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APPENDICES

Appendix A Specifications of Diesel Generator

Table A1 Engine Technical specifications in SI units

Generator	Model	DG3LE
	Generator Type	Single phase AC generator
	Frequency (Hz)	60
	Rated power (Kw)	2.8
	Cont.power (kW)	2.6
	Voltage (AC) (V)	120/240
	Current (DC) (A)	8.3
	Speed (rpm)	3600
	Power factor (cosφ)	1
	Phase type	Single phase
	Insulation	B
	Engine model	ETQ170FG
Type	Single-cylinder, vertical, 4 stoke, air-cooled, direct injection	
Output	Continuous (kw) 2.98	
	Maximum (kw) 3.36	
Bore x Stoke (mm)	70 x 55	
Displacment (cc)	219	
Cooling system	Force air cooling by flywheel fan	
Lubricating system	Pressure splash, duplex type lubrication	
Lube-oil capacity	0.75	
Starting system	Recoil manual start / Electric start (optional)	
Fuel tank capacity (L)	15	
Dry weight	53	
Dimensions (LxWxH) (mm)	690x470x555	

Appendix B Fuel Properties Testing Results

Table B1 Fuel Properties Results of Diesohol Emulsion (Diesel-Ethanol-Ethyl Acetate Blends)

No.	Ratio			Fuel Properties					
	%D	% EA	%Et	Density (g/cm ³)	Cetane Index	Flash Point (°C)	Pour Point (°C)	Energy content (MJ/kg) *	Viscosity @40°C (cSt)
1	90	0	10	0.8268	45.7	14.5	3	43.5	1.880
2	90	5	5	0.8339	44.7	12.5	3	43.5	1.825
3	90	10	0	0.8394	43.1	10.0	3	42.4	1.712
4	85	0	15	0.8247	45.8	13.0	3	42.6	1.812
5	85	5	10	0.8329	43.8	11.0	3	42.5	1.739
6	85	10	5	0.8378	42.8	9.0	3	41.6	1.590
7	85	15	0	0.8429	41.1	8.0	3	41.1	1.532
8	80	5	15	0.8309	43.1	9.5	3	41.7	1.639
9	80	10	10	0.8356	41.8	8.5	0	41.0	1.522
10	80	15	5	0.8406	39.9	7.5	3	40.4	1.413
11	0	100	0	0.9057	-	-5	-84	23.1	-
12	100	0	0	0.8354	47.6	69	1	45.0	2.273
13	0	0	100	0.7955	-	13	-117.3	27.0	-

Note: D = Diesel, EA = Ethyl Acetate, Et = Ethanol (purity 99.5%)

Appendix C Engine Testing Results and Fuel consumption Rates

Table C1 Emission Results and Fuel Consumption Rate of Diesohol Emulsion
(Diesel-Ethanol-Ethyl Acetate Blends)

No	Ratio			% Load	Emissions			Fuel Consumption (lit/hr)
	%D	%EA	%Et		CO (%vol)	HC (ppm vol)	NOx (ppm vol)	
1	100	0	0	100	1.75	146	169	1.09
				60	0.04	10	292	0.85
				30	0.04	11	247	0.67
				0	0.08	21	226	0.47
2	90	5	5	100	1.04	55	463	0.98
				60	0.06	34	413	0.86
				30	0.08	40	224	0.75
				0	0.13	42	168	0.50
3	90	0	10	100	0.88	42	515	1.20
				60	0.14	34	350	0.81
				30	0.12	35	255	0.78
				0	0.11	45	98	0.44
4	90	10	0	100	0.7	37	539	1.19
				60	0.05	16	484	0.94
				30	0.06	11	303	0.69
				0	0.08	19	160	0.49
5	85	0	15	100	0.92	69	538	1.03
				60	0.05	40	454	0.78
				30	0.09	56	260	0.54
				0	0.12	88	132	0.48
6	85	5	10	100	0.51	38	443	1.24
				60	0.04	32	344	0.92
				30	0.08	56	262	0.68
				0	0.1	70	132	0.50

Table C1 Emission Results and Fuel Consumption Rate of Diesohol Emulsion
(Diesel-Ethanol-Ethyl Acetate Blends) (continue)

No	Ratio			% Load	Emissions			Fuel Consumption (lit/hr)
	%D	%EA	%Et		CO (%vol)	HC (ppm vol)	NOx (ppm vol)	
7	85	10	5	100	0.97	50	452	1.17
				60	0.06	27	385	0.94
				30	0.1	43	199	0.72
				0	0.15	122	132	0.58
8	85	15	0	100	1.13	49	490	1.23
				60	0.05	18	453	0.89
				30	0.06	19	300	0.75
				0	0.07	28	152	0.60
9	80	5	15	100	0.66	51	502	1.11
				60	0.06	38	386	0.87
				30	0.09	54	197	0.77
				0	0.17	199	135	0.52
10	80	10	10	100	0.78	54	479	1.38
				60	0.08	38	327	0.95
				30	0.13	65	285	0.83
				0	0.08	73	145	0.58
11	80	15	5	100	0.81	49	317	1.44
				60	0.14	42	278	0.97
				30	0.12	58	207	0.88
				0	0.09	91	120	0.61

Appendix D Specification for Diesel Fuel

Table D1 Thailand Diesel Products Specification

Type/Specification	Limits	Type of Diesel Fuel		Test Method
		HSD	LSD	
1. Specific Gravity at 15.6/15.6°C	min	0.81	-	ASTM D1298
	max	0.87	0.92	
2. Cetane number or Calculated Cetane Index	min	47	45	ASTM D613
3. Viscosity (cSt) 3.1 at 40°C 3.2 at 50°C	min	1.8	-	ASTM D445
	max	-	8	
	min	-	-	
	max	4.1	6	
4. Pour Point (°C)	max	10	16	ASTM D97
5. Sulphur Content (%wt)	max	0.035	1.5	ASTM D 2622
6. Copper Strip Corrosion (number)	max	no.1		ASTM D 130
7. Carbon Residue (%wt)	max	0.05		ASTM D 189
8. Water and Sediment (%vol)	max	0.05	0.3	ASTM D 2709
9. Ash (%wt)	max	0.01	0.02	ASTM D 482
10. Flash Point (°C)	min	52	52	ASTM D93
11. Distillation 90% Recovered (°C)	max	357		ASTM D86
12. Colour	min	-	4.5	ASTM D1500
	max	4	7.5	
13. Lubricity by HFRR (um)	max	460		CEC F-06-A-96

(Taken from the Department of Alternative Energy Development and Efficiency Ministry of Energy, 2003)

Appendix E Physical and Chemical Properties of Commercial Ethyl Acetate

Table E1 Physical and Chemical Properties of Commercial Ethyl Acetate

Name	Ethyl Acetate
Synonyms	Acetic acid ethyl ester; Acetic ether; Acetoxyethane; Ethyl Acetic Ester; Ethyl ethanoate
Chemical Formula	CH ₃ COOC ₂ H ₅
Class	ester
Molecular Weight	88
Specific Gravity	0.902@20°C
Viscosity (cP)	0.426@25°C
Flash Point	(-4°C)
Boiling Point	77°C
Melting Point	(-84°C)
Vapor Density (Air=1)	3
Vapor Pressure (mmHg)	76 @20°C
Evaporation Rate (BuAc=1)	6
Autoignition temperature	485°C
Appearance	Clear liquid
Odor	Fruity odor
Solubility	1 ml/10ml water @25°C

(Taken from Material Safety Data Sheet of J.T. Baker Company)

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