

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J2512

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Towing Equipment Ratings and Practices

1. Scope—This SAE Recommended Practice applies to all trucks that are equipped with armlift bodies, carrier bodies, wheel lift bodies, wrecker, and underlift bodies. Additional rating methods are provided for tow slings, truck hitches, and chain assemblies.

1.1 Purpose—The purpose of this document is to establish guidelines for rating towing and recovery equipment and carriers. It is applicable to all towing and recovery equipment manufacturers.

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J115—Safety Signs

SAE J201—In-Service Brake Performance Test Procedure Passenger-Car and Light-Duty Truck

SAE J179—Labeling—Disc Wheel and Demountable Rims—Trucks

SAE J254—Instrumentation and Techniques for Exhaust Gas Emissions Measurement

SAE J274—Rated Suspension Spring Capacity

SAE J284—Safety Alert Symbol for Agricultural, Construction, and Industrial Equipment

SAE J670—Vehicle Dynamics Terminology

SAE J687c—Nomenclature—Truck, Bus, Trailer

SAE J706—Rating of Winches

SAE J743—Lift Capacity Calculation and Test Procedure—Pipelayer and Sideboom

SAE J853—Vehicle Identification Numbers

SAE J959—Lifting Crane, Wire-Rope Strength Factors

SAE J1085—Test for Dynamic Properties of Elastomeric Isolators

SAE J1213-2—Glossary of Reliability Terminology Associated with Automotive Electronics

SAE J1229—Truck Identification Terminology

SAE J1404—Service Brake Structural Integrity Requirements—Vehicles Over 10 000 lb (4500 kg) GVWR

SAE J1451—A Dictionary of Terms for the Dynamics and Handling of Single Track Vehicles (Motorcycles, Mopeds, and Bicycles)

SAE J1473—Brake Performance—Rubber-Tired Earthmoving Machines

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2.1.2 FMVSS PUBLICATIONS—Available from the Superintendent of Documents, U. S. Government Printing Office, Mail Stop: SSOP, Washington, DC 20402-9320.

FMVSS 393.70(3)—Federal Motor Carrier Safety Regulations—Coupling Devices and Towing Methods, Except for Drive-a-way-tow-a-way Operations

FMVSS 393.102(b)—Tiedown Assemblies

FMVSS 393.106—Front End Structures

2.1.3 TEMA PUBLICATIONS—Available from National Truck Equipment Association, an Industry Division of the National Truck Equipment Association, 37400 Hills Tech Drive, Farmington Hills, MI 48331.

TRP100—Recommended Practices for towing and Recovery equipment (Nov, 1989)

TRP 101—Glossary (July, 1988)

2.1.4 PUBLIC LAW

Public Law 89-563

3. **Definitions**

3.1 **Above Cab Carrier**—A platform above the cab, which may be in a fixed or hydraulically adjustable position, for transporting vehicles.

3.2 **Aero-Skirting**—Aero-designed panels attached to lower side, or surrounding the lower side of the vehicle. See Air Dam, Fascia, Valence, and Cladding.

3.3 **Air Dam**—Flexible air deflecting panel usually located below radiator support.

3.4 **Air Resistance**—A measure of the “drag” on a vehicle moving through air. Air resistance increases as a square of the speed; thus power requirements increase much faster than vehicle speed.

3.5 **Ambient Temperature**—The temperature of the environment that surrounds the test specimen. (See SAE J1085.)

3.6 **Anchoring Device**—Used to attach cable ends, snatch blocks, safety chains, and tie-down assemblies to the towing vehicle.

3.7 **Approach Angle**—Angle between the plane of the platform and the ground.

3.8 **Auxiliary Braking Device**—A device which attaches to the disabled vehicle to assist the tow truck’s brakes in retarding or stopping both vehicles.

3.9 **Auxiliary Equipment**—Equipment that is not necessary to perform the basic function of the primary equipment.

3.10 **Auxiliary Fuel Tanks**—Fuel tanks installed in addition to the standard equipment tank.

3.11 **Auxiliary Towing Lights**—Stop, tail, and turn signal lights attached to the trailing end of the towed vehicle and operated as part of the towing vehicle lighting system.

3.12 **Axle Covers**—Device used to cover drive axle shaft openings to eliminate contamination or loss of wheel bearing lubrication during transporting operations.

- 3.13 Axle (Dead)**—A dead axle is merely a means of support for the wheels at each end. This is contrasted to a “live” axle, which is connected to the wheels and rotates with the wheels.
- 3.14 Axle (Drive)**—Axle designed to support a portion of the vehicle weight and to transmit a driving force to the wheels. (See SAE J687c.)
- 3.15 Axle (Tandem)**—Any group of two or more axles, any of which may be powered, and/or steering, and which are attached one behind the other to the same vehicle and associated through a mechanism designed to provide a specific relationship between loading. (See SAE J687c.)
- 3.16 BA (Bumper to Axle)**—The distance from the foremost point on the front bumper to the centerline of the front axle. See Chassis Manufacturer’s dimensions.
- 3.17 Baffle**—A plate or shield used for deflecting, checking, or regulating the flow of liquids, gases, or air.
- 3.18 Barrel**—A cylindrical component of the hydraulic cylinder (piston chamber).
- 3.19 Battery**—A DC voltage source which converts chemical, nuclear, thermal, or solar energy into electrical energy. (See SAE J1213.)
- 3.20 BBC (Bumper to Back of Cab)**—The distance from the foremost point on the front bumper to the back of the cab. See Chassis Manufacturer’s Dimensions.
- 3.21 Bending Moment**—The force times the distance from a reference point to the point the force is applied causing bending.
- 3.22 BHP**—Brake Horsepower.
- 3.23 Body**—The structure mounted on a chassis cab or that portion of the vehicle that carries the load.
- 3.24 Body Hinge**—The attachment mechanism connecting the body to the hinge pin at the pivot axis about which the body rotates into the tilt position.
- 3.25 Body Subframe**—Another term for body understructure or mounting subframe.
- 3.26 Body Understructure**—Crossmembers and longitudinal members under body floor.
- 3.27 Body Weight**—Unmounted weight of body with applicable options.
- 3.28 Bogie Axle**—See Tandem Axle.
- 3.29 Bolsters**—The transverse members that are used to define the horizontal support for the diagonal braces of a vertical mast.
- 3.30 Boom**—The Structural member that supports the load. (See SAE J743.)
- 3.31 Boom Angle**—The boom angle is measured between a horizontal line and a line through the boom pivot and the center of the sheave.
- 3.32 Boom Head**—The structural member at one end of the boom which can swivel and support the load lifted through the sheave and sheave support device.
- 3.33 Brake, Engine**—The engine’s compression pressure is used for retarding the truck.

- 3.34 Brakes—Parking**—A system used to hold a stopped machine in a stationary position. (See SAE J1473.)
- 3.35 Brakes—Service**—The primary brake system used for retarding and stopping the truck. (See SAE J404 and SAE J201.)
- 3.36 Bridle**—A V or Y type coupling device used to attach and center a cable in recovery, loading, and unloading operations.
- 3.37 Bumper Systems**—A system, the primary function of which is to provide protection against damage affecting the performance of front and rear external lamps and other components during low-speed impacts, as in vehicle parking maneuvers.
- 3.38 CA (Cab to Axle)**—The distance from the back of the truck cab to the center of the rear axle. See Chassis Manufacturer's Dimensions.
- 3.39 Cab**—The driver/passenger carrying compartment.
- 3.40 Cab Protector**—Reference to Federal Highway Administration Title 49, Section 393.106.
- 3.41 Cab Control Levels**—Control handles to engage power takeoff and hydraulic valve, usually located in truck cab convenient to driver's hand.
- 3.42 Cable**—Steel wire rope used for pulling or support.
- 3.43 Camber**—The inclination of the wheel plane to the vertical. It is considered positive when the wheel leans outward at the top and negative when it leans inward. (See SAE J670.)
- 3.44 Car Carrier**—Vehicles equipped to transport other vehicles mounted on a flat platform and/or with an additional assembly attached to the rear to facilitate towing a second vehicle. These units are also known as slidebacks, rollbacks, transporting equipment carriers and flatbeds. See Carrier.
- 3.45 CG (Center of Gravity)**—If the vehicle is supported at this point, it will not rotate due to the force of gravity. (See SAE J1451.)
- 3.46 Carrier**—A platform body with a winch for loading.
- 3.47 Caster**—The angle in side elevation between the steering axis and the vertical. It is considered positive when the steering axis is inclined rearward (in the upward direction) and negative when the steering axis is inclined forward. (See SAE J670.)
- 3.48 Certification Label**—Required by Public Law 89-563, which states that a motor vehicle or item of motor vehicle equipment complies with all applicable Federal Motor Vehicle Safety Standards (FMVSS) in effect on the date of manufacture.
- 3.49 Chassis Cab**—A vehicle consisting of a chassis on which is mounted a cab; capable of being driven by the addition of wheels or other items of running gear, but lacking a body or load-carrying structure.
- 3.50 Cladding**—See Aero-Skirting.
- 3.51 Classification of Trucks by Ground Contact**—Trucks are classified by the number of wheels and the number of driving wheels. If a truck is designated as a 4 x 2, it has four wheels and two driving wheels. A 4 x 4 truck has four wheels and four driving wheels. A 6 x 4 truck has six wheels and four driving wheels. Wheels are considered a unit whether they have single or dual tires.

- 3.52 Claws**—See Wheel Arm.
- 3.53 COE (Cab over Engine)**—Cab design where driver is actually as far forward as possible. Engine directly under cab.
- 3.54 Completed Vehicle**—A vehicle that requires no further manufacturing operations to perform its intended function, other than minor finishing operations such as painting.
- 3.55 Control Lever**—A device for imparting motion into control linkage.
- 3.56 Crossbar**—See Lift Bar.
- 3.57 Cross-Members**—General term applied to transverse members in the understructure.
- 3.58 Curb Weight**—The weight of a vehicle in operational status, with all standard and commonly installed equipment and the gas tank filled to capacity. (See SAE J254.)
- 3.59 Cylinder**—A complete hydraulic cylinder assembly.
- 3.60 Cylinder Base**—End of hydraulic cylinder opposite to header or rod end.
- 3.61 Cylinder Head**—End of a hydraulic cylinder through which the piston rod extends. Also called header.
- 3.62 Damage Resistance**—Increases in resistance due to damage to the load. See Resistance.
- 3.63 Dedicated**—Wrecker or underlift as separate independent devices.
- 3.64 Deflector**—See Snatch Block.
- 3.65 D-Ring**—See Anchoring Device.
- 3.66 Disabled Vehicle**—Any vehicle that cannot operate under its own power.
- 3.67 Displacement**—Volume of oil required to extend piston rod through its working stroke. Product of multiplying the area times the length of stroke usually measured in cubic inches.
- 3.68 Diverter Valve**—Auxiliary valve to provide hydraulic power from the hydraulic pump by switching the oil flow from its usual passageways into additional pieces of equipment such as snow plows or other lifting cylinders. Also called diversion or selector valve.
- 3.69 Dolly**—A four-wheeled carriage used in towing to support the trailing end of the towed vehicle.
- 3.70 Dolly Towing**—Procedure used to support wheels, not supported by sling or wheel-lift towing equipment that should not touch road surface as damage to driveline may result.
- 3.71 DOT (Department of Transportation)**—A federal agency dealing with regulations concerning both the manufacture and operation of motor vehicles and motor vehicle equipment. See NHTSA.
- 3.72 Driveline**—The driveshaft and associated joints.
- 3.73 Drivetrain**—Combination of a specific transmission (make, model, size, type), a specific differential assembly (make, model, size, type), and a specific driveline, if required.
- 3.74 Dynamic Application**—Reference to rating specifications.

- 3.75 Electrical Power**—Derived from energy produced by electricity. See Power.
- 3.76 Equipment Carrier**—See Car Carrier.
- 3.77 Extension Cylinder**—Reference to Slide Back Extension Cylinder.
- 3.78 Fascia**—Flexible material commonly used as a bumper cover (could extend below bumper).
- 3.79 FC (Frame to Cab)**—Distance from the top of the frame rail to the top of the cab.
- 3.80 Final Stage Manufacturer**—A person, firm, or corporation who performs such manufacturing operations on an incomplete vehicle that it becomes a completed (end-user) vehicle. (See SAE J1229.)
- 3.81 FMVSS (Federal Motor Vehicle Safety Standard)**—Regulations promulgated by NHTSA under Public Law 89-563, which are mandatory and must be complied with when motor vehicles or items of motor vehicle equipment are manufactured and certified thereto.
- 3.82 Frame Cutoff**—Centerline of rear axle(s) to the rearmost point of the chassis frame as modified for body installation.
- 3.83 Frame Lift**—See Underlift.
- 3.84 Free Spool**—The operation of unspooling wire rope from a drum by pulling on the end of the rope while the winch is stationary. The drum is disconnected (declutched) from its powertrain during this operation.
- 3.85 Forks**—A device attached to the lift bar for lifting a vehicle by the tires, axle, frame, or structural member. May be classified as chain, axle, or frame forks.
- 3.86 Full Drum**—A drum containing the maximum permissible number of layers of cable as defined in SAE J706, paragraph 3.5.)
- 3.87 FW (Frame Width)**—Overall width of the chassis frame measured outside-to-outside.
- 3.88 GAWR (Gross Axle Weight Rating)**—The value specified by the manufacturer as the load-carrying capacity of a single-axle system as measured at the tire-roadway interface. (See SAE J1451.)
- 3.89 GCWR (Gross Combination Weight Rating)**—Represents the entire weight of a vehicle on the ground with a trailer or trailers including vehicle, equipment, driver, fuel, and payload (everything that moves with the vehicle.) Gross combination weights published represent maximum allowed.
- 3.90 Grab Hook**—For use with safety chains and some tow-sling hookups.
- 3.91 Grade Resistance**—Increases in resistance due to grade (slope, angle). See Resistance.
- 3.92 GVWR (Gross Vehicle Weight Rating)**—The maximum total vehicle rated capacity, measured at the tire ground interface, as rated by the chassis manufacturer.
- 3.93 GVW (Gross Vehicle Weight)**—Value specified by the manufacturer as the maximum loaded weight of a single vehicle including all equipment, fuel, body, payload, driver, etc. (See SAE J1451.)
- 3.94 HCG (Horizontal Center of Gravity)**—See CG (Center of Gravity).
- 3.95 Headboard**—Reference to Federal Highway Administration Title 49, Section 393.106.

- 3.96 Hydraulic Control Valve**—A mechanical device to divert or control the flow of fluid in a hydraulic system.
- 3.97 Hydraulic Hose**—Flexible oil lines used to transmit fluid.
- 3.98 Hydraulic Oil**—Fluid used in operation of hydraulic systems.
- 3.99 Hydraulic Power**—Derived from energy produced by fluid under pressure. See Power.
- 3.100 Hydraulic Relief Valve**—A mechanical device used to limit the pressure in a hydraulic circuit.
- 3.101 Incomplete Vehicle**—As assemblage consisting, as a minimum, of a frame and chassis structure, powertrain, steering system, suspension system, and braking system to the extent that those systems are to be part of the complete vehicle that requires further manufacturing operations.
- 3.102 Integrated**—Wrecker and underlift combined together as a complete unit.
- 3.103 Intermediate Manufacturer**—A facility, other than the incomplete vehicle manufacturer or the final stage manufacturer, who performs manufacturing operations on an incomplete vehicle.
- 3.104 J-Hook**—Attachment device used for towing.
- 3.105 JIC Standard (Joint Industry Committee)**—An organization set up to standardize hydraulic fittings specifications and symbols.
- 3.106 L-Arm**—See Wheel Arm.
- 3.107 LCG (Lateral Center of Gravity)**—See CG (Center of Gravity).
- 3.108 Lift Bar**—A transverse horizontally pivoting member attached to the boom of a wheel-lift or under-lift for attaching towing accessories.
- 3.109 Lift Cylinder**—See Tilt Cylinder.
- 3.110 Lift Forks**—See Forks.
- 3.111 Lift Tow Rating**—Maximum Steering Towing Load. Refer to towing equipment manufacturer's specifications.
- 3.112 Locker**—A term used to describe a tool compartment
- 3.113 Emergency Light Bar**—An array of lamps used in accordance with local ordinances.
- 3.114 Light Pylon**—Structure on which an emergency light bar is mounted.
- 3.115 Load Cell**—A device used to measure a load.
- 3.116 Longitudinals**—The lengthwise structural members of the body understructure. Also called long beams, long members, and stringers.
- 3.117 Manufacturer (Vehicle)**—Any facility engaged in the manufacturing or assembling of motor vehicle or motor vehicle equipment, including any facility importing same, for resale as defined by DOT for vehicle certification.
- 3.118 Marker Lights**—Small amber and red lights attached to bodies to indicate overall clearance at night.

- 3.119 Mast**—Structure that houses the boom and winches. Also called a winch frame or wrecker frame.
- 3.120 Maximum Load Rating—Tires**—The load rating at the maximum permissible inflation pressure for that tire.
- 3.121 Maximum Permissible Inflation Pressure—Tires**—The maximum cold inflation pressure to which a tire may be inflated when fitted on the rim or wheel. (See SAE J179.)
- 3.122 Mechanical Power**—Work accomplished by a machine or other mechanical device. The source of power may be energy produced by electricity, hydraulics, or other means, such as an engine. See Power.
- 3.123 Motor Vehicle Safety Standards**—See FMVSS.
- 3.124 Mounting Brackets**—Attaching fittings used to fasten equipment to the chassis. Also called mounting clip, angles, or bars.
- 3.125 Mounting Height**—Distance from top of chassis cab frame at the back of the cab to a reference point on a body.
- 3.126 Mounting Subframe**—Subframe members securely affixed to a truck chassis frame. See Body Subframe.
- 3.127 Mudflaps**—Splash-deflecting shields at rear of wheels.
- 3.128 NHTSA (National Highway Traffic Safety Administration)**—The federal agency responsible for promulgating and insuring compliance of regulations dealing with the manufacture and certification of motor vehicles or items of motor vehicle equipment. See DOT.
- 3.129 Overhang**—The horizontal distance from the centerline of a single rear axle or center point of a tandem rear axle to a point where the vertical component load is imposed.
- 3.130 Overall Vehicle Height**—Distance from the ground to the highest point on the vehicle with equipment in stowed position.
- 3.131 Overlift**—Wrecker boom as opposed to underlift boom.
- 3.132 Overall Vehicle Width**—The design dimension of the widest part of the vehicle, exclusive of signal lamps, outside rearview mirrors, flexible fender extensions, and mud flaps, determined with doors and windows closed and the wheels in the straight ahead position.
- 3.133 Outreach**—Extendable wrecker or underlift boom.
- 3.134 Pickup Chains**—See Tow Chain.
- 3.135 Piggy Backing**—The act of decking one truck on top of a primary drive vehicle by the front steering axle for the purpose of transporting.
- 3.136 Platform**—Load-carrying bed with or without removable sides. May be supplied with hydraulic cylinders to tilt and slide platform. See Car Carrier.
- 3.137 Power**—Capacity for doing work. Amount of work done in a certain period of time. Power equals force times distance, divided by time.
- 3.138 Power Divider**—A small auxiliary gearbox or chain-driven device to allow distribution of driveshaft power to several different mechanical devices mounted on the same truck.

- 3.139 PTO (Power Takeoff)**—Mechanical device used to transmit engine power to auxiliary equipment. Power takeoffs can be mounted on either a main or auxiliary transmission. Front mounted and flywheel mounted power takeoffs are also used in various applications.
- 3.140 Powertrain**—The components that handle the engine power from the truck engine to the driving wheels. This includes transmission, driveshafts, as well as differentials and driving axles.
- 3.141 Pulley**—A wheel grooved for a wire rope, belt, or chain to transfer power.
- 3.142 Pylon**—See Light Pylon.
- 3.143 RBM (Resisting Bending Moment)**—Resisting bending moment is a calculation used to compare frames of different section modules (shape) and of different material. It is the product of the section modulus times the minimum yield strength of the frame material and the formula is expressed as shown in Equation 1:

$$\text{RBM} = \text{Section Modulus} \times \text{Minimum Yield Strength} \quad (\text{Eq. 1})$$

It is readily apparent from Equation 1 that yield strength and section modulus both affect frame strength. When materials of different strengths are used together, the lowest yield strength must be used to determine RBM. See Yield Strength and Section Modulus.

- 3.144 Rear Axle Ratio**—The numerical ratio of the driveshaft speed to the speed of the rear tires.
- 3.145 Rear Jack**—One or more devices designed, when used, to stabilize chassis.
- 3.146 Recovery**—Act of moving a vehicle to a position from which it can be driven or towed.
- 3.147 Recovery Attachment Points**—Areas provided and identified by the vehicle manufacturer, which can support the recovery connecting devices necessary in recovery operations.
- 3.148 Recovery Connecting Device**—Attachable device, used in winching recovery operations, compatible with the designated attachment points of a vehicle.
- 3.149 Recovery Vehicle**—Vehicle to retrieve and if necessary, lift other tow vehicles. See Tow Vehicle.
- 3.150 Reflectors**—Glass or plastic prism lenses that reflect light.
- 3.151 Resistance**—Restraining forces contributed to the load.
- 3.152 Rollback**—See Car Carrier.
- 3.153 Rolling Resistance**—The restraining forces contributed to the load when rolling on wheels. See Resistance.
- 3.154 Rub Rail**—Member running longitudinally providing rub service on side of body.
- 3.155 RVR (Recovery Vehicle Rating)**—Manufacturer's rated capacity of recovery vehicle.
- 3.156 Saddle Mount**—A device that bolts on the front steering axle I-beam so the unit can be piggyback transported.
- 3.157 SAE**—Society of Automotive Engineers.
- 3.158 Safety Chain(s)/Cable(s)**—Used to connect the towing and towed vehicle as a secondary coupling system



to prevent separation of a vehicle trailer, converter dolly, or towed vehicle, should the primary coupling become detached.

- 3.159 Safety Wrap**—Wrapping the tow chain(s) around the grab hooks of the tow bar inboard of chain.
- 3.160 Scotch Blocks**—A device used to prevent chassis movement.
- 3.161 Section Modulus**—Frame section modulus is the engineering concept that relates shape to strength and stiffness. It takes into account frame depth, flange width, and material thickness. All other things being equal, the frame with the largest section modulus will have the greatest strength and stiffness, i.e., the ability to more effectively resist deflection under load.
- 3.162 Serial Number**—An identification number stamped on a metal plate by the passenger car, van, or truck manufacturer (see VIN), or the towing equipment manufacturer, and placed on chassis, body, or components for identification purposes.
- 3.163 Sheave**—See Pulley.
- 3.164 Short Chain**—Method of attaching a tow sling to a towed vehicle so that the tow chains support entire load.
- 3.165 Side Rails**—Horizontal extensions of the body sides, either sheet or tubular metal.
- 3.166 Slide Back Extension Cylinder**—A hydraulic cylinder, usually a long stroke, mounted horizontally at front of body used to slide body forward or rearward.
- 3.167 Snatch Block**—A single or multiple pulley used to reduce line tension or change cable direction.
- 3.168 Spacer**—Steel or wood section between chassis frame and body under frame to give proper tire clearance and/or required ground to floor height.
- 3.169 Spacer Block Pad**—Designated area to accept a spacer block.
- 3.170 Spacer Blocks**—Used in conjunction with the 102 mm (4 in) x 102 mm (4 in) wood beam to provide additional clearance between the tow bar, chains, and the body of the vehicle.
- 3.171 Spade**—One or more ground penetrating devices designed primarily, when used, to stabilize rearward chassis movement. Refer to towing equipment manufacturer's procedures.
- 3.172 Splashguard**—See Mud Flaps.
- 3.173 Spoiler**—Wind drag cosmetic device mounted on trunk of vehicle.
- 3.174 Spring Capacity**—A load rating assigned to each spring installation and vehicle application which will provide adequate spring durability and vehicle stability under all intended load conditions. The value of the load rating must equal or exceed that portion of the maximum allowable force of gravity (usually called "weight" and equaling mass times acceleration of gravity) at the ground which relates directly to the spring.

Therefore, the load rating is based on the total spring and unsprung forces of gravity (usually called "spring weight" and "unsprung weight") of the loaded vehicle. (See SAE J274.)
- 3.175 Stabilizers**—A hydraulic or manually operated leg device (i.e., outboard legs, outriggers, or jack legs) attached to trucks to give additional support down to the ground for improved stability.



- 3.176 Stakes**—Metal or wood posts by means of which sides are attached to platforms or when used alone are means of retaining loads on flat deck platforms.
- 3.177 Stake Pockets**—Apertures in the floor or sides of bodies for the reception of stakes.
- 3.178 Steering System Area**—Consists of control arms, struts, ball joints, idler arm, stabilizer bar, shock absorbers, tie rods, CV joints, and CV boots. Application depends on year, make, and model of vehicle.
- 3.179 Steering, Towing Load Limit**—Maximum load that can be lifted without dangerously unloading the tow truck's front axle. See Figure 8 for a formula used to calculate steering weight.
- 3.180 Steering Wheel Securing Device**—Used to secure front wheels in lieu of standard steering column lock.
- 3.181 Swage**—Cable/wire rope coupling device.
- 3.182 Swivel Head**—See Boom Head.
- 3.183 Suction Line**—A tubular connection line to convey fluid between a reservoir or tank and the inlet of a hydraulic pump.
- 3.184 Supply Tank**—An oil reservoir used in the hydraulic system.
- 3.185 Suspension Area**—Consists of springs, shock absorbers, axles, stabilizer bar, torsion bar, and sway bar. Application depends on year, make, and model of vehicle.
- 3.186 Tag Axle**—An auxiliary axle installed in conjunction with the rear axles of a truck chassis. A tag axle is installed behind the rearmost axle thus extending the length of the wheelbase. See Tandem Axle.
- 3.187 Tandem Axle**—Two rear axles (three axles placed together if sometimes referred to as a tri-axle tandem.) There are three axle drive types:
- a. Dual-Drive Tandem—Both axles have drive mechanisms and are connected to engine power unit.
 - b. Pusher Tandem—Only the rearmost axle is driving type and forward unit is free rolling (load carrying only).
 - c. Trailing Axle Tandem (Tag Axle)—Forward unit of tandem is driving type while rear unit is freely rolling.
- 3.188 T-Hook**—Attachment device used for towing.
- 3.189 Tail Plate**—Rearmost part of the towing vehicle body.
- 3.190 Thimble**—A shield to protect cable at hook assembly.
- 3.191 Tie-Down Assemblies**—Device(s) used to restrain cargo or vehicles (i.e., strap, bridle, chain, or cable.) Reference Federal Highway Administration (FSA) Title 49, Section 393.102(b).
- 3.192 Tilt Cab**—See COE.
- 3.193 Tilt Cylinder**—Cylinders used to change the attitude of a structure or body.
- 3.194 Tire Clearance**—Necessary space between tires and the nearest component to allow operation of truck without damage to the tires.
- 3.195 TOE**—Measurement of how much the wheels are turned in/out from the straight-ahead position (in = positive, out = negative). Insures wheels roll parallel.

- 3.196 TOW**—Act of transporting a vehicle from one point to another by a second vehicle.
- 3.197 Towing**—See Tow.
- 3.198 Towing Angle Iron**—A device used for towing or recovery that minimizes damage by equalizing the load through the frame members.
- 3.199 Tow Apparatus**—Equipment mounted on a chassis to facilitate the mission of tow or recovery vehicle.
- 3.200 Tow Bar**—A device for positioning a towed vehicle behind a towing vehicle.
- 3.201 Tow Chain**—Length of chain used to connect the sling with the towed vehicle.
- 3.202 Tow Pad**—See Space Block Pad.
- 3.203 Tow Sling**—A device used for lifting and towing vehicles with a partial load supported on rubber belts.
- 3.204 Tow Vehicle**—Vehicle used to lift-tow other vehicles.
- 3.205 Towing Dolly Wheel Securing Device**—Used to secure towed vehicle wheels onto dollies.
- 3.206 Towing Light/Bar**—See Auxiliary Towing Lights.
- 3.207 Trailer Tow Plate**—A plate attached to a tow truck-lifting device that captivates the kingpin on trailers allowing a trailer to be towed in the same manner as intended by the trailer manufacturer.
- 3.208 Transporter**—See Car Carrier.
- 3.209 Truck Hitch**—A device for positioning and supporting one end of a towed vehicle.
- 3.210 Turning Circle**—The shortest distance in feet required for a vehicle to negotiate a full circle or 360 degree turn.
- 3.211 Turning Radius**—One half the shortest distance in feet required for a given truck to negotiate a U-turn or make a 180-degree turn, the outer limit.
- 3.212 Underlift**—A device used for towing vehicles by lifting one end of the towed vehicle from under the axle or structural member.
- 3.213 Underlift Securing Device**—A device that eliminates the separation of the disabled vehicle from the Underlift or Underlift T bar.
- 3.214 Unloaded Vehicle Weight**—Means the weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, but without cargo or occupants. Also referred to as curb weight.
- 3.215 VCG (Vertical Center of Gravity)**—See CG (Center of Gravity).
- 3.216 VIN (Vehicle Identification Number)**—The number assigned to a vehicle by the manufacturer primarily for registration and identification purposes. It may consist of numerals, letters, or combination thereof. (See SAE J853.)
- 3.217 Valance Panel**—Material usually incorporated with fascia to afford cosmetic balance of vehicle.
- 3.218 Weight Distribution**—The portion of total weight of the vehicle on each axle. (See SAE J1451.)

- 3.219 Wheel Arm**—A device that attaches to the lift bar for engaging the tires of a towed vehicle.
- 3.220 Wheelbase**—Horizontal dimension from centerline of front axle to the effective centerline of rear axle(s).
- 3.221 Wheel Box**—See Wheel Well.
- 3.222 Wheel Fork**—See Wheel Arm.
- 3.223 Wheel Housings**—Pockets in body floor to allow clearance over tires.
- 3.224 Wheel-Lift**—A device used for towing vehicles by lifting one end of the towed vehicle by the wheels.
- 3.225 Wheel Securing Device**—A strap or mechanical device, when attached to the lift-bar, which limits the potential for separation of the towed vehicle from the underlift, during operating conditions.
- 3.226 Wheel Straps**—Used to tie down wheels of the towed vehicle when using wheel-lift, car carrier, or dolly towing equipment to limit the potential for separation of the towed vehicle from the towing apparatus.
- 3.227 Wheel Well**—See Wheel Housings.
- 3.228 Winch**—A device for winding and unwinding cable. Reference SAE J706.
- 3.229 Winch Frame**—See Mast.
- 3.230 Wire Rope**—See Cable.
- 3.231 Wood Beam, 102 mm (4 in) x 102 mm (4 in)**—A block or section of wood used in conjunction with a tow sling to support or protect the body of the vehicle when lifting.
- 3.232 Working Load Limit**—Minimum breaking strength divided by the factor of safety.
- 3.233 Wrap**—A single coil of wire rope wound on a drum.
- 3.234 Wrecker**—See Tow Vehicle, Recovery Vehicle, or Tow Apparatus.
- 3.235 Yield Strength**—Yield strength describes the inherent strength of a material by indicating the maximum stress, which can be applied to that material before permanent deformation occurs. Yield strength will vary with material composition and processing.
- 4. Equipment Limitation Considerations**—All towing equipment, recovery equipment, and carrier ratings are based on structural factors only.
- NOTE—Actual towing, carrying, and recovery capacity may be limited by the capacity of the chassis and the optional equipment selected.
- 5. Recovery Equipment Boom Rating**—The basic performance rating of the recovery equipment is the static weight the equipment can lift at a specified boom length, when the boom is elevated at an angle of 30 degrees above horizontal. If lifting is done by winching, load lines must be vertical and the lifting cables should share the load equally, measured with a live (weight) or load cell.
- (The specified boom length is the length of the boom when measured parallel to the boom structure, from the centerline of the boom pivot, (heel) to the centerline of the wire rope.)

- 5.1** The structural design of the recovery equipment must have a higher load capacity than the performance rating(s).
- 5.2** Winch ratings shall be published in the towing and recovery equipment manufacturer's specifications. Winches shall conform to, or exceed, the requirements of SAE J706. All new winches introduced into commerce for towing or recovery applications shall conform to or exceed, the requirements of SAE J706, as amended and adopted. Wire rope/cable size, rated breaking strength, working limit, type, and class, should be specified by the towing recovery equipment manufacturer.
- 5.3** All ratings for wire rope/cable and chain assemblies are for the undamaged assembly condition and must comply with SAE J959.

NOTE—SAE J959 applies to wire rope only and does not apply to winches that are covered by SAE J706.

- 5.4 Wheel Lift/Underlift—Recommended Lifting and Towing Capacities in kg (lb) Based on Structural Capacities—See Table 1.**

**TABLE 1—WHEEL LIFT/UNDERLIFT—RECOMMENDED LIFTING AND TOWING CAPACITIES
IN KG (LB) BASED ON STRUCTURAL CAPACITIES**

Equipment Type Range	Lift Rating Range	Lift Point mm (in)	Tow Rating (GCWR)
Light-Duty Wheel Lift	1135 (2500) to 2724 (5999)	2413 (95) ⁽¹⁾	2724 (6000) to 10896 (23999)
Medium-Duty Underlift	2724 (6000) to 5448 (11999)	2159 (85) ⁽²⁾	10896 (24000) to 36320 (79999)
Heavy-Duty Underlift	5448 (12000) to 11350 (24999)	2540 (100) ⁽²⁾	36320 (80000) and over
Super Heavy-Duty Underlift	11350 (25000) and over	2540 (100) ⁽²⁾	36320 (80000) and over

1. Measured from the centerline of the rear axle of the towing vehicle to 254 mm (10 in) behind the back face of the lifting bar.
2. Measured from the centerline of the rearmost axle to the center of the lift forks.

- 5.5 Tow Sling/Truck Hitch—Recommended Lifting and Towing Ratings, in kg (lb) Based on Structural Capacities Only—See Table 2.**

**TABLE 2—TOW SLING/TRUCK HITCH—RECOMMENDED LIFTING AND TOWING RATINGS,
IN KG (LB) BASED ON STRUCTURAL CAPACITIES**

Equipment Type	Minimum Lift Rating	Minimum Tow Rating
Auto Tow Sling	1362 (3000)	2724 (6000)
Light-Duty Truck Hitch	2043 (4500)	5448 (12000)
Medium-Duty Truck Hitch	3178 (7000)	10896 (24000)
Heavy-Duty Truck Hitch	5448 (12000)	36320 (80000)
Super Heavy-Duty Truck Hitch	10442 (23000)	36320 (80000)

- 5.6 Carrier Rating—**The basic performance rating of the equipment carrier is the weight the carrier is capable of handling at any stage of operation (from rest on the ground to a traveling position) when the vehicle is on a level plane using the rating method described as follows.

Consult the chassis manufacturer's literature for detailed capacity information.

- 5.6.1 **EVENLY DISTRIBUTED LOAD RATING**—Method of rating carrier beds with the assumption of an evenly distributed (water level) load over the entire bed surface.
- 5.6.2 **SIMULATED PAYLOAD RATING**—Method of rating carrier beds by dividing the rated load into two equal halves and centering each part a maximum of 15% of the bed length in from the ends of the bed.

5.7 Carrier—Recommended Bed, Lift, and Tow Capacities in kg (lb)—See Table 3.

TABLE 3—CARRIER—RECOMMENDED BED, LIFT, AND TOW CAPACITIES IN KG, (LB)

	Minimum Bed Rating	Minimum Wheel Lift Rating	Lift/Hitch Tow Rating
Class A	3178 (7000)	681 (1500) ⁽¹⁾	2270 (5000)
Class B	4540 (10000)	1135 (2500) ⁽¹⁾	3178 (7000)
Class C	9080 (20000)	1588 (3500) ⁽¹⁾	5448 (12000)
Class D	13608 (30000)	1588 (3500) ⁽¹⁾	5448 (12000)

1. Measured from a point 48 in rearward of the end of the carrier bed, at the centerline.

- 5.7.1 Whenever practical, car carriers should be designed to have an approach angle no greater than 13 degrees. Ramps may be used to meet this recommendation.
- 5.8 Chain Assembly Ratings—Recommended Minimum Ratings per Chain Assembly in a Two-Chain System in kg (lb)**—See Table 4.

TABLE 4—CHAIN ASSEMBLY RATINGS—RECOMMENDED MINIMUM RATINGS PER CHAIN ASSEMBLY IN A TWO-CHAIN SYSTEM IN KG (LB)

Vehicle Type	Tow Chain Assembly Minimum Working Limit (per chain)	Safety Chain Assembly Minimum Break Test (per chain)
Automobile	1771 (3900)	1816 (4000)
Light-Duty Truck	2452 (5400)	3632 (8000)
Medium-Duty Truck	3269 (7200)	7264 (16000)
Heavy-Duty Truck	4177 (9200)	23608 (52000)
Super Heavy-Duty Truck	5221 (11500)	23608 (52000)

- 5.8.1 In no case will the safety chain rating be less than the Federal Standard 393.70(3) as amended from time to time.
- 5.8.2 Sheave pitch diameter to wire rope/cable diameter ratios should be a minimum of 8 to 1.
- Boom support wire rope/cables that are static under load should have a minimum Sheave to cable ratio of 6 to 1.
- 5.9 Limitation Considerations for Towing**—The Gross Combination Weight Rating (GCWR) of the towing vehicle must be equal to or greater than the sum of the towing and towed vehicles.
- 5.9.1 The Gross Axle Weight Ratings (GAWR) of the front and rear axles should not be exceeded.
- 5.9.2 The maximum recommended lift load for stable steering for each equipment and chassis combination, as determined by the retained front axle weight can be calculated with Equation 2:

$$\text{Lift Load} = \frac{(1 - K) \times \text{FA} \times \text{WB}}{\text{OH}} \quad (\text{Eq. 2})$$

where:

FA is the weight on the front axle, including driver, without any towing load

K is the desired percentage of the towing vehicle front axle weight remaining when the load is lifted

OH is the distance from the centerline of the rear axle(s) to the lift point

WB is the wheelbase of the chassis

- 5.9.3 The required rear axle capacity for each equipment and chassis combination can be calculated with Equation 3:

$$\text{Required GAWR (rear)} = \frac{(\text{WB} + \text{OH}) \times \text{LR}}{\text{WB}} + \text{RA} \quad (\text{Eq. 3})$$

where:

LR is the lift rating

OH is the distance from the centerline of the rear axle(s) to the lift point

RA is the rear axle weight of the completed vehicle with all equipment

WB is the wheelbase of the chassis

- 5.9.4 Chassis, terrain, weather, and road conditions can effect the proper "K" factor. Historically industry practice is to use a "K" factor of 0.50 (50%) for general purpose towing under non-adverse conditions.

- 5.9.5 Refer to the chassis manufacturer's weight distribution numbers, when they are available, to establish allowable axle loads.

5.10 Safety Label Guidelines—As a guide for labels to signal Caution, Warning, and Danger, refer to SAE J115. It is recommended that the Safety Alert Symbol be used on safety labels, reference SAE J284.

5.11 Identification Label Recommendations—This document is a guide to proper identification of towing and recovery equipment and carriers. It is recommended that labels be permanently affixed to the equipment in a prominent location to identify the manufacturer, serial number, model, and rated capacity.

- 5.11.1 It is further recommended that the equipment be stamped with a number for identification in the event the original label becomes detached.

PREPARED BY THE SAE TOWING AND RECOVERY SPECIFICATIONS COMMITTEE



Rationale—Not applicable.

Relationship of SAE Standard to ISO Standard—Not applicable.

Application—This SAE Recommended Practice applies to all trucks that are equipped with armlift bodies, carrier bodies, wheel lift bodies, wrecker, and underlift bodies. Additional rating methods are provided for tow slings, truck hitches, and chain assemblies.

Reference Section

SAE J115—Safety Signs

SAE J179—Labeling—Disc Wheel and Demountable Rims—Trucks

SAE J201—In-Service Brake Performance Test Procedure Passenger-Car and Light-Duty Truck

SAE J254—Instrumentation and Techniques for Exhaust Gas Emissions Measurement

SAE J274—Rated Suspension Spring Capacity

SAE J284—Safety Alert Symbol for Agricultural, Construction, and Industrial Equipment

SAE J670—Vehicle Dynamics Terminology

SAE J687c—Nomenclature—Truck, Bus, Trailer

SAE J706—Rating of Winches

SAE J743—Lift Capacity Calculation and Test Procedure—Pipelayer and Sideboom

SAE J853—Vehicle Identification Numbers

SAE J959—Lifting Crane, Wire-Rope Strength Factors

SAE J1085—Test for Dynamic Properties of Elastomeric Isolators

SAE J1213-2—Glossary of Reliability Terminology Associated with Automotive Electronics

SAE J1229—Truck Identification Terminology

SAE J1404—Service Brake Structural Integrity Requirements—Vehicles Over 10 000 lb (4500 kg)
GVWR

SAE J1451—A Dictionary of Terms for the Dynamics and Handling of Single Track Vehicles
(Motorcycles, Mopeds, and Bicycles)

SAE J1473—Brake Performance—Rubber-Tired Earthmoving Machines

FMVSS 393.70(3)—Federal Motor Carrier Safety Regulations—Coupling Devices and Towing Methods,
Except for Drive-a-way-tow-away Operations

FMVSS 393.102(b)—Tiedown Assemblies

FMVSS 393.106—Front End Structure



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TRP 101—Glossary (July, 1988)

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