



MOVE IT SAFELY

**PACKAGING SOLUTIONS
FOR IMPROVED LOAD STABILITY**

Introduction

Welcome to Dow's **Move it Safely** Book, your reference for industrial and consumer packaging solutions for a wide range of applications. Dow's portfolio of packaging resins and adhesives has been developed to meet the needs of an evolving society and food supply chain, where goods need to travel longer distances and where globalization is increasingly requiring safer, cheaper and more sustainable transport solutions. Our ultimate goal is to ensure that goods are safely transported along the supply chain to the end consumer by improving pallet load stability.

Contents:

- **Why Does Load Stability Matter?**
- **Pallet Unitization**
- **Goods Safely Packed**

We hope you will find this **Move it Safely** Book a helpful reference tool.

1. WHY DOES LOAD STABILITY MATTER?

2. PALLET UNITIZATION

Stretch Film

Stretch Hood

3. GOODS SAFELY PACKED

Collation Shrink

Heavy Duty Shipping Sacks

Adhesives Solutions

Why Does Load Stability Matter?

In 2014, **14 billion tons** of goods were transported by road in Europe¹. Of these, approximately 4% (560 million tons) is estimated to have been lost or damaged during transportation – the equivalent of **373 million pallets** of goods.

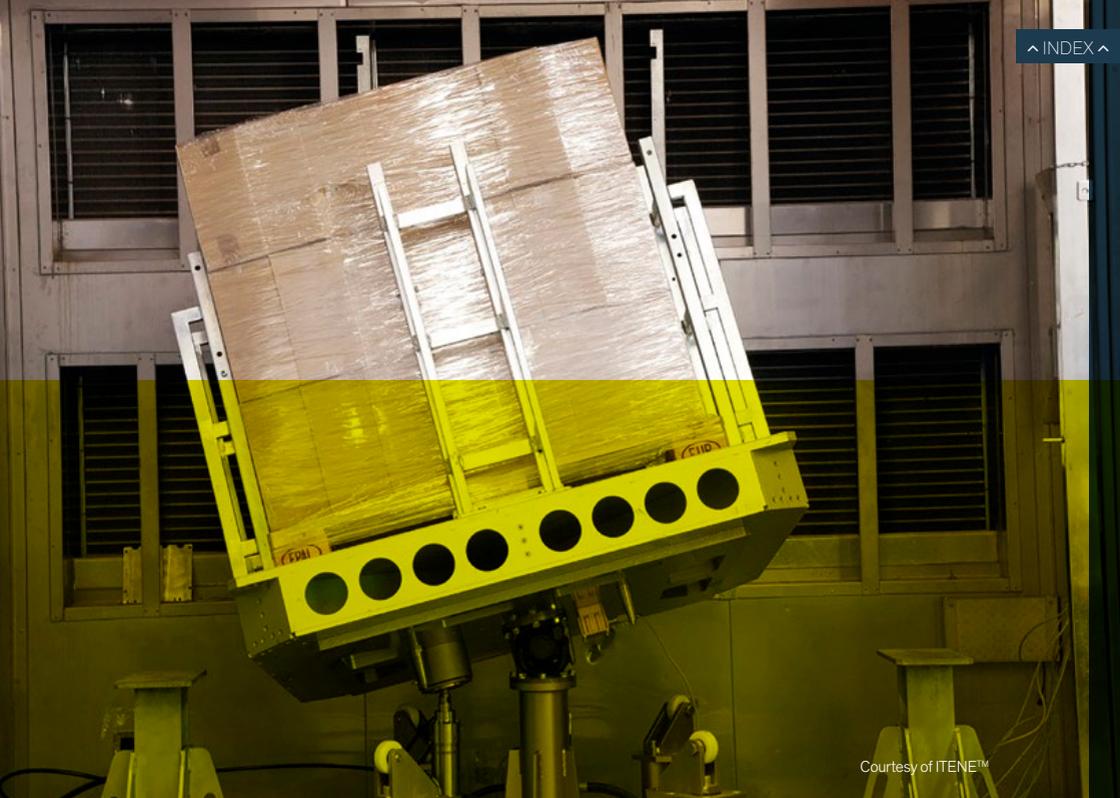
The bulk of transport activity falls between 150 and 1,000 km (58%), with very long distances of more than 1,000 km recording a significant increase since 2011 (+4.8 %).

This trend is driven by a globalized economy, societal changes and growing e-commerce, requiring not only more goods to be shipped, but also for those goods to travel longer distances.

By 2050 it is estimated there will be an **80% increase in freight transportation** compared to 2005². With this, transportation and regulatory requirements will increase, calling for safer, cheaper and more sustainable transport solutions.

¹ Eurostat: Road freight transport statistics 2014

² http://ec.europa.eu/transport/themes/strategies/doc/2011_white_paper/white_paper_2011_ia_full_en.pdf



Courtesy of ITENE™

With the increase in freight transport distances and the sometimes difficult road conditions, load security is a major challenge for the supply chain and the freight industry, as cargo failures represent a major economic, safety and waste issue. In Europe, new load security requirements have recently been introduced to increase people's safety, whilst minimizing product damage³.

Retailers, brand owners, logistic and shipping companies are today looking for solutions to help reduce the economic and safety impact of cargo failures and ensure goods arrive safely at their final destination.

The use of packaging solutions delivering high load stability, package integrity and durability, helps to improve pallet load stability and reduce cargo failures. It also improves safety for both people and goods, helps reduce waste, and ensures that food and other merchandise are protected and transported safely from the manufacturer to the end consumer.

³ European Standard EN12195-1 on cargo & load securing

Load Stability Benefits



IMPROVED HUMAN SAFETY

Improved Human Safety

It has been estimated that up to 25% of accidents involving trucks are caused by inadequate cargo securing⁴. By increasing the security of pallet loads, therefore, human safety will be improved due to a reduction in accidents.

Cost Benefits

A damaged product has a direct consequence on costs and brand reputation. The cost of replacing a damaged product can be up to 17 times the cost of shipping⁵, while the negative consumer experience resulting from a damaged good has a direct impact on brand reputation



COST BENEFITS

and future purchasing decisions. A study on the effects of damaged product on consumer preferences shows that 83% of those surveyed had received a package containing a damaged item in the past, with 75% indicating that they would unlikely purchase from that supplier again⁶.

By increasing pallet load stability, product damage and wastage during transportation is reduced, thereby decreasing the economic impact of cargo failures. There will also be a reduction in the cost incurred as a result of road accidents due to cargo failure, as well as damage and insurance costs.



ENHANCED SUSTAINABILITY

⁴ Extracted From European Agency for Safety and Health at Work (EU-OSHA)

^{5,6} <http://www.packworld.com/trends-and-issues/e-commerce/how-e-commerce-changing-packaging-landscape>

GREENHOUSE GAS REDUCTION BY **FILM DOWNGAUGING** FROM 20 TO 12 μ IS ENOUGH TO SAVE...

Data for 10 million sqm of film downgauged from 20 μ to 12 μ thick, on EU average values for cars and NA for houses



Enhanced Sustainability

By increasing pallet load stability, product spillage and wastage during transportation is avoided, thereby reducing the environmental impact of cargo failures.

Industrial packaging solutions based on Dow's high performance resins enable the required load stability by providing the right level of mechanical performance such as holding force and puncture resistance. Adhesives solutions for carton sealing tapes help ensure goods stay inside the boxes during transportation and arrive

safely to their destination. The improved load stability means all members of the value chain benefit from its positive environmental impact.

Dow's high performance solutions also allow film producers to downgauge films while maintaining the same level of technical performance. Thinner films help to reduce greenhouse gases generated during production and transportation, and impact directly upon the end of life: less waste, less film to recycle, less energy required and fewer fees to be paid.

What is Dow Doing to Improve Load Stability?

Value Chain Collaboration

Collaboration across the value chain is critical to enable the successful evaluation and improvement of packaging technologies and for the development of load stability solutions that meet industry requirements and regulatory standards.

Dow is a member of EUMOS, an association of experts focused on cargo transport safety, including packing, storage, loading and cargo securing. Its goal is to stimulate the development of new know-how, standards and test methods related to cargo transport safety.

Dow also works with certified testing institutes to ensure its resins contribute to

superior load stability. Pallets are tested to the limit and various external stresses are applied including vibration, acceleration, jolting, temperature and humidity, according to the regulation criteria.

Advanced Load Stability Solutions

In the following pages you will discover Dow's comprehensive portfolio of packaging resins and adhesives solutions. These will help you to achieve improved load stability, helping your customers to reduce the economic and safety impact of cargo failures and ensure their goods arrive safely at their final destination.

2



Pallet Unitization

2 | Pallet Unitization

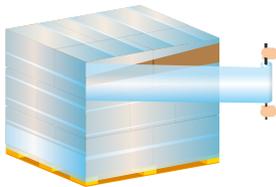


Stretch Film

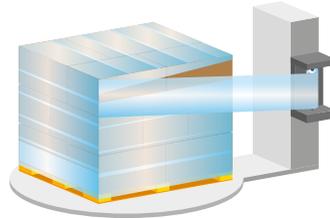
What Is Stretch Film?

Stretch film is highly stretchable plastic film that can be wrapped around items to unitize pallet loads and facilitates goods' transportation.

Packages can be wrapped until the desired cargo stability is achieved, either by hand or machines.

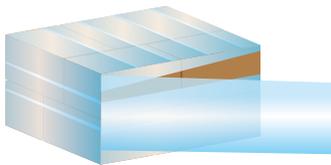


Manual wrap

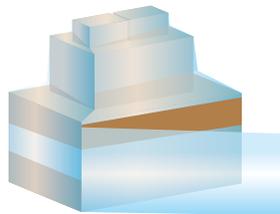


Machine wrap

Stretch film technology enables wrapping regular and irregular shaped goods and offers the lowest packaging cost per unit.



Regular-shaped goods



Irregular-shaped goods

Benefits of Stretch Film throughout the Value Chain

Whatever the type of film – from hand to machine, from medium to high stretch – Dow's broad portfolio of high performance resins gives converters, packers, logistics experts and brand owners the competitive edge.

FILM CONVERTER

Efficient and cost competitive film production

- Improved sustainability from downgauging potential maximizes material savings and reduces energy consumption
- High output application with high holding force
- Consistent cling quality and mechanical properties to answer market needs
- Tailored solutions for manual or machine wrapping
- Big market: over 1 million tonnes/year in Europe and growing at higher rate than GDP
- Formulation can be tailored to specific needs, achieving film gauge optimization



PACKER

Efficient and cost competitive packing

- Packaging speed up to 180 pallets/hour for fully automated machines and 100-150 pallets/hour for semi-automated machines
- Can be tailored to specific needs, achieving film weight optimization
- Applicable for irregular shaped goods
- Flexible technology: manual or machine
- High holding force and tear and puncture resistance
- Low noise



BRAND OWNER
Goods safely transported

- Broadly used in the beverage industry as it provides strong holding force for all types of product
- High tear and puncture resistance for improved safety of goods
- Applicable for irregular shaped goods
- Stretch level and film performance can be tailored to specific needs, achieving film weight optimization
- Enables reduction of other packaging elements such as carton – cost effective solution



LOGISTICS EXPERT
Reduction of wasted goods due to packaging failure

- High holding force, high puncture and tear resistance for edge and corner stability
- Can be tailored to specific application needs, achieving film weight optimization
- Reduction of injuries from packaging failure
- Low noise



Stretch Film | Machine Films

Applications

1. STANDARD PERFORMANCE FILMS

- 17-23 μm
- 150% to 200% stretch
- For semi-automatic/standard wrapping, and lower rate of pallets packed/hour

2. MEDIUM TO HIGH PERFORMANCE FILMS

- 15-23 μm
- 200% to 250% stretch
- High packaging rate of pallets packed /hour

3. HIGH PERFORMANCE FILMS

- 12-20 μm
- Over 250% to 350% stretch
- Highest wrapping speed and rate of pallets packed/hour

Dow Toolbox for Stretch Film



Affinity
Superior cling performance

Elite
Enhanced stretch and mechanical behavior

Elite AT
Improved performance for downgauging

Innate
precision packaging resins

Attane
Cling performance

LDPE
Extrusion processing

Dowlex
Slip behavior (MDPE)
Stretch and mechanical behavior



Dow's Toolbox Concept has been designed to expand the potential of polyethylene films, advance your business and ultimately enable every member of the value chain to reap the benefits.

With an extensive line of suitable and innovative polyolefin resins, Dow can help Stretch Film converters create differentiated film structures that yield excellent fabrication and application performance.

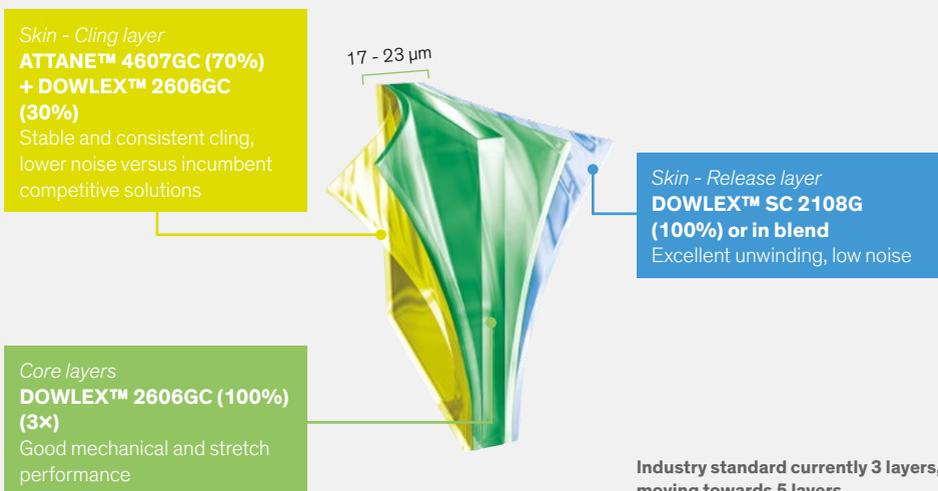
Standard Performance Films

17-23 μm , 150% to 200% stretch

CAST

Layer	Toolbox	Density, g/cm^3 & MI, dg/min	Layer formulation
Skin - Cling	ATTANE™ 4607GC	0.904 / 4.0	Blend, 50-70% with core layer resin
Skin - Release	DOWLEX™ SC 2108G	0.935 / 2.7	Pure or blend with core layer resin
Core layer options	DOWLEX™ 2606GC	0.920 / 4.0	Pure
	DOWLEX™ 2607GC	0.918 / 2.3	Pure

ZOOM ZONE



BLOWN

Layer	Toolbox	Density, g/cm ³ & MI, dg/min	Layer formulation
Skin - Cling	AFFINITY™ EG 8100G	0.870 / 1.0	Pure
Skin - Release	DOWLEX™ 2645G	0.920 / 1.0	Pure or blend
Core layer option	DOWLEX™ 2645G	0.920 / 1.0	Pure

ZOOM ZONE



Medium to High Performance Films

15-23 μm , 200% to 250% stretch

CAST

Layer	Toolbox	Density, g/cm^3 & MI, dg/min	Layer formulation
Skin - Cling	ATTANE™ 4607GC	0.904 / 4.0	Blend, 50-70% with core layer resin
Skin - Release	DOWLEX™ SC 2108G	0.935 / 2.7	Pure or blend with core layer resin
Core layer options	DOWLEX™ 2107GC	0.917 / 2.3	Pure
	DOWLEX™ 2106GC	0.917 / 3.3	Pure
	DOWLEX™ 2111GC	0.920 / 3.7	Pure

ZOOM ZONE

Skin - Cling layer
ATTANE™ 4607GC (70%) + DOWLEX™ 2111GC (30%)
 Stable and consistent cling, lower noise versus incumbent competitive solutions

15 - 23 μm

Skin - Release layer
DOWLEX™ SC 2108G (100%) or in blend
 Excellent unwinding, low noise

Core layers
DOWLEX™ 2111GC (100%) (3x)
 Higher stretch performance, good mechanical performance

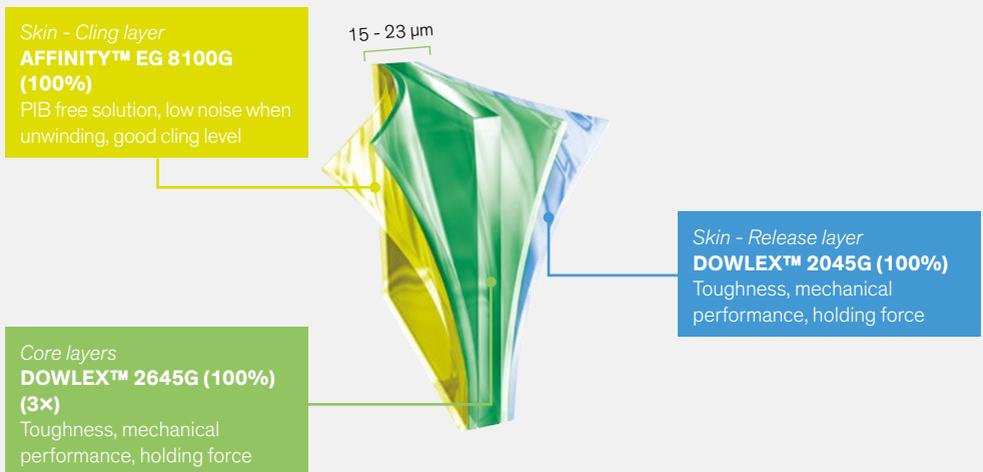
Coextruded film formulated with Dow resins offer 30% higher puncture resistance and 25% higher stretch force and puncture elongation. See graph 1 on page 25.

Industry standard currently 3 layers, moving towards 5 layers

BLOWN

Layer	Toolbox	Density, g/cm ³ & MI, dg/min	Layer formulation
Skin - Cling	AFFINITY™ EG 8100G	0.870 / 1.0	Pure
Skin - Release	DOWLEX™ 2045G	0.920 / 1.0	Pure or blend
Core layer option	DOWLEX™ 2045G	0.920 / 1.0	Pure

ZOOM ZONE



High Performance Films

Below 15 μm , over 250% stretch

CAST

Layer	Toolbox	Density, g/cm ³ & MI, dg/min	Layer formulation
Skin - Cling	ATTANE™ 4607GC	0.904 / 4.0	Blend, 50-70% with core layer resin
	AFFINITY™ KC 8852G	0.875 / 3.0	Blend, 20-30%
Skin - Release	DOWLEX™ SC 2108G	0.935 / 2.7	Pure or blend with core layer resin
Core layer options	ELITE™ 5230GC	0.917 / 4.0	Pure
	ELITE™ AT 6111	0.912 / 3.7	Pure

ZOOM ZONE

Co-extruded film formulated with Dow resins offer 20-25% better processability, 30-35% higher tear resistance and down-gauging potential to 17 μm without compromising performance. See graph 2 on page 25.

Skin - Cling layer

**ATTANE™ 4607GC (70%)
+ DOWLEX™ 2111GC (30%)**

Stable and consistent cling, lower noise versus incumbent competitive solutions

15 - 23 μm



Skin - Release layer

DOWLEX™ SC 2108G

Excellent unwinding, low noise

Core layers

**ELITE™ 5230GC (100%) (3x)
DOWLEX™ 2111 GC (100%) (2x)**

High mechanical performance and outstanding puncture resistance

Industry standard currently 5 to 7 layers, moving towards 9 layers, 11 layers extrusion capacity

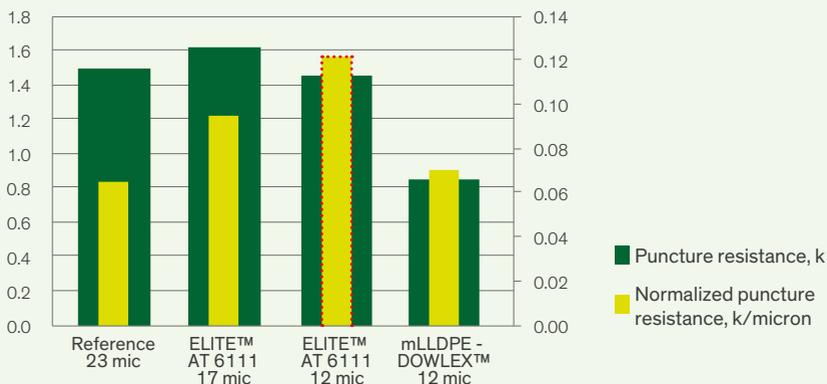
PRODUCT FOCUS

ELITE™ AT 6111 – Thin and High Power Cast Film

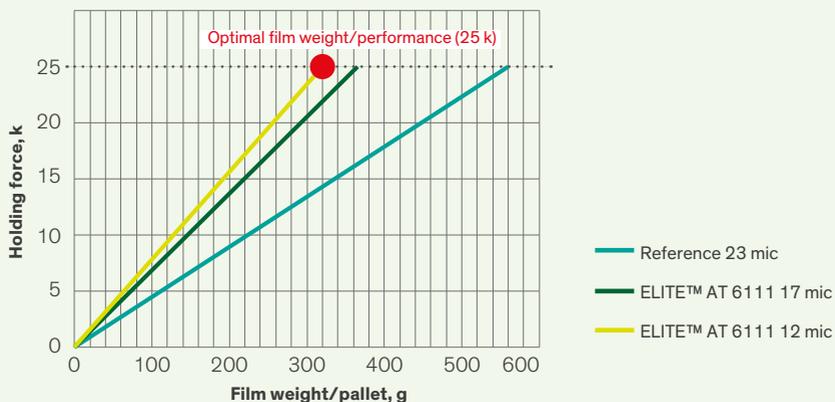


Outstanding puncture resistance and holding force for the optimal film weight/performance balance and load stability performance.

Puncture Resistance at 250%



Optimal Film Weight/Performance



For relative property comparison, see graph 3 on page 25.

k = Kilogram force
k/micron = Kilogram/film micron

Tilting Endurance Tests

Comparison of high performance and conventional films in tilting endurance tests

Tilting angle: 19 degrees

A: ELITE™ AT 6111 / 12 μ film

B: Conventional LLDPE / 23 μ film

Stretch wrap applied manually

After 16 hours, the pallet wrapped with a conventional film solution collapsed. The ELITE™ AT based film is still standing and perfectly holding the cargo!

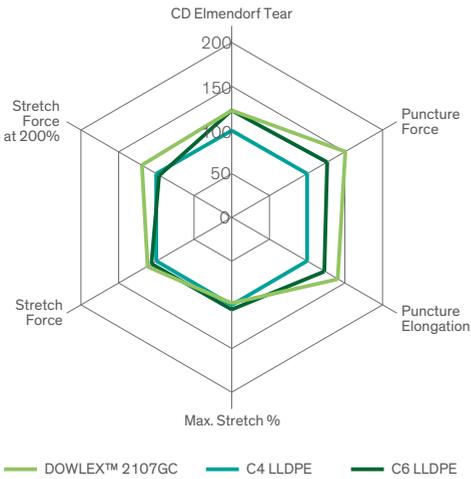
After 7 days, the pallet remained in its original position due to the strong holding force and superior performance of the ELITE™ AT based film!

**Outcome =
less flm AND greater load stability**

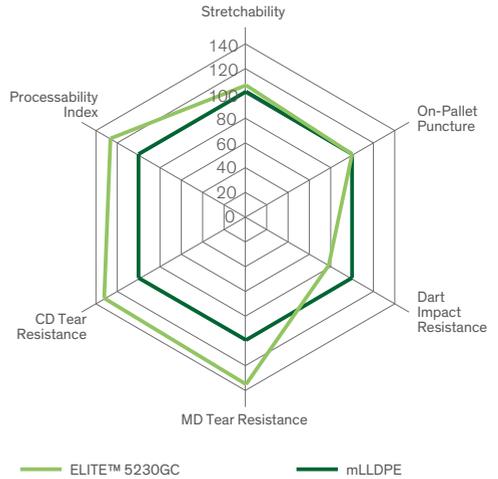


Technical Appendix

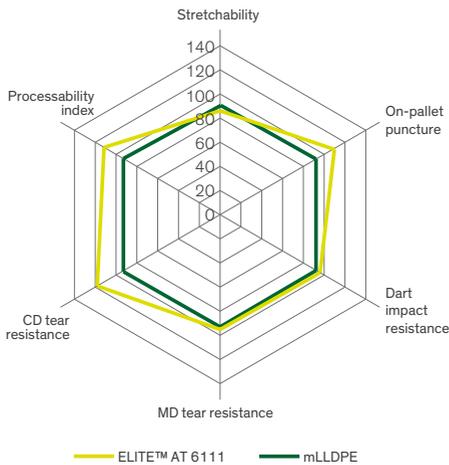
Graph 1. Medium to High Performance Films



Graph 2. High Performance Films



Graph 3. Relative Property Comparison
New ELITE™ AT 6111 vs mLLDPE





Stretch Film | Manual Films

Applications

1.

CONVENTIONAL FILMS

- 17-23 μm
- Max 50% stretch
- For repacking, retailing and distribution purposes, and irregular loads

2.

PRE-ORIENTED FILMS

- 7-10 μm
- Little stretch left
- For repacking, retailing and distribution purposes, and irregular loads

Conventional Films

17-23 μm , maximum 50% stretch

CAST

Layer	Toolbox	Density, g/cm^3 & MI, dg/min	Layer formulation
Skin - Cling	ATTANE™ 4607GC	0.904 / 4.0	Blend, 50-70% with core layer resin
Skin - Release	DOWLEX™ SC 2108G	0.935 / 2.7	Pure or blend
Core layer options	DOWLEX™ 2606GC	0.920 / 4.0	Pure
	DOWLEX™ 2607GC	0.918 / 2.3	Pure

ZOOM ZONE

Skin - Cling layer

**ATTANE™ 4607GC (70%)
+ DOWLEX™ 2606GC (30%)**

Stable and consistent cling,
lower noise versus incumbent
competitive solutions

17 - 23 μm



Skin - Release layer

**DOWLEX™ SC 2108G
(100%) or in blend**

Excellent unwinding, low noise

Core layer

DOWLEX™ 2606GC (100%)

Good mechanical and stretch
performance

BLOWN

Layer	Toolbox	Density, g/cm ³ & MI, dg/min	Layer formulation
Skin - Cling	AFFINITY™ EG 8100G	0.870 / 1.0	Pure
Skin - Release	DOWLEX™ 2645G	0.920 / 1.0	Pure or blend
Core layer options	DOWLEX™ 2645G	0.920 / 1.0	Pure
	DOWLEX™ 2045G	0.920 / 1.0	Pure

ZOOM ZONE



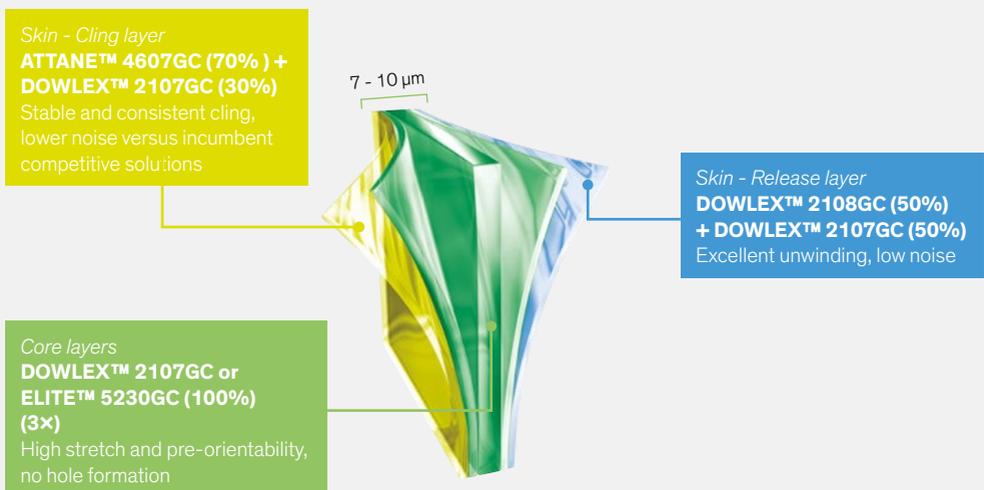
Pre-oriented Films

7-10 μm , little stretch left

CAST

Layer	Toolbox	Density, g/cm^3 & MI, dg/min	Layer formulation
Skin - Cling	ATTANE™ 4607GC	0.904 / 4.0	Blend, 50-70% with core layer resin
Skin - Release	DOWLEX™ SC 2108G	0.935 / 2.7	Pure or blend with LDPE
Core layer options	DOWLEX™ 2107GC	0.917 / 2.3	Pure
	ELITE™ 5230GC	0.917 / 4.0	Pure

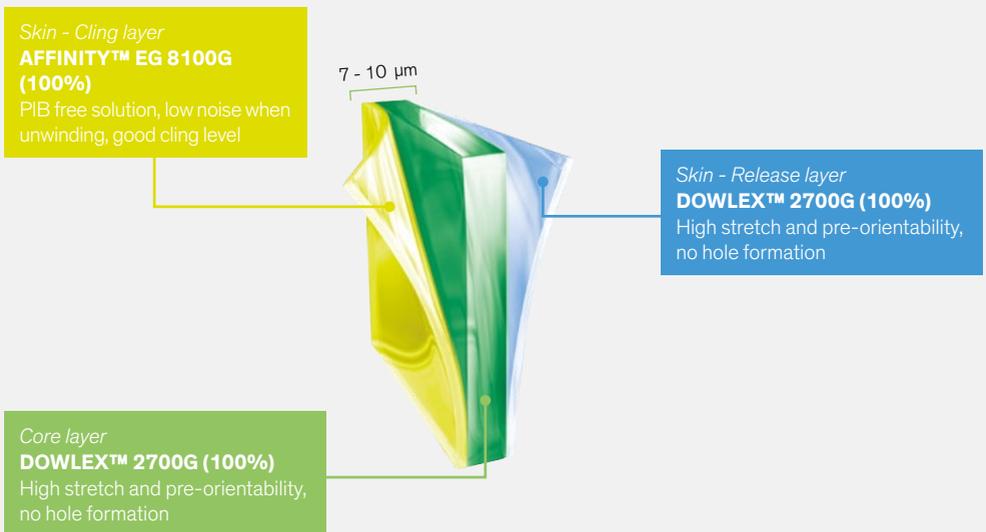
ZOOM ZONE



BLOWN

Layer	Toolbox	Density, g/cm ³ & MI, dg/min	Layer formulation
Skin - Cling	AFFINITY™ EG 8100G	0.870 / 1.0	Pure
Skin - Release	DOWLEX™ 2700G	0.918 / 1.0	Pure or blend with LDPE
Core layer option	DOWLEX™ 2700G	0.918 / 1.0	Pure

ZOOM ZONE



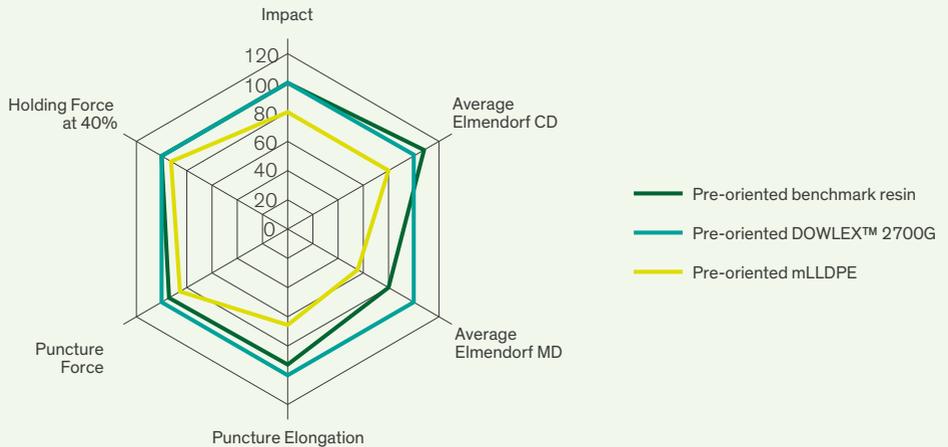
PRODUCT FOCUS

DOWLEX™ 2700G – The Most Advanced Resin for Pre-oriented Films



- Very easy orientability
- Less hole formation
- Superior mechanical properties when film is oriented

Pre-oriented Blown Film Comparison



Benefits of Pre-oriented Films over Conventional Manual Wrap

Applies to both cast and blown:

- **Outstanding mechanical performance:** puncture, tear resistance and holding force
- Significant improvement in yield per roll vs conventional manual films **at least 60% savings*!**
- **Reduced transportation cost**
- **Cling consistency**, no handling problems
- **Ease of application** for end user (no stretch force required)

* Comparing a 7 μm pre-oriented film to a 17 μm manual film stretched 50% becoming 12 μm after stretch



2 | Pallet Unitization

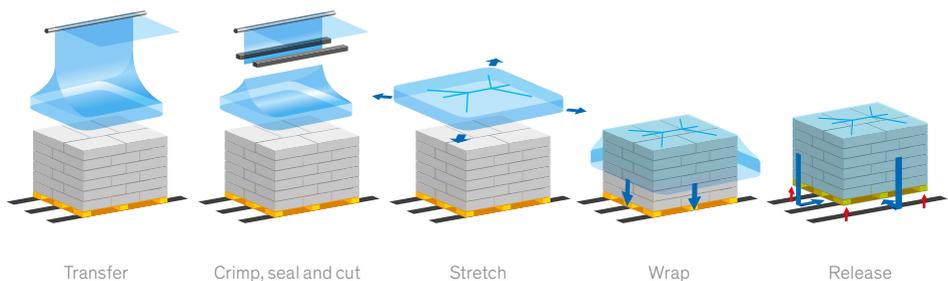


Stretch Hood

What Is Stretch Hood?

A Stretch Hood is a tube of film sealed on one end, which is stretched over a palletized load to secure the contents to the pallet.

This innovative technology can increase packaging efficiency and enable cost savings – in transport and logistics. It offers weather protection as well as excellent load aesthetics.



The film is cut to the appropriate length, heat sealed on the top end, and gathered on four 'fingers'. These fingers stretch the film in the horizontal (transverse) direction until the film dimensions are slightly larger than the load dimensions. The stretched film is then drawn down over the pallet,

unrolling and wrapping it as they go. By varying the unrolling rate, a degree of vertical (machine) direction stretch can be obtained to better hold the load on the pallet. At the bottom of the pallet, the fingers release the film, which typically wraps under the pallet bottom.

Benefits of Stretch Hood throughout the Value Chain

With an extensive line of suitable and innovative polyolefin resins, Dow can help stretch hood film converters create differentiated film structures that yield excellent fabrication and application performance. A broad range of defined solutions can be tailored to create custom film structures to address customers' specific performance requirements and needs.

FILM CONVERTER

Efficient and cost competitive film production

- Fast extrusion speed with best thickness tolerance
- Downgauge optimization 40-150 μm
- Lower weight solutions for higher yield per roll
- EVA free solution
- Single component optimization customized for end use



PACKER

Efficient and cost competitive packing

- Packing speed with up to 200 pallets/hour
- Elevated levels of elastic recovery for broad application range
- Technology applicable for pressure and temperature sensitive goods
- Lower energy consumption and maintenance cost compared to shrink hood technology



BRAND OWNER

Goods safely transported and brand promotion

- Excellent optical properties and high quality printing allowing constant brand recognition
- Tamper evident packaging (security)
- Technology applicable for pressure and temperature sensitive goods



LOGISTICS EXPERT

Reduction of wasted goods due to packaging failure

- Higher holding force, high puncture and tear resistance for edge and corner stability
- Reduction of injuries from packaging failure
- Five-sided weather and dirt protection
- Tamper evident packaging (security)
- Excellent optical properties allowing easy bar code reading



Stretch Hood

Applications

1.

LOW STRETCH LEVEL

- 40% stretch on machine when packing
- 20% final stretch
- For building materials, bricks, insulation panels

2.

MEDIUM STRETCH LEVEL

- 80% machine
- 60% final stretch
- For heavy duty shipping sacks

3.

HIGH STRETCH LEVEL

- > 80% machine
- 60% final stretch
- For irregular loads, beverages, appliances

Dow Toolbox for Stretch Hood

LDPE

Improved extrusion /
bubble stability

Elite AT

Remarkable elasticity-abuse
resistance balance

Attane

Good elasticity / excellent
abuse resistance

Dowlex

COF control and excellent
tear resistance

VERSIFY

PLASTOMERS AND ELASTOMERS





Dow's Toolbox Concept has been designed to expand the potential of polyethylene films, advance your business and ultimately enable every member of the value chain to reap the benefits.

With an extensive line of suitable and innovative polyolefin resins, Dow can help Stretch Hood film converters create differentiated film structures that yield excellent fabrication and application performance.

Stretch Hood Toolbox

A Full Portfolio of Solutions

Skins		
DOWLEX™ 2645G/2045G	mC6⁽¹⁾ (1.0g/0.918)	XZ89499

BRAND POSITIONING AND RECOGNITION

Optical properties – see-through	✓	✓	✓✓
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PROCESS IMPROVEMENTS ALONG THE VALUE CHAIN

Film extrusion speed & bubble stability ⁽²⁾	✓	✓	✓✓
Elastic recovery for improved packing speed			
Stretch level	✓✓	✓✓	✓✓✓

FEWER GOODS WASTED DUE TO PACKAGING FAILURE

Tear and puncture resistance	✓	✓	✓✓
Holding force			

✓ = lowest performance, ✓✓✓ = highest performance

⁽¹⁾ not part of Dow offering

⁽²⁾ If LDPE needed, we recommend DOW™ LDPE 310E & 150E

⁽³⁾ The level of stretch-ability can be increased with the use of VERSIFY™ 2300

A broad range of defined solutions can be **tailored to create custom film structures** to address specific performance requirements and needs.

Core			
	EVA free Solutions		
EVA based alternative ⁽¹⁾	ATTANE™ 4102	ELITE™ AT 6101 ⁽³⁾	XZ89507 ⁽³⁾
✓	✓	✓✓✓	✓✓✓
✓✓✓	✓	✓	✓✓
✓	✓✓	✓✓	✓✓✓
✓✓✓	✓	✓✓	✓✓✓
✓✓	✓	✓✓✓	✓✓
✓	✓✓✓	✓✓✓	✓✓

PRODUCT FOCUS – Skin layers

XZ89499

Benefits across the value chain

XZ89499 resins offer excellent processing characteristics, including controlled melt temperatures and backpressures in extruders and therefore desirable bubble stability. XZ89499 features excellent toughness, elastic recovery, and optics – all of which are important properties and requirements for Stretch Hood applications.



I AM A CONVERTER

How does XZ89499 meet my cost improvement demands?

- XZ89499 enables ease of extrusion thanks to lower extrusion temperature and pressure
- XZ89499 enables tailored solutions and multiple film design options

For processability and efficiency advantages of XZ89499, see graph 1 on page 46.



I AM A PACKER

Why would I recommend people to use XZ89499 on my machines? How does XZ89499 perform when it comes to packaging speed versus other alternatives?

- XZ89499 reduces blocking of the Stretch hoods for fast and improved processability for fully automated machines that produce less damage and have a higher packaging integrity
- XZ89499 enables low seal temperature for high speed packaging lines
- XZ89499 leads to more flexible Stretch hoods which allows faster and more reliable packing

For performance advantages of XZ89499, see graph 2 on page 46.



I AM A BRAND OWNER

How can XZ89499 help me reduce goods waste? Can XZ89499 help me promoting my products?

- XZ89499 offers improved mechanical properties for reducing the failure of packaging during handling and transport
- XZ89499 improves the optical properties of the Stretch Hoods such as see-through and overall presentation of the goods packed

For performance advantages of XZ89499 with LDPE, see graph 3 on page 46.

PRODUCT FOCUS – Core layer

ELITE™ AT 6101 & XZ89507

Benefits across the value chain



ELITE™ AT 6101 & XZ89507 resin feature excellent toughness, elastic recovery, holding force, optics and ease of processing – all of which are important properties and requirements for stretch hood applications.



I AM A CONVERTER

How does ELITE™ AT meet my downgauging demands?

- ELITE™ AT offers material saving up to 3.5%
- ELITE™ AT enables ease of extrusion of VA-free solution at industry-like high output
- Dow's offering enables tailored solutions and multiple film design options

For processability advantages of ELITE™ AT, see graph 4 on page 46.



I AM A PACKER

Why would I recommend people to use ELITE™ AT on my machines?

- Elite AT 6101 provides improved load stability due to 20% higher holding force than EVA film
- ELITE™ AT 6101 & XZ89507 can be used in a broad range of application with fully automated machines where a low level of damages and a high packaging integrity are required
- XZ89507 enables better performance even at low temperatures

For efficiency advantages of ELITE™ AT, see graph 5 on page 47.



I AM A BRAND OWNER

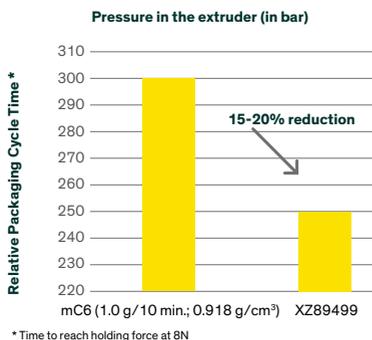
How can ELITE™ AT & XZ89507 help me improve my product positioning? Can Dow help me reduce damaged goods even in extreme temperatures?

- ELITE™ AT 6101 & XZ89507 enable superior optical properties and transparency for a better product recognition and presentation
- ELITE™ AT & XZ89507 enable improved load stability thanks to an improved holding force and offer the right balance on toughness to reduce film failures during handling and transport
- ELITE™ AT enables application flexibility and facilitates global supply chains

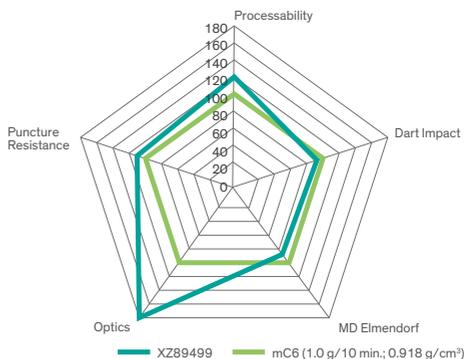
For performance advantages of ELITE™ AT, see graph 6 on page 47.

Technical Appendix

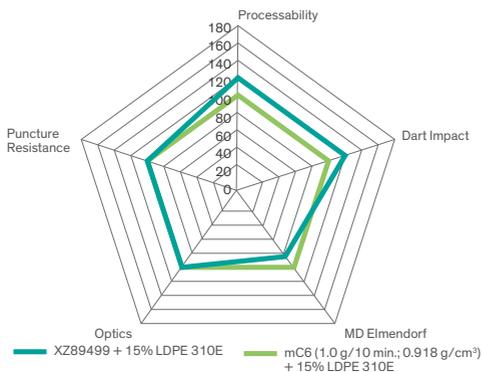
Graph 1. Processability and efficiency advantages of XZ89499



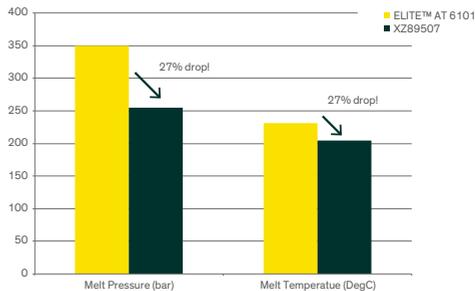
Graph 2. Performance advantages of XZ89499



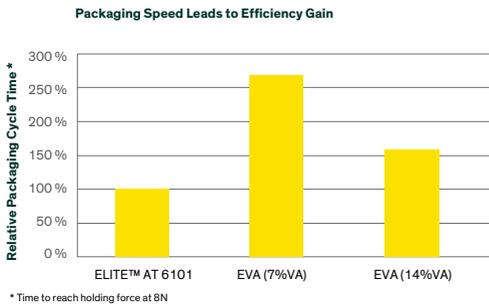
Graph 3. Performance advantages of XZ89499 with LDPE



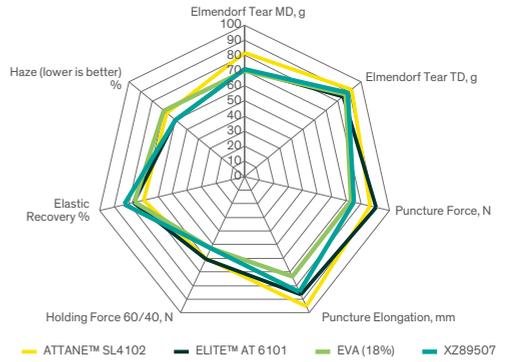
Graph 4. Processability advantages of ELITE™ AT



Graph 5. Efficiency advantages of ELITE™ AT



Graph 6. Performance advantages of ELITE™ AT



3



Goods Safely Packed

3 | Goods Safely Packed

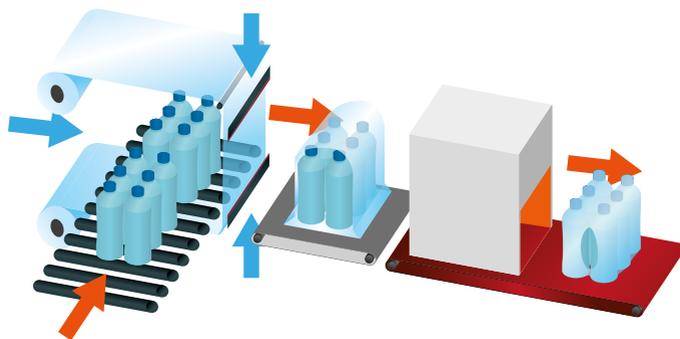


Collation Shrink

What Is Collation Shrink?

Collation shrink films are applied loosely around items and shrink tightly with heat. They bundle together objects such as beverage bottles, food cans, health and beauty products, and household items.

Collation Shrink is a versatile means of packaging and can be used in different forms: transparent or coloured, with or without printing and with different film thicknesses vary from 20 to 150 μm . Premium collation shrink films offer remarkable shelf appeal.



1. The individual goods (bottles, cans, cartons, etc.) are put together to multipacks which are ready to be wrapped.
2. The multipack is enveloped in a shrink film.
3. It then passes through a heated shrink tunnel, causing the film to shrink tightly and neatly around the pack.
4. The shrink wrapped multipack exits the shrink tunnel, cools and is ready for handling.

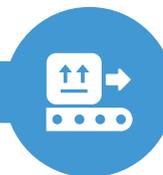
Benefits of Collation Shrink throughout the Value Chain

Dow resin formulations for multilayer premium collation shrink film applications are designed to help brand owners create high shelf-appeal, and offer fantastic opportunities for film converters to design a film that helps suit a specific application.

FILM CONVERTER

Efficient and cost competitive film production

- Trend for improved manufacturing output during extrusion while maintaining optimum thickness tolerance
- Continuous drive to downgauge films own gauge optimization 40 μm for 3-layer structures or 30 μm for 5-layer structures
- Products with high versatility for broader use in different formulations and package formats



PACKER

Efficient and cost competitive packing

- Trend for high speed packing machines
- Homogeneous shrinking behavior in both directions
- Applicable for a broad range of products and formats



BRAND OWNER

Goods safely transported and brand promotion

- High quality printing and glossy appearance allowing constant brand recognition and promotion
- High quality appearance after shrinking – no wrinkles and uniform bullseyes
- Balanced tear resistance for easy opening and portioning of the pack
- Tamper evident packaging (security)



LOGISTICS EXPERT

Reduction of wasted goods due to packaging failure

- Low creep resistance & high shrink force to ensure pallet and load stability
- High puncture for edge and corner stability
- Weather and dirt protection – improved storage time
- Tamper evident packaging (security)
- High quality printing allowing easy bar code reading



Collation Shrink

Applications

**1.
STANDARD COLLATION
SHRINK**

**2.
PREMIUM COLLATION
SHRINK – 3 LAYERS**

**3.
PREMIUM COLLATION
SHRINK – 5 LAYERS**

Dow Toolbox for Collation Shrink

Dowlex
COF control and excellent tear resistance

LDPE
Improved extrusion / bubble stability

Elite
Remarkable elasticity-abuse resistance balance



Innate
precision packaging resins



Dow's Toolbox Concept has been designed to expand the potential of polyethylene films, advance your business and ultimately enable every member of the value chain to reap the benefits.

With an extensive line of suitable and innovative polyolefin resins, Dow can help Collation Shrink film converters create differentiated film structures that yield excellent fabrication and application performance.

Collation Shrink Toolbox

A Full Portfolio of Solutions

Core		
DOW™ LDPE 555E	HDPE ⁽¹⁾	ELITE™ 5940 ST

PROCESS IMPROVEMENTS ALONG THE VALUE CHAIN

Film thickness – downgauging	✓✓✓	✓✓	✓✓✓
------------------------------	-----	----	-----

FASTER PACKING SPEED

Film rigidity for fast film cutting	✓✓	✓✓✓	✓✓
Shrink performance	✓✓✓	✓	✓✓
Low COF			

FEWER GOODS WASTED DUE TO PACKAGING FAILURE

Film resistance & stiffness/toughness resistance	✓✓✓	✓	✓✓✓
--	-----	---	-----

BRAND POSITIONING & RECOGNITION

Optical properties – controllable design:			
Transparency/See-through and gloss	✓✓✓	✓	✓✓✓
Matt surface			
Printability			

✓ = lowest performance, ✓✓✓ = highest performance

⁽¹⁾ not part of Dow offering

⁽²⁾ can be offered with slip & anti block under DOWLEX™ 4056.01G

⁽³⁾ Innate helps to incorporate MDPE in the skin layers

A broad range of defined solutions can be **tailored to create custom film structures** to address specific performance requirements and needs.

Skins				
DOW™ LDPE 303E	DOW™ LDPE 320E	DOWLEX™ 4056G	DOWLEX™ 5066G	INNATE™
	✓	✓	✓✓	✓✓✓
	✓	✓✓	✓✓✓	✓✓✓✓ ⁽³⁾
✓✓✓	✓✓✓	✓✓	✓✓	✓✓
		✓✓ ⁽²⁾	✓✓	
	✓	✓	✓✓	✓✓✓
✓	✓✓	✓✓	✓	✓✓✓
			✓✓	
✓	✓✓	✓✓	✓✓	✓✓

PRODUCT FOCUS – Core layer

ELITE™ and DOW™ LDPE Benefits across the value chain

ELITE™ Enhanced Polyethylene Resins and DOW™ Low Density Polyethylene (LDPE) Resins offer excellent processing characteristics. The resins are designed to deliver top-level performance and enable you to tailor according to your exact packaging needs.



I AM A CONVERTER

How does the Dow Toolbox meet my downgauging demands and reduce my production costs?

The products from the Dow Toolbox:

- enable ease of extrusion through continuous drive to downgauge films optimization: 40 µm for 3-layer structures or 30 µm for 5-layer structures
- enable tailored solutions and multiple film designs

See drawing 1 on page 61 for the 3-layer film structure.



I AM A PACKER

Why would I recommend people to use products from the Dow Tool? How do Dow products perform when it comes to packaging speed versus alternatives?

The products from the Dow Toolbox:

- enable a fast & constant shrink behavior
- offer a low COF fast efficient packing process

See drawing 2 on page 61 for the 5-layer film structure.



I AM A BRAND OWNER

How can ELITE™ & DOW™ LDPE help me improve my product positioning? How can I increase my sales with a nice packaging appearance?

The products from the Dow Toolbox:

- enable improved optical performances such as see-through and high gloss, (further improved with the 5 layer structure)
- improve the brand position and recognition through improved printability

See graph 1 on page 61 for the advantages of 5- vs 3-layer films.

PRODUCT FOCUS – Skin layers

INNATE™

Benefits across the value chain

INNATE™ Precision Packaging Resins address some of today's more challenging packaging performance gaps with an unprecedented balance of toughness and stiffness in combination with excellent tear and puncture resistance, processing ease and improved sustainability profiles.



I AM A CONVERTER

How does Innate reduce my production costs?

INNATE™ from the Dow toolbox:

- offer cost savings versus incumbent technology through continuous drive to downgauge
- enable tailored solutions and multiple film designs

See drawing 3 on page 61 for the 3-layer film structure.



I AM A PACKER

Why would I recommend people to use products from the Dow Tool? How do Dow products perform when it comes to packaging speed versus alternatives?

INNATE™ from the dow toolbox:

- enable a fast & constant shrink behavior thanks to the increased amount of MDPE contained in the formulation.
- enable a tailoring of the Seal ability with “shrinkable” MDPE in the skins
- offers a higher stiffness because of the higher MDPE content in the core layer



I AM A BRAND OWNER

How can the Dow Toolbox help me reduce my environmental footprint by reducing damaged goods? How can I increase my sales with a nice packaging appearance?

INNATE™ from the Dow Toolbox:

- offers balanced properties between toughness in the skins and stiffness in the core for improved packaging performance and reduction of film failures during handling and transport
- improve the brand positioning of the product with reduction of wrinkles and improved see-through performance of the film

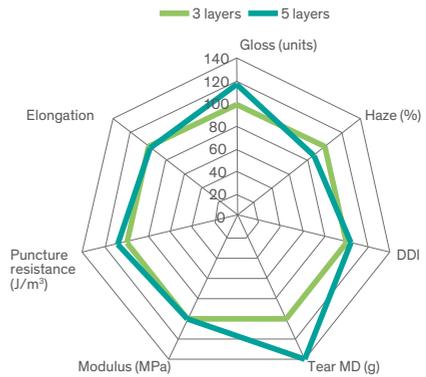
Technical Appendix

Drawing 1. 3-Layer Film Structure

A-B-A configuration with layer distribution
20/60/20%



Graph 1. Advantages of 5- vs 3-Layer Films



Drawing 2. 5-Layer Film Structure

A-B-C-B-D configuration with layer distribution
10/15/50/15/10%



Drawing 3. 3-Layer Film Structure

A-B-A configuration with layer distribution
20/60/20%



3 | Goods Safely Packed



Polyethylene Heavy Duty Shipping Sacks

What Are PE Heavy Duty Shipping Sacks?

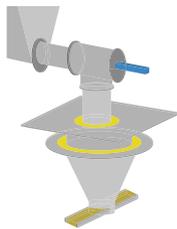
PE Heavy Duty Shipping Sacks are used for a broad range of applications in the food, chemical and pharmaceutical industries. They are a time- and cost-saving packaging solution and enable high product protection. For branding recognition, the bags can be printed for individual requirements.



Three different technologies are used for Polyethylene Heavy Duty Shipping Sacks:

Form, Fill and Seal packaging lines

The form fill sealing technology (FFS) is an automated assembly-line product packaging system. The plastic bags are assembled out of a flat roll. At the same time preformed bags are filled with powder and/or granule product and the filled bags are sealed.



Valve filling

The valve bags are placed on in-line spouts and filled to the desired weight; afterwards the filled bags are sealed.



Open mouth

The open mouth bags are closed on one side of the tube, either by sewing or by gluing. An automated machine fills the pre-formed bags to the desired weight; afterwards the filled bags are sealed.

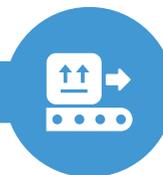
Benefits of PE HDSS throughout the Value Chain

Whether you are a converter, a packer, a logistics expert or a brand owner, Heavy Duty Shipping Sacks will offer you the competitive advantage you need.

FILM CONVERTER

Efficient and cost competitive film production

- Trend for improved manufacturing output during extrusion while maintaining optimum thickness tolerance
- Continuous drive for raw material source reduction by reducing film thickness to 100 μm or below



PACKER

Efficient and cost competitive packing

- Increase of high speed packing machines with speed up to 2,400 bags/hour
- Applicable for a broad range of products: granulated, grainy or powder form
- Broad seal performance window for optimum sealing quality



BRAND OWNER

Goods safely transported and brand promotion

- High quality printing and glossy appearance, allowing effective brand recognition
- Tamper evident packaging (security)



LOGISTICS EXPERT

Reduction of wasted goods due to packaging failure

- Exceptional creep resistance to ensure pallet stability
- High puncture and tear resistance for edge and corner stability
- Full weather and dirt protection
- Improved storage time
- Tamper evident packaging (security)
- High quality printing allowing easy bar code reading



PE Heavy Duty Shipping Sacks

Applications

1. FORM, FILL AND SEAL SACKS

Tubular & flat film – PE

- Agriculture: animal feeds, fertilizers, herbicides, pesticides
- Polymers: PE,PP, PS, synthetic rubber, PC, phenolic & melamine resins
- Chemicals: salts, polymer additives, detergents
- Food: pet food

2. VALVE SACKS

Pre-made sacks – PE/PP or paper

- Agriculture: animal feeds, seeds, fertilizers
- Polymers: suspension PVC
- Chemicals: carbon black, pharmaceuticals, pigments
- Food: fine powders, corn, dried milk, fish meal, flours
- Minerals: powders, clays, building materials

3. OPEN MOUTH SACKS

Tubular film or pre-made sacks – PE/PP or paper

- Agriculture: animal feeds, fertilizers, herbicides, pesticides
- Polymers: powdered PE, emulsion PVC & other polymer resins, master batch
- Chemicals: water softeners, soaps, salts, detergents, waxes
- Food: pet food, salts, vegetables, beans
- Minerals: abrasives, building materials, pet litter, gardening materials

Dow Toolbox for Heavy Duty Shipping Sacks

LDPE

Improved extrusion /
bubble stability

Elite™

Remarkable elasticity-abuse
resistance balance



Dowlex™

COF control and excellent
tear resistance

Innate™
precision packaging resins



Dow's Toolbox Concept has been designed to expand the potential of polyethylene films, advance your business and ultimately enable every member of the value chain to reap the benefits.

With an extensive line of suitable and innovative polyolefin resins, Dow can help HDSS converters create differentiated film structures that yield excellent fabrication and application performance.

PE HDSS Toolbox

A Full Portfolio of Solutions

	Skins ⁽²⁾			
	DOWLEX™ 2645G/2045G	ELITE™ 5100	ELITE™ 5110	ELITE™ 5400

PROCESS IMPROVEMENTS IN THE FILM PRODUCTION

Film thickness – downgauging	✓	✓✓	✓✓	✓✓
------------------------------	---	----	----	----

FASTER PACKING SPEED

Improved stiffness	✓	✓✓	✓✓✓	✓✓
Faster sealing	✓	✓✓	✓✓	✓✓✓

REDUCED GOODS WASTE DUE TO PACKAGING FAILURE

Sack toughness when loading on the pallet & handling	✓	✓✓	✓✓	✓✓✓
Improved load stability - reduced creep				

BRAND POSITIONING & RECOGNITION

Optical properties - gloss	✓	✓✓	✓✓	✓✓✓
----------------------------	---	----	----	-----

✓ = lowest performance, ✓ ✓ ✓ = highest performance

⁽¹⁾ not part of Dow offering

⁽²⁾ LDPE can be added

Core					
DOWLEX™ 2645G/2045G	ELITE™ 5100	ELITE™ 5110	ELITE™ 5400	HDPE ⁽¹⁾	ELITE™ 5940 ST

✓	✓✓	✓✓	✓✓	✓✓	✓✓
---	----	----	----	----	----

✓	✓	✓✓	✓	✓✓	✓

✓	✓✓	✓✓	✓✓✓	✓✓	✓✓✓
✓	✓	✓✓	✓	✓✓✓	✓✓

PRODUCT FOCUS

ELITE™

Benefits across the value chain

ELITE™ Enhanced Polyethylene Resins from Dow provides a material solution that goes beyond the traditional combination of performance attributes. With increased lightweighting capabilities and enhanced processability, you can benefit from improved sustainability benefits while ensuring that performance is maintained.



I AM A CONVERTER

How does ELITE™ meet my cost improvement demands?

- ELITE™ AT offers cost savings versus incumbent technology
- ELITE™ enables ease of extrusion
- ELITE™ technology enables tailored solutions and multiple film design options



I AM A PACKER

Why would I recommend people to use ELITE™ AT on my machines? How does ELITE™ AT perform when it comes to packaging speed versus other alternatives?

- ELITE™ enables faster filling with improved mechanical properties
- ELITE™ enables low seal temperature for high speed packaging lines



I AM A BRAND OWNER

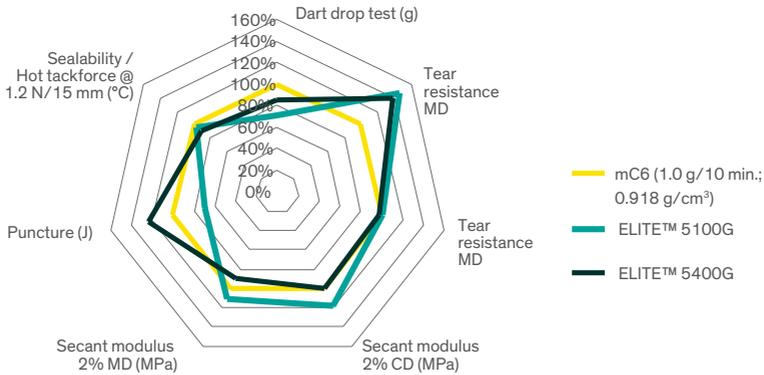
Can ELITE™ help me reduce damaged goods?

- ELITE™ enables superior film quality for prevention of damages on sacks
- ELITE™ is the solution of choice when especially dart impact and modulus improvements are required

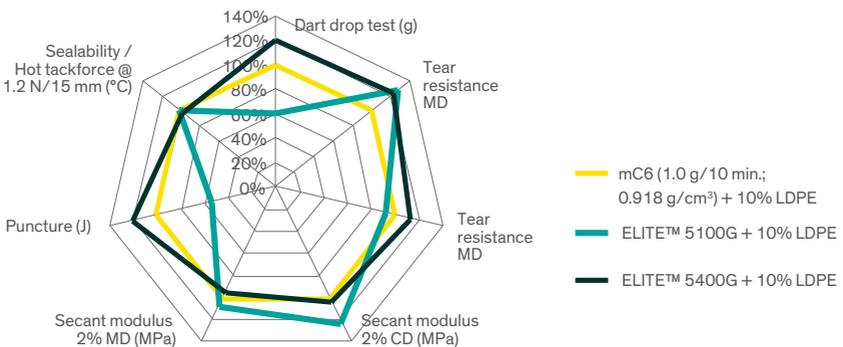
See graphs 1 and 2 on page 73 for the performance advantages of ELITE™ AT with and without LDPE.

Technical Appendix

Graph 1. Performance advantages of ELITE™ AT



Graph 2. Performance advantages of ELITE™ AT with LDPE



3 | Goods Safely Packed



Adhesives Solutions

Leading Adhesives Capabilities

Building on a **strong heritage**, Dow Adhesives has been the pioneer for many adhesives-based technologies such as low-noise packaging tapes and waterborne adhesive for non-water whitening solution for labelling and graphics.

Our comprehensive portfolio offers **reliable quality, consistency, process safety and proven bonding performance** for a broad range of transportation packaging applications.



Adhesives for Labels

Parcels, boxes and logistic packages all require reliable solutions to track, trace and identify the item and its contents, all the way from sender to the final recipient. Self-adhesives labels can provide the desired confidence and reliability. Critical to their success are the adhesive materials that make them functioning. Dow offers aqueous acrylic pressure sensitive adhesives for a wide range of labelling applications with paper and film label constructions for industrial and logistics packaging.

Dow's broad portfolio of **ROBOND™**

Waterborne Adhesives offers:

- Excellent adhesion on a broad variety of substrates.
- Excellent cohesion in dispensing and end-use.
- Flexibility of formulation thanks to its innovative polymer design.



PRODUCT FOCUS

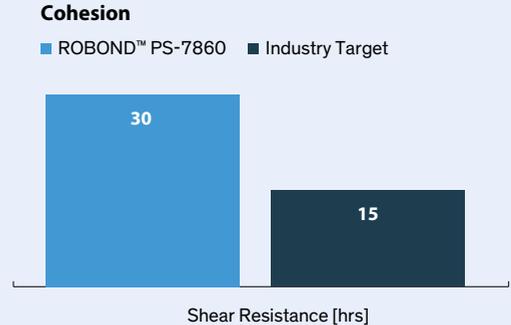
ROBOND™ PS-7860

High Solids Acrylic Adhesive



ROBOND™ PS-7860 is suitable for a broad variety of paper label end uses, from food to transport, logistic and retails, to pharmaceutical or office products.

- **Versatile:** Designed to fit curtain and gravure applications.
- **Efficient:** Maximum productivity, minimum energy demand, with a content of solids up to 67%.
- **Reliable:** Uncompromised cohesion in dispensing and end-use.

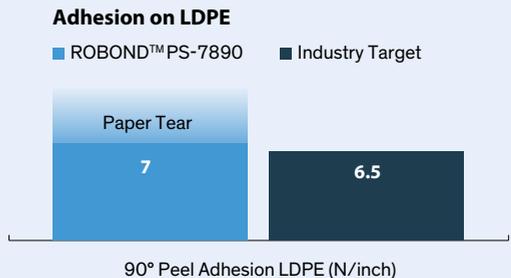


ROBOND™ PS-7890

High Solids Acrylic Adhesive for Gravure Coating

Label producers benefit from ROBOND™ PS-7890 coater-ready design, fit to multiple gravure coating technologies and performance reliability in paper label applications.

- **Ready:** Coater-ready product, does not demand additional formulation adjustments.
- **Efficient:** Minimum energy demand in conversion, with maximum productivity.
- **Adaptable:** Suitable to multiple coating head designs for gravure coating application.
- **Versatile:** Reliable adhesion on glass and cardboard with unparalleled affinity to low surface energy material.



Adhesives for Packaging Tapes

Packaging tapes must have excellent adhesive properties for a variety of materials to ensure goods remain inside the boxes, while dispensing easily and silently. Dow applies its extensive experience in water-based acrylic adhesives, combined with world class material science innovation, to meet these industry demands.

Dow's broad portfolio of **ROBOND™ Waterborne Adhesives** includes tailored solutions for transportation packaging offering:

- Low noise and easy dispensing.
- Excellent box closing with broad window of application temperatures.
- Possibility to post-print for enhanced package branding and appeal.
- No solvent emission is use, or fumes from hot melt adhesives in conversion.



PRODUCT FOCUS

ROBOND™ FD-07



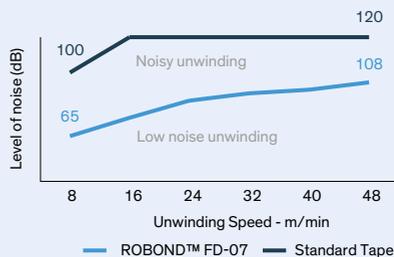
High speed fast dry technology, thanks to the high solids content (60%), for low noise and printed packaging tapes applications.

- **Excellent box closing** performance, thanks to tailored interaction between adhesive film and cardboard material.
- **Low noise**, quiet and smooth unwinding, when combined with treatment of the film.
- **Target adhesion on release side**, to allow direct printing and customization.
- **APEO* free** formulation, ready-to-coat.

Physical Properties

Property	Value
% Solids	60
pH	8.5
Viscosity	200
Release	No

Consistently Lower Noise in Manual and Automatic Application



ROBOND™ FD-07

Corona treatment for low noise unwinding
35-36 dyn/cm backside

Flame treatment
42 dyn/cm adhesive side

*APEO (Alkyl Phenol Ethoxylates) is not intentionally added to Dow adhesive products. Therefore, to the best of Dow's present knowledge, APEO's are not present in the final product composition, unless at trace levels, as an unknown impurity from the raw materials

Adhesives for Protective Films

Dow's aqueous acrylic Pressure Sensitive Adhesives provide excellent performance for several temporary surface protective applications and are suitable for metal, uPVC profile, plastic sheet, glass, textile and carpets, among other materials

Dow's broad portfolio of **ROBOND™ Waterborne Adhesives** includes tailored solutions for protective films applications offering:

- Excellent surface protection, keep protective films in place.
- Easy & clean film removability over time, no adhesive residue after peeling.
- Excellent UV resistance for improved adhesive aging and film removability performance.
- Water Whitening Resistance (WWR) for excellent and stable film clarity over time.



PRODUCT FOCUS

ROBOND™ PS-1049 Adhesive



ROBOND™ PS-1049 Adhesive is a versatile pressure sensitive adhesive dispersion for protective film applications where easy and clean removability is required after a long period of time.

ROBOND™ PS-1049 Adhesive, appropriately formulated with an adequate crosslinker, like CR-3, represents a suitable solution for temporary film protection on a variety of materials, from glass to extruded profiles, to coated and uncoated metal surfaces.

- **Low peel build up:** For easy and clean film removability over time and no adhesive residue on the surface after peeling.
- **Excellent crosslinker response:** For use with different CR-3 crosslinker levels.

Typical performances that can be obtained using ROBOND™ PS-1049 with different CR-3 crosslinker levels



Contact a Dow representative today to learn more.
For more information please visit www.dowplastics.com.

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