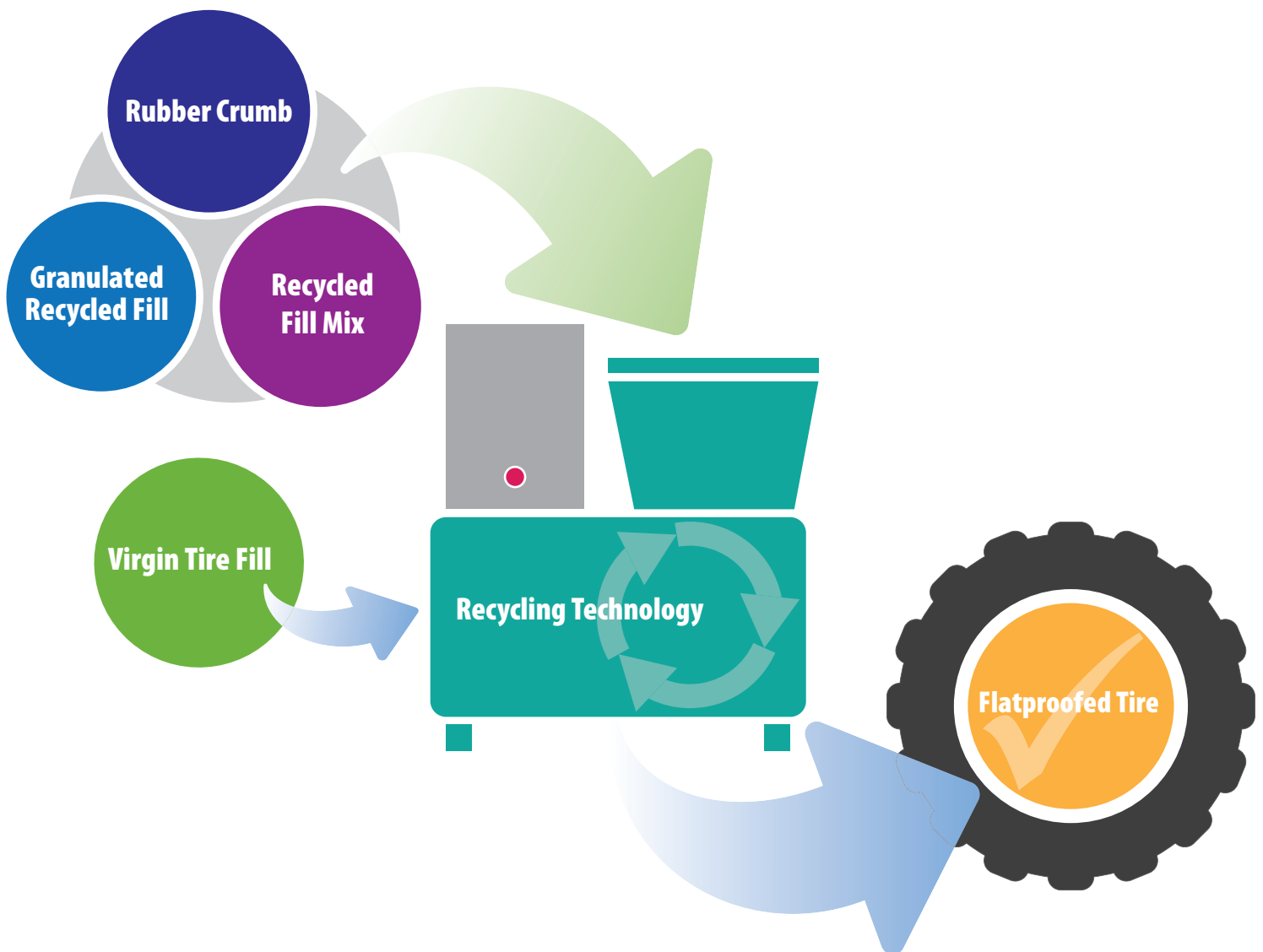


Carlisle TyrFil:

Leading the Industry in Best Practices for Materials Handling by Recycling, Not Chunking



History of Chunking

For approximately the past 40 years, the process of “chunking” has been practiced with varying degrees of success. Chunking is the term used to describe filling tires with “chunks” of used tire fill, and then filling the remainder of the tire with virgin tire fill. The chunking process first started in slow moving vehicles which tend to destroy the tire carcass in a relatively short period of time; tire dealers found the economics of filling these tires with approximately 50% chunk and 50% virgin urethane fill to be favorable. Encouraged by the potential to increase profits by chunking, many tire dealers started to cheapen the end product in additional applications.

Unfortunately, some tire dealers carried the concept of chunking to unacceptable extremes and started to mega-chunk at the 80% to 90% level. Dealers who had been filling tires with virgin material found themselves uncompetitive and were forced to chunk to meet new low prices. The downward spiral of decreasing prices, especially

at the wholesale (dealer to dealer) level, got so low that many dealers quit selling filled tires entirely or purchased them from the mega-chunking dealers. At one point, the only dealers making any money on flatproofing were the so-called mega-chunkers.

Not only is chunking unethical—it’s unsafe. It was well known throughout the industry that chunk filled tires do not perform as well as a tire filled with virgin or clean fill (See Graph I). The ultimate result of all this mega-chunking was that tires were now failing at an ever increasing rate, customers were being turned-off to flatproofing and the entire market was beginning to decline.

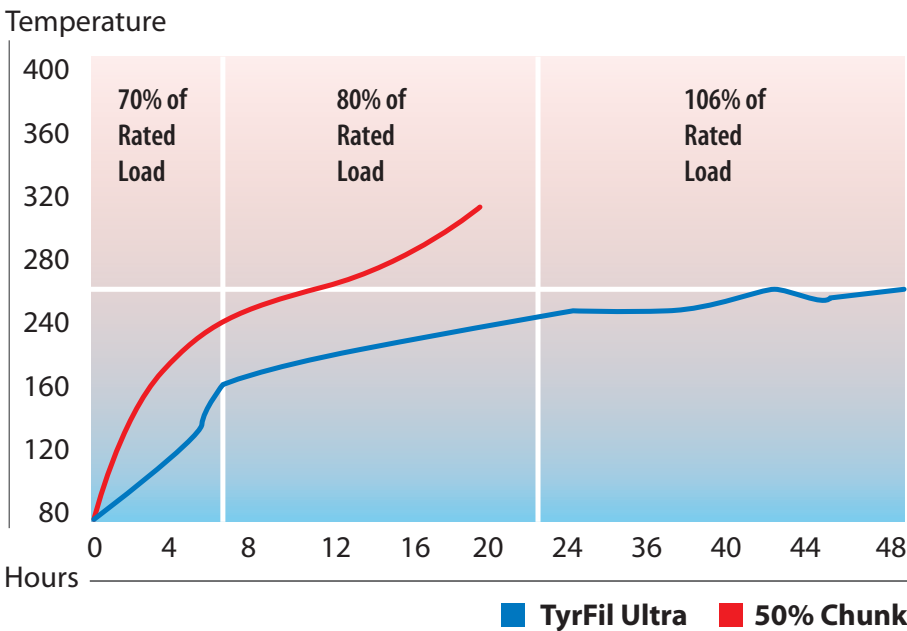
In the early 1990’s, several new polymer companies entered the flatproofing market with inferior products (see Graph II), exacerbating the situation and contributing to the overall decline of fill prices. The market’s perception of filled tires and confidence in tire dealers suffered as a consequence.

Graph I

Chunking can decrease tire carcass life by over 50%.

The chunking of tires causes heat of friction, resulting in rapid overheating and tire failure.

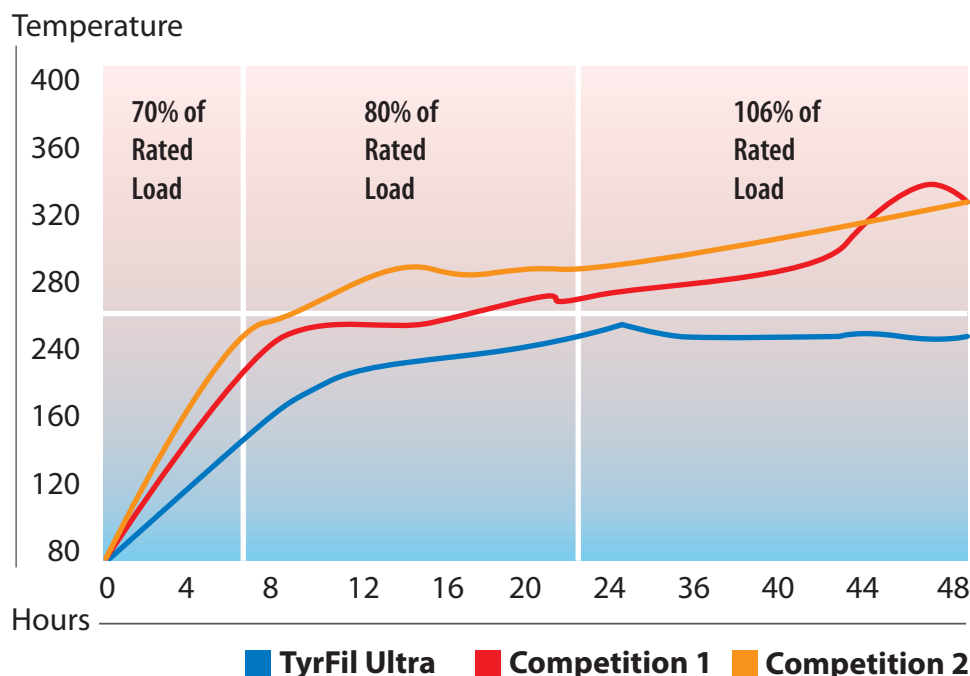
Filled Tire Time/Temperature Tests (Per FMVSS 119)



Graph II

Filled Tire Time/ Temperature Tests

(Per FMVSS 119)



Sadly, this damaged the reputations of dealers who were committed to delivering high performance flatproofing but were still negatively associated with mega-chunkers.

The tire fill industry was in trouble, and the leaders, Arnco and Pathway Polymers (both now named Carlisle TyrFil) each developed recycling processing equipment, Green Machine and Auto-Fil, as the solution to mega-chunking.

The recycling processing equipment meters and mixes controlled amounts of virgin tire fill and granulated cured tire fill to a homogenous TyrFil mixture that fills the tire exactly the same as virgin liquid tire fill. For more than a decade, the TyrFil recycling processing equipment has been a cost-effective, safer alternative to mega-chunking.

Chunking vs. Virgin or Recycled Filled Tires

The only way to ensure the quality of flatproofed tires is to fill them with high performance polymers similar to those offered by Carlisle TyrFil, according to the strict process recommendations of the tire and polymer manufacturers (view the TyrFil technical training manuals found at www.carlisletyrfil.com for details).

The real value of flatproofing is to provide a tire which can operate without failure in a hazardous environment, delivering 100% of the expected tread wear and capable of being retreaded multiple times (see Graph III). Virgin tire fill and virgin/recycled flatproofing polymer provides the greatest opportunity for delivering the maximum consumer value and satisfaction.

Graph III: *Chunking vs. Virgin/Recycled Filled Tires: Which is the best value?*

	Virgin/Recycled Fill	Chunked Fill
Price	10% - 20% Higher	Lower
Durability (FMVSS 119)	Passes	Fails
Heat Resistance	Excellent	Poor
Consistent Quality	Yes	No
% Chunk Fill	N/A	Up to 90%
Age/Heat History	None	Extensive
Durometer	Consistent	Variable
Ride	Softer	More Harsh
Warranty		
Fill Manufacturer	Yes	Void
Tire Manufacturer	Yes	Void

The Reasons Why Chunking Does Not Work

Although chunking has met with a degree of success in a few non-severe service applications, chunked tires are not capable of optimum tire performance compared to a properly filled tire. In most applications, chunked tires get less tire performance hours and prematurely fail. Several reasons can contribute to this less than optimal performance:

Mega-chunking

Old chunks of polyurethane do not bond to the new/virgin liquid fill, so the more a tire is chunked, the more surfaces or interfaces are created increasing the heat of friction generated within a tire.

Incompatibility

There are now more than five distinctly different types of flatproofing polymers available as potential virgin or chunk fill (see Photo I). The durometer (see Graph IV) as well as chemical composition varies widely. This wide variation in products increases the probability that the virgin and/or chunking polymer will be incompatible. Even if the material for chunk was identically formulated, the older the material used for chunking, the more apt it is to not bond, physically or chemically, with



Photo I: This picture above shows 3 distinctly different (incompatible) chunks of fill taken from the same tire (1-Green, 2-Amber, 3-Brown)

the new urethane.

Heat History

Premature failure of a filled-pneumatic tire is generally due to excessive heat build-up in the tire carcass and polymer. This over-heated polyurethane polymer (see Photo II) is totally unacceptable for use in “chunking” as it has already begun to degrade or revert. Unfortunately, due to the increasing demand for “old chunk”, a significant amount of high-heat history “chunk” is finding its way into unsuspecting customers’ tires. The use of this “old chunk” will result in the premature fail-



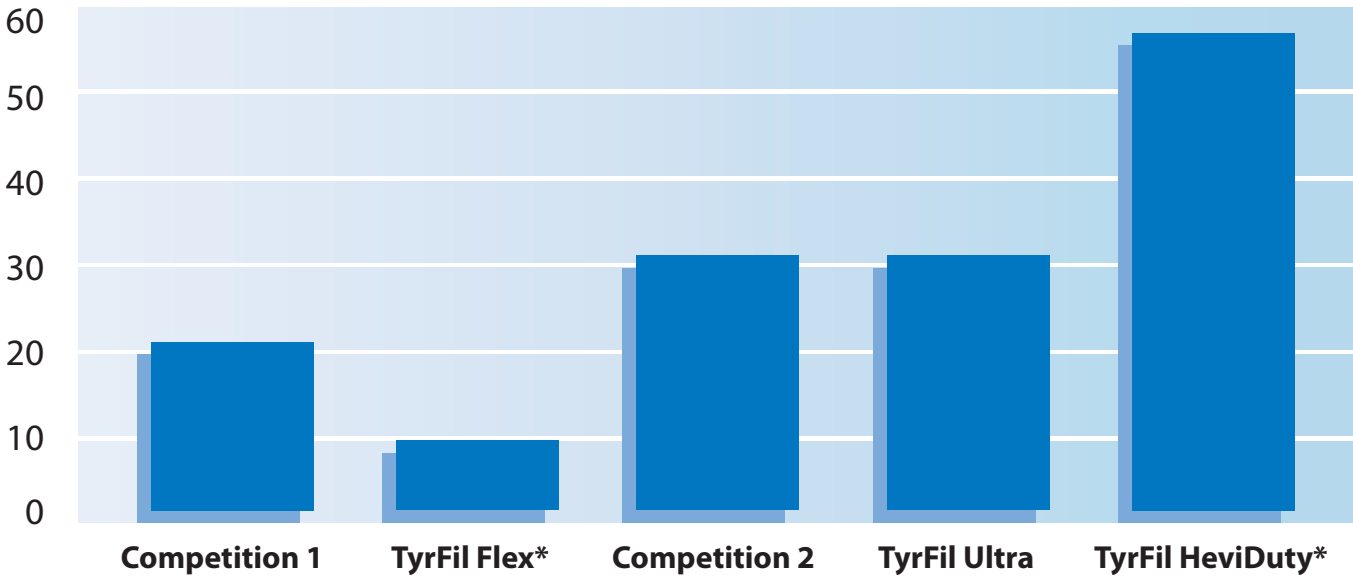
ure of filled tires due to run-away overheating.

Process Variability

Due to the very nature of the “chunking” process and component “raw materials”, it is virtually impossible to ensure any level of consistency in a filled tire which has been chunked (see Photo III). Some tire dealers claim to select their chunk carefully choosing only the “good chunk”. Others actually grade their chunk or attempt to match the size of the “chunks” to the size of the carcass to be filled. However, the bottom line is this: there is no way to determine with certainty the quality of “chunks” to be used in the “chunking” process. Therefore, at best, “chunking” is a hit or miss process solely dependent upon the ability of the processing personnel to determine the acceptability of the “chunks”, the quantity to be used and the placement of the “chunks” in the carcass.

Photo II: This “chunk” is an example of material with excessive heat history demonstrating “Thermal Fracturing”. This material is estimated to be over 10 years old.

Graph IV: “A” Durometer



A wide variation in durometers increases the probability that the virgin and/or chunking polymer will be incompatible – resulting in overdeflection and runaway thermal degradation.

*TyrFil Flex and TyrFil HeviDuty are special duty products with exceptional heat resistance.



Photo III: This photo shows the wide diversity of old fill used as chunking material in new tires. Many of these pieces were chunk of chunk of chunk.

Tire Carcass Over-Heating

Tire carcass over-heating is a common occurrence for tire failures to be attributed to abuse resulting from operating in a hazardous environment. However, tires filled with chunk (and/or inferior quality polymers—Graph II) can overheat resulting in tire carcass failures. The fill in these same tires may appear to be intact without degradation. However, frequently the excessive heat generated by the “chunk” or inferior polymer will cause the tire carcass to fail prior to any noticeable degradation in the fill mass. Dynamic testing of chunked vs. virgin filled tires has proven conclusively that “chunk” filling will generate excessive heat resulting in premature tire carcass failure (Refer to Photo IV).

Although once perceived as a way of adding value for the consumer of flatproofed tires, “chunking” has been taken to extremes resulting in unacceptable levels of product performance. Testing has confirmed the effects of chunking on tire overheating and premature failure in dynamic applications. Inferior low durometer products and excessive heat-history “chunks” have increased the variability of the chunking process beyond acceptable parameters. This process is not safe and can result in injury to individuals and damage to property. Due to significant safety and liability issues, chunking is not recommended.

The Risks of Chunking

Businesses that chunk expose themselves to a variety of risks and situations that could prove harmful to their business and their customers. Such perils include providing an inferior product, endangering users, exposing the company to legal liabilities and jeopardizing customer relationships.



Photo IV: This picture shows what happens to a tire when the “Chunk” overheats. The “Chunked” core has disintegrated while the new virgin fill remained intact encapsulating the “Chunk”. The tire failed due to the failure of the chunk – it had approximately 2” of good tread life remaining when the carcass failed.

Inferior Product

Since tire chunk is not granulated, it cannot be examined for foreign particles such as metal, sealants or other contaminants. These contaminants affect the bonding of tire fill material. If a tire contains chunk with contaminants, the fill materials will not adhere properly resulting in voids and uneven fill.



Obviously, one cannot see through a tire. Therefore, these flaws go undetected by the tire fill operator. Occasionally, early signs of chunked-tire failure can be visible including a partially collapsed sidewall or an isolated bulge in the casing. But it is usually when the end user experiences poor performance, or worse, a complete product failure, that the defects are discovered. There is no way to restore the integrity of the core and little likelihood it could be removed and the tire salvaged. The tire is lost and the customer incurs downtime. The flat-proof system is designed to eliminate both issues.

Liability

Companies who practice chunking are vulnerable to legal risks. Due to uneven fill patterns and unpredictable performance, tires filled with chunk are hazardous. If an end user is injured as the result of using a tire filled with chunk, the dealer who provided that tire is in jeopardy of litigation, either for property damage or worse, personal injury. The risk is heightened in cases where the end user was not informed of the chunking practice prior to having his tire filled.



Additionally, poor performing tires filled with chunk have significant consequences for end users, including lost time and resources. If a business must shut down operations, or take equipment out of service, it may seek reimbursement or damages from the tire filler.

Loss of Customers

Companies who chunk run the risk of losing valued customers. Once a customer experiences poor performance or a failure, the consequences are severe. The tire filler's reputation has been tarnished, perhaps beyond repair.



As we all know, it is much more difficult and expensive to attract a new customer than to retain an existing one. When customers experience poor performance, they take their business elsewhere. Furthermore, consumers who have experienced poor service are much more likely to share their negative experiences and opinions with their peers in the marketplace.

The Cost is Too High

The cost of chunking is just too high. Knowingly distributing an inferior product with defects and flaws exposes you to legal action. It also jeopardizes your customer relationships and it gambles with the safety of your customers. Nothing is worth that.



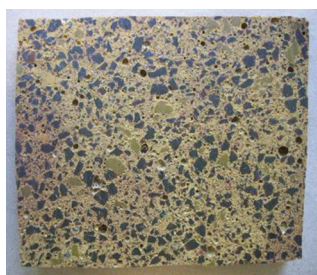
The Solution to Chunking

The practice of chunking used to be almost universal within the flatproofing industry until Carlisle TyrFil developed an effective alternative that not only saves money but also reduces carbon footprint. Carlisle TyrFil is the only manufacturer in the industry to offer recycling technology: AutoFil and Green Machine. Both the AutoFil and Green Machine mixes virgin TyrFil with either used tire flatproofing, crumb rubber, or even previously mixed materials.

The TyrFil Recycling Technology offers the industry a consistent and controllable process. The computer systems of the AutoFil and Green Machine are field-proven for more than a decade to meter and mix controlled amounts of virgin liquid tire fill and granulated tire fill to a homogenous TyrFil mixture that fills the tire exactly the same as virgin liquid tire fill.



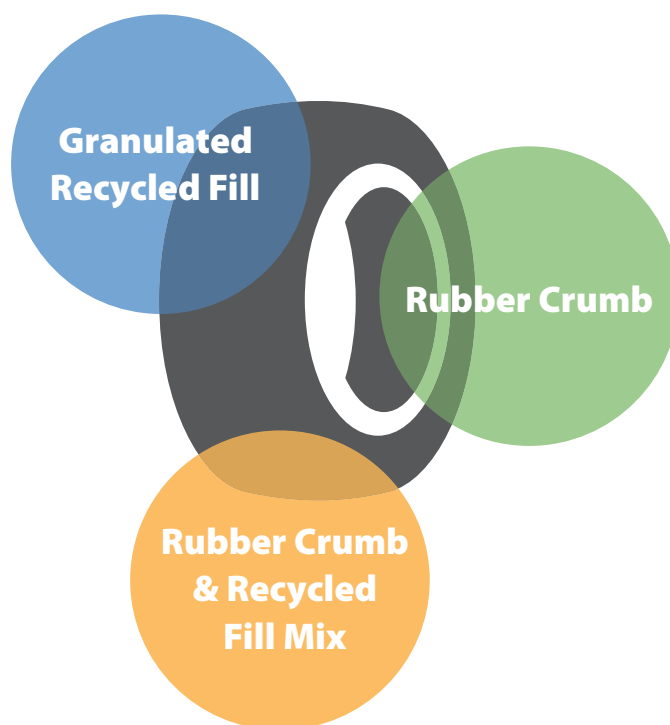
Chunking



Recycling

Carlisle TyrFil Recycling Technology:

- Blends all material together BEFORE filling
- Processes recycled tire fill as well as crumb rubber
- Exceeds EPA's requirements for post-consumer materials content
- Computer controlled
- Optimized ratio
- Optimized profit
- Consistent durometer



Typical Blend Media Samples

Unfortunately, several dealers still choose the risky business practice of chunking. Many of these tire fillers still assume that chunking saves money. However, the converse is true. Since chunks are not finely ground, the practice results in many gaps, cracks and holes in the tire cavity that need to be filled. These breaches are filled with virgin fill, which is much more costly than using a mix of finely ground recycled tire fill with virgin fill. Ultimately, operators who chunk use exponentially more virgin fill than those who do not, thus negating any cost savings presumed by chunking.

Additionally, the TyrFil Recycling Technology Systems deliver faster, allowing more tires to be filled in a shorter time. The AutoFil pumps up to 28 pounds per minute and the Green Machine pumps up to 40 pounds per minute compared to a virgin tire fill pump at 11 pounds per minute.

Carlisle TyrFil is the only manufacturer in the industry to offer recycling technology: AutoFil and Green Machine.



Green Machine



AutoFil

TyrFil Recycling Technology = Performance, Safety & Sustainability

Not only did the TyrFil Recycling Technology solve the chunking issue plaguing the industry, but it also created a closed-loop sustainability process, significantly reducing the environmental impact of traditional tire flatproofing by:

- Recycling and using up to 65% post-consumer tire fill
- Eliminating up to 65% of the petrochemicals (including oil) normally required to fill an Off-the-Road (OTR) tire
- Keeping used tire fill out of landfills and eliminating landfill disposal fees

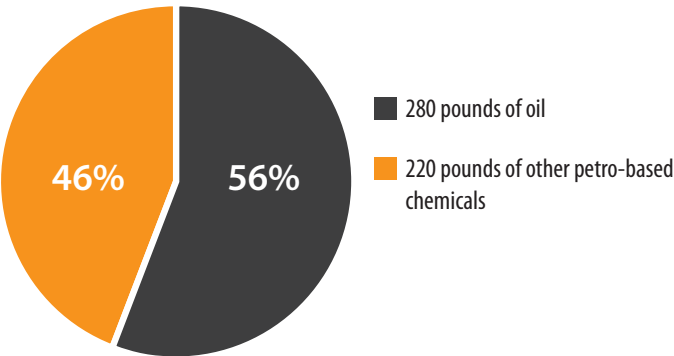
Carlisle TyrFil made providing environmentally supportive products a long-term strategic business priority. The TyrFil Recycling Technology is just another example of this commitment. This processing equipment made it possible to keep more than 150 million pounds of tire fill out of landfills.



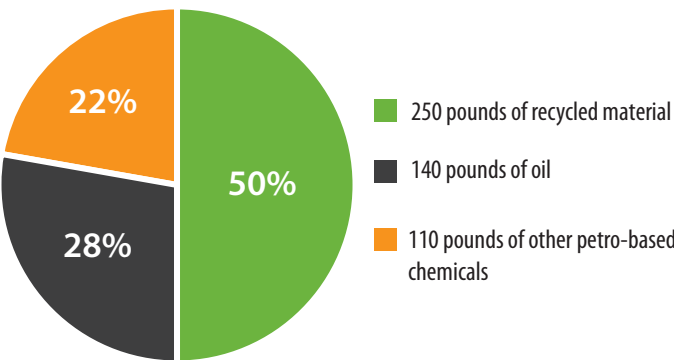
Using TyrFil Recycling Technology, tires can be filled with up to 65% recycled materials.

The Green Machine allows the tire dealer to use a ratio of 65/35 by volume of recycled material and virgin TyrFil Flatproofing material. The AutoFil Machine allows either 65/35 by volume or 55/45 by volume depending on the application. The environmental benefit can be illustrated by looking at the 65/35 by volume ratio in one of the most frequently filled tires, a 13.00-24 which can take 500 pounds of fill:

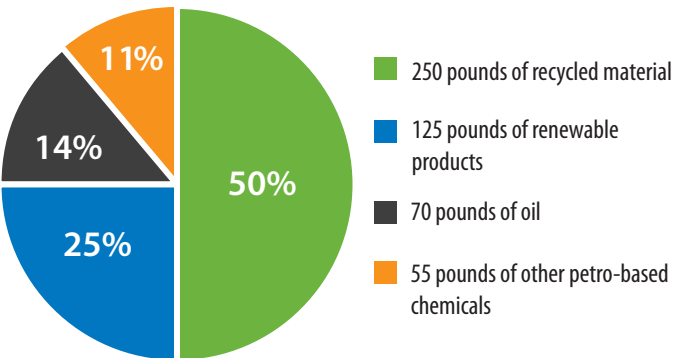
Traditional Fill = 500 pounds



Recycling System with Traditional Fill = 500 pounds



Recycling System with TyrFil EcoFil = 500 pounds



Conclusion

When standards are compromised, it affects the entire industry and Carlisle TyrFil is committed to continually advocate for safety and materials handling best practices. Our certified dealers go through a rigorous training and certification process to assure the highest standards of production, technical compliance and performance. Flatproofed tires must be processed correctly to provide the customer with the maximum benefits of no flat tires, full tire life, consistent internal pressure, no rim slippage, improved safety, proper tire flex, cost savings, and retreadability.

Carlisle TyrFil and our certified dealer network is wholly committed to delivering its flatproofing product line with the utmost integrity and quality assurance. We work side-by-side to ensure that best practices for materials handling becomes synonymous with polyurethane tire fill technology. That’s why our motto—“It’s What’s Inside That Counts” can be taken very seriously.



No Flats



Best Cost In Use



Uncompromising Performance







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