

ZZ-T-441H
June 13, 1989
SUPERSEDING
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FEDERAL SPECIFICATION

TIRE, PNEUMATIC: RETREADED AND REPAIRED

This Federal specification is approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal Agencies.

1. SCOPE AND CLASSIFICATION

1.1. Scope. This specification prescribes methods, procedures, and acceptable commercial practice processing applicable to retreading or repairing of pneumatic tires for use by U.S. Government activities with the goal of providing reliable performance capabilities as specified in Federal Specifications ZZ-T-381, ZZ-T-410, ZZ-T1083, and ZZ-T-1619, with economy and conservation of resources; and in addition, specifically requires mandatory preaward facility certification.

1.2 Classification.

1.2.1 Groups. Tires are grouped as follows:

1. Passenger car
2. Light truck, light utility trailers and other miscellaneous light vehicles.
3. Truck, bus and medium to large trailers
4. Special service (including Military, agricultural, off-the-highway, and industrial tires marked not for highway services (NHS)).

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1.2.2 Types. Retreaded and repaired tires shall be of the following types as specified (see 6.1):

I. Retread: uncured tread method

Type I-A Full
Type I-B Top
Type I-C Relugged
Type I-D Bead-to-bead

II. Retread: precured tread method

Type II-A Full
Type II-B Top

III. Repair

Type III-A Nail hole
Type III-B Spot
Type III-C Reinforcement
Type III-D Section

1.2.3 Classes.

Class r/t - Regular tread
Class a/s - All season tread
Class s/t - Snow tread
Class a/t - All terrain tread
Class o/o - On/off highway tread
Class d/a - Drive axle tread

2. APPLICABLE DOCUMENTS

2.1. Government Documents. The following documents, issues in effect on date of invitation for bids or requests for proposal, form a part of this specification to the extent specified herein.

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Federal Specifications:

ZZ-P-112 - Patch, Repair (Self-Vulcanizing, Hot, for Inner Tubes and Tubeless Tires)

ZZ-T-416 - Tire, Pneumatic: Retread and Repair Material.

Fed. Test Method Std. No. 601 - Rubber: Sampling and Testing

ZZ-T-381 - Tire, Pneumatic, Vehicular (Highway)

ZZ-T-410 - Tire, Pneumatic, Industrial

ZZ-T-1083 - Tire, Pneumatic, Low Speed, Off Highway

ZZ-T-1619 - Tire, Pneumatic, Agricultural

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards, and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington D.C. 20402).

(Single copies of this specification, and other Federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from the General Services Administration Business Service Centers in Boston, MA; New York, NY; Philadelphia, PA; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; Auburn, WA; and Washington D.C.)

(Federal Government activities may obtain copies of Federal standardization documents and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

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Military Specification:

MIL-T-4 Tire, Pneumatic, and Inner Tube, Pneumatic Tire:
Tire with Flap; Packaging and Packing of.

Military Standards:

MIL-STD-105 Sampling Procedures and Table for Inspection
by Attributes.

MIL-STD-51312 Patch, Pneumatic Tire Repair, Uncured.

(Copies of military specifications and standards required by
contractors in connection with specific acquisition functions
should be obtained from the procuring activity or as directed by
the contracting officer.)

Department of Transportation:

49 CFR Tire Identification and Record Keeping

49 CFR 571.117 Retreaded Pneumatic Tires.

(The Code of Federal Regulations (CFR) and the Federal
Register (FR) are for sale on a subscription basis by the
Superintendent of Documents, U.S. Government Printing Office,
Washington D.C. 20402. When indicated, reprints of certain
regulations may be obtained from the Federal agency responsible for
issuance thereof.)

2.2 Non-Government Publications: The following documents from a
part of this specification to the extent specified herein. Unless
a specific issue is identified, the issue in effect on date of
invitation for bids or request for proposal shall apply.

The Tire and Rim Association, Inc. Year Book:

(Copies may be obtained from the Tire and Rim Association,
Inc., 3200 West Market Street, Akron, Ohio 44313.)

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The Rubber Manufacturers Association:

RMA Shop Bulletin No. 29 - Standard Buffing Textures-
Retreading and Repairing

(Copies of the RMA bulletin can be obtained from the Rubber
Manufacturers Association, 1400 K Street, N.W., Washington D.C.
20005.)

The American Society For Testing and Materials (ASTM)

ASTM D2240 - Rubber Property-Durometer Hardness, Test Method
For.

(Copies may be obtained from The American Society For Testing
and Materials, 1916 Race Street, Philadelphia, PA 19103.

2.3 Order of precedence. In the event of a conflict between the
text of this specification and the references specified herein, the
text of this specification shall take precedence. Nothing in this
specification, however, shall supersede applicable laws and
regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1. Production Facility Requirements.

3.1.1 Facility Certification. The tires serviced under this
specification shall be processed only in facilities accepted by the
Government. Acceptance shall be through a production inspection
conducted in accordance with Section 10 Appendix and a certified
rating of Approved. As an alternative, the prospective contractor
may provide evidence of certification of the production facility
from a Government approved nationally recognized tire retreading
association or a Government approved tire retreading quality
assurance system, within the previous 12 month period.

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3.1.2 Processing Standards. Written standards conforming to the American Retreaders Association (ARA), National Tire Dealers and Retreaders Association (NTDRA), or the Rubber Manufacturers Association (RMA) industry recognized procedures shall be followed in the performance of each operation. Copies of the written procedure(s) shall be available at the appropriate location and shall be furnished to the Government representative for reference during the preaward survey. Such procedures shall establish responsibilities for personnel performing the operation, to include:

- (a) Conditioning of casings (drying, etc.).
- (b) Inspection procedures; sequence and scope of inspections.
- (c) Buffing.
- (d) Cementing.
- (e) Tread rubber application.
- (f) Curing.
- (g) Trimming and finishing.
- (h) Final inspection.

3.2 Materials. All materials used in the process of retreading and repairing tires shall conform to ZZ-T-416 (see 4.2).

3.3. Casing Inspection and Selection for Retreading. (All casings to be retreaded shall be supplied by the Government. Rejected casings shall remain the property of the agency that supplied the tire for retreading. The agency shall arrange for the proper disposal of any rejected casings). Casings inspection shall be made by a skilled operator and shall include: demounting the tire from the rim (when required), and placing the tire on a mechanical spreader under 300 ft. candle recommended, 200 ft candles minimum lighting, and distorting the natural contour of the tire sufficiently for visual and manual examination. To avoid possible damage, the casing shall not be distorted more than 30 percent of the section height. Casings accepted for retreading shall not contain any of the following defects:

- a. Ply separation.
- b. Broken, damaged, kinked or exposed bead wire.
- c. Injuries to the body plies in the bead area.
- d. Flex breaks.

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- e. Loose cords on the inside ply or evidence of having been run underinflated or overloaded.
- f. Tread separations which cannot be removed during buffing.
- g. Sidewall separation.
- h. Weather checking extending to the body plies or deeper than 2/32 inch.
- i. Non-repairable damage to the inner liner or bead seating area on tubeless type tires.
- j. Wear into the belt, breaker or body plies on passenger car tires.
- k. Nail holes or injuries exceeding the sizes as specified in Appendix B that cannot be repaired using acceptable commercial practices.
- l. Cut, exposed or broken cords of the belt, breaker or body plies on passenger car tires.
- m. Labeling of passenger car sizes not in accordance with the requirements of 49 CFR 571.117 - Retread Pneumatic Tire.
- n. Belt separation on radial type tires.
- o. Bias type truck tires worn to the body plies which would require more than 10 percent of the circumference of the top ply to be removed during buffing.
- p. Radial truck tires worn into the top belt material more than 10 percent of the worn tire circumference. On tires that have been constructed with a protector belt, it may be removed without replacement if the practice is acceptable to the original tire manufacturer. NOTE: If the protector belt is removed without replacement, the tires must be so identified.
- q. Circumferential cracking.
- r. Bead distortion in radial type tires.
- s. Porous liners in tubeless type tires.
- t. Rusted steel belts in radial ply tires.

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3.4 Processing.

3.4.1 Buffing. The buffed casing shall be to the original dimensions of the casing manufacturer minus the tread pattern and depth. The worn tread surface shall be removed to a symmetrical profile in accordance with the procedure specifications. The buffed surface on the casing shall be free of contamination or oxidation. The buffing radii used must be in accordance with specifications approved by both the retread supplier and the original tire manufacturer. For tires needing repairs at this point, see Appendix B. After buffing, the casing shall be inspected using the items listed under 3.3.

3.4.1.1 Uncured tread retreading. (Type I). The casing utilizing uncured tread rubber shall be uniformly buffed using a matrix template or other system of measure to insure matching of the matrix tread contour and size. The casing with the uncured tread rubber applied shall be shaped and properly fitted into the matrix in accordance with bead to bead, diameter and section width as published in the specifications for the equipment used.

3.4.1.2 Precured tread retreading. (Type II). Tires must be built in an inflated condition. The casing utilizing precured tread rubber shall be buffed to the width that is appropriate to the fixed dimensions of the precured tread rubber specified. The radius of the buffed area shall have all tread grooves removed and shall be centered on the casing with equal shoulder heights. The finished tire shall be as close as possible to the specified radius. The precured tread rubber width shall be within +/- 1/8" of the casings original tread width.

3.4.2 Cementing. Buffed casings to be cemented shall be clean and free of foreign materials such as buffing dust, dirt, oil, or any foreign matter. Cementing shall be accomplished within a maximum of 8 hours after buffing. Buffed casings stored over 8 hours shall be rebuffed/reworked prior to cementing. In procedures that do not require cementing of the casing, the tread shall be applied within 8 hours or the casing reworked to comply with the 8 hour requirement. Tires shall be built within 12 hours of cementing; otherwise the casing shall be reworked, cleaned and/or recemented.

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3.4.3 Tread Rubber Application (Building).

3.4.3.1 Uncured tread retreading. (Type I). The tread shall be of a crown, base and gauge dimension as required for the matrix design and size in which the tire is to be cured and shall provide a minimum undertread gauge as specified in paragraph 3.6.4. Tread rubber adhesive surfaces shall not be contaminated. Tread rubber must be centered around the buffed circumference of the tire. Stitching shall be performed in such a way as to eliminate trapped air pockets, pulling the tread area off center, distortion of the rubber shoulders, folds, and wrinkles in the rubber shoulders. Splices shall be made in such a manner to insure minimum distortion of the rubber.

3.4.3.2 Precured tread retreading. Tires must be built in an inflated condition. The tread rubber shall be centered around the buffed circumference of the tire. The tread pattern interruption shall be minimized at the tread splice. The cut ends of the tread shall be texturized and cemented over the entire surface, and cushion gum shall be applied to at least one cut edge. All ends shall be free of contamination.

3.4.3.3 Tread patterns. The tread patterns shall be of the following classes for Groups 1, 2, and 3. The contractor shall furnish the ordering activity their commercially available tread pattern which meets the performance criteria of the class specified. (See 6.1). Tread patterns for Group 4 shall be classified as Highway Service, Traction Tread, or Trailering Service.

Class r/t (regular tread) - This tread pattern is a general purpose, all-wheel position, rib pattern, for use on highways. The pattern must be ideally suited for year-round use in southern U.S. and for spring, summer, and fall in North U.S. this tread pattern shall also provide adequate traction in mild winter conditions.

Class a/s (all season) - This tread pattern is to be a general purpose, all-position tread that combines most of the benefits of the regular tread and the snow tread tire. Ideally suited for year-round use.

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Class s/t (snow tread) - This tread pattern is to be a general purpose tread for use in winter driving conditions. The tread pattern shall be aggressive and provide good traction on loose and packed snow covered roads and where mild mud conditions exist.

Class a/t (all terrain) - This tread pattern is to be an aggressive lug pattern for use on vehicles where a substantial portion of the driving will be off-road on trails and cross-country type situations. It shall provide good off-road performance with respect to mud, sand and snow traction.

Class o/o (on/off highway) - This tread pattern shall provide a pattern for vehicles used extensively on dirt and gravel roads. The pattern shall be designed so that it will not retain rocks and other debris in the grooves. This pattern shall be offered for both steering and drive axles versions. The pattern shall provide good traction in mud and snow conditions.

Class d/a (drive axle) - This tread pattern is for year round use on medium and heavy trucks used primarily on the highway. This tread pattern shall provide higher mileage and better driving traction than the class r/t (regular tread) but less traction in snow conditions than class s/t (snow tread).

3.4.4 Curing.

3.4.4.1 Uncured tread retreading (Type I). Tires to be cured shall be stored in such a manner to prevent distortion of the uncured rubber and shall be kept free of contamination. Curing procedures to include specifications on curing time, temperature, pressure and proper curing tubes and rims, if used, shall be available in the work area of the shop at all times. The beads during curing shall be in a relaxed position, if inside curing rims are used. The distance between the beads of the tire during curing shall be that which is considered good commercial practice.

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3.4.4.2 Precured tread retreading (Type II). Envelopes or diaphragms used to cure the tire shall be free of leaks. Curing procedures shall include specifications on curing time, temperature, pressure, and proper curing tubes and rims, when required. All curing procedures shall be available in the work area of the shop at all times. Air trapped between the envelope, diaphragm and the tire during curing shall be removed by venting as necessary. The distance between the beads of a tire during curing shall be the same as when the tire is mounted and properly inflated on the recommended rim width.

3.5 Repairing.

3.5.1 Permissible Repair Limits (Non-Military). Final determination of repairability, type of repair and repair unit size must be made after skiving or drilling, in accordance with Table III. Maximum dimension is indicated numerically or as a percentage of cross section. Spot repairs are limited by the amount of cord damage.

TABLE I. Size, Number, and Location of Permissible Repairs

Type of Repair	Group 1	Group 2	Group 3	Group 4 (Off-the-Highway & Tires Marked NHS)	Group 4 (Agricultural)	Group 4 (Military)
Nail Hole	1/4 inch	1/4 inch	3/8 inch	(see 3.3.3)	(see 3.5.3)	3/8 inch
Spot	(see 3.5.4)	25%	25%	25%	25%	25%
Reinforcement (See 3.5.5)	None allowed	25%	25%	25%	50%	25%
Section (See 3.5.6)	None allowed	25%	25%	25%*	50%	(See Table IA)
Minimum Distance Skived Edge From Bead	None allowed	4 inches	4 inches up to 16.00 - 4 inches	18.00 - 24.00- 8 inches 27.00 - 30.00- 10 inches 36.00 - 37.00- 12 inches 44.50- 14 inches	4	(See Table IA)
Maximum Number of Reinforcement and Section Repairs per Tire	0	2**	4**	4**	4**	2**

*33 percent for size 18.00 up (see 3.5.6).

**Must be at least 20 inches apart measured from the edge of one patch to the closest edge of another reinforcement or section repair patch.

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3.5.2 Permissible Repair Limits (Military Tire). When specified (see 6.1), section repair of military tires shall be accomplished in accordance with Table IIIA, Group 4 (military tires).

TABLE IA. Group 4 (Military Tires)

Tire Size Designation	Ply Rating	Maximum Dimension of Opening in Plies After Shiving for Section Repair		Minimum Distance of Shived Edge From Bend		Maximum Number of Repairs Per Tire
		Tread in inches (mm)	Sidewall in inches (mm)	in inches (mm)	in inches (mm)	
6.00-16 LW	6	-	-	-	-	0
7.00-16 LW	6	-	-	-	-	0
9.00-20	8	2 1/4 (57)	1 (25)	3 (76)		1
9.00-20	8	2 1/4 (57)	1 (25)	3 (76)		1
9.00-20	10	2 1/4 (57)	1 (25)	3 (76)		1
11.00-18	6	2 1/4 (57)	1 (25)	3 (76)		1
12.00-20	12	2 3/4 (70)	1 3/4 (44)	3 (76)		2*
12.00-20	14	3 (76)	2 (51)	4 (102)		2*
14.00-24	20	3 1/2 (82)	2 1/2 (63)	4 (102)		2*

*When two repairs are permitted, they must be at least 20 inches apart.

3.5.3 Nail Hole Repair (Type III-A) Bias and Radial. Once demounted, a nail hole repair shall be made from the inside of the tire for injuries caused by penetration throughout the tread or shoulder. The injury shall be cleaned, cemented, filled, reinforced and vulcanized using materials conforming to ZZ-P-112 or ZZ-T-416, as applicable. Maximum repair limit for passenger car tires shall be 1/4 inch. The limit for light truck and high speed industrial tires shall be 15" rim diameter designation - 3/8", 1/4" for all load range B. All other tires shall be 3/8 inch maximum diameter. (See Repair Unit Selection Guide).

TABLE II

**REPAIR UNIT SELECTION GUIDE FOR
NAIL HOLE OVAL OR ROUND REPAIR UNITS**

INJURY SIZE	PASSENGER & LIGHT TRUCK	ALL OTHERS
	Diameter or Minimum Dimension	Diameter or Minimum Dimension
Up to 1/4"	2" bias 1 1/2" radial	2 1/8" bias 2 1/8" radial
3/8"	-	2 3/4" bias 2 1/8" radial

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3.5.4 Spot Repair (Type III-B) Bias Type Tires Only. A spot repair shall be made to injuries on the outside of the tire when up to but not including 25 percent of the total number of actual full plies are injured. No outside fabric reinforcement shall be required. The outside of the tire shall be built up and properly cured with repair materials conforming to ZZ-T-416. Tires of four ply rating or less shall not be spot repaired, if more than two adjacent cords on bias ply tires and three in the belted tires are broken in the tread area. Other tires shall not be spot repaired if the longest dimension of the cord damage is more than 1/4 of the tire cross section when measured in any direction in the plane of the cord surface.

3.5.5 Reinforcement (Type III-C) Bias Type Tires Only. A reinforcement repair shall be made for injuries to a tire when 25 percent or more of the body plies, but less than 50 percent, are injured. Reinforcement repair to passenger car tires is prohibited, casing shall be rejected. For high speed truck-bus tires, a maximum repair limit of 1/4 the tire cross section shall apply, measured at the maximum dimension of the hole through any ply of the tire after all injured material has been removed. A maximum repair limit of 1/3 the tire cross section measured as above shall apply for tires in Group 4 except for Group 4-Agricultural, to which 1/2 shall apply. (See Table III) Repair unit size and ply requirements shall be determined as for section repairs and the plug shall be formed and properly cured using repair materials conforming to ZZ-T-416.

3.5.6 Section Repair (Type III-D). The platform of a repair unit is defined as the dimension of the smallest overlap of all plies (see Repair Unit Selection Guide)

3.5.6.1 Bias Type Tires Only. A section repair shall be made with tire repair units on any injury which requires a replacement of cord body strength when the injury is through 50% or more of the body plies. Section repairs to passenger car tires is prohibited, casing shall be rejected. Repair units shall be either uncured, semicured, precured or chemical cured conforming to ZZ-T-416. Either the repair material manufacturer's recommendation or MIL-STD-51312 shall be followed to determine repair unit size and ply requirements. The repair shall be properly cured. A section repair may be used for large injuries (up to 1/3 cross section) on Group 4 tires, size 18.00 and larger (see Table III).

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3.5.6.2 Radial Type Tires Only. A section repair shall be made on an injury to the cord body where more than one cord is broken or where more than two breakers are damaged. Section repairs to passenger car tires is prohibited, casing shall be rejected. Repair units shall be either of uncured, semicured or chemical cured conforming to ZZ-T-416.

TABLE IIA
REPAIR UNIT SELECTION GUIDE FOR
SECTION REPAIRS BIAS TRUCK TIRES

<u>INJURY SIZE</u>	<u>TIRE PLY RATING(S)</u>	<u>MINIMUM PLATFORM</u>	<u>MINIMUM NUMBER OF PLYS IN PLATFORM</u>
Up to 1/2"	8-14	1"	2
5/8" to 1"	8-14	2"	3
1 1/8" to 1 1/2"	8-14	2 1/4"	4
1 5/8" to 2"	8-12 14	2 1/4" 2 1/4"	4 6
2 1/8" to 2 1/2"	8 10-14	2 1/4" 2 1/4"	4 6
2 5/8"	10-14	3 3/8"	6

TABLE IIB
SECTION REPAIR SIZES FOR RADIAL TRUCK TIRES

<u>TIRE CROSS SECTION</u>	<u>SIDEWALL MAXIMUM INJURY DIMENSION</u>		<u>MINIMUM PLATFORM</u>		<u>MINIMUM NUMBER OF PILES IN PLATFORM</u>
	<u>WIDTH</u>	<u>LENGTH</u>			
7.50R,8R	3/8"	x 3 1/2"	1 1/2"	x 4"	3
	3/4"	x 2"	1 1/2"	x 1 1/2"	3
	1"	x 1"	1"	x 4"	3
8.25R,9R	3/8"	x 4"	2"	x 5"	3
	3/4"	x 3"	2"	x 5"	3
	1"	x 2"	2"	x 5"	3
9.00R,10R	3/8"	x 4 1/2"	2"	x 5"	3
	3/4"	x 3"	2"	x 5"	3
	1 1/2"	x 2"	1 1/2"	x 5"	4
10.00R,11R	3/8"	x 4 1/2"	7/8"	x 8"	3
	3/4"	x 4"	2"	x 8"	3
	1 1/2"	x 2"	1 1/2"	x 8"	4
11.00R,12R	3/8"	x 4 1/2"	7/8"	x 8"	3
	3/4"	x 3"	1 1/4"	x 8 1/2"	4
	1 1/2"	x 2"	1 1/2"	x 8"	4
12.00R,13R	3/8"	x 5"	7/8"	x 8 1/4"	3
	3/4"	x 4"	1 1/2"	x 5"	4
	1 3/4"	x 2"	3"	x 9"	5

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3.5.7 Tread Surface Repair. Repairs in the tread area shall be molded or regrooved to match the tread design. Excess rubber shall be removed so that the tread design contour is not affected.

TABLE IIC

SECTION REPAIR SIZES FOR RADIAL TRUCK TIRES

<u>TIRE CROSS SECTION</u>	<u>TREAD MAXIMUM INJURY DIMENSION</u>	<u>MINIMUM PLATFORM</u>	<u>MINIMUM NUMBER OF PLYS IN PLATFORM</u>
7.50R,8R	1"	2" x 3"	3
8.25R,9R	1 1/2"	1 1/2" x 3"	4
9.00R,10R	1 1/2"	1 1/2" x 4"	4
10.00R,11R	1 1/2"	1 1/2" x 4"	4
11.00R,12R	1 1/2"	1 1/2" x 8"	4
12.00R,13R	2"	2" x 6 1/2"	4

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3.6 Finished Tire, Retreaded:

3.6.1 Tread wear indicators. All highway tires (including military where applicable) shall incorporate tread wear indicators, in not less than six equally spaced (to the extent that is practical) locations around the circumference of the tire, that will provide visual indication when the tire has worn to a tread depth of 2/32 inch above the base of the groove.

3.6.2 Environmental resistance requirements.

3.6.2.1 Commercial tires. Unless otherwise specified, commercial tires shall be processed using materials containing antioxidants and antiozonants of a quality to provide standard commercial resistance to weathering as specified in ZZ-T-416.

3.6.2.2 Military tires. Unless otherwise specified, all military tires shall be processed using materials meeting the ozone resistance and low temperature property requirements as specified in ZZ-T-416.

3.6.3 Skid depth. When tested in accordance with 4.5, the skid depth of a particular tread pattern shall meet the requirements as specified in Table I.

TABLE I - SKID DEPTH MINIMUM - MEASURED IN 32nd IN. (mm)

Group 1 - Passenger Car Tires				
Tire Size	Class r/t & a/s		Class s/t	
All	9 (7)		12 (9)	
Group 2 - Light Truck Tires				
Tire Size	Commercial Tires			Military Tires
	Class r/t, a/s	Class s/t	Class a/t, o/o, d/a	Class a/t, o/o, d/a
All	9 (7)	12 (9)	14 (11)	14 (11)
6.00-16LT				15 (12)
7.00-16LT				16 (13)
7.50-16LT				16 (13)
9.00-16LT				18 (14)

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Group 3 - Truck/Bus and Trailer Tires

Tire Size	Commercial Tires			Military Tires
	Class r/t, a/s	Class s/t	Class a/t, o/o, d/a	Class a/t, o/o, d/a
7.00-16	13 (10)	13 (10)	13 (10)	16 (13)
7.50-15	13 (10)	13 (10)	13 (10)	16 (13)
7.50-17	13 (10)	15 (12)	15 (12)	16 (13)
7.50-18	13 (10)	15 (12)	15 (12)	16 (13)
7.50-20	13 (10)	15 (12)	15 (12)	16 (13)
8-19.5	14 (11)	15 (12)	15 (12)	15 (13)
8-22.5	14 (11)	15 (12)	15 (12)	15 (13)
8.25-15TR	14 (11)	-- --	-- --	-- --
8.25-17	14 (11)	15 (12)	15 (12)	16 (13)
8.25-20	14 (11)	19 (15)	19 (15)	19 (15)
9.00-15TR	15 (12)	19 (15)	19 (15)	19 (15)
9.00-20	15 (12)	19 (15)	19 (15)	19 (15)
9-22.5	14 (11)	19 (15)	19 (15)	19 (15)
10.00-15TR	15 (12)	-- --	-- --	-- --
10.00-18	15 (12)	19 (15)	19 (15)	19 (15)
10.00-20	15 (12)	19 (15)	19 (15)	19 (15)
10.00-22	15 (12)	19 (15)	19 (15)	19 (15)
10-22.5	15 (12)	19 (15)	19 (15)	19 (15)
10.00-24ML	15 (12)	-- --	19 (15)	19 (15)
11.00-15TR	16 (13)	-- --	-- --	-- --
11.00-18	-- --	-- --	-- --	20 (16)
11.00-20	16 (13)	19 (15)	19 (15)	20 (16)
11.00-22	16 (13)	19 (15)	19 (15)	20 (16)
11-22.5	15 (12)	19 (15)	19 (15)	19 (15)
11.00-24	16 (13)	19 (15)	19 (15)	20 (16)
11-24.5	15 (13)	19 (15)	19 (15)	19 (15)
12.00-20	16 (13)	19 (15)	19 (15)	21 (17)
12-22.5	16 (13)	19 (15)	19 (15)	19 (15)
12.00-24	16 (13)	19 (15)	19 (15)	21 (17)
12-24.5	16 (13)	19 (15)	19 (15)	19 (15)
13.00-20	17 (13)	-- --	-- --	21 (17)
14.00-20	18 (14)	-- --	-- --	24 (19)
14.00-24	18 (14)	-- --	-- --	24 (19)

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Groups 2 and 3 - Wide Base Tires

Tire Size	Class	Class
	r/t, a/s	o/o, a/t, s/t, d/a
10-17.5LT	15 (12)	19 (15)
12-16.5LT	15 (12)	19 (15)
14-17.5	15 (12)	19 (15)
15-19.5	16 (13)	20 (16)
15-22.5	18 (14)	20 (16)
16.5-19.5	18 (14)	21 (17)
16.5-22.5	18 (14)	21 (17)
18-19.5	19 (15)	21 (17)
18-22.5	19 (15)	21 (17)
19.5-19.5	20 (16)	21 (17)

Groups 2 and 4 - Highway Tires for trailers and special service vehicles. (NHS excluded).

Tire Size	Class s/t	Class
	Highway Service	Traction tread
5.70-8	9 (7)	9 (7)
5.70-8NHS	9 (7)	9 (7)
6.90-9	10 (8)	10 (8)
6.90-9NHS	10 (8)	10 (8)
6.50-10	11 (9)	11 (9)
6.50-10NHS	11 (9)	11 (9)
7.00-12NHS	12 (9)	12 (9)
7.50-10	12 (9)	12 (9)
7.50-10NHS	12 (9)	12 (9)
7.50-15NHS	12 (9)	13 (10)
8.25-15NHS	12 (9)	14 (11)
9.00-10NHS	12 (9)	14 (11)
20.5X8.0-10	9 (7)	9 (7)

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**Group 4 - Special Service, Off Road
Regular tread depth**

***Skid Depth - Minimum - Measured in Inches (millimeters)**

Tire Size (Section Width in Inches)	Traction Tread	Trailing Tread
7.00	.67 (17)	.52 (13)
7.50	.68 (17)	.42 (11)
8.25	.71 (18)	.44 (11)
9.00	.75 (19)	.46 (12)
10.00	.78 (20)	.48 (12)
11.00	.81 (21)	.50 (13)
12.00	.81 (21)	.52 (13)
13.00	.94 (24)	.54 (14)
14.00	1.00 (25)	.57 (14)
15.50	.94 (24)	.54 (14)
16.00	1.06 (27)	.62 (16)
17.50	1.00 (25)	.57 (14)
18.00	1.24 (31)	.70 (18)
20.50	1.06 (27)	.62 (16)
21.00	1.37 (35)	.77 (19)
23.50	1.24 (31)	.70 (18)
24.00	1.50 (38)	.84 (21)
26.50	1.37 (35)	.77 (19)
27.00	1.67 (42)	.92 (23)
29.50	1.50 (38)	.84 (21)
30.00	1.81 (46)	1.01 (26)
33.25	1.67 (42)	.92 (23)
33.50	1.67 (42)	.92 (23)
37.50	1.81 (46)	1.01 (26)

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Extra Tread, Loader-Dozer, Earth Moving, Mining, and Logging

*Skid Depth - Minimum - Measured in Inches (millimeters).

<u>Tire Size</u> <u>(Section Width in Inches)</u>	<u>Traction Tread</u>
10.00	1.00 (25)
11.00	1.06 (27)
12.00	1.09 (28)
13.00	1.70 (43)
14.00	1.50 (38)
16.00	1.60 (41)
18.00	2.00 (51)
21.00	2.00 (51)
24.00	2.25 (57)
27.00	2.50 (63)
30.00	2.70 (69)

Extra Deep Tread, Wide Base Loader-Dozer Tires

*Skid Depth - Minimum - Measured in Inches (millimeters).

<u>Tire Size</u> <u>(Section Width in Inches)</u>	<u>Traction Tread</u>
15.50	2.25 (57)
17.50	2.50 (63)
20.50	2.50 (63)
23.50	3.00 (76)
26.50	3.25 (82)
29.50	3.50 (89)
33.25	4.00 (102)
33.50	4.00 (102)
37.50	4.00 (102)

* Skid Depth - Minimum in inches minus tolerance of 5 percent allowed.

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3.6.4 Retread undertread thickness. Retread undertread thickness is the rubber gauge between the base of the tread and the buffed line. Undertread thickness (percentage of the distance between the base of the tread and the buff line) shall not be less than 20 percent, except for off-the-road tires which shall not be less than 15 percent of the skid (tread) depth. Undertread thickness shall be gauged after the tire has been cured and does not necessarily reflect tread rubber thickness.

3.7 Marking. Prior to delivery to the Government, each retreaded tire shall be permanently marked to meet the requirement of the 49 CFR 574, Tire Identification and Record Keeping, in the manner and location as depicted in Figure 2 thereof.

3.7.1 Special marking required. Marking shall meet the following additional requirements: the name or other positive identification of the individual plant in which the tires were retreaded shall be permanently affixed to the tire during the curing process. The identification shall be made on the serial number side in the shoulder or edge of tread area at the point nearest to the serial number. This identification may be in the form of a medallion, by imprinting, or by raised configuration produced by stamping the matrix. Marking symbols shall be not less than 5/32 inch in height. All other new tire markings shall remain. Repaired tires shall be permanently marked as in 3.7, on the repair (i.e., III-B, III-C, III-D). Nail hole repairs (type III-A) are excepted from the permanent marking required by this paragraph.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for Inspection. Unless specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the contractor may use his/her own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure that supplies and services conform to prescribed requirements.

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4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this specification shall become part of the contractor's overall inspection system or quality program. The absence of any inspection requirement in the specification shall not relieve the contractor of the responsibility of assuring that all products, supplies, or services submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Inspection of Materials and Components. The contractor is responsible for insuring that the materials and components used are manufactured, sampled, examined, and tested to meet the requirements of this specification. The contractor is responsible for maintaining evidence of compliance with 3.2 for all materials. Chemical analysis of the finished product shall be available for review by the Government if required to insure this compliance.

4.3 Initial and In-process Inspection. The contractor shall perform inspections initially and throughout the processing to assure that no deviation is made from the indicated requirements. These shall include all processes. Whenever a deviation is noted, correction shall be made.

4.4 Final Inspection by Contractors. The retreader shall make a final inspection of the completed retreaded tire. The inside of the tire shall be checked on a spreader with 300 foot candle recommended minimum lighting, 200 foot candle minimum lighting to insure that all repairs are properly bonded and in accordance with Appendix B. The outside of the tire shall be checked to insure that it has been adequately molded and cured. If the retreaded tire shows any defects that will result in other than optimum tire performance, the retreaded tire shall be rejected and reworked, if possible (see Table I). In the case that a completed retreaded tire is rejected and cannot be reworked due to defective materials, processing, or workmanship, the contractor shall credit to the Government the cost of retreading the casing. The agency shall arrange for the disposal of the rejected tire or casing.

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4.5 Skid Depth. The depth of a groove, which is located nearest to the centerline of the crown (excluding spacer if used), shall be measured to the nearest 1/32nd inch at six points equally spaced around the inflated tire and the results averaged. Tread designs with cross ribs, lugs, or cleats shall be measured at the deepest point not more than 25 percent of the nominal cross section to either side of the tread center line.

4.6 Tread Hardness. The durometer hardness of the vulcanized tread material shall be obtained in accordance with ASTM D2240 and shall conform to the requirements of ZZ-T-416.

4.7 Destination Inspection. Retreaded tires found to be defective when inspected at destination shall be returned to the contractor and reworked. Provisions in Paragraph 4.4 shall apply if the retreaded tire(s) cannot be reworked. The shipping of the tire(s) shall be at the expense of the contractor.

4.8 In-service Failures. If retreaded tires fail while in service and the cause is defective materials, improper repairs, or poor workmanship, the retreaded tire shall be returned to the contractor at his/her expense and shall be adjusted as follows:

- (a) Tires worn up to one half of the original skid depth; the contractor shall refund to the Government the full cost of retreading the casing.
- (b) Tires worn beyond one half of the original skid depth to 2/32nds inch remaining skid depth; the contractor shall refund to the Government one-half the cost for the retreading of the casing.

TABLE II.: FINAL AND DESTINATION INSPECTION - REASONS FOR REJECTION OR, IF POSSIBLE, REWORKING.

Reasons	Method of Inspection
1. Other conditions (see 3.3).	visual

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- | | | |
|-----|---|--------|
| 2. | Bead kink; bulge 1/16 inch or more in height for Group 1, 1/8 inch or more for Groups 2, 3, and 4, military, agricultural, and industrial tires marked Not for Highway Service (NHS). Off-the-highway not applicable. | gauge |
| 3. | Sidewall crack(s) or radial split(s) | visual |
| 4. | Cut, loose, or damaged plies or cords: any evidence - reject. | visual |
| 5. | Ply, tread, or sidewall separation: any visible evidence - reject. | visual |
| 6. | Tread folds or tread element rounding, with radii over one-half or skid depth or over 1 inch long. | scale |
| 7. | Mold folds or mold tearing: any visible evidence - reject. | visual |
| 8. | Light spots exceeding 1/16 inch deep. | visual |
| 9. | Open tread splice. | visual |
| 10. | Tubeless tire liner or open liner splice: any area showing cord. | visual |
| 11. | Foreign items cured into inside or outside of tire: any visible evidence not repaired - reject. | visual |
| 12. | Off register treads: treads radially off register more than 1/16 inch in 8.55 or smaller tires, or more than 1/8 inch on tires larger than 8.55. | scale |
| 13. | Tread flash: thickness at mold registering greater than the following for the range of the tire sizes indicated: | scale |
| | Sizes 9.00 and smaller - 1/32 inch | |
| | Sizes over 9.00 - 2/32 inch | |

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- | | |
|--|------------------|
| 14. Exposed bead wires or damaged bead cover on tubeless tires sufficient to affect sealing qualities of bead - reject. | visual |
| 15. Off center treads: over 1/8 inch for Group 1, 1/4 inch for Groups 2 and 3, and 1/2 inch Group 4, matrix cured off-the-road tires up to 18.00-25 size. | scale |
| 16. Nail hole(s) not repaired: any visible evidence - reject. | visual |
| 17. Sidewall or shoulder injuries not repaired which would affect tire performance. | visual |
| 18. Soft, porous or incomplete cure (tread hardness) | gauge/
visual |
| 19. Cupping, dimpling, bulging, buckling or separation of fabric, repair unit or tread. | visual |
| 20. Splitting, shrinking, or separation of a repair plug from the casing, any visible evidence - reject. | visual |
| 21. Bulging of the repair plug, or bulging of the area on the surface over a reinforcement or section repair made from inside the tire exceeding 3/8 inch. | scale |
| 22. Tread area repairs not regrooved. | visual |

5. PREPARATION FOR DELIVERY

5.1 Packaging. Packaging shall be level A or C, as specified (see 6.1).

5.1.1 Level A. The tires shall be packaged in accordance with level A requirements of MIL-T-4.

5.1.2 Level C. The tires shall be packaged in accordance with supplier's commercial practice.

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5.2 Packing. Packing shall be level A, B, or C as specified (see 6.1).

5.2.1 Level A. The tires shall be packed in accordance with the level A requirements of MIL-T-4.

5.2.2 Level B. The tires shall be packed in accordance with the level B requirements of MIL-T-4.

5.2.3 Level C. The tires shall be packed to insure carrier acceptance and safe delivery to destination in containers complying with the rules and regulations applicable to the mode of transportation.

5.3 Marking. (See special marking in Section 3.7).

5.3.1 Civil agencies. In addition to markings required by the contract, the tires and shipping containers shall be marked in accordance with Fed. Std. No. 123.

5.3.2 Military activities. In addition to markings required by the contract, the tires and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES

6.1 Ordering Data. Purchasers should select the preferred options permitted herein, and include the following information in procurement documents.

- (a) Title, number and date of this specification.
- (b) Type of retread or repair (see 1.2.2).
- (c) Tire size and tread design (see 3.4.3.3)
- (d) Ozone resistance and low temperature property requirements for non-military tire (3.6.2).
- (e) Selection of applicable level of packaging and packing required (see 5.3).
- (f) Marking required (see 5.3).

6.2 Materials Furnished for Certification or Inspections and Tests. If tires are used for certification or in test they shall be furnished by the supplier without cost to the Government.

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6.3 Type Comparison. Comparison of this Federal Specification and U.S. Army designation of retreaded and repaired tires is as follows:

<u>Operation</u>	<u>Specification ZZ-T-441</u>	<u>Designation</u>
Uncured tread: Full retread	Type I - A	R - 3
Top retread	Type I - B	T - 1
Relugged	Type I - C	
Bead-to-bead	Type I - D	
Precured tread: Top tread	Type II - A	
Top retread	Type II - B	
Nail hole repair	Type III - A	X on each bead (circle)
Spot repair	Type III - B	
Reinforcement repair	Type III - C	R - 4
Section repair	Type III - D	X

MILITARY INTERESTS:Military Coordinating Activity:

U.S. Army - AT (TACOM)

Custodians:

Army - AT
Navy - YD
Air Force - 99

Reviewing Activity:

Navy - MC

Civil Agency Coordinating
Activities:

DOT - ACO, MVP
USDA - AFS
JUSTICE - FBI

Preparing Activity:

GSA - PSS (FCAE)

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10.0 Appendix A

GENERAL SERVICES ADMINISTRATION
PRODUCTION FACILITY INSPECTION
FOR THE
RETREADING AND REPAIRING OF PNEUMATIC TIRES
IN COMPLIANCE WITH
FEDERAL SPECIFICATION ZZ-T-441

10.1 Scope. The object of this inspection is to establish that the inspected plant is currently producing retreaded and repaired pneumatic tires similar to those which would be produced for the Government. These retreaded and repaired tires currently being produced must clearly indicate that the production quality standards, equipment condition and personnel training are consistently within the accepted standards and tolerances set forth in this specification.

The inspection is to be performed on site by an established and experienced plant inspector who is not an employee of a proposed contractor or the business firm being inspected. The inspector shall be a Government representative familiar with tire retreading procedures, a representative of a Government approved nationally recognized industry association or a Government approved tire retreading quality assurance system. Cost of the facility inspection shall be the responsibility of the plant requesting certification. The inspection shall consist of two parts: (1) Product examination; and (2) Comprehensive Procedure/Process inspection, and be combined to result in an overall facility rating.

10.1.1 Product Examination. The inspector shall randomly select at least 10 tires of each group specifically required by the Government or, if not specified, the inspection sample shall represent a typical cross section of those groups and types normally procured by the Government. Inspection of a facility not regularly producing tires specifically required, such as military tires, shall be evaluated based on similar sizes and types which are in production and a sample of three (3) specifically required type tires produced for the inspection (see 6.2).

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The selected sample of tires shall be examined in accordance with Tables I, II, III and IIIA. If any of the tires from the sample group fails to pass the examination, one additional group of four (4) tires of the same type and size as the failed items shall be selected and inspected. If recurring significant defects are found, the plant will receive an overall facility Not Approved facility rating.

10.1.2 Procedure/Process Inspection. The inspector shall review the plant operation and complete the Production Facility Inspection Checklist (see 20.0) factually documenting item by item findings. There are two possible ratings for each item under this inspection: Acceptable (A), Approved with Minor Deviations (AMD), Not Acceptable (NA). All "Not Acceptable" ratings shall indicate the degree of unacceptableness and whether the item is major (#) or minor (*) (see 2.0). Rating of "Not Acceptable" for any item considered major will result in a "Not Approved" overall facility rating. Rating of "Not Acceptable" for 20% or more of all items considered minor will result in a "Not Approved" overall facility rating.

The overall facility rating (see 30.0) shall result in either certification as Approved or Approved with Minor Deviations, or no certification with a rating of Not Approved.

Approved (A) is defined as the present production facilities and procedures meet the quality standards of Federal Specification ZZ-T-441 and can result in a product meeting the contractual requirements.

Approved with Minor Deviations (AMD) is defined as the quality level is in compliance with a few minor exceptions. It is recognized that minor problems are common and reoccurring in all production processes. It is expected that those detected during the inspection and listed under a conditional approval shall be corrected prior to producing retreaded or repaired tires for the Government. Correction of all deviations shall be certified by the contractor signing and dating a copy of the Approved with Minor Deviations certification form and forwarding it to the Contracting Officer.

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A Not Approved (NA) rating by an inspector shall clearly explain in writing those items which are not in compliance. A Not Approved rating shall constitute the finding of Incapable of Performing and may lead to a determination of non-responsibility (FAR Part 9). Another inspection (reinspection) may be authorized and scheduled, provided that evidence is furnished showing the major problems have been satisfactorily corrected.

20.0 PLANT FACILITY INSPECTION CHECKLIST

The following codes will be used to indicate a rating for a particular item under this checklist:

A = Acceptable
NA = Not Acceptable

The following codes indicate the degree of deviation acceptance of a particular item:

= major (NA, not acceptable)
* = minor (AMD, acceptable with minor deviation, must be corrected prior to performing work under Government contract.)

Rating

PLANT SUPERVISION

- | | |
|--|---------|
| 1. Familiar with provisions of contract? | # _____ |
| 2. Trained to supervise the type of retreading under contract? | # _____ |
| 3. Trained second-in-command? | * _____ |
| 4. Meetings held with plant personnel periodically to discuss: | |
| a) Adjusted tires? | * _____ |
| b) Shop practices? | * _____ |
| c) Procedures? | * _____ |
| d) Specification changes? | * _____ |
| e) Equipment maintenance? | * _____ |

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- | | <u>Rating</u> |
|---|---------------|
| 5. System to keep track of "Returned-as-Received" (RAR) and "Returned-for-Adjustment (RFA) tires? | # _____ |
| 6. Inspector competent to analyze RAR and RFA tires? | # _____ |
| 7. Formal procedure to update specifications? | * _____ |
| 8. Recheck all processing operations at regular intervals? | # _____ |
| 9. Plant area reasonably clean and orderly? | # _____ |

PLANT PERSONNEL

1. Trained in the following areas:
 - a) Casing inspections? # _____
 - b) Casing repair? # _____
 - c) Buffing? # _____
 - d) Sizing? # _____
 - e) Repairing? # _____
 - f) Cement application? # _____
 - g) Rubber application? # _____
 - h) Curing operations? # _____
 - i) Final inspection? # _____
2. Trained backup personnel for above operations? * _____
3. Standards available at each operation? * _____
4. Workers familiar with standards? * _____
5. Workers aware of specification changes at intervals? * _____

PLANT MANUAL OR SPECIFICATIONS

1. Plant manual, specifications or written procedures:
 - a) Covers all operations? # _____
 - b) Up-to-date? # _____

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- | | <u>Rating</u> |
|--|---------------|
| 2. Legible copy of specifications available at each work station on: | |
| a) Casing inspection? | * _____ |
| b) Casing repair? | * _____ |
| c) Buffing? | * _____ |
| d) Sizing? | * _____ |
| e) Repairing? | * _____ |
| f) Cement application? | * _____ |
| g) Rubber application? | * _____ |
| h) Curing operations? | * _____ |
| i) Final inspection? | * _____ |
| 3. Tire adjustments used as basis for process revision? | # _____ |
| 4. Procedures established for maintaining following records: | |
| a) Grade of tread rubber used? | # _____ |
| b) Proper certification of tread rubber received? | # _____ |
| c) Date code and batch number of rubber recorded by date of use? | # _____ |

INCOMING CASING INSPECTION

- | | |
|---|---------|
| 1. Facilities available for dry storage of casings? | # _____ |
| 2. Tires dry before processing? | # _____ |
| 3. Operating bead spreader or tire inspection machine? | # _____ |
| 4. Well lighted initial inspection area (300 foot candles recommended, 200 foot candles minimum)? | # _____ |
| 5. Chart showing standards of acceptability posted? | * _____ |
| 6. Bias truck tire beads vented? | # _____ |
| 7. Old balance pads removed? | # _____ |
| 8. Old repairs inspected and marked for replacement as required? | # _____ |

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- | | <u>Rating</u> |
|--|---------------|
| 9. Nail holes cleaned, filled and repaired as required? | # _____ |
| 10. Tires with the following conditions rejected? | |
| a) Ply separation? | # _____ |
| b) Broken, damaged, kinked or exposed bead wire? | # _____ |
| c) Injuries to the plies in the bead area? | # _____ |
| d) Flex breaks? | # _____ |
| e) Loose cords on the inside ply or evidence of having been run underinflated or overloaded? | # _____ |
| f) Tread separations not removed during buffing? | # _____ |
| g) Sidewall separation? | # _____ |
| h) Non-repairable damage to the innerliner or bead seating area of tires identified as tubeless? | # _____ |
| i) Wear into the belt, breaker or body plies on passenger car tires? | # _____ |
| j) Nail holes or injuries of sizes and numbers that can not be repaired in accordance with Paragraph 3.5. | # _____ |
| k) When buffed as cut, exposed or broken cords of the belt, breaker or body plies on passenger car tires? | # _____ |
| l) When labeling is not in accordance with 49 CFR 571.117 and this specification? | # _____ |
| m) Bias truck tires worn to the body plies which would require more than 10% of the circumference of the top ply to be removed during buffing? | # _____ |
| n) Radial truck tires worn into the top belt material for more than 10% of the worn tire circumference (protector belt excluded)? | # _____ |
| 11. Markings employed to show: | |
| a) Repair needed? | # _____ |
| b) Inspection approval? | # _____ |
| 12. Charts showing matrix/tire compatibility posted, if appropriate? | * _____ |
| <u>BUFFING</u> | |
| 1. Charts posted showing buffed tire dimensions? | * _____ |

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	<u>Rating</u>
2. Worker aware of importance of proper buffing and dimensions to quality of retread?	# _____
3. Buffer working properly:	
a) All components tight and properly aligned?	# _____
b) Regulators and gauges working and easy to read?	# _____
c) Ample capacity for tires to be processed?	# _____
d) Tire air pressure as specified?	# _____
4. Buffer hub concentric?	# _____
5. Satisfactory lighting at buffing surface (300 recommended, 200 foot candle minimum).	* _____
6. Proper measuring devices provided?	# _____
7. Markings employed to show:	
a) Matrix design?	# _____
b) Additional buildup needed?	# _____
c) Repairs needed?	# _____
d) Additional cure needed?	# _____
8. Markings clear and understandable?	# _____
9. Rasps sharp?	# _____
10. Adequate range of wheels or hubs?	# _____
11. Measurements made to control buff with:	
a) Crown?	# _____
b) Overall buff?	# _____
12. Specified buffed crown radius maintained and centered?	# _____
13. Buffed contour symmetrical?	# _____
14. Specified diameter achieved?	# _____
15. Tires properly handled to avoid contamination of buffed surfaces?	# _____

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	<u>Rating</u>
<u>AFTER BUFF INSPECTION</u>	
1. Suitable tools for inspection and buzzout?	# _____
2. Proper lighting (300 recommended, 200 foot candles minimum)?	* _____
3. Proper handling of cuts or injuries (3/4" length, not beyond 1 ply on spot repair)?	# _____
4. Specified RMA buff texture obtained?	# _____
5. Surface free from scorch:	
a) Buff?	# _____
b) Sidewall brushing?	# _____
c) Skiving?	# _____
6. All oxidized material removed in buffing or by hand rasping?	# _____
7. Exposed cord properly treated?	# _____
8. All injuries properly repaired?	# _____
<u>REPAIRS</u>	
1. Repair limit charts posted (in accordance with Appendix B)?	* _____
2. Repair procedures available?	* _____
3. Clean, well lighted repair station (300 foot candles minimum)?	* _____
4. Air with rear exhaust or electric buffing tools with proper rpm in good working order?	* _____
5. Operating bead spreader?	# _____
6. Rasps sharp and concentric?	* _____
7. Proper cleaning after buff?	* _____

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- | | <u>Rating</u> |
|--|---------------|
| 8. Repair materials clean and current? | # _____ |
| 9. Cement for use with repair materials based on supplier recommendation? | * _____ |
| 10. Curing equipment in good condition - develops specified temperature and pressure, +/- 5 degrees F and PSI? | # _____ |
| 11. Completed repairs inspected and marked. | # _____ |

CEMENTING

- | | |
|---|---------|
| 1. Specified cement in use? | # _____ |
| 2. Specified rubber solvent used? | # _____ |
| 3. Date code and batch number of cement recorded by date of use? | # _____ |
| 4. Provisions for thorough and continuous mixing of cements? | # _____ |
| 5. Cement equipment kept clean of contamination? | # _____ |
| 6. Moisture traps on air line used? | # _____ |
| 7. Moisture traps on air line inspected daily? | * _____ |
| 8. Separate booth or room used with adequate ventilation system? | # _____ |
| 9. Equipment for evenly coating the buffed surface with cement; spray or brush? | # _____ |
| 10. Proper treatment of skives and exposed cord? | # _____ |
| 11. Provision for allowing cement to dry sufficiently? | # _____ |
| 12. Cemented tires handled and stored to prevent contamination? | # _____ |
| 13. Cemented tires protected from dust? | # _____ |

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<u>RUBBER APPLICATION</u>		<u>Rating</u>
1. Buildup using die-size tread rubber:		
a) Rubber specifications posted?		* _____
b) Dimension specification check made after opening new box of tread rubber?		# _____
c) In-plant extruder:		
1) Regular checks made to assure proper die-size, dimensions or weight?		* _____
2) Cement reservoir free of contamination?		# _____
d) Tread properly centered without distortion?		# _____
e) Knife used to cut splice below 160 F?		# _____
f) Precautions taken to avoid contamination of splice and tread base?		# _____
g) Splice properly sealed?		# _____
h) Machine stitcher working properly?		# _____
i) Tires stored and handled to prevent contamination?		# _____
2. Buildup using strip-wind equipment:		
a) Proper programs for size/design of tires?		# _____
b) Program cards in good condition?		* _____
c) Extruder functioning properly?		# _____
d) Extruder barrel and head temperature within specified range?		# _____
e) Extruder temperatures checked on a regular basis?		* _____
f) Rubber properly centered and wound on tires?		# _____
g) Treads checked for specified gauge, width and weight?		# _____
h) Stitchers working properly?		# _____
i) Tires stored and handled to prevent distortion?		# _____
j) Splice made tightly with rubber gum per posted instructions?		# _____
k) Tread thoroughly stitched to the tire from the center outward?		# _____
l) Tires wicked/vented per specification?		# _____
m) Envelope checked for leaks before curing?		# _____
3. Build-up using precured treads:		
a) Buffed tread width: zero to 1/4 inch wider than tread base width to be used?		# _____
b) Buff texture appropriate for process?		# _____

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- c) Appropriate cure rate cushion used? # _____
- d) Cushion covers area of contact? # _____
- e) Cushion applied smoothly with no wrinkles? # _____
- f) Dimension check of tread rubber? # _____
- g) Tread ends cut at 90 degree angle and properly buffed/texturized for good adhesion? # _____
- h) Tread ends cemented and allowed to dry? # _____
- i) Tread properly centered without distortion? # _____
- j) Splice made tightly with rubber compressed against splice gum per posted instructions? # _____
- k) Tread thoroughly stitched to the tire from the center outward? # _____
- l) Tires wicked/vented per specification? # _____
- m) Envelope checked for leaks before curing? # _____

CURING

1. Matrix Curing Process and Equipment:

- a) Matrices in good condition:
 - 1) Tread design clean, not pitted or dirty? # _____
 - 2) Vents open, not plugged? # _____
 - 3) Locking system tight, flash thickness does not exceed specifications? # _____
 - 4) Tread design offset does not exceed specifications? # _____
- b) Rim and tube selection charts provided? * _____
- c) Required rims and tubes available for matrices or molds? # _____
- d) Rim meter available to operator? # _____
- e) Rim, tube, and flexible matrix storage provided? * _____
- f) Tires checked for proper matrix fit? # _____
- g) Bead centering equipment used according to manufacturer's specifications? * _____
- h) Loading system is operating properly as specified by the manufacturer? * _____
- i) Curing times posted? / # _____
- j) Curing time system or equipment is accurate to minus zero, plus 5 minutes per hour of cure time? # _____
- k) Curing temperatures are correct and equipment is available to detect variations of curing temperatures? # _____

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	<u>Rating</u>
1) Curing pressure stable in normal operations, controlled within +/- 10.0 PSI?	# _____
m) Ventilation provided to area without drafts on molds?	# _____
2. Electric Matrices:	
a) Thermostats functioning?	# _____
b) Operation of thermostats checked on daily basis against certified unit?	* _____
c) Electric capacity large enough to handle all matrices in operation?	# _____
d) Connection cords in good condition?	* _____
e) Power indicators working?	# _____
f) Mold surface temperatures checked at intervals:	* _____
3. Steam Matrices:	
a) Boiler and piping adequate for full load demand?	# _____
b) Warning device used to show low steam pressure?	# _____
c) Steam headers insulated?	# _____
d) Pressure chart recorder on master line?	* _____
e) Steam pressure regulator employed to assure proper matrix surface temperature?	# _____
f) Accurate thermometer in discharge line adjacent to each curing station?	# _____
g) Adequate drip legs properly installed in header?	* _____
h) Steam header properly sloped?	# _____
i) Shop promptly repairs all leaks?	# _____
j) All traps functioning?	# _____
k) Strainers cleaned regularly?	# _____
4. Air Supply	
a) Intake filters properly serviced?	# _____
b) Correct air pressure maintained in headers?	# _____
c) Air headers properly equipped with drip legs and traps?	* _____
d) Compressor capacity sufficient for maximum use?	# _____
e) Piping large enough to move necessary volume of air?	# _____
f) Air header properly sloped?	# _____
g) Quick coupler available at compressor to permit checking with certified gauge?	* _____

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	<u>Rating</u>
h) Air takeoff from top of header?	# _____
i) Measures taken to prevent severe air pressure fluctuation?	# _____
j) Accurate pressure gauge located after each regulator?	* _____
k) Low air pressure warning device?	# _____
l) Safety valves clear and functioning?	# _____
m) Quick couplers applied to all enclosed matrices to check pressure during cure?	* _____
n) Regulators function properly?	# _____
o) Hoses in good condition?	* _____
p) Air leaks promptly repaired?	# _____
q) Compressors provided with outside clean air?	# _____
r) Traps drained regularly?	* _____
5. Pre-Cure:	
a) Curing specifications posted?	* _____
b) Curing chamber operating in compliance with manufacturers specifications?	# _____
1) Temperature?	# _____
2) Pressure?	# _____
3) Timing controls?	# _____
c) Steam and air connections operating with no leaks?	# _____
d) Quick connections provided to check chamber pressure with certified gauge during cure?	* _____
e) Specifications available for use of rims, tubes, envelopes and wicking/venting?	* _____
f) Correct rims, tubes and envelopes available?	# _____
g) Handling and storage of tubes and envelopes adequate to prevent damage?	# _____
h) Accurate heat and pressure indicators installed?	# _____
i) Loading and unloading:	
1) Equipment in satisfactory operating condition?	# _____
2) Procedures in accordance with manufacturer's recommendations?	# _____
6. Flexible matrices used in compliance with manufacturer's recommendations?	# _____

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FINAL INSPECTION

1. Bead spreader or inspection machine available in good operating condition? # _____
2. Adequate lighting (300 foot candles recommended, 200 ft candles minimum)? # _____
3. All finished tires thoroughly inspected? # _____
4. Rejected tires analyzed for reworking if possible? # _____
5. Test tires cut to check for specifications compliance? # _____
6. Passenger tires inspected for proper markings and identification per 49 CFR 571.117 and this specification? # _____
7. Truck tires inspected for retread shop code matrix or chamber code and date clear and in compliance with 49 CFR 571.117 & 574? # _____

QUALITY CONTROL

1. Accurate equipment for measuring air pressures and curing temperature? # _____
2. Temperature checks made daily and recorded? # _____
3. Steam and air pressure checks made daily and recorded? # _____
4. Material input records kept:
 - a) Cements? # _____
 - b) Cushion? # _____
 - c) Tread rubber? # _____
 - d) Repair materials? # _____
5. Regular and periodical inspections made of:
 - a) Buffer uniformity? # _____
 - b) Steam boiler? # _____
 - c) Air compressor? # _____

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	<u>Rating</u>
d) In-shop extruders?	# _____
e) Cement sprayers?	# _____
f) Curing presses?	# _____
g) Curing chambers?	# _____
6. Records kept of equipment condition and maintenance and processing?	# _____
7. Where required, samples of materials used submitted to outside laboratories for checking to specifications?	# _____
8. Adhesion pull tests made on finished product at intervals?	# _____
9. Adjustment records maintained?	# _____
10. Adjustment returns cut and analyzed to determine cause of failure?	# _____

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30.0 PRODUCTION FACILITY SUMMARY, ANALYSIS, AND RATING**30.1 Item Rating Summary.**

	<u>No. of Rated Items</u>	<u>Number Minor Items Rated NA</u>	<u>Number Major Items Rated NA</u>
Plant Supervision	9	_____	_____
Plant Personnel	5	_____	_____
Plant Manual	4	_____	_____
Casing Inspection	12	_____	_____
Buffing	15	_____	_____
After Buff Inspection	8	_____	_____
Repairs	10	_____	_____
Cementing	13	_____	_____
Rubber Application	3	_____	_____
Curing	5	_____	_____
Final Inspection	7	_____	_____
Quality Control	10	_____	_____

30.2 Analysis. (comments, remarks, etc.)

Inspectors'

Analysis: _____
