



ARMSTRONG

TECHNICAL DATA

FILE NO.	90.71
DATE:	Nov. 30, 1968
SUPERSEDES:	NEW
DATE:	

SERVICE MANUAL 1090.71

MECHANICAL SEALS

HISTORICAL DEVELOPMENT AND SELECTION

by Allan Jones

In order to understand the present use of mechanical seals in centrifugal pumps, it is helpful to review developments with respect to packing glands and mechanical seals that have occurred since 1930 in connection with circulating pumps for residential and commercial installations.

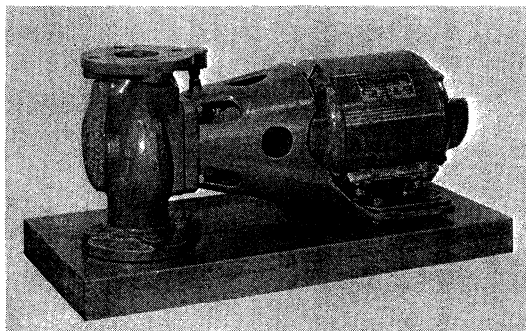
About 1932, interest was starting to grow in the use of small circulating pumps for residential hot water heating systems. Previous to that time, base-mounted pumps had been used here and there on larger hydronic systems for apartments and commercial buildings, but progress was slow and the use of circulators in both small and large buildings was held back by the inherent problems in the use of packing glands in pump designs of that era. Armstrong Circulators manufactured in this period utilized a packing gland sealing arrangement that incorporated a grease cup to facilitate lubrication of the packing material and reduce water loss along the shaft. Mechanical seals suitable for pumps of this type had not been developed. Packing glands generally used at that time which required (and still require) frequent adjustments, repacking and replacement of scored shafts, and the steady loss of a small trickle of water from the gland to lubricate and cool, needed attention beyond the ability and time of the average residential homeowner or the superintendent of the average apartment or office

building.

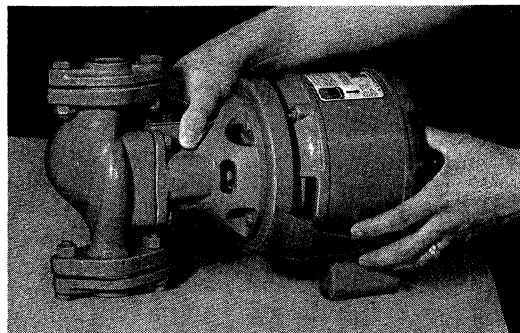
The continual replacement of water in the hot water heating system with fresh water—due to loss from packing glands and due to evaporation from open systems—caused excessive deposits of carbonates which created problems in the heat transfer parts of the system and further aggravated the packing gland with regard to service attention.

About 1936, mechanical seals using bakelite running against a stationary cast iron face began to replace packing glands on residential circulators. This was a step in the right direction, but life-time was somewhat short. However, the inherent problems of packing glands were largely solved, and circulators—especially for residential areas—began to grow in popularity.

About a year later, the most important development came with the use of carbon to replace the bakelite and, with the extension of seal life, circulating pumps jumped in popularity; also, closed systems became almost universal in their use on this continent. To this day, our mechanical seals in the broadest sense, consist of carbon rotating against a cast iron face. There has been a regular and steady stream of improvements, in detail, in an attempt to keep pace with the widening applications of circulating



Armstrong 2" circulator ... vintage 1934 ... equipped with adjustable packing gland, grease-lubricated.

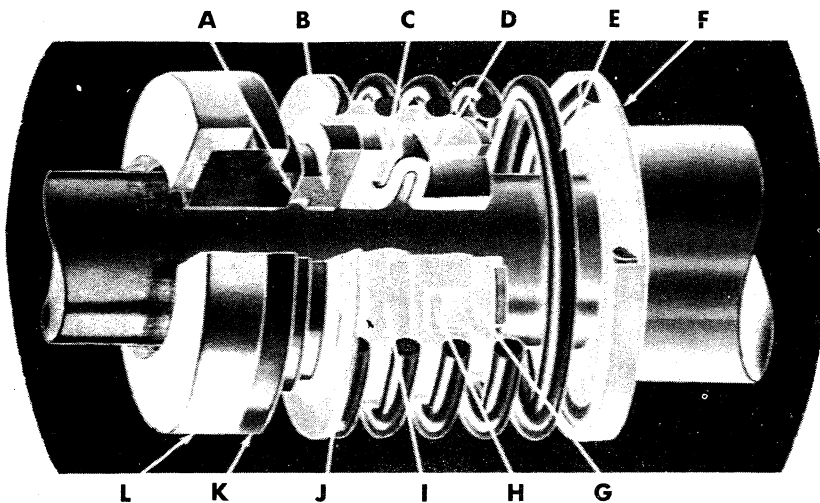


This modern Armstrong circulator illustrates today's popular design, using mechanical seal.

pumps to higher temperatures, higher pressures, and conditions in various types of hydronic systems.

Most improvements in the rotating part of the mechanical seal since the initial development of the carbon seal have been with respect to the rubber parts that seal the carbon to the shaft. These rubbers all look much the same; mixed up in a bin it is almost impossible to judge materials. The materials for sealing carbon to the shaft were developed roughly in the following order:

1. Natural rubber: easily softened by oil and heat-seldom used now.
2. Neoprene: oil-resistant but seldom used today.



- A. Sealing faces
- B. Rotating carbon seal washer
- C. Disc washer
- D. Rubber bellows
- E. Spring
- F. Spring washer
- G. Driver
- H. Driving band lug
- I. Retainer sleeve
- J. Driving washer
- K. Stationary insert
- L. Seat ring or cup

3. Buna "N": gasoline and oil-resistant -most popular material today.
4. Viton: good for higher temperature application.
5. Teflon: Excellent inert material, but easily damaged if not carefully handled.
6. Several new types are under development.

Improvements to the stationary part of the seal have been in the face material and surface finish. The most popular materials are:

1. Cast Iron.
2. Ceramic Insert.
3. Special material: Ni-resist, Stellite, Tungsten Carbide, etc. (all expensive and seldom used in the average hydronic system.)

In addition to the use of various kinds of rubber to seal the carbon at the shaft, the inert material known as Teflon has found considerable acceptance for higher temperatures as a replacement for the rubber parts. (It is still carbon that runs against the ceramic insert). This type of mechanical seal is good for unusual fluids or temperature requirements, but has some disadvantages that should be understood and respected:

1. It is expensive
2. Requires accurately ground shaft (or ground shaft sleeve.)
3. Requires extreme care when installing (just as you can nick a Teflon-coated frying-pan with a metal knife or fork).

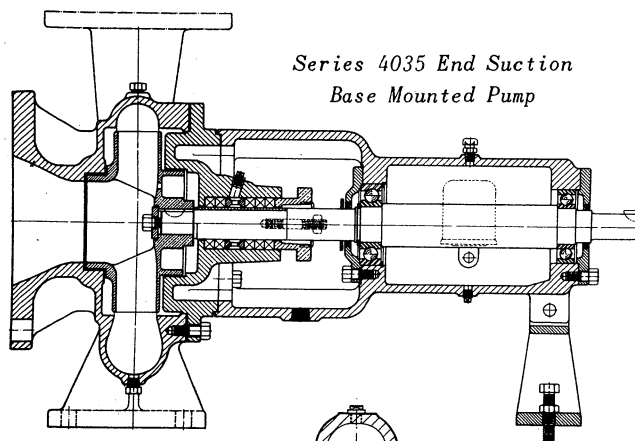
The mechanical seals presently used on most Armstrong circulators and commercial pumps are relatively simple in design, and the materials are the best available at this time for their particular use. It will be judged, having read this far, that the design of mechanical seals has been a steady development that is likely to be continued in the future by a series of steps in the further development of new materials and methods. It can be seen that the selection of a mechanical seal for a given application is not entirely an exact science; life-time is not exactly predictable. But, for closed hydronic systems and a multitude of commercial applications, mechanical seals as we know them today are the best general answer to all the requirements.

There are many complicated (and very expensive) mechanical seals on the market suitable for exceptional temperatures, pressures and corros-

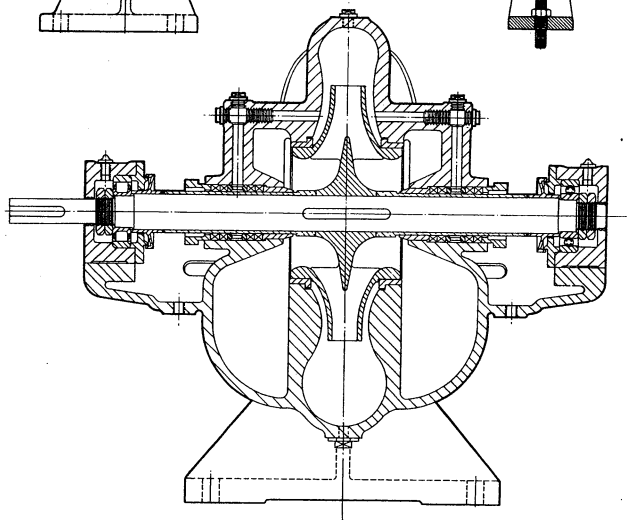
ive fluids, but these are not generally needed and are seldom used for the hydronic and commercial application of Armstrong pumps.

Packing gland pumps such as Armstrong Series 4035, Series 4285 and Series 4600 Type "P" are available where the type of system or operating conditions indicate their use is preferred or desirable.

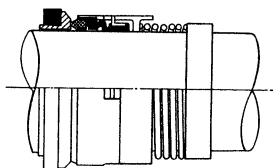
TYPICAL ARMSTRONG PACKING GLAND PUMPS



Series 4035 End Suction
Base Mounted Pump



Series 4600 Double-Suction Horizontal
Split-Case Pump



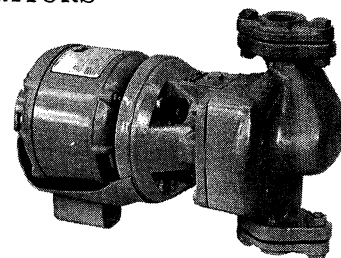
Alternative Mechanical Seal
for Series 4600

The following is a brief summary of the type of mechanical seal presently used in Armstrong Pumps, which is standard equipment unless otherwise specified:

STANDARD CIRCULATORS

Models:

S25	H32
S34	H41
S35	
S45	
S46	



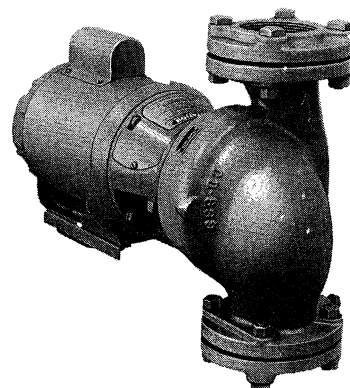
Rotating parts: Carbon face
Buna "N" flexible bellows
Brass trim
Stainless steel spring

Stationary parts: Cast iron seat (standard construction)
Ceramic seat (all-bronze construction)

HIGH DUTY CIRCULATORS

Models:

S55	H51
S57	to
S63	H68
Series 4240	



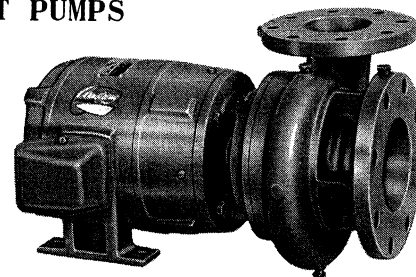
Rotating parts: Carbon face
Buna "N" flexible bellows
Brass trim
Stainless steel spring

Stationary parts: Ceramic seat (standard, bronze-fitted or all-bronze construction)

MOTOR MOUNT PUMPS

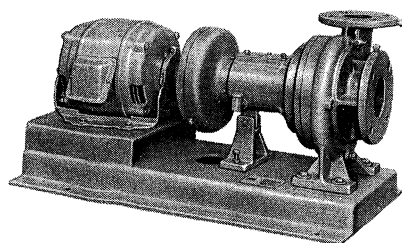
Series:

4260
4280



Rotating parts: Carbon face
Buna "N" flexible bellows
Brass trim
Stainless steel spring

Stationary parts: Ceramic seat (bronze-fitted or all-bronze construction)



BASE MOUNTED PUMPS

Series
4020
4030
4600

Rotating parts: Carbon face
Buna "N" flexible bellows
Brass trim
Stainless steel spring

Stationary parts: Ceramic seat (bronze-fitted or all-bronze construction)

The above standard "Armseal" arrangements are suitable for temperatures up to 225°F. which will cover about 95% of installations. When that point is reached, the question of judgment comes into play:

1. An installation that reaches, say, 230°F. only once in a long time-and for a short time-may suggest the use of a standard mechanical seal. But use judgment ... high temperatures mean reduced seal life!
2. For temperature over 225°F. but not exceeding 275°F., Viton is usually first choice, especially where system temperatures are relatively steady.
3. For wide variations in system temperatures, operating over 225°F. but not exceeding 275°F., Teflon is generally specified. A stainless steel sleeve or stainless steel shaft (accurately ground to diameter) must be specified and installed when Teflon is used.



Allan T. Jones graduated from University of Toronto with a B.A. Sc. degree in mechanical engineering in 1930. He has been with S. A. Armstrong Limited since 1934 holding various positions in Engineering. He is presently serving in the capacity of Technical Co-Ordinator.

A member of ASHRAE, he was active on the Technical Advisory Committee on Hot Water Heating for several years and was a member of the Guide Committee from

1954 to 1956. He is also a member of A.S.M.E. and the Association of Professional Engineers of Ontario.

4. A Double Mechanical Seal may be supplied on motor mount Series 4290 pumps and base-mounted Series 4040 pumps. In some cases they are arranged for the circulation of clean, cool tap water between the seals where system water temperature is high and poor water quality warrants the extra cost of this construction. The fresh water thus reduces seal temperature and keeps treated or contaminated system water away from the seal faces.
 5. Quality of system water greatly affects mechanical seal life. The addition of silicates (very often found in stop-leak or cleaning compounds) and their being left in a system after serving their immediate purpose, will result in unsatisfactory seal life. These materials are, of course, also detrimental to packing glands and cause shaft scoring.
- Some forms of water treatment used improperly or in excess quantity, or quantities of core sand, iron oxide or other foreign materials in the system water, can cause repeated seal trouble. At start-up, the introduction of water treatment sometimes loosens iron oxide scale, etc., temporarily causing seal problems until flushed out and refilled. Adequate cleaning and flushing of a dirty system will pay big dividends whether it is an old or new piping system.
6. Where unusual temperature, pressures, or system water conditions occur, a little extra attention to seal selection and system start-up can bring you satisfied customers.

- PAGE 4 OF 4 -



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