



Zero Turning Radius Mowers

Selection, Use, Maintenance, Safety



Zero turning radius mowers (Figure 1) have become the standard riding mower type for professional use and are becoming increasingly popular for homeowners. They offer tremendous versatility and productivity, but because of their dual hydraulic systems, they cost somewhat more than traditional riding mowers and lawn/garden tractors of comparable size and quality. This bulletin is intended to help you select the correct zero-turn mower for your purpose, then use it and maintain it correctly and safely. Although some walk-behind and most stand-on commercial mowers use the zero-turn principle, this bulletin addresses only sit-down zero-turn riding mowers.



Figure 1. Commercial ZTR mower.

What is a Zero-Turn Mower?

Zero-turn mowers have separate hydraulic pumps driving the left and right tires, and each side is controlled separately. One tire can be turning forward, while the other is turning in reverse; thus, the mower can pivot around its own center. This feature allows amazing versatility in trimming while mowing. Zero-turn mowers have taken over the commercial riding mower market, and homeowner models are now available from many manufacturers.

Advantages. The biggest advantage of zero-turn mowers is their ability to maneuver easily and trim around obstacles. They can easily spin around after a mowing pass and be immediately ready for a return pass, with no clutching, shifting or braking. Speed control is infinitely continuous from full-forward to full-reverse, and speed changes can be very smooth. Mowing effort and mowing time are dramatically reduced for turf areas with many obstacles to trim around.

Disadvantages. A primary disadvantage is cost; these machines are more expensive than other comparably sized lawnmowers. Zero-turn mowers are available in sizes ranging from homeowner models with 30-inch single-spindle (1-blade) decks for around \$2,000 up to professional models with 72-inch triple-spindle (3-blade) decks that sell for \$8,000-\$12,000 (or more). For a fair comparison, however, they should be compared with top-of-the-line tractor mowers since they match that category.

Another disadvantage is that zero-turn mowers are usually dedicated machines. They are designed to mow and, with the exception of some front-deck models, cannot be used for other chores. Some commercial zero-turn mower manufacturers offer other accessories such as brushes or dethatchers for their front-deck machines, but these are normally not available for home lawn zero-turn machines. If you want a multipurpose garden tractor, a zero-turn mower is not for you.

Operational factors. Most zero-turn mowers are steered with two levers, one operating each hydraulic pump. Some use a single joystick for speed and steering control (Figure 2). When using a zero-turn mower, the operator

has to be very careful to avoid turf damage or accidents. If the lever(s) are moved too rapidly, a wheel can slide or spin, causing a loss of control and unexpected steering reactions. Tire sliding or spinning can also damage grass or even adjacent ornamental plants. Smooth, deliberate movement of the steering mechanism is highly desirable.



Figure 2. ZTR mower with joystick control.

Learning to use one. Zero-turn mowers are easy to operate, but they are very different from conventional riding mowers and garden tractors. Most folks are used to driving with a steering wheel and pedals; most zero-turn mowers use levers. If you are the type who can't walk and chew gum at the same time, you should expect to spend some time learning to operate a zero-turn. You can be driving one in a few minutes, but it may take several hours of actual operation before you are marginally comfortable, and a full season before it feels natural to you. Once you become comfortable with one, you'll never go back to anything else!

Availability. Commercial zero-turn mowers are available from many companies, and some are better than others. Homeowner zero-turn mowers are currently available from several manufacturers. Most of the homeowner machines are smaller versions of commercial machines (Figure 3). Some homeowners buy



Figure 3. Homeowner ZTR mower. full-size commercial machines. The commercial machines are more expensive, but they are powerful and very heavy duty. They are priced similarly to a large, high-quality garden tractor and are designed for many hours of hard professional use.

Professional Zero-Turn Mowers

Zero-turn mowers dominate the commercial mowing market. Walk-behind units are still used for smaller areas, and larger mower units of several types are available for large turf areas like golf courses and sports fields, but most commercial turf maintenance is done with zero-turn mowers (Figure 4).



Figure 4. Commercial ZTR mower

Pricing. The price range for commercial zero-turn mowers is very wide. You can find some small 48-inch commercial units for as little as \$4,000-5,000. The heart of the market is the 52-72 inch range,

typically with 25-35 hp gasoline engines for about \$7,000-\$10,000. Heavier duty water-cooled diesel machines with 72-inch decks may cost \$10,000-\$12,000.

Features. Good professional zero-turn mowers incorporate high-quality commercial engines (Figure 5), usually with a horizontal shaft and high quality hydraulic components. The engines are water-cooled on the more expensive machines. They usually have a heavy-gage welded steel deck rather than a formed deck. They have long-life deck spindles and caster wheel bearings. The



Figure 5. Water-cooled engine on commercial ZTR mower.

better machines use a shaft drive to the deck. Most major manufacturers now offer rollover protective structures (ROPS) including seatbelts as standard equipment. All zero-turn mowers should be equipped with ROPS. A ROPS will provide a protected envelope for the operator in the event of an overturn and can greatly improve your chances of avoiding injury if your machine does roll over.

Quality. Although professional zero-turn mowers tend to be higher quality than homeowner machines, there are certainly differences among brands and models. Some are built with higher quality components and superior design. From just looking at a variety of machines it is obvious that some look professional and others are

just welded up from available components. It pays to invest in a high-quality unit. Both performance and reliability will be better with a quality machine.

Life Span. A good commercial zero-turn mower should run 2,000 hours with minimal repair cost. Most of the better machines can be run even longer if you are willing to invest time and money in repairs, but many turf professionals trade off the machines after about 2,000 hours to avoid the costs of downtime. Paying a little more initially to get a true professional-quality machine can reduce downtime and repair costs throughout the life of the machine.

Low Cost Zero-Turn Mowers for Home Lawns

Zero-turn mowers have taken over the commercial riding mower market. In the past, few low-cost models were available to homeowners, but this has changed. Low-cost homeowner models are now available from several companies.

Pricing. Commercial zero-turn mowers are priced from around \$5,000 on up to more than



Figure 6. Low-cost homeowner ZTR mower.

\$12,000, depending on size and features. Some homeowner zero-turn models are now available for \$2,000-\$3,000 (Figure 6). This is still a significant cost, but it is comparable to the price of many

lawn tractors. There are also smaller semi-commercial models that bridge the gap between strictly homeowner mowers and full-fledged commercial mowers (Figure 7). There is a continuous range of pricing from the low end to the high end.



Figure 7. Smaller commercial ZTR mower.

Features. The small homeowner zero-turn mowers offer the same type of dual hydrostatic system used on commercial machines, but typically lack some other features found on higher priced machines. The small homeowner machines typically have smaller (lower horsepower) engines and smaller mowing decks. They usually have vertical-shaft single cylinder engines and belt drives for the decks. Most of the smaller zero-turn mowers do not have ROPS, although all should have.

Quality. As is often the case, you get what you pay for. The small, low-cost homeowner machines are built with lighter, lower quality components. The engines are smaller and are designed for a shorter lifespan. The dual hydraulic systems also are lower quality and have a shorter design life. The frames are lighter and not as strong, thus more subject to damage from collisions. The control systems may not be as sophisticated and may be more prone to going out of adjustment and having “slop” in the linkages.

Life Span. A probable design life for the low-cost homeowner zero-turn mowers is about 500 hours. This may be good enough for you. If you spend an hour a week mowing (remember, the zero-turn mower will reduce your mowing time compared with whatever you have used in the past), you will run the mower about 25-30 hours per year. That equates to 17-20 years of life with a mower designed for a 500-hour lifespan. Most people won't want to keep a mower any longer than that anyway.

The question you need to answer is: Is a low-cost zero-turn mower “good enough” for me? For people with smooth lawns less than an acre in size, the answer may well be yes. For larger lawns or rougher areas, the strength and durability of a small commercial machine might be justified. The choice is yours, but today you do have a choice. Remember that moving up to a commercial machine may provide you with the safety of ROPS.

Mid-mount and Front-mount Decks on Zero-Turn Mowers

Professional zero-turn mowers are available in two configurations: mid-mount decks (Figure 8) and front-mount decks (Figure 9). Some manufacturers offer both



Figure 8. ZTR mower with mid-mount deck.



Figure 9. ZTR mower with front-mount deck. Homeowner machines are generally mid-mount. Each configuration has advantages and disadvantages, and each has proponents. Mid-mount decks are much more popular than front-mount decks.



Figure 10. Front mount deck on mower with steerable rear wheels (not a ZTR mower)

Stability. Mowers with front-mount decks tend to be a little more stable since they have longer wheelbases. In general, front-mount models tend to have lower centers of gravity also (Figure 11).

Length. The extra length that makes front-mount models more stable is a disadvantage when the mower must be hauled on a truck or trailer. The more compact mid-mount models have an advantage here since they take up less space on a truck or trailer. Because they are shorter, the mid-mount models can maneuver better in tight places.

Mowing Under Obstacles. Front-mount decks are better able to mow under decks, fences, shrubs, trees and other low-



Figure 11. ZTR mowers with front-mount decks can have a very low center of gravity, hanging obstacles since the area over the deck is clear. Mid-mount decks generally have some clear overhang on the sides and front, but not as much as front-mount decks.

Mowing Around Obstacles.

Operators differ on this one. Some operators feel that the front-mount decks are better for trimming since the deck swings around in front of the mower; other operators prefer maneuvering a mid-mount deck around trees and bushes. Since both types of machine have a zero turning radius, either can trim very effectively.

Some manufacturers also offer front-mount decks on vehicles that have steerable rear wheels controlled by a steering wheel (Figure 10). Those machines are not true zero-turn mowers; they are versatile and have short turning radii, but cannot spin around their centers. They are best suited to larger turf areas with minimal trimming requirements. They tend to be larger and more expensive than true zero-turn machines.

Optional Attachments.

Front-mount decks can be readily replaced by optional attachments such as aerators or rotary brushes (Figure 12). Mid-mount decks generally do not accommodate these attachments.

Ease of Service. Some front-mount decks can be tilted up for under-deck service (Figure 13) or to take up less space on trailers. This is normally not possible with mid-mount mowers, but some mid-mount mowers allow the whole machine to be tilted up on a leg or front wheel (Figure 14) for under-deck service.

In summary, personal preference plays a major role in choosing between mid-mount and front-mount zero-turn mowers. Either type of mower can do a good job of mowing and trimming. You just have to pick the one that best suits

your needs and mowing style.

Optional Features on Zero-Turn Mowers

Zero-turn mowers are very popular for professional use, and their terrific versatility is making them increasing popular for homeowners with larger lawns. Zero-turn manufacturers offer many new and/or optional features on their mowers that further increase their versatility and ease of use. Many of these features will be primarily of interest to professionals because of the cost, but homeowners should be aware of the availability of these features.



Figure 13. Tilt-up deck on front-mount ZTR mower.

Rollover Protective

Structures. ROPS are standard on major brands of commercial zero-turn mowers but still optional with a few small manufacturers. ROPS can get in the way when working in low-clearance situations such as under trees, but offer significant protection in the event of a rollover – if the seatbelt is used. Seatbelts and ROPS should always be used together. Some ROPS on zero-turn mowers are designed to fold when needed for temporary clearance (Figure 15). If you fold your ROPS, be sure to move it back to its upright position as soon you finish the low-clearance area. A ROPS should be standard equipment on every zero-turn mower.



Figure 14. Leg at front of ZTR mower to tilt entire machine for deck service.

Grass Catcher. The most common option on zero-turn mowers is a grass collection system. This is useful in situations where clippings must be collected, but adds weight, cost and complexity to the mower and can



Figure 12. Aerator attachment on front-mount ZTR mower.



Figure 15. Folded ROPS on ZTR mower.

adversely affect stability on slopes. Some grass collection devices are add-ons and require a separate engine; others are more integrated. You may need to add front weights to balance a rear grass catcher.

Floating Front Suspension.

Many zero-turn mowers have rigid frames with fixed front axles. This is adequate for smooth lawns, but if the surface undulates, one front wheel can leave the ground. Some models now have a front axle frame that pivots at the center, allowing the front wheels to remain in contact with the ground or a full floating front suspension. With a floating front suspension, the gage wheels on the deck help prevent scalping when the front tires move up and down (Figure 16). The deck may be suspended from the frame or from the oscillating front axle beam. On some models, the front wheels are mounted on a spring suspension.



Figure 16. Floating front suspension.

Independent Rear

Suspension. Some models go a step further and incorporate an independent spring suspension on each rear wheel (Figure 17). This improves the ride. Once again, the gage wheels will have to do more work to prevent scalping.

Tilt-up Decks. Some mower decks can be tilted up for service (Figure 13). This makes it easier to change blades or clean the underside of the deck. On other models, it is necessary to either remove the deck for service or run the mower up on ramps. Tilt-up decks are generally found only on mowers with front mount decks; the frame prevents tilting the deck on most mid-mount mowers.



Figure 17. Rear independent suspension on ZTR mower.

Tilt-up Mowers. Some mid-mount mowers allow easy tilting up of the entire mower for under-deck service. These mowers have a leg mounted on the front of the mower that can be rotated down. In some cases, the mower is driven forward, causing the leg to pivot into a vertical position which raises the front of the whole machine. In other cases, the leg is manually cranked to raise the front of the machine. Other models have a provision for cranking the axle beam down to support the front on one wheel (Figure 14).

Hydraulic Deck Lift. Most zero-turn mowers have a spring-assisted manual lift for the deck,

but some offer hydraulic or electric deck lift. With a heavy deck, this can be a welcome feature when it is necessary to lift the deck often.

Edger Attachment. Some zero-turn mowers can be equipped with a side-mounted edging wheel to allow edging along sidewalks, driveways or patios (Figure 18).

Attachments to Replace the Deck. Many front-deck models have optional attachments available to mount in place of the mowing deck. These attachments include rotary brushes, snow blades and blowers and turf aerators (Figure 12).

In summary, each brand and model of zero-turn mowers offers different features. Some of these features may be valuable to you; others will not.

Zero-Turn Mower Maintenance

Zero-turn mowers, like all lawnmowers, operate in a dirty environment. They are exposed to dust, dirt, vegetative waste such as clippings and weed seeds, mud, water, sunshine and sometimes rain. Proper and regular maintenance is needed to keep your mower operating at top efficiency and minimize costly repairs and downtime.



Figure 18. Edging attachment on ZTR mower.

Air Filters. Every engine requires abundant clean air. This can be a real challenge for a zero-turn mower since the engine rides low and at the rear of a machine that tends to kick up lots of dust, chaff and trash if the turf and ground are dry. Frequency of cleaning or replacing your air filter depends on your operating conditions as well as the type of filtration you have. Many mowers are now equipped with high-capacity air filters that require less service. Some machines still use a pleated paper primary filter surrounded by an oil-impregnated foam pre-filter (*Figure 19*). The pre-filter catches much of the dirt and thus needs service more frequently than the primary filter. Under very dusty conditions, the foam pre-filter may need to be changed or cleaned twice a day. If you properly maintain the pre-filter, the primary filter may need replacement only after every five to ten pre-filter changes. Be sure to blow off the filter area before servicing filters so that you do not introduce dirt into the engine. If your engine uses a foam pre-filter, be sure to oil it before installation. Foam pre-filters can be washed (in hot soapy water), dried and reused, but it is much easier to just replace it and new pre-filters typically cost only \$2-\$3.



Figure 19. Air filter and foam prefilter.

Engine Oil. Oil is the lifeblood of your engine. You should change it at least as often as recommended by the manufacturer and more often under dusty conditions. Use the oil recommended by the manufacturer, and change the filter (*Figure 20*) with every oil change. Check your oil level at least daily and add oil as needed. Again, be careful not to introduce dirt when checking or adding oil.



Figure 20. Oil filter on ZTR mower.

Fuel. Some old farm tractors carried a label that read, "Buy clean fuel and keep it clean." That is still good advice. You will probably be buying good, clean fuel, but it is important that you keep it clean. You normally gas up your car or truck at a service station under clean conditions, but you probably buy and store fuel for your mower. You need to store it in a clean and closed container, and be sure not to get any dirt into the fuel or fuel tank when transferring it to the mower. It is easy to dump dirt from the top of a fuel can into the mower fuel tank. It is also important to change fuel filters (*Figure 21*) on the mower regularly. Your fuel should be fresh. If you must store fuel for more than a month, use a fuel stabilizer. Note that a fuel stabilizer is effective only if added while the fuel is fresh; it will not restore deteriorated fuel.



Figure 21. Fuel filter on ZTR mower.

Hydraulic Oil. Hydraulic oil is the lifeblood of your hydrostatic transmissions. Cleanliness is even more important here than it is with engine oil. Check your transmission oil daily and add the correct oil as needed. Be very careful not to introduce dirt. Change your oil and filter (*Figure 22*) at the recommended interval. Be sure to use the recommended weight of oil. If your mower has a hydraulic oil cooler, keep it clean. Don't assume that your mower uses tractor hydraulic oil; some mowers use various weights of engine oil for the hydraulic system.

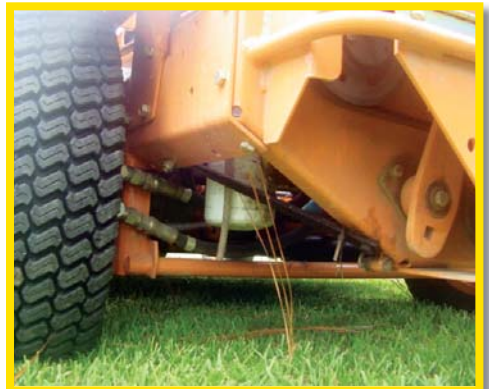


Figure 22. Hydraulic filter on ZTR mower.

Lubrication. Most zero-turn mowers have several grease fittings that need to be greased regularly. Fortunately, the lubrication interval on many zero-turn mowers has been increased to the point that commercial operators may need to grease their mowers only once a week – and perhaps less often for some fittings. You

should follow your manufacturer's recommendations regarding frequency and type of grease to use. Don't neglect the grease fittings in hard-to-get-at places like the deck drive shaft. If it is hard to get at to grease, think how difficult it will be to replace.

Cooling. Keep your engine's cooling system clean. For air-cooled engines, that means to keep the cooling fins on the engine, including those under the shroud, clean. For water-cooled engines, you must keep the radiator clean.

Battery. The batteries on most zero-turn mowers are smaller than on cars, trucks and tractors. The smaller batteries are adequate for the small engines used on zero-turn mowers if kept charged, but have less reserve if partially discharged. Check the water level in the battery often and add distilled water as needed. Pay particular attention to keeping the top of the battery and the terminal area clean. It only takes a blade or two of grass or a little dirt to short out from the terminal to the battery box and drain your battery.

Deck Maintenance. Grass clippings are corrosive. They also impede flow if they build up under your deck. A well-designed deck operating in dry grass will not have a problem with buildup under the deck, but if clippings do build up you will need to clean them out. Blowing the deck out with air is one good way to remove clippings, but the deck still needs to be washed occasionally to remove stubborn buildup. The top of the deck is perhaps more important than the bottom. The top of many decks tends to trap more clippings than the underside (*Figure 23*), and must be cleaned often to avoid corrosion and damage to drive belts.

Blades. It is important that you keep the blades sharp. The

blades will tear the grass blades and require more power if the blades are not sharp. Some commercial operators routinely replace the worn blades with new ones rather than sharpening them. The labor to sharpen blades can exceed the cost of new blades. For homeowners whose time is less valuable, sharpening is the best approach.



Figure 23. Grass clippings on top of mower deck.

Overall Protection. You have a major investment in your expensive zero-turn mower, and it is wise to keep it out of the weather when not in use. Both rain and sunshine will cause deterioration of the mower finish and of many mower components. If you take care of your zero-turn mower, it should give you many hours of faithful service.

Slippage With Zero-Turn Mowers

Zero-turn riding mowers can do a wonderful job of maintaining turf, but the rapid response and maneuverability that make them so handy can also cause problems if you aren't careful with them.

The Problem. Zero-turn mowers allow you stop, turn or reverse direction almost instantly by rapidly moving the steering levers. Sometimes the momentum or inertia of the mower resists rapid changes in speed and/or direction, causing the drive wheel(s) to

slide or spin. This is an especially common problem on wet turf, but it can (and does) happen on dry grass also. It is a serious safety problem on when mowing on hillsides.

This slippage has several detrimental effects. First, it causes a loss of control. If the mower is sliding or spinning, you are not in control of the vehicle motion. It is easy to run into a tree or other obstacle when the mower slides. Second, wheel slippage may cause severe turf damage. A rapid start, stop or turn can strip the turf from a square foot or more of turf, leaving the soil bare for months until the turf recovers (*Figure 24*).

A more serious problem is side slippage on slopes. If operating on a slope, the mower may slide all the way down the slope before it stops. If there is a ditch, pond, creek or dropoff of any kind at the bottom of the slope, the mower can overturn. Most zero-turn mower overturns are the result of sliding. It can also slam into a wall, fence, tree or anything else that happens to be at the bottom of the slope. Ideally, you should back up a slope and drive down rather than driving across the slope, but that recommendation is not always possible to follow. In fact, tire slippage may make it impossible to back up a slope with a zero-turn mower. If you do have to drive around a contour on a slope, you may notice the rear tires slipping

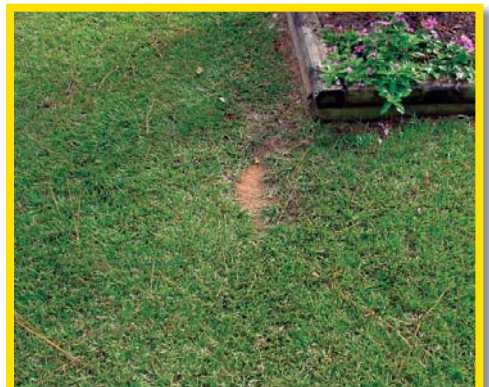


Figure 24. Turf damage from pivoting ZTR mower around corner.

downhill slightly, causing the mower to run at a slight angle to the direction of travel (called “yaw”).

Recommendations. The best advice for avoiding these problems is to move the steering levers smoothly and slowly – and have a rollover protective structure (ROPS) on your mower.

Just because you have the capability of spinning the mower around its center or stopping on a dime doesn’t mean it is wise to do it often. You should avoid pivot turns – you will cause much less turf damage if you keep both drive tires rotating while you turn. You can make short turns without slippage or turf damage if you just decelerate gradually before the turn, then turn slowly and accelerate gently. With a little practice, you will learn how gently you have to drive your mower under different turf conditions. Avoiding wet turf certainly helps minimize slippage problems.

If you encounter slide slippage or yaw on a slope, you will have to speed up the lower drive wheel and slow the upper wheel, allowing the mower to run with the amount of yaw angle necessary to maintain your travel across the slope.

In summary, fully using the quick-maneuvering capabilities of your zero-turn mower can damage turf, cause you to run into fixed objects or cause you to slide all the way down a slope – and possibly overturn. A gentle touch on the steering levers will do the job just as fast but with minimal slippage and damage.

Safety Standards for Zero-Turn Riding Mowers

Commercial-size riding mowers and homeowner riding mowers, including zero-turn mowers, are covered by two safety standards

promulgated by the American National Standards Institute (ANSI) (www.ansi.org). Even though many of the commercial mowers are used by homeowners, those that are designed primarily for commercial use are considered commercial machines; thus, they fall under a commercial mower standard. These standards were developed by the Outdoor Power Equipment Institute (OPEI) (www.opei.org), an organization composed of manufacturers of this type of equipment, with assistance and input from more than 20 other technical organizations including the American Society of Agricultural and Biological Engineers. They were then reviewed and approved by ANSI. These are industry consensus standards, meaning that manufacturers voluntarily comply with them; they are not enforced by any governmental agency.

ANSI B71.1-2003, Walk-Behind Mowers and Ride-On Machines With Mowers - Safety Specifications and ANSI/OPEI B71.4-2004 Commercial Turf Care Equipment - Safety Specifications.

All zero-turn mowers are covered by one of these standards, depending on whether they are intended for homeowner or commercial use. Compliance certification may be done by an independent testing organization or by the manufacturer. The manufacturer has to pay for the compliance testing. Not all manufacturers of commercial mowers choose to comply with this standard or obtain certification; only fully compliant mowers should be considered for purchase.

Guarding and Shielding.

The standards list specific areas that require guarding such as rotating components, hot surfaces, pinch points, etc. and include

requirements for functionality and durability of the guards. Protection from thrown objects is a major part of the standards.

Labels and Instructions.

The standards contain detailed requirements for safety signs and operator’s manual content. Durability of labels and safety signs is prescribed.

Operator’s Zone and Controls. The standards require that the operator’s zone be protected from engine exhaust, moving components, and battery, fuel, oil and coolant system components or reservoirs. A finger-probe test is required to ensure that an operator cannot reach into a dangerous area from the operator’s position. Operator-presence controls (OPC) are required. This control must automatically stop the mower when the operator leaves the operator’s position. This is sometimes accomplished with a switch under the seat that disengages the mower clutch and engages a blade brake if the operator rises from the seat or a switch that kills the engine if the operator rises from the seat while the blades are engaged.

Stability and Overturn Protection. The standards require testing of the mower on a tilt table to determine its susceptibility to side and rearward overturns. The mower must not start to tilt with a longitudinal slope of 30° nor a lateral slope of 20° (25 degrees for homeowner machines). Braking on slopes also has requirements. A rollover protective structure (ROPS) is recommended if a commercial mower weighs more than 1,236 pounds, and the tip angle is less than 40°. Although B71.1 does not require ROPS, and B71.4 recommends ROPS only on larger mowers, ROPS should be standard equipment on all zero-turn mowers. Most major manufacturers

now include ROPS as standard equipment on commercial machines. One company puts a standard ROPS on any machine weighing more than 800 pounds. Future versions of these two standards should require ROPS on all zero-turn mowers.

Mower Deck Safety Requirements. Several requirements make up the standards for mower deck safety, including blade guarding, protection from thrown objects and blade impact resistance (when striking a solid object). A foot probe must be used to verify efficacy of the guarding. Blade tip speed is limited by the standards to 19,000 ft/min (216 mph).

Other Features of the Standards. The standards also cover many other safety areas involving fuel, hydraulics, control layout, etc.

These standards, like most industry consensus standards, are constantly evolving. Industry committees, made up primarily of design engineers, work to update and improve the standards as new technology is developed. For instance, new versions of these standards should require the use of ROPS on zero-turn mowers. This effort includes making the standards relevant to new equipment designs and also requires that manufacturers constantly improve the safety features of their machines to meet new versions of the standards. Although no standard can completely anticipate all hazards or prevent all accidents, these industry consensus standards do go a long way toward improving the safety of mower operators. Be very sure that any mower considered for purchase is certified to be in compliance with ANSI B71.1 or ANSI/OPEI B71.4.

Preventing Overturns With Zero-Turn Mowers

Zero-turning-radius mowers are often used to mow ditches, pond banks and other slopes. Operators need to be aware of safe practices to prevent overturns, and machines should be equipped with a rollover protective structure in case an overturn does occur.

Zero-turn mowers are somewhat different from conventional tractors, and safe practices to prevent overturns are different in some cases. Zero-turn mowers tend to have low centers of gravity. They are fairly stable, but their short wheelbases and narrow wheel spacings can contribute to overturns. A ROPS and seatbelt should always be used with any zero-turn mower, even the smaller models. A folding ROPS should always be locked in the upright position unless it is necessary to lower it temporarily for loading into enclosed trailers or driving under low-hanging obstacles. Raise the ROPS as soon as you move out from under the low obstacle.

Side Overturns. Side overturns are not common with zero-turn mowers, but they are possible. The wider the deck, the less chance of a sideways overturn, since a deck out beyond the tires will help stabilize the machine. It is always desirable to mow up and down slopes with a zero-turn mower rather than across slopes to reduce the risk of a side overturn. If it is absolutely necessary to operate on the contour of a slope, the operator should be prepared to take emergency action if an overturn seems imminent.

The correct emergency action is different for mid-mount and front-mount mowers. With a mid-mount mower, the drive wheels are at the rear, so the operator should always turn **downhill** if a side overturn is

sensed. Front-mount mowers have the drive wheels at the front of the tractor unit. Even though they have a deck out front, many decks can tilt up, providing minimal overturn protection. It is best to turn a front-mount mower **uphill** if a side overturn is sensed (assuming the front-mount mower has two rear wheels; on models with a single rear wheel, the operator should turn downhill as with mid-mount mowers since the single rear wheel design is less stable).

Front/Rear Overturns. As noted above, the dynamics of mid-mount and front-mount zero-turn mowers are different. Mid-mount zero-turn mowers should be backed uphill and driven downhill. That keeps the drive wheels and the weight of the engine on the uphill side so the torque reaction of the drive wheels will be counter to an overturn. With front-mount zero-turn mowers, the drive wheels are at the front of the “tractor” portion of the machine. If the front-mount mower has two rear wheels, it is best to drive uphill and back downhill to keep the driving axle uphill. This is probably not best with front-mount mowers having only one rear wheel; they are less stable, and the single wheel should probably be kept uphill – and extra caution used.

General Safety Suggestions. It is always a good idea to avoid jerky maneuvers. On flat ground, jerking the steering levers will tear up the turf, shorten tire life and stress the hydraulic system, but jerking the levers while on a slope can result in a mower turning over on top of you or sliding down the slope and then overturning on top of you. Avoid steep slopes with a riding mower; use a walk-behind mower (operated across the slope) or a string trimmer. All zero-turn mowers should have a ROPS. If your mower has a rollover protective

structure and a seatbelt, be sure to wear the seatbelt; the ROPS is of limited value unless the seatbelt is fastened.

Zero-turn mowers are generally stable, but you must still use reasonable caution to avoid overturns. Good driving practices that are desirable on level ground will help you avoid overturns. A ROPS is important to protect you in case an overturn does occur.

Transporting Zero-Turn Mowers Safely

As with driving on hillsides, loading a zero-turn mower onto a truck or trailer can potentially result in an overturn. Once again, the general rule is to keep the drive wheels uphill. A mid-mount zero-turn mower should be backed up ramps (Figure 25) and a front-mount zero-turn mower should be driven up forwards. Be sure the loading ramps are secured to the truck or trailer before loading or unloading. You should have a ROPS on your mower and should be sure your seatbelt is fastened before driving on or off a trailer. Not only can the mower overturn on the ramps, but the tires can slip and cause the mower to fall sideways off the ramps and overturn to the side.



Figure 25. Mid-mount ZTR mowers should be backed up ramps and slopes to avoid overturns.

Be sure to secure your mower to the truck or trailer with chains or straps and lock the brake before hauling. It is also a good idea to remove the key when hauling – if your key is on a key ring with any kind of key fob, it can easily blow out of the ignition and be lost while the machine is being hauled down the road.

Fire Safety Issue With Professional Turf Mowers

A municipal parks worker in south Louisiana was seriously injured when the professional zero-turn mower he was using caught fire. Like many zero-turn mowers, the mower involved in that incident had plastic gasoline tanks mounted like fenders, over and in front of the drive tires and thus right beside the operator. The operator was mowing around a steel frame from a picnic table. He got too close to the table frame and the right gasoline tank hit the angle iron frame, puncturing the gasoline tank. The gasoline from that tank poured out, vaporized and ignited. The fire then caused the left tank to explode. The operator was trapped in the seat by the steering levers while engulfed in burning gasoline. In his pain and confusion, he was unable to get the levers into the neutral position so that he could fold them out of the way, and he therefore had to bend the levers out of the way before he could escape. He was severely burned by the time he got away from the burning mower.

There are two lessons to be learned from this accident:

1. A zero-turn mower with exposed gasoline tanks over the wheels beside the operator is an accident waiting to happen. It is recommended that all bid specs

for zero-turn mowers address this issue. Turf professionals should specify and purchase zero-turn mowers with fuel tanks in less vulnerable locations. Many models of zero-turn mowers on the market incorporate better fuel tank designs. Some manufacturers of zero-turn mowers mount the fuel tanks in more protected locations such as under the seat and under a heavy steel plate (to further protect the operator), behind the drive wheels, or inside steel fenders or guards. Some manufacturers use steel fuel tanks. Safety considerations should be a concern when specifying/purchasing a mower.

2. Operators of zero-turn mowers need to be aware of the danger of gasoline fires on their machines and be very careful to avoid impacting the fuel tank(s) when trimming around obstacles. Any fire on a zero-turn mower will likely involve and injure the operator since the machines have open operator's stations and are small and compact; thus, the fuel tank(s) can't be very far away from the operator. Zero-turn mowers are designed and purchased specifically for trimming around obstacles, and these obstacles certainly can puncture fuel tanks if there is a collision.

Summary

Zero-turn mowers offer outstanding performance and maneuverability. They are available in a wide range of prices, sizes and quality levels to meet professional and homeowner needs. They do need to be maintained properly and used safely.

Author:
Richard L. Parish, PhD, PE



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