TriStar

Engineered Plastic Solutions™

Food and Beverage Packaging Equipment Manufacturers:

Discover How Polymer and Composite Bearings Can Increase Production Rates — and Revenues

food packaging

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Food packaging is constantly evolving as consumer preferences, regulatory guidelines, and merchandising trends dictate. While the industry saw a downturn throughout 2010, new innovations in flexible materials and metalized film have helped to reverse that trend. And the forecast for 2012 looks good, with an anticipated 3-5% growth rate — a positive sign for packaging companies, and for the equipment manufacturers who serve them.

Once considered just a portal for getting goods to market, food packaging is now viewed as a collaboration of art and science; the art meant to attract consumer interest and buyers, the science of design engineering and food compatibility. While consumers actually purchase the contents of a package, they also have high expectations for the design of the package — demanding more earth-friendly, tamper-proof, and BPA-free options. Retailers want the same attributes, but also need better functionality and space-saving options. All of these demands are taxing packaging companies as they try to balance new innovations with rising costs.

The industry is also faced with steep increases in commodity pricing. The price of PET, a key resin of plastic films and bottles, has swelled up to 40% in the last year. And as the largest market for corrugated boxes, food and beverage packagers are strained by swelling paperboard costs. Add to that increased fuel and delivery expenditures, and it becomes clear how the industry can quickly lose revenue.

To offset these challenges, packaging companies are looking inward to maintain costs. Production lines are under review for linear flow and lean manufacturing. Mechanical systems are also under closer scrutiny, which is where many OEMs have discovered an equipment component that may be small in size, yet yields big savings.

Durable, long-lasting, and value-driven, composite and polymer materials are appearing on the workhorses of the packaging industry: the conveyors, bins, fillers, molds, dryers, boxing and labeling machines. They are also driving substantial savings for the industry's food processors. These new engineered components are increasing production rates — and plant revenues — one bearing at a time.

To offset rising commodity prices, packaging manufacturers are reviewing their equipment components, and demanding value-driven composite and polymer bearings.

Food Packaging Outside the Box and At the Source

The food industry is unique in that while most packaging is done within manufacturing facilities, some sectors handle processing and packaging functions right at the source. With fresh apples, for instance, nearly 60% of the US harvest is consumed as whole fruit, and growers regularly box and bag the apples right at the farm for quick transport to market.

Similarly, seafood packaging is often handled at sea aboard massive factory ships or "floating canneries." Here, salmon and other species are sorted, processed, and canned at the source. This quick turnaround promotes quality and freshness, as the processors can guarantee the product has been out of the water for less than 24 hours before being packaged for market.

While at-the-source packaging is good for product quality and freshness, it can wreak havoc on packaging equipment. Exposure to dusty farm soil and corrosive sea spray can prematurely deteriorate the metal and bronze components of the fleet. Equipment manufacturers need a durable bearing solution that will outlast and outperform conventional bearing materials.

Packaging and Labeling Regulations Add Pressure

Another constant pressure for food packagers is the regulations set forth by federal, state and independent agencies; each with specialized mandates. Since the packaging process can expose food to indirect additives, materials must be pre-approved for food contact.

Likewise, food labels are also scrutinized by federal agencies, as they provide consumers with critical nutrition and allergen information. Misbranded and mislabeled products are considered "adulterated goods," and are unfit for market. To keep pace with these mandates, food packaging companies are demanding better accuracy from their labeling equipment.

The US Food Safety Modernization Act (FSMA) *of 2011 calls for improved plant inspections and prevention controls in food packaging and processing. Agencies involved in food safety include:*

Food and Drug Administration (FDA): *regulates the composition, additives and properties of materials for food contact*

US Department of Agriculture (USDA): *regulates food safety and inspection for manufacturing, packaging, and handling practices, including meat, poultry, fruits and vegetables*

National Sanitation Foundation (NSF): *an independent agency devoted to achieving solutions relative to public health and the environment*

3-A Sanitary Standards: *an independent agency dedicated to advancing hygienic equipment design for the food, beverage, and pharmaceutical industries*

The Plastics Industry Has the Solution for Food Packaging Equipment: Long-lasting Polymer and Composite Bearing Materials

With composite and polymer bearings on the conveyors, bins, fillers, molds, dryers, and boxing and labeling machines, manufacturers of packaging equipment are realizing significant gains in plant uptime and revenues. Innovative polymer and composites deliver key benefits over metal, bronze and nylon materials:

- **Self-lubricating design** eliminates the need for expensive food-grade grease on packaging components, which promotes a sanitary food packaging environment
- **Vibration and impact resistance** accommodates heavy loads and keeps conveyors rolling to increase production rates
- **Superior strength and wear** for extended use in a demanding, 24/7 packaging environment
- **Combats corrosion** without pitting or flaking into foodstuffs, even with acidic products such as citrus; also resists at-the-source environmental hazards
- **Minimizes moisture absorption** to reduce bearing expansion, even in wet environments like bottling applications
- **Withstands high loads yet is lightweight** a compact strength-to-weight ratio for good durability and flexible design options
- **Meets appropriate industry standards** for food contact applications, giving manufacturers easy regulation compliancy

A proud partner to the food and beverage industry, TriStar Plastics Corp. has been developing and manufacturing the finest composite and polymer materials for three decades. They are also a key supplier to the leading food processors in the industry. From single machines to complete packaging lines, TriStar has a host of materials that are suitable for food usage, including CJ, Ultracomp®, Techtron® HPV, and Tivar® 1000. TriStar is also the exclusive, US distributor of the Rulon® family of high-performance bearing materials, many of which are food-contact compliant. The company also boasts in-house design, material selection, fabrication and production capabilities, and a robust Surface Modification Division to alter the properties of plastic materials.

TriStar's food-compliant bearings deliver good value, strength and wear — and can shorten installation certification time.

The TriStar Advantage: Complete bottle drying for better label adhesion and throughput

Labeling is a critical step in the packaging process. Given the rise in food allergies and dietary restrictions, consumers depend on label accuracy to decipher ingredients before consumption. And CJ bearings have become a critical part of the labeling equipment. A thermosetting, filament-reinforced resin with a PTFE liner, CJ bearings are recognized for strength and good mechanical properties. They also remain dimensionally stable in wet beverage environments.

CJ in Bottle Drying Systems

Challenge:

A major bottler of carbonated beverages approached us to solve their air-drying challenge. Excess moisture was left on the bottles after filling, which prevented the equipment from properly adhering product labels. Without proper label placement and adhesion, the bottles were unfit for market, which resulted in a significant amount of waste and production loss.

Solution:

Our team visited the plant and studied the function of the bronze bearings on the manufacturing drying systems. They discovered the bronze bushings on the idler arm of the air knife system failed repeatedly, and caused inconsistent drying on the filled bottles. By replacing the bronze bushings with CJ bearings, our client has had superior drying results and better label adhesion. In fact, the CJ bearings have helped our client exceed their throughput.

See page 12 for CJ Design Criteria

CJ bearings excel in beverage labeling equipment, and are also located on the compressors of refrigerated delivery trucks – therefore ensuring goods are not only properly labeled, but delivered cold.

The TriStar Advantage: Increased production speeds and plant revenue

Ultracomp® bearings keep the conveyors rolling in ice cream production, where speed is critical to prevent melting and product deterioration. With a long lifespan and good temperature tolerance, Ultracomp bearings excel in frozen food processing and packaging. They also give appropriate food-contact compliance and resist sanitation chemicals.

Ultracomp® in Ice Cream Conveyors

Challenge:

The market leader of ice cream treats was unable to meet production demands because of inconsistent speeds and pauses on their conveyor systems. The conveyors would seize and stop rolling, which prevented the product from moving from processing to packaging. This hampered overall productivity and reduced profits.

Solution:

After reviewing the requirements of the application, our team replaced the factory's traditional metal bearings with Ultracomp on the conveyor belt rollers. Ultracomp readily adapted to the high speeds required of this application.

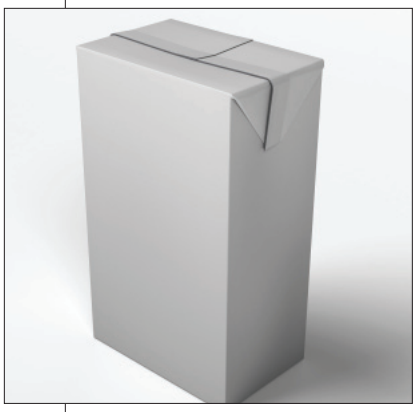
Ultracomp bearings resist both the cryogenic-level temperatures and hot-steam sanitation baths needed in ice cream production — without ever absorbing moisture. They also have the strength and stamina to run against the line's stainless and aluminum shafts. And because they do not need manual lubrication, the bearings have presented a sanitary environment for food packaging. Our client was so pleased with the results of Ultracomp bearings on their rolling conveyors, they have also retrofitted their dasher blades with Ultracomp.

See page 13 for Ultracomp Design Criteria

Download our food processing white paper to learn how Ultracomp composite bearings promote improved dairy processing.

The TriStar Advantage: Food-contact compliance and custom fabrication

Techtron® HPV PPS has the compression resistance and good mechanical strength to excel in this mold-making function. Techtron is an excellent alternative to aluminum and PEEK, and can resist most solvents. Our clients also like that it can be custom fabricated to tight tolerances.



Techtron® HPV PPS in Specialty Molds

Challenge:

A major manufacturer of customized packaging contacted us for a new mold material to replace their failing aluminum molds. Their molds are used to compress and form special paperboard shipping containers to hold soups and other liquid foods. The aluminum molds they were using continually corroded from exposure to liquid spillover. The molds were also negatively impacted by the cleaning and sanitation chemicals our client used.

Solution:

Techtron HPV PPS combats corrosion better than stainless steel and aluminum, and was an ideal fit for this wet application. The material boasts good stability for mold-forming compression, without moisture pickup and with a low CLTE. The material also resists the harsh chemical cleaners and steam sterilizations required of a food environment.

Our client notes that Techtron HPV PPS has saved significantly over the cost of aluminum, and can hold liquids of all temperatures.

See page 14 for Techtron HPV PPS Design Criteria

The TriStar Advantage: Sanitation control in canning

Consumers have a clear preference for aluminum cans, as they are convenient, single-serve receptacles that can be easily recycled. TriStar is pleased to distribute Rulon® materials to the equipment manufacturers of one of the country's premier canning operations. With Rulon bearings on their equipment, the client has gained an edge in sanitation and decorative spraying applications. Rulon is considered the gold standard in bearing-grade materials, and can be formulated and produced to countless specifications.

Rulon® LR for Beverage Coatings

Challenge:

Our client provides canning equipment to many of the nation's top makers of aluminum beverage cans including one company which produces an average of 2.5 million cans a day. Their equipment includes high-speed systems used to apply sanitary coatings and decorative paints to the aluminum cans. The machines needed wear components that were capable of withstanding the loads and speeds of the application while also being compatible with the cleaning solutions and the coatings being applied to the cans.

Solution:

TriStar is the exclusive US distributor of Rulon materials, and boasts an inventory of over 300 different Rulon formulas. Our design experts knew that Rulon LR, a material with superior chemical inertness, plus a ceramic filler for better dielectric and thermal insulation, would excel in this unique wear application. Rulon LR also gives the best chemical resistance for mild-to-hardened steel shafting and counterfaces. Rulon LR has given consistent performance and exceeded our client's longevity and reliability expectations — without ever needing manual lubrication.

See page 15 for Rulon LR Design Criteria

The TriStar Advantage: At-the-source production in the field

At-the-source processing presents unique challenges for packaging equipment. While packagers covet the freshness and product-quality gains that can be obtained directly from the farm, extreme weather, dusty farm soil and other corrosives readily deteriorate metal bearings. Ultracomp bearings are able to resist these harsh agricultural conditions.

Ultracomp® 300 in Agricultural Tipping Bins

Challenge:

Our client sells equipment to the top agricultural companies, including harvesters who sort and bag apples right in the orchards. Their bulk-capacity tipping bins have a screen on either end, and are shaken and tilted to remove stems, leaves and other debris from the apples, before moving them to the hopper for bagging. The bronze bearings on the bins were insufficient for the extreme loads required of this application. Continual exposure to outdoor hazards such as rain and soil also caused the bearings to fail.

Solution:

Since moving to Ultracomp® 300 on the tipping bins, our client has increased their apple harvest production levels. Unlike bronze bushings, Ultracomp excels in the high-impact and high-vibration environment, without ever needing to be manually lubricated. Ultracomp bearings offer superior resistance to the detrimental effects of an outdoor agricultural processing and packaging environment.

Refer to Page 13 for Ultracomp Design Criteria

The TriStar Advantage: Custom-fabricated components for better rolling and sliding

Another at-the-source environment, factory ships have adopted Tivar® 1000 for its extreme toughness, excellent chemical resistance, low coefficient and near-zero moisture absorption. All of these attributes have helped our at-sea partner with their canning conveyor systems.

Tivar® 1000 in Canning Belts

Challenge:

All canning operations require smooth sliding elements for better production, but canning conveyors at sea face additional challenges. A major seafood processing ship approached our team when their conveyor belts would no longer roll and slide consistently. The belts were not lasting per design specifications, and caused gaps in production, which was an unacceptable delay given tight shipping deadlines.

Solution:

Our design experts constructed conveyor belts made of Tivar® 1000, a polymer material with exceptional sliding properties and high wear resistance. Boasting good strength and temperature range, Tivar 1000 also has excellent resistance to moisture; an important feature in a seafood processing environment. With Tivar 1000 on the conveyors, sanitation wash down procedures are easy to maintain without the fear of corrosion.

Our clients depend on Tivar 1000 to expedite their conveyor lines for improved canning production.

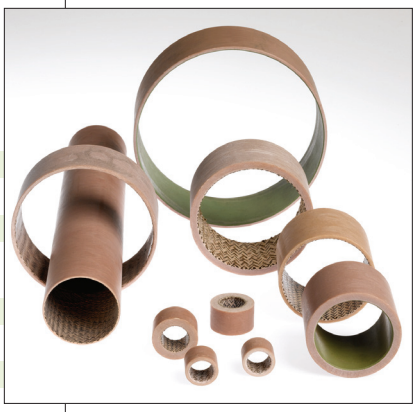
Refer to Page 16 for Tivar 1000 Design Criteria

The TriStar Advantage: Leading the way to enhanced packaging production and better revenues

Food packages — with their wide range of options, sizes and densities — will continue to evolve given fickle consumer tastes and changing market trends. But the makers of food packaging equipment will always strive to help their manufacturing partners achieve production gains. TriStar's line of strong, non-corrosive, and cost-effective self-lubricating bearings will help lead the way to that savings — for the manufacturer, for the retailer, and for the consumer.

Experience the TriStar Advantage to see how installing polymer and composite bearings on your equipment can help increase your production rates, and your revenues. And we invite you to download our other food industry paper – Purity and Production in Food Processing to learn about engineered bearings in the dairy, poultry, and bakery industries.

CJ Design Criteria

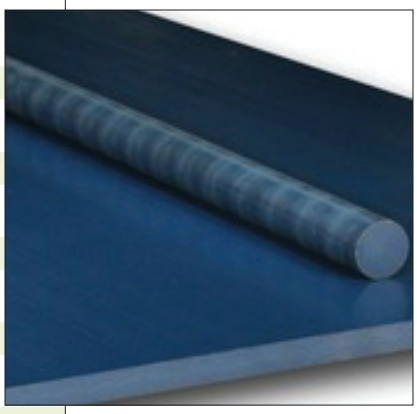


Properties		CJ	FCJ
Maximum Pressure (P)			
(static)	psi	35,000 (1)	20,000
	MPa	241	138
(dynamic)	psi	20,000	20,000
	MPa	140	140
Maximum Velocity			
(V)	ft/min	150	500
(no load)	m/sec.	76	2.54
Lubrication		No	No
Temperature	°F	-320/+300	-320/+300
— Typical Range	°C	-195/+149	-195/+149
Shaft Hardness		Rc 50	Rb 25
— Minimum, Rockwell Scale			
Shaft Finish		8-16	8-16
Recommended			
Ra (Microinches)			
Shaft Material		Steel	Steel
Coefficient of Friction		.02 – .25	.01 – .20
(Static/Dynamic Range)			
Water Absorption		< .5%	< .5%
(ASTM D570)			
Corrosion Resistance		Excellent	Excellent
Linear Coefficient of	in/in/°F	7×10^{-6}	7×10^{-6}
Thermal Expansion	cm/cm/°C	13×10^{-6}	13×10^{-6}
(ASTM D696)			
78°F to 300°			
F26°C to 149°C			

Ultracomp® Design Criteria

Property	Units	UC200/200FR	UC300	UC400	UC500
Specific Gravity	g/cc	1.35	1.35	1.32	1.35
Tensile Strength	psi	17,500	17,500	9,500	17,500
Elongation	%	26	26	26	26
Compressive Strength					
Perpendicular to Laminate					
Yield	psi	18,500	14,000	16,000	18,000
Ultimate	psi	54,400	45,000	52,000	50,000
Modulus	psi	750,000	650,000	730,000	750,000
Impact Strength - Notched	ft-lbs/in.	> 20	> 20	> 20	> 20
Flexural Strength	psi	13,500	14,000	13,000	13,500
Operating Temperature					
Minimum	_	Cryogenic	Cryogenic	Cryogenic	Cryogenic
Maximum - Continuous	°F	266	266	335	335
Maximum - Short Term	°F	360	360	360	360
Coefficient of Friction – Dry	_	0.15	0.08	0.12	0.15
Water Absorption- 24 hour saturation	%	< 0.1	< 0.1	< 0.1	< 0.1ngs

Techtron® HPV PPS Design Criteria



Specific Gravity, 73°F	1.43	
Tensile Strength @ Yield, 73°F	10,900	psi
Tensile Modulus of Elasticity, 73°F	540,000	psi
Tensile Elongation (at break), 73°F	5	%
Flexural Strength, 73°F	17,500	psi
Flexural Modulus of Elasticity	535,000	psi
Shear Strength, 73°F	9,000	psi
Compressive Strength 10% Deformation	21,000	psi
Compressive Modulus of Elasticity, 73°F	430,000	psi
Hardness, Durometer (Shore "D" scale)	85	
Hardness, Rockwell (Scale as noted)	M84, R125	
Izod Impact, Notched @ 73°F	1.4	ft.lbs./in. of notch
Coefficient of Friction (Dry vs Steel) Dynamic	.16	
Maximum Static Bearing Load (P)	1500	psi
Maximum Unlubricated No Load Bearing Velocity (V)	400	ft/minute
Maximum Limiting PV (Unlubricated)	17,000	psi x ft/min.
Wear Factor "K"x 10^{-10}	85	Cubic in.-min/ft.lbs.hr.
Coefficient of Linear Thermal Expansion	3.3	in/in/ °F x 10^{-5}
Heat Deflection Temperature 264 psi	240	°F
Embrittlement Temperature	-320	°F Min.
Continuous Service Temperature in Air	430	°F Max.
Melting Point (Crystaline Peak)	536	°F
Thermal Conductivity	2.1	BTU-in/(hr/ft^2 °F)
Dielectric Strength Short Term	500	Volts/mil
Volume Resistivity	10e + 014	ohm-cm
Surface Resistivity	10e + 013	ohm-cm
Dielectric Constant, 10^6 Hz	3.0	
Dissipation Factor, 10^6 Hz	.0013	
Flammability @ 3.1mm (1/8 in.) UL 94	V-0	
Water Absorption, Immersion 24 Hours	.01	%
Water Absorption, Immersion Saturation	.03	%
Machinability Rating	3	1 = easy, 10 = difficult
Rod Diameter Availability (Off the Shelf)	.236 - 3.94	inches
Sheet Thickness Availability (Off the Shelf)	.315 - 1.97	inches

Rulon® LR Design Criteria

Specific Gravity, 73°F	2.27	
Tensile Strength @ Yield, 73°F	1,500	psi
Tensile Modulus of Elasticity, 73°F	200,000	psi
Tensile Elongation (at break), 73°F	150	%
Flexural Strength, 73°F	700	psi
Flexural Modulus of Elasticity	110,000	psi
Compressive Strength 10% Deformation	1,800	psi
Deformation Under Load	3.0	%
Hardness, Durometer (Shore “D” scale)	65	
Izod Impact, Notched @ 73°F	6.0	ft.lbs./in. of notch
Coefficient of Friction (Dry vs Steel) Static	0.1	
Maximum Static Bearing Load (P)	1000	psi
Maximum Unlubricated No Load Bearing Velocity (V)	400	ft/minute
Maximum Limiting PV (Unlubricated)	10000	psi x ft/min.
Minimum Mating Surface Hardness	C-35 (327)	Rockwell (Brinnell)
Coefficient of Thermal Expansion // to Laminates	8.2	in/in/ °F x 10^{-5}
Coefficient of Thermal Expansion I to Laminates	8.7	in/in/ °F x 10^{-5}
Heat Deflection Temperature 264 psi	240	°F
Embrittlement Temperature	-400	°F Min.
Continuous Service Temperature in Air	550	°F Max.
Short Term Service Temperature	600	°F Max.
Dielectric Strength Short Term	400	Volts/mil
Volume Resistivity	1e + 015	ohm-cm
Surface Resistivity	2e + 013 >	ohm-cm
Dielectric Constant, 106 Hz	2.5	
Dissipation Factor, 106 Hz	0.001 to 0.004	
Arc Resistance	180 to 240	seconds
Water Absorption, Immersion 24 Hours	nil	%
Water Absorption, Immersion Saturation	nil	%
Machinability Rating	3	1 = easy, 10 = difficult

Tivar® 1000 Design Criteria

Specific Gravity, 73°F		.94
Tensile Strength @ Yield, 73°F	5,800 - 6,000	psi
Tensile Modulus of Elasticity, 73°F	73,000	psi
Tensile Elongation (at break), 73°F	4,600-6,800	%
Flexural Strength, 73°F	3,500	psi
Flexural Modulus of Elasticity	100,000-150,000	psi
Shear Strength, 73°F	4,800	psi
Compressive Strength 10%	3,000	psi
Deformation		
Compressive Modulus of Elasticity, 73°F	80,000	psi
Hardness, Durometer (Shore "D" scale)	63 - 68	
Hardness, Rockwell (Scale as noted)	R-67	
Izod Impact, Notched @ 73°F	No Break	ft.lbs./in. of notch
Coefficient of Friction (Dry vs Steel) Static	.2-.25	
Coefficient of Friction (Dry vs Steel) Dynamic	.14-.19	
Maximum Static Bearing Load (P)	800	psi
Maximum Unlubricated No Load Bearing Velocity (V)	50	ft/minute
Maximum Limiting PV (Unlubricated)	1000	psi x ft/min.
Sand Wheel Wear/Abrasion Test	100	UHMW = 100
Coefficient of Linear Thermal Expansion	11	in/in/ °F x 10^{-5}
Embrittlement Temperature	-350	°F Min.
Continuous Service Temperature in Air	180	°F Max.
Short Term Service Temperature	180	°F Max.
Melting Point (Crystaline Peak)	280	°F
Dielectric Strength Short Term	2,300	Volts/mil
Volume Resistivity	5e + 014	ohm-cm
Surface Resistivity	10E17	ohm-cm
Water Absorption, Immersion 24 Hours	nil	%
Water Absorption, Immersion Saturation	nil	%
Rod Diameter Availability (Off the Shelf)	1/4 Thru 10	inches
Sheet Thickness Availability (Off the Shelf)	.005 Thru 7	inches