RS INDUSTRIA

# Keep your Cool.

USE CASE

How RS Industria could help make significant savings for industries utilising spiral freezers & chillers.

## Introduction.

**In a typical frozen foods manufacturing facility, and many ambient baked goods sites, there are various types of industrial refrigerators and chillers employed to maintain consistent quality, texture, and temperature of products.**

Spiral freezers and chillers are one means of refrigeration that are popular with food processors, given their compact spiral belt and their ability to freeze or chill large numbers of products with longer dwell times.

Spiral blast-freezing of food products is the most energy-intensive process in a typical frozen foods manufacturing facility, with air temperatures regularly in the range of +5C to -40C depending on the type of product to be frozen or chilled.

Unlike tunnel freezers, which require a long, linear wire-mesh belt to convey products through a sub-zero blast-freezing room, spiral freezers use self-stacking, multi-tiered belts to maintain product quality and minimize the refrigeration space required in the plant. Most modern spiral freezers offer a high level of customizability and are generally fairly easy to install on the plant floor.

## What we monitor.

## The Challenges.

### Energy

Spiral freezers are expensive to operate as they typically run at low temperatures. Often, the suction pressure of the plant's refrigeration system (which defines the energy used in the refrigeration plant) is determined by the temperature required by the spiral freezer. Many spiral freezer systems are not optimised as many of the key parameters such as airflow and the entering & leaving temperatures are not controlled.

Many manufacturing facilities employ multiple spiral freezers. However, by managing the entire freezing process with the right advanced monitoring and controls systems in place, plant operators can achieve energy savings of between 30% to 50% or more on an annual basis.

### Operations

Spiral freezers and Chillers generally have few significant operational challenges.

### Maintenance

The chiller is a critical asset on any production line, and the line cannot run without the chiller. Lines are typically used continuously and have minimal maintenance windows due to production requirements, so active protection of the chiller is very important, as chillers often have little or no installed condition monitoring and rely on Planned Preventative Maintenances to find potential failures.

## Our Solutions.

### Energy

The main energy use in the chiller is the cooling process, typically supplied by a centralised ammonia refrigeration compressor and distributed throughout the site either directly as ammonia, or indirectly through a glycol system. Energy transfer from the cooling fluid to the chiller can be measured by monitoring the flow rate and temperature of the cooling fluid.

Energy consumption for the belt drive motor can be easily measured either from the inverter drive or through using CT clamps on the power line.

### Operations

Where the chiller is controlled by a local PLC, this data can easily be collected to enrich the energy and maintenance data, providing vital operational context for each of the operating modes (such as production or defrost).

### Maintenance

Typical failure modes on spiral chillers are:

- Chain snagging due to poor synchronisation of the drive motors, leading to the drive chains snapping.
- Water contamination of the gearbox oil due to condensation from the heat / chill cycle, leading to early failure of the gearbox.
- Wrong choice of gearbox lubricant as people often use an ambient oil, which then turns to grease when at low operating temperatures.
- Bores, but catastrophic if it happens, is failure of the main bottom bearing or the shaft.

To provide early warning of these potential failures, enabling maintenance teams to take prior action to avoid or mitigate failure, we would recommend:

- Collecting all available drive and current consumption data from the motors as this often shows very early indication of the mechanical degradation, as well as potential rotor / stator failure in the motor.
- Continuous monitoring of the gearbox oil with a suitable sensor to monitor the water content of the lubricant, its temperature, and any ferrous contamination from gear box wear.
- Vibration monitoring on the motor/gearbox
- Ultrasound monitoring of the bottom bearing/bush as the slow rotational speed makes vibration monitoring ineffective.

## Your Benefits.

### Typical Cost Savings

Better operating insight means better management of processes and their assets, resulting in lower operating costs. Here are some examples, based on our real-world experience in production environments:

### Energy

Spiral freezers are large consumers of cooling from the refrigeration compressors. A 300kg/hour freezer, operating at -20C typically consumes circa 250kW of cooling. Assuming your fridge has a CoP of 3, this represents about 80kW of electricity, or around £100,000/annum cost (at June 2022 prices). Improving heat transfer by 10% will save around £10,000 per annum.

### Operations

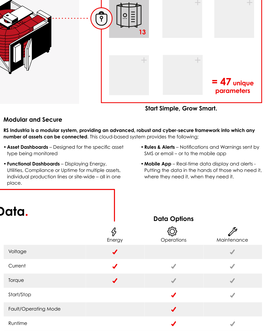
These items of equipment are such that, from an operational perspective, there is limited opportunity to improve.

### Maintenance

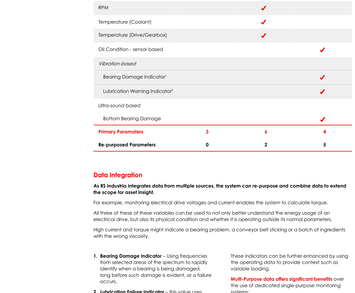
A typical failure could take 24 to 48 hours to fix and lead to a shutdown of the line. At an operating value of around £1,000 per hour, together with the scrapping of all the product currently on the line, the consequence of failure could easily be in excess of £50,000.

### Payback & ROI

These indicative calculations show that the system could potentially pay for itself, **on electricity savings alone**, within just twelve months.




## Modular Framework.




**Start Simple. Grow Smart.**

**Modular and Secure**

**RS Industria is a modular system, providing an advanced, robust and cyber-secure framework into which any number of assets can be connected.** This cloud-based system provides the following:

- **Asset Dashboards** – Designed for the specific asset type being monitored
- **Functional Dashboards** – Displaying Energy, Utilities, Compliance or Uptime for multiple assets, individual production lines or site-wide – all in one place.
- **Rules & Alerts** – Notifications and Warnings sent by SMS or email – or to the mobile app
- **Mobile App** – Real-time data display and alerts - Putting the data in the hands of those who need it, where they need it, when they need it.

## Multi-Purpose Data.

**Data Integration**

*As RS Industria integrates data from multiple sources, the system can re-purpose and combine data to extend the scope for asset insight.*

| Data Options | Energy | Operations | Maintenance |
|---|---|---|---|
| Voltage | ✓ | | ✓ |
| Current | ✓ | ✓ | ✓ |
| Torque | ✓ | ✓ | ✓ |
| Start/Stop | | ✓ | ✓ |
| Fault/Operating Mode | | ✓ | |
| Runtime | | ✓ | ✓ |
| RPM | | ✓ | |
| Temperature (Coolant) | | ✓ | |
| Temperature (Drive/Gearbox) | | ✓ | |
| Oil Condition - sensor based | | | ✓ |
| Vibration-based | | | |
| Bearing Damage Indicator* | | | ✓ |
| Lubrication Warning Indicator* | | | ✓ |
| Ultra-sound based | | | |
| Bottom Bearing Damage | | | ✓ |
| **Primary Parameters** | 3 | 6 | 4 |
| **Re-purposed Parameters** | 0 | 2 | 5 |

**Data Integration**

**As RS Industria integrates data from multiple sources, the system can re-purpose and combine data to extend the scope for asset insight.**

For example, monitoring electrical drive voltages and current enables the system to calculate torque.

All three of these of these variables can be used to not only better understand the energy usage of an electrical drive, but also its physical condition and whether it is operating outside its normal parameters.

High current and torque might indicate a bearing problem, a conveyor belt sticking or a batch of ingredients with the wrong viscosity.

1. **Bearing Damage Indicator** - Using frequencies from selected areas of the spectrum to rapidly identify when a bearing is being damaged, long before such damage is evident, or a failure occurs.
2. **Lubrication Failure Indicator** – this value uses specific frequencies to warn if a bearing is insufficiently lubricated, whether the lubricant is manually or automatically delivered.

These indicators can be further enhanced by using the operating data to provide context such as variable loading.

**Multi-Purpose data offers significant benefits** over the use of dedicated single-purpose monitoring systems:

- **Single point of integrated data** – enables comparison between different variables, potentially offering greater insight
- **Context-sensitive alerts** - take account of normal operational variances to avoid false alarms

## Gain Asset Insight Now

**Find out how we can help lower energy usage, enhance reliability and improve operational performance in a way that is simple, fast and affordable.**

1

**Book Requirements Review**

Review your requirements with one of our consultants. We'll help you prepare for the next step in the process, which is a detailed discussion with one of our solution design engineers. To book a Requirements Review, **click this link.**

2

**Browse Our website**

To find out more details including:
- Real-world case studies
- Use-cases like this one
- Product videos
...and more. Visit our website to see what is possible with RS Industria.

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**Start Simple Grow Smart®**