We have unsurpassed expertise in the manufacture of super-mirror-polished steel belts with a choice of IPCO steel grades, belt widths/thicknesses and polished surface finishes to meet your specific application needs.

Ipco.com

SUPER MIRROR POLISHED STEEL BELTS FOR FILM/SHEET PRODUCTION

——STRONG, SMOOTH AND FLAT – THE PERFECT SURFACE FOR A POLISHED PERFORMANCE

Steel belts are among the most versatile tools available to industry, being used for everything from chemical processing to the manufacture of wood-based panels. They're chosen for their inherent qualities of strength, durability and the ability to be used in the most aggressive of environments.

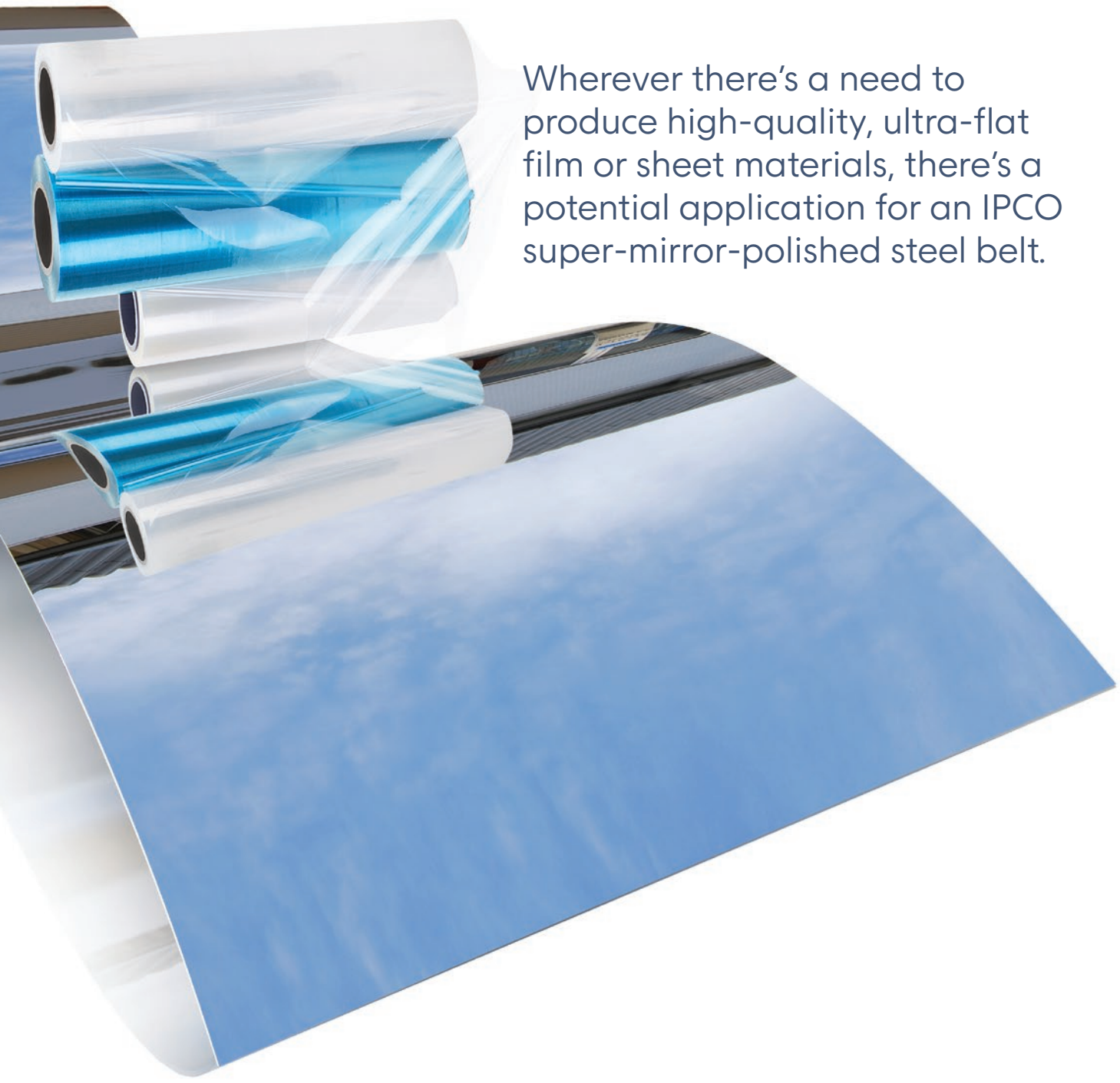
But there's much more to steel belts than sheer strength: they're also extremely flat and smooth, and this makes them ideally suited to casting applications, where the quality of end product literally mirrors the quality of the material on which it's produced.

Super-mirror-polished steel belts have been used in the manufacture of photographic films and ceramic sheets for many years. Today, growing recognition of the qualities of this unique processing material has seen film casting applications expand to include specialist films for liquid crystal displays (LCDs) on cameras and notebooks; thin films for printed circuit boards (PCBs); filter membranes for medical use and plastic films for high quality packaging.

Steel belts can also be used in the production of multi-layer laminates, and double-belt systems can apply pressure and heat as well as providing a perfectly smooth surface.

In other words, wherever there's a need to produce high-quality, ultra-flat film or sheet materials, there's a potential application for an IPCO super-mirror-polished steel belt.

From specialist films for LCD displays through PCB films, filter membranes and plastic films for packaging, the potential applications for film/sheet materials continue to grow



Wherever there's a need to produce high-quality, ultra-flat film or sheet materials, there's a potential application for an IPCO super-mirror-polished steel belt.

Steel belts and IPCO experience

The properties of the steel belt are unique: no other material offers the same combination of strength, flatness, ease of cleaning, resistance to corrosion, hardness, flexibility and repairability.

And when it comes to steel belts, our experience is without equal. From the development of the world's first steel belt, to many other world firsts since, our leadership in this field is acknowledged the world over. And this means we are able to offer precisely the right grade of belt for every application.

The right belt material for your application

Our super-mirror-polished belts are produced by polishing an IPCO stainless steel belt, but polishing alone cannot produce the optimum surface quality: the highest surface grades require special materials.

For this, we use ESR/VAR, a steel with very low inclusion levels and capable of delivering an exceptionally high-quality surface. It is produced via one of two processes – Electro Slag Remelting (ESR) or Vacuum Arc Remelting (VAR) – and, as the table below shows, is available in IPCO 1000SA and 1200SA grades.

For applications where the highest surface specifications are not critical, belts can be manufactured via the AOD (Argon Oxygen Decarburization) melting practice.

A choice of belt thicknesses and widths

IPCO steel belts can be manufactured in a range of thicknesses to suit different applications and, as with belt grades and materials, our expertise ensures that your belt delivers precisely the right characteristics for your application.

Recent years have seen growth in demand for wider belts and we are now able to meet requirements for widths up to 3 m.

Belts up to 2 m wide are produced in a single strip. Where requirements exceed this, two belts are welded together longitudinally and the entire surface is ground to ensure even belt thickness. The whole steel belt surface is then polished to deliver consistent quality.

If you have a special requirement – perhaps a belt size that's not shown here – contact your IPCO sales office and we'll provide all the advice you need.

Belt thicknesses and widths

Type	Steel belt grade	Standard thickness (mm)	Typical products / applications
Austenitic AOD	IPCO 1000SA AOD (AISI 316)	1.0. 1.2	• Ceramic sheet for fuels cells & capacitors • Filter membrane for medical filters
Austenitic AOD	IPCO 1200SA AOD (ASI 301)	0.6, 0.8, 1.0, 1.2, 1.6, 2.0	• Ceramic sheet for fuels cells & capacitors • Filter membrane for medical filters
Austenitic ESR/VAR	IPCO 1000SA ESR/VAR (AISI 316)	1.1, 1.6	• Optical film (e.g. TAC, PC, PVA etc.) for LCD panels • Film for substrate use (e.g. PI etc.) for digital cameras, mobile phones, laptops, solar batteries etc.
Austenitic ESR/VAR	IPCO 1200SA ESR/VAR (AISI 301)	1.1	• Optical film (e.g. TAC, PC, PVA etc.) for LCD panels • Film for substrate use (e.g. PI etc.) for digital cameras, mobile phones, laptops, solar batteries etc.
Martensitic AOD	IPCO 1050SM AOD	0.8, 1.0, 1.2	• Extruded packaging film (e.g. PP, PVC etc.) for commodity goods • Pressed laminate sheet products for PCBs, automotive parts, fuel cell parts, solar battery parts etc.
Martensitic AOD	IPCO 1650SM AOD	0.8, 1.0, 1.2, 1.6, 1.8, 2.0	• Extruded packaging film (e.g. PP, PVC etc.) for commodity goods • Pressed laminate sheet products for PCBs, automotive parts, fuel cell parts, solar battery parts etc.

Smooth, smoother, smoothest – selecting the right polishing grade

The grade of polish applied to your steel belt determines the smoothness of your end product so it is essential to get this right.

The first two grades in the table below are 'Fine grind' (FG) and 'Buff' (BF). Both use regular AOD materials and are polished by grinding or buffing. Thickness variation will be ≤80µm and the acceptable level of surface roughness will be agreed with you at the time of placing the order. Surface conditions can vary depending on the technique used so, if requested, we will provide a sample. This quality is suitable for products such as the ceramic sheets used in fuel cells.

The next two grades, PF-0 and PF-1, also use AOD material but are produced to higher tolerances with limited inclusions, a smoother surface and minimal variation in thickness.

Finally, there are the highest grade polished surfaces, all of which use ESR/VAR material and are suitable for casting products such as optical films for LCD displays and substrate films for high quality electrical products such as digital cameras, mobile phones and notebook PCs.

We can provide any advice you need on the suitability of a polished grade to your particular application.

Custom solutions mean you don't need to compromise

Our experience in this field means we can also achieve surface grades specific to a your requirements, such as a level of inclusions that falls between our standard grades.

Looking beyond polishing, we can work with you to develop a solution to any requirement, such as a surface that delivers enhanced film release properties, a unique surface pattern or maybe even a solution involving us working with samples of your material to develop a special surface.

Polished steel belt surface specifications

Polishing grade	Inclusions		Surface roughness	Thickness variation – typical	Melting practice
FG-0.XX	No definition		Can be specified in range of Ra = 0.10-0.22 µm	≤80 µm	AOD
BF-0.XX	No definition		Can be specified in range of Ra = 0.04-0.12 µm	≤80 µm	AOD
PF-0	>500 µm ≤500 µm	Not allowed No restriction	Ra ≤0.02 µm (Rz ≤0.08 µm)	≤50 µm (except cross welding zone)	AOD
PF-1	>500 µm ≥100 µm - ≤500 µm <100 µm	Not allowed Max 20/m^2 No restriction	Ra ≤0.02 µm (Rz ≤0.08 µm)	≤50 µm (except cross welding zone)	AOD
PF-2	>100 µm ≥50 µm - ≤100 µm <50 µm	Not allowed Max 5/m^2 No restriction	Ra ≤0.01 µm (Rz ≤0.04 µm)	≤50 µm	ESR/VAR
PF-3	>70 µm ≥40 µm - ≤70 µm <40 µm	Not allowed Max 5/m^2 No restriction	Ra ≤0.01 µm (Rz ≤0.04 µm)	≤40 µm	ESR/VAR

Getting it right with quality control at every stage

After polishing, the steel belt undergoes a series of inspection processes. Data such as thickness, inclusions and surface roughness is measured, checked for compliance with your agreed specification and an inspection report produced.

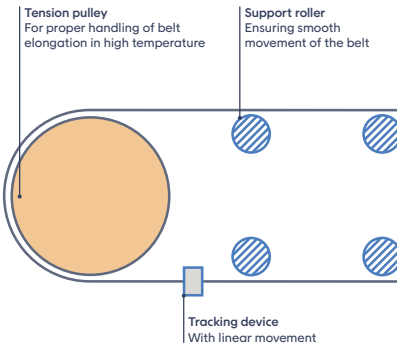
In the case of high-grade polished belts, surface polish requirements will vary from one customer to another. For instance, the pore pits created by minute inclusions may be unacceptable due to their impact on the quality of end products, or you may have specific requirements in terms of the shape of inclusions or a small detail in a surface pattern.

For this reason, surface specifications should be clearly agreed at the ordering stage.

In order to avoid problems after delivery, we strongly encourage a factory visit accompanied by an IPCO specialist. Ahead of your visit, we will supply full inspection data. For the visit itself, we will provide whatever support you need to undertake the inspection and, if an issue is identified, we can discuss modifications.

A factory inspection also provides the opportunity to discuss installation and maintenance, and we will be happy to answer any questions regarding cleaning methods and troubleshooting.

After inspection, the steel belt is packed with protective films on the surface and delivered to your location.



Installation and welding of a polished steel belt

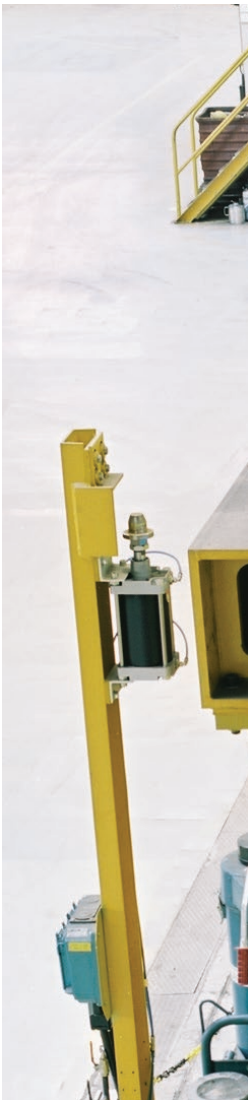
In most cases, your polished steel belt can be delivered in either endless loop form or as an open length for on-site welding. Either way, the weld quality is critical: the surface has to be the same across the welding line as it is across the rest of its length.

If your belt is delivered in endless form, it will be cross-welded and polished in the IPCO factory, and delivered to your location with a protective film that should not be removed until the belt has been installed.

If you have ordered an open length, the steel belt will be delivered in coil form, and welding and partial polishing will be carried out once the belt has been installed on your machine on-site.

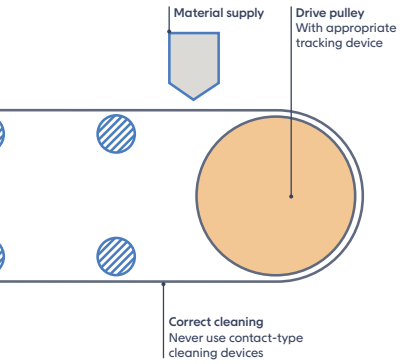
There are advantages to each method but the open length can be preferable if you have a large machine requiring a long belt. Another factor to consider is that the installation of an endless belt will require the removal of the entire machine side panel, whereas an open belt can be installed without doing so, saving time and money.

Your IPCO sales office can provide additional advice and details of our field service.



Maximize your return on investment

A steel belt of any kind can represent a sizeable investment so it's important to maximize its profitable working life. Polished belts are sensitive products so particular care needs to be taken.



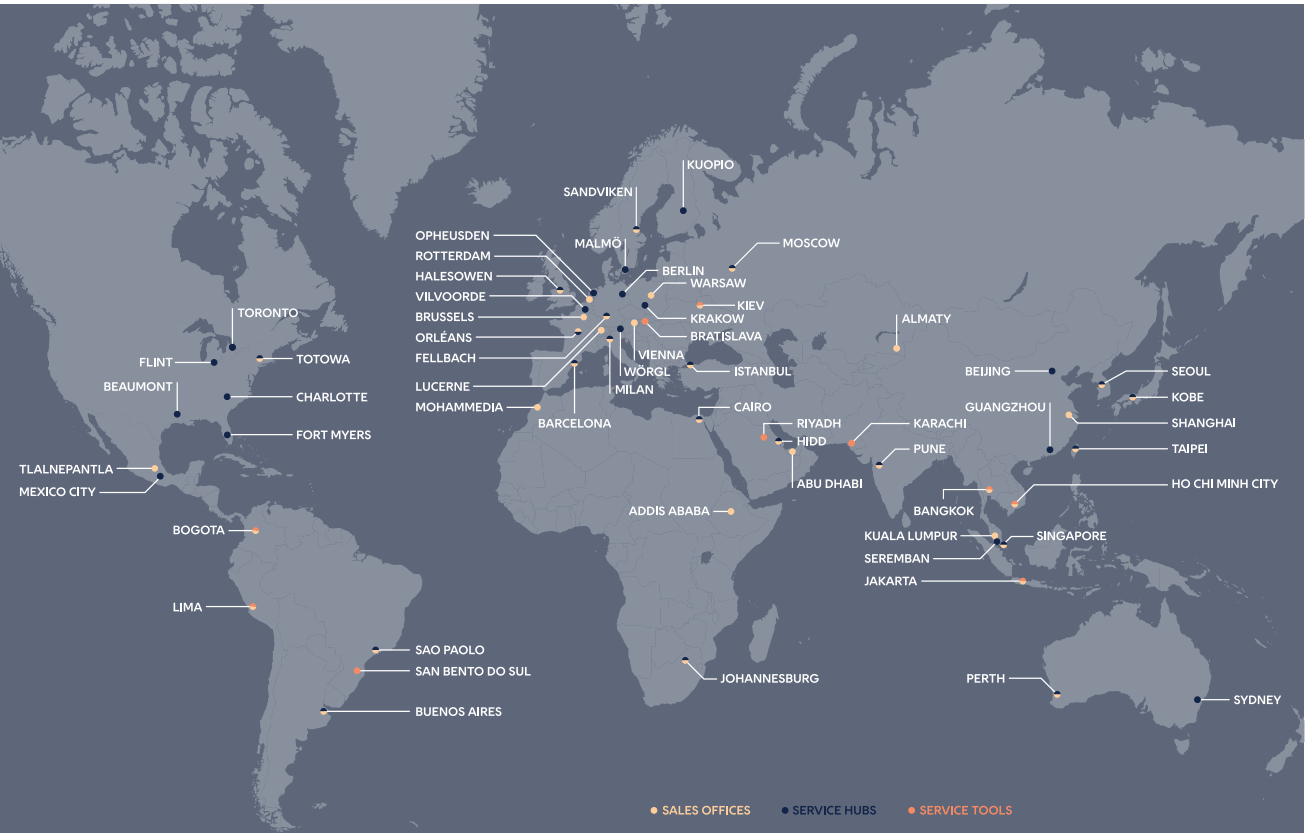
- Never allow potentially damaging objects to come into contact with the belt
- This may seem obvious but among the most common causes of problems are machine parts coming into contact with the belt surface or operators dropping tools onto the steel belt.
- Ensure that the belt runs smoothly
- Special attention should be paid to machine alignment, linear belt tracking and smooth support roller movement etc.
- Follow correct cleaning practices
- Careful belt handling is required: every operator should be trained in proper cleaning practices – under no circumstances should contact-type cleaning devices be used
- Carry out planned maintenance
- Prevention of problems is far more cost effective than repair. Even if problems are sometimes unavoidable, early detection can keep costly downtime to the minimum.

Our experience in the installation, maintenance and repair of steel belts means we can offer advice on aspects such as machine design, cleaning, preventative maintenance and operator training.

With proper maintenance and ongoing care, you'll protect your investment and ensure a long and profitable life for your steel belt. Talk to us about how we can help keep your belt at its most productive.

Global support to keep your business running

Accidents do happen and the important thing is to ensure that downtime is kept to the absolute minimum.



In the case of minor surface scratches, it can be possible to carry out repairs on-site and our trained technicians are equipped with the most advanced tools available.

However, if scratches are deep or extensive, or if on-site repair cannot be guaranteed to meet critical thickness/surface tolerances, your belt will need to be returned for factory repair. We therefore recommend that all customers hold a spare belt. This may seem excessive but just a few days' lost production can equate to the cost of a new belt.

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