

Probable Inlet Valve Diameter (IVD) for some recent 4 v/c engines
(with a **Sub Note** on Porsche P01)



N.B. IVD is always taken in this review as Overall Head Diameter.

In [Appendix 1](#) there are some recent engines for which Bore (B), Stroke (S) and Peak Power RPM (NP) are known but not IVD. A good estimate of their IVD was needed so that Mean Gas Velocity at inlet at Peak Power (MGVP) could be calculated for comparison with other units.

For this purpose the known IVD and B figures of a wide sample of 4 v/c racing engines over the period 1982 – 2001 was tabled on P.2 and plotted on P.3. The data have been extended subsequently to 2012 engines.

The relation between IVD and B was quite close, with an original linear regression value of $IVD/B = 40.6\%$ - the subsequent extension gave the slope shown of 41.1% .

If the combustion chamber does not overhang the cylinder bore, a feature which *was* used in Henri's Peugeots in order to obtain larger valves before it was appreciated that this not only caused "*Negative Squish*" but also *too low* a value of Mean Gas Velocity at inlet (MGVP) (see [Note 34](#)), the space available for the inlet valve in a 4 v/c design is $50\%B$. Therefore an average valve at $41.1\%B$ occupies about 82% of the space available. The balance seems to have been found necessary by many designers for strength of the head around the seats and also to avoid masking the inlet flow near the cylinder wall. Concerning the latter, the $42.1\%B$ obtained in the 2000 Ferrari 049 (Eg. 85) was with a 6° longitudinal included angle between the valves, which takes the lifted heads away from the wall. The 1985 Porsche P01 (Eg. 66) had the same feature, although it had the smallest IVD/B at 37.2% (see the Sub Note). A 3-dimensional cam is needed to operate valves with such longitudinal inclination.

Sub Note: Porsche P01

Ref (21) provides the 4 v/c P01 IVD as 30.5 mm in $B = 82$ mm so $IVD/B = 37.2\%$. This is nearly 4 %points below the relation established from many other engines, which would have given a diameter of 33.7 mm, 10% larger.

This is *assuming* the given dimension as being overall head diameter, the same as the other figures. It is possible that the figure given by Porsche to ref. (21) was an *inlet port throat diameter*. This is really what is needed for a proper scientific analysis and it was often the figure provided for early engines (although adjusted in this review to overall head when the fact was known). It is simply not available in most cases.

Without a cross-section drawing the suggested possibility cannot be checked.

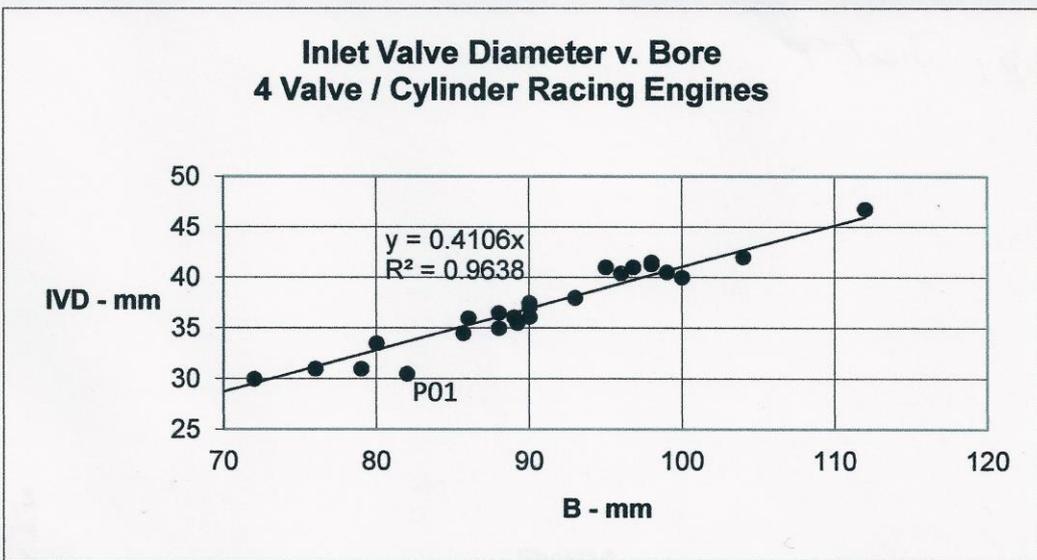
Year	Source	Make	Model	B - mm	IVD - mm	IVD/B %	IVA/PA	VIAX deg.
<u>CoY Examples</u>								
<u>Appendix1</u>								
1982	Eg. 62	Cosworth	DFV	85.6742	34.5	40.3	0.324	
1983	Eg. 64	BMW	M12/13	89.2	35.5	39.8	0.317	
1985	Eg.66	Porsche	PO1	82	30.5	37.2	0.277	Some
1988	Eg.71	Honda	RA168E	79	31	39.2	0.308	
2000	Eg. 85	Ferrari	49	96	40.4	42.1	0.354	6
<u>"Significant Other" Examples</u>								
<u>Appendix 1</u>								
1992	SO20	Honda	RA122E/B	88	36.5	41.5	0.344	
1995	SO22	Opel	DTM/1*	89	36.1	40.6	0.329	
1995	SO23	Vauxhall	XE20BTCC**	88	35	39.8	0.316	
<u>DASO</u>		<u>Other</u>						
1983	59,62,554	Cosworth	DFY	90	36.1	40.1	0.322	
1988	47,62	Cosworth	DFR	90	37.1	41.2	0.340	
1989	47,81	Judd	EV	99	40.5	40.9	0.335	
1991	468,	Mercedes	M292	86	36	41.9	0.350	
1996	672,	MugenHonda	MF301HA	93	38	40.9	0.334	
1996	674,	YamahaJudd	OX11A	90	37.5	41.7	0.347	
1996	494,495,	Suzuki	GSXR750	72	30	41.7	0.347	
2001	1039,1040,	Ducati	996R	100	40	40.0	0.320	
1967	G.Beale	Honda	RC174	41	17	41.5	0.344	
2005	1107	Cosworth	TJ	95	41	43.2	0.373	
2005	1095	BMW	P85	98	41.5	42.3	0.359	
2006	1107	Cosworth	CA	98	41.3	42.1	0.355	6
2009	1091	Toyota	RVX-09H	96.8	41	42.4	0.359	3.2
2012	1109	Ducati	999	104	42	40.4	0.326	
2012	'	'	Panigale	112	46.8	41.8	0.349	
2012	'	Kawasaki	ZX-10R	76	31	40.8	0.333	
2012	'	BMW	S1000R	80	33.5	41.9	0.351	

*Cosworth type KC

**Originally Cosworth type KBA in 1987

VIAX = Valve Included Angle in longitudinal direction

DASO (Additional to Appendix 3)1091; *Race Engine Technology* No.49, Sept/Oct 2010.1095; *Ten Years of BMW F1 Engines*; Prof. Dr-Ing. Mario Theissen at al. 2010.1107; *Race engine Technology* No.73, Sept/Oct 2013.1109; *Performance Bike* Oct 2012.



When IVD/B = 0.4106, IVA/PA = 0.337.

