FACTOR 55

PRECISION ENGINEERING

OFF-ROAD SAFETY ACADEMY™

Basic Guide to Kinetic Energy Recovery & Towing a Disabled Vehicle Off Road

Principles, Safety Considerations, and Common Rigging Set-Ups

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Thank you for purchasing Factor 55 recovery equipment, including nylon Kinetic Energy Recovery Ropes (KERRs) and polyester Standard Duty or Extreme Duty Tow Straps. With proper use, your Factor 55 KERR and Tow Strap will provide you with many years of reliable service.

By following the basic principles, safety considerations, and common rigging set-ups outlined in this guide, your off-road recovery efforts will be more effective and safer. Because no two recovery situations are alike, it is impossible to examine all the possible recreational and at-work use scenarios in this guide. Seek hands-on recovery skill training through a professional off-road instructor. Use the *Stuck Assessment and Recovery Plan Checklist*™ at the end of this guide to help you better analyze your specific recovery situation and apply common sense recovery techniques by Stopping, Thinking, Observing, Planning, and then Acting (STOPA).

As you read through this guide, you will see WARNINGS, EQUIPMENT CAUTIONS and NOTES. Each has a specific purpose.

WARNING
Information indicating a potentially hazardous situation or consideration. If these WARNINGS are ignored, serious injury or death could result.

EQUIPMENT CAUTION
Information that can assist you in avoiding vehicle or equipment damage. May also provide important equipment tips and considerations.

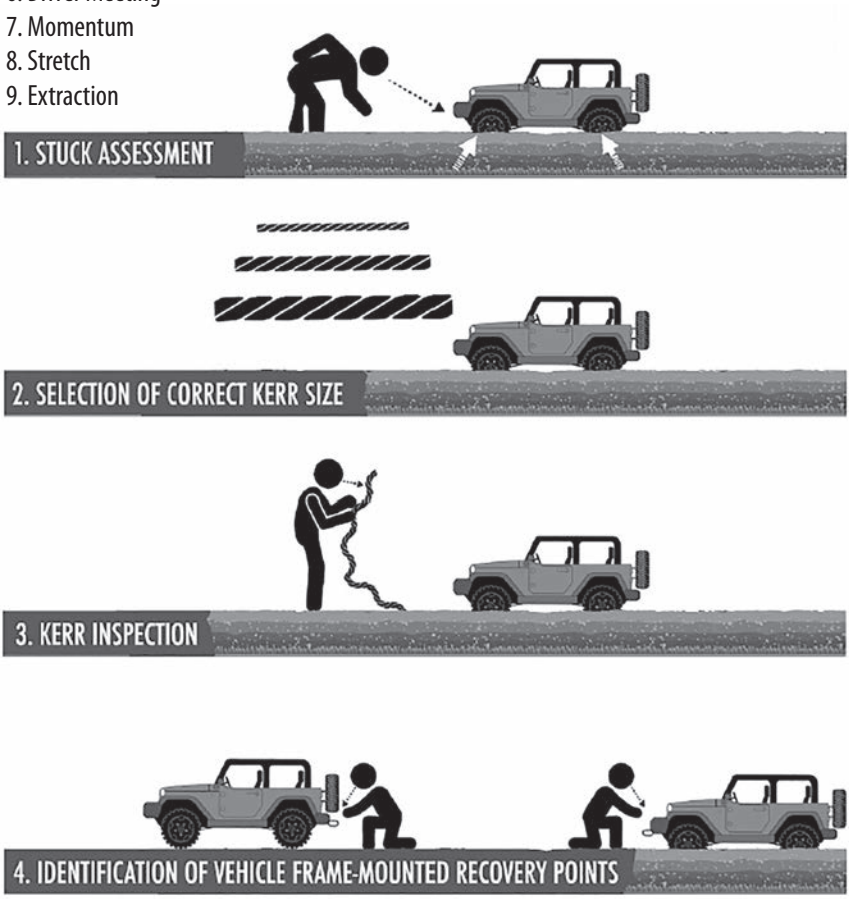
NOTE
Additional information to help you complete a procedure or bring additional knowledge to your attention.

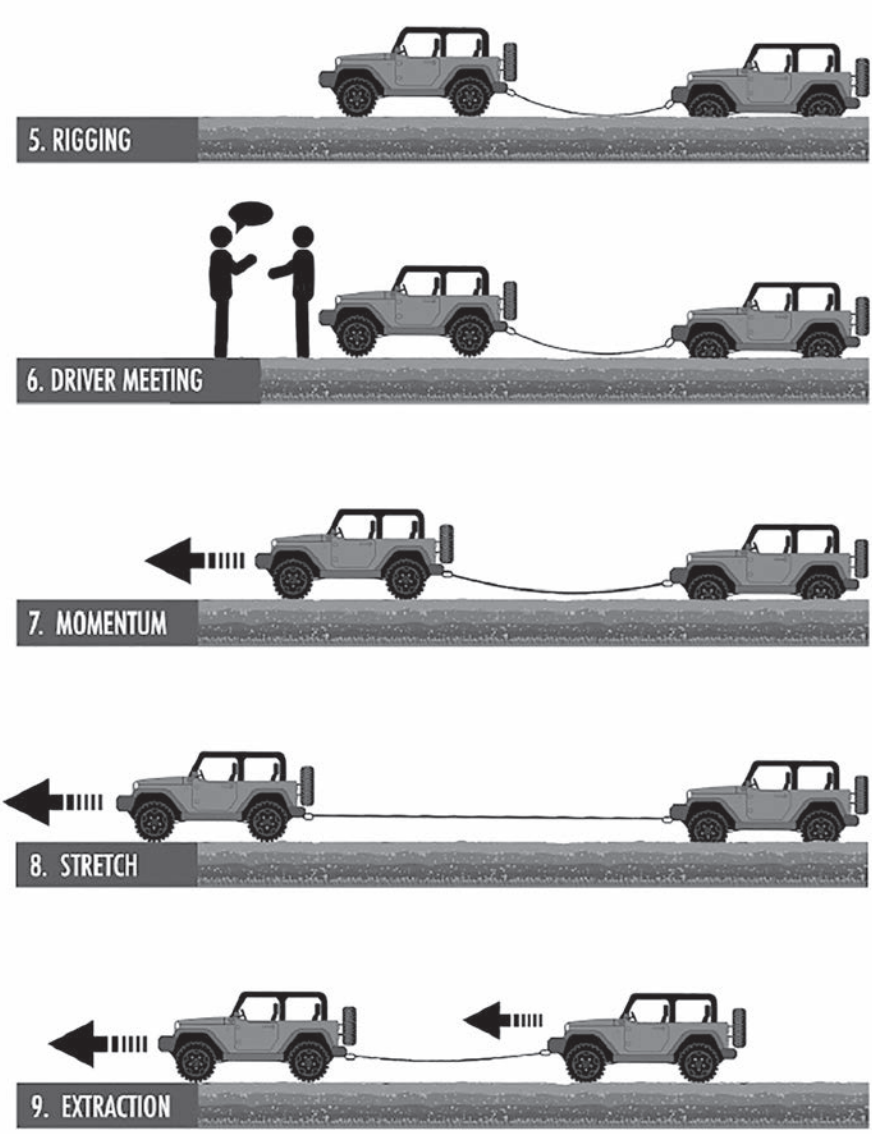
How Kinetic Energy Recovery Works

The Factor 55 Kinetic Energy Recovery Rope (KERR) can stretch approximately 20-25 percent its total length when connected to a stuck vehicle and pulled by a four-wheel drive recovery vehicle with traction and measured momentum. Once stretched, a KERR absorbs a huge amount of elastic potential energy. If during a kinetic energy recovery pull the resistance of the stuck vehicle is overcome by the KERR's elastic potential energy, it transforms into kinetic (motion) energy, resulting in an effective, efficient, and relatively smooth extraction.

There are NINE PHASES of kinetic energy recovery.

1. Stuck Assessment (STOPA – Stop, Think, Observe, Plan, Act)
2. Selection of Correct KERR Size
3. KERR Inspection
4. Identification of Vehicle Frame-Mounted Recovery Points
5. Rigging
6. Driver Meeting
7. Momentum
8. Stretch
9. Extraction





The Benefits of Kinetic Energy Recovery with KERRs

The following are benefits of kinetic energy recovery with a Factor 55 KERR.

- **Lightweight Equipment.** Compared to the weight of other recovery equipment commonly taken into the backcountry by off-roaders, a KERR is the lightest of any complete recovery system you can carry in your vehicle.

- **Easy Extraction from Sand, Mud, and Snow.** A KERR allows safe and smooth extraction of a vehicle stuck in compression-type terrain (sand, mud, and snow). It is exactly these types of terrain in which most off-roaders and overlanders typically get stuck.
- **Recovery of a Heavier Vehicle with a Lighter Vehicle.** With a KERR it is possible to get a heavy vehicle unstuck with a lighter vehicle using kinetic energy recovery. This is simply not possible with very low-stretch polyester straps or chain.
- **Soft and Smooth Extraction of a Stuck Vehicle.** Very low-stretch polyester rigging straps and metal chain cannot extract a stuck vehicle as softly, as smoothly, or as effectively as a properly used KERR. Conducting a vehicle-assisted extraction of a stuck vehicle with very low-stretch rigging almost always results in hard jerks and jolts that can actually damage vehicles. Once very low-stretch rigging is tightened between two vehicles (in an attempt to reduce the jerks and jolts), the recovery vehicle often has a hard time securing traction and momentum since it must instantly pull a resistance load.
- **Ability to Secure Traction and Momentum Prior to Pulling a Resistance Load.** A recovery vehicle using a KERR can secure traction and measured momentum ("mass in motion") before and while stretching the nylon rope and building elastic energy in its fibers. When the elastic energy in a KERR becomes greater than the load resistance of the stuck vehicle, kinetic energy is released helping free the stuck vehicle.
- **Greater Stretch with a KERR.** In similar recovery situations, a Kinetic Energy Recovery Rope is capable of stretching a greater percentage than a Kinetic Energy Recovery Strap. Compared to a KERR, this means that the use of a flat nylon strap results in less elastic potential energy available for vehicle extraction through kinetic energy.
- **Faster Recovery Time.** More often than not, you should take your time when conducting any type of off-road recovery of a stuck vehicle. However, there are situations when a quick recovery is necessary (e.g. stuck on a beach with the tide coming in, bad weather on the horizon, vehicle sliding off a trail or tipping over). In these situations, kinetic energy recovery of an endangered vehicle may be your best recovery option because it can be deployed and used faster than many other recovery options.
- **Helps You Adhere to Tread Lightly Principles.** Use your KERR to recover a stuck vehicle to preserve the environment and reduce trail damage. The spinning tires of a stuck vehicle only damage trails and tear up the environment.

Considerations for Using Your Kinetic Energy Rope

WARNING

Follow these warnings, considerations, and guidelines for all Factor 55 KERR products. Enroll in formal training with a professional off-road educator and practice kinetic energy recovery skills under their watchful eye.

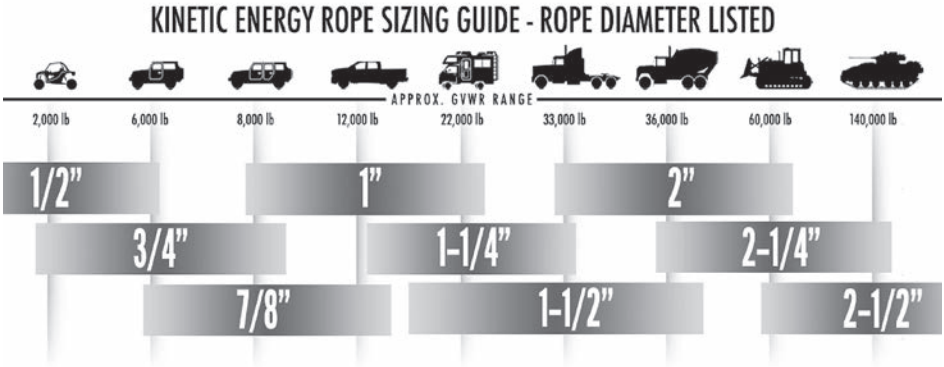
The following are important considerations when using Factor 55 kinetic energy recovery ropes.

- **Be Smart About Recovery, Not Hasty.** Once stuck, take a pause to consider all aspects of the recovery. Conduct a stuck assessment and formulate a recovery plan based on your circumstances.

NOTE

See the *STOPA - Stuck Assessment and Recovery Plan Checklist*™ at the end of this guide. In general, begin recovery efforts with the easiest, most low-impact recovery method (airing down tires, shovels, traction boards). If that fails to get you unstuck, work your way to more vigorous forms of recovery, like kinetic energy recovery.

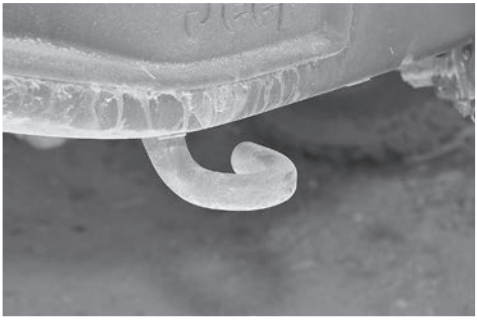
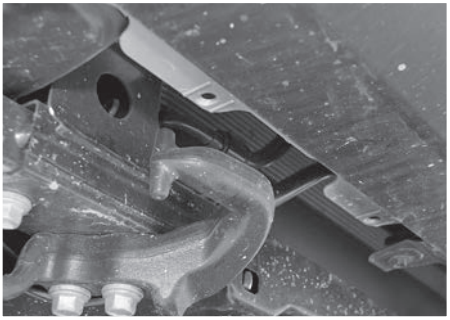
- **Don't Get Stuck When Helping.** Kinetic energy recovery is a vehicle-assisted effort – you need two vehicles. When pulling close to the stuck vehicle to connect a KERR, don't get the recovery vehicle stuck.
- **Excavate Around the Stuck Vehicle.** If the stuck vehicle is deeply buried in sand, snow, or mud, use a shovel to remove excess terrain from around its tire prior to a kinetic energy recovery.
- **Size Your KERR to Your Vehicle.** Purchase your Factor 55 KERR based on your vehicle's gross vehicular weight rating (GVWR). A properly sized rope for typical SUVs and trucks is one that has a 4:1 to 6:1 minimum breaking strength to GVWR ratio. For larger vehicles (Unimogs, EarthRoamers, Earth Cruisers, heavier military trucks, etc.), a 2:1 to 4:1 ratio may be acceptable. If you use a smaller and lighter KERR, rope breakage might occur. If too large and heavy, the rope won't stretch enough, reducing the maximum kinetic energy assist. The KERR must be suited to the GVWR of the lighter of the two vehicles used in the recovery process.

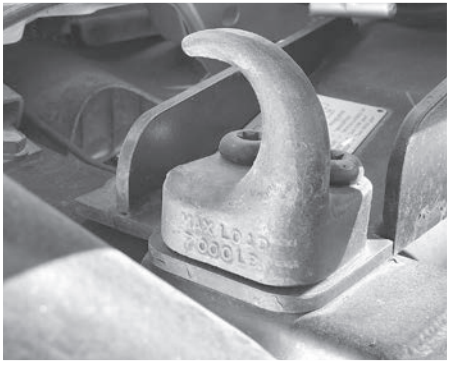


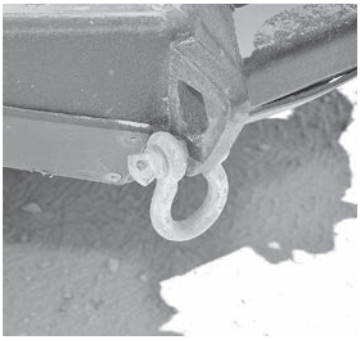
Recommended Kinetic Energy Recovery Rope diameters based on approximate GVWR of vehicle.

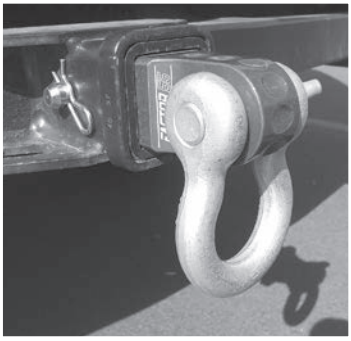
NOTE
Calculation Example: At a 4:1 ratio, the stuck vehicle has a GVWR of 5,000 pounds/2,268 kilograms; it would require a KERR with minimum breaking strength of at least 20,000 pounds/9,072 kilograms.

- **Be Courteous – Use Your KERR When Stuck.** Should you get stuck and need another vehicle to pull you out, it's always courteous to use your own properly sized KERR for extraction.
- **Inspect Your KERR Before Use.** A frayed, cut, or discolored rope must disqualify its use.
- **Give Your KERR a Rest.** Your KERR needs *rest* after repeated hard pulls, sometimes up to 48 hours. Nylon elasticity is at its best when fresh and properly put away after use. Watch for excessive heat build-up in the KERR after repeated hard pulls. If the line feels noticeably warm, give it time to rest and cool down.
- **Don't Tow or Lift With Your Factor 55 Nylon KERR.** Long-distance towing with a KERR can cause excessive stretching, resulting in nylon fiber break down. This destroys its stretching ability, and the rope should be retired from kinetic energy recovery. Ropes can also be abraded during the actual towing process by accidental dragging on the ground. Also, never use your KERR to lift objects vertically.
- **Use Only Frame-Mounted Recovery Points.** Only attach a KERR or tow strap to appropriate, frame-mounted recovery points. See photos.





⚠ EQUIPMENT CAUTION

The following connection points are dangerous and should NEVER be used for kinetic energy recoveries or vehicle towing: 1) trailer hitch ball; 2) vehicle's tie-down transport frame hooks; 3) bumper's bull BAR; 4) around a sharp or weak bumper; or 5) around suspension items or axles under a vehicle.



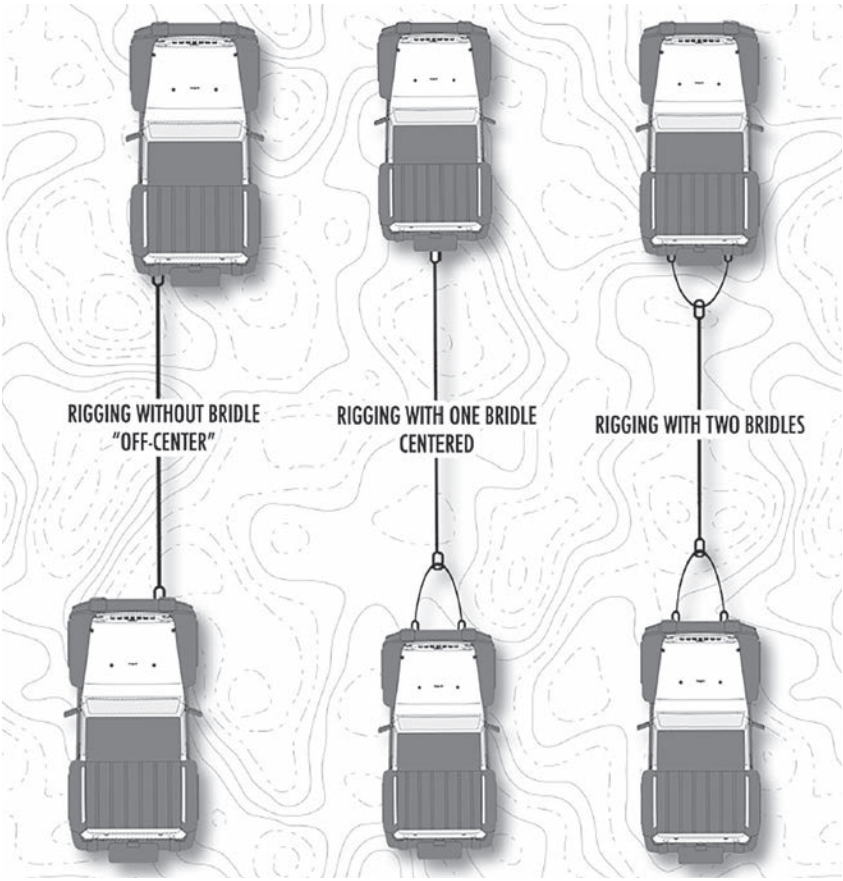

- **Be Careful With Open Frame-Mounted Recovery Points.** If you are forced to use open-style frame-mounted recovery points (hooks) with your KERR or tow strap, secure the rope or strap loops in the open recovery point with Factor 55 Strap Wraps (shown in photo), electrical tape, or zip ties. Ropes and straps have been known to "jump" out of these open connections during moments of slack tension.

⚠ EQUIPMENT CAUTION

Avoid Sharp, Rusted, and Homemade Connection Points. Sharp edges can cut through a tensioned KERR or tow strap. Stuffing a KERR or tow strap in the open end of a trailer hitch receiver that has sharp edges can be a danger during an angled pull. It would be better to use a receiver shackle bracket such as the Factor 55 Hitchlink. Further, be cautious of rusted or untested and home-welded recovery points.

- **Use Chafe Protection.** When pulling over rough surfaces (e.g. rocks), use chafe protection coverings or devices (wood blocks, traction boards, etc.).
- **Conduct Straight Pulls.** Alignment between the two vehicles should permit for a fairly straight pull. If you must conduct a kinetic energy pull at an angle, use an appropriately sized bridle; see the next consideration.
- **Use a Bridle to Distribute the Load.** If a stuck vehicle has two frame-mounted recovery connection points in the direction you intend to pull, consider using both connections by setting up a recovery bridle. It's best to use at least an 8- to 10-foot/2.5- to 3-meter strap or rope. Longer bridles are better than shorter ones. A bridle allows the pull force on the stuck vehicle to align more closely with the centerline of a vehicle. Using a single recovery point that is off-centered produces a higher amount of stress on that side of the vehicle. Also, using two frame-mounted recovery points distributes the pulling force between two connections. In short, using a bridle increases safety and prevents potential damage to the

vehicle frame. The following diagram shows various connection methods, both with and without bridles. If it is impossible to use a bridle, rig as shown in the illustration.



- **Recovery Vehicle – Pull From the Rear.** Whenever possible, conduct a kinetic energy extraction from the rear of the recovery vehicle. Admittedly, this is not always possible. However, automobiles are primarily designed to drive forward. They are stronger when driven forward, and designed to handle forward stresses. You also have more gears to choose from.
- **Use Recovery Dampers.** Consider placing one recovery damper in the center of your KERR when rigged to conduct a pull. You could also put a recovery damper near each end of your KERR, close to the connection point on each vehicle. Recovery dampers should be made of fabric only and all the pockets should be empty, void of weighted material. If you happen to own a Factor 55 gear bag, it may be used as a damper by hanging the bag on the line.

- **Use Engine Hood Protection.** Consider lifting the engine hood of the stuck vehicle for protection of the driver. To steer properly, the driver of the stuck vehicle does need to be able to see ahead, however.

WARNING

Properly Join Two KERRs to Make One. Never use a metal anchor shackle to join two KERRs. Should something break or give way, the shackle can become a heavy and very dangerous missile that can injure or kill. If two KERRs need to be joined together to reach the stuck vehicle, only attach them as shown in the illustration and photo. To keep the two ropes from locking together when tension is applied, place something lightweight between the connections (e.g. magazine, small dowel, or soft shackle). Also, try to join two KERRs that are the same diameter and have the same maximum breaking strength rating.

WARNING

Use Properly Rated Shackles. Use appropriately rated, quality metal anchor or soft shackles to connect your KERR directly to a vehicle. Use of shackles purchased from Factor 55 is recommended.

- **Beware of Melting Your KERR.** Keep nylon away from hot vehicle components.

WARNING

Clear Bystanders Away from the Yanking Area. Have everyone stand no closer to the pull than at least 1.5 times the total stretched length of the rope. Also, passengers should not ride in either the stuck or recovery vehicle. All bystanders should watch the pull carefully, ready to avoid flying objects.

- **Recovery Driver Is In Charge.** The stuck and recovery vehicle drivers should communicate with one another prior to and during the pull. The driver of the recovery vehicle should be in charge of the recovery plan and coordinate the pull.
- **Keep Your KERR Clean.** From time to time, clean your KERR in a bucket of soapy water.

While in the cleaning solution, compress the fibers together and shake the rope to release dirt and debris stuck within. Perform this action along the entire length of the KERR.

- **Properly Store Your KERR.** Store your KERR out of the sunlight. UV rays degrade the nylon fibers (although less so with a coated Factor 55 KERR) and greatly reduce their stretching capacity. Also, keep them dry and away from wet or moist conditions. Dry your KERR first and, when dry, keep it in a Factor 55 bag for ultimate protection. Although water doesn't degrade nylon, avoid using a wet rope. Wet nylon does not allow a build-up of elastic potential energy as well as dry nylon.
- **Initial Pulls Should Use Measured Momentum Rather than Jerks or Jolts.** Kinetic energy recovery pulls should begin with safer, and gentler low-load pulls and progress to more forceful, high-load pulls.

Guidelines for Conducting a Kinetic Energy Recovery

The following are only guidelines. Every off-road recovery situation is different. Apply these guidelines with a mature attitude and focused attention on safety. If you follow the guidelines, you avoid aggressive pulls leading to shock loading, possibly preventing vehicle damage, rigging breakage, and personal injury.

NOTE

Sometimes others come along and offer to help you get unstuck, using their equipment. In this situation it is helpful to have an understanding of these guidelines. Because of your knowledge, you will know if this individual is thoughtful and safe in their use of kinetic energy recovery techniques.

Step One: Conduct a Stuck Assessment and Formulate a Recovery Plan

- Complete the *Stuck Assessment and Recovery Plan Checklist*™ to help you develop a thoughtful recovery plan.

Step Two: Conduct a Driver Meeting

- Discuss the details of the pull and communications between each driver. This can include hand signals or radio communication.
- Place a mark on the ground where the stuck vehicle needs to end up so it remains unstuck. The driver of the stuck vehicle should be able to clearly see this mark outside his window.
- The driver of the stuck vehicle needs to avoid running over the KERR once unstuck.

Step Three: Remove Mud, Sand, or Snow From Around Tires of Stuck Vehicle

- If possible or practical, use a shovel or other trail tools to remove mud, sand, or snow from around the stuck vehicle's tires and underbody.

- Do this in the intended direction of travel of the pull.
- Eliminate the small terrain "hills" formed in front of and/or behind spinning tires.
- Try to identify and remove large obstacles (rocks, logs, etc.) in front of the tires of the stuck vehicle. Pay attention to this step when the stuck vehicle is in deep snow or water. Take time to perform this important step.

- If the vehicle is really stuck, consider placing traction boards/mats or bridging ladders under at least two of the stuck vehicle's wheels. Combining these two recovery techniques may make it easier to free the stuck vehicle.

Step Four: Position Recovery Vehicle

- Whenever possible, try to pull a stuck vehicle from the rear of the recovery vehicle.
- Do not get the recovery vehicle stuck while helping.
- Alignment between the two vehicles should permit a straight pull. Avoid pulls more than 10 degrees left/right from a straight line.

Step Five: Connect the KERR to Both Vehicles

- Use only frame-mounted recovery points.
- Choose a KERR that is in top condition and has the correct Maximum Breaking Strength matched to the stuck vehicle.
- Use appropriately rated, quality anchor or soft shackles to connect your KERR directly to a vehicle.
- Whenever possible, use at least an 8- to 10-foot/2.5- to 3-meter bridle between two off-center frame-mounted connection points.

Step Six: Clear Bystanders/Passengers – Consider Using Recovery Damper(s)

- Have everyone stand no closer to the pull than at least 1.5 times the total stretched length of the deployed KERR. No person should stand between the two vehicles. No passengers should ride in either vehicle during a pull.
- Consider using recovery damper(s).

Step Seven: Conduct a LEVEL ONE Kinetic Energy Recovery

- Between vehicles, place approximately 6 feet/2 meters of slack in your KERR.
- Place slacked KERR in the shape of an "S" between vehicles, on the ground. Confirm there are no twists, kinks, or overlaps in the rope.
- The stuck vehicle should have its brakes off and engine running, if possible. Having the engine running on the stuck vehicle allows:
  - It to easily steer and apply brakes once unstuck.
  - For a powered-assist. To perform a powered assist, the stuck vehicle should be in 4WD-Low, with the transmission in 1st gear (or reverse), matching the gearing in the recovery vehicle. The stuck vehicle driver should wait to apply power until the KERR is tensioned between the vehicles.

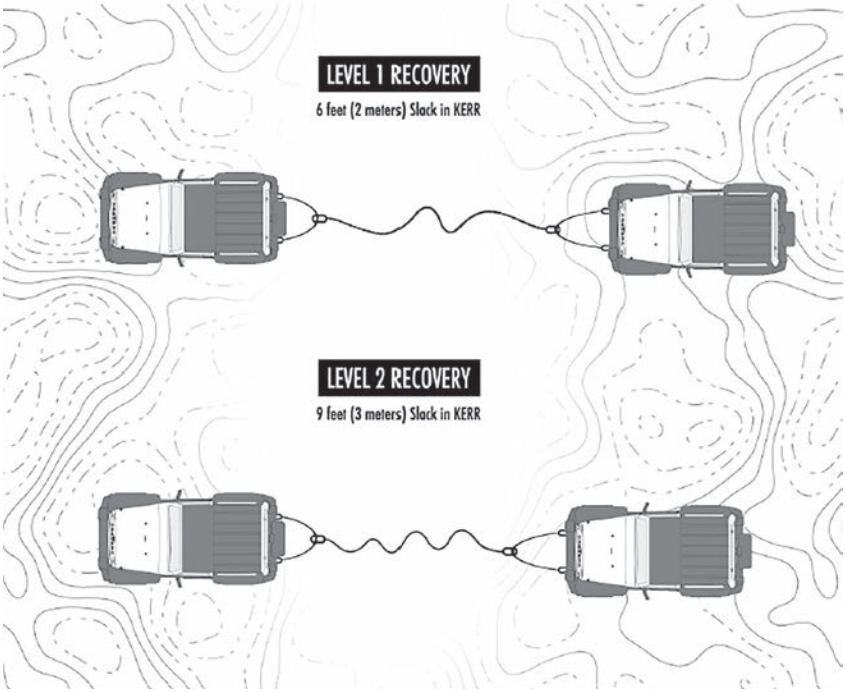
- If the stuck vehicle's engine is not functioning, it should have its transfer case and transmission in neutral with all brakes off.
- Place the recovery vehicle in 4WD-Low, with the transmission in 1st gear (or reverse).
- Drivers should communicate, and acknowledge they are both ready for the pull. The driver of the recovery vehicle initiates the pull, after informing the other driver.

Initiate the pull, going no faster than roughly 8 mph/12 kph. NO "pedal to the metal." Use *measured momentum*.

- Stuck vehicle moved? **YES? NO?**
  - ☐ **YES:** Try the same pull again if not completely unstuck. As long as the recovery vehicle has traction and the stuck vehicle continues to make progress to where it can get traction, continue using this level of pull up to four or five times. After that many pulls, give your KERR a rest.
  - ☐ **NO:** Try a Level-Two Pull.

Step Eight: Conduct a LEVEL-TWO Kinetic Energy Recovery

- Recheck stuck vehicle.
  - ☐ Double check for obstructive objects under the stuck vehicle and its tires.
  - ☐ Double check connection points and rigging for structural reliability.
- Between vehicles, place approximately 9 feet/3 meters of slack in your KERR.
- Place slacked rope in the shape of an "S" between vehicles, on the ground. Confirm there are no twists, kinks, or overlaps in the rope.
- Place the recovery vehicle in 4WD-Low, with the transmission in 2nd gear.
- If capable, the stuck vehicle should again help the recovery effort with a powered-assist, matching the recovery vehicle's gearing.
- Initiate the pull, going no faster than roughly 20 mph/32 kph. NO "pedal to the metal." Use *measured momentum*.
- When you achieve full rope stretch (some amount of jerk will be felt), consider pushing in the recovery vehicle's clutch (manual transmission) or moving gearing to neutral (automatic transmission).
  - ☐ This takes practice.
  - ☐ When performed correctly, this lessens the strain on the recovery vehicle's driveline.
  - ☐ Even without continual driveline power, the momentum of the moving recovery vehicle and the kinetic energy produced by the recoil in the KERR should extract the stuck vehicle.
- Stuck vehicle moved? **YES? NO?**
  - ☐ **YES:** Try the same pull again if not completely unstuck. As long as the recovery vehicle has traction and the stuck vehicle continues to make progress to where it can get traction, continue using this level of pull up to four or five times. After that many pulls, give your KERR a rest.
  - ☐ **NO:** Rethink entire recovery plan; perhaps try another form of recovery.


LEVEL 1 RECOVERY
6 feet (2 meters) Slack in KERR
LEVEL 2 RECOVERY
9 feet (3 meters) Slack in KERR

Towing a Disabled Vehicle Off-Road

Towing a disabled vehicle off road can be difficult, and some makes/models of vehicles cannot be towed with all four wheels on the ground without driveline damage. The very act of towing a disabled vehicle off road is a careful *dance* between two vehicles. This *dance* should be more like a well-practiced *Tango* than an unrehearsed and free-form *Twist*. The effort needs to be sensibly choreographed and organized, especially when towing over rough and uneven terrain, up or down steep slopes, or around tight corners like narrow trail switchbacks. Communication between both drivers is key, and radios are very helpful. If the disabled vehicle's engine still operates, turn it on to enable the power brakes and steering. If the engine is inoperable, which is common, steering needs to be unlocked and a bit of strength is needed to turn and work the brakes.

NOTE

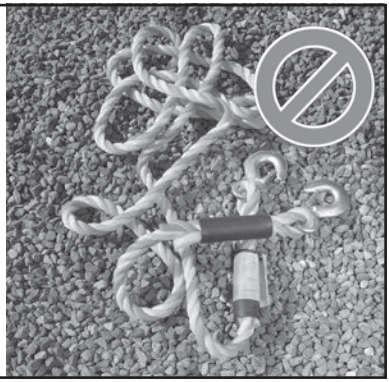
Towing a disabled vehicle a long distance can be exhausting and may require changes to the recovery plan along the way. The work often requires periodic rest periods by the recovery vehicle driver and disabled vehicle driver.

You may use just about any type of rope or strap to tow a disabled vehicle off road. As the saying goes, "what works is what counts" if you need to help a vehicle back to the pavement. However, avoid towing vehicles off road with nylon kinetic energy ropes (KERRs) or kinetic energy straps (KERSs). When towing a disabled vehicle off road over difficult terrain, KERRs and KERSs will repeatedly stretch and contract. This type of repetitive shock loading causes nylon fibers to break down over time. Nylon fiber degradation could last the life of the rope or strap and reduce its effectiveness as a stretchable recovery KERR or KERS. Also, nylon ropes and straps are more susceptible to abrasion than ropes and straps made of polyester. To greater or lesser degrees, all tow straps will drag on the ground when slack between vehicles. It is even possible for the disabled vehicle to run over straps dragging on the ground. Any ground contact while towing will quickly fray and degrade expensive nylon KERRs or KERSs. If you must tow

a disabled vehicle with your nylon rope or strap, the person you are rescuing should offer to purchase you a new KERR or KERS once you've rescued them. In practically all situations it is best to tow a disabled vehicle off road with sturdier, low-stretch 100 percent polyester straps, like those available from Factor 55.

EQUIPMENT CAUTION

Polypropylene rope with cheap metal hooks, sold at most auto parts stores, should not be used to tow a vehicle off road. These ropes include hooks on both ends that are weak and made from molded metal (not forged). These hooks are not capable of withstanding the jerk-type, shock-loading forces involved in towing another vehicle on uneven and soft terrain.

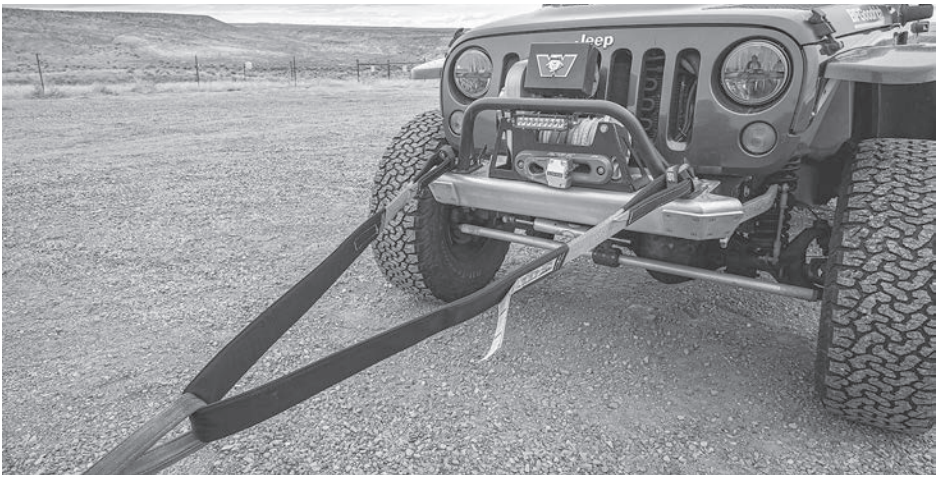


With these towing concerns in mind, there is good news. Factor 55 sells two tow straps specifically designed for off-roading. The Standard and Extreme Duty Tow Straps are excellent for towing and serve double duty for winching since both are made from low-stretch 100 percent polyester. These 2-inch/5-centimeter wide straps fit easily into common ¾ -inch screw pin anchor shackles. The 2-inch/5-centimeter wide straps are also not as easily abraded when dragged on the ground, as are wider 3- and 4-inch/7.6- and 10-centimeters wide straps. To reach a higher minimum tensile strength of 31,000 pounds/14,061 kilograms (USA tested and repeatable), Factor 55 doubled the ply of each strap and stitched it the entire length. The strap's loops are wrapped and reinforced with a durable Cordura sleeve. The Extreme Duty Tow Strap sports a Cordura covering its entire 30-foot/9-meter length. The extra protection will provide the Extreme Duty Tow Strap with extended service, protecting it from excess abrasion over time.

Factor 55 Standard (top) and Extreme Duty (bottom) Tow Straps

Important Considerations When Towing a Disabled Vehicle Off-Road

- **Use Only Frame-Mounted Recovery Points.** Only attach a Factor 55 Tow Strap to appropriate, frame-mounted connection points. See the previous Equipment Caution regarding the use of appropriate frame-mounted recovery points.
- **Be Careful With Open Frame-Mounted Recovery Points.** If you use open style frame-mounted recovery points (hooks) with a Factor 55 Tow Strap, secure the strap loops with Factor 55 Strap Wraps, electrical tape, or zip ties. Tow straps have been known to "jump" out of open connections during momentary slack conditions during towing.
- **When Possible Use Soft Shackles for Towing.** Connect a tow strap to vehicles using the same considerations as when connecting a kinetic energy recovery rope. When possible, avoid using metal anchor shackles to connect a tow strap directly to a vehicle. Synthetic rope shackles work great with tow straps as long as there are no sharp edges on the vehicle's frame-mounted recovery connection. Some "open" style frame-mounted recovery hooks allow for the eye of a tow strap to be firmly secured without shackles. Use this type of set-up when possible. Any shackle used for towing, metal or soft, should have a greater minimum breaking strength or tensile rating than the tow strap used.
- **Use Bridles to Share the Load.** Consider using a low-stretch polyester bridle set-up at the front of the disabled vehicle and/or rear of the towing vehicle if a vehicle has two off-centered recovery points. A Factor 55 Tree Saver Strap may be used as a bridle. Bridles also 1) allow for extended side-to-side movement of the tow strap when towing around tight corners on a narrow trail, and 2) use two connection points, which are often stronger than one alone.



- **Pulling from the Center.** Try to pull with a tow strap from the center of a vehicle. Pulling from the centerline is best as it reduces forces on one side or another. Bridles also allow for an excellent centerline pull.

- **Only Tow Forward.** Towing a disabled vehicle backward can often cause severe damage to the vehicle's transfer case. READ YOUR OWNER'S MANUAL ON HOW TO TWO YOUR MAKE AND MODEL 4WD.
- **Enable Steering.** The disabled vehicle needs to be able to steer. Even if the disabled vehicle's engine will not start, insert the key to unlock the steering wheel. Without engine power you will still be able to steer, although with much more difficulty. Same for using the brakes.
- **Make Sure A Disabled Vehicle Can Be Towed Without Causing Driveline Damage.** Different vehicle makes and models have different towing procedures and some vehicles can NOT be towed on all four wheels without driveline damage. CAREFULLY READ YOUR OWNER'S MANUAL ON HOW TO TOW YOUR VEHICLE. FOLLOW THESE MANUFACTURER'S GUIDELINES EXACTLY.

⚠ EQUIPMENT CAUTION

Owners of disabled vehicles need to make sure their vehicles aren't damaged during towing. An owner's manual provides specific instructions and warnings for each vehicle. It is critically important that vehicles be towed according to the owner's manual instructions. If you don't know how to safely tow a vehicle on all four wheels without driveline damage, don't tow the vehicle. Call for a professional tow truck driver's assistance. The disabled vehicle may need to be placed on a flatbed tow truck.

- **Place Towed 4WD Vehicle's Transfer Case in NEUTRAL.** To tow some 4WD vehicles off road without driveline damage (e.g. Jeep Wranglers and Ford F150 trucks) the *transfer case* is shifted into NEUTRAL, with the *transmission* either in gear (manual transmissions) or in PARK (automatic transmissions). Some 4WD vehicles require the transmission to also be in neutral when towing with all four wheels on the ground. It is critically important that vehicles be towed according to the owner's manual instructions. Typically, to get a transfer case into NEUTRAL you first have to place your transmission into NEUTRAL. This is easy with a manual transmission. But with automatic transmissions, especially on a disabled vehicle, this can be tricky. Note:
  - ☐ If the battery is still functional, simply insert the key, step on the foot brake and slip it into NEUTRAL. This action overrides the shifter interlock solenoid, allowing the shifter to be moved.
  - ☐ If the battery is dead or the vehicle has other malfunctions, you may not be able to override the solenoid and shift the transmission into NEUTRAL. In this situation you may need to use the *shift lever override*. SEE YOUR OWNER'S MANUAL ON HOW TO ACTIVATE THE SHIFT LEVER OVERRIDE.
- **Not Too Short, but Not Too Long.** The Factor 55 Tow Straps are 30 feet/9 meters long. This is a perfect length for towing in most situations. Too short and the disabled vehicle may not have time to stop once motion is halted. Too long and the vehicles won't track together properly (e.g. on sections with tight switchbacks).

- **Tow Slowly.** When towing a disabled vehicle over difficult terrain, the first rule of off-roading is very important: *Travel as slow as possible, and as fast as necessary.* Towing a disabled vehicle off road will be (should be) slow. Tow even more slowly over uneven and challenging terrain. The driver of the disabled vehicle needs to be able to stop quickly.
- **Keep the Tow Strap Taut.** Between vehicles, the tow strap should remain taut. This keeps the strap off the ground and reduces the possibility of a vehicle accidentally driving over the strap.

NOTE

It is the responsibility of the person in the towed vehicle to steer appropriately, and to appropriately apply the foot brake to keep the strap taut between vehicles, especially over uneven and challenging terrain.

- **Communicate Between Vehicles.** Towing a vehicle off road is a type of *partnership* between the recovery vehicle driver and the driver of the disabled vehicle. Radio communication between the assisting vehicle driver and the disabled vehicle driver is almost a must. The tow vehicle's driver should inform the driver of the disabled vehicle when approaching difficult terrain.
- **Pay Attention When On Switchbacks and Tight Turns.** When towing a disabled vehicle on narrow trails around tight switchbacks or turns, you may need to shorten the tow strap between the vehicles.
- **Don't Tow or Pull by Connecting to a Winch.** Don't tow a disabled vehicle with a winch. A winch brake system is not designed to hold the constant load of towing the vehicle with a winch. The same is true with the connection point of a kinetic energy rope or strap. Don't attach the tow strap to a winch hook or winch line shackle mount.
- **Supervising a Disabled Vehicle Down a Steep Hill.** If while towing a disabled vehicle out of the backcountry you come to a long steep (and perhaps slippery) hill, consider two options. 1) Disconnect your Factor 55 Tow Strap and allow the disabled vehicle to brake slowly down the hill on its own – coasting VERY slowly and carefully. 2) Disconnect your Factor 55 Tow Strap from the front of the disabled vehicle and connect to its rear. Place the functional vehicle at the rear of the disabled vehicle. Now, slowly guide the disabled vehicle down the long steep hill using braking power, engine compression, and Downhill Assist in extreme low gearing.
- **Illegal Towing on Pavement.** In many states, it is illegal to tow a disabled vehicle on public streets. Once you return to the pavement, call a local professional tow truck to finish the job, returning the disabled vehicle to an urban center or repair shop.

⚠ WARNING

If safety is ever in question while towing a vehicle off-road, don't tow the vehicle. Call a professional off-road tow truck service.

STOPA –
Stop, Think, Observe, Plan, Act Stuck Assessment and Recovery Plan Checklist™

START HERE Accept that you are bogged – stuck. If you are physically well and healthy, then most other problems pale in comparison. Relax. Breath naturally. Refuse to get agitated, frustrated, embarrassed, or humiliated. Go about recovery patiently, deliberately, and methodically.

Select Kilograms or Pounds for Load Assessment

Work in either Metric or Imperial measurements, not both. The Working Load Limit (WLL) ratings of anchor shackles and some other recovery gear are often listed in metric tons and some in U.S. tons. Refer to manufacturer information for which tonnage is used – metric or U.S. If unsure of the type of tonnage rating, use the U.S. ton, as its rating would be more conservative.

Convert metric tons to either kilograms or pounds. Rigging straps, pulley blocks, and other winching gear should be labeled with WLLs. If not, it is hard to conduct a thorough load assessment.

- 1 U.S. Ton (AKA *Short Ton*) = 2,000 pounds (4 ¾-Ton Anchor Shackle = 9,500 pounds; 3 ¼-Ton Anchor Shackle = 6,500 pounds)
- 1 Metric Ton = 2,205 pounds (4 ¾-Ton Anchor Shackle = 10,474 pounds; 3 ¼-Ton Anchor Shackle = 7,166 pounds)
- 1 U.S. Ton = 907 kilograms
- 1 Pound = 0.45 kilogram
- 1 Kilogram = 2.2 pounds
- 1 Metric Ton = 1,000 kilograms

S = **S**top, **S**it down, and/or **S**tay put until the situation is **S**afe.

Directions: Check box if statement is true.

☐ Driver(s) or Passenger(s) are Physically Hurt

Do not begin recovery; begin appropriate wilderness first aid assessment/treatment. Call for assistance if necessary.

☐ Immediate Danger to You, Others, or Vehicle?

I need to hurry through the Checklist due to a time-sensitive situation. Vehicle fire? Tide coming in?

- ☐ I Can Work Slowly
- ☐ I Need to Hydrate/Eat Before Continuing
- ☐ I Need to Rest Before Continuing

T = Think.

Directions: Check box when you've thought about the situation.

- ☐ Solo Adventure? (Self-Recovery Necessary)
- ☐ With Other Vehicles? (Vehicle-Assisted Recovery Possible)
- ☐ Traction Recovery?
- ☐ Powered Winch Recovery?
- ☐ Hand Winch Recovery?
- ☐ Kinetic Energy Recovery? (Yank Strap/Rope)
- ☐ Field Repair Recovery?
- ☐ Towing Recovery?
- ☐ Think About Vehicle Rolling Uncontrollably Once Unstuck
- ☐ Think About Your Location – Distance to Definitive Assistance

If Necessary:

- ☐ Think About Where Help Might Come From
  Commercial Towing? Search & Rescue?
- ☐ Think About How to Reach Out for Help
  Emergency Communication Devices
- ☐ Think About Your Survival Supplies in Vehicle
- ☐ Think About Your Wilderness First Aid Training

O = Observe.

Directions: Check box when observation complete, or write out requested information.

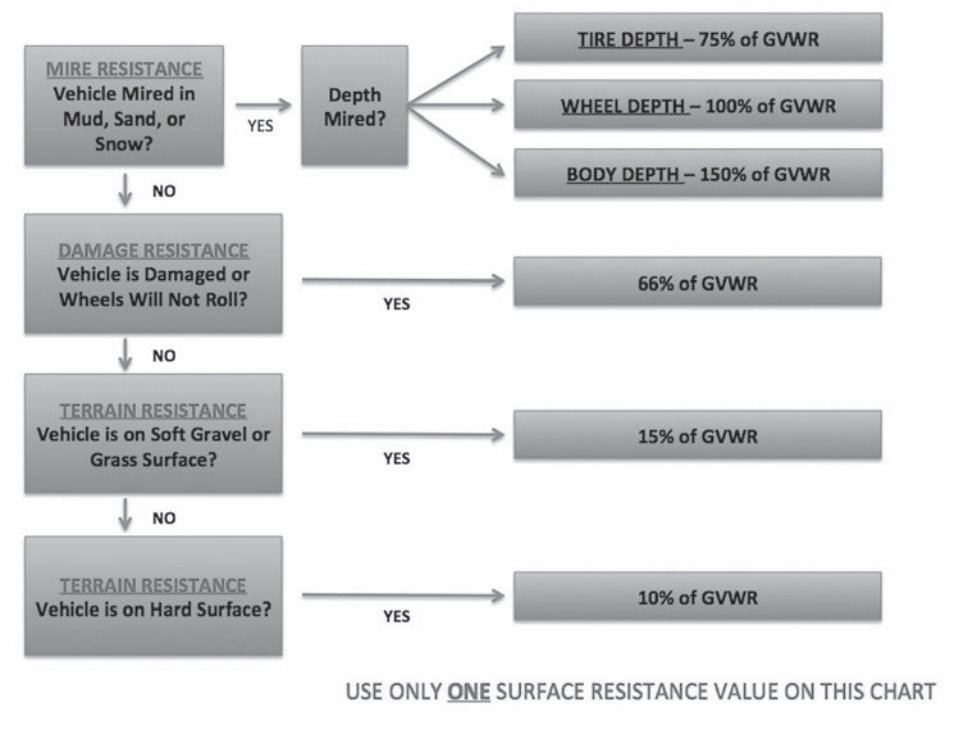
- ☐ Walk Around Stuck Vehicle Twice – Observe:
  - O Possible Dangers: _____
  - O Condition of Vehicle: _____
  - O Inspect Vehicle for Broken/Malfunctioning Powertrain or Steering/Suspension Components
- ☐ Observe Stuck Vehicle's Underbody
  - O High-center Problem?
  - O Damaged Powertrain, Steering, or Suspension Components?
  - O Dripping Liquids or Moisture?
  - O Dangling Cables, Wires, Components?
- ☐ Determine Why Vehicle is Stuck
  List Reason(s): _____

- ☐ Observe Trail to the Rear of Stuck Location
  Easier? Better Traction?
- ☐ Observe Trail In Front of Stuck Location
  Easier? Better Traction?
- ☐ Observe Existing Tire Tracks to Identify Easy Route on Trail
- ☐ Observe Map/GPS - How Far to Assistance or Fuel/Supplies?
- ☐ Observe How Difficult/Far is the Entire Route Ahead of You?
- ☐ Observe How Difficult/Far is the Entire Route Behind You?
- ☐ Observe Fuel Level & Battery Condition
- ☐ Observe Tire Condition and Current Pressure
- ☐ Observe Appropriate Working Load Limits (WLL) of All Recovery Equipment Relative to Approximate Recovery Resistance Values
- ☐ Observe Recovery Vehicle
  - O Winch? ☐ Yes ☐ No
  - O Number of Front Frame-Mounted Recovery Points: _____
  - O Number of Rear Frame-Mounted Recovery Points: _____
  - O GVWR of Recovery Vehicle: _____ Kilograms/Pounds
  - O Needs Rearward Anchor to Hold in Place when Winching

By Observation:
Determine Approximate Recovery Resistance Values

- **GVWR** of Stuck Vehicle:_____ (See Door Jamb Sticker)
- **Surface Resistance**:_____
  Use Chart 1 to determine Surface Resistance. Choose ONE: Mire, Damage, or Terrain Resistance
- **Slope Resistance**: _____
  Use Chart 2 to determine Slope Resistance.
- **TOTAL** (Surface + Slope Resistance) = _____
  [Consider adding 10% of GVWR as a Safety Margin to above total]

CHART 1 Approximate Surface Resistance Values*



Mire Depth

CHART 2 Approximate Slope Resistance Values*

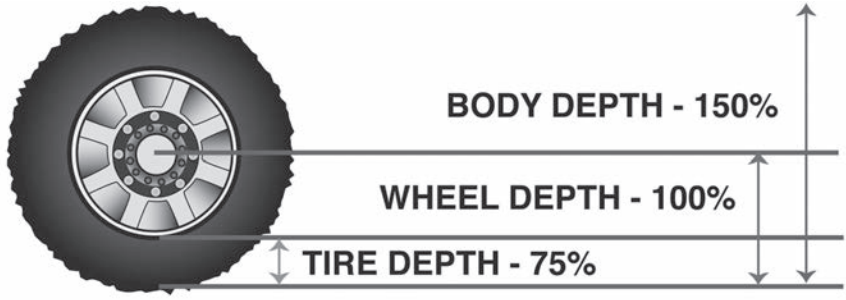
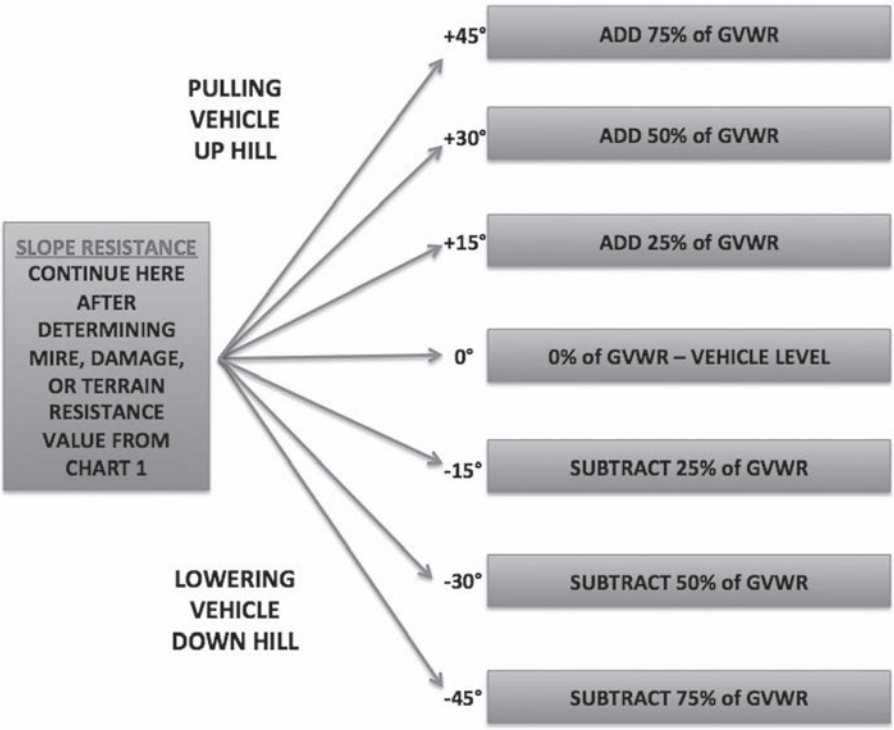


*Chart 1 and 2 Resistance Values come directly from WreckMaster, the pre-eminent North American



tow truck training company. Their resistance values have been scientifically determined by quantitative methodology and validated by years of in-field experience.

P = Plan

Directions: Check appropriate box or write out requested information.

- ☐ Self-Recovery
- ☐ Vehicle-Assisted Recovery – Conduct Drivers Meeting
- ☐ Move Stuck Vehicle Forward – Easier, Better Traction
- ☐ Move Stuck Vehicle Rearward – Easier, Better Traction
- ☐ Right a Tipped or Rolled Over Vehicle

If Stuck – Primary Recovery Plan Will Use These Traction-Aiding Devices (TADs) or Strategies:

- ☐ Engage 4WD
- ☐ Engage Electronic Traction Control

- ☐ Engage Center Locker
- ☐ Engage Rear Locker
- ☐ Engage Front Locker
- ☐ Disconnect Sway Bar
- ☐ Lower Tire Pressure
  Initial Air-Down or Lowering Tire Pressure Further to 70% of Manufacturer-Recommended kPa/PSI
- ☐ Trail Reconstruction or Reconfiguration
- ☐ Solve High-Center Problem
- ☐ Move a Small Vehicle Sideways Back on Trail
- ☐ Deploy Traction Boards
- ☐ Deploy Bridging Ladders
- ☐ Install Snow Chains
- ☐ Deploy Powered Winch and Rigging Accessories
  Use Approximate Total Recovery Resistance Value to Determine Appropriate WLLs
- ☐ Deploy Hand Winch and Rigging Accessories
  Use Approximate Total Recovery Resistance Value to Determine Appropriate WLLs
- ☐ Deploy Kinetic Energy Recovery Rope or Strap
  Use Approximate Total Recovery Resistance Value to Determine Appropriate WLLs
- ☐ Jump Start Dead Battery
- ☐ Remove Weight from Heavy Vehicle

A = **A**ct

*Directions: Check box when completed. If after acting on your primary and secondary recovery plan it fails to get you unstuck or moving again, return to the **P**lan step and formulate another recovery plan.*

- ☐ Move All Passengers/Spectators to a Position of Safety
- ☐ Begin Working the Primary Recovery Plan
- ☐ Double Check all Recovery Rigging Connections for Safety
- ☐ Primary Recovery Plan Fails – Initiate Secondary Recovery Plan

Recovery Effort Fails – You are Solo:

- ☐ Use Electronic Communication Device to Call for Assistance
- ☐ Make Camp and Use Survival Kit to Wait for Assistance
- ☐ Prepare Near-Location Signaling Devices

Recovery Effort Fails – You are With Other Vehicles:

- ☐ Call for Assistance
  Cell; Emergency Communication Device
- ☐ Tow Disabled Vehicle
- ☐ Abandon Vehicle, Send/Go with Others for Assistance

Actual Winch Capacity

Manufacturer Maximum Rated Winch Capacity: _____ Kilograms/Pounds
Actual Winch Capacity: _____ Kilograms/Pounds

Winch – Actual Pulling Capacity*

Number Layers on Winch Drum	Percent of Maximum Winch Rated Capacity	Percent of Loss Winch Capacity**
1st Layer of Drum	100%	0%
2nd Layer of Drum	90%	10% (.1)
3rd Layer of Drum	80%	20% (.2)
4th Layer of Drum	70%	30% (.3)
5th Layer of Drum	60%	40% (.4)

***Manufacturer maximum winch capacity ratings are only valid with one layer of winch line on the drum. More than one layer of winch line on the drum reduces the winch's physical pulling capacity. Begin a winch recovery with at least five evenly spaced wraps of steel cable, or 10 evenly spaced wraps of synthetic rope winch line, around the drum.**

****To calculate the total winching capacity with more than one layer of wraps on the drum, use this formula: Total Winch Capacity – [Total Winch Capacity x (percent loss Winch Capacity)] = Reduced Winch Capacity. Example for a 9,000-pound rated winch with four layers of line on the drum: 9,000 – (9,000 x .3) = 9,000 – 2,700 = 6,300 pounds of pulling capacity.**

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