



SPICER

Drivetrain Products

Axles
Driveshafts
Off-Highway Transmissions

VICTOR REINZ

Sealing Products

Gaskets and Seals
Cylinder-Head Cover Modules
Thermal-Acoustic Protective Shielding

LONG

Thermal Products

Transmission Oil Coolers
Engine Oil Coolers



About Dana Holding Corporation

Dana is an integral partner for virtually every major vehicle and engine manufacturer worldwide. Dana is a leading supplier of driveline, sealing, and thermal technologies to the global automotive, commercial-vehicle, and off-highway markets. Founded in 1904, the company employs thousands of people across five continents.

What Can Dana Do For You?

Dana provides high quality automotive product solutions in three core areas of the vehicle — driveline, sealing, and thermal systems. This lineup of technologies from one source is designed to offer flexibility to vehicle manufacturers around the world — whether in automotive centers or emerging markets — and ensures that customers get the latest state-of-the-art technologies, as well as products adjusted for specific local markets. With more than a dozen technology centers strategically located throughout the world, Dana engineers have the superior resources to develop, design, test, and manufacture to suit individual customer needs. This close collaboration allows Dana to create everything from advanced single components to fully integrated modular systems.

Driveline Products
Axles and Propshafts for Light Vehicles



Dana Holding Corporation
3939 Technology Drive
Maumee, Ohio, USA 43537
T: 419.887.3000
F: 419.887.5961
www.dana.com



Modern vehicle platforms require advanced driveline technologies. Dana engineers provide innovative solutions tailored to meet the unique needs of individual customers.





Driveline Technology Dana offers a broad range of Spicer® axle and propshaft products that have a history of durable, proven performance. Drawing upon more than 100 years of experience in every type of application, from small passenger cars to the largest on- and off-road construction vehicles, Dana's team of designers will engineer a solution tailored to specific package and budget requirements.

Continuing a Century of Driveline Leadership

Ever since Clarence Spicer engineered the first universal joint in 1904, Dana has been at the forefront of driveline innovation. Today, Dana is a world leader in the supply of axles and propshafts, which offer the combination of time-tested durability and performance, along with continual advancements that meet the evolving needs of new vehicle platforms.



▶ Design and testing take place at the company's research and development center near Toledo, Ohio, USA – one of more than a dozen Dana technology facilities globally.

◀ Centering and staking universal joints is just one of the technologies Dana utilizes in its propshaft manufacturing process.





Spicer® Axles Dana can meet the demands of a full range of vehicle applications – passenger cars, CUVs, SUVs, light trucks, vans, and other commercial and off-highway vehicles. For the light vehicle market, the Spicer axle product line includes independent front and rear axles, front and rear beam-style axles, and differential systems with advanced hypoid gear technology. Axle styles include banjo, clamshell, and Salisbury designs, each of which are tailored to individual customer specifications.

Dana engineers design axles that perform at the highest level, contributing to class-leading noise, vibration, and harshness (NVH) performance required by today's discerning drivers. Dana focuses on issues such as efficiency, weight reduction through materials and power density, and active torque management for stability and mobility. Dana provides products that contribute to the superior ride and safety performance that today's drivers expect.



AdvanTEK® Axles

These high-performance axles are a prime example of Dana's efforts to address efficiency, power density, fuel economy, torque-carrying capacity, and weight. AdvanTEK axles make it possible for vehicles to handle today's high-torque engines.

Features Include:

- Improved gear power density for smaller, lighter axles
- Optimized design for low NVH
- Gear geometry designed specifically for use with aluminum housings
- Enhanced efficiency through lower hypoid offsets
- Improved bearing technology

Dana's light-axle facilities utilizes machining cells with integrated robotics to manufacture precision components.



To support customer vehicle validation and testing, Dana builds thousands of axle and propshaft prototypes each year.

All Dana global manufacturing facilities are supported with local product validation, including dynamometers measuring fatigue on gears and differentials.





Spicer® Propshafts Dana designs and manufactures propshafts for passenger cars, CUVs, SUVs, light trucks, vans, and other commercial and off-highway vehicles, as well as the industrial market. Dana offers a full range of sizes and torque capacities, and material options include high-strength lightweight steel and aluminum.

Dana's light-duty propshaft offering includes seven ranges of traditional snap-ring style cardan joints and a new generation of centered-and-staked cardan joints. Dana's joint offerings include cardan universal joints, double cardan universal joints, flexible couplings, fixed and plunging constant-velocity joints, sealed slip splined joints, and other major subsystems.



Making a difference in the process

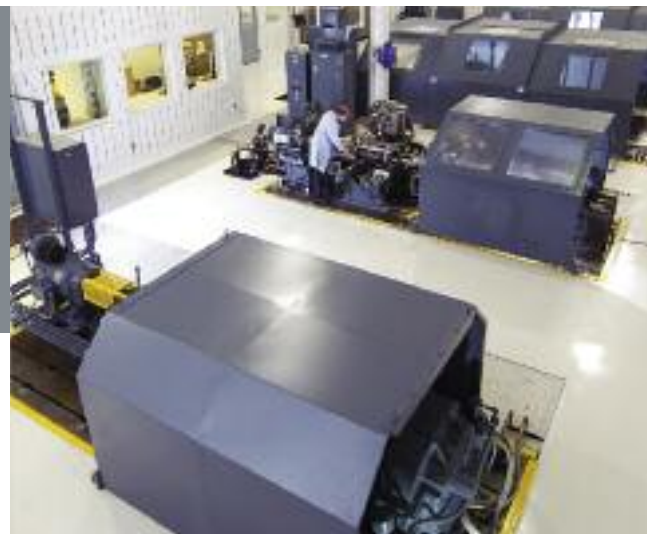
In addition to its global engineering support and proven products, another advantage that sets Dana apart is the sophistication and efficiency of its manufacturing processes.

Features Include:

- Friction welding
- Metal inert gas (MIG) welding
- Magnetarc welding
- Magnetic pulse welding
- Centering-and-staking kits
- High-speed, low unbalance operation for refined ride and drive

The high-speed balancer automatically corrects the propshaft, maximizing NVH performance.

Dana's propshaft dynamometers test bearing life through accelerated durability.



Advantages of magnetarc welding are a quick and highly reproducible process with high precision joining accuracy.





Testing Capabilities From problem solving to new product testing, Dana has the technical expertise and resources to diagnose and resolve key vehicle performance challenges. Dana also has highly advanced metallurgical analysis that enables it to analyze the effects of virtually any conditions.

Driveline testing technologies include:

Fatigue – Beam, impact, linear, spline wear, and torsional.

Tensile/torsion – Axle housing torsional deflection, carrier spreads, propshaft ultimate, fasteners, and tension/compression.

Axle dynamometers – Block cycle durability, differential case fatigue, gear fatigue, and gear score.

Propshaft dynamometers – Bearing life through accelerated durability by varying torque, speed, angle, and temperature conditions.

Environmental – Hot/cold, lube flow analysis, mud bath, and salt corrosion.

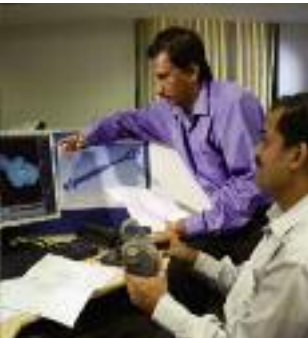
Materials engineering – Hardness, microstructure, chemistry, fractography, mechanical properties, impact, fatigue, residual stress, corrosion, non-destructive testing, and friction and wear testing.



Dana engineers evaluate microstructures of materials.



Dana is able to verify the tooth profile of pinions and rings, as well as splines and precision indices.



Noise, Vibration, and Harshness Dana has extensive experience in the automotive industry assessing and resolving noise, vibration, and harshness (NVH) issues. With its global resources, Dana's NVH experts are able to support its customers in their local locations.

NVH capabilities:

- Component and vehicle level diagnostic capabilities
- Critical speed testing, damper design
- In-vehicle noise and vibration analysis, driveline investigation for NVH
- In-vehicle dynamic speed, torque, angle, force, and displacement measurement
- In-vehicle system balancing
- Vehicle dynamics, testing for life prediction
- Applied research and development for next generation of NVH requirements
- Driveline components NVH integration in full vehicle system

Dana engineering capabilities also include advanced prototyping technology. In-house CAD-based systems enable Dana to precisely model an axle or propshaft to customer specifications.



Dana's Taipei, Taiwan, facility supplies axles and propshafts in the Asia-Pacific region.

Strain gauging axles and propshafts evaluates the performance of the components under real-life vehicle stress conditions.

Global Driveline Presence One of Dana's key strengths is its comprehensive global footprint, which ensures that customers have convenient and timely access to extensive manufacturing, design, and testing resources. Dana operates design centers that are strategically located around the world to provide local support for its axle and propshaft customers. Furthermore, plans are underway to expand this footprint and develop additional locations in high-growth regions of the world.

