Vendor:

Request **F**or **Q**uotation Date :

THIS IS NOT A PURCHASE ORDER

THIS PURCHASING SPECIFICATION - R.F.Q.

(is comprised of : those items where data is shown and of those items which are checked "x")

For Flow Fluctuation reducers AND OR Pressure Pulsation "dampers"

PLEASE PROVIDE NOT LATER THAN [ ] YOUR LOWEST PRICE
& BEST AVAILABILITY IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS

*NOTE : Subclauses denoted by letters a. through p. are thereby cross referenced to the **Pulsation Dictionary of Terms***

The vendor shall provide item/s [ ] and [ ] or [ ] recommendation
for system modification [ ] and [ ] or [ ] for pump modification,
Performance improvement (not equipment part #) shall form the basis of any contract, that is based on your response to this RFQ , which shall ensure SUITABILITY FOR THE PURPOSE OF:

FLOW FLUCTUATION REDUCTION

1. Flow Fluctuation reduction in a piping system carrying [ ] USGPM

1.1 Flow Fluctuations to be reduced to a level of not greater than [ ] % peak to valley, of the theoretical steady state flow rate

1.1.1 To ensure that :

FLOW CONTROL VALVES

a. Flow Fluctuation generated by the modulation of in line or "T" off line "flow / process control - valves", responding @ [ ] Hz.

BACK PRESSURE VALVES

b. Flow Fluctuation generated by the modulation of "back pressure valves", hunting at a natural frequency of [ ] Hz.

CHECK VALVE CHATTER

c. Flow Fluctuations generated by oscillation of "check valves" opening and closing at a natural frequency of [ ] Hz.

PUMPS

d. Flow Fluctuations generated by the pumping action of

Air [ ], Hydraulically [ ], Motor / Rotary [ ] , DRIVEN pump

@ [ ] R.P.M./SPM to [ ] R. P. M. /SPM after any gear / belt speed reduction

CENTRIFUGAL

i. number of cut waters / impeller vanes per rev [ ]

GEAR or LOBE

ii. number of gear teeth per revolution [ ]

VANE

iii. number of vanes per revolution [ ]

TUBE

iv. number of tube / peristaltic "shoes / rollers" per rev [ ]

DIAPHRAGM or A.O.D.

v. number of diaphragms displacements per complete cycle [ ]

phased together [ ] phased offset [ ] / [ ] / [ ] / [ ] degrees

Work Notes

vi. number of piston or plungers displacements per cycle

Work Notes

phased together ☐ phased offset ☐/ ☐/ ☐/ ☐/ degrees

ARE REDUCED TO a flow fluctuation % LEVEL SPECIFIED AT1.1 ☐

PRESSURE PULSATION PREVENTION aka "Dampening"

2. Pressure Pulsation "damping" "dampening" "dampening"

2.2 To be reduced to a level of not greater than +&- ☐ %
of theoretical steady state pipe line pressure

2.2.1 To ensure that in the suction supply system:

SUCTION

a. The pump does not "vapor lock" or "cavitate" ☐
EX: The requirement of the pump to accelerate the liquid sufficiently to enable the pump to fill, does not cause the pressure to fall to such a level that dissolved air comes out of solution, or the liquid does not phase change to a gas such that the pump fails to fill efficiently .

b. The requirement for the acceleration of liquid mass does not cause the liquid pressure to fall to an extent, which causes temporary voids to form , which when they collapse generate shock waves which then drive the suction supply line into mass oscillation, causing the pump to become erratic or unstable . ☐

2.2.2 To ensure that, in the discharge pumping system, the pressure pulsations are sufficiently small not to cause :

DISCHARGE

a. Damage to pump parts, or overload to the drive. 2.2.2.1
EX: 12% allowable pressure pulsation. ☐

b. i. weeping of the system relief valve, 2.2.2.2
ii. premature relief valve lift,
iii. fatigue of safety overload "burst " or "rupture" disks,
iv. premature activation of "safety shut down" systems
EX: 9% allowable pressure pulsation. ☐

c. i. Shaking of pipework 2.2.2.3
ii. Weld hardening
iii. Pipe hanger tearing
iv. Flange gasket, valve stuffing box, failure
v. API 618 3.9.2.2.3
EX: 7% allowable pressure pulsation ☐

d. API 674 3.6.2.2.1 allowable pressure pulsation not to exceed the relevant percentage peak to valley as tabulated below:

2.2.3. **MULTIPLEX & "POWER PUMPS"** ☐

EXAMPLES : (Note f=frequency)

Nominal Pipe Diameter	1" Pipe	3" Pipe	6" Pipe	12" Pipe [3]
Schedule	XXH	160	XXH	160
ID	0.599"	2.626"	4.897"	10.26"
Assuming a quintuplex pump with displacers phased at 72 degrees running at up to 500rpm (f=41.6Hz)				
Allowable pressure pulsation	20 psi	10 psi	7 psi	5 psi
Assuming a triplex pump with displacers phased at 120 degrees running at up to 300rpm (f=15Hz)				
Allowable pressure pulsation	34 psi	16 psi	12 psi	8 psi
Assuming a duplex pump with displacers phased at 180 degrees running at up to 175rpm (f=5.8Hz)				
Allowable pressure pulsation	54 psi	26 psi	19 psi	13 psi

Figures are Calculated by

$$\text{PSI Pulse} = \frac{100}{\sqrt{(\text{ID}" \times f)}}$$

2.2.4 METERING, DOSING, INJECTING, & PROPORTIONING PUMPS

(may be generally applicable up to 2" pipe systems)

Work Notes

API 675 @ 3.6.2 says see API 618 as below

Total swing

API 618 @ 3.9.2.5 approx. = 2.25% @ 500psi or 25 psi
1.75% @ 1,000psi 17.5psi
1.35% @ 3,000psi 40 psi
1.0% @ 10,000psi 100 psi

2.2.5 FOR INSTRUMENTATION

P.I. 2.2.5.1

e. Damage to bourdon tube type pressure indicators "dial type gages"
EX: 6% allowable pressure pulsation.

SPRAY SYSTEMS 2.2.5.2

f. "Atomization" constant size of droplets which may be drying or solidifying as they fall in a tower (Note - this is not generally smooth enough for film or coating applications)
EX: 5% allowable pressure pulsation

MIXING 2.2.5.3

g. Preventing intermittent jets of liquid entering a pressurized stream leading to a "Static Mixer"
EX: 4% allowable pressure pulsation

METERS 2.2.5.4

h. MAG 2.2.5.4.1
Pulsed magnetic field distortion meter accuracy
EX: 3% allowable pressure pulsation

PADDLE WHEEL "METER" (flow indicator) 2.2.5.4.2

j. Prevent surging or "ratcheting" of paddle wheel blades projecting into the flow path
EX: 2% allowable pressure pulsation

TURBINE METER 2.2.5.4.3

k. Prevent pressure wave impingement on the turbine blades from jerking it to spin at an irrelevant speed.
EX: 1.5% allowable pressure pulsation

CORIOLIS METERS 2.2.5.4.4

m. Prevent pressure wave amplitude , at any frequency that is the same as, a power of, a divisor of , the natural frequency at which the corolis tube is being vibrated, from causing over-excitation, which will result in the meter indicating a greater rate of mass transfer than is occurring.
EX 1 % allowable pressure pulsation. Typically at 1000Hz for straight tube meters . Typically 90 Hz for loop tube meters.

VORTEX SHEDDING METERS 2.2.5.4.5

n. Prevent pressure wave disturbances form being read as vortex pulsation and causing erroneous readings EX: 0.75 % pulsation

DELTA P (Differential pressure across an orifice) METERS 2.2.5.4.6

p. Prevent all pressure fluctuations in excess of 1 (one) psi

3.0 THE SYSTEM

3.1 **System Pressures** 3.1.1 Suction Supply head

3.1.2 Resistance to discharge by the system

3.1.3 Relief Valve set pressure

3.1.4 Design Pressure

3.2 **System Temperatures** 3.2.1 Design Temp. for allowable metal stress

3.2.2 Maximum working pressure

3.2.3 Minimum working pressure

3.2.4 (for AMSE VIII -1)Minimum design metal temperature "MDMT"

3.3. **System Liquid**

3.3.1 System Liquid Specific Gravity "SG "Grams / Cubic Centimeter

3.3.2 System Liquid Viscosity cP centepoise

3.3.3 System Liquid Compressibility Liters per bar at system Temperature and Pressure (This is a vital figure)

3.4 **Other system parameters :**

3.4.1 System Liquid Vapor Pressure at pumping temperature

3.4.2 Pressure of any absorbed gasses EX "Nitrogen" or "Air Pad" applied to the liquid supply - any reduction to which will cause absorbed gasses to come out of solution.

3.5 **System Piping**

3.5.1 Pipe Isometric attached, yes no

3.5.2 Length from source of supply head 3.5.3 pipe Internal Diameter

3.5.4 Length from pump outlet to end / vessel 3.5.5 pipe Internal Diameter

3.6 **Connections to the system , and configuration / orientation**

Horizontal Vertical

Center line axis of cylinder C L or of disk axis C/L shaped vessel chamber

3.6.1 Cylinder Horizontal or Disk horizontal

3.6.2 Cylinder Vertical or Disk Vertical

3.6.3 For Vertical For Horizontal One up it & one in left field "New England Style" ,

Note = Typical flanged

3.6.4 Horizontal one left one right " Bull horns " "Texas Style" or Vertical

(Would you buy a filter with one connection !

3.6.5 "Seal Horse" Any which way is up aka Louisiana style"

3.6.6 One connection (pressure pulses travel at 3,500 M.P.H. and go straight past , not in-place flushable either) Designed in Washington ! aka "DC Style"

Would you buy a filter with one connection ! Would you fit a "T" under your car and put your muffler on it?

OTHER Sketch

3.6.7 ANSI B16.5 Flanged " # face Preferred Material

3.6.8 High Pressure clamp type Hubs "Diameter Rating OTHER

4 .0 Design CODE 4.1 ASME VIII Div.1 "U" 4.2 LDI Safety Design Code SDC1 Rev.

6.0 Other requirements EX earthquake and wind loading calcs - describe

We, above mentioned vendor number acknowledge receipt of your specification and will - will not be tendering -

- or -

Please provide additional information as tabulated on the list which we hereto attach, marked -

Signed ..... for & on behalf of above named vendor _