



**A Guide to Hygienic
Product Recovery
(Pigging) for the
Process
Industries**

**HPS Product Recovery
Solutions**

Product Recovery and Transfer Specialists

www.HPS-Pigging.com



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Summary

For companies that process liquids, hygienic product recovery (“pigging”) is one of the most effective ways to improve product yields, reduce waste, speed up production time and save water. And because pigging saves product and other resources, it has a positive impact on the environment and helps companies towards their sustainability goals.

Hygienic product recovery and pigging systems are particularly effective, and in wide use, in the process industries. That’s because processing companies can achieve significant gains from product recovery and the efficiency improvements provided by HPS pigging solutions.

As well as improving efficiency, productivity and profits, pigging systems also offer a wide variety of additional benefits such as speeding up changeover times, improving product quality and consistency (helping to pass audits and avoid recalls) and increasing the flexibility of operations. HPS pigging systems also deliver rapid payback and return on investment.

This guide provides an overview of hygienic (often called sanitary) pigging for the processing industries. It includes an introduction to how pigging works, the benefits of pigging, types of hygienic pigging system and types of pig and how to plan a pigging project. It also has sources of further information.



“HPS provided a great product and a great service. We’re extremely satisfied with our experience with HPS and would happily recommend them to others”

- KIK Custom Products

The Challenges

Here are some of the main challenges facing liquid processing companies and why an increasing number of them are implementing pigging systems into their manufacturing plants and production facilities.

Increasing Competition

Competition in the liquid processing industries is intense. Manufacturers that aren't agile and efficient risk being left behind.

Raw Material Prices Fluctuating

Raw material costs are constantly fluctuating. Therefore, manufacturers want to ensure they use everything they buy and avoid throwing high-priced inputs down the drain.

The Threat of Cross-Contamination

When an incident occurs, it can attract media attention that has a negative impact on a brand. Therefore, manufacturers are implementing technologies to improve safety and minimise the risk.

Demanding Customers

Customers are becoming more discerning and demanding, which is putting pressure on liquid processing companies to innovate and introduce new products. As such, they need flexible equipment that can handle multiple products.

Sustainability

Many manufacturers have sustainability targets they need to meet, for example waste reduction, energy reduction targets. At the same time, customers are demanding products that are greener and sustainably produced.

Key Statistics and Takeaways:

- ✓ The highest quality pigging systems typically recover up to **99.5%** of useable, residual liquid from pipes. This recovered liquid can continue to be processed, packaged and sold.
- ✓ Payback from Pigging is typically less than 12 months, delivering a high ROI.
- ✓ There are different types of pigging system, from simple source-to-destination solutions to multiple-source and multiple-destination projects. Nearly all pigging solutions are bespoke, and most are either semi or fully automatic.
- ✓ Savings are significant – a leading soft drinks company implemented a pigging system which is saving them roughly **\$31,500 a day**.
- ✓ A US home-care manufacturer implemented a pigging system that saves about **160 gallons of dishwasher fluid** per batch run. Based on the cost of a standard size bottle of the product when sold in the store, that works out about **\$2735**.
- ✓ A well-known Australian pet food manufacturer is estimated to save **roughly \$42,000 AUS per year** in product alone. This is in addition to savings from faster changeovers and reduced downtime, and savings from lower CIP and water usage.
- ✓ Pigging saves water. For example, an Australian winery saves over **40 million litres** of water each year, along with wine savings of approximately **40,000 litres**.
- ✓ Pigging reduces waste and its associated costs. A wine processor has reduced effluent production by roughly **1,500 litres** per bottling run, which equates to around **500,000 litres** per year.
- ✓ A personal care manufacturer installed a pigging system which reduced washout times by **more than 50 per cent** (from 15 to 7 minutes). As well as reducing washout times, queuing is eliminated completely, so there's no time losses from waiting or shutdowns.
- ✓ By reducing waste and improving efficiency, pigging improves environmental sustainability.



What Is Pigging?

If you drink wine, beer, spirits, fruit juices, cola or other types of soft drinks; if you eat chocolate, sweets, ready meals, dips, sauces, yoghurt, soup or honey; or if you use paint, varnish, shampoo, cosmetics, toothpaste, washing up liquid or other household product, then the chances are you've drunk, eaten or used something that's been 'pigged' during its processing or production.

In the processing industries, hygienic pigging recovers residual liquid product from pipes. If it wasn't recovered by pigging, this liquid would go to waste. This product is perfectly useable so can be sold or continue to be processed along with the rest of the batch, rather than being flushed down the drain.

How Pigging Works

In its simplest form, a pigging system consists of a solid projectile (the 'pig') with a diameter slightly larger than the pipeline transporting the liquid. The pigging process introduces this pig into the pipeline (usually automatically) and pushes it through the pipe.

To 'pig' a system, pigs are propelled through the pipe by pressurising the pipework behind it. Compressed air, carbon dioxide, nitrogen, clean water or even the next product (depending on the application) provide the pressure. Instead of being flushed to drain, waste treatment or collection areas, the liquid residue in the pipe is recovered: pushed by the pig and forced to the destination filler or tank, or returned to source, to continue processing along with the rest of the product.

HPS pigs, which are the benchmark of the industry, recover up to 99.5% of product. As well as increasing yields, pigging at this level also reduces the need for water flush and clean-in-place, saving time, labour, water, cleaning fluids and waste disposal costs.

Benefits of Pigging

Hygienic Pigging and Product Recovery Systems deliver a wide range of benefits and a high return on investment. The benefits include:

- ✓ **Higher Product Yields**
- ✓ **Increased Productivity, Efficiency and Profits**
- ✓ **Higher Capacity and Increased Flexibility**
- ✓ **Faster Changeovers**
- ✓ **Lower Cleaning and Labour Costs**
- ✓ **Improved Production Quality and Lot Control**
- ✓ **Less Downtime**
- ✓ **Reduced Product Contamination Risks**
- ✓ **Reduced Waste Processing**
- ✓ **Reduced Water Usage**
- ✓ **Prevention of Aeration, Foaming and Dissolved Oxygen**
- ✓ **Minimised Product Mixing, Dilution and Interface**
- ✓ **Improved Environmental Sustainability**

Higher Product Yields

Increased product yield is one of the most common reasons organisations use a pigging system.

Whenever a process transfers liquid along a pipe, there's nearly always product residue left in the pipe. Even gravity fed lines don't evacuate all the product. The more viscous the product, the more residue there is. Pigging systems will help you recover nearly all this residue, as useable product.

As an example, HPS provided an automatic pigging system for a soft drink manufacturer located in Costa Rica. The pigging system is saving the company roughly **\$31,500 a day**.

HPS also provided three fully automatic pigging systems for a plant that manufactures one of the world's most popular fizzy drinks. Each system delivers product from any one of four tanks to a filling machine. The three pigging systems delivered a **4%** increase in product yield, equating to **48,000 extra cans** per week.

A wine bottling plant implemented a pigging system and now saves an average of **256,000 litres of wine** every year.

HPS provided pigging systems to a well-known Australian pet food manufacturer. This pet food manufacturer processes hot meat slurry, pumping it through 2.5-inch pipe over 100 feet. In product alone, the manufacturer is estimated to save roughly **\$42,000 AUS per year**. This is in addition to savings from faster changeovers and increase in available production time, and savings from lower CIP and water usage.

Increased Efficiency and Profits

Because pigging systems recover significant amounts of useable product from processes, there's more product to sell. Alternatively, less is required to achieve the same output.

In addition to increased profits, pigging systems streamline processing; reducing effort required and making various operations a lot quicker. They can even eliminate some process stages altogether, for example dismantling pipework or flush outs.

Typically, a correctly designed and implemented pigging solution will pay back the initial cost of the system within one year. Good quality pigging systems last a long time (some HPS systems are still in use after 20 years), so return on investment is significant.

For example, a large chocolate manufacturer in California uses a combination of semi-automated and fully automated pigging systems in a range of sizes. These systems massively increase efficiency, reduce the risk of human error, speed up processing and changeovers, and minimise waste.

Lower Cleaning and Labour Costs

Pigging reduces the effort and resources needed to clean pipelines. Because there's less product to remove, it is quicker and requires less labour. It also speeds up changeover times so there's less downtime. Semi-automated and fully automated pigging systems reduce labour costs even further.



Faster Changeovers

When companies expand product ranges, it's often desirable to use previously dedicated pipelines. However, changeover from one batch to another can account for significant product loss, high wastage costs and less productive human-resource hours.

Pigging speeds up product changeovers because it reduces the length of the wash. If there is only a slight change in product colour or flavour it is often possible to follow on immediately with the next product after pigging, eliminating the need for flushing altogether.

For example, a well-known personal care manufacturer, estimates that since the installation of HPS pigging systems, **changeover times have more than halved**.

Improved Production Quality and Lot Control

Some products should not be left stationary within a pipeline, either because they may deteriorate or because they may solidify. Using pigging, a well-known manufacturer of chocolate coatings pushes significant amounts of product to storage rather than leaving it in the pipelines. This improves lot control and prevents products from sitting unavailable for extended periods of time. It also helps prevent settling and freeze-ups because operators can clear the pipe as frequently as they like with little to no effort.

Reduced Product Contamination Risks

Because HPS pigging systems have high product recovery rates, the chances of product contamination and cross-contamination are greatly reduced. This in turn means more consistent product output, lower rework and better control over raw material and finished product inventory are among the many benefits of pigging systems.

In product to product pushes, pigging minimises mixing and dilution, which improves quality as well as saving operator time. This in turn reduces the risk of failing audits and expensive product recalls.

Reduced Waste Processing

By increasing product yields through pigging, there's less product to send to waste. What's more, the cleaning and changeover processes also use less cleaning fluids. In this way, hygienic product recovery and pigging systems directly reduce waste processing costs.

For example, an Australian winery has reduced effluent production by **1,500 liters** per bottling run, which equates to around **500,000 liters per year**.

Also, a consumer goods company implemented a pigging system and has reduced cleaning chemical usage from **60kg per washout down to 20kg**. The system also enables recycling of some of the cleaning chemicals, which improves environmental sustainability.

Higher Capacity and Increased Flexibility

Manufacturers pump many different formulations and configurations of product. However, it's inefficient to have a dedicated line or lines for each product.

Because HPS pigging systems recover nearly all residual product from the pipeline(s), this enables the same lines to be used for more than one product and reduces the number of dedicated lines there are. So, the many dedicated lines can be replaced with a lower number of shared lines. This increases the capacity and flexibility of operations and enables manufacturers to meet the demand for greater product variety. It also reduces the costs of new installations.

As an example, a well-known pet food manufacturer uses automatic pigging in its 3-inch pouch making lines. They use water flush outs and CIP. It is estimated that pigging saves **€60,000 per year in product alone**. This is in addition to savings from faster changeovers and increased available production time, and savings from lower CIP and water usage.



Reduced Water Usage

Often the first part of a clean-in-place cycle is to flush out the product residue with water for a period of time before actually proceeding with the cleaning process. If most of the product has already been removed by pigging, then there's no requirement for a lengthy flush out. This reduces water usage significantly.

For example, a well-known wine producer, which has a number of HPS systems in place, estimates that they are finding water savings of around **40 million liters** per year, in addition to wine savings of **440,000 liters** per year.

Reduced Use of CO2

Some manufacturers may use CO2 to purge the lines before they transfer the product from storage to the filler, in order to prevent oxygenation. Hygienic product recovery and pigging systems send a specialist projectile (a 'pig') from the filler down to the product pump outlet, which pushes out all of the oxygen from the line.

The pig acts as an interface between the product and oxygen and so prevents oxygen from coming into contact with the product. In this way, pigging prevents the need to charge lines with CO2.

Positive Environmental Impact

Many liquid processing companies have strong environmental initiatives. Therefore, the positive environmental impact of pigging is a key benefit to many of these producers and processors.

As well as forming part of an ethical business strategy, being environmentally responsible is increasingly important to consumers, employees and other company stakeholders.

The costs of removal or treatment of waste from plants has become a major expense to many liquid processing companies. Additionally, changes in legislation and environmental policies can lead to companies deploying extra resources and incurring further cost. An effective way of reducing these costs, while reducing carbon footprint and improving sustainability, is to pig the product transfer pipelines. This significantly reduces waste and associated costs.

Pigging saves water and saves energy. It reduces the use of harmful chemicals and associated disposal requirements. It also means fewer trucks on the road. In practical terms, the positive environmental benefits of pigging are considerable.

Prevention of Aeration, Foaming and Dissolved Oxygen

As liquid travels through a pipeline, the flow is usually turbulent. If there's air in the pipe, it can mix with the liquid, and the liquid becomes aerated. With certain liquids, even a small amount of air or gas can cause foaming. Others can be degraded or rendered unusable if they come into contact with air. Dissolved oxygen is a particular problem with wine, for example.

One of the most effective ways to prevent liquid coming in to contact with air during processing is to use a double-pig system.



Types of Pigging System

Pigging systems can be deployed in existing plants, as well as part of new projects or installations.

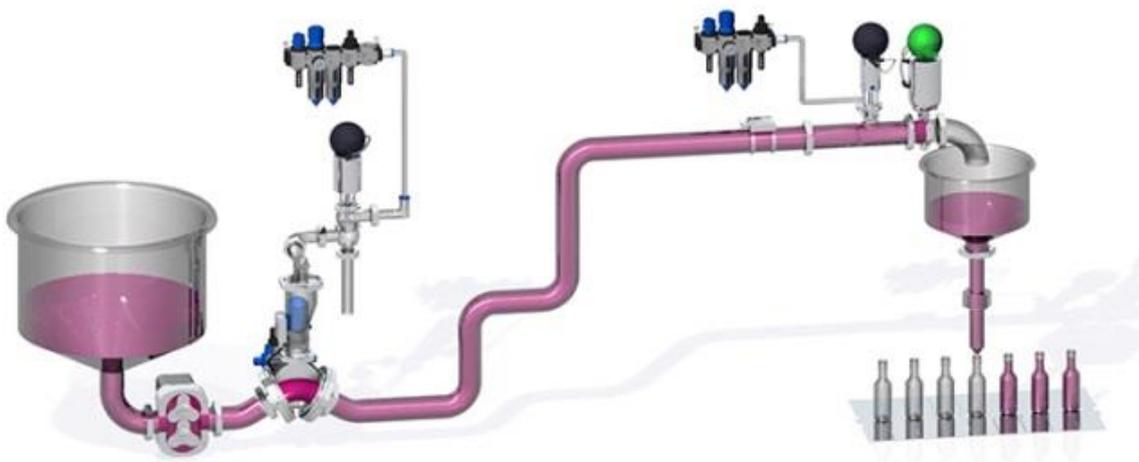
Because every company's processes and systems are different, every pigging system implementation is bespoke; there's no such thing as an effective 'off-the-shelf' hygienic pigging system. However, in liquid processing, pigging systems tend to fall in to one of three categories:

- ✓ Single-Pig Systems
- ✓ Double-Pig Systems
- ✓ Tank Drop-Off Systems

While these systems can be controlled manually or semi-automatically, most are controlled fully automatically. In particular, double-pig and tank drop-off systems are nearly always fully automatic.

Single-Pig System

Single-pig systems are the most common type of pipeline product recovery solution. They are also the simplest; generally sending one pig from one source to one destination when the main product transfer process has paused or finished.



Single-pig System

In a single-pig system, the pig can either send recovered product to the destination (for example a tank) or back to the source tank.

Double-Pig System

The double-pig system is typically used for processes where the product cannot come into contact with air. This is either because air contact may degrade the product, for example increasing the dissolved oxygen content in wine, or because the product has a tendency to aerate or foam, which can cause processing problems or delays.

Double-pig systems, as the name suggests, use two separate pigs. The sequence of each pig travelling through the pipe ensures that the system recovers residual product and transfers product efficiently, while always using the pigs to seal the product from air in the pipe, so avoiding air contact and aeration.

Products commonly associated with a double-pig system include wine, beer and foam gel products.



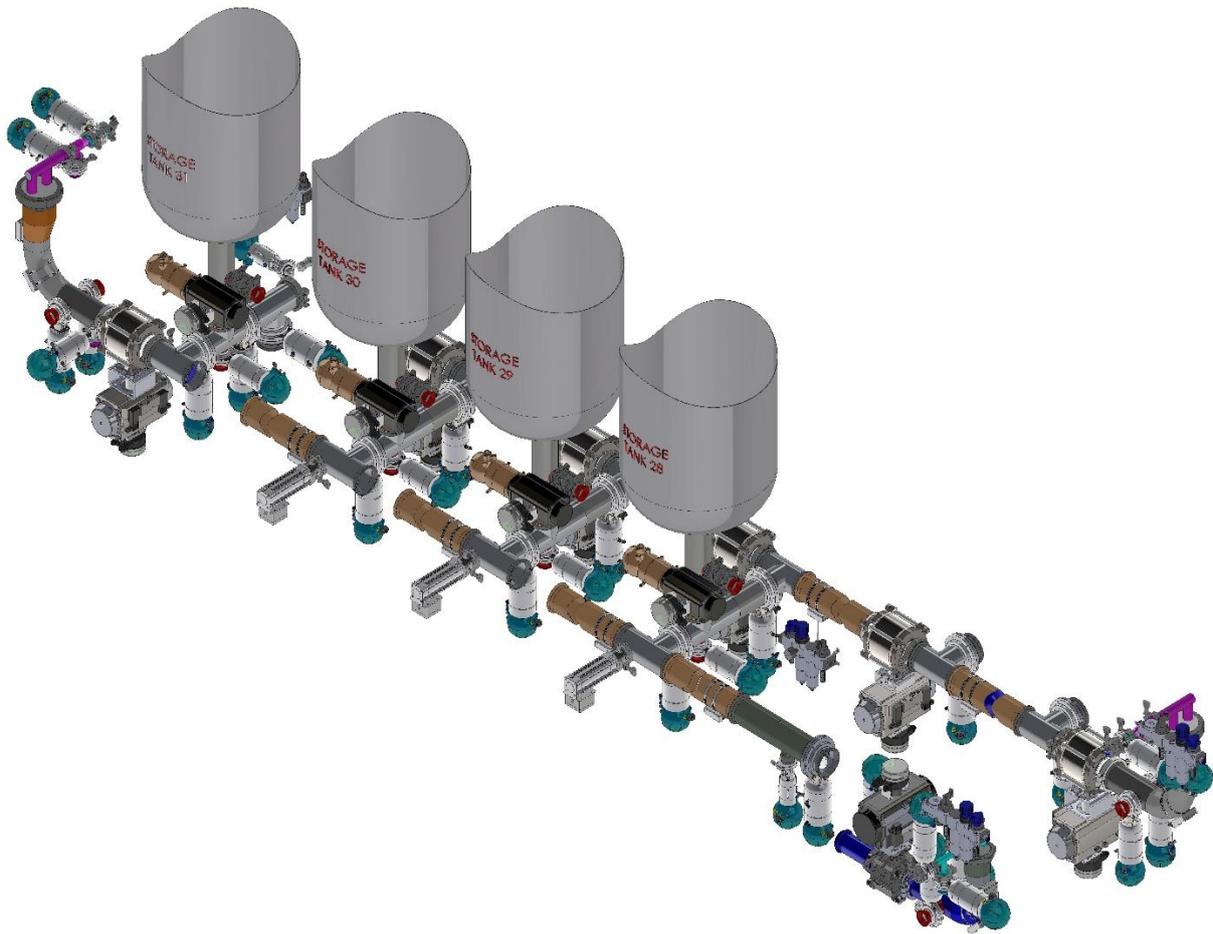
Double-pig System

Tank Drop-off

Tank drop-off systems are similar to single-pig systems, but incorporate multiple destinations on the same line, rather than a single destination.

There is no limit on the number of drop-offs. After transfer to a tank, the automatic pigging sequence sends a pig to a blocking valve at the appropriate tank. Any blocking valves between the destination and the pig are opened to allow for a clear route. The pig is then returned with the same receive return station used on a single-pig system.

For more detailed information about the different types of pigging system, including video animations, please visit <https://www.hps-pigging.com/pigging-system-demonstration-videos/>



Tank Drop-off System

Types of Pigs

Pigging systems include a variety of components, including launch and receive stations, specialist valves, propellant supplies, pig detectors, control software, PLCs and so on.

However, one of the most important components is the pig (or pigs). There is a variety of pigs available for hygienic and sanitary applications.



Basic Requirements

HPS patented process pigs are specially designed for highly effective, reliable and efficient hygienic (sanitary) pipe line pigging.

They should allow steam cleaning to a reasonable temperature without degradation. While being flexible (so that they can travel around bends and still efficiently recover product), they should ideally be solid; that is, not include caps or assembled components that could catch, break or fall off. Similarly, finned pigs should be avoided. This is because the fins tend to rip or have small pieces break off, while effectively cleaning between the fins is also difficult.

Detection

To enable full automation, pigs should be fully detectable and ideally be provided with a purpose-designed pig detection system. As well as being detectable, they should also be bi-directional.

To reduce contamination risks, pigs should not contain any solid magnets. Solid magnets and other assembled parts can break free from the pig and contaminate the product. For example, HPS pigs have a flexible silicone-based magnetic core, which will not shatter and so avoids the risk of contaminating the processed product with fragments of magnets. This flexibility also means the pig can travel around 1.5 D bends while still efficiently recovering product.



Pipeline Pig Materials

Pigs should be manufactured from different materials, depending on the application. For example, for food and beverage applications, pigs need to be manufactured from FDA approved food grade material. However, for paints and coatings applications, pigs need to be manufactured from solvent resistant materials.

Reliability and Effectiveness

Like any component, pigs should have a long working life and include a minimum usage guarantee. They should be available in a range of sizes to suit different pipeline specifications. Above all, they should be effective.

Recover up to 99.5% of Product

To ensure maximum recovery rates, pigs should maintain full body contact with the inside of the pipe and recover upwards of 99% of product.



"The HPS systems resulted in a clear increase in product yield, equating to 48,000 extra cans per week"

-Coca-Cola

Planning a Pigging System

Compared to many systems, implementing a product recovery and pigging solution is relatively straightforward. However, to ensure your project runs smoothly, here are some factors to consider at the initial stages of your project.

Aims and Objectives

While efficient product recovery is a key driver to most pigging system projects, overall objectives often include reducing environmental impact, streamlining operations, increasing efficiency or profit maximisation. Objectives that are more specific typically include improved pipe cleaning, increasing overall processing speed, and reduction of cleaning product use. However, these objectives vary depending on application. For example, a pet food processor may focus on increasing product yields and improving the efficiency of their operations, while a confectionery company that uses high-cost ingredients may focus on eliminating as much product waste as possible.

Regardless of the solution you choose, being clear about your objectives will ensure your pigging system design meets your needs.

Your Products

As well as the type of products you process, effective pigging system design will require information about typical operating temperatures, viscosity, pumping pressures and so on.

Your Current Operation

Before recommending a pigging solution, it is important to outline to your pigging system provider how your current liquid processing system is set up. For example, how many product sources you have, how many destinations, the approximate distance between each, how you currently clean between changeovers, changeover frequency and so on. It is also important to consider future additions or changes to your processing, and any plans for plant expansion.

Existing Services

There are different ways to propel pigs. The most common is by using compressed air or using a gas such as nitrogen or carbon dioxide. Other methods of propelling pigs include water or even the next product to be processed. It is usually preferable to use existing services if possible, so take a note of the compressed air, gas or other services you have available, including their rating.

Existing Pipeline Infrastructure

The dimensions, material and condition of your existing pipeline infrastructure will directly influence the design of your pigging system. We recommend you consider the following points before implementing a pigging system, as well as during the life of the system:

- ✓ Make sure the length of the pipe you are intending to pig is free from dents and damage.
- ✓ Welds must be clean and have minimal intrusion into the internal bore of the pipe.
- ✓ To prevent progressive damage to the pigged pipe, use anti-vibration cushion-sleeve pipe support clamps instead of metal-on-metal clamps.
- ✓ Instead of rod hangers, use rigid supports such as 'L' frames for the pigged pipe. This will prevent possible movement of the pipe while the hygienic pigs are propelled through it.
- ✓ If you're using compressed air, carbon dioxide or nitrogen to propel the pig, use rigid air pipe rather than flexible air lines (flexible air lines can get distorted and prevent air flow)

Special Considerations

There are some special considerations with certain products such as confectionery, wine, beer and foam-gel products. For example, with confectionery and chocolate-based products, because the transfer lines are often jacketed (heated to keep the chocolate fluid), the pigging equipment must also be jacketed and able to retain and sustain the heat without degradation. In addition, for chocolate-based confectionery, products such as butter, oil or

both are used for flushing. This is instead of water, which is often used when flushing other foodstuffs.

Because too much dissolved oxygen can make wine degrade quickly, the pigging equipment must be designed where the product cannot come into contact with air. This also applies to products which have a tendency to aerate or foam, which can cause processing delays.

Pigging System Automation

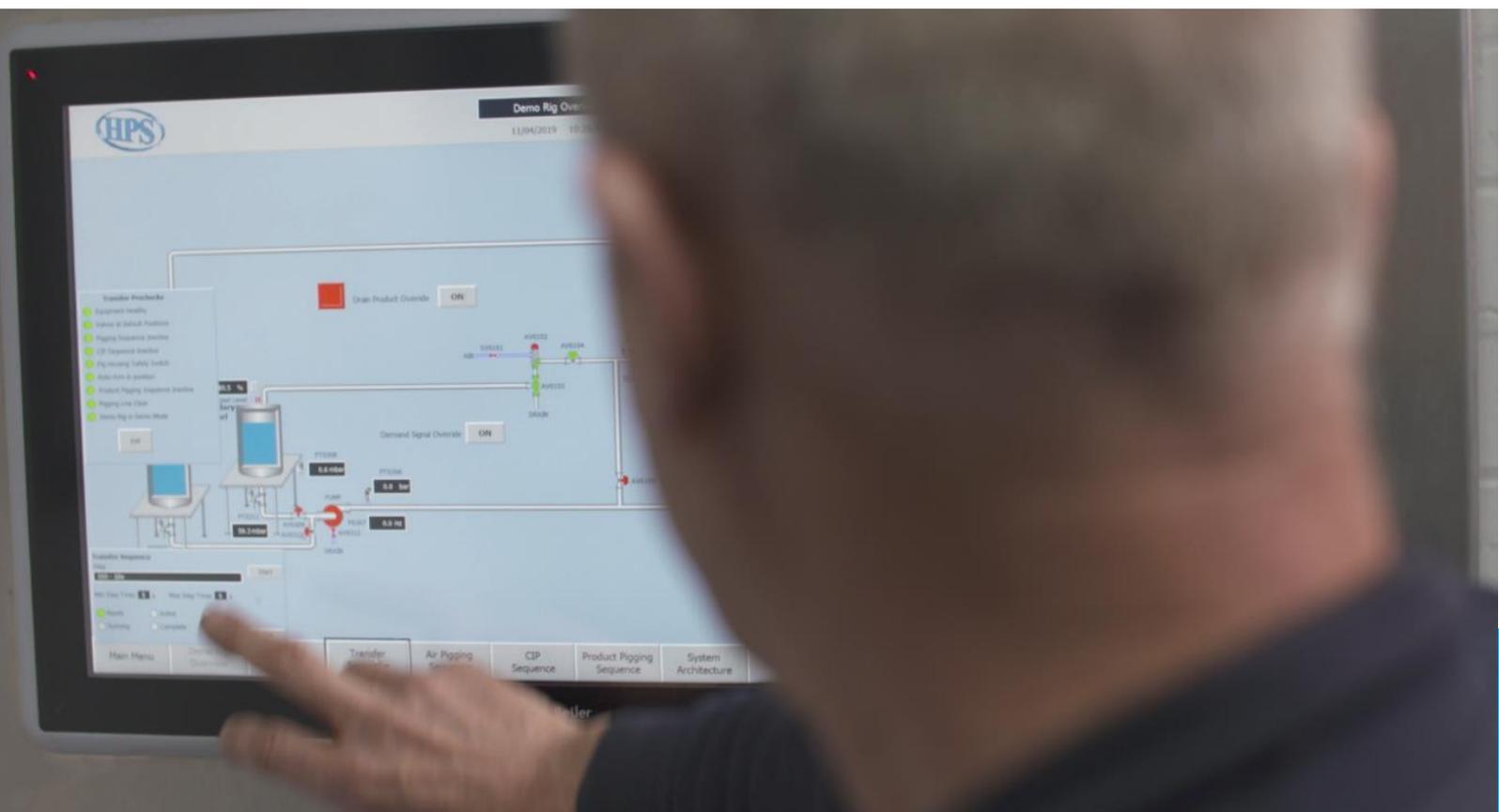
Automated pigging systems are more efficient, more reliable, easier to run and safer than manual systems. You may have your own PLC, SCADA or HMI system specialists that will be able to set up programming and control for you. Alternatively, you can ask your chosen pigging system provider to set up the automation for you.

Pigging system automation systems can be standalone or integrated. Standalone systems have a separate panel from the existing set up to automatically control the pigging process. Although standalone, it is possible to set up communications to pass data from one PLC to another. It is also possible to hard wire any interlocks and other safety features into the panel.

If there is space on an existing PLC and HMI for integration, it is usually possible to merge the pigging system automation code into it.

Use a Specialist

Although the principles of pigging are straightforward, it takes many years of experience and high levels of expertise to successfully design and implement a pigging system. That's why, if you're considering a pigging solution for your organisation, you should always work with a specialist hygienic product recovery company.





"The pigging solution was simple to use. The HMI was customisable to suit our needs and everyone we dealt with from sales to parts to installation and programming was fantastic to work with"

-Log House Foods

Further Information

There's a wealth of information about Hygienic Pigging and Product Recovery on the [HPS Website](#). Here are some of the most popular articles:

- [Pigging – What Is It](#)
- [Benefits of Pigging](#)
- [Types of Pigging System and Demonstration Videos](#)
- [Hygienic \(Sanitary\) Pigs](#)
- [Pigging System Savings Calculator](#)
- [How Pigging Helps the Environment \(with Infographic\)](#)
- [HPS News and Blog](#)
- [How to Reduce Cross-Contamination Risks During Changeovers in Liquid Processing](#)
- [Key Components of a Pigging System](#)
- [How to Reduce CIP and Downtime in Liquid Processing](#)
- [Pipeline Infrastructure for Pigging Systems](#)
- [Pigging System Case Studies](#)
- [Pigging and Product Recovery FAQ's](#)
- [Myths About Pigging](#)
- [Get a Pigging System Quote](#)
- [Pigging System Demonstration Videos](#)



About HPS

HPS is the world's leading specialist in pigging, liquid product recovery and transfer for companies that pump liquids or wet products. This includes manufacturers, producers and processors of food, beverages, confectionery, homecare, pet food, cosmetics, personal care, paint and many others.



HPS clients include Coca-Cola, Unilever, P&G, Akzo Nobel, Johnson and Johnson, Lindt, Buffalo Trace, Haribo, Kraft Foods and many others. There are thousands of HPS systems in use throughout the world.

Established in 1995, HPS has extensive experience in liquid processing which ensures highly efficient, reliable and cost-effective operation.

HPS head office is in the UK. The company also has offices in the US and Australia, and a network of agents and official representatives throughout the world.

You can't take risks with your processes. That's why HPS engineers will work with you to ensure your solution meets your operational requirements – *before you deploy it*. For more information, please see our contact details on the next page or [click here to find your nearest HPS office, agent or representative.](#)

Our Customers



Contact HPS

If you process liquids and wet products and want to improve the efficiency and effectiveness of your operations, please contact your nearest HPS Office:

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We have agents throughout the world.

Please contact the HPS head office and we will put you in touch with your local HPS representative:

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You can also find us on:

