shall be piped to a common outlet using **(PVC/steel/304SS/316SS/other) (tubing/pipe).** A **(PVC/steel/stainless steel)** valve shall be provided at each pump discharge.

Three Pump System: Pump discharges shall be piped to two outlets with the center pump piped as spare for either of the other pumps. Pump discharge piping shall be **(PVC/steel/304SS/316SS/other) (tubing/pipe).** A total of four **(PVC/steel/stainless steel)** valves shall be provided in the discharge piping.

7.0 ACCESSORIES

7.1. The Chemical Feed Systems shall include the following accessories:

7.2. Calibration column with isolation valve, provided on suction line branched between tank isolation valve and strainer. Column shall be sized to allow at least a one minute draw-down test.

7.3. Pressure gauge with **(snubber/diaphragm seal)** shall be mounted on pump discharge. Gauge shall be furnished with valves for isolation and test. Pressure gauge should be sized at least 25% higher than the maximum pump internal relief valve setting.

7.4. Back pressure valve sized to provide a minimum of 50 psi back pressure.

7.5. Relief valve and return line to tank shall be provided at the discharge of each metering pump. External relief valve shall be set at a pressure lower than the pump internal relief valve. Return piping shall be transparent to allow viewing of liquid in the line.

7.6. Level switch **(PVC/stainless steel)** float type, SPDT rated 10 amp to actuate 1" above suction outlet.

7.7. Level gauge **(valved tubular/unbreakable non-valved)** level gauge shall be included.

7.8. Measuring tank with piping and valve shall be mounted on tank lid. Measuring tank shall include a calibrated level indicator to allow accurate measurement of concentrated chemicals for dilution.

7.9. Injection point assemblies shall be provided for each discharge. Provide a **(PVC/Kynar/316SS/C-20)** injection quill with isolation valve for each injection point (corporation stop shall be provided with each quill).

*(**Note to Specification Writer**: Corporation stop is used on low pressure systems, typically cooling water systems, to allow removal or reinsertion of the injection quill without draining the system. Corporation stops are not used on systems above 150 psi.)*

8.0 CONTROLS

Chemical Feed Systems shall be provided with all necessary controls including motor starters and appropriately sized overloads such that connection to a single **(1PH-120/208v or 3PH-460/other)** power supply is the only required field electrical work. A motor starter with ON/OFF switch shall be provided for each motor on the chemical feed system. Running lights shall be provided for each motor. All switches, lights and other electrical components shall be NEMA4. All electrical devices shall be wired in conduit to the control panel.

*(**Note to Specification Writer**: The following paragraph is required only for systems using control signals for electric stroke length adjustment:*

Signal wiring for milliamp or voltage follower signals shall not be run in the same conduit and shall not be terminated in the same enclosure box as power and motor control wiring.)

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AUTOMATIC PROPORTIONAL CONTROL

Variable Speed vs. Variable Stroke Length

Chemical metering pumps can be controlled by flow, pH or other process instruments using either variable speed drives or variable stroke length mechanisms.

Please understand how these two methods differ and how they may impact the process.

Turndown – generally speaking variable stroke length adjustment will allow the greater automatic turndown. The full 10:1 turndown available from the metering pump is always available from an electric stroke length adjustment mechanism. Variable speed drives are limited in turndown either through torque loss and stalling at low RPM or by requiring stroking speeds that are below the practical limit of the pump operating range. We recommend that pumps not be operated below 20 spm, and poor performance can be expected below 15 spm, hence, a 40 spm pump would be limited to a 2:1 or 3:1 turndown if it were used with a variable speed drive. Practical turn down limits of a higher speed, 120 spm pump are still only 6:1.

Adjustable Range – use of a variable speed drive does increase the combined manual and automatic adjustable range of the pump. The metering dial remains available as an independent adjustment. In some applications this may be an advantage.

Slug Feed Phenomenon – an important consideration in many applications is the uniform delivery of chemical. Use of variable stroke length adjustment mechanisms causes a smaller dose of chemical to be dispensed, however, the frequency of injection remains constant. Variable speed drive results in the same size slug of chemical being injected,. The frequency of injection is varied.

Applications which require injection in to a flowing line may be poorly served by a variable speed mechanism because the slugs of chemical become fewer more widely separated as the pump slows down unless flow in the line slows proportionately.

Do be aware of these differences when choosing between automatic stroke length or automatic motor speed controls.