

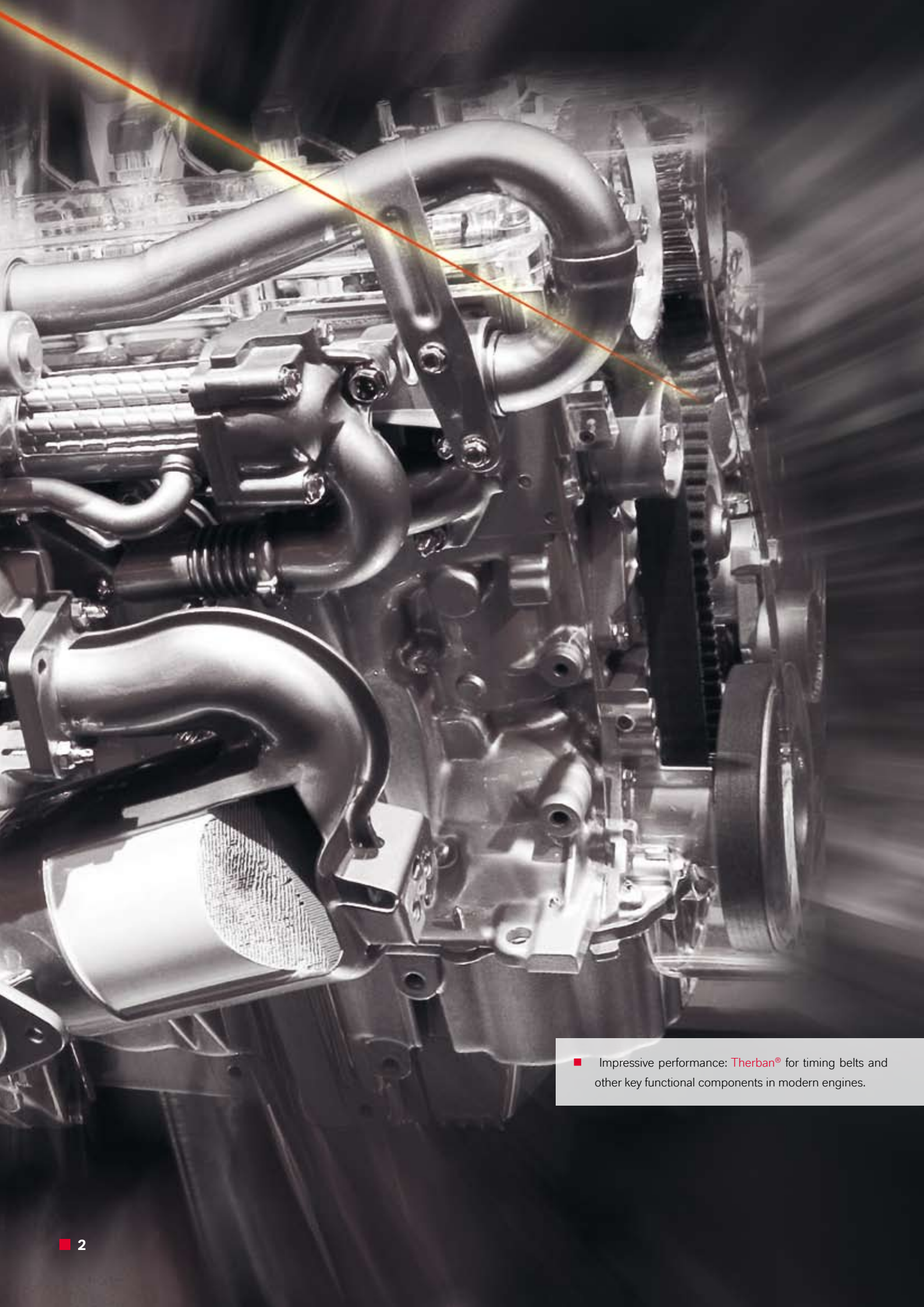


ENDURANCE ENERGIZED BY

LANXESS
Energizing Chemistry

High performance elastomer HNBR **Therban**[®]. Excellent properties e.g. for engine components. Reliable resistance to aggressive fluids, oil and grease – able to function up to 165°C.

X Therban[®]



■ Impressive performance: **Therban®** for timing belts and other key functional components in modern engines.

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THE HIGH-PERFORMANCE HNBR – THERBAN® FROM LANXESS

Therban® – the answer to your needs

Modern automotive engineering demands elastomers that can withstand high temperatures and aggressive substances and can meet the particular requirements of fuel-saving engine and car body designs. The demands in the oil exploration industry are just as stringent. Here, elastomers must weather aggressive environments and high mechanical stresses.

Standards were set in these fields over 25 years ago with the invention of Therban®, the world's first hydrogenated acrylonitrile-butadiene rubber. Since then, our research scientists have been constantly working on improvements. The result is a range of new Therban® grades which will help you to find solutions for the most demanding applications. Our committed team of experts will give you the necessary detailed advice.

Therban® offers:

- high resistance to oil and grease
- ability to function at temperatures from - 40 °C to 165 °C
- superior performance in aggressive fluids such as power steering fluids, automatic transmission fluids, engine oils, fuels, diesel and brake fluids
- a unique range of thermally stable grades with both partial and full saturation, ranging from 20 % ACN to 50 % ACN

- The Therban® plant at Chempark Leverkusen is regarded as one of the most modern facilities of its kind.

The material which assures market success

Better performance gives the competitive edge. For Therban®, high performance is standard. And that means wherever and however it is used. The outstanding property profile ensures excellent vulcanizate properties. Our specialists from research and development will help you to find the Therban® grade that will best meet your needs.

Achievable Therban® vulcanizate properties

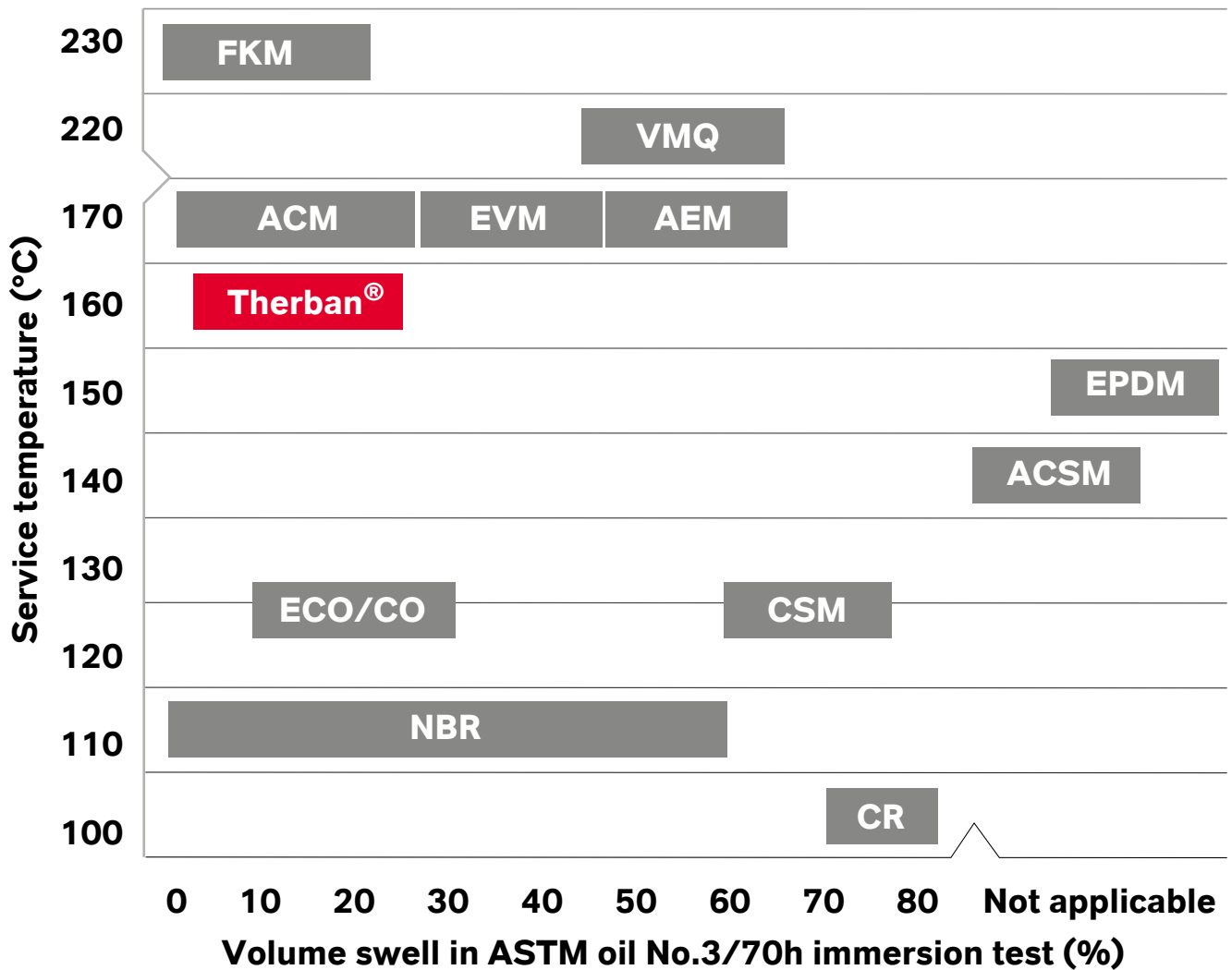
Hardness (Shore A)	30-95
Tensile strength	15-38
Elongation at break	100-600
Modulus at 100 % elongation (MPa)	3-20
Modulus at 300 % elongation (MPa)	5-30
“Resilience” (%)	
RT	30-55
70 °C	55-65
Compression set (examples)	
70 h/RT	15
70 h/150 °C	20
70 h/200 °C	25
Abrasion (measured according to DIN 53516)	
RT (mm ³ loss)	30-80
150 °C (mm ³ loss)	50-80
Low-temperature properties	- 39
Temperature retraction TR10 (°C)	-33
Brittle point (°C)	<-70



In a class of its own

Therban® is an adaptable high-performance elastomer that can replace many other specialty materials because Therban® combines exceptional performance with cost-efficiency and versatility.

Classification of elastomers with respect to heat and oil resistance



Therban® – THE SUCCESSFUL HNBR BRAND

Therban® – superior in many disciplines

A direct comparison shows that Therban® is superior to many other elastomers and materials in several respects. This means that you can turn to Therban® HNBR in applications where you previously needed more expensive solutions.

FKM

Therban® is superior to FKM (fluoroelastomer) in:

- mechanical properties at operation temperature
- chemical resistance to alkaline oil additives
- low-temperature properties
- adhesion

AEM

Therban® is superior to AEM (ethylene-acrylic elastomer) in:

- oil and fuel resistance
- processing properties
- physical properties at high operating temperature
- odor

ACM

Therban® is superior to ACM (acrylate elastomers) in:

- processing behavior
- low-temperature properties
- physical properties
- adhesion

ECO/CO

Therban® is superior to ECO/CO (epichlorohydrin elastomers) in:

- heat resistance
- sensitivity to certain oil additives
- corrosion resistance
- sour gas resistance

CM/CSM

Therban® is superior to CM/CSM (chlorinated/chlorosulfonated polyethylene) in:

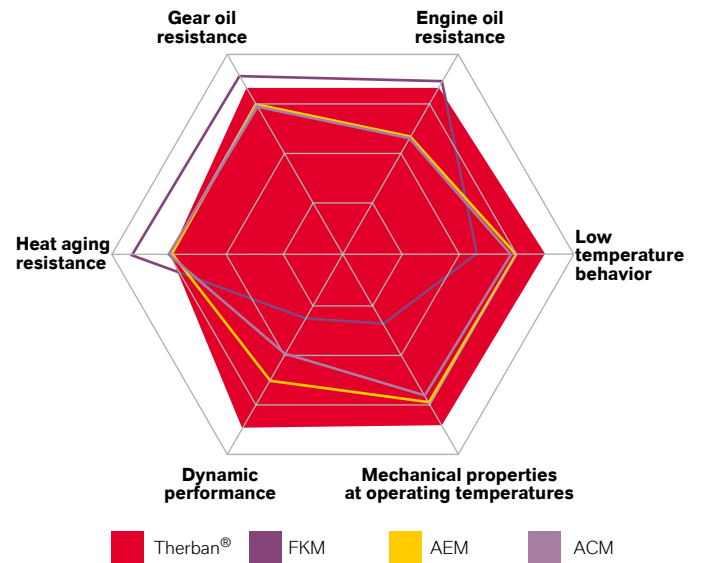
- heat resistance
- sensitivity to certain oil additives
- corrosion resistance
- sour gas resistance

EVM

Therban® is superior to EVM (ethylene-vinylacetate copolymers) / EAM (ethylene-acrylate copolymers) in:

- physical properties
- low-temperature behavior
- oil swell

Comparison of Therban® with other elastomers



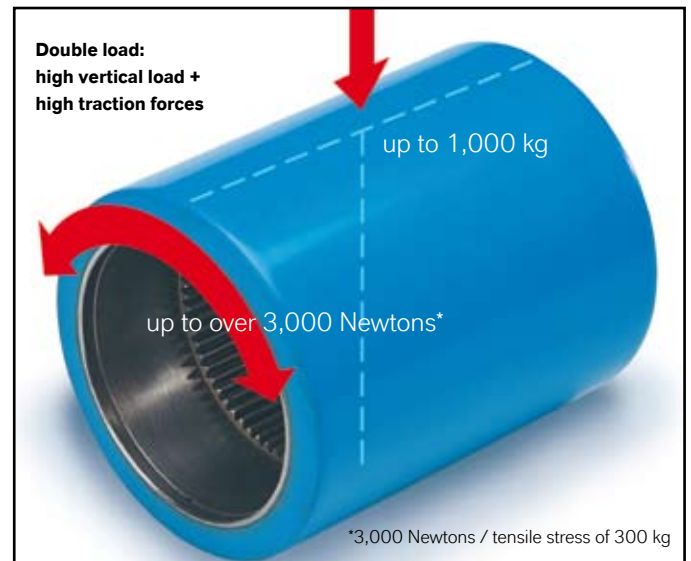
- Threat of abrasion, aggressive fluids, thermal challenges - Therban® resists.



Extremely high demands - extremely customized solutions

Therban® for covering the rollers of power drive units in the cargo-loading system of one of the world's largest transport planes: top performance in all key criteria including dynamic strength, dimensional and thermal stability, abrasion resistance, resistance to technical fluids and chemicals. The basis for the success is the precisely adjustability of this high-performance elastomer from LANXESS to meet specific requirements.

Big in performance, small in size: outer diameter 74 mm, length 91 mm.



- Camshaft absorbers with Therban® HNBR: Longer lifetimes for timing belts and perfect engine management.



- Fuel, diesel, oil, brake fluid or other aggressive substances – Therban® hoses for exceptional performance and cost-efficiency.



Faster production, smoother surfaces and sharper edges with Therban® AT

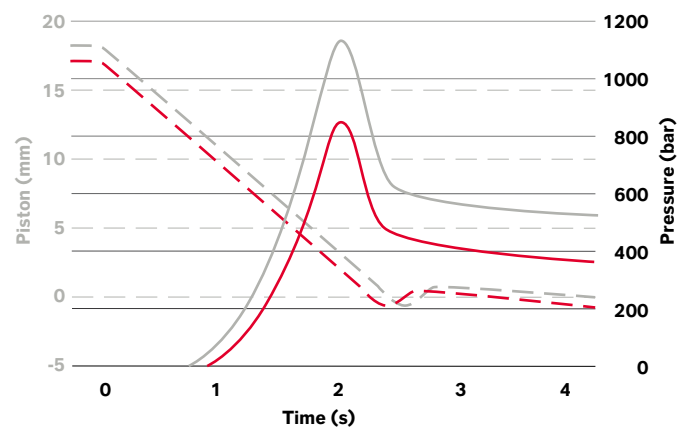
The charts on the right show the significant benefits of Therban® AT for injection molding and extrusion. Besides time and energy savings in processing, Therban® AT improves the quality of the finished article. Improved flow results in smoother surfaces and sharper edges.

Adjustments of recipe and crosslinking agent to enhance vulcanizate properties for Therban® AT applications

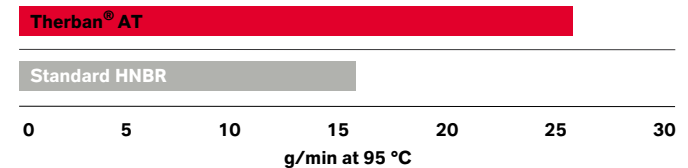
The comparison of various compound properties shows only minor differences, which can be handled simply and safely. A possible slightly lower crosslink density can be compensated for by a minor adjustment of the crosslinking agent or through higher filler loading, which in turn leads to a cost advantage.

	Therban® AT 3404 40 phr / 50 phr N330	Standard HNBR 40 phr N330
Modulus (100%) (MPa)	5.6 / 7.5	6.5
Ultimate tensile strength (MPa)	26.6 / 27.8	27.4
Ultimate elongation (%)	273 / 256	237
Shore A hardness (pts)	64 / 69	66
Compound Mooney	57 / 69	101

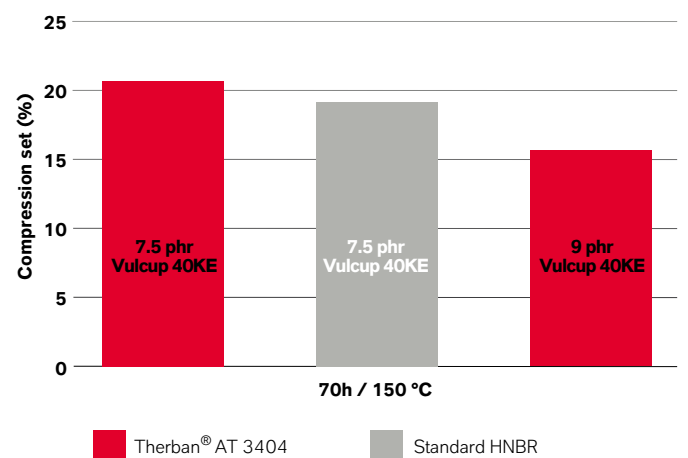
Injection molding



Extrusion rate



Compound properties





THERBAN® AT GRADES WITH ULTRA HIGH ACN CONTENT

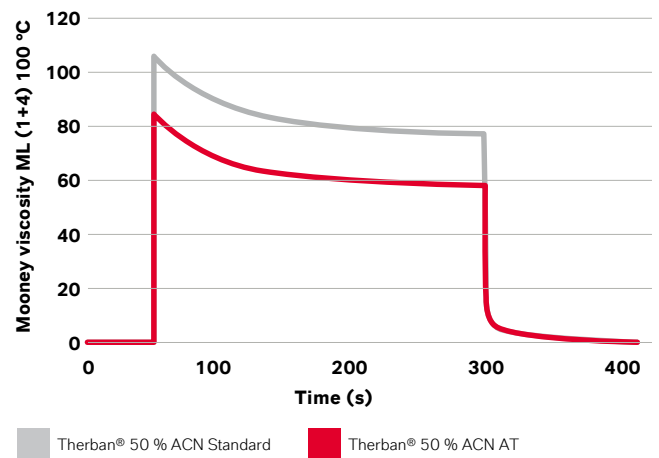
For easy-to-process, high-performance rubber parts with maximum media resistance

State-of-the-art production technologies in premium industries call for high-performance elastomers that provide a maximum lifetime of respective parts, ensuring minimum downtimes and ultimate efficiency of operations. A new generation of environmentally friendly fuels requires the development of elastomers that provide a specific performance profile to assure the reliability of all parts employed – without losing sight of reasonable costs. Our response: The new Ultra High ACN Therban® AT grade family!

With these easy-to-process high-ACN grades, LANXESS addresses industry's need for a combination of optimum processing with maximum media resistance – namely in environments with crude and refined oil, and for the latest generations of flex fuels, such as E10⁽¹⁾, E85⁽¹⁾ or bio-diesel.

Both products belong to the Therban® AT family, which features low viscosity levels that the industry has come to appreciate for their unmatched HNBR processability (see following figure).

Coumpound Mooney

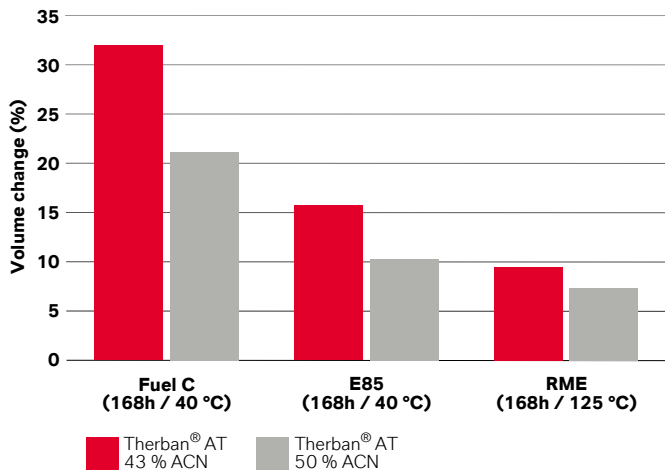


- From the field to the tank. Fuels contain more and more (chemically aggressive) organic components. Pipes and components with Therban® are up to the challenges.

The new high-ACN grades will be of particular interest for large parts with complex shapes and / or long flow paths, such as stators or blow-out preventers in the oil well industry. Due to their low viscosity, a minimum of process aids is needed, which in turn eliminates a known source of failure for the finished part in the long term.

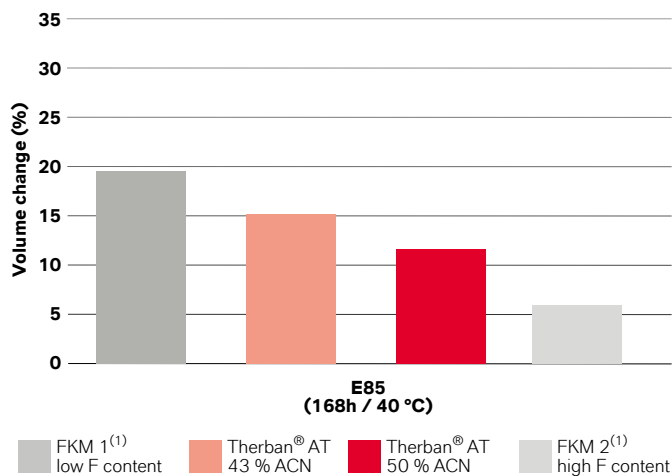
As for other extruded or injection-molded parts, such as hoses and seals, enhanced swelling resistance compared with lower ACN grades can be expected. The following figure depicts the influence of increased ACN content in benchmark fuel.

Volume change in fuels



The next figure gives an example of the volume change performance of **Therban® AT** grades in comparison to commonly deployed FKM grades (64 % and 70 % F content) in E85⁽¹⁾ “superethanol”.

Comparison of Therban® AT and FKM



⁽¹⁾ R. Stevens; ACS 2006 paper no. 86A

Besides providing significantly better economics (lower density and higher filler acceptance), the **Therban® AT 5005 VP*** grade outperforms FKM rubber with a standard fluorine content (64%).

* Trial product (VP=Versuchsprodukt), please see page 15.



■ Aggressive environments, explosive decompression and high mechanical stresses – **Therban®** has the answer!

ThERBAN® PRODUCT RANGE

Fully and partially saturated grades

	ACN cont. (%)	Mooney viscosity ⁽¹⁾ ML (1+4) 100 °C	Residual double bond content (%)	Density (g/cm ³)	Standard packaging	Remarks
Fully saturated (suitable for peroxide crosslinking)						
Therban® 3406	34.0	63	max. 0.9	0.95	Bulk-Box with 20 bales of 25 kg each wrapped in polyethylene film or 25 kg bales individually packed in boxes	similar to Therban® 3407, but with improved flow behavior ⁽²⁾
Therban® 3407	34.0	70	max. 0.9	0.95		for lifetime belts, O-rings, gaskets and seals requiring maximum heat resistance and dynamic performance combined with an optimal compromise of low-temperature properties and oil resistance
Therban® 3607	36.0	66	max. 0.9	0.95		lower swelling compared to Therban® 3407
Therban® 3907	39.0	70	max. 0.9	0.96		further improved oil swelling resistance compared to Therban® 3607, excellent for fuel-resistant hoses, belts, seals, O-rings and gaskets
Therban® 4307	43.0	63	max. 0.9	0.98		very high temperature resistance combined with minimal swelling in oils and fuels; optimal sour gas resistance; ideal for severe application conditions in hoses, diaphragms, O-rings and seals for automotive and oil field applications
Therban® 4309	43.0	100	max. 0.9	0.98		similar to Therban® 4307 for special compounds with high filler and plasticizer loads
Partially saturated grades (suitable for peroxide and sulfur crosslinking)						
Therban® 3446	34.0	61	4.0	0.95	Bulk-Box with 20 bales of 25 kg each wrapped in polyethylene film or 25 kg bales individually packed in boxes	optimal combination of heat resistance, dynamic properties and processing
Therban® 3467	34.0	68	5.5	0.95		recommended standard grade for sulfur cure; excellent dynamic properties
Therban® 3496 (formerly Therban® KA 8837 VP*)	34.0	55	18.0	0.96		optimal compromise between low-temperature compression set and oil swell resistance; especially suited for rolls and dynamic oil field components
Therban® 3627	36.0	66	2.0	0.96		special low RDB type, comparable to Therban® 3607 (peroxide cure recommended) to increase crosslink density for high modulus and/or low compression set applications
Therban® 3629	36.0	87	2.0	0.96		special low RDB type, similar to Therban® 3627 for higher filler load capacity (peroxide cure recommended)
Therban® 3668 VP*	36.0	87	6.0	0.95		high RDB, high Mooney grade similar to Therban® 3627 for higher filler and plasticizer load capacity
Therban® 4367	43.0	61	5.5	0.98		excellent resistance to oils; should be used instead of Therban® 4307 in case improved dynamic and bonding properties are required
Therban® 4369	43.0	97	5.5	0.98		similar to Therban® 4307 with capacity for higher filler loads

(1) unmassed (DIN 53523; ASTM D 1646)

(2) see Therban® AT for maximum flow

* Trial product (VP=Versuchsprodukt), please see page 15.

Specialty grades

	ACN cont. (%)	Mooney viscosity⁽¹⁾ ML (1+4) 100 °C	Residual double bond content (%)	Density (g/cm³)	Standard packaging	Remarks
Low Temperature Technology – LT						
Therban® LT 2157	21.0	70	5.5	0.96		optimal low-temperature flexibility balanced with good oil resistance for use in low-temperature belts, seals, O-rings and gaskets
Therban® LT 2007	21.0	74	max. 0.9	0.96		similar to Therban® LT 2157 with optimal combination of heat and low-temperature resistance, designed for extreme service conditions (peroxide curable)
Therban® LT 2057	21.0	67	5.5	0.96		similar to Therban® LT 2157 with outstanding low mold fouling properties (sulfur and peroxide curable)
Therban® LT 2568	25.0	77	5.5	0.96		similar to Therban® LT 2157 low mold fouling grade with improved oil resistance
Low Mooney – Advanced Technology – AT						
Therban® AT 3404 (formerly Therban® KA 8966 VP*)	34.0	39	max. 0.9	0.95		similar to Therban® 3406 with extra low Mooney viscosity for outstanding processing properties for use in O-rings, seals, spread compounds or as viscosity modifier for high-viscosity compounds (peroxide curable)
Therban® AT 3443 VP*	34.0	39	4.0	0.95		similar to Therban® 3446 combined with processing advantages of new Advanced Technology (sulfur and peroxide curable)
Therban® AT 3904 VP*	39.0	39	max. 0.9	0.95		similar to Therban® 3907 combined with processing advantages of new Advanced Technology (peroxide curable)
Therban® AT 4364 VP*	43.0	39	5.5	0.98		similar to Therban® 4367 combined with processing advantages of new Advanced Technology (sulfur and peroxide curable)
Therban® AT 5005 VP*	49.0	55	max. 0.9	1.00		optimized oil and fuel resistance; excellent heat resistance for high nitrile grades; improved process ability; optimized for biofuel applications
Therban® AT LT 2004 VP* (Low Temperature/ Low Mold Fouling)	21.0	39	max. 0.9	0.96		similar to Therban® LT 2007 combined with processing advantages of new Advanced Technology (peroxide curable)
Carboxylated Technology – XT						
Therban® XT KA 8889 VP*	33.0	77	3.5	0.97		maximum wear resistance and adhesive properties; in combination with Therban® ART strong synergies observed; use for belts, rolls, oil field applications and as adhesive promoter for fabrics and cords (sulfur and peroxide curable)
Acrylate Reinforced Technology – ART						
Therban® ART KA 8796 VP*	34.0 ⁽²⁾	22 ⁽³⁾	5.5 ⁽²⁾	1.14	20 kg boxes on pallets contents: 800 kg	enhanced stiffness, abrasion and load bearing properties, excellent adhesion to metal; use where extreme dynamic performance is warranted e.g. lifetime belts, paper and steel rolls (peroxide curable)

Bulk-Box with 20 bales of 25 kg each wrapped in polyethylene film or 25 kg bales individually packed in boxes

(1) unmassed (DIN 53523; ASTM D 1646)

(2) of base polymer

(3) compound Mooney

* Trial product (VP=Versuchsprodukt), please see page 15.

THERBAN®

TYPICAL APPLICATIONS

A winning formula in practice

Therban® is already indispensable in automotive systems, oil exploration, mechanical engineering and aerospace. Our research team is focused on extending this advantage.

Why not contact us to find out more? We would be delighted to help you discover new applications and develop new projects.

Seals

Therban's® superior line of fully saturated grades with high heat resistance is suited to seal applications in automotive systems and heavy equipment.

Our fully saturated LT grade Therban® KA 8882 VP* provides an excellent combination of high and low-temperature performance, ozone and oil resistance and is ideal for long-term performance in off-the-road vehicle and automotive seals which come into contact with oil and grease.

Use Therban® for:

- wheel bearing seals
- shock absorber seals
- camshaft seals
- power steering assembly seals
- O-rings
- water pump seals
- gearbox shaft seals
- air conditioning system seals
- fuel system seals for diesel and RME

Oil well specialties

High ACN saturated grades are best for low swell and explosive decompression resistance. This also applies to fuel and refrigerant applications. No other supplier offers a line of fully saturated HNBR grades that equals Therban® for performance.

Use Therban® for:

- blow-out preventers
- packers
- drill-pipe protectors
- stator pumps
- drill bit seals

Wires and cables

Medium-high ACN fully saturated grades are ideal for wire and cable applications.

Use Therban® for:

- protective components for electrical systems
- protective jackets for electrical cables and wires
- blends with EVM/Al(OH)₃ for cable jackets with excellent flame-retardant properties

Belts, hoses, mountings

Therban® LT grades are especially suitable for applications where cold flex cracking is a problem, as in snowmobile belts. Therban® partially hydrogenated grades are the right choice in these dynamic applications.

Use Therban® for:

- air conditioning hoses
- timing belts
- engine mountings
- oil-cooler hoses
- poly-v-belts
- torsional vibration dampeners
- boots and bellows
- chain tensioning devices
- fuel hoses
- overflow caps
- power steering hoses
- ship couplings
- high-pressure hydraulic hoses with a high dynamic load

Roll coverings

Therban® AT grades are especially suited to high hardness roll applications; they combine high modulus and good dynamic properties with low compound viscosity. All partially saturated Therban® grades from LANXESS are ideal for these dynamic applications.

Use Therban® for:

- metal-working rolls
- paper industry rolls
- printing rolls
- elastomer components for looms
- textile rolls
- rolls for transport of containers in aircraft

* Trial product (VP=Versuchsprodukt), please see page 15.

Your direct contact to Therban® experts in your region

EMEA

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Quality & Environmental Management

Therban® is produced under strict control regarding safety, environmental protection and quality. The whole supply chain, from production to customer service, is covered by ISO 9001 and ISO 14001 certification.

Product safety

Relevant safety data and references as well as the necessary hazard warning labels can be found in the Material Safety Data Sheet.

Food contact

Information concerning FDA and BfR compliance can be obtained on request from the Health, Safety, Environment and Quality Department (HSEQ) of Lanxess.

* As with any product, use of the products mentioned in this publication in a given application must be tested (including field testing, etc.) by the user in advance to determine suitability.

Health and Safety Information:

Appropriate literature has been assembled which provides information concerning the health and safety precautions that must be observed when handling the LANXESS products mentioned in this publication. For materials mentioned which are not LANXESS products, appropriate industrial hygiene and other safety precautions recommended by their manufacturers should be followed. Before working with any of these products, you must read and become familiar with the available information on their hazards, proper use and handling. This cannot be overemphasized. Information is available in several forms, e.g., material safety data sheets and product labels. Consult your LANXESS representative in Germany or contact the Health, Safety, Environment and Quality Department (HSEQ) of LANXESS Germany or - for business in the USA - the LANXESS Product Safety and Regulatory Affairs Department in Pittsburgh, PA.

Regulatory Compliance Information: Some of the end uses of the products described in this publication must comply with applicable regulations, such as the FDA, BfR, NSF, USDA, and CPSC. If you have any questions on the regulatory status of these products, contact your LANXESS Corporation representative, the LANXESS Regulatory Affairs Manager in Pittsburgh, PA or the Health, Safety, Environment and Quality Department (HSEQ) of LANXESS Germany.

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HNBR ENERGIZED BY

LANXESS
Energizing Chemistry

High performance elastomer **Therban®**. Excellent properties e.g. for engine components. Reliable resistance to aggressive fluids, oil and grease – able to function down to - 40°C.

LANXESS Deutschland GmbH, Business Unit High Performance Elastomers
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