

CHAPTER 2

NIRT EQUIPMENT

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CHAPTER 2

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2.1 OFFICIAL EQUIPMENT

Table 1, Approved Models

	Models 1225, 1226, 1227, and 1229	Models 1225, 1226, 1227, and 1229 with IRIS software	Model 1241
<b>Wheat (ANN<sup>1</sup>)</b> Protein Wet gluten	no	✓	✓
	no	✓	✓
<b>Barley (ANN)</b> Protein	no	✓	✓
<b>Soybeans (PLS<sup>2</sup>)</b> Protein Oil	✓	✓	✓
	✓	✓	✓
<b>Corn (PLS)</b> Protein Oil Starch	✓	✓	✓
	✓	✓	✓
	✓	✓	✓

- a. Foss Infratec Grain Analyzer Model 1241 and older Infratec models equipped with IRIS operating software are approved for official wheat protein and wet gluten; and barley protein determinations.
- b. Foss Infratec Grain Analyzer Models 1225, 1226, 1227, 1229 and 1241 are approved for official soybean protein and oil; and corn protein, oil, and starch determinations.

<sup>1</sup> Artificial Neural Network calibration.

<sup>2</sup> Partial Least Squares calibration

## 2.2 CALIBRATION

- a. All approved models require official calibrations to be loaded into the instrument prior to use. Use the following FGIS approved calibrations for official NIRT instruments. TSD is responsible for maintaining and updating calibrations for official NIRT instruments.
- b. TSD has worked with Foss to prepare an official calibration diskette that contains all of the application models needed to test wheat protein and barley protein. TSD has also developed application models for wet gluten, soybean, and corn constituents.

Table 2, Approved Calibrations

	Disk name	Application model	Where to get the disk
Wheat and Barley Protein	"Small Grain F". This item is maintained in Foss's inventory as Part Number 10014260.	Wheat Protein application model WH050101  Barley Protein application model BA050101	FOSS
Wheat Wet Gluten, HRW/HRS	USDA GIPSA NIRT WET GLUTEN (WH050150)  Requires purchase of Foss Part# 10014260	Application model WH050150	TSD
Soybeans	GIPSA NIRT Calibration Version: Sept. 1, 2001	Application model SB081401	TSD
Corn	GIPSA NIRT Calibration Version: Sept. 1, 2001	Application model CN081401	TSD

1. Wheat and barley calibrations: Infratec Application Disk "Small Grain F", Part Number 10014260 includes an all class wheat protein application model, as well as an individual-class application models which use the wheat prediction model WBPR0028. A separate disk is required for each NIRT instrument. The disk will contain 10 application models named: "Wheat"; "Durum"; "Hard White Wheat"; "Hard Red Spring Wheat"; "Hard Red Winter Wheat"; "Soft Red Winter Wheat"; "Soft White Wheat"; "Barley"; "Six-rowed Barley"; and "Two-rowed Barley".
2. For wet gluten, contact TSD to obtain the approved calibration disk.

3. For soybean protein and oil, and corn protein, oil and starch calibrations, contact TSD to obtain the approved calibration disk, standard slope settings, and reference sample sets. TSD provides one soybean/corn disk for each NIRT instrument. This disk will contain FGIS approved soybean and corn calibrations and the current operating system software. TSD will provide calibration disks with both official calibrations unless otherwise requested.
- c. Instruments are issued the standard slope settings for each grain type they test. Analyze the appropriate Standard Reference Samples (SRS) twice and bias the instruments using the Level II tolerances before the instrument is used for official testing. Replacing the sample cell will require that the pathlength be measured and the SRS tested to check the bias before official testing can resume. Operators must use the standard slope settings, SRS sets, and baseline values provided by TSD.
- Note: Infratec Models 1229 and 1241 that are equipped with the variable (adjustable) sample cell do not need to standardize the pathlength. They will use the software assigned pathlength of 18.00 millimeters for wheat and/or 30.00 millimeters for corn and soybeans.**
- d. TSD will maintain a master list of all NIRT instruments in the official system and their approved calibration information. Upon request, TSD will forward a list of all instruments and their approved calibration information to the appropriate FGIS field office or official agency.
  - e. FGIS field office and official agency managers shall verify the following:
    - (1) The calibration name is identical to that currently specified by TSD;
    - (2) The calibration disk is the current version approved by TSD;
    - (3) Slope values agree with TSD records; and
    - (4) NIRT instruments are configured by FGIS calibration to give readings corrected to the appropriate moisture basis:

Table 3, Displayed Moisture Basis

Constituent	Moisture Basis
Wheat protein	12.0 percent
Wheat wet gluten	14.0 percent
Barley protein	dry matter
Soybean protein and oil	13.0 percent
Corn protein, oil, and starch	dry matter

### 2.3 NIRT LOCATION AND ENVIRONMENT

Equipment location and environmental factors can affect the performance of NIRT equipment.

- a. Location of Equipment. NIRT instruments must be placed in a location conducive to a dust-free and stable environment. If the NIRT instrument is not located in its own room, all dust-emitting devices located in the same room must be operated with a functional dust collection system. The NIRT instruments must be protected from drafts, heating and cooling vents, and windows. Also, a vibration-free table is recommended to support the NIRT instrument.
- b. Environmental Requirements. The space and facilities required to perform official NIRT determinations must meet the specifications outlined below:
  - (1) Temperature affects the stability of NIRT instruments. Each testing site shall install a thermometer near the NIRT instrument(s). **The temperature of the room where official testing occurs must be maintained between 60° and 80°F (16° and 27°C).** Official testing shall be suspended if the room temperature is outside the acceptable range. Once the temperature is restored to the acceptable range, check instrument accuracy using the SRS set and, if necessary, bias adjust the instrument.
 

If the room temperature changes by  $\pm 5^{\circ}\text{F}$  ( $2.5^{\circ}\text{C}$ ) or more from the temperature recorded during the daily instrument check, retest the SRS and, if necessary, bias the instrument.
  - (2) Relative Humidity (RH) must be kept between 20 and 75 percent. Each testing site shall install a hygrometer (calibrated to  $\pm 3$  percent RH) near the NIRT instrument(s). When the laboratory's RH is outside of the

acceptable range, retest the SRS and, if necessary, bias adjust the instrument based on LEVEL-I tolerances. Once the laboratory's RH returns to the acceptable range, the SRS need to be retested **only if** a bias adjustment was made while the RH was outside the acceptable range. If necessary, bias adjust the instrument based on the LEVEL-I tolerances. SRS sets collected when the RH is outside of the acceptable range may not be used for the LEVEL-II and higher tolerances. All LEVEL tolerances are listed in section 3.2 for wheat, section 3.3 for barley, section 3.4 for soybeans, and section 3.5 for corn.

FGIS field offices shall periodically check individual testing location(s) hygrometers using a battery powered psychrometer. Before checking the hygrometers, check the psychrometer thermometers when both are dry to determine if they are in agreement. Then check hygrometers against the psychrometer and apply a tolerance of  $\pm 5$  percentage points. Repair or replace hygrometers which deviate from the psychrometer by more than 5 percentage points.

- (3) The power for all NIRT instruments shall be supplied by a 120 + 10 VAC/15-20 amp dedicated circuit. A maximum of two electronic instruments (i.e., NIRT, NMR or Hardness Tester) plus their associated printers and/or computers may be placed on one dedicated circuit. No other equipment shall be used on the circuit. The Tripp-lite line protector supplied with the Infratec 1241 should be used when a dedicated circuit is available.

If a dedicated circuit cannot be provided, a standby uninterruptable power supply (UPS) is an acceptable alternative. The UPS should be rated as shown.

Capacity:	at least 300VA
Runtime:	at least 5 minutes at full load
Switching time:	less than 4 milliseconds

NOTE: if other equipment (e.g., external computer) is used on the UPS, the capacity should be upgraded accordingly.

The UPS should incorporate surge suppression and filtering. The Tripp-lite protector supplied with the Infratec 1241 should not be used in conjunction with a UPS.

A power line conditioner is recommended for use if line voltage variation is a suspected problem. Before purchasing and installing a voltage regulation device, contact the instrument manufacturer to determine which device is best suited for this purpose.

An NIRT instrument may be turned off if it will not be used for at least 8 hours. After turning the instrument on, it must be allowed to warm up at least 15 minutes before testing. Outliers in the "A" or "B" position of the outlier code may be indicated as a result of insufficient warm up.

- (4) Smoke and Dust. Post "**NO SMOKING**" signs in the testing area. Follow good housekeeping practices to maintain a clean and dust-free environment. Use a vacuum cleaner or brush for proper laboratory cleanup. Do not use compressed air for cleanup purposes.

## 2.4 SETUP

Official testing agencies and FGIS field offices must observe certain guidelines when establishing new laboratories, placing new equipment on-line, or relocating NIRT equipment.

### a. Laboratory Setup.

- (1) Official agency managers must notify the appropriate FGIS field office manager concerning plans for a new laboratory and provide a diagram of the proposed design. The diagram should contain the proposed locations of NIRT equipment, location of major inspection equipment, and description of the power supply. Any additional information regarding the laboratory setup or equipment should also be included.
- (2) Upon request, TSD will assist official agencies in planning and preparing laboratories for official NIRT testing. The field office manager should forward a copy of all submitted information to TSD for review. Upon receipt, TSD will advise the official agency and field office manager.

### b. Equipment Setup.

- (1) Official personnel shall notify TSD and the appropriate field office when new NIRT instruments are purchased. TSD will provide the necessary samples and instructions to check the accuracy of the instrument(s). Contact TSD as soon as possible because the checkout process may take several days to complete.

- (2) When an NIRT instrument is moved to a new location, the instrument must be allowed to reach temperature equilibrium with its environment before performing official tests. Generally, the instrument should sit for at least 2 hours before use after being moved. If the instrument might have been subjected to extreme temperatures during shipment, allow the unit to sit overnight in the new location before operating it.

## 2.5 EQUIPMENT MAINTENANCE

### a. General.

- (1) Using a brush or cloth, dust out the sample hopper and path at the end of each day.
- (2) Replacement lamps for the instrument are expensive and, therefore, the lamp life should be extended as long as possible. Turning the lamp on and off frequently decreases its life. Turn the instrument off only if it will not be used for a period of 8 hours or more.

### b. Repair of FGIS-owned NIRT Equipment.

- (1) Repair and service of FGIS-owned instruments are coordinated by FGIS personnel at the FGIS Technical Center in Kansas City, Missouri.
- (2) TSD personnel are assigned to assist field office personnel in:
  - (a) maintaining instruments,
  - (b) performing diagnostic tests needed to verify acceptable performance, and
  - (c) performing modular replacement when required.
- (3) Repair Procedures.
  - (a) If an NIRT instrument malfunctions, the designated field office NIRT coordinator should contact TSD at (816) 891-0446 to report the problem.

- (b) The NIRT coordinator should be prepared to answer all questions regarding the symptoms of the failure (error codes, erroneous readings, malfunctioning display, etc.) and to perform diagnostic tests while maintaining telephone communications with TSD.
- (c) TSD will take one of the following actions:
  - 1 If the NIRT instrument is determined to be field-repairable, TSD will coordinate the shipment of replacement parts (boards, etc.) to the field office.
  - 2 If it is not field-repairable, TSD will recommend return of the instrument to Foss. The field office will be responsible for shipping and repair costs. If possible, a replacement instrument will be furnished to the field office by TSD. A written summary of the malfunction should be sent to TSD.
- c. Repair of Other NIRT Equipment. Official Inspection Agency managers must ensure that only qualified technicians perform repairs on NIRT instruments used for official testing. Operators must notify the field office NIRT coordinator and TSD when instruments malfunction.
- d. NIRT Lamp Replacement.
  - (1) Newer Infratec models 1229 and 1241 are equipped with the “NIRs” monochromator. Replacement lamps for these must be purchased directly from the instrument manufacturer (Foss). The Foss “NIRs” lamp (model number 1000 8310) cost is approximately \$150.
  - (2) Older Infratec models 1225/1226 may be equipped with either a “Bruins” monochromator or a “NIRs” monochromator. To determine the type of lamp check the style, type of connection, and manner the lamp is fastened to the monochromator.
    - (a) The NIRs lamp is a halogen lamp equipped with a reflector around the bulb. It has a 2-pin connector which plugs into the lamp housing. The NIRs lamp is fastened with three (3) screws.
    - (b) The Bruins lamp is hardwired into the lamp housing and is fastened to the monochromator with two (2) screws.

Official agencies operating NIRT instruments equipped with the Bruins monochromator may obtain replacement lamps by

contacting TSD. The defective lamp with lamp holder must be sent to the TSD in order to obtain a replacement lamp. Fees will be assessed based on the hourly rate for repair, plus parts, and handling cost. Under normal circumstances, the total cost will not exceed \$100.00.

- (3) If the replacement lamp does not work upon receipt, or if it does work but the Infratec instrument displays an error code (e.g., Error 56, "No light is reaching the detector") contact TSD immediately.
- e. Equipment Maintenance Log. Record any information pertaining to instrument repairs (e.g., lamp replacement) and other relevant information concerning unusual instrument operation. Information entered into the log is used as a troubleshooting aid for repair personnel and provides the agency with a maintenance history of the instrument.