

### CATERPILLAR MOTOREN GmbH & Co. KG

En abril de 2003, ingenieros del departamento de Investigación y Desarrollo de Caterpillar probaron la tecnología enzimática XBEE y sus efectos en el combustible. El experimento se realizó en un motor 6M25 que cumple la norma ISO 3046 y quema gasóleo marino.

Las emisiones de gases se han medido con equipos y métodos conformes a la norma ISO 8178 tras sólo 15 horas de trabajo.

#### Carta de recomendación

En 2003, Visto Mannheim distribuía la tecnología XBEE y tuvo la oportunidad de presentarla a Caterpillar Motoren GmbH & Co. KG en Kiel, Alemania.

Malte Rautenstrauch, Ingeniero de Pruebas Senior y jefe del departamento de Desarrollo y Pruebas de Motores de MaK/Caterpillar, ha probado la Tecnología de Combustible XBEE y ha observado los resultados aquí mencionados.

En consecuencia, Caterpillar ha emitido una carta de recomendación en la que afirma la capacidad de XBEE para mejorar las prestaciones de sus motores y preservar el medio ambiente.

Por favor, vea dicha carta en la siguiente página.

#### Motor Mak/Caterpillar 6M25

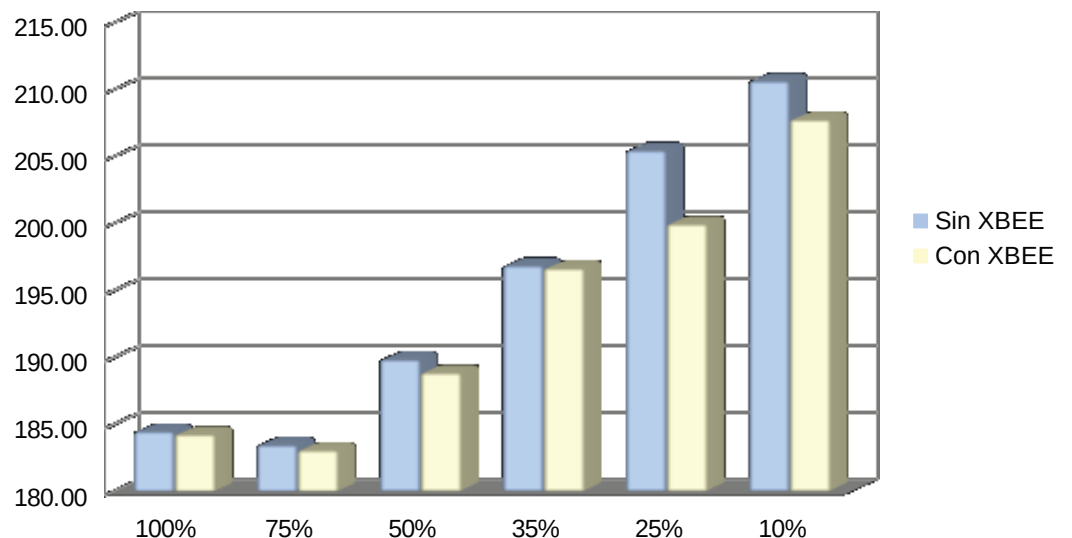
##### Potencia en la hélice

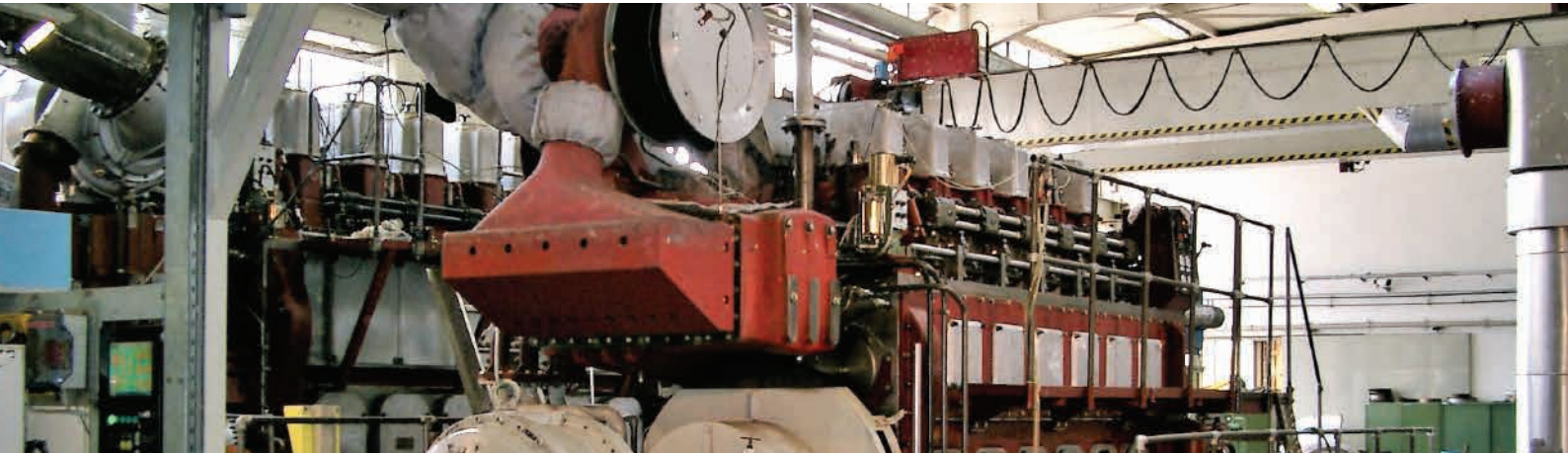
Carga motor (%)	100%	75%	50%	35%	25%	10%
Potencia (kW)	1980	1481	990	698	495	198
RPM	750	681	595	529	476	357

#### Consumo Especifico

Sin XBEE	184.50	183.50	189.90	196.90	205.50	210.70
Con XBEE	184.30	183.10	188.90	196.70	200.00	207.80

#### Consumo Especifico de combustible





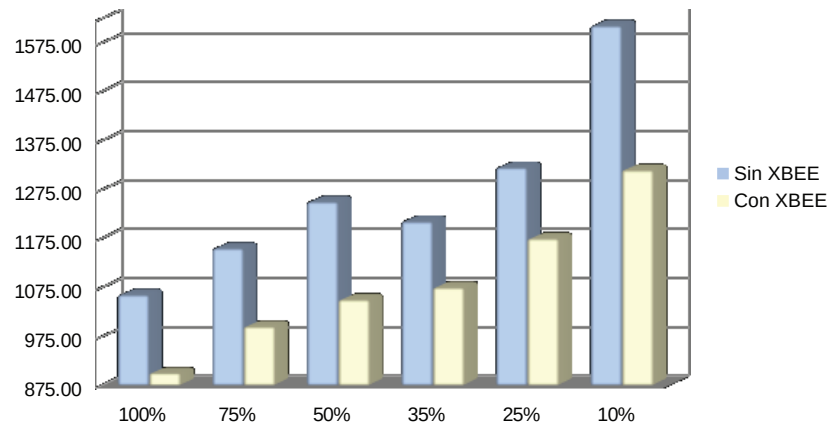
**RECORDATORIO DATOS DE LAS PRUEBAS DE BANCO**

*Potencia en la hélice*

Carga motor (%)	100%	75%	50%	35%	25%	10%
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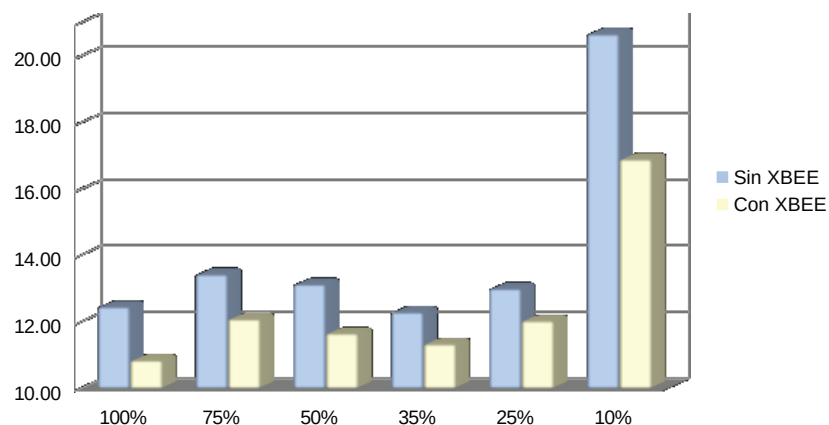
*Óxido de Nitrógeno (NOx ppm)*

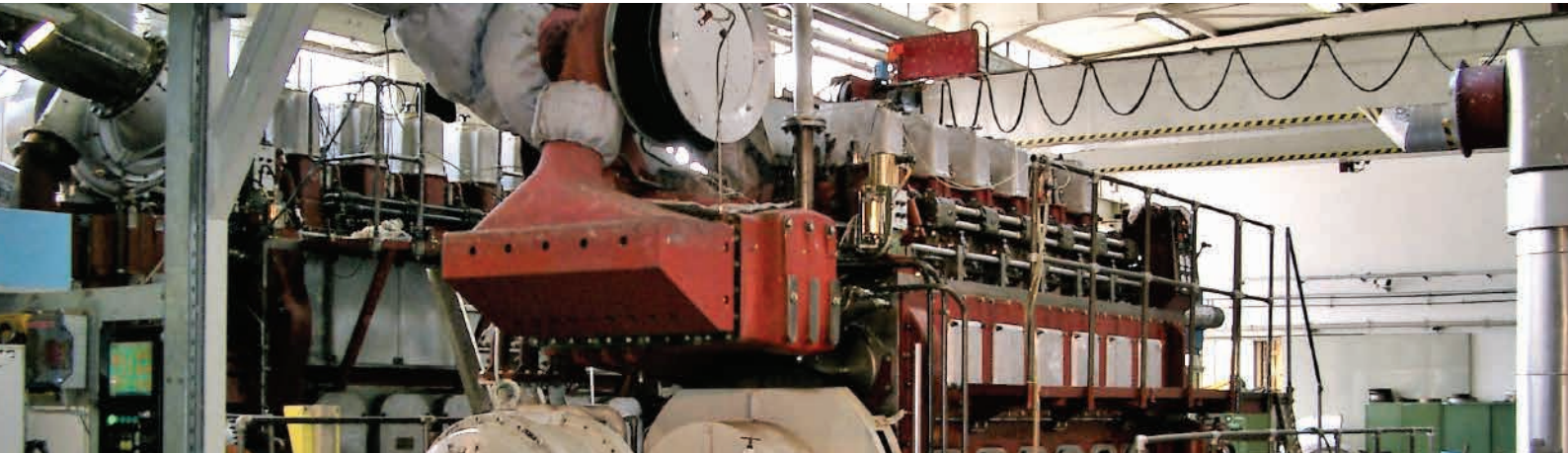
Sin XBEE	1060	1155	1250	1210	1320	1610
Con XBEE	900	995	1050	1075	1175	1315



*Óxido Nitrógeno (Nox gKw/h)*

Sin XBEE	12.45	13.43	13.13	12.29	13.00	20.66
Con XBEE	10.84	12.08	11.65	11.33	12.03	16.89





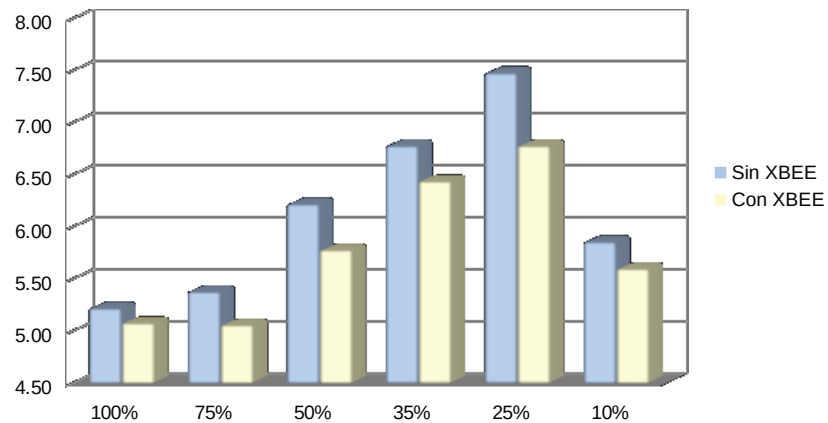
## RECORDATORIO DATOS DE LAS PRUEBAS DE BANCO

### Potencia en la hélice

Carga motor (%)	100%	75%	50%	35%	25%	10%
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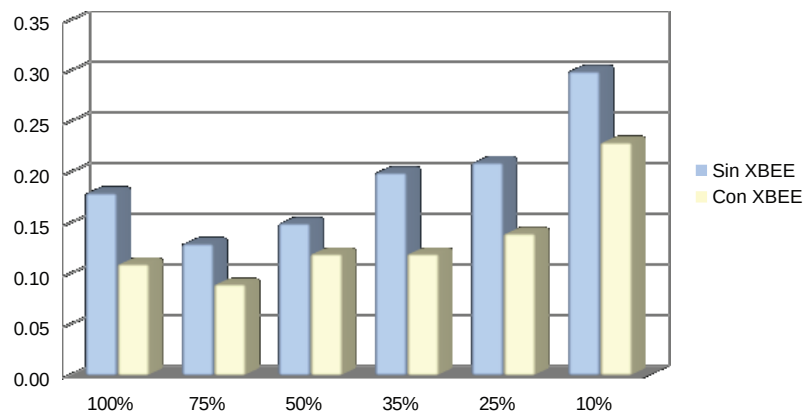
### Dióxido de Carbono (%)

Sin XBEE	5.22	5.38	6.22	6.78	7.48	5.86
Con XBEE	5.08	5.06	5.78	6.44	6.78	5.60



### Concentración de masa de hollín (FSN)

Sin XBEE	0.18	0.13	0.15	0.20	0.21	0.30
Con XBEE	0.11	0.09	0.12	0.12	0.14	0.23





Motor Mak/Caterpillar 6M25							
Potencia en la hélice							
Niveles de rendimiento (%)	100%	75%	50%	35%	25%	10%	
Potencia (kW)	1980	1481	990	698	495	198	
Número de revoluciones	750	681	595	529	476	357	
Sin XBEE							
Con XBEE							Media
Consumo Especifico (be)	184.50	183.50	189.90	196.90	205.50	210.70	195.17
	184.30	183.10	188.90	196.70	200.00	207.80	193.47
	-0.11%	-0.22%	-0.53%	-0.10%	-2.68%	-1.38%	<b>-0.87%</b>
Volumen de aire específico (le)	7.20	7.03	6.46	6.26	6.07	8.69	6.95
	7.31	7.04	6.50	6.30	6.44	9.28	7.15
	1.53%	0.14%	0.62%	0.64%	6.10%	6.79%	<b>2.78%</b>
Temperatura gases de escape antes de la turbina (tAvT)	477.00	468.00	501.00	519.00	515.00	368.00	474.67
	472.00	465.00	496.00	516.00	511.00	387.00	474.50
	-1.05%	-0.64%	-1.00%	-0.58%	-0.78%	5.16%	<b>-0.04%</b>
Temperatura gases de escape después del cilindro (tAnZ)	346.00	335.00	353.00	361.00	364.00	303.00	343.67
	341.00	332.00	349.00	359.00	359.00	311.00	341.83
	-1.45%	-0.90%	-1.13%	-0.55%	-1.37%	2.64%	<b>-0.53%</b>
Temperatura gases de escape después de turbina (tAnT)	290.00	315.00	386.00	429.00	427.00	345.00	365.33
	291.00	320.00	385.00	432.00	446.00	385.00	376.50
	0.34%	1.59%	-0.26%	0.70%	4.45%	11.59%	<b>3.06%</b>
Óxido de Nitrógeno (Nox ppm)	1,060	1,155	1,250	1,210	1,320	1,610	1,267.50
	900	995	1,050	1,075	1,175	1,315	1,085.00
	-15.09%	-13.85%	-16.00%	-11.16%	-10.98%	-18.32%	<b>-14.40%</b>
Óxido de nitrógeno en el escape (Nox gKW/h)	12.45	13.43	13.13	12.29	13.00	20.66	14.16
	10.84	12.08	11.65	11.33	12.03	16.89	12.47
	-12.93%	-10.05%	-11.27%	-7.81%	-7.46%	-18.25%	<b>-11.94%</b>
Cantidad Monóxido de carbono (ppm)	102.00	94.00	142.00	268.00	318.00	170.00	182.33
	94.00	92.00	208.00	384.00	326.00	212.00	219.33
	-7.84%	-2.13%	46.48%	43.28%	2.52%	24.71%	<b>20.29%</b>
Porcentaje Dióxido de carbono	5.22	5.38	6.22	6.78	7.48	5.86	6.16
	5.08	5.06	5.78	6.44	6.78	5.60	5.79
	-2.68%	-5.95%	-7.07%	-5.01%	-9.36%	-4.44%	<b>-5.96%</b>
Número de densidad del hollín (FSN)	0.18	0.13	0.15	0.20	0.21	0.30	0.20
	0.11	0.09	0.12	0.12	0.14	0.23	0.14
	-38.89%	-30.77%	-20.00%	-40.00%	-33.33%	-23.33%	<b>-30.77%</b>

Verteiler:

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**Test Bench Results with Xbee**

Dear Mr. Frey, dear Mr. Filler!

The department of motor development and testing of MaK/Caterpillar has been requested by your company to test the fuel additive Xbee for its efficacy with diesel combustion engines.

We have concluded this test in April 2003 with these results:

The test engine, a medium speed type M25, has been tested for all relevant operating data and at the same measuring points firstly without and thereafter with your additive Xbee.

The evaluation proved considerable improvements at all measuring points (see the testing records) which was a very positive surprise for us.

We suppose that any deposits of carbons will be considerably reduced using this additive and that the intervals of maintenance could be extended due to the reduction of the quantity of soot particles (up to 40%) within the exhaust gas.

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Management Board: Jan E. Grundtman, Chairman  
Oswald Schöffel, Paul Wroblewski

We could not state any damages at the engine having mixed this additive with the diesel fuel.

For our part we do not see any problem for the use of Xbee with all of our engines and we herewith issue a general release for its use.

We believe that using this fuel additive with diesel engines the operating characteristics of the engines will be improved considerably. Due to the reduction of emissions there will be a positive effect for the environment too.

Therefore we may recommend that our customers could use this fuel additive.

With kind regards

  
i. A. Kuo 