



## Chapter 6. **Test & Results**

Je-ju Thermal Power Plant  
(Internal combustion engine No.2)



# 6. Je-ju T'mal Power Plant Test (Overview)

[ Source : Test Report of Internal combustion Engine No. 2 in Je-ju Thermal Power Plant, 27<sup>th</sup> Jun.,2014/ IPTC ]

## ❖ Test reasons & purpose

This test was carried out based on Letter of Agreement for the provision of test bed between "Je-ju thermal power plant" and "Techno-bio Co., Ltd." signed on 17<sup>th</sup> Feb.,2014 for reliable performance verification and for performance comparison of before & after using additive on the operation status with two different types of fuel additives to collect a data such as output, fuel consumption ratio and NO<sub>x</sub>, PM(DUST) measurements .

## ❖ Test scope & Standard of application

This performance test was carried out basis of following related code, written & submitted by research project supervision & project management company, and performed according to a mutually agreed procedure.

The results of final test is also calculated by method as specified in this test procedures.

- Diesel Generator Facility : ISO 3046 standard based
- PM(Dust),NO<sub>x</sub> Measurement : National environmental protection laws

# 6. Je-ju T'mal Power Plant Test (Overview)

## ❖ Test Memo

### 1. Test bed : Je-ju Thermal Power Plant / Internal combustion engine No.2 (40MW)

2Stroke Diesel Engine(12K80MC-S) / Maker : Doosan Heavy I&C/ Built : 9<sup>th</sup> Jun.,2009  
FOC: about 160~180 Ton/day, HFO 180~380cst)

### 2. Verification : Korea Electric Power Corporation (KEPCO) licensed Performance Test Management Company

### 3. Test Item : For performance verification of Before / After using fuel additive

- Test Load : 30%, 50%, 75%, 100%
- Specific Fuel Oil Consumption
- NOx Emission, PM Level

### 4. Tested Method : Comparative test with Additive-A & Additive-B

- . Additive-A : Power-Z of "Techno-bio Co., Ltd." [Local company]
- . Additive-B : Oxxxxxx F35 of "lxxxxxx Co., Ltd." [Foreign company]

### 5. Test period : 14<sup>th</sup> Mar.,2014 ~ 03<sup>rd</sup> Jun.,2014

(1<sup>st</sup> Test : 14<sup>th</sup> Mar.,2014, 23<sup>rd</sup> Apr.,2014 / 2<sup>nd</sup> Test : 24<sup>th</sup> Apr., 2014, 03<sup>rd</sup> Jun.,2014)

Jeju Power Plant

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# 6. Je-ju T'mal Power Plant Test (Time table)

## ❖ TEST Timetable

- 2014. 02. 17 Signed an agreement for provision of TEST BED between Je-ju Th. power plant and Techno-bio.
- 2014. 02. 25 Provide of fuel additive(Power-Z) & installed a supply pump.- Internal combustion engine No.2
- 2014. 02. 26 Installed a measuring device(IPTC)
- 2014. 03. 14~ Carried out 1<sup>st</sup> TEST before using additive (Additive-A) : **Power-Z**
- 2014. 04. 23~ Carried out 2<sup>nd</sup> TEST after using additive-A
- 2014. 04. 24~ Carried out 1<sup>st</sup> TEST before using additive (Additive-B) : **OXXXXXX F35**
- 2014. 06. 03~ Carried out 2<sup>nd</sup> TEST after using additive-B
- 2014. 06. 27 Issued the TEST REPORT(IPTC)

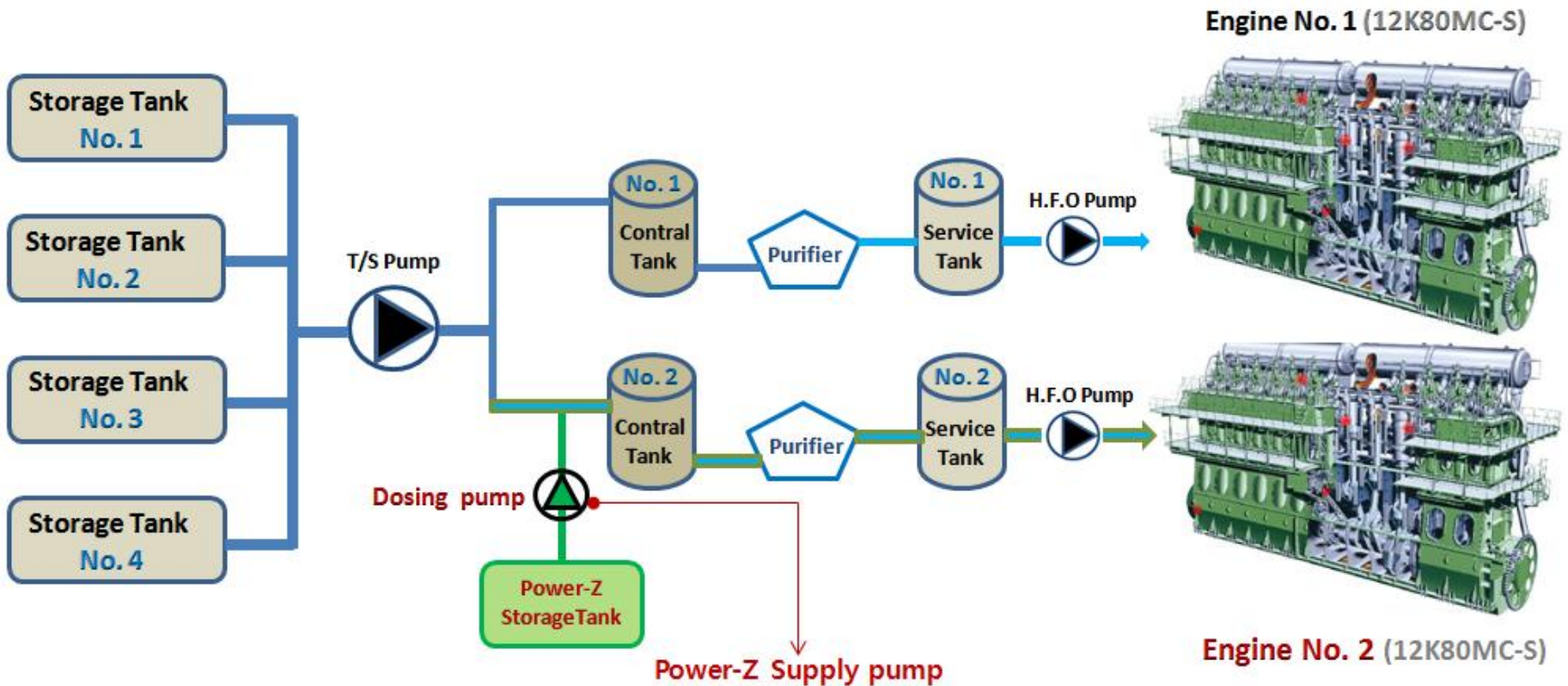
## ❖ Reference Photo



Jeju Power

# 6. Je-ju T'mal Power Plant Test (TEST BED)

## ❖ TEST BED Construction (Internal combustion Engine No.2)



# 6. Je-ju T'mal Power Plant Test (FOC)

## ❖ Comparison Table

### Additive A&B : Comparison table of fuel consumption rate

1. Fuel consumption rate Before & After using the Additive A [Techno-bio Co., Ltd.]

[Unit : g/kWh]

Test Item	100%NR	75%NR	50%NR	30%NR
Before using (14 <sup>th</sup> Mar.,2014)	188.665	186.747	207.615	240.716
After using A (23 <sup>rd</sup> Apr.,2014)	186.913	185.103	202.833	231.087
Difference	-1.752	-1.644	-4.782	-9.629
Decreased rate	-0.929%	-0.880%	-2.303%	-4.000%

2. Fuel consumption rate Before & After using the Additive B [IXXXXXXX Co.,Ltd.]

[Unit : g/kWh]

Test Item	100%NR	75%NR	50%NR	30%NR
Before using (14 <sup>th</sup> Mar.,2014)	188.665	186.747	207.615	240.716
After using B (03 <sup>rd</sup> Jun.,2014)	188.172	186.482	204.921	234.165
Difference	-0.493	-0.265	-2.694	-6.551
Decreased rate	-0.261%	-0.142%	-1.293%	-2.721%

3. Comparison of average fuel consumption rate Before & After using the Additive A [Techno-bio Co., Ltd.]

Load	100%+75%+50%NR Average	75%+50%+30%NR Average	50%+30%NR Average
Decreased rate	-1.371%	-2.394%	-3.152%

4. Comparison of average fuel consumption rate Before & After using the Additive B [IXXXXXXX Co., Ltd.]

Load	100%+75%+50%NR Average	75%+50%+30%NR Average	50%+30%NR Average
Decreased rate	-0.567%	-1.387%	-2.010%



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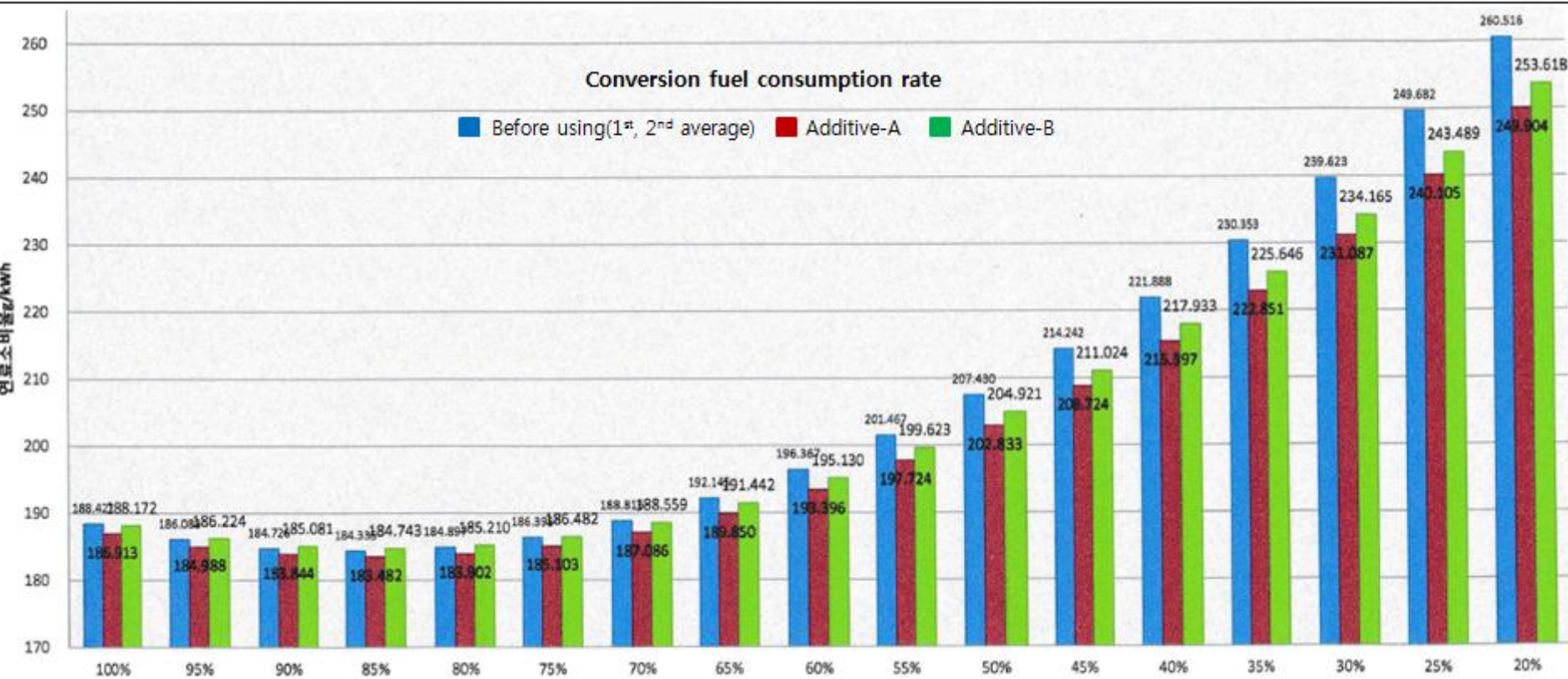
# 6. Je-ju T'mal Power Plant Test (Fuel efficiency)



## ❖ Comparison Chart

Comparison of average (1<sup>st</sup> & 2<sup>nd</sup> Test) fuel consumption rate before & after using the additive.

Test Item	100%	95%	90%	85%	80%	75%	70%	65%	60%	55%	50%	45%	40%	35%	30%	25%	20%
Before using (1 <sup>st</sup> , 2 <sup>nd</sup> Average)	188.422	186.083	184.726	184.335	184.897	186.395	188.816	192.145	196.367	201.467	207.430	214.242	221.888	230.353	239.623	249.682	260.516
Additive - A	186.913	184.988	183.844	183.482	183.902	185.103	187.086	189.850	193.396	197.724	202.833	208.724	215.397	222.851	231.087	240.105	249.904
Additive - B	188.172	186.224	185.081	184.743	185.210	186.482	188.559	191.442	195.130	199.623	204.921	211.024	217.933	225.646	234.165	243.489	253.618





# 6. Je-ju T'mal Power Plant Test (NO<sub>x</sub>, PM)

## Additive A&B : Comparison table of air pollutants decrease rate

### ❖ Comparison Table(con.)

#### 1. Comparison of NO<sub>x</sub> measurement(at SCR inlet) (PPM)@13%O<sub>2</sub>

Load	Before using Additive (14 <sup>th</sup> Mar.)	On using additive-A (23 <sup>rd</sup> Apr.)		On using additive-B (03 <sup>rd</sup> Jun.)	
		PPM	Decreased rate (%)	PPM	Decreased rate (%)
50%NR	1387.4	1068.0	-23.02	1158.2	-16.52
75%NR	1620.4	1092.0	-32.61	1340.3	-17.29
100%NR	1714.6	1262.2	-26.39	1376.2	-19.74
Decreased rate (Average)			-27.34		-17.85

#### 2. Comparison of PM(dust) measurement ( at EP inlet) (mg/m<sup>3</sup> )

Load	Before using Additive (14 <sup>th</sup> Mar.)	On using additive-A (23 <sup>rd</sup> Apr.)		On using additive-B (03 <sup>rd</sup> Jun.)	
		mg/m <sup>3</sup>	Decreased rate (%)	mg/m <sup>3</sup>	Decreased rate (%)
50%NR	64.1	27.3	-57.4	39.2	-38.8
75%NR	100.8	40.9	-59.4	60.5	-40.0
100%NR	108.6	43.8	-59.7	64.2	-40.9
Decreased rate (Average)			-58.8		-39.9



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● Additive - A : Technobio Co., Ltd

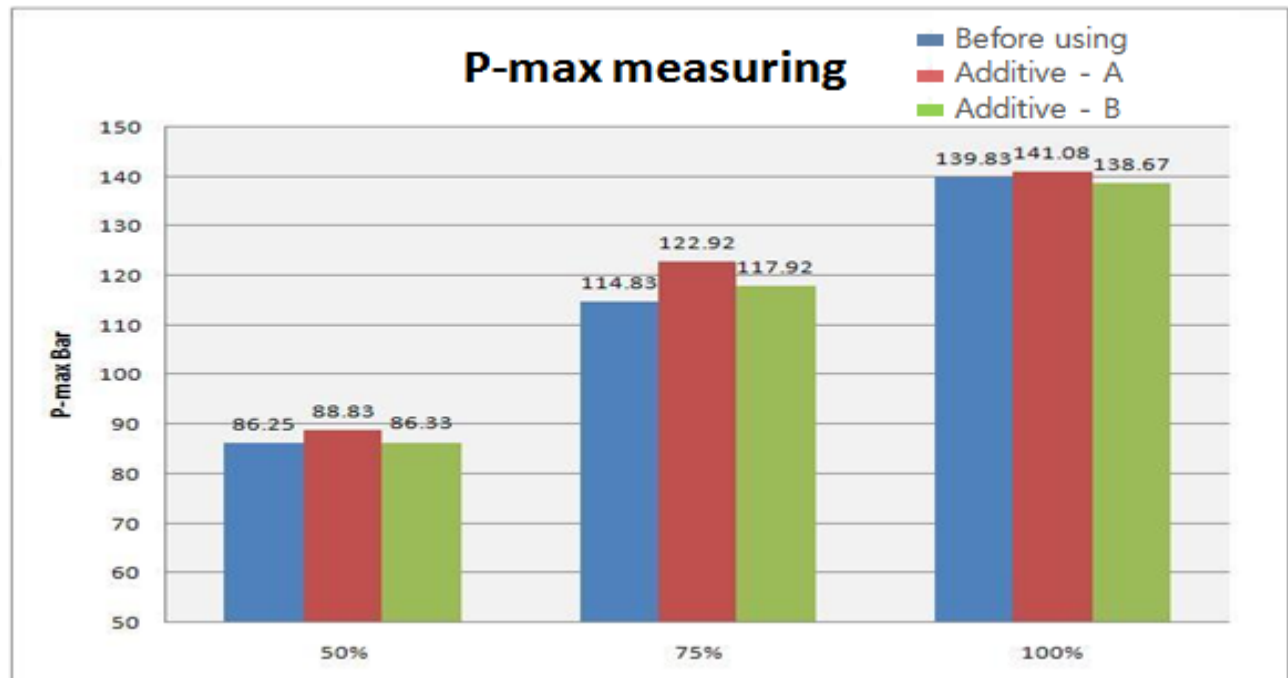
● Additive - B : Ixxxxxxx Co., Ltd

# 6. Je-ju T'mal Power Plant Test (P-max)

## ❖ P-max measuring

Load	Before using Additive	Additive-A	Additive-B
30%NR	-	-	-
50%NR	86.25	88.83	86.33
75%NR	114.83	122.92	117.92
100%NR	139.83	141.08	138.67

➔ [P-max comparison table](#)



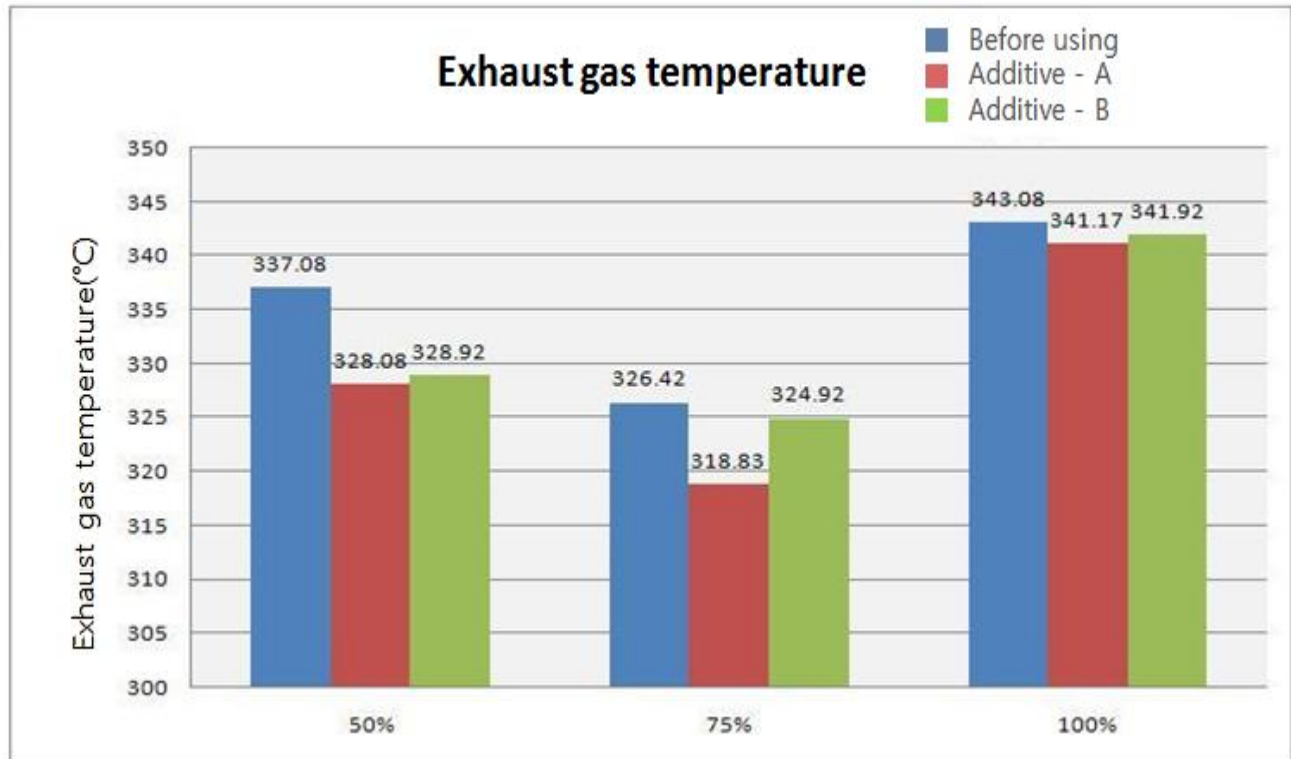
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# 6. Je-ju T'mal Power Plant Test (Ex-gas temperature)

## ❖ Exhaust gas temperature (Engine No.2)

Load	Before using Additive	Additive-A	Additive-B
50%NR	337.08	328.08	328.92
75%NR	326.42	318.83	324.92
100%NR	343.08	341.17	341.92

➔ [Temperature comparison table](#)



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# 6. Je-ju T'mal Power Plant Test (Results)

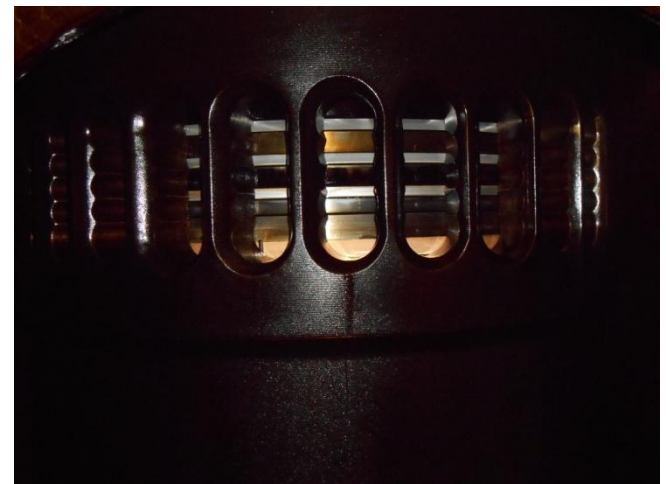
## ❖ Comparison **SCAV. Chamber** state(Before/After using Power-Z)



Before using Power-Z(Photographing : 12<sup>th</sup> Mar.,2014 )

After using Power-Z(Photographing : 09<sup>th</sup> Apr.,2014)

## ❖ Comparison **PISTON** state(Before/After using Power-Z)



Before using Power-Z(Photographing : 12<sup>th</sup> Mar.,2014 )

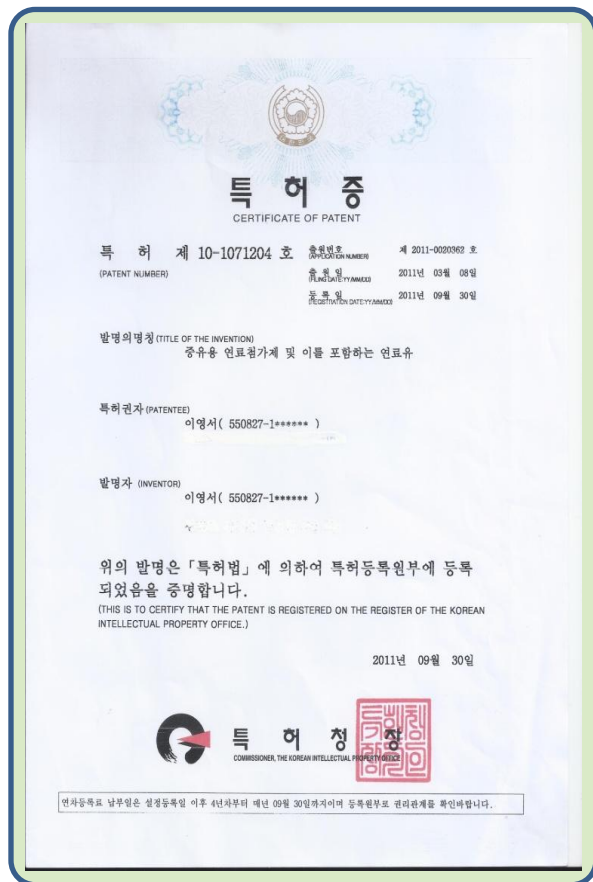
After using Power-Z(Photographing : 09<sup>th</sup> Apr.,2014)

## Chapter 7. Sales Reference (Marine)

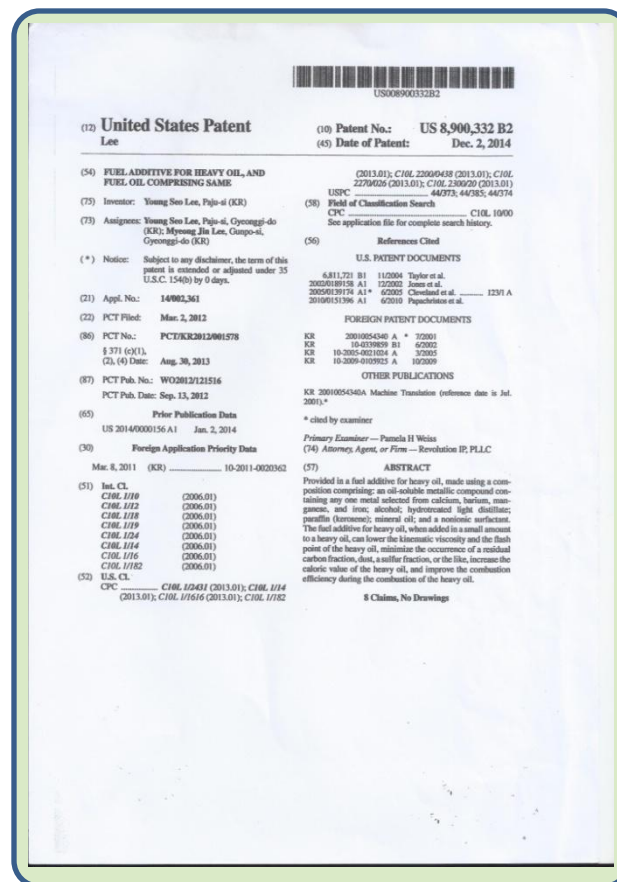


# 7. Sales Reference (Marine)

## Patent



KOREA



U.S.A



CHINA





# Thank you

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