

# **PFI Standards Program**

## **Densified Fuels Testing - 101**

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# PFI Standard Specifications

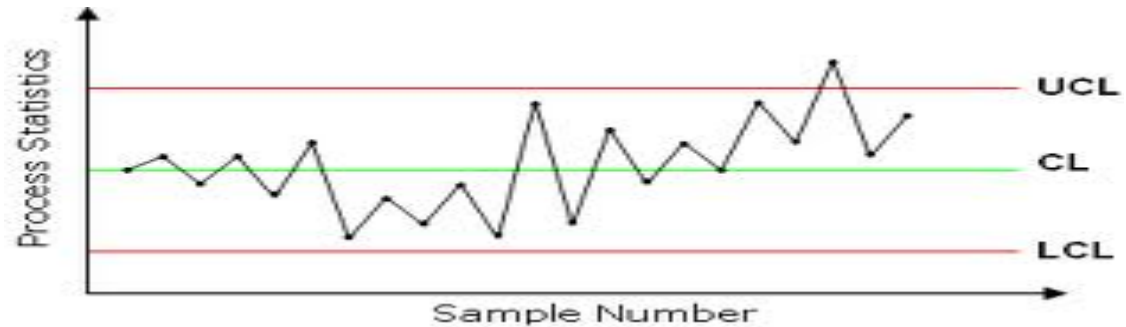
- Grade criteria and test methods are clearly defined
- Accredited labs test for all normative parameters on audit samples
- Several test procedures are easily performed at the production facility
- Alternative testing procedures are allowed at the production facility

Fuel Property	Residential/Commercial Densified Fuel Standards		
	See Notes 1 - 3		
	PFI Premium	PFI Standard	PFI Utility
<b>Normative Information - Mandatory</b>			
Bulk Density, lb./cubic foot	40.0 - 46.0	38.0 - 46.0	38.0 - 46.0
Diameter, inches	0.230 - 0.285	0.230 - 0.285	0.230 - 0.285
Diameter, mm	5.84 - 7.25	5.84 - 7.25	5.84 - 7.25
Pellet Durability Index	≥ 96.5	≥ 95.0	≥ 95.0
Fines, % (at the mill gate)	≤ 0.50	≤ 1.0	≤ 1.0
Inorganic Ash, %	≤ 1.0	≤ 2.0	≤ 6.0
Length, % greater than 1.50 inches	≤ 1.0	≤ 1.0	≤ 1.0
Moisture, %	≤ 8.0	≤ 10.0	≤ 10.0
Chloride, ppm	≤ 300	≤ 300	≤ 300
Heating Value	NA	NA	NA
<b>Informative Only - Not Mandatory</b>			
Ash Fusion	NA	NA	NA

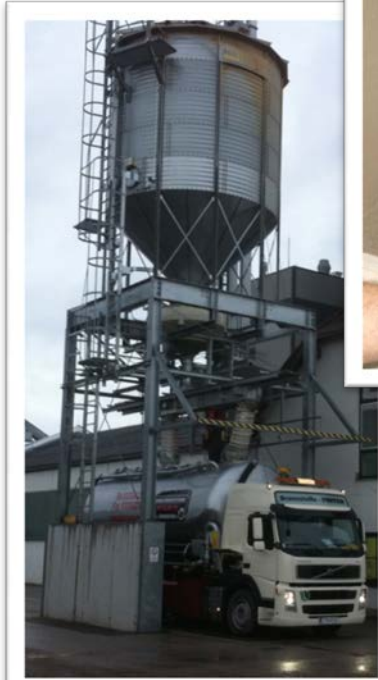


# Components of Testing

- Sample Collection
- Sample Preparation
- Calibration & Verification
- Conducting the Test
- Data Management



# Sample Collection



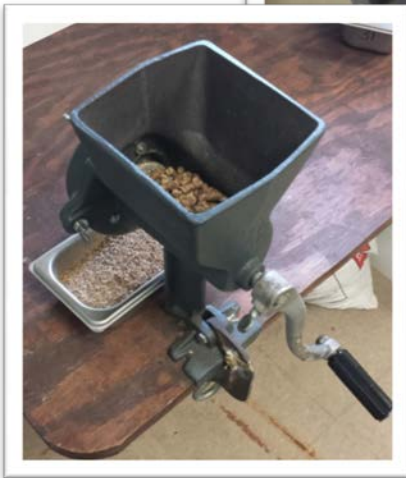
- Determine the appropriate location from which to collect the sample
- Determine the correct means by which to collect the sample
- Be sure to collect enough sample to run the necessary tests
- Be sure to treat the sample in a manner that will preserve the original quality of the material.



# Sample Preparation



- Use appropriate means to reduce the sample in volume and particle size to conduct the various tests (minimizes bias)
- Pay close attention to minimum sample sizes
- Be sure to treat the prepared sample in a manner that will preserve the original quality of the material
- Annex B.1 provides guidance



# Calibration & Verification

- Be sure to calibrate all measuring devices
- Check calibrations regularly with a verification standard
- Check the level on all balances regularly
- Don't forget about the bulk density containers



# Bulk Density

- PFI Standard Specifications Section 8.1.1
- Modified ASTM E873
- Container size is 0.25 cubic feet
- Sample size is approx. 12 pounds
- Fill height is 2 feet
- Compaction is 25 taps from 1 inch
- Strike off



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# Fines

- PFI Standard Specifications Section 8.1.4
- Minimum sample size is 2.5 pounds, larger samples may be used
- Maximum sieve loading of 1 pound per 100 inches of sieve surface
- Tilt screen side to side 10 times
- Screen in increments
- Alternative test procedure in Annex C.1

# Length & Diameter

- PFI Standard Specifications Sections 8.1.2 & 8.1.7
- Minimum sample size – 2.5 lbs
- Can be conducted in conjunction with the fines test
- Diameter – measure 5 random pellets
- Length – weight % of all pellets over 1.5 inches



# Durability

- PFI Standard Specifications Annex A.1
- Can be conducted in conjunction with the fines test
- Requires 1,100 grams of material (close to 2.5 lbs)
- 500 gram +/- 10 gram sub-samples
- Rotate at 50 +/- 2 rotations per minute for 500 rotations
- Be sure to use the correct tumbler.



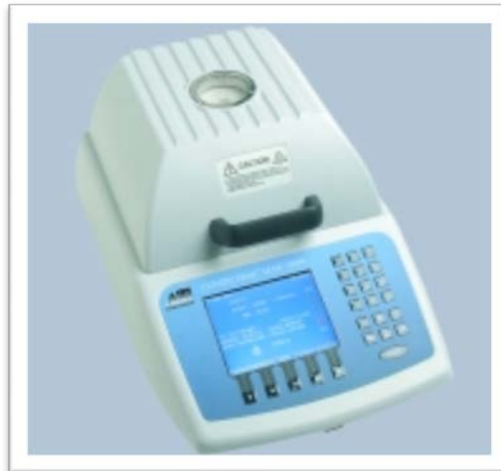
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# Moisture



- ASTM E-871 (oven method)
- Alternate test methods - moisture balance or direct read technology
- Consider sample preparation requirements
- Compare alternative test procedures with the referee method to assure accuracy

# Ash



- Referee Method ASTM D1102 (furnace method)
- Be sure to closely adhere to the furnace temperature and sample preparation requirements
- Be careful with moisture absorption and temperature differences when weighing
- Compare test results with an accredited lab
- Alternative test procedure AZI Computrac MAX 5000
- Compare alternative test procedures with the referee method to assure accuracy

# Testing by Accredited Labs



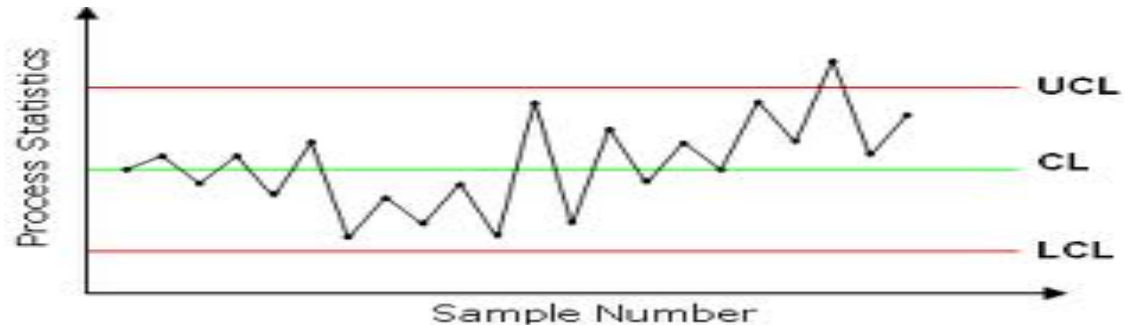
- Testing of audit samples is for all normative parameters
- Fines compliance is determined by the production facility
- Accredited labs are not allowed to use alternate test procedures
- Parameters tested by accredited labs that are not commonly tested at the production facility include:
  - Calorific Value
  - Chlorine
  - Ash Fusion Temperatures (informative)



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# Data Management

- Track and trend data
- Verify accuracy with an accredited testing lab



Sample Date	Weight % <1.5 inches	Total Moisture (%)	Ash (%)	Durability Index	Fines <1/8 inch (%)	Diameter (mm)
7/11/2014	0.00	6.73	0.46	99.3	0.1	0.254
7/15/2014	0.00	5.86	0.56	98.9	0.21	0.256
7/22/2014	0.12	6.86	0.47	99.1	0.12	0.251
7/30/2014	0.11	6.34	0.49	98.7	0.24	0.255
8/8/2014	0.00	6.35	0.55	98.5	0.13	0.256
8/8/2014	0.00	6.85	0.56	98.4	0.16	0.258
8/15/2014	0.25	6.33	0.48	98.7	0.11	0.251
8/19/2014	0.00	5.60	0.54	98.3	0.22	0.249



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# *Thank You*

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