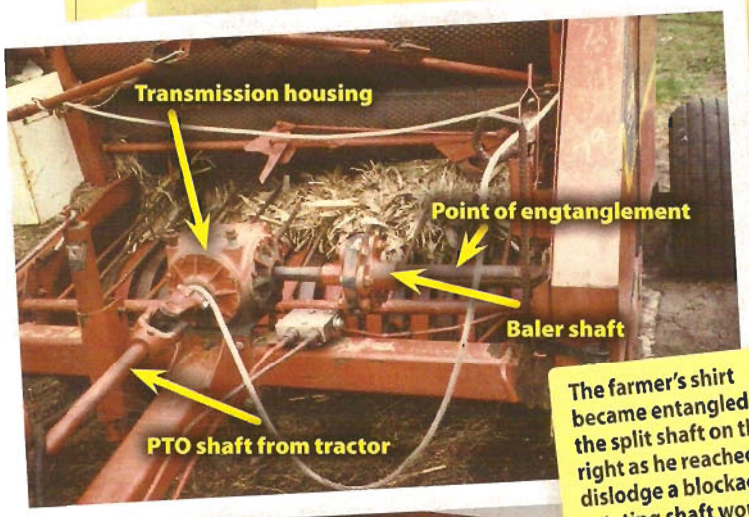
Baler operation takes a **tragic** turn

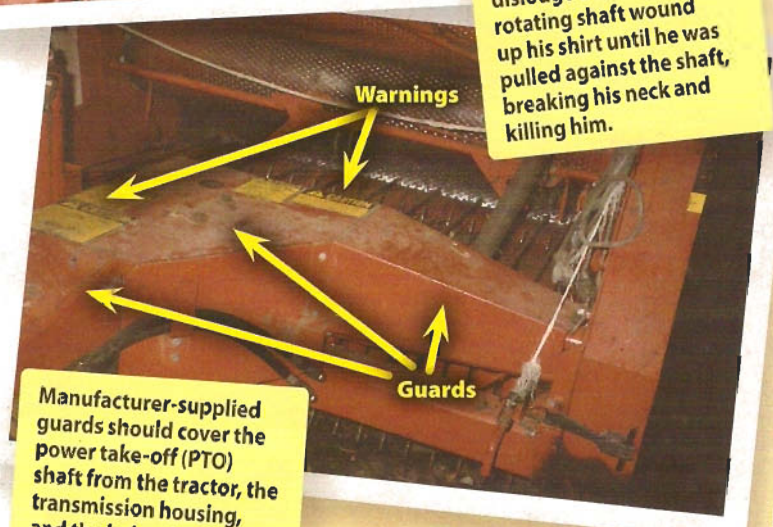
A 10-year-old boy was watching cartoons after school when he realized his father had not returned from working in the fields at his usual time. The boy rode his bike out to look for his father and found him leaning, unresponsive, over a baler attached to his idling tractor. The boy turned off the tractor and pedaled back home to call 911.

Emergency responders found the farmer's shirt had wrapped around the rotating power take-off (PTO) shaft to the baler, pulling him toward the machine and breaking his neck. He was pronounced dead at the scene.

The farmer had traded the square bailer he previously owned for a used **Owatonna Manufacturing Co.** Round Baler Model 595 earlier that year. He used the baler for about six months before the accident.



The farmer's shirt became entangled in the split shaft on the right as he reached to dislodge a blockage. The rotating shaft wound up his shirt until he was pulled against the shaft, breaking his neck and killing him.



Manufacturer-supplied guards should cover the power take-off (PTO) shaft from the tractor, the transmission housing, and the baler shaft. The guards also warn against removing them during operation, approaching rotating components, and servicing the baler without disconnecting the PTO.

The farmer had completed some repairs to the round baler before removing it from the equipment dealer's premises, but the machine did not have the manufacturer-supplied guards when he traded for it or when he took it home. The guards are meant to cover the PTO shaft from the tractor, the transmission housing that couples the PTO to the baler shaft, and the baler shaft itself.

Warnings printed on these guards alert users not to service the baler without decoupling it from the PTO and not to remove the guards while the machine is in operation.

It appeared the farmer left the tractor idling and the PTO running while he tried to dislodge some cornstalks that were stuck in the conveyor that moves stalks or hay into the baler mechanism. The spinning PTO driveline caught his shirt and pulled him to his death against the baler housing.

Investigators determined the accident would not have happened if the guards had been present or if the farmer had disconnected the baler from the PTO before trying to remove the blockage.

Because the equipment dealer had executed the baler trade without supplying the round baler's manufacturer-supplied guards, the farmer's family sued the equipment dealer's company for trading or selling the machine in a dangerous condition. The family argued the dealer should have known based on his expertise and a reasonable inspection that the baler needed guards to cover the PTO driveline.

Unfortunately, the farmer's death was another reminder that those operating used equipment must take extra care to ensure all manufacturer-supplied safety measures are functioning and to be sure they have a comprehensive user's manual for the equipment. **MD**

This month's safety violation comes from the files of Lanny Berke, a registered professional engineer and Certified Safety Professional involved in forensic engineering since 1972. Got a safety violation to share? Send your images and explanations to jessica.shapiro@penton.com.

Edited by **Jessica Shapiro**

No warnings, guards, or **safety analyses** on the route to injury

A worker cutting plywood with a router noticed that the roller clamp holding the plywood to the router table had loosened again. While the router was still running, he applied a wrench to the adjustment bolt. As he did so, his hand slipped. It hit the router's spinning bit directly below the bolt, injuring him.

The worker's employer was a job shop with a contract to a larger company. The contracting company had designed the router, table, and roller clamps, and supplied them to the job shop cutting plywood for trailer floors. The design included a handheld router that was bolted upside-down to the bottom of the table. A frame over the table supported roller clamps that held the plywood down to contact the router bit.

The clamp-adjustment bolts had a habit of working themselves loose after about 5 min of operation. To tighten them, workers had to apply a crescent wrench to the bolts, located about 7 in. above the router bit.

If a board was already loaded in the table when adjustment was needed, operators would tighten the clamps while the machine was still running. If no board was loaded, they would unplug the unit from the wall before making the adjustment.

Disconnecting the power was the only way to stop the router bit from spinning; there was no emergency kill switch or on-off-control on the router. In addition, the router's bit was not guarded.

The router system designed by the contracting company had an unguarded router bit and a board-hold-down mechanism that required frequent adjustment. The router could only be powered off by unplugging it, so the operator adjusted it while bit was spinning. His wrench slipped, and his hand hit the spinning blade.

Investigators found that the contracting company had designed and supplied the router system without conducting any safety analyses, writing a user manual, or warning operators via printed labels on the system.

Turning off the router by whatever means necessary would be a logical precursor to adjusting the clamps. However, because operators had to tighten the bolts every 5 min, and because there was not a readily accessible power-off mechanism, it was reasonably foreseeable that they would tighten the bolts with the router running. In fact, on-the-fly adjustments were standard practice at the contracting company as well as its job shop.

The worker could have prevented his own injury by unplugging the router before adjusting the clamp. However, his employer and the contracting company had a responsibility to make sure operators had clear instructions and warnings about using the equipment.

If the machine's designers had conducted a safety analysis, they would have seen the need for an accessible power-off mechanism and proper guards against both intended and reasonably foreseeable uses. After the accident, the contracting company added a metal guard over the router bit.

MD

WHAT'S THIS?

When you see a code like this, take a photo of it with your smart phone (iPhone 3G-S gives best results) and, using software from *www.neoreader.com*, you will be connected to relevant content on *machinedesign.com*

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Extra **wiring** is a real firestarter

A mechanic opened his shop one morning to discover a smoldering lump of metal where he had towed a truck the day before.

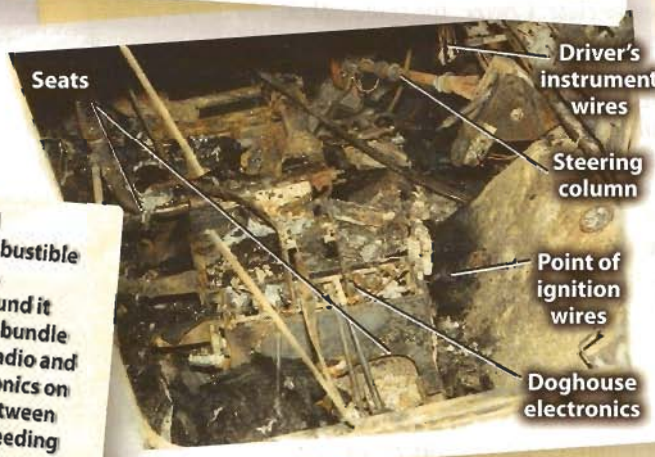
The mechanic had previously worked on the truck's two transmissions — one that drove the vehicle and one that drove its utilities — in the field. When the initial repairs failed to solve the problem, the mechanic towed the truck into his shop for a more-thorough work over. The truck was towed and stored without being started. Investigators were called in to see if the transmission work caused the fire.

The edges of the fiberglass hood had burned away, but its center had simply melted. The front tires and some other combustible material in the engine compartment were intact, leading investigators to rule out the engine compartment as the point of ignition.

The cab of the truck sustained worse damage: Anything combustible, from seat covers and foam to steering-wheel and dashboard covers, had burned away. Because combustion was so complete, it appeared the fire had burned hot which is typical of electrical fires.

Wires near the steering wheel that fed the driver's instrument cluster were mostly intact. However, wires that led to the CB radio and other accessory instruments mounted on the "doghouse" between the passenger and driver seats were broken and bare of insulation. Investigators determined that the accessory wire bundle was the point of ignition.

An overnight fire melted and partially burned a delivery truck's fiberglass hood. Because the hood, combustible materials in the engine compartment, and front tires were mostly intact, investigators determined the fire had not started in the engine compartment.



The fire burned everything combustible in the truck cab. Investigators found it started in a wire bundle that fed the CB radio and accessory electronics on the doghouse between the seats. Wires feeding the driver instrument cluster were intact.

As Lanny Berke pointed out in his column in the March 18 issue of MACHINE DESIGN ("Third-party vehicle modifications still need safety checks"), many vehicle electrical fires are caused by third-party electronics that are improperly installed. If wiring passes through a vehicle's frame without a grommet, normal vibration can wear away the wiring insulation and set up conditions for a fire.

In this case, the wires serving the truck's CB radio and supplementary instrument cluster ignited and set the truck on fire. Those who installed the CB radio and other electronics in the cab should have been careful to protect wires from vibration and wear with grommets. **MD**

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Vent line missing from drawing; five **workers burned**

Five workers were badly burned when a condensate tank they were checking for leaks ruptured, splashing them with hot condensate.

The tank, located in a cold area of the mill, had dripped water onto the floor which eventually froze to create a slip hazard. Maintenance personnel locked out the power to the electric pump, drained the tank, disconnected the piping, and removed the bolts holding the tank to a concrete pad.

When they tipped the tank onto its end, the pump appeared loose, so they checked its gasket and reseated it. Then they rebolted the tank to the pad, reconnected the piping, and opened the inlet and discharge valves each a quarter turn to allow condensate back into the tank.

The drip began again almost immediately. One worker knelt down to visually locate the leak. Moments later a burst of steam escaped and the bottom of the tank blew off. Steam and hot condensate gave the worker and four others second-degree burns.

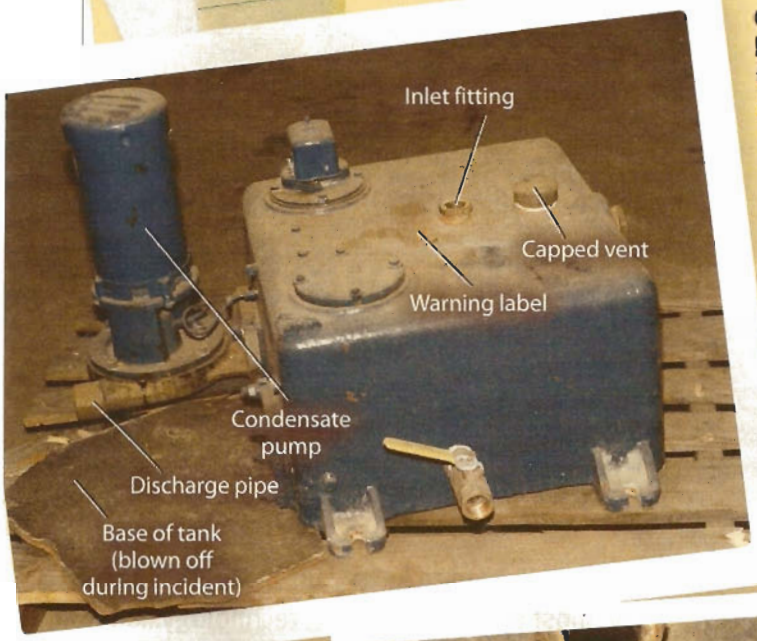
The square, cast-iron condensate tank was not intended to be a pressure vessel. When the inlet valve was open, pressure built to an unsafe level and caused the rupture. Opening the valve on the discharge pipe did not help relieve the pressure because the pump that fed the discharge pipe was still off.

A warning label near the inlet fitting said as much and indicated the tank had to be vented at all times. But the label was covered with dirt, and workers said they were unaware of the need for a vent. Indeed, a vent at the top of the tank had been capped off.

A construction company had installed the tank, working from drawings that did not show a vent line or specify the need to vent the tank to the outdoors. The tank manufacturer said the vent line had been mistakenly omitted from the drawings.

The installers admitted they would not have drawn attention to the need for an external vent line if one wasn't specified because that would have exceeded the scope of their work. They may have capped the vent, or a mill worker may have capped it later to prevent vent steam from escaping into the work area.

After the accident, the mill replaced the ruptured condensate tank with an ASME-approved pressure-vessel system with pressure gages, relief valves, and lockout-ready power sources. Management also reviewed lockout procedures throughout the plant because the inlet pipe delivering hot condensate to the tank should have been considered an energy source and properly locked out before the workers started their maintenance. **MD**



The cast-iron condensate tank ruptured and burned five workers with steam and hot condensate when it was improperly pressurized. A warning label cautions against pressure buildups, but the tank was installed without a vent line to relieve pressure.

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