DualPac®

Packing Principles • What makes DualPac so good • Case Histories

A dual-fibre compression packing designed to reduce rotating equipment operating expenses

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DualPac® Handbook

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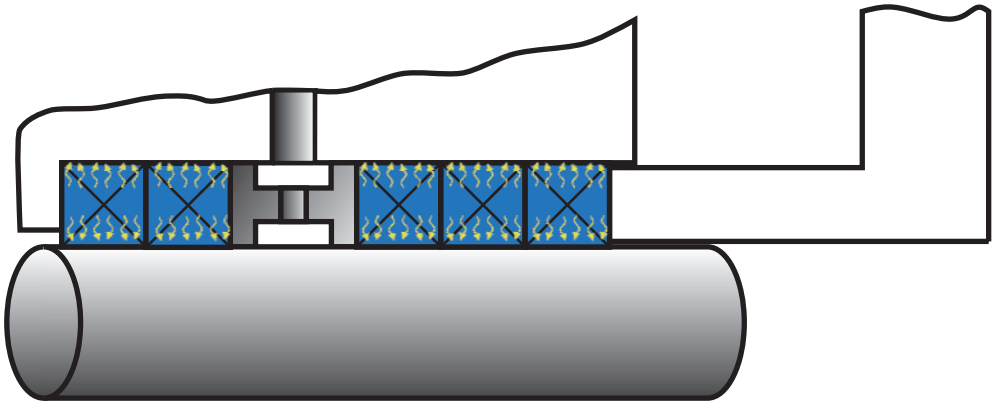
Chapter 1

HOW COMPRESSION PACKING WORKS…

- ►How packing works
- ►Why we have different packing materials
- ►Radar charts for different products/materials
- ►Material properties for different materials

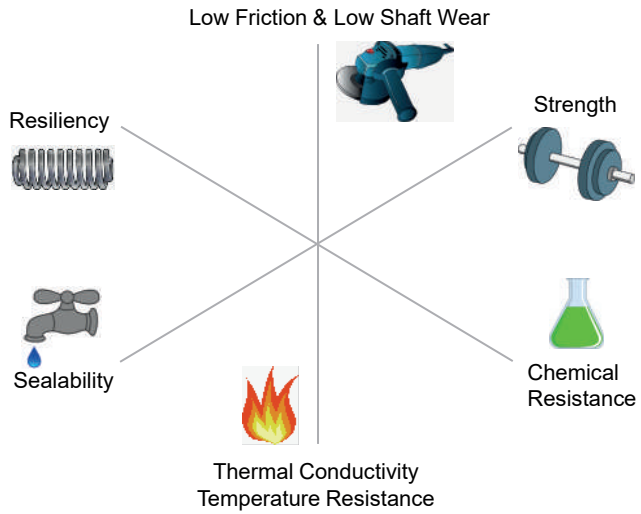
How packing works

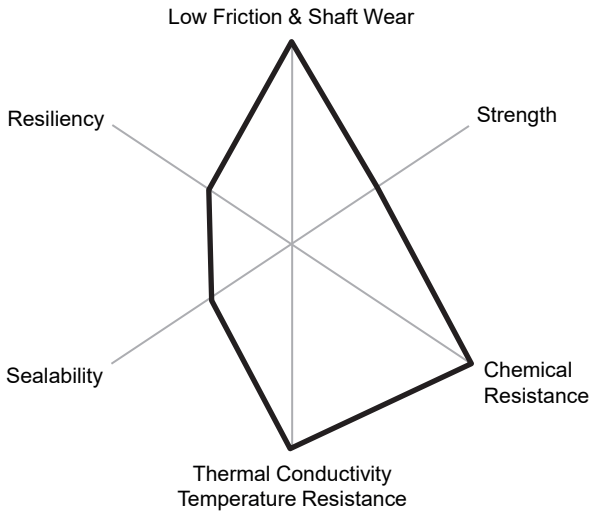
Packing rings are made of fibres that give the packing its structure and its strength. Blocking agents fill the gaps between the fibres and make the packing nonporous. Blocking agents often double as lubricants. Lubricants lower the friction between shaft (sleeve) and packing, lower friction between the fibres to make the packing more conformable, and lower friction between 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. This axial force is being transduced in the packing rings to a radial force. This radial force 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.

The requirements of compression packing





Above we see a radar chart that visualizes the requirements for a compression packing. This radar chart helps us to create a typical "fingerprint" for each individual packing. An example for a material with very good thermal properties and chemical resistance is in the picture on the right. This radar chart can help you to understand that each packing material and every packing style is strong at some requirements, but that no material is good at all requirements. This is the reason that there are so many different packing styles. Every application requires a packing that is good at one or some 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, then you need a packing with good chemical resistance. So, for an application sealing a chemical at higher temperature the packing with the radar chart on the top right might be good choice.
In the next section we will explain each of the requirements in more detail.

Packing Requirement: Wear Resistance and Strength

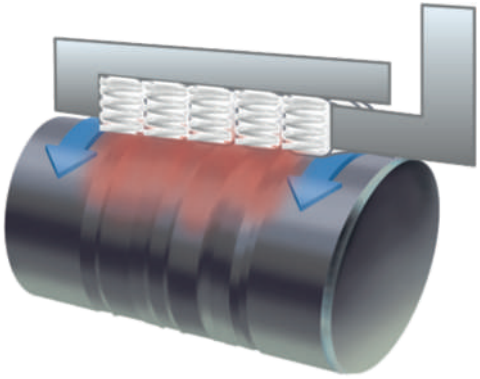
When a packing material is too weak it can be pressed through the clearances at the stuffing box bottom and under the gland. As well the packing material can be worn away by the rotating shaft or shaft sleeve or even by the leaking medium that might be abrasive. For this reason, the material that a packing is made of needs to be strong enough that it cannot extrude under high gland pressure and it will not be worn away. Ultimately, stronger packing material will ensure that the packing will last longer as well as enable it to withstand higher pressure.
Examples of strong materials that are used for packings are Carbon fibre, synthetic fibres and an example of a material with extreme strength is para-aramid (see table).

	Aramid	Carbon	Graphite	PTFE	gPTFE	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/m2/°K)	0.04	14	43	0.24	22	11
pH	2-12	3-11	0-14	0-14	0-14	1-13
Tensile Strength (KP/cm2)	35000	4100	10	3500	3500	2500
Elasticity (%)	42	34	9	28	28	95

Packing Requirement: Resiliency

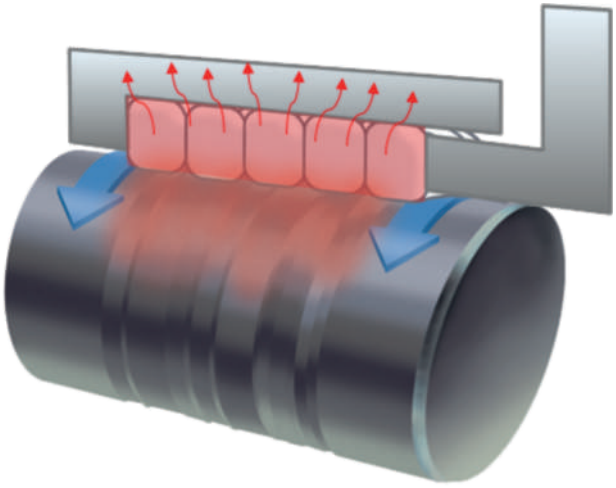
If you look at a seal, which ever seal you can think about, they all have something in common. Whether we are talking about a mechanical seal, a flange gasket, a lip seal, an O-ring. They all consist of at least the following elements:
- An elastic element
- A contact face

A mechanical seal has springs, a lip seal has an elastic lip, a flange gasket has elastic bolts, an O-ring uses elastic rubber. The function of the spring or elastic behaviour in these seals is to store and release energy to keep the sealing force on the sealing element. In a mechanical seal, 2 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 and it needs a constant sealing force to press that sealing surface tight.



Therefore, resiliency of the packing material is very beneficial to maintain a constant sealing force. Resiliency will extend the time periods between retightening the packing. It will 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. The strong and stiff fibres, when braided form a very resilient material that keep the seal tight in the stuffing box.

Packing Requirement: Thermal conductivity & Temperature resistance

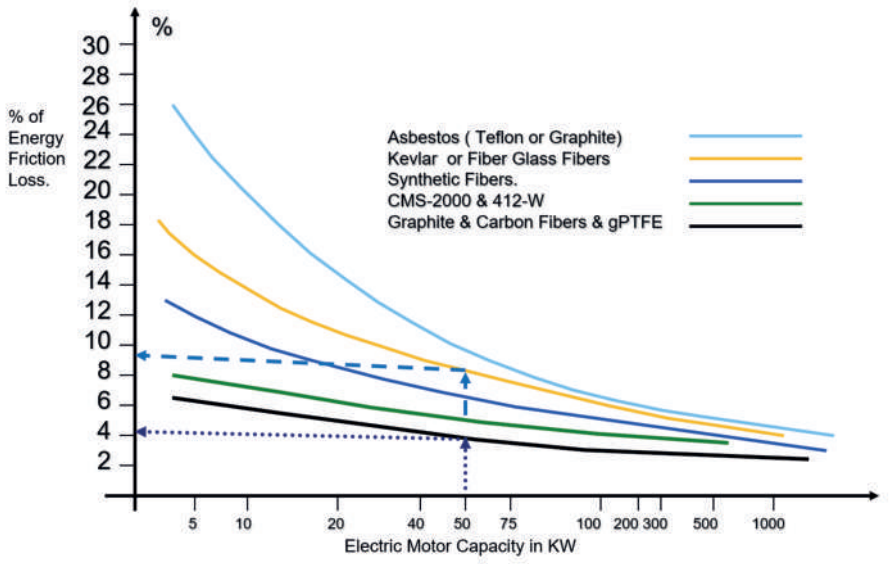


Frictional heat is being generated between packing and a rotating shaft. The mechanical properties of any sealing material will worsen at high temperature. The packing strength will decrease and therefore will wear faster, leading to decreased sealing abilities. The same goes for the material for the 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 efficient 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 of the packing and it 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 8 shows that graphite and carbon have very high thermal conductivity. As well their temperature resistance is good. gPTFE is PTFE where graphite has been added to improve its thermal characteristics. For this reason, the thermal conductivity of gPTFE is very good as well.

Packing Requirement: Low friction and Non-Abrasive

We saw that frictional heat is being generated between packing and rotating shaft. The higher the friction between the packing and the shaft, the higher the frictional heat that is being generated. As well the more difficult it is to rotate the shaft and therefore the higher the energy consumption. For this reason, lubricants are added to the compression packing and it is beneficial to use fibres that have the lowest possible coefficient of friction. The table on page 8 shows that PTFE has a very good coefficient of friction. PTFE is as well used as a blocking agent and lubricant to reduce the friction in a braided fibre packing.



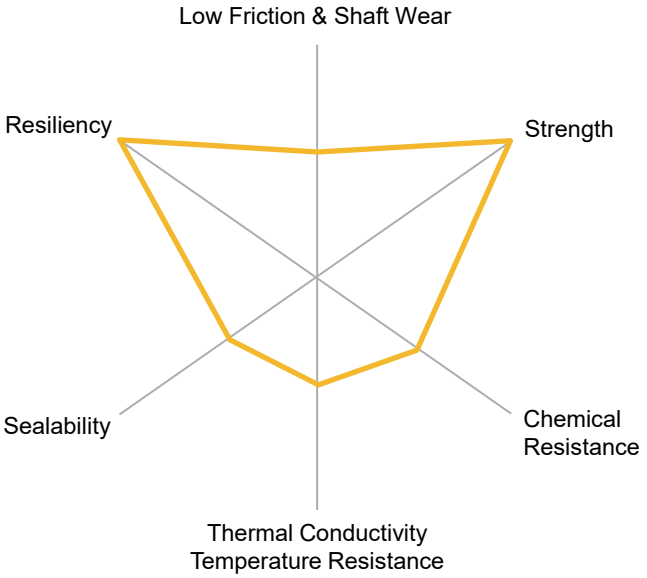
Another very important requirement is that the packing does not wear the shaft or shaft sleeve. The strength and hardness of the material is of influence here, but as well lower friction means that less material is worn away from both packing and shaft. Less friction means less energy consumption. The graph on the previous page was made by a large chemical corporation from Germany in the 1980's, when packing was still commonly used in their plants. This graph 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 seal. There are 2 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 mouldable and flexible so that it adapts its shape to the shape of the stuffing box and its corners and surface irregularities. Secondly this means that the packing needs to be non-porous. For this reason, blocking agents are added to the packing. Blocking agents can be oils or greases that serve as a lubricant as well. As well PTFE particles are added to packing to decrease its porosity.

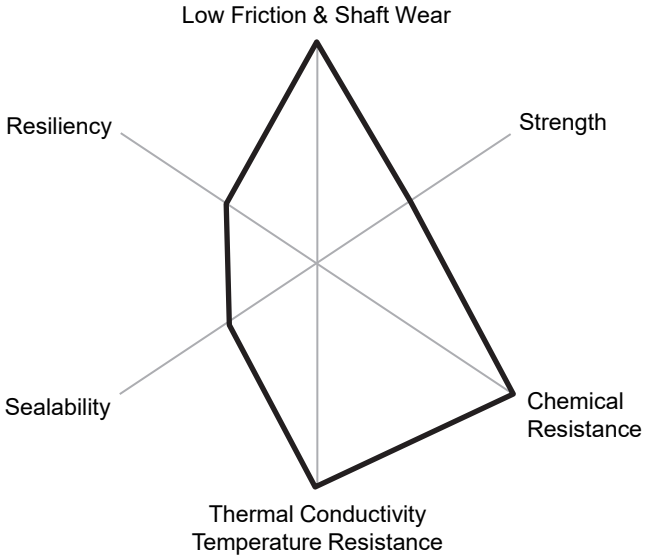
Packing Requirement: Chemical compatibility

The packing materials need to be resistant to the chemical that is being sealed. Chemical attack of a packing material will mean that its strength is decreased. If a lubricant is not chemically resistance 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 increase of packing wear and friction. All packing from Chesterton have a pH rating that indicates where the packing can be used. The table on page 8 shows the pH rating of some materials.

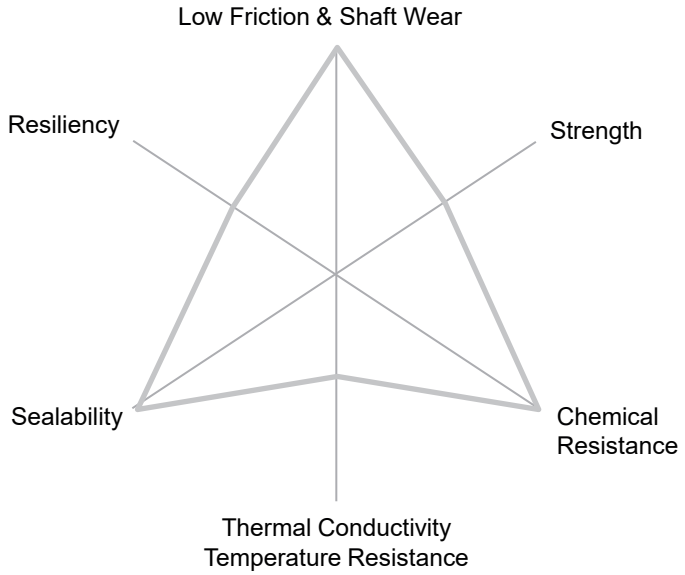


Para-Aramid

So, we learned that different applications have different requirements and for that reason, there are so many different styles of packing because every application has a different need. This means as well that many times a compromise must be made as far as packing capabilities. If an application requires a strong material like a para-aramid packing the user must take the trade-off of the high friction and poor thermal characteristics of 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 also settle for its low strength.



Graphite



PTFE

Chapter 2

SO WHAT MAKES DUALPAC® SO GOOD…

- ▶ DualPac® 2211
- ▶ DualPac® 2212
- ▶ Competitor dual-yarn products

The DualPac® braiding technology

Compression packing exists already for many years and the principle of the machine element is the same as it used to be a century ago. The main improvements have been in the materials that are used to make the packing.
In 2016, Chesterton came with a real breakthrough: a newly invented braiding technique that appeared to be a change in the way we look at materials for packing and their inherent compromises. Chesterton invented and patented the DualPac® braiding technology including the products manufactured with that technology.

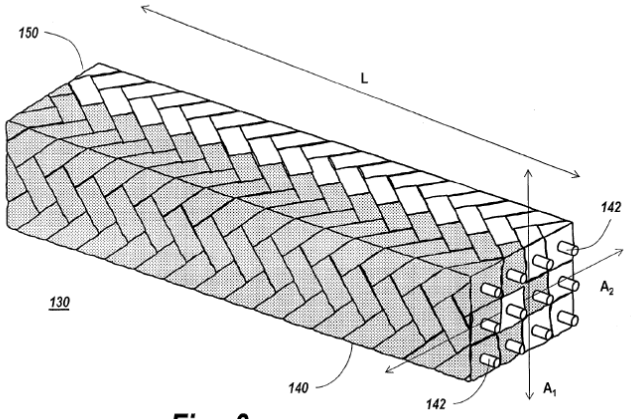


Fig. 3

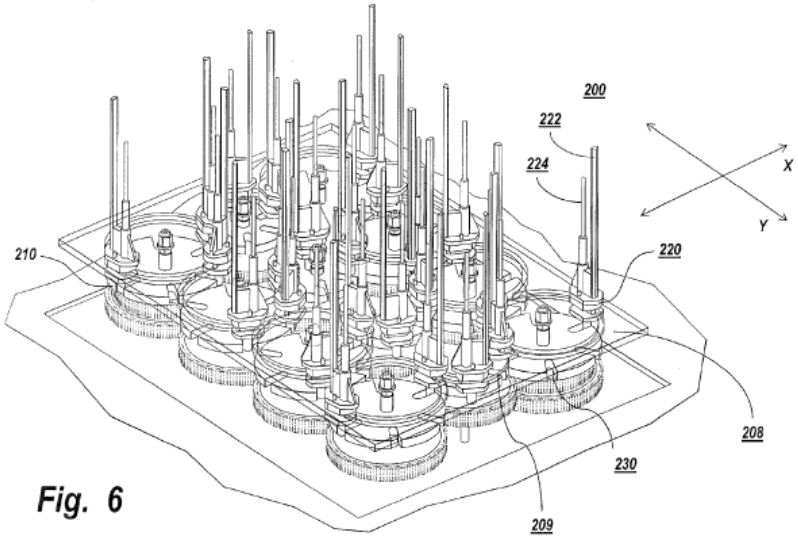
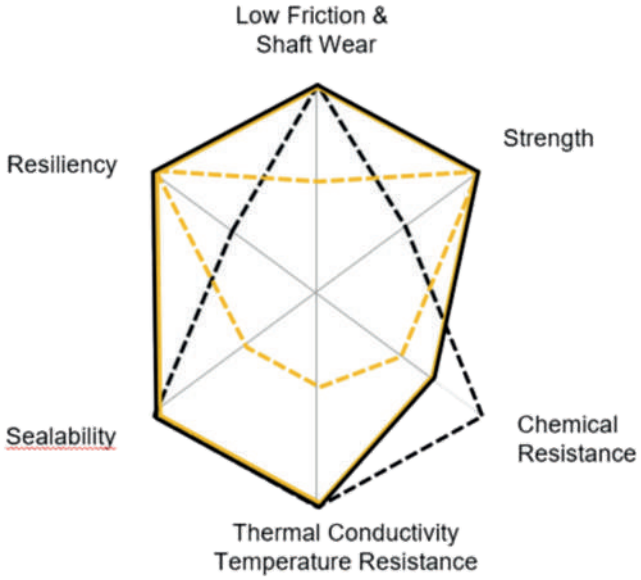


Fig. 6

Check out patents US9810324B2 and US20180051810A1 for some more background information and details about these patents.
Chesterton is currently using the DualPac® technology for pump packings and can make cross sections of 6.4mm and above.

DualPac® 2211

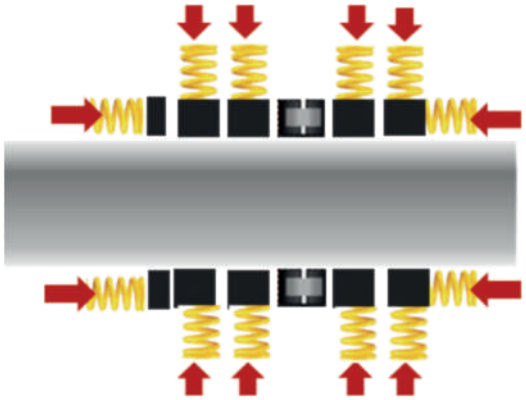


DualPac® 2211 combines the beneficial properties of graphited PTFE with those of para-aramid. It combines the low friction, sealability, and thermal conductivity of gPTFE (graphited PTFE) with the strength and resilience of para-aramid. See the radar chart above to explain this further. See the table below for the technical details of DualPac® 2211.

Para-aramid fibres have an extremely high strength and elastic modulus. Because of these properties these fibres are for example used to construct body armour like bullet proof vests. The downside of these extreme mechanical properties is that the fibre is extremely abrasive. Expensive hardened or ceramic shaft sleeves must be used with packings made of this material.

	Para-Aramid	Meta-Aramid (continuous filament)	gPTFE
Breaking strength (g/d)	23.6 (denier 1140)*	5 (1200 denier, 2 dpf)**	2.3
Elongation @ Break (%)	2.4	30.5	>100
Thermal Conductivity (W/m*°K)	0.04	0.25	22

Because of the stiffness of Para-Aramid it forms a spring-like structure when braided into a packing. This will help to extend the time between the need to retighten the packing and will keep a constant 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.de range of applications		
Available sizes	6,4 mm to 25,4 mm (1/4" to 1")		
Pressure	20 bar g (300 psig)	Temperature	260°C (500°F)
Chemical Resistance	3 to 11	Speed	10 m/s (2000 fpm)

Benefits of DualPac® 2211

Longer MTBR

- Para-Aramid fibre strength and wear resistance ensure less packing extrusion and wear
- gPTFE 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, less shaft sleeve wear

Less frequent gland adjustments

- Para-Aramid resiliency maintains sealing pressure, reducing packing retightening need, reduces tightening packing over compression

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

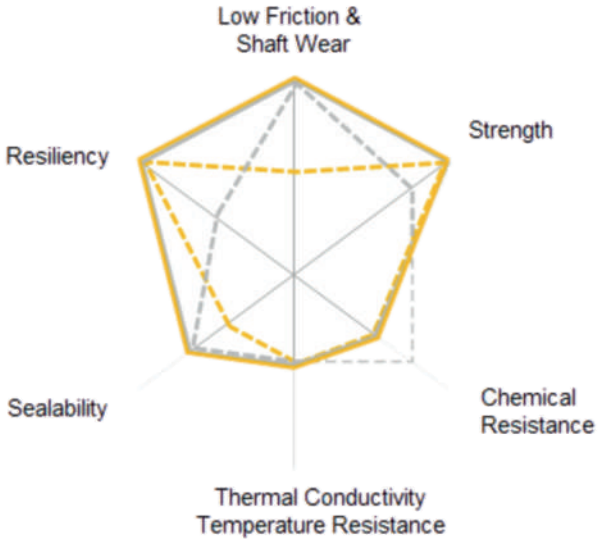
- gPTFE low friction reduces motor electrical energy consumption

Less leakage (less housekeeping, less waste water 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

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

DualPac® 2212



DualPac® 2212 combines the sealability and shaft friendliness and easy run in properties of meta-aramid with the strength and resiliency of para-aramid. Meta-aramid is a fibre with very good thermal resistance. The fibre is used for example to make fire resistant suits for refinery workers or racing drivers. This makes it hard to burn or glaze the fibre which makes meta-aramid packing very easy to run in.

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

Longer MTBR

- Para-Aramid fibre 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, reducing packing retightening need, reduces tightening packing over compression

Less or no flush required

- Meta-Aramid low wear and burn resistance reduce the need for flush water

Less leakage (less housekeeping, less waste water treatment costs)

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

Non-Staining

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

High pressure capability

- Combined strength of para-aramid and meta-aramid gives high pressure capability

Dual Yarn Competitor Products

There are as well competitors on the market that have products that are made from 2 yarns. These products generally are fibre packings with Para-Aramid reinforced corners. These products are made on a standard braiding machine and are not patented. The argument for these products is that extrusion resistance is improved by reinforcing the corners with Para-Aramid.

The biggest concern with this design of product is that the Para-Aramid takes up at least 50% of the surface in contact with the shaft (sleeve). This is where DualPac® is completely different. The DualPac® technology allows us to use a material completely different on the dynamic side of the packing.

Chapter 3

THIS IS HOW WELL DUALPAC® WORKS…

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

Pulp and Paper Case Histories

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

Challenge

A paper plant in Sweden had issues with 3 centrifugal pumps pumping recycled paper stock. The challenge is that the recycled stock has not been separated from plastics or small metal parts. We and the customer have tried many other solutions before DualPac®.
The competitor Garlock 98 was destroyed in a few weeks. Kevlar packing burned in 8 weeks.

Solution

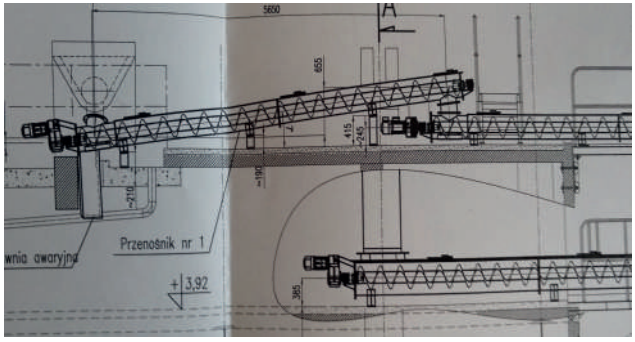
We repacked the pump at a short shutdown. The shaft sleeve was a little bit worn but not so much that it will reduce the packing lifetime.

Results

The DualPac® has been installed for about 8 month now. Savings were EUR 1000 per pump. It was however much more important for the customer to get a reliable packing in his plant. The customer will install DualPac® on other equipment because of this success.

Challenge

A Polish Pulp & Paper Causticizing plant has 3 double-sided screw conveyors transporting very abrasive lime slurry of 50°C. Rotational speed is 50 rpm. Lime slurry is the waste of the causticizing process and is very abrasive. The stuffing boxes were previously packed with various kinds of packing from various suppliers (Teadit, Spetech, etc). The leakage appears a few days after installation and the gland needs to be adjusted. The leakage contaminates bearings which have to be changed every year.



Solution

DualPac® 2211

Results

DualpPac extended packing life 4x.
Cost of existing solution:
Set of packing rings for one conveyor = 60 EUR x 5 changes = 360 EUR
Maintenance – 2 bearings + labor = 400 EUR + 4x12x25 EUR = 1200 EUR
Total cost = 1560 EUR
3 conveyors = 4680 EUR
Cost of Chesterton Solution:
Set of packing rings for one conveyor = 100 EUR x 1 change = 200 EUR
Maintenance = 300 EUR
Total cost = 500 EUR
3 conveyors = 1500 EUR
Savings = 3 180 EUR/year
This success enabled the specialist to enter other plants of the same group to seal more applications.

Challenge
A specialist in the Czech Republic needed to supply packing for a large shut down at a paper mill. There were various applications to seal like centrifugal pumps, fan pumps and agitators. Media are raw water with a higher percentage of solids, paper stock of 1.5%
The challenges with sealing abrasive media are the short life of packing and fast sleeve wear.

Solution
The specialist installed DualPac® 2212 on most applications and some combinations of 2212 and SpiralTrac on some applications.

Results
Applications have been installed during the shut down and are running without issues for 6 months.

We have just positive installation experiences with smooth start-up and break-in of packing.

Challenge

A pump repair facility in Spain is doing revision of vacuum pumps that are mainly used in the paper industry. They find that the seal is the most common reason (70% of the cases) to bring the pump in for repair. This is as well because often the bearings get damaged because of leaking water. A bearing set can cost 5000 EUR on this type of equipment. Sometimes a very cheap packing is used by the customer and the pump lasts only 2-3 months.

Solution

The solution that the repair company uses is a set of DualPac® 2212.

Results

The DualPac® packing is working considerably longer than conventional packing and the repair house is using the 2212 now for all their vacuum pumps revisions. They supply as well a repair set of packing with their revision.

Challenge

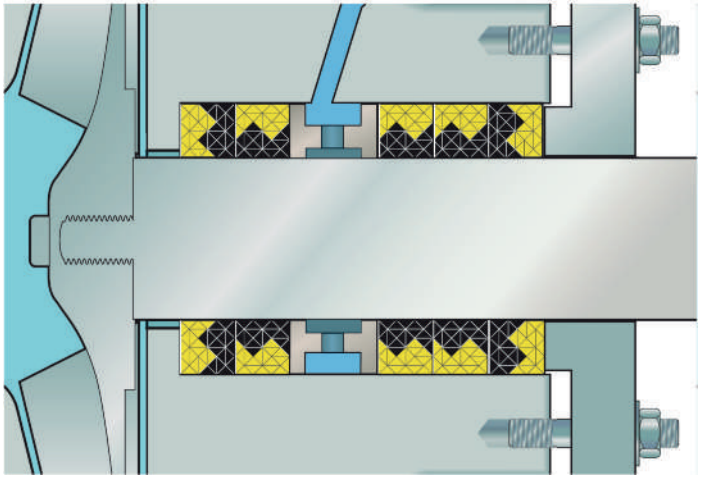
A Pulp and Paper customer was using a competitor's packing on an agitator in a chemical application. The packing wore down the sleeve, requiring replacement of both packing and sleeve every three months.
Sleeve Cost: $500 every 3 months = $2,000/year
Competitor Packing cost = $1,000/year
Labor Cost = $1,600/year
Total Cost = $4,600/year
The customer's goal was to increase continuous service time to support plant cycle and reduce costs.

Solution

Five rings of DualPac® 2211 were installed as shown in Figure 2 for solids resistance. With the DualPac® 2211 aramid side against the bottom of the stuffing box, you achieve resistance to extrusion and solids yet there is minimal contact between the aramid and shaft. This unique ability reduces shaft wear and increases uptime.

Results

The improved packing solution has lasted over six months and sleeve wear is not an issue anymore.
The customer is extremely pleased.
Sleeve Cost = $500/year
2211 Packing = $1600/year
Labor Cost = $400/year
DualPac® 2211 cost per agitator = $2500/year
Total Cost Savings = $4600 - $2500 = $2100/year per agitator.



Challenge

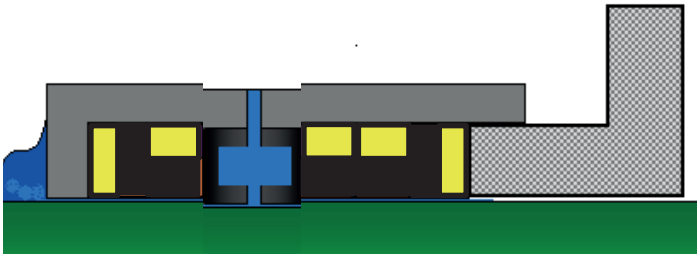
A Fiberboard plant in Virginia, USA was using a competitor's PTFE packing on pumps used for high consistency pulp stock. The packing required replacement every three weeks.
The customer's goal was to increase the length of continuous service to support plant cycle and reduce costs.

Solution

Five rings of DualPac® 2211 were installed as shown on the right for solids resistance. With DualPac® 2211 aramid side against the bottom of the stuffing box, you achieve resistance to extrusion and solids yet there is minimal contact between the aramid and shaft. This unique ability reduces shaft wear and increases uptime.

Results

The client reported sixty days of trouble-free performance and the equipment is still running (3X the life of previous packing).
Repair Costs / MTBR / Savings
Labor cost = $ 20,800/year
Product (process) savings = $ 10,400/year
Packing cost = $ 16,000/year
Total Savings = $ 3,500/month = $ 42,000/year

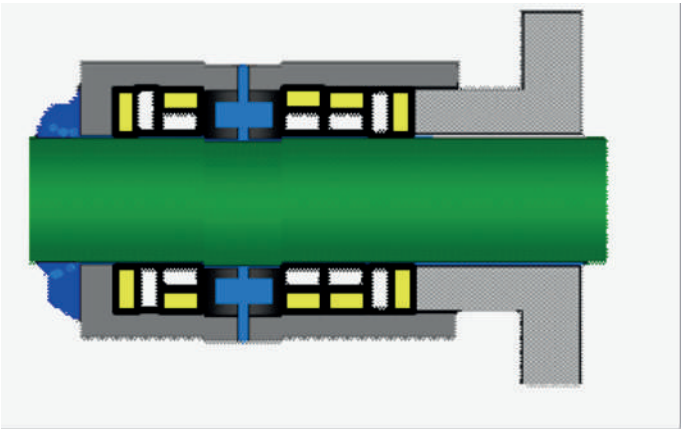


Challenge

A pulp mill in British Columbia in Canada was having some issues with their Hayward Gordon fan pump (30x36 DG). The pump was pumping water, pressure 4-6 bar, 885 rpm. The existing packing solution (Nomex packing) was only lasting 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 educe maintenance costs. The goal was 18 months desired running time before a repack.

Solution

A Chesterton 2212 - 5 ring set was installed on each of the stuffing boxes.



Results

The customer installed the DualPac® packing in June 2019 and was running at least 6 months without issues and with no need for gland adjustments. The customer is so impressed with the performance of the test packing set thus far, that they have already ordered another set for one of their Hayward Gordon PRH (14x16) 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 the next shut-down arrives. The leakage is creating major housekeeping issues and is impacting gear/bearing life.

Solution
5 rings of DualPac® 2211 where installed.

Results
After two months and approaching a shut down the leakage is minor. As a result the customer ordered more 2211 sets and the specialist leveraged into more packing sales of other styles.

Challenge

A P&P company in Mexico was experiencing several problems with an old refiner.
Refiner Sprout Walden, 4% consistency, 500rpm, shaft size 3.750", packing size 20mm.
The mill is a small plant without much budget to buy new equipment. Flush water is not available for this equipment. Previous packing lasted 5 days, it needed daily gland adjustments. Pulp leakage was very high. Poor equipment conditions, cross section is not standard.
The customer wanted to exceed previous packing life at least 4 times (20 days) to reach a direct ROI and needed to be able to justify his savings on packing consumption only.

Solution

5 rings of DualPac® 2211 where installed.

Results

The average MTBR of the 2211 packing was 46 days with new sleeve, when a worn sleeve was used the MTBR was more than 30 days. Gland adjustments are performed each 4 days.
MTBR increased 8-12x
Customer saved monthly US$570 on packing use only. Labor for changing and adjusting packing was not quantified.
Yearly savings: more than US$6,840

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. Excessive leaking product resulted in dramatic sleeve wear.
Existing packing was consolidating and wearing causing loss of compression, allowing product leakage which in turn, caused sleeve damage. The customer's goal was to achieve 14 days of continuous service.

Solution

Installed four rings of DualPac® 2211 Packing in 4 pumps as follows. DualPac 2211 Packing is ideal for this application since it uses a proprietary braiding technology to combine aramid and ePTFE in a way that will resist solids abrasion while achieving a tight seal with fewer adjustments.

Results

Average Mean Time Between Failure (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/month in packing
Customer saved $1,167/month in sleeves
Total savings: $1,965/month = $23,580/year

Challenge

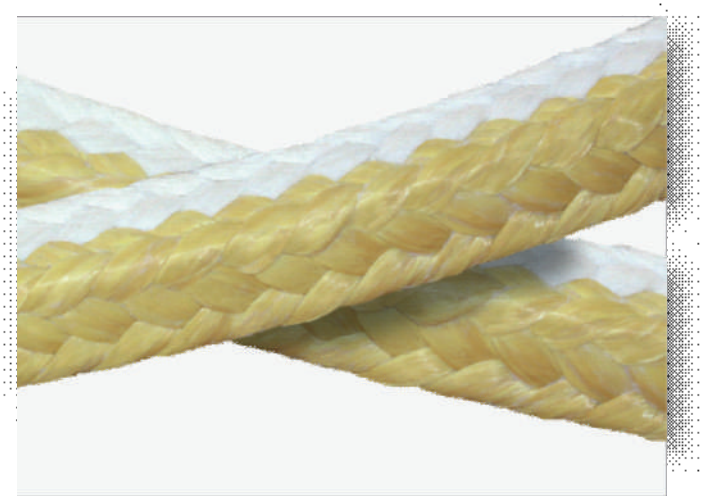
A salt processing plant in Germany is already using Chesterton 1740 as the solution on their very abrasive pumping applications. However the customer is under pressure to reduce costs and is trying lower priced competitor products. The Kevlar packing needed to be adjusted frequently.

Solution

Customer tried now DualPac 2211 and 2212 on multiple pumps.

Results

DualPac has proven to need only half the adjustments that Kevlar packing does. The internal live loading technology that is incorporated in the DualPac technology gives the packing additional elasticity whilst not severely wearing the shaft.



Challenge

A gold mine in Argentina has some pumps pumping mineral pulp with cyanurate solution for gold extraction. The pumps were packed with standard packing and had constant leaks and needed to be repacked every 2 weeks. The customer was looking to increase the MTBF and to reduce his maintenance costs.

Solution

Chesterton Style 2211 was installed.
A test scheme was implemented in 2 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. As well 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 due to reduced leakage.

Challenge

A mineral sand plant has a Goulds 14x12-29 SRL-C pump running. Speed 900 RPM. The pump was packed with Robco Slurry packing. The medium is slurry with 6 to 12% solids. Operating pressure 2 bar and the stuffing box is flushed with 4 bar flush water. The packing needed to be replaced when the gland follower bottomed out resulting in excessive leakage at gland. Packing MTBR typically 2 months. Sleeve changed out every 6 months.

Solution

Pump was repacked with the SuperSet and three rings of 2211.

Results

Customer set the flush water flow at 50% of the previous rate. They took the pump for inspection after 3 months to inspect the shaft sleeve. No Issues.

The total amount of water saved per year is 21,024,000 gallons/year.

Challenge

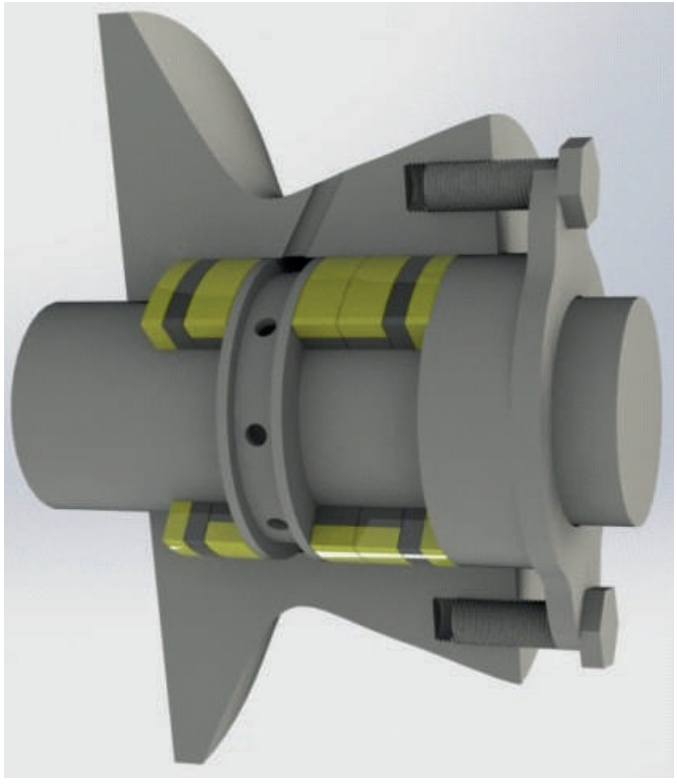
A Tar Sands Mine is operating a remote tailings pump that is experiencing frequent leakage. Because of the remote location the pump is not monitored closely. Excessive leakage causes shaft damage and limits packing life. The customer typically adjusts the packing gland 8 to 10 times per 1000 hours of running time.

Solution

5 rings of DualPac® 2211 were installed.

Results

Pump has run 1000 hours with only one adjustment. Because of this success the customer is expanding the use of DualPac 2211 to other areas.



Power Industry Case Histories

- Centrifugal Pumps
- Plunger Pumps
- Conveyors

Challenge

A power plant in Bulgaria has sealing problems with a Habermann Model KBL350 Ash Pump. The existing packing lasts about 2 weeks due to the abrasive slurry and needs constant adjustments which, combined with leaking product, resulted in excessive sleeve wear. The shaft sleeve needs replacement every 3 months. The customer goals were to achieve 2 months of continuous service to support plant cycle and to achieve at least 6 months without replacing the sleeve.

Solution

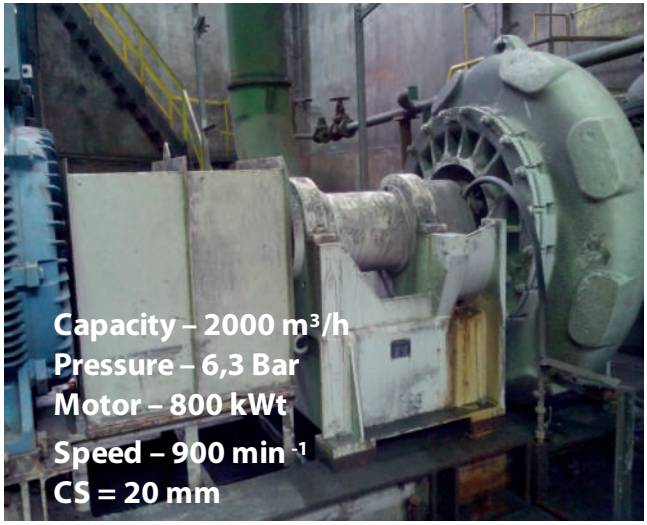
Customer installed DualPac 2211 in a configuration shown on the right.

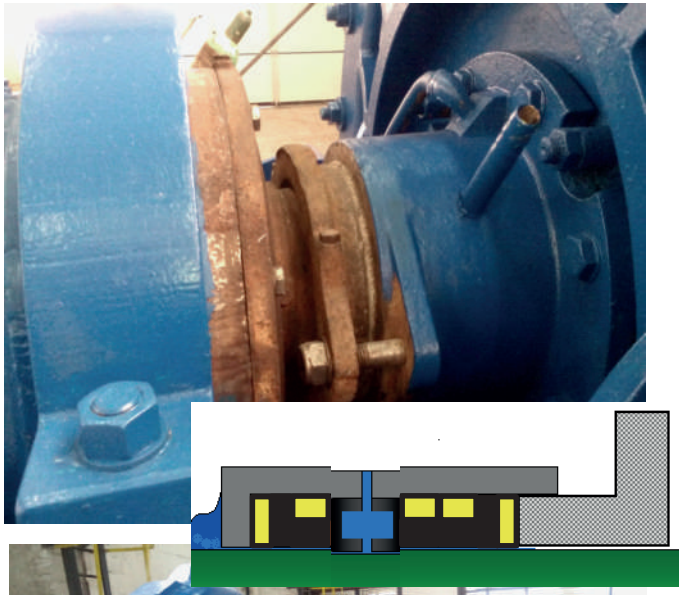
Results

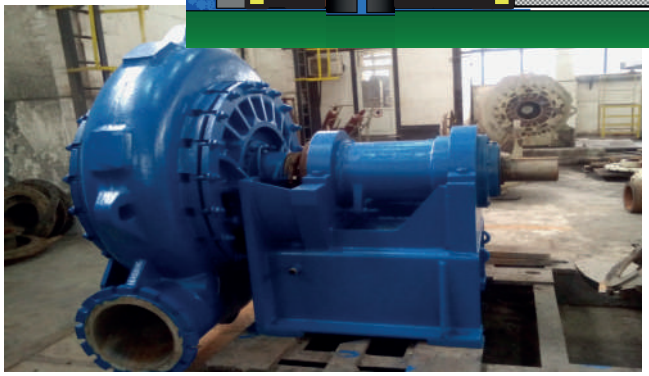
Average MTBF of packing increased to 3 months.
The MTBF of the sleeve increased to 12 months.
Price of existing packing set – about 150 €
Price of Chesterton packing set – 320 €
Price of the sleeve – about 500 €

ROI / Savings
Sleeve Savings - 140 € /month
Packing cost savings – 180 € /month
Labor Savings - about 600 € /month
Total Savings 920 € /month
Total Savings 11 000 € /year

Based on the success of the Field Test and ROI, the Chesterton representative hopes to standardize DualPac 2211 as a seal for all 4 ash pumps and lime milk pumps in the plant.





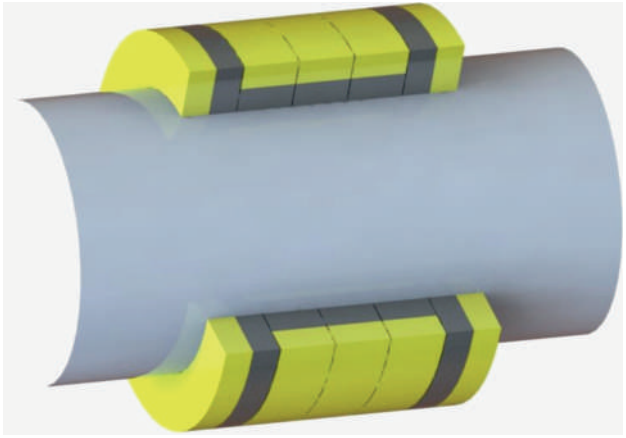


Challenge

A power plant in the Czech Republic has 2 plunger pumps pumping waste water. The customer faced a lot of problems with leakage and has therefore housekeeping issues. He was using a PTFE packing supplied by a service company that clearly wasn't performing. 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. For the customer it was very clear that he wanted to solve the leakage problem and the short MTBR.

Solution

The solution was DualPac 2211 – 12 mm packing installed in a configuration as on the right - 6 rings of packing rings installed.



Results

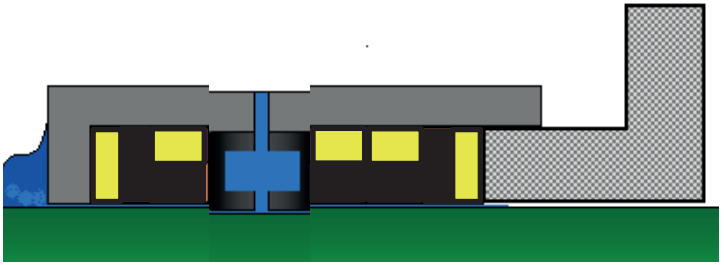
Packing installed 8 months ago and is still running with no leakage.
Cost of **previous solution**: approximately EUR 60, MTBR: 1 month, repair time: 1 hour, labor rate: EUR 15 /hr.
Material costs: EUR 60 x 12 = EUR 720
Labor costs: EUR 15 x 1 hr x 12 = EUR 180
Total costs: EUR 900
Cost of **Chesterton solution**: EUR 110
Currently running: 8 months (assume as MTBR)
Material costs: EUR 110 x (12/8) = EUR 165
Labor costs: EUR 15 x 1 hr. x (12/8) = EUR 22.50
Total costs: EUR 187.50
Total annual savings: EUR 712.50 per application
Customer bought 2211 for applications as a result.

Challenge

A power plant in Virginia, USA used general packing on a coal submerged scraper conveyor. There was significant leakage, which caused premature pillow block bearing failure along with significant water loss The old style packing and bearings were being replaced every month.
Packing Cost: $200/month = $2,400/year
Bearing Cost: $300/month = $3,600/year
Labor Cost: $800/month = $9,600/year
Total Cost: $15,600/year
The goal was to increase time of continuous service to support plant cycle and reduce costs.

Solution

A Chesterton Sealing Specialist recommended DualPac® 2211. Five rings of DualPac 2211 were installed as shown in Figure 2 for solids resistance. With DualPac 2211 aramid side against the bottom of the stuffing box, you achieve resistance to extrusion and solids yet there is minimal contact between the aramid and shaft. This unique ability reduces shaft wear and increases uptime.



Results

Leakage was reduced significantly. Customer no longer experiencing frequent bearing failure. Over six months of trouble-free performance and still running.
Repair Costs / MTBR / Savings
DualPac 2211 Packing: $2,000/year
Labor cost: $ 800/year
Total cost: $2,800/year
Total savings: $12,800/year

Challenge

A heating plant in Poland has packing issues with a pump pumping slurry containing clinker, sand, sludge and ashes. The flushed packing was lasting 1 month and needed to be adjusted every few days.
The pump is a POWEN WaFa – type: PH 150.
Running 2 times per hour appr. 15-20 min.
Sleeve OD: 85 mm
Stuffing Box Bore: 110 mm
Previous packing is Spetech – type SKD 664 IS 85 x OD 110mm (Para Aramid with PTFE lubricant).
The price of this packing is approximately 50% price of 2211
If SKD 664 was installed on new sleeve, the lifetime was up to 1 year. But with time, the sleeve wear increased, which results in excessive leakage and high maintenance required and frequent gland adjustments. Thus in some cases, if the sleeve is too worn, maintenance staff must repack the packing every one month.

Solution

2211 DualPac

Results

After installation packing was compressed only slightly with the gland follower, and the bolts were tightened very lightly with hands (with no tools). One month after installation the gland didn't need to be retightened.
Customer goes from frequent gland adjustments to 0 gland adjustments. Packing runs without further issues.

Food & Beverage Case Histories

- Centrifugal Pumps
- Steam Peelers
- Other equipment

Challenge

A sugar refinery in Saudi Arabia was having issues sealing 8 Striker Receivers. Speed:1700 rpm, Pressure:19 bar, temperature: 90°C. No lantern ring. The old asbestos packing had to be adjusted every 2 weeks and replaced every 5-7 weeks. The shaft sleeve was scored. The currently used packing was low in price and customer was hesitant to go away from the OEM recommendation. As well plant management was hesitant to go to a new technology. One of the requirements from the customer was for the distributor to have always a replacement packing on his shelf.

Solution

Customer installed DualPac 2211

Results

MTBR Asbestos : 2 Months
Cost of asbestos packing $3,200 /year
Labor Cost = $32,000 /year
Product loss = $160,000 /year
Total cost = $195,200 /year
Cost of DualPac $865
Product lifetime for Dual Pack 2211: 12 Months
Labor Cost = $5300
Product loss = $26600
Total US $ 32,765
Saving = US $ 195,200-32,765 = US $ 162,435
Saving for Eight (8) units 162,337 x 8= US $ 1,298,696

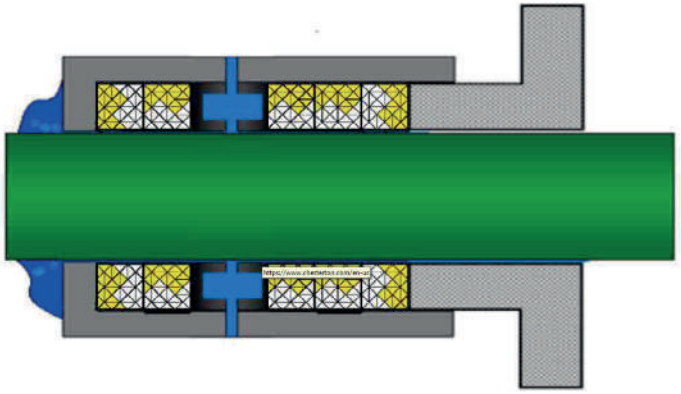
Challenge

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 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 below.



Results

DualPac 2212 lasted twice the life of the competitor's packing. Customer's expectations were exceeded.

ROI

Labor cost = $10/hour

Downtime cost = $50/hour

Packing cost savings = $4,751

Downtime cost savings = $1,600

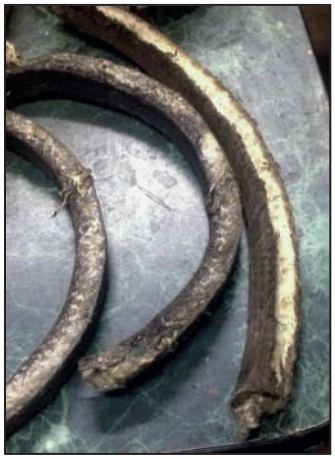
Labor cost savings = $320

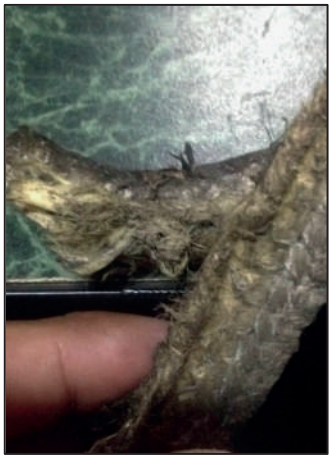
Total Savings = $6,671 per year

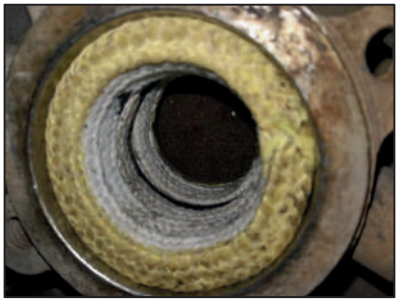
Challenge
A sugar mill in Ecuador experienced short life on their packing. Existing packing shows extrusion and glazing due to lack of lubrication

Solution
5 rings of DualPac® 2212 were installed

Results
The client reported 25 days of trouble free performance and still running.
The customer is extremely pleased.
Repair Costs / MTBR / $savings
Machining Savings $281/month
Labor Savings $1,054/month
Product (Process) Savings $4,215/month
Packing cost - $271/month
Total Savings:
$5,629/month, $67,554/year





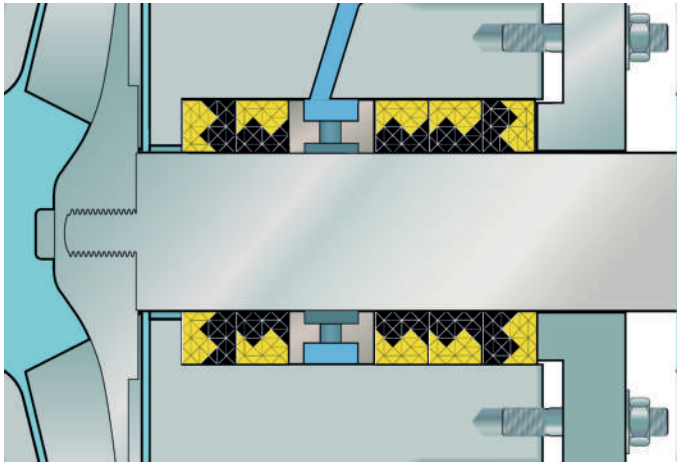


Challenge

A food plant had tried multiple types of packing (PTFE, graphite, Kevlar reinforced corners, …) to achieve more reliable sealing of potato steam peeler. The best results they were able to achieve: two months before the set blew out (catastrophic failure) and had to be completely replaced. The customer's goal was to increase Mean Time Between Failure (MTBF) and reduce maintenance costs
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

Plant switched to Chesterton DualPac® 2211, a braided packing that brings together the best of aramid and PTFE packing with distinct shaft-facing and outward-facing properties.



Results

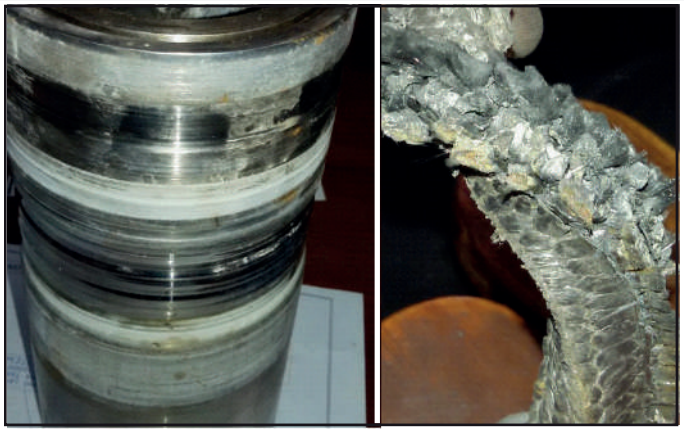
DualPac® 2211 performed the best of any packing they had ever tried in this equipment. The peeler has been running for 21 months to date without a packing blow out and without any significant leakage.

Chemical Industry Case Histories

- Centrifugal Pumps
- Conveyors
- Mixers

Challenge

Issue: Existing packing lasted only three days due to abrasive gypsum slurry in fertilizer mineral manufacturing process. The shaft required replacement every few days.
Root Cause: Existing packing failed due to a loss of compression, allowing the gypsum mineral to enter the stuffing box, fret the shaft, damage the packing, and cause uncontrollable leakage.
Goal: Achieve 15 days of continuous service to support plant cycle.



Solution

Installed five rings of DualPac® 2211 Packing. DualPac® Packing uses patented braiding technology that combines graphite filled ePTFE with a high strength and resiliency aramid. It results in significantly longer packing life and low wear on shafts.

Results

Client Reported: achieved over 25 days of continuous service.
Repair Costs/MTBF/Savings
Sleeve Savings $351/month
Machining Savings $281/month
Labor Savings $1,054/month
Product Savings $4,215/month
Packing cost $271/month
Total Savings $5,630/month

Challenge

A fertilizer manufacturing plant in the Czech Republic experienced 1 month packing life on their screw conveyor transporting dry granules. Temperature is ambient, pressure is low, the speed is 60 RPM. The customer is using Gore GFO packing. House keeping and maintenance issues, equipment downtime.

Solution

The solution was DualPac® 2211 – 16 mm packing. DualPac® takes the discussion away from comparing the Chesterton product with an apparently similar competitor product. 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

Current packing cost: approximately EUR 50, MTBR: 1 month, repair time: 1 hour, labor rate: EUR 15 /hr.
Total yearly costs:
Material: EUR 50 x 12 = EUR 600
Labor: UR 15 x 1 hr. x 12 = EUR 180
Total: EUR 780
Cost of Chesterton solution: EUR 160
Currently running: 6 months (assume as MTBR).
Total yearly costs:
Material: EUR 160 x 2 = EUR 320
Labor: EUR 15 x 1 hr. x 2 = EUR 30
Total: EUR 350
Total annual savings: EUR 430 per application

Challenge

Customer has a Continental rollo mixer (Dupont plant) and he reported that the packing they were using lasted 3-6 months and 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 change.

Solution

One continuous ring of ¾" 2211 packing inserted with a bladder behind pressing against blender drum.

Results

Packing has lasted a year and continues to run. Changing packing every 3-6 months costs $1500 for packing. Plus the cost of down time to replace.

The DualPac® solution cost $1330 and resulted in no down time for repairs.

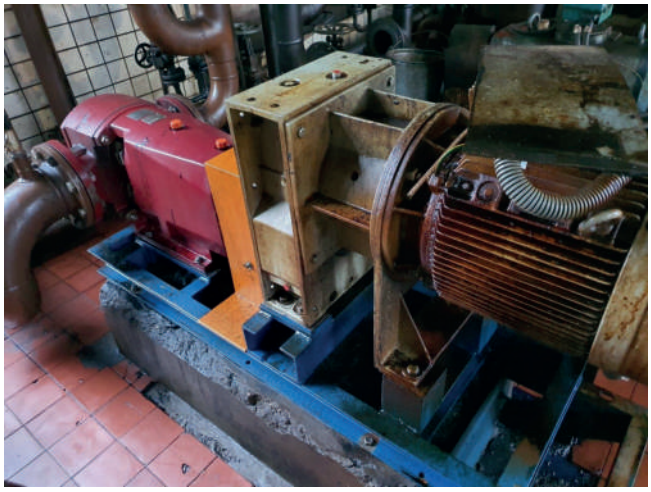
Estimated savings were $7,000-10,000 per year.

Other Industries Case Histories

- Centrifugal Pumps
- Lobe Pumps
- Other equipment

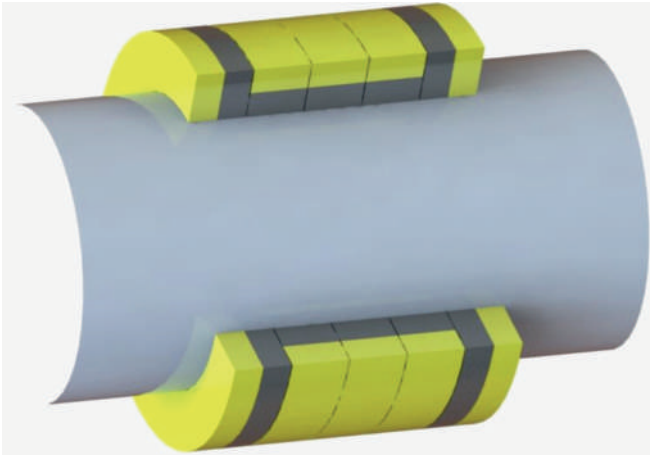
Challenge

An oil refinery in the Czech republic is sealing SSP-D6–0420 lobe pumps with packing. The lobe pumps are pumping oil slurry, 40°C, from 2 to 10 bar into a filter. The medium consists of oil and up to 30% of clay. Packing MTBR 1 week. Sleeve MTBR 2 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 make an end to the issues the customer installed DualPac® 2211 – 8 mm packing in a configuration as on the right. The packing ran at least for 4 months. No leakage on the start and low leakage on the end of pumping cycle.



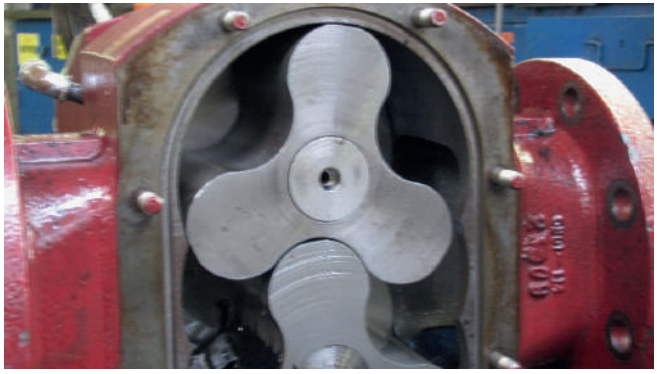
Results

Previous Solution:

Old packing EUR 10 - MTBR: 1 week
Material: EUR 10 x 50 weeks = **EUR 500**
Repair time: 1 hour, Labor rate: EUR 15 /hr
Labor: EUR 15 x 1 hr. x 50 = **EUR 750**
Total Cost: **EUR 1250 per year**

Chesterton solution:

2211 Packing set EUR 45, Currently running: 4 months (assume as MTBR)
Material: EUR 45 x (12/4) = **EUR 135**
Labor: EUR 15 x 1 hr. x (12/4) = **EUR 45**
Total Cost: **EUR 180 per year**
Total annual savings: **EUR 1070** per pump



Challenge

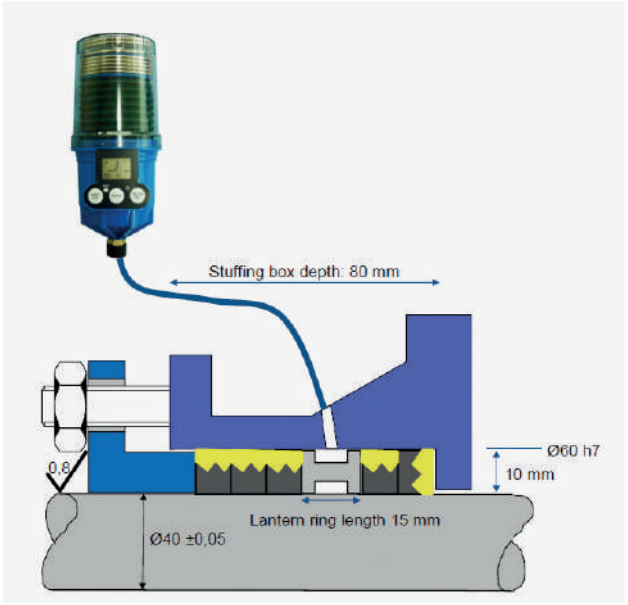
A manufacturer of road marking equipment was seeing extremely short packing life on their machines. The medium is a liquid thermoplastic containing glass pearls (Ø0,5 to Ø1,5 mm), silica and titanium oxide. The temperature of the medium can vary from 10 to 220°C. The screw runs only at temperatures over 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). Customer uses Klinger type K25 (Kevlar with PTFE lubrication) and the packing MTBF is 1 day.

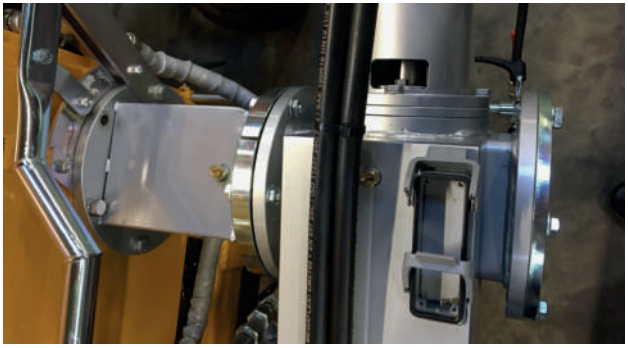
Solution

The Chesterton distributor applied Solution 2 + 3 rings of Style 2211 DualPac® (10 mm) in combination with a lantern ring and a Lubricup EM with Chesterton 615 grease.

Results

The packing MTBR was improved from 1 day to 6 months (at least). The customer uses the Chesterton DualPac® solution now as a standard.





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Global Solutions, Local Service.

Challenge

Customer experienced a significant problem with sealing a Warman® type 4/3AH cement pump.
Fluid: Cement 65% of 35°C. Speed 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 replacement monthly. With sleeve costs, packing costs, and labor, the mine spent $10,800 annually maintaining this pump.
Goal: Increase Mean Time Between Repair (MTBF) and reduce maintenance costs.

Solution

The Chesterton Sealing Specialist recommended switching to Chesterton® DualPac® 2211. Chesterton® DualPac 2211, a patented braided packing that brings together the best of aramid and PTFE packing with distinct shaft-facing and outward-facing properties.

Results

Client Reported good running and easy adjustments after installation of DualPac® 2211.
MTBR increased by 11X and still running.
Customer placed order to have DualPac® 2211 in stock.
Customer eliminated sleeve replacement costs and associated labor for a total annual savings of $8,400 per year.

CHESTERTON®
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Brochure – English
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