



U.S. ARMY COMBAT CAPABILITIES DEVELOPMENT COMMAND – GROUND VEHICLE SYSTEMS CENTER

Land Vehicle Tire Qualification
3 Dec 2019

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LAND VEHICLE TIRE QUALIFICATION



- Qualification for Land Vehicle Tires for the Global Tires Program (GTP) Contract
- Qualification Process Dependent upon Classification:
 - SAE J2014 / Approved Manufacturer's Part No.
 - Cooperative Approved Tire List (CATL)
 - Product Description (ZZ-T-391, ZZ-T-410, ZZ-T-1619)
- Vehicle qualification testing inherently qualifies OEM tire for that vehicle system
- Replacement tires qualified via testing requirements per classification



SAE J2014 / APPROVED MANUFACTURER'S PART NUMBER



Qualification Process:

1. Need or interest established for additional tire source for vehicle system
2. Testing criteria defined based on vehicle performance requirements (Vehicle Mission Profile, Military Requirements, etc.)
3. Testing funded by tire manufacturer/supplier unless Govt. determines critical need for second source
4. SAE J2014 test costs prohibitive (est. \$800K-\$1.4M)
5. Upon successful completion of testing/PM approval, tire P/N added to specific NSN



SAE J2014



SAE J2014 Pneumatic Tire/Wheel/Runflat Assembly Qualifications for Military Tactical Wheeled Vehicles

- Applies to all combinations of pneumatic tires, wheels, or runflat devices for military tactical wheeled vehicles
- Society of Automotive Engineers' specification
- Developed by SAE Truck and Bus Military Industry Tire Task Force
- Describes test and test methodology which contains the information needed to evaluate and measure tire/wheel/runflat systems and changes in vehicle performance
- Tests required based on vehicle system and mission profile
- Used as basis for procurement for military vehicles
- TACOM Administrator's Manual (AM) for use with SAE J2014, Pneumatic Tire/Wheel/Runflat Assembly Qualifications for Military Tactical Wheeled Vehicles is a separate document which specifies the pass/fail criteria



SAE J2014



- Latest Version: March 2013
 - Scope expanded from tires to tire/wheel/runflat assemblies including individual components used on Military vehicles.
 - Provides commonality (same type of test) for qualification of a tire vs. wheel vs. runflat
 - Provides vehicle related test standard for military wheels as a supplement to SAEJ1992 lab test.
 - Establishes a standard within SAE for military runflat
- 2019: Currently being updated by SAE Truck and Bus Military Industry Tire Task Force
 - Task Force comprised of Government and Industry
 - Potential revisions /additions include:
 - Ozone testing
 - Winter Tire Testing



SAE J2014 TESTS



- *Tire Traction 4.4.2*
- *Vehicle Evasive Maneuver 4.4.3*
- *Bead Unseating 4.4.4*
- *Rolling Resistance 4.4.5*
- *Dimensional Criteria 4.4.6*
- *Mechanical Reliability (Off-road Durability) 4.4.7*
- *Tire Treadlife Durability 4.4.8*
- *Comparative Stopping Distance 4.4.9*
- *Tire Single Wheel Skid Resistance 4.4.10*
- *Rim Slip 4.4.11 ASTM F2803*
- *Load Deflection 4.4.12 SAE J2704*
- *Mission Profile Runflat 4.4.13*
- *Paved Runflat 4.4.14*
- *Curb Impact 4.4.15*
- *Half Round 4.4.16*
- *Absorbed Power Ride Quality 4.4.17*
- *Mission Profile Speed Evaluation 4.4.18*
- *High Speed Evaluation 4.4.19*
- *Steady State Dynamic Stability 4.4.20*
- *Tire Underbody Impingement 4.4.21*
- *Convoy Escort 4.4.22*

The Majority of tests listed are on-vehicle performance tests. The main performance tests are Vehicle Evasive Maneuver, Comparative Stopping Distance, and Steady State Dynamic Stability. These typically include mixed fitment testing of the candidate and reference tire to ensure compatibility. The two main durability tests are the Mechanical Reliability and Tire Treadlife Durability. The tests listed are a menu of tests, and the actual tests to be conducted will depend upon the vehicle system.



SAE J2014

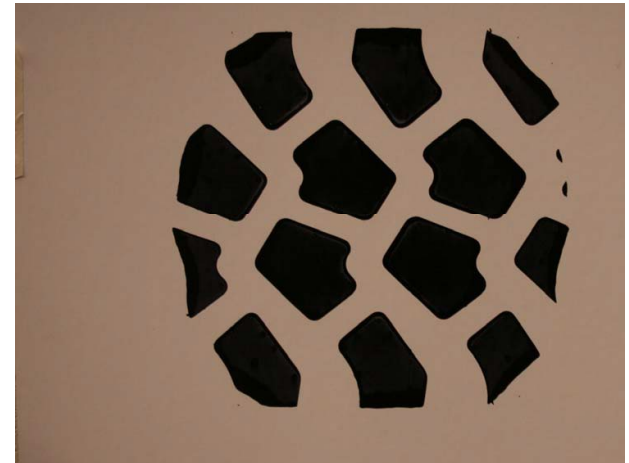


Dimensional Criteria

- Measurements of Candidate Tire compared to Reference
- Overall diameter, section width, weight, tread depth, revolutions per mile, bead width
- Comply with T&RA or ETRTO
- Meet requirements for compatibility with reference tire

Load Deflection

- Vertical force and deflection properties of tire at prescribed conditions including contact patch characteristics
- SAE J2704





SAE J2014 – BRAKING TESTS



Comparative Stopping Distance

- Comparison of stopping distance of candidate with reference tire.
- Wet / Dry Surface
- Candidate tire stopping distance no more than 5% greater than reference tire
- Mixed Fitment

Tire Single Wheel, Skid-Resistance

- Candidate tire on test rig vehicle
- ASTM E274
- Candidate tire peak and slide performance no less than 95% of reference tire



SAE J2014 – HANDLING TESTS



Vehicle Evasive Maneuver

- NATO Lane Change
- Wet /Dry Pavement
- Comparison to reference tire
- Mixed Fitment (reference tire & candidate tire on same vehicle)

Steady State Dynamic Stability

- Steady State Handling
- Vehicle driven at increasing speeds around circle recording lateral acceleration and steering wheel angle
- SAE J2181
- Mixed Fitment





SAE J2014



Tire Traction

- Traction performance of candidate tire relative to reference tire.
- Mud / Sand / Snow
- No less than 95% of reference tire.

Rolling Resistance

- In Accordance with SAE J1269
- Lower Rolling Resistance => Improved Fuel Economy
- Rolling Resistance Coefficient of candidate tire not exceed reference tire by more than 5%
- Pending update to replace with ISO 28580





SAE J2014 – RIDE QUALITY



Half Round

- Vehicle traverses Semi-circle obstacle courses
- Measures vehicle ride comfort & durability of tire/runflat.

Absorbed Power Ride Quality

- Max Speed over RMS roughness course at 6W
- Maximum sustainable power absorbed by human body

Mission Profile Speed Evaluation

- Mission Profile Course
- Max. speed at 6W
- Maximum sustainable power absorbed by human body



Bead Unseating

- Determine tire/rim slip, air loss or bead unseating at minimum recommended inflation pressure
- Figure 8 course
- Sand (moisture content as prescribed)
- Candidate tires compared to reference regarding tire/rim slip and air loss

Rim Slip

- Measure rotational slip at tire/wheel interface under heavy longitudinal load conditions
- ASTM F2803





SAE J2014 MECHANICAL RELIABILITY



Mechanical Reliability (Off-Road Durability)

- Tire durability in off-road conditions
- Durability course:
 - washboard (as prescribed)
 - rock terrain (as prescribed)
 - cross-country (hills/curves with embedded stones)
- 2400 miles duration (Inspection as prescribed)

Criteria:

- Candidate tire must exceed 95% of reference tire mileage
- Candidate tire equal to or less like failures than reference tire (Failure Criteria)
- Candidate tire equal to or better than reference tire in Performance Attributes (*heel/toe wear, chunking, cutting, stone retention, physical appearance*)



SAE J2014 MECHANICAL RELIABILITY



Failure Criteria:

- *Broken or displaced belts or breakers*
- Tread separation exposing casing
- Ply separation
- Bead damage / separation
- Severe open splices and/or liner separations
- Tire induced loss of air
- Exposed or broken casing
- Bulges in tread or sidewall

Performance Attributes:

- Heel/toe wear
- Tread chunking
- Cut growth/cutting
- Number of tires completing the test
- Stone and object retention
- Overall physical appearance



SAE J2014 TIRE TREADLIFE DURABILITY



Tire Treadlife Durability

- Mission profile courses
- 10000 mile duration
- Evaluate tread wear durability performance of candidate tire
- Measurements at prescribed intervals
 - Tread depth at centerline & shoulder
 - Diameter, section width, tread arc width

Criteria:

- Candidate tire exceeds 95% of reference tire mileage
- Candidate tire equal to or less like failures than reference tire (Failure Criteria)
- Candidate tire equal or better than reference in Performance Attributes (heel/toe wear, chunking, cutting, stone retention, physical appearance)
- Candidate tire less than or equal to 1.05 times the references tire overall average percent tread consumed



SAE J2014 – RUNFLAT TESTS



- Mission Profile Runflat Test
 - Mobility of vehicle during air loss of tire
 - Course based on Vehicle system mission profile
 - Specified distance and speed
- Paved Surface Runflat Test
 - Mobility of vehicle during air loss of tire
 - Paved Surface
 - Specified distance and speed





SAE J2014- SELECTIVE TESTS



Curb Impact

- 8 Inch Curb Height
- Evaluates ride comfort and tire/wheel/runflat degradation during operation over curb.



High Speed Evaluation

- Evaluate environmental and vibration forces for tire/wheel/runflat assemblies
- Maximum speed of vehicle, tire, wheel or runflat system.
- Acceleration / Deceleration



SAE J2014- SELECTIVE TESTS



Tire Underbody Impingement

- Evaluates potential interference of tires with underbody
- Full Compression and Full Extension of Suspension



Convoy Escort

- Evaluate tire thermal properties at continuous operation
- High ambient temperatures, highway speed



VEHICLE SPECIFIC TESTING



Approved Manufacturer's Part Number Classification:

Other tests may be required in conjunction with SAE J2014
or specific to the vehicle system

Example: Backward Stability ASME B30.5
- Crane Application



COOPERATIVE APPROVED TIRE LIST (CATL)



- List of approved commercial tires qualified through limited testing
- CATL-1922 - Highway Tires
- CATL-1923 – Off-Road Tires
- Standards Used
 - ASTM F-1922, Standard Test Method for Highway Tires
 - ASTM F-1923 Standard Test Method for Off Road and Low Speed Tire



PRODUCT DESCRIPTION



Tires defined by Product Description (ZZ-T-391, ZZ-T-410, ZZ-T-1619)

- Commercial item (Agricultural, Mining, Skid Steer, Solid tires)
- Tire must meet product description (size designation, load/ ply rating, load and inflation pressure)
- Dimensional requirements (tire diameter, width, tread depth) must be in accordance with industry standards (T&RA, ETRTO)
- Each ZZ-T spec has specific categories in the part number to define which service category, radial or bias, tubetype or tubeless, tread type.
- Tire must meet any additional product description requirements
 - Example: Solid Tires (non-marking compound)



SUMMARY:



- Qualification Process Dependent upon Classification:
 1. SAE J2014 / Approved Manufacturer's Part No.
 2. Cooperative Approved Tire List (CATL)
 3. Product Description (ZZ-T-391, ZZ-T-410, ZZ-T-1619)



SUMMARY



- Questions?