DualPac®
Technology

DualPac® Packing Technology

How DualPac packings lower operating costs and improve reliability in rotating equipment.

CHESTERTON®
Global Solutions, Local Service.

DualPac® Packing Technology

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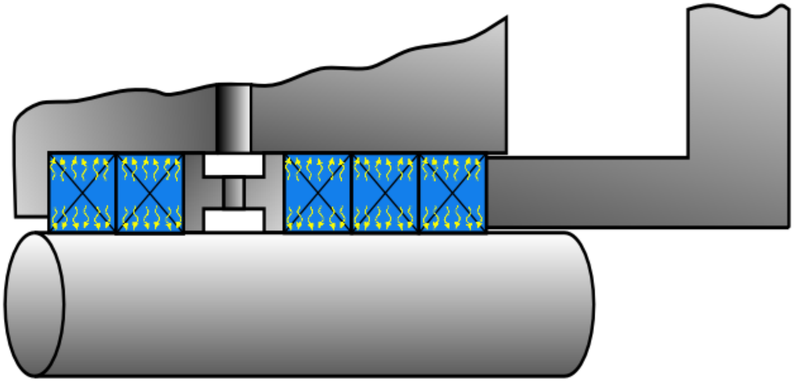
Chapter 1

How Compression Packing Works

- How Pump Packing Works
- Materials vs. Requirements
- Packing Requirements
- Radar Charts

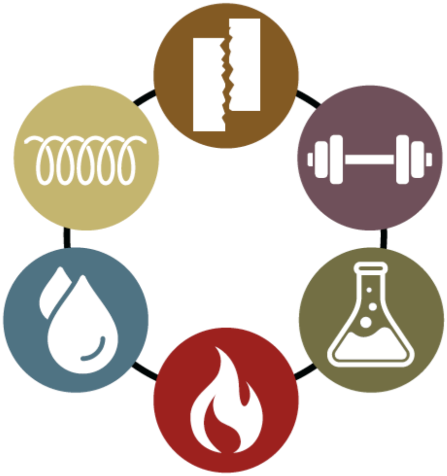
How Pump Packing Works

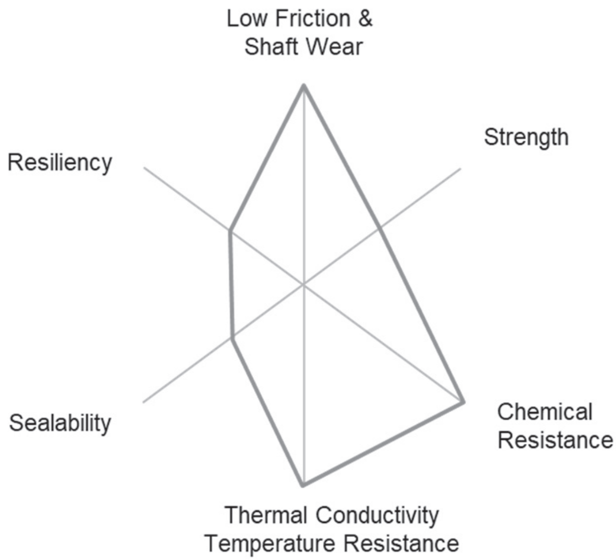
Packing rings are made of fibers that give the packing its structure and its strength. Blocking agents fill the gaps between the fibers and make the packing nonporous. Blocking agents often double as lubricants. Lubricants lower the friction between shaft (sleeve) and packing, between the fibers to make the packing more conformable, and between the stuffing box and the packing so it conforms well to the shape of the stuffing box.



When packing is installed, an axial force is being placed on the packing with the gland follower. The axial force is converted to radial force in the packing rings. This radial force not only provides the sealing force for the packing but also creates friction between shaft and packing. The gland force slowly squeezes lubricant out of the packing to provide continuous lubrication. At some point, the lubricant will be used up, and the packing will need to be replaced.

Materials vs. Requirements





The above radar chart shows the requirements for compression packing. This radar chart helps us understand the typical "fingerprint" for each individual packing. This example chart reflects a material with very good thermal properties and chemical resistance.

This radar chart illustrates that each packing material and packing style is strong in some requirements, but that no material is good in all requirements. This is the reason why there are so many different packing styles. Every application requires a packing that is good at one or more requirements. If you are sealing a high-temperature fluid, then you need a packing that has good temperature resistance. If you are sealing a strong chemical, you need a packing with good chemical resistance. So, for an application that requires sealing a chemical at a higher temperature, the packing with the radar chart pictured here might be a good choice. In the pages following we will explain each of the requirements in more detail.

Packing Requirements: Strength

When a packing material is too weak, it can be pressed through the clearances at the bottom of the stuffing box and under the gland. Packing material can also be worn away by the rotating shaft or shaft sleeve or even by an abrasive leaking medium. For this reason, the packing material needs to be strong enough so that it will not extrude under high gland pressure and will not quickly wear away. Ultimately, stronger packing material help the packing to last longer as well as enable it to withstand higher pressure.

Examples of strong materials that are used for packing are carbon fiber and synthetic fibers. Para-aramid is an example of a material with extreme strength (see table).

	Aramid	Carbon	Graphite	PTFE	ePTFE	Polymer
Temperature Limit (°C)	280	450	2760	260	260	240
Coefficient of Friction	0.3	0.1	0.05	0.04	0.04	0.08
Thermal Conductivity (W/m^2/°K)	0.04	14	43	22	22	11
pH	2 – 12	3 – 11	0 – 14	0 – 14	0 – 14	1 – 13
Tensile Strength (KP/cm^2)	35000	4100	10	3500	3500	2500
Elasticity (%)	42	34	9	28	28	95

Packing Requirement: Resiliency

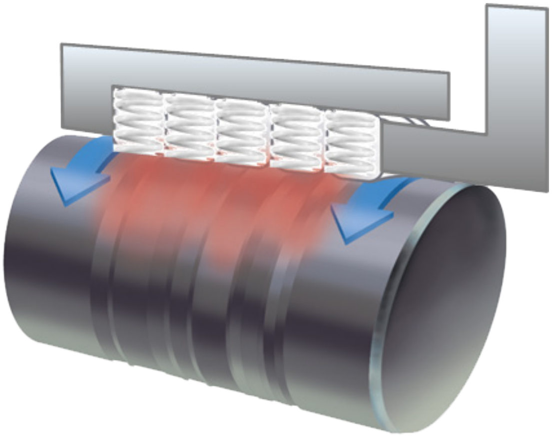
All seals have something in common, whether we are talking about a mechanical seal, a flange gasket, a lip seal, or an O-Ring. They all consist of at least the following elements:

An elastic element

A contact face

A mechanical seal has springs, a lip seal has an elastic lip, a flange gasket has elastic bolts, and an O-Ring has elastic rubber. The function of the spring or elastic in these seals is to store and release energy to keep the sealing force on the sealing element. In a mechanical seal, two very exact flat contact faces maintain the seal. In a lip seal, an elastic lip adapts its shape to the irregularities of the surface that it is sealing. Finally, O-Rings and flange gaskets adapt their shape to the surface that they are sealing.

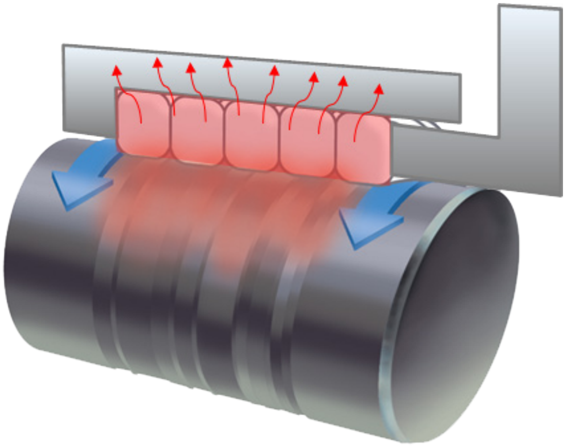
A packing ring works in the same way —it needs to adapt its shape to the irregularities of the stuffing box to make an effective seal. It also needs a constant sealing force to press that sealing surface tightly.



Therefore, resiliency in the packing material is very beneficial in maintaining a constant sealing force. Resiliency will extend the time periods between re-tightening the packing, as well assure a more constant sealing force, therefore extending the mean time between repair of the packing set.

Para-aramid is an example of a very resilient material. When braided, the strong and stiff fibers form a very resilient material that keeps the seal tight in the stuffing box.

Packing Requirement: Thermal Conductivity and Temperature Resistance



Frictional heat is generated between the packing and a rotating shaft. The mechanical properties of any sealing material will worsen at high temperatures. The packing strength will decrease and, therefore, will wear faster, leading to decreased sealing abilities. The same is true for the material of the counter member of the seal, in the case of rotating equipment the shaft or shaft sleeve. This frictional heat is transported away through the packing and through the body of the equipment. The higher the thermal conductivity of the packing material, the more efficiently, it can transport this heat away. If the packing material is not able to do this efficiently, then, for example, flush water needs to be injected in the stuffing box to dispose of this heat.

Good thermal conductivity of the packing material will extend the MTBR and will reduce the need for other heat dissipation methods (like flush water). Therefore, it will reduce usage costs.

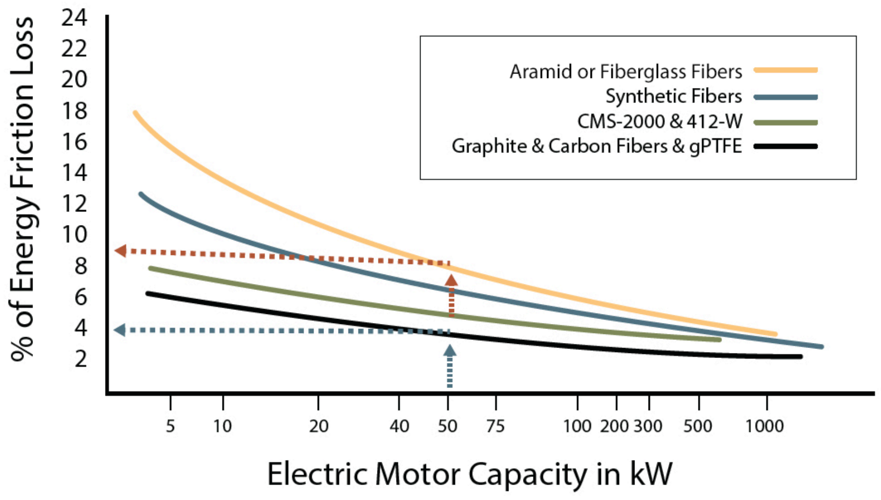
Good thermal conductivity means that higher rotating speeds are achievable. A packing material also needs to be resistant to the temperature of the applications. The application temperature is determined by the sum of the fluid temperature plus added frictional heat.

Therefore, the higher the temperature resistance of the material and the higher the thermal conductivity, the higher the allowed fluid temperature. The table on page 10 shows that graphite and carbon have very high thermal conductivity. Their temperature resistance is also good. Graphite is often added to PTFE fiber to improve its thermal characteristics. For this reason, the thermal conductivity of gPTFE is very good as well.

Packing Requirement: Low Friction and Shaft Wear

We saw that frictional heat is generated between packing and a rotating shaft. The higher the friction between the packing and the shaft, the higher the frictional heat generated. Friction also makes shaft rotation more difficult and, therefore, increases energy consumption. It is beneficial to use fibers that have the lowest possible coefficient of friction. Also, lubricants are added to the compression packing. The table on page 10 shows that PTFE has a very good coefficient of friction. PTFE is also used as a blocking agent and lubricant to reduce the friction in a braided fiber packing.

Energy Loss by Packing Material



Another very important requirement is that the packing does not wear the shaft or shaft sleeve. The strength and hardness of the material is a factor, but lower friction means that less material is worn away from both packing and shaft. Less friction means less energy consumption.

The graph on the previous page shows the energy loss associated with different types of packing materials. Graphite and gPTFE show low energy consumption while para-aramid packing shows a high energy consumption.

Packing Requirement: Sealability

The main function of a compression packing is to create a seal. There are two leak paths when we deal with packing. Leakage can either pass along the sides of the packing, or it can pass through the packing. This means that the packing needs to be moldable and flexible so that it adapts its shape to the shape of the stuffing box, including its corners and surface irregularities.

Also, packing needs to be nonporous. For this reason, blocking agents are added to the packing. Blocking agents can be oils or greases that serve as a lubricant as well.

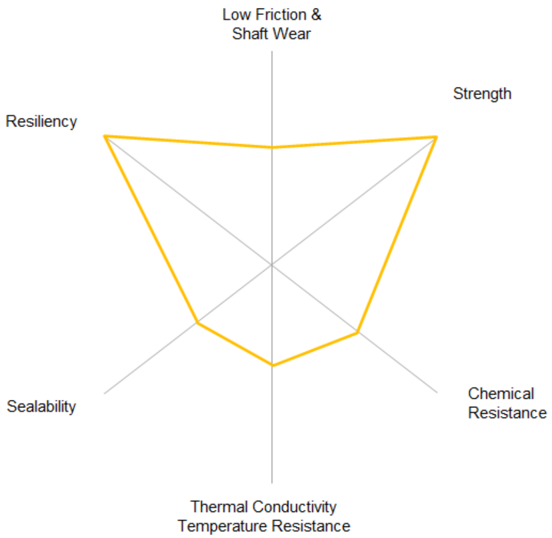
Finally, PTFE particles are added to packing to decrease its porosity.

Packing Requirement: Chemical Resistance

The packing materials need to be resistant to the chemical that is being sealed. Chemical attack of a packing material decreases its strength. If a lubricant is not chemically resistant it will mean that either the properties of that lubricant are being changed or that the lubricant is being washed away, leading to volume loss and increased packing wear and friction.

All packing from Chesterton has a pH rating that indicates where the packing can be used. The table on page 10 shows the pH rating of some materials.

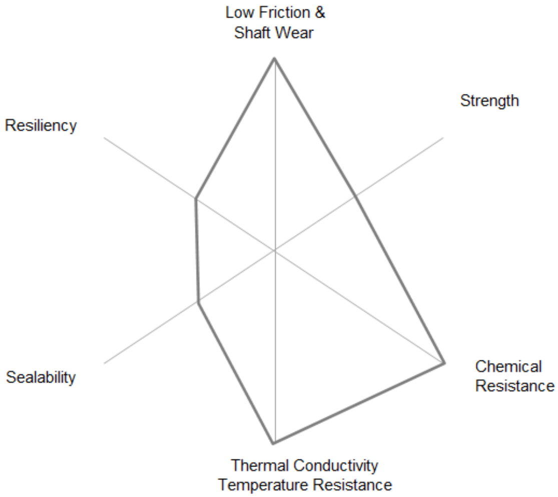
Radar Charts for Different Products/Materials



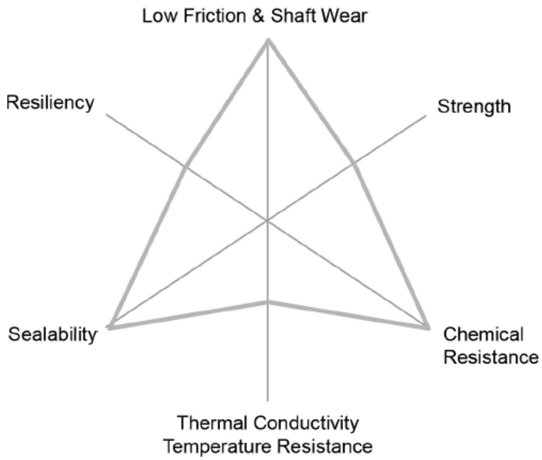
Para-Aramid

Different applications have different requirements, and needs, and for these reasons, there are many different styles of packing.

This means that, many times, a compromise must be made relative to packing capabilities. If an application requires a strong material like a para-aramid, the user must accept the trade-off of the high friction and poor thermal characteristics of a para-aramid. If the chemical compatibility of PTFE is required, there might be a compromise regarding temperature resistance. If the temperature resistance of graphite is needed, the user might have to settle for its low strength.



Graphite



PTFE

Chapter 2

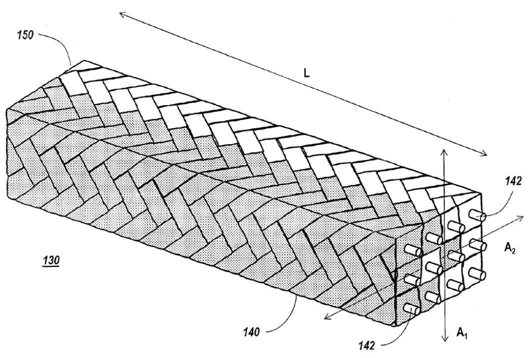
Why DualPac® Technology Works So Well

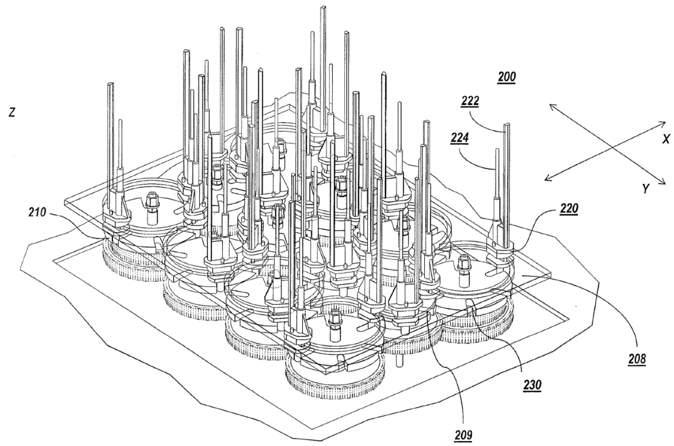
- The DualPac Packing Technology Advantage
- DualPac 2211 Packing
- DualPac 2212 Packing
- DualPac Packing Technology vs. Other Dual Fiber Packing Products

The DualPac Packing Technology Advantage

In the past more than 100 years the manufacturing technology to make packing has remained more or less unchanged. The main advances in the packing technology have been in the materials used to make packing.

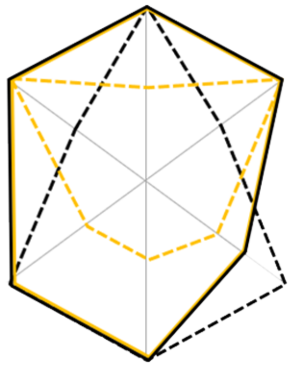
In 2016, Chesterton developed a technique that was a significant breakthrough: a newly invented braiding technique that changed how we view materials for packing and their inherent compromises. The packing made, using this sophisticated process, combines two fibers and exploits the strengths of each on the shaft side and the stuffing box side. Chesterton invented DualPac packing technology and patented the braiding technology and the products manufactured with it.





See patents USP 9,810,324 and USP 10,711,898 for more background information and details. Chesterton is currently using DualPac packing technology for pump packings and can make cross sections of 6.4 mm (0.25") and above.

DualPac 2211 Packing



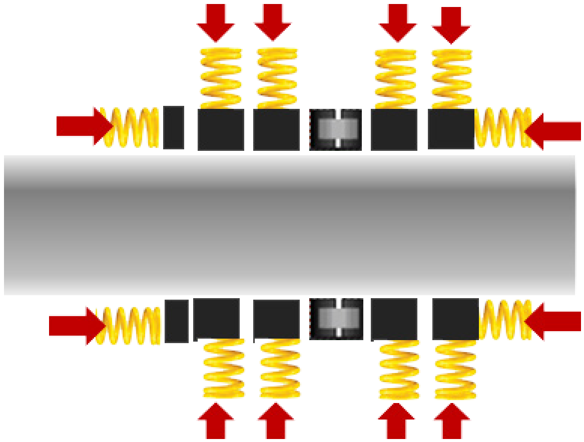
DualPac 2211 packing combines the low friction, sealability, and thermal conductivity of gPTFE (graphited PTFE, which is black) with the strength and resilience of para-aramid (yellow fiber). See the radar chart above to explain this further.

Para-aramid fibers have extremely high strength and elastic modulus. Because of these properties these fibers are, for example, used to construct body armor such as bulletproof vests. The downside of these extreme mechanical properties is that the para-aramid is extremely abrasive. Expensive hardened or ceramic shaft sleeves must be used with packing made of this material.

See the table on page 20 for the technical details of DualPac 2211 packing.

	Para-aramid	Meta-aramid (continuous filament)	gPTFE
Breaking Strength (g/d)	23.6 (denier 1140)*	5 (1200 denier, 2 dpf)**	2.3
Elongation @ Break (%)	24	30.5	>100
Thermal Conductivity (W/m²/°K)	0.04	0.25	22

Para-aramid forms a spring-like structure when braided into a packing. This tension decreases the need for constant readjustments to tighten the packing and will keep a steady pressure on the dynamic sealing surface of the packing.



DualPac 2211 Technical Data	
Applications	For use in ore slurries, mineral handling, dewatering tailing pumps, and other slurry processing applications
Available Sizes	6,4 mm – 25,4 mm (1/4" – 1")
Pressure	20 bar g (300 psig)
Temperature	260°C (500°F)
Chemical Resistance	3 – 11
Speed	10 m/s (2000 fpm)

** denier, a unit of measure for the linear mass density of fibers, is the mass in grams per 9000 meters of the fiber.*
*** dpf = total denier/quantity of uniform filaments.*

Benefits of DualPac 2211 Packing

Longer Mean Time Between Repair (MTBR)

- Para-aramid fiber strength and wear resistance ensure less packing extrusion and wear
- Graphite-infused ePTFE thermal conductivity dissipates heat away from the sealing surface ensuring a cooler and longer lasting packing
- gPTFE low friction and wear ensures lower temperature, thus longer packing life, less packing wear, and less shaft sleeve wear

Less Frequent Gland Adjustments

- Para-aramid resiliency maintains sealing pressure, reduces the need for packing re-tightening, and reduces packing overcompression

Less or No Flush Required

- gPTFE thermal conductivity dissipates heat away from the sealing surface, reducing the need for flush water
- gPTFE low friction and wear reduces heat generation, thus reducing the need for flush water

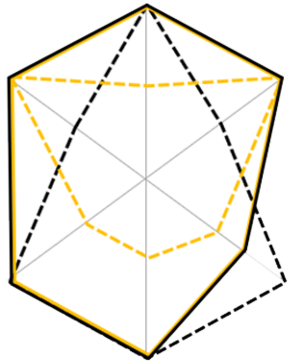
Lower Energy Consumption

- gPTFE low friction reduces motor electrical energy consumption

Less Leakage (Less Housekeeping, Lower Wastewater Treatment Costs)

- Para-aramid resiliency maintains sealing pressure over an extended time
- gPTFE adapts to the shape of the stuffing box and is an excellent dynamic sealing material

DualPac 2212 Packing



DualPac 2212 packing combines the sealability, shaft friendliness, and easy run-in properties of meta-aramid fiber with the strength and resiliency of para-aramid fiber. Meta-aramid is a fiber with very good thermal resistance. The fiber is used, for example, to make fire-resistant suits for refinery workers and racing drivers. Its use in 2212 makes the packing highly burn-resistant and easy to run-in.

DualPac 2212 Technical Data	
Applications	For use in ore slurries, mineral handling, dewatering tailing pumps, and other slurry processing applications
Available Sizes	6,4 mm – 25,4 mm (1/4” – 1”)
Pressure	35 bar g (500 psig)
Temperature	260°C (500°F)
Chemical Resistance	3 – 11
Speed	10 m/s (2000 fpm)

Benefits of DualPac 2212 Packing

Longer MTBR

- Para-aramid fiber strength and wear resistance ensure less packing extrusion and wear
- Meta-aramid low wear ensures less shaft sleeve wear

Less Frequent Gland Adjustments

- Para-aramid resiliency maintains sealing pressure, reduces the need for re-tightening, and reduces packing overcompression

Less or No Flush Required

- Meta-aramid low wear and burn resistance reduces the need for flush water

Less Leakage (Less Housekeeping, Lower Wastewater Treatment Costs)

- Para-aramid resiliency maintains sealing pressure over an extended time
- Meta-aramid easy run-in keeps leakage low at start-up and over time

Non-Staining

- Para-aramid, meta-aramid, and the lubricants are completely non-staining

High-Pressure Capability

- The combined strength of para-aramid and meta-aramid gives high-pressure capability

DualPac Packing vs. Other Dual Fiber Braided Products

DualPac packing technology creates a totally unique product. This technology meets the needs of specific applications by creating a sophisticated braided packing with a completely different material on each side. In contrast, other packing products made from two fibers are typically manufactured on a standard braiding machine using traditional (non-patented) methods. In those products, both materials are present on all sides of the braided packing.

Chesterton DualPac® 2211 packing

Chapter 3

How Well DualPac Packing Works

- Pulp and Paper Case Histories
- Mining Case Histories
- Power Industry Case Histories
- Food and Beverage Case Histories
- Chemical Industry Case Histories
- Other Industries Case Histories

Pulp and Paper Case Histories

- Centrifugal Pumps
- Pulpers
- Agitators
- Screw Conveyors
- Vacuum Pumps
- Refiners

Challenge

A paper plant had issues with three centrifugal pumps handling recycled paper stock. The challenge was that the recycled stock was not separated from plastics or small metal parts. The customer tried many other sealing solutions including a competing pump packing which was destroyed in a few weeks. A competitor's common heat-resistant and strong synthetic fiber packing burned in eight weeks.

Solution

The pump was repacked with DualPac 2211 packing during a brief shutdown.

Results

The DualPac 2211 packing has been installed successfully for eight plus months with minimal shaft wear. To avoid additional downtime, the customer installed DualPac packing on other equipment in the plant due to this success.

Challenge

A pulp and paper causticizing plant has three double-sided screw conveyors transporting very abrasive lime slurry at 122°F (50°C). The rotational speed is 50 rpm.

The stuffing boxes were previously packed with various competitors' packing products. Leakage usually occured a few days after installation and the gland needed adjustment.

The leakage contaminates the bearings, which must be replaced annually.

Solution

The stuffing boxes were repacked with DualPac 2211 packing.

Results

The DualPac packing extended the packing life by 4X. The plant saved $657 US/year (540 EUR/year) less the cost of a product and avoided significant downtime and maintenance.

Challenge

A specialist needed to supply packing for a large shutdown at a paper mill. There were various applications to seal including centrifugal pumps, fan pumps, and agitators. The fluid being sealed is raw water with a high percentage (1.5%) of paper stock solids. The challenges with sealing abrasive media are the short life of packing and fast sleeve wear.

Solution

The specialist installed DualPac 2212 packing on most applications and some combinations of the 2212 and SpiralTrac™ environmental controller on other applications.

Results

Applications with DualPac packing were installed during the shutdown and have been running without issues for six months.

Installations were all positive with easy start-up and smooth break-in of packing.

Challenge

A pump repair facility wanted to upgrade vacuum pumps that are mainly used in the paper industry. They found that seal failure was their most common reason (70% of the cases) for pump repairs. This is often because the bearings get damaged from leaking water. A bearing set can cost $600 US (5000 EUR) on this type of equipment. Sometimes inexpensive packing is used by the customer and the pump lasts only 2 – 3 months.

Solution

The customer switched to DualPac 2212 packing.

Results

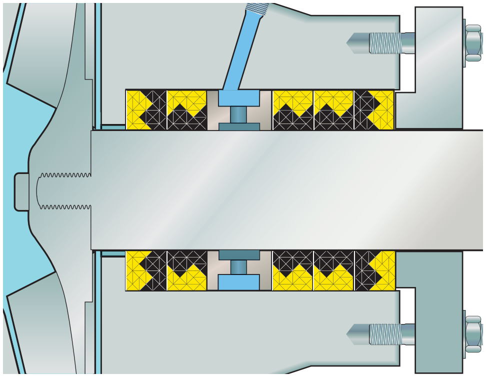
The DualPac packing is lasting considerably longer than conventional packing. The repair house is now using DualPac 2212 packing for all their vacuum pumps.

Challenge

A pulp and paper customer was using a competitor's packing on an agitator in a chemical application. The packing wore down the sleeve, requiring replacement of both packing and sleeve every three months.

Sleeve Cost: $500 US (410 EUR) every three months = $2,000 US/year (1,640 EUR/year)
Competitor Packing Cost: $1,000 US/year (820 EUR/year)
Labor Cost: $1,600 US/year (1,312 EUR/year)
Total Cost Per Agitator: $4,600 US/year (3,819 EUR/year)

The customer's goal was to increase continuous service time to support plant cycle and reduce costs.



Solution

Five rings of DualPac 2211 packing were installed as shown for solids resistance. With the DualPac 2211 packing aramid side against the bottom of the stuffing box, resistance to extrusion and solids is achieved with minimal contact between the aramid and the shaft. This unique configuration reduces shaft wear and increases uptime.

Results

The improved packing solution has lasted over six months and sleeve wear is no longer an issue. The customer is extremely pleased.

Sleeve Cost: $500 US/year (410 EUR/year)
2211 Packing: $1,600 US/year (1,312 EUR/year)
Labor Cost: $400 US/year (328 EUR/year)
Total Cost Per Agitator: $2,500 US/year (2,050 EUR/year)
Total Savings: $4,600 US (3,772 EUR) – $2,500 US (2,050 EUR) = $2,100 US/year (1,722 EUR) per agitator

Challenge

A fiberboard plant was using a competitor's PTFE packing on pumps used for high-consistency pulp stock. The packing required replacement every three weeks. The customer's goal was to increase the length of continuous service to support plant cycle and reduce costs.

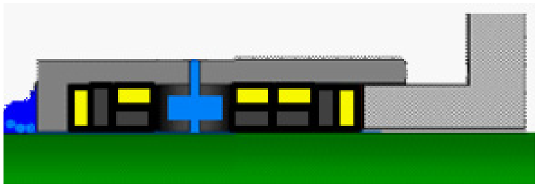
Solution

Five rings of DualPac 2211 packing were installed, as shown on the bottom right, for solids resistance. With the DualPac 2211 packing aramid side against the bottom of the stuffing box, resistance to extrusion and solids is achieved with minimal contact between the aramid and the shaft. This unique configuration reduces shaft wear and increases uptime.

Results

At the time of publishing the client reported 60 days of trouble-free performance (3X the life of the previous packing).

Labor Cost: $20,800 US/year (17,056 EUR/year)
Product (Process) Savings: $10,400 US/year (8,528 EUR/year)
Packing Cost: $16,000 US/year (13,120 EUR/year)
Total Savings: $47,200 US/year (38,704 EUR/year)

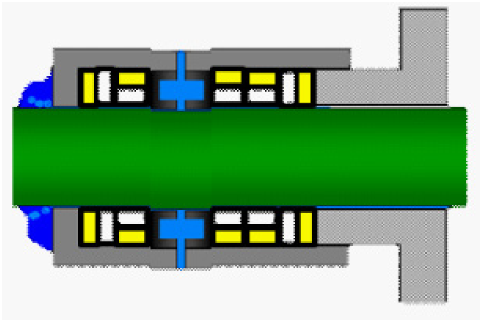


Challenge

A pulp mill was having some issues with their fan pump (30 x 36 DG). It was pumping water at a pressure of 4 – 6 bar, 885 rpm. The existing packing solution was lasting only 6 – 9 months before needing a complete repack. The gland needed to be adjusted frequently and, in some cases, a partial ring replacement between repacks was necessary. The customer wanted to increase the MTBF and to reduce maintenance costs. The goal was 18 months desired running time before a repack.

Solution

A DualPac 2212 packing 5-ring set was installed on each of the stuffing boxes as shown to the right.



Results

The customer installed the DualPac packing and was running at least six months without issues and with no need for gland adjustments. The customer was so impressed with the performance of the test packing set thus far that they quickly ordered another set for one of their 14 x 16 pumps.

Challenge

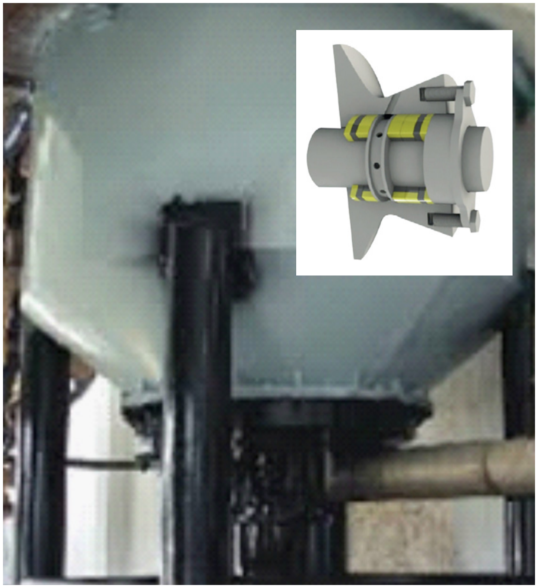
The gland of a recycle hydropulper cannot be adjusted when running because the drive shaft is exposed. The packing is leaking excessively by the time of the next shutdown. The leakage is creating major housekeeping issues and is impacting gear/bearing life.

Solution

Five rings of DualPac 2211 packing were installed.

Results

After two months and approaching the next shutdown the leakage is minor. As a result, the customer ordered more 2211 sets.



Challenge

A pulp and paper company was experiencing several problems with an old refiner (4% consistency, 500 rpm, shaft size 3.750", packing size 20 mm). The mill is a small plant without much budget to buy new equipment. Flush water is not available for this equipment. Previous packing lasted five days: it needed daily gland adjustments. Pulp leakage was very high. The equipment conditions were poor, and the cross section is not standard. The customer wanted to exceed previous packing life by at least 4X (20 days) to reach a direct ROI. They needed to be able to justify their savings on packing consumption only.

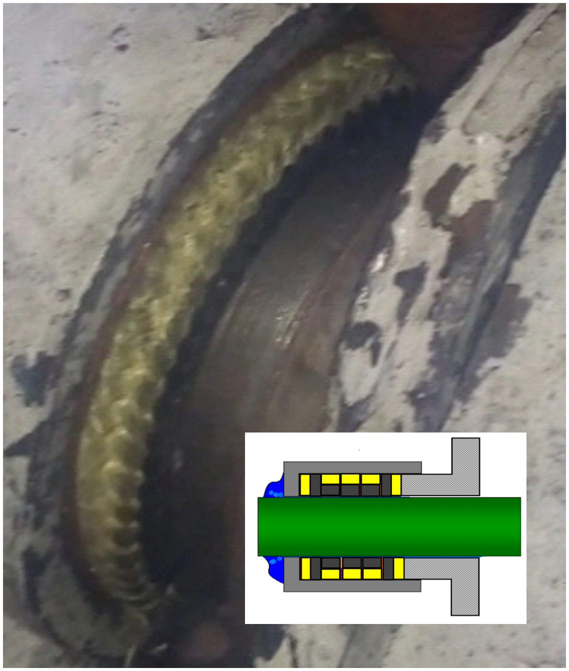
Solution

Five rings of DualPac 2211 packing were installed.

Results

The average MTBR of the 2211 packing was 46 days with a new sleeve. When a worn sleeve was used, the MTBR was more than 30 days. Gland adjustments are performed every four days. MTBR increased 8 – 12X. The customer saved monthly $570 US (473 EUR) on packing use only. Labor for changing and adjusting packing was not quantified.

Yearly Savings: more than $6,840 US (5,679 EUR)



Mining
Case Histories

- Centrifugal Pumps

Challenge

A gold mine sealing a cyanide pulp with 60% solids was having severe issues. The previous packing was lasting only 3 – 5 days and required constant adjustments. Existing packing was consolidating and wear was causing loss of compression. This resulted in product leakage which, in turn, caused dramatic sleeve damage. The customer's goal was to achieve 14 days of continuous service.

Solution

Four rings of DualPac 2211 packing were installed in four pumps. DualPac 2211 packing is ideal for this application since it uses a proprietary braiding technology to combine para-aramid and ePTFE in a way that will resist solids abrasion while achieving a tight seal with fewer adjustments.

Results

The average MTBF of packing increased to 25 – 35 days and failure was often equipment related (plugged flush line, worn-out metallic components).

MTBF increased 5 – 11X

Customer Saved:

$798 US (654 EUR)/month in packing

$1,167 US (957 EUR)/month in sleeves

Total Net Savings: $1,965 US (1611 EUR)/month = $23,580 US (19,335 EUR)/year

Challenge

A salt processing plant is already using a para-aramid packing as the solution on their very abrasive pumping applications. However, the customer is under pressure to reduce costs and is trying lower expensive competitor products. In addition, the existing packing needed to be adjusted frequently.

Solution

The customer tried DualPac 2211 packing and DualPac 2212 packing on multiple pumps.

Results

DualPac packing has proven to require only half the adjustments compared with the previous packing. The internal live loading technology that is incorporated in the DualPac packing gives the packing additional elasticity while not severely wearing the shaft.

Challenge

A gold mine has pumps that handle handling mineral pulp with cyanurate solution for gold extraction. The pumps were packed with standard packing and had constant leaks. This required repacking every 2 – 3 weeks. The customer was looking to increase the MTBF and reduce his maintenance costs.

Solution

DualPac 2211 packing was installed. A test scheme was implemented in two pairs of pumps, making improvements in the installation, settlement and washing for better sealing. In addition, a training course was offered for the installation of packing. The customer was trained on the relaxation of packing and how to monitor and re-tighten the gland follower. Improvements were made in the flush water supply by recommending new flush water piping to improve the quality of the flush water.

Results

The MTBR was increased from 2 – 3 weeks to 6 – 8 weeks. The plant is considerably cleaner and safer due to reduced leakage.

Challenge

A mineral sand plant has a 14 x 12 – 29 rubber-lined slurry pump. The pump was packed with slurry packing. The medium is slurry with 6 – 2% solids. Operating pressure is two bar, and the stuffing box is flushed with four bar flush water. The packing needed to be replaced when the gland follower bottomed out, resulting in excessive leakage at the gland. Packing MTBR is typically two months. The sleeve was changed out every six months.

Solution

Pump was repacked with Chesterton SuperSet™ solution with SpiralTrac™ environmental controller, and three rings of DualPac 2211 packing.

Results

The customer set the flush water flow at 50% of the previous rate. The total amount of water saved per year is estimated to be 21,024,000 gallons/year.

The customer has now applied this solution to three pumps. They repack the pumps every 16 weeks or so (2X MTBR than the previous packing). The customer says, "When we pull it out, it's all in one piece, not shredded." No sleeve wear has occurred yet due to the SpiralTrac solution.

Customer quote: *"This was a win for our plant."*

SpiralTrac™ is a trademark of EnviroSeal Engineering Products Ltd.

Challenge

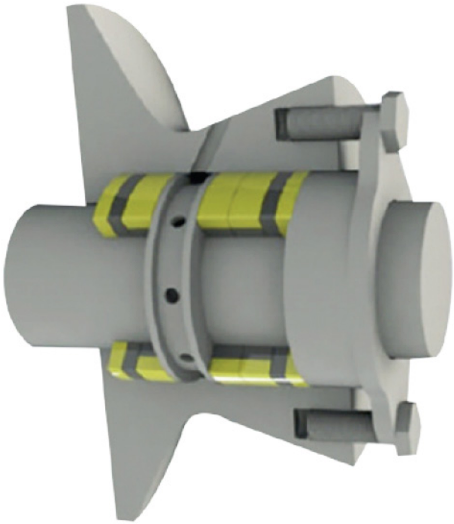
A tar sands mine was operating a remote tailings pump that was experiencing frequent leakage. Because of the remote location, the pump was not monitored closely. Excessive leakage caused shaft damage and limited packing life. The customer typically adjusts the packing gland 8 – 10 times per 1000 hours of running time.

Solution

Five rings of DualPac 2211 packing were installed.

Results

The pump has run 1000 hours with only one adjustment, which has lowered maintenance costs significantly. Because of this success, the customer is already expanding the use of DualPac 2211 packing to other areas.



Power Industry Case Histories

- Centrifugal Pumps
- Plunger Pumps
- Conveyors

Challenge

A power plant has sealing problems with an ash pump. The existing packing lasts about two weeks due to the abrasive slurry and it needs constant adjustments which, combined with leaking product, resulted in excessive sleeve wear. The shaft sleeve needs replacement every three months. The customer's goals were to achieve two months of continuous service to support the plant cycle and to achieve at least six months without replacing the sleeve.

Solution

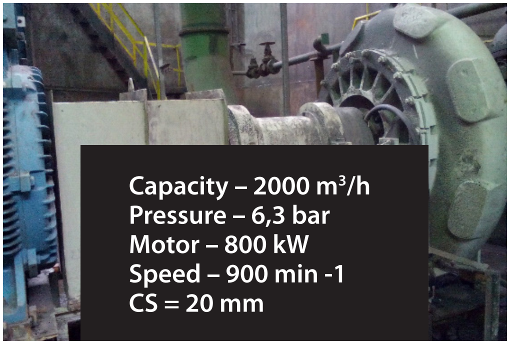
The customer installed DualPac 2211 packing in the configuration shown on the lower right.

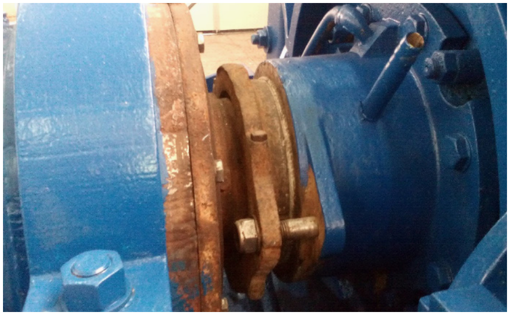
Results

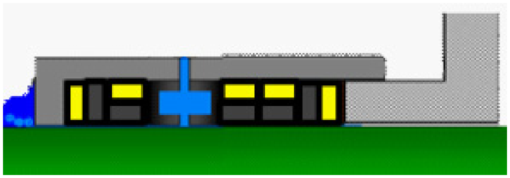
Average MTBF of packing increased to three months. The MTBF of the sleeve increased to 12 months.

Total Savings (less the cost of the product):
$1,107 US (908 EUR)/month
Total Savings: $13,284 US (10,893 EUR)/year

Based on the success of the field test and return on investment, the Chesterton representative hopes to standardize DualPac 2211 packing as a seal for all four ash pumps and lime milk pumps in the plant.







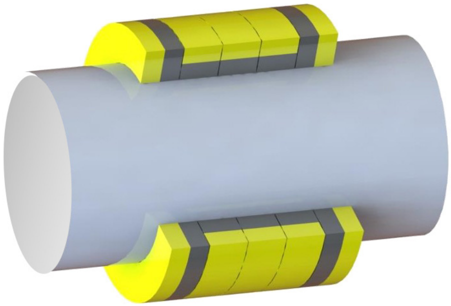
Challenge

A power plant has two plunger pumps pumping wastewater. The customer faced a lot of problems with leakage and has housekeeping issues as a result. They were using a PTFE packing, supplied by a service company, that clearly wasn't performing well. The MTBR was +/- 1 month. Temperature: ambient. Pressure: 15 bar.

Plunger pumps are quite challenging to seal, due to the high pressures involved and the fact that the packing set is continuously pushed linearly from one side to the other. The customer clearly wanted to solve the leakage problem and the short MTBR.

Solution

The solution was 12 mm DualPac 2211 packing installed in a configuration as shown on the right—six rings of packing installed.



Results

After eight months, the packing was still running with no leakage.

Total Net Annual Savings: $857 US (712.50 EUR) per application per year

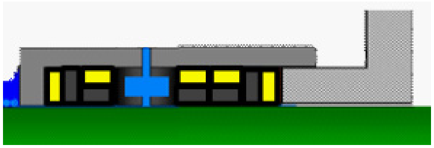
The customer bought DualPac 2211 packing for other applications as a result.

Challenge

A power plant used general packing on a submerged scraper conveyor for coal. There was significant leakage, which caused premature pillow block bearing failure along with significant water loss. The old-style packing and bearings that they used were being replaced every month.

Packing Cost: $200 US (164 EUR)/month = $2,400 US (1,968 EUR)/year
Bearing Cost: $300 US (246 EUR)/month = $3,600 US (2,952 EUR)/year
Labor Cost: $800 US (656 EUR)/month = $9,600 US (7872 EUR)/year
Total Cost: $15,600 US (12,792 EUR)/year

The goal was to increase the time of continuous service to support plant cycle and reduce costs.



Solution

Five rings of DualPac 2211 packing were installed, as shown to the right, for solids resistance. With the DualPac 2211 packing aramid side against the bottom of the stuffing box, resistance to extrusion and solids is achieved with minimal contact between the aramid and the shaft. This unique configuration reduces shaft wear considerably and increases uptime.

Results

Leakage was reduced significantly. The customer no longer experienced frequent bearing failure. DualPac packing has resulted in over 6 months of trouble-free performance and is still running.

DualPac 2211 Packing: $2,000 US (1,640 EUR)/year
Labor Cost: $800 US (656 EUR)/year, Total Cost: $2,800 US (2,296 EUR)/year
Total Savings: $12,800 US (10,496 EUR)/year
($15,600 US (12,792 EUR)/year vs. $2,800 US (2,296 EUR)/year)

Challenge

A heating plant had packing issues with a pump handling slurry that contained clinker, sand, sludge, and ashes. The flushed packing lasted only one month and needed to be adjusted every few days.

The pump runs two times per hour, approximately 15 – 20 min. Sleeve OD: 85 mm. Stuffing Box Bore: 110 mm. The previous packing was para-aramid with PTFE lubricant.

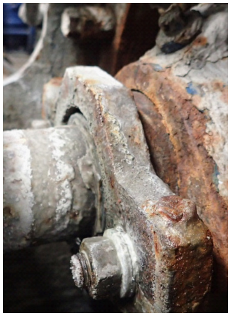
With time, the sleeve wear increased, which resulted in excessive leakage, high maintenance, and frequent gland adjustments. In some cases, if the sleeve was too worn, maintenance staff needed to repack the packing every month.

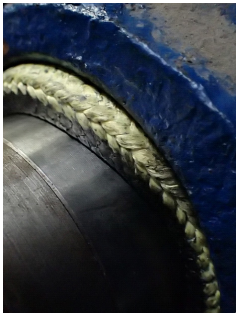
Solution

Chesterton DualPac 2211 packing was installed.

Results

After installation, the 2211 packing was compressed only slightly with the gland follower, and the bolts were tightened very lightly by hand (no tools). One month after installation, the gland didn't need to be re-tightened. The customer makes very few adjustments now. The packing has been running without any issues and labor and replacement costs have been significantly lowered.





Food and Beverage Case Histories

- Centrifugal Pumps
- Steam Peelers
- Other Equipment

Challenge

A sugar refinery was having issues sealing eight striker receivers. The old asbestos packing had to be adjusted every two weeks and replaced every 5 – 7 weeks at a cost of $160,000 US (13,1200 EUR)/year as well as $32,000 US (26,240 EUR)/year in labor. The total cost of the packing, product loss, and labor is $195,200 US (160,064 EUR)/year.

The shaft sleeve was scored. The current packing was cheap, and the customer was hesitant to change from the OEM recommendation. Plant management was also hesitant to update to a new technology. One of the requirements from the customer was for their distributor to always have a replacement packing in stock.

Solution

The customer installed DualPac 2211 packing.

Results

Net Cost of Maintaining DualPac Packing:
$32,765 US (26,867 EUR)/year
Net Savings: $162,525 US (133,270 EUR)/year
$195,200 (160,064 EUR) vs. $32,765 US (26,867 EUR)
Savings for 8 Units: Over $1.3 million US (1.1 million EUR)/year

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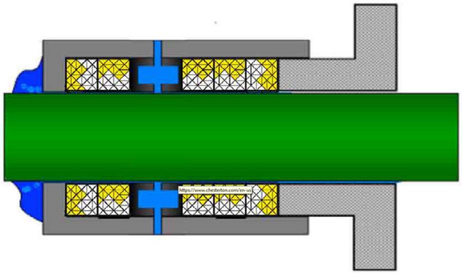
Challenge

A sugar mill was trying to seal heavy slurry (63% solids) in multiple centrifugal pumps. The pump packing in use lasted on average only three weeks. The plant considered the impact on these applications as a major reliability issue.

Packing was deforming under pressure and the customer was unable to control leakage. The customer's goal was to increase the packing life to five weeks to support the existing plant cycle.

Solution

Chesterton DualPac 2212 packing was installed in two pumps side by side. Each pump required five rings of packing installed as shown right.



Results

DualPac 2212 packing lasted twice as long as the competitor's packing. The customer's expectations were exceeded.

Packing Cost Savings: $4,751 US (3,895 EUR)/year
Downtime Cost Savings: $1,600 US (1,312 EUR)/year
Labor Cost Savings: $320 US (262 EUR)/year
Total Savings: $6,671 US (5,470 EUR)/year

Challenge

A sugar mill experienced a short life on their packing. The existing packing resulted in extrusion and glazing due to lack of lubrication.

Solution

Five rings of DualPac 2212 packing were installed.

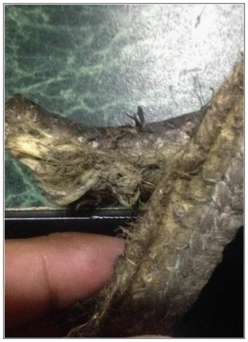
Results

The client reported 25 days of trouble-free performance and still going. The customer is extremely pleased.

Repair Costs/MTBR/$ Savings:

Machining Savings: $281 US (230 EUR)/month
Labor Savings: $1,054 US (864 EUR)/month
Product (Process) Savings: $4,215 US (3,456 EUR)/month
Packing Cost: $271 US (222 EUR)/month

Total Net Savings:
$5,550 US (4,551 EUR)/month
$66,600 US (54,612 EUR)/year



Challenge

A food plant tried multiple types of packing (PTFE, graphite, reinforced corners, etc.) to achieve more reliable sealing of potato steam peeler. The best MTBF they were able to achieve with other packing was two months before catastrophic failure when the packings needed to be completely replaced. The customer's goal was to increase MTBF and reduce maintenance costs.

Operating conditions: Frequent, rapid pressurization 0 – 19 bar (0 – 80 psi) and rapid decompression 19 – 0 bar (280 – 0 psi). Bi-directional equipment.

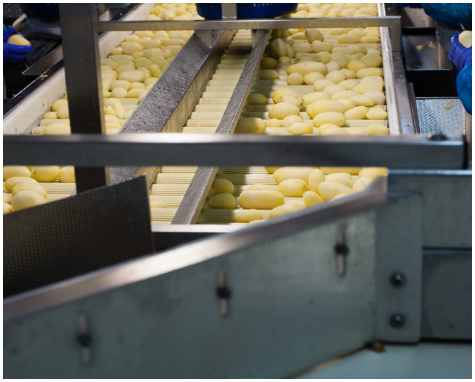
Temperature: 212°C (415°F)
Speed: 18 rpm

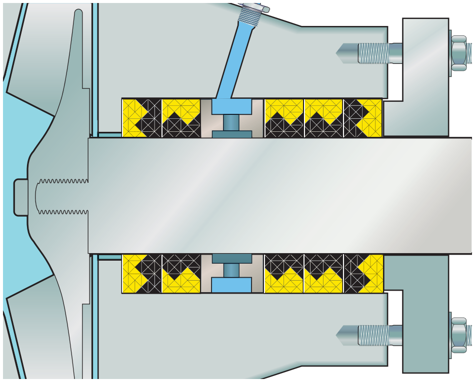
Solution

The plant switched to Chesterton DualPac 2211 packing.

Results

DualPac 2211 packing performed the best of any packing they had ever tried in this equipment. The peeler has been running for 21 months to date without a repack and without any significant leakage.





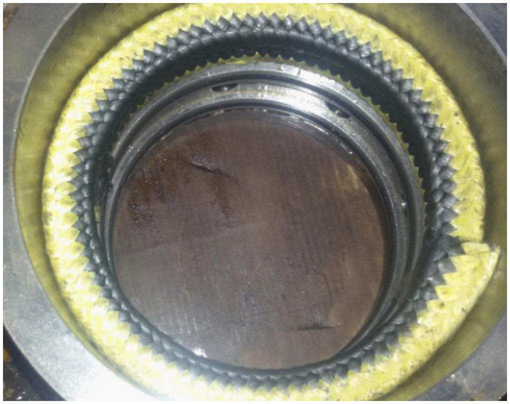
Chemical Industry Case Histories

- Centrifugal Pumps
- Conveyors
- Mixers

Challenge
Existing packing lasted only three days due to abrasive gypsum slurry in a fertilizer mineral manufacturing process. The shaft required replacement every few days.

The existing packing failed due to a loss of compression, which allowed the gypsum mineral to enter the stuffing box, fret the shaft, damage the packing, and cause uncontrollable leakage.

The goal was to achieve 15 days of continuous service to support plant cycle.



Solution
The distributor installed five rings of DualPac 2211 packing.

Results
The client reported over 25 days of continuous service versus three days with previous packing.

Sleeve Savings: $351 US (288 EUR)/month
Machining Savings: $281 US (230 EUR)/month
Labor Savings: $1,054 US (864 EUR)/month
Product Savings: $4,215 US (3,456 EUR)/month
Less Packing Cost: $271 US (222 EUR)/month
Total Net Savings: $5,630 US (4,616 EUR)/month

Challenge

A fertilizer manufacturing plant experienced one-month packing life on their screw conveyor transporting dry granules. The temperature is ambient, pressure is low, the speed is 60 RPM. The customer is using a general service ePTFE interwoven packing, which is resulting in housekeeping issues, maintenance time, and equipment downtime.

Solution

The plant switched to 16 mm DualPac 2211 packing. Avoiding the hassle of continuous repair, stopping product losses and protecting the environment were much more important in this case than the generated financial savings.

Results

Total Net Savings: $518 US/year (430 EUR/year) per application

Challenge

A customer has a rotary drum mixer with packing that lasted only 3 – 6 months. One batch of their fertilizer granules would completely destroy the packing. The root cause was that the packing was not strong enough to resist the fertilizer granules.

The customer's objective was to find a different packing that would last at least a year before needing changed.

Solution

One continuous ring of 3/4" DualPac 2211 packing was inserted with a bladder behind to press against blender drum.

Results

2211 packing has lasted a year and continues to run, exceeding the customer's goal. The DualPac packing solution resulted in no downtime for repairs.

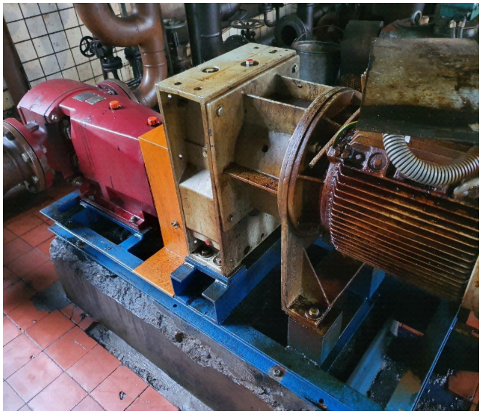
Estimated Savings: $7,000 US (5,740 EUR) – $10,000 US (8,200 EUR)/year.

Other Industry Case Histories

- Centrifugal Pumps
- Lobe Pumps
- Other Equipment

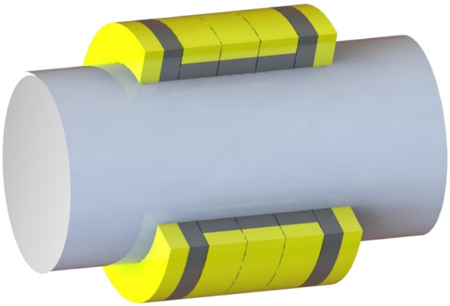
Challenge

An oil refinery is sealing lobe pumps with packing. The lobe pumps are pumping oil slurry, 40°C, from 2 – 10 bar, into a filter. The medium consists of oil and up to 30% of clay. Packing MTBR is only one week. Sleeve MTBR is two years. The application is challenging to seal due to the increasing pressure and abrasive clay inside the oil. Increasing pressure due to filter clogging causes different leakages on the start and on the end of the pumping cycle.



Solution

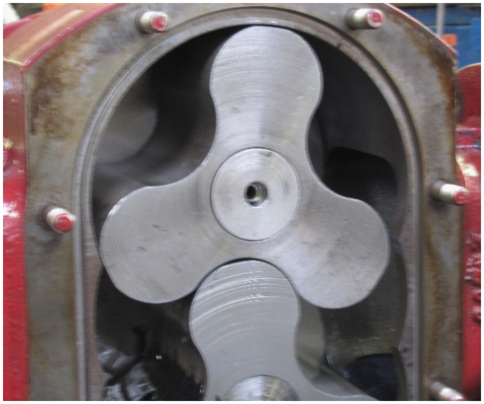
To end these ongoing issues, the customer installed 8 mm DualPac 2211 packing in a configuration as shown on the right. The packing ran at least for 4 months with no leakage on the start and low leakage on the end of pumping cycle.



Results

Change in MTBR: 12X to date

Total Annual Savings: $1,305 US (1,070 EUR) per pump

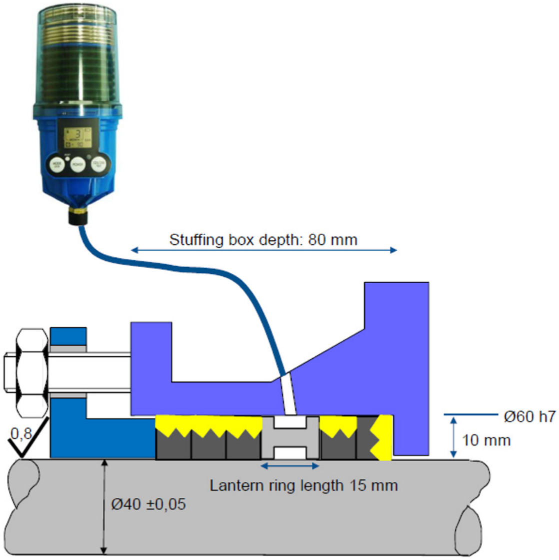


Challenge

A manufacturer of road marking equipment experienced extremely short packing life on their machines. The medium is a liquid thermoplastic containing glass pearls (Ø0.5 – Ø1.5 mm), silica, and titanium oxide. The temperature of the medium can vary from 10 – 220°C. The screw runs only at temperatures over 150°C. Speed 1000 rpm, but can vary. In theory the screw cannot supply pressure, but only transport the material. However, in practice, due to medium viscosity, it can supply both vacuum as quite high discharge pressures (estimated to be 20 – 30 bar). The customer uses a heat-resistant aramid packing (PTFE lubrication). The packing MTBF is one day.

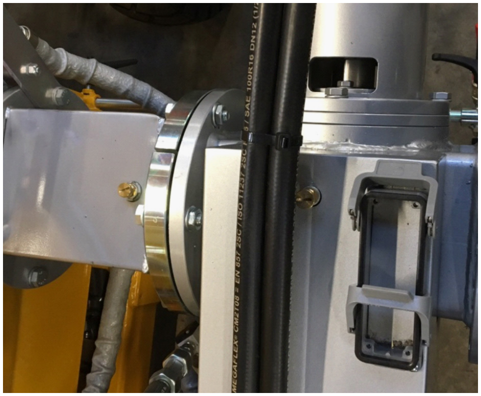
Solution

The Chesterton distributor applied three rings of 10 mm DualPac 2211 packing in combination with a lantern ring and a Lubri-Cup™ EM with Chesterton 615 grease.



Results

The packing MTBR improved from one day to six months and counting (600%+). The customer uses the DualPac packing solution now as a standard.



Challenge

A customer experienced a significant problem with sealing a 4/3AH cement pump. The fluid being sealed was 65% cement at 35°C. The speed was 1450 rpm. They were forced to replace packing weekly due to leakage and a dirty pump area. Due to packing wear, the shaft sleeve needed replaced monthly. With sleeve costs, packing costs, and labor, the mine spent $10,800 US (8,856 EUR) annually maintaining this pump.

The goal is to increase MTBF and reduce maintenance costs.

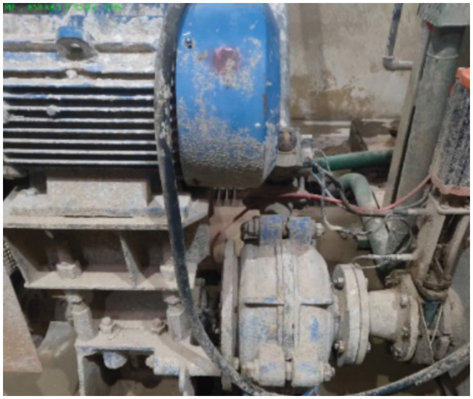
Solution

The Chesterton sealing specialist recommended switching to DualPac packing.

Results

The client reported good running and easy adjustments after installation of DualPac 2211 packing. MTBR increased by 11X and is still running. The customer placed an order to have DualPac 2211 packing in stock.

The customer eliminated sleeve replacement costs and associated labor for a total annual savings of $8,400 US (6,888 EUR)/year.



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Handbook
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