PERFORMANCE ENHANCEMENT OF PETROL START KEROSENE RUN ENGINE BY ALTERTION OF FUEL

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ABSTRACT

PM. Diesel Pvt. Ltd is one of the Leading manufacturer & assembler of diesel engine. One of their most running product is Petrol Start Kerosene Run Engine (1.1 kW) as per IS 7347. The Engine starts on petrol and after 10 seconds with the help of the knob the engine can run on kerosene. The major problem of this engine is the availability of kerosene so we have tried to manufacture the engine using same design which can run on Diesel rather than Kerosene.

In this paper, an attempt has been made to modify the petrol start kerosene run engine such that the same engine can run on diesel. 3 major modifications are made in the design and than performance have been evaluated.

1) The Design of the spark Plug is changed from M-14 to M-18 to reduce the carbon deposition as diesel is a high carbon fuel if the same spark plug is used than there will be a lot of carbon deposition so 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 down side but for combustion of diesel engine requires more air so the design of 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 the fuel can enter in the cylinder.

So by making the above modifications the performance of the engine has been taken and the results obtained from testing is satisfying the IS 7347. The comparison also made between Petrol Start Diesel Run Engine and Petrol Start Kerosene Run Engine

1. INTRODUCTION

P.M. Diesels Pvt. Ltd is one of the leading manufacturers of Diesel Engine. They are manufacturing Petrol Start Kerosene Run engines up to 1.1 kW but the major problem faced by them was the availability of kerosene and if they run the engine on petrol During my visit to the firm I got an idea of developing the Petrol Start Diesel Run engine which start on petrol and after 10 seconds it can run on Diesel so that availability of the fuel and the running cost of the engine both problems can be solved simultaneously.

2. MODIFICATIONS REQUIRED

2.1 Spark Plug

Traditionally in Petrol Start Kerosene Run small engine the firm is using M-14 Spark Plug but if the same spark plug is used in Petrol Start Diesel Run engine than there will be lot of carbon deposition in the plug and not enough spark will be produced for the combustion of the Diesel so to reduce the carbon deposition as well

as to produce enough spark for the combustion of diesel the diameter of the spark plug is to be increased from M-14 to M-18. The drawing of the spark plug M-18 is enclosed herewith.

2.2 Compression Ratio

Compression ratio of Petrol- Kerosene and Petrol-Diesel engine are almost same however there should be a slight increase in the compression ratio to achieve better efficiency.

2.3 Carburetor

The Diameter of carburetor Jet has to decrease slightly to modify the air fuel ratio. As a diesel is the fuel with high specific gravity it mixes less with the air as compare to kerosene so if the jet diameter is not reduced than some diesel remain unburned to avoid this the diameter of the jet has reduced slightly.

Further the firm is using down drop carburetor for petrol-kerosene engine as for the combustion of diesel more air is needed so the carburetor is to be changed from down drop to side drop. The drawing of carburetor is enclosed.

2.4 Cylinder Head

As the diameter of spark plug has been increased from M-14 to M-18 than the diameter of the cylinder head is also to be increased for accommodate the large diameter sparkplug.

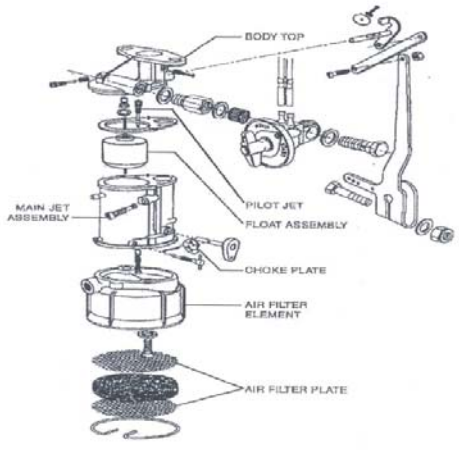

Fig-1Carburetor

3 PERFORMANCES AND TESTING

The Performance and testing of Petrol-Kerosene and Petrol-Diesel engine are taken as per IS 7347 the main features of IS 7347 are as follows.

3.1 About IS: 7347

1. This standard specifically meant for conforming the output measured with the help of electrical parameters. The fuel consumption is measure simultaneously there after graph is plotted for power V/s Fuel consumption and at the rated output fuel consumption should be lowest than specified value.
2. Declaration of power and specific fuel consumption is made.
3. The rating test at 100%, 110%, 75%, 50%, 25% of rated load and idling load i.e. 0% is carried out.
4. During test ambient conditions, dynamometer load, engine speed, fuel consumption, temperature of cooling water, temperature of lubricating oil in sump are taken at the end of full load run.
5. The Power correction factor α depending upon the side conditions is applied to the power to obtain values at standard condition.

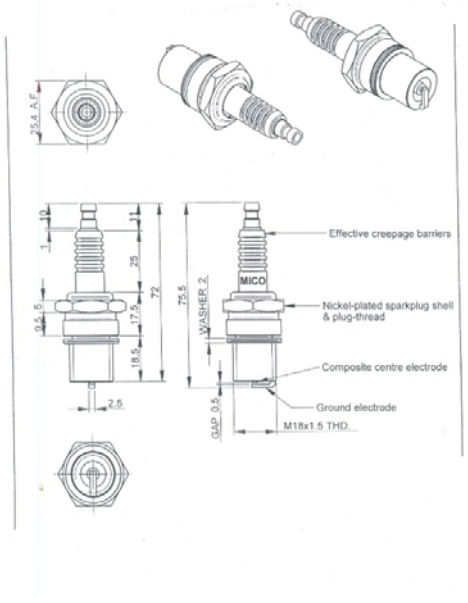

Fig-2 M-18 Spark Plug

6. The specific fuel consumption correction factor α depending upon the side conditions is applied to the specific fuel consumption to obtain values at standard condition.
7. Depending upon selection of class of governing either 1 or 2, the momentarily change and permanent change is measured and compared with clause 9.3.1 of IS standard.
8. Lubricating oil consumption is measured at the end of test.
9. The endurance test of 98 hours duration in nonstop cycles of 7 hrs at 100% rated load, 75% rated load, 100% rated load and 50% rated load is done on engine.
10. Before and after endurance test rating test is taken .
11. After completion of test strip examination of the engine is carried out.
12. Reassembly is done after above examination.
13. The different varieties of engines are designated by marking of rated power and speed on the name plate.

3.2 Experimental Setup

The readings were taken in to the testing laboratory of P.M. Diesels Pvt. Ltd. with the following apparatus.

1) To Measure the brake power Electric panel is used.
2) Dry bulb and Wet bulb thermometer is used for measurement of dry bulb and wet bulb temperature.
3) Exhaust back pressure is measure with U tube manometer.
4) Relative humidity is measure with Heir Hygrometer.
5) Tachometer is used for measurement of RPM.
6) Time for consumption of 50 cc fuel is measured with the stop watch.
7) The Power correction factor α and fuel
8) Correction factor β is taken with the help of IS 11170 chart.
9) Finally power and specific fuel consumption is corrected and performance is measured.

The Performance and testing of Petrol – Kerosene and Petrol-Diesel engine are taken as per IS 7347 is as follows.

In this particular test the engine is start and put on full load the readings were taken every hour are as follows.

1) The Petrol-Kerosene Engine started at 7:30 am and Put on Full Load.
2) After completing 8 hr Full Load test the Loop test was taken on petrol –Kerosene Engine in which first the load on the engine changed from No Load to 10% Over Load and the readings were taken than after every half hour by keeping the engine on 75% Load, 50% Load, 25% Load and finally on No Load. This test is known as a loop test and it is taken for checking the stability of the engine and variation in Specific Fuel Consumption with change in Load.

3.3 TESITING RESULTS OF 1.1 KW PETROL KEROSENE ENGINE

Ti	Pb	Tw	Td	RH	N	P1 kW	α	P2 kW	TI	F.C.	β	C.F.C	S.F.C
8:30	98.90	298	307	75	3000	1.1	0.934	1.03	233	618.03	1.0104	611.64	595.04
9:30	98.90	298	307	72	3000	1.1	0.937	1.03	233	618.03	1.0101	611.85	593.92
10:30	98.90	298	307	72	3002	1.1	0.937	1.03	233	618.03	1.0101	611.85	593.92
11:30	98.90	298	308	70	3000	1.1	0.932	1.03	234	615.38	1.0108	608.82	593.57

12:30	99.00	299	308	70	3000	1.1	0.934	1.03	234	615.38	1.0106	608.94	592.94
13:30	99.00	299	308	70	3000	1.1	0.934	1.03	234	615.38	1.0106	608.94	592.94
14:30	99.00	299	309	68	3000	1.1	0.930	1.02	235	612.77	1.0103	605.93	592.59
15:30	99.10	299	310	64	3000	1.1	0.928	1.02	235	612.77	1.0105	605.81	593.21
16:00	99.10	301	310	64	2970	1.21	0.928	1.12	222	648.65	1.0105	641.28	570.86
16:30	99.10	301	310	60	3055	0.825	0.932	0.77	251	573.71	1.0109	567.50	738.35
17:00	99.10	301	311	60	3080	0.550	0.926	0.51	272	529.41	1.0118	523.22	1026.87
17:30	99.10	302	311	60	3110	0.275	0.926	0.25	300	480.00	1.0118	474.39	1862.06
18:00	99.20	302	311	58	3119	0.000	0.929	0.00	340	423.53	1.0113	418.78	NA

3.2 TESITING RESULTS OF 1.1 KW PETROL DIESEL ENGINE.

Ti	**Pb**	**Tw**	**Td**	**RH**	**N**	**P1 kW**	**α**	**P2 kW**	**TI**	**F.C.**	**β**	**C.F.C**	**S.F.C**
8:30	98.80	300	308	70	3000	1.1	0.943	1.04	236	633.05	1.0090	627.40	604.85
9:30	98.80	300	308	65	3000	1.1	0.947	1.04	236	633.05	1.0084	627.78	602.86
10:30	98.70	300	308	60	3000	1.1	0.949	1.04	236	633.05	1.0080	628.04	601.52
11:30	98.70	302	308	60	3000	1.1	0.949	1.04	236	633.05	1.0080	628.04	601.52
12:30	99.60	302	309	58	3000	1.1	0.944	1.04	237	630.38	1.0088	624.89	601.58
13:30	99.60	302	309	53	3000	1.1	0.948	1.04	237	630.38	1.0081	625.29	599.51
14:30	99.60	303	309	51	3000	1.1	0.950	1.04	237	630.38	1.0079	625.45	598.68
15:30	99.60	303	310	48	3000	1.1	0.947	1.04	237	630.38	1.0083	625.20	599.99
16:00	99.60	303	310	48	2979	1.21	0.947	1.15	229	652.40	1.0083	647.04	564.50
16:30	99.60	303	310	48	3065	0.825	0.947	0.78	281	531.67	1.0083	527.30	674.72

17:00	99.60	303	310	48	3092	0.550	0.947	0.52	336	444.64	1.0083	440.99	846.42
17:30	99.60	303	310	48	3115	0.275	0.947	0.26	370	403.78	1.0083	400.46	1537.28
18:00	99.60	303	310	48	3133	0.000	0.947	0.00	429	348.25	1.0083	345.39	NA

3.3 NOMENCLATURE of Table 3.1 & 3.2

Symbol	Meaning	Unit
Ti	**Time**	**Hr:Min**
Pb	**Exhaust Pressure**	**Kpa**
Tw	**Wet Bulb Temperature**	**Kelvin**
Td	**Dry Bulb Temperature**	**Kelvin**
Rh	**Relative Humidity**	**%**
N	**RPM**	**RPM**
P1	**Net Power**	**kW**
α	**Correction Factor for power**	**---**
P2	**Corrected Power**	**kW**
TI	**Time for 50 cc Consumption**	**Second**
F.C.	**Fuel Consumption**	**gm/hr**
β	**Correction Factor for fuel consumption**	**---**
C.F.C	**Corrected Specific fuel consumption**	**gm/hr**
S.F.C	**Specific Fuel Consumption**	**gm/kW hr**

3.4 COMPARISION OF BOTH THE RESULTS

1. The readings were taken after applying the correction factor for power as well as correction factor for Specific fuel consumption to negotiate the effect of altitude so theses observations can be accepted anywhere in the world.
2. Both the engines (i.e. Petrol-Kerosene & Petrol-Diesel) found quite stable at full load during the 8 hr performance test.
3. The Average corrected power for petrol kerosene engine at full load is 1.027 while the same for the Petrol Diesel engine is 1.04 so average corrected power is slightly better for Petrol-Diesel Engine.
4. The Average corrected fuel consumption for petrol kerosene engine is 609.22 gm/hr while the same for the Petrol Diesel engine is 626.51 gm/hr so the fuel consumption is slightly higher for petrol diesel engine for the full load.
5. For Partial load (75%, 50% and 25%) the specific fuel consumption of Petrol Kerosene engine are 738.35, 1026.87 & 1862.06 while the same for the Petrol Diesel Engine are 674.72, 846.42 & 1537.28 so for the partial load operations Petrol Diesel engine gives less fuel consumption as compare to petrol Kerosene engine.

3.5 OVERALL COMPARISION

Sr No	Parameter	Petrol-Diesel	Petrol-Kerosene
1	**Fuel**	Pure Fuel	Chances of adult red kerosene
2	**Smoke**	Black Smoke in running condition	Clear Smoke in running condition
3	**Starting Trouble**	No Starting trouble	More starting trouble
4	**Fuel Consumption**	Almost same SFC	Almost same SFC
5	**Availability of Fuel**	Easy availability	Scarce Availability
6	**Torque Transmission**	High Torque Transmission	Low Torque Transmission
7	**Noise**	Better Sound	Bitter Sound
8	**Compression Ratio**	Same	Same

3.6 CONCLUSION

After taking the reading and comprehensive comparison we came to conclusion that by the modification made in Spark Plug, Carburetor and

cylinder head we can achieve the performance of Petrol Diesel Engine very similar to Petrol Kerosene engine without making much changes in compression ratio or other dimensions of parts. As the availability of diesel is much more as compare to kerosene engine and the pollution is less than petrol kerosene engine the Petrol Start Diesel run engine is very good alternative of petrol start Kerosene Run Engine

4. 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