

ZZ-T-381P
AMENDMENT -1
MARCH 15, 1984

FEDERAL SPECIFICATION
TIRES, PNEUMATIC, VEHICULAR (HIGHWAY)

THIS AMENDMENT, WHICH FORMS PART OF FEDERAL SPECIFICATION
ZZ-T-381P, DATED AUGUST 1, 1983, WAS APPROVED BY THE GENERAL
SERVICES ADMINISTRATION FOR THE USE OF ALL FEDERAL AGENCIES.

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PARAGRAPH 4.6.1.1: DELETE IN ITS ENTIRETY AND SUBSTITUTE:

4.6.1.1 VEHICLES. THE VEHICLES USED FOR TESTING (CONVENTIONAL TYPE TIRES) A PARTICULAR GROUP OF TIRES SHALL BE OF THE SAME MODEL, HAVE IDENTICAL HORSEPOWER ENGINES, BRAKE SHOES, BRAKE DRUMS, SUSPENSION, ETC., AND HAVE IDENTICAL CURB WEIGHT. THE LOAD ON EACH WHEEL SHALL BE NOT LESS THAN 100 PERCENT, AND NO MORE THAN 104 PERCENT OF THE LOAD SPECIFIED IN APPENDIX A. AFTER THE VEHICLES ARE CORRECTLY LOADED, THEY SHALL STAND FOR 48 HOURS. THIS IS DONE TO VERIFY THAT THE SUSPENSION SYSTEM HAS THE LOAD CARRYING CAPACITY. IF THE SUSPENSION BOTTOMS OUT. THE VEHICLE SHALL NOT BE USED, A CONSTANT WEIGHT SHALL BE MAINTAINED IN THE DRIVER'S SEAT AREA IN EACH VEHICLE. VEHICLES SHALL BE ALIGNED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS, THE WHEELS SHALL BE ALIGNED BEFORE EACH TEST. THE TOE-IN AND OVERALL VEHICLE WHEEL ALIGNMENT SHALL BE CHECKED BEFORE EACH 500-MILE PERIOD. ANY CHANGE IN THE VEHICLE OR WHEEL ALIGNMENT TO THAT WHICH IS NOT WITHIN THE MANUFACTURER'S SPECIFICATIONS SHALL BE RECORDED AND CORRECTED, VEHICLES SHALL BE INSPECTED BEFORE EACH 500-MILE PERIOD FOR LOOSE STEERING LINKAGE, LOOSE SUSPENSION, LOOSE WHEEL NUTS, RIMS, ETC. (PASSENGER CAR RIMS SHALL NOT HAVE MORE THAN .034 INCH (TIR) LATERAL OR RADIAL RUNOUT. LIGHT TRUCK RIMS SHALL HAVE NOT MORE THAN .055 INCH (TIR) LATERAL OR RADIAL RUNOUT. TRUCK-BUS RIMS SHALL NOT HAVE MORE THAN .065 INCH (TIR) LATERAL OR RADIAL RUNOUT.) DEFECTS SHALL BE RECORDED AND CORRECTED, THE VEHICLES ON WHICH M TIRES ARE MOUNTED SHALL BE OPERATED ON HIGHWAYS WITH AT LEAST FOUR (4) LANES (TWO (2) LANES IN EACH DIRECTION WITH PAVED SURFACES FREE OF ICE AND SNOW AND OVER THE SAME ROUTE. AT LEAST 80 PERCENT OF THE TESTING SHALL BE CONDUCTED AT 55 MPH. TIRES OF MIXED SIZES SHALL NOT BE ALLOWED ON ANY TEST VEHICLE, THE TEST TIRES OF GROUPS 1A, 2, 2S, 3, AND 3S SHALL BE MOUNTED ON THE TEST VEHICLES AS SINGLES, ONE TIRE ON EACH WHEEL POSITION. TIRES OF EACH GROUP SHALL BE TESTED ON VEHICLES IN CARAVAN RUNNING AT THE SAME TIME, WITH THE VEHICLES A SHORT DISTANCE APART (PREFERABLY NOT MORE THAN TWO (2) VEHICLE LENGTHS APART), TO ASSURE THAT EACH TIRE IS TESTED UNDER THE SAME CLIMATIC AND ROAD CONDITIONS, THE TESTING SHALL CONSIST OF THE FOLLOWING:

THE TEST SHALL CONSIST OF 16,000 MILES (~~120~~ MILES) OF OPERATION FOR EACH TIRE IN GROUP 1A, "AND 20,000 MILES (~~120~~ MILES) OF OPERATION FOR EACH TIRE IN GROUPS 2, 2A, 3, AND 3A. EACH TIRE SHALL BE ROTATED TO A DIFFERENT WHEEL POSITION AT EACH 500-MILE PERIOD OF THE TEST. THIS ROTATION PLAN CONTINUES FROM ONE VEHICLE TO ANOTHER UNTIL THE REQUIRED MILES OF TESTING, AS SPECIFIED FOR EACH INDIVIDUAL TIRE ARE COMPLETED. IN THIS ROTATION PLAN, THE TEST TIRES OF A PARTICULAR TIRE MANUFACTURER SHALL BE MOUNTED ON THE SAME AXLE AT ALL TIMES DURING THE TEST (SEE TABLE III WHICH SHOWS TYPICAL TIRE ROTATION PLAN FOR GROUP 2A TIRES, NUMBER 1 THROUGH 24 BEING ROTATED THROUGH 6 VEHICLES FOR 12,000 MILES), IF ONLY A SINGLE VEHICLE IS INVOLVED, THE TIRE ROTATION FOR ALL GROUPS AND TYPE OF TIRES SHALL CONTINUE ON THAT VEHICLE OR THE DURATION OF THE TEST. EACH DRIVER SHALL BE ROTATED TO A DIFFERENT VEHICLE AT EACH 500-MILE PERIOD OF THE TEST. WHEN ALL THE VEHICLES OF A PARTICULAR CARAVAN HAVE BEEN USED, THEN THE DRIVER ROTATION IS REPEATED IN THE SAME MANNER AND IN THE SAME CARAVAN UNTIL THE COMPLETION OF THE MILEAGE TEST REQUIREMENTS FOR THE TIRES OF THAT PARTICULAR CARAVAN, EACH VEHICLE SHALL BE ROTATED TO A DIFFERENT POSITION IN A PARTICULAR CARAVAN AT EACH 500-MILE PERIOD OF THE TEST, WHEN ALL THE POSITIONS OF A PARTICULAR CARAVAN HAVE BEEN USED, THEN THE VEHICLE ROTATION IS REPEATED IN THE SAME MANNER AND IN THE SAME CARAVAN UNTIL THE COMPLETION OF THE MILEAGE TEST REQUIREMENTS FOR THE TIRES OF THAT PARTICULAR CARAVAN,

PARAGRAPH 4.6.1.4: DELETE IN ITS ENTIRETY AND SUBSTITUTE:

4.6.1.4 TREAD LIFE, A COMPUTATION SHALL BE MADE AND RECORDED OF THE TREAD LOSS (PERCENT SKID DEPTH LOSS) OF THE TIRES SUBMITTED FOR QUALIFICATION, THE TREAD LOSS SHALL BE DETERMINED FROM SKID DEPTH MEASUREMENTS TO THE NEAREST 0.001-INCH TAKEN AT THE IDENTICAL POINTS WITHIN EACH TIRE GROOVE, AS USED IN THE NEW TIRE, EQUALLY SPACED AROUND THE CIRCUMFERENCE OF THE TIRE AND THE RESULTS AVERAGED. THE FIRST MEASURING POINT (THE MEASURING POINT SHALL BE A DIMPLE APPROXIMATELY 1/64 INCH DEEP AND 1/16 INCH ROUND) IN EACH GROOVE SHALL BE DOWN AND LONGITUDINAL FROM THE MEASURING POINT IN THE PRECEDING GROOVE TO ALLOW FOR MAXIMUM COVERAGE OF THE TREAD. NUMBER OF MEASURING POINTS DEPENDS ON THE NUMBER OF GROOVES. MEASUREMENTS SHALL BE MADE WHILE FACING THE SERIAL SIDE OF THE TIRE, AND LOOKING DOWN INTO THE GROOVE, AT 3 O'CLOCK, AT THE EDGE OF THE DIMPLE, DO NOT MEASURE ON THE TREADWEAR INDICATORS, EACH SUCCEEDING 2,000-MILE MEASUREMENT SHALL BE AT THE SAME IDENTICAL POINTS.

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IF A TIRE DOES NOT HAVE AT LEAST THREE MAJOR GROOVES WITH ONE OF THESE GROOVES WITHIN 1/2 INCH OF THE CENTERLINE OR AT LEAST FOUR MAJOR GROOVES WITH TWO OF THESE GROOVES SO LOCATED THAT THEIR OUTERMOST POINT IS WITHIN TEN PERCENT OF THE S70 OF THE CENTERLINE, THE MANUFACTURER SHALL MOLD OR CUT SIX MEASURING VOIDS IN THE AREA NOT MEETING THE ABOVE REQUIREMENT, THE SIX MEASURING VOIDS SHALL BE EQUALLY SPACED AROUND THE TIRE TO THE EXTENT THAT IS PRACTICAL, EACH MEASURING VOID MAY BE PLACED ON EITHER SIDE OF THE CENTERLINE OF THE TIRE. THE MEASURING VOIDS SHALL HAVE A MINIMUM DEPTH AS SHOWN IN APPENDIX A FOR A PARTICULAR TIRE SIZE, THE SUGGESTED TOOLS USED TO INSTALL MEASURING VOIDS MAY BE A STANDARD HOT KNIFE, REGROWING TOOL, OR AN APPROXIMATE 1 TO 1 3/4 INCH BY 1/8 TO 1/4 INCH BUFFING DISC. THE MOLDED OR CUT-IN MEASURING VOIDS SHOULD BE CRESCENT SHAPED. STUD HOLE TYPE VOIDS SHALL NOT BE ALLOWED. MINOR CRACKING OR CUTTING ASSOCIATED WITH THESE VOIDS SHALL NOT RESULT IN A TEST FAILURE. (NOTE: MEASURING VOIDS ARE ONLY REQUIRED FOR THE TIRE SUBMITTED FOR TESTING AND NOT FOR TIRES SUPPLIED UNDER CONTRACTS.) THE PERCENT SKID DEPTH LOSS OF THE TIRES SUBMITTED FOR QUALIFICATION SHALL BE COMPUTED BY THE FORMULA:

$$\frac{\text{ORIGINAL SKID DEPTH MINUS REMAINING SKID DEPTH} \times 100}{\text{ORIGINAL SKID DEPTH}}$$

THE MAXIMUM ALLOWABLE PERCENT SKID DEPTH LOSS OF TIRES (AVERAGE OF TWO TIRES) SUBMITTED BY THE MANUFACTURERS FOR QUALIFICATION SHALL BE NOT GREATER THAN THE AVERAGE DEPTH LOSS OF ALL TIRES TESTED PLUS ONE STANDARD DEVIATION, EXCLUDING THE EXTREME VALUES FROM THE COMPUTATION (SEE 3,4.7)0 THE STANDARD DEVIATION SHALL BE COMPUTED BY THE FOLLOWING FORMULA:

$$\sigma = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{(n-1)}}$$

σ = STANDARD DEVIATION

\bar{x} = AVERAGE

$(\sum x)^2$ = SUM SQUARED

$\sum x^2$ = SUM OF SQUARES

n = NUMBER OF POPULATION

$n-1$ = NUMBER OF POPULATION MINUS ONE

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PARAGRAPH 4.7.1: LINE 11, BETWEEN "ON" AND "PAVED", ADD: "A TRACK WITH",

PARAGRAPH 4.7.3: LINE 1, DELETE: "ON PAVED SURFACES",

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PARAGRAPH 4.8.1: DELETE IN ITS ENTIRETY AND SUBSTITUTE:

4.8.1 VEHICLES. THE VEHICLES USED FOR TESTING HIGH SPEED GROUP 1A TIRES SHALL BE OF THE SAME MODEL, HAVE IDENTICAL HORSEPOWER ENGINES, BRAKE SHOES, BRAKE DRUMS, SUSPENSION, ETC., AND HAVE IDENTICAL CURB WEIGHT, THE LOAD ON EACH WHEEL SHALL BE NOT LESS THAN 100 PERCENT, AND NO MORE THAN 104 PERCENT OF THE LOAD SPECIFIED IN APPENDIX A. AFTER THE VEHICLES ARE CORRECTLY LOADED, THEY SHALL STAND FOR 48 HOURS. THIS IS DONE TO VERIFY THAT THE SUSPENSION SYSTEM HAS THE LOAD CARRYING CAPACITY IF THE SUSPENSION BOTTOMS OUT, THE VEHICLES SHALL NOT BE USED, THE VEHICLES SHALL BE ALIGNED IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS, THE WHEELS SHALL BE ALIGNED BEFORE EACH TEST, THE TOE-IN AND OVERALL VEHICLE AND WHEEL ALIGNMENT SHALL BE CHECKED BEFORE EACH 500-MILE PERIOD. ANY CHANGE IN THE VEHICLE OR WHEEL ALIGNMENT TO THAT WHICH IS NOT WITHIN THE MANUFACTURER'S SPECIFICATIONS SHALL BE RECORDED AND CORRECTED,

VEHICLES SHALL BE INSPECTED BEFORE EACH 500-MILE PERIOD FOR LOOSE STEERING LINKAGE, LOOSE SUSPENSION, LOOSE WHEEL NUTS, RIMS, ETC. (RIMS SHALL NOT HAVE MORE THAN .034 INCH (TIR) LATERAL OR RADIAL RUNOUT.) DEFECTS SHALL BE RECORDED AND CORRECTED. THE VEHICLES ON WHICH THE TIRES ARE MOUNTED SHALL OPERATE ON PAVED SURFACES FREE OF ICE AND SNOW AND OVER THE SAME ROUTE AT A SPEED OF 85 ± 5 MPH TO THE EXTENT PRACTICABLE, AT LEAST 80 PERCENT OF THE TESTING SHALL BE CONDUCTED AT SPEEDS OF 85 ± 5 MPH. TIRES OF MIXED SIZES SHALL NOT BE ALLOWED ON ANY TEST VEHICLE, TIRES SHALL BE TESTED ON VEHICLES IN CARAVAN RUNNING AT THE SAME TIME TO ASSURE THAT EACH TIRE IS TESTED UNDER THE SAME CLIMATIC AND ROAD CONDITIONS. TESTING SHALL CONSIST OF THE FOLLOWING:

THE TEST SHALL CONSIST OF 4,000 MILES (~~±20~~ MILES) OF OPERATION FOR EACH TIRE. EACH TIRE SHALL BE ROTATED TO A DIFFERENT WHEEL POSITION AT EACH 500-MILE PERIOD OF THE TEST, THIS ROTATION PLAN CONTINUES FROM ONE VEHICLE TO ANOTHER UNTIL THE REQUIRED MILES OF TESTING, AS SPECIFIED FOR EACH INDIVIDUAL TIRE, ARE COMPLETED. IN THIS ROTATION PLAN, THE TEST TIRES OF A PARTICULAR TIRE MANUFACTURER SHALL BE MOUNTED ON EACH END OF THE SAME AXLE AT ALL TIMES DURING THE TEST (SEE TABLE 111 WHICH SHOWS TYPICAL TIRE ROTATION PLAN). IF ONLY A SINGLE VEHICLE IS INVOLVED, THE TIRE ROTATION SHALL CONTINUE ON THAT VEHICLE FOR THE DURATION OF THE TEST, EACH DRIVER SHALL BE ROTATED TO A DIFFERENT VEHICLE AT EACH 500-MILE PERIOD OF THE TEST, WHEN ALL THE VEHICLES OF A PARTICULAR CARAVAN HAVE BEEN USED, THEN THE DRIVER ROTATION IS REPEATED IN THE SAME MANNER AND IN THE SAME CARAVAN UNTIL THE COMPLETION OF THE MILEAGE TEST REQUIREMENTS FOR THE TIRES OF THAT PARTICULAR CARAVAN, A CONSTANT WEIGHT SHALL BE MAINTAINED IN THE DRIVER'S SEAT AREA BY USE OF MOVEABLE WEIGHTS, IN EACH VEHICLE OF A CARAVAN, EACH VEHICLE SHALL BE ROTATED TO A DIFFERENT POSITION IN A PARTICULAR CARAVAN AT EACH 500-MILE PERIOD OF THE TEST. WHEN ALL THE POSITIONS OF A PARTICULAR CARAVAN HAVE BEEN USED, THEN THE VEHICLE ROTATION IS REPEATED IN THE SAME MANNER AND IN THE SAME CARAVAN UNTIL THE COMPLETION OF THE MILEAGE TEST REQUIREMENTS FOR THE TIRES OF THAT PARTICULAR CARAVAN,

PARAGRAPH 4.8.3: LINE 1, DELETE: "ON PAVED SURFACES",

PARAGRAPH 4.8.4: DELETE IN ITS ENTIRETY AND SUBSTITUTE:

4.8.4 TREAD LIFE. A COMPUTATION SHALL BE MADE AND RECORDED OF THE TREAD LOSS (PERCENT SKID DEPTH LOSS) OF THE TIRES SUBMITTED FOR QUALIFICATION. THE TREAD LOSS SHALL BE DETERMINED FROM SKID DEPTH MEASUREMENTS TO THE NEAREST 0.001 INCH TAKEN AT THE IDENTICAL POINTS IN EACH TIRE GROOVE, AS USED IN THE NEW TIRE, EQUALLY SPACED AROUND THE CIRCUMFERENCE OF THE TIRE AND THE RESULTS AVERAGED. THE FIRST MEASURING POINT (THE MEASURING POINT SHALL BE A DIMPLE APPROXIMATELY 1/64 INCH DEEP AND 1/16 INCH ROUND) IN EACH GROOVE SHALL BE DOWN AND LONGITUDINAL FROM THE MEASURING POINT IN THE PRECEDING GROOVE TO ALLOW MAXIMUM COVERAGE OF THE TREAD, NUMBER OF MEASURING POINTS DEPENDS ON THE NUMBER OF GROOVES, MEASUREMENTS SHALL BE MADE WHILE FACING THE SERIAL SIDE OF THE TIRE, AND LOOKING DOWN INTO THE GROOVE, AT 3 O'CLOCK, AT THE EDGE OF THE DIMPLE. Do NOT MEASURE ON THE TREADWEAR INDICATORS, EACH SUCCEEDING 2,000-MILE MEASUREMENT SHALL BE AT THE SAME, IDENTICAL POINTS.

THE PERCENT SKID DEPTH LOSS OF THE TIRES SUBMITTED FOR QUALIFICATION SHALL BE COMPUTED BY THE FORMULA:

$$\frac{\text{ORIGINAL SKID DEPTH MINUS REMAINING SKID DEPTH} \times 100}{\text{ORIGINAL SKID DEPTH}}$$

THE MAXIMUM ALLOWABLE PERCENT SKID DEPTH LOSS OF TIRES (AVERAGE OF TWO TIRES) SUBMITTED BY THE MANUFACTURERS FOR QUALIFICATION SHALL BE NOT GREATER THAN THE AVERAGE DEPTH LOSS OF ALL TIRES TESTED PLUS ONE STANDARD DEVIATION, EXCLUDING THE EXTREME VALUES FROM THE COMPUTATION (SEE 3,4,7), THE STANDARD DEVIATION SHALL BE COMPUTED BY THE FOLLOWING FORMULA:

$$\sigma = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{(n-1)}}$$

σ = STANDARD DEVIATION

\bar{x} = AVERAGE

$(\sum x)^2$ = SUM SQUARED

$\sum x^2$ = SUM OF SQUARES

n = NUMBER OF POPULATION

$n-1$ = NUMBER OF POPULATION MINUS ONE