	Service Bulletin (revised)	Ref No.: CS-2018-052_EN
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		Editor : Jaekoo Doh

Subject	BIODIESEL FUEL BD20 for DOOSAN ENGINE		
Model	Engines for Construction Equipment only		
Applied Date	September 13, 2018	Region	Asia

1. BIODIESEL INFORMATION

Biodiesel is an oxygenated fuel made from renewable resources such as soybeans or rapeseeds. Biodiesel used in the fuel blend must meet the standards set by the American Society of Testing Materials (ASTM) D6751 or European Standard (EN) 14214. The biodiesel BD20, when intended to be used, must comply with both EN590/ASTM D975 grade 2 and EN14214/ ASTM D6751.

2. ALLOWED FUEL

2.1 Diesel fuel must comply with EN590/ASTM D975 grade 2.

2.2 Biodiesel fuel must comply with EN14214/ASTM D6751.

* Refer to Specification data sheet in Appendix A.1, A.2

3. IMPACT AND PRECAUTION WHEN USING BIODIESEL

Biodiesel affects equipment performance and its components. It can degrade the fuel system components of the engine and equipment. When operating the applicable Doosan engine with biodiesel BD20, the customer should comply with Doosan's special requirements specified hereafter.

3.1 GENEARL CAUTION AND DISADVANTAGE

1) Depending on biodiesel contents of the fuel, engine power and fuel economy could be decreased.
2) Biodiesel reduces water separator efficiency.
3) Biodiesel increases the flow restriction of fuel line.
4) Biodiesel can cause corrosion and deposit formation due to its higher acidity.

3.2 IMPACT OF BIODIESEL ON MATERIAL

1) Aluminum, Brass, Bronze, Copper and Zinc can accelerate the oxidation of biodiesel.
2) Biodiesel damages and finally seeps through certain seals, gaskets, hoses, glues and plastics.

3) Certain natural rubbers, nitride and butyl rubbers will become inflexible, brittle and degraded when used with biodiesel.

4. SPECIAL REQUIREMENTS

4.1 The original service interval (per the operation manual) for the followings should be halved:

1) Replacement interval of fuel filter and the water separator.
2) Replacement interval of Oil filter and Engine Oil.

4.2 Replace the fuel line if leakage or vulcanized rubber are existed.

4.3 Clean or replace the fuel injector if engine power deration or abnormal smoke are observed.

4.4 If the equipment has not been used for a period of 4 weeks or longer, Biodiesel fuel must be completely drained from the engine. Then, flush the fuel system on the equipment with pure diesel by driving the engine at least 1 hour.

4.5 Doosan strongly recommends using biodiesel in ambient temperature above 0 °C. The high viscosity at low temperature will increase the risk of fuel injection system failures and filter blockage.

4.6 Biodiesel must be used at least within 3 months from delivery date from fuel suppliers.

4.7 Sediments and water in fuel tank must be removed periodically.

5. ENGINE WARRANTY

Doosan engine warranty covers failures that are a result of defects in material or factory workmanship. Failures caused by poor quality fuel of any type, including biodiesel case, cannot be compensated under its warranty.

6. PROHIBITION OF BD20 USAGE

Unless otherwise specified, it is prohibited to use BD20 for the engines applied into emergency (stand-by) and stationary applications (emergency power generation and emergency fire pump drivers) which could be harmed by BD20 usage, due to the engine hardly ever running and the fuel going deteriorated.

Property	ASTM D975 2GRADE		ASTM D6751	
Flash point, min	No 2D 52°C	D93	93°C	D93
Water & sediment, max	0.05% vol	D2709	0.050% vol	D2709
Distillation temperature (% vol recovered)	90%:	D86	90%: 360°C max	D1160
	2D 282-338°C			
Kinematic viscosity (at 40°C)	2D 1.9-4.1 mm^2/s	D445	1.9-6.0 mm^2/s	D445
Ester content	5% vol. max	EN 14078		
Ash, max	0.01% wt	D482		
Sulfated Ash, max			0.020% mass	D874
Sulfur, max (by mass)	2D	D5453 D2622 D129[2]	Two grades:	D5453
	S15 15 mg/kg		S15 15 ppm	
	S500 0.05%		S500 0.05%	
	S5000 0.50%			
Copper strip corrosion, max	No 3	D130	No 3	D130
Cetane number, min	40	D613	47	D613
- cetane index	40 min	D976-80		
- aromaticity	35% vol max	D1319		
Operability, one of:	Report	D2500 D4539 D6371		
- cloud point				
- LTFT/CFPP				
Cloud point			Report	D2500
Carbon residue on 10% distillation residue, max		D524	0.050% wt[5]	D4530
	2D: 0.35% wt			
Acid number, max			0.50 mg KOH/g	D664
Oxidation stability, max			3 hrs min	EN 14112
Alcohol control			0.2% wt methanol max, or	EN14110
			130°C flash point min	D93
Monoglycerides, diglycerides & triglycerides,				D6584
Group I metals (Na + K), max			5 mg/kg	EN 14538
Group II metals (Ca + Mg), max			5 mg/kg	EN 14538
Free glycerin, max			0.020% wt	D6584
Total glycerin, max			0.240% wt	D6584
Phosphorous, max			0.001% wt	D4951
Lubricity (at 60°C), max	520 µm	D6079 D7688		
Conductivity, min	25 pS/m	D2624 D4308		
Cold soak filtration time (CSFT), max			360 s[4]	D7501

Property	EN 590:2013		EN 14214:2012	
Flash point, min	55°C	EN 2719	101°C	EN ISO 2719
Water, max	200 mg/kg	EN ISO 12937	500 mg/kg	EN ISO 12937
Total contamination, max	24 mg/kg	EN 12662	24 mg/kg	EN 12662
Distillation temperature (% vol recovered)	65%: 250°C 85%: 350°C	EN ISO 3405		
Kinematic viscosity (at 40°C)	2.0-4.5 mm^2/s	EN ISO 3104	3.5-5.0 mm^2/s	EN ISO 3104
Density(at 15°C)	820-845 kg/m^3	EN ISO 3675 EN ISO 12185	860-900 kg/m^3	EN ISO 3675 EN ISO 12185
Ester content	7% vol. max FAME	EN 14078	96.5% min	EN 14103
Ash, max	0.01% wt	EN ISO 6245		
Sulfated Ash, max			0.02% mass	ISO 3987
Sulfur, max (by mass)	10 	EN ISO 20846 EN ISO 20884 EN ISO 13032	10.0 mg/kg	EN ISO 20846 EN ISO 20884 EN ISO 13032
Copper strip corrosion, max	class 1	EN ISO 2160	class 1	EN ISO 2160
Cetane number, min	51	EN ISO 5165	51	EN ISO 5165
Cetane index, min	46	EN ISO 4264		
- cetane index				
- aromaticity				
PAH, max	11% wt	EN 12916		
Cloud point	Location & season dependant	EN 23015	Location & season dependant	EN 23015
CFPP	Location & season dependant	EN 116	Location & season dependant	EN 116
Carbon residue on 10% distillation residue, max	0.30% wt	EN ISO 10370		
Acid number, max			0.50 mg KOH/g	EN 14104
Oxidation stability, max	25 g/m^3	EN ISO 12205	8 hrs min	EN 14112
Iodine value, max			120[1] g Iod/100g	EN 14111 EN 16300
Linolenic acid methyl ester, max			12.0% wt	EN 14103
Polyunstatured methyl esters, max			1.00% wt	EN 15779
Alcohol control			0.20% wt methanol max	EN 14110
Monoglycerides, diglycerides & triglycerides, max			MG 0.70% wt DG 0.20% wt TG 0.20% wt	EN 14105
Group I metals (Na + K), max			5.0 mg/kg	EN 14108 EN 14109 EN 14538
Group II metals (Ca + Mg), max			5.0 mg/kg	EN 14538
Free glycerin, max			0.02% wt	EN 14105 EN 14106
Total glycerin, max			0.25% wt	EN 14105
Phosphorous, max			4.0 mg/kg	EN 14107 prEN 16294
Lubricity (at 60°C), max	460 µm	ISO 12156-1		