FILTRAN

Innovative Filtration Solutions for Future Transmission Trends

Speaker: Wolfgang Stausberg

Author: Abe Khalil — Director Global Development
Wolfgang Stausberg — Chief Technical Officer

Innovative Filtration Solutions for Future Transmission Trends

Agenda

1. **Company Introduction**

2. **Dependency between Demands on Transmissions and Filtration**
   Increasing requirements for future transmission filtration

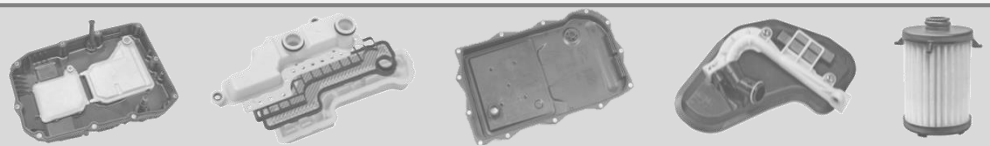
3. **Innovative Filtration Solutions for Modern & Future Transmissions**

   Example 1 – FORD/GM 10 Speed
   High Performance Suction Filter System

   Example 2 – Daimler NAG-3
   Innovative Plastic Oil Pan Module

4. **Future Outlook**

5. **Summary and Conclusions**



1. Company Introduction

Detroit - Farmington Hills MI, USA

IBS FILTRAN - Morsbach, Cologne, Germany

Filtran Japan Office, Fujinomija, Japan

Chicago - DesPlaines IL, USA

New Mexico Plant

2 Plants in Beijing, China

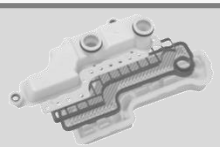
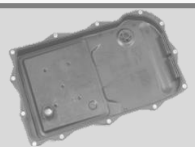
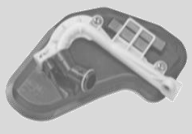
Seoul, Dongan, Korea

FILTRAN

A leading global supplier of automatic transmission filtration, supplying virtually every OEM in the world!

Footprint:	**NAFTA, Europe, China, Korea, Japan**
Employees:	**approx. 650**
Revenue:	**180 million US$ (2014)**

Filtration Group
filtering the world

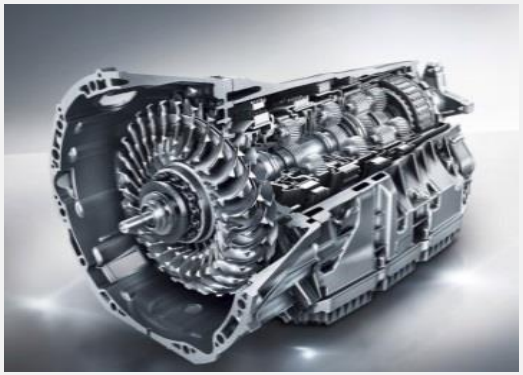






2. Dependency between demands on transmissions and filtration

Increased requirements for future transmission trends

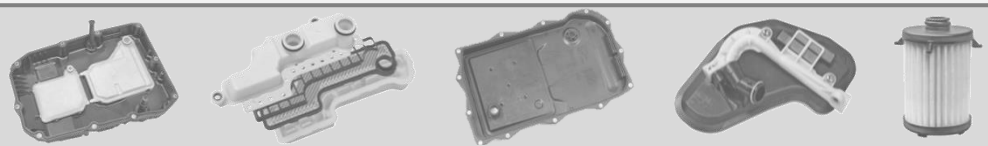
Performance:
→ higher torque
→ larger transmission ratio spread
→ increased performance per weight
→ faster response

Comfort:
→ no sudden movement
→ reduction of noise
→ better operator control
→ faster feedback



Environmental:
→ transmission's efficiency
→ lightweight
→ compactness

Transmission requirements must be refined to <u>mechanical and hydraulic</u> characteristics



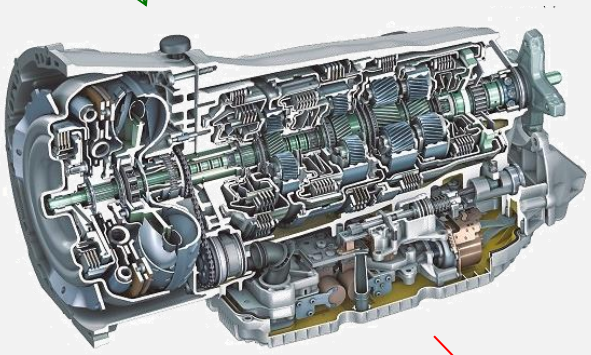
2. Dependency between demands on transmissions and filtration

Consequences for the transmission concept and layout

new design

new concepts

new materials / fluids



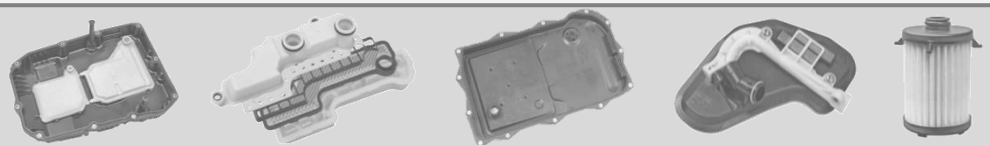
less losses

higher cleanliness level

higher pressure

smaller and more sensitive components

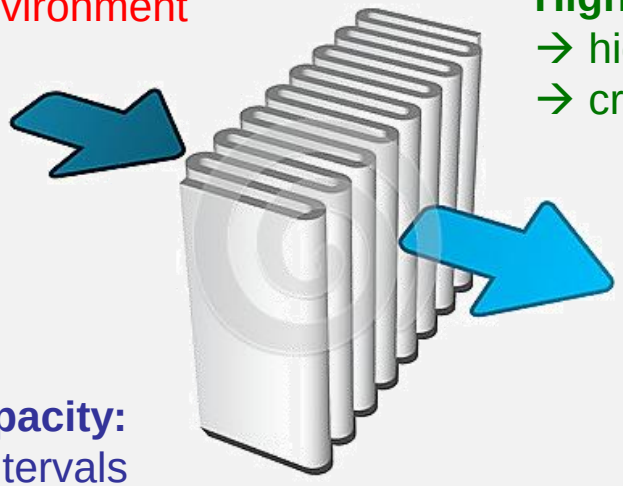
Hydraulic requirements must be refined to <u>filtration</u> characteristics



2. Dependency between demands on transmissions and filtration

Consequences for filtration

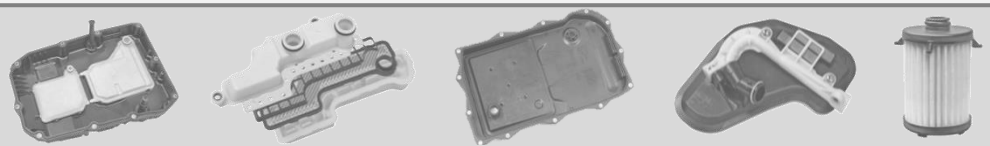
Lower Pressure Differential:
→ feed of oil at cold start
→ effectiveness
→ avoid cavitation
→ compensate for smaller environment



Higher Filtration Efficiency:
→ higher cleanliness level
→ critical particle size captured

Higher Dirt Holding Capacity:
→ reduction of service intervals
→ life time filters
→ compensate for smaller environment and higher efficiency

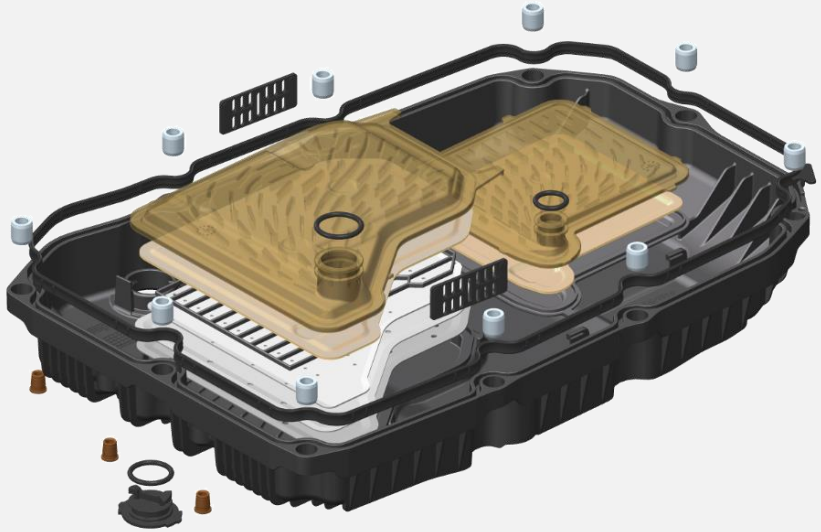
Filtration Characteristics must be refined to filter requirements



2. Dependency between demands on transmissions and filtration

Consequences for filter design

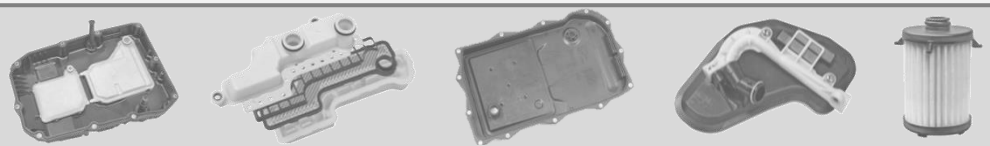
1st Trend:
High Performance Filtration
→ to achieve higher oil cleanliness



2nd Trend:
Lightweight, Compactness & Cleaner Parts

3rd Trend:
Function Integration & Modularization
→ system supply

Transmission requirements must be refined to generate supporting filter concepts!



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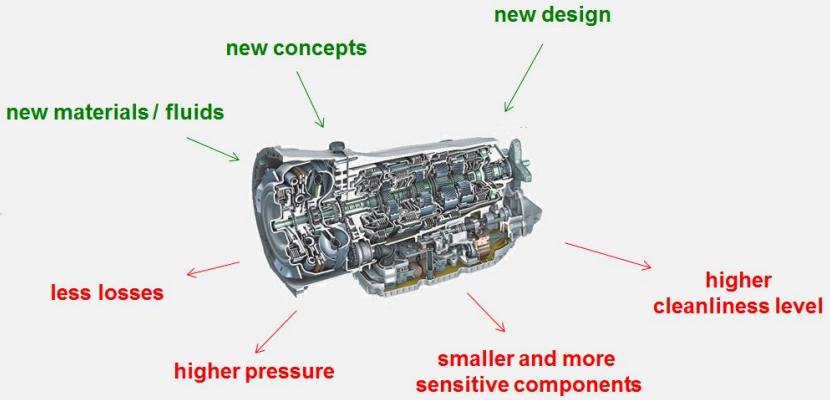
Consequences for the transmission concept and layout



Hydraulic requirements must be refined to filtration characteristics

Consequences for filtration

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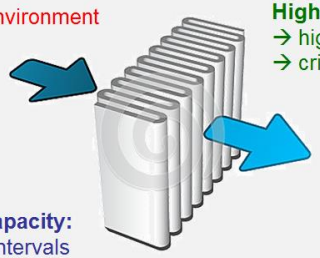

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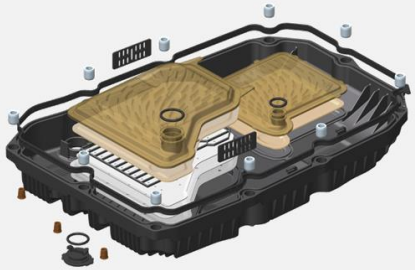

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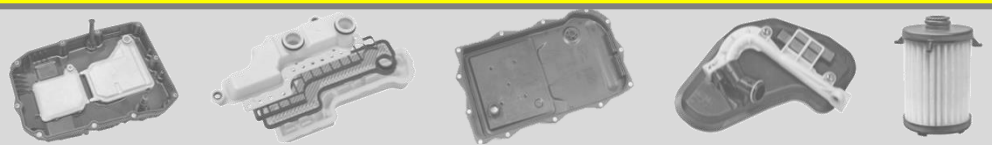


3. Innovative Filtration Solutions for Modern & Future Transmission

Example 1: FORD /GM 10 speed Filter System

Development Target: To increase transmission's efficiency and reaction time!

→ direct operating control valves

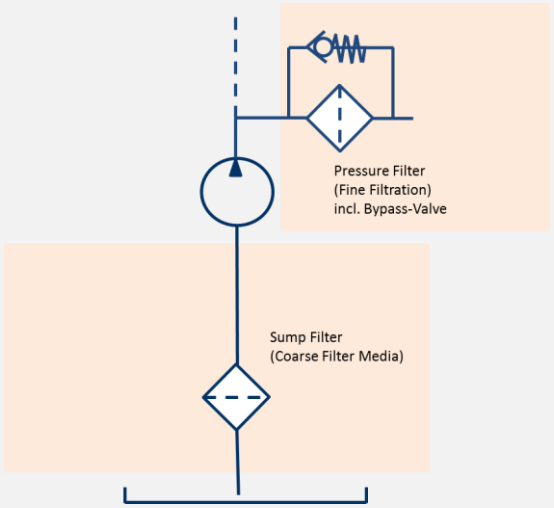
→ require high level of oil cleanliness

→ need for high performance filtration

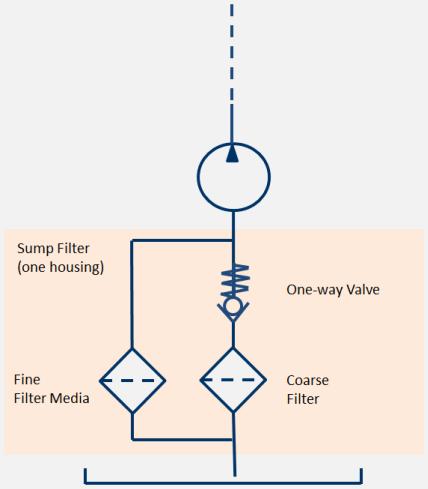
→ high efficiency filter media must be considered!

Where is the best place to integrate the fine filtration media?

A.) On the pressure side (as usual)?



B.) On the suction side (the FILTRAN way)?



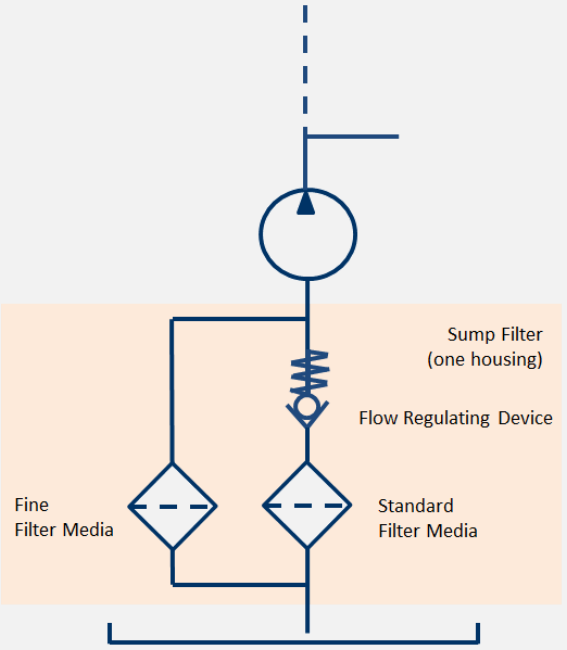
3. Innovative Filtration Solutions for Modern & Future Transmission

Example 1: FORD /GM 10 speed Filter System

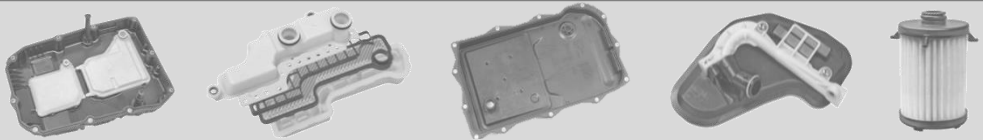
Advantages to integrate the fine filter media on the suction side:

1.) No need for additional pressure filter and adaptation
- → less installation space (compactness)
- → less weight
- → lower logistical burden
- → lower assembly effort
- → cost improvement

2.) Based on the natural boundary conditions on suction side
- → low pressure drop is required
- → generates higher system efficiency



Disadvantages in comparison to using pressure side filter:
- → slower initial cleaning rate
  (ranked as uncritical!)



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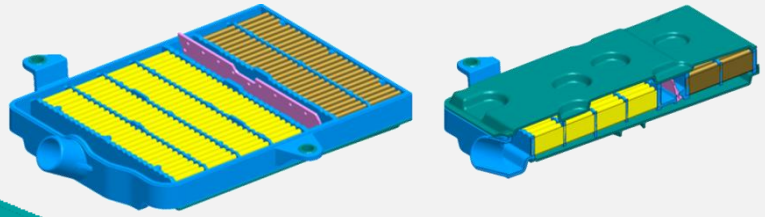
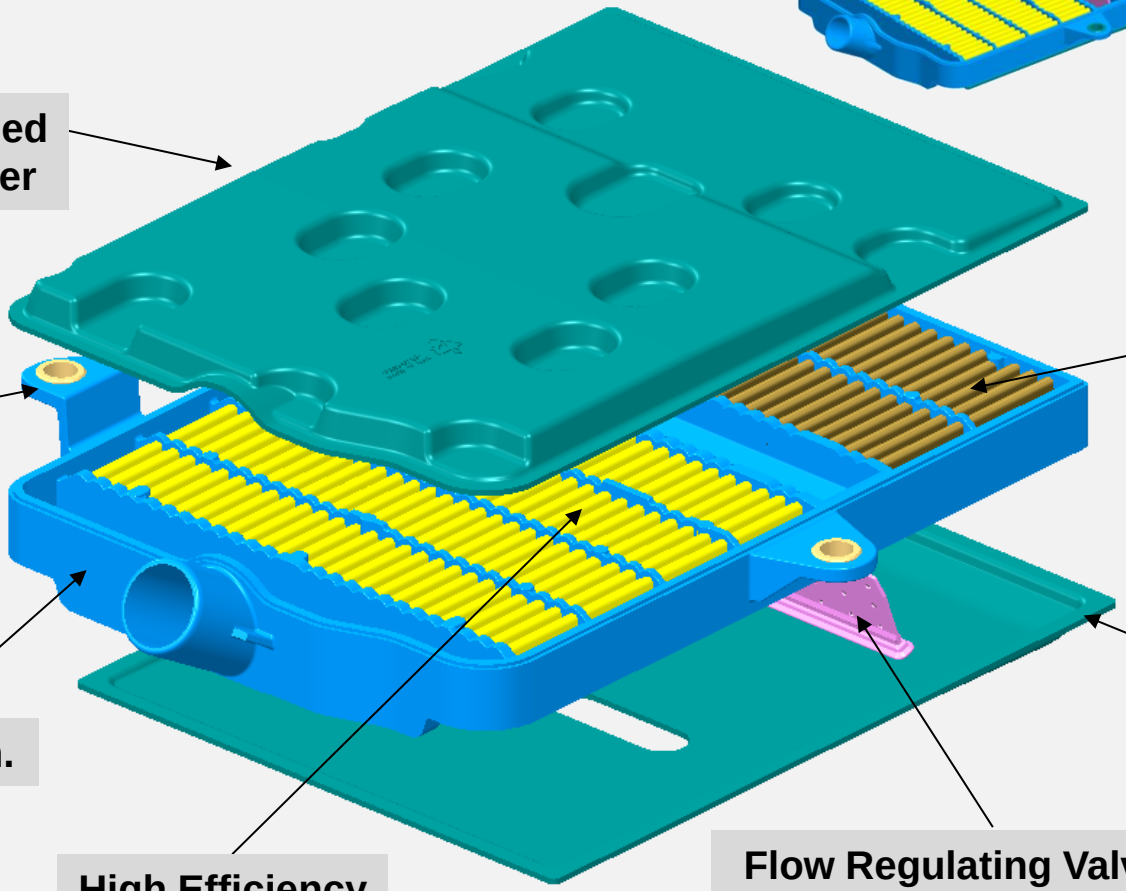




Laser-Welded Upper Cover

Standard Efficiency Filter Media

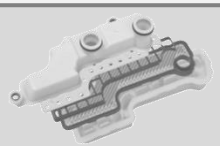
Bushings (x2)

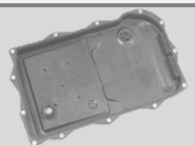
Pleat Pack Asm.

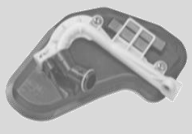
Laser-Welded Lower Cover

High Efficiency Filter Media

Flow Regulating Valve, Flexible







3. Innovative Filtration Solutions for Modern & Future Transmission

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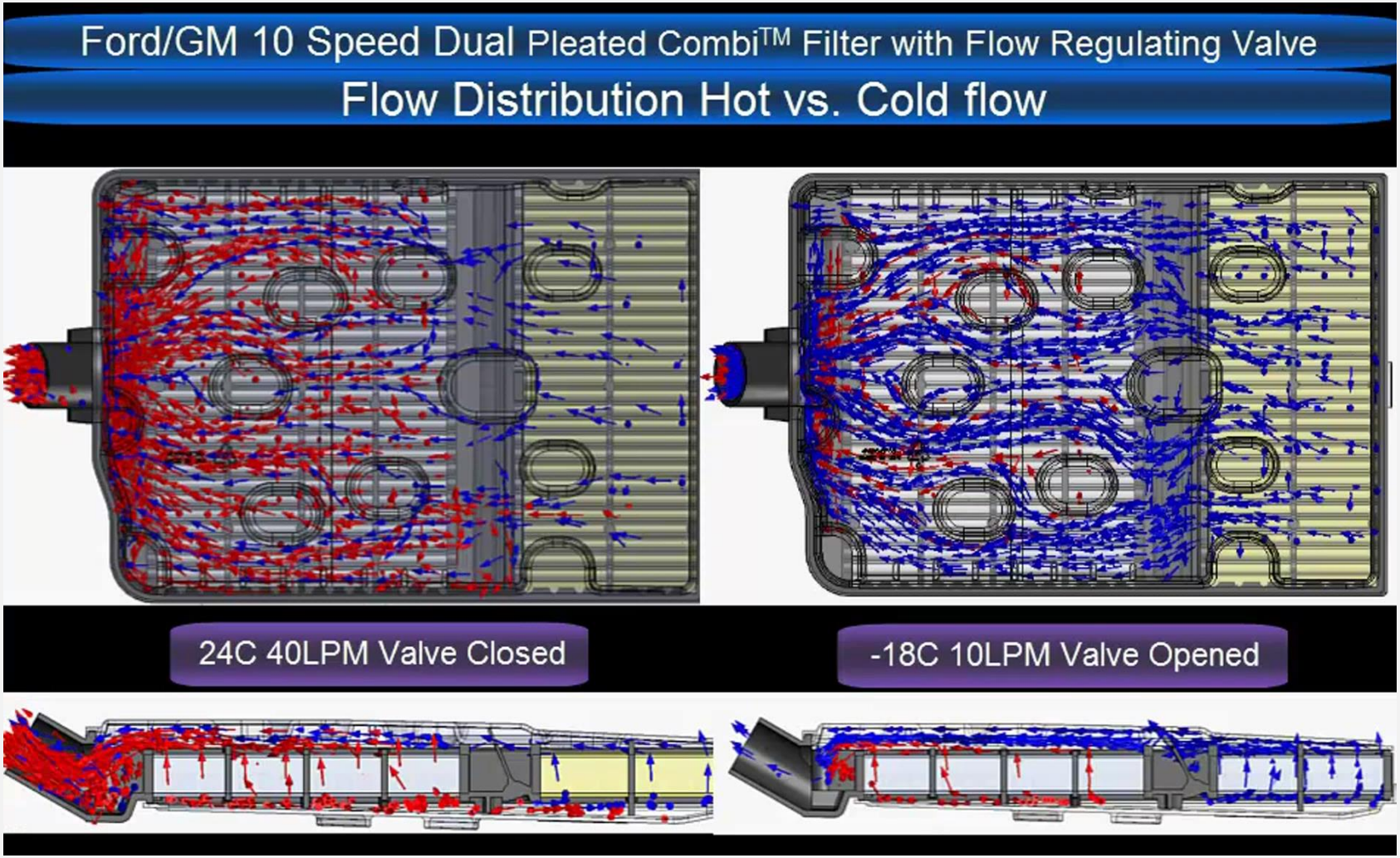


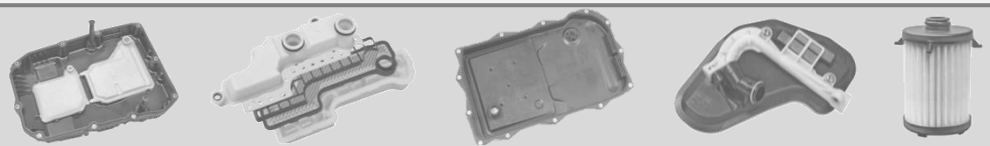
3. Innovative Filtration Solutions for Modern & Future Transmission

Example 1: FORD /GM 10 speed Filter System

Trend 1 - *Performance*:
The innovative suction filter system *CombiMedia®-Dual Pleat* generates outstanding filter-performance:
→ achieves requested cleanliness levels
→ fulfils the pressure drop requirements
→ doubles the dirt hold capacity (as compared to standard filter)

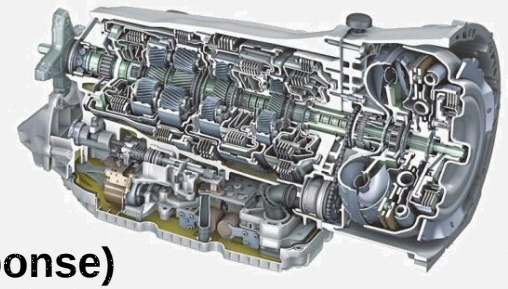
Trend 2 – *Lightweight, Compactness & Cleanliness*:
The sump filter system integrates fine and standard filter media, to avoid the need of an additional pressure filter - assembled by clean laser-welding technology:
→ light, compact and clean
→ less assembly amount and logistical effort
→ less costs

Trend 3 – System Supply and Modularization:
Standard- & fine filtration and the control function are integrated into one system, developed and designed, tested and produced out of one source .
→ elimination of interfaces and extra components
→ only one responsible supplier



3. Innovative Filtration Solutions for Modern & Future Transmission

Example 2: Daimler NAG-3 Oil Pan Module



Technical Development Requirements:

→ lightweight, compactness, clean parts

→ new materials and optimized wall-thicknesses

→ direct operating control valves (low losses, fast response)

→ high level of oil cleanliness

→ need for high performance filtration

→ high efficiency filter media

→ system supply of a multi-functional module

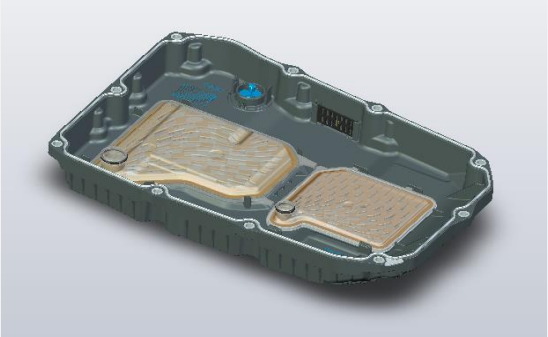
→ developed & designed

→ tested & validated

→ and produced

out of one source

→ cost competitiveness!



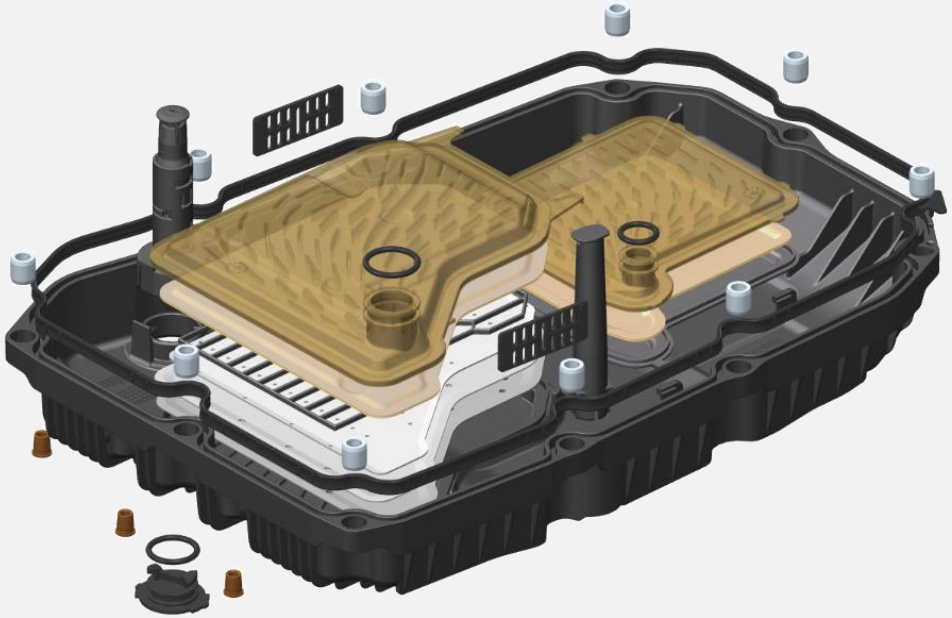
3. Innovative Filtration Solutions for Modern & Future Transmission

Example 2: Daimler NAG-3 Oil Pan Module

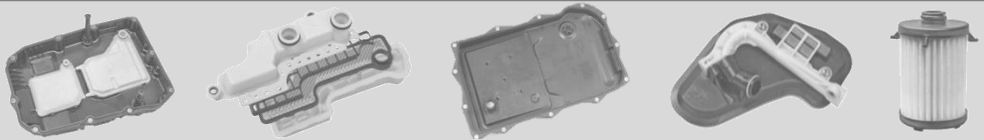
DAIMLER

Integrated Functions:

- **oil reservoir**
- **gasket**
- **drain plug**
- **plastic bonded magnets**
- **threaded inserts for cable fastening**
- **variable oil level control and fill-in tube**
- **ultrasonic oil level measurement tube**
- **high-performance filter system**
  main filter in front of mechanical pump
  secondary filter in front of electric pump



→ **Trend: System Supply & Modularization!**



3. Innovative Filtration Solutions for Modern & Future Transmission

Example 2: Daimler NAG-3 Oil Pan Module

DAIMLER

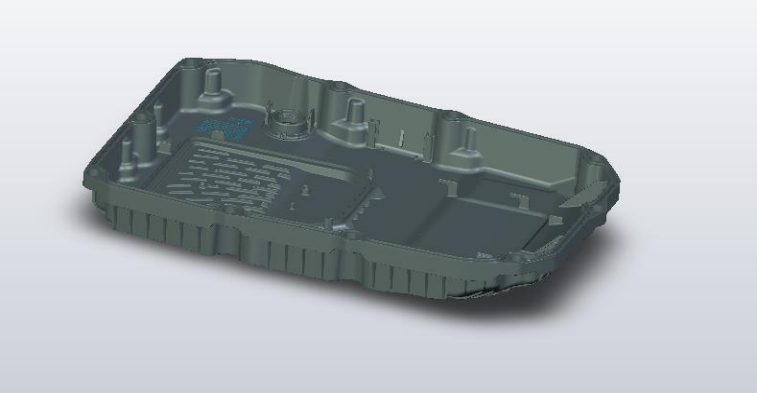
Lightweight, Compactness & Cleanliness

- **Continuous improved design, optimized wall-thickness and integrated filter layout: generated a weight-saving of 1,35kg**
  → light
  versus a metal pan with separated filter

- **Installation space creation by integrated filter layout for multi-layer filter design:**
  → compact

- **Laser-welding as joining technology combines high strength and best cleanliness**
  → clean

- **Plastic Material has the opportunity to substitute heavy and expensive metal parts!**

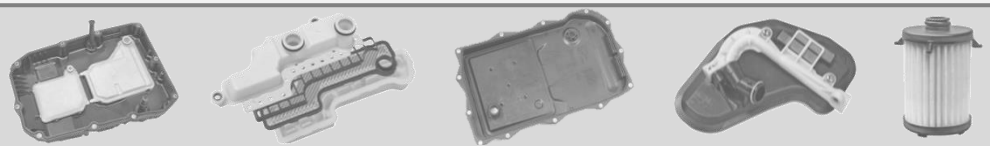


FILTRAN

> 15 million transmission oil pans since 2001 (first plastic pan for vehicles)

> 30 different tools

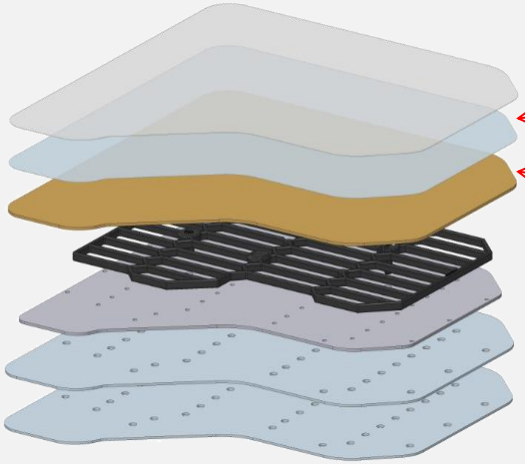
produced in USA, Germany and China

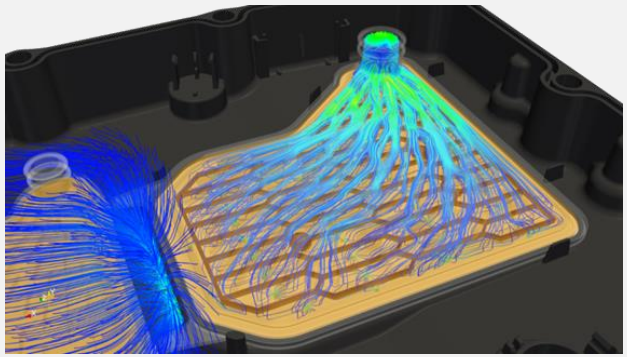


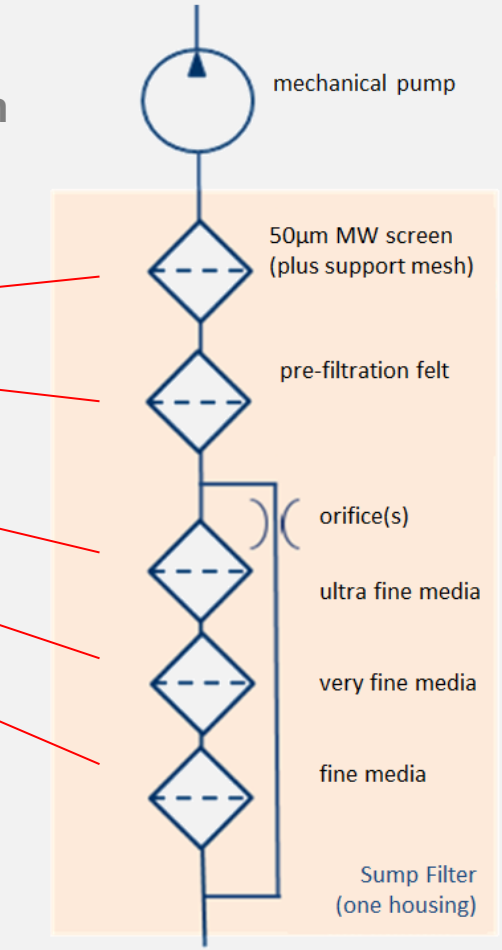
3. Innovative Filtration Solutions for Modern & Future Transmission

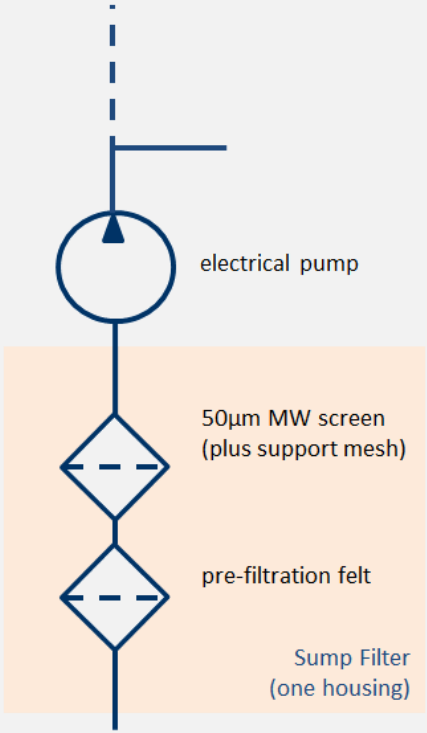
Example 2: Daimler NAG-3 Oil Pan Module

SmartMedia™ Suction Filter System









3. Innovative Filtration Solutions for Modern & Future Transmission

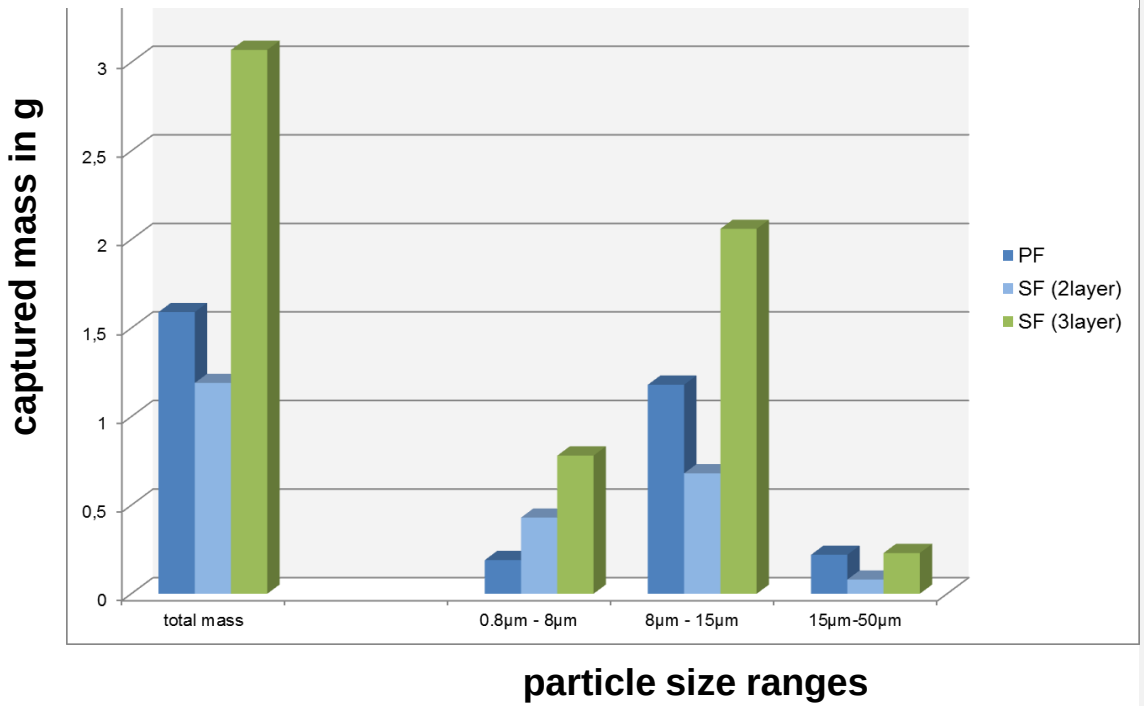
Example 2: Daimler NAG-3 Oil Pan Module

DAIMLER

High-Performance Filtration System

Filter Field Return Analysis (mileage: > 50000km) 2-layer

(based on an average-no. of 36 transmission test runs)



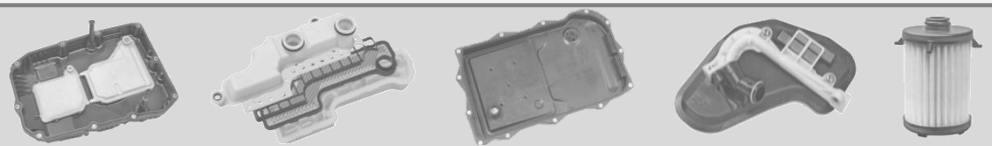
2-layer

+

vs.

3-layer

SMART Suction Filter alone captures similar particle amount as combo of suction & pressure filter



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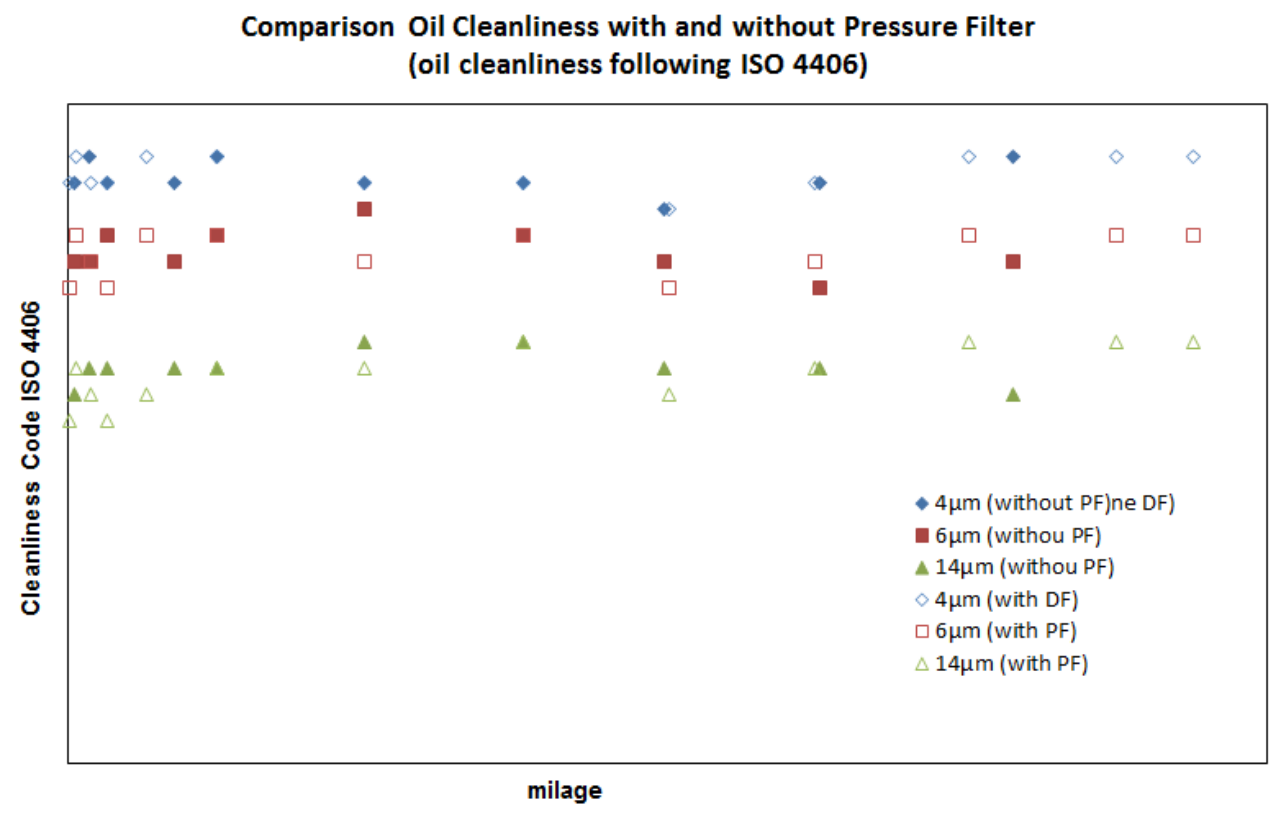

2-layer

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SMART suction filter alone achieves similar oil cleanliness as combo of suction & pressure filter

4. Future Outlook

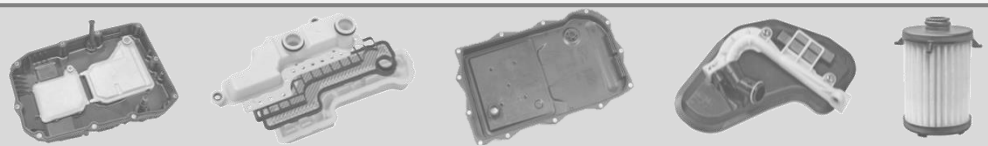
Additional Concepts for Further Modularization:

Integrated Functions:

- **Filtration** ✓
- **Oil Management Features** ✓
- **Sensors & Electric Connectors** ✓
- **Heat-Exchanger** ✓
- **Thermal Valves** ✓
- **Pumps** ✓

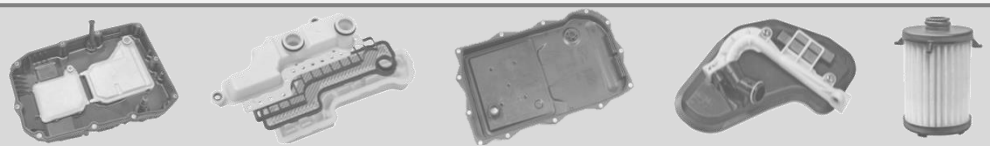
- **What's next?**

➔ **Due to the high level of design-freedom, plastic material offers the chance for function integration, weight-saving and improved functions!**



5. Summary and Conclusion

- **Future transmissions will require much cleaner oil to achieve lifetime durability and functional requirements**
- **New filtration systems are needed to achieve cleaner oil**
- **The best individual solution (function & costs) must be found for each program**
- **FILTRAN offers, beside the complete standard range of transmission filtration options, the innovative CombiMedia® & SmartMedia™ technology, which opens up new potential design options**
- **Functional Integration and Modularization of filter systems are continuously increasing**



Thanks
for your attention!

Q & A