

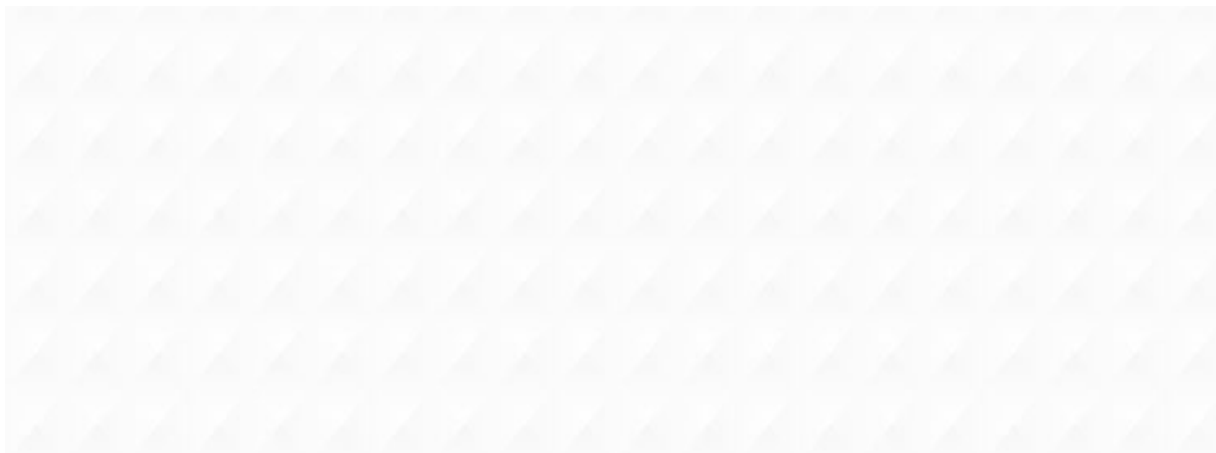


Ultrasonic Heat Exchanger Cleaning Technology

Ultrasonic Clean-in-Place technology allows heat exchanger cleaning to take place during full process operation.

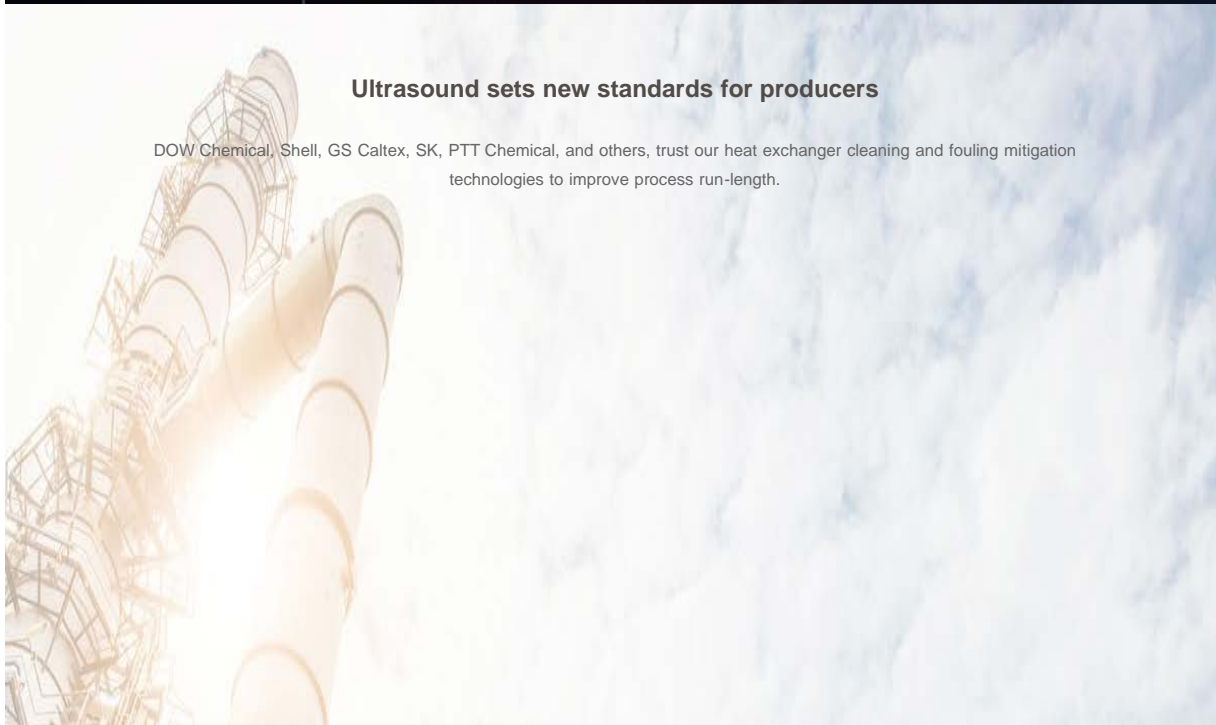
Ultrasonic Cleaning keeps heat exchangers online with minimal operating or maintenance costs

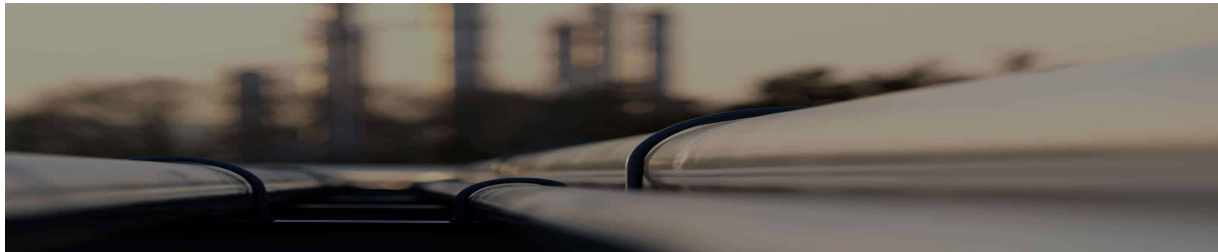
Clean and prevent heat exchanger fouling in your most critical processing units with the diligence and speed only sound waves can offer. Ultrasonic cleaning technologies by Orange Ultrasonics improve run-time and energy recovery to meet expected demand.



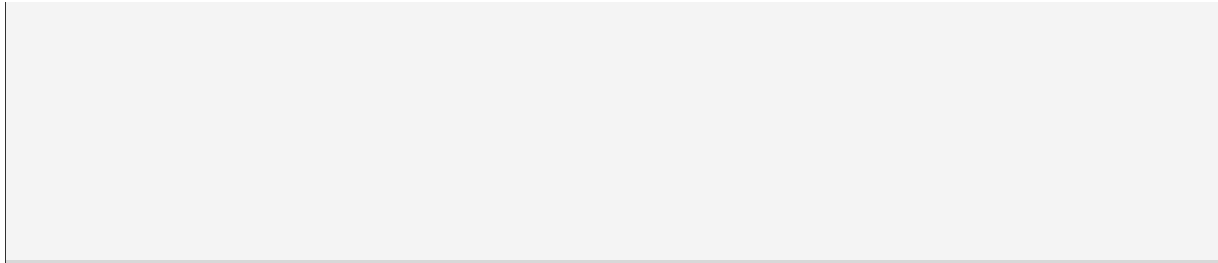
Ultrasound sets new standards for producers

DOW Chemical, Shell, GS Caltex, SK, PTT Chemical, and others, trust our heat exchanger cleaning and fouling mitigation technologies to improve process run-length.









Engineering sound into superior cleaning technology™

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Ultrasonic Heat Exchanger Clean In Place Technology

USP Technology cleans heat exchangers continuously and during operation using ultrasound. Specialized transducers are affixed to the tube-sheet of shell and tube exchangers. High frequency, low displacement vibrations prevent mineral scale and fouling build-up from settling, which improves heat transfer efficiency and significantly lowers operational-energy costs.

[BENEFITS OF USP](#)

[TECHNICAL FAQ](#)

[PROCESS CANDIDATES](#)

Ultrasonic Clean-In-Place (CIP) Improves Processing Capacity

The improved energy recovery and furnace efficiency has allowed our unit to recovery \$1.5 million (USD) in savings.

The key benefit for us is uptime. Before USP we were cleaning in situ every 6-8 weeks. With USP, our boilers did not need cleaning for 3 years.

USP has had a significant effect in reducing the fouling rate.

[VIEW BENEFITS](#)

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FEATURED USE CASE

USP Improves Heat Transfer & Furnace Duty

[SEE THE RESULTS](#)

FEATURED USE CASE

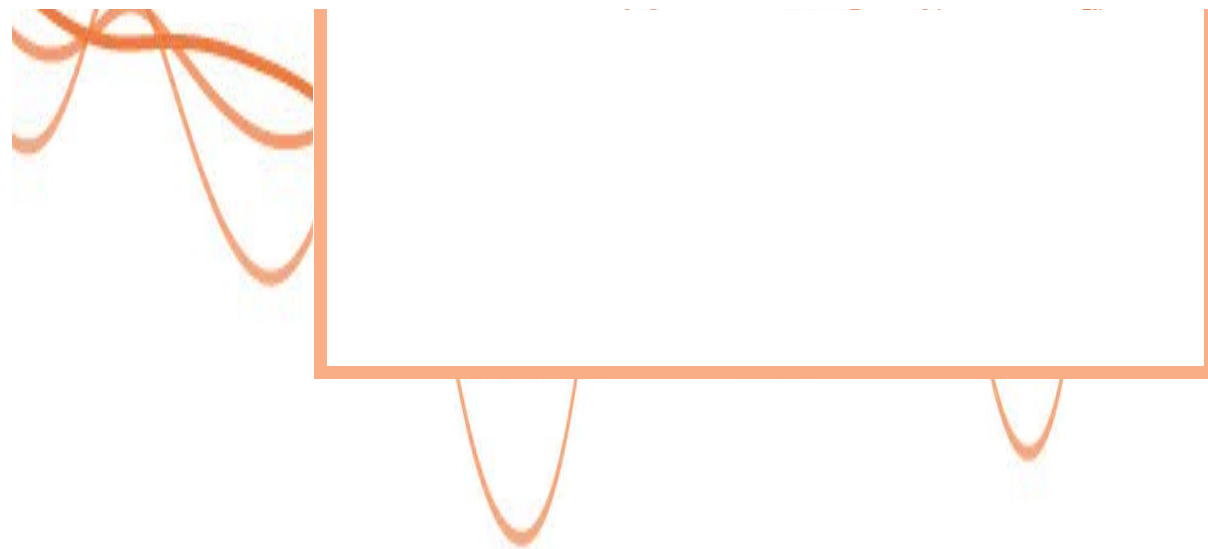
USP Increases Energy Savings & Throughput

[SEE THE RESULTS](#)

Is your Process a Candidate for Ultrasonic Clean-In-Place?

Our Candidate Form verifies if a heat exchanger is a candidate for ultrasonic Clean-In-Place technology.

Receive a copy of the Ultrasonic Clean-In-Place Candidate Form



Installation of MORKO USP – Shell Pernis, 2015.

Installation of MORKO USP – Dow Chemical Terneuzen, 2017.

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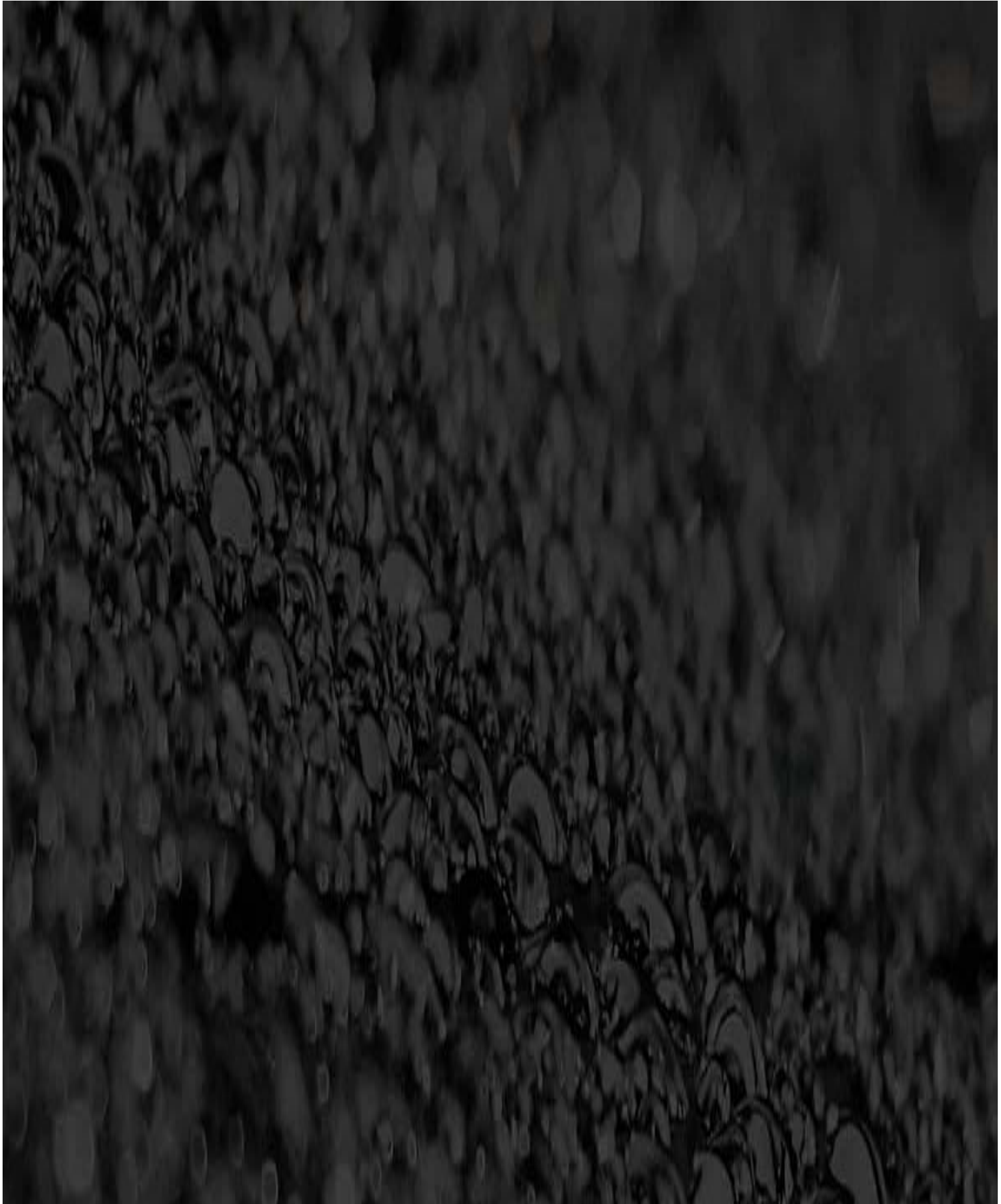


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Effective January 7, 2018

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You agree to indemnify, defend and hold harmless the Company and its subsidiaries, affiliates, directors, officers, employees, representatives, licensors and licensees, from any damages, losses, costs and expenses (including reasonable legal fees), incurred in connection with any third party claim or demand alleging or based upon your breach of this Agreement or your violation of any law or the rights of such third party. The Company reserves the right, at its own expense, to assume the exclusive defense and control of any matter otherwise subject to indemnification by you hereunder, and you shall cooperate as fully as reasonably required by the Company.

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dispute arising under this Agreement shall be resolved exclusively by the courts located in Toronto in the Province of Ontario. You agree not to bring any legal action against the Company in any jurisdiction except the Province of Ontario and you shall submit and consent to such jurisdiction. If any provision of this Agreement shall be deemed unlawful by a court of law, then the impugned provision shall be deemed severed and shall not affect the validity and enforceability of any remaining provisions. This Agreement constitutes the entire agreement between you and the Company in connection with your use of this website. Your use of this website is not intended and shall not be deemed to create any agency, joint venture or other legal relationship of any kind between you and the Company other than that of independent contractors.

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The Company reserves the right to change, modify or amend this Agreement, or add or remove portions of this website and any Products and Services, at any time and you agree to be bound by such changes, modifications, additions or deletions. The current version of this Agreement will be posted on this website at all times. Please check back frequently to see any updates or changes to this Agreement. Your continued use of this website following the posting of changes will constitute your agreement to be bound by such changes.



ORANGE Ultrasonics Website Privacy Policy

Effective January 7, 2018

WEBSITE PRIVACY POLICY

ORANGE Ultrasonics Inc. (the “**Company**”) respects the privacy of our customers and the users of our website and has instituted the policies and practices described below to ensure that your personal information is handled in a responsible manner. Our online privacy policy describes the types of personal information we may collect from you when you visit our website, how we use this information, and when we share it with third parties or our affiliated companies. The information on this website and our privacy policy are subject to change from time to time. Any changes to our privacy policy and practices will be reflected on this page so that you can be aware of what information we collect and how we are using and/or disclosing it. By using our website, you consent to the collection and use of this information by the Company.

Your Privacy Rights

In Canada, organizations engaged in the collection of personal information in the course of commercial activities must comply with the *Personal Information Protection and Electronic Documents Act* (the “**Act**”).

The Company is responsible for the personal information we collect, use, maintain and disclose. To ensure this accountability, we have developed this

policy, and trained our staff about our policies and practices.

What is “personal information?”

Personal information is any information that identifies you, or by which your identity could be deduced. It does not include your name, business address, business title, professional designation(s) or business telephone number.

Automatic information is information that we collect automatically whenever you interact with this website such as your IP address, the type of computer you use, and the web browser you use. An IP address is a number assigned to your computer when you connect to the Internet. Each time you visit this site, our web server may automatically recognize and collect this information.

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Why do we collect personal information from you?

We collect personal information from you to communicate with you, to respond to your enquiries, update you on news and events, or re-market our products and services to you through Google’s Adwords program.

Consent

In most cases, we shall ask you to provide explicit consent, if we collect, use, or disclose your personal information. Normally, we ask for your consent in writing, but in some circumstances, we may accept your verbal consent. Sometimes, your consent may be implied through your conduct with us, such as when you submit comments or questions to us on our website.

Use of Your Information

We use your personal information to communicate with you. If you tell us that you no longer wish to receive information about our services, we will not send any further material.

The Company does not sell your information to third party vendors or advertisers. However, we may use information collected by Google to re-market products or services of interest to you through Google's Adwords program, which includes a network of third party vendors. Google utilizes Cookies to track user behavior and offer relevant advertising based on previous activity. Information about how you can opt out of Google's use of cookies is available by visiting [Google's Ads Settings](#). Alternatively, you opt out of a third-party vendor's use of cookies by visiting the [Network Advertising Initiative opt-out page](#).

Disclosure of your Personal Information

Under certain circumstances, the Company will disclose your personal information:

- when we are required or authorized by law to do so, for example if a court issues a subpoena;
- when you have consented to the disclosure;
- if we engage a third party to provide administrative services to us (such as computer back-up services or archival file storage) and the third party is bound by our privacy policy;
- if the information is already publicly known;

Updating Your Information

Since we use your personal information to provide services to you, it is important that the information be accurate and up-to-date.

If any of your information changes, please inform us so that we can make any necessary changes.

Is My Personal Information Secure?

The Company takes all reasonable precautions to ensure that your personal information is kept safe from loss, unauthorized access, modification or disclosure. Among the steps taken to protect your information are:

- premises security;
- restricted file access to personal information;
- deploying technological safeguards such as security software and firewalls to prevent hacking or unauthorized computer access;
- internal password and security policies.

Access to Your Personal Information

You may ask for access to any personal information we hold about you.

Summary information is available on request. More detailed requests which require archive or other retrieval costs may be subject to our normal professional and disbursement fees.

Correcting Errors

If the Company holds information about you and if you can establish that it is not accurate, complete and up-to-date, the Company will take reasonable steps to correct it.

Can I be Denied Access to My Personal Information?

Your rights to access your personal information are not absolute.

We may deny access when:

- denial of access is required or authorized by law;
- when granting you access would have an unreasonable impact on other people's privacy;
- to protect our firm's rights and property;
- where the request is frivolous or vexatious.

If we deny your request for access to, or refuse a request to correct information, we shall explain why.

How Long do you Keep my Personal Information?

We keep your personal information as long as is reasonably necessary for us to complete our dealings with you, or as may be required by law, whichever is longer.

Communicating with Us

You should be aware that email is not a 100% secure medium, and you should be aware of this when contacting us to send personal or confidential information.

Changes to this Privacy Policy

Since the Company regularly reviews all of its policies and procedures, we may change our Privacy Policy from time to time.

Request for Access

If you have any questions, or wish to access your personal information, please write to us at [\[email protected\]](#)



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Benefits of Ultrasonic Clean-in-Place

The overarching benefit of USP Technology is the extended run-length you'll achieve

—Here's how.

USP Technology is a Clean-in-Place (CIP) system that works 24/7, during full-process operation. USP uses calibrated ultrasound to mitigate the formation and adherence of fouling and scale deposits from settling on heat transfer surfaces. This continuous cleaning mechanism leads to multiple processing benefits.

Extend Process Run-time

The production losses due to cleaning-related downtime, whether shutdown or turnaround, can cost a facility far more than outage activities themselves. Conventional methods like hydro-blasting or chemical circulation always require unit downtime. They cannot guarantee optimal heat exchanger performance through the run.

USP Technology allows your process to work in full operation as continuous cleaning takes place. [Some processing organizations](#) have been able to skip multiple-cleaning outages by leveraging Ultrasonic Clean-In-Place.

Enhanced Energy Recovery

Fouling reduces the amount of heat recovered from product streams. More heat must be supplied by the furnace/heat source to compensate for the lower feed temperature. Operating costs can increase by up to 6%¹ from increased fuel consumption.

USP Technology increases turbulent flow and sustains surface cleanliness, allowing for better heat transfer. [A refinery who implemented our Ultrasonic CIP system](#) reported OHTC levels similar to when this heat train was first put into service, 5 years previous.

Improved Product Throughput

Fouling in heat exchangers will reduce the productive diameter through which heat exchangers are able to operate. Throughput limits include hydraulic pressure or duty constraints. Common procedures for restoring some throughput, are either online spalling of the tubes or by incurring a production shut down to clean the assets.

USP Technology disrupts scale and fouling deposition every hour of the day. The ultrasound keeps transfer surfaces clean for longer— improving pump, furnace and fuel efficiencies.

Cost Avoidance

Cleaning a heat exchanger(Hx) can involve 20+ activities: unit bypass, depressurizing, in-situ pre-clean treatments, scaffold assembly, Hx disassembly, crane, bundle extraction, transporting to a cleaning area, cleaning contractor, water, chemicals and of course the remediation of the water, chemical and waste products. This process nearly repeats in reverse for putting an exchanger back into service. Each step involves multiple contractors, permits, meetings, reports, and potential delays.

As **USP Technology** continuously mitigates fouling during full operation, processors need not shut down as frequently to clean. Sure, maintenance cost savings can be a significant benefit. However, it's only a fraction of the financial benefit when compared to the margin gained on potential process throughput had you not shut down at all.

Health, Safety, and the Environment

Having to open heat exchangers for cleaning, the cleaning methods and chemicals themselves, all share in the reliability, safety, and environmental risks. Hundreds of our colleagues are injured each year in cleaning. It's estimated that 1-2.5% of global CO₂ emissions come from heat exchanger fouling and cleaning. That's significant.

USP Technology helps to reduce these figures by keeping the heat exchangers cleaner, for longer intervals. Cleaner exchangers require less fuel to operate. Less fuel and less cleaning is good for all of us.

¹ S. Machietto et al., 2009, *International Conference on Heat Exchanger Fouling and Cleaning VIII*

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Technical FAQ

Questions and answers about Ultrasonic Clean-In-Place (CIP) Technology.
Can't find your question here? [Contact us anytime.](#)

What is Ultrasonic Clean-In-Place (CIP)?

3

About USP & Ultrasonic CIP

[In which industries can USP be applied?](#)

[What fouling substances does USP work on?](#)

[Is ultrasound from USP safe for my equipment?](#)

[Is my heat exchanger a candidate for USP?](#)

Implementation of USP

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[What are the maintenance requirements?](#)

USP Specifications

[How much power does USP consume per day?](#)

[What certifications does USP have?](#)

[What are the limitations of USP Technology?](#)

[Ask us your own question >>](#)

About USP & Ultrasonic Clean-In-Place (CIP)

In which industries can USP be applied?

USP Technology is currently in service for producers in oil and gas, petrochemical, pharmaceutical, pulp and paper, automotive, and power plant applications. [Don't see your industry listed?](#)

What fouling substances does USP work on?

USP effectively mitigates both organic and inorganic fouling. USP has been demonstrated in heat exchangers with a sticky polymer type fouling and in applications where hard, brittle mineral scale precipitates and forms on the heat transfer surface.

Is the ultrasound from USP safe for my equipment?

There are no records of damage from our customers who have been using the USP. The mechanical energy generated from USP, as determined from in-field analysis, has revealed that the vibrations are less than 5 microns in size. That is far less than the vibrations already present in your operation.

Is my heat exchanger a candidate for Ultrasonic Clean-In-Place?

Our engineering team reviews each candidate individually to determine if they are a candidate for USP. [Find out if your process is a candidate.](#)

[Ask your question about Ultrasonic Clean-In-Place >>](#)

Implementation of USP

Who is currently using USP Technology?

Some of our customers include Dow Chemical, Shell, PPT, GS Caltex, S-Oil, Thaioil, and ExxonMobil. Many are also repeat customers.

What is the procedure for installing USP?

USP is installed during your scheduled T/A or cleaning outage. The ultrasonic transducers are welded to the heat exchanger and generators are mounted nearby, connected by cabling. After the system is in place, our engineers calibrate and commission the Clean-In-Place system on-site.

How much will USP cost?

Cost is dependent to how many sets of the USP system each exchanger needs for proper fouling mitigation. Our [heat exchanger candidate form](#) allows us to determine this and provide you a project estimate.

What are the maintenance requirements?

Operating the USP system is as simple as leaving it ON. First maintenance is after 2 years in operation, then every 2 years thereafter.

[Ask your question about implementing USP >>](#)

USP Specifications

How much power does USP consume per day?

The system works on a very low draw of power and actual electrical energy that is transferred to mechanical energy is less than a 150watts.

What certifications does USP have?

All USP equipment is certified for the country of use. UL, CE and ATEX certification are standard.

What are the limitations of USP Technology?

USP can operate under a maximum temperature of 385 degrees Celsius. Aluminum metallurgy and plate and frame exchangers which have *gasketed* plates are not candidates. Each heat exchanger is reviewed by our engineering team, and you can [submit your exchanger here](#).

[Ask your question about USP specifications >>](#)

Is your process a candidate for Ultrasonic Clean-In-Place Technology?

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Is Your Process a Candidate for Ultrasonic Clean-In-Place?

Find out with our Heat Exchanger Candidate Form

For us to verify if your process is a candidate for the USP solution, we need to first understand your process. We use a Heat Exchanger Candidate Form to gather some information on process parameters and equipment design.

[Get a copy of the Candidate Form](#)

Inside the Candidate Form

- Overview of applicable processing conditions
- Questions about your processing conditions
- Overview of applicable heat exchanger designs

- Questions about your heat exchanger design

Common Questions About USP Technology

Which kinds of fouling and scaling does the USP system mitigate?	a
Can ultrasonic cleaning of heat exchangers cause harm to my equipment or its surroundings?	a
Does my equipment need to come out of the operating unit for USP to be installed?	a
Who else is using USP technology?	a
How much will this cost?	a
What certifications does USP have?	a

Have more questions?

Contact us [here](#), or email us anytime at [\[email protected\]](#)



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INDUSTRY

Oil & Gas

LOCATION

Netherlands

CAPACITY

416 000 bpd

The Crude Distillation Unit 6 at this European oil refinery has two kerosene shell-and-tube heat exchangers purposed with recovering heat to boil kerosene. They are 11 metres in length and experience a hard scaling precipitant on the process side and a sticky, polymerization fouling on the intermediate side.

In 2015, the Heat Transfer Engineering Team had only two options: Replace both bundles at significant procurement and downtime costs, or try something new. They opted to implement **USP Technology**, an Ultrasonic Clean-in-Place system.

Quick Outcomes

Run-time Improvement

The process team was able to extend heat exchanger run-time from 6-8 weeks to avoiding all cleaning for 3 years.

Heat Recovery Savings

Improvements in energy recovery and furnace efficiency led to annual savings of \$1.4 million (USD) in the first year of service.

Duty Target Achieved

Initially hoping to achieve 6 MW Duty in this process, the Process Team was able to sustain 8 MW duty in the first year of service.

Is your process a candidate for Ultrasonic Clean-In-Place Technology?

CANDIDATES FOR USP

BACKGROUND

The Decision to Implement Ultrasonic Clean-In-Place Systems

Between 2006 to 2014, CDU reboilers were being cleaned in situ every 6-8 weeks by flushing the exchangers with gasoline, followed by high-velocity steam. In addition, an extensive mechanical cleaning was required every 1-2 years depending on opportunity crudes, operating changes, and other factors. During this time, the unit must be shut down for 10-16 days (and sometimes falling outside of a turnaround.)

The tubes were fouled with salt deposits, with 20% of tubes being completely blocked. On the shell-side, 50L of coke and sediment deposits from the crude were accumulating to form a troublesome sticky layer inhibiting energy recovery.

None of the chemical cleaning options tried were sufficient. After only 8 years of service, the process team was considering replacement of these 11m bundles altogether. In 2015, they decided to implement the Ultrasonic Clean-In-Place (CIP) system provided by Orange Ultrasonics, **USP Technology**.

CDU Reboiler E-214A with USP installed

CDU Reboiler E-214B with USP installed

DUTY

Results: Mitigate Reboiler Fouling with Ultrasonic CIP

Ultrasonic Clean-In-Place (CIP) was able to generate substantial cost savings for this European Oil Major. Below is a graph collected by the refinery that measures Duty (MW) for this train. The green line illustrates performance from the train when the bundles were initially put into operation.

Only five years later, the Process Team was having difficulties maintaining their target 6 MW Duty, and minimum allowable Duty of 5 MW.

By implementing **USP Technology** after their 2015 turnaround, we have exceeded the 6 MW Duty benchmark, allowing the refiner to achieve 8 MW duty for the period measured and sustain greater than 6 MW Duty three years later.

OHTC

Results: Improve Reboiler Heat Transfer with Ultrasonic CIP

Similar to improving furnace efficiency, Ultrasonic Clean-In-Place (CIP) was able to improve Overall Heat Transfer Coefficient (OHTC) for this European Oil Major. Below is a graph collected by the refinery that measures OHTC for this train. The green line illustrates performance from the train when the bundles were initially put into operation, while the purple line shows performance 5 years later.

By implementing **USP Technology** after their 2015 turnaround, we can see that the OHTC levels with the technology installed are similar to that of the green line, the energy recovery obtained in the first year of this train's operation.

See how USP Technology can unlock new capabilities in your process

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INDUSTRY

Oil & Gas

LOCATION

Philippines

CAPACITY

416 000 bpd

About 6% of the energy content of each crude barrel processed in an oil refinery is used in the refinery itself, of which a large amount is in the crude distillation unit.

Heat Exchangers E-118A is the use case subject, and is susceptible to heavy shell-side (crude) fouling, causing hydraulic and thermal obstructions. Over six months, duty of the entire exchanger network would drop significantly from 3.8MW to only 2MW.

In 2012, the Process Team decided to implement **USP Technology**, an Ultrasonic Clean-In-Place system, to improve CDU intake and improve energy recovery.

Quick Outcomes

Heat Recovery Savings

Improvements in energy recovery and furnace efficiency led to savings of \$790,000 (USD) in the first year with Ultrasonic CIP.

Preheat Feed Rate

Improvements in preheat throughput unlocked \$700,000 (USD) in additional revenues in the first year with Ultrasonic CIP.

Energy Intensity Index

Our customer was able to improve their Solomon Energy Intensity Index by 0.7.

Is your process a candidate for Ultrasonic Clean-In-Place Technology?

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Fouled crude bundle E-118A before cleaning or applying USP.

BACKGROUND

The Decision to Implement Ultrasonic Clean-In-Place (CIP)

The preheat exchangers in our customer's refinery are the workhorses of the Crude Distillation Unit, processing heavy opportunity crudes regularly.

Between 2009 and 2012, the refinery was cleaning their CDU preheat exchangers in situ every 10-12 months using high-pressure water and steam blasting.

The design duty of this heat exchanger network is 3.8 MW. After only 6 months, fouling in the train would reduce this metric to as low as 2 MW.

In 2012, the Process Team decided to implement an Ultrasonic Clean-In-Place solution on these preheaters to compare them to their counterparts running in parallel.

RESULTS

Reduce Heat Exchanger Fouling with Ultrasonic CIP

Ultrasonic Clean-In-Place (CIP) was able to generate substantial cost savings for this Asian Oil Major. Below is a graph collected by the refinery and provided to us that measures Duty (MW) and Overall Heat Transfer Coefficient (OHTC) of E-118 to that of a train in similar service.

By implementing **USP Technology** after their 2012 turnaround, we have helped our customer to achieve 4.53 MW duty, sustaining even two years after first installation. This customer continues to proliferate USP within their refinery today.

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