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Research Article

Testing and Performance of Petrol Start Diesel Run Engine as per IS:7347: by making modifications in Petrol Start Kerosene Run Engine

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ABSTRACT

Rajkot is very famous place for manufacturing and assembly of diesel engine. P.M. Diesel Pvt. Ltd. Is one of the leading manufacturer and assembler of diesel engine. They are also assembling small multi fuel engine which run on more than one fuel and follow the standard IS 7347. One of their most popular product is Petrol Start Kerosene Run engine (1.1 kW) to be tested as per IS 7347. The main application of this product is in small Generator set. The engine starts on petrol and after 10 seconds with the help of knob the engine can run on kerosene. The major problem of this product is the availability of kerosene for commercial purpose so it is requirement of the industries to find an alternative of the kerosene without raising the fuel cost.

So the main objective of this paper is to modify the petrol start kerosene run engine such that the same engine can run on diesel. 3 major modifications are made in the engine and then performance of both the engines is compared.

1) The design of the spark plug is changed from M-14 to M-18 to control the Carbon deposition during the use of the diesel as a fuel. Because if same spark plug is used than there will be a lot of carbon deposition and high maintenance will be required. So the spark plug is changed from M-14 to M-18.

2) The design of the carburetor for Petrol start Diesel run engine is down drop So the air enter in the cylinder from the down side but for the combustion of diesel in the cylinder the design of the carburetor is to be changed from down drop to side drop.

3)As the specific gravity of kerosene is less (0.80 as compare to diesel (0.83) the diameter of fuel jet is to be increased slightly so that the same amount of fuel can enter in the cylinder.

After doing the above modifications the performance and testing of the engine is carried out and its brake thermal efficiency at different load conditions are measured and the same is compared with the Petrol Kerosene engine. And finally we can conclude after comparing both the results that the Petrol diesel engine can easily replace the Petrol Kerosene engine as the performance of both the engines from efficiency point of view is almost similar

Keywords: Carburetor, Spark Plug, Petrol, Kerosene

Introduction

Rajkot is very famous for the diesel engine and P.M Diesel Pvt. Ltd. Is one of the leading assembler of the diesel engine. They are also assembling Small Spark Ignition Engine.(up to 3 hp) These engines are multi fuel engine they generally start on Petrol and can run after very short time in Kerosene. These engines are to be tested as per IS 7347.

These small multi fuel engines were first developed by In Field India Ltd. In 1965. In India these engines were manufactured by Isher India Limited finally from Isher India Ltd was purchased by Greeves Ltd.. P.M Diesel Limited was manufacturing Small size Spark Ignition Engine which were Petrol Start Kerosene Run engine. These engines were starting on Petrol and after 10 seconds we are able to run the same engines on Kerosene so that the fuel cost can be reduced.

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However the main problem faced by the company is the availability of Kerosene for commercial use. So the Company was facing the problem due to non availability of fuel. In this paper my Objective is to modify the Petrol Start Kerosene engine of 1.5 hp such that the same engine can be converted in Petrol Start Diesel run engine and then compare the different results obtained from the performance testing of both the engine as per IS 7347. And finally compare the advantages and disadvantages of engine and given the conclusion.

Modifications Done in Engine

For converting the engine from Petrol-Kerosene engine to Petrol-Diesel Engine we have taken the 1.5 hp (1.1kW) engine as an model on which the experiments are to be made.
After going through the brief study of the engine we found that the following modifications are required in the engine so that the engine can run on spark plug in spite of being a diesel engine.

1.The Spark Plug of Mieco -M-14- has to be replaced by Mieco -M-18- so that the spark produced will be more. Further the carbon deposition can be reduced so that the periodic maintenance of the spark plug can be reduced.
2.The compression ratio of petrol Kerosene and petrol-Diesel engine are almost same.
3.The strength of cylinder head is also increased as the size of the spark plug has been increased.
4.The diameter of carburetor jet is decreased to change the air fuel ratio as
diesel is a fuel which mixes less with the air so if same air fuel ratio is used than some unburn & unmix diesel remain in the carburetor so the air fuel ratio has to be reduced and for doing this the jet diameter has reduced. Further the firm is using the down drop Carburetor for traditional Petrol Kerosene Engine. But for the combustion of the diesel more air is needed so the design of the carburetor is to be changed from side drop to down drop. The drawing of the down drop carburetor is enclosed for the reference.

Testing of Engine

Table 1. Performance test of Petrol Start Diesel Run Engine

Type	Petrol Start Diesel Run Engine	BHP/KW	1.5/1.1
Rated Speed	3000 RPM	Stroke	50.0
Bore	55.0 mm	C.C.	0.1187
Compression Ratio	4.5:1	No. of Cylinder	1
Specific Gravity	0.83	Dynamometer Type	Alternator (Brushless)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
8:30	99.80	300	308	310	70	3000	100.00	1.1	0.943	1.04	236	633.05	1.0090	627.40	604.85
9:30	99.80	300	308	310	65	3000	100.00	1.1	0.947	1.04	236	633.05	1.0084	627.78	602.86
10:30	99.70	300	308	310	60	3000	100.00	1.1	0.949	1.04	236	633.05	1.0080	628.04	601.52
11:30	99.70	302	308	310	60	3000	100.00	1.1	0.949	1.04	236	633.05	1.0080	628.04	601.52
12:30	99.60	302	309	311	58	3000	100.00	1.1	0.944	1.04	237	630.38	1.0088	624.89	601.58
13:30	99.60	302	309	311	53	3000	100.00	1.1	0.948	1.04	237	630.38	1.0081	625.29	599.51

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Type	Petrol Start Kerosene Run	BHP/KW	1.5/1.1
Rated Speed	3000 RPM	Stroke	50.0
Bore	55.0 mm	C.C.	0.1187
Compression Ratio	4.5:1	No. of Cylinder	1
Specific Gravity	0.80	Dynamometer Type	Alternator (Brushless)

14:30	99.60	303	309	311	51	3000	100.00	1.1	0.950	1.04	237	630.38	1.0079	625.45	598.68
15:30	99.60	303	310	312	48	3000	100.00	1.1	0.947	1.04	237	630.38	1.0083	625.204	599.99
16:00	99.60	303	310	312	48	2979	110.00	1.21	0.947	1.15	229	652.40	1.0083	647.04	564.50
16:10	99.60	303	310	312	48	3065	75.00	0.825	0.947	0.78	281	531.67	1.0083	527.30	674.72
16:20	99.60	303	310	312	48	3092	50.00	0.550	0.947	0.52	336	444.64	1.0083	440.99	846.42
16:30	99.60	303	310	312	48	3115	25.00	0.275	0.947	0.26	370	403.78	1.0083	400.46	1537.28

Table 2. Performance test of Petrol Start Kerosene Run Engine

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
8:30	98.90	298	307	309	75	3000	100.00	1.1	0.934	1.03	233	618.03	1.0104	611.64	595.04
9:30	98.90	298	307	309	72	3000	100.00	1.1	0.937	1.03	233	618.03	1.0101	611.85	593.92
10:30	98.90	298	307	309	72	3002	100.00	1.1	0.937	1.03	233	618.03	1.0101	611.85	593.92
11:30	98.90	298	308	310	70	3000	100.00	1.1	0.932	1.03	234	615.38	1.0108	608.82	593.57
12:30	99.00	299	308	310	70	3000	100.00	1.1	0.934	1.03	234	615.38	1.0106	608.94	592.94
13:30	99.00	299	308	310	70	3000	100.00	1.1	0.934	1.03	234	615.38	1.0106	608.94	592.94
14:30	99.00	299	309	311	68	3000	100.00	1.1	0.930	1.02	235	612.77	1.0113	605.93	592.59
15:30	99.10	299	310	312	64	3000	100.00	1.1	0.928	1.02	235	612.77	1.0115	605.81	593.21
16:00	99.10	301	310	312	64	2970	110.00	1.210	0.928	1.12	222	648.65	1.0115	641.28	570.86

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16:10	99.10	301	310	312	60	3055	75.00	0.825	0.932	0.77	251	573.71	1.0109	567.50	738.35
16:20	99.10	301	311	313	60	3080	50.00	0.550	0.926	0.51	272	529.41	1.0118	523.22	1026.87
16:30	99.10	302	311	313	60	3110	25.00	0.275	0.926	0.25	300	480.00	1.0118	474.39	1862.06
16:40	99.20	302	311	313	58	3119	0.00	0.00	0.929	0.0	340	423.53	1.0113	418.78	--N.A.

Table 3. Specifications of Table-1 & Table-2

Designation	Specification	Designation	Specification	Designation	Specification
A	Time Hr: min	G	Observed Speed in RPM	M	Fuel Consumption in gm/hr
B	Barometer Reading in Kpa	H	Brake Load in %	N	Correction factor for fuel β
C	Wet bulb Temperature in K	I	Load Observed in kW	O	Corrected Fuel Consumption rate in gm/hr
D	Dry bulb Temperature in K	J	Correction Factor for Power α	P	Corrected SFC rate in gm/Kw hr
E	Air Engine Intake Temperature in K	K	Corrected Power in kW		
F	Relative Humidity in %	L	Time for 50 C.C. fuel in sec		

Assumptions & Calculation of Thermal Efficiency

Assuming
ηm = 0.80, Specific Gravity of Diesel = 0.83, ,
Specific Gravity of Kerosene= 0.80,
Calorific Value of Diesel Cv = 40000 KJ/Kg ,
Calorific Value of Kerosene Cv = 38900 KJ/Kg

Calculations are performed by using following formulas :
1)Corrected Power = Measured Brake Power X Correction Factor
2)F.C. in Gm/hr = 50XSp.Gravity of FuelX3600Time for consumption of 50 CC fuel
3)Corrected F.C. =Corrected F.C.Coreection Factor β
4)BRAKE SPECIFIC FUEL CONSUMPTION (BSFC) = Corrected F.C.Corrected BP
5)Brake Thermal Efficiency in ηbth =B.P.X3600Corrected F..C. X Cv

Result Table and Conclusion

LOAD in %	PETROL START PETROL RUN ENGINE			PETROL START DIESEL RUN ENGINE		
	SFC in gm/hr	BSFC in gm/kw hr	Brake Thermal Efficiency in %	SFC in gm/hr	BSFC in gm/kw hr	Brake Thermal Efficiency in %
N.L.	405.09	----	----	345.39	----	----
25	459.92	1768.92	4.52	400.46	1540.23	5.83
50	506.75	974.52	8.20	440.98	848.04	10.64
75	548.65	694.49	11.51	527.3	676.02	13.32
100	598.03	569.55	14.04	625.19	601.14	14.98
110	616.62	536.19	14.91	647.03	562.64	15.99

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Conclusion:

After going through the results and observations we can say that although the petrol Diesel engine has the fuel cost slightly higher as compare to Petrol Kerosene engine but due to the availability of the kerosene is a very big problem so we can use the Petrol Diesel Engine as a very good alternative of petrol Kerosene Engine.

References:

[1] IS:7347:1974 Performance of small size spark ignition engine for agricultural sprayer and similar application.
[2] IS: 11170:1985 Performance requirements of Constant speed C.I.(Diesel) engine for agricultural purposes(upto 20 kW)
[3] IS: 10001:1981Performance requirements of Constant speed C.I.(Diesel) engine for general purposes(upto 20 kW)
[4] IS: 10001(Pt-1 to 13): All are related to clarifications made clause vise of IS 10001 and IS 11170