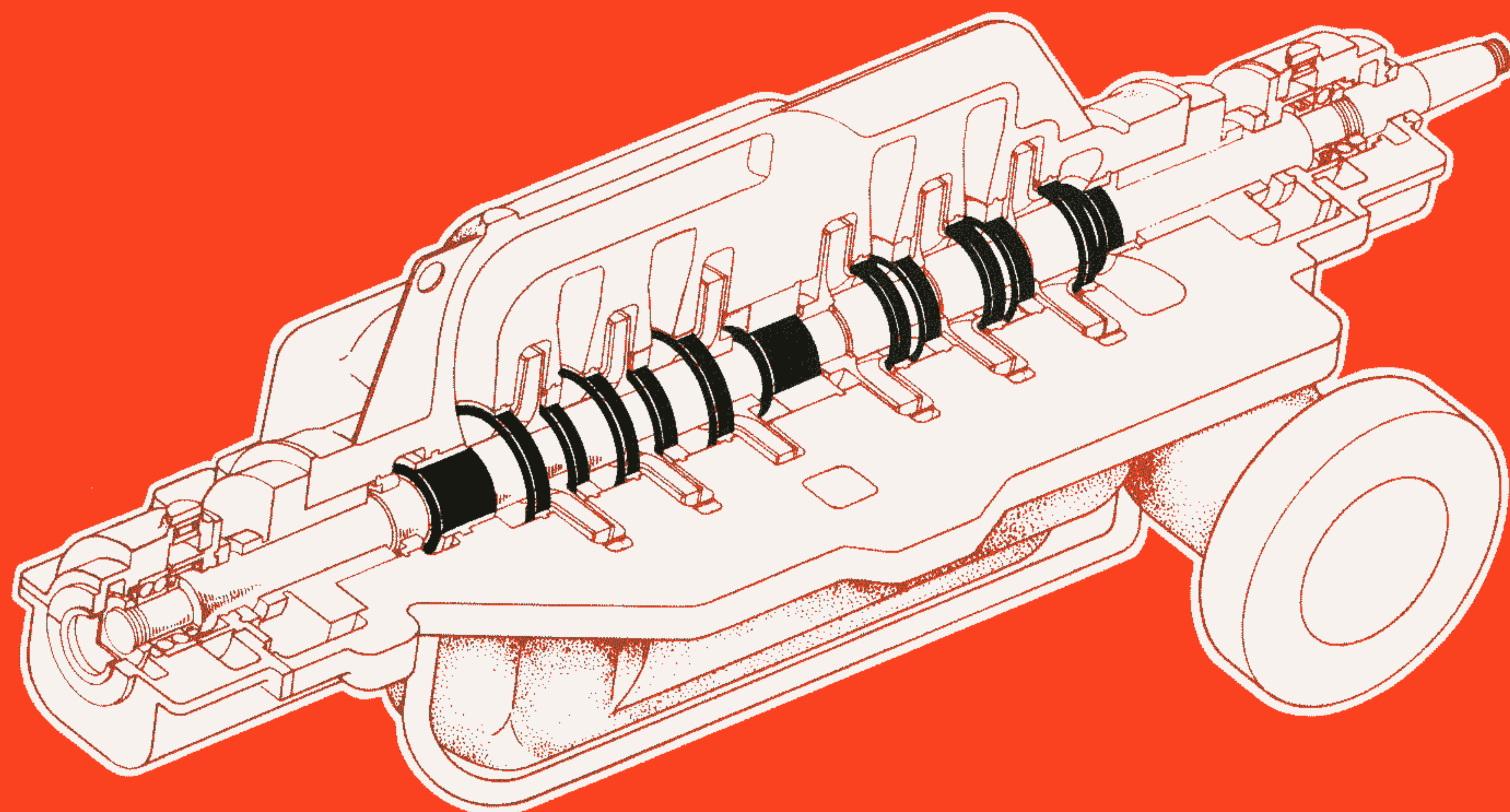




**THE GRAPHALLOY® UPGRADE
IMPROVES RELIABILITY
and EFFICIENCY**



GRAPHALLOY® HORIZONTAL PUMP TEST RESULTS

**GRAPHITE METALLIZING
CORPORATION**

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To Improve the Reliability and Efficiency of your horizontal pumps, Look to GRAPHALLOY® as the Answer to YOUR Problems.

GRAPHALLOY, a graphite-metal alloy manufactured only by Graphite Metallizing Corporation, has long been used to provide reliability when pumping low-specific-gravity fluids or when "run dry" conditions occur. Successful applications include heater drain and condensate hotwell services in electric generating power stations, stripper pumps on barges, and light hydrocarbons pumps at hot, ambient and cryogenic temperatures in petrochemical plants and refineries.

Because of these uses in vertical pumps, Graphite Metallizing Corporation next began working with pump manufacturers and repair facilities to apply our GRAPHALLOY experience to horizontal pumps.

The first horizontal applications were field conversions of pumps with histories of frequent breakdowns. Often these were handling low-specific-gravity liquids. In a standard pump design with metal wear rings and metal stationary parts, poor lubrication or transient run-dry conditions cause the pump to gall or seize. GRAPHALLOY stationary wear rings improved reliability, lowered vibration and provided higher efficiency. Since 1979 horizontal pumps of many manufactures have been upgraded with GRAPHALLOY wear parts in applications from pipelines to boiler feed services. Each has enhanced GRAPHALLOY's reputation as the effective solution to a trouble-prone pump.

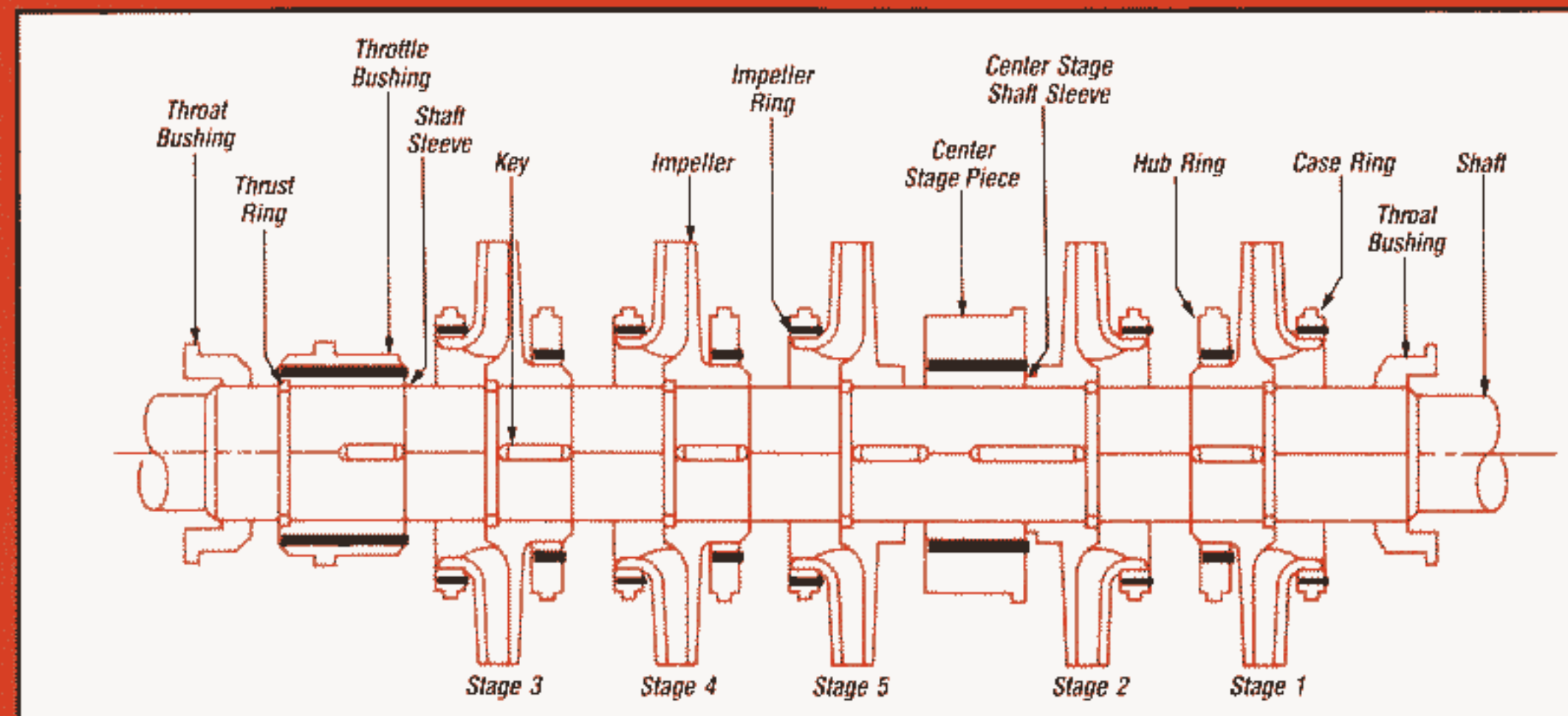
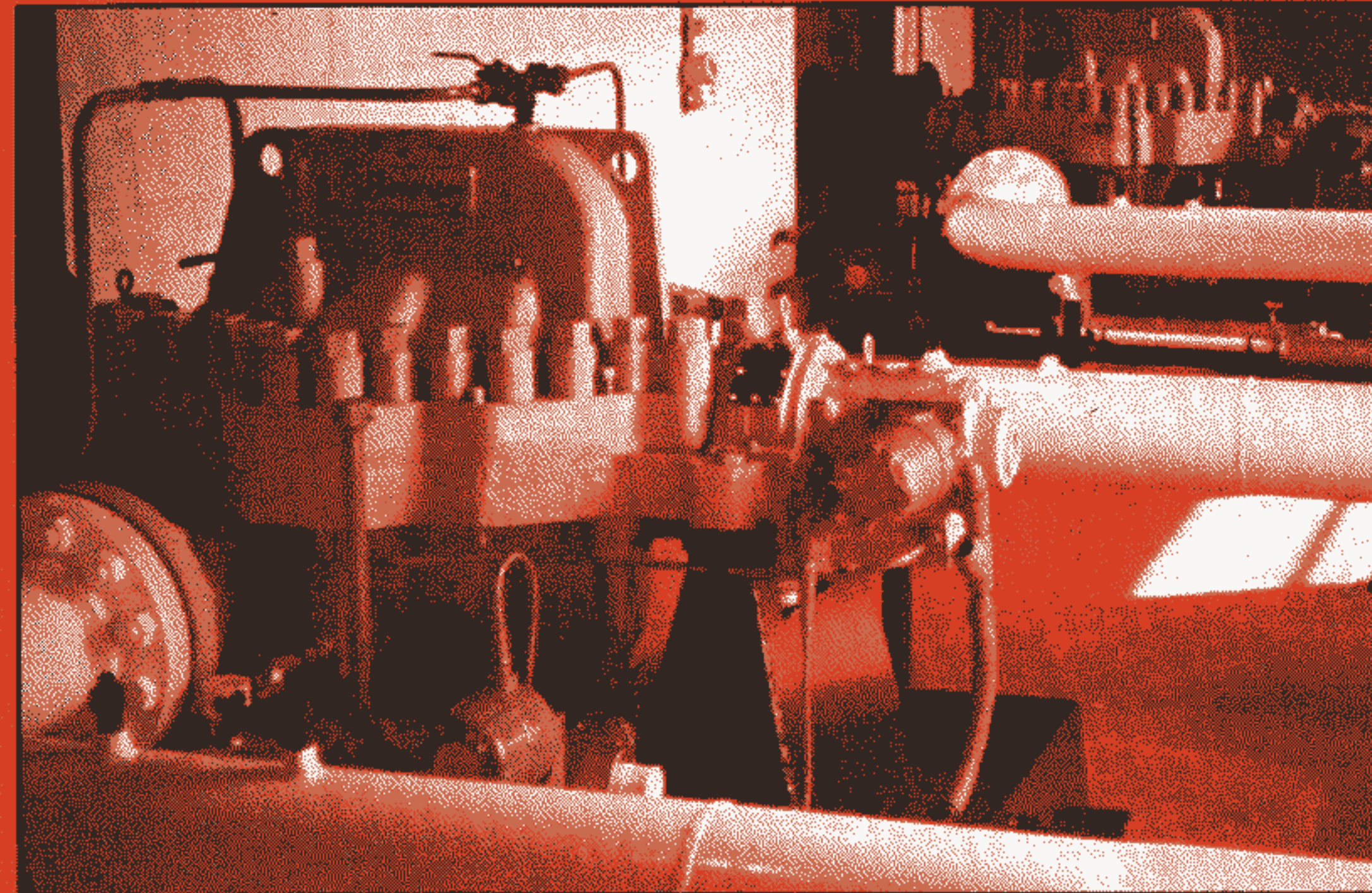
THE QUESTION...HOW MUCH CAN GRAPHALLOY IMPROVE PUMP OPERATION?

GRAPHALLOY field upgrades gave us individual case specifics. In order to corroborate this field data, Graphite Metallizing Corporation and Sulzer Bingham Pumps, Inc. collaborated in a program to test a horizontal pump fitted with GRAPHALLOY stationary wear parts...and then with standard chrome design in the same set-up at Sulzer Bingham's Portland test facility.

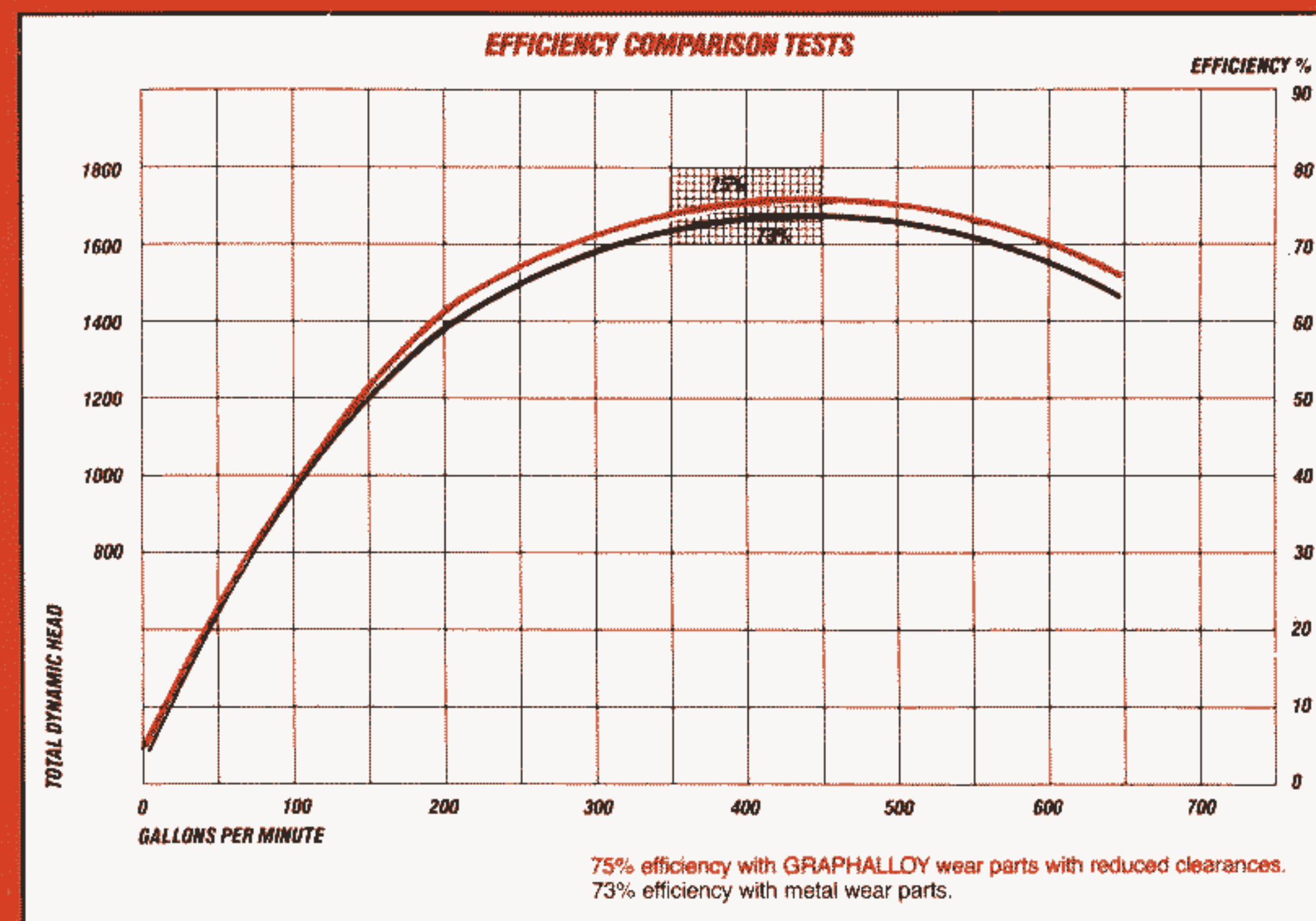
THE OBJECTIVE...COMPARE THE GRAPHALLOY PERFORMANCE TO THE INDUSTRY STANDARD

The tests will demonstrate these well-known benefits of a GRAPHALLOY UPGRADE:

- Higher efficiency.
- Lower vibration levels.
- Ability to "run dry".
- Improved reliability under transient adverse conditions.



The test pump was a five-stage, split case, 3600 r.p.m. type MSD with the GRAPHALLOY wear parts being the case rings, hub rings, throttle bushings and the center stage piece.



Test results showed a significant increase

- **OBJECTIVE:** To compare the performance of a GRAPHALLOY-fitted versus a chrome-fitted pump.

Test 1: Pump fitted with chrome parts having standard clearance of .013" was given the six-point test for total head, horsepower and vibration level vs. capacity.

RESULTS: Total Head @ 425 GPM: 1400 Ft.
Efficiency @ 425 GPM: 73%
Vibration @ 425 GPM: .78 Mills

Test 2: The same pump fitted with GRAPHALLOY parts having tighter clearances was given the same test.

RESULTS: Total Head @ 425 GPM: 1450 Ft. (3.6% better)
Efficiency @ 425 GPM: 75% (2% pts. better)
Vibration @ 425 GPM: .40 Mills (49% better)

- **OBJECTIVE:** To prove the GRAPHALLOY-fitted pump can withstand a complete loss of suction without seizure.

Test 3: The GRAPHALLOY-fitted pump was run dry for 22 minutes after the suction valve was closed and then performance-tested under the above Test 2 procedure.

RESULTS: The pump ran throughout.
No damage to the wear parts.
No decline in operating performance.

- **OBJECTIVE:** To prove the GRAPHALLOY-fitted pump will survive transient thermal shock and suction pulsations without seizure.

Test 4: The GRAPHALLOY-fitted pump was run at 'shut-off' for 54 minutes to increase the fluid temperature from 60 to 315°F. Quick opening of the discharge valve then caused the pump to be thermally shocked to a maximum ramp of 22°F per second down to ambient.

Test 4a: A rapid opening and closing of the suction valve generated pulsing of the liquid through the pump. Fifty cycles then were completed.

RESULTS: The pump ran throughout.
No damage to the pump.
No reduction of normal operating performance.

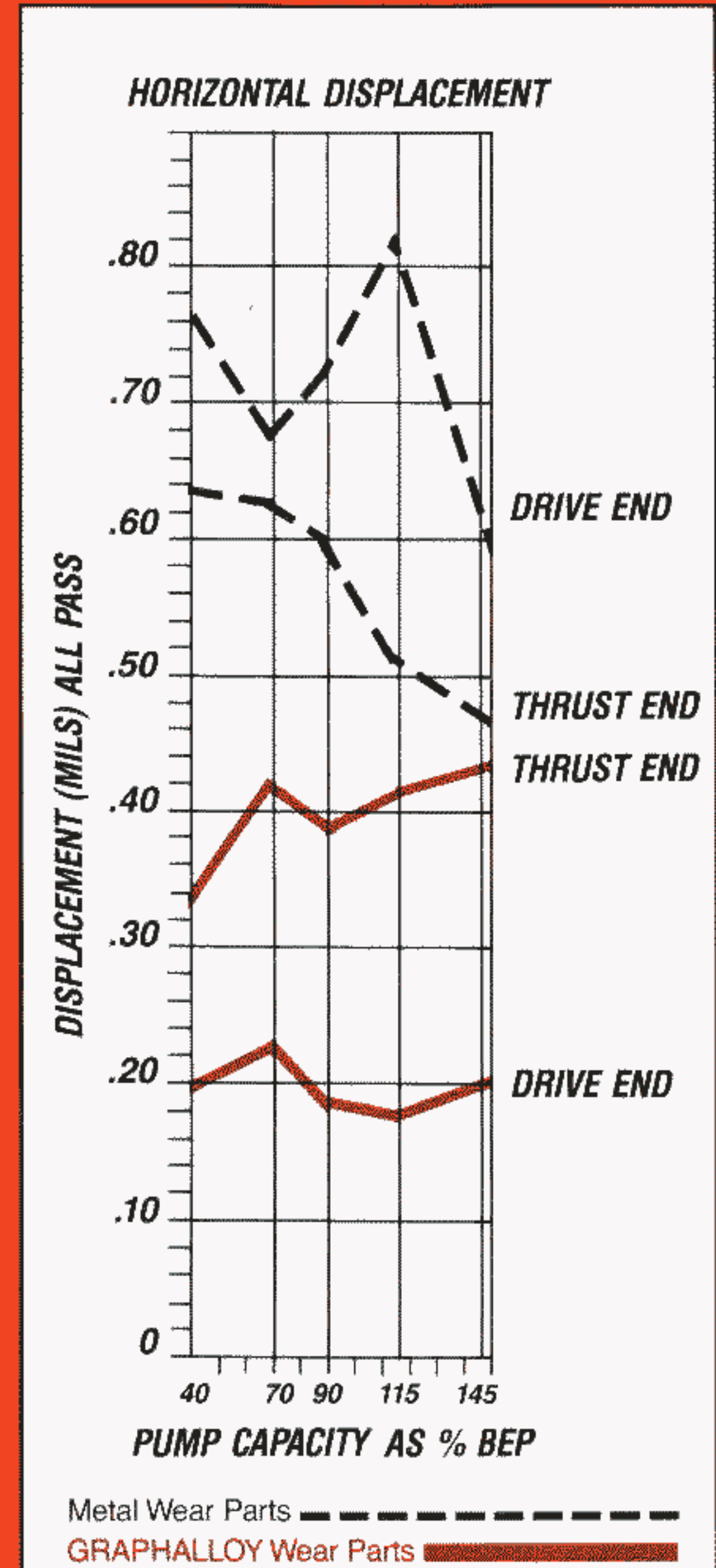
- **OBJECTIVE:** To show that a chrome-fitted pump will seize when suction flow is lost.

Test 5: The procedure of Test 3 was followed but the metal-fitted pump could run only for 2 minutes 10 seconds of "run dry" operation.

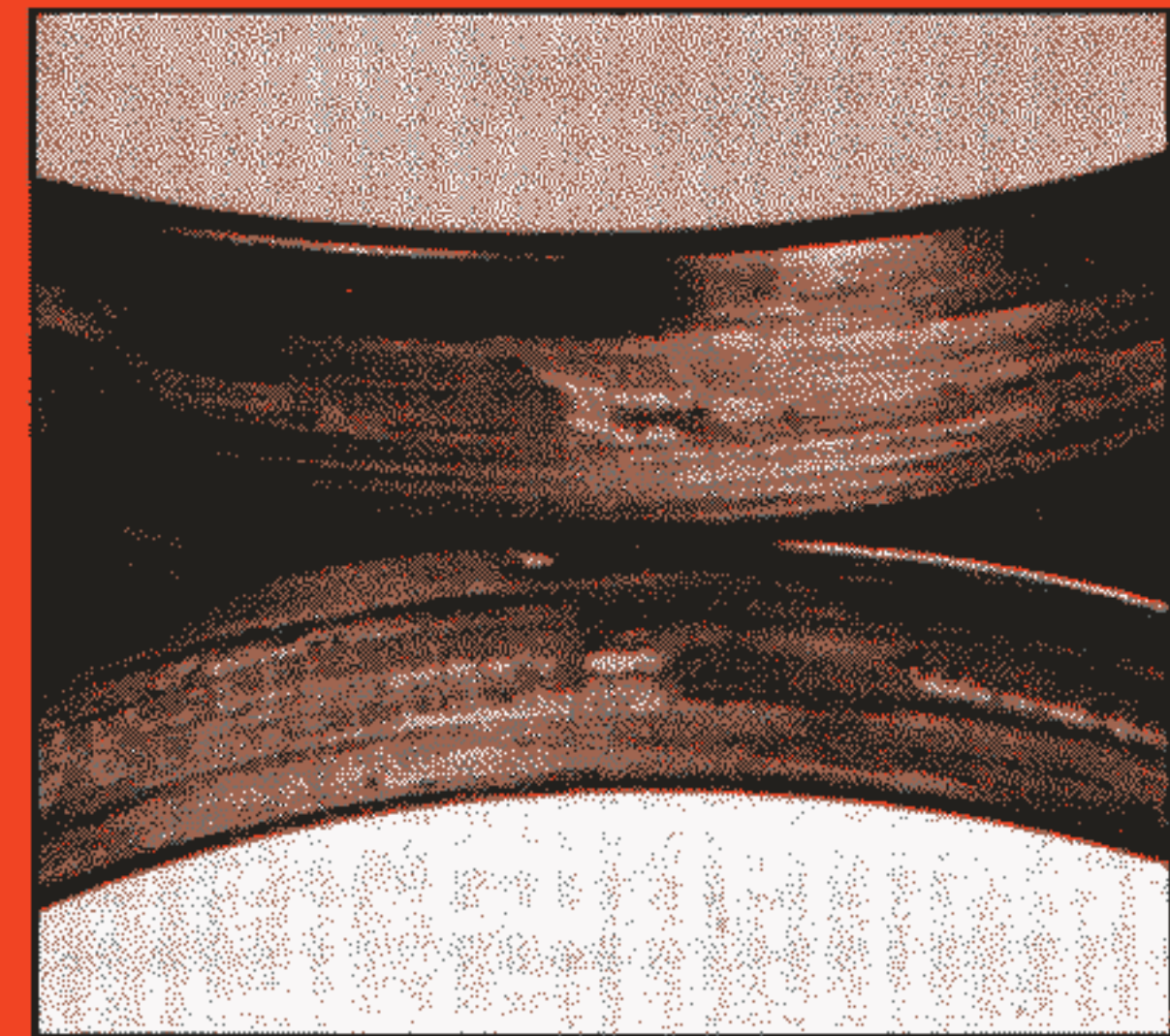
RESULTS: The pump seized.
The suction eye ring failed.
The stationary and rotating wear rings friction-welded together.
The throttle bushing and shaft sleeve galled.

THE ANSWER...SPECIFYING GRAPHALLOY® PROVIDES REAL ADVANTAGES.

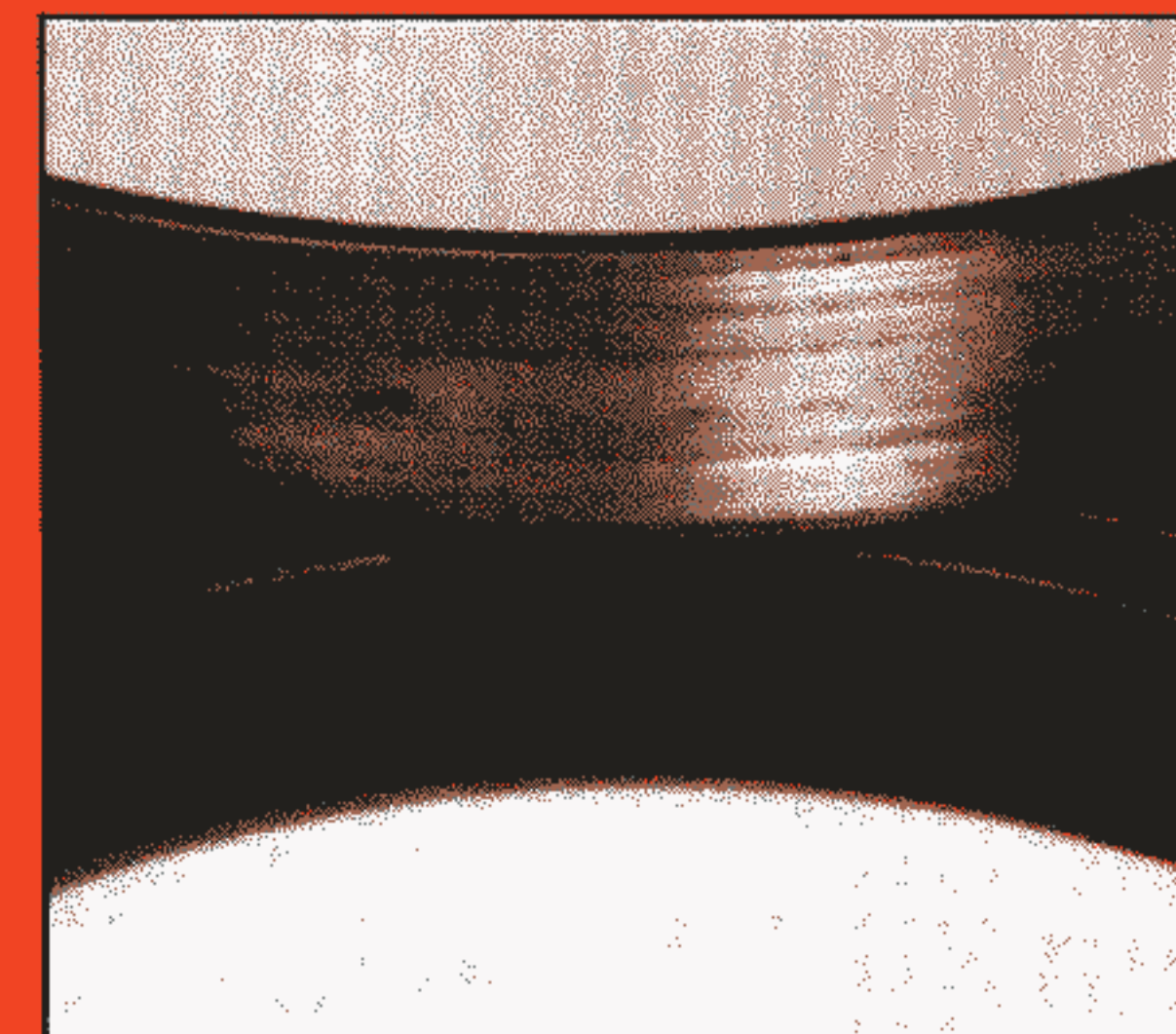
We are indebted to Sulzer Bingham Pumps, Inc. for their principal role in demonstrating these test program results.



Test results showed a significant decrease in vibration levels.



Metal Wear Parts after Dry Run Test.



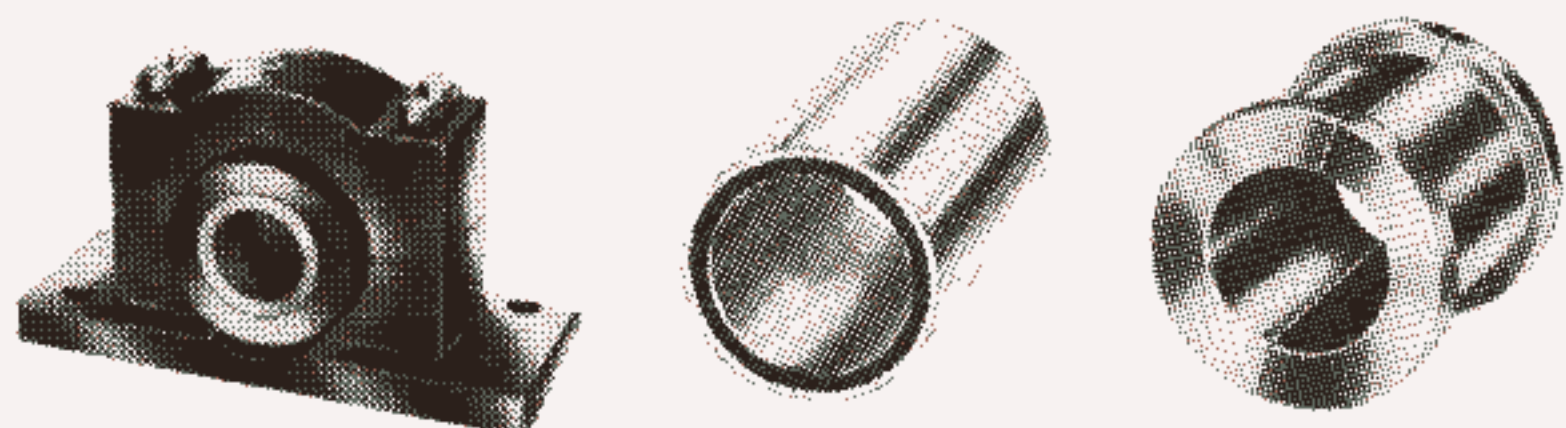
GRAPHALLOY Wear Parts after Dry Run Test. Test Results Showed GRAPHALLOY Wear Parts could survive Run Dry operation.

**THE FINDINGS...YOU CAN CONCLUDE,
BOTH FROM OUR FIELD UPGRADES AND THIS
LABORATORY TEST PROGRAM, THAT:**

1. A pump fitted with GRAPHALLOY wear parts survives system upsets that would cause a metal-fitted pump to seize immediately.
2. A pump fitted with GRAPHALLOY wear parts produces a higher efficiency and greater output than the same pump fitted with metal stationary parts.
3. A pump fitted with GRAPHALLOY wear parts has lower vibration levels.

**THE REQUEST...THAT YOU CHOOSE
THE GRAPHALLOY UPGRADE FOR YOUR NEXT
PUMP PURCHASE OR REPAIR!**

When you need the advantages that our GRAPHALLOY wear parts can provide...either in new pumps or in those retrofitted in the field...call your regional GRAPHALLOY representative or our sales engineers to evaluate your requirements.



**...AND LOOK TO OUR GRAPHALLOY PRODUCTS
TO SOLVE OTHER BEARING PROBLEMS!**

CASE #45—SUBMERGED IN RIVER WATER

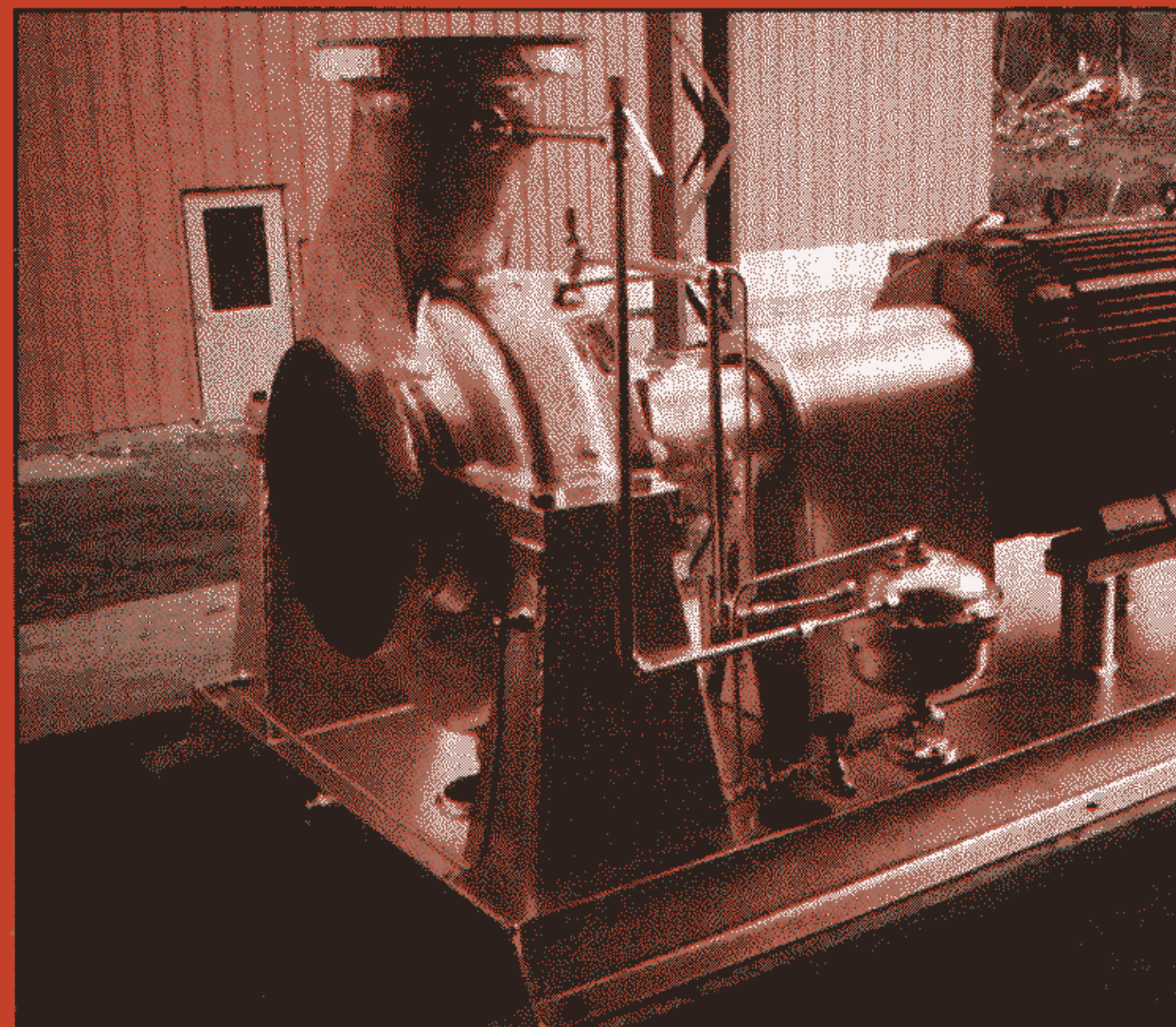
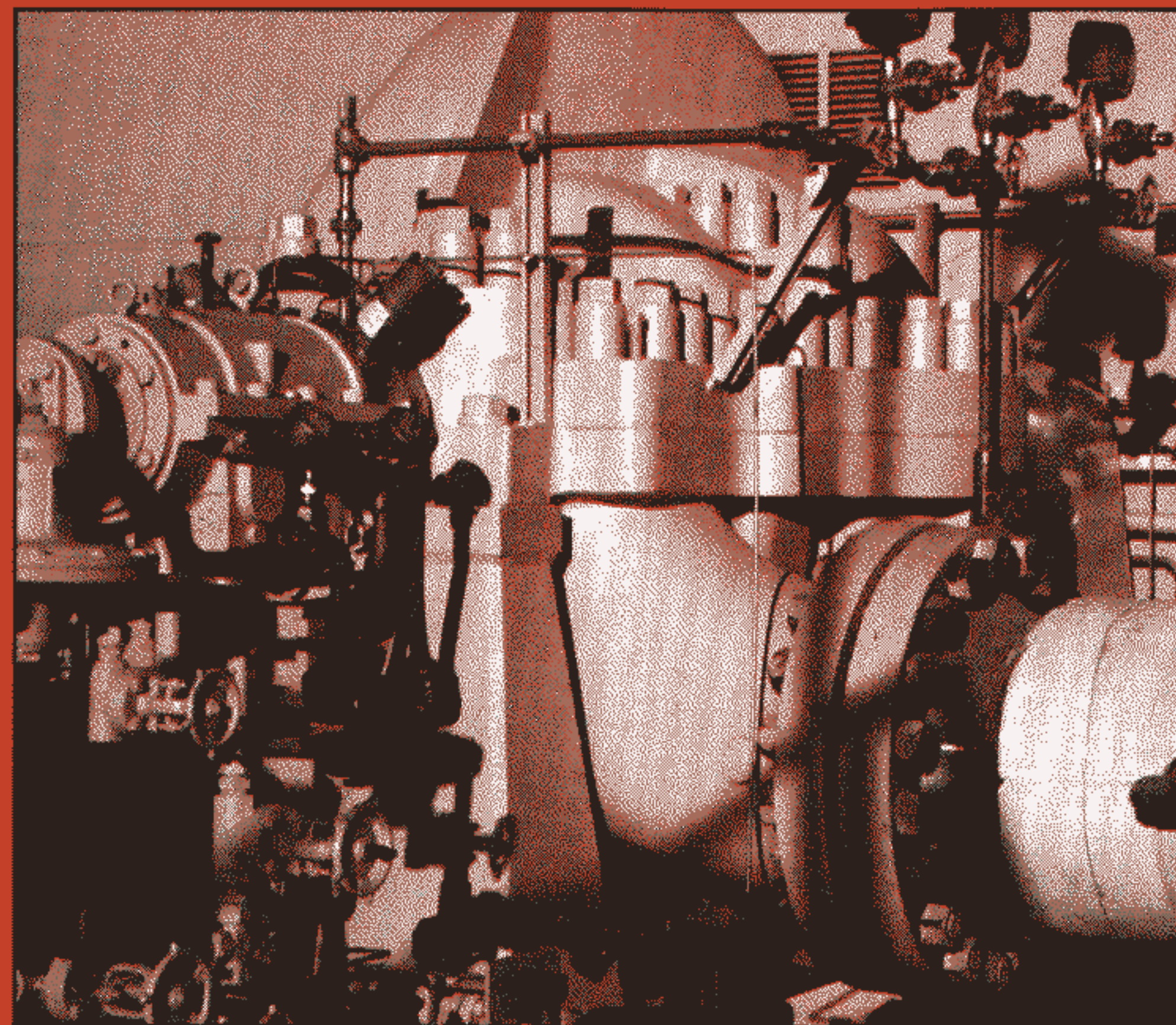
Moving screens keep fish and debris out of the generating turbines. Bearing specifications called for high loads, rough installation, plus the demanding requirement for years of maintenance- and lubrication-free operation. GRAPHALLOY heavy duty pillow blocks are continuing to give maintenance-free service *after five years*.

CASE #46—HIGH TEMPERATURE COAL/ASH CONVEYOR

Coal ash handling equipment required a bushing for a flapper valve to control hot coal ash. This is a 650 degree F. environment. The flapper valve must operate reliably without sticking and without lubrication. GRAPHALLOY solved this high-temperature problem.

CASE #49—HEAVY CURRENT-CARRYING BUSHING

The U.S. Bureau of Mines uses GRAPHALLOY Bushings to carry over 8,000 amperes to an electric metal-melting furnace. These double-flanged, split bushings stabilize a rotating shaft and carry the current. Years of reliable operation have been demonstrated.



Standard and Custom-designed GRAPHALLOY® products since 1913.

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