



Apache

PIPELINE PRODUCTS

Apache Pipeline Products is a major manufacturer of pipeline cleaning and maintenance equipment.

We produce and supply a complete line of pigs and pigging equipment for oil, natural gas, and industrial pipelines around the world.

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STATEMENT

- Apache manufactures pigs to provide operators with a safe, efficient, cost effective means of maintaining their pipeline.
- Reduce the risk of critical failure.
- To increase profits by improving production.
- Maximizing the term of their investment.
- Reduce operating costs.



PIPELINE DESIGN CONSIDERATIONS

- The ideal pipeline would be perfectly straight from end to end, have a consistent ID, no weld penetration, be round, have no off takes, no valves, no flanges or other devices, have a polished or epoxy coated inside surface and of course be seamless.
- Transport only a light, refined oil.



PIGGING BENDS

- For pigging, 3D bends should be considered the minimum.
- Although many pigs can negotiate 1.5D bends, they can only do so under certain conditions.



JUNCTIONS

- Unbarred T's are not pig friendly, only spheres and foam pigs can negotiate a 90 degree change in direction.
- Standard pigs can only traverse wyes in one direction.
- The two most common wyes have a 30 and 22 degree convergence angle, although the 22 reduces the impact angle it does however increase the seal length required if the pig is to maintain seal as it traverses the lateral.



VALVES

- Valves are generally the biggest single cause of pigging problems.
- In a perfect world valves should be of full-bore design.
- Gate valves should be a through-conduit type to prevent the pig from contacting the seats etc.
- All valves should be checked to ensure the stops are set correctly.
- All valves need to be in the fully open position or pig damage or stuck pigs can occur.



CORROSION FACTS

- 52% of corrosion failures are internal and are growing due to the age of pipelines.
- 65% of these failures could have been prevented with current corrosion control methodology.
- Water is found in all petroleum based systems.
- Entrainment of water will occur in oil pipelines below 3ft/sec.



OPERATIONAL GOALS & OBJECTIVES

- Increase pigging frequency with ease of operation.
- Improve the efficiency of pigging by better suited pig design to reduce pig runs.
- Reduce corrosion rates by improving operations.
- Enhance production rates with cleaner lines.



DEBRIS CHALLENGES

- Types of debris being encountered:
 - Liquids
 - Dry Black Powder
 - Wet Black Powder
 - Grease / Hydrocarbon Based Debris
 - Combinations
 - Construction Debris
 - Paraffin



DEBRIS CHALLENGES

Considerations

- Debris versus deposits
- Composition (sampling)
- Source point & ability to isolate
- Product velocity
- Quantity of debris
- Line history (pigging, scrubbers, flow, pressure, etc.)
- Line characteristics (length, elevation, WT, etc.)



PROGRESSIVE CLEANING

- Initial assessment, line history, pipeline questionnaire, etc.
- Initial cleaning run
- Sampling
- Further assessment
- Formation of line specific cleaning strategy based on results, analysis, experience, etc. (decision tree)



PIG CRITERIA

- Pig must be sized properly for wall thickness providing it the ability to seal.
- Must have sufficient seal length to traverse laterals.
- Capable of pushing liquids and/or debris.
- Can negotiate 1.5D bends.
- Not hang up on fittings.

PIPELINE QUESTIONNAIRE



PIGGING QUESTIONNAIRE

PIPELINE LOCATION: _____
AGE OF PIPELINE: _____

Customer Name: _____
Contact Info: _____

PIPING DIMENSIONS

Nominal Diameter (ND) _____ ☐ inches ☐ mm
Wall Thickness (WT) _____ ☐ inches ☐ mm
Length of Pipeline _____ ☐ m ☐ ft ☐ Mi ☐ Km
Type of Pipe ☐ Carbon Steel ☐ HDPE ☐ PVC
☐ Ductile Iron ☐ Cast Iron ☐ Other _____
Pipe Bends ☐ 1.5D ☐ 3D ☐ 5D+ ☐ Miter ☐ Unknown ☐ Other _____

BRANCHED FITTINGS

Wyes / Tees? ☐ Wyes ☐ Tees ☐ None ☐ Other _____
Are Tees Barred? ☐ Yes ☐ No
Can Branched Fittings Be Isolated? ☐ Yes ☐ No

VALVES & TRACKING

Type of Valve ☐ Gate ☐ Ball ☐ Check ☐ Other _____
Tracking ☐ Yes ☐ No ☐ Transmitter Dims _____

PIGGING HISTORY

Previously Pigged? ☐ Yes ☐ No
Freq. of Pigging ☐ Daily ☐ Weekly ☐ Monthly ☐ Less Than Monthly
Most Recent Pigging Month _____ Year _____
Type of Pigging ☐ Construction ☐ Maintenance ☐ Operational ☐ On-Line
Media Used to Pig ☐ Product ☐ Air ☐ Water ☐ Natural Gas ☐ Other _____
Types of Pigs Used ☐ Steel Mandrel with Cups ☐ Steel Mandrel with Brushes ☐ Solid Urethane Pigs
☐ Steel Mandrel with Discs ☐ Polly-Pig / Foam Pigs ☐ Sphere
Other _____
Launchers Installed? ☐ Yes ☐ No Receivers Installed? ☐ Yes ☐ No
Type _____ Type _____

Continued on next page



PIGGING QUESTIONNAIRE

PIPELINE LOCATION: _____
AGE OF PIPELINE: _____

PRODUCT IN PIPELINE

	Normal	Max	Min	Units		
Flow				<input type="checkbox"/> gpm	<input type="checkbox"/> bbl/hr	
Pressure				<input type="checkbox"/> psi	<input type="checkbox"/> kPa	<input type="checkbox"/> m ² /hr
Temp				<input type="checkbox"/> °F	<input type="checkbox"/> °C	

If there are pig detectors on the line what kind are they? _____

QUESTIONS FOR PROPER PIPELINE PIG SELECTION

What is the purpose of the pig operation? (water removal, wax removal, batching, cleaning)

If it is a products pipeline is there any H2S in the product? _____

If so, what percentage? _____

Diluent/Dilbit Inhibitor (MSDS) _____

Details of internal condition of the pipeline
(i.e. mill scale, rust, epoxy lined, heavy wax, when was the pipeline last pigged, pig type, date of last run)

Notes:






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CLEANING PIGS

HEAVY DENSITY (8-10 lb/ft³ or 128-160 kg/m³)






STYLE	TYPE	FUNCTION
	HDBS Heavy Density Bare Squeegee	Heavy Drying
	HDCC Heavy Density Criss Cross	Heavy Wiping
	HDWB Heavy Density Wire Brush	Heavy Scraping
	HDSC Heavy Density Silicon Carbide	Heavy Scraping
	PORCUPINE Total Wire Brush	Max Scraping

LIGHT DENSITY (1-2 lb/ft³ or 32 kg/m³)





STYLE	TYPE	FUNCTION
	MLS Medium Light Swab	Light Drying
	LDBS Light Density Bare Squeegee	Light Drying
	SLS Super Light Swab	Light Drying

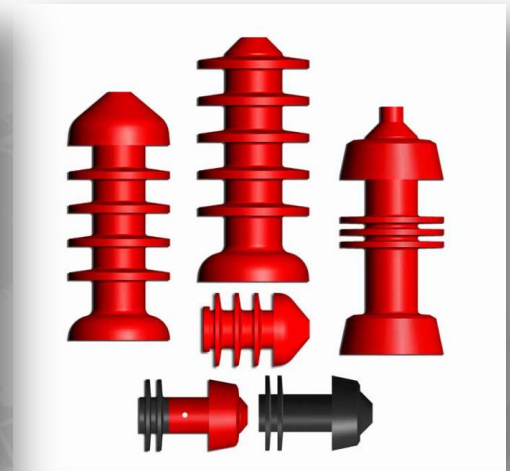
- STANDARD SIZES ARE AVAILABLE IN WHOLE, QUARTER AND HALF INCH SIZING
- CUSTOM DESIGNS AND SIZES ARE AVAILABLE

MEDIUM DENSITY (5-7 lb/ft³ or 80-112 kg/m³)

STYLE	TYPE	FUNCTION
	MDBS Medium Density Bare Squeegee	Regular Drying Flow Rates
	MDCC Medium Density Criss Cross	Regular Wiping
	MDWB Medium Density Wire Brush	Regular Scraping
	MDSC Medium Density Silicon Carbide	Regular Scraping
	MDPB Medium Density Plastic Brush	Regular Scraping in Lined or Plastic Pipe

OPTIONS

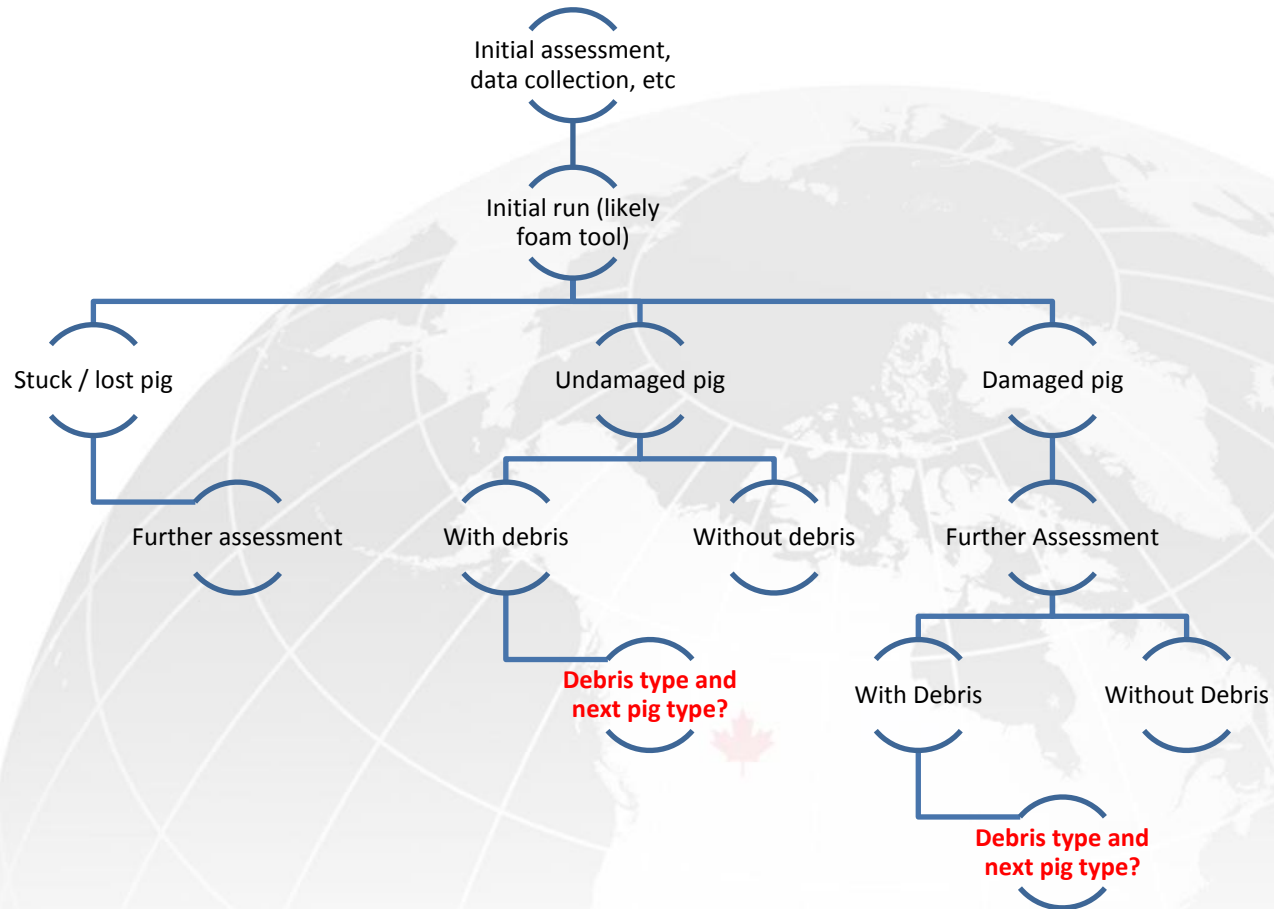
STYLE	TYPE	FUNCTION
	Handling Rope	Polypropylene rope for one or both ends of the pig for ease of handling.
	Transmitter Cavity	Standard and customized cavity for encasing transmitters for pig tracking.
	Double Dish	Ideal for bi-directional operations and evacuation of liquids.
	Foam Balls	Bi-directional, short radius bends for drying, wiping and scraping.



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DECISION TREE





INTERNAL CORROSION CONTROL

- Most corrosion programs involve a chemical treatment with inhibitors to form a protective layer on the pipe wall.
- Corrosion inhibitors are surface active (Cationic surfactant) chemicals which have a affinity to metal but will bond to any particle.

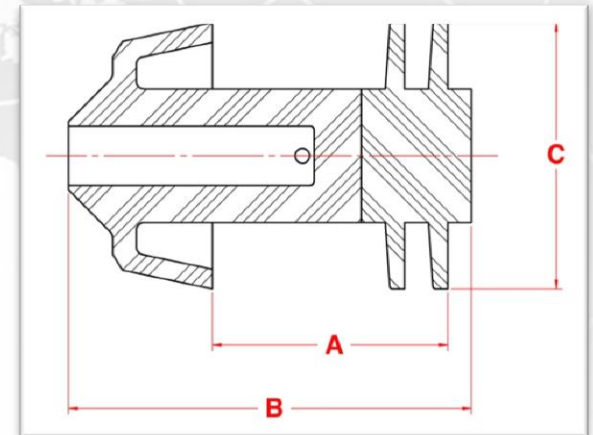
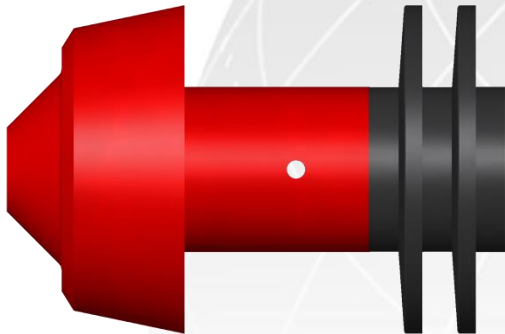


INTERNAL CORROSION CONTROL

- If deposits exist (dirt, paraffin's, bacteria, water, etc.) they will both consume and prevent the chemical from contacting the pipe wall.
- For these reasons the pipeline should be as clean as possible prior to application or injection (continuous feed).

FILMING PIGS

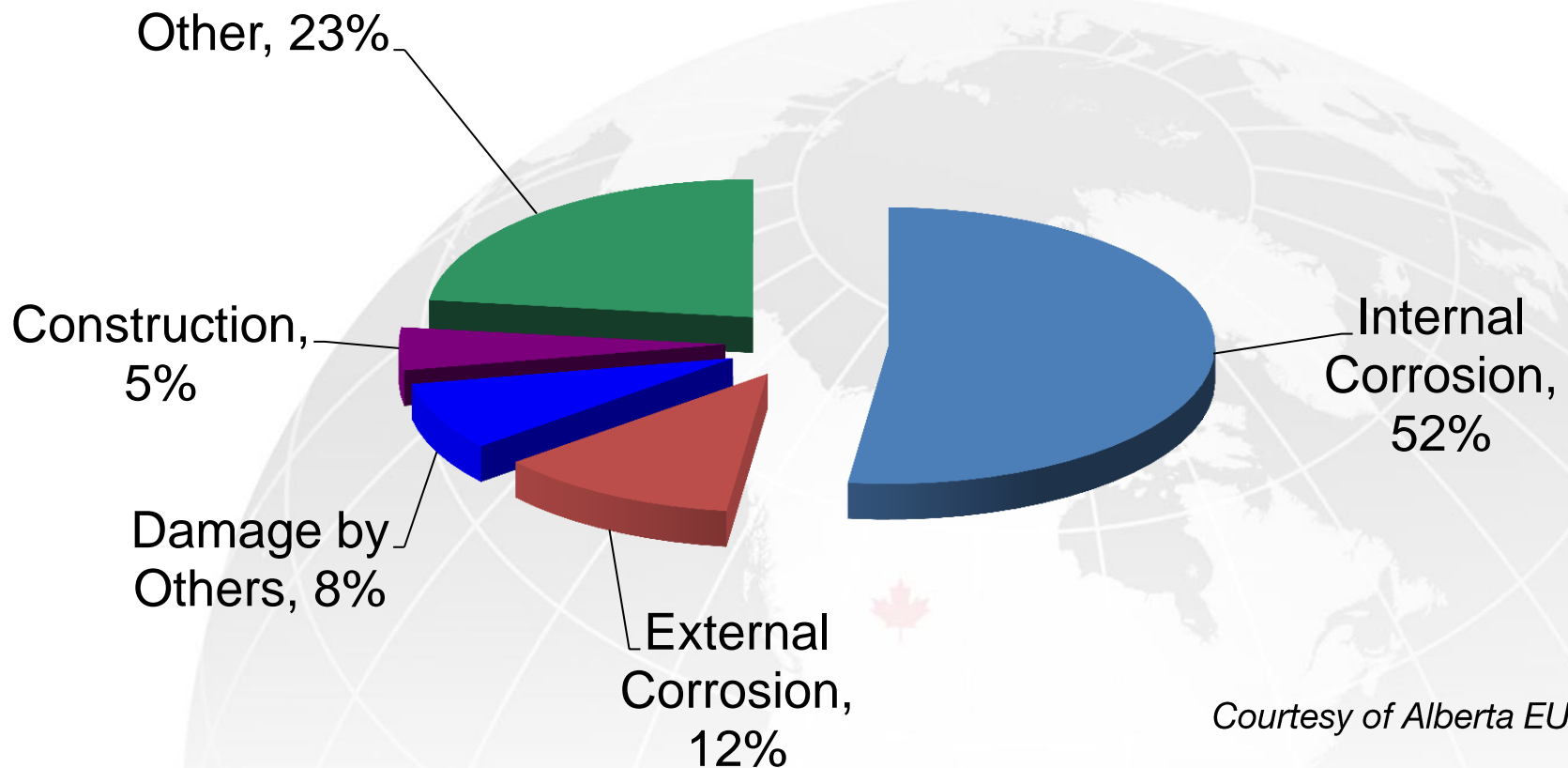
- Unique design of dual durometer Hurricane FP pig has a front hollow mandrel with two port holes in the middle.
- Allows inhibitor to travel to the front of the pig and then through the port holes.
- Inhibitor is then contained between the 86 durometer leading cup and two 62 durometer rear sealing discs allowing the pig to leave a film of inhibitor on the pipe wall.



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TOTAL FAILURES BY CAUSE

(1980 – 2004)



Courtesy of Alberta EUB

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EFFICIENCY

- Once a line is placed in service the efficiency begins to diminish.
- A regular maintenance program can keep the line flowing near capacity.
- It is not uncommon to increase flow rate by 3% with a single pig run.
- Increases in efficiency reduces the energy needed to ship the product.



RECOMMENDATIONS

- Both chemical treating and mechanical pigging offer solutions to various operating problems.
- Neither method alone will provide the benefits of a combination program.
- Pigs are best used to remove bulk deposits and entrapped fluids, to prepare surface for application and help distribute the chemicals evenly throughout.



PIG SELECTION

- Spheres are NOT cleaning tools.
- Spheres in oil pipelines act as a paraffin applicator.
- The removal of wax is not accomplished by the pigs ability to seal but to scrape and push the debris.
- For removal of liquid pushing also applies.
- For batching chemical a good sealing pig is required.



PIG SELECTION

- Cups - the ability to seal & carry a load.
- Disc - ability to scrape.
- Number of discs - scraping surfaces.
- Number of discs - driving force.
- Spacing - improved cleaning.
- Oversize - increased lubrication.
 - decrease in efficiency.

Negative effect



Apache Pipeline Products PRODUCT LINE

- Pipeline Pigs
- Pig Parts & Accessories
- Apache pigPRO™ Indicators
- Custom Urethane Products
- Stocking Distributor for CDI Tracking Equipment

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SERIES C CUPS

Scraper Cup

2" – 48"
51mm – 1219 mm



- **Unique design**

- the cleaning advantages of a scraper cup
- Standard shoulder design helps to maintain cup sealing ability and strength

- **Longer cup life**

- wear surface is *three times larger* compared to other scrapers

- **Optimum seal**

- the pressure of the cup keeps the cutting edge firmly against the pipe wall

- **Can traverse 15% reductions in pipe bore**

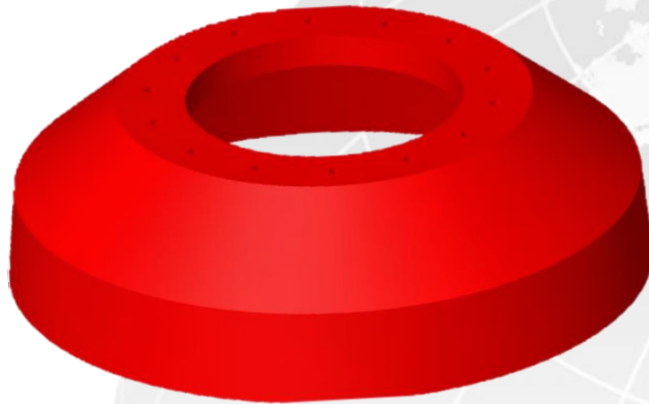
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SERIES M CUPS

Conical

3" – 48"
76 mm – 1219 mm



- Flexible design - continuous seal in the pipeline.
- The mounted cup helps negotiate pipe bore reductions of up to 20%.
- Available with a variety of wear resistant additives.
- Proprietary chemically-resistant urethane for severe environments

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SERIES JC CUPS

Jetted

3" – 48"
76mm – 1219mm



- Unique design
- All the advantages of the Series C cup plus benefits of the jetting action.
- The turbulence created jets away debris.
- The grooves allow fluid to pass along the wall of the pipe to jet away wax, sand, etc.
- Works well in oil, gas and products pipelines. Great for low flow applications.
- The design of the jetting grooves causes the pig to rotate as it travels.

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APACHE CUPS

Physical Properties

Hardness, Shore A	84-88	Bashore Rebound	29
100% Modulus, psi (Mpa)	850 (5.8)	Compression Set, Method B	
200% Modulus, psi (Mpa)	1100 (7.6)	22 Hrs. @ 158EF (70EC)	33
300% Modulus, psi (Mpa)	1850 (12.7)	Specific Gravity	1.26
Tensile, psi (Mpa)	7100 (49)	Compressive Modulus, psi (Mpa)	
Elongation, %	550	5%	190 (1.3)
Tear Strength, pli (kN/m)		10%	310 (2.1)
Die C (D-624)	480 (84)	15%	430 (3.0)
Split (D-470)	130 (23)	20%	600 (4.1)
Trouser (D-1938)	260 (46)	25%	800 (5.5)

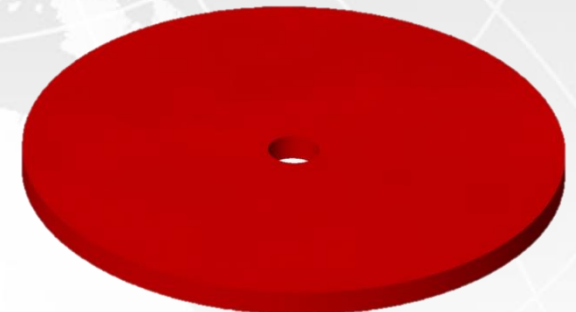


GUIDE & SEALER DISCS

- Can be used in both *bi-directional* and *uni-directional* applications or in conjunction with Series C cups as sealing or guide discs
- The dimensions, durometer or composition of the discs can be varied to meet any special requirements
- Available with a variety of wear resistant additives
- Proprietary chemically-resistant urethane



GUIDE

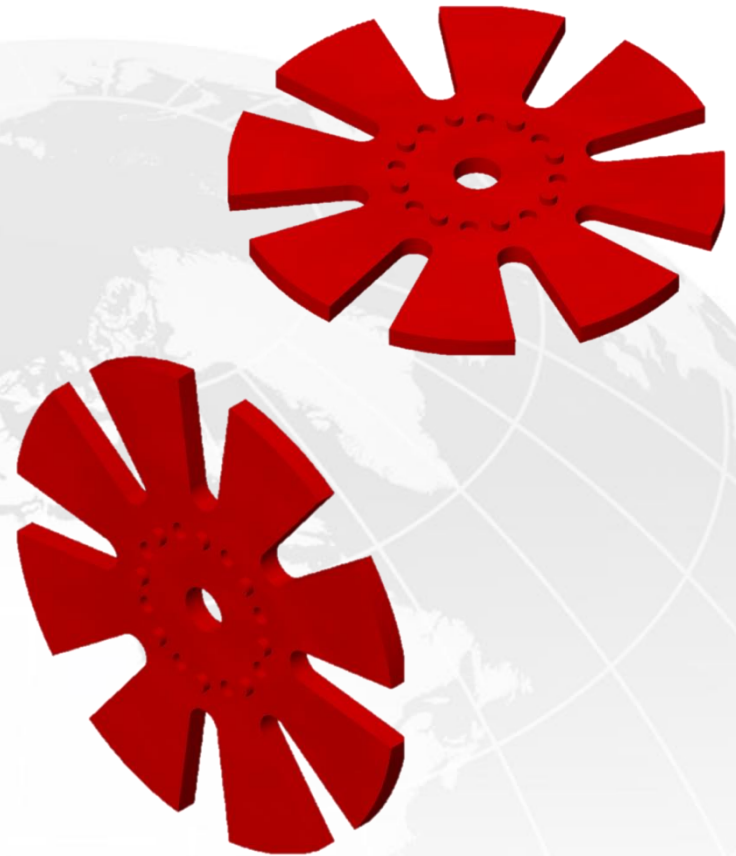


SEALER



BUTTERFLY DISCS

- Apache Butterfly Discs allow the operator to run pigs in pipelines with changes in inside diameter and can be used in both Bi-Directional and Uni-Directional applications.
- The durometer or composition of the discs can be varied to meet any special requirements.



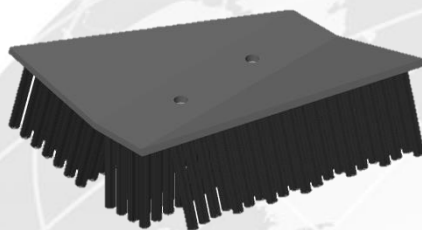


BRUSHES

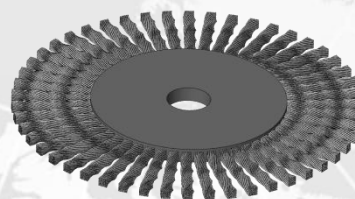
- Available for all Apache cleaning pigs
- Materials: carbon steel, stainless steel, nylon
- Custom trim lengths available on special order



HDPE-PB



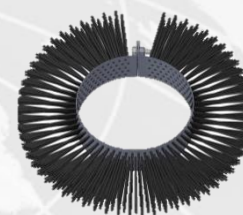
XB PENCIL



TB



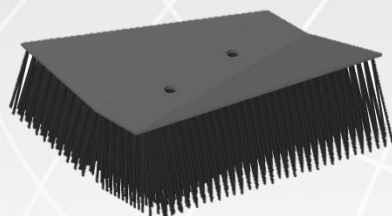
BB PENCIL



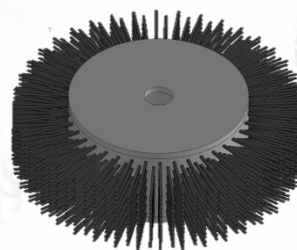
BB



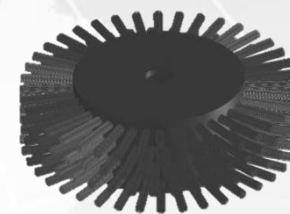
INTEGRITY XB



XB



RB BRUSH



RB PENCIL

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PIPELINE PIGS

- Bi-Directional Pigs
- Scraper Cup Pigs
- Conical Cup Pigs
- All-Urethane Pigs
- Foam Pigs



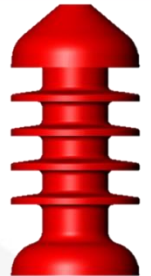
DCD



UT-DCD



PURGER VP



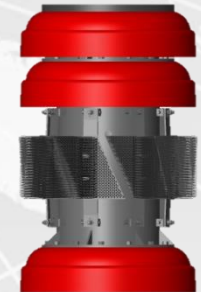
PURGER II



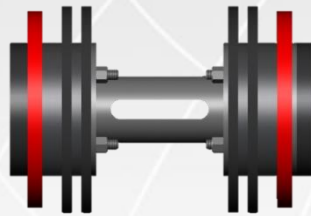
XF



UM2



UC3X



UT



FOAM MDCC



HURRICANE FP



ED

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BI-DIRECTIONAL PIGS

ED Series

Description

The series ED pigs are bi-directional and used primarily for air and water displacement applications during the pressure test stage of construction. Designed to travel in either direction, the operator can fill the line with water and displace the water without removing the pig.

Features

The ED version, with a combination of 4 sealing discs and 2 guide discs, offers a sealing arrangement suitable for separation of dissimilar fluids or for dewatering during hydrostatic testing. Sealing discs experiencing wear can reverse direction without compromising sealing characteristics.

Options

- Aluminum or steel gauging plates are available in either slotted or standard styles.
- Magnets available
- Bumper noses are available to prevent damage to both the pig and in-line auxiliary equipment in sizes 16" – 48".
- Transmitter housing to accommodate electronic tracking equipment in sizes 16" – 48".



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SCRAPER CUP PIGS

UC Series

Description

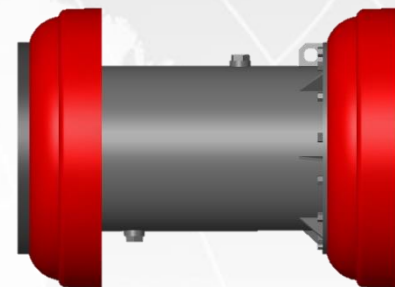
The basic two cup series UC pigs are generally used for batching of dissimilar fluids. The UC series is available in three versions. The two cup design of this pig provides a positive seal between fluid interfaces while the three and four cup design is widely used for light cleaning of pipelines or batching/separation operations.

Features

The large wear surface of the cup promotes longer life while the product pressure keeps the cutting edge firm against the pipe wall. Cups can be changed or adapted to different configurations as the application dictates.

Options

- Gauging plates of aluminum or steel, and either in slotted or standard styles are available.
- Magnets are available
- Bumper noses are available to prevent damage to both the pig and in-line auxiliary equipment in sizes 16" – 48".
- Transmitter housing to accommodate electronic tracking equipment in sizes 16" – 48".



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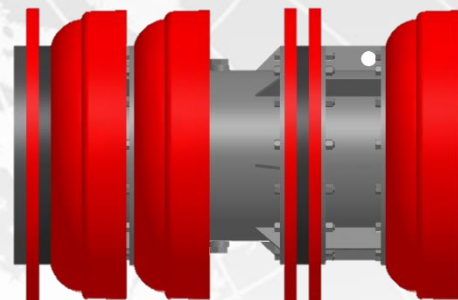
XF PIGS

Description

The Apache XF pig comes standard with a combination of three sealing discs and three series C cups, providing a positive seal between dissimilar fluids and scraping compatibility. XF are typically used for longer distance batching operations and for light cleaning of pipelines. Cups and discs can be easily changed or adapted to different configurations as the application dictates.

Options

- Gauging plates of aluminum or steel, and either in slotted or standard styles.
- Magnets are available
- Bumper noses are available to prevent damage to both the pig and in-line auxiliary equipment in sizes 16" – 48".
- Transmitter housing to accommodate electronic tracking equipment in sizes 16" – 48".





CONICAL CUP PIGS

UM Series

Description

The basic two cup series UM pigs are generally used for batching of dissimilar fluids. The UM series is available in three versions. The two cup design of this pig provides a positive seal between fluid interfaces while the three and four cup design is widely used for light cleaning of pipelines or batching/separation operations.

Features

Configuration of the UM2 pig offers a sealing arrangement suitable for separation of dissimilar fluids together with light scraping of pipeline during longer distance operations. Pipeline pigs mounted with conical cups can traverse pipeline anomalies of up to 20% without damage to inline auxiliary equipment.

Options

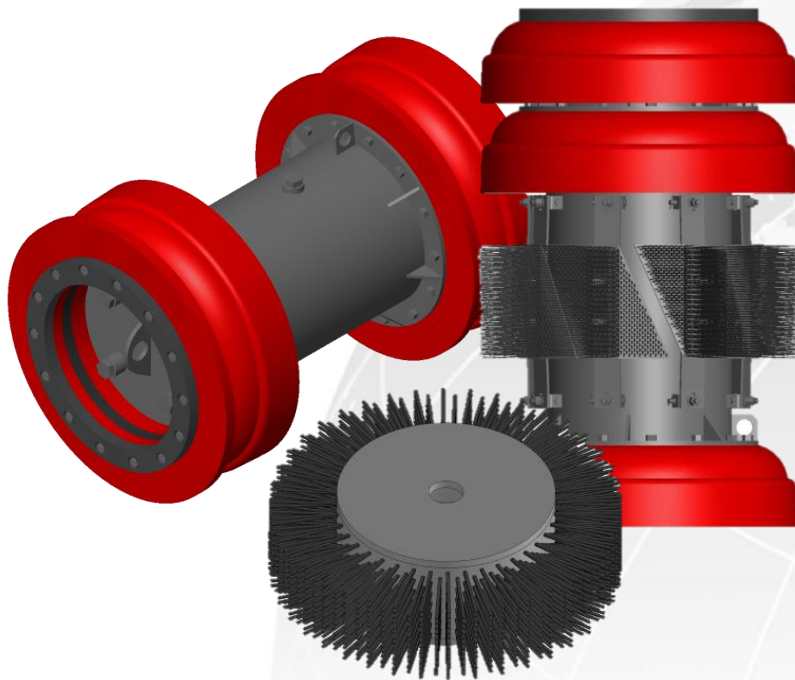
- Flat carbon steel, stainless steel, pencil or nylon brushes.
- Aluminum or steel gauging plates are available in either slotted or standard styles.
- Magnets available.
- Bumper noses are available to prevent damage to both the pig and in-line auxiliary equipment in sizes 16" – 48".
- Transmitter housing to accommodate electronic tracking equipment in sizes 16" – 48".



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BATCHING / CLEANING PIGS

3" – 48"
76 mm – 1219 mm



- Typically used for longer distance batching operations and for light cleaning of pipelines
- Provides a positive seal between dissimilar fluids and scraping capability
- Cups and discs can be easily changed or adapted to different configurations
- Can be configured to accommodate magnets.



ALL-URETHANE PIGS

Solid Cast

2" – 36"
51mm – 610mm

Options

- Solid core
- Variety of sizes and durometers
- Flat carbon steel/stainless steel brushes



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ALL-URETHANE PIGS

Solid Cast

Purger I (2" – 36") & Purger II (2" – 24")

Description

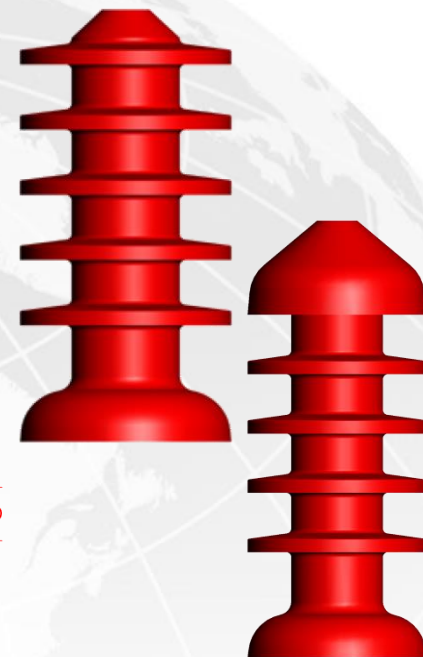
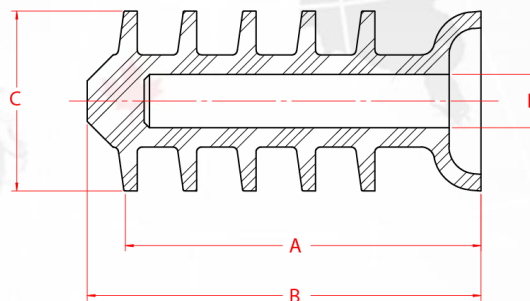
The Apache Purger I and Purger II are tough, all-urethane, maintenance free pipeline pigs. An efficient batching, cleaning or displacement pig, the Purger I & II's flexible design ensures the sealing elements are centered in the pipeline thus resulting in consistent wear.

Features

- Lightweight
- No metal components.
- Flexible design allows easy navigation of bends
- Improved sealing as hollow core allows pressure to expand the pig body
- Multiple seals offer excellent product interface.

Options

- Solid core.
- Variety of sizes and durometers.
- Flat steel wire, stainless or nylon brushes



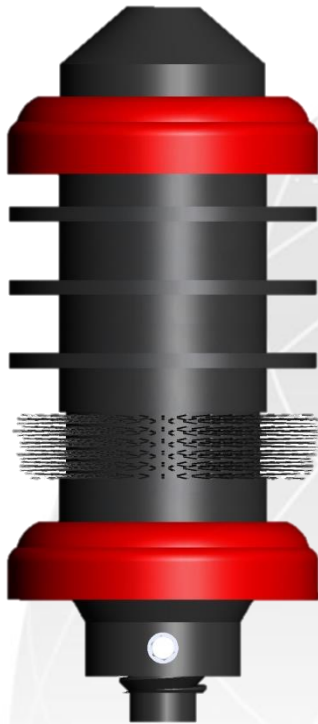
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ALL-URETHANE PIGS

Modular Cast

6" – 20"
152mm – 508mm



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ALL-URETHANE PIGS

Modular Cast

Versi I, II & III (6" – 20")

Description

The Apache Versi Pig is an all-urethane, durable and economical pipeline pigs. Designed for versatility, it can easily be fitted for cleaning, batching, or displacement operations.

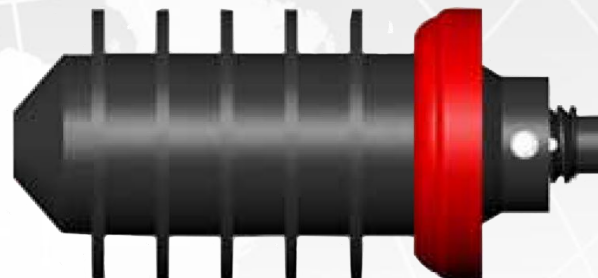
The addition of wire or plastic brushes further enhances its usefulness. The flexibility of the solid urethane shaft means even wear of the sealing elements, an inherent problem with heavy steel mandrel shafts.

Features

- No metal parts to bend, corrode or damage pipe lining
- Remove and replace only worn parts instead of entire assembly
- Customize configurations to suit application
- Light-weight

Options

- Configure with any combination of cups and discs
- Circular flat carbon steel, stainless, or nylon brushes
- Different hardness and materials



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FOAM PIGS

SLS

Super Light Swab

1lb/ft³

(16-32 kg/m³)

Light drying

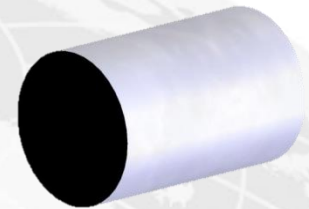


MLS

Medium Light Swab

2lbs/ft³

(16-32kg/m³)



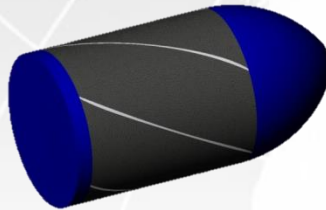
Porcupine

Total Covered Wire Brush

8-10 lb/ft³

(128-160 kg/m³)

Maximum scraping

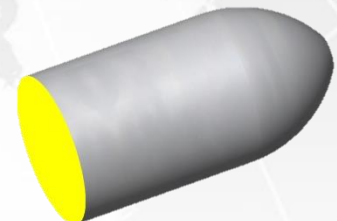


LDBS

Light Density Bare Squeegee

2 lbs/ft³

(16-32 kg/m³)



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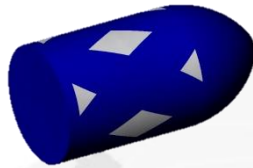
FOAM PIGS

Heavy Density 8-10 lb/ft³ (128-160 kg/m³)



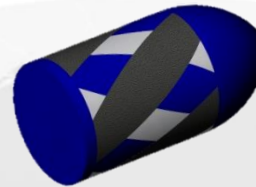
HDBS

Heavy Density
Bare Squeegee
Light drying



HDCC

Heavy Density
Criss Cross
Heavy Wiping



HDWB

Heavy Density
Wire Brush
Heavy scraping



HDSC

Heavy Density
Silicone Carbide
Heavy scraping

Medium Density 5-7 lb/ft³ (128-160 kg/m³)



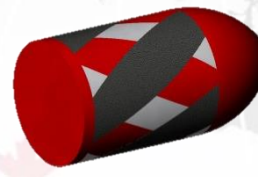
MDBS

Heavy Density
Bare Squeegee
Light drying



MDCC

Heavy Density
Criss Cross
Heavy Wiping



MDWB

Heavy Density
Wire Brush
Heavy scraping



MDSC

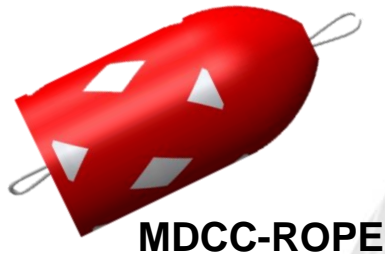
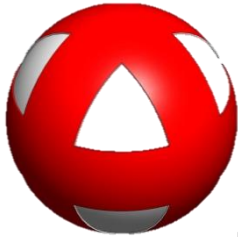
Heavy Density
Silicone Carbide
Heavy scraping

world class world wide



FOAM PIGS

FOAM BALL MBCC



MDCC-ROPE



MDCC



DOUBLE DISH

They are widely used in a complete range of applications such as:

- Oil & Gas
- Gathering Systems
- Petrochemical
- Municipal Water and Waste Management
- Gas Distribution

Features

The basic foam pig design can be adopted to include a variety of tough urethane coatings. The addition of aggressive wire brushes into the urethane coating provide a durable and efficient cleaner for hard pipe scale applications. *Foam pigs and spheres are the most cost effective, versatile design of pipeline cleaner in the market today.*

world class world wide



PIG PASSAGE INDICATORS

- There are two basic types, intrusive and non-intrusive.
- Intrusive signalers are activated by either a lever or plunger. Caution should be taken as some lever types can only operate in one direction, this causes problems should the pig need to be reversed or if installed incorrectly.

PIG PASSAGE INDICATORS

pigPRO™

The patented pigPRO™ indicator is designed to accurately detect the passage of a pipeline cleaner traveling within a pipeline system.



Features

- adjustable plunger
- compression spring
- easy connection to hot tapping equipment

Material

- stainless steel components
- conform to NACE standards

Reliability

- hemispherical shape of the plunger
- absence of gears in the trigger Indication
- visual flag/manual reset
- electrical switch/auto reset
- combination of both

world class world wide

PIG PASSAGE INDICATORS

pigPRO™



Flange Mount

Flange base models are manufactured to mount to existing flanged connections and are available in class 150, 300, 600 or 900 ANSI flanges.

Conversions kits are also available which enable installation onto the mountings of other manufacturers.



Extension Pole

Aluminum extensions can be attached to enable detection of the pigs passage on buried pipelines.

All pressure sealing components remain below the extension module.

Available in lengths 2' to 8'.

world class world wide



CDI at APACHE

**APACHE IS PROUD TO ANNOUNCE
OUR NEW PARTNERSHIP WITH CDI**

This new venture will allow us to bring you new opportunities for pipeline pig location, tracking and non-intrusive pig passage detection products.



CDI at

Apache
PIPELINE PRODUCTS

world class world wide



CDI at APACHE

CD52 BANDIT



CD52 Non-Intrusive Pig Passage Signaler

- Non-Intrusive pig passage signaler
- Reliable Patented technology
- UL/CSA rated with ATEX as an option
- Relay closure available for SCADA networks, PLCs, Lights and Horns
- LineStat satellite service may provide detailed email or text messages to an operator when a pig passes.
- Operates on +24 volts or D-CELL battery for one year

world class world wide



CDI at APACHE TRAXALL 770

TRAXALL 770 Pipeline Pig Location & Tracking System

- Sophisticated software allows the tracking of up to 7 transmitters simultaneously, each with its own unique color assignment
- Tracking and location of MFL tools without transmitter
- Pinpointer user interface allows for easy pig location to within centimeters
- GPS locations may be Waypointed and Trackpoints can store breadcrumb trails for easy retrace of routes
- Bluetooth allows remote viewing and downloading of the system from a vehicle in bad weather
- One-piece design for easy handling
- Color graphics display has a temperature range of -20°C to 70°C



Color coded transmitters

world class world wide



CDI at APACHE

CD42 TRANSMITTERS

CD42 Pipeline Pigging Transmitter Family

- Fit pigs 2" through 60"
- Pressures as high as 10,000 psi (689 bar)
- Pressure switch activation options for commissioning work
- ATEX Transmitters available in Q1 2014
- Transmitters with and without pressure housings
- Custom designs are routine



world class world wide

Thank you for your time and interest in



Apache
PIPELINE PRODUCTS

If you require further information please contact us
at the address and / or numbers listed below.

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