

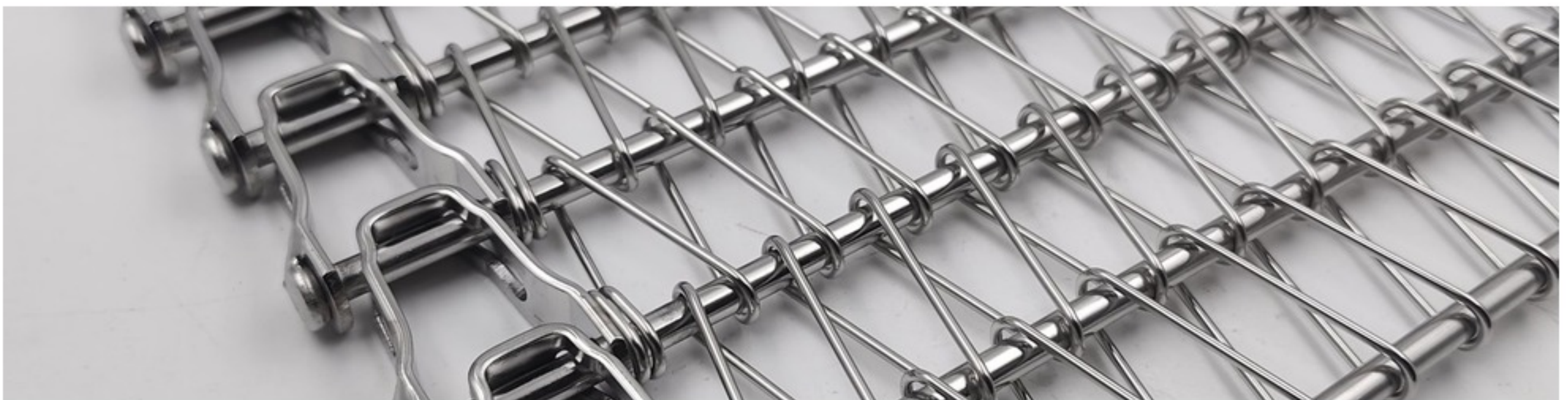
It sticks to a magnet. Is it still SUS304?

What cold work does to a stainless steel Spiral Freezer Belt, and how to verify the grade before you accept it.

Key takeaways

This report answers one question we hear often from spiral freezer OEMs and distributors: "My SUS304 belt sticks to a magnet. Is it really 304?" Here is the short version for busy engineers and buyers.

- 01** A SUS304 Spiral Freezer Belt can attract a magnet. Cold drawing, coiling and forming turn part of the steel's austenite into martensite, which is magnetic.
- 02** The cross rods usually react most, because they take the heaviest cold work. Weld zones react slightly.
- 03** A magnet test fails in both directions. It rejects good cold-worked 304 and can pass a wrong, low-nickel grade.
- 04** Only composition data confirms the grade: spectral screening for routine checks, laboratory spark OES for final answers, and material documentation with traceability.
- 05** Buyers can avoid most disputes by writing the grade, documents and verification method into the RFQ.



A SUS304 Spiral Freezer Belt: cross rods, spiral wire overlay and side links.

01

The question buyers keep asking

"SS304 will not stick to a magnet, as you know. ... Please explain as our customer is getting very nervous of why this is happening."

That message came from an Australian distributor a few days after installing a 400 m SUS304 Spiral Freezer Belt in a bakery's spiral cooling tower. During start-up, someone held a magnet against the belt, and it stuck to the rods. The sample received before the order had not. The end customer was large enough to test the belt and make a claim if the material was wrong.



The same magnet on SUS304 wire rod as received (left) and on cold-drawn cross rods (right).

The question usually arrives at the worst moment: after installation, during incoming inspection, or in an end-customer audit. The buyer is really asking three things:

- Did the supplier substitute a cheaper grade?
- Can I prove the material to my own customer?
- Will this belt rust or fail early?

02

Why SUS304 becomes magnetic

SUS304 (AISI 304, EN 1.4301) contains about 18% chromium and 8% nickel. In the annealed condition, it holds an austenitic structure that is essentially non-magnetic. A Spiral Freezer Belt is not annealed sheet. Every component goes through heavy cold work:

Process step	What happens	Effect on magnetism
Wire drawing	Wire is pulled through a series of dies to its final diameter	Part of the austenite transforms into martensite
Rod drawing	Bar is drawn to cross-rod diameter with a large reduction	The largest martensite content in the belt
Coiling and forming	Tight bends, headed rod ends, pressed links	More local transformation at bends
Welding	Weld metal holds a little ferrite to prevent hot cracking	Slight magnetism at weld points



In-house stainless steel wire-drawing line. Every pass through a die adds cold work.

Metallurgists call this deformation-induced martensite. The chemistry does not change; the steel is still SUS304. How much martensite forms depends on the deformation and on small differences between heats, which is why two belts, or two parts of one belt, can feel different to a magnet.

03

Which parts of a Spiral Freezer Belt react most?

When a buyer finds one magnetic spot, the natural reaction is to assume the whole belt is wrong. In practice, the pattern of where the magnet grips tells you a lot.

Cross rods Heavy reduction in rod drawing; headed ends	 Usually strongest
Spiral wire Multi-pass drawing and tight coiling	 Noticeable
Side links Bending and pressing	 Local, at bends
Weld zones Weld metal with a small ferrite content	 Slight
Wire rod, undrawn Hot rolled or annealed	 Very weak or none

Illustration of a general pattern, not measured values.

In our own production, the cross rods react more than the spiral wire. A cross rod carries the belt tension around the drum, so it needs high strength. To get that strength, the rod goes through a large reduction in drawing. More reduction means more martensite, and a stronger magnetic response.

WHAT THIS MEANS FOR BUYERS

A pre-order sample and a production belt can feel different to a magnet, because they went through different deformation. The grade has not changed. Check composition on the part you are worried about.

04

Why a magnet test fails both ways

A magnet is cheap and fast, so it is tempting to use it as an acceptance test. The problem is that it gives wrong answers in both directions.

FALSE ALARM

Genuine SUS304 sticks

Cold-worked SUS304 responds to the magnet. The buyer rejects good material, delays the project and damages a supplier relationship for no reason.

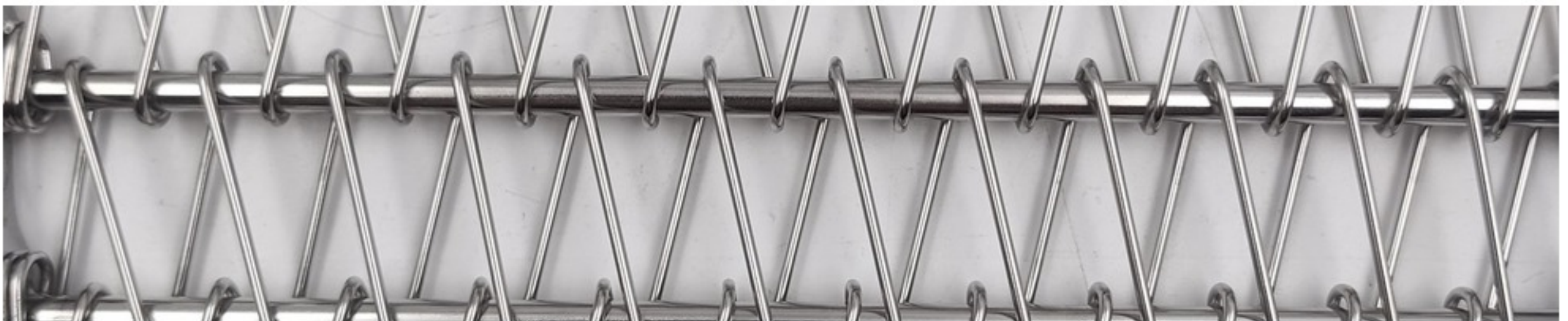
FALSE COMFORT

A wrong grade passes

Some lower-cost austenitic grades, such as 200-series steels with less nickel and more manganese, can show little magnetism before forming. They pass the magnet test and still are not SUS304.

The second case is the dangerous one. A belt made from the wrong material can look fine on delivery. The weakness shows up months later, after repeated washdown and temperature cycling, as rust or a belt that no longer runs flat.

By then the belt is installed and the line is running. Replacing it costs far more than checking it would have.



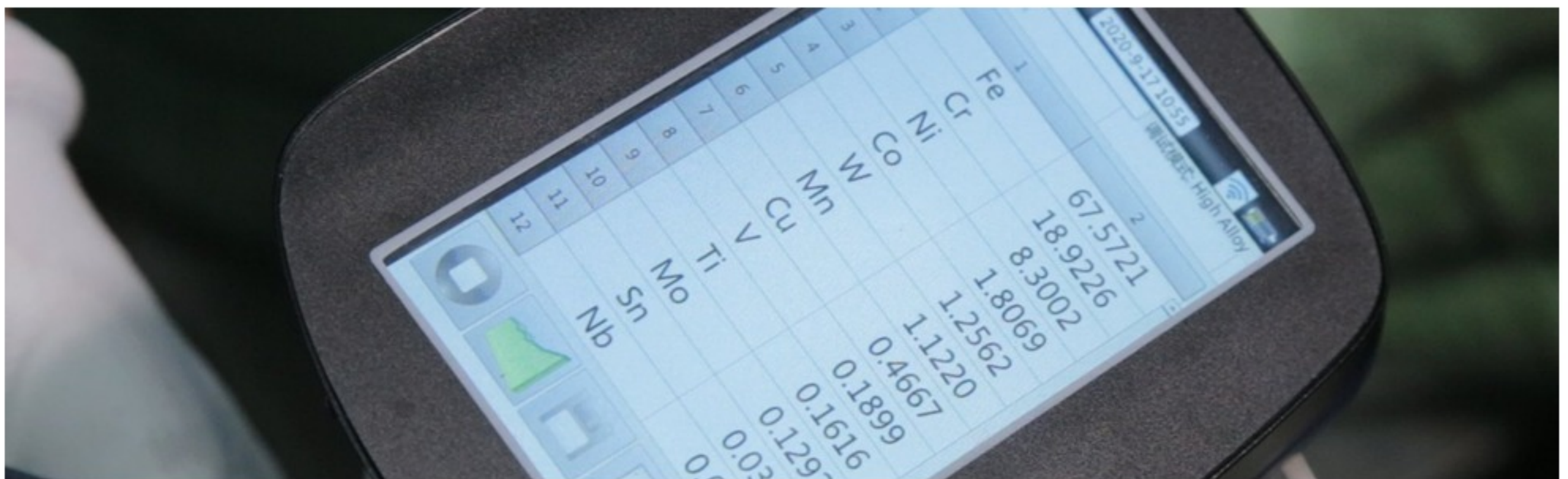
Spiral wire overlay close-up of a SUS304 Spiral Freezer Belt.

05

How to verify the grade

If your own customer asks whether the belt is really 304, you need an answer you can put in writing. A magnet photo will not do that. Composition data will.

Method	What it tells you	What it cannot tell you	Best use
Magnet	Whether an area responds to a magnet	The grade, nickel or manganese	Not for grade acceptance
Handheld spectral analyser	Cr, Ni, Mn and other main elements in seconds	Carbon, reliably	Incoming screening
Laboratory spark OES	Full composition, including carbon	Anything beyond the sample	Final answer, disputes
Material documentation	Declared composition of the material	Link to your belt, without traceability	Traceability, audits



Handheld spectral screening of incoming SUS304 material.

Two practical points. Test a clean, flat spot: oil, product residue and curved surfaces affect handheld readings. And if you send samples to a laboratory, ask for its minimum sample size first. A short piece of thin wire may be too small to classify.

06

What the numbers should say, and does magnetism matter?

For SUS304, screening results should fall within these limits:

Element	SUS304 limit (JIS G4309 / G4303)	What to look for
Chromium (Cr)	18.00–20.00 %	The main source of corrosion resistance
Nickel (Ni)	8.00–10.50 %	Low nickel is a warning sign
Manganese (Mn)	2.00 % max.	High Mn with low Ni suggests a 200-series steel
Carbon (C)	0.08 % max.	Needs a laboratory method

Once the grade is confirmed, the next worry is whether the magnetic areas will rust or fail early. In typical spiral freezing, cooling and washdown service, the small amount of martensite in a cold-worked SUS304 belt has little practical effect on corrosion resistance. That mainly depends on chromium content and a clean passive surface.



Drawn stainless steel cross rods. Cold drawing raises strength, and with it the magnetic response.

Cold work also raises strength, which is why wire and rods are drawn in the first place. There are limits: very heavy cold work plus strong chloride exposure or harsh cleaning chemicals can reduce pitting resistance. Then the right step is to review the grade, for example SUS316, not to worry about the magnet.

07 Project case 1 · Independent lab analysis in Brazil

Buyer	A spiral freezer equipment manufacturer in Brazil
Product	SUS304 Spiral Freezer Belt
Buyer's question	Can we prove, independently of supplier documents, that the belt material is SUS304?
What was tested	Three samples from the belt: a side link, a piece of spiral wire and a cross rod
Method	Spark OES at an independent laboratory (ASTM E1086 method)
Result	Side link and cross rod: main elements within the type 304 limits listed in the lab report. Spiral wire: sample too small to classify
Outcome	The customer confirmed in writing that the material was SUS304



Side links, spiral wire and cross rods: the parts tested in this case.

The customer took samples from the delivered belt and sent them to a laboratory of its own choice. A result like that does not depend on the supplier's documents or instruments, which makes it the strongest evidence a buyer can hold.

BUYER LESSON

Choose parts with enough material, such as a cross rod or side link, and ask the lab for its minimum sample size before you cut.

07 Project case 2 · Magnet test at start-up in Australia

Buyer	An Australian distributor; end user: a large bakery
Product	400 m SUS304 Spiral Freezer Belt, 5 mm cross rods, spiral cooling tower
Trigger	At start-up, a magnet stuck to the rods. The pre-order sample had not
Buyer's concern	Had production used a different grade? The end customer could test the belt and make a claim
What we checked	The same magnet on the wire rod as received and on the drawn 5 mm rods; the rods by spectral analysis
Explanation	Drawing wire rod down to a 5 mm rod is heavy cold work, which creates magnetic martensite
Outcome	We explained the source of the magnetism in a technical note; the customer accepted it



Drawn stainless steel cross rods: the cold work behind the magnetic response.

The distributor wrote: "SS304 will not stick to a magnet, as you know ... did production use a 321 grade or something like that, as the sample we have here (sent before the job) does not stick to a magnet." The difference was in the processing, not the grade.

BUYER LESSON

A sample and a production belt can respond differently to a magnet. Write a composition-based acceptance method into the RFQ.

08

What we learned, and why we control material at the source

We learned the material lesson the hard way. For years we bought stainless steel wire from outside suppliers. Four problems kept coming back:

- We could not control the base material the wire was drawn from.
- Some wire sold as 304 had impurities. Belts made from it rusted after longer service.
- Wire straightness and strength varied from batch to batch, which showed up as uneven shrinkage and a belt surface that was not flat.
- Waiting for wire deliveries sometimes held up production.



Raw material warehouse: wire rod and bar stored by batch before screening and drawing.

A magnet would not have caught any of this. So we changed the source. Today we buy wire rod from a major stainless steel mill, screen incoming material by spectral analysis, and draw wire and cross rods in-house on our own wire-drawing and round-bar drawing equipment. We keep retained samples of wire and finished product, and each belt has a material record.

When a customer questions our material, we don't argue about the magnet. We send our spectral results with the results from the retained sample of that order, and let the customer judge.

09

When magnetism matters, and what to write in your RFQ

Some buyers ask about magnetism because of their equipment, not the grade. If the belt runs near magnetic drives, magnetic separators or sensitive sensors, say so at RFQ stage. State whether the belt must be attracted, for example by a magnetic drive, or stay as non-magnetic as possible. These two needs lead to opposite choices. If you need a limit, give a measurable value and the measurement method.

- ☒ Grade and standard: SUS304 / AISI 304, or SUS316
- ☒ Components covered: cross rods, spiral wire, side links, sprockets
- ☒ Magnetic requirement: none, or a measurable limit and method
- ☒ Documents: material documentation and a traceable material record
- ☒ Supplier screening: spectral analysis of incoming wire rod and bar
- ☒ Retained samples: wire and finished-product samples kept
- ☒ Your arrival check: handheld screening of Cr, Ni and Mn
- ☒ Laboratory test: spark OES when the grade is critical or disputed
- ☒ Lab sample size: ask the lab first; a rod length beats thin wire
- ☒ Application: temperature, cleaning chemicals, chlorides, magnetic equipment

CONCLUSION

Judge a SUS304 Spiral Freezer Belt by its composition, not by a magnet. Cold drawing and forming make parts of the belt magnetic, and that is normal. The real risk is a wrong grade that passes the magnet test and fails months later in service.

Send your belt parameters.
We review them with you.

- Belt drawing or photos of your current belt
- Width, rod pitch, rod and wire diameter, turn ratio
- Grade, magnetic and document requirements

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