United States Department of Agriculture
Agricultural Marketing Service
Federal Grain Inspection Service

Directive 9180.84 May 1, 2019

NATIONAL FALLING NUMBER QUALITY ASSURANCE PROGRAM

Contents

Distribution: FGIS, OSP, Industry Originating Office: TSD, ACB

1. PURPOSE

This directive establishes the policies and procedures for operation of the Federal Grain Inspection Service (FGIS) National Falling Number Quality Assurance Program (NFQAP).

2. POLICY

All official service providers of falling number testing will follow this directive. The effective date of this directive is May 1, 2019.

3. REPLACEMENT HIGHLIGHTS

This directive supersedes FGIS Program Directive 9180.84, Falling Number National Quality Assurance Program, dated April 23, 2014. The following, significant changes were made:

- Adobe Acrobat is required to open and view the attachments for this directive.
- Updated the format to be consistent with FGIS Administrative Directive 3010.2;
- Changed the monitoring sample submission rate to at least one sample per instrument per week regardless of whether the instrument was used for an official inspection that week;
- Required validation of new instruments or those that have undergone significant repair prior to use;
- Corrected the percentage associated with the confidence range for the action limits to 99.7 percent;
- Corrected the number of results expected outside the action limits to one out of 333;
- Changed shipping procedure so that Technology and Science Division (TSD) is charged for all shipping of inspection monitoring samples; Federal offices no longer use their own funding code or UPS account code;
- Changed contact for inquiries to the Falling Number Program, Analytical Chemistry Branch;
- Updated attachment 1, Sample Submission Form.

4. BACKGROUND

The falling number (FN) method is an indirect measurement of the amount of alpha-amylase activity in wheat. High alpha-amylase activity is associated with the natural germination process that results in the breakdown of starch and ultimately in sprouting of the wheat kernel. High alpha-amylase activity adversely affects the end-use quality of wheat, and as a result, assessment of this factor is important in the domestic and international trade of wheat.

The FN result is the time in seconds required for the instrument to mix the sample with a plunger, release the plunger, and allow it to fall through the hot aqueous mixture. A high FN indicates a high viscosity of the mixture and low alpha-amylase activity. A low FN indicates a low viscosity of the mixture and high alpha-amylase activity.

FN is the most widely accepted method of evaluating alpha-amylase activity and has been standardized by American Association of Cereal Chemists International (AACCI 56-81.03), International Association for Cereal Science and Technology (ICC 107/1), and International Organization for Standardization (ISO 3093-2009).

FGIS, along with the official agencies it supervises, provides approximately 40,000 FN inspections each year following FGIS Program Directive 9180.38.

In 2014, FGIS established a national quality assurance program for official FN testing to provide information on measurement uncertainty and improve the quality of official FN testing. The program is administered by TSD and consists of several components, including proficiency testing, inspection monitoring, training, and instrument validation. The components of this program act synergistically to promote consistently accurate official FN testing services to the wheat industry.

5. PROCEDURES

a. Check Sample Program

There will be two annual check sample distributions to evaluate all instruments used for official FN inspections. TSD will send blind samples (both ground and unground) with a cover letter giving specific instructions to follow for testing the samples and reporting the results. A summary report will be provided to each service point following each distribution.

b. **Inspection Monitoring Program**

Submit at least one sample per instrument per week regardless of whether the instrument was used for an official inspection that week. Complete a sample submission form for each sample (attachment 1).

NOTE: Backup or seasonal instruments must complete the validation process (section 5.c of this directive) prior to reinstatement for official falling number determinations.

NOTE: Report actual FN results even if results are above 400 seconds.

The work week is Sunday through Saturday. For the week ending on Saturday, the samples should be mailed to TSD on the following Monday, but no later than Wednesday. For samples to be run by FN service points will need to collect an additional 650-gram quantity of wheat before the removal of dockage.

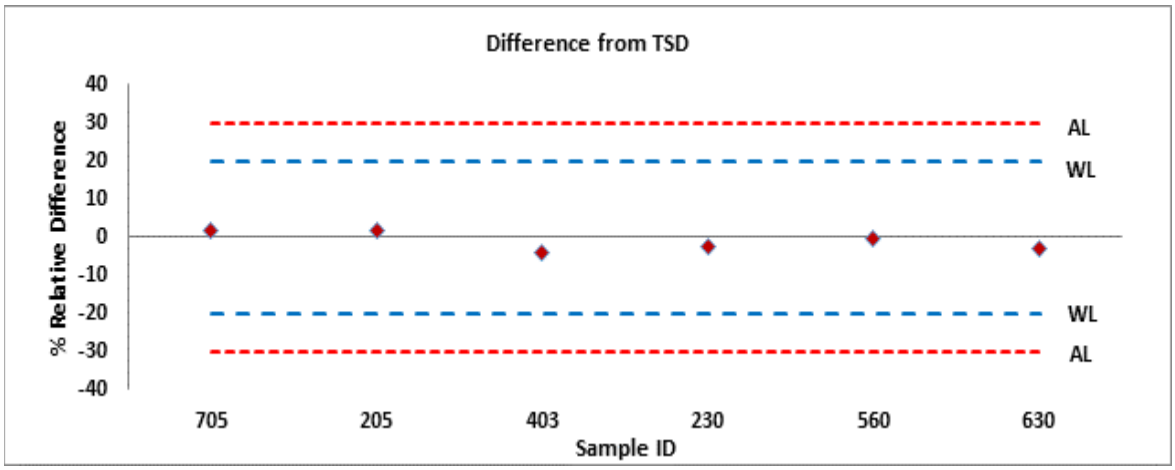
Service points should submit at least 650 grams (before the removal of dockage), seal the sample in a 6-mil plastic bag, and mark the sample number on each bag using an indelible marker. All field offices and official agencies should ship samples using UPS 2nd Day Air service and charge shipping costs to TSD. Please contact TSD to obtain the UPS account code.

Mail samples to:

Falling Number Program
USDA FGIS NGC
Technology and Science Division
10383 N. Ambassador Drive
Kansas City, MO 64153-1394

The results will be communicated to each service point using the following example spreadsheet and chart.

	All State Grain Inspection Falling Number Instrument Model 1700 Serial Number 1234567						
	Date		TSD	All State			%
Sample ID	Inspected	TSD Analysis	FN	FN	Difference	Relative Difference	Relative Difference
2662	8/02/2013	8/05/2013	335	340	5	0.015	1.493
2994	8/09/2013	8/14/2013	335	341	6	0.018	1.791
3488	8/16/2013	8/21/2013	375	360	-15	-0.040	-4.000
670	8/23/2013	8/26/2013	401	390	-11	-0.027	-2.743
1897	8/30/2013	9/02/2013	433	430	-3	-0.007	-0.693
3353	9/06/2013	9/08/2013	429	416	-13	-0.030	-3.030



- The blue lines represent the 95 percent confidence range and serve as the warning limits (WL). Service points should examine the result with current and historical results to determine if this result can be accepted. No more than 1 out of every 20 samples should be observed outside the warning limits, but inside the action limits.
- The red lines represent the 99.7 percent confidence range and serve as the action limits (AL). Service points should examine the result with current and historical results to determine if this result can be accepted. No more than 1 out of every

333 samples should be observed outside of the action limits. Corrective action should be taken when results are outside these limits.

- Each service point is responsible for taking the appropriate corrective action when FN readings are outside of these limits.

c. **Validation of New or Repaired Instruments**

New instruments or instruments that have undergone significant repair must be validated prior to use for official FN certification.

Contact TSD to arrange for reference material to be sent for testing.

TSD will send 150 grams of reference material with a mean FN of 250–350 seconds to the lab's point of contact.

Perform six FN tests and report the results to TSD using attachment 2. The worksheet automatically corrects for barometric pressure, reports on an "as-is" moisture basis, and compares the measured value to the reference value.

To be considered validated for official use, the mean of the six tests must be within 7.00 percent of the reference value and the relative standard deviation of no more than 3.00 percent.

NOTE: It is recommended that the operator practice with their own sample prior to attempting the validation using the reference material.

6. TROUBLESHOOTING

Refer to attachment 4 of FGIS Program Directive 9180.38 for aid in troubleshooting of FN results.

7. INQUIRIES

Direct inquiries regarding this directive to the Falling Number Program, Analytical Chemistry Branch at 816-891-0401 or FGISFallingNumber@usda.gov.

8. ATTACHMENTS

Open the attachment navigation pane on the left of the display. Double click on an attachment to open it. The attachments can be saved locally for use.

Attachment 1: Sample Submission Form

Attachment 2: Instrument Validation Worksheet