

TIER 4 FINAL

PROFITABLE LOW EMISSIONS 2.0



TIER 4



**STRONG PARTNERS.
TOUGH TRUCKS.™**

**Advanced Solutions for Meeting 2014 EPA Tier 4 Final Engine
Emission Regulations on H400-1150HD Lift Trucks and ReachStackers**

PROFITABLE LOW EMISSIONS

LOWERING OWNERSHIP COSTS WITH INNOVATIVE TECHNOLOGY

To address the 2014 U.S. Environmental Protection Agency (EPA) emission standards for off-highway diesel engines, Hyster Company has developed innovative technology that not only meets the requirements of the new regulations but lowers the total cost of ownership for our customers over the life of the truck in a variety of applications.

■ TIER 4 FINAL

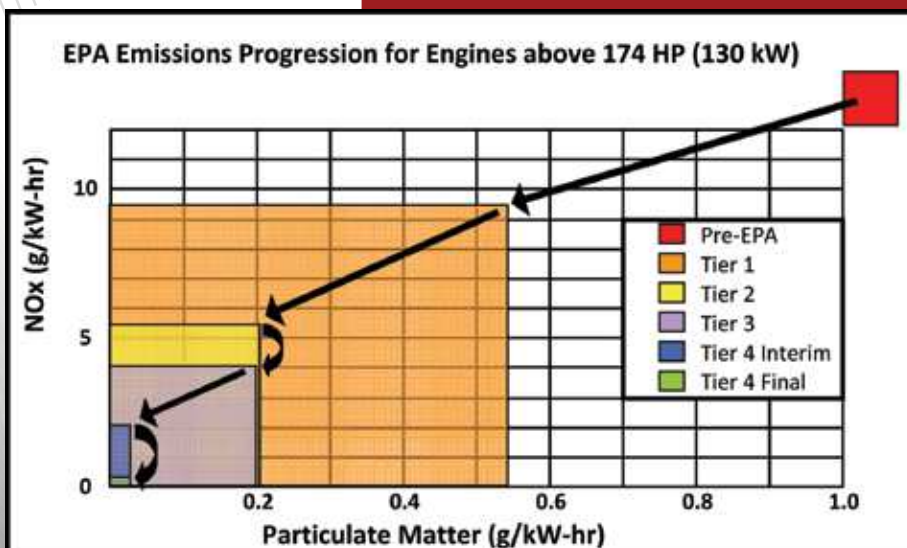
Tier 4 Final is the U.S. Environmental Protection Agency (EPA) emissions regulations requirement for off-highway diesel engines in North America for 2014. (Stage IV is the near equivalent emissions regulatory requirement for European Union member states.) Beginning in 2014, EPA Tier 4 Final (and EU Stage IV) will require an additional significant emissions reduction from the Tier 4 Interim baseline for engines in certain power categories.

While the U.S. / Canada and European regulations are similar, EPA-certified trucks cannot be sold in Europe and vice-versa. Hyster is certified for both markets and is able to bring innovative technology that lowers operation costs for our customers in all markets in which we operate. Canadian legislation, while required to be in compliance with Tier 4 Final regulations as dictated by the EPA, allows a transition program under which engines from 75 hp through 300 hp have until 2018 to be in compliance with the Tier 4 Final mandate.

■ THERE ARE TWO MAIN REGULATED EMISSIONS COMPONENTS FOR OFF-HIGHWAY EQUIPMENT

NO_x: Nitrogen oxides NO and NO₂ are regulated gaseous emissions. NO_x is a primary contributor to smog.

Particulate Matter: PM, or particulates, includes mainly soot (carbon particles) and residues of lubricating oil; seen as smoke in exhaust.



■ TIER 4 FINAL ENGINE TECHNOLOGY

Hyster Company has continued to work closely with Cummins to develop a leading compliance solution that is best for lift truck applications with frequent transient loading. This has resulted in Tier 4 Final engine technology that meets compliance requirements while lowering the total cost of ownership.

In addition to implementing a long-term solution engine technology, Hyster has developed a number of customer value-added features. The three-part solution includes:

1. Cummins' cooled Exhaust Gas Recirculation (EGR) with Selective Catalytic Reduction (SCR) exhaust after-treatment system technology. SCR reduces the NOx levels in diesel engine exhaust by combining the exhaust gases with ammonia in the form of urea (or diesel exhaust fluid) and passing that mixture over a catalyst.
2. Right-sized engines offer the same and/or greater horsepower and torque characteristics than prior offerings while consuming less fuel. The result is reduced fuel consumption which helps to lower the total cost of ownership while continuing to deliver high performance.
3. Hyster has implemented intelligent design to further reduce fuel consumption through performance optimization technologies such as ECO-mode, idle management with empty seat engine shutdown technology, on-demand cooling and a new 5-speed transmission.

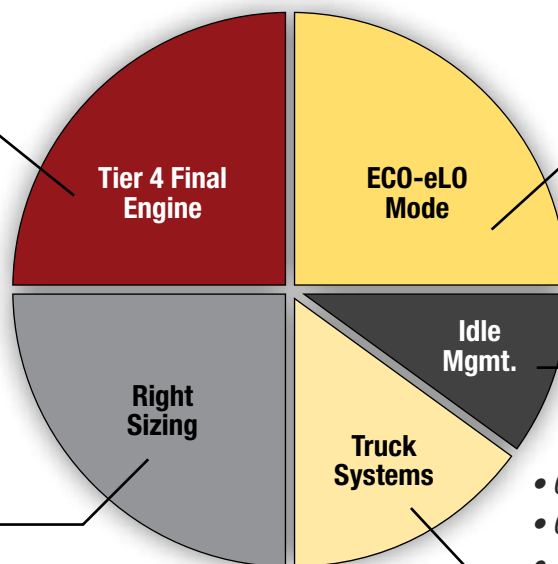
All Tier 4 Final engines will require ultra-low sulfur diesel (ULSD) fuel to function properly.



ENGINE TECHNOLOGY

- Cooled EGR with SCR
- Uses less fuel

- Reduced fuel consumption
- Improved engine response
- Lower total cost of ownership



INTELLIGENT DESIGN

- RPM management
- Throttle response/automatic throttle-up
- Shift point selection

- Hibernate idle
- Empty seat engine shutdown

- Cooling on demand
- On-demand hydraulics
- More gears in transmission

TIER 4 FINAL EMISSIONS SOLUTION

To maximize customer value and benefit, Hyster and Cummins collaborated to develop an innovative design that utilizes Cummins cooled exhaust gas recirculation (EGR) and variable geometry turbocharging (VGT) in the engine along with a Diesel Oxidation Catalyst (DOC) for particulate matter (PM) removal. A Selective Catalytic Reduction (SCR) based aftertreatment system is utilized to realize Tier 4 Final compliant NOx reduction levels. The injection of diesel exhaust fluid (DEF) into the exhaust stream in the Decomposition Reactor Tube (DRT) reduces the NOx gases to harmless by-product that is passed on to the diluter which lowers the temperature of the exhaust stream.

Advanced electronic control is used to ensure particulate matter (PM) is oxidized by a continuous process of passive regeneration. The technology harnessed by Hyster enabled significant reductions in NOx and PM levels without the use of a Diesel Particulate Filter (DPF). The up-front cost of achieving compliance using cooled EGR, variable geometry turbocharging and PM removal is more than offset by lower operating costs in the Hyster solution. With improved engine response, operators can also expect improved equipment productivity along with the benefit of cleaner, quieter operation and reduced fuel costs.

HYSTER TECHNOLOGY COMPARISON

	Tier 3: No After-Treatment		Tier 4 Interim: EGR + DPF		Tier 4 Final: EGR + DOC + SCR	
EQUIPMENT COST						
New parts on engine	+	No	—	EGR Cooler + Valve	—	EGR Cooler + Valve + DRT
Exhaust system	+	No	—	DPF	+	DOC + SCR
Additional parts	+	No	+	No	—	DEF Injector, DEF Pump, DEF Tank
OPERATING COST						
Fuel efficiency	+	Baseline	+	Yes > 5% over baseline	+	Yes > 5% over baseline
Additional fluids	+	No	+	No	—	Yes 3 - 5% DEF
FEATURES & TECHNOLOGY						
Cooling on demand	×	No	✓	Yes	✓	Yes
ECO-eLo	×	No	✓	Yes	✓	Yes
Hibernate idle	×	No	×	No	✓	Yes
On-demand hydraulics	✓	Yes	✓	Yes	✓ *	Yes
Auto throttle-up	×	No	✓	Yes	✓	Yes
Empty seat engine shutdown	×	No	✓	Yes	✓	Yes

* Not available on all Tier 4 Final model series



The Variable Geometry Turbo (VGT) design combines the benefit of both a small and large turbocharger in a single unit, enabling Hyster® Tier 4 Final engines to achieve significantly improved response compared to a Tier 3 engine, as demonstrated in customer field tests. The VGT is a key technology asset in meeting emissions and increasing engine performance and fuel efficiency due to elevated pressure in the combustion chamber.

■ SYSTEM INTEGRATION

Hyster has collaborated closely with engine builder, Cummins, and transmission builder, ZF, to engineer a well-integrated powertrain in a number of Hyster® jumbo trucks, resulting in paired engines and transmissions that yield the highest output while operating efficiently in the Hyster big and jumbo truck category.

With Cummins' internally developed technologies—such as cooled EGR and variable geometry turbocharging—as well as ZF's reliable transmissions, the teamwork between Hyster, Cummins and ZF results in industry leading solutions that help provide high performing trucks with low fuel consumption.

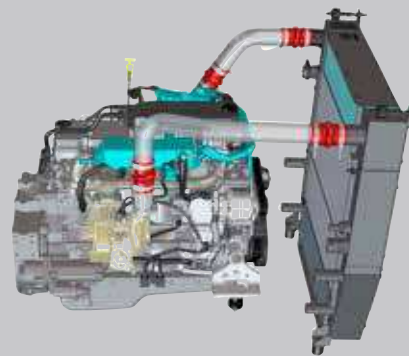
■ RIGHT SIZING TO REDUCE COST AND IMPROVE PRODUCTIVITY

In certain cases, the new Hyster® Tier 4 final compliant engines are right sized to displace less fuel while providing increased power and responsiveness. Right sized engines—in addition to innovative features on Hyster® trucks such as on-demand hydraulics, on-demand cooling and automatic throttle-up—have demonstrated up to 20 percent* reduction in fuel consumption during extensive testing compared to Tier 3 trucks, depending on rating and duty cycle. Extensive testing has also shown a 3-5 percent fuel consumption reduction over the Tier 4 Interim baseline. Noise tests demonstrate consistently lower noise levels both inside and outside the cab, a testament to the superior engineering of our new powertrain solution.

** Results from fuel comparison testing conducted by Big Truck Development Center, March 2014.*

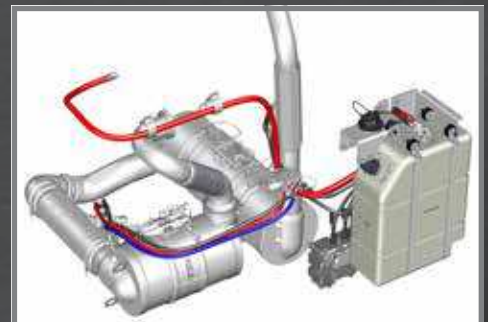
■ THE COOLED EGR SYSTEM

The Hyster solution utilizes cooled EGR to effectively control NOx emissions by re-circulating a varying proportion of the exhaust gas back to the cylinder. This process reduces oxygen content by ensuring a more complete combustion of the diesel fuel-air mixture, which lowers combustion temperature, resulting in a reduction of NOx formation.



■ SELECTIVE CATALYTIC REDUCTION EXHAUST AFTER-TREATMENT SYSTEM

The Selective Catalytic Reduction (SCR) system replaces the Tier 4 Interim Diesel Particulate Filter (DPF) system (which replaced the Tier 3 muffler) and provides even further NOx reduction from Tier 4 Interim levels. SCR reduces the remaining NOx in diesel engine exhaust by up to 95 percent, by combining the exhaust gases with ammonia in the form of Diesel Exhaust Fluid (DEF), also known as urea, and passing the mixture over a Diesel Oxidation Catalyst (DOC). The urea is injected into the exhaust stream in the Decomposition Reactor Tube (DRT) by a DEF dosing module. This mixture results in an exhaust stream containing harmless elemental nitrogen, water vapor and carbon dioxide. Roughly one gallon of DEF is required for every 25 gallons of diesel fuel burned. This stream passes into a particulate filter where Particulate Matter (PM) is collected and removed from the exhaust stream. No active regeneration is required using this technology. Hyster® trucks feature a diluter which helps to keep exhaust temperatures down. The Hyster Tier 4 Final solution does not require a DPF and removes passive regeneration, increasing productivity for the operator.



TIER 4 FINAL EMISSIONS SOLUTION

■ TRUCK SYSTEMS

- The on-demand engine cooling system is designed so that the cooling fan will provide only the level of engine cooling required. Because the fan will usually be running slower, noise levels are reduced and less fuel is consumed.
- Selectable hydraulic performance modes match the hydraulic responsiveness to the application requirement.
- Automatic throttle-up increases engine speed when the operator activates a hydraulic function. This feature enhances the overall operator ergonomics while operating the truck and eliminates the need to lean into the throttle pedal to provide additional hydraulic load demands further reducing the fuel consumed. Automatic throttle-up will select the best engine speed for the selected load condition and ensure optimized fuel consumption under all operating conditions.

■ ECO-MODES

Hyster introduced selectable operating modes so that trucks can be switched to perform at optimum efficiency levels according to application demands. A key switch, located in the operator compartment, enables supervisors or service engineers to select either e-Lo or Hi-P mode.

- Hi-P provides maximum performance and good fuel economy.
- e-Lo provides minimum fuel consumption without losing productivity.
- Automatic throttle-up feature enables truck to operate within its most efficient speed under varying load conditions.

■ IMPLEMENTATION

- Flex rules for implementation affects OEMs differently.
- The Hyster roll-out:
 - Tier 4 Interim and Tier 4 Final engines will not be available concurrently. All Tier 4 Interim engines will be used up before Tier 4 Final engines are introduced for that model series.
 - Tier 3 engines will continue to be available in Canada under the Canada Unique Transition Engine program.
 - Tier 3 engines will be available indefinitely in Latin American markets.

■ IDLE MANAGEMENT

Idle management incorporates an innovative hibernate idle mode into Hyster® Tier 4 Final trucks. When there is no demand for engine or hydraulic control for more than 30 seconds, the engine goes into hibernate idle mode, which lowers engine rpm and reduces fuel usage and emissions by 20 to 30 percent. Another design addition is the empty seat engine shutdown option. This option, with an adjustable time delay, shuts the engine down a few minutes after the operator leaves the seat of the truck. The results are further reduced emissions, as well as fuel and money savings.

■ INTELLIGENT DESIGN

The ECO-eLo function, together with the use of on-demand cooling, on-demand hydraulics and idle management featuring empty seat engine shutdown, all help to reduce operating costs.



FORKLIFT TRUCKS

	H400-450HD/S				H550-700HD/S				H800-1050HD/S			
	New Offering		No Longer Available		New Offering		No Longer Available		New Offering		No Longer Available	
Regulatory Tier*	Tier 4**	New Tier 3***	Tier 4i	Old Tier 3	Tier 4**	New Tier 3***	Tier 4i	Old Tier 3	Tier 4**	New Tier 3***	Tier 4i	Old Tier 3
Engine	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSC 8.3L	Cummins QSL 9	Cummins QSM 11L	Cummins QSL 9	Cummins QSM 11L
	230 hp	230 hp	230 hp	230 hp	270 hp	260 hp	270 hp	230 hp	370 hp	365 hp	370 hp	365 hp
Technology to reach emission legislation	EGR	Muffler	EGR	Muffler	EGR	Muffler	EGR	Muffler	EGR	Muffler	EGR	Muffler
	DOC		DOC		DOC		DOC		DOC		DOC	
	SCR*		DPF		SCR*		DPF		SCR*		DPF	
Transmission	ZF WG 211	ZF WG 211	SOH TE17	SOH TE17	ZF WG 211	ZF WG 211	SOH TE17	SOH TE17	SOH TE32	SOH TE32	SOH TE32	SOH TE32
	5 forward	5 forward	3 forward	3 forward	5 forward	5 forward	3 forward	3 forward	4 forward	4 forward	4 forward	4 forward
	3 reverse	3 reverse	3 reverse	3 reverse	3 reverse	3 reverse	3 reverse	3 reverse	4 reverse	4 reverse	4 reverse	4 reverse
Cooling on-demand	✓	No	✓	No	✓	No	✓	No	✓	✓	✓	No
ECO-eLo	✓	✓	✓	No	✓	✓	✓	No	✓	✓	✓	No
Hibernate idle	✓	No	✓	No	✓	No	✓	No	✓	✓	✓	No
On-demand hydraulics	✓	✓	No	No	✓	✓	✓	No	No	No	No	No
Auto throttle-up	✓	No	No	No	✓	No	✓	No	✓	✓	✓	No

CONTAINER HANDLERS

	H400-500HD-EC				H1050-1150HD-CH				REACHSTACKER			
	New Offering		No Longer Available		New Offering		No Longer Available		New Offering		No Longer Available	
Regulatory Tier*	Tier 4**	New Tier 3***	Tier 4i	Old Tier 3	Tier 4**	New Tier 3***	Tier 4i	Old Tier 3	Tier 4**	New Tier 3***	Tier 4i	Old Tier 3
Engine	Cummins QSB 6.7	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSB 6.7L	Cummins QSL 9	Cummins QSC 11L	Cummins QSL 9	Cummins QSC 11L	Cummins QSL 9	Cummins QSC 11L	Cummins QSL 9	Cummins QSC 11L
	230 hp	230 hp	230 hp	230 hp	363 hp	365 hp	370 hp	365 hp	363 hp	365 hp	370 hp	365 hp
Technology to reach emission legislation	EGR	Muffler	EGR	Muffler	EGR	Muffler	EGR	Muffler	EGR	Muffler	EGR	Muffler
	DOC		DOC		DOC		DOC		DOC		DOC	
	SCR*		DPF		SCR*		DPF		SCR*		DPF	
Transmission	ZF WG 211	ZF WG 211	SOH TE17	SOH TE17	SOH TE32	SOH TE32	SOH TE32	SOH TE32	SOH TE32	SOH TE32	SOH TE32	SOH TE32
	5 forward	5 forward	3 forward	3 forward	4 forward	4 forward	4 forward	4 forward	4 forward	4 forward	4 forward	4 forward
	3 reverse	3 reverse	3 reverse	3 reverse	4 reverse	4 reverse	4 reverse	4 reverse	4 reverse	4 reverse	4 reverse	4 reverse
Cooling on-demand	✓	No	✓	No	✓	No	✓	No	✓	No	✓	No
ECO-eLo	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Hibernate idle	✓	No	✓	No	✓	No	✓	No	✓	No	✓	No
On-demand hydraulics	✓	No	No	No	No	No	No	No	✓	No	✓	No
Auto throttle-up	✓	No	No	No	✓	No	✓	No	✓	No	✓	No

* Tier 4 Final requires Ultra Low Sulphur Diesel (ULSD) fuel and low ash oil

** Requires Diesel Exhaust Fluid (DEF)

*** Tier 3 engines subject to availability in regulated markets



INNOVATIVE TRUCKS ENGINEERED TO MEET THE MOST DEMANDING APPLICATIONS

For more than 80 years, Hyster has been conquering the world's most demanding applications. In the 1920's Hyster started as a manufacturer of lifting machines used in the rigorous logging industry of the United States' Pacific Northwest. A few years later the first forklift trucks were invented and the Hyster brand quickly gained its reputation for rugged quality. Hyster® lift trucks are designed to lower your cost of operations. Every truck we make — gasoline, LPG, diesel and electric — is purpose-built to excel in its application. Every truck is also backed by an unmatched network of specialists.



Dealer Network — Our Dealer Network can offer the expertise of fleet managers, parts suppliers, capital procurement specialists and trainers. Hyster's carefully chosen dealers fully understand customer applications, assist in selecting the right lift truck and provide fast, reliable support.



Hyster Fleet Services — Even if you operate other brands, we can manage your maintenance and replacement plan. We can offer complete fleet analysis, fleet history summary and a cost-effective proposal for replacement and scheduled maintenance.



Parts — With genuine Hyster replacement parts and UNISOURCE™ parts for all makes of lift trucks, we are your one-stop source for lift truck parts. In fact, we offer more than 2 million part number crosses for most brands of materials handling and other in-plant mobile equipment.



Rental Products — When leasing or buying isn't a practical option, we have access to more than 14,000 units for short- and long-term rental. We'll help you maintain output in a cost-effective manner.



Hyster Capital — We can arrange solutions for special financing requirements, taking the difficulties out of buying the equipment you need. Whether you purchase or lease a new or used lift truck, Hyster Capital offers superior service and competitive rates.



Special Products Engineering Department (SPED) — Different materials require different handling. That's why we can work with you to customize your lift trucks. From strobe lights to specially made forks, SPED has the tools to help you get the job done right.



Operator Training — Proper education in operating lift trucks minimizes the risk of injuries due to accidents while increasing productivity. Hyster offers OSHA-compliant materials that support the training of qualified operators.




Service — Your local Hyster® dealer offers a flexible, customized and comprehensive maintenance plan based on each lift truck's operation environment. Hyster service programs offer scheduled inspections and maintenance, along with quick, responsive service dispatched to your location.



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