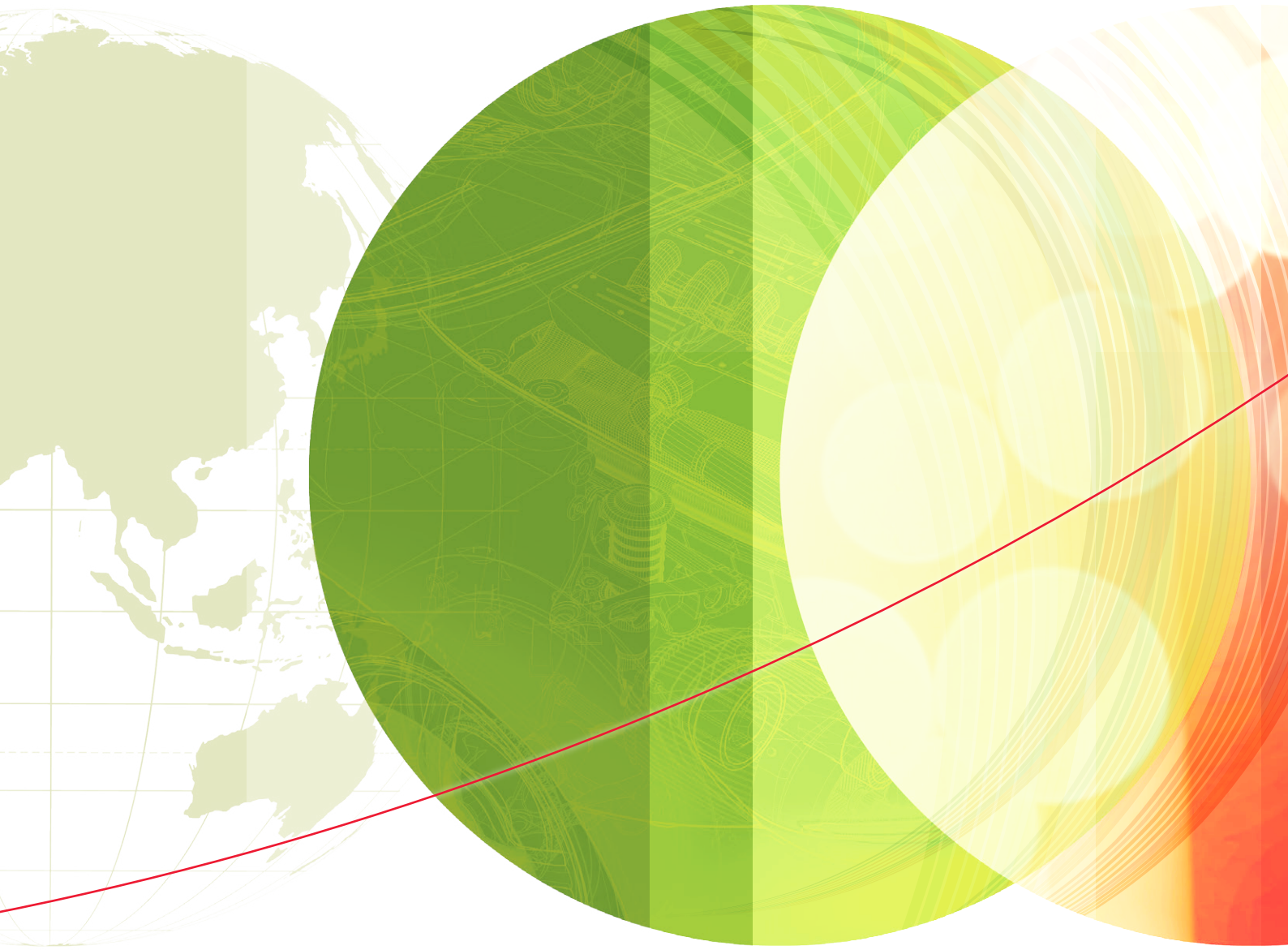
GMORS®
GE MAO RUBBER INDUSTRIAL CO., LTD.



Sealing Solutions for Automotive Industry

Certified GMORS

GMORS is a leading Taiwan supplier of rubber seals to Tier II and Tier III for light vehicle and heavy truck systems in automotive industry. Developing in automotive industry for 20 years, we provide sealing solutions to customers from Europe, Japan, North America, China, South Korea and Thailand. GMORS produces both non-safety and safety parts, according to IATF 16949:2016 process and customer's requested procedures. GMORS offers professional advice to customer's new vehicle design and market-led seal parts. We listen to all customers' demand, and design compatible rubber material, seal shape and prototype for trial run. We collect customer's test feedback and update our DFMEA (Design Failure Mode and Effects Analysis) for next improvement until customers feel satisfied.

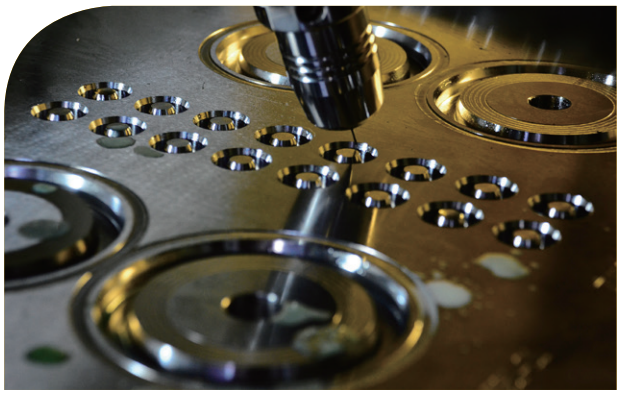
bsi. IATF 16949 Automotive Quality Management — 38010-000
ISO 14001 Environmental Management — EMS 610117
ISO 45001 Occupational Health and Safety Management — OHS 610119

In-house Laboratory

To react promptly to customer's need for research and development, GMORS develops in-house laboratory and chemical engineers to design, mix and test rubber recipe. GMORS laboratory is equipped with advanced testing equipments and knowledgeable engineers. Moreover, GMORS laboratory follows rigorous procedures, which are certified by TAF (ISO17025). According to ASTM requirements, "TGA", "FTIR" and "3 Sigma" standard deviation measures are used to check the performance of mixing quality per batch for quarterly or annual revalidation. GMORS has more than 100 rubber materials that meet automotive specifications and are also certified by automotive customers.

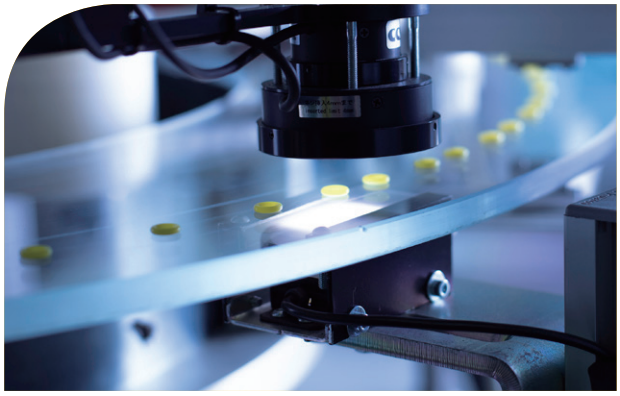
Mold Design

GMORS owns a mold shop with 3 axial and 5 axial CNC cutting machines to offer high-level seal surface finish. Highly precise cutting guarantees consistent dimension in each cavity. Also, the mistakeproofing device can avoid mismatch and mold operation damage for long molding cycles.



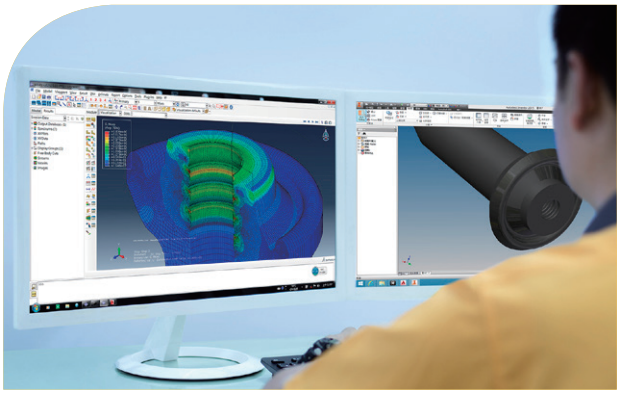
Quality Assurance

10% lower "gauge R&R" (Repeatability and Reproducibility) measuring equipments are used to make sure all dimension results are right. CPK>=1.33 and PPK>=1.67 are required and further prove GMORS capability and all records are utilized for constant improvement.
MES (Manufacturing execution system-barcode system), a control system for managing and monitoring work in process on a factory floor, provide reliable traceability.



Excellent Engineering team

To meet customer's requirements for the product, GMORS engineering team applies advanced equipment and a variety of design tools. The use of finite element analysis (FEA) helps GMORS to provide optimum sealing solutions for each customer's requests.



Cost Reduction

PPAP level III is our standard documents for automotive. Except control plan are divided into two sections: non-safety and safety parts. GMORS R&D engineers will design process for non-safety and safety issues according to the details of drawing, material specification and risk coefficient from technical review and analysis with customers.
For tracing and PPAP re-submission, PLM (Product Life-cycle Management) software system manages PFEMA, controls and records all "ECN" (Engineer Change Note) and "ECR" (Engineer Change Requirement) which need to be approved by right auditors. "Part Born" and "Process Born" in SAP system can calculate "Run at Rate" to guarantee 100% delivery performance. Via SAP finance system, we analyze actual cost for each process to figure out where the cost is wasting. "6 Sigma" and "TPM projects" can help reduce the defect rate, and therefore, cost reduction is supervised quarterly and annually.

Cleanroom Class - Class 100,000
Cleaning and Inspection

Cleanliness of Components

Customer Special Requirement - Cleanliness of components

CCC=A(D14/E12/F9/G6/H3/IJK00)

Code	Particle Size	Contamination Level	Number of particles per	
			More than	Up to (include)
D	25-50	14	8,000	16,000
E	50-100	12	2,000	4,000
F	100-150	9	250	500
G	150-200	6	32	64
H	200-400	3	4	8
I	400-600	00	0	0
J	600-1000	00	0	0
K	>1000	00	0	0

Automotive Systems and Sealing Solutions

Intake & Exhaust System

Entering the era of low-carbon emission and sustainability imperative, you need better sealing solutions to withstand an even harsher environment such as in EGR system and turbo intercoolers. In addition to that, GMORS also provides sealing solutions for SCR system (Selective Catalytic Reduction), and for aflertreatment system of diesel exhaust emissions from diesel engines such as AdBlue®. Especially for SCR system, we provide seals in custom compounds with extra reliability to fulfill the complete sealing purpose.

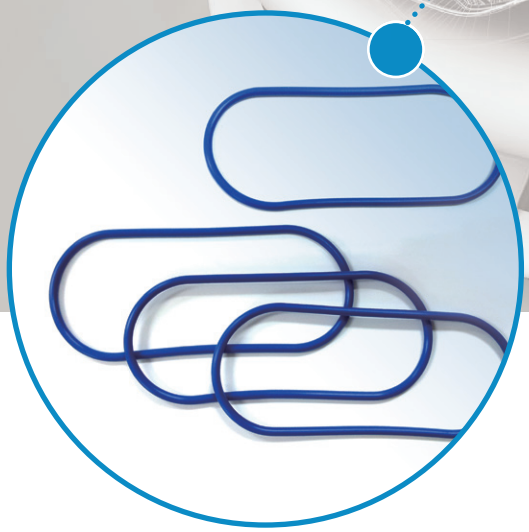


Table: Intake and Exhaust System

Intake and Exhaust System	Material	Compound
Intake Manifold	Silicone	S5012AP
EGR System (Exhaust Gas Recirculation)	Vamac [1)] FKM [1)]	V7014AA
Exhaust Manifold (Blow-By gas / AdBlue®	HNBR EPDM	H7019AK E7002AA
O2 Sensor	FKM	V8040AA

1) GMORS compound have been approved by automotive customers.
2) Surface coating are available for more assembly cycles low friction.

Braking System

Seals in braking system are the most "system critical" automotive components. GMORS understands your concern and need. We ensure you a reliable control of braking function by providing you with optimum sealing solutions. We can meet requirements for hydraulic, pneumatic circuits, and system control. Our strict process control is to assure seals of working conditions like compression set, stress, strain, creep and etc. We also increase seal's friction and wea in order to maximize the service life.

Table: Braking System

Braking System	Material	Compound
Fluid Brake DOT#3,4,5	EPDM [1)]	E8000AA、E7905AA、E7005AA、E8005AA
Air Brake	EPDM [1)]	E6935AA、E8105AA、E8005AA

1) GMORS compound have been approved by automotive customers.

Fuel System

Seal application in fuel system is regarded as safety critical with challenging requirements. Therefore, in early stage of development, GMORS is able to design compounds according to kinds of sealing considerations, and test under harsh environments, such as volume expansion, erosionresistance, and different additives. GMORS sealing solutions apply to a variety of biodiesel, rapeseed methyl ester (RME), flex fuel, compressed natural gas (CNG), liquid petroleum gas (LPG) and so on. We can also meet your need for new fuel alternatives. For instance, in high-pressure diesel systems, we ensure sealing solution of the low permeability and the high sealing reliability (such as injector) for a successful function of engine even in challenging working environments.

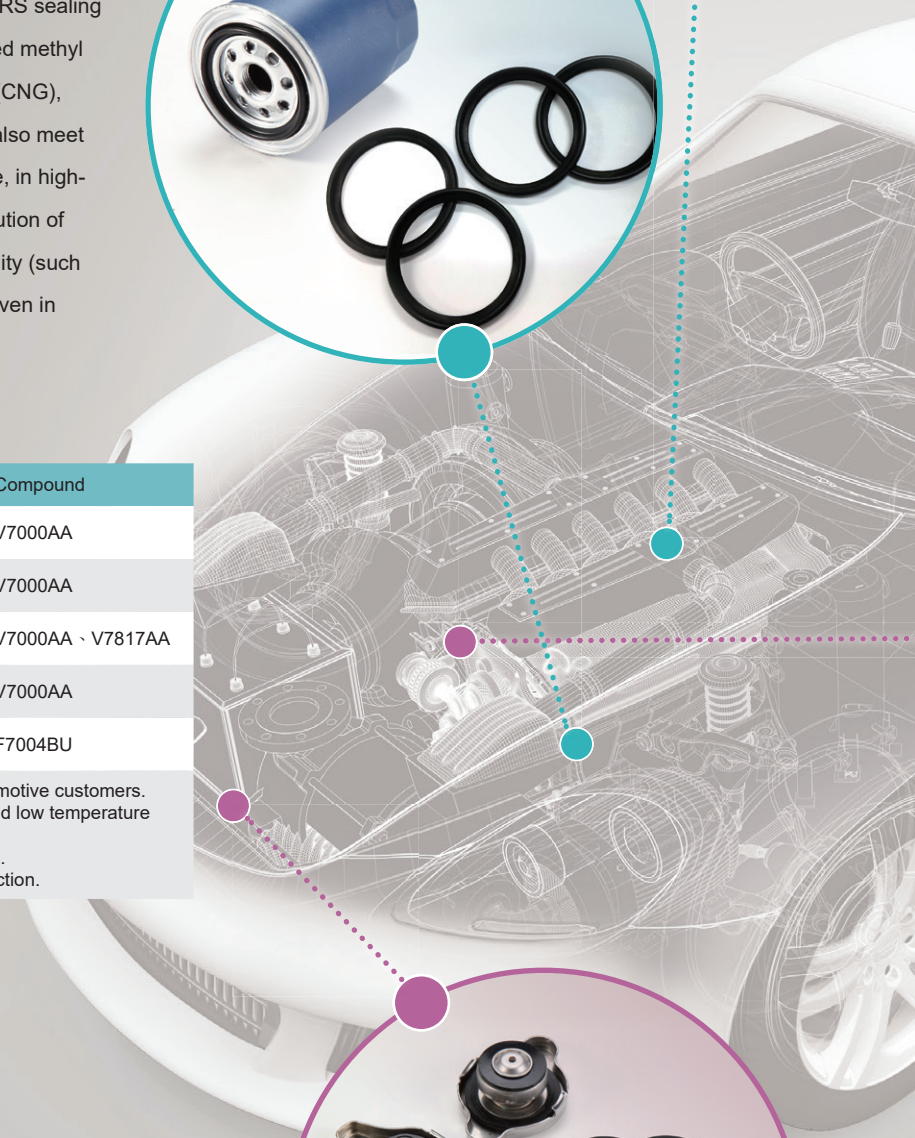


Table: Fuel / LPG Injector

Type of gasoline	Material [4]	Compound
Unleaded fuel	FKM [1] [2]	V7000AA
Diesel	FKM [1] [2]	V7000AA
Biodiesel	FKM	V7000AA、V7817AA
Biofuel	FKM [1] [2]	V7000AA
LPG (liquid petroleum gas)	Fluorosilicone [1] [3]	F7004BU

1) GMORS compounds have been approved by automotive customers.
2) GMORS has general compound (-20°C~200°C) and low temperature compound (-40°C~200°C).
3) Fluorosilicone service temperature is -70°C~200°C.
4) Surface coating is available to reduce assembly friction.

Cooling and Air Conditioning System

When water temperature of the engine is increased to a greater mobility of the fuel oil, leading to better fuel economy, the seal has to be able to withstand a higher temperature cooling environment. GMORS high-performance materials with good compression set and stress relaxation property. Excellent property materials meet the latest regulations on refrigerants and the environments, and suit applications of condenser, evaporator, compressor, various valves, and sensors. GMORS offers perfect sealing solutions to stand the conditions such as permeability, chemical resistance, and control of volume expansion. And according to your system's refrigerant, our sealing solutions can help prevent and control the refrigerant loss from the circuit.

Table: Cooling System

Cooling System	Material	Compound
Radiator	EPDM Silicone	E6502AA、E5002AA、E5533AA、E6133AA S7413AB
Thermostat	HNBR	H6509AR

Table: Air Conditioning System

Air conditioning system medium	Material	Compound
Freon R-134a [2],HFO-1234yf	HNBR	H7013AA、H8100AA
Freon R-134a [2],PAG(lubricant)	EPDM [1]	E7579AH、E6502AA
R744(CO2)	HNBR EPDM	H7013AA E7579AH
Freon R-12,R-22	Neoprene/ CR	C7505AA

1) Rubber materials have been approved by VOLKSWAGEN TL 524 32.
2) Freon R-134a and synthetic lubricant with PAG or POE.

Transmission & Steering System

Designers of transmission and steering system are usually challenged to improve the system performance, such as by reducing size, integrating application structure and enhancing system efficiency. Therefore, seal with multi-function feature is required. Our engineering team can meet your request for the design and development of new series, providing seals with low noise, low friction / wear, and long service life. Under high pressure and high speed working environments, a total sealing solution also helps to eliminate noise vibration.

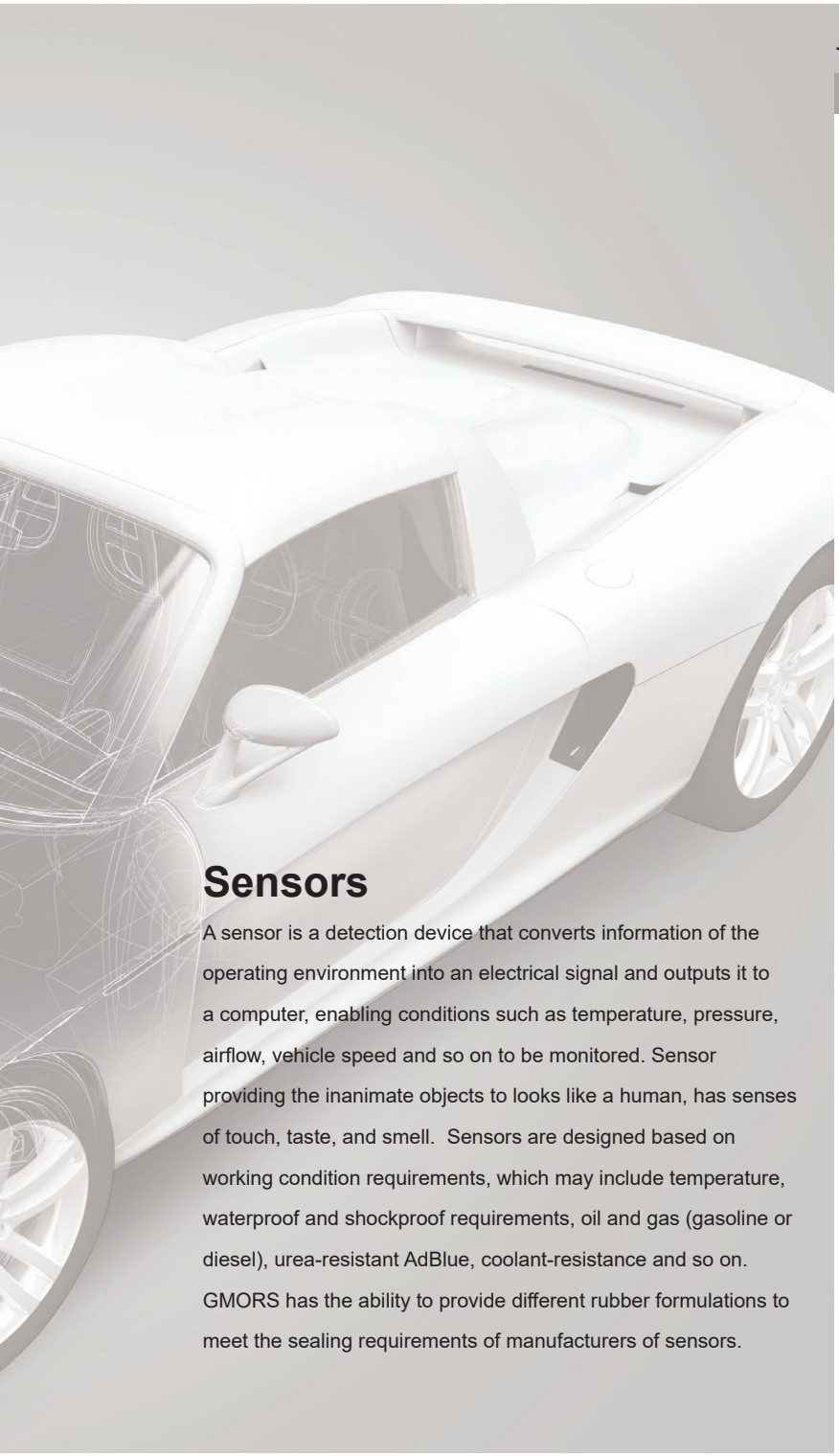
Table: Transmission System

Transmission Fluid Resistance		Material	Compound
DEXRON III	DEXRON VI		
V		General FKM	V7500AA、V7500AB、V7531AA
V	V	Low Temperature FKM	V7544AA
V	V	VAMAC	G6506AA、G6005AA、G8500AA
V	V	ACM	P7000AA

Table: Steering System

Steering System	Material	Compound
Columns	HNBR(1)	H7518AA
Half shaft	HNBR(1) NBR(1)	H7026AA N8369AA
Hose	HNBR(1)	H8024AA
Int Gear	HNBR(1) NBR(1)	H7315AA N8369AA
Pump	HNBR(1)	H8000AA
RP Gear	HNBR(1)	H9024AA

1) Rubber materials have been approved by automotive customers.



Sensors

A sensor is a detection device that converts information of the operating environment into an electrical signal and outputs it to a computer, enabling conditions such as temperature, pressure, airflow, vehicle speed and so on to be monitored. Sensor providing the inanimate objects to looks like a human, has senses of touch, taste, and smell. Sensors are designed based on working condition requirements, which may include temperature, waterproof and shockproof requirements, oil and gas (gasoline or diesel), urea-resistant AdBlue, coolant-resistance and so on. GMORS has the ability to provide different rubber formulations to meet the sealing requirements of manufacturers of sensors.

Table: Sensor

Sensor	Material	Compound
• Engine • Exhaust after-treatment • Transmission • Tire pressure monitoring • Air conditioning • Electronic stability	EPDM	E4000AA
		E6935AA
		E7083AA
	Fluorosilicone	F6004BU
	HNBR	H6915AA
		H7036AA
		H7500AA
		H7500AB
	NBR	N4006AA
		N5071AA
		N7000AA
		N7000AP
		N7027AA
		N7034AA
		N7577AA
		N9026AA
		N7000AA
	Silicone	S5006BU
		S7000AA
		S7000AB
		S7000AD
		S7000AF
		S7000AN
		S7000AU
		S7017AB
	FKM	V6017AA
		V7000AE
		V7000AG
		V7000AR
		V7082AA
		V7500AA
		V7500AB
		V7500AC
		V7500AG
		V7544AA
		V7582AC
		V8040AA
		V8081AA
		V8184AA
		V9082AB

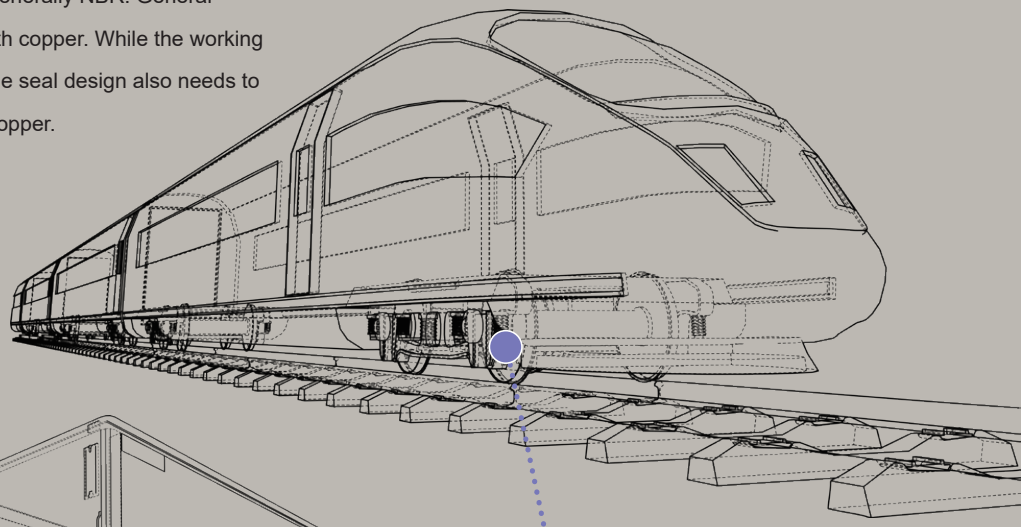
Trucks and Railway Air Brake System

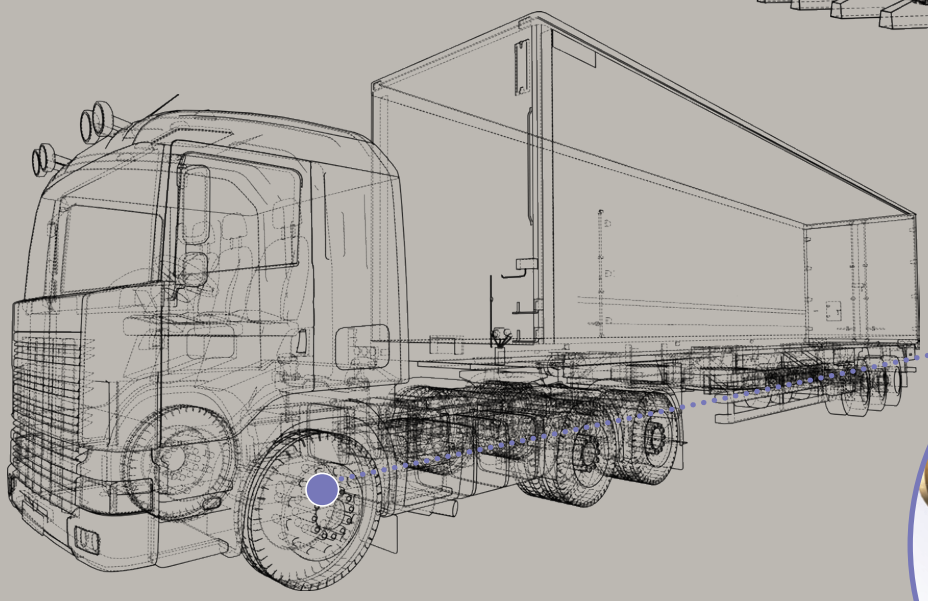
The components of an air brake system consists of an air storage tank, safety valve, low pressure indicator, a compressor, pressure governer and release valve, brake valve, relay valve, quick release valve and brake chamber.

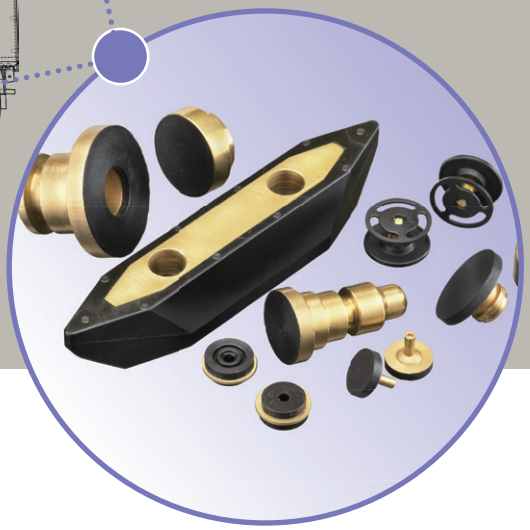
The air brake system makes use of air intake and exhaust at high pressure to generate braking efficiency for trucks and trains. The rubber material that is used is generally NBR. General product design is rubber sintered with copper. While the working environment under high pressure, the seal design also needs to be sintered with rubber, fabric and copper.

Table: Braking System

	Material	Compound
Air Brake Systems	NBR	N8088AA







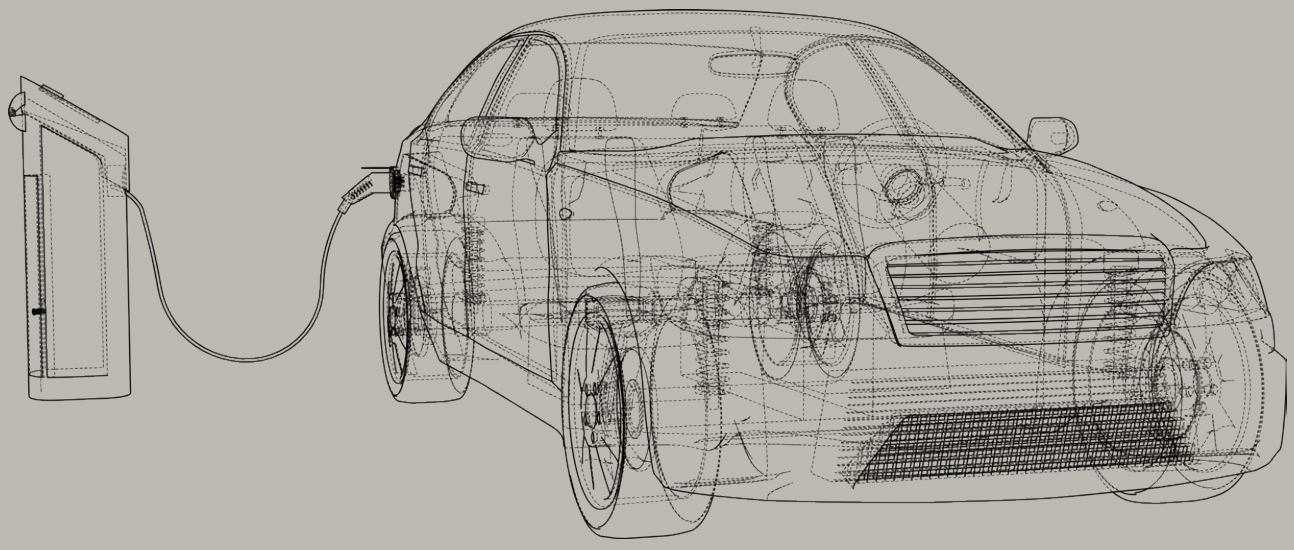
Electric Vehicle Battery Module

The automotive industry is moving towards a watershed. With the innovation of new technologies, automotive components are becoming increasingly diversified. Compared with traditional fuel-driven vehicles, the key components of electric vehicles (EV) comprise of batteries and batteries thermal management systems (BTMS).

Batteries that power today's electric vehicles and hybrid vehicles have significantly higher amperages and energy volumes, and have to be more robust and of higher quality than those used in consumer applications. Batteries for electric vehicles operate under more demanding temperature and pressure conditions, and also have to be protected against the ingress of dust and moisture from the environment. Elastomeric seals contribute toward extending the batteries service life under such tough service conditions.

Table: Battery Module

Battery Module	Material	Compound
	EPDM	E7010AA



MEMO

O-Ring Master

GMORS O-Ring Master is the completed tool for standard rubber seal sizes.
When you use this APP, you don't need to have internet and catalog.
Except O-Ring sizes, it also includes the search functions of X-Ring and Back-Up Ring.
Otherwise, you can also use O-Ring Housing to choose suitable O-Ring in your application.

Material Master

GMORS Material Master give you the materials recommendation for your O-Ring application, based on the working temperature and medium of working environment. We provide thousand kinds of environment condition for compatibility evaluation. In addition, GMORS provide certified rubber compounds for various international standards, such as NSF61, WRAS, ACS, KTW, W-270, Din EN549, UL157, API 6A, NORSOK M-710, TOTAL EP PVV 142 and NACE TM0297.
Please email us for further information.

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