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Information Sheet # 45

Fuel Maintenance for Diesel Generator Sets

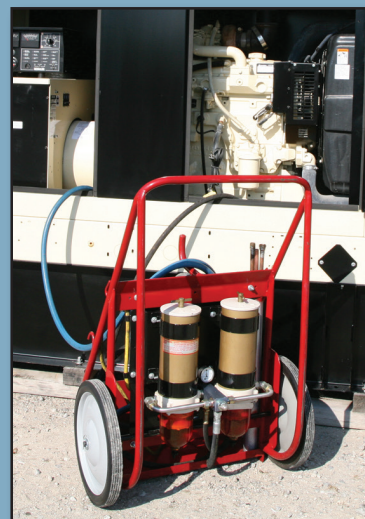
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Many generator systems use diesel engines as the prime mover. Stored diesel fuel is susceptible to many forms of contamination and if left untreated will substantially degrade. Maintaining and testing a generator's diesel fuel storage is crucial, especially on standby generator systems where the fuel may remain unused for long periods.

This information sheet discusses the benefits of a fuel maintenance being incorporated into Planned Maintenance programs.

Chart for 50 gallon "Top Off" frequency				
Average Fuel Consumption (Gallons Consumed)				
kW Size	1 Month	3 Months	6 Months	12 Months
Exercising weekly with no load for 15-mins				
0 - 15	0.2	0.6	1.2	2.4
16 - 30	0.6	1.8	3.6	7.2
31 - 50	0.9	2.7	5.4	10.8
51 - 100	1.8	5.4	10.8	21.6
101 - 175	2.6	7.8	15.6	31.2
176 - 300	5.1	15.3	30.6	61.2
301 - 500	8.0	24.0	48.0	96.0
501 - 750	11.7	35.1	70.2	140.4
751 - 900	13.7	41.1	82.2	164.4
901 - 1250	18.4	55.2	110.4	220.8
1251 - 1500	28.3	84.9	169.8	339.6
1501 - 2000	31.1	93.3	186.6	373.2
2001 - 2250	39.9	119.6	239.1	478.2
2251 - 2500	46.7	140.0	280.0	560.0
2501 - 2800	50.4	151.2	302.4	604.7
2801 - 3000	56.1	168.4	336.8	673.5
3001 - 3250	59.0	177.1	354.1	708.2
Exercising weekly no load for 15-mins & monthly for 30-mins @ 50% load				
0 - 15	0.7	2.1	4.2	8.4
16 - 30	1.4	4.2	8.4	16.9
31 - 50	2.3	6.9	13.7	27.4
51 - 100	3.9	11.6	23.2	46.4
101 - 175	6.0	17.9	35.9	71.7
176 - 300	9.8	29.3	58.6	117.1
301 - 500	15.9	47.7	95.5	191.0
501 - 750	23.7	71.0	141.9	283.8
751 - 900	27.9	83.6	167.2	334.5
901 - 1250	38.4	115.3	230.5	461.1
1251 - 1500	50.1	150.3	300.7	601.4
1501 - 2000	60.5	181.5	362.9	725.9
2001 - 2250	77.4	232.3	464.6	929.2
2251 - 2500	90.7	272.0	544.1	1088.1
2501 - 2800	97.9	293.7	587.5	1175.0
2801 - 3000	109.1	327.2	654.4	1308.7
3001 - 3250	114.7	344.0	688.1	1376.2
Note the following regarding the above chart numbers:				
Note 1.	The above figures are averages. Refer to generator's spec. sheet			
Note 2.	Red-shaded areas indicate 50-gals service top-off keeps tank full			

Chart for 50 gallon "Top Off" frequency				
Average Fuel Consumption (Gallons Consumed)				
kW Size	1 Month	3 Months	6 Months	12 Months
Exercising @ 50% of load weekly for 15-mins				
0 - 15	0.8	2.4	4.8	9.6
16 - 30	1.6	4.8	9.6	19.2
31 - 50	2.6	7.8	15.6	31.2
51 - 100	4.4	13.2	26.4	52.8
101 - 175	6.8	20.4	40.8	81.6
176 - 300	11.1	33.3	66.6	133.2
301 - 500	18.1	54.3	108.5	217.2
501 - 750	26.9	80.7	161.4	322.8
751 - 900	31.7	95.1	190.2	380.4
901 - 1250	43.7	131.1	262.2	524.4
1251 - 1500	57.0	171.0	342.0	684.0
1501 - 2000	68.8	206.4	412.8	825.6
2001 - 2250	88.1	264.2	528.5	1056.9
2251 - 2500	103.1	309.4	618.8	1237.6
2501 - 2800	111.4	334.1	668.2	1336.4
2801 - 3000	124.0	372.1	744.3	1488.5
3001 - 3250	130.4	391.3	782.6	1565.2



Photo

Shown is the filtration unit used to remove water and other contaminants from a generator's sub-base fuel tank.

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The installation information provided in this information sheet is informational in nature only and should not be considered the advice of a properly licensed and qualified electrician or used in place of a detailed review of the applicable National Electric Codes, NFPA 99/110 and local codes. Specific questions about how this information may affect any particular situation should be addressed to a licensed and qualified engineer and/or electrician.



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The following are the principal reasons diesel fuel becomes degraded:

Water contamination - Water builds up from condensation on the interior walls and top of the fuel tank. This occurs almost everyday when the outdoor temperature increases faster than the fuel and tank can increase. Water collects at the bottom of the tank and if ingested by the engine can harm the fuel pump due to lack of lubrication. It can also blow off an injector tip on a running engine resulting in significant engine damage. Water separators in the fuel line between the tank and engine will reduce the risk of water ingested to the engine.

A primary accelerant for growth of microorganisms such as bacteria and fungi in the fuel tank is water buildup.

Microbial organisms - Microbes are always present in diesel fuel. Too many of them will prematurely clog filters, which will not be evident until the engine must pull full load.

Gelling - Diesel fuel freezes at a much higher temperature than most other fuels. Standard diesel can freeze at any temperature below 32°F which will lead to gelling and clog fuel pipe lines.

Degradation - Diesel fuel has a limited shelf life and starts to degrade after six months. This degradation can render fuel useless after 2 years. Degradation can affect flash and cloud points, distillation, and impair engine performance by altering the fuel's cetane level.

Maintenance required to reduce or eliminate degraded fuel:

The generator set distributor supporting a generator set installation through a planned maintenance (PM) program will usually offer fuel maintenance services as part of their overall PM program.

There are four fuel services available to ensure diesel fuel allows the engine to run as required:

1. *Fifty Gallon Fuel Top Off - prevent condensation and reduce water in the system.*
2. *Fuel Sampling - verify the fuel is stable enough to run the engine at full load.*
3. *Fuel Treatment - the use of additives will correct and prevent buildup of contaminants.*
4. *Fuel Filtering - a method used to remove water and other contaminants.*

Fifty Gallon Fuel Top Off - Topping off the fuel reduces or eliminates sidewall surfaces where condensation can form. Filling the tank to capacity as part of a regular PM program will require fewer visits by fuel vendors.

Fuel Sampling - The PM provider checks fuel samples to see if water in the system has accelerated the growth of microorganisms such as bacteria and fungi that degrades the fuel's cetane level.

Fuel Treatment - To ensure full performance, it is important to treat fuel with the right products to correct any contaminant problems. New fuel added to the system should also be treated to prevent recontamination.

There are a variety of diesel additives that work as follows: *(The generator distributor will know the best brands)*

Diesel fuel supplements - Used to boost cetane and as an anti-gel. Supplements also increase the lubrication of older engine fuel systems using the new low-sulfur diesel fuel required by the EPA.

1. *Fuel life additives - These additives stabilize fuel and disperse contaminants.*
2. *Anti-micro additives - They fight the growth of microbial organisms in standing fuel systems.*
3. *Shock treatment - This is a treatment given to fuel that has been contaminated, but can be restored.*

Fuel Maintenance for a Diesel Generator Set:

Fuel Filtering - When an excessive amount of water is found in the fuel tank system, it must be removed. Draining the fuel is typically not an option on a fuel tank. Pumping the water out of the system is the best option.

Using a filtering system (see photo) will filter contaminants off the bottom of the tank as well as remove water.

With this method, it is not necessary to waste the entire fuel supply. The fuel is separated, filtered and returned to the tank.

After a major filtering of the fuel to remove water and contaminants, shock treatment of the fuel is usually recommended. The use of additives for shock treatment will boost the cetane rating, reduce the microbial contaminants, protect against gelling and return the diesel fuel to full performance grade.

Initial cleaning and fuel treating will significantly improve the quality of the fuel. Proper fuel maintenance and follow up testing will prevent the problems from reoccurring.

Treatment for Other Diesel Fuels:

Low sulfur diesel - Many older style engines relied on the sulfur in the diesel to lubricate injection equipment. Starting Jan 01, 2007 to meet Federal requirements to reduce exhaust emissions refiners started to ship Ultra Low Sulfur Diesel (ULSD) that has less than 15 ppm sulfur content. Additives should be added to the fuel to ensure older engine fuel systems are adequately lubricated.

Bio diesel - While more earth friendly than fossil fuels bio diesel is more likely to gel if not circulated, and is more prone to mold growth in hotter climates. To prevent gelling and the growth of mold the fuel should be tested and treated with the appropriate additive during a PM installation visit.