

AccuRay GAUGES - ZINC PLATING MEASUREMENT

GENERAL

The AccuRay beta gauge Model RBM is a non-contacting gauging device for the measurement of continuous hot-dip galvanized strip. A complete installation consists of two consoles, twin source-detector units, and interconnecting accessories.

The console is a floor mounted, sheet steel housing for a wide strip electronic recorder, measuring circuitry, control panels, indicator panels, standardization circuitry, regulated electronic power supply, constant voltage transformer, and junction box. The various functions are either individually or as a group contained in utilized metal housings. Individual units are interconnected by a cable harness which terminates at each unit in either open barrier terminal strips or multiterminal (AN) connectors. Unitized construction and this type connection allow ease of servicing and interchanging units.

The source of radiation and the radiation detecting unit are enclosed in a cast aluminum enclosure. This casting is arranged to traverse the width of the sheet on precision ground steel tubes. Both source-detector units are arranged to be simultaneously positioned by an electrical servo mechanism. Position of the source-detector unit on the sheet is remotely controlled by a dial on the control panel of the console. The air gap between sheet and detector is $3/4$ ".

SOURCE

The appropriate source is contained in a hermetically sealed capsule. The source is equipped with a solenoid-operated shutter which effectively cuts off radiation when the solenoid is de-energized. The entire source and solenoid mechanism is enclosed in the source-detector unit.

DETECTOR

The detector unit is located in the upper part of a source-detector unit directly above the source. Detection takes place in an ionization chamber. Signal voltage is developed across a high megohm resistor which is housed in a heated, temperature controlled, metal slug. Shock sensitive components in the detector unit are shock mounted. The rigidity of construction and shock mounting make the detector unit free from the effects of physical shock and vibration frequently found in industrial plants.

MEASURING CIRCUITRY

The measuring circuit is a 100 per cent feed back null balancing system. This system is very stable and independent of component variations. All components are precision units for maximum accuracy. Precalibrated ranges covering the desired measuring range are furnished. The desired range is selected by a selector switch on the control panel of the console. Consequently, standard samples or operator manipulation of dials is unnecessary.

AUTOMATIC STANDARDIZATION

Every 30 minutes, or upon pressing the standardize button, the gauge will automatically standardize. Standardization corrects for any accumulation of foreign matter on the source window, change in air column weight, circuit variations, and source decay. This unique manner in which standardization is accomplished in the AccuRay beta gauge assures measurement accuracy. Standardization is physically accomplished by electrical servo mechanisms which drive precision multiturn potentiometers. The use of this type potentiometer assures precision adjustment. Accomplishing standardization in this manner eliminates the possibility of human error in making adjustments.

STANDARDIZATION CIRCUITRY MONITOR

Should any component fail or other condition exist such that standardization cannot be properly executed, a limit switch is actuated which causes the gauge to cease measuring. A red service light is then illuminated on the console indicator panel and a second light in the recorder case is illuminated indicating the type trouble encountered. Consequently, rapid diagnosis of the trouble is afforded.

MEASUREMENT PRESENTATION

A two-pen wide strip electronic recording instrument is used to indicate measurements of both sides of the sheet. The recorder is an integral part of the null balance measuring systems. The recorder is equipped with an externally adjustable specification pointer and pen which records the desired operating point. The recorder chart speed is adjustable by changing drive gears.

POWER SUPPLY

The power supply furnishing DC voltages to the measuring circuit is a regulated electronic supply. The output voltage is regulated to assure accuracy of measurement. In addition, the AC input to the power supply is furnished through a constant voltage transformer. The two regulating devices make it possible for input voltages to vary from 100 volts to 130 volts with no effect on gauge accuracy.

POWER CONSUMPTION

The AccuRay beta gauge's current consumption, based on 115 volt, 60 cycle supply, is: standby condition - 3.0 amperes; measuring - 5.0 amperes.

CALIBRATION

The AccuRay beta gauge is so designed that it can be permanently calibrated on an absolute weight per unit area basis. Consequently, any point of the recorder scale represents a definite weight per unit area. Standardization assures that the original calibration will be maintained, thus the time-consuming standard sample technique of setting up ranges is eliminated.

PERFORMANCE SPECIFICATIONS

The resolution of the AccuRay beta gauge is such that changes of 1/2 of 1% of full recorder scale can be read and smaller increments approximated.

The reproducibility of the AccuRay beta gauge is such that if a sample is placed in the measuring gap, measured, removed, then replaced in the same position, the two readings will agree to within 1/2 of 1% of full recorder scale.

If means are provided for holding the pass line variation to within $\pm .030$ " over the entire sheet width, the accuracy of measurement will be as follows, utilizing the following definitions.

One standard error of estimate is defined as the square root of the sum of the squares of the difference between gauge reading and true weight divided by the number of samples.

X_t represents true coating weight per unit area

X_g represents weight per unit area reported by gauge

N represents number of samples tested, at least 25 on any one specified weight of coating.

Then

$$S_e = \sqrt{\frac{E \left[(X_t - X_g)^2 \right]}{N}} \leq .03 \text{ oz./ft.}^2$$

The pass line is defined as the surface of the base metal upon which the coating being measured is deposited.

Electrical noise generated within the instrument, as observed on the recorder chart while measuring a static sample, will be within plus or minus 1.5% of full recorder scale 99% of the time (3 sigma limits).

SUMMATION COMPUTER

As described above, measurements are presented on a two-pen recorder, each pen indicating coating weight on one side. A summation computer adds the two weights presented on this recorder and indicates their sum on a single-pen recorder housed in the console normally without a recorder.

CONTINUOUS SCANNING WITH TWO-SPEED TRAVERSING

The electrical servo positioning system specified above is replaced with a two-speed electro hydraulic system. When the scanning unit is energized, the source-detector units scan the sheet at approximately 2, 5 feed per minute, measuring as they traverse. When a preset point is reached, the units reverse and traverse at approximately 25 feed per minute, not measuring as

they move until a second preset point is reached. The cycle is then repeated. The reversing points are externally adjustable. The scanning unit can be de-energized and the gauge positioned with the manual control mentioned above.

The scanning mechanism can also be furnished with photo electric unit which reverses gauge at edge of sheet. This is desirable whenever various widths of strip are frequently processed or whenever the strip is running off center.

WELD PROTECTION UNIT

Should a thick weld pass through the measuring gap, damage to the source-detector unit may result. To eliminate this danger, a system is available to move the gauge off sheet when a weld approaches. The gauge remains off sheet until the weld has passed. This safety system is activated by a switch closure furnished by the customer. Safety circuits are included to warn the operator should a failure occur and the gauge not move off the sheet.