Light Vehicle Driveline Technologies

Delivering innovative solutions for all driveline configurations

Dana continuously provides greater value to customers by engineering the most state-of-the-art technologies to enhance the fuel economy and durability of today’s light vehicles.
Integrated Driveline Solutions

Dana’s best-in-class technologies offer customers solutions that fit their drivetrain configuration. We are committed to innovation. Our differentiating products accommodate new industry trends to enable the most efficient, high-performance vehicles on the market today.

**Versatile Spicer® Axles**
We engineer Spicer® axles to meet exact customer requirements with various features, materials, and options, including Spicer AdvanTEK® gearing, to do significantly more with less.

**Customizable Spicer® Propshafts**
To meet any vehicle packaging requirement, Dana offers the broadest range of Spicer propshafts on the market today. This offering includes constant velocity and flexible coupling joints with lightweight tube options.

**VariGlide® Continuously Variable Transmission (CVT) Technology**
Providing exceptional drivability, smooth shifting, and fuel savings 5-10% greater than competitive belt technologies, Dana’s completely scalable VariGlide variator has a modular coaxial design compatible with transverse and longitudinal transmission configurations.
Systems for Passenger Cars, Crossovers, SUVs, and Pickup Trucks

**AWD**

All-Wheel Drive

- Disconnecting and full-time AWD systems for transverse and longitudinal drivelines.

**4WD**

Four-Wheel Drive

- Lightweight front and rear axles for fully independent suspension systems.
- Durable front and rear beam axles for rugged applications.

**RWD**

Rear-Wheel Drive

- Lightweight rear axles for fully independent suspension systems.
- Durable rear beam axles for rugged applications.

**Put to the Test**

Dana delivers heavy-duty solutions that provide light-vehicle original equipment manufacturers (OEMs) with the fuel economy, mobility, and durability they seek. Achieving this requires an ongoing commitment to rigorous testing. Every Dana breakthrough is challenged, measured, affirmed – and then tested again. These extensive efforts ultimately benefit customers. Our innovations aren’t just concepts. They’re proven to work.
Spicer® AdvanTEK® Axles

Spicer® AdvanTEK® axles deliver more miles per gallon, enhanced vehicle performance, and maximum durability for the complete spectrum of light vehicles. Even with a compact design, these axles provide greater power density than similar offerings while reducing driveline weight with lighter, higher strength materials and advanced gearing.

Axle Application Range

<table>
<thead>
<tr>
<th>Drive Unit</th>
<th>Beam Axle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mini Car, Truck, Van</td>
<td>M135 M140 M150 M160 M170 M180 M190 M200 M210 M220</td>
</tr>
<tr>
<td>Small Car, Crossover, Minivan</td>
<td>M235 M250 M275 M300</td>
</tr>
<tr>
<td>Mid-size Car, Crossover</td>
<td></td>
</tr>
<tr>
<td>Small SUV</td>
<td></td>
</tr>
<tr>
<td>Mid-size Pickup, Crossover</td>
<td></td>
</tr>
<tr>
<td>Full-size Car, Pickup, SUV, Commercial Light Vehicle</td>
<td></td>
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</tbody>
</table>

Note: Model numbers indicate axle’s ring gear diameter in millimeters.

Torque Management with High-Performance Differentials

Dana offers unique differentials for Spicer AdvanTEK axles, which help customers enhance mobility and improve vehicle performance.

**Trac-Lok®**

This torque-sensing, clutch-style limited slip differential improves both traction and performance. It complements brake-based traction control systems to increase torque transfer and improve brake durability.

**Powr-Lok™**

This differential maintains the same benefits of a Trac-Lok; but adds independent adjustability for bias in drive and coast. The tunable design enables enhanced performance and control on the track or off-road.

**Locking Differential**

Pneumatic or electric differentials can transfer full driveline torque to one wheel by preventing wheel differentiation. Both wheels are required to turn at the same speed in all conditions for increased mobility.
Advanced Axle Technologies for Improved Mobility and Handling

All-Wheel Drive (AWD) Systems

AWD is the fastest growing light-vehicle segment today. Right now, Dana is developing cost-effective product solutions for the AWD segment that are helping to meet the increasing need for more efficient powertrains.

With decades of expertise as a full systems solution provider, Dana is bringing next-generation AWD performance to OEMs of passenger cars, crossovers, and vans. Delivering best-in-class fuel economy and safety, our SmartConnect™ disconnecting AWD system automatically connects and disconnects the secondary driveline – rapidly, and only as required. It is available on both transverse and longitudinal drivelines, with transverse drivelines having the option of either a value-optimizing single disconnect coupling, or a performance-enhancing twin-coupling system that is capable of torque-vectoring, limited-slip, and disconnecting.

Electronic Limited Slip Differential

With Electronic Limited Slip Differential (ELSD) technology, Dana is building on its driveline expertise. ELSD bridges the gap between a full AWD system and a two-wheel drive open differential system, delivering maximum tractive effort.

Our ELSD technology improves stability while cornering, and delivers higher torque capacity and greater controllability. Utilizing proprietary software to determine optimum torque corrections, this innovation corrects unwanted driving behaviors such as oversteer or loss of traction in seconds.

Similar to Dana’s disconnecting AWD technology, it disconnects when not in use to maximize efficiency. In addition, ELSD is available as a bolt-on solution for any FWD transaxle or as a bolt-on or fully integrated solution for any front or rear axle.
Spicer® Propshafts

Spicer® propshafts offer significant benefits for passenger cars, crossovers, SUVs, and light commercial vehicles all around the world. Our propshafts, from U-joints and tubes to the materials and manufacturing processes used, are customized to meet customer specifications and challenging space requirements. Delivering more torque in smaller packages, Spicer propshafts are precision engineered to reduce driveline weight and are expertly balanced for a smoother, quieter ride.

Vehicle Packaging Flexibility in Every Configuration

Our expert engineering/sales team can help you optimize your drivetrain with various packaging options to accommodate specific requirements while improving vehicle performance and efficiency.

Multi-piece propshaft with standard options

Centered and Staked Cardan Joints
Low flex effort and joint looseness.

Advanced Sealed Center Bearings
Extensive range of solutions for on-road, heavy-duty or off-road performance.

Steel Tube and Damper
Tube and damper designs to meet each vehicle’s balance and NVH needs.

One-piece propshaft with maximized options

Constant Velocity End Joints
High angle and power dense design solutions.

No Midshaft Connection
Fewer mechanical parts for greater reliability and reduced weight.

Steel or Aluminum Splined Plunging Tube
Offers lower weight, improved balance, lower plunge force, and meets stringent collapsibility requirements.

Wide Range of Torque Capacities

<table>
<thead>
<tr>
<th>Vehicle Segment</th>
<th>A.</th>
<th>B.</th>
<th>C.</th>
<th>Torque Capacity (Nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>900</td>
</tr>
<tr>
<td>Snap Ring Cardan Joints</td>
<td>103</td>
<td>112</td>
<td>SPL-10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>110</td>
<td></td>
<td>SPL-14</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>118</td>
<td>SPL-18</td>
<td></td>
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<td></td>
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<td></td>
<td>SPL-27</td>
<td></td>
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<td></td>
<td></td>
<td>SPL-38</td>
<td></td>
</tr>
<tr>
<td>Fixed, Rzeppa, and DPM CV Joints</td>
<td>1,000 Nm DOJ</td>
<td>1,400 Nm Rzeppa</td>
<td>3,300 Nm Rzeppa</td>
<td>6,000 Nm Rzeppa</td>
</tr>
<tr>
<td></td>
<td>1,900</td>
<td></td>
<td>SPL-10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1,300</td>
<td></td>
<td>SPL-14</td>
<td></td>
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<td></td>
<td>1,000</td>
<td></td>
<td>SPL-18</td>
<td></td>
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<td></td>
<td>1,560</td>
<td></td>
<td>SPL-27</td>
<td></td>
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<tr>
<td></td>
<td>1,800</td>
<td></td>
<td>SPL-38</td>
<td></td>
</tr>
<tr>
<td>Plunging, Double Offset, and Cross Groove CV Joints</td>
<td>1,000 Nm DOJ</td>
<td>1,400 Nm DOJ</td>
<td>3,300 Nm Cross Groove</td>
<td>6,500 Nm Cross Groove</td>
</tr>
<tr>
<td></td>
<td>1,900</td>
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<td>SPL-10</td>
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<td></td>
<td>1,300</td>
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<td></td>
<td>1,800</td>
<td></td>
<td>SPL-38</td>
<td></td>
</tr>
<tr>
<td>Torque Capacity (Nm)</td>
<td>900</td>
<td></td>
<td>SPL-10</td>
<td></td>
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<td></td>
<td>1,300</td>
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<td></td>
<td>1,800</td>
<td></td>
<td>SPL-38</td>
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</tbody>
</table>
Customized propshaft options to meet customer design requirements

<table>
<thead>
<tr>
<th></th>
<th>Rubber Coupling</th>
<th>Cardan</th>
<th>Staked Cardan</th>
<th>Double Cardan</th>
<th>Rzeppa</th>
<th>Double Offset</th>
<th>Plunging Cross Groove</th>
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</thead>
<tbody>
<tr>
<td>Mass</td>
<td>Medium</td>
<td>Low – Med.</td>
<td>Low – Med.</td>
<td>Highest</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Fixed or Plunging</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Fixed</td>
<td>Plunging</td>
<td>Plunging</td>
</tr>
<tr>
<td>Power</td>
<td>Torque</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
</tr>
<tr>
<td>Speed</td>
<td>Speed</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Maximum Operating Angle</td>
<td>1°</td>
<td>-3°</td>
<td>-3°</td>
<td>8°</td>
<td>12°</td>
<td>6°</td>
<td>8°</td>
</tr>
<tr>
<td>NVH</td>
<td>Constant Velocity</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Plunge Force</td>
<td>N/A</td>
<td>High (Slip Spline)</td>
<td>High (Slip Spline)</td>
<td>High (Slip Spline)</td>
<td>N/A</td>
<td>Low – Med.</td>
</tr>
<tr>
<td></td>
<td>Plunge Stroke Capability</td>
<td>N/A</td>
<td>Long</td>
<td>Long</td>
<td>Long</td>
<td>N/A</td>
<td>Long</td>
</tr>
<tr>
<td></td>
<td>Residual Unbalance</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>High</td>
<td>Low</td>
<td>Medium</td>
</tr>
</tbody>
</table>

Versatility Through Premium Spicer® U-Joints

Our large portfolio of U-joints is engineered to offer long-lasting, reliable performance and reduced noise, vibration, and harshness (NVH) for various driveline configurations.

**Constant Velocity Joints**

Constant velocity joints deliver uniform motion at high joint angles and plunge for reduced driveline NVH. Our fixed Rzeppa joints offer high power density and can operate continually at angles up to 10 degrees and ambient temperatures between -40° to +130° Celsius. Plunging cross groove and double offset joints can continuously operate at angles up to 6 degrees, plunging up to 50 mm at ambient temperatures between -40° to +130° Celsius.

**Cardan Joints**

To fit both steel and aluminum propshafts, a large portfolio of centered and staked and industry standard serviceable snap ring single and double cardan joints are available. These long-lasting cardan joints are engineered for reliability with low maintenance and maintenance-free operation using bearings with advanced grease and sealing for ambient temperatures between -40° to +130° Celsius. Joint articulation torque is precisely controlled for reduced driveline NVH.

**Flexible Coupling Joints**

Flexible couplings are engineered to absorb torsional peaks and lower driveline NVH. End fittings are engineered for long reliable life to fit both steel and aluminum propshafts. Joint operating angle is usually limited to less than 2 degrees and ambient temperatures between -40° to +130° Celsius.

Providing longer life, increased bearing capacity, and lower maintenance costs, Spicer Life® Series U-joints consistently outperform competing products.
Innovations in **Power Conveyance**

Dana understands the pressure that comes with meeting increasing government regulations. That’s why we continually develop the most innovative technologies to solve power conveyance challenges. We leverage more than 110 years of industry experience, as well as our market and customer diversity, to customize technologies for a wide range of vehicles – from passenger cars to light commercial trucks.

The promise of CVT technology – realized

Representing a breakthrough in CVT technology, Dana’s VariGlide® planetary variator provides enhancements relative to dual-clutch transmissions, multi-speed automatics, and conventional belt CVTs.

Unlike the limited efficiency gains of existing belt CVT technologies, beltless VariGlide technology offers a highly adaptable, robust alternative for FWD, RWD, AWD, and hybrid configurations, and its unique modular design and ratio control responsiveness help engineers develop custom transmission architectures and calibrations.

This scalable solution proves more durable than competing belt-based solutions, and provides 5-10% greater fuel economy.

A dedicated VariGlide® team at Dana’s Cedar Park, Texas, global technology center oversees in-house design, prototype manufacturing, and simulation, including a Cadillac ATS test vehicle.
On the forefront of electric and hybrid vehicle technologies

Expanding the company’s portfolio of power technologies and drive axles for electric and hybrid vehicles, Dana has introduced the Spicer® Electrified™ portfolio of fully integrated motor, control, and e-drive technologies that advance electric propulsion systems.

Spicer® gearbox for electric vehicles

Dana offers a variety of electric motor-driven gearboxes for modern electric vehicles. Our designs are optimized for system level performance, considering efficiency, range, packaging, vehicle dynamics, and cost.

One example is our 265 Nm high-speed gearbox, designed for medium-large electric vehicles. This gearbox is paired with a 220 kw motor and reaches input speeds of 14,000 RPM. The gearbox is offered with and without a parking pawl device.

Bringing hybrid advances to market

In the light-vehicle category, Dana’s credibility is now extending into emerging hybrid technologies. With more than a century of axle and gearing expertise, Dana has a unique vantage point. Today, our team of engineers is devising ways to incorporate electric motors into vehicles that had been previously powered solely by an engine.

Today, Dana is leveraging its experience and research across all vehicle markets to accelerate the introduction of cleaner, more efficient drivetrain components for electric and hybrid vehicles. Dana collaborates with automotive manufacturers to develop efficient, lightweight solutions that offer high power density in a smaller package, which is integral in advancing the electric driveline technology and real-world applications of tomorrow.

A network of technology centers

Another Dana strength is our testing prowess. With a network of technology centers located around the world, Dana boasts a significant reach in both regional and global testing applications. Each day, we are working with OEMs to weigh the benefits of new approaches via simulations, to help turn innovative concepts into real-life products.
We’re where our customers are, and where they’re going.

One of the ways we create value is by positioning our technical and manufacturing resources where customers need us globally. Dana now operates in 34 countries.
Dana’s global aftermarket network

Our global aftermarket network provides performance-oriented products for passionate car enthusiasts. With Dana craftsmanship, customers can count on longer life and less downtime. And because we are constantly innovating manufacturing processes, our Spicer® replacement parts will meet or exceed the OE parts that are being replaced. Additionally, complete interchangeability with existing parts provides total product compatibility with no change in part numbers.

A key industry driver

Year after year, Dana puts its technologies to the test by taking part in a number of popular off-roading events. In the past year, Spicer products played an active role in more than two dozen off-roading competitions in three countries. We appreciate that the off-road community values Dana drivetrains. So we do our part through promotions and sponsorships to leverage our brand credibility in the category and build additional excitement among consumers.

Tools that make it easier

Beyond engineering industry-leading performance parts, Dana offers extensive support resources to ensure customers are getting the most out of their vehicles. Brochures, catalogs, software, and apps are all available at spicerparts.com.
Market-Driven Innovation

With more than 110 years of experience, Dana is a world-leading supplier of complete drivetrain solutions for all light vehicles – from mini-cars to light commercial trucks to vans. Spicer® products are consistently proven to outperform the competition with unique features designed to enhance performance, versatility, and durability.

We deliver innovative technologies that meet customer demands worldwide. By anticipating market trends, Dana uses its industry expertise to deliver product solutions that achieve customer goals.

About Dana Incorporated

Dana is a world leader in highly engineered solutions for improving the efficiency, performance, and sustainability of powered vehicles and machinery. Dana supports the passenger vehicle, commercial truck, and off-highway markets, as well as industrial and stationary equipment applications. Founded in 1904, Dana employs thousands of people in 34 countries on six continents who are committed to delivering long-term value to customers.

About Dana’s Light Vehicle Driveline Group

Dana is a leading supplier of traditional and electrified light-vehicle driveline technologies, including complete drivetrain systems and components for passenger cars, crossover vehicles, SUVs, vans, and light trucks. Dana works collaboratively with original-equipment manufacturers and the aftermarket to deliver Dana® axles, Spicer® driv shafts, VanGlide® planetary variator transmission technology, and driveline components with best-in-class efficiency.