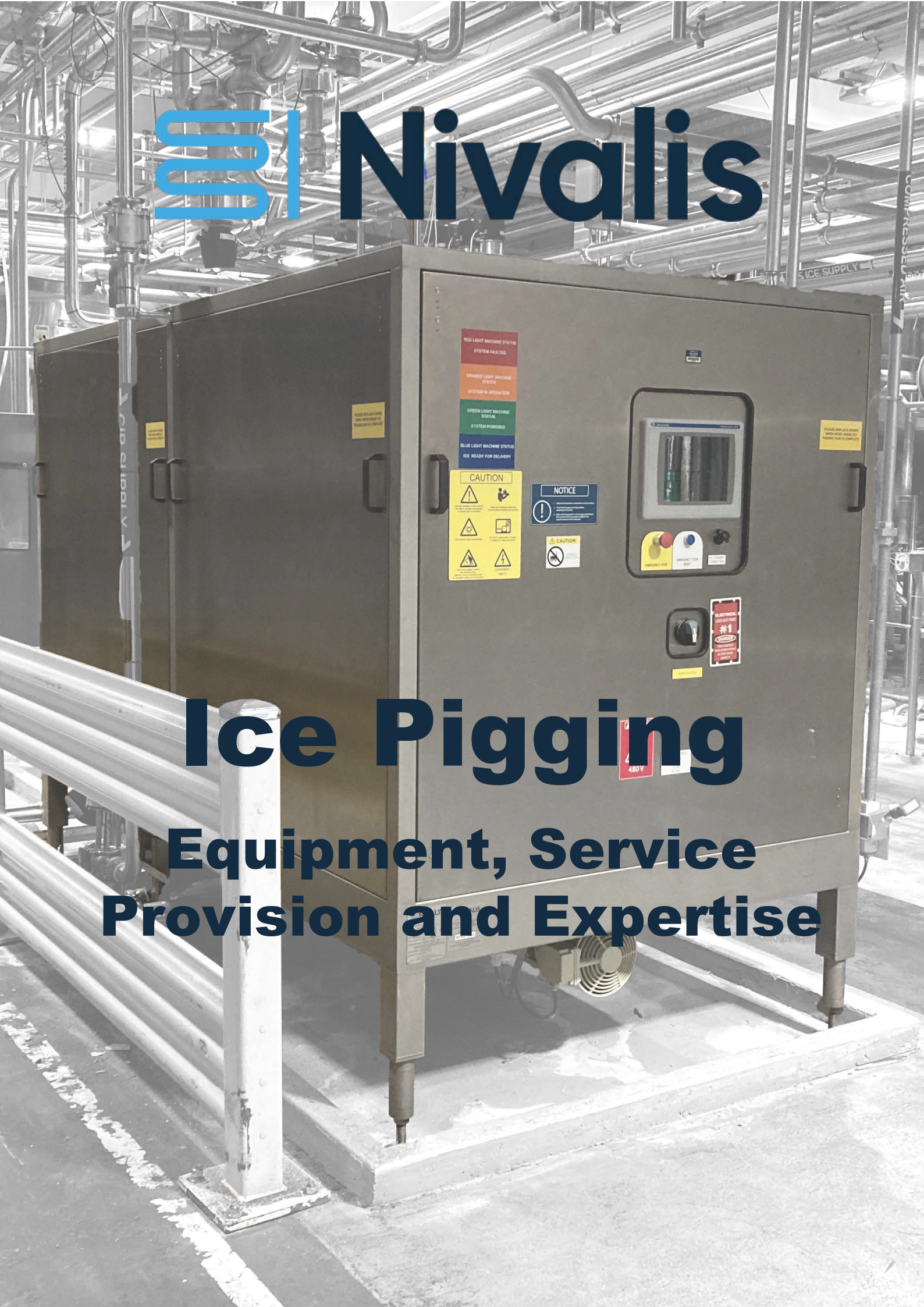




Nivalis

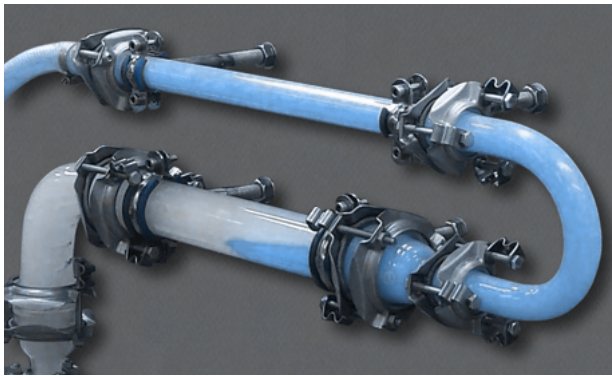
Ice Pigging

Equipment, Service Provision and Expertise



What is Ice Pigging?

Ice Pigging is a highly effective pipe cleaning technique in which ice slurry is moved through the network to remove unwanted material, sediment, or product residues from the pipe.



Ice Pigging is capable of navigating complex pipework which may incorporate changes in pipe diameter, bends, valve systems, heat exchangers, and other obstructions with no risk of becoming stuck.

The ice slurry is composed of fine ice crystals and a freezing point depressant used to control the structure of the slurry and to prevent it from forming large crystals.

Using an additive keeps the ice in a mobile state, allowing for navigation through complex pipework.

Where can it be applied?

The Ice Pigging process is highly flexible, making it suited to a diverse range of products within a number of industries:



High-value Engineering



Maritime



Automotive



Chemical and Pharma



Paint and Coatings

How does it work?

1 Preparation

Once the factory's process has completed and the line is ready for either cleaning or push out, the factory calls the NIV500 Ice Pigging machine to inject ice. The NIV500 automatically pushes ice to the purge valve, with the injection valve closed. This removes any melt which may have occurred to ensure a sharp product interface. Once the purge volume has been delivered, the plant stops and alerts the factory that ice is ready for injection.

2 Injection

The machine then injects the correct volume of ice for the selected recipe. Upon completion, the factory receives a confirmation signal and can proceed to the ice propulsion stage.



3 Delivery

The Ice Pig is then moved along the pipe system under pressure. This task is undertaken by the factory and can be achieved using several methods, including water push, or even using the next production run.

4 Waste collection

Once the Ice Pigging operation is complete (ice has been delivered into the pipe and "pushed" through the pipe system), the ice slurry will now also contain the waste material. This waste needs to be detected and disposed of (or in some cases re-worked). Detection of the Ice Pig is usually via a divert valve. This can then direct the Ice Pig to a separate collection point. Several options are available for interface detection and, where possible, sensors present in the system can be used. Suitable measurements include density, brix, conductivity, turbidity, and temperature.

What are the benefits?

Ice Pigging is fast, effective, and achieves enhanced cleaning.



PRODUCTION TIME SAVINGS

A rapid cleaning process where equipment downtime is significantly reduced.



LOW RISK

Exceptionally low risk – if ever the ice gets stuck, it will simply melt.



COST

Overall costs can be significantly reduced as a result of time savings and cleaning efficiency.



NO-DISMANTLING

Removes materials and residues that have built up over time and may otherwise be impossible to remove without disassembling pipework.



CLEANS AND CLEARS

Enhanced cleaning of complex pipework systems clearing problem contaminants and materials, expelling them from pipework.

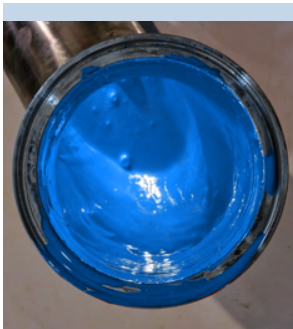


ENVIRONMENTAL BENEFITS

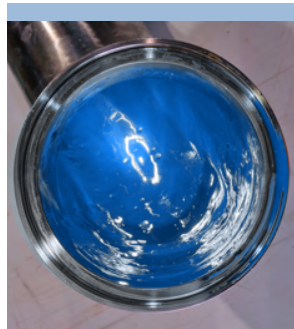
Minimal volumes of water are involved compared with conventional cleaning and no harmful chemicals are used. Significant reduction in waste volumes.

How does Ice Pigging compare to water flushing?

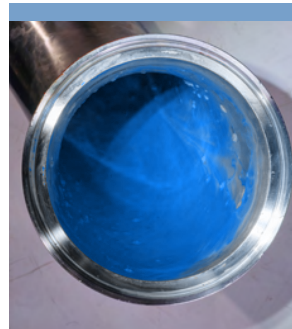
A comparison of Ice Pigging with a cold water flush and a hot water flush for a viscous liquid (PVA glue with dye).



START:
PVA GLUE WITH DYE



METHOD 1:
COLD WATER FLUSH



METHOD 2:
HOT WATER FLUSH



METHOD 3:
ICE PIGGING



It is easy to see the difference between water flushing and Ice Pigging. It is extremely effective at removing viscous material. The quality of clean with Ice Pigging is significantly higher (up to 1000 times cleaner) than can be achieved by water flushing alone.



Nivalis Ice Pigging from start to finish.

⇒ Initial feasibility assessment.

- Customer specific paper-based study of potential benefits.
- Site survey to capture physical layout of key plant infrastructure.
- Understanding current line processes and cleaning methods.
- Equipment available for product / process trials.

⇒ Ice Pigging system specification.

- Selection of suitable Ice Pig additive.
- Customisation of ice quality to suit product and process.
- Component specification to suit plant operating conditions.
- Determining appropriate requirements.

⇒ Installation proposals.

- Detailed proposal of required equipment.
- Factory integration plan:
 - Ice Pig injection locations,
 - Process line modifications,
 - Ice Pig distribution to required lines,
 - Factory – machine communication.

⇒ Commissioning of Ice Pigging process.

- Installation of ice production plant.
- Verification of machine - factory interfaces.
- Optimisation of process to achieve maximum benefit.
- Operator training.

⇒ Support.

- Remote support for diagnosis and health checks.
- On-site Ice Pigging plant service support.
- Ice Pigging optimisation following factory changes.
- Expansion of Ice Pigging application.





The Nivalis Ice Pigging machine.

The machine is a factory ready Ice Pigging machine which can be used for effective line cleaning and where applicable, improved product recovery. It is ideally suited to cleaning complex pipe geometries.

The ice production system combines ice production, storage, maintenance, and delivery into one unit. The purpose of the unit is to manufacture a two-phase ice slurry using potable water and a selected freezing point depressant. The system operates on a continuous basis, capable of delivering "always-ready" conditioned ice for the purpose of Ice Pigging of enclosed pipelines.

- ⇒ All parts in contact with liquids are made from 316 grade stainless steel.
- ⇒ All equipment is suitable for clean-in-place (CIP), where applicable.
- ⇒ Suitable for multiple Freezing Point Depressant choices (by design).



Ice Pigging has proved to be a "game changer" for us. Ice Pigging has now been adopted for other production sites.

— Johnson Matthey – customer quote.

Supporting equipment

The NIV200 is a mobile ice delivery system.

Additional flexibility can be gained with a mobile delivery unit, including:

- ▶▶ Cleaning lines where cleaning requirements are infrequent.
- ▶▶ Cleaning lines in remote locations, away from the NIV500.
- ▶▶ Cleaning lines or process components that require manual operation of operator supervision.



The NIV-FAS is a mobile flow analysis system.

- ▶▶ Many customers require quality validation on completion of Ice Pigging.



About Nivalis

The Nivalis team are responsible for developing the concept of Ice Pigging from its origin. We still work closely with Professor Joe Quarini who invented the process.

In recent years, we have concentrated on and successfully implemented Ice Pigging into several diverse sectors. Many of our customers carry out niche, high value manufacturing, and Ice Pigging can be a game changer in terms of time saved and production efficiency. We continue to learn as a team and use Ice Pigging and our transferable knowledge in new areas, establishing Ice Pigging as a standard operation.

Visit our dedicated website at:
www.nivalis-tech.com



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