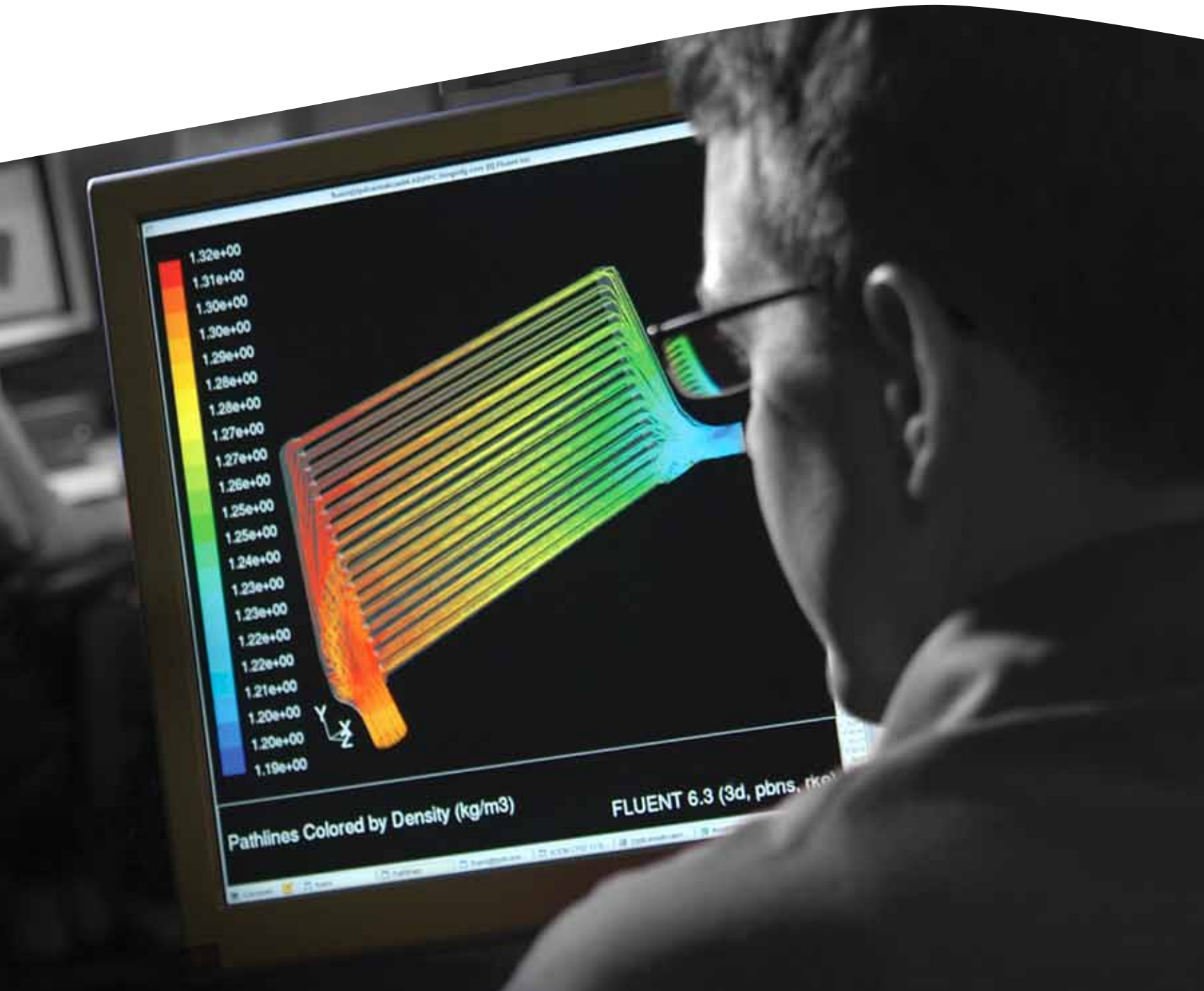


Thermal Products

Using Proven Technology To Create Custom Solutions



LONG[®]
Thermal Products



A world leader in thermal technologies, Dana engineers work to provide heat-transfer solutions that are the result of meticulous design, manufacturing, and testing.

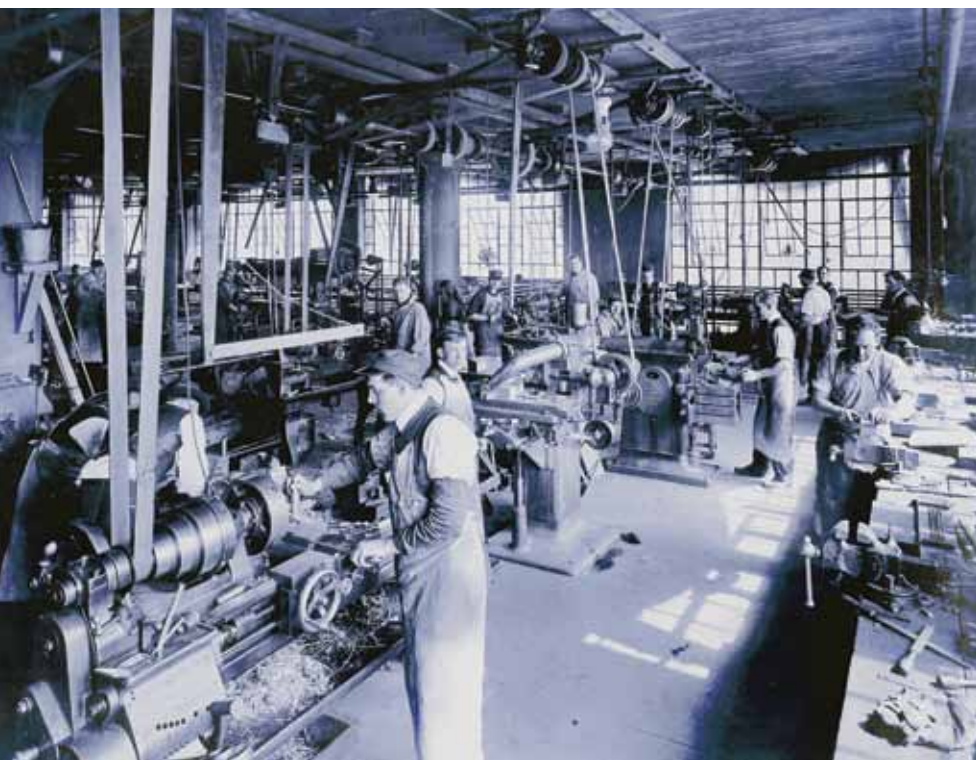




Our Vision The Dana Thermal Products Group strives to be a growth-oriented, world-class supplier of thermal products, providing customers with technology-driven engineered solutions that elevate their products to new levels of excellence.

A Unique Approach

The Dana Thermal Products Group believes that one size does not fit all. Dana engineers work closely with customers to design and create specific solutions, based on requirements such as the space available under the hood. That level of customization enables the majority of Dana thermal products to either outperform competitive heat exchangers of the same size, or to achieve equal performance with a smaller package size. Either way, the result is better value for you.



In 1903, Dana Thermal Products Group, then known as Long Manufacturing, opened for business as specialists in radiator production.



A Complete Range of High-Performance Cooling Products

Dana offers an extensive range of heat-exchange solutions designed to meet customers' changing requirements – everything from enhancing vehicle performance to reducing emissions.



Engine and Transmission Oil Cooling and Warming Products

When engines and transmissions operate at elevated levels for prolonged periods, the heat they generate must be effectively managed to ensure optimum operating conditions and long-term durability.

Oil cooling can be accomplished by air-cooled heat exchangers or coolant-based oil coolers. Likewise, automatic and manual transmissions subjected to high output levels must also be cooled via air or coolant. Dana accomplishes this through a range of custom cooling modules for engines of all sizes.



Fuel Cooling

High-speed diesel engines are being subjected to increasingly stringent emissions standards. High injection pressure provides many benefits, but one side effect is a large increase in the fuel temperature when the fuel is depressurized and sent back to the tank via the return line. This can create extremely hot return fuel that exceeds the limitations of the fuel tank (which is often plastic) and the fuel-injection equipment. To counter this, Dana engineers have developed a variety of fuel-cooling designs. Many of these coolers are designed for underbody mounting (cooled by ambient air), but engine-mounted, liquid-cooled solutions are possible as well.



Power Steering Oil Cooling

Some power steering systems reach temperatures that have the potential to significantly reduce the life of the system. The power steering system creates pressure, in turn creating heat. The rise in the temperature of the system can create loss of steering assist as well as leakage. This primarily occurs when the temperature of the fluid exceeds the specification of hoses and of the seals in the pump. Dana divides power steering oil coolers into four distinct categories: Tube and Fin Cooler, Enhanced Tube Cooler, Combo-Cooler™ System, and Plate Cooler. As the end consumers demand longer warranty periods, power steering oil coolers are one of the components used to ensure a robust system and achieve longer vehicle life.

Charge Air Cooling

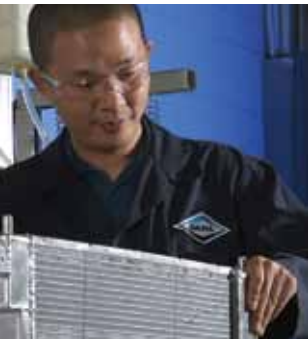
Dana offers a variety of advanced heat exchanger designs for charge air cooling. All provide improved engine volumetric efficiency for specified engine performance. Air-cooled charge air coolers can be packaged in the engine-cooling module along with radiators and condensers, below engine-cooling modules, or in wheel wells for performance-vehicle applications. Water-cooled charge air cooling offers a smaller packaging space for the heat exchanger, which is often mounted on the engine.

Small-Engine Cooling

An extensive range of engine oil cooling products, flexible radiator manufacturing capacity, and cooling-module capability enables Dana to provide highly innovative concepts and quality. Curved coolers, for example, can be customized to individual project specifications.

Fuel-Cell Support Center

Dana operates four facilities worldwide dedicated to fuel-cell technology. Engineers develop thermal-management solutions for fuel processors, water condensers, pre-heaters, and complete cooling modules with integral fans and motors. Engineers are also working to develop solutions for conveying hydrogen, carbon-based fluids, de-ionized water, and air to various parts of the fuel-cell system. Metal bipolar plates are being developed with special coatings, high-temperature flow field channels, high-temperature seals, and heat shields. Additionally, technology is being developed for composite bipolar plates molded to net shape, as well as manifolds and integrated seals.



Technologically Advanced Solutions To achieve an optimized end result, the development of technologically demanding heat-transfer solutions requires a highly collaborative process. Dana engineers and customers work closely throughout the entire development cycle, resulting in products that consistently meet cost and performance targets.

Design

Dana's Product Design Center merges traditional research concepts, "what-if" thinking, and team experience to foster creative solutions. Implementation is accomplished by using the most advanced tools available, including computer-aided design, computational fluid dynamics, and finite element analysis to enhance and upgrade systems.

The combined efforts of Dana's engineering and design staff result in fluid-system designs that incorporate heat exchangers, fans, and hoses to create multi-component units, reducing online assembly times and allowing for pre-vehicle assembly testing. These efforts have also enabled Dana to take the lead in processes such as flux-less aluminum brazing, in which the company utilizes its patented nickel-plated process.

Development

Applied product development dramatically reduces preparation time. Implemented by mixed discipline feasibility teams, this strategy allows for rapid modification and deployment — from prototyping and piloting to full production. Any project's success depends on goal integration as well as constant communication among the sales, engineering, and production staff, so Dana emphasizes this approach.

Dana employs a unique stepped process to product development:

- **Vehicle system approach to heat-transfer design.** Optimal heat-exchange component design, subsystem design integration opportunity.
- **Rapid prototyping support.** Size and performance flexibility.

- **Concurrently engineered new product and process.**

Dedicated product team approach to launch new products, rapid deployment of innovative products and manufacturing methods.

- **Ability to provide required components or complete subsystem.**

Manufacturing

Dana's use of cellular manufacturing enables it to keep costs competitive while providing a higher degree of production flexibility. Dana is able to size its manufacturing equipment to increase utilization while lowering the initial capital costs of developing new products.





Dana's core manufacturing expertise includes:

Balanced Cellular Manufacturing

Manufacturing is conducted on the principle of one-piece flow — all manufacturing operations within a given cell are conducted in a continuous sequence. Cellular manufacturing enables Dana to deliver components significantly faster than using the equivalent equipment on batch production set to run on similar cycle times. This improvement is achieved by reducing the time normally lost while waiting for the accumulation of work in production (WIP) between machines, when arranged for batch production.

Brazing Dana's patented process includes aluminum (flux-less and Controlled Atmosphere Brazing [CAB]), stainless steel, steel, and copper alloy.

Metal Forming Dana employs the use of both mechanical and hydraulic presses with dedicated stamping tooling for high-volume manufacturing. These presses also control, monitor, and record clamp force and position along with punch force and position. Dana has also developed more flexible, lower cost tooling methods, particularly for smaller volume production.

Continuous Strip Plating Dana includes in its process continuous strip plating, which results in substantial savings, as components can be selectively plated on functional surfaces only.

Testing

Dana has a long history of proven in-house testing capabilities that completely validate the product when it graduates from the prototype stage to actual production.

These tests may include:

- Hot and cold temperature field testing
- Cold chamber testing
- In-vehicle testing
- Wind tunnel testing
- Pressure/leak testing
- Vibration testing
- Corrosion testing
- Metallurgical-lab image analysis
- Assembly testing
- Flatness testing
- Testing in an environmental chamber with vehicle chassis dynamometer





Ensuring That Our Global Footprint Leaves the Right Mark As a world leader in the vehicle industry, Dana is committed to undertaking and supporting initiatives that protect the environment. From strict compliance with international policies to its own internal management systems, Dana is dedicated to manufacturing products and creating a workplace that is environmentally friendly in all aspects.

A Commitment To Our Communities

Dana places heavy emphasis on developing and adhering to environmentally friendly processes and products. The company studies and analyzes appropriate laws and directives and then develops and implements its own policies to further protect the environments in which it operates.

Environmental Management

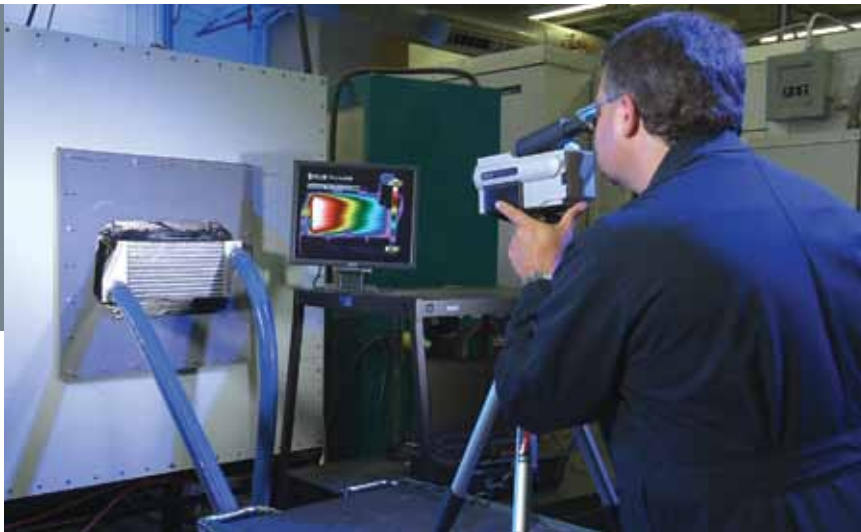
Via stringent internal environmental management systems and policies based on the requirements of ISO 14001, emissions are analyzed against both global and internal standards. Third-party auditing firms ensure that Dana's environmental management programs are in compliance and effective. Environmental management also is evident in energy reduction and the responsible recycling and disposal of hazardous waste.

Health and Safety

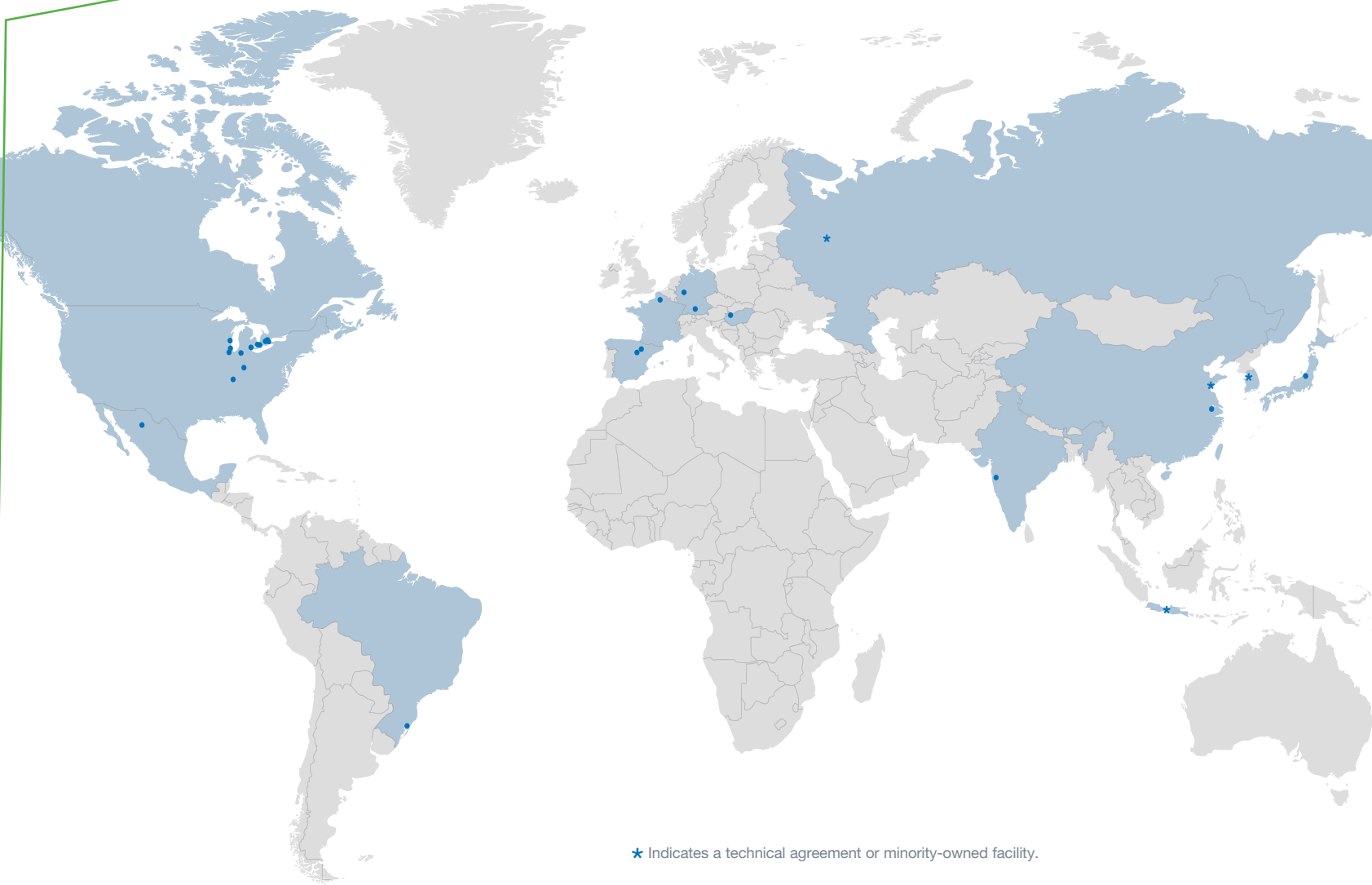
Dana places strict emphasis on health and safety management. In the Thermal Products Group, this translates into a program that exceeds industry standards. All Thermal Products facilities are either already registered for, or working toward, the international safety standard OHSAS 18001. Through a structured risk assessment process, all new and existing equipment and processes are scrutinized to identify potential plant hazards and to reduce risk wherever possible. Where needed, procedures are developed, documented, reviewed, and maintained through a global electronic system. Plant managers, supervisors, and upper management use a cohesive, collaborative approach in deploying processes that keep Dana's people and products safe.

Quality Management

The Dana quality management team tests products not only to ensure internal standards are met, but also to minimize the possibility for recall and establish traceability in the event of a recall. Material and processes are analyzed as they relate to the environment. Once a project concept is formalized, the quality management team performs risk analysis on the design. Testing scripts are created and bench testing is conducted on prototypes.



Dana Power Technologies Group



★ Indicates a technical agreement or minority-owned facility.

GLOBAL MANUFACTURING FACILITIES

Cambridge, Ontario, **Canada**
Mississauga, Ontario, **Canada**
Mount Forest, Ontario, **Canada**
Oakville, Ontario, **Canada**
Wuxi, Jiangsu Province, **China**

Guiscard, Picardie, **France**
Győr, Győr-Moson-Sopron, **Hungary**
Chihuahua, Chihuahua, **Mexico**
Rochester Hills, Michigan, **USA**
St. Clair, Michigan, **USA**





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.

Dana Power Technologies Group

Global Research and Development Locations

Lisle, Illinois, USA
Gravatá, Brazil

Paris, Tennessee, USA
Wuxi, China

Oakville, Ontario, Canada
Neu-Ulm, Germany

Pune, India



LONG®

Thermal Products

For more information, please call 1-888-670-DANA (3262) or visit www.dana.com

Application Policy

Capacity ratings, features, and specifications vary depending upon the model and type of service. Application approvals must be obtained from Dana; contact your representative for application approval. We reserve the right to change or modify our product specifications, configurations, or dimensions at any time without notice.