TECHNICAL NOTE 03-00
WATER RESTRAINT SYSTEM
NOZZLE PRESSURE AND PIPING CONSIDERATIONS

Dated July 3, 2000

INTRODUCTION

The Hydro-Force Water Restraint System (HFWRS), stationary installation requires that the nozzle be placed where the best yard coverage is provided. This means that the nozzle location will be separate from the water and pump by some distance. The pipe that carries the high-pressure water from the pump to the nozzle must connect the two locations. This document provides guidelines and recommendations for the placement of the pump and water tank in relation to the nozzle location.

BACKGROUND

The HFWRS utilizes a motor and pump to develop the water pressure needed to deliver water and chemical for distances up to 200 feet. The pressure developed at the pump is the maximum system pressure. This pressure is reduced when the water must travel through piping and bends before reaching the nozzle. Therefore, each additional length of piping and each pipe bend will reduce the effective water pressure at the nozzle and therefore the distance that the system can deliver the water stream.

CALCULATIONS

1. The table below shows loss calculations based on the typical HFWRS water delivery rate of 400 GPM and a typical HFWRS nozzle pressure of 175 psi. The calculations are shown for two sizes of piping; the 2-½ inch normally installed piping and the 3 inch oversized piping used for longer runs.
2. The numbers shown are the pressure loss based on the length of piping and the percentage loss of the optimum nozzle pressure. You can add the percentage loss for the piping length plus the loss caused by the number of elbows to obtain the total loss as a percentage of the system pressure. The other coupling losses are not included in these calculations.
3. You can use this information to obtain some idea of the percentage pressure loss caused by the runs that in turn compromises the impact force and the shooting distance. Finding an exact value for the reduction in impact force and shooting distance is much more complicated and involves many other factors.

Piping	2 ½ inch		3 inch	
Distance (ft.)	PSI loss	%	PSI loss	%
10	6.8	3.9	1.9	1.1
20	13.6	7.8	3.8	2.2
30	20.4	11.7	5.7	3.3
40	27.2	15.6	7.6	4.4
50	34.0	19.5	9.5	5.4
60	40.8	23.4	11.4	6.5
70	47.6	27.3	13.3	7.6
80	54.4	31.2	15.2	8.7
90 deg. coup.	6.0	3.5	4.0	2.5

For example: A 40 foot 2 ½ inch pipe with 4 – 90 degree turns will result in a system pressure loss of 15.6 + 14 = 29.6%. The same pipe at 3 inch will have a system pressure loss of 4.4 + 10 = 14.4%. You can see that long pipe runs of this size can be detrimental to system operation.

RECOMMENDATIONS

1. We recommend that the calculated percentage pressure loss of any system installation be below 15 % whenever possible. Installations requiring longer piping runs should use 3 inch piping.
2. The pump and the nozzle are normally connected using a 2 1/2 pipe. A 3-inch pipe can be used for longer delivery distances. The longer the pipe the more the pressure loss with a resultant reduction in the shooting distance. A 25-foot length of 2½-inch pipe and no more than 2-90 degree turns from the pump unit to the nozzle unit is acceptable. If you have any installation that needs a longer distance, 3-inch piping should be used. You should contact us for additional engineering assistance.
3. Systems with shorter overall shooting distances may have longer piping runs because the water stream does not have to be delivered over a long distance. However, the impact force is still affected.
4. The vertical distance or elevation is not as important as the distance but can also affect the output pressure. In general, a vertical distance of 20 feet is no problem. If you have any installation that needs a greater vertical distance, you should contact us for additional engineering assistance.
5. The water tank is designed to be near the pump. The planned system delivery will have the pump and tank mounted on the same mounting frame. The further the tank is from the pump, the more pressure loss there will be.
6. The tank and pump are mounted on the same frame. However, they can be separated for special installations. The separation should be no more than 10 feet unless we look at the interconnecting pipe sizes. The best solution is to more the pump/tank/mounting frame combination to the desired location.

MAINTENANCE CONSIDERATIONS

1. The close proximity of the pumping and chemical equipment to the nozzle and control panel makes servicing and repair much easier. The ability to see the equipment from the control panel location allows the service man to view the system operation and water stream shooting from one location making problem diagnosis simple and quick.
2. Equipment not located in view of the control panel location may need an additional technician to monitor the equipment operation while another technician operates the system. If line of site voice or visual communications cannot be established, the two technicians must communicate via radios or an intercommunications link.

Please contact us if you have any comments or questions.

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