



ASTM Standards:  
**Driving Quality and Safety  
in the Automotive Industry**

When the estimated 600 million passenger cars travel the roads of the world each day, ASTM International standards are helping to enhance the quality, safety and performance of the vehicles we drive. Throughout the industry supply chain, ASTM standards assist in the delivery of high quality, expertly tested parts and materials to automotive manufacturers. At local car dealerships, ASTM standards aid consumer confidence by better ensuring that the vehicles they buy are durable. And out on the road where safety and reliability matter most, ASTM standards facilitate dependable vehicle performance.



## ASTM STANDARDS: FACILITATING QUALITY IN THE AUTOMOTIVE SUPPLY CHAIN

To supply the automotive sector, steel manufacturers often depend upon test methods developed by ASTM International's oldest committee, **A01 on Steel, Stainless Steel and Related Alloys**. With a membership of 1,000 industry professionals who participate on one or more of 22 standards-writing subcommittees, A01 has responsibility for more than 500 materials specifications and test methods.

To test the readiness and integrity of steel for the rigors of automotive production, manufacturers use such A01 standards as **ASTM A370, Test Methods and Definitions for Mechanical Testing of Steel Products**, which is particularly useful in determining the strength and ductility of steel. Another notable, similarly useful standard is **ASTM A764, Specification for Metallic Coated Carbon Steel Wire, Coated at Size and Drawn to Size for Mechanical Springs**.

## COMMITTEE E28: THE LEADER IN MECHANICAL TESTING STANDARDS

Automotive material suppliers also rely on standards of ASTM International **Committee E28 on Mechanical Testing** to meet quality control demands. Across its 11 subcommittees, E28 maintains more than 55 standards that address ductility and formability, indentation hardness, impact and residual stress — all critical requirements for automotive materials.

One widely referenced E28 standard is **ASTM E8/E8M, Test Methods for Tension Testing of Metallic Materials**. During automotive manufacturing, flat-rolled metals are shaped into finished car designs. Tension tests provide a valuable reference for suppliers to measure the strength and ductility of materials under uniaxial tensile stresses, information used in material comparison, alloy development, quality control and design.

Another key automotive material consideration is springback, which occurs when a metal or alloy is cold-worked; on release of the forming force, the material tends to partially return to its original shape because of elastic recovery properties. To respond to marketplace needs, Committee E28 released **ASTM E2492, Test Method for Evaluating Springback of Sheet Metal Using the Demeri Split Ring Test**. Developed with input from automotive industry stakeholders, E2492 provides a test to evaluate metal springback behavior through simulating a stretch-draw forming process.

## B09: ADVANCING INNOVATION IN POWDER METALLURGY FOR AUTOMOTIVE PARTS

Vital to automotive parts production is powder metallurgy, a process to convert fine metal powders into solid products. Powder metallurgy eliminates the casting, forging and machining operations of conventional fabrication processes, lowering costs and manufacturing cycle time in creating high strength, high precision automotive parts. Through recycling and raw materials conservation, powder metallurgy also reduces waste and energy consumption in manufacturing. Automotive powder metallurgy applications extend throughout the engine, transmission, brakes,

steering, suspension and exhaust systems as well as to such hardware as seats, locks and windshield wipers.

ASTM International advances automotive powder metallurgy technology through **Committee B09 on Metal Powders and Metal Powder Products**, and standards for automotive-related applications can be found in Subcommittee B09.05 on Structural Parts. Included is **ASTM B895, Test Methods for Evaluating the Corrosion Resistance of Stainless Steel Powder Metallurgy (P/M) Parts/Specimens by Immersion in a Sodium Chloride Solution**, which addresses the corrosion resistance of automotive stainless steel powder parts.

Another B09 standard widely used to support powder metallurgy parts for brake and steering systems is **ASTM B823, Specification for Materials for Copper Base Powder Metallurgy (P/M) Structural Parts**. In 2009, Committee B09 released two new standards (**B962** and **B963**) to test sintered metallurgy products properties. Examples of automotive related product applications include gear carriers, transfer case components, air bags, safety restraints, shock absorbers, and auxiliary motor, brake and seat components.

## F16 FASTENER STANDARDS: MAKING A DIFFERENCE IN AUTOMOBILE SAFETY

Fasteners — nuts, bolts, screws, retainers, spring clips or washers — play an important role in car equipment safety. Typically made from plastic or steel, fasteners must have a high shock and vibration resistance and most important, must be strong enough to withstand the impact of accidents.

To test the quality, strength and durability of the fasteners they supply to the automotive market, manufacturers rely on the more than 77 standards developed by ASTM International **Committee F16 on Fasteners**.

Subcommittee F16.02 on Steel Bolts, Nuts, Rivets and Washers has an extensive array of standards, including many that are widely referenced by fastener manufacturers. Notable among these is **A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength**, which covers the chemical and mechanical requirements of three grades of carbon steel bolts and studs in sizes ranging from 1/4 to 4 inches. Also utilized by automotive suppliers is **A325, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength**, which covers the requirements for heavy hex structural bolts intended for use in structural connections.

## ASTM PAINT STANDARDS: EXTENDING THE SERVICE LIFE OF TODAY'S AUTOMOBILES

One important factor that impacts vehicle service life is a car's finish and its ability to withstand corrosion or other degradation. Thanks to many standards from ASTM International **Committee D01 on Paint and Related Coatings, Materials and Applications**, consumers can trust that the luster and durability of their car's finish can stand the test of time. Formed in 1902, D01 today has a diverse membership of 625 global stakeholders and a portfolio of 635 standards. Among its 30 technical subcommittees,

one of the most prominent ones addressing automotive sector standards requirements is D01.27 on Accelerated Testing.

D01.27 provides standards to evaluate film performance of applied paint and finishes subjected to accelerated deterioration in normal and abnormal service environments. Improvements in automotive coating performance and durability can be attributed in part to the group's accelerated test procedures. One popular D01.27 standard for automotive applications is **D6695, Practice for Xenon-Arc Exposures of Paint and Related Coatings**, which simulates the effects of sunlight, moisture and heat on paints. A popular weathering and corrosion test procedure is **ASTM D5894, Practice for Cyclic Salt Fog/UV Exposure of Painted Metal**, which blends cyclic corrosion testing with the evaluation of ultraviolet exposure of paints on metal.

Extreme weather conditions are the focus of another widely referenced D01.27 standard, **D6675, Practice for Salt-Accelerated Outdoor Cosmetic Corrosion Testing of Organic Coatings on Automotive Sheet Steel**. D6675 helps to evaluate the corrosion resistance of organic coatings on metal products exposed to highly salty environments such as areas subjected to deicing salts or coastal areas.

## REDUCING THE HEALTH RISKS OF VOLATILE ORGANIC COMPOUNDS

A critical issue in the automobile industry is identifying and quantifying volatile organic compounds (VOCs) in newly manufactured automobiles. Indoor air contamination is caused by VOC emissions from paints, fabrics, upholstery, carpets and adhesives as well as from exhaust fumes. The toxicity of many of these components creates potential health risks.

In the United States, regulations limiting VOC emissions from paints and coatings rely on ASTM measurement standards for total volatile content, exempt solvent content and paint or coating density. The U.S. Environmental Protection Agency references numerous D01 standards in regulations as acceptable test methods for regulatory compliance. Among these are **D1475, Test Method for Density of Liquid Coatings, Inks and Related Products**, and **D2369, Test Method for Volatile Content of Coatings**.

## G03 HELPS BUILD DURABLE AUTOS

Complementing D01 activities in serving automotive standards needs is ASTM International **Committee G03 on Weathering and Durability**. G03 publishes more than 30 standards, many of which provide valuable utility for automotive manufacturers and suppliers in measuring the performance of automotive paint and coatings, and interior dashboard materials, in varying weathering exposures. Many D01 material standards reference G03 weathering standards for guidance on specimen conditioning and preparation as well as for specifying laboratory accelerated test apparatus and natural outdoor exposure protocols.

Key G03 performance standards are **G151, Practice for Exposing Nonmetallic Materials in Accelerated Test Devices that Use Laboratory Light Sources**; **G152, Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic**

**Materials**; and **G154, Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials**. All of these standards help measure the effects of sunlight (either direct or through window glass), moisture such as rain or dew and heat on automotive components.

## ROAD SAFETY AND PERFORMANCE WITH THE HELP OF ASTM AIRBAG STANDARDS

Airbags play a vital part in protecting people from injury as a result of automobile accidents. Companies involved in the manufacturing of airbags can better ensure their products' performance thanks to ASTM standards focused on the design, quality and performance of inflatable restraints.

ASTM Subcommittee D13.20 on Inflatable Restraints, which is part of **Committee D13 on Textiles**, has taken the lead in developing test methods and practices for such airbag requirements as air permeability on deployment, seam strength, fabric stability during stress, ability to hold inflation pressure and durability. Many of the 12 standards from D13.20 are cited in automotive material specifications used by manufacturers worldwide.

Newest among these is **ASTM D7559/D7559M, Test Method for Determining Pressure Decay of Inflatable Restraint Cushions**, a cost-effective screening test to judge the ability of a roll-over side curtain airbag to maintain needed pressure over time. Side curtain airbags are usually mounted in the roof of a vehicle and burst through the headliner to cover the side window area in the event of a side impact or rollover accident. Other notable D13.20 standards provide guidelines to assess inflatable restraint fabric quality. These include **D5426, Practices for Visual Inspection and Grading of Fabrics Used for Inflatable Restraints**, and **D5446, Practice for Determining Physical Properties of Fabrics, Yarns and Sewing Thread Used in Inflatable Restraints**.

## COMMITTEE F09: EXPERT SOURCE FOR TIRE SAFETY STANDARDS

For nearly 40 years, ASTM **Committee F09 on Tires** has been the pre-eminent source for tire safety standards widely accepted worldwide. Committee F09's 105 members include a broad cross section of industry and public stakeholders who work together to create critical tire performance test methods. F09 has a long history of delivering the relevant, high quality standards that guide tire-related regulatory requirements set forth by the National Highway Traffic Safety Administration.

A recent significant F09 focus has been the testing and measurement of tire aging because of increased tire wear life and resulting additional industry and regulatory interest in the subject. The U.S. Congress formalized this need when it passed the Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act, which calls for an upgrade of tire safety standards, including an aged durability test for light vehicle tires.

Subcommittee F09.30 on Laboratory (Non-Vehicular) Testing responded to the call with a task group to spearhead the development of a protocol to artificially age radial light vehicle tires in the laboratory and then evaluate tire durability on a roadwheel.

A proposed standard that will be useful to manufacturers for tire development, product procurement specifications and government regulatory purposes is also currently under way.

## RELIABILITY IN SEVERE WEATHER DRIVING

Another important role of F09 standards is to measure tire performance in severe weather. ASTM F1572, **Test Methods for Tire Performance Testing on Snow and Ice Surfaces**, and F1805, **Test Method for Single Wheel Driving Traction in a Straight Line on Snow- and Ice-Covered Surfaces**, help assess tire performance on snow and ice. These tests are often done in conjunction with ASTM E1136, **Specification for a Radial Standard Reference Test Tire**, which is used as a reference for tire traction performance evaluations. Today, many tire manufacturers use a product graphic of a peaked mountain with a snowflake to signify that their product has passed these industry accepted traction performance tests for severe snow, ice and winter conditions.

## D02 STANDARDS: CLEANER GASOLINE, BETTER AUTOMOBILE PERFORMANCE

With more than 2,200 members from 65 countries, ASTM **Committee D02 on Petroleum Products and Lubricants** benefits from global expertise that has produced more than 725 standards accepted worldwide.

Virtually any product that requires fuels or operates on moving parts depends on standards developed by D02's 33 subcommittees. Highlighting the diverse D02 portfolio are standards that provide for safe, economical and environmentally sound fuels. These include ASTM D2700, **Test Method for Motor Octane Number of Spark-Ignition Engine Fuel**, and D4814, **Specification for Automotive Spark-Ignition Engine Fuel**, both of which ensure the indicated octane number at local gas stations.

As momentum continues to build for alternative fuels, Committee D02 has established a leadership position in standards for fuels such as ethanol and biodiesel. Ethanol is widely used in the U.S. as a gasoline extender and octane enhancer; it also helps to reduce harmful emissions. Committee D02 has contributed standards that assist in the production of ethanol, including D5798, **Specification for Fuel Ethanol (Ed75-Ed85) for Automotive Spark-Ignition Engines**, and D4806, **Specification for Denatured Fuel Ethanol for Blending with Gasolines for Use as Automotive Spark-Ignition Engine Fuel**.

Biodiesel is an alternative fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats. D02's flagship biodiesel standards are ASTM D6751, **Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels**, and D7467, **Specification for Diesel Fuel Oil, Biodiesel Blend (B6 to B20)**.

Committee D02 also provides standards that address the oil and lubricants used in automotive engines. The performance of motor oil to cool engine parts, reduce friction and protect against

wear and corrosion is supported by D02 standards such as ASTM D4485, **Specification for Performance of Engine Oils**.

## COOPERATION FOR ENGINE COOLANTS

Standards from ASTM International **Committee D15 on Engine Coolants** address a wide range of automotive related issues including cavitation, corrosion and formulations of coolants for cars, light trucks and heavy duty engines. Formed in 1947, D15 now numbers 130 technical experts from 13 countries.

Recent D15 activities respond to changing emissions restrictions and consumer desire for lower automotive cooling system maintenance costs. In 2009, Committee D15 issued three new standards focused on the formulation of 1,3-propanediol (PDO) based engine coolants. PDO, an isomer of propylene glycol, offers dramatically better oxidation resistance than either ethylene glycol or propylene glycol. The D15 standards — D7515, D7517 and D7518 — will help advance the use of PDO in coolant formulations for light, medium and heavy duty automotive engines.

From the early stages of the supply chain, through to manufacturing and assembly operations, and onto the roads and highways throughout the world, ASTM standards are the building blocks of reliable, durable automobiles that are safe to drive.

In addition to standards for the components and technologies of automobiles, ASTM International committees such as D04 on Road and Paving Materials and E17 on Vehicle - Pavement Systems develop standards for the roads and infrastructure used by automobiles, which are not covered in this overview.

## ASTM INTERNATIONAL TECHNICAL COMMITTEES FOR THE AUTOMOTIVE INDUSTRY

The ASTM technical committees highlighted in this piece include:

- ▶ [A01 on Steel, Stainless Steel and Related Alloys](#)
- ▶ [B09 on Metal Powders and Metal Powder Products](#)
- ▶ [D01 on Paint and Related Coatings, Materials and Applications](#)
- ▶ [D02 on Petroleum Products and Lubricants](#)
- ▶ [D13 on Textiles](#)
- ▶ [D15 on Engine Coolants](#)
- ▶ [E28 on Mechanical Testing](#)
- ▶ [F09 on Tires](#)
- ▶ [F16 on Fasteners](#)
- ▶ [G03 on Weathering and Durability](#)