

## 7 / LOADING AND WEIGHING

You, as the trailer operator, are responsible for the safe operation of the trailer. A very important part of safe trailer operation is proper loading. This guide will provide you with information about the proper way to load and weigh your trailer. We'll also discuss the relationship between loading, weighing and proper tire inflation, related chassis components, your tow vehicle and towing equipment. We have also provided some safe driving and towing guidelines. There are some very important terms and concepts about weights and loading that you must understand. **Please study this section carefully** and refer to it often as you prepare your trailer for travel.

Towing a trailer will present different challenges on the highway than you may have experienced before. You should always be careful and think safety first. An accident with a tow vehicle and trailer can have much greater consequences than carelessness with a small car. Take your job as a tow vehicle driver very seriously. Learn all you can about doing the job safely and well. Balancing the load and preparing the trailer and tow vehicle are critical to safe handling.

A critical aspect of safely operating a trailer is knowing the weights involved and where they are placed. You must determine how much is being towed. You must assure that it is within the capacities of the equipment you are using. The location of the load in the trailer is critical to the way your rig will handle on the road.

There are some basic loading and towing rules that you must follow for safe towing. If a trailer doesn't tow properly when all the basic rules have been followed, the answer can be very complex. We will discuss some of the rules of safe trailering and how you can reduce the possibility of having serious towing problems like swaying or instability.

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## CHASSIS WEIGHT SPECIFICATIONS AND LIMITS

The trailer chassis was designed to carry a specific maximum weight. That weight includes everything: the chassis components, the empty trailer body as completed at the factory, all of your cargo and belongings, fuel, fresh water, waste water, propane, and anything else that might be attached to or carried in the trailer. **You must never exceed this maximum weight.** If you exceed this weight, you will change the way your trailer and/or tow vehicle handles. Tires and suspension components may be overloaded. This may lead to unsafe conditions, loss of control, and the loss of your trailer and/or tow vehicle.

Chassis weight specifications include terms that require some explanation. As we discuss loading and weighing, we'll refer to these terms. The following include definitions used by the recreational vehicle industry:

**GVWR (Gross Vehicle Weight Rating)** is the maximum permissible weight of the fully loaded trailer. It is the **absolute total allowable weight** on the wheels and tongue. This is the limit of the specified axles and tongue components as engineered by the trailer manufacturer. It represents the manufacturer's **maximum** loaded weight that the trailer is designed to carry. The GVWR has been determined by weighing a sample of units with the hitch weight added to the sum of the GAWRs.

**UVW (Unloaded Vehicle Weight)** is the weight of the trailer as manufactured at the factory. The UVW *does not* include cargo, fresh water, propane, factory installed options, or dealer installed accessories. UVW also includes all weight at the axles and coupler. If applicable, it also includes full generator fluids, including generator engine fuel, engine oil, and coolants. The UVW of the trailer is noted on the trailer weight placard.

**GCWR (Gross Combined Weight Rating)** is the total combined maximum weight specified by the tow vehicle manufacturer. It is the total weight that the tow vehicle is designed to tow and stop.

**CCC (Cargo Carrying Capacity)** is the maximum weight of all personal belongings: food, tools, dealer installed accessories, etc. that can be carried by your trailer. CCC is equal to GVWR minus each of the following: UVW, full fresh (potable) water weight (including water heater), and full propane gas weight.

**GAWR (Gross Axle Weight Rating)** means the maximum permissible loaded weight a specific axle is designed to carry when being towed. Each axle has its own GAWR. The GAWR is prescribed by the axle manufacturer for each axle. It is the lowest rated component of the axle system, including wheels and tires. The total GAWR for the trailer is GAWR per axle times the number of axles.

**GTW (Gross Towed Weight)** means the maximum permissible loaded weight of any towed load (trailer, car, etc.) that your tow vehicle has been designed to tow, as specified by the tow vehicle manufacturer. *You cannot increase this weight by changing the trailer hitch on the tow vehicle.*

**Maximum Tire Load** is the maximum amount of weight a tire is designed to carry when the tire is inflated according to the tire manufacturer's specifications.

You may see other weight terms and definitions in publications such as sales literature, magazines, books or on-line. Many of these terms are interchangeable, and may require some interpretation and conversion to avoid confusion. The following are several of those other terms, what they mean and how you can translate between them:

**DRY WEIGHT** is the weight of the trailer as it comes out of the factory with no fluids - completely empty and dry. This is the weight of the trailer as built with all standard features, and includes options normally added to the trailer by MVP RV. **DRY WEIGHT does not** include accessories or components added by the dealer or the owner. It does not include any gasoline for the generator (if equipped), gasoline for the fuel station (if equipped), water, propane or other **CARGO**.

**CARGO** is anything loaded in or on the trailer that is *not* generator or fuel station gasoline, water or propane.

Subtract **DRY WEIGHT** from **GVWR** to get **PAYLOAD CAPACITY**. This figure represents the maximum amount of gasoline fuel, water, propane and other cargo which can be added to, loaded in or loaded on the trailer.

**PAYLOAD** is *anything* added to the factory-bare trailer.

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*Fresh water weighs 8.3 lbs./gal.*

*Propane weighs 4.2 lbs. /gal.*

*Gasoline weighs 6.0 lbs./gal.*

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This includes:

water

generator and fuel station gasoline

propane

food

tools

personal belongings, clothes, bedding, furnishings not installed at the factory, camping items, etc. that you load for your recreational activities; and anything not on or in the trailer when it left the factory. Any accessory or component added to the trailer by the dealer or the owner is considered “payload” and reduces the **PAYLOAD CAPACITY** by the amount of the weight of the item(s) added.

**Example:** If the specified payload capacity of the unit is 2200 lbs., and a dealer or owner adds accessories that weigh 600 lbs., the actual payload capacity or the amount that can safely be loaded in the trailer without overloading is now 1600 lbs.

**UNLOADED VEHICLE WEIGHT (UVW)** is the **DRY WEIGHT** of the trailer plus **only** the weight of generator and fuel station gasoline if the trailer is equipped with a fuel station, is equipped with a generator or can be equipped with a generator (manufactured as “generator-ready”).

Subtract **UVW**, the weight of water and the weight of propane, from **GVWR** to get **CCC (Cargo Carrying Capacity)**. You will see references to **CCC** on weight certification tags or in other publications.

**PAYLOAD CAPACITY** and **CARGO CARRYING CAPACITY** are not the same thing. Remember that the weight of generator and fuel station gasoline, water and propane are included in what is considered “cargo”.

## CARRYING CAPACITY

Although all the weight and load ratings and weight definitions are important, the one you will be concerned with on a daily basis is **Cargo Carrying Capacity**. If you fill all the tanks, compartments, cabinets and other storage spaces, the trailer will probably be overloaded. Always remember that the storage compartments and facilities have been designed and positioned for convenience.

Carefully plan your loading and the items you load. Be aware of the weight of everything you load. Take all you need, but no more than you need.

Carefully plan how to distribute the items you carry so you can load correct amounts of weight from front-to-rear and side-to-side. Properly distributing the weight will help you keep within the axle and individual tire and wheel weight limits. When you load properly, the trailer and your tow vehicle will handle and respond safely, and you and your passengers will be more comfortable and confident while on the road. If you load improperly, your trailer/tow vehicle may be unsafe and/or uncomfortable to drive, and your tires may be overloaded. If the vehicle is too heavy or too heavy on one side, it can be overturned in a curve or during an emergency steering maneuver. Proper weight distribution is very important to overall stability and towing characteristics. Poor weight distribution, especially in the rear of the trailer, can cause trailer swaying or handling instability. Always include the essential things you need, but **DON'T OVERLOAD**.

## HOW OVERLOADING AFFECTS YOUR TRAILER

The results of overloading can have serious consequences for safety. Too much weight on your trailer's suspension system can cause spring, shock absorber, or brake failure, handling or steering problems, irregular tire wear, tire failure or other damage. An overloaded trailer is hard to tow and hard to stop. In cases of serious overloading, brakes can fail completely, particularly on steep hills.

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Overloading a trailer beyond its rated capacity, even though it may be well balanced and seem to handle fine, is a very dangerous practice. Eventually something is bound to fail with dramatic and unpleasant results. Overloading places excess strain not only on your tow vehicle causing possible failures at the hitch or in your capacity to safely bring it to a stop in an emergency, it also overloads the trailer's frame, axles, bearings and tires.

Load your trailer well below the maximum for the first tow with a new rig or while you are learning. Keep track of the weights of the individual items as you load them. When in doubt guess high. Using a scale, adjust the load so that you have around 12% to 15% (15 to 25% for fifth-wheels) of your best estimated total weight on the hitch. Attach the trailer to the tow vehicle and note how much the rear end drops. If it looks excessive, check the tow vehicle's load capabilities.

### CARGO CAPACITIES

The certification label attached to left front corner of the trailer body shows trailer and axle weight ratings, tire size and cold inflation pressures. The label indicates the vehicle's gross vehicle weight rating (GVWR). This is the most the fully loaded vehicle can safely weigh. It also states the gross axle weight rating (GAWR). This is the most a particular axle can safely weigh. If there are multiple axles, the GAWR of each axle is stated.

Cargo can be added to the trailer, up to the maximum weight specified on the label. The combined weight of the trailer and the cargo is provided as a single number. In any case, **remember that the total weight of a fully loaded vehicle can not exceed the stated GVWR.**

Water and propane also need to be considered. The weight of the fully filled propane containers is considered part of the weight of the RV before it is loaded with cargo and is not considered part of the usable cargo load. Water however, is a cargo weight and is treated as such. If there is a fresh water storage tank of 100 gallons, this tank when filled would weigh over 800 pounds. Consider this if your travel plans require you to carry water. Remember to keep the total amount of cargo added to the vehicle within the limits of the GVWR so as not to overload the trailer. Understanding this flexibility will allow you, the owner, to make choices that fit your travel needs.

When loading your cargo, be sure it is distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed near or on the floor and as close to the axle positions as reasonable. Too many items on one side may overload a tire. The best way to know the actual weight of the vehicle is to weigh it at a public scale.

## PLACING THE LOAD

There are many different trailer designs but the loading rules are generally the same no matter what type of trailer you have. Typically, RV trailers fall into two categories: ramp trailers which are the ones commonly known as “toyboxes” or “toyhaulers”, and non-ramp or conventional style trailers. Ramp trailers combine RV living quarters with a large cargo area. All of the loading rules apply to both styles of trailer, but there are a couple of special loading rules for ramp trailers. When you load a ramp trailer, you should place approximately 60% of the total cargo weight either over or slightly forward of the center line of the axle assembly. On two-axle trailers this would be a point midway between the axles, and on three-axle trailers this point would be over the center axle. Load vehicles and heavy cargo items in the cargo area as far forward as possible.

Big, heavy items should be loaded where they can be securely tied down. Everything should be securely tied down but that is not always possible. Start with top heavy items if you have them. That’s usually a good place to start because you must have plenty of room available to properly tie them down. Tying them straight down is not secure enough. They need to be tied off at several angles or they could fall over in an abrupt change in speed or direction. You need room to accomplish this. Smaller items can be used to fill the spaces around them later.

Once you have the heavy items located, check the tongue weight. If the load is radically off, make the changes necessary to get close. The smaller items can be loaded in such a way that they balance out the load. They should be located so that they will stay put. Placing them next to items that have already been tied down helps, but your main concern should be to not lose the balance of

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the trailer. Don't forget you can also get one side of a trailer a lot heavier than the other without a little planning. This can cause tire failures from overloading. This can also cause a very serious problem when cornering, even causing the trailer to turn over in a sudden turn.

Top heavy loads can cause problems not only in cornering but also in hard braking. They have a tendency to make the trailer "dive" in hard braking conditions. This suddenly increases tongue weight and can decrease tow vehicle front axle loading just when you need steering and brakes the most. Center top heavy items or arrange the remainder of the load to act as a counter weight to minimize this effect.

Never place heavy objects on add-on devices hung on the rear bumper or placed across the tongue frame. This places heavy objects where they will dramatically effect handling in corners or bumps. Heavy weights placed well behind the axle can also reduce stability. A bicycle may be fine to hang out in back, but not a motorcycle.

Use good common sense and to always allow plenty of margin for safety.

### **How To Weigh Your Loaded Trailer**

Though it is not necessary to weigh your trailer every time you load it, it is important to verify that you have proper balance and have not exceeded any ratings. Once you have a feel for it, a good estimate is usually close enough unless you are loading to near your trailer's maximum limits.

Find a public weigh station. Locations of weigh stations or scales can be found in your local telephone directory. Many truck stops, grain elevators, moving and storage companies, gravel pits, and recycling centers have weigh stations that may be able to help you. Be sure your trailer is loaded as you intend for travel. Generally, the procedure will be similar to the following. There are several types of scales in use, and you should follow the attendant's instructions for positioning your trailer for the type of scale. The following procedure assumes a single platform scale is being used.

1. Pull the trailer onto the scales so that the trailer is centered on the platform and the rear wheels of the tow vehicle are off the scale platform and the trailer is centered on the platform. Leave the trailer hitched to the tow vehicle. Take a reading. This weight is the axle weight. This weight must not be more than the total of the Gross Axle Weight Ratings for all of the trailer axles.
2. If necessary, back the trailer until it can be unhitched from the tow vehicle and the landing gear or tongue jack can be lowered onto the scale platform. Unhitch the trailer from the tow vehicle, lower the landing gear or tongue so the trailer is level, and drive the tow vehicle off the scale platform. The trailer alone should be sitting on the scale platform. Take a reading. This weight is the total trailer weight. This weight must not be more than the Gross Vehicle Weight Rating (GVWR) or the GTW (Gross Towed Weight) as specified by the tow vehicle manufacturer.
3. Refer to the trailer weight information placard typically located on the left front side of the trailer. The Gross Weight limits of the axles and the Gross Vehicle Weight limit are printed on these forms. Compare the readings on the scale to the values printed on the placard. ***If any reading is higher than the printed rating, you must adjust or remove the excess weight.***
4. To determine the left and/or right side weights, center only the left side trailer wheels on the scale platform. The trailer wheels on the other side will be off the scale platform. Take a reading. Write down this reading as "Left side weight". Subtract this reading from the total axle weight. The result is the weight on the opposite side. Write down this value as "Right side weight". This weight will help you determine whether one side or the other is overloaded.
5. To determine the Gross Combined Weight, center both the trailer and tow vehicle on the scale platform. Take a reading. Compare the weight to the tow vehicle GCWR specification as listed on the two vehicle weight ratings placard.

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## **NOW THAT YOU HAVE WEIGHED YOUR TRAILER . . .**

The information you collect when you weigh your trailer will help you load your trailer properly so that you don't overload the trailer chassis components, tires, or your tow vehicle.

If you find a difference in the weights on one side of the trailer as compared to weights on the other side, tires, wheels, brakes, springs and other components on the heavier side could be overloaded, even though the total axle load is within the GAWR. It is important that you redistribute the load to avoid component failure, as well as to improve the handling characteristics of the trailer. With the actual weights in hand, you can now compare them against the GAWR, GVWR and tire capacities. The actual weights should also be used to help determine the proper air pressure for the tires. Redistribute the load to avoid component failure, as well as to improve the handling characteristics of the trailer.

## **DETERMINING THE CORRECT PIN/TONGUE WEIGHT PERCENTAGE**

You must determine the amount of weight on the trailer coupler or fifth-wheel pin. Your trailer is the most stable when towing if the weight on the coupler is between 9% and 15% of the total loaded trailer weight, or between 15% and 25% for fifth-wheels. With these weights correct, the possibility of trailer sway is reduced. Sway is usually caused by a trailer that is "tail heavy." The worksheet on the following page will help you determine the correct tongue/pin weights. Rearrange your load until the percentages fall into the correct range.



# Loading & Weighing Worksheet

## Determining the Pin or Tongue Weight Percentage

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<b>Trailer GVWR</b> _____	<b>lbs. (kg)</b>	}	(See the weight tag attached to the front roadside of the trailer.)
<b>Trailer tongue load rating</b> _____	<b>lbs. (kg)</b>		
<b>Tow Vehicle GVWR</b> _____	<b>lbs. (kg)</b>	}	(For these values, see the tow vehicle build tag or the weight tag attached to the front door pillar. Write the values in the spaces for your reference.)
<b>Tow Vehicle Front GAWR</b> _____	<b>lbs. (kg)</b>		
<b>Tow Vehicle Rear GAWR</b> _____	<b>lbs. (kg)</b>		

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**1.** Take Scale Reading 1 with the trailer fully loaded with cargo, water and propane. The entire trailer should be on the scale with the tow vehicle disconnected and off the scale. The tongue jack or 5th-wheel landing gear should be extended to support the front of the trailer.

**Scale reading 1** \_\_\_\_\_ **lbs. (kg) Loaded Trailer Weight**

**2.** Take Scale Reading 2 after moving the the trailer so that only its axles are on the scale. Be sure to keep the trailer level. Keep the landing gear up on 5th-wheels.

**Scale reading 2** \_\_\_\_\_ **lbs. (kg) Loaded Trailer Axle(s) Weight**

**3.** Calculate the pin/tongue weight percentage.

**Scale reading 1** \_\_\_\_\_ **lbs. (kg)**

**Minus Scale reading 2** \_\_\_\_\_ **lbs. (kg)**

**equals (=) Loaded pin/tongue weight** \_\_\_\_\_ **lbs. (kg)** This should not exceed the pin/tongue weight rating

**Loaded pin/tongue weight divided by Scale Reading 1 times 100 =** \_\_\_\_\_ **% tongue weight**

Tongue weight should be between 15% and 25% for 5th-wheels and between 9% and 15% for travel trailers