



Canadian Grain
Commission

Commission canadienne
des grains

Protein and Oil Determination using the FOSS Grain Analyzer

Standard operating procedure

AC04.521.v7

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1. Purpose

This document has been developed to ensure consistent and accurate operation, maintenance, and results of FOSS grain analyzers to determine protein and oil content throughout the Canadian Grain Commission. The FOSS grain analyzers use near infrared technology by transmittance mode and are calibrated for protein based on the Grain Research Laboratory's ISO 17025-accredited Combustion Nitrogen Analysis method.

2. Abbreviations

- 2.1 CNA – Combustion Nitrogen Analysis
- 2.2 CWRS – Canada Western Red Spring
- 2.3 GRL – Grain Research Laboratory
- 2.4 ISO – International Organization for Standardization
- 2.5 QSO – Quality System Occurrence
- 2.6 m.b. – Moisture basis
- 2.7 OSCAR – Online Shipping Certification and Reporting

3. Health and safety

- 3.1 The Canadian Grain Commission's health and safety program complies with the *Canada Labour Code Part II* and the Canada Occupational Health and Safety Regulations. Contact the Manager, Health and Safety, for further details.
- 3.2 Refer to applicable equipment and instrument operating manuals for manufacturer recommended safety precautions.
- 3.3 Review applicable Safety Data Sheet (SDS) information for chemicals prior to use.
- 3.4 Review applicable Job Safety Analysis (JSA) procedures before testing.
- 3.5 Wear appropriate personal protective equipment (PPE).

4. Responsibilities

- 4.1 The GRL Protein Technician (or delegate) is responsible for training staff and overseeing operations.
- 4.2 Technicians are responsible for processing samples submitted to the laboratory.
- 4.3 Inspectors are responsible for processing samples pertaining to inspection and submitted sample activities.

5. Equipment and materials

Instrumentation

- 5.1 FOSS grain analyzer
- 5.2 Analytical balance
- 5.3 Carter dockage tester

Equipment

- 5.4 Boerner divider
- 5.5 Brush
- 5.6 Canned air or equivalent

Software

- 5.7 Microsoft Excel
- 5.8 The appropriate application:
 - 5.8.1 Harvest Survey app
 - 5.8.2 OSCAR app
 - 5.8.3 SOS app

Reference materials

- 5.9 Daily CWRS ABC check samples
 - 5.9.1 Note: At initial distribution, these samples will be provided as blind (that is, without the protein percentage identified) for use in the Canadian Grain Commission's proficiency testing program. Upon completion of the proficiency testing, the protein percentages will be clearly labelled on the sample containers for

routine daily use. Refer to the **Canadian Grain Commission proficiency testing** section of this procedure for further details.

5.10 Daily Soybean ABC(D) check samples

5.11 Calibration sets

5.12 Moisture check sample

6. Required training

6.1 Laboratory staff must read and acknowledge this procedure in SoftExpert Suite (SES) and complete applicable sections of AC06.1344 before work commences.

6.2 Non-laboratory staff, such as inspection staff, are encouraged to complete AC06.1344 before commencing work. However, the requirement to complete training is at the discretion of managers/supervisors.

7. Procedure

Verifying grain analyzer performance using check samples

7.1 Turn the FOSS grain analyzer on and allow it to perform a start-up test. The main window will appear on the screen when the start-up test is complete, and the FOSS grain analyzer is ready to use.

7.1.1 If possible, the FOSS grain analyzers with the touchscreen (TM model) are to remain on at all times.

7.1.2 Older models of the FOSS grain analyzer should be turned off at the end of the day to prolong the life of the lamp. Older models only take about 10 minutes to warm up.

7.1.3 7.1.3 If either instrument model fails to start up correctly, contact the appropriate support personnel, including the regional laboratories, the GRL Protein Technician, or the Regional Inspection Manager. If the issue remains unresolved, initiate a QSO report in accordance with procedure AC04.127.

7.2 Ensure the catchment drawer is empty.

7.3 Click the application model button and select the appropriate commodity or grain from the list, based on the check sample, to be run through the analyzer.

- 7.3.1 All wheat protein results on the FOSS grain analyzer are expressed on a 13.5% moisture basis (m.b.). Soybean protein, soybean oil and barley protein on the FOSS grain analyzer are expressed on a dry moisture basis (0% m.b.).
- 7.3.2 Run one commodity at a time. Appropriate daily check samples are **required to be** run for each commodity tested on that day.
- 7.3.3 Run the daily CWRS ABC checks before analyzing wheat, barley and oat samples. If the checks are within tolerance, all wheat, barley and oat application models are ready to use for the day.
- 7.3.4 Run the daily soybean ABC(D) checks before analyzing soybean samples. If the checks are within tolerance, all soybean (protein and oil) application models are ready to use for the day.
- 7.3.5 If testing barley samples only, run the barley calibration set before analyzing barley samples. If the checks are within tolerance, all barley application models are ready to use for the day.
- 7.3.6 One check sample must also be analyzed in duplicate and pass tolerances each day for each commodity. The difference of replicates must be within $\pm 0.2\%$ protein for wheat, $\pm 0.3\%$ protein for barley, $\pm 0.5\%$ oil for soybeans and $\pm 1.0\%$ protein for soybeans.
- 7.4 Pour the required sample into the hopper, double check that the correct application model is selected and press the **Analyze** key to begin the test.
- 7.5 The results will appear on the screen once the analysis is completed.
- 7.6 Record the check results (protein only for CWRS, protein and oil for soybeans, protein only for barley) and duplicate the test in AC06.1345 Daily FOSS Grain Analyzer Check and Cleaning Log.

Analyzing samples on the grain analyzer

- 7.7 Ensure samples are commercially cleaned prior to testing. Refer to the Official Grain Grading Guide.
- 7.8 Ensure the catchment drawer of the FOSS grain analyzer is empty.
- 7.9 Click the application model button and select the appropriate grain or commodity (application model) from the list based on the sample to be run through the analyzer.
- 7.10 Pour the sample into the hopper, double check that the correct application model is selected, and press the **Analyze** key to begin the test.

7.10.1 If a sample is less than 500g, the instrument will prompt for additional sample, at which time the sample from the catchment drawer can be used to complete the test by returning to the hopper.

7.11 The protein, moisture (if applicable) and oil (if applicable) results will appear on the screen after the analysis has been completed.

7.12 Enter the results into the appropriate application such as the Harvest Survey app, SOS app, or OSCAR app.

7.13 Unless otherwise instructed, single tests are performed. Repeat testing is only required when error messages are displayed on the grain analyzer screen.

7.13.1 The instrument needs to be cleaned and the checks required to be used again to verify the instrument performance, in accordance to steps 10.4 and 10.7.

Running calibration sets

7.14 When locations receive their annual calibration sets, ensure the grain analyzer is cleaned and analyze in duplicate on each grain analyzer. Refer to the Analyzing samples on the grain analyzer section of this procedure.

7.15 Record the calibration results on form AC06.1347 CGC Annual Grain Analyzer Calibration Results saved on the ischecktests shared drive and advise a GRL Protein Technician.

7.16 A designated GRL Protein Technician will review the calibration data. If a grain analyzer requires adjustment, a GRL Protein Technician will guide staff to make an intercept adjustment. After the intercept is adjusted, there will be a request to rerun the calibration set. If a rerun is requested, record the results on form AC06.1347 CGC Annual Grain Analyzer Calibration Results saved on the ischecktests shared drive.

7.17 Proceed with the use of the grain analyzer only once the grain analyzer has been approved for use by a designated GRL Protein Technician.

Running moisture verification

7.18 When locations receive their moisture check sample, follow procedure AC04.608 Moisture Check Samples.

Canadian Grain Commission proficiency testing

7.19 At the beginning of each year, CWRS samples will be sent to each Canadian Grain Commission location that is responsible for analyzing samples using FOSS grain

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analyzers. These samples will be labelled A,B,C but will not contain any protein identifying information.

7.20 Using the CWRs application model, analyze each of the samples three times, on each in-use instrument and report the results on form AC06.1359 Canadian Grain Commission Proficiency Test - Protein Sample Results. Send the completed form to protein-proteines@grainscanada.gc.ca.

7.20.1 When possible, have a different employee analyze the proficiency samples on different instruments. For example, have employee A analyze the samples on instrument A and employee B analyze the samples on instrument B.

7.20.2 Ensure that the bag number of each sample is recorded on form AC06.1359 Canadian Grain Commission Proficiency Test - Protein Sample Results.

7.21 Once the results have been received by the protein lab and compared against the reference values for each sample, labels displaying the reference values will be provided for use throughout the remainder of the year. Any concerns or discrepancies identified during the review will be communicated accordingly.

7.22 In August of the same year, a single blind CWRs sample will be distributed to each location. This sample must be analyzed according to the procedure outlined in section 7.20. Once the proficiency test has been completed and the results have been reviewed and accepted by the protein lab, the sample may be discarded.

8. Quality control

8.1 Proceed with protein testing of wheat, rye, barley and oat samples on the grain analyzer only if the following criteria are met:

8.1.1 The annual calibration set has passed and approval has been received from a designated GRL Protein Technician to use the instrument.

8.1.2 The monthly moisture check sample verification has passed. Refer to AC04.608 Moisture Check Samples. Refer to the GRL moisture lab for more information.

8.1.3 The results of the daily CWRs ABC check samples are within $\pm 0.2\%$ of the target average protein value.

8.1.4 The sample that was analyzed in duplicate must be within the applicable tolerance for its commodity.

8.2 Proceed with protein and oil testing of soybean samples on the grain analyzer only if the following criteria are met:

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- 8.2.1 The annual calibration set has passed and approval has been received from a designated GRL Protein Technician to use the instrument.
- 8.2.2 The results of the daily soybean ABC(D) check samples are within $\pm 0.5\%$ of the average target oil and $\pm 1.0\%$ of the average target protein value.
- 8.2.3 The sample that was analyzed in duplicate must be within the applicable tolerance for its commodity.
- 8.3** Proceed with protein testing of barley samples on the grain analyzer only if the following criteria are met:
 - 8.3.1 The annual calibration set has passed and approval has been received from a designated GRL Protein Technician to use the instrument.
 - 8.3.2 The results of the barley calibration set are within $\pm 0.3\%$ of the average target protein value or the results of the daily CWRS ABC check samples are within $\pm 0.2\%$ of the target average protein value.
 - 8.3.3 The sample that was analyzed in duplicate must be within the applicable tolerance for its commodity.
- 8.4** If any of the criteria in sections 8.1 to 8.3 are not met:
 - 8.4.1 Do not proceed with testing.
 - 8.4.2 Do not release the result.
 - 8.4.3 Contact the regional labs, the GRL Protein Technician, or regional inspection manager and initiate a QSO report following AC04.127 if necessary.

9. Reporting results

- 9.1** Record check sample results and duplicate results in form AC06.1345 Daily FOSS Grain Analyzer Check and Cleaning Log.
- 9.2** Record blind CWRS ABCs in form AC06.1359 Canadian Grain Commission Proficiency Test - Protein Sample Results.
- 9.3** Report results as a percentage (%) to one decimal place.
- 9.4** Enter official test results into either the Harvest Survey app, SOS app or OSCAR app.
- 9.5** Data must be verified after transfer to an electronic database.
- 9.6** Test results must be reviewed and authorized prior to release to customers.
- 9.7** IS Grain Inspectors or Laboratory Technicians can review and authorize test results.

10. Equipment maintenance

Routine cleaning

10.1 FOSS grain analyzers require regular cleaning to prevent excessive dust build-up.

Grain analyzers must be cleaned:

10.1.1 At least once a month. It is recommended to clean the grain analyzers once a week during periods of high-volume testing.

10.1.2 After infested samples.

10.1.3 When the instrument displays outlier errors or fails check samples.

10.2 To clean the grain analyzer, press the **Flush** button on the FOSS grain analyzer 1241 screen or the Instrument Care button the newer models and follow the step-by-step instructions on the instrument's screen. Use a brush and canned air to assist in cleaning. Refer to the manufacturer manual and/or AC04.523 Setup and Maintenance of FOSS Grain Analyzers for additional information on the grain analyzer cleaning procedure.

10.3 Record the date of cleaning in the AC06.1345 Daily FOSS Grain Analyzer Check and Cleaning Log on the ischecktests shared drive.

Troubleshooting, maintenance and repairs

10.4 When the grain analyzer displays a sample error on its screen:

10.4.1 Clean the instrument.

10.4.2 Perform a retest of the sample.

10.4.3 If the issue persists, consult the manufacturer manual, troubleshoot with a GRL Protein Technician, regional laboratory staff, and/or Regional Inspection Manager and initiate a QSO report following AC04.127 if necessary.

10.4.4 Refer to procedure AC04.523 Setup and Maintenance of FOSS Grain Analyzers and follow all applicable setup and maintenance procedures for further guidance on troubleshooting errors.

10.5 Repairs of the grain analyzers will be performed as needed by a designated GRL Protein Technician following AC04.523 Setup and Maintenance of FOSS Grain Analyzers.

10.6 Replace lamp and piston components as needed. An error message indicating that the lamp current is too low will appear when the lamp requires replacement.

10.6.1 On touchscreen models, the lightning bolt icon in the bottom left corner will turn red. Tap the lightning bolt icon to display the list of active errors.

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10.6.2 Follow the manufacturer manual and/or procedure AC04.523 Setup and Maintenance of FOSS Grain Analyzers.

10.7 Applicable checks must be analyzed after any instrument error displays, maintenance performed, repairs completed, instrument power cycling or intercept adjustment before resuming analysis of samples.

11. References

11.1 Official Grain Grading Guide

11.2 AC04.127 Quality System Occurrence

11.3 AC04.512 Operation of the Boerner-type Divider

11.4 AC04.523 Setup and Maintenance of FOSS Grain Analyzers

11.5 AC04.608 Moisture Check Samples

11.6 AC06.1344 FOSS Grain Analyzer Training Form

11.7 AC06.1345 Daily FOSS Grain Analyzer Check and Cleaning Log

11.8 AC06.1347 CGC Annual Grain Analyzer Calibration Results

11.9 AC06.1359 CGC Proficiency Test - Protein Sample Results