HEAT TREATMENT SERVICES

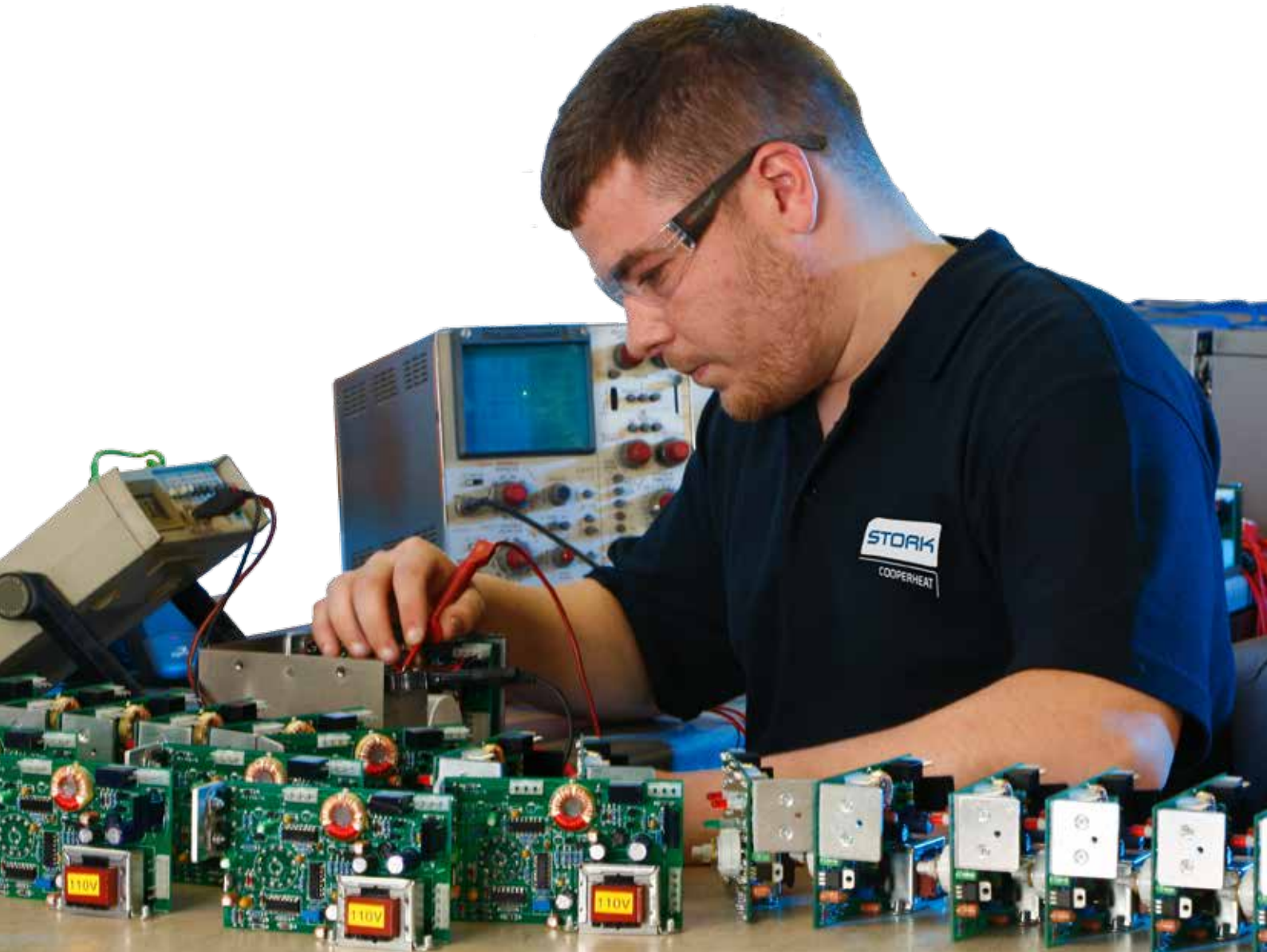
LEADING INNOVATORS IN THERMAL TECHNOLOGY TO THE OIL & GAS, CHEMICAL AND POWER INDUSTRIES

ASSET INTEGRITY PARTNER

STORK
COOPERHEAT

HEAT TREATMENT

Stork Cooperheat provide a full range of heat treatment services on site or at our facilities. With global resources including more than 1,000 sets of electrical heat treatment equipment, 50 gas and oil burner sets and more than 400 experienced heat treatment technicians, Stork Cooperheat are leading innovators in thermal technology to the Oil & Gas, Chemical & Power Industries.

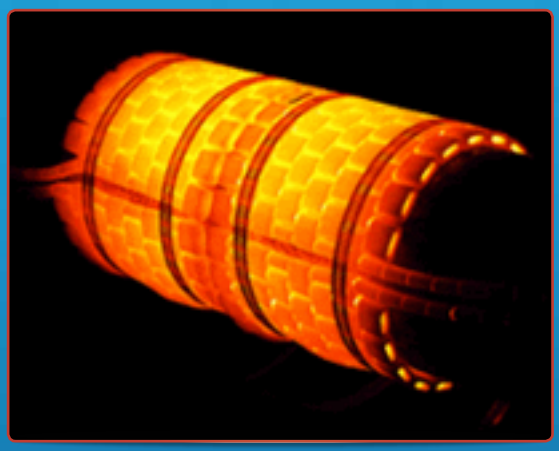


HISTORY

The heat treatment of metals has been practised in various forms for many centuries. Initially heat treatment was used to enhance the properties of raw iron for tools and weapons. The heat treatment process produced excellent combination of toughness and flexibility in blades, combined with a very hard cutting edge using only the most basic of forges, though operated by highly experienced craftsmen.

Heat treatment is a method of altering the physical and sometimes chemical properties of metals and essentially can be defined as the controlled heating and cooling of a metal or metal alloy, in its solid state, to produce certain changes in its properties.

The heat treatment is generally designed to leave the steel free from harmful, unevenly distributed internal stresses, yet leaving it hard and tough enough to be serviceable. It removes the external brittle micro structures that follow quenching and restores toughness and ductility, according to the temperatures adopted.



A REPUTATION BUILT ON EXPERTISE AND EXPERIENCE

Stork Cooperheat has established a reputation in thermal technology design and engineering excellence for petrochemical, chemical, oil and gas and power industries. Our global footprint has generated a wealth of experience and today an international network of operations makes Stork Cooperheat the world's largest specialist heat treatment company.

Located in the UK, Netherlands, Saudi Arabia, UAE, Australia, New Zealand and South East Asia, Stork Cooperheat offers a complete range of heat treatment project services which add value and deliver clients the following benefits:

- Improved structural integrity of plant and asset life
- Reduced costs
- Customised configurations to meet client specific requirements
- Global resources ensure rapid response to challenges with fast and effective services
- Turnkey service for a full range of fully engineered heat treatment services and solutions
- Access to in-house experts and experienced heat treatment engineers and technicians

Stork Cooperheat is committed to quality onsite services which have developed the company a well-earned reputation built on the highest safety, quality and technical expertise.

INDUSTRY CHALLENGES

Stork Cooperheat's experienced team of designers and engineers are dedicated to solving thermal technology challenges anywhere in the world. Whether it is through unique product designs or onsite procedures and project management, these experts work to the highest possible disciplines of quality and technology to ensure that problems are solved and challenges overcome quickly, calmly, efficiently and cost effectively.

With the ability to respond at short notice, Stork Cooperheat adopts a total service approach ensuring optimum results. This commitment and dedication, based on many years of practical expertise, has ensured that Stork Cooperheat continues to lead in the field as innovators in thermal technology and total service providers.

INDUSTRY CHALLENGES TODAY

It is vital in industry today to respond quickly to any heat treatment challenges. Heat Treatment requirements can lead to loss of operational capacity which can be costly therefore a fast and effective heat treatment specialist to deliver solutions and avoid such costs is essential. Positive analysis and effective recommendations are required prior to onsite operations.

Stork Cooperheats' experts produce a feasibility study based on the information provided and data gained from site visits. Practical possibilities are examined for suitability before submitting recommended courses of action for final consideration by the company. Such feasibility studies can also detail labour planning and costs as well as financial planning linked to the time constraints within the operation.

The length of time required for feasibility studies depends on the complexity of the requirement; however Stork Cooperheat's ability to respond quickly to heat treatment challenges and questions is recognised worldwide.

Once the most suitable technical option has been determined, Stork Cooperheat deliver a cost effective and safe, procedure and equipment selection to quickly implement the required solution. With six decades of global experience, Stork Cooperheat can instantly mobilise personnel, equipment resources and engineering support anywhere in the world.

Furnace control panel and burner manufacture

TWO SINGLE MOST COMMON FORMS OF HEAT TREATMENT

Preheat

Preheat is the term associated with the application of heat to a metal component prior to and during welding.

There are a number of reasons that preheat may be required, including reduction of residual stresses after the component has been welded, and minimising absorption of Hydrogen into the weld during welding.

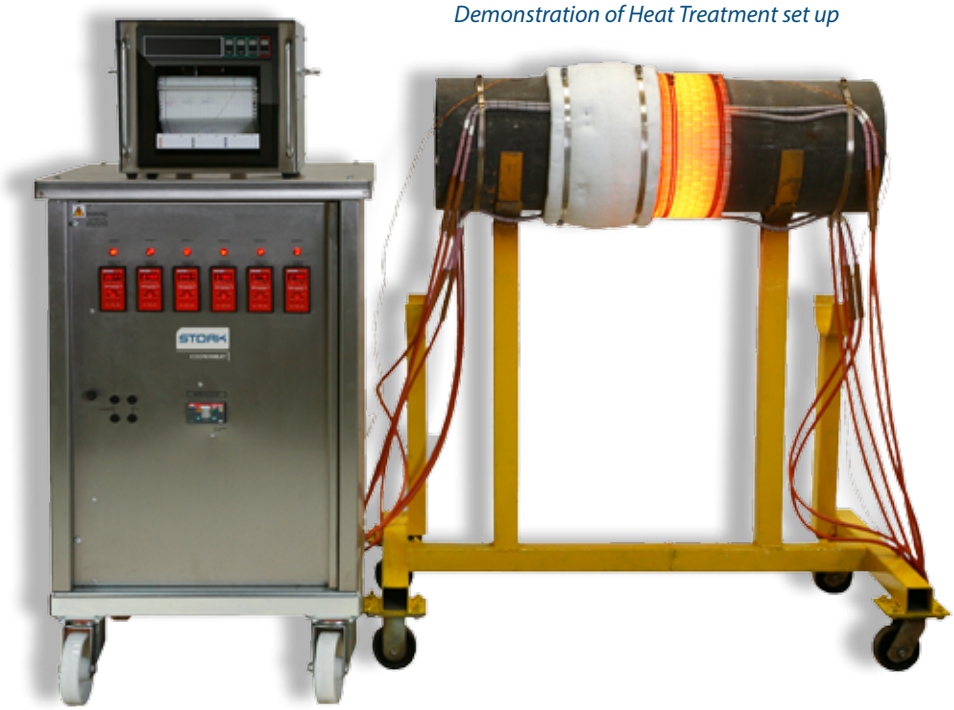
Preheat temperatures are generally relatively low, ranging typically from 50°C up to 250°C.

Post Weld Heat Treatment

Post Weld Heat Treatment (PWHT) is the term used to describe the heating of an entire weld to a temperature high enough to reduce the residual stresses within the weld. PWHT temperatures are typically in the range of 600 – 700°C.

There are a variety of application methods for heat to weld geometries in order to achieve the desired temperature, ranging from locally applied electrical heaters, to larger gas fired furnaces. The method used is usually determined by the fabrication geometry, size, access restrictions and site constraints.

Demonstration of Heat Treatment set up



OTHER COMMON TYPES OF HEAT TREATMENT:

Hydrogen Bake Out
Also commonly referred to as Post Heat, a Hydrogen bake out is normally carried out immediately after welding is complete, and at temperatures in the region 350-400°C. As the name suggests, the process is used to promote the release of hydrogen from the weld metal, which under certain conditions can cause 'Hydrogen Cracking'.

Annealing
Full Annealing is the process that involves heating steels above their 'transformation' temperature and cooling very slowly, which results in the softening of the steel, to make it more suitable for working with.

Stress relieving
Stress relief is a term commonly used to refer to Post Weld Heat Treatment; however, it should always be qualified further, as most heat treatments have the effect of reducing stresses.

Normalising
Normalising is a similar process to annealing, except that after heating to the desired temperature (commonly around 900°C for typical carbon steels) the steel is cooled in still air, which results in a much more rapid cooling. This has the benefits of improving the grain structure of the material following welding or cold working and reducing hardness and improving machinability of the material.

Quench hardening
Heating a metal up to a high temperature and then rapidly cooling in still air, water or suitable oil, which results in making the metal hard.

Tempering
This is a heat treatment, which follows a quenching hardening heat treatment. Tempering will increase the toughness of the hardened metal.

Solution annealing
This is most commonly applied to certain types of stainless steels, and requires temperatures in the range of 1000 - 1150°C. The process also requires rapid cooling, which for thicker materials, often requires water quenching. The process generally returns the material back to its original design properties and improves corrosion resistance following welding.

Expansion heating
Often, especially in the turbine related industries it is necessary to remove or fit rotor ring. This can be achieved more effectively by heating the ring quickly so that the ring expands more than the shaft allowing for its removal or fitting.

REFRACTORY DRY OUTS

The drying out of refractory linings within vessels and structures by carefully controlled heating and ventilating operations produces optimum refractory properties. Failure to do so may lead to disruption owing to steam generation and high associated costs.

Stork Cooperheat's expertise in this area ensures maximum flexibility and minimum downtime. By using state-of-the-art equipment, including digital process controllers, fully proportional electronic fuel actuators and safety features, Stork Cooperheat engineers provide a flexible service to meet all specifications. Moisture is carefully removed by controlled heating procedures to avoid damage to the refractory in service.

The use of high velocity gas burners allows large volumes of combusted gases to circulate throughout the structure at closely controlled temperatures.

PROJECT MANAGEMENT

Whether your requirement is for an overnight emergency call out for a single 6" pipe weld, a short term plant maintenance shutdown project, long term major plant construction, one off vessel or tank fabrication or a highly specialised requirement,
Stork Cooperheat will take care of all workscopes.

Ranging from heat treatment services to the full management of full turnkey projects that include Storks full range of specialist services, for example scaffolding, inspection, cathodic protection rope access and more.
Stork Cooperheat truly are the one stop shop for heat treatment services.

TURNKEY AND PROJECT MANAGEMENT

Providing a wide range of technical disciplines as well as the highest level of safety and quality assurance has always been at the core of Stork Cooperheat's heat treatment services. By simply mobilising technicians and equipment or, delivering full scale project management teams anywhere in the world, Stork Cooperheat can provide a total range of services on site, supplying supervisory staff whilst utilising using local labour for the majority of the work.

Stork Cooperheat's project management resources provides full design, management and services for complete turnkey heat treatment projects; ranging from heat treatment of oil platform legs in the North Sea through to varied projects on the Indian Sub-Continent. A controlled and interdisciplinary approach to all aspects of design, manufacture and installation are essential features of the Stork Cooperheat philosophy, backed by project management teams with the expertise to weld these disciplines into a workable, cost effective package. This has given the company a worldwide reputation for project management from initial survey through to final commissioning.

LARGE AND COMPLEX HEAT TREATMENT PROJECTS

Stork Cooperheat is the world leader in preheat and post weld heat treatment of all welded constructions. Fired by gas, oil or powered by electricity, Stork Cooperheat use highly experienced and trained technicians utilising their compressive global range of automated equipment to achieve outstanding results. Stork Cooperheat specialise in the heat treatment of large vessels and have led the way in developing process for the internal firing of vessels and spheres. The development of internal bulk heat methods for closing seams, using a range of channel heating elements and associated channel heater power and control equipment is also available.

DESIGN & CONSULTANCY

36 Channel Unit

DESIGN AND DEVELOPMENT

Stork Cooperheat has maintained its position as leader in the production of specialised thermal equipment by the development of suitable equipment to enble it to meet the ever developing needs of its heat treatment services customers.

Within the development department at Stork Cooperheat, standard items of equipment have been designed and developed, e.g. infra-red, gas panel burners, multi-channel control units, 9kVA compact heat treatment units, remote control programmers, and data recorders.

GLASS INDUSTRY SERVICES

Stork Cooperheat's high velocity gas burner systems provide rapid yet fully controlled and safe heat up of even the largest and most complex glass furnace structures. With our wealth of expertise and experience, Stork Cooperheat provide a complete range of service including:

- Glass furnace heat ups
- Controlled cool downs
- Expansion and Tie –rod control and adjustment
- Cullet fill
- Furnace tapping
- Thermal cleaning of regenerator
- Hot repairs

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CONSULTANCY SERVICES

Since Stork Cooperheat have been resolving thermal technology challenges around the world. Thousands of companies have benefitted from this unrivalled expertise to the extent that the Stork Cooperheat design and engineering staff are consistently working on major projects in widely varying climatic and operating conditions.

As new techniques develop, new challenges are faced. Therefore, new procedure, techniques and product development is a priority for Stork Cooperheat in order to meet the future requirements of industry. Globally recognised as innovators in thermal technology, Stork Cooperheat are experts within this highly specialised field and can offer the widest spectrum of consultancy services.

CONSULTANCY

The demand for detailed engineering procedures is increasing and is essential for oil, gas, power and chemical related maintenance, fabrication and construction industries.

Stork Cooperheat can provide this consultancy either directly or as part of a larger project package, covering heat treatment and all forms of thermal technology and direct engineering consultancy.

As the pioneers of on-site heat treatment services, Stork Cooperheat has set standards for quality assurance and control and has enabled the company to offer a quality assurance service in the production of specifications, procedures and quality plans.

Stork Cooperheat can also provide advice, analysis, precautions and recommendations relating to stress points, stability and expansion in welded fabrications during the heat treatment process. The value of Stork Cooperheat's consultancy service, which is available on a national and international basis, is recognised by industry as a whole.

TRAINING

Stork Cooperheat deliver operator training programmes both on site and at our global facilities. Training courses are tailored to meet particular applications and the requirement of the customer. fired furnaces. The method used is usually determined by the fabrication geometry, size, access restrictions and site constraints.

Stork Cooperheat's global portfolio of heat treatment project and engineering services are designed to overcome thermal technology challenges, both now and in the future. This includes:

- Onsite pre and post weld heat treatment of pipe welds and all welded constructions
- Refractory Dry Out
- Glass Industry processes including warm up, cool down, furnace tapping and draining
- On-site temporary furnaces
- Hire of heat treatment equipment and technicians
- Engineering Consultancy Service in Thermal Technology, including provision of procedures, analysis, advice and drawings for thermal technology projects
- Complete turnkey and project management for heat treatment projects including design and development, on site supervision, quality assurance auditing, equipment hire, supply, site services and training

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SAFETY IS OUR No.1 PRIORITY

Stork is fully committed to being recognised as a world leader in safety and to help us achieve this goal, we have REACH. REACH is Stork's award-winning, global initiative on which we build and communicate our safety culture.

It helps us to measure our safety performance, so that we can continue to improve upon it – at all levels.

By placing safety unequivocally as our No.1 priority, REACH helps us to deliver complex projects to the highest safety standards without compromising quality. It provides us with the practical tools and support we need to ensure we get every single employee home safely at the end of each and every shift.

REACH enables us to improve safety performance through:

- **INDIVIDUAL RESPONSIBILITY**
- **VISIBLE LEADERSHIP**
- **WORKFORCE ENGAGEMENT**
- **PERSONAL AWARENESS**
- **EFFECTIVE INTERVENTION**
- **TWO WAY COMMUNICATION**

REACH provides a mechanism for benchmarking our performance in a meaningful way, on the basis that: if you can't measure performance you can't improve it. Tracking our global and regional safety performance, whilst measuring against industry standards, allows us to identify where we need to improve and engage with our employee community.

A 'breakthrough' initiative, REACH drives value for our clients by:

1. **Improving safety performance on their assets**
2. **Engaging with and challenging their safety culture**
3. **Transparent HSEQ reporting, sharing information, learnings & alerts**
4. **Leading topical debate, discussion and knowledge-sharing**

We share our REACH resources, which include safety videos, campaigns, alerts and lessons learned, so that we can work with our colleagues, peers and wider industry to improve safety together.

For more information visit the REACH website:
www.reachsafety.com

REACH
IMPROVING SAFETY TOGETHER

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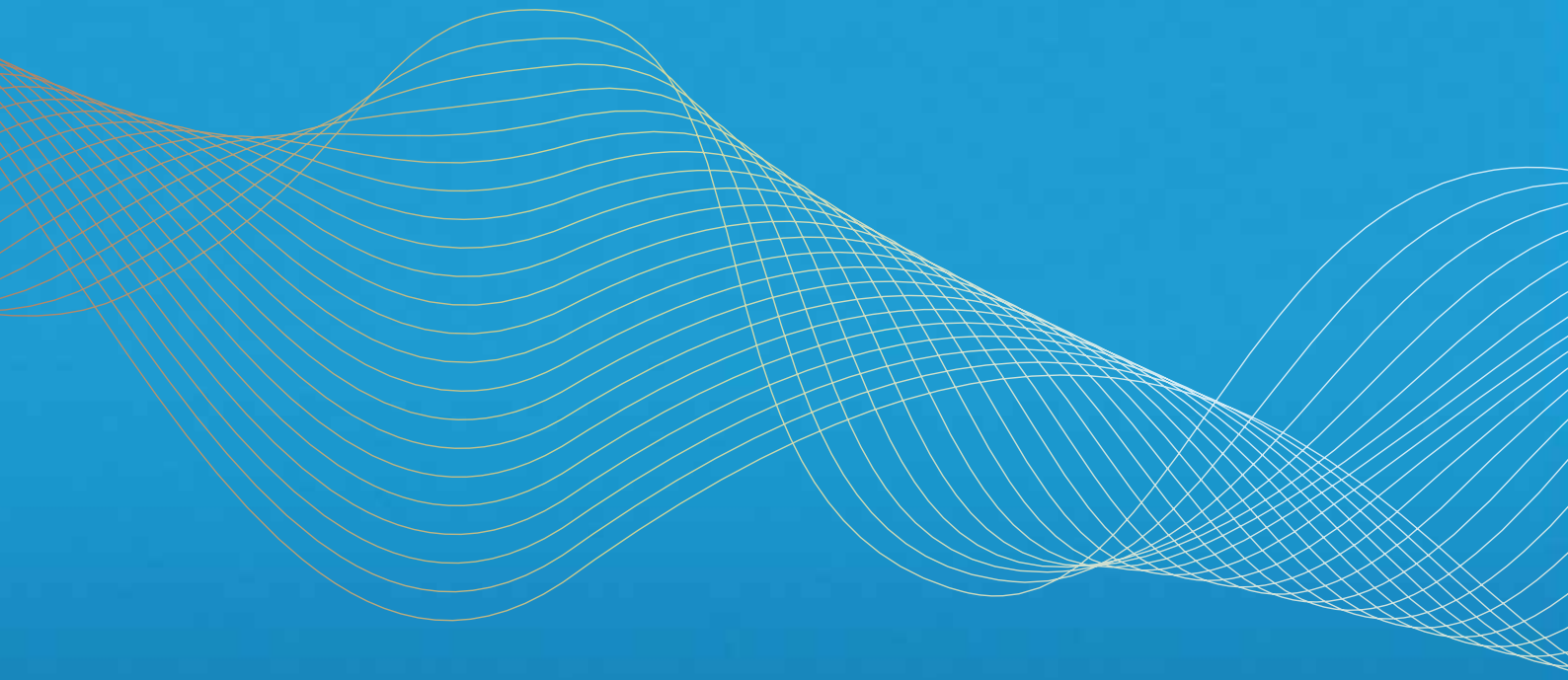

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