

SERVICE MANUAL

SERVICE MANUAL SECTION

WHEELS, RIMS AND TIRES

s17001y, Formerly CTS-5017

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DESCRIPTION

WHEEL COMPONENTS

This section covers wheel assemblies for medium and heavy duty vehicles. Various types of wheels (cast spoke or disc) are available and vary in size, types and material (steel or aluminum).

Figure 1, Figure 2, Figure 3, Figure 4 and Figure 5 illustrate the types of DISC WHEELS or RIMS used on International vehicles.

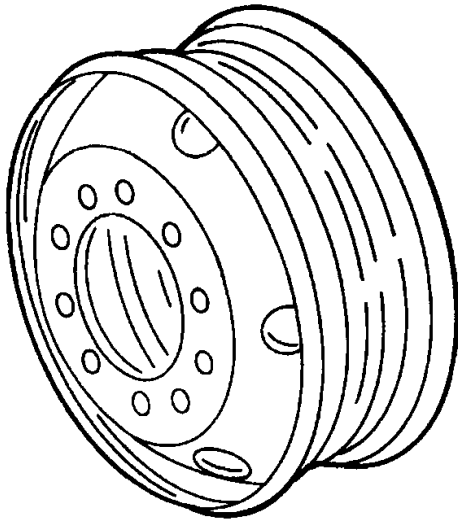


Figure 1 Steel or Aluminum or Aluminum Disc Wheel with Tubeless Tire

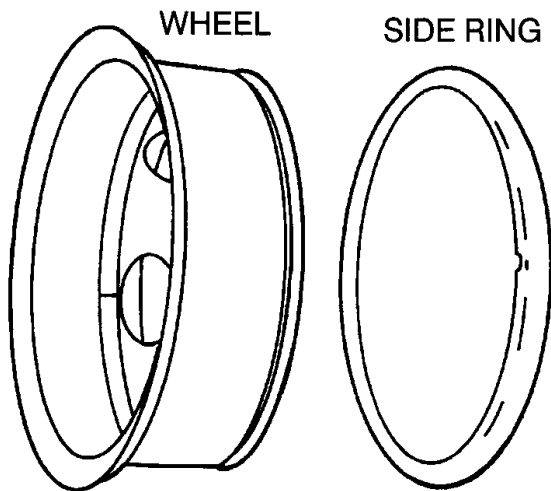


Figure 2 Steel Disc Wheel with Tube Type Tire

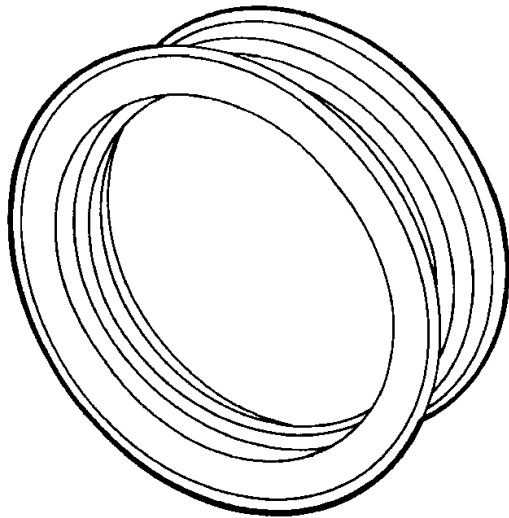


Figure 3 Rim for Cast Spoke Wheel with Tubeless Tire

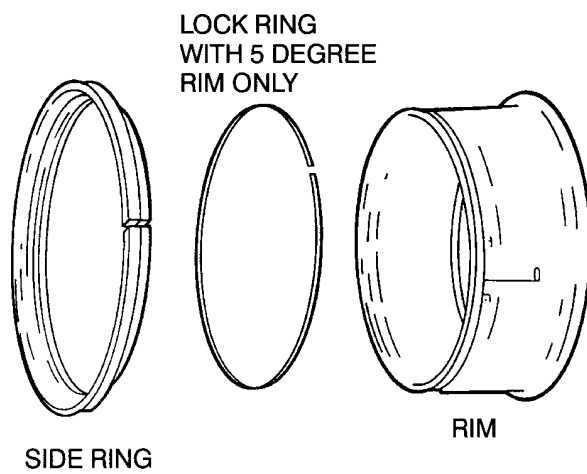


Figure 4 Rim for Cast Spoke Wheel with Tube Type Tire

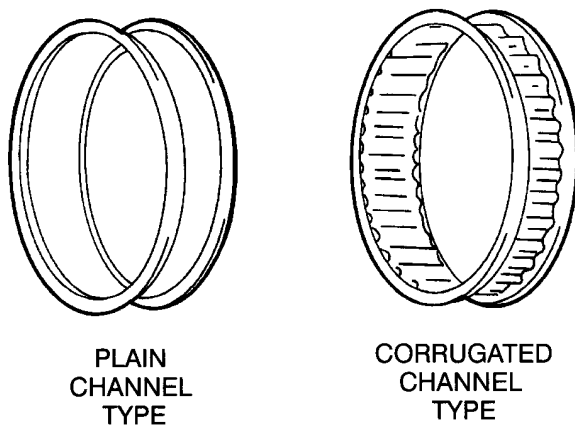


Figure 5 Rim Spacers Used on Dual Rear Spoke Wheels

Two different locations of drum mountings are also used:

- A. Inboard mounted drums are secured to hub on brake group side of hub. Inboard mounted drums are always used with a cast spoke wheel. Also, some disc wheels use this application (Figure 6).
- B. Outboard mounted drums are secured between the wheel and hub, and are held in place by the wheel assembly. Outboard mounted drums will be used with disc wheels only (Figure 7).

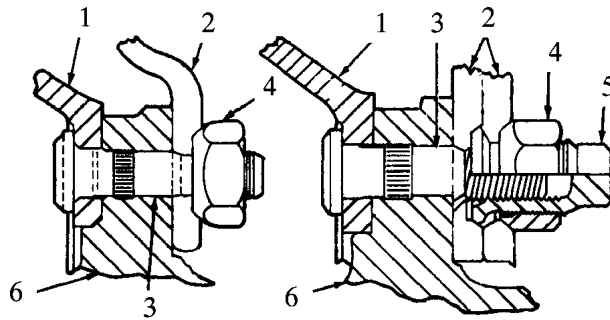


Figure 6 Inboard Mounted Drum Ball Seat (Conical) Nuts

1. DRUM
2. WHEEL
3. WHEEL BOLT
4. WHEEL OUTER NUT
5. WHEEL INNER NUT
6. WHEEL HUB

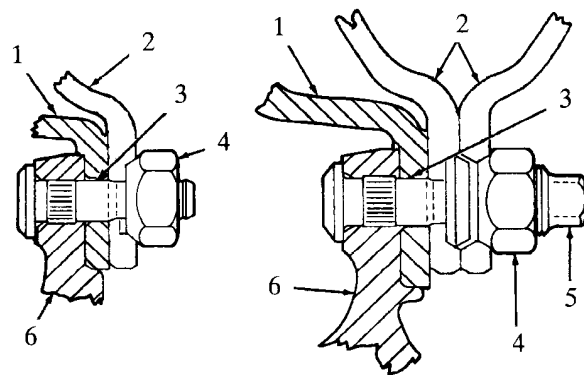


Figure 7 Outboard Mounted Drum With Ball Seat Nuts

1. DRUM
2. WHEEL
3. WHEEL BOLT
4. WHEEL OUTER NUT
5. WHEEL INNER NUT
6. WHEEL HUB

Figure 6 and Figure 7 also illustrate the use of the BALL SEAT NUT MOUNTING SYSTEM.

Figure 8 and Figure 9 illustrate the use of the FLANGE NUT WHEEL MOUNTING SYSTEM .

Refer to INSTALLATION, TIGHTENING AND ALIGNMENT (See INSTALLATION, TIGHTENING AND ALIGNMENT (LATERAL RUN-OUT), page 15) for procedures.

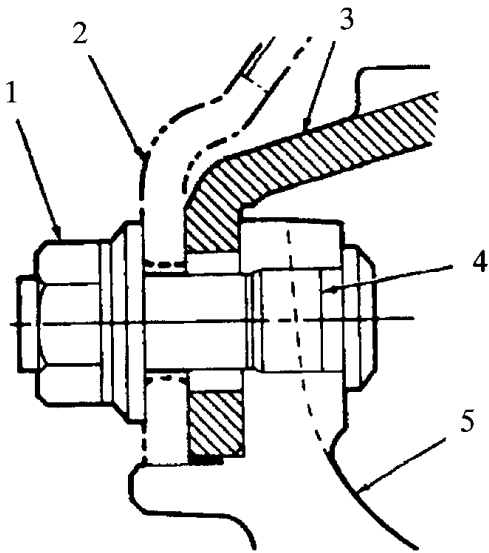


Figure 8 Flange Nut System, Front Wheel Mounting

1. FLANGE NUT
2. WHEEL
3. BRAKE DRUM
4. WHEEL STUD (22mm)
5. WHEEL HUB

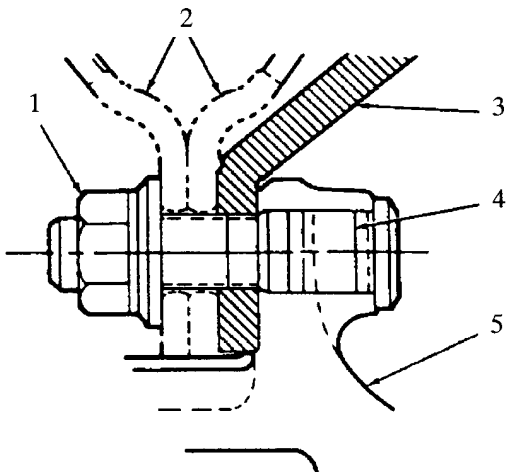


Figure 9 Flange Nut System, Rear Wheels Mounting

1. FLANGE NUT
2. WHEELS
3. BRAKE DRUM
4. WHEEL STUD (22mm)
5. WHEEL HUB

WARNINGS

WARNING – Failure to observe the following warnings may result in property damage, personal injury, or death.

Always loosen rim clamps before complete removal of nut from stud (cast spoke wheels). With loosened nuts on stud, strike clamps with a heavy hammer and be sure each clamp is loose.

Always deflate tires completely before removing locks or side rings.

Always inspect and clean all parts before assembly.

Always inflate tires in a safety cage.

Always use a "clip-on" air chuck with remote control valve to inflate tires.

Never strike cast spokes of wheel assembly when loosening rim clamps.

Never mix rim side rings or lock rings of different types or size.

Never use cracked, bent or badly rusted parts.

Never reinflate flat tires on vehicle - use the spare.

Never add air until certain each side or lock ring is fully seated.

Never hammer side or lock ring on a partially or fully inflated tire.

When installing the tire and rim assembly on disc braked axles, make sure the tire valve stem clears the brake caliper. The use of a valve stem retainer or a tire manufacturer's stem-forming tool are the only acceptable methods of obtaining clearance when necessary.

Use only the same type and style wheels and mounting hardware to replace original parts. Failure to do so may result in an assembly which looks fine, but does not fit together properly which could possibly cause wheel or fastener failures which might result in personal injury.

Do not attempt to mix ball seat wheels or fasteners with flange nut wheels or fasteners.

Do not mix foreign (not made in North America) parts with domestic (made in North America) parts. Many foreign wheel components are similar, but not exactly the same as North American-made parts.

Do not change from aluminum wheels to steel wheels or vice versa without changing the mounting hardware where required or in some cases with flange nut mounting systems changing the hub and stud assembly.

Consult your Service Parts Catalog or wheel/rim distributor before attempting any wheel or fastener changes.

1. SERVICE PROCEDURE

When servicing wheels, different procedures will be required for different types of wheels.

1.1. TIRE SERVICE

This requires removal of disc wheel and tire on vehicles with disc wheels. On vehicles with cast spoke wheel, tire and rim assembly will be removed for tire service.

1.2. BRAKE SERVICE

1. Vehicles with Hydraulic Disc Brakes will have to have the Wheel or Rim Tire Assembly removed to service the Wheel/ Brake Components.
2. Vehicles with cast spoke wheels or disc wheels and inboard mounted brake drums (single or dual tires): remove wheel, hub and drum as an assembly to perform brake service.
3. Vehicles with disc wheels (single or dual tires) with outboard mounted brake drums: remove wheel or dual wheels assembly. Then remove brake drum leaving hub assembly intact on vehicle. Wheel bearing and seal service will not be required with this procedure.

For more detailed information on Brake Service, refer to GROUP 04 - BRAKES in the CTS-5000 Master Service Manual.

2. WHEEL AND WHEEL ASSEMBLIES REMOVAL AND INSTALLATION

2.1. CAST SPOKE WHEELS

Tire and Rim (Removal)

Refer to Figure 10 and Figure 11 .

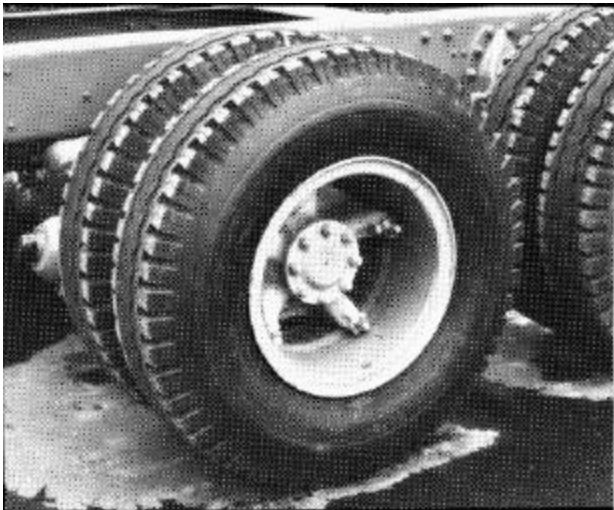


Figure 10 Cast Spoke Rear Wheel Assembly



Figure 11 Cast Spoke Front Wheel Assembly

1. Set parking brake and block wheels not being serviced to prevent vehicle from moving.
2. Break all wheel nuts loose on wheel(s) being serviced.
3. Position vehicle on floor stand(s).



WARNING – A jack must never be used alone to support vehicle while under-chassis service is being performed. The jack may lower and serious personal injury could result. Always support vehicle with floor stands.

4. Loosen all wheel nuts almost to the end of the stud on the wheel being serviced. Before removing nuts, use a heavy hammer and strike the rim clamps. Make sure each clamp is loose, then remove the nuts, clamps, and tire/rim. If servicing rear dual wheels, remove outer tire/rim assembly rim spacer and inner tire/rim assembly. Do not strike cast spokes of wheel assembly.

Tire and Rim (Installation)

When installing rims, be certain stud threads are clean to permit correct torquing of nuts. Do not use any type of lubrication on threads.

Refer to INSTALLATION, TIGHTENING AND ALIGNMENT for additional procedures for installing rims used with cast spoke wheels.

Refer to TORQUE CHART for correct torque values for wheel nuts.

2.2. DISC WHEELS (REMOVAL)

Tire and Wheel

Refer to Figure 12 and Figure 13.



Figure 12 Disc Rear Wheel Assembly



Figure 13 Disc Front Wheel Assembly

1. Set parking brake and block wheels not being serviced to prevent vehicle from moving.
2. Break all wheel nuts loose on wheel(s) being serviced.
3. Position vehicle on floor stand(s).



WARNING – A jack must never be used alone to support vehicle while under-chassis service is being performed. The jack may lower and serious personal injury could result. Always support vehicle with floor stands.

4. If brake service is to be performed, loosen or back off brake adjustment so that the drum will move freely without drag (not required with disc brakes). Refer to GROUP 04 - BRAKES in the CTS-5000 Master Service Manual.
5. Remove wheel nuts (outer nuts with dual wheels at rear) (Figure 14).

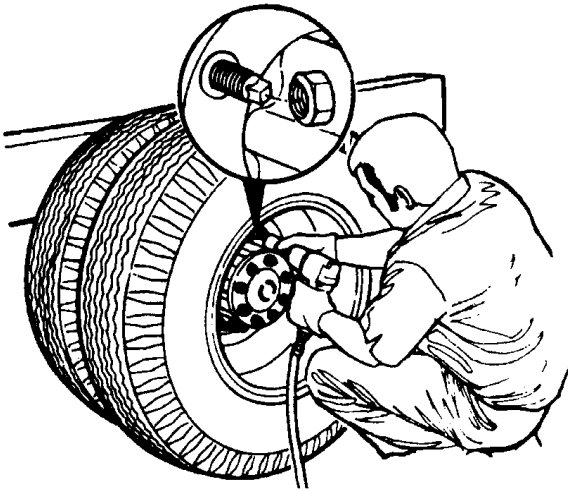


Figure 14 Remove Outer Wheel Nuts (Ball Seat)

6. Remove wheel from wheel studs.
7. On dual wheel application, remove the inner wheel nuts and wheel (Figure 15).

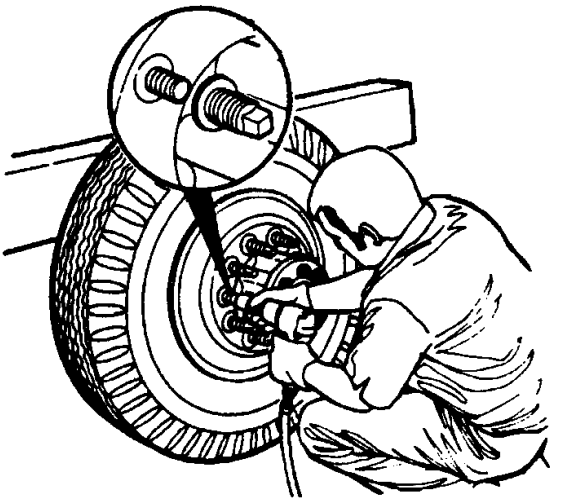


Figure 15 Remove Inner Wheel Nuts (Ball Seat)

2.3. DISC WHEELS (INSTALLATION)

1. Installation of wheel and tire assembly is essentially the reverse of the removal procedure. Special attention must be given to the following:
 - a. Before mounting wheel assemblies on vehicles, be sure all parts are clean and free from foreign matter. Excess paint on wheel stud hole perimeters can cause wheel mounting nuts to loosen with use.
 - b. Be certain wheel stud threads are clean to allow correct torquing of nuts. Do not apply any lubricant on threads.
2. Install wheel assembly. Refer to INSTALLATION, TIGHTENING AND ALIGNMENT.

Refer to TORQUE CHART for correct torque values for wheel nuts.

3. OSHA STANDARDS

The Occupational Safety and Health Administration (OSHA) has established rules and regulations pertaining to servicing Multi-Piece Rim Wheels.

The text herein refers to selected excerpts from the OSHA standard. For complete details, refer to the complete OSHA standard 1910.177 to ensure compliance.

Basically, the regulations state that it is up to the employer to provide employee training to instruct all employees who service multi-piece rims in the safety hazards involved and the safety procedures to be followed.

The employer shall see that no employee services multi-piece or single piece rim wheels unless trained, and demonstrates and maintains the ability to service multi-piece rim wheels safely.

This shall include the following tasks:

- A. Demounting of tires, which includes deflation.
- B. Inspection of components.
- C. Mounting of tires, which includes inflator with restraining device.
- D. Use of restraining device.
- E. Handling of wheels.
- F. Inflation of tires when a wheel is mounted on the vehicle.
- G. An understanding of the necessity of standing outside the trajectory both during the inflation of the tire and during inspection of the rim wheel following inflation.
- H. Installation and removal of wheels.

OSHA also states the type of tire servicing equipment to be used.

- A. Restraining device (inflation cage).
- B. Clip-on-chuck with enough hose to permit employees to stand clear of potential trajectory of wheel components. An in-line valve with gauge or pressure regulator preset to a desired value must also be provided.
- C. Current charts must be posted in service area.
- D. Current rim manual containing instructions for types of rims being serviced shall be available in service area.
- E. The employer must assure that only tools recommended in the rim manual are used to service multi-piece rim wheels.

4. WALL CHARTS

The National Highway Traffic Safety Administration (NHTSA) has prepared two charts which are to be posted in the rim wheel service area. These charts alert service personnel of the hazards involved when working with multi-piece wheels.

One chart is called "Safety Chart" which illustrates the proper safety precautions to be followed when servicing truck and bus multi-piece wheels.

The second chart is called "Matching Chart" which provides the guidance of various wheel makes and components which can be safely interchanged.

These charts are available to all persons who service multi-piece wheels as follows:

Individuals who service such wheels may obtain a single copy of each chart, without cost, by writing:

General Services Division/Distribution
National Highway Traffic Safety Admin.
400 Seventh Street, S.W.
Washington, D.C. 20590

Establishments and other organizations desiring these charts may order same in any quantity desired from:

Superintendent of Documents
Government Printing Office (GPO)
Washington, D.C. 20402

The GPO ordering numbers for charts are:

Safety Chart #050-003-0315-8
Matching Chart #050-003-00316-6

5. CARE AND MAINTENANCE

Wheel rims should be periodically inspected both on the vehicle and during tire changes for cracks, loose wheel studs, worn mounting holes or being bent.

Disc wheels have rims which are integral with the wheel itself; the important thing to note is that the wheel stud nuts must be kept tight. This means they should be inspected and tightened at regular intervals. When checking the mounting studs and nuts on dual disc wheels (Figure 16), the outer nut should be backed off before attempting to tighten the inner nut. Try all cap nuts after the first trip or any wheel change. When properly installed, they should remain tight indefinitely.

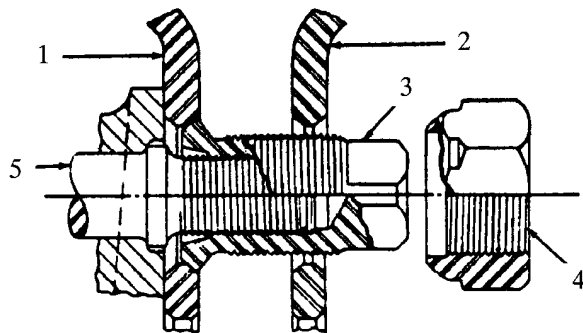


Figure 16 Dual Disc Wheel Installation

1. INNER WHEEL
2. OUTER WHEEL
3. INNER NUT
4. OUTER NUT
5. STUD

Left-hand thread nuts can be identified by the small groove machined around the flats, or the letter "L" stamped on the nut. Left-hand studs can be identified by the letter "L" stamped on the head. Use left-hand nuts on the left side of the truck.

Cast spoke wheels have the rim and tire assembly mounted to the spoke wheel by rim clamps; the rim clamp nuts should also be kept tight. Rim and tire to wheel alignment should be checked frequently to make sure the tire is running true.

Whenever a tire is removed, clean off all grease and road dirt. Use a wire brush or steel wool to remove the rubber from the wheel/rim bead seat.

Projections on the side wall of the gutter may cause uneven seating of the side ring and lead to chipping of the gutter. Remove these and other projections in the mounting area to assure the best possible fits.

Nicks and gouges in the vicinity of the fixed flange may lead to rim fracture.

Do not heat or weld wheels or rims in an attempt to straighten or repair severe road damage; replace component. The special alloy used in these components is heat-treated, and uncontrolled heating from welding torch affects the properties of the material.

To avoid possible corrosive effects to aluminum wheels, use only a slight amount of water and neutral soap (similar to Ivory Snow, etc. - no detergents) when mounting tires. Do not use commercial rubber lubricants.

Do not allow dirt to enter the mounting area during installation.

5.1. WHEEL STUDS AND MOUNTING NUTS

Maintaining wheel stud and mounting nut tightness does much to insure safe and satisfactory wheel operation. Loose wheel mounting can cause vibration, shimmy, tire wear, stud breakage, worn studs, mounting nuts (Figure 17) and worn or elongated stud holes (Figure 18). Parts with these characteristics must be replaced. Always keep wheel stud nuts tightened to specified torque. Refer to TORQUE CHART for correct torque values.

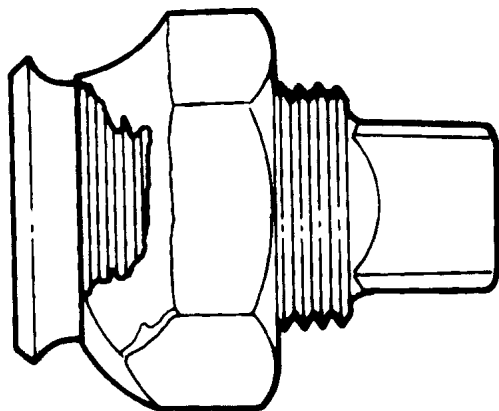


Figure 17 Defective Mounting Nut

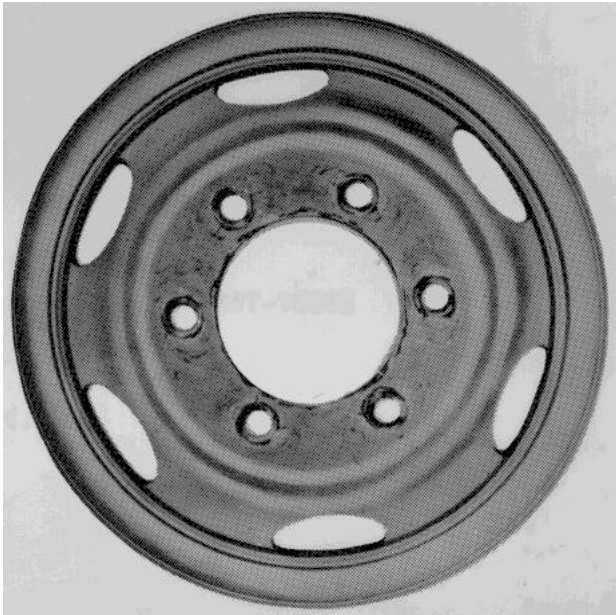


Figure 18 Elongated Stud Holes

Check for uniform seating of the nuts (Figure 19). It is extremely important that the various nuts are not interchanged or intermixed. The nut on the top is in good condition. The one on the bottom is exemplary of a scarred and galled nut that should be replaced.

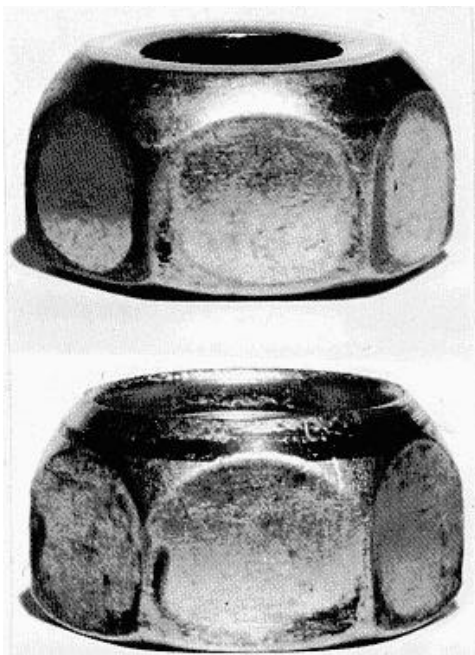


Figure 19 Comparing Mounting Nuts

Rust streaks (Figure 20) from stud holes are a good indication that mounting nuts are not tightened to the specified torque.



Figure 20 Indication of Loose Mounting Nuts

Before mounting wheel assemblies on vehicle, make sure all parts are clean and free from foreign matter. Excess paint on wheel mounting face stud hole perimeters can cause wheel mounting nuts to loosen with use.

5.2. INSTALLATION, TIGHTENING AND ALIGNMENT (LATERAL RUN-OUT)

Disc Wheels or Cast Spoke Wheels

When installing disc wheels or demountable rims with cast spoke wheels, be certain that the threads on studs and nuts are clean to permit correct torquing of nuts. The mounting surfaces of rims, wheels, spacer rings and clamps should be free of dirt, rust or damage. Use a wire brush to clean mounting contact surfaces. Do not use lubricant on threads.

After rim or wheel has been properly torqued, the assembly should be checked for tire lateral run-out. This can be accomplished by attaching a tire run-out dial indicator to a steady, firm surface and placed to just barely touch the outside surface of tire curb rib (Figure 21). If this area is scuffed, cut or gouged, you will get an improper reading on the dial indicator. The lateral run-out on front steering tires should not exceed 0.125 inch. For rear axles with dual wheels, the lateral run-out should not exceed 0.187 inch. If the lateral run-out exceeds these measurements, check for bent or cocked rims, improperly adjusted wheel bearings, and/or improper tire bead seating. Make corrections as needed. Loosen all lug nuts and rim clamps and re-torque to specifications. Then re-check lateral run-out.

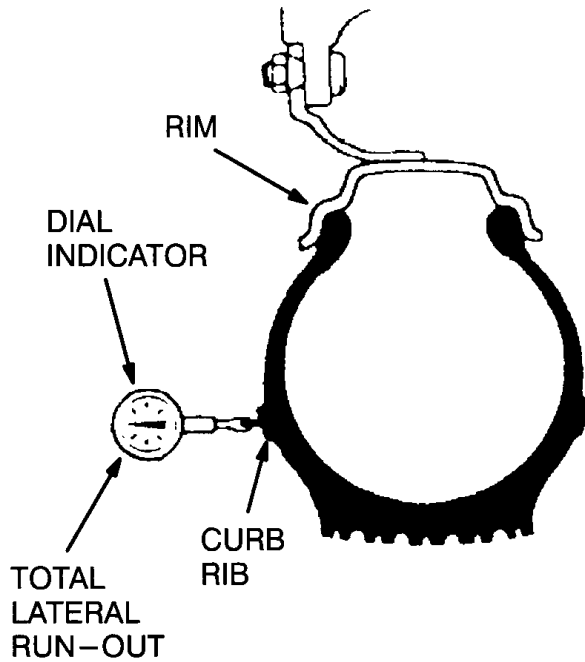


Figure 21 Checking Total Lateral Run-out

Cast Spoke Wheels

1. Slide inner rear or front tire and rim assembly over the cast spoke wheel and push it back into position against tapered mounting surface. Be sure valve stem faces out and is centered between two spokes (and clears disc brake calipers if applicable).
2. Slide spacer ring over wheel. Check spacer ring for concentricity by rotating spacer ring around cast spoke wheel (rear wheel only).
3. Slide the outside rear tire and rim assembly on the wheel, making sure the valve stem faces inboard and is located in the same relative position as the inner valve stem (rear wheel only).
4. Assemble all rim clamps and nuts. Turn nuts on studs until each nut is flush with end of stud.
5. Turn top nut "1" (Figure 22) until it is snug.

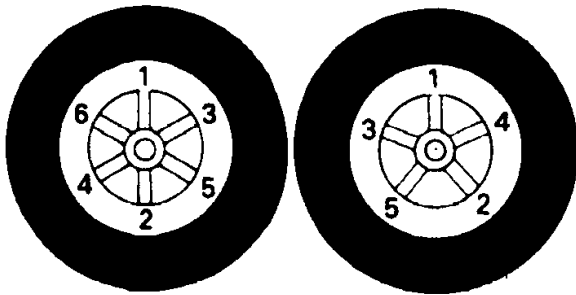


Figure 22 Cast Spoke Wheel Tightening Sequence

6. Rotate wheel and rim until nut "2" (Figure 22) is at top position and snug nut.

7. Rotate wheel and rim until nut "3" (Figure 22) is at top position and snug nut.
8. Rotate wheel and rim until nuts "4," "5" and "6" are respectively at top and snug these nuts.

Since the entire weight of tire and rim assembly is on top spoke, the foregoing procedure (crisscross sequence) will assure even application of force at all points on the rim, keeping the rim in proper alignment.

9. Repeat the sequence of tightening the nuts to torque value listed in the TORQUE CHART.

After wheel assembly is properly torqued, check for rim alignment as mentioned above.

10. After operating the vehicle approximately 50 miles (80 km), check the stud nuts for tightness in same sequence shown in Figure 22 . Once each week, inspect and re-torque wheel stud nuts (Figure 23).

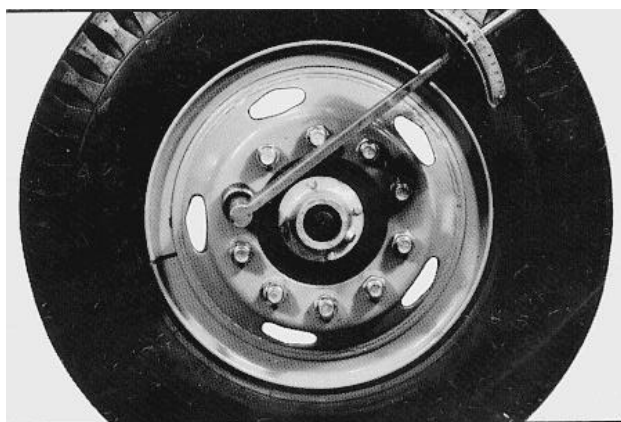


Figure 23 Using Torque Wrench to Torque Wheel Nuts

Disc Wheels with (Ball Seat) Nuts

1. Slide inner/rear or front tire and wheel in position over studs and push back as far as possible. Use care to avoid damage to threads on studs and inspect the valve stem to caliper for clearance if applicable.
2. Install the wheel nut on front wheels and inner wheel nut on rear dual wheels. Run nuts on studs until the nuts start to contact the wheel. Rotate wheel a half turn to allow parts to seat naturally.
3. Draw up stud nuts alternately following the sequence (crisscross pattern) illustrated in Figure 24. Do not fully tighten the nuts at this time. This procedure will allow a uniform seating of nuts and insure the even face-to-face contact of wheel and hub.

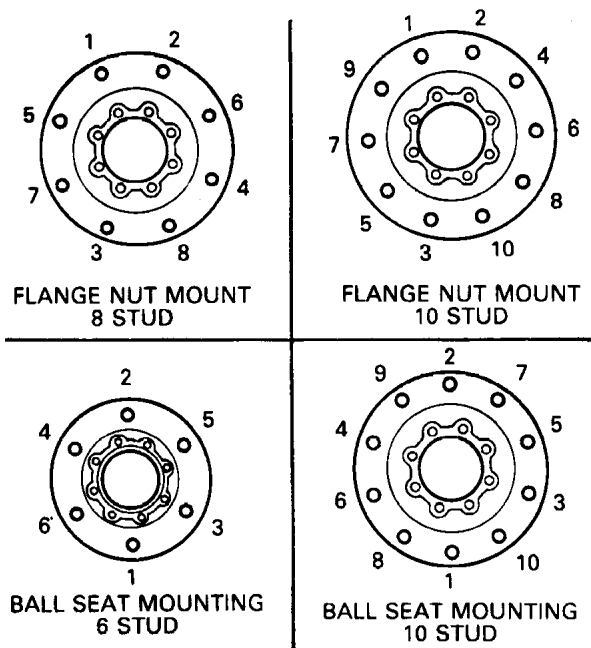


Figure 24 Disc Wheel Tightening Sequence

4. Continue tightening the nuts to the torque value in the TORQUE CHART, using the same alternating method shown in Figure 24 .
5. Install the outer rear wheel and nuts. Repeat the preceding method. Be sure that both inner and outer tire valve stems are accessible.
6. After operating the vehicle approximately 50 miles (80 km), check the stud nuts for tightness. Some natural seating of parts may be encountered and the torque on nuts will drop. Retighten all nuts to specified torque value.

To check and tighten the inner wheel to proper torque, first loosen the outer wheel nuts several turns and tighten the inner nuts, then retighten the outer nuts (rear wheel only).

To prevent losing the seating of the outer wheel when checking the inner wheel torque, it is suggested that alternate outer nuts be loosened and tighten the inner nuts, then retighten the outer nuts. Then loosen the remaining outer nuts, tighten inner nuts and then retighten the outer nuts.

Once each week inspect and re-torque wheel stud nuts, if necessary (Figure 23).

Disc Wheels with Flange Nuts

Refer to Figure 25 and Figure 26 for cross section view of flange nut installation.

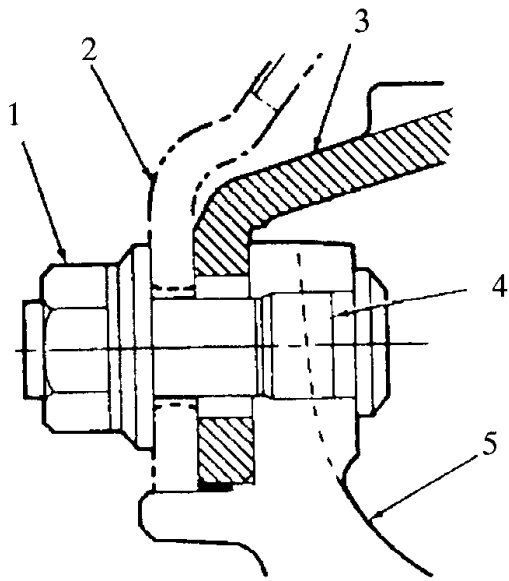


Figure 25 Flange Nut System, Front Wheel Mounting

1. FLANGE NUT
2. WHEEL
3. BRAKE DRUM
4. WHEEL STUD (22mm)
5. WHEEL HUB

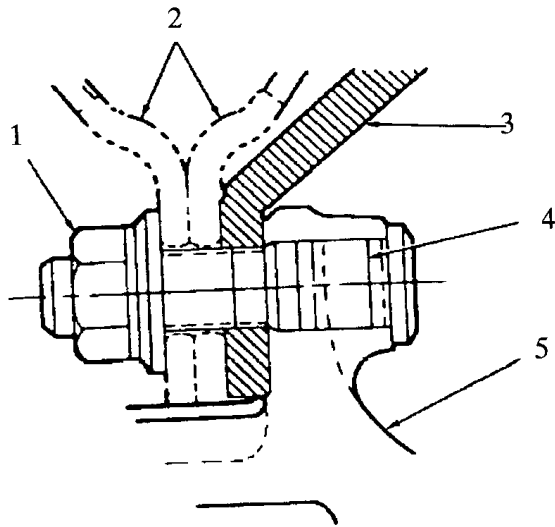


Figure 26 Flange Nut System, Rear Wheel Mounting

1. FLANGE NUT
2. WHEELS
3. BRAKE DRUM
4. WHEEL STUD (22mm)
5. WHEEL HUB

1. Slide inner rear or front tire and wheel in position over studs and push back as far as possible. Use care so that the threads on studs are not damaged. Inspect the valve stem to brake caliper for clearance, if applicable.
2. Position outer rear tire and wheel in place over the studs and push back as far as possible. Again use care so that the threads on studs are not damaged.
3. Run the nuts on the studs until nuts contact the wheel or wheels. Rotate wheel assembly a half turn to permit parts to seat naturally.
4. Draw up nuts alternately following the (crisscross pattern) sequence illustrated in Figure 24 . Do not fully tighten nuts at this time. This procedure will allow uniform seating of nuts and assure even face-to-face contact of wheel and hub.
5. Continue tightening the nuts to values in the TORQUE CHART using the same alternating method shown in Figure 24 .

Once each week inspect and re-torque wheel stud nuts, if necessary (Figure 23).

6. WHEEL AND TIRE BALANCING

Front wheel and tire assemblies must be balanced to prevent wheel vibration and bounce. While the correct front wheel alignment is necessary for easy steering and maximum tire life, the cause of unstable steering can frequently be traced to improper balance of front wheels. When this condition exists, the wheel and tire assembly should be properly balanced.

A vulcanized or retreaded tire, or a tire that has a boot in it, **MUST NOT** be used as a front steering tire.

6.1. STATIC BALANCING

A wheel out of balance statically has a tendency to bounce up and down, resulting in rapid tire wear in round or oblong spots.

Static balancing is performed while wheel is stationary by attaching weights to rim flange to offset an opposite heavy point.

Static balancing may be sufficient in some instances where vehicle is operated only at slow speeds, however, dynamic balancing (in motion) balances the wheel and tire assembly statically as well as dynamically, thereby eliminating vibrations and wheel bounce at both low and high speeds.

A wheel may be perfectly balanced statically (not in motion) but may still vibrate and bounce at high speed rotation because of its being out of balance dynamically.

6.2. DYNAMIC BALANCING

Dynamic balancing is the complete wheel balancing procedure of which static balancing is only a part.

Dynamic balancing (in motion) takes into consideration the distribution of weight to be added to the wheel. This is accomplished by rapidly rotating (normal truck operating speed) the wheel and tire assembly either on the vehicle or with the wheel assembly removed and placed on a dynamic balancing machine. This determines the heavy point on the wheel.

When the amount of weight required to offset a heavy part in a wheel assembly is known, it is sometimes necessary to attach one half of the weight to the outside rim flange and the remaining half to the inside rim flange.

With the weight properly distributed on the wheel assembly, the wheel should be in balance both statically and dynamically and should rotate free of vibration and bounce at normal truck operating speeds.

7. TIRE CARE

7.1. INSPECTION

A regular program of tire inspection is essential for the prevention of rapid air loss failures. At a minimum, tires should be inspected at the time of the regular preventive maintenance checks.

In any tire inspection routine, tires should be inspected for the following conditions. If any are found, the tire should be removed and repaired, retreaded or scrapped as the condition indicates.

- A. Any blister, bump or raised portion anywhere on the surface of the tire tread or sidewall (other than a bump made by a repair). These indicate the start of internal separation.
- B. Any cut that reaches to the belt or ply cords, or any cut that is large enough to grow in size and depth.
- C. Any nail or puncturing object.
- D. If any stone or object is held by a tread groove and is starting to drill into the tread base, remove the object.
- E. Look for skid spots and irregular wear conditions.

Proper tire inflation, tire loads, and road speeds are important determining factors governing tire mileage, and also affect steering ease and maneuverability. How much these factors affect tire wear is illustrated in the paragraphs which follow.

7.2. INFLATION

Tire pressures should be checked at regular and frequent intervals and the pressures maintained to specifications. Use an accurate tire pressure gauge and check when tires are cool.

Over-inflated or under-inflated tires will reduce the service life of the tire.

Never "bleed" (remove) air from hot tires. The pressure will be reduced but an increase in temperature will result as soon as driving continues.

7.3. LOADS

Loading vehicles beyond tire load capacity decreases tire life, requiring more frequent replacement of tires.

7.4. TIRE MATCHING

Dual Tires

Dual tires should be matched using tires of equivalent size. Tires which differ more than 1/4 inch (6.35mm) in diameter or 3/4 inch (19.05mm) in circumference should not be mounted on the same dual wheel. The larger or less worn tire should be mounted on the outside.

Tandem Drive Axles

When mounting tires on tandem drive axles, follow the same instructions as specified for dual tires. However, never install the four largest tires on one driving axle and the four smallest on the other. This method of tire mounting will cause high axle lubricant temperatures which may lead to premature axle failures.

Front Wheel Drive, 4x4, 6x6 and 8x6

Replacement tires must have same rolling radius as original equipment tires to avoid damage to the drive train components and to have proper steering effort. Refer to line setting ticket for original equipment tire size.

7.5. MIXING RADIAL/BIAS PLY TIRES

Radial and Bias Ply Tires

It is recommended for best overall performance that only bias or only radial tires be used on a vehicle. However, different heavy truck tires may be used under the following conditions:

- A. If radials are mixed with bias tires, the best handling will be obtained with the bias tires on the steer axle.
- B. Bias or radial tires may be used on either axle of two-axle vehicles, providing the vehicle has dual rear wheels or is equipped with wide-base single tires.
- C. Either bias or radial tires may be used on the steering axle of vehicles with three or more axles. Either all bias or all radial tires should be used on the nonsteering axles.
- D. Never mix different tire sizes or tire constructions on the same axle.
- E. Never mix bias and radial tires in a tandem or multiple axle combination.

7.6. ROTATION

Rotation Is Always Advisable:

- 1. If front (steering) axle tires become irregularly worn, move to rear drive axle or trailer position.
- 2. In a dual assembly, if one tire wears much faster than its mate, reverse position of tires.

Rotation May Be Advisable:

- 1. If tires are highway type tread design:

Front (Steering) Axle - When required, replace tire when tire tread is worn to 1/8 inch (3.17mm) or less. Rotate worn tires to any other position. Retreaded or recapped tires are not to be used on steering axles.

Rear and Trailer Axles - Tires must be removed when tread is worn to no less than 1/16 inch (1.58mm). However, tires identified by the word "regroovable" molded on the sidewall can be regrooved.

- 2. If rib or highway type tire is used on front axle and lug or off-road type on rear axle positions:

Front (Steering Axle) - Install new tires at front wheels when tread is worn to 1/8 inch (3.17mm) or less. These tires can be moved to trailer positions.

Rear and Trailer Axles - Tires must be removed when the tread is worn to 1/16 inch (1.58mm) or less. Tires identified with the word "regroovable" molded on the sidewall can be regrooved.

7.7. ALIGNMENT - FRONT AXLE

Before any alignment adjustment is performed, always check the vehicle for loose king pins, worn wheel bearings and tire rod ends, or any looseness in the steering system. Attempts to correct alignment on a vehicle with worn components are fruitless. Refer to GROUP 02 - FRONT AXLES in the CTS-5000 Master Service Manual for front axle alignment information.

7.8. ALIGNMENT - REAR AXLE

In recent years, the importance of drive-axle alignment has become increasingly evident. Tandem-drive axles that are not parallel to each other or axles that are not perpendicular to the chassis centerline have a definite effect on steer-tire wear. For rear axle alignment information, refer to GROUP 14 - REAR AXLES in the CTS-5000 Master Service Manual.

7.9. TIRE WEAR

Radial tires can exhibit three types of normal wear patterns: 1. Even, 2. Erosion, 3. Shoulder.

Even Wear. Like a bias tire, radial tires which have an even wear pattern is a sign that they are being properly used and maintained.

Erosion Wear has also been called rolling wear, channel or river wear and can be found in both bias or radial tires. Erosion wear is found more often at free rolling tires. This is an indication that the tire is used in a slow wearing operation. What happens is that the belt plies are held very rigid and the tread is not allowed to distort as it passes through the contact area. Wear will only occur at the edge of the tread. The tire is not being worn fast enough through normal driving. No corrective action required. If erosion gets to be 1/16 inch (1.588mm) or more, the tire should be rotated.

Shoulder Wear even with tires inflated properly is a normal wear of certain radial tire designs. If both inside and outside shoulders are wearing evenly around the tire, no further action is required. Do not over-inflate tire to correct this effect. To do so could lead to premature failure when impact of road hazard is encountered.

7.10. SERVICE LOAD AND INFLATION CHARTS

Table 1 SERVICE LOAD AND INFLATION CHART (NOT MICHELIN) (For Trucks, Buses and Trailers in Normal Highway Service)

Tire Size Designations		TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)													
Tube Type	Tube-less	65	70	75	80	85	90	95	100	105	110	115	120		
	8R19.5	D	2350	2460	2570	2700	2780	2880	3000	3070	3160	3375F			
		S	2410	2540	2680	2800	2930	3060	3170	3280	3400	3500F			
	9R22.5	D	3120	3270	3410	3550	3690	3820	3950F	4070	4200				
		S	3190	3370	3560	3730	3890	4050	4210	4350	4500F				
	10R22.5	D	3690	3870	4040	4200	4375	4520	4670	4875F	4970	5110	5250G		
		S	3770	4000	4210	4410	4610	4790	4970	5150F	5320	5490	5680G		
10.00R20	11R22.5	D				4760F	4950	5120	5300	5470	5750G	5800H			
		S				4990	5220	5430F	5640	5840	6175G	6240	6430	6610H	
11.00R20	12R22.5	D				5190	5390	5590	5780G	5960	6150	6320	6500	6750H	
		S				5450	5690	5920	6140	6370	6590G	6790	7010	7390H	
12.00R20		D				5910	6140	6360	6580	6790	7000	7200J			
		S				6200	6480	6740	7010	7250	7500	7740	7980	8210J	
14.00R20		D				8120	8430	8740	9030	9320	9610L				
		S				8510	8890	9260	9610	9960	10300	10620	10960L		
	11R24.5	D				5070	5260	5450	5640	5820	6000G	6170H			
		S				5310	5550	5780	6000	6210	6430G	6630	6840	7030H	
11.00R22	12R24.5	D				5520	5730	5940	6140	6330	6530	6720H			
		S				5790	6040	6290	6530	6770	7000	7220	7440	7660H	

Table 1 SERVICE LOAD AND INFLATION CHART (NOT MICHELIN) (For Trucks, Buses and Trailers in Normal Highway Service) (cont.)

Tire Size Designations		TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)											
Tube Type	Tube-less	65	70	75	80	85	90	95	100	105	110	115	120
12.00R24		D			6650	6910	7160	7410	7640	7870	8100J		
		S			6980	7280	7580	7880	8160	8450	8710	8970	9230J
D=Dual Tire Usage													
S=Single Tire Usage													
Letters listed with loads designate the maximum load range for that load range. Do not exceed rim load and/or inflation limits													

Table 2 SERVICE LOAD AND INFLATION CHART (NOT MICHELIN) (For Trucks, Buses and Trailers in Normal Highway Service) (Cont.)

Tire Size Designations	TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)															
	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	
Tubeless																
225/70R19.5	D 2150	2300	2445	2600	2720	2860	3000E	3115	3245	3415F	3490	3615	3750G			
	S 2270	2445	2600	2755	2895	3040	3195E	3315	3450	3640F	3715	3845	3970G			
245/70R19.5	D 2755	2910	3070	3220	3415	3515	3655	3875F	3940	4075	4375G	4500	4625H			
	S 2930	3085	3265	3425	3640	3740	3890	4080F	4190	4335	4545G	4620	4805H			
265/70R19.5	D 2755	2900	3085	3195	3430	3600	3750	3930	4095	4300	4405	4560	4805	4860	5070G	
	S 2910	3085	3280	3415	3650	3830	3970	4180	4355	4540	4685	4850	5070	5170	5355G	
245/75R22.5	D 2600	2760	2930	3085	3260	3425	3640	3740	3890	4080	4190	4335	4410G			
	S 2755	2935	3115	3305	3470	3645	3860	3980	4140	4300	4455	4610	4675G			
255/70R22.5	D 2835	3030	3220	3415	3585	3765	3970	4110	4275	4410	4455	4610	4675G	5070H		
	S 3000	3225	3425	3640	3815	4005	4190	4370	4550	4675	4895	5065	5205G	5510H		
D = Dual Tire Usage																
S = Single Tire Usage																
Letters listed with loads designate the maximum load range for that load range. Do not exceed rim load and/or inflation limits.																

Table 3 SERVICE LOAD AND INFLATION CHART (NOT MICHELIN) (For Trucks, Buses and Trailers in Normal Highway Service) (Cont.)

Tire Size Designations	TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)													
Tubeless	70	75	80	85	90	95	100	105	110	115	120	125	130	
265/75R22.5	D	4040	4205	4370	4525	4685	4805G							
S		4070	4255	4440	4620	4800	4975	5150	5205G					
275/70R22.5	D			4535	4750	4960	5165	5370	5575	5775	5975	6175H		
S				4885	5080	5305	5530	5750	5965	6185	6400	6610H		
275/80R22.5	D			4855	5080	5305	5525	5745	5965	6180	6395H			
S				5265	5515	5755	6000	6235	6475	6710	6940H			
295/75R22.5	D	4690	4885	5070	5260	5440	5675G	5800	6005H					
S		4725	4945	5155	5370	5510	5780	5980	6175G	6370	6610H			
295/80R22.5	D		4855	5100	5335	5570	5805	6035	6265	6490	6720	6940H		
S			5480	5750	6020	6285	6550	6810	7070	7320	7580	7830H		
315/80R22.5	D			5840	6070	6395	6540	6770	6940	7210	7610J			
S				6415	6670	6940	7190	7440	7610	7920	8270J			
315/80R22.5	D				6220	6425	6690	6955	7220	7480	7750L			
Goodyear (55 MPH Max Spd)	S				6940	7460	7770	8080	8380	8690	9000L			
315/80R22.5	D				6070	6395	6540	6770	6940	7210	7610	7850	8190L	
Bridge- stone (55 MPH Max Spd)	S				6670	6940	7190	7440	7610	7920	8270	8600	9000L	
285/75R24.5	D	4740	4930	5205	5310	5495	5675G	5860	6175H					
S		4770	4990	5210	5420	5675	5835	6040	6175G	6440	6780H			

Table 3 SERVICE LOAD AND INFLATION CHART (NOT MICHELIN) (For Trucks, Buses and Trailers in Normal Highway Service)
(Cont.) (cont.)

Tire Size Designations	TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)												
	70	75	80	85	90	95	100	105	110	115	120	125	130
Tubeless													
385/65R22.5 S			6940	7350	7650	8050	8230	8510	8820	9050	9370J		
425/65R22.5 S			8270	8740	9100	9370	9790	10100	10500J	10800	11400L		
445/65R22.5 S			9090	9480	9870	10200	10600	11000	11400	11700	12300L		
D = Dual Tire Usage													
S = Single Tire Usage													
Letters listed with loads designate the maximum load range for that load range. Do not exceed rim load and/or inflation limits.													

Table 4 SERVICE LOAD AND INFLATION CHART (MICHELIN ONLY) (For Trucks, Buses and Trailers in Normal Highway Service)

Tire Size Designations		TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)												
Tube Type	Tube-less	65	70	75	80	85	90	95	100	105	110	115	120	
	9R22.5	D		3474	3671	3835	4050	4300F						
		S		3700	3912	4050	4307	4540F						
	10R22.5	D		3914	4131	4349	4566	4740F	4995	5080G				
		S		4255	4490	4725	4962	5150F	5600	5680G				
10.00R20	11R22.5	D		4224	4450	4650	4922	5180	5750G	5778	5880	5950H		
		S		4692	4950	5215	5470	5755	6175G	6245	6427	6610H		
11.00R20	12R22.5	D		4425	4675	4950	5200	5500	5800	6100	6400	6750H		
		S		4990	5280	5570	5870	6155	6455	6740	7030	7390H		
12.00R20		D		4629	4815	5181	5435	5725	5966	6255	6500	6755	7160J	
		S		5197	5512	5827	6117	6447	6725	7055	7330	7605	8270J	
14.00R20		D				8077	8473	8887	9232	9645	9900M			
		S				8832	9287	9782	10197	10692	11000M			
	11R24.5	D	3640	3993	4224	4455	4693	4923	5180	5790G	5970	6330H		
		S	4390	4705	4960	5235	5513	5780	6105	6430G	6630	7030H		
11.00R22	12R24.5	D	4915	5116	5300	5520	5730	5940	6140	6330	6530	6720H		
		S	5060	5303	5520	5790	6040	6290	6530	6770	7000	7220	7440	
													7660H	

Table 4 SERVICE LOAD AND INFLATION CHART (MICHELIN ONLY) (For Trucks, Buses and Trailers in Normal Highway Service) (cont.)

Tire Size Designations		TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)											
Tube Type	Tube-less	65	70	75	80	85	90	95	100	105	110	115	120
12.00R24	D	5922	6167	6390	6650	6910	7160	7410	7640	7870	8100J		
	S	6135	6420	6660	6980	7280	7580	7880	8160	8450	8710	8970	9230J
D= Dual Tire Usage													
S= Single Tire Usage													
Letters listed with loads designate the maximum load range for that load range. Do not exceed rim load and/or inflation limits													

Table 5 SERVICE LOAD AND INFLATION CHART (MICHELIN ONLY) (For Trucks, Buses and Trailers in Normal Highway Service) (Cont.)

Tire Size Designations	TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)															
	65	70	75	80	85	90	95	100	105	110	115	120	125	130		
Tubeless																
225/70R19.5		2920	3085	3250	3415F											
		3040	3220	3405	3640F											
245/70R19.5		3315	3415	3515	3655	3860F	4025	4197	4368	4540G						
		3540	3640	3740	3890	4080F	4218	4412	4609	4805G						
265/70R19.5		3400	3610	3820	4030	4235	4445	4655	4860	5070G						
		3570	3795	4020	4240	4465	4690	4910	5135	5355G						
285/70R19.5		3620	3843	4070	4290	4518	4743	5071	5217	5375	5675H					
		3935	4175	4425	4665	4910	5155	5511	5733	5963	6175H					
305/70R19.5		4108	4354	4600	4840	5079	5328	5583	5843	6085	6395J					
		4388	4658	4928	5180	5440	5705	5965	6223	6470	6780J					
235/80R22.5			3813	4035	4277	4410G										
			4035	4277	4542	4675G										
255/70R22.5			3521	3712	3905	4096	4280	4420	4540	4852	5070H					
			3810	4022	4235	4447	4652	4805	5000	5273	5510H					
255/80R22.5			3910	4135	4355	4575	4810G									
			4235	4465	4710	4960	5205G									
275/80R22.5			4350	4587	4832	5070	5335	5675G								
			4825	5090	5365	5625	5920	6175G								
295/80R22.5			4375	4698	4960	5222	5483	5744	6005	6267	6780H					
			5065	5360	5645	5930	6215	6500	6788	7078	7390H					

**Table 5 SERVICE LOAD AND INFLATION CHART (MICHELIN ONLY) (For Trucks, Buses and Trailers in Normal Highway Service)
(Cont.) (cont.)**

Tire Size Designations	TIRE LOAD LIMITS (POUNDS) AT VARIOUS COLD INFLATION PRESSURES (PSI)													
Tubeless	65	70	75	80	85	90	95	100	105	110	115	120	125	130
315/80R22.5	D		4798	5105	5413	5780	6055	6330	6605	6885	7160	7560	7893	8255L
	S		5850	6140	6435	6675	6995	7310	7630	7950	8270	8485	8750	9000L
275/80R24.5	D	3833	4112	4350	4587	4832	5070	5335	5675G					
	S	4285	4560	4825	5090	5365	5625	5920	6175G					
305/75R24.5	D	5222	5483	5744	6005	6267	6528	6789	6945H					
	S	5358	5645	5930	6215	6500	6788	7078	7368	7658	7830H			
385/65R22.5	S			6333	6640	6940	7280	7580	7890	8220	8530	8900	9150	9370J
425/65R22.5	S			7670	8000	8400	8840	9220	9590	10000	10500	10740	11110	11400L
445/65R22.5	S			8033	8465	8850	9330	9780	10240	10655	11070	11490	11945	12320
D = Dual Tire Usage														
S = Single Tire Usage														
Letters listed with loads designate the maximum load range for that load range. Do not exceed rim load and/or inflation limits.														

7.11. TIRE AND RIM COMBINATIONS

Table 6 TIRE AND RIM COMBINATIONS - Tires Designed for Normal Highway Service

TUBE TYPE		TUBELESS	
Tire Size	Rim Width	Tire Size	Rim Width
14/80R20	10.00	225/70R19.5	6.00, 6.75
365/80R20	10.00	235/80R22.5	6.75, 7.50
		245/70R19.5	6.75, 7.50
		255/70R22.5	7.50, 8.25
		265/70R19.5	6.75, 7.50, 8.25
		275/80R22.5	7.50, 8.25
		285/75R24.5	7.50, 8.25
		295/75R22.5	7.50, 8.25
		315/80R22.5	9.00
		385/65R22.5	12.25
		425/65R22.5	12.25, 13.00
		445/65R22.5	13.00, 14.00

CAUTION – Always use approved tire and rim combinations for diameters and contours. After mounting dual tires, insure tires do not contact each other under a loaded condition.



WARNING – Do not mount tube type tires on tubeless wheels or tubeless tires on tube type wheels. To do so could result in severe personal injury.

CAUTION – Not applicable for ML (Mining and Logging) tires.

7.12. PLY RATING VS. LOAD RANGE

Table 7 Ply Rating vs. Load Range

Load Range	Replaces Ply Rating
D	8
E	10
F	12
G	14
H	16

Table 7 Ply Rating vs. Load Range (cont.)

Load Range	Replaces Ply Rating
J	18
L	20
M	22
N	24

TORQUE

Table 8 TORQUE CHART

DISC WHEELS			
SIZE	NUT MOUNTING	TORQUE	
		Ft Lbs	N-m
11/16"	Flange	350-400	475-543
22mm	Flange		
	Motor Wheel - 37.5mm Across Flats	450-500	610-678
	International®/Budd - 33mm Across Flats	450-500	610-678
BALL SEAT (CONICAL NUT)			
$\frac{3}{4}$ "	Standard Square Cap: 13/16" Across Flats	450-500	610-678
	1- $\frac{1}{8}$ " Across Flats	450-500	610-678
1-1/8"	Standard Hex Cap: 1- $\frac{3}{4}$ " Across Flats	450-500	610-678
15/16"	Heavy Duty Square Cap: 15/16" Across Flats	750-900	1017-1221
1-5/16"	Heavy Duty Cap: 1- $\frac{3}{4}$ " Across Flats	750-900	1017-1221
CAST WHEELS			
5/8"	Rim Clamp Nut	160-175	217-237
$\frac{3}{4}$ "	Rim Clamp Nut	200-240	271-325
<p>Dry Threads - No Lubrication</p> <p>Where excessive corrosion exists, a light coat of lubricant on first three threads of stud bolt is permitted.</p> <p>Keep lubricant away from cap nut ball faces, or ball seats of disc wheels and rim clamps of cast wheels.</p>			