

Data Summary

Dual Drain Flow Tests

DYNAMIC DIFFERENTIAL ANALYSIS

New Water Solutions, Inc.

Presented by:

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The ability to state the problem is often more effective than the solution.

Len Fuchs (Thoughts While Shaving)

INTRODUCTION

The purpose of the dual drain flow tests was to measure the dynamic pressure differential created when one suction outlet is blocked, and to compute from this data the maximum resultant hold down force for commonly used commercially available sumps and outlet covers. The separation distance between the connected drain sumps, pipe size, fitting configuration, outlet connection sizes, and suction outlet cover open area/design-types are all factors that are evaluated to determine system curves and actual hold down forces related to dynamic differential pressure.

The prepackaged manufactured sump and cover kits used in this analysis and flow tests are as follows:

<u>Sump and Cover Kit Designation / Description</u>	<u>Diameter of Sealing Circle</u>	<u>Computed Max Sealing Area</u>
• Hayward SP1048 E – 1-1/2” side outlet connections	7-3/8 in.	42.72 in ²
• Hayward SP1048 E – 2” side outlet connections	7-3/8 in.	42.72 in ²
• Pentair 861059 XX – 1-1/2” bottom outlet connections	7-3/16 in.	40.57 in ²
• Pentair 861059 XX – 2” bottom outlet connection	7-3/16 in.	40.57 in ²
• Waterway 640-2920 - 2” side outlet connections	7-1/2 in.	44.18 in ²

DATA SUMMARY

The attached charts characterize the inches of water drawdown data collected for each of the above sump and cover kits, over a flow range of 10 to 90 gpm, with zero to three 90 degree elbows in the connector piping system, for a given outlet and connector piping size configuration.

In addition, the computed maximum hold down force levels of 15 lbs, 30 lbs and 45 lbs are represented on each chart. The pounds force representations are based on the product of the drawdown (expressed in pounds per square inch units) and the computed maximum sealing area (previous slide).

The tests were conducted incorporating up to three 90 degree elbows in the connector piping between the blocked sump and the junction tee. The equivalent length of PVC Schedule 40 pipe represented by each PVC elbow can be estimated as follows:

<u>Pipe Diameter</u>	<u>Number of 90 0 Elbows</u>	<u>Equivalent Length of Pipe</u>
2 inches	1	5 feet – 8 inches
2 inches	2	11 feet – 4 inches
2 inches	3	17 feet
2-1/2 inches	1	7 feet
2-1/2 inches	2	14 feet
2-1/2 inches	3	21 feet
3 inches	1	8 feet
3 inches	2	16 feet
3 inches	3	24 feet

¹ Source: www.EngineeringToolBox.com

DATA POINTS AND SKETCHES

Chart 1

HAYWARD SP1048 E - 1-1/2" OUTLET W/ 2" CONNECTOR PIPING

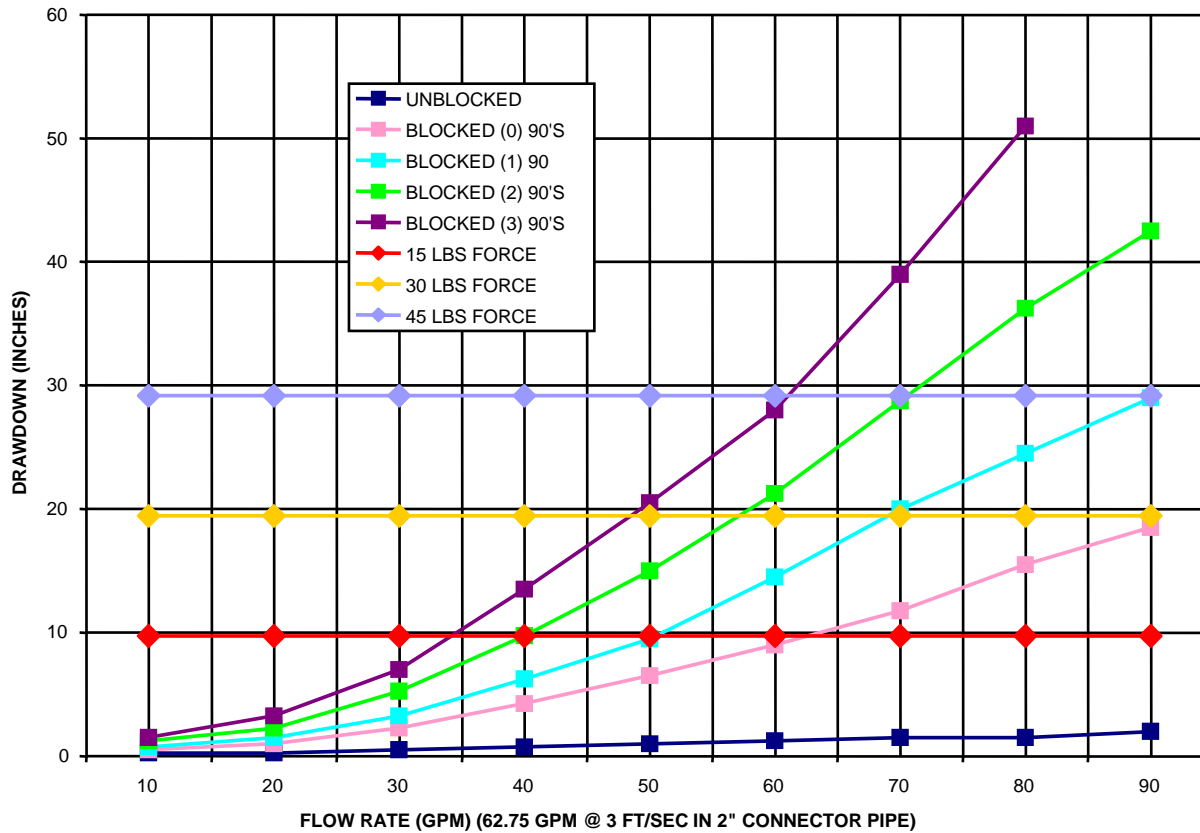


Chart 2

HAYWARD SP1048 E - 2" OUTLET W/ 2" CONNECTOR PIPING

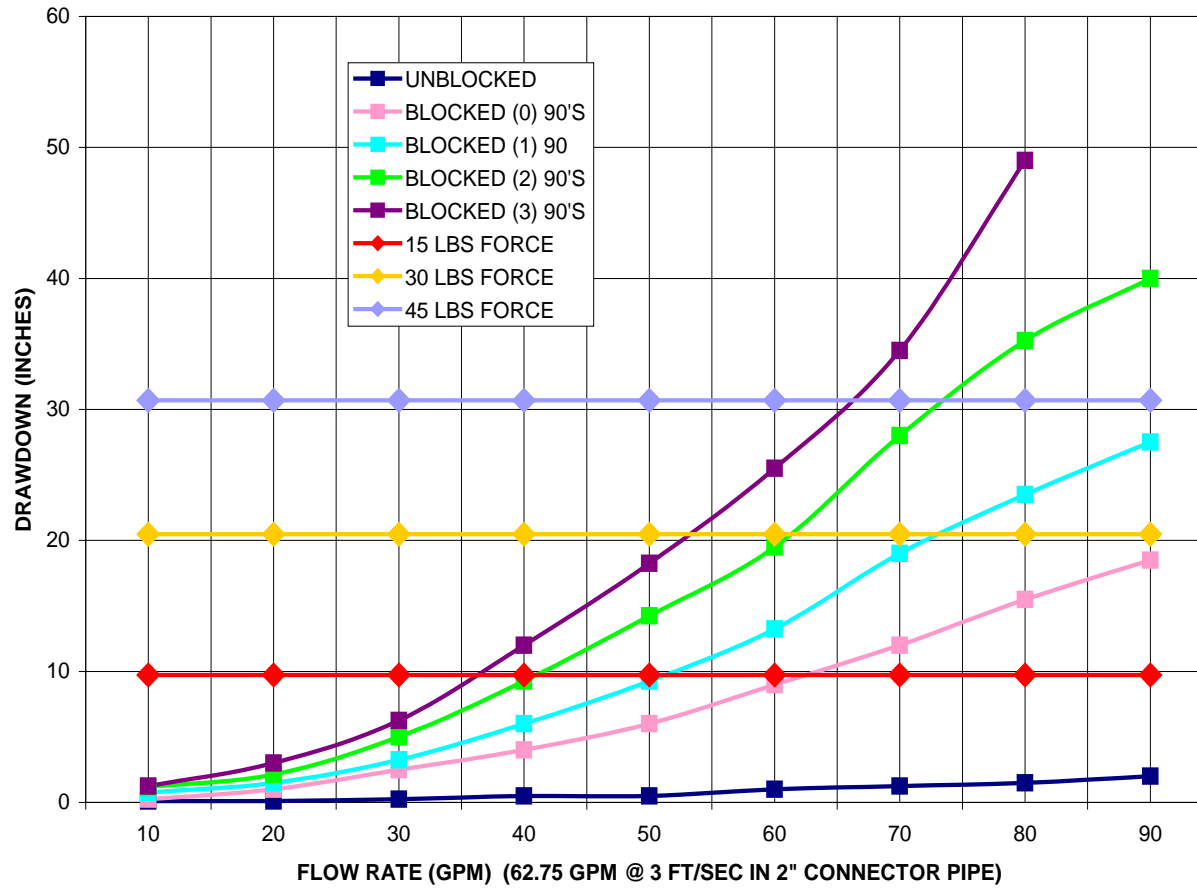


Chart 3

HAYWARD SP1048 E - 2" OUTLET W/ 2-1/2" CONNECTOR PIPING

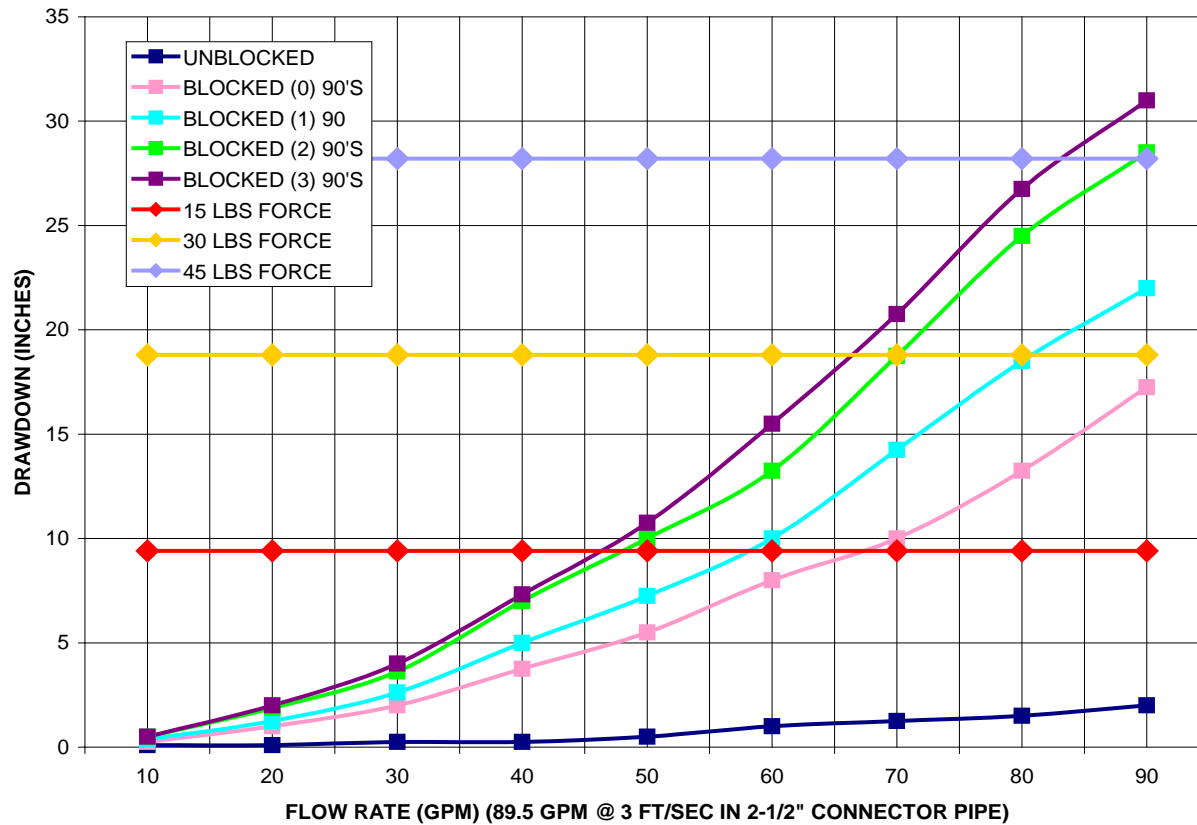


Chart 4

HAYWARD SP1048 E - 2" OUTLET W/ 3" CONNECTOR PIPING

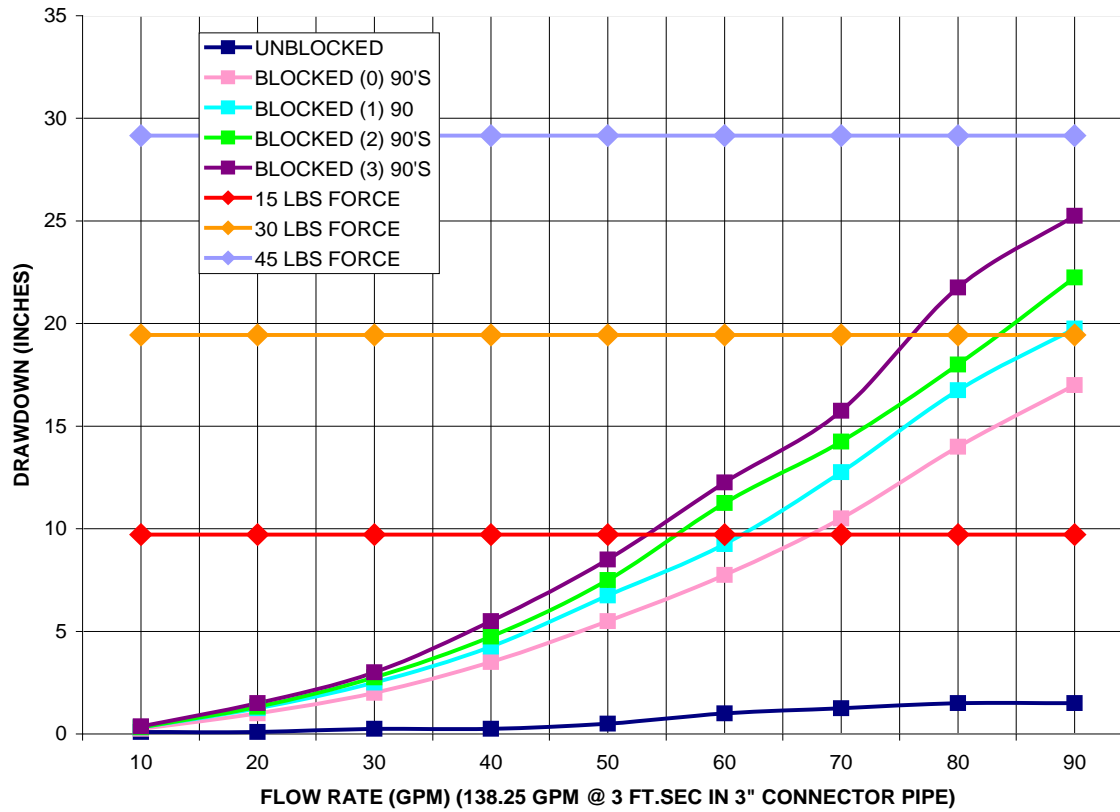


Chart 5

PENTAIR 861059 XX - 2" OUTLET W/ 3" CONNECTOR PIPING

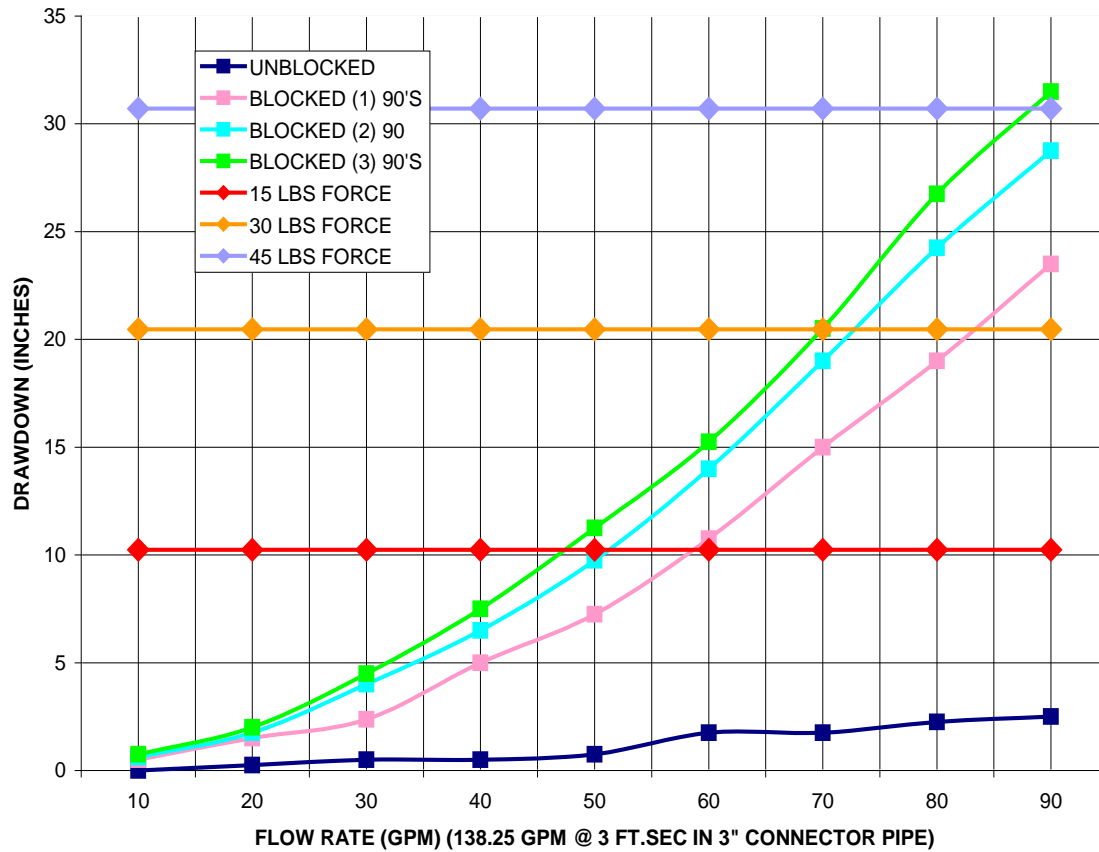


Chart 6

PENTAIR 861059 XX - 2" OUTLET W/ 2-1/2" CONNECTOR PIPING

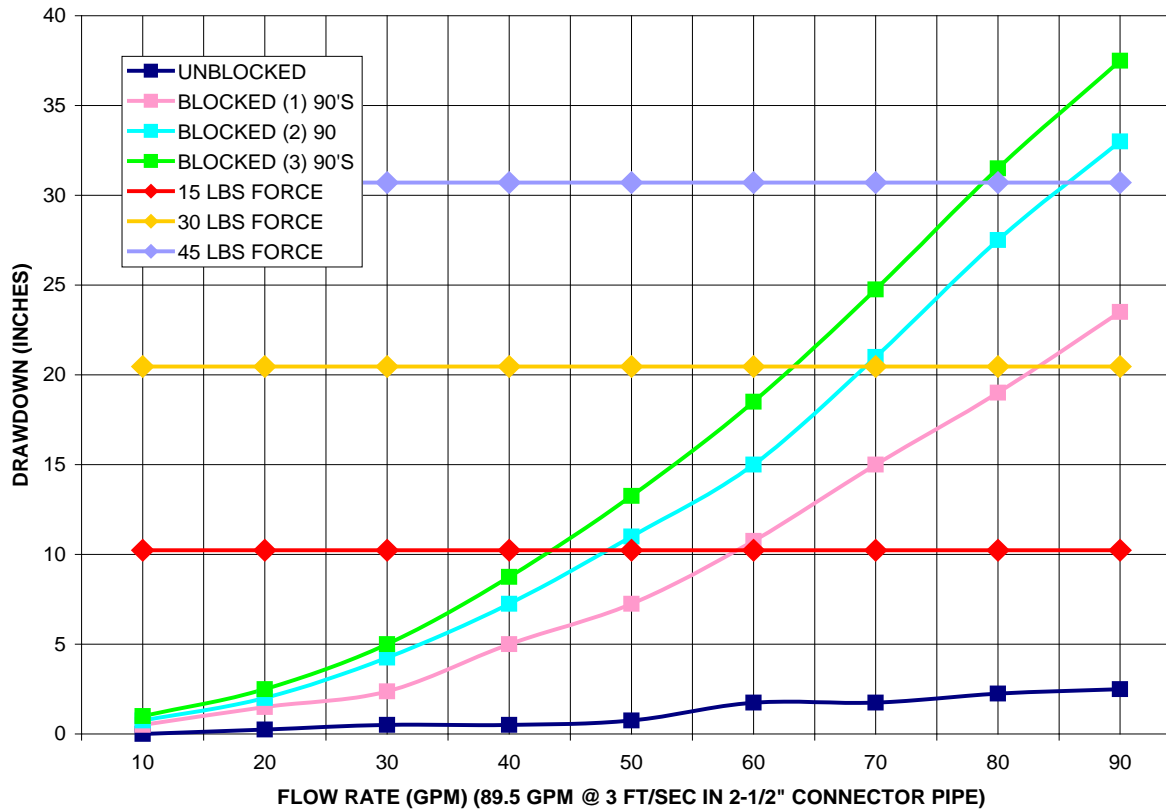


Chart 7

PENTAIR 861059 XX - 2" OUTLET W/ 2" CONNECTOR PIPING

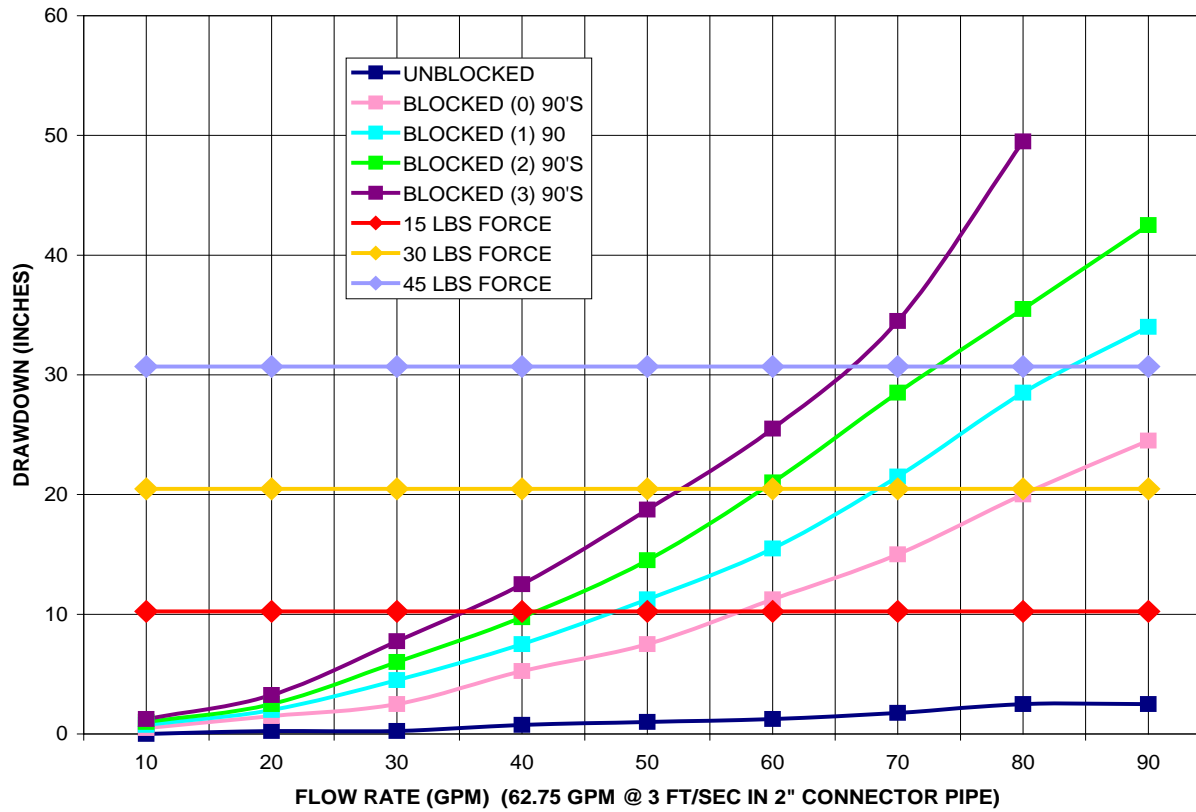


Chart 8

PENTAIR 861059 XX - 1-1/2" OUTLET W/ 2" CONNECTOR PIPING

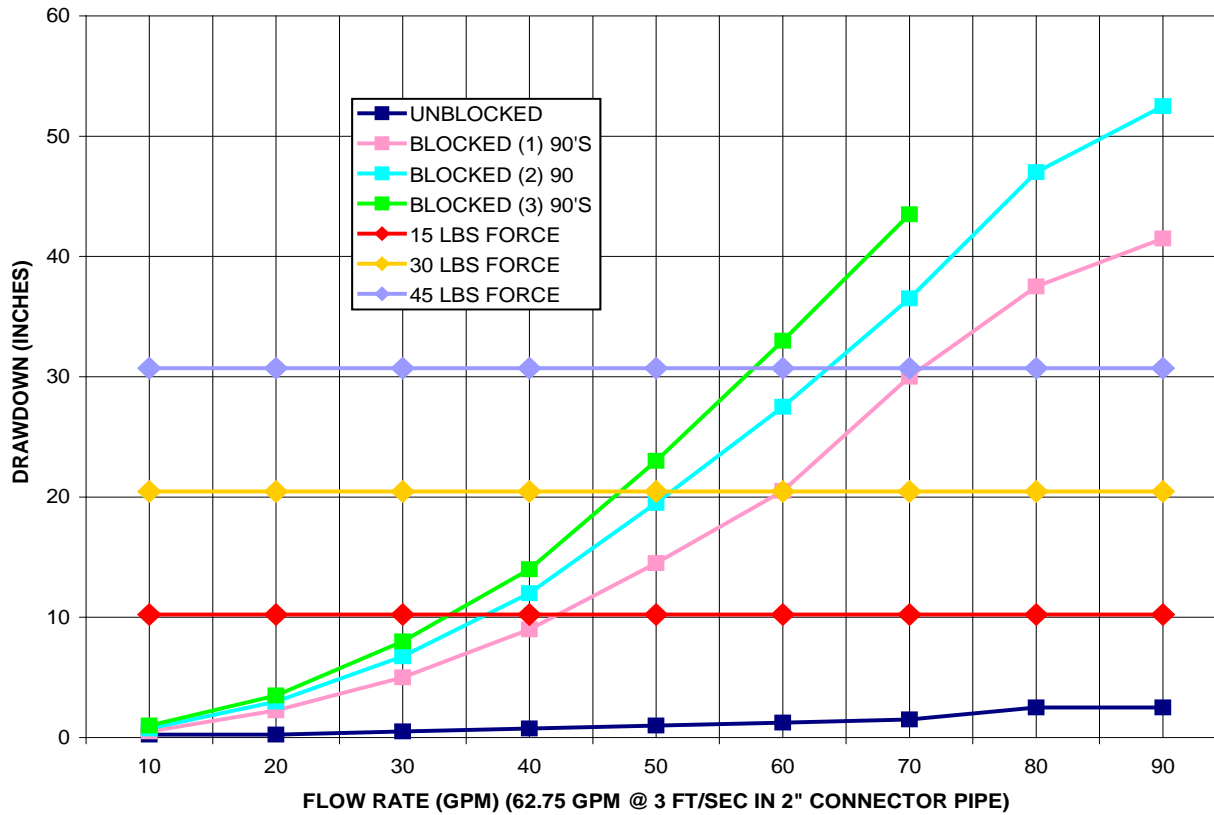


Chart 9

WATERWAY NO. 640-2920 - 2" OUTLET W/ 2" CONNECTOR PIPING

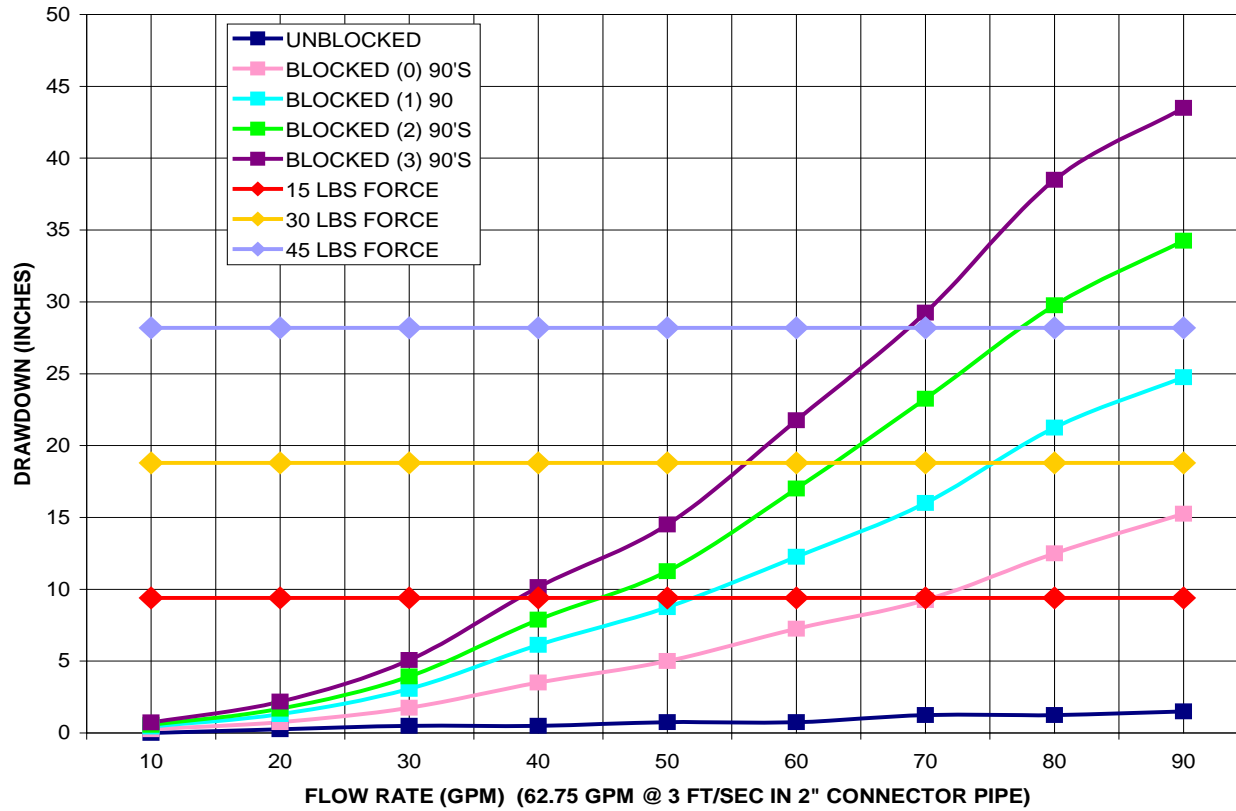


Chart 10

WATERWAY NO. 640-2920 - 2" OUTLET W/ 2-1/2" CONNECTOR PIPING

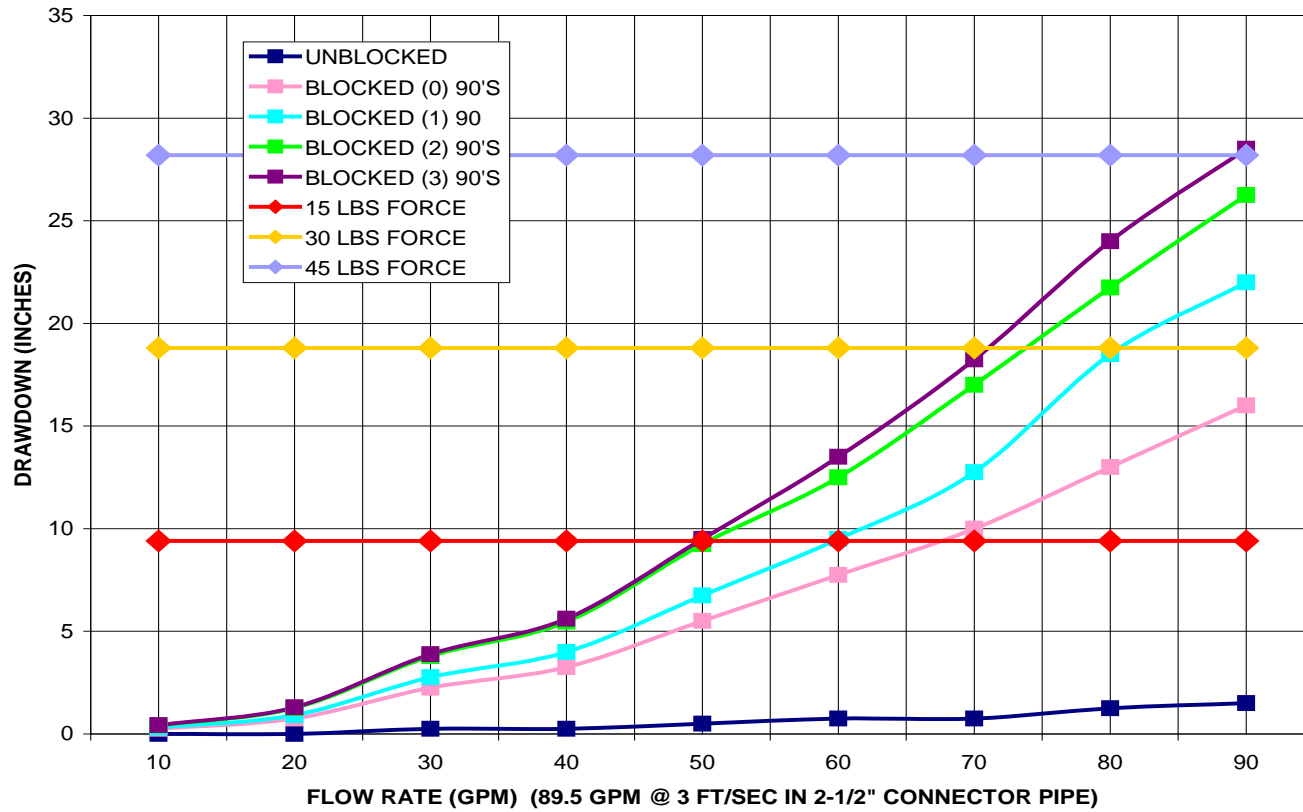
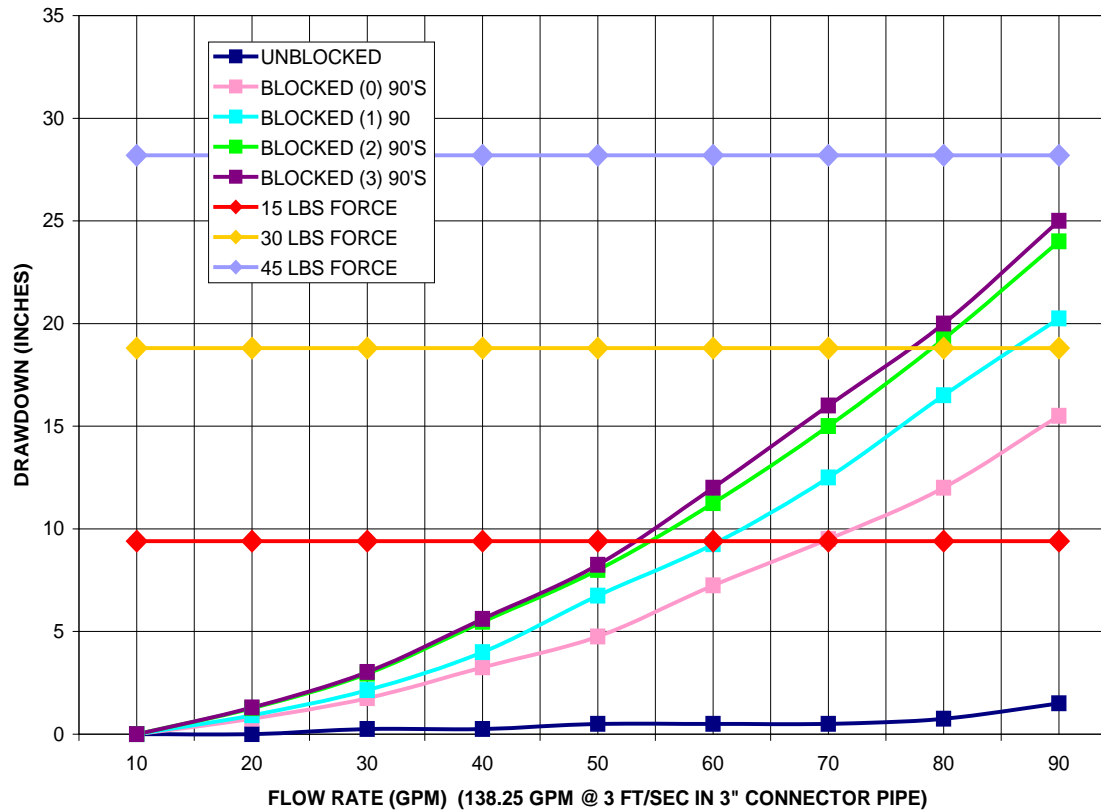


Chart 11

WATERWAY NO. 640-2920 - 2" OUTLET W/ 3" CONNECTOR PIPING



CONCLUSIONS

Suction outlet covers have characteristic hydraulic pressure drops influenced by available open area and flow path geometry. ASME A112.19.8 requires maximum flow rates to be permanently stamped on drain covers. For dual drain installations, safe flow rates are sometimes less than the ASME A112.19.8 rated flow for the cover.

The tests demonstrate that the dynamic hold down force on a blocked sump in a dual drain system is proportional to the square of the flow rate, and is impacted by head loss through the suction outlet cover, the sump outlet, connector pipe fittings, and the connector pipe length to the junction tee.

To minimize dynamic hold down force, the following dual drain construction methods should be practiced.

CONCLUSION: The Prescription for Safer Suction Outlet Hydraulics

- 1. Hold down force on a dual drain system shall be limited to 15 pounds maximum on an standard 8" diameter sump when one of the pair of sumps is blocked.
Note: This requirement shall be applicable to nominal eight inch diameter sumps exclusively.**
- 2. Suction outlet sump separation distances shall be held to a minimum and maximum of three feet. Greater separation distances increase the dynamic hold down force when one sump is blocked.**
- 3. Sump connection outlet ports shall be 2" minimum. Avoid the use of sumps with 1-1/2" connection outlet ports when constructing a dual drain system.**
- 4. Connector piping shall be minimum 2-1/2" diameter to reduce velocity and decrease dynamic hold down force.**
- 5. Installation of 90 and 45 degree elbows in the connector piping increase the hold down force when one sump is blocked. The use of 90 and 45 degree elbow type fittings should be minimized, and avoided wherever possible.**
- 6. Use anti-entrapment covers that have a large open area to minimize the dynamic hold down force created by the pressure drop across the cover.**

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Thank you for promoting suction outlet entrapment avoidance.

www.drainsafe.com