

## Maximizing Operational Efficiencies Through Proper Rotary Wheel Rebuilds

### Financial Justification

Category	Typical Part Costs - 12 Stations	Typical Part Costs - 24 Stations	Typical Labor Costs - 12 Stations	Typical Labor Costs - 24 Stations	Notes
1 - Pins & Bushings	\$8,078	\$16,709	\$23,650	\$41,387	Labor Rates Include On-site Expenses
2 - Linkage Rebuild	\$55,252	\$127,118	\$41,387	\$70,950	
3 - Complete Station Rebuild	\$134,775	\$412,436	\$70,950	\$130,075	
4 - Complete Spool Rebuild	\$307,007	\$561,451	\$47,300	\$82,775	Labor Performed at Graham Engineering
5 - New Spool & Cam	\$695,000	\$995,000	Includes labor to build spool. On-site installation extra.		

- Rebuild costs for Category 1-3 include typical travel & expenses. Rates vary by geographic region.
- Graham Engineering reserves the right to quote rebuild hours based upon condition & location of machines. Estimates will vary.
- Labor costs based on standard 2017 Graham Engineering assembly & Service rates. Rebuild labor costs do not include removing & re-integration of spool into frame.
- Prices for parts & labor are estimates only & will vary based on size (model) of wheel, number of stations, condition of the machine, & other factors. We will be glad to provide a detailed quotation based upon a thorough inspection by a Graham Engineering technician.

### Other Considerations

We are often asked how to justify the cost of doing rebuilds. While the factors vary for each customer, the following should be considered when deciding to do a rebuild.

- “Pay Now or Pay Later” – delaying a rebuild will ultimately raise overall maintenance costs as wear will accelerate, requiring even more extensive parts replacements in the future.
- Lost production due to poor bottle quality.
- Lost production due to frequent machine stoppages to deal with issues such as popping molds, mold damage, or breaking of components.
- Down time for machine repairs will be minimized by following proper rebuilding and maintenance procedures.

“As a rule of thumb, when the speed of the wheel (in RPMs) times the number of years of operation reaches the range of 60-70, you should evaluate the need for a Category 4 rebuild.”



Graham Engineering® rotary wheel spools before (foreground) & after (background) a major rebuild. Minor rebuilds are used to maintain your machine in peak running condition, while major rebuilds are used to obtain “like new” performance.

## Your Graham Engineering Rotary Wheel

Graham Engineering wheels are designed to operate for decades. We estimate that well over 90% of all GEC wheel machines produced since we began manufacturing wheels in 1968 are still in production today. In fact, the first GEC wheel, serial number 00001, is still in production in Mexico.

Like any mechanical machine, rotary wheel machines from Graham Engineering require routine maintenance, as well as periodic rebuilds. To ensure the prolonged life of your machine, it is important to establish a schedule for both routine maintenance & the replacement of worn parts.

In this guide, we will help you fully understand the rebuilding options available to you & show you how to optimize your production & extend the life of your Graham Engineering rotary wheel blow molding machines

### Understanding Symptoms

The following symptoms may indicate the need for a rebuild:

- Bottle quality deterioration
- Parting line mismatch
- Bottle drop inconsistencies, or bottles staying in the molds
- Issues from mold pinches becoming worn, such as bad trimming. (This may be due to mold misalignment of overcompensating for station wear by increasing clamp forces)
- General tightening up of the processing window
- Molds blowing open or loss of clamp pressure
- Frequent issues causing stopping & restarting of the process
- Damage to molds – pinches & leader pins
- Noticeable “play” in the linkages
- Evidence of fretting or metal particles around the bearings
- Excessive wear in the cam – such as a rolled out “lip” noticeable to the touch, or “dishing out” of the cam track
- Breaking of guide rod or tie bar bolts. (This is often evidence of major wear or even cracked parts due to failure to perform appropriate rebuilds)

### Understanding Timing

The following charts give an indication of the typical durations and costs to perform category 1, 2, 3 & 4 rebuilds on 12-Station and 24-Station Rotary Wheel Machines.

	Category	Items Replaced	Typical Frequency
Major Spool Rebuild or Replacement	Complete Stations	1 Pins Bushings	~ 4 Years
		2 Items in Category 1 + Linkages, Spring Stack, Pivot Blocks	~ 6-8 Years
		3 Items in Category 2 & 3 + Guide Rods & Bearings, Actuating Rods & Bearings, Slide Block Bases & Gibs Cam Followers	~ 8-12 Years
	4	All Items Above + Main Shaft, Cam, All Rotating Parts, Valves, Hosing, Rotary Unions + Insert Tubes (Everything both the Bull-Gear & Center Support)	Varies**
	5	Entire Spool Replaced (Labor Hours for on-site replacement)	Varies**

\*\* Varies widely based on frequency of Category 1-3 rebuilds and maintenance practices

### Category 1 - Pin & Bushing Replacement

Generally, the first “rebuild” required on a rotary wheel machine is the simple replacement of linkage pins & bushings.



These can be replaced as needed. Generally when a few stations show excessive “play” in the linkages, it is beneficial to replace the pins and bushings on all the stations at the same time.

### Category 2 - Linkage Replacement

A Category 2 “rebuild” contains the following parts:

- Pins & bushings (Category 1)
- Linkages (as needed)
- Spring stacks



Linkages require replacement when they have become worn from grinding against other linkages, or when they become wobbly as the bearing holes may “wallow out” due to loose fitting of the pins & bearings over time.

When the linkages require replacement, it is our experience that the spring stacks are also due for replacement. Most customers opt to replace all of these units at one time when undergoing a category 2 rebuild.

### Category 3 - Complete Station Rebuild

A Category 3 rebuild contains the following parts:

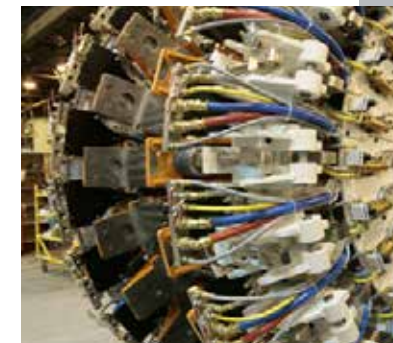
- Everything listed under categories 1 & 2
- Guide rods & guide rod bearings
- Pivot blocks
- Actuating rods & actuating rod bearings
- Bases & gibs (slides) on the cam follower slide blocks
- Cam followers



### Category 4 - Complete Spool Rebuild

This replaces the following parts:

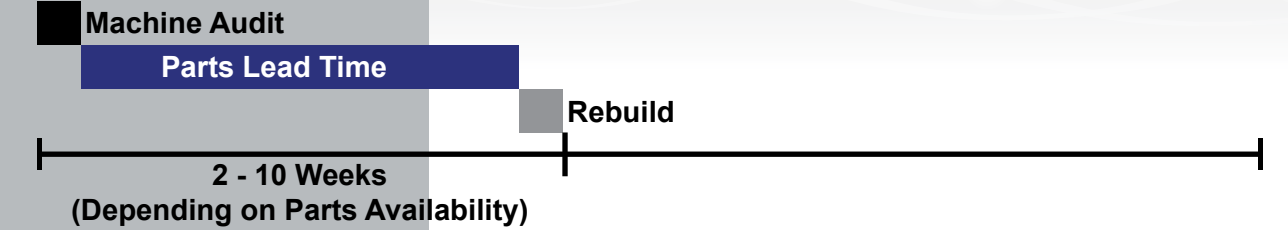
- Everything listed under categories 1, 2 & 3
- Main shaft
- Mold opening cam
- All rotating parts
- Valves, hosing
- Rotary unions & shaft insert tubes



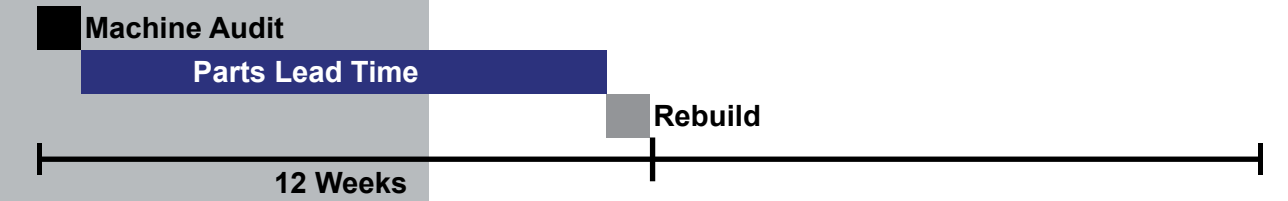
### Category 5 - Spool & Cam Replacement

For equipment that has worked for many years & shows symptoms of wear at the rotary shaft union, bull gear, shaft keyways, & cams, we offer complete spool replacement. All rotating parts are replaced. This will also reduce the time needed for repair. Category 5 is the best option when the line has to be back in production with minimum downtime. Typical change over time is 6-10 days.

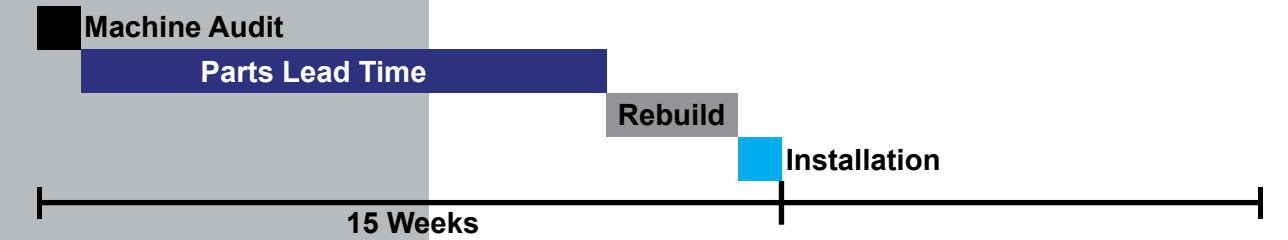
### Category 1 Timeline



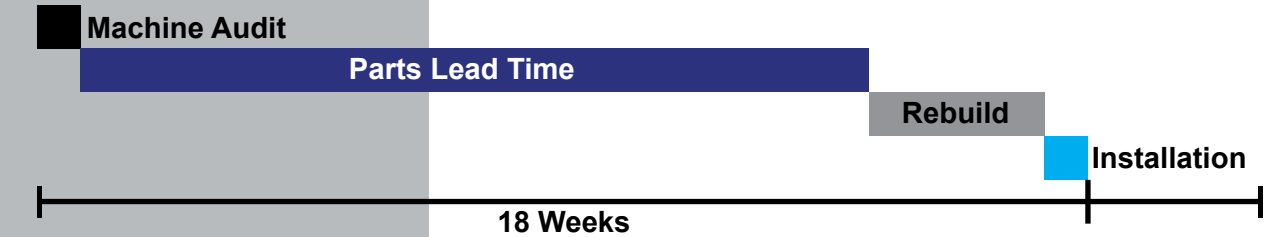
### Category 2 Timeline



### Category 3 Timeline



### Category 4 Timeline



### Category 5 Timeline

