

Cleaning Pigs & Darts

Consisting of gritted foam pigs, plain foam pigs, foam wiper darts & polyurethane wiper darts.

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1 – Introduction & Nomenclature

A broad range of pigs and darts has been developed over many years to meet requirements for tubing, pipe and related applications. The range has continually evolved in response to changes in tubing sizes, wall thicknesses, materials, operating requirements and customer requirements.



Examples of Benoil’s cleaning products

Our cleaning products have primarily been used for internal surface cleaning of coil tubing, although downhole and non-oilfield applications have also been accommodated. Larger versions are available for drill pipe and oilfield tubulars.

Popular cleaning products are generally available from stock, whereas specialised designs can be manufactured to suit specified dimensions and/or operating conditions.

Benoil's family of cleaning products enable the internal cleaning of coiled tubing from a state of significant rust and/or debris build-up to a clean and polished surface ready for the application of anti-corrosion coatings prior to coil storage. Coarse grit pigs, polish grit pigs, plain pigs can be run interchangeably, followed by foam or polyurethane wiper darts. This allows for recently used coil tubing to be restored ready for storage.

Significant rust and deposit build-up can be removed. Some customers also use our foam products to apply anti-rust treatment.

2 – Development of the Cleaning System

Benoil Foam Pigs were developed progressively in approximately increasing order of toughness and cleaning capability. Our Wiper Darts were initially foam-only but are now made from polyurethane as a tougher option, as well as foam (green).

2.1 – Polyurethane Foam Sponge Wiper Darts (Green)

Our P/N 133xxx series was developed as the softest form of wiper pig. Green, cellular polyurethane foam is used, primarily to leave a film of anti-rust treatment within tubing. An extreme example was developed to wipe 2.875" tube, pass through a restriction, and subsequently wipe a 2.0" tube. The chevron design allows for high variability in tube ID, whilst maintaining wiper performance.

Our foam-based pigs are rated up to approximately 2000 psi, after which foam collapse can occur. They are available in ODs from 1" to 2.875".

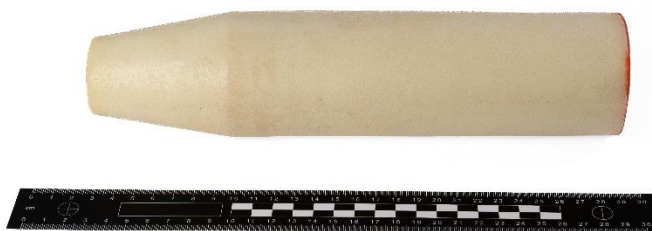


2.2 – Polyurethane Foam Sponge Cylinder Wiper Pigs

The P/N 1230xx series was developed using the same PU foam system as the foam wiper darts, but with cylindrical geometry. These products are suitable for fluid displacement and removal of soft deposits.

They are designed for low bypass, but with sufficient flex to pass over firmly adhered deposits. These products are principally used for cleaning tubing before or after servicing, including removal of condensate, residues, and flushing water.

Larger versions are supplied for drill pipe and other oilfield tubulars. The series is capable of extension to other diameters and wall thicknesses. They are available in sizes from 0.75” to 3.5”. These products are rated up to approximately 2000 psi, after which foam collapse can occur.



2.3 – Polyurethane Elastomer Wiper Darts (Orange)

The P/N 124xxx series is made from orange 75A polyurethane as a tougher alternative to foam. The stiff chevron construction provides improved cleaning whilst retaining fluid displacement capabilities.

Five-chevron and ten-chevron versions are available for 1.25” to 2” coiled tubing. The ten-chevron versions are generally used where additional length is advantageous. 2.375” to 3.5” wiper darts are only available as five chevrons. These products were developed for both coil tubing and standard tubing, with drill-pipe versions subsequently added. The range was expanded and renumbered because of increasing diversity in customer demand.



2.4 – Polish Grit Silicon Carbide Abrasive Pigs

The P/N 12103x series was developed from the established foam-cylinder design, with fine-grade SiC bonded to the cylinder wall.

The polishing versions are identified by green sealed faces. These products are for abrasive cleaning and polishing of tubing and pipe, particularly for removal of surface rust and hard residues before and/or after operations. The foam construction allows the pig to accommodate different wall thicknesses and tapered coiled tubing strings.



2.5 – Coarse Grit Silicon Carbide Abrasive Pigs

The P/N 12105x series was developed with coarse silicon carbide bonded in helical strips around a foam cylinder. Hard deposits inside the tubular are cut away, whilst the flutes encourage a flushing or jetting effect across the working surface. Coarse grade SiC pigs are identified by orange end caps.

The foam core allows the abrasive sections to compress inside heavier-wall tubing, maintaining firm wall contact in tapered strings. The coarse products are designed for heavy-duty cleaning and should be followed by other less aggressive pigs and/or darts.



2.6 – Older Product Types

The following products are no longer supplied:

- Elastomer Scraper Pigs (P/N 120xxx series)
- Hippo Turbo Pigs (P/N 136xxx series)

3 – Operational Use & Field Experience

3.1 – Cleaning & Fluid Displacement

Foam and elastomer darts are used for cleaning tubing before and after operations and during yard inspection. Applications include the removal of condensate, residual fluids, flushing water and other residues. Foam cylinders are particularly well-suited to fluid displacement where minimum bypass is desirable, while softer foam wipers are used where an anti-rust treatment film is intended to remain on the tubing inner wall.

The choice between foam and elastomer wipers is influenced by operating requirements and customer preference. Different configurations are used for different applications, with some operators favouring foam cylinders and others preferring standard five-chevron elastomer wipers.

Standard elastomer wipers are used as general-purpose cleaning darts and are effective for sweeping liquids and residues from the tubing. Five-chevron and ten-chevron configurations are available, with the five-chevron configuration generally being used as the standard arrangement. Softer polyurethane versions are also available where a less aggressive wiping action is required.

3.2 – Restrictions & Changes in Bore

Tubing wall thickness is an important consideration in the selection of wiper darts. The nominal size of a dart represents the tubing condition for which its interference fit is designed. A parallel string provides the most straightforward application, while tapered strings require the dart to be selected according to the section having the least wall thickness.

Where a dart is selected for the smaller section of a tapered string, additional pressure is therefore when the dart enters a larger-bore section. For example, a dart selected for a 0.109" wall condition can be used through a .156/.125/.109" tapered string, although greater pressure is required in the 0.156" section.

Where practical, reverse pigging is used in yard applications so that the wiping lips are presented to the wider bore with maximum effectiveness. In extreme tapers, a single conventional wiper cannot provide optimum performance throughout the complete string, as sufficient engagement in the smaller bore can result in excessive squeeze in the larger sections. Special development is available where the standard configurations are unsuitable.

3.4 – Operational Pressure & Handling

Foam cleaning darts are subject to pressure limitations and are not intended to be operated above approximately 2,000 psi. Excessive pressure can cause collapse of the foam structure, so the operating pressure is considered when the appropriate dart construction is selected.

Most cleaning pigs are designed to pass completely through the tubing and emerge at the far end, with no catcher being required. This allows cleaning and fluid displacement to be carried out as a continuous operation.

3.5 – Wear & Service Life

Internal weld beads and weld flash are important considerations in the selection and operation of cleaning darts. A circumferential weld bead produces a local reduction in internal diameter and can therefore interfere with the passage of pigs, particularly where the bead is relatively pronounced or where the available clearance is already limited. In coiled tubing, internal weld flash and variations in internal diameter are recognised features that can affect the passage and effectiveness of wiper pigs.

As a cleaning dart passes over a weld bead, the wiping elements are subjected to a local increase in interference and contact pressure. Repeated passage can therefore produce additional local wear of the polyurethane or foam wiping surfaces. More generally, polyurethane pig sealing elements are subject to abrasive wear, surface fatigue and other forms of degradation when operated against steel surfaces, with increased interference producing increased wear. Excessive wear can ultimately result in loss of sealing performance and, in severe cases, instability or sticking. Accordingly, Benoil's cleaning range is rated for single use only.

4 – Current Product Range

Within each product type, there are variations in terms of coiled tubing ID, wall thickness and chevron count (for darts).

Benoil P/N Range	Product Type
12105x	Coarse SiC Foam Pigs
12103x	Polish SiC Foam Pigs
12303x	Plain Foam Pigs
1240xx	Elastomer Wiper Darts
13303x	Foam Wiper Darts

5 – Identification and Storage

Benoil's P/N, the batch code, and product description are clearly labelled on product packaging. No identification markings appear on the product itself. It is advised to store all of our cleaning products in their own packaging to prevent misidentification.



6 – Contact Details

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