



Wear Piping **Products and Capabilities**

Our Innovation. Your Advantage.



From crushing to tailings, Bradken Edmonton specializes in providing wear piping and wear parts for high abrasion and impact environments in all areas of the plant.



Experience and Expertise

With over 20 years' experience in the wear piping business and with world-class manufacturing facilities located locally and globally, Bradken has the knowledge, expertise, and capability to produce a wide variety of wear parts used across the mining and resources industries.



Trusted Partners

We endeavor to work with our customers to extend the service life of slurry pipelines and equipment while providing improved total cost of ownership.



Innovation and Design

Fully engineered custom products for site specific applications.



Safety

Bradken products provide comprehensive safety features designed specifically to prevent accidents that may be caused by infield maintenance or installation and removal. We are committed to achieving zero harm at our work-sites, and helping you achieve zero harm at yours.



Local Sales and Support Networks

Bradken's global sales and distribution networks supply the world's major mining and industrial regions with ease.



Sustainability and Environment

Bradken is committed to reducing its impact on the environment through a comprehensive and targeted sustainability plan.



Equal Opportunities

We value diversity and inclusion in the workplace. We seek to recruit, develop and retain the most talented people from diverse cultures, perspectives, skills and experiences within our workforce.

Product Overview



Wear Piping

Bradken can manufacture slurry piping utilizing four wear resistant materials.

CCO Piping: A relatively low cost and short lead-time solution to high erosion environments.

CWI Piping: Thick replaceable wear castings for long wear life.

DX Piping: A short lead time solution with superior wear and impact resistance compared to CCO.

Neoprene: A thick rubber lined solution for long wear life.

Our reputation for providing high **quality, dependable products** has been proven over decades of supplying to the Oil Sands market.

Expansion Barrels

A telescoping spool that allows for thermal contraction and expansion of a slurry line.

Cast Products

Bradken has a global network of foundries that provide custom chrome white iron and alloy castings.

Wear Monitoring SmartLiner[®]

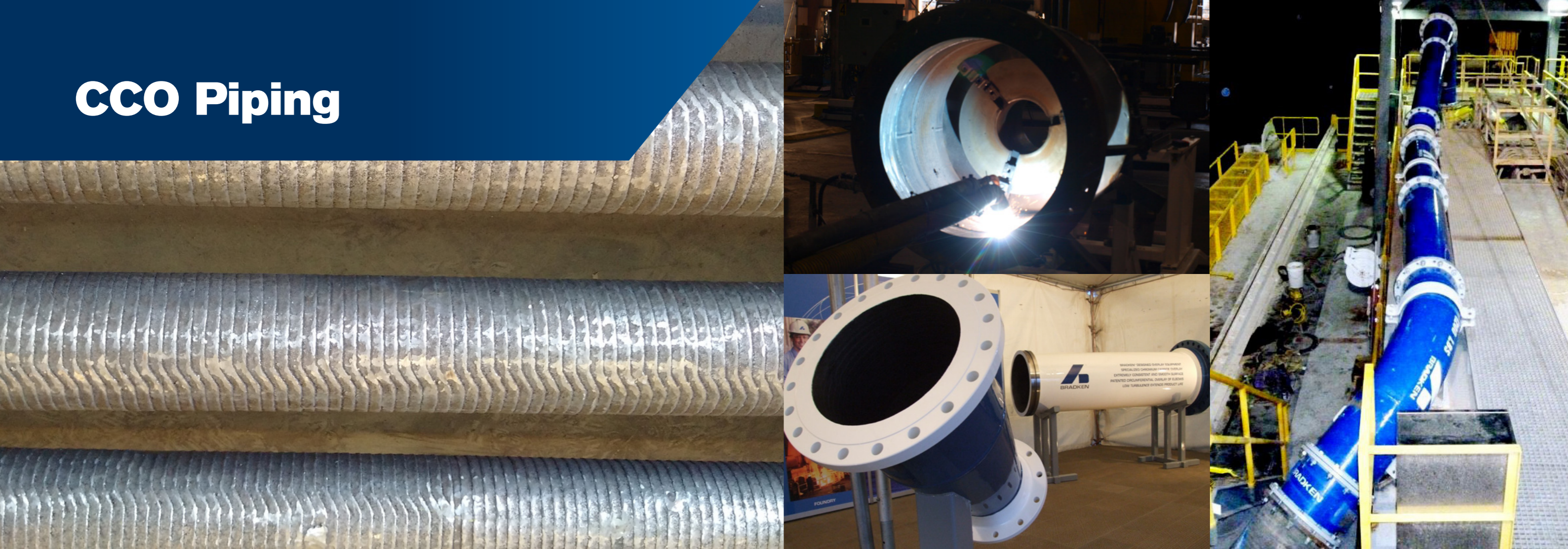
Remote wear monitoring for slurry piping and fixed assets.

Wear Liner Packages

Designed to protect the walls of a chute or pump box. We can offer many different materials depending on the allowable weight and requirements.

- CWI liners – bi-metallic CWI block and plates
- Overlaid Plate – Chromium Carbide Overlay, DX Overlay
- Rubber/Ceramic liners – Rubber bonded ceramic liners.

CCO Piping



Overview

- CCO Piping is utilized when transporting slurry
- Useful in locations that experience a combination of aggressive erosion and moderate impact

What are the main features/benefits?

- Increased erosion resistance to conventional carbon steel
- Short lead-times
- Low-cost solution for aggressive erosion and moderate impact
- Easily repairable and modifiable in the field
- 1" wide oscillated bead running perpendicular to flow

| Features | Advantages | Benefits |
|---|---|--|
| 1" wide oscillated bead | Increases the strength of the bond with the base material | The material is less prone to spallation |
| Applied perpendicular to the flow of material | Reduces the channelling effect of fluid dynamics | Increases the life of the erosion resistant material and reduces the frequency and cost of repairs |
| Up to 12mm thick in 2 passes while still passing impact testing | 50% additional wear life compared to industry standard 8mm 2 pass overlay | Extremely cost effective, reduces time between maintenance, reduces cost of repairs |
| Easily repairable in the field | Quick repairs during minor events | Customer can do a quick repair, and reinstall the spool efficiently |
| Easy modification | Can be modified in the field | Reduced time and cost required for spool modification |
| Short lead times | Ability to react quickly | Will reduce environmental and economic impacts during an unexpected maintenance event |
| Optional Built in Wear Sensor | See SmartLiner® Wear Monitoring on page 24 | Remote condition monitoring |

DX Piping



Overview

- DX Piping is utilized when transporting slurry
- Useful in locations that experience a combination of extreme erosion and/or extreme impact

What are the main features/benefits?

- Homogenous dispersion of tightly packed carbides from the surface to the fusion line
- Increased erosion resistance compared to chromium carbide overlays
- Easily repairable and modifiable in the field
- Predictable wear rates and end of life
- Utilizes the same application technology as CCO, allowing for quick turnaround
- Extremely resistant to impact

| Features | Advantages | Benefits |
|---|---|---|
| Extremely tightly packed cubic carbides | Eliminates preferential wear path through substrate | Increases wear life over long platelike carbides by 2.5 to 4 times! |
| Homogenous dispersion of carbides | Consistent wear rates from surface to base steel | Predictable wear rates through the life of the overlay |
| Easily repairable in the field(SMAW/GMAW) | Quick repairs during minor events | Customer can do a quick repair, and reinstall the spool efficiently |
| Easy modification | Can be modified in the field | Reduced time and cost required for spool modification |
| Short lead times | Ability to react quickly | Will reduce environmental and economic impacts during an unexpected maintenance event |
| Extreme resistance to impact | Greatly improves pipe spool life in areas experiencing heavy impact | Longer service life, reduced frequency and cost of repairs |
| Optional Built in Wear Sensor | See SmartLiner® Wear Monitoring on page 24 | Remote condition monitoring |

Cast Products



Overview

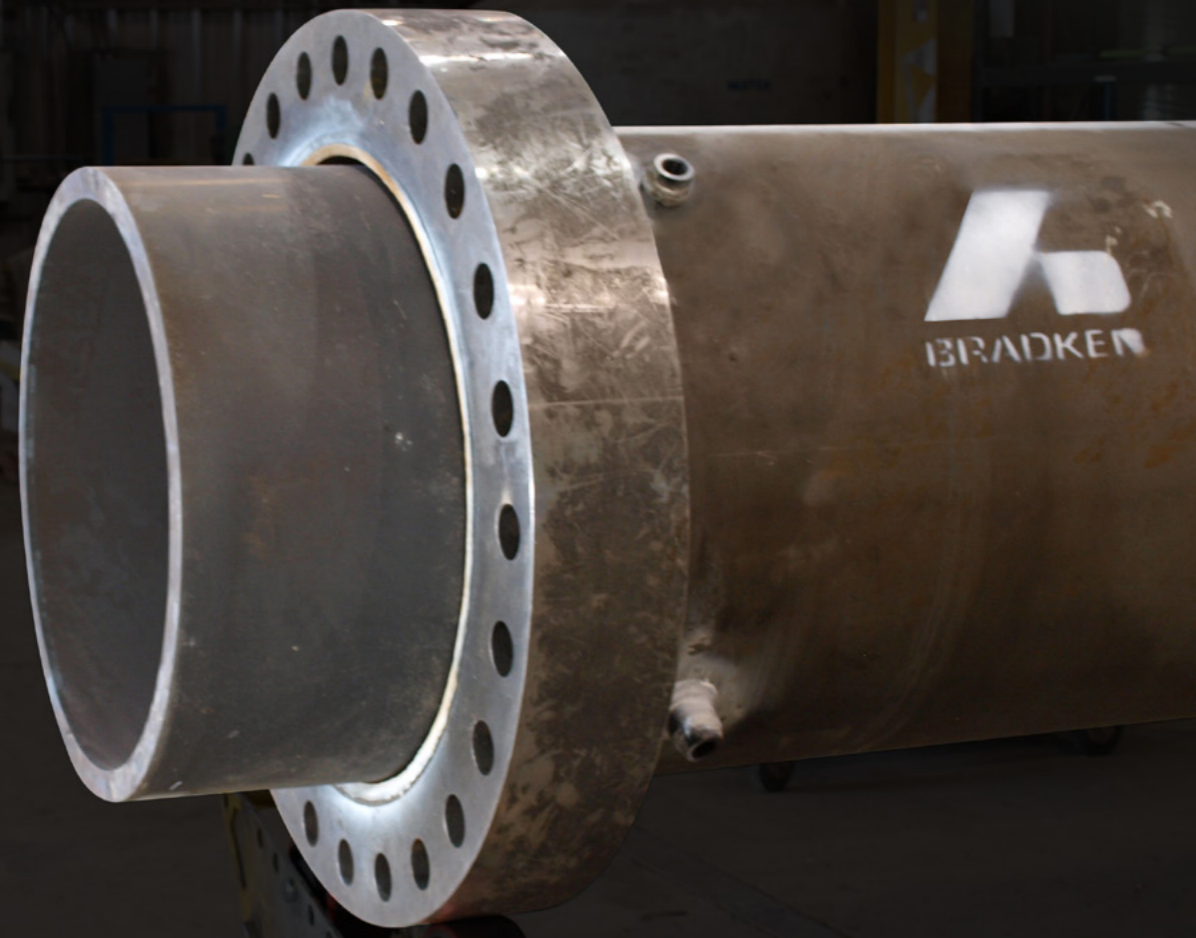
- Bradken has one of the largest networks of foundries globally that can manufacture effective solutions
- We work with a variety of cast materials including specialty irons, alloy steels, and stainless steels
- We can produce castings up to 55,000lbs
- Bradken is an industry leader with experience in small single node jobs to large projects which include hundreds of cast steel elements
- Products include: crusher segments and platens, manganese reject chute liners, cyclones and custom components as needed

What are the main features/benefits?

- Reduced costs and superior first article process
- A vast spectrum of industry experience and resources to ensure quality products are to specification

| Features | Advantages | Benefits |
|-----------------------------------|--|---|
| Global network of foundries | Foundries located in cost efficient locations | Reduced cost of finished goods |
| | Highly technical foundries | Provide high quality and difficult castings |
| Superior first article process | Higher quality when providing new products | Low rates of re-work and fitment issues |
| Industry experience and resources | We can understand and plan for barriers in production without sacrificing quality or lead-time | Less delays due to supply chain issues |

High Chrome White Iron Piping



Overview

- Fabricated pipe spool lined with casted Chrome White Iron (CWI) wear liner
- CWI liners are casted to ASTM A532 and meet specification requirements of Oil Sands Producers
- Used in slurry piping systems for protection against sliding abrasion and impact wear
- Excellent for impact wear resistance due to large, sharp particles when compared to non-metallic liners.
- Excellent corrosion resistance
- Can be configured as straights, bends, nozzles, wyes, expansion barrels
- Sizes range from NPS 10 up to NPS 36+

| Features | Advantages | Benefits |
|--|--|--|
| Customizable Wear Liner Thickness (32 – 50+ mm) | Strategically placed wear material in high wear areas | Decrease the frequency of shutdowns required to change out / maintain piping equipment |
| Replaceable Wear Liner | Worn liners can be rotated or replaced – particularly at the leading/trailing edge of the spool. Worn liners can be recycled | Decreased costs and increased sustainability by reusing fabricated pipe spool |
| Customizable chemistry and heat treat parameters | Ability to tune the level of abrasion resistance, toughness, and corrosion resistance required | Increased wear performance for specific applications or environments |
| Optional Built in Wear Sensor | See SmartLiner® Wear Monitoring on page 24 | Remote condition monitoring |

Expansion Barrel



Overview

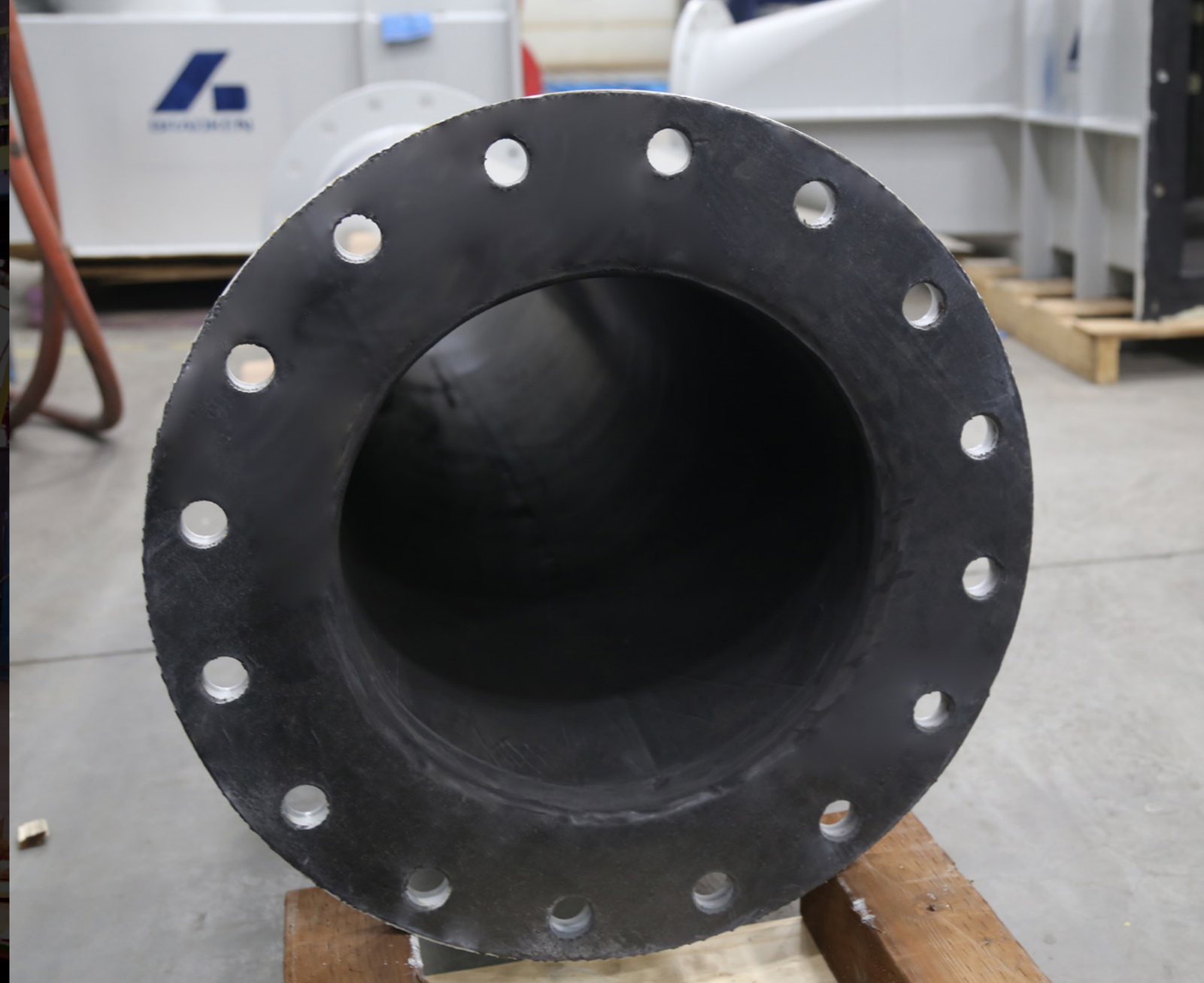
- An expansion barrel is a telescoping pipe assembly that allows expansion/contraction in pipelines
- Custom engineered to suit any design requirements

| Features | Advantages | Benefits |
|--|--|--|
| Hard chromed surface with multiple sealing options | Chromed and ground surface for reliable and long-lasting Sealing | Prevents corrosion of sealing sections. Allows for uniform sealing, which mitigates leaks |
| Can be lined with CCO, DX, CWI or Neoprene | Ability to match liner material to wear environment | Selecting the appropriate liner material optimizes wear life and cost |
| Optional External or Internal Stop | Stops barrel from separating after maximum extension | Barrel will not separate even if surrounding anchors fail offering piece of mind |
| Optional Built in Wear Sensor | See SmartLiner® Wear Monitoring on page 24 | Remote condition monitoring |

“Bradken is proud to supply high quality wear resistant components and condition monitoring solutions that support the plant in locations that experience extreme erosion and impact.”



Neoprene Lined Pipe and Products



Overview

- Fabricated pipe spool lined with thick layer of neoprene
- Used in slurry piping to protect against sliding abrasion and light impact from non-angular particles
- 100% corrosion resistant
- Different grades of neoprene are available and can be applied in bends and other configurations

| Features | Advantages | Benefits |
|---|---|---|
| Excellent abrasion and impact resistance against small, non angular particles | Reduce frequency of plant shut down for inspection or maintenance | Increase plant efficiency, lowering maintenance costs |
| Customizable Thickness (6 – 50+ mm) | Strategically placed wear material in high wear areas | |
| Ability to remove, recycle and replace worn liner | Reuse of fabricated pipe spool | Decreased costs and lead times |
| Customizable chemistry | Ability to tune the level of abrasion resistance and toughness | Increased sustainability |
| Optional Built in Wear Sensor | See SmartLiner® Wear Monitoring on page 24 | Increased wear performance for specific environments |
| | | Remote condition monitoring |

Custom Wear Liner Solutions



Overview

- Upgraded Wear Liner Packages for pump boxes, nozzles, hoppers, chutes, bins
- Ability to 3D scan existing asset and build custom wear packages
- Custom wear packages can be designed to simplify installation and maintenance
- Ability to use Discrete Element Method (DEM) modeling to predict high wear areas
- High wear areas can be bolstered with variety of wear materials:
 - Overlaid plate (Duaplate D60, D80 or DX)
 - Chrome White Iron (Duablock D70)
 - Rubber Ceramics (Vulcabrix A92, ZTA)
- High wear areas can also be remotely monitored using Bradken SmartLiner®



| Features | Advantages | Benefits |
|--|--|---|
| Bradken can laser scan existing assets to custom fit a wear package | Fast and accurate measurements of geometry | Understand wear rates and high wear areas in fixed asset Laser scans provide accurate measurements to design precision fit wear packages |
| Range of wear resistant materials | Provides options to combat wear due to abrasion, impact, and corrosion | Materials can be tailored for specific wear mechanisms to increase the period between change-outs |
| Engineered solutions and DEM and scanned data | DEM will predict high wear areas in a virtual environment | Allows Bradken engineer to understand and optimize entry and flow of wear medium |
| | Engineered solutions aim to simplify installation/maintenance | Reduced downtime and maintenance costs for install + change-outs |
| Wear packages are compatible with Bradken's wireless remote monitoring system: SmartLiner® | See SmartLiner® Wear Monitoring on page 24 | Remote condition monitoring |

Induction Pipe Bending



Overview

- Due to Market conditions, Bradken vertically integrated induction bending
- Bradken has been providing induction bends to the market since 2013
- Capable of bending 8" through 32" up to 90°
- Able to achieve 1.5D, 3D, 5D, and many custom bend Radii
- Compliant to all Oil Sands end-user specifications



What are the main features/benefits?

- Able to control the bending schedule to ensure on-time delivery
- Can adjust quickly to changing priorities
- Bradken designed and fabricated a water cooler/reservoir for added sustainability

| Features | Advantages | Benefits |
|---|--|--|
| Able to induction bend in-house | Can control schedule | No need to rely on a sub-contractor for a major component of bend spools |
| Control the production schedule | Can adjust quickly to changing priorities | Able to adjust quickly for any rush requirements |
| Water cooler/recirculation | Reduces the amount of water required to operate and allows for proper waste water disposal | Long term environmental sustainability |
| Redundant critical spares and in-house maintenance team | Reduces downtime related to waiting for parts or personnel during unplanned maintenance | Greater reliability and comfort for our valued customers |

SmartLiner® Wear Monitoring



Overview

- Remote wear monitoring for slurry piping and fixed assets
- Wireless sensors embedded into pipe in high wear areas (leading/trailing edge, extrados)
- Wireless sensor can also be imbedded in known high wear areas in bins, chutes, hoppers
- Sensors tell operators how much wear life is remaining via Bradken app or online.
- Sensors can be imbedded to CCO, DX, CWI, and Neoprene lined products

| Features | Advantages | Benefits |
|--|---|---|
| Live data | Reduce frequency of plant shut down for maintenance | Increase plant efficiency, lowering costs |
| Monitor wear rates remotely | Reduce manual wear inspections | Avoids putting inspectors in hazardous environments |
| Predicts when piping or fixed assets will wear out | Eliminates pre-mature replacement | Operators can optimize maintenance schedules |
| | | Extract full wear potential |

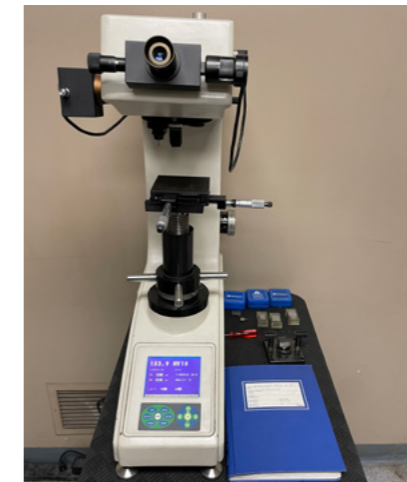
Metallurgy Laboratory



Our lab has the capability to perform Metallurgical analysis on a broad range of metallic products from different types of Iron based overlays to mild carbon steel and ground engaging tools. From sectioning and polishing specimens to view at a microscopic level, to full destructive testing such as Tensile, Charpy and ASTM G65 Dry Sand Abrasion, we provide test results that are backed by ISO 17025 accreditation.

Overview

- Due to Market conditions and excessive lead times, Bradken integrated Mechanical/Destructive testing activities
- Bradken Metallurgy Laboratory has been accredited to ISO 17025 since 2017
- Capable of testing Metallics and abrasive wear solution products
- Able to achieve and report test results with < 15 day turnaround
- Compliant to all Oil Sands end-user specifications



What are the main features/benefits?

- Abrasion Resistance Testing on hard facing overlay which includes but not limited to CCO, WCO, CWI (ASTM G65)
- Vickers Hardness Testing on hard facing overlay which includes but not limited to CCO, WCO, CWI carbon steel pipes and plates
- Metallurgical Examination – Grain Size measurement, Carbide Volume Fraction measurement. Identification of microstructural phases to 1000x magnification
- Tensile Testing on Metals and Alloys, pipe bends, welds and fittings
- Charpy V-Notch Impact Testing up to 150 J from -45°C to 0°C
- Chemical Analysis of Low and High Alloy steels and wear products by Optical Emission Spectroscopy

| Features | Advantages | Benefits |
|--|--|---|
| Able to do all destructive testing, and most non-destructive testing, in-house | Can control schedule | No need to rely on a sub-contractor for test results prior to releasing product |
| ISO 17025 certified | Extremely tight controls on procedures and calibration | confidence in testing outcomes |
| Can turn around testing and reporting in less than 15 days | Can have results very quickly | No waiting when turnaround time is critical |

Contact Bradken globally to find a solution for your business.



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