SECTION 1
Construction Features

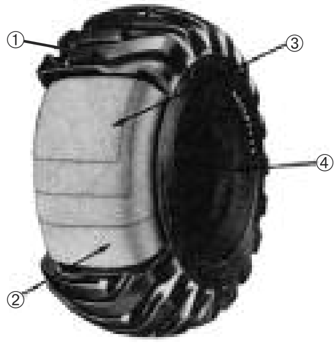


Fig. 1 Bias Tire

Fig. 1B Bias/Belted Tire

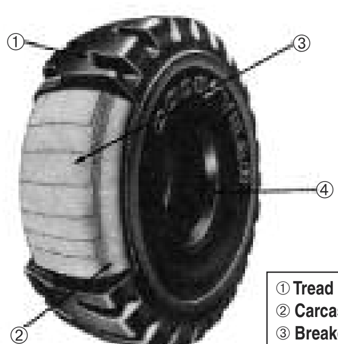


Fig. 1C Radial Tire

① **Tread**
② **Carcass**
③ **Breakers**
④ **Bead**

Basic Design

Earthmover tires are produced in three basic constructions:

- Bias
- Bias/Belted
- Radial

All share a common nomenclature.

Tread
The part of the tire in contact with the ground. It must provide traction, long wear and cut resistance. The tread depth and design vary based on site and application.

Carcass
Contains the inflation medium. The greater its strength, the greater the pressure it can hold. Bias and bias/belted tire carcasses use many angled plies of fabric to achieve strength. Radials have one ply of steel wire.

Breakers (Belts)
These are placed between the tread and carcass. They help to join these parts. They also distribute road shock to protect the carcass. In bias/belted and radial constructions, they control the diameter of the tire. They also impart superior tread impact and penetration resistance.

Bead
Bundles of high tensile steel wire. They anchor the tire to the rim. Bias and bias/belted tires may have several bead bundles. Radials have one large bead bundle.

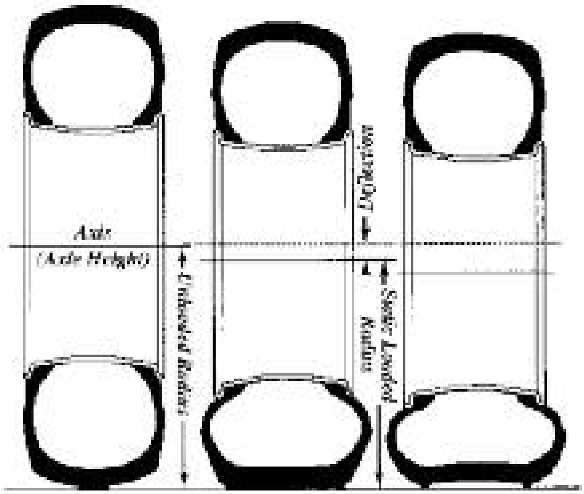
Sidewalls
The protective rubber cover on the side of a tire. The rubber is compounded to flex without cracking. It also resists cuts and

forms a barrier to protect the carcass from the weather.

Inner Liner

A specially formulated rubber compound inside the tire that minimizes permeation. It works with the rim and O-ring to contain the inflation medium in tubeless designs.

Basic Factors Tire Maintenance



UNDEFLECTED *(Zero Load)*   **NORMAL DEFLECTION** *(Rated Load/Inflation)*   **OVERDEFLECTION** *(Overload and/or Underinflation)*

Deflection

Many people think that deflection describes the bulge at the bottom of a loaded tire. Actually, this bulge occurs as a result of deflection.

Deflection really describes the change in the tire's radius when a normal load is applied. The radius is measured from the center of the axle/hub to the ground (See Figure 2, above).

Unloaded Radius is measured with no weight on the tire. The tire is mounted on a rim and inflated to working pressure. The tire is stood and supported so the tread touches the ground. However, no load is applied (ie. not even the weight of the tire and rim).

Static Loaded Radius is measured with the weight of the vehicle and payload on the tire. Static means that the tire is standing still.

The deflection is the difference between the Unloaded Radius and Static Loaded Radius. This is the same distance that the axle lowers when the vehicle is fully loaded.

Deflection is extremely important. Engineers design tires to operate at a certain percentage of deflection. Operating with too much deflection reduces tire life.

Load and Pressure Relationship

Each tire is designed to carry a specific load at a specific inflation pressure. (Load/Inflation Tables are in the back of this book). When the tire is inflated to the correct pressure for the load, deflection will be within design limits.

Loading a tire above the specified limit will result in overdeflection.

Inflating a tire above the specified limit will result in underdeflection.

⚠ WARNING

Overinflation and or overloading can lead to a tire explosion. This can lead to death, serious injury or property damage. Do not overinflate or overload OTR tires.

For a given tire size, inflation pressure determines how much load can be carried (the inflation medium can be air or nitrogen).

THE MOST IMPORTANT AND CRITICAL PART OF TIRE MAINTENANCE IS MAINTAINING PROPER INFLATION PRESSURE.

Loads

The inflation pressure carries the load. The tire's pressure capacity is determined by its carcass strength.

Carcass strength is indicated by a ply rating (PR) for bias and bias/belted tires. Symbol or Star Ratings are used to indicate radial tire strength (symbol and star mean the same thing).

Some Off-the-road tires are marked with Load Indexes and Speed Symbols. A Load Index is a numerical code associated with the maximum load a tire can carry at the speed indicated by the Speed Symbol under specified service conditions. A Speed Symbol indicates the maximum speed that the tire was designed to operate under specified service conditions. Some Earthmover Speed symbols are:

A2	5 mph	10 kmph
B	30 mph	50 kmph
E	43 mph	70 kmph

NOTE: none of the terms (PR, Symbol, Star, LISS) indicate the actual number of plies.

There are factors other than inflation pressure which affect tire load capacity. Larger tires (with larger internal air volumes) can carry higher loads at the same pressure.

Load capacity also varies with speed. The tire standards associations (T&RA, ETRTO and JATMA) publish tables of maximum loads at specified speeds. These tables correspond to:

- 30 MPH (50 KMPH) for scrapers, trucks.
- 25 MPH (40 KMPH) for graders.
- 5 MPH (10 KMPH) for dozers, loaders.
- Drive-away speeds for roading equipment.

Operators sometimes overload tires. They are willing to sacrifice tire performance for fewer trips or higher production (bigger loads).

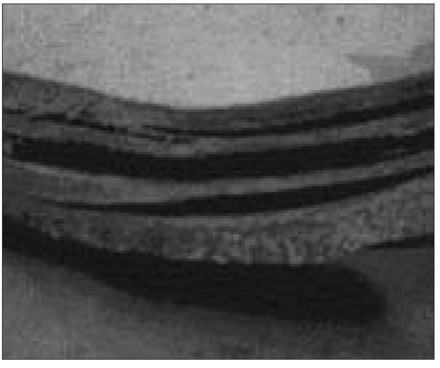


Fig. 3. Ply separation/fatigue due to overloading.

Even a slight, but constant, overload will result in reduced tire performance. This leads directly to a higher cost per ton mile or kilometer.

Overloading may lead to premature tire failure. If inflation pressure is not adjusted to heavier loads, tires will become unserviceable due to:

- Tread and ply separation.
- Disintegration of the carcass and inner liner (fatigue).
- Radial sidewall cracking.
- Excessive bead chafing.

Overloads with the inflation adjusted to compensate may exceed the carcass strength. This will result in:

- Impact breaks and cuts.
- Rapid wear.
- Fabric fatigue (loss of nylon cord or steel cables strength).

Tires and Operating Conditions

Tires represent one of the major direct expenses in off-the-road (OTR) equipment operations.

Regular maintenance will help OTR tires last longer. Longer life translates directly to a lower cost per ton-mile.

Every OTR project should have a tire maintenance program. The program should be overseen by a team which includes members from:

- Project Management /Job Superintendent.
- Engineering Department Representative.
- Operations/Mining Department.
- Maintenance Department Representative.
- Tire Department Representative.

Tire company representatives can serve as a resource for the OTR tire team.

Project or Mine Manager and Job Superintendent Responsibilities

Successful tire cost management and control begins with top management.

Their involvement in the program will emphasize its importance. They are also in the best position to anticipate changes in tire requirements.

Changes often occur as a project progresses. For example, hauls may get longer. Higher speeds or heavier loads may be required to maintain production. These may require a change in tires or equipment used.

A keen, dedicated, cost conscious, tirewise manager or superintendent will be aware of these ongoing changes. Appropriate tires and equipment can then be ordered as needed.

Engineering Department Responsibilities

Haulroad design plays an important role in tire cost control. Both tire wear and hazard exposure can be minimized by proper design. This is especially true on larger projects where roads are used for a long time.

Layout and surface condition of the haulroad affect tire life.

Steep grades, sharp turns, poor superelevation increase tire slippage resulting in fast, abrasive tread wear.

Imbedded or loose rocks increase tread cutting, sidewall cutting, and impact break hazards. They often lead to speed restrictions which reduce production. Equipment breakdown and maintenance costs also increase.

Poor drainage leads to mud and chuck holes. These result in tire spinning, fast tread wear, cuts and increased vehicle fuel usage.

The cost of equipment and labor to maintain haulroads is significant. However, the cost of delays and tire and equipment repair is far greater.

Permanent haulroad criteria should be:

1) Maximum grade not to exceed 7%.

2) Road width to allow two trucks to pass without spillage. A two lane road should be 3.5 times the widest vehicle. A three lane road 5.0 times the widest vehicle.

3) Road crown, slope or crossfall as flat as possible and still drain. Typical road crown is 2%- 4% (2.5"-5.0" drop per 10' of lane width/6.4 cm-12.7 cm drop per 3.0 meters of lane width).

4) Curve radii as large as possible. Haulroads should be superelevated to correspond to vehicle travel speeds. Superelevation minimizes the variation in tire load while transversing a curve which may lead to longer tire life.

Vehicle travel speed affects the need for superelevation more than curve radius. Table 1 shows the effects of different speeds and radii on superelevation requirements.

TABLE 1

Vehicle MPH	Speed KPH	Curve Radius FT	M	SuperElev Grade Reqd.
15	24	200	61	7.5%
30	48	200	61	30%
15	24	400	122	3.5%
30	48	400	122	15%

In actual practice, haulroad superelevation seldom exceeds 4-5%. This minimizes top dressing flow in rainy or wet operating conditions.

In addition, site size, topography and ground conditions often restrict curve radii.

Reduced speed on curves is the most practical way to minimize centrifugal side forces on tires.

The U.S.A. Department of the Interior publication, Design of Surface Mine Haulage Roads Bureau of Mines Information Circular 8758, contains additional information on mine/project haulage road design.

Operations Department Responsibilities

The people who operate equipment play a very key role in how well tires perform.

Driver/operator education should include more than how to drive. Drivers who learn and follow tire procedures to identify and avoid tire obstructions help reduce tire costs. These rules include:

1) Visually inspect all tires and perform hot inflation checks at the start of each shift.

2) Keep front windshield, headlights and rear view mirrors clean. This provides good visibility needed to avoid hazards.

3) Check to be sure rear axle rock ejectors are in place and working properly (Fig. 6). Remove rocks lodged between dual tires (Fig. 7).

Fig. 6.

Fig. 7.

4) Avoid waterholes/potholes as they could hide submerged tire hazards.

5) Never turn front steering axle tires when the vehicle is standing. This creates very high stress and sheer forces within the tires.

6) Keep off windrows. These are often present when haulroads are being graded.

7) Do not drive on the berm of the road. Obstructions are often present.

8) Do not drive over spillage. Spillage can damage tires. Report it so that it can be cleaned up (Fig. 8).

Fig. 8.

9) Do not drive or back over rocks at shovel or dump areas. (Fig. 9)

Fig. 9.

10) Do not spin tires. This includes jackrabbit starts and locked brake stops.

11) Reduce speed in areas where underfoot conditions continuously change. Conditions in shovel and dump areas change with each load. The condition of secondary roadways is unpredictable.

Conscientious Operation by Drivers

Careful drivers avoid road obstructions that cause cuts and impact breaks. They do not spin drive wheels and cause excessive tread wear.

Good drivers see that mechanical problems are corrected promptly. This includes correct front axle alignment, correct strut settings, no loose or broken springs and no grabbing brakes.

Good drivers regularly check for leaky grease fittings. Oil and grease can causes rapid deterioration of tires.

Good drivers check rims and flanges regularly. Bent, chipped, broken or improperly sized flanges strain the bead. Rust, oil or grease on rim assemblies leads to rubber deterioration which will lead to a shorter service life.

Fig. 10. This tire was worn smooth in 500 hours by spinning on abrasive material.

Check inflation pressures and request adjustment if needed.

Check tires for damage due to machine obstructions. Spring clips, fender bolts and other components may clear tires in normal service. Under unusual operating conditions, vehicle body movement may cause contact with tires. Cutting or abrasion can result. Dry, caked mud and wedged rocks are also tire hazards.

Fig. 11. Grease and oil are highly damaging to tires.

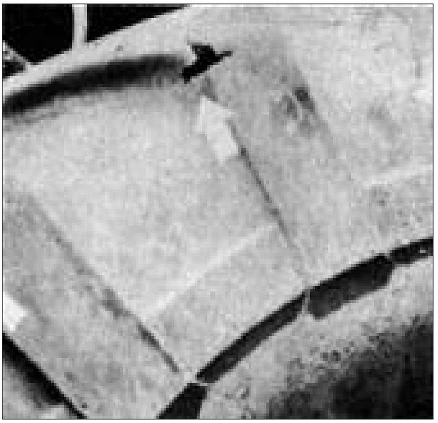


Fig. 12. A machine obstruction takes a bite out of this tire tread at each revolution.

In addition to these general guidelines, operators should develop good work habits. These will vary by the type of equipment and operation.

Shovel/Wheel Loader Operators

Control spillage and maintain a level working pad at loading areas.

1) Do not overload haulage trucks.

2) Properly center load in bed of truck. This distributes the load on the wheels correctly and reduces spillage. (Fig. 13)

Fig. 13. Correct truck payload positioning.

Fig. 13a. Incorrect truck payload positioning

3) Properly mate dragline, shovel or wheel loader to trucks being loaded. Excessive spillage is caused when loading equipment is too large for the truck (Fig. 13b). Loading different size trucks with the same shovel almost always creates spillage.

Fig. 13b. Loading equipment too large for truck.

4) Station a cleanup dozer at each loading area. Its responsibility is to immediately clear any spillage that does occur. It should also help keep the area as level as possible.

Loader/Dozer Operators

1) Travel slowly between work locations. Thick, heavy loader/dozer tires quickly generate internal heat. This heat dissipates slowly. Excess heat can result in tread separation.

2) Use ballast at recommended fill levels where recommended (See page 68 for additional discussion).

3) In load and carry operations, do not exceed tire's Work Capability Factor (WCF) (See page 65 for additional discussion).

4) Avoid tire spin. Use hydraulics to crowd into the bank or pile.

5) Use bucket to clear a path or level the surface. This will provide smooth, clean footing for the dozer and other vehicles.

6) Bucket should be wider than the outside-to-outside width of tires on front axle. This will prevent or minimize damage to the sidewalls. Loader wings should be added to help prevent tire damage.

Grader Operators

1) Patrol haulroads and clean up spillage. Main roads where haulage speeds are highest should get the most attention. Two graders should work roads where haulage vehicles are wider than a single grader blade.

2) Don't leave high windrows. They can cause damage to haulage truck tires. Tandem patrols help to reduce grader created windrows.

3) Create and maintain road crown to provide proper drainage.

4) Fill depressions and dips in the road. This will eliminate excessive tire deflection on high speed haulage vehicles.

Watertruck or Wagon Operators

Limit watering to control dust.

1) Do not overwater haulroads or work areas. This can lead to unnecessary cuts in tire treads and sidewalls.

    - Water acts as a lubricant for rubber.

    - Wet rubber cuts more easily than dry rubber.

2) Some watering benefits grading operations.

3) Excessive watering of hard packed, smooth surfaces is a safety hazard. Vehicle control/safety is reduced on a slick, wet road surface.

Scraper Operators

1) Avoid tire spinning during loading. If a scraper is not designed for self-loading, wait to be push loaded.

2) Dead stick loading minimizes tire spin. It is essential where ripped rock or rock/earth material is being loaded.

3) Avoid sharp turns.

Never make sharp turns while being push loaded.

Rear tires can be cut and destroyed by the blade of a push dozer. Use a straight not a curved blade on the push dozer.

4) Dump and spread slowly. Whenever possible, avoid driving over rocks in the fill or dump areas.

5) Check for and remove any rocks lodged between vehicle frame and between rear duals.

Tire Department Responsibilities

The most important item in a tire maintenance program is a sound, regular *inflation maintenance program*.

Inflation supports and carries the load. Inflation must be maintained as specified for the load and service condition.

Tires are designed and built to deflect in service.

Inflation pressures are established to assure tires deflect properly. The pressures required vary with the load, speed and type of service. When inflation pressure is too high or too low, the tire does not deflect within design limits. Tires deteriorate quickly under these conditions.

Generally, low speed off-the-road operations allow heavier loads at a given inflation. ***At high speeds, loads must be decreased.***

Recommended loads and inflations should always be the norm.

Overinflation

Overinflation results in high cord stress even when the tire isn't overloaded. Stress reduces resistance to loss of inflation from impacts. It also increases the risk of rock cutting. The problem is made worse by poorly maintained haulroads or spillage.

Figures 14 and 15 show typical overinflation damage.

Fig. 14. This break resulted from a severe blow while overinflated.

Fig. 15. Rapid air loss like this occurs frequently when tires are overinflated and suffer an impact.

Underinflation

An underinflated tire will deflect too much leading to excessive sidewall flexing.

Underinflation typically results in:

- Irregular or uneven tread wear.
- Sidewall radial cracks.
- Ply separation.
- Loose or broken cords inside the tire.
- Fabric carcass fatigue. (Fig. 16)
- Belt edge separation

Tires operated in soft soil or sand have lower inflation recommendations. Tires operated on paved or hard gravel surfaces have higher inflation recommendations.

In soft soil, the tire makes an impression. The impression cradles the tire and reduces excess deflection. Inflation can be reduced.

Tires operated on hard surfaces do not receive this support. They have to control deflection by inflation pressure. Higher pressures are required.

Indirect, but important, advantages of lower inflation pressures include:

- Better flotation.
- Better traction.
- Better resistance to cutting and impact breaks.

Fig. 16.

Fig. 17.

Loose or broken cords can result from severe underinflation.

Radial cracks indicate continuous underinflation and/or overload operation. (Fig. 17)

Continuous operation results in heat buildup in a tire. The hot air expands as a result of the increase in temperature. The tire's carcass restricts this expansion so pressure increases.

In normal off-the-road operation this does not cause deterioration. The pressure becomes stabilized when internal heating is balanced by external cooling.

NOTICE

Don't bleed hot OTR tires to correct buildup of air pressure.

Bleeding air pressure will result in dangerous underinflation. As the tire cools at the end of the day, inflation pressure will drop. The tire will be seriously underinflated at the start of the next shift or day.

Even if the tire is operated through the night, underinflation will occur. Cooler night air will cause the tire to run cooler. Inflation pressure will drop. The tire will suffer excessive deflection and flexing. Damage is inevitable.

Bleeding tire pressure actually begins a vicious cycle. Reduced pressure causes increased deflection and flexing. These generate heat. Pressure builds up again. The tire is bled to reduce pressure and the cycle repeats. It continues until a complete tire breakdown results.

Proper attention to tire inflation, loads and speeds is the best prevention of tire related problems. These factors need especially careful attention in hot weather.

Correct air pressure only when tires are at ambient temperatures.

Correct Tire Inflation:

1) Assures load carrying ability.
2) Avoids damage due to run-low or run-flat operation. Carcass fatigue, (tubeless) liner failure and radial cracks are the most common signs of damage.
3) Reduces tread separation due to overdeflection.
4) Reduces impact breaks, bruise damage, tread cuts and penetration.
5) Reduces irregular and rapid tread wear.

Incorrect Inflation

Underinflation results in irreversible damage such as:

1) Carcass fatigue.
2) Tubeless liner failure.
3) Tread, ply or bead area separation.

Overinflation can be as serious as underinflation:

1) Overinflation overstresses the tire carcass.
2) It reduces the tire's ability to envelope irregular objects in the travel path.
3) It causes a loss of traction.
4) It makes tires more vulnerable to spin cuts and shock load damage.
5) It reduces flotation in soft ground.
6) It produces a hard ride and vehicle vibration. This contributes to:
   - Payload spillage.
   - Poor vehicle handling.
   - Operator fatigue.

Proper Tire Inflation Procedures

Recommended inflation pressures are always based on a cold reading. A cold tire is one:

1) That has been idle at least 24 hours.
2) Has reached ambient temperatures.

Proper inflation for each wheel position should be determined. Ideally, this is based on actual tire loads determined by an on site weight study.

When actual wheel loads aren't known, tires should be inflated to the pressure recommended for the size and ply rating.

When checking cold inflation pressures the correct pressure is:

Cold pressure + 5 PSI (+.25 Bar), - 0 PSI.

Inflation pressure recommendations vary with the type of service. The type of service also determines the operating speeds:

- Haulage units (earthmoving, mining, logging, etc.): 30 MPH/50 KPH maximum speed.
- Dozer/loader units (shovels, mining cars, loaders, etc.): 5 MPH/10 KPH maximum speed.
- Road graders: 25 MPH/40 KPH maximum speed.

Special service conditions also impose speed limits based on tire load and construction. These special applications include compactor, sand, straddle carriers, driveaway and intermittent highway use.

Load and inflation tables for all types of service are in the back of this book.

Essential Parts of a Sound Inflation Maintenance Program

1) Cold inflation checks and adjustments should be made once a week. Hot checks should be made daily.

2) Never bleed air from a hot tire to correct pressure. Normal equipment operation causes inflation pressure to increase. A hot pressure increase up to 20% is acceptable.

   If excessive pressure is present, find and fix the cause. Bleeding air will result in serious underinflation and tire damage.

3) Record inflation pressure every time it is checked. Records provide information that can be used to detect problems and schedule preventive maintenance.

4) Accurate pressure gauges must be used. Service gauges must be calibrated with a master gauge once a week.

5) Before placing pressure gauge on valve:

   - Clean any dust, dirt, grease or other matter from tip of valve stem.
   - Press the valve core briefly and release a small quantity of air.

This cleaning procedure will help assure an accurate reading and prevent damage to the gauge.

6) Use a valve cap on every valve. It acts as the primary air seal. It also helps to prevent dirt, dust and water damage to the core.

7) Check spuds, stems and extensions. Be sure all joints are tight and secure to avoid leaks in service.

8) Use valve extensions or hosing for easy access for inflation checks.

9) Compressors:

   - Must have a minimum, capacity of 150 PSI (10.0 Bar).
   - Compressors must have water trap assemblies to prevent moisture inside tires.
   - Moisture can:
     – rust rim parts.
     – plug valve stems with rust from rims or ice crystals.
     – reduce pressure gauge life and accuracy.
     – complicate dismounting procedures.

10) Use a new, correctly sized O-ring each time a tire is changed. Use a new grommet on tubeless spuds.

11) Thoroughly clean rims and rim parts before mounting tires. Wire brush:

- bead seat areas.
- flanges.
- O-ring and lock-ring grooves.
- lock ring.

Bare metal must be painted or coated with rust inhibitor.

If necessary, sandblast components to bare metal and paint with rust preventative paint.

Clean components are easier to mount. They also allow a more thorough inspection for stress cracks, broken welds and other damage.

12) Store rim components in a dry area to prevent rust and corrosion.

- Separate components for storage (don't store assembled rims).
- Be sure components are properly matched before mounting tires.

13) The use of nitrogen inflation is recommended (See page 24).

- It reduces rim corrosion.
- It reduces the risk of auto-ignition (tire explosion) from an external heat source. These include: vehicle fires, hot brakes or lightening strikes.

To be effective, nitrogen must be used for all maintenance refills.

Hot Inflation Checks

When vehicles operate around the clock, cold inflation checks may not be possible.

A hot tire correction factor can be determined by experiment:

- Check as many tires as possible when cold.
- Check the same tires after four hours of normal operation.
- Determine the average difference in cold and hot inflation pressure.

This average difference should be added to the recommended inflation pressure for tires in constant operation.

A tire that shows a significant variation from the average pressure could have a problem. The vehicle should be stood down until the cause can be determined.

NOTE: Cold inflation checks should be done at every opportunity. These include holiday and weekend shutdowns or regular vehicle maintenance periods.

Matching of Duals

Tire assemblies operated as a dual pair must:

- Have the same outside diameter (Within variation listed below).
- Be from the same manufacturer.
- Be of the same type (industry code).
- Be of the same construction (both bias or both radials).

Bias and radial constructions must never be mixed on dual assemblies.

Tires on dual assemblies must match in size. If they do not, they will not carry equal shares of the load. The larger tire will carry a greater load. It will wear faster than its smaller partner. It will also suffer greater stress which makes it vulnerable to damage.

The smaller tire will also suffer irregular scuff wear. This will lead to early replacement.

In addition to fast wear, mismatching may result in axle breaks and difficult steering.

Maximum diameter variation for duals should be:

Tire Size	O.D. Difference (Inches/MM)
Through 8.25-20	0.25 Inch/7 mm.
9.00-20 through 21.00-35	0.5 Inch/13 mm.
24.00-35 through 33.00-51	0.75 Inch/19 mm.
36.00-51 and larger	1.00 Inch/25 mm.

Circumferential measurement is a more accurate guide for larger tires. The circumference is measured with a steel tape. For accuracy, tires must be measured mounted on rims and inflated.

Tire and Rim Association (T&RA)

This is an organization of technical representatives from all tire and rim equipment manufacturers. Its purpose is to set industry standards/guidelines.

Its work has prevented chaos in the sizes and types of equipment available. This makes rims, tubes, valves and other components widely interchangeable. It also gives equipment operators easy access to replacement parts and service.

The Association also establishes load and inflation recommendations. These are used by equipment manufacturers in the design of their machines.

The T&RA yearbook contains many references to load and inflation tables. These recommendations are based on the best engineering principles. They have been refined over years of actual field experience. Importantly, they are based on information gathered from the entire industry, not a single manufacturer.

European Tire and Rim Technical Organization (ETRTO)

Located in Brussels, Belgium, this group is very similar to the T&RA. It too sets standards and issues recommendations followed by industry suppliers. This results in common dimensional measurements and load/inflation relationships beneficial to equipment users.

ETRTO data are expressed in metric units. T&RA data are expressed in English and metric units. They are not necessarily identical.

ETRTO data are not formula conversions of English units. They are independent recommendations. They are based on engineering principles and field experience of the group's members. When available, ETRTO data are included in the load/inflation tables in this book. However, ETRTO standards do not exist for all sizes. Where a size is not covered, SI (System International) conversion formulas are used.

Japan Automobile Tyre Manufacturers Association (JATMA)

Located in Tokyo Japan this association is similar to T&RA AND ETRTO. It sets standards and issues recommendations that are followed by type and rim manufacturers. This results in common dimensional measurements and load/inflation relationships which benefit equipment manufacturers and end users. JATMA data is expressed in metric units. due to calculations and rounding the dimensions, loads and inflations of T&RA, ETRTO and JATMA may not be identical but are close. Use the standards/guidelines from the organization from your region of the world.

How To Calculate Loads and Load Distribution

Fig. 18. Scales set and ready for use.

The best method is to weigh the loaded machine one axle at a time.

When this is impractical, tire load can be estimated with the following formulas. They take into account vehicle designs that result in uneven load distribution on the axles.

To use the formulas, you need to know:

1) Empty weight per axle.
2) Weight of payload (estimated if necessary).
3) Measurements shown in Fig. 19.

In our formula:

A = Distance from front axle to center of payload in inches.
B = Distance from rear axle to center of payload in inches.
C = Wheelbase in inches.
F = Empty weight on front axle.
R = Empty weight on rear axle.

With this information, the load on each axle can be determined.

Load on rear axle = (A/C X payload) + R

Load on front axle = (B/C X payload) + F

For example, if:

A = 108”
B = 132”
C = 240”
F = 10,000 #
R = 8,000 #
Payload = 36,000#

then Rear Axle Load =

(A/C	X Payload	+	R =
(108/240	X 36,000)	+	8,000 =
(.45 X	36,000)	+	8,000 =
16,200		+	8,000 = 24,200

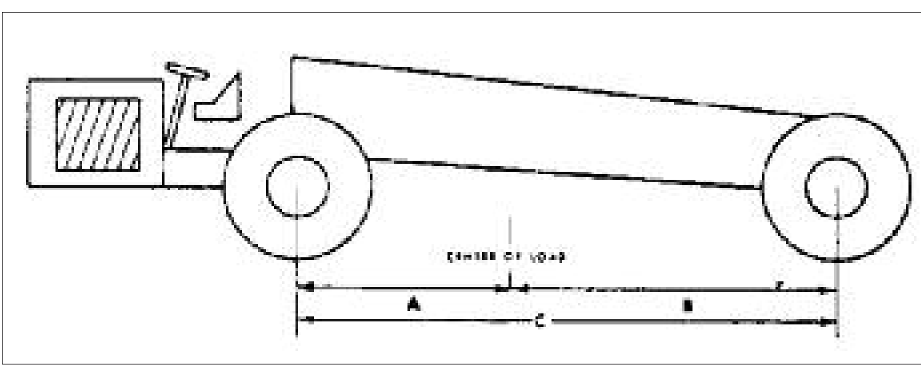


Fig. 19. Center of Load.

and Front Axle Load =

(B/C	X Payload	+	F =
(132/240	X 36,000)	+	10,000 =
(.55 X 36,000)		+	10,000 =
19,800		+	10,000 = 29,800

Our example also shows that the part of the load on each axle is a percentage of the wheelbase.

In our example, the distance from the center of the payload to the front axle is 45% of the wheelbase:

108/240 = .45 = 45%

This is the percentage of the load carried by the rear axle.

The distance from the center of the payload to the rear axle is 55% of the wheelbase:

132/240 = .55 = 55%

This is the percentage of the load carried by the front axle.

These percentages give us a ratio:

45:55 = 100.

This is important because it applies to any load in that vehicle. Thus, it allows us quickly to calculate the effects of lighter or heavier loads.

Load Distribution on Other Types of Carriers

The formula may be applied to all types of wheeled machines. Some slight changes in description may be needed, however.

For example, in a tractor/trailer combination:

The wheelbase is the distance from the pivot point to the rear axle.

To determine the weight distribution on the tractor:

The pivot point is the center of the load.

The load on the pivot point is the total payload on the tractor.

Burned Beads

⚠ WARNING

Burned beads are very dangerous. They can cause a sudden loss of air that can lead to death, serious injury or property damage. These have been reported more than an hour after a vehicle was parked.

Another risk is a loss of inflation long after the machine is parked. When the machine is shut down, cooling air does not circulate. The hot brake quickly transfers heat to the rim base. Air pressure builds and the bead becomes hot and weak. Eventually, an explosive, potentially dangerous rupture may occurs.

The air in an earthmover tire has extremely high energy when released suddenly. Since burned beads can lead to a sudden rupture, extreme caution must be exercised.

The machine should be parked outside, remote from all personnel.

DO NOT STAND NEAR A TIRE AND RIM ASSEMBLY WITH A HOT BRAKE.

Burned beads are usually caused by brake problems. Excessive braking or dragging brakes are the most common source.

Excessive braking can result in temperatures up to 500º F (246º C). This heat is transmitted through the brake drum to the rim. The rim heats the inside bead and burns it.

Temperature above 250º F (123º C) may reduces bead durability.

Burned beads can cause several kinds of tire failure.

The most common is a reduction in compressive fit between bead and rim. This causes a leak. If it does not produce a flat tire, it will result in underinflation. An underinflated tire will generate more heat. This will lead to ply separation and a loss of strength. Rapid air loss will occur. This most likely will be in the bead or lower sidewall.

Air wicking through the carcass is another problem bead condition. This causes pressure to build up within the carcass and a separation of tire components.

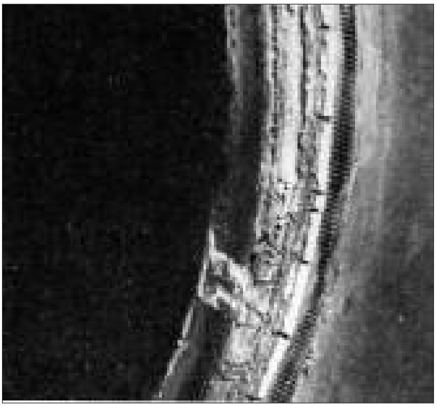


Fig. 20. Toe has been burned and chaffed due to burned bead.

Fig. 21. Rupture resulted from burned bead.

After the brake has cooled, the tire can be replaced.

Modern equipment design has made brake overheating rare.

Engine retarders are common. These slow the equipment without excessive braking. Proper training will assure that operators use this feature effectively.

Some machines use wheel coolants. These transfer heat from the bead area. Coolant must be checked regularly and maintained at proper levels.

Most burned bead problems occur with new equipment or new operators. Proper training and a conscious effort to avoid excessive braking can prevent most problems.

Fig. 22. Heal damage due to burned bead.

Repairs

Both tube-type and tubeless tires can be repaired. Regular inspection can detect repairable injuries before they become serious. Immediate attention may prevent extensive or costly damage.

Tread and sidewall cuts are a major source of off-the-road tire trouble. Tires should be checked at the start of each shift and during regular inflation checks. Cuts which extend to or into the belts or cord body must be repaired. The tire must be taken off for repair.

Shallow cuts in the tread can be treated without dismounting tires. Small rocks and dirt will get into these shallow cuts. If neglected, the rocks will gradually be pounded or drilled through the cord body.

Clean out cuts with an awl to remove any lodged in or embedded material. Use a sharp, small blade knife to cut a cone-shaped cavity. The cavity should extend to the bottom of the injury. Sides of the cavity should slant enough to prevent stones from wedging. Tires with cuts treated in this manner may continue in service and cut growth should be reduced.

All small cuts should be repaired when tires are removed for major cut repairs. Tires with very high hours (greater than 10,000) are not good repair candidates.

Tire repair may be possible, but may not be economical in older tires. The cost of the repair must be justified by the remaining service life.

Fig. 23 Deep tread rock cut – If left unattended will cause cut separation or cut through.

Fig. 25. Skiving reveals close-up of rock cut damage into working belt.

Fig 24. Deep tread rock cut – If left unattended will cause tread rock cut separation.

Recapping/Retreading

Both tube-type and tubeless tires can be recapped.

Recapped tubeless earthmover tires do not require a tube to return to service.

A good tire maintenance program will result in tire cost savings. It will also improve tire retreadability for future savings.

Some service conditions take too much life out of the carcass. Retreading should not be considered for tires operated:

- At high speeds.
- Overloaded.
- Underinflated.

Tires with very high hours (greater than 10,000) should not be retreaded.

The best recapping candidates are tires which had fast tread wear. This occurs at sites with steep grades or abrasive surfaces.

Handling and Storage of Tires, Tubes and Rims

Proper handling and storage will prevent damage to tubeless tires.

Unmounted tires should be shipped and stored vertically. Horizontal storage may compress the beads. This may make initial inflation difficult.

Some new tires are shipped banded to preserve their shape. Do not remove bands until tires are ready to mount.

Do not lift tires by the beads. Sharp hooks or forks cut and tear beads. In service, beads may leak at these lifting points.

Foreign material and moisture must be removed from the inside of the tire before mounting.

Rims

Tubeless rims are an important part of the air seal in a mounted tire. Do not distort or mutilate rim parts.

Never lift rims by valve holes.

Never drop, tumble or roll rim parts.

Use babbit or lead hammers sparingly during assembly. Sledge hammers can damage rim parts.

Store O-ring seals in a cool, dry place.

Lay flat. Do not stack other materials on O-rings.

Store valves in a clean, cool, dry place.

Tire and Tube Storage

Tires and tubes deteriorate rapidly if improperly stored.

Improper storage conditions include:

- Direct sunlight.
- Heat.
- Air in motion.
- Ozone.
- Gasoline and oil.
- Dust and dirt.
- Water or moisture inside tires.

Even short term storage should avoid exposure to these conditions.

Storage time should be minimized by using tires in the order received.

New Tires

1) Store indoors in a cool, dark, dry, draft free area. If tires must be stored outdoors, they should be covered. An opaque, waterproof tarpaulin is a good

cover. Water and moisture must be kept out of the tire.

If possible, mount on wheels and inflate to 10% of operating pressure. Store vertically. Cover with a tarpaulin.

2) Store away from electrical devices such as motors and switches. These are a source of ozone.

3) Do not store in rooms with or near gasoline or lubricants. Rubber absorbs vapors from these materials and they can cause deterioration.

4) Provide carbon dioxide fire extinguishers in tire storage areas.

Used Tires

1) Carefully clean and inspect tires before storage. Make necessary repairs before storage. Repairs to injuries which expose tire cord are especially important. Moisture can get into exposed cord.

2) Observe all storage rules listed for new tires.

Mounted Tires

1) If tires are stored on a machine, it should be blocked up. Air should be released to 10 psi (.7 bar) or less. If machine cannot be blocked up, check air pressure frequently. Maintain pressure at proper level.

2) Protect each tire with an opaque, waterproof cover.

3) Machines resting on tires should be moved once a month. This prevents deflection strain on only one part of the tire.

4) Do not use paint to preserve tires. If severe storage conditions are expected, consult tire supplier for recommendations.

Tubes

1) Store in original package until ready for use. Keep in a cool, dry, draft free area.

2) Used tubes must be removed from the tire. They must be completely deflated, cleaned and folded. Store in a cool, dry, draft free area.

SECTION II

Procedure for Changing Tires and Tubes

Changing Off-The-Road Tires

Replacement of off-the-road tires is a difficult job. They are often located in rough, hilly terrain. Most are used in remote geographical locations. Site conditions are usually far from ideal. Proper equipment may not be available.

The procedures in this section describe changing larger size tires. Both ideal and difficult conditions are covered.

The procedures are based on both field and shop experience. They are designed to make the change as easy as possible.

Nitrogen Inflation

Many original equipment manufacturers recommend nitrogen inflation. It helps to minimize the possibility of explosion due to excessive heat from external sources.

Typical sources are:

- Vehicle fires.
- Excessive braking.
- Dragging brakes.
- Welding on rims of mounted tires.
- Lightening strikes.

All these can cause the inside of the tire to ignite and burn.

⚠ WARNING

An explosion caused by tire auto-ignition is much more violent than other sudden air loss situations.

Serious injuries and death can result from such explosions.

Never weld on a rim of a mounted tire.

Inflating with nitrogen should be done only by trained personnel using proper equipment. This includes:

- ***An appropriate relief valve.***
- ***A pressure regulator set for no more than 20 PSI (1.5 Bar) over desired inflation.***
- ***A remote control clip-on chuck. This allows personnel to stand clear of tire/rim assembly during inflation.***

Proper inflation pressure for tires inflated with nitrogen is the same as for air.

Nitrogen tanks are pressurized to 2200 PSI (152 Bar).

Correct equipment must be used and proper safety precautions taken. Otherwise, an explosion or blowout of the tire/rim assembly could result. This can cause death, serious personal injury and property damage.

There are several other benefits to nitrogen inflation:

- It offers improved pressure retention
- It minimizes rim rust.

Tire Changing Equipment and Tools

Tire changing procedures vary with individual operators. Certain tools, however, are essential.

1) Heavy equipment jack.

2) Tire tools and irons. These include:

   - Several irons with dished or spoon shaped ends.
   - Crowbar.
   - Heavy duty rubber or wood mallet or lead or babbit hammer.

3) Wheel chucks.

4) Jack stands

5) Air compressor.

6) Service truck. In larger operations, a fully equipped truck can minimize down time. The truck should be equipped with:

   - A mounted hoist. The hoist should be strong enough to handle the largest tires.
   - An air compressor with a regulator. Models are available which operate off the truck engine or are self powered.
   - Large bore/super large bore inflating equipment. This minimizes inflation time.
   - Clip-on chucks with remote controls. These allow inflation from a safe distance.

Before performing any service on Off-The-Road tires, read and understand all safety precautions. Do not mount or demount tires without proper training.

GENERAL SAFETY INSTRUCTIONS

The following section of this Manual contains important safety information, including steps necessary to avoid accidents that may result in death, serious injury or property damage. Follow all procedures and safety instructions exactly. Wear proper personal protective equipment (PPE).

DEMOUNTING

PRECAUTION	REASON FOR PRECAUTION
Before removing any rim or wheel component (i.e., nuts or rim clamps): • **Exhaust all air from a single tire.** • **Exhaust all air from both tires of a dual assembly.**	A broken rim part under pressure can blow apart and cause fatal injury. If you remove lugs while tire is under pressure, the assembly may fly apart.
Remove valve core completely. This will assure all air is exhausted from tire. • **Remove both cores from dual assembly.** • **Run a piece of wire through stem to be sure it's not plugged.**	Foreign material may clog the valve stem during deflation. Ice may form as the air leaves the tire. This can clog the valve stem.
Always stand clear during deflation.	If the assembly bursts, the operator should be far away from the explosive force.
Use approved eye protection.	Protect eyes from dust and dirt when exhausting air from tires.

Use mechanical aids when removing heavy rim components.	This will help protect you from injury. A dropped flange can crush a hand or foot. Attempting to grab a falling flange or bead seat can cause serious injury.
Demounting tools apply high pressure to rim flanges when unseating tire beads.	If tool slips, it can fly with enough force to cause severe injury or death. Keep fingers clear. Always stand to one side when you apply pressure.

INSPECTION

PRECAUTION	REASON FOR PRECAUTION
Clean and repaint rims. This will stop corrosion. It will also make it easier to mount and check components.	Parts must be clean for proper fit. This is especially true of the gutter section which holds lock ring in position.
Clean dirt and rust from lock ring and gutter.	This is important to seat the lock ring properly.
Air inflation equipment should have a filter in the air line. Filter must be checked frequently to see that it works properly.	This will prevent moisture from entering the tire and prevent corrosion.
Check rim components for cracks Replace all components which are: • Cracked • Badly worn • Damaged • Severely rusted	Parts that are cracked, damaged or excessively rusted are weakened. Bent or repaired parts may not engage properly.
Use new component of same size and type. Replacement parts must not be cracked, broken or damaged.	This allows for proper fit and function.

Never, under any circumstances, attempt to rework, weld, heat, or braze any rim components that are cracked, broken or damaged. **Replace with parts that are not cracked, broken or damaged. Always use parts of the same size and type.**	Heating may weaken a part. It may then be unable to withstand forces of inflation or operation. This can lead to an incident resulting in serious injury or death.
Be sure correct parts are being assembled. **Check the parts' distributor or manufacturer if you have any doubts.** **Do not be careless or take chances.**	Mismatched parts may appear to fit. When the tire is inflated they can fly apart with explosive force. This may lead to serious injury or death.
If you are not sure about proper mating of rim and wheel parts, consult an expert.	This may be the tire man who services your fleet. It may be your wheel distributor.
Don't reinflate a tire that has been run flat until you inspect: • **Tire** • **Tube** • **Flap** • **Rim and wheel assembly** **Double check:** • **Flange(s)** • **Bead seat** • **Lock ring** • **O-ring** **Be sure they are secure in the gutter before inflation.** **Stand clear of the tire while inflating.**	Components can be damaged or dislocated when a tire is run flat or seriously underinflated. This can lead to an incident resulting in death or serious injury.

MOUNTING AND INFLATION

PRECAUTION	REASON FOR PRECAUTION
Don't hammer bead seat rings or other components while tire is inflated. You may tap the lock ring when inflation begins with a rubber or shot hammer to insure it is properly seated.	If parts are improperly installed they may fly apart with explosive force.
Double check to be sure all components are properly seated before inflating.	If parts are improperly installed they may fly apart with explosive force.
Inflate in a safety cage. Use safety chains or equivalent restraining devices during inflation.	Parts can fly apart with explosive force during inflation.
Don't inflate tire before all components are properly in place. Place in safety cage or use chain sling and inflate to approximately 5 PSI (.5 Bar). Recheck components for proper assembly. If assembly is not proper at approximately 5 PSI (.5Bar) completely deflate tire (both tube-type and tubeless) and start over. Inflation to recommended operating pressure should be done on the vehicle. Never hammer on a fully or partially inflated tire/rim assembly.	Properly matched and assembled components will seat without tapping. If a part is tapped, it or the tool can fly out with explosive force.
Never sit or stand in front of a tire and rim assembly that is being inflated. Use a clip-on chuck. Use inflation hose long enough to stand to side of tire. Do not stand in front or back of tire assembly.	Parts can fly apart with explosive force.

Follow tire and rim manufacturers' recommended procedures for: • Mounting • Demounting • Inflating • Deflating	Failure to do so can result in death or serious injury.
Don't hammer on rims or components with steel hammers. **If necessary to tap uninflated components together, use mallets with faces of:** • Rubber • Lead • Plastic • Brass	Steel hammers may damage components and cause improper fit.
Stand clear when using a steel cable or chain sling.	The cable or chain may break. If it does it can lash out and cause serious injury.
Never weld on a tire/rim assembly.	Heat from welding will cause a sudden rise in pressure. This may result in a powerful explosion. Deflated tires also can catch fire inside the chamber. Pressure will build up. An explosion may occur.
Mixing parts of one type rim with those of another is potentially dangerous. **Always check DOT chart or manufacturer for approval.**	Mismatched parts may appear to fit. When the tire is inflated they can fly apart with explosive force.

Never introduce a flammable substance into a tire before, during or after mounting.	This is unsafe and could result in: • Fire • Internal tire damage • Rim damage • Potentially dangerous vapors. Any of these conditions can cause death or serious personal injury during mounting and inflation.

OPERATION

PRECAUTION	REASON FOR PRECAUTION
Don't use undersized rims. **Use recommended rim for tire. Check Goodyear catalogs for proper tire/rim matching.**	Excessive overload can cause damage to the tire and rim assembly.
Don't overload or overinflate tire/rim assemblies. **Check with your tire and rim manufacturer if special operating conditions are required.**	Excessive overload due to undersized rims can cause damage to the tire and rim assembly.
Never run a vehicle on one tire of a dual assembly.	This will exceed the carrying capacity of the single tire and rim. Operating a vehicle in this manner can result in damage to rim and tire.
Never use a tube in a tubeless tire where the rim assembly is suspected of leaking.	Loss of air pressure warns you of a potential rim failure due to fatigue cracks or other fractures. This indicator is lost when tubes are used with leaking rims. Continued use may cause the rim to burst with explosive force.
Always inspect rims and wheels for damage during tire checks.	Early detection of rim damage or wear may prevent an accident.

Never modify a rim without approval from the manufacturer. **Never heat, weld or braze a rim.** **Always remove the tire from the rim before service.**	Modification or heating of the rim or one of its parts can weaken it. It may not withstand inflation or operation forces.
If vehicle wheels have been designed to contain wheel coolant, never operate vehicle without coolant. **Always use the mix and amount of coolant recommended by the manufacturer.**	An explosion can occur when a tire is exposed to extreme temperatures from an external source. This can cause death, serious injury or property damage. Wheel coolant helps keep operating temperatures down. It must be used where recommended.
Don't let the brakes become overheated. **Avoid abuses that can overheat brakes. These include:** • Dragging of brakes • Speeding • Poor brake adjustment • Overloading	An explosion can occur when a tire is exposed to extreme temperatures from external sources. This can cause death, serious personal injury or property damage.
Clear the area if excessive brake heat is suspected. Warnings include: • The smell of burning rubber • The smell of hot brakes **Wait at least one hour before approaching machine.** **Carefully follow manufacturer's recommendations for:** • Operating practices • Use of retarders • Brakes • Brake maintenance	The risk of explosion is greatest soon after the vehicle is stopped.

SERVICING TIRE AND RIM ON MACHINE

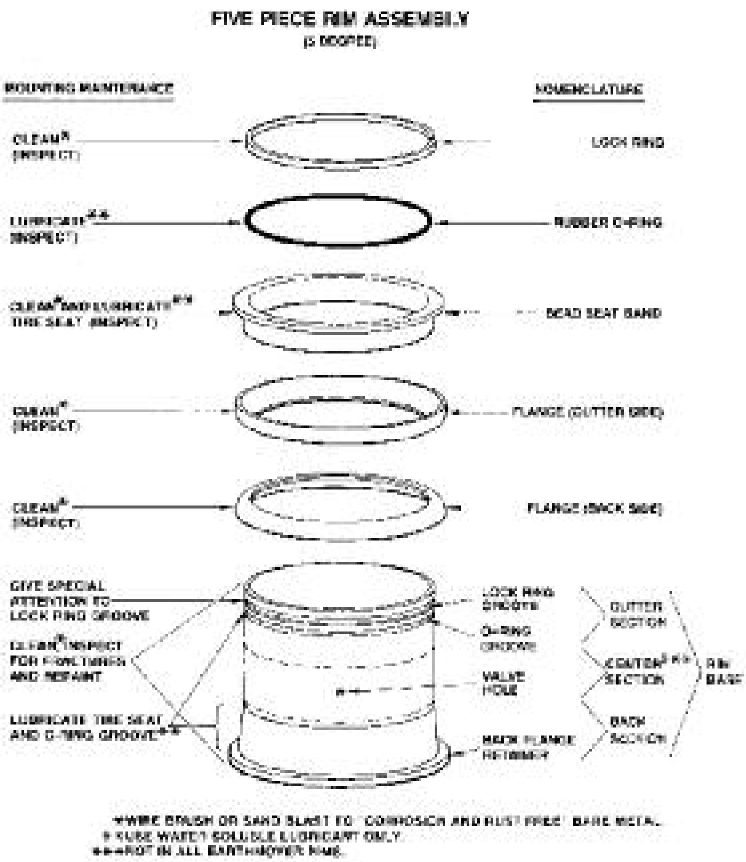
PRECAUTION	REASON FOR PRECAUTION
Block tire and wheel on opposite side of machine before placing jack in position.	Machine may shift and slip off jack. This can cause death or serious injury.
Put hardwood blocks under jack. Use blocks regardless of how hard or firm ground appears to be. Always crib up a vehicle with blocks or a jack stand	Machine may shift and slip off jack. This can cause death or serious injury.
Before loosening nuts or clamps, always secure a tire/rim assembly with: • A sling • Tire handler • Other support equipment Consult vehicle manufacturer for detailed instructions on removal of tire/rim assemblies.	Unsecured assemblies may fall when fasteners are removed.
Don't hammer to drive a tire and rim assembly over a cast spoke wheel. Deflate and examine to determine the reason for improper fit. Look for distortion or components not properly locked or seated.	Failure to fit can indicate distorted or incorrectly assembled components. In either case, the assembly could fly apart if hammered and cause death or serious injury.

Do not, under any circumstances, use any type of heat source on an inflated tire.

Welding or other heating of an inflated tire/rim assembly can cause an explosion. This can cause death, serious injury or property damage.

Welding or brazing a rim with a deflated tire can cause damage to the tire. When reinflated, the damaged tire could also explode.

Welding or brazing a rim with no tire is contrary to recommendations of rim manufacturers. It can cause a structural weakness in the rim. This can also lead to failure under inflation or service conditions.



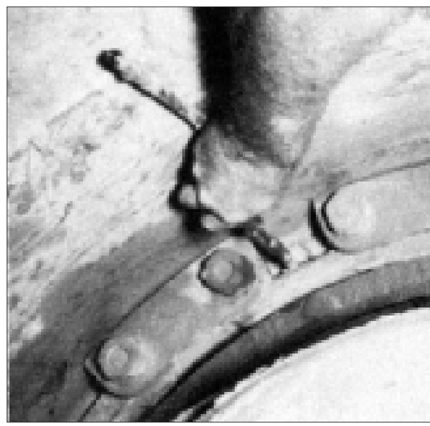
Demounting Procedures

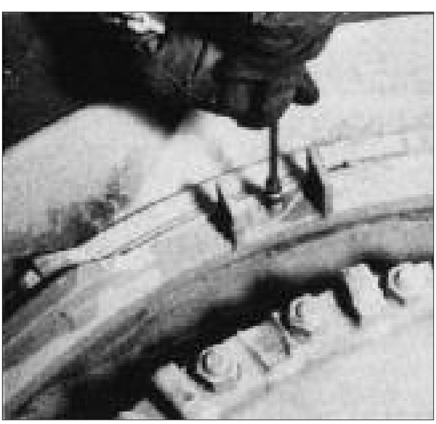
Before removing any rim or wheel component:

- Wear proper personal protective equipment (PPE)
- Remove the valve core.
- Exhaust all air from the tire.
- Run a piece of wire through the stem to be sure it is not plugged.

Exhaust air from both tires of a dual assembly before working on either.

Failure to follow this procedure may lead to death or serious injury.





Demounting Instructions

Semi Drop-Center Rims

Three Piece Type TG - TGD - TGF (Graders)

⚠ **Read safety instructions (pages 26-35) before proceeding.**

PROCEDURE REQUIRES:

- 2 Goose-necked bead unseating tools.
- Rubber lubricant.
- Rubber, plastic, lead or brass faced mallet.

Before removing any rim or wheel component:

- **Wear proper personal protective equipment (PPE)**
- **Remove the valve core.**
- **Exhaust all air from the tire.**
- **Run a piece of wire through the stem to be sure it is not plugged.**

Exhaust air from both tires of a dual assembly before working on either.

Photo 1

Photo 2

After complete deflation, place assembly on blocks with loose flange side up. Follow steps in order shown.

1. Drive goose-necked end of two tools between tire and flange. They should be about 2-feet (70 cm) apart. (Photo 1)

2a. Pry both tools outward and sideways through an arc of about 70º. (Photo 2)

2b. Leave one tool in position and move second about 5-inches (13 cm) beyond. Pry down and out as above.

2c. Repeat the process until the entire bead is unseated.

3. Stand on sidewall. Use foot to force flange down along rim base. Pry loose lock ring. (Photo 3)

4. Hold side of flange down with hooked end of tool. Grab and remove O-ring from O-ring groove. (Photo 4)

5. Remove side flange. (Photo 5)

6. Turn tire over.

7. Follow steps 1 and 2 to break tire loose from fixed flange side of rim.

8. Lift rim base from tire. (Photo 6)

Photo 3

Photo 4

Photo 5

Photo 6

Demounting Instructions

Single Piece Rims

(Graders and Small Front End Loaders)

⚠ **Read safety instructions (pages 26-35) before proceeding.**

PROCEDURE REQUIRES:

- 1 goose-neck bead unseating tool
- 3 tire irons
- Rubber lubricant

Photo 1

Before working on tire or rim:

- **Wear proper personal protective equipment (PPE)**
- **Remove the valve core.**
- **Exhaust all air from the tire.**
- **Run a piece of wire through the stem to be sure it is not plugged.**

Exhaust air from both tires of a dual assembly before working on either.

After complete deflation, place assembly on blocks with loose flange side up. Follow steps in order shown.

1. Stand on tire. Use goose-neck tool to break bead from wheel flange.

2. Lubricate top tire bead and top flange area on wheel.

3. Insert two tire irons close together under top bead. (Photo 1)

4. Hold one tire iron down in original position. Hold firmly so it does not fly up and strike you.

Photo 2

5. Work 2nd tire iron around wheel until bead is completely demounted. (Photo 2)
   - Use standing weight to help push bead into wheel well.
6. Stand tire/wheel assembly up.
   - Break bead from second wheel flange.
   - Lubricate near tire bead and back flange area on wheel.
   - Pull top of wheel out of tire as far as possible. Use foot on bottom of wheel to hold in cocked position. Tire bead should be in wheel well.
7. Force spoon of tire iron between bead and wheel flange. (Photo 3) Raise tire iron until it is straight up. Hold in position.


Photo 3

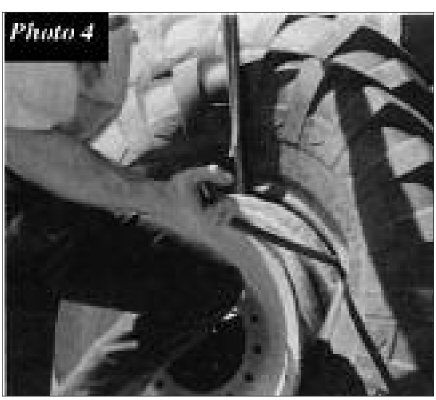


Photo 4

8. Position 2nd tire iron 12” to right of first iron.(Photo 4) Force spoon under bead and over wheel flange.
9. Rotate 2nd tire iron 90º. (Photo 5) Lift 2nd tire iron straight up.
10. Hold 1st and 2nd tire irons in one hand so they form a triangle. Position 3rd tire iron 12” to left of first iron. Rotate 3rd tire iron 90º to wheel. (Photo 6) Lift 3rd tire iron straight up.
11. Once bead is over flange, finish demounting with one tire iron.


Photo 5

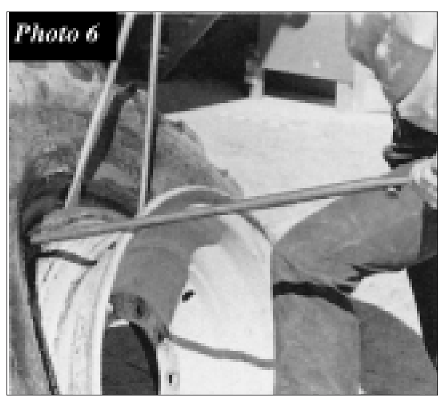


Photo 6

Horizontal Demounting 25” - 49” Diameter Rims

⚠ Read safety instructions (pages 26-35) before proceeding.

PROCEDURE REQUIRES:

- Hydraulic demounting tool
- 2 pry bars

Before removing any rim or wheel component:

- **Wear proper personal protective equipment (PPE)**
- **Remove the valve core.**
- **Exhaust all air from the tire.**
- **Run a piece of wire through the stem to be sure it is not plugged.**

Exhaust air from both tires of a dual assembly before working on either.

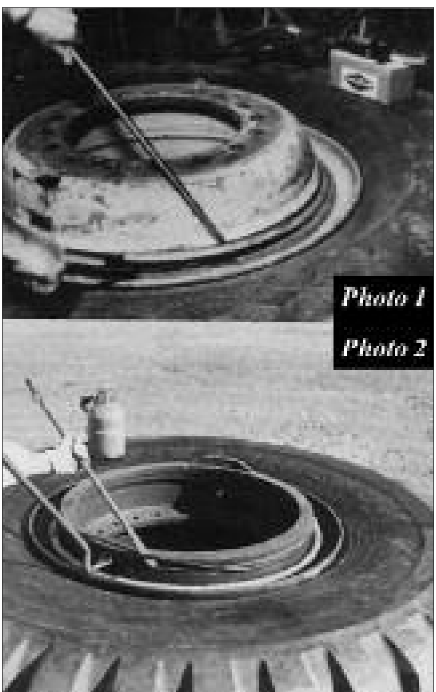


Photo 1

Photo 2

After complete deflation, place assembly on blocks with gutter side up. Follow steps in order shown.

1. Force pry bars under lock ring from opposite sides. They should be separated by about 10-inches. Push bars in opposite directions to pry lock ring out. (Photo1)

   NOTE: If lock ring cannot be removed, unseat bead with lock ring and O-ring in place.

2. Pry the beat seat band back. Insert a pry bar or screwdriver under O-ring and pull it from groove. (Photo 2)

   Cut through O-ring to be sure a new one will be used for remounting.

3. Place hook of hydraulic demounting tool into pry bar pocket. (A continuous lip is provided on some bases.) Adjust the ram adjusting screw so the tool will remain vertical under pressure. (Photo 3) In some cases, the pressure foot may have to be removed to assure a good fit.

Photo 3

Be sure tool is properly seated. If not properly seated it can fly off with great force. Always stand away from tool when it is under pressure.

4. Stand away from assembly and activate hydraulic pump to apply pressure. If necessary, release pressure and readjust ram adjusting screw. Depress flange 1/2" - 3/4" (13-19 mm). Use a screwdriver to slip a nut (or similar object) between flange and lip of beat seat.

Keep fingers clear at all times.

Release pressure slowly. Check to make sure the nut (or other spacer) will not slip out. If not securely positioned, it can become a projectile and cause serious injury.

5. Move tool 2-feet around rim for second bite.

Do not use tool near flange butt weld. (Photo 4)

Take additional bites at 2-foot intervals until bead is unseated.

6. Use hoist or pry bar to remove bead seat band. (Photo 5)
7. Remove flange.
8. Turn assembly over. Use procedure to unseat bead on back.
9. Use hoist to lift rim base from tire.
10. Remove back flange.

NOTE: When the bead is difficult to loosen, use two hydraulic demounting tools.

When using two tools, be careful not to bend flange or damage butt weld.

Also, work around the tire several times. Each time, make a slightly greater push. Block with larger objects.

Photo 4

Photo 5

Horizontal Demounting 51" and Larger HDT Rims

⚠ **Read safety instructions (pages 26-35) before proceeding.**

PROCEDURE REQUIRES:

- Hydraulic demounting tool
- 2 pry bars

Before removing any rim or wheel component:

- **Wear proper personal protective equipment (PPE)**
- **Remove the valve core.**
- **Exhaust all air from the tire.**
- **Run a piece of wire through the stem to be sure it is not plugged.**

Exhaust air from both tires of a dual assembly before working on either.

Photo 1

Photo 3

After complete deflation, place assembly on blocks with gutter side up. (Photo 1) Follow steps in order shown.

1. Stand inside rim. Use 2 pry bars and carefully remove lock ring. Start at split and work tools around the ring. (Photo 2 and Photo 3)

2. Insert a pry bar or screwdriver under O-ring and pull it from groove. (Photo 4)

   Cut through O-ring to be sure a new one will be used for remounting.

3. Start 30-degrees from flange butt weld. Place hooks of hydraulic demounting tool under bead seat band. Adjust the ram adjusting screw so the tool will remain vertical under pressure. (Photo 5)

Photo 2

Photo 4

Be sure tool is properly seated. If not properly seated it can fly off with great force. Always stand away from tool when it is under pressure to avoid risk of serious injury.

4. Stand away from assembly and activate hydraulic pump to apply pressure. If necessary, release pressure and readjust ram adjusting screw. Depress flange 3/4" -1" (19-25mm). Use a screwdriver to slip a nut (or similar object) between flange and lip of bead seat. (Photo 6)

Keep fingers clear at all times.

Release pressure slowly. Check to make sure the nut (or other spacer) will not slip out. If not securely positioned, it can become a projectile and may cause serious injury.

5. Move tool 2- to 3-feet (60-90 cm) around rim for second bite.

Do not use tool within 12" (30cm) of flange butt weld.

Take additional bites at 2- to 3-foot intervals until bead is unseated.

Stand clear when using a cable or chain sling. It can snap and lash out.

6. Use hoist or pry bar to remove bead seat band.

7. Remove flange.

8. Turn assembly over. Use procedure described to unseat bead on back.

9. Use hoist to lift rim base from tire (Photo 7)

10. Use hoist to lift and remove back flange. (Photo 8)

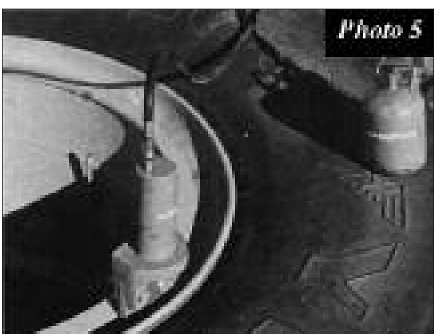


Photo 5


Photo 7


Photo 6


Photo 8

Vertical Demounting Tires on a Machine

⚠ **Read safety instructions (pages 26-35) before proceeding.**

PROCEDURE REQUIRES:

- Hydraulic demounting tool (Foot activated model is recommended – Photo 1)
- Pry bar

Before placing jack in position, block tire and wheel on other side of vehicle.

Always use hardwood blocks under jack, or steel stand.

Jack may slip. Always crib up vehicle with blocks, or stand.

Before removing any rim or wheel component:

- **Wear proper personal protective equipment (PPE).**
- **Remove the valve core. (Photo 1)**
- **Exhaust all air from the tire.**
- **Run a piece of wire through the stem to be sure it is not plugged.**

Exhaust air from both tires of a dual assembly before working on either.

Tire and wheel components are heavy. To avoid back and foot injuries, two people should lower components.

1. Place hook of hydraulic demounting tool into pry bar pocket. (A continuous lip is provided on some bases.) Adjust ram adjusting screw so tool will remain perpendicular to tire under pressure (Photo 2)

Be sure tool is properly seated. If not properly seated it can fly off with great force. Always stand away from tool when it is under pressure to avoid risk of death or serious injury.

2. Stand away from assembly and activate hydraulic pump to apply pressure. If necessary, release pressure and readjust ram adjusting screw. Depress flange 3/4” (19mm). Place end of pry bar between flange and lip of bead seat band.

Keep fingers clear at all times.

Release pressure.

3. Move tool 2-feet around rim for second bite.

Do not use tool near flange butt weld.

Take additional bites at 2-foot intervals until bead is unseated.

4. Use pry bar to remove lock ring. Start near split. (Photo 3)
5. Insert a pry bar or screwdriver under O-ring and pull it from groove. (Photo4) Cut through O-ring to be sure a new one will be used for remounting.
6. Insert pry bar under flange and pry bead seat band loose. (Photo 5) Support band on thigh. With assistance, lower it to ground. Roll out of way. (Photo 6)
7. With assistance, remove flange. Carefully lower it to ground. Roll out of way.

8. Unseat back tire bead. Use hydraulic tool. If insufficient clearance, use shorty ram between vehicle frame and back flange. (Photo 7)

9. Use boom truck and sling or tire handler to remove tire.


Photo 1


Photo 2


Photo 3

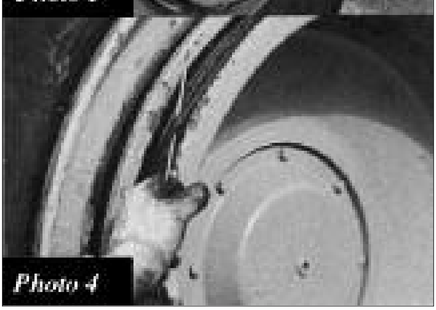


Photo 4

Stand clear when using a cable or chain sling. It can snap and lash out.

10. With assistance, remove back flange.


Photo 5


Photo 6

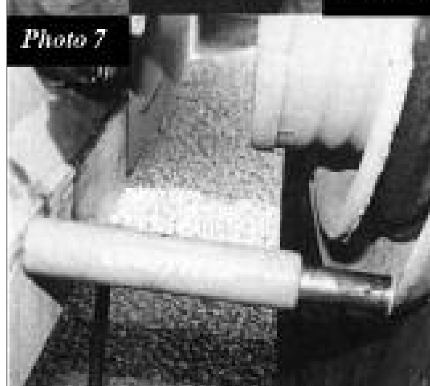


Photo 7

Demounting Tube-Type Off-The-Road Tires

⚠ **Read safety instructions (pages 26-35) before proceeding.**

Before moving any rim or wheel component:

- **Wear proper personal protective equipment (PPE).**
- **Remove the valve core.**
- **Exhaust all air from the tire.**
- **Run a piece of wire through the stem to be sure it is not plugged.**

Exhaust air from both tires of a dual assembly before working on either.

1. Unseat beads as described for the size assembly involved.

2. Before removing tire from rim, be sure valve will clear gutter section.

3. Remove flap from tire. Use tool with a rounded end to pry out and away from beads.

NOTE: If necessary, use a tire spreader to spread the beads. A small auto jack can be used as a spreader.

4. Remove the tube. Be careful not to pull on valve stem or enlarge any areas of damage.

Inflation Procedures for Proper Mounting After Tire & Rim Assembly Has Been Placed on Machine

During mounting, all off-the-road tires must be inflated, deflated, and reinflated. This procedure has two purposes.

First, it helps assure that the beads are seated properly. Beads must seat against rim flanges and be in compression on tapered bead seats.

Second, it removes buckles and uneven stress from flaps and tubes.

Initial inflation varies with rim size:

- Grader tires inflate to 50 PSI (3.50 Bar)
- Less than 29" rim diameter tires inflate to 75 PSI (5.25 Bar)
- Larger than 29" rim diameter tires inflate to 90 PSI (6.25 Bar)

Failure to seat the beads can cause bead durability problems. In tubeless tires, it can also allow air leakage under the beads.

Air pressure is the only positive method to fully seat off-the-road tire beads. Operating a tire will not seat an improperly mounted tire. It will result in damage to the beads and shortened tire life.

Mounting Off-The-Road Tires
On Type T - TL - TLD - TGD and TGF Rims

(Tubeless-type. See page 60 for additional instructions for tube and flap insertion.)

⚠ **Read safety instructions (pages 26-35) before proceeding.**

1. Before mounting:

   - Clean all rim components. Remove rust and dirt. Lock ring and O-ring grooves must be clean and rust free for proper seating and seal. (Photo 1)
   - Inspect parts for damage. Replace all cracked, worn, damaged, or severely rusted components.
   - Paint or coat all parts with rust inhibitor.
   - Double check to be sure correct parts are being used.
   - Inspect inside of tire. Remove any foreign matter. Use compressed air to dry any moisture.

2. Install valve spud on rim. Tighten to proper torque.

3. Place rim on 4”-6” blocks (10-13 cm) or mounting stand. Fixed flange side must be down.

4. Lubricate bead seat area on rim and both tire beads with vegetable lubricant. Use only approved vegetable-based lubricants.

   - Lubricate from toe to GG ring on tire.

   - Lubricate moderately, but thoroughly.

5. Place tire over rim base.

6. Place side flange over rim base. (Photo 2)

   - Push down as far as possible.
   - Make sure flange does not bind on rim base.

7. Stand on flange to position it below both grooves in the rim base. Snap lock ring into (upper) lock ring groove. (Photo 3 –next page)

   - Be sure the embossed safety bulge on lock ring is up.

(continued on next page)

Photo 1

Photo 2

8. Lubricate O-ring with vegetable lubricant.

9. Lubricate entire O-ring groove area with vegetable lubricant.

10. Snap O-ring into place. Place on one side. Stretch like a rubber band. Seat on other side. (Photo 4)

    - Do not roll O-ring into place.
    - If necessary, push side flange down with hand tool to expose O-ring groove.

11. Check components for proper assembly.

NOTE: Lock rings must be fully seated in gutter around the flange.

12. Insert drive lugs as required.

13. Place assembly in safety cage. (Photo 5)

NOTE: If no cage is available, some other approved restraining device must be used during inflation. Inflation above 10% of recommended is to be done only after assembly is installed on the machine

- Always stand away from the rim during inflation.

- After pressure has reached 3 PSI (.5 Bar), check all around rim for proper component seating. If necessary, deflate tire and adjust components.

15. If assembly is ok, inflate to 50 PSI (3.5 Bar).

NOTE: Air inflation equipment should have a filter to remove moisture. This prevents corrosion inside the tire. Check filter frequently to be sure it functions properly.

16. Adjust to proper operating pressure

    Ballasted tires (liquid or dry filled) must first be seated with air.

    After seating, exhaust air and add ballast. (See pages 68-73 for additional information.)

Photo 3

Photo 4

Photo 5

Mounting Bias Off-The-Road Tires on EM Rims

(Tubeless-type. See page 60 for additional instructions for tube and flap insertion.)

⚠ Read safety instructions (pages 26-35) before proceeding.

1. Before mounting:

   - Clean all rim components. Remove rust and dirt. Lock ring and O-ring grooves must be clean and rust free for proper seating and seal. (Photo 1)
   - Inspect parts for damage. Replace all cracked, worn, damaged, or severely rusted components.
   - Paint or coat all parts with rust inhibitor.
   - Double check to be sure correct parts are being used.
   - Inspect inside of tire. Remove any foreign matter. Use compressed air to dry any moisture.

2. Place base on 4" - 6" blocks (10-13 cm) or mounting stand. Gutter side must be up.

3. Place back flange on base. (Photo 2)

4. Lubricate tire beads with vegetable lubricant.

   - Use only approved vegetable-based lubricants.
   - Lubricate from toe to GG ring on tire.
   - Lubricate moderately, but thoroughly.

5. Use tire hoist with sling or tire handler to lift tire. Place on rim. (Photo 3)

Stand clear when using a cable or chain sling. It can snap and lash out.

6. Depress tire bead area to ease assembly of next components. (Photo 4)

(Continued on next page)

Photo 1

Photo 2

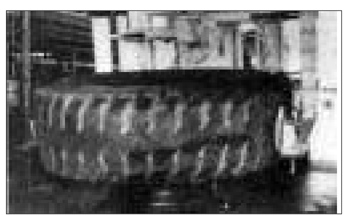


Photo 3

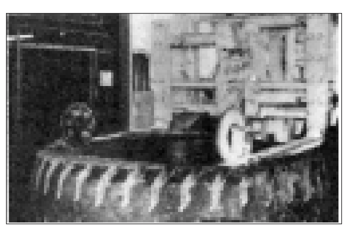


Photo 4

7. Place front flange over rim base. (Photo 5)

8. Place bead seat band on rim base.

   Be sure driver pockets in bead seat band and base are in line (if present).

   Band will bind if cocked even slightly. If it becomes wedged, DO NOT HAMMER INTO PLACE! Lift, and lower it correctly. If necessary, use a rubber, lead, plastic or brass-faced mallet and tap lightly upward. (Photo 6)

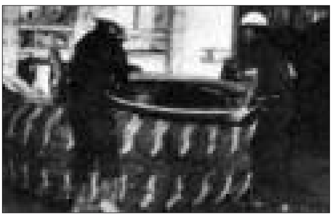
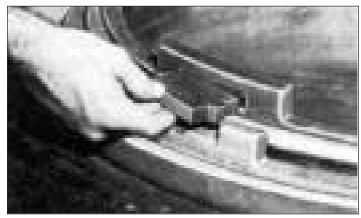


Photo 5

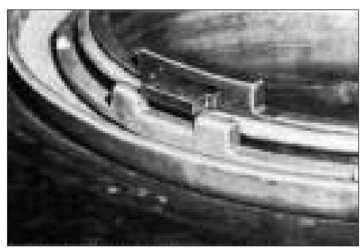
Photo 6

Typical Heavy Duty Driver Application

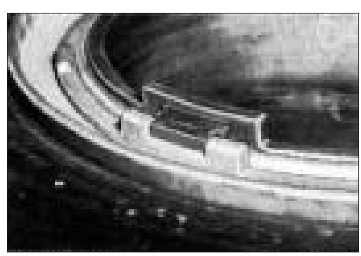
Align driver pockets in bead seat band and base.



Insert driving slug into driver pocket on base.



Make sure all parts are properly aligned before inflation.



View of final assembly.

9. Lubricate O-ring with vegetable lubricant.

10. Lubricate entire O-ring groove area with vegetable lubricant. (Photo 7)

11. Snap O-ring into place. Place on one side. Stretch like a rubber band. Seat on other side. (Photo 8)

12. Start the lock ring in the lock ring groove. Push or walk it into place. (Photo 9)

13. Place drive key in pockets as required.

14. Place assembly in safety cage.

NOTE: ***If no cage is available, some other approved restraining device must be used during inflation.***

- ***Always stand away from the rim during inflation.***

Photo 7

Photo 8

- After pressure has reached 5 PSI (.5 Bar), check all around rim for proper component seating. If necessary, deflate tire and adjust components.
- Inflation above 10% of recommended is to be done only after assembly is installed on the machine.

Do not inflate tires with 16 ply rating or less above 75 PSI (5.25 Bar).

15. If assembly is ok, inflate as follows:

    - Tires less than 29” in diameter = 75 PSI (5.25 Bar)
    - Tires 29” and larger in diameter = 90 PSI (6.25 Bar)

NOTE: Air inflation equipment should have a filter to remove moisture. This prevents corrosion inside the tire. Check filter frequently to be sure it functions properly.

16. Adjust to proper operating pressure.

Photo 9

Mounting Radial Off-The-Road Tires on EM Rims

Read safety instructions (pages 26-35) before proceeding.

1. Before mounting:
   - Clean all rim components. Remove rust and dirt. Lock ring and O-ring grooves must be clean and rust free for proper seating and seal. (Photo 1 and Photo 2)
   - Inspect parts for damage. Replace all cracked, worn, damaged, or severely rusted components.
   - Paint or coat all parts with rust inhibitor. (Photo 3)
   - Double check to be sure correct parts are being used.
   - Inspect inside of tire. Remove any foreign matter. Use compressed air to dry any moisture.

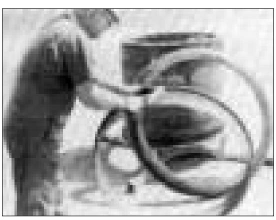


Photo 1

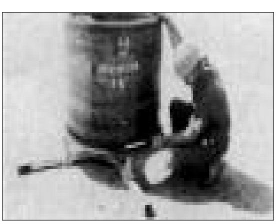


Photo 2

2. Place base on 4” - 6” blocks (10-13 cm) or mounting stand. Gutter side must be up.
3. Lubricate tire beads with vegetable lubricant. (Photo 4).
   - Use only approved vegetable-based lubricants.
   - Lubricate from toe to GG ring on tire.
   - Lubricate moderately, but thoroughly.
4. Lubricate the following areas on the rim:
   - Back rim base knurled area.
   - Front O-ring groove area.
5. Lubricate components: (Photo 5)
   - Bead seat band knurled area
   - O-ring

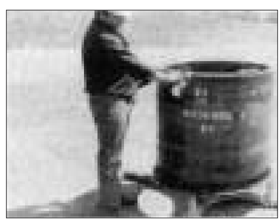


Photo 3

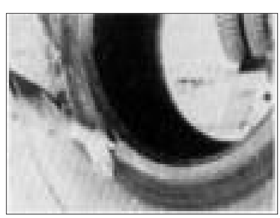


Photo 4

6. Place back flange on rim base.
7. Use cable sling or tire handler to lift tire. Place on rim. (Photo 6)

Stand clear when using a cable or chain sling. It can snap and lash out.

8. Depress tire bead area to ease assembly of next components (Photo 7–next page)
9. Place front flange over rim base.
10. Place bead seat band on rim base.

    Be sure driver pockets in bead seat band and base are in line (if present).

    Band will bind if cocked even slightly. If it becomes wedged, DO NOT HAMMER INTO PLACE! Lift, and lower it correctly. If necessary, use a rubber, lead, plastic or brass-faced mallet and tap lightly upward.

(Continued on next page)

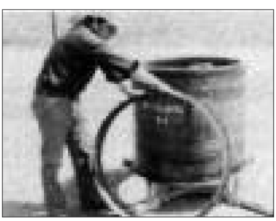


Photo 5

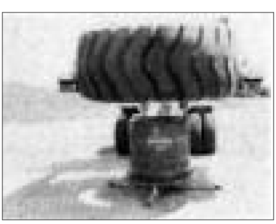
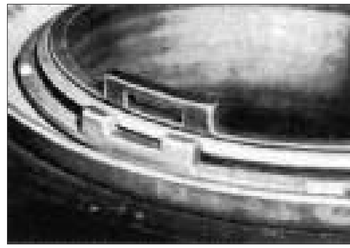
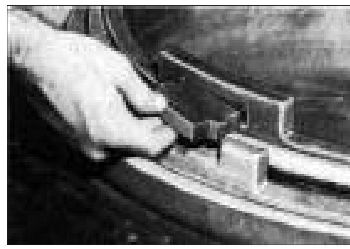


Photo 6

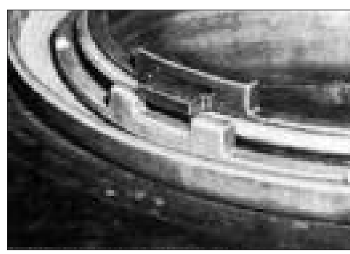
Typical Heavy Duty Driver Application



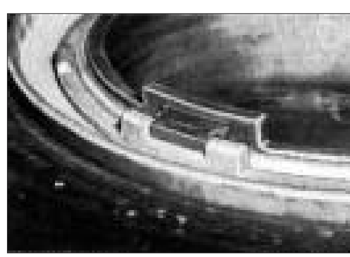
Align driver pockets in bead seat band and base.



Insert driving slug into driver pocket on base.



Make sure all parts are properly aligned before inflation.



View of final assembly.

11. Snap O-ring into place. Place on one side. Stretch like a rubber band. Seat on other side.

12. Start the lock ring in the lock ring groove. Push or walk it into place. (Photo 8)

13. Place drive key in pockets as required.

NOTE: If tire is to be inflated horizontally, support rim above ground level. This allows bottom bead to pilot (self-center) onto bead seat taper.

If tire is to be inflated vertically, support both tread and rim during inflation. This prevents excessive bead to rim eccentricity.

14. Place assembly in safety cage.

NOTE: ***If no cage is available, some other approved restraining device must be used during inflation.***

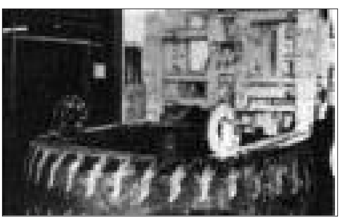


Photo 7

Photo 8

- ***Always stand away from the rim during inflation.***
- After pressure has reached 5 PSI (.5 Bar), check all around rim for proper component seating. (Photo 9) If necessary, deflate tire and adjust components.

15. Inflation above 10% of recommended is to be done only after assembly is installed on the machine.

- Tires 25” and larger in diameter = 90 PSI (6.25 Bar)
- If recommended operating pressure is higher than 90 PSI, inflate to operating pressure.

NOTE: Air inflation equipment should have a filter to remove moisture. This prevents corrosion inside the tire. Check filter frequently to be sure it functions properly.

Do not run tire until pressure has been adjusted to operating pressure.

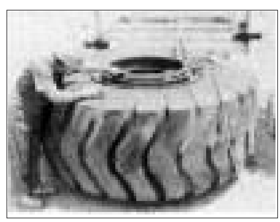


Photo 9

Mounting Radial Off-The-Road Tires on Single Piece Rims

⚠ **Read safety instructions (pages 26-35) before proceeding.**

1. Before mounting:
   - Clean wheel. Use wire brush to remove rust and dirt.
   - Inspect wheel for damage. Do not use cracked, worn, damaged, or severely rusted wheels.
   - Paint or coat wheel with rust inhibitor.
   - Inspect inside of tire. Remove any foreign matter. Use compressed air to dry any moisture.
2. Attach a small C-clamp to wheel flange. This will keep bead from slipping around wheel flange during mounting. (Photo 1)

Photo 1

3. Lubricate wheel flanges, wheel well and tire bead with vegetable lubricant.
   - Use only approved vegetable-based lubricants.
   - Lubricate moderately, but thoroughly.
4. Hook tire bead over C-clamp. This prevents slippage.
5. Use tire iron to hook bead onto wheel. (Photos 2, this page, and 3, next page) Be sure bead is slipping into wheel well.
6. Place tire iron between top bead and wheel. Push down to force bead below wheel flange.
7. Place vice grips on wheel flange to hold top bead start position.
   - Be sure vice grips are firmly attached to wheel. (Photo 4)
   - Lubricate 2nd bead 90° on both sides of vice grips.
8. Start 90° on either side of vice grips. Walk iron around top bead to hook onto wheel.

(Continued on next page)

Photo 2

9. Place one tire iron across wheel. Use 2nd iron as lever to help hook final bead section onto wheel. (Photo 5)

10. Place assembly in safety cage.

NOTE: ***If no cage is available, some other approved restraining device must be used during inflation.***

- ***Always stand away from the wheel during inflation.***

Photo 3

Photo 4

- After pressure has reached 5 PSI (.5 Bar), check all around wheel for proper seating. If necessary, deflate tire and adjust fit.
- Inflation above 10% of recommended is to be done only after assembly is installed on the machine

11. If assembly is ok, inflate to working pressure

NOTE: Air inflation equipment should have a filter to remove moisture. This prevents corrosion inside the tire. Check filter frequently to be sure it functions properly.

Photo 5

Mounting Tires on a Machine

(Tubeless-type. See page 60 for additional instructions for tube and flap insertion.)

⚠ Read safety instructions (pages 26-35) before proceeding.

1. Before mounting:
   - Clean all rim components. Remove rust and dirt. Lock ring and O-ring grooves must be clean and rust free for proper seating and seal. (Photo 1)
   - Inspect parts for damage. Replace all cracked, worn, damaged, or severely rusted components.
   - Paint or coat all parts with rust inhibitor.
   - Double check to be sure correct parts are being used.
   - Inspect inside of tire. Remove any foreign matter. Used compressed air to dry any moisture.
2. Place back flange on rim base.
3. Lubricate tire beads with vegetable lubricant.
   - Use only approved vegetable-base lubricants.
   - Lubricate from toe to GG ring on tire.
   - Lubricate moderately, but thoroughly.
4. Use tire boom or tire handler to lift tire. Place on rim. (Photo 2)

Stand clear when using a cable or chain sling. It can snap and lash out.

5. Use boom to position front flange on base. (Photo 3–next page)

(Continued on next page)

Photo 1

Photo 2

6. Use boom to position bead seat band on rim base. (Photo 4)

   Be sure driver pockets in bead seat band and base are in line (if present).

   Band will bind if cocked even slightly. If it becomes wedged, DO NOT HAMMER INTO PLACE! Remove from rim and position it correctly. If necessary, use a rubber, lead, plastic or brass-faced mallet and tap lightly upward.

7. Lubricate O-ring with vegetable lubricant.

8. Use boom to hold rim components out of way while installing O-ring.

9. Lubricate entire O-ring groove area with vegetable lubricant.

10. Snap O-ring into place. Place on one side. Stretch like a rubber band. Seat on other side. (Photo 5)

11. Start the lock ring in the lock ring groove. Push or walk it into place. (Photo 6)

Photo 3

12. Place drive key in pockets as required.

13. ***An approved restraining device must be used during inflation.***

   - ***Always stand away from assembly during inflation.***
   - After pressure has reached 5 PSI (.5 Bar), check all around rim for proper component seating. If necessary, deflate tire and adjust components.

15. If assembly is ok, inflate as recommended.

NOTE: Air inflation equipment should have a filter to remove moisture. This prevents corrosion inside the tire. Check filter frequently to be sure it functions properly.

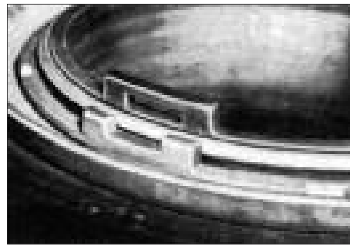
16. Adjust to proper operating pressure.

Photo 4

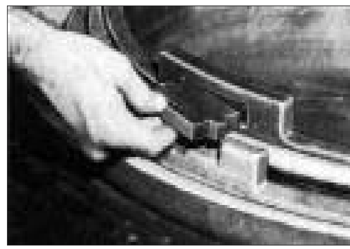
Photo 5

Photo 6

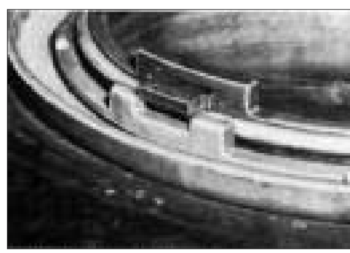
Typical Heavy Duty Driver Application



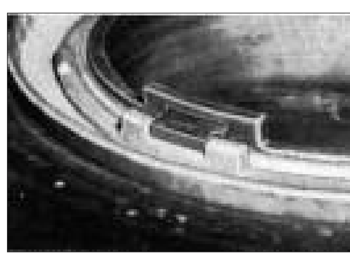
Align driver pockets in bead seat band and base.



Insert driving slug into driver pocket on base.



Make sure all parts are properly aligned before inflation.



View of final assembly.

Mounting Tube-Type Off-The-Highway Tires

Read safety instructions (pages 25-35) before proceeding.

Rim preparation and component installation procedures are the same as tubeless.

The tube is installed in tire before it is placed on the rim.

1. Inspect casing inside and out for breaks, bruises and nails.
   - Remove any foreign matter inside the tire.
   - Use compressed air to dry any moisture.
2. Stand tire vertically.
3. Place tube in casing.
   - Start at bottom.
   - Add air as tube is worked into tire. This will hold it in place and prevent wrinkles.
4. Insert flap.
   - Be sure it is properly centered.
   - Be sure it is free of wrinkles.
   - Rotate tire as the flap is worked in. Part being inserted is always at bottom.
   - If necessary, use a dry lubricant (such as soapstone) on flap and tube.
   - If necessary, use a spreader or car jack to spread beads.
5. ***When ready to inflate, place assembly in safety cage.***

NOTE: ***If no cage is available, some other approved restraining device must be used during inflation.***

- ***Always stand away from the rim during inflation.***
- After pressure has reached 5 PSI (.5 Bar), check all around rim for proper component seating. If necessary, deflate tire and adjust components.

Inflation above 10% of recommended is to be done only after assembly is installed on the machine.

Do not inflate tires with 16 ply rating or less above 75 PSI (5.25 Bar).

6. If assembly is ok, inflate as follows:
   - Tires less than 29" in diameter = 75 PSI (5.25 Bar)
   - Tires 29" and larger in diameter = 90 PSI (6.25 Bar)

NOTE: Air inflation equipment should have a filter to remove moisture. This prevents corrosion inside the tire. Check filter frequently to be sure it functions properly.

7. Completely deflate tire. This removes buckles and uneven stresses from tube and flap.
8. Reinflate to proper operating pressure.

SECTION III
Tire Selection for Expected Service Conditions

All off-the-road (OTR) tires are subject to the demands imposed by:

- heavy loads
- less than desirable operating conditions

All require:

- High carcass strength to hold the inflation pressure necessary to carry great loads and resist impact damage.
- Tread and sidewalls constructed rubber to help resist cuts and bruises.
- Tread patterns designed for high traction to help transmit high engine horsepower.
- Flotation capabilities in soft underfoot conditions.

Some operations, however, require different tire construction features for the job site conditions. For example, operations with long haulage cycles need more heat resistant tread. Sharp rock service demands extra tread depth to minimize cutting. Soft underfoot or muddy conditions call for better traction.

Unfortunately, improvements in one area of a tire's performance often result in compromise.

Increased tread depth typically results in reduced heat resistance. Heat is detrimental to tire life. Loads or speeds may have to be reduced to minimize heat generation. Otherwise, the tire may suffer structural damage and lose service life.

Similarly, improved traction is usually gained at the expense of tread wear. This occurs because tread volume decreases as tread elements are spaced further apart. The greater the spacing, the better the tire can dig in. But with less rubber on the ground, the tread wears faster.

To minimize compromises, Goodyear offers a variety of off-the-road-tires with choices of:

- tread design
- non-skid (tread) depth
- tread rubber compounds

for customers to select.

Tire Selection Criteria

There are four major areas to evaluate to determine the best tire for an earthmover:

- Will it fit?
- Will it carry the load?
- Will it work in the underfoot conditions?
- Does it meet TMPH/WCF requirements?

OTR equipment manufacturers supply technical data needed to determine tire loading. These include:

- Empty and loaded vehicle weight.
- Load distribution by axle.

Equipment manufacturers typically deliver their vehicles with a base tire. This base tire is suitable for standard loads and inflations. Users, however, typically want to carry larger loads to achieve maximum productivity. To carry heavier loads, larger or higher ply rated tires must be used.

Equipment manufacturers recommend optional tires sizes and ply ratings for different loading and operating conditions. However, other considerations can affect the tire choice.

Factors involved in tire selection include:

- Material density. The weight per cubic yard (cubic meter) varies greatly.
- Optional equipment can add substantial weight. It can also affect weight distribution.
- Equipment modifications can affect weight and its distribution. This is especially true of modifications by users.
- As equipment ages, it tends to become heavier when empty. Thus, empty weight and distribution will change over time.

Because of these factors, it is necessary to estimate the actual operational tire loads. An appropriate tire can then be selected using recommended load and inflation tables.

The Tire and Rim Association (T&RA) publishes suggested maximum inflation recommendations for OTR tires.

While it may be necessary to estimate wheel loads, actual load data is extremely desirable. This can be obtained through an on-site load study.

Goodyear has a sizeable history of tire load data for a wide range of equipment. This information is available to users to help in their selection of OTR tires.

Higher vs. Lower Inflation Pressure

Usually, you have two choices to carry a given load:

1) a smaller size tire with a higher ply rating and inflation pressure; or

2) a larger tire which will carry the load at a lower inflation pressure.

If possible, the tire with a lower inflation pressure should be selected. As a general rule, lower inflation pressure offers these advantages:

- Increased tread wear.
- Reduced cut and impact potential.
- Improved repairability.
- Improved retreadability.
- Reduced rim and wheel breakage.
- Reduced vehicle maintenance and repair costs.
- Less road maintenance required.

Remember, however, that inflation supports and carries the load. If the weight demands high inflation pressure, the use of lower inflation pressure is not an option.

Vehicle clearance must be considered.