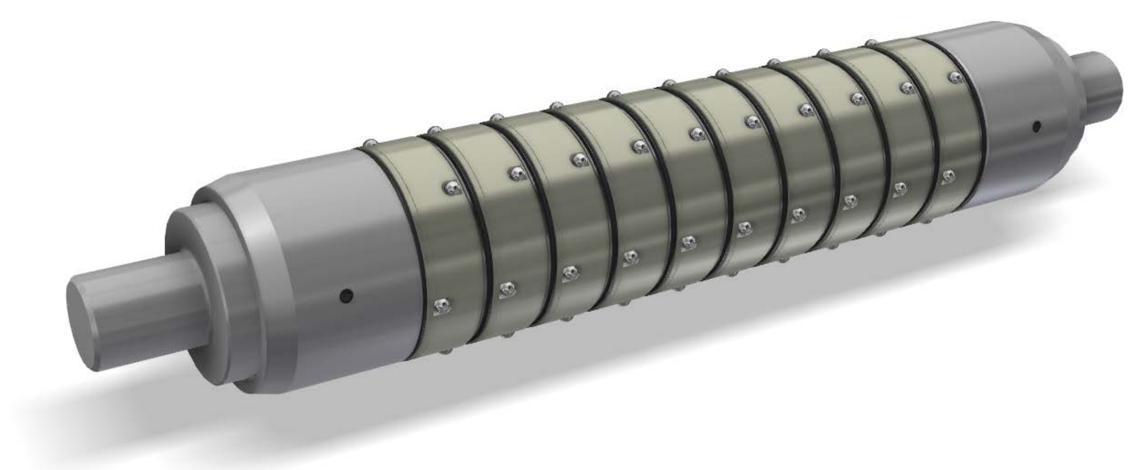
GOLDENROD
CORPORATION

1250-CL

Cam-Lock Differential Shafts

Operation and Maintenance



Important Safety Instructions

When using this Goldenrod product, basic safety precautions should always be followed to reduce the risk of personal injury. Your company's safety instructions and procedures should always be followed. When using this product with any other equipment or machinery, all safety requirements stipulated by that equipment or machinery manufacturer must be followed. Compliance with local, state, and federal safety requirements is your responsibility. No part of these or the following instructions should be construed as conflicting with or nullifying the instructions from other sources. Be familiar with the hazards and safety requirements in your work environment and always work safely.

1. Read and understand all instructions and shaft design application limits before operation.

2. Never use this product for a purpose or in a machine that it was not specifically designed for.

3. Do not exceed the operation loads for this shaft as noted on its engineered drawing.

4. Inspect the shaft for wear and/or other safety and functional deficiencies daily, before each use.

5. Wear safety glasses or proper eye protection when inflating or deflating or otherwise operating the air system.

6. Do not remove or otherwise alter any setscrews or fastening devices prior to using this product.

7. Do not operate this product if any setscrews or other fastening devices are missing.

8. Do not lift shaft manually if it is beyond your capacity. Loads over 1/3 your body weight may be prohibitive. Consult your company safety policy.

9. When lifting a shaft, use proper lifting techniques, keeping back straight and lifting with the legs.

10. Do not carry or lift this product over wet or slippery surfaces.

11. Use appropriate mechanical lifting devices, such as a hoist or shaft puller, for heavier shafts.

12. When performing maintenance or repair procedures, do not pressurize the shaft if journal screws are loose or missing.

13. When performing maintenance procedures, do not pressurize the shaft if the journal is missing.

14. All replacement parts used on this product should be made to original Goldenrod specifications.

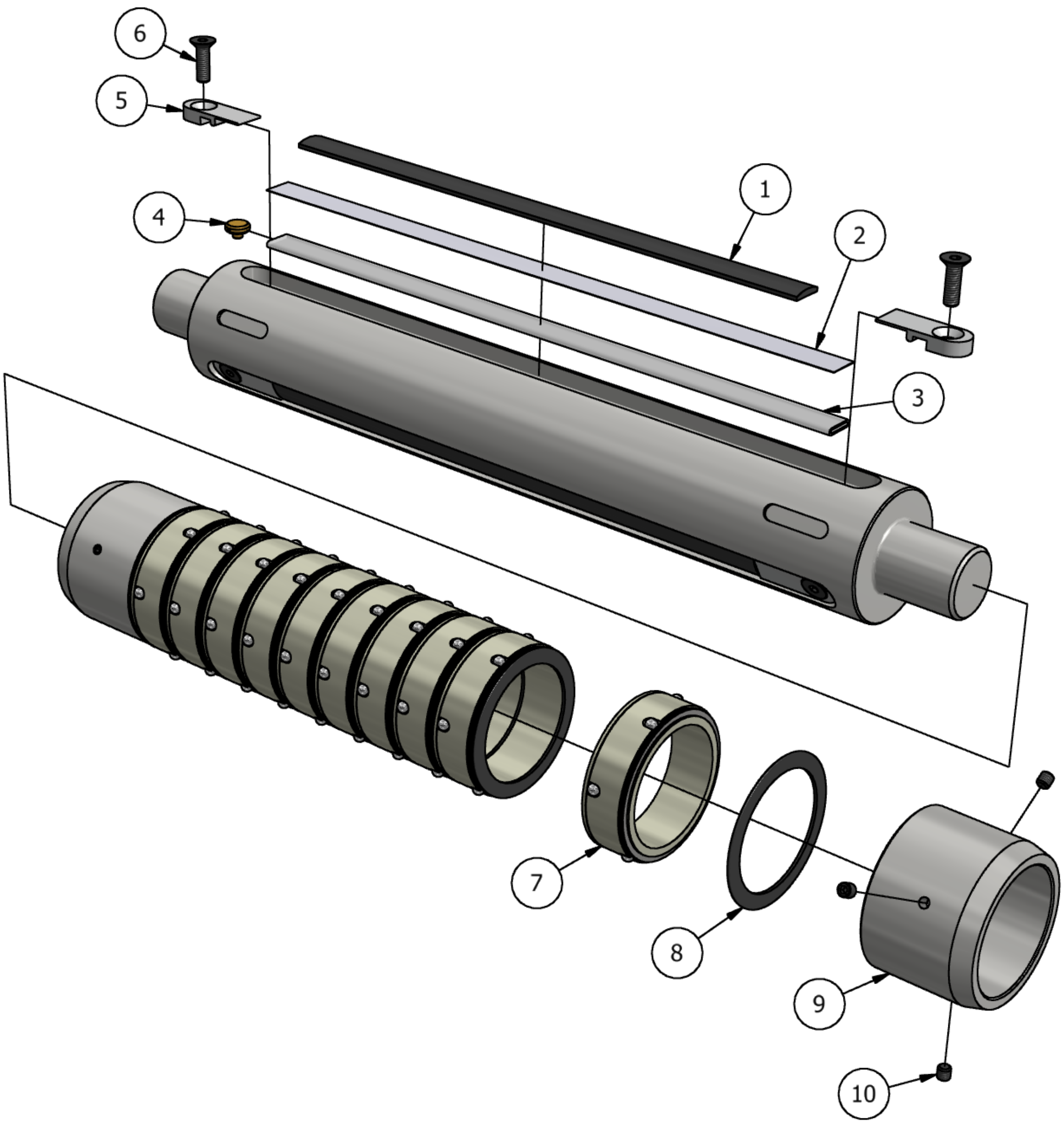
15. All maintenance and repair procedures performed on this product should be done to Goldenrod specifications by qualified personnel.

Contents of This Manual

Component Names and Part Numbers

These are the parts found in a typical 1250-CL shaft. Your customized shaft may vary. Some parts are cut to size for your shaft length, so have your serial number ready when ordering replacement parts.

Item	Part No.	Description	Item	Part No.	Description
1	PL-15-CAM	Friction Ledge	6	FHCS M6x20	Flat Head Cap Screw
2	PL-15	Protective Liner	7	CLR-076.2-23.5	Cam-Lock Ring
3	UT-15	Urethane Bladder	8	SPA-074-60-1.5	Plastic Spacer
4	BP-15	Air Connector	9	(Serial #)-SL	Adjustable End Sleeve
5	CL-4015-CL	Crimping Lug	10	SS M6x6	Set Screw



General Shaft Care

Maintenance Schedule

- Inspect the shaft for wear and safety or functional deficiencies daily, before use.
- During operation shifts, use compressed air to keep shaft free of dust and debris.
- Remove sticky residue as needed.
- Replace damaged or worn out components as needed.
- Monthly, check the tightness of crimping lug screws.
- **Do not oil your Goldenrod shaft**. Lubricants accumulate dust, preventing the shaft from functioning properly. Petroleum-based lubricants will damage polyurethane bladders.

Shaft Cleaning

- Clean shaft with a soft cloth.
- If necessary, a mild solvent such as isopropanol, ethanol, or acetone may be used. Apply this solvent to the cloth, not directly to the shaft. Ensure that the shaft slot and all parts are wiped completely dry of solvents before beginning reassembly.

Cam-Lock Ring Care

- Periodically check that the cam lock rings move freely through their whole range of motion. Consider replacing cam-lock rings that are worn.
- Use compressed air to remove core dust and debris from inside the cam-lock rings. If excessive dust is a problem, check the troubleshooting section for a solution.

Friction Ledge Care

- Periodically remove the cam-lock rings to check the friction ledges for wear.
- Consider replacing friction ledges that have worn unevenly. Friction ledges are interchangeable.
- Goldenrod felt friction ledges run dry, and should not be oiled.

Operation

Air System

Successful operation of the Goldenrod Model CL Cam-Lock Differential Shaft depends upon proper internal air pressure. The Goldenrod Model CL is equipped with one air inlet, which controls the air pressure in the friction ledges.

Your Goldenrod shaft may use one of these two typical designs to supply continuously variable air pressure to the differential ledges:

- "Lift-out" shafts need an easily removable air inflation system. Quick disconnects can work well. Non-rotating quick disconnect connectors may be used in front of the rotary union. This ensures that the rotation happens in the union and not in the quick disconnect fitting.
- Cantilevered or flange-mounted shafts are ideal for supplying constant air to the shaft, as the rotary union can remain in the machine between runs.

Cores

Use good-quality cardboard cores with a minimum .375" thickness for optimal differential winding performance. The inner diameter of the cores should be held to a tolerance of ±.010" for consistently excellent winding.

Always **check the fit of the cores** on the shaft. Make certain that the cores being tested are "good" production-quality cores, not salvaged cores taken from scrap. Measure all cores for the first 5 to 10 trial runs to verify they are within the specification. A core that is too tight or a core cut too long may lock onto the shaft.

Measure core internal diameters to verify they are within specification. Inspect the core edges and internal diameter surface. Loose inner wraps can hang up on ledge slots and cause the core to collapse or lock onto the shaft. Loose particles or ragged edges on the core edges create debris and may be a problem for some customers.

Cam-Lock Rings

Cam-lock rings move with the core in one direction only. When installed on the shaft, they lock the cardboard cores in place when turned in the established direction of winding. Turning the ring backwards releases the rings' hold on the cores for unloading and loading.

When the cam-lock rings are locked into the cores, the cam-lock rings move with the core but can rotate relative to the base shaft. This prevents side-to-side core motion but allows the cam-lock rings to turn at different speeds for differential winding.

The cam-lock rings are positioned using adjustable sleeves at either end of the shaft. Each sleeve is held in place with three set screws. The sleeves should be installed so that there is no wiggle room between rings or spacers, but the rings are not squeezed together with any significant force.

Once cores are set, determine necessary air pressure for tension ledges. Initial ballpark settings are as follows:

Air Pressure	Tension
6-10 PSI	1 PLI

15-25 PSI	2 PLI
30-35 PSI	3 PLI
40-45 PSI	4 PLI

With trials and testing, minor adjustments to the pressure can optimize the shaft for your cores. A simple "air pressure vs. tension" test utilizing a test core and spring scale can be used to verify tension.

HINT: During initial setup, a fiber core of known width can be mounted on the shaft. Attach a cord or cable to the core. Attach a spring scale to the cord. Put a known air pressure into the shaft and pull on the scale attached to the cord. Try this test every 5 psi. Tabulate or graph your results. If the roll weights are high and contribute significantly to the tension you may need to perform the same tension test with a full diameter slit roll.

Verify the overspeed by putting a black mark on the core edge and shaft body. This is simply a quick visual check. Note that the cam-lock rings should turn 1-to-1 with the cores; overspeed should be measured relative to the base shaft. As the roll builds and the diameter increases, the base shaft needs to slow down to maintain the correct overspeed.

HINT: **Overspeed is typically set at 5-10%.** Mark the edge of a core with a black marker to visualize the amount of overspeed. The shaft must have overspeed to function. With 25% overspeed, which is usually too much overspeed, the marked core will move from 1 slot to the next slot per rotation on a 4-ledge shaft. 10% over speed will move the mark about an inch on a 3" diameter shaft.

Core and Roll Removal

To remove the cores from the shaft, keep the friction ledges inflated. Rotate the shaft slightly, in the direction opposite the direction of winding. This will disengage the cam-lock rings, allowing the cores to slide off the shaft. Be sure that the shaft turns relative to the cores to disengage the rings. For lift-out shafts, the friction ledges can be deflated once the cam-lock rings are disengaged. If too much resistance is encountered in changing cores even after the cam-lock rings are disengaged, consider getting cam-lock rings without spring-loaded grip rollers.

Maximizing Winding Quality

For successful differential winding, we need to control tension and overspeed of the differential shaft. It is best to have both web tension and roll diameter sensors to do so. Always start with light tension if possible. Start with low overspeed, light lay-on pressure, and low air pressure in the shaft (around 4 – 10 psi). It is always easier to increase the parameters than it is to decrease them.

The rewind tension is influenced by the roll weight, the air pressure in the differential elements, and the lay-on pressure (nip pressure). The roll weight is of course not adjustable, so tension control must be achieved via the lay-on pressure and the air pressure in the differential ledges.

Tension

In general, as the roll diameter increases, the air pressure in the shaft must be increased to maintain the same tension. Depending on roll build, the increase in air pressure based on roll diameter may not be linear. The air pressure may be "tapered" at some point as roll diameters climb. This is due to the change in moment arm length. Roll weight increases as diameter builds and taper tension will reduce the amount of air pressure change required.

Taper tension is the practice of decreasing web tension as roll diameter increases. Taper tension helps prevent telescoping, crushed cores, and overly tight or loose rolls. Any roll built in excess of about 18" diameter on a 3" core will require taper tension. Refer to your machine manufacturer's manual for specific information on your machine's rewind controls and capabilities.

Obtaining diameter information through an ultrasonic sensor and using that to control the air in the differential shaft will work. This is not as accurate as a load cell but it is much more accurate than the alternative of having an operator manually adjust the air pressure as he notices changes in the rewind roll diameter. If we assume that we know the required air pressure for a given material at the core outer diameter, then we can trim that pressure as the diameter increases. The operator programs a starting air pressure and as the diameter increases the system automatically changes the air pressure. This system can also account for increases in roll weight and taper tension.

Overspeed

If we know the line speed (usually via a rotary encoder on an idler of known diameter) and the rewind roll diameter, we can calculate the required rewind motor speed. The roll diameter information can again be an ultrasonic sensor, a lay-on type position sensor, shaft position sensor (center surface Cameron type), or calculated from material thickness and footage. Most machines have a speed sensor of some type. This tension and overspeed information need to be fed to a simple controller to maintain overspeed and ultimately create a successful differential rewind upgrade.

Unwind Tension

Start with a light brake if possible. If you need 20 psi of air in the shaft to start the web there is probably too much brake force. It is very important that the unwind tension remains constant. A dancer or load cell should control the brake. If the unwind tension is not constant it is very difficult to maintain a constant rewind tension. Make sure the dancer is not at the full top or bottom of its travel range.

Replacement of Air Bladders

1. Bladder material supplied for replacement will be longer than the required finished length. Do not cut bladders to length until instructed. Bladders are made from either clear polyurethane (typical) or weaker but more-flexible black rubber.

2. Deflate the shaft. To remove the bladder you will first need to remove the cam-lock rings and sleeves covering it. Follow the cam-lock ring replacement instructions in the appropriate section below to remove the rings and uncover the bladder.

3. Remove the crimping lugs by unscrewing them with a 4-mm hex key. Pull the bladder and plastic liner out of the slot. Be careful not to lose the air bushing and O-ring that conduct air to the bladder in some shafts. Retrieve the button-shaped brass air connector from the bladder if you will be reusing the connector.

4. If you bought replacement bladders with air connectors pre-installed, skip this step. To install air connectors yourself, use a Goldenrod bladder punch to punch a hole in the bladder with the correct inset and diameter. Stick a thin tool, such as a small hex key with the tip filed to a slight taper, into the air connector's side hole. Use this tool to push the connector into the end of the bladder until the inlet pops through the punched hole in the bladder.

5. Clean the ledge slot, ensuring that it is dry before installing the new bladder. Place the air connector inlet into the air hole, found at one end of the slot, and press the bladder into the slot. Cover the bladder with the plastic liner and screw the crimping lug in to crimp the air end of the bladder.

6. Install the ledge back into the slot. The uncut bladder (and plastic liner) should be hanging out of the slot. You may pull gently on the bladder to prevent it from bunching up, but do not stretch it out.

7. Pressing the bladder into the end of the slot with one hand, draw a cut line on the bladder about 1/8" from the edge of the M6 screw hole. Cut along this line. Regular, sharp scissors will do. Screw in the crimping lug and tighten to 30-40 lb-in. Inflate the shaft and check for leaks. Never inflate a bladder without the friction ledge and cam-lock rings installed.

Replacement of Friction Ledges

1. Each friction ledge is a strip of either wear-resistant ultra-high molecular weight polyethylene plastic (standard) or tough dry felt. In operation, the cam-lock rings rub directly on the friction ledges.

2. Because the friction ledges are held into the ledge slots only by the cam-lock rings, they are very easy to replace once the cam-lock rings and sleeves are removed. Deflate the shaft, then follow the cam-lock ring replacement instructions in the section below to remove the rings and uncover the ledges.

3. It is usually a good idea to replace the bladders when replacing the friction ledges. Follow the instructions in the section above to replace the bladders if doing so. Otherwise, just clean the ledge slot with compressed air and a clean, damp cloth.

4. When the slot is dry, place the new ledge into the slot. When finished replacing all the friction ledges, reinstall the cam-lock rings to secure them.

Replacement of Cam-Lock Rings

1. The cam-lock rings are held in place by adjustable sleeves at the ends of the shaft. These sleeves are usually interchangeable, and lock in place using three set screws each. Thin plastic spacers keep the rings from rubbing metal-on-metal with the sleeves or with each other.

2. Unscrew the set screws from the sleeves enough that the sleeves move freely. Pull all the rings, spacers, and sleeves off of the shaft. The friction ledges are held in their slots only by the cam-lock rings, so be aware that they will fall out.

3. Take this opportunity to clean under the friction ledges. Core dust eventually builds up here and can impede the functioning of the shaft.

4. Install the new cam-lock rings. Don't forget the plastic spacers. Ensure that the rings are installed such that they lock when the base shaft is turned in the direction of winding.

5. Adjust the lateral positioning of the cam-lock rings using one sleeve, and lock it in place using its set screws. Install the second sleeve so that there is no wiggle room between rings or spacers, but the rings are not squeezed together with any significant force.

Troubleshooting

Problem	Possible Cause	Recommended Solution
Cam-lock rings do not lock into cores	Air Leak or obstruction in air system	Make sure crimping lug screws are tightened to 30-40 lb·in. Inflate bladders and use soapy water at crimping lugs to locate leaks. Replace bladders or air lines as needed.
Cam-lock rings do not lock into cores	Cam-lock ring(s) installed backward	Reinstall cam-lock rings with the locking direction the same as the winding direction.
Friction ledges do not activate	Friction ledges jammed with core dust or debris	Remove cores; use compressed air to remove dust and debris.
Grip rollers do not retract	Cam-lock rings jammed with core dust or debris	Cut web and cores from shaft; use compressed air to remove dust and debris.
Grip rollers do not retract	Shaft not turned backwards before cores are removed	Rotate the shaft in the opposite direction of winding to disengage the cam-lock mechanism.
Friction ledges do not retract	Overheated shaft has deformed the bladder(s)	Cut web and cores from shaft; replace bladder(s).
Overheated shaft	Shaft spins inside cores after winding operation has stopped	Stop shaft rotation when not in winding operation.
Overheated shaft	Excessive friction caused by dust or residue buildup	Stop winding operation; remove cores and clean shaft (see Shaft Care section).
Overheated shaft	Excess overspeed	Reduce winding speed: 10% max overspeed, 5% recommended.
Different tension from individual shafts (duplex winding)	Leak or obstruction in air system	Check all bladders for holes, deformation or debris around air fittings.
Excessive core dust	Poor quality cores with rough edges	Replace cores.
Cores stuck on shaft	Excessive tension crushing core	Reduce winding speed: 5% overspeed recommended. Lower the range tension pressure or adjust taper tension. Check Bleeder Valve adjustment.
Cores stuck on shaft	Core crushed by web shrinkage (e.g., stretchable materials)	Cut web and core from shaft
Cores stuck on shaft	Core residue binding core to shaft	Cut web and core from shaft. Clean shaft (see Shaft Care section). Let shaft dry completely before reloading cores.
Cores stuck on shaft	Damaged or jammed cam-lock rings are not retracting	Try rotating the shaft backwards to disengage cam mechanism. If rotation fails, cut web and core from shaft; clean or replace cam-lock rings.
One rewind slit is wandering	Lay-on roller is skewed or may be in uneven contact with web	Adjust/repair the lay-on roll(s).

Other Considerations

Ultrasonic Distance Sensors

An ultrasonic distance sensor can provide an output proportional to the diameter of a roll of material as it winds on a machine. Diameter measurements are used for the following: to control a motor to maintain or match line speed, inertia compensation in a tension control, or to control a clutch or brake to change material tension as the roll diameter changes.

If using an ultrasonic diameter sensor to monitor rewind roll diameter, check its operation to make certain it is working properly. This sensor is used to monitor roll diameter and send a signal that will convert into the appropriate air pressure to your Goldenrod differential shafts. Put your hand in front of the sensor at different distances and check for a change in overspeed of the shaft. If the tension is also controlled by the diameter sensor, check for a change in air pressure in the shaft.

Load Cells

A load cell is a sensor that converts force into a signal that can be used by your machine for tension feedback control. Unlike a dancer or an ultrasonic distance sensor, a load cell's measurement of tension is direct instead of inferred. Load cells are therefore the most accurate and preferred way to control web tension. However, not all older machines can be retrofitted with load cell feedback.

Taper Tension

Taper tension is important and is used in most slitter rewinders. As a roll is built, constant tension squeezes inner layers and can cause wrinkling, starring, and crushed cores. Check for the presence of some taper and if it is controllable. A taper tension setting of 40% is typical. This means that tension will taper off linearly from 100% at the core diameter to 40% at maximum roll diameter.

Lay-On Arms

If using lay-on arms, you should easily be able to lift the lay-on arms. The faster the line speed, the more lay-on pressure is required. If cores are collapsing check the lay-on force. This is often overlooked. Ensure that each of the individual lay-ons exert the same or similar force. Some systems automatically increase lay-on pressure as the line speed increases. It may be a programmable parameter.

HINT: Do the lay-ons contact at the same angle? Do the lay-on air cylinders both push the rolls down or does one push and the other pull? This is common on center – surface winders, i.e. Cameron. If the geometries are not identical the differential air pressure and lay-on or nip pressures of the 2 shafts may need to be very different.

For help or spare parts

Call 1-800-GOLD-ROD (1-800-465-3763) or send an email to cservice@goldenrodcorp.com.

For direct service

Contact your area sales representative. An interactive sales and service map can be found at www.goldenrodcorp.com/saleschart.php.

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