PENSKE RACING SHOCKS

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TECHNICAL MEMO BLEED SHIM v. BLEED HOLE

There are differences in dynamic response of a bleed shim when compared to a bleed hole. Although the equivalent bleed value (total area) may be the same, there are quantitative differences dyno curves and more qualitative differences in set-up theory and on-track performance.

For comparison, two drag builds were matched, one with a 1.350 x .006 x 3N bleed shim and other with a single drilled bleed hole in one rebound port. Both have virtually the same bleed area .0007 sq in. (hole) v .00075 sq. in.(shim). However, the effect in the low-speed area of the graph is different as well as through the entire velocity range.

Shock model:	8760 Drag (Rear)
Oil:	2.5 wt Silkolene
Pressure:	150 psi
Temp:	90 F
Dyno:	EMA-023
Technician:	MRM

Build 1 (Bleed Shim):	Build 2 (Bleed Hole):
14HF	14HF (same piston used in Build 1)
135006x3N	1 x .030 bleed hole in RD port
	1 x 1.350 x .006 shim added to compensate for bleed shim thickness
Comp-A	Comp-A
Reb-135012x2 D	Reb-135012x2 D
.750 constants	.750 constants

Figure 1: Bleed Equivalence Calculator

A	B	C	D	E	F	G	H	I	J	K
Bleed Equivalence Chart				Desired Bleed Hole Size			Ø 0.030	Equiv. Bleed Area		0.000707
9 holes	H1	H2	H3	H4	H5	H6	H7	H8	H9	Total Bleed Area
	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100	0.000707
8 holes	H1	H2	H3	H4	H5	H6	H7	H8	Total Bleed Area	
	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.000707	
7 holes	H1	H2	H3	H4	H5	H6	H7	Total Bleed Area		
	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.0113	0.000707		
6 holes	H1	H2	H3	H4	H5	H6	Total Bleed Area			
	0.0122	0.0122	0.0122	0.0122	0.0122	0.0122	0.000707			
5 holes	H1	H2	H3	H4	H5	Total Bleed Area				
	0.0134	0.0134	0.0134	0.0134	0.0134	0.000707				
4 holes	H1	H2	H3	H4	Total Bleed Area					
	0.0150	0.0150	0.0150	0.0150	0.000707					
3 holes	H1	H2	H3	Total Bleed Area						
	0.0173	0.0173	0.0173	0.000707						
2 holes	H1	H2	Total Bleed Area							
	0.0212	0.0212	0.000707							
1 hole	H1	Total Bleed Area								
	0.0300	0.000707								

Figure 2: Bleed Shim Chart

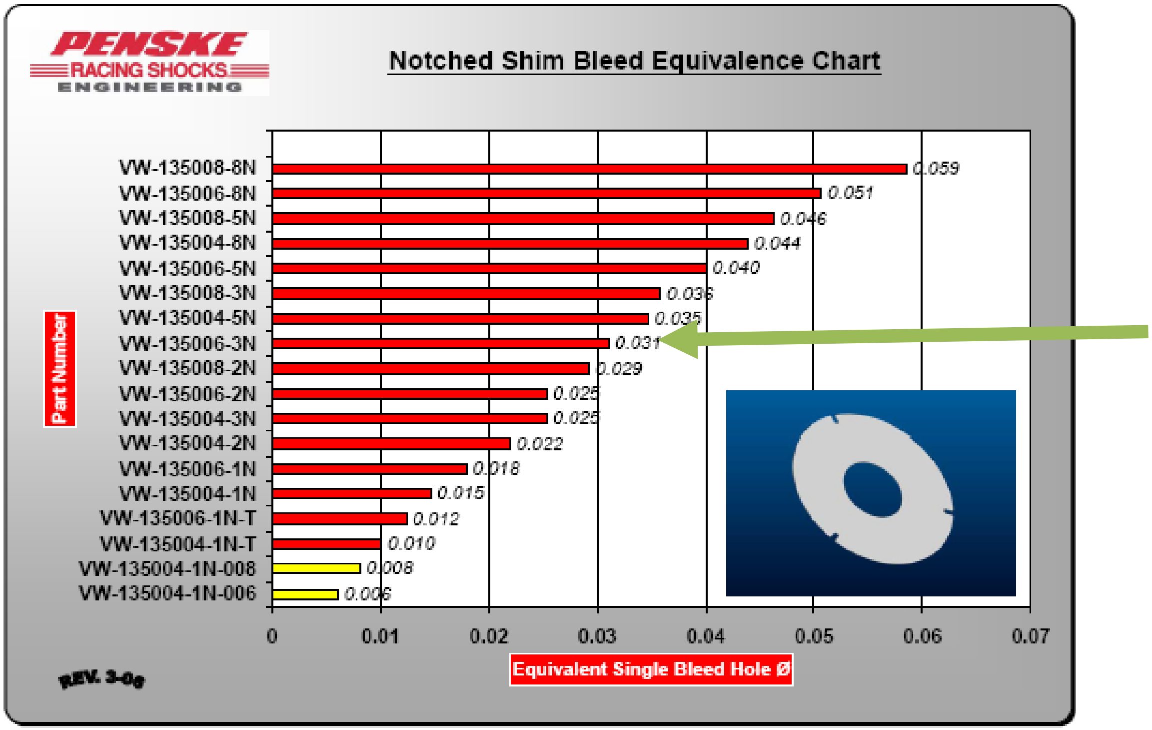


Figure 3: 0.25 in/sec Comparison

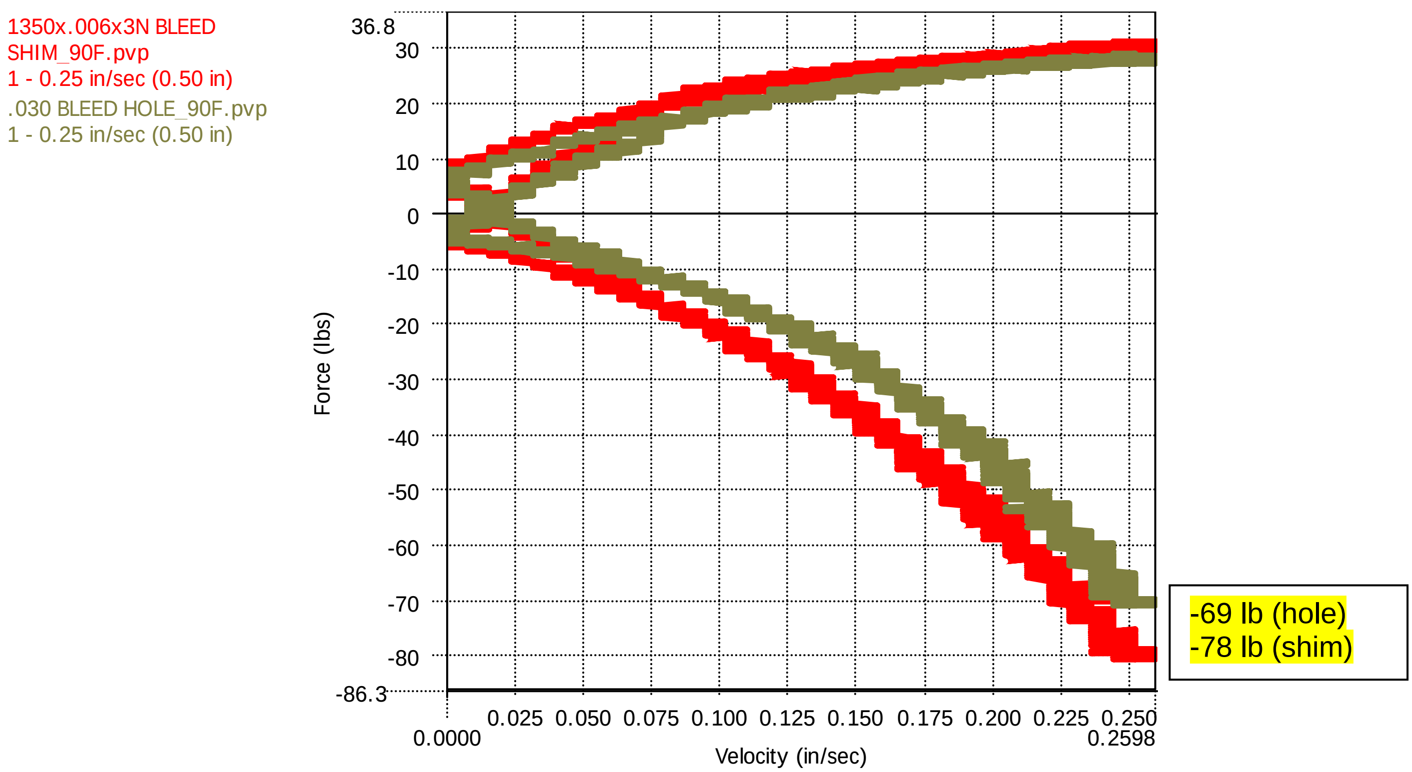


Figure 4: <u>1.00 in/sec Comparison</u>

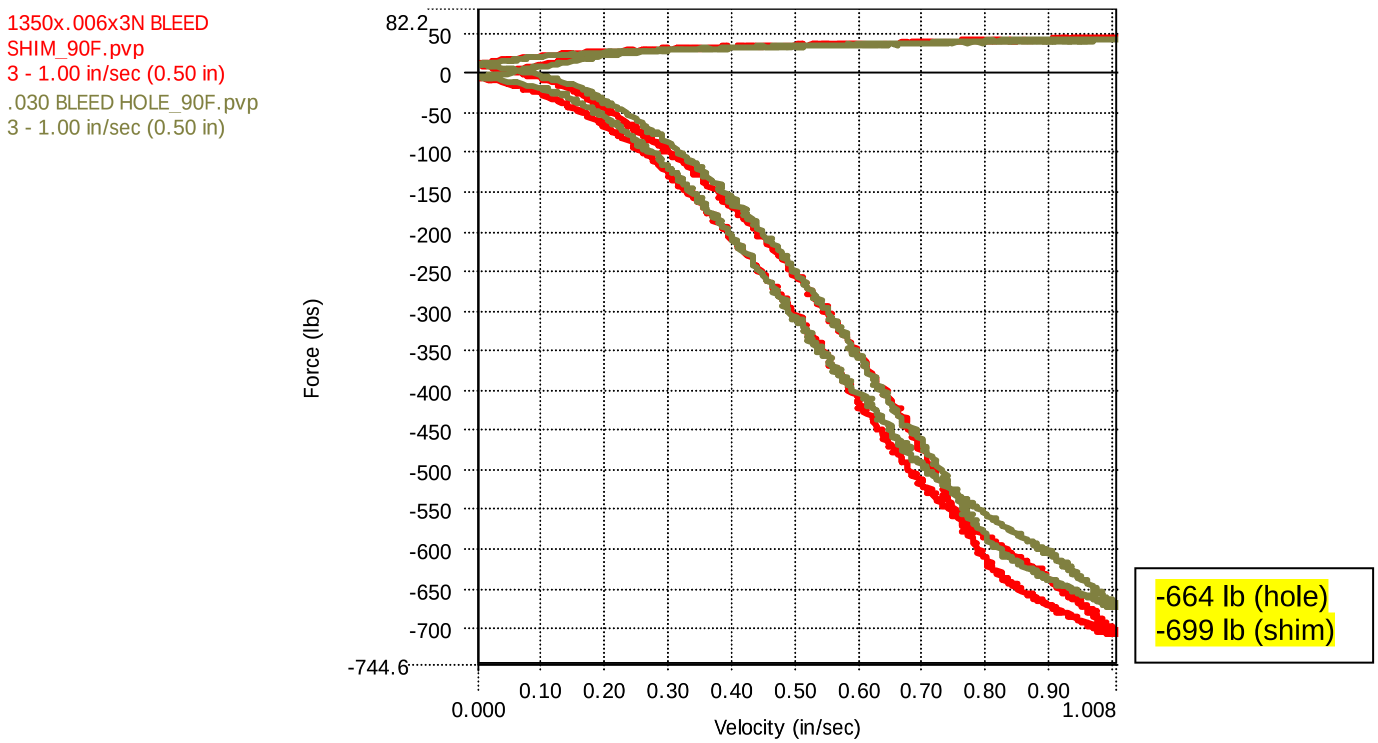


Figure 5: <u>2.00 in/sec Comparison</u>

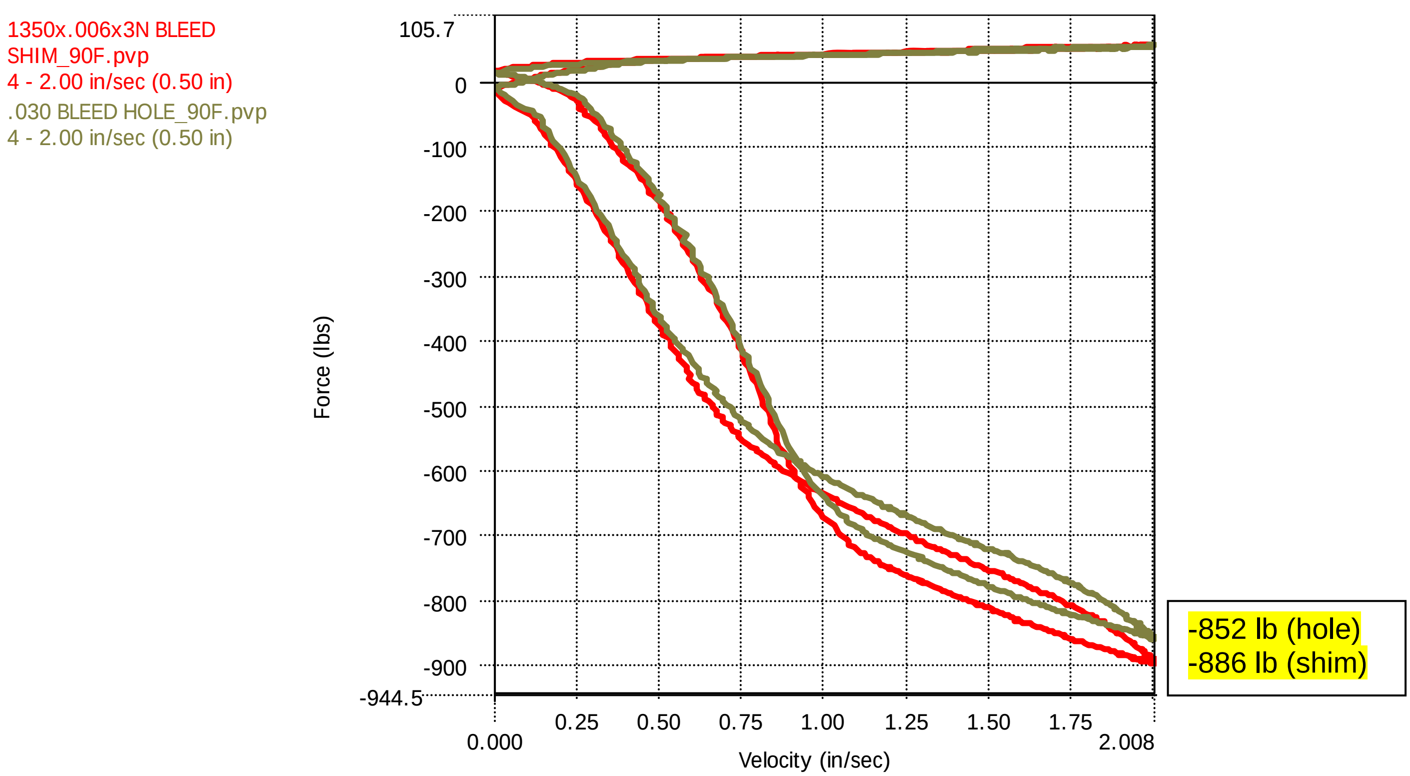


Figure 6: 5.00 in/sec Comparison

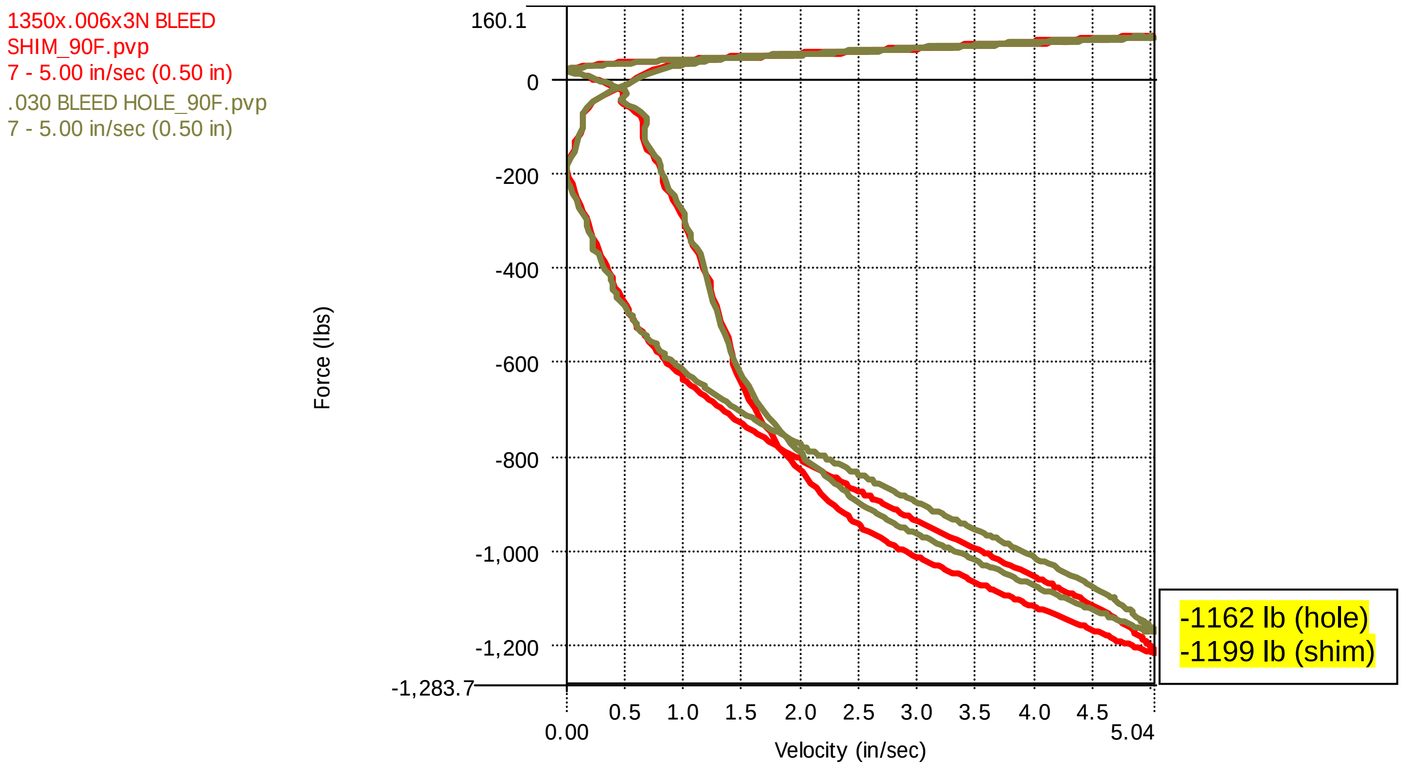
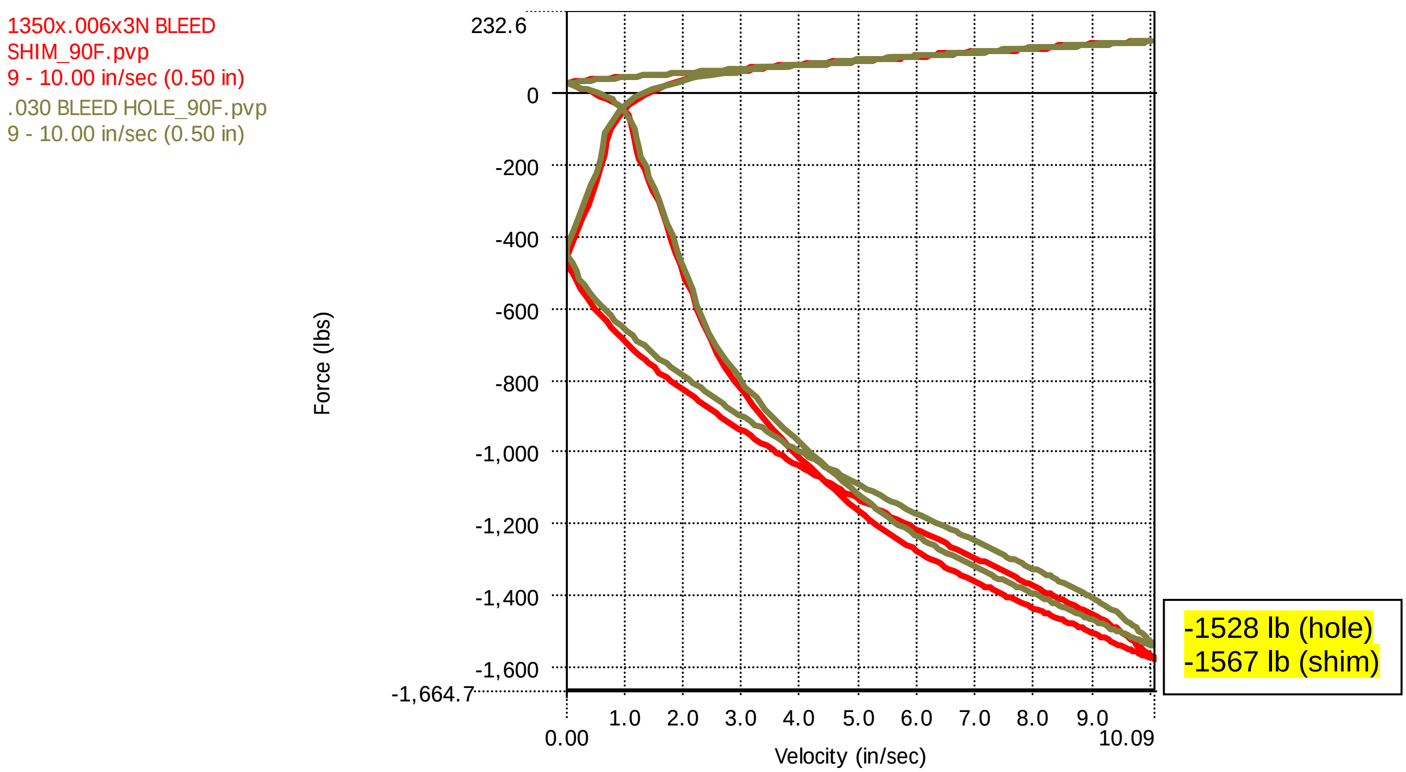


Figure 7: 10.00 in/sec Comparison



Conclusion:

The overall bleed area is the same for both the bleed shim and the hole. However, the effect is different in the low-speed area of the curve through the entire range. The differences in dynamic effect are quantified in the attached data for this particular example. However, the hydraulic flow characteristics of a single hole v. multiple slots in a shim are also different which allows the shim bleed to maintain a higher force through the range. The multiple smaller slots choke off faster allowing the transition to working of the shims earlier. A common practice where bleed shims are not able to be used is to use multiple small bleed holes drilled in a piston versus a single larger bleed hole. On track, there are differences as well in terms of driver feedback and performance.

Bleed has become an extremely sensitive and powerful method to tune suspensions and shock builds to achieve different affects and objectives. We are seeing massive differences in set-ups and how cars respond to differences as little as .001"-.002". This is most evident in NASCAR and Drag racing. In NASCAR specifically, substantial fines can and have been divvied out due to a difference of .002 in a bleed hole size. This is due to the advantage one can have on track with a lower splitter, etc, directly caused from a shock with extra low-speed rebound. We personally have seen a situation where a team was fined $25,000 because they did not open their RHS poppet large enough and failed post race tech on the Gadget gauge. This is the same thing we see in Drag racing where a click of a dual-bleed adjuster on the strut transforms the launch and 60 ft. Because of this, it is vitally important that our shock builders place the same amount of emphasis on bleed and how it is used and achieved in set-ups.

It is the recommendation of Engineering that bleed shims are used in most cases. The only exception would be if a specific piston type is used that would exclude their use (i.e. use of a 2N shim on a high-flow or linear is impossible). In these cases, we recommend multiple bleed holes versus single. Also, using a bleed shim saves drilling of pistons which can be costly.

If you have any questions or concerns, please contact Jim Arentz or Aaron Lambert.

Thank you!