



## DOWNGAUGING QENOS RESIN BAGS WITH ALKAMAX mLLDPE AND ALKATANE HDPE

Qenos supplies polyethylene resin in the form of 25 kg bags which are palletised and stretch-wrapped to many of its customers. While bulk supply is more efficient for high volume usage, bags can be very cost effective and convenient for lower volume applications. With the drive to reduce the amount of packaging material used, Qenos partnered with a customer and major film supplier to develop a high performance downgauged film for use in its 25kg bags. According to Qenos' logistics provider, who fills, warehouses and delivers Qenos PE to customers around Australia, the downgauged film performs exceptionally well across the entire supply chain.

### A CHALLENGING APPLICATION

**The supply chain for PE resin places many demands on the packaging film**

The most important characteristics of a suitable resin are:

- optimum stiffness for conveying film and holding the bag open during filling
- excellent sealability for both the bottom and top seals (including gussets) to prevent leakage
- optimum coefficient of friction for conveying and palletising the filled bags, while also high enough to prevent bags sliding under the most extreme road and rail conditions
- tensile properties that prevent the bags from deforming and potentially failing (the weight in a full pallet creates high forces within the bottom layers, causing the resin to shift within the bags and push against the sides)
- resistance to creep (slow stretching of the film) in which forces within the bags may result in deformation, potentially causing the pallet to become unstable during long term storage

- impact and puncture resistance to reduce the risk of holes due to minor accidental contact from forklifts or from end users dropping the bags

Resins with a combination of high slip additives and certain pellet shapes are known to move easily inside the bags, potentially leading to problems with storage and transport. Other factors such as overhang of bags beyond the edge of the timber pallet base can further intensify these challenges.

Qenos bags were previously produced using a blend of heavy duty LLDPE and LDPE, such as Alkatuff LL501 and Alkathene XDS34. The LLDPE component provides significant toughness and resistance to creep, while the inclusion of LDPE aids in film extrusion and sealing. Such blends have provided excellent performance over many years.

“ THE NEW DOWNGAUGED FILM HAS PERFORMED WELL THROUGH THE WHOLE SUPPLY CHAIN, AND IS NOW USED IN ALL QENOS RESIN BAGS. ”

## CREATING THE NEXT GENERATION IN HEAVY DUTY FILM

### Qenos Alkatane HDPE provides the key to the downgauging of heavy duty sack films

The packaging industry is focussed on reducing the amount of material used in packaging. This is most often achieved through downgauging. Product evaluation in the Qenos Technical Centre and on Qenos' logistics provider's packaging lines revealed that the previous film had reached the limit of material reduction through downgauging alone. Thinner films made from the traditional blends of LLDPE and LDPE would not provide sufficient creep resistance during transport and storage of pallets.

The inclusion of HDPE in the film is an ideal means of improving creep resistance as the crystalline structure of HDPE makes the film more resistant to both stretching and deformation. In particular, resins with higher molecular weight (lower melt flow index) such as Alkatane GM4755F are preferred because the longer molecules provide more tie chains that hold the structure together. Qenos trials showed that the inclusion of HDPE resulted in a significant reduction in the amount of creep, with GM4755F providing a significantly greater reduction than HDPE of lower molecular weight.

Other properties such as impact resistance are altered when HDPE is added to the blend. A reduction in impact resistance is overcome by changing the LLDPE component from a conventional LLDPE to a metallocene LLDPE, such as Alkamax ML1810PN. The addition of HDPE also results in a smoother surface with a lower coefficient of friction (COF). If the COF becomes too low, the film may slip during packaging and allow the bags to slide during transport, potentially resulting in unstable pallets.

The challenge was to find the optimum level of HDPE that would preserve the creep resistance in a thinner film, without changing the COF enough to result in bags sliding.



## COLLABORATION WITH THE CUSTOMER

### Qenos partnered with a major customer in the development of a thinner film formulation

In the initial stages of the development, Qenos extruded small scale film samples of different compositions in Qenos' Altona Technical Centre. Qenos has developed its own method for the measurement of the creep resistance of heavy duty films. These trials revealed that a level of 15% to 20% HDPE would allow downgauging of approximately 10%.

Films containing higher levels of HDPE did show improvement in creep resistance but were found to have an insufficient COF.

In the second stage of development, a major Qenos customer supplier conducted trials on its commercial scale film line. The experienced team at the customer's facility further refined the Qenos' trial formulations, enabling them to fully benefit from the capabilities of the commercial scale line. A range of trial films were extruded in a process that would ultimately lead to a structure that provided the best combination of extrusion performance and the properties required for this challenging, high volume application.



## SUCCESS WHERE IT COUNTS MOST

### Less material, lower cost and no compromise in performance

The final stage of evaluation was a set of comprehensive field trials conducted by Qenos' logistics provider. This involved a number of stages:

- Monitoring sealing and handling on the packing line
- Bag drop tests to confirm film strength and seal integrity
- Checking the pallet stability after a few weeks of storage
- Transporting pallets across the country by road and rail, followed by further checks of pallet integrity and stability

Once these tests were completed successfully, a controlled release of the packaged product to selected customers was initiated to enable further monitoring and feedback. Evaluations were also conducted on an alternate packaging line to ensure equivalent performance was achieved across different equipment.

These trials demonstrated that the new 10% thinner film based on Alkamax mLLDPE and Alkatane HDPE fully met the performance criteria for this challenging application.

Following the extended validation program, production was transferred to the new formulation which has been used in all Qenos 25kg bags since late 2019.

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