

## ReVerie Wind Tunnel Test Session @ MIRA 13/04/2007

### Overview

A Standard Exige was Wind tunnel tested @ MIRA and data recorded for comparison to the Modified ReVerie Wide Arch Exige developed to optimise grip through increased track and improved down force with a balance similar to the std car for Gt3 and Brit car type race series.

The ride heights on both cars were set to 120mm front and rear.

The Frontal area for the standard car was 1.7 sq metres and the wide arch car 1.74sq metres

Please note the std exige had been modified with an above diffuser exhaust installed which allowed the centre tunnel to work very well, the ReVerie exige still had the factory stage 2 exhaust and diffuser fitted the centre tunnel performance was badly effected by the disturbance to airflow the exhaust tips caused. This can be seen in the tech movies clips on our web-site (click here – link)

You may also note the stalled flow in the outer rear diffuser tunnels perhaps best seen on the clips of the std exige, We make a wider mid floor and special diffuser with longer side tunnels to restore laminar flow to these tunnels by filling in under the rear wishbones (only cars with reduced droop suspension travel) and therefore enhance down force with zero drag increase. This & the horizontal sill extension were not shown in the smoke movies but were tested on the day. Full results & Data from the testing can be found in the technical data section of this site (click here)”

### Parts Fitted & Tested:

#### Std Exige

As Lotus supplied except ride heights set to 120mm front & rear with modified exhaust with exit above diffuser and 111s rear diffuser fitted with no exhaust hole.

#### ReVerie Race Modified Exige

Wide Arch kit +40mm front & Rear supplied fitted & painted at ReVerie

7.5x17” Et18 (fitted with 20mm spacers) Team dynamics front wheels with 215/40R17 Toyo T1-r tyres from Hangar 111

9x18” Et25 (fitted with 20mm spacers) Team dynamics front wheels with 245/35R18 Toyo T1-r tyres from Hangar 111

Fitted with McBeath designed lotus optimised profile for ReVerie 230mm adjustable (plan view curved) clamshell mounted 230mm chord carbon race rear wing, 1650mm wide with end plates (in all tests below, tested at various heights as listed to achieve best balance in Test 5)

Fitted with Wide arch exige s2 front spoiler (Narrower version for std width cars also available) (in all tests below)

Fitted with bolt on front S2 Elise / Exige Canards (in all tests below)

Simulated with New ReVerie Wider Rear Mid Floor (Tests 7,8,9 only)

Simulated with New ReVerie Horizontal S2 Elise / Exige Sill extensions (Tests 8 & 9 only)

Simulated with New ReVerie longer rear diffuser vanes to run under rear wishbones (Tests 8 & 9 only)

Note regrettably this car had a stage 2 exhaust with tip exits in the centre rear diffuser tunnel as the std 111r and Exige 240R / Exige S

This disturbs the flow in the centre tunnel and a exhaust with exit above the rear diffuser is preferable as now sported on the 2007 Lotus Exige Gt3 concept car.



## Results

Table of Coefficients

Standard Exige S2 but modified exhaust system	CD	CL	CLf	CLr	%F	L/D	Frontal area
0. Std apart from exhaust exit in rear panel and not in diffuser	0.442	-0.204	-0.086	-0.119	42.16%	-0.462	1.70m <sup>2</sup>
<b>ReVerie Race Modified Exige S2</b>							
1. Baseline, as delivered to w/tunnel Rear wing at 12 deg AOA, 223mm above rear deck*	0.556	-0.613	-0.195	-0.436	31.81%	-1.103	1.74m <sup>2</sup>
2. As 1 but rear wing to 10 deg AOA, 223mm above rear deck*	0.544	-0.606	-0.204	-0.402	33.66%	-1.114	"
3. As 1 but rear wing to 17 deg AOA, 223mm above rear deck*	0.577	-0.659	-0.184	-0.475	27.92%	-1.142	"
4. Rear wing raised to 283mm above rear deck*, wing at 10 deg AOA	0.547	-0.614	-0.194	-0.420	31.60%	-1.122	"
5. Rear wing lowered to 93mm above rear deck*, wing at 10 deg AOA	0.526	-0.526	-0.228	-0.298	43.35%	-1.000	"
6. As 5 but rear wing to 17 deg AOA	0.562	-0.600	-0.208	-0.392	34.67%	-1.068	"
7. As 6 but panel over gaps in outer diffuser tunnels & Mid floor to cover under rear wishbones.	0.559	-0.589	-0.205	-0.384	34.80%	-1.054	"
8. As 7 plus small vertical fences on outer ends of front splitter, plus wide horizontal side sill skirt extensions	0.555	-0.589	-0.201	-0.388	34.13%	-1.061	"
9. As 8 plus extended outer diffuser vanes to shroud off rear wheels	0.496	-0.697	-0.217	-0.480	31.13%	-1.405	"

\*Wing height measured to underside surface of rear wing from 'trough' ahead of rear deck spoiler

**Forces, N at 100mph**

<b>Standard Exige S2 but modified exhaust system</b>	<b>Drag</b>	<b>Total Df</b>	<b>Front Df</b>	<b>Rear Df</b>	<b>O/A balance^</b>	<b>Frontal area</b>	<b>Additional Drag</b>	<b>Additional D/Force</b>
0. Std apart from exhaust exit in rear panel and not in diffuser	928.7	424.9	177.9	247.0	39.31%	1.70m^2	0.00%	0
<b>ReVerie Race Modified Exige S2</b>								
1. Baseline, as delivered to w/tunnel Rear wing at 12 deg AOA, 223mm above rear deck*	1195.2	1346.3	416.2	930.0	38.07%	1.74m^2	28.70%	216.85%
2. As 1 but rear wing to 10 deg AOA, 223mm above rear deck*	1169.4	1292.4	435.4	857.1	39.90%	"	25.92%	204.17%
3. As 1 but rear wing to 17 deg AOA, 223mm above rear deck*	1239.8	1405.0	392.8	1012.2	39.11%	"	33.50%	230.67%
4. Rear wing raised to 283mm above rear deck*, wing at 10 deg AOA	1175.8	1309.3	413.3	896.1	39.64%	"	26.61%	208.14%
5. Rear wing lowered to 93mm above rear deck*, wing at 10 deg AOA	1131.7	1122.1	486.0	636.1	40.98%	"	21.86%	164.09%
6. As 5 but rear wing to 17 deg AOA	1207.9	1279.1	442.1	837.0	40.00%	"	30.06%	201.04%
7. As 6 but panel over gaps in outer diffuser tunnels & Mid floor to cover under rear wishbones.	1201.1	1256.3	437.7	818.6	40.05%	"	29.33%	195.67%
8. As 7 plus small vertical fences on outer ends of front splitter, plus wide horizontal side sill skirt extensions	1193.5	1256.3	427.9	828.4	39.96%	"	28.51%	195.67%
9. As 8 plus extended outer diffuser vanes to shroud off rear wheels	1065.9	1485.6	462.0	1023.6	39.45%	"	14.77%	249.64%

\*Wing height measured to underside surface of rear wing from 'trough' ahead of rear deck spoiler

^ Overall balance = (static weight front + Df front) / (static weight total + Df total)

**Std car had a static balance of 39.2% front**  
**Modified car had a static balance of 40.7% front**

**Forces, N at 150mph**

<b>Standard Exige S2 but modified exhaust system</b>	<b>Drag</b>	<b>Total Df</b>	<b>Front Df</b>	<b>Rear Df</b>	<b>O/A balance^</b>	<b>Frontal area</b>	<b>Additional Drag</b>	<b>Additional D/Force</b>
0. Std apart from exhaust exit in rear panel and not in diffuser	2089.6	956.0	400.3	555.8	39.45%	1.70m^2	0.00%	0
<b>Reverie Race Modified Exige S2</b>								
1. Baseline, as delivered to w/tunnel Rear wing at 12 deg AOA, 223mm above rear deck*	2689.2	3029.2	936.5	2092.5	37.03%	1.74m^2	28.69%	216.86%
2. As 1 but rear wing to 10 deg AOA, 223mm above rear deck*	2631.1	2907.9	979.7	1928.5	39.11%	"	25.91%	204.17%
3. As 1 but rear wing to 17 deg AOA, 223mm above rear deck*	2789.6	3161.3	883.8	2277.5	37.60%	"	33.50%	230.68%
4. Rear wing raised to 283mm above rear deck*, wing at 10 deg AOA	2645.6	2945.9	929.9	2016.2	38.60%	"	26.61%	208.15%
5. Rear wing lowered to 93mm above rear deck*, wing at 10 deg AOA	2546.3	2524.7	1093.5	1431.2	41.25%	"	21.86%	164.09%
6. As 5 but rear wing to 17 deg AOA	2717.8	2878.0	994.7	1883.2	39.32%	"	30.06%	201.05%
7. As 6 but panel over gaps in outer diffuser tunnels & Mid floor to cover under rear wishbones.	2702.5	2826.7	984.8	1841.9	39.40%	"	29.33%	195.68%
8. As 7 plus small vertical fences on outer ends of front splitter, plus wide horizontal side sill skirt extensions	2685.4	2826.7	962.8	1822.5	39.22%	"	28.51%	195.68%
9. As 8 plus extended outer diffuser vanes to shroud off rear wheels	2398.3	3342.6	1039.5	2303.1	38.27%	"	14.77%	249.64%

\*Wing height measured to underside surface of rear wing from 'trough' ahead of rear deck spoiler

^ Overall balance = (static weight front + Df front) / (static weight total + Df total)

**Std car had a static balance of 39.2% front**  
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Images (where relevant test numbers indicated, otherwise general images)



0. Std Car (flows over rear wing)



2. ReVerie Wing @223mm 10' AOA



Vortex's generated by end plate design



Front Canards & Spoiler (0 mph)



4. Rear wing raised to 283mm 10' AOA



5. Rear wing lowered to 93mm 10' AOA



8. Side Fences fitted to front spoiler



8. Horizontal side sills simulated



Disturbed rear diffuser centre tunnel flow by exhaust



## Conclusion

The std Exige had been modified with an above diffuser exhaust installed which allowed the centre tunnel to work very well, the ReVerie Exige still had the factory stage 2 exhaust and diffuser fitted the centre tunnel performance was badly effected by the disturbance to airflow the exhaust tips caused. This can be seen in the tech movies clips on our web-site ([click here – link](#))

You may also note the stalled flow in the outer rear diffuser tunnels perhaps best seen on the clips of the std Exige, We make a wider mid floor and special diffuser with longer side tunnels to restore laminar flow to these tunnels by filling in under the rear wishbones (only cars with reduced droop suspension travel) and therefore enhance down force with zero drag increase. This & the horizontal sill extension were not shown in the smoke movies but were tested on the day.

We achieved a good Aerodynamic balance with the modified car once we had lowered the rear wing to a height with its underside 93mm above the rear deck. Unfortunately the interaction of flows between the rear wing and rear diffuser could not be properly tested as the cars stage 2 exhaust exit tips were interfering with the flows in the centre rear diffuser tunnel.

The New ReVerie wider mid floor, longer rear diffuser tunnels linking under the rear wishbones and the new horizontal side sill extensions gave a huge leap in down force and a marked reduction in drag. The longer side rear diffuser vanes restore laminar flow to these tunnels by filling in under the rear wishbones (only cars with reduced droop suspension travel) and therefore enhance down force with a reduction in drag. This & the horizontal sill extension were not shown in the smoke movies but were tested on the day.

The Whole final package as tested in 9 had only 14.77% more drag yet a huge 249% more down force with a O/A balance similar to the stock factory car.

The front canards also appeared particularly effective from studies of the smoke flow movies. The rear wing had to be lowered as it was felt un practice and a styling disaster to increase the forward protrusion on the front splitter or fit an additional front aerodynamic devices therefore we could not increase front down force so had to reduce the rear and by reducing the height of the rear wing which reduced its efficiency slightly but also reduced the pitching moment that it had on the high mounts.



Left Image: Stalled flow in side diffuser tunnels  
Due to no floor / diffuser under rear wishbones  
Right Image: Good flow in centre tunnel as exhaust  
Exit above diffuser and 111s style diffuser fitted.



### Millbrook High Speed Bowl

After the MIRA wind tunnel test the ReVerie modified wide arch Exige car was then taken to Millbrook High speed proving ground. Colin from CAT driver training tested the exige on the high speed bowl where the Hangar 111 Turbo drive converted car pulled 149mph in 5<sup>th</sup> gear at 8000rpm, sith gear was slower as the engine would only pull 7000rpm, well below the peak 250bhp power quoted.

The base VVTi Exige S2 with 189bhp manages 147mph top speed, with Cd of 0.43 and frontal area of 1.7m<sup>2</sup> consumes 168.8bhp, or 89% of flywheel peak power at its quoted top speed of 147mph.

The ReVerie race modified, Hangar 111 Turbo drive converted Exige S2 with Cd of 0.545 in optimised aerodynamic configuration and frontal area of 1.74m<sup>2</sup> consumes 228.1bhp, or roughly 91% of flywheel peak power at 149mph.

Both cars appear to absorb about 10% +/-1% of peak power in mechanical and frictional drag,

The ReVerie Car was not tested for top speed with the wider mid floor, longer outer diffuser vanes or horizontal sill extensions these were MIRA tested to reduce drag by 10% on the wide arch car (giving only 14.7% more drag than the std car) in the final config. With these modifications the ReVerie Exige would have managed 153.8mph theoretically



Car 001 GT3 Exige Cadena 2006 Replica with ReVerie Vented Arches To reduce high pressure build up and hence lift under arches



Tested Exige S2 with blended in ReVerie Wide Arch kit Wing shown in pre-test 223mm position. N.B Car not fitted with wide mid floor, horizontal side sill fences or longer diffuser