

# Impact of Fuel Properties on Pollutants / CO<sub>2</sub>

Prepared by Japan

# Overview

- ◆ **Purpose:** In order to consider the harmonized reference test fuel for UNR WLTP, Japan made a study to see the emissions and fuel consumption impact when using JPN and EU reference fuels.
- ◆ **Fuel:** JPN (Regular, Premium), EU (for Type I and VI test)
- ◆ **Test Temperature :** under the 23°C and -7°C
- ◆ **Road load:**
  - 23°C: Fixed run method@23°C
  - -7°C: Fixed run method@-7°C (set 10% decrease of CD time)
- ◆ **Test mode :** WLTC Cold
- ◆ **Measured items:** CO, THC, NMHC, NOx , CO2, FC, PN\* \*) only -7°C testing
- ◆ **Test vehicles:** 3 vehicles (Gasoline Direct Injection)

Vehicle	Base Fuel	Displacement	Rated Power	Engine Feature	Transmission	Remarks
18G01	JPN regular	2.0 L	109 kW	NA DI	6AT	-
18G02	JPN regular	1.2 L	85 kW	TC DI	6MT	-
18G03	JPN Premium	1.5 L	134 kW	TC DI	CVT	GPF

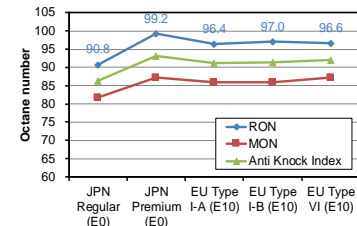
# Fuel property

## ◆Fuel property

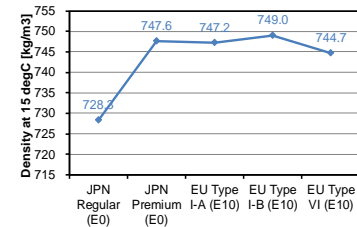
Parameter		Unit	JPN		EU		
			Regular	Premium	Type I-A	Type I-B	Type VI
Octane number	RON	-	90.8	99.2	96.4	97.0	96.6
	MON	-	81.8	87.3	86.0	86.0	87.3
	Anti Knock Index	-	86.3	93.3	91.2	91.5	92.0
Density at 15 °C	kg/m3		728.3	747.6	747.2	749.0	(744.7)
Vapor pressure (DVPE or RVP)	kPa		58.6	58.8	58.5	57.8	(89.2)
Water content	% Vol		-	-	0.024	0.012	0.023
Distillation:	Initial boiling point	°C	37.5	36.0	36.2	35.9	(30.0)
	5% point	°C	46.5	47.0	51.0	51.6	(39.5)
	10% point	°C	52.5	53.5	54.2	54.9	(46.5)
	20% point	°C	60.5	62.0	59.1	59.8	(56.0)
	30% point	°C	69.0	71.0	63.6	64.0	(63.5)
	40% point	°C	80.0	81.0	67.7	69.2	(68.5)
	50% point	°C	93.5	92.5	92.5	93.7	(90.0)
	60% point	°C	109.0	103.5	103.3	103.9	(105.5)
	70% point	°C	126.5	112.5	109.0	110.2	(112.5)
	80% point	°C	145.5	122.5	118.2	119.0	(126.0)
	90% point	°C	162.0	147.5	147.5	146.0	(165.5)
	95% point	°C	168.0	164.0	170.3	167.9	174.6
	97% point	°C	171.5	167.5	-	-	(180)
	Final boiling point	°C	177.5	174.0	183.1	187.6	(186.5)
	Evaporated at 70°C	vol%	-	-	43.3	41.3	(42.5)
	Evaporated at 100°C	vol%	-	-	56.4	55.6	55.4
	Evaporated at 130°C	vol%	(71.5)	(84.0)	(86.5)	(85.5)	(81.5)
Evaporated at 150°C	vol%	-	-	91.5	91.5	86.9	
Evaporated at 170°C	vol%	(96.0)	(97.5)	(95.5)	(95.5)	(92.5)	
Evaporated at 180°C	vol%	-	-	98.0	98.0	97.3	
Residue	vol%	1.0	1.0	0.9	0.8	(1.0)	
Loss	vol%	1.5	1.5	1.0	0.7	-	
Hydrocarbon analysis:	Olefines	vol%	17.8	16.4	7.3	7.8	(8.0)
	Aromatics	vol%	22.4	36.9	27.2	28.8	(27.4)
	Benzene	vol%	0.4	0.4	0.2	0.4	(0.1)
	Saturates	vol%	-	-	56.0	54	(54.6)
Carbon/hydrogen ratio	%Mass	-	-	6.201	6.256	(6.137)	
Carbon/oxygen ratio	%Mass	-	-	23.743	23.771	(22.392)	
Induction Period	minutes	-	-	-	> 480	-	
Oxygen content	% m/m	< 0.1	< 0.1	3.5	3.44	(3.7)	
Solvent washed gum (Exsistant gum content)	mg/100ml	0	0	< 1	< 1	< 1	
Sulphur content	mg/kg	6.0	5.0	3.4	4.1	< 3.0	
Copper corrosion 3hrs, 50degC	merit	-	-	1b	1b	1b	
Lead content	mg/l	< 0.001	< 0.001	< 5.0	< 5.0	< 5	
Phosphorus content	mg/l	-	-	<0.2	< 1.3	< 0.2	
Ethanol	vol%	< 0.1	< 0.1	9.5	9.4	(10.0)	
MTBE	vol%	< 0.1	< 0.1	-	-	-	
Methanol	vol%	< 0.1	< 0.1	-	-	-	
Kerosene	vol%	< 0.7	< 0.7	-	-	-	
Colore / Visual aspect	-	-	-	Clear and bright	Clear and bright	Clear and bright	
NHV (EST)	MJ/kg	43.36	42.64	-	-	-	
Low calorific value measured	MJ/kg	-	-	41.27	41.25	41.50	
PM-Index (based on PONA analysis)	-	(1.22)	(1.40)	(1.35)	(1.12)	(1.48)	
SPMI (based on E130 and E170)	-	(1.40)	(0.89)	(0.94)	(0.98)	(1.30)	

\*) Value in red with brackets are the results of re-analysis

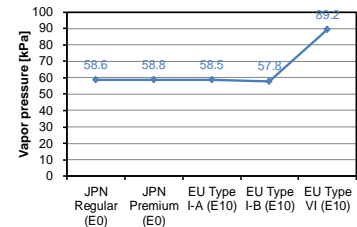
## ◆Octan number



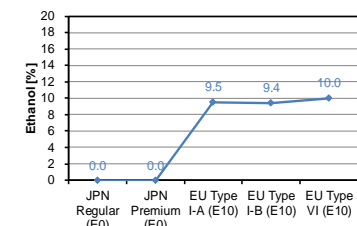
## ◆Density



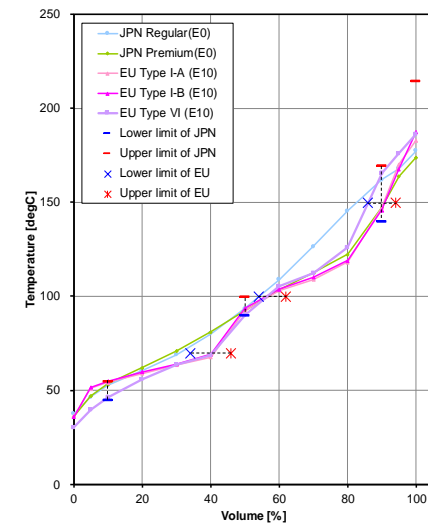
## ◆Vapor pressure



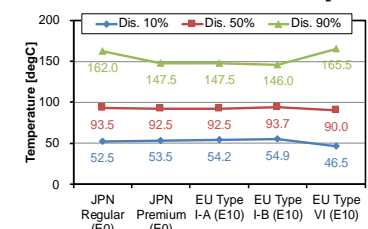
## ◆Ethanol



## ◆Distillation

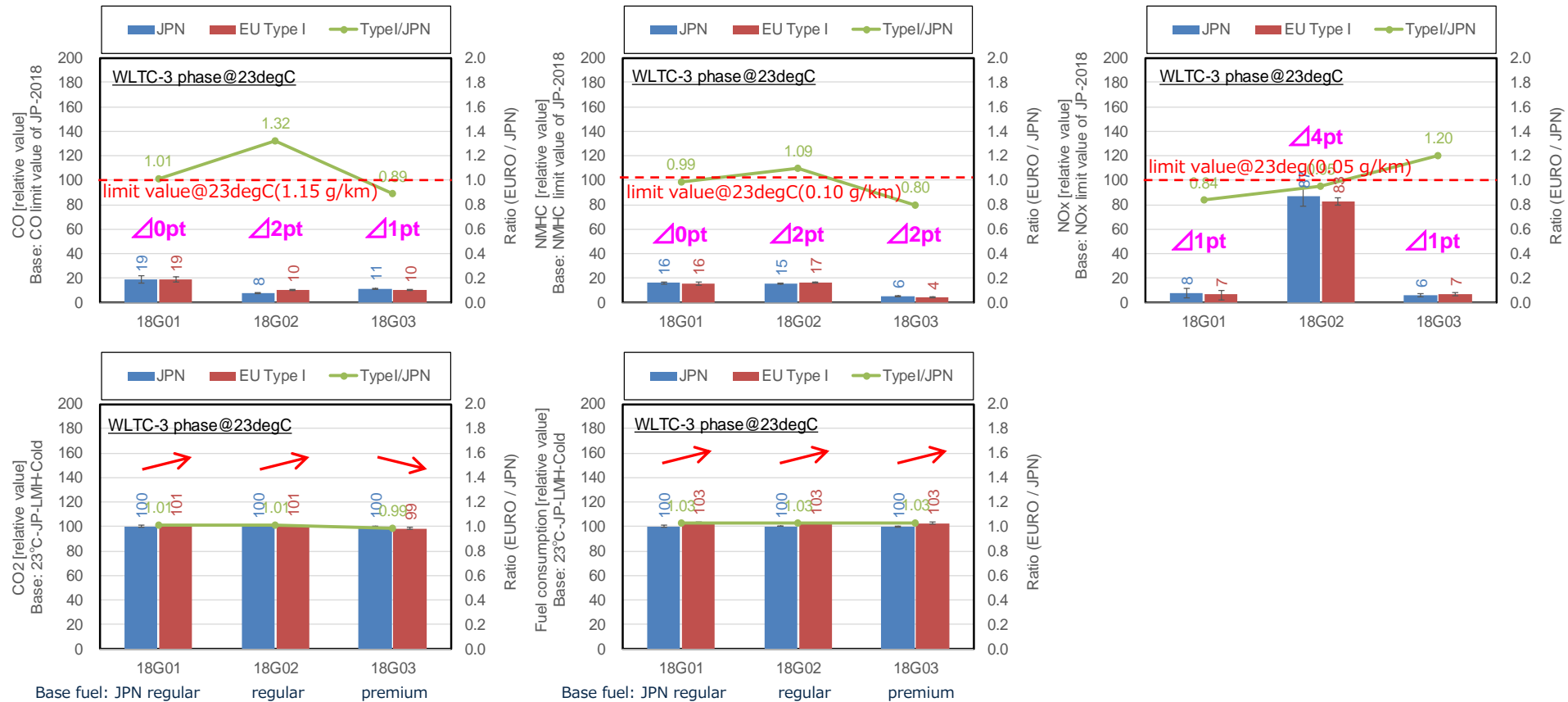


## ◆Distillation Temp.



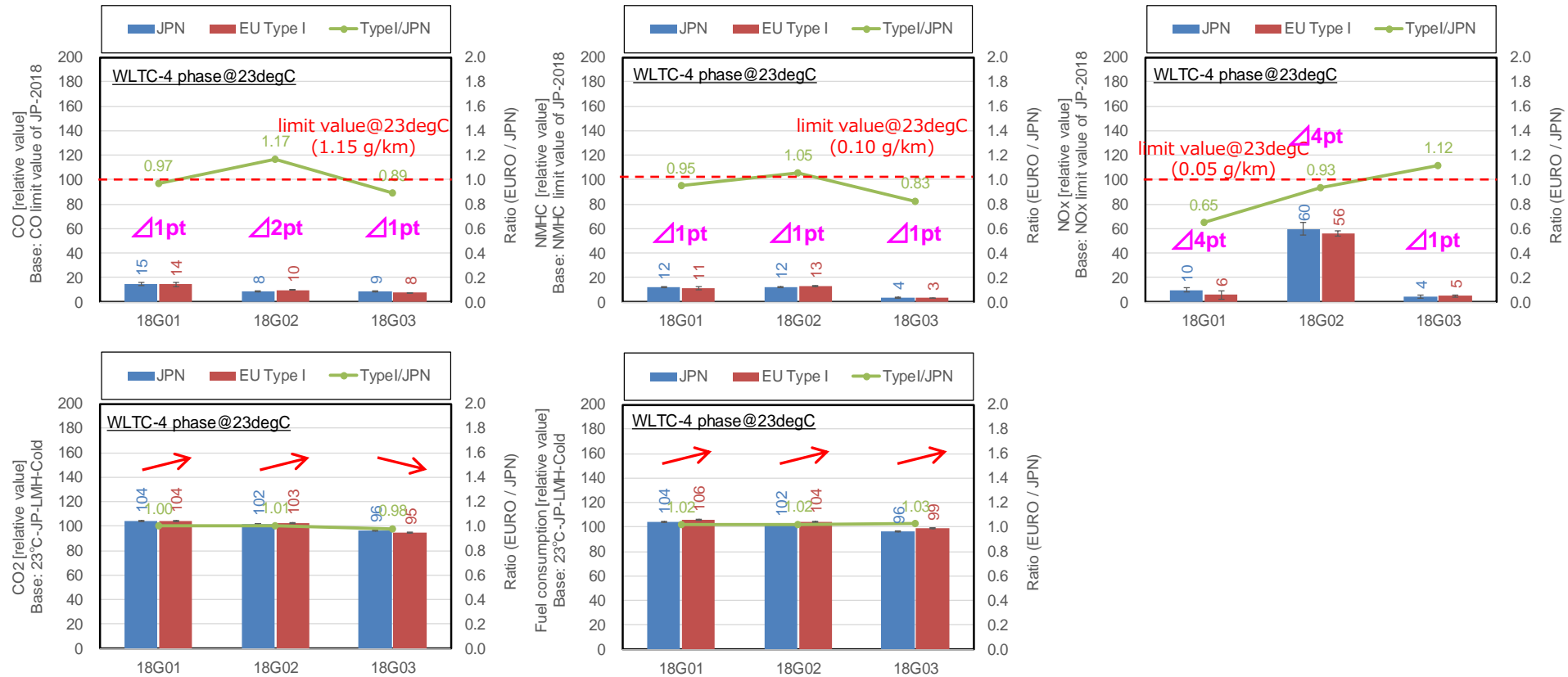
# Test results (WLTC 3 phase@23degC)

- ◆ The difference of the emissions(CO, NMHC and NOx) between JPN and EU type I fuel are within 4 % compared with current limit in Japan.
  - No clear trend could be confirmed.



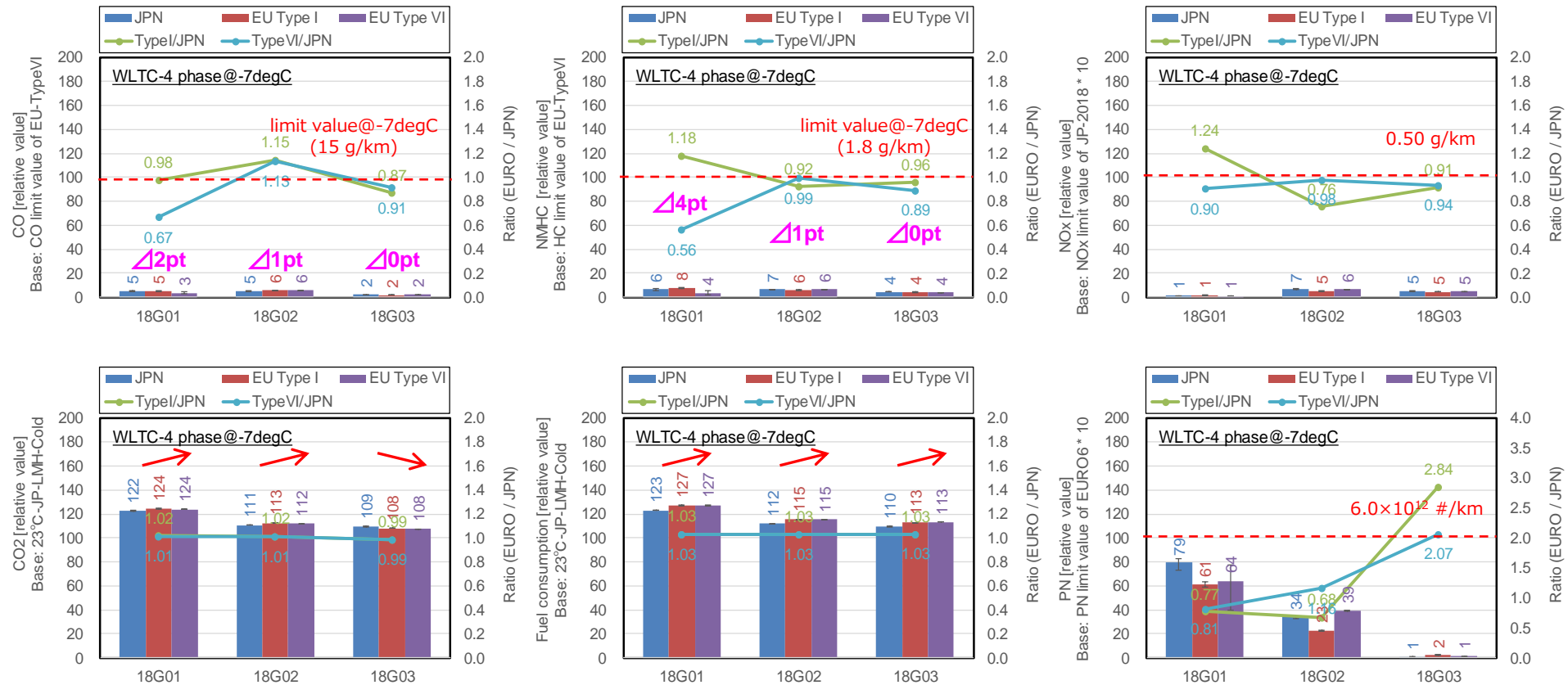
# Test results (WLTC 4 phase@23degC)

- ◆ The difference of the emissions(CO, NMHC and NOx) between JPN and EU type I fuel are within 4 % compared with current limit in Japan.
  - No clear trend could be confirmed.



# Test results (WLTC 4 phase@-7degC)

- ◆ The difference of the emissions(CO and NMHC) between JPN and EU fuel are within 4 % compared with current limit in EU.  
→ **No clear trend could be confirmed.**
- ◆ Regarding PN, the difference is approximately 20% compared with  $6.0 \times 10^{12}$  level. → **No clear trend could be confirmed.**



# Test results (WLTC 3phase@-7degC)

- ◆ The difference of the emissions(CO and NMHC) between JPN and EU fuel are within 5% compared with current limit in EU.
  - No clear trend could be confirmed.
- ◆ Regarding PN, the difference is approximately 20% compared with  $6.0 \times 10^{12}$  level. → No clear trend could be confirmed.

