APP/StopTech Heavy Duty Braking Systems for Armored Vehicle Applications

Toyota LC200 B5/B6/B7 UNIVERSAL HD brake system
# APP/StopTech Heavy Duty Braking Systems for Armored Vehicle Applications

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Size</th>
<th>Model</th>
<th>CAD Data</th>
<th>Confirm Fit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Front Rear</td>
<td>42611-60620</td>
<td>17x7 Toyota OE Steel</td>
<td>CAD data shows 2mm min spoke clearance and 2mm min radial clearance</td>
</tr>
<tr>
<td>2</td>
<td>Front Rear</td>
<td>17x8</td>
<td>Toyota OE Steel</td>
<td>CAD data shows 2mm min spoke clearance and 2mm min radial clearance</td>
</tr>
<tr>
<td>3</td>
<td>Front Rear</td>
<td>18x8</td>
<td>Toyota OE Steel</td>
<td>CAD data shows 2mm min spoke clearance</td>
</tr>
<tr>
<td>4</td>
<td>Front Rear</td>
<td>42611-60650</td>
<td>18x8 Toyota OE Aluminum</td>
<td>WFC shows 2mm min spoke clearance</td>
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<tr>
<td>5</td>
<td>Front Rear</td>
<td>18x8</td>
<td>Toyota OE Aluminum</td>
<td>WFC shows 2mm min spoke clearance</td>
</tr>
<tr>
<td>6</td>
<td>Front Rear</td>
<td>18x8.5</td>
<td>TSS Aluminum</td>
<td>WFC shows 2mm min spoke clearance</td>
</tr>
</tbody>
</table>
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ST-HD Brake System Testing on Toyota LC200 Platform, Armor Simulation

The data and content of this report has been pulled from two locations or testing sources.

StopTech, Compton California

- Test vehicle was a 2012 Lexus LX 570
  
  • Simulated light armor configuration with 1420 lb of ballast in addition to passenger and driver, with each axle at its factory rated gross axle weight (3595 lb front, 4300 lb rear, Manufactures max GVW). Weight was distributed on the floorboards of the vehicle, 60 percent behind the driver/passenger seat and 40 percent behind the second row of seats.

United Arab Emirates

- Test vehicles was a 2012 LC – 200
  
  • Armored protected vehicle B6 with a loaded weight of 11,000 pounds
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Stop Tech Testing:

Two brake configurations were tested, each with freshly-installed, new components:

- OE-equivalent Centric Premium rotors and original equipment Toyota pads with OEM calipers.
  - Front Rotors: 340 x 32mm, straight-vane
  - Rear Rotors: 345 x 18mm, straight-vane

- ST-HD six-piston and four-piston calipers, directional vane rotors and performance pads
  - Front Rotors: 354 x 34mm, AeroVane
  - Front Calipers: ST-HD six-piston
  - Rear Rotors: 354 x 28mm, AeroVane
  - Rear Calipers: ST-HD four-piston

Front ST-HD

Rear ST-HD system
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Stop Tech Testing USA:

- Stopping tests were conducted from 40-0, 60-0, 80-0 and 100-0 mph with both brake configurations. ABS was activated on all stops performed.

- **OEM-Equivalent Components:**
  - Testing from 60-0 mph was interrupted after 10 stops due to brake fade.
  - Brake fade was experienced on 40-0 stops 11 and 12, 60-0 stops 9 and 10, 80-0 stop 4.
  - Average 60-0 mph stopping distance before fade: 143 ft (43.5m)
  - Average 80-0 mph stopping distance before fade: 249 ft (75.9m)

- **StopTech STHD Components:**
  - Completed 16 successful 60-0 stops with no noticeable brake fade.
  - No noticeable brake fade experienced during all testing.
  - Average 60-0 mph stopping distance: 134 ft (40.8m)
  - Average 80-0 mph stopping distance: 241 ft (73.5m)
Stop Tech Testing:

- Analysis of hydraulic pressure measurements indicates that the original equipment brake system suffers substantially from rear-led fade – the small rotor and pad overheat and lose friction capacity steadily, finally resulting in the front system being overheated and stopping distance increasing dramatically.

- StopTech’s ST-HD caliper system substantially increases rear-axle thermal capacity and pad volume, preventing this runaway condition. Furthermore, pressure measurements show that useful brake capacity reserve is available on the rear axle to support additional armor and payload weight increase.

- Measurements before and after testing show the actual consumption of friction material mass was reduced by 46 percent front and 18 percent rear, even though the total braking work done by the ST-HD system was 34 percent greater over the course of the testing that was completed. Combined with increases of 86 percent front and 36 percent rear in friction material loaded, the miles between brake services may be doubled.
USA TESTING

- The Land Cruiser equipped with the ST-HD system achieved a consistent stopping distance of 90-100 feet, with complete control and stability in all stops.
- The Land Cruiser equipped with original equipment brakes exhibited directional instability, tremendously limiting driver confidence and control, and a stopping distance of 140-145 feet, increasing with each further stop by 2-4 further feet as the brakes overheated and faded.
The photo above shows the physical separation of the lead vehicle with OE brakes compared to an identical LC 200 with the ST-HD brake system, stopping from 60mph.
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United Arab Emirates Testing:

- Testing was conducted in the field between two armored Land Cruisers, at approximately 11,000 lbs loaded. Both vehicles were armored to B6 levels, and testing was conducted on a smooth tarmac road surface with air temperatures at 30 Centigrade.
  - 5 stops from 100-0 km/h were conducted with each vehicle/system
    - The ST – HD system consistently stopped 40-50 feet shorter than the OE equipped vehicle.
    - The Land Cruiser equipped with the ST-HD system achieved a consistent stopping distance of 90-100 feet, with complete control and stability in all stops.
    - The Land Cruiser equipped with original equipment brakes exhibited directional instability, tremendously limiting driver confidence and control, and a stopping distance of 140-145 feet, increasing with each further stop by 2-4 further feet as the brakes overheated and faded.
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United Arab Emirates Testing:

Though time and equipment did not allow measurements with the precision of those obtained by StopTech’s engineering group, the tests indicated dramatic improvements from the first stop and directionally as much as 50 percent reduction in braking distance with the ST-HD brake system after several stops. The results achieved in the UAE were performed on 2 - B6 armored LC200s’, the results achieved in the USA were on a stock LX570 with 1420lb of ballast added. This creates some differences obviously in the numbers, but not in the overall direction of the results.

In summary the ST-HD system provides a significant performance increase, extended service life, and increase vehicle stability/safety during hard braking. The prototype systems are now being updated and converted to production parts. They are designed to be used in conjunction with 17” X 7J, 17’ X 8J, and all 18/19” wheels.

Production systems are available ex Stock California, from July 2012 onwards. Further testing on vehicles is being done, and the results will be updated to reflect this.
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## Key features and benefits for the NEW LC200 UNIVERSAL HD brake system.

<table>
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<tr>
<th>Feature</th>
<th>Benefit</th>
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<tbody>
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<td>• Designed specifically for this armored application, NOT adapted from something else.</td>
<td>• Direct bolt on installation. No brackets needed.</td>
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<td>• Engineered to vehicle manufacturer standards.</td>
<td>• FITS ALL STOCK OEM 17&quot; and 18&quot; WHEELS without SPACERS.</td>
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<td>• Unique design and tooling investment so cannot be copied.</td>
<td>• Simplifies service parts needs.</td>
</tr>
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<td>• Braking performance is 50% better than the stock system on the armored platform.</td>
<td>• Price point of the complete system is considerably below other systems on the market, making standard equipment a real option.</td>
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<tr>
<td>• Vehicle stability is greatly increased under braking, improving safety.</td>
<td>• German TUV approved (in process)</td>
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<td>• Low key, unobtrusive optics keep system upgrade invisible.</td>
<td>• Will fit B5, B6, and B7 GVW vehicles.</td>
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<td>• System resistance to IEDs' is improved over aluminum caliper systems.</td>
<td>• 1 brake system for all LC200 versions, and wheel sizes.</td>
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