

TOWING BASICS



AXLE RATIOS

An axle ratio is the ratio between the driveshaft rpm and axle shaft rpm. This ratio is critical in the operation of the engine/transmission/driveshaft/axle system that transmits engine torque to the driving wheels and lets the engine develop sufficient rpm to run efficiently. This takes on added importance when towing a trailer.

With too few rpm, an engine pulling a load on a grade is likely to “lug” and overheat. With too many rpm, an engine will run noisily, get poor fuel economy and wear faster. The best rear axle ratio for the intended application lets the engine operate in its optimum power range.

The axle ratio is determined by the size of the ring (axle) and pinion (driveshaft) gears inside the differential. With a ratio of 4.00:1, the pinion gear on the driveshaft makes four rotations for each rotation of the larger differential ring gear on the axle driving shaft.

A low numerical axle ratio, such as 3.21:1, is called a “fast” ratio because the road speed is relatively fast for any given engine speed. The characteristics of a low numerical ratio are:

- ▶ Lower engine rpm
- ▶ Reduced power output
- ▶ Better fuel economy
- ▶ Reduced engine noise

A high numerical axle ratio, such as 3.92:1, is called a “slow” ratio because the road speed is relatively slow when compared to engine speed. The characteristics of this ratio are:

- ▶ Higher engine rpm
- ▶ Increased power output
- ▶ Lower fuel economy
- ▶ Increased engine noise

TOWING BASICS



WIND AND ROLLING RESISTANCE

When a trailer is hitched to a vehicle, the wind and rolling resistance of the equipment are increased. Therefore, it's necessary to make sure the tow vehicle has the powertrain and special equipment to overcome the conditions.

Usually, wind and rolling resistance are not critical on equipment hauling a trailer weighing less than 2,000 lb. But with a trailer that weighs 2,000 lb or more, or has significant frontal area, you'll more than likely have to select optional equipment.

TRAILERS

TWO BASIC TYPES

- ▶ Trailers fall under two basic types:
 - [1] Conventional trailers produce tongue weight
 - [2] Gooseneck or fifth-wheel trailers produce king pin weight

THE MATTER OF WEIGHT

- ▶ Placing too much weight on a hitch can damage the truck's suspension and driveline components
 - Also reduces contact patch of the front tires, creating a "hard to handle," unsafe vehicle
- ▶ Placing too little weight can cause the rear end of the towing vehicle to lift
 - If that occurs, it reduces rear-wheel traction, which can cause jackknifing
- ▶ Depending on a tow vehicle's size and drivetrain, there is a maximum amount of trailer weight it can pull
 - That's why it's so important that a customer provide the gross trailer weight rating of the trailer
 - Other factors to take into consideration include the trailer length and the aerodynamics

TOWING BASICS



TRAILER CLASSES

- ▶ Even though trailers come in all shapes and sizes, they all fall into one of five weight classifications
 - A trailer's maximum loaded weight determines its classification
- ▶ It's important to know them so you can recommend the right vehicle for your customers' needs

TRAILER CLASSES				
CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
TRAILER TYPE				
Light Duty	Medium Duty	Heavy Duty	Extra Heavy Duty	Maximum Duty
GTWR				
Up to 2,000 lb	Up to 3,500 lb	Up to 5,000 lb	Up to 12,000 lb	Up to 18,000 lb (Fifth-wheel or gooseneck trailer recommended for applications over 12,000 lb)
TYPICAL CONFIGURATIONS				
Single-axle trailer	Single-axle trailer	Single- or dual-axle trailers	Tandem-axle trailers	Conventional, fifth-wheel and gooseneck trailers
TYPICAL APPLICATIONS				
Pop-up camper trailers, trailers for motorcycles, snowmobiles and Jet Skis	Open utility trailers, small speedboat trailers	Larger campers and boats, enclosed utility trailers	Large travel trailers and horse trailers	Largest horse and travel trailers, fifth-wheel and gooseneck trailers for transporting construction equipment materials

TOWING BASICS



HITCH CLASSES & TYPES

- ▶ The connection between the tow vehicle and trailer is only as strong as its weakest link, so it's very important to match the right hitch to the weight of the trailer it's going to pull
- ▶ The Society of Automotive Engineers (SAE) defines Classes I through IV
 - These are the most widely used weight classifications
- ▶ The SAE doesn't actually define Class V hitches, but the trailer industry generally considers anything above 10,000 lb as Class V
- ▶ SAE guidelines for Hitch Classes I through IV have gained almost universal acceptance
 - But be aware that some vehicle manufacturers may state trailer hitch weight limits above or below the SAE classification guidelines
 - Always follow the manufacturer's specific trailer hitch information

HITCH CLASSES

CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
Compact cars and mid-size cars	Mid-size cars, minivans and mid-size SUVs	Minivans, full-size cars, vans, pickups and SUVs	Full-size vans, SUVs and pickup trucks	Pickup trucks or properly upfit Chassis Cabs only
HITCH TYPE				
Light Duty Weight-carrying hitch — fixed or removable drawbar	Regular Duty Weight-carrying hitch Receiver-type hitch, frame-mounted with removable drawbar	Heavy Duty Weight-carrying or weight-distributing hitch Receiver-type hitch, frame-mounted with removable drawbar	Extra Heavy Duty Weight-distributing hitch Receiver-type hitch, frame-mounted with removable drawbar	Extra Heavy Duty Weight-distributing hitch Receiver-type hitch, frame-mounted with removable drawbar Fifth-wheel and gooseneck
GTWR				
Up to 2,000 lb Tongue weight 200-lb recommended maximum	Up to 3,500 lb Tongue weight 350-lb recommended maximum	Up to 5,000 lb Tongue weight 500-lb recommended maximum	Up to 12,000 lb Tongue weight 1200-lb recommended maximum	Up to 18,000 lb (conventional trailers) Tongue weight 1,800-lb recommended maximum Up to 30,000-lb (fifth-wheel/ gooseneck trailers) King pin weight 6,500-lb recommended maximum (Ram 3500)
TRAILER EXAMPLES				
Utility trailer Small boat trailer	Open utility trailer Boat trailer	Enclosed cargo trailer Single-axle trailer with sailboat	Double-axle camper trailer Two-horse trailer	Double-axle camper trailer Fifth-wheel recreational trailer Gooseneck flatbed trailer with large loader/backhoe on it



WEIGHT CARRYING HITCH

- ▶ Supports the trailer tongue weight as if it were luggage located at a hitch ball or some other connecting point of the vehicle
- ▶ Most popular on the market today
- ▶ Commonly used to tow small- and medium-size trailers
- ▶ Two styles of weight-carrying hitches:
 - Fixed Drawbar — ball platform permanently welded to the hitch
 - Removable Drawbar (commonly referred to as a drawbar for Class I and II hookups) — ball platform removable from the hitch receiver by taking out a heavy steel pin



WEIGHT CARRYING FIXED DRAWBAR HITCH

WEIGHT CARRYING REMOVABLE DRAWBAR HITCH

- ▶ Components of a Removable Drawbar Hitch:
 - Hitch receiver or hitch box — square opening in the hitch receiver that receives the shank of the hitch ball mount
 - Hitch shank — holds the hitch ball mount, retained in the receiver with a heavy steel pin
 - Hitch box cover — protects the hitch box or receiver from the elements when the shank is removed

TOWING BASICS



HITCH BALL

- ▶ Fits into the socket of the coupler on the tongue of a trailer, providing the means by which the trailer pivots during cornering
- ▶ It's extremely important that the ball diameter correctly matches the internal diameter of the trailer coupler
 - Too small may cause the coupler to bounce loose
 - Too large will not allow proper trailer attachment
- ▶ Common hitch-ball diameter sizes:
 - 1-7/8" Light-Duty
 - 2" Medium-Duty
 - 2-1/4" Heavy-Duty

- ▶ Hitch ball attachment must also be compatible with the shank hole size and thickness of the drawbar or removable hitch shank on the tow vehicle
- ▶ Common shank diameters:
 - 3/4"
 - 1"
 - 1-1/4"
 - 1-3/8"
- ▶ Common shank lengths:
 - 1-1/2"
 - 2"
 - 2-1/8"
- ▶ Ball material and shank diameter determine the tow rating of the ball:
 - 1" ball may be rated at 2,000 lb trailer weight
 - 2" ball may be rated from 3,000 lb to 9,000 lb trailer weight
 - 2-5/8" ball may be rated from 6,000 lb to 30,000 lb trailer weight



WEIGHT-DISTRIBUTING HITCH

- ▶ Also called a load-equalizing hitch
- ▶ Applies leverage between the tow vehicle and the trailer
 - Rather than merely supporting the tongue weight of a trailer
- ▶ Distributes tongue weight to all the wheels of the tow vehicle and trailer
- ▶ Air springs, air shocks and overload springs are not substitutes for the weight-distributing hitch, because they cannot redistribute a load's weight to other axles

COMPONENTS OF A WEIGHT-DISTRIBUTING HITCH

- ▶ Hitch head (with ball)
 - Adjustable ball mount (angle and height)
 - Shank, hitch ball and spring bars attached
- ▶ Hitch receiver
 - Square opening in the hitch platform that receives the shank of the hitch ball mount
 - Shank retained in the receiver with a heavy steel pin
- ▶ Spring bars
 - Spring bars (one for each side)
 - Also called equalizing bars
 - Distribute weight to other areas of the tow vehicle and trailer
 - Constructed of spring steel
 - Have chains connected at the trailer end that attach to snap-up brackets on the trailer tongue
 - Length of the chains varies in spring bars — shorter chain length increases tension in the spring bars, which transfer more tongue weight into the tow vehicle hitch
 - Each bar acts as a spring to maintain a constant pressure on the hitch
 - Spring bars have different tensions built into them — if a truck customer wants to tow a 3,000- , 5,000- or 7,000-lb trailer, be sure the customer has correct spring bars to match the trailer weight
- ▶ Hookup brackets
 - Hook the spring bars to the trailer frame by means of spring bar chains
 - Adjust the spring bars to level the trailer and the tow vehicle
- ▶ Sway damping
 - An adjustable friction device that applies lateral (left-to-right) damping force to the trailer tongue to minimize the tendency of the trailer to sway in adverse conditions



TOWING BASICS



FIFTH-WHEEL HITCH

- ▶ Smaller version of a commercial 18-wheeler-type hitch
- ▶ Most popular with large travel and other types of trailers
- ▶ Mounting a fifth-wheel hitch over the rear axle of a pickup improves trailer sway and makes long trailers more maneuverable
- ▶ Fifth-wheel trailer connector attaches to the specially designed “fifth-wheel” platform hitch installed in the bed of a pickup and attached to the truck frame
 - Must be attached to the pickup frame — not the pickup bed
- ▶ Pickup or Chassis Cab with flatbed must be used to tow a fifth-wheel or gooseneck trailer



FIFTH-WHEEL TRAILER



FIFTH-WHEEL TRAILER CONNECTOR



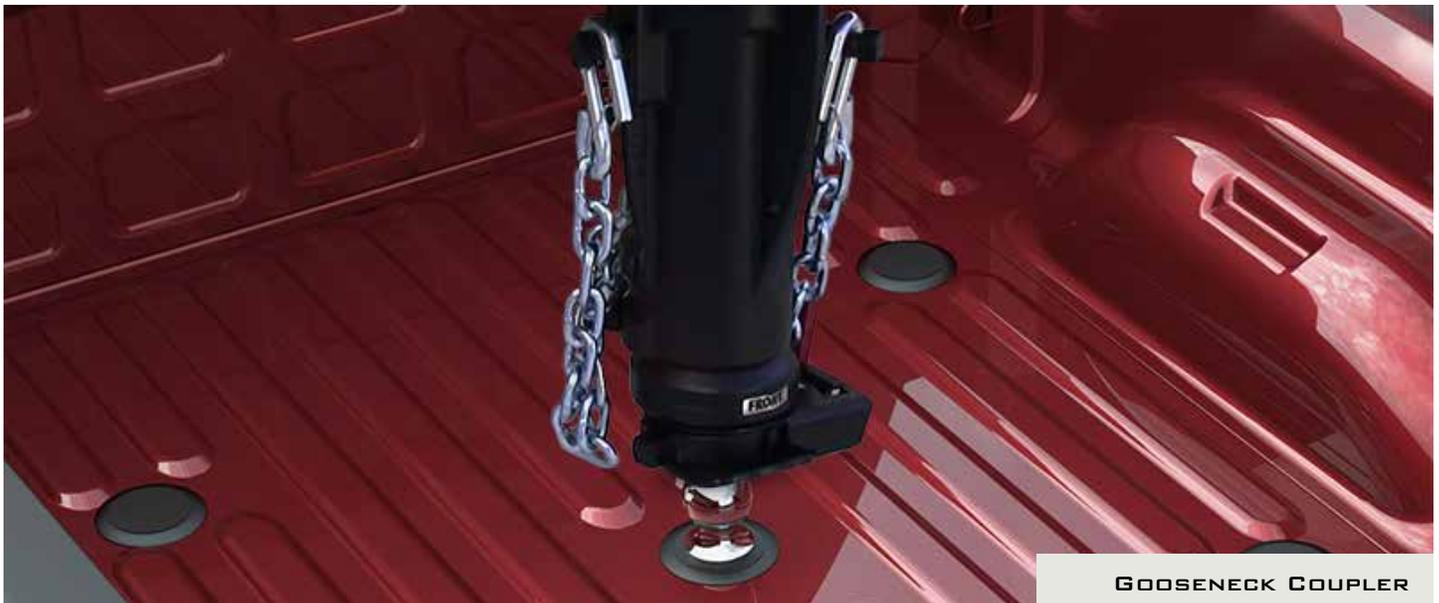
FIFTH-WHEEL HITCH

TOWING BASICS



GOOSENECK HITCH

- ▶ Uses a ball in the pickup bed
- ▶ Employs a pivoted coupling arm that attaches to the ball mounted in the bed of a pickup or a properly upfit Chassis Cab
 - Coupling arm connects to the hitch mounted over the rear axle in the truck bed



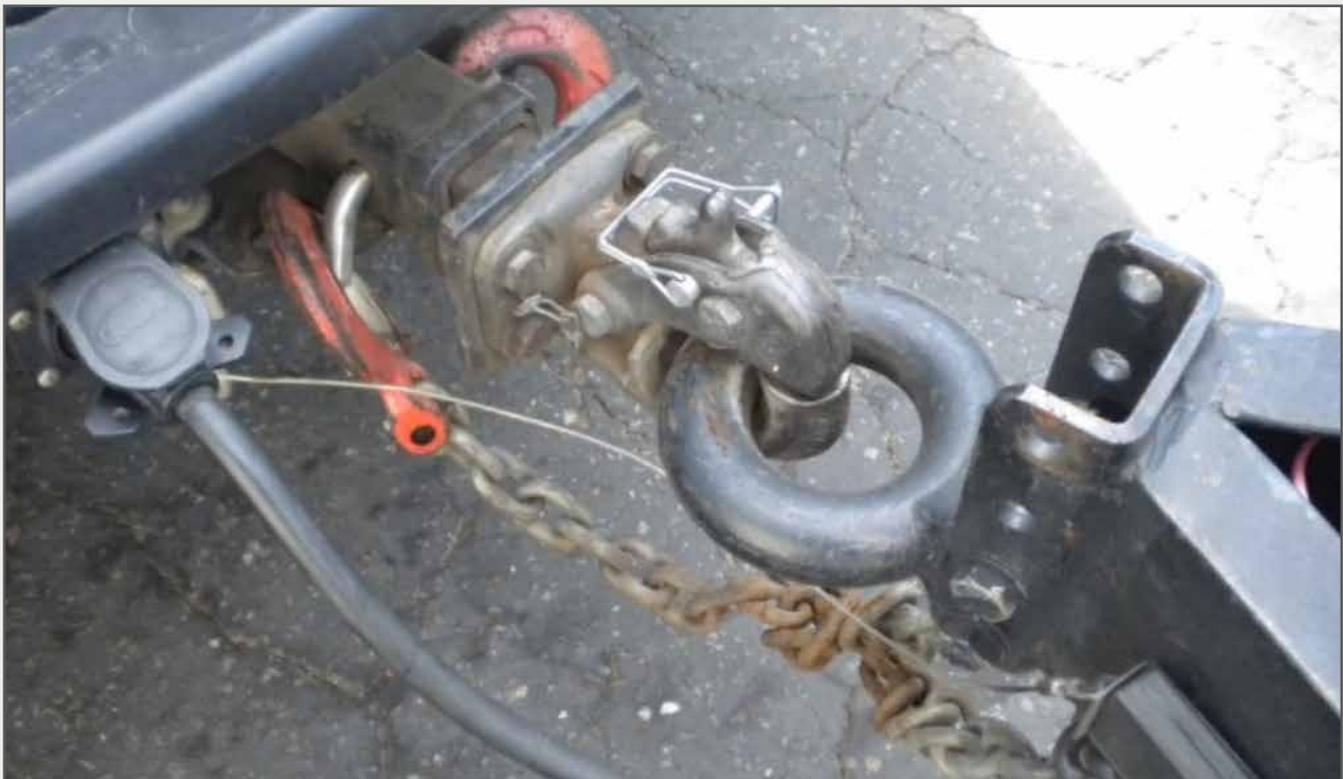
TOWING BASICS



PINTLE HITCH (TYPICALLY CLASS V)

Type of tow hitch that uses a hinged jaw which closes through a round ring

- ▶ Pintle hook — the upper latch that opens for attachment
- ▶ Lunette — tow ring on a trailer which connects to the pintle on the towing vehicle
 - Used in place of a ball coupler on a trailer
- ▶ Pintle hitch designed primarily for heavy-weight hauling
 - More secure than a ball hitch for heavy loads
 - Effectively locks down the load with less danger of a breakaway
 - Better for off-road hauling as well
 - More secure connection in the case of potholes, washboard surfaces and obstructions
- ▶ Available in different sizes depending on the towing weight of the trailer



THE PINTLE HOOK CLOSSES THROUGH THE ROUND TOW RING, CALLED A LUNETTE.

TOWING BASICS



1-2-5-12 RULE OF TRAILERS

The **1-2-5-12** rule will assist you in remembering key points of trailer towing to help ensure your customer enjoys a safe trailering experience

1 = 1,000: Trailers over 1,000 lb should have their own brakes

2 = 2,000: Trailers over 2,000 lb require maximum engine cooling and an auxiliary automatic-transmission cooler on the tow vehicle, as well as brakes at all wheel positions.

5 = 5,000/500: For conventional trailers over 5,000 lb or tongue weight over 500 lb, a weight-distributing hitch is recommended

12 = 12,000: Trailers over 12,000 lb must be gooseneck or fifth-wheel

This information should be considered as general guidelines. Hitch manufacturers may state higher or lower capacities. Never surpass the maximum limits for vehicles when equipping them for trailering.

DISCLAIMERS

Customers should not exceed the GAWR, GVWR or GCWR of the vehicle when towing a trailer. It is the customer's responsibility to comply with and not exceed the GAWR, GVWR and GCWR of the vehicle.

The recommended tongue weight for a conventional hitch is 10 percent of the gross trailer weight.

The maximum tongue weight for Class IV hitch receiver is limited to 1,100 lb.

The maximum tongue weight for Class V (receiver hitch) is limited to 1,800 lb.

A weight-distributing hitch is recommended for trailers over 5,000 lb.

For gooseneck and 5th-wheel trailers, the tongue weight (king pin weight) should never exceed any of the manufacturer recommendations including, but not limited to, payload and GAWR.

A 5th-wheel or gooseneck hitch is required for trailers over 18,000 lb; a gooseneck hitch is required for trailers over 25,000 lb.