



Australian Government
**National Measurement
Institute**



NITP 15.1

National Instrument Test Procedures for
Measuring Instruments for Grain Quality

Protein measuring instruments

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NITP V 10

First edition — December 2005
Second edition — December 2007

NITP 15.1

First edition — December 2011
First edition, first revision — January 2014

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AMENDMENTS

Item no.	Date	Page	Location	Details of change
1	01/2014		all	Minor editorial changes and elimination of redundancy (e.g. terminology in other documents).
2	01/2014	2, 4	Clause 3.1 and test report	Added field for “Calibration names” which applies where an instrument has more than one calibration for wheat and/or barley.
3	01/2014	2	Clause 4	Shelf life and usage conditions to be defined in ACRM certificate instead of NITP. Added recommendation to address persistent bias (mean error) observed during tests.
4	01/2014	3	Clause 5	Daily testing only required when bias zeroing adjustment will be or has been applied. Removed ‘three times’ in point 3. If adjustment is not confirmed, a few more attempts are permitted before the procedure in clause 4 is required.

PREFACE

NMI’s Chief Metrologist has determined that NITP 15.1 contains the test procedure for the verification of instruments which measure the protein content of grain.

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EXPLANATION OF TERMS

For explanations of terms see [General Information for Test Procedures](#). For other terms relating to grain protein measuring instruments, refer to [NMI M 8](#).

ABBREVIATIONS

ACRM	Australian Certified Reference Material
MPE	maximum permissible error
%	percentage by weight

1. SCOPE

NITP 15.1 describes the test procedures for the verification and in-service inspection of protein measuring instruments to assess they measure within the maximum permissible errors (MPEs) specified in the *National Trade Measurement Regulations 2009* (Cth) and that they comply with their Certificate of Approval.

Certificates of Approval are based on *NMI M 8. Pattern Approval Specifications for Protein Measuring Instruments*. Refer to [NMI M 8](#) for all metrological and technical requirements.

Protein measuring instruments may be whole grain instruments or ground grain instruments. For ground grain instruments the grinder is considered to be part of the instrument under test and must be identified.

Some protein measuring instruments are linked, either electronically or manually, to a quality system database containing the results from a certified measuring instrument and/or an Australian Certified Reference Material (ACRM) and/or the reference method. This allows the performance of the protein measuring instrument to be monitored. An adequate data set accumulated through daily monitoring is a prerequisite for performing 'bias zeroing adjustments' described in clause 5.

All instruments must also comply with the *National Measurement Act 1960* (Cth), the *National Measurement Regulations 1999* (Cth) and the *National Trade Measurement Regulations 2009* (Cth).

2. EQUIPMENT

1. Certificate of Approval.
2. A test report (see Appendix A) and where instruments are electronically networked or manually linked, access to a quality system database.

Note: Inspectors shall have access to view the contents of the database, and the presentation of test results therein shall be logical and unambiguous.

3. A set of whole grain Australian Certified Reference Materials (ACRMs) with current Regulation 48 certificates

The set shall contain three to five different wholegrain ACRMs that cover the spread of protein concentrations that reflect the operating range of the instrument/s under test, e.g. 9%, 10.5%, 12% protein concentration (see clause 4).

3. VISUAL INSPECTION

Visually inspect the protein measuring instrument and determine if:

- all the required data; and
- the applicable characteristics of the instrument are correctly marked.

Where required, record details on the test report (Appendix A).

3.1 Required Data

1. Test report reference number.
2. Date of test.
3. Type of test: verification or in-service inspection (ensure that the verification mark is in place for in-service inspection or reverification).
4. Verifier's name.
5. Name of owner/user.
6. Address of owner/user.
7. Name of contact person on premises.

8. Address of instrument location.
9. Description of instrument.
10. Manufacturer.
11. Model.
12. Serial number.
13. Certificate of Approval number.
14. Grain type (wheat and/or barley).
15. Name of protein calibrations (if more than one is available for wheat or barley).
16. Operating range (% protein).
17. Identification of grinder type if applicable (make, model).

3.2 Characteristics of the Instrument

The protein measuring instrument and its use shall comply with the following clauses:

1. The instrument shall comply with its Certificate of Approval.
2. The instrument shall be used in an appropriate manner.
3. All mandatory descriptive markings shall be clearly and permanently marked on the data plate.
4. The data plate shall be fixed on the instrument.
5. The instrument shall be complete.
6. The instrument shall be clean.
7. The instrument shall be operational.
8. The operation of the instrument shall be free of any apparent obstructions.
9. Where applicable, the instrument shall be mounted on a firm and level base.
10. The operator shall have a clear and unobstructed view of the indicating device.
11. Where applicable, the instrument shall be adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance.
12. Where applicable, additional indicating devices exactly repeat the information on the primary indication and any device for ticket/label printing comply with the requirements of General Supplementary Certificate of Approval [S1/0/A](#) or [S1/0/B](#).

4. TEST PROCEDURE

The following test procedure determines if the performance of a protein measuring instrument meets requirements and whether the instrument requires adjustment or service.

The test procedure shall be carried out on all instruments used for trade:

- pre-harvest or annually; and
- after any repair, adjustment or change that affects metrological performance (in which case you must remember to obliterate any existing mark and apply a new mark).

If instruments that are networked electronically or linked manually are to be corrected via bias zeroing adjustments, the affected instruments shall also be tested according to clause 5.

The ACRMs selected shall:

- be comprised of the same type of grain as that being measured by the instrument;

- be accompanied by a Regulations 48 certificate indicating that the reference material has a defined shelf life and usage conditions; one certificate could cover a batch or a days production;
- be stored and transported in a rigid, moisture-proof, sealed container away from direct sunlight and direct heat radiation; and
- be sealed immediately after use.

The test procedure shall be carried out for each grain type measured by the instrument.

Note: All protein calibrations for wheat and barley that can be accessed by the user shall be tested.

The size of the grain sample used to test ground grain protein measuring instruments shall be not less than 100 g. Unused grist can be stored as described above for a period of 14 days for use in the same instrument.

Protein results shall be expressed on an 11% moisture basis for wheat and 0% for barley.

1. Complete the warm-up cycle ensuring the instrument under test cannot be operated until this cycle is completed.
2. Record the identification and the assigned protein concentration of each whole grain ACRM in the set used to test the instrument.
3. Ensure the grain path, sample test cell and collection tray are free of any contaminants including any previous grain sample.
4. Analyse the protein concentration of **one** ACRM in the set **three** times.

Note: Ground grain samples shall be repacked using a different portion of the grist or a separate portion of ground grain for each repeat.

5. Confirm that the result of each ACRM analysis is equal to the certified value or any difference is within the MPE shown in Table 1.

Table 1. MPEs for verification and in-service inspection

Grain	MPE
Barley	±0.5%
Wheat	±0.4%

6. Record results on a test report, or if the instrument is electronically networked or manually linked, enter the results into the quality system database.
7. Repeat steps 3 to 6 using each of the remaining ACRM from the set.
8. The instrument owner should be advised if the tests over a couple of years indicate that there is a systematic error (i.e. average bias greater than zero). This condition should be investigated and rectified where possible. Repeat steps 1 to 7 as required.
9. Carry out anything else you need to do to complete the procedure. See [General Information for Test Procedures](#) and the Certificate of Approval for more information. This may include:
 - obliterating verification marks from the instrument;
 - applying a verification mark; and
 - stamping the instrument.

5. BIAS ZEROING ADJUSTMENTS

As described below, instruments that are corrected via bias zeroing adjustments shall be tested on a daily basis.

The results from several consecutive days of monitoring shall be taken into account in the decision to correct an instrument and to review the effectiveness of an applied adjustment.

The bias is calculated as the average error observed over the ACRMs used to monitor the instrument.

1. Complete steps 1 to 7 in clause 4.
2. Initiate any bias adjustment required — bias adjustments are only permitted towards zero.
3. Confirm the adjustment by analysing the protein concentration of **all** ACRMs in the set.
4. Enter all results into the database/ test report.
5. The bias zeroing adjustment is confirmed if **all** results are within half of the MPE shown in Table 1. Steps 2 to 4 shall be repeated if it is not confirmed. However if after a few attempts, the bias zeroing adjustment is still **not** confirmed, the instrument shall be adjusted and verified again (see clause 4 for the verification procedure).

APPENDIX A. TEST REPORT

Appendix A contains a test report on which to record the results.

Although the format of the test report may vary according to the individual needs and requirements of trade measurement inspectors and servicing licensees, the following test report contains the minimum amount of information that must be recorded.

Note: This test report does not accommodate for additional data required for instruments corrected via bias zeroing adjustments (see clause 5).

In the case of electronically networked or manually linked instruments, the quality system database becomes the test report.

If the Certificate of Approval requires additional tests, attach pages that record the results of these tests.

Number each page of the test report in the style shown at the top of each of the following pages.

Test Report for Grain Protein Measuring Instrument

Test report reference number Date of test

Type of test (tick one) Verification In-service inspection

For in-service inspection or reverification, record the verification mark:.....

Name of owner/user

Name of owner/user

Address of owner/user

Name of contact person on premises

Address of instrument location

Description of instrument

Approved operating range (% protein)

Manufacturer Model

Serial number Certificate of Approval number

Grain type (wheat and/or barley)

Calibration names (if more than one for a grain type)

Identification of grinder (make, model) if applicable

General Characteristics (clause 3.2)	Yes, no or N/A
Does the instrument comply with its Certificate of Approval?	
Is the instrument being used in an appropriate manner?	
Are all mandatory descriptive markings clearly and permanently marked on the data plate?	
Is the data plate fixed on the instrument?	
Is the instrument complete?	
Is the instrument clean?	
Is the instrument operational?	
Is the operation of the instrument free of any apparent obstructions?	
If applicable, is the instrument mounted on a firm and level base?	
Does the operator have a clear and unobstructed view of the indicating device?	
If applicable, is the instrument adequately protected against abnormal dust, air movement, vibrations, atmospheric conditions and any other influence likely to affect its performance?	
If applicable, do the additional indicating devices exactly repeat the information on the primary indication and any device for ticket/label printing comply with the requirements of General Supplementary Certificate of Approval S1/0/A or S1/0/B?	

Test results (copy additional pages if required)

Grain type or Calibration ID (if applicable)

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

Overall result **Pass** **Fail**

Grain type or Calibration ID (if applicable)

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

ACRM sample ID: Protein content (%):

Instrument results (%)			
Difference (ACRM and instrument)			

Overall result **Pass** **Fail**

Details of the Whole Grain Australian Certified Reference Materials (clause 2)

Grain type	ACRM ID	Reg. 48 certificate number	Certificate expiry date

Comments

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Verifier's name Identification number

Signature