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

Directive

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PARAMETERS FOR AUTOMATED MONITORING AND SUPERVISION OF OFFICIAL WEIGHING

Contents

1. PURPOSE

This Program Directive establishes a list of parameters for developing an automated monitoring system. This system will produce necessary documentation and incorporate necessary safeguards such that automated official grain weighing and material handling systems can be operated without 100 percent official physical supervision. This can be accomplished by installing an approved Federal Grain Inspection Service (FGIS) Federal Control System (FCS). FGIS makes no effort to dictate specific design of the system; however, each FCS must meet the requirements of FGIS regulations and instructions and will be inspected and tested by FGIS prior to approval for official use. On November 10, 1993, FGIS published Program Directive 9160.2, “Implementation of Automated Official Monitoring and Control Systems,” which provides guidance for implementation of these projects.

2. REPLACEMENT HIGHLIGHTS

This directive supersedes FGIS Program Directive 9160.3, dated 3-06-95. This revised directive specifies requirements for digital video storage (DVR) to be used for closedcircuit television (CCTV) systems. Time-lapse video cassette recorders are no longer acceptable. Additionally, it is updated to reflect organizational and format changes.

3. POLICY

It is FGIS policy to encourage the grain industry to automate weighing, sampling, and material handling systems to assist in improving the efficiency and effectiveness of official service.

4. AUTHORITY

Authority to provide this service is included in the United States Grain Standards Act, as amended (USGSA) in Section 7A (a), (b), (c)(1), and the regulations and instructions written thereunder.

5. BACKGROUND

Official grain weighing is required under the USGSA to ensure accurate and correct operation of grain scales and related grain handling equipment, and to document official weighing. Official supervision and monitoring requires observing and documenting performance of the weighing and material handling system. Weight logs, scale record logs, printed scale tapes, scale test reports, video recording, etc., can be used to verify that performance. The following parameters have been developed and sent to interested grain elevators and contractors for use in developing new systems. These parameters are guidelines and are not intended to be, nor can they be, all-inclusive, due to the wide differences between elevator designs and material handling equipment used. In order to eliminate the need for an FGIS weigher to be physically present during official weighing, all the duties and tasks of that position must be performed automatically by the FCS or other official personnel. Only FGIS has the authority to determine whether its regulations and instructions are being met.

6. SYSTEM PARAMETERS

The following parameters include examples of methods, equipment, and procedures that have been found acceptable by FGIS on past approved systems.

a. Basic System Parameters. Basic system parameters must include, but not be limited to the following:

(1) The system must be relatively SIMPLE to operate. (Consideration must be given to physical layout of equipment, facility workload, and ease of operation when integrating weighing and inspection services.) The system MUST NOT be accessible to elevator personnel except for operational controls expressly designed for their use. (Security is a major consideration in approving the system. Physical security, i.e., key locks or seals, is recommended.)

(2) The scale system must meet or exceed all the appropriate specifications and tolerances of the National Institute of Standards and Technology (NIST) Handbook 44, 2002 Edition, as defined by FGIS.

(3) The system must be under the complete control of FGIS at all times. The system must be secure from use or intervention except when authorized by FGIS.

(4) The system must provide visual indications and a nonvolatile record of all elevator operations necessary to ensure correct operation as defined by handling system's critical paths and the designation and position of all movable devices such as gates, slides, basket valves, turn heads, sampling equipment etc. Belt, drag, leg, and diverter type mechanical sampler movement, and grain flow must be displayed as close to real time as possible.

(5) The system must be designed so that no data or information can be lost during standard operating procedures or in the event of a power failure. Uninterruptible power supplies are suggested and have been used successfully.

(6) Equipment design incorporating self-diagnostic checks that ensure the integrity of the official material handling system, and weighing system and the proper operation of the grain sampling equipment is strongly encouraged. Automatic self-diagnostic checks are encouraged. A record of these checks is required.

(7) The system must provide an audible/visual alarm, print a record, and stop operation should the weighing, mechanical sampling, or material handling system fail, operate out of sequence, or operate incorrectly. Alarms must be visual and audible, and distinguishable from one another, if necessary.

(8) The system must provide for weighing documentation as defined by FGIS and required in Chapters 1, 2, and 3 of the Weighing Handbook. In addition, an "Events Log" must be produced which provides a chronological record of all events. A machine-readable events log is preferred. (An event is defined as any incident, occurrence, milestone, happening, phenomenon, or action requiring documentation, as defined by FGIS.)

(9) The system must be capable of determining when a component and sublot is reached as outlined in the Grain Inspection and Weighing Handbooks, and capable of consecutively numbering and recording sublots.

(10) Input/Output devices used in the system (i.e., printers, monitors, etc.) must be reliable and of high quality.

(11) The system must be capable of operating for other than official weights, if necessary. The ability to perform unofficial weighing, transferring grain, etc., if necessary, must be designed into the system, so that it does not compromise FGIS system security.

(12) The system must be designed to accept modifications necessary to facilitate changes in elevator operations or FGIS procedures.

b. Weighing System Requirements. The scale system must include, but not be limited to, the following specific requirements as defined by FGIS:

(1) The scale system must have National Type Evaluation Program (NTEP) approval. Caution should be taken when modifying or adding to an approved NTEP scale system, so as not to damage the approval. Modifications to approved NTEP systems must be re-approved by NTEP and/or FGIS.

(2) The system must meet the appropriate requirements of FGIS regulations (parts 800, 801, and 802), the Mechanical Sampling Systems Handbook, and instructions as listed in Chapters 1, 2, and 3 of the FGIS Weighing Handbook.

(3) The scale system must incorporate an automated testing system capable of accuracy and linearity testing to capacity. Consideration should be given to provide automated means of buildup testing and strain testing in order to obtain maximum levels of efficiency during normal equipment testing procedures.

(4) Time and date must be incorporated internally in the system for recording as required (hours, minutes, seconds) and be set only by FGIS. Consecutive numbering must be maintained during a power failure. Synchronization of all clocks in the system must ensure that all documentation recorded with time can be used to accurately reconstruct official operation of the system.

(5) The scale system must be capable of printing a minimum of an original and one copy of the following information in a format approved by FGIS. (FGIS recognizes that elevator operations vary widely and that special considerations may be necessary under special circumstances.)

(a) Elevator name and location.

(b) Designated scale number.

(c) Time of each draft.

(d) Date at the beginning of each automatic series of weighing and at a date change.

(e) Mode of operation in alphabetic characters only.

(f) Gross weight of each draft.

(g) Tare weight of each draft.

(h) Accumulated weight of each draft.

(i) Sublot number (0-99) at the beginning of each sublot.

(j) Sublot size.

(k) Preset draft size.

(l) Alarm conditions and time of alarm conditions.

(m) Recording of corrective actions taken to relieve alarm conditions.

(6) Control wiring between the scale console and remote scale equipment such as gate solenoids, limit switches, and level detectors must be under FGIS' control. There must be no electrical contacts or other devices in series with scale control wiring unless those devices (e.g., programmable controllers) are under the complete control of FGIS, including hardware and software. Wiring junction points, such as terminal strips, must be capable of being sealed with security seals provided by FGIS.

(7) Input and output wiring for load cells must be installed in separate conduit between the scale and control console. Load cell junction boxes must be capable of being security sealed by FGIS. Multiple scale installations may use common conduit for all load cell input and output wiring.

c. Basic Security Requirements. The system must be made secure from security breaches as defined by FGIS, resulting from, but not limited to:

(1) Irresponsibility - willfully or accidentally causing damage to the system, such as deletion or corruption of data files;

(2) Probing - exploiting an inherent weakness in the design of a system to intentionally seek access to protected data, controls, or permissives; or

(3) Penetration - intentional breaking of system security for the purpose of gaining access to protected data, controls, or permissives.

d. Specific Control System Requirements. A material handling system interfaced with the weighing system must include, but not be limited to, the following specific requirements as defined by FGIS:

(1) Provisions must be made to automatically ensure that all grain offered for official inbound weights is delivered from the carrier to the scale, and all grain offered for official outbound weighing is delivered from the scale to the carrier and properly stowed.

(2) All critical paths and diversion points must be automatically monitored by the FCS. Typically, this has been accomplished by using a programmable logic controller (PLC) under the security of FGIS.

(3) Provisions must be made to ensure that all exported grain is officially weighed. Automatic diverter-type grain sampler operation monitoring must be included in the official record.

(4) Provisions must be made to ensure that once official automatic operation has been initiated, any change in the preset conditions of the material handling system, sampling system, or weighing system will cause an alarm to indicate visibly and audibly, record on the event printer, and stop the weighing operation. (Diversion points should be controlled and automatically monitored to eliminate time-consuming physical checking by official personnel.)

(5) Shipping bin discharge permissive switches must be under the complete control of FGIS.

(6) Provisions must be made to ensure proper automatic purging of all belts, drags, legs, etc.

e. Basic Operator Interface Requirements. Basic operator interface requirements must include, but not be limited to:

(1) A visual graphic display of the material handling system, including all components (i.e., belts, drags, legs, mechanical or automated diversion points, etc.), must be provided to verify flow paths. The present operating condition (on/off position) of gates or valves (open/closed) must be clearly indicated and automatically monitored.

(2) The video graphic display of the material handling system must be designed to be displayed on one screen, whenever possible. Multi-screen material handling system displays must have a screen update time of 5 seconds or less (screen to screen.)

(3) Input and output devices must be of high quality and easily operated. Keyboards must have permanent key markings and dust covers, if necessary. Trackball rather than mouse operation is recommended hardware.

(4) Terminals not under direct FGIS control must have “view only” access to the system.

f. Automatic Checking Parameters. The system must provide for, but not be limited to, the following automatic check functions:

(1) The system must provide for time to be printed to the nearest second and for all clocks in all components of the system to be automatically synchronized at least three times in a 24-hour period at the beginning of each shift.

(2) The system must provide for automatic monitoring of tare weights as described in the FGIS Weighing Handbook. Erratic or unusual tare conditions must cause an alarm and print a record of the alarm condition.

(3) The system must provide for the automatic checking for leaks in upper garner and scale gates at least once per 8-hour period. Automated gate leak checks and possible gate leak conditions must cause an alarm and a record of such conditions.

(4) The system must provide for lifting of scale test weights with a prompt for official personnel to monitor the test. An interlock must be provided to ensure that test weights cannot be lifted on a scale while the scale is performing official weighing.

g. Closed Circuit Television (CCTV) - Digital Video Recording (DVR) Requirements. CCTV and DVR incorporated into the official system must meet the following requirements:

(1) CCTV must be in compliance with FGIS Program Directive 9160.1. The field office will determine the number of cameras necessary to verify proper operation.

(2) The DVR device must be capable of recording at least as many simultaneous inputs as there are cameras. It must be capable of continuous video playback of a selected individual camera input from the multiple inputs recorded, and have built-in programmable sequence switching or a split screen display with a separate output to permit operator viewing of video inputs. The DVR device must also meet the following requirements:

(a) Commercial quality.

(b) Industrial grade packaging.

(c) Sufficient storage to retain 90 days of time-lapse video without requiring manual replacement of storage media or devices.

(d) Ability to display previously recorded video while recording current video.

(e) Ability to search forward a specific date and time.

(f) Ability to write selected video to a CD, DVD, or other secure nonrewritable storage medium in a form that can be viewed on a desktop computer.

(g) Built-in time and date stamp

(h) Operating temperature range: at least 41° to 104° F.

(i) Operating humidity range: at least 35 to 80 percent.

(j) If video storage is motion-activated, all cameras must be recorded whenever any one is being recorded. Recording must occur continuously at a minimum rate of one frame per second for each camera whenever a vessel or barge containing officially weighed or inspected grain is at the facility.

(3) Video may not be stored at lower resolution than the original images, or in black and white if the original was in color, for purposes of data compression. However, the field office may grant an exception to this requirement if it has evaluated the stored video and found it adequate.

h. Printer Parameters.

(1) Printers used with the weighing system or automated monitoring system must be of high quality and capable of printing on multi-copy official certificates. The printed information must be immediately available for review.

(2) All printers printing official documentation must be under the complete control of FGIS.

i. FGIS Permissive Requirements. The term “FGIS Permissive” is defined as a control requiring a physical action or response by official personnel during normal operation to maintain grain flow security (e.g., release of a shipping bin after receiving a grade, consent to proceed with normal operation after obtaining a correct barge number, or consent to proceed with official weighing). FGIS permissives should not be confused with “Interlocks,” which are designed into the system but which operate automatically.

The following permissives are required to be designed into the system to give FGIS the necessary controls during operation. This list contains the minimum permissives required and additions may be necessary. FGIS recognizes that there are many ways of obtaining a permissive action during official operation and is not attempting to suggest design. We recognize that time and efficiency are of the essence.

(1) A “Sign-On” permissive is required at the start of each shift which will allow the names or initials of the official operating personnel and the time to be recorded on the event record. Capability for recording changes in personnel are also necessary, however, no delays in operation should be encountered for recording changes in personnel. Sign-on entries must have password security.

(2) An “OK to Weigh” permissive is required which will prohibit official operation until official personnel are on station, have signed on, and are ready for official operation of the system. This must be recorded with the time.

(3) A “Fill Complete - Pull Sample” indication is required which will be provided to the official personnel and must be acknowledged. The sampler will be provided with indications of sampler/shipping bin in start, use, and complete.

(4) A “SHIP” or “REJECT” permissive is required to prevent release of a shipping bin until a grade is determined and a decision is made to accept or reject the bin. This must be recorded with the time.

(5) An “END OF SHIP WEIGH BACK” or “EOSWB” permissive is required to signal the end of the ship and allow any remaining portion of a lot to be officially weighed back to the house. This must be recorded with the time.

(6) A “Barge ID Checked” or “Barge ID Recorded” permissive is required to ensure the barge number is checked and properly recorded prior to weighing the barge grain. CCTV is generally used to make this check. This must be recorded with the time.

(7) A “Barge Complete” or “Barge Empty” with “Yes/No” permissive is required to ensure the barge has been checked for clean-out and if necessary, an estimate is physically made of remaining grain. This must be recorded with the time.

j. Alarm Requirements. An alarm is defined as an indication that an improper condition exists within the system; i.e., sampler malfunction, improper flow path detected, gate opened manually, erratic tare weight detected. The system must provide for, but not be limited to, the following alarm criteria as defined by FGIS:

(1) Alarm conditions must be visible, audible, and printed on the event record.

(2) The system must provide for recording of corrective actions taken to relieve alarm conditions.

(3) The system must provide for, but not be limited to, the following required alarm conditions:

(a) Erratic tare weight.

(b) Scale over capacity.

(c) Scale in test mode.

(d) Sampler malfunctions or sampler inoperative.

(e) Possible spill alarms for spill areas not covered by CCTV; e.g., plug chute alarm.

(f) Improper flow conditions.

(g) Unauthorized gate, valve, slide, or other openings.

(h) Improper gate, valve, turnhead sets; i.e., double sets.

(i) Printer malfunctions.

(j) PLC system alarms; e.g., rack fault, PLC processor in program mode, online programming being performed.

k. Required System Documentation. As defined by FGIS and required under FGIS regulations the following documentation must be provided to FGIS and will include, but not be limited to:

(1) One system proposal describing, in detail, the system and the proposed operation.

(2) One complete reproducible set of the field wiring diagrams.

(3) One complete reproducible set of technical manuals/operating instructions for all hardware and software.

(4) One complete set of software programming on all components of the system in diskette form.

7. FGIS APPROVAL

FGIS approval of an FCS is provided in writing from the Director, Field Management Division, upon completion of the following requirements:

a. Successful completion of a 6-month test period initiated by FGIS upon completion of installation and system check-out by the elevator/contractor. During this trial period, all seals and other security measures intended for use with the system will be applied; and problems, corrections, and changes to the system will be documented.

b. On-the-job training in system operation is provided to FGIS personnel.

c. Receipt of local field office manager's recommendation for approval of the system by the Policies and Procedures Branch (PPB).

d. Receipt of all required documentation by the PPB.