RG NDT INTERNATIONAL INC

Sucker Rod and Tubing Inspection System

User Manual

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GENERAL OVERVIEW

Features two (2) inline inspection stations for the detection of:

1. Transverse and three dimensional flaws, and
2. Wall or metal loss.

The flaw detecting station employs air actuated shoes that contact the product surface. The shoes contain small coils to detect flux leakage
caused by flaws. The detected signals are amplified and processed via a Z2120 single board computer.

The largest indication at any given time is scaled and transferred to a laptop computer that serves as a display and recorder. A second means of recording is provided through the use of a four (4)-channel thermal chart recorder.
Odd channels are displayed on one trace (trace Number 3), while even channels are displayed on a second trace (trace Number 4). The electronics also feature preamplifiers and peak-detectors to assure that the computer recognizes the significance of every indication.

The wall monitoring station employs an encircling array of Hall devices that monitor the product traveling through the station. These non-contact transducers detect metal loss or gain. Changes in metal thickness are detected and processed via a second Z2120 single board computer. When tubing is inspected the computer provides two (2) outputs, the first output indicates the average wall thickness (trace Number 1) and the second output indicates the smallest wall (trace Number 2). When sucker rod is inspected, one output indicates total metal loss and the second its smallest diameter.
Tubing metal hardness alter magnetic wall thickness monitoring.

These two (2) computers, flaw detection preamplifiers, flaw peak detectors,
an interface card for magnetic wall, electronic power supply, and relays to control magnetizing point are housed in the electronic desk. The controls allow the operator to set sensitivity and linearity. Alarms are both audible and visual. Tracking numbers can be placed on the chart through the keyboard and streamlined to memory.
Four (4) photo eyes control the pinch rolls, the activation of the flaw shoes,
and the magnetization point.

THE FLAW DETECTING AND PROCESSING SYSTEM

The Z2120 has the following seven (7) control keys:

1. A right arrow key to move the a cursor to the right,
2. A left arrow key to move the cursor to the left,
3. An Up arrow key to move the cursor up,
4. A down arrow key to move the cursor down,
5. A "+" key to increase the gain,
6. A "-" key to decrease the gain,
7. An "enter" key to lock the desired setting.

In addition:

1. A ten (10) turn potentiometer labeled REJECT allows linear rejection of small noise indications from the thermal recorder and the laptop computer screen,
2. A switch labeled ALARM enables the audible alarm,
3. A switch labeled FAST enables fast operation while disabling the display screen.

The display (122x32 LCD) screen. is both graphical and alpha numeric. Vertical bars labeled 1 through 8 indicate the flaw signal levels. A vertical bar labeled R, with a dashed line on top indicates the REJECT threshold. The right hand of the display contains the alpha numeric information.

The first line indicates the program version "inspect 3".
The second line allows moving from the RUN mode to the reset (RST) mode, to the calibrate (CAL) mode. This is accomplished when the RUN/FAST switch is in the RUN mode and the cursor is addressed through the "UP", "DOWN", "RIGHT", and "LEFT" keys.

The third item on the right hand indicates the overall gain of the system as "N=1.00". This overall gain can be raised or lowered with the "+" and "-" keys. A RETURN key is used to lock the new setting. The bottom line of the alpha numeric display allows monitoring of individual channel gain and reject threshold.

The RIGHT and LEFT keys allow moving from one channel to the other. The respective gain is displayed and can be increased or decreased with the "+" and "-" keys only when the channel is selected. A RETURN key should be used to lock any setting. The Questionable and REJECT threshold level settings are to the right of channel 8.

When a small diameter tube or a sucker rod is inspected four (4) shoes are engaged with the product after it passes through the second photo eye. When a larger diameter tube is inspected eight (8) shoes are engaged with the product after it passes through this photo eye. The photo eye detects the incoming product and activates a timer, at the end of the timing interval the air head

shoes are lowered. Activation of the shoes can be disabled, enabled or executed automatically by a manual switch labeled ”AIRHEAD”.
In the AUTO position the airhead is activated a short time after the pipe passes through photo eye Number 2. In the OPEN position the shoes will not activate, and in the close position the shoes are forced down.

Signals from the coils in the shoes are cabled to preamplifiers via a 17 pin plug, processed via a peak detector and scaled by the computer. The operator can select any specific channel and alter its sensitivity with the “+” or “-“ keys. A RETURN assures that the selected sensitivity is maintained. The sensitivity of a channel is shown as “G1=010”, for example. This label can be read as Gain of channel 1 is set to 10%. A display indication of “G3=015” shows that the Gain of channel 3 is set to 15%.

Address the channel, and increase or decrease the sensitivity with the “+” and “-“ keys, locking the sensitivity with the RETURN key. The “N= 1.0” allows raising or lowering the sensitivity of all channels. Two alarm thresholds are provided. One is the yellow “Y=” threshold and the second is the red “R=” threshold. The threshold levels are shown on the display. The threshold level are changed with the “+” and “-“ keys and should be locked with the return key. After the sensitivity, and two (2) alarm thresholds are set the screed can be switched to the FAST mode to speed up processing of data.

Switches are provided to disable/enable individual channels and LEDs are featured to indicate when a signal exceeds the red threshold values. The led is timed to flash for 2 seconds on each detected flaw.

When all the channels are adjusted a reject potentiometer allows rejection of noise (unwanted signals) from the thermal recorder and the laptop computer.

In the CAL mode the reset sequence of individual channels is disrupted and the computer will display the largest indication for each channel until the curser is moved to the RUN position.

A RST cursor position followed by the ENTER key resets all gain to the default settings of the computer (10% of each channel gain and the overall gain N to l.00). This is indicated, for example, as G1=010 , N=1.00.
The gain can be changed at 1% increments from 1% to 99% (G1=001 to G1=099). Once the desired gain setting is reached it should be secured with the RETURN key and the computer will “remember” the settings (until in a RESET position followed by the RETURN button is activated).

In a four (4) shoes arrangement G1, G2, G3, G4 are used. In an eight (8) shoe arrangement G1, G2, G3, G4, G5, G6, G7, G8 are used. When a four (4) shoe system is employed the operator is to de-activate the unused channel with the individual switches.

The “Y” (questionable) and “R” (bad) threshold are set via the keyboard by addressing the Y (to the right of channel 8) and selecting the “Yellow alarm level” with the”+” and “-“buttons, securing it with the RETUN key.

The “R” (reject) alarm level is to the right of the Y alarm level.
Only when an indication exceeds the R alarm level does the respective LED and sound alarm activate.

The “N= “ allows overall gain adjustments by increasing the sensitivity with the “+” button or decreasing the sensitivity with the “-” button. The RETURN key is to be activated to secure the reading.

An audible alarm is activated when the switch is the ALARM position and a flaw exceeds the reject threshold.

Use the RUN or (preferably) the FAST mode while inspecting.

The ALARM light are timed to come on for two seconds for each flaw that causes a signal that exceeds the R threshold. A toggle switch enables/disables the audible ALARM.

A REJECT potentiometer allows removal of small stray signals. Make sure that the desired signals are at least twice the size of the rejected noise.

Calibration Suggestion:

Set the Mag current to 1 amp for every .100” of wall thickness.
(2 amp for wall of 0.200”, 3 amp for wall of 0.300” etc.). Increase the
voltage of the power supply and reduce the current to this level.
Pass the “standard” tubing at the specified speed of (45 to 60 fpm or13 to 18 mps) in the CAL mode.
Adjust individual channel sensitivity to indicate bars that are about 90% of the screen.
Set the questionable level to 50% of screen and the reject level to 70% of the screen.
Move to the RUN mode and verify calibration. Switch to the FAST position.

THE WALL DETECTING AND PROCESSING SYSTEM

The Z2120 has the following seven (7) control keys:

1. A right arrow key to move the a cursor to the right,
2. A left arrow key to move the cursor to the left,
3. An Up arrow key to move the cursor up,
4. A down arrow key to move the cursor down,
5. A "+" key to increase the gain,
6. A "-" key to decrease the gain,
7. An "enter" key to lock the desired setting.

In addition:

1. A ten (10) turn potentiometer labeled BIAS allows bringing various thicknesses to the operating range of the computer,
2. A switch labeled ALARM enables the audible alarm,
3. A switch labeled FAST enables fast operation while disabling the display screen.

When a small diameter tube or a sucker rod is inspected four (4) non- contact arrays are engaged positioned around the product in a constant magnetic field. Signals from the array of Hall elements are preamplifiers at the inspection station and cabled to be processed and scaled by the computer.

The operator can select any specific channel and adjust the "wall readings" when a standard product is within the magnetic field. The "CAL_HI" position allows for such individual adjustments. The "CAL_LO" position allows for calibration using a reduced body wall section. Addressing the desired channel with the cursor and altering the reading to a number related to the thickness with the "+" or the "-" buttons will serve as a calibration procedure. A return key activation secures the selected sensitivity.

The "BIAS" potentiometer allows the adjustment needed to bring various different thicknesses to the operating range of the computer. Changes in wall thickness can be monitored on a small 122x32 LCD screen when in the "RUN" mode. In the "FAST" mode the display screen is de-activated to allow for faster processing. The graphic
display part of the screen is deactivated also in the "CAL_HI" and "CAL_LO" modes.

An ALARM level is selected at the R= position. Inputs below this alarm level will
trigger the audible and visual alarms for the duration of the occurrence. Switches are provided to disable/enable individual channels.

The scale of the screen is automatically adjusted to 120% of the NOMINAL pipe thickness that was selected at the N= position. The default value of the R= is calculated to be 80% of the

nominal wall thickness. The R= default level can be altered with the “+” and “-“ buttons. Note to secure the number with the RETURN key.

One toggle switch controls the audible ALARM, and another toggle switch allows selection of the “FAST” mode (when the computer is completely engaged in the inspection process and the screen is not updated) or the “RUN” mode (when the graphic display is activated).
The keys of the Z2120 computer are similar to the keys of the previously described Flaw Detector system.

DESK CONTROLS

Two (2) Elgar/Sorenson power supplies furnish the current for the two magnetizing coils. It is recommended to operate them in the "constant current" mode. The voltage controlled potentiometer should be higher so that when the coil is hot the current does not change.

A Minarik regenerating power supply furnishes the power to the product translating motors. The conveyor speed is adjusted with an on board potentiometer. A bi-directional switch allows reversal of product direction. The pipe is translated with four (4) motors. Two (2) are mounted on the entry and exit conveyers, and two (2) are mounted on the pinch-rolls.

As the Flaw detecting shoes and the pinch rolls are not protected by the photocells in the reverse direction, make sure that the shoes are disengaged when the pipe/ sucker rod are reversed.

The Exit conveyor is furnished with an air activated kick-out. The direction of the exiting product and the kick-out timing are operator controlled.

The Sub desk contains two (2) sets of breakers. A dual breaker to limit the 220 VAC current to magnetizing supplies and a single breaker to limit the 110VAC current to conveyor supply. The Desk contains one (1) breaker limit the current to the electronics.

DIRECTION OF MAG CURRENT

The proper direction of magnetic current is so that the initial readings on the display are decreased in amplitude with an increase in magnetic current.

If the readings are increasing with an increase in magnetic current, turn off magnetic supply and reverse the magnetic current direction by switching the two leads from supply to the coil.

Turn on magnetic supply and verify that the readings are decreasing with an increase in magnetic current.

Computer programs are sole property of RG NDT Int., inc. Houston, Texas. Any change or abuse voids all warrant.

RG NDT INT. INC. warrant that the **InSpect 3** will be free from defects in material and workmanship and that it will perform substantially in accordance with this written document for a period of **ONE YEAR** from the day of purchase.

The warranty for the inspection heads, transducers and cables is limited to 60 DAYS from day of purchase.

RG NDT will repair or replace, at its sole option and **free of charge** to the original customer, any equipment that is found to be defective provided that the customer returns the defective instrument or system to RG NDT with transportation prepaid. This warranty is **void** if the defects, based on the sole judgment of IST, resulted from misapplication, accident, abuse, negligence, **tampering** or modification of the product by persons not authorized by RG NDT .

Within the ONE YEAR warranty period RG NDT will repair returned equipment that was damaged accidentally or by misapplication, at cost plus 30%.

Equipment damaged due to **abuse**, **tampering**, or **modification to the electronics will not** be repaired and will be shipped back to customer.

In no event will RG NDT be liable for any indirect, incidental or consequential damage or loss of revenue arising from the use or failure of this product. Purchaser agrees to indemnify, hold harmless and defend, including but not limited to attorney's fees, court costs travel cost, RG NDT from any claims or lawsuits that arise from the use of this product.

RG NDT reserves the right to make any changes in design or construction without incurring any obligation to retrofit units previously delivered.

This Equipment is NOT certified to be used in hazardous areas.