

Cummins Westport The Natural Choice



2018 Products

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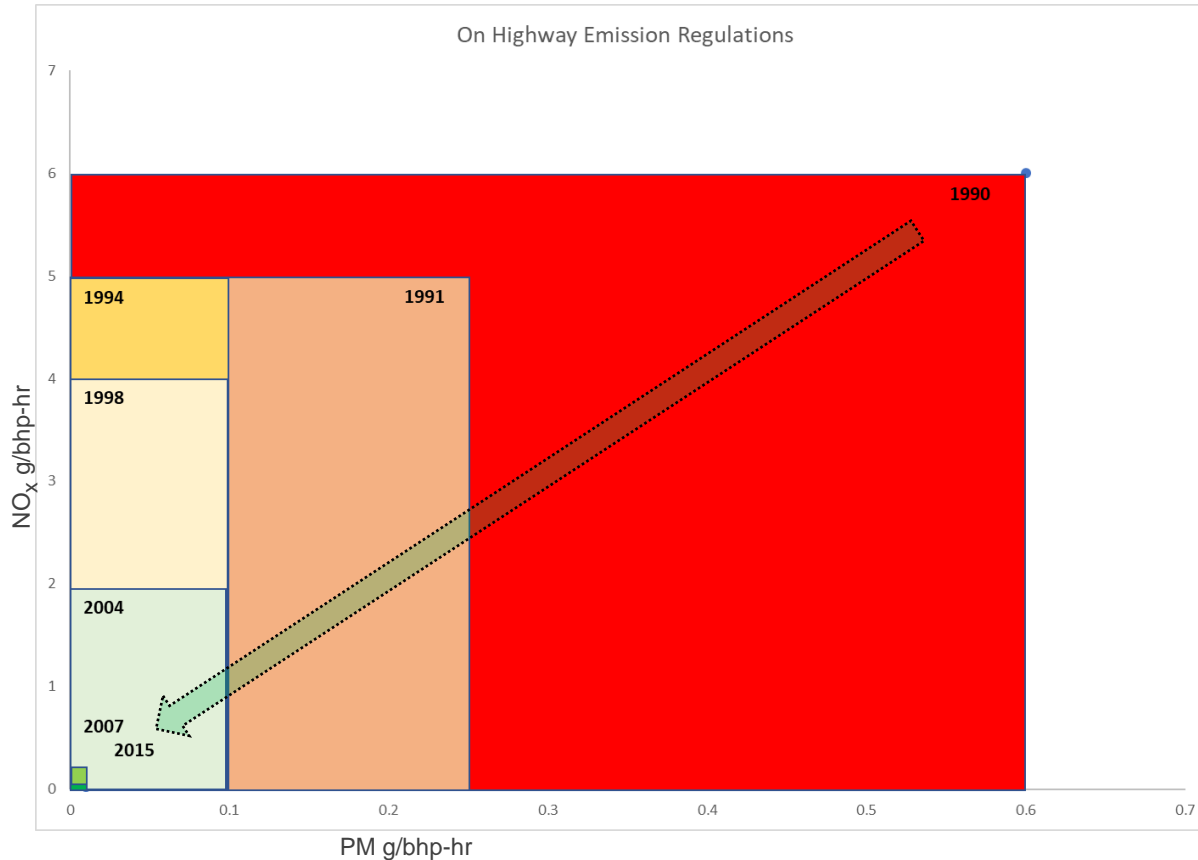


Cummins Natural Gas Products

- Cummins Started Working on On-Highway Natural Gas Engines in the 1980s
- There were limited business opportunities in that space at the time
- Cummins and Westport Joined to form a Joint Venture (CWI) in 2001
- CWI started the production of Natural Gas engines with the release of C Gas Plus (8.3L) and B Gas Plus (5.9L) Engines



Progressive Emission Regulations



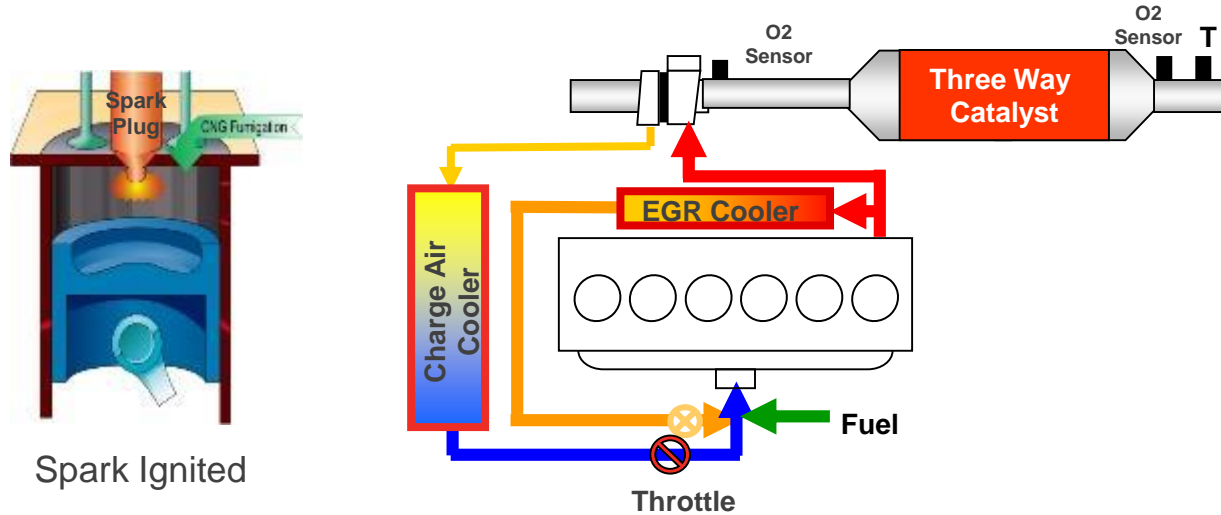
- NO_x and PM have come down significantly (optional low NO_x is at the Near Zero value of 0.02 gm)
- The next set of regulations have focused on CO_2
- Natural Gas engines are suited to meet GHG requirements better because of the inherent molecular structure of Methane

Cummins Westport Products

- **CWI Natural Gas Engines**
 - 5.9L => 6.7L, 8.3L => 8.9L and 11.9L engines
- **Predominant presence in North America**
 - EPA and CARB compliant
- **Some global presence**
 - Europe, South America, India and China



Cummins Westport Engine Architecture



- Cummins Westport engines feature spark ignition with Stoichiometric / EGR combustion
- This combustion technology was introduced in 2007 with the ISL G, the first heavy duty engine to meet the EPA 2010 standards (0.2 g/bhp-hr NOx, 0.01 g/bhp-hr PM)
- **SEGR Technology capability provides pathway to Near Zero NOx and GHG emissions**
- Cummins Westport engines are factory built, natural gas engines that are based on Cummins diesel engine platforms with nearly 80% parts commonality

Move to Zero ... new for 2018

- ✓ Certified to Near Zero/ Low NOx
- ✓ On-Board Diagnostics
- ✓ EPA/ARB Ultra Low emissions certification
- ✓ Lowest Emission MR and HD engines in North America



ISX12N™

Certified to Near Zero / Optional Ultra Low NOx
0.02g/bhp-hr



L9N™



B6.7N™

Certified to Optional Low NOx
0.1g/bhp-hr



Cummins Westport Engine Manufacturing



- Medium size engines manufactured at RMEP in Rocky Mount, North Carolina
 - 6.7L and 8.9L engines
- Large size engine manufactured at JEP in Jamestown, New York
 - 11.9L engine

Why Cummins Westport Natural Gas Engines?

2018

Environmental Leadership

- Lowest NOx
- 50 - 90% Below EPA Standard
- RNG => negative carbon intensity



Move
to
Zero

Energy Security

- Abundant Fuel
- Extensive network
 - Renewable

Economic Advantage

- Mature technology
 - Affordable
 - Ready Now

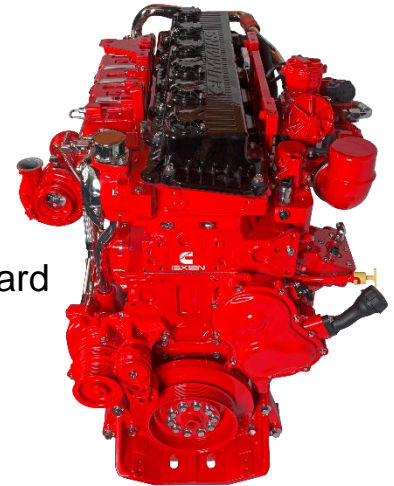


2018 Changes	ISX12N™	L9N™	B6.7N™
Emission Certification	EPA/CARB Optional Near Zero 0.02 g NOx	EPA/CARB Optional Near Zero 0.02 g NOx	EPA/CARB Optional Low NOx 0.1 g NOx
NOx Reduction to 2017 EPA	90%	90%	50%
OBD	YES	YES	YES
CCV	YES	YES	YES
TWC	<ul style="list-style-type: none"> • Increase in size • One piece design • Mid bed O2/Temp Sensor • OEM Harness 	<ul style="list-style-type: none"> • Same size as '17 ISL G NZ • One piece design • Mid bed O2/Temp Sensor • OEM Harness 	<ul style="list-style-type: none"> • Same size as '17 ISB6.7 G • One piece design • Mid bed O2/Temp Sensor • OEM Harness
Product Changes	<ul style="list-style-type: none"> • New fuel system improves performance and reduces parts content • On-engine electric CCV filter with 2 CCP sensors • CM2380 ECM • 500 kbaud datalink • New wiring harness • New Ignition Control Module 	<ul style="list-style-type: none"> • Steel Pistons • New Liners • Improved Ring Pack • New Valve Seat Material • New Oil Cooler • Improved Piston Cooling • Additional crankcase pressure sensor • New CM2380 ECM • 500 kbaud datalink • New wiring harness • New Ignition Control Module 	<ul style="list-style-type: none"> • Additional crankcase pressure sensor • New CM2380 ECM • 500 kbaud datalink • New wiring harness • New Ignition Control Module

ISX12N™

■ Key Product Attributes

- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement – 11.9 litres (726.2 cu in)
- Certified to CARB Optional Near Zero (ultra-low) NO_x 0.02g Standard
- Exceeds 2017 EPA GHG requirements (good until 2021)
- **2018 On-Board Diagnostics (OBD lite)**
- **2019 On-Board Diagnostics (OBD)**
- 100% natural gas engine
- Engine braking
- **Peak rating: 400 hp, 1450 lb-ft**
- Maintenance-free Three-Way Catalyst Aftertreatment
- **Up to 80,000 lb. GVW**





■ Key Product Attributes

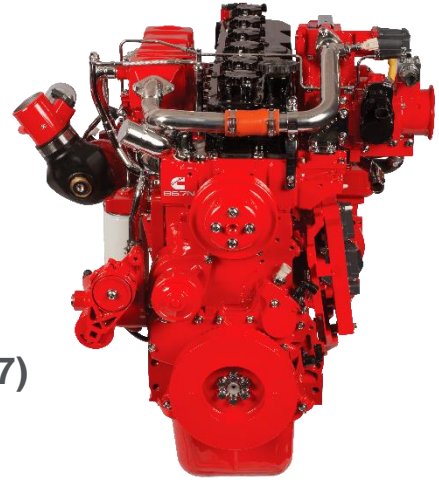
- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement - 8.9 Litre (540 cu. in.)
- Certified to CARB Optional Near Zero (ultra-low) NO_x 0.02g Standard
- **Exceeds 2017 EPA GHG requirements (good beyond 2027)**
- **2018 On-Board Diagnostics (OBD)**
- 100% natural gas engine
- **Peak rating: 320 hp, 1000 lb-ft**
- Maintenance-free Three-Way Catalyst aftertreatment
- **Up to 66,000 lb. GVW**



B6.7N™

■ Key Product Attributes

- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement – 6.7 litres (408.9 cu in)
- Certified to CARB Optional Low NOx 0.1g Standard
 - Evaluating the need for Near Zero NO_x 0.02g engine
- Exceeds 2017 EPA GHG requirements (good beyond 2027)
- **2018 On-Board Diagnostics (OBD)**
- 100% natural gas engine
- **Peak rating: 240 hp, 560 lb-ft**
- Maintenance-free Three-Way Catalyst aftertreatment
- Automatic Transmissions
- **Up to 33,000 lb. GVW**



Questions