GRAPHALLOY® INDUSTRY APPLICATIONS

Bushing and Bearings • Pillow and Flange Black Assemblies
Hanger Assemblies • Sales and Packing rings • Electrical Brushes and Contacts

GRAPHITE METALLIZING
CORPORATION

GRAPHALLOY SOLUTIONS

GRAPHALLOY, graphite/metal alloy, is a unique self-lubricating bearing material that offers superior performance in hundreds of mechanical and electrical applications.

GRAPHALLOY standard and custom designed products provide lifetime cost savings and sig nificant operating advantages over conventional bushings and bearings.

GRAPHALLOY Solutions and Savings

Reduces Downtime
Reduces Maintenance Costs
Solves High Heat ApplicationsReplaces Ball Bearings, Metal and Plastic BushingsWorks in Submerged ApplicationsSolves
Run Dry Conditions (loss of lubrication)
Solves Current Carrying Problems

GRAPHALLOY Applications

GRAPHALLOY products are used in virtually every
manufacturing and processing industry such as:

Pumps	Ovens	Plating Tanks
Conveyors	Dryers	Microwave Equipment
Valves	Mixers	Extruders
Turbines	Kilns	Food Processing and
more		

BENEFITS	BENEFITS
Self-lubricating :	Requires no grease or oil. Permits continuous operation and eliminates downtime. Will not attract dust.
Hot :	Works at higher temperatures where oil-based lubricants burn-off or oxidize and plastics fail. Operating temperatures to 1,000^{0}F(525^{0}C). Will not gum or seize.
Cold :	Does not congeal or solidify at low temperatures or cryogenic conditions. Maintains self lubricating qualities.
Dry :	Works without lubrication. Survives run dry applications. Eliminates galling or seizing in hot and dry conditions.
Wet :	Operates in submerged conditions and hostile liquids. Will not swell. No lubricant wash out.
Chemically Resistant	Insoluble in most industrial liquids. Works in acids, alkalies, hydrocarbons and liquid gases.
Low Coefficient of Friction :	Constant, low coefficient of friction. Not just a surface layer, solid throughout.
Linear Motion :	Maintains lubrication during linear motion. Lubricationis not drawn out and dust is not pulled in. .
Current Conducting	Eliminates sparks and static. Conducts well.
FDA Accepted :	Acceptedfor food services. No lubricant to drip or cleanup. Easily steam cleaned.

SOLUTIONS TO TOUGH BEARING PROBLEMS... GRAPHALLOY

Custom & Standard Bushings

GRAPHALLOY Bushings are available in over 100 grades of material, any size range, cylindrical with or without grooves, flange or double flange, split, metal backed, or any other design. Contact us for a custom solution or to help you select a standard part.

Pillow & Flange Block Assemblies

GRAPHALLOY Pillow and Flange Block Assemblies are available in solid, self-aligning,split, cast iron, stainless steel, two or four bolt arrangements.
Contact us for off-the-shelf solutions to your design and maintenance problems.

Electrical Products

GRAPHALLOY Brushes, Contacts and Slip rings solve signal applications where low noise is a requirement. Available in various sizes and grades including copper, bronze and silver. Contact us for your current carrying applications.

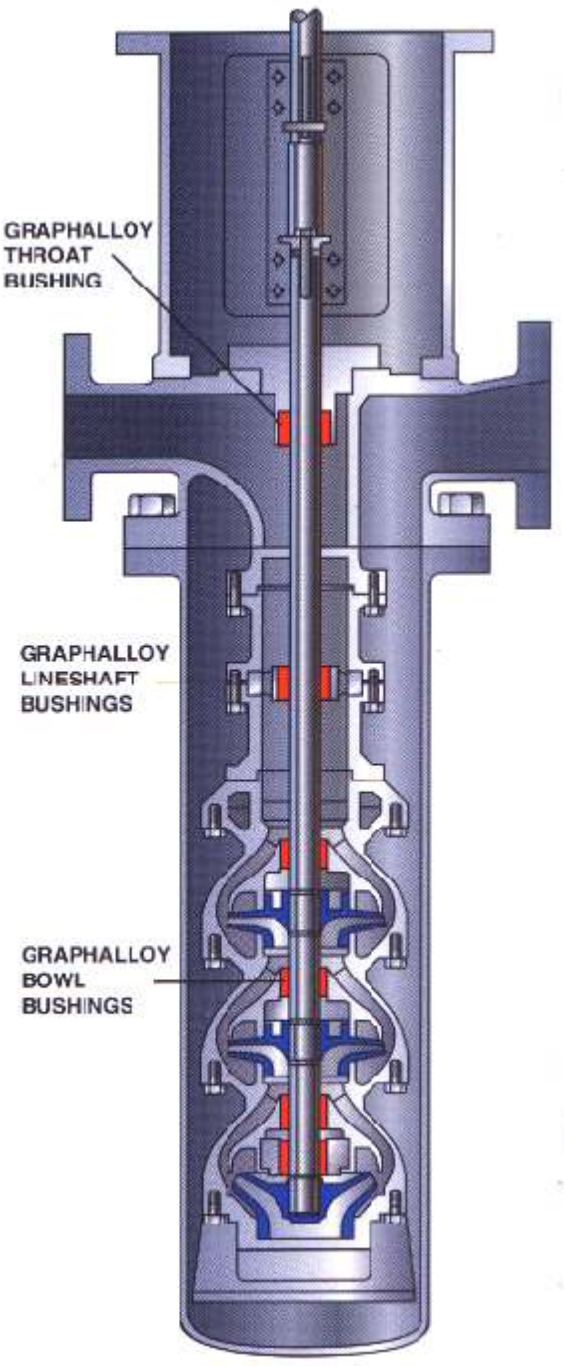
GRAPHALLOY?

Bearings for Pump Survival

The Question .....
How Much can GRAPHALLOY Improve pump Operation?
The Answer.....
Specifying GRAPHALLOY Provides Advantages.

What is GRAPHALLOY?

GRAPHALLOY, graphite/metal alloy is a self-lubricating bearing materialused by designers and maintenance engineers to solve the toughest pump applications-from new installations to retrofitting existing units. GRAPHALLOY is non-galling, corrosion resistant, dimensionally stable and performs at temperatures from cryogenic to higher than 1000! F. GRAPHALLOY allows pumps to survive "run dry" conditions, slow rolloperation and frequent stops/starts where metal and plastics fail. GRAPHALLOY works in low lubricity, corrosive and sour liquids. The use of GRAPHALLOY pump wear parts results in lower operating and repair costs and provides assurance against catastrophic failures.

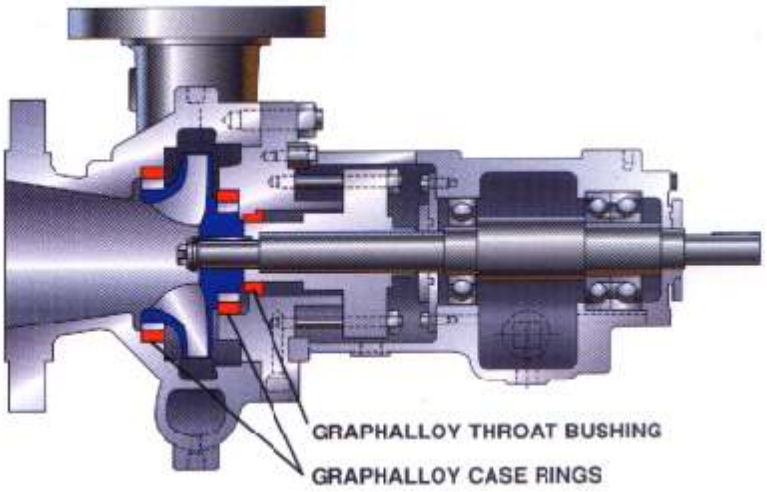


What Makes it work better

FEATURE	BENEFITS
Self-lubricating	Handles low lubricity fluids such as light hydro carbons, liquefied gases and hot water in which metallic bearings wear excessively.
Hot	Runs at temperatures well above the limit of plastic-even in molten metals above 1000^0 F and survives thermal shocks of 22 degrees per second down to ambient.
Cold	Performs in cryogenic temperatures to 450^0 where other materials suffer embrittlement and Seizure.
Dry Running	Survives "loss of pumpage" operation for pro longed periods without either damage or preventing pump restart.
Wet	Resists attack by most corrosive liquids includ ing sulfuric acid, chlorine water, and caustics.
Non-Galling	Permits closer running clearances between rotating parts resulting in higher pump efficiency and lower shaft vibration.
Dimensionally Stable	Maintains dimensional stability when sub merged, under static pressure loading, and over wide temperature swings, providing constant running clearance for all operating conditions. .

The Question .....
How Much can GRAPHALLOY Improve pump Operation?
The Answer.....
Specifying GRAPHALLOY Provides Advantages.

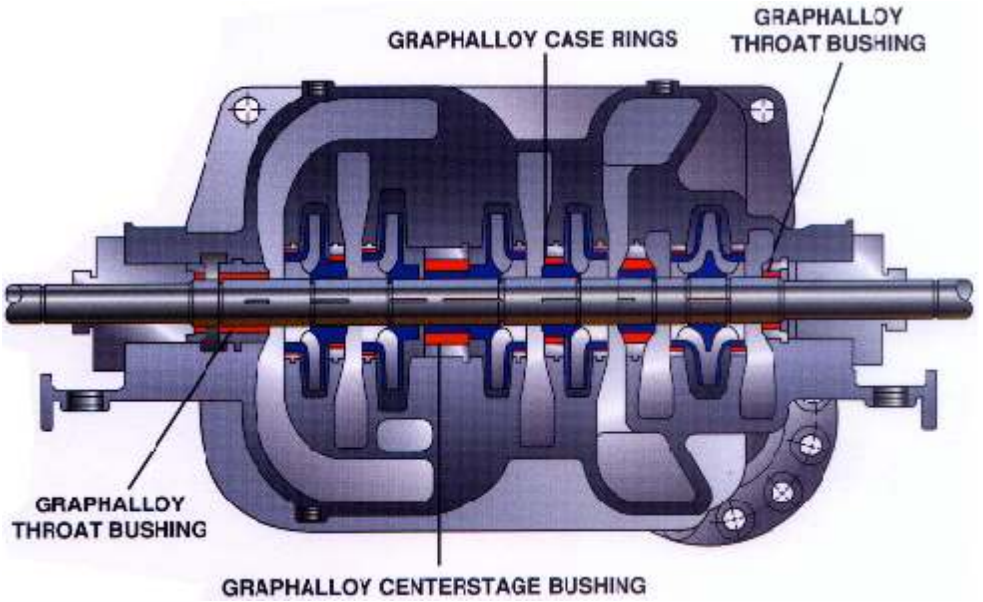
GRAPHALLOY Reduces Vibration
Pumps with mechanical seals have frequent failures due to excessive shaft vibration. Upgrades using GRAPHALLOY case rings and close clearance throat bushings provide reduced vibration levels-in one specific case from 1.2 to less than .05 ips. The result is fewer seal and bearing failures and increased MTBF. This upgrade is recognized in the current API 682 standard.
GRAPHALLOY more than meets this specification.



GRAPHALLOY Extends Life for Continuous Service
Selflubricating GRAPHALLOY has long been the standard, bearing in vertical "can" pumps in the refinery tank farm area. The typical light hydrocarbon products have poor lubricity and tendency to "flash".
This, combined with recurring "run dry" operation when the tanks emptied, motivated designers and operators to search for a replacement of the bronze bearing material. GRAPHALLOY is now the over whelming choice (confirmed by the API 610 Eighth Edition) for lower wear rates and "run dry" survival.

GRAPHALLOY Survives Frequent Loss of Suction
Boiler Feed pumps for industrial steam generators are frequently subjected to loss of suction flow during transient switch over. Pumps fitted with metal and plastic wear parts fail in a few minutes of dry running, while those fitted with GRAPHALLOY will survive and resume pumping when flow returns without wear parts damage. At a chemical plant, three pumps experienced 25 failures in eight years at a cost of $15,000 per failure. Following a GRAPHALLOY retrofit of all pumps, failures were reduced by 68% and the average repair cost by over 90% during the next five years.

GRAPHALLOY Permits Dry Starts
Deep setting vertical turbine well pumps require pre-lubrication of the standard bronze or rubber bearings between the low water level and the dis charge surface. Environmental concerns have now restricted the use of oil and grease. The alternate of water from a local source for startup requires a complicated auxiliary system. The solution is to use GRAPHALLOY lineshaft bushings which eliminate the need for any pre lubrication by running dry until pump discharge flow is established. At one installation, the engineer estimated that it would take more than five minutes for the pumpage to reach the surface discharge from lower water level. GRAPHALLOY survived this duration with margin to spare.



Graphalloy Bearing Applications in refineries and chemical processing

REACTOR SHAFT BUSHING

GRAPHALLOY Increases Equipment Life

The horizontal reactor shaft bushing supports the circulat ing impeller and internal mechanical seal in this continu ous duty application. Although the combination of a low lubricity sealing fluid, intermittent slugs of concentrated sulfuric acid, and high bearing load creates a trouble some environment for other bearing materials, self-lubri-cating GRAPHALLOY will provide superior performance. It resists the acid chemical attack. It does not deform under load and maintains a close running clearance. At one installation the GRAPHALLOY bushing had only .003" wear after four years of operation.

SHELL DEWAXER SPIDER BEARINGS

GRAPHALLOY Lasts Longer

Lube oil stock mixed with MEK and toluene is fed through the chiller to crystallize the wax in solution. The interior scrapper assembly bushings are subjected to temperature swings and attacked by harsh chemicals. GRAPHALLOY works in this environment. It remains dimensionally stable under load and close operating clearance is maintained regardless of the temperature changes. At one refinery, GRAPHALLOY bearings have run four times longer with less than onehalf the measurable wear of the original bronze bearings.

VALVE BODY BUSHINGS

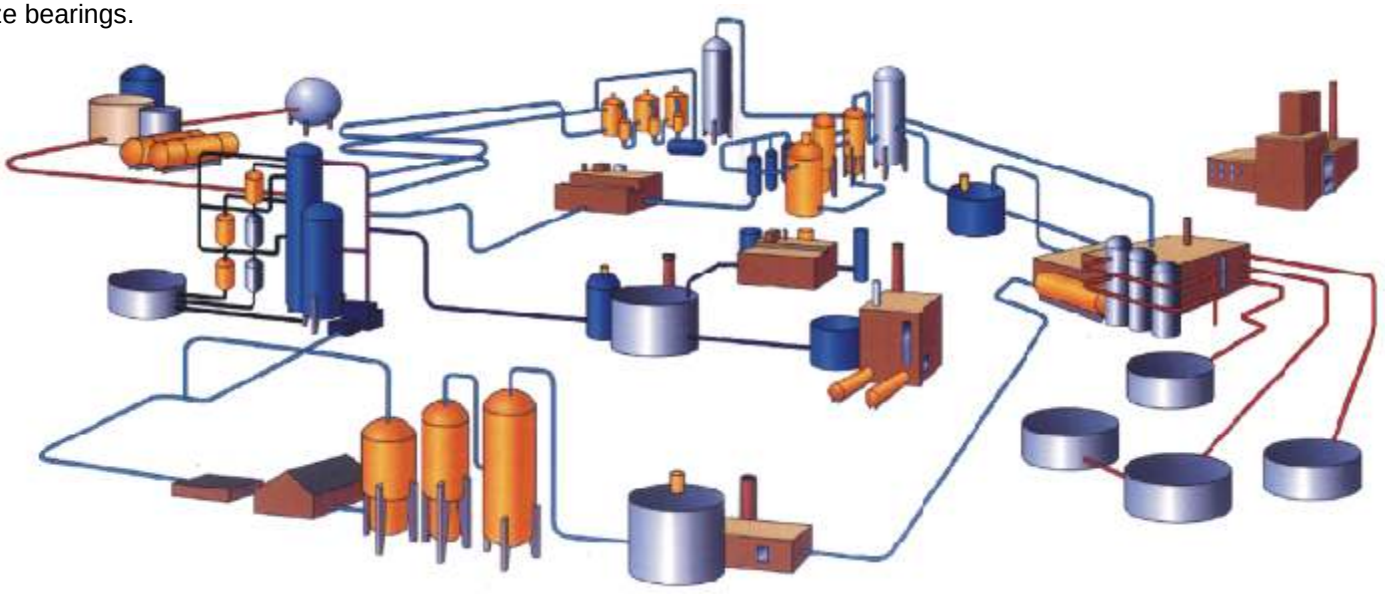
GRAPHALLOY Operation at High Temperatures

In the SMR process gas cooler, the flow of the 1400T hydrogen stream is controlled byblade and butterfly dampers. The OEM furnished bear ings supporting the damper shafts often seized, making the regulation of the process difficult. They were replaced with GRAPHALLOY grade GM GDG2 bushings. Inspected after several years of troublefree operation in this high temperature environment, the GRAPHALLOY bushings were found in excellent condition with the shafts free to rotate.

PUMP THROAT BUSHINGS

GRAPHALLOY Reduces Vibration

Excessive shaft vibration can cause repetitive mechanical seal failures in process pumps. A non-galling, close clearance GRAPHALLOY throat bushing lowers the shaft deflection and improves rotor stability. It also reduces flush liquid consumption. This application is recognized in the current API 682 standard.



Graphalloy Bearing Applications in refineries and chemical processing

GEAR PUMP INTERNAL BEARINGS

GRAPHALLOY Delivers Reliable Operation

Pumping recirculated creosote is always a maintenance headache. The liquid is hot, gritty and provides no lubricity to internal pump parts. One operator tried bronze, plain carbon and tungsten carbide for the idler bushing, but never obtained an operating period greater than 150 hours. Switching to GRAPHALLOY increased service life to over 400 hours.

DUCT DAMPER FLANGE ASSEMBLIES

GRAPHALLOY Simplifies Maintenance

Damper bearings in the power house have always caused maintenance problems due to heat and poor lubrication practices. Changing to dry GRAPHALLOY material eliminates the need for any lubricant which would burn off, gum up or harden at these higher temperatures. At one installation, the upgrade to GRAPHALLOY flange blocks resulted in maintenance free operation for more than seven years.

LINESHAFT BUSHINGS

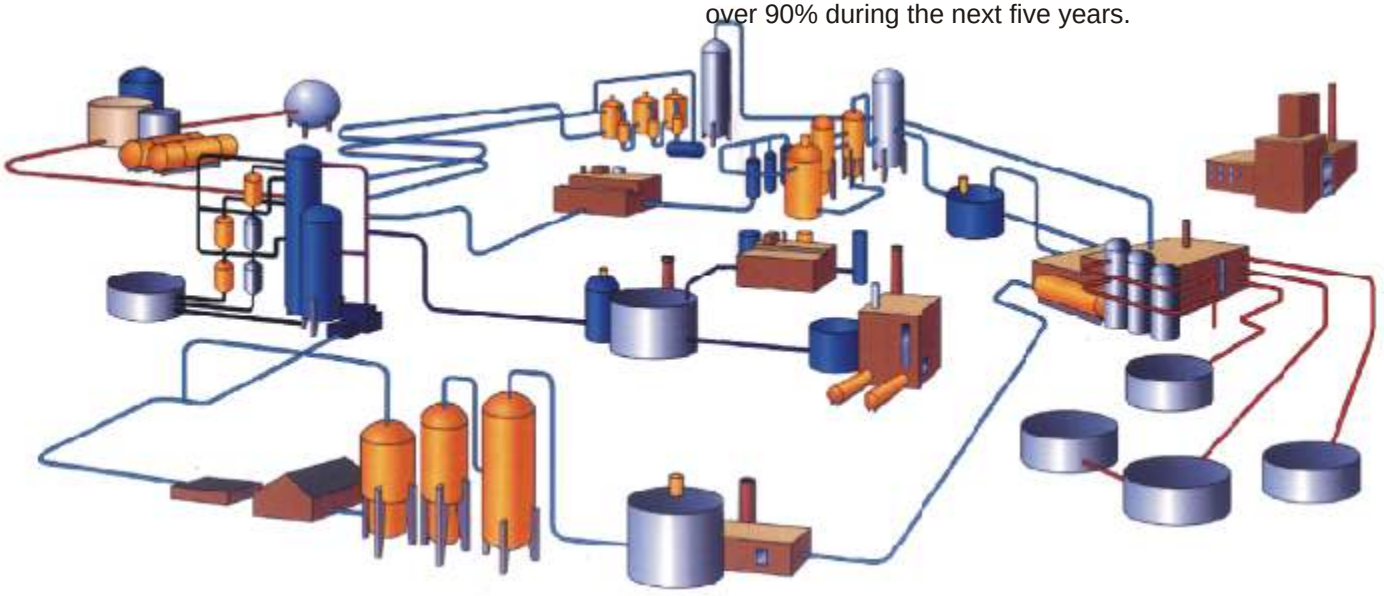
GRAPHALLOY Extends MTBR

Self-lubricating GRAPHALLOY is now the bearing material standard for vertical "can" pumps in the refinery tank farm area. Bronze bearings had proven unsatisfactory when pumping the light hydrocarbon products because of the liquids' poor lubricity and tendency to "flash". This, combined with "dry running" when the tanks emptied, motivated operators to select GRAPHALLOY (confirmed by the API 610 Eighth Edition) for lower wear rates and "run dry" survival.

BOILER FEED PUMP CASE RING & STAGE BUSHINGS

GRAPHALLOY Survives Loss of suction

Boiler Feed pumps for industrial steam generators are frequently subjected to loss of suction flow during transients. Pumps fitted with metal and plastic wear parts fail in a few minutes of dry running, while those fitted with GRAPHALLOY survive and resume pumping when flow returns without wear parts damage. At a Texas chemical plant, three pumps experienced 25 failures at a cost of $15,000 per failure. Following a GRAPHALLOY retrofit program, pump failures were reduced by 68% and the average repair cost dropped by over 90% during the next five years.



Graphalloy Bearing Applications in Paper Making

BOILER FEED PUMP
CASE RING & STAGE BUSHINGS

GRAPHALLOY Survives Loss of Suction

Boiler Feed pumps for industrial steam generators are frequently subjected to loss of suction flow during transients. Pumps fitted with metal and plastic wear parts fail in a few minutes of dry running, while those fitted with GRAPHALLOY survive and resume pumping when flow returns without wear parts damage.

DUCT DAMPER FLANGE ASSEMBLIES

GRAPHALLOY Simplifies Maintenance

Damper bearings have always caused maintenance headaches due to heat and poor lubrication practices. Changing to dry, self-lubricating GRAPHALLOY eliminates the burn-off, gum-up and hardening expected when using grease and oil at higher temperatures. At one installation, the switch to GRAPHALLOY flange blocks resulted in maintenance free operation for more than two years.

SCREW CONVEYOR SPLIT BUSHINGS

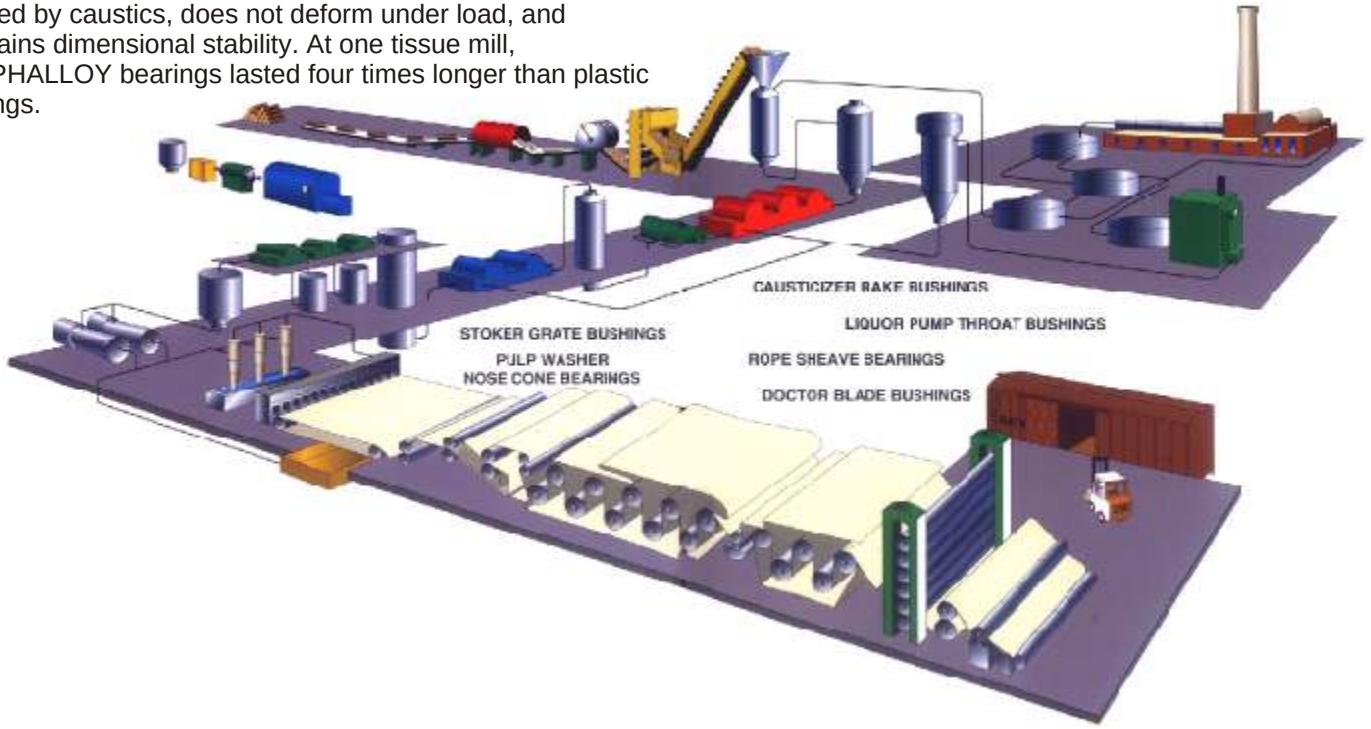
GRAPHALLOY Lasts Longer

Washed pulp is fed through screw conveyors into storage tanks. The split hanger bearings which support these screws are submerged in high consistency stock and attacked by the chemicals and heat. GRAPHALLOY provides superior performance in this continuous duty application. It is not affected by caustics, does not deform under load, and maintains dimensional stability. At one tissue mill, GRAPHALLOY bearings lasted four times longer than plastic bearings.

PUMP THROAT BUSHINGS

GRAPHALLOY Reduces Vibration

Excessive shaft vibration is often the root cause of repeti tive mechanical seal failures in process pumps. Using nongalling, close clearance GRAPHALLOY throat bush ings reduces the vibration levelsùthereby improving rotor stability, and resulting in fewer seal and frame bearing failures. As an added benefit, the tight shaft to bushing clearance reduces flush water consumption.



Graphalloy Bearing Applications in Paper Making

AGITATOR SHAFT BEARINGS

HOT LIME CONVEYOR PILLOW BLOCKS

GRAPHALLOY Increases Equipment Life

Stock agitator bushings frequently run dry because of changing liquid levels. The ability of GRAPHALLOY to operate in these constantly changing wet to dry conditions as well as resist caustic and acidic chemical attack will significantly extend the time between equipment shut downs. At one mill, life was more than tripled with a cost savings of $40,000 annually in parts and labor.

GRAPHALLOY Operates at High Temperatures

The conveyor that moves the hot lime from the kiln to storage needs return roller pillow blocks with bearings that can survive temperatures above the rating of grease lubricants. GRAPHALLOY material can meet this needup to 750^{0}F as complete assemblies or replacement bushings.

SALT CAKE DRAG
CONVEYOR PILLOW BLOCKS

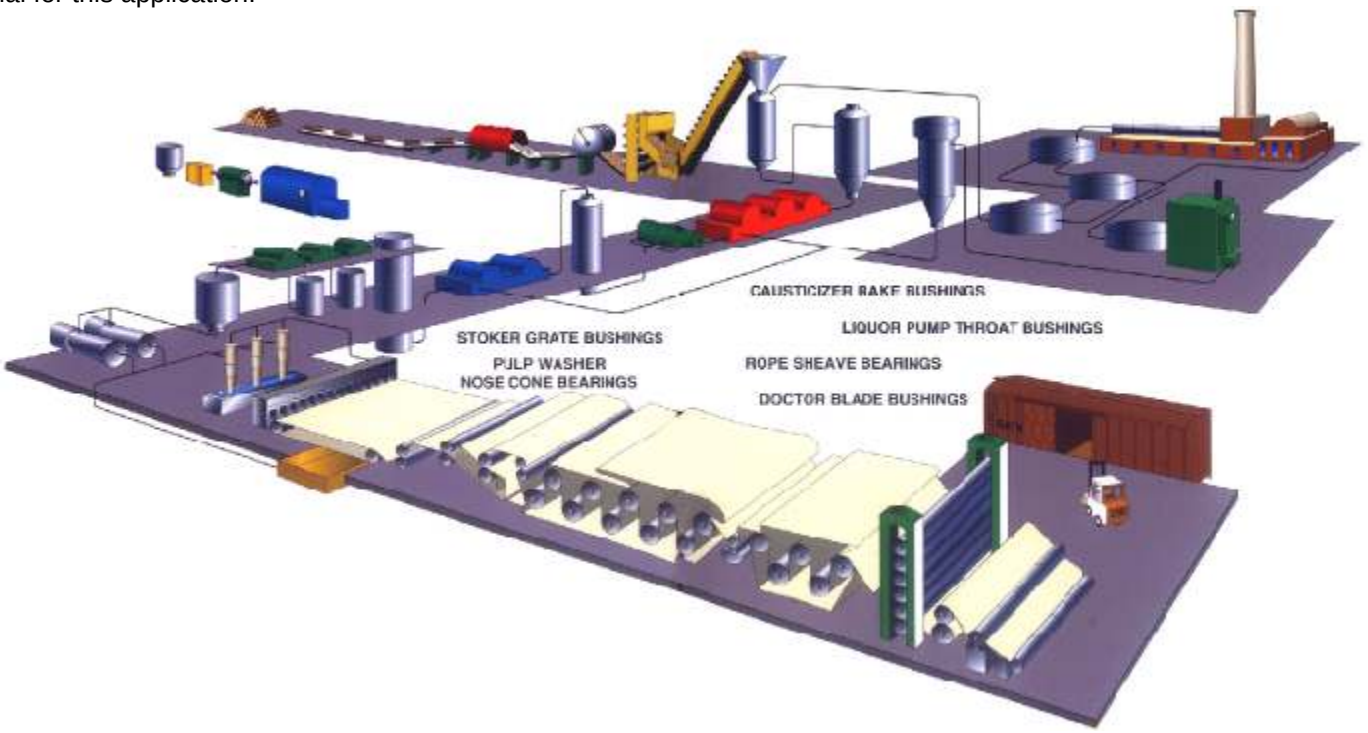
ROLL HEADER GLUING MACHINE
PILLOW BLOCKS

GRAPHALLOY Requires No Lubrication

Pillow block bushings in precipitator drag conveyor systems are exposed to the hot, corrosive environment of salt cake ash. Because it requires no oil or grease, GRAPHALLOY does not attract or hold these abrasive particulates and eliminates seizure caused by met~ltometal contact. It is the preferred material for this application.

GRAPHALLOY Requires No Lubrication

Header gluing machines run 24 hours per day, 7 days per week. This continuous operation requires, low maintenance, long life components. GRAPHALLOY self-lubricating pillow blocks assure this along with the capability to operate in the 400^{0}F environment of the air release systems.



GRAPHALLOY BEARINGS IN METAL PROCESSING

DUCT DAMPER FLANGE ASSEMBLIES

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FURNACE TAP GATE CAM FOLLOWERS

GRAPHALLOY Does Not Seize

In this design of a furnace tap gate, the 18 in. x 15 in. Metal plate slides open and closed via cam followers rolling on stationary rails. Although the travel is short and the gate opens only once an hour, conventional grease lubricated cam followers would certainly lockup when exposed to the expected 750^{0}F. Therefore the OEM chose this component with GRAPHALLOY bearing material. It was dimensionally interchangeable with needle bearing configuration, but required NO LUBRICATION.

ENTRY PINCH ROLL BUSHINGS

GRAPHALLOY Increases Equipment Life

The interior temperature of an annealing furnace is in the range of 1200! F. Even though bearings supporting the pinch rolls are outside the walls, they still reach temperatures up to 750^{0}F ...and yet must be able to compensate for shaft expansion from cold startup to production temperature levels. Rigid, grease lubricated rolling element bearings could not meet these conditions, so the operators specified GRAPHALLOY journal sleeve bushings - sized for installation in a special metal shell and inserted into the existing housing. Since 1990 the design has been operating successfully in this tortuous environment.

COOLING BED LINE UP ROLL PILLOW BLOCKS

GRAPHALLOY Saves Maintenance Costs

The pillow blocks supporting the line up rolls originally had grease lubricated ball bearings. However, the combination of high temperature and intermittent operation caused frequent maintenance problems... numerous bearing replacements, seizures with the resulting roll "flat spot" repairs, and the occasional production line shut down. The engineering solution was to replace the OEM supplied ball bearings with interchangeable pillow blocks using GRAPHALLOY bushings. The initial cost was higher, but annual dollar savings in roll life, replacements, labor and lubricants was over $200,000

GRAPHALLOY BEARINGS IN FOOD APPLICATION

- FDA Accepted Grades
- SelfLubricatingWorks without External Lubrication
- Operates to +750! F
- No Lubricant Loss in Steam or Pressure Washes
- Solves Grease Seepage into Food Product
- Works Submerged in Low Viscosity and Corrosive Liquids
- Proven to Reduce Downtime

GRAPHALLOY Products Include...

- Sleeve Bearings ò Flange Bushings
- Cam Followers ò Pillow and Flange Blocks

GRAPHALLOY Bearing Solutions for...

- Ovens
- Pumps
- Mixers
- Conveyors
- Roasters.

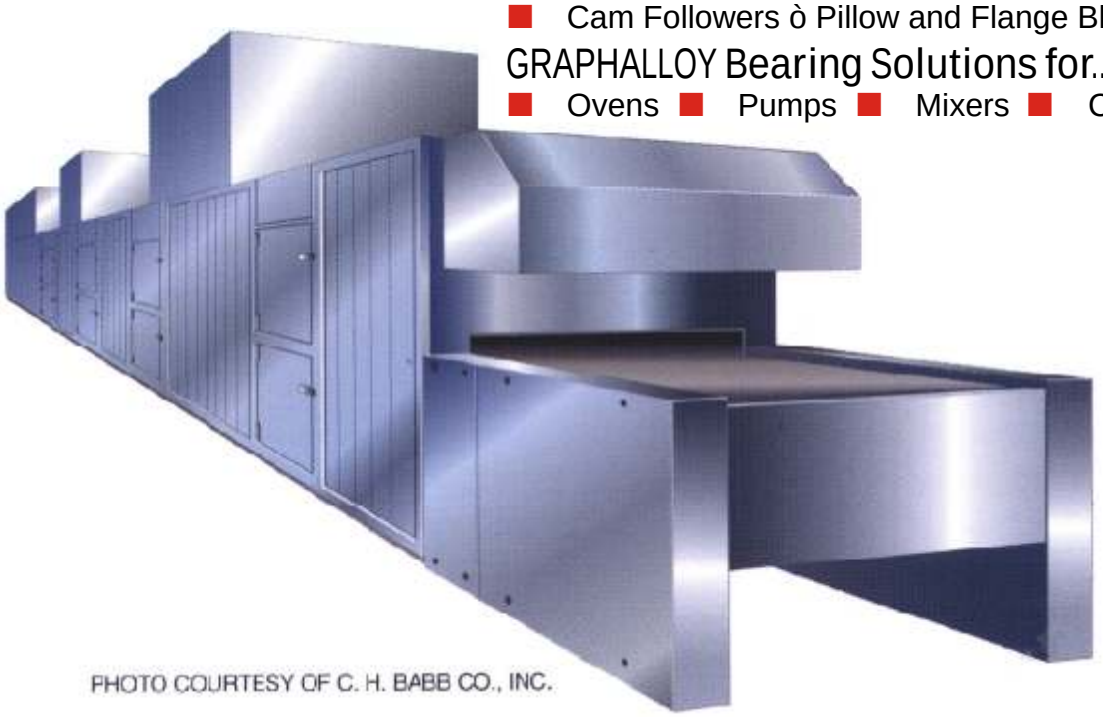

PHOTO COURTESY OF C. H. BABB CO., INC.

GRAPHALLOY is the Answer to Your
Bearing Problems
in These and Other Applications...

Horizontal and Vertical Pumps
"...GRAPHALLOY is the choice for lower wear rates
and run dry survival..."

Dampers and Louvers
"...GRAPHALLOY prevents stuck assemblies..."

Agitators and Mixing Equipment
"...GRAPHALLOYtriples bearing life..."

Reactors and Shell Dewaxers
"...GRAPHALLOY works in harsh chemicals..."

Submerged Trash Screens
"...GRAPHALLOY still gives troublefree service
after years on the job..."

Extrusion Machines
"...GRAPHALLOY eliminates product contamination..."

Wash Down and Cleaning Lines
"...GRAPHALLOY's life farexceeds that of metal..."

Switch Block Valves
"...GRAPHALLOY provides needed valve stem support
in retrofit design..."

Screw Conveyers
"...GRAPHALLOY lasts four times longer than plastic..."

Ovens & Furnaces
"...GRAPHALLOY withstands the high heat without lubrication..."

GRAPHALLOY

Advanced Materials & Tribology

Division of Amcats Pvt. Ltd.

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