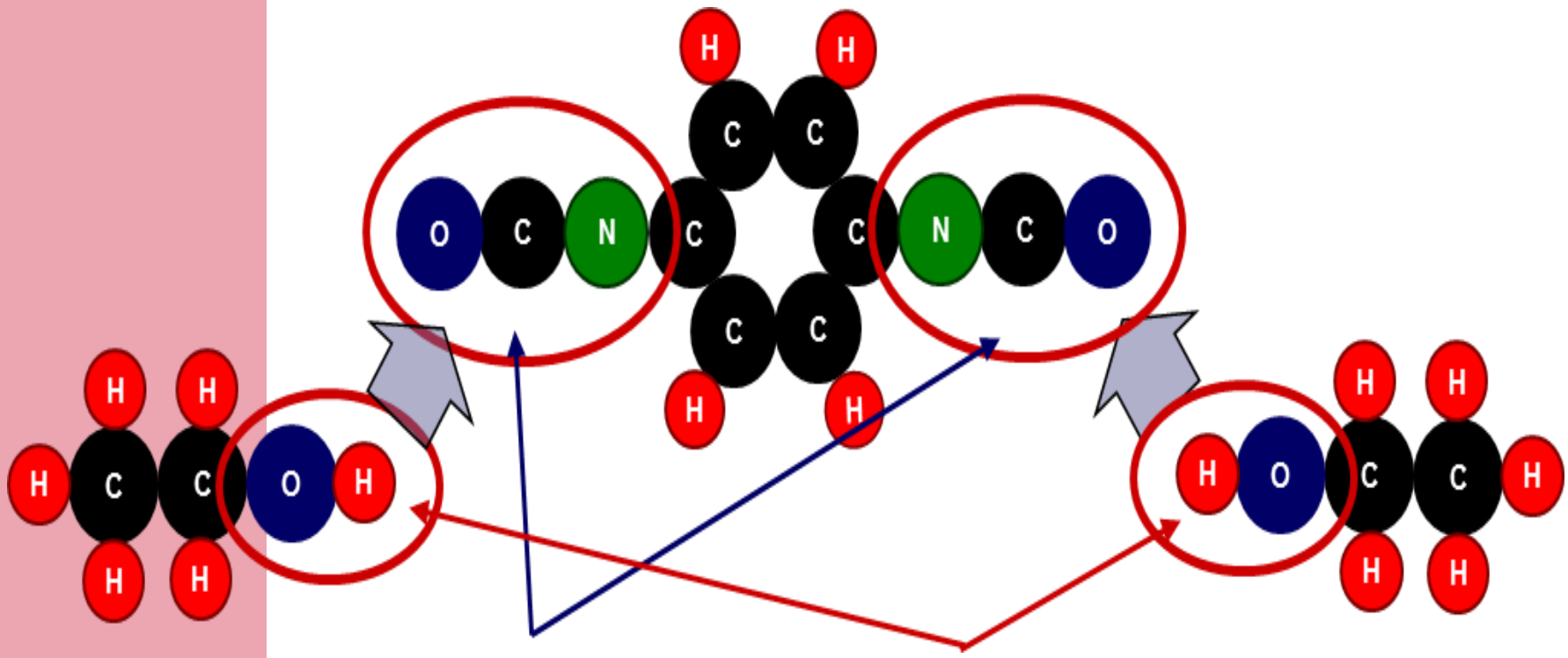

Cast Elastomers Webinar

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What is a Cast Urethane Elastomer

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- The most versatile durable material available in manufacturing
- For many applications a viable alternative to plastics, metals and rubber
- Could be as elastic as rubber band and as rigid as metal
- Low tooling costs, easy prototyping and lower cost processing equipment
- Ideal for low volume applications

Advantages

Vs. Plastic

Polyurethane can be formulated for superior load-bearing capability, abrasion resistance and impact absorption.
In addition, unlike plastic, cast polyurethane doesn't require high pressure tooling, which allows for quicker turnarounds and lower-cost molds.

- Tooling costs 1/5 that of plastic
- Faster, more accurate prototypes

Advantages

Vs. Metal

One of the most overlooked characteristics of polyurethane is its ability to be formulated for high rigidity, making it often a viable alternative to metal for hardware such as valves and gears. Cast polyurethane's advanced manufacturability also eliminates the need for secondary operations such as stamping, punching and painting, which saves time and costs in production.

- Lighter weight
- Faster turnarounds and lower total costs
- Higher corrosion resistance

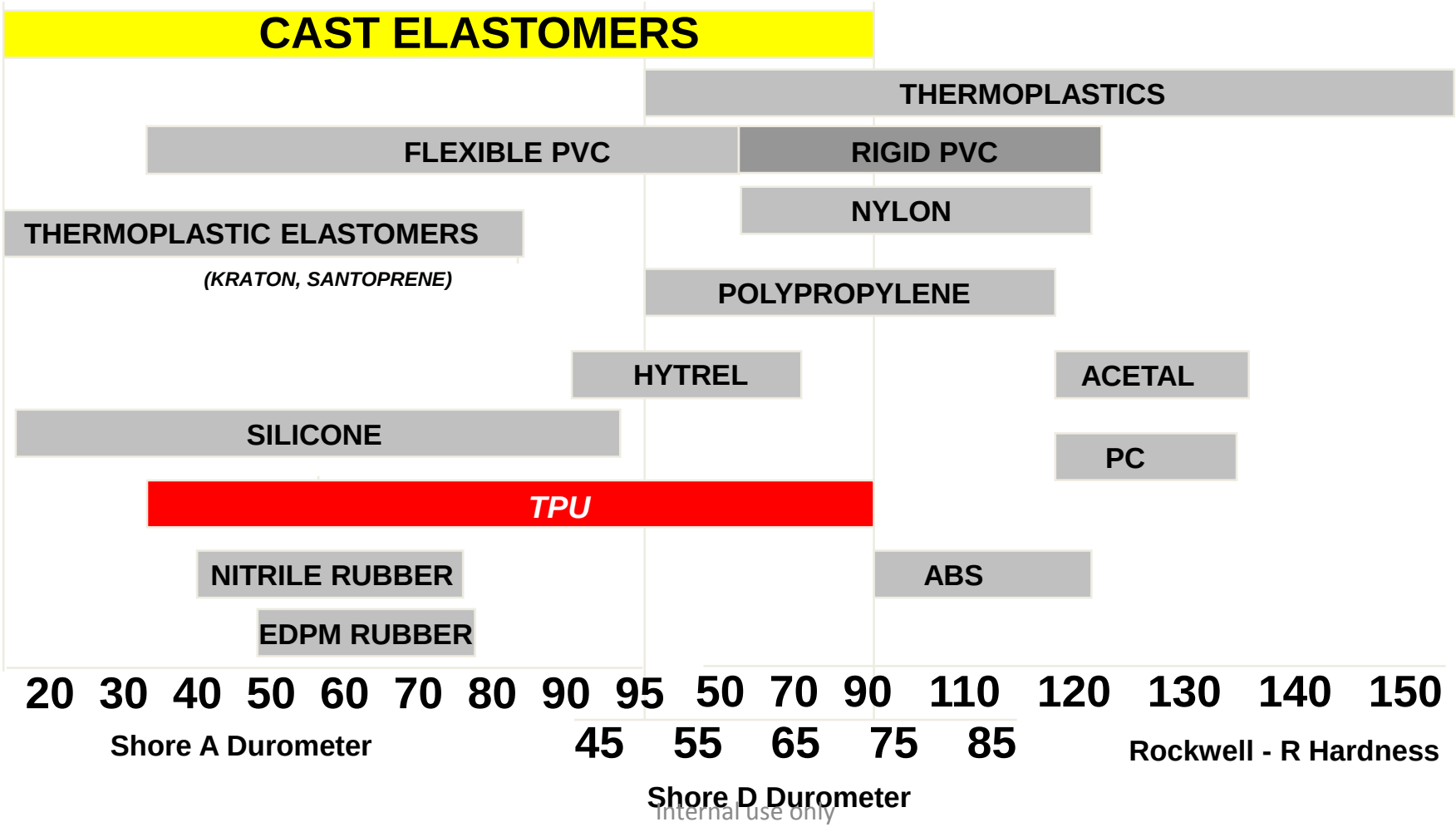
Advantages

Vs. Rubber

Featuring the elastic capability of rubber, while measuring higher on the hardness scale, polyurethane can be a good choice for certain parts because of its:

- Better wear resistance
- Higher load-bearing capacity

Hardness Ranges



Polyurethane Prepolymer Processing

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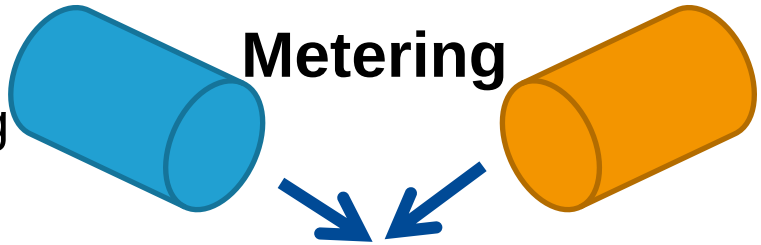
Cast polyurethanes: mix of 2+ liquids, pouring into a mold

Prepolymer
(melting), Warming
& Degassing



Curative
(melting), Warming
& Degassing

Mixing
↓ Dispensing
Molding
↓ Curing
Demold
↓ Dispensing
Finishing

Liquid “castabilty” of Cast Urethanes

Liquid castabilty:

- Versatile liquid processing
- Low initial capital
  - Low Temperatures (eg. 25 to 120ºC (77 to 248ºF))
  - Low pressures
  - Plant, equipment or tooling
  - Inexpensive materials

Reduced set-up time:

- No need for accurate settings
- Different shapes can be formed on the same pad
- Minimum of wear and corrosion

Processing Characteristics: Hot Cast vs. Cold Cast

	Hot Cast	Cold Cast
Pot life	3-20 min.	1-15 min.
Viscosity	High	Low
Ratio Control	10:1	3:1 to 1:1
Demold time	>30 min.	<30 min.
Process Temp	85-100°C	RT-65°C
Mold Temp	>110°C	RT-90°C
Post-Curing	16hr. @ 100°C	Not required
Mold Release	Required (Si/wax)	Required (Si)

Selecting a Polyurethane Elastomer

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1. **Properties** of importance
2. Select **Polymer/curative** systems
3. Consider engineering **Design Principles**
4. Consult suppliers for **recommendations/info**
5. Plant **capabilities**
6. Run preliminary **tests**
7. **Prototype units** of candidates systems
8. **Field test** in actual service and make comparisons
9. **Approval** from future customers
10. Gear up for production
11. Grades available for **FDA** and **NSF** applications

Key Attributes and Properties
Resistance

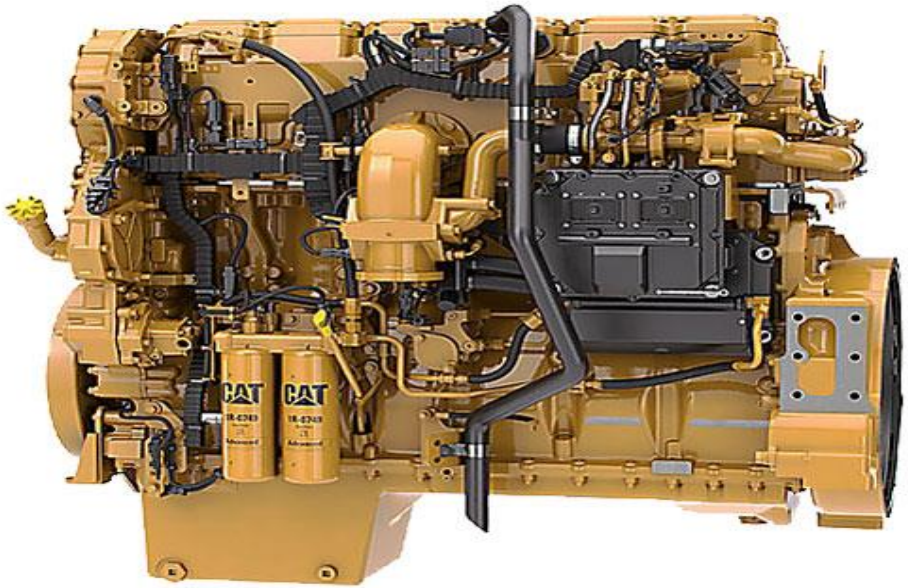
- Abrasion resistance
- Cut and tear resistance
- Good ozone resistance
- Wide hardness range
- Fuel and oil resistance
- Good heat resistance
- Weatherability

Key Attributes and Properties
Physical properties

- Good clarity and translucence
- No-marking, non-staining
- Easily pourable - castable
- Can be tailored for low or high rebound (resilience)
- Excellent flex properties
- Good overall electrical properties

Use Limitations

- Continuous service temperatures >100°C should be avoided
- Avoid exposure to strong acids and bases
- No contact with steam



Applications

Key Cast Elastomers Markets

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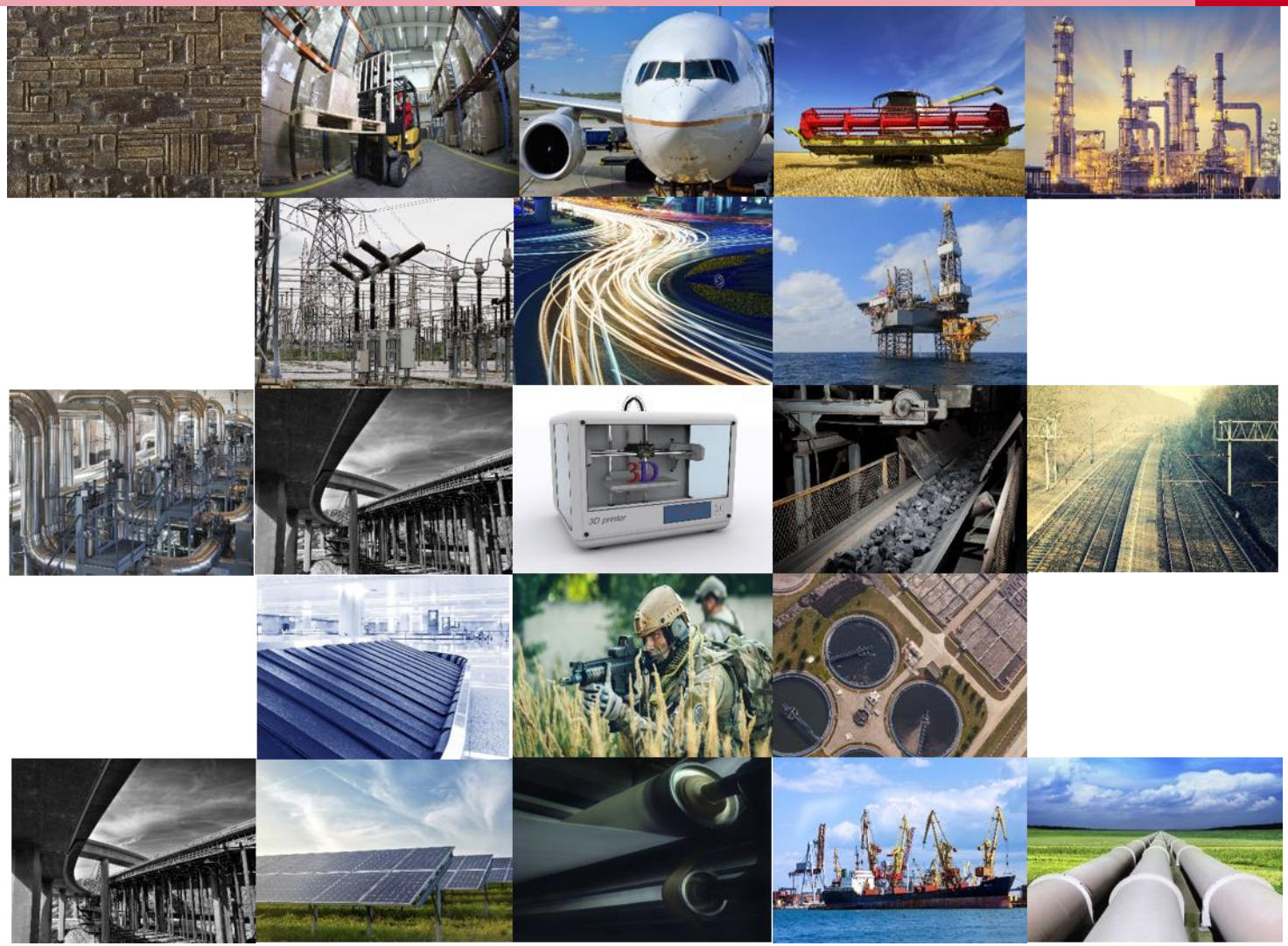

Typical Applications by Markets

Market	Applications	Market	Applications
Agricultural	Articulation stop, bearings, cab mounts, dampeners, dunnage, fuel filters, seals, sorting starts, soft touch cab, shock mounts, tire fill, wear pads, wear plates and protective sheeting	**Automotive / Transportation**	Motor and transmission mounts, suspension pads, damper springs, bushing, drive belt, dunnage, bed liners, filters, wheels, tires, tire fill and rollers
Binders	Adhesives, binders, binder abrasive fillers in polishing pads for metals, glass, etc…	**Mechanical**	Gears, sprockets and sorting stars, etc.
Elevator & Escalator	Elevator sheaves, guide wheels and cable guides and escalator wheels	**Food Handling**	Deboning belts, liners and sheets, pump diaphragms, rings and seals
Marine	Boat rollers and pads, fenders, mooring buoys, propeller shaft bearings, pump impellers and rub strips	**Material Handling**	Bumpers, dunnage, guides, trays, conveyor belting, land conveyor wheels, forklift wheels, material cart wheels and casters
Recreation	Bowling balls, mallets & hammers, roller-skate wheels, skateboard wheel, ski lift sheaves and swim fins	**Recreation**	Bowling pin setting equipment, amusement ride wheels and ball pitching machines

Typical Applications by Markets

Metal Forming	Foundry casting pattern, grit blast masks and curtains, hydraulic forming diaphragms, metal handling rolls and pads, punch press die springs and strippers, cradles and dunnage	**Mining**	Agitators, classification screens, conveyor belt scrapers, crossover pads, hydrocyclone, pipelining, pump impellers, water proofing, and chute liners
Oil & Gas	Pipelining bend restrictors, bend stiffeners, fluid separation pigs, hydraulic seals, pipe thread protectors, pipeline cleaning and inspection pigs and pipe coatings	**Paper Making**	Couch rolls, lump-breaker rolls, press rolls, reel rolls, shoe press belt and suction rolls
Power Transmission	Bearings and bushing, flat and V belt, gears, sprockets and cams, nail gun bumpers, nozzles for abrasive material, timing belts, vibration-isolation pads, wear pads and bumpers	**3D Printing & Printing**	3D printed parts, 3D Printed Tools, Cutter bars, metal decorating rollers, printing rollers and sheet metal coaters,

Forlift Wheel Applications

Forklift wheels

Wheels are used in many forklift applications, wheels can range from narrow aisle wheels, rough terrain wheels etc. Made from rubber or polyurethane.

Forklift wheel coatings

Polyurethane coated wheels are great for non-marking, great application for lift trucks and pump carts.

Casters

Can be made from a variety of materials including polyurethane, solid urethane, and rubber in many different sizes in order to accommodate different requirements.

Mining Wear pieces

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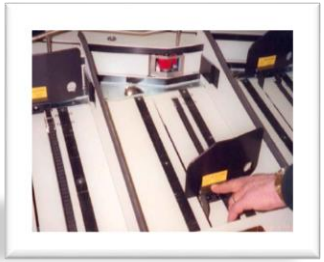
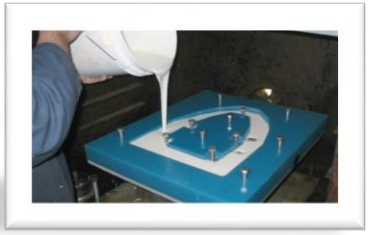
Bumper pads
Bumpers protect products in service. Noise levels are effectively reduced, and machine life is extended for long-run economy.



Wear Strips
Reduced equipment damage, noise, and maintenance.

Protective sleeves
Reduces wear, absorbs vibration, reduces noise, and extends equipment life.

Sprockets
Can be custom made; extends chain life, gives cleaner operation with grease and pitch resistance, absorbs vibration for quieter operation



Custom molded parts
Custom molded wear parts to fit individual requirements.

Pipeline Pig applications

Foam Pigs

Foam Pigs are constructed from open-cell, flexible polyurethane foam and are usually moulded in one piece. Foam pigs are generally used for swabbing, drying, liquid removal, product separation and many cleaning tasks. The flexible nature of these pigs allows for negotiation of both short radius bends and unexpected reductions in pipe bore. Foam pigs are the most cost effective and versatile design of pipeline cleaner in the market today.

Sphere Pigs

Pig balls can be made of Neoprene, Buna, Natural Rubber, Urethane and Hard Density Foam. The foam balls can be fully coated, crisscross, or wire brush and are used for scraping and sweeping of lines. Some pipeline systems are only capable of using Ball pigs due to specialized pig senders and/or tight radius bends.

Solid Cast Pigs

Solid Cast Pigs are made in one piece using specially formulated elastomers (usually polyurethane) with superior physical properties. It is resistant to wear. Many different designs available. Used for versatile cleaning, scraping, fluid removal, and other applications.

Pipeline Pig applications

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Component/ Metal Mandrel Pigs

Component Pigs are also known as “Steel Body”, “Mandrel”, or “Modular” Pigs. They consist of a number of individual parts mounted on a body tube. The component parts can be replaced or reconfigured as required. Often, there are many possible configurations for each model and the assembly can be altered to suit different applications. Component pigs are most often used in larger diameter pipelines.

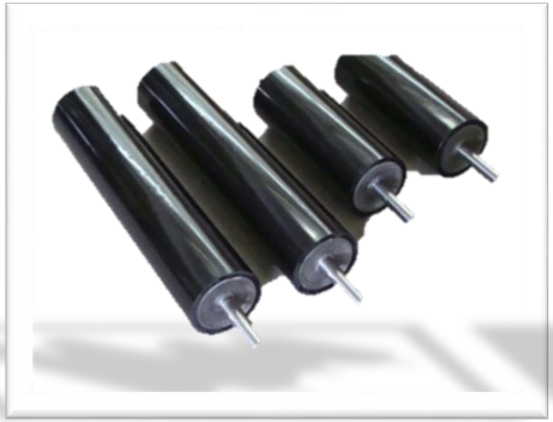
Urethane Cups and Discs

Important parts of many component pigs. Cups offer an improved seal compared to discs, and also include increased contact area for reduced wear. Both cups and discs can be made in many designs.

Custom Designed Pigs

Pigs can be custom designed to suit any application and specifications.

Print Roller applications



Conveyor rollers
Rollers for use in conveyor lines.

Industrial rollers Rollers for industries including: glue, printing, ink coaters, paper & issue, woodworking, steel & aluminum, plastic, glass industries

Wheel and Roller coverings
Urethane wheel and roller coverings

Concrete Formliners

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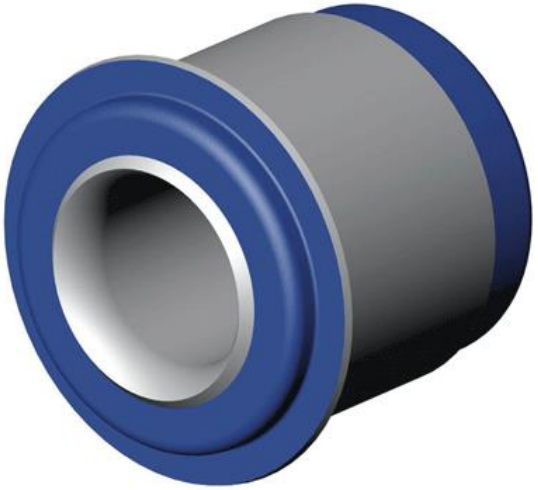
CONSTRUCTION

Other applications

AUTOMOTIVE MARKET



Suspension bushings

Air Filters

After-market suspension parts

Other applications

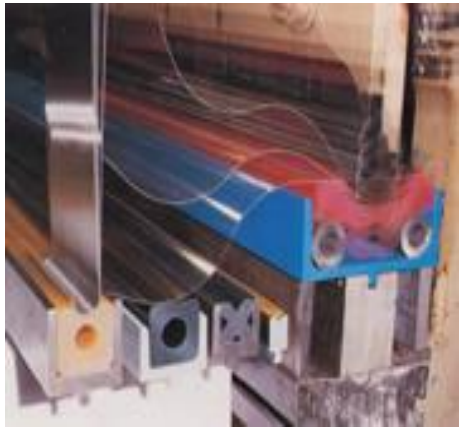
Couplers

Squeegees

Cross-over pads

Other applications

Flexible couplings transmit power without shock. They reduce misalignment forces which shorten bearing life.



The high compression forces required to deflect urethanes are used in **Metal-Forming** operations. Forming costs are reduced because the need for matched punches and dies is eliminated. Urethanes don’t scratch metal.

Other applications

The ease of fabrication and long wear with this **Pneumatic valve** drastically reduce maintenance costs. Castable urethanes outlast metal valves more than two times.

Snowplow blades prevent road damage while resisting abrasion and providing impact resistance at very low temperatures.

Other applications

Long-wearing role coverings provide high pressure transfer in many industrial applications.

Delicate instruments are protected from the abuse of handling, weather, oils, chemicals and solvents. Color ability allows easy identification of instrument types.

Other applications

The castable nature of urethanes permits **Precision cast locators** and fixtures to be used in automated assembly operations. While holding dimensional tolerances, urethanes resist wear and impact.

Resistance to wear and flex fatigue under extreme weather conditions makes **Urethane tracks reliable in snowmobiles**

Other applications

Mining applications such as **Paddle wheels** provide long life in abrasive slurries.

This **Snowblower** manufacturer selected a urethane elastomer auger for this new lightweight unit. The urethane elastomer provided abrasion resistance and eliminated the corrosion problems of the steel augers it replaced.

Other applications

Many types of **Cogs, star wheels, sprockets and gears** can employ the high-modulus urethanes to reduce noise while transmitting power.

Today's top-of-the-line **Bowling balls** are cast urethane. They offer a more consistent level of performance, long life, and less deflection when hitting pins, which translates into higher scores. Good bowlers find the balls can be made to "hook" more for higher scores

Other applications

- **Industrial wheels** can be designed for high cut and wear resistance while achieving enhanced impact absorption using the bending beam principle. This design is an example of the application of finite element analysis to achieve buckling above a pre-described operation deflection.

Intricate shapes – such as **These components for filtering presses** – can be easily molded.

Other applications

Silk-screening applications require durability for the straight edges, flexibility, and solvent resistance without damaging the screen itself

The availability of a large variety of **Sheet, rods and blocks** provides engineers with a quick way to evaluate urethanes for suitability. Even prototype shapes can be machined with metal-working tools.

Other applications

In the **Paper converting industry**, the cost of the longer-lasting urethane **Log pusher** (right) is only 75% the cost of the steel pusher (left) it replaced. An added bonus: if the large saw blade accidentally contacts the urethane pusher, you must replace the pusher – but the $300 saw blade is not damaged.

Urethanes are currently used in the manufacture of everything from skate and roller-coaster wheels to **Conveyor drive rollers**. Weatherability, shock absorption and abrasion resistance are the principal reasons, but high load-bearing properties, resilience, non-marking characteristics, and strong bonding to metal hubs are also important.

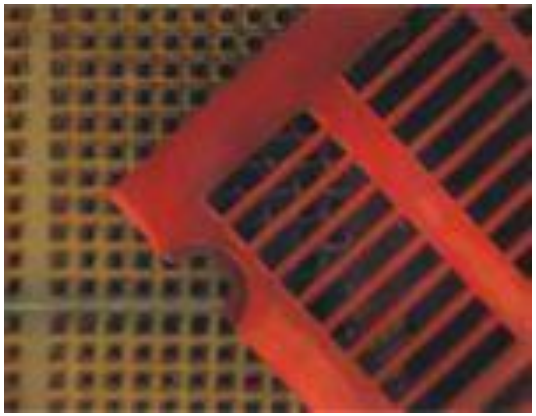
Other applications

Short lead times and **Low-cost tooling**, as well as increas*ed durability, often make urethane components the most economical choice for limited production*.

High load-bearing capacity (two to four times that of conventional rubber), long wear (three to six times that of conventional rubber, cut resistance, low rolling resistance and non-marking of concrete floors are principal reasons why urethanes are preferred.

Other applications

Sanitary waste facilities create harsh environments but urethanes outperform other elastomers in these **guide wheels.**



Mining separator screens are another example in which superior abrasion, impact and cut resistance combine with resilience to provide long service life.