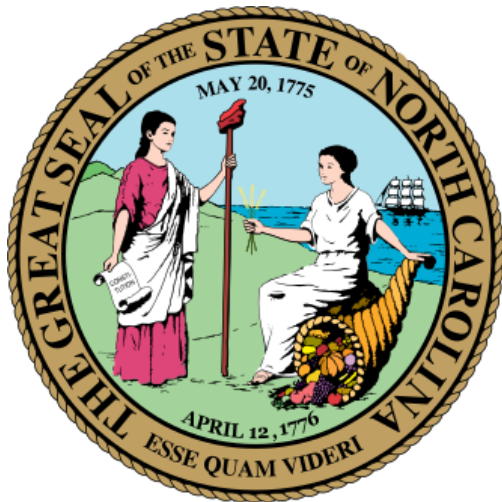


Safe Trailering & Towing

North Carolina Department of Environmental Quality- Marine Fisheries Division



Purpose

Many Division of Marine Fisheries employees must trailer and launch boats as part of their jobs.

This training will provide you the knowledge required to safely trailer and launch boats while avoiding personal injury or property damage.



NHTSA Statistics

- Each year there are over 50,000 accidents related to towing in the US
- From 1975 to 2013 17,000 people were killed in accidents involving a vehicle towing a trailer

(Source: National Highway Transportation Safety Administration)



Statistics

90% of boat trailering accidents can be traced back to failure to dedicate time to the most basic preventative maintenance including:

- Wheel Bearings
- Suspension Parts
- Lights
- Other Components

(Source: US Coast Guard Auxiliary)



Lack of Regulation & Training

- Special licenses and/or classifications are required for motorcycles, school buses, & vehicles with air brakes.
- No special licenses or training are required in NC to trailer a boat.
- Trailers are not required to be inspected in NC



Scope

This training will cover the following topics:

- Selecting Hitch Components
- Attaching the Trailer
- Safe Towing Procedures
- Safe Launching Procedures



Selecting Safe Hitch Components

The hitch assembly includes the following components:

- Receiver
- Draw Bar or Ball Mount
- Hitch Pins
- Ball



Selecting Safe Hitch Components

- Each of these four components has a maximum weight rating
- The entire hitch assembly is only as strong as its weakest component



Receiver Type Hitches

Most DMF vehicles use receiver-type hitches, but few bumper mounted hitches are still around. A hitch receiver mounts to the vehicle frame. A bumper mount attaches to the bumper and will have a lower weight capacity than a frame mounted receiver type hitch.



Receiver Type Hitches

- Receiver type hitches have a square receiver tube with a standard size of 1 ¼” to 2” though they can be larger
- Receiver hitches are rated class 1-4 depending on their Gross Towing Weight Capacity (GTW)



Receiver Hitch Classes

<u>Hitch Class</u>	<u>GTW Capacity (lbs.)</u>	<u>Tongue Capacity (lbs.)</u>
1	2,000	200
2	3,500	350
3	5,000	500
4	12,000	1,200



Draw Bar or Ball Mount

- The draw bar or ball mount slides into the receiver and has its own maximum weight capacity. This weight capacity will be stamped on the draw bar.



Hitch Pin

The hitch pin locks the draw bar into the receiver. Hitch pins usually have a weight rating between 10,000-15,000 lbs. Over time grooves can wear into the hitch pin and cause weakening. Hitch pins should be inspected frequently for grooves and replaced as necessary.



Trailer Ball

There are four standard trailer ball diameters:

- 1 7/8"
- 2"
- 2 5/16"
- 3"



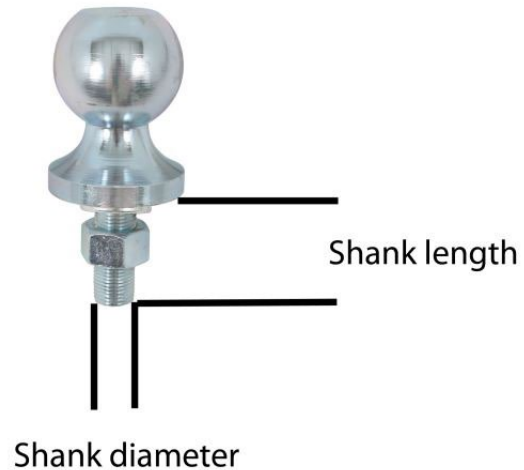
The ball diameter and maximum weight will be stamped on the ball.



Trailer Ball

Trailer balls also come in different shank diameters ranging from $\frac{3}{4}$ " to 2".

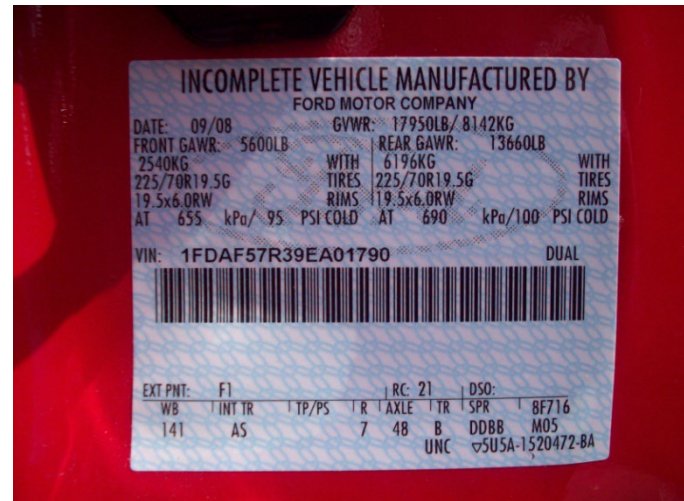
The shank diameter must fit the ball mount, and the ball diameter must fit the trailer coupler.



Vehicle Towing Capacities

Vehicle towing capacities must also be considered. Vehicle towing capacities can be found in several locations:

- Driver Door Post
- Glove Compartment
- Owner's Manual
- Internet Search



Factors in Towing Capacity

Many people assume the listed towing capacity for the vehicle is what it can tow. While true in principle, the legal and safe towing capacity depends on several factors and can seem a complex process. Before we discuss that, let's look at some terms that we will use later



Towing Capacity Definitions

- **GVWR: Gross Vehicle Weight Rating:** This is the maximum safe weight of your vehicle. Exceeding this weight puts the transmission, axles, engine, and probably most important the brakes, beyond their designed safe limit.
- **GCWR: Gross Combined Weight Rating:** This is the maximum safe weight of your combined vehicle and trailer. It includes everything you have packed in your car and everything you have loaded or mounted on your boat. Exceeding this rating puts similar stresses on the vehicle with even more emphasis on braking



Towing Capacity Definitions

- **GCW: Gross Combination Weight:** This is the combined actual weight of the vehicle and the trailer, loaded. This weight cannot exceed the GCWR.
- **GAWR: Gross Axle Weight Rating:** Usually given as 2 numbers. This is the maximum weight that can be placed on your front or rear wheels. Exceeding this can cause handling issues.



Towing Capacity Definitions

- **GTW: Gross trailer weight:** This is the weight of the trailer, the boat, motor, gas, equipment, etc.
- **Tongue Weight:** This is the weight of the coupler on the ball when the trailer is fully loaded and level.



Determining Tongue Weight

The tongue weight should be at least 10% of the Gross Trailer Weight and should not exceed 15% of the Gross Trailer Weight. Not enough tongue weight can result in poor handling or even violent trailer movement (fishtailing). Too much tongue weight will make the vehicle work much harder to tow and many affect front end handling.

The DMF Facilities Maintenance Section has a tongue weight scale and can assist you in determining the proper tongue weight for your situation. Most trailer winch stands can be adjusted to move forward or back to adjust the tongue weight. Any time a boat or trailer is replaced the proper tongue weight should be determined and measured.



Determining Trailer Weight

Trailer weight can be determined by looking at manufacturer's specifications for the trailer and motor(s). Many trailers have this information on a label or stamped into the trailer.

You can also go to a landfill, highway weigh station, or the state ports to weigh your trailer. Remember this weight is the fully loaded trailer. This includes the motor(s), fuel, equipment and gear, added T-tops or accessories, etc. Gasoline weighs approximately 6.2 lbs. per gallon. (Some DMF boats can carry over 1,000 lbs. of fuel!)



Determining Vehicle Towing Capacity

- Now that we are familiar with all the terms, let's look at how the towing capacity is determined. Towing capacity is a "WEAK LINK" system. The weakest link in the system determines the legal and safe capacity.
- To determine towing capacity, we need to determine the weak link in our system. The order of these is not important, but you should look at all factors when initially determining the towing capacity of your vehicle



Towing Capacity Example

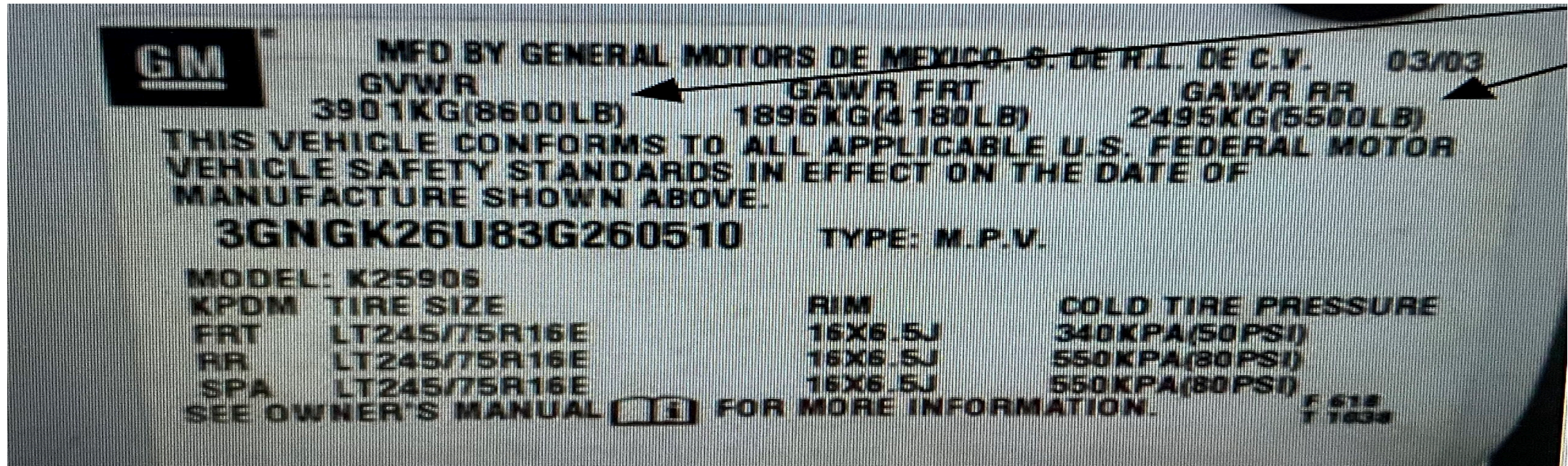
Our vehicle is a 2003 $\frac{3}{4}$ ton Chevy Suburban 4WD with a 6.0 Liter V8 as shown by the arrows. First, we need the manufacturer's capacity for trailer weight and GCWR, (owner manual). On our example we can see the maximum trailer weight is 9,600 lbs. and the GCWR is 16,000 lbs.

Vehicle*	Axle Ratio	Maximum Trailer Weight	GCWR
K-2500 (4WD)*			
6000 V8 (Suburban/Yukon XL)†	3.73	7,600 lbs. (3 447 kg)	14,000 lbs. (6 356 kg)
	4.10	9,600 lbs. (4 354kg)	16,000 lbs. (7 264 kg)**
6,000 V8 w/4WS	3.73	7,300 lbs. (3 311 kg)	14,000 lbs. (6 350 kg)
	4.10	9,300 lbs. (4 218 kg)	16, 000 lbs (7 257 kg)
8100 V8	3.73	10,100 lbs. (4 581 kg)	17,000 lbs. (7 718 kg)
	4.10	12,000 lbs. (5 448 kg)	19,000 lbs. (8 626 kg)

*Tongue weight should be 10 percent to 15 percent of trailer weight up to 1,500 lbs. (681 kg)
**GCWR limited to 14,000 lbs. (6 356 kg) on vehicles with Z83 suspension.
†2500 Suburban/Yukon XL (4WD) equipped with Z83 base suspension limited to 7,900 lbs. (3 586 kg) trailer.

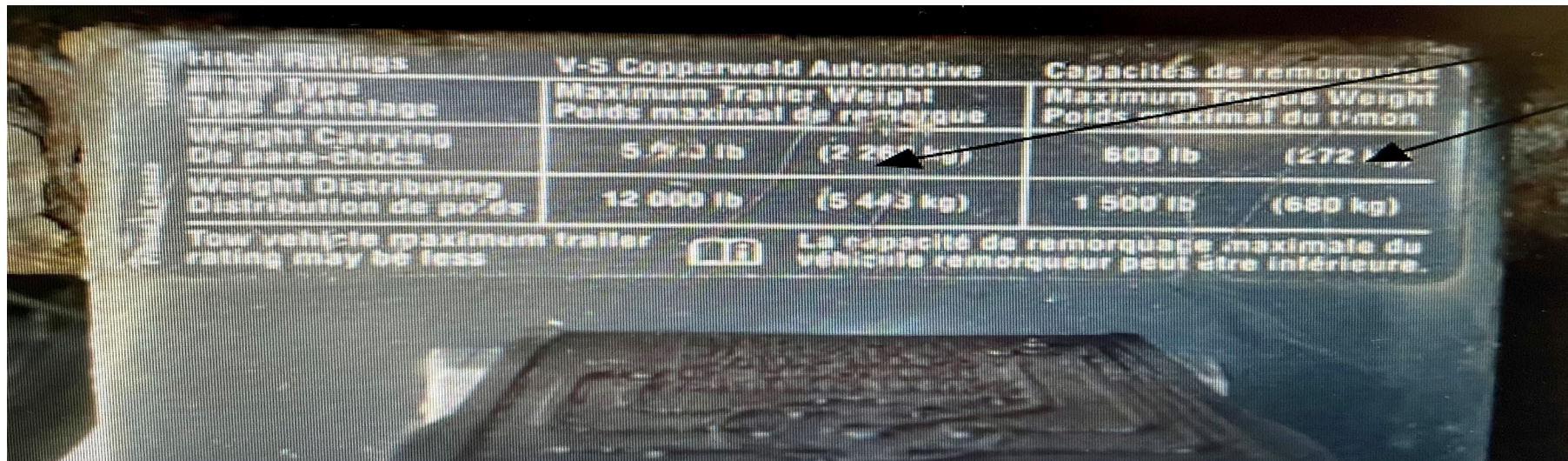
Towing Capacity Example

We also need to know the GVWR and the GAWR for our vehicle. This is either in the manual or on the inside of the door. For this model, the GVWR is 8,600 lb. and the real axle GAWR is 5,500 lb.



Towing Capacity Example

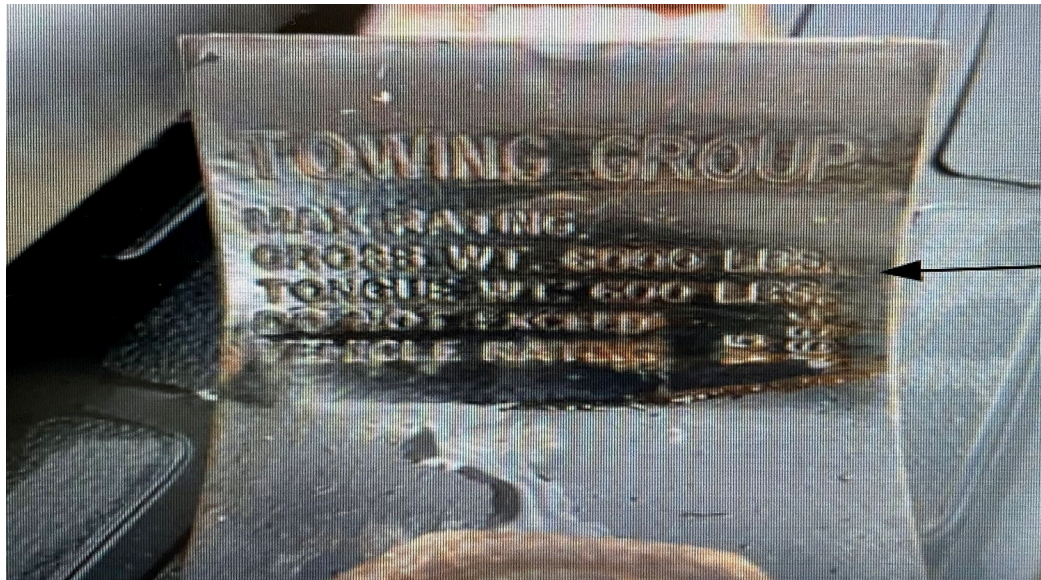
We need to know some information about the other parts of the towing package. Below is the capacity information on the Receiver Hitch mounted to our Suburban. It is rated to tow up to a 12,000 lb. trailer. However, that is the rating with a weight distributing configuration. We have a weight carrying configuration with a ball mount, so the maximum trailer weight is 5,000 lbs. It also lists the maximum tongue weight (TW) at 600 lbs.



Hitch Ratings	V-5 Copperweld Automotive		Capacités de remorquage	
Hitch Type Type d'attelage	Maximum Trailer Weight Poids maximal de remorque		Maximum Tongue Weight Poids maximal du timon	
Weight Carrying Dépense-Chocs	5,000 lb	(2,268 kg)	600 lb	(272 kg)
Weight Distributing Distribution de poids	12,000 lb	(5,443 kg)	1,500 lb	(680 kg)
Tow vehicle maximum trailer rating may be less	La capacité de remorquage maximale du véhicule remorqueur peut être inférieure.			

Towing Capacity Example

Next, we need to look at the capacity of the Draw Bar or Ball Mount that slides into the receiver. This information is usually stamped somewhere on the mount. The maximum capacity for this mount is 6,000 pounds with a maximum tongue weight of 600 lbs.



Towing Capacity Example

Our hitch pin is also an important component. These pins vary in shear strength but are typically between 10,000 and 15,000 lbs. However, back and forth movement over time can cause grooving and wear that can alter the shear strength. Check them for wear and buy high quality hitch pins.



Towing Capacity Example

Finally, the towing ball capacity must be determined. This ball has a capacity of 6,000 pounds.



Towing Capacity Example

Gross Combined Weight Rating (GCWR)	16,000 lbs.	
Maximum Trailer Weight	9,600 lbs.	
Gross Vehicle Weight Rating (GWR)	8,600 lbs.	
Gross Axle Weight Rating	5,500 lbs.	
Receiver Hitch Capacity (weight carrying)	5,000 lbs.	600 lbs. tongue weight
Ball Mount Capacity	6,000 lbs.	600 lbs. tongue weight
Hitch Pin (no wear)	10,000 lbs.	
Ball	6,000 lbs.	

In this example, we can safely and legally tow a trailer with a gross trailer weight \leq 5000 lb. and tongue weight \leq 600 lb.

Trailer Loading

- Horizontal Loading: Place about 60% of the load weight forward of the axle & 40% behind the axle
- Center of Gravity: Keep the load as low as possible to avoid a top-heavy trailer
- Vertical Loading: Place heaviest items on the floor over the axle
- Left to Right: Keep weight evenly distributed



Proper Trailer Hitching

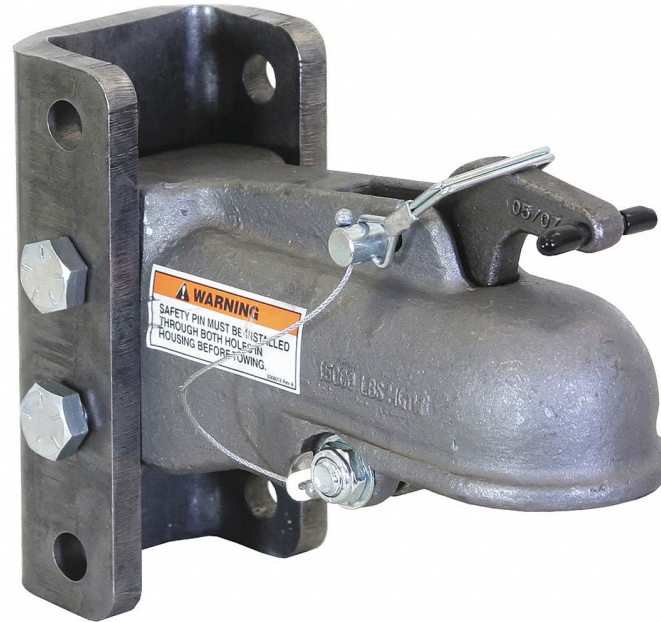
Before coupling the trailer to the tow vehicle:

1. Wipe the ball clean and inspect it carefully for flat spots, cracks or pits.
2. Rock the ball to make sure it is tight to the hitch. Make sure the hitch ball nut is tight against the lock washer and hitch frame.
3. Wipe the inside and outside of the coupler clean and inspect it for cracks or deformities. Be sure to feel the inside for worn spots and pits.



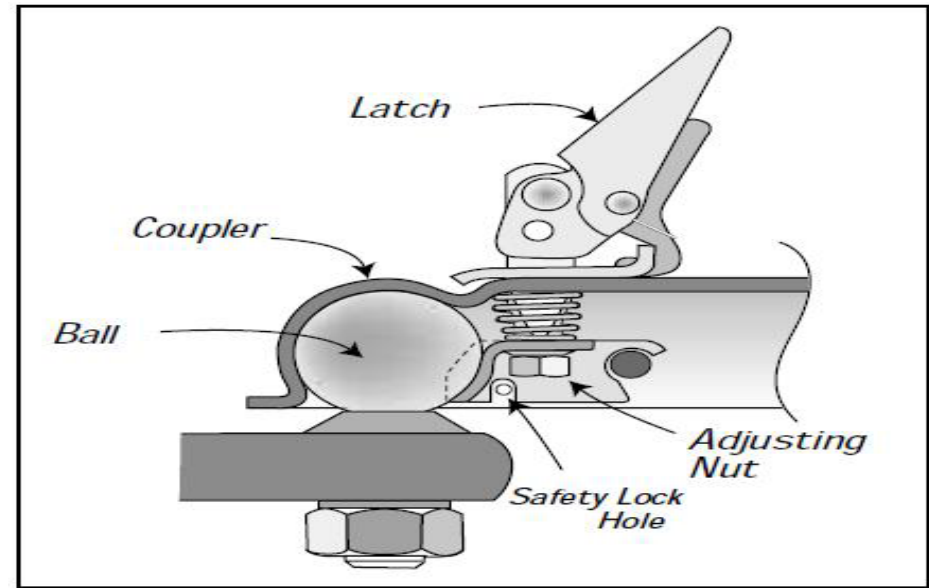
Prepare the Coupler and Hitch:

1. Lubricate the hitch ball and inside of the coupler with a thin layer of automotive bearing grease.
2. Remove the safety latch pin and open the coupler locking mechanism. The coupler should be able to fully drop onto the hitch ball in the open position.



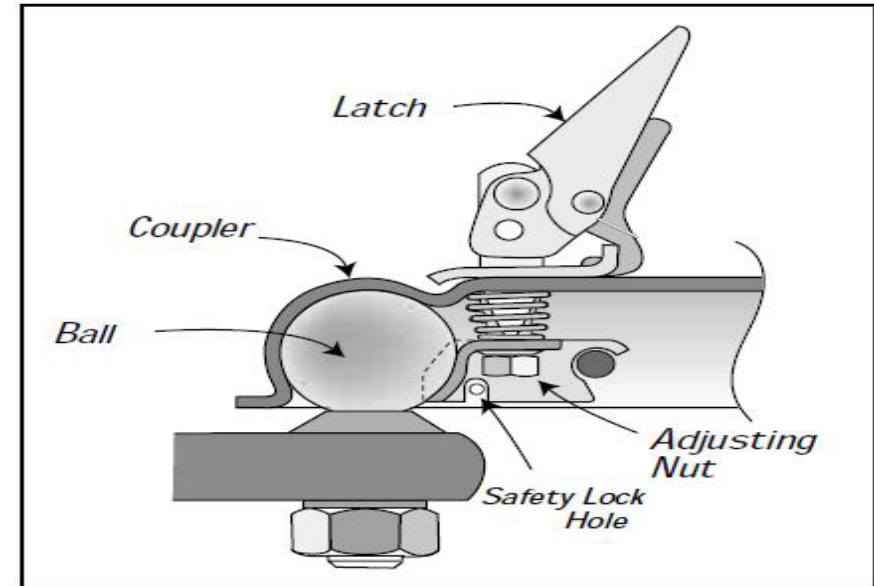
Couple the Trailer to the Vehicle

1. Make sure your tow vehicle is in line with your trailer and slowly back up, so the hitch ball is near or aligned with the coupler. It may be helpful to have someone assist you so that you are certain everything lines up.
2. Lower your trailer's tongue until the coupler fully engages with the hitch ball. If the coupler and hitch ball don't line up, adjust your tow vehicle's position.
3. Close the latch and engage the coupler locking mechanism. When engaged, this will securely hold the coupler to the hitch ball.



Couple the Trailer to the Vehicle

4. Insert the safety lock pin through the hole in the locking mechanism.
5. Be sure the coupler is all the way on the hitch ball and the locking mechanism is engaged. A properly engaged locking mechanism will allow the coupler to raise the rear of the tow vehicle. Use a trailer jack to test whether you can raise the rear of the tow vehicle 1-inch after the coupler is locked to the hitch.



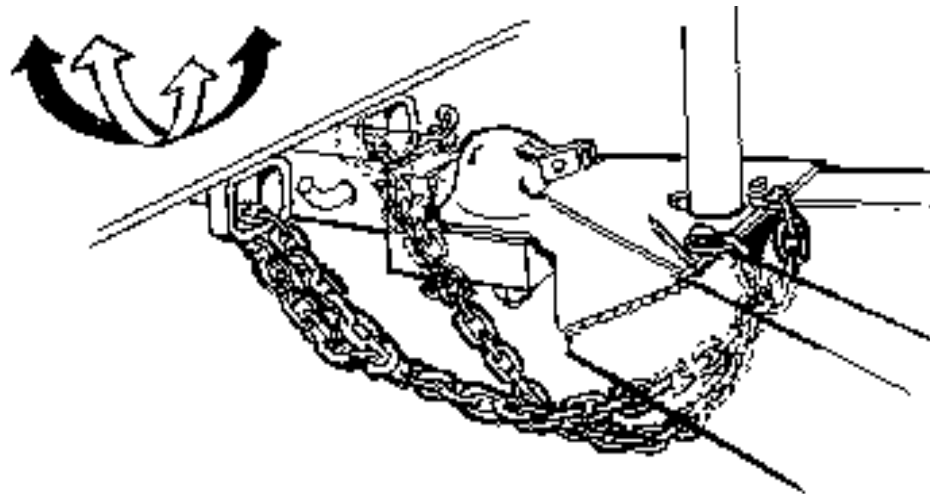
Couple the Trailer to the Vehicle

6. Lower the trailer so the entire tongue weight is held by the hitch and continue retracting the jack to its fully retracted position. Fully retract the jack drop leg if equipped.
7. Cross the safety chains and attach them to the hitch. If they are too long and may scrape the road twist them together as needed.
8. Attach the electrical harness and breakaway brake cable if so equipped.



Safety Chains

- Safety Chains are required on all trailers except fifth wheels
- They are the only backup for a coupler failure
- Chains must be rated for trailer weight
- Chains are crossed to create a cradle effect



Safety Checklist: Before Leaving Home

Wheels, Tires, and Bearings:

- Check cold tires for proper inflation
- Visually check tires for dry rot and uneven wear
- Check the lug nuts. Are they all there? All tight?
- Check bearings or bearing protectors for adequate grease, but don't overfill them
- Check your spare tire for inflation and dry rot



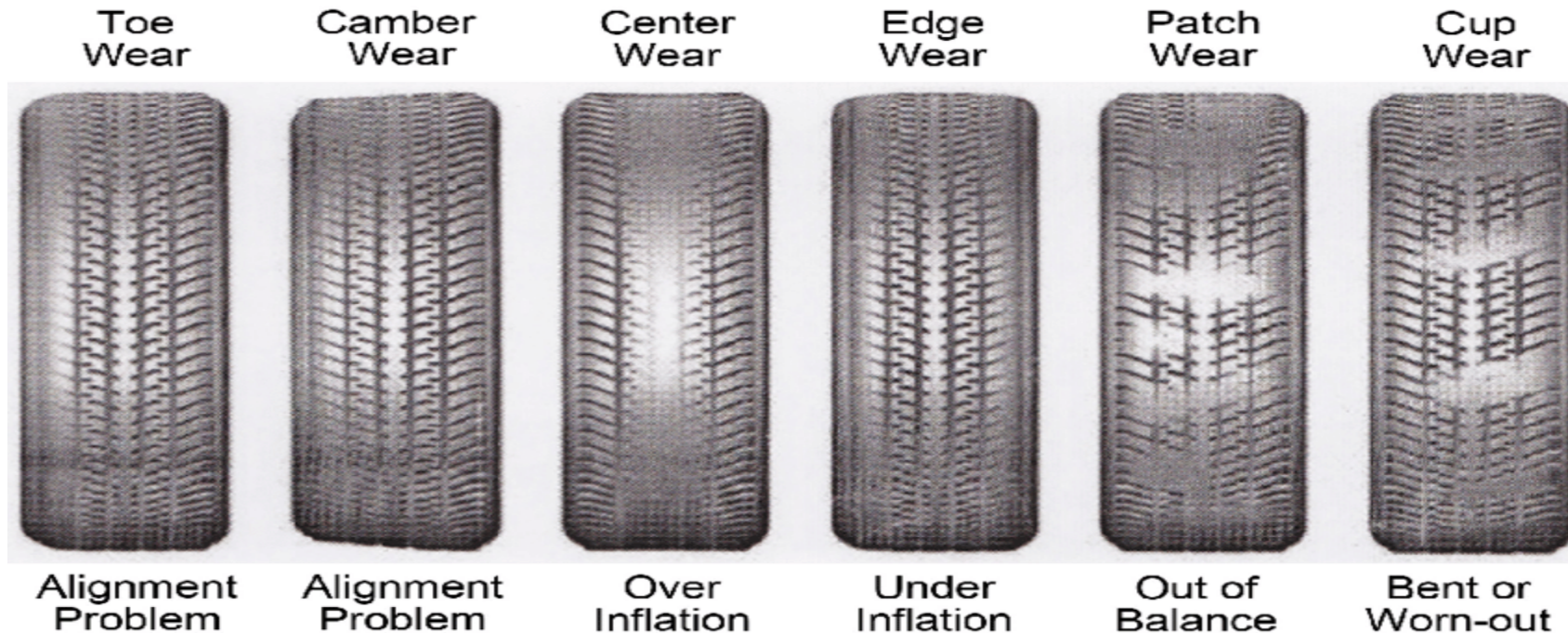
Tire Care

Trailer tires are usually not driven daily. They should be visually inspected for dry rot. Trailer tires can suffer catastrophic failures due to dry rot well before the treads are worn down.



Tire Wear

Tires can wear unevenly due to improper inflation, alignment, or suspension problems. Tires should be inspected visually for uneven wear.



Emergency Kit or Emergency Items

- Spare Tire
- Jack
- Jack Stands
- Board or Paver for soft Ground
- Trailer Ramps
- Cordless Impact Wrench & Lug Nut Socket
- Wheel Chocks
- Lug Wrench
- Extra Lug Nuts
- Reflective Triangles or Flares
- Extra Light Bulbs
- Extra Fuses
- Flashlight
- Basic Hand Tools
- Basic Socket Set



Pre-Trailer Video



Risk Factors

High Risk Activities and Factors Include:

- Highway Speeds
- Passing Other Vehicles
- High Winds
- Backing Up
- Launching



Safe Trailering & Towing



Safe Driving while Towing a Boat

- Acceleration-towing a boat will reduce your acceleration. Be aware of this fact when merging
- Braking-braking distances will be significantly increased so longer following distances behind other vehicles are necessary. 4 second rule in good weather. 5 second rule (or more) in bad weather.
- Turning-turns must be made more slowly and deliberately.

The trailer will not turn in the same arc as the towing vehicle.



Safe Driving while Towing a Boat

- Speed-any problems while towing a trailer will be exaggerated at higher speeds. Never exceed a safe speed for the conditions
- Length-always be aware of the extended length of your rig while towing a boat, especially when changing lanes, merging, exiting, entering parking lots, and parking
- Turn Signals-use turn signals well in advance to communicate your intentions to other drivers



Fishtailing Trailers

Fishtailing refers to side-to-side swaying in trailer.

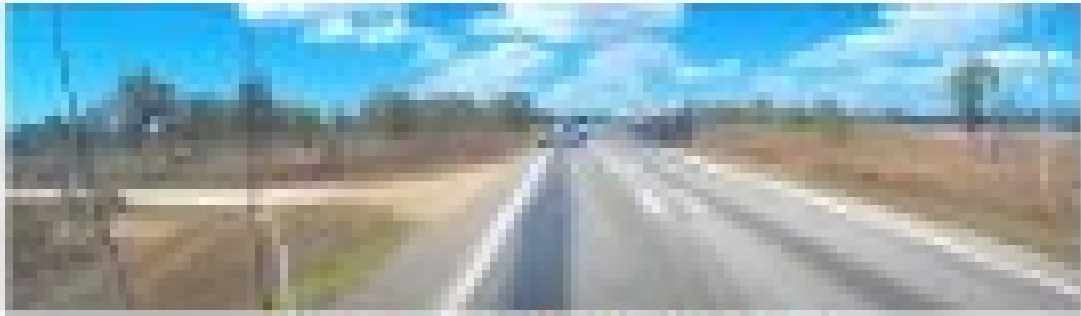
Causes of Fishtailing:

- Loss of traction
- Improper loading
- Trailer too heavy for tow vehicle
- Too little tongue weight
- High winds
- Gusts from passing vehicles
- Driving too fast



Fishtailing Trailers

10 THINGS THAT MAKE YOUR TRAILER



SWAY



Fishtailing Trailers: How to Respond

- Resist the urge to brake
- Lift off the accelerator
- Keep the steering wheel straight



How to Handle a Tire Blowout

- Stay calm
- Firmly grip the steering wheel
- Resist the urge to brake
- Accelerate slightly to regain control
- Coast until about 30 mph
- Apply the brakes lightly
- Pull over somewhere safe and stop
- Turn on your flashers



How to Change a Trailer Tire

Before trailering any rig for the first time make sure you have everything you need for a tire change:

- A safe, properly inflated spare tire
- Tire chocks and reflective triangles or flares
- A jack of the correct size, type, and in working order
- The correct lug nut wrench
- Extra lug nuts



Spare Tire

- Properly Inflated
- No Dry Rot
- Same size and rating as currently installed
- Be aware of speed ratings



Wheel Chocks

- Wheel chocks are used under the front and back of a tire to keep the vehicle from moving while it is jacked up
- Wheel chocks should be used on the opposite side of the flat tire
- On a dual axle trailer they should be used on the opposite side of the flat and on the axle without a flat tire



Proper Type Jack

- Floor Jacks or Bottle Jacks are normally used to raise trailers
- Bottle Jacks are easier to store and move around
- The jack must be rated to lift the weight of the trailer, boat and contents



Bottle Jacks

- Bottle jacks are lighter, smaller, easier to store, and easier to move around than floor jacks
- They have a smaller footprint, so they can be less stable than floor jacks.



Floor Jacks

- Floor jacks are heavier and require more storage space than bottle jacks
- Floor jacks have a longer footprint and are more stable than bottle jacks.



Proper Type Jack

- Trailers are jacked under the frame near the tire. Do not use a jack on the spring suspension or axle
- The frame can be high off the ground so you must select a jack that can raise the trailer a sufficient height or use other materials to raise the base of the jack



Jack Safety

- The ground under the jack should be firm and level
- Carrying some short boards can assist with stability on soft or sloped ground or with raising the base of the jack
- The more the top of the jack is unscrewed the more unstable it becomes
- Once trailer is raised jack stands should be placed under the trailer in case the jack fails or the trailer rocks off the jack



Lug Nut Wrench

- A cross shaped lug nut wrench will provide more torque than the standard L shaped wrench provided with most vehicles.
- Torque is very important on stubborn, corroded lug nuts



Reflective Triangles or Flares

- Flares or reflective triangles should be placed 200-300 feet behind your vehicle before attempting a tire change. LED flares are an option.
- Try not to use flares unless in low visibility conditions
- Never ignite flares near flammable materials



How to Change a Trailer Tire: 1

- Pull as far off the road as possible in a safe, level location
- Set out reflective triangles or flares starting 200-300 feet behind the vehicle on the road and near the shoulder
- Use wheel chocks under the front and rear of a tire on the opposite side of the flat
- Loosen but do not remove the lug nuts



How to Change a Trailer Tire: 2

- Set the jack in a stable location under the trailer frame
- If the ground is soft place a board under the jack
- Raise the trailer until the tire can be removed
- Place jack stands under the trailer frame
- Remove the lug nuts and flat tire



How to Change a Trailer Tire: 3

- Install the new tire
- Tighten the lug nuts hand tight
- Remove the jack stands
- Lower the jack until all the weight is on the tires
- Tighten the lug nuts in a star pattern.
- Use a torque wrench if possible



Safe Fueling at Service Stations:

- Park the boat on a level surface
- Turn off tow vehicle engine & other electronics
- Clear any people not involved in fueling
- Extinguish any smoking materials
- Know your boat's fuel requirements (octane & ethanol)
- Fill portable tanks outside of the boat
- Close any open doors or hatches on the boat



Safe Fueling at Service Stations:

- Do not use hands free pump clips
- Know your tank capacity. Fill only 90% to allow for expansion. Do not top off the tank.
- Keep nozzle touching side of fill tube to prevent static electricity
- Use an absorbent pad to wipe away any excessive fuel



Safe Fueling in the Water

- Secure your boat to the dock
- Turn off engine, all electronics, and blowers
- Close any open doors to storage areas
- Know your fuel requirements (octane & ethanol)
- Do not fill above 90%. Allow for expansion
- Never use a hands-free fuel clip
- Keep the nozzle touching the side of the fill tube
- Wipe any spills with an absorbent pad
- Run blowers at least 4 minutes before starting engines



Safely Launching a Boat

While in the parking lot:

- Remove any boat cover and transom straps
- Install all drain plug(s) & hull plug(s) if present
- Raise antennas if so equipped
- Load any gear from the tow vehicle
- Raise the engine if its' an outboard or I/O



Safely Backing a Trailer



Safely Backing a Trailer

- Put the tow vehicle in 4WD if so equipped
- Place your hand at the 6 o'clock position on the steering wheel.
- Alternate looking in both mirrors.
- Turn the wheel in the direction you want the trailer to move
- Make wide turns and go slowly.
- If the trailer begins to jackknife slowly pull forward until it straightens out



Safe Boat Launching



Safely Launching a Boat

At the Ramp:

- 1) If you have two people place the driver in the boat
- 2) Slowly back down the center of the ramp
- 3) Stop just when the boat becomes buoyant
- 4) Put the vehicle in park and apply the parking brake



Safely Launching a Boat

- 5) The ramp may be slick due to algae. If entering the water maintain as many points of contact as possible between your hands and the boat
- 6) If moving the boat by hand attach a bow line
- 7) Disconnect the winch safety chain
- 8) Use the winch to carefully release pressure off the winch brake and turn the winch brake off. Release enough tension with the winch handle to disconnect the winch line from the bow. Be very careful as a turning winch handle can cause serious injuries to arms or hands.

Boat Winch Injuries

- Boat winch handles can cause injuries to hands, fingers and arms
- Maintain a firm grip on the winch handle at all times
- Never release the handle when the ratchet is in the unlocked position with a load on the winch. The handle will spin violently which could cause serious injury.



Boat Winch Injuries

- Never try to grab a winch handle that is spinning out of control
- Wait for the winch handle to stop moving before you attempt to grab the handle



Safely Getting a Boat out of the Water



Safely Getting a Boat out of the Water

- Drop off the driver at the dock
- Tie off the boat or idle out of other's way
- Back the trailer down a sufficient distance
- Place the vehicle in park and apply the parking brake
- Raise the outboard or stern drive as needed
- Float or slowly drive the boat onto the trailer
- Be mindful of slick ramps and walking surfaces
- Maintain contact with the boat and at least one hand
- Winch the boat snugly against the winch post
- Make sure the winch brake is on



Safely Getting a Boat out of the Water

- Take off the parking brake and slowly pull forward
- Park somewhere out of the way
- Install the winch safety chain
- Install the transom strap
- Remove the drain plug
- Empty the live well if you have one
- Put the outboard or stern drive into the towing position
- Remove any items that may blow out while trailering
- Re-inspect tires, lug nuts, and lights



Why Tow Vehicles Slide into the Water

- Tires lose friction due to algae on the ramp
- Backing too far into the water
- Steeper than usual ramp
- Leaving the transom strap on during launch
- (trailer becomes buoyant)



Why Tow Vehicles Slide into the Water

- Boat & trailer too heavy for tow vehicle
- Forgetting to put the vehicle into park
- Failure to use parking brake
- Failure to use 4-wheel drive
- Failure to chock front wheels



Slippery Boat Ramps



Avoid Tow Vehicle Sliding into the Water

- Be especially careful at low tide
- Back in slowly or coast backwards in neutral
- Back no farther than necessary
- Avoid obvious algae spots on ramp
- Put vehicle in park and apply parking brake with force
- Use chocks behind front wheels if ramp is slippery
- Pull forward in low gear
- Remember the chocks & don't run over them



Limitations on Parking Brakes

- On 2 WD rear drive vehicles the parking brake only locks one rear wheel
- On 2 WD rear drive vehicles the front wheels will spin freely down the ramp if the rear wheels lose traction
- Do not have a false sense of security on a steep or slippery ramp because the parking brake is on



End of Ramp Washout

- Trailer wheels may drop over the rear edge of the boat ramp
- This is often a “low tide” problem
- This hazard occurs because boaters used their engines to drive on trailers and eroded the bottom at the end of the ramp



Ramp Closed due to Washout



Response to End of Ramp Washout

- If the boat is on the trailer unload it and tie it up safely. You will probably not overcome the drop off with a boat on the trailer
- Rotate the steering wheel to one side or another if there is room. The trailer is more likely to overcome the drop off one tire at a time. Try to come out at an angle
- When retrieving the boat wade in the water to determine how far you can safely back in



Lug Nut Tampering

- Someone may tamper with your lug nuts by loosening them while you are parked or on the water.
- Current policy is to paint stripes over each lug and lug nut. These stripes allow you to quickly identify tampering.



Lug Nut Tampering

The product used to stripe lug nuts is Dykem Cross Check Torque

Seal, and it's available in the DMF Store



Lug and Lug Nut Striping

This is what properly striped lug nuts should look like:



Hitch Pin Tampering

- Someone may also tamper with one of your hitch pins while your trailer is unattended
- Always check your two hitch pins before trailering a boat. You should have one hitch pin on the trailer coupler and a second securing the tow bar to the receiver.



Conclusion

Trailer and launching a boat involves many important tasks:

- Take your time. Do not feel pressured or rushed at public boat ramps.
- You may to may want to make checklists for your specific tow vehicle, boat, and trailer package.

