

# SUPPLEMENTAL WHTC TESTING FOR EURO IV/V HEAVY-DUTY VEHICLES IN CHINA

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China's Ministry of Environmental Protection (MEP) has issued a new, nationwide standard requiring China IV and V (equivalent to Euro IV and V) heavy-duty diesel engines for use in urban vehicles to be tested over the World Harmonized Transient Cycle (WHTC).<sup>1</sup> The testing is supplemental to all requirements under the existing China IV/V standards.<sup>2</sup> The new standard, which stipulates revised limit values for NO<sub>x</sub> emissions when the engines are tested over the WHTC, is designed to prevent excess NO<sub>x</sub> emissions from vehicles operating in low-load or low-speed applications.

The standard applies to all diesel-fueled public buses, postal trucks, and municipal cleaning vehicles (e.g. garbage trucks) over 3500 kg for use in urban applications.

Manufacturers are required to meet the new standard immediately for new engine/vehicle type approvals. For the China IV stage, the standard goes into force for all engine/vehicle sales and registrations on January 1, 2015. For the China V stage, the new standard will become effective on the same date the full China V standard goes into force (TBD).<sup>3</sup>

This nationwide standard, which follows similar action by the Beijing city government last year,<sup>4</sup> is a critical step towards reducing urban air pollution, and sets an important precedent for other regions around the world following the European system of tailpipe emission standards.

## BACKGROUND

It has been widely demonstrated in Europe and Beijing that some heavy-duty diesel vehicles certified to the Euro IV and V tailpipe emission standards emit excess NO<sub>x</sub> emissions when operating in low-speed, urban driving conditions. In some cases, real-world NO<sub>x</sub> emissions from these vehicles even exceed those of Euro III vehicles. These excess emissions result from the fact that the test cycles Euro IV and V engines are tested and certified over—the European Transient Cycle (ETC) and European Stationary

- 1 The standard, HJ 698-2014, is available online at: [http://kjs.mep.gov.cn/hjbhzbz/bzwb/dqjhjbh/dqdywrwpfbz/201401/t20140126\\_266957.htm](http://kjs.mep.gov.cn/hjbhzbz/bzwb/dqjhjbh/dqdywrwpfbz/201401/t20140126_266957.htm)
- 2 GB17691-2005, available online at: [http://kjs.mep.gov.cn/hjbhzbz/bzwb/dqjhjbh/dqdywrwpfbz/200701/t20070101\\_67495.htm](http://kjs.mep.gov.cn/hjbhzbz/bzwb/dqjhjbh/dqdywrwpfbz/200701/t20070101_67495.htm)
- 3 The China V standard was initially scheduled to be implemented beginning 1/1/2012, but has been delayed indefinitely; for more information see: [http://transportpolicy.net/index.php?title=China:\\_Heavy-duty:\\_Emissions](http://transportpolicy.net/index.php?title=China:_Heavy-duty:_Emissions)
- 4 See ICCT policy update at: <http://theicct.org/supplemental-nox-standards-beijing>

Cycle (ESC)—are not representative of real-world driving conditions, especially in urban areas. Many of the emission control systems on these vehicles are not optimized for urban driving conditions, leading to excess, “off-cycle” emissions. For a detailed description of the technical and policy causes of these excess NO<sub>x</sub> emissions, see two earlier ICCT publications:

- » Lowell, D. and Kamakaté, F., 2012. “Urban off-cycle NO<sub>x</sub> emissions from Euro IV/V trucks and buses.” Available online at: <http://www.theicct.org/urban-cycle-nox-emissions-euro-ivv-trucks-and-buses>
- » Tu, J. and Wagner, D.V., 2013. “Supplemental NO<sub>x</sub> standards for Euro IV/V HDVs in Beijing.” Available online at: <http://www.theicct.org/supplemental-nox-standards-beijing>

The World Harmonized Transient Cycle (WHTC) was specifically developed to be more representative of real-world driving, and includes a much higher percentage of low-speed and low-load conditions. The use of the WHTC should force manufacturers to employ NO<sub>x</sub> reductions strategies—such as engine tuning, thermal management, SCR catalyst switching, and others—that function across a broader range of vehicle operating conditions.

In the EU, the WHTC is not required until the Euro VI stage, which is currently being phased-in. China, however, has only just implemented the China IV heavy-duty diesel vehicle emission standards nationwide, and there is no clear timeline yet for the implementation of Euro VI-equivalent standards. Because Euro IV and V-equivalent vehicles are likely to be sold for many years in China, policy makers there are eager to adopt an interim solution to prevent excess NO<sub>x</sub> emissions from these vehicles.

In February 2013, the Beijing Municipal Environmental Protection Bureau (BJEPB) released two new local standards specifically designed to prevent these excess NO<sub>x</sub> emissions.<sup>5</sup> However, Beijing’s standards only apply to vehicles sold and registered in the Beijing municipal area. The recently-released standard from MEP applies to all applicable vehicles across the entire country.

## TECHNICAL STANDARDS

The new standard, which was released by the Ministry of Environmental Protection as a national Environmental Protection Standard, requires all engines (or engine families) to be tested over the WHTC prior to receiving Type Approval. The standard also requires the supplemental testing to be performed as part of the standard demonstration of Conformity of Production.

Both cold and hot-start testing are required, with emissions testing results weighted 86% / 14% for hot-start / cold-start respectively.

The limit values for China IV/V engines tested over the WHTC are as follows:

Stage	CO (g/kWh)	HC (g/kWh)	NO <sub>x</sub> (g/kWh)	PM (g/kWh)
IV	4.0	0.55	4.20	0.03
V	4.0	0.55	2.80	0.03

5 See ICCT policy update at: <http://www.theicct.org/supplemental-nox-standards-beijing>

For CO, HC, and PM, the limit values are identical to the existing limit values for testing over the ETC. Only the NO<sub>x</sub> values have been revised. In the national standard, the NO<sub>x</sub> values when tested over the weighted cold/hot-start WHTC has been revised up by 20% for China IV and 40% for China V. Given that urban excess NO<sub>x</sub> emissions from Euro IV and V vehicles have been commonly measured to be 2-3x the ETC limit value, these new limit values should be effective at forcing manufacturers to adopt different NO<sub>x</sub> control strategies that function over a broader range of operating conditions.

The following table compares the ETC NO<sub>x</sub> limit value with the limit values for testing over the WHTC prescribed in this national standard and the Beijing standard. Note that Beijing's China IV WHTC limit value is more stringent than the national limit value.

Stage	ETC NO <sub>x</sub> limit	MEP WHTC NO <sub>x</sub> limit		Beijing EPB WHTC NO <sub>x</sub> limit	
	g/kWh	g/kWh	Increase over ETC	g/kWh	Increase over ETC
IV	3.5	4.20	20%	3.7	6%
V	2.0	2.80	40%	2.8	40%

The new standard is a supplemental requirement; engines must still meet all of the requirements of the existing China IV/V standards (as specified in GB 17691-2005). The standard also requires engines to be labeled as compliant with the new standard, "Fulfills the requirements of HJ 689-2014."

## DIFFERENCES TO THE DRAFT STANDARD

The final standard released by MEP differs significantly from the draft standard released in 2012.<sup>6</sup> The draft standard required testing exclusively over the cold-start WHTC, with NO<sub>x</sub> emission limits for the China IV and V stages set at 4.9 and 2.8 g/kWh. Those limits over cold-start testing only were apparently deemed technically too difficult for manufacturers to meet, so the standard was revised to include weighted hot and cold-start testing results. In addition, the draft standard was proposed to apply to a slightly broader range of vehicles, while the approved, final national standard is limited to urban diesel vehicles. It is unclear when or if this standard will extend to other types of vehicles.

<sup>6</sup> Draft standard available online at: [http://www.mep.gov.cn/gkml/hbb/bgth/201208/t20120810\\_234647.htm](http://www.mep.gov.cn/gkml/hbb/bgth/201208/t20120810_234647.htm)