



SBD CCM



SBD CCB

PART 1 COMPARISON

Items	CCM	CCB
High-Temp Resistance and oxidation resistance	<p>Pros: It possesses basic oxidation resistance and has no risk of thermal stress cracking in the coating.</p> <p>Cons: The high porosity and the tendency of micropores to adsorb oxygen can lead to oxidation of the matrix.</p>	<p>Pros: The dense coating isolates oxygen from the substrate, increasing the oxidation resistance temperature to 1000~1300°C and significantly improving high-temperature thermal stability;</p>
Corrosion resistance (Core difference)	<p>Pros: There is no risk of coating peeling; mild corrosion only affects surface micropores and does not penetrate into the substrate.</p> <p>Cons: Micropores act as channels for corrosive media, allowing water, salt spray, acid mist, and de-icing agents to penetrate them. In coastal or high-salt-spray environments, tiny corrosion spots can appear on the surface, reducing the smoothness of the friction surface over long-term use.</p>	<p>Pros: The dense coating completely isolates corrosive media, achieving zero-penetration protection. Even in harsh environments such as coastal areas, high salt spray, humid conditions, dusty environments, and areas using de-icing agents, the substrate shows no corrosion, maintaining top-level corrosion resistance throughout its entire lifespan.</p>
Abrasion resistance and service life	<p>Pros: The friction surface has uniform hardness, and when matched with special brake pads, the brake pad wear rate is lower (higher coating hardness can easily accelerate brake pad wear).</p> <p>Cons: Micropores can lead to uneven wear on the friction surface. When impurities such as sand and gravel get stuck in the pores, the wear on the friction surface is accelerated. The total lifespan is approximately (150,000 miles to 250,000 miles) 250,000 to 400,000 kilometers (street) / (50,000 miles to 75,000 miles) 80,000 to 120,000 kilometers (racetrack), which is 15% to 30% lower than the coated version.</p>	<p>Pros: The coating has higher hardness and is dense and non-porous, resulting in excellent uniformity of wear on the friction surface; the coating effectively protects the substrate.</p> <p>Cons: High-hardness coatings will cause brake pad wear to be slightly higher (approximately 10%~20% higher); it is necessary to use genuine brand low-wear brake pads, as generic brake pads are prone to abnormal wear.</p>
Braking performance (friction characteristics)	<p>Pros: After break-in, the friction surface exhibits excellent stability in the coefficient of friction (μ), with a coefficient decay rate of <5% at high temperatures (>900°C); during the uncoated break-in transition period, braking force output is more direct under extreme operating conditions.</p> <p>Cons: The break-in period is longer, resulting in a lower initial coefficient of during the break-in period. The micropores absorb water, causing a brief "water film effect" during the first braking action in rainy weather, with a slight lag in braking force.</p>	<p>Pros: With an extremely short break-in period, it possesses a stable coefficient of friction from the factory, resulting in rapid cold/initial braking response; its dense coating is non-absorbent, eliminating the water film effect in rainy weather, and maintaining a braking coefficient consistency of >95% in both dry and wet conditions; the coefficient of friction decay is <8% under high and low temperatures, providing excellent braking linearity.</p> <p>Cons: The friction coefficient stability at high temperatures (>1000°C) is slightly inferior to the uncoated version (the attenuation rate is 2%~3% higher).</p>

PART 1 COMPARISON

Items	CCM	CCB
<p>NVH performance (noise/vibration)</p>	<p>Pros: No hard contact resonance between the uncoated brake pad and the brake pad; under extreme braking (heavy/emergency braking), low-frequency vibration is slightly less than the coated version.</p> <p>Cons: The original friction surface has micropores, resulting in slightly higher surface roughness. When rubbing against the brake pad, it is prone to high-frequency resonance, occasionally causing brake squealing/abnormal noise during light braking at low speeds & softer pedal feel.</p>	<p>Pros: The coating surface is precision ground, resulting in low roughness, high friction surface flatness, and excellent adhesion to the brake pads. It exhibits virtually no brake squeal or abnormal noise, achieving top-tier NVH performance in the industry. The brake pedal offers a smooth, solid feel with minimal play, providing precise braking force feedback.</p>
<p>Lightweighting and unsprung mass</p>	<p>Pros: No added weight from coating; 50-150g lighter per disc for the same size compared to the coated version (depending on coating thickness); slightly better unsprung mass.</p>	<p>Cons: The weight is slightly higher than the uncoated version, with a slight difference due to the extreme need for lightweight design.</p>
<p>Structural strength and impact resistance</p>	<p>Pros: Better resistance to thermal and mechanical shock; no risk of coating delamination or peeling under severe track conditions (continuous heavy braking + bumps);</p>	<p>Pros: The dense coating fills micropores, resulting in better structural integrity of the friction surface, no stress concentration points, and the coating can prevent surface microcracks from propagating into the substrate, effectively protecting the substrate structure.</p> <p>Cons: There is a slight difference in the coefficient of thermal expansion between the coating and the substrate, and the coating is prone to microcracks (only on the surface, not affecting the strength of the substrate) under extreme thermal shock.</p>

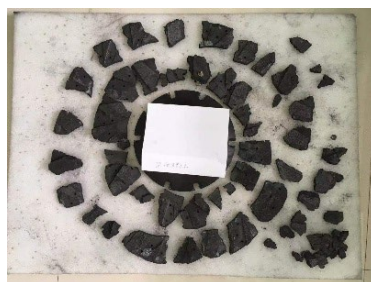
PART 2 CCM ROTOR TEST

Strength test

Brake Disc Strength Test		
No,	Project	Conditions
1.0	Strength Test	A rotational strength testing machine was used to accelerate the rotation of the brake disc until it broke. Requirement: The breaking speed of a new disc must be ≥ 5500 r/min.



Equipment



Rotors after test

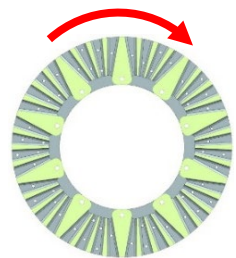
Conditions	Brand	前/后盘	Code	Results	PASS
When the brake disc breaks, the speed is >5500 r/min	SBD	Rear $\phi 410*32$	SBD001	Broken at 6,535 RPM	YES
When the brake disc breaks, the speed is >5500 r/min	SBD	Rear $\phi 410*32$	SBD002	Broken at 6,667 RPM	YES
When the brake disc breaks, the speed is >5500 r/min	SBD	Front $\Phi 440*40$	SBD003	Broken at 6,389 RPM	YES
When the brake disc breaks, the speed is >5500 r/min	SBD	Front $\Phi 440*40$	SBD004	Broken at 6,285 RPM	YES
When the brake disc breaks, the speed is >5500 r/min	MFR B	Front $\Phi 440*40$	/	Broken at 5,823 RPM	NO

- SBD's CCM is stronger than MFR B's
- After testing, the strength of the SBD'S brake discs met the requirements.

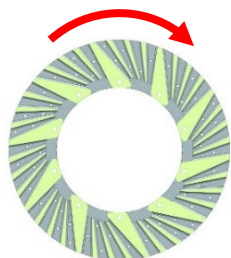
PART 2 CCM ROTOR TEST

Cooling Rate Test

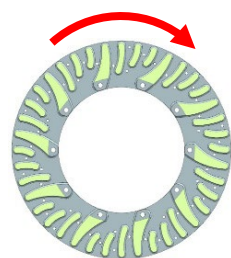
Cooling Rate Test		
No	Project	Conditions
1.0	Cooling Rate Test	Heating: 1. Speed: 90km/h 2. Braking pressure: 3MPa 3. Initial temperature: 20°C 4. Maximum temperature: 500°C Cooling: 1. Speed: 90km/h 2. Braking pressure: 0MPa 3. Cooling time: Record the cooling time from 500°C to 150°C and from 500°C to 100°C.



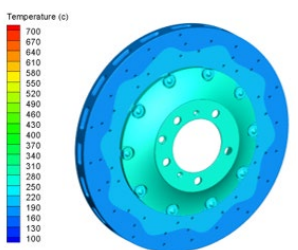
SBD DESIGN A



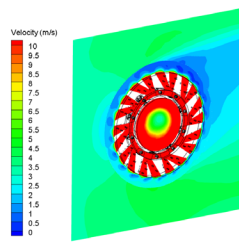
SBD DESIGN B



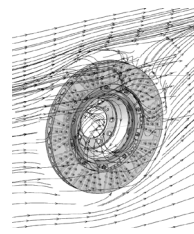
MFR B's design



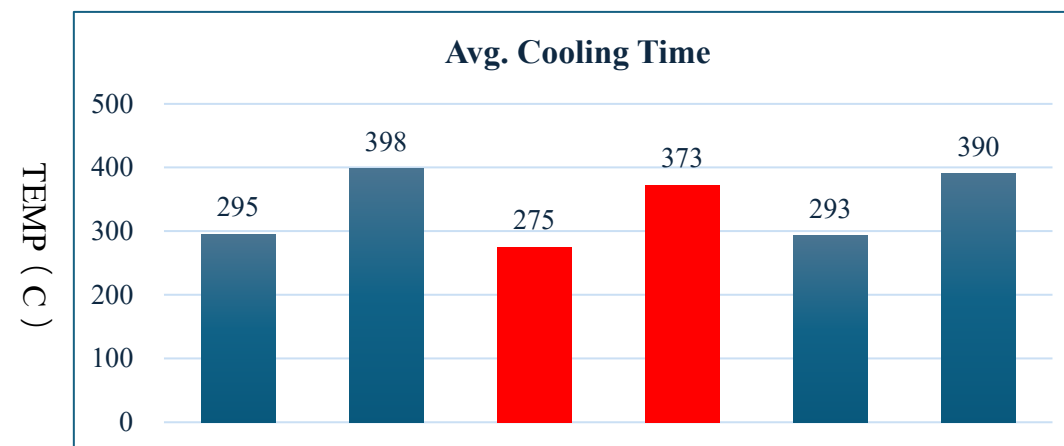
Finite element temperature distribution cloud map



Finite element cross section air velocity distribution cloud map



Finite element streamline diagram



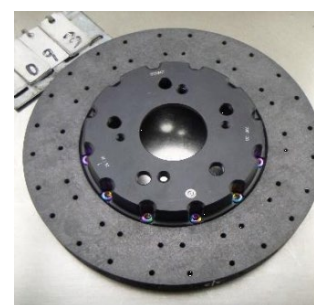
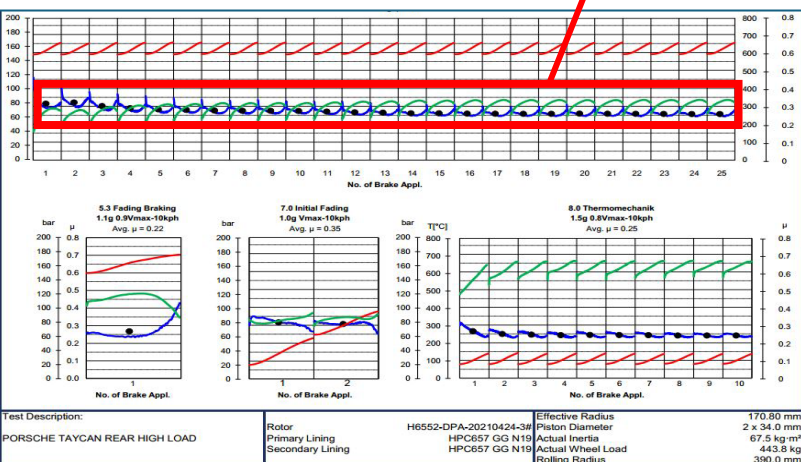
	500 to 150°C (s)	500 to 100°C (s)
SBD A	295	398
SBD B	275	373
MFR B	293	390

- SBD's CCM rotors have a approx. 6% faster cooling rate
- SBD's product meets cooling rate standard

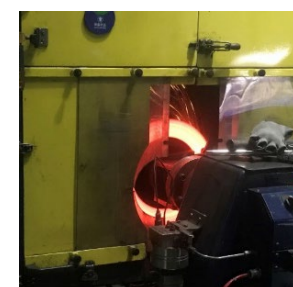
PART 2 CCM ROTOR TEST

High Load Test

High-temperature braking without braking fade



Initial state

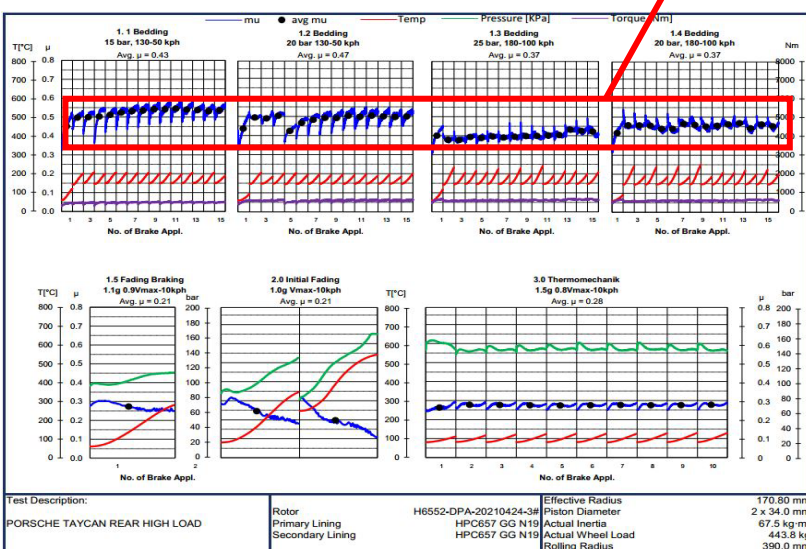


Testing



After Testing

Stable friction coefficient under different working conditions

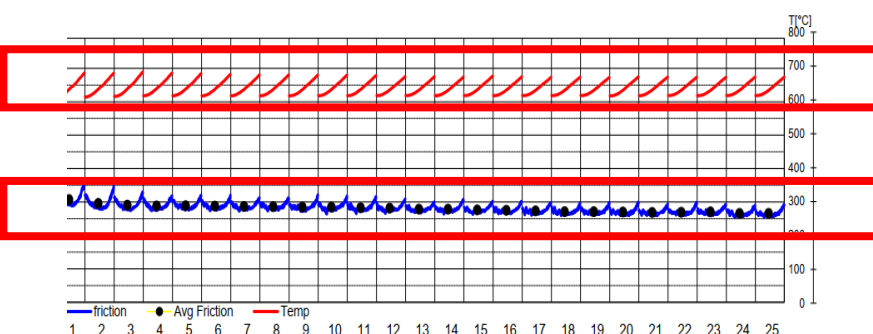
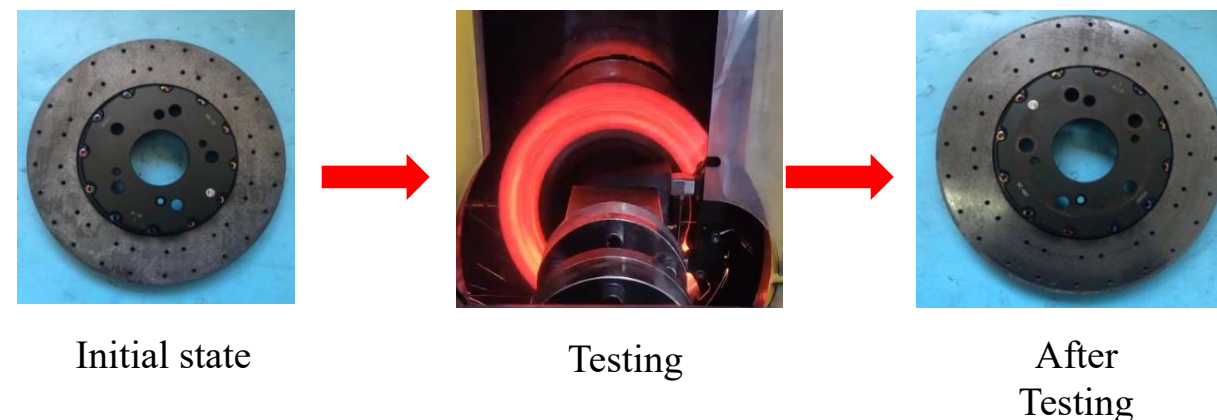


- During the high-load test, the brake disc friction coefficient remained stable throughout the entire process ; ;
- During the 5.2 degradation program, under continuous 700°C and 25 braking cycles, the friction coefficient remained stable and there was no thermal degradation
- The disk surface is normal, **with no obvious wear;**
- The high-load test of the brake disc bench met the requirements.

PART 2 CCM ROTOR TEST

High Temperature Durability Test

High Temp Test		
No.	Project	Conditions
1.0	Break-in	Number of braking cycles: 50; Braking pressure: 25 bar; Initial speed: 150 km/h; Final speed: 50 km/h; Cooling airflow: 4000 m ³ /h; Initial braking temperature: <150°C
2.0	Thermal Decay	Number of braking cycles: 2000; Deceleration: 0.8g; Initial speed: 234km/h; Final speed: 90km/h; Cooling airflow: 4000m ³ /h; Initial braking temperature: calculated by formula; Maximum temperature: 725°C



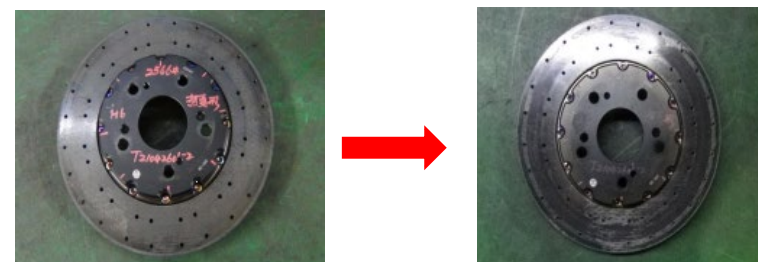
Braking at 700°C continuously, the friction coefficient of the brake disc shows no thermal decay

- During the high-temperature durability test, the brake disc friction coefficient remained stable throughout the entire process.
- During continuous braking at 700°C for 2000 cycles, the coefficient of friction remained stable with no thermal fade.
- After the high-temperature durability test, the brake disc surface was normal, with no obvious wear.

PART 2 CCM ROTOR TEST

Bench Salt Spray Corrosion Test

Salt Spray Corrosion Test Procedure		
No	Project	Conditions
1.0	Break-in	Number of braking cycles: 50; Braking pressure: 25 bar; Initial speed: 150 km/h; Final speed: 50 km/h; Initial braking temperature: <150°C
2.0	120 km/h Variable pressure	Number of braking cycles: 1; Braking pressure: 10, 20, 30, 40, 60, 80, 100, 120 bar; Initial speed: 120 km/h; Final speed: 80 km/h; Cooling airflow: 2000 m ³ /h; Initial spray temperature: 80°C; Spray speed: 10 km/h; Spray duration: 10 s
3.0	200 km/h Variable pressure	Number of braking cycles: 1; Braking pressure: 10, 20, 30, 40, 60, 80, 100, 120 bar; Initial speed: 200 km/h; Final speed: 170 km/h; Cooling airflow: 2000 m ³ /h; Initial spray temperature: 80°C; Spray speed: 10 km/h; Spray duration: 10 s
4.0	0.6g high- speed braking	Number of braking cycles: 1 Deceleration: 0.6g Initial speed: 200km/h Final speed: 60km/h Cooling airflow: 4000m ³ /h Initial temperature: 50°C Maximum braking pressure: 160bar
5.0	0.8g high- speed braking	Number of braking cycles: 1 Deceleration: 0.8g Initial speed: 200km/h Final speed: 60km/h Cooling airflow: 4000m ³ /h Initial temperature: 50°C Maximum braking pressure: 160bar
6.0	Cycle	3 times

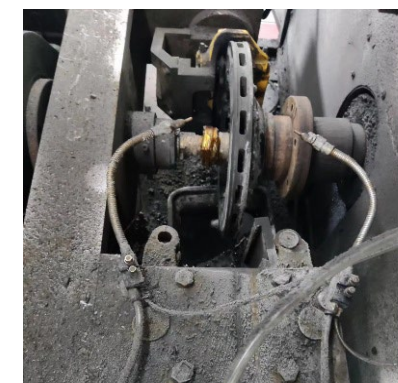


Before Test

After Test



Pads after testing



Testing on the bench

- After the salt spray corrosion test, the brake disc surface was normal, **with no obvious corrosion or wear.**