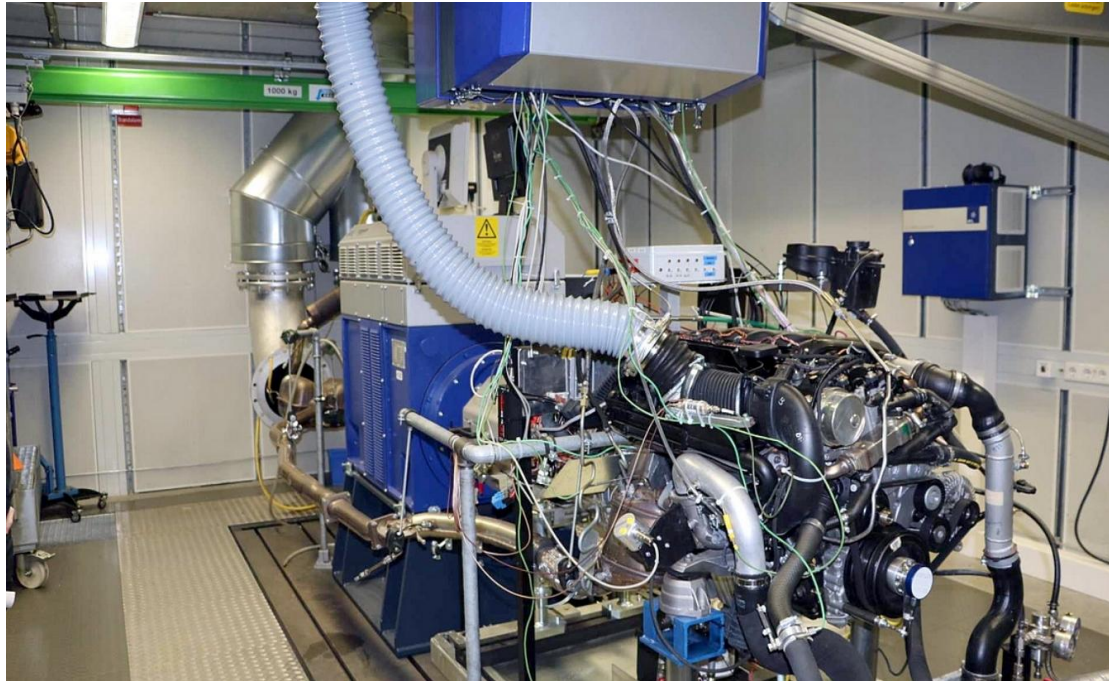
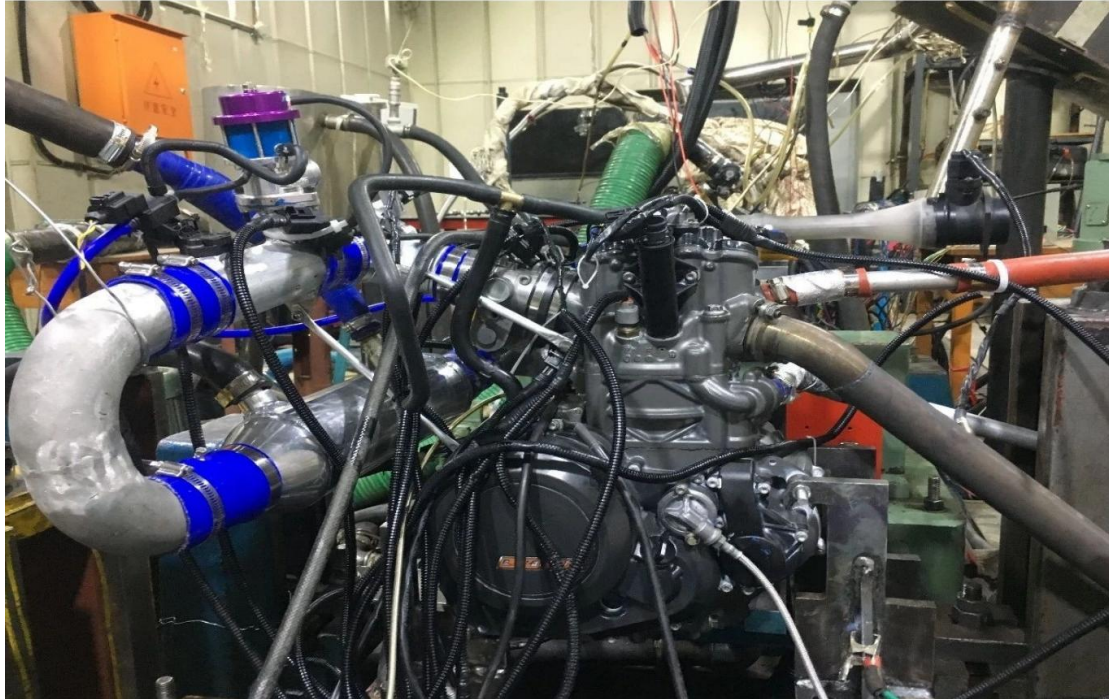


XSNano Fuel Additive Bench test report of multi cylinder engine

Diesel engine model: 16V480MAN





**China Academy of Railway Sciences Locomotive Car
Research Institute
Jan. 19th, 2021**

**XSNano Diesel Saving Additive Test Report of Multi
Cylinder Diesel Engine**

According to the quality management measures and certification procedures of locomotive energy-saving products, The China Academy of Railway Sciences Locomotive Car Research Institute conducted quality assessment on Xunsn nano fuel additive products provided by Xunsn nanotechnology R & D center. After the energy-saving effect was proved by single cylinder engine bench test, the 1:1 multi cylinder engine energy-saving effect test was conducted at the diesel engine test station of Tangshan Locomotive and rolling stock works.

The test was conducted by The China Academy of Railway Sciences Locomotive Car Research Institute and completed jointly with Tangshan rolling stock works in January 2021. At the same time, the Institute of energy conservation and environmental protection of China Academy of Railway Sciences has done the exhaust emission detection and analysis.

Units and personnel participating in the test:

Technical director: Wang Liqin, Ji Hong, Wang Fengzhu

China Academy of Railway Sciences Locomotive Car Research Institute:

Wang Liqin, Liu Chaoran

Tangshan locomotive rolling stock: Ji Hong, Tang Yongqing

Institute of energy conservation and environmental protection of The

China Academy of Railway Sciences: Chen Jing, Li Furong

1, Test method and conditions

The method of comparison was adopted for the test. The diesel engine which has not been overhauled in Tangshan Locomotive rolling stock works is tested on the test bench of product quality acceptance according to the proposed comparative test program for fuel energy saving condition contrast test.

The data test of diesel engine without additives was carried out first. After that, the diesel engine was shut down and the additive was added according to the ratio of 1:10,000.

In the condition comparison test, the output power, fuel consumption and fuel consumption time are measured and the fuel consumption rate is calculated under the condition that the control parameters (such as speed, power, lubricating oil, cooling water temperature, etc.) are consistent as far as possible, so that the fuel consumption rate reflects the energy saving effect.

2, Test equipment and instruments

I. Diesel engine for test

Machine repair manufacturer: Tangshan Locomotive and rolling stock works

Diesel engine number: DG2388

Diesel engine model: 16V480MAN

Supercharger model: KN660D

II. Power test equipment

Diesel engine loading test bed:

DC voltmeter: 0.5

DC ammeter: 0.5

III. Speed test equipment

Special speed sensor and tachometer for test bench :1.5

IV. Fuel consumption test equipment

Scales: Grade 3 ($\pm 1\%$)

Stopwatch: ± 0.1 seconds

V. Atmospheric parameter testing instrument

Barometer: 0.4

Thermometer: 1

VI. Peak pressure gauge test equipment

Peak pressure gauge: 1.5

VII. Pressure and temperature measuring instruments of oil, water and air

Electric thermometer: 1

Pressure gauge: 1

3, Test results

I. The measured data of test conditions are shown in Schedule 1

II. See Curve 1 for fuel consumption rate

III. Diesel engine emission test report

4, Conclusions

I. Seen from the explosion pressure and exhaust temperature, the thermal state is basically stable.

II. The energy saving effect of the product is obvious. The fuel consumption of diesel with XSNano additive is significantly lower than that without XSNano.

III. The harmful components of exhaust gas emission also decrease obviously, which is favorable for environmental protection

Air condition:
 No XSNano: Temperature 29.2°C
 Atmospheric pressure 746.5mmHg
 XSNano added: Temperature 28.6 °C
 Atmospheric pressure 746.0mmHg

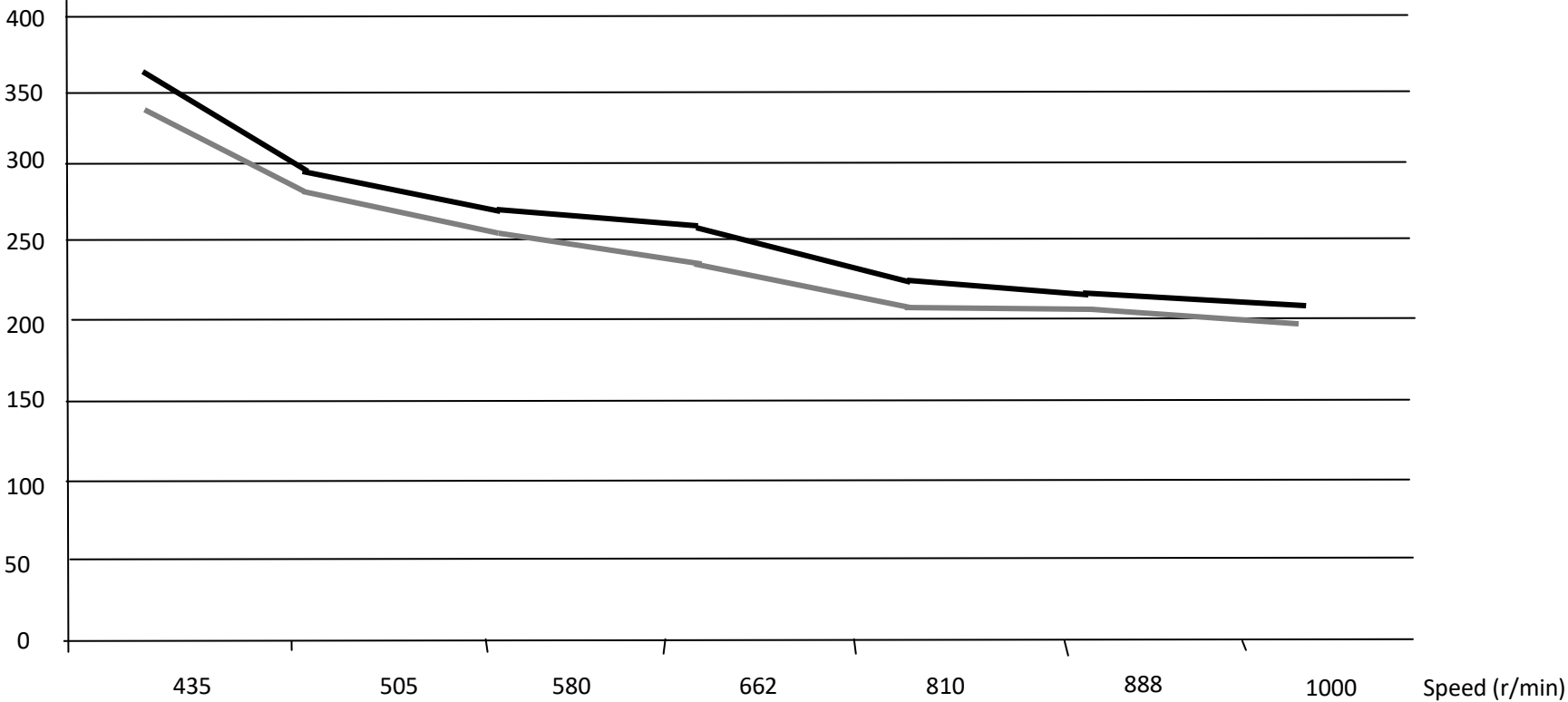
Test data sheet of XSNano fuel additive multi cylinder machine

Speed	Power	Outlet temp of high-temp water	Outlet temp of lubricating oil	Outlet temp of low-temp water	Average temp of intake air (after inter cooling)	Average pressure of intake air (after inter cooling)	Average temp of exhaust pipe	peak pressure	Fuel consumption rate	Additive	Fuel consumption reduction rate
rpm	KW	°C	°C	°C	°C	Mpa	°C	Mpa	g/kwh		%
435	134.40	59.4	59.7	33.0	26.0	0.003	156	4.70	364.18	NO	7.05
430	138.60	59.3	59.0	33.0	31.5	0.000	159	4.64	338.51	YES	
507	284.00	67.3	62.1	37.2	28.1	0.000	224	5.29	298.26	NO	7.20
505	293.30	67.0	62.0	37.2	28.7	0.000	206	5.36	276.78	YES	
585	427.51	67.0	66.7	40.0	29.7	0.002	276	5.69	274.32	NO	8.30
580	438.60	67.0	66.0	40.0	29.7	0.002	255	5.68	251.55	YES	
662	758.72	69.0	70.3	42.0	31.6	0.011	323	7.05	264.19	NO	9.90
660	769.32	70.0	70.0	42.0	32.2	0.011	323	7.04	238.03	YES	
809	1446.42	69.0	69.8	47.3	39.4	0.054	341	9.29	230.93	NO	10.70
810	1462.13	69.0	69.0	47.0	40.0	0.053	347	9.17	206.22	YES	
888	1906.37	67.4	72.8	50.0	40.1	0.098	346	10.68	225.61	NO	11.10
890	1949.45	67.5	72.0	52.0	41.5	0.098	348	10.56	200.56	YES	
1000	2402.83	69.2	76.6	54.0	46.9	0.150	358	11.70	223.72	NO	10.90
1000	2463.71	69.2	75.0	55.0	47.0	0.150	355	11.57	199.33	YES	

Conclusions: 1. Seen from the explosion pressure and exhaust temperature, the thermal state is basically stable.
 2. Through test and comparison, the energy saving effect of XSNano additive is obvious.

Fuel consumption curve

Fuel consumption rate(g/kwh)



Without XSNano

With XSNano

Test report of diesel engine emission

Test instrument: KNOS-60 NOX analyzer, UREX-311 CO and HC analyzer

Date: Jan. 15th -18th, 2021

Standard basis: GB/T8190.0-2020

Place: Tangshan Locomotive rolling stock works

Test sample: XSNano diesel saving additive

Tester: Chen Jing

	No.	Speed r/min	Power KW	Fuel consumption kg/h	Air consumption kg/h	Intake TEMP °C	Intake humidity%	Dry / wet correction factor	NO _x correction factor	Measured value ppm			Specific emission g/(kw.h)		
										NO _x	CO	HC	NO _x	CO	HC
No XSNano	1	809	1446.72	336.45	12240	29.0	58.0	0.9258	1.058	1950	800	19	26.34	6.22	0.073
	2	88	1906.37	428.42	15984	29.4	56.8	0.9266	1.056	1680	600	17	20.86	4.62	0.065
	3	1000	2408.83	531.52	23256	29.7	52.8	0.9354	0.9972	1390	300	14	19.73	2.68	0.062
XSNano added	1	810	1446.72	330.85	12240	27.9	60.7	0.9267	1.064	1810	800	17	24.51	6.22	0.061
	2	890	1899.45	419.89	15984	28.9	56.6	0.9283	1.056	1420	400	13	19.42	3.10	0.046
	3	1000	2408.83	518.28	23256	28.7	56.2	0.9362	1.052	1150	200	11	17.98	1.79	0.041

Conclusions: 1.The result of HC test is low because the pipeline is not insulated, so it is only for relative comparison.

2. After adding XSNano, except for the improvement of CO emission at 810 r/min, NO_x, CO and HC emission in other working conditions decreased significantly