NEW GEN SMALL WASTE GATE TURBOCHARGER

India GT-SUITE Conference 2017
Contents

✓ Emission and Regulation Trend

✓ Product Portfolio Overview

✓ Target setting Overview

✓ New Generation Benefit

✓ Conclusion
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Engine requirement trend

- Low end Torque increase
- Transient improvement

- CO₂ reduction
- NOx / Particulate reduction

New generation for better Performance & BS VI compliance
Emission regulations trend

CO₂ challenge

- US
- Europe
- Japan
- China
- S.Korea
- India

NOx challenge

Emission norms more stringent & closer to real life
Contents

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✔ Conclusion
Small WG - Overview

GT12 New Generation

- Better controllability
- Emissions
- Performance
- Transient
- Fuel Eco

New Aero Compressor & Turbine

- Transient
- Fuel Eco
- NVH
- Low oil flow

GT06
0.8L – 1.3L
20 kW – 60 kW

GT08
GT10
GT12

GT12 New Generation

- Two-Stage
- Mono/Two-Stage

GT08
GT10
GT12

GT06

GT12 New Gen for ~1.5L Monostage India and for Two-Stage EU/US

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New Gen Features

Compressor
• Higher Efficiency @ low flow & pressure ratio

Turbine
• Higher Efficiency for Fuel Economy

Bearing
• Lower Power loss for Transient

Innovation in each sub system
Contents

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Target Setting methodology

Virtual development based on GT-POWER

Independent parameters:
- Compressor Efficiency & Flow
- Turbine Efficiency & Flow

Dependent parameters:
- Engine low end Torque
- Fuel Economy
- Transient
Target Setting methodology

Data Collection

- Torque [Nm]
- Air-Fuel Ratio
- BSFC [g/kWh]
- Temperature [°C]

Data Synthesis

- Torque [Nm]
- Air-Fuel Ratio
- BSFC [g/kWh]
- Temperature [°C]

Result Validation

- Torque [Nm]
- A/F
- BSFC [g/kWh]
- Temperature [°C]

GT-POWER Model Calibration

Calibrated GT-POWER Engine Model for virtual assessment
Contents

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New generation benefits

**Compressor**

![Compressor Efficiency Chart]

- **Compressor Corrected Flow**
- **Base line**
- **New Gen**

**Turbine**

![Turbine Efficiency Chart]

- **Turbine Corrected Flow**
- **Base line**
- **New Gen**

Higher Efficiency for Performance & Fuel Eco

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New generation benefits

- Dual piston ring for reduced oil leak & emission
- Improved balancing

Bearing Design

Bearing Performance

1250 RPM, Engine Speed

~16% of Compressor Power

~11% of Compressor Power

Base line
New Gen

Shaft Speed [kRPM]

Power Loss [W]
Simulation results, Performance

Low end Torque

- Low end Torque >> Drivability

Transient

- Transient >> Driving Pleasure

Improved Performance
Simulation results, Emission

Fuel Eco points

Fuel Eco benefit

Up to 2% Fuel Eco benefit
Simulation results, Emission

**Particulate**
- Lower Engine Back Pressure @ iso Torque – DPF enabler

**NOx**
- Up to 2% FE @ iso NOx,
- CO₂ benefit could be trade off for better NOx
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✓ Conclusion
New generation benefits, Summary

Improved Performance & Emission while enabling DPF
Conclusion

**DIESEL CHALLENGES**

- Emissions:
  - After-Treatment
  - Turbocharger design

- System optimization

**HONEYWELL PATH**

- New Generation of small waste gate Turbocharger for:
  - Improved Performance
  - Better Emission
  - Better Reliability

- New development processes:
  - Customer centered global & regional
  - Target Setting / Optimization
  - System level GT-POWER competence
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