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Grain Inspection Handbook Book I Sampling

Program Handbook

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Grain Inspection Handbook – Book I Sampling

Foreword

Book I Sampling sets forth the policies and procedures for sampling grain in accordance with the regulations under the United States Grain Standards Act (USGSA), as amended. The information contained in this handbook is applicable to official grain inspection services performed by the Federal Grain Inspection Service (FGIS), delegated State agencies, and designated State and private agencies. Persons interested in obtaining official services may contact any FGIS field office or official agency.

Sampling procedures and equipment may differ when sampling products under the Agricultural Marketing Act (AMA). Refer to the appropriate AMA handbook or instructions when sampling products under the AMA.

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TABLE OF CONTENTS

CHAPTER 1: GENERAL INFORMATION

CHAPTER 2: PROBE/TRIER SAMPLING

CHAPTER 3: SAMPLING WITH A DIVERTER-TYPE SAMPLER

CHAPTER 4: ELLIS CUP AND PELICAN SAMPLING

CHAPTER 5: REVISION HISTORY

APPENDIX 1 - LOCAL QUALITY CONTROL PROCEDURES

**CHAPTER 1
GENERAL INFORMATION**

CONTENTS

1.1	DEFINITIONS.....	1-2
1.2	ABBREVIATIONS.....	1-3
1.3	SAFETY.....	1-4
1.4	REPRESENTATIVE SAMPLE.....	1-10
1.5	DETAILED WORK RECORD	1-12
1.6	ACCESSIBILITY.....	1-14
1.7	SAMPLE INTEGRITY	1-16
1.8	PROPORTIONAL SAMPLING.....	1-17
1.9	UNUSUAL CONDITIONS.....	1-19
	FIGURE 1.1 – PROPORTION SAMPLING	1-18
	TABLE 1.1 – ODOR CLASSIFICATION CHART	1-22

1.1 DEFINITIONS

Carrier. A truck, trailer, truck/trailer combination, railcar, barge, ship, or other container used to transport bulk, sacked, or packaged grain.

Certification. The process of issuing an official certificate which indicates the quality of a lot or sample of grain or the results of some other official service.

Composite Sample. A single sample composed of small portions collected throughout the sampling process of a lot grain.

Lot. An identified amount of grain offered by an applicant for inspection.

Lot Inspection. The process of obtaining a representative sample(s) of an identified lot of grain, inspecting or testing the sample(s), and certifying the results.

Official Personnel. Any authorized Department employee or person licensed by FGIS to perform all or specified functions under the USGSA.

Official Sample. A representative sample drawn by official personnel or personnel authorized by FGIS.

Sampling. The process of obtaining a representative sample from a lot of grain.

Sample Security Box. A locked box in which official personnel store grain samples, supplies, and equipment.

Stowage Examination. The process of visually determining if an identified carrier or container is clean; dry; free of live infestation, rodents, toxic substances, and foreign odor; suitable to store or carry grain; and certifying the results.

Submitted Sample Inspection. The process of inspecting or testing an unofficial sample of grain submitted by an applicant and certifying the sample results.

1.2 ABBREVIATIONS

The following abbreviations may be shown on work records:

ANFL	Animal Filth	GAR	Garlicky
MOTHS	Angoumois Moths	HTG	Heating
BRDX	Bird Excreta	INF	Infested
BNS	Bottom Not Sampled	MUST	Musty
GLAS	Broken Glass	RODX	Rodent Excreta
CBUR	Cockleburs	SOUR	Sour
COFO	Commercially Objectionable Foreign Odor	SR	See Reverse
DLQ	Distinctly Low Quality	SMUT	Smutty
		FSUB	Unknown Foreign Substance

1.3 SAFETY

- a. The safety requirements referenced in this section are mandatory for FGIS employees. Official agency employees are strongly encouraged to follow them as well as all Occupational Safety and Health Administration (OSHA) regulations.
- b. General. Comply with all FGIS safety requirements and the [AMS Safety Handbook](#) as well as all pertinent OSHA requirements (i.e., 29 CFR 1910–1918).
 - (1) Comply with all posted warning signs and wear appropriate protective equipment when conditions warrant (e.g., ear protection when the noise level is high).
 - (2) When practical, carry a communication device and use it in emergency situations (e.g., two-way radio). The communication device must be intrinsically safe for the environment in which it is being used.
 - (3) Before sampling railcars, check to see if a fall assessment is required, in accordance with [FGIS Directive 9170.14](#), “FGIS Rolling Stock Fall Protections.” FGIS employees must complete Fall Hazard Awareness Training in accordance with the directive. The requirements of this directive apply to FGIS employees only. Official Agencies may adopt this policy or use it as a guideline to establish their own policy to comply with local and national safety requirements.
- c. Life Vests. Wear a fastened, Stearns life vest, model IWV-222-1 (if not available, any U.S. Coast Guard-approved Type I, II, III, or V PFD life vests may be worn) when aboard barges or other vessels (midstream or dockside).

Note: Life vests must be international orange in color and contain retro-reflective panels. If used at night, vests must be equipped with a light and whistle.

d. Clothing.

- (1) Wear hard hats in compliance with the American National Standards Institute (ANSI) Z89.1 or Z89.2 criteria.
- (2) Wear shoes or boots that have nonslip soles and definite heels for good footing on ladders.
- (3) Wear clothes that are reasonably close-fitting to reduce the possibility of becoming snagged on moving belts, ladders, or other equipment found in and around elevators and on carriers.
- (4) Wear gloves should when climbing ladders and opening or closing hatches and doors.

Note: FGIS personnel must follow the clothing requirements found in [FGIS Directive 4735.2](#), “Uniform and Identity Apparel and Dress Code Policy.”

e. Gangways and Ladders.

- (1) Check gangways before boarding. Do not use defective gangways.
- (2) Exercise extreme care when using ladders that are permanently affixed to carriers. Such ladders can become bent, broken, twisted, corroded, or have missing rungs. Do not use defective ladders.
- (3) Do not hand carry sampling equipment, radios, or other equipment while climbing ladders.

f. Chemical Treatments. Remain alert to your physical condition, especially when drawing samples inside carriers. Grain is often treated with chemicals, usually for the purpose of controlling insect infestation. Contact with toxic fumes or sprays from these chemicals can cause serious injury or death. Shortness of breath, headache, light-headedness, or drowsiness can be indicative of a dangerous atmosphere. When these symptoms are experienced, immediately leave the area and seek medical attention.

g. Transportation.

- (1) Travel to and from barges and ships anchored in midstream by a U.S. Coast Guard-approved launch, tugboat, or water taxi or by a Federal Aviation Administration-approved helicopter or air taxi.
- (2) Do not jump on or off a barge or ship. You must be able to step easily from the launch to the vessel without stretching or straining over water. Expect slippery or obstructed deck conditions when boarding a barge or ship.

h. Dock Areas.

- (1) Be alert for loose or rotting boards that may not support your weight when walking on a dock or wharf.
- (2) Learn the locations of life rings, emergency ladders, and telephones. Stay clear of all cables, whether slack or under tension.
- (3) Watch out for forklifts, cranes, cables, and debris.

i. Barges and Ships.

- (1) Do not probe/trier sample barges at night unless they are docked and there is sufficient artificial light.
- (2) Use caution when walking on ship decks, barge tops, and ship gangways because they are uneven, slippery when wet, and have protruding cleats and latches. Stay clear of mooring ropes when they are being adjusted.
- (3) Do not remain on barges while they are being moved. Be aware of nearby barges, docks, or vessels, which could collide with the vessel you are working on. Even a gentle bump can cause covers to roll.
- (4) Require the applicant to roll back the hatches and rolltop covers and lock them in place with lock pins. Do not permit hatches to be opened or closed while you are inside the barge or ship.
- (5) Do not sample barges alone unless you are being monitored by someone who is in a position to render aid if needed. (That person may be an elevator employee or tugboat crew member.)

j. Railcars.

- (1) Before entering a railyard, notify your immediate supervisor, the yardmaster, switch-crew foreman, and any other essential persons of your presence. Also, inquire about possible switching activities, cars carrying hazardous cargo, and any other unusual activity. Do not sample railcars alone unless you are being monitored by someone who is in a position to render aid if needed (e.g., an elevator employee).
- (2) Before beginning sampling, see that all activity ceases on the track where you will be working and adhere to the following guidelines listed below:
 - (a) Require the track to be locked-out;
 - (b) Require derails to be installed at both ends of the string of cars; and
 - (c) Follow other appropriate, locally-approved precautions. For example, using blue flags with radio communication between official personnel and the switch engine operation; using one or more additional employees as safety observers to warn-off approaching railcars; or using blue flags and a lock-out switch on an elevator hold-track where no railcar or switch engine movement takes place during the performance of official functions.
- (3) Do not probe/trier sample railcars at night unless adequate artificial light is provided.
- (4) Do not walk on rails. Always walk outside of tracks, never between.
- (5) Ensure that no power lines are close enough to present an electrical hazard (minimum safe distance from power lines is 25 feet in all directions).
- (6) Check for placarded railcars. If a railcar is not placarded but a fumigant odor is detected, do not enter the car, withhold sampling, and notify your supervisor immediately.
- (7) Never crawl under, through, or over railcar couplings.
- (8) Never walk through a break in a string of railcars separated by only a few feet (minimum safe distance is 20 feet).

- (9) Always be alert to such hazards as moving railcars, cables, debris, metal strapping, and broken ladders.
- (10) Be alert to seasonal conditions, such as icy or muddy walking surfaces, standing water, snow, and rain in the colder months and rodents, snakes, insects, and other animals in the warmer months.
- (11) Always exercise caution when opening or closing hatches or doors. If a hatch or door is stuck open or closed, request assistance from the applicant.
- (12) If at all possible, do not use your hands to break seals. Use a cutting tool or pry bar.
- (13) Do not ride on a switch engine or a moving railcar. If inside a railcar and it starts to move, assume a sitting or kneeling position on top of or in the car to avoid losing your balance and hold on. Do not attempt to descend the ladder or jump to the ground until the car has stopped and you can do so safely. Report all such incidents to the yardmaster and your supervisor.
- (14) Before leaving the railyard, notify the yardmaster or switch-crew foreman, and any other essential persons that you are leaving the work area.
- (15) Report "bad order cars" (e.g., missing ladder rungs and broken doors) to the car owner, the railyard superintendent, or the applicant for inspection and record on a work record.

k. Trucks.

- (1) Do not walk through a break in a string of trucks separated by only a few feet.
- (2) Be alert to such hazards as moving trucks, cables, debris, metal strapping, or broken ladders. Additionally, be aware of other potential fall hazards.
- (3) Avoid breathing diesel exhaust fumes.

I. Diverter-Type (D/T) Sampler Sites.

- (1) Watch out for dangerous accumulations of dust and grain spills.
- (2) Be familiar with elevator evacuation plans and follow the recommendation of the elevator manager if an evacuation is required.

Caution: Follow appropriate lockout procedure—see Chapter 4, section 4, of the [FGIS Mechanical Sampling Systems Handbook \(MSSH\)](#)—before opening either the primary or the secondary sampler inspection doors.

1.4 REPRESENTATIVE SAMPLE

Obtaining a representative sample from a lot of grain is an essential part of the grain inspection process. If the sample is not representative, the inspector's final grade will not reflect the true condition of the lot. For a sample to be considered representative, it must be the following:

- a. Obtained by official personnel, using official procedures and FGIS approved equipment.
 - (1) Official personnel include licensed samplers, technicians, and inspectors employed by official agencies and FGIS employees authorized to sample grain.
 - (2) Official procedures include FGIS directives, handbooks, policy bulletins, and local FGIS field office/official agency policy memorandums.

See the [FGIS Equipment Handbook](#) for a complete list of approved equipment types. Representative samples may be drawn from sacked grain, containerlots, trucklots, carlots, and domestic movement bargelots by probe/trier, pelican, Ellis cup, or diverter-type mechanical sampler. Except in an emergency, export shiplots and bargelots must be sampled by diverter-type mechanical sampler.

- b. Of the prescribed size—approximately 2,500 grams, but not less than 2,000 grams in size. Additional samples or a larger sample may be necessary when additional tests beyond grading are requested.

- c. Handled securely, protected from manipulation, substitution, and careless handling. Samples must never be out of the sampler's control and/or observation, as samples may lose their representativeness by being:
- (1) Thrown or dropped from a railcar or other carrier.
 - (2) Spilled, no matter how little is lost or how much is recovered.
 - (3) Left unattended.
 - (4) Stored in an improper manner, or in an area not under the control of official personnel. For those samples which are not graded on the same day as they are obtained, store in an approved, moisture-proof container(s) to prevent any change in condition.
 - (5) Transported by means that do not ensure the integrity of the sample. Official samples may be shipped via public transportation (e.g., commercial bus or air freight) provided that all necessary security precautions are taken, including—but not limited to—enclosing the sample bag in a lock box or mail bag, secured by a metal seal or lock.

1.5 DETAILED WORK RECORD

The accurate recording of the lot's identity and condition at the time of sampling is vital to the correct certification of the lot's quality. It is not unusual for a grade-determining condition, such as large stones, heating grain, or moths, to be readily apparent in the lot during sampling but not in the sample. Also, insects, debris, and unknown foreign substances may be found around hatch openings and under walkways of carriers. When such conditions are found, clearly note the condition—in detail—on the sample ticket or comparable work record.

Sample tickets must contain the following information:

- a. Sampler's signature or initials.
- b. Date the sample was obtained.
- c. Location of the lot at the time of sampling (e.g., Union Pacific Yard). If the city and/or State are not obvious, this must also be shown.
- d. Identification of the lot, including the following:

- (1) For trucklots, the truck's license plate number, with State abbreviation;

Note: Sometimes, a truck may return to an elevator more than once a day. To keep the trucklots separate, show additional identifiers, such as a contract numbers or the time each sample was taken.

- (2) For truck-trailerlots, the trailer's license plate number (not the tractor's) with the state abbreviation;

Note: Trucklots, truck-trailerlots, and similar lots may be identified by other identifiers provided the applicant agrees with the identifier used and the identifier permits clear identification of the lot.

- (3) For container lots, the alphanumeric identifier located on the rear door of the container;
- (4) For railcar lots, the alphanumeric identifier on the side of the car (make sure that the same identifier is shown on all sides of the car);
- (5) For bargelots, the complete name and/or alphanumeric identifier as shown on the barge;

- (6) For shiplots, the name of the vessel preceded by the abbreviation for its means of propulsion (e.g., MV); and
 - (7) For sacked lots, the special and unique identification code which is applied to no less than 25 percent of the sacks in each carrier/sublot, the carrier identification and seal numbers of the lot witnessed being loaded and sealed, or identify the warehouse space by an identification scheme and strategically place marks on sacks or pallets for later identification—see [FGIS Directive 9180.41](#), “Sacked Grain,” for further information on each identification procedure, one of which is required to be used.
- e. Type of carrier (e.g., truck, hopper car, container, or barge).
 - f. Type of movement (i.e., in, out, local, or export).
 - g. When applicable, the number and prefix of seals broken and applied.
 - h. Method of sampling.
 - i. When applicable, any information related to the condition of the carrier's stowage area.
 - j. Other pertinent information that may affect the grading or certification of the lot, such as the notation "Top ___ feet sampled. Bottom not sampled."

Note: Qualifying statements such as, “Bottom not sampled,” are not allowed on export certificates. Therefore, the trier must reach the bottom of the export carrier.

1.6 ACCESSIBILITY

To obtain a representative sample, the entire lot must be completely and safely accessible.

- a. Hazardous Conditions. When hazardous conditions exist, which could endanger the health of the sampler, consider the lot inaccessible and dismiss the inspection request. Dismissal of service must be performed in accordance with [Part 800.48](#) of the regulations, "Dismissal of Request for Official Services." Hazardous conditions include, but are not limited to the following:
 - (1) The presence of insecticides, fumigants, or other chemical odors;
 - (2) Uncontrolled railyard switching;
 - (3) Electrical storms;
 - (4) Ice on top of barges, railcars, and ships;
 - (5) Broken or unsecured ladders; and
 - (6) Low hanging electrical wires.
- b. Heavily Loaded. If a container is loaded in such a manner as to prevent drawing a sample according to established procedures, consider it to be "heavily loaded."
 - (1) Dismiss requests for sampling and inspection of "heavily loaded" out-bound movements of grain.
 - (2) "Heavily loaded" in-bound and local movements of grain must be sampled as accurately as possible, and the statement "Partial Inspection - Heavily Loaded" must be shown on the sample ticket with a description of the sampling method and location from which the samples were drawn. An example would be if an applicant requests that a shipping container be probe/trier sampled and the grain is loaded so high that the probe/trier cannot be inserted straight down as required due to the probe/trier hitting the top of the container.

c. Entrances.

- (1) Trucks. Consider grain in trucks to be inaccessible for sampling when tarps, coverings, or doors are not fully removed or opened.
- (2) Other Carriers. Consider grain in other carriers to be inaccessible for sampling when hatches or doors cannot be opened.

1.7 SAMPLE INTEGRITY

- a. Often, when grain is sampled online by either mechanical or manual sampling devices, there is a break in the loading/unloading process and official personnel are dismissed. In such situations, if adequate security measures are not taken, grain could be loaded on top of the lot or removed from the lot during the sampler's absence. As a result, the sample would not be representative of the grain in the carrier and a false or incorrect certificate might be issued.
- b. Whenever there is a break in online sampling activities, take all necessary actions to ensure that no grain can be loaded into or unloaded from the carrier until you return to the work site and sampling activities resume. If the break exceeds 88 consecutive hours, including weekends and holidays, notify the applicant that the lot will be cut off at that point and a new lot started. As per [FGIS Directive 9020.1](#), "Exemptions and Waivers of Official Inspection and Class X Weighing Requirements," Field Office Managers are delegated the authority to waive this requirement, upon the applicant's request.

Note: Official agency and/or FGIS field office managers are responsible for determining what precautions are needed at each facility.

- c. Note on the sample ticket, or another comparable work record, what and when such precautions are taken. Appropriate precautions may include, but are not limited to, the following:
- d. Locking-out belt trippers and other elevator grain handling equipment;
- e. Applying seals(s) to the carrier to deter and detect any carrier-related grain handling activity;
- f. Physically monitoring the elevator and carrier; and
- g. Preparing notes and diagrams regarding the position of grain within the carrier, draft level, or other pertinent information to assist in determining if grain was added or removed.

Note: If you suspect that grain was loaded into or unloaded from a carrier during a break in sampling operations, notify your supervisor immediately in accordance with [FGIS Directive 9070.6](#), "Reporting Violations of the U.S. Grain Standards Act and the Agricultural Marketing Act of 1946," and [FGIS Directive 9070.5](#), "Grain Handling Practices."

1.8 PROPORTIONAL SAMPLING

- a. Frequently, a sample drawn from one carrier or portion of a carrier is combined with other sample(s) to form a component, subplot, or combined-lot sample. Prior to combining such samples, the sampler must ensure that the samples are proportional (i.e., samples of like size represent like amounts of grain).
- b. The following are two common problem situations:
 - (1) When grain is being loaded into a barge or ship, the amount of sample that is obtained by an online sampling device (e.g., D/T) can vary from sample to sample depending on the elevator's load-out rate. As the load-out rate increases, the amount of sample obtained usually decreases. Consequently, one subsample may weigh 3,000 grams, while another subsample that represents the same amount may weigh only 2,000 grams.
 - (2) When two or more separate trucklots, carlots, or bargelots are offered for inspection as a combined lot, the volume of grain in each of the carriers can range widely. But often—particularly if the lots are probe/trier sampled—the individual lot samples will all be about the same size, regardless of the actual amount of grain in the individual lots. That is, a sample drawn from a 200,000-pound railcar lot will weigh the same as a sample drawn from a 150,000-pound railcar lot.
- c. Unless you are aware of such situations and take necessary precautions, a significant portion of a lot could be over- or under-represented. Before combining samples:
 - (1) Establish an acceptable sampling ratio (e.g., for each 5,000 bushels of grain there will be exactly 1,250 grams of sample). This ratio should be based on the minimum amount of sample that can be expected to be obtained from any single subsample or lot sample.
 - (2) Weigh (or visually determine) the size of each sample before combining.

- (3) If a sample weighs more than it should for the amount of grain it represents, reduce the sample so that it conforms to the established sampling ratio.

For Example: If a D/T normally delivers 1,250 grams of sample for each (if approximate 5,000 bushels of grain is sampled), then all samples drawn from the lot must conform to the 1,250 grams-to-5,000-bushel ratio. Samples that are not reasonably proportional must be adjusted before being combined with other samples. (“Reasonably proportional” means the standard sample size $\pm 5\%$.)

Figure 1.1 – Proportion Sampling illustrates this example:

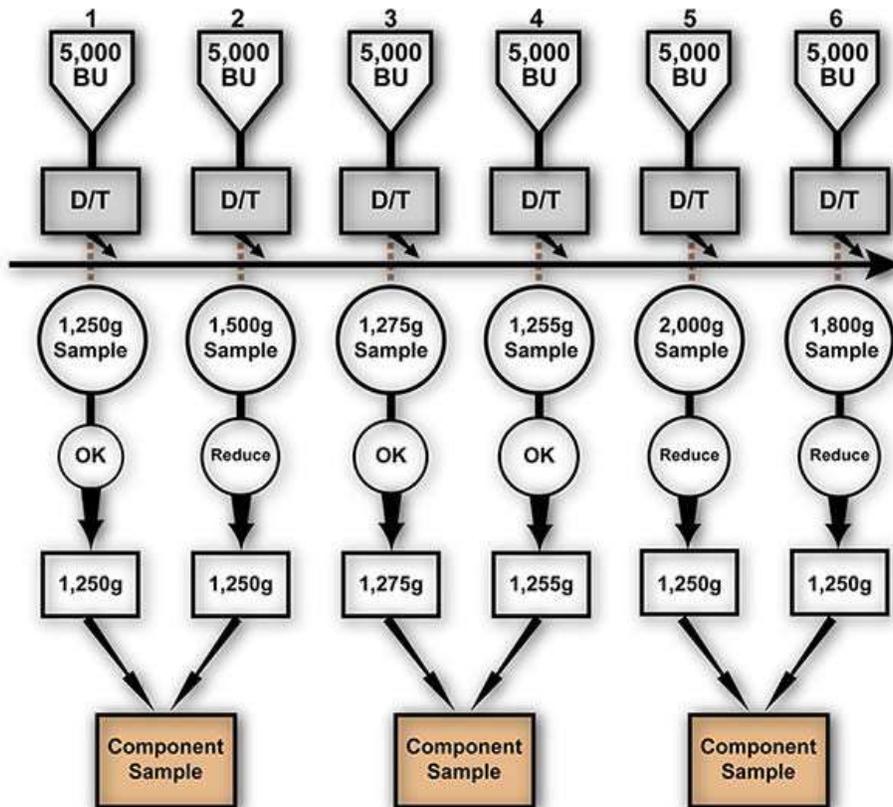


FIGURE 1.1 – PROPORTION SAMPLING

1.9 UNUSUAL CONDITIONS

- a. Do not allow yourself to be hurried to the point that the integrity of the sample is undermined or a condition, such as objectionable odor, insect infestation, or heating, is overlooked. Remember, obtaining a representative sample is the most important aspect of a sampler's job.
- b. If you suspect that the quality of the grain in the sample is not indicative of the true quality of the grain in the lot or that the carrier might be deceptively loaded (see [FGIS Program Directive 9070.5](#), "Grain Handling Practices," for examples of deceptive practices), draw another representative sample using a slightly different sampling pattern or a longer probe/trier, or draw an auxiliary sample. If the original sample was obtained during continuous loading, an alternative sampling method can be used to obtain the auxiliary sample.

Note: If deceptive loading is suspected, notify your supervisor as soon as possible.

- c. An auxiliary sample is drawn only for the purpose of determining if the lot's true condition is indicated by the representative sample.
 - (1) An auxiliary sample is used to "backup" the representative sample, not as another representative sample. For example, if you suspect that a hopper car containing grain is contaminated with fertilizer—even though no fertilizer was present in the probe/trier sample—draw an auxiliary sample.
 - (2) Auxiliary samples may be obtained in any safe manner that is effective in obtaining a sample from the portion of the lot that is suspected of being contaminated or of being a distinctly different quality than the remainder of the lot. (e.g., in a hopper car, an unusually long probe/trier may be used or a well may be dug so that the bottom of the carrier can be reached.)
 - (a) If an unusual condition is found in an auxiliary sample, identify the auxiliary sample with a separate sample ticket and provide the auxiliary sample along with the representative sample.
 - (b) The identification should indicate the specific location in the lot where the auxiliary sample was drawn (e.g., "Auxiliary Sample, Compartment B-1, N&W 176186").

Note: Do not mix the auxiliary sample with the representative sample.

- d. If you observe any of the following conditions in a lot, a representative sample, or an auxiliary sample, report the condition on the sample ticket.
- (1) Angoumois Moths. If moths are found flying or crawling around the lot or the carrier, record an estimate of the number observed.
 - (2) Infestation. If weevils, grain borers, insect larvae, bran bugs, or other insects injurious to stored grain are found on, around, or about the lot, note the number, type, and location where observed. Different grains have different limits for insects. Providing this information to the inspector will allow the inspector to determine if the lot will be considered infested.

Note: To aid in insect identification, refer to [FGIS Visual Reference Images \(VRI\) IN-1.0 through IN-30.0](#), “Insects Commonly Found in Grain” available on the FGIS Website (<https://www.ams.usda.gov/>).

- (3) Large Debris and Other Sample Grade Factors. If any of the following conditions are observed in a lot, record the amount, size, number (whichever is more applicable) and the location where found:
 - (a) Large stones, large sticks, cobs, cement;
 - (b) Pieces of metal, glass, or fertilizer;
 - (c) Rodent or bird excreta;
 - (d) Castor beans, crotalaria seeds, or cocklebur;
 - (e) Lumps of grain, unknown foreign substances, toxic material, or unnatural odors (see [Table 1.1 - Odor Classification Chart](#)); and
 - (f) Material too large to enter a probe/trier.

Note: The number found in a lot may require reporting to the FDA. See [FGIS Directive 9060.2](#), “Implementation of the FGIS-FDA Memorandum of Understanding.”

- (4) Heating Grain. When high temperatures develop in grain as a result of excessive respiration, such grain is called "heating." Heating grain usually gives off a sour or musty odor. However, sour or musty odors are not a requirement for determining that the grain is heating.
- (a) Note the location and quantity on the sample ticket.
 - (b) Do not confuse heating grain with grain that is warm due to storage in bins, cars, or other receptacles during warm weather.
- (5) Distinct Differences in Quality or Other Unusual Conditions. Describe the condition in detail on the sample ticket.
- (6) Odors. Odors should be detected on the original sample at the time of sampling.
- (a) In railyards and other locations where an inspector is not accessible, immediately place the suspect sample into an airtight container for transport to the laboratory for examination by an inspector.
 - (b) Musty and sour odors are the result of mold growth or fermentation and heating. These odors are indexes of deterioration in grain quality that materially lowers the grain's value to end users.
 - (c) Commercially objectionable foreign odors are the result of absorption by grain of residual odors from hides, oil, and other material.

See [Table 1.1 - Odor Classification Chart](#), below for a list of these and other odors that may be found in grain. Some commercially objectionable foreign odors must be reported to the Food and Drug Administration once the last inspection is performed. Reporting specifics and procedures are found in [FGIS Directive 9060.2](#), "Implementation of the FGIS-FDA Memorandum of Understanding."

TABLE 1.1 – ODOR CLASSIFICATION CHART

Sour	Musty	Commercially Objectionable Foreign Odors
Boot (bottom of leg)	Moldy	Animal Hides
Pig pen	Earth	Decaying Animal and Vegetable Matter
Fermenting Grain	Ground	Fertilizer
Insect Odor	Insect Odor	Skunk
Heating Grain	Heating Grain	Oil Products
		Smoke
		Weed Seed

Caution: Do not place your face or nose in grain that has recently been treated for the purpose of destroying insects.

**CHAPTER 2
PROBE/TRIER SAMPLING**

CONTENTS

2.1	EQUIPMENT	2-3
2.2	GENERAL PROCEDURES	2-6
2.3	CARRIERS CONTAINING INFERIOR PORTIONS	2-8
2.4	SAMPLING PATTERNS	2-11
2.5	SAMPLING SACKED GRAIN	2-21
2.6	PROBE-/TRIER- TYPE MECHANICAL SAMPLER (Truck only)	2-22
	TABLE 2.1 - PROBE/TRIER SAMPLING SPECIFICATION CHART	2-3
	TABLE 2.2 - STANDARD SIZES OF SAMPLING CANVASES AND BAGS	2-5
	FIGURE 2.1 - ADDITIONAL PROBES/TRIERS	2-9
	FIGURE 2.2 - COMPUTING FRACTIONAL PORTIONS OF INFERIOR GRAIN	2-10
	FIGURE 2.3 - FIBERGLASS HATCH TOP BARGE	2-11
	FIGURE 2.4 - LIFT TOP AND ROLL TOP BARGE	2-12
	FIGURE 2.5 - 3-COMPARTMENT, TROUGH OR DOOR TYPE HOPPER CAR	2-13
	FIGURE 2.6 - 3 COMPARTMENT, 10 HATCH TYPE HOPPER CAR	2-13
	FIGURE 2.7 - 2 COMPARTMENT, 8 HATCH TYPE HOPPER CAR	2-14
	FIGURE 2.8 - 2 COMPARTMENT, OPEN TOP HOPPER CAR	2-14
	FIGURE 2.9 - 4 COMPARTMENT, 12 HATCH TYPE HOPPER CAR	2-15
	FIGURE 2.10 - ARTICULATED TYPE HOPPER CAR	2-16
	FIGURE 2.11 - BOXCAR	2-17
	FIGURE 2.12 - FLAT BOTTOM TRUCK OR TRAILER	2-18
	FIGURE 2.13 - FLAT BOTTOM TRUCK AND TRAILER	2-19
	FIGURE 2.14 - ALUMINUM HOPPER BOTTOM CONTAINER	2-20

FIGURE 2.15 - HOPPER-BOTTOM TRUCK AND TRAILER2-20

2.1 EQUIPMENT

- a. Probe/Trier. Probes/Triers are constructed of brass or aluminum and come in various sizes, with standard lengths of 5, 6, 8, 10, and 12 feet. The depth of the carrier or container dictates the length of probe/trier that is used to draw the sample.
- (1) Probes/Triers consist of two tubes, one inside the other. The inner tube is divided into compartments. Depending on its length, a probe/trier may have 11, 12, 16, or 20 compartments. The outer tube has slots that match the compartment openings of the inner tube.
 - (2) When the slots in the tubes are aligned, grain can enter into and be emptied from the compartments.

TABLE 2.1 - PROBE/TRIER SAMPLING SPECIFICATION CHART

Carriers	Probe/Trier Lengths	Compartments
Barges and bay boats	12-foot	20 compartments
Hopper cars	10- or 12-foot	20 compartments
Boxcars	6-foot	12 compartments
Truck	5- or 6-foot	11 or 12 compartments
Hopper-bottom trucks	6-, 8-, or 10-foot	12, 16, or 20 compartments
Other containers: use grain probes/triers that will reach the bottom of the container		

Note: For USGSA, non-compartmented grain probes/triers and open-ended grain probes/triers are not approved for official sample lot inspections for grain but may be used for official commercial inspections.

- (3) Whenever the bottom of a carrier/container is not reached by *all* probes/triers, show this special statement on the sample ticket: "Top feet sampled. Bottom not sampled." The number of feet shown in the statement must correspond to the estimated average depth of all probes/triers that *did not* reach the bottom of the carrier.

Note: Reaching the bottom of the carrier/container is a requirement for export shipments.

For example: A sampler is unable to reach the bottom of a hopper car compartment after inserting the probe/trier to its full 10-foot depth. The bottom of the next compartment is not reached after the probe/trier is inserted 8 feet. In the last compartment, the probe/trier reaches the bottom after being inserted 9 feet. Since the bottom of the container was not reached with all probes/trieurs, add the depth of the two probes/trieurs that did not reach the bottom (8 feet + 10 feet = 18 feet), then divide that sum by two ($18 \div 2 = 9$ feet). Show this on the sample ticket: "Top 9 feet sampled. Bottom not sampled."

b. Sampling Canvas, Cloth, or Troughs.

- (1) Sampling canvases, which are usually made of flat duck cloth or similar material, must be longer than the probe/trier used to draw the sample. This "extra length" is needed so that the grain from the entire length of each probe/trier may be placed on the canvas and examined without being spilled.

Note: Always keep sampling canvases clean, dry, and free of holes.

- (2) Half sections of pipe or troughs (e.g., rain gutters) may be used instead of sampling canvases. Troughs must be longer than the probe/trier used to draw the sample.

c. Sample Bags. Sample bags must be constructed from heavy cloth or canvas and have a draw string closure, and they should be large enough to contain up to 4,000 grams of grain.

- (1) Sample bags must be free of all old grain, insects, and foreign material.
- (2) To prevent a change in moisture or odor, it is recommended that a plastic liner be inserted inside the sample bag. The sample ticket or other records should be inserted between the liner and the bag, not directly in the sample.

- (3) Containers, such as metal buckets or plastic cans, may be used instead of sample bags, provided the containers are clean and dry.

TABLE 2.2 - STANDARD SIZES OF SAMPLING CANVASES AND BAGS

Sampling Canvases	Sampling Bags
30 inches X 5.5 feet	8 inches X 16 inches
30 inches X 6.5 feet	8.5 inches X 19 inches
30 inches X 10.5 feet	9 inches X 16 inches
30 inches X 12.5 feet	10.5 inches X 16.5 inches

2.2 GENERAL PROCEDURES

Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See [Appendix 1](#), Local Quality Control Procedures, for additional information.

a. Prior to Sampling.

- (1) Record the carrier's identification number on the sample ticket.
- (2) Break any seals that secure hatches or doors that must be opened. Record the prefix code number of broken seals on the ticket.
- (3) Open the hatches/doors and enter the carrier.

Note: The applicant for inspection is responsible for removing truck tarps, opening roll top barges, and trimming (leveling) the grain in the carrier.

- (4) After entering the carrier, visually examine the top of the grain for any debris, lumps, glass, and other harmful material. Take a handful of grain from several locations and check it for odor. Record any unusual conditions or off odors on the sample ticket.
- (5) Next, spread the canvas on a level surface. Make sure the probe/trier and canvas are clean and dry.

b. Drawing the Sample. For each type of carrier, there is an established sampling pattern (see [section 2.4](#), Sampling Patterns). Probe/Trier the carrier in the areas identified for that particular type of carrier. There are many techniques for using a probe/trier. Regardless of which technique is used, follow these general rules to obtain a representative sample:

- (1) Insert the probe/trier at a 10-degree angle from the vertical, with the slots facing upward and completely closed. Keep the slots closed until the probe/trier is inserted as deeply as possible into the grain. If the slots are not kept closed, a disproportionate amount of grain from the top of the lot will fall into the probe's/trier's compartments as it is being inserted.
- (2) If the grain contains sand or grit, it is permissible to insert the probe/trier with the slots facing downward to avoid "freezing" the probe/trier. After the probe/trier is inserted, turn the slots upward before opening.

- (3) After the probe/trier is fully inserted (with the slots facing upward), open the slots and move the probe/trier up and down in two quick, short motions. When sampling grains, such as oats and barley, additional up and down movements may be necessary to fill the probe/trier.
- (4) Close the slots completely. Then, grasp the probe/trier by the outer tube and withdraw it from the grain.

Caution: Do not pull the probe/trier by the wooden handle. This can cause the inner tube to be pulled out of the outer tube. If this occurs, the probe/trier must be emptied and reassembled, and the area must be re-probed/re-tried.

- (5) Empty the probe/trier on the canvas and compare the grain in each compartment for uniformity of kind, condition, and infestation. Also, compare the sample to others drawn from the same lot. If all samples and portions of samples are uniform, composite them in a sample bag with a completed sample ticket.

Note: When using a trough, examine the grain in each compartment *before* emptying the probe/trier sample into the trough.

- (6) If the examination of the individual probe/trier samples indicate that the grain is not uniform in condition (i.e., part of the lot is musty, sour, or heating), a sample from each of the different parts—in addition to a sample that represents the carrier as a whole—must then be drawn. For reference, see [section 2.3](#), Carriers Containing Inferior Portions, of this chapter.
- (7) When transferring the sample from the canvas to the sample bag, take care not to spill any portion of the sample or allow fine material to be blown away.
- (8) After placing the sample and completed sample ticket into the sample bag, tighten the drawstrings at the top of the bag so that it is closed securely. Carefully remove the bag from the carrier so that none of the sample is lost or spilled.

Caution: Do not throw or drop the sample to the ground.

- (9) Close all hatches or doors. Then, replace all broken seals with new seals unless directed by the applicant for inspection not to do so. Record the prefix code and number of all seals applied on the sample ticket.

2.3 CARRIERS CONTAINING INFERIOR PORTIONS

- a. One of the most common errors in sampling is failing to obtain the required number of samples from a lot that appears to contain an inferior portion (e.g., musty, sour, or heating grain).
- b. Whenever a lot appears to contain an inferior portion, the sampler must draw three separate samples: a sample of the entire lot, a sample of the inferior portion, and a sample of the remainder of the lot. The absence of any one of these samples gives the inspector an incomplete picture of the grain in the carrier.

Note: Each of the three samples must contain a minimum of 2000 grams of grain and be accompanied by a completed sample ticket.

- c. Draw the three samples as follows:
 - (1) First, determine the boundaries of the inferior portion by repeated sampling and examination of individual probe/trier samples.
 - (2) Once the boundaries have been found, draw a sample of the inferior portion, a sample of the remainder, and a sample of the entire lot.
 - (3) Estimate the approximate amount of grain represented by each sample and note the location of the grain in the carrier. Make the estimate using fractional parts, such as $\frac{1}{4}$, $\frac{1}{2}$, and $\frac{3}{4}$, to indicate the portion of the lot represented by each sample. The probe/trier can be useful in performing this task.
 - (a) To form a fraction using the probe/trier, count the number of compartments containing the inferior grain and place that number over the total number of filled compartments.
 - (b) Reduce the fraction to its lowest form. This is the fractional part containing the inferior grain.
 - (c) Show this information, with a rough diagram of the portions, on the respective sample ticket completed for each sample.
 - (d) Note on the sample ticket the location of the inferior portions of grain in terms such as these: for Hopper cars, B-1 (the bay or compartment closest to the brake end), B-2 (the middle hopper), and B-3 (the compartment opposite the brake end); and for barges, stern end, bow end, port, or starboard.

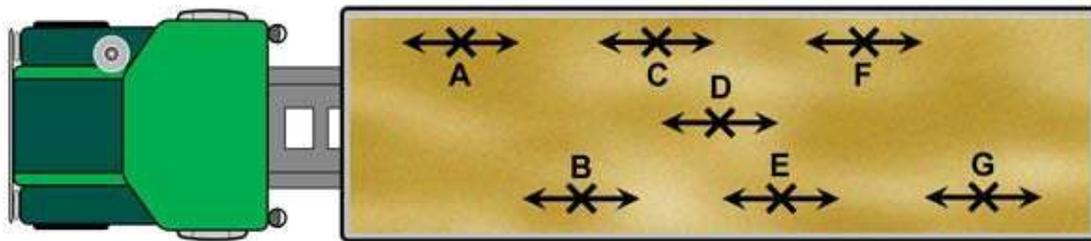
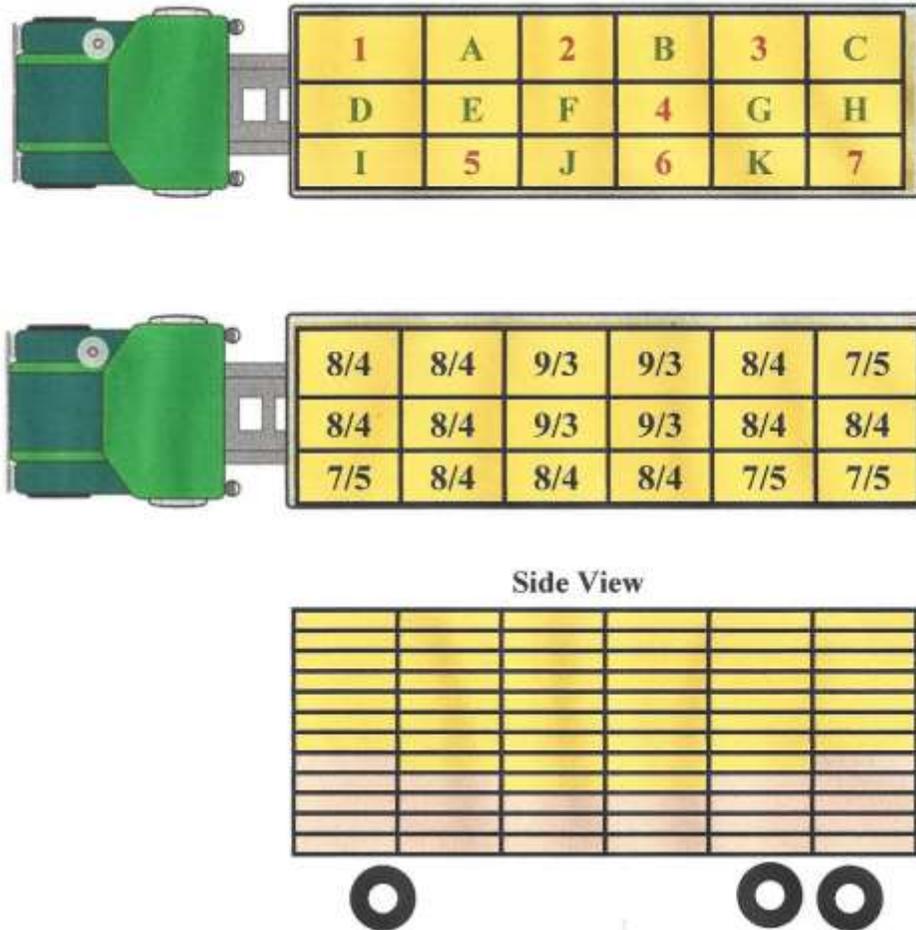


FIGURE 2.1 - ADDITIONAL PROBES/TRIERS

For example: An inferior portion has been found in a trucklot of grain—see [Figure 2.1 – Additional Probes/Triers](#). The letters A, B, C, D, E, F, and G represent additional probes/triers taken. This should give the sampler an indication of the size and location of the inferior portion.

However, if you believe that more samples are needed, then they should be taken—see [Figure 2.2 Computing Fractional Portions of Inferior Grain](#). The proper procedure for estimating the fractional portions of inferior grain in the lot is to count the compartments of good grain and the compartments of inferior grain. Show the count on the back of the sample ticket.



Example: The procedure for computing the fractional portion of inferior grain in the lot is as follows: There are 44 compartments of sound grain and 72 compartments of inferior grain. Show the count on the back of the sample ticket.

$$144 \div 4 = 36 \div 18 = 2$$

$$216 \div 4 = 54 \div 18 = 3$$

2/3 of the lot contains good grain



$$72 \div 4 = 18 \div 18 = 1$$

$$216 \div 4 = 54 \div 18 = 3$$

1/3 of the lot contains inferior grain



FIGURE 2.2 - COMPUTING FRACTIONAL PORTIONS OF INFERIOR GRAIN

Note: The procedure may be modified and used to estimate inferior portions on all carriers sampled with a probe/trier.

2.4 SAMPLING PATTERNS

Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See [Appendix 1](#), Local Quality Control Procedures, for additional information.

- a. The following diagrams show the standard sampling patterns. Each lot must be probed/tried in as many additional locations as are necessary to ensure that the sample is the required size and representative of the lot.
 - (1) Additional probes/tryers must be drawn in a balanced manner. For example, one compartment of a hopper car must not be probed/tried twice unless the other compartments are also probed/tried twice, regardless of the amount of grain in any one compartment or the amount of additional sample needed.
 - (2) The sampling patterns in this section must be used by all official inspection personnel when sampling grain at rest. Insert the probe/trier at the points marked (X), with the tip of the probe/trier pointed toward the direction of the arrowhead. When two arrowheads are shown, the tip of the probe/trier may be pointed in either direction.
- b. Sampling Patterns for Barges.
 - (1) Fiberglass Hatch Top Barges. See [Figure 2.3 – Fiberglass Hatch Top Barge](#). Draw one probe/trier sample from each opening, in the direction of the arrowhead. Insert the probe/trier in the center of the opening, approximately 7 feet from the side edge.

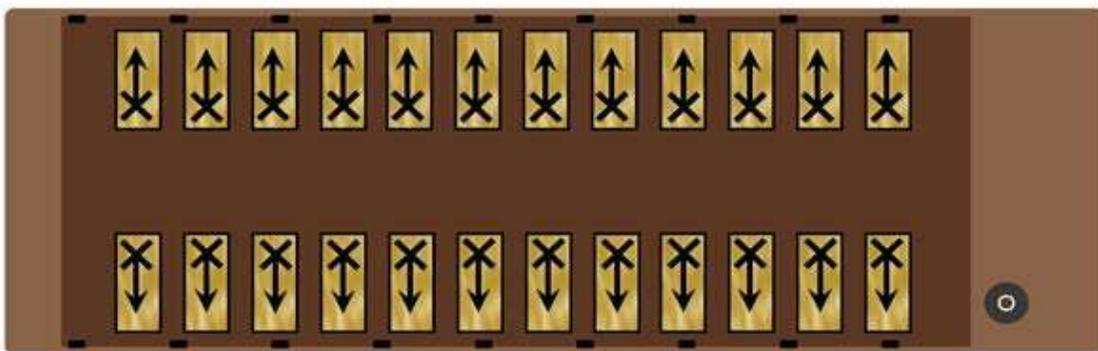


FIGURE 2.3 - FIBERGLASS HATCH TOP BARGE

- (2) Lift Top and Roll Top Barges. [See Figure 2.4 – Lift Top and Roll Top Barge.](#) Draw the first probe/trier approximately 4 feet in from the stern end of the barge and approximately 7 feet from the side. Take the next probe/trier approximately 15 feet from the first probe/trier. Proceed to take probes/trieurs at 15-foot intervals until the bow end of the barge is reached. The last probe/trier must be taken approximately 4 feet from the opposite end and approximately 7 feet from the side. Sample both sides of the barge in this manner until the entire barge is sampled.

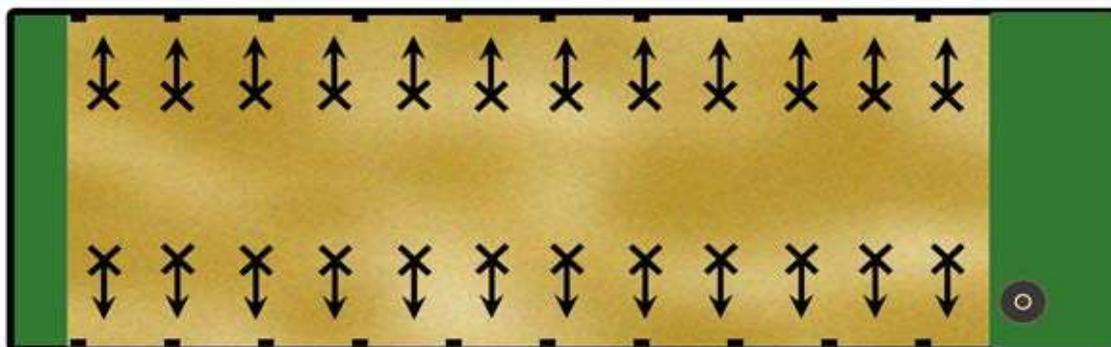


FIGURE 2.4 - LIFT TOP AND ROLL TOP BARGE

- (3) Other Types of Barges. When sampling barges other than those listed above, use the sampling pattern that will provide the most representative sample.
- (4) Probe/Trier Sampling Barges During Loading.
- Using the prescribed pattern(s), as shown above, sample up to the point that the barge is fully loaded.
 - Mark this point on the side of the barge.
 - Place the sample in an airtight container.
 - After the next section(s) is loaded, sample from the point marked to the point that loading stopped.
 - Place this sample in a separate container.
 - Repeat the procedure until loading is completed. If all samples are uniform, combine them into one sample.

c. Sampling Patterns for Hopper Cars.

- (1) 3-Compartment, Trough or Door Type Hopper Cars. As shown below, in [Figure 2.5 – Compartment, Trough or Door Type Hopper Car](#), insert probe/trier in the direction of the arrow at approximately a 10-degree angle, the probe/trier may be inserted either in the center of each hopper or slightly off center in order to miss the cross beam.

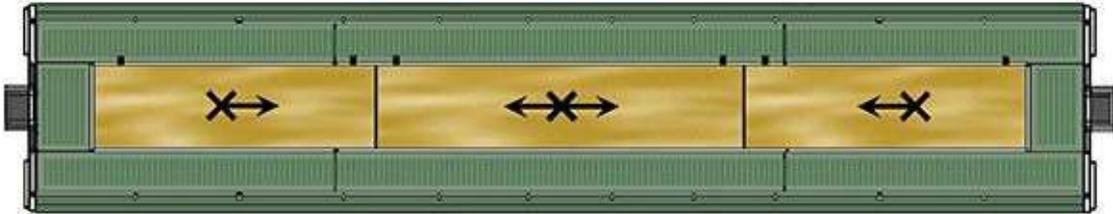


FIGURE 2.5 - 3-COMPARTMENT, TROUGH OR DOOR TYPE HOPPER CAR

- (2) 3-Compartment, 10-Hatch Type Hopper Cars. As shown below, in [Figure 2.6 – Compartment, 10-Hatch Type Hopper Car](#), insert probe/trier in the direction of the arrow at approximately a 10-degree angle.

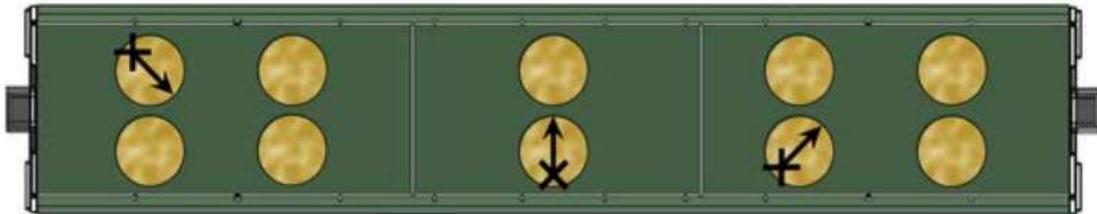


FIGURE 2.6 - 3 COMPARTMENT, 10 HATCH TYPE HOPPER CAR

- (3) 2-Compartment, 8-Hatch Type Hopper Cars. As shown below, in [Figure 2.7 – Compartment, 8-Hatch Type Hopper Car](#), insert probe/trier in the direction of the arrow at approximately a 10-degree angle.

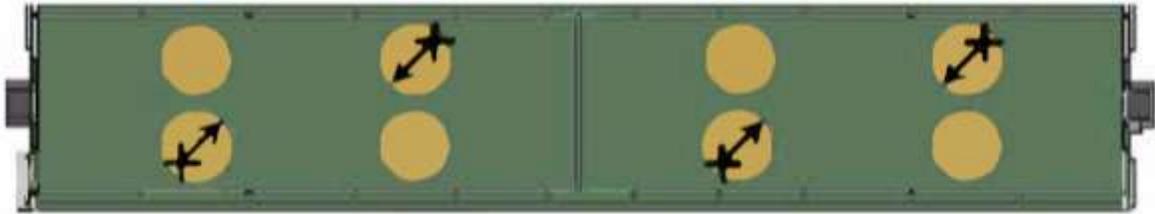


FIGURE 2.7 - 2 COMPARTMENT, 8 HATCH TYPE HOPPER CAR

- (4) 2-Compartment, Open Top Type Hopper Cars. As shown below, in [Figure 2.8 – Compartment, Open Top Hopper Car](#), insert probe/trier in the direction of the arrow at approximately a 10-degree angle.

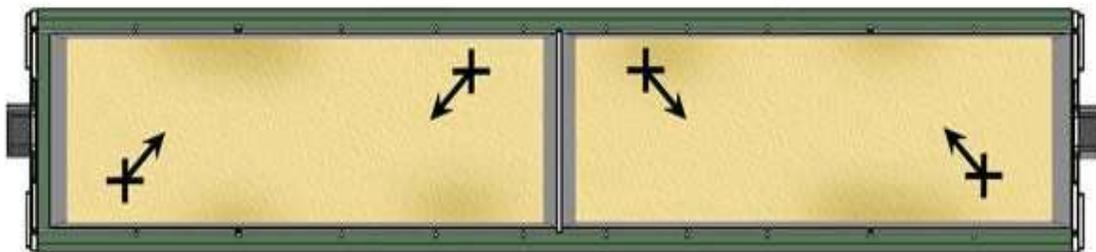


FIGURE 2.8 - 2 COMPARTMENT, OPEN TOP HOPPER CAR

- (5) 4-Compartment, 12-Hatch Type Hopper Cars. As shown below, in [Figure 2.9 – 4-Compartment, 12-Hatch Type Hopper Car](#), insert probe/trier in the direction of the arrow at approximately a 10-degree angle.

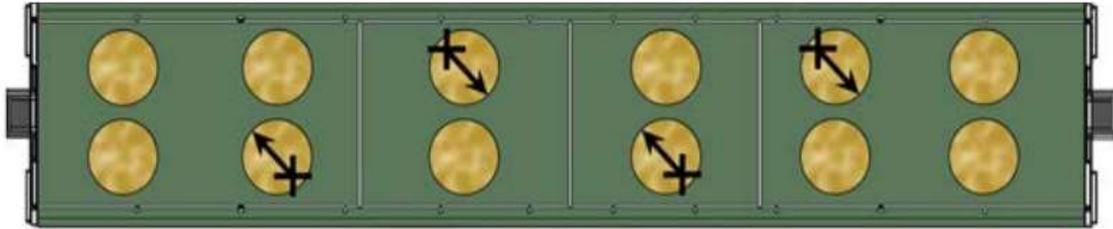


FIGURE 2.9 - 4 COMPARTMENT, 12 HATCH TYPE HOPPER CAR

- (6) Articulated Type Hopper Cars. As shown below, in [Figure 2.10 – Articulated Type Hopper Car](#), insert probe/trier in the direction of the arrow at approximately a 10-degree angle.
- (a) Articulated type hopper cars (e.g., "Super Hoppers") are easily recognized because of their configuration. The cars' design permanently mounts five, 2-hatch type hopper cars onto 6 sets of wheels. The five-car units carry the equivalent of three jumbo hopper cars.
 - (b) Since articulated hopper cars are unique in design, samplers should also be aware that their identification system is different from that of standard hopper cars. Often, articulated hopper car units are labeled by the manufacturer. If they are, use this information for identification. If they are not labeled, identify one end unit of the car as the A unit and identify the other end unit as the B unit. Then, identify the three middle units as C, D, and E, going from unit B to unit A. Each unit has two compartments or hoppers. The B-end compartment within a unit is identified as 1 and the A-end unit within the same compartment is identified as 2. For reference, see [Figure 2.10 – Articulated Type Hopper Car](#).

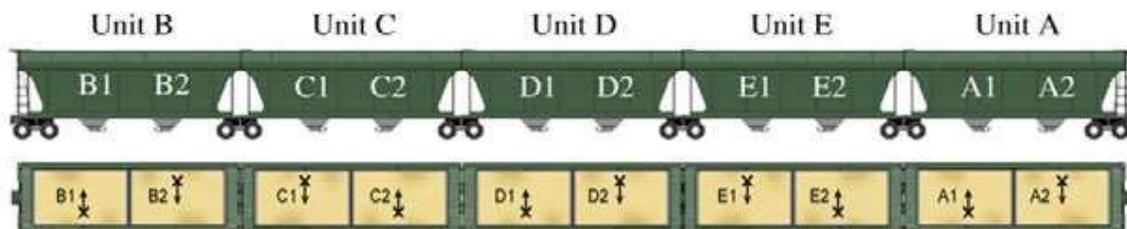


FIGURE 2.10 - ARTICULATED TYPE HOPPER CAR

(7) Other Types of Hopper Cars. When sampling other types of hopper cars, use the sampling pattern which will provide the most representative sample.

d. Sampling Pattern for Box Cars. As shown below in [Figure 2.11 – Boxcar](#), insert the probe/trier at approximately a 10-degree angle in the direction of the arrows shown in the diagram. The probe/trier pattern shown may also be used in reverse.

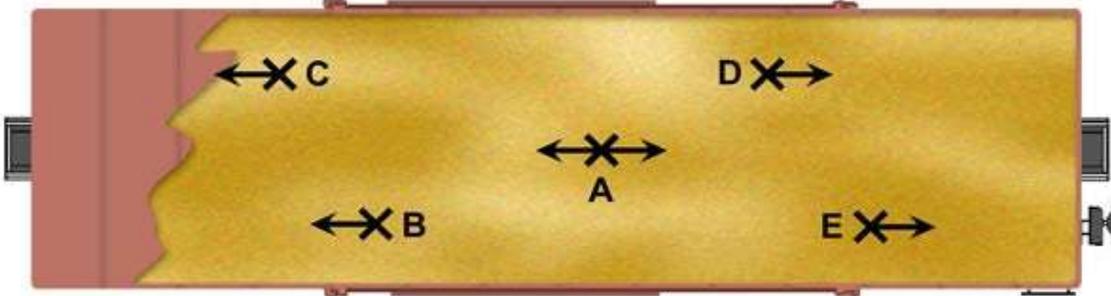


FIGURE 2.11 - BOXCAR

SITE A	Draw a sample from the center of the car. The probe/trier may be taken with the slots facing toward either end of the car.
SITE B	Draw a sample approximately 3–5 feet back from the doorpost and approximately 2–4 feet out from the side of car. The slots in the probe/trier face toward the end of the car.
SITE C	Draw a sample approximately 3–5 feet from the same end of the car and approximately 2–4 feet from the opposite side of the car from site B. The slots in the probe/trier face toward the end of the car.
SITE D	Draw a sample approximately 3–5 feet back from the doorpost and approximately 2–4 feet out from the side of car opposite of site B. The slots in the probe/trier face toward the end of the car.
SITE E	Draw a sample approximately 3–5 feet from the same end of the car and approximately 2–4 feet from the opposite side of the car from site D. The slots in the probe/trier face toward the end of the car.

- e. Sampling Patterns for Trucks. Insert the probe/trier at approximately a 10-degree angle in the direction of the arrows shown in the diagram. The probe/trier pattern shown may also be used in reverse of the one shown.

Note: The 5-hand probe/trier boxcar pattern may also be used for sampling flat-bottom trucks or trailers, only if a sufficient sized sample is obtained. If not enough sample can be obtained, then the following methods can be used, as shown in [Figure 2.12 – Flat Bottom Truck or Trailer](#), [Figure 2.13 – Flat Bottom Truck and Trailer](#), [Figure 2.14 – Aluminum Hopper-Bottom Container](#), and [Figure 2.15 – Hopper-Bottom Truck and Trailer](#).

- (1) Flat-Bottom Trucks or Trailers Containing Grain More Than 4-Feet Deep or 8 Filled Probe/Trier Compartments. See [Figure 2.12 – Flat Bottom Truck and Trailer](#) below for illustrative sampling instructions.

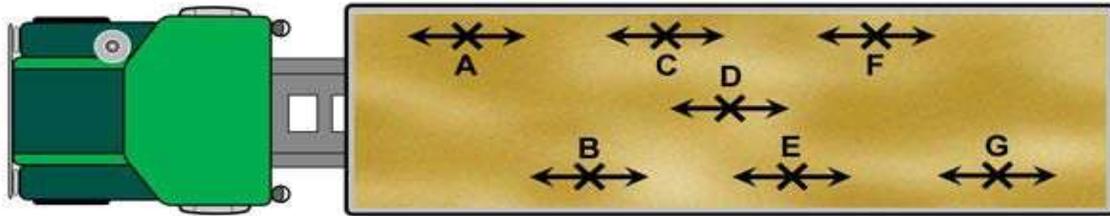


FIGURE 2.12 - FLAT BOTTOM TRUCK OR TRAILER

SITE A	Draw a sample approximately 2 feet from the front and side.
SITE B	Draw a sample from the opposite side of site A, approximately halfway between the front and center of the carrier, and approximately 2 feet from the side.
SITE C	Draw a sample from the same side as site A, approximately $\frac{3}{4}$ (three fourths) of the distance between the front and center of the truck and approximately 2 feet from the side.
SITE D	Draw a sample from the center of the carrier.
SITE E	Draw a sample from the side opposite site C, approximately $\frac{3}{4}$ (three fourths) of the distance between the rear and center, approximately 2 feet from the side.
SITE F	Draw a sample from the side opposite site E, approximately $\frac{1}{2}$ (one half) the distance between the rear and center, approximately 2 feet from the side.
SITE G	Draw a sample from the same side as site E, approximately 2 feet from the rear and side of the carrier.

- (2) Flat-Bottom Trucks or Trailers Containing Grain Less Than 4-Feet Deep or Fewer Than 8 Filled Probe/Trier Compartments. See [Figure 2.13 – Flat Bottom Truck and Trailer](#) below for illustrative sampling instructions.

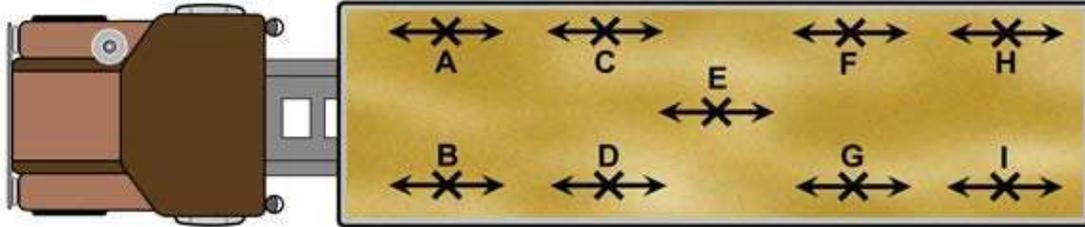


FIGURE 2.13 - FLAT BOTTOM TRUCK AND TRAILER

SITE A	Draw a sample approximately 2 feet from the front and side.
SITE B	Draw a sample from the opposite side of site A, approximately 2 feet from the side.
SITE C	Draw a sample from the same side as site A, approximately $\frac{3}{4}$ (three fourths) of the distance between the front and center of the truck and approximately 2 feet from the side.
SITE D	Draw a sample from the same side as site B, and opposite of site C, approximately $\frac{3}{4}$ (three fourths) of the distance between the front and center and approximately 2 feet from the side.
SITE E	Draw a sample from the center.
SITE F	Draw a sample from the same side as site C, approximately $\frac{3}{4}$ (three fourths) of the distance between the center and rear of the truck and approximately 2 feet from the side.
SITE G	Draw a sample from the same side as site D, approximately $\frac{3}{4}$ (three fourths) of the distance between the center and rear of the truck and approximately 2 feet from the side.
SITE H	Draw a sample from the same side as site F, approximately 2 feet from the rear and side of the carrier.
SITE I	Draw a sample from the same side as site G, approximately 2 feet from the rear and side of the carrier.

Note: Use caution when inserting probes/trieers into aluminum trailers so as not to pierce the trailer. Do not throw the probe/trier into the grain, as it can also pierce aluminum carriers.

- (3) Sampling Pattern for Hopper Bottom Containers, Trucks, and Trailers. As shown below in [Figure 2.14 – Aluminum Hopper Bottom Container](#) and [Figure 2.15 – Hopper-Bottom Truck and Trailer](#), insert the probe/trier at an approximate 10-degree angle in the direction of the arrows shown in the diagram(s) below.

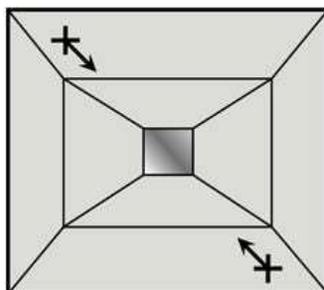


FIGURE 2.14 - ALUMINUM HOPPER BOTTOM CONTAINER

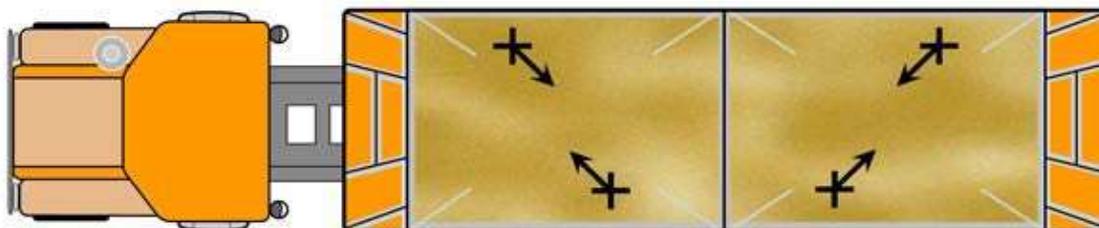


FIGURE 2.15 - HOPPER-BOTTOM TRUCK AND TRAILER

2.5 SAMPLING SACKED GRAIN

When sampling sacked grain, use a double-tubed, compartmented grain probe/trier (minimum length: 4 feet).

Caution: When working in warehouses, watch out for forklifts and tow motors. Also be alert for sacks slipping (falling) from improperly stacked pallets.

- a. Determine the number of sacks in the lot. If the lot contains more than 10,000 sacks, divide the lot into 2 or more (approximately) equal-sized sublots.
- b. For each lot or subplot, randomly select 36 sacks for sampling.

Note: All sacks in the lot must be accessible for selection.

- c. Stand each selected sack on end and insert the probe/trier into the top corner of the sack.
- d. Push the probe/trier, with the slots facing upward, diagonally through the sack until the end of the probe/trier touches the opposite bottom corner.
- e. Open the probe/trier, make two quick up and down motions, and then close and remove the probe/trier.
- f. Empty the contents of the probe/trier onto a sampling canvas and examine the grain for condition.
- g. If all probe/trier samples are uniform, composite the samples and place them into one sample bag.
- h. If the examination of the probe/trier samples indicates that the lot is made up of distinctly different parts with regard to condition, draw a sample from each of the different parts in addition to the sample as a whole.

2.6 PROBE-/TRIER- TYPE MECHANICAL SAMPLER (TRUCK ONLY)

Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See [Appendix 1](#), Local Quality Control Procedures, for additional information.

Note: Probe-/Trier- type mechanical samplers are only approved for sampling trucks. Requests for sampling other types of carriers should be forwarded to FGIS headquarters. Refer to the [Mechanical Sampling Systems Handbook](#) (MSSH) for further information regarding approval, operation, and record retention requirements.

- a. Periodically, examine the sampling system—including the delivery pipes and the sample collection box—to ensure that the system is not clogged-up or leaking and does not contain grain or other material from previous lots. Refer to the [Mechanical Sampling Systems Handbook](#) (MSSH) for further information regarding examination of the sampling system.
- b. Using the standard sampling pattern (refer to [section 2.4](#), Sampling Patterns), draw one sample from each probe/trier site.

Note: If the sampler is not owned by the official agency, it may—at the owner's discretion—be operated by an elevator employee under the direct supervision of official personnel.

- (1) Insert the probe/trier vertically into the grain until it reaches the bottom of the carrier.

Caution: Exercise extreme care when inserting the probe/trier to prevent damage to the bottom of the carrier—do not continue to exert downward pressure after reaching the bottom.

- (2) Once the probe/trier has been fully inserted, transfer the sample to the collection box. Many probes/trieurs have limit switches that automatically "cycle" the probe/trier and transfer the grain to the collection box.
- (3) During sampling operations, keep a constant check for possible system malfunctions. Be aware of any change in the sample, such as the following:
 - (a) If the sample flow stops but the vacuum motor is laboring, the delivery system may be plugged; or

- (b) If the sample becomes noticeably smaller but the vacuum motor is running freely, the system may have a leak.

Should any of the above situations arise, please refer to [section 3.2](#), D/T Checks, for further instruction.

Note: Carriers with shallow loads may need to have additional probes/trieers taken to obtain the proper amount of sample. Draw additional probes/trieers in a representative manner. (For example, one portion of a trucklot must not be probed/tried twice unless the entire truck is probed/tried twice.)

- (4) After all samples are drawn, empty the sample collection box and examine the grain for unusual conditions, such as off odors, heating, infestation, or nonuniformity.

**CHAPTER 3
SAMPLING WITH A DIVERTER-TYPE SAMPLER**

CONTENTS

3.1	GENERAL INFORMATION	3-2
3.2	D/T CHECKS.....	3-3
3.3	SECURITY	3-5
3.4	GRAIN QUALITY CHECKS	3-7
	TABLE 3.1 - SAMPLE ANALYSIS INTERVALS	3-9
	TABLE 3.2 - TROUBLESHOOTING GUIDE FOR SAMPLERS	3-10

3.1 GENERAL INFORMATION

- a. Diverter-type (D/T) mechanical samplers may be mounted in grain spouts, at the end of belts, or at the head of elevator legs. Regardless of their location, all D/T's draw a sample in the same way—by periodically moving a diverter (often called the "pelican") completely across a stream of grain.
 - (1) The frequency that the pelican moves through the grain, or takes a "cut," is controlled by a timing device. Grain collected by each "cut" of the pelican flows to a secondary sampler (SM) which reduces the sample size. From the SM, the sample flows to a collection box.
 - (2) For further information about D/T samplers, refer to the [FGIS Mechanical Sampling Systems Handbook \(MSSH\)](#).
- b. D/T sampler attendants are responsible for:
 - (1) Ensuring that the D/T sampler and sampling system are functioning properly. (See [section 3.2](#), D/T Checks.)
 - (2) Securing D/T sampling system access points and grain flow diversion points. (See [section 3.3](#), Security.)
 - (3) Checking the grain during loading/unloading for infestation, condition, and uniformity. (See [section 3.4](#), Grain Quality Checks.)
 - (4) When sampling outbound grain, ensure that applicable personnel conduct a prior-to-loading stowage examination of the carrier or container. (See [FGIS Directive 9180.48](#), "Stowage Examination Services.")

3.2 D/T CHECKS

Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See [Appendix 1](#), Local Quality Control Procedures, for additional information.

a. Prior-to-Use Checks. Each workday before using the D/T, physically examine the sampling system, including the elevator load out/in system, to make sure that the sampling system is operating properly, and all previously applied security seals/locks are still intact. This must include—but not be limited to—the following checks:

- (1) General System Check. Examine the primary sampler, secondary sampler, and the sample delivery system (i.e., sample delivery tube and collection area) to ensure that they are working properly and free from any noticeable obstructions and leaks.
- (2) Pelican/Dust Seal Check.
 - (a) Check the movement of the pelican (e.g., Is it smooth?).
 - (b) Check the dust seals for wear and tear.
 - (c) Check for objects stuck in the pelican opening or body.
 - (d) Check that the pelican fits against the dust seals.

Caution: Follow appropriate lockout procedure—see Chapter 4, section 4, of the [FGIS Mechanical Sampling Systems Handbook \(MSSH\)](#)—before opening either the primary or the secondary sampler inspection doors.

- (3) Grain Flow System Check. Examine elevator load out/in belts, trippers, turnheads, garners, scales, and bins to ensure that they are properly configured and free of residual grain and foreign material.
- (4) Timer Check. Check the timer on the D/T sampler control panel to ensure that it is set for—and takes a cut at—the correct time interval. (Refer to [the FGIS Mechanical Sampling Systems Handbook \(MSSH\)](#) for timer setting requirements.)
- (5) Security Check. Check all D/T system access points and grain flow diversion points to ensure that all security seals/locks are in place.

- b. In-Use Checks.
- (1) During sampling operations, constantly check for possible system malfunctions. Be especially aware of any change in the sample, such as the following:
 - (a) If the sample flow stops, the delivery system may be plugged.
 - (b) If the sample contains an unusual amount of dust or foreign material, the dust seals may be torn or worn.
 - (c) If the sample continues to dribble, even when the D/T control panel lights indicate that the pelican is not moving, then the pelican may not be resting properly against the dust seals.
 - (2) If you suspect a problem, *stop using the D/T immediately* and inform your supervisor and the elevator manager of the situation. Then, inspect the D/T sampling system. If the inspection indicates that there is a physical or mechanical problem with the system, do the following:
 - (a) Discontinue use of the D/T until the problem is corrected and the sampler has been fully examined and/or tested. Sample the remainder of the lot using an Ellis cup or pelican sampler, or re-sample the entire lot using a probe/trier. Note on the sample ticket the amount of grain sampled by the D/T and the amount sampled by another device.
 - (b) Document the problem, repair, and all subsequent activities. Keep a copy of all documentation at the specified service point and, when practicable, at the elevator/work site.
- c. Performance Tests. Prior to authorizing new D/T sampling systems and, in some cases, before using systems with suspended authorizations, official personnel must check the performance of the system according to the procedures in the [FGIS Mechanical Sampling Systems Handbook \(MSSH\)](#). Whenever a performance test is required, a semi-annual examination must also be performed.

3.3 SECURITY

Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See [Appendix 1](#), Local Quality Control Procedures, for additional information.

- a. Controlling System Access and Diversion Points. Seal or lock all D/T sampler and sampling system access points (e.g., inspection plates and pipe connections) and elevator load out/in diversion points (e.g., turnheads) that cannot be visually or electronically monitored by official personnel.

Note: Generally, use security seals—not locks—unless official personnel are always onsite.

- b. Broken Seals/Locks.
 - (1) If the elevator manager informs you that elevator personnel broke one or more security seals/locks in the course of normal operations (e.g., replacing a torn D/T dust seal), physically examine the affected area or equipment and, if the integrity of the D/T sampling system is not compromised, replace the broken security seals/locks.
 - (2) If the elevator manager does not inform you that any security seals/locks are broken, but on subsequent investigation you find one or more broken security seals/locks, determine if there is a reasonable explanation:
 - (a) *If yes*—physically examine the affected area or equipment and, if satisfied that the integrity of the D/T sampling system is not compromised, replace the broken security seals/locks.
 - (b) *If no*—suspend the D/T's authorization and inform your supervisor and the elevator manager.
 - (c) *If unsure*—contact your supervisor or the local FGIS field office manager.
 - (3) Document the situation, including the reason why (if known) the seals/locks were broken, and all seal/lock numbers (broken and new). In accordance with monthly check procedures, listed in Chapter 4 of the [FGIS Mechanical Sampling Systems Handbook \(MSSH\)](#), maintain original paperwork and documentation in the D/T logbook at the elevator/work site and, when practical, keep a copy of all documentation at the specified service point.

- (4) If suspended, the D/T system must undergo a complete semi-annual examination before being returned to service. When deemed necessary, official personnel may also require that a performance test, as described in the FGIS Mechanical Sampling Systems Handbook, be performed.
 - (a) After a suspended system has been returned to service, physically check the security seals/locks on a daily basis until the next semi-annual examination.
 - (b) If the sampling system security is not compromised during this 6-month period, return to checking seals and locks on a periodic basis.

3.4 GRAIN QUALITY CHECKS

Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See [Appendix 1](#), Local Quality Control Procedures, for additional information.

When sampling grain which is being loaded into or unloaded from a unit train (Cu-sum only), a fleet of barges (Cu-sum only), a standard-size (river) barge, or an ocean-going vessel, perform the following:

- a. Periodically, monitor elevator operations to ensure that the sample being collected represents the lot being loaded/unloaded.
- b. Examine subsamples and component samples for heating, distinctly low quality (DLQ), unusual conditions, odor, and infestation. If inspected under the Cu-sum plan, check grading factors. (See [Table 3.1 – Sample Analysis Intervals](#).)

Note: If it is not possible to examine subsamples/component samples at the collection site, examine them later at an inspection laboratory.

- (1) At least once every 5,000 bushels, remove the grain sample from the collection box or container. This sample is called a subsample.
- (2) Determine if the subsample is heating, DLQ, has any unusual condition, or has a musty, sour, or commercially objectionable foreign odor.

Note: Subsamples may also be examined for insects injurious to stored grain. If this procedure is used, the total number of insects found in all subsamples comprising the component must be used to determine if the component is "[infested](#)."

For instance, if one weevil is found in the first subsample and one in the second, the component has two weevils and is considered to be "[infested](#)." (See the [FGIS Stored-Grain Insect Reference](#), linked here and above.) If the subsamples are checked for insects, it is not necessary to combine subsamples and examine component samples.

- (3) If the subsample is found to be heating, DLQ, have an unusual condition, or have an off odor, complete a sample ticket that notes the condition found. Then, place the sample—with the sample ticket—in a separate container and notify your supervisor and the elevator manager immediately.
 - (4) If the subsample is in sound condition, then it may be combined with the next consecutively drawn subsample(s) to form a component sample. A component sample represents approximately 10,000 bushels of grain and should be approximately 2,500 grams in size.
 - (5) Sieve the component sample and then check the grain on top of the sieve and the material that passed through the sieve for insects. Do not sieve more than 1,000 grams at a time. For sieve size selection, follow the guidelines listed below:
 - (a) Use an 8/64-inch round-hole sieve for corn and soybeans.
 - (b) Use a .064-inch X 3/8-inch oblong-hole sieve for other grains.
 - (c) With the approval of both the official agency and the local FGIS field office manager, other sieve sizes may be used if needed to optimize particle separation and enhance the examination process.
 - (6) If insects are detected, note the kind and number of insects found on a sample ticket. Then, place the sample—with the sample ticket—in a separate container and notify your supervisor and the elevator manager immediately.
 - (7) If the component sample does not contain any insect(s) injurious to stored grain, then it may be combined with another component sample(s) to form a subplot or lot sample.
- c. Monitor the grain stream, as practical, for foreign material too large to enter the D/T and SM samplers, such as cobs, coal, concrete, stones, wood, paper, glass, lumps, and dead animals. If large foreign material is present in the grain stream, immediately inform your supervisor and the elevator manager. Document your observation on the sample ticket.

Caution: Do not attempt to remove objects from the grain stream.

TABLE 3.1 - SAMPLE ANALYSIS INTERVALS

CARRIER(S)	FREQUENCY OF EXAM (Approximate)	FACTOR(S) ANALYZED
Ships/Barges (Cu-sum)	Maximum 5,000 bushels (subsample)	Odor, heating, DLQ, unusual conditions
	Maximum 10,000 bushels (Component)	Grading factors¹, Infestation²
Unit Trains (Cu-sum)	Individual car basis (Subsample/Component)	Grading factors¹, Infestation², odor, DLQ, heating, unusual conditions
Articulated Railcars (Cu-sum)	Individual "unit" basis (Subsample/Component)	
Articulated Railcars (Single-Lot)	Individual "unit" basis	Infestation², odor, heating, DLQ, unusual conditions
Standard Railcars (Single-Lot)	Individual car basis	Infestation², odor, heating, DLQ, unusual conditions
Barges (Single-Lot and Cu- sum)	Maximum 5,000 bushels (subsample)	Odor, heating, DLQ, unusual conditions
	Maximum 10,000 bushels (Component)	Infestation²
Trucks (Single-Lot)	Individual truck basis	Infestation², odor, heating, DLQ, unusual conditions

¹ Under the Cu-Sum plan, examine for "more than a two-grade difference in grade factor results" (see the [FGIS Grain Inspection Handbook, Book III](#), for more information about checking the quality of grain loaded aboard ships, barges, and unit trains).

² Tolerances apply to individual trucks, railcars, rail "units," and barge/ship/unit train components. Minimum sampling rate for bargelots/shiplots is 500 grams for each 2000 bushels sampled.

TABLE 3.2 - TROUBLESHOOTING GUIDE FOR SAMPLERS

INCIDENT	POSSIBLE CAUSE	ACTION
1. Grain does not flow into collection box or only dribbles.	1–2. The sample delivery system and/ or the grain flow system is: (1) clogged with lumps of grain or dust, (2) leaking, (3) plugged with stones or other debris too large to enter the pelican, or (4) not operating properly because the timer is set incorrectly.	1–2. Notify the elevator manager of problem. Check operation and/or timer setting—reset timer if needed.
2. Grain flows into collection box, but when collected, the sample is not the normal/proper size (i.e., there is more, or less grain than usual.)		
3. Grain in the collection box contains an unusual amount of dust or foreign material.	3. If the delivery system is secure and tight, then the dust seals may not be properly installed, or they may be worn or torn.	3. Have elevator manager check, replace, or reinstall dust seals. If dust seals are working, check delivery system.
4. The control panel indicates that the D/T pelican is at rest, but grain continues to dribble into the collection box.	4. The pelican is not properly seating/resting against the dust seals, dust seals are worn, or dust seals are torn.	4. Have elevator manager align pelican or replace/reinstall dust seals.
5. The sampling area is dirty and/or contains spilled grain, debris, or other obstructions.	5. Sampling area is not being cleaned.	5. Ask the elevator manager to have the area cleaned.
6. The lighting in the sampling area is poor or the lighting is inadequate to properly perform sampling duties.	6. Insufficient lighting in sampling area.	6. Ask the elevator manager to replace the bulbs or replace the light fixtures in the affected area.
7. The D/T sampling system breaks down during the sampling of an export cargo grain shipment and there is no other D/T sampling system available.	7. D/T sampler breakdown.	7. Sample the remainder of the lot with either a pelican or Ellis cup sampler.
8. The D/T sampling system fails during the sampling of a domestic grain lot. No other D/T sampling system available.	8. D/T sampling system fails.	8. Sample the remainder of the lot with an alternative sampling device. Show the actual sampling method(s) used on the sample ticket regardless of the time or amount of grain loaded after D/T failure.
9. The D/T sampling system is making an unusual noise and/or becomes hot during operation.	9. A potentially hazardous condition.	9. Leave the sampling area immediately and notify the elevator manager.
10. Air pressure and/or voltage is low with or without a load (e.g., pelican slows).	10. Air pressure and voltage not being maintained.	10. Notify the elevator manager

INCIDENT	POSSIBLE CAUSE	ACTION
11. A sample is spilled, thrown, dropped, stored in an improper manner, or stored in an area not under control of official personnel.	11. Sample mishandled.	11. Immediately notify your supervisor. Such samples are no longer representative. The sample may, however, be inspected as a submitted sample.
12. Angoumois moths are found flying or crawling around the lot.	12. Angoumois moths present in or around grain lot being sampled.	12. Estimate the number of moths observed and record on the sample ticket.
13. Insect infestation is found in, on, or about the lot/carrier.	13. Insects present in or around grain lot being sampled.	13. Record the number and type of insects on the sample ticket.
14. Large stones and sticks, pieces of metal, fertilizer, or rodent or bird excreta are found in, on, or about the lot/carrier.	14. Large stones and sticks, pieces of metal, fertilizer, or rodent or bird excreta are found in, on, or about the lot/carrier.	14. Record, as applicable, the amount, size, number, and the location of such material on the sample ticket.
15. An unusual condition is observed that may affect the quality of the lot.	15. The lot being sampled has an unusual condition that may affect the quality determination.	15. Describe the condition, in detail, on the sample
16. An off odor is detected.	16. The being sampled has an off odor.	16. Describe odor on the sample ticket.

**CHAPTER 4
ELLIS CUP AND PELICAN SAMPLING**

CONTENTS

4.1	ELLIS CUP SAMPLING.....	4-2
4.2	PELICAN SAMPLING.....	4-4
4.3	GRAIN QUALITY CHECKS	4-6
	TABLE 4.1 - MINIMUM NUMBER OF SETS.....	4-2
	TABLE 4.2 - MINIMUM NUMBER OF CUTS	4-4

4.1 ELLIS CUP SAMPLING

- a. The Ellis cup is a manual device, constructed of lightweight, high tensile strength aluminum, and designed to draw a sample from grain as it moves on conveyor belts. See Chapter 7, section 4, of the [FGIS Equipment Handbook](#) for design specifications.
- b. To obtain a representative sample with an Ellis cup, the sampler must periodically (approximately once each 500 bushels) draw three cup-fills of grain (a set) from the moving stream. [Table 4.1 – Minimum Number of Sets](#), shown below, provides the minimum number of sets that must be drawn from each type of carrier:

TABLE 4.1 - MINIMUM NUMBER OF SETS

Carrier	Minimum Number of Sets
Hopper Car	2 sets per compartment
Boxcar	4 sets
Truck	2 sets
Barge/Ship	1 set per 500 bushels

- c. When using an Ellis cup, the sample must be drawn at a location in the elevator's load-out or load-in system that will ensure its representativeness.
 - (1) Outbound Grain. Draw the sample after the final elevation of the grain and as close as physically practicable to the end of the loading spout.
 - (2) Inbound Grain. Draw the sample before, or immediately after, the initial elevation of the grain.
- d. Draw sets at random intervals as follows:
 - (1) Face "upstream" and firmly grasp the Ellis cup in both hands.
 - (2) Stand as close to the point where the grain is delivered to the conveyor belt as possible. The area where you stand should be free of loose grain and be well-lit.
 - (3) To avoid the possible loss of the Ellis cup, fasten one end of a cord to the cup and the other end to a secure object.

Caution: Under no circumstances should the Ellis cup be tied to you or another person or in a manner that increases the potential for injury.

- (4) With its open-end facing into the grain flow, insert the heel (curved portion) of the Ellis cup into the center of the grain stream.
- (5) Push the open end downward through the grain until the bottom of the cup is parallel with the belt.

Caution: Avoid catching the cup on the splice that connects the belt ends. The location of the splice can be identified by ripples that usually occur over it in the grain stream.

- (6) When the cup is full, move the open end of the cup upward and remove the cup from the stream. Pour the contents of the cup into a sample collection container.
- (7) Draw two more portions from the stream, one at a point halfway between the center and the right edge of the stream, and the other at a point halfway between the center and the left edge. Pour each cup into the sample collection container.

4.2 PELICAN SAMPLING

- a. Pelican samplers are constructed of a russet, top grade cowhide pouch attached to a metal frame. The back edge of the frame is higher than the front to help catch more grain and direct it into the pouch, even when the pelican is not perfectly vertical in the grain stream. See the [FGIS Equipment Handbook](#) for design specifications and the [Sampling Procedures](#) training resources available on the AMS website.
- b. To obtain a representative sample with a pelican, the sampler must periodically (approximately once each 500 bushels) take a pelican (i.e., a cut) of grain from the falling stream. The following [Table 4.2 – Minimum Number of Cuts](#), shows the minimum number of cuts required for each type of carrier.

TABLE 4.2 - MINIMUM NUMBER OF CUTS

Carrier	Minimum Number of Cuts
Container	2 cuts
Hopper Car	2 cuts per compartment
Boxcar	4 cuts
Truck	2 cuts
Barge/Ship	1 cut per 500 bushels

- c. Take cuts at random intervals as follows:
- (1) Have the loading spout positioned so that the pelican can be easily swung through the entire falling stream of grain.
 - (2) Check your footing and position yourself close to the spout. Be sure that the area is reasonably clear of grain, debris, and any obstacles.
 - (3) Hold the pelican so that the pouch is next to the falling stream with the high side next to the stream of grain, such that it enters the grain stream first.
 - (4) Grasp the pelican firmly, then swing it completely through the stream of grain in one continuous motion. The direction of the swing is not specified, but it is important to keep the pelican opening facing into the grain stream throughout the swing and to cut the entire stream of grain.
 - (5) Pour the contents of the pelican (i.e., the cut) into a sample collection container.

4.3 GRAIN QUALITY CHECKS

Official agency managers, in cooperation with local FGIS field office managers, may modify these procedures, when deemed necessary. See [Appendix 1](#), Local Quality Control Procedures, for additional information.

When sampling grain being loaded into or unloaded from a unit train (Cu-sum only), a fleet of barges (Cu-sum only), a standard-size (river) barge, or an ocean-going vessel, do the following:

- a. Periodically, monitor elevator operations to ensure that the sample being collected represents the lot being loaded/unloaded.
- b. Examine subsamples and component samples for heating, DLQ, unusual conditions, odor, and infestation. DLQ conditions are found for each type of grain in the [FGIS Grain Inspection Handbook II, Grain Grading Procedures](#). If the lot is being inspected under the Cu-sum plan, also check grading factors. (See [Table 3.1 – Sample Analysis Intervals](#).)

Note: If it is not possible to examine subsamples/component samples at the collection site, examine them later at an inspection laboratory.

- (1) At least once every 5,000 bushels, remove the grain sample from the collection box or container. This sample is called a subsample.
- (2) Determine if the subsample is heating, DLQ, has any unusual condition, or has a musty, sour, or commercially objectionable foreign odor.

Note: Subsamples may also be examined for insects injurious to stored grain. If this procedure is used, the total number of insects found in all sub-samples comprising the component must be used to determine if the component is "[infested](#)." (See the [FGIS Stored-Grain Insect Reference](#), linked here and above.)

For instance, if one weevil is found in the first subsample and one in the second, the component has two weevils and is considered to be "[infested](#)." If the subsamples are checked for insects, it isn't necessary to combine subsamples and examine component samples.

- (3) If the subsample is found to be heating, DLQ, have an unusual condition, or have an off odor, complete a sample ticket that notes the condition found. Then, place the sample—with the sample ticket—in a separate container and notify your supervisor and the elevator manager immediately.
 - (4) If the subsample is in sound condition, then it may be combined with the next consecutively drawn subsample(s) to form a component sample. A component sample represents approximately 10,000 bushels of grain and should be approximately 2,500 grams in size.
 - (5) Sieve the component sample and then check the grain on top of the sieve and the material that passed through the sieve for insects. Do not sieve more than 1,000 grams at a time. For sieve size selection, follow the guidelines listed below:
 - (a) Use an 8/64-inch round-hole sieve for corn and soybeans.
 - (b) Use a .064-inch X 3/8-inch oblong-hole sieve for other grains.
 - (c) With the approval of both the official agency and the local FGIS field office managers, other sieve sizes may be used if needed to optimize particle separation and enhance the examination process.
 - (6) If insects are detected, note the kind and number of insects found on a sample ticket. Then, place the sample—with the sample ticket—in a separate container and notify your supervisor and the elevator manager immediately.
 - (7) If the component sample does not contain any insect(s) injurious to stored grain, then it may be combined with another component sample(s) to form a subplot or lot sample.
- c. Monitor the grain stream, as practical, for foreign material too large to enter the Ellis cup or pelican samplers, such as corn cobs, coal, concrete, stones, wood, paper, glass, lumps, and dead animals. If large foreign material is present in the grain stream, immediately inform your supervisor and the elevator manager. Document your observation on the sample ticket.

Caution: Do not attempt to remove objects from the grain stream.

**CHAPTER 5
REVISION HISTORY**

CONTENTS

CHANGE NO. 1: JULY 23, 20205-2

The Grain Inspection Handbook, Book I, Sampling, was revised to incorporate policy and procedural changes throughout the entire handbook, since its initial date of publication, as well as re-formatting and editorial updates to maintain in compliance with [FGIS Administrative Directive 3010.2](#), “Policies, Procedures, and Guidance Issuance.”

For all substantive revisions, updated hyperlinks were embedded within the text to link directly to both internal and external content wherever possible. Explicit reference was made to the following FGIS Directives:

- [FGIS Directive 9070.6](#), “Reporting Violations of the U.S. Grain Standards Act and the Agricultural Marketing Act of 1946”
- [FGIS Directive 9070.5](#), “Grain Handling Practices”
- [FGIS Directive 9060.2](#), “Implementation of the FGIS-FDA Memorandum of Understanding”
- [FGIS Directive 9170.14](#), “FGIS Rolling Stock Fall Protections”
- [FGIS Directive 4735.2](#), “Uniform and Identity Apparel and Dress Code Policy”
- [FGIS Directive 9180.41](#), “Sacked Grain”
- [FGIS Directive 9020.1](#), “Exemptions and Waivers of Official Inspection and Class X Weighing Requirements”

Additionally, acronyms and organizational details were updated to reflect accurate administrative structure and associated program information (e.g., reference to the Grain Inspection Packers and Stockyards Administration (GIPSA) was replaced by the Federal Grain Inspection Service (FGIS)).

**APPENDIX 1
LOCAL QUALITY CONTROL PROCEDURES**

CONTENTS

1.	GENERAL	A1-2
2.	RESPONSIBILITIES.....	A1-2
3.	APPROVAL CRITERIA.....	A1-2
4.	REQUEST FOR APPROVAL	A1-3

1. GENERAL

Even though this handbook is designed to be used by all official samplers at all sampling sites, FGIS realizes that some of the requirements and stipulations stated herein may not be appropriate or necessary in all situations. To better address such situations, official agency/FGIS field office managers may develop *local quality control procedures*. These procedures, which must comply with certain general requirements (see below), may be used in conjunction with or in place of the procedures established by Book I, Sampling.

2. RESPONSIBILITIES

Local quality control procedures.

- a. May be developed by official agency managers and/or FGIS field office managers.
- b. Must be reviewed and approved by both the official agency manager (when applicable) and the local FGIS field office manager prior to being implemented.
- c. Once approved, must be submitted to the Policies, Procedures, and Market Analysis branch by the local FGIS field office manager.

3. APPROVAL CRITERIA

Local quality control procedures.

- a. Be reasonable (i.e., proper for the situation, cost-effective, and practical).
- b. Comply with applicable provisions of the USGSA and the regulations thereunder.
- c. Comply with all FGIS and OSHA safety requirements.
- d. Have the consent of elevator management if elevator operations are affected (e.g., the D/T sampler must be shut down every 4 hours).
- e. Not compromise the integrity/representativeness of the official sample.
- f. Be nondiscriminatory.

4. REQUEST FOR APPROVAL

- a. All requests for approval of local quality control procedures must be submitted, in writing, to the local FGIS field office manager for final approval.
- b. The approved request must be signed and dated by both the official agency manager (when applicable) and the local FGIS field office manager.
 - (1) A copy of the request and quality control plan must be placed on file at the official agency's main office (when applicable) and at the local FGIS field office. They must remain on file until such time as the procedures are changed or rescinded.
 - (2) A copy of the quality control plan must be available at the service point/sampling site.