Food safety of Protact®
Compliance with current and future food contact legislation

Protact is a fully compliant packaging material
Current food contact legislation is designed to:
• safeguard human health
• protect packaged foodstuffs from unacceptable changes in composition and quality.
Protact laminated steel is fully compliant with all relevant European and USA food contact legislation. Furthermore, well-controlled purity levels of all chemical substances used in Protact enable compliance to upcoming legislation on non-intentionally added substances (NIAS).

Using a packaging steel substrate laminated with a three-layer polymer coating system on each side, the chemical substances used in Protact are specifically formulated without bisphenol A diglycidyl ether (BADGE), novolac glycidyl ether (NOGE), Bisphenol A (BPA) or bisphenol F diglycidyl ether (BFDGE). Protact complies with food contact legislation as set out in:
• the Plastic Implementation Measure (PIM) under European Commission (EC) legislation
• the Code of Federal Regulation (CFR) under the USA’s Food and Drug Administration legislation.

European Union (EU) and USA food contact regulations
In the manufacture of Protact, Tata Steel maintains strict compliance to the EU and USA food contact regulatory systems and their requirements. Adherence to all relevant legislated procedures ensures that Protact is certified compliant with food safety legislation.

In the EU, substances and practices are scientifically evaluated by the independent European Food Safety Authority (EFSA) and formulated into practical legislation by the European Commission. The EC regulates food contact materials through:
• Frame Work Regulation (EC 1935/2004) – defining general principles
• GMP Regulation (EC 2023/2006) – defining general principles
• Plastic Implementation Measure (PIM, EU 10/2011) and amendments – defining requirements specific to polymers and polymer coatings.

Protact undergoes the required EC compliance testing which is based on composition, processing and storage conditions. Composition of the packed food product is used to select the appropriate stimulant. Heat processing, storage time and temperatures during the test are based on actual conditions during can processing.
In the USA, the Food and Drug Administration (FDA) has a central role in scientific evaluation of new substances, formulation of legislation and enforcement of regulations. Food safety is regulated through:
• the Code of Federal Regulation (CFR)
• a specific Food Contact Notification (FCN)

Protact undergoes compliance testing as required by the FDA. In FDA regulations, food composition defines the extraction liquid. Heat processing of the extraction liquid is based on heat processing of the canned food product. This approach to testing focuses on the dominant part in the pickup of substances from packaging materials.

Independent compliance testing
Protact compliance testing is undertaken by TNO Triskelion, an independent and respected European research institute. The institute evaluates and certifies compliance to the relevant European and American food contact legislation (see figure 1).

Figure 1: Steps in the Protact food safety certification process executed by independent institute, TNO Triskelion.
TNO Triskelion uses migration cells to establish substance migration and extraction from packaging materials (see figure 2). By testing product stimulants and the packaging material in secure migration cells, inert test conditions are ensured. A fixed volume and surface area of packaging material is tested. This rigorous testing is in line with food contact legislation.

![Use of migration cells](image)

Figure 2: Use of migration cells (open on left, closed on right) ensures the legislatively prescribed conditions for migration and extraction testing are securely met.

TNO Triskelion certification for Protact contains the following statements on Protact compliance:

- regarding compliance with FDA legislation – Protact “can be used for packaging, transporting, or holding food”
- regarding compliance with EC legislation – “overall migrations, relevant specific migrations and residual contents meet the limits of the ‘Regulations’”.

Compliance with future NIAS legislation

European and American legislation increasingly requires food safety evaluation of direct food contact materials with regard to non-intentionally added substances (NIAS). The objective is to prevent introduction into foodstuffs of:

- by-products
- impurities
- other non-intentionally added substances.

The scientific and regulatory debate on non-intentionally added substances is ongoing. Protact offers a safeguard against any tightening of NIAS regulation. Purity levels and processing conditions of the chemical substances used in Protact manufacture are well-controlled.

Independent screening confirms very few and less prominent ‘peaks’ when compared with the ‘forest of peaks’ in thermoset lacquer (see figure 3). Fewer and less prominent peaks indicate very few NIAS substances, proving that Protact has excellent levels of food safety.

![Graph A: Protact (PET)](image)

Graph A: Protact (PET) shows the results of Protact coating screening undertaken by TNO Triskelion. Infrequent and less prominent ‘peaks’ are shown – confirming that Protact introduces very few non-intentionally added substances into packaged foodstuffs.

![Graph B: Liquid coating (epoxy)](image)

Graph B: Liquid coating (epoxy) shows the ‘forest of peaks’ found in a typical epoxyphenolic lacquer. These prominent and more frequent peaks represent a large number of non-intentionally added substances that could potentially transfer into foodstuffs.

One innovative regulatory methodology to assess the food safety of packaging materials is the screening of Non Intentionally Added Substances (NIAS). Following recommendation from the International Life Sciences Institute (ILSI) a NIAS screening was carried out for Protact. In typical food contact compliance tests the focus is on starting substances, however, NIAS screenings also measure impurities and reaction by-products in coatings. With this method endocrine (hormonal) and carcinogenic activity is evaluated by a standardised method. After a thorough and detailed chemical analysis of all substances, samples of Protact were screened by Bluescreen® and other bioassays. The results of the NIAS screening showed no activity, demonstrating that Protact is indeed a very clean coated material, providing further evidence of the food safety of the product.

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System change for efficiency in 2-piece D&I food cans
Protact® laminated steel - a safe and sustainable material solution

**Background**
Canmakers, to compete, must comply with stringent legislation for materials in contact with food. Bisphenol A (BPA) is an organic synthetic compound used to make certain plastics and epoxy resins such as lacquers traditionally used to coat food cans. BPA in lacquers has come under intense scrutiny. Lacquers remain susceptible to possible future food safety issues. In addition, environmental legislation has led to strict allowances for volatile organic compound (VOC) emissions associated with the use of lacquers on metal packaging. Growing demands for sustainability mean many canmakers are seeking to limit the use of raw materials and energy in their processes. Brand owners and retailers are also seeking fully recyclable products.
Against this legislative and regulatory background, canmakers are under pressure to become increasingly more efficient and innovative in the highly competitive food packaging market.

**Efficiency to meet market needs**
Tata Steel developed Protact laminated steel for two reasons. First, it meets market needs for more sustainable, reliable and safe packaging material. Second, it offers canmakers an opportunity to increase yield and be more competitive by removing cost-intensive unit operations in both greenfield and brownfield canmaking. Already technically proven in beer and beverage packaging and used commercially for various food applications such as deep drawn cans, Protact is a fully approved and controlled food-safe product. It is BPA-free and comprises a steel substrate and a coating of thin layers of Polyethylene Terephthalate (PET) or Polypropylene (PP) to meet a variety of performance requirements (see figure 3).

Using Protact for 2-piece D&I canmaking eliminates the need for operations related to lacquering (see figures 1 and 2). This enables a reduction in associated manning and maintenance. It also eliminates emission of VOCs in the canmaking process and significantly reduces energy consumption. Use of Protact can also reduce water consumption. To deliver further gains, Tata Steel has developed Protact laminated steel to full D&I width for optimised can line output.

**Food safety**
PET is acknowledged as one of the safest food contact materials in use. The PET coating in Protact comprises polyester types proven in PET bottles. These contain few chemical components. Purity levels and processing conditions of the chemical substances used in Protact manufacture are well-controlled. Independent screening of Protact confirms very few and less prominent substance-related ‘peaks’ when compared with the ‘forest of peaks’ in thermoset lacquer. Fewer and less prominent peaks indicate very few non-intentionally added substances, proving that Protact has excellent levels of food safety.
Protact’s inert polymer coating has excellent organoleptic properties. This ensures that the original taste of packaged food is not affected by the
packaging material. The packaging material does not scalp or taint food flavour. The food safety status of Protact is rigorously controlled by the respected European independent food institute, TNO Triskelion. Protact complies fully with European Food Safety Authority and US Food and Drug Administration food safety regulations. See Tata Steel's Food safety of Protact* data sheet for additional information.

Sustainable packaging

Protact’s polymer coating and steel substrate are infinitely recyclable. Steel is the most recycled packaging material in Europe – with recycling levels at 76% in 2014. The polymer coating of thin PET layers is burned off during the conversion of recycled Protact cans at around 1550°C in the steel making process. This produces thermal energy and high quality steel scrap.

Sustainable process

Protact enables improved environmental performance in the canmaking process. Removal of lacquer-related operations – washcoat, spraying and curing – reduces energy consumption and CO₂ emissions from gas-fired ovens. It also means that VOC emission is eliminated from the canmaking process, along with the need for equipment dedicated to VOC removal. In Europe, VOC emission continues to be a focus for attention in potential updates to the Best Available Techniques Reference Document (BREF). Use of Protact offers a safeguard against further tightening of VOC-related legislation and the costs that this could entail.

Using Protact, 2-piece D&I food cans can be made in a wet or dry canmaking process. In a dry process there is no requirement for an emulsion or for subsequent can washing. In addition to reducing water consumption, it enables canmakers to dispense with water treatment facilities. Tata Steel continually conducts company-wide life cycle analysis against competitor materials and can provide insights on individual request.

Adopting laminated steel for food can production

Greenfield investments can benefit immediately from the adoption of Protact laminated steel. Without washing and lacquering operations, capital investment and manning costs are significantly lower. There is no need to build and maintain technical expertise in lacquering. The simplified canmaking lines are shorter and can be built on a smaller physical footprint. With no need to store inflammable compounds, insurance costs are reduced due to a lower risk of fire or explosion.

Tata Steel's Customer Technical Service team and Research & Development experts can assist customers in converting or adapting existing canmaking lines. Lines can be readily converted for Protact by making adaptations at the cupper and bodymaker. Tata Steel has developed techniques for cupping and canmaking that are vital to successful line conversion. These techniques ensure that no polymer hairs are made in the forming process. Hair formation would result in clogging or contamination. Hair formation can be a problem with some laminated steels in 2-piece can formation.

But, with Protact, Tata Steel’s techniques ensure that hair-free canmaking is achieved in the final moments of the drawing process. This entails precise control of timing of the blank holder lift-off to prevent pinching of the blank edge. Dry D&I canmaking also requires modifications to the dies and punch to ensure that heat generated in the process is removed.

In the bodymaking process, small adaptations are needed to run Protact through the installation. These comprise modifications to the wall ironing process and the redraw step in the bodymaker. The changes ensure wall ironing reductions of 50 - 55% are possible, as required for food cans. Tata Steel is recognised for the support it gives customers in assisting in the design of tooling and modifications needed to move from a traditional lacquer-based process to one using Protact laminated steel.

Conclusion

Food-safe and infinitely recyclable, Protact offers significant benefits for 2-piece D&I food can production. It eliminates up to five unit operations related to lacquering – delivering safer, more sustainable canmaking operations with a reduced environmental footprint. Canmakers can save money through a reduction in manning, energy bills, insurance premiums and investment. In addition to efficiency gains, Protact offers the opportunity to maximise yield because it is available in widths up to 1220mm. Extra width allows an increase of 10 – 15% in cupper output, compared to standard 1000mm wide material.

Elimination of VOC emission – coupled with the fact that Protact is BPA-free – provides a safeguard against potential tightening of environmental and food contact regulation. Canmakers operating in VOC-capped manufacturing environments, such as California, can increase their production volumes whilst eliminating their VOC output completely.

The D&I canmaking line at Tata Steel's R&D facility is run at commercial speeds. In co-operation with customers, it offers the opportunity for development of the canmaking process for 2-piece D&I food cans using Protact laminated steel.

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Tata Steel Europe Limited
Protact® for 3-piece cans
Optimised laminated steel for rationalised canmaking

Protact laminated steel from Tata Steel is a fully approved and controlled food-safe product. In addition, Protact is also suited for paint and general line applications. Already a proven material solution in 2-piece canmaking, we have now developed Protact to meet the needs of 3-piece canmakers.

The material’s coating-free zones are tailored to enable welding of the required can diameter and height. It removes the need for cost-intensive lacquering on the internal side of the can material and if present the external side. This frees up capacity and simplifies 3-piece canmaking operations.

Protact for 3-piece cans offers good side stripe adhesion performance. It is suitable for all 3-piece canmaking operations including welding, flanging, beading and double seaming.

Product features
Protact for 3-piece cans comprises:

■ a tinplate substrate – delivering the required elongation properties for successful welding, flanging, beading and seaming
■ a three-layer polymer coating system – can be applied on each side of the substrate or on one side only. The coating system is optimised for food, aerosol, beer and beverage, and general line product applications
■ polymer coating-free zones – customised to can diameter requirements for H-grain welding, resulting in a coating that does not shrink or delaminate during welding, side strip curing and can be sterilised.

Polymer coating system and food safety
Protact’s multi-layered polymer coating system can be tailored to meet a variety of needs (see Figure 1). The coating comprises PolyEthylene Terephthalate (PET). Internal polymer layers have proven product contact performance for the products contained within Protact packaging. Protact is available with a total coating thickness ranging from 15 to 30 μm. Protact is fully compliant with all relevant European Food Safety Authority and US Food and Drug Administration food contact regulations. Compliance is certified by the independent and respected European research institute, TNO Triskelion.

Current food safety focus for cans is on Bisphenol A (BPA) in lacquers. Protact is BPA-free. The chemical substances used in Protact are also specifically formulated without Bisphenol A diglycidyl ether (BADGE), novolac glycidyl ether (NOGE) or Bisphenol F diglycidyl ether (BFDGE). Kosher certification is available with Protact.

Can making
The coating-free zones in Protact for 3-piece cans allow for H-grain welding (see figure 2). The position and width of the zones can be varied to accommodate all standard can and aerosol diameter requirements from 45 mm and up. The consistent width and position of the coating-free zone and close control of tolerances enable stable and efficient welding operations. Side striping can be applied with good adhesion.

The choice of substrate ensures the required elongation properties for successful flanging and double seaming. Protact’s optimised polymer coating system is entirely compatible with these operations and its performance levels remain intact. Protact for 3-piece food cans is suitable for beading.
Corrosion protection

Protact’s optimised layer system ensures a low level of porosity. Compared with lacquered cans, this delivers superior corrosion protection for corrosive and hard-to-hold substances such as solvents used in aerosols and other general line applications. The product area affected by the heat of welding and side stripe curing has shown a good corrosion performance. The product can also be applied for food applications. This also applies to the overlapping area of the side stripe and the laminate (see figure 3). However we advise our customers to verify the corrosion performance with the fill goods to be used.

Dimensions

Protact for 3-piece cans is available in a range of widths up to 1058 mm and in a thickness range of 0.15 mm to 0.60 mm. Welding margins can be created to produce cans from a diameter 45 mm and upwards. Obviously the layout is determined by your requirements. Ongoing product development is extending the choice of dimensions. Please contact us to discuss your needs.

Product support

Our material experts and customer technical support are available to support the deployment of our products in your individual can format and product application. This includes support for adoption of H-grain welding to realise the benefits offered by Protact for 3-piece cans.

For more information:

E: infopackaging@tatasteel.com

Figure 2

Figure 3
Protact®
Optimised, efficient and sustainable laminated steel for packaging

Protact laminated steel from Tata Steel is a fully approved and controlled food-safe product. It is a proven material solution across a number of high performance canmaking applications and formats. Protact removes the need for complex, cost-intensive operations associated with the use of lacquer.

For example, using Protact to manufacture 2-piece drawn and wall ironed (D&W) food cans removes up to five unit operations. It also means the canmaking process consumes less energy and can be water-free. With Protact, there are no volatile organic compound (VOC) emissions during canmaking.

Product features
Protact comprises:
• packaging steel substrate
• a three-layer polymer coating system on each side of the substrate which has been optimised for food, aerosol and general line product applications.

Coating system
Protact’s multi-layered polymer coating system can be tailored to meet a variety of needs. Depending on the application, the coating comprises polyethylene terephthalate (PET) or polypropylene (PP). Internal polymer layers have proven product contact performance for the products contained within Protact packaging. Protact is available with a total coating thickness ranging from 12 to 40 µm.

The three layers of coating on each side of the substrate comprise an adhesion layer, a main layer and a surface layer (see figure 1).

Each layer in Protact’s polymer coating system is independently optimised to meet can performance requirements and ensure efficient processing during canmaking (see figure 2).

Formability and canmaking
Both the internal and external three-layer coating systems enable high wall ironing ratios, so Protact does not crack or perforate during the D&W process in 2-piece can production. The coating, in conjunction with small modifications to the canmaking line, ensures wall ironing reductions of 50 - 55% are possible, as required for food cans. This has been proven in commercial production for D&W aerosol and beer and beverage cans where the coating remains robust and reliable after formation. Protact’s containment performance is not compromized during forming. The unique build-up of Protact’s coating layers delivers a non-abrasive material – minimising tool wear during canmaking.

Sustainability
Protact is a permanent available material that is infinitely recyclable with no loss of quality. It is a chlorine-free, fully integrated polymer coated laminated solution for packaging. Recycling and reuse of Protact material does not require complex separation techniques or special treatments.

Use of Protact in the canmaking process removes up to five unit operations related to lacquering. It eliminates emission of VOCs and significantly reduces energy consumption and related CO2 emission – for an improved environmental footprint. Used in a dry canmaking process, water consumption is reduced. Tata Steel continually conducts company-wide life cycle analysis (LCA) against competitor materials and can provide insights on individual request.

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Protact is fully compliant with all relevant European Food Safety Authority and US Food and Drug Administration food contact regulations. Compliance is certified by the independent and respected European research institute, TNO Triskelion.

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Figure 1. The independently optimised layers of Protact’s coating system offer unique advantages. These include improved canmaking efficiency and enhanced product aesthetics for market differentiation.
Corrosion protection

Protact’s optimised layer system ensures a low level of porosity. Compared with lacquered cans, this delivers superior corrosion protection for corrosive and hard-to-hold substances such as solvents used in aerosols and other general line applications.

Print and colour

Protact is compatible with varnishes, UV and thermo-cured inks. It provides a good base layer for optimised print and improved branding performance. Protact is available in a range of base colours:

- white
- clear
- black
- gold

Dimensions

Protact comes in a range of widths and dimensions (see figure 3). Availability of some dimensions depends on the packaging steel substrate and relevant polymer coating for the product application. Please contact us to discuss your needs.

<table>
<thead>
<tr>
<th>Application</th>
<th>Adhesion layer</th>
<th>Main layer</th>
<th>Surface layer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>Optimised for sterilisation</td>
<td>Optimised for non-blushing performance or coating colour</td>
<td>Optimised for forming performance or content release</td>
</tr>
<tr>
<td>Aerosol</td>
<td>Optimised for heat resistance</td>
<td>Optimised for barrier performance or coating colour</td>
<td></td>
</tr>
<tr>
<td>General Line (Paint)</td>
<td>Optimised for chemical resistance</td>
<td>Optimised for barrier properties or coating colour</td>
<td></td>
</tr>
<tr>
<td>Beer and beverage</td>
<td>Optimised for adhesion</td>
<td>Optimised for barrier performance, deformation stresses and coating colour</td>
<td>Optimised for forming performance and print</td>
</tr>
</tbody>
</table>

Figure 2. Protact can be customised to meet specific applications and canmaking needs.

Product support

Our material experts and customer technical support are there to support the deployment of our products in your individual can format and product application.

For more information:
E: infopackaging@tatasteel.com

Figure 3. Protact dimensional capability.
Steel for packaging applications
Product range and technical specifications

<table>
<thead>
<tr>
<th>Grade</th>
<th>TS230</th>
<th>TS245</th>
<th>TS260</th>
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<td>DR8</td>
<td>DR8.5</td>
<td>DR9</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| * Beer and beverage cans *

Specifications shown here are typical values. For all enquiries, including outside of these specifications, please contact us.

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HIGH PERFORMANCE STEEL FOR PACKAGING

A comprehensive product portfolio for demanding canmaking operations.

Tata Steel’s range of products includes regular, tin-free steels (EOS), high-strength, and our market leading Tata Impedance Spectroscopy, high-strength and advanced steels. Our range of materials is tailored to meet the specific needs of canmakers. We have the flexibility and expertise to customize products to meet specific end-application requirements. Our partners value us as an expert to optimize the process efficiency of canmaking.

We have the technical expertise of a dedicated packaging steel (EN) team (based on metal experience and advanced capabilities including canmaking via continuous annealing and hot/cold forming). Tata Steel’s expertise helps our partners create more efficient can-making products and improve pack performance. Our product testing facility helps to bring packaging solutions to market faster.

Downgauging is an important trend in the metal packaging industry for both efficiency and sustainability. We collaborate with canmakers on a dedicated project to project basis for mutual benefit.

We encourage sustainability by focusing on manufacture efficiency and waste reduction. Working with national industry associations, we showcase how steel is truly recyclable and 100 per cent sustainable. Steel is the most recyclable packaging material. Only steel has a recycling rate of over 70 per cent - the highest recycling rate of any material. Only steel has a recycling rate of over 70 per cent - the highest recycling rate of any material.

For canmakers, Tata Steel’s range of D&I and EOE grades offers an attractive combination of formability and strength. The grades are designed to meet specific end-application requirements, including canmaking. Tata Steel’s range of D&I and EOE grades offers an attractive combination of formability and strength.

Specifications:

For Packaging

Our product testing facility helps to bring more efficient designs for Impedance Spectroscopy, have helped our advanced capabilities including canmaking. Tata Steel offers a dedicated packaging steel (EN) team (based on metal experience and advanced capabilities including canmaking via continuous annealing and hot/cold forming). Tata Steel’s expertise helps our partners create more efficient can-making products and improve pack performance. Our product testing facility helps to bring packaging solutions to market faster.

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