Empowering Pumps & Industry Conference

November 12-13, 2024 • Colorado School Of Mines • Golden, CO

Innovation and Pump Sealing

CHESTERTON
Global Solutions, Local Service.

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Presenters

Chesterton

- Ron Frisard
  - Director of Product Line Management, Packing & Gasketing
    - BSME, Northeastern University
    - 33 years as a technical expert
    - Industry influencer, global traveler
    - Presented 35+ conferences, globally
    - Published 20+ articles, industrial
    - Current chair of the Gasketing division, Fluid Sealing Association (FSA)

- Doug Ell
  - Global Industry Leader, Mining & Ore Processing
    - BSME, MSBM, MBA
    - 34 years industrial experience
    - Engineering, marketing, consulting, business development and sales
    - Global traveler, visited mines across NA, LATAM, EMEA and APAC regions
    - Member of Society for Mining, Metallurgy & Exploration (SME)

Todays Topics

Innovation in Pump Sealing (Tailings pumps)

- One of the most difficult sealing tasks in mining, is dealing with tailings pumps.
  - Explore traditional packing methods and challenges
  - Discuss latest technologies and improvement opportunities
  - Share proven solutions

- Topics:
  - Slurry Sealing Challenges
  - Best Practices
  - Innovative Solutions

Factors and Considerations

Slurry Sealing Challenges

Best Available Technology: US DOE – "The preferred technology …after taking into account factors related to technology, *economics*, policy, and other parameters…."

Ex: centrifugal slurry pump

- Considerations on the sealing element:
  - Capital: Expected pump life, Equipment condition, New pump cost, Lead time, Budget
  - Production: Cost of downtime, Loss of product, Water usage, Budget
  - Maintenance: Stuffing box accessibility,, Ease of installation, Best practices
  - Planning: Scheduling, Shutdowns, Manpower, Equipment availability
  - Technology: Equipment design, slurry characteristics, packing/seal life,, ROI

- Decision Tree
  - Does an investment increase reliability and lower operating costs?
  - Does a solution offer a reasonable rate of return?
  - What impact does it have environmental stewardship, water consumption, effluent discharge etc.?

There is no one size fits all to seal slurry pumps, but evaluation of best available technology can help identify a sealing solution that is well suited to a given slurry application.

Consistencies & Types

Slurry Sealing Challenges

Understand slurry type to be sealed in order to provide the right solution for the application!

1. **Settling** (solids settle out)
   - Particle sizes: > 75µm (0.003”)
   - Most abrasive particulates (e.g. Tailings Pumps)
2. Non-Settling (solids don’t settle out)
   - Particle sizes (<75µm / 0.003”)
   - Smoother particles, form a homogenous, viscous mixture
3. Dewatering (solids stay in suspension)
   - Tend to pack-up and clog

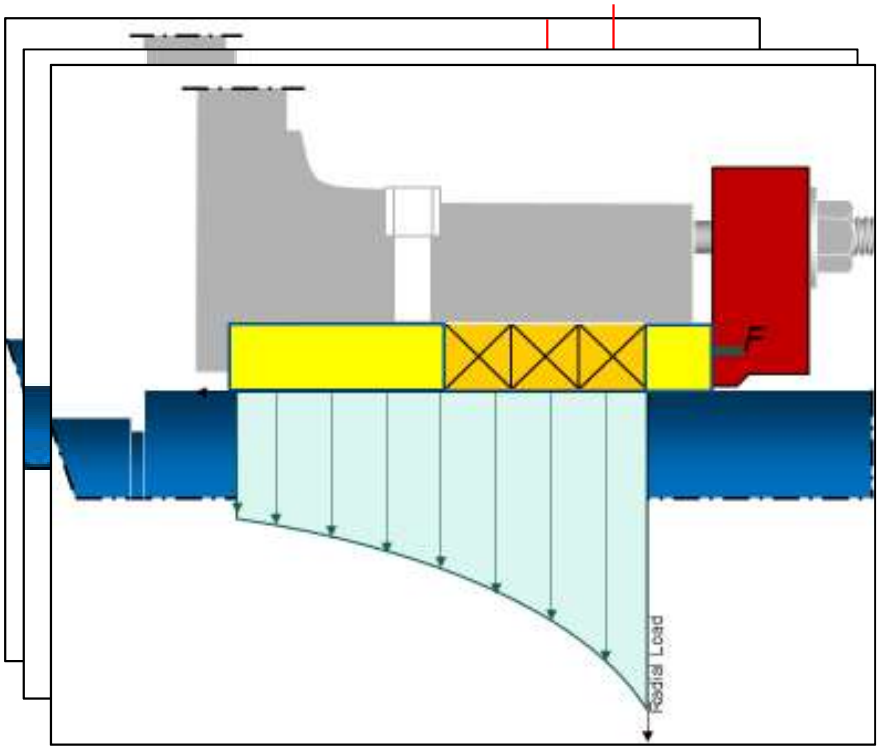
*Class	Slurry Class	Slurry Consistencies	Description
1	Light	<10 %	Mildly abrasive
2	Medium	10 – 20%	Abrasive
3	Heavy	20 – 40%	Highly abrasive
4	Very Heavy	> 40%	Extremely abrasive

* Hydraulic Institute

Improving Packing Life

Slurry Sealing Challenges

- Gland follower length dictates travel load to packing
  - No load transfer when bottomed out
- After Adjustments (F)
  A. Lubricants washed out, packing hardens, lifeless
  B. Lantern ring dislocates, obstructs flush flow
  C. High sleeve wear, shortened packing life
- Reduce # of rings
  - Minimize volume loss, prolong time to bottom out



Compression Packing or Mechanical Seals

Best Available Technologies

- Where heavy slurries are common, compression packing is often the primary method of sealing pumps.
  - Pump equipment is large therefore performance and reliability often outweighs the cost of flushing.

Advantages

- Cost
- Ease of Use
- Durability
- Equipment conditions
- Downtime
- Risk

Other considerations:

- Fretting, sleeve wear
- Leakage required, environmental
- Leak Rates, water usage, dilution or sleeve wear
- Adjustments required, safety

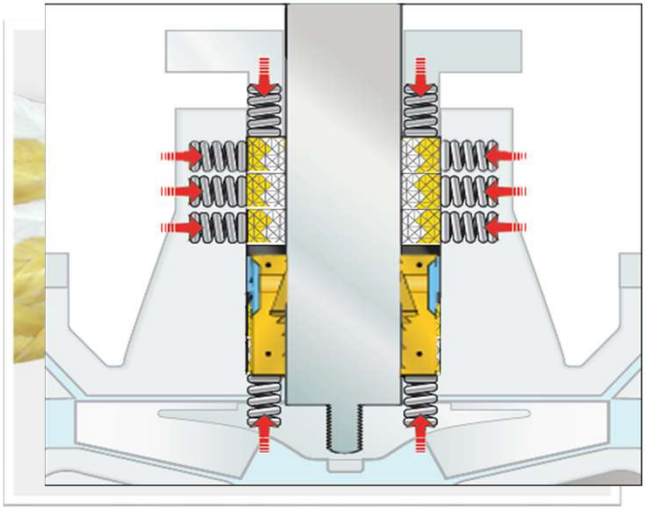
Dispelling Perceptions

Best Available Technologies

- Some packing is specifically designed for challenging slurry environments
- Perception is that packing requires significant flushing for cooling, lubrication and cleaning to be reliable
- Improved material technologies now exhibit less heat generation, better thermal conductivity, improved durability and require lower flush rates.
- A high performance slurry pump packing can reduce water usage while increasing reliability!!!

New Slurry Sealing Packing

Best Available Technologies



- Chesterton® patented DualPac 2212 combines a burn-resistant material on the packing's shaft side with a highly resilient outer fiber.
  - – Kevlar fibers provide durability and resiliency
    - Uses the gland load more efficiently and achieves a reliable and quicker break-in period.
  - – Nomex® heat-resistant fibers will not burn up
    - Lower power consumption Superior sealing and extrusion resistance in one packing
    - High-pressure capabilities
    - User-friendly: easy to cut, install, and maintain
    - Non-staining

Technical Data	
Material	ePTFE and aramid
Applications	Slurry processing applications such as ore slurries, mineral handling, and dewatering tailing pumps.
Available Sizes	8 mm – 25.4 mm (5/16" – 1")
Pressure Limit	20 bar g (300 psig)
Shaft Speed	10 m/s (2000 fpm)
Temperature Limit	260°C (500°F)
Chemical Resistance	pH 3 – 11

Water Usage and Cost

Best Available Technologies

- Flush water is essential to the proper operation of pump packing
- Slurry pumps are often overlooked, source of water consumption
- Cost of flushing can add up…for example;

A single pump using ~2 US gallons per minute for flush;

Yearly water consumption operating 24/7/365:

2 gal./min.	120 gal./hr	2,880 gal/day	1,051,201 gal./yr.	
16 “	**960 “**	**23,040 “**	**8, 409,60**	**(OEM recommended**
8 “	480 “	5760 “	2,102,400 “	(w/SpriralTrac)

Drastically reduce flush water usage using SpiralTrac® technology

OEM flush recommendations

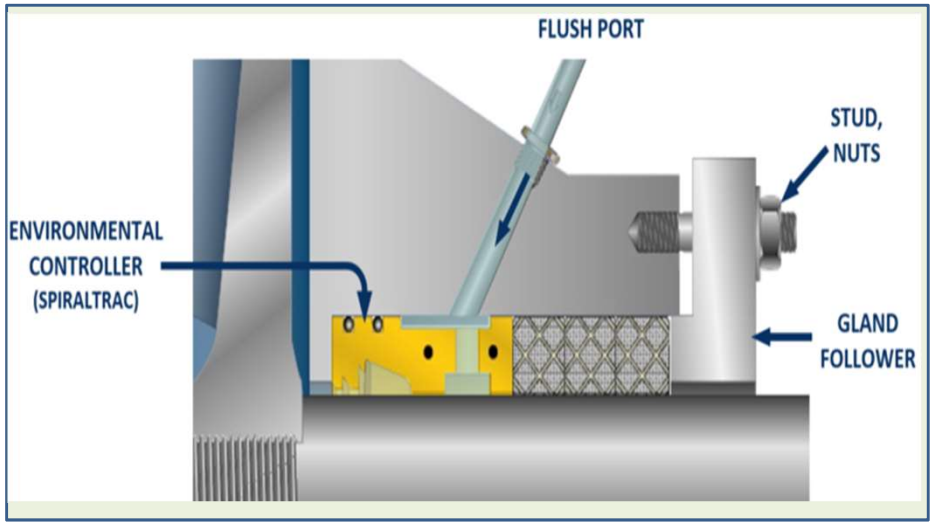
Pump OEM	Model	Sleeve OD (mm)	Sleeve OD (in.)	OEM Flow Rate (US GPM)	SuperSet Flow Rate (US GPM)
GIW	LSA 44, TBC 44	216.15	8.510	44	14
GIW	LSA 44, TBC 46	216.15	8.510	44	14
GIW	TBC 54,LSA 58	266.70	10.500	68	21
GIW	LSA-	302.26	11.900	88	27
GIW	TBC 57	357.45	14.073	120	37
GIW	LCC	125.00	4.921	16	5
GIW	LCC	145.00	5.709	20	7
GIW	LCC	190.50	7.500	36	11
WEIR-WARMAN	12 TAHF	177.80	7.000	16	TBD
WEIR-WARMAN	20x18 TUAHP	220.00	8.661	32	20
WEIR-WARMAN	20x18 UAH	300.00	11.811	49	26
WEIR-WARMAN	600 UTHP	300.00	11.811	49	26
WEIR-WARMAN	650ULP	300.00	11.811	49	26
WEIR-WARMAN	200 EYM	101.35	3.990	11	5.5
WEIR-WARMAN	12x10 FAH	177.85	7.002	16	7.9
WEIR-WARMAN	1.5x1 B-M	45.34	1.785	4	2.0
WEIR-WARMAN	2x1.5 B-AH	45.34	1.785	4	2.0
WEIR-WARMAN	3x2 C-AH	58.72	2.312	6	2.8
WEIR-WARMAN	4x3 C-AM	58.72	2.312	6	2.8
WEIR-WARMAN	4x3 D-AH	82.55	3.250	9	4.4

WEIR-WARMAN	12x10 FAH	177.85	7.002	16	7.9

Environmental Controller With Packing

Proven Solution

- The SpiralTrac® is a unique throat bushing engineered to control flow and improve the internal stuffing box environment in rotating process equipment.



- Modifies the flows that exist inside rotating processing equipment

Benefits:

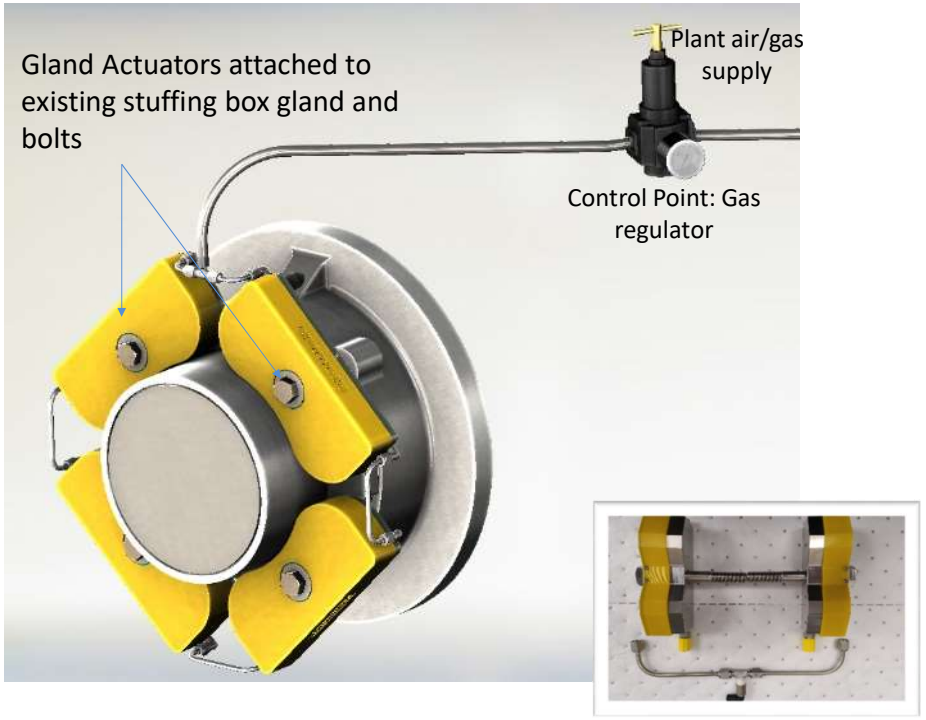
- Eliminates the need for a lantern ring
- Provides a clean flush to the sealing rings
- Enables solids to be removed from the stuffing box
- Permits air to evacuate the stuffing box upon flooding
- Reduces cost of flushing
- Reduces product dilution

AMPS (Automatic Mechanical Packing System)

New Patented Technology

- Features:
  - No Equipment Disassembly
  - No Manual Adjustments
  - Single Point Adjustment
  - Address Safety mandates

- Benefits
  - Safety, automatic adjustments
  - Accessibility, ease to maintain
  - Training, maintenance friendly
  - Remote locations, upkeep of equipment



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Questions?

Thank You!

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Case Studies

(Sealing Solutions: Tailings Pumps)

Phosphate Mining | Slurry | Packing

Application Info and Challenge

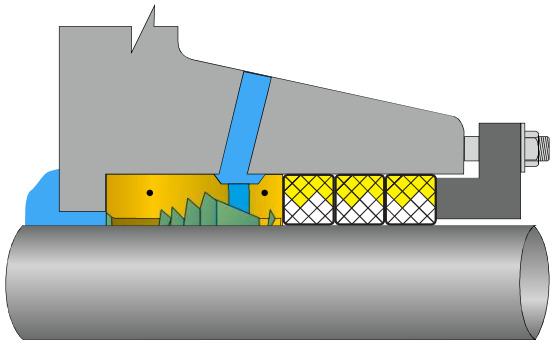
DualPac® Technology

Customer was using a competitor's PTFE packing on large centrifugal pumps used in phosphate mining.
Heavy leakage led to frequent adjustments (every few days) and costly repacking. Goal is to increase the length of continuous service to support plant cycle and reduce maintenance costs.

Solution

- **Packing Version SpiralTrac™**
- **3 rings of DualPac 2212 packing.**
- **Chesterton Live Loading**

Application had two large 20x20 centrifugal pumps with 54" impellers and 2000 hp motors. Three rings of 2212 packing were installed alongside with the Version P SpiralTrac. The active throat bushing enables particulates to be removed from the stuffing box and away from packing. It also reduces the need for flush water.
Bolts were fitted Chesterton Live Loading and torqued to engineering specs.



Result

Client reported that after 4 months and no adjustments, the pumps are still maintaining the required minimal leakage.
This is a total savings of $12.000 / year, not to mention the other added benefits to the customer (cleaner environment, reliable predictable operation).

Application Highlight

DualPac™ Technology

North Mine Sand Plant | Slurry | Packing

Application Info & Challenge

- **Product:** Slurry, 6-12% solids
- Goulds 14x12-29 SLR-C pump, 900 RPM. Operating pressure: 2 bar, stuffing box flush pressure is 4 bar.

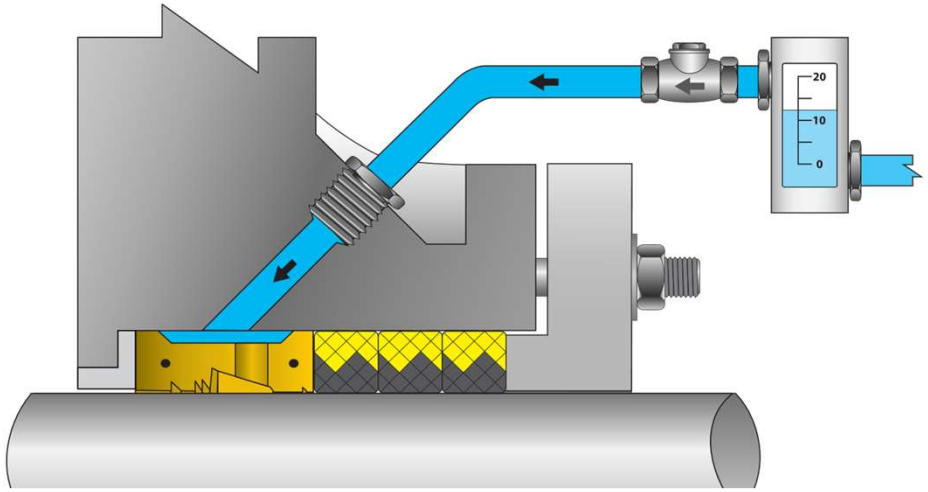
Goal to extend packing life and minimize flush water usage. Currently gland adjustment is checked daily and adjusted weekly, **packing lasts 2 months** (gland follower bottoms out). Sleeve have to be replaced every 6 months due to sleeve wear.

Solution & Result

- **Chesterton SuperSet with 3 rings of DualPac 2211 Packing and Packing Version SpiralTrac , part #: PI6255RS7875(ESC)0L2.750**

After installation, flush water was manually reduced by 50%. Sleeve was inspected 3 months after installation, no issues.

Total amount of water saved per year is **21,024,000 gallons**.
Huge savings in Maintenance & Materials costs.
Customer identified additional pump targets for similar conversion.
“This was a win for our plant!“ - *Plant maintenance manager*



Application Highlight

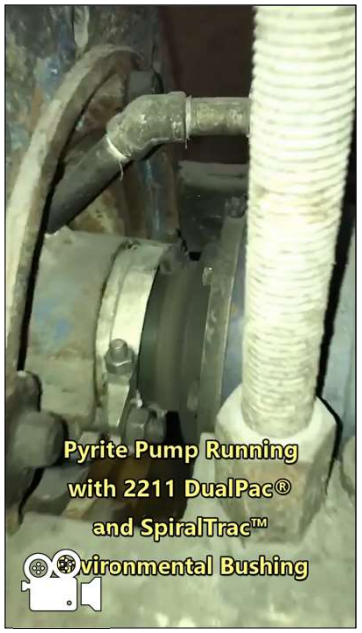
DualPac™ Technology

Mining | Slurry | Packing

Application Info and Challenge

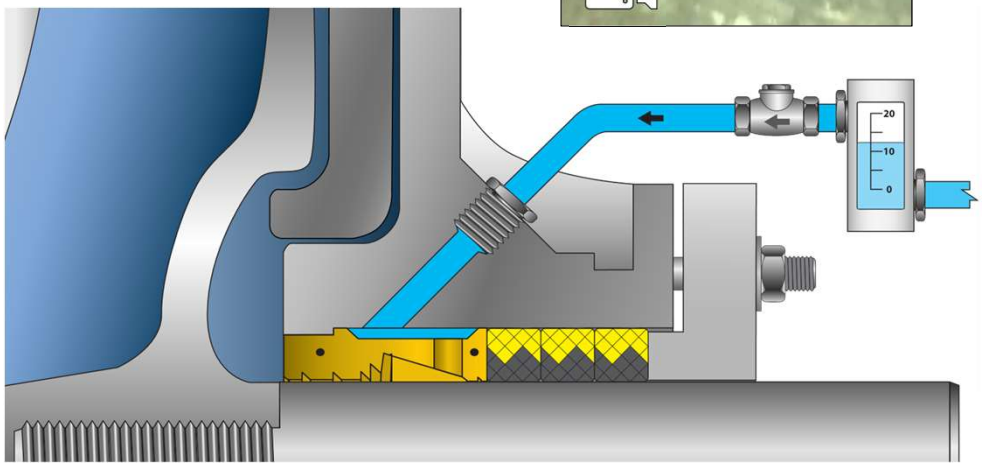
- **Warman 8/6 EAH Pyrite Slurry Pump**

Customer set up high flush pressure to the stuffing box, thinking that the higher flush pressure will help seal the box. This resulted in excessive spraying at the gland, constant packing adjustment and frequent sleeve replacements.



Solution & Result

- **Chesterton SuperSet:** 3 rings of Chesterton DualPac® 2211 packing and Packing Version SpiralTrac.



After installation, flush pressure has been reduced to 1 bar (15 Psi) over product pressure (with the help of flow controls).
Application has been **running for 3 years with original SpiralTrac and packing rings**, no issues, no repacking needed in three years! Flush water significantly reduced, spraying at the gland eliminated.

This success opened the door to many opportunities for the Chesterton Specialist with the customer.

Application Highlight

Nickel Mining | Tailings Deposit | Packing

Problem

Previous MTBR was 7 days
Each repack cost approximately **$7,467**
The cost of lost production was a large factor in the price of each repack
Seven weeks of repacks, production downtime, labour and sleeves **added up to $52,271.25**

Application Info

Pump: Warman
Model: 10 x 8
Shaft Speed: 1480 RPM
Product: Tailings Deposits
Temp: Ambient

Solution

SpiralTrac Version P Type A
PM17800RA22800(174)10-0304
Chesterton 1830SSP Packing

Result

The new sealing solution **cost $12,165**
Current MTBR is now **seven weeks**.
Total cost savings over seven weeks of **$40,100**
Return on investment period seven weeks!

Tailings Pumps

Cliente: Codelco Teniente
Proceso: Minera de Cobre
Área Proceso: Planta tratamiento de relave mina
Aplicación : Superset
Equipo: Bombas de ITT12x10, Bomba GIW LSA en pulpa de Cobre

- **Situación anterior**: Cliente usaba empaquetadura con anillo de linterna, teniendo una constante pérdida de producto y agua.
- **Solución:** Se utiliza **SpiralTrac** versión P (**ESC**) con empaque **1830SSP**, logrando eliminar la fuga, mayor duración de las camisas y reduciendo el consumo de agua.

Tailings Pumps

Aplicação: Gaxeta DualPac **2212** em bomba Warman
Equipamento: Bomba 20x18 Warman

Cliente: Vale Unidade Mina do Pico - MG
Processo: Rejeito minério
Área Processo: Rejeitoduto
Especialista: Julio Cesar de Oliveira

Situação Anterior:

Troca gaxeta em 3 dias , ajuste com 6 horas de operação. Alto desgaste de buchas , rolamentos e eixos.

Solução Chesterton:

Gaxeta 2212
Alcançado MTBF de 30 dias .
Instaladas em 10 bombas

Tailings Pumps

Cliente: Teck Carmen de Andacollo
Proceso: Minera de Cobre
Área Proceso: Bombeo de Relaves
Aplicación: Superset / 1830SSP
Equipo: Bombas Krebs 650

- **Situación anterior**: Cliente usaba empaquetadura con anillo de linterna teniendo una constante pérdida de producto y agua al ambiente

- **Solución:** Se utiliza SpiralTrac versión P (BRZ) con empaque **1830SSP,** logrando eliminar la fuga, mayor duración de las camisas y reduciendo el consumo de agua.