

Enduro Pipeline Services, Inc.

P.O. Box 3489
Tulsa, OK 74101 U.S.A.

Various Enduro Pigs & Pigging Information

Running pipeline cleaning pigs on a regular basis is very important for many reasons; maintain the pipelines integrity, increase pipeline throughput, maintain continuous operation, provide timely information of developing problems, and to prepare and preserve pipeline cleanliness for internal smart pig inspections. However, prior to running cleaning pigs many important factors must be considered:

- Minimum bend radii (1.5D, 2D, 3D, etc...)
- Minimum and maximum wall thickness
- Line length
- Product being transported during time of pigging
- Normal and maximum operating pressure
- Estimated flow rate
- Type and amount of debris expected to be removed
- Prior pigging operations performed (includes frequency and type of pigs used)

Generally speaking, **Enduro** offers many types of pig configurations, including Custom designs to specifically meet the **Customers** pipeline needs. **Enduro** offers pigs ranging in sizes from 2-inch through 60-inches in diameter, including dual diameter pigs. Each pig can be equipped with cups, discs, brushes, magnets, tracking devices, or a combination there of. Moreover, varying hardnesses of urethane durometer are available for different applications.

Other modifications such as adjusting pig lengths for safe transitions through valves and lateral connections can also be accomplished. Furthermore, dependant upon each pipelines specific make-up, **Enduro** can add bi-pass ports through the pigs to aid in debris removal.

Customers are encouraged to complete an “*Enduro Pigging Questionnaire*” for each line section that requires pigging. **Enduro** will review the completed questionnaire and make the appropriate pigging recommendations based on information the **Customer** provides.

Pipelines that have been routinely pigged can usually incorporate other pig designs that are slightly more aggressive in nature than what has typically been ran. For instance, if a combination, cup and disc pig is utilized on a monthly basis with little or no debris being retrieved, the **Customer** could then potentially increase the pigs effectiveness by adding brushes or another pig section all together. However, pipelines which have not been frequently pigged, or that have never been pigged should be approached with careful consideration.

Typically, these types of pipelines will need to incorporate a progressive pigging program, requiring the first pig passes to be accomplished by using less effective pigs than the later pig passes. Initially the line should be pigged with a tool that is relatively risk free, designed for light duty cleaning, safely pass 1.5D bends, most restrictions, and will prove the line piggable (*all pig configurations when ran for the first time should be equipped with a transmitter for tracking and locating purposes*).

Once the “prover” pig has been received in good condition and little or no debris is retrieved, the **Customer** can then progress to the next pigging configuration which will be slightly more aggressive than the last. This process will be repeated until the final cleaning pig stage is reached which will usually incorporate an aggressive cleaning pig train equipped with a combination of cleaning elements such as cups, discs, brushes, blades and magnets.

When the line has been determined to be clean, the **Customer** can then proceed on to the next phase of the pigging program which will require running **Enduro’s** Digital Geometry Tool (*DdL*). Once the geometry phase has been completed, **Enduro’s** Digital Flux Logger (*DfL Corrosion Tool*) should then be implemented. Finally, upon the successful running of the *DfL* tool, a regularly scheduled pigging program should be implemented to prevent the reoccurrence of debris build-up, and to keep the line prepared for future in-line inspection operations.

Below are various pictures of a few **Enduro** pigs that can be utilized for petroleum or other pipeline cleaning and maintenance applications.

1. **Pigs recommended for *stage one* cleaning programs and proving operations; light to moderate cleaning (*I have attempted to show the pigs from least to most aggressive*).**
 - 1a. Foam pigs are available in light, medium and heavy densities. Bare swabs, urethane coated and brushes are available.



Foam Pigs

- 1b. ADV-2CC pigs are equipped with two conical cups and are bolted onto a metal pig mandrel. Ideal for proving, tracking and light duty cleaning applications. Brushes and blades can be added to enhance the pigs cleaning abilities. All **Enduro** brushes will provide 360° of internal pipe wall coverage.



16" ADV-2CC



12" ADV-2CC-BRW



20" ADV-2CC_BL

2. Pigs recommended for *stage two* cleaning programs and routine maintenance; moderate to heavy cleaning.

- 2a. ADV-4CC pigs are typically used for nitrogen purges, batching and regular duty cleaning applications (*also available with three cups*).



16" ADV-4CC-KW



10" ADV-4CC-BRW

- 2b. **Enduro** UreCast pigs are constructed of 100% urethane and are equipped with (2) cups and (2), or in some cases, (3) scraper discs. The UreCast can be equipped with wrap brushes and is ideal for purging, batching, cleaning and tracking applications.



Enduro UreCast Pigs

- 2c. ADV-3D-2CC (BR) (BRW) pigs contain a combination of cups and discs bolted to a metal pig mandrel. Ideally, the ADV-3D-2CC is used for regular duty cleaning and batching applications. Wrap brushes or spring loaded brushes or blades can be added to the ADV-3D-2CC in order to achieve a more aggressive design.



16" ADV-3D-2CC



16" ADV-3D-2CC-BRW



16" ADV-3D-2CC-BR

- 2d. BI-DI pigs are commonly used as fill and de-watering pigs during hydro-static testing operations. They can also be used as cleaning, batching and displacement pigs when bi-directional applications are necessary. Typically, BI-DI pigs are equipped with as little as two discs and as many as eight. Wrap brushes and magnets can also be added to the BI-DI pig to enhance its cleaning abilities.



12" BI-DI-6D



12" BI-DI-6D-BRW



16" BI-DI-8D

3. **Pigs recommended for *stage three* cleaning programs and routine maintenance; heavy to aggressive cleaning.**

- 3a. Multi-section pig trains are often ran as the final pigging configuration prior to starting inline-inspection runs. These pig trains are commonly configured as two, three and sometimes four section trains (*length and amount of cleaning elements are dependant upon pipeline bend radii and barrel lengths*). The additional amount of cups, discs, brushes and magnets make pig trains extremely aggressive, allowing the pig to accomplish excellent cleaning results. Pig sections are typically coupled together by urethane Pig Links or metal u-joints. Shown below are several types of pig train configurations, any of which are ideal for cleaning most any pipeline.



6" ADV-2CC/PL/2D-BRW/PL/MG Pig Train



10" ADV-3D-2CC-BRW/PL/UNI-DI-6D-MG Pig Train



12" ADV-2CC/MU/4D-BRW/MU/4D-MG Pig Train



10" ADV-2CC/PL/4D-BRW/4D-MG Pig Train

4. Dual diameter cleaning, batching and gauging pigs for multi-diameter pipe runs.

- 4a. Dual diameter pigs ranging in sizes from 3" x 4" to 36" x 48" are also available at **Enduro**. Dual diameter pigs can be equipped with discs, cups, brushes blades and magnets. Each dual diameter pig is designed to achieve maximum seal in multi-diameter pipe and the spring loaded brushes / blades are designed to be effective in all diameters, providing 360° of internal pipe wall coverage. Shown below are just a few **Enduro**, dual diameter pig designs.



10" x 12" DDC/PL/DD-BR-MG Pig Train



10" x 12" DDC/PL/DD-NBR



16" x 18" DDC-BR-MG Pig Train



18" x 20" DDC-BR

As a reminder, **Enduro** will treat each and every pipeline on an individual basis; **no two pipeline atmospheres are the same.** Therefore, it is imperative to provide as much detailed information as possible for each pipeline section that requires pigging. As stated earlier, this can be accomplished by completing an **Enduro Pigging Questionnaire** and submitting it to an **Enduro** representative for review. Once the gathered information has been processed, **Enduro** will provide the best solutions available for solving all our **Customers** pipeline needs.

J.R. Morgan - Product Sales
Enduro Pipeline Services, Inc.
Tel: 918-446-1934
Fax: 918-446-8125
Email: jrm@enduropls.com